

The
Authoritative
Magazine
About
High Fidelity

Audio

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Ray Dolby
EXCLUSIVE INTERVIEW



**8th ANNUAL
CAR STEREO
DIRECTORY**

**AM STEREO:
FCC FIASCO!**

**EXCLUSIVE
ONE-BRAND
SYSTEM TEST-
KENWOOD
SPECTRUM 70**

**REVIEWED
B&O 9000
CASSETTE
DECK**

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JENSEN

Audio

JULY 1982

VOL. 66, NO. 7



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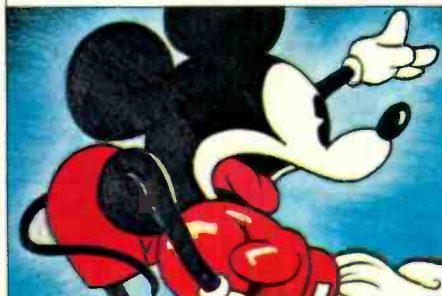
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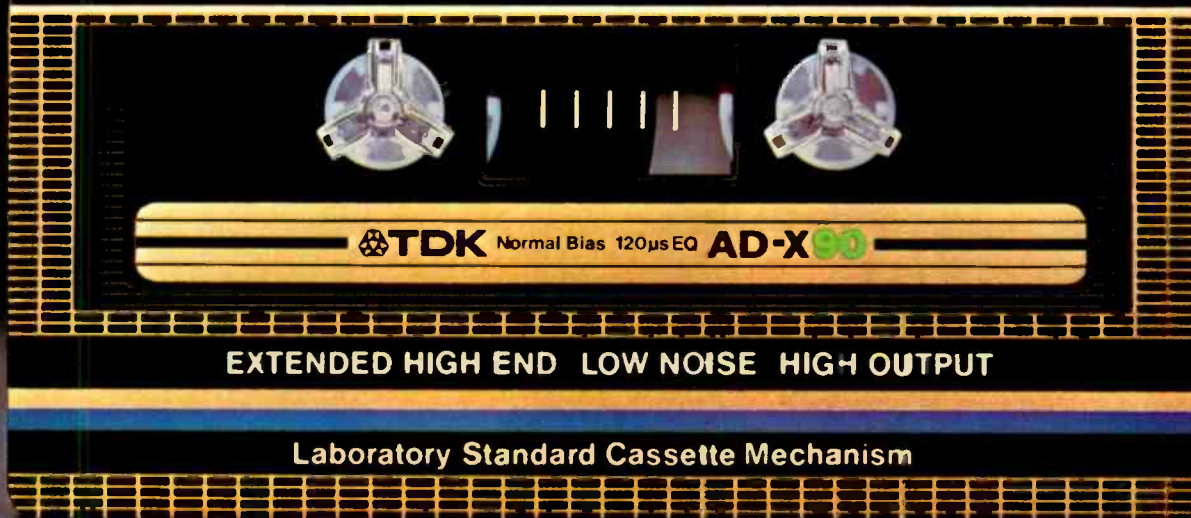
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Publisher

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Robert J. Krefling, President

George H. Allen, Senior Vice President/Magazines

Michael Brennan, Vice President and Gen. Manager

Leon Rosenfield, Circulation Marketing Director

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James Stockbower, Associate Business Manager

Karen L. Rosen, Production Director

ADVERTISING SALES

Audio, 1515 Broadway, New York, N.Y. 10036

Jay L. Butler, Publisher

Telephone (212) 719-6330

Stephen W. Withholt, Eastern Adv. Mgr.

Telephone (212) 719-6337

West Coast Sales Office:

Audio, 3507 Wilshire Blvd., Suite 1201

Los Angeles, Calif. 90010

Jay Martin, Western Adv. Mgr.

Telephone (213) 487-5880

Classified Advertising:

Audio, 1515 Broadway, New York, N.Y. 10036

Laura J. LoVecchio, Classified Adv. Mgr.

Telephone (212) 719-6338

England: The Paul Singer-Lawrence Media Group,

54 Burton Court, London SW 3 5Y4, England

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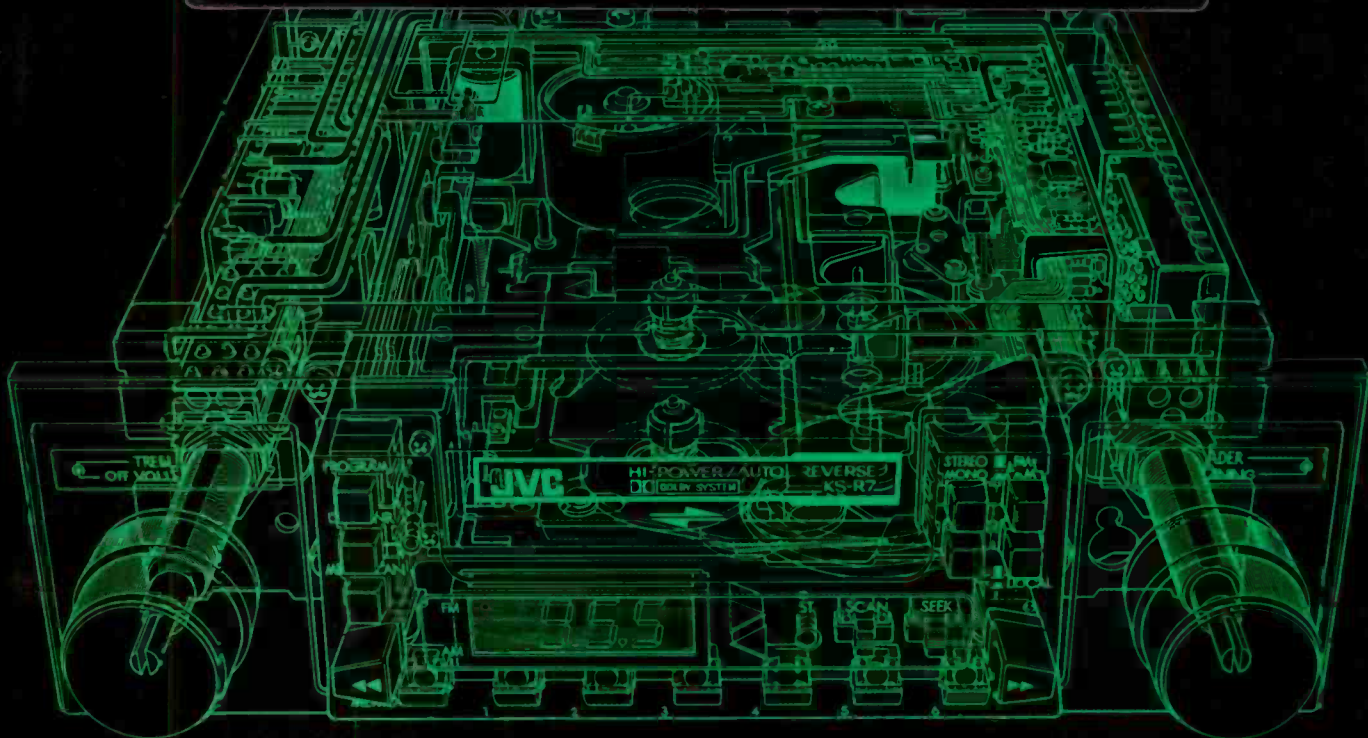
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WAS PHASE THE ANSWER?

Two continuing items this time around: The Stereophoner of Dr. Hermann Scherchen, and more fun & games with Technics' Studio Collection.

Things are seldom what they seem, observed Gilbert & Sullivan a century ago, adding that, all too often, skimmed milk masquerades as cream. Can mono masquerade as stereo? In the 1950s could an enhanced mono, two channels derived from one, be taken as a serious popular challenge to the then complexities of true stereo, with two of everything?

Indeed it could and Dr. Scherchen's Stereophoner was not the only try, then or since, towards a mono-derived dimensional soundspace in audio reproduction for a big improvement over the point-source beaming of sound from a single loudspeaker, most people's only audio experience before stereo. As per my May account, an impressive variety of European listeners "raved" over the novel effect of Scherchen's realistic spread of sound. His device was perhaps unique in having behind it such an energetic and famous, even awesome, promotor during its brief success.

I left the Stereophoner in May at the point of its somewhat sensational meltdown in my kitchen, filling the place with noxious fumes, running red rivers of hideous potting gunk to reveal at last the inner components of this peculiarly elementary gadget. Inside the small metal cube there could only be a handful of parts of the sort that were standard in the 1950s. Maybe even none at all? Just an illusion, a sleight of ear? Possible but not probable. Dr. S. could hardly have gotten away with that, if indeed he wanted to.

Inside the de-potted box I found only three components and a bit of wire. One leg of the mono input (15 ohms) did in fact run straight through, a solid ground to the metal case and maybe the nearest water pipe. No floating grounds in those days. (If I am right, most early stereo used the same sort of common ground for both channels.) The other input leg, "plus," went to the business elements, a pot or rheostat marked 50 ohms, a small unmarked electrolytic "condenser" (capacitor), aluminum clad, and a choke coil with a laminated iron core, this last



covered with dense varnish as well as potting gunk. That was it.

My cooperative technician friend in San Francisco, working at Pacific Stereo, took one look at the mangled mess I sent out to him and pronounced himself "aghast." But he wasn't about to leave it at that. He immediately reassembled the Stereophoner (minus gunk) and, without measuring anything, set it to work. Good man! Listen first. That's the attitude I like. "Gadzooks!" he exclaimed, and made this further comment: "It does indeed provide a convincing bass-right, treble-left early fake-stereo image. Could be quite nice to listen to." This from a man who has heard a million stereo systems of much more recent date. Might the sound have seemed even better for listeners in the late 1950s? I should think so.

He found it surprising that the Stereophoner worked at all after so long, plus my enforced meltdown. Good, British quality components. Even so, it was clear to him, as it may be to you, that the Stereophoner with one unexplained exception was nothing but a simple crossover circuit, much like thousands still used today in more modest two-way speaker systems. Instead of applying the crossover to woofer and tweeter in one speaker box, it merely sent its pair of signals

right and left to spaced-out speakers. Such a lot of fuss over nothing!

The "minus" mono input being ground, the other leg was divided. The choke coil sent bass towards the "R" output, while the capacitor and resistor in series delivered highs to the "L" output. My friend's meters zeroed in at an 800-Hz crossover. The slope each way was mild, at 6 dB or less. Nothing special at all. The variable pot, he said, served for balance, to attenuate the highs as desired.

But to his report he added one very significant item: "Does not keep good phase relationships." He wrote this first as a criticism, which would surely apply to any speaker crossover of the usual sort. Then he did a double take. As I did too, reading him.

Phasing! There, by golly, might be Dr. Scherchen's secret, neatly buried in potting gunk. For is not phasing, between several channels of info, one of the major creators of audio directionality and spatial illusion? We should not forget that the entire corpus of matrix four-channel coding and decoding had to do with highly subtle matters of phasing. Phasing, too, is of the essence in genuine live two-eared soundspace. If that simple crossover circuit was inaccurate in the phasing of its derived left and right channels, *might its designers have so intended?*

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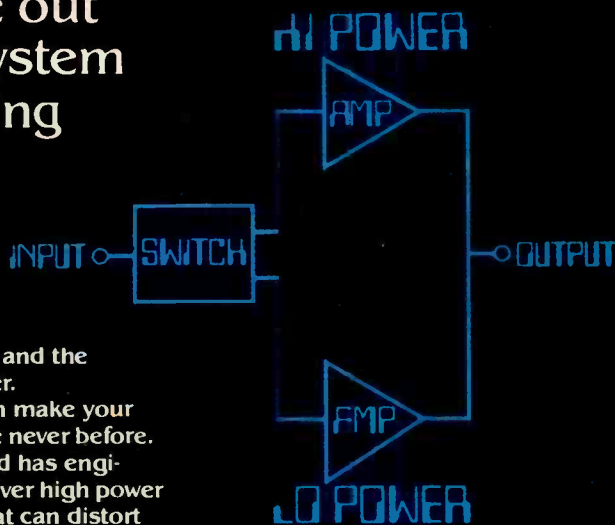
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Scherchen's Stereophoner, with one exception, was nothing more than a simple crossover circuit, much like those used today.

Might they deliberately have designed in a phase inconsistency, to give an illusion of depth? And a species of directionality over and beyond the simple volume contrasts of lows emphasized on one side and highs on the other? And so the plot thickens.

I began to describe all this to my neighbor, whose mind works at the speed of light. I had no sooner got the word "crossover" out of my mouth than he bellowed "PHASING!" Instantaneous perception. He wouldn't stop for 10 minutes. Of course it must be the phasing, and he told me why in enormous detail.

So you see, maybe old Dr. Scherchen was not as simple-minded as you thought. Maybe the skimmed milk was cream? And all those authoritative 1950s listeners were not as gullible as they appear to be. There is indeed something tricky in this Stereophoner that no doubt accounts for its unusual impact as much as Dr. Scherchen's backing and the then rudimentary state of commercial true stereo.

Even if I were to give you the exact values for those three components, I suspect that you would not have a Stereophoner. (The pot was 50 ohms, the capacitor estimated at around 10 μ F at 50 volts, the coil unmeasured—but if you know how, you could easily derive an 800-Hz crossover circuit of the same sort.) However, I would not want to try to analyze that phasing inconsistency's effect on the sound. That, surely, was Dr. Scherchen's special ingredient. The original specs may exist somewhere, at Gravesano or perhaps in the files of the British-licensed firm which manufactured the 1959 "Symphony" line of hi-fi. Or you can dial Dr. Scherchen in Heaven. Betcha he won't tell you a thing, though.

I never did think I'd get to try all of Technics' Studio Collection simultaneously, and I haven't yet. But I have used the speakers long enough to know their smooth, shiny sound and to note that their angular distribution to the sides is not quite as broad as I would like for walk-around stereo. But my biggest fun has been with the ST-S8 quartz synthesizer AM/FM tuner and, of course, the quartz direct-drive linear turntable described in January. (There are other lesser models using

Phasing might be Scherchen's secret ingredient in the Stereophoner, one extra bit which made convincing stereo out of mono signals.

the same linear drive principle.) I continue to be amazed at how faultlessly this table performs, considering the once-insoluble complexity of a side-wise-driven arm tracking an irregular spiral groove. And I am glad to note that its special Technics cartridge is now congruent with a number of other makes, including an Audio-Technica and an adaptation of the Shure V-15 Type IV. Please, let's keep our hard won compatibility!

I caught the Technics table off-base only once, and it was all this mag's fault. The machine is so foolproof that without a thought I pulled out our Bob Carver insert record and put it on the table, closed the lid, and pushed the start. Phew! The arm moved inwards, dropped down—and played all four corners of the square, flopping wildly up and down and sidewise; I frantically pressed everything in sight, but these automatics move at their own majestic pace and it took many disastrous seconds to stop the thing. But the experience was useful. No damage to arm, cartridge or stylus. Some systems really can take it, miniaturized or not.

As for the Technics tuner, it is the first of the new breed with which I have become really intimate and it has been an experience. I began, first, with a useful comparison, my earlier Pioneer TX-9500 II, an excellent late representative of the traditional tuner with the familiar dial and tuning knob, plus meters for signal strength and channel center. Give the TX-9500 II knob a spin and it runs the whole length of the dial; mark your preferred stations where they fall, all in numerical order. This tuner has two degrees of muting and with the strongest I still could pick up some 43 FM stations with my roof antenna pointing SSW towards New York 100 miles away. With less muting, and more fuzz, I counted well over 50.

There's a sort of dial on the Technics, so small you can hardly see it, but no tuning knob. Only micro-touch buttons with memory, two stations on each button, short-push and long-push, which have to be programmed in, to your choice, in any old order and either FM or AM. You can make a hideous jumble, dialwise, or even tune them all to the SAME station. Crazy and wonderful. But with all those frequencies to remember, it is common

sense to program in numerical order, the tiny dial serving as a rough indicator of where you are via little red LEDs. Even this isn't too easy, because the 16 tunable channels are staggered over those eight buttons, channels 1 and 9, 2 and 10 and so on, a short push for the lower number, long push for the higher. It's zigzag at best, and I ended up tuning both channels to the same station, in case I mis-pushed.

Moreover, the fancy memory button also has two modes, short-push and long, the latter going into automatic scan, erasing EVERYTHING and setting up its own array of stations which, of course, are merely the loudest ones around. I don't know how many times I erased my entire selection because, trying to push long with one hand and short with the other, I got them mixed up. It's like driving your first time with a manual-shift transmission.

But I enjoyed the main tuning buttons, one for up and one for down or left and right. These also are short-

push and long. The short tunes step by step, frequency by frequency, AM or FM; the long runs rapidly over the "dial," coasting to a stop when you lift your finger. If your memory channel buttons are haywire, you can always find your station quickly this way, but you do have to remember its frequency.

You get the idea: Tricky. But once you learn to drive it, this is really a fabulous tuner, even on AM (which is skimpy on many tuners). The sound is terrific, the sensitivity and selectivity in practice are far ahead of anything I had previously tried and, best of all, the inevitable stereo hiss somehow is reduced to the mildest ffffff, just a velvet purr. I could pick a lot of minor criticisms and I don't much like the cybernetics, the almost invisible lettering, the long row of identical pushbuttons, the narrow eye-level readout, but I mention only that one really serious blunder—the memory button that you keep setting off by mistake. Instant erase! You can have that, thanks. **A**



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Using a Master Tape

Q. I have a 10½-in. reel of tape that I use for recording material off the radio; this material is then transferred to cassette. How many times can I use the tape reel before poor reproduction occurs?—Michael Conner, St. Louis, Mo.

A. As a very rough guess, your master tape should be good for 100 to 1,000 plays before its performance begins to drop noticeably. So much depends on the quality of the tape, on how gently it is treated by the deck, on the tape speed (the faster the speed, the greater the wear for a given recording time), on temperature and humidity conditions, etc. that it is difficult to be specific.

Scratchy Tapes

Q. For some reason, my cassette tapes have scratches. Please tell me what causes this and how I can prevent it. —Violet Hurdle, Brooklyn, N.Y.

A. I am not sure what you mean by scratches. If you refer to the fine striations that run the length of the tape, these are normal and due to friction between the tape and the heads. If you refer to audible scratchy sounds, the cause would seem to lie in the electronics of your deck.

Capstan Encapsulated

Q. I am trying to choose between two open-reel tape decks, one having dual-capstan drive and the other a single capstan. Is dual-capstan drive that much better than single?—Arthur Airame, Waltham, Mass.

A. There are usually several engineering approaches to a stated objective, and one is not necessarily better than the other—what counts is how well the approach is executed. Hence, a deck with dual-capstan drive may be better in terms of motion performance, but not necessarily. There are single-capstan decks which deliver very fine performance.

Circuit Trap

Q. I am rebuilding the electronics of my tape deck. The circuit that I intend to use for the record preamp has a parallel resonant trap connected between the output of the record amplifier and the record head. I am not sure what this part of the circuit does.—Earl Blackman Jr., Florence, S.C.

A. The purpose is to prevent the bias current, which is fed to the record head along with the audio signal, from getting back to the signal amplification section and interfering with its proper operation. The trap has maximum impedance at the bias frequency (to which the trap is tuned), but at audio frequencies, the trap presents minimal impedance so that the audio signal can pass from the audio amplification section to the record head.

Reel Standardization

Q. I am curious as to why open-reel tape on 10½-in. reels is usually available in the United States only on standard NAB reels. Assuming that one does not expect to use the tape on a studio deck that only accepts NAB reels, is there any advantage to using them?—Mark Goldfield, Brooklyn, N.Y.

A. The reasons for standardizing an item such as a tape reel are to achieve optimum performance and to assure compatibility with the decks for which it is intended.

Inasmuch as the demand for 10½-in. reels in this country is largely by those using professional decks which take the standard reel, tape manufacturers have not elected to serve the much smaller market which would like other types of 10½-in. reels. In any event, adaptors are available to permit the NAB reel to be used on home decks which operate at 15 ips but which cannot accommodate the standard reel.

Blown Speakers

Q. While recording a phono disc, with the "input volume" sliders of my cassette deck set at about the "4" position, I blew my speaker's fuses. The preamp's volume control was not more than ¼ of the way up. After turning the disc over in order to tape the second side, I may have changed the preamp's selector setting from Phono to Tape.—Joseph Cuiifo, Utica, N.Y.

A. The blown fuses are likely due to your accidentally turning the preamp's selector switch from Phono to Tape. This could cause feedback oscillation, resulting in a signal powerful enough to blow the fuses. To avoid a recurrence, set the volume control of your audio system at a very low level—

nearly off—when making your settings for tape recording, and then gradually turn up the volume of your preamp. If you hear a squeal or other loud sound, quickly turn down the volume and check all your switch settings.

Ratios Revisited

Q. In reference to your Tape Guide column in a past issue, I would like to point out that a ratio of 1,000 to 1 is 30 dB, not 60 dB as stated.—Michael Carlin, Malvern, Pa.


A. The Tape Guide stated that a 1,000 to 1 ratio between two voltages is 60 dB. That is a correct statement. If I had referred to a 1,000 to 1 ratio between two amounts of power, that would be 30 dB.

Each multiplication of power by 10 is represented by 10 dB. Each multiplication of voltage by 10 is represented by 20 dB (assuming that the load resistance is unchanged).

Power = E^2/R , where E is voltage and R is resistance. Accordingly, power rises with the square of the voltage. Thus, a 1,000 to 1 voltage ratio results in a 1,000,000 to 1 power ratio, which is represented by 60 dB.

High Bias Tapes

Q. Recently a company came out with a high bias tape which I thought might give better results than the one I've been using. The first time I used the new tape, the reproduced sound was very close to the original. But when I recorded on a second cassette of the new brand, the playback level was low, with a lot of distortion and fuzziness. This never happened with my old tapes. What's wrong?—Eugene Bolabek Jr., Linden, N.J.

A. My guess is the tape. But in all fairness, it should be recognized that occasionally one finds certain combinations of tape brand and tape deck which work well individually but not together. In other words, the new tape you tried might work perfectly well with other decks, even though it doesn't do so with yours. This situation, however, sounds like variation between batches of the new tape. 

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.

HEAVY VELVET.

Massively built. Delicately precise. Elegantly styled. That's Yamaha's PX-2 tangential tracking quartz-locked turntable. The one that



knows its way around records because it plays them the same way they were cut — straight. Yet, the PX-2 is not the first turntable to do this. It's just the first to do

it with the precise performance and rugged construction the others lack.

Precise performance that results not only in negligible tracking error and harmonic distortion, but also in dramatically reduced intermodulation distortion, minimum crosstalk, precise left/right balance,

exceptional stereo imaging, and an unbeatable 80dB signal-to-noise ratio.

Rugged construction such as 5mm-thick die-cast aluminum base, solid aluminum heads shell, even a 5mm-thick acrylic

cover, all contributing to resonance-free performance.

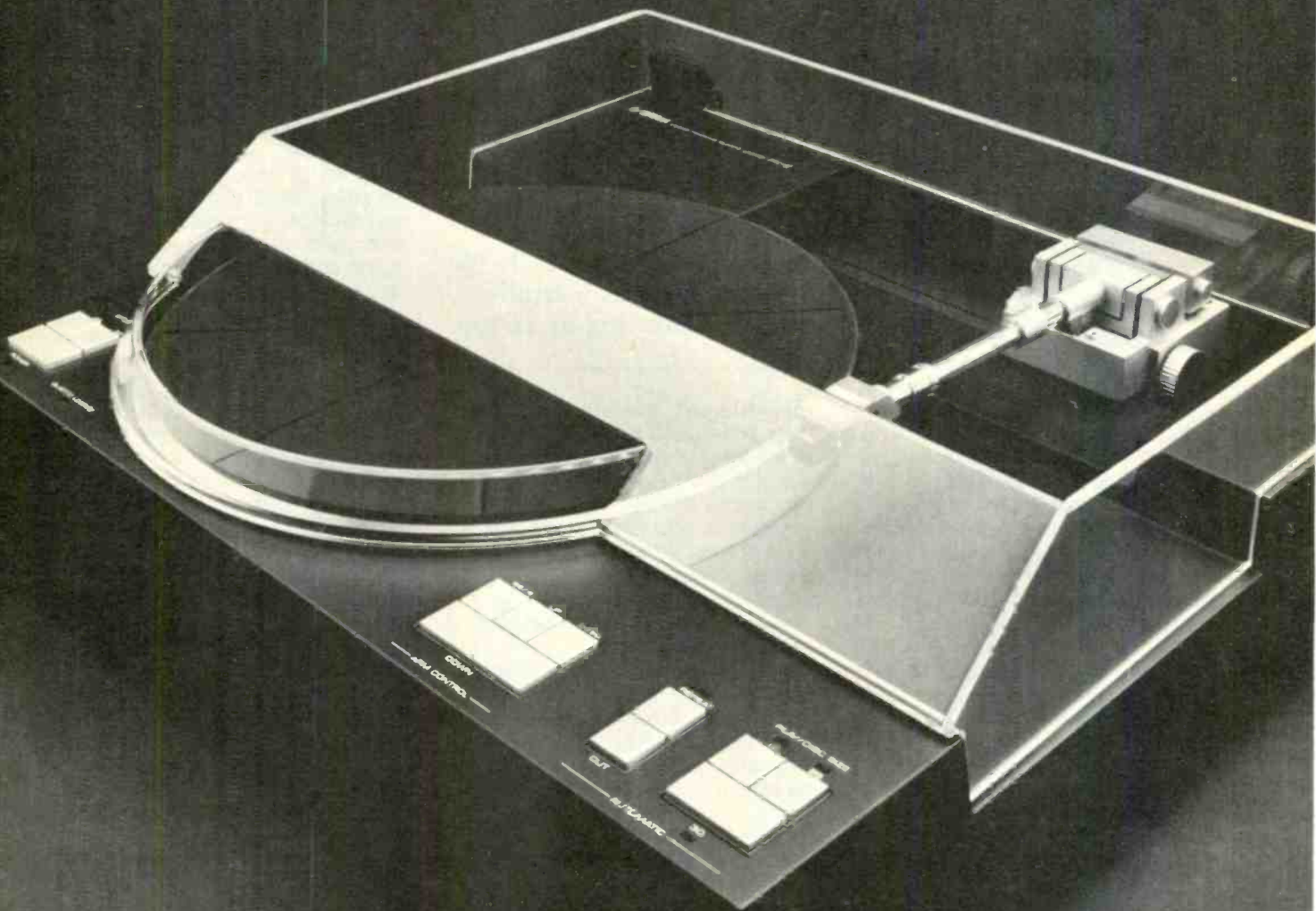
And if you're big on performance but smaller in budget, the PX-3 offers an unbeatable cost/performance ratio.

Yamaha's PX-2 and PX-3. Built like anvils. Yet perform as delicately as a butterfly. All to bring out the music in you.

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For the music in you.

YAMAHA



DAVID LANDER

RAY DOLBY



Stanford student Dolby (third from left) started at Ampex.

Few scientists get to see their names on movie marquees. Ray Milton Dolby does—frequently—and the famous double-D symbol of Dolby Laboratories adorns cassette decks the world over. Indeed, the name has become almost synonymous with noise reduction. The professional Dolby A-type NR system, so popular with filmmakers, is becoming part of the TV production scene. More than 70 million Dolby B items for consumers have been produced since that NR system was introduced with open-reel decks in 1968, followed two years later with cassette decks. Currently being shipped or about to go into production are 112 different models of products with Dolby C-type noise reduction.

Yet the 49-year-old Dolby, whose career has taken him from the San Francisco Bay area, where he was raised and educated, to England, India and back again, remains unassuming, even shy. He is cautious when it comes to predicting the future of his C-type system. But as the discussion progresses he candidly admits to frustrations with both professionals and consumers who often seem either unable or unwilling to appreciate the sonic improvements Dolby has endeavored to bring to tape recordings, FM broadcasts and films.—D.L.

According to your biography, you worked at Ampex while attending Stanford University. Did you go to college at night?

No, I was on a normal course, but I had a fairly flexible arrangement at Ampex. I worked about 15 hours a week. I just came in whenever it suited me, sometimes during the day, sometimes at night.

How did this come about?

I met [Ampex founder Alexander] Poniatoff when I was 16 years old. He had hired me to show a film for his mental health society. He was always interested in health things. Following the showing he invited me to see his plant and tape recorder and in due course asked if I'd like to work for him—as soon as an opening occurred. He had only about 25 people then.

You spent six years at Cambridge University in England after graduating from Stanford. What did you pursue for that length of time?

Most of the work I did in Cambridge could be described as a kind of noise-reduction effort. I was trying to get information about the concentrations of certain elements in specimens—for example, carbon, nitrogen and oxygen—through the bombardment of the specimen with an electron beam and the analysis of the X-rays that come out. In the X-rays there's a lot of hash and garbage and so on. So for six years I tried to devise various methods of cutting through the hash and getting at the information I wanted.

Henry Kloss wanted a recorder running at 3¾ ips to be as good as a studio recorder running at 15 ips.

How does this "hash" and extraneous noise show up in X-rays?

In the form of graininess. It would be like a grainy television picture, and I had to devise ways of taking the raw information, analyzing it, unscrambling it in the most efficient way possible so the image was as free of grain as possible.

And you see this as analogous to eliminating tape hiss?

Yes, except that you might characterize what I was doing there as single-ended noise reduction. In other words, after-the-fact noise reduction. There was no possibility of encoding the signal ahead of time in order to decode it later.

You also pursued your hobby of tape recording in Cambridge. Were you bothered by tape hiss at the time?

I had my Ampex 600 in very good tune, but still there was this tape hiss problem. I accepted, let's say, the state of the art. The tape hiss was there, and it was disturbing and annoying. To switch from line-in to line-out and hear that tape hiss was very annoying, but it was something you had to live with. Once in a while I would think about the problem, and I remember in Cambridge contemplating this idea. Imagine the signal is 100 or 1,000 times as big as the noise that's causing this trouble. Isn't it ridiculous that such a small quantity can cause such annoyance. There ought to be something you could do about that. Previous attempts had been to squash and expand the whole signal, and it had become a byword that it just didn't work, that the distortions and side effects just weren't worth any noise reduction. It was better to get a pure recording coming back with the noise than to suffer these distortions with some noise reduction.

From Cambridge you went on to India—in 1963. What did you do there?

I was working for UNESCO on a technical aid project. In my spare time, I recorded Indian street musicians. I ran my microphone lines out to the street and used to pay street musicians to come and perform. I also invited them into my house—this was usually prearranged—and they would perform North Indian music. I'd set one room up as a sort of control room, and they'd be playing two doors away. And throughout this time I continued to be bothered by the tape hiss problem. I had formed an idea about a noise-reduction system that might just work, but I knew there would be some distortions connected with it. I was calculating these when it just hit me that I could bypass the whole problem by dividing the treatment of the signal into two regimes, mainly this high-level regime with loud signals which I would do nothing to, and have separate circuitry for dealing with the low-level signals. The low-level signal circuitry would cut in only under very quiet conditions where the noise was. That was the key to the problem.

To the problem of building the system, you mean. Not of selling it.

Yeah. [Laughs] I've described the easy part so far.

Imagine the music signal
100 or 1,000 times bigger
than the noise that's
causing this trouble.

In fact, after starting your company in London and delivering your first order of A-type units to Decca, isn't it true that you couldn't find another customer in England?

It turned out, to my dismay, that Decca was virtually unique. The other companies said things like, "We don't have noise problems. We adjust our recorders every morning. We use the best tapes." That was quite a contrast with the very eager reception which I'd had at Decca. So I didn't sell anything else in England, and by October 1966, things were getting a bit desperate. The money was running out very, very rapidly.

Didn't it occur to you to come home and try to sell your system to the Americans?

That's what I did! I got hold of the New York studio directory and fired off about 30 letters. And I received back four telegrams. Seymour Solomon [of Vanguard] immediately telexed and said, "We're very interested. Please come as fast as you can and demonstrate this." And John Eargle at RCA sent a similar kind of message. So it was really quite a different kind of picture.

I heard that Henry Kloss, then still with KLH, learned about your system from one of his key executives and reached for the phone and called you immediately.

He phoned me in London on a Friday afternoon in March 1967, and asked, "Have you ever thought of doing anything with a consumer product?" And I said, "Well, yes, in due course, I have that in mind." He then asked, "When are you going to be in the U.S. again?" I said, "Well, I'm due to go to the Audio Engineering Society in April in Los Angeles." And he said, "I really want to talk to you right away. Could I come over to London to see you? How about tomorrow?" I was quite taken aback by this. And he went out and got himself a ticket and flew overnight. I picked him up at the airport the next morning. We spent the whole weekend discussing and speculating on the possibilities. He wanted to build an open-reel tape recorder which was *the* best. He wanted this recorder to be, at 3¾ inches per second, as good as a studio recorder at 15 inches per second. I felt uncomfort-



I've been to so many parties where people will say, "Oh, you're the guy with the switch. What's it do?"

able about being pushed so far so fast because I knew how far it would stretch our resources, but he was determined, so I agreed to jump in and start the project.

So you started work on your B-type noise-reduction system. How long did it take to complete?

Well, the final touches weren't put on the system until the middle of 1969.

When did the idea of applying it to the cassette format occur to you?

In early '69. I started investigating cassettes even though the slow tape speed seemed to be a deterrent, and I was amazed at how well you could do

with a cassette if you really tried. After working with various machines, I came up with a Harman/Kardon CAD-4 as a demo machine. That was all souped up and optimized and used with a free-standing noise-reduction unit which was called the 505. I took the first 505 with me to the Audio Engineering Society together with that pampered CAD-4 in October 1969. I stopped in Boston and gave Henry Kloss a demonstration, and he was amazed. He had not considered cassettes before. He had founded Advent by then and was very eager to get moving on something, and I decided to give him a license to manufacture a free-standing noise-reduction unit and also a cassette deck. He started on both things simultaneously, and that's what brought about the Advent Model 100 noise-reduction unit and the 101, and then the Advent 200 cassette recorder.

Was there some specific event that occurred or some precise point in time

Our effort to clean up FM broadcasting has not worked at all because most people simply don't care about the quality.



At the bench, scientist and engineer Dolby is caught between those who demand even better NR and people who never hear noise.

When you knew that your noise-reduction system had become a standard?
No, it was very, very gradual. It was a matter of giving a lot of demonstrations and talking to a lot of people, explaining and overcoming confusion and misunderstandings and misconceptions.

Did you ever dream the system would gain such widespread acceptance?

Yes, I could see that. One thing that was of enormous value to me in this whole venture was that I had seen the same kind of thing happen to my previous work, the videotape recorder which I'd worked on during my early 20s at Ampex.

And that was the first videotape recording system.

Yes, and I designed most of the electronics for that system.

At that early age?

I was 23 when the first videotape recorder was exhibited at the NAB in Chicago.

Had you even graduated from college at that point?

No. That was the work I was doing part time. My Ampex title, while I was still in college, was consultant. I got very good treatment there. I could come in and hand in my latest designs to be built and next time I would come I'd test them, give instructions. . . .

So you really were something of a prodigy. Here you were, still in college, and these people were working with your designs. You weren't just somebody's assistant who went for coffee.

No, but I'd hesitate to use the term prodigy. I was, I think, just a very practical, capable person with my head screwed on. I mean, I knew how to get things done.

Do you feel now that Dolby C is going to be the new standard?

I don't know whether it's going to be a new standard or not. Nobody knows.

A lot of people in the audio industry are predicting it.

People predict a lot of things, but nobody knows. All you can do is try. And hope. Or maybe say they're crazy if they don't take it. But there were all these expectations with four-channel sound, for example. . . .

What about your HX system? That hasn't been adopted by many manufacturers. Are you disappointed?

Yes. It proved the thesis that you can't persuade people to pay for more qual-

ity than they perceive a need for. Also our effort to clean up FM broadcasting has not worked at all. The reason is that most people simply don't care. Most people listen to FM as sort of a background music while they're shaving or whatever, and they don't care about the quality. That was an endeavor that just didn't work out.

Earlier, you said much the same thing about the record companies in England, other than Decca, of course. It sounds like the fact that most people just don't care about quality may have been one of the biggest frustrations you've faced in business.

That's right. For instance, we started work on our movie program in 1970, and it wasn't until about 1976 or '77 that we began to have the feeling that maybe it was going to go. Because throughout those early years, people in Hollywood, in London and in other places would tell us "You're wasting your time. Nobody cares about the sound. They go for the stars or the plot or the ambience of the event. They don't care about the technical quality of the soundtrack."

But you persisted. When was the breakthrough?

People like to point to *Star Wars*. But, of course, we had various other pictures. So it was just one little step after another, and there wasn't any single breakthrough. But there was a certain turning point in my own mind, which I suppose occurred around that *Star Wars* time. Before then I didn't know whether I was pouring money down an endless hole; it was really an article of faith up to that time. I thought there had to be some people out there who'd care what it sounds like to hear a good movie soundtrack, and I was

going to try long enough until I proved it one way or another. In other words, movies just barely made it. FM radio did not quite make it. It's like the A system. It just barely made it because somehow or other there were just enough studios who said, "Well, I don't know. We don't really have a noise problem, but on the other hand, if we had a gadget that would reduce noise a little bit, I guess that would be handy."

Do you think of yourself as a man who just barely made it?

[Pause] That's really what it is. You know, the cassette, before noise reduction was applied to it, did not quite make it as a quality recording medium. Okay, B-type noise reduction was enough to just barely push it over, and so it did make it. But then there were certain rumblings of dissatisfaction even with the results with B-type. You know, the people who were the real audiophiles, the enthusiasts, they said, yeah, B-type is probably okay for the mass market, but we want something better.

So you're caught between the audiophiles, who want perfection at any cost, and the average listener, who might not want to pay for any noise-reduction system at all.

That's why I'm cautious when I say I don't know whether C-type will become a new standard or not. Because the average listener hasn't heard tape hiss with or without noise reduction. I've been to so many cocktail and dinner parties where people will say, "Oh, you're the guy with the switch. Tell me, what does that switch do, anyway?" And I'll say, "Well, it reduces the hiss." "Hiss," they'll say. "I've never noticed any hiss." A

8TH ANNUAL CAR STEREO DIRECTORY

For Manufacturers' Addresses, see page 33



ADS Power Plate 100

AMPS/EQUALIZERS

MANUFACTURER	Model	Price, \$	Amp		EQ		Separate Controls for Each Stereo Channel?	Boost Cut Range, ±dB	S/N Ratio, dB	Watts into 4 Ohms, per IHR A-202	% THD at Rated Output, per IHR A-202	Dimensions, inches	Notes
			Both	Pre	Both	Pre							
ADS	P100	328.00	Amp	†	No	†	90	50	0.00	12 1/4 x 6 1/2 x 2	†Three-position bass EQ; high/low inputs.		
AIWA	AE-202Y	110.00	Both	7	No	12		20	0.2	6 x 6 1/2 x 2			
ALPHASONIK	PEQ-7	100.00	Pre, EQ	7	No	12	80		0.02	1 1/2 x 6 x 4 1/4	EQ bypass; fader. †Bass ±15, mid ±13, treble ±12.		
	PA-1	130.00	Pre	3	No	†	70		0.01	1 1/2 x 7 x 4			
	A201E	95.00	Amp		No		85	20	0.5	2 1/8 x 5 1/4 x 6 3/8			
	A451	149.00	Amp		No		85	40	0.25	2 1/8 x 7 1/2 x 6 3/8			
	AS01E	250.00	Amp		No		85	50	0.1	2 1/8 x 9 1/2 x 6 3/8			
AS2000	120.00	Amp		No		85	60	0.25	5 3/4 x 2 1/4 x 6 1/2				
ALPINE	3011	149.95	EQ	5	Yes	12	80			5 1/8 x 1 1/4 x 3 1/8	Digital time delay, fader, line or speaker level inputs. Fader, subwoofer output, remote control. Bridgeable, line or speaker level inputs, remote control. Bridgeable, remote control. Line or speaker level inputs. Fader.		
	3316	199.95	EQ	7	Yes	12	100		0.02	6 1/4 x 1 x 4 3/4			
	3506	199.95	Amp				97	25	0.04	6 1/4 x 2 x 7 7/8			
	3508	249.95	Amp				97	40	0.04	6 1/4 x 2 x 7 7/8			
	3002	249.95	Amp		No		85	65	8.0	8 x 2 1/4 x 8			
3023	149.95	Both	7	Yes	12	65	18	8.0	5 1/8 x 1 1/4 x 5 7/8				
AMERICAN AUDIO	7505	299.95	EQ	5	No		60	15	10	7 x 5 3/4 x 1 3/4			
	4700	249.95	Both	5	No		60	15	10	7 x 5 3/4 x 1 3/4			
	4505	199.95	Both	5	No		60	15	10	7 x 4 1/2 x 2 1/8			
	6000	249.95	EQ	5	No		60	15	1	6 1/8 x 3 7/8 x 1 3/8			
	6040	319.95	EQ	5	No		60	15	1	6 1/8 x 4 x 1 1/8			
	8500	279.95	EQ	5	No		60	15	1	5 1/2 x 4 1/8 x 1			
ARA-MOTOROLA	PA100		Amp†				68	14	0.9	5 7/8 x 7 x 1 7/8	†4 channel.		
AUDIOBAHN ELECTRONICS	AB-100 WPB	149.95	Amp†							7 1/2 x 2 x 4 1/4	†4 channel. High low variable gain.		
	AB-100 EQ	139.95	Pre, EQ	7		12	70		0.02	4 1/2 x 7 1/2 x 3			
AUDIOMOBILE	SA 400	199.95	Amp				100	40	0.25	4 3/4 x 5 1/2 x 2	High and low level inputs. Adjustable input sensitivity. Three power amps, SP300 preamp, crossover, fader, etc. inc. As above. As above.		
	SA 1000	479.95	Amp				100	100	0.2	7 3/4 x 7 3/8 x 4 1/4			
	SA 2000	699.95	Amp				100	200	0.2	7 3/4 x 7 3/8 x 4 1/4			
	SP 300	299.95	Pre, EQ	3	No	15	90		0.05	4 1/2 x 1 3/8 x 4 1/8			
	AR-2	1679.95	Both	3	No	15	90	180	0.2	10 x 23 x 5			
	AR-3	1979.95	Both	3	No	15	90	240	0.2	10 x 23 x 5			
AR-4	2279.95	Both	3	No	15	90	360	0.2	10 x 23 x 5				
AUDIOVOX	AMP-500	33.90	Amp		No		70	20	10.0	1 1/4 x 4 1/8 x 6 1/2			
	AMP-550	73.00	Both	5	No	12	75	20	10.0	1 1/4 x 4 x 5			
	AMP-575	87.00	Both	5	No	12	75	20	10.0	1 1/4 x 4 x 5 1/2			
	AMP-600	100.00	Both	5	No	12	75	20	10.0	3 7/8 x 6 1/2 x 6			
	AMP-700	170.00	Both	7	No	12	80	30	1.0	1 1/4 x 7 x 7 1/4			
	AMP-775	110.00	Both	7	No	12	75	20	10.0	1 1/4 x 4 1/8 x 5 3/8			

AMPS/EQUALIZERS



Jet Sound JS-121

MANUFACTURER	Model	Price, \$	Amp = Amp; EQ = Equalizer; Both = Both; Pre = Preamp	Number of EQ Bands	Separate Controls for Each Stereo Channel?	Boost/Cut Range, ±dB	S/N Ratio, dB	Watts into 4 Ohms, per IHF A-202	% THD at Rated Output, per IHF A-202	Dimensions, inches	Notes
BON SONIC	AE202	79.99	Both	5	No	20	50	50	0.03		
	AE207	99.99	Both	7	No	20	50	50	0.03		
BOSE	1401	255.00	Both		Yes	†	78	80	0.00	1 1/4 x 10 x 4 1/4	†Active spatial control—not boost/cut as in passive faders; see "Speakers" section.
CONCORD ELECTRONICS	HPA-25	119.95	Amp				80	12	0.8	3 3/8 x 1 1/4 x 1 1/8	Auto EQ. As above.
	HPA-41	149.95	Amp				86	20	0.5	6 x 2 1/2 x 5 1/2	
	HPA-45	169.95	Amp				86	35	0.5	6 x 2 1/2 x 5 1/2	
	HPA-70	369.95	Amp				90	70	0.5	9 x 3 1/2 x 8	
FUJITSU TEN	QM-104	129.00	Amp†		No		90	13	1	1 3/8 x 5 1/8 x 5 1/2	†4 channel.
	PA-130	75.00	Amp					12		2 7/8 x 4 3/4 x 5 1/2	
	OA-150	183.95	Amp†					12		2 3/4 x 7 1/2 x 9 7/8	
	PA-200	140.00	Amp			70	40			2 3/4 x 5 3/4 x 9 7/8	
	PA-160	239.99	Amp†			70	40			2 3/4 x 5 3/4 x 9 7/8	
FULTRON	15-0733	149.95	Both	7	Yes	12		42	5	7 x 1 7/8 x 6 7/8	Preamp inputs, Dynamic NR, fader, Echo, EQ bypass, Dynamic NR, fader. Fader.
	15-0732	189.95	Both	7	No	12		20	5	6 3/4 x 1 7/8 x 5 7/8	
	15-0731	79.95	Both	5	No	12		14	5	3 3/8 x 1 1/4 x 5 5/8	
	15-0720	49.95	Both	2	No	12		14	5	4 3/4 x 1 3/8 x 4 5/8	
JENSEN	A30	79.95	Amp				80	30	0.3	2 1/4 x 7 1/4 x 9 3/8	
	EQA3000	139.95	Both	5	Yes	12	80	34	0.3	2 1/2 x 6 1/4 x 6 7/8	
JET SOUND	JSE 41	59.95	Both	3	No	12	60	20		4 1/2 x 1 7/8 x 5 7/8	High and low input levels. As above. As above. As above. As above.
	JSE 51	79.95	Both	5	No	12	60	20	1	4 1/2 x 1 3/8 x 5 7/8	
	JSE 61	99.95	Both	5	No	12	60	30	1	4 1/2 x 1 3/8 x 5 7/8	
	JSE 71	149.95	Both	8	No	12	60	40	1	7 1/4 x 1 7/8 x 6 1/8	
	JSE 121	199.95	Both	12	No	12	60	50	1	7 1/4 x 1 7/8 x 6 1/8	
	JSE 81	99.95	Amp				60	50	1	7 1/4 x 1 7/8 x 6 1/8	
KENWOOD	KAC-901	369.00	Amp		No		92	100		11 3/8 x 2 3/4 x 8 3/8	†4 channel. †4 x 2 and 15 x 2.
	KAC-801	249.00	Amp		No		80	50		11 3/8 x 2 3/4 x 6 7/8	
	KAC-887	149.00	Amp†		No		92	15		5 5/8 x 2 x 6 1/8	
	KAC-501	79.00	Amp		No		94	15		5 3/4 x 1 x 5 1/2	
	KGC-737	249.00	Both	7	No	12	85	1	0.02	5 7/8 x 1 7/8 x 5 7/8	
	KGC-447	139.00	EQ	5	No	12	70	1	0.02	4 1/2 x 1 3/8 x 3 1/2	
KRACO	KE-7	169.95	Both	7	Yes	12		20	1.0	7 1/8 x 7 1/8 x 2 1/2	
	KE-6	89.95	Both	5	Yes	12		15	1.0	6 1/2 x 6 x 2	
	KE-5	79.95	Both	5	Yes	12		15	1.0	5 1/2 x 7 1/2 x 2	
	KE-4	79.95	Both	5	Yes	12		15	1.0	4 x 4 1/2 x 1 1/4	
	KE-3	59.95	Both	3	Yes	12		10	1.0	5 1/2 x 2 x 6 1/2	
	P8-131	39.95	Amp					15	10	4 1/4 x 6 x 1 1/2	
	LINEAR POWER	401	139.95	Amp		No		95	20	0.15	
601		189.95	Amp		No		95	30	0.15	8 x 6 1/2 x 2 1/4	
901		249.95	Amp		No		95	45	0.15	7 1/8 x 6 1/2 x 4 1/8	
1501		429.95	Amp		No		95	75	0.15	7 1/8 x 9 1/2 x 4 1/8	
300		699.95	Amp		No		95	150	0.15	7 1/8 x 13 1/2 x 4 1/8	
EO-1		179.95	Pre, EQ	6	No	9	95		0.006	4 1/2 x 5 1/8 x 1 3/4	
PA-1		109.95	Pre, EQ	3	No	12	95		0.05	7 x 3 3/4 x 1 1/2	
MAGNADYNE		EO30B	79.95	Both	5	Yes		28	1	1	1 1/2 x 4 1/2 x 6 1/2
	EO43B	89.95	Both†	7	Yes		28	1	1	1 1/2 x 6 1/4 x 4 1/4	
	EO48B	109.95	Pre, EQ	10	Yes		28	1	1	1 3/4 x 6 x 4 1/2	
	EO50B	119.95	Both	10	Yes		36	1	1	1 3/4 x 6 x 5 1/2	
MITSUBISHI	CV-25	129.95	Amp†				65	17	5		†4 channel.
	CV-24	49.95	Amp				60	4	5		
	CV-23	179.95	Both	6			65	15	5		
PANASONIC	CY-SB25	79.95	Amp		No		85	12	1	5 1/2 x 4 1/4 x 1 1/2	
PARASOUND	160EQB	129.95	Both	7	No	12	75	18	0.25	6 x 1 1/4 x 5	OK for common ground, fader. Fader.
	180EQB	169.95	Both	7	No	12	80	24	0.18	5 7/8 x 1 1/4 x 7	
	50B	99.95	Amp				70	18	0.8	2 x 1 x 3 1/4	

AMPS/EQUALIZERS



Magnadyne EQ50B

MANUFACTURER	Model	Price \$	Amp = Amp, EQ = Equalizer, Both = Both, Pre = Preamp	Number of EQ Bands	Separate Controls for Each Stereo Channel?	Boost Cut Range, ±dB	S/N Ratio, dB	Watts into 4 Ohms, per IHF A-202	% THD @ Rated Output, per IHF A-202	Dimensions, Inches	Notes
PHILIPS	EN220 EN250 EN2100 EN600	199.95 349.95 449.95 299.95	Amp Amp Amp Pre, EQ	6	Yes	12	100 100 100 80	20 50 100	0.05 0.05 0.05 0.05	5 x 7 x 2 1/4 6 1/2 x 9 1/2 x 2 1/4 6 1/2 x 12 x 2 1/4 6 x 6 1/2 x 1 1/2	Switchable input sensitivity. As above. As above. Master control and accessory jack inc.
PIONEER	GM-2 GM-4 GM-120 CD-5 BP-320 AD-360 BP-520 BP-720	44.95 69.95 149.95 129.95 69.95 149.95 109.95 169.95	Amp Amp Amp EQ Amp Amp Both Both	7	No	12	75 70 75 70 70 70 70 70	2.8 10 30	0.8 0.8 0.3	1 x 5 1/8 x 3 3/8 1 x 5 1/8 x 6 2 3/8 x 7 x 8 1/4 2 x 5 1/8 x 6 1/2 2 x 4 1/4 x 5 1/8 2 1/8 x 9 x 8 2 x 5 1/8 x 6 2 x 5 1/8 x 6	
RADIO SHACK	12-1862 12-1863 12-1860	79.95 49.95 47.95	Both Both †	7 5	No No	12	40 40	40	1 0.3 1	2 x 5 1/2 x 6 2 x 5 1/2 x 6 1 1/4 x 4 1/8 x 6 1/8	Seven-band fader. Five-band fader. †Booster.
ROADSTAR	RS-691	134.00	Both	8	No	18	70	15	0.1	5 1/4 x 1 1/8 x 5 1/8	Echo, fader, level meter, power defeat switch, ESS.
ROCKFORD FOSGATE	Punch 40 Punch 100 Z-2 ZK-2 PR-2100 HR RX-5 System 40	200.00 350.00 520.00 700.00 770.00 950.00 450.00	Amp Amp Pre, EQ Pre, EQ Amp† Pre, EQ Amp	2 2 5 5 3 5 2	No No No No Yes No No	12	75 80 80 80 80 80 75	20 50 50 50 100 100 20	0.05 0.05 0.05 0.05 0.05 0.05 0.05	5 1/4 x 7 1/4 x 1 1/4 7 1/4 x 7 1/4 x 1 1/4 Two Pieces Two Pieces Two Pieces Two Pieces 5 1/4 x 7 1/4 x 1 1/4	High/low inputs. As above. Two Pieces With dbx. †Switchable crossover, biamplified. With dbx, switchable crossover. Inc. pair of 6 x 9 woofers and pair of midrange tweeters.
ROYAL SOUND	RC2000 RA600N RA600 EA500 EA600 EA700	350.00 100.00 350.00 90.00 150.00 200.00	Pre, EQ Amp Amp Both Both Both	7	No	12	90 70 95 80 80 80	40 70 20 40 60	0.02 0.2 0.06 0.2 0.2 0.2	2 3/8 x 4 1/2 x 6 5/8 1 3/4 x 6 1/4 x 5 3/4 2 3/4 x 7 1/8 x 9 3/8 4 1/4 x 1 1/4 x 6 2 3/8 x 7 1/2 x 6 3/8 2 1/4 x 6 3/4 x 6 3/8	Fader As above plus APC. As above plus ambience control.
SANYO	PA6030 PA6040 PA6050 PA6100 PA6110 EQ26210 EQA600	79.95 99.95 129.95 159.95 179.95 79.95 129.95	Amp Amp Amp Amp Amp EQ Both	7	No	12	70† 70† 70† 70† 70† 70† 70†	15 20 25 50 50	0.3 0.1 0.05 0.05 0.05	6 x 3 3/8 x 1 7 1/8 x 6 x 2 7 1/2 x 7 1/2 x 3 3/4 7 1/2 x 7 1/2 x 3 3/4 7 1/2 x 7 1/2 x 3 3/4 6 1/2 x 4 3/4 x 2 6 x 5 3/4 x 2	†A weighted. Push-type connectors. Line or speaker level inputs. Fader. As above.
SONY	XM-120 XM-55 XM-45 XM-25 XM-E7 XE-9 XE-9B	349.95 149.95 99.95 59.95 219.95 129.95 129.95	Amp Amp Amp Amp Both EQ EQ	2	No	+6	92 84 78 78 84 90 90	60 14 10 4.5 14	0.1 0.5 0.8 0.8 0.5 0.01 0.01	7 1/8 x 1 1/4 x 10 3/8 5 3/8 x 6 3/8 x 6 1/2 5 3/8 x 1 3/8 x 5 1/4 3 3/8 x 4 3/8 x 4 1/8 5 3/8 x 4 1/8 x 6 5 3/8 x 1 3/8 x 7 5 3/8 x 6 3/8 x 7	Three-way input with gain control. As above. Two-way input for preamp or speaker level. Three-way input with gain control.
SPARKOMATIC	GE-1000 GE-50 LC-102 LC-52	100.00 80.00 40.00 20.00	Both Amp Both Amp	7 6 3		12	70 70 70 70	80 22.5 20 20	0.01 10 10 10	7 1/2 x 2 1/2 x 9 1/4 4 3/4 x 1 3/8 x 4 3/4 5 1/2 x 1 1/8 x 6 3/8 4 1/8 x 1 1/4 x 4	
SPECO	EPB-50 EPB-40 SPB-40	119.95 110.95 52.00	Both Both Amp	5	No	12	25	25	10	1 3/8 x 4 3/4 x 6 1 3/4 x 4 3/8 x 6 1/2 1 3/4 x 4 3/8 x 6 1/2	Compatible with common and floating ground radios (BTL). As above.
SPECTRON	602 600 302	450.00 340.00 260.00	Amp Amp EQ	3	No	20	95 95 72	75 80	0.05 0.05 0.05	3 1/4 x 7 1/2 x 5 1/4 3 3/4 x 7 1/4 x 5 1/2 1 3/4 x 4 1/2 x 3 3/4	Adjustable sensitivity.
ZAPCO	PEQ PX 150H 150HA	320.00 400.00 450.00 625.00	EQ EQ Amp Amp	9 4	Yes No	18 18	86 92 106 106	75 150 155	0.05 0.02 0.2 0.03	4 1/4 x 8 3/4 x 1 1/8 2 x 4 x 6 1/2 5 1/4 x 5 1/4 x 1 3/4† 7 x 8 x 2 1/8†† †	Adjustable input matching. Paraphonic EQ/active crossover. †Amp, ††power supply. †Units as above plus ESM, 3 x 5 1/4 x 1 1/4, increasing power and bandwidth.

8TH ANNUAL CAR STEREO DIRECTORY

RADIOS/TAPE PLAYERS



Audiovox AVX-615

MANUFACTURER	Model	Price, \$	Stereo (S) Mono (M), or 4-Channel (4)	FM Sensitivity, uV (For 30dB Outlining)	Sensitivity, dB	Preamp Output?	Average Watts Channel, per IHR A-202	Amplifier S/N Ratio, dB	% THD at Rated Output	Local/Distance Switch?	Total Number of Presets	Separate Tone Controls?	Cassette (C), 8-Track (8)	Auto Reverse?	Noise Reduction Circuit? See Code	Bias EQ Switch?	Fast Tape Speeds?	In-Dash (I), Under-Dash (U), Convertible (C)	Dimensions, Inches
AIWA	CTR-70	270.00	S			8		Yes	12	No	C	Yes	No	No	Yes	I	2 x 4 3/4 x 7 1/4		
	CTR-50	200.00	S			8		Yes	5	No	C	Yes	No	No	Yes	I	2 x 4 3/4 x 7 1/4		
	CTR-30	180.00	S	2.0		8	50	Yes	0	No	C	Yes	No	No	Yes	I	1 3/4 x 6 3/8 x 4 3/4		
	CTR-20	125.00	S	2.0		8	50	Yes	0	No	C	Yes	No	No	Yes	I	1 3/4 x 6 3/8 x 4 3/4		
ALPINE	7124	219.95	S	1.8	50	Yes	6	8	No	10	No	C	Yes	Yes	Yes	I	6 1/4 x 2 x 4 1/2		
	7128	299.95	S	2.2	80	Yes	6	8	No	10	No	C	Yes	Yes	Yes	I	7 x 2 x 5 1/4		
	7135	349.95	S	1.8	80	Yes	6	8	Yes	10	Yes	C	Yes	Yes	Yes	I	6 1/4 x 2 x 5 1/4		
	7140	269.95	S	1.8	60	Yes	6	8	Yes	10	Yes	C	Yes	Yes	Yes	I	6 1/4 x 2 x 5 1/4		
	7146	499.95	S	1.8	80	Yes	6	8	Yes	10	Yes	C	Yes	B	Yes	I	7 1/4 x 2 x 5 1/4		
	7225	249.95	S	1.8	60	Yes	16	8	Yes	10	Yes	C	Yes	Yes	Yes	I	6 1/4 x 2 x 5 1/4		
	7337	499.95	S	1.8	80	Yes			Yes	10	Yes	C	No	B	Yes	I	6 1/4 x 2 x 5 1/4		
	7138	349.95	S	1.8	80	Yes	6	8	No	10	No	C	Yes	B	Yes	I	7 x 2 x 5 1/4		
	7136	449.95	S	1.8	80	Yes	6	8	Yes	10	No	C	Yes	B	Yes	I	6 1/4 x 2 x 5 1/4		
	7125	199.95	S	1.8	60	No	6	8	No	10	No	C	Yes	No	Yes	I	6 1/4 x 2 x 4 1/2		
	AMERICAN AUDIO	3505	188.95	S			No	5	45	10	Yes	5	No	C	Yes		Yes	I	7 x 5 1/4 x 2
2405		159.95	S			No	5	45	10	Yes	5	No	C	No		Yes	I	7 x 4 3/4 x 2 1/4	
1705		104.95	S		53	No	5	45	10	No	No	C	No		Yes	I	7 x 4 3/4 x 1 3/4		
505		37.95	S			No	5	45	10	No	No	C	No		Yes	U	4 1/2 x 6 1/4 x 2		
2255		146.95	4			No	5	40	10	Yes	5	No	8	No	No	I	7 x 4 3/4 x 2 1/4		
1655		99.95	4			No	5	40	10	Yes		No	8	No	No	I	7 x 4 3/4 x 2		
7100		169.95	S			No	18	50	3	No	No	C	No		Yes	I	7 x 5 3/8 x 1 3/4		
3705		199.95	S			No	5	45	10	No	5	No	C	Yes	Yes	I	7 x 5 3/8 x 1 3/4		
4600		157.95	S		53	No	5	45	10	No	No	C	Yes	Yes	Yes	I	7 x 5 1/2 x 1 3/4		
2500		136.95	S		53	No	5	45	10	No	No	C	Yes	Yes	Yes	I	7 x 5 1/2 x 1 3/4		
1100		94.95	S		52	No	5	45	10	No	No	C	No	Yes	Yes	I	7 x 4 3/4 x 1 3/4		
5300		159.95	S		53	No	5	45	10	No	5	No	C	No	Yes	I	6 1/4 x 4 3/4 x 1 3/4		
5100		109.95	S		53	No	5	45	10	No	No	C	No	Yes	Yes	I	6 1/4 x 4 3/4 x 1 3/4		
ARA-MOTOROLA		P-100	189.95	S	3.5	50	No	3		1.0	Auto	0	No	C	No	No	Yes	I	2 x 5 x 7
	P-200	209.95	S	3.5	50	No	3		1.0	Auto	5	Yes	C	No	B	Yes	I	2 x 5 x 7	
	P-300	239.95	S	3.5	50	No	3		1.0	Auto	0	Yes	C	Yes	B	Yes	I	2 x 5 x 7	
	P-400	269.95	S	3.5	50	No	3		1.0	Auto	5	Yes	C	Yes	B	Yes	I	2 x 5 x 7	
	P-500	289.95	S	3.5	50	Yes	3		1.0	Auto	5	Yes	C	Yes	B	Yes	I	2 x 5 x 7	
	P-1000	399.95	S	3.5	60	Yes	3		1.0	Auto	10	Yes	C	Yes	B	Yes	I	2 x 5 x 7	
AUDIOBAHM ELECTRONICS	AB-1000 ETX	569.95	S	20	50	Yes	5	40	10	Yes	12	EQ	C	Yes	B	Yes	I	7 x 2 1/2 x 6 1/4	
	AB-39 ETX	509.95	S	2.5	50	Yes	5	40	10	Yes	12	Yes	C	Yes	B	Yes	I	7 x 2 x 5 3/8	
	AB-38 CSPB	329.95	S	3	50	Yes	5	40	10	Yes	5	Yes	C	Yes	B	Yes	I	7 x 2 x 5 3/8	
AUDIOVOX	AVX-400	130.00	S	3	60	No	5	70	10.0	Yes	0	No	8	No	No	No	I	2 x 7 1/8 x 5 1/2	
	AVX-600	130.00	S	3	60	No	5	70	10.0	Yes	0	No	C	No	No	Yes	I	2 x 7 1/8 x 5	
	AVX-605	130.00	S	3	60	No	5	70	10.0	Yes	0	No	C	No	No	Yes	I	1 3/4 x 6 1/4 x 4 1/2	
	AVX-615	210.00	S	3	60	No	5	70	10.0	No	0	No	C	Yes	No	Yes	I	1 3/4 x 6 1/4 x 5	
	AVX-680	250.00	S	2	60	No	16	75	10.0	No	0	Yes	C	No	B	Yes	I	2 1/2 x 7 x 5 1/4	
	AVX-685	210.00	S	3	60	No	16	75	10.0	Yes	0	Yes	C	No	No	Yes	I	2 x 7 x 5	
	AVX-730	210.00	S	3	60	No	5	70	10.0	No	5	No	C	No	No	Yes	I	1 3/4 x 6 1/4 x 4 3/4	
	AVX-780	300.00	S	2	60	No	16	75	10.0	No	5	Yes	C	Yes	No	Yes	I	1 3/4 x 7 x 5 1/4	
	AVX-900	260.00	S	3	60	No	5	70	10.0	Yes	0	No	C	No	No	Yes	I	2 x 7 1/8 x 5 1/2	
	AVX-950	420.00	S	2	60	No	5	70	10.0	Yes	12	No	C	No	No	Yes	I	2 x 7 1/8 x 6	
	AVX-610	150.00	S	3	60	No	5	70	10.0	Yes	0	No	C	No	No	Yes	I	2 x 7 1/8 x 5 1/2	
	2000	106.00	S	3	60	No	5	70	10.0	Yes	0	No	8	No	No	No	I	2 x 7 1/8 x 5 1/2	
	3000	106.00	S	3	60	No	5	70	10.0	Yes	0	No	C	No	No	Yes	I	2 x 7 1/8 x 5 1/2	
	UC-10	54.00	S			No	4.5	65	10.0	0	No	C	No	No	No	Yes	U	1 5/8 x 5 1/4 x 5 1/2	
	C-902A	50.00	S			No	4.5	65	10.0	0	No	8	No	No	No	No	U	2 x 5 1/4 x 6 1/2	
	C-988	79.90	S			No	5	65	10.0	0	No	C	No	No	No	Yes	U	1 7/8 x 5 1/4 x 6 3/8	
	AUTOTEK	CSR3050	169.95	S	2	60	No	6.75	60	1	Auto	5	No	C	No	No	Yes	I	1 3/4 x 4 1/4 x 6 1/4
CSR3150		209.95	S	2	60	No	2.5	60	1	Yes	5	Yes	C	Yes	No	Yes	I	1 3/4 x 4 3/4 x 6 1/4	
CSR2200		209.95	S	2	60	Yes	2.5	60	1	Yes	0	Yes	C	Yes	No	Yes	I	2 x 5 1/4 x 7	
CSR2300		259.95	S	2	60	Yes	2.5	60	1	Yes	0	Yes	C	Yes	B	Yes	I	2 x 5 1/4 x 7	
CSR3300		299.95	S	2	60	Yes	2.5	60	1	Yes	5	Yes	C	Yes	B	Yes	I	2 x 5 1/4 x 7	
BON SONIC	R453J	100.00	S	15	30	No	7	40	3.0	No	0	No	C	Yes	No	Yes	I	1 3/4 x 5 1/4 x 6	
	201	50.00	S	15	30	No	8	45	3.0	No	0	No	C	No	No	Yes	I	2 1/4 x 4 3/4 x 7	
	560-b	179.00	S	5	40	No	15	45	5	No	0	Yes	C	Yes	Yes	Yes	I	1 3/4 x 5 3/4 x 7; EQ inc.	
	014	99.00	S	10	30	No	7	40	3.0	Yes	5	No	C	Yes	No	Yes	I	1 3/4 x 5 3/4 x 7	
	103	50	S	15	30	No	6	45	3.0	No	0	No	8	No	No	No	I	2 1/8 x 4 3/4 x 7	
BOSE	CRC	480.00	S	19dB	55	Yes		0.4	Yes	12	Yes	C	Yes	B	Yes	Yes	I	7 x 5 1/4 x 2 1/8	



RADIOS/TAPE PLAYERS

Bose CRC

MANUFACTURER	Model	Price, \$	Stereo (S), Mono (M), or 4 Channel (4)		FM Sensitivity, μ V (For 30dB Distortion)	Selectivity, dB	Preamp Output?	Average Watts, Channel, per IWE A-202	Amplifier S/N Ratio, dB	% THD at Rated Output	Local Distance Switch?	Total Number of Presets	Separate Tone Controls?	Cassette (C), 8-Track (8)	Auto Reverse?	Noise Reduction Circuit?	Bass EQ Switch?	Fast Tape Speeds?	In-Dash (I) Under-Dash (U), Convertible (C)	Dimensions, Inches
			NR Code	NR Code																
CONCORD ELECTRONICS	HPL-101	249.95	S	11.2 dB	70	Yes	5	48	0.8	Yes	0	Yes	C	No	B	Yes	Yes	I	7 1/8 x 2 1/8 x 4 3/4	
	HPL-112	279.95	S	11.2 dB	70	Yes	5	48	0.8	Yes	0	Yes	C	No	B	Yes	Yes	I	7 1/8 x 2 1/8 x 4 3/4	
	HPL-115	349.95	S	11.2 dB	70	Yes	12	48	0.8	Yes	0	Yes	C	No	B	Yes	Yes	I	7 1/8 x 2 x 6	
	HPL-118	379.95	S	11.2 dB	70	Yes	12	48	0.8	Yes	5	Yes	C	No	B	Yes	Yes	I	7 x 2 x 6	
	HPL-120	429.95	S	11.2 dB	70	Yes	12	48	0.8	Yes	0	Yes	C	No	B	Yes	Yes	I	7 1/8 x 2 x 6	
	HPL-130	529.95	S	11.2 dB	70	Yes	12	48	0.8	Yes	12	Yes	C	No	B	Yes	Yes	I	7 1/8 x 2 x 6	
	HPL-515	469.95	S	11.2 dB	70	Yes	12	48	0.8	Yes	0	Yes	C	No	B	Yes	Yes	I	7 1/8 x 2 x 6 1/2	
	HPL-118F (With fader)	429.95	S	11.2 dB	70	Yes	12	48	0.8	Yes	5	Yes	C	No	B	Yes	Yes	I	7 x 2 x 6	
HPL-122	449.95	S	11.2 dB	70	Yes	5	48	0.8	Yes	10	Yes	C	No	B	Yes	Yes	I	7 x 2 x 5		
FUJITSU TEN	CE-4133	649.95	4	20dB	65	Only				Yes	10	EQ	C	Yes	B	Yes	Yes	I	7 x 2 x 5 1/8	
	CR-1134	319.95	4	20dB	60	No	10	60	1	Yes	5	Yes	C	Yes	B	No	Yes	I	7 x 1 3/4 x 5 3/4	
	CR-1031	289.95	S	20dB	60	No	7			Yes	5	Yes	C	Yes	B	No	Yes	I	7 x 1 3/4 x 5 3/4	
	DP-1000	129.95	S	22dB	64	No	4			Yes	0	No	C	No	No	No	Yes	I	1 5/8 x 4 3/4 x 6 3/4	
	DP-1006	149.95	S	22dB	64	No	4			Yes	0	Yes	C	No	No	No	Yes	I	1 5/8 x 4 3/4 x 6 3/4	
	GP-1010	189.95	S	22dB	64	No	4			Yes	5	No	C	No	No	No	Yes	I	1 5/8 x 4 3/4 x 6 3/4	
	DP-7872	175.00	S	20dB	64	No	5			No	0	No	C	Yes	No	No	Yes	I	1 3/4 x 5 3/8 x 7	
	CR-1030	239.95	S	20dB	64	No	5			No	5	No	C	Yes	No	Yes	Yes	I	1 3/4 x 5 3/8 x 7	
	CA-1130	299.95	S	20dB	64	No	16			No	5	No	C	Yes	B	Yes	Yes	I	1 3/4 x 5 3/8 x 7	
	EP-820	599.95	S	20dB	64	Yes				Yes	10	EQ	C	Yes	B	Yes	Yes	I	1 3/4 x 5 3/8 x 7	
	DP-620	150.00	S	20dB	64	No	5			No	0	No	C	Yes	No	No	Yes	I	1 3/4 x 5 1/2 x 7	
	DP-640	184.95	S	20dB	64	No	5			No	0	No	C	Yes	No	No	Yes	I	1 3/4 x 5 1/2 x 7	
	DP-644	229.95	S	20dB	64	No	16			No	0	Yes	C	Yes	No	Yes	Yes	I	1 3/4 x 5 1/2 x 7	
	SP-600	110.00	S	20dB	64	No	5			No	0	No	C	No	No	No	Yes	U	2 x 5 3/4 x 4 3/4	
	CP-5-81	120.00	S			No	5			No	0	No	C	No	No	No	Yes	U	2 x 6 3/4 x 5 7/8	
	FULTRON	16-6900	379.95	S			Yes	4		3	No	12	Yes	C	Yes	B	Yes		I	2 x 4 7/8 x 7
		16-6700	199.95	S			Yes	4		3	No	5	Yes	C	Yes	B	No	Yes	I	1 5/8 x 4 1/4 x 7
16-6100		149.95	S			Yes	4		3	No	5	No	C	No	No	No	I	1 5/8 x 4 7/8 x 7		
16-5700		169.95	S			Yes	4		3	No	Yes	C	Yes	B	No	No	I	1 5/8 x 4 7/8 x 7		
16-5500		139.95	S			No	4		3	Yes	No	C	Yes	No	No	No	I	1 3/4 x 4 3/4 x 6 5/8		
16-5600		119.95	S			No	4		3	Yes	No	8	No	No	No	No	I	1 5/8 x 4 3/4 x 7		
16-5080		99.95	S			No	4		3	Yes	No	C	No	No	No	No	I	1 5/8 x 4 1/4 x 6 1/4		
16-5000		89.95	S			No	4		3	Yes	No	C	No	No	No	No	I	1 5/8 x 4 3/4 x 6 5/8		
JENSEN	RE518 ETR	399.95	4	2.5 @ 50dB	60	No	4	50	2.5	Yes	10	Yes	C	Yes	B	Yes	Yes	I	1 3/4 x 4 3/4 x 7 1/8	
	RE512 ETR	369.95	4	2.5 @ 50dB	60	No	4	50	2.5	Yes	10	Yes	C	Yes	Nb	No	Yes	I	1 3/4 x 4 1/2 x 6 3/8	
	R425	349.95	4	2.5 @ 50dB	60	Yes	3.5	55	2.5	Auto	5	Yes	C	Yes	B	No	Yes	I	2 x 5 3/8 x 7 1/8	
	RE508 ETR	299.95	S	2.5 @ 50dB	60	No	4	50	2.5	Auto	8	No	C	Yes	No	No	Yes	I	1 3/4 x 4 3/4 x 7 1/8	
	T415 Tuner	299.95	S	2.5 @ 50dB	60	Only		55		No	5	Yes	C	Yes	B	No	Yes	I	2 x 5 3/8 x 7	
	R406	289.95	4	2.5 @ 50dB	60	No	2.5	50	2.5	Auto	5	Yes	C	Yes	No	No	Yes	I	1 3/4 x 6 x 7	
	R401	259.95	4	2.5 @ 50dB	60	No	3.5 @	52	2.5	No	5	Yes	C	No	No	No	Yes	I	1 3/4 x 5 3/8 x 7 1/8	
	R210	199.95	4	5.0 @ 50dB	60	No	3.5	50	2.5	Auto	5	No	C	No	No	No	Yes	I	1 3/4 x 4 3/4 x 6 3/8	
	R200	149.95	S	2.0	No	3.5	50	2.5	Auto	0	No	C	No	No	No	No	Yes	I	1 3/4 x 4 1/2 x 6 3/8	
	JR115	239.95	S	3.2 @ 50dB	70	No	3.5	50	2.5	Auto	5	No	C	Yes	No	No	Yes	I	1 5/8 x 5 3/8 x 7 1/8	
	JR110	199.95	S	5.0 @ 50dB	60	No	3.5	50	2.5	Auto	5	No	C	No	No	No	Yes	I	1 3/4 x 4 3/4 x 6 3/8	
	JR105	169.95	S	3.2 @ 50dB	65	No	3.5	50	2.5	Auto	0	Yes	C	No	No	No	Yes	I	1 3/4 x 4 5/8 x 7 1/8	
JR100	149.95	S	2.0	No	3.5	50	2.5	Auto	0	No	C	No	No	No	No	Yes	I	1 3/4 x 4 1/2 x 6 3/8		
JET SOUND	JS9351	109.95	S	1.5	50	No	7	50	1.0	Yes		Yes	C	No		No	Yes	I	6 1/4 x 1 3/4 x 4 3/4	
	JS9401	159.95	S	1.5	50	No	7	50	1.0	Yes		Yes	C	Yes	B	No	Yes	I	6 1/4 x 1 3/4 x 4 3/4	
	JS9417	229.95	S	1.5	50	Yes	7	50	1.0	Yes		Yes	C	Yes	B	Yes	Yes	I	6 5/8 x 1 3/4 x 4 1/8	
	JS9418	269.95	S	1.5	50	Yes	7	50	1.0	Yes	10	Yes	C	Yes	B	Yes	Yes	I	6 5/8 x 1 3/4 x 4 1/8	
	JS9419	299.95	S	1.5	50	Yes	7	50	1.0	Yes	10	Yes	C	Yes	B	Yes	Yes	I	6 5/8 x 1 3/4 x 4 1/8	
JVC	KS-R3	219.95	S	3 @ 50 dB	65	No	10	52	1.0	Yes		Yes	C	No	B	Yes	Yes	I	1 3/4 x 7 x 5 1/8	
	KS-R5	299.95	S	3 @ 50 dB	65	No	10	52	1.0	Yes	5	Yes	C	Yes	B	Yes	Yes	I	2 x 7 x 6	
	KS-R7	379.95	S	3 @ 50 dB	65	No	10	52	1.0	Yes	12	Yes	C	Yes	B	Yes	Yes	I	2 x 7 x 6	
KENWOOD	KRC-1022	649.00	S	2.3 @ 50dB	65	Yes				Yes	12	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 2 x 5 3/4	
	KRC-922	569.00	S	2.3 @ 50dB	65	Yes				Yes	10	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 2 x 5 3/4	
	KRC-722	499.00	S	2.3 @ 50dB	65	Yes				Yes	10	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 2 x 5 1/4	
	KRC-322	299.00	S	2.5 @ 50dB	65	Yes				Yes	5	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 2 x 5 1/4	

(Continued)

8TH ANNUAL CAR STEREO DIRECTORY

RADIOS/TAPE PLAYERS



Jensen RE 518

MANUFACTURER	Model	Price \$	Stereo (S), Mono (M), or 4-Channel (4)		FM Sensitivity, V (For 30-dB Outlines)	Selectivity, dB	Preamp Output?	Average Watts Per Input A-202	Amplifier S/N Ratio, dB	% THD at Rated Output	Local Distance Switch?	Total Number of Presets	Separate Tone Controls?	Cassette (C), B Track (B)	Auto Reverse?	Noise Reduction?	Bias EQ Switch?	Fast Tape Speeds?	In-Dash (I), Under-Dash (U), Convertible (C)	Dimensions, inches
			FM Sensitivity, V (For 30-dB Outlines)	FM Sensitivity, V (For 30-dB Outlines)																
KENWOOD (Continued)	KRC-712	519.00	S	2.3 @ 50dB	65	Yes	15		Yes	10	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 2 x 6		
	KRC-511	439.00	S	2.3 @ 50dB	65	Yes	4		Yes	10	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 2 3/4 x 5 1/4		
	KRC-312	279.00	S	2.5 @ 50dB	65	Yes	15		Yes	5	Yes	C	Yes		Yes	Yes	I	7 1/8 x 2 x 5 1/4		
	KRC-311	259.00	S	2.5 @ 50dB	65	Yes	4			5		C	Yes		Yes	Yes	I	7 1/8 x 2 x 5 1/4		
	KRC-512	429.00	S	2.4 @ 50dB	65	Yes	5			10	Yes	C	Yes	B	Yes	Yes	I	6 3/8 x 1 3/4 x 4 3/4		
	KRC-411	369.00	S	2.4 @ 50dB	65		5		Yes	10		C	Yes		Yes	Yes	I	7 1/8 x 1 3/4 x 4 3/4		
	KRC-212	249.00	S	2.5 @ 50dB	65	Yes	5			5	Yes	C	Yes		Yes	Yes	I	6 3/8 x 2 x 4 7/8		
	KRC-112	199.00	S	2.5 @ 50dB	65	Yes	5					C	Yes			Yes	Yes	I	6 3/8 x 2 x 4 7/8	
	KTC-767	329.00	S	2.2 @ 50dB	80	Yes				Yes	12	Yes						U	5 7/8 x 1 7/8 x 5 7/8	
	KXC-757	299.00	S			Yes						Yes	C	Yes	B	Yes	Yes	U	5 7/8 x 1 7/8 x 5 7/8	
KZC-657	299.00	S			Yes		15				Yes	C	Yes	B	Yes	Yes	U	5 7/8 x 1 7/8 x 5 7/8		
KRACO	ETR-1098	279.95	S	10	40	No	4.5	45	10	No	10	No	C	Yes	B	Yes	Yes	C	7 x 5 1/2 x 2	
	KHP-1087	279.95	S	10	50	No	15	48	10	Yes	8	Yes	C	Yes	B	No	Yes	C	7 x 5 1/2 x 2	
	KHP-1085	249.95	S	2	40	No	15	50	10	Yes	0	Yes	C	Yes	B	Yes	Yes	C	7 x 5 1/2 x 2	
	KGE-803	249.95	S	2	45	No	15	40	10	No	0	No	C	Yes	No	No	Yes	C	7 x 5 1/2 x 1 3/4	
	KID-597	239.95	S	10	50	No	5	47	10	No	8	Yes	C	Yes	No	No	Yes	C	7 x 5 1/2 x 2	
	KID-588B	169.95	S	13	45	No	3.6	47	10	Yes	0	Yes	C	Yes	No	No	Yes	C	7 x 6 x 2	
	KGE-801	239.95	S	10	50	No	15	48	10	Yes	0	Yes	C	No	No	Yes	Yes	C	7 x 5 x 2	
	KXI-89	189.95	S	2	35	No	4.5	45	10	No	0	Yes	C	Yes	No	No	Yes	C	6 x 5 x 2	
	MAGNA DYNE	M2100B	89.95	S	10	50	No	0	50	8	Yes		Yes	C				Yes	I	1 3/4 x 4 1/2 x 7
MC2600		119.95	S	10	50	No	4	50	1	Yes		Yes	C	Yes			Yes	I	1 3/4 x 4 3/8 x 6	
MIDLAND INTERNATIONAL	67-300	51.00	S	5	45	No	4.8	65	10	Yes	0	Yes	C	No	No	No		I	4 3/8 x 1 3/4 x 6 3/8	
	67-350	49.95	S	5	45	No	4.8	65	10	Yes	0	Yes	C	No	No	No		I	4 3/8 x 1 3/4 x 6 3/8	
	67-434	99.95	S	5	45	No	4.8	65	10	Yes	0	Yes	C	No	No	No		I	4 3/8 x 1 3/4 x 6 3/8	
	67-533	99.95	S	5	45	No	4.8	65	10	Yes	0	Yes	C	No	No	No		I	4 3/8 x 1 3/4 x 6 3/8	
	67-456	119.95	S	5	45	No	4.8	65	10	Yes	0	Yes	C	No	No	No		I	4 3/8 x 1 3/4 x 6 3/8	
	67-463	139.95	S	5	45	No	4.8	60	10	Yes	0	Yes	C	No	No	No		I	4 3/8 x 1 3/4 x 7	
	67-458	139.95	S	5	40	No	4.8	40	10	Yes	0	Yes	C	Yes	No	No		I	5 1/8 x 1 3/4 x 7	
	67-470	149.95	S	5	40	No	4.8	45	10	Yes	0	Yes	C	No	No	No		I	5 1/8 x 1 3/8 x 7 1/8	
MITSUBISHI	CZ747	499.95	S	24dB	80	Yes				Yes	5	Yes	C	Yes	B	Yes	Yes	I		
	CZ725	229.95	S	22dB	80	Yes				Yes		Yes	C	Yes	B	Yes	Yes	I		
	RX791	349.95	S	22dB	86		14		5		5	Yes	C	Yes	B	Yes	Yes	I		
	RX79	289.95	S	24dB	70		9		5	Yes	5	Yes	C	Yes	B	Yes	Yes	I		
	RX723	159.95	S	17dB	68		3.5		5				C					I		
	GX101	99.95	S			Yes	3.5		5				C					U		
	GX102	169.95	S			Yes	3.5		5			Yes	C	Yes				U		
	RX103	169.95	S			Yes	3.5		5			Yes	C					U		
	RX711	179.95	S	17dB	70	Yes	3.5		5	Yes	5	No	C	No	No	Yes	Yes	I	7 3/8 x 2 1/2 x 4 3/4	
	RX726	199.95	S	23dB	65	No	7		3.5	Yes	0	No	C	Yes	No	Yes	Yes	I	6 3/8 x 2 x 4 3/4	
	RX735	319.95	S			No	8		4.5	Yes	6		C	Yes	No	No	Yes	I	6 3/8 x 2 x 4 3/4	
RX755	269.95	S			No	8		5	Yes	5		C	Yes	No	No		I	7 x 2 x 6		
PANASONIC	CQ-S900	449.95	S	19dB	Yes	3	50	3.0	Yes	12	Yes	C	Yes	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S820	349.95	S	19dB	Yes	3	50	3.0	Yes	10	Yes	C	No	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S747	249.95	S	19dB	No	14	50	3.0	No	5	Yes	C	No	B	Yes	Yes	Yes	I	7 x 5 1/8 x 1 3/4	
	CQ-S742	259.95	S	15dB	No	3	50	3.0	No	5	Yes	C	Yes	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S708	219.95	S	19dB	No	3	50	3.0	No	5	Yes	C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S717	219.95	S	19dB	No	3	50	3.0	No	5	No	C	Yes	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S661	199.95	S	15dB	No	2	50	3.0	No	5	No	C	No	B	Yes	Yes	Yes	I	7 x 5 1/4 x 1 3/4	
	CQ-S646	169.95	S	15dB	No	2	50	3.0	No	5	No	C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 1 3/4	
	CQ-S791	319.95	S	15dB	Yes	3	50	3.0	No	5	Yes	C	Yes	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S761	289.95	S	15dB	No	3	50	3.0	No	5	Yes	C	Yes	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S737	239.95	S	15dB	No	3	50	3.0	No	5	No	C	Yes	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S700	229.95	S	15dB	No	3	50	3.0	No	5	Yes	C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S707	219.95	S	15dB	No	3	50	3.0	No	5	No	C	Yes	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-S686	199.95	S	15dB	No	3	50	3.0	No	5	No	C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
	CQ-6800	149.95	S	10dB	No			45					C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 1 3/4
	CX-1000	89.95	S										C	No	No	No	Yes	Yes	U	5 1/2 x 6 x 2
	CQ-S756	269.95	S	15dB	No	3	50	3	No	5	No	C	Yes	B	Yes	Yes	Yes	I	7 x 5 1/4 x 2 1/8	
CQ-S703	229.95	S	15dB	No	3	50	3	No	5	No	C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8		
CQ-S680	199.95	S	15dB	No	3	50	3	No	5	No	C	No	No	No	Yes	Yes	I	7 x 5 1/4 x 2 1/8		
PIONEER	TP-6006	129.95	S		No	No	3.0	5.0	Yes		No	B						I	2 x 7 1/8 x 7 1/2	
	KP-373	114.95	S		No	No	3.0	5.0			No	C		No				U	2 x 4 3/4 x 6 1/8	
	KP-575	129.95	S		No	No	3.0	5.0			No	C		No				U	2 x 4 3/4 x 6 1/8	
	KP-500	189.95	S	14.3	No	No	3.0	5.0	Yes		Yes	C		No				U	3 x 7 3/8 x 7 1/2	
	KP-1500	129.95	S	20.7	No	No	2.5	5.0	Yes		No	C		No				I	1 3/4 x 6 3/8 x 5 3/4	
	KP-2500	149.95	S	19.2	No	No	3.2	5.0			No	C		No				I	2 x 7 1/8 x 7 1/8	
	KP-4500	169.95	S	19.2	No	No	3.2	5.0			No	C		No				I	2 x 7 1/8 x 7 1/8	
	UKP-2200	169.95	S	23.2	No	No	3.2	5.0			No	C		No				I	1 3/4 x 7 1/8 x 5 7/8	
	KP-3500	179.95	S	23.2	No	No	3.0	5.0	Yes		No	C		No				I	2 x 7 1/8 x 6 3/4	

RADIOS/TAPE PLAYERS



Pioneer UKE-7100

MANUFACTURER	Model	Price \$	Stereo (S) Mono (M), or 4-Channel (4)		Selectivity, dB	Preamp Output, V	Average Watts Channel, per IHF A-202	Amplifier S/N Ratio, dB	% THD at Rated Output	Local Distance Switch?	Total Number of Presets	Separate Tone Controls?	Cassette (C), 8-Track (8)	Auto Reverse?	Noise Reduction?	Bias/EO Circuit? See Code	Fast Tape Speeds?	In-Dash (I), Under-Dash (U), Convertible (C)	Dimensions, inches
			FM Sensitivity, dB (For 30-108 Collecting)	FM Sensitivity, dB															
PIONEER (Continued)	KP-5500	189.95	S	14.3	74	No	3.0	5.0	5	No	No	C	No	No	No	No	I	2 x 7 1/8 x 7 1/8	
	UKP-4200	189.95	S	23.2	50	No	3.2	5.0	5	No	No	C	No	No	No	I	1 3/4 x 7 1/8 x 5 7/8		
	KP-8500	199.95	S	14.3	74	No	3.0	5.0	5	Yes	No	C	No	No	No	I	3 x 7 1/8 x 7 1/8		
	UKP-5200	209.95	S	23.2	50	No	3.2	5.0	5	No	No	C	No	B	No	I	2 x 7 1/8 x 5 7/8		
	KP-6500	219.95	S	19.2	74	No	2.9	5.0	5	No	No	C	No	No	No	I	2 x 7 1/8 x 7 1/8		
	UKP-7200	239.95	S	23.2	50	No	3.2	5.0	5	No	No	C	Yes	No	No	I	2 x 7 1/8 x 5 7/8		
	UKP-5600	249.95	S	19.2	70	No	3.2	5.0	5	Yes	Yes	C	No	No	No	I	2 x 7 1/8 x 5 7/8		
	KE-2100	249.95	S	14.3	74	No	3.2	5.0	5	Yes	10	No	C	No	B	Yes	I	2 x 7 1/8 x 7 1/8	
	KP-7500	259.95	S	19.2	74	No	2.9	5.0	5	No	No	C	Yes	B	Yes	I	2 x 7 1/8 x 7 1/8		
	UKP-7600	279.95	S	19.2	70	No	3.2	5.0	5	5	Yes	C	Yes	B	Yes	I	2 x 7 1/8 x 5 7/8		
	UKE-3100	279.95	S	19.2	50	No	3.2	5.0	5	15	Yes	C	No	No	No	I	2 x 7 1/8 x 5 7/8		
	KE-5100	299.95	S	19.2	70	No	2.9	5.0	5	15	No	C	No	No	No	I	2 x 7 1/8 x 5 7/8		
	KE-6100	349.95	S	19.2	70	No	2.9	5.0	5	15	No	C	No	B	Yes	I	2 x 7 1/8 x 7 1/8		
	UKE-7100	399.95	S	19.2	70	No	3.2	5.0	5	15	Yes	C	Yes	B	Yes	I	2 x 7 1/8 x 7 1/8		
	KPX-600	139.95	S	14.3	74	No	No	No	No	15	Yes	C	Yes	B	Yes	I	2 x 7 1/8 x 5 7/8		
	KP-202G	139.95	S	No	No	No	No	No	No	Yes	Yes	C	No	No	Yes	U	2 3/8 x 7 1/8 x 6 7/8		
	KP-404G	159.95	S	No	No	No	No	No	No	Yes	Yes	C	No	B	Yes	U	2 x 5 1/8 x 5 1/8		
	KP-707G	199.95	S	No	No	No	No	No	No	Yes	Yes	C	No	B	Yes	U	2 x 5 1/8 x 5 1/8		
	KP-909G	379.95	S	No	No	No	No	No	No	Yes	Yes	C	Yes	B	Yes	U	2 x 6 x 6 1/4		
	GEX-60 Tuner	219.95	S	19.2	70	No	No	No	No	15	Yes	C	Yes	B	Yes	U	2 x 5 1/8 x 6 1/4		
GEX-90 Tuner	299.95	S	19.2	70	No	No	No	No	15	Yes	C	Yes	B	Yes	U	2 x 5 1/8 x 5 1/8			
UPX-9600	299.95	S	19.2	70	No	No	No	No	5	Yes	C	Yes	B	Yes	I	2 x 7 1/8 x 5 7/8			
KEX-20	299.95	S	19.2	74	No	No	No	No	15	Yes	C	No	B	Yes	I	2 x 7 1/8 x 7 1/8			
KEX-50	379.95	S	19.2	70	No	No	No	No	15	Yes	C	No	B	Yes	I	2 x 7 1/8 x 7 1/8			
KEX-65	419.95	S	19.2	70	No	No	No	No	15	Yes	C	Yes	B	Yes	I	2 x 7 1/8 x 5 1/8			
RADIO SHACK	12-1893	99.95	S	3	No	No	4	50	10	Yes	0	No	C	No	No	Yes	U	1 3/4 x 6 1/4 x 4 1/2	
	12-1807	39.95	S	No	No	No	4	50	10	Yes	0	No	C	No	No	Yes	U	1 1/2 x 5 3/4 x 3 3/4	
	12-1803	59.95	S	No	No	No	4	50	10	Yes	0	No	C	No	No	Yes	C	1 3/8 x 5 1/8 x 5 3/8	
	12-1800	39.95	S	No	No	No	4	50	10	Yes	0	No	C	No	No	Yes	U	2 1/2 x 4 3/4 x 6 1/8	
	12-1894	199.95	S	3	No	14	50	10	10	Yes	5	Yes	C	No	No	Yes	I	2 1/4 x 7 1/8 x 6	
	12-1896	119.95	S	3	No	8	50	10	10	Yes	5	No	C	No	No	Yes	I	1 3/4 x 7 1/8 x 4 3/8	
	12-1880	79.95	S	3	No	8	50	10	10	Yes	0	No	C	No	No	Yes	I	1 3/4 x 7 x 4 3/8	
	12-1892	99.95	S	3	No	4	50	10	10	Yes	0	No	C	No	No	Yes	I	2 1/4 x 6 7/8 x 4 3/8	
	12-1888	169.95	S	3	No	12	50	10	10	Yes	0	Yes	C	No	No	Yes	C	1 3/4 x 7 x 5 7/8	
	12-1889	179.95	S	3	No	7	50	10	10	Yes	0	No	C	No	Yes	Yes	C	1 3/4 x 7 x 5 1/8	
	12-1898	129.95	S	2	No	4	50	10	10	Yes	0	No	C	Yes	Yes	Yes	C	1 3/4 x 4 3/4 x 6 1/4	
	12-1895	89.95	S	2	No	4	50	10	10	Yes	0	No	C	No	Yes	Yes	C	1 3/4 x 6 1/4 x 4 3/4	
ROADSTAR	RS-2970U	319.95	S	5	60	Yes	4	60	5.0	No	5	Yes	C	Yes	Yes	Yes	I	11 1/8 x 2 x 5 3/8	
ROYAL SOUND	RS1900		S	2	50	No	10	50	3.0	Yes	No	No	C	No	No	Yes	I	1 3/4 x 7 x 5	
	RS2010M	120.00	S	2	50	Yes	10	50	3.0	Yes	No	No	C	No	No	Yes	I	1 3/4 x 7 x 5	
	RS2210	205.00	S	2	50	No	25	70	1.0	Yes	No	No	C	No	No	Yes	I	1 3/4 x 7 x 5	
	RS2300		S	2	50	No	10	50	3.0	Yes	No	No	C	Yes	No	Yes	I	1 3/4 x 7 x 5	
	RS2310	260.00	S	2	50	Yes	10	70	1.0	Yes	Yes	Yes	C	Yes	No	Yes	I	1 3/4 x 7 x 5 7/8	
	RS2500		S	2	50	Yes	10	70	1.0	No	Yes	Yes	C	Yes	No	Yes	I	1 3/4 x 7 x 5	
	RS2610	550.00	S	2	50	Yes	25	70	1.0	No	Yes	Yes	C	Yes	Yes	Yes	I	1 3/4 x 7 x 5	
	RS3210	325.00	S	2	50	Yes	25	70	1.0	Yes	Yes	Yes	C	No	Yes	Yes	I	1 3/4 x 7 x 5 7/8	
SANYO	FTC1	59.95	S	26.2dB	35	No	3	10.0	10.0	Yes	Yes	C	No	No	No	Yes	I	6 1/4 x 4 1/2 x 1 3/4	
	FTC2	69.95	S	26.2dB	35	No	3.8	10.0	10.0	Yes	Yes	C	No	No	No	Yes	I	6 1/4 x 4 3/4 x 1 3/4	
	FTC4	79.95	S	21.6dB	55	No	3.5	10.0	10.0	Yes	Yes	C	No	No	No	Yes	I	6 1/4 x 4 3/4 x 1 3/4	
	FTC5	89.95	S	26.2dB	35	No	3.8	10.0	10.0	Yes	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 3/4 x 2	
	FTC6	99.95	S	21.6dB	55	No	3.5	10.0	10.0	Yes	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 3/4 x 1 3/4	
	FTC35	109.95	S	21.6dB	55	No	3	10.0	10.0	Yes	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 3/4 x 1 3/4	
	FTC8	129.95	S	21.6dB	55	No	3.5	10.0	10.0	Yes	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 3/4 x 2	
	FTC26	129.95	S	20.2dB	60	No	9.5	1.0	1.0	Yes	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 1/4 x 2	
	FTC45	139.95	S	21.6dB	55	No	4	10.0	10.0	Yes	5	Yes	C	Yes	No	No	Yes	I	8 1/4 x 4 3/4 x 2
	FTC13	139.95	S	21.6dB	60	No	3	10.0	10.0	Yes	5	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 1/4 x 1 3/4
	FTC12	149.95	S	20.2dB	60	No	2.4	5.0	5.0	Yes	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 3/4 x 2	
	FTC27	169.95	S	20.2dB	60	No	9.5	1.0	1.0	Yes	Yes	C	Yes	B	No	Yes	I	6 1/4 x 4 1/4 x 2	
	FTC15	179.95	S	21.6dB	55	No	4	10.0	10.0	Yes	5	Yes	C	Yes	No	No	Yes	I	6 1/4 x 4 3/4 x 2
	FTC16	179.95	S	16.2dB	65	Yes	3.5	10.0	10.0	Yes	Yes	C	Yes	B	Yes	Yes	I	6 1/4 x 5 x 2	
	FTC66	199.95	S	21.6dB	70	Yes	3	10.0	10.0	Yes	Yes	C	Yes	B	Yes	Yes	I	6 1/4 x 4 3/4 x 2	
	FTC18	199.95	S	21.6dB	60	Yes	3	10.0	10.0	Yes	5	Yes	C	Yes	B	Yes	Yes	I	6 1/4 x 4 3/4 x 2
	FT526	99.95	S	21.6dB	60	No	2.4	5.0	5.0	Yes	Yes	C	Yes	B	Yes	Yes	I	6 1/4 x 4 3/4 x 2	
	FTV77	109.95	S	21.6dB	60	No	9	1.0	1.0	Yes	Yes	C	No	No	No	Yes	I	7 1/8 x 4 3/4 x 2	
	FTV82	129.95	S	23.8dB	60	No	3	5.0	5.0	Yes	Yes	C	No	No	No	Yes	I	7 x 5 1/2 x 2	
	FT510	149.95	S	30.0dB	60	No	9.5	1.0	1.0	Yes	Yes	C	Yes	No	No	Yes	I	7 1/8 x 4 1/8 x 2	
	FTV88	159.95	S	21.6dB	70	No	3	10.0	10.0	Yes	Yes	C	Yes	No	No	Yes	I	7 1/8 x 5 x 2	
	FT240	179.95	S	21.6dB	70	No	3.5	5.0	5.0	Yes	Yes	C	Yes	B	No	Yes	I	7 x 5 1/2 x 2	
	FT9	179.95	S	21.6dB	70	No	4	10.0	10.0	Yes	5	Yes	C	Yes	No	No	Yes	I	7 x 5 x 2
	FTV92	199.95	S	18.2dB	70	No	9.5	1.0	1.0	Yes	5	Yes	C	Yes	No	Yes	I	7 x 5 1/2 x 2	
	FTV96	199.95	S	18.2dB	65	No	9.5	1.0	1.0	Yes	5	Yes	C	Yes	B	No	Yes	I	7 1/8 x 5 1/8 x 2
	FT30	249.95	S	21.6dB	70	Yes	4	10.0	10.0	Yes	5	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 5 1/8 x 2
	FT590	379.95	S	20.2dB	70	Yes	10	1.0	1.0	Yes	10	Yes	C	Yes	B	Yes	Yes	I	7 x 5 1/2 x 2
	FTC120	269.95	S	16.8dB	70	Yes	10	0.3	0.3	Yes	Yes	C	Yes	B	Yes	Yes	I	6 1/4 x 5 1/8 x 2	
	FTX140	299.95	S	16.8dB	70	Yes	15	0.3	0.3	Yes	Yes	C	Yes	B	Yes	Yes	I	7 1/8 x 5 1/8 x 2	
	FTX160	349.95	S	16.8dB	70	Yes	15	0.3	0.3	Yes	Yes	C	Yes	B					

8TH ANNUAL CAR STEREO DIRECTORY

RADIOS/TAPE PLAYERS



Sanyo FTX180

MANUFACTURER		Model	Price, \$	Stereo (S), Mono (M), or 2-Channel (4)	FM Sensitivity, μ V (For 30-dB Quieting)	Selectivity, dB	Preamp Output?	Average Watts Channel, per IHF A-202	Amplifier S/N Ratio, dB	% THD at Rated Output	Local Distance Switch?	Total Number of Presets	Separate Tone Controls?	Cassette (C), 8-Track (8)	Auto Reverse?	Noise Reduction Circuit?	Bias EQ Switch?	Fast Tape Speeds?	In-Dash (I), Under-Dash (U), Convertible (C)	Dimensions, Inches
SONY	XR-77	499.95	S	1.2	75	Yes	12	0.5	Yes	10	Yes	C	No	B	Yes	Yes	Yes	I	2 1/2 x 6 x 7 1/8	
	XR-75B	449.95	S	1.6	70	Only			Yes	12	Yes	C	Yes	B	Yes	Yes	Yes	I	2 x 6 x 7 1/8	
	XR-75	449.95	S	1.6	70	Only			Yes	12	Yes	C	Yes	B	Yes	Yes	Yes	I	2 1/4 x 6 x 7 1/8	
	XR-70B	449.95	S	1.2	75	Only			Yes	10	Yes	C	No	B	Yes	Yes	Yes	I	1 3/4 x 6 x 7 1/8	
	XR70	449.95	S	1.2	75	Only			Yes	10	Yes	C	No	B	Yes	Yes	Yes	I	1 3/4 x 6 x 7 1/8	
	XR-55	369.95	S	1.6	65	Yes	10	1.0	Yes	6	Yes	C	Yes	B	Yes	Yes	Yes	I	1 3/4 x 6 x 7 1/8	
	XR-50B	329.95	S	1.4	60	Yes	4.5	1.0	Yes	0	Yes	C	No	No	Yes	Yes	Yes	I	1 3/4 x 6 x 7 1/8	
	XR-50	329.95	S	1.4	60	Yes	4.5	1.0	Yes	0	Yes	C	No	No	Yes	Yes	Yes	I	1 3/4 x 6 x 7 1/8	
	XR-35	279.95	S	1.6	65	Yes	4	1.0	Yes	0	3	C	Yes	B	Yes	Yes	Yes	I	1 3/4 x 5 3/4 x 6 3/8	
	XR-25	239.95	S	1.6	65	Yes	4	1.0	Yes	0	3	C	Yes	No	Yes	Yes	Yes	I	1 3/4 x 4 3/4 x 6 3/8	
	XR-15	219.95	S	2.2	60	No	4	1.0	No	0	No	C	Yes	No	Yes	Yes	Yes	I	2 x 5 1/8 x 7 1/8	
	SPARKOMATIC	SR340	239.95	S	2	55		6	70	10	Yes		Yes	C	No			Yes	I	7 x 1 3/4 x 5 1/2
SR330D		249.95	S	2	55		22.5	70	10	Yes		Yes	C	Yes			Yes	I	7 x 1 3/4 x 5 1/2	
SR330		219.95	S	2	55		6	70	10	Yes		Yes	C	Yes			Yes	I	7 x 1 3/4 x 5 1/2	
SR310D		219.95	S	2	55		22.5	70	10	Yes		Yes	C	No			Yes	I	7 x 1 3/4 x 5 1/2	
SR310		189.95	S	2	55		6	70	10	Yes		Yes	C	No			Yes	I	7 x 1 3/4 x 3 1/2	
SR300		89.95	S	6	50		4.5	60	10	Yes		Yes	C	No			Yes	I	7 x 1 3/4 x 4	
SR202		149.95	S	6	50		5	60	10	Yes	10	Yes	8	No			No	I	7 1/8 x 2 1/8 x 4 7/8	
SR201		119.95	S	6	50		5	60	10	Yes		Yes	8	No			No	I	6 1/8 x 1 3/4 x 5 1/8	
SR306		129.95	S	4	50		22.5	60	10	Yes		Yes	C	No		No	Yes	I	7 x 1 3/4 x 5 1/2	
SR305		149.95	S	4	50		22.5	60	10	Yes		Yes	C	No		No	Yes	I	7 x 1 3/4 x 5 1/2	
SR304		119.95	S	4	50		5	60	10	Yes		Yes	C	Yes		No	Yes	I	6 3/8 x 1 5/8 x 4 3/8	
SR303		149.95	S	4	50		5	60	10	Yes		Yes	C	Yes		No	Yes	I	7 x 1 3/4 x 4 3/4	
SR302		149.95	S	6	50		5	60	10	Yes	10	Yes	C	No		No	Yes	I	7 1/8 x 2 1/8 x 4 7/8	
SR301		119.95	S	6	50		5	60	10	Yes		Yes	C	No		No	Yes	I	6 1/8 x 1 3/4 x 4 7/8	
SR300		89.95	S	6	50		4.5	60	10	Yes		Yes	C	No		No	Yes	I	7 x 1 3/4 x 4 3/4	
SR340D		269.95	S	2	55		22.5	70	10	Yes		Yes	C	No		No	Yes	I	7 x 1 3/4 x 5 1/2	
SR200		89.95	S	6	50		5	60	10	Yes		Yes	8	No		No	No	I	7 x 1 3/4 x 4 3/4	
SS100	34.95			6	50		2	55	10	No		8	No		No	No	U	5 1/2 x 2 1/4 x 5 3/4		
SS200	34.95			6	50		2	55	10	No		C	No		No	No	U	4 3/8 x 1 3/4 x 6 1/8		
WESTPORT LABS	WL180	99.95	S	16.8dB	65	Mc	5	52	10	Auto		No	C	No		No	Yes	I	1 3/4 x 4 1/2 x 6	
	WL190	129.95	S	16.8dB	65	Mc	5	52	10	Auto		No	C	Yes		Yes	Yes	I	1 3/4 x 4 3/4 x 7	
	WL210	199.95	S	16.8dB	65	No	5	52	10	Auto	5	Yes	C	Yes		Yes	Yes	I	1 3/4 x 5 1/2 x 7	
	WL220	249.95	S	16.8dB	65	Mc	5	52	10	Auto	5	Yes	C	No		No	Yes	I	1 3/4 x 5 1/2 x 7	
	WL230	279.95	S	16.8dB	65	Mc	5	52	10	Auto	12	No	C	Yes		Yes	Yes	I	1 3/4 x 6 x 7	
	WL250	319.95	S	16.8dB	65	No	10	52	10	Auto	12	Yes	C	No	B	Yes	Yes	I	1 3/4 x 5 1/2 x 7	

"...strikingly balanced, uncolored sound..."

-Stereo Review



DA-30 Stereo-trio System

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"...a most attractive system..."
Read the entire review and hear the exciting DA-30 Stereo-trio at your Design Acoustics dealer today!

DA DESIGN ACOUSTICS
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AFS Kriket 8976

SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Woofer Size, Inches	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Woofer (W), 3-Way (3), 4-Way (4)	Flush Mount (C), Surface Mount (S), Convertible (C)	Dimensions, Inches	Notes	
AAL	RU 375		150	8 Dia.	8	35-7		C		8 Dia. x 3 ³ / ₄		
	KU 362		25	4 1/2	8	80-8		C		4 1/2 Dia. x 2 1/2		
	P 1038		50	3 3/4	8	4k-40k		C		3 3/4 Dia. x 2 1/4		
	SK 10		40	3 1/2	8	2k-20k		C		3 1/2 Dia. x 1 1/2		
ADS	300I	134.50	100	5 1/4	4	50-20 ± 3	2	F		8 1/2 x 5 1/4 x 1 1/4	† Flush-mount woofer, 5 1/4 dia. x 3; surface-mount tweeter, 2 1/4 dia. x 1 1/4. Inc. AX-1 electronic crossover. Inc. PX-1 passive crossover.	
	320I	189.50	100	5 1/4	4	58-20 ± 3	2	f		† Two Poles		
	CS400A		250.00	100	2 x 7	4	32-150 Hz ± 3		F	(2) 7 x 7 x 3		
	CS400P		250.00	100	2 x 7	4	32-150 Hz ± 3		F	(2) 7 x 7 x 3		
	200C	134.50	50	4	4	85-20 ± 3	2	S		6 1/4 x 4 1/4 x 4 3/4		
300C	174.50	75	5 1/4	4	68-20 ± 3	2	S		8 1/2 x 5 3/4 x 5 3/4			
AFS KRIKET	8976	199.95	100	6 x 9	4	35-22	3	F		6 3/8 x 9 x 3 3/4	Blamp capable.	
	8974	164.95	90	6 x 9	4	40-20	2	F		6 3/8 x 9 x 3 3/4		
	8074	149.95	60	4 x 10	8	55-22 ±	2	F		4 x 10 x 3 3/4		
	8234	129.95	35	5 1/4	4	60-22 ± 5	2	F		5 1/4 Dia. x 2 1/2		
	8424	112.95	25	4	4	70-22 ± 5	2	F		4 Dia. x 1 1/2		
	2734	57.50	30	5 x 7	8	65-22 ± 5	2	F		5 x 7 x 2 1/2		
	8972	118.95	80	6 x 9	4	40-18 ± 5	2	F		6 3/8 x 9 x 3 1/2		
	8932	87.50	70	6 x 9	4	45-18 ± 5	2	F		6 3/8 x 9 x 3 1/4		
	8072	95.95	60	4 x 10	8	55-18 ± 5	2	F		4 x 10 x 3 3/4		
	8032	86.50	50	4 x 10	8	55-18 ± 5	2	F		4 x 10 x 3		
	8272	97.50	60	5 1/4	4	60-20 ± 5	2	F		5 1/4 Dia. x 3		
	8232	84.95	50	5 1/4	4	60-20 ± 5	2	F		5 1/4 Dia. x 2 1/2		
	8931	64.95	70	6 x 9	8	45-15 ± 5	2	F		6 3/8 x 9 x 3 1/4		
	8231	59.95	50	5 1/4	4	60-15 ± 5	W	F		5 1/4 Dia. x 2 1/2		
	8531	59.95	40	4 1/2	8	65-15 ± 5	W	F		4 7/8 Dia. x 2 1/2		
	8311	37.50	20	3 1/2	8	70-17 ± 5	W	F		3 1/2 Dia. x 1 1/2		
	2031	26.50	35	4 x 10	8	55-16 ± 5	W	F		4 x 10 x 2 3/4		
	2421	21.50	25	4	4	65-16 ± 5	W	F		4 Dia. x 1 3/4		
	0002		69.95	60	4 1/2	8	5k-22k ± 5		C			3 1/2 Dia. x 3 3/8
	0003		59.95	60	4 1/2	8	100-5 ± 5		F			4 7/8 Dia. x 2
	0004		91.50	60	6 x 9	8	30-5 ± 5		F			6 3/8 x 9 x 3 1/2
	0005		169.95	80	6 x 9	8	40-22 ± 5	2	F			6 3/8 x 9 x 3 1/2
	0006		69.95	60	4 x 10	8	55-5 ± 5		F			4 x 10 x 3 3/4
AIWA	SC-160Y	60.00	35	6	4	70-13	2	F		6 1/2 Dia. x 1 3/4		
	SC-16Y	80.00	30	5 1/4	4	90-20	3	F		10 3/8 x 6 3/4 x 1 1/2		
ALPINE	6108	99.95	80	8	4	35-400 Hz		F		8 x 8 x 3 1/2		
	6110	139.95	120	10	4	25-400 Hz				10 x 10 x 4 3/4		
	6112	159.95	150	12	4	20-400 Hz				12 x 12 x 5 1/4		
	6130	44.95	20	3 1/2	4	130-20	W	C		5 x 5 x 3 1/4		
	6209	99.95	80	6 x 9	4	45-25	2	C		10 x 6 3/4 x 3 1/2		
	6214	99.95	60	4 x 10	4	60-20	2	C		10 5/8 x 4 7/8 x 5/8		
	6207	129.95	80	5 1/4	4	50-20	2	S				
	6217	109.95	60	4	4	80-20	2	S				
	6227	199.95	80	5 1/4	4	70-35	2	S				
	6206	79.95	50	5 1/4	4	50-20	2	C				
	ARA-MOTOROLA	6700600	39.95	35	4 x 10	4-8	55-16 ± 5	W	F			
6700602		39.95	50	5 1/4	4	60-15 ± 5	W	F				
6700603		59.95	60	5 1/4	4	60-20 ± 5	2	F				
6700604		59.95	60	4 x 10	8	55-5 ± 5	W	F				
6700605		75.95	60	4 x 10	4-8	58-18 ± 5	2	F				
6700606		79.95	80	6 x 9	4	40-22 ± 5	2	F				
6700607		119.95	90	6 x 9	4	40-22 ± 5	2	F				
6700608		129.95	100	6 x 9	4	35-40	3	F				
6700610		49.95	60	3	8	5k-20k	W	S				
AUDIOSOURCE	LS-One	199.95	40	4	8	100-20	2	S		7 1/8 x 4 1/2 x 4 3/8		
	LS-5	159.95	40	4 x 2 3/4	4	100-20	2	S		3 x 7 1/4 x 5		
	LS-Four	169.95	50	4	4	100-20	2	F		7 1/8 x 5 1/8 x 2 3/4		
AUDIODOX	COMP-60	122.00	40	6 1/2	4	50-20	2	F				
	COMP-100	132.00	50	4	4	50-20	2	S				
	TRYVOX-20	76.00	30	6 x 9	4	70-17	3	F				
	TRYVOX-25	67.00	25	5 1/4	4	65-16.5	3	F				
	TRYVOX-30	94.00	30	5 1/4	4	65-18	3	F				
	TRYVOX-40	76.00	25	4 x 10	4	70-18	3	F				
	COID-69-208	58.00	25	6 x 9	4	60-16	2	F				
	COID-57-20	58.00	25	5 x 7	4	85-16.5	2	F				
	COID-41-20	58.00	25	4 x 10	4	70-18	2	F				
	COSC-20	47.00	25	5 1/4	4	50-16	2	F				
	COSC-6	46.00	20	5 1/4	4	100-20	2	F				
COSC-5A	43.00	20	5	4	120-20	2	F					

8TH ANNUAL CAR STEREO DIRECTORY



SPEAKERS

MANUFACTURER	Model	Price - \$ (If Sold Individually)	Price - \$ (If Sold in Pairs)	Recommended Max. Power. Watts	Wooler Size, Inches	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Whizzer (W) 2-Way (2) 3-Way (3), 4-Way (4)	High Woofer (F) Surround Woofer (S) Convertible (C)	Dimensions, Inches	Notes
AUDIOVOX (Continued)	COSC-4	46.00	20	4	4	110-14	2	F			
	CSW-40A	40.00	15	4	4	100-15	2	C			
	SC-10	25.00	15	5 1/4	4	70-14.5	W	F			
	SC-5	25.00	15	5	4	120-10		F			
	SC-3	17.00	10	3 1/2	4	160-15		F			
	ID-69-10A	34.00	15	6 x 9	4	80-15	W	F			
	ID-36	28.00	15	4	4	70-14.5		F			
	MRS-10	19.00	10	2 3/4	4	110-16		F			
	CWM-10	23.00	10	2 3/4	4	110-16		C			
	SC-4	24.00	10	4	4	110-15	W	F			
	CWM-20	29.50	10	4	4	110-15	W	C			
DSW-30	28.00	15	5 1/4	4	95-14		C				
BECKER ELECTRONICS	HCS693	139.95	80	6 x 9	4	38-20 ± 6	3	F			Blamp capable.
	RCS413	119.95	45	4 x 10	4	45-20 ± 6	3	F			
	RCS52	99.95	30	5 1/4	4	62-20 ± 6	2	F			
	RCS41	199.95	90	4	4	75-20 ± 3	2	S			Switchable high end. Inc. cover.
	6S	129.90	100	6	4	42-200 Hz ± 1		S			
BEVADA INTERNATIONAL	BE 463	69.50	30	4 x 6	8	80-18	3	F			
	BE 69250	110.50	125	6 x 9	4	40-22	3	F		4 x 6 1/4 x 9 1/4	
	BE 54200	89.95	100	5 1/4	4	40-22	3	F		3 x 6 1/4	
	BE 3001	119.50	50	5	8	50-20	3	S		7 3/8 x 4 1/2 x 4 1/2	
	BE 695	74.50	60	6 x 9	4	40-20	3	F		4 x 6 1/4 x 9 1/4	
	BE 5405	29.95	20	4 Dia.	8	90-17	2	F		5 1/2 Dia. x 1 3/8	
BDN SONIC	TRXX3	48.00	88.00	36	6 x 9	8	38-20	3	F		
	TRX-4	48.00	88.00	36	9 x 9	8	38-20	4	F		
BOSE	Direct Reflecting†	118.00	188	100	0.45	48-17 ± 1		C		4 1/2 Dia. x 1 1/4	† Must be used with 1401 booster/EQ.
	Accessory†	168.00	188	100	0.45	48-17 ± 1		C		4 1/2 Dia. x 1 1/4	
CANTON	HC 100	250.00	35	4	4-8	48-30	2	S		5 1/2 x 7 1/4 x 4 3/4	Internally blamped.
	AC 200	350.00	Inc.	4		48-25	2	S		5 1/2 x 7 1/4 x 4 3/4	
CERWIN-VEGA	CS-7	104.00	40	6 x 9	4	50-16 ± 4	2	F		6 1/2 x 9 1/2 x 3	
	CS-18	150.00	75	6 x 9	4	40-20 ± 3	2	F		6 1/2 x 9 1/2 x 4 1/2	
	DC-5	135.00	40	5	4	80-17 ± 4	2	S		4 3/4 x 7 3/4 x 4 3/4	
CONCORD ELECTRONICS	HPS-151	79.95	30	5 1/4	4	50-14		F		5 1/4 Dia. x 1 1/4	Blamp capable.
	HPS-152	89.95	30	5 1/4	4	50-17	2	F		5 1/4 Dia. x 1 1/4	
	HPS-260	99.95	50	6 1/2	4	40-20	2	F		6 1/2 Dia. x 2 3/4	
	HPS-265	109.95	80	6 1/2	4	40-20	2	F		6 1/2 Dia. x 2 3/4	
	HPS-266	139.95	120	6 1/2	4	40-20	2	F		6 1/2 Dia. x 2 3/4	
	HPS-267	109.95	120	6 1/2	4	35-4		F		6 1/2 Dia. x 2 3/4	
	HPS-271	159.95	120	6 x 9	4	40-25	2	F		6 x 9 x 2 3/4	
DYNAMIC ACOUSTICS	LPS-4010	52.50	30	4	4	100-18	2	S			
	LPS-5010	59.50	40	5 1/4	4	70-19	2	S			
	LPS-6515	83.50	50	6 1/2	4	60-19	3	S			
	LPS-6915	94.50	50	6 x 9	4	50-19	3	F			
	HPS-6520	99.50	80	6 1/2	4	55-20	2	S			
	HPS-6920	142.50	100	6 x 9	4	45-20	3	F			
	BHT-85Ds	16.00	40	1	4/8	1.5k-22k		S			
	120DFW268	20.00	50	4	4/8	75-6		C			
	130RFW10P	25.00	80	5 1/4	4/8	45-4		C			
	160RFW27P	30.00	80	8 1/2	4/8	50-4		C			
	CS-6900P	59.50	100	6 x 9	4	45-4		C			
	200RFW30P	64.50	100	8	4/8	55-2.5		C			
	DCM-1	149.50	50	4	4	70-20		S		7 1/8 x 4 3/8 x 4 1/8	
	DCM-2	119.50	60	4	4	500-20		S		7 1/8 x 4 3/8 x 1 3/8	
ELECTRONIC RESEARCH ASSOCIATES	A500	39.95	10	4 1/2 x 8 1/2	4-8	80-20 ± 5		C		7 1/8 x 6 x 10	
	A505	44.95	20	4 1/2 x 8 1/2	4-8	80-20 ± 5		C		1 3/8 x 6 x 10	
	A2000	37.95	10	5 1/4 Dia.	4-8	70-20 ± 5		F		6 1/8 Dia. x 7 1/8	
	A2005	42.95	20	5 1/4 Dia.	4-8	70-20 ± 5		F		6 1/8 Dia. x 1 1/2	
	A3000	44.95	10		4-8	80-20 ± 5		S		7 Dia. x 3 1/4	
	A3005	49.95	20	5 1/4 Dia.	4-8	80-20 ± 5		S		7 Dia. x 3 1/4	
	A4000	45.95	10	4 1/2 x 8 1/2	4-8	90-20 ± 5		S		1 3/8 x 5 1/8 x 9 1/2	
EPI	LS-70	170.00	6	4 1/2	8	70-20 ± 3	2	C		9 1/8 x 7 x 3 3/8	Cabinet version of LS-81. † Convertible midrange/tweeter, flush-mount woofer.
	LS-81	200.00	4	4 1/2	4	80-20 ± 3	2	C		7 3/8 x 4 7/8 x 2 1/2	
	LS-81C	230.00	4	4 1/2	4	95-20 ± 3	2	S		7 7/8 x 5 1/8 x 5 3/8	
	LS-641	300.00	6		4	55-20 ± 3	3	†		Two Pieces	
	LS-841	340.00	8		4	45-20 ± 3	3	†		Two Pieces	
LS-35	50.00			8	150-5		F		3 1/2 Dia. x 1 1/4		

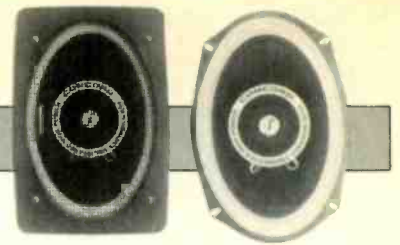


Canton HC 100

SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Woofer Size, Inches	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Whizzer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Flush Mount (F), Surface Mount (S), Convertible (C)	Dimensions, Inches	Notes
FUJITSU TEN	SG-1003	42.50	30	4	4	50-17		F			
	SSB-8G11	34.95	20	4	8	915		F			
	SG-1002	59.95	70	4	4	90-16		F			
	SG-1301	54.50	30	5	4	60-19	W	F			
	SSB-8G4	26.95	20	5 1/4	8	50-20	W	F			
	SSB-4G25	24.95	10	5 1/4	4	50-20	W	F			
	SG-1602	57.00	30	5 1/4	4	50-20	W	F			
	SSB-8G5	16.50	20	5 x 7	8	80-15	W	F			
	SSB-4G31	14.95	10	5 x 7	4	80-15	W	F			
	SG-9601	139.95	70	6 x 9	4	70-15	2	F			
	FULTRON	15-9990	119.95	100	6 x 9	4		3	F		
15-9790		99.95	75	5 1/4	4		3	F			As above.
15-9735		69.95	50	4 1/2	4		2	F			
15-9260		119.95	50	4	4		2	S		7 1/2 x 4 1/2 x 4 1/2	
15-9696		79.95	35	6 x 9	8		4	F			
15-9690		69.95	30	6 x 9	8		3	F			
15-9670		54.95	25	6 x 9	8		2	F			
15-9590		59.95	30	4 x 10	8		3	F			
15-9490		59.95	30	5 1/4	8		3	F			
15-9470		46.95	25	5 1/4	8		2	F			
15-9435		39.95	20	4	8		2	F			
15-9425		24.95	15	3 1/2	8		W	F			Inc. 4 x 6 adapter.
15-9240		21.95	7	5	8			C		6 x 5 x 5	
INFINITY SYSTEMS		1-Car	177.00	240.00	15	5	4	40-32	2	C	9 1/4 Dia. x 2 1/2
ISOPHON	30-50	162.50	325.00	30	6 1/2	4	35-20 ± 3	3		8 1/2 Dia. x 12	
JBL	T205	99.95	50	4 1/2	4		2	F			
	T420	119.95	80	6 1/2	4		2	F			
	T540	149.95	100	6 x 9	4		2	F			Biamp capable. As above.
	T545	179.95	100	6 x 9	4		3	F			
JENSEN	J2033	179.95	100	6 x 9	4	38-40 ± 3	3	F		3 7/8 x 6 5/8 x 9 1/2	Biamp capable. As above.
	J2130	179.95	50	4 x 10	4	43-40 ± 3	3	F		3 1/2 x 4 1/2 x 10 3/8	
	J1279	149.95	75	6 1/2	4	52-40 ± 3	3	F		1 3/8 x 6 1/2 x 6 1/2	
	J2037	129.95	90	6 x 9	4	38-20 ± 3	2	F		3 7/8 x 6 5/8 x 9 1/2	
	J1201	119.95	50	6 1/2	4	55-20 ± 3	2	F		3/4 x 8 1/2 x 6 1/2	
	J2041	99.95	75	5 1/4	4	58-40 ± 3	2	F		2 3/4 x 5 1/2 x 5 1/2	
	J2126	94.95	50	4 1/2	4	63-40 ± 3	2	F		2 3/8 x 4 3/4 x 4 3/4	
	J1294	54.95	75		4-8	1.7k-24k ± 3		F		Var.	
	J1242	159.95	55	6 x 9	4	40-20 ± 3	4	F		4 x 6 1/2 x 9	
	J1065	129.95	50	6 x 9	4	40-20 ± 3	3	F		3 3/4 x 6 3/4 x 9	
	J1101	129.95	45	4 x 10	4	45-20 ± 3	3	F		3 1/2 x 4 1/2 x 10 1/4	
	J1069	84.95	45	6 x 9	4	40-18 ± 3	2	F		3 3/4 x 6 3/8 x 9	
	J1105	84.95	45	4 x 10	4	45-18 ± 3	2	F		3 1/2 x 4 1/2 x 9 1/4	
	J1188	84.95	45	6 1/2	4	58-18 ± 3	2	F		2 3/8 x 6 1/4 x 6 1/4	
	J1077	79.95	45	5 1/4	4	60-18 ± 3	2	F		2 1/2 x 5 1/2 x 5 1/2	
	J1093	71.95	40	4 1/2	4	65-18 ± 3	2	F		2 x 4 1/2 x 4 1/2	
	J1245	39.95	40	6 1/2	4	50-14 ± 3	W	C		1 1/2 x 6 1/4 x 6 1/4 †	† Flush mount; †† surface mount
	J1186	76.95	40	4 1/2	4	65-18 ± 3	2	C		3 3/8 x 8 1/2 x 8 ††	†, †† As above.
	J1292	59.95	40	5 1/4	4	70-14 ± 3		F		2 x 4 1/2 x 4 1/2 †	
J1283	49.95	30	4	4-8	80-12 ± 3		F		3 7/8 x 6 1/2 x 6 1/2 ††		
J1134	37.95	15	4 x 6	4	70-14 ± 3	W	F		1 1/2 x 5 1/2 x 5 1/2		
J1117	32.95	12	3 1/2	4	80-12 ± 3	W	F		1 3/8 x 4 x 4		
J2000	269.95	50	4 1/2	4	40-16 ± 3	3	S		3 3/4 x 6 3/8 x 9	Swivel mount.	
J2000									5 1/4 Dia. x 12 3/8		
JET SOUND	JS 415	24.95	20	5 1/2	4	80-16		F			
	JS 425	34.95	30	5 1/2	4	80-18		F			
	JS 510	29.75	40	6 1/2	4	70-16	2	F			
	JS 540	39.75	50	6 1/2	4	70-18	2	F			
	JS 975	59.95	100	6 x 9	4	55-20	2	F			
	JS 985	89.95	100	6 x 9	4	55-20	3	F			
	JVC	CS692	140.00	70	6 x 9	4	30-25	2	F		6 3/8 x 9 3/4 x 4 1/2
CS691		79.95	40	6 x 9	4	35-18	W	F		6 3/8 x 9 3/4 x 3 3/8	
CS81		61.95	40	6 1/2 Dia.	4	40-18	W	F		6 1/2 Dia. x 2	
CS41		41.95	25	4 Dia.	4	45-18	W	F		5 Dia. x 1 3/4	
KENWOOD	KFC-160	125.00	60	6 1/2	4	50-20 ± 3	3	F			
	KFC-1610	99.00	50	6 1/2	4	50-20 ± 3	2	F			
	KFC-161	89.00	25	6 1/2	4	50-20 ± 3	2	F			
	KFC-1630	75.00	25	6 1/2	4	55-20 ± 3	2	F			
	KFC-1640	49.00	20	6 1/2	4	55-20 ± 3	W	F			
	KFC-571	119.00	60	5 x 7	4	50-20 ± 3	2	F			
(Continued)	KSC-701B	229.00	70	4	4	60-21 ± 3	3	S			

SPEAKERS



Concord HPS-271

MANUFACTURER	Model	Price: \$ (If Sold Individually)	Price: \$ (If Sold in Pairs)	Recommended Max. Power. Watts	Woofer Size, Inches	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Whizzer (W), 2-Way (2), 3-Way (3), & 4-Way (4)	Flush Mount (F), Surface Mount (S), Coaxial (C)	Dimensions, Inches	Notes		
KENWOOD (Continued)	KSC-501B	159.00	40	4	4	60-20 ±3	2	S					
	KFC-6900	199.00	100	6 x 9	4	35-21 ±3	3	F					
	KFC-6910	149.00	80	6 x 9	4	40-20 ±3	3	F					
	KFC-6920	125.00	80	6 x 9	4	45-20 ±3	2	F					
	KFC-694	65.00	25	6 x 9	4	45-20 ±3	W	F					
	KFC-120	75.00	25	5	4	60-20 ±3	2	F					
	KFC-1220	65.00	25	5	4	60-20 ±3	W	F					
	KFC-121	39.00	15	5	4	100-20 ±3	W	F					
	KFC-4610	75.00	20	4 x 6	4	60-20 ±3	2	F					
	KFC-103	65.00	20	4	4	100-20 ±3	W	F					
KFC-83	32.00	20	3½	4	100-20 ±3	W	C						
KRACO	THP-693	129.95	100	6 x 9	4	40-20	3	F		9½ x 6½ x 3½			
	THP-692	109.95	100	6 x 9	4	45-18	2	F		9½ x 6½ x 3½			
	THP-413	129.95	75	4 x 10	4	70-15	3	F		10 x 4½ x 3½			
	THP-543	129.95	100	5¼	4	70-20	3	F		6¼ Dia. x 3			
	THP-542	69.95	100	5¼	4	70-15	3	F		6¼ Dia. x 3			
	TRI-369	69.95	20	6 x 9	8	60-17 ±5	3	F		3¼ x 6½ x 9¼			
LINEAR POWER	Bass Vent	199.95	150	(2)8	8	20-120Hz ±3		F		10 x 10 x 3 x 9			
MAGNAOYNE	SF3UX		25	3½	4	90-16	2	C					
	SF128X		30	4	48	70-20	2	C					
	SF46X		25	4 x 6	48	80-18	2	F					
	SF95D		40	6 x 9	4	65-20	2	C					
	SF95T		40	6 x 9	4	65-22	3	C					
MATRECS ELECTRONICS	Domeplex 13	129.95	45	5¼	4	50-22	2	F		5¼ x 5¼ x 2¼	Blamp capable.		
	Domeplex 19	139.95	45	4 x 10	4	45-22	2	F		4 x 10 x 4			
	Domeplex 30	169.95	75	8 x 9	4	35-22	2	F		6¼ x 9 x 4½			
	Domeplex 40	229.95	150	6 x 9	4	30-22	2	F		6¼ x 9 x 4½			
	Domeplex 100	219.95	60	4½	4	45-22	2	S		9 x 6 x 5			
MESA ELECTRONICS	15	119.95	30	3	4/8	60-20	2	S		6 x 3½ x 3			
	20ZX	129.95	40	3½	4	60-20	2	S		8½ x 4¼ x 6			
	25E	139.95	45	3	4	60-20	2	S		3¾ x 8 x 3¾			
	30S	159.95	50	4	48	60-25	2	S		7¼ x 4¾ x 4¼			
	50	135.00	80	5	48	50-25	2	S		9½ x 6½ x 4¼			
	75	155.00	90	6	4	50-25	3	S		12½ x 9½ x 7½			
	100	175.00	125	8	4	50-25	3	S		14 x 9½ x 6¼			
MITSUBISHI	SG-69TB	139.95	100	6 x 9	4	50-20	3	F					
	SG-69CB	99.95	40	6 x 9	4	50-20	2	F					
	SG-40CB	99.95	50	4 x 10	4	50-20	2	F					
	SG-13CD	79.95	30	5¼	4	60-15	2	F					
	SG-13WD	59.95	30	5¼	4	70-15	W	F					
	SG-12MA	54.95	30	5	4	80-15	W	F					
	SG-10WE	49.95	4	4	4	100-17	W	F					
	SR-35WA	34.95	20	3½	4	120-13	W	F					
	SX40SA	189.95	100	4	4	10-12	2	S					
	S82SA	39.95	20	4	4	5k-20k		S					
PANASONIC	EAB-920	169.95	100	6 x 9	4	30-25	3	F					
	EAB-940	119.95	100	6 x 9	4	40-25	2	F					
	EAB-692	89.95	30	6 x 9	4	40-25	2	F					
	EAB-691	64.95	30	6 x 9	4	45-20	W	F					
	EAB-412	79.95	25	4 x 10	4	60-20	W	F					
	EAB-411	64.95	25	4 x 10	4	60-20	W	F					
	EAB-080	179.95	100	8	4	30-20	2	F					
	EAB-030	29.95	20	3½	4	100-20	W	F					
	EAB-063	84.95	25	6½	4	40-25	2	F					
	EAB-062	74.95	25	6½	4	45-25	2	F					
	EAB-061	59.95	25	6½	4	25-20	W	F					
	EAB-930	109.95	100	5¼	4	50-20	2	F					
	EAB-050A	52.95	25	5	4	50-16	W	F					
	EAB-040	49.95	25	4	4	70-18	W	F					
	EAB-911	39.95	20	5	4	50-15		F					
	EAB-909	34.95	8	5	4	50-15		F					
	EAB-915	39.95	30	4	4	60-15		F					
	EAB-914	34.95	8	4	4	65-14		F					
	EAB-009	299.95	60	5¼	4	40-22	2	F					
	EAB-069	89.95	60	6½	4	40-25	2	F					
	EAB-049	69.95	30	4	4	50-25	2	F					
	PARASOUND	SX40	44.95	20	4	4	80-20 ±4		F			5 Dia. x 17½	
		SCX65	89.95	25	6½	4	65-22 ±4	2	F			6½ Dia. x 1¾	
		STH96	119.95	40	6 x 9	4	50-22 ±4	3	F			9¼ x 6¼ x 4	
PHILIPS (Continued)	EN8741	59.95	40	4	4	60-20 ±5	W	F		4¾ x 4¾ x 2¾	Blamp capable.		
	EN8710	129.95	50	4 x 10	4	65-20 ±5	2	F		4¾ x 10½ x 4½			
	EN8769	149.95	100	6 x 9	4	40-20 ±5	2	F		6¾ x 9¾ x 4½			
	EN8751	59.95	25	5¼	4	60-16 ±5	W	F		5½ Dia. x 1¾			
	EN8330	49.95	50		4	1.2k-20k ±5		F					



EPI LS81C

8TH ANNUAL CAR STEREO DIRECTORY

SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Woofer Size, Inches	Impedance, Ohms	Frequency Response, Hz to KHz, ±dB	Woofer (W) 2-Way (2), 3-Way (3), 4-Way (4)	Flux Mount (F) Surface Mount (S) Conventional (C)	Dimensions, Inches	Notes
PHILIPS (Continued)	EN8331	49.95	50		4	1.2k-20k ±5		F			Adjustable mount. Forty-dB level control.
	EN8390	249.95	50	5 1/4	4	35-20 ±5	2	F		10 1/2 x 6 x 3	
	EN8365	199.95	40	4	4	80-20 ±5	2	S		9 1/4 x 4 3/4 x 5 3/8	
	EN8320	79.95	40	4	4	1.2k-20k ±5		C		4 1/2 x 5 1/8 x 1 1/2	
	EN8875	139.96	60	6 1/2	4	25-20 ±5	2	F		7 Dia. x 3 3/4	
	EN8855	119.95	50	5 1/4	4	35-20 ±5	2	F		5 1/2 x 5 1/8 x 3 1/2	
PIONEER	P-10L	26.95	8	4	4	70-12		F		4 x 4 x 1 1/2	
	TS-100	34.95	8	4	4	50-14		F		4 x 4 x 1 3/4	
	TS-100DX	38.95	8	4	4	50-14		F		4 x 4 x 1 3/4	
	TS-106	49.95	20	4	4	50-16		F		4 x 4 x 1 3/4	
	TS-107	54.95	20	4	4	50-20	W	F		5 Dia. x 1 3/4	
	TS-108	69.95	20	4	4	50-20	2	F		5 Dia. x 1 3/4	
	TS-120	39.95	8	5 1/2	4	80-16		F		5 3/8 Dia. x 1	
	TS-121	44.95	20	5 1/2	4	80-16		F		5 3/8 Dia. x 1	
	TS-1211	49.95	20	5 1/2	4	70-17		F		5 3/8 Dia. x 1	
	TS-1222	54.95	20	5 1/2	4	50-20		F		5 3/8 Dia. x 1 3/8	
	P-16L	29.95	8	6 1/2	4	50-10		F		6 3/4 Dia. x 1 3/4	
	TS-160DX	42.95	20	6 1/2	4	40-20	W	F		6 3/4 Dia. x 2 1/8	
	TS-162DX	55.95	20	6 1/2	4	40-16	W	F		6 1/4 Dia. x 2 1/8	
	TS-1622	59.95	25	6 1/2	4	40-20	W	F		6 1/4 Dia. x 1 1/2	
	TS-164	64.95	20	6 1/2	4	40-16	2	F		6 1/4 Dia. x 2 1/8	
	TS-165	69.95	20	6 1/2	4	30-16	2	F		6 1/4 Dia. x 2 1/8	
	TS-167	79.95	20	6 1/2	4	30-20	2	F		6 1/4 Dia. x 2 1/8	
	TS-1644	89.95	25	6 1/2	4	40-20	2	F		6 1/4 Dia. x 1 1/2	
	TS-168	124.95	40	6 1/2	4	35-20	3	F		6 1/4 Dia. x 2 3/8	
	TS-87	29.95	20	3 1/2	4	100-18		F		4 3/4 x 3 3/8	
	TS-T3	49.95	60		4	250-20		F		3 3/8 x 4 3/8 x 2 3/8	
	TS-M2	49.95	20	4	4	450-20		F		4 1/2 x 3 x 1 1/4	
	TS-M6	99.95	20	4	4	350-22	2	F		4 7/8 x 3 1/8 x 1 3/4	
	TS-1600	169.95	60	6 1/2	4	40-20	2	F		6 3/4 x 7 1/8 x 2 3/8	
	TS-2000	199.95	60	8	4	30-21	2	F		8 3/4 x 7 1/8 x 3 3/4	
	TS-462	49.95	20	4 x 6	4	60-20		F		6 7/8 x 4 x 2	
	TS-411	69.95	20	4 x 10	4	50-20	2	F		10 x 4 1/4 x 3 1/4	
	TS-571	59.95	20	5 x 7	4	50-18	2	F		8 3/4 x 5 x 2 3/8	
	TS-691	49.95	20	6 x 9	4	40-16	W	F		10 x 6 3/8 x 3 1/2	
	TS-692	63.95	20	6 x 9	4	35-16	W	F		10 x 6 3/8 x 3 1/4	
	TS-694	85.95	25	6 x 9	4	35-16		F		9 3/4 x 6 3/8 x 3 3/4	
	TS-696	119.95	40	6 x 9	4	30-20	2	F		9 3/4 x 6 3/8 x 3 3/4	
	TS-697	139.95	60	6 x 9	4	30-22	2	F		9 3/4 x 6 3/8 x 3 3/4	
	TS-695	149.95	40	6 x 9	4	30-20	3	F		9 3/4 x 6 3/8 x 3 3/4	
TS-W203	149.95	60	8	4	28-10		F		8 3/4 x 7 3/4 x 3 1/2		
TS-698	169.95	60	6 x 9	4	30-22	3	F		8 3/4 x 7 3/8 x 3 3/4		
TS-202	179.95	60	8	4	30-20	2	F		8 3/4 x 7 3/8 x 3 3/4		
TS-205	199.95	60	8	4	30-22	3	F		8 3/4 x 7 3/8 x 3 3/4		
TS-5	29.95	8	5 1/4	4	80-13		S		6 3/8 x 5 7/8 x 4 3/8		
TS-X1	44.95	20	3 1/2	4	120-18		S		3 7/8 x 4 1/4 x 4 1/8		
TS-35	74.95	40	5 1/4	4	80-13		S		6 3/8 x 5 7/8 x 4 1/4		
TS-X5	99.95	20	4	4	80-20		S		9 3/8 x 5 3/8 x 5 1/4		
TS-X6	109.95	20	4	4	80-20	2	S		9 3/8 x 6 3/4 x 5 1/8		
TS-X9	199.95	40	3 3/8	4	50-22	2	S		8 7/8 x 7 1/8 x 5 1/2		
TS-X11	299.95	60	4 3/4	4	47-25	3	S		11 1/8 x 7 1/2 x 5 3/8		
TS-Z80	399.95	60	6 1/2	4	70-20	2	S		7 1/2 x 8 1/2 x 10 1/2		
POLK AUDIO	Mini-Monitor II	290.00	60	4 1/2	6	60-20.5 ±2	3	S		13 1/4 x 6 x 4 3/4	
PSB SPEAKERS	Alpha II	295.00	60	4	4	100-20 ±2.5	2	S		9 x 5 x 5	
PYLE INDUSTRIES	F69C200-FCD	70.25	156.15	85	6 x 9	4-8	50-20	2	F	3 7/8 x 6 3/8 x 9 3/8	
	F69C290-FCD	82.75	183.60	100	6 x 9	4-8	50-20	2	F	4 x 6 3/8 x 9 3/8	
	F69C100-FT	49.90	117.95	55	6 x 9	4-8	55-20	2	F	3 3/8 x 6 3/8 x 9 3/8	
	F69C200-FT	62.45	140.55	85	6 x 9	4-8	50-20	2	F	3 7/8 x 6 3/8 x 9 3/8	
	F69C290-FT	76.50	170.95	100	6 x 9	4-8	50-20	2	F	4 x 6 3/8 x 9 3/8	
	F52C100-FP	42.90	99.95	45	5 1/4	4-8	60-40	2	F	2 7/8 x 5 1/4 x 5 1/4	
	F52C165-FP	49.85	117.10	55	5 1/4	4-8	55-40	2	F	3 1/8 x 5 1/4 x 5 1/4	
	F410C100-FP	43.60	101.50	45	4 x 10	4-8	60-40	2	F	3 3/4 x 4 1/4 x 10	
	F410C160-FP	51.50	117.10	50	4 x 10	4-8	55-40	2	F	3 1/2 x 4 1/4 x 10	
	F35C30-WF	19.95		30	3 1/2	4-8	90-18	W	F	1 3/8 x 3 3/8 x 4 1/4	
	F4C99-F	23.35	70.25	35	4	4-8	70-18	W	F	1 7/8 x 4 x 4	
	F5C100-WF	23.35	70.25	45	5	4-8	60-18	W	F	5 Dia. x 2 3/8	
	F52C100-WF	23.35	70.25	45	5 1/4	4-8	60-18	W	F	2 3/8 x 5 1/4 x 5 1/4	
	F6C100-WF	24.95	50	6	4-8	60-18	W	F	6 1/2 Dia. x 2 3/8		
	F46C55-WF	22.65	35	4 x 6	4-8	70-18	W	F	1 7/8 x 4 1/8 x 6 1/8		
	F57C100-WF	25.85	45	5 x 7	4-8	80-18	W	F	2 1/2 x 5 x 7 1/4		
	F69C100-WF	26.50	71.80	55	6 x 9	4-8	55-18	W	F	3 x 6 3/8 x 9 3/8	
	F69C180-WF	32.75	82.05	55	6 x 9	4-8	50-18	W	F	3 1/2 x 6 3/8 x 9 3/8	
	F410C100-WF	26.20	68.70	45	4 x 10	4-8	60-18	W	F	2 3/8 x 4 1/4 x 10	
	WM5C100-F	24.45	45	5	8	50-8.5		F		5 Dia. x 2 1/8	
	W52C165-F	30.50	55	5 1/4	8	50-8		F		2 3/4 x 5 1/4 x 5 1/4	
	W6C200-F	37.95	85	6	8	35-7.5		F		6 1/2 Dia. x 3 1/4	
	W8C170-F	36.75	100	8	8	30-7		F		8 1/2 Dia. x 3 1/2	
	W8C200-F	40.55	100	8	8	30-7		F		8 1/2 Dia. x 3 3/8	

8TH ANNUAL CAR STEREO DIRECTORY

SPEAKERS



JVC CS692

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Woofer Size, Inches	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Whizzer (W), 3-Way (3), 4-Way (4)	Flare Mount (F), Surface Mount (S), Component (C)	Dimensions, Inches	Notes	
PYLE INDUSTRIES (Continued)	W8C200-F4	41.15		100	8	4	30-7		F	8 1/4 Dia. x 3 3/4		
	W8C300-F	54.60		115	8	8	30-4.5		F	8 1/4 Dia. x 3 3/4		
	W10C170-F	41.40		105	10	8	30-6.5		F	10 1/8 Dia. x 4 1/4		
	W10C200-F	45.25		105	10	8	25-6.5		F	10 1/8 Dia. x 4 3/8		
	W10C200-F4	45.85		105	10	4	25-6.5		F	10 1/8 Dia. x 4 3/8		
	W10C300-F	58.95		120	10	8	20-4.5		F	10 1/8 Dia. x 4 3/4		
	W12C200-F	51.15		115	12	8	20-6		F	12 1/4 Dia. x 5 1/4		
	W12C200-F4	51.75		115	12	4	20-6		F	12 1/4 Dia. x 5 1/4		
	W12C300-F	63.30		130	12	8	20-4.5		F	12 1/4 Dia. x 5 1/4		
	W69C200-F	41.40		85	6 x 9	8	40-7		F	3 1/2 x 6 3/8 x 9 3/8		
	W69C200-F4	42.10		85	6 x 9	4	40-7		F	3 1/2 x 6 3/8 x 9 3/8		
	W69C290-F	49.95		100	6 x 9	8	35-7		F	4 x 6 3/8 x 9 3/8		
	W69C290-F4	50.80		100	6 x 9	4	35-7		F	4 x 6 3/8 x 9 3/8		
	W410C160-F	30.85		50	4 x 10	8	45-7.5		F	3 1/2 x 4 1/4 x 10		
	MSC99-F	24.60		55	5	8	700-14		F	5 Dia. x 2 1/2		
	MSC160-F	28.50		70	5	8	400-10		F	5 Dia. x 2 1/2		
	T17C55-X	19.15	38.30	45	1 1/4	8	2.5k-20k		F	4 1/4 Dia. x 1 1/4		
	T3C24-X	17.15	34.30	65	3	8	3.5k-20k		F	3 3/8 Dia. x 1 1/4		
	T3PA	16.00	32.00	35	2 1/2		3k-40k		F	3 1/4 Dia. x 3/4		
	T3PAS	14.75	29.50	35	3 3/4		3k-20k		F	3 3/4 Dia. x 1 1/8		
	H35A15-X	24.18	48.35	50	3 1/2	8	2.5k-20k		F	2 1/2 x 3 3/8 x 5 1/8		
	HT35P	22.65		35	3 1/2		4k-40k		F	2 1/4 x 3 3/8 x 3 3/8		
CD4C80-X	28.08	56.15	50	4	8	3k-20k		F	4 3/8 Dia. x 1 1/2			
QUAM-NICHOLS	62C10FEX	19.50		15	5 1/4	8	75-15		W	2 1/4 x 5 1/4 x 5 1/4		
	68C20FEX	25.65		15	6 x 8	8	45-17		W	3 3/8 x 6 3/8 x 8		
	68C10FEX	21.40		15	6 x 9	8	45-17		2	3 3/8 x 6 3/8 x 9 1/4		
	69C30FEX	42.05		50	4 x 8	8	35-15		W	3 3/8 x 6 3/8 x 9 1/4		
	69C10FECO	36.40		15	6 x 9	8	45-20		2	3 3/8 x 6 3/8 x 9 1/4		
	20X		59.50	18	6 x 9	8	45-17		W	3 1/2 x 6 3/8 x 9 1/4		
	20C0		94.50	35	6 x 9	8	40-19		2	3 1/2 x 6 3/8 x 10 x 9 1/4		
	30C25Z8	9.40		5	3	8	200-12		F	1 1/4 x 3 x 3		
	3C3Z8U	10.55		5	3	8	180-9		C	1 1/8 x 3 1/2 x 3 1/2		
	5C3Z8	10.35		5	5	8	90-13		C	1 x 4 3/8 x 4 3/8		
	52C10Z8	14.70		10	5 1/4	8	125-9		C	2 1/4 x 5 1/4 x 5 1/4	Kit. As above.	
RADIO SHACK	40-2039	49.95		40	4	8	50-20		2	7 1/8 x 5 x 4 3/8	Black finish; Model 40-2034, silver.	
	40-1355	24.95		30	6 x 9	8	60-15		2			
	40-1356	29.95		30	6 x 9	8	60-16		3			
	40-1382		24.00	50	6 1/2							
	40-1243	8.59		10		↑			W		↑4/8 16.	
	40-1297	12.95		30		8			W			
	40-1284	9.95		20		8						
	40-1909	6.95		10		8						
	40-1240	5.79		5		8						
	40-1333	5.99		4								
	40-1260	16.95		30		8			W			
	40-1268	9.99		10		8			W			
	40-1269	6.95		10		8			W			
	40-1261	7.99		10		↑			W			
	40-1298	6.95		10		8						
	40-1241	5.99		8		8						
	12-1856		59.95	60	5 1/4	8	80-16		3	F		
	12-1853		59.95	60	5 1/2	8	120-18		2	S	3 x 9 1/2 x 6 1/4	
	12-1854		79.95	80	5 1/4	8	100-15		3	F	2 1/4 x 9 1/4 x 6 3/4	
	12-1855		29.95	40	5 1/4	8				F	5 1/4 Dia. x 1 1/2	
12-1849		29.95	40	5 1/4	8			W	S	7 3/4 Dia. x 7 1/2		
12-1843		17.95	20	5 1/4	8			W	S			
12-1844		17.95	20	5 1/4	8			W	S	7 3/4 Dia. x 7 1/2		
12-1851		11.95	20	5	8			W	S			
12-1852		11.95	20	3	8				S			
ROADSTAR	RS-6022	74.95		30	5 3/8	4	70-18 ± 10		2	C	9 3/8 x 4 1/2 x 6 1/8	
ROYAL SOUND	RS400	80.00		25	4 x 10	4	70-20 ± 5		2	F	9 1/2 x 4 1/8 x 3	
	RS410	60.00		20	4	4	100-17 ± 5		W	F	4 x 4 x 2	
	RS500N	30.00		20	5 1/4	4	80-15 ± 5		W	F	6 x 6 x 2	
	RS510N	60.00		20	5 1/4	4	60-17 ± 5		2	F	6 x 6 x 2	
	RS520N	75.00		20	5 1/4	4	60-18 ± 5		3	F	6 x 6 x 2	
	RS600	160.00		50	6	4	60-20 ± 6		2	F	3 x 6 3/8 x 9 3/8	
	RS700	125.00		30	6 x 9	4	60-18 ± 6		2	F	3 x 6 3/8 x 9 3/4	
	RS800	60.00		25	6 x 9	4	70-20 ± 5		3	F	3 x 6 3/8 x 9 3/4	
	RS900	75.00		50	6 x 9	4	60-20 ± 5		3	F	3 x 6 3/8 x 9 3/4	
	RS6010	60.00		30	3	4	120-13 ± 10		W	S	5 1/4 x 3 3/8 x 4	
	RS6020	100.00		30	3	4	120-18 ± 10		2	S	5 1/8 x 3 1/2 x 3 3/8	
	RS6030	125.00		30	3	4	100-20 ± 6		2	S	6 x 3 5/8 x 3	
	RS6035	140.00		30	3	4	120-18 ± 10		3	S	5 1/4 x 3 3/8 x 4	
	RS6045N	200.00		45	4	8	80-20 ± 6		2	S	6 3/8 x 4 x 4 1/4	
	RS6100	250.00		100	4	4	45-20 ± 6		2	S	7 1/8 x 4 3/4 x 5 1/8	
RS6120	125.00		30	6 1/2	4	18-2 ± 2			C	8 3/8 x 8 3/8 x 6 3/8		



SPEAKERS

Mesa 20-ZX

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Max. Power. Watts	Woofer Size. Inches	Impedance. Ohms	Frequency Response. Hz to kHz. ± dB	Wattage (W) 2-Way (2), 3-Way (3), 4-Way (4)	Flush Mount (F), Surface Mount (S), Conceivable (C)	Dimensions. Inches	Notes
SANYO	SP709	22.95	10	4	4	90-16	W	F			
	SP721A	39.95	10	4	4	80-16	2	F			
	SP44	39.95	30	4	4	80-15	W	F			
	SP40	49.95	30	4	4	70-20	2	F			
	SP55	34.95	15	5 1/4	4	80-12	2	F			
	SP700	15.95	5	6 1/2	4	100-12		F			
	SP711	29.95	15	6 1/2	4	80-16	W	F			
	SP66	49.95	30	6 1/2	4	70-15	W	F			
	SP9035	59.95	30	6 1/2	4	70-17	2	F			
	SP9036	69.95	30	6 1/2	4	70-20	2	F			
	SP9046H	99.95	100	6 1/2	4	60-20	2	F			
	SP758A	54.95	30	5 x 7	4	80-16	2	C			
	SP766A	69.95	30	6 x 9	4	50-16	2	F			
	SP772A	79.95	30	6 x 9	4	50-20	3	F			
	SP778	99.95	30	6 x 9	4	50-20	3	F			
	SP69A	199.95	120	6 x 9	4	40-20	3	F			
	SP14	69.95	30	4 x 10	4	70-16	2	F			
	SP412A	89.95	30	4 x 10	4	70-20	3	F			
SP88	99.95	30	4	4	80-20	2	S		7 3/4 x 5 1/2 x 4 3/4		
SP90	219.95	100	4	4	80-20	2	S		9 3/4 x 7 x 5 3/4		
S J A INDUSTRIES	525	124.00	30	5 1/4	4	40-15	2	S			
	500	106.00	30	5 1/4	4	40-8		S			
	6825	178.00	40	6 x 9	4	30-15	2	C			
	6900	162.00	40	6 x 9	4	30-7.5		C			
	40125	152.00	40	4 x 10	4	35-15	2	C			
	40100	134.00	40	4 x 10	4	35-7.5		C			
	M400		30	4 1/2	4	60-12		S			
	850	13.90	75	8	4-8	30-3		S			
	1050	31.90	80	10	4-8	30-3		S			
	52515		132.00	50	5 1/4	4	35-15	2	S		
	50015		114.00	50	5 1/4	4	35-6		S		
	692515		192.00	60	6 x 9	4	30-15	2	C		
	690015		172.00	60	6 x 9	4	30-5		C		
	625	29.90	50	6	4	30-6		S			
	SONY	XS-3	34.95	20	3 1/2	4	100-20 ±3	W	F		3 1/2 Dia. x 1 1/2
XS-101		64.95	20	4	4	50-18 ±3	W	F		4 1/2 x 4 1/2 x 2 1/4	
XS-102		79.95	20	4	4	50-20 ±3	2	F		4 1/2 x 4 1/2 x 2 1/2	
XS-301		89.95	20	5 1/4	4	47-20 ±3	2	F		5 3/8 x 5 3/8 x 2 1/2	
XS-606		99.95	30	6 1/2	4	45-20 ±3	2	F		6 1/2 Dia. x 3	
XS-18		299.95	100	5	4	45-40 ±3	2	S		10 1/2 x 5 1/2 x 7 3/4	
XS-11		199.95	70	5	4	45-19 ±3	2	S		9 x 5 1/4 x 7 3/4	
XS-L20		199.95	60	8	4	18-4 ±3		F		8 3/4 x 8 3/4 x 3 1/4	
XS-L16		129.95	40	6 1/2	4	32-4 ±3		F		6 1/2 Dia. x 3 1/2	
XS-66		159.95	80	6 x 9	4	45-19 ±3	3	F		6 3/4 x 9 3/4 x 4 3/4	
XS-63		139.95	40	6 x 9	4	50-19 ±3	3	F		6 3/4 x 9 3/4 x 4 3/4	
XS-62		109.95	40	6 x 9	4	55-18 ±3	2	F		6 3/4 x 9 3/4 x 4	
XS-43		139.95	40	4 x 10	4	65-18 ±3	3	F		4 5/8 x 10 3/4 x 3 3/4	
XS-880		189.95	60	8	4	30-21 ±3	3	F		8 3/8 x 8 3/4 x 3 1/2	
XS-691		129.95	40	6 x 9	4	35-21 ±3	3	F		6 3/4 x 9 3/4 x 4	
XS-690		94.95	30	6 x 9	4	35-20 ±3	2	F		6 3/4 x 9 3/4 x 4	
XS-613S		89.95	20	6 1/2	4	70-15 ±3	2	F		7 1/2 Dia. x 2 1/4	
XS-211S		59.95	15	5	4	85-12.5 ±3	W	F		6 1/2 Dia. x 1 1/4	
SPARKOMATIC	SK6950	99.95	100	6 x 9	4	50-20	4	S		5 1/2 x 9 1/4 x 4	
	SK550	89.95	100	5 x 7	4	60-20	4	S		8 x 6 x 5 1/2	
	SK650	74.95	100	6	4	70-20	4	F		6 1/4 x 6 1/4 x 3	
	SK8922T	69.95	40	6 x 9	4	30-17	3	S		6 1/4 x 9 1/4 x 3 1/2	
	SK522T	59.95	5	5 x 7	4	60-17	3	S		8 x 6 x 5 1/2	
	SK622T	54.95	6	4	4	50-4	3	F		8 1/4 x 6 1/4 x 2 3/4	
	SK6900	89.95	40	6 x 9	4	40-18	3	S		6 1/2 x 10 1/2 x 3	
	SK6920C	47.95	25	6 x 9	4-8	30-15	2	S		6 1/2 x 9 1/4 x 3 3/8	
	SK520C	44.95	25	5 x 7	4-8	60-15	2	S		8 x 6 x 5 1/2	
	SK620C	39.95	25	6	4-8	50-15	2	F		6 1/4 x 6 1/4 x 2 3/4	
	SK4120C	47.95	25	4 x 10	4-8	50-15	2	S		4 1/4 x 10 x 3 3/8	
	SK410	29.95	20	2	4-8	90-15		S		5 1/2 x 6 3/8 x 5	
	SK400	24.95	20	3 3/4	4-8	90-15		F		4 x 4 x 1 1/4	
	SK600	39.95	15	5 1/2	4-8	70-15	2	F		6 1/4 x 6 1/4 x 1 1/2	
	SK300	19.95	20	3 1/4	4-8	90-15		F		3 1/2 x 4 3/4 x 1 1/2	
	SK690	29.95	15	6 x 9	4-8	50-12		S		6 3/4 x 9 3/4 x 3 1/2	
	SK510	29.95	15	5 x 7	4-8	60-12		S		8 x 6 x 5 1/2	
	SK610	19.95	15	6	4-8	70-12		F		6 1/4 x 6 1/4 x 2 1/4	
SPECO	DMS-3	119.95	50	4	8	55-20	3	S		7 1/2 x 4 1/2 x 4 3/4	
	DMS-2	99.95	30	3	8	60-20	2	S		5 1/2 x 3 3/4 x 3	
	SK6920T	89.95	40	6 x 9	8	50-20	3	F			
	SK4120C	31.95	40	4 x 10	8	50-20	2	F			
	WC5110C	55.00	20	5 1/4	8	50-15	2	C			
SPECTROM	700	250.00	50	5	8	70-20 ±3	2	F		7 3/4 x 5 1/2 x 1 1/4	
	760	300.00	80	6 1/2	8	50-20 ±3	2	F		6 3/4 x 9 1/2 x 1	

SPEAKERS

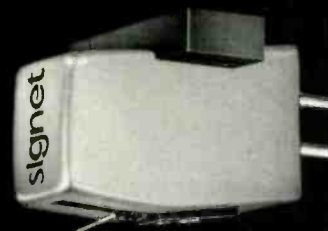


JBL T545

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Woofer Size, Inches	Impedance, Ohms	Frequency Response, Hz to KHz, ±dB	Whizzer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Flush Mount (F), Surface Mount (S), Convertible (C)	Dimensions, Inches	Notes	
TAMON AUTO SOUND	LB-1010	84.98	40	3	4	100-12	3	S		6 7/8 x 5 1/4 x 4 1/2		
	CS-300DX	95.98	40	5	4	70-20	3	F		9 1/4 x 5 3/4 x 1 1/2		
	CS-401	34.98	25	4	8	110-15		F		3 1/2 x 3 1/2 x 7/8		
	CS-440	43.98	40	4	4	100-18		F		4 3/4 x 4 3/4 x 5/8		
	CS-550	37.98	35	5	4	120-15		F		5 7/8 x 5 7/8 x 1/2		
	CS-500CX	54.98	25	5 1/4	4	75-18	2	F		6 1/2 Dia. x 1 1/4		
	CS-560CX	75.98	60	5 1/4	4	70-20	2	F		6 1/2 Dia. x 1 1/4		
	CS-560TX	99.98	60	5 1/4	4	70-20	3	F		6 1/2 Dia. x 1 1/4		
	CS-6100CX	134.98	100	6 x 9	4	60-20	2	F		9 3/4 x 6 3/4 x 1 1/4		
	CS-6100TX	154.98	100	6 x 9	4	60-20	3	F		9 3/4 x 6 3/4 x 1 1/4		
	BS-350DU	14.98	29.98	20	3 1/2	4	150-18		F			
	BS-460CX	21.98	42.98	40	4 x 6	4	150-18	2	F			
	BS-460DU	14.98	29.98	40	4 x 6	4	150-18		F			
	BS-460VW	13.98	27.98	20	4 x 6	4	150-18		F			
VISONIK	Alphasonik D3200	75.00	150.00	45	4	4	66-22 +4, -8	2	F	6 3/4 x 4 1/4 x 1 1/4		
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AM ST

AN FCC FIASCO!!

LEONARD FELDMAN

By the time you read this, you may be able to turn on the radio in your car or home and listen to a stereo broadcast—on the AM radio band. Or, you may be able to listen to two different AM stereo broadcast systems—or three—or four, or possibly even *five*!

That's because the Federal Communications Commission, unable to decide *which* of five proposed systems for AM stereo was "best," took the easy way out. Instead of providing the country with a national standard for this new service (one of the purposes for which the FCC was ostensibly created), that august body of seven commissioners and assorted technical staff, after spending more than five years on this subject, issuing a tentative decision in favor of one of the systems (Magnavox) more than two years ago, and then, a few months later, retracting its tentative decision for the purpose of "taking another look at the data," has brought forth what amounts to a colossal *non-decision*.

The FCC has asked the American

public to decide which system (if any) should dominate. In other words, U.S. AM radio stations are now free to go on the air, using any one of the five systems they wish, and transmit stereo programming. What the American public is supposed to do to receive these broadcasts is left to the manufacturers of home and car stereo equipment.

The makers of such equipment can "bet" on a single system at the outset and produce receivers which can detect and decode that system. Or they can build receivers containing multiple decoder circuits and a selector switch—at considerable additional cost to the purchaser. They can probably even devise receivers which will automatically respond to the type of transmission being received and switch over to appropriate decoder circuitry without the listener having to do a thing—again, at a considerable increase in cost of the receiver. Or, as may very well happen, they can sit back in a classical chicken and egg dilemma, waiting for broadcasters to

make up their minds, while the broadcasters wait for the receiver manufacturers to make up theirs!

It would be one thing, of course, if all five systems were nearly identical in operation. Under those circumstances, a single circuit with minor switched-in modifications might be possible without adding too much cost to the receiver. But, as a quick look at the sidebars will show, the five proposed AM stereo systems are quite different from each other. To be sure, National Semiconductor, for example, has developed a single chip (LM1981) which, though originally designed for the "about to be approved" Magnavox system, can, according to its developers, be modified (by changes in external componentry) for use with at least two other proposed systems (Motorola and Belar), and, possibly, with the addition or substitution of yet additional components, for the other two proposed systems (Harris and Kahn/Hazeltine) as well. Still, time alone will tell whether the FCC non-decision leads to the creation of a new type of radio service in the United States or results in abandonment of the entire idea of AM stereo.

At stake are enormous sums of money. Car audio is particularly ripe for AM stereo. In many places, such as the Bay Area of California, automobile commuters cannot listen to a single FM station throughout the drive to and from work. Indeed, at least six leaders in car audio already have built prototype receivers.

While AM stereo will not automatically make existing gear obsolete, the industry estimates that five million AM stereo receivers could be sold in 1983, *if* a single system is established. But by leaving the decision to the marketplace, where price, advertising and other considerations may be as significant as quality, this becomes a very large IF.

Nevertheless, some interested parties have already picked their horse in the AM stereo derby. National Semi-

STEREO

1

The Magnavox System

Almost gaining approval of the FCC, the Magnavox system uses a combination of amplitude modulation and linear phase modulation. As is true in FM stereo broadcasting (and with *all* of the proposed AM stereo techniques), stereophonic program material is first matrixed into (L+R) and (L-R) signals. The (L+R) signal amplitude-modulates the r.f. carrier, while the (L-R) signal phase-modulates the carrier. This system also includes a 5-Hz FM signal on the carrier which can be used for automatic identification of stereo broadcasts and, perhaps, automatic switching of receiver circuitry from mono to stereo.

A three-step process generates the required composite signal for the Magnavox system; the elements are shown in the block diagram of Fig. 1. First, a 3.69-MHz oscillator is frequency-modulated with a 5-Hz identification tone. Phase deviation is limited to 4 radians. Next, a phase modulator adds the (L-R) audio component as phase deviation to the output of a tunable frequency synthesizer. Tuning range is from 4 to 6 MHz, and the maximum peak deviation contributed by the (L-R) component is limited to a maximum of one radian. The two modulated signals are down-converted by a heterodyning process, applied to a standard AM transmitter's r.f. input, and amplified to

full station power. This amplified carrier is also amplitude-modulated by the (L+R) component using the modulation circuitry already found in the standard AM transmitter. A delay network equalizes the time delays which the (L+R) and (L-R) signals encounter prior to transmission.

A block diagram of a possible decoder circuit for the Magnavox system is shown in Fig. 2. All r.f. and i.f. circuitry is the same as it

would be in a monophonic AM receiver. At the i.f. amplifier output, the signal splits into two directions. A typical envelope detector may be used to extract the amplitude modulated material (L+R) and to detect the r.f. carrier level for an a.g.c. function. At the same time, the i.f. amplifier output is limited to remove amplitude modulation, and a phase modulation (PM) detector extracts the (L-R) audio signal and

the 5-Hz identification tone. Next, AM and PM channel outputs are applied to the matrix block. If a 5-Hz tone is present (indicating that stereo is being transmitted), the stereo/mono switch is placed in the stereo mode. In the absence of this identification tone, the mono/stereo switch reverts to the mono mode, and the (L+R) signal appears at both outputs—a monophonic signal from both loudspeakers.

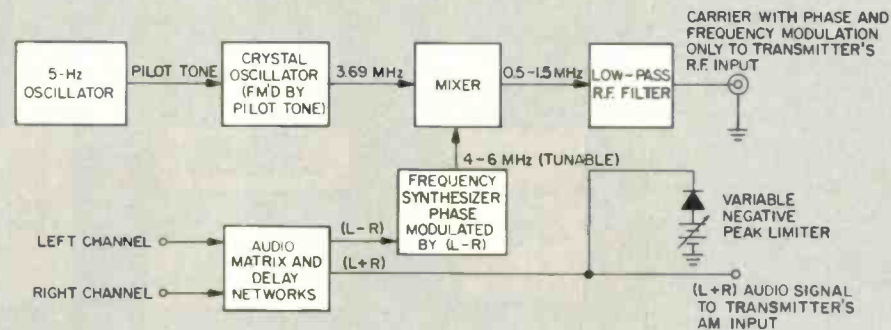


Fig. 1—Transmission of the composite Magnavox AM stereo signal.

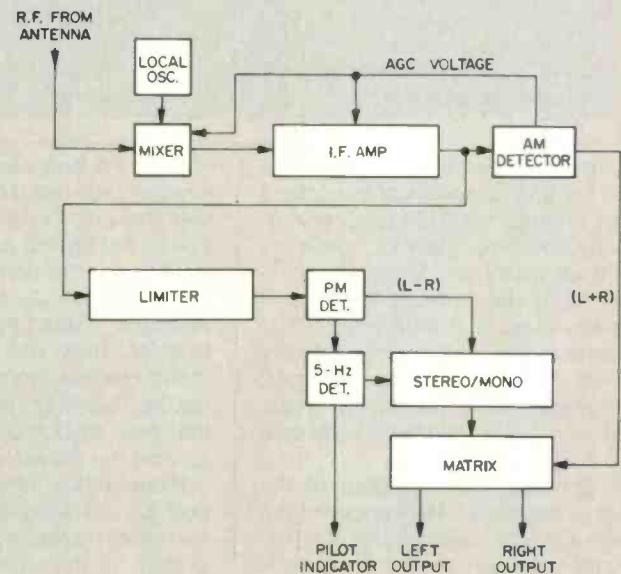


Fig. 2—Elements of the receiver/decoder needed for the Magnavox system.

2

The Belar System

Belar Electronics Laboratory proposed a system derived from an original proposal by RCA (which was not an active proponent in the FCC AM Stereo Docket). The Belar transmission method is illustrated in the block diagram of Fig. 3. As in the Magnavox system, matrixed (L+R) and (L-R) signals are used. The (L-R) component is first pre-emphasized using a 400-mS time constant. It is then routed through a variable-delay line to an FM modulator input, where it *frequency-modulates* the r.f. signal used to drive the transmitter. At the same time, the (L+R) signal *amplitude-modulates* the carrier in the conventional way. Peak low-frequency deviation of the carrier by the (L-R) component is limited to ± 1.25 kHz.

A typical receiver decoding circuit for the Belar system is shown in block diagram form in Fig. 4. Again, the r.f. and i.f. stages would be the same as in an ordinary monophonic AM receiver. The output of the i.f. amplifier is split into two separate detection paths. One path applies the signal to a limiter amplifier which removes any AM modulation, leaving an FM square wave to be de-

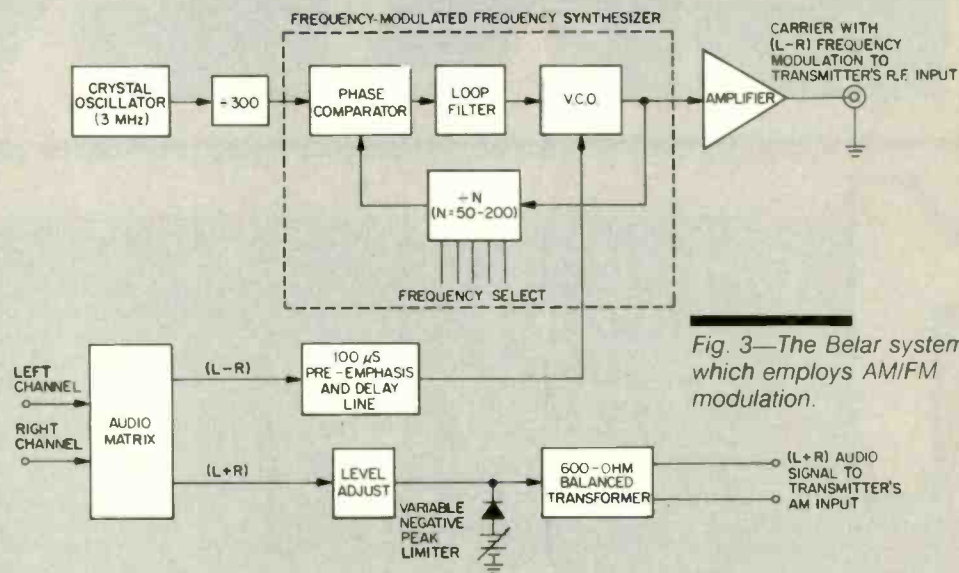


Fig. 3—The Belar system, which employs AM/FM modulation.

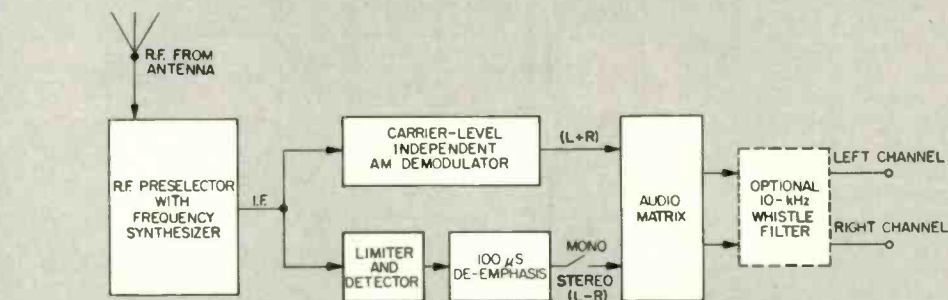


Fig. 4—Decoding of the Belar system, involving separate AM and FM detectors plus matrix addition and subtraction of (L+R) and (L-R) signals.

conductor, for example, one of the world's leading suppliers of integrated circuits, entered the AM stereo field in 1976. By the time the FCC gave its initial approval of the Magnavox system in 1980, National Semiconductor was ready to go to market with its first AM stereo decoder. It was specifically designed for the Magnavox system, and although the chips can be made to suit two other systems, National openly prefers Magnavox.

Dan Shockey, an executive of the company, has said, "Momentum in the receiver industry towards the Magnavox system, based on the 1980 deci-

sion, is the only clear momentum anywhere." He has also claimed that it was the only "existing, practical solution to AM stereo at the crucial receiver level . . . the only one system ready for production at major receiver manufacturers." Shockey warns that failure to establish an AM stereo system within the next six months will confuse the public, resulting in the kind of reaction that has all but destroyed quad and slowed the growth of videodiscs.

Pioneer has offered cautious support for the Magnavox system. "After extensive research on the proposed system of implementing AM stereo,"

said company President Jack Doyle, "Pioneer has determined the Magnavox format to be one of the best and most effective." However, Pioneer has yet to make any AM stereo receivers.

Sansui has built a prototype tuner capable of automatically detecting and decoding the Magnavox, Harris or Kahn systems. But Sansui Vice President Tom Yoda says, "We are not supporting any specific AM stereo system at this time."

Ford Motor Company, whose subsidiary Ford Aerospace and Communications Corp. manufactures car receivers, notified the FCC that it favored

AM STEREO

either the Magnavox or Belar systems. Ford reported that its engineers found that the costs for Motorola, Harris and Kahn systems would be roughly double that of Belar or Magnavox "without perceivable improvement."

On behalf of its candidate, the Harris Corp. intends to enter the market aggressively, using the company's

unique leverage. Of all the manufacturers, Harris is the only one that also produces transmitters and in that role supplied more than half of all AM and FM transmitters installed by U.S. broadcasters last year. The company claims to have 150 "contingent" orders from AM stations for stereo systems and will immediately seek to con-

vert these to firm commitments.

Meanwhile, Sanyo, Matsushita, Trio-Kenwood, Aiwa, Sony, Sharp, JVC, Nippon Columbia, Akai, et al. appear to be waiting for more information before making any decisions on a system. Their hesitation is not based solely on the uncertainty in the U.S. market, because the Japanese govern-

3

The Harris System

Harris Corp. calls its system a compatible phase-multiplex system (CPM). As shown in Fig. 5, in this system, the left-channel signal amplitude-modulates a carrier which lags the transmitted resultant by 15°; the right channel modulates a carrier which leads the transmitted resultant carrier by 15°. When these two signals are added together, they form coherent (L+R) sidebands which are identical to those of a conventional monophonic signal, as well as (L-R) quadrature sidebands which are reduced in amplitude with respect to the (L+R) sidebands because of the use of the 30° angle. The CPM system might therefore be described as a modified quadrature system. It uses a technique which is very similar to that used in color TV for transmitting two chroma (color) signals on a single carrier. In Fig. 5, the composite signal, $V(t)$, created by the addition of the leading and lagging r.f. signals, must be separated into its envelope components, $V_e(t)$, and phase-modulated carrier components, $V_c(t)$, before it can be transmitted by a conventional AM transmitter. A clipper circuit recovers the phase modulation, while an envelope AM detector recovers the amplitude modulation. These two components, $V_c(t)$ and $V_e(t)$, are then applied, respectively, to the r.f. and audio inputs of the transmitter.

One possible form of receiving decoder circuitry for the Harris system is illustrated in the block diagram of Fig. 6. An ordinary AM receiving circuit is used up to the point of i.f. detection. There, a phase-locked loop circuit regenerates an unmodulated i.f. signal from the incoming i.f. signal. The regenerated i.f. signal from the voltage-controlled oscillator of the PLL circuit is 90° out of phase with respect to the incoming modulated i.f. signal, so that mixer M_2 demodulates the quadrature (L-R) information directly. A 90° phase-shift network produces unmodulated i.f. that is in phase with the incoming modulated i.f. signals. This signal is combined with the modulated i.f. signal in a second mixer, M_1 , to demodulate

the in-phase (L+R) information. After appropriate gain adjustments, the two recovered signals are matrixed to produce separate "L" and "R" signals. Though not shown in the diagrams of Figs. 5 and 6, Harris has also suggested that a 20 to 25 Hz signal, at 9% modulation of the (L-R) channel, be transmitted as a stereo-indicating or switching signal.

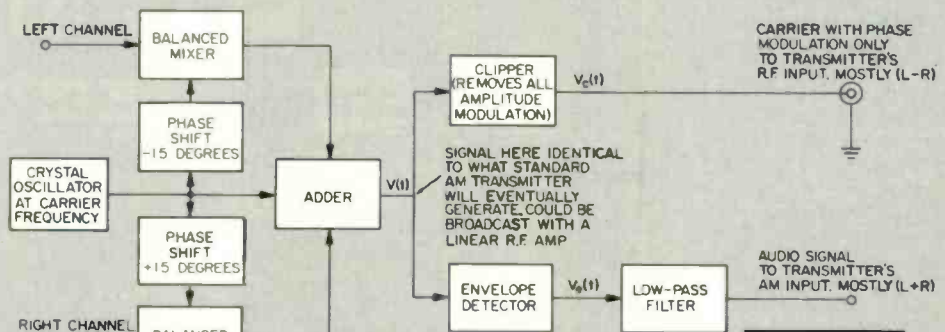


Fig. 5—In the Harris system, two carriers, 30° apart in phase, are employed to create a composite r.f. carrier signal.

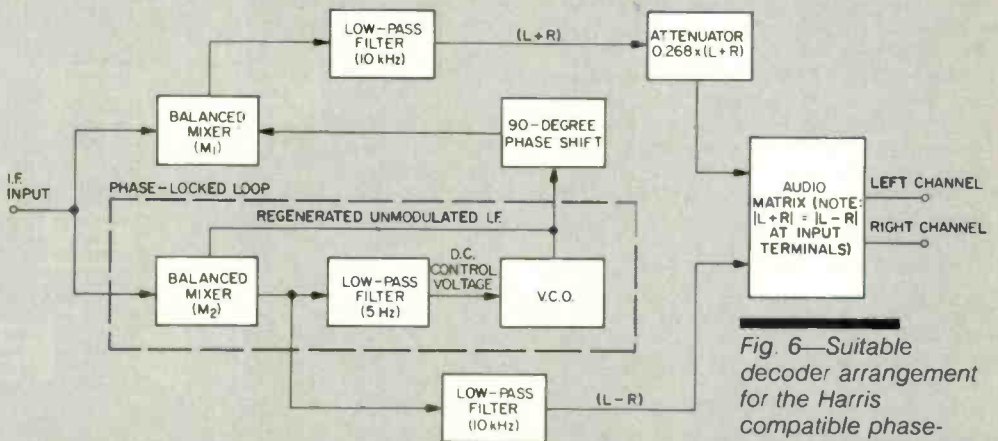


Fig. 6—Suitable decoder arrangement for the Harris compatible phase-multiplex (CPM) system.

AM STEREO

ernment has also failed to choose a system for AM stereo in that country.

While there are some similarities between the five systems now "approved" by the FCC, by no stretch of the imagination could all five systems be said to be compatible with each other. No one can predict at this time which system (if any) will gain suprem-

acy. What is certain is that even if one system ultimately wins out, there is little guarantee that it will be the "best" system, from a technical point of view. At least three commissioners at the FCC agree with that unfortunate conclusion.

I'd like to quote, verbatim, from a statement of FCC Commissioner

James H. Quello who, while concurring in the result of the FCC deliberations, said, in part:

"The marketplace has very little competence to determine the relative merits of one technical standard versus another over the short term since its decisions are generally influenced by marketing efforts more than by

4

The Motorola System

This system is known as C-QUAM. One method of transmitting two signals on one carrier is to modulate two carriers of the same frequency which are 90° apart in phase.

The problem with ordinary quadrature amplitude modulation (QUAM), when applied to the broadcast band for the transmission of stereo, is mono compatibility. When large amounts of stereo information (L-R) are present in the composite signal, the audio signal recovered by a monophonic receiver's envelope detector becomes *not* the linear sum of left-plus-right, as it should be, but contains high orders of intermodulation distortion. To counter this problem, Motorola developed compatible QUAM or C-QUAM, and a block diagram of their transmitter arrangement is shown in Fig. 7. The monophonic-equivalent (L+R) signal follows two paths. One goes directly to the transmitter's AM modulator, while the other impresses a crystal-controlled carrier, F_c , with (L+R) modulation through a balanced modulator. At the same time, the (L-R) audio signal is passed through a different balanced modulator which generates the required pure-quadrature modulation. The (L+R) amplitude-modulated carrier and the quadrature-modulated carrier are added together and filtered to form an ordinary QUAM r.f. sig-

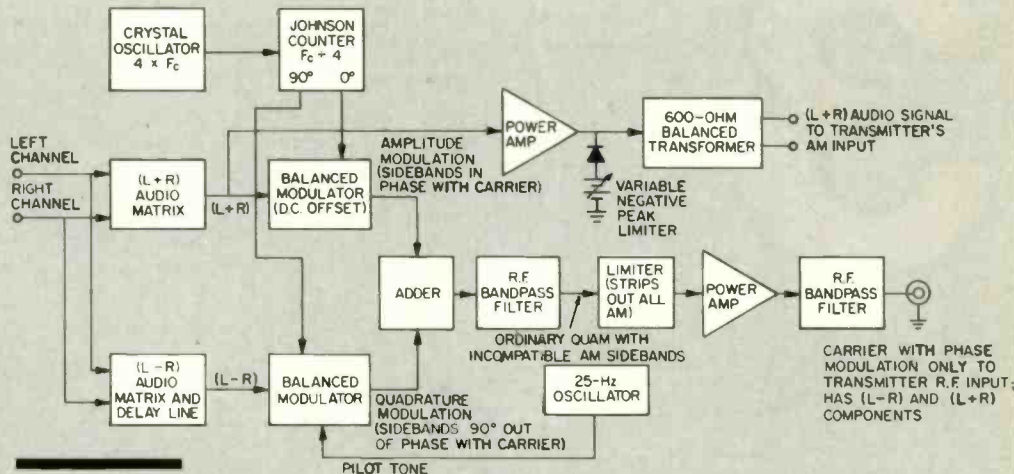


Fig. 7—Transmitter arrangement used in Motorola's C-QUAM system.

nal. This QUAM signal is limited (incompatible AM sidebands are removed), amplified, filtered, and delivered as a phase-modulated carrier to the transmitter's r.f. input. The standard AM transmitter, amplitude-modulating this phase-modulated carrier with an (L+R) signal, is what actually generates the C-QUAM signal. For stereo identification purposes, the Motorola system uses a 25-Hz tone.

To receive and decode Motorola C-QUAM AM stereo, a decoder such as the one in Fig. 8 would be used. Here, the output of the i.f. amplifier is applied to a carrier level modulator and limiter. The voltage-controlled oscillator (VCO), which is locked in phase with the i.f. carrier, is used with the limiter output to provide input signals to a phase-detector circuit. The phase detector and low-pass filter provide the control signal which maintains the VCO locked in quadrature phase relationship with the i.f. carrier signal. The VCO output is shifted 90° to provide a signal in phase with the

i.f. carrier. When the phase-shifted VCO signal is used together with a signal from the limiter to supply the phase detector, a signal proportional to $\cos \Theta$ is derived. The $\cos \Theta$ signal is used to supply the carrier level modulator which restores QUAM signals at their inputs.

its outputs. Left and right audio signals can be demodulated by synchronous detectors (balanced modulators), supplied with signals at $\cos(\omega_c t \pm \pi/4)$ to derive "L" and "R" signals directly, since the signals are QUAM at their inputs.

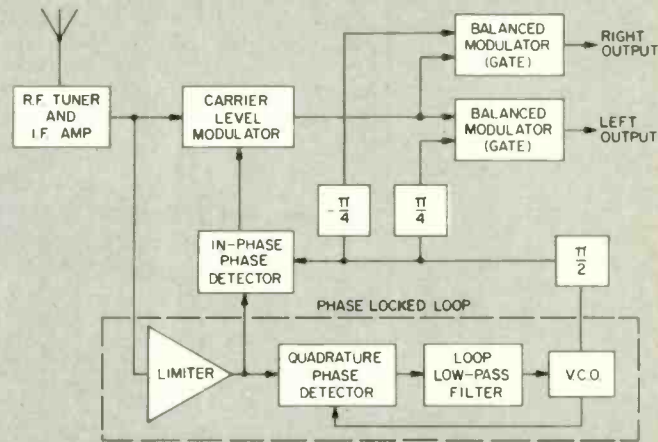


Fig. 8—Receiver arrangement for C-QUAM.

AM STEREO

technical superiority. To expect the American public to select a nationally compatible AM stereo system in a reasonable period of time from among five systems now before this Commission is sheer folly. In the first instance, the decision as to what system to select falls upon the broadcaster. He must guess which system will gain

enough public acceptance over time to survive. It is at that point that the public must cast its votes with each broadcaster, principally with a view toward avoiding, if possible, early obsolescence of receivers. Should two or more incompatible systems develop within a listening area, competition for listeners effectively takes place only

until stereo receivers are purchased. From then on, the purchaser is "locked" into the system selected insofar as stereo is concerned.

"I am appalled that it has taken this Commission five years to decide that it cannot decide this issue . . ."

So are we, Commissioner Quello, so are we! A

5

The Kahn/Hazeltine System

Leonard Kahn, an inventor and engineering consultant based on Long Island, New York, has been involved in AM stereo since the late 1950s. In 1977, he gained the support and endorsement of the well-known Hazeltine Corporation, also of Long Island. Kahn calls his system ISB for Independent Sideband. A block diagram of the transmission side is shown in Fig. 9. Left and right audio signals are again matrixed together and fed through a constant-phase-difference (-45°), constant-amplitude network to form an $(L+R)$ signal. At the same time, an $(L-R)$ signal is fed through another phase-shift network ($+45^\circ$) so that the $(L+R)$ and $(L-R)$ signals are now 90° apart in phase. The $(L-R)$ signal now feeds a summing circuit and a level-squaring circuit. A variable time-delay network adjusts the time delay of the $(L-R)$ path so that it equals the time delay of the $(L+R)$ path. Outputs from the time-delay circuit and the transmitter's crystal oscillator are sent to a phase-modulator/frequency multiplier chain which finally provides a phase-modulated carrier wave, at the correct frequency, to the standard AM transmitter's r.f. input. What may not be immediately apparent from the above description is that in the Kahn/Hazeltine system, phase modulation of the carrier with $(L-R)$ information occurs in such a way

that amplitude modulation of the carrier will place most of the left-channel stereo information in the lower sideband of the AM transmission, and most of the right-channel stereo information will appear in the upper sideband. To this basic system, Kahn/Hazeltine have added a pilot (identification) tone at 15 Hz which angle-modulates the r.f. carrier by approximately 0.1 radian.

As a result of the distribution of left and right signal energy in the upper and lower sidebands, an interesting side benefit of the Kahn/Hazeltine system is that two ordinary radios, placed apart from each other in the listening room, can be used to receive AM stereo broadcasts transmitted using this system. The left radio is simply tuned slightly below the center station frequency, while

the right radio is tuned slightly above center frequency. Tuned in this manner, the two radios will directly demodulate the upper and lower AM sidebands and produce "L" and "R" audio channels. Of course, a more sophisticated approach in the form of a single receiver specifically designed for the system is also possible and is illustrated in the block diagram of Fig. 10.

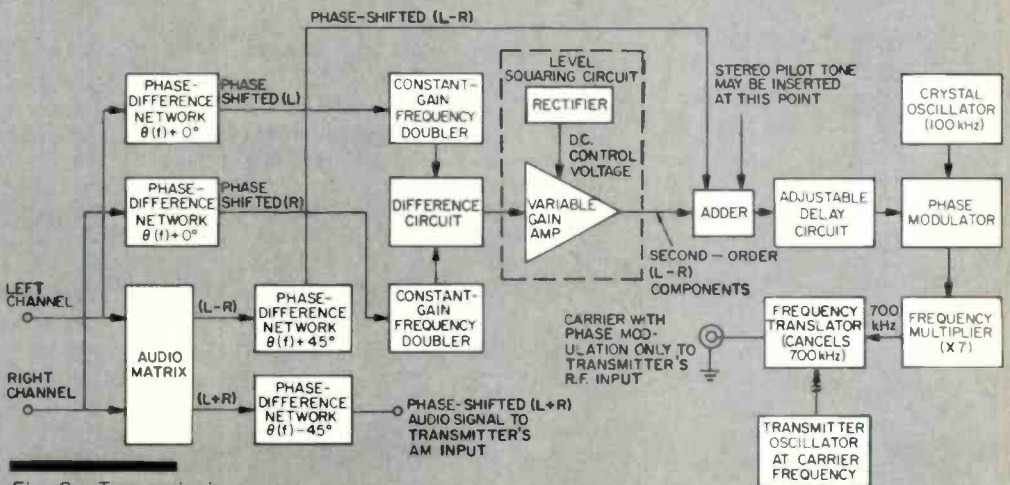


Fig. 9—Transmission for the Kahn/Hazeltine system.

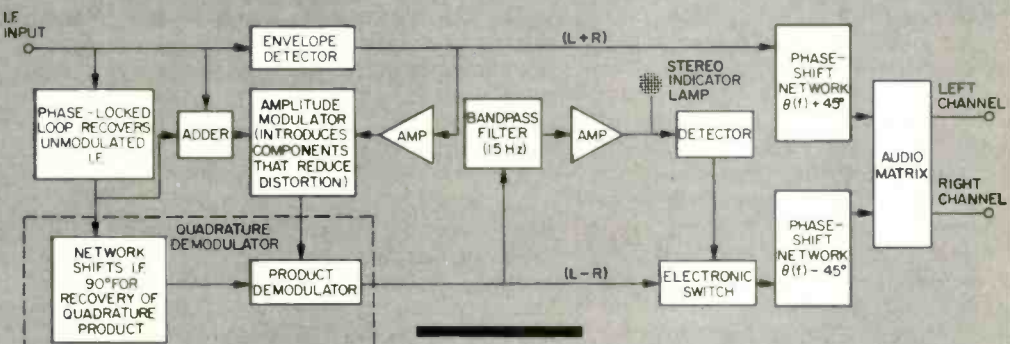


Fig. 10—Possible receiver/decoder circuit arrangement for the Kahn/Hazeltine ISB system.

KENWOOD SPECTRUM 70



One-brand systems, among other attractions, offer audio connoisseurs an economical solution for a second sound system in the home or an installation at a summer place. Kenwood, which makes a fine line of home and car stereo gear, recently introduced a novel video/audio integrated amplifier and now has plunged into the burgeoning field of one-brand systems.

Kenwood's top-of-the-line Spectrum 70 system consists of an integrated amplifier (Model KA-70), an AM-FM tuner (Model KT-50), a direct-drive fully automatic turntable (Model KD-50F), and a cassette tape deck (Model KX-70). Three-way speaker systems

(Model JL800) are also supplied (though I did not include them in my tests). The system is housed in an attractive, simulated walnut-finish cabinet with a glass door and has a hinged glass cover over the turntable. A twin-section low-boy cabinet, using the same components, is available as the Spectrum 77.

Kenwood has simplified the system's assembly by installing a special Pickering phono cartridge into the separate headshell of the tonearm. This cartridge is quite similar to Pickering's well-accepted 625 series of conical-style cartridges that provide a relatively high output and track at between 2 and 5 grams. Happily, in the Ken-

wood turntable with its light-touch, front-mounted controls and its straight tonearm, the cartridge performed well. But for a turntable of this quality and features, I would have preferred to see a somewhat higher quality pickup, since I usually wouldn't want to play my discs at 2.5 grams tracking force.

The system's integrated amplifier has a simplified panel featuring a large LED display that tells you how much power is being produced by each channel. Input (program) selection is by means of rectangular pushbuttons with a bar that lights up when selected. Less-used bass, treble and balance controls are set almost flush with the front panel. Other features include

two tape monitor circuits for recording and dubbing and independent push-button selection of two sets of speakers. A subsonic filter lessens the rumble produced by warped discs, and there's a loudness switch for low-volume listening, as well as the usual headphone jack.

The amplifier, though surpassing its rated output by a wide margin, produced a shade more harmonic distortion than claimed. However, this level of distortion (0.07%) is still far below audibility. Frequency response of the phono equalizer was so accurate that I really would be inclined to call it "error free." Overall, the amp has adequate

but not overdone controls that are smooth in operation and easy to use.

The AM/FM stereo tuner has both a digital frequency display and a conventional analog dial and pointer. It features what Kenwood calls "touch-sensor servo-lock" tuning, which simply means that it fine tunes and locks in the desired station when you let go of the tuning knob. Tuning aids and signal-strength meters take the form of fast-response LEDs. Though I feel too much signal was required in the stereo mode to reach the 50-dB level of quieting, I strongly suspect that some alignment touch-up would have increased the sensitivity of this tuner both in

mono and stereo. I suggest you check this out when auditioning the system on FM to make sure the unit you get includes a properly aligned tuner. The lack of sensitivity didn't affect the excellent stereo separation.

As for stereo signal-to-noise, one reason for my out-of-spec reading was the presence of an inordinately high amount of residual stereo pilot-carrier signal (19 kHz) which Kenwood probably doesn't count as "noise" but which registers on my test instruments. Fortunately, you can't hear the 19 kHz and it won't affect recordings on the companion cassette deck because it has an effective multiplex filter.

The cassette deck has two motors (one for the capstan, the other for driving the cassette reels) and delivered a very low wow and flutter of only 0.05% (a bit shy of the 0.04% claimed by the maker). Its Direct Program Search system allows access to as many as 15 musical selections. Other functions include single-selection and full-side repeat play, as well as a timer standby.

Other features of the deck include Dolby B noise reduction, a tape-type selector, a seven-LED peak-level recording meter, a recording mute switch, two mike jacks, a headphone jack, and automatic transport shutoff in all modes. I checked the frequency response, using appropriate grades of Maxell tape, and obtained best results (both for frequency response and S/N) with Maxell's MX metal tape, though their chrome-equivalent XL II-S tape did nearly as well.

Unweighted rumble was an excellent 60 dB for the turntable, which also exhibited exceptionally low wow and flutter of 0.025%. Response of the supplied cartridge tended to roll off at the extreme high end and exhibited the usual peak at around 13 or 14 kHz, indicating that a better match could have been obtained between the cartridge and preamp inputs in this system. This result reinforces my suggestion about upgrading the pickup.

Aside from the poorly aligned tuner (which could be corrected), Kenwood has come up with a very respectable component system. Purchased separately, the components would cost considerably more than the listed price of \$2,041.

Leonard Feldman

Enter No. 98 on Reader Service Card

ONE-BRAND SYSTEM RATINGS

Manufacturer: Kenwood
Dimensions: Not available.
Price: \$2,041.00.

Model: Spectrum 70

Component & Specification	Claimed	Measured	Rating
<i>Power Amp Section (KA-70)</i>			
Power/Channel, watts	65	75	♪♪
Rated THD, %	0.05	0.07	♪♪
<i>Preamp Section (KA-70)</i>			
Freq. Resp., Phono, dB	RIAA ± 0.3	RIAA ± 0.1	♪♪♪♪
Phono S/N, dB	79 (re: 5 mV)	77	♪♪
<i>FM Tuner Section (KT-50)</i>			
50-dB Quieting, Stereo, dB†	37.2 (39.9 µV)	49 (155 µV)	♪†
S/N, Stereo, dB	70	67	♪
THD, Stereo, 1 kHz, %	0.2	0.2	♪♪
Separation, 1 kHz, dB	45	45	♪♪
Alt. Chan. Selectivity, dB	50	52	♪
<i>Turntable/Cartridge Section (KD-50F)</i>			
Freq. Response, Hz-kHz, ±dB	N/A	20-20, +3.2, -5	♪
Separation, 1kHz, dB	N/A	22.3	♪
Rumble, DIN B, dB	-75	60 (unwtd.)	♪♪
Wow & Flutter, % w rms	0.025	0.025	♪♪
<i>Cassette Recorder Section (KX-70)</i>			
Freq. Resp., Hz-kHz, ±3 dB			
Normal Tape	30-16	22-13.5	♪
Chrome Tape	30-16	22-16	♪
Metal Tape	30-17	22-16.5	♪
S/N, Best Tape, with NR, dB	68	65.5	♪
Wow & Flutter, % w rms	0.04	0.05	♪

† See Text.

Rating System

♪ = Poor; ♪ = Good; ♪♪ = Very Good; ♪♪♪ = Excellent; ♪♪♪♪ = Superb.

General Comments

Power Amplifier: Listening panel approved, construction and reliability as good as separates. *Preamp:* Excellent, especially phono; controls innovative. *Turntable & Cartridge:* Not perfectly loaded by preamp but turntable excellent. *Tuner:* Good sound with a strong signal, tunes easily. *Cassette Recorder:* With better grades of tape it's fine but needs tape counter badly.

Overall Rating: ♪♪

"You're Hearing America"

TOM BINGHAM

"Radio is a listener's medium, where the listener really can be included. Television gives you everything and becomes a passive medium. As a listener's medium, radio interests me; the act of listening interests me. And as a sound recordist, I have the opportunity to go out and rediscover the experience of listening.

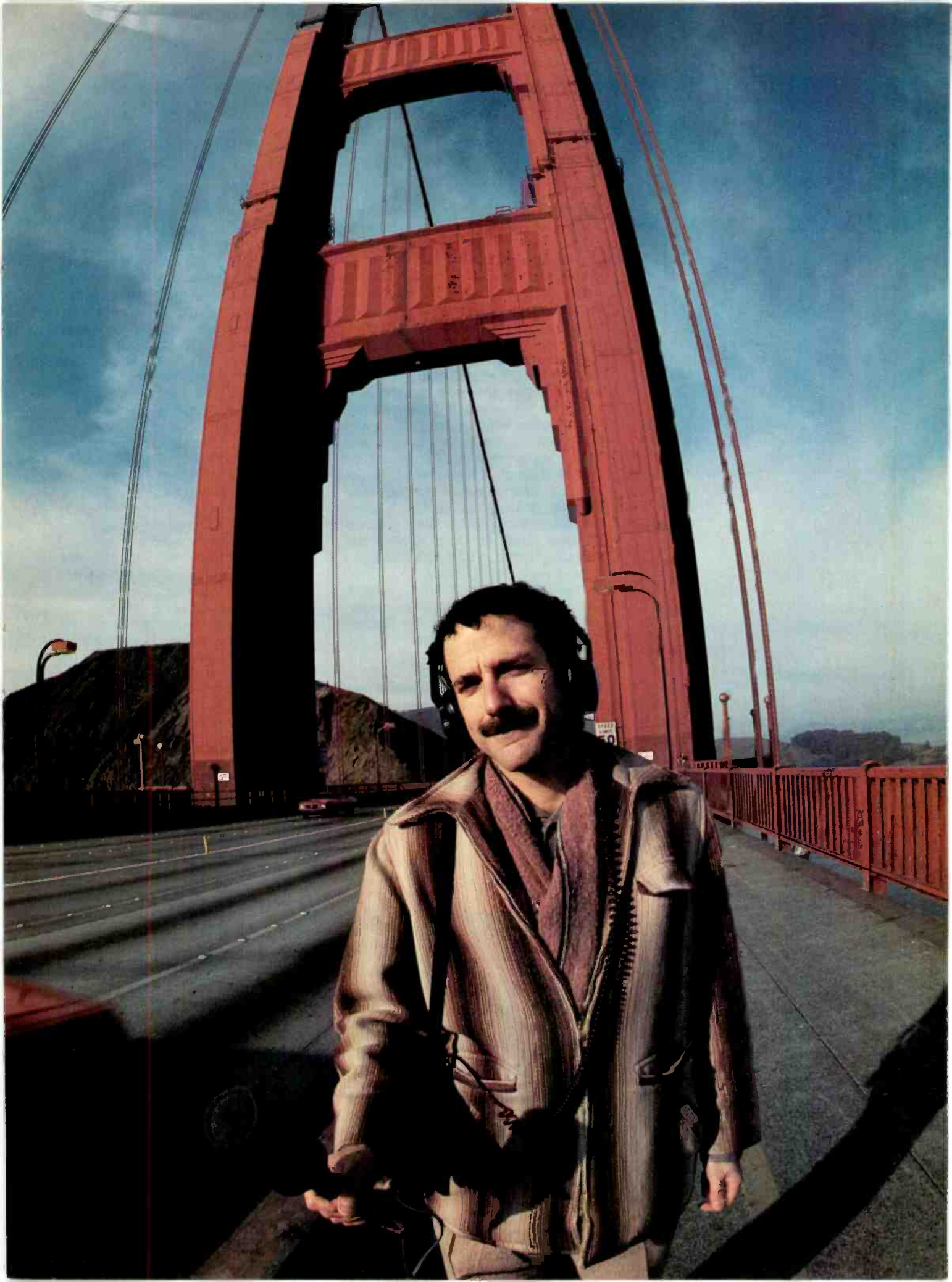
"Every so often I am witness to an extraordinary sound, a moment in sound. On such occasions there is a wish to share this moment in sound, to communicate it to others. It may be something as simple as the sound of somebody's voice. Maybe I'm talking to an old person, or someone who sings a song with real feeling. It's the feeling in that person's voice, the way they're telling a story that begs to be shared. It demands to be heard by other people.

"I put my microphones on a bocce court. Through your ears you literally become a witness to this bocce game, almost a participant. You're surrounded by the game—the laughter of the players, the rhythm of their speech, the way they respond to the game. You become caught up in the



Syndicated shows such as the "King Biscuit Flour Hour" and "A Prairie Home Companion" prove the resurgence of interest in listening—truly listening—to radio programs rather than the drone of formatted tapes offering background music. One of the prime movers in radio's new sound is the subject of this interview, recordist *par excellence* Jim Metzner.

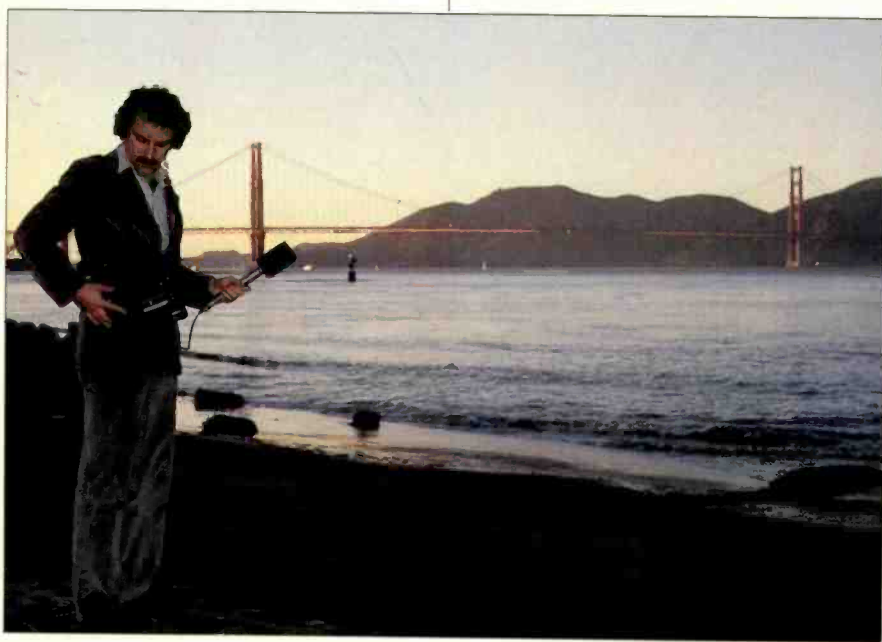
Jim Metzner captures the sounds of San Francisco's Golden Gate Bridge.





One is tempted to use the words "captured" or "got," which are very greedy kinds of words.

Armed with his Sony 989 mike, Metzner checks his tape recorder before seeking to get the sounds of the Bay Shore for "You're Hearing America."



excitement, the humor, the feeling, the gusto. That kind of subtlety, that kind of intimacy is rare in TV because a television crew with all its equipment usually destroys the delicate, subtle quality of this kind of moment."

You are listening to Jim Metzner, a high priest of the aural arts, whose new show "You're Hearing America" is surely one of the freshest, most innovative things to spice the renaissance of radio. Now airing in a few selected major markets (see box for details), "You're Hearing America" is an imaginative blend of sound, music and narration packed into daily, two-minute segments that are entertaining, informative and even revelatory. The shows combine the actual sounds of an event in progress, a natural phenomenon or a machine with brief comments or reminiscences by people close to these sounds. Appropriate music may be added, and Metzner himself contributes a short narration. One program might concern Chicago street vendors, another the sounds of rodeo, a third San Francisco cable cars.

"You're Hearing America" dates back to 1979 when Metzner began producing its forerunner, the Gabriel Award winning local program "You're Hearing Boston." Metzner recalls the birth of the idea: "I had been recording the sounds of Boston for years. I had all these sounds and something was cooking. One spring day I was sitting in my apartment and through the open window I heard the sounds of a horse on the street. It had to be a policeman;

they're the only people riding horses around Boston. I grabbed my tape recorder and under some pretext started recording the horse's hooves and foot-steps. I forget how I explained myself to the policeman. Then I started talking to him about being a policeman on horseback. Something clicked inside. 'Of course, that's it! It's going to be a radio show about all these sounds and how extraordinarily interesting they are.' I don't think I've even used the policeman on horseback in a show, believe it or not.

"The idea sprang from the 'dimensionality' of sound, the 3D aspect when you record in stereo and then listen to the sound or play it back to someone with earphones. One is tempted to use the words 'captured' or 'got,' very greedy kinds of words. I 'captured' this moment in sound, I 'got' it on tape. What you actually have is a very pale reflection of the life of a moment. It is like dropping a stone in a pond; what you have is maybe the second or third wave of ripples. But it's still something that can touch us *if* the listener is willing to enter into the *spirit* of the recording."

Convinced of the worth of the idea, Metzner sought an outlet. "I did a program on spec and took it to WEEI-FM, a local soft-rock station whose format and music I liked. I had considered the context, I tried to remember that people would be listening to music both before and after the show. I wanted my program to be compatible. I gave the station a bite-sized, digestible chunk.

"After certain suggestions from WEEI-FM I came up with a two-minute program. The station found a sponsor and I had a radio show. The program director at WEEI-FM took a certain risk. It was something new, something a little different. I think we were a success. The show was on the air about two years and we did perhaps 250 of them. People became used to the idea that around 3:00 in the afternoon there'd be this little moment in sound. You didn't quite know what it'd be from day to day."

Following a move to San Francisco, Metzner began producing "You're Hearing San Francisco" for KYUU. At the same time he was preparing the national version of "You're Hearing America," which debuted in April un-

der the sponsorship of Maxell Corp. In the national series, which sticks to the two-minute format, Metzner works with a number of independent producers from around the country.

"For the local shows," says Metzner, "I got in the habit of reading the newspapers, keeping my eyes open. People would come to me with ideas. Sometimes I might just go out with a recorder, ready for anything. With the national series it's altogether different. We're working with a community of independent producers that I think can be a real force in radio. They've been heard to a certain extent in noncommercial radio. They'll be heard more on commercial radio, and it's a group of people who really deserve to be heard—Jay Allison in New York; the Kitchen Sisters, Davia Nelson and Nicki Silva in Santa Cruz; a fellow named John Rieger in the San Francisco area. There are many others."

Much of the initial production and editing is done by the producers themselves, who then send the material to Metzner for final production, fine tuning and the voice-over. "We give the producers a lot of feedback and suggestions on recording techniques and interviewing", says Metzner. "If anyone reading this article is interested in producing for the series or has ideas for the show, they can write to us, Sound Image, 533 Diamond Street, San Francisco, Cal. 94114."

The style of the show excludes the voice of the interviewer. This can be tricky and as Metzner explains, "The interviewer somehow must be coaxed or instructed to speak in complete sentences that become the narration for the body of the program. We like to get the person to say what he or she hears. Listeners then hear through this individual's ears. For example, a mechanic who tunes up cars uses his sense of hearing. He'll say, 'Hear that ping, ping, ping noise? Well, that's a faulty piston.' Suddenly, we listeners hear the ping, ping, ping noise too. Through the ears of another person you become more sensitive to what's there in the way of sound."

Over the years, Metzner has experimented with a variety of gear. "The prime tape recorder I use now is a Sony TCD5M. Before that I used a Nakamichi 550. It's a great machine but

really bulky. The 5M is very good. You need to monitor the levels on it carefully, at least on the one I use in the field. Otherwise it distorts, although it's less of a problem with metal tape. I use either Maxell UD-XL II tape or a new bit of formulation now, XL II-S, which is very good, or metal tape. The 5M with either the XL II-S or Maxell MX metal tape is hard to beat, very good signal-to-noise ratio.

"I use a Sony 989 microphone. It's a single-point-source stereo microphone with an MS pattern. The nice thing is you can adjust the polarity, the pattern of the microphone, from a fairly straight-ahead cardioid pattern to a spread of 90° between microphone capsules. If you put on earphones and then operate the little control, it's as if you were spreading a pair of microphones apart 90°, 120° and finally 150°. That's what it *sounds* like. Actually, I think you're adjusting the balance between a cardioid and a figure-eight pattern inside the microphone.

"I use the 0° setting for an interview, the 90° for a conversation, a small musical performance or an event that has a relatively narrow field of focus. For a bigger musical ensemble or an occurrence that involves a larger field of focus, say the size of a room, I'll go to 120°. If I'm in an airplane hangar or a symphony hall or someplace where I



My show listens
through a mechanic's
ears to the ping, ping,
ping of a faulty
piston.

At ringside, Metzner thrusts his mike forward to record the last words as a boxer's trainer leaves the fight zone.





Five frantic hours of editing, writing, bouncing and mixing tracks add up to two minutes of tape.

want a feeling of the largeness of the space, I use the 150° setting.

"My earphones provide relative isolation. I hear only what the mike gets; little outside sound reaches my ears."

Occasionally, even a purist like Metzner must compromise. A problem was an attempt to record a rodeo calf-roping contest. "The calves leave this chute quickly followed by two riders, a header and a heeler. One of them ropes the calf from the head, the other from behind," recalls Metzner. "There are several sounds, the chute opening, galloping horses, the twirling lasso, finally roping the calf. It was impossible to get on a horse and follow closely without getting in the way of the event. That was one of the rare times I've had to 'create' the sound. I recorded all the different pieces, the sound of the chute, the horses, lassoing—the lasso makes a kind of shoo-woo-woo sound as it goes through the air. I pieced them all together but the result sounded like you were on that horse, lassoing that calf."

Short as the shows are, they demand an enormous amount of Metzner's energy and time. "For a two-minute spot I record an average of 40 minutes of field stuff. Then I listen to every bit, notating it. I have my own rating system of stars and asterisks for a particular sound, sentence or phrase that really stands out. With notation completed, there's a skeleton of a script in my mind. Then I can try to come up with what needs to be said to

set the context or give the flavor. The script itself takes maybe an hour to write.

"The requirements of the premix depend upon the show. Some I can whip up right there, within an hour or perhaps two. For the final mix I work in four tracks although I'm in the process of switching to eight now. I bounce tracks a lot. For example, a track for narration may be mono and I'll have a stereo program and want to mix in another stereo piece. I've got five tracks right there. How do I do that on a four-track machine? The answer is to bounce tracks. Final mixes can require an hour or much longer.

"On my voice in the studio I have a Sony electret condenser microphone, an ECM56F. It's a cardioid pattern microphone, a studio mike. In the studio I use a Sound Workshop 1280 board. I have a TEAC 3440 four-track recorder and a TEAC two-track, 3300SX. I also have an Otari two-track MX5050B2HD, and I just got an Otari eight-track, one from the 5050 series, which solved my bouncing-of-tracks situation. I have two dbx 150s on my multi-track. With the eight-track I've added more dbx units for simultaneous encoder-decoder noise reduction. They're nice because you don't have to keep punching them in when you're recording. I leave them in the in position when I want the dbx in, kind of forget about them once they're calibrated.

"I use a Dyna-mite as a limiter, as an expander and as a de-esser. It can also do noise gating, frequency-selective expansion, keying and ducking but I don't have a need for those functions. Other gear includes a Sony PSLX2 turntable and two Reference 208L speakers. The program goes to the stations on Maxell 35-90B reel-to-reel tape. My latest addition is an Orban 674A paragraphic equalizer.

"Sometimes I use a little EQ and limiting on the sounds if they seem to need it. We mix all over the place. The two minutes don't just happen. It's a matter of blending a number of moments to give an impression. I hope you don't hear the mix. That's the hallmark of a good mix; you don't hear it."

In an era when video seems to dominate, Jim Metzner is demonstrating that radio devoted to the art of listening is still alive and thriving. **A**

Where to Catch "You're Hearing America"

New York	WQXR-AM/FM	Between midnight and 2:00 AM, 1:30 PM
Boston	WEEI-FM	9:50 AM, 8:50 PM
Denver	KBCO-FM	7:15 AM, 3:45 PM
Chicago	WFYR-FM	Various times during night
Seattle	KZAM-FM	4:10 AM, 1:10 PM, 9:10 PM
San Francisco	KTIM-FM	2:30 AM, 7:30 AM, 12:30 PM, 5:30 PM

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EXTRAORDINARY**

No other cartridge, at
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SIDE-GUARD PROTECTION SYSTEM

Protects stylus from
accidental breakage
by withdrawing shank
assembly into
stylus housing.

MASAR™-POLISHED HYPERELLIPTICAL STYLUS TIP

Assures accurate, distortion-free
tracking—plus reduced record and
stylus tip wear.

BERYLLIUM/Be™ MICROWALL/ STYLUS SHANK

Unprecedented high frequency
trackability due to this revolutionary
new high stiffness, low mass
stylus shank.

DYNAMIC STABILIZER/ DESTATICIZER

Exclusive! Functions like a miniature shock
absorber to eliminate warp-related problems
such as signal wow, groove skipping, and
cartridge bottoming. Simultaneously
discharges surface static electricity and
sweeps away microdust.

PLUS!

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Enter No. 17 on Reader Service Card

1

BANG & OLUFSEN BEOCORD 9000 CASSETTE DECK

Manufacturer's Specifications

Frequency Response: 20 Hz to 20 kHz, ± 1.5 dB.

Signal/Noise Ratio: 80 dBA with Dolby C NR.

Separation: 35 dB.

Erasure: 75 dB.

Input Sensitivity: Mike, 0.15 mV; line, 15 mV; DIN, 0.4 mV; AUX, 40 mV.

Output Level: Line, adjustable from 0.5 to 2.0 V; headphones, 10 V at 56 ohms.

Flutter: 0.045% W rms, $\pm 0.1\%$ weighted peak.

Wind Times: 70 seconds for C-60 cassette.

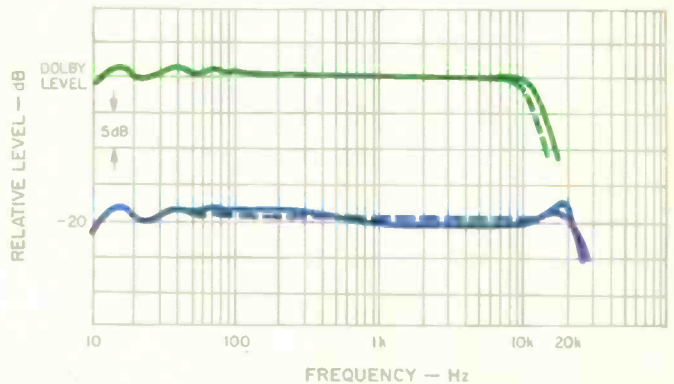
Dimensions: 20.7 in. (530 mm) W \times 5.1 in. (130 mm) H \times 11.6 in. (300 mm) D.

Weight: 17 lbs. (7.8 kg).

Price: \$1,800.00.



Fig. 1—Frequency responses with Scotch Master I tape with and without Dolby C NR.





The Bang & Olufsen Beocord 9000 cassette deck provides a package of interesting and worthwhile features in a distinctive-looking form. The left side of the angled top panel is mostly brushed aluminum, while the right is mostly black. A push-on *Programming* on the center black strip at the left causes the large cover behind it to open, providing access to several switches and the left and right record-level slider-type controls. Also revealed is the cassette carrier and well and the headphones slider, just to the left. There are light-touch pushbuttons for *Tape Type*, *Rec Cal*, *Store*, *Rec Open*, *Timer Start*, *Timer Stop*, *Time Set* and *Tape End*. When a cassette is inserted, there is automatic detection of tape type, provided the shell has the proper sensing holes. Status lights above the switches (*Fe*, *Cr*, *Metal*) indicate which type the deck is set for. *Tape Type* is pushed, repeatedly if necessary, to step to the correct

matching. Type III tapes require that both *Fe* and *Cr* be on. Before any recording is possible, *Rec Open* must be indicated after a push of its button, provided that the erase-prevention tab has not been removed. This amounts to a record-ready function, a valuable feature for many users because it prevents inadvertent recording.

A simple touch of *Rec Cal* initiates what B & O calls CCC, Computer Controlled Calibration. There are a total of seven basic steps, all accomplished within the short time of less than 10 seconds: (1) Check for tape in place, (2) tape type selection to match sensing holes, (3) right-channel bias adjustment with level matching between 333 Hz and 7 kHz, (4) left-channel bias adjustment, (5) record equalization adjustment for both channels for flat response at 17 kHz, (6) 333-Hz record sensitivity adjustment for Dolby NR matching, and (7) finding the record level for 5% third-harmonic distortion and adjusting the level-meter calibration so that a zero-level indication corresponds to 2% third-harmonic distortion. The automatic meter calibration is a unique feature of the Beocord 9000, and in ways it is the star of the show. One of the challenges facing the recordist at all times is trying to record at high levels for good signal/noise ratio without noticeable distortion. Normally, the problem is complicated further because each tape formulation has its own maximum record levels. With the B & O meter calibration scheme, *all* recording calls for the same maximum meter indications (about "+1"); the user is not required to rate one tape compared to the other and make compensating level adjustments—*Rec Cal* does it all with nary a fuss.

The system does allow using 70- μ S EQ (*Fe* & *Cr*) with ferrics for lower noise or 120 μ S (*Fe*) with Type IIs for better high-frequency MRLs. In such a case, it is possible that the calibration settings *cannot* be stored as in the normal cases, because of an out-of-range condition. If that happens, approximately 3 seconds into the calibration process, the *No Store* indicator will light. It is impossible to make

Addenda: John Marovskis Audio MIT-1 Phono Cartridge Review

The scanning electron microscope photo, published in the Nov. 1981 issue of *Audio Magazine* as Fig. 1, was supplied to *Audio Magazine* by John Marovskis Audio Systems, Inc. The photo was originally published in the Nov. 1980 issue of *Audio Alternatives* (Vol. 1, No. 2) as part of their review of the Marovskis MIT-1 cartridge. Additionally, some of the data on groove deformation and geometry, though reinterpreted to *Audio Magazine* by JMAS, also first appeared in *Audio Alternatives*. These materials were originally developed as a result of research initiated and conducted by AA as part of their continuing investigation of "Stylus-Groove Interactions" (Vol. 1, No. 3; March 1981). We commend both the review and the articles to our readers' attention. *Audio Alternatives* is an independent hi-fi publication published quarterly. Subscription information and back issues can be obtained from *Audio Alternatives*, P.O. Box 466, Midlothian, Va. 23113.

The Beocord 9000's seven-step automatic meter calibration is a unique feature, and in ways it is the star of the show.

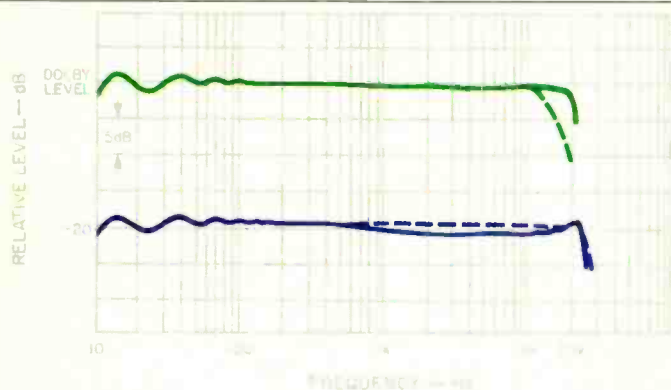


Fig. 2—Frequency responses with TDK SA-X tape with and without (---) Dolby C NR.

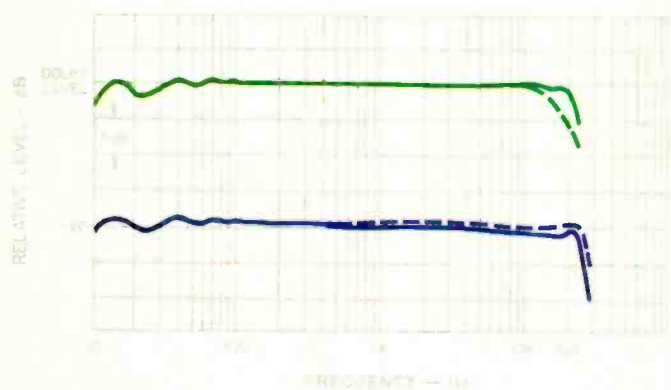


Fig. 3—Frequency responses with Sony Metallic tape with and without (---) Dolby C NR.

abnormal changes in settings, as CCC will automatically determine the best tape-type setting; if a bad choice is made, it will be changed to the correct one.

The *Time Set* function utilizes the 12-button keypad (0 to 9, *CE* and *Go*) at the lower right to enter actual local time (24-hour basis). The deck's internal clock maintains this time reference as long as the deck remains plugged in. Thus, timer start and stop functions are very easily programmed on the deck itself without the need for any external timing. Normally, the four-digit display, just to the right of the level meters, shows record/play time in minutes and seconds, very helpful when the timing of a recording is needed. It is possible to do the calibration from the beginning of the tape, making every location on the tape time-related. *Tape End* will provide a calibration of the actual tape length in time, with readouts of the time remaining as

the tape end nears. For the audiophile who records in a time frame, as I do many times, this feature is a considerable convenience. Normal time calibration is from the beginning of the tape, and that is done automatically if an instruction requires it.

The Dolby NR slide-type switch (*Off/B/C*) is in the same group as the pushbuttons discussed above. The movement from one setting to the next is rather small, so care is needed to ensure that the position is as desired. On the underside of the cover are abbreviated instructions for programming. The cassette carrier swings downward easily, latching with a somewhat firm push. Access for maintenance is excellent with the empty carrier latched down. B & O supplied an excellent accessory in the form of an alignment cassette with a 10-kHz tone on it, and there is a nonmagnetic screwdriver to adjust the head assembly. The long-term usefulness of the test cassette is enhanced because the 9000 has automatic demagnetization of the heads at each turn-off. *Eject* works in any mode and whether the cover is up or down, a possible convenience at times. When the cover is down, the status lights can still be seen, although not well if the lighting is bright.

The peak-responding meters to the right are also of low intensity, with eight segments for each channel in a horizontal LED-ladder form. This makes for fewer steps with changing levels than many similar units, but judgment was reserved until the in-use tests. The manufacturer stated that consumers had shown a preference for a limited number of segments, and the meters do have good resolution around zero. Tape motion functions are controlled with light-touch switches with good-size rectangular pads, with play and wind modes basically the same as most decks. The first touch of *Record* prepares the unit, with a flashing annunciator below the level meters. The second touch starts recording; *Play* is not used. The first touch of *Stop* mutes the incoming signal, but recording continues for a few seconds, automatically putting in a blank space before stopping in what amounts to record/pause. Two successive touches of *Stop* obtains an immediate stop. *Return* secures a rewind to just before the start of recording and play to that point, where it goes into record/pause. *Memo Set* is used to insert the time counter reading into memory, and *Memo Go* is used to get a fast wind to that point: Into play mode with a short touch, or for a stop with a touch of at least two seconds. *Standby* turns the recorder off, but the clock maintains its time, and all of the *Tape Cal* inputs remain in memory.

On the front edge of the deck are a phone jack for a single-channel microphone, a DIN socket which can be used for stereo microphone or AUX sources, a *Mic/Aux/Amplif* slide switch, and the headphones jack. When the switch is in the *Amplif* position (normal for line in/out), connections to other units are made to a DIN socket on the rear panel. A switch on the bottom of the unit selects either DIN or line-level sensitivity for the inputs. Also on the bottom is the multiplex filter switch which might not be needed with high-quality tuners such as those made by B & O, but it would be inconvenient for those with a need to use the switch at times.

With the loosening of two screws, it was possible to lift the

All S/N results were superb, and in fact are the best measured to date on a cassette deck.

entire top section of the recorder away from the bottom, exposing most of the interior. The soldering on the 10 or so good-size p.c. boards was excellent, with all parts identified and adjustments labeled. Interconnections between cards were made with multi-pin cabling. A general impression was gained of high-quality parts and good construction.

Measurements

A quick check with an alignment tape showed that the deck would benefit from the use of the supplied test tape. After peaking azimuth with it, all points were within 2 dB for both equalizations. Tape play speed was about 0.2% fast, and indications for a standard level were slightly high. A large number of tapes were tried using the deck's CCC system, and excellent results were possible in every case, with the exception of a couple of low-bias ferrics. Because calibration included automatic setting of the meter sensitivity, an extra test step was necessary. Upon completion of *Rec Cal*, use of *Stop* and *Tape Type* with the keypad (1 to 5) allows reading out the actual bias, equalization, sensitivity and meter reference level ("07" = 250 nWb/m) in the four-digit display. For tests at Dolby level the reference is "05," so a readout of "11" would call for the test signal to be 6 dB below meter zero for Dolby-level recording. Thus, there is some extra work for the evaluator, but not so for the user who will have the same meter readings whatever the tape. Of the many tapes that gave excellent results, Scotch Master I, TDK SA-X and Sony Metallic were selected for the detailed testing. Figures 1 to 3 show the swept-frequency plots at Dolby level and 20 dB below that, both with and without Dolby C NR. They are all quite flat over the entire band with relatively small Dolby NR mistracking. Take note of the increased headroom with Dolby C with contribution from B & O/Dolby HX Professional, which is also quite evident in the Table I listing of the -3 dB points. The outstanding flatness of the responses is most obvious at Dolby level and without NR at -20 dB. Although the deck has three heads, there is no playback at the line outputs during the process of recording, and the headphone monitoring is of the input. This would be a limitation for those who need simultaneous playback.

Playback of a recorded 10-kHz tone had less than 25° phase discrepancy between tracks, and the jitter was just 15° total. The multiplex filter response was 37.0 dB down, right at 19 kHz. Separation and crosstalk at 1 kHz were 42 and 66 dB down respectively, both good figures. Erasure with metal tape at 100 Hz was a very good 67 dB.

Figure 4 is a plotting of the results of measuring HDL₃ (third-harmonic distortion) from -8 dB to the 3% limit in Dolby C mode with the three tapes. The curves are similar in most respects, with the 3% points in close correspondence. With the automatic meter calibrations, the meter zeros were at about +4 dB relative to Dolby level, and all were very close to the 2% B & O criterion. Figure 5 shows the variation in HDL₃ over the frequency range of 30 Hz to 7 kHz at -10 dB with Dolby C NR using Sony Metallic tape. The mid-band distortion was very low, with the expected rises at the frequency extremes, albeit lower than many decks. Signal-to-noise ratios were measured with the three tapes at Dolby level and at the 3% points with and without



Fig. 4—
Third-harmonic distortion vs. level at 1 kHz with Dolby C NR.

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

Tape Type	With Dolby C NR				Without Dolby C NR			
	Dolby Lvl		-20 dB		Dolby Lvl		-20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Scotch Master I	9	13.3	9	24.0	9	11.4	9	24.7
TDK SA-X	9	21.0	8	25.3	9	15.3	8	27.1
Sony Metallic	9	22.0	8	24.0	9	17.4	8	26.3

Dolby C NR with both IEC A and CCIR/ARM weightings. All of the results are superb, and they are the best to date measured on a cassette deck.

The input sensitivities were 0.15 mV for mike and 27 mV for line with TDK SA-X. Because of the automatic meter calibration, the tape type has an effect on the measured sensitivity for zero meter indication. A tape with lower MRL might have garnered a line sensitivity of 15 mV, for example. This might be an oddity for the tester, but it is absolutely no problem for the user. The input overloads were 45 mV for mike and 4.0 V for line, both quite satisfactory. Output clipping appeared at a level equivalent to about +12 dB relative to meter zero. The line input impedance was a constant 11 kilohms across the band, and the input-pot settings had no effect on this value. The line output levels were adjustable (bottom-chassis trimmers) from about 400

Although it requires a little time to "make friends," the B & O 9000 will deliver excellent performance.

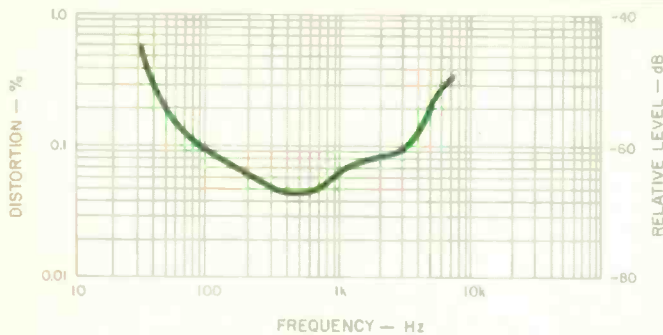


Fig. 5—Third-harmonic distortion vs. frequency with Dolby C NR at 10 dB below Dolby level with Sony Metallic tape.

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

Tape Type	IEC A Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby NR		Without NR		W/Dolby NR		Without NR	
	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%
Scotch Master I	70.8	77.5	53.5	59.5	70.3	77.0	51.2	57.2
TDK SA-X	72.2	78.0	55.5	60.8	72.5	78.3	53.7	59.0
Sony Metallic	71.9	78.1	55.6	61.3	71.5	77.7	52.4	58.1

mV to 2.4 V. When set to 1000 mV unloaded, they dropped to 700 mV with a 10-kilohm load, indicative of an output impedance of 4.2 kilohms. The headphone output was a hefty 1.4 V at 8 ohms, and very high levels were possible with any of the headphones tried, easily moderated with the slider. Because the feed to the meters is post-EQ, it is not possible to state the -3 dB response limits. This is yet another challenge for the tester perhaps, but in this reviewer's opinion, it's a better way for setting record levels correctly to prevent unwanted distortion. The meters had a very fast response, reaching -1 dB with a burst of less than 3 mS, and the decay time was 0.9 S, also shorter than the IEC standard. Scale calibrations were very accurate, within 0.2 dB from "-8" to "+5."

Tape play speed was stable, and there were no changes with changes in line voltage. Flutter was $\pm 0.08\%$ weighted peak and 0.05% W rms with a slight rise at the very end of the tape pack with some cassettes. Wind times were 69 seconds for a C-60, and logic response times and run-out to stop were all one second or less.

Use and Listening Tests

Tape loading was simple and direct, and access for maintenance was excellent, as mentioned earlier. All switches and controls were completely reliable throughout the testing. The instruction manual has text that really is too

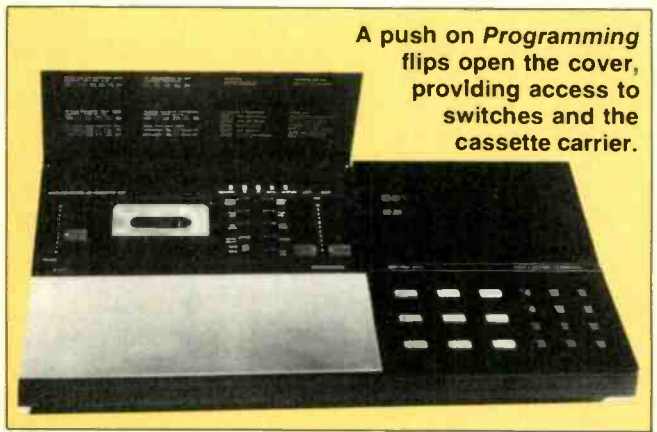
concise, taking on a cryptic character in some instructions. Some of the illustrations are too close-up, making general orientation difficult. A period of familiarization, therefore, is important with this deck to take best advantage of its features. *Rec Cal* readout of settings, for example, calls for the simultaneous use of *Stop* and *Tape Type*. If *Tape Type* is pushed first, by even the slightest time, tape type is changed, and there is no readout. Pushing *Stop* first, and then *Tape Type* immediately after, works every time. *Rec Cal* itself worked very well each and every time, always taking less than 10 seconds. Time and tape-end calibrations were useful on a number of occasions. Timer functions worked as expected, and it was rather handy to be able to read out real time whenever of interest. There were no record, pause or stop sounds detected by ear or by meter.

Listening tests of record/playback performance included pink noise (Dolby-tracking checks) and discs from Mobile Fidelity and dbx, with their encoding. It was possible to hear a shift in the pink-noise playback when Dolby C NR was used, but it was quite a subtle tilt with more bass, or was it less brightness? The disc copying did *not* result in a similar conclusion: There was excellent sound across the band, good solid bass and a clean high end. It was very easy to set levels for peaks to zero or slightly more, although the room lighting had to be kept low for best metering with the low-intensity display. It would have been helpful to have had lower level display segments for classical recording. At one point in the recording, there was a shift of energy to the lower bass, and there was an immediate indication of the need to reduce levels. In the playback, the short trip into distortion was apparent, but it was concluded that the post-EQ metering of the 9000 promptly showed the need for correction: The meters on most recorders would not have shown a change in level, and the distortion would have continued unabated.

The B & O deck does not offer some popular features, such as mike/line mixing or a multi-selection program scheme, and it requires a little time to "make friends." However, it will deliver excellent responses, superb signal-to-noise ratios, CCC and several time-related functions—all with a great metering scheme for its premium price.

Howard A. Roberson

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2

DUAL C844 CASSETTE DECK

Manufacturer's Specifications

Speeds: 1 7/8 and 3 3/4 ips.

Wow & Flutter: 0.06% at 3 3/4 ips, 0.10% at 1 7/8 ips.

Frequency Response: 20 Hz to 24 kHz at 3 3/4 ips, 20 Hz to 18 kHz at 1 7/8 ips with CrO₂ tape, 20 Hz to 20 kHz with metal tape.

S/N: At 1 7/8 ips, 67 to 69 dB with Dolby B NR, 74 to 76 dB with Dolby C NR; at 3 3/4 ips, 69 to 71 dB with Dolby B NR, 76 to 78 dB with Dolby C NR.

Dimensions: 19 in. (48.26 cm) W x 13 in. (33.02 cm) D x 4 in. (10.16 cm) H.

Price: \$700.00.

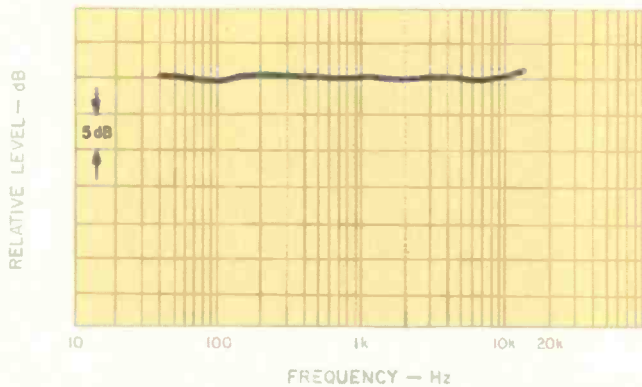


Fig. 1—Playback response with a standard test tape.



Dual's new C844 cassette deck is one of the few models available currently to have the 3 3/4 ips speed option, and it also offers a number of other features, such as both Dolby B and C noise reduction, a monitor head, a fade/edit control, a six-position tape selector, a Music Finder system, an electronic digital counter, and provision for microphone mixing.

The C844 is a sleek, modern low-profile design with the tape compartment on the left and tape-transport controls to the right, on the main panel. In addition to the usual recording and directional controls are additional pushbuttons marked *Autospace*, *Repeat*, and *Double Speed*. The *Autospace* control creates a blank space at the end of a recorded section which is used by the Music Finder to stop the tape. Underneath these pushbuttons is the six-position tape selector, the Dolby switch (C, Off, and B), the MPX switch, and the tape monitor. The dual-concentric line input control is to the right with the microphone input sockets and the microphone input control. Above the microphone sockets are three fade/edit switches. The first switches the circuit on, the second fades out the signal, and the third fades in the signal. The system works only during playback, to monitor the fade action on recorded tapes. I wish it worked on record too, such as for dubbing. A long dial at the top contains the large VU meters, peak-reading indicators, electronic digital counter, and memory switch while over to the left, on the other side of the cassette compartment, is the on/off switch, phone jack, and timer switch.

The peak-reading indicators are a little unusual in that they are connected to the equalization circuit so that the characteristics are "tailored" to the kind of tape used. More about that later, but for now some details about the Music Finder system. Both fast-wind buttons are marked Music Finder, and if one is depressed after the Stop button is activated, the tape is wound back in that direction to the end of the tape. If either is depressed after the Repeat button is pushed, the tape is wound to the first music gap reached, and automatically switched to the playback mode. If either is pressed after Record, the tape will stop after reaching the first gap. The gap can be made deliberately, as mentioned earlier, or it can be the normal gap between bands on a disc.

Table 1—Signal-to-noise ratios, dB, A weighted, ref. to 3% THD.

Tape Type	Without NR, 1 7/8 ips	Dolby B, 1 7/8 ips	Dolby C, 1 7/8 ips	Dolby C, 3 3/4 ips
TDK MA	59.0	68.0	76.0	78.5
TDK SA	58.0	67.0	75.0	77.5
BASF Pro I	59.5	68.5	76.5	79.0

When the Record button is depressed, a red light appears above it, and a flashing green indicator lights up near the Repeat button. After the levels have been set, the Repeat button is depressed to start the recording process,

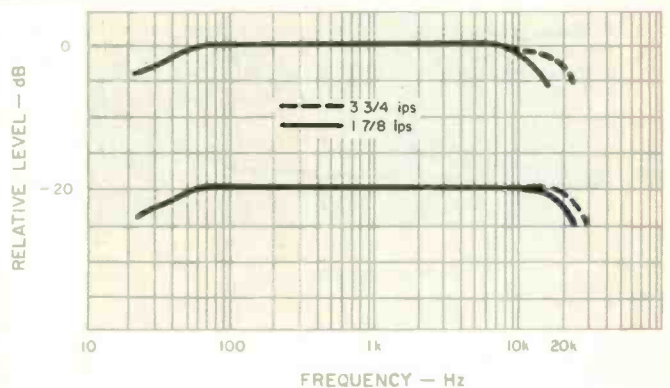


Fig. 2—Record-replay response with TDK MA metal tape.

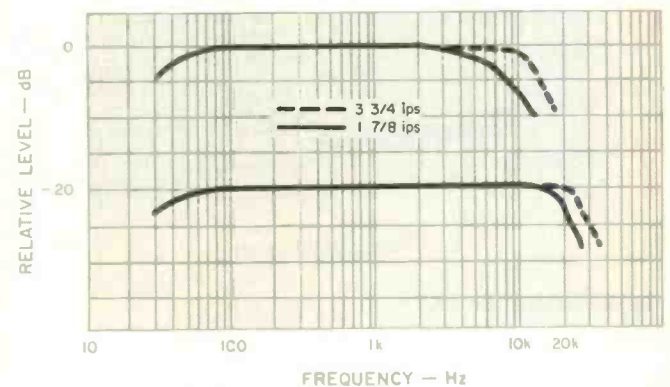


Fig. 3—Record-replay response with TDK SA tape.

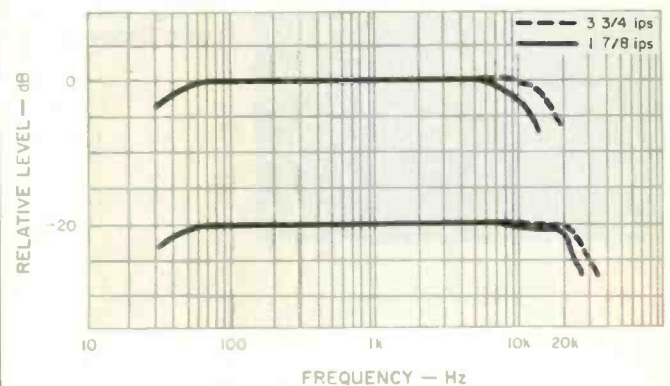


Fig. 4—Record-replay response with BASF Professional I tape.

Marking peak-reading LEDs in percentages to indicate available headroom is a most ingenious idea.

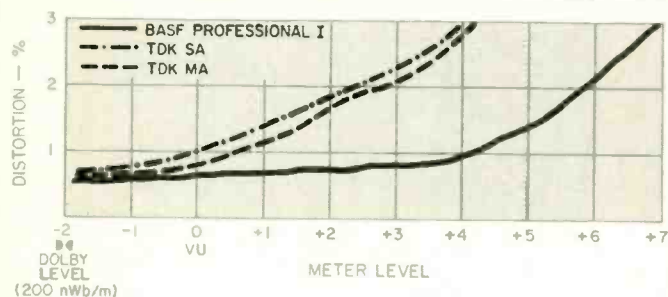


Fig. 5—Distortion and headroom at 1 kHz.

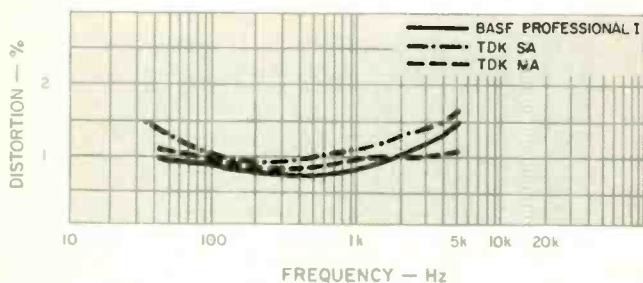


Fig. 6—Distortion vs. frequency, 0 VU.

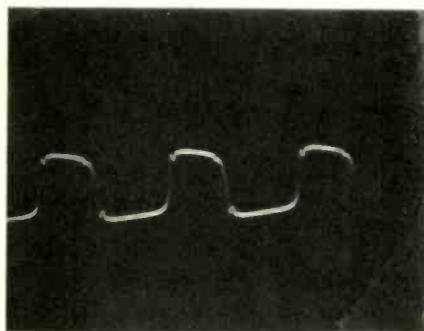


Fig. 7—Square-wave response at 1 kHz, 3 3/4 ips, with Dolby C NR.

and the flashing stops. It is thus unnecessary to use the Pause control for initial adjustments. If a speed change is made during operation, the tape stops completely for a few seconds before starting again at the required speed.

The cassette compartment has no door, since a direct-loading method is employed. The Dual infrared system automatically stops the drive motor and retracts the heads as soon as a hand is placed near the cassette for withdrawal. There are two drive motors, one for the reels and one for the capstan, and provision has been made for remote control with a DIN-type connecting socket on the back panel.

Measurements

Playback response was within 1 dB from 40 Hz to 12 kHz using a standard test tape (Fig. 1). The first test tape used for record-replay measurements was a TDK MA metal formulation, and results are shown in Fig. 2. At 0 VU, changing from the slow to the fast tape speed extended the -3 dB point from 16 to 21 kHz, and similarly added 3 kHz to the 23 kHz response at -20 dB. With the second tape tested, TDK's SA, a high-bias $70\text{-}\mu\text{S}$ formulation, the advantages of the fast speed were even more dramatic, as can be seen in Fig. 3. At 0 VU, the -3 dB frequency was moved from 7 to 13 kHz—quite a difference! At -20 dB, the -3 dB frequencies were 21 and 25 kHz. The third tape was a ferric $120\text{-}\mu\text{S}$ type, BASF Professional I, and here again the improvement with the $3\frac{3}{4}$ ips speed was particularly effective at 0 VU. At $1\frac{1}{8}$ ips, the -3 dB frequency was 8.5 kHz, but at $3\frac{3}{4}$ ips it had increased to nearly 16 kHz! (See Fig. 4.) The response at -20 dB was quite similar to that of the TDK, with the exception of a very slight droop above 10 kHz.

Figure 5 shows the distortion and headroom at 0 VU, and Fig. 6 compares distortion for the three tapes from 40 Hz to 5 kHz for levels of 0 VU. Signal-to-noise figures can be seen in Table I; note that the fast speed increases the already high figures by 2.5 dB. Input required for 0 VU was 24.5 mV, and the output varied from 339 to 436 mV, depending on the kind of tape used. Microphone sensitivity was 0.5 mV, with a maximum handling capacity of 177 mV, which provided a better than average margin against overload. Both Dolby B and C systems tracked down to -40 dB within 1.5 dB with all three test tapes.

The six equalization positions on the C844 consist of two for $120\text{-}\mu\text{S}$ ferrics, two for high-bias chromium dioxides or similar $70\text{-}\mu\text{S}$ tapes, one for FeCr types, and one for metal-particle formulations. In order to reflect the differences in high-frequency headroom, the four peak-reading LEDs are marked in percentages to indicate how much headroom is available on the particular tape used. Thus, the 75% indicator lights up at 0 VU with metal tape, 100% with FeCr, and so on. This is a most ingenious idea and also takes into account the effect of the Dolby C system. The VU meters had a slight overshoot with a standard ASA 300-mS, 1-kHz pulse, but the peak indicators were very accurate, and the manufacturer rightly says that the LED display is more important than the meters.

Erase efficiency was better than 70 dB, as claimed, while wow and flutter measured 0.03% at $1\frac{1}{8}$ ips and 0.02% at $3\frac{3}{4}$ ips—considerably better than the specifications. Rewind time for a C-90 was 150 seconds at $1\frac{1}{8}$ ips, and

In terms of basic performance, the Dual C844 cassette deck is probably a state-of-the-art design.

speed in both modes was less than 0.1% fast.

Encouraged by the quite remarkable frequency response, I thought I'd take a look at the square-wave performance, and the result can be seen in Fig. 7. Using TDK's MA metal tape and applying a 1-kHz square-wave signal, there was an absence of ringing together with a fast rise-time—unusually good for a tape deck.

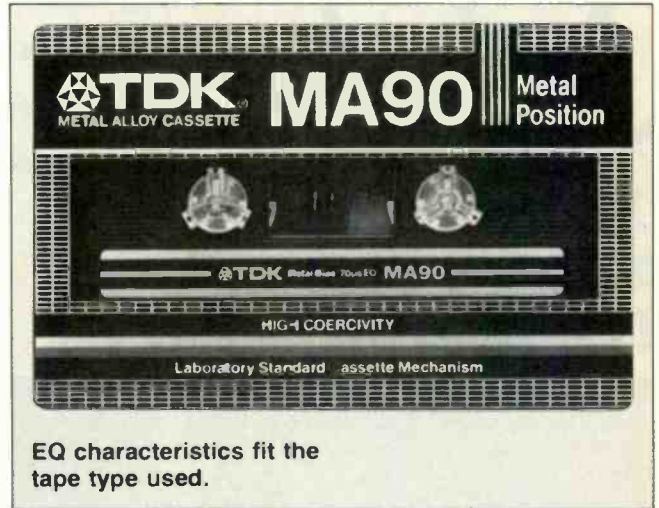
Use and Listening Tests

As the test figures show quite clearly, the C844 is a high-quality cassette deck, probably a state-of-the-art design in terms of basic performance, and it compares favorably with some open-reel models. The logic controls all worked smoothly, with a professional feeling, and mode changes can be made without danger of tape strain or breakages. The 3¾ ips speed, with its greater headroom, is definitely worthwhile for direct recordings made with first-class microphones (I used B & K 4134s) or for taping direct-to-disc recordings. For most purposes, the slower speed is perfectly adequate, especially if Dolby C NR is used. The Music Finder system will certainly appeal to some users, but I was more impressed with other features like the microphone mixing facility, the versatile tape selector, and the care taken to match the peak level indicators to the different tape characteristics. The electronic tape counter, with its large eye-catching green display, can be read from a consider-

able distance—a great improvement on the mechanical indicators that almost need a magnifying glass to read. The only criticisms I could possibly make relate to the fader controls (described earlier) and a personal preference for a variable output control.

George W. Tillett

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EQ characteristics fit the tape type used.

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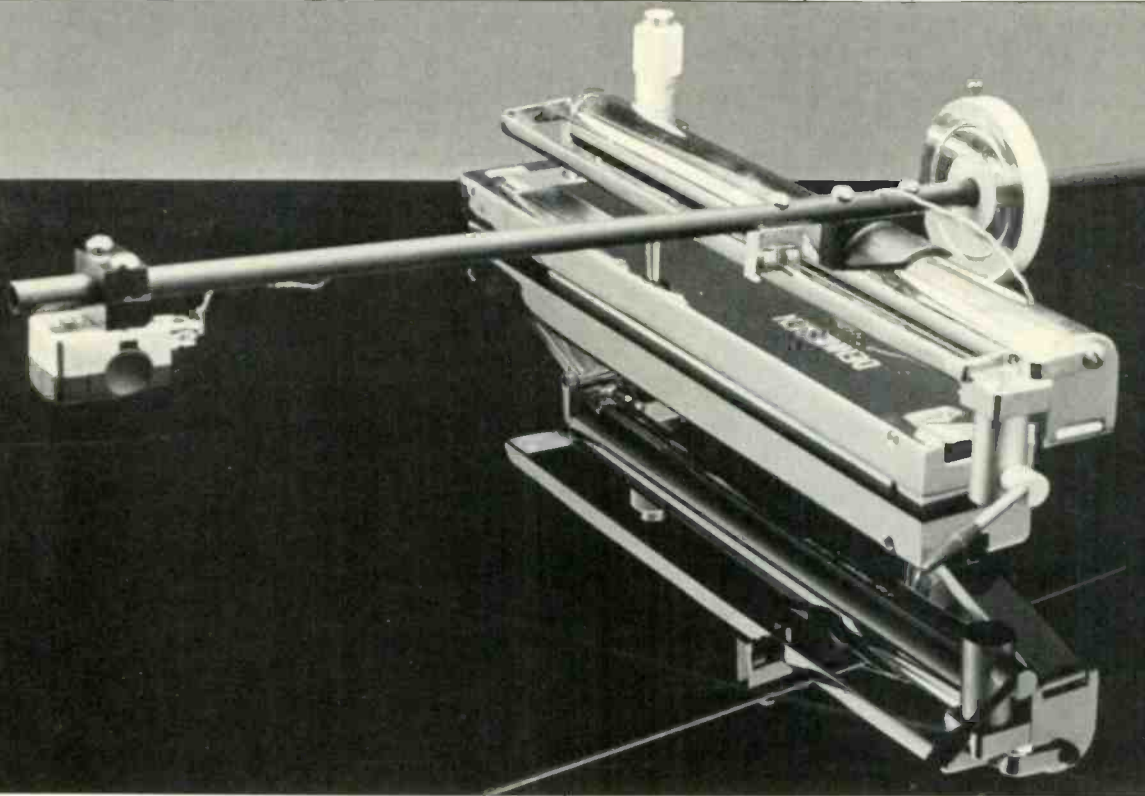
3

DENNESEN
ABLT-1
TONEARM**Manufacturer's Specifications****Overall Length of Radial Tracking**

Tonearm: 9½ inches.

Pivot to Stylus Distance: 7 to 8½ inches.**Maximum Tracking Error:** 0°.**Cueing Assembly:** Damped and adjustable.**Anti-Skating Adjustment:** Not required.**Tracking Force Range:** Up to 6 grams.**Cartridge Weight Range:** Up to 20 grams.**Vertical Bearing Type:** Air.**Lateral Bearing Type:** Air.**Damping System:** Magnetic.**Vertical Tracking Angle Adjustment:**

Micrometer calibrated in 0.001-inch increments.

Headshell: Integral part of tonearm.**Tonearm:** Interchangeable.**Finish:** 24-karat gold plate.**Price:** \$1,250.00; additional tonearm tubes, \$100.00.

Record "masters" are made on an aluminum-acetate blank using a straight-line cutting lathe with a heated chisel-like cutting stylus to cut the stereo information into the blank. To accurately reproduce the information on the groove walls, it is necessary to maintain the stereo playback stylus absolutely tangential to the record groove wall so as to trace the exact path of the cutting stylus used in the recording process. If the playback stylus deviates from a straight line, the stereo information presented to the play-

back stylus will be somewhat different from the original, and the sound that is produced will also be slightly different.

The vast majority of tonearms in use today are of the pivoted type, having either a J or S shape. When properly mounted, the pivoted tonearm stylus path scribes an arc across the record. This curvilinear motion causes a varying error in the angle between the stylus and the record groove, which will be minimal if the cartridge is mounted correctly. The stylus can be tangential to the record groove at only

two points along the entire arc. The tracking error can range from 1.5° to 3.5° . Additionally, a frictional drag of the stylus in the groove, in combination with the offset of the cartridge, generates a centripetal force in the groove over most of the arc. This, in turn, causes an increase in the stylus pressure on the inner groove wall. To reduce this angular force, an anti-skating device is usually employed, but these devices frequently introduce other problems.

On the other hand, a tangential (lateral) tracking tonearm follows the path of the original cutting stylus, nullifying tracking angle error and obviating the need for anti-skating devices, as the arm is always tangential to the record groove. It is quite obvious that a lateral tracking tonearm is inherently a better design than a pivoted arm, but individual lateral arm designs can enhance or diminish this advantage.

Lateral tracking tonearms have been around for some time. The early lateral tonearms operated in real time since they were driven only by the record groove. As the record groove propelled the stylus along its path, the stylus-cantilever assembly also attempted to move the arm in real time along its guide rails, but simply could not overcome the friction present at this point. Eventually, the cantilever broke or was badly bent in the process of moving the arm.

The first relatively successful linear tracking tonearm was the Rabco, which utilized a servo system both to move the tonearm across the record and keep the stylus tangential to the groove. Unfortunately, the servo motors generate noise in their attempt to consistently keep the lateral tracking error of the stylus at zero. The small deviation made by the stylus advancing towards the center of the record must first be detected by the servo motor before any correction can be made. Only then does the servo motor move the arm to the new tangential position. Consequently, servo-equipped tonearms always exhibit a varying lateral tracking angle (tracking error) because the correction is always after the fact.

The Dennesen Air-Bearing Linear Tracking Tonearm (ABLT-1) probably represents the first major advance in tonearm design since Rabco developed their unique linear tracking tonearm. The Dennesen ABLT-1 tonearm, designed by Alan Sliski, utilizes basic principles of physics rather than motion induced by an electromechanical system to keep the stylus consistently tangential to the record groove. It combines the desirable features of the linear tracking tonearm without using a servo system. A single air-bearing surface provides the two desirable degrees of freedom while restricting all others. Once the bearing has been made frictionless, the need for a complex electromechanical servo system no longer exists. The ABLT-1 arm uses the force of air emitted against an aerodynamically designed foil, causing the arm tube to "hover" in a frictionless state slightly above the air-bearing assembly, while the record groove propels the stylus and arm in real time across the record surface. The vertical tracking angle may be varied by a built-in micrometer which permits accurate adjustments to be made *while the record is being played*. The design also permits the decoupling of the arm-tube from the base assembly, which allows for easily interchangeable tonearm tubes, thereby simplifying cartridge changes. A specific counterweight is used to properly offset the mass of the cartridge.

Description

The ABLT-1's air-bearing assembly is designed as a parallelogram (a quadrilateral with opposite sides being both equal and parallel). This assembly is made up of four parts held together by rotating pins (a form of hinge) at the corners. The four parts consist of the base which attaches to the turntable and also houses the signal and ground connections, the air-bearing tube, and the two legs that hold the base and air-bearing tube together to form the parallelogram. The parallelogram arrangement allows the air-bearing tube height (which also determines the vertical tracking angle) to be adjusted in 0.001-inch increments with the attached micrometer while maintaining the air-bearing tube constantly parallel with its mounting surface at any height. The entire air-bearing assembly, less tonearm, weighs $1\frac{3}{4}$ pounds (793.8 grams).

The air-bearing tube itself is made from a round brass tube, ground to a tolerance of 0.0001 inch. The entire length of the tube's top surface has a single row of 0.010-inch holes, out of which pressurized air is emitted to support the airfoil of the tonearm tube approximately 1 to $1\frac{1}{2}$ mils above the air-bearing tube in an essentially friction-free manner. Due to the shapes of the airfoil and the tube, motion in the system is restricted to rotation around the tube (vertical) and sideways along the tube (horizontal). No other motion is possible and, therefore, improper or nontangential tracking is impossible.

The micrometer, located at the rear of the air-bearing tube, adjusts the height of the tonearm above the record via the air-bearing tube, thus permitting the vertical tracking angle to be adjusted while the system is playing. The overall limit of the micrometer may be extended with the addition of one or two quarter-inch spacers, in effect raising the parallelogram to a greater height.

The damped cueing assembly is located at the forward end of the air-bearing tube. A copper bar runs from the cueing assembly to the back of the air-bearing tube to allow cueing the arm up at any point on the record.

Brass was chosen as the base metal due to its machinability and acoustically dead quality. To prevent oxidation (tarnish) and thus alteration of machined tolerances, each machined metal part is carefully polished and plated with 24-karat gold.

The tonearm consists of a black anodized, drawn aluminum tube that is internally resonance-damped. Wiring is pure copper, Litz-type cable with gold cartridge connecting clips and a four-prong, gold-plated signal plug that is connected to its gold-plated mate on the base. The airfoil is made from aircraft-grade aluminum, precision machined to 0.0005 inch, polished, and black anodized. It is attached to the tonearm tube about three inches from the rear. The entire tonearm, less the cartridge and counterweights, weighs less than one ounce (25.2 grams). Cartridge counter balancing and resonance tuning is provided by varying combinations of four counterweights (two weights, each 15 grams, and two large rings, each 22 grams, which fit over the smaller weights and are secured by a set screw). The counterweights are attached at the rear of the tonearm via a friction fit provided by an elastomeric decoupling compound that is a part of the weights. This allows a

The Dennesen ABLT-1 probably represents the first major advance in tonearm design since Rabco's unique linear tracking arm.

range of weights from 15 to 74 grams, and the tonearm can therefore be utilized with cartridges ranging from low to high mass and from low to high compliance. The cartridge is mounted via an adjustable clamp, bearing on a stiffened portion of the tonearm tube. The tonearm tube allows mounting the cartridge up to 8½ inches from the air-bearing. This reduces wow and varying VTA over warps to a minimum.

Magnetic (eddy current) damping is provided by two samarium-cobalt magnets mounted on a small horseshoe on the tonearm. In use, this horseshoe with its magnets sits on either side of the copper cueing bar, thereby applying magnetic damping.

Air at a pressure of 1½ pounds per square inch is supplied to the air-bearing assembly by a bellows-type air pump designed for reliable long life operation. The pump is contained within a walnut enclosure along with two air filters. One filter removes dirt, insuring air purity, and the other filter removes pulsations, assuring a smooth, steady airflow. The pump is attached to the air fitting at the rear of the air-bearing tube via 25 feet of 5/16-inch clear plastic tubing to allow placing the air pump in a remote location.

To set up the ABLT-1 for proper alignment, a specially designed Lateral Soundtractor is used to assure that the offset angle is 0° with no overhang. A bubble level is used

to properly level the turntable and the air-bearing tube. The tonearm may be attached to the turntable base by using either heavy-duty double-stick tape or machine screws.

Measurements

The Dennesen ABLT-1 was mounted on a Luxman PD-555 vacuum turntable with heavy-duty double-stick tape, and it has been held in place for about six months without any noticeable deterioration of the tape or movement of the tonearm base.

All measurements were made using the Empire EDR.9 phono cartridge, which weighs 5.2 grams. It is not necessary to statically balance the tonearm prior to setting the tracking force. The tracking force was set at 1.25 grams with the aid of Technics' SH-50P1 Stylus Pressure Gauge.

The capacitance of the tonearm's pure copper Litz wires from the mounting clips to the phono jacks in the base is 30 pF for each pair. Capacitance between the two "hot" leads is 19 pF. Resistance of one pure copper Litz lead from phono jack to cartridge mounting clips is 0.8 ohm.

Using a Dynamic Mass Analyzer (DMA-1) and Low Frequency Vibration Platform (LFP-20) from Dynamic Sound Devices (P.O. Box 369, Commack, N.Y. 11725), I measured the arm-cartridge dynamic mass as 18.5 grams (minus cartridge mass of 5.2 grams = 13.3 grams). The vertical resonant frequency measured 8.5 Hz, and the dynamic compliance measured 20×10^{-6} cm/dyne at the 8.5-Hz vertical resonance frequency. The lateral resonant frequency, using a test record, measured 12.5 Hz with an amplitude of 4.6 dB. In general, the ABLT-1 is a very well-damped tonearm.

Use and Listening Tests

I have used the Dennesen Air-Bearing Lateral Tracking Tonearm for almost a year, playing all types of music, without encountering a problem. The arm functions very well with any warped record without producing audible distortion. The airfoil constantly maintains its proper position without regard to the variation in musical dynamics or even minor jarring of the turntable. I never fail to be amazed by the fact that the single physical contact between the tonearm and any other point is strictly via the stylus, which is in direct contact with the record groove, and that the "hovering" arm is propelled across the record surface only by the stylus as it negotiates the modulated grooves of the record.

I have tried the arm with several phono cartridges, including those with a very high compliance. It was quite comforting to note that I could not detect any spurious resonances or other colorations. The cleanness of the sound was quite extraordinary in all cases. Any fear of damage to highly compliant cantilevers can be dismissed.

As with all precision instruments, the performance of the ABLT-1 tonearm is wholly dependent on the accuracy of the initial setup. When the setup is properly executed, the ABLT-1 simply works as its designer had intended.

Needless to say, a precision tonearm, such as the Dennesen ABLT-1, does not come cheaply. However, if you want the monarch of today's tonearms, it is well worth the price.

B. V. Pisha



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4

LUXMAN PD-375 TURNTABLE

Manufacturer's Specifications

Speeds: 33 $\frac{1}{3}$ and 45 rpm.

Wow & Flutter: Less than 0.03% wtd. rms.

Rumble: -70 dB (DIN B).

Arm Type: Straight static-balance.

Cartridge Weight: 5 to 10 grams.

Stylus Force: 0 to 3 grams.

Dimensions: 14.6 in. (37.08 cm) W x 6.4 in. (16.25 cm) H x 13.9 in. (35.30 cm) D.

Weight: 23.1 lbs. (10.39 kg).

Price: \$599.95.



About two years ago, Luxman demonstrated a unique turntable that featured a built-in vacuum pump which pulled the record firmly to the platter. Its price of about \$2,900 was a bit too steep for many would-be owners, but the company recently introduced a far less expensive model, the PD-375, which costs \$600. With some justification it is claimed that proper interface between the record and platter lowers

distortion, reduces resonances, as well as inhibits acoustic feedback.

We know that every action causes a reaction, and this applies to the behavior of a phono cartridge stylus in a record groove. This reaction produces some energy which is either dissipated as heat or is passed in some form back to the stylus. A soft mat can absorb most internal reflec-

The PD-375's ingenious vacuum pump system uses a platter constructed like a sandwich with an air space between the two sections.

tions, but it is not easy to find a material having the same characteristics at all frequencies as well as one that provides a close contact—hence the growing popularity of record clamps.

All the foregoing might seem rather academic to the hardened cynic, but it must be remembered that the modulation in the record groove is comparable with the wavelength of ultraviolet light, that is, incredibly small. This was highlighted at a seminar conducted by Discwasher some months ago when Bob Pruitt said that the noise floor of a really good record is -70 dB at 1 kHz. However, on examining an EMI recording of *Scheherazade*, it was found that at one point a violin plays a fundamental of 900 Hz with harmonics extending all the way up to the 19th at 17.1 kHz. The amplitude was -57.6 dB with a peak-to-peak value of 34 billionths of an inch! The amazing thing was that the 19th harmonic was not visible on a 2000 \times electron microscope, although it was well clear of the noise floor and was picked up by the stylus.

Now back to the PD-375 and its ingenious vacuum pump system. The platter is constructed like a sandwich with an air space between the two sections. The bottom section has a neoprene, corrugated surround, permitting it to move. If the lower section is pressed hard enough, air is expelled from two small holes in the top platter; if the lower section is pulled back, the air is drawn in, causing a suction which is sufficient to bond a record tightly. When the Start button is depressed, two rollers move out to pull the lower section down. At the end of the record, the rollers move out again and push the section back. It sounds quite simple, but obviously a lot of thought has been given to the design of this mechanism.

The platter motor is a d.c. slotless direct-drive type, servo-controlled with a quartz reference. Weight of the aluminum diecast platter is 6 lbs., and it has a mirror-finished edge which looks most attractive. The arm is a straight type, measuring 9.05 inches from pivot to stylus, constructed from tubular aluminum. Tracking force is set by a calibrated rear balance weight, while a wire and weight "outrigger" adjusts the anti-skating force. Both arm and motor are mounted independently from the top panel, which extends over the front. This panel is a satin-finished aluminum, making a pleasant contrast to the two rosewood sidepieces. All controls, apart from the anti-skating device, are accessible with the dust cover closed, and they are as follows: Combined on-off and speed selector, function switch (Repeat, Auto and Auto-Lift Off), vacuum on, vacuum off, and a dual-function button marked Start/Cut. This last button works in conjunction with the function switch—the Repeat is obvious, to return motion is back to its rest if Start/Cut is pushed while the function switch is turned to Auto, and the arm simply raises up off the record, as with an ordinary cueing lever, if the function switch is in Auto-Lift Off.

The VDS (Vacuum Disc System) is activated by pressing the VDS On button to start the pump. If the VDS Off button is pressed immediately after using the Start switch, however, a memory circuit triggers the mechanism to release the air when the arm is back in its rest position. Since the VDS cannot function with badly warped records, the turntable comes with a 12-inch plastic wheel which fits over the

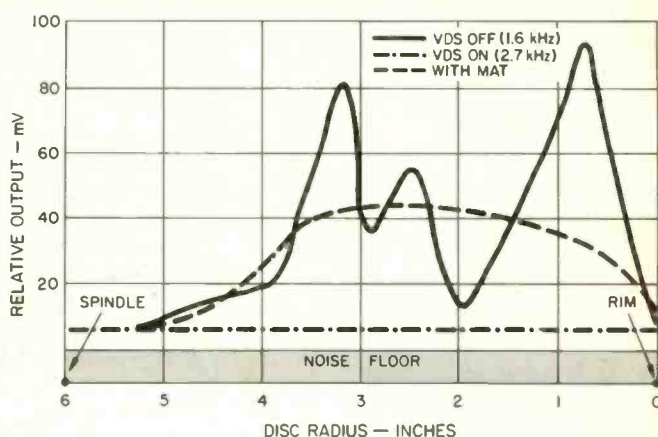


Fig. 1—Effects of a radiated signal on a record.

center spindle. The record can be gently pressed down by hand until the vacuum takes over. Also provided is a heavy rubber platter mat which accommodates 7- and 10-inch records.

Measurements

For test purposes, an Empire 600 LAC cartridge was mounted on the low-mass shell, which does not have the usual termination wires because the plug connections are at the end of the arm itself. The shell is mounted securely on the arm by means of a split clamp and screw, a method which has some advantages although extra care must be taken to see that the cartridge is level. Tracking force was set to 1.7 grams, and the anti-skating weight moved to the 1.8-gram position. The initial tests were made with the VDS switched off. The records rested on two neoprene rings, one at the rim and the other about $3\frac{1}{2}$ inches in. Thus, there was about one-tenth of an inch air space immediately under most of the record. The rings, or seals, are mounted in such a way that the application of the vacuum enables the record to push the rings down below the level of the platter so the disc is perfectly flat. The results of the initial tests were: Rumble, 62 dB (ARRL); wow and flutter, 0.045% (DIN 45-507), and arm resonance, 8 Hz with a rise of 4 dB. The measurements were repeated with the VDS switched on, but there were no significant differences. Tracking weight calibration was within 5% in the 1 to 2 gram range, and tracking error was $+2^\circ$ and $-1\frac{1}{2}^\circ$, using a Cart-A-Lign two-point gauge. Speed was less than 0.1% fast.

Next, some equipment was assembled to see how the VDS would affect the resonances of a record. A loudspeaker was mounted 20 inches above the record and fed with a swept-frequency signal. Instead of using the time-honored lycopodium powder method to show the various modes, the cartridge was placed on a stationary record, and the induced output measured. The upper curve of Fig. 1 was taken at the most significant mode frequency of 1.6 kHz with the VDS off; note that there are three peaks of

Switching in the VDS damped all high frequency modes, and output from the cartridge was in the noise floor.

0.75, 2.5, and 3.3 inches from the rim. Switching in the VDS damped all high-frequency modes, and output from the cartridge was in the noise floor. The mat also provided an appreciable amount of damping, but the main resonant frequency was raised to 2.7 kHz. Output from the driving loudspeaker was kept to a level of approximately 100 dB SPL at the record, and the highest peak in the 1.6-kHz mode (VDS off) was 30 dB below a reference signal of 3.54 cm/S from a standard test record.

As the initial tests were made with a stationary record, I decided to repeat them with a record turning at 33 $\frac{1}{3}$ rpm. Using an unmodulated record (not easy to get!), the results were substantially unchanged. It is true that SPLs of 100 dB are not terribly likely to impinge on a record—except in a disco—but music peaks of only 80 dB were easily detected with the VDS off. The mat was very effective in absorbing these signals, but it is quite possible that some breakthrough could occur with a poorly designed mat, causing a smearing effect. (This is why most turntables now have fairly solid mats instead of the ribbed designs with air pockets, which could form miniature Helmholtz resonators.)

Although external excitation does give a clue to internal damping, I felt impulse testing might provide further information and so conducted some experiments using 4-Hz pulses obtained from a suspended ball driven by a transducer. The results were predictable: A single pulse followed

by a train of pulses with the VDS off, a single pulse with the VDS on, and a trace of ringing when the mat was used.

Use and Listening Tests

Listening tests were made with a wide variety of records, and I found the effect of the VDS to be quite subtle. Vocals seemed to sound more natural, with less sibilance, while complex orchestral works sounded cleaner and more detailed. The flute and orchestral bell sections on the Shure—Era IV test record appeared to have an extra clarity, a kind of firmness.

Operation of the Luxman PD-375 is quite simple. After a touch of the VDS button, a whirring noise is heard, followed by a definite "thunk" as the record is pulled in. Suction is maintained until the end of play. In fact, the record cannot be removed unless the release button is depressed. As mentioned earlier, this can be done after the Start button is depressed, and the vacuum will then be released automatically when the arm returns to its rest. The unit is reasonably free from acoustic feedback thanks to the efficient arm and motor suspension system plus the four resilient feet.

In sum, the Luxman PD-375 is a handsome turntable with good basic wow and flutter and rumble performance, combined with a nearly unique feature, the vacuum platter.

George W. Tillet

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ZX-7...Maximum Performance through Complete Control

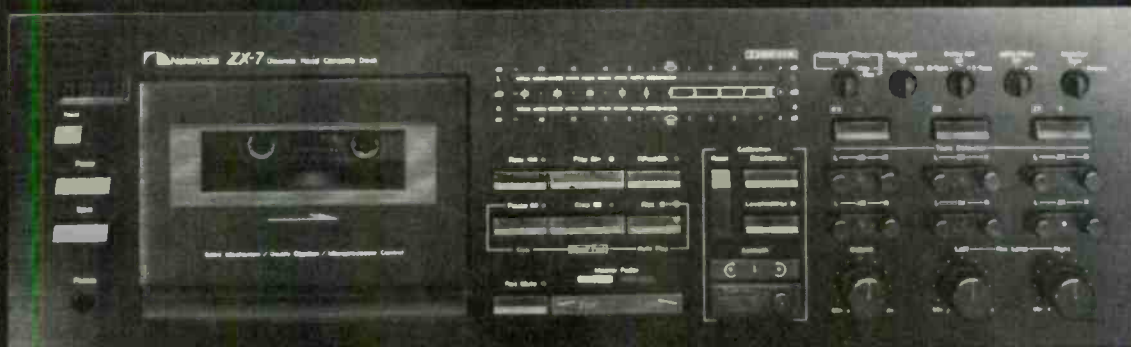
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dbx Car Decoder

The Model 22 auto decoder enables high-end car stereo systems to reproduce the full dynamic range of tape recordings with dbx noise reduction. Price: \$159.00. Enter No. 101 on Reader Service Card

Visonik Car Stereo Amplifier

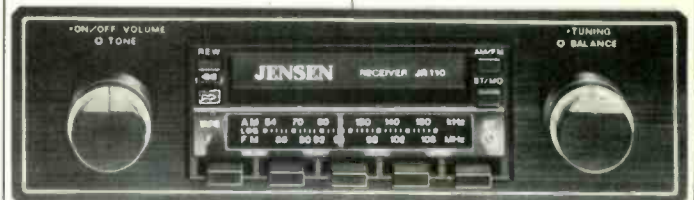
The 50-watt-per channel Alphasonik A-501E power amp features dual protection to prevent short-circuit damage. The Perma-Tect circuit, applied to the power amplification stage, monitors output current and voltage across the output transistors, limiting power without interfering with the signal. Even if the speaker leads happen to touch, the amplifier transistor will not blow. In addition, a pair of

thermal breakers monitor heat-sink temperatures and independently shut off power for each channel when the heat-sink hits 155° F, turning the channels back on when the temperature cools to 130° F. The frequency range of the A-501E is 20 Hz to 20 kHz with no more than 0.1% THD. When activated, an EQ switch for deep bass boosts input at 60 Hz by 6 dB with a 6 dB/octave slope. Price: \$250.00. Enter No. 100 on Reader Service Card



B & G Electronics Autosound Information

The B & G Information Package contains brochures on products from 30 to 35 companies manufacturing gear for car sound systems. The materials enable car stereo buffs to choose and install equipment more easily. Price: \$6.00. Enter No. 102 on Reader Service Card



Jensen Car Cassette Receiver

The in-dash AM/FM model JR110 with a mini-size chassis and 8 watts total power is designed to fit most X-body and import cars. Features include tone control, stereo FM indicator,

balance control, mono/stereo selector, automatic local/distance switching, five station presets, automatic loudness compensation, and locking fast forward and rewind. Price: \$199.95. Enter No. 103 on Reader Service Card

Sony Walkman Professional

The WM-D6, designed for stereo cassette recording from external microphones or from a home system via line-level inputs, employs Dolby B noise reduction and a quartz-lock capstan servo system to maintain tape speed. A disc drive for tape transport minimizes torque loss and slippage while the unit is in motion. The WM-D6 comes with Sony's MDR-50L stereo headphones. Frequency response extends from 40

Hz to 15 kHz \pm 3 dB. Wow and flutter is claimed as 0.04% (wtd. rms). Signal-to-noise ratio exceeds 58 dB, Dolby NR off. Price: \$349.95. Enter No. 104 on Reader Service Card



Autotek In-Dash Stereo Cassette

The pushbutton, mini chassis CSR 3050, with a power rating of 13 watts per channel, is designed to fit all foreign and domestic cars. Because it is adaptable to any size, the

purchaser can be confident of fit in difficult installations. The unit features automatic control stereo, four-way fader control, soft mute, dual-gate MOS-FET, and locking fast forward and rewind. The claimed specs include frequency response of 30 Hz to 40 kHz \pm 3 dB, FM radio usable sensitivity of 17.3 dBf (2.0 μ V/75 ohms), tape response of 40 Hz to 14.5 kHz \pm 3 dB and wow and flutter of 0.2% wtd. rms. Price: \$169.95. Enter No. 106 on Reader Service Card



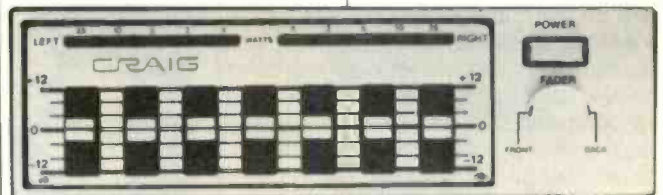
Discwasher Pinch Roller Cleaner

The Perfect Path C.P.R. cleaning system is intended to prevent both home and car stereo machines from damaging tape. The fluid will not extract vital rubber stabilizers, and the cassette has a Positive Drive system to permit thorough pinch roller cleaning. Price: \$10.95. Enter No. 105 on Reader Service Card

Craig Graphic Equalizer/Booster

Compact and designed for car stereo use, the seven-band Model V507 has a built-in fader for four-

speaker systems, tricolored LED power-level monitors, boost/bypass switch, and 50 watts maximum total output. Price: \$79.95. Enter No. 107 on Reader Service Card



THE COLUMN

MICHAEL TEARSON
JON & SALLY TIVEN



Tug of War: Paul McCartney
Columbia TC 37462, stereo.

Sound: A+ Performance: B+

Tug of War is an exercise in craft. If the last album by Macca was a resort to minimalism, his latest features an emphasis upon production, arranging, and having exactly the right people on each track. Although Paul is still playing most of the instruments himself, when guest stars like Stevie Wonder, Ringo, Carl Perkins, Stanley Clarke and Steve Gadd make appearances, it's more than just a courtesy call. McCartney is making music that doesn't rock all that much, but is expertly played, magnificently recorded, and sometimes downright inspired. Instead of continually being upbeat, his approach is MOR/ballad-oriented, the mellowed ex-Beatle brought down by the loss of his colleague/friend.

McCartney isn't completely lost to melancholy, but those who dismiss his excursions into the Paul Simon Land of the Eternally Inspid won't find much to chew on here. "Tug of War" and "Ballroom Dancing" rock but don't exactly take off like "Jet," and "Take it Away" is a pleasant sequel to "Ob La Di." The two tracks with Stevie Wonder are obviously fated to get the bulk of attention, and while "Ebony & Ivory" is what you'd call a pleasant disappointment, the jam song, "What's That You're Doing" is a fine collaboration between

these two multimillionaires. McCartney's being very fickle and stingy on *Tug of War*, giving out just enough meat to keep up with the advance hype on the record, but he's made far better albums and he knows it. Lucky for him, his minor works rank far above most of his contemporaries' finest hours.

Jon & Sally Tiven

Maybe It's Live: Robert Palmer
Island ILPS 9665, stereo, \$8.98.

Sound: B- to A Performance: B

This album sounds like it was put together to fulfill contractual obligations, which is not to denigrate the music particularly. But as far as a bunch of tracks that hang together coherently, this ain't it. You don't quite get the



Robert Palmer Live Show, just six tracks recorded in London a year and a half ago. And the new studio tracks are strange little items cut over a period of time with varying personnel, hardly any of it featuring his touring band. The result is a gem here and there but no real consistency, and at the end of a listening you don't really feel like you've heard an album. It's like asking someone what he's been doing and he says a little of this, a little of that, but nothing overall special.

The live stuff is genuinely exciting, covering practically the entire span of Palmer's solo career, from "Sneakin' Sally" through big hits like "Bad Case of Lovin' You" and Andy Fraser's "Every Kinda People." The band sounds killer, particularly drummer Michael Dawe and the magnificent bass runs of Chris Bishop, and the sound of these recordings has a tremendous amount of body and presence. Side two compiles Palmer's various studio excursions, and a lot of this material sounds trashy and thin by comparison. The best of the bunch are "Maybe It's You" and his current U.K. hit, "Some Guys Have All the Luck," but where is his long-rumored version of Chrissie Hynde's "Kid"? Considering that this is his first album in two years, you'd think he'd be able to produce something a little more monumental.

Jon & Sally Tiven

Green Light: Bonnie Raitt
Warner Bros. BSK 3630, stereo,
\$8.98.

Sound: C Performance: C+

Renee Geyer
Portrait ARR 37949, stereo, \$6.98.

Sound: B- Performance: C+

Old Enough: Lou Ann Barton
Asylum EI-60032, stereo, \$8.98.

Sound: A- Performance: A+

The Glory of Alberta Hunter: Alberta Hunter
Columbia FC 37691, stereo.

Sound: A- Performance: A+

Bonnie Raitt's failure to deliver a hit record in a full decade of recording and nonstop roadwork is a genuine mystery that rapidly boils down to one question: Why don't her records crack-

le with verve and excitement like she invariably does live?

Obviously the question has gotten to Bonnie as well, for *Green Light* is a nearly total rethinking of her recording style. She has joined forces with the sleek, tough, rock-out Bump Band consisting of ex-Faces and Stones keyboard man Ian McLagen, ex-Beach Boy drummer Rickey Fataar, bassist Ray Ohara and guitarist Johnny Lee Schell. The new combo has toughened Bonnie's stance and the project seems well thought-out.

But (and watch out for them "buts") there's a hitch or two. Rarely has Bonnie Raitt ever missed the emotional connection so completely as she does this time around. Technically she is fine, but she could have mailed in her emotion from the beach. And the song choices are not very good. The originals and contributions from the band are weak songs, pure and simple. This year's Eric Kaz contribution, "River of Tears," is a highlight of the set with Richard Manuel's wonderful accompanying vocal, but the song is pure formula, one we've heard again and again over the years. Bob Dylan's bitter blues, "Let's Keep It Between Us," is savaged by Bonnie's offhanded goofy treatment and total lack of commitment. Bonnie glides so lightly over the words that when she sings "And it's making me so angry," she sounds like she's kidding. A disturbingly empty performance.

Renee Geyer appears to be at least partly a Bonnie Raitt protégé. Her album was recorded with the Bump Band in the same time frame, same studio, and with the same producer as *Green Light*. She obviously shares Bonnie's love of Little Feat, as she has the Bumpers emulating Little Feat trademark licks with regularity, not only on her version of the Allen Toussaint blues "On the Way Down" previously recorded by the Feat.

Actually, the Bumpers play it a bit looser on the Geyer album, and the fun of recording is evident from the occasional whoops and bits of patter included. But the problem is that Renee never establishes a core personality for the album, and so it never really takes off, despite the band's strong contributions.

The sleeper here is Lou Ann Barton

from Texas. She has had the great fortune to have been discovered by the legendary Jerry Wexler, who subsequently coproduced with Glenn Frey of the now-defunct Eagles. The recording site was Muscle Shoals, Alabama, where Wexler cut countless sides with Aretha Franklin, Wilson Pickett, and many more in the late '60s.

This lady is a torrid singer whose exhilaration is infectious. By turns she is sassy, sweet and sad. And totally committed. Besides a wonderful Texas accent, she has a terrific rolling growl and a squeaky Brenda Lee crying catch in her voice that make a devastating left/right combination. She can convincingly gun the rockers from Hank Ballard's "Finger Poppin' Time" to newcomer Marshall Crenshaw's "Brand New Lover," and she can carry the ballads with grit, especially The Chantels' oldie "Maybe," an impossibly stupid song in lesser hands.

The arrangements are crisp and to the point. They are not stripped down; they have been built right without any clutter at all. Barton's obviously strong sincerity is the extra ingredient that makes it come alive.

I hope Bonnie Raitt and Renee Geyer take note of what went right here. Even more than that, I hope this album of pure '60s-style soul, an unfortunately unfashionable form these last several years, will become the smash hit it richly deserves.

Now while we're on the subject of girl singers, there's the new album, her third for Columbia, by Alberta Hunter, 86 years young. The woman is a treasure, getting better each album since her return to action. Nobody gives more pure pleasure singing, whether gospel, standards or originals.

Her combo is a crackerjack swinging unit filled with great players, especially leader/pianist Gerald Cook and horn men Vic Dickinson and the redoubtable Doc Cheatham. The elegance and class and taste of producer John Hammond permeate the project. His contribution is the clarity and intimacy of the sound, a truly excellent job.

The Glory of Alberta Hunter is one of the finest and most wonderfully human albums of this or any season. How can you hear that woman and not feel more alive yourself? *Michael Tearson*

Bonnie Raitt



Renee Geyer



Lou Ann Barton



Alberta Hunter



THE BEATLES: WHITE ALBUM



The White Album: The Beatles
Mobile Fidelity MFSL-2-072, stereo,
 \$24.95.

Sound: A Performance: A

When one speaks of seminal recordings that have influenced current pop music, The Beatles are almost taken for granted. To think of the so-called *White Album* as an early progenitor of Cheap Trick, Pat Benatar, or The Bush Tetras makes anyone who owned a copy when it was released feel positively ancient. *The White Album* marked the end of the '60s, the beginning of progressive rock, and the rise of FM radio as a major force upon the music business. To have such an artifact on one's turntable should evoke nostalgia, or one of those emotions that 16-year-olds supposedly haven't learned yet.

This new version of *The White Album* sounds like a new record—it's not dated either musically or technically. When each of The Beatles was sequestered in his own studio, furiously working on his tracks for the upcoming record, the finest engineers of the day were being employed for the project. Geoff Emerick (producer of Robin Trower and UFO currently) was most probably in the room with Paul, Chris Thomas (producer of The Pretenders, The Sex Pistols and Elton John) handled John's sessions, and Ken Scott (producer of David Bowie and Supertramp) bounced from room to room. These would-be millionaires, then simply trained hands, were preserving

what was ostensibly the last real album by The Beatles. While the creative minds were drifting apart, these three were making sure the music would be something to remember the group by.

This version of *that* record is, one would guess, the version they would like us to have as our own. All of the vocals, the incredible spaciousness, Ringo's snare attack, George's exchanges with Eric Clapton on "While My Guitar Gently Weeps," and the blinding array of diverse talents run amok sound more timely now than they did 14 years ago. The extraordinary creativity of this recording unit, coupled with their refusal to comply with the trends of the day, urges one to say with full sincerity and 100% accuracy that they just don't make records like this anymore. The only telltale clue to the album's age is the stereo placement, which often puts the drums to one side.

For non-initiates, this is required listening and no apologies are necessary. For those already well acquainted, perhaps you'd now like to know what *The White Album* sounded like to those who made it. *Jon & Sally Tiven*

Two from Opus-3

Opus-3 is a small Swedish label that, in the same spirit as the better-known Proprius label, believes in straightforward recording of small ensembles in appropriate acoustical surroundings. Their efforts are mainly confined to chamber music, jazz and

folk music, and their products are aimed at the audiophile who has grown weary of production excesses and too many microphones. While there is little technical information in the liner notes, it is clear that minimal, but high-quality, gear has been used in making these recordings. To my ears, the basic pick-up is by way of a single coincident microphone pair (probably Blumlein), and the localization of each instrument is precise and natural. The disc transfer is done at sensible levels, and the pressings are superb.

Gitarr-Kvartetten: Music of Bach, Telemann, Frescobaldi and Cimarosa
Opus-3 7915, \$17.95.

This disc presents tasteful transcriptions for a quartet of guitars, said to be the only group of its kind in the world. The instruments include alto, bass, and soprano guitars in addition to the standard instrument. The simple microphone array places the instruments clearly in an arc across the stereo stage. Timbres are natural, and the playing is sensitive and competent.

Buddy Bolden Stomp: Arranged by Tomas Örnberg
Opus-3 79-10, \$17.95.

I must confess that I couldn't sit through an entire side of this disc, so my comments are based on spot-checking. These are New Orleans jazz arrangements of the earthiest sort, presumably in the style of Buddy Bolden, an early New Orleans jazz trum-

peter. As on the above Opus-3 recording, the players are arranged across the stage with pinpoint accuracy. Every musical line can be distinguished clearly, and, for those with an affinity for such music, this disc should be a real delight. Again, the transfer and pressing quality are excellent.

John Eargle

The Sheffield Drum Record: Improvisations by Jim Keltner and Ron Tutt
Sheffield Lab 14, direct-to-disc, \$16.95.

Doug Sax began the "audiophile disc" movement some 13 years ago, and his activities at the Mastering Lab are a legend in the audio industry. When Sax brought out his first direct-to-disc album, there was a clear superiority of that medium over the analog tape process of the day. In the intervening years, both digital and advanced analog techniques have narrowed that margin significantly. Today, Sax's label, Sheffield Labs, remains the only one committed to direct-to-disc techniques, most other audiophile labels having been won over long ago to digital recording.

The Sheffield Drum Record fits nicely into the direct-to-disc scheme; each side is devoted to a single performer, and the improvisatory nature of the performances discounts any thought of editing. The disc was conceived as something of an obstacle course for audio components, phono cartridges as well as electronics, and this it does beautifully. The sides are short (7:11 and 6:23 minutes), and the ending diameters are large. The peak levels are generally well within VU peak values of 3.5 cm/S (1-kHz reference).

Because of the high crest factors (peak-to-rms ratios) characteristic of a drum set, the average levels on this disc are low, leaving generous headroom for peaks. Herein lies the value of the disc; subsequent elements in the audio chain are likely to fail, or show their weaknesses, long before tracking problems are encountered. The level on the disc is moderate enough such that many phono cartridges (properly mounted) can handle it in stride.

The miking is simple: A basic stereo pair overhead, with one additional mike for highlighting the kick drum

and, on the Tutt side, another for the snare drum. To me, the Keltner side seems more spontaneous and farther ranging in its use of the somewhat limited textures of the standard drum set. Both sides will give the average hi-fi system fits. No record that I know of better delineates the wide perform-

ance range we are likely to encounter with state-of-the-art components.

When listened to over a system worthy of it, *The Sheffield Drum Record* cannot fail to impress any musician with the strides made in recent years in the mechanics of quality sound reproduction in the home. *John Eargle*

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P-1

CLASSICAL REVIEWS

EDWARD TATNALL CANBY



Béla Bartók: Style and power evoked.

Béla Bartók: Bartók Piano Music. Dances, peasant songs, folk tune settings, "For Children," Vol. 1. Lili Kraus. Vanguard VSD 71249, stereo, \$8.98.
Perahia/Bartók: Suite Op. 14, Sonata 1926, Out of Doors, etc. Murray Perahia. CBS 36704, stereo.

The Bartók One Hundredth brings us plenty of piano music; Bartók was a fantastic pianist himself and composed music for his instrument accordingly, from the simplest Hungarian folk tunes for children to the most incredibly complex and original works of dissonance. Here are two performers, at opposite poles but both excellent.

Lili Kraus, herself from Hungary, is a grand dame of the older piano generation, a performer of immense delicacy and elegance. Her Bartók, carefully chosen from among the more ingratiating and humanistic small works, is the quintessential Bartók. There is a certain Old World charm about her playing—but Bartók himself belonged in that same world and the few recorded examples of his own virtuosity show a remarkably similar piano style. Children who have enjoyed the little Bartók pieces in their piano lessons, and the teachers who use them, will be delighted by Madame Kraus; the rest of us can enjoy the Hungarian tunes and the

deft, sometimes violent, always sympathetic musical settings Bartók gave them.

Murray Perahia, although much younger, plays the finest contemporary Bartók I have heard. Awesome. The man is astonishing; his technique is so extraordinary that he can ignore it, like other great pianists—his performances are as smooth and genial as his smile on so many record jackets, yet their sheer power is unbelievable. For him, the Bartók idiom is absolutely, transparently clear and that is the way he plays; there is no forcing, no show-off, no piano pounding (for lack of anything better to do). Columbia's piano recording is gorgeous, a bit hard sometimes—but only as the music itself demands. Great!

Mozart: Four-Hand Sonatas, Vol. I (Sonatas in D, K. 381; F, K. 497). Malcolm Bilson, Robert Levin, forte-piano.

Nonesuch N-78013, stereo, \$8.98.

Sound: A Recording: B Surfaces: B+

This is Mozart for one piano, two players side by side, and the single piano is Malcolm Bilson's already familiar modern version of one of the Viennese Walter pianos that Mozart used, back in the late 18th century. For many ears, this instrument will sound disappointingly "modern" since it does not twang and jangle quaintly, like some of the genuine oldies! But if we stop to remember that even our modern steel-framed pianos get to sound pretty jangly after a remarkably few years, let alone an even 200, then we must assume that Mozart's own pianos might well have sounded pretty good—at the time, like this one.

What you do hear in this (and other Bilson recordings) is a treble that is more "woody" than the modern piano and a bass range that is distinctly and pleurably twangy in a gentle way; also a far more articulate and big sounding ensemble than, curiously, we can get on a big modern grand. The bigger the modern piano, the smaller Mozart sounds, which is one of the anomalies of musical sonics, especially in recording, where the volumes of big and small instruments are the same on disc or tape.

I am bothered by the closeness of

this recording. Though it was made in a concert auditorium, the room sound is almost inaudible and the general effect is close and dry—I found it much easier listening off in another room, to put a bit of space between me and the piano. One school of solo piano recording, of course, has always taken the instrument down close, minus ambience except that of the strings themselves; another school puts the music off in a "concert hall" space and this, my ears say, is generally the best idea for home listening results. However, one can compromise halfway, too.

Impeccable performances, carefully phrased and rhythmized, and quite minus that false "delicacy" which used to be a hallmark of Mozart style—on big pianos, of course. When the moment comes, these two players light into their piano with healthy gusto, and their slow movements are straightforward too. In the new (and original) manner, ornamentation is added occasionally to the printed notes, which may shock some conservative music teachers. Mozart! Well, if Mozart did it, why shouldn't we? About time, I say.

Malcolm Bilson: Mozart's own sound.



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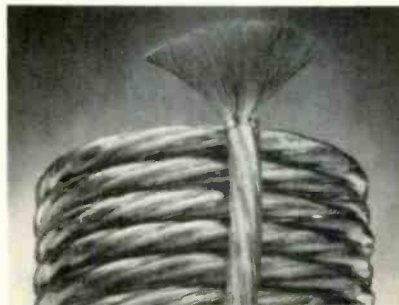
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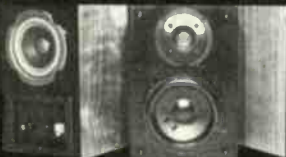
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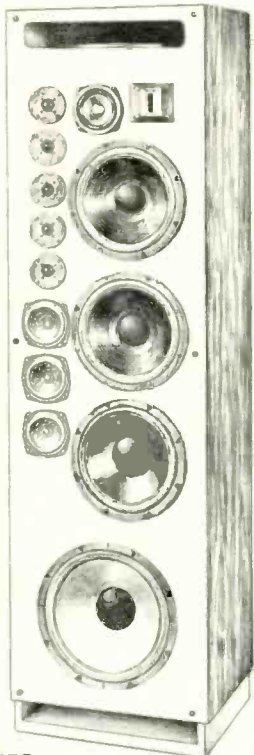
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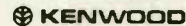
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This is not to say that we believe that the intelligent and sensitive loudspeaker designer can totally ignore the need to design a loudspeaker for as accurate a frequency response as is possible given the limits of current technology. Clearly, it is the task of a loudspeaker to faithfully reproduce the signal that is being fed to it by the other elements in the audio chain. At GNP our loudspeakers are not intended to compensate for deficiencies in the other links in the reproduction chain by introducing complementary tonal balance errors.

We also hold no brief with the view that, in comparing two or more loudspeaker systems, you should select the one whose euphonic colorations you subjectively prefer. This is a trap you should avoid at all costs. Proper testing methodology dictates that what we should be comparing is not the sound of one component with another, but each component against the only external standard of reference we have: the natural sound of live acoustic music. At GNP Loudspeakers it is this philosophy of striving for perfection to which we personally and professionally subscribe.

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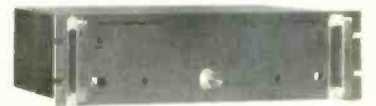
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Harry F. Olson

Dr. Harry F. Olson, a pioneer in acoustics and electronic sound recording whose inventions led recorded sound out of the primitive era of the gramophone to modern electronic high-fidelity microphones and loudspeakers, died this April at 80. Olson, who held more than 100 U.S. patents on devices and systems in the audio field, was Staff Vice President, Acoustical and Electromechanical Research for RCA Laboratories when he retired in 1967.

During his career, Olson developed mikes for both broadcasting and recording, high-fidelity loudspeakers, phonograph pickups and recording equipment, underwater sound gear, sound for motion pictures, and public address systems. He was also recognized for achievements in magnetic tape recorders, the music synthesizer, a speech processing system, and an experimental phonetic typewriter.

He wrote more than 130 articles and professional papers, as well as a number of technical books, *Modern Sound Reproduction*, *Applied Acoustics*, *Elements of Acoustical Engineering*, and *Musical Engineering*.

Elected to the National Academy of Sciences in 1959, Olson was a Fellow of the American Physical Society, the Institute of Electrical and Electronic Engineers, the Audio Engineering Society, the Society of Motion Picture and Television Engineers, and the Acoustical Society of America (of which he was a past president).

He was honored with the John H. Potts Medal of the Audio Engineering Society, the John Ericsson Medal of the American Society of Swedish Engi-

neers, the Mervin J. Kelly Award, the Consumer Electronics Award and the Lamme Medal—the last three from the IEEE. He received the first Silver Medal ever given for engineering acoustics by the Acoustical Society of America in 1974 and that organization's coveted Gold Medal in 1981.

Harold W. Lindsay

Harold W. Lindsay, the project engineer and chief designer of the Ampex Model 200, the first practical high-fidelity magnetic-tape audio recorder, and developer of the industrial design of the VR-1000, the first videotape recorder introduced by Ampex, died in April at age 72.

Lured to Ampex soon after World War II by Alexander M. Poniatoff, the founder of the company, Lindsay, who had witnessed a demonstration of the German Magnetophon tape recorder, created the first U.S. device to capture



sound on tape. Following a demonstration of the Model 200 in 1947, the ABC Radio Network bought the first 20 production units. By April of 1948, the recorder was used to broadcast the Bing Crosby Show and for network daylight savings time-delays. As a consequence, Ampex, which had been a small subcontractor of electric motors during World War II, became a major hi-fi recorder producer.

Following the success of the Model 200, Lindsay directed development of later generations of Ampex audio recorders, set up the first quality control and industrial design departments at Ampex, and, through his involvement in the latter, developed the industrial design for the VR-1000, the first videotape recorder, in 1956. **A**

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"Bass Brawl" Erratum

Your statement in the Dec. 1981 issue that "two 8-inch speakers have a total combined area greater than one 12-inch speaker" is in error. The areas are respectively 2 times 4^2 times π which equals 100.53 square inches, vs. 1 times 6^2 times π which equals 113.10 square inches. This difference is more pronounced if we deal with actual cone diameters rather than nominal ones.—Emerson S. Hawley, Brooklyn, N. Y.

Defining Wow and Flutter

Q. What is meant by wow and flutter?—Daniel Walter, Brooklyn, N.Y.

A. Wow and flutter are terms which are closely related. Wow refers to relatively slow speed changes, one or two such changes per second, and applies to the motion of tape decks and turntables. Wow manifests itself aurally in changes of musical pitch, and the most striking examples can be heard during sustained notes on piano and clarinet. Flutter also indicates a speed fluctuation of a device, but at a rapid rate.

ABCs of MMs and MCs

Q. I recently purchased a new receiver which has a built-in pre-preamp for moving-coil cartridges. What is the difference between a moving-coil and a moving-magnet phono cartridge? What are the advantages of each?—Edward J. Liney, Jr., Dresher, Pa.

A. A moving-magnet phono cartridge is the more common of the two. It is relatively simple to construct, rugged and reliable. In this cartridge is a set of coils located in the proximity of a magnet mounted on the stylus assembly. The relative motion of the magnet with respect to the stationary coils will produce a voltage in the coils which is proportional to the motion of the stylus.

The moving-coil phono cartridge is similar, except that the coils are attached to the stylus assembly, and the magnets are stationary. Such a cartridge can be made to have a very high compliance and low, effective stylus tip mass. Each coil is light, having only a very few turns. The "pigtail" wires from such coil assemblies are constantly flexed when the cartridge is used, a potential source of trouble.

While possibly better in transient re-

sponse when constructed properly, moving-coil cartridges are expensive to produce. Their output voltage is low because of the relatively small number of turns wound on each coil. This means that special, low-noise preamplifiers are required if the playback equipment is to have a good signal-to-noise ratio. In addition, most such cartridges must be retipped at the factory.

Phasing In and Out

Q. My turntable plays records out-of-phase. When I reverse the leads to one pair of speakers, the sound is in phase. I must, however, return the leads of this speaker to proper phase to play other program sources. Is there a way to change phase at the turntable to eliminate the need to change speaker connections?—Harvey B. Wyche, Roslyn Heights, N. Y.

A. It sounds as though you have wired your cartridge out-of-phase or that there was a manufacturer's error in wiring the innards.

In any event, merely interchange the leads of one channel of your cartridge, and proper phase will once again be realized.

More Power to the Speaker

Q. What does the term "minimum power" for a speaker refer to?—Eric Freund, Sacramento, Cal.

A. The minimum power required by a loudspeaker is that power which will fill an average listening room to a relatively loud sound level. Do not select a speaker whose minimum power requirements cannot be met by your amplifier. The amplifier should be capable of producing at least twice the minimum power required by your speaker.

Where your room is larger than average or where there is a large amount of overstuffed furniture or heavy drapery present, you will want an amplifier which can produce at least the maximum power capable of being handled by your speakers.

By maximum I refer to that level of power which, when exceeded, will either produce audible distortion or physical and electrical damage to the innards of your speaker.

There are those who will say that, by using these guidelines, there is no reserve power for transient peaks. This is

a discussion which can consume a lot of space. Suffice it to say, these guidelines are at least a practical, readily understood approach to the conditions discussed here.

Do I Hear a Pre-Echo Waltz?

Q. When a very quiet groove immediately precedes a loud groove, even on the best European phonograph records, some reasonably audible portion of the loud passage is heard prematurely. Would it be reasonable to assume that during sustained, very loud passages, the information in such grooves is continuously imposing on other grooves and that such imposition could produce distortion levels exceeding the levels found in even the most modest tuners, amplifiers and speakers?

Years ago, London Records did make a few recordings with more space between grooves. Are there any such records being made today or even contemplated?—Frank Alliegro, Washington Crossing, Pa.

A. Upon visual examination of most disc recordings, you will find that the more heavily modulated grooves are spaced further apart than the low-level portions of the same disc. This is done partly to reduce the problem under discussion—known as pre-echo—and partly to insure proper tracking during playback.

If discs were recorded with uniform, wide groove spacing, the time per side would be limited.

Pre-echo can also result from electroplating problems during the record-making process. If the early stage of this process is rushed, the plating does not completely represent the modulation of the grooves. Therefore, there is a slight "smearing" of the grooves which will not add distortion, as in a tuner or speaker, but will cause the louder signal levels to be imposed on silent grooves or on the softer passages.

It would also appear that some playback styli aggravate this condition, and I suspect this has something to do with momentary deformation of the groove walls. It has been long recognized that grooves are springy and can be displaced as the playback stylus passes through them. This can momentarily shift them slightly closer to

FOR THE SHEER LOVE OF MUSIC

adjacent grooves, helping to produce the pre-echo, or "ghost" as it is sometimes known.

Because of the somewhat elastic nature of phonographic records, the grooves spring back to their original positions after having been played.


Let Me Count the Ways

Q. I am planning to add more speakers to my component system. What is the difference between two- and three-way speaker systems. Are three-way systems really better?—David Holladay, Hayneville, Ala.

A. The two-way speaker system consists of a woofer and a tweeter. The audio frequency spectrum is divided in such a way that the woofer carries low frequencies (perhaps up to 1 kHz), and the tweeter carries, or produces, high frequencies, starting from the point at which the woofer drops off in response.

The three-way system is designed to slice the frequency spectrum into three parts rather than the two we have just mentioned. Here we have a woofer to handle the lowest frequencies, a midrange to handle frequencies between, say, 200 Hz and 2 kHz, and a tweeter to handle all frequencies above the highest frequency passed by the midrange speaker.

Engineering decisions are made as to the exact frequency range covered by each speaker in the system.

I do not believe that anyone can, or should even try, to select a loud-speaker system merely on the basis of whether they are two-way or three-way systems. You must listen to the speakers and compare their sound quality, one to the other. Because the speaker system makes the largest single difference in the overall sound of your installation, its selection deserves the greatest amount of care. I believe that the matter of whether a system is a two- or three-way unit is an engineering decision only. Although one can come up with arguments for and against each of these designs, the ear is the ultimate judge. 

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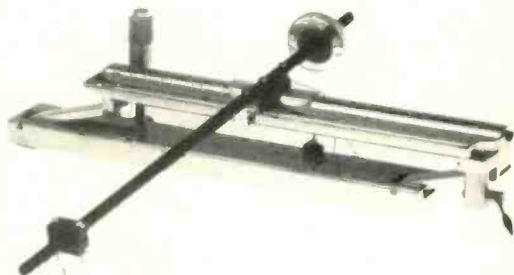
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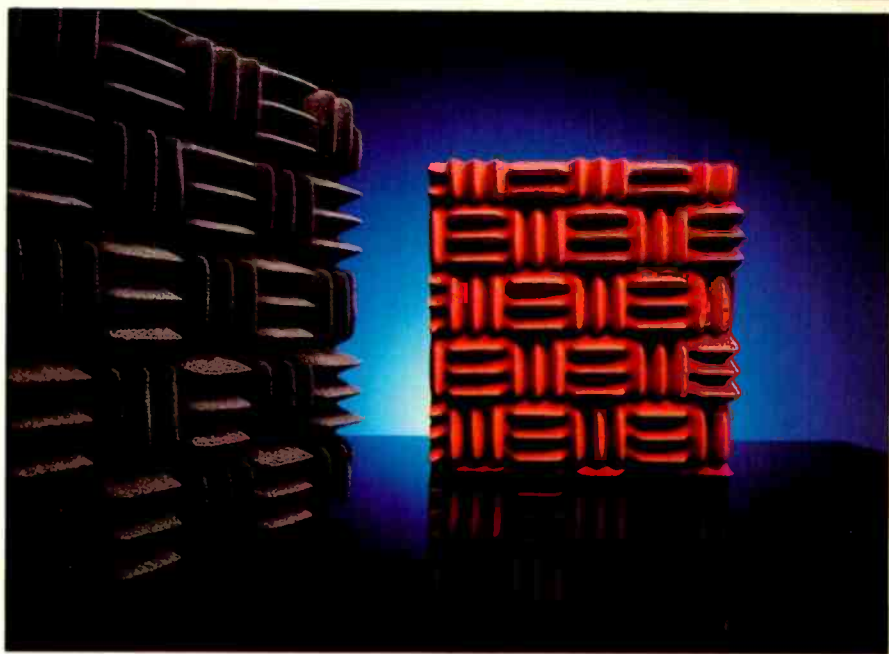
BERT WHYTE

LEDE LISTENING ROOM

Last month I reported on a somewhat radical idea in creating a new type of acoustical environment for listening to music. This was the LEDE or "live end, dead end" concept, in which the loudspeakers are placed in the acoustically dead front third of the room—with the remaining two-thirds of the room kept as live and reflective as possible. The dead end is achieved through use of a special open-celled polyurethane foam called Sonex, manufactured by Illbruck/USA of Minneapolis and sculpted in male and female anechoic wedge patterns.

There are three ways of applying Sonex sheets to a wall. For an extra \$6.00 per sheet, they can be obtained with self-adhesive backings. You can also use a special gun to apply a type of mastic or adhesive to the back of the Sonex sheets; the gun costs \$7.50 and extra cartridges of adhesive are \$3.50 each. The third method, and in my opinion the easiest, is to use an electric power staple gun with half-inch staples. The stapler is placed close to the base of the anechoic wedges so that the staples don't have to penetrate the full 2-, 3-, or 4-inch thickness of the Sonex. The adhesives are all right, but if the Sonex must ever be removed, it could be quite a mess. The staples, on the other hand, can be pried out fairly easily with a small screwdriver. I experimented using this method and found that on plaster-board walls a coat of latex paint effectively hid the staple holes. Repairing wood paneling is more difficult, but a color-matched wood filler will hide the staple holes, and they can be finished off with a furniture touch-up stick.

In applying the 4 × 4 foot Sonex sheets to my side walls, I used only the male anechoic wedge pattern. This provided optimum propagation of the sound waves down the walls of the room and aided in attenuating standing wave modes. I used the indented or female Sonex pattern on the back wall behind the loudspeakers. The entire stapling procedure for my listening room took about five hours, with the installation of audiotiles on the ceiling accounting for a major portion of this time. The ceiling is literally a pain in the neck, and one might be tempted to leave it untreated. That is a big, fat "no no." The ceiling is a primary source of



reflections and a major offender in terms of diaphragmatic flexure. Using Sonex on the floor is obviously impractical, but thick pile carpeting over thick rubber padding serves quite well.

It is true that if one had access to the elaborate equipment needed for TDS (time-delay spectrometry) measurements of TEF (time-energy-frequency) curves, it would be possible to determine precisely where the Sonex should be applied in the front dead end of the room. In other words, less Sonex could be used, but this assemblage of equipment currently costs about \$22,000. (Although Crown International is expected to introduce a single dedicated TDS instrument this year with a price reportedly about \$10,000.) Of course, one could also hire one of Don Davis' licensed TDS practitioners who have the requisite equipment, but they don't come cheaply either!

What does it cost to create a live end, dead end listening room? The size of the room is the governing factor. I needed three six-sheet cartons of the 4 × 4 foot Sonex at \$222.00 each. I also required two 28-piece cartons of audiotiles for the ceiling at \$195.00 each. Total costs came to \$1,056.00 for Sonex and a \$5.00 rental of the stapler. Not cheap, I'll agree, but I can't think of any comparably priced audio equipment that would even ap-

proach the dramatically heightened sense of realism afforded by Sonex in the LEDE configuration.

In my LEDE listening room, I use a pair of B & W 801F speakers driven by a Levinson ML-3 amplifier. The amp is between the speakers and connected by short lengths of Live Wire Big Red speaker cable made by Audioquest of Santa Monica, Cal. This cable is *huge*, about 1½ inches in diameter and comprised of Litz wires in a special configuration. Quite incidentally, I have always been very skeptical about so-called super wires and the alleged improvements they make in music reproduction. Yet I must say Big Red seems to fly in the face of engineering theory and logic, for I certainly noted a smoother high-end response and, most especially, a cleaner bass, with more extension and plenty of weight and punch. But at \$20.00 per foot, short lengths are the order of the day!

Positioning the amplifier close to the speakers is not a new idea, but it appears to be gaining more and more favor among audiophiles. The speakers, while placed away from the walls, are nonetheless "surrounded" by the Sonex. Thus, those pesky close-order early reflections normally produced in all non-LEDE listening rooms are absorbed. Listening to a familiar loudspeaker in the LEDE environment, one

is immediately aware of the great increase in the clarity and cleanness of the sound. Bass is singularly free of boominess or overhang. Instruments seem more clearly defined. Dense and complex musical textures are more articulate. Depth perception is greatly enhanced, as is the sense of ambience and the reverberant characteristics of the recording hall. Loudspeakers with superb imaging, like the B & W 801F, achieve new heights of instrumental localization and positioning; speakers with lesser degrees of imaging are considerably improved.

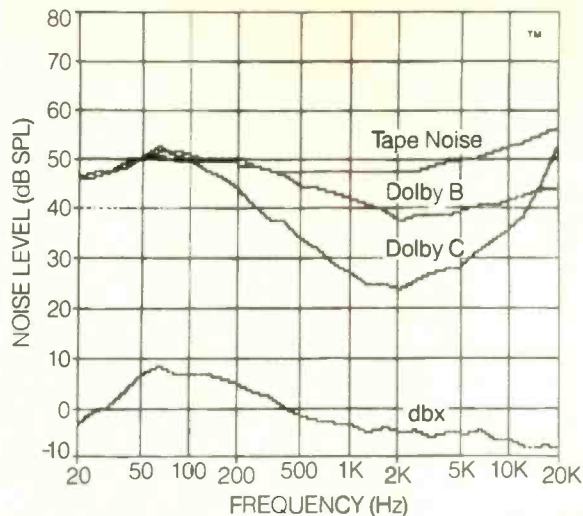
While most loudspeakers will benefit from the LEDE room, there are designs, like the Bose 901, which obviously would suffer from absorption of their rear sound output. On the other hand, dipoles like the Quad and the Acoustat electrostatic speakers perform exceptionally well. In a sense, these speakers "think" they are in a far bigger room. For those who have always yearned for a bigger room, in order to keep electrostatics well away from walls, LEDE is the answer.

The LEDE configuration allows you to get further into the music, be it performed in a studio or concert hall. However, therein lurk some annoyances. What once was masked by the interaction of listening room acoustics with loudspeakers is now all too clearly revealed. Poor mike techniques, especially multi-mike, can be devastating to hear—for example, some gross "pan-potting" in which you can plainly hear left/right manipulations and "gain riding." In addition to all kinds of sonic anomalies, there are matters of performance. Poor intonation becomes easily apparent, as does inaccurate "unison" playing.

Needless to say, the LEDE room is not for everyone; it helps to live alone or with tolerant people. For those who can't go all out for an LEDE room at present, Sonex still can make an improvement. If you install one Sonex sheet on each side wall in the front of your listening room, and position your speakers so they are adjacent to the Sonex, some of the close-order early reflections will be absorbed.

I can truthfully say that my LEDE room has given me more unalloyed listening pleasure than I ever expected to hear in my home. A

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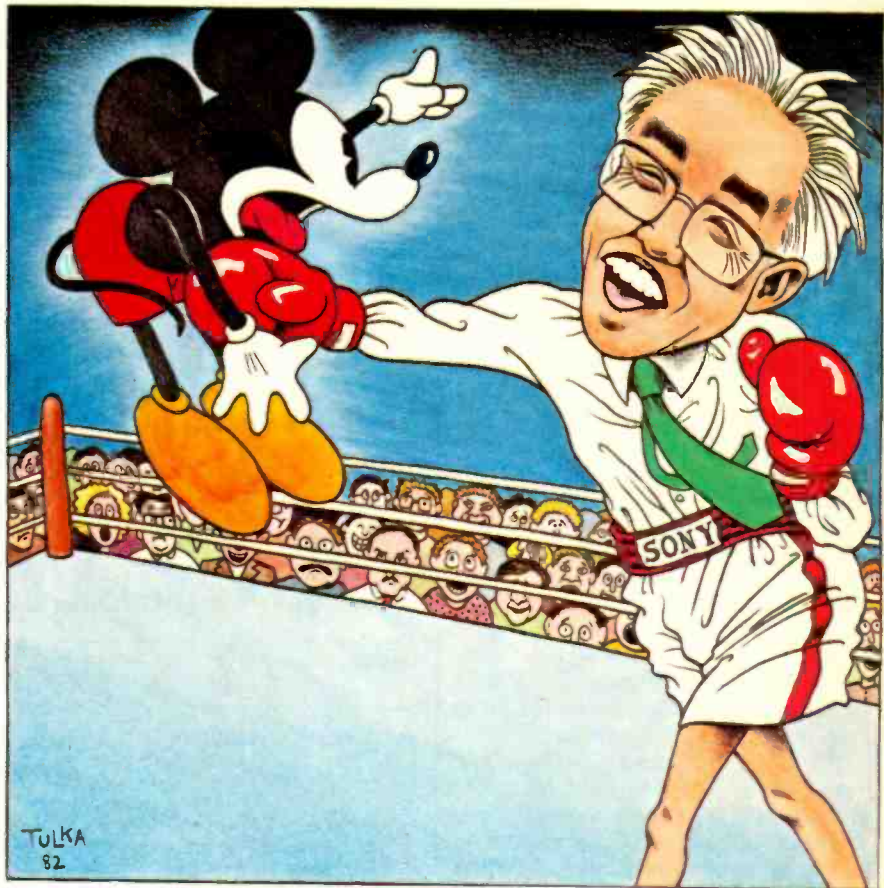
BERT WHYTE

SONY FIGHTS BACK

In the February 1982 issue of *Audio*, I reported on the now infamous decision of the Ninth Circuit Court of Appeals in favor of Universal MCA/Disney in its suit against Sony in which it was claimed that off-the-air videotaping is an infringement of the copyright laws. With over three million VCRs in use in American homes, this ruling in effect instantly created over three million criminals. You may recall that I urged you to write your representative and demand that legislation be enacted to exempt home videotaping from the Copyright Act. Much has happened since then, and I feel it is time to bring you up to date.

Evidently the hue and cry over legislative relief for home videotaping was of such dimensions that a number of bills have been introduced in Congress. In the Senate, Sen. Dennis DeConcini (R, Arizona) sponsored S. 1758, which specifically exempts home videotaping from the Copyright Act, and it seems to be the most favored bill among proponents of such legislation. Unfortunately, a very big "fly in the ointment" amendment was tacked on to S. 1758 by Sen. Charles Mathias, Jr. (R, Maryland), which calls for royalties to be paid on blank videotape and videotape recorders. To make matters worse, he added audio taping to the copyright exemption provisions and then asked for the same sort of royalties on audio tape and recording equipment. As you can imagine, this caused great consternation among the supporters of home taping. As it stands now, the Mathias amendment will somehow have to be removed from S. 1758, or an entirely new bill without such royalty provisions introduced.

As I have noted in the past, I certainly am not against copyright protection per se. Creative people—artists, writers and especially composers—deserve protection for the fruits of their fertile minds, though composers are, of course, presently well covered under the umbrellas of ASCAP and BMI. In Germany, a modest royalty fee on blank tape and recording equipment has been in effect for some time. I don't believe there would be much objection to a *truly modest* royalty fee in this country, but greed has already reared its ugly head and those allied



against home taping are asking for, as a *starting point*, a *minimum* of \$2.00 per blank videocassette and \$50.00 per video recorder!

Meanwhile, Sony has petitioned the Supreme Court to review the decision of the Ninth Circuit Court of Appeals. In its petition, Sony pointed out that Universal and Disney admitted they had not suffered any damages and could not show that home videotaping would reduce the potential market for their film productions. Sony noted that billions of dollars in sales and thousands of American jobs would be threatened if the Ninth Circuit Court decision stands. They also pointed out that Universal has now sued in the same court 42 other manufacturers, distributors, and advertisers of home video recording equipment, including RCA, Zenith, Panasonic, Toshiba, Sears and Sanyo—in essence, the entire home VCR industry.

While Sony carries its banner into

the Supreme Court, battle lines are being drawn by the supporters and opponents of home taping. An organization called the Home Recording Rights Coalition was formed in Washington, D.C. Such groups as the National Association of Retail Dealers of America, with 10,000 retail outlets, the American Video Association, the American Retail Federation, the National Retail Merchants Association, Sears Roebuck, and many VCR and blank tape manufacturers have joined the Coalition.

The Coalition opposes the royalty tax in S. 1758, and urges Congress to pass a clear, simple exemption of home taping from the Copyright Act. Julius Kretzer, President of the NARDA group, says, "The movie industry is already dipping into the consumer's pockets in many ways. Movie companies are paid when consumers see the movie in a theater. They are paid again when they sell the movie rights to television. They are paid when they sell

The Complete Guide to Car Audio by Martin Clifford. Howard W. Sams & Co., 1981, 232 pp., \$9.95.

This is quite a thorough little manual on the generalized subject of car stereo, with 11 chapters, each treating a specific aspect of car stereo, antennas, understanding specifications, speakers, equalizers, amps, and so on. Clifford's writing style, while somewhat less spellbinding than Dostoyevsky's, is probably perfect for a work of this sort—deadpan and straightforward. Advertising claims the book is nontechnical and meant for the average car stereo consumer, and it seems accessible to anyone with ordinary reading ability. Explanations range from excellent to moribund, but at least an attempt is made in all cases where one seems needed. The author can be forgiven for his explanatory "failures" as very few auto or home audiophiles really care to know the intricacies of Phase Lock Loop circuits when you get down to it.

The strongest part of the book is the chapter on noise, one of the most thorough and clear treatments of the subject I have come across. Spurious noise from automobile engines and peripheral electrical circuits is becoming the main problem in autosound these days. Paradoxically, it is a by-product of the improvement in equipment. Increased amplifier power and tuner sensitivity have combined to make today's better car stereos far more susceptible to noise problems than in the past. The problem is compounded by the dramatic increase in use of electronic circuits in automobiles (electronic ignition, fuel injection, microcircuit checks of system status, etc.) and in the use of thinner metals which save weight, and thus gas, but don't provide the wonderful shielding of older jalopies.

There is also a useful, if laborious, run-down of all the system types you might want to install in your car. Diagrams and explanations are provided for 20 systems, ranging from a monophonic radio and one speaker to an incredible system composed of 16 speakers, four equalizers, four digital time-delay units, six amplifiers, two electronic crossovers, and a tuner/tape deck.

On the other hand, Clifford does the consumer a disservice in his chapter on antennas, as he fails to warn against the unsatisfactory performance of windshield antennas. He also neglects to mention that an electronic amplifying antenna is not the solution for multipath problems in picking up FM signals while on the move.

It should be noted that Alpine Electronics of America, a manufacturer of premium-grade car stereo equipment, sponsored the book. They state in the preface that it is meant for the prospective car stereo buyer in the belief that the educated consumer will be a better consumer. Although Alpine claims the book is not meant to sell their goods, all diagrams of units and systems feature Alpine equipment. However, no effort is made to push the product in the copy.

The most pertinent question to be asked is who will need this book, and when an author entitles a book "The Complete Guide To . . ." he places a very heavy burden upon the work. It ought to be the definitive statement on the subject. There are probably 1000 car stereo units on the market and 300 or so vehicles available in which to place them. This makes for 300,000 possible combinations and permutations. Obviously, no book could cover that extent of material.

In sum, the car stereo buyer will find *The Complete Guide . . .* a useful source of information to supplement essential data he will need to gather from retailers or mail-order catalogs.

John Wade
(John Wade is the former editor of Car Stereo magazine and currently operates a consulting firm in Charlottesville, Va.)

The Compleat Beatles edited by Milton Okun. Delilah/ATV, two volumes, paperbound, \$39.95.

The specter of John Lennon has dominated most of this past year's music scene, and one suspects that it will loom with no less power as his physical presence becomes even more sorely missed. *The Compleat Beatles* is a book he probably would have scorned on principle alone — John was no great Beatles fan in his later years — yet there is much in this two-

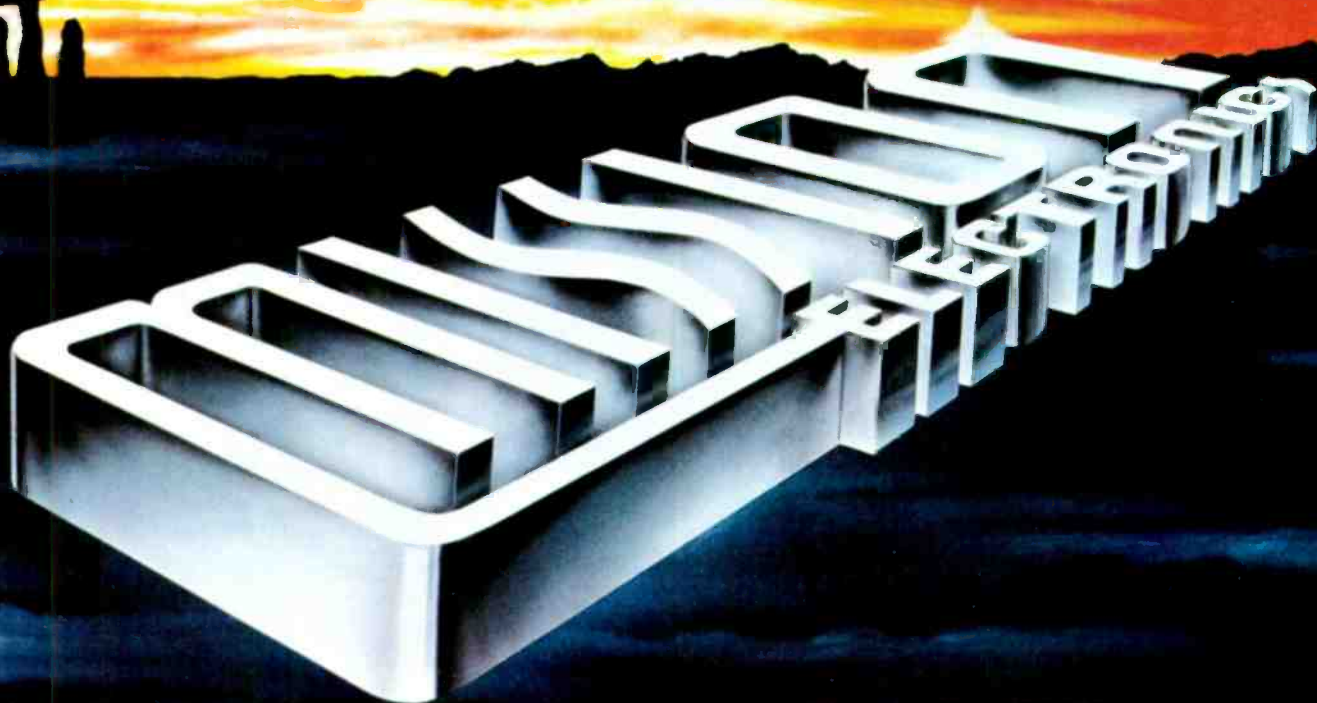
volume set that is of great interest to the Beatles collector/researcher, and it is practically invaluable to guitar students or beginning songwriters.

The text and photo section of this set is hardly comprehensive and seems to be padded with overt filler more often than not. The *Playboy* John Lennon interview and *Musician* McCartney dialogue serve the most useful purpose of any of the pieces here and they've already been widely circulated, although the *Hit Parader* interview with John about who-wrote-what offers valuable insight. The George Martin piece is absorbing but only scratches the surface of one of the most interesting sides of the history of The Beatles, i.e. their production, and *Audio's* own interview with Martin of a few years back presented far more information. The photos herein are all black and white, and not all of these have made the rounds before.

However, the meat of this book is the words and music to all of The Beatles' music, and what music student could ignore this kind of collection? Although the transcriptions of their chords are not always accurate (one can assume they were done by a lead sheet pro rather than the group itself), they're close enough to educate one to a world of chords, melodies and words which defined modern music to a greater extent than any songwriter or songwriting team in history. Although The Beatles' songs usually managed to sound simple and straightforward, the beauty of their gift was in disguising clever and innovative music changes by injecting them with a captivating energy and incessant backbeat. In other words, they hooked you viscerally in order to turn your head musically and thus were able to bring about monumental musical progressions working under the guise of simple pop hits.

From day one they were creating music way beyond that of their peers, without ever sounding like eggheads and never giving the air that they were writing beneath their level. For this alone, *The Compleat Beatles* is value for money, and as for the rest of the book, one can be sure that there will be many Beatles books that will be far better. But for the songs themselves, this is THE book. *Jon & Sally Tiven*

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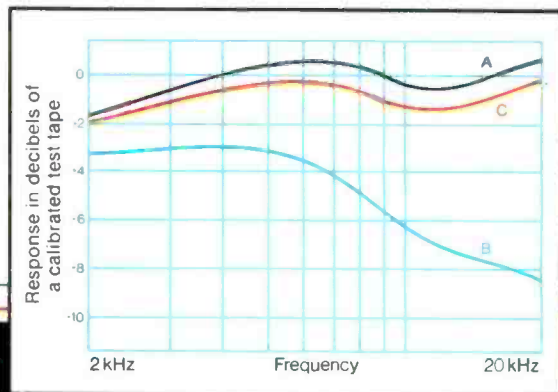


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