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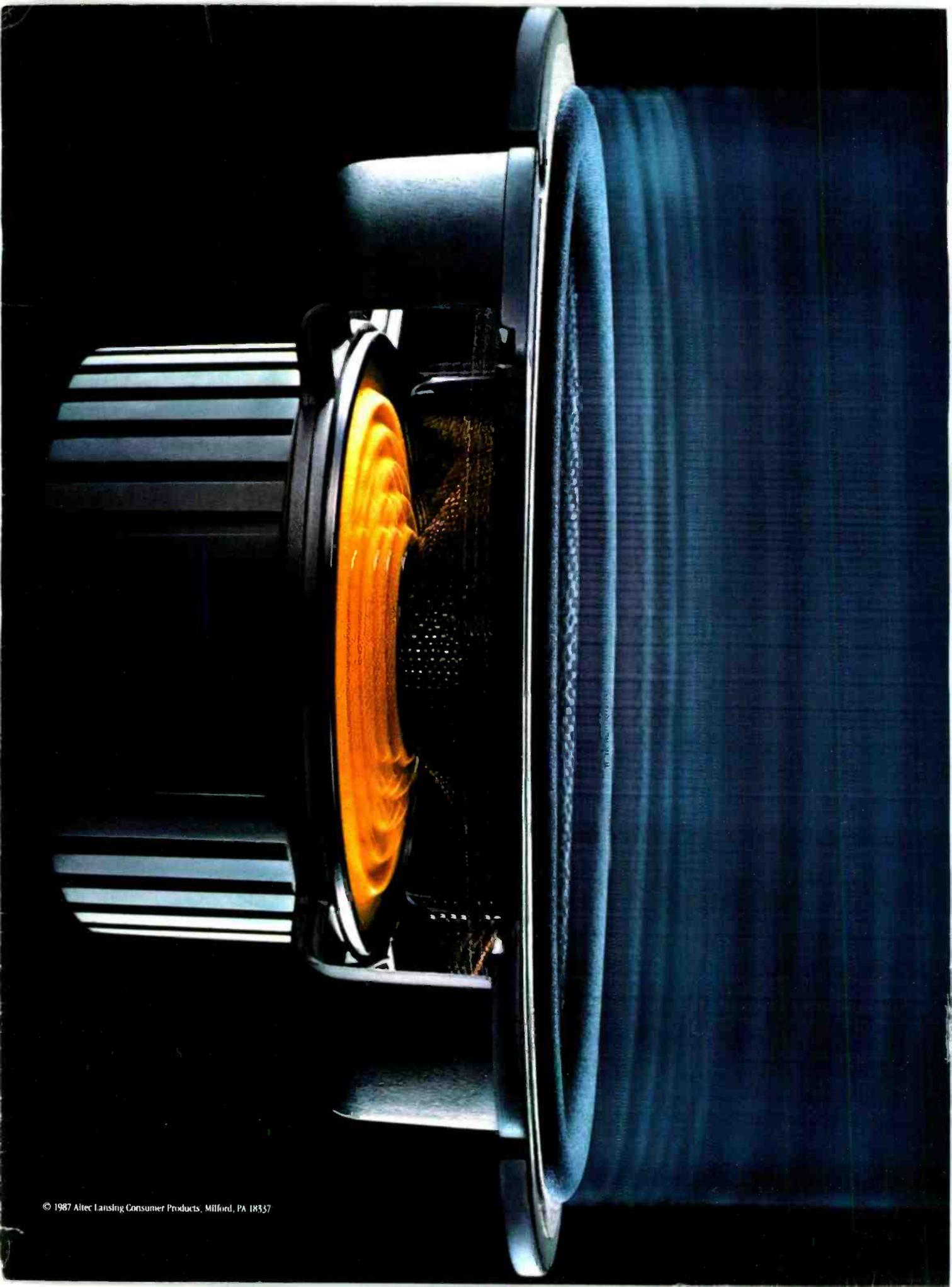
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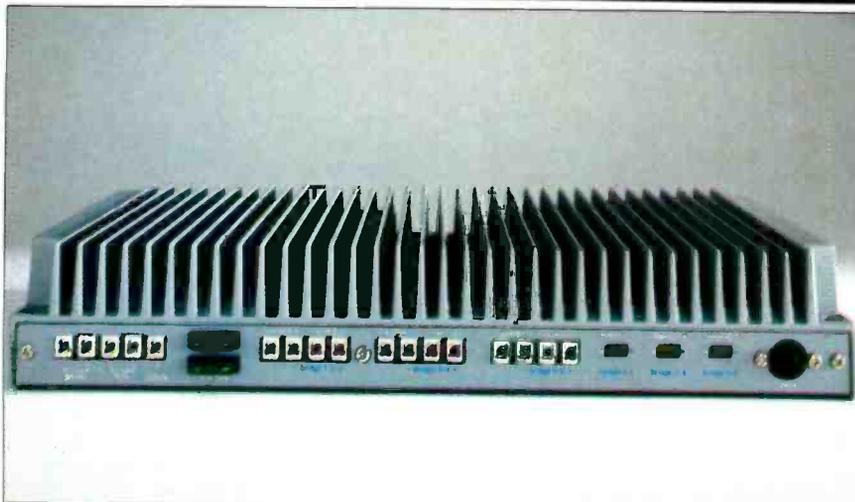


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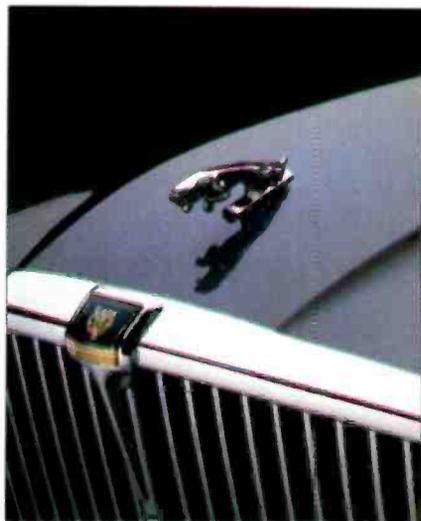
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The Cover Subject: 1987 Jaguar XJ6  
The Cover Photographer: ©1988, Bill Ashe.

Audio Publishing, Editorial, and Advertising Offices,  
1515 Broadway, New York, N.Y. 10036

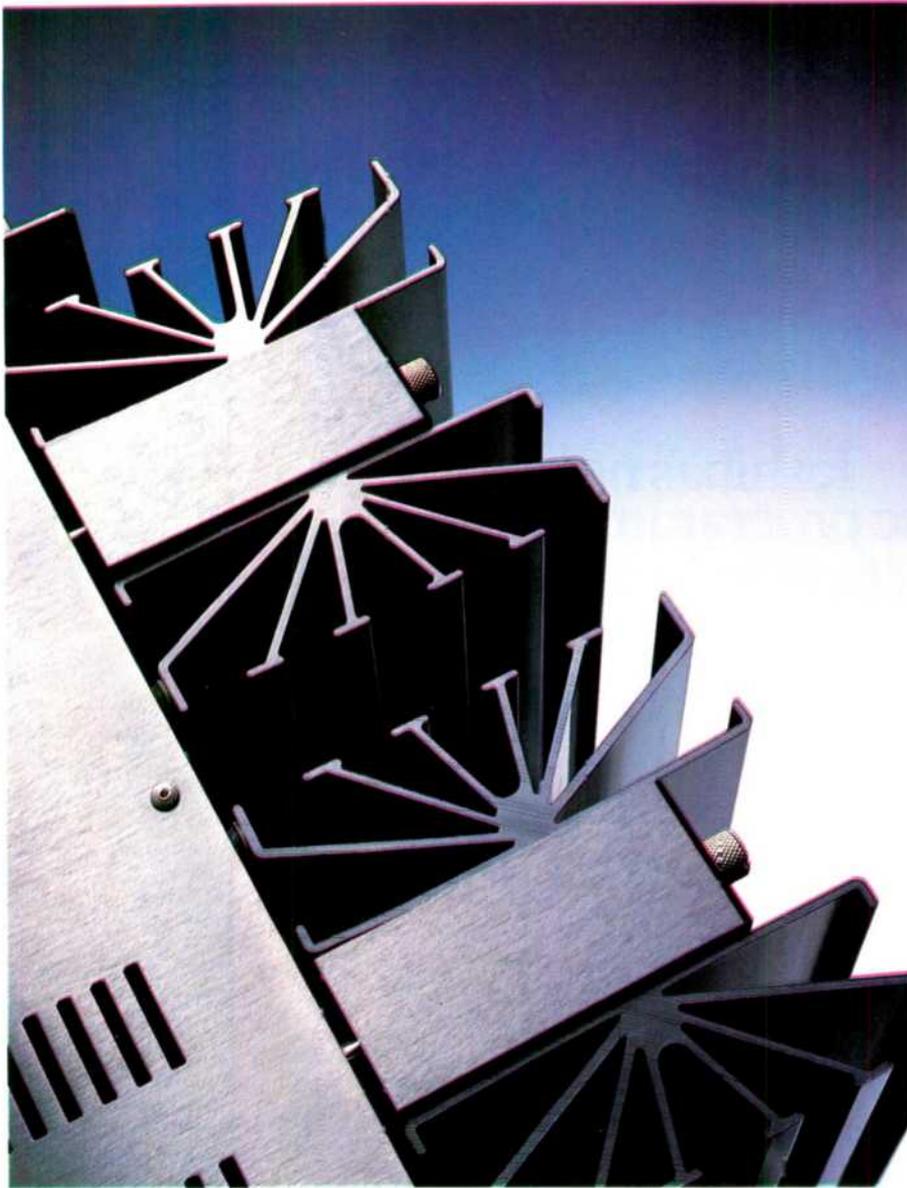
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HEATSINK—July 1986

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**AUDIO** (ISSN 0004-752X, Dewey Decimal Number 621.381 or 778.5) is published monthly by DCI at 1515 Broadway, New York, N.Y. 10036. Printed in U.S.A. at Dyersburg, Tenn. Distributed by Warner Publisher Services Inc. Second class postage paid at New York, N.Y. 10001 and additional mailing offices. Subscriptions in the U.S., \$19.94 for one year, \$35.94 for two years, \$49.94 for three years; other countries, add \$6.00 per year.

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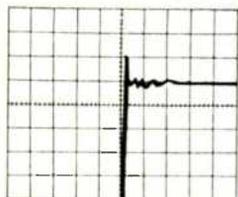
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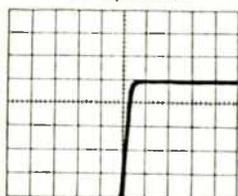
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## AUDIOCLINIC

JOSEPH GIOVANELLI

### Interpreting Cartridge Output

*Q. My preamplifier's phono input sensitivity is 2 mV. I am considering the purchase of a cartridge whose output is 1.5 mV. Does this mean that my preamplifier will not have enough signal to drive my power amplifier to full output? Or will it just mean that I will have to advance my volume control slightly? My present cartridge has an output of 3 mV, and that works very well. I am also considering another cartridge, whose output is 4 mV. My preamp has a signal overload level of 150 mV. Will this latter cartridge possibly overload my preamp?—Eugene Bershad, Freehold, N.J.*

A. The difference in cartridge output may not be as it seems; it depends on what groove velocity (1 cm/S or 5 cm/S) each cartridge's output specification is referred to. If the output figures for your current and prospective cartridges both refer to the same groove velocity, then the 1.5-mV cartridge will have half the voltage output of your present one, or 6 dB less. But if the new cartridge's specifications refer to the higher velocity and the old cartridge's to the lower, the new one's output would actually be one-tenth the old one's, or 10 dB less. If the new cartridge's specification refers to 1 cm/S and the old one's to 5 cm/S, the new cartridge would have 2.5 times (8 dB) greater output than your old one.

Assuming the new cartridge's output is lower: If you are not now approaching your volume control's upper limit when playing records at the highest volume you like, there is probably sufficient gain to provide adequate volume from the new cartridge.

There is another consideration, however. During very soft musical passages, do you hear any background noise—not record-surface noise—from the preamplifier itself? If you do, it means that use of the cartridge having less output will result in even more background noise. This additional noise could intrude in those soft passages.

As for the 4-mV cartridge, there will not be a problem of sufficient amplifier power. Any background noise will be less than what you now hear. Even with the most highly modulated discs, it is unlikely that the output voltage would be anything near 150 mV. I believe that

50 mV is a more realistic number, and this is well below overload.

Although it is not necessarily true, very often a cartridge will produce high output at the expense of overall quality. Frequency response may be reduced, and stylus tip mass may well be higher than that of cartridges producing less signal. Some cartridges which produce high output voltages may be physically heavier than those producing less. If yours is among these, be sure that your tonearm can accept this added weight.

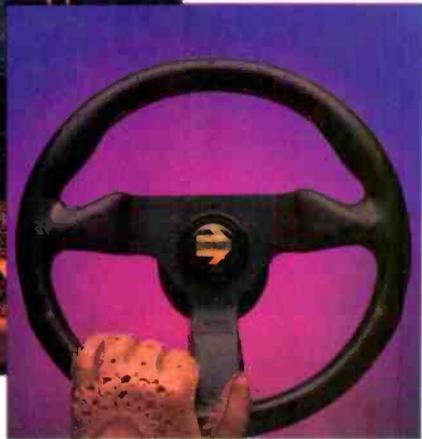
### More on Dust

*As an environmental engineer, I generally wouldn't presume to comment on the technical content of Audio magazine, but your answer to reader Jose E. Gonzalez's inquiry concerning dust (January 1988) strays into my area of knowledge. The dust in question comes from the solids in the water that his ultrasonic humidifier sprays into the air. The water droplets evaporate, leaving behind solid particles representing both the suspended and the dissolved minerals in the tap water.*

*Filtration only removes the suspended particles in the water, and there are most likely very few of these. The larger problem is the dissolved solids. These are generally removed by a water softener, but this device merely substitutes "hard minerals" with soft minerals, so the resulting "softened" water still contains solids and would still produce dust. The substitution of distilled water for tap water solves the problem, as stated, but at a high cost, as also stated.*

*The best solution to eliminate the damage of dust—not only to the hi-fi equipment but also to residents' lungs—would be to replace the ultrasonic humidifier with an old-fashioned evaporative humidifier. These incorporate a wheel or belt rotated through a water sump and past a fan, causing a high rate of evaporation. The minerals accumulate in the sump and must be washed out once in a while.—William Blakeslee, Ambler, 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

### Cassette-Type Demagnetizers

*Q. There are several types of cassette-deck demagnetizers on the market which are enclosed in cassette shells. Some are battery operated, and some work via a spinning magnet. Are there any differences in performance among them? In general, do these work as well as the prod-type demagnetizers? And finally, do they demagnetize other parts of the deck besides the playback head, namely the erase head, capstans, etc.?*—Craig Anduss, Arlington, Tex.

*A.* The prod-type demagnetizer is considered superior to the cassette type. However, where access to the heads is difficult, as in car decks, the cassette type will be more practical.

As with all other audio products, I would imagine there are differences among the various cassette-type demagnetizers with respect to efficiency. Perhaps my colleague Howard Roberson, an *Audio* Senior Editor, will investigate this matter in his laboratory. (Mr. Roberson does report that the battery-operated demagnetizers he's seen work only on the recording and playback heads, but that the spinning-magnet models he's used do demagnetize the entire tape path.)

### Open-Reel Tape Types

*Q. In the owner's manual for an older open-reel deck, tapes are rated as "standard" and "LH." Is LH tape the same as EE tape?*—Carlton Henderson, Danville, Va.

A LH stands for low noise, high output. It applies to a ferric-oxide tape formulation, introduced about 15 years ago, which has greater output, less noise, and more extended frequency response than the early ferric oxide tapes. LH tapes require more bias and more treble boost in recording than the old-time standard tapes. For any ferric oxide open-reel tape bought in the past 15 years, you should probably use the LH settings of your deck when recording.

EE stands for extra efficiency. It is claimed that decks will operate as well with EE tape at 3¾ ips as they do with LH tape at 7½ ips. These open-reel tapes have much the same characteristics as Type II tapes for cassette decks. In comparison to LH open-reel formulations, EE tapes require appreciably more bias and more record treble boost. They also take playback equalization different from that required by LH tapes. Altogether, an open-reel deck must be specially set up with respect to bias, record equalization, and playback equalization in order to realize the potential of EE tapes.

ciably more bias and more record treble boost. They also take playback equalization different from that required by LH tapes. Altogether, an open-reel deck must be specially set up with respect to bias, record equalization, and playback equalization in order to realize the potential of EE tapes.

### Azimuth Control

*Q. Is there any deck in existence that adjusts azimuth automatically for any tape that it plays, so as to give correct sound? If not, is there any deck that permits simple and reliable manual adjustment of azimuth?*—Anthony Hudaverdi, Santa Monica, Cal.

*A.* The only cassette deck I know of that automatically adjusts azimuth during playback is the Nakamichi Dragon; this is Nakamichi's top-of-the-line unit, with a list price of about \$2,000.

There are several decks that permit easy manual adjustment. These include the Nakamichi CR-7A, the SAE C101, and the Tandberg 3014A; there may be others as well. At least two companies, NAD and Parasound, offer a feature called "Play Trim," which compensates for azimuth misalignment. The compensation consists of variable playback boost at the very high end of the treble range.

### Audio Engineering Career

*Q. I am wondering about career opportunities as a recording engineer. What exactly does a recording engineer do? What do mixing and mastering engineers do, and how do their jobs differ from those of recording engineers? There is a dearth of information about required training for such jobs, and I was hoping you could tell me how to break into the field.*—Bion Chen, Miami, Fla.

*A.* Rather than try to answer your questions, let me refer you to what is probably the best source on the subject: *Guide to Careers in Audio Engineering*, published by the Audio Engineering Society, 60 East 42nd St., New York, N.Y. 10165.

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.

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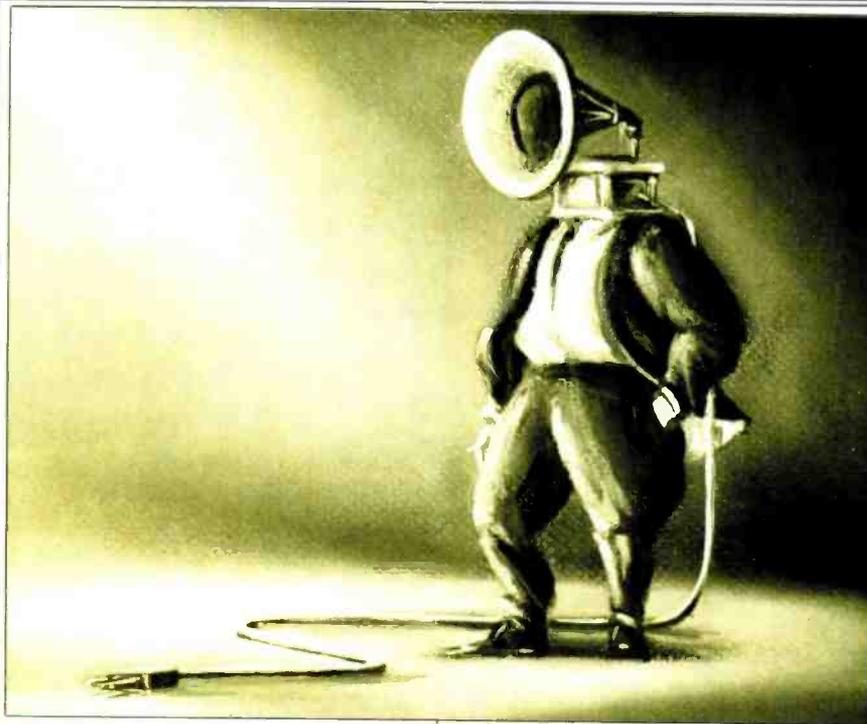
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BERT WHYTE

## CRITICAL DIFFERENCES



**I** note that with this issue, *Audio* begins its 41st year of publication. This issue also marks the 20th anniversary of "Behind the Scenes." Writing this column has been very rewarding, and I'm happy to say that over the years I've received more bouquets than brickbats.

In these two event-filled decades, I've met a fairly broad spectrum of people in the fields of music, recording, and audio. Whether these people are devotees of digital sound or advocates of analog, they usually can be characterized as either pure music-lovers or audiophiles. They are usually pretty positive in their attitudes, to say the least. While the dedicated music-lovers are not totally indifferent to the sonic qualities of recorded music, there is little doubt that the musical aspects and most especially the performance values are almost the only things of major significance to them. These people seem to have developed an ear/brain "filter" which effectively masks the distortions and noises and other artifacts of poor recordings.

Luckily for the audio component and record industry, the majority of audiophiles are also music-lovers. Historically, recordings of classical music have led the way in reflecting the tech-

nical advances of their times, and in turn they have been used to document the sonic values of audio equipment. Thus, there is a very large group of audiophiles who are deeply involved with recordings of classical music. It is important to understand that most of the people in this audiophile cum music-lover fraternity are not musically erudite. In respect to the music, most of them fall into the "I know what I like" school. They are far, far more discriminating in matters of sound, and they want the music they like available to them with the best sound state-of-the-art equipment can provide.

Most of these people are keenly interested in new recordings and, in this era of the Compact Disc, avidly follow reviews of them in *Audio* and other "buff" magazines in this country. Many read the British audio journals as well. One of the common and ongoing complaints of this group is that they are confused and distressed by conflicting reviews of the same recording in the various enthusiast publications. They are especially concerned about differences of opinion with respect to sound quality. How, they ask, can one reviewer wax rhapsodic about a recording's "superbly natural sound" while another reviewer condemns the same record-

ing as "compressed, lacking in ambience, and rolled-off in the bass"?

Such diametrically opposite views are not uncommon. The problem is rarely that of hearing perception or aural acuity, but rather of inadequacies in the reviewer's audio components in a poor listening environment. If the audio consumer finds these conflicting reviews confusing and annoying, you can imagine the consternation and even the rage of the record company exec, who feels that his recording has been unjustly maligned. As a former record producer and engineer, I've been on that side of the street too! A good friend of mine who was the engineering director for one of the most prestigious record companies used to get so incensed by technically inaccurate reviews that he would go to the bother and expense of bringing the offending critic to the record company laboratories, where he could audition the recording in question through a very high-quality system in an acoustically treated room. While the critic might privately show some chagrin, he rarely publicly recanted or subsequently modified his reviewing style.

A current example of the conflicting review problem is now before me. In a well-known British record magazine, a critic praised the "open, spacious, natural quality" of a recording of a great piano concerto, performed by a famous piano virtuoso with a world-class orchestra and conductor. In my opinion, the performance was great, the music-making exemplary in all respects. The sound of the disc was quite another matter—I found it exhibited all the anomalies and ills of excessive multi-miking. The orchestral choirs were grossly compartmentalized and totally lacking in depth perspectives. The piano was brash and clangorous. There are other equally glaring examples of conflicting reviews of sound quality. For instance, I stated in one of my own reviews that in a particular recording, some off-stage trumpets are heard at the proper distance with the appropriate depth perspective. Another critic finds the same trumpets "lacking in depth." On another recording, critic X states that the "recording is bass-shy." For my part, I can clearly discern the low-level, 31-Hz fundamental of the bass drum.

Illustration: Karen Stolper

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How can one reviewer wax rhapsodic about a disc's superb sound while another condemns it as compressed and lacking in ambience?

Obviously, it would be very helpful in deciding which review is more likely to be accurate if one knew what components were in the reviewer's audio system. Normally, this information is very difficult to obtain. Once in a while, however, an audio publication will do an article on their reviewers' listening rooms and their audio equipment. Usually, these reports are disheartening, revealing generally inadequate listening rooms and audio components that are rarely much above the mid-fi level. When one finds out that critic X uses some tiny loudspeaker driven by a 25-watt receiver, it is perfectly clear why he finds an inordinate number of recordings lacking in bass!

Many years ago, when reviewing records for *Radio TV News*, I used to list all the audio equipment I was using. Currently, that venerable British journal *The Gramophone* publishes a column which comments on top recordings in various categories, and the editors list the audio equipment they use in their evaluations. This sort of information certainly provides a bit of help in judging reviews. I'm not suggesting that critics band together in some sort of "guild" or "league" wherein membership is contingent on maintaining a certain minimum level of component quality. However, it certainly would seem to be logical for the reviewer to describe his component system. I know this is fraught with problems of "commercialism," but if our British cousins can do it ethically, surely we can too.

(*Editor's Note:* As Mr. Whyte points out, the only item that need be of interest to readers and recording companies is that the record reviewers' component systems meet a minimum level of quality. Beyond that baseline certification, we get involved in the Ancient Game of Egos, wherein one tries to see who can die with the most expensive toys. We, at this magazine, generally try not to confuse this game with record reviewing. Otherwise, one would be in the somewhat ludicrous position of saying that the best critic is the one with the biggest equipment budget. Or, perhaps, that he is the one boldest in requesting long-term loans of expensive components. Forcefully rejecting this bit of nonlogic is the only way to understand, finally, that synergy lies

in the performance of a piece of equipment, not in its price tag.

(Beyond the mere "having" of the equipment, there is the substantially larger problem of implied endorsement by the simple inclusion of some piece of gear in a reviewer's system. Such piles of gear, most usually, are not meant for display. There is a radical difference between what a writer would recommend as "The Best on the Market" and what his budget allows him to purchase for his own system. There is a similarly large difference between what a writer would pick as a working tool and what he might recommend for a majority of systems. Very often, equipment will be in an editor's system solely because he's trying to get familiar with it. Not rarely, a piece will be a castoff from another editor. Allowing the general public to be misled in these ways is as bad as appearing in an ad for a firm practicing rampantly poor engineering.—E.P.)

One of the phenomena of the mid-'70s was the Great Quadraphonic Sound System Debacle, which also illuminates the differences between the music-lover and the audiophile. We all know quad basically flopped because there were too many competing systems, all of which had various technical idiosyncrasies. But quadraphonic sound also failed from a philosophical point of view—too many of those in charge thought it was okay to make recordings using anything that would provide sonic sensationalism. When such techniques were applied to classical music, those who crassly placed discrete instruments *behind* the listener were subverting hundreds of years of concert-hall performance. The resulting sound was unnatural and unnerving. When the rear channels were used in a reasonable way, to provide some of the ambience of the recording space, this heightened the illusion of listening in a concert hall. The trouble was that few companies recorded in this audiophile fashion.

I currently see some developments which could mean that multi-channel sound will become the dominant form of in-home sonic reproduction. One of these is the recent popularity of movies with Dolby Surround Sound, and I detailed my recent experiments in this area in my February 1988 column.

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**REASON #9:** Speaker System switching, 1, 2, or both... plus the High Current low impedance power to drive Multiple Speaker Hookups in addition to Systems 1 and 2.

**REASON #10:** It shares the outstanding Performance/Value rating of all 16 Soundcraftsmen Professional and Hi-Fi amplifiers, ALL designed AND manufactured right here in Santa Ana, California.

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I see evidence suggesting that multi-channel sound will become the dominant form of in-home sonic reproduction.

While a number of processors do include facilities for hall simulation, it is clear to me that the most successful are those which have been designed from an audiophile's standpoint rather than just to impress the uninitiated.

Indeed, the history of quadraphonic sound in the '70s might have been

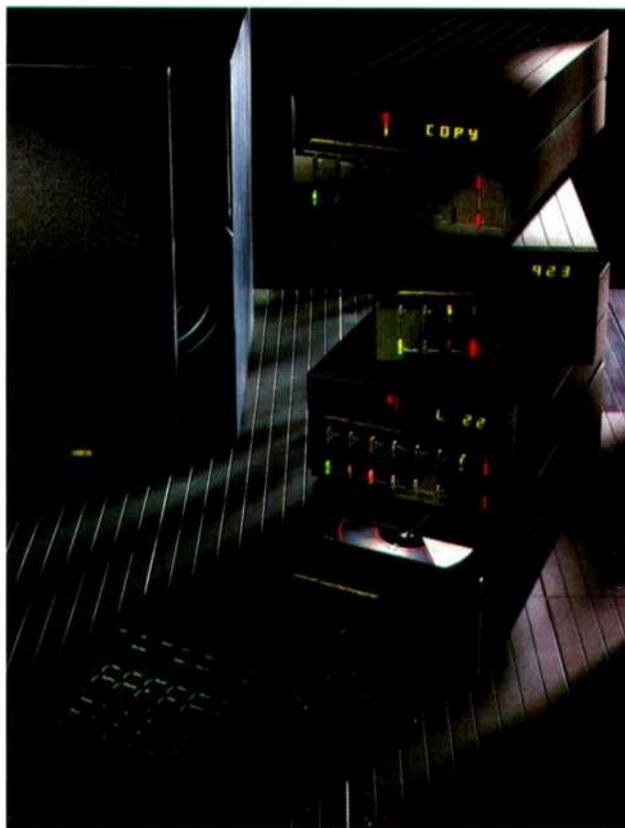
different had we then been presented with the sophistication of Ambisonics. This multi-channel system conveys the spatial characteristics of a hall, including the height dimension. This is achieved through the use of the Calrec Soundfield microphone, a single-point microphone with four capsules in a tet-

rahedral array. The system originated in England, where the Nimbus Record Co., an enterprising "purist" label which operates its own CD manufacturing plant, has been the principal backer of the Ambisonic process and has made quite a number of recordings using this system. Ambisonic playback of these recordings requires a UHJ decoder and a front and rear speaker array, but when properly recorded and with optimum playback parameters observed, it can indeed provide a stunningly realistic simulation of listening in a concert hall. Nimbus CDs are now widely distributed in this country, and a large percentage of them are Ambisonic encoded. (Incidentally, without a UHJ decoder, the CDs will still provide excellent stereo sound with normal playback through a CD player.)

I have made several mentions of the Colossus four-channel digital tape recorder, the brainchild of Lou Dorren and Brad Miller. Colossus is a four-channel, 16-bit PCM recorder with some interesting proprietary coding features, and it is now coming into wider use. Jack Renner of Telarc used it in his recent recording of "Alexander Nevsky," and John Eargle has just used it for a Delos recording of the Seattle Symphony Orchestra. The enterprising Bainbridge label recently issued a number of new CDs recorded with the Colossus system.

Now, consider this intriguing information. When Philips laid down the specifications for CD, they included a protocol for a four-channel disc! This would make four discrete channels available, with a separation of more than 90 dB. When used for four channels, the time on a CD is halved, to about 37 minutes—though, unbeknownst to most people, the CD label side can be recorded too, providing another 37 minutes. Such a CD could be used to store an hour's worth of four-channel sound from Colossus, or Ambisonic signals from the Soundfield microphone. A number of four-channel Colossus recordings are "in the can," and Bainbridge is committed to issuing four-channel CDs as soon as players for this medium are available.

Happily, both music-lovers and audiophiles may be served by such a development.



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# FIFTEEN YEARS AGO BRITAIN THOUGHT THIS MAN WAS CRAZY.

Fascination with the way things work led Ivor Tiefenbrun astray from a very young age. But in the early seventies, the dark ages of hi-fi, things really took a turn for the worse.

It was a grim time all round. Cordless phones were hard to come by. People wore flares. And even the **experts** still believed that the hi-fi chain started with the speakers and worked down to the turntable.

This understanding dominated the way the industry as a whole designed new systems.

And it drove Ivor to distraction. Because it was diametrically opposed to his own **opinion**. He believed that the turntable was the most important element.

As **crazy** as it seemed at the time - his reasoning was pretty straightforward. Commonsense really.

To pick up the music the needle follows the record grooves for information stored in the groove walls. What most people don't realise is how intricate an operation this is. Movements so minute, they are measured in microns.

Take a few minutes to watch closely while a record is playing. The process is hypnotic. Because you live in a world where things are measured in inches.

It's when you scale the 'groove world' up to inches that things start to get pretty **hair-raising**.

Suddenly you are in a deep crevice. The walls are undulated. Approaching at an alarming speed is a bobsled. As it hurtles through the passage it has to pick up tiny pieces of information.

The bobsled is, of course, the needle. And to pick up a deep organ note it has to swerve 10 feet 6 inches. For a high violin note it's less than an inch. A difference which may not seem staggering in itself. Until you stop to consider that the needle is travelling 6 miles per second. And that the pivot point of the lever controlling it is four **miles away**.

In these terms you can see how easy it is to miss out on critical information.

And how even the slightest, imperceptible movement can cause the needle to miss out on the more delicate notes.

Ironically, that which gives a piece its musicality.

No speakers in the world can bring back lost music. It must be dealt with at its source. The turntable.

A **painfully obvious** idea. Yet the entire industry ridiculed it. Because it pointed out they were wrong.

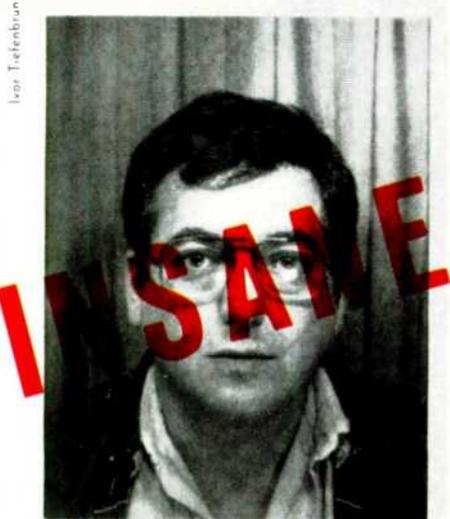
Ivor would have had more luck arguing that the world was round or man would fly.

So he did what Ivor always does when people tell him he's wrong. He ignored them. And quietly set about building a turntable.

The fruit of his labor, was the Linn LP12. And with it he **proved categorically** that the signal

hi-fi industry as a whole, the LP12 has served history well.

As a shining example of the time honoured truth



that sometimes things are too **simple** for people to understand.

Because not only was it the undoubted industry leader in technical terms: it also sounded demonstrably better than any other turntable.

## TODAY AMERICA THINKS HE'S CRAZY.

But for some mysterious reason the concept that one turntable might sound better than another was too much for some people to cope with.

Such was Ivor Tiefenbrun's dilemma. He was just a guy who wanted people to calm down and listen to the music.

And when they were too uptight to try it, he behaved in a slightly **deranged** manner. He called hi-fi reviewers who refused to listen 'cloth ears'. They called him a heretic. The score remained fairly even.

But the press love vocal crazies and Ivor was forever giving interviews.

Interviews in which he issued challenges to the hi-fi aficionados, calling on them to explain what the speakers can do about restoring music the needle has failed to pick up.

Their answers spoke volumes about their understanding of hi-fi. The industry leaders told Ivor he was **certifiable**. Out to lunch. **Looney** tunes. Living in Gagaland. Not to mention rather rude.

This upset Ivor. He doesn't like to be thought of as rude.

Alas these Board Room **diagnoses** came too late. Ivor's **insanity** had proved infectious. The industry

was in turmoil. Music lovers everywhere, of worshipping false gods, listened to the turntable and were converted.

Up and down the country naive listeners began to confess. A Vicar here, a Member of Parliament there, even somebody's mother in Shropshire, all heard the difference. Because the Linn proposition is so simple to prove.

Anyone can hear the difference between good and bad hi-fi. All you have to do is listen.

This fundamental belief is at the root of everything we do. And it governs our retailing philosophy.

Comparisons, using a single set of speakers, are a matter of course at all our dealers. And have been ever since the dawn of Linn. No gimmicks. No obligations. Just a straightforward listen.

And whether you compare Linn to a similarly priced system, or one at ten times the price, the results are the same: Time and time again, Linn's superiority rings true.

By the late seventies, the LP12 reigned supreme, yet Ivor still would not rest. Having proved that the turntable was the **critical** component, he then applied his fanatical attention to detail to the problem of the hierarchy itself.

He tweaked and tested, designed and refined. And established that the correct order of the hi-fi chain is, turntable, tonearm, cartridge, amplifier, and speakers.

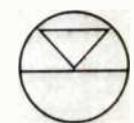
The rest is, as they say, history.

Now music lovers can choose between a variety of Linn components in the hi-fi chain. And with the recent introduction of the Axis turntable, starting to build-up a Linn system is more affordable than ever before.

Today Linn products are sold in thirty countries. In America Linn are the recognised leaders in

specialist hi-fi. And worldwide Ivor is the undisputed protector of the faith.

While the problem of the hi-fi chain has been happily resolved, the larger question of Ivor Tiefenbrun's **mental status** still looms. What's your opinion? Just clip the coupon and send it to your nearest Linn dealer (p. 150). YOU'VE NEVER HEARD IT SO GOOD.



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Yes, this guy is **crazy**. He's probably **crazy**, but I'm reserving judgement until I get more information.

If you promise he won't be there I'll come in for a listening comparison.

He seems perfectly **sane** to me. (hee hee ho ho ha ha.)

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## LEVELS OF REALITY



Illustration: Sara Swan

**A**udio these days is an incredible merry-go-round. Not so much the audio itself as what goes 'round with it. It is part of everything, and not always the best part. As language, audio carries the actual message, but it is mostly degraded. "Gobblegobblegobble" announces the airport sound system. Another delay? "Burglar! Burglar!" screams a hoarse synthetic voice from some car being stolen or, more likely, not being stolen. "Squaaawwkk!" says the informative subway conductor into his microphone. Is it a derailment, or just a watch-your-step? The synthetic Directory Assistance voice says to me on the phone, "The number is: Six three four, five noun two seven . . ." How the noun got in there I cannot say, but it is uninformative. I've heard that one at least three different times.

When entertainment is at hand, reproduced entertainment, things get more serious. Audio quality seems always to come out last. Are we losing our sonic grip, in spite of our ability to produce the best sound ever? Video pictures get dramatically better, 3-D TV is coming via liquid-crystal glasses, and home camcorders are almost miniature; but the ever-present audio in

these is mostly ignored. Dolby, to be sure, is doing okay in movies and cassettes, and people do like stereo TV sound. But the pictures still dominate. It's what we see, not what we hear, that gets talked about.

The whole phenomenon of mass reproduced entertainment is recent in our culture. We have adapted, astonishingly, to these utterly new combinations of stimuli to our senses. But in our minds we are still reluctant to admit that "recorded" is different from "live." In the name of fidelity, engineers still cling to the thought that they are recreating the live situation. The "best seat in the concert hall" continues to exist, if a bit faintly, among recordists—even though no concert-goers I know of have ever agreed on such a seat.

Do we re-establish the live situation—any live situation? Never! The world of audio, along with that of the reproduced picture, is a different world, merely derived from the live one. And so we must make or discover our own rules—what works and what doesn't—and these, of course, in terms of our perceptions as we are faced with new experiences.

I have always thought that, in this

area, the most important mental activity of all is *knowing*—knowing (or imagining) where the entertainment is taking place, and even more important, knowing where you actually are located in time and space. Are we ever fooled? Do we really think we are in a concert hall when we really aren't? Of course not. We just enjoy imagining it. It's the audio engineer's job to help us in this nice fantasy. He knows how best to set our imaginations going, and it is *not* by any sort of literal reproduction, as though you actually were in a concert hall. The plain fact is that you are not. That is what matters. The same goes for all the other reproduced entertainments, each via its own particular technology.

Do you think that it isn't important, this knowing? Is there music coming from behind that big banquet-hall curtain you see before you? If so, and if you were an 18th-century gentleman, you would *know* that there were live musicians, in the flesh, behind that curtain. How about today? Loudspeakers. The excellent audio makes the sound just as good, after all.

If you can't tell the recorded sound from the live, what difference does it make whether it's the one or the other? Plenty. Just walk up to that curtain with a long, sharp sword and thrust it with all your might straight at the source of the sound. If by some chance there are actual live musicians there—not impossible at our audio press banquets—then there *is* a difference of some importance. A simple matter of knowing. Many an eavesdropping conspirator was knowingly murdered in this quick fashion in the pre-reproduction days, when heavy curtains were hung everywhere as insulation. True, not many musicians were eavesdroppers, but the point is still valid.

If you listen to a symphony with your ears and look at your home surroundings with your eyes, you *know*. You are always *where you are*, though it is nice to imagine otherwise. The day you rise up from your home easy chair and fall four feet off the front of a concert-hall stage, you may be permitted to think that you aren't really sure where you are. The rest of the time, you may be perfectly secure, whatever the reproduced entertainment.

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The "best seat in the hall" continues to exist among recordists, even though concert-goers do not agree on precisely where it is.

that you are not where the entertainment says you are, makes our entire entertainment world go 'round. This is new, this double whammy, to be *here* and yet to be *there*. At least, it's new in the curious combinations it allows us to enjoy. We aren't the slightest bit bothered, for instance, by a concert hall

that goes rocketing along at 55-plus in our car. We know what the situation really is. We have adapted to what once would have been a frightening inconsistency.

It used to be that we had one world in entertainment: The real world, where sounds and sights agree with other

perceptions, and all is sensibly harmonious. We do still have that. But there's also the new world of reproduced entertainment, where we accept and enjoy the most astonishing contradictions with the greatest of ease. Some of us practically live in this world: "*Hi, this is your friend Joe from Grabit Savings & Loan,*" says the young man on my telephone, and instantly I know he thinks he's on TV. He thinks I am too. He is wrong and finds it out when I cut him off. But most of us keep a very sane balance, whereby we always know where we stand (or sit), and thus can enjoy the reproduced world to its fullest extent.

Being at a "real" event certainly has its attractions. Why else do so many thousands of us jam ourselves into a mass of bodies at big sports events when TV's superb sports information, reproduced, is so accessible? The amount of energy we expend just to be there, in real time and real life, shows how much we still value in-the-flesh reality. Distantly, we see the sports stars in person, actually there at the very moment, living, breathing. It's for real and we are thrilled. (Isn't it a paradox that we can "watch TV" right there on the huge video screens at the games, the real flesh assisted by the reproduction?)

In the same way, we find it thrilling to see famous people on the street, on a stage, on speakers' platforms—anywhere, just as long as they are *real*. It seems almost silly to have to say it, but right here is the key to that other world, the world of reproduced information. In this age, audio reproduction is reality's opposite number, like matter and anti-matter. Audio too has its own peculiar reality, the same yet utterly different; it is a changed mirror of life like Alice's looking-glass world of mathematical opposites.

How clever he was, Lewis Carroll, that modest Oxford don who wrote the Alice books more than a century ago. In Alice's world even time went backwards. Remember the nutty Duchess who cried "ouch!" *before* she got pricked by a pin? If Carroll were being literal about things running backwards, he might have had her saying "Ihcuo," or he might have had the letters themselves facing backwards, as in a literal mirror. Literal, but not very good enter-

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out of cars sold in the U.S. (including the Honda Accord LXI, Mazda 626 and Nissan Maxima SE). And as *Motor Trend* simply put it: "We should all stand up and applaud."

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Audio is a different world, merely derived from the live one. So we must make our own rules about what works and what doesn't.

tainment. The same goes for us. We cannot be literal in our audio and video reproductions. We have to do everything with a grain of anti-salt; we take the real world and make our own world out of it.

What about our standard inherited perceptions in this new world of ad-

dled time and multiple spaces? No problem. We adapt with astonishing ease. We are versatile. We revel in unheard-of sensory contradictions and put them aside without a thought. Just as our present species, homo sapiens sapiens, is physically adaptable to all sorts of climes and diets (where Nean-

derthal apparently could not get free of the Ice Age), so we learn very fast to take in the new contradictions between our senses' messages. This learning instinct, in fact, moves much faster than the stilted logic our educated minds come up with to explain it. The concert-hall analogy keeps coming back to plague us in audio, for instance, even though large segments of listeners have never set foot in a concert hall and have not the faintest idea of how it really sounds. In our time, the two worlds I speak of are equal, or as some audio buffs find (to their dismay) on going to a live concert, even more than equal. That is, they much prefer the recorded version. The two experiences are utterly, shockingly different on first comparison. And these differences include that vital factor: Your awareness of where you really are, at home or in the hall itself, and all your senses there with you.

By no coincidence at all, we are seeing everywhere among scientists today an intense study of the bodily channels of perception and integration, how the eyes and ears, the processing centers and subcenters, treat and combine information. Step by step, we are getting right down to the quantum level, looking at the individual firing nerve cells—which use an on/off binary (or digital) code. That is getting awfully close to our own audio circuitry.

These studies, of course, are sparked by new technologies for observation and measurement. But the force behind them is the force behind us—a tremendous need to know exactly how our internal information-processing system works, so that we can understand and even predict human reactions to all sorts of new stimuli, as well as the old. Weightlessness, for instance. TV in 3-D? Audio in four digital channels? Beethoven under water?

Scientists work with objective experiment, laying out their conclusions for still further experiment. Audio and video engineers do the same but with further goals (not excluding profit)—new entertainments devised for our use, as new and untried kinds of reproducing equipment test our quick-adapting senses once again. To me, these engineers belong in the artistic category. Don't you agree? I hope they appreciate the compliment. **A**

## Part one: Monster speaker cables.

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Audio industry professionals rely on Monster speaker cable for the most accurate reproduction possible of the audio signal.

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With M1, the delicate interrelationships of frequency and time are preserved. And music is reproduced with a transparency and musicality that must be heard to be believed.

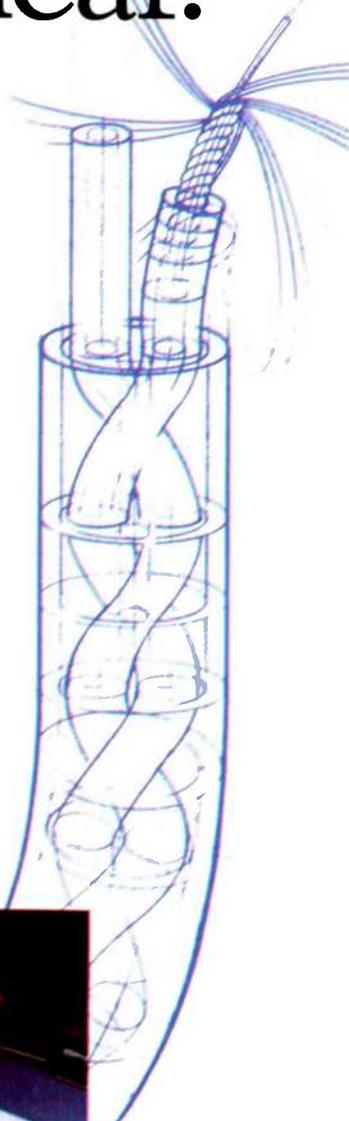
Of course, these technical descriptions don't mean much if the sound isn't right, for you. So we invite you to compare different cables in listening tests of your own.

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Julian Hirsch of Stereo Review summed it up well in his rave review of the SDA-SRS: "The composite frequency response was exceptional...The SDA system works...The effect can be quite spectacular...We heard the sound to our sides, a full 90 degrees away from the speakers...As good as the SDA feature is, we were even more impressed by the overall quality of the Polk SDA-SRS...The sound is superbly balanced and totally effortless...Exceptional low bass. We have never measured a low bass distortion level as low as that of the SDA-SRS...It is quite an experience! Furthermore it is not necessary to play the music loud to enjoy the tactile qualities of deep bass...Exceptional performance no matter how you look at it."

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## "DATs DE BREAKS"

**T**he CBS Records Copy-Code system which would prevent consumers from properly using Digital Audio Tape (DAT) recorders has now been buried, once and for all. The scheme would have required all DAT recorders to incorporate a circuit that would detect a deliberately introduced "notch" within the audible spectrum of prerecorded software such as Compact Discs and other DAT tapes. Potentially the notch and Copy-Code system could have been applied to LPs and even to radio and television broadcasts. This basic plan was submitted to Congress as legislation, and fortunately Congress had the good sense to ask the National Bureau of Standards (NBS) three very basic questions about the system:

1. Does the CBS Copy-Code system actually work as it is said to by its inventors?

2. Does the notch audibly alter or degrade the recorded music to which it is applied?

3. Could the system be defeated by consumers, and if so, how easily?

In a "Forum" column in the August 1987 issue of *Audio*, I explained in detail the CBS Copy-Code system and insisted that introduction of such a brute-force technology would represent a major step backwards in the quest for better sound reproduction. I

also noted that the right of consumers to copy music on tape for their own enjoyment (so long as the tapes are not sold) had been established time and time again by Congress. I and others also maintained that even if the introduction of the notch were *not* audible, the decoder chip in the DAT recorder would likely make mistakes from time to time, inhibiting the recording of *unencoded or unnotched* material and even failing to inhibit recording of some material that was encoded. In my testimony before several Congressional committees concerned with this issue, I stressed that point as well as the fact that inserting a notch into high-fidelity musical recordings was equivalent to removing a couple of keys from a piano keyboard and then asking Vladimir Horowitz to use that instrument in his next concert.

In the course of testifying on this issue, I used a notch filter in order to demonstrate its effect on various signals, including musical selections. Proponents of the Copy-Code system insisted that my notch demonstration was flawed because I didn't know the exact nature of their notch. Yet, when I and others begged them to reveal the exact parameters of their notch, they refused. Even when both sides agreed to submit the system for evaluation by the National Bureau of Standards, CBS

Records filed a lengthy legal brief insisting that the exact parameters of their system remain secret until the NBS tests were completed. Well, now the tests have been completed, and before going over the results, which are contained in a well-documented, 76-page report followed by nine supporting appendices, I'd just like to remind readers (and the folks who accused me of demonstrating the "wrong" notch) of the parameters of my demo notch filter. The filter that I used had its center frequency at 3,840 Hz, and the width of the filter (for the -3 dB points), when measured by an independent lab other than my own, turned out to be 220 Hz wide (not 250 Hz, as I had stated). My filter had an attenuation of about -60 dB at the center frequency.

Here's how the National Bureau of Standards described the CBS Copy-Code notch filter:

The encoding notch filter removes energy at frequencies in the vicinity of 3,840 Hz . . . . The level reduction near the center frequency of 3,840 Hz is more than 80 dB. . . . At frequencies away from the center frequency, the reduction is less, becoming 3 dB at about 110 Hz above and below the center frequency. . . .

I guess I wasn't so far off in my calculation of the filter after all! Turning to my earlier contention that the system might misfire, either by preventing recording of unencoded material or by allowing encoded material to be recorded, NBS referred to these as "false positives" and "false negatives," respectively. Here's how they summarized this point:

For about half of the recorded tracks studied, the system exhibited false negatives; i.e., notched material was nonetheless recorded. In addition, the system also exhibited *false positive* behavior; i.e., the system failed to record unnotched material. NBS studied 502 tracks on 54 Compact Discs and found false positives for 16 tracks on 10 discs.

An amusing sidelight of this finding is the fact that the DAT recorder equipped with the CBS decoder refused to record a CD version of Mendelssohn's "Wedding March." It seems that this selection has what Dr. Lyons of the National Bureau of Standards

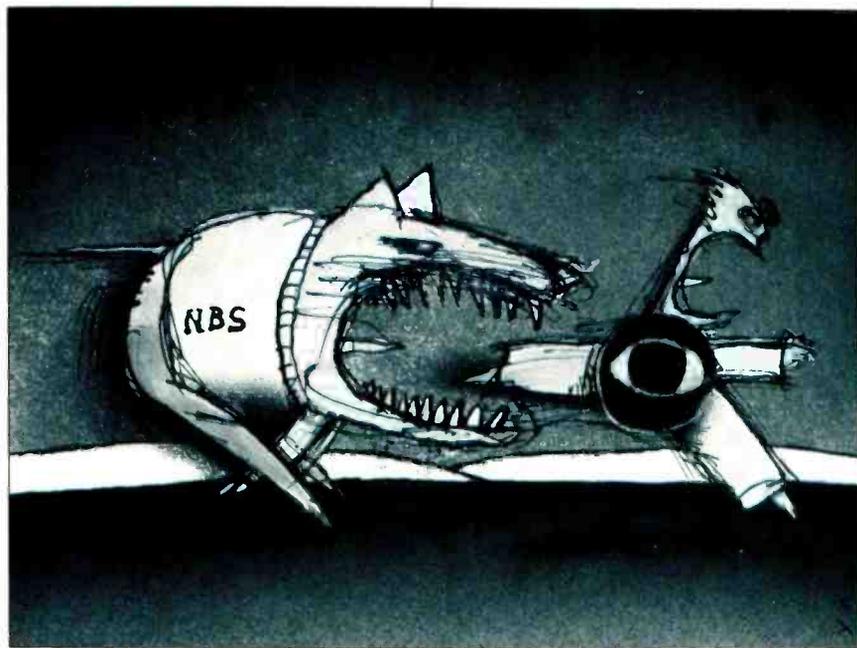
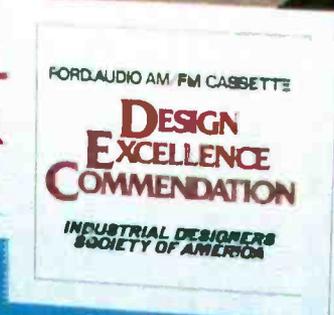
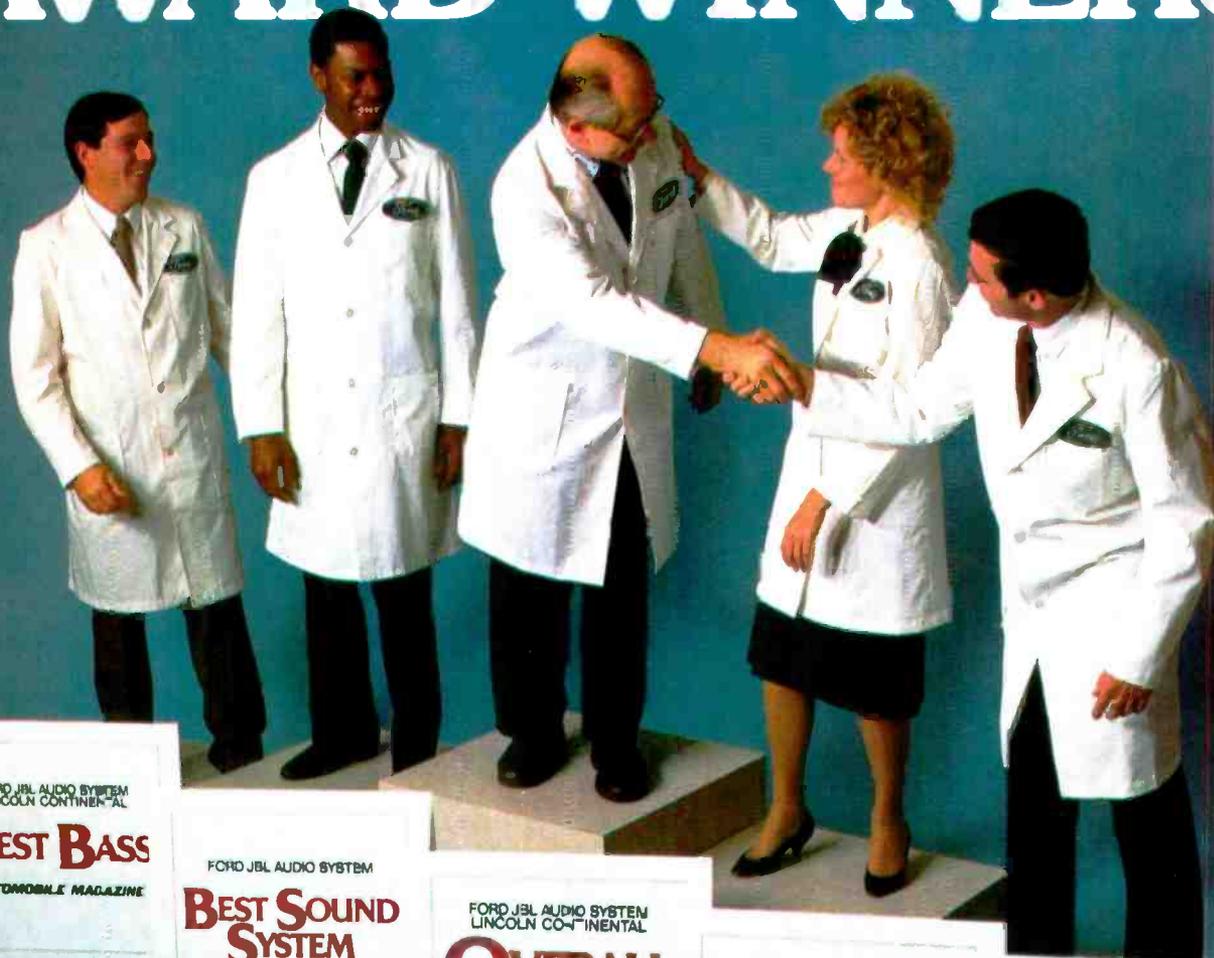


Illustration: James Yang

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*Automobile Magazine*

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*Playboy*

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*Popular Mechanics*

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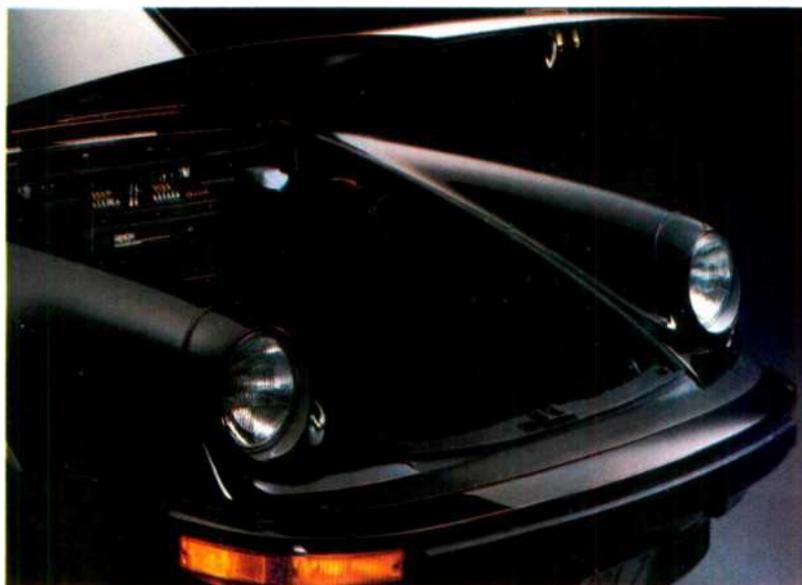
the color of your dashboard lights. So instead of clashing with your car's interior, a Denon system integrates seamlessly.

Of course, we never forget that superior performance is the only attribute that makes high-end car audio worth the money.

That's why we endow our car audio with such advanced technologies as the Denon Optimum Reception System to tailor FM tuning to the reception conditions. Or our Dynamic Expansion to restore



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THE DENON DCA-3500 INCLUDES FRONT AND REAR STEREO AMPS, AN ELECTRONIC CROSSOVER AND A SUBWOOFER AMP - WITH ROOM LEFT OVER FOR LUGGAGE.

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Audio's Ivan Berger on the DCR-7600

Denon home high fidelity. Which means, no matter what you drive, you've finally found car stereo as good as your car.

# DENON

DESIGN INTEGRITY

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CBS claimed the notch's effects were inaudible, but in light of this study, their listeners must have been tone-deaf.



*In the National Bureau of Standards' parallel listening tests, subjects were asked to pick out which of two recordings had been encoded with the Copy-Code notch, by reference to a third, unencoded recording. The average percentage of correct identifications was 62.3%.*

Of course, this comes as no surprise to those of us who participated in earlier tests of this kind at various AES meetings and other conferences. I can recall testifying before a California state legislative committee that had been considering banning DAT importation into that state last year. On that occasion, Mr. Stebbings played parts of that very Streisand album, the spectrum analysis of which now graces the NBS report cover. He played other selections as well, all of which were intended to show that there is no audible difference between the notched and unnotched versions. One of the young legislators on the panel smiled proudly as she indicated that she could tell which version was encoded and which wasn't, three out of three times!

In the same April 2, 1987 testimony, Mr. Stebbings went on to maintain that "even professional listeners, record producers, and studio engineers have not been able to reliably detect which CD was encoded and which was not." In light of the NBS study, Stebbings must surely have tested some pretty tone-deaf engineers. Here's how NBS

described the results of their double-blind tests:

In a second series, 15 experienced listeners worked with 10 selections presented on parallel tape tracks such that the subject could switch back and forth from notched to unnotched material. For 2 out of 10 selections, the encoded version was correctly identified 12 out of 15 times; these results are statistically significant.

I would add that for all of the selections used, the average percentage of correct identification by these listeners was 62.3%—far greater than the 50% accuracy one would expect if selections were made strictly by guess.

Congress also asked the NBS to see if the Copy-Code system could be defeated. If it could, then even if legislation mandating its inclusion in DAT recorders sold in the U.S. were passed, it is likely that there would almost immediately be little "black boxes" that you could buy to defeat the system. In response to this question, NBS engineers designed and constructed several electronic circuits for implement-

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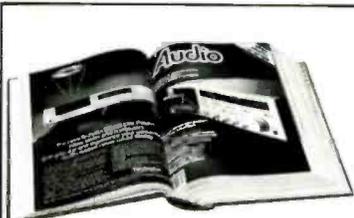
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The RIAA admits to losing the Copy-Code battle but will not admit defeat in the home-taping war.



*The NBS listening room used sound-absorbing materials on the wall behind the speakers, on the side walls, and on the ceiling; sound-diffusing panels were used on the fourth wall (not shown). Only two subjects were allowed to listen at a time.*

ing five different methods to circumvent or defeat the copy-prevention system by the use of external signal conditioning. All five methods succeeded in bypassing the copy prevention system. The circuits, according to NBS, are simple and easy to construct; their cost would be on the order of \$100.

Now can we please have DAT in the United States? With such a definitive "thumbs down" given to the Copy-Code system and no chance of its being made into law by Congress, you'd think that the companies who have been selling DAT recorders to consumers in Japan and in some European countries would be loading up the planes and ships and heading them out to the U.S. I wish that were so. The same day that the NBS issued its report, the Record Industry Association of America (RIAA), the leader in the fight against consumer DAT recorders, held a press conference in which they admitted losing this battle, but they would not admit losing the war. They said that they are willing to "negotiate" with hardware manufacturers, providing that those manufacturers come up with a system to stop home taping.

Failing that, they claim they will seek other forms of legislative "protection." That could mean seeking a tax on tape or on DAT players themselves—a tactic they tried some years ago with ordinary audio cassette tape and cassette recorders. Failing that, the RIAA threatened to sue the first major company that imports DAT recorders into this country. Legally, I don't think they would have a leg to stand on in such a suit, but unfortunately, many of the Japanese firms who make DAT recorders cringe whenever litigation is threatened, regardless of the merits of the case (or lack thereof).

So, until this whole tempest in a teapot is finally and ultimately resolved, if you want a DAT recorder, you'd better do what I did. Hop on the first plane to Japan and pick one up at the fabulous Akihabara electronic district in Tokyo. Customs won't stop you when you bring it back, I promise. After all, it's never been illegal to import DAT recorders into the U.S., and they are just as legal now as they've always been. I just wish our friends in Japan would stop holding back this wonderful technology from their favorite customers, U.S. consumers!





Illustration: Valerie Pizzo

# An Informal History Of Car Amps

JOHN R. BISHOP

“It was 20 years ago today” when Sgt. Pepper first came our way. When we played The Beatles on our home systems back then (actually, it was 21 years ago), the sound was good and we enjoyed the music. Our Marantz amps and Altec speakers did a pretty fine job in our living rooms. In 1967, however, our car stereo systems didn’t do quite as well. Typically, such a system would consist of a 4-track cartridge tape player with 2 or 3 watts of power per channel driving a pair of full-range 5-inch loudspeakers. That was it. It did indeed take “a little help from our friends” before we could convince ourselves that a noisy, distorted system with a bandwidth of 100 Hz to 8 kHz could actually produce enjoyable music. But we did convince ourselves. Perhaps it was mass hysteria, perhaps it was the low expectations fostered by the then-standard mobile music medium, AM radio. Whatever the reason, a love affair began, as cartridge tape gave us the first practical means for taking our own music on the road with us. It was this alternative to Wolfman Jack that kicked off the early days of car stereo, with names like Muntz, Lear

*John R. Bishop began his car stereo career in the early 1970s as service and installation manager for a Southern California retailer. In 1978 he joined the AudioMobile Division of Advent Corp., where he served as Technical Director and then as Vice President Sales and Marketing. Later, while Vice President of the A/D/S/I Automotive Division, Bishop introduced six-channel amplifier technology, the OFR power-supply design, and universal source-interface circuitry to the industry. He is a member of the Audio Engineering Society, the Society of Automotive Engineers, and the American Radio Relay League.*

# CAR AMPS



An early Lear Jet 8-track player, the Model A-20 was designed to fit under the dash (note brackets), and sold for \$29.88.



Craig's Model 3125 supplemented a car's in-dash AM radio with stereo FM and 8-track tape in a console that locked to a plate on the transmission hump.



This compact booster amp, by Boman Astrosonix, promised to increase a car system's power to "40 watts peak power," which probably translated to 5 or 10 continuous watts per channel at reasonable distortion levels.

Jet, Automatic Radio, Boman, Craig, and Pioneer. It wasn't hi-fi, but the wheels were set in motion.

At this stage, all three elements of the car sound system were substantially inferior to their home counterparts. The first element, the source, was certainly inferior. The sound of a 4-track cartridge could not compare to that of an LP or an open-reel tape. The second element, power amplification, also was well behind home technology. With only 2 or 3 watts per channel in the car, performance suffered both in quantity and in quality. The third element, the loudspeaker, perhaps had the farthest to go, with the greatest obstacles before it.

Since then, evolutionary and even revolutionary improvements have taken place in all three car hi-fi equipment categories, and home-level performance has been achieved in today's best car stereo systems. Though the technological advances in sources, amplifiers, and loudspeakers are interlinked, a focus on amplification reveals some of the most interesting aspects of car stereo's transformation since the days when "Sgt. Pepper taught us how to play."

## The Early Days

By the early to mid 1970s, it was recognized that car stereo was "singing out of tune" with the standards of home hi-fi. Some improvements were in the wind, however, starting with the introduction of coaxial and triaxial loudspeakers by Jensen and others. Pseudo multi-way loudspeakers (usually with no crossover) extended speaker bandwidth. Eight-track tape improved source performance and playing time, and cassette began to emerge.

Amplifier technology was "boosted," literally, by the introduction of outboard booster amplifiers by Pioneer, Craig, and others. These amplifiers could be connected directly to the source unit's 3-watt amplifiers, increasing power to 10 or 20 watts per channel.

Two methods were used to gain higher power in these early outboard amplifiers. The first was to combine two smaller amplifiers into a single bridge-mode amp, with the two amplifiers driving the speaker's positive and negative terminals in opposite phase. The signal voltage swing across the speaker was doubled to yield a theoretical fourfold increase in power. The 2- to 5-watt amplifiers were paired up to develop 8 to 20 watts into typical car stereo loudspeakers.

The second approach involved the amplifier's power supply. The rms sine-wave voltage used to calculate the power output is the amplifier's peak-to-peak voltage swing divided by 2.828. The 12-V battery limits the amplifier's swing to 12 V and the rms voltage to a little over 4 V, giving 4 watts into 4 ohms (Power =  $E^2 \div R$ , and  $4^2V \div 4$  ohms = 4 watts).

A way to increase power is to create a higher power-supply voltage. The car's 12-V d.c. is converted to an a.c. voltage by an oscillator that turns high-current switching transistors on and off. The ensuing train of d.c. pulses acts like an a.c. voltage, which can be increased using a transformer. The a.c. pulses are smoothed back into continuous d.c. voltage by rectification and filtering, just as in a home amplifier's power supply. As a result, higher power-supply voltages can be obtained, and so can higher audio power outputs.

The early Pioneer units developed 12 or 20 watts per channel using this technique. Their switching frequency was around 400 Hz (400 pulses per second). Mechanical noise generated by transformer and/or capacitor plate vibrations was a serious side effect; it manifested itself as a strong 400-Hz whine emanating from the amplifier chassis. Perhaps this is what led to the now-common practice of mounting amplifiers in the trunk.

Also emerging in the early/mid '70s were IC power amplifiers. Their small size allowed easier packaging within a radio/tape-player chassis. Using two ICs per channel was a convenient way to achieve 10 to 15 watts output in a small space. Combination equalizer/amplifiers (such as the Clarion 100-EQB) were among the beneficiaries of this new technology.

But it still wasn't hi-fi—not by any accepted criteria for living-room sound, that is. Fortunately, by the late 1970s, reasonable hi-fi alternatives were becoming available. It was clear that the cassette was taking over Dolby noise reduction and home recording had significantly improved software quality. Strides had also been made in car loudspeaker design, most notably the introduction of home-component-quality systems and driver units. These systems had long-excursion, low-distortion woofers and 1-inch dome tweeters with good response and dispersion; there were also the minispeakers, with 4-inch woofers and 1-inch tweeters. Speakers like these from a/d/s/ and Braun, as well as driv-

# CAR AMPS

ers adapted directly from home hi-fi loudspeakers, had deeper bass and longer excursion—making them better but less efficient, as more power was required to drive them to reasonable listening levels.

The real breakthrough came from the high-efficiency digital-switching power supply. The first car product to employ this technology was the a/d/s/ Model 2001 power amplifier, which attained a wide-band power level of 50 watts per channel. A number of other innovative companies also started the manufacture of hi-fi car amplifiers around this time; AudioMobile, Linear Power, and Fosgate were some of the more successful ones.

In the late '70s, there was no such thing as a component tuner/cassette car unit with preamp-level outputs. All in-dash source units contained built-in amplifiers, mostly the low-fi IC types. Control preamplifiers (which also contained volume, balance, and tone controls) were therefore developed to interface such source units to car amplifiers' preamp-level inputs. The input signal for these preamplifiers was obtained by "tapping" the source unit's signal ahead of its built-in low-fi amplifiers. The outboard amplifier was a component amplifier, not just a booster in series with the noise or distortion problems ahead of it.

With these developments, it was becoming possible to build a real hi-fi system in the car. It took some pretty advanced installation skill, and it was fairly costly. But if "Lucy in the Sky" had enough diamonds, she could also afford the \$700 to \$1,000 required for a simple but truly hi-fi car stereo setup (regular systems of the day ranged from \$200 to \$400, for the good stuff).

One of the major differences between the hi-fi car system and the more typical car stereo was the power amplifier. As high power output be-



**By the mid-'70s, there were several attempts to improve car sound, including booster amps and multi-way speakers.**

came synonymous with quality, a power race ensued, wherein specs were greatly abused. Often, amplifiers whose wide-band power was in reality 15 watts per channel were rated at 50, 70, or even 170 watts per channel—in "car stereo watts." With the threat of FTC intervention, an ad hoc committee of manufacturers and industry experts began to establish standards. Most makers went along with the rules, and "car stereo watts" or "peak envelope pre-Chernobyl wattage" power ratings became the low-end exceptions.

## The 1980s

With the approach of the 1980s, there was a real explosion of technological improvements. For the first time, hi-fi products were being designed specifically for the automotive

environment, and more was being learned about car acoustics.

One such area was the problem of ambient noise levels, which can range from 67 to 80 dBA in a car, depending on both the particular automobile as well as the road conditions.

The noise spectrum proved to be bass intensive, with levels of 100 dB common in the octave band centered on 30 Hz. It was clear that if the wide-band performance of home hi-fi was to be approached in the car, then high bass output would be necessary to compensate for the masking effects of this noise. Lots of bass requires large loudspeakers. However, they cannot be mounted in those

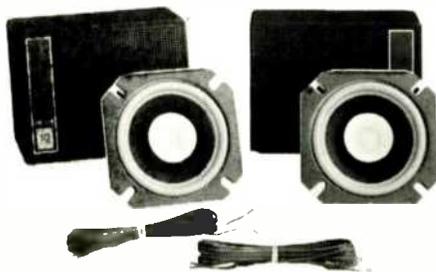
car locations that are suitable for optimum mid/treble clarity and for proper stereo imaging.

The answer was the satellite/subwoofer system, using low-level electronic crossovers to drive a separate amplifier for each speaker. A number of companies adopted this biamplification technology, and by the late 1970s, a/d/s/ and AudioMobile both had crossover networks designed for such multi-amplifier satellite subwoofer systems.

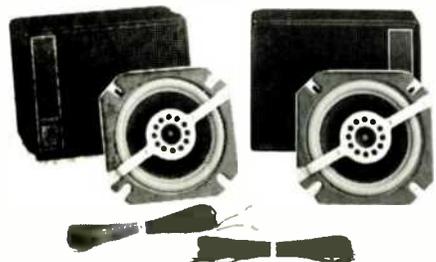
The ultimate in system architecture consisted of four corner satellites operating above 100 Hz: A front pair mounted in dash tops or doors, and a rear pair mounted in the doors or rear deck. The ultimate system also had one or more subwoofers, operating below 100 Hz, mounted in the rear deck and vented into the trunk. These systems had three stereo amplifiers—more, if any were operated in bridged mode. There was a sudden increase in the attention given to amplifiers as system installers and designers began experimenting with new applications. Amplifiers of 20, 50, and even 100 watts per channel became available. Some were bridgeable, allowing all of their two-channel power to be deliv-

Illustration: Trish Doktor

# CAR AMPS



A



B

**Speakers with stiff whizzer cones (A) extended speaker bandwidth somewhat, but true coaxials (B), with tweeters and crossovers, extended it still further. These Jensen units date from the 1970s.**



**Most car minispeakers were the same as home models, but with mounting brackets added. The a/d/s/ 2002, however, also had a built-in amplifier.**



**A Linear Power amplifier from 1976.**

ered into a single loudspeaker load. Now the fun began!

Unfortunately, reliability was the nemesis of many car amplifier makers in the early '80s. A number of factors contributed to these problems, and they all related directly to power.

Consider a 50-watt/channel stereo amplifier with efficiency in the 50% range. For each channel, 100 watts must be put into the amplifier to get 50 watts out to the loudspeaker. That's 200 watts total, coming not from the local utility company but from the switching power supply in the amplifier. At an efficiency of around 70%, the power supply must convert 285 watts before the amplifier can do what a 50-watt/channel home amplifier does. The switching transistors must handle nearly 300 watts of power and 30 amperes of current to accomplish this.

Where transistors and transformers were too small for the job, failure resulted; there were few reliable amps in the 50-watt/channel class, and almost none in the 100-watt/channel category. AudioMobile was perhaps the first to build a successful 100-watt product, using a power supply which had nearly 600 watts continuous output capacity. (Power supplies that large are still rare today.) There were two keys to AudioMobile's success: Improved efficiency at higher switching rates (25 to 35 kHz), and the use of large switching devices capable of handling the peak currents. The AudioMobile design yielded efficiencies in the 80% region using bipolar devices with 80-ampere ratings.

Amplifier output transistors too small for the job also were prone to failure. Bipolar transistors have a power-versus-time safe operating area (SOA), and if their limits are exceeded even momentarily, failure will result. In the unpredictable world of car stereo, there's real risk involved.

Car stereo speakers typically have impedances of 4 ohms. Add another pair of speakers in parallel, and you have a 2-ohm load, a common case in car stereo. Most transistor amplifiers double their power output when the load impedance they feed is cut in half—or at least they try to. The 50-watt/channel amplifier trying to muster 100 watts per channel under these circumstances must do or die. Many did the latter. The highly reactive loads of multi-way loudspeaker systems and their passive crossover networks also created problems for output transistors, which had to deliver their peak voltages and peak currents to these

tough loads simultaneously. When the SOA was exceeded, "poof," you were "fixing a hole where the rain gets in." Now imagine the 100-watt/channel amplifier, which required a power supply of 600 to 700 watts to develop its two channels' 200 watts of output. The 400 watts of power supply and amplifier dissipation that didn't become music became heat. That being the case, it's a miracle that component car amplifiers have made it this far. But in fact, the lessons learned by the early designers are bearing fruit today.

## Today

That was then, this is now. Now we have CD for the automobile—ultimate source quality at home performance levels. Car loudspeakers have also matured and improved, with some systems using the same components and technology as the industry's finer home loudspeakers. We have car amplifiers of every size and description. We also have the car manufacturers installing better and better source units as standard equipment—units with Dolby B and C noise reduction, built-in equalizers, and CD options.

Today's amplifiers are more reliable and offer more performance than ever. In the power-supply area, several different improvements have been incorporated. Larger, faster switching devices with higher saturation currents are now available. FETs with higher power ratings are widely available. As switchers, FETs have advantages over bipolar transistors. They're typically faster, they require less drive current to fully saturate, and their drain current has a negative temperature coefficient. This means that if one device begins to hog more current than the others, it heats up and its drain current decreases, thereby cooling it back down. You can stack 'em high and let 'em fly. As a not uncommon example, in an a/d/s/ amplifier rated at 200 watts per channel in two-channel mode, 14 FET switchers are paralleled for a capacity of close to 100 amperes, with a power supply of nearly 800 watts (!) continuous output.

Many designers have opted to solve the power-supply capacity problem by dividing the work load among multiple, smaller power supplies. A stereo amplifier rated at 100 watts per channel can use two small supplies, each about the size of a single supply for a 50-watt/channel unit. Each 100-watt channel gets its own supply. This approach is sometimes called "dual mono" and offers the advantages of

# CAR AMPS

smaller peak current switching and more reasonable requirements for transformers.

Amplifier technology is also constantly improving. Special circuitry which monitors voltage and current in the output devices can protect against exceeding SOA limits. Larger devices are also being used to increase the SOA and thus eliminate the need for amplifier protection circuits, which can cause poor sound. Thermal detection is being employed to control the bias in bipolar amplifier designs, thus preventing thermal runaway.

Delay turn-on circuits are also commonplace for the big amplifiers. The power supply or amplifier (or both) is held off by the delay circuit until 2 or 3 S after the source unit is turned on. In this way, output transients from the source are allowed to completely die away.

## Tomorrow

So what lies ahead for car stereo? For one thing, FET technology is finding its way into amplifier design for the car. FETs require no thermal protection or SOA protection, since they do not suffer from secondary breakdown or thermal runaway. Output designs which incorporate FET technology can be safe into lower impedance loads, again because they essentially act as their own current limiters. Simpler circuitry and self-protection are the advantages; current limiting and susceptibility to overload distortion are the main disadvantages.

Bipolar designs are still the most prevalent among high-quality car amplifiers. The most sophisticated employ full complementary-symmetry circuits with Class-AB biasing. Distortion and noise factors are comparable to what is found in better home units, with some designs achieving less than 0.1% THD + N in the car.

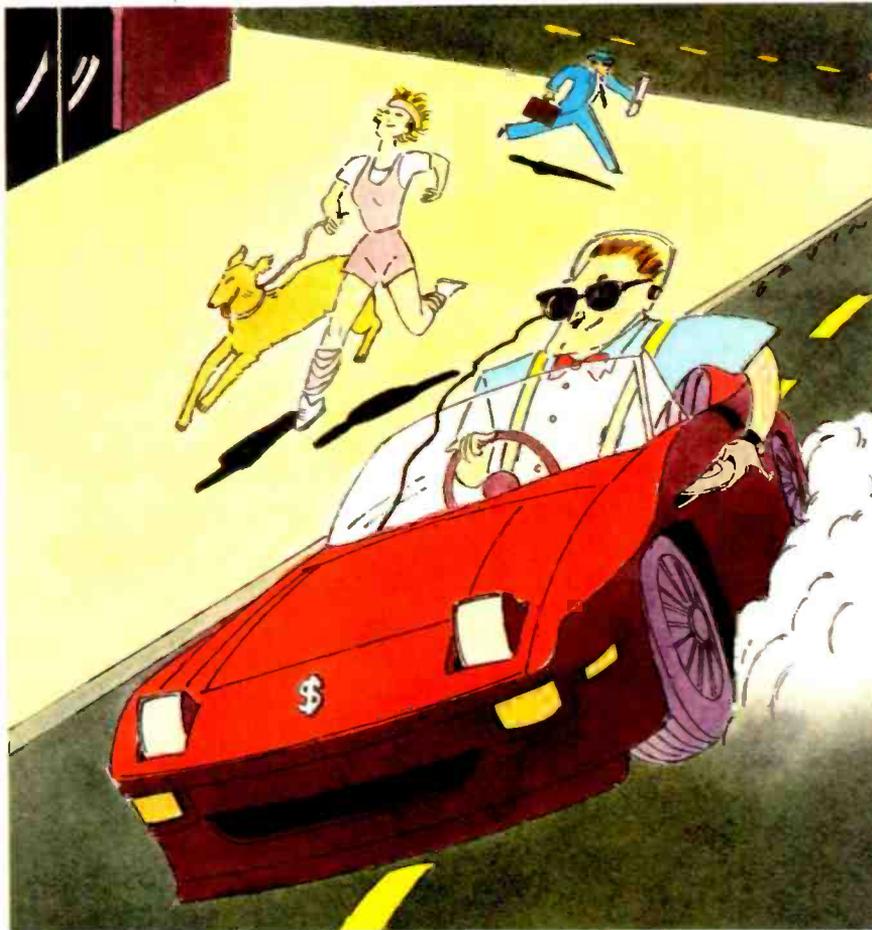


Illustration: Kerry Gavin

**By the '80s, car amp makers were producing truly powerful designs, while speakers could easily rival home types.**

Class-A designs have recently appeared, providing something to talk about, if nothing else. Class-A biasing is designed to eliminate crossover distortion by biasing the output devices to operate in the middle of their linear region so that the entire swing of the musical signal can be handled without turning the devices off. This does eliminate crossover distortion, but at a great cost in efficiency. Imagine needing a 600-watt power supply for a 50-watt/channel amplifier! The necessary large power supplies limit these designs to somewhat lower current, lower power units; they're good trunk heaters, though. The more typical, fully complementary Class-AB designs have essentially eliminated crossover distortion even at the milliwatt level, with efficiencies more in keeping with the

needs of an automotive electrical system.

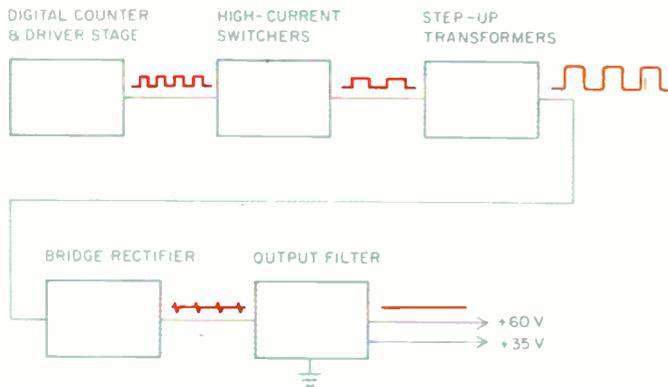
Compact Disc and other digital program material have placed new demands on car hi-fi amplifiers in several critical areas of performance. The first one is dynamic headroom, which returns us again to the power supply. The most sophisticated power-supply design of the early 1980s was the pulse-width-modulated (PWM), fully regulated type. The advantage of this PWM design was its ability to maintain the constant power-supply voltage, regardless of variations in the load current or input voltage caused by the car's electrical system.

The car battery's actual terminal voltage can range from 12 to 16 V. In nonregulated power-supply designs, the power output is directly affected by these input-voltage swings. Car amplifiers are rated at the standard voltage of 14.4 V d.c. At 12 V, PWM-type amplifiers will still deliver rated power, where unregulated amps will deliver less. At 16 V, the PWM design will still be at rated power, while the unregulated design will deliver much more.

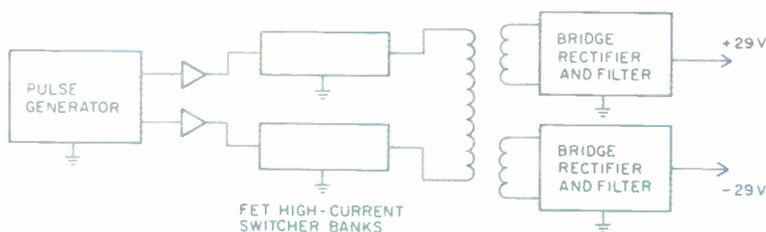
The dynamic-headroom requirements of digitally recorded material tend to favor nonregulated or multi-rail designs. Some amplifier designers have incorporated higher-voltage supplies, specifically to address short-duration transients mimicked by the 20-mS, 1-kHz burst of the IHF dynamic-headroom measurement. Rail-switching designs like these can yield dynamic headroom specs of 3 to 6 dB. A 50-watt amplifier can reproduce a 20-mS burst at 100 watts, or it can even do so at 200 watts if its headroom factor is 6 dB.

A new design employed by a/d/s/, dubbed the "oversize floating rail," uses both an extremely high rail voltage and a high current capacity. The

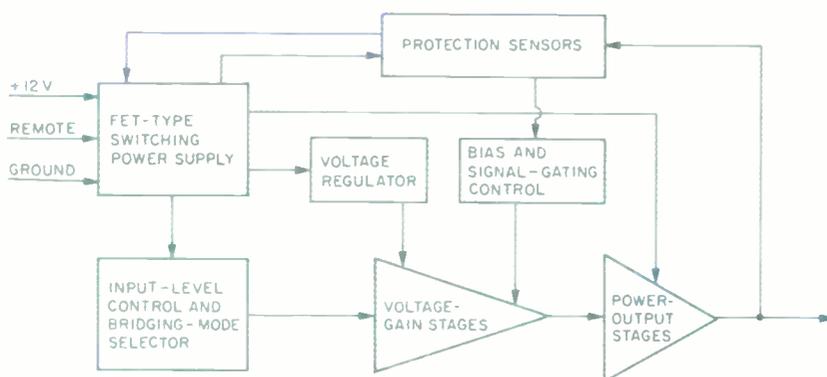
# CAR AMPS



**The switching power supply of the a/d/s/ 2001.**



**A 750-watt FET switching power supply from a modern a/d/s/ amplifier. Using a switching frequency of 33 kHz, it produces positive and negative 29-V current (58 V rail-to-rail) from the car's 12 to 16 V d.c.**



**One channel of a modern, multi-channel power amplifier, with built-in bridging circuits, an FET switching power supply, and protection circuitry. In this a/d/s/ model, the protection circuits control bias and drive to the voltage gain stages, reducing signal input to the power stages when safe operating-area limits are approached.**

supplies are large and unregulated, allowing continuous mid-band amplifier power levels of 2 to 3 dB above rated wide-band power. Under heavy load conditions, the rail voltage is allowed to drop, but rated power plus 8% to 10% is achieved at the 14.4-V d.c. standard input voltage. In this way, the crest factors of digital material have more headroom, and on a continuous basis rather than for 20 ms only. In addition, hard clipping is minimized and specified power levels are better maintained under worst-case load and input voltage conditions.

The wide dynamic range of CDs presents other problems for amplifiers—noise generation and noise immunity. Low-noise op-amps have made the design of input circuits (which are the chief source of internal noise) much easier. Noise figures on the order of 90 dBA relative to 1 watt output are available in some better designs today. Noise immunity is a bigger problem, since the car's electrical system is full of noisy contaminants. High amplifier input impedances and low output impedances for signal source units and processors have helped. Differential input circuitry is also being used by some designers to improve common-mode rejection and noise immunity.

For car hi-fi systems of the next generation, work remains to be done in the areas of systems, packaging, and costs. Today, all the tools are available to build mobile sound systems of any type or size. During the past decade, application experiments have exposed several basic system architectures as the clear performance leaders in terms of musical quality and cost-effectiveness. Systems of two, four, and six channels are the architectures most often installed by custom dealers. The two-channel system with two loudspeakers is identical to the living-room type. The four-channel system, with speakers both front and rear, offers improved ambience, dynamics, and imaging with front-to-rear fading control. The ultimate is certainly the six-channel system, with front and rear satellites plus subwoofers to yield all the bandwidth and dynamics of a home hi-fi under real-world driving conditions.

The goal of future car hi-fi must be to move away from multiple-amplifier installations which may require many days of work and eight or nine components expertly installed and aligned. We must move towards much simpler installation, and the way to achieve this is through multi-channel amplifier

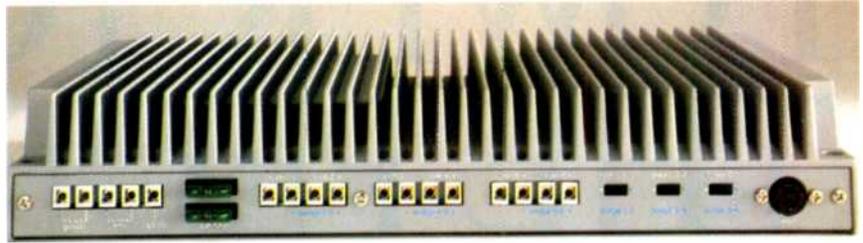
# CAR AMPS

packaging. Many companies already offer four-channel amplifiers, which simplify the popular four-speaker system installations. The first six-channel amplifiers were recently introduced by a/d/s/, and Denon offers a five-channel model. Multi-channel amplifier packaging greatly simplifies installation while reducing costs and space requirements. Performance also is improved: The six-channel system, with its single massive power supply, is ready to respond to any one channel's demands with all that power, instantaneously. Since it would be rare to approach clipping on all six channels simultaneously, especially in a bi-amplified system, large excess power-supply capacity is always on tap.

With key system architectures made simpler and more cost-effective, the next step is compatibility with hi-fi source units of every make and model, even the units installed at the car factories in Europe, Japan, and Detroit. The days of tapping and modifying sources must give way to better methods. Many companies are working to create better compatibility between car hi-fi amplification and speaker systems and the various source units available.

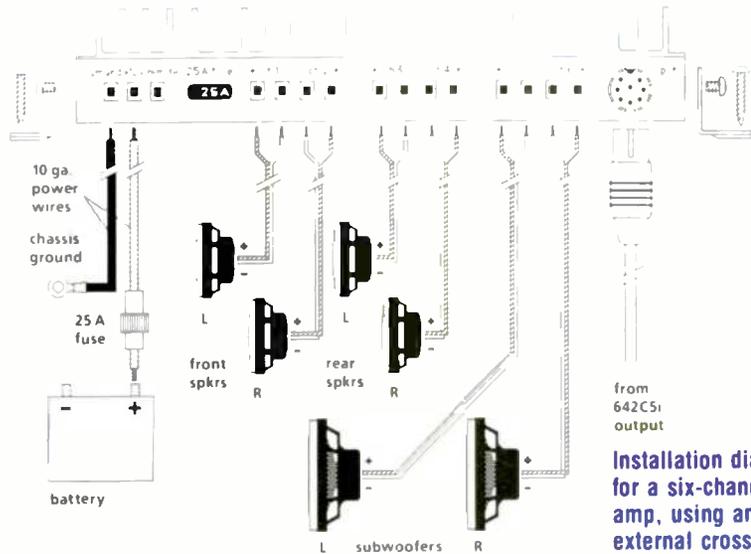
And what about "car wars," the car stereo "tractor pull" events which pit kilowatt car stereos against each other in a "death by decibels" extravaganza? "How much power do I need?" certainly is a good, basic question, but the answer need not be in kilowatts. Very nice systems can be installed using less than 100 watts of home-quality power. Sophisticated loudspeaker systems generally require 20 to 40 watts per channel to achieve levels of 90 to 100 dB, sufficient for comfortable peak output. A six-channel system as small as 120 watts or as large as 720 watts can be simply installed and can offer great fidelity by home hi-fi standards. The goal is not to see how many ways there are "to blow one's mind out in a car," but rather to create the same music in our rolling studio as we enjoy in our living rooms.

While it's true that there is much mediocrity out there, there is also much quality. The great sound systems are easy to differentiate from the rest—you just sit in the car, listen, and if you think "it's wonderful to be here, it's certainly a thrill, I'd like to take this home with me, I'd love to take it home," then you know. A car hi-fi that would sound great in your living room is possible now—and today, we certainly have the power!

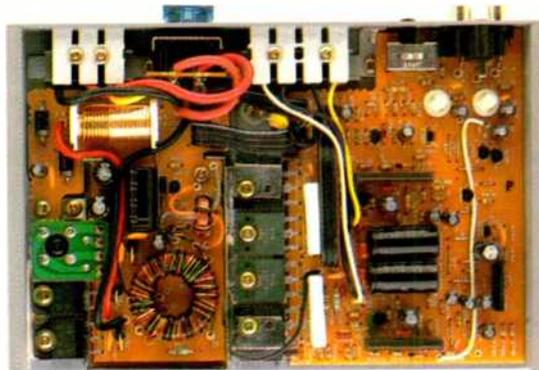


Multi-channel amplifiers, like this a/d/s/ PH15, simplify the installer's job. Note the switches which allow the amp

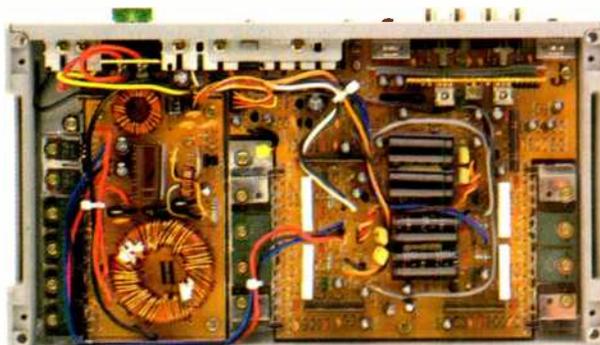
to be bridged from six channels (of 50 watts) to five, four, or three channels.



Installation diagram for a six-channel amp, using an external crossover.



Interior of a modern car stereo amplifier.



Interior of a modern four-channel car amplifier.

# POWER TO THE PEOPLE

**Build this do-it-yourself subwoofer, which can be moved from car to car, and you'll have deep bass *and* room.**

**E**ven after 20 years in the audio business, and 30 years of singing and playing music, I still thrill to the excitement of great music and great sound. But lately, between time spent at work, time spent with my family, and time spent driving back and forth between them, I haven't had much time left for music.

The obvious solution was to listen in the car, where I spend 15 to 20 hours

frequency range as reasonably possible. Its imaging had to be controllable from side to side and from front to rear. Instruments and voices needed to have excellent clarity and detail throughout their range. The equipment had to be inconspicuous, to minimize the risk of theft and maintain the interior cosmetics. The source material would be Compact Disc and FM, and the system would have to incorporate a

**RICHARD A. FRANK**

and cosmetically blend with, the system during the week. But for weekends, the system would have to allow the subwoofer to be disconnected easily and the front and rear speakers to resume handling their full range.

The sound system that came with my Tracer wagon consisted of an in-dash AM/FM/cassette unit with a built-in amplifier and two pairs of single-cone, full-range speakers. The front speakers were mounted in the slanting panel beneath the dashboard, aimed towards the driver's and passenger's feet. The rear speakers flanked the tailgate, just above the cargo floor, and were aimed forward toward a point along the car's centerline. This setup met my cosmetic and practical requirements but not my sonic ones.

## Replacing the Speakers

The full-range speakers were deficient in both bass and treble. The speaker placement made things worse. Highs from the front speakers were directed uselessly at the floor and seats, while highs from the rear were blocked when there was cargo in the back. All of this interfered with imaging as well as frequency response. There wasn't much power to drive the speakers. And I wanted CD, not tape, as my main music source.

Photographs: © 1988, Bill Ashe



alone each week—more than 10 times as many hours as I can spend listening at home. But to make that pleasurable, I needed a better sound system than the one that came with my economy station wagon. After being immersed in great home audio equipment for so long, what would it take to create a high-fidelity car-stereo system that would allow me to focus on just the music?

It did not take long to define the system's objectives—sonic, cosmetic, and practical. Since I'm accustomed to great sound at home, my highway hi-fi needed to have as smooth and wide a

subwoofer to allow for proper deep bass response.

The thought of a separate subwoofer for my 1988 Mercury Tracer station wagon brought my reverie to a screeching halt. Although most of my mileage is solo, my weekend driving is devoted to hauling Cub Scouts, Little Leaguers, lumber, skates, rock salt (I live in New England), and an endless list of other items. That is why I own a small station wagon instead of an exotic sports car.

So my subwoofer had to be removable. It would have to be designed so that it would acoustically cross over to,

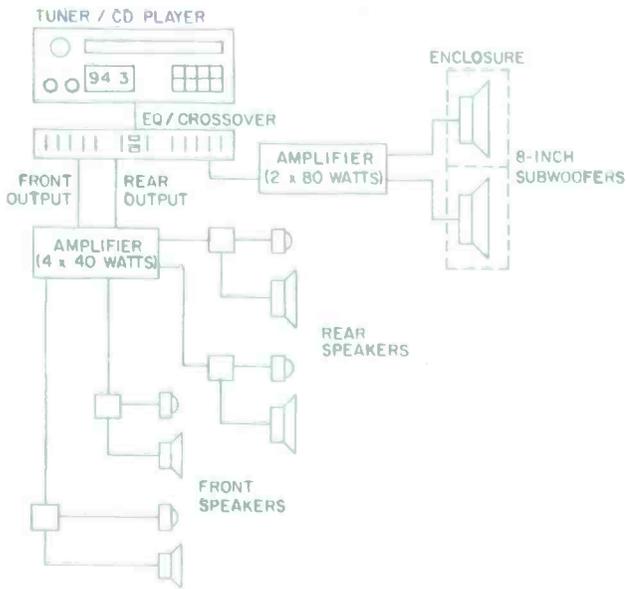
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*Richard A. Frank is Director of Marketing for Boston Acoustics and is a 20-year veteran of the audio industry. He has owned a high-end hi-fi store, been sales and marketing manager for Dahlquist, was sales manager of Carver Corp., has sold advertising space for High Fidelity magazine, and was Sales Manager and, later, Director of Marketing for dbx. Boston Acoustics, in addition to producing speaker systems for the home, is a major supplier of component speakers for car stereo systems.*



Two views of the subwoofer enclosure show that it does not intrude terribly into the cargo space, despite having a fairly large volume. Note the amplifier fins emerging from the enclosure as well as the quick-disconnect plugs. (The shiny diagonal on the floor is a cargo tiedown.) The front tweeters were flush-mounted in the doors, while tweeters for the rear system were hung from the roof, pointing forward toward the passengers.





**Fig. 1—System components.**

To solve the speaker problems, I used component speakers, woofers in the car's original speaker locations to simplify the installation and keep the audio gear inconspicuous, but I put the tweeters where their high-frequency dispersion would be unobstructed. For the rear, I used Boston Acoustics Model 761 speakers; the 6½-inch woofers fit easily in place of the car's original speakers, and provide a much more convincing low end. The Varimount tweeter pods were mounted upside down from the roof, facing forward. Placing the tweeters this high ensures that their sound will not be blocked by normal cargo loads or the heads of passengers in the back seat. The tweeter pods were painted gray, to match the headliner and make them inconspicuous; in their high position,

## Detailing a Subwoofer System

The dimensions and shape of the subwoofer box were mainly derived from the interior measurements of the car, the reclined position of the rear seats, and the need not to block the rear-mounted satellite woofers, as well as from the enclosure-volume requirements of the subwoofer drivers I used. Woofer designs and enclosure requirements vary, so should you build a box like this for yourself, be sure to check with your woofer's manufacturer or your car-audio specialist for design guidelines.

As the perspective view (Fig. B1) shows, the front of the box, slopes up, and the interior is divided in two to isolate the woofers from each other. The amplifier is set into a box at the

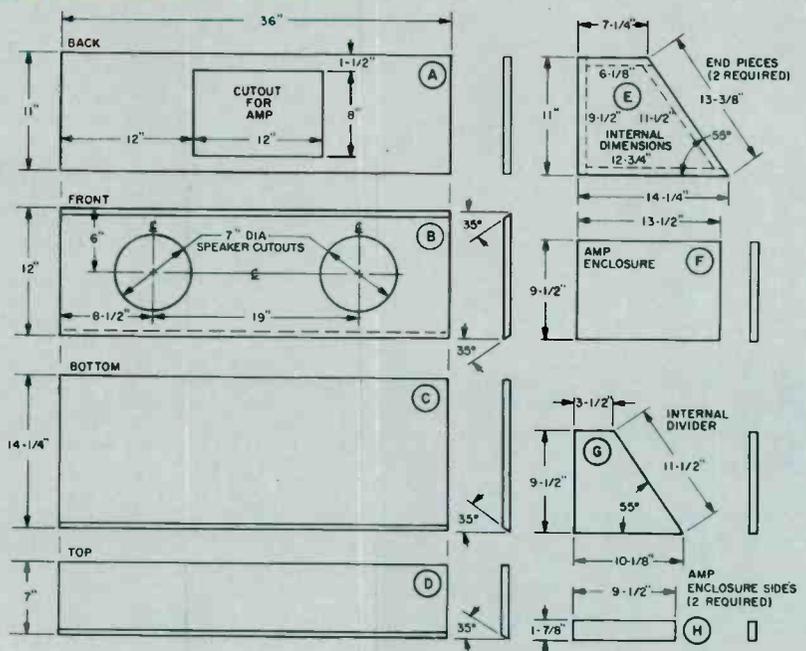
rear of the enclosure, where it is out of harm's way and relatively inconspicuous. In hindsight, I would not enclose the amplifier as completely as I did; it looks and sounds great, but should I need to get at the amp, it would be more difficult than necessary.

The enclosure was built from MD 44

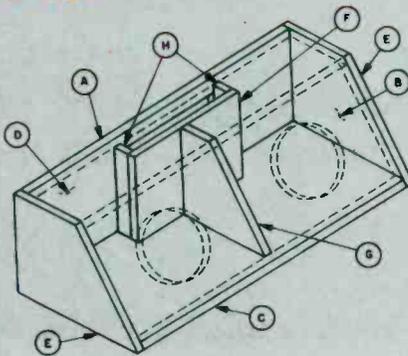
particleboard, a sturdy, dense material that minimizes wall resonances which could otherwise absorb power and lessen bass performance. Once all the pieces (Fig. B2) were cut to size, they were glued and screwed together and then caulked to ensure an airtight enclosure.

Before the box's final assembly, the AI-

**Fig. B2—Plans for the enclosure.**



**Fig. B1—How the enclosure was constructed. Note the cutout and enclosure box for the amplifier; see text.**



# Getting a car stereo system to play louder is more than cranking up the volume control. New amps and speakers are required.

they're hard to see from outside the car, anyway.

For the front, I used Boston Acoustics Model 741 speakers, whose 4-inch midrange/woofers fit the mounting locations of the car's original speakers. The tweeters (which are the same as in the Model 761) were removed from their Varimount housings and mounted flush in the door, high up and far forward. Their smooth, broad dispersion allows for good imaging in that position, and this setup gives me wider, smoother frequency response, with unobstructed high-frequency dispersion for better clarity and detail. Again, the tweeter grilles were painted gray to blend into the car's interior.

I had planned from the beginning to add a subwoofer. Small speakers, without acoustically designed enclo-

tures, can give pretty good bass response (the 741s are specified as flat, within  $\pm 3$  dB, down to 85 Hz and the 761s down to 48 Hz). However, only with a subwoofer can you get sufficient low bass to overcome a car's low-frequency noise and to realize accurate, musical bass response.

In a sedan, subwoofers can often be mounted in the parcel shelf just behind the rear seats, with the trunk cavity used as an infinite-baffle enclosure. In a station wagon, of course, there's no such shelf, so a removable enclosure had to be designed and built. The Boston Acoustics Model 780LF 8-inch subwoofers I used were designed for infinite-baffle installation, but they can also perform well in acoustic-suspension systems having internal volumes of as little as 0.75 cubic feet. As the

volume of the box is made larger, some deepening of bass response occurs, although whether this additional low bass is noticeable in the real world depends on the vehicle and the listener. I wanted to maximize sound quality while minimizing the size of the enclosure; the final design provides approximately 0.84 cubic feet for each subwoofer. (See sidebar below for details on the enclosure's design and construction.)

## Replacing the Electronics

To get the best sound from my new speakers required more power than the Tracer's head unit could provide. To simplify installation, I decided to use a four-channel amplifier, the Alpine 3530, which had been recommended to me as sounding clean, while being reliable and cool-running. It is an attractive, compact package that fits well under the passenger seat and still leaves room for the storage drawer beneath that seat to move freely.

The 3530 is rated at 40 watts per channel for 0.08% THD, from 20 Hz to 20 kHz, into 4 ohms. This is close to the 50-watt maximum recommended power for the Model 761 rear speakers. However, it is double the 20-watt maximum recommended for the Model 741 front speakers. This did not bother me, for two reasons: I feel Boston's maximum power ratings are very conservative, and I never listen at the ear-splattering levels that draw high power levels from the amp.

To power the subwoofers, I used an Alpine 3537 amplifier. This amp delivers 80 watts per channel, very close to the 75 watts recommended as maximum for the Model 780LF.

The crossover to the woofer amps is handled by an Alpine 3312, which also provides independent five-band equalization for the front and rear speaker systems. This worked better for my system than a dedicated crossover would, because the 3312 has a subwoofer on/off switch on its front panel. When the switch is on, frequencies below 120 Hz are fed to the subwoofer amp, and only frequencies above that point are fed to the rear speakers. When I remove the subwoofer, I turn the switch off; the rear speaker systems then operate full-range.

For my head unit, I chose the Alpine 7902 tuner/CD player because of its good reputation for sound quality and

pine 3537 amp was installed in the upright rear panel of the enclosure. The amp's fuses were moved to fuse-holders which were set into the box, for easy access. Power and signal connections were routed to AMP quick-disconnect plugs so that the subwoofer box could be quickly removed and full use of the cargo area be made available. To be a press fit, the hole was cut to the exact dimensions of the amp (the hole dimensions shown on the plans are only approximate). Small rubber feet were placed between the amp's mounting flange and the panel to keep it from working its way forward or rattling.

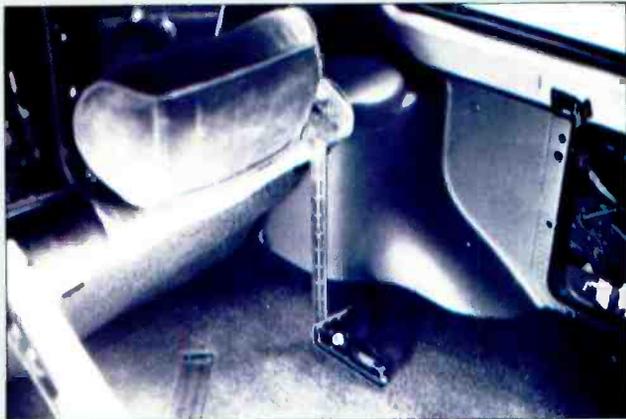
It was simplest to assemble the top, bottom, and two end pieces first, and then the rear panel with the amplifier. Once that panel was glued, screwed and caulked in place, the amp enclosure sides and back, and the center divider, were mounted in the same way. With the speaker leads protruding into the enclosure, the angled side, with the holes cut for the subwoofer

drivers, was attached, completing the enclosure.

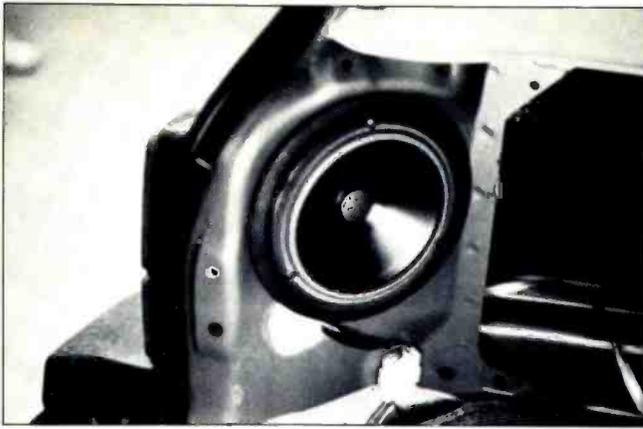
The enclosure was wrapped with carpet that matched the car's interior, for both cosmetic and security reasons. Once carpeted, the speaker holes were cut through the carpet, the leads were attached to the drivers, damping material (in this case, Dacron) was inserted, and the drivers were installed. After the grilles and handles were added, the removable subwoofer was ready to rock and roll.

At the moment, the enclosure is held in place by large patches of Velcro on the floor, which engage the rug. However, Ivan Berger has suggested that I have small, flat metal loops welded to the floor of the wagon bed, just in front of and behind the woofer position, and that hold-down straps be threaded through the loops. This would lessen the chance of the enclosure flying loose in an accident and would give me a useful tiedown for weekend cargo.

R.A.F.



Measuring the rear seat to determine the enclosure height and angle.



**The car's rear speakers were replaced by 6½-inch woofers.**



**The dashboard radio slot was gradually enlarged to be a snug fit for the new Alpine electronics.**



**A custom-cut plastic trim piece gave the installation an original-equipment look.**



**Wires were wrapped and tied down so that they would not buzz or rattle.**

shock resistance while playing. Unlike most such combinations, it all fits on one chassis, making it easier to install.

Luckily, the dashboard panel which held the Tracer's original head unit had enough space for both the new head unit and equalizer/crossover. Installing the two units on that panel was therefore possible, but not easy. First, the dash had to be partially disassembled, and this panel (which also holds the cigarette lighter, ashtray, and a few controls) removed. The two Alpine units were then bracketed together, and the panel's radio opening was carefully enlarged to fit them. This took a number of test fittings before the hole was the right size. A trim piece was cut from plastic, to complete the factory-installed look.

#### **Connections**

As you might guess from the diagram (Fig. 1), there's a fair amount of wiring in my system. Phoenix Gold speaker cables replaced the Tracer's original speaking wiring, and Monster Cable interconnect cables were used between the head unit, equalizer, and amplifiers. All wires were wrapped together at 6-inch intervals with wire ties, and this "snake" was then securely fastened in place, to eliminate any potential buzzes or rattles. Additionally, care was taken to route the wires so that they would not be unduly pinched, stretched, or even melted.

The 12-V power connections were routed through the firewall and connected to two automatic-reset circuit breakers. These circuit breakers were installed at the battery for protection against fire or excessive battery drain due to shorts or other problems in the sound system's circuits. Power cables were routed on the opposite side of the car from the signal leads, to prevent noise pickup. During all installation work, the hot lead on the battery was disconnected for safety.

#### **Sonic Rewards**

How good are the results? They're good enough that I've been known to pass right by the audio system in my living room and go out to the car for an hour's listening—a trip to nowhere, at 105 dB SPL—especially after the kids have been tucked in. And my 12-year-old daughter and 9-year-old son have been known to borrow the car keys for

# Truly deep bass is possible in a car if you use a subwoofer. With this removable design, the loss of space isn't permanent.

**Table I—Equalizer settings, as determined by spectrum analyzer and revised by ear.**

	Analyzer Settings		Revised Settings	
	Front	Rear	Front	Rear
<b>35 Hz</b>	-12	-1	-12	+1
<b>180 Hz</b>	+6	-12	+2	-6
<b>750 Hz</b>	-6	+4	-2	+2
<b>3.5 kHz</b>	+3	+11	+1	+4
<b>12 kHz</b>	-2	+5	0	+2

a Saturday morning listening session. This lets them get their morning juices flowing with The Beach Boys' "Surfin' U.S.A.," while I get another hour's sleep.

Even without using the equalizer, the sound was so good that the drive from Boston to New York seemed shorter than ever before. There was enough bass to shiver my stomach, when the music called for it. But overall frequency response was still not as smooth and balanced as I wanted—not unexpected, considering where I'd had to put some of the drivers. Ivan Berger, *Audio's* Technical Editor, gave the system a quick check with an Audio Control SA-3050A third-octave spectrum analyzer. There was time for only a single-point measurement, rather than the far more accurate method of averaging results from several points. Still, the results seemed to correspond well with the problems we were hearing. The front speakers, for example, had a broad dip from about 125 to 315 Hz, a peak at 500 Hz, and another broad dip from 1.6 to 5 kHz, followed by a roll-off from 8 to 12 kHz.

There's no law that says an equalizer must be set flat—otherwise, why buy one in the first place? So, using the analyzer as a guide, Ivan set my equalizer for flatter response. The result was an improvement, but still not quite right. My equalizer's filters were not centered on the same frequencies as the sound's peaks and dips, and Ivan's recommended settings were made for flat response in a stationary car, without taking road noise into account. On the trip home to Boston, I modified his settings by ear for the best sound.

Basically, I followed the curve Ivan suggested but made its settings less extreme. I kept his sharp, low-bass cut for the front speakers, so the small front woofers would not overload, but I

cut back on his 180-Hz boost, to make the sound mellower and smoother. In the rear, I found that, after his cuts, bass disappeared into the road noise as soon as the car got moving, so I changed his slight 35-Hz cut to a slight boost and tamed his 180-Hz cut. In the midrange, I raised the level at 750 Hz in the front, for a fuller, richer sound, but cut it in the back to keep the sound balanced after I cut the top end. At 3.5 kHz, I reduced level slightly in the front, to keep the sound from getting a bit too bright on peaks, and cut it sharply in the back, where I found Ivan's original boost sounded unnaturally "hot" for sounds coming from the rear. At 12 kHz, I had to remove Ivan's cut in the front, because wind noise tended to mask that frequency range once I got rolling. In the rear, I brought the EQ down a bit so that cymbal crashes wouldn't make me wince from excess treble. Both Ivan's suggestions and my revised settings are shown in Table I.

I was surprised to learn that the subwoofer crossover was only hooked in with the rear channels of the Alpine 3312. As a result, when I set the 3312's fader towards the front, I lost response from the subwoofer. Also, the crossover keeps bass frequencies out of the rear speakers but not the front ones, even though the rear speakers can handle those frequencies better than the front ones can. Even so, I noticed

that the sound got smoother and cleaner when the subwoofer was switched in, because the rear speakers no longer had to work as hard. I tried switching the connections, but they were wired in too securely. However, making the switch might cause a new problem: My 120-Hz crossover setting might be high enough to make the split between bass from the rear and midrange/treble from the front too apparent.

The installation was done by the Tweeter Etc. store in Seekonk, Mass. Yes, you can save money by doing it yourself. However, be advised: While professional installation may seem expensive, properly installing a system like this requires serious effort. Some tasks are easier than others for the do-it-yourselfer; some I wouldn't dream of doing. And when an installer really cares about his work, it's hard to put any price on it. Steve Medeiros, Scott Harris, and Jim Walker at Tweeter Etc. did an excellent job and taught me a lot. Hopefully, with their help, some of *Audio's* readers will add many hours of listening enjoyment on the road to their home audio pursuits.

My car system is not inexpensive, as the breakdown of costs in Table II shows. Neither is my home audio system. But I get more out of my car system, because I get the chance to use it more. I should have travelled this route sooner. ▲

**Table II—System components and approximate costs.**

	Equipment & Materials	Installation & Labor
<b>Alpine 7902 tuner/CD player</b>	\$ 850	\$ 45
<b>Alpine 3312 EQ/crossover</b>	280	45
<b>Alpine 3530 amplifier</b>	430	45
<b>Alpine 3537 amplifier</b>	470	75
<b>Boston Acoustics speakers</b>		
<b>Model 741 (two front)</b>	220	130
<b>Model 761 (two rear)</b>	240	75
<b>Model 780LF subwoofers (two)</b>	120	275
<b>MD 44 particleboard, 3/4 inch</b>	36	
<b>AMP connectors</b>	80	
<b>Carpeting, 2 yards</b>	34	40
<b>Ampersand DIN-to-RCA adaptor</b>	27	
<b>Grilles, handles &amp; hardware</b>	73	
<b>Phoenix Gold speaker cables &amp; Monster Cable interconnects</b>	305	90
	<u>\$3,165</u>	<u>\$820</u>
<b>Total: \$3,985</b>		

# 1

## FORD PREMIUM CAR STEREO

### Manufacturer's Specifications:

None available.

**Price:** Ford Premium sound system included in base price of Lincoln Continental and other cars; Ford JBL option (Continental only), \$506; CD player, \$600.



Normally, buyers of factory-installed car stereo equipment have to take its performance on faith. The car manufacturers publish no specifications, and reviewers never receive factory-installed stereo systems for independent testing. Recently, however, Ford sent us its Premium head unit for review. This FM/AM/cassette unit is part of the Premium sound systems in several Ford, Mercury, and Lincoln models, and in the Ford JBL system offered as an option on the Continental. Ford also supplied a Continental equipped with the Ford JBL system and optional CD player for road testing by Technical Editor Ivan Berger. The conclusions he reached from that enviable task appear after my purely technical lab report.

Though I was able to test only the head unit, let me start by describing the sound systems in which it operates. The Premium sound system consists of the head unit I tested, a four-channel amplifier rated at 20 watts per channel, and six speaker drivers (two 3-inch tweeters in the dash, two 5¼-inch midrange drivers in the doors, and two 6-inch by 9-inch drivers in the rear deck). For an additional \$506, Continental owners can move up to the Ford JBL system, designed in an effort to overcome the common perception that factory-supplied car stereo systems are never hi-fi. A Sony-built CD player is also available for installation in the Continental, for \$600. The Ford JBL system's four-channel amplifier is rated at 35 watts per channel. That amplifier also has fixed equalization, custom-matched to the acoustics of the particular car model. The equalization also includes bass boost to overcome road noise, so the extra power per channel is probably needed. The Ford JBL system in the Continental has four more drivers than the Premium system, but two fewer speaker locations. The dashboard tweeters are removed, and the speakers in the doors are replaced by two-way coaxials. According to Ford, having all the front-channel sound coming from the same place improves imaging. In the rear, the single-cone woofers are replaced with three-way systems for improved response and dispersion.

Ford calls the Premium head unit "listener friendly," and I have to agree with that assessment. Controls are softly illuminated, creating a sort of halo effect. The bass, treble, balance, and front/rear fader controls can be conveniently recessed, just about flush with the panel, once they are adjusted. To readjust, one simply pushes the appropriate knob and it pops out again for easy access.

The tuner section has automatic signal-seeking, with one-way scan and two-way seek functions and a switchable local/distant sensitivity control. The volume control is ideally designed for the driver's use, consisting of a small, lever-like rocker switch with two concave indentations, one above the other. Press down from the top to lower listening levels; press up from beneath, and volume is increased.

Six numbered soft-touch buttons are used to store up to 6 AM and 12 FM stations. The FM stations are accessed by selecting an "FM1" or an "FM2" band, using a button that also switches between AM and FM reception. Switchable Dynamic Noise Reduction (DNR) is available on both the AM and FM bands.

The soft-touch cassette section is electronically controlled, with motorized cassette ejection, auto-reverse, seek and scan functions, and automatic tape-type equalization.

When the cassette player is in use, Dolby B noise reduction can be switched in and out.

The Compact Disc player supplied by Sony and available as an option in the Ford JBL system is not unlike that company's own CDX-5 car CD player. It has a mechanism that makes loading a disc virtually fumble-proof: You insert the disc partway, and the loading mechanism draws it in the rest of the way, seating it properly on the rotating spindle inside the player. A small display area shows track number or elapsed time. The player is equipped with Automatic Music Search (AMS) for quick access to any track, as well as high-speed audible scanning at 10 times the normal playing speed. Repeat play of the entire disc or of the current track has also been incorporated. Additionally, you can return to the beginning of the disc at the touch of a single button. Discs can be ejected at any time by means of an eject button; the disc is then partially ejected, just enough so you can grasp it and remove it from the disc slot. If the disc is not removed from the slot within 15 S it is automatically reloaded and stored within the player. Once a disc is inserted, the slot locks to prevent accidental insertion of a second disc.

Perhaps one of the most important and uncommon circuit features of this car CD player is its compression control. Having now had some experience listening to CDs in automobiles, I am firmly convinced that there is no volume level at which you can enjoy all the dynamics of a wide-range CD while travelling along a highway. If you adjust the volume control so that soft passages can be heard above road and wind noise, loud passages will reach you at jarringly high levels. If you reduce the level of these passages to a comfortable range, the next quiet passages will disappear into the noise. An effective compressor circuit is, therefore, a must for car CD players, but few such players have one.

The four-channel amplifier that comes with the Ford JBL system was jointly engineered and developed by Ford and JBL, Inc. It is actually made up of two separate units (for the right and left channels) in the front and the rear of the car. As I've mentioned, this amplifier incorporates custom equalization for the car it's sold with. Another key feature is its "Excursion Control Computer," which backs off on the bass boost when listening at very high levels to prevent low-frequency overload and consequent distortion.

The amplifier has no operating controls and the user therefore need not have access to it during normal operation. Connection to the amplifier is made by means of cable harnesses which are normally built into the car during assembly, and which use special multi-pin plugs totally unlike the RCA and DIN plugs used by independent car stereo makers. One plug handles power input and speaker output connections; the other, at the opposite end of the same chassis panel, accepts audio signal inputs from the radio chassis via another portion of the cable harness.

The DIN-sized front panel of the AM/FM/cassette head unit has the previously described "Volume" control button at its upper left, the area closest to the driver. Below this up/down rocker are smaller rocker switches for the "Seek" and manual tuning functions. A "Power" on/off button is located at the bottom of this row. To the right of the volume button, above the small display area, are "Scan," "Band," and

# Amazing.



## *How it works.*

### *A brief conversation with Bob Carver.*

*Q. How can The Amazing Loudspeaker put out so much powerful, extended bass?*

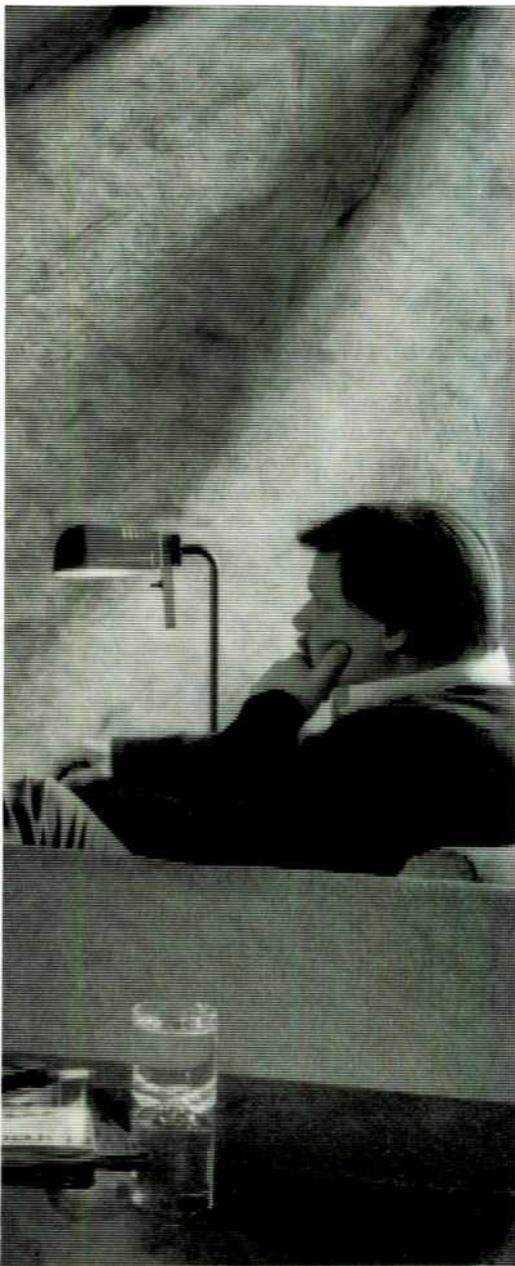
*A. Brute force. A total of 8 subwoofers, each with 4 times the excursion of regular bass drivers for a total displacement (area times excursion) of almost 2000 cubic inches. The low frequency 3dB point is 18Hz!*

*Q. Why use a ribbon driver?*

*A. Because the sound of a ribbon is nothing short of glorious! Free of individual driver anomalies and crossover problems, the Amazing Loudspeaker's extended line source driver delivers a majestic sonic image that literally floats in 3-dimensional acoustic space. Simultaneously, it reproduces an amazing amount of musical detail that's simply unmatched by any point source driver.*

POWERFUL

Distributed in Canada by evolution  
technology



*This is not a typical speaker ad. Because The Amazing Loudspeaker is anything but a typical speaker.*

This isn't even a typical *Carver* ad.

True, the Amazing Loudspeaker breaks so many conventional speaker rules — and succeeds so spectacularly at it — that we're tempted to fill this ad with a litany of hertz, watts and exotic buzz words the way our competitors' ads do.

*"Its overall sound is spectacular, its bass performance surpasses that of almost any other speaker one might name."*

STEREO REVIEW

Because there's bound to be quite a story behind a speaker that's 5½ feet tall and yet just 1½ inches thick. Especially when Bob Carver has a hand (or rather two hands, both feet and a year or so of lab time) in its creation.

But ingenious design is only our means to an end. The beginning of a dramatic awakening that will re-define for you the very essence of music.

*"The image is as wide, deep and multi-layered as I have ever heard. Only Infinity's \$35,000 Reference Standard impressed me more."*

Henry Hood  
Hi Fidelity Editor  
HOUSTON POST

The Amazing Loudspeaker can etch a sonic image so detailed you can almost see rosin drift from a bow onto the polished surface of a violin.

It can brighten your listening room with the sheen of a #4 drumstick on a Ziljan hi-hat cymbal. Or darken it with the smokey midnight growl of a battered baritone sax.

*"It solves certain design problems and achieves certain sonic results with a simplicity and flair that can only be called, well, amazing."*

Peter Wozel  
THE AUDIO CRITIC

It can stun your senses and rearrange your furniture with thunderous salvos of tight, perfectly controlled low bass.

It can meticulously separate every instrument and vocal on a dense, multi-track mix and project each in sharp relief at precise points across the sound field.

In short, the Carver Amazing Loudspeaker restores what time and reading too many speaker ads often takes away.

Sheer wonder.

*"It's price is ridiculously low for what it does and... what comparable products cost."*

Julius Hirsch  
STEREO REVIEW

We have merely touched on the highlights of this truly amazing loudspeaker. We'd be happy to send you more information, including reprints of several great reviews.

However, if your immediate interest is the sensation of a listening room melting away to reveal the crystalline clarity of pure music, you need only visit your nearest Carver dealer.

Your amazement will begin when you discover just how affordable the Carver Amazing Loudspeaker really is.

**CARVER**

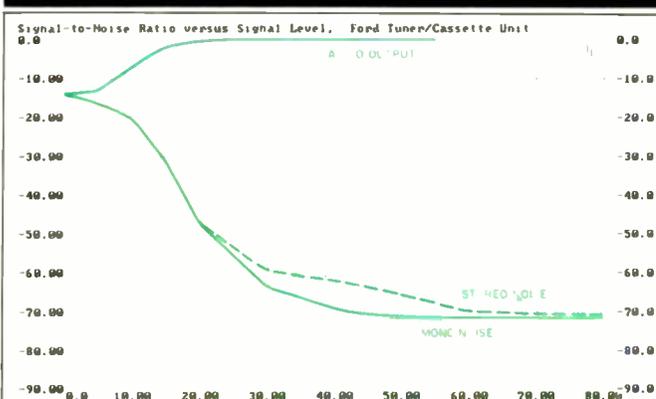
ACCURATE

MUSICAL

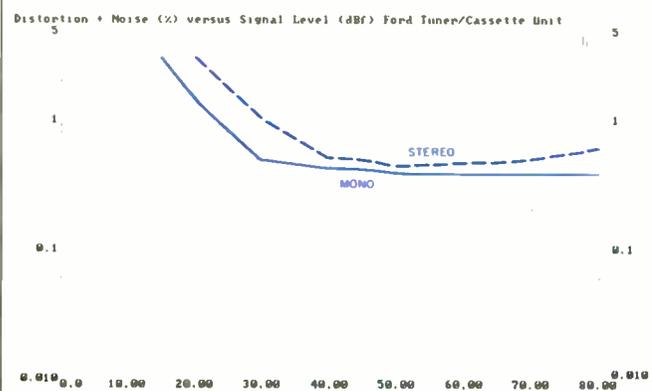
*Q. But aren't ribbon drivers inefficient?*

*A. Not when designed with enough magnetic field strength. Each Amazing Loudspeaker ribbon uses 30 feet of high energy magnets in a special focused field gap. At 82dB efficiency, that's almost twice as efficient as any other ribbon that goes down to 100Hz. Our M 1.01 power amplifier yields peak SPLs exceeding 106dB; up to 110dB with an M-1.5! More than ample to deliver a symphonic orchestra's sonic power, fifth row center.*

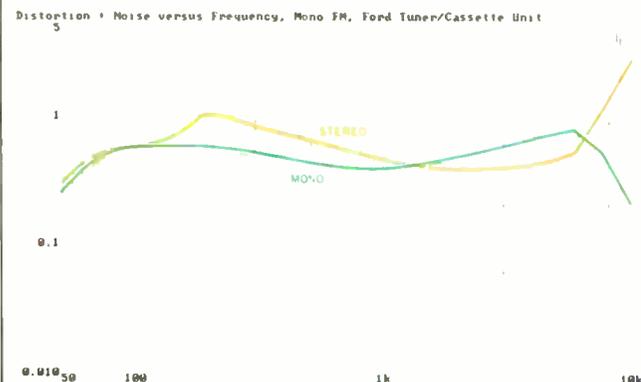
Ford calls the Premium head unit "user friendly," and I have to agree with that assessment.



**Fig. 1—Mono and stereo quieting characteristics, FM section.**



**Fig. 2—Mono and stereo distortion characteristics at 1 kHz, FM section.**



**Fig. 3—Mono and stereo harmonic distortion vs. modulating frequency, FM section.**

"Loc" (local/distant) buttons. The display area shows frequency of the AM or FM station to which you are tuned. When the CD player is being used, the display lights up with the letters "CD," and when a cassette is inserted the display shows the word "Tape." Pressing the "Band" button sequentially switches the set from FM1 (for accessing the first six possible FM station presets) to FM2 (for an additional six FM presets) to AM and then back to FM1, with the display indicating the band chosen. Of course, manual tuning over the entire FM band can be done with either the FM1 or FM2 display showing.

The six buttons used to set and recall presets are arranged below the display area. To their right are small rotary "Bass," "Treble," "Balance," and "Fade" controls, and above them is the cassette slot. Cassettes are inserted sideways, short end first. At the extreme right side of the panel are the rewind and fast-forward buttons, the "Eject" button, the "Play" button (which also is used to reverse tape direction), and a noise-reduction button that activates Dolby B NR in the tape play mode and DNR (Dynamic Noise Reduction) in the radio mode.

The front panel of the CD player matches that of the head unit in its dimensions, its black color, and its intelligent, ergonomic layout. The disc-insertion slot occupies almost the entire width of the panel, with an eject button immediately to its right. A small display area is just below the slot. All operating pushbuttons are arranged along the lower edge of the panel. These include a "Repeat" button, the compressor button, a "Display" button that switches the display between selection-number and elapsed-time modes, a "Replay" button, a rocker switch for audible fast scanning, the forward and reverse "AMS" buttons, and a larger, easily identified "Play/Pause" button. I was rather amused by the nomenclature associated with the fast-scan rocker switch: It reads "REW" and "FF." Force of habit, I guess, from so many years of applying those designations to car cassette players!

### Tuner Measurements

Figure 1 shows the quieting characteristics of the FM tuner section as a function of input signal strength. Mono usable sensitivity measured 15 dBm, and the 50-dB quieting point in mono was reached at 21 dBm. Maximum S/N for strong-signal mono reception was 72 dB, rather good for a car tuner. Even more impressive was the stereo S/N at strong signal levels: It was 71 dB, only 1 dB poorer than in mono. As is true of most car stereo FM tuners, this one gradually blends to mono as signals become weaker. That accounts for the overlap of the mono and stereo noise curves below about 20 dBm. At or below that signal level, reception is fully monophonic, even if a stereo signal is being broadcast.

Figure 2 shows how THD + N varied with FM signal strength. The audio signal modulating the carrier was at 1 kHz. For mono reception, THD + N at strong signal levels (65 dBm) was 0.37%, and in stereo, THD + N was 0.47%, only marginally higher.

In mono, THD + N remained well below 1% at all significant audio frequencies. In stereo, THD + N reached the 1% level for a 200-Hz modulating signal but remained well below that level at 6 kHz (the highest frequency at which FM

# One Button, One Smart System



With one button, select a music source on your Revox Wireless Remote Control from any component in your Revox audio system . . . CD, for instance.

Press the "CD" button, and the Revox Timer Controller turns on all the required components. Your Revox B226 Compact Disc player fills the room with music.

Now, jump from one music source to another—CD to turntable. The Revox B203/205 Control System shuts down one source and changes over to the new one for you.

*One button, one finger. It's that easy.*

And smart? Try this . . . tell the B203/205 that you want to wake up to a classical music station at 7 each morning, Monday through Friday. Tell it to shut off your system at 8. Then tell it to wake you to a favorite CD on Saturday.

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Civilized, solid, smart. Like all Revox equipment, the B203/205 Control System is built to exacting Swiss standards of excellence. Try it, at your audio specialist in the USA. For information, call or write Studer Revox America, Inc.

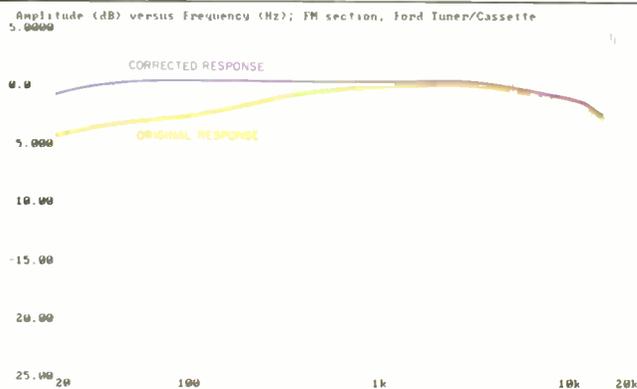


B203 Timer Controller and B205 Wireless Remote Control

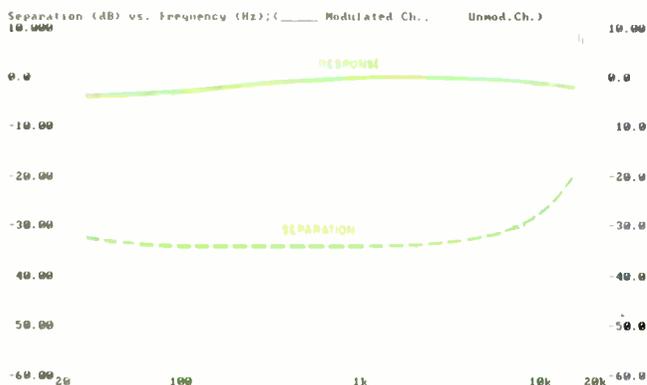
**STUDER REVOX**

1425 Elm Hill Pike, Nashville, Tennessee 37210  
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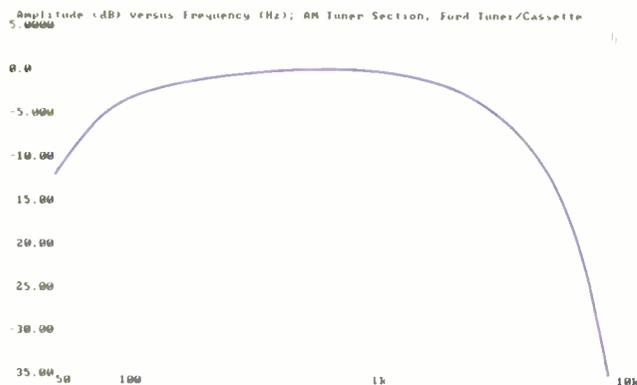
In FM, stereo separation was better than what I usually measure for car units and was uniform across the audio range.



**Fig. 4—Frequency response before and after adjustment of bass control (see text).**



**Fig. 5—FM frequency response (top curve) and separation for strong signals (bottom).**



**Fig. 6—AM frequency response.**

THD is relevant), with a reading of only 0.52%. These results are shown in Fig. 3. Capture ratio was 2.0 dB.

Figure 4 presents two plots of frequency response for the FM tuner section. At 15 kHz (the highest frequency broadcast by an FM station), response was down 2.5 dB. However, at 30 Hz, response was off by 3.5 dB. I carefully checked to make sure that the bass control had not been accidentally turned slightly counterclockwise from its center position. It hadn't been. It's possible that Ford's engineers purposely built in this gentle roll-off at the bass end as a further protection against woofer overload. In any case, I wanted to see how much bass boost it would take to correct the slight bass attenuation. I found that about a 10° clockwise rotation of the control past its center detent was all that was required. The corrected response curve of Fig. 4 shows the results.

Separation at 1 kHz measured 33 dB for strong stereo FM signals. At 100 Hz it was almost as great, and at 10 kHz it decreased to a still perfectly acceptable 27.5 dB. Figure 5 shows how nearly uniform separation is maintained over most of the FM audio frequency range. These are better separation characteristics than I have measured on a great many car stereo FM tuners and receivers. Of course, at weaker signal levels separation decreases, owing to the blend circuits used to reduce background noise.

The tuner's AM frequency response, plotted in Fig. 6, is about what I have come to expect from most home and mobile tuners and receivers. I am told that the AM section in this unit is capable of receiving and decoding Motorola (C-Quam) AM stereo broadcasts, but I will leave it up to Ivan Berger to comment on how good he thought the AM stereo reception was.

### Cassette Player Measurements

Using my standard IEC Type I and Type II reference tapes, I plotted the frequency response of the head unit's tape player section. These reference tapes are recorded at a -20 dB level relative to 250 nWb/m and so, in the curves of Fig. 7, I have normalized results to -20 dB. Response for the Type I was down -3 dB at 31.5 Hz (the lowest test tone on my reference test tape) and at 7 kHz. Response for the Type II tape was just as good at the bass end but was down -3 dB at 5.5 kHz. From the looks of both curves, I suspect that the high-frequency roll-off was caused more by slight azimuth misalignment than by any fault in equalization or other electronic components of the tape player circuitry.

Figure 8 is a spectrum analysis of residual tape noise with and without noise reduction, using a 1/3-octave band-pass tracking filter in my Audio Precision test equipment. Note that the improvement from noise reduction begins at 700 Hz, and that in the vicinity of 10 kHz the improvement is almost precisely the 10 dB predicted by Dolby. To measure overall S/N, I used a high-quality Type I tape recorded with a bias signal but with no audio signal; I obtained A-weighted S/N readings of 57 dB without Dolby NR and 66.7 dB with NR. Results are referenced to a 0-dB level corresponding to 250 nWb/m. Certainly these are excellent S/N figures for any cassette player. Average wow and flutter, plotted over a period of close to 30 s (Fig. 9), hovered around the 0.25% mark, which was a bit disappointing.



Exactly how easy is the Revox B203/205 Control System . . . ?

Press the "CD" button on the B205 Wireless Remote Control. The B203 Timer Controller turns on all the required components, and your Revox B226 Compact Disc player fills the room with music.

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**B203 Timer Controller and B205 Wireless Remote Control**

Why is it so easy? Because the B203/205 is so smart. Test its memory . . . tell it that you want to

wake up to a favorite CD on Saturday at 8 AM and a classical music station at 9 on Sunday. Then tell it to play an album at 5:30 Monday evening, just as you walk in the door.

The B203/205 does it all for you. But it will do much more too.

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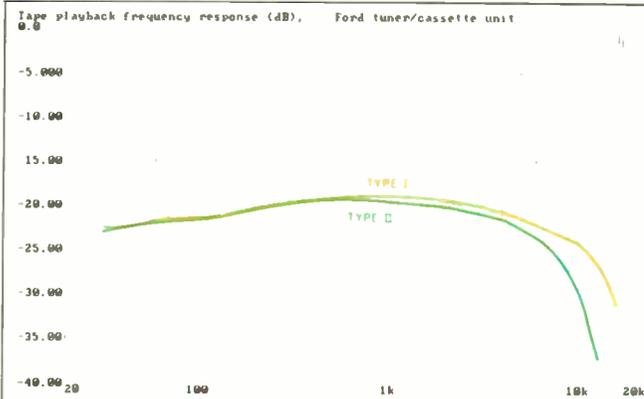
There's absolutely nothing like it.

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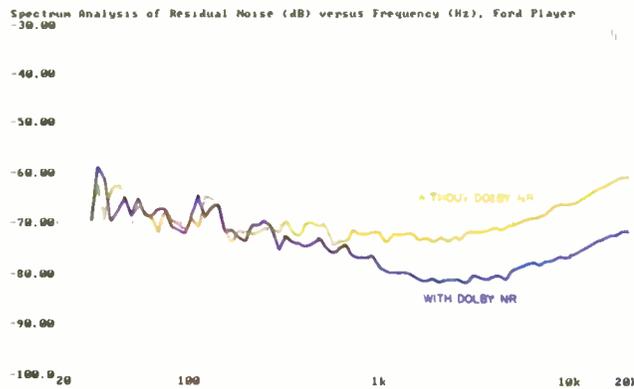
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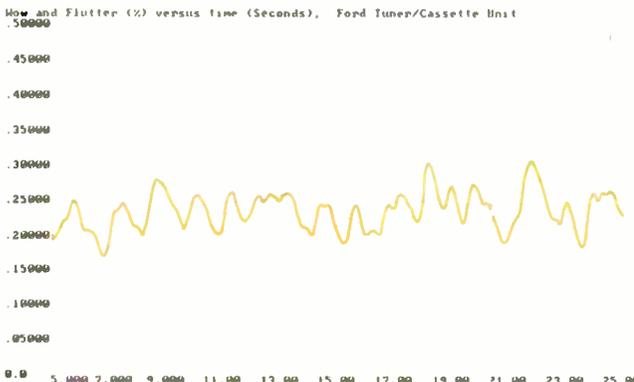
In the cassette section,  
I got S/N readings of  
57 dB without Dolby NR  
and 66.7 dB with NR,  
certainly excellent results.



**Fig. 7—Frequency response, tape section, for Type I and Type II tapes.**



**Fig. 8—S/N analysis, tape section, with and without Dolby B NR.**



**Fig. 9—Wow and flutter, tape section.**

Figure 10 shows that the unit's tone controls provide full boost and cut, like those on good home components and aftermarket car receivers. They are not the simple bass-cut or treble-cut types found on some of the lesser factory-installed car audio equipment.

At least in this high-end head unit, Ford has truly come up with "a better idea," as their commercials used to claim. And now, over to you, Ivan: Release the hand brake and let's take off!

*Leonard Feldman*

### Behind the Wheel

Ford is very proud of the human engineering in this head unit, and they have a right to be. For one thing, it's got one of the most intelligent control layouts I've yet seen or felt.

Since the volume control is the one that's used most often, Ford made it the most accessible, by placing it nearest the driver and having it jut out farther from the panel than the other controls do. Its up/down paddle design is logical and unique among this unit's controls. Volume can be lowered faster than it can be raised, so this paddle in effect doubles as a muting switch—clever!

The next most-used controls, "Scan" and up/down "Seek" (both of which, logically, perform the same functions for tape as for radio), are well placed, immediately adjacent to the volume paddle. Using rocker switches for the two up/down tuning controls ("Seek" and manual "Tune") was a good ergonomic choice, though the rockers could use a less mushy pivot. The six station-preset buttons are grouped in two rows of three instead of one over-long row. And all the tuning controls are clustered around the tuning display. My only gripe was the antenna up/down switch, some distance away on the dashboard. Why couldn't the antenna be made to go up automatically when the tuner goes on, as it does in almost every aftermarket head unit? Ford says this is done to reduce wear and tear on the power antenna, but power antennas that can stand such wear and tear are available.

I liked the fact that all controls for tape operation (except "Seek" and "Scan") are grouped together at the front panel's right side. I found that a tape can be inserted, but not ejected, with the power off. When the system is on, inserting a tape overrides the radio, and tape slack is taken up before play begins. The radio automatically comes on when the tape is ejected, but since it does *not* come on louder than the tape, this is not much of a problem if you're within range of the station you're tuned to. Once you're out of range it can be bothersome, as the tuner does not mute when it's getting weak signals or no signal at all.

The display is clear and easy to read by day or night. It glows brightest by day; when the car's lights are on, it dims along with the dashboard illumination. It gives all important operating information at a glance, substituting "Tape" or "CD" for the radio station frequency when those sources are in use. It's always seemed silly, to me, that most other head units display station frequencies even in non-radio modes.

The CD player's ergonomics and night illumination were good, but not as sensational as the head unit's. With the exception of the eject button at the upper right, all controls were in a single row at the bottom—but they were grouped by function and differentiated by size. The buttons which



# The Quietspeakers

Revox speakers play to the civilized ear. And they speak most distinctly where the civilized ear does its listening.

We make speakers that make beautiful music—absolutely clear, richly detailed music. At low listening levels, where other speakers are at a loss, the sound from Revox speakers is always precise, focused, vividly present. These speakers impress with their fineness, their ability to reveal music's quiet subtleties, its lucid stillness.

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This is one of the most intelligent control layouts I have ever seen or felt; no wonder Ford is proud.

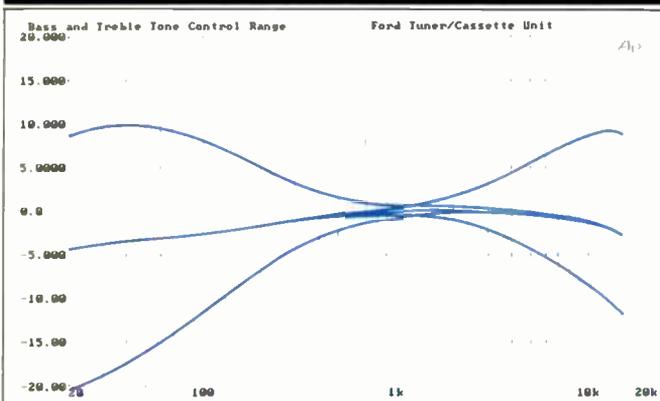


Fig. 10—Tone-control characteristics.

shift forward or back between selections were bigger than the forward/reverse search rocker, which is used less often. The manual doesn't mention it, but search is audible—the only kind that makes sense in a car player. The player's compression circuit was a *most* welcome addition, even in a car as quiet as the Continental. However, the light which indicated whether it was on or not was impossible to read by daylight, making it the only control indicator that gave me any problems. At night, the loading slot and main controls glow, but the minor controls are invisible. Beeps confirm button presses; they can easily be shut off if desired.

The system does not turn itself on when a CD or tape is inserted, but once it's on, switching to either of those sources is easy. Inserting a tape overrides the radio, and inserting a CD overrides both other sources. If the ignition is turned off while a CD is playing, play will resume if power is restored within 15 S; after that, the radio will go on when power is restored. You can also switch from CD back to radio by pressing the player's pause control for about 2 S.

The CD player operated perfectly. I did not find any washboard roads or speed bumps to try it on, but over New York City's potholes it never skipped.

Overall, sound quality was very good. It was best on CD, as you'd expect, and very good on tape. Tape sounded a lot better, in fact, than Len Feldman's measured response curves would indicate, leading me to believe that the frequency errors he measured probably were due to azimuth differences between his test tapes and the Ford unit's tape heads. On FM, the sound seemed a bit veiled, but I don't know whether that was due to high-frequency roll-off, the slightly high tuner distortion Len measured (it was never high enough to be heard as distortion *per se*), or both; without the tape and CD handy for comparison, it would not have been as noticeable. As with most car stereos, the sound on AM had the familiar super-mellow quality and midrange honkiness caused by excessive high-end roll-off and a noticeable bass roll-off, which throw the midrange into over-prominent relief. Yeah, almost everybody does it this way, but that's no excuse.

With the car sitting still, the sound seemed bass-heavy, due to the bass boost the Ford JBL system uses to over-

come road noise; this can be cured with an adjustment of the bass control. Even with the bass turned down when the car was stationary, the system did provide substantial output down to 30 or 40 Hz, enough to produce a pleasant rumble in my body when I listened to music containing sustained low tones. The bass seemed gutsier when I had the fader turned full rear than when I had it turned full front, though that may have been only because at that setting, less treble came from the rear to complete with it. At any rate, the bass did not (as happens in too many car systems) disappear when the rear speakers were shut off.

Imaging was pretty good. Images which should be centered seemed to come from directly in front of the listener rather than from the center line of the car, unless the balance control was readjusted slightly. There was some front-to-rear depth, but not a lot of it. Imaging became a bit richer and more centered when I added a bit of rear fill to the front speakers.

The tuner's designers gave it the wrong mix of virtues for the car. This head unit's high S/N and its high and uniform separation would be more noticeable under home listening conditions than they are in the car. In the car I was more aware of the little puffs of noise that intruded softly during suburban reception of New York stations, which indicated less than optimum sensitivity. In the city, resistance to multipath was moderate at best.

I tested the tuner in two locations as well as on the road. In the first location, all tuner functions worked well, and the number of stations I could receive (though not the number I could receive *well*) was about the same as for my reference tuner used in that area. In the second location, the seek and scan circuits stopped just before and after some strong stations on the FM band and on FM and AM frequencies where no signals were audible. This may have been due to a strong local signal source of some kind, since a loud buzz obscured all but the strongest AM signals in that location.

When an AM station using the C-Quam stereo system is tuned in, the stereo-signal display light illuminates after a second or two (this delay is common in AM stereo car units). Stereo definitely made AM music listening more pleasant.

Overall, I found the head unit's r.f. performance a bit disappointing and its human engineering superb. The sound quality varied with the source material, but performance on its best source, CD, showed that the Ford JBL system is basically excellent. About the only important features it lacks are FM muting and Dolby C NR—and the lack of muting won't cause much problem if you tune by seek or scan, as most users probably would. Give this head unit a bit more sensitivity, better capture ratio and AM rejection, and a bit flatter response, and I'd covet it for my car. The rest of the Ford JBL system is excellent, just as it is. This is one of three car systems I've auditioned in the past three weeks—two with preset equalization matched to the particular cars, one with a user-set equalizer in the dash. It's obvious from these experiences that, no matter how good the drivers and speaker locations, good EQ can make a tremendous difference in the overall sound—and that a fixed EQ engineered for a particular car does a better job than a regular graphic equalizer, even when an analyzer is at hand to set that equalizer up.

Ivan Berger

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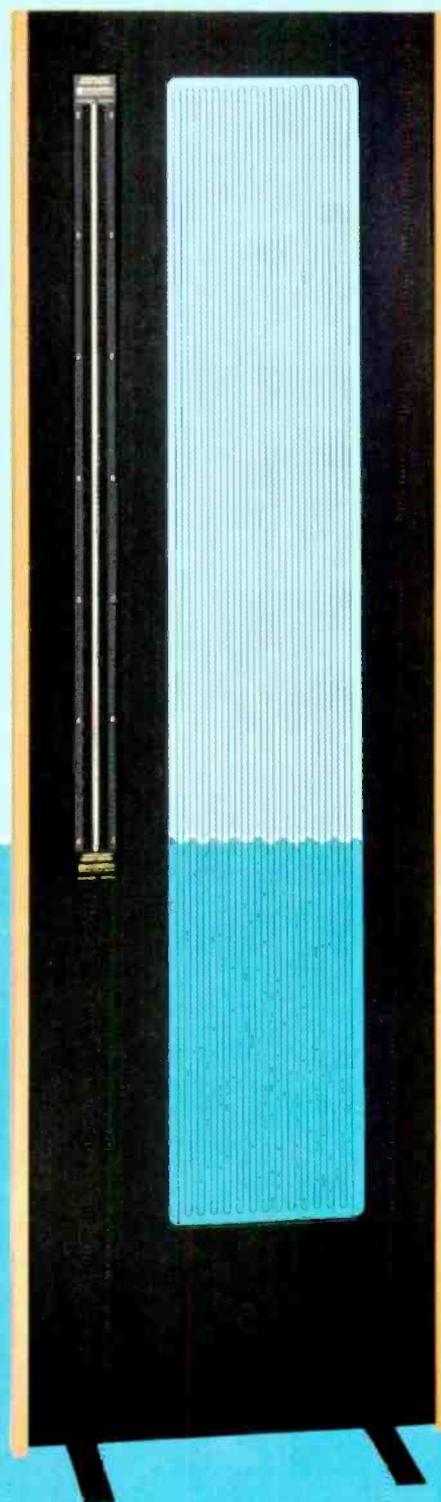
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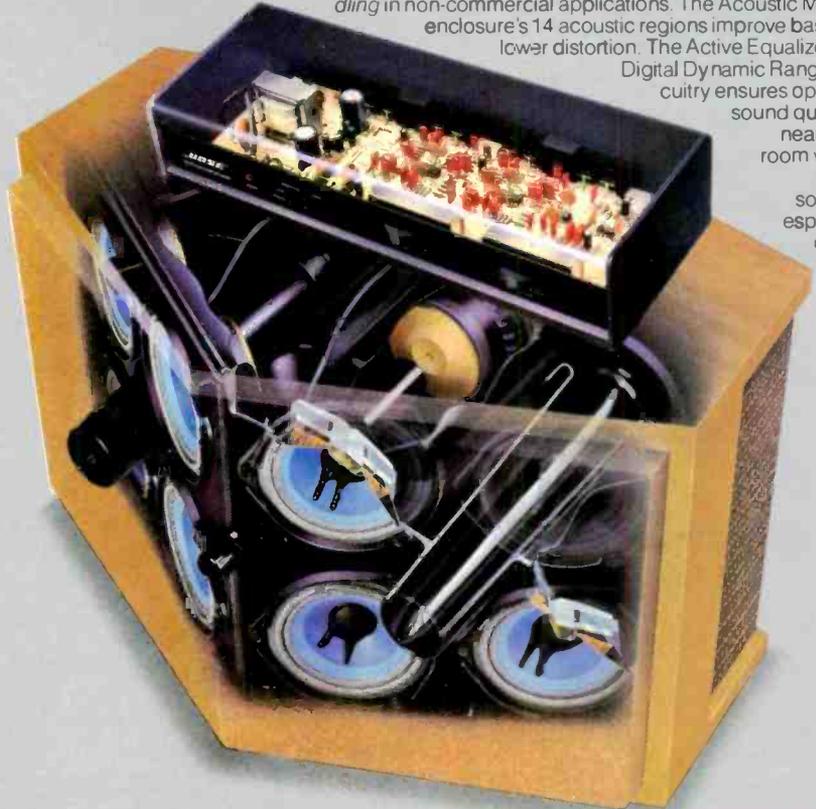
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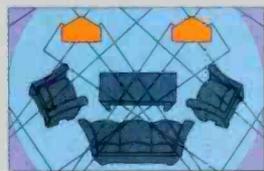
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Live music is a combination of direct and reflected sounds (left), but conventional speakers (middle) reproduce mainly direct sounds—and offer full stereo in a small area only. The Bose 901 Direct/Reflecting® speakers (right) accurately reproduce live music's balance of direct and reflected sound, providing greater realism in full stereo (blue area) throughout the listening room.

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## 2

**BLAUPUNKT  
BERLIN TQR 07  
CAR STEREO**
**Manufacturer's Specifications**
**Tuner Section**
**FM Usable Sensitivity:** Mono, 13 dBf.

**FM 50-dB Quieting Sensitivity:** Mono, 22 dBf.

**Alternate-Channel Selectivity:** 78 dB.

**S/N:** Mono, 65 dB.

**AM Rejection:** 60 dB.

**Image Rejection:** 65 dB.

**I.f. Rejection:** 90 dB.

**Capture Ratio:** 1.5 dB.

**Frequency Response:** 35 Hz to 16 kHz,  $\pm 3$  dB.

**Stereo Separation:** 32 dB at 1 kHz.

**AM Usable Sensitivity:** 7  $\mu$ V.

**AM 50-dB Quieting Sensitivity:** 40  $\mu$ V.

**Cassette Section**
**Frequency Response (120- or 70- $\mu$ S Equalization):** 35 Hz to 18 kHz,  $\pm 3$  dB.

**S/N (120- $\mu$ S Equalization):** 52 dB, A-weighted, without Dolby NR.

**Wow and Flutter:** 0.1% wtd. rms.

**Separation at 1 kHz:** 45 dB.

**General Specifications**
**Output Voltage:** 2.0 V.

**THD at 0.5 V Output:** 0.1%.

**Tone-Control Range:**  $\pm 10$  dB at 50 Hz and at 10 kHz.

**Dimensions:** Main chassis, 7 $\frac{1}{16}$  in. W  $\times$  2 $\frac{1}{16}$  in. H  $\times$  6 $\frac{5}{16}$  in. D (17.9 cm  $\times$  5.2 cm  $\times$  16 cm); tuner control unit, 7 $\frac{1}{16}$  in. W  $\times$  2 $\frac{1}{16}$  in. H  $\times$  6 $\frac{5}{16}$  in. D (17.9 cm  $\times$  5.2 cm  $\times$  16 cm).

**Weight:** 4.3 lbs. (1.95 kg).

**Price:** \$1,599.95.

**Company Address:** 2800 South 25th Ave., Broadview, Ill. 60153.

For literature, circle No. 91



The Blaupunkt Berlin TQR 07 AM/FM tuner/cassette deck offers high performance and numerous features, but is any car stereo worth nearly \$1,600? I'll let you be the judge of that, after you've read about the incredible conveniences built into this two-piece product. Yes, two separate chassis are required to permit installation of this complex, technologically advanced product in the greatest variety of vehicles. Much of the tuner section, as well as the volume and tone-control circuitry, is contained in the secondary chassis.

Like the main, dash-mounted chassis, the secondary unit is DIN-sized, but it has no controls that need to be accessed during operation of the system. The TQR 07 incorporates a 16-bit, 32-kilobyte microprocessor and a data-bus linking system that provides the necessary interface between the two components.

Data-bus technology also transmits digital information, continuously monitoring and adjusting AM and FM filtering, frequency tuning, and automatic volume control for opti-

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**This unit actually adjusts volume level according to changes in ambient noise. Open your windows, and the volume will go up!**

imum system performance. By automatic volume control, I don't mean the function commonly called AVC, which keeps a receiver's audio or video output constant despite variations in r.f. input level. Rather, the TQR 07 actually adjusts listening level according to changes in ambient noise levels in the car. Open your car windows, and this feature will raise the volume level to compensate for the increased wind and road noise!

The microprocessor-controlled TQR 07 also uses diversity tuning, with two r.f. "front ends," each connected to a separate antenna input. The tuner samples both signals constantly, switching between them as needed to provide the best FM reception.

Another feature, which Blaupunkt calls "Travel Store," automatically enters into the preset memories frequencies of the 16 strongest signals on the currently selected band, while simultaneously saving the presets' previous contents in another memory, so you can switch back and forth between the two sets of stations. As the name implies, a prime application of "Travel Store" would be to program local stations when you travel, without disturbing the station memories you use back home. An LED shows which set of memories is active.

The Berlin has three reception bands: FM, AM, and ARI. ARI, widely used in Europe and now available in some parts of the U.S. and Canada, is an automatic traffic and emergency reporting system. If you tune the TQR 07 to a local ARI station, you will hear bulletins as they are broadcast, but you can elect to hear that station's normal programming, a cassette, or nothing at all between ARI messages. Volume, tone, balance, and fader settings can be preset for the ARI mode; this allows the driver to set volume and tone for maximum voice clarity and to shift the sound entirely to the speaker nearest the driver's seat.

All told, the Berlin's regular memories can hold 16 stations on each of its three bands, *plus* an equal number on each band in "Travel Store" mode. Adding all of that up, you can store up to 96 separate radio frequencies for quick recall! The 16 stations on each band are divided into four "memory levels"; to access a given preset station, one must first select the appropriate memory level and then pick the individual station.

The TQR 07 also enables you to program a four-digit security code that renders the unit inoperative if it is stolen. Blaupunkt provides window decals to make the potential thief aware of that feature before he or she bothers to break into your car.

For once, here is a car stereo tuner with AM reception that's as close to high fidelity as AM can be. Furthermore, the AM tuner section is equipped with a stereo decoding circuit for the Motorola C-Quam system, which the majority of U.S. AM stereo stations employ. Additional features of the tuner section include automatic or manual mono/stereo switching, manual or "seek" tuning, preset station scanning, and last-station memory; there is also an improved type of noise quieting.

The tape-deck section of the TQR 07 is a full-logic, front-loading mechanism featuring large brass flywheels for accurate tape motion and low wow and flutter. An extended-range playback head incorporated in this auto-reverse deck

provides identical frequency response in both directions of tape travel. A program-search feature advances the tape to the next track, or rewinds to the beginning of the current track, when it is activated during fast forward or reverse tape winding. Music scan samples the beginning of each track for about 8 S before moving on to the next selection. Dolby B and C noise-reduction circuitry is included in the tape section, as are such common features as a tape equalization switch for normal or high-bias tapes and tape ejection when the car's ignition is turned off.

The preamplifier section of the TQR 07 delivers a high output (around 2V rms) to provide extended headroom and to avoid the noise problems often associated with lower output preamp stages. There is loudness-contour adjustment for compensation at low listening levels, but it cannot be switched off. All audio adjustments (such as volume, bass, treble, balance, and front/rear fade) are made electronically, so there's no possibility that the TQR 07 will develop noisy controls.

### Control Layout

The multi-function display area occupying the left end of the Blaupunkt's dash-mounted section presents no fewer than five kinds of readout, which change according to how the tuner/tape deck is being used. When in the AM or FM tuner mode, the upper display panel shows the band, the selected station frequency, which preset memory button and level are in use, whether the currently tuned station is in stereo, and, for AM, whether the tuner is in narrow-band mode. At the same time, the lower panels show the frequencies of the four stations in the current memory level, each directly above the round button which selects it.

In tape mode, the main display says "Tape" and shows the tape direction and the current noise-reduction setting, while the small displays show the four functions then controlled by the round buttons. During play, these are: Fast rewind ("FR"), tape-direction reverse ("Rev"), fast forward ("FF"), and eject ("EJ"). In fast-forward or rewind mode, "Ply" (play) illuminates in the place otherwise occupied by the "Rev" readout.

Another display appears when you set or re-enter your anti-theft code, its four digits scrolling from 0 through 9 as you press the appropriate buttons. During ARI reception (which is treated as a separate band, even though FM stations are involved), still another display appears, indicating identification numbers for the ARI stations in the currently selected memory level and the ARI station frequency currently being received. When the "Time" button is pressed, the display, naturally, shows the time.

The cassette-insertion slot is at the upper right of the panel, and just below it are four small buttons with LED indicators. The first of these is for manual/automatic tuning selection. The next button activates music scan (for tapes) and preset scan (for radio). Farther to the right is a button with *three* functions, selecting metal/normal tape EQ, mono/stereo reception, and AM bandwidth compression. The button just to its right selects Dolby noise reduction in the tape mode and high or low seek sensitivity in the tuner mode. Another row of small buttons, below those just mentioned, includes the power button, the band selector (AM, FM, or



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The Blaupunkt can hold 16 stations in each of three bands, plus an equal number in "Travel Store," for a total of 96 presets!

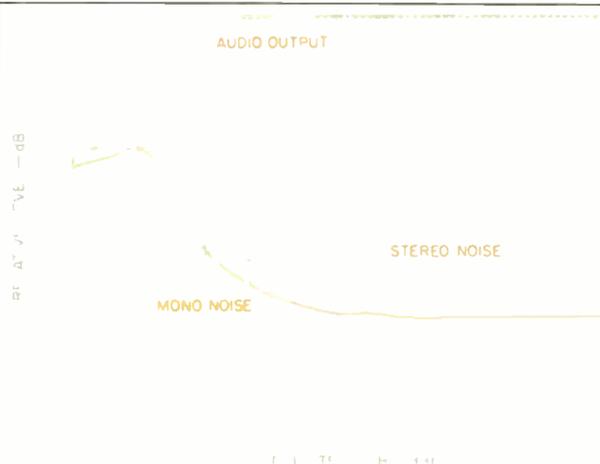


Fig. 1—Mono and stereo quieting characteristics, FM section.



Fig. 2—Mono and stereo distortion characteristics at 1 kHz, FM section.

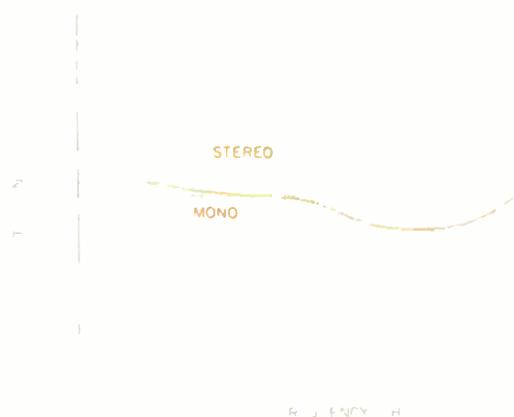


Fig. 3—Mono and stereo distortion vs. modulating frequency (see text).

FM-ARI), a button that selects between "Store" and "Travel Store" modes, a button for setting and displaying the time, the "AVC" activation button, and a "Mode" button that determines the functions of the lowest row of buttons.

The first four buttons in that row, labelled "1" through "4," are normally used to select the four preset memory levels. The next two buttons, with left- and right-pointing arrows, are used for advancing to the station at the next higher or lower frequency—or, during tape playback, to move to the beginning of the next track or the start of the current track. Finally, the two rightmost buttons in this row serve as an electronic volume control, gradually lowering or increasing volume levels as they are pressed and held down.

All of the buttons in this lower row serve secondary functions as well. When the "Mode" switch is pressed, new nomenclature, illuminated in red, appears over each of these buttons. Now the buttons labelled "1" through "4" serve as bass cut, bass boost, treble cut, and treble boost controls. What were previously the search/scan controls now serve as balance controls, and the former volume up/down buttons now serve as front/rear fader buttons. The number of functions Blaupunkt has managed to fit onto a DIN-sized front panel is absolutely incredible!

#### Tuner Measurements

I found it surprising that, on the test bench, the actual performance of the Berlin TQR 07 as an FM tuner was so far from the best I have ever measured. Of course, when it comes to car stereo tuner performance, there is a lot to consider besides measured specs. There are, for example, such things as multipath rejection, picket-fencing, background noise, and the like, all of which show up quite differently in a moving vehicle, compared to the way a tuner measures when it is stably positioned on the test bench. For that reason, I hope readers will be guided as much by what Technical Editor Ivan Berger has to say about this unit's behavior on the road, as by my measurements.

Mono FM usable sensitivity fell somewhat short of the claimed 13 dBf, measuring 16 dBf. It was 27 dBf in stereo. In mono, 50-dB quieting sensitivity was 19.5 dBf, somewhat better than the 22 dBf claimed by Blaupunkt. Best signal-to-noise ratio in mono was 68 dB, as against 65 dB claimed. Even in stereo, I measured an S/N ratio of 66 dB for an input of 65 dBf. These results, as well as plots of quieting versus input-signal strength, are shown in Fig. 1. Figure 2 shows how THD + N varied with increasing signal input levels for mono and stereo operation. The unit's THD + N was 0.44% in mono and 0.55% in stereo for a 1-kHz test signal at an input level of 65 dBf.

As is typical of many car stereo FM tuners, Blaupunkt made no attempt whatsoever to filter out residual 19- and 38-kHz subcarrier products after stereo multiplex decoding. As a result, while THD + N remained reasonably constant in mono over the modulating frequency range from 50 Hz to 10 kHz, the measured THD + N in stereo reached 4% at 10 kHz even with a low-pass filter inserted in the measurement path, as shown in Fig. 3. (I hesitate to even quote the figure without the filter!) Obviously, that high THD + N figure has nothing to do with actual harmonic distortion, but arises because of the high levels of 19- and 38-kHz products

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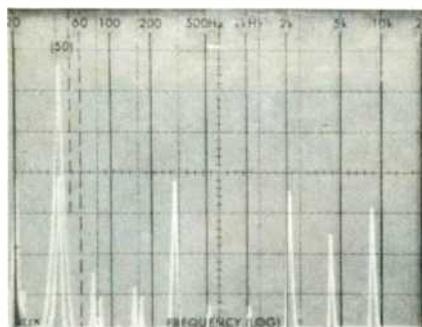
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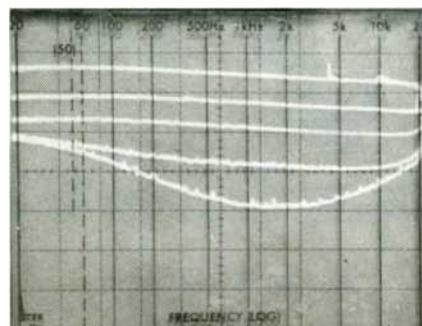
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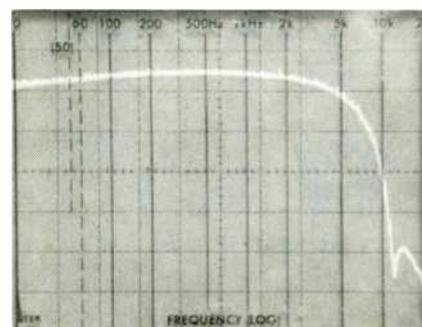
Here is a car stereo tuner with AM reception that's as close to high fidelity as AM can be.



**Fig. 4—FM stereo crosstalk and distortion for a 5-kHz modulating signal.**



**Fig. 5—FM frequency response (top trace) and separation for four r.f. signal levels. Separation for strong signals is at bottom, with separation for progressively weaker signals above. (The plot is logarithmic, from 20 Hz to 20 kHz; the vertical scale is 10 dB/div.)**



**Fig. 6—AM frequency response for normal (wide-band) mode.**

present at the output of the system. These can be clearly seen in the spectrum analyzer 'scope photo of Fig. 4, linearly plotted from 0 Hz to 50 kHz. The tall spike at the left and the short spike contained within it represent the desired 5-kHz output and the undesired crosstalk amplitude out of the opposite channel, but all of the tall spikes farther to the right represent 19 kHz, 38 kHz, and subcarrier sideband products that have not been suppressed by the tuner's multiplex decoder circuitry. The cumulative sum of all these ultrasonic products is only about 20 to 25 dB below the 100%-modulation reference level. It can be argued that this should be of no concern in a car stereo product, since the tape deck is a play-only unit and such high frequencies are of concern only because they might affect Dolby tracking during cassette recording. Well, maybe that's true, but I hear tell that there are some young drivers out there who can hear 19 kHz quite clearly. There are also a fair number of car tweeters that may not take kindly to being subjected to a constant level of 19-kHz energy!

Don't mistake Fig. 5 for a loudness-curve plot. It is actually a multiple plot of separation versus signal input level for the Blaupunkt's FM tuner section. The top trace is the frequency response of the modulated channel, while the bottom trace shows separation as a function of modulating frequency. Frequency response was off by  $-2.2$  dB at 30 Hz and by  $-1.7$  dB at 15 kHz. Intermediate traces show how separation changes with decreased signal levels. This is the usual "blend" feature found in most car stereo tuners, and it is effective in reducing noise for weak-signal stereo reception while retaining enough separation to yield an acceptable stereo effect. Separation at mid-frequencies measured 31 dB, decreasing to 21 dB at 50 Hz and 23 dB at 10 kHz. Stereo threshold was set at around 15 dBf.

Capture ratio measured exactly 1.5 dB, as claimed, and AM rejection was just short of the 60 dB claimed. Image rejection and i.f. rejection were both a bit better than claimed, with readings of 68 and 93 dB, respectively. Alternate-channel selectivity measured 80 dB.

As for the AM tuner section, it was one of the best I've measured, either in a home tuner or in a car unit. I was not able to measure AM stereo separation (I'm not about to invest in an AM stereo generator until the industry—or the FCC—makes up its mind as to which system really is the national standard). However, I can attest to the fact that the TQR 07 delivered good stereo imaging and acceptable levels of stereo separation on the three C-Quam stations in my area. I was able to measure other AM performance parameters, all of which were excellent. Usable sensitivity was a mere  $10 \mu\text{V}$  and maximum quieting was better than 55 dB, with only  $40 \mu\text{V}$  required to achieve 50 dB of quieting. Most impressive of all was the AM frequency response when the tuner was operated with unrestricted bandwidth, as shown in Fig. 6. Notice that it extends to well beyond 5 kHz and that there is an effective 10-kHz "whistle filter" incorporated in the circuit to eliminate "beats" from adjacent-channel signals.

#### Cassette Player Measurements

As shown in Fig. 7, playback frequency response of the cassette deck section, using Type II (high-bias,  $70\text{-}\mu\text{S}$



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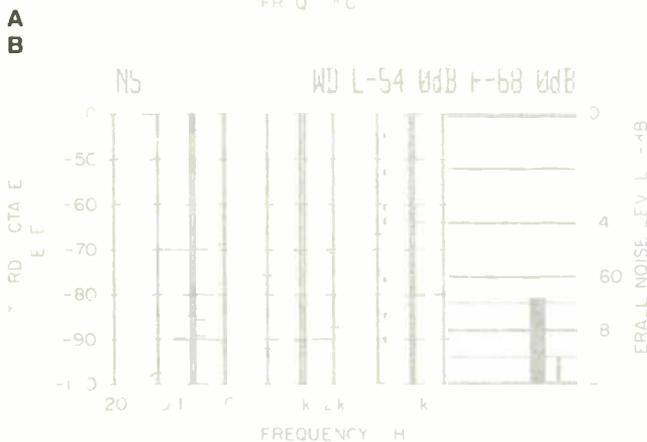
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The human engineering in this unit is very nice, with well-placed controls that are easier to find than one might think.

**Fig. 7—Frequency response, tape section, for Type II tape; response for Type I tape was virtually identical.**



**Fig. 8—A-weighted S/N analysis, tape section. In each figure, top curve shows S/N without NR. Bottom curve in (A) is S/N with Dolby B NR; bottom curve in (B) is with Dolby C.**

equalization) tape, was superb, extending from around 40 Hz to well above 18 kHz for the  $-3$  dB cutoff points. Since results were almost identical for Type I (normal-bias, 120- $\mu$ S equalization) tapes, I saw no point in repeating the curves for that type of tape. Signal-to-noise for Type I tape measured nearly 54 dB without Dolby NR (as against 52 dB claimed), increasing to 61.9 dB with Dolby B NR turned on (Fig. 8A). Using Dolby C NR, S/N improved still further, to 68.0 dB (Fig. 8B). Weighted wow and flutter measured 0.11% rms, close enough to the specified 0.1% so that I won't quibble about the difference. An analysis of the wow and flutter components is shown in Fig. 9. I checked tape-speed accuracy, plotting deviation from perfect  $1\frac{7}{8}$ -ips speed over several minutes (Fig. 10). After only 1 minute of tape movement, tape speed settled in to being so close to perfect that I discontinued the test after 4 minutes. There was virtually no evidence of any speed shift, even with changes in supply voltage.

#### Use Tests

As I stated earlier, measurements and even home listening tests cannot fully evaluate the performance of a car stereo unit. Nevertheless, I did operate this amazing piece of equipment on the test bench and can report that every one of its many features worked as claimed. I was especially impressed with the panel ergonomics, which are, after all, particularly important in a car environment. It took me only a few minutes to become comfortable with this superbly engineered product's control buttons and clearly legible displays. I know that reading about the multiple-function controls and about the numerous features of this remarkable tuner/cassette player may be a bit daunting to the less experienced car stereo enthusiast. But let me assure you that, within a short while, you too will be completely at home with this unit.

Getting back to my original question as to whether any car stereo tuner/cassette player is worth \$1,600, I'll reserve judgment until Ivan Berger files his road-test report. If he reacts as favorably to this product while driving as I did while measuring it, I think the answer will be a resounding yes—if it's Blaupunkt's top-of-the-line Berlin TQR 07.

*Leonard Feldman*

#### Behind the Wheel

Despite the 20-odd buttons on the Berlin's front panel, its designers have managed to make it seem uncluttered. That's largely because there's plenty of space around them. The buttons are also well designed: There are several types and sizes, some spaced more closely or widely than others. The buttons in the bottom row, which perform dual functions, are divided into pairs; between the buttons of each pair is a rigid partition which helps you press one button or the other, never two at once.

Three of the four buttons in the top row also perform dual functions. The designations for this row of buttons were confusing to me, though the LEDs which showed how the buttons were set were a bit of a help, once I learned what each one stood for.

The display was a pleasure, easy to read by night or day. The two extra display lines just above the round preset

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Anthony Cordesman

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vol. 8, no. 4



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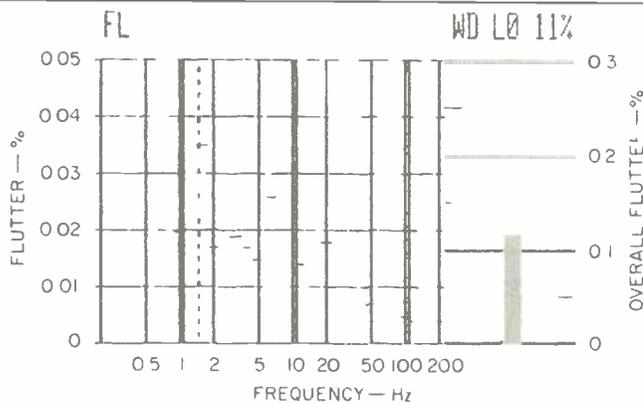


Fig. 9—Wow and flutter, tape section.

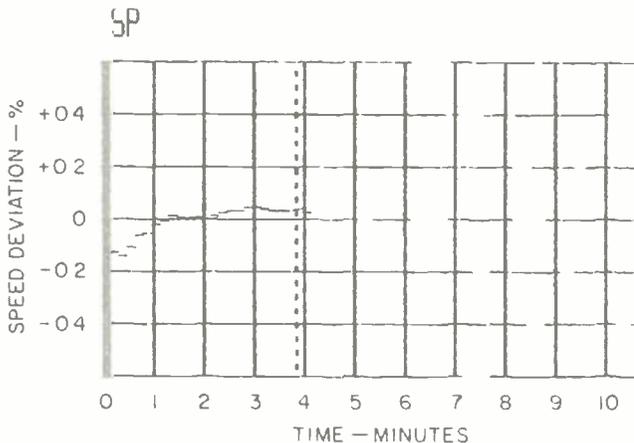


Fig. 10—Tape-speed accuracy. Note how speed quickly settled in to nearly perfect accuracy; speed error at the dashed cursor (3'50" after start of test) is only +0.046%.

buttons at the bottom left were unique and helpful. It's surprisingly useful to be able to see just what frequencies each preset button is tuned to. (It's also a necessity, when the 16 stations on each band are divided into four memory banks, as they are here!)

Several of the Berlin's special features were quite handy: The AVC kept volume level reasonably listenable despite my old car's massive fluctuations in ambient noise. The mono/stereo switch was rarely needed, but it's a feature I always welcome as a hedge against strong but degraded signals. Having 16 AM and 16 FM stations at my command was useful in the station-studded New York City area, and being able to save those settings while memorizing 32 more stations was useful when I travelled.

The "96" stations that the manual says can be memorized

include those 64 plus 32 more for the ARI band—more ARI stations than anyone will actually put into preset memory, I suspect. I never got a chance to use this information service, since it only seems to be broadcast on weekdays, around here, and I rarely drive then. It would have been a blessing, therefore, if I could have programmed the "Band" selector button to go straight from FM to AM without ARI mode intervening.

Night illumination was excellent. All controls were easy to see and read, even from a distance. The major controls and the tape slot were illuminated even when the unit was off.

All in all, I'd say the Berlin's human engineering was very nice—once I got used to it. Control labels were visible but cryptic; control buttons were well placed and spaced, easier to find by touch than would at first appear.

Based on my experience with diversity-tuned sets, I'd say the breed is very free from multipath problems and picket-fencing; the Berlin, even though its owner's manual doesn't mention diversity, was no exception. In suburban locations, it received just about as many stations in static tests as did my reference set, and received them just about as well. Out in the boondocks, however, it picked up many more stations, from greater distances, than my reference unit. Long-distance reception is one area where the Berlin really shines, both on FM and on AM.

This is the first set I've used that could receive stereo AM with response both wide and flat enough for pleasurable listening. The frequency response curves of most mobile AM tuners show not only a ridiculously low treble cutoff but a severely sloping bass, all of which makes the midrange painfully prominent. (What do they think they're building—telephones?) As Fig. 6 shows, this is definitely not the case with the Berlin. It pays to be patient when scanning for AM stereo stations, however; the Berlin switches to stereo about 1 S after the station is locked in.

Scan tuning in general seemed to move at a considered pace. With the scan sensitivity set high, the tuner stopped at all reasonably listenable FM stations, neither skipping any good bets nor recognizing any bad ones. Occasionally, it seemed to pick up more stations when going down the dial than when going up. On AM, the scanning also worked well, though it occasionally stopped on channels adjacent to strong local signals.

Sound quality was basically good, though it seemed a bit edgy on radio until I applied a mild treble cut. There was a soft but annoying click or dropout every time I adjusted the volume, balance, or fader controls. (There was no such problem with the bass and treble adjustments.)

With its multiple connections (apparently including a lead to hook the panel designation lights to the car's dashboard dimmer) and its two full-sized chassis, this is not a tuner for an amateur to install—especially as there's a more liberal warranty if it is installed by a franchised Blaupunkt dealer.

The Berlin's looks are functional rather than stylish. It costs a mint, and its dual-chassis design makes it hard to install in many cars. But it combines exceptional radio performance with a package of prime and uncommon features, plus a design that makes it surprisingly easy to use. Overall, I feel about the Berlin rather as I do about opera—despite major quibbles. I'm an enthusiast. *Ivan Berger*



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3

## CLARION AUDIA 2000E CAR STEREO

### Manufacturer's Specifications Tuner Section

**30-dB FM Quieting Sensitivity:** 12 dBf.

**50-dB FM Quieting Sensitivity:** 17 dBf.

**Alternate-Channel Selectivity:** 70 dB.

**Frequency Response:** 30 Hz to 15 kHz.

**AM Sensitivity:** 20  $\mu$ V.

### Cassette Section

**Wow and Flutter:** 0.07% wtd. rms.

**S/N (120- $\mu$ S):** 53 dB; 63 dB with Dolby B NR, 71 dB with Dolby C NR.

**Frequency Response ( $\pm 3$  dB):** 30 Hz to 18 kHz with 120- $\mu$ S tape; 30 Hz to 20 kHz with 70- $\mu$ S tape.

### General Specifications

**Output Level:** 900 mV (adjustable).

**Dimensions:** 7 in. W  $\times$  2 in. H  $\times$  5 $\frac{7}{8}$  in. D (17.8 cm  $\times$  5 cm  $\times$  14.9 cm).

**Weight:** 5 $\frac{1}{2}$  lbs. (2.5 kg).

**Price:** \$699.95.

**Company Address:** 5500 Rosecrans Ave., Lawndale, Cal. 90260.

For literature, circle No. 92



There is a set of measurement standards that nearly all major car audio manufacturers have agreed to follow when reporting the performance of their products. Hasn't Clarion heard of these standards? Judging from their specs for the Audia 2000E, apparently not. I haven't seen such a dearth of specifications regarding a car audio product in a long time. Even usable sensitivity, the most fundamental of FM performance parameters, is not properly specified. The absence of meaningful specs is all the more surprising considering the fact that the Audia 2000E has such a great deal to commend it and, during my own lab measurements, turned out to be quite good.

Once I got over the omissions in its specifications, I was favorably impressed by the many features—usual and unusual—offered by this DIN-sized tuner/cassette deck. Perhaps the most important of these is the dual antenna input, which allows you to use a form of diversity FM reception. If you're willing to install a second car antenna at some distance from your regular one, this tuner will automatically switch over, as you travel, to whichever antenna provides the cleanest, most multipath-free signal. To this end, Clarion supplies a ribbon-type antenna that can easily be affixed to the front or rear window, to supplement whatever antenna the car already has.

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Many of the pushbuttons on the Clarion's front panel serve dual functions, and one actually controls *five* different adjustments.

Two features address the problem of security against theft. The first, and least significant, is an anti-theft cover which snaps onto the front panel of the installed unit. Unfortunately, most thieves are familiar with such covers. What will thwart a thief who manages to get into your car and make off with this unit is a system called CATS (Computer Controlled Anti-Theft System). Once the 2000E has been disconnected from its source of power, the next time anyone tries to use it, he or she will have to key in a four-digit code to match the one programmed (by the owner) into the unit's memory. If they don't get the code right, there's no way to turn on the tuner or make the cassette deck play. The nice thing about this system is that you don't have to use the code each time you operate the set, provided that it remains connected to the car battery. Of course, the potential thief may not know about this, so Clarion supplies a warning sticker you can paste on your window.

The 2000E offers AM stereo as well as FM stereo, and there's even a choice of AM bandwidths, so that if interference is at a minimum, you can enjoy somewhat better AM frequency response than would otherwise be the case. Although there are only six preset buttons on the front panel, you can store up to 12 FM frequencies together with 6 AM frequencies for one-touch recall, thanks to an FM band selector switch. Presets can be scanned, with the tuner pausing at each for 5 S. If you're travelling in unknown territory, you can even have the tuner scan and store the six strongest station signals in the area. All of this, of course, is in addition to the usual manual up and down tuning modes and a "Seek" tuning mode which looks for the next usable signal up or down the dial.

As is true of so many multi-featured high-end car stereos these days, many of the Clarion's front-panel pushbuttons serve dual functions. One rocker switch actually controls no fewer than *five* audio adjustments: Volume, balance, bass, treble, and front/rear fade. This clever, space-conserving arrangement is made possible by a tiny "Audio Mode" button which, with successive touches, steps through the various functions of that rocker switch.

The cassette player too is loaded with advanced features, such as "blank tape skip," tape scan, a program repeat-play function, and a selection-finder system which Clarion calls Automatic Program Control, or APC. To access this function, you simply press the fast-forward or rewind button twice; the tape mechanism will then automatically stop at the end (or beginning) of the currently playing selection and play the next (or repeat the last) selection. Dolby B and C

Clarion supplies an anti-theft cover which can be snapped onto the 2000E's front panel.



noise reduction are both available, and tape equalization (70- or 120- $\mu$ S) is selected automatically. I especially liked the way the stop/eject button operates. If you push this button once, the tape stops playing but remains inside the unit. Push it a second time, and the tape pops out.

Audio output level is adjustable upon installation to suit the requirements of any power amplifier with which the system is likely to be used. The frequency display can be switched to a digital clock display. Clarion has obviously studied a variety of car interiors and has concluded that a filter at a center frequency of around 180 Hz would be a good thing to have to reduce the bass resonance often found in cars. They've added such a filter, and it can be activated at the touch of still another front-panel button. Any button you push on this front panel responds with an audible beep to let you know that a command has been received—a comforting thing, when you're driving and not actually looking at the front panel.

Considering the many features and functions incorporated in this small chassis, the control layout turned out to be less intimidating than I would have expected. Aside from a few abbreviations on some of the pushbuttons that the user must learn, most of the functions of the buttons and switches are fairly obvious, and the comprehensive display provides additional help, both when making audio adjustments and when using the tuner or cassette deck's advanced features.

### Control Layout

A multi-purpose rocker switch labelled "Level—Audio Control" is at the lower left of the panel, below the display. Just to its right is the "Audio Mode" selector button mentioned earlier, which sequentially alters the function of the "Level" switch to that of a volume control, balance control, bass or treble control, and front/rear fader. The current function of the control at any given time is displayed in the form of an abbreviation in the display (e.g., "BAS" for bass, "VOL" for volume, etc.). The display also reports selection of any of the wide variety of tuner and tape-player functions. Audio level, as well as balance and tone-control settings,



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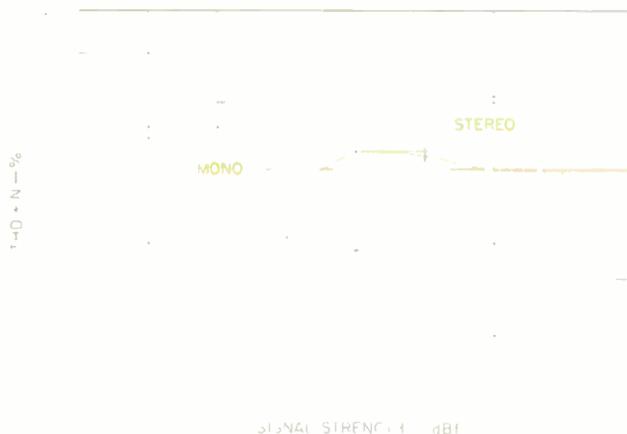
\*Dolby B is a registered trademark of Dolby Labs, Inc.

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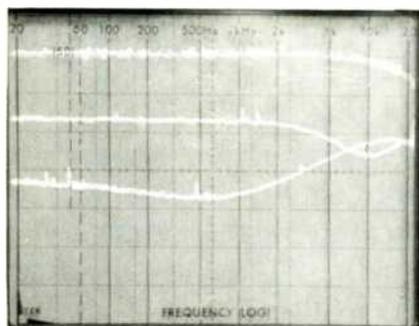
The unusual stereo S/N curve is a direct result of this unit's stereo-to-mono blending: Below 40 dBf, noise actually decreases.



**Fig. 1—Mono and stereo quieting characteristics, FM section.**



**Fig. 2—Mono and stereo distortion characteristics at 1 kHz, FM section.**



**Fig. 3—FM frequency response (top trace), separation for strong signals (bottom), and separation for weaker signals (middle).**

are also shown, by means of a horizontal meter-like display. A loudness control and a button for activating the 180-Hz filter are just above the "Audio Mode" selector.

An illuminated tape slot and a "Stop/Eject" button dominate the top center of the panel, with "FF" (fast forward), "PRO—Play/Program," and "REW" (rewind) buttons just below. Still lower on the panel are the six numbered buttons used for storing and selecting preset stations. When playing tapes, five of these buttons take on other functions, as indicated by their secondary labels: "BLS" (for blank tape skip), "SCN" (tape scan), "RPT" (tape repeat selection), "DDB" (Dolby B noise reduction), and, you guessed it, "DDC" (Dolby C NR).

An up/down tuning rocker is at the lower right corner of the panel, and above it are eight small pushbuttons arranged in two vertical rows. These are used to select tuning mode (manual or seek); AM, FM1, or FM2 bands; AM bandwidth; clock display; Automatic Station Store; audio muting, and radio turn-on and turn-off.

You may be wondering how the "CATS" security code is programmed or keyed in after the unit is disconnected and reconnected to the power supply. The four-digit code is programmed using a combination of the tuning mode, radio on/off, and preset pushbuttons. These buttons are also used to enter the code after the 2000E has been disconnected from and reconnected to its power source.

Electrical connection of the Clarion unit is relatively simple, thanks to a DIN-to-RCA adaptor supplied with it. A second eight-pin accessory terminal, intended for connection of an optional CD player, is also provided. This receptacle has what appears to be a plastic insert plugged into it, but it's not just a dust cover for the DIN socket. It has some pins that act as "jumpers" to maintain audio signal continuity, so if you're not planning to add a CD player, do not pull out that plastic piece. Unfortunately, I discovered that the hard way. When I see a piece of plastic plugged into a receptacle, my inclination is to pull it out so as to examine the receptacle itself. After setting up the unit on the test bench and applying the proper voltage and test signals to the antenna, I spent the next half hour wondering why I wasn't getting anything out of either the front or the rear line-level outputs. Only after I had concluded that the unit must be defective and began to repack it did I notice that the plastic "cover" had four little metal pins sticking out of it to complete the circuit when there's no CD player in the system. I hope you will profit by my experience if you buy and install this head unit!

### Tuner Measurements

Usable mono FM sensitivity (not 30-dB quieting sensitivity, which is quite another thing and which was specified by Clarion as being 12 dBf) measured 15 dBf. Sensitivity for 50-dB quieting in mono required a signal input of 20 dBf as against 17 dBf claimed by Clarion. You can't really speak of usable sensitivity in stereo in car tuners, since most of them (including the 2000E) gradually blend from full stereo back to totally monophonic reception at low signal-input levels. However, 50-dB quieting in stereo is a valid measurement, and it turned out to be 40 dBf. Figure 1 shows how FM noise varies with antenna input signal strength, and it may be

AM frequency response is hardly "high fidelity," but at least the 2000E gives you a choice of two AM bandwidths.

strange looking if you're used to curves for home tuners. However, it is a direct result of the stereo-to-mono blending: As signal strength decreases, noise in stereo increases. It reaches a high point at around 40 dBf, but below that signal level, because the tuner is gradually reverting to mono operation, noise actually decreases for a while. Finally, it follows the mono S/N curve precisely. Most manufacturers feel (and I fully agree) that in the hostile environment of a moving car, it's better to blend back to mono under weak signal conditions than to try to listen to very noisy stereo FM.

Figure 2 shows how distortion varies with signal strength for the FM tuner section. For 100% modulation by a 1-kHz audio tone, THD + N for a 65-dBf signal was 0.3% in mono. In stereo it fluctuated, temporarily reaching a low of 0.25% at the 65-dBf standard measuring point, but rapidly going back up to 0.4% thereafter. The stereo curve may seem to be a bit strange, but that's what I measured. The slight dip in THD + N below about 45 dBf is caused, once more, by the blending action of the stereo circuitry, while the increase in THD + N above 65 dBf may well be due to slight signal overloading.

FM frequency response and separation are plotted in the spectrum analyzer 'scope photo of Fig. 3. Frequency response (top trace) was down 1.5 dB at 30 Hz and down 1.4 dB at 10 kHz; it was 3.4 dB down at 15 kHz. The bottom trace shows separation for a strong signal (65 dBf); the middle trace shows separation for an input signal of about 45 dBf, where significant blending has already taken place. At strong signal levels, I measured FM separation of 38 dB at 1 kHz, 28 dB at 100 Hz, and 22 dB at 10 kHz. Figure 4 shows separation and crosstalk when a 5-kHz audio signal was used to modulate one channel on the FM carrier. Separation (the difference in height between the tall spike at the left and the shorter spike contained within it) was in excess of 25 dB, but distortion and subcarrier sideband products, as well as the 19-kHz output from the unmodulated channel, were quite severe. The 19-kHz suppression measured 57 dB, and SCA rejection was 64 dB. Figure 5 shows how distortion varied with modulating frequency for mono and stereo reception, at strong signal levels. As is true with most car stereo FM sets, little effort was made to suppress the subcarrier products that are present in the stereo mode. This accounts for the rapidly rising distortion as higher frequencies are reached in Fig. 5.

Capture ratio for this tuner measured 2.0 dB, and alternate-channel selectivity was 73 dB, a bit better than claimed. Image rejection was approximately 65 dB, i.f. rejection measured 80 dB, and AM suppression was slightly greater than 50 dB. Spurious-response rejection was in excess of 80 dB.

Figure 6 is a comparison of the 2000E's AM frequency response for its wide and narrow bandwidth settings. The wide setting yielded a slightly better response curve, though it still would hardly qualify as "high fidelity" AM. But at least the 2000E provides some choice for listeners who are not bothered by adjacent-channel and other forms of interference and who want a bit more treble response. As far as AM stereo reception is concerned, my lab is not equipped to measure it, so I had to base my judgment upon listening tests, which I'll discuss later.

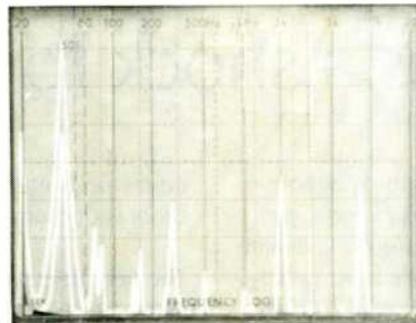


Fig. 4—FM stereo crosstalk and distortion for a 5-kHz modulating signal.



Fig. 5—Harmonic distortion vs. modulating frequency, FM section.

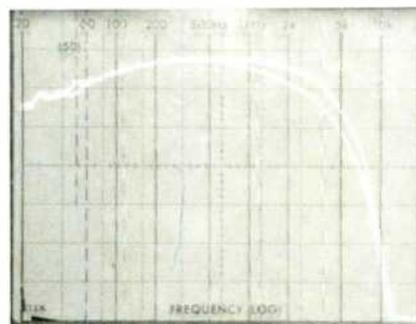


Fig. 6—AM frequency response for wide bandwidth (upper trace) and narrow bandwidth (lower trace).

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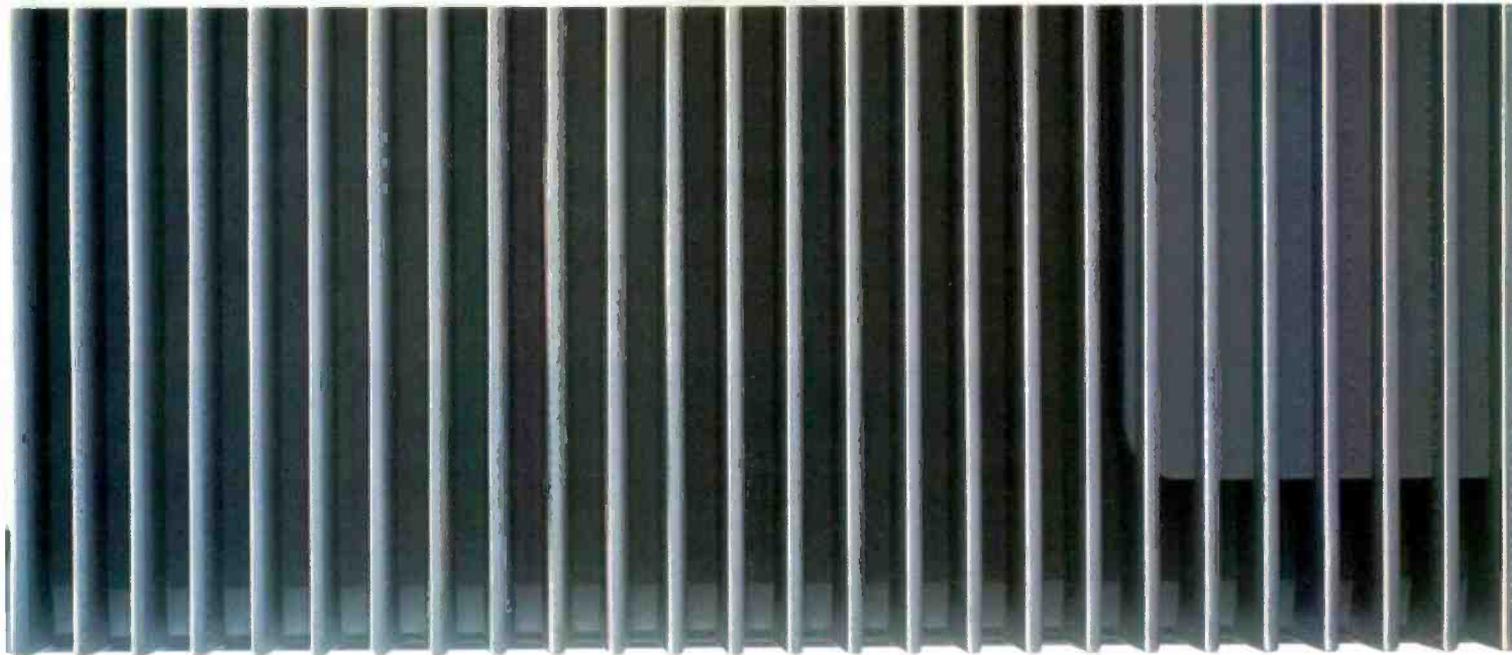
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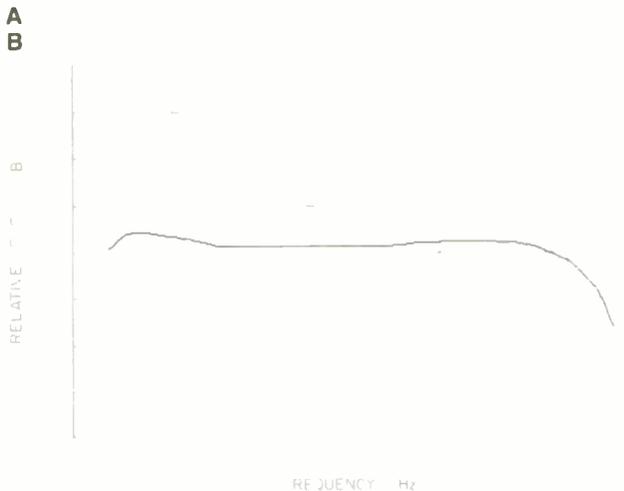
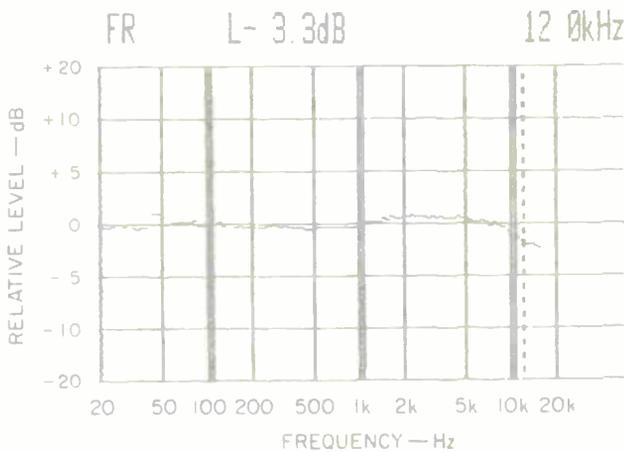
It took as many as 8 separate components in a conventional custom sound system to approximate the performance of this 300-watt, 6-channel sound system.

Sound Distributors	Huntsville	AL	Auto Radio	All Locations	GA	Ultrasmith Systems, Inc.	New York	NY
Lou's Stereo	Mobile	AL	Hi-Fi Buys	All Locations	GA	Autotech Sound Effects	New York	NY
Car Stereo Shop	All Locations	AL	Hilo Audio, Inc.	Hilo	HI	Square Deal Radio & TV, Inc.	Patchogue	NY
Jerry's Audio Exchange	Phoenix	AZ	Island Sound Inc.	Honolulu	HI	The Sound Concept	Rochester	NY
Classic Car Sounds, Inc.	Tucson	AZ	Spencer Sound Systems	Coralville	IA	Sound Concepts, Inc.	Roslyn	NY
Dealer's Car Stereo	Los Altos	CA	Good Vibes Sound	Chicago	IL	Le Sounde	Saratoga Springs	NY
Franks of Berkeley	Berkeley	CA	Chicago Speakerworks Inc.	Chicago	IL	Autosound Consultants	White Plains	NY
The Whistle Stop	Covina	CA	Columbia Audio/Video	All Locations	IL	TRC Auto Sound & Security	White Plains	NY
Haas Auto Stereo	Culver City	CA	Autobahn Services	All Locations	IL	Leonard Radio, Inc.	All Locations	NY
Stereo Vision	Encinitas	CA	Music In Motion	All Locations	IL	Auto Spec	Manhasset	NY
Autometics	Gardena	CA	Soundpro	Carmel	IN	Audio Craft Co., Inc.	Cleveland	OH
Radio Lab	Glendale	CA	Good Vibes Sound	Lafayette	IN	Chelsea Audio Video	Beaverton	OR
Century Stereo	All Locations	CA	California Sound	Wichita	KS	Goodman Radio Co.	Bryn Mawr	PA
Speakerworks	Orange	CA	Mike's Audio	Baton Rouge	LA	Sassafras Records & Audio	All Locations	PA
Auto Sound Specialists	San Carlos	CA	Creative Car Stereo	Ashland	MA	Listening Post, Inc.	Pittsburgh	PA
Autohaus Automotive Inc.	Hayward	CA	Trolley Stereo	Belmont	MA	Auto Radio, U.S.A.	Philadelphia	PA
Crazy Stereo	Lawndale	CA	Sound Trak Audio	Brockton	MA	Island Audio	Warwick	RI
Auto Stereo Warehouse	Los Angeles	CA	Tweeter Etc.	All Locations	MA	Rogers Stereo	All Locations	SC
Sound Factor	All Locations	CA	Natural Sound, Inc.	Framingham	MA	Cartunes, Inc.	Knoxville	TN
Rodeo Auto Accessories	N. Hollywood	CA	Autotronics Unltd	Stoneham	MA	Dalworth Stereo	Dallas/Ft. Worth	TX
Perfect Sound	Porterville	CA	Northeast Security & Stereo	Saugus	MA	Earmark	Addison	TX
Paradyme Consumer	All Locations	CA	Rich's Car Tunes, Inc.	Watertown	MA	Music Systems	El Paso	TX
Electronics			Beaconwood Motors	Watertown	MA	Custom Car Stereo	Houston	TX
Electronic Dreams, LTD	San Clemente	CA	Great Northern Sound Co.	All Locations	ME	Home Entertainment, Inc.	All Locations	TX
Radioman, Inc.	San Diego	CA	Car Stereo Systems	All Locations	ME	San Antonio Audio Concepts	San Antonio	TX
LaJolla Audio	San Diego	CA	Gramophone, Ltd.	Lutherville	MD	Custom Sounds	Austin	TX
Peter's Auto Stereo	San Francisco	CA	Ken El Inc.	Timonium	MD	Arrow Audio	St. George	UT
Pan Auto Sounds	San Mateo	CA	Gramophone Co., Inc.	Birmingham	MI	Audio Associates	All Locations	VA
Marin Auto Stereo & Alarm	San Rafael	CA	Stereo TV Village, Inc.	Burton	MI	Car Stereo Systems	All Locations	VA
Safe & Sound			Audio King	All Locations	MN	Don's Car Stereo	Lynchburg	VA
AdvanceMobile	Santa Monica	CA	Independence Audio	Independence	MO	Greg's Auto Radio	All Locations	VA
Kar Tunes Auto Stereo Alarm	Santa Monica	CA	Ideal Acoustics	Starkville	MS	Auto Sound of Virginia	Richmond	VA
Installations Unlimited	Seaside	CA	Carolina Car Stereo, Inc.	Charlotte	NC	Go Ho Auto Audio	All Locations	VA
Stereo Showcase	Torrance	CA	Dashboard Stereo	All Locations	NC	Magnolia Hi Fi	Seattle	WA
Car Fidelity	All Locations	CA	Car Stereo Unlimited, Inc.	Fayetteville	NC	Hi Fi Heaven, Inc.	Green Bay	WI
Custom Audio Video	W. Hollywood	CA	Autobahn Sound Systems, Inc.	Lincoln	NE	Flanner & Hafsos Music Ltd.	Milwaukee	WI
Radioactive Sound	Walnut	CA	Tweeter Etc.	All Locations	NH			
Transonic TSS	Walnut Creek	CA	Zippo's Car Stereo	Belleville	NJ			
Paris Audio	All Locations	CA	Soundworks	Cherry Hill	NJ			
Walnut Creek Auto Radio	Walnut	CA	Atlantic Stereo	E. Brunswick	NJ			
Madjacks	All Locations	CA	Auto Audiofile	Ft. Lee	NJ			
Listen Up Audio/Video	Walnut Creek	CA	Perfection Plus, Inc.	Paramus	NJ			
Car Tunes, Inc.	All Locations	CA	The Rolling Tone	Ramsey	NJ			
Carston Stereo	Denver	CO	Rand's Camera & HiFi, Inc.	Toms River	NJ			
Audio Design	Cromwell	CT	Samm Sound Distributors	West Caldwell	NJ			
Autofidelity	Danbury	CT	Car Audio Systems	Reno	NV			
Auto Sound, Ltd.	Fairfield	CT	Boston Road Customer Center	Bronx	NY			
Installations Unlimited, Inc.	Glastonbury	CT	TCI Autosound & Security Ltd.	Bronx	NY			
Moonroof, Inc.	Greenwich	CT	Rabson's	All Locations	NY			
Audiocom	Milford	CT	Phil's Auto Radio	Brooklyn	NY			
Sound Advice	New Haven	CT	Sound Approach	Commack	NY			
Audio Advisors	Old Haven	CT	Sounds Great	Albany	NY			
Cartronics of America	All Locations	FL	Rogers Stereo, Inc.	Freeport	NY			
Sensuous Sound Systems	The Palm Beaches	FL	Hi-Way Hi-Fi	Ithaca	NY			
The Audiohouse	Miami	FL	Bruckner Auto Radio Sales	Jackson Heights	NY			
Cartunes, Inc.	Tampa	FL	Auto Sound Systems, Inc.	All Locations	NY			
Audio Warehouse	Vero Beach	FL	Cosmophonik Sound Inc.	New York	NY			
	Atlanta	GA	Martin Motor Sales, Inc.	New York	NY			
	Savannah	GA						

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# a/d/s/

Judging by the 2000E's value and features, the years Clarion has spent making car stereos have clearly paid off.



**Fig. 7—Frequency response, tape section, for normal-bias (A) and high-bias (B) tapes.**

7A. My high-bias test tape has spot frequencies rather than a continuous sweep, so the response curve shown in Fig. 7B was generated by a computer graphics program after I entered data obtained from manual plotting. For this tape, response extended out to 14 kHz for the  $-3$  dB roll-off point.

A comparison of signal-to-noise ratios with no NR and with Dolby B NR, using a high grade of normal-bias tape, is plotted in Fig. 8A. I measured an S/N of 50.5 dB without NR and 58.7 dB with Dolby B turned on. For Fig. 8B, the same analysis was repeated, this time with no NR and with Dolby C NR. S/N with Dolby C was 66.8 dB versus 50.2 without. (The difference of 0.3 dB between the two results without NR is due to normal measurement variation.) All measurements are referenced to a level of 200 nWb/m; for comparison with measurements referenced to 250 nWb/m, you would have to add approximately 2 dB to each of these readings.

An analysis of wow and flutter is shown in Fig. 9. Overall wow and flutter measured 0.071% wtd. rms, almost precisely the value claimed by Clarion. Figures 10A and 10B, showing azimuth error for forward and reverse directions of tape travel, highlight one of the important features of this section: Not only are the degrees of error well within acceptable limits, but there is not much difference in error between forward and reverse. I should point out that the results shown in Figs. 10A and 10B were obtained with sophisticated new software which now links my Sound Technology 1500A tape tester to my computer. Instead of simply analyzing a single pass of the azimuth error test, this equipment permits me to average several passes; the results shown here are for 20 such tests. Clarion claims to have "Auto Reverse with Dual Direction Automatic Azimuth Adjustment," and the results of these tests tend to confirm that.

Audio output level corresponding to 100% FM modulation measured 950 mV with the internal, screwdriver-adjustable gain controls set to maximum. Of course, if that's too much for the amplifiers of your choice, the level can be reduced to any other value. Separate adjustments for left and right outputs are provided, in case other elements in your system aren't perfectly balanced. Figure 11 shows the boost and cut range of the 2000E's bass and treble tone-control circuits. Note that there is far less adjustment range for the bass than for the treble. I'm sure Clarion planned it that way, to avoid possible power amplifier overloading and because the acoustic environment within a car makes for somewhat boomy bass to begin with. I operated the loudness control, but its effect was so minimal that the difference in response between high and low volume levels would hardly be noticeable if presented on my usual spectrum analyzer 'scope display. No more than 2 or 3 dB of bass boost is provided at low listening levels when the loudness button is pressed.

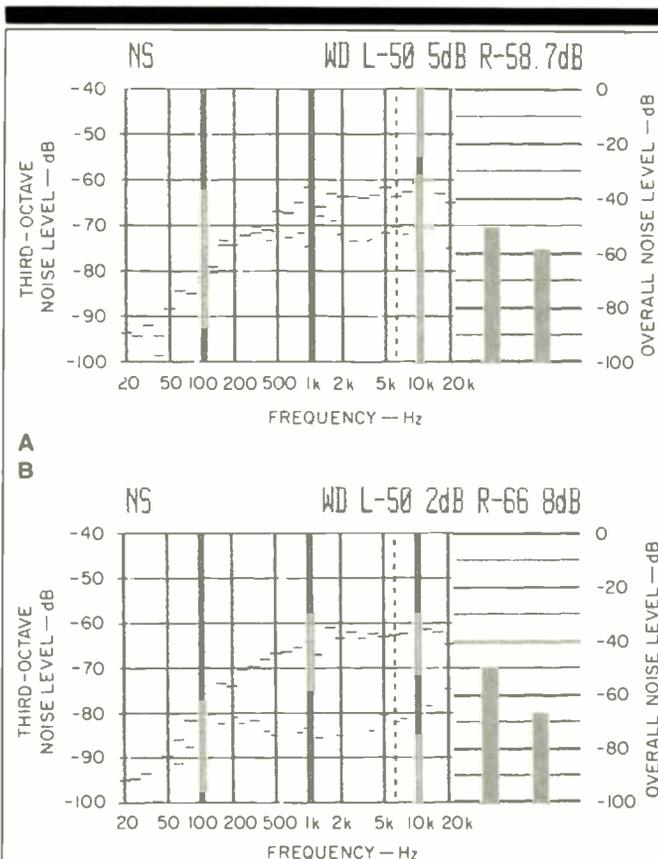
#### Use Tests

While there is not much point in commenting on the sound quality of a car stereo unit by listening to it in a home or laboratory, I did want to check out the 2000E's AM stereo performance since I was unable to actually measure it. Two mutually incompatible AM stereo systems, Kahn and C-Quam, are used by stations in my listening area; the Clarion,

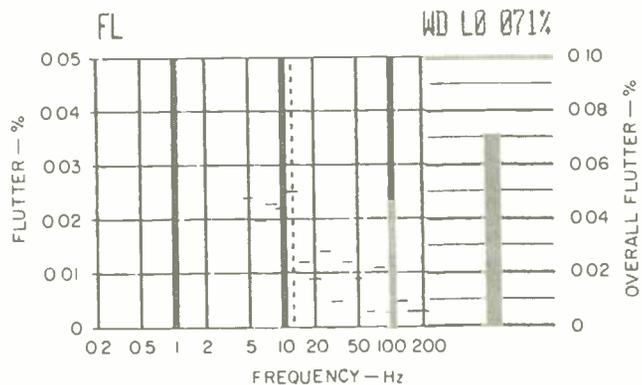
#### Cassette Player Measurements

Using my sweep-frequency normal-bias test tape (120- $\mu$ S equalization), frequency response of the cassette section was excellent all the way down to 20 Hz, and it extended to around 12 kHz for the  $-3$  dB roll-off point at the treble end of the spectrum. Results for this test tape are plotted in Fig.

The display was easy to read by day and by night, and I liked the fact that it showed whether I was listening to radio or tape.



**Fig. 8—A-weighted S/N analysis, tape section. In each figure, upper curves show S/N without NR. Lower curve in (A) is S/N with Dolby B NR; lower curve in (B) is with Dolby C NR.**



**Fig. 9—Wow and flutter, tape section.**

like most car stereo units, receives only C-Quam. As far as I could judge, the 2000E provided adequate separation on C-Quam stations. I would guess that the long-range reception capabilities of AM, augmented by stereo, would be a pleasant experience indeed on a long trip, where FM stereo stations tend to fade quickly and are subject to multipath problems. The C-Quam system, on the other hand, is subject to a problem of its own, generally referred to as "Platform Motion"—a condition that causes the received left and right stereo signals to reverse themselves, moving from side to side, especially during evening hours. Of course, during stationary listening, I observed no such problem, but perhaps results would be different on the road.

As far as the ergonomics of the 2000E are concerned, I found the unit easy to operate, considering the number of features that are available at the touch of a button. The visibility of the display is good, compared to most others of this type, and all of the tape scanning and accessing features worked as claimed, as did the FM and AM tuning and preset features. Clarion is hardly a newcomer in the car stereo field, having been at the forefront of this part of the audio industry from its inception. Judging from the value and the features found in the Audia 2000E, the years Clarion has spent designing and producing car stereo equipment have clearly paid off.

*Leonard Feldman*

#### Behind the Wheel

I do not envy Clarion's designers their task of making this complex unit both good-looking and easy to use while keeping it compact. To me, they succeeded very well in making it attractive, and rather well in making such a complex product usable.

The illumination was virtually beyond reproach. The tape slot and clock are lit even when the 2000E is turned off, so the unit is easy to find and turn on in the dark. The display was easy to read by day and by night; I also liked the fact that it showed whether I was listening to radio or tape. Not all displays tell you that, and it's easy to forget while you're driving.

The controls have their good and bad points. The volume and tuning rockers are easy to find, since they're large and placed at the unit's lower corners, and the tuning bar has a little ridge to help you differentiate it from the volume control. However, your finger can all too easily land on the large, flat center of each rocker rather than on the desired end; there's no predicting which end will be actuated when this happens. Since you can't read volume level from a knob position, there's a volume indicator bar on the display. The "Audio Mode" system, whereby the "Level" rocker can be switched to control the balance, fader, and tone-control functions, is an excellent space-saver, at least for someone who uses those functions as seldom as I do.

One function I did use was Automatic Station Store, which saves your original station preset frequencies in an alternate memory and "resets" six presets to the strongest signals in your area. Logically, since you probably wouldn't use this function every day, the "A/S" button which activates it (and which restores your original presets when it's pressed again) is a bit out of the way, and it must be held down firmly for a good 2 S before it takes effect.

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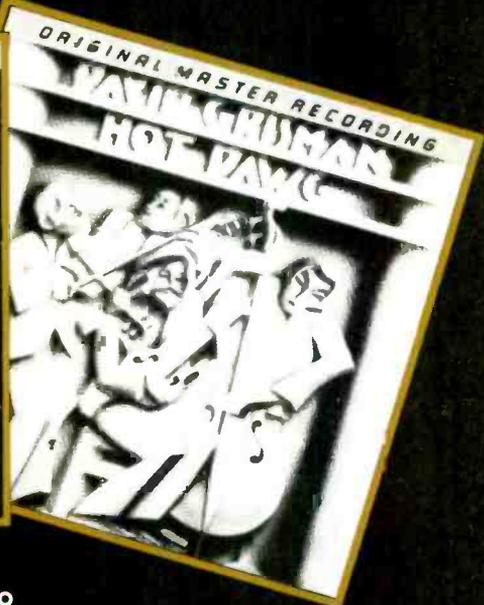
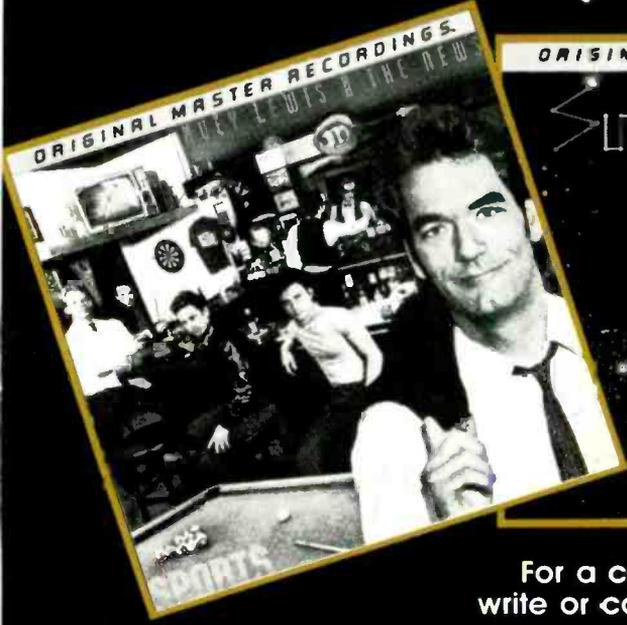
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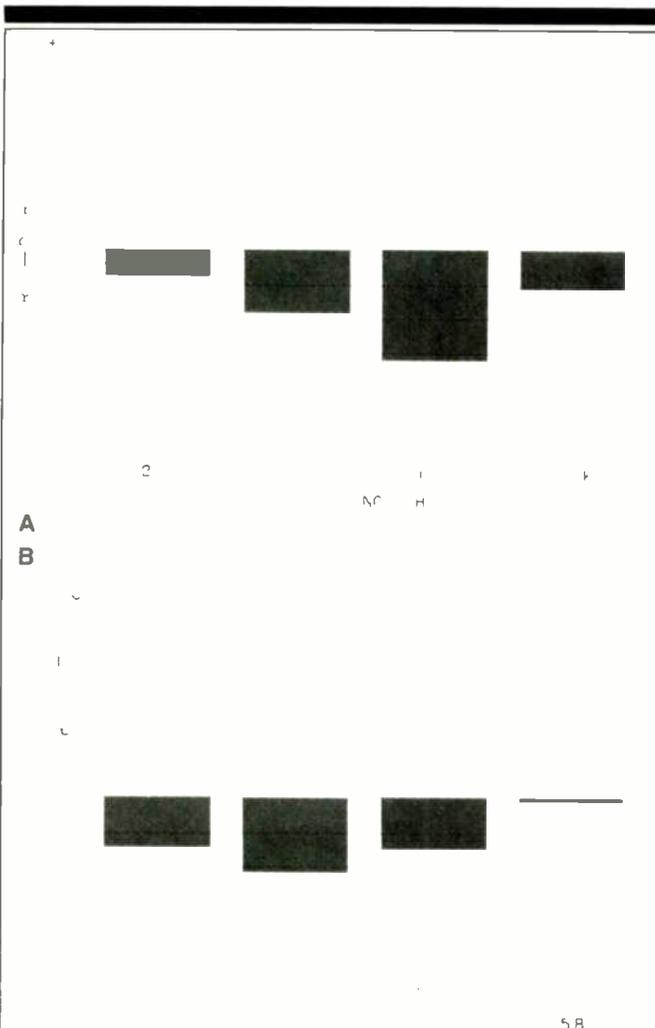


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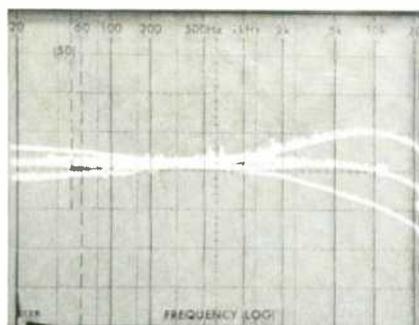
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The Clarion is neither easy to master nor cheap, but its features are worth learning and its radio performance worth the price.



**Fig. 10—Azimuth error for forward (A) and reverse (B) tape directions; note the close match between the two.**



**Fig. 11—Tone-control range; note difference in range between bass and treble (see text).**

Instead of making you hunt for a separate memory-activation button, the 2000E lets you preset stations by holding the appropriate station button down for 2 S. These buttons, though flat, have tiny raised dots marking their centers, so you can be sure you're pressing just one button at a time. However, because the dots are all alike and the buttons are in one long row, it's hard to tell which is which without looking. This is not too serious a problem when you're using these buttons to select radio stations, but it is bothersome when using them to control tape functions—especially scan, which is buried in the middle of the row. The tape transport buttons are rather good, thanks to their large size and to Clarion's attempt at distinguishing the feel of the central "Play/Program" button from that of the rewind and fast-forward buttons which flank it.

The buttons at the upper right are small and feel very much alike, but the most-used buttons are in the top and bottom rows, which makes them easy to find. Also, the bottom two buttons, for tuning mode and band, are logically positioned just above the tuning rocker. When "Mute" is activated, the display's volume bar flashes; this is a good idea, but I'd have preferred having the "Mute" button flash, to call your attention to it rather than to a spot diagonally across the panel.

In the car, the 180-Hz filter definitely clarified the sound when I switched it in. I'd like to see this feature become common. The "wide" AM bandwidth setting also improved the sound, though only a little. This impression coincides with Len Feldman's lab measurements (which I didn't look at until after my road tests): As Fig. 6 shows, there's actually very little difference in frequency response between the two bandwidth settings.

Where the 2000E really shone was as a tuner. In the city, its resistance to both multipath and overload were excellent. On the road, New York FM stations that normally fade out as I turn the rocky corner from Route 684 onto Route 84 held their quality for several miles. The diversity tuning system definitely seemed to be a factor in those good results. In a stationary test about 50 miles from New York, I found that several stations came in better on the front antenna than on the rear one, and about an equal number came in better on the rear antenna than on the front one. Most stations, however, came in about equally well on each antenna. I suppose one shouldn't overestimate the difference that diversity tuning makes.

On AM, the 2000E gave me even more pleasant surprises. Sitting in a Connecticut driveway, I found that every AM station I'd preset in New York came in clearly. I hadn't gotten such AM reception in that driveway since the '50s, when car radios were optimized for AM and airborne interference was less plentiful!

When I first tried the 2000E, I thought it a bit hard to operate and found its sound a trifle edgy. But a few months later, when I checked out a custom system that used the 2000E, I heard no trace of edginess and found operation of the controls easy to remember on reacquaintance.

No stereo with as many features as Clarion's Audia 2000E is easy to master, or cheap. But the features are well worth mastering, and its radio performance, at least, is worth the price.

*Ivan Berger*



# TDK HAS THE NEW TECHNOLOGIES. ANY QUESTIONS?

Super VHS and DAT are the newest stars in video and audio tape recording. But these new technologies require a new generation of hardware and tapes.

And that inevitably brings up new questions from your customers. That's where TDK can help. When it comes to state-of-the-art recording technology, we have the answers.

## Q. WHAT IS DAT?

A. DAT, short for Digital Audio Tape, is one of the most significant achievements in recent magnetic recording history, representing the collective engineering of the world's leading audio hardware and tape manufacturers. In a sophisticated ultra-compact cassette (about half the size of the analog audio cassette) DAT provides up to 2 hours (4 hours in EP mode) of uninterrupted digital recording with specs that equal the performance characteristics of professional studio digital recorders.

## Q. DOES THE DAT SYSTEM MEAN I'M LIMITED TO RECORDING DIGITAL SOURCES?

A. Not at all. There is a significant improvement in sound reproduction when recording from your analog library of LPs and tapes. However, DAT's sophisticated recording technology will be fully realized when using today's highest quality digital sources.

## Q. HOW GOOD IS DAT?

A. You'll have to hear DAT to believe how good the sound can be. The quality is comparable to Compact Discs. Frequency response is flat from 2 to 22,000Hz. Dynamic range is an incredible 96dB over the entire audio band. Hiss and modulation noise, wow and flutter, and distortion are essentially nonexistent. That means whatever you record suffers virtually no degradation in signal quality when played back. In addition, its unique transport system allows extremely fast track-to-track scanning and rewind time.

## Q. HOW CAN DAT DO IT ALL IN SUCH A SMALL PACKAGE?

A. Achieving the required recording density of 3 million bits per second using a tape only 3.81mm wide is no easy feat. The tape is withdrawn from the cassette housing and threaded around a rotating head drum—a technique similar to that used in VCRs. Typical DAT mechanisms use a 30mm diameter drum rotating at 2,000 RPM with the tape contacting a quarter of its circumference. The tracks laid down by the rotating heads are narrower than the width of a human hair!

## Q. WHAT HAPPENS IF A TAPE DROPOUT OCCURS?

A. In addition to extremely tight cassette and deck mechanism tolerances, DAT relies on a highly sophisticated error correction system. Most data losses which might be encountered are reconstructed by the built-in hardware circuitry.

## Q. DOES THIS MEAN I DON'T HAVE TO WORRY ABOUT THE QUALITY OF TAPE I USE?

A. To the contrary. As with any other recording system—audio, video, or data—using inferior magnetic media is just asking for trouble. For over a decade, TDK has pioneered the development of metal particle technology, Super Finavinx, which has become an IEC standard for Type IV audio cassettes. In addition, TDK's experience with precision cassette mechanisms and shell construction helped accelerate the development of the DAT system. So, instead of depending on your DAT hardware's correction circuitry, **you can count on the dependability and reliability of TDK's DAT cassettes.**



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**Q. WHAT IS SUPER VHS?**

**A.** Super VHS, or S-VHS for short, is the latest generation of VHS. With 425 lines of horizontal resolution (nearly double the 240-line capability of standard VHS) it delivers dramatic improvements in color and clarity.

**Q. IS SUPER VHS COMPATIBLE WITH STANDARD VHS?**

**A.** Yes and no. Because Super VHS uses a higher frequency band to record the video signals, Super VHS recordings made on the new VCRs cannot be played on conventional VHS VCRs. Conventional VHS tapes, however, can be recorded, played, and freely interchanged between Super VHS and conventional VHS equipment.

**Q. WHAT DO I NEED TO ENJOY THE FULL BENEFIT OF SUPER VHS?**

**A.** You'll need a Super VHS VCR, a high-quality video monitor preferably equipped with an S-Video (or Y/C) connector, and, for live taping, a Super VHS camcorder. You'll, of course, also need a supply of Super VHS cassettes.

**Q. CAN I GET THE SAME RESULTS WITH MY CONVENTIONAL TV?**

**A.** You *can* use Super VHS VCRs with conventional TVs and camcorders that don't have S-Video connectors, but the resolution will be limited to the specifications of the TV or camcorder.

**Q. WHAT IS S-VIDEO, AND WHY IS IT IMPORTANT?**

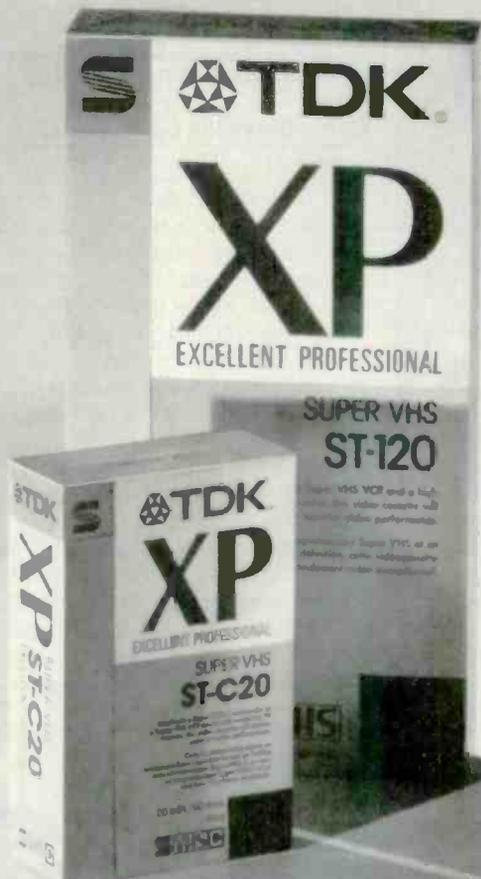
**A.** S-Video is one of the ways Super VHS achieves its superior performance. S-Video cables and connectors separate the luminance and chrominance components of the video signal, which are normally combined in conventional video connections. This eliminates interference (noise) and provides cleaner, truer color pictures and greater audio fidelity.

**Q. WILL I NOTICE A DIFFERENCE IN PICTURE QUALITY WHEN I USE SUPER VHS TO TAPE BROADCASTS?**

**A.** Yes. The incoming TV broadcast signal is higher in horizontal resolution (336 lines) than conventional VHS recording. The difference you see will, of course, depend on the resolution ability of your television set or monitor. You'll see the greatest improvement when taping "live" with a Super VHS camera or camcorder because this equipment takes full advantage of Super VHS's 425-line resolution capability.

**Q. WHY DO I HAVE TO USE SUPER VHS CASSETTES IN ORDER TO MAKE SUPER VHS RECORDINGS?**

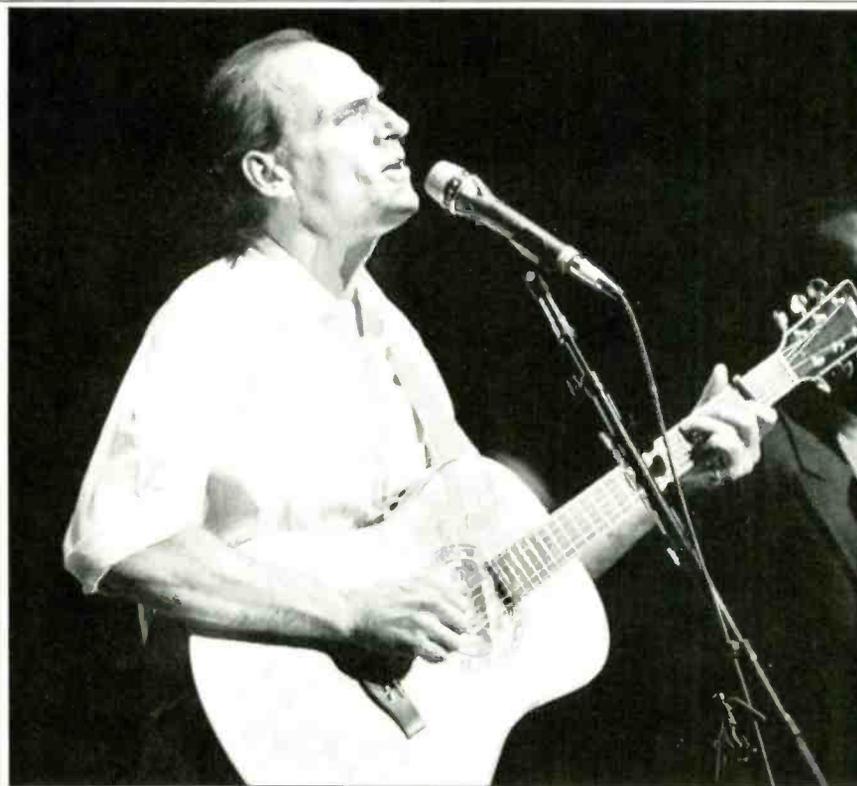
**A.** Super VHS video tape must meet short wavelength recording requirements: high output, high frequency response, and an extremely smooth tape surface, just to name a few. TDK Super VHS XP, available in VHS and VHS-C formats, utilizes an ultra-fine Super Avilyn formulation possessing all the magnetic and physical properties needed for high-quality Super VHS recording. For professional-quality performance, reliability, and durability, you need look no further than TDK XP.



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## TAYLORED TALES



**Never Die Young:** James Taylor  
Columbia CK 40851, CD.

Sound: B+      Performance: B+

Call him what you will—Baby Boom Baritone, Yodeller of Yuppieville—James Taylor is nonetheless a very fine songwriter. His subject matter is never tough or dirty, nor are his songs steeped in bitterness or violence. In truth, many of his songs are like children's nursery rhymes. Taylor's tunes can be sad, even melancholy, while others are uplifting and cheerful. No matter, they never stray too far from heartfelt sentimentality. Few recording musicians are true songwriters—that is, capable of *crafting* songs, putting stories to music. James Taylor is one of the few.

In the recent past, Taylor's fame has essentially been maintained through releasing cover tunes such as "Handyman." A strange path to travel for an original songwriter. Now, though, comes a new release, *Never Die Young*, and it contains only original material. At this writing, it is doing very well in the music charts, possibly indicating that the album may be one of

James Taylor's most popular releases in some time.

The title song is certainly the strongest of the 10 tracks. Both lyrically and melodically, it outshines the rest, and the musical arrangement is the most supportive. "Valentine's Day" and "Sun on the Moon" are also quite clever, despite their deceptively simple structures. Producer/keyboardist Don Grolnick has, by and large, done a fine job simply by letting Taylor be himself, and as a result the production works in harmony with the musical content. (The pseudo-gospel vocal chorus in "Sun on the Moon" and the Muzak-like arrangements on "First of May" are two exceptions.)

The *Never Die Young* CD offers an extremely transparent sound. Transients are cleanly presented, and the fidelity of the vocals and all the instruments—especially the hi-hat, guitars, and synths—is very true. There is a lack of ambient depth, manifesting itself in a somewhat one-dimensional mix in which all musical parts share the same space. This is a common complaint from CD listeners who don't realize that what they are missing is noise,

which seems to provide depth. But in this case, the drums and guitars could have benefited from additional room miking to create greater depth.

As with his previous recordings, James Taylor has, with *Never Die Young*, given us a collection of songs which are at heart simple, shared remembrances and witty stories. There is no news here, but there *is* well-written, warm, and reassuring music.

Hector G. La Torre

**In No Sense? Nonsense!:** The Art of Noise

China/Chrysalis OV 41570, LP.

Sound: C+      Performance: A-

*In No Sense? Nonsense!* is weird; with a title like that, how could it be otherwise? Yet it's what you might call expectedly weird, being the third LP from synth weirdmasters The Art of Noise. Having emigrated from Trevor Horn's ZTT Records, the source of the thunderous aural technicians Frankie Goes to Hollywood and the brilliant Propaganda, The Art of Noise carries forward on this album a sound as fascinating as ever yet more accessible than usual.

This means, of course, that *In No Sense? Nonsense!* is, for all its virtues, as self-consciously avant-garde as anything Andy Warhol ever painted. (Check out the "classy" cathedral



Photograph © 1987, Ebel Roberts

# COMPACT DISCLOSURES

May CDs of Note



Years after the demise of the British punk movement, one group of punk pioneers shows no signs of releasing its Strangler hold on a huge number of fans. Now on their tenth LP, THE ONCE-NOTORIOUS STRANGLERS strike with their first live album, "All Live And All Of The Night."

*the stranglers*

Featuring everything from early hits like "Golden Brown" and "Nice 'N' Sleazy," to their recent chart-topping "All Day And All Of The Night," The Stranglers' newest is ready to kill on CD this month.



"Ooo La La La" is the fittingly-titled single intro to TEENA MARIE going "Naked To The World." Completely written, arranged and produced by Teena Marie, the new album promises to gain even more, uh, exposure for a

woman who is already a bona fide urban superstar. Two duets, both with Rick James,\* are included along with a lush selection of dance grooves and ballads. See Teena on her current tour and catch her "Naked To The World" on CD this month.

## THE STRANGLERS PUT THE SQUEEZE ON LIVE

## TEENA MARIE BARES ALL

## THE O'KANES TIRE OF THE RUNNIN'

## DEACON BLUE BREAK THROUGH



One of the most promising new Nashville acts of recent years, THE O'KANES has been on a dizzying ascent of the country world in the year and a half since their single debut. What with Grammy Awards, Top-10 singles and virtually non-stop touring, they have every right to call their second LP, "Tired Of The Running," The O'Kanes' latest is a breakthrough effort that brings much of their concert style to recording. Debuts on CD this month.



Is there a single city in the British Isles without its own up-and-coming band? Now from Glasgow, comes one of the hottest groups to make the London scene in years, DEACON BLUE. Described by some as a Scottish Simply Red and acclaimed by British critics as "simply too good to fail" and "simply excellent," Deacon Blue are now ready to capture the U.S. with their first recording, "Raintown," which includes the single "Dignity." Raintown pipes onto CD this May.



### OTHER MAY CD RELEASES!

- ARTHUR BLYTHE "Basic Blythe"
- CHEAP TRICK "Lap Of Luxury"
- THE CLASH "The Story Of The Clash Volume #1" (2 CD Set)
- RICHARD CLAYDERMAN "Romantic America"
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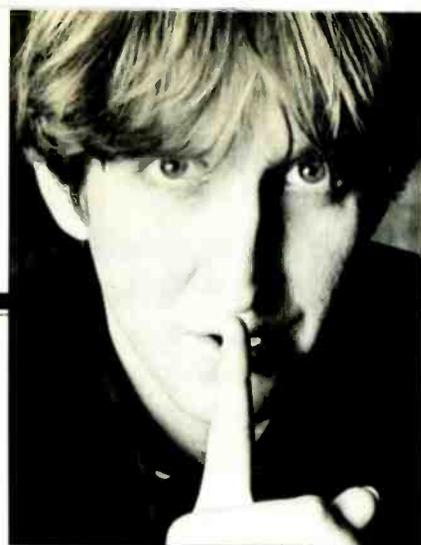


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Although T Bone Burnett is one of the songwriters I most respect and admire, *The Talking Animals* isn't as focused as it should be.



choir of "Counterpoint" and the electronic farts of "Roller 1," for instance.) But since you'll either be dancing to this or spacing out on it, the overreaching isn't bothersome, nor is it serious—the rhythm keeps this a pop record. As usual, The Art of Noise has given us music as cool as an ocean wave. And

as far as I'm concerned, surf's up.

The synthed-out version of the "Dragnet" theme, from last summer's movie, typifies the sound. At once familiar and alien, with a punching rhythm and a melody line that weaves and bobs around the signature, the tune seems to want to incorporate ev-

ery sound ever made. It fails, of course, but it's a nice try. A voice (apparently an uncredited Dan Aykroyd) cuts in with the familiar "Dragnet" epigraph, lending a human moment before spiraling into a tone like a dying robot.

A lot of the cuts are like that—voices, footsteps, indecipherable yet warm hallway chatter, all of it sounding like it's being delivered by androids. These sound bites are plastered against synthesizers that evoke tractor-trailer horns, motorcycle revs, robot burps, electronic oscillations, and the sounds of Brasilia at some time in the future. Except for the LP's intermittent cracks and pops, which seem more offensive than usual on such a gorgeously produced record, this is a great listen, equally at home on a dance floor and a 21st-century torture chamber.

Frank Lovece

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**The Talking Animals:** T Bone Burnett  
Columbia BFC 40792, LP; CK 40792, CD.

Sound: C + /B + Performance: B -

T Bone Burnett is among the songwriters I most admire and respect, but his songs on *The Talking Animals* are not the best he has presented. To be sure, there is some truly inventive and clever thinking at work here, in such songs as "Euromad," with its fractured view of an awful sojourn, and "The Wild Truth," a flat-out, rocking manifesto. But problems occur when Burnett's aims outpace his reach. "Images," sung in English, French, Spanish, and Russian, is quite Brechtian, with a weird arrangement by Van Dyke Parks, but in the end it leaves me asking, "What's the point?" Or take the finale, "The Strange Case of Frank Cash and the Morning Paper," which relates the rags-to-riches-to-rags tale of a guy who finds next week's football scores in his paper. It's clever and funny, but it gets old fast.

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George Thorogood is not a technician on guitars or vocals, but he brings to his records passion and working-class exuberance.

least once in the past 15 years. "I'm Movin' On" and "You Can't Catch Me" were Stones choices. Fleetwood Mac did "Shake Your Moneymaker." The Yardbirds raved-up "Smokestack Lightning," and "I'm Ready" has been a staple in Dave Edmunds' live set for years. This is not a put-down. Of the

original material, only "You Talk Too Much" really rates, but who cares? Listening to George Thorogood and The Destroyers is about hearing your favorite Chuck Berry tunes played by a band that's passionate about this kind of music. They do not let you down.

*Jon & Sally Tiven*

The music is usually punchy—crisp and angular; credit coproducer and guitarist David Rhodes, best known for his striking work with Peter Gabriel, Tony Levin, Jerry Scheff, and T-Bone Wolk split bass chores, with Mickey Curry on drums, Tom Canning on piano, and Mitchell Froom on other keys.

The LP sound is okay generally, but compared to the wider stereo scope and presence of the CD, it sounds cramped. The more atmospheric songs simply take on more menace and impact on the CD.

In the end, *The Talking Animals* isn't as focused as it should be. Burnett's regrettably out-of-print 1983 album, *Proof Through the Night*, had a hard-boiled slant to its songs. His self-titled 1986 acoustic country album had the very simplest of arrangements and from-the-heart songwriting. Maybe that's what's missing—*The Talking Animals* is too brainy for its own good.

*Michael Tearson*

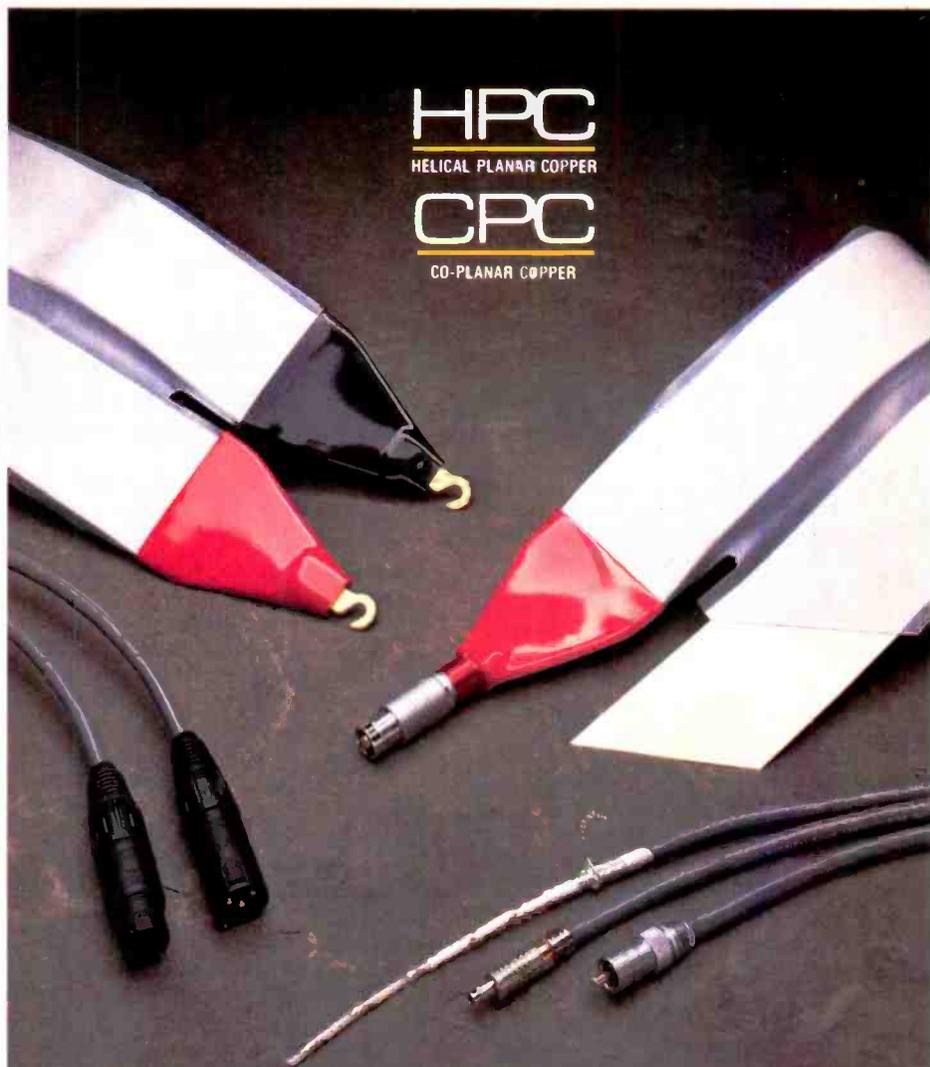
**Born to Be Bad:** George Thorogood & The Destroyers

**EMI/Manhattan E1-46973, LP.**

Sound: B Performance: B+

You can't argue with the fact that what George Thorogood does, he does well. In the grand tradition of Johnny Winter, the early Rolling Stones, and Mojo Nixon, he plays white-boy blues in a style that appeals to the young. He's a missionary from the church of Chuck Berry, Elmore James, Howlin' Wolf, and Bo Diddley, bringing the Chess Records classics to a new generation. He's not a technician on guitar or vocals, but he brings to his records a working-class exuberance that 15-year-olds can relate to.

*Born to Be Bad*, which seems to be doing far better than Thorogood's last two records, features several songs that have already been covered at

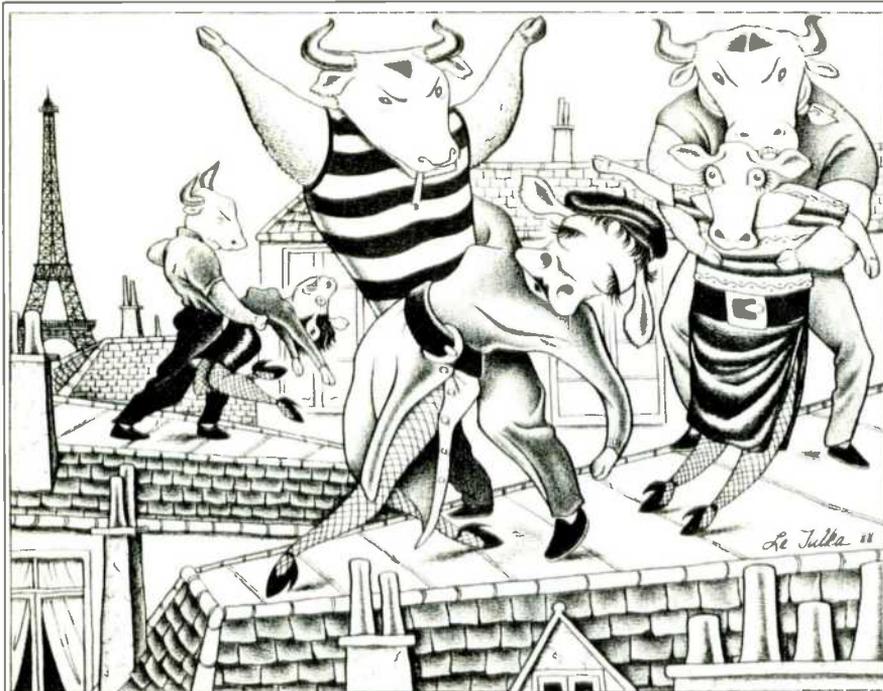


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## CZECH IT OUT



**Milhaud: *Le Boeuf sur le Toit*; Poulenc: *Les Biches*; Satie: *Parade*.** The Czech Philharmonic Orchestra, Vladimir Válek.  
Supraphon 3300-1518, CD.

Here is an instant nomination for CD of the year, to suit all comers. It is perfect on every count, including top-notch digital recording, but what is most outstanding is the extraordinary pep and verve of the Czech Philharmonic, an unlikely choice for such peculiarly Western music.

The music is French, Parisian in first performance, dating from 1917 to 1924, the very beginning of that loud-mouthed anti-Romantic age which, in the '20s, produced one outrageously brassy, blatty work after another, to the horror (and sometimes secret delight) of everybody. In those days it was the French who looked over *our* shoulders—and picked up ragtime, jazz, folk, Broadway, almost before we got into it ourselves. It is astonishing to hear it so early—old Satie, born in 1866, fills "*Parade*" with ragtime and Gershwin-like syncopation in 1917—before the jazz age began; Milhaud's "*Boeuf sur le Toit* (Beef on the Roof)," Latin American flavored, is also full of naughty dissonance as of 1918, and

young Poulenc's inelegant (but beautifully written) ballet came in 1924. The three works, often heard in excerpts or separately, go together to depict this period as never before.

What strange fate dictates that, of all organizations, the Czech Philharmonic should open up this zany time in such a marvelous fashion? The logic is obvious. Most Western musicians, long ago tired of the '20s, find it all very much out of style and old hat at this point. (It'll come back.) On the other hand, a couple of generations of Eastern musicians have grown up entirely detached from our earlier Western "modern" music, knowing nothing of it. Decadent, evil stuff, strictly not allowed. There has been a slow but massive change in recent years: these Easterners, so near to Vienna and the surrounding West, are now in the midst of exploring the once-forbidden, the unknown, as are the Russians themselves—and do they love it! A whole world of new and naughty delight, after so much state-imposed conformity. That just has to be the story.

If you don't believe me, then listen. Every note here radiates enthusiasm and appreciation and pleasure in the playing. Moreover, the music, typically for its period, is ideal for recording,

with clean textures, plenty of brass and percussion (and even milk bottles, glass ones of the old sort). The Supraphon people do a fine engineering job, the very best. If there's a choice of formats, buy the CD if you can. The blats are blattier.

Edward Tatnall Canby

**Robert Davidovici, Violin.**  
New World NW 334-1, LP.

The grand prize for the Carnegie Hall International American Music Competition—with a total value this year of \$75,000—includes a Carnegie Hall recital, a sizable sum of cash, and a contract with New World Records. Herewith Robert Davidovici, a cowerner (with Maryvonne Le Dizes-Richard) of the 1983 competition for violinists. Davidovici is joined on piano by 1977 Van Cliburn Competition winner Steven De Groote and by pianist/composer Paul Schoenfield on the latter's "*Three Country Fiddle Pieces*."

One of the unique goals of this competition—which is biannual and rotates among violinists, pianists, and vocalists—is the dissemination of the American repertoire. To that end it succeeds splendidly here, for none of these pieces is available elsewhere on record, according to the current *Schwann*, and all are fresh, distinguished additions to the violin repertoire.

Copland's early (1926) "*Nocturne*" is an unexpected treasure. Its pleasant pastoral character arising from the piano's repeated motif of a descending major second in the treble and simultaneously descending (by minor seconds) open fifths in the bass. A contemplative violin melody moves slowly but steadily through this spacious context, and Davidovici takes full advantage of the simple line's potentially wide expressive range. Copland later used this theme in his "*Symphonic Ode*."

By contrast, Gunther Schuller's "*Recitative and Rondo*" is a diamond in the rough. Alternately jagged and lyrical, it is an intense, highly dramatic piece that often becomes a heated exchange between the two instruments. Davidovici has the stage to himself on Hugh Aitken's "*Partita for Solo Violin*," allowing him plenty of room for the wide leaps, double and triple stops,

and various other athletic feats required by the score. Though at times emotionally remote, the violinist seems unflappable and is always in technical command.

Far more fun, and no less challenging, are the three Schoenfield pieces. "Who Let the Cat Out Last Night?" is a foot-stompin', knee-slappin' blues romp that shows Davidovici, a Rumanian-born, Juilliard-trained artist, to be one hell of a country fiddler and his partner on the keyboard one hot ragtime composer/pianist. The charm of the Schoenfield pieces is the ease with which they move in and out of classical and blues-based idioms; Schoenfield has created a positively seamless fusion, red-hot on "Cat" and bluesy-cool but nonetheless complex on "Pining for Betsy." It's a dazzling display all around.

Whether accompanist or equal partner, De Groote's pianism is superb throughout. Among other stiff tests, he tackles the rapid passagework in the third movement of Walter Piston's "Sonatina" with fleet, facile fingers. Producer Arthur Moorhead has supervised an unpretentious recording; aside from an occasional, unavoidable dollop of into-the-string murk, the sound of Davidovici's 1710 Davis Stradivarius is clean and unencumbered; surfaces are equally pristine.

Susan Elliott

**Philip Glass: Akhnaten.** The Stuttgart State Opera Orchestra and Chorus, Dennis Russell Davies.

**CBS Masterworks M2K 42457, CD.**

*Akhnaten* is the latest assault by Philip Glass on the operatic world. It's a lush work, full of heroic cadences and surging themes. Unlike his avant-garde opera, *Einstein on the Beach*, which used the composer's own ensemble plus spoken texts, or *Satyagraha*, which employed an unusual grouping of strings and woodwinds, *Akhnaten* makes use of a full orchestra and chorus. Still, with its repeated cycles highlighting music of compelling grandeur and lyricism, the results remain undeniably Philip Glass.

Akhnaten was an Egyptian king who ruled for a few brief years, from 1375 to 1358 B.C. His reign is most noted for its unsuccessful introduction of mono-



Robert Davidovici

theism to the land of sun gods and sphinxes. After his downfall at the age of 17, his memory was virtually erased from ancient Egyptian history.

For the voice of *Akhnaten*, the child-king, Glass chose Paul Esswood, a countertenor. It's a range usually heard in Renaissance and baroque music. In *Satyagraha*, the singing was in Sanskrit; in *Akhnaten*, Glass uses ancient Egyptian mixed with English and Hebrew. Esswood doesn't enter until Act 1 of Scene 3, but when he does, his voice rings with an angelic glow as he declares his religion of monotheism.

Later in the same scene, Glass applies overlapping scoring to the voices in a segment of solos, duos and trios, with Akhnaten, Nefertiti (alto Milagro Vargas), and Queen Tye (soprano Melinda Liebermann). In an idyllic flow,

the voices intertwine and become almost indistinguishable. As the king overthrows the priests of Amon and is then himself overthrown, the atmosphere of innocence becomes tinged with pathos.

Anyone familiar with Glass' music will be comfortable with *Akhnaten*. The composer even borrows several themes from his *Photographer* and *Songs from Liquid Days*. But as with *Satyagraha*, the opera format gives Glass more of a range to play within, and we get everything from Akhnaten's quiet soliloquy in Scene 3, Act 2 ("Hymn") through the dynamic orchestral crescendo of Scene 2, Act 3 ("Attack and Fall") to the military march of the funerals that frame the opera.

Performed by the Stuttgart State Opera Orchestra and Chorus under the baton of Dennis Russell Davies, Glass' opera springs with ease and grace. Unlike the recording of *Satyagraha*, which was slightly marred by close miking techniques, extensive overdubbing, and punch-ins, *Akhnaten* has a presence and naturalness of flow that enhances Glass' still relentless cyclical drive. At the same time, it takes advantage of being a recording: The Scribe (David Warlow), who relates details of the era in spoken English, has his own acoustic space, sometimes reverberant, sometimes dry and close. The pounding bass drums of Scene 1, Act 1 ("Funeral of Amenhotep III") roll



Philip Glass

In varied and difficult pieces, Itzhak Perlman delivers the pyrotechnics with polished ease.



across the stereo field, and synthesizers prowl the bottom.

Philip Glass is a scientist of 20th-century music—focused, stripped to the essentials, and emotionally refined. But with *Akhnaten*, he also evokes gut-wrenching sadness and heroic strength. *John Diliberto*

**Sarasate: Carmen Fantasy, Op. 25; Saint-Saëns: Introduction & Rondo Capriccioso, Op. 28, Havanaise for Violin & Orchestra, Op. 83; Ravel: Tzigane for Violin & Orchestra; Chausson: Poème for Violin & Orchestra, Op. 25.** New York Philharmonic. Zubin Mehta; Itzhak Perlman, violin.

**Deutsche Grammophon DG 423063-2, CD.**

Devotees of Itzhak Perlman will love this CD, for it shows off his dazzling virtuosity with some of the great display pieces in the violin repertoire. Perlman delivers the violinistic pyrotechnics of these varied and difficult pieces with polished ease, incredible security, and ravishing tonal beauty, while Mehta and the New York Philharmonic furnish sympathetic accompaniment. The sound of Perlman's instrument is slightly forward, very clean and smooth. All of the complexities of his playing are clearly delineated on this superb Compact Disc. *Bert Whyte*

**Dupré: Symphony in G Minor for Organ and Orchestra, Op. 25; Rheinberger: Concerto No. 1 in F for Organ and Orchestra, Op. 137.** Royal Philharmonic Orchestra, Jahja Ling; Michael Murray, organ.

**Telarc CD-80136, CD.**

The Royal Albert Hall in London is a vast auditorium seating some 7,000 people. Being this big, it has a reverberation time of about 4 seconds. Needless to say, if an organ is to be capable of filling this huge volume, it must be built on a grandiose scale. The organ at the Royal Albert has more than 140 stops, 11,000 pipes, and a gargantuan 64-foot pedal stop which "speaks" at 8 Hz! To supply air for this behemoth instrument requires five blowers driven by motors supplying 42 horsepower!

Be warned that the wind pressures produce an omnipresent but low-level "hissy" noise throughout this Jack Renner recording. This is a small price to pay for some of the grandest and most exciting organ and orchestral sound you'll ever hear! Organ virtuoso Michael Murray plays these works with great skill and panache, fully utilizing all the vast resources of the great in-



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Elgar's sound permeates the music of Gerald Finzi, whose work is gracious, quirky, and often humorous.

strument. The music is quite thrilling and ultra-sonorous. There are really no speakers or subwoofers that can reproduce the gut-rumbling, 8-Hz sound of the 64-foot pedal, but my Duntech Sovereigns *can* play the first harmonic, at 16 Hz, and believe me, that sound itself is impressive!

For owners of big speaker systems and brute amplifiers, this Compact Disc provides both a challenge and an utterly thrilling musical experience.

Bert Whyte

**Gerald Finzi: Love's Labours Lost Suite, Clarinet Concerto, Prelude, Romance.** English String Orchestra, William Boughton, Alan Hacker, clarinet.

**Nimbus NI 5101, CD.**

Who is Finzi, and what is Nimbus?

Nimbus is an ambitious, Telarc-like, all-CD company in England which is now invading the American market with considerable energy and is promoting much British music.

Finzi is, in spite of his name, a wholly British composer, and still another of those very, very late Romantics who went musically underground, so to speak, during the jazzy, noisy '20s and '30s. Like so many other Romantics, he then resumed composing in an older, more elegant manner—as if nothing had happened—in his later years. Now he is being "rediscovered" at last. Romantic music, you see, has returned to favor.

Finzi's work here dates from early 1939 or so through 1955. It is gracious, quirky, often humorous, and once in a while corny, but it will remind you of a milder Dvořák or Grieg, and above all Elgar, whose sound permeates this music, so many years later. It is a good sound.

The Shakespeare suite ("Love's Labours") was first composed for broadcast, then expanded for an outdoor performance, and finally presented as a wholly separate work. It is gentle and not profound, just right for early Shakespeare in an English production, like good movie music. The "Clarinet Concerto" is something else again, much more biting and telling, with a splendid solo section that will dazzle your ears—especially if you are a jazz clarinetist. If you fancy this wonderful in-

strument, here's a CD you simply must have on hand.

There's another reason I recommend this disc: Alan Hacker is the most astonishing clarinetist I ever hope to hear. He is, well, *electric*, his music blazing with a superhuman energy, though it's never out of control. Hack-

er's sound is that of the most intense of jazz greats—sharp, ecstatic, edgy, and marvelously raw—and yet he plays the classics! Take Benny Goodman, charge him up to 10 times his normal voltage, and you will have Hacker. He makes this Finzi first-class music.

Edward Tatnall Carby

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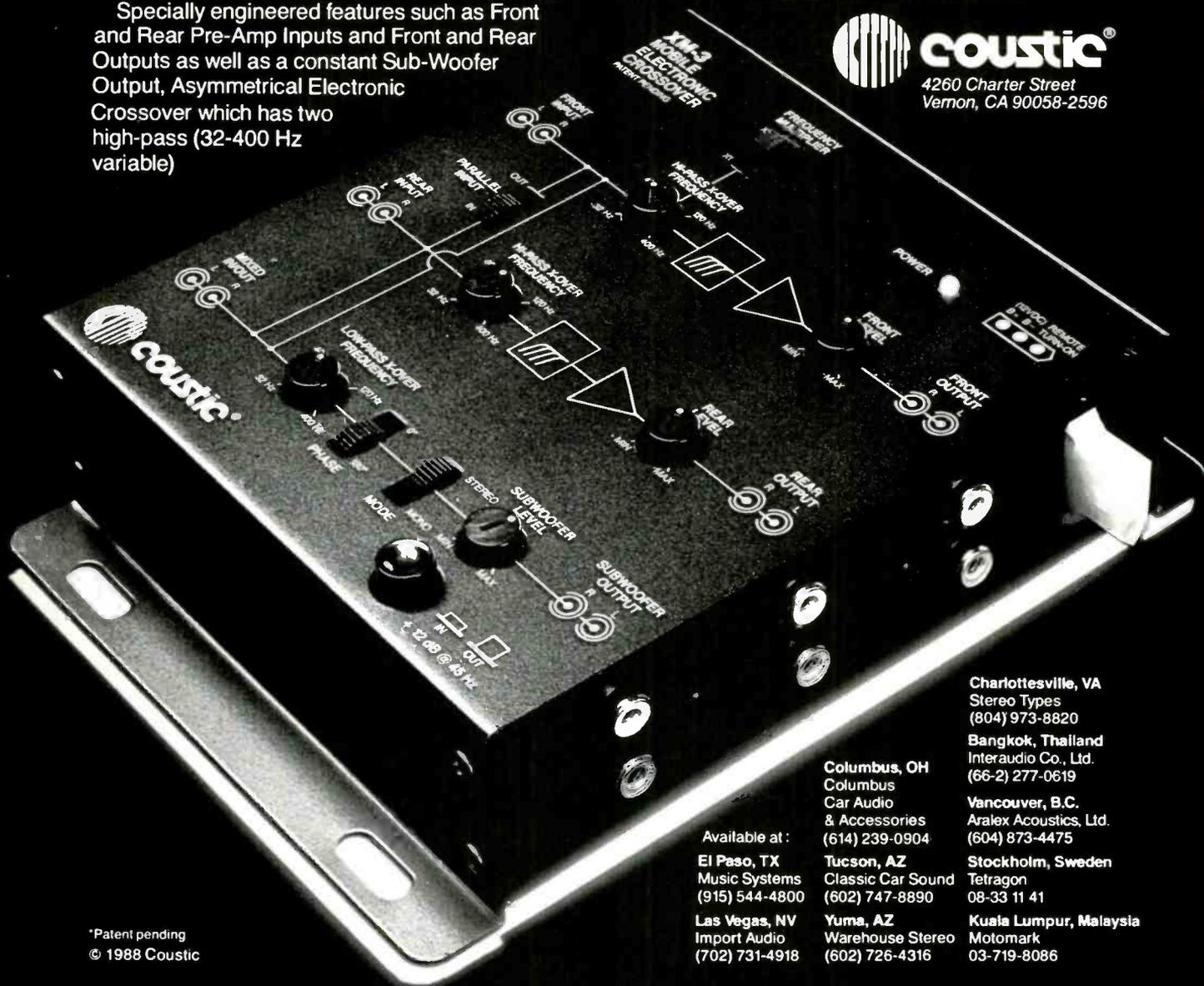
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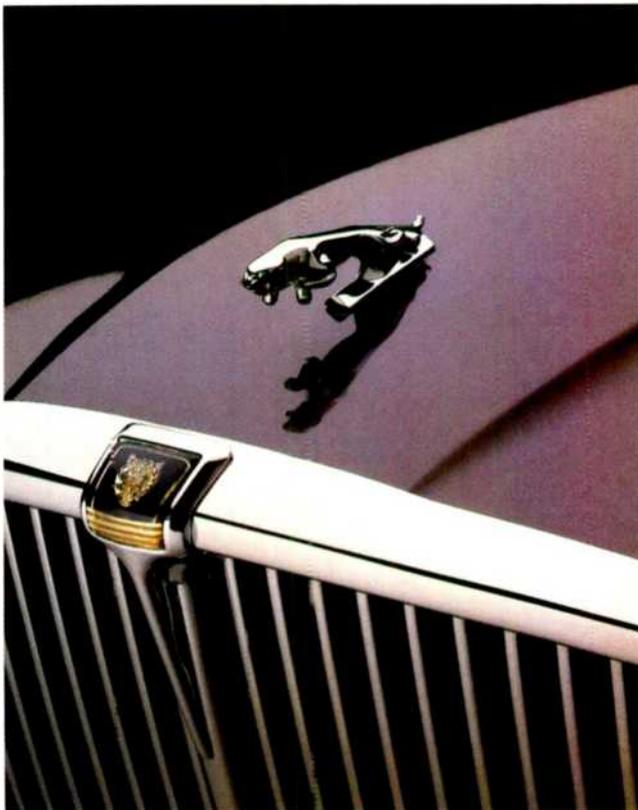
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# 14th ANNUAL CAR STEREO DIRECTORY



Photograph: © 1988, Bill Ashe

**F**ourteen years is a very long time in the automotive stereo field; it is also the age of our Car Stereo Directory. I can remember being hooted at by my peers at various electronics shows because they thought it was impossible to have decent sound, let alone decent sound systems, in the car. The industry itself has changed from using ratings incorporating Peak Chernobyl Power to ones which would quite satisfy an engineering teacher. To their merit, the manufacturers have done this via an ad hoc committee—to keep from driving over their own toes. They also quickly saw how tuner designs should be adopted to meet the demands of the road. They were quick to offer Compact Disc players, in both single-play and changer styles. And, in this country at least, they beat their home hi-fi maker counterparts to the marketplace with Digital Audio Tape players, which—not incidentally—we are adding to our Directory this year. Another interesting change over the past few years has been the increased sophistication and complexity of the amplifier, crossover, and speaker systems which have come about because they can be designed, or at least assembled from stock, as a unified whole. This is reflected in our Directory, which this year lists more amps and equalizers than radio/tape players.

Another item I applaud is the increasing prevalence of the secret operating code, which must be key-padded into the head end when it is first powered up to make it operate. While it would be a nuisance if one's car battery went dead very often, widespread use of the system by car stereo maker's will, undoubtedly, reduce thefts of car hi-fi systems.

As usual, the data given in the tables is from the manufacturers and not the result of our lab tests. We have endeavored to be uniform in our measurement systems, e.g., normalizing furlongs per fortnight; to dynes per hour/ton. Finally, let me ask that you welcome Ronn Smith, our newest inductee into this exquisite form of eyeball torture.—**E.P.**

## DAT PLAYERS

MANUFACTURER	Model (R) = Remote Included	Price, \$	Frequency Response, Hz to kHz, ±dB	Dynamic Range, dB	TFR at 1 kHz, %	Filtration: Analog Only (A), Digital + Analog (D)	AUX Input?	Repeat Functions: Tapa (A), Track (S), Entire Program (C)	Audible Fast Search?	Automatic Rewinding?	Controls: Volume (V), Balance (B), Fader (F), Tone (T)	Programm Search?	Intro Setup?	Direct-Access Numeric Keypad?	Includes Tuner Section?	Dimensions, Inches	Thief Protection: Full-Dur (F), Secret Code (S)	RCA Out Jacks?
ALPINE	5700	1650.00	5-22 ±1	90	0.005	D	Yes	A/B/C	No	No	V/B/F/T	Yes	Yes	No	No	7 x 2 x 6	S	Yes
CLARION	Audio DAC 2000	1749.95	20-20 ±1	92	0.05	D	Yes	A/B	Yes	Yes	V/B/T	Yes	Yes	No	No	7 x 2 x 6	No	No
JVC	KS-D1		5-20	90			Yes	A/B	No	Yes	V/B/F/T	Yes	Yes	Yes	No	7 1/8 x 2 x 5 3/4	No	Yes
KENWOOD	KDT-99R(RI)	2000.00	10-20 ±1	92	0.005	A	Yes	A/B	No		V/B/F/T	Yes	Yes	No	Yes	7 1/8 x 2 x 6 1/8	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	Ways/Channel into 4 Ohms, per EIA-190	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, %	Impedance, per EIA-190	Level, Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, inches	Notes
A/D/S/	PS5	280.00	A			105	40		20-20	0.05	P				Yes	7 1/4 x 1 3/4 x 5 1/2	Bridges to 90 watts. 35 watts x 4 into 2 ohms. †Two-channel mode, 80 watts x 2; three-channel, 80 watts x 1 and 40 watts x 2; four-channel, 40 watts x 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. †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. †Fixed boost/cut via plug-in modules. Parametric EQ. For two-, four-, or six-channel systems; six-channel crossover.	
	PQ8	210.00	A			105	20 x 4		20-20	0.3	P				Yes	9 3/4 x 1 1/2 x 5 1/2		
	PQ10	510.00	A			105	†		20-20	0.05	P				Yes	11 3/4 x 2 x 6 1/2		
	PQ20	770.00	A			105	†		20-20	0.05	P			Yes	14 x 2 3/4 x 8 1/4			
	PH12	330.00	A			105	20 x 6		20-20	0.3	P			No	9 3/4 x 1 1/2 x 7 1/4			
	PH15	690.00	A			105	†		20-20	0.05	P			No	14 x 2 3/4 x 8 1/4			
	EQ1	200.00	E	16	†	110				0.05	P			No	9 x 1 1/4 x 6 1/4			
	642CSI	230.00	P			110				0.05	P/S		Yes	Yes	9 x 1 1/4 x 6 1/4			
AIWA	MA-6000	250.00	A			98	45		10-40	0.5	P	No	No	Yes	9 1/2 x 2 3/4 x 6 1/2	Bridgeable. As above.		
	MA-3000	180.00	A			94	27		10-40	0.5	P	No	No	Yes	8 3/4 x 2 3/4 x 6 1/2			
ALPHASONIK	MA2101	434.50	A			98	100		20-20	0.01	P/S	No	No	Yes	2 1/2 x 7 1/2 x 11 1/4	Bridgeable; Class A. As above. As above. Mono subwoofer amp; parametric EQ. As above. Bridgeable. As above; Class A. Bridgeable. As above.		
	MA2175	570.00	A			98	175		20-20	0.01	P	No	No	Yes	2 1/2 x 8 x 14 1/2			
	MA2300	99.00	A			98	300		20-20	0.01	P	No	No	Yes	2 1/2 x 8 x 16 1/2			
	MAS1060	159.50	A/E	1	+12	90	60 x 1		15-160 Hz	0.01	P/S	No	Yes	Yes	2 x 6 1/2 x 8			
	MAS1100	275.00	A/E	1	+12	90	100 x 1		15-160 Hz	0.01	P/S	No	Yes	Yes	2 x 6 1/2 x 8			
	PEQ7B	110.00	P/E	7	18	95			20-20	0.02	P/S	Yes	No	Yes	1 x 7 x 4 3/4			
	A2018II	69.00	A			75	18		20-20	1	P/S	No	No	Yes	1 1/4 x 4 x 4 1/4			
	A4018II	99.00	A			75	18 x 4		20-20	1	P/S	No	No	Yes	1 1/2 x 5 1/4 x 6 3/4			
	MA2025	137.50	A			90	25		20-20	0.05	P/S	No	No	Yes	2 1/2 x 7 1/2 x 5 1/2			
	MA2035	203.50	A			90	35		20-20	0.01	P/S	No	No	Yes	2 1/2 x 7 1/2 x 7 1/2			
MA2050	220.00	A			90	50		20-20	0.05	P/S	No	No	Yes	2 1/2 x 7 1/2 x 7 1/2				
MA2070	297.00	A			90	70		20-20	0.05	P/S	No	No	Yes	2 1/2 x 7 1/2 x 10				
ALPINE	3321	250.00	P/E	11	12	100					P	Yes	Yes	Yes	7 x 1 x 4 3/4	Selectable crossover frequencies. †Three bands, ±18 dB; four bands, ±12 dB. Four EQ presets. †Five front EQ bands, five rear. †Three bands, ±18 dB; four bands, ±12 dB. Controlled by wired remote; main unit, 7 x 1 x 5 1/2 inches; four EQ presets. Controlled by wired remote; main unit, 4 3/4 x 1 1/4 x 2 3/4 inches. Bridges to 700 watts. Bridges to 400 watts. Bridges to 200 watts. Bridges to 85 watts x 2. Bridges to 80 watts x 2. Bridges to 160 watts. Bridges to 100 watts. Parametric EQ.		
	3318	570.00	P/E	7	†	95					P	Yes	Yes	Yes	7 x 1 x 5 1/2			
	3312	330.00	P/E	†	12	100					P	Yes	Yes	Yes	7 x 1 x 5 1/4			
	3308	130.00	P/E	7	†	100					P	Yes	No	Yes	7 x 1 x 4 1/2			
	3213	220.00	A/E	7	†	80	13		30-20	0.8	P/S	Yes	No	No	7 x 1 x 5 1/2			
	3210	120.00	A/E	7	12	75	8		30-20	0.8	P/S	Yes	No	No	7 x 1 x 5 1/4			
	3337	420.00	P/E	7	12	95					P	Yes	No	Yes	5 1/2 x 2 x 3 1/2			
	3330	200.00	P/E	7	12	95					P	Yes	No	Yes	5 1/2 x 2 1/2 x 3 1/2			
	3545	1500.00	A			110	250		20-20	0.08	P	No	Yes	Yes	17 3/8 x 2 1/2 x 9 1/2			
	3539	760.00	A			110	150		20-20	0.08	P	No	Yes	Yes	10 1/2 x 2 1/2 x 6 1/4			
	3537	550.00	A			110	80		20-20	0.08	P	No	Yes	Yes	12 x 2 1/4 x 17			
	3530	480.00	A			105	40 x 4		20-20	0.08	P	No	Yes	Yes	12 x 2 1/4 x 7 1/2			
	3528	370.00	A			105	30 x 4		20-20	0.08	P	No	Yes	Yes	10 1/2 x 2 1/4 x 6 1/2			
	3525	340.00	A			105	60		20-20	0.08	P	No	Yes	Yes	10 1/2 x 2 1/4 x 6 1/4			
3523	270.00	A			105	40		20-20	0.08	P	No	Yes	Yes	10 1/2 x 2 1/4 x 5 1/2				
3517	190.00	A			100	30		20-20	0.08	P	No	Yes	Yes	7 1/4 x 1 3/4 x 5 1/2				
3501	80.00	A			90	13		20-20	0.8	P/S	No	Yes	Yes	5 1/2 x 1 1/4 x 2 3/4				
3401	500.00	P/E	7	15	100					P	No	No	Yes	9 1/2 x 1 3/4 x 6 1/4				
ALTEC LANSING	ALA 435	420.00	A			95	35 x 4		10-40	0.1	P/S	No	No	Yes	12 3/4 x 8 1/2 x 2 3/8	Bridgeable; transformer-isolated speaker-level inputs. As above.		
	ALA 270	380.00	A			95	70		10-40	0.1	P/S	No	No	Yes	12 3/4 x 7 1/2 x 2 3/8			
AMBRIA	DA-100	440.00	A			104	40		20-80	0.05	P/S			Yes	8 x 6 1/4 x 2	80 watts x 2 into 1 ohm; 0.5-ohm capable.		
AR	GCS 80/40	380.00	A			100	40 x 4		10-50	0.2	P	No		Yes	10 3/8 x 2 1/4 x 8 3/8	Bridges to two channels.		
AUDIO CONTROL	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. †Two-way crossover. Four-channel operation. Mono.		
	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			
	EQQ	349.00	P/E	12	12	110				0.005	P/S	No	No	Yes	2 3/4 x 9 1/2 x 6 3/4			
	EQT	289.00	P/E	30	12	110				0.005	P/S	No	No	Yes	2 3/4 x 9 1/2 x 6 3/4			
AUDIOMOBILE	SP300	312.00	P/E	3	†	110			20-20	0.05	P/S	No	No	No	4 1/2 x 1 1/2 x 4 1/4	†75 to 90 dB, depending on gain control. 40 watts x 4 into 1 ohm. 2-ohm capable for subwoofer; 4-ohm only for satellites.		
	SA1600	598.00	A			110	20 x 4		20-20	0.05	P/S	Yes	Yes	Yes	4 1/2 x 1 1/2 x 2			
	SA1200	536.00	A			110	20 x 4		20-20	0.05	P/S	Yes	Yes	Yes	4 1/2 x 1 1/2 x 2			
AUTOTEK	7600	1000.00	A			102	300		20-20	0.015	P	No	No	Yes	19 x 6 1/2 x 2 3/4	Bridges to 800 watts. Bridges to 350 watts. Bridges to 180 watts. Half DIN size.		
	7200	600.00	A			100	100		20-20	0.015	P	No	No	Yes	11 1/2 x 6 1/2 x 2 3/4			
	7100	350.00	A			95	50		20-20	0.015	P	No	No	Yes	6 1/2 x 6 1/2 x 2 3/4			
	7000	300.00	P/E	7	12	82				0.04	P	Yes	Yes	Yes	6 3/4 x 1 1/2 x 5 1/2			
	A-231	199.00	A			90	65		20-20	0.5	P/S	No	Yes	Yes	1 3/4 x 6 1/2 x 8 1/4			
	A-181	169.00	A			90	40		20-20	0.5	P/S	No	No	Yes	1 3/4 x 6 1/2 x 7			

# 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 EA-400	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, % Per EA-400	Input Level, Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, Inches	Notes
SEVADA	ST-1000	499.95	A		75	125 x 4	20-30	0.15	P/S	No	Yes	Yes	10 1/4 x 25 1/2 x 4 1/2	Bridges to one or two channels. Bridgeable. Bridges to one or two channels. Surround sound with adjustable delay; volume control. CD input jack.	
	ST-50	299.95	A		50	125	20-30	0.25	P/S	No	No	Yes	9 1/4 x 9 x 2 3/4		
	ST-24	189.95	A		65	25 x 4	20-30	0.5	P/S	No	No	Yes	9 1/4 x 4 x 2 1/2		
	ST-7950	249.95	A/E	7	12	65	15 x 4	20-30	0.3	P/S	Yes	No	Yes		7 x 2 x 7 1/4
	ST-7800	129.95	P/E	7						P/S	Yes	Yes	Yes		9 x 1 1/4 x 5
BLACK MAGIC	PA-352	199.95	A		92	35	20-50	0.05	P	No	No	Yes	10 x 1 1/2 x 6 1/2	Bridgeable. As above.	
	PA-752	287.95	A		92	75	20-50	0.05	P	No	No	Yes	10 x 1 1/2 x 7 1/2		
BLAUPUNKT	BPA 2120B	479.95	A		92	100	20-20	0.2	P/S	No	Yes	Yes	11 x 2 1/4 x 9	Bridgeable. As above. †Three front EQ bands, three rear. Parametric EQ programmable by car-specific modules. Four EQ presets. Mounted on flexible stalk.	
	BPA 430	299.95	A		90	30 x 4	10-30	0.1	P/S	No	No	Yes	7 1/4 x 2 1/4 x 10 1/2		
	BPA 230B	219.95	A		90	30	10-30	0.1	P/S	No	No	Yes	6 x 2 1/2 x 9 1/4		
	BPA 420	119.95	A		89	20 x 4	10-30	0.1	P/S	No	No	Yes	4 1/4 x 1 1/4 x 7 1/4		
	BSA 58MS	89.95	A		90	20	20-30	0.1	P/S	No	No	Yes	4 x 1 1/4 x 4		
	PSA 10B	249.95	A/E	†	15	90	25 x 4	20-20	0.25	P/S	No	Yes	8 1/4 x 6 1/4 x 2 1/2		
	BEQ 08E	349.95	E	9	12	80			0.03	P/S	Yes	Yes	Yes		7 x 1 x 5 1/2
	BEQ 65	229.95	E	5	12	80			0.03	P/S	Yes	No	Yes		2 1/4 x 6 1/4 x 7 1/4
BEA 100E	299.95	A/E	7	12	80	25 x 4	15-30	0.03	P/S	Yes	Yes	Yes	5 1/2 x 1 1/4 x 5 1/2		
BEA 80	209.95	A/E	7	12	80	20 x 4	15-40	0.03	P/S	Yes	No	Yes	5 1/2 x 1 1/4 x 5 1/2		
CANTON	M 50	200.00	A		90	50 x 1	20-20	0.1	P/S	No	Yes	No	6 1/4 x 3 3/4 x 1 1/4	Mono amp module for Model MF 3 or MF 5 mainframe. Model MF 3, holds three amp modules, 10 1/2 x 6 1/4 x 1 1/2 inches, \$150.00; Model MF 5, holds five modules, 18 1/4 x 6 1/4 x 1 1/2 inches, \$250.00.	
CARVER	M240		A		100	120	20-20	0.15	P/S	No	Yes	Yes	2 3/4 x 12 1/2 x 6	Bridgeable.	
CERWIN-VEGA	DB-10C	54.95	E	1	†			0.05	P	No	No	Yes	7 1/2 x 2 1/4 x 1 1/4	†At 30 Hz, +10 dB.	
CLARION	100EQB-6	99.95	A/E	5	12	80	13.5	20-20	1	\$	Yes	Yes	7 1/4 x 1 x 5 1/2	Bridgeable. As above. Two-, three-, or four-channel operation. As above.	
	51EQ	99.95	E	5	12	85				P/S	Yes	Yes	7 1/4 x 1 x 5 1/2		
	71EQ	159.95	E	7	12	85				P	Yes	Yes	7 1/4 x 1 x 5 1/2		
	711EQ	329.95	E	7	12	85				P	Yes	Yes	7 1/4 x 1 x 5 1/2		
	501EQA	129.95	A/E	5	12	80	13.5	20-20	1	P/S	Yes	Yes	7 1/4 x 1 x 5 1/2		
	701EQA	169.95	A/E	7	12	80	13.5	20-20	1	P/S	Yes	Yes	7 1/4 x 1 x 5 1/2		
	702EQA	209.95	A/E	7	12	80	13.5 x 4	20-20	1	P/S	Yes	Yes	7 1/4 x 1 x 5 1/2		
	200A	79.95	A			90	13.5	20-20	1	P/S	No	Yes	7 x 1 x 5 1/2		
	401A	119.95	A			90	13.5 x 4	20-20	1	P/S	No	Yes	7 x 1 x 5 1/2		
	600A	209.95	A			100	30	20-20	0.1	P	No	Yes	7 1/2 x 1 1/4 x 8 1/2		
	1000A	309.95	A			103	50	20-20	0.1	P	No	Yes	9 1/4 x 2 1/2 x 6 1/4		
	1600A	429.95	A			107	80	20-20	0.1	P	No	Yes	9 1/4 x 2 1/2 x 8 1/4		
	1801A	499.95	A			103	40 x 4	20-20	0.1	P	No	Yes	8 1/4 x 2 1/2 x 12 1/4		
	3200A	799.95	A			107	80 x 4	20-20	0.1	P	No	Yes	13 1/4 x 2 1/2 x 12 1/4		
CONCORD	CEQ7 + CA 20.2	299.95	E	7	12	96			1.0	P	Yes	Yes	7 x 1 x 5 1/2	Four EQ presets; parametric bass EQ. Bridges to two channels. Bridgeable. Bridges to 500 watts.	
	CA 50.2	99.95	A			90	20		0.08	P/S	No	Yes	7 1/4 x 6 1/4 x 1 1/4		
	CA 30.4	189.95	A			90	50	20-20	0.06	P	No	Yes	10 1/4 x 8 1/4 x 2 3/4		
	CA 100.2	329.95	A			100	30 x 4	20-20	0.06	P	No	Yes	11 1/4 x 7 1/4 x 2 1/2		
	CA 100.2	429.95	A			100	100	20-20	0.06	P	No	Yes	13 1/4 x 7 1/4 x 2 1/2		
	CA 200.2	529.95	A			100	200	20-20	0.06	P	No	Yes	15 1/4 x 7 1/4 x 2 1/2		
COUSTIC	EQ-990	114.95	A/E	7	12	65	16	40-25	0.9	P/S	Yes	Yes	6 1/4 x 1 1/4 x 6	Bridgeable. As above. Includes pink-noise spectrum analyzer. dbx noise reduction.	
	EQ-970	94.95	A/E	7	12	65	16	40-25	0.9	P/S	Yes	Yes	6 1/4 x 1 1/4 x 6		
	AMP-560	1550.00	A			92	220	20-20	0.05	P	No	Yes	3 1/2 x 12 x 3 1/2		
	AMP-190	199.95	A			92	35	20-20	0.05	P/S	No	Yes	2 1/4 x 7 1/4 x 9 1/2		
	AMP-380	309.95	A			92	75	20-20	0.05	P/S	No	Yes	2 1/4 x 7 1/4 x 13 1/2		
	AMP-120	139.95	A			92	30	20-20	0.05	P/S	No	Yes	2 1/4 x 7 1/4 x 7 1/4		
	EQ-1030	449.95	P/E	7	12	92			0.02	P	Yes	Yes	2 1/4 x 6 1/4 x 8 1/4		
	EQ-1100	199.95	P/E	7	12	98			0.02	P	Yes	Yes	7 x 1 x 6		
	EQ-1020	249.95	A/E	7	12	65	12 x 2, 18 x 2	30-30	0.9	P/S	Yes	Yes	Yes		5 1/4 x 1 1/2 x 6 1/4
	EQ-1010	199.95	A/E	7	12	65	18	30-30	0.9	P/S	Yes	Yes	Yes		5 1/4 x 1 1/2 x 6 1/4
	EQ-1000	124.95	P/E	7	12	90			0.05	P/S	Yes	Yes	Yes		5 1/4 x 1 1/2 x 6 1/4
	EQ-1007	149.95	A/E	7	12	65	16	30-30	0.9	P/S	Yes	Yes	Yes		5 1/4 x 1 1/2 x 6 1/4
	AMP-100A	64.95	A			70	18	30-20	0.9	P/S	Yes	Yes	Yes		1 1/4 x 5 1/2 x 6 1/4
	CRAIG	V506A	44.95	A/E	5	12	70	12	80-15	5.0	\$	Yes	Yes		No
V508		54.95	A/E	7	12	70	12	80-15	5.0	\$	Yes	Yes	No	5 x 1 1/2 x 5	
V509		124.95	A/E	7	12	70	20	50-20	5.0	P/S	Yes	Yes	No	6 1/4 x 2 x 6 1/4	
V511		69.95	A/E	10	12	70	20	40-20	5.0	P/S	Yes	Yes	No	6 1/4 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 1/2	
V530		64.95	A			75	20	50-20	5.0	P/S	No	No	No	3 1/4 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	1.0	P/S	No	No	No	15 1/4 x 2 x 7 1/4	
CYBERNET	CMS-4050	549.00	A/E	5	10	80	50	50-20	0.4	P	No	Yes	Yes	7 1/2 x 3 x 11 3/4	
DELTASONIK	D360	525.00	A		95	180	20-20	1	P/S	No	No	Yes	2 1/2 x 14 1/2 x 8 1/2	Two-, three-, or four-channel operation. As above. Bridgeable. †Two-way subwoofer crossover.	
	D200	325.00	A		90	100	20-20	1	P/S	No	No	Yes	2 1/2 x 10 x 8 1/2		
	D90	155.00	A		90	45	20-20	1	P/S	No	No	Yes	7 1/4 x 8 1/4 x 5 1/4		
	D40	69.00	A		75	18	20-20	1	P/S	No	No	Yes	1 1/4 x 4 x 4 1/4		
	PS7A	200.00	E	7	18	95			0.02	P/S	Yes	†	Yes		1 x 7 x 4 1/4

# 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)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, inches	Notes	
DENON	DCA-3500	570.00	A			90	28 x 4, 60 x 1	20-20	0.05	P	Yes	Yes	Yes	15 3/4 x 2 1/8 x 8 1/2	Three- or five-channel operation.	
	DCA-3400	430.00	A			90	28 x 4	20-20	0.05	P		Yes	Yes	14 3/8 x 2 1/8 x 8 1/2	Bridgeable; Class A. As above. Class A; isolated ground. As above. Isolated ground. As above. Half DIN size.	
	DCA-3280	300.00	A			90	40	20-20	0.05	P		Yes	Yes	9 1/2 x 2 1/8 x 8 1/2		
	DCA-3180	220.00	A			90	28	20-20	0.05	P		Yes	Yes	10 3/4 x 1 1/8 x 6 1/4		
	DCA-3175	190.00	A			90	28	20-20	0.05	P		Yes	Yes	8 3/4 x 1 1/4 x 8 1/2		
	DCA-3150	190.00	A			90	12 x 4	20-20	0.5	P		Yes	Yes	9 3/4 x 1 1/4 x 6		
	DCA-3120	100.00	A			90	12	20-20	0.5	P		Yes	Yes	4 1/4 x 1 1/4 x 3 3/4		
DCE-2155	200.00	E	7	12	97					Yes	Yes	Yes	7 1/4 x 1 x 5 1/4			
ECLIPSE	UM-142	614.95	A			100	100		0.03			Yes	Yes	15 3/4 x 2 3/8 x 8 1/4	Two- or four-channel operation.	
FAS	PE-70	87.95	P/E	7	12	80			0.5	P/S	Yes	No	Yes	6 3/4 x 2 x 4 5/8	Includes spectrum analyzer. Four EQ presets.	
	PE-60	114.95	P/E	7	12	65			0.5	P/S	Yes	No	Yes	7 x 1 x 5 1/2		
	EEQ-100	199.95	A/E	7	12	65	18 x 4	20-20 ±1	0.3	P/S	Yes	No	Yes	6 1/2 x 2 x 7		
	EA-120	137.95	A/E	9	12	65	14 x 4	20-20 ±1	1	P/S	Yes	No	Yes	6 3/8 x 2 x 6 3/8		
	EA-70	122.95	A/E	10	12	65	50	20-20 ±0.5	10	P/S	Yes	No	Yes	7 x 1 1/4 x 5 5/8	Includes spectrum analyzer.	
	EA-65	124.95	A/E	7	12	65	14	20-20 ±1	1	P/S	Yes	No	Yes	7 x 1 x 5 1/2		
	EA-60	69.95	A/E	7	12	70	15	30-20 ±3	0.5	S	Yes	No	No	6 3/8 x 1 x 5 1/4		
	PA-400	499.95	A			100	150	15-35	0.05	P/S		Yes	Yes			Bridgeable; external crossover control box.
	PA-151	349.95	A				75	15-30	0.05	P/S			Yes			Bridgeable.
	PA-101	224.95	A				50	15-30	0.08	P/S			Yes			
PA-81	144.95	A				30	20-25	0.05	P/S			Yes				
PA-25	54.95	A			86	12.5	20-20	1	P/S			Yes				
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 1/2 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	15-0735	149.95	P/A E	7	12	60	15 x 4	20-20	5	P/S	Yes	No	Yes	6 1/4 x 1 1/4 x 5 1/8	Four EQ presets.	
	15-0732	99.95	P/A E	7	12	40	15	20-30	5	P/S	Yes	No	Yes	6 3/4 x 1 1/4 x 4 1/4	Bridgeable.	
	15-0727	59.95	P/A	2	12		15	30-20	5	P/S	No	No	Yes	3 3/8 x 1 1/8 x 4 1/8		
	15-0750	169.95	P/A			70	50	20-60	1	P/S	No	Yes	Yes	8 1/4 x 2 3/4 x 8 1/4		
G & S DESIGNS	COMP 100	249.95	A			100	50	20-20	0.02	P	No	No	Yes	2 1/4 x 8 x 9	Dual mono. Independent low and high shelving EQ. AUX loop.	
	COMP 150	329.95	A			100	75	20-20	0.02	P	No	No	Yes	2 1/4 x 8 x 9		
	COMP 200	389.95	A			100	100	20-20	0.02	P	No	No	Yes	2 1/4 x 8 x 12		
	COMP 300	539.95	A			100	150	20-20	0.02	P	No	No	Yes	2 1/4 x 8 x 12		
	COMP 450	429.95	A			100	50 x 4	20-20	0.02	P	No	No	Yes	2 1/4 x 8 x 15		
	COMP 700	749.95	A			100	350	20-20	0.02	P	No	No	Yes	2 1/4 x 8 x 24		
	EX-300	249.95	P/E	2	10	102			0.01	P	No	Yes	Yes	1 x 6 x 5		
	PA-400	289.95	P/E	4	12	102			0.01	P	Yes	No	Yes	1 x 6 x 5		
DAVID HAFLEL CO.	MA-1	450.00	A			100	100	20-20	0.02	P/S	No	No	Yes	12 x 8 x 2 1/2	Bridgeable; MOS-FET output.	
HARMAN/KARDON	CA205		A			90	3.5	10-100	0.20	P	No	No	Yes	1 1/2 x 7 x 4 1/4	Half DIN size. Bridgeable. As above. Half DIN size; CD input jack.	
	CA212		A			84	12	10-30	0.5	P	No	No	Yes	1 x 7 x 5 1/8		
	CA215		A			84	12	10-100	0.20	P	No	No	Yes	1 1/4 x 8 1/4 x 6 1/8		
	CA240		A			72	40	10-100	0.10	P/S	No	Yes	Yes	2 3/4 x 12 1/2 x 8		
	CA260		A			80	60	10-100	0.10	P/S	No	Yes	Yes	3 3/8 x 15 3/8 x 7 1/8		
	CQ10		E	7	10					P	Yes	Yes	Yes	1 x 7 x 5 1/8		
HI-COMP	HCB-818	60.00	A			75	18	20-20	1	P/S			Yes	1 1/2 x 4 x 4 3/4	Bridgeable. As above. Bridges to two channels. CD input jack.	
	HCB-825	140.00	A			75	25 x 4	20-20	1	P/S			Yes	1 1/2 x 5 1/2 x 7 1/4		
	HCB-840	150.00	A			90	40	20-20	0.05	P/S			Yes	2 3/4 x 6 3/4 x 7 1/2		
	HCB-865	225.00	A			90	40	20-20	0.05	P/S			Yes	2 3/4 x 6 3/4 x 11 3/4		
	HCB-880	250.00	A			90	40 x 2, 80 x 2	20-20	0.05	P			Yes	3 x 8 1/2 x 10		
	HCE-765	100.00	E	7	12	80				P	Yes	Yes	Yes			
HIFONICS	Mercury	130.00	A			88	20	20-20	0.05	P/S			Yes	2 1/4 x 7 3/8 x 2 1/2	Bridges to 100 watts. Bridges to 160 watts. Bridges to 240 watts. Bridges to 350 watts. Bridges to 900 watts. Mono subwoofer amp. For trunk mount. Parametric EQ. Bridges to 1800 watts. Bridges to 70 watts. Bridges to 140 watts. Bridges to 360 watts. Mono subwoofer amp. As above.	
	Pluto	195.00	A			90	30	10-32	0.02	P			Yes	2 1/4 x 7 3/8 x 4 1/4		
	Vulcan	270.00	A			95	50	10-32	0.02	P			Yes	2 3/4 x 9 x 4 1/8		
	Odin	370.00	A			97	75	10-32	0.02	P			Yes	2 3/4 x 9 x 5 1/2		
	Thor	500.00	A			100	125	10-32	0.02	P			Yes	2 3/4 x 9 x 7 1/2		
	Zeus	775.00	A			102	300	10-32	0.02	P			Yes	2 3/4 x 9 x 15		
	Hercules	380.00	A			103	200 x 1	10-32	0.02	P		Yes	Yes	2 1/4 x 7 3/8 x 8 5/8		
	Triton	240.00	E	10	12	85			0.02	P	Yes	Yes	Yes			
	Cygnas	210.00	E	10	12	87			0.02	P	Yes	Yes	Yes			
	Ceres	420.00	E	3	20	85			0.02	P	Yes	Yes	Yes			
	Colossus	600.00	A			110	600	5-24	0.02	P			Yes	2 3/4 x 9 x 29		
	Europa	365.00	A			88	25 x 4	10-32	0.02	P		Yes	Yes	2 1/4 x 7 3/8 x 6 1/4		
	Gemini	525.00	A			95	50 x 4	10-32	0.02	P		Yes	Yes	2 1/4 x 7 3/8 x 8 5/8		
	Olympus	750.00	A			100	110 x 4	10-32	0.02	P		Yes	Yes	2 1/4 x 7 3/8 x 14 3/8		
	Eros	210.00	A			95	50 x 1	10-32	0.02	P		Yes	Yes	2 1/4 x 7 3/8 x 5 3/4		
	Cyclops	285.00	A			100	100 x 1	10-32	0.02	P		Yes	Yes	2 1/4 x 7 3/8 x 6 1/4		

# WHAT IT CAN DO SOUNDS LIKE SCIENCE FICTION. WHAT IT SOUNDS LIKE IS OUT OF THIS WORLD.

Introducing the Technics Car CD Changer. It plays 12 discs. Remembers 55 songs. And controls them by wireless remote.

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The CX-DP10 allows you to add our optional stereo tuner (CR-TU10) and other compatible components. The changer can even be used with most of the car audio systems out on the road today.\*

The new CX-DP10 12-disc car CD changer. It's not science fiction. It's Technics. The science of sound.

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\* Optional adaptors and/or professional installation may be required.

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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 into 4 Ohms per EIA-190	Full-Power Bandwidth, Hz to kHz	THD % Rated Output, Hz to kHz per EIA-190	Input Levels: Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, Inches	Notes
HITACHI	MA-D4 MA-9A	89.95 299.95	A A			75 20	20-45 5-30	0.1	P P	No Yes	No No	Yes Yes	7 x 1 x 6 1/4 8 3/4 x 2 1/4 x 8 3/4		
INFINITY	RSA 4.40 RSA 120 RSA 250 RSA 450	399.00 349.00 499.00 649.00	A A A A			100 100 100 100	40 x 4 20-20 20-20 20-20	0.05 0.05 0.05 0.05	P P P P	No No No No	No No No No	Yes Yes Yes Yes	3 x 7.6 x 14.5 3 x 7.6 x 10 3 x 7.6 x 14.5 3 x 7.6 x 16	Bridges to two channels. Bridgeable. Bridges to 300 watts. Bridges to 500 watts.	
JENSEN	A-80 A-200 EOA70 EOA100	69.95 199.95 109.95 137.95	A A A/E A/E			80 18 86 85 85	18 50 15 15	20-20 20-20 1.0 0.5 1.0 1.0	P/S P/S P/S P/S	No No Yes Yes	No No Yes Yes	Yes Yes	4 1/2 x 1 1/2 x 4 1/2 7 1/4 x 2 1/2 x 7 1/4 5 x 1 1/2 x 5 1/2 6 3/4 x 1 1/2 x 5 1/2	Bridgeable.	
JVC	KS-A51 KS-A102 KS-A152 KS-A202 KS-EA400 KS-EA200 KS-E75	89.95 219.95 319.95 379.95 269.95 189.95 269.95	A A A A/E A/E A/E E			90 90 90 90 90 90 90	12 30 45 60 12 x 4 12 12	40-20 20-40 20-40 20-40 20-30 20-30 20-30	0.8 0.4 0.4 0.4 0.8 0.8 0.8	P/S P P P P P P	No No No No Yes No Yes	No No No No No No No	Yes Yes Yes Yes Yes Yes Yes	5 1/2 x 1 1/4 x 3 1/4 9 x 1 1/2 x 5 1/2 10 1/2 x 2 x 6 1/2 10 1/2 x 2 x 7 7 1/4 x 1 x 6 7 1/4 x 1 x 6 7 1/4 x 1 x 6	Bridgeable. As above. As above.
KENWOOD	KGC 4041 KGC 4030 KGC 6040 KGC 9400 KAC 520 KAC 8070 KAC 720 KAC 820 KAC 920 KAC 1020	179.00 219.00 259.00 359.00 129.00 349.00 299.00 429.00 549.00 1099.00	P/E A/E P/E P/E A A A A A A	5 7 8 7	↑ 12 12 12	100 97 100 97 100 100 100 100 100 100		20-20 20-20 20-20 20-20 20 x 2, 37 x 2 20-20 20-20 20-20 20-20 20-20	1 1 1 0.50 1 0.50 0.50 0.50 0.50 0.50	P P/S P/S P/S P P P/S P/S P/S P/S	Yes Yes Yes No No No No No No No	Yes No No No Yes Yes Yes Yes Yes Yes	No No No No No No Yes Yes Yes Yes	3 1/2 x 1 x 4 1/2 7 1/4 x 1 x 5 1/2 7 1/4 x 1 x 5 1/2 7 1/4 x 1 x 5 1/2 3 1/2 x 1 1/4 x 5 1/2 9 1/2 x 2 1/4 x 6 1/2 7 1/4 x 2 1/4 x 5 1/2 7 1/4 x 2 3/8 x 11 1/4 9 1/4 x 2 3/8 x 11 1/4 15 3/4 x 2 3/8 x 11 1/4	†At 50 and 200 Hz, ±18 dB; other bands, ±12 dB. EQ memory; includes spectrum analyzer. Bridgeable.
KRACO	KEC-6 KEC-4 KPA-100	99.95 69.95 119.95	A/E A/E A	7 5	12 12	70 65 75	20 15 42	15-10 12-10 12-15	10 10 10	S S P/S	Yes Yes No	No No No	No No Yes	5 x 5 x 1 1/4 4 x 4 1/2 x 1 1/4 7 1/4 x 7 1/4 x 2 1/2	
LEAR JET STEREO	6865 6840 4500 4505 6835 6863 6861B 6021	169.00 109.00 159.00 132.00 85.00 60.00 41.00 22.00	A A A/E E A/E A/E A/E A			90 90 80 80 80 65 20 20 20	65 40 20 22 20 20 20 20	20-20 20-20 20-20 20-20 20-21 30-20 30-20 50-15	0.03 0.03 0.03 0.03 0.03 0.03 0.02 0.02	P/S P/S P/S P P/S P/S P/S S	No No No No Yes Yes Yes No	No No No No No No No No	Yes Yes Yes Yes Yes Yes No No	2 1/4 x 6 3/4 x 11 1/2 2 1/4 x 6 3/4 x 9 6 3/4 x 2 x 6 3/4 6 3/4 x 2 x 5 1/2 7 3/4 x 1 1/4 x 5 1/4 8 1/2 x 1 1/4 x 5 1/2 4 1/4 x 1 1/4 x 6 1/2 4 x 1 x 4	Bridgeable. As above.
LINEAR POWER	"Runt" 452 452 i 952 952 i 1752 3002 5002 4225 2602 PA-II 1752S	130.00 230.00 260.00 300.00 340.00 500.00 700.00 1000.00 400.00 400.00 400.00 1500.00	A A A A A A A A A A P/E A			16 22.5 22.5 47.5 47.5 87.5 150 250 30 x 4 30 x 2, 60 x 1 175 x 1	20-20 20-20 20-20 20-20 20-20 20-20 19-20 19-20 20-20 20-20 20-100 Hz	0.75 0.12 0.12 0.05 0.05 0.09 0.20 0.12 0.12 0.12 0.04 0.09	P/S P/S P/S P/S P/S P/S P/S P/S P/S P/S P/S	No No No No No No No No No No Yes No	No No No No No No No No No No Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	1 3/8 x 4 x 4 1/2 2 x 7 3/4 x 5 1/2 2 x 7 3/4 x 5 1/2 2 x 7 3/4 x 7 1/2 2 x 7 3/4 x 7 1/2 3 x 9 1/2 x 9 3/4 3 x 9 1/2 x 12 3 x 9 1/2 x 14 1/2 2 x 7 3/4 x 7 1/2 3 x 8 x 10 3/4 x 6 x 3 1/2 3 x 9 1/2 x 9 3/4	Bridgeable with Model XD-2 crossover. 2-ohm capable. As above; bridgeable. As above. As above. As above. As above. As above. As above. †Mono subwoofer out, 20 to 77 Hz; stereo, 77 Hz to 20 kHz. 32-dB gain; selectable faceplate color. Feedback-servo mono subwoofer amp; system includes four 8-inch subwoofers. (See "Speakers.")	
MAGNADYNE	LS3001 LS5001 LS2010	199.95 299.95 179.95	A A P/E	7	12	90 90 95	50 100	10-35 20-20	1.0 1.0	P/S P/S P/S	No No Yes	No Yes Yes	Yes Yes Yes	Bridgeable. As above. Half DIN size; three EQ presets; mono subwoofer output; includes spectrum analyzer.	
MAGTONE	CPA-40 CPA-300 CEQ-810	49.95 299.95 99.95	A A P/E	7	12	80 92 100	18 75 x 4	20-20 20-20	0.5 0.05 0.01	P/S P/S P/S	No No Yes	No No Yes	Yes Yes Yes	1 1/2 x 3 1/4 x 4 3/4 2 3/4 x 9 3/4 x 17 1 1/2 x 5 1/2 x 7	Bridges to two channels.
MAJESTIC	MEB670 MEB1010 MEB1070S MEB8070CD MEB7400A MEB7600 MPA7000 MPA8000 MPA9000	49.95 79.95 99.95 119.95 199.95 169.95 69.95 79.95 129.95	A/E A/E A/E A/E P/A/E A/E P/E P/E P/E	7 10 7 7 7	12 12 12 12 12	55 30 30 70 65 65 65 65 80	30 30 40 40 x 4 50 x 4 50 x 4	20-20 20-20 20-20 20-20 20-20	0.10 0.10 1 1 1 1 1 1 1	P/S P/S P/S P/S P/S P/S P P P	Yes Yes Yes No Yes Yes Yes Yes Yes	No No No No Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes	4 1/2 x 1 x 4 1/4 4 x 1 x 4 1/4 7 x 1 x 5 1/2 6 3/4 x 1 3/4 x 6 1/4 7 x 2 x 7 1/4 7 x 2 x 7 1/4 5 1/2 x 1 1/2 x 4 7 x 1 x 5 1/2 6 3/4 x 2 x 6 1/4	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.

# 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-190	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	
MAJESTIC (Continued)	MPA5000	199.95	P/E	7	12	80				P	Yes	Yes			Four EQ presets; CO input jack; includes spectrum analyzer with pink-noise generator and mike.	
	MA60	49.95	A			50	30	50-15	0.9	P/S	No	Yes	4 1/4 x 1 x 5 1/2			
	MA110HD	79.95	A			65	50	20-20	0.7	P/S	No	Yes	8 1/2 x 2 3/4 x 3 3/4			
	MA160HD	119.95	A			65	80	20-20	1	P/S		Yes	8 1/2 x 2 3/4 x 5 1/2			
	MA200HD	109.95	A			65	75	20-20	1	P/S		Yes	7 3/4 x 2 x 6 1/2			
	MA550HD	149.95	A			70	50	20-20	0.1	P/S	Yes	Yes	7 1/4 x 7 1/4 x 2 1/2		Class A; bridgeable. As above.	
	MA770HD	269.95	A			70	70	20-20	0.1	P/S	Yes	Yes	7 3/4 x 8 3/4 x 3 3/4			
	MA240HD	139.95	A			70	30 x 2, 75 x 2	20-20	1	P/S		Yes	7 3/4 x 2 x 6 1/2			
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		Bridges to one, two, or three channels. As above.		
MA480HD	399.95	A			80	75 x 4	20-20	0.1	P/S	Yes	Yes	11 x 2 3/4 x 13				
MB QUART ELECTRONICS	QM-1		A			105	25	12-80	0.1	P/S			8 1/4 x 4 1/2 x 2 1/4		Bridgeable.	
MEI	PA705H	34.95	A			60	20	40-20	8	P/S		Yes	4 1/4 x 1 x 5			
	PA300H	89.95	A			70	30	20-20	8	P/S		Yes	6 1/4 x 2 1/2 x 6 1/2			
	PA400H	149.95	A			75	40	20-20	8	P/S		Yes	7 x 2 3/4 x 6 1/2		Bridgeable. As above.	
	PA600H	229.95	A			75	60	20-20	8	P/S		Yes	7 x 2 3/4 x 9 1/2			
	EA825B	64.95	A/E	5	12	60	18	30-18	8	S	Yes	No	5 1/2 x 1 1/4 x 5			
	EA837H	79.95	A/E	7	12	70	18	40-18	8	P/S	Yes	Yes	6 1/2 x 1 1/4 x 5 1/2			
	EA850H	149.95	A/E	7	12	60	40	20-30	8	P/S	Yes	Yes	6 1/2 x 2 x 5 1/4			
	EA860E	199.95	A/E	7	12	70	20 x 2, 50 x 2	20-20	8	P/S	Yes	Yes	7 1/4 x 2 x 7 1/4		Four EQ presets; includes spectrum analyzer.	
MILBERT AMPLIFIERS	8aM-230	1495.00	A			90	30	5-60	2	P/S	No	No	Yes	18 x 6 1/4 x 4 1/2	Tube design.	
MITSUBISHI	CVX-10	379.95	A			105	65 x 4		0.1	P	No	No	Yes	2 3/4 x 9 1/4 x 15 3/4	Bridges to two channels. As above.	
	CVX-5	259.95	A			102	35 x 4		0.1	P	No	No	Yes	2 3/4 x 9 1/4 x 10 3/4		
	CVX-3	189.95	A			75	40	70-20	1.0	P	No	No	3 x 7 x 9			
	CVX-2	99.95	A			80	17	70-20	1.0	P	No	No	1 x 6 1/2 x 5 1/2			
MONDLITHIC SOUND	PA-5000	1199.00	A				250	20-20	0.05	P	No	No	Yes	14 1/2 x 4 x 11	Dual mono.	
	PA-2400X	649.00	A				60 x 4	20-20	0.05	P	No	Yes	6 1/2 x 2 3/4 x 11 1/2		†Includes outboard fader.	
	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	Mono. MOS-FET. As above.	
	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		
	PA-700	399.00	A				70	20-20	0.05	P	No	No	Yes	6 1/2 x 2 3/4 x 6 1/4		
	PA-600	399.00	A				20 x 6	20-20	0.1	P	Yes	Yes	Yes	4 1/4 x 1 3/4 x 4 3/4		
	PA-400	239.00	A				20 x 4	20-20	0.1	P	No	No	Yes	4 1/4 x 1 3/4 x 4 3/4		
	PA-200	149.00	A				20	20-20	0.1	P	No	No	Yes	1 1/2 x 4 3/4 x 3 1/2	Bi-FET.	
	EQ-4	299.00	P/E	4	18				0.05	P	No	No	Yes	7 1/2 x 2 x 5 1/2		
	TUNEQ	299.00	E	9	24				0.05	P	Yes	Yes	Yes			
MTX	BTA250	299.95	A		†		50	10-25	0.05	P	No	No	Yes	2 1/4 x 8 1/2 x 9 1/2	†At 45 Hz, +15 dB; at 10 kHz, +6 dB. Bridgeable.	
	BTA2100	439.95	A		†		100	10-25	0.05	P	No	No	Yes	2 1/4 x 8 1/2 x 12 1/2	All as above.	
	BTA435		A				35 x 4	10-25	0.05	P	No	No	Yes	2 1/4 x 8 1/2 x 12 1/2	Bridges to two channels.	
NAKAMICHI	PA-400M	529.00	A			110	140 x 1	5-50	0.002	P			Yes	12 3/4 x 2 1/2 x 6 1/2	220 watts x 1 into 2 ohms; L + R summing circuit. Bridgeable with Model BA-50 adaptor. As above.	
	PA-350	495.00	A			110	35 x 4	5-50	0.005	P			Yes	12 3/4 x 2 1/2 x 6 1/2		
	PA-300H	425.00	A			115	75	5-50	0.003	P			Yes	12 3/4 x 2 1/2 x 6 1/2		
	PA-200	250.00	A			110	30	10-50	0.005	P/S			Yes	7 1/2 x 1 3/4 x 6 1/2	As above.	
	PA-150	235.00	A			100	14 x 4	20-20	0.05	P			Yes	5 1/4 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		
PANASONIC	CY-SG55	119.95	A/E	5	12	83	12.5	20-30	0.8	S	Yes	No	No	1 x 7 x 5 1/2		
	CY-SG60	139.95	A/E	7	12	83	12.5	20-30	0.8	P/S	Yes	No	Yes	1 x 7 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 3/4 x 2 x 10 1/4		Bridgeable.	
PIONEER	GM-4000	450.00	A			104	100	20-20	0.008	P/S		Yes	10 1/2 x 2 1/4 x 8 3/4		Bridgeable; 2-ohm capable.	
	GM-3000	430.00	A			103	†	20-20	0.015	P/S		Yes	11 3/4 x 2 1/2 x 8 3/4		†Two-channel mode, 75 watts x 2; three-channel, 38 watts x 2 and 75 watts x 1; four-channel, 38 watts x 4. Two-ohm capable.	
	GM-2000	300.00	A			102	50	20-20	0.015	P/S		Yes	10 1/2 x 2 1/4 x 8 3/4		Bridgeable; 2-ohm capable. Bass boost switch.	
	GM-1000	220.00	A			101	30	20-20	0.015	P/S		Yes	10 1/2 x 1 1/4 x 8 3/4			
	GM-43A	85.00	A			93	13	30-20	0.8	P/S		Yes	5 1/4 x 1 x 5 1/4			
	EQ-E303	300.00	E	7	12	85				P	Yes	No	Yes	5 1/4 x 1 x 5 1/4	Three EQ presets; includes spectrum analyzer.	
	EQ-220	240.00	E	9	12	85				P	Yes	No	Yes	7 1/4 x 1 x 5 1/4	Front or rear EQ bypass; surround sound.	
	EQ-5000	190.00	E	9	12	85				P	Yes	Yes	Yes	7 1/4 x 1 x 5 1/4	As above.	
	EQ-3000	140.00	E	9	12	85				P	Yes	No	Yes	7 1/4 x 1 x 5 1/4	Front or rear EQ bypass.	
	EQ-100	135.00	E	9	12	85				P	Yes	No	Yes	7 1/4 x 1 x 5 1/4	As above.	
BP-880	200.00	A/E	7	12	85	8 x 4	50-15	5	P/S	Yes	No	Yes	7 x 1 x 5 1/4			
BP-680	150.00	A/E	7	12	85	12	50-15	5	P/S	Yes	No	Yes	7 x 1 x 5 1/4			
BP-450	120.00	A/E	7	12	85	12	50-15	5	S	No	No	No	7 x 1 x 5 1/4			

# 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
PROTON	271	149.00	A/E	7	†	95	50	5-100 ±3	0.03	P		Yes	Yes	6 7/8 x 1 3/8 x 5 7/8	† ±12 or ±18 dB.
	Q275	299.00	A			100	75	20-20	0.04	P	No	No		7 3/4 x 2 x 1 1/4	Bridgeable. 2-ohm capable.
	D230	199.00	A			90	30	20-20	0.04	P	No	No		7 3/4 x 2 x 6 1/4	
	222	129.00	A			90	22	20-20	0.02	P	No	No		7 1/2 x 1 3/8 x 5 3/8	
220	69.00	A			78	14	20-50		P	No	No		7 7/8 x 2 3/8 x 2		
PYLE	A50	199.95	A			100	25	10-50	0.09	P	No	No	Yes	2 x 8 x 7 7/8	Bridgeable. As above. As above. Bi-FET; CD input jack.
	A100	309.95	A			100	50	10-50	0.09	P	No	No	Yes	2 1/2 x 10 1/4 x 7 7/8	
	A200	459.95	A			100	100	10-50	0.09	P	No	No	Yes	2 5/8 x 9 3/8 x 12	
	A400	649.95	A			100	200	10-50	0.09	P	No	No	Yes	2 5/8 x 9 3/8 x 15 1/4	
	A140/4	365.95	A			100	35 x 4	10-50	0.09	P	No	No	Yes	2 5/8 x 12 1/4 x 7 7/8	
	PA1	219.95	P/E	4	12	100			0.01	P	Yes	No	Yes	1 1/2 x 5 3/8 x 4 1/2	
REALISTIC	12-1956	99.95	E	7								Yes	Yes	1 5/8 x 7 x 6 1/8	CD input jack.
	12-1953	79.95	E	7	12							Yes	Yes	1 7/8 x 7 1/8 x 6 1/4	
	12-1958	119.95	E	7	12						Yes	Yes	Yes	2 x 7 1/4 x 6 3/4	
	12-1952	34.95	E	5									Yes	1 3/4 x 5 x 6	
	12-1954	54.95	E	7							Yes	Yes	Yes	1 1/4 x 5 7/8 x 5 3/4	
	12-1955	59.95	E	7							Yes	Yes	Yes	1 3/4 x 6 3/8 x 5 3/8	
ROADSTAR	PA200	89.95	A			68	14 x 4	60-17	0.9	P/S	No	No	Yes	5 7/8 x 7 x 1 1/8	
	PA220	54.95	A			68	14	60-20	1.0	P/S	No	No	Yes	4 3/8 x 6 3/8 x 1 1/2	
	PA230	139.95	A			68	40	20-20	1.0	P/S	No	No	Yes	5 1/2 x 2 3/8 x 7 7/8	
ROCKFORD FOSGATE	Punch 45	215.00	A	2		80	22.5 x 4	20-20	0.05	P	No	No	Yes	5 1/8 x 8 x 2	Bridges to two channels. As above. As above. Two-, three-, or four-channel operation. As above.
	Punch 75	335.00	A	2		80	37.5 x 4	20-20	0.05	P	No	No	Yes	6 1/2 x 8 x 2	
	Punch 150	465.00	A	2		80	75 x 4	20-20	0.05	P	No	No	Yes	8 1/2 x 8 x 2	
	Power 300	950.00	A	2		80	50 x 4	20-20	0.05	P	No	Yes	Yes	14 1/4 x 8 1/8 x 2 1/2	
	Power 650	1500.00	A			80	125 x 4	20-20	0.05	P	No	Yes	Yes	18 3/8 x 8 1/8 x 2 1/2	
	Power 1000	2500.00	A			80	150 x 4	20-20	0.05	P	No	No	Yes	26 1/8 x 7 3/8 x 3 3/8	
	PA-1	350.00	P/E	3		90			0.01		Yes	No	Yes	6 3/4 x 3 1/2 x 1 1/2	
QEQ-1	300.00	E	9		90					No	No	Yes			
SANSUI	SM-X700	449.95	A			100	90	5-100	0.03		No	No	Yes	12 3/8 x 3 3/8 x 11	Bridgeable.
	SM-X500	249.95	A			90	50	20-40	0.03		No	No	Yes	7 7/8 x 2 1/2 x 9	
	SM-X300	169.95	A			85	35	20-40	0.05		No	No	Yes	7 1/8 x 1 x 1/4	
	SM-X70	89.95	A			85	15	10-100	0.05		No	No	Yes	3 1/2 x 4 3/8 x 3 1/2	
	SG-7B	99.95	E	7	12	85			0.05		No	No	No	4 1/4 x 1 1/8 x 3 1/2	
	SANYO	PA7520	219.99	A			100	50 x 2, 20 x 2	20-20	0.05	P/S	No	No	Yes	
PA7220		159.99	A			100	20 x 4	20-20	0.05	P/S	No	No	Yes	7 7/8 x 2 3/8 x 9	
PA7215		119.99	A			85	15 x 4	20-20	1	P/S	No	No	Yes	7 x 1 x 5 1/8	
PA7050		169.99	A			100	50	20-20	0.05	P/S	No	No	Yes	11 1/8 x 3 x 7 3/8	
PA7020		99.99	A			100	20	20-20	0.05	P/S	No	No	Yes	8 1/2 x 2 x 6 3/8	
SENTREK	SAQ 1407	44.95	A/E	7	12	84	12	80-20	1	S	Yes		Yes	5 1/2 x 1 x 4 1/4	IMX dimensional enhancement system.  As above; includes spectrum analyzer. Includes spectrum analyzer.
	SAQ 1409	54.95	A/E	7	12	84	16	80-20	1	S	Yes		Yes	5 1/2 x 1 1/4 x 3 3/8	
	SAQ 1507	59.95	A/E	5	12	84	18	80-20	1	P/S	Yes		Yes	4 x 1 1/4 x 5 1/2	
	SAQ 1707	69.95	A/E	7	12	84	18	80-20	1	P/S	Yes		Yes	5 x 1 1/4 x 5 1/2	
	SAQ 2007	84.95	A/E	10	12	84	18	80-20	1	P/S	Yes		Yes	7 x 1 1/4 x 5 1/2	
	SAQ 2008	94.95	A/E	10	12	84	18	80-20	1	P/S	Yes		Yes	7 x 1 x 5 1/2	
	SAQ 2207	109.95	A/E	10	12	84	18	80-20	1	P/S	Yes		Yes	7 x 1 1/4 x 5 1/2	
	SAQ 2308	104.95	A/E	7	12	84	18	80-20	1	P/S	Yes		Yes	7 x 1 x 5 1/2	
	SAQ 8000	114.95	A/E	10	12	84	15	80-20	1	P/S	Yes		Yes	5 7/8 x 1 1/8 x 6	
	SAQ 3800	159.95	A/E	7	12	84	15 x 2, 28 x 2	80-20	1	P/S	Yes		Yes	7 3/8 x 2 x 7	
	SAQ 7200	184.95	A/E	7	12	84	18 x 4	80-20	1	P/S	Yes		Yes	6 3/8 x 2 x 6 5/8	
	SEQ 700	69.95	E	7	12	90				P/S	Yes		Yes	4 1/2 x 1 1/8 x 5 1/4	
	SEQ 800	79.95	E	7	12	90				P/S	Yes		Yes	7 x 1 x 5 1/2	
	SEQ 900	94.95	E	7	12	90				P/S	Yes		Yes	7 x 1 x 5 1/2	
	SPA 065	32.95	A			86	12	40-15	1	S		Yes	Yes	4 3/4 x 4 7/8 x 1 3/8	
	SPA 070	39.95	A			86	12	20-20	1	P/S			Yes	4 1/8 x 1 x 5 1/2	
	SPA 130	79.95	A			86	18	80-20	1	P/S			Yes	8 3/4 x 2 3/8 x 3	
	SPA 180	119.95	A			86	28	80-20	1	P/S			Yes	8 5/8 x 2 1/2 x 5 1/8	
	SPA 185	119.95	A			86	28	80-20	1	P/S		Yes	Yes	8 5/8 x 2 1/2 x 5 1/8	
SPA 330	209.95	A			86	65	20-20	0.5	P/S		Yes	Yes	8 5/8 x 2 1/2 x 7 7/8		
SHERWOOD	SEQ200	199.95	E	7		98	20	10-30		P	Yes	Yes	Yes	1 x 7 x 5 1/8	Dolby surround.
	EQA280	79.95	A/E	7	10	85	40	10-30	0.5	P	Yes	No	Yes	2 1/2 x 7 3/8 x 9 1/8	
	SCA2250	119.95	A			85	40	10-30	0.2	P			Yes	3 3/4 x 8 x 9 3/4	
	SCA2100	189.95	A			90	70	10-30	0.5	P			Yes	12 x 2 1/4 x 8 7/8	
	SCP802	249.95	A			90	†	16-27		P					
	SCP1002	299.95	A			90	†	16-27	0.5	P		Yes	Yes	12 1/4 x 2 7/8 x 9	

# 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-450	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, % per IEC-450	Input Levels, Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, inches	Notes
SONY	XE-8	329.95	P/E	7	12	95		0.006	P	Yes	Yes	Yes	7 1/8 x 1 x 6	Bridges to 100 watts x 2. Bridgeable. As above.	
	XE-90	219.95	P/E	9	12	95		0.008	P	Yes	Yes	Yes	7 1/8 x 1 x 6		
	XM-E50	159.95	A/E	5	12	75	12	1.0	P	Yes	No	Yes	7 1/8 x 1 x 5 1/4		
	XM-E71	229.95	A/E	7	12	75	12	1.0	P/S	Yes	No	Yes	7 1/8 x 1 1/8 x 6		
	XM-1000	599.95	A			108	45 x 4	3-150	1.0	P/S	No	Yes	12 1/8 x 2 x 8 3/4		
	XM-801	449.95	A			108	80	3-150	0.5	P/S	No	Yes	7 1/8 x 2 1/4 x 13 1/8		
	XM-701	269.95	A			106	45	3-150	0.5	P/S	No	Yes	7 1/8 x 2 1/4 x 7 1/8		
	XM-641	199.95	A			105	22	5-150	0.5	P/S	No	Yes	7 1/8 x 1 1/8 x 5 1/8		
	XM-601	139.95	A			85	14 x 4	20-50	0.5	P/S	No	Yes	9 1/2 x 1 1/4 x 6 1/2		
	XM-301	99.95	A			85	14	20-50	0.5	P/S	No	Yes	7 1/8 x 1 x 6 1/2		
SOUNDSTREAM	MC-500	1295.00	A	1		100	†	15-75	0.1	P/S	No	Yes	19 1/4 x 10 3/8 x 3 3/8	†Two-channel mode, 250 watts x 2; three-channel, 125 watts x 2 and 120 watts x 1; four-channel, 125 watts x 4. Dual mono; bridgeable. Class A; bridges to 90 watts. Bridges to 120 watts. †Three-channel mode, 15 watts x 2 and 80 watts x 1; four-channel, 15 watts x 2 and 30 watts x 2. Bridges to 85 watts. 2-ohm capable.	
	D-200	479.00	A			100	100	15-75	0.1	P/S	No	Yes	2 1/4 x 7 x 11 1/8		
	Class A50	350.00	A			100	25	15-75	0.1	P/S	No	Yes	2 1/4 x 7 x 6 1/2		
	D-100	295.00	A			100	50	15-75	0.1	P/S	No	Yes	2 1/4 x 7 x 6 1/8		
	SF-90	350.00	A			100	†	15-75	0.1	P/S	No	Yes	2 1/4 x 7 x 6 1/8		
	D-60	198.00	A			100	30	15-75	0.1	P/S	No	Yes	2 1/4 x 7 x 4 1/8		
	D-30	119.00	A			85	15	20-20	0.25	P/S	No	Yes	5 1/2 x 1 1/2 x 5 1/8		
D-10	69.00	A			100	5	20-20	0.1	P	No	Yes	1 1/4 x 2 1/4 x 1 3/8			
SPARKOMATIC	SBE7	54.95	A/E	7	12	55	20	20-20	5			No	1 3/8 x 5 1/8 x 4 7/8		
	GE50	39.95	A/E	5	12	55	20	20-20	5			Yes	4 3/4 x 1 3/8 x 4 3/4		
	LC52	19.95	A			55	20	20-20	5			No	4 1/4 x 1 1/4 x 4		
SPECO	HPA-200	229.95	A			70	100	20-20	0.05	S	No	Yes	2 1/8 x 7 1/8 x 7 1/8	Bridgeable. As above. Common or floating ground. As above.	
	HPA-300	349.95	A			70	150	20-20	0.05	S	No	Yes	2 1/8 x 10 7/8 x 7 1/8		
	EPB-100	94.95	A/E	7	12	45	30	20-20	1.0	P	Yes	No	1 1/4 x 5 1/8 x 5 3/8		
	EPB-150	124.95	A/E	10	12	30	30	20-20	1.0	P	Yes	No	1 1/4 x 6 1/2 x 5 3/8		
SUNTECH	AMP162	209.95	A			75	55	20-20	0.08	P/S	No	Yes	3 x 7 x 10	Bridges to 300 watts.	
	AMP142	99.95	A			70	40	20-20	0.1	P/S	No	Yes	2 3/8 x 6 3/4 x 5 1/2		
	EQ309	59.95	A/E	10	12	30	30	30-16	0.1	S	Yes	No	1 1/8 x 5 3/4 x 5 1/2		
	EQ319	89.95	A/E	10	12	35	30	30-16	0.1	P/S	Yes	No	1 1/2 x 7 x 5 1/2		
	EQ329	99.95	A/E	9	12	30	30	60-16	0.1	P/S	Yes	No	1 3/4 x 6 1/4 x 5 1/2		
	EQ347	119.95	A/E	7	12	30	30 x 4	60-15	0.1	P/S	Yes	No	1 3/4 x 6 1/4 x 6		
	EQ357	169.95	A/E	7	12	50	4	60-14	0.1	P/S	Yes	No	1 3/4 x 7 x 6 1/2		
	EQ363	199.95	A/E	7	12	75	2, 30 x 2	60-15	0.1	P/S	Yes	No	2 x 7 x 6		
TARGA	A-9100	129.95	A			90	32	20-20	1	P/S	No	Yes	10 3/8 x 2 1/8 x 7		
	A-9300	169.95	A			90	64	20-20	1	P/S	No	Yes	10 3/8 x 2 3/8 x 7 1/4		
	HT-7102	69.95	A/E	7	12	50	16	20-20	1	P/S	Yes	Yes	7 x 1 x 5 1/8		
	HT-7200	139.95	A/E	7	12	60	33	20-20	1	P/S	Yes	Yes	6 1/4 x 1 1/4 x 6 1/2		
TECHNICS	CY-M50	120.00	A			100	12.5	20-20	0.2	P	No	Yes		Two-, three-, or four-channel operation.	
	CY-M120	200.00	A			100	20	20-20	0.09	P	No	Yes	10 1/8 x 2 1/4 x 4 3/4		
	CY-M200	300.00	A			100	40	20-20	0.09	P	No	Yes	10 1/8 x 2 1/4 x 7 1/8		
	CY-M400	400.00	A			100	40 x 4	20-20	0.09	P	No	Yes	11 1/8 x 2 1/8 x 9 3/8		
YAMAHA	YPA-1000	499.00	A			115	†	10-100	0.1	P/S	Yes	Yes	17 1/4 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.	
	YPA-700	369.00	A			105	†	10-100	0.1	P/S	No	Yes	11 1/8 x 2 x 8 1/2		
	YPA-600	289.00	A			90	50	30-20	0.01	P/S	Yes	Yes	8 3/8 x 3 x 9 3/8		
	YPA-300	199.00	A			105	40	10-100	0.1	P/S	No	Yes	11 1/4 x 2 x 5 1/8		
	YPA-200	129.00	A			100	18	30-30	0.1	P/S	No	Yes	8 1/4 x 1 3/8 x 6 1/2		
	YPA-100	85.00	A			100	12	20-20	1.0	P/S	No	Yes	7 x 1 1/4 x 3 3/4		
	YGE-400	179.00	P/E	7	12	100		0.02	P/S	Yes	Yes	Yes	6 1/2 x 1 1/2 x 5 3/8		
YEC-400	129.00	P			115		0.01	P	Yes	Yes	Yes	8 1/4 x 1 3/8 x 6 1/2			
ZAPCO	Z220	680.00	A			110	110	10-100	0.01	P	No	Yes	12 x 8 1/2 x 3	Bridges to 275 watts. †Amp, 5 1/4 x 5 1/8 x 3 3/4; 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 x 1 1/2. †Nine bands with separate controls for left and right channels. 60 watts x 2 into 2 ohms. Variable crossover.	
	System 200A	660.00	A			110	100	10-100	0.02	P	No	Yes	†		
	PX	550.00	E	4	20	105		0.004	P	No	Yes	Yes	†		
	PEQ	380.00	E	†	18	92		0.05	P	No	No	Yes	8 3/4 x 4 1/4 x 1 1/4		
	S80	320.00	A			105	40	10-100	0.03	P	No	Yes	8 3/8 x 6 1/4 x 2		
	M80+	300.00	A			108	80	10-500 Hz	0.03	P	No	Yes	8 3/8 x 6 1/4 x 2		
	M80	245.00	A			108	80	10-100 Hz	0.03	P	No	Yes	7 1/2 x 6 1/4 x 2		
AGM	90.00	P			95		0.005	P	No	No	Yes	5 1/2 x 3 x 1 1/2			

# 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)			AUX 1 Input?	Repeat Functions: Track (T), Entire Program (E)	Audible Fast Search?	Auto Scan: Disc (D), Tuner (T)	FM Sensitivity, dBf (For 30-dB Quieting)				TUNER		Built-in Amp Power: Watts Channel (If Applicable)	Tape Protection: Full (F), Stereo Code (S)	RCA In/Out Jacks?
						D	No	Yes					D	D	D	D	D	D			
ALPINE	7907	900.00	5-20 ±1	95	0.004	D	No	Yes	D/T/E	Yes	D	16.3	80	60	18					Yes	
	7905	800.00	5-20 ±1	90	0.008	D	No	Yes	D/T/E	Yes	D	16.3	80	60	24					Yes	
	5950	1500.00	5-20 ±1	90	0.005	A	No	12	Yes	D/T/E	Yes									No	
	Tuner for Above Model: 1341 5905	220.00 650.00	5-20 ±1	90	0.008	D	No	Yes	D/T/E	Yes	D	16.3	80	60	18						No
BLAUPUNKT	CDP 05	579.95	5-20 ±0.25	90	0.004	D	No	No	T	No	D	13	75	70	20					Yes	
	Chicago SCD 08	799.95	5-20 ±0.15	90	0.003	D	No	No	D/T	No	D/T									Yes	
CLARION	Audia 5000	829.95	20-20 +0.3	90	0.03	D	No	Yes	D/T/E	Yes	D/T	12	70		18				S	Yes	
DENON	DCC-8920	900.00	5-20 ±1	90	0.005	D	No	Yes	D	Yes	D/T	14.8	70	60	24				P	Yes	
ECLIPSE	ECD-110	1100.00	30-15 ±3		0.007	D	No	Yes	D/E	Yes	D/T	14			27					Yes	
HI-CDMP	HCD-100	500.00	5-20 ±3	92	0.05	D	No	No	D/T/E	Yes	D/T	11	75	70	12					Out	
JVC	XL-C30	699.95	5-20	90	0.0015	D	No	Yes	T	Yes	D/T	16.3	65	60	20					Yes	
KENWOOD	KDC-80	749.00	5-20 ±1	90	0.005	D	No	No	D	Yes	D								P	No	
	KDC-90R	999.00	5-20 ±1	90	0.005	D	No	Yes	D	Yes	D/T	15.2	80	75	18	15			P	No	
LEAR JET STEREO	LCD-550	510.00					No	Yes	D/T							10				Yes	
	LCD-500	420.00					No	No	D/T											Yes	
PANASONIC	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	
PIONEER	CDX-M100 Head Units for Above Model: KEX-M700(RI)	650.00	5-20 ±1	87	0.008	D	6	No	D/T/E	Yes	D/T									No	
	DEX-M300(RI)	450.00										17@ 50 dB	70	70	24				S	Yes	
	DEH-66	800.00	5-20 ±1	85	0.01	D	No	No	D/T/E	Yes	D/T	17@ 50 dB	70	70		10			S	Yes	
	CDX-2 Head Units for Above Model: KEX-900(RI)	650.00	5-20 ±1	90	0.005	A	No	No	D/T/E	Yes	D	17@ 50 dB								No	
		750.00										17@ 50 dB	70	70	24				S	No	
	KEX-500(RI)	580.00										17@ 50 dB	70	70	24				S	No	
REALISTIC	CD-3100	279.95	5-20 ±0.5	80	0.05	D	No	No		Yes	D				16				P	No	
SANYO	FT3000	499.99	5-20	90	0.05	A	No	No	D/T/E	Yes	D	19.2	65	65	12				No	Yes	
	FT5000	599.99	5-20	90	0.05	A	No	No	D/T/E	Yes	D	19.2	65	65	12	15 x 4			No	Yes	
SONY	CDX-A20 Wired Remote/Preamp for Above Model: RM-X2 Tuner for RM-X2: XT-20	749.95	5-20 ±1	90	0.05	D	10													No	
		229.95						Yes	E	Yes										Yes	
		179.95									T	15@ 50 dB	75	70	20					No	
	Head Units for CDX-A20: XR-7300	699.95						Yes	E	No	T	15@ 50 dB	75	70	24	17 x 4			P	Yes	
	XR-7200	649.95						No	D/T/E	No	D/T	15@ 50 dB	70	70	18				P	Yes	
	CDX-R88	749.95	5-20 ±3	90	0.008	D	No	Yes		Yes		15@ 50 dB	75	70	18	13				Yes	
CDX-80	549.95	5-20 ±3	90	0.008	D	No	Yes	D/T/E	Yes	D									Yes		
TECHNICS	CQ-DP5	700.00	5-20 ±1	90	0.005	A	No	No	D/T/E	Yes	D/T	15.2@ 50 dB	75	70	18					No	
	CX-DP10	1000.00	5-20 ±1	90	0.005	A	12	Yes	D/T/E	Yes	D									Yes	
	Tuner for Above Model: CR-TU10	250.00						No			T	17.2@ 50 dB	75	70	15					No	
YAMAHA	YCDT-1000	699.00	20-20 +0.3	90	0.05	D	No	No	D	Yes	D/T	16.3	80	70	18					Yes	
	YCD-500	549.00	20-20 +0.3	90	0.05	D	No	No	D/T	Yes	D									Yes	

# 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)	Number of Tone or EQ Controls	FM Sensitivity (dB) (for 30-dB Quieting)	Alternate-Channel Selectivity, dB	FM Noise S/N Ratio, -dB	Total Number of Station Presets	Tunings: Seek (A), Scan (B), Both (C)	Local Display Control: Manual (M), Automatic (A)	AM Stereo Capable?	Frequency Response, Hz to kHz, ±dB	Noise-Reduction Circuit? See Code (with M or N applicable)	Auto Reverse?	Program Search?	Tape EQ Switch?	In-Deck (D), Out-Deck (O) Under-Deck (U) Push-In (P), Secret Thrust Code (S)	RCA In-Out Jacks?		
AIWA	CT-X5500	450.00	8	0.8	(2)P	5	17.2 <sup>(a)</sup> 50 dB	80	67	18	C	M	No	40-20	B/C	76	Yes	Yes		P	Yes	
	CT-X5300	390.00	8	0.8	P	2	17.2 <sup>(a)</sup> 50 dB	80	67	18	C	M	No	40-18	B	64	Yes	Yes		P	Yes	
	CT-X5200	350.00	8	0.8	P	2	17.2 <sup>(a)</sup> 50 dB	80	67	18	C	M	No	40-18	B	64	Yes	Yes		D	Yes	
	CT-X3500	250.00	8	0.8	P	2	17.2 <sup>(a)</sup> 50 dB	65	63	12	A	M	No	40-16	B	64	Yes	No		D	Yes	
	CT-X3300	200.00	4	0.8	P	2	17.2 <sup>(a)</sup> 50 dB	65	63	12	A	M	No	40-16	No	54	Yes	No		D	Yes	
	CT-S1100	185.00	8	0.9	S	5	19.2 <sup>(a)</sup> 50 dB	60	60				M	No	60-12	No	52	Yes	No		I	No
ALPINE	7385	600.00			P	2	16.3	80	60	18	A	M/A	No	20-22 ±3	B/C	72	Yes	Yes	Auto	P	Yes	
	7284	550.00	16		P/S	2	16.3	80	60	18	A	M/A	No	30-20 ±3	B	64	Yes	Yes	Auto	P	Yes	
	7280	450.00	16		P/S	2	16.3	80	60	18	A	M/A	No	40-18 ±3	B	64	Yes	Yes	Auto	P	Yes	
	7180	400.00	8		P/S	2	16.3	80	60	18	A	M/A	No	40-18 ±3	B	64	Yes	Yes	Auto	P	Yes	
	7179	350.00	8		P/S	2	16.3	80	60	18	A	M/A	No	40-16 ±3	No	55	Yes	No	Auto	P	Yes	
	7256	350.00	16		P/S	2	16.3	80	60	18	A	M/A	No	40-19 ±3	B	64	Yes	Yes	Auto	I	No	
	7158	320.00	8		P/S	2	16.3	80	60	18	A	M/A	No	40-16 ±3	No	55	Yes	Yes	Auto	I	No	
	7156	260.00	8		P/S	2	16.3	80	60	18	A	M/A	No	40-16 ±3	No	55	Yes	Yes	Auto	I	No	
AUDIODEK	3018	70.00	8		S	1	20.8	60	55			A	No	50-12		45	No	No		I	No	
	3021	68.00	8		S	1	28.1	60	55			M	No	50-12		45	Yes	No		I	No	
	3014	45.00	9		S	1	25.2	60	70			M	No	50-15		58	No	No		I	No	
	3078	126.00	9		S	1	18.3	65	60	12	C	M	No	40-14		50	Yes	No		I	No	
	3035	120.00	9		S	1	23.3	65	60	12	C	M	No	40-14		50	No	No		D	No	
	3062	180.00	30		S	5	21.3	65	60	12	C	M	No	30-14		55	Yes	Yes	Yes	I	No	
	3063	169.00	30		S	3	22.1	65	60	12	C	M	No	40-14	B	50	Yes	No		I	No	
	3052	169.00	9		S	2	22.7	65	60	12	C	M	Wc	40-14	D	50	Yes	No		I	No	
	3072	144.00	30		S	5	20.8	65	60	10	B	M	No	30-14		55	No	No		I	No	
	3079	130.00	9		S	1	22.1	65	60	12	C	M	No	50-14		55	Yes	No		I	No	
	3030	105.00	9		S	1	20.8	65	60	12	C	M	No	30-14		55	No	No	Yes	I	No	
AUTOTEK	70	149.95	4	1	P/S	2	18	50	62			M	No	50-12.5 ±3		54	Yes	Yes	Yes	I	Yes	
	710	219.95	4	1	P/S	2	11	50	62	12	C	M	No	50-12.5 ±3		54	Yes	No	No	I	Yes	
	700	249.95	5	1	P/S	2	11	50	62	12	C	M	No	50-12.5 ±3		54	Yes	Yes	Yes	I	Yes	
	720	279.95	5	1	P/S	2	11	50	62	12	C	M	No	50-12.5 ±3	B	54	Yes	Yes	Yes	I	Yes	
	770	359.95	5	1	P/S	2	11	50	62	12	C	A	No	50-12.5 ±3	B/C	54	Yes	Yes	Yes	D/P	Yes	
BEVADA	ST-890	399.95	25		P/S	2				12	C	M	No		D		Yes	No	Auto	D/P	Yes	
	ST-850	249.95	10		P/S	2				12	C	M	No		D		Yes	No	Auto	I	Yes	
	ST-870	299.95	25		P/S	2				12	C	M	No		D		Yes	No	Auto	I	Yes	
BLAUPUNKT	Berlin TOR 07	1599.95		0.1	P	2	13	78	65	96	C	A	Yes	35-18 ±3	B/C	67	Yes	Yes	Yes	D/S	Out	
	Houston SQR 06(RI)	769.95		0.03	P	2	13	80	70	24	C	A	No	30-20 ±3	A/B/C	67	Yes	Yes	Yes	D	Out	
	Tucson SQR 06	649.95		0.03	P	2	13	80	70	24	C	A	No	30-20 ±3	B/C/D	67	Yes	Yes	Yes	D	Out	
	Washington SQR 47	539.95	8 x 4	1	P/S	2	15	78	65	10	A	A	Yes	35-18 ±3	B/C/D	67	Yes	Yes	Yes	D/P/S	Out	
	Lexington SQR 46	499.95	16 x 2, 5 x 4	1	P/S	2	13	78	65	12	C	A	No	30-18 ±3	B/D	62	Yes	Yes	Yes	O/P	Out	
	Aspen SQR 27	389.95	7.5	1	P/S	2	13	75	70	12	A	A	No	30-16 ±3	B/D	62	Yes	Yes	Yes	D/P	Out	
	Portland SQR 28	359.95	7.5	1	P/S	2	13	75	70	12	A	A	No	30-16 ±3	D	60	Yes	No	Yes	D/P/S	Out	
	Denver SQR 26	279.95	7.5	1	S	2	13	65	65	12	A	M	No	30-14 ±3	D	60	Yes	No	No	O	Out	
	San Diego SQR 28	239.95	7.5	1	S	2	13	65	70	12	A	M	No	30-14 ±3		53	Yes	No	No	O	Out	
	Seattle SQR 27	229.95	7.5 x 4	1	S	1	13	65	65	12	A	M	No	30-16 ±3		53	Yes	No	Yes	O/P		
Dallas SQM 88 (Stalk Mount) Tape Player for Above Model: CCP 08	389.95	20 x 4	1	P/S	2	13	80	70	20	C	A	Yes									Yes	
	279.95												30-16 ±3	B/C	67	Yes	Yes	Yes	Yes	D/P	Out	
CARVER	TX-Nine	775.00					13	68	74	30	C	A			B/C	65	Yes	Yes	Yes	D	Yes	
	TX-Seven	650.00					15	60	68	30	C	A			B	60	Yes	Yes	Yes	D	Yes	
CLARION	Audia 2000E	699.95			P	2	12	70	18	18	C	A	Yes	30-20 ±3	B/C	74	Yes	Yes	Auto	D/S	Yes	
	Audia 200E	489.95			P	2	12	70	18	18	C	A	Yes	30-20 ±3	B/C	74	Yes	Yes	Yes	D	Yes	
	Audia 200	469.95			P	2	12	70	18	18	C	A	Yes	30-20 ±3	B/C	74	Yes	Yes	Yes	I	Yes	
	Audia 20	379.95			P	2	12	70	18	18	C	A	No	30-20 ±3	B/C	74	Yes	Yes	Yes	I	Yes	
	9970RT	699.95	6 x 4, 12 x 2	1	P/S	2	12	70	18	18	C	A	No	30-20 ±3	B/C	74	Yes	Yes	Auto	D/P	Yes	
	9200RT	409.95	6 x 4, 12 x 2	1	P/S	2	12	70	18	18	C	A	No	30-18 ±3	B/C	71	Yes	Yes	Yes	I	Yes	
	9100RT	299.95	6 x 4, 12 x 2	1	P/S	2	12	70	18	18	C	A	No	30-16 ±3		53	Yes	Yes	Yes	I	Yes	
	8701RT	299.95	3.2	1	P/S	2	12	70	18	18	C	A	No	30-16 ±3	B	66	Yes	Yes	Yes	I	Yes	
	8825RT	409.95	6 x 4, 12 x 2	1	P/S	2	12	70	18	18	C	A	No	30-16 ±3	B	63	Yes	Yes	Yes	O/P	Yes	
	8670RT	349.95	3.2		P/S	2	12	70	18	18	C	A	No	30-16 ±3		56	Yes	Yes	Yes	D/P	Yes	
	8401RT	229.95	3.2		P/S	2	12	70	18	18	C	A	No	30-16 ±3		56	Yes	No	Yes	I	Yes	
	8330R	229.95	3.2		S	1	12	70	10	10	A	A	No	30-14 ±3		53	Yes	No	No	D	Yes	
	8301R	209.95	3.2		S	1	12	70	18	18	A	A	No	30-14 ±3		53	Yes	No	No	I	Yes	
8200R	189.95	3.2		S	1	12	70	18	18	A	A	No	30-14 ±3		53	No	No	No	I	Yes		

# RADIOS/TAPE PLAYERS

MANUFACTURER	Model (RI) = Remote Included, (RD) = Remote Optional	Price, \$	AMPLIFIER					TUNER					TAPE								
			Average Watts Channel, per EA-450	THD at Rated Output, % per EA-450	Output Level: Preamp (P), Speaker (S)	Number of Taps or EQ Controls	FM Sensitivity, dBf (for 30-avg Quieting)	Alternate-Channel Selectivity, dB	FM Mono S/N Ratio, dB	Total Number of Station Presets	Tuning: Seek (A), Scan (B), Both (C)	Local Display Control: Manual (M), Automatic (A)	AM Stereo Capable?	Frequency Response, Hz to kHz, ±dB	Noise-Reduction Circuit? See Code	Tape S/N Ratio, dB, A=Weighted (With W/T if applicable)	Auto Reverse?	Program Search?	Tape EQ Switch?	In-Deck (I), Out-Deck (O) User-Selectable (U), Power (P) Secret (S), Code (C)	RCA In/Out Jacks?
CONCORD	CX10	279.95	4.5 x 4	0.08	P/S	2	13.5	60	12	B	A	No	40-19 ±3	B	49	Yes	No	Yes	I	Yes	
	CX20	329.95	4.5 x 4	0.08	P/S	2	13.5	60	12	B	A	No	40-19 ±3	B	59	Yes	Yes	I	Yes		
	CX30	379.95	4.5 x 4, 12 x 2	0.08	P/S	2	13.5	60	12	B	A	No	40-19 ±3	B	59	Yes	Yes	I	Yes		
	CX40	399.95	4.5 x 4	0.08	P/S	2	13.5	60	18	C	A	No	40-19 ±3	B	60	Yes	Yes	Yes	D	Yes	
	CX50	499.95	4.5 x 4	0.08	P/S	2	11.3	65	18	C	A	No	30-19 ±3	B	60	Yes	Yes	Yes	P	Yes	
	CX60	599.95	4.5 x 4, 12 x 2	0.08	P/S	2	11.3	65	18	C	A	No	30-19 ±3	B/C	68	Yes	Yes	Yes	P	Yes	
	CX70	749.95	4.5 x 4, 12 x 2	0.08	P/S	2	11.3	65	18	C	A	No	30-19 ±3	A/B/C	78	Yes	Yes	Yes	P	Yes	
COUSTIC	RX-512	309.95	25	0.9	P/S	2	20	60	12	A	M	No	40-18	B/C	40	Yes	Yes	Yes	I		
	RX-506	258.95	8	0.9	P/S	2	20	60	12	A	M	No	40-16	B	70	Yes	Yes	Yes	I		
	RX-505	218.95	25	0.9	P/S	2	25	50	12	C	M	No	50-15	D	50	Yes	Yes	I			
	RX-504	174.95	25	0.9	P/S	2	25	50	12	C	M	No	50-15	B	60	Yes	Yes	I			
	RX-503	139.95	8	0.9	P/S	2	25	50	12	C	M	No	50-15	B	70	Yes	Yes	I			
	RX-533	449.95	25	0.9	P/S	2	18	60	24	A	M	No	30-20 ±5	B/C	70	Yes	Yes	Yes	D/P	Yes	
	RX-531	349.95	25	0.9	P/S	2	18	60	24	A	M	No	30-20 ±5	B/C	70	Yes	Yes	D/P	Yes		
CRAIG	T730	139.95	4.5	5.0	S	2	17.3	60	60	12	B	A	No	63-10 ±3	No	54	No	No	I		
	T732	189.95	4.5	5.0	P/S	2	17.3	60	60	12	B	A	No	63-10 ±3	No	54	Yes	No	I		
	T734	219.95	16	5.0	P/S	2	17.3	60	60	10	B	A	No	63-10 ±3	D	54	Yes	No	I		
	T563	179.95	4.5	5.0	P/S	2	17.3	60	60	12	B	A	No	63-10 ±3	No	54	Yes	No	I		
	T840	279.95	4.5	5.0	P/S	2	14.8	60	60	24	A	A	No	63-10 ±3	B	60	Yes	Yes	D		
	T870	329.95	12	5.0	P/S	2	14.8	60	60	24	A	A	No	63-10 ±3	B	60	Yes	Yes	P		
	TS10	49.95	4.0	5.0	S	1	20.8	60	60	60		M	No	63-10 ±6	No	50	No	No	I		
	TS12	74.95	4.0	5.0	S	1	20.8	60	60	60		M	No	63-10 ±6	No	50	No	No	I		
	TS12F	79.95	4.0	5.0	S	1	20.8	60	60	60		M	No	63-10 ±6	No	50	No	No	I		
	TS14	89.95	4.0	5.0	P/S	1	20.8	60	60	60		M	No	63-10 ±6	No	50	No	No	I		
	TS32	99.95	4.0	5.0	S	1	20.8	60	60	60	12	C	M	No	63-10 ±6	No	50	No	No	I	
	TS34	129.95	4.0	5.0	S	1	20.8	60	60	60	12	C	M	No	63-10 ±6	No	50	Yes	No	I	
	CUSTOM AUTOSOUND	USA2	149.00	7	1	S	1	20.8	45	0	C	M	No	100-12	No		No	Yes	I	No	
USA1		219.00	6 x 4	1	S	1	19.4	50	12	C	M	No	40-18	No		No	Yes	I	Yes		
CYBERNET	CMS-3000	549.00	18	10	P/S	3	14.8	60	60	12	C	M	No	40-12.5 ±3	B	59	Yes	No	Yes	U	Yes
	CMS-4000	699.00	20	10	P/S	3	14.8	60	60	12	C	A	Yes	40-12.5 ±3	A/B	68	Yes	Yes	Yes	U	Yes
DENON	DCR-5520	630.00	10	0.8	P/S	2	14.8	70	60	24	C	M/A		30-16 ±3	B/C	72	Yes	Yes	Auto	D/P	Yes
	DCR-5425	500.00	10 x 2, 4 x 4	0.8	P/S	2	14.8	70	60	24	C	M/A		30-16 ±3	B/C	72	Yes	Yes	Auto	D/P	Yes
	DCR-5320	400.00	10 x 2, 4 x 4	0.8	P/S	2	14.8	70	60	12	C	M/A		40-14 ±3	B/C	70	Yes		Yes	D/P	Yes
	DCR-5220	330.00	4 x 2, 2 x 2		P/S	2	14.8	70	60	24	C	M/A		40-14 ±3	B	62	Yes		Yes	D/P	Yes
ECLIPSE	K11-R	599.95	20 x 4	0.007		3	13 @ 50 dB		18		M		30-15 ±3	B		Yes	Yes	Auto	P	Yes	
EPI	LSR-15	149.95	4	1.0	S	1	14.8	55	52	12	C	M	No	50-12 ±3		52	No	No	Yes	I	No
	LSR-20	219.95	8	0.8	S	2	14.7	55	52	12	C	M	No	50-13 ±3	D	55	Yes	No	Yes	I	No
	LSR-24	269.95	8	0.8	P/S	2	14.7	55	52	12	C	A	No	50-13 ±3	B	60	Yes	Yes	Yes	I	No
	LSR-45	369.95	4.5 x 4	0.8	P/S	2	13.5	60	60	18	C	A	No	40-17 ±3	B	60	Yes	Yes	Yes	D/P	Yes
FAS	DAR-50	349.95	12	1	P/S	2		65	24	C	A	No	30-18 ±3	B	75	Yes	Yes	Yes	D/P	Yes	
	DAR-35	299.95	18	1	P/S	2	19.2	50	12	C	A	No	50-15 ±3	B	60	Yes	Yes	Yes	I	Yes	
	DAR-20	249.95	18	1	P/S	2	19.2	60	12	C	A	No	50-15 ±3	B	60	Yes	No	Yes	I	Yes	
	DAR-5	149.95	7	1	S	1	19.2	60	12	C	A	No	50-15 ±3	60	No	No	No	I	No		
	M-1	149.95	8	1	P/S	2	20.8	80	0	C	A	No	30-18 ±3	50	Yes	No	Yes	I	Yes		
FUJITSU TEN	M-3	339.95	14 x 4	5	P/S	2	16	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D		
	M-2	299.95	6 x 4	5	P/S	2	16	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D		
	M-1	239.95	6 x 4	5	S	1	18	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D		
	QMX-3570	599.95	25	1	S	3	16	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D		
	RX-M3	389.95	14 x 4	5	P/S	2	16	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D/P		
	RX-M2	349.95	6 x 4	5	P/S	2	16	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D/P		
	RX-M1	295.95	6 x 4	5	S	1	18	75	12	A	M	No	30-15	B	55	Yes	Yes	Yes	D/P		
	L-12	239.95	10 x 4	1	S	2	60	60	12	A	M	No	30-15	B	52	Yes			I		
	L-3	319.95	13 x 4	3	S	2	20	60	10	A	M	No	30-15	B	53	Yes			I		
	L-2	284.95	26	3	P/S	2	20	60	10	A	M	No	30-15	D	53	Yes			I		
	L-1	239.95	9	5	S	2	22	60	10	A	M	No	30-15	D	53	Yes			I		
FULTRON	16-7700	279.95	10	3	P/S	2			12	C	A	No	30-15	D		Yes	Yes	Yes	D	Yes	
	16-7400	259.95	10	3	P/S	2			12	C	A	No	30-15	D		Yes	Yes	Yes	D	Yes	
	16-7600	229.95	4	3	P/S	2			12	C	A	No	30-15			Yes	No	Yes	I	Yes	
	16-7300	229.95	4	3	P/S	2			12	C	A	No	30-15			Yes	No	Yes	I	Yes	
	16-7000	209.95	4	3	P/S	1			12	C	A	No	30-15			Yes	No	No	I	No	
	16-6700	199.95	4	3	S	1			12	C	A	No	30-15			Yes	No	No	I	No	
	16-6100	159.95	4	3	S	1			18	C	A	No	20-20			No	No	No	I	No	
	16-5900	99.95	4	3	S	1			0			No	30-15			No	No	No	I	No	
	16-5100	109.95	4	3	S	1			0			No	30-15			No	No	No	I	No	
	16-5800	69.95	4	3	S	1			0			No	30-15			No	No	No	I	No	
HARMAN/KARDON	CH161				P	2	14.8	70	72	12	B	M	No	20-20 ±3	B/C	72	No	Yes	Yes	D	Yes
	CH141				P	2	14.8	70	72	12	B	M	No	20-20 ±3	B	64	No	No	Yes	D	Yes
	CH160				P	2	14.8	70	72	12	B	M	No	20-20 ±3	B/C	70	No	No	Yes	I	Yes
	CH140				P	2	14.8	70	72	12	A	M	No	20-20 ±3	B	64	No	Yes	Yes	I	Yes
	CR151		12	0.50	P/S	2	14.8	70	72	24	C	M	No	20-18 ±3	B/C	72	Yes	Yes	Yes	P	Yes
	CR131		12	0.50	P/S	2	14.8	70	72	24	C	M	No	20-18 ±3	B	64	Yes	Yes	Yes	P	Yes

# Soundstream, the One to WIN!

## Experience Soundstream and Sign Up to Win

We're giving away over 240 new TC301 Cassette/Receivers (shown below) and over 1400 award-winning Soundstream t-shirts. And it's easy to win! Just go to any one of the dealers listed on the other side of the entry below. Give any Soundstream product a look and a listen, then drop off your entry form and you are qualified to win one of the great prizes, including the fantastic two-system Grand Prize.

## The No-Compromise Grand Prize

For the big winner we'll be giving away a Soundstream



Reference Car Audio System comprised of a top-of-the-line TC308 Tuner/Cassette Deck, our flagship MC500 4/3/2-Channel Five Hundred Watt Power Amplifier, and a pair of SS12 Twelve-inch Reference Subwoofers  
AS WELL AS . . .  
A Soundstream

SYSTEM•1 Reference Home Audio System comprised of a C•1 A/V Preamplifier, DA•1 Dual Monaural 400 Watt Power

Amplifier, T•1 Stereo Tuner with R•1 remote. (The amazing R•1 Programmable Remote not only controls the entire SYSTEM•1, but can be easily programmed to control virtually any brand of infrared remote controlled audio/video component.) Grand Prize Car and Home Reference Systems are valued at over \$5500.



## It's Easy to Win

There are lots of prizes, and that means there will be lots of winners. So visit one of the participating authorized dealers listed on the other side of this page, experience Soundstream and sign up to win. Good luck!

### The Reference Standard

*Solid design based on sophistication through refined simplicity, premium parts and the strictest quality control standards combine for superior performance. Soundstream . . . the industry's Reference Standard.*



## TC301 Cassette/Receiver

The moderately-priced TC301 Cassette/Receiver shares much of the award-winning styling and technical excellence of the top-of-the-line Soundstream TC308 Cassette/Tuner. As well, the TC301

has something its world-famous sibling doesn't – built in power for one or two pair of speakers. (Or, it will integrate *perfectly* with any of the superb Soundstream amplifiers.) Great looks, performance and power – it's a real winner.

Name \_\_\_\_\_

Address \_\_\_\_\_

State, City, Zip \_\_\_\_\_

Phone \_\_\_\_\_

T-Shirt Size (circle one): Small Medium Large XL

Dealer Name \_\_\_\_\_

Dealer Address \_\_\_\_\_

### "Experience Soundstream" Contest Rules

1. Prize winners will be selected in random drawings to be held for each participating location by Soundstream Technologies the week of July 18, 1988. Winners will be notified by mail.
2. The Grand Prize winner will be drawn from the total number of entries received from all participating dealers.
3. Only completely filled out entry blanks received at Soundstream Technologies before July 18, 1988 are eligible for the drawing. Taxes are the responsibility of the winners. The odds of winning are determined by the total number of entries received for each dealer drawing. All federal, state and local regulations apply. Void where prohibited by law. NO PURCHASE REQUIRED.
4. Contest is open to all residents of the United States and Canada, 18 years and over. Employees and family members of Soundstream Technologies, and authorized dealers are not eligible.
5. For a list of prize winners, send a separate, self-addressed, stamped envelope to: Soundstream Technologies, 2907 W. 182nd Street, Redondo Beach, CA 90278 - attn: "Experience Soundstream" Contest.

**SOUNDSTREAM**<sup>®</sup>  
C A R A U D I O

**Listen to the Best, Sign Up and WIN!**



# RADIOS/TAPE PLAYERS

MANUFACTURER	Model (RI) = Remote Included. (RO) = Remote Optional	Price, \$	AMPLIFIER										TUNER						TAPE				
			Average Watts Channel, per EIA-590		THD at Rated Output, % per EIA-590	Output Level, Preamp (P), Speaker (S)	Number of Tone or EQ Controls	FM Sensitivity, dBf (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 Station Control: Manual (M), Automatic (A)	AM Stereo Capable?	Frequency Response, Hz to kHz, ±dB	Noise-Reduction Circuit? See Code	Tape EQ Rec. with A-Weighting (With NR if Applicable)	Auto Reverse?	Program Search?	Tape EQ Switch?	In-Deck (D), Out-Deck (O), Under-Deck (U), Flip-Up (P), Secret Theft Code (S)	RCA In-Out Jacks?	
HI-COMP	HCC-1035	140.00	3	1	S	2	16	60	65	12	A	M	No	60-12.5 ±3		50	No	No	No	I	No		
	HCC-1070	220.00	3	1	S	2	16	65	65	12	A	M	No	60-12.5 ±3		50	No	No	I	No			
	HCC-1170	290.00	13	1	P/S	2	11	74	70	18	C	C	No	40-12.5 ±3	B	60	Yes	No	I	Out			
	HCC-1270	330.00	13	1	P/S	2	11	74	70	18	C	C	No	40-12.5 ±3	B	60	Yes	No	I	Out			
	HCC-2300	350.00	13	1	P/S	2	11	74	70	18	C	M	No	40-12.5 ±3	B	60	Yes	No	I	Out			
HCC-2500	500.00	7 x 4	1	P/S	2	11	74	70	24	C	C	No	40-12.5 ±3	B/C	60	Yes	No	P	S	Out			
HITACHI	CSK-551A	999.95			P/S	5				15	B		No		3/C	55	Yes	No	Auto	O	Yes		
	CSK-451A	429.95	12 x 4	0.2	P/S	5	16.3	80	60	18	B	A	No	40-16 ±3	4/C	68	Yes	Yes	Yes	O	Yes		
	CSK-361A	419.95	12 x 4	0.2	P/S	2	16.3	80	60	18	B	A	No	40-16 ±3	B	62	Yes	Yes	Yes	O	Yes		
	CSK-321AR	329.95	12 x 4	0.2	P/S	2	16.3	78	60	12	B	M	No	40-16 ±3	B	62	Yes	Yes	Yes	I	Yes		
	CSK-281AR	279.95	12 x 4	0.2	P/S	2	16.3	78	60	12	B	M	No	40-16 ±3	B	52	Yes	Yes	Yes	I	Yes		
	CSK-251AR	219.95	12 x 4	0.2	S	2	16.3	78	60	12	B	M	No	40-16 ±3	B	52	Yes	No	Yes	I	No		
JENSEN	SJS7000	239.95	5	2.5	P/S	2	20.8	60	60	10	B	A	No	40-8 ±3	B	55	Yes	No	Yes	I	No		
	SJS8000	269.95	18	2.5	P/S	2	20.8	60	60	12	B	A	No	40-8 ±3	B	55	Yes	Yes	Yes	I	No		
	SJS9000	329.95	18	2.5	P/S	2	20.8	60	60	12	B	A	No	40-8 ±3	B	55	Yes	Yes	Yes	P	No		
	JS8400	289.95	15	2.5	S	2	28.2	57	58	12	B	M	No	80-10 ±3	B	60	Yes	No	Yes	I	No		
	JS6200	249.95	3.5	2.5	S	2	28.2	57	58	12	C	C	No	80-10 ±3	B	50	Yes	No	Yes	I	No		
	JS6100	169.95	3.5	2.5	S	1	28.2	57	58	12	C	A	No	80-10 ±3	B	50	No	No	Yes	I	No		
	CS-4800	199.95	3	2.5	S	1	28.2	57	58	8	C	A	No	80-10 ±3	B	50	No	No	Yes	I	No		
	CS-2000	169.95	3	2.5	S	1	28.2	57	58	8	A	A	No	80-10 ±3	B	50	No	No	Yes	I	No		
	JVC	KS-R18	219.95	3	0.008	P/S	2	17.2	65	60	20	B	A	No	50-13 ±0.3	B	52	Yes	No	I	No		
		KS-R28	279.95	3	0.008	P/S	2	17.2	65	60	20	B	A	No	50-13 ±0.3	B	60	Yes	Yes	Yes	I	Out	
KS-RX208		329.95	8	0.008	P/S	2	16.3	65	60	20	B	A	No	50-15 ±0.3	B	60	Yes	Yes	Yes	I	Out		
KS-RX308		379.95	8 x 2, 3 x 2	0.008	P/S	2	16.3	65	60	20	B	A	No	40-15 ±0.3	B	60	Yes	Yes	Yes	I	Yes		
KS-RX408		479.95	8 x 2, 3 x 2	0.008	P/S	2	16.3	65	60	20	B	M	No	40-15 ±0.3	B/C	68	Yes	Yes	Yes	I	Yes		
KS-R38		249.95	3	0.008	P/S	2	17.2	65	60	20	C	A	No	50-13 ±0.3	B	52	Yes	No	D	Out			
KS-R48		299.95	3	0.008	P/S	2	16.3	65	60	20	C	C	No	50-15 ±0.3	B	52	Yes	No	P	Yes			
KS-RX418		389.95	8	0.008	P/S	2	16.3	65	60	20	C	A	No	50-15 ±0.3	B	60	Yes	Yes	Auto	P	Yes		
KS-RX518		469.95	8 x 2, 3 x 2	0.008	P/S	2	16.3	65	60	24	C	M	No	40-15 ±0.3	B	60	Yes	Yes	Auto	P	Yes		
KS-RX618		529.95	8 x 2, 3 x 2	0.008	P/S	5	16.3	65	60	24	C	M	No	40-15 ±0.3	B	60	Yes	Yes	Auto	P	Yes		
KS-RX710	499.95	12	0.008	P/S	5	16.3	65	60	20	B	M	No	40-15 ±0.3	B	60	Yes	Yes	Yes	I	Yes			
KENWOOD	KRC 2000A	289.00	4	1.0	P/S	2	19.0	65	66	12	A	M	No	40-16 ±3	Nc	53	Yes	Yes	Yes	I	No		
	KRC 3002	349.00	10	1.0	P/S	2	15.2	70	70	24	A	M	No	40-16 ±3	B	63	Yes	Yes	Yes	I	No		
	KRC 5001	499.00	10 x 4	1.0	P/S	2	19.0	65	70	12	A	M	No	40-16 ±3	B	64	Yes	Yes	Yes	I	No		
	KRC 8081	652.00	10	1.0	P/S	2	18.4	65	70	24	C	A	Yes	30-18 ±3	B/C	73	Yes	Yes	Yes	I	No		
	KRC 353	349.00	10	1.0	P/S	2	15.2	70	70	24	A	A	No	40-16 ±3	O	59	Yes	Yes	Yes	O	No		
	KRC 434	499.00	10	1.0	P/S	2	19.0	65	65	12	A	M	No	40-16 ±3	B	64	Yes	Yes	Yes	D/P	No		
	KRC 757	619.00	4	1.8	P/S	2	15.2	70	70	30	C	A	No	30-19 ±3	B/C	73	Yes	Yes	Yes	D/P	No		
	KRC 858	739.00	10	1.0	P/S	2	15.2	70	70	30	C	A	No	30-19 ±3	B/C	73	Yes	Yes	Yes	O/P	No		
	KRC 959(RO)	1099.00	7	15.2	P	7	15.2	80	75	20	C	M	No	20-22.5 ±3	B/E	76	Yes	Yes	Yes	O	No		
	KRC 999H(RI)	1799.00	7	15.2	P	7	15.2	80	75	20	C	M	No	20-22.5 ±3	A/B/C	86	Yes	Yes	Yes	O	No		
	KRACO	KF-1108	349.95	33	0.09	S	2	30.3	55	60	15	C	A	No	47-12 ±3	No	62	Yes	No	No	P	No	
		ETR-1084	329.95	33	0.09	S	2	30.3	53	60	12	C	A	Yes	49-12 ±3	D	60	Yes	Yes	Yes	I	No	
ETR-808B		279.95	33	0.09	S	5	30.3	53	60	10	C	M	No	50-12 ±3	No	60	Yes	No	No	I	No		
KF-1107		199.95	32	0.10	P/S	5	28.1	45	60	8	M	M	No	50-10 ±3	No	50	Yes	No	No	I	Yes		
ETR-1082		169.95	10	0.10	S	1	30.3	55	58	0	C	M	No	50-10 ±3	No	59	Yes	No	No	I	No		
ETR-1080		169.95	10	0.10	S	3	28.1	53	55	18	C	A	No	50-10 ±3	No	60	No	No	No	I	No		
KGE-8801B		149.95	32	0.10	S	5	30.3	45	55	0	M	M	No	50-12 ±3	No	60	No	No	No	I	No		
ETR-1079		149.95	10	0.10	S	1	28.1	50	58	10	A	M	No	50-8 ±3	No	55	No	No	No	I	No		
KF-1103		89.95	8	0.10	S	1	30.3	45	55	0	M	M	No	50-8 ±3	No	55	Yes	No	No	I	No		
KID-B588B		99.95	8	0.10	S	1	30.3	45	60	0	M	M	No	50-8 ±3	No	55	Yes	No	No	I	No		
KGE-601		99.95	8	0.10	S	3	30.3	50	55	0	M	M	No	50-8 ±3	No	50	No	No	No	I	No		
KRO-581		79.95	8	0.10	S	1	30.3	45	55	0	M	M	No	50-8 ±3	No	50	No	No	No	I	No		
LEAR JET STEREO		A-412	180.00	9		S	2	23.3	65	60	12	A	A	No	30-14	D	55	Yes	Yes	Yes	D	No	
	A-410	252.00	30		P/S	2	20.8	85	60	12	C	M	No	30-14	B	55	Yes	Yes	Yes	I	Yes		
	A-330	219.00	30		P/S	5	20.8	65	60	12	C	M	No	30-14	B	55	Yes	Yes	Yes	I	Yes		
	A-305	144.00	30		S	5	20.8	65	60	10	B	M	No	30-14	B	55	No	No	No	I	No		
	A-250	192.00	30		P/S	2	20.8	65	60	12	C	M	No	50-15	B	55	No	No	No	I	Yes		
	A-260	156.00	9		P/S	2	20.8	65	60	12	C	M	No	40-14	B	50	Yes	No	No	I	Yes		
	A-252	144.00	9		S	1	20.0	65	60	12	C	M	No	50-14	B	55	Yes	No	No	I	No		
	A-114	132.00	28		S	2	22.1	65	60	12	C	M	No	30-14	B	55	No	No	Yes	I	No		
	A-113	120.00	9		S	1	20.8	65	60	12	C	M	No	30-14	B	55	No	No	Yes	I	No		
	A-293	102.00	9		S	1		65	60		C	M	No	40-14	B	50	Yes	Yes	Yes	I	No		
	A-177	58.00	9		S	1		60	55		C	M	No	50-12	B	45	No	No	Yes	I	No		
	R-300F	84.00	9		S	1	19.8	85	60	12	C	M	No	40-14	B	45	No	No	Yes	I	No		
MAGNADYNE	M3085	99.95	5	1.0	S	1	22			12	C	M	No	45-20		55	No	No	Yes	I	No		
	M3095	179.95	5	1.0	S	1	22			12	C	C	No	45-20		50	Yes	No	No	I	No		
	M3110H	229.95	12.5	1.0	S	2	18.9			12	C	A	No	20-20		50	Yes	No	Yes	D	No		
	LS1001	279.95	12.5	1.0	P/S	2	17																

# RADIOS/TAPE PLAYERS

MANUFACTURER	Model (RI) = Remote Included, (RO) = Remote Optional	Price, \$	Average Watts Channel	THD at Rated Output, % per EIA-490	AMPLIFIER					TUNER					TAPE							
					Output Levels: Preamp (P), Speaker (S)	Number of Taps or EQ Controls	FM Sensitivity (For 30-dB Quieting)	Alternate Channel Selectivity, dB	FM Mono S/M Ratio, -dB	Total Number of Station Presets	Tuning: Seek (A), Scan (S), Both (C)	Local/Variant Control: Manual (M), Automatic (A)	AM Stereo Capable?	Frequency Response, Hz to kHz, ±dB	Noise-Reduction Circuit? See Code	Type S or X Music (M) with 1/3 Octave Equalizer	Auto Reverse?	Program Search?	Tape EQ Switch?	In-Deck (D), Out-Deck (O), Uprate-Drive (U), Auto-Clear (A), Stereo (S), Pilot Code (C)	RCA In Out Jacks?	
																						1
MAJESTIC	MCR1100	79.95	8		S	1	17.2					M	No	80-10 +0.6		50	No	No		I	No	
	MCR1500	119.95	5.5		S	1					M	No	50-10 +0.6		50	Yes	No		I	No		
	MCR64-400	129.95	7		P/S	2					M	No	60-8 +0.6		50	Yes	No	Yes	I	Yes		
	MCR3700AN	179.95	6		P/S	2			10	A	C	No	80-10 +0.6		50	Yes	No		I	Yes		
	MCR3500	149.95	7		P/S	1					M	No	50-10 +0.6		40	No	No		I	Yes		
	MCR3900	159.95	7		P/S	1					M	No	50-10 +0.6		50	Yes	No		I	Yes		
	MCR4100	179.95	7		P/S	2					M	No	50-10 +0.6		50	Yes	No		I	Yes		
	MCR6400HP	219.95	25		P/S	2					A	No	50-10 +0.6	B	50	Yes	Yes	Yes	I	Yes		
	MCR6100HP	199.95	25		P/S	3					A	No	60-10 +0.6		40	Yes	Yes	Yes	I	Yes		
	MCR5900HP	299.95	25		P/S	3					A	No	80-10 +0.6	B	50	Yes	Yes	Yes	P	Yes		
MCR6700HP	399.95	25		P/S	5					A	No	60-10	B/C	50	Yes	Yes	Yes	I	Yes			
MEI	CX154E	113.85	18	8	S	5	20	52	54	10	A	M	No	40-15 ±3		54	Yes	No	Yes	I	No	
	CX2350	107.85	5	8	P/S	2	15.5	52	60	10	A	M	No	40-15 ±3		50	Yes	No	Yes	I	No	
	CX2650	122.85	5	8	P/S	2	15.5	52	60	10	C	A	No	40-15 ±3		50	Yes	No	Yes	D	No	
	CXR158E	299.95	5	8	P/S	2	15.5	55	58	12	C	A	No	40-15 ±3		52	Yes	No	Yes	D/P	No	
	CXR168E	349.95	18	8	P/S	5	15.5	52	64	12	A	M	No	30-19 ±3	B/C	53	Yes	Yes	Yes	D/P	Yes	
	CX135E	154.95	5.5	8	S	1	19.5	50	54	12	A	M	No	40-12 ±3		40	No	No	Auto	I	No	
	CX152E	164.95	5.5	8	S	1	19.5	50	54	12	A	M	No	40-12 ±3		40	No	No	Auto	I	No	
	CX143E	189.95	5.5	8	S	1	15.5	52	60	12	A	M	No	60-12.5 ±3		55	Yes	No	Yes	I	No	
	CX148E	209.95	5.5	8	P/S	2	15.5	52	60	12	A	M	No	40-15 ±3		50	Yes	No	Yes	I	No	
	CX167E	259.95	18	8	P/S	2	17.5	52	62	12	A	M	No	40-15 ±3	B	50	Yes	Yes	Yes	I	No	
	CX117M	89.95	5.5	8	S	1	16	70	60		A	A	No	40-20 ±3		46	No	No	Auto	I	No	
	CX118M	74.95	5.5	8	S	1	16	70	59		A	A	No	80-10 ±3		50	No	No	Auto	I	No	
	CX119M	79.95	5.5	8	S	1	16	70	59		A	A	No	80-10 ±3		50	No	No	Auto	I	No	
	CX127M	124.95	5.5	8	S	1	17	58	60		M	No	80-10 ±3		53	No	No	Yes	I	No		
	CX1650	109.95	5.5	8	S	1	17	70	59		M	No	80-10 ±3		50	No	No	No	I	No		
CX1800	159.95	5.5	8	S	1	17	58	60		M	No	80-10 ±3		53	Yes	No	Yes	I	No			
MITSUBISHI	DX-4	429.95	3.5 x 4	1	P/S	2	20@ 50 dB	65	60	15	A	M	Yes	50-14 ±3	B/C	70	Yes	Yes	Yes	D		
	DX-3	369.95	13	1	P/S	2	20@ 50 dB	65	60	12	A	M	No	50-14 ±3	B	62	Yes	Yes	Yes	D		
	MX-4	349.95	13	1	P/S	2	20@ 50 dB	65	60	15	A	M	Yes	50-14 ±3	B/C	70	Yes	Yes	Yes	I		
	MX-35	289.95	3.5	1	P/S	2	20@ 50 dB	65	60	15	A	M	No	50-14 ±3	B	62	Yes	Yes	Yes	D		
	MX-2	219.95	3.5	1	P/S	2	20@ 50 dB	65	60	15	A	M	No	50-12 ±3	No	52	Yes	No	No	I		
	JX-3	389.95	14	1	S	6	20@ 50 dB	65	60	18	C	M	Yes	50-14 ±3	B	62	Yes	Yes	Yes	I		
	JX-2	319.95	17	1	S	2	20@ 50 dB	65	60	18	C	M	No	50-14 ±3	B	62	Yes	Yes	Yes	I		
	RX-731	159.95	3.5	1	S	1	16	65	60	10	A	M	No		No	50	No	No	No	I		
RX-722	89.95	3.5	1	S	1	22@ 50 dB	80	60	0	No	M	No	50-10 ±3	No	52	No	No	No	I			
NAKAMICHI	TD-1200II	1595.00			P	3	20	60	65	10	A	A	No	20-22 ±3	B/C	70	Yes	No	Yes	I	Yes	
	TD-700	995.00			P	3	18	65	65	12	B	M	No	20-21 ±3	B/C	70	No	Yes	Yes	D	Yes	
	TD-500	795.00			P	3	18	65	65	10	B	M	No	20-21 ±3	B/C	70	No	Yes	Yes	D	Yes	
	TD-400	529.00			P	2	20	65	65	12	A	M	No	25-20 ±3	B/C	70	No	Yes	Yes	D	Yes	
	RD-450	529.00	4 x 4	0.05	P/S	2	20	65	60	18	A	M	No	30-18 ±3	B/C	70	Yes	Yes	Yes	D	Yes	
RD-350	395.00		0.05	P/S	2	20	65	60	18	A	M	No	30-18 ±3	B	64	Yes	Yes	Yes	D	Yes		
PANASONIC	CO-506		2	3.0	S	1	19	55			A	A	No	80-10 ±3		50	Yes	No	No	I	No	
	CO-E290	169.95	3.0	3.0	S	1	17.2	75	65	10	A	A	No	35-12.5 ±3		52	No	No	No	I	No	
	CO-E300A	179.95	3.0	3.0	S	1	17.2	75	65	10	A	A	No	35-12.5 ±3		52	Yes	No	No	I	No	
	CO-E321	199.95	3.0	3.0	S	2	17.2	75	65	10	A	A	No	35-16 ±3		52	Yes	No	No	I	No	
	CO-E350	239.95	3	3.0	P/S	2	17.2	75	65	10	C	A	A	No	35-16 ±3	B	62	Yes	No	No	I	Yes
	CO-E360	249.95	6.0	3.0	P/S	2	15.2	75	70	15	C	A	A	No	35-16 ±3	B	62	Yes	No	No	I	Yes
	CO-E390	299.95	6	3	P/S	2	17.2	75	70	15	C	A	A	No	35-16 ±3	B	62	Yes	Yes	No	I	Yes
	CO-E302	249.95	3	3	P/S	1	17.2	75	70	12	A	A	A	No	35-16 ±3		52	Yes	No	No	D	Yes
	CO-E303	299.95	6	3	S	2	17.2	75	70	15	C	A	A	No	35-16 ±3		52	Yes	No	No	D	Yes
	CO-E352	299.95	3	3	P/S	3	17.2	75	70	12	C	A	A	No	35-16 ±3	B	62	Yes	No	No	D	Yes
	CO-E353	319.95	6	3	S	3	17.2	75	70	15	C	A	A	No	35-16 ±3	B	62	Yes	No	No	D	Yes
	CO-E410	399.95	24 x 4	1	S	3	15.2	75	70	24	C	A	A	No	30-17 ±3	B	62	Yes	No	No	D/P	No
	CO-E430	449.95	24 x 4	1.0	S	3	15.2	75	70	24	C	A	A	No	30-17 ±3	B	62	Yes	Yes	No	D/P	No
	PIONEER	KEX-900(RI)	750.00			P	7	17@ 50 dB	70	70	24	A	A	No	30-20 ±0.3	B/C	70	Yes	Yes	Auto	D/S	No
KEX-M700(RI)		650.00			P	2	17@ 50 dB	70	70	24	A	A	No	30-20 ±0.3	B/C	70	Yes	Yes	Auto	D/S	Yes	
KEX-500(RI)		580.00			P	2	17@ 50 dB	70	70	24	A	A	No	30-19 ±0.3	B	63	Yes	Yes	Auto	D/S	No	
KEH-8050(RI)		520.00	10	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-19 ±0.3	B	60	Yes	Yes	Auto	D/S	Yes	
KEH-9292		420.00	11	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B/C	67	Yes	Yes	Yes	I	Yes	
KEH-6050QR		410.00	10	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes	Yes	D/P	Yes	
KEH-8282TR		390.00	11	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes	Yes	I	Yes	
KEH-6050		380.00	10	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes	Yes	D/S	Yes	
KEH-7272		370.00	11	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes	Yes	I	Yes	
KE-4060QR		360.00	4	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes	Yes	D/P	Yes	
KEH-6262TR		340.00	11	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-14 ±0.3		52	Yes	Yes	No	I	Yes	
KE-4060		340.00	3.2	5	P/S	2	17@ 50 dB	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes	Yes	D	Yes	

# RADIOS/TAPE PLAYERS

MANUFACTURER	Model (RI) = Remote Included, (RD) = Remote Optional	Price, \$	AMPLIFIER										TUNER					TAPE																		
			Average Wtts Channel, per EIA-490		THD at Rated Output, % per EIA-490		Output Levels: Preamp (P), Speaker (S)		Number of Tones or EQ Controls		FM Sensitivity, dB (For 30-dB Dwellings)		Alternate Channel Selectivity, dB		FM Mono S/N Ratio, -dB		Total Number of Station Presets		Local Display Control: Manual (M), Automatic (A)		AM Stereo Capable?		Frequency Response, Hz to kHz, ±dB		Noise-Reduction Circuitry? See Code		Tape S/N Ratio, -dB, A-Weighted		Auto Reverse?		Program Search?		Tape Eject Switch?		In Dash (I), Dash In-Dash (D), Under-Dash (U), Full-Depth (F), RCA In-Dash Jacks?	
			5	P/S	2	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes	Yes	Yes	D/P	Yes																
PIONEER (Continued)	KE-4010QR	320.00	3.2	5	P/S	2	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes	Yes	Yes	D/P	Yes															
	KE-6363	310.00	3.2	5	P/S	2	17(a)	70	70	24	A	A	No	50-17 ±0.3	B	60	Yes	Yes		I	Yes															
	KE-4010	300.00	3.2	5	P/S	2	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes	Yes		D	Yes															
	KE-5353	290.00	3.2	5	P/S	2	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes	Yes		I	Yes															
	KE-4343	270.00	3.2	5	P/S	2	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes	Yes		I	Yes															
	KE-3333	250.00	3.2	5	P/S	2	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes	Yes		I	Yes															
	KE-2323	225.00	3.2	5	S	1	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	Yes		I	No																
	KE-1212	215.00	3.2	5	S	1	17(a)	70	70	24	A	A	No	50-14 ±0.3	B	52	No		I	No																
	KE-1003	190.00	3.2	5	S	1	20(a)	70	70	15	A	A	No	50-13 ±0.3	B	52	No		I	No																
	KP-5550	175.00	3.2	5	S	2	23.2(a)	50	65					50-14 ±0.3	B	52	Yes		I	No																
	KP-4440	160.00	3.2	5	S	1	23.2(a)	50	65					50-14 ±0.3	B	52	Yes		I	No																
KP-2220	150.00	3.2	5	S	1	23.2(a)	50	60					50-13 ±0.3	B	52			I	No																	
DEX-M300(RI)	500.00				P	2	17(a)	70	70	24	A	A	No							D/P	Yes															
PROTON	203T II	429.00	6	0.05	P	3	9.3	65	65	24	C	M	No	20-29 ±3	B	67	Yes	Yes	Yes	D	Yes															
	214CD II	399.00	18		P	3	12.8	65	65	16	C	M	No	20-20 ±3	B/C	76	Yes	Yes	Yes	D	Yes															
	203CD II	369.00	6		P	3	12.8	65	65	16	C	M	No	20-20 ±3	B/C	76	Yes	Yes	Yes	D	Yes															
	215	329.00	16		P	2	12.8	65	65	12	C	M	No	35-16 ±3	B	67	Yes	Yes	Yes	D	Yes															
	205	299.00	6		P	2	12.8	65	65	12	C	M	No	35-16 ±3	B	67	Yes	Yes	Yes	D	Yes															
	CR-360	289.00	18		P	3		65	65	12	C	M	No	20-20 ±3	B/C	76	Yes	Yes	Yes	D	Yes															
	CR-310 II	269.00	6		P	3	12.8	55	60	12	C	M	No	20-20 ±3	B/C	50	Yes			D	Yes															
REALISTIC	12-1924	99.95	8		S	1				12	C	M	No				Yes	No		I																
	12-1928	89.95	8		S	1							No				Yes	No		I																
	12-1927	49.95	8		S	1							No				Yes	No		I																
	12-1922	69.95	24		S								No				Yes	No			Yes															
	12-1934	249.95	15		S					12	C	M	No				Yes	Yes			Yes															
	12-1929	239.95	15		S					12	C	M	No				Yes	Yes			Yes															
	12-1931	179.95	15		S					12	C	M	No				Yes	Yes			Yes															
	12-1932	169.95	15		S					12	C	M	No				Yes	Yes			Yes															
	12-1912	155.95	12		S					12	C	M	No				Yes	Yes			Yes															
	12-1930	149.95	12		S	5				12	C	M	No				Yes	Yes			Yes															
	12-1933	139.95	12		S					12	C	M	No				Yes	Yes			Yes															
	12-1926	129.95	12		S					12	C	M	No				Yes	Yes			Yes															
RDADSTAR	RS1200	79.95	3	10	P/S	1	22	60	60				No	125-8	No	50	No	No	No	D	Yes															
	RS1600	99.95	3	10	P/S	1	25	60	60				No	125-10	No	50	No	No	No	D	Yes															
	RS2000	129.95	4	10	P/S	1	18	60	60	12	A	M	No	125-12.5	No	50	No	No	No	D	Yes															
	RS2200	164.95	4	10	P/S	2	18	60	60	12	A	M	No	125-12.5	No	50	No	No	No	D	Yes															
	RS2500	199.95	3	10	P/S	2	15	60	60	12	A	M	No	125-10	No	50	Yes	No	No	D	Yes															
	RS3000	189.95	4	10	P/S	1	22	60	60	12	A	M	No	125-12.5	No	50	Yes	No	No	D	Yes															
	RS5000	219.95	15	10	P/S	2	18	60	60	12	C	M	No	125-14	D	50	Yes	No	No	D	Yes															
	RS6000	249.95	15	10	P/S	5	15	65	65	12	C	M	No	125-14	D	50	Yes	No	No	D	Yes															
SANSUI	RE-7	899.95	16	0.05	P/S	7	16.2	70	18	C	M	No	30-18 ±3	B	67	Yes	Yes	Yes	D	Out																
	GTX-7000	599.95	16		P	2	16.2	70	24	C	M	No	30-18 ±3	B/C	78	Yes	Yes	Yes	D	Out																
	RE-5	499.95	16	0.05	S	7	16.2	70	18	C	M	No	30-15 ±3	B	65	Yes	Yes	Yes	D	Out																
	RX-7100	419.95	16	0.05	P/S	2	16.2	70	18	C	M	No	30-16 ±3	B	65	Yes	Yes	Yes	D/P	Out																
	RX-5100	379.95	16	0.05	S	2	16.2	70	18	C	M	No	30-16 ±3	O	60	Yes	No	No	D/P	Out																
	RX-3100	229.95	8	0.1	S	2	15.2	18	B	M	No	No	55-14 ±3	B	50	Yes	Yes	Yes	D	No																
	RX-550	319.95	16	0.05	P/S	2	14.8	70	24	C	M	No	30-16 ±3	B	65	Yes	Yes	Yes	I/S	Out																
	RX-455	329.95	16	0.05	P/S	2	14.8	70	24	B	A	No	30-15 ±3	B/C	70	Yes	Yes	Yes	I	Out																
	RX-355	269.95	10	0.05	P/S	2	14.8	70	24	B	A	No	30-15 ±3	B	65	Yes	No	Yes	I	Out																
	RX-255	229.95	4	0.05	P/S	2	14.8	70	24	B	A	No	30-15 ±3	O	55	Yes	No	Yes	I	Out																
	RX-350	199.95	10	0.05	S	2	14.8	70	18	B	M	No	30-16 ±3	O	60	Yes	No	Yes	I	Out																
	RX-222	69.95	35	0.1	S	2	15.2	55	12	B	M	No	40-14 ±3	B	50	Yes	No	No	I	No																
	SANYO	FT325i	79.99	3	1	S	1	20.8	60	50	12	A	M	No	80-10	No	50	No	No	No	I	No														
FT528		99.99	3 x 4	1	S	1	20.8	60	50	12	A	M	No	80-10	No	50	No	No	No	I	No															
FT635i		149.99	6 x 4	1	S	2	19.2	65	60	12	A	M	No	63-12.5	No	50	Yes	No	Yes	I	No															
FT911		179.99	6 x 4	1	S	2	19.2	65	60	12	A	M	No	63-14	B	60	Yes	No	Yes	I	No															
FT928		199.99	9.5 x 4	1	P/S	2	19.2	65	60	12	A	M	No	63-14	B	60	Yes	No	Yes	I	Yes															
FT928S4		219.99	9.5 x 4	1	P/S	2	19.2	65	60	24	A	M	No	63-14	B	60	Yes	No	Yes	I/S	Yes															
FT450		239.99	6 x 4	1	S	2	19.2	65	60	12	A	M	No	63-14	B	60	Yes	No	Yes	D/P	No															
SENTREK	SCR 090	59.95	4	5	S	1	17	60	65	0			No	80-8 +0,-6		45	No	No	No	I	No															
	SCR 100	69.95	4	5	S	1	17	60	65	0			No	60-15 +0,-3		45	No	No	No	I	No															
	SCR 105	74.95	4	5	S	1	17	60	65	0			No	60-15 +0,-3		45	No	No	No	I	No															
	SCR 140	94.95	4	5	S	1	17	60	65	0			No	80-8 +0,-6		40	Yes	No	No	I	No															
	SCR 150	119.95	4	5	S	1	17	60	65	0			No	80-8 +0,-6		45	Yes	No	No	I	No															
	SCR 160	134.95	4	5	P/S	3	17	60	65	0			No	80-8 +0,-6		45	Yes	Yes	Yes	I	Out															
	SCR 560	139.95	4	5	S	1	17	60	65	12	C	M	No	50-8 +0,-6		45	Yes	No	No	I	Out															
	SCR 710	169.95	4	5	S	1	17	60	65	12	C	M	No	60-10 +0,-3		45	No	No	No	I	No															
	SCR 760	179.95	4	5	P/S	2	17	60	65	12	C	M	No	40-12 +0,-3		50	No	No	No	I	No															
	(Continued)																					Out														

# RADIOS/TAPE PLAYERS

MANUFACTURER	Model (RD) = Remote Included, (RD) = Remote Optional	Price, \$	AMPLIFIER										TUNER						TAPE					
			Average Waits/Channel, per EIA-490		THD at Rated Output, % per EIA-490	Output Levels: Preamp (P), Speaker (S)		Number of Taps or ED 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 (E)	Least-Used Control: Manual (M), Automatic (A)	AM Stereo Capable?	Frequency Response, Hz to kHz, ±dB	Noise-Reduction Circuit? See Code	Tape S/R Ratio, dB, A.V. (with R/R 1, 2, 3, 4, 5, 6, 7, 8, 9, 10)	Auto Reverse?	Program Search?	Tape Eject Switch?	In-Deck (D), Out-Deck (O), Dual (D), Single (S), Serial (S), Other (P)	RCA In/Out Jacks?	
SENTREK (Continued)	SCR 780	189.95	4	5	P/S	2	17	60	65	10	A	M	No	40-12 + 0,-6		50	Yes	No	No	I	Dut			
	SCR 960	199.95	15	5	P/S	3	17	60	65	12	C	M	No	40-12 ± 3		50	Yes	Yes	I	Dut				
	SCR 1000	239.95	15	5	P/S	3	17	60	65	12	C	M	No	40-12 ± 3		50	Yes	Yes	I	Dut				
	SCR 1150	239.95	15	5	P/S	2	17	60	65	12	C	M	No	50-10 ± 3		50	Yes	No	D	Out				
SHARP	RG-F816	459.00	25	1		4				13	C	M	No		B	52	Yes	Yes	O S	Out				
	RG-F810	329.00	25	1		4				13	C	M	No		B	52	Yes	Yes	O	Out				
	RG-8926	219.00	25			2				12	A	M	No		B	61	Yes	No	I					
	RG-8920	189.00				1				12	A	M	No		B	61	Yes	No	I					
	RG-8608	159.00				1				12	A	M	No		B	61	Yes	No	I					
SHERWOOD	CRO-155	139.95	6	10	S	2				12	C	M	No	15-30		55	No	No	I	No				
	CRD-165	179.95	6	10	S	2		65		12	C	M	No	30-15		52	No	No	I	No				
	CRO-175	229.95	6	10	P/S	2		65		12	C	M	No	30-17		62	Yes	Yes	I	Yes				
	CRO-210	279.95	20	10	P/S	2				12	C	M	Yes	30-17	B/C	71	Yes	Yes	I	Yes				
	CRO-230	279.95	20	10	P/S	3		60		18	C	M	No	30-17	B	63	Yes	Yes	D	Yes				
	CRD-350	329.95	20	10	P/S	3		65		12	C	M	Yes	30-17	B/C	71	Yes	Yes	D	Yes				
SONY	XR-7300	699.95	17 x 4	1.0	(4)P, (4)S	2	15 (Gr) 50 dB	75	70	24	B	M	No	30-18 ± 3	B/C	76	Yes	Yes	Yes	P	Yes			
	XR-7200	649.95			(4)S (6)P	2	15 (Gr) 50 dB	70	70	18	B	M	No	30-18 ± 3	B/C	76	Yes	Yes	Yes	P	Out			
	XR-7150	439.95	13	1.0	P/S	2	15 (Gr) 50 dB	70	70	24	B	M	No	30-18 ± 3	B/C	76	Yes	Yes	Yes	P	Out			
	XR-7100	499.95	13 x 4	1.0	P/S	2	15 (Gr) 50 dB	70	70	18	A	M	No	30-18 ± 3	B	66	Yes	Yes	Yes	O	Yes			
	XR-7050	329.95	11	1.0	P/S	2	20 (Gr) 50 dB	70	65	18	B	M	No	40-16 ± 3	B	66	Yes	Yes	Yes	P	Out			
	XR-5000	319.95	4	1.5	(4)P, (4)S	2	20 (Gr) 50 dB	70	65	12	B	M	No	40-16 ± 3	B	66	Yes	Yes	Yes	D	Dut			
	XR-510R	269.95	4	1.5	P/S	2	20 (Gr) 50 dB	70	65	18	B	M	No	40-16	B	58	Yes	Yes	No	O	Out			
	XR-6300	329.95	13	1.0	P/S	2	20 (Gr) 50 dB	65	65	18	A	M	No	40-16	B	66	Yes	Yes	Yes	I	Dut			
	XR-6200	279.95	4	1.0	(4)P, (4)S	2	20 (Gr) 50 dB	65	65	18	A	M	No	40-16	B	66	Yes	Yes	Yes	I	Out			
	XR-6150	239.95	4	1.0	P/S	2	20 (Gr) 50 dB	65	65	18	A	M	No	40-16	B	58	Yes	Yes	Yes	I	Dut			
	XR-6000	199.95	4	1.0	S	2	20 (Gr) 50 dB	65	65	18	A	M	No	40-16	B	58	Yes	No	Yes	I	No			
XR-170	159.95	4	1.5	S	2	23 (Gr) 50 dB	65	68				No	40-14		53	Yes	No	No	I	No				
SOUNDSTREAM	TC-308	679.00			(4)P	3	20	65	67	12	B	M	No	30-20 ± 3	B/C	70	Yes	Yes	Yes	D P	Yes			
	TC-305	519.00			(4)P	3	20	65	67	12	B	M	No	30-18 ± 3	B/C	70	Yes	No	Yes	D/P	Yes			
	Powered TC-305	569.00	5	0.1	P/S	3	20	65	67	12	B	M	No	30-18 ± 3	B/C	70	Yes	No	Yes	D/P	Yes			
	TC-303	399.00	4.5 x 4, 11 x 2	0.8	P/S	2	20	65	70	12	B	A	No	30-18 ± 3	B/C	68	Yes	Yes	Yes	O/P	Yes			
TC-301	299.00	11	0.8	P/S	2	20	65	70	10	A	A	No	30-18 ± 3	B	62	Yes	Yes	Yes	I	Yes				
SPARKOMATIC	SR338	109.95	5	1	S	1	9	50	60	10	C	A	A	70-12 ± 3		55	No	No	I					
	SR334	106.95	5	1	S	1	15	60	60			A	No	75-10 ± 3		35	Yes	No	I					
	SR36	84.95	5	1	S	1	18	45	60			A	No	75-10 ± 3		35	Yes	No	I					
	SR37	69.95	5	1	S	3	18	45	60			A	No	75-10 ± 3		35	No	No	I					
	SR300	54.95	5	1	S	1	18	45	60			M	No	75-10 ± 3		35	No	No	I					
	SR35	54.95	5	1	S	1	20	40	50				No	100-9 ± 3		35	No	No	I					
	SR340	129.95	5	1	S	1	9	50	80	15	C	A	No	70-12 ± 3	No	65	No	No	D					
	SR38	99.95	5	1	S	5	18	45	60			M	No	50-12 ± 3		65	No	No	D					
	SR340	279.95	20	1	S	5	9	65	60	10	C	C	Yes	20-20 ± 3	D	65	Yes	Yes	D					
	SR317	199.95	20	1	S	5	9	65	60	10	C	C	No	20-20 ± 3	D	65	Yes	No	D					
	SR360	179.95	5	1	S	2	9	65	60	15	C		No	60-20 ± 3	O	65	Yes	No	D					
	SR350	149.95	5	1	S	1	9	65	60	15	C		No	60-20 ± 3	O	65	Yes	No	D					
	SUNTECH	CS108H0	189.95	25	0.1	P/S	5	25.2	60	0		M	No	50-10	D		Yes	No	Yes	I	Yes			
CS439R		319.95	25	0.08	P/S	2	23.3	60	12	C	M	No	50-15	O		Yes	No	Yes	D/P	Yes				
TARGA	R-780	399.95	16	1	P/S	2	22	65	12	A	M	No	40-16.5 ± 3	B	65	Yes	Yes	Yes	D/P					
	R-550	329.95	16	1	P/S	2	23	60	12	A	M	No	50-15 ± 3	B	65	Yes	Yes	Yes	D/P					
	R-500	269.95	4.5	1	P/S	2	23	60	12	A	M	No	60-12 ± 3	No	55	Yes	Yes	Yes	D/P					
	R-350	259.95	16	1	P/S	2	22	60	12	C	M	No	60-13.5 ± 3	B	65	Yes	Yes	Yes	I					
	R-330	219.95	16	1	P/S	2	22	60	12	C	M	No	60-12 ± 3	No	55	Yes	Yes	No	I					
TECHNICS	CO-H9320	360.00	Ext.	0.8	Ext.	2	30	75	70	24	C	A		20-15 ± 3	B	62	Yes			D/P	No			
	CO-H9310	330.00	Ext.	0.8	Ext.	2	30	75	70	18	C	A		30-15 ± 3	B	62	Yes			D/P	No			
	Output Mounts for Above Models:																							
	CY-AM01	100.00			P																			
CY-AM50	120.00	8 x 4, 25 x 2		P/S																				
CY-AM100	120.00	25 x 4		S																				
CQ-R900	240.00	7.5	3	P/S	2	30	75	70	10	C	A		30-15 ± 3	B	62	Yes			I	Yes				
YAMAHA	YCR-220	260.00	20	8	P/S	2	16.3	75	70	6	C	A	No	40-15 ± 3	B	58	Yes	No	Yes	I	Yes			
	YCR-420	330.00	20 x 4	8	P/S	2	16.3	75	70	6	C	A	No	40-16 ± 3	B	67	Yes	Yes	Yes	I	Yes			
	YCR-305	330.00	20	8	P/S	2	16.3	75	70	24	C	A	No	40-16 ± 3	B	67	Yes	Yes	Yes	D/P	Yes			
	YCR-505	380.00	20 x 4	8	P/S	2	16.3	75	70	24	C	A	No	40-16 ± 3	B	67	Yes	Yes	Yes	D/P	Yes			

Kappa Automotive Series

 Infinity<sup>®</sup>



**T**wo decades ago a small group of music-obsessed aerospace physicists discovered they shared an absolute dissatisfaction with existing speaker technology. They decided to put all they knew about audio, electronics and music to the task: to push the technological boundaries to the limit to create the kind of speaker *they* could live with.



Over the years, Infinity's passion for the true sound of music has repeatedly led the company to redefine the State of the Art. The benchmark 7½ foot tall \$45,000 Infinity Reference Standard V currently serves as the embodiment of Infinity's advanced technology; it is also the source of much of the technology used in Infinity's more popularly priced speakers.

**The science of Kappa:  
Now you can believe everything  
you hear.**

The Kappa Home Series represents more than five years of intensive research and development. Like the IRS series, it was born of Infinity's demand to "push the performance envelope" of sonic reproduction.

Originally developed for the home, our Kappa technology immediately presented exciting possibilities for automotive applications. Those possibilities have been realized in our Kappa Automotive Series.

Using state-of-the-art home audio technology—revolutionary new woofer cone materials, improved transducer elements and radically new driver designs—it is no surprise that the Kappa Automotive Series has proven to be sonically and environmentally superior to virtually any other automotive speakers on the market today.

Because the obsession for music doesn't end in the living room, it's only natural we take our home speaker technology to the road. Since we first introduced our Reference Standard Automotive speakers, we have been at the forefront of car loudspeaker design, and continue that commitment now with the Infinity Kappa Automotive Series.

## Polypropylene/Graphite equals speed, strength and musicality.

Infinity debuts the first automotive use of injection-molded polypropylene/graphite in a loudspeaker cone.

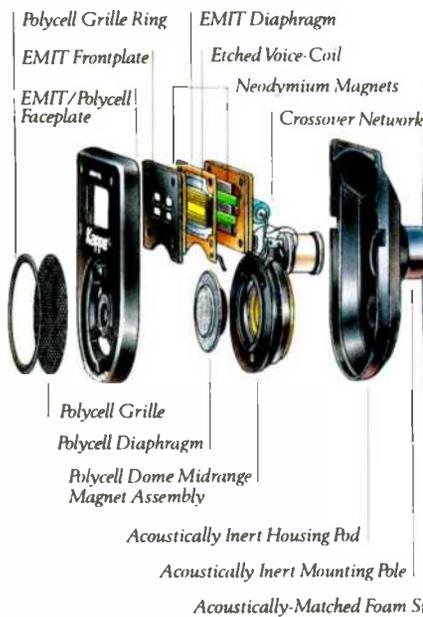
Polypropylene, a durable, acoustically inert polymer (used for the first time by Infinity in 1977), produces superb tonal detail and outstanding internal damping of resonances. Graphite fibers, radiating from the center of the cone, ensure excellent rigidity. With an improved stiffness-to-mass ratio over polypropylene-only cones, this new composite cone can react more quickly and accurately than ever to sudden transient impulses.

The result is clear, taut, powerful bass and rich, articulate lower-midrange at all volume levels, plus a smoother transition to higher frequency drivers.

The polypropylene/graphite composite also lends itself remarkably well to environmental extremes of moisture and heat, making it the most effective cone material currently available.

## Polycell™ captures the fundamentals.

The critical midrange of frequencies contains most of the instrumental and vocal fundamentals. To capture all the musical energy within the midrange, Infinity created the Polycell dome driver.



The Polycell dome is fabricated from air-filled polypropylene foam which gives the diaphragm exceptionally low mass, along with the solid polypropylene properties of rigidity and effective self-damping of resonances.

Voices and instruments assume a remarkable solidity and naturalness, free from coloration and distortion.

In our two-way integrated speaker systems, we use the Polycell, where its high stiffness-to-mass ratio provides exemplary high-frequency performance in tweeter applications.

## The EMIT k™ tweeter: Improving the state-of-the-art.

Since its introduction in 1974, Infinity's EMIT (Electromagnetic Induction Tweeter) has become one of the most widely acclaimed tweeters in the audio industry, and is considered by many to be the best tweeter in the world.

The new EMIT *k* reflects Infinity's latest proprietary materials research, and like other Kappa components, is an evolution of the speaker technology developed for the Infinity Reference Standard V. (72 EMITs are used in the IRS V.)

The EMIT *k* utilizes exotic rare earth, ultra-high gauss neodymium magnets, improving efficiency, and a micro-thin etched kapton diaphragm (half the mass of previous EMIT diaphragms) for more accurate transient response.

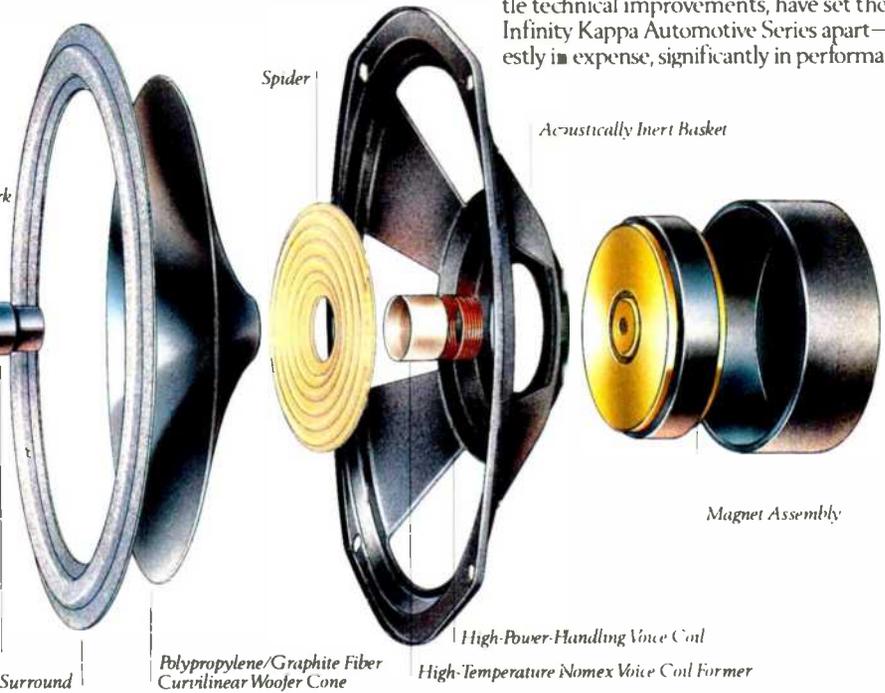
With its frequency response now extending to 45kHz, the EMIT *k* brings perfect sharpness, timbre and immediacy to the high treble of piano, strings, flute and cymbals.

## More products of high-tech imagination.

Integrating all of the components of a Kappa driver into a whole required the same kind of technological re-thinking as creating the individual driver elements themselves.

Such integration entails new computer-optimized crossovers for seamless frequency transitions; a new low-diffraction midrange/tweeter housing pod, fully enclosed from the rear to prevent bass impulse interference; a cosmetically redesigned ABS-reinforced grille impervious to temperature extremes; and heavy-duty stamped steel frames designed to maintain the structural integrity of each driver over time.

These, along with hundreds of subtle technical improvements, have set the Infinity Kappa Automotive Series apart—modestly in expense, significantly in performance.



## The RS 693 k: The Definitive Acoustic Motor.

If you think of a loudspeaker as a mechanical device which converts electrical energy into moving air, you begin to see that it is, in fact, a motor.

In this context, the RS 693 *k* might be viewed as the ultimate high-performance acoustic motor. A motor whose multiple components were designed for maximum acceleration, efficiency and endurance.

The entire synergy of Kappa driver technology has been integrated into this three-way system—composite polypropylene/graphite woofer cone, ultra-low-mass Polycell midrange and neodymium EMIT *k* tweeter. The result: superior transient response, wide dynamic range, seamless frequency crossovers and exceptional durability.

The definitive acoustic motor, a landmark achievement in automotive high fidelity, the RS 693 *k* is the most technologically-advanced, most sonically stunning 6" x 9" loudspeaker on the road today.

**RS 693k and RS 63k. Unlimited musicality in a limited space.**



It's natural to assume that if a car forces you to compromise on speaker space, it would similarly force you to compromise on speaker performance. The RS 693k and RS 63k prove that the contrary is true.

Both three-ways feature injection-molded polypropylene/graphite fiber woofers which are shaped steeply inward to increase surface area, thus improving efficiency. Because the new composite cone is both lighter and more rigid, its effective frequency range extends well into a seamless overlap with the Polycell. An impedance-matched foam surround also contributes to the woofer's ability to render lower midrange flawlessly.

Housed flush with the grille in a low-diffraction ABS plastic pod are the Polycell dome midrange and the state-of-the-art EMIT k tweeter.

Together they deliver midrange and high frequencies with extreme sonic accuracy. The special housing pod, mounted on an acoustically inert mounting pole, effectively isolates the drivers and integrated crossover network from the vigorous bass impulses of the woofer.

The finishing touch is the attractive low profile grille, ideally suited to these unobtrusive one-piece speaker systems. (Visual aesthetics have always been part of the Infinity philosophy.)

The RS 693k and RS 63k represent the highest degree of sonic perfection now attainable in an integrated three-way automotive speaker system.

**RS 692k, RS 62k, and RS 52k. Excellence in Kappa two-ways.**



Two-way loudspeakers, while inherently simpler than three-ways, can be much more difficult to design if you are trying to achieve near-equal performance. Simply two drivers must be made to do virtually the same job as three. Each driver must exhibit extraordinarily uniform response over a wider range of frequencies, and each individually must handle more power.

The Kappa composite woofer and Polycell midrange/tweeter fulfill these requirements admirably.

The combination of the woofer's unique contoured shape and its polypropylene/graphite construction accommodate excellent repro-

duction of frequencies into the lower midrange with a smoothness not possible with traditional cones.

The rest of the frequency range is handled by a Polycell dome midrange/tweeter which extends from the center midrange all the way past the range of human hearing. The result is a smooth, unstressed sound free from midrange drop-outs—with all the depth, warmth and presence typical of Infinity speaker performance.

These Kappa two-ways promise superior sonic performance whether powered by a cassette/receiver's internal amp, or a higher powered external component amplifier.

## CS-1k and CS-2k. The purist's component systems.



CS-2k polypropylene/graphite woofer.



The full, unbridled potential of Kappa Automotive technology is realized in these three-way component systems. Completely separate drivers provide the ultimate versatility in installation strategies. Each speaker can be independently located in your car for best frequency reproduction and imaging. A separate, user-configurable crossover module allows for maximum installation flexibility and offers new two- and three-amp con-

figurations for maximum dynamic range and purist performance.

Powerful, taut, accurate bass is achieved with either a 6" x 9" (CS-1k) or 6.5" (CS-2k) length-over polypropylene/graphite woofer. Each woofer is capable of delivering authoritative low end response without any trace of bass overhang.

Midrange is rendered by a high-power-handling injection-molded polypropylene/graphite midrange driver. Its swift acceleration and unparalleled linearity provides for crisp, full-bodied reproduction of the middle frequencies, the area where more than half of the musical information resides.

New EMIT k tweeters complete both CS Kappa systems.

Because they are separate components, they may be positioned higher than the other drivers for optimum dispersion. With new neodymium magnets and a thinner kapton diaphragm, the EMIT k faultlessly reproduces the delicate overtones which give individual instruments their character.

The CS-1k and CS-2k Component Systems belong in the very finest automotive installations, and will provide you with unflinching musicality for many years to come.

## RS 462k, RS 42k and RS 32k. Kappa upgrades for the economy-minded.



Even at its most affordable price point, Kappa technology offers a significant improvement over conventional car loudspeakers.

Each of these two-way speakers combines an integrated polypropylene woofer and tweeter for better high end response.

While the 4" RS 42k is applicable in a wide range of installations, the RS 462k 4" x 6" and RS 32k 3.5" dual cone units are specially designed as drop-in replacements for existing factory car speakers—indisputably the weakest link in most original equipment stereo systems.

In most cases, only a screwdriver and ten minutes of your time are all that are required to upgrade your present paper cone speakers to Infinity polypropylene speakers, with a quantum leap in sound quality.

The Kappa Automotive Series was designed by and for those whose enjoyment of music approaches sheer obsession. It is the product of the engineering imagination and the stubbornness not to settle for anything less than a landmark achievement. It is, in short, the love of music taken to Infinity.

The details on the speakers that bring you more musical detail than ever before.

Model	Configuration	Power Capacity	Frequency Response	Crossover Frequencies	Sensitivity 1 Watt/1 Meter	Impedance	Mounting Depth
CS-1k	(two each) EMIT k tweeter 4" midrange 6" x 9" woofer Crossover network	200 watts (50) (50) (100)	34Hz to 45kHz	250- 4,000Hz	87 dB	4-8 ohms	Surface mount 1 <sup>5</sup> / <sub>16</sub> " (4.92 cm) 3 <sup>1</sup> / <sub>8</sub> " (7.94 cm)
CS-2k	(two each) EMIT k tweeter 4" midrange 6 <sup>1</sup> / <sub>2</sub> " woofer Crossover network	200 watts (50) (50) (100)	40Hz to 45kHz	250- 4,000Hz	87 dB	4-8 ohms	Surface mount 1 <sup>5</sup> / <sub>16</sub> " (4.92 cm) 2 <sup>1</sup> / <sub>4</sub> " (5.81 cm)
RS 693k	Three-way, 6" x 9"	100 watts	34Hz to 45kHz	4,000Hz, 8,000Hz	90 dB	4 ohms	3 <sup>1</sup> / <sub>8</sub> " (7.94 cm)
RS 63k	Three-way, 6 <sup>1</sup> / <sub>2</sub> "	55 watts	58Hz to 45kHz	4,000Hz, 8,000Hz	88 dB	4 ohms	2 <sup>3</sup> / <sub>8</sub> " (6.03 cm)
RS 692k	Two-way, 6" x 9"	75 watts	34Hz to 22kHz	4,000Hz	90 dB	4 ohms	3 <sup>1</sup> / <sub>8</sub> " (7.94 cm)
RS 62k	Two-way, 6 <sup>1</sup> / <sub>2</sub> "	55 watts	58Hz to 22kHz	4,000Hz	88 dB	4 ohms	2 <sup>3</sup> / <sub>8</sub> " (6.03 cm)
RS 52k	Two-way, 5 <sup>1</sup> / <sub>4</sub> "	30 watts	63Hz to 22kHz	4,000Hz	88 dB	4 ohms	1 <sup>7</sup> / <sub>8</sub> " (4.76 cm)
RS 42k	Two-way, 4"	25 watts	98Hz to 16kHz	3,000Hz Mechanical	87 dB	4 ohms	1 <sup>7</sup> / <sub>8</sub> " (4.76 cm)
RS 462k	4" x 6" Replacement Speaker	25 watts	98Hz to 16kHz	3,000Hz Mechanical	86 dB	4 ohms	1 <sup>3</sup> / <sub>4</sub> " (4.45 cm)
RS 32k	3 <sup>1</sup> / <sub>2</sub> " Replacement Speaker	18 watts	112Hz to 16kHz	3,000Hz Mechanical	86 dB	4 ohms	1 <sup>5</sup> / <sub>8</sub> " (4.12 cm)
EMIT k	Neodymium tweeter with crossover network	50 watts	3,500Hz to 45kHz	3,500Hz	86 dB	4 ohms	Surface mount

Because Infinity constantly strives to improve existing products, specifications are subject to change without notice. Infinity Kappa Automotive Speakers carry a 1-year non-transferable Parts and Labor Limited Warranty. For details, see the complete Warranty statement packed with each speaker, or consult your Infinity dealer.

# SPEAKERS

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Maximum Power, Watts				Sensitivity, dB SPL (1 Watt 1 Meter)				Frequency Response, Hz to kHz, ±dB				DRIVERS				Notes
				8	4	2	1	8	4	2	1	Woofer Size, Inches	Woofer (W), 3-Way (3), 4-Way (4)	Applied Tweeters (T), Adjustable Tweeters (A)	Separately Mounted Drivers?	Flush Mount (F), Concealed (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?		
A/D S/	200i		260.00	50	88	4	150-20 ±3		4	2		No	P	1 5/8	Yes	Includes separate crossover with tweeter level control; fits 4 x 6-inch holes. Cabinet enclosure. Tweeter level control; flush-mount kit optional. Cabinet enclosure. Includes separate crossover with tweeter level control; blamp capable.				
	L200cc		330.00	50	88	4	85-23 ±3		4	2		No	S		Yes					
	300i		340.00	100	90	4	68-23 ±3		5 1/4	2		No	P	1 1/2	Yes					
	L300cc		420.00	75	90	4	68-20 ±3		5 1/4	2		No	S		Yes					
	320i		510.00	100	91	4	50-20 ±3		5 1/4	2	P	Yes	F	1 5/8	Yes					
	S7	110.00		120	91	4	30-85 Hz ±3	S	7 1/2				F	2 3/4	Yes					
	S6.2	160.00		100	90	4	30-85 Hz ±3	S	(2)6 1/2				F, P	2 3/4	Yes					
	S10	220.00		150	90	4	20-85 Hz ±3	S	10				F, S	3 1/4	Yes					
	SB7	400.00		160	90	4	30-85 Hz ±3	S	(2)7 1/2				S		Yes					
	SB10	650.00		300	90	4	30-85 Hz ±3	S	(2)10				S		Yes					
AIWA	SC-X770		160.00	100	90	4	40-21		6 x 9	3	No	No	F	3 3/4	No					
	SC-X550		110.00	70	90	4	50-20		6 1/2	2	No	No	F	2	No					
	SC-X330		80.00	50	90	4	60-20		5	2	No	No	F	1 3/4	No					
	SC-X220		55.00	30	88	4	65-20		4	2	No	No	F	1 3/4	No					
ALPHASONIK	O6200	98.00		50	4	70-25 ±3		4 1/2	2		No	P	1 1/2	No						
	O6300	150.00		60	4	70-25 ±3		4 1/2	2		No	S		Yes						
	O7200	117.50		65	4	45-25 ±3		5 1/4	2		Yes	F, C	2 1/2	No						
	MOT-1G	42.95		120	4	1.4k-30k ±3	T					C		No						
	SW6025G	78.00		60	4	40-2.5 ±3	W	6				F	2 1/2	Yes						
SW8030	78.00		75	4	40-2 ±3	W	8				F	3 1/2	Yes							
ALPINE	6394		240.00	100	91	4	50-21		6 x 9	3				3 1/4	Optional grille.  †Flush-mount woofer, surface-mount tweeter.  Dual voice-coils. †30 watts per coil. ††4 ohms per coil. Woofer and midrange.					
	6294		190.00	100	91	4	50-21		6 x 9	2				3 1/4						
	6392		160.00	60	94	4	50-21		6 x 9	3				2 7/8						
	6205		130.00	60	92	4	45-21		6 x 9	2				3 1/4						
	6265		180.00	80	88	4	45-21		6 1/2	2				3 1/4						
	6368		160.00	60	87	4	50-20		6 1/2	3				2						
	6266		90.00	40	90	4	60-20		6 1/2	2				2						
	6256		110.00	60	90	4	50-22		5 1/4	2				2 1/4						
	6258		80.00	40	90	4	60-20		5	2				1 3/8						
	6204		90.00	40	90	4	75-20		4 x 6	2				1 3/4						
	6244		90.00	40	88	4	60-21		4	2				1 3/8						
	6149		70.00	20	88	4	60-20		4	W				1 3/8						
	6210		140.00	60	90	4	50-22		4 x 10	2				2 3/4						
	6133		50.00	20	90	4	60-20		3 1/2	W				1 1/2						
	6255		320.00	100	87	4	50-23		5 1/4	2	P		†	2						
	6010		150.00	40	92	6	2k-23k	T					C	1/2						
	6040		110.00	60	91	4	100-16	M						1 3/4						
	6060		120.00	80	90	4	50-10		6 1/2					2 3/8						
	6015	400.00		800	96	4	30-300 Hz	S	15					6 1/4						
	6012	350.00		800	95	4	40-2.5	S	12					5 3/4						
6102		290.00	200	89	4	25-6	S	10					3 3/4							
6191	80.00		†	94	††	35-5	S	6 x 9												
6062		270.00	200	89	8	40-5 ±3		6 1/2			Yes									
6022		170.00	300	91	8	1k-30k	T													
ALTEC LANSING	ALS693		260.00	120	93	4	50-22 ±3		6 x 9	3		No	C	3 1/2	Yes					
	ALS692		220.00	120	93	4	50-20 ±3		6 x 9	2		No	S	3 1/2	Yes					
	ALS62		160.00	100	91	4	60-22 ±3		6 1/2	2	A	No	C		Yes					
	ALS40		110.00	50	90	4	100-20 ±3		4	W			S		Yes					
	ALS25		280.00	100	89	4	60-22 ±3		5 1/4	2	Yes	C	2 1/4	Yes						
	ALS500		260.00	100	89	4	60-22 ±3		5 1/4	2		S	1 1/2	Yes						
	ALS35		70.00	30	88	4	90-22 ±3		3 1/2	W		C	2 1/4	Yes						
	ALS8		200.00	150	90	4	45-3 ±3	S	8			No	C	1 1/2	Yes					
	ALS2		160.00	60	90	4	88-22 ±3		5 1/4	2			C		No					
	ALS25		100.00	100	91	4		T				Yes	S		No					
	55		250.00	80	85	4	95-20		4	2			F		Yes					
	AMBRIA	T-10		90.00	100	95	8	1.5k-20k ±2.5	T			P		C	1/2					
S-50			300.00	110	96	4	110-20 ±3		4	2		Yes	S							
S-450 Kit 4			330.00	110	95	93	35-3 ±3	S	(2)5 1/4	4			F	1 1/2						
AMERICAN ACOUSTICS	Nomad 1		349.95	200	89.4	4 8	80-20		8	2		Yes			No					
	Nomad 2		399.95	250	91.1	4/8		10	3	A	Yes				No					
	Nomad 3	369.95		300	91.6	4/8	70-20	(2)10	3	A	Yes				No					
AR	GCS100		350.00	100	93	4	33-30		6 x 9	3		Yes	F, S	3 3/4	Yes					
	GCS300		220.00	100	93	4	30-30		6 x 9	3	A		F	3 3/4	Yes					
	GCS400		180.00	90	92	4	58-30		6 1/2	2			F	2	Yes					
	GCS500		150.00	60	92	4	42-30		5 1/4	2			F	2 1/4	Yes					
	GCS600		90.00	35	92	4	75-25		4	W			F	1 3/4	Yes					
	GCS1200		56.00	35	91	4	63-20		4 x 6	W			F	2	Yes					
	GCS1400		46.00	20	88	4	120-12		3 1/2	W			F	1 3/4	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
								Subwoofer Only (S) Midrange Only (M), Tweeter Only (T)	Woofer Size, Inches	Whether (W): 2-Way (2), 3-Way (3), 4-Way (4), Adjustable Tweeters (A)	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Rack (R), P	Maximum Required Mounting Depth, Inches	Weatherproofed?				
AUDIODEK	3084	34.00	30	91	4	60-20		6 x 9	3		Yes	F						
	3082	21.00	25	89	4	60-20		5 1/4	2		Yes	F						
	3096	29.00	50	90	4	60-20		6 x 9	3		Yes	F						
	3094	19.00	25	87	4	80-18		4	2		Yes	F						
	3093	30.00	20	81	4	100-17		3	3		Yes	S						
AUDIOMOBILE	SW6x9	74.00	148.00	100	2		S	6 x 9				C						
AUDIOPHILE	2.5	349.00	100	89	4	50-19		5 1/4		A	Yes	†	1.9	Yes	†Flush-mount woofer, surface-mount tweeter. Includes crossover.			
	1.5	199.00	100	91	4	27-90 Hz	S	8				F	3.5	Yes				
AUDIOSOURCE	LS-ONE	179.95	80	87	4	80-20		4	2		No	S			With grille and bracket, Model LS-ONE W T, \$199.95 per pair.			
AUDIX	5-B	59.00	35	90	4/8	55-10	W	5				C	2 3/8	No				
	8-B	64.00	50	95	4/8	60-6	W	8				C	3 1/8	No				
	10-B	89.00	100	96	4/8	50-4.5	W	10				C	4 3/8	No				
	12-B	109.00	100	96	4/8	50-4	W	12				C	5 1/8	No				
	15-B	125.00	100	96	4/8	50-4	W	15				C	6 3/8	No				
	12-XB	145.00	150	97	4/8	34-3.5	W	12				C	5 1/8	No				
	15-XB	170.00	200	99	4/8	30-3.5	W	15				C	6 3/8	No				
	15-C	399.00	400	99	8	32-1	W	15				C	6 3/8	No				
	18-C	429.00	400	99	8	25-1	S	18				C	7 1/8	No				
	24-C	659.00	400	101	8	20-1.2	S	24				C	8 3/8	No				
	10-S	219.00	150	98	8	50-2	W	10				C	4 1/2	No				
	12-S	239.00	150	100	8	35-4.5	W	12				C	5 1/8	No				
	15-S	245.00	200	100	8	35-3.5	W	15				C	6 3/8	No				
	18-S	455.00	400	100	8	20-1	S	18				C	7 1/4	No				
	10-CX								10	2			C		No			
	12-CX	630.00	200	99	8	55-20			12	2			C	7 3/4	No			
	15-CX	630.00	200	102	8	55-20			15	2			C	8 3/8	No			
	18-CX	899.00	300	98	8	48-20			18	2			C	8 3/4	No			
AUTOTEK	65XE	89.95	60	92	4	40-20 ±3		6	2		Yes	F	1 1/2	Yes				
	46XE	89.95	25	91	4	40-20 ±3		4 x 6	2		Yes	F	1 3/4	Yes				
BLAUPUNKT	OL 3525	19.95	49.95	25	88	4	65-20		3 1/2	W		F	1 1/2	No	Drop-in replacement.			
	OL 4031		49.95	30	91	4	50-22		4	W		No	1 3/4	No				
	CL 1031		79.95	30	90	4	70-22		4	2		F	1 3/4	Yes				
	CL 1530		79.95	30	90	4	65-22		4 x 6	2		No	1 3/4	Yes				
	CL 4656		109.95	50	92	4	80-20		4 x 6	2		No	2 1/4	Yes				
	CL 1340		89.95	50	91	4	50-22		5	2		No	2 1/4	Yes				
	CL 1650		99.95	50	92	4	40-22		6 1/2	2		No	2 3/8	Yes				
	CL 1600		119.95	100	92	4	40-22		6 1/2	2		No	2 5/8	Yes				
	CL 4180		129.95	80	94	4	50-20		4 x 10	2	A	No	3	Yes				
	CL 6900		149.95	100	94	4	40-20		6 x 9	2	A	No	3 1/4	Yes				
	XL 1300		209.95	100	88	4	40-25		5	2	P	†	2	Yes				
	XL 1612		239.95	120	90	4	35-25		6 1/2	2	P	†	2 3/8	Yes				
	XL 2015		279.95	150	92	4	28-25		8	2	P	†	2 3/4	Yes				
	HC 1030		79.95	30	89	4	70-20		4			No	1 3/4	Yes				
	HC 1340		89.95	40	90	4	50-22		5			No	1 3/4	Yes				
	HC 1660		99.95	60	91	4	45-18		6 1/2			No	1 3/4	Yes				
	CL 4665P		119.95	60	90	4	90-20		4 x 6	2		P	1 1/2	Yes				
	CL 5400P		199.95	100	92	4	45-20		5 1/4	2		P	1 1/8	Yes				
	CB 4500		159.95	100	89	4	30-20		4	2		P	1 1/8	Yes				
	QL 6500		179.95	100	90	4	50-20		6 1/2	2		F	2 3/4	Yes				
	QL 5470		139.95	70	88	4	55-20		5 1/4	2		F	2	Yes				
	QL 5060		119.95	60	90	4	65-20		5	2		F	2	Yes				
	ACS 1220	109.95	100	93	4	20-3		W	12			F	4 3/4	Yes				
	ACS 1020	79.95	100	93	4	25-3		W	10			F	4 1/4	Yes				
	ACS 8020	69.95	200	90	4	35-3		W	8			F	3 3/8	Yes				
	ACS 6500		100	92	4	40-4		W	6 1/2			F	2 7/8	Yes				
	ACS 5400	79.95	100	92	4	50-8		W	5 1/4			F	2 1/2	Yes				
	ACS 5090	69.95	90	93	4	400-9		M				F	2	No				
	ACS 1000	99.95	100	90	4	3k-20k		T				S		Yes				
	BOSE	121 Mobile Monitor	259.00	100	89	4							S			Yes	Cabinet enclosure.	
	BOSTON ACoustics	C700 Series II	199.95	80	87	4	58-20 ±3		3 1/4	2		No	P	1 1/2		Yes	Includes crossovers.	
		790LF	159.95	100	87	4	36-120 Hz ±3	S	6 x 9				F	3 3/8		Yes		
780LF		119.95	150	90	4	35-120 Hz ±3	S	8				F	3 3/4	Yes				
760LF		109.95	100	87	4	45-120 Hz ±3	S	6 1/2				F	2 1/2	Yes				
797		199.95	80	89	4	36-20 ±4		6 x 9	3			No	3 3/8	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				
761		239.95	100	87	4	48-20 ±3		6 1/2	2	A/P	Yes	C	2 1/2	Yes				
751		229.95	80	87	4	58-20 ±3		5 1/4	2	A/P	Yes	C	2	Yes				
741		219.95	40	87	4	85-20 ±3		4	2	A/P	Yes	C	1 3/4	Yes				
767		139.95	50	89	4	60-20 ±4		6 1/2	2		No	F	2 1/2	Yes				
757		119.95	50	87	4	58-20 ±4		5 1/4	2		No	F	2 1/2	Yes				
707		59.95	15	90	4	70-14 ±3		4 x 6	W			F	1 3/8	Yes				
705	79.95	40	90	4	58-17 ±3		5 1/4	W			F	1 3/4	Yes					
704	79.95	25	90	4	90-17 ±3		4	W			F	1 3/4	Yes					
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 1/2	Yes				

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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
								Supwoofer Only (S) Midrange Only (M), Tweeter Only (T)	Woofer Size, Inches	Wizzer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Agreed Tweeter(s) = A, Pointable Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Pilot (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
ACOUSTIC	HS-862	52.95	60	90	4	68-18 ±5	6½	2	A	No								
	HS-860	36.95	60	90	4	87-18 ±5	6½	2	A	No								
	HS-842	36.95	40	88	4	106-18 ±5	4	2	A	No								
	HS-840	29.95	40	88	4	106-18 ±5	4	2	W	No								
	HS-830	16.95	25	86	4	180-15 ±5	3½	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	3¾						
	HS-890	54.95	80															
	HS-863	64.95	60	91	4	75-19 ±5	6½	3	A	No								
	HT-620	104.95	60	89	4	60-19 ±2	5¼	2		No	P	1½	Yes					
	HT-621	124.95	60	89	4	60-19 ±2	5¼	2	P	Yes	C	4	Yes					
	HT-640		64.95	100	91	4	32-600 Hz ±3	8										
HT-650		84.95	150	92	4	24-600 Hz ±3	10					4½	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	1¾	Yes					
	V426	64.95	100	90	4	60-20 +0, -6	6½	2		No	F	2½	Yes					
	V431	74.95	100	90	4	60-20 +0, -6	6½	3		No	F	2½	Yes					
	V481	119.95	100	86	4	60-20 +0, -6	4	4		No	S							
	V110	25.95	20	85	4		4	W		F	F	1½	Yes					
	V111	25.95	25	85	4		5	W		F	F	1	Yes					
	V112	29.95	25	85	4		6½	W		F	F	1¾	Yes					
	V232	49.95	35	85	4		6½	3		F	F	2¼	Yes					
	V244	44.95	25	87	4		6 x 9	2		F	F	3	Yes					
	V254	67.95	50	87	4		6 x 9	3		F	F	3	Yes					
	V306A	24.95	20	85	4		3½	W		F	F	1½	Yes					
	V404	39.95	50	85	4		4	W		F	F		Yes					
	V424	49.95	50	85	4		4	W		F	F		Yes					
	V462	99.95	150	92	4	60-21 +0, -6	6 x 9	2		F	F	3½	Yes					
V452	109.95	150	92	4	60-21 +0, -6	6 x 9	3		F	F	3½	Yes						
V479	84.95	50	84	4	80-20 +0, -6	4	3		S									
CYBERNET	CSP 123	138.00	60	85	8	60-22 ±6	4	3	P	No	C	4¾	Yes					
	CSP 402	138.00	35	87	8	80-22 ±6	4	2	P	No	F	1	Yes					
	CSP 602	169.00	80	89	4	58-20 ±6	6	2	P	No	F	2½	Yes					
	CSP 603	199.00	100	90	4	68-22 ±6	6	3	P	No	F	3½	Yes					
DELTASONIK	MP5GX	26.10	60	4	4	1k-6k ±3	M				F	2						
	DTX-1	25.00	100	4	4	4k-25k ±3	T				S							
	WP820B	56.70	60	4	4	40-3 ±4	W	8			F	4				Optional grille.		
	WP1030B	50.40	160	4	4	30-2 ±4	W	10			F	5						
	WP1230B	65.65	160	4	4	29-2 ±4	W	12			F	5½						
	WP6920	54.00	60	4	4	40-2.5 ±4	W	6 x 9			F	4				As above.		
DENON	DCS-691	180.00	100	91	4	40-21	6 x 9	3		F	F	4	Yes					
	DCS-401	75.00	35	91	4	80-20	4	W		F	F	1¾	Yes					
	DCS-351	43.00	20	89	4	90-20	3½	W		F	F	1½	Yes					
DYNAMIC ACOUSTICS	DAT-1	22.00	40	95	4	1.1k-21k	T				C	¾	Yes					
	DAT-2	17.00	30	92	4	1.7k-19k	T				C	1	Yes					
	DAT-3	20.00	30	94	4	1.15k-19k	T				C	¾	Yes					
	DAT-4	8.00	10	91	4	1.7k-18k	T				C	¾	No					
	DAM-4010	26.00	40	92	4	120-6	M				C	2½	Yes					
	DAM-4510	32.00	50	92	4	130-5	M				C	2	Yes					
	DAM-5010	45.00	60	92	4/8	60-5	W				C	2½	Yes					
	DAW-5015	50.00	60	89	4/8	55-2.5	W	5¼			C	2½	Yes					
	DAW-6510	55.00	70	92	4/8	55-4	W	6½			C	2½	Yes					
	DAW-6515	60.00	80	91	4/8	50-2.5	W	6½			C	3	Yes					
	DAW-6915	65.00	100	91	4	55-2.5	W	6 x 9			C	3	Yes					
	DAW-8015	70.00	100	91	4	55-2.5	W	8			C	2¾	Yes					
	DAW-1015	75.00	100	92	4	38-3	W	10			S		Yes					
	DCM-1	159.50	50	91	4	75-19	4	2		No	F		Yes					
	DCM-2	129.50	50	92	4	70-19	4			No	P	1	Yes					
DCM-3	179.50	70	92	4	50-19	5¼	2		No	P	1¼	Yes						
ECLIPSE	SG-6907	404.95	809.50	200	93	30-28	6 x 9	3		F	F	3½	Yes					
EPI	LS46	79.95	50	91	4	100-20	4 x 6	2		No	F	1½						
	LS50	69.95	40	91	4	110-20	4	2		No	F	1½						
	LS55	89.95	50	91	4	90-20	5¼	2		No	F	1½						
	LS60	99.95	50	94	4	90-20	6½	2		No	F	1½						
	LS66	129.95	70	94	4	75-20	6 x 9	3		No	F	3						
	LS70X	199.95	80	88	8	70-20 ±3	6	2		No	P	2¼						

# 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					
								Supermid Only (S)	Midrange Only (M)	Woofer Only (W)	Woofer Size, Inches	Woofer (W) 2-Way (2)	3-Way (3), 4-Way (4)	Any (A) Tweeter(s) = A, Passive Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Pole (P)	Maximum Required Mounting Depth, Inches		Weatherproofed?				
EXCALIBUR	EX-6913		39.95	150	4			6 x 9	3			F											
	PP-6923		49.95	150	4			6 x 9	3			F											
	EX-4102		39.95	100	4			4 x 10	2			F											Yes
	EX-501		29.95	80	4			5 1/4	W			F											
	EX-502		39.95	100	4			5 1/4	2			F											
	EX-512		49.95	100	4			5 1/4	2			F											
	PP-522		59.95	100	4			5 1/4	2			F											
	EX-401		39.95	60	4			4	W			F											Yes
	EX-402		49.95	80	4			4	2			F											
	PP-422		59.95	80	4			4	2			F											Yes
	EX-4612		49.95	60	4			4 x 6	2			F											
	EX-301		39.95	50	4			3 1/2	W			F											
	EX-2001		59.95	80	4			(2)3				F											
	EX-3001		69.95	100	4			(2)4				S											
	PP-621	39.95		100	8							F											Yes
	PP-821	59.95		150	8				8			F											Yes
	PP-1021	79.95		150	8				10			F											Yes
PP-1221	99.95		150	8				12			F											Yes	
TW-1	39.95		50	4				T			F												
TW-4	39.95		100	4							F												
FAS	CS369		135.95	80	93	4	50-25	6 x 9	3			No	F	2 7/8	Yes								
	CS269		104.95	90	91	4	50-21	6 x 9	2			No	F	2 3/4	Yes								
	CS365		99.95	70	93	4	60-25	6 1/2	3			No	F	1 3/4	Yes								
	CS265		95.95	70	93	4	60-21	6 1/2	2			No	F	1 3/4	Yes								
	PS4		31.95	20	4		100-15	4	W			No	F	1 1/2	No								
	PS3		25.95	10	4		120-16	3 1/2	W			No	F	1 1/2	No								
FDCAL	SC018 DBW	85.00		40	91	4	60-20 ± 3	5 1/4	3			Yes	S		No								
	7K018 DBW	115.00		50	93	4	40-20 ± 3	7	3			Yes	S		No								
	KIT 448	133.00		40	91	4	60-20 ± 3	5 1/4	3			Yes	S		No								
	KIT 458	266.00		50	93	4	40-20 ± 3	7	3			Yes	S		No								
	10K515 DB	150.00		200	94	4	30-200 Hz	S	10			Yes	S		No								Dual voice-coils.
FUJITSU TEN	SG-1035		49.95	45	4	75-21	4	W				F	1 1/2										
	SG-1036		69.95	45	4	70-22	4	2				F	1 3/8										
	SG-1214		89.95	45	4	60-22	5	2		P		F	1 3/8										
	SG-1630		59.95	45	4	55-22	6 1/2	W				F	1 1/2										
	SG-1631		99.95	60	4	50-22	6 1/2	2		P		F	1 1/2										
	SG-1632		79.95	45	4	50-20	6 1/2	W				F	1 1/8										
	SG-1633		119.95	60	4	45-20	6 1/2	2		P		F	2										
	SG-1634		139.95	100	4	45-22	6 1/2	3		P		F	2 1/2										
	SG-6908		124.95	100	4	40-21	6 x 9	3		P		F	3										
	SG-6909		169.95	120	4	35-22	6 x 9	3		P		F	3										
	SG-6910		199.95	150	4	30-23	6 x 9	4		P		F	3 1/8										
FULTRON	15-9990S		219.95	100	101	4	20-20	6 x 9	3		P	Yes	†	2 7/8	Yes								†Flush-mount woofer, surface-mount midrange and tweeter. Midrange and tweeter.
	15-9290S		99.50	100	101	4	1k-20k		2			Yes	S		Yes								
	15-9690		119.95	60	100	4	35-20	6 x 9	3		P	Yes	S	2 7/8	Yes								
	15-9670		99.95	60	99	4	40-20	6 x 9	2			No	F	2 7/8	Yes								
	15-9560		79.95	40	96	4	50-20	4 x 10	2			No	F	2 1/2	Yes								
	15-9490		99.95	50	98	4	50-20	5 1/4	3			No	F	2 3/8	Yes								
	15-9470		79.95	40	98	4	60-20	5 1/4	2			No	F	2 3/8	Yes								
	15-9460		74.95	25	96	4	65-20	4 x 6	2			No	F	1 3/4	Yes								
	15-9435		59.95	20	95	4	70-17	4	2			No	F	1 3/8	Yes								
	15-9425		36.95	15	96	4	80-15	3 1/2	W			No	F	1 3/8	Yes								
	15-9270		149.95	50	4	50-20	4	3				No	S		Yes								Includes 4 x 6-inch adaptor plate. Three-position tweeter level control. Two-position tweeter level control. Wedge enclosure.
	15-9250		89.95	35	4	60-20	3	2				No	S		Yes								
	15-9240		36.95	15	4	90-14	5					No	C	5/8	Yes								
	15-9369		79.95	60	94	4	40-20	6 x 9	3			No	F	1 3/8	No								
	15-9306		59.95	60	94	4	50-20	6	3			No	F	1 3/8	No								
	15-9305		49.95	50	92	4	60-20	5	3			No	F	1 1/8	No								
	15-9069		39.95	30	4	40-20	6 x 9	W				No	F	3	No								
	15-9066		36.95	25	4	65-18	6 1/2	W				No	F	2 1/8	No								
GLENMONITOR	Lo-Mo Sub	350.00		250	94	4	20-150 Hz	S	(2)10				S		Yes								
GOLD SOUND	GS110		79.00	60	91	4	3k-21k ± 3	T					F	1	Yes								
	GS410		79.00	60	91	4	100-8 ± 3	M					F	2	Yes								
	GS512		79.00	60	92	4	70-6 ± 3	W	5 1/4		Yes	F	2 1/4	Yes									
	GS520		99.00	100	93	4	60-5 ± 3	W	5 1/4			F	3	Yes									
	GS612		79.00	60	92	4	45-5 ± 3	W	6 1/2			F	3 1/2	Yes									
	GS821		125.00	100	91	4/8	35-2 ± 3	S	8			F	3 7/8	Yes									
	GS841		175.00	150	95	4/8	33-1 ± 3	S	8			F	4	Yes									
	GS1041		195.00	150	95	4/8	32-1 ± 3	S	10			F	4 1/2	Yes									
	GS1071		345.00	250	95	4/8	28-1 ± 3	S	10			F	4 3/4	Yes									
	GS1271		365.00	250	96	4/8	22-1 ± 3	S	12			F	5 1/4	Yes									
	GS620		109.00	100	92	4/8	40-3.5 ± 3	W	6 1/2			F	3 1/2	Yes									
	GS69A		119.00	100	92	4	35-2 ± 3	W	6 x 9			F	3 1/2	Yes									
	GS820		129.00	100	91	4/8	35-2 ± 3	S	8			F	3 7/8	Yes									Dual voice-coils.
	GS840		179.00	150	95	4/8	33-1 ± 3	S	8														

# BACKSEAT DRIVERS.



Cerwin-Vega Road Woofers™ are built to rock and roll. In your car.

More specifically, in the backseat or the trunk. Because we've put our best speakers into rugged, carpet-covered, portable enclosures.

All of which you can hook up, or unhook, in minutes. And fit into some very tight places. Like hatchbacks and pickups.

Each Road Woofer™ cabinet has been computer optimized for size and shape.

And, of course, sound.

Meaning with Cerwin-Vega Road Woofers™, you'll hear the music.

And not the road.



**Cerwin-Vega!**

*For more information, please write or call:  
Cerwin-Vega: 555 E. Easy Street, Simi Valley, CA 93065 805-584-9332*

Enter No. 13 on Reader Service Card

# 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 Tweeters = A, Pointable Tweeters = P	Separately Mounted Drivers?	Flux Mount (F), Surface Mount (S), Conventional (C), Plate (P)	
GOLO SOUND (Continued)	GS6x9C	139.00	60	92	4	4	42-30 ± 3	6 x 9	2				F	3 1/2	Yes	As above.		
	GS6x9AC	219.00	100	92	4	4	40-25 ± 3	6 x 9	2				F	4	Yes			
	GS8C	149.00	60	92	4/8	4	40-30 ± 3	8	2				F	3 1/2	Yes			
	GS4C	119.00	60	92	4	4		4	2				F	2	Yes			
	GS4x6C	129.00	60	92	4	4		4 x 6	2				F	2 1/2	Yes			
	GS4x10C	139.00	60	92	4	4		4 x 10	2				F	2 3/4	Yes			
	GS5C	129.00	60	92	4	4		5 1/4	2				F	2	Yes			
	GS5AC	199.00	100	92	4	4		5 1/4	2				F	3	Yes			
	GS5x7C	129.00	60	92	4	4		5 x 7	2				F	2 1/2	Yes			
	GS8AC	229.00	100	92	4/8	4	32-21	8	2				F	4 1/4	Yes			
	GS Rolling Thunder	399.00	160	92	4	4	32-21	8	2	A			F	6	Yes			
	G & S/ NIGHT STALKER	NS-4.5PM	25.00	60	92	4/8	90-6	W	4 1/2					F			No	140 watts with 7-kHz, 12-dB/octave crossover.
NS-10S2		28.50	60	92	4/8	70-5	W	5 1/4					F		No			
NS-206		45.00	100	92	4/8	40-4	W	6 1/2					F		No			
NS-308		58.50	100	92	4/8	30-2	S	8					F		No			
NS-4010		66.95	150	94	4/8	20-2	S	10					F		No			
NS-7010		99.95	180	94	4/8	30-2	S	10					F		No			
NS-4012		75.00	150	93	4/8	22-1	S	12					F		No			
NS-6012		83.50	200	94	4/8	22-1	S	12					F		No			
NS-6015		117.00	200	94	4/8	20-1	S	15					F		No			
NS-7015		133.50	250	94	4/8	20-1	S	15					F		No			
830-PSW		66.95	160	92	4	4	32-2	S	8				F		No			
1040-PSW		83.50	160	94	4	4	30-2	S	10				F		No			
1260-PSW		99.95	300	98	4	4	28-2	S	12				F		No			
1560-PSW		150.00	300	98	4	4	25-1	S	15				F		No			
NS-4PCX		45.00	60	91	4	4	68-20	4 1/2	2		No		F		No			
NS-5PCX		59.00	60	92	4	4	65-20	5 1/4	2		No		F		No			
NS-206PCX		79.00	100	92	4	4	40-18	6 1/2	2		No		F		No			
NS-308PCX		99.00	120	92	4	4	30-18	8	2		No		F		No			
NS-MT-1		15.00	†	89	8	8	3k-20k	T					F		Yes			
NS-DT-1		27.00	40	92	6	6	3k-20k	T					F		No			
NS-HT-1		30.00	40	96	8	8	3.5k-18k	T					F		No			
NS-PDT-5		17.00	40	92	8	8	3k-22k	T					F		No			
NS-PDT-10		20.00	50	93	8	8	3k-22k	T					F		No			
NS-PHT-26		20.00	70	92	8	8	2k-40k	T					F		Yes			
NS-DM-39	29.00	60	93	8	8	500-10	M					F	1 1/2	Yes				
NS-DM-75	35.00	60	94	8	8	500-10	M					F	1 1/2	Yes				
G & S/ REDLINE PERFORMANCE	GE1045	24.95	30	92	8	70-12		4 1/2					F	1 3/4	No	10 1/2-inch-diameter enclosure.		
	GE1050	26.95	30	91	8	400-12	M	4 1/2					F	1 3/4	No			
	GE1052	28.50	50	89	8	150-14		5 1/4	W				F	1 7/8	No			
	GE1053	28.50	50	88	8	150-8		5 1/4	W				F	1 7/8	No			
	GE165	38.50	60	88	8	60-5		5 1/4	W				F	1 7/8	No			
	GE206	45.00	80	98	8	39-4.5		6 1/2	W				F	2 3/4	No			
	GE408	58.50	100	94	8	35-4		8	S				F	3 1/2	No			
	GE4010	66.95	120	94	8	30-4		10	S				F	4 1/2	No			
	GE6010	83.50	150	96	8	30-4		10	S				F	4 1/4	No			
	GE7010	99.95	180	98	8	25-4		10	S				F	4 1/2	No			
	GE8012	99.95	175	97	8	25-3.5		12	S				F	4 3/4	No			
	GE7015	133.50	180	98	8	22-3		15	S				F	6 1/4	No			
	GE80CX	83.50	120	95	8	38-20		6 x 9	2		No		F	3 1/2	No			
	GEMR10	19.50	20	90	8	3k-18k		T					F	1 1/4	No			
	GESR10	21.95	30	93	8	3k-20k		T					F	1 1/4	No			
	GEHT-1	29.95	30	96	8	3.5k-18k		T					F	2 1/4	No			
	GEMHT	49.95	40	100	8	4k-18k		T					F	7 1/4	No			
	DDI-10	150.00	150	96	8	32-4		10	S				F	4 3/4	No			
	DDI-12	167.00	150	97	8	30-4		12	S				F	5 1/4	No			
	DDI-15	184.00	150	98	8	28-4		15	S				F	6 1/2	No			
	DDII-10	200.00	200	97	8	30-4		10	S				F	4 3/4	No			
	DDII-12	234.00	200	98	8	26-4		12	S				F	5 1/2	No			
	DDII-15	249.00	200	100	8	25-4		15	S				F	6 1/2	No			
	ODE-12	267.00	400	99	8	25-4		12	S				F	5 1/2	No			
	ODE-15	450.00	400	100	8	25-4		15	S				F	7	No			
	ODE-18	450.00	400	101	8	20-4		18	S				F	8	No			
	DD-1824	133.50	60	104	8	500-6		M					F	11 1/2	No			
	8HP	50.00	60	104	8	500-6		M					F	11 1/2	No			
	DD-PMR	216.50	120	104	8	200-6		M					F	2 3/4	No			
	DD-61DM	84.00	100	93	8	500-8		M					F	1 3/4	No			
	DD-RH-1	217.00	75	108	8	500-16		M					F	8 1/4	No			
	DD-THT	150.00	40	110	8	2.5k-20k		T					F	4	Yes			
	DD-KD	100.00	40	94	8	1.5k-18k		T					F	1 3/4	No			
	HARMS LABS	ZP	200.00	80	91	8	60-22 ± 4		6 1/2	2	A	No	S		No		Wedge-shaped enclosure. As above. As above. As above.	
ZD		300.00	80	91	8	60-20 ± 3		6 1/2	2	A	No	S		No				
Big P		250.00	80	92	8	30-22 ± 4		8	2	A	No	S		No				
Big D		350.00	80	92	8	30-20 ± 4		8	2	A	No	S		No				
Pickup Box		250.00	80	92	8	30-22 ± 4		8	2		No	S		No				
HI-COMP	HS-16	40.00	25	95	4/8	90-18		4	W		No	F	1 3/4	No				
	HS-21	50.00	30	95	4/8	90-20		4 x 6	2		No	F	1 3/4	No				
	HS-30	30.00	20	90	4/8	90-18		3 1/2	W		No	F	1 1/2	No				
	HS-41	60.00	30	95	4/8	90-20		4	2		No	F	1 3/4	No				
	HS-51	80.00	40	95	4/8	70-20		5 1/4	2		No	F	2	No				
	HS-56	50.00	30	92	4/8	100-18		5	W		No	F	1 1/2	No				
	HS-71	90.00	100	95	4/8	40-20		6 x 9	2		No	F	3 3/4	No				
	HS-75	80.00	40	95	4/8	60-20		4 x 10	2		No	F	2 1/2	No				
	HS-81	130.00	100	96	4/8	40-20		6 x 9	3		No	F	3 3/4	No				

# SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended	Sensitivity, dB SPL (1 Watt 1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	DRIVERS										Notes
								Maximum Power, Watts	Separate Mid (S), Tweeter Only (W), Midrange Only (M), Tweeter Only (T)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Amph Tweeter(s) = A, Passive Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Conceal (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproof?		
HITACHI	SF-1001		59.95	50	90	4	50-21 ±3		4			No	F	1½	Yes			
	SF-1002		79.95	50	90	4	50-21 ±3		4	2		No	F	1½	Yes			
	SF-123		42.95	25	89	4	80-18 ±3		5			No	F	1½	Yes			
	SF-124		66.95	25	89	4	80-20 ±3		5	2		No	F	1½	Yes			
	SF-1301		74.95	60	91	4	50-22 ±3		5¼			No	F	1½	Yes			
	SF-1302		99.95	100	91	4	50-22 ±3		5¼	2		No	F	1½	Yes			
	SF-166		89.95	80	91	4	50-22 ±3		6½	2		No	F	2¼	Yes			
	SF-1601		76.95	80	92	4	50-22 ±3		6½	2		No	F	1½	Yes			
	SF-1602		106.95	120	92	4	50-22 ±3		6½	2	2	No	F	1½	Yes			
	SF-4060		69.95	50	90	4	50-22 ±3		4 x 6	2	2	No	F	1¾	Yes			
	SF-6092		135.95	120	92	4	50-22 ±3		6 x 9	3		No	F	2½	Yes			
	SF-6093		149.95	120	93	4	40-22 ±3		6 x 9	2		No	F	3½	Yes			
	SF-6094		159.95	150	93	4	40-22 ±3		6 x 9	3		No	F	3½	Yes			
	SX-103		144.95	30	88	4	70-22 ±3		4	2		No	S		Yes			
INFINITY	RSOS 12" Pro	300.00		300	92	4	22-1.5 ±3	W	12				F	6¼	Yes			
	RSOS 12"	225.00		250	90	4	26-1.5 ±3	W	12				F	5¼	Yes			
	RSOS 10"	175.00		175	90	4	30-1.5 ±3	W	10				F	4¾	Yes			
	RSOS 8"	135.00		150	89	4	35-2 ±3	W	8				F	4¼	Yes			
	RSOS			75	89	4	100-800 Hz ±2	W	5				F	1½	Yes			
	Polygraph																	
	RSOS Polydome			50	88	4	700-4 ±3	M					F	¾	Yes			
	RSOS 4"	40.00		50	89	4	200-10 ±3	M					S	1½	Yes			
	RSOS EMIT		175.00	50	91	4	4k-45k ±3	T					S		Yes			
	RSOS Polycell		125.00	40	94	4	3.5k-22k ±3	T					S		Yes			
	CS-1k		399.95	200	87	4	34-45		6 x 9				S	3½	Yes			
	CS-2k		379.95	200	87	4	40-45		6½				†	2¼	Yes			
	RS 693k		249.95	100	90	4	34-45		6 x 9	3		P	Yes	3¼	Yes			
	RS 63k		199.95	55	88	4	58-45		6½	3			F	2¾	Yes			
	RS 692k		189.95	75	90	4	34-22		6 x 9	2			F	3¼	Yes			
	RS 62k		149.95	55	88	4	58-22		6½	2			F	2¾	Yes			
	RS 52k		144.95	30	88	4	63-22		5¼	2			F	1¾	Yes			
	RS 42k		99.95	25	87	4	98-16		4	2			F	1½	Yes			
	RS 462k		54.95	25	86	4	98-16		4 x 6	2			F	1¾	Yes			
RS 32k		44.95	18	86	4	112-16		3½	2			F	1¾	Yes				
EMIT k		174.95	50	86	4	3.5k-45k	T			P		S		Yes				
JAMO	Jamocar 30R		59.95	50	87	4	70-14		4				F		Yes			
	Jamocar 40		74.95	60	88	4	70-20		4	2			F		Yes			
	Jamocar 50R		84.95	70	89	4	60-20		5	2			F		Yes			
	Jamocar 45		99.95	75	88	4	70-20		4	2			F		Yes			
	Jamocar 70		109.95	95	91	4	50-20		6½	2			S		Yes			
	Jamocar 60		179.95	85	89	4	70-20		4	3		A	S		Yes			
	Jamocar 90		189.95	130	94	4	40-20		6 x 9	3			S		Yes			
	Jamocar 30S		249.95	10	20	10k	50-20		5	2			F		Yes			
	Electronic			Inc.												Biamped.		
JBL	T90		185.00	125	93	4	65-3 ±3	W	6 x 9				C	3½	Yes			
	T60		160.00	100	91	4	65-3 ±3	W	6½				C	2¾	Yes			
	T50		125.00	75	88	4	85-3 ±3	M					C	1¾	Yes			
	T06		110.00	100	93	4	3k-27k ±3	T					C		Yes			
	T75		250.00	100	85	4	75-26 ±3	S	5¼	2		No	P	1½	Yes			
	T180	395.00		400	94	4	30-800 Hz	S	18				C		Yes			
	T150	295.00		400	93.5	4	30-1.2	S	15				C		Yes			
	T120	235.00		300	92	4	40-1.2	S	12				C		Yes			
	T100	140.00		200	91	8	35-2.5	S	10				C	4½	Yes			
	T80	100.00		150	88	4	40-3	W	8				C	3½	Yes			
	TL900		220.00	100	93	4	50-20 ±3		6 x 9	3		No	C	3½	Yes			
	TL600		160.00	60	90	4	60-20 ±3		6½	2		No	S		Yes			
	TL500		120.00	40	88	4	80-20 ±3		5	2		No	S		Yes			
	TL460		55.00	20	88	4	90-12 ±3		4 x 6				S		Yes			
	TL400		90.00	25	87	4	100-14 ±3		4						Yes			
	TL350		45.00	15	87	4	115-15 ±3		3½						Yes			
	T545		270.00	100	92	4	40-18 ±3		6 x 9	3	A		C	6	Yes			
	T95		320.00	125	93	4	65-26 ±3		6 x 9	3		No	C	3½	Yes			
T65		230.00	100	91	4	65-26 ±3		6½	2		No	S		Yes				
T55		160.00	75	88	4	85-20 ±3		5	2		No	S		Yes				
JENSEN	JTE-602		160.95	100	91	4	75-22		6½	2		No	S		For pickup trucks.			
	JTX-300		119.95	150	92	4	40-25		6 x 9	3		No	F	4				
	JCX-200		89.95	150	91	4	40-22		6 x 9	2		No	F	4				
	JTX-365		99.95	120	91	4	58-20		6½	3		No	F	1½				
	JCX-265		69.95	90	90	4	60-20		6½	2		No	F	1½				
	JFX-140		44.95	60	88	4	70-20		4	W		No	F	1½				
	JXL-693		129.95	175	93	4	40-26		6 x 9	3		No	F	4				
	JXL-653		109.95	135	91	4	58-23		6½	3		No	F	1½				
	JXL-452		69.95	80	90	4	65-23		4½	2		No	F	1¾				
	JXL-401		49.95	65	88	4	70-21		4	W		No	F	1½				
	JXL-461		37.95	50	91	4	65-21		4 x 6	W		No	F	1½				
	JXL-351		32.95	50	86	4	70-20		3½	W		No	F	1¾				
	J1445		34.95	25	88	4	70-17		4½	W		No	C	1¾				
	J1401		129.95	45	92	4	40-20		4 x 10	3		No	F	2¾				
J1405		84.95	45	92	4	45-18		4 x 10	2		No	F	2¾					
J1350		32.95	25	83	4	80-15		3½	W		No	F	1¾					
JTE-802		249.95	150	94	4	60-25		8	2	A	No	S		As above.				

# SPEAKERS

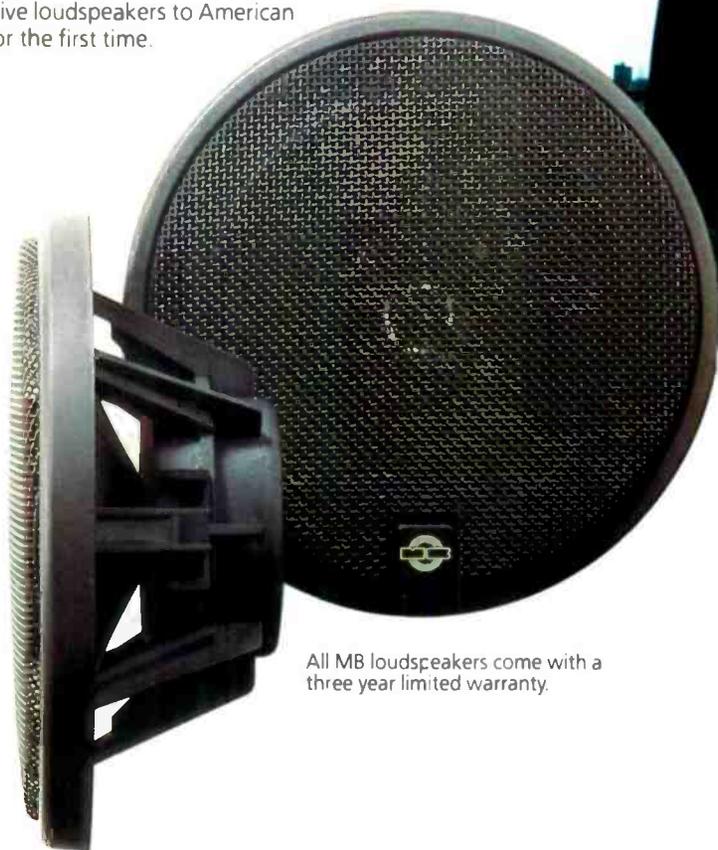
MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Maximum Power: Watts	Sensitivity, dB SPL (1 Watt 1 Meter)	Impedance: Ohms	Frequency Response, Hz to kHz, ±dB	DRIVERS										Notes
								Speaker Dia. (S) Midrange Dia. (M) Woofer Dia. (W) Tweeter Dia. (T)	Woofer Dia. (W) Tweeter Dia. (T)	Whizzer (W): 2-Way (2); 3-Way (3); 4-Way (4)	Applied Tweeters: = A, Portable Tweeters: = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Rack (R)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
JVC	CS6935	239.95	150	93	4	30-20	6 x 9	3		No	F	3 1/2	Yes	For American cars; for European cars, Model CS4625, includes grille, \$99.95 per pair.  Bass reflex enclosure. Dash mount. For narrow rear decks of GM cars.				
	CS635	159.95	120	89	4	30-20	6 1/2	3		No	F	2 1/4	Yes					
	CS525	79.95	60	90	4	50-20	5 1/4	2		No	F	1 3/8	Yes					
	CS4624	89.95	45	89	4	50-20	4 x 6	2		No	F	1 1/2	Yes					
	CS106	469.95	150	88	4	25-35	6 1/2	3		No	P	1 1/8	Yes					
	CS105	319.95	120	87	4	30-30	5 1/4	2		No	P	1 1/4	Yes					
	CS103	229.95	60	88	4	40-25	4	2		No	P	1	Yes					
	CSF600		200	88	4	20-150 Hz	6 3/8			No	F, S							
	CSB007	179.95	70	90	4	50-20	4	3		No	F, S							
	CS304	34.95	30	87	4	80-15 ±2	3 1/2	W		No	S	1 1/2	Yes					
	CS4124	129.95	60	90	4	40-20 ±2	4 x 10	2		No	S	3	Yes					
	CS5724	129.95	60	91	4	40-20 ±2	5 x 7	2		No	F	2 1/2	Yes					
	CS614	59.95	60	90	4	40-17 ±2	6 1/2	W		No	F	1 1/4	Yes					
	CS624	69.95	100	90	4	40-20 ±2	6 1/2	2		No	F	1 1/8	Yes					
	CS514	49.95	30	90	4	60-17 ±2	5 1/4	W		No	F	1 1/8	Yes					
	CS414	39.95	45	87	4	50-20 ±2	4	W		No	F	1 1/4	Yes					
	CS424	49.95	45	86	4	50-20 ±2	4	2		No	F	1 1/4	Yes					
	CS6914	59.95	75	92	4	30-15 ±2	6 x 9	W		No	F	2 1/2	Yes					
CS6924	79.95	75	92	4	30-20 ±2	6 x 9	2		No	F	2 1/2	Yes						
CS6934	119.95	150	91	4	30-20 ±2	6 x 9	3		No	F	2 1/2	Yes						
KEF	GT-100	250.00	50	90	4	50-20 ±3	4 1/2	2		No	P	1 1/4	Yes	1 1/4 inches for satellites, 12 inches for enclosed subwoofers. External crossover required. As above. As above.				
	GT-200	575.00	100	90	4	50-20 ±3	8	3		Yes	P	†	Yes					
	KAR-33A	100.00	100	90	4	2.5k-20k	T		A	P	S		Yes					
	KAR-33F	100.00	100	90	4	2.5k-20k	W				F	1 3/4	Yes					
	KAR-110	100.00	100	90	4	50-5	4 1/2				F	2 1/8	Yes					
KAR-200SW	350.00	100	90	4	30-250 Hz	M	8			F	12	Yes	As above; enclosed subwoofer.					
KENWOOD	KFC-W169	239.00	200	89	4	45-7	S	6 x 9			F	3 1/2	Yes	Requires external crossover. As above. As above.  Fits Mercedes, Audi, and Toyota pickup trucks. Fits most GM cars.  Fits VW Golf and Porsche.  Fits most GM cars.  Tweeter overload protection. As above. Box enclosure.  Yes				
	KFC-M105	139.00	300	88	4	45-7	M				F	2 1/4	Yes					
	KFC-M104	129.00	300	87	4	45-10	M				F	1 1/4	Yes					
	KFC-T101	129.00	300	88	4	2k-23k	T				F	3/8	No					
	KFC-103D	99.00	45	90	4	60-20		4	W	A	No	F	1 1/4		Yes			
	KFC-104B	99.00	30	90	4	60-20		4	W	A	No	F	1 1/8		No			
	KFC-830G	49.00	30	89	4	100-20		3 1/2	W		No	F	1 1/8		No			
	KFC-W110	299.00	400	89	4	35-1	S	10				F	4 3/8		No			
	KFC-W108	239.00	300	89	4	45-2	S	8				F	8 3/8		No			
	KFC-463V	99.00	45	89	4	70-20		4 x 6	2	A	No	F	1 1/8		Yes			
	KFC-1691	189.00	150	86	4	35-22		6 1/2	2	A	No	F	2 1/8		Yes			
	KFC-1681	149.00	110	90	4	45-21		6 1/2	3	A	No	F	2 1/8		Yes			
	KFC-1671	119.00	90	90	4	55-20		6 1/2	2	A	No	F	1 1/8		Yes			
	KFC-1661	99.00	60	90	4	55-20		6 1/2	W	A	No	F	1 1/4		Yes			
	KFC-127B	119.00	75	92	4	50-20		5	2	A	No	F	1 1/8		Yes			
	KFC-1281	129.00	50	90	4	50-21		5	3	A	No	F	1 1/4		Yes			
	KFC-1271	119.00	45	90	4	50-20		5	2	A	No	F	1 1/4		Yes			
	KFC-1261	69.00	45	90	4	60-20		5	W	A	No	F	1 1/4		Yes			
	KFC-1071	109.00	45	90	4	60-21		4	2	A	No	F	1 1/4		Yes			
	KFC-6971	159.00	100	91	4	45-20		6 x 9	3	A	No	F	3		Yes			
	KFC-6961	129.00	50	90	4	45-20		6 x 9	2	A	No	F	2 1/2		Yes			
	KFC-411G	119.00	100	91	4	60-20		4 x 10	2	A	No	F	1 1/8		Yes			
KFC-4671	129.00	45	91	4	60-20		4 x 6	2	A	No	F	1 1/8	Yes					
KSC-3300	299.00	100	90	4	50-30		5	2	A	No	P	1 1/8	Yes					
KSC-2200	239.00	100	90	4	50-20		5	2	A	No	P	1 1/8	Yes					
KSC-5100	189.00	50	85	4	60-20		4	2	A	No	F	1 1/8	Yes					
KFC-6991	259.00	200	92	4	35-25		6 x 9	3	A	No	F	3 1/2	Yes					
KFC-6981	209.00	150	92	4	40-20		6 x 9	4	A	No	F	3 1/2	Yes					
KRACO	TPS-694	119.95	100	92	4	20-20 ±10	6 x 9	4	P	No	F	3 1/8	Yes					
	TPS-693	99.95	100	92	4	40-20 ±10	6 x 9	3	A	No	F	3 1/8	Yes					
	TPS-552	89.95	60	92	4	50-20 ±10	5 1/2	2	P	No	F	1 1/4	Yes					
LEAR JET STEREO	8526	28.00	30	90	4	70-16	6 1/2	2		Yes	F							
	503G	39.00	50	86	4	10-16	5	3		Yes	F							
	8406	30.00	40	86	4	80-20	4	2		Yes	F							
	8405	23.00	30	89	4	100-18	4	W			F							
	9350	16.00	25	86	4	100-16	3 1/2	W			F							
	LSP-60930		40		4	120-18	6 x 9	3			F							
	W-300	45.00	50	82	4	100-20	4	3		Yes	S							
	8695	86.00	150	90	4	50-20	6 x 9	3		Yes	F							
	LSP-60910	60.00	60	92	4	50-20	6 x 9	3		Yes	F							
	8693	41.00	40	91	4	65-20	6 x 9	3		Yes	F							
LSP-65021	32.00	50	88	4	55-20	6 1/2	2		Yes	F								
LSP-40021	39.00	40	86	4	65-20	4	2		Yes	F								
LINEAR POWER	BV-1	199.95	150	90	†	20-150 Hz	S	(2)8			F	10	No	†8 ohms in mono mode, 4 ohms in stereo. Two woofers fire through one 3 x 9-inch faceplate. Mono; includes feedback-servo amp. (See "Amps Equalizers.")				
	1752S	1500. Sys.	175 Inc.			20-100 Hz	S	(4)8			F	3 1/4	No					
MAGNUM	4512D	129.95	40	85	4	85-20	4 1/2	2		No	S		No	Box enclosure. Carpeted box enclosure. As above. Box enclosure.				
	5312D	149.95	50	85	4	65-20	5 1/4	2		No	S		No					
	4112D	169.95	50	87	4	45-20	4 x 10	2		No	S		No					
	6912D	169.95	60	89	4	45-20	6 x 9	2		No	S		No					
	6944XP	229.95	100	99	4	30-22	6 x 9	2		No	S		No					
	Mover 8	179.95	100	91.5	4	75-20	8	2		No	S		No					
	MB 8	319.95	100	94	4/8	39-1.8	8	2		No	S		No					
MB 10	419.95	150	97	4		10	3		No	S		No						
MB 12		150	97	4/8	22-1.8		12	3		No	S		No					

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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
								Speaker Qty (S) Midrange Qty (M), Tweeter Qty (T)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Applied Tweeter(s) = A, Poleable Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Cornerhole (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
MAGTONE	P-900		89.95	50	4	4	50-20 ±3		6 x 9	3		P	No		2 1/8			
	P-600		79.95	50	4	4	70-20 ±3		6 1/2	3		P	No		2 1/8			
	P-410		84.95	30	4	4	70-20 ±3		4 x 10	3		P	No					
	P-500		69.95	40	4	4	70-20 ±3		5 1/4	2		P	No					
	P-460		59.95	25	92.0	4	90-20 ±3		4 x 6	2		P	No					
	P-400		55.95	20	93.0	4	90-20 ±3		4	2		P	No					
	P-300		34.95	20	94.0	4	100-18 ±3		3 1/2	2		P	No					
	CSP-6930P		149.95	120	93.0	4	40-20 ±3		6 x 9	3		P	No					
	CSP-6530P		139.95	120	92.0	4	50-20 ±3		6 1/2	3		P	No					
	CSP-522P		79.95	40	93.0	4	60-20 ±3		5 1/4	2		P	No					
	CSP-402P		69.95	40	92	4	80-20 ±3		4	2		P	No					
	CSP-521PP		89.95	40	94	4	45-20 ±3		5	2		A	No					
	CSP-81P		39.95	100	98.0	4	30-4	S	8									
	CSP-101P		59.95	150	100	4	25-3.5	S	10									
	CSP-121P		74.95	200	100	4	20-2.5	S	12									
CSP-500M			22.95	60	96.0	4	850-10	M										
MSP-5221			124.95	40	4	4	50-20		5 1/4	2							Yes	
MAJESTIC	MCS1250	79.95		250	92	4	18-3	S	12						5 1/2			
	MCS1550	89.95		300	92	4	18-2	S	15						6 1/2			
	MS285HE		24.95	20	4	4	60-18		6 1/2	2					2			
	MS269HE		49.95	25	4	4	60-18		6 x 9	2					3 1/8			
	MS530		49.95	100	4	4	80-21		3 1/2	3								
	MS540		99.95	120	4	4	80-21		4	3								
	MS550		99.95	200	4	4	60-20		4	3								
	MS590		149.95	200	4	4	60-24		4	4								
	MCS1050	69.95		300	92	4	4	20-3	S	10						4 1/2		Bass reflex enclosure. As above. As above; honeycomb woofer. As above.
	MB QUART ELECTRONICS	QM120K		169.00	80	90	4	40-20		6 1/2	2				C	2 1/2	Yes	
QM130K			179.00	60	88	4	50-32		5 1/4	2			C	2	Yes			
QM130K W-124			189.00	60	88	4	50-32		4 1/4	2			F	2 1/4	Yes			
QM160K			219.00	80	90	4	40-32		6 1/2	2			C	2 1/4	Yes			
QM19HC			90.00	60	92	4	3.5k-32k	T					S					
QM200TC			254.00	100	90	4	35-300 Hz	W	(2)8						2 1/4	Yes		
QM215CS			244.00	60	90	4	48-32		5 1/4	2		Yes		2	Yes			
QM218CS			270.00	80	90	4	40-32		6 1/2	2		Yes		2 1/4	Yes			
QM325CS		424.00	60	90	4	48-32		5 1/4	3		Yes		2	Yes				
QM328CS		454.00	60	90	4	38-32		6 1/2	3		Yes		2 1/4	Yes				
MEI	DS6930	139.95		150	92	4	50-21 ±3		6 x 9	3		A	No	F	3	Yes		
	DS6530	109.95		120	90	4	60-21 ±3		6 1/2	3		A	No	F	2 1/2	Yes		
	DS6920	119.20		150	92	4	50-20 ±3		6 x 9	2		A	No	F	3	Yes		
	DS4020	29.85		60	91	4	90-20 ±3		4	2		A	No	F	2	Yes		
	CK8050	109.95		150	90	4	50-2 ±3	W	8					F	3 1/2	Yes		
	CK6950	89.95		150	92	4	60-10 ±3	W	6 x 9					F	3 1/4	Yes		
	CK6550	64.95		120	90	4	60-3 ±3	W	6 1/2					F	2 3/4	Yes		
	CK4050	44.95		75	91	4	600-18 ±3	M						F	1 3/4	Yes		
	CK3550	49.95		75	90	4	2k-20k ±3	T						F	1	Yes		
	SK412F	59.95		30	92	4	60-20 ±3		4 x 10				No	F	1 3/4	No		
	SK691F	44.95		30	90	4	50-16 ±3		6 x 9	2			No	F	3	No		
	SK693F	59.95		30	90	4	40-16 ±3		6 x 9	3			No	F	3 1/2	No		
	SK696F	109.95		100	91	4	40-20 ±3		6 x 9	3			No	F	4 1/4	Yes		
	SK345S	109.95		100	88	4	80-20 ±3		4	3			No	S		Yes	Bass reflex enclosure; honeycomb woofer.	
	SK525F	49.95		20	90	4	50-18 ±3		5 1/4	2			No	F	1	No		
	SK601F	24.95		10	88	4	60-12 ±3		6 1/2	W			No	F	1 3/4	No		
	SK605F	39.95		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	No		
SK426F	44.95		20	90	4	65-20 ±3		4 x 6	2			No	F	1 3/4	No			
SK401F	34.95		20	91	4	50-18 ±3		4	W			No	F	1 1/2	No			
SK405F	39.95		20	91.5	4	50-18 ±3		4	W			No	F	1 1/2	No			
SK420F	59.95		40	90	4	70-20 ±3		4	2			No	F	1 1/2	No			
MINGAR	MS-6901		79.95	100	92	4	30-20		6 x 9	3			No	F	2 3/4	No		
	MS-6902		69.95	100	89	8	30-20		6 x 9	3			No	F	3	No		
	MS-5401		59.95	100	89	4	80-20		5 1/4	3			No	F	2 1/2	No		
MISCO-REDLINE	JC69CD	17.15		30	95	8	50-13		6 x 9	W				F	3 1/8			
	JC54CDP	14.90		30	91	8	90-12		5 1/4	W				F	2 1/8	Yes		
	LC8A	41.78		50	91	8	25-3	W	8				F	3 1/4				
	LC10A	47.05		50	90	8	25-3	W	10				F	4				
	LC12A	50.79		50	89	8	20-2.5	W	12				F	4 1/2				
MONOLITHIC SOUND	W-700	59.00		125	91	8	40-2	S	7				S		Yes			
	M-350		59.00	50	93	4	50-20	S	3 1/2				S					
	WA-100	199.00		50	98	4	30-200 Hz	S	7				S			Box enclosure.		
MOREL ACOUSTICS	162-M		259.00	100	88	4	40-25 ±3		6	2	P	Yes	S					
	224-M		369.00	120	91	4	35-25 ±3		8	2	P	Yes	S					
	224-M 3		549.00	120	91	4	35-25 ±3		8	3	P	Yes	S					
	MDT-104		79.00	100	92	8	1.5k-12k ±3	T					F		1 1/2			
	Integra 1 MKII		229.00	100	91	4	45-25 ±3		6	2	P	No	F		2 1/4			
	Integra 2 MKII		259.00	120	92	4	35-25 ±3		6	2	P	No	F		2 1/4			
	Coax-162		179.00	80	93	4	45-20 ±3		6	2	P	No	F		2 1/4			
	CR-3		448.00	200	90	4	500-25 ±3			2	P	Yes	S					
CR-7		498.00	125	90	4			6	2	P	Yes	S						
CR-8		448.00	150	90	4	70-25 ±3		6	2	P	Yes	S						
MDT-80		64.00	40	93	4	4k-20k ±3	T						S		5/8	Midrange and tweeter in open-back cabinet enclosure. Cabinet enclosure. As above.		

# SPEAKERS

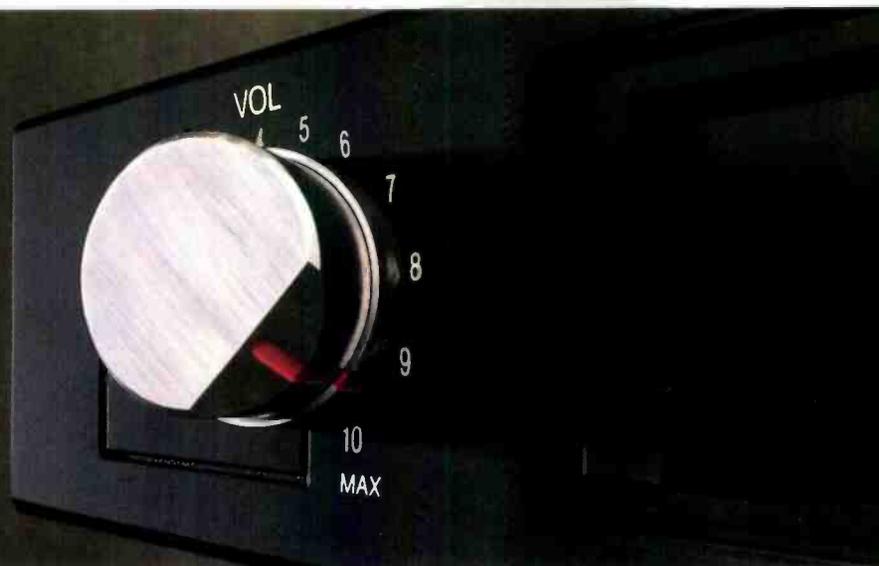
MANUFACTURER	Model					DRIVERS										Notes				
		Price, \$ (if Sold Individually)	Price, \$ (if Sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt 1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Subwoofer Only (S), Midrange Only (M), Tweeter Only (T)	Woofer Size, Inches	Whizzer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Angle Tweeters, = A, Polarizable Tweeters (P)	Separately Mounted Drivers?	Finish Mount (F), Convertible (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?					
MOREL ACOUSTICS (Continued)	MOT-101		99.00	200	91	6.4	1.2k-25k	T												
	COM-75		179.00	100	91	6.4	400-5 ± 3	M												
	MCW-162		159.00	150	88	4	40-50 ± 3		6			No	F	2 1/4						
	MCW-164		179.00	150	91	4	40-50 ± 3		6			No	F	2 1/4						
	MCW-220		179.00	150	90	4	30-30 ± 3		8			No	F	2 1/4						
	MCW-224		198.00	150	92	4	25-30 ± 3		8			No	F	2 1/4						
	PPC-8	148.00	150	94	4	23-500 Hz	S	8				No	F	2 1/4						Dual voice-coils.
MTX	8NC699	79.95	100	89	4	36-2	S	8				F	3 1/2	No					External crossover required.	
	10NC728	89.95	130	91	4	27-2.5	S	10				F	4 1/2	No					As above.	
	12NC713	99.95	150	92	4	19-2	S	12				F	4 1/2	No					As above.	
	QT-1	69.95	60	91	4	2k-20k	T			P		F	1/2	No					As above.	
	Micro 100C	199.95	70	86.6	4	130-20			2	P	Yes	F	1/2	Yes					Midrange and tweeter in cabinet enclosure.	
	Micro 300	269.95	100	91.6	4	400-20		6 1/2	2		Yes	F	1 1/4	No					Cabinet enclosure.	
	46P	79.95	60	92	4	400-20		4 x 6	2		Yes	P	1 1/4	No						
	RFL71	119.95	107	8		5k-20k	T						P	2 1/2	No					†250 watts with 12-dB/octave external crossover.
	PL5G	74.95	100	95	8	800-10	M						F	1 1/4	No					External crossover required.
	RFL69	89.95	200	93	4	35-2	W	6 x 9					F	3 1/2	No					As above.
	RFL8	99.95	250	93	4	34-2	W	8					F	3 1/2	No					As above.
	RFL840	99.95	250	91	8	34-2	W	8					F	3 1/2	No					As above.
	RFL10	109.95	300	93	4	32-2	S	10					F	4 1/2	No					As above.
	RFL1040	109.95	250	93	8	45-3	S	10					F	4 1/4	No					As above.
	RFL12	299.95	600	93	4	25-2	S	12					F	5 1/4	No					As above.
	RFL1240	299.95	250	94.5	8	43-3	S	12					F	4 1/4	No					As above.
	RFL15	389.95	800	95	4	20-2	S	15					F	6 1/2	No					As above.
	RFL18	449.95	800	96	4	18-1.5	S	18					F	7 1/2	No					As above.
	RFL410	59.95	100	100	8	800-16	S	4 x 10					F	8	No					
	52KB494	39.95	80	88	4	74-5.5	S	5 1/4					F	2 3/4	No					As above.
	69MC469P	59.95	150	88	4/8	45-3.5	S	6 x 9					F	3 1/4	No					As above.
	6JC497P	59.95	120	88	4/8	35-3.5	S	6					F	3 3/8	No					As above.
	8NC588P	69.95	200	90	4/8	39-3.5	S	8					F	3 3/8	No					As above.
	10NC590P	74.95	200	88	4/8	28-2	S	10					F	4 3/8	No					As above.
	12NC596P	79.95	200	89	4/8	19-1.7	S	12					F	5	No					As above.
	15MD682	109.95	200	88	4	22-2	S	15					F	6 1/2	No					As above.
	15RO758	99.95	300	93	2	26-2	S	15					F	6 1/2	No					As above.
	69KB798	39.95	200	94	4	95-5	M						F	3	No					As above.
	MB7DC	89.95	360	91	8	50-4	M						F	3 1/2	No					As above; fits 6 x 9-inch holes.
	35FA621	26.95	60	83	4	100-7	M						F	1 1/4	No					External crossover required.
	4-721	18.95	†	91	8	600-10	M						F	2	No					†200 watts with 2 kHz, 6-dB/octave external crossover.
	45FB545	34.95	60	84	4	70-5	M						F	1 1/4	No					External crossover required.
	5MB599	35.95	60	89	8	600-5	M						F	2 1/4	No					As above; closed back.
	372684	17.95	60	95.5	†	3.5k-20k	T						F	2 1/2	No					†20 ohms minimum. External crossover required.
	1CU757	16.95	†	92	4	3k-20k	T						F	1/2	No					†80 watts with 5 kHz, 12-dB/octave external crossover.
	1EB714	59.95	†	100	8	2k-20k	T						F	2 1/2	No					†As above but 200 watts.
	1HB804	39.95	†	94	4	2.5k-20k	T						F		No					†150 watts with 4 kHz, 12-dB octave external crossover.
	1HB805	39.95	†	95	8	2k-20k	T						F		No					†250 watts with 6 kHz, 12-dB octave external crossover.
	B3.5	26.95	60	91.5	4	130-20		3 1/2	W			No	F	1 1/2	No					
	B4.0	39.95	60	96	4	150-20		4				No	F	1 1/2	No					
	B4.5	59.95	144.95	60	89.5	4	90-20	4 1/2	2			No	F	1 1/4	No					
	B5.3	64.95	149.95	60	91	4	75-20	5 1/4	2			No	F	2 1/2	No					
	B6.5	69.95	159.95	60	94	4	60-20	6 1/2	2			No	F	2 1/2	No					
	B6.9	74.95	169.95	60	94	4	55-20	6 x 9	2			No	F	3	No					
	B7.5	89.95	239.95	200	99	4	30-22	6 x 9	2			No	F	3 1/4	No					
	B8.5	89.95		200	91	4	39-20	8	2			No	F	3 1/2	No					
	65HB	419.95	300	91	4/8	50-22	(2)10			A	Yes		F		No					Carpeted enclosure.
	55HB	349.95	300	97	4/8	40-22	12	3		A	Yes		F		No					As above.
	45S8		419.95	300	97	4/8	55-22	10	3	A	Yes		F		No					As above.
	35S8		319.95	200	94	4/8	60-22	8	2		Yes		F		No					As above.
25S8		249.95	90	90	4/8	80-22	8	2		Yes		F		No					As above.	
BX1010	329.95	200	96	4	30-2	S	(2)10					S		No					As above; external crossover required.	
Mini-subts	199.25	100	90.5	4	50-2	S	4 x 10					S		No					As above.	
J810	299.95	150	92.7	4	70-230 Hz	S	10					S		No					As above.	
BTW 834	59.95	140	85	4	25-2.5	S	8					F	3 3/4	No					External crossover required.	
BTW 1049	69.95	200	82.5	4	21-2.5	S	10					F	4 3/8	No					As above.	
BTW 1244	79.95	300	84.5	4	21-2	S	12					F	5 1/8	No					As above.	
BTW 838	59.95	140	85	8	25-2.5	S	8					F	3 3/4	No					As above.	
BTW 1048	69.95	200	82.5	8	21-2.5	S	10					F	4 3/8	No					As above.	
BTW 1248	79.95	300	84.5	8	21-2	S	12					F	5 1/8	No					As above.	
MTW 84	59.95	200	87	4	33-2	S	8					F	3 3/4	No					As above.	
MTW 104	69.95	250	89.5	4	23-1.8	S	10					F	4 3/8	No					As above.	
MTW 124	79.95	300	90	4	24-2	S	12					F	3 3/8	No					As above.	
MTW 154	106.25	300	87	4	24-1.6	S	15					F	6 1/4	No					As above.	
MTW 88	59.95	200	87	8	33-2	S	8					F	3 3/4	No					As above.	
MTW 108	69.95	250	89.5	8	23-1.8	S	10					F	4 3/8	No					As above.	
MTW 128	79.95	300	90	8	24-2	S	12					F	5 1/8	No					As above.	
MTW 158	106.25	300	87	8	24-1.6	S	15					F	6 1/4	No					As above.	
NAKAMICHI	SP-1010	195.00	200	90	4	25-4	S	9 1/2				F	4 1/2	Yes						
	SP-65C		325.00	80	86	4	45-22	S	6 1/2		†	††	F	2 5/8	Yes					†Optional angle mount, Model MK-1. ††Detachable tweeter.
	SP-35		75.00	20	87	4	90-20		3 1/2	W		F	1 3/8	Yes						
	SP-300		425.00	80	86	4	50-22		5 1/2	2	A/P	No	P	1 3/8	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
								Woofer Only (W) Midrange Only (M) Tweeter Only (T)	Woofer Size, inches	Woofer (W) 2-Way (2) 3-Way (3), 6-Way (6)	Angled Tweeter(s) = A, Round Tweeter(s) = P	Separately Mounted Drivers?	Fitch Mount (F), Surface Mount (S), Compatible (C), Plug (P)	Maximum Required Mounting Depth, inches	Weatherproofed?			
ORA ELECTRONICS	Auto Spec ASPQ-8W0	69.95	100	97	4	38-10	W	8					C	2%	No	Biamp capable.		
	ASPQ-69W0	49.95	100	97	4	38-10	W	6 x 9					F	3	No	As above.		
	ASPQ-69D3	59.95	100	94	4	35-20		6 x 9	3				F	2%	No	As above.		
	ASPQ-69S3	47.95	70	94	4	38-22		6 x 9	3		No		F	1%	No	As above.		
	ASPQ-55S3	39.95	60	94	4	65-18		6 1/2	3		No		F	1%	No	As above.		
	ASPQ-5S3	27.95	50	92	4	60-20		5	3				F	1%	No	As above.		
	ASPQ-42W ASPQ-DT	23.95 21.95	40 80	91 96	4	50-20 4k-22k	T	4	2				F C	1 1/2	No	As above.		
ORCA	One	690.00	100	93	4	70-19 ± 2		5 1/4	2				P	2%	Yes	†Optional angled base.		
	Two	880.00	100	95	4	55-19 ± 1.5		7	2				P	2%	Yes			
	Depth	520.00	200	93	4	45-200 Hz ± 3	S	(2)7					P	2%	Yes			
	Great Depth	590.00	200	95	4	35-200 Hz ± 3	S	(2)8					P	3	Yes			
PANASONIC	EAB-D450	89.95	100	92.5	4	40-22 ± 3		4	2		A	No	F	2	Yes			
	EAB-D650	109.95	120	93	4	30-22 ± 3		6 1/2			A	No	F	2	Yes			
	EAB-D970	149.95	150	94	4	28-25 ± 3		6 x 9	3		A	No	F	4 1/2	Yes			
	EAB-911	39.95	20	93	4	50-15 ± 3		5	W			No	F	1 1/4	Yes			
	EAB-1501	52.95	40	89	4	50-16 ± 3		5	W			No	F	3 1/2	Yes			
	EAB-1651	84.95	50	92	4	40-22 ± 3		6 1/2	2		A	No	F	1 1/2	Yes			
	EAB-466	54.95	50	90	4	60-22 ± 3		4 x 6	2			No	F	1 1/2	Yes			
	EAB-4152	89.95	60	92	4	45-22 ± 3		4 x 10	2			No	F	3 1/2	Yes			
	EAB-3651	62.95	50	92	4	40-22 ± 3		6 1/2	2		A	No	F	1 1/2	Yes			
	EAB-0852	84.95	80	92	4	40-22 ± 3		6 1/2	2		A	No	F	1 1/2	Yes			
	EAB-3691	83.95	80	92	4	40-22 ± 3		6 x 9	2		A	No	F	3 1/4	Yes			
	EAB-6951	99.95	80	94.5	4	30-22 ± 3		6 x 9	2		A	No	F	4	Yes			
	EAB-6971	124.95	100	94.5	4	30-25 ± 3		6 x 9	3		A	No	F	4	Yes			
	EAB-030	31.95	20	90	4	100-20 ± 3		3 1/2	W			No	F	1 1/4	Yes			
	EAB-S412	39.95	40	91	4	50-20 ± 3		4	W			No	F	1 1/4	Yes			
	EAB-S452	51.95	40	92	4	50-22 ± 3		4	W			No	F	1 1/4	Yes			
	EAB-0552	62.95	60	91	4	40-22 ± 3		5 1/4	2		A	No	F	2 1/2	Yes			
EAB-S611	51.95	50	92	4	40-20 ± 3		6 1/2	W			No	F	1 1/4	Yes				
PARASOUND	CMs330	215.00	80	89	4	60-22 ± 4		4	2			No	S		No			
	CRs220	110.00	60	82	4	80-20 ± 4		4	2			No	S		No			
PHASE LINEAR	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 1/4				
	PL 2450	85.00	100	89	4	60-27		4 1/2	2			No	F	1 1/4				
	PL 2460		90	91	4	65-22		4	2			No	P	1 1/4				
	PL 2650	130.00	160	90	4	55-27		6 1/2	2			No	F	1 1/2				
	PL 3690	200.00	250	92	4	36-27		6 x 9	3			No	F	4 1/2				
	PL S600		100	91	4	30-5	S	8				No	F	4 1/4				
	PL S1000		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					
PIONEER	TS-1001	42.00	40	90	4	50-16		4	W			No	F	1 1/2	No			
	TS-1065	55.00	40	90	4	50-21		4	W			No	F	1 1/2	Yes			
	TS-1002	63.00	40	91	4	50-20		4	2			No	F	1 1/2	No			
	TS-1085	85.00	40	91	4	50-22		4	2			No	F	1 1/4	Yes			
	TS-V10	160.00	60	90	4	48-25		4	2			No	F	1 1/2	Yes			
	TS-1606	98.00	150	91	4	30-20		6 1/2	3			No	F	2 1/2	Yes			
	TS-1607	130.00	120	91	4	30-20		6 1/2	3			No	F	2 1/2	Yes			
	TS-1609	130.00	180	91	4	30-20		6 1/2	3			No	F	2 1/2	Yes			
	TS-V16	165.00	180	91	4	30-25		6 1/2	3			No	F	2 1/2	Yes			
	TS-F202	240.00	60	89	4	48-20		5 x 5				No	F	2 1/2	Yes			
	TS-1225	70.00	50	91	4	60-20 ± 3		5	2			No	F	1 1/2	Yes	Honeycomb woofer.		
	TS-139	85.00	100	90	4	45-20		5 1/4	2			No	F	1 1/4	Yes			
	TS-1601	48.00	60	92	4	40-20		6 1/2	2			No	F	2 1/2	Yes			
	TS-1602	68.00	60	92	4	40-20		6 1/2	2			No	F	1 1/2	No			
	TS-1604	87.00	100	91	4	30-20		6 1/2	2			No	F	1 1/2	Yes			
	TS-F606	130.00	120	91	4	38-23		6 1/2 x	2			No	F	1 1/2	Yes	As above.		
	TS-6922	65.00	80	93	4	40-20		6 x 9	W			No	F	2 1/2	No			
	TS-6933	95.00	100	93	4	35-23		6 x 9	2			No	F	2 1/2	No			
	TS-6944	135.00	120	93	4	35-26		6 x 9	3			No	F	2 1/2	No			
	TS-6966	155.00	150	93	4	28-26		6 x 9	3			No	F	3 1/4	No			
	TS-U697	185.00	100	91	4	28-30		6 x 9	2			No	F	3 1/2	Yes			
	TS-6977	210.00	200	93	4	28-30		6 x 9	4			No	F	3 1/2	Yes			
	TS-U699	230.00	100	91	4	28-32		6 x 9	3			No	F	3 1/2	Yes			
	TS-6985	250.00	200	94	4	29-28		6 x 9	3			No	F	3 1/2	Yes			
	TS-6995	285.00	200	94	4	28-32		6 x 9	4			No	F	3 1/2	Yes			
	TS-44	38.00	40	88	4	180-20		4	W			No	S		No			
	TS-66	48.00	40	90	4	180-18		5 1/2	W			No	S		No			
	TS-X3	100.00	60	89	4	90-20		4	2			No	S		No			
	TS-X25	130.00	80	89	4	70-20		4	3			No	S		No			
	TS-TRX3	160.00	100	90	4	75-22		5	2			No	S		No	For trucks.		
	TS-X35	210.00	120	89	4	50-30		4 x 4	3			No	S		No			
	TS-TRX5	280.00	150	93	4	65-22		5 1/2	2			No	S		No	As above.		
	TS-X45	330.00	150	89	4	47-25		4 1/2 x	4			No	S		No			
TS-877	42.00	40	88	4	90-20		3 1/2	W			No	F	1 1/2	No				
TS-879	65.00	40	88	4	90-20		3 1/2	2			No	F	1 1/2	No				
TS-1018	63.00	40	88	4	50-20		4	2			No	F	1 1/2	No	For Toyota dashboards.			
TS-1026	75.00	40	91	4	50-22		4	2			No	F	1 1/2	No	For GM dashboards.			
TS-467	50.00	40	89	4	60-20		4 x 6	W			No	F	1 1/2	No				
TS-468	72.00	40	89	4	50-20		4 x 6	2			No	F	1 1/2	No				
TS-469	82.00	40	89	4	50-22		4 x 6	3			No	F	1 1/2	No				
TS-4133	110.00	100	92	4	40-20		4 x 10	2			No	F	2 1/2	No				
TS-4155	145.00	100	93	4	38-20		4 x 10	3			No	F	2 1/2	No				







# AT PHASE LINEAR, WE BELIEVE THIS END OF THE DIAL DOESN'T HAVE TO BE THE END OF THE ROAD.

It's that section of your volume control where most car speakers begin to lose their composure. And some come completely unglued. We call it Phase Linear territory — and for good reason.



Once you reach a certain volume level, the cones of ordinary car speakers start to "break up," causing distortion of your music (a generally unpleasant experience). It's a situation that can make you want to avoid the upper reaches of your car stereo system at all costs. Fortunately, Phase Linear has a simple (yet sophisticated) solution.

## PHASE LINEAR® GRAPHITE™ SPEAKERS— OUR LATEST INNOVATION.

Last year we introduced Phase Linear graphite speakers. And we've watched our invention become the standard of excellence for the rest of the industry. For excellent reasons. Woofer cones that are felted and molded of graphite-fibre are lighter and more rigid than conventional paper or plastic. When you combine light weight with high rigidity, you get a speaker that offers less coloration and distortion.

A speaker so rich and responsive, so true to the original source material that we might have copied the design ourselves — if we hadn't invented it!

## PHASE LINEAR SPEAKERS HAVE AN APPETITE FOR POWER.

We know that many of today's top-of-the-line car systems possess incredible amounts of power.

So we build speakers with an appetite for wattage that's *equally* enormous! Right here in the U.S.A. Our 6" x 9" speaker, for example, delivers 250 watts of peak power handling. And other Phase Linear speakers have comparably high ratings. Add to that mix polycarbonate midranges, ferrofluid-filled tweeters and long-throw woofers — and you've got all the power-handling ability you'll ever need.



## OUR SPEAKERS LOOK AT LEAST AS GOOD AS THEY SOUND.

Phase Linear carries this high level of excellence right down to our sleek and handsome appearance, too. No matter what kind of car you drive, our equipment will look, fit and sound top-notch. And we have models that can upgrade the sound of any dashboard, door or deck, too!

So, before you decide to travel with a pair of ordinary car speakers, climb up to Phase Linear territory. You'll discover music like you've never heard it before.

At any level.



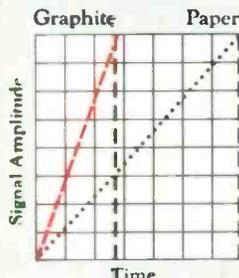
GRAPHITE™

Making the best of sound technology.



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### THE GRAPHITE DIFFERENCE



The rigid graphite cone responds more quickly and accurately to changes in the music than a conventional paper cone. This improved impulse response results in a greater sense of realism and immediacy than possible without the graphite. The heightened level of realism is the graphite difference, it's what you've been listening for.

# 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)	Tweeter Only (T)				Woofer Size, Inches	Woofer (W), 2-Way (2) 2-Way (2), 4-Way (4)	Amplifier Tweeters = A, Passive Tweeters = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Concealed (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?				
ROCKFORD FOSGATE	SPP-184/188	480.00	200	95.4	4	8	20-500 Hz	S	18				C	7 3/4	Yes	Includes Model TX-124-8 crossover. Includes Model TX-184/188 crossover. Includes two SP-84 woofers, two SP-34 midranges, two SPT-4 tweeters with crossovers, and two SPL-46 4 x 6-inch plates. Includes two SP-694 woofers plus midranges, tweeters, and plates as above. Midrange, tweeter, and crossover on 4 x 6-inch plate. Includes SP-44/48 midrange and SPT-14 tweeter with crossover. Enclosed mono subwoofer; fits rear well of Camaro. As above but for hatchback. As above but for pickup trucks.				
	SPP-154/158	350.00	200	93.5	4	8	20-500 Hz	S	15				C	6 3/4	Yes					
	SPP-124/128	330.00	200	92.5	4	8	20-500 Hz	S	12				C	5 3/4	Yes					
	SPP-104/108	220.00	200	92.0	4	8	20-500 Hz	S	10				C	4 3/4	Yes					
	SP-84-88	175.00	150	91.0	4	8		W	8				C	4 1/8	Yes					
	SP-415/815	160.00	100	92.4	4	8	20-500 Hz	W	15				C	6 1/4	Yes					
	SP-412/812	145.00	100	91.3	4	8	20-500 Hz	W	12				C	5	Yes					
	SP-104/108	119.00	100	92.0	4	8	40-1	W	10				C	4 1/2	Yes					
	SP-84-88	89.00	100	89.7	4	8	50-500 Hz	W	8				C	4	Yes					
	SP-694	75.00	100	89.7	4	8	50-500 Hz	W	6 x 9				C	3 1/4	Yes					
	SP-64-68	75.00	100	89.0	4	8	80-2	W	6 1/2				C	3 1/4	Yes					
	SP-54-58	45.00	100	92.0	4	8	100-5	M					C	2 1/4	Yes					
	SP-44/48	40.00	50	88.0	4	8	275-10	M					C	2 1/4	Yes					
	SP-34-38	35.00	50	89.0	4	8	250-10	M					C	2 1/4	Yes					
SPT-14/18	46.00	50	88.0	4	8	1.5k-20k	T					C	1 3/4	Yes						
SPT-4-8	28.00	50	91.3	4	8	3k-20k	T					C		Yes						
SP-8464	365.00																			
SP-69464	335.00																			
The Plate 4 8	75.00						275-20 ±3						P							
SAT 44/48	270.00																			
FCC	373.00				4		35-100 Hz	W	(2)8											
FCU	373.00				4		35-100 Hz	W	(2)8				S							
FCP	373.00						35-100 Hz	W	(2)8				S							
SABRE SOUND	CF-150	499.00	150	93	4	4	32-22 ±3		12	3			S		Yes	For 1982-1988 Camaros, Firebirds, and Trans-Ams. For cars, trucks, and vans. For mounting atop transmission hump of trucks and vans. For trucks, hatchbacks, and sport utility vehicles. As above. For hatchbacks and extended cab trucks. For cars and trucks. For 1982-1988 Camaros, Firebirds, and Trans-Ams.				
	S-800	299.00	100	89	4	4	50-22 ±3		8	2			S		Yes					
	C-800	349.00	100	90	4	4	45-22 ±3		8	2			S		Yes					
	T-800	399.00	150	91	4	4	40-22 ±3		8	3			S		Yes					
	T-1000	449.00	150	93	4	4	38-22 ±3		10	3			S		Yes					
	HB-800	399.00	100	92	4	4	40-22 ±3		8	3			S		Yes					
	LB-700	349.00	100	91	4	4	38-22 ±3		8	3			S		Yes					
CF-150SW	449.00	150	92	4	4	32-200 Hz ±3	S	12					S		Yes					
SANSUI	SB-4900X	199.95	200	92	4	4	28-30					No	F	3 1/2	Yes					
	SB-W6900	199.95	200	91	4	4	30-7	S	6 x 9	4			F	3 3/4	Yes					
	SB-3900X	189.95	160	92	4	4	28-25		6 x 9			No	F	3 3/4	Yes					
	SB-2900X	149.95	130	92	4	4	28-22		6 x 9	3		No	F	3 1/4	Yes					
	SB-3600X	139.95	120	90	4	4	30-22		6 x 9	2		No	F	3 1/4	Yes					
	SB-3901	139.95	130	93	4	4	30-22		6 x 9	3		No	F	2 1/8	No					
	SB-3500X	109.95	70	90	4	4	45-22		5 1/4	3		No	F	1 3/4	Yes					
	SB-2600	109.95	100	91	4	4	35-22		6 1/2	3		No	F	2 1/4	No					
	SB-3501	99.95	70	91	4	4	48-22		5 1/4	2		No	F	1 3/4	Yes					
	SB-2601	89.95	60	90	4	4	40-20		6 1/2	2		No	F	1 3/4	Yes					
	SB-2400	79.95	70	90	4	4	50-22		4	2		No	F	1 3/4	Yes					
	SB-2500	69.95	50	90	4	4	50-20		5	2		No	F	1 3/4	Yes					
	SB-1400	69.95	100	90	4	4	50-20		4	2		No	F	1 3/4	Yes					
	SB-D460	49.95	45	90	4	4	60-19		4 x 6			No	F	1 3/4	No					
	SB-1401	39.95	40	90	4	4	50-20		4			No	F	1	Yes					
	SB-D50	39.95	20	90	4	4	95-20		3 1/2			No	F	1 3/4	No					
	SANYO	SP43	19.95	20	89	4	4	80-15		4	2		A	No	F		1 1/4	Yes		
SP45		39.95	30	90	4	4	80-20		4	2		A	No	F	1 1/2	Yes				
SP60A		11.95	10		4	4	65-13		6 1/2				F	1	Yes					
SP61		14.95	15	90	4	4	65-13		6 1/2				F	1	Yes					
SP63		29.95	25	92	4	4	60-15		6 1/2			A	No	F	1 1/4	Yes				
SP65		49.95	30	92	4	4	60-20		6 1/2	2		A	No	F	1 1/4	Yes				
SP93		54.95	50	93	4	4	50-20		6 x 9	2		A	No	F	3 3/4	Yes				
SP95		79.95	50	93	4	4	50-20		6 x 9	3		A	No	F	3 3/4	Yes				
SP85A		89.95	40	88	4	4	80-20		4	2		A	No	S	Yes					
SP1000		59.95	50	91	4	4	70-20		5	2		A	Yes	F	2	Yes				
SP3000		129.95	150	94	4	4	50-20		6 x 9	4		A	Yes	F	3 3/4	Yes				
SP2000		79.95	100	92	4	4	60-20		6 1/2	3		A	Yes	F	2	Yes				
SP121		99.99	60	88	4	4	80-20		4	2		Yes	S		Yes					
SAS	T62	218.00	100	98	4	4	39-1.5 ±3	W	6						Yes	Tube enclosure. As above. As above. As above. As above.				
	T82	298.00	150	100	4	4	39-1.5 ±3	W	8						Yes					
	T16	218.00	100	98	4	4	39-1.5 ±3	W	6						Yes					
	T18	298.00	150	100	4	4	39-1.5 ±3	W	8						Yes					
	T102	204.00	200	102	4	4	39-1.5 ±3	W	10						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
								Subwoofer Only (W)	Midrange Only (M)	Tweeter Only (T)	Woofer Size, Inches	Woofer (W) 2-Way (2) 3-Way (3), 4-Way (4)	Angle Tweeter (A) = A, Pivotal Tweeter (P) = P	Separately Mounted Driver?	Flat Mount (F), Surface Mount (S), Convolute (C), Pole (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?	
SENTREK	SR9206T	47.95	60	90	4	50-20 ±3	6 x 9	3				F	3					
	SR1206T	49.95	60	88	4	50-20 ±3	4 x 10	3				F	3					
	SR5103	25.95	30	86	4	60-16 ±3	5	W				F	1					
	SR3041	16.95	20	87	4	100-15 ±3	3½	W				F	1¼					
	SR2502C	36.95	20	91	8	350-20 ±3		2	P			S					Midrange and tweeter.	
	SR695T	59.95	60	90	4	45-20 ±3	6 x 9	3				F	3					
	SR615T	42.95	40	88	4	60-20 ±3	6½	3				F	2					
	SR615C	39.95	40	88	4	60-20 ±3	6½	2				F	2					
	SR515C	39.95	30	88	4	60-18 ±3	5¼	2				F	¾					
	SR415C	36.95	30	85	4	70-18 ±3	4	2				F	¾					
	SR465C	36.95	30	87	4	70-18 ±3	4 x 6	2				F	1½					
	SP9210T	69.95	100	90	4	40-20 ±3	6 x 9	3				F	3	Yes				
	SP6106T	49.95	60	89	4	50-20 ±3	6½	3				F	2	Yes				
	SP6106C	44.95	60	88	4	50-20 ±3	6½	2				F	1½	Yes				
	SP4656C	39.95	60	87	4	60-18 ±3	4 x 6	2				F	¾	Yes				
	SP4106C	39.95	60	88	4	50-18 ±3	4	2				F	¾	Yes				
	SP3043	20.95	30	85	4	80-18 ±3	3½	W				F	1½	Yes				
	SC200	49.95	80	88	4	50-20 ±3	4	3				S	3					
	SC360	44.95	80	85	4	60-20 ±3	3	2				S	2					
	SC480	67.95	80	87	4	40-20 ±3	4	2				S	2					
SC490	84.95	100	88	4	50-20 ±3	4	3				S	3						
SC500	89.95	100	89	4	40-22 ±3	4	4				S	4						
SC600	119.95	120	89	4	35-22 ±3	4x5½	4				S						Bass reflex enclosure. As above. As above; honeycomb woofer. As above. As above.	
SHARP	CP-FA30	179.95	60		4		10½	3	A	Yes	S		Yes				Flat woofer. As above.	
	CP-FA20	129.95	40		4		10½	2	A	Yes	S		Yes				As above.	
	CP-FA10	69.95	40		4		10½			No	F						Rear deck mount.	
	CP-6903	89.95	80		4	40-20	6 x 9	3		No			¾				As above.	
	CP-6902	79.95	80		4	45-20	6 x 9	2		No			¾				Rear deck or door mount.	
	CP-602	69.95	60		4	75-20	6½	2		No			¾					
	CP-502	59.95	50		4	80-20	5¼	2		No			¾					
CP-402	44.95	40		4	100-20	4	2		No			¾						
SHERWOOD	SX693	99.95	100		4	45-20	6 x 9	3										
	SX653	69.95	75		4	60-20	6½	3										
	SX462	59.95	40		4	70-20	4 x 6	2										
	SX402	49.95	40		4	80-20	4	2										
	SX305S	29.95	40		4	90-20	3½	W										

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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 (1) Midrange Only (M) Tweeter Only (T)	Woofer Size, Inches	Woofer (W) 3-Way (3) 2-Way (2) 4-Way (4)	Amplifier Tweeter(s) = 1, Passive Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Pole (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
SONY	XS-33	39.95	35	88	4	70-20		3½	W			F	1½	No	Includes 4 x 6-inch adaptor. For European cars.			
	XS-44	99.95	35	88	4	55-20		4	2			F	1½	Yes				
	XS-4622	99.95	45	89	4	50-20		4 x 6	2			F	1¼	No				
	XS-1011	49.95	40	89	4	50-20		4	W			F	1¼	Yes				
	XS-3011	54.95	45	90	4	35-20		5¼	W			F	1¼	Yes				
	XS-6011	59.95	60	91	4	35-20		6½	W			F	2½	Yes				
	XS-6911	69.95	60	92	4	30-20		6 x 9	W			F	2¼	Yes				
	XS-1021	79.95	45	89	4	50-20		4	2			F	1¼	Yes				
	XS-3021	89.95	45	90	4	35-20		5¼	2			F	1¼	Yes				
	XS-6021	99.95	75	90	4	35-20		6½	2			F	2½	Yes				
	XS-6921	99.95	90	92	4	30-20		6 x 9	2			F	2½	Yes				
	XS-6931	139.95	90	93	4	30-20		6 x 9	3			F	2¼	Yes				
	XS-417	139.95	75	91	4	30-20		4 x 10	3			F	3½	Yes				
	XS-6051	169.95	100	88	4	35-22		6½	2			F	2¼	Yes				
	XS-6951	209.95	120	90	4	28-22		6 x 9	3			F	2½	Yes				
	XS-616	89.95	60	90	4	40-20		6½	W			P	2½	Yes				
	XS-PL55	249.95	100	88	4	40-22		5¼	2	A/P	No	P	2	Yes				
	XS-HL55	299.95	100	88	4	40-22		5¼	2	A/P	No	C	2½	Yes				
	XS-H5	129.95	100	88	4	6k-22k	T	5¼	4	A/P	A/P	C	½	Yes				
	XS-L5	139.95	100	88	4	40-10		5¼	4			C	2½	Yes				
XS-L202	169.95	150	87	4	20-44		8				F	3½	Yes					
SOUNDSTREAM	SS-12	280.00	350	95	4	26-1	S	12					4½	Yes	For rear deck mount or for enclosure; enclosure specs available on request. As above.			
	SS-10	220.00	300	93	4	32-1.5	S	10					3¾	Yes				
SS-8	115.00	180	92	4	35-2	S	8						3¼	Yes				
SPARKOMATIC	ASK3000	89.95	20 Inc.	92	22	80-20 ± 3		4	2		No	S		Yes	Biamped.  For pickups, vans, and RVs.  Drop-in dash replacement.			
	SK6950	79.95	400	92	4	50-20 ± 3		6 x 9	4		No	F	4	Yes				
	SK6922	49.95	250	96.6	4	30-17 ± 3		6 x 9	3		No	F	3½	Yes				
	SK6920	41.95	150	95.3	4	30-15 ± 3		6 x 9	2		No	F	3½	Yes				
	SK693	34.95	160	95.3	4	30-17 ± 3		6 x 9	3		No	F	3½	Yes				
	SK692	24.95	100	96.6	4	30-15 ± 3		6 x 9	2		No	F	3½	Yes				
	SK650	74.95	400	92	4	70-20 ± 3		6	4		No	F	4¾	Yes				
	SK622	44.95	200	96.6	4	50-17 ± 3		6	3		No	F	3¾	Yes				
	SK620	36.95	150	95	4	50-15 ± 3		6	2		No	F	3¾	Yes				
	SK63	29.95	120	90	4	60-16 ± 3		6	3		No	F	2¾	Yes				
	SK415	29.95	80	86	8	90-15 ± 3		4	W		No	S		Yes				
	SK410	29.95	80	86	4	90-15 ± 3		4	W		No	S		Yes				
	SK400	29.95	80	86	4	90-15 ± 3		4	W		No	F	1¾	Yes				
	SK355	16.95	20	88	8	100-10 ± 3		3½	W		No	F	1¾	Yes				
	SK313	16.95	20	85	8	125-8 ± 3		3½	W		No	S		Yes				
	SK300	19.95	80	86	4	90-15 ± 3		3½	W		No	F		Yes				
SK520	49.95	100	95	8	60-15 ± 3		5 x 7	2		No	S	1½	Yes					
SPECO	DMS-2	69.50	60	4	4	60-20 ± 3		3	2		No	S		No	Biamp capable.			
	DMS-3	94.95	100	4	4	55-20 ± 3		4	3		No	S		No				
	DMS-3A	94.95	100	4	4	55-20 ± 3		4	3		No	S		No				
	SK6920Q	74.95	100	4	4	50-20 ± 3		6 x 9	4		No	C		No				
	SK6920T	69.95	60	4	4	50-20 ± 3		6 x 9	3		No	C		No				
	SK6920C	61.95	50	4	4	50-20 ± 3		6 x 9	2		No	C		No				
	SK6925TD	124.95	120	4	4	30-20 ± 3		6 x 9	3	A	No	C		No				
	SK4120C	57.95	50	4	4	50-20 ± 3		4 x 10	2		No	C		No				
	SK5120T	61.95	60	4	4	80-20 ± 3		5¼	3		No	C		No				
	SK5110C	49.95	30	4	4	50-20 ± 3		5¼	2		No	C		No				
	SK5110A	39.75	30	4	4	80-15 ± 3		5¼	W		No	C		No				
	SK5C10	47.95	40	4	4	50-20 ± 3		4	2		No	C	1¾	No				
	SK4A10	42.95	30	4	4	30-17 ± 3		4	W		No	C	1¾	No				
	SK4F3	25.95	10	4	4	130-8 ± 5		4			No	F		No				
	WC5110C	53.95	30	4	4	50-15 ± 3		5¼	2		No	S		No				
WC5110A	45.95	30	4	4	50-12 ± 3		5¼			No	S		No					
WSCF3	20.95	10	4	4	75-10 ± 3		5			No	S		No					
STILLWATER DESIGNS	ST-12	479.95	250	4	4	35-39		(2)12	2	A	No	S		No	Cabinet enclosure; for trucks. Cabinet enclosure; for small trucks. Cabinet enclosure; for hatchbacks and four-wheel drive vehicles. Mounts behind seat in pickups. Mounts behind seat in mini trucks. Mounts behind seat in full-sized pickups. Rear mount in hatchbacks and 4 x 4 vehicles. As above. Cabinet enclosure; drops in rear well of Camaros, Trans Ams, and Firebirds. Mounts on rear decks in cars, ceiling mount in vans, behind seat in pickups. Mounts on rear side panels in 4 x 4 vehicles and vans, on rear deck in cars. Satellite and subwoofer system. Cabinet enclosure; for trucks. Cabinet enclosure; for hatchbacks and fastbacks. Requires 3.6-cubic-foot box enclosure. Requires enclosure; available in free-air version.			
	ST-10	429.95	200	4	4	38-39		(2)10	2	A	No	S		No				
	SS-12	479.95	250	4	4	30-39		(2)12	2	A	No	S		No				
	Kicker	279.95	100	4	4	40-39		(2)6½	2	A	No	S		No				
	Side-Kicks	299.95	100	4	4	40-39		(2)6½	2	A	No	S		No				
	Super-Kicks	349.95	100	4	4	38-39		(2)8	2	A	No	S		No				
	Kicker II	289.95	100	4	4	40-39		(2)6½	2	A	No	S		No				
	Super II	349.95	150	4	4	38-39		(2)8	2	A	No	S		No				
	CTF	439.95	150	4	4	29-39		(2)8	2	A	No	S		No				
	Classic	229.95	75	4	4	50-29		(2)5	2	A	No	S		No				
	Colts	249.95	75	4	4	50-29		(2)5	2		No	S		No				
	Compact	289.95	75	4	4	40-20		(2)5	2		Yes	S		No				
Bandits	199.95	50	4	4	50-27		(2)6½	2	A	No	S		No					
Bullets	199.95	50	4	4	50-27		(2)6½	2	A	No	S		No					
C-18	389.50	700	93	4/8	20-1.5	S	18				F	7½	Yes					
C-15	157.50	300	93	4/8	25-3	S	15				F	6	Yes					
C-12	112.50	300	94	4/8	25-3	S	12				F	5	Yes					
C-10	100.00	300	96	4/8	25-3	S	10				F	4¾	Yes					
C-8	70.00	200	95	4/8	30-3.5	W	8				F	3¾	Yes					
C-6.5	65.00	200	96	4/8	30-3.5	W	6½				F	2¾	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 Only (S) Woofer Only (W) Tweeter Only (T)	Woofer Size, Inches	Woofer (W), 2-Way (S), 3-Way (S), 4-Way (S)	Amplifier Tweeters (A), Passive Tweeters (P)	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Conceivable (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
STILLWATER DESIGNS (Continued)	F-6x9	70.00		200	96	4.8	30-3.5	W	6 x 9					F	3 3/8	Yes	Biamp capable.	
	F-5.25	46.50		150	91	4.8	50-6	W	5 1/4				F	2 1/2	Yes			
	F-4	31.50		100	89	4.8	60-6	W					F	2 1/8	Yes			
	F-3.5	28.50		60	88	4.8	90-16	M					F	1 3/8	Yes			
	FX-69		239.50	200	96	4	30-21		6 x 9	2	No		S		Yes			
	FX-65		229.50	200	96	4	30-21		6 1/2	2	No		S		Yes			
	D-20	26.50		75	93	6	3k-21k	T					C	3/4	Yes			
SUNTECH	SP3018		49.95	92	4.8	80-20 ±3		3	3		No		S		No	Box enclosure. As above.		
	SP4018		74.95	94	4.8	50-20 ±3		4	3		No		S		No			
	SP40-1		39.95	80	89	4.8	80-16 ±3		4	W	No		F	1 1/2	Yes			
	SP40-2		44.95	80	84	4.8	20-23 ±3		4	2	No		F	1 7/8	Yes			
	SP65-1		49.95	80	84	4.8	20-23 ±3		6 1/2	W	No		F	1 7/8	Yes			
	SP65-2		64.95	100	89	4.8	20-23 ±3		6 1/2	2	No		F	2	Yes			
	SP65-3		69.95	100	89	4.8	20-20 ±3		6 1/2	3	No		F	2 1/8	Yes			
	SP69-3		79.95	120	92	4.8	20-20 ±3		6 x 9	3	No		F	3	Yes			
	SPW-802		79.95	100	4		20-1	S	8				F	3 1/2	Yes			
	SPW-102		89.95	100	4		20-1	S	10				F	4 1/2	Yes			
	SPW-103		99.95	100	4		20-1	S	10				F	4 1/2	Yes			
	SPW-123		109.95	100	4		20-1	S	12				F	5	Yes			
	SPW-153		149.95	120	4		20-1	S	15				F	6	Yes			
	TARGA	S-6393		69.95	60	93	4	70-20		6 x 9	3		No	F	3		Yes	
S-6292			59.95	50	93	4	70-20		6 x 9	2		No	F	3	Yes			
S-6122			49.95	30	91	4	95-20		6 1/2	2		No	F	2	Yes			
S-6121			44.95	25	91	4	95-20		6 1/2	W		No	F	2	Yes			
S-4102			54.95	50	90	4	95-20		4 x 10	2		No	F	2 1/2	Yes			
S-4061			39.95	20	90	4	100-20		4 x 6	W		No	F	1 3/4	Yes			
S-4022			39.95	20	90	4	120-20		4	2		No	F	1 3/8	Yes			
S-4011			24.95	15	90	4	120-19		4	W		No	F	1 3/8	Yes			
S-3121			19.95	15	89	4	150-19		3 1/2	W		No	F	1 1/2	Yes			
TECHNICS		EAB-F550	130.00	120	93	4	30-22		6 1/2	2	A	No	F	2 1/2	Yes			
	EAB-F850	155.00	150	94	4	24-22		6 x 9	2	A	No	F	2 1/4	Yes				
	EAB-F440	120.00	100	92.5	4	40-22		4	2	A	No	F	2	Yes				
	EAB-F660	160.00	120	93	4	30-22		6 1/2	3	A	No	F	2 1/2	Yes				
	EAB-F990	180.00	150	94.5	4	24-22		6 x 9	3	A	No	F	2 1/8	Yes				
	EAB-C67	120.00	80	93	4	35-22		6 1/2	3	A	No	F	1 7/8	Yes				
	EAB-C97	130.00	100	94	4	30-22		6 x 9	3	A	No	F	3	Yes				
	EAB-C417	105.00	60	93	4	40-22		4 x 10	3	A	No	F	3 1/8	Yes				
	EAB-CT62	85.00	50	92	4	50-22		6 1/2	2	A	No	F	1 1/2	Yes				
	EAB-C461	70.00	50	92	4	50-22		4	2	A	No	F	1 3/4	Yes				
	EAB-C66	85.00	80	92.5	4	40-22		6 1/2	2	A	No	F	3 7/8	Yes				
	EAB-C96	105.00	80	94.5	4	30-22		6 x 9	2	A	No	F	3	Yes				
	ULTIMATE SOUND	UBC 12-3	349.00	200	93	4	20-30		12	3			S			Box enclosure. As above.		
UBC 10-3		339.90	175	93	4	30-30		10	3			S						
UBC Hatchback		249.95	100	93	4	40-20		8	2	P		S						
UBC Pick-up		249.95	100	93	4	45-20		8	2	P		S						
UBC PB		269.95	100	93	4	40-20		8	2	P		S						
UBC Dak		299.95	100	93	4	45-20		8	2	P		S						
HCB 120B		279.95	80	93	4	52-20		5	2	P		S						
UBC10-2		309.95	100	93	4	35-22		10	2	P		S		No				
UBCPB 10-3		339.95	100	95	4	35-25		10	2	P		S		No				
UBCPB 10-2		309.95	100	93	4	35-22		10	2	P		S		No				
UBCP Bass		159.95	100	90	4	35-1.5		10	2	P		S		No				
UT743		10.90	80	93	8	3k-20k	S				P		C	2	No			
UT610		54.95	60	95	8	2k-20k	T				P		C	2	No			
UT01XP		89.95	100	91	6	5k-40k	T				P		C	2	No			
UT01D		14.95	100	93	4	3k-35k	T				P		C	2	No			
UTR3510P		52.95	50	93	8	1.5k-20k	T				P		C	2	No			
UWP6935		59.95	150	95	4	30-5.5		6 x 9					F		No			
UWP6525		49.95	120	92	4	40-6		6 1/2					F		No			
UWP1020A		49.95	100	94	4	20-3		10					F		No			
UWP6920A		39.95	140	93	4	20-3		6 x 9					F		No			
UWP8020A		39.95	100	93	4	38-4		8					F		No			
HCT100P		89.95	100	93	6	3k-20k					P		C	2	No			
UWP1540		99.95	200	97	4	20-2.5		15					F		No			
UWP1235		84.95	180	96	4	20-3		12					F		No			
UWP1035		69.95	160	95	4	25-3		10					F		No			
UWP8035		59.95	150	94	4	30-3		8					F		No			
UWP6520A		34.95	80	92	4	45-5		6 1/2					F		No			
UMP5210P		59.95	50	91	4	80-10							F		No			
UMP4010P		49.95	50	91	4	100-10							F		No			
PC6920TX		99.95	75	96	4	35-20		6 x 9	3	P			F	3	No			
PC6920CX	89.95	75	96	4	35-18		6 x 9	2	P			F	3	No				
PC6510TX	84.95	50	94	4	40-20		6 1/2	3	P			F	2 1/4	No				
PC6510CX	74.95	45	92	4	40-18		6 1/2	2	P			F	2 1/4	No				
PC4606CX	69.95	25	92	4	45-18		4 x 6	2	P			F	1 3/4	No				
PC4006CX	59.95	25	90	4	50-18		4	2	P			F	2	No				
PC3506CX	49.95	20	89	4	60-18		3 1/2	2	P			F	1 3/8	No				
PC202	139.95	50	90	4	60-20		4	2	P	No		S		No				
YAMAHA	YCS-301	130.00	40	88	4	5k-20k ±3	T					S		Yes	Includes crossover.			
	YCS-350	50.00	50	89	4	80-20 ±3		3 1/2	W	2		F	1 3/4	Yes				
	YCS-460	100.00	60	90	4	70-20 ±3		4 x 6	W	2		C	1 7/8	Yes				
	YCS-4010	60.00	60	91	4	60-20 ±3		4	W	W		F	1 3/4	Yes				
	YCS-4610	60.00	60	90	4	70-20		4 x 6	W	W		C	1 5/8	Yes				
	YCS-500	110.00	100	88	4	60-10 ±3		5 1/4				F	2 3/8	Yes				
(Continued)	YCS-5010	60.00	80	89	4	60-20 ±3		5 1/4	W	2		F	1 3/4	Yes	1 1/2-inch mounting depth with adaptor ring.			
	YCS-600	130.00	100	91	4	60-20 ±3		6 1/2	2	A		F	2	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					
									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 Tweeters = A, Placable Tweeters = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convential (C), Plus (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?								
YAMAHA (Continued)	YCS-6010	70.00	80	92	4	50-20 ± 3		6 1/2	W															
	YCS-602	130.00	120	90	4	55-10 ± 3		6 1/2														As above but 2 inches.		
	YCS-6020	90.00	120	92	4	50-20 ± 3		6 1/2	2													Yes		
	YCS-691	210.00	120	91	4	40-20 ± 3		6 x 9	2	A												As above but 1 1/4 inches.		
	YCS-692	140.00	120	90	4	40-20 ± 3		6 x 9	2													Yes		
	YCS-6920	110.00	180	90	4	40-20 ± 3		6 x 9	2													Yes		
	YCS-800	170.00	200	92	4	40-1 ± 3	W	8														Fits 6 x 9-inch hole.		
	YCS-1010	220.00	200	91	4	35-1 ± 3	S	10														Yes		
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	1500.	390	89	4	20-22		8	3	A	Yes												Triamp capable; satellite and subwoofer system of above models.	
	911-SWU	1050.	125	89	4	20-200 Hz	S	8															Subwoofer for Porsche 911 console.	
	911-UOF2	940.00	140	89	4	100-22			2	A	Yes												Biamp capable; replaces door moldings on Porsche 911.	
	911CB-R2	560.00	140	89	4	80-22			2	A	Yes												Biamp capable; for rear side panels of Porsche 911.	
	928-F2	560.00	140	89	4	100-22			2	A	Yes	P											Biamp capable; for upper doors of Porsche 928.	
	928-R2	560.00	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-UOF2	510.00	140	89	4	100-22			2	A	Yes												Biamp capable; for upper doors of Mercedes SL.	
	SL-SR2	560.00	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	1900.	390	89	4	20-22		†	3	A	Yes												†One 8-inch or two 6-inch woofers.	
	190E-R3	1900.	390	89	4	20-22		†	3	A	Yes													Triamp capable; satellite and subwoofer system for rear deck of Mercedes 300E.
	635-F2	940.00	140	89	4	100-22			2	A	Yes													All as above but for rear deck of Mercedes 190E.
	635-R3	1440.	390	89	4	20-22			8	3	A	Yes												Biamp capable; replaces door moldings of BMW 635.
	735-F2	1260.00		89	4	100-22			2	A	Yes													Triamp capable; satellite and subwoofer system for rear deck of BMW 635.
	735-R2	560.00		89	4	80-22			2	A	Yes													Biamp capable; replaces door molding of BMW 735.
	325-MP2	560.00	140	89	4	100-22			2	A	Yes													Biamp capable; for rear deck of BMW 735.
	308-AR2	1120.00		89	4	20-22			2	A	Yes													Biamp capable; replaces map pockets of BMW 325.
	308-F2	780.00		89	4	200-22			2	A	Yes													Biamp capable; replaces door armrests of Ferrari 308.
	308-SW	750.00	125	89	4	20-200 Hz	S	8																Biamp capable; for lower doors of Ferrari 308.
	328-F2	780.00	140	89	4	100-22			2	A	Yes													Enclosed subwoofer; mounts under footwell plate of Ferrari 308.
	328-SW	1050.	125	89	4	20-200 Hz	S	8																Biamp capable; for upper doors of Ferrari 328.
	MON-F2	1120.00	140	89	4	100-22			2	A	Yes													Subwoofer for Ferrari 328 console; mounts under dash.
	MON-R2	780.00	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																Biamp capable; for rear sides of Ferrari Mondial.
	RR-F2	560.00	140	89	4	100-22			2	A	Yes													Subwoofer for Ferrari Mondial console; mounts under dash.
RR-R2	600.00	140	89	4	100-22			2	A	Yes													Mounts on stock location in Range Rover door.	
VET-F2B	560.00	140	89	4	100-22			2	A	Yes													Mounts on sides of Range Rover rear headliner.	
VET-R3B	1100.00	390	89	4	20-22			8	3	A	Yes												Biamp capable; for Corvette doors.	
C/F-F2	740.00	140	89	4	100-22			2	A	Yes													Triamp capable; satellite and subwoofer system for rear of Corvette.	
C F-R4	5600.		4		20-22			(4)8, (2)12	4		Yes												Biamp capable; for doors of Camaro and Firebird.	
614-U	420.00	140	89	4	100-22			2	A	Yes	S												Quad amp capable; for rear hatch and back seat area of Camaro and Firebird.	
628-U	460.00	140	89	4	100-22			2	A	Yes	P												Biamp capable.	

# COMPANY ADDRESSES

## A

### **a/d/s**

One Progress Way  
Wilmington, Mass 01887

### **Aiwa**

35 Oxford Dr  
Moonachie, N J 07074

### **Alphasonik**

701 Heinz St  
Berkeley, Cal 94710

### **Alpine**

19145 Gramercy Pl  
Torrance, Cal 90501

### **Altec Lansing**

Milford, Pa 18337

### **Ambria**

See Parasound

### **American Acoustics**

See Mitek

### **AR**

Acoustic Research  
330 Turnpike St  
Canton, Mass 02021

### **A.R.A. Manufacturing**

1002 Fountain Pkwy  
Grand Prairie, Tex 75050

### **Audio Control**

P O Box 3199  
Lynnwood, Wash 98036

### **Audiodek**

See Carrady Electronics

### **AudioMobile**

1575 Executive Dr  
Elgin, Ill 60120

### **audiophile**

11562 Encore Circle  
Minnetonka, Minn 55343

### **AudioSource**

1185 Chess Dr  
Foster City, Cal 94404

### **Audiovox**

150 Marcus Blvd  
Hauppauge, N Y 11788

### **Audix**

5653 Stoneridge Dr  
Unit 120  
Pleasanton, Cal 94566

### **Autotek**

855 Cowan Rd  
Burlingame, Cal 94010

## B

### **Bevada International**

8473 Shirley Ave  
Northridge, Cal 91324

### **Black Magic**

See U S Omnivox

### **Blaupunkt**

2800 South 25th Ave  
Broadview, Ill 60153

### **Bose**

100 The Mountain Rd  
Framingham, Mass 01701

### **Boston Acoustics**

247 Lynnfield St  
Peabody, Mass 01960

### **B & W Loudspeakers**

P O Box 653  
Buffalo, N Y 14240

## C

### **Canton**

915 Washington Ave South  
Minneapolis, Minn 55415

### **Carrady Electronics**

18 Coldwater Rd  
Don Mills, Ont  
Canada M3B 1Y7

### **Carver**

P O Box 1237  
Lynnwood, Wash 98046

### **Cerwin-Vega**

555 East Easy St  
Simi Valley, Cal 93065

### **Clarion**

5500 Rosecrans Ave  
Lawndale, Cal 90260

### **Classic Research and Engineering**

3215 East Lincoln St  
Tucson, Ariz 85714

### **Concord Systems**

See Epicure Products

### **Cooustic**

4260 Charter St  
Vernon, Cal 90058

### **Craig**

**Consumer Electronics**  
921 West Artesia Blvd  
Compton, Cal 90220

### **Custom Autosound**

808 West Vermont Ave  
Anaheim Cal 92805

### **Cybernet**

100 Randolph Rd  
CN 6700  
Somerset N J 08873

## D E

### **Deltasonik**

See Alphasonik

### **Denon**

P O Box 5370  
Parsippany N J 07054

### **Dynamic Acoustics**

P O Box 646  
San Ramon Cal 94583

### **Eclipse**

See Fujitsu Ten

### **EPI**

### **Epicure Products**

25 Hale St  
Newburyport, Mass 01950

### **Excalibur**

8757 South Flatrock Rd  
Douglasville, Ga 30134

## F G

### **FAS Industries**

1476 Camden Ave  
Campbell, Cal 95008

### **Focal**

1531 Lcokout Dr  
Agoura, Cal 91301

### **Fujitsu Ten**

19281 Pacific Gateway Dr  
Torrance, Cal 90502

### **Fultron**

Arthur Fulmer Inc  
P O Box 177  
Memphis, Tenn 38101

### **GlenMonitor Speaker Systems**

169 River St  
Troy, N Y 12181

### **Gold Sound**

P O Box 141  
Englewood Colo 80151

### **G & S Designs G & S/Night Stalker G & S/Redline Performance**

600 First St  
Unit 2  
Hermosa Beach, Cal 90254

## H

### **David Hafler Co.**

5910 Crescent Blvd  
Pennsauken, N J 08109

### **Harman America Harman/Kardon**

240 Crossways Park West  
Woodbury, N Y 11797

### **Harms Labs**

3040 West Vine Dr  
Fort Collins, Colo 80521

### **Hi-Comp**

See Audiovox

### **Hifonics**

845 Broad Ave  
Ridgefield N J 07657

### **Hitachi**

401 West Artesia Blvd  
Compton Cal 90220

## I

### **Infinity Systems**

9409 Owensmouth Ave  
Chatsworth, Cal 91311

## J

### **Jamo**

425 Huehl Rd  
Northbrook Ill 60062

### **JBL**

See Harman America

### **Jensen**

4136 North United Pkwy  
Schiller Park, Ill 60176

### **JVC**

41 Slater Dr  
Elmwood Park, N J 07407

# COMPANY ADDRESSES

## K L

### KEF

14120-K Sullyfield Circle  
Chantilly, Va. 22021

### Kenwood

2201 East Dominguez St.  
Long Beach, Cal. 90801

### Kraco

505 East Euclid Ave.  
Compton, Cal. 90224

### Lear Jet Stereo

See Carrady Electronics

### Leisure Time Electronics

9450 Harwin, Suite L  
Houston, Tex. 77036

### Linear Power

11545 D Ave.  
Auburn, Cal. 95603

## M

### Magnadyne

P.O. Box 5365  
Carson, Cal. 90749

### Magnum

See Mitek

### Magtone

MGT Audio Systems  
20445 Gramercy Pl.  
Suite 204  
Torrance, Cal. 90501

### Majestic Electronics

14614 Lanark St.  
Panorama City, Cal. 91402

### MB Quart Electronics

25 Walpole Park South  
Walpole, Mass. 02081

### MEI

Mansoor Electronics  
Industries  
72 Fadem Rd.  
Springfield, N.J. 07081

### Milbert Amplifiers

18 Warrior Brook Court  
Germantown, Md. 20874

### Mingar

See Leisure Time

### MISCO-Redline

Minneapolis Speaker Co.  
3806 Grand Ave.  
Minneapolis, Minn. 55409

### Mitek

One Mitek Plaza  
Winslow, Ill. 61089

### Mitsubishi

800 Biermann Court  
Mount Prospect, Ill. 60056

### Monolithic Sound

515 Sandydale Rd.  
Nipomo, Cal. 93444

### Morel Acoustics

414 Harvard St.  
Brookline, Mass. 02146

### MTX

See Mitek

## N

### Nakamichi

19701 South Vermont Ave.  
Torrance, Cal. 90502

## O

### ORA Electronics

20120 Plummer St.  
Chatsworth, Cal. 91313

### Orca

See Focal

## P

### Panasonic

One Panasonic Way  
Secaucus, N.J. 07094

### Parasound

945 Front St.  
San Francisco, Cal. 94111

### Phase Linear

4134 North United Pkwy.  
Schiller Park, Ill. 60176

### Pioneer

P.O. Box 1540  
Long Beach, Cal. 90801

### Polk Audio

5601 Metro Dr.  
Baltimore, Md. 21215

### Polydax

10 Upton Dr.  
Wilmington, Mass. 01887

### Proton

737 West Artesia Blvd.  
Compton, Cal. 90220

### Pyle Industries

501 Center St.  
Huntington, Ind. 46750

## R

### Realistic

Radio Shack  
1700 One Tandy Center  
Fort Worth, Tex. 76102

### Roadstar

See A.R.A. Manufacturing

### Rockford Fosgate

613 South Rockford Dr.  
Tempe, Ariz. 85281

## S

### Sabre Sound

7308 Campbell Rd.  
Dallas, Tex. 75248

### Sansui

1250 Valley Brook Ave.  
Lyndhurst, N.J. 07071

### Sanyo

21350 Lassen St.  
Chatsworth, Cal. 91311

### SAS

Southern Audio Services  
2909 Crater Lake  
Baton Rouge, La. 70814

### Sentrek Industries

751 Racquet Club Dr.  
Addison, Ill. 60101

### Sharp Electronics

10 Sharp Plaza  
Paramus, N.J. 07652

### Sherwood

13845 Artesia Blvd.  
Cerritos, Cal. 90701

### Sony

Sony Dr.  
Park Ridge, N.J. 07656

### Soundstream Technologies

2907 West 182nd St.  
Redondo Beach, Cal. 90278

### Sparkomatic

Routes 6 and 29  
Milford, Pa. 18337

### SPECO

Div., Component Specialties  
P.O. Box 624  
Lindenhurst, N.Y. 11757

### Stillwater Designs

1210 South Main  
Stillwater, Okla. 74074

### Suntech

See Leisure Time

## T U

### Targa

11307 South Shoemaker Ave.  
Santa Fe Springs, Cal. 90670

### Technics

One Panasonic Way  
Secaucus, N.J. 07094

### Ultimate Sound

19330 East San Jose Ave.  
City of Industry, Cal. 91748

### U.S. Omnivox

760 West 16th St.  
Suite E  
Costa Mesa, Cal. 92627

## Y Z

### Yamaha

6660 Orangethorpe Ave.  
Buena Park, Cal. 90620

### Zapco

Zeff Advanced Products  
2549 Yosemite Blvd.  
Suite F  
Modesto, Cal. 95354

### Z-Box

See Classic Research and  
Engineering

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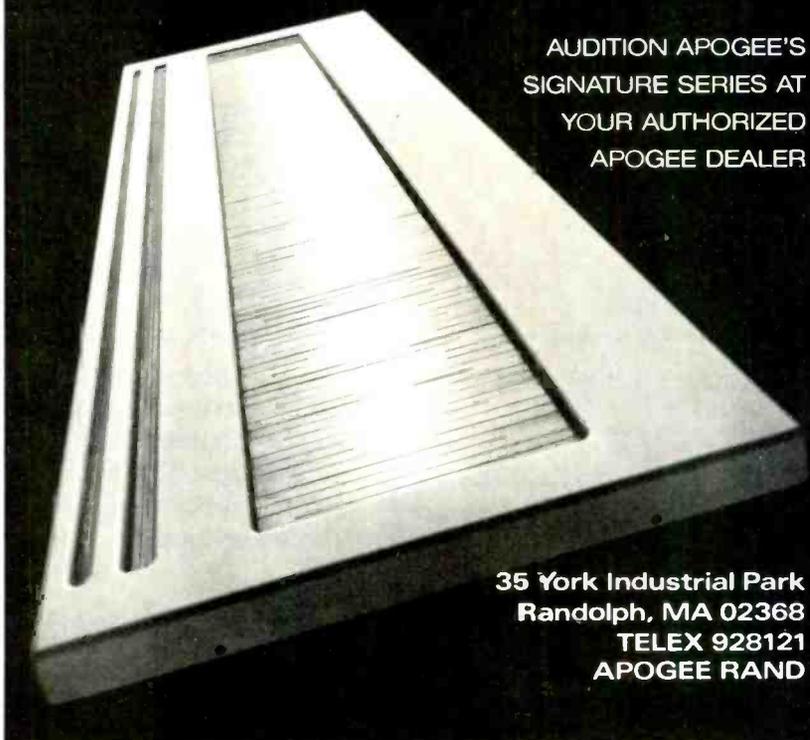
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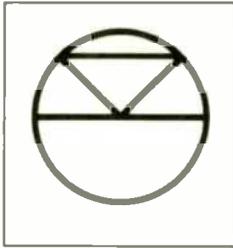
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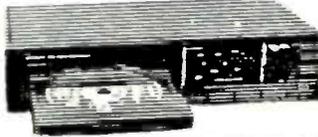
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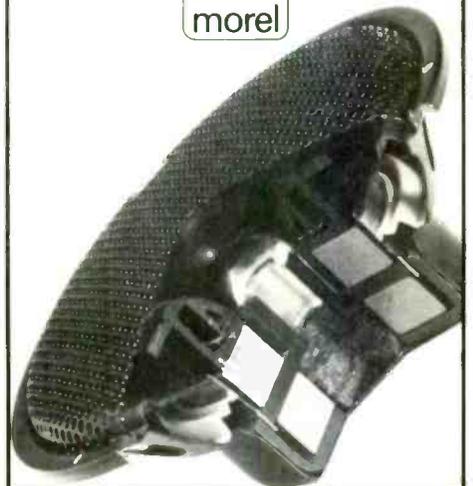
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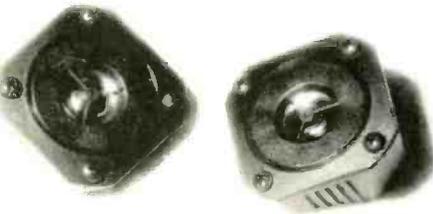
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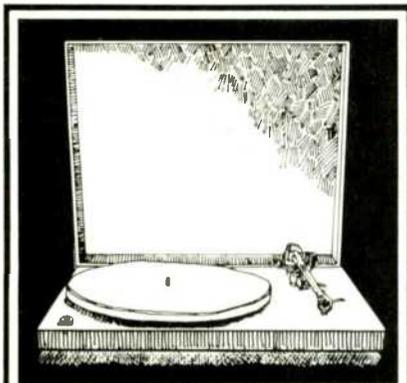
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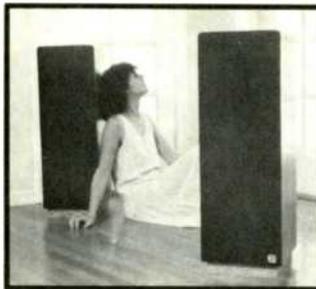
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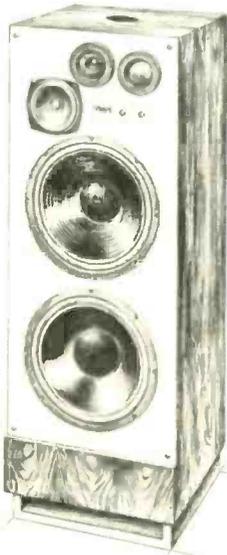


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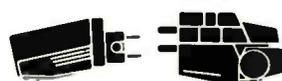
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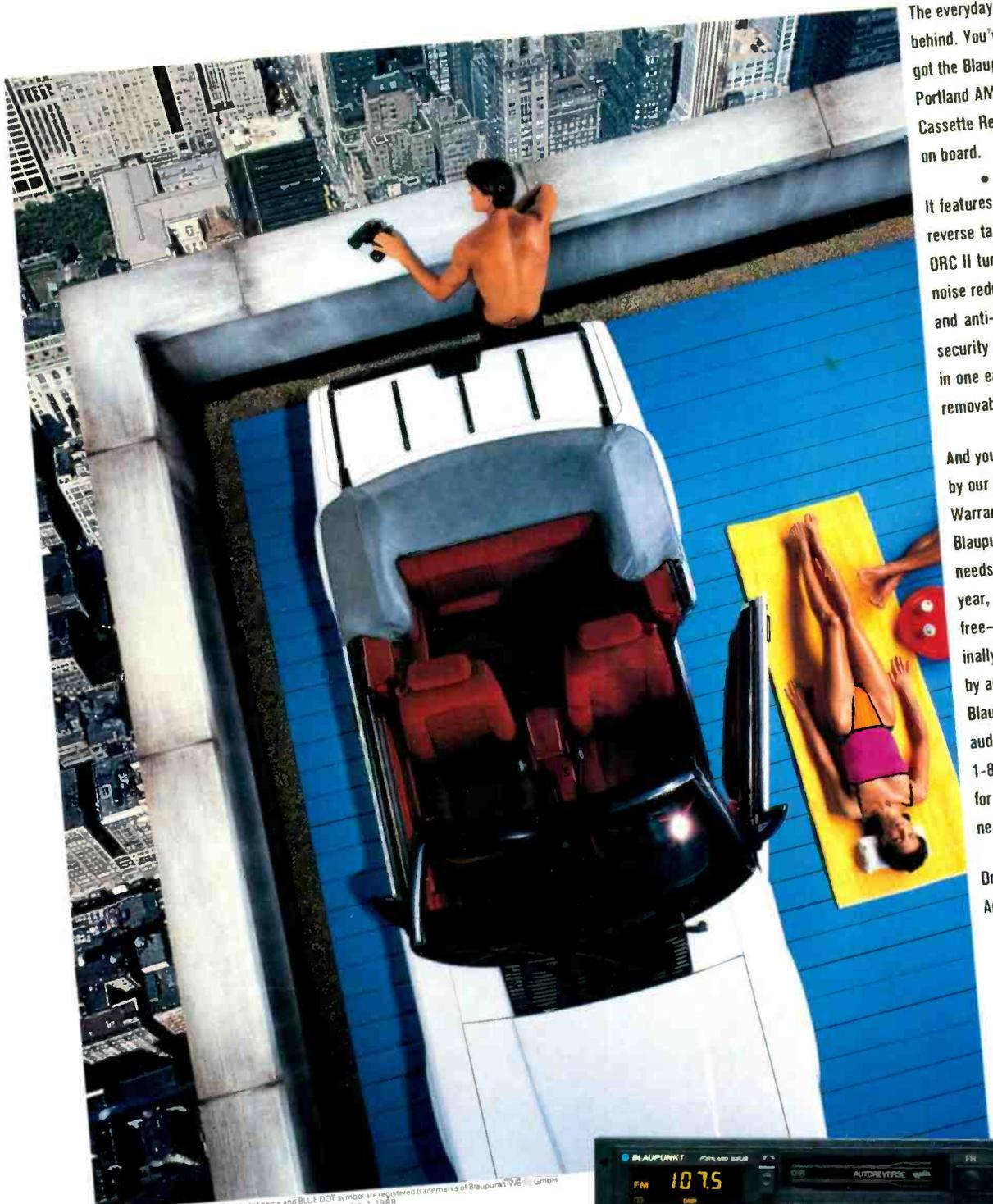
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