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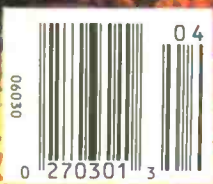
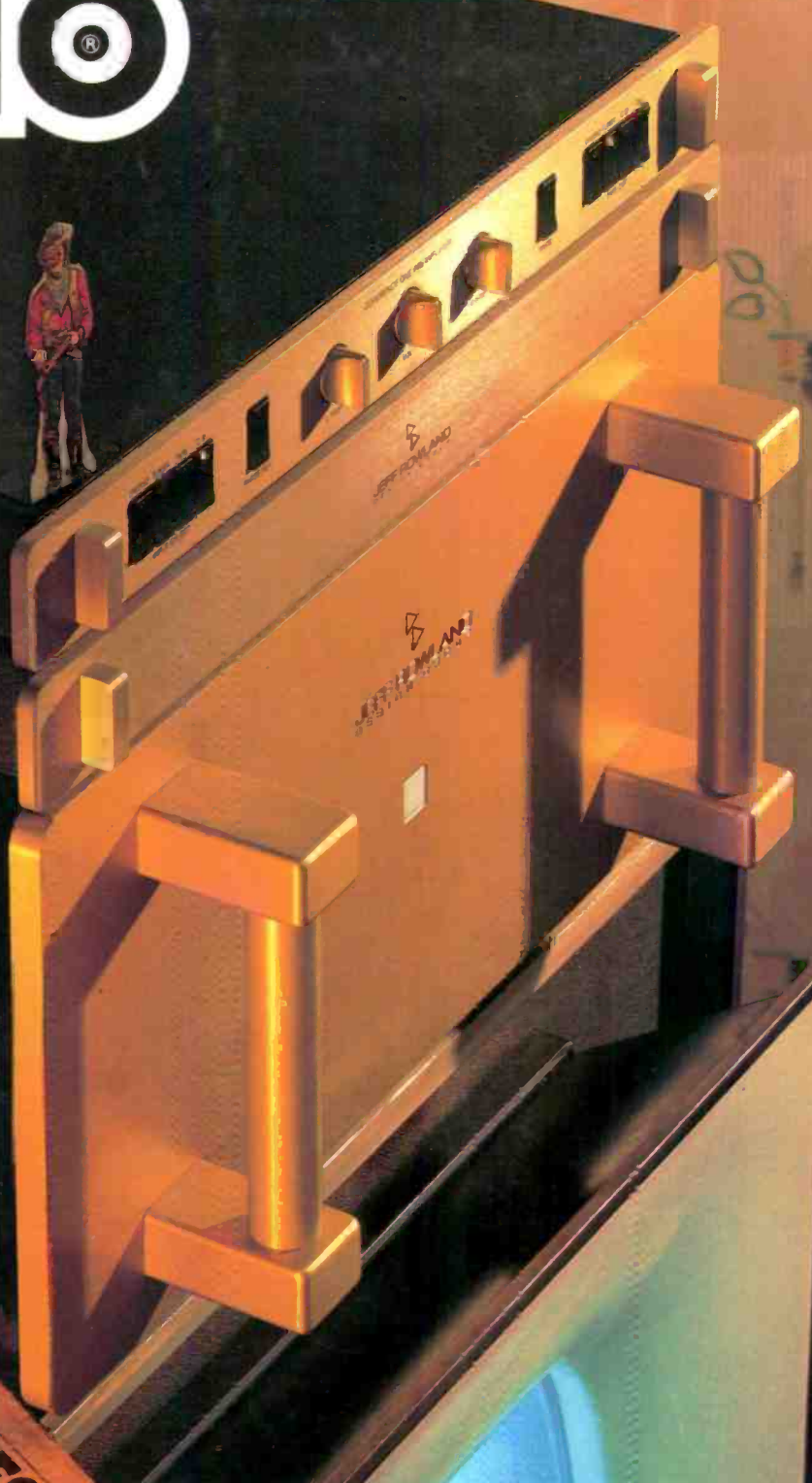
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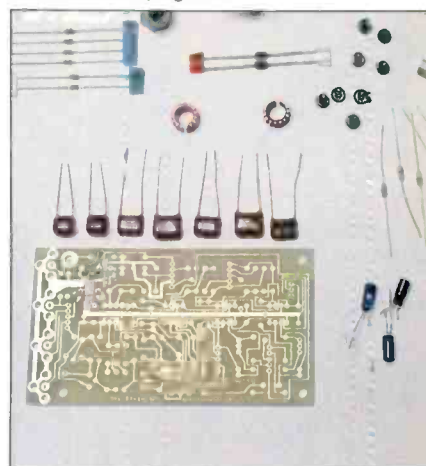
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Are You Shure?

Dear Editor:

In the September 1989 "Spectrum," it was said that the original Shure V15 was the first elliptical diamond stylus made. Not so, if you'll forgive me for picking nits. There was an Edison phonograph with an elliptical diamond stylus long before magnetic, or even ceramic, cartridges were around. I read that somewhere—probably in *Audio*!

Steve Graham
 Studio Engineer
 University of Michigan
 Public Radio Stations
 Ann Arbor, Mich.

No Mere Coincidence

Dear Editor:

Having read the correspondence on stereo miking technique in the July 1989 "Signals & Noise" column, may I throw in my penny's worth from this side of the Atlantic? The first most important fact we must accept is that all forms of mechanically reproduced sound are the result of a physiological and psychological confidence trick. No way will we ever be able to simulate with 100% success the original source sound; all we can ever hope to do is get close to what we *think* is correct. I use the word "think" advisedly, because another factor enters into it. By definition, recording and reproducing sound is as much an art as a science. So, anything goes—provided it produces results in conformity with our expectations of what we believe it ought to sound like. If anyone needs an illustration of this, it is an established fact that genuine high-quality sound reproduction and commercial hi-fi now have very little in common, and the gulf is getting wider. But that is another argument altogether.

It is what we expect subjectively that determines the recording technique used. Within these expectations, a disparity exists between the two sides of the Atlantic. I suggest that, in the case of the U.K., they are linked strongly to Blumlein's work and the broadcast practices of the BBC. Similarly, in the U.S., it is the early work at Bell and broadcast practice. The average balance engineer of any nationality is notoriously reactionary, and understandably so. With an accountant looking over one shoulder and the musicians'

union rep holding a stopwatch and peering over the other, the engineer is far less likely to deviate from what he was brought up with, understands, and has hitherto used successfully.

It is, I suggest, inappropriate to talk of "purist" techniques because nowhere, to my knowledge, are recordings produced that use so-called pure coincident miking technique. I have one or two early (circa 1955) EMI tapes that probably were made this way. In the real world of commercial recording, it just does not work in many cases, and cannot be expected to. It also follows that, in the real world, to simply use coincident figure-of-eight mikes without signal processing is not appropriate either. I have tried it myself many times; the rear pickup produces confused images in a reverberant environment. If one insists upon trying coincident miking, the use of M-S gives better results.

As it so happens, I have been studying with fascination the fine print of the original Blumlein patent of 1933, which should be mandatory reading for anyone interested in the subject. The first discovery I made was that Blumlein devotes as much detail to a spaced omni technique as he does to the use of coincident ribbons. (We must remember that this type of directional microphone had only just been invented.) In fact, his original work established that above roughly 700 Hz, intensity differences were the determining factor in re-creating the stereo image; below this, phase. He also recognized that when reproducing signals over spaced loudspeakers in a real domestic situation, preservation of the phase information was impossible. So, below 700 Hz, he converted phase to amplitude with his so-called "Shuffler," essentially a first-order low-pass filter in a difference channel. He retained this technique when using coincident ribbons with a cosine pickup pattern.

"How effective was it?" I hear you ask. Well, as it so happens, I also have copies of the test recordings Blumlein and his team made in 1933. Similarly, I have those made by Bell some three years later. These are quite remarkable, when one remembers they were made well over half a century ago. My (British) subjective expectations were

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Blumlein's basic reason for using spaced pressure mikes was to synthesize coincident directional microphone pairs.

fully met. The Bell recordings reveal all the inherent defects of spaced miking—a vague, amorphous image lacking in detail, and a massive hole in the middle. Those by Blumlein are perfectly natural—a sharp sense of direction and natural soundstage image, one that's impressively so when heard via

headphones. The image is also much sharper and more natural when reproduced on speakers with a bi-directional characteristic (Quad ESL 63s). I haven't the slightest doubt that Steve Graham, author of one of the aforementioned letters in the July 1989 issue, might take the opposite view.

I know which I prefer, and if my fellow readers think this is an example of British fence-sitting, they are absolutely right.

Reg Williamson
University of Keele
Staffs, England

Stanley Lipshitz Replies: I would like to comment on just one point made by Reg Williamson—namely, that in his original experiments (as described in his 1933 patent), Alan Blumlein used a "spaced omni technique." This does not accord with my reading of his patent (reprinted in the *Journal of the Audio Engineering Society*, Vol. 6, April 1958, pages 91 to 98). My understanding is that, at the time of the original experiments, he had only omnidirectional microphones available; in his patent, he describes how, by matrixing and "shuffling" the outputs of a closely spaced pair of omnis, he was able to create an approximation of the desired coincident pair of directional patterns he needed for intensity stereo recording. His capsules were spaced by about a human head's width, and his shuffler converted the phase differences created by the angle of incidence into intensity differences dependent upon this angle—that is, into the desired sideways-facing figure-eight polar pattern, below about 700 Hz. Further matrixing with the sum signal produced an approximation to an angled pair of coincident directional microphones below 700 Hz. In his later patents (see references [5] to [7] of my paper, "Stereo Microphone Techniques—Are the Purists Wrong?" in the *JAES*, Vol. 34, September 1986), Blumlein specifically referred to the use of crossed figure-eight microphones (not available at the time of the original experiments) as the basic X-Y concept, and showed how conversion between X-Y and M-S was possible. The RCA ribbon microphone had, you see, become available in the meantime. His only reason for using spaced pressure microphones in the first place was to synthesize coincident directional microphone pairs! His original shuffled pair of omnis effectively behaved like an M-S pair.

Stanley P. Lipshitz
Audio Research Group
University of Waterloo
Waterloo, Ont., Canada

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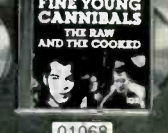
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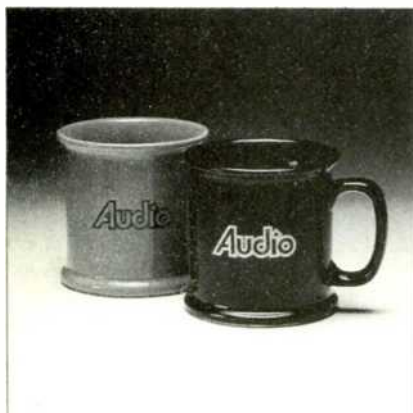
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AUDIOCLINIC

JOSEPH GIOVANELLI

Shifting Stereo Image

Q. When I turn up the volume on my stereo system, I hear sound from the left speaker first. As I raise the volume, the sound balances out and I hear the "voice" move to the center, where it belongs. Is this normal?—Joseph Barbera, Cheektowaga, N.Y.

A. I have seen some less expensive systems in which what you have described is usual. The shift occurs at the very lowest settings of the volume control. Because most listening is done at higher volume, the condition can be overlooked. It occurs because of differences in resistance between the two potentiometers of the volume control. One potentiometer governs the level of the left channel, the other governs the level of the right. If the equipment is considered high end, a shift of stereo image should not occur; if it does, you should have the system's volume control replaced.

Shielding TV Sets From Magnetic Fields

Q. What material can I get to shield my television set from the magnetic fields in my loudspeakers? I notice that when I have the set near the loudspeakers, I get distortion in the picture.—Barry Pearl, Little Neck, N.Y.

A. One of the best materials used to shield equipment from magnetic fields is Mumetal. It is very expensive when bought in sheets large enough to shield a TV set from fields generated by a loudspeaker system. However, the simplest and least expensive solution is to move the TV set away from the offending speakers. Moving them by just 1 or 2 feet is usually all that is required to reduce the strength of the fields to a point where they won't distort the picture.

I realize that in some installations, there is no way to move the TV or the loudspeakers. In those cases, some kind of shield must be placed between the speakers and the TV set, as you mentioned. Mumetal works well because it is "permeable" to magnetic fields. In other words, it tends to short the fields around the TV set because such fields prefer the easier path through the permeable material. Fortunately, more common materials also have high permeability. Sheet steel is quite good and is readily obtained be-

cause it forms the cabinets of many home appliances, such as washing machines and dryers. However, care must be taken to ensure that no one cuts himself on the edge of such a shield—especially because a large sheet will probably have to be cut to obtain a sheet of the proper size, thus leaving some rough edges. Use a file to smooth these out a bit. Although I have not tried using sheet steel specifically for this purpose, I can't see why it won't work just fine.

Fiber Optics in Home Audio

Q. Does a fiber-optic cable transmit a better signal than a coaxial or standard phono cable? If so, why do very few preamplifiers or integrated amplifiers have such inputs?—Ralph Nelson, Hayward, Cal.

A. Fiber-optic cables employ light to carry signals, and conventional, coaxial cables do this by means of electrical conduction in copper. If you examine the connectors used to feed fiber-optic cables, you will quickly realize that the fittings are completely different from those that are used for attaching coaxial cables.

To pass information to a fiber-optic cable requires that the information modulate the output of a laser or an LED. The light is sent along the fiber-optic cable. At the far end of the cable, the light enters a demodulator which recovers the information.

Fiber optics have primarily been used in audio for digital signals only, because the fiber-optic system provides the wide bandwidth needed to handle digital information. So far, the only preamps, amps, and receivers with optical connections are those which have built-in D/A converters. Fiber optics can carry analog signals, but their only significant advantage in analog audio would be their immunity to electrical and magnetic interference. Analog fiber-optic systems are therefore now beginning to be used in some custom car stereo systems, to alleviate the noise problems inherent in car installations. **A**

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

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TAPE GUIDE

HERMAN BURSTEIN

Type I EQ for Type II Tape

Q. A number of prerecorded tapes I own claim to use chrome tape, which is Type II, but require 120- μ S playback equalization, which is Type I. Is this correct? What advantage is there in using Type I equalization with Type II tape?—Chris Kim, Plano, Tex.

A To the record company, the advantage is compatibility with older or lower cost players that have only this equalization. In home recording, the question is a bit more complex.

It is usually quite feasible to use Type I (120- μ S) equalization with Type II tape. Use of 120- μ S rather than 70- μ S (Type II) playback equalization signifies less treble drop (converse of bass boost) in playback, and correspondingly less treble boost in recording. (The reasons for this are rather technical; see my article, "The Whys and Hows of Cassette Equalization," in the June 1985 *Audio*.) With less treble boost in recording, there is less danger of overloading the tape at high record-

ing levels; hence there is less danger of distortion and treble loss—in other words, more recording headroom.


Type II tape is generally capable of more extended treble response in recording than Type I. Therefore, in playback one can use an equalization characteristic with more treble drop yet maintain treble response satisfactorily. This greater treble drop in playback produces an improvement in S/N of about 4.5 dB. However, in these days of very high S/N ratios, it is quite practical to forge an improvement in S/N of some 4 or 5 dB without appreciable effect on listening pleasure in most circumstances. That is, one may use 120- μ S equalization with Type II tape, instead of 70 μ S, and thereby gain more headroom in recording.

So . . . if your prerecorded cassette says to use 120- μ S playback equalization, do so. If, instead, you use 70 μ S, you will experience some treble loss, which may or may not bother you—or it might even be pleasing. Always ex-

periment with options. Settle for that which sounds best, not that which is merely technically correct.

Poor Erasure

Q. My cassette deck allows user adjustments of bias and record level via a test signal. After making these adjustments, I record right over the test signal. Recently, I recorded a CD and, in playback, heard the test signal on the recording. What could have happened?—Name withheld

A. It appears that the erase head is not operating properly. This could be the result of a defect in the head (such as a partial short circuit), insufficient oscillator current reaching the head, dirt on the erase head, or other factors preventing close contact between tape and head. 

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

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PLAYING FOR TIMES

Perspective, perspective! I do not mean 3-D, nor even surround sound. I'm talking about the kind of mental perspective we so desperately need if we are really to understand the continuity of our own business. The better the knowledge of the past (and how it turned into *now*), the more accurately we figure our likely future in practical dimensions. But who has this sort of perspective?

Surely not those in high places. As I keep having to observe, our biggest commercial outfits are collectively the most dense in seeing forward for their own interests. All too often, this denseness is cleverly covered up—the miscalculations papered over, the losses in millions quietly absorbed—so that all of us on the outside scarcely notice the difference. A long standing theme of this column!

No—perspective, like genius, can pop up anywhere and in anybody, often the most unlikely. That's a triple pun, please. In any *body*, any individual person—anybody. Also, frequently, in some cutting-edge body of workers pooling their abilities, a think (and act) tank, which becomes miraculously inspired with useful perspective.

Do we call their products *innovative*? "Nova" means new, yet even the stupidest misfit product is technically new at some point! What we mean by innovative is "new with perspective," giving a new shaping to the grand continuity that is both past and future. In my browsing through the mass of ill-assorted (i.e., unfiled) sonic and printed material that jams my mailbox, adding to the bigger mass of stuff left from the long past, I keep stumbling on things that contribute to this sort of perspective as I see it, however oddly and unexpectedly. I solemnly count it my duty to bring you a few—just in case—to keep you amused, maybe to be helpful. For after all, the finest of man's superior abilities, the ultimate, is the perception of *time itself* and all that swims along with it. (No animal can do this, not even a dog. Try putting a wristwatch on your canine's front paw. You think your poochie knows exactly when it's supper time? It's only that inner urge, and the sequence of sounds, sights, and scents that go with the poochish ceremony. Same with those regular trips to the nearest fire-



Illustration: Beata Szpura

plug. Well timed, but not *timed*! Not, at least, by the dog.)

Item, in the present. I highly recommend to you, in the mag *db* ("dee-bee," please), a recent series of narratives concerning those fabulous around-the-world trips of various pop groups for performances in exotic places, largely sponsored by that elderly promoter of things American, Uncle Sam. The adventures of these guys and their gear, the problems of incredible fierceness—with, say, an audience of 30,000 Tongans or whatever sweating under the coconut trees—and the happy (usually) solutions make fascinating reading. For every Mr. Murphy with his Law in the U.S.A., a thousand oriental cousins and African uncles are out there, lurking to jinx all types of reliable audio.

Just the mismatched voltages and plugs are enough to make you gasp. And the aplomb of our audio heroes! The good thing about this *db* series is that it goes as far as any professional could want into chatty detail about the equipment itself and the troubles encountered, and yet the style is such that any of our own readers with a nominal understanding of audio basics

can get the drift with ease. *db*, of course, is a specialist mag for audio professionals, particularly in recording and assorted show biz.

What we learn as to present perspective in these *db* accounts is the *total dependence on audio* which belongs with all our major entertainment formats. Somehow, the exotic *db* venues make this point with drama. Imagine it: In the South Seas, in the hottest and the wettest places, in monsoons and typhoons and 120° temperatures—every spot you've seen in those romantic tourist ads! And maybe the coldest—Lapland? Or North China, where the steam railroad fans now go in winter. All in the day's work and the night's haulage—by plane, ox cart or, for all I know, rickshaw. Definitely, our present all-too-routine big audio is exciting and remarkable in such situations. Gives us present perspective.

Some items from the past. All *Audio* readers are familiar with large-scale show-biz audio, live, in huge halls or outdoors. It's getting so we can call Woodstock the prototype, the definitive event, though the type had been around awhile by then, growing from large to larger. Alternatively, you can

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We can almost call Woodstock the definitive, large-scale audio event, though the type had been around for a while, growing from large to larger.

date your modern monster audio from Shea Stadium and The Beatles. Those guys started in small nightclubs, holes in the walls, Liverpoolian, but they ended up with show after show on a huge scale. Maybe their audio was terrible, but without it, there would have been—silence.

Can you imagine The Beatles playing to an audience of thousands with the plugs pulled out? Ten feet away, you would hear nothing but maybe a faint croak from Ringo or a distant falsetto squeak from Lennon. Not even a whisper from the unpowered instruments. Total dependence on audio, whether a proper 120/240 V or, as in *db*, perhaps 260 V (plus or minus a lot) at 50 Hz (plus or minus a lot).

In 1956, on tour in France, I attended one of the early *Son et Lumière* shows (Sound and Light), then recently devised in France to show off the superb historical examples of French architecture all over the country. This one was at Vézelay, a highly dramatic early cathedral perched on top of one of those steep, island-like hills that dot central France, each with its hilltop fortress walls, and the town inside, its cathedral high above and gorgeous views in all directions. (The views, of course, were not the original interest, which was safety and strategic military superiority over threatening armies below. Also, the dramatization of assorted objects of pilgrimage such as saints' bones, which could bring thousands and thousands to visit.)

It was at Vézelay that St. Bernard, the great preacher, launched the second crusade. He was a spellbinder, it is said—he inspired whole peoples with his orations. More to our point, he spoke to an enormous multitude from the edge of the steep cliffs below the cathedral of Vézelay, people spread out below in a vast sea, all humanity. The 1956 *Son et Lumière* sought, at night, to re-create this astonishing scene via a vast audio setup—loudspeakers over a half mile or so of space—and dramatic lighting. We saw and heard St. Bernard's speech and, even more interesting, we heard all the people down below our vantage point murmuring, shouting, and talking as though they were actually down there, densely packed as far as the ear could hear (but the eye could not see, it be-

ing night as we listened). This was done via I don't know how many separate taped tracks, each leading to a speaker mounted inconspicuously somewhere down below or on the side of the steep decline. Next day, I went exploring, trying to find where that compelling, real "people sound" had come from. I managed to find only one speaker, in the middle of a lot of thorny bushes, at a 45° angle. Beautiful job, let me tell you. The rest I couldn't even locate.

I leave you with only one thought from Vézelay, in the year 1146 when all this happened, more than eight centuries ago. St. Bernard's audience, if I remember my history well, was approximately 300,000 people, outdoors. Just how, I ask you, could one man, one voice, address 300,000 people to miraculous effect *minus audio*? What did he sound like; how did he speak? He *did*—it's a fact.

Let us now move on to the "next to present," almost the full eight centuries after Saint B. A few years before my visit to Vézelay (I've been back since), I spent much of the winter of 1952-'53 in St. Louis—not France, Missouri. It was at this time that I first experimented, knowing next to nothing, in "binaural" sound via that notable first two-channel tape recorder, the Magne-cord. (Bert Whyte was also on hand, separately, with another Magne-cord.) During my stay, I explored, in off hours, that great tract of land called Forest Park—contemporary with New York's Central Park and of similar size—it being only a block from where I was staying. By degrees, it dawned on me that here, right in front of me, was the site of the greatest of World's Fairs, The Louisiana Purchase Exposition of 1904, of which I had vaguely heard. On February 24, 1953, I bought a slim book, published 10 years earlier, *Forest Park and Its History*, which instantly fascinated me—much of it, including dozens of photos, was devoted to the great Exposition, and I could now see exactly where it all had happened, only 49 years before, right across the way from my window.

St. Louis, in those late days, was still a typical mid-American booster town, full of its own enormous importance, bound for Progress in every area from streetcars to art. Indeed, in 1904, it

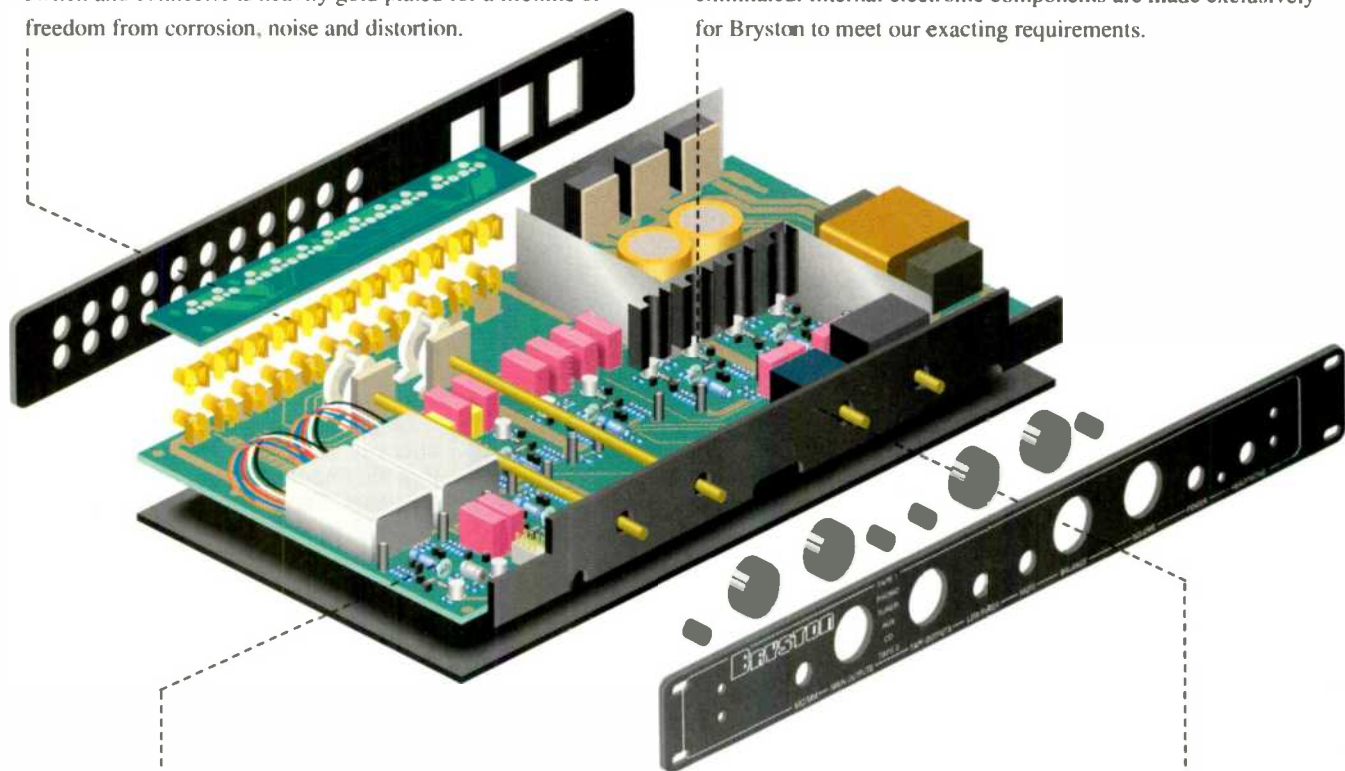
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You can date modern monster audio from Shea Stadium and The Beatles. Maybe the audio was terrible, but without it, there would have been silence.


was a continental hub, the focus of rail lines across the Mississippi to the burgeoning West and just plain exploding at its various expansion joints, one of these being Forest Park. In the mid-1870s, the Park had been set aside far outside the original small town, in an unlikely forest wilderness. By 1904, the

town had caught up. The Park was developed—with lakes, golf, tennis, horses, winding roads and all—but the St. Louis moguls had bigger things in mind. It was indeed to be a huge affair and still a fresh and new idea, this grand Exposition with its neoclassic buildings out of Rome via Paris, with

added (*much* added) décor. And, in a single summer, it made money! Believe it or not. The Whole World was represented there, more or less, and St. Louis patted itself in dizzying pride: "How could we ever be so great and world-famous!" The account, in my 1943 volume, is really amusing, so unashamed was all the glory of world achievement.

It was at this Expo that the great organ, which later became the Wanamaker organ in Philadelphia, was set up—with electric wind power. In fact, the Expo was a dazzling exhibit of early electricity in full bloom, the whole place heavily powered and illuminated to an extent that shows dramatically in the photos.

So great was the momentum of Expo success (and only the one summer) that the impetus for big things went on for years. Thus, 10 years after the Exposition, a new idea sprang up: An enormous Pageant, to be presented to millions of people on the ex-fairgrounds via a cast of thousands. It was all about pioneers, great heroes, the Indians, the Spanish, St. Louis (the French king, on his horse up on a high pedestal)—every patriotic idea you can imagine. "The Pageant and Masque of St. Louis" came off on four successive days in late May of 1914. World War I, a few months away in Europe, could not have been more remote. On each of those four days, the daytime Pageant drew a vast seated crowd—the largest around 180,000—which massed on a bowl-like circular hill before an Expo lagoon. On top of the lagoon was a huge stage more than 800 feet wide, with the Mississippi in front of it—125 feet of water—plus a cast of 5,600, a hidden chorus of 500, and a 100-piece band. The Masque, held at evening, with electricity galore for new stage magic, was sensational. "In the silver-washed dusk, companioned by a brilliant star, the crescent moon like a lantern hung. . . down the purpling night." That gives you the feeling.

Please note: In all of this, day and night, *there was no audio*. No amplified narrator, no loud-miked solos, no speeches the same. All purely acoustic and yet on a Woodstock scale! Just like St. Bernard, after almost 800 years. How's that for audio perspective? 

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- *Sound & Vision Magazine*

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- *Hi Fi Heretic Magazine*



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BERT WHYTE

LORE OF NOSES

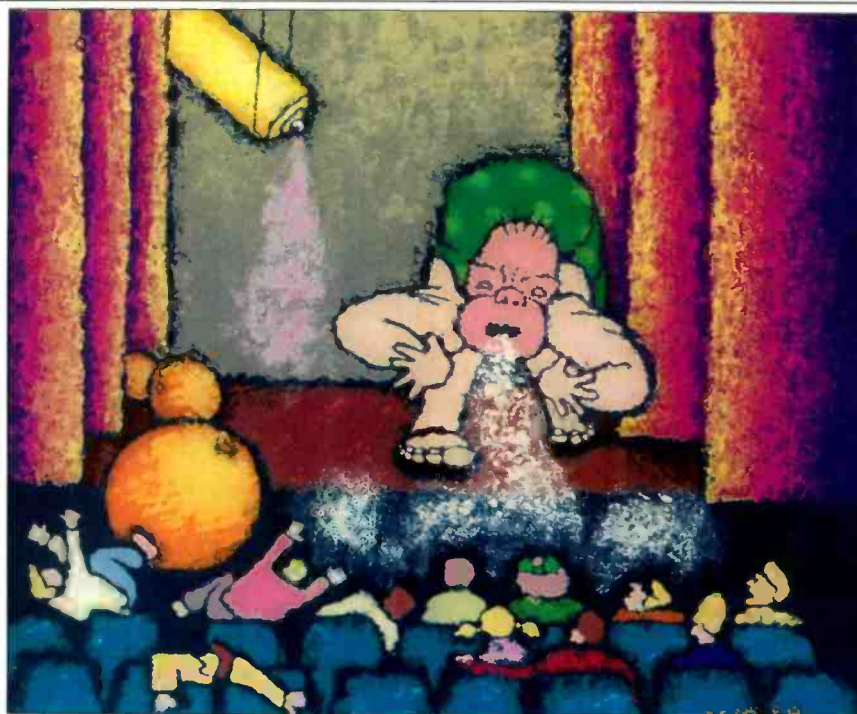


Illustration: Robert Bender

The Sunday, December 31, 1989 edition of *The New York Times* featured an article in its "Arts and Leisure" section that was intriguing and amusing. In his facetious but somewhat frightening glimpse into the future of entertainment media, John Rockwell told about the English National Opera's new London production of Prokofiev's satirical opera, *Love for Three Oranges*. It certainly is a work that is not presented very often, but what made this production unique was that director Robert Jones had provided each audience member with a card containing a number of those scratch-and-sniff panels that have been appearing in magazine ads for some years now. Each panel was cued to a key scene. As you might expect, scratching one panel produced the smell of oranges; others emitted the smells of rotting meat, disinfectant, and "a cross between bad eggs and body odor," which emulated the giant Farfarello's bad breath. An exotic perfume was used for the finale. Thus, this was a multi-sensory experience for the audience, which saw, heard, and smelled its way through the opera. Tongue in cheek, reporter Rockwell suggested that future productions could include the scent of roses for

Der Rosenkavalier, gingerbread for *Hansel and Gretel*, and briny smells for Wagner's *Flying Dutchman*.

By sheer chance, a few days after reading this article, I received Virgin Classics' two-CD set of the first recording of the original French version of Prokofiev's *Love for Three Oranges*. I hasten to add that it was not accompanied by scratch-and-sniff panels, but how far off can the day be when some company opts for this gimmick, along with visual elements through CD graphics? The CD Video operas would be a likely medium, a thought that will send chills through many!

The unusual production of *Love for Three Oranges* proves once again that there is nothing new under the sun. Way back in 1959, there was such a thing as SmelloVision. When Mike Todd, Jr. wanted to make a blockbuster production like his flamboyant father's *Around the World in 80 Days*, someone sold him on the idea of incorporating a wide-screen, Cinemascope-type format, six channels of surround sound, and the production of odors cued to the action on the screen. The film was entitled *Scent of Mystery* and starred Peter Lorre. I recorded the six-channel stereo on 35-mm magnetic film in the famous Cinecitta film studios

in Rome. What an experience! The score was composed by Mario Nascimbene, well known for music for "spaghetti westerns." The conductor of the large symphony orchestra that was used, a protege of Toscanini, kept insisting that his involvement with the recording be kept secret because he considered it "demeaning"! The action was set in Spain, and when Peter Lorre walked by one of those "beehive" ovens seen in the Spanish countryside, the SmelloVision process produced the odor of freshly baked bread. In all, over 40 smells were used.

Scent of Mystery opened at the Rialto Theater in New York City. On each seat back, a rectangular black box was mounted. As the frames ran through the film gate, optical cues triggered from the black box whatever smells were appropriate to the scene. Even though none of the odors was really offensive and the odors' integration with the scenes was quite clever, *Scent of Mystery* was a resounding flop.

For many years, the movie industry has attempted to create more audio/visual impact and a heightened sense of realism in its productions. The appearance and threat of TV, which for a while shuttered many movie houses, made advances in sound and projection even more desirable and urgent.

In the early 1950s, 3-D films offered novelty, but the necessity of wearing glasses with red and blue lenses in order to view them, and their very low screen brightness, were negative factors. Writer Arch Oboler produced a famous 3-D film, *Bwana Devil*, starring a young Robert Stack. When I was with Magnecord in Chicago, Oboler asked me to record a binaural soundtrack for *Bwana Devil*. However, the logistics of the undertaking were just too formidable in those days, so the idea was abandoned.

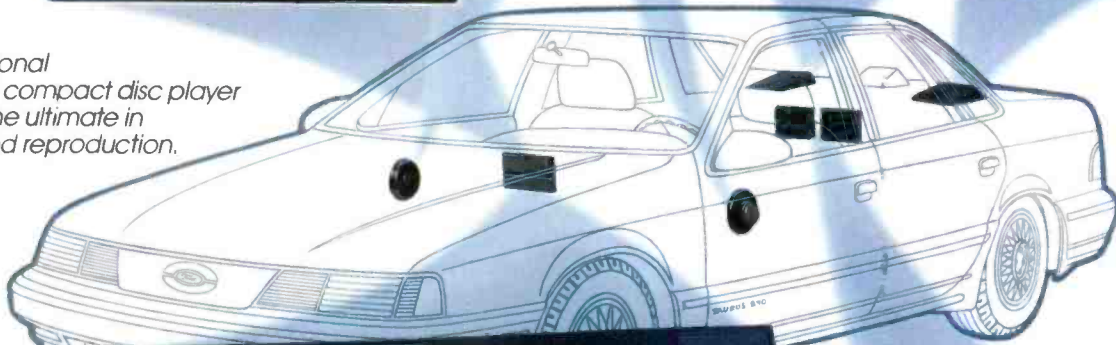
I have previously related the story of wide-screen Cinemascope and its original stereophonic sound. There is not much doubt that the best of the wide-screen processes incorporating stereo sound was Cinerama. The idea was developed from the simulated scenery used in the Link Trainer to instruct aircraft pilots. The Cinerama screen curved around 168°, pretty close to the limits of human peripheral

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In one scene from the film *How the West Was Won*, an explosion hurtled wooden barrels at the audience—or so Cinerama made it seem.

vision. Three special cameras were used to photograph scenes. The processed film was shown through three synchronized projectors, and you could faintly see areas where the edges of the images overlapped. Six channels of stereophonic sound were used in a non-surround configuration. Several well-known personalities were connected with Cinerama, including Lowell Thomas and my friend Sherman Fairchild.

Sherman had an engineer, Wentworth Fling, who modified Fairchild tape recorders (originally used by Bob Fine for his Mercury Olympian recordings) for the Cinerama stereo soundtrack. The theaters themselves had to be modified to show Cinerama, and they were in various places in the U.S. and overseas. Because of the films' international distribution, their soundtracks were remixed for various foreign languages. This was done just 20 minutes from my home in a unique facility on Long Island, an area once known as the Gold Coast because of the huge estates of the very rich. By the early '50s, when Cinerama was developed, this facility, the Woodward estate, had become a white elephant, virtually unused. However, it had indoor tennis courts so huge that a complete Cinerama screen and theater were installed in the building.

Sherman Fairchild allowed me free run of the place, and I was often privileged to be the only occupant of the theater, where I saw and heard *This Is Cinerama* in German, French, Italian, and Spanish. If you were lucky enough to be seated at the center of the Cinerama screen, at a distance at which your peripheral vision was within the 168° screen wraparound, the sense of three-dimensional immersion in the film was truly fantastic!

In the Cinerama production of *Windjammer* is a scene of a square-rigged ship under full sail. As the ship swings on a starboard tack, the long-pointed bowsprit sweeps across your vision and can make you a bit dizzy. In *How the West Was Won*, an explosion on a riverbank sends wooden barrels hurtling out of the screen at you! As for this film's six-channel stereophonic sound, a chorus singing, "Oh, Shenandoah" at the beginning was quite breathtaking. Alas, production costs



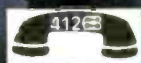
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My "enclave" theory is that the home is becoming more self-sufficient, a bastion with all the necessities as well as the niceties.

and other factors caused the demise of Cinerama, but it was one hell of an audio/visual thrill.

This brings us full circle, to the modern technology that gives us the Dolby Stereo movie theater experience and its re-creation in the home via prerecorded videotapes and laser video-

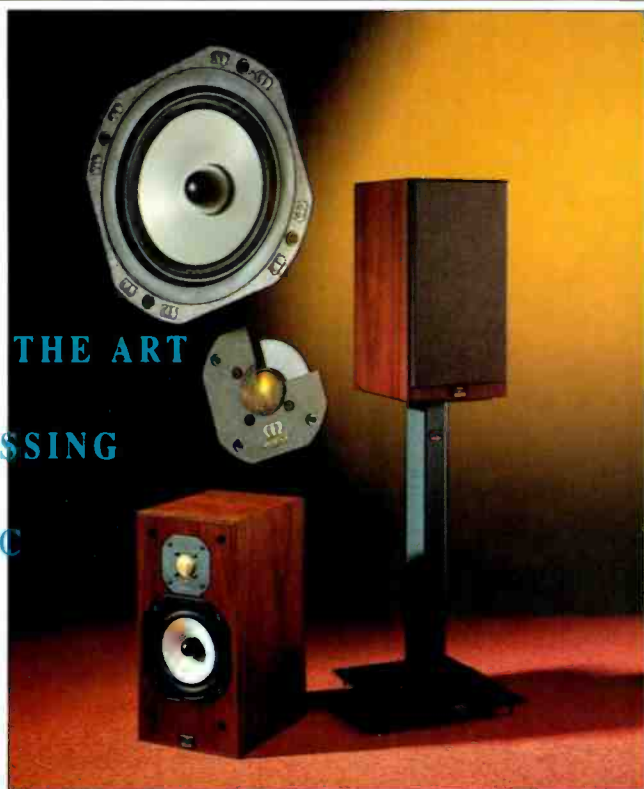
discs. The proliferation of Dolby Surround processors and integrated audio/video home theater systems has become something of a phenomenon. During the Winter CES in Las Vegas, speakers at various seminars made much of the home theater system as an increasingly important segment of

the consumer electronics industry. Keynote speaker Bernard F. Brennan, chairman and president of Montgomery Ward, when discussing the home theater and surround sound market, stated, "A major factor that will affect the '90s is the graying of the consumer base. This change in demographics to an older population is developing the concept of 'cocooning'—that is, spending a great deal of time in one's home. This trend offers us the opportunity to fulfill the home theater needs of this growing consumer group."

I am a little amused by the reference to "cocooning." Eleven years ago, at the 1979 AES Convention in Los Angeles, a special UCLA Extension conference was hosted by Martin Polon (who now writes witty and informative columns for *Studio Sound*). The conference was entitled "The Revolution in Home Entertainment: New Technology's Impact on the Arts." The panel of experts included John Eargle; the late Richard Heyser; John Dykstra, the special-effects engineer for *Star Wars*, and yours truly. Some very high-flying ideas were proposed, and some have become reality in the past few years. A May 18, 1979 article in *The Los Angeles Times* reported on the far-ranging concepts at the conference. The writer quoted me directly on what I call my "enclave theory"—the idea of people becoming more and more involved in a wholly self-contained, self-sufficient home, a sort of intellectual bastion with all the hardware and software necessary for audio and video entertainment and all the environmental concerns under one centralized control. It was at this conference that I first publicly discussed the idea of the computer-accessible central audio/video library I mentioned in last issue's column.

Today, various aspects of the home electronics enclave, including high-definition TV, are widely discussed. But in all this talk, HDTV is bandied about as if its introduction is imminent. Unfortunately, this is not the case; despite all the activity, no standards have been formulated, no system chosen. It will be quite some time before anyone in the U.S. will be able to walk into a dealer to buy a 1,125-line TV set. For now, it's as much a reality as attempts to expand the theater experience beyond sound and vision.

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"Stereophile" Vol.10, No.5 Aug. 1987

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"The Death of Mid-Fi: The Big Chill in Vegas"

Michael Fremer
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We weren't there.

CES — Winter '89

"...I am pleased to note that the sound in the Kinergetics room was stunningly true to the sound of the original Steinway. Nice one, Ken and Tony!"

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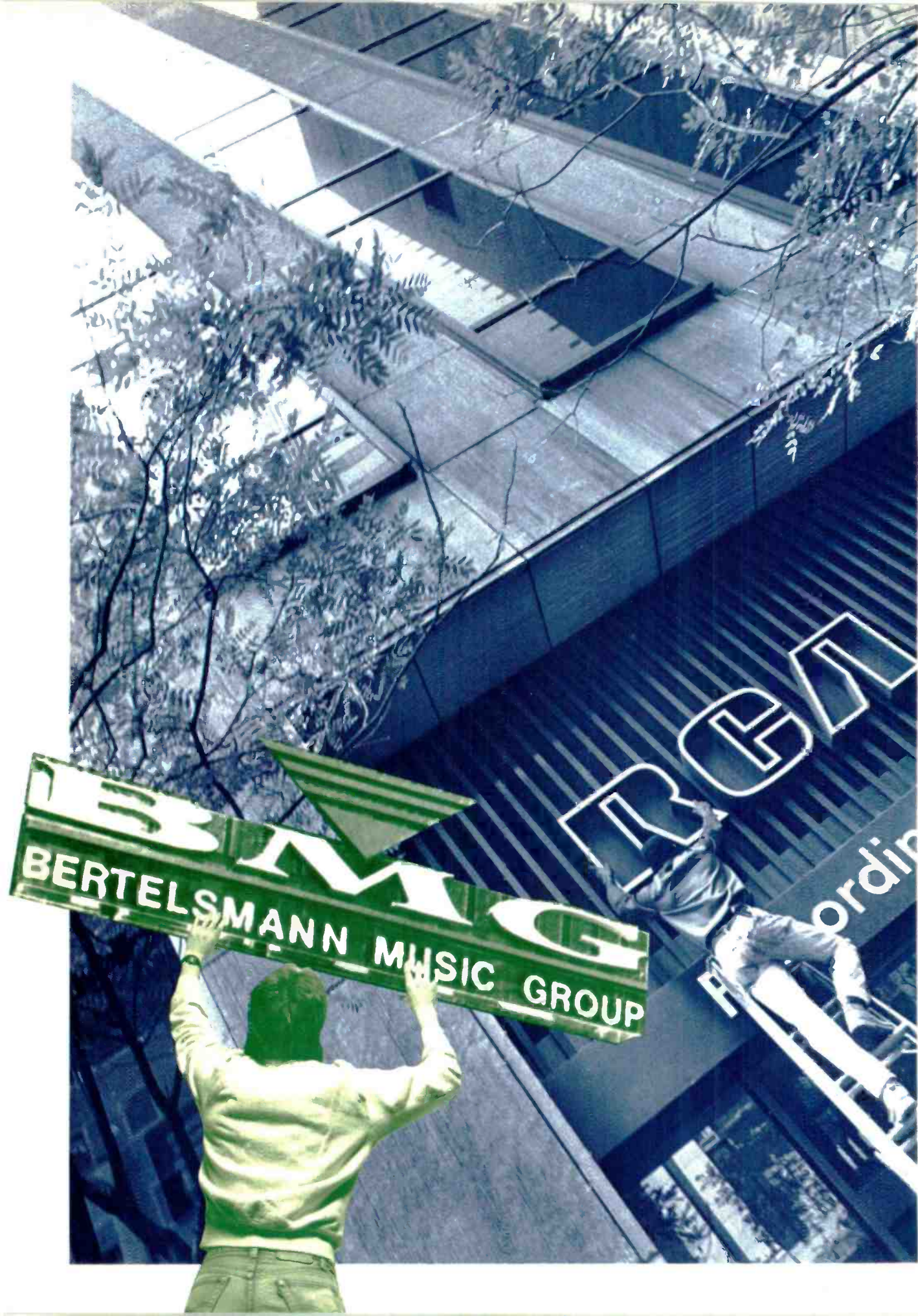
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SUSAN ELLIOTT

Since opening in 1969, RCA—now BMG—Studios on West 44th Street in New York City has probably been the site of as much recording history as any other facility in the country. Its six studios have hosted virtually all of Stephen Sondheim's original Broadway cast recordings; albums by Vladimir Horowitz, Artur Schnabel, and Wynton Marsalis, and recent film soundtracks (Harry Connick, Jr.'s score for *When Harry Met Sally* and the score for Spike Lee's *Do the Right Thing*).

General Electric purchased RCA Corporation in 1986 and, a year later, sold the record label, the studios, and the record clubs to the Bertelsmann Music Group (BMG), a huge entertainment conglomerate based in Guetersloh, West Germany. When BMG assumed ownership, the studios were operating below capacity. The word on the street was that RCA Studios was a white elephant: Much of the equipment was outdated, as was the technical knowledge of the engineering staff.

BMG appointed Tom Kraus, who heads up BMG's Special Products Division, to look into the situation. Together with Director of Studio Operations Larry Schnapf, Kraus has been turning the facility around. In the following interview, Kraus and Schnapf explain how.

Shortly after this interview took place, BMG brought in Susan Planer, former head of Mediasound and consultant to Sigma Sound studios, to replace Schnapf, who is now a consultant to BMG.



We're the biggest studio in New York, no question about it—and that's in terms of size, number of rooms, and number of employees.

At one time, RCA was planning to unload the studios. What made BMG decide to make a go of it?

T.K.: RCA is a deep-catalog company, and BMG felt that, just to cover internal production needs—such as CD remastering and so forth—we'd have to invest at least \$1 million, so why not broaden the updating a bit?

When and how did the renovation start?

L.S.: We started early in 1987. Stage One was to replace the console in Studio C with the Sony MPX 3000 series. That gave us more flexibility. We also sacrificed some of the floor space [the studio measures 75 x 50 x 30 feet] to build some isolation booths. All of that did, in fact, bring in more business, both records and jingles.

T.K.: At the same time, we started bringing the internal production facilities up to date. Some of the consoles in the TM [tape mastering] rooms were 25 or 30 years old—they were actually adding noise to digital recordings. So we replaced all of the consoles and brought in more digital equipment—Sony

DAT, PCM 1630, and DASH; Harmonia Mundi, etc.

L.S.: Sony tells us that we probably have more Sony digital equipment under one roof than anybody else in the country. Stage Two was to replace the console in Studio B. It was one of several 12- or 14-year-old Neves we had. They were very good but past their time. We put the Sony MPX 3000 series in there as well. It's a 72-input console, fully automated. We also equipped Studios A, B, and C with video capabilities so we can sync video to audio.

Tell me about the famous garage sale in Studio A.

T.K.: There was a lot of equipment that, while still viable in the marketplace, we didn't need any more. So we got a commitment from Bertelsmann that any money we generated from a ga-

BMG

rage sale—which turned out to be around \$240,000—could be invested back into the business. That's essentially how we paid for the console in Studio B.

So what was the investment in Stage One?

L.S.: It incorporated both the production facilities and the studios, so I'd say over \$1 million.

T.K.: Right. Studio C alone cost close to \$400,000, and we spent well over a half a million in the production areas. Ironically, just as we finished Stage One, in the spring of '88 the writers' strike hit and wiped out all the opportunities we had looked at. Production on jingles, TV shows, and films simply stopped. Needless to say, 1988 was a tough one for us. [This was also about the time that ad agency mergers began to affect the studio business in New York. Many agencies built their own in-house facilities.]

L.S.: The strike lasted about a year, and some studios weren't strong enough to stay alive. That gave us a better opportunity to attract business.

Which ones failed?

L.S.: Sigma Sound was sold to Edit Masters in New Jersey. Record Plant went bankrupt. Automated, right around the corner, went down—that was a very large jingle house. We've picked up a lot of their business.

So who's left, besides you?

T.K.: Hit Factory, Power Station, Clinton Studios, Right Track . . . mainly studios that do a lot of the kind of work we're seeking—like jingles and film scoring.

No matter what you put into a studio, people talk about what you haven't put in. We like to think that BMG is comfortably into the 1990s.

What was the return on investment in Stage One?

L.S.: The first thing that happened was the activity level started to climb in Studio C. We got some block bookings, which created the need for another facility.

Who was the first big client in C?

T.K.: Probably Spike Lee and School Daze.

L.S.: And then came the Marsalis brothers. They bounce back and forth between Studio C and Studio A.

What about the engineering staff? There used to be a lot of old-timers around. Now I see a lot of new faces. How did you effect so many changes in a union shop?

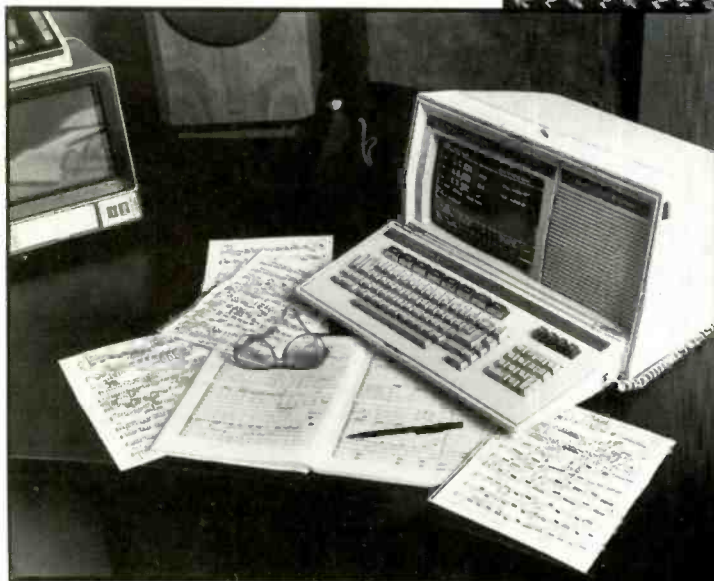
T.K.: Because of the purchase of RCA from GE, there was a perceived risk on the part of some employees that certain benefits available to them from RCA had a time limit. A number of them elected to retire in June of '88, since a lump-sum option was guaranteed only through that time. Almost all of them were senior guys with between 25 and 40 years of experience.

How many left?

L.S.: Fifteen between July and December—about 40% of the staff.

And then you rehired some of those same people?

Photographs: ©1990, Waring Abbott



T.K.: Yes. Paul Goodman, Dick Baxter, Tony Salvatore, and Sal D'Angelo.

Where did the new staff come from?

L.S.: Recommendations. We put an ad in the trade papers and received 80 or 100 applications. We were in an enviable position to cherry-pick the best.

What's their background?

L.S.: Several have music degrees, some have electrical engineering degrees, most have had vast practical studio experience.

Any woman engineers?

L.S.: Two. Marian Conaty and Sandy Palmer.

How many engineers, total?

T.K.: There are 36 engineers plus four trainees—people with good credentials just out of school. The first few of those have been super.

L.S.: Some of the schools are doing a hell of a job in instructing these kids.

Which schools?

T.K.: One came out of Berklee and one came out of SUNY Fredonia—a young man and a young woman. Tremendously enthusiastic.

How big is the maintenance staff?

L.S.: Six out of 40 engineers.

Is that good?

L.S.: That's heavily overworked.

Where has the union been in all of this?

T.K.: We went through some negotiations, in the early part of 1989, in which the union showed tremendous cooperation in making the studios more competitive.

How so?

T.K.: One of the big steps they took was this: Previously, there always had to be at least one union engineer on a session. Now, if somebody wants to lease a studio and they have qualified engineers who are familiar with the equipment, they don't have to use a BMG engineer.

Does BMG have to pay a penalty fee for that?

L.S.: No. It really was a major concession on the union's part.

How did you get them to agree to it?

L.S.: Just hard negotiations and people being honest with each other across the table.

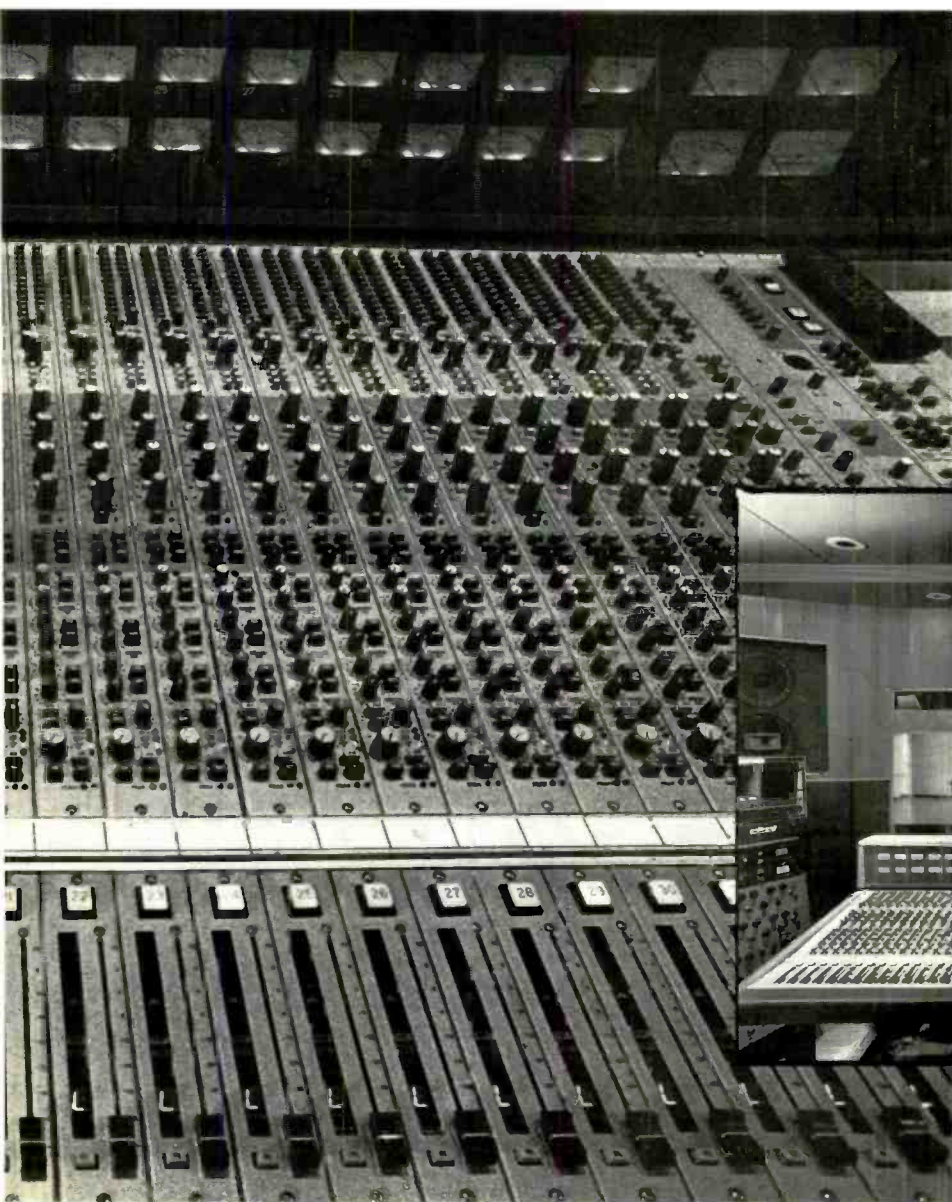
Relations have historically been thorny. . . .

T.K.: Perhaps, but the level of cooperation between the engineers and management has increased tremendously over the last couple of years.

I've often heard it said that, since BMG is a union shop—about the only one left in New York—its engineers are less motivated and therefore less competent than the ones at, say, the Power Station.

L.S.: That's a cross the studios have had to bear for many years. But there is no stigma. These are very competent, highly skilled, highly motivated people. The fact that they have a representative who protects their interests has nothing to do with their performance. Yes, it's a perceived problem, and it's one I'd like to overcome.

T.K.: I think, over the last six months, the level of repeat bookings says that



BMG inherited the world's only Soundstream digital editor (far left), then added a Sony MPX 3000 console (center and below).





Photographs: ©1990, Waring Abbott

the people who actually used the studios don't have a problem. If they perceived one before, they get through it right away.

L.S.: "Union" should not be a dirty word.

Was Studio B the end of the upgrading process?

T.K.: No. Just when I thought we were finished, Larry started getting on my case to re-outfit Studio A. It's a fantastic facility, but Larry thought it required a new console—one that would generate respect in the industry, which is why we went for the new Neve.

L.S.: It's the VR series. At this point, there are probably only 20 Neve VR series consoles installed in the U.S. We're the second in New York City. It's fully automated, with total recall. It has 60 dedicated inputs. It's the classic, ironclad, wonderful working machine.

Did you do anything in Studio A besides update the console?

L.S.: We worked on the decor and the floor, which hadn't been touched in 20 years. Any time you tamper with a surface, you're apt to affect the acoustics of the room, so we had to be careful.

Have you used any outside consulting firms?

L.S.: In the past, we used Jack Edwards and George Augspurger of Perception Inc. And for Control Room B, we used Tom Hidley.

T.K.: But the latest work that we've done has been primarily internally generated.

How many production rooms are there?

L.S.: There are nine tape mastering rooms, and we've added two suites specifically designed for digital work. They can accommodate virtually any digital method and convert it—you can go Mitsubishi to Sony to JVC, or any combination thereof. We have five Harmonia Mundi systems, which take all

BMG

No more fashion shows in Studio A. The revenue was nice in tougher times, but from now on, we'll win or lose as a music studio.

these different formats and lock them into a common mode.

What exactly does the Harmonia Mundi system do?

L.S.: Basically, it enables you to cross-relate the different digital standards of this nonstandard world we currently live in. It allows you to stay completely in the digital domain—you don't have to go from digital to analog to digital when you mix. The hardware remains the same. It's the processing that's different.

RCA purchased the Soundstream digital editing system several years ago. Is it still in use?

T.K.: Oh, yes—mostly for classical recording. In fact, it's pretty much been booked solid since we bought it. Soundstream is still the preeminent hard-disk editing system; ours is the only one in the world.

Was anything done to the physical characteristics of the TM rooms? There always used to be complaints that you couldn't hear properly in them.

L.S.: There are plans to modernize their acoustics and make them more reliable, so the room doesn't colorize the sound. TM 6 is the prototype for future acoustic-design modifications. It

was designed by Vin Gizzi. [Gizzi also designed the Soundstream suite.] It's been under test for about six months now. So far, it's doing fine.

Once the TM rooms are updated, will the renovation be complete?

L.S.: I wish I could sit here and say yes, but as the state of the art changes, the dictates of the industry change. We like to feel that we're comfortably in the 1990s now.

T.K.: It can be very frustrating, because no matter what you put into the studio, people talk about what you haven't put in. For a long time, I took it personally. But then I realized it's just the nature of the business. If you put in six new toys, they want to know where the seventh and eighth are. If I had known two years ago what I know now—which is just enough to be dangerous—we might have done things a little differently. We might have put the Neve in first. But we've come a long way, and we've created a totally new environment. In most respects, we are state of the art, and our engineering staff is one that I would stack against anybody's.

What's the total investment so far?

L.S.: I'd say it's close to \$2 million.

Is this the first renovation since the studios were built in 1969?

L.S.: There was an attempt in 1973. That's how Studio D ended up that way.

That's the old rock 'n' roll studio with all the carpet on the walls.

L.S.: It was designed for The Jefferson Airplane. We've recently redone it.

What have you done with the lacquer-cutting rooms?

L.S.: They're still active. We're down to three rooms from five.

Do you have rooms that are dedicated strictly to CD mastering?

L.S.: Two of the rooms are specifically dedicated to that. And the two digital



The space is familiar, but Studios A, B, and C (left to right) have been redone and CD mastering rooms (below) have been added.



suites are capable of doing whatever, either in the analog domain or in the digital domain for CD.

I understand that, just as you are preserving a heritage with the studio renovation, someone has also finally started looking after the vaults.

T.K.: Over the last two years, we have built a new vault for the company-owned masters. We're also creating a computerized vault-location system to track every master that the company owns.

What an enormous job. How many components are there?

L.S.: There are about 400,000 production cards, total. The information from about half of them has been input so far—from 1950 to the present. We still have from 1920 to 1950 to go.

T.K.: The cards not only tell where the tape is but also its azimuth settings and other technical data.

Where were the vaults, besides New York?

L.S.: Fogelsville, Pa., Nashville, Hollywood, and Indianapolis. Those vaults have all been merged to Indianapolis, though New York, Hollywood, and Nashville still maintain vaults for works in progress.

T.K.: We built a new facility in Indy by converting the pressing plant. It's a closed environment with a Halon fire-control system; it's climate-controlled. [Halon is an inert gas that, in essence, smothers fires.]

L.S.: It's also double-tiered, which minimizes the amount of search time since you don't have to fool around with ladders and so forth.

Getting back to the overall complex, is it the biggest in New York?

L.S.: No question, in terms of number of studios, size, and number of employees. We have six studios—A, B, C, D, E, and F.

The biggest in the Northeast?

L.S.: There's none bigger that I'm aware of.

T.K.: Not in terms of the amount of product produced, especially with the digital revolution. The RCA catalog is so vast. BMG Classics alone has probably put out 300 releases per year for the last couple of years.

Are your rates competitive? Lower than most?

L.S.: Lower than some, not higher than many.

To what percentage of capacity are you booked right now?

T.K.: It depends on the studio. Last week, Studio A was out of commission because of the console installation. Studios B, C, and D had double holds

behind confirmed bookings. We're getting very busy.

And the tape mastering rooms?

T.K.: The tape mastering rooms and the two digital suites are booked solid. People want to know what time of night the suites are available. And the Soundstream suite is operational around the clock—literally.

How does it break out, jingle business versus film and records?

L.S.: We lump film and jingles together. Record dates are far fewer than those. That's the next avenue we'll pursue.

How big is the sound-effects library?

L.S.: There are thousands and thousands of items in it—virtually anything you'd want.

Will you continue the fashion shows in Studio A?

T.K.: No, we stopped that last year. We've decided that we're strictly a music-production operation. Besides, some of the requirements for fashion shows—like set building—were damaging to the walls and the ceiling, which ultimately can hurt the acoustic environment. The revenue was nice in tougher times, but it just isn't appropriate anymore. We'll win or lose by being a music studio operation. **A**



BUILD TH

Ralph E. Gonzalez

Unless you own a good subwoofer, chances are your system does not reproduce much of the lower bass range—those frequencies below about 50 Hz. In addition, many otherwise outstanding speakers exhibit a peak or a prematurely falling response near the bass cutoff frequency. The electronic circuit described in this article can be applied

your speaker to function like a speaker with a much deeper, well-controlled bass response.

Acoustic-suspension speakers have a corner frequency (f_s) below which their output drops by approximately 12 dB for every octave. Figure 1 shows bass response curves for typical acoustic-suspension speakers, for var-

ious values of Q_s . While a Q_s of 0.7 gives the "maximally flat" (or Butterworth) re-

ponse, a Q_s of 0.5 gives the "critically damped" response. Figure 2 shows the transient response of various hypothetical acoustic-suspension woofers when fed a "step" input, an electrical test signal consisting of a sudden increase in voltage. (The horizontal axis in Fig. 2 represents time, so that you see the output of the speaker for the fraction of a second following the step input.) A speaker would require a flat response down to 0 Hz to accurately reproduce the step; the response of a typical speaker will instead drop back



to nearly any acoustic-suspension loudspeaker to smooth the bass response and produce a range of possible bass extensions. In effect, it allows

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ious values of Q_s . This parameter, which is related to a speaker's damping, indicates the output level of the speaker at its corner frequency in relation to its output at higher frequencies. For example, for Q_s equals 0.7, response is down by 3 dB (-3 dB equals 20 times the logarithm of 0.7) at f_s . For Q_s greater than 0.7, a bass peak begins to appear slightly above f_s . (The frequency of this peak is the resonant frequency, a term often somewhat incorrectly applied to f_s .) In speakers

response, a Q_s of 0.5 gives the "critically damped" response. Figure 2 shows the transient response of various hypothetical acoustic-suspension woofers when fed a "step" input, an electrical test signal consisting of a sudden increase in voltage. (The horizontal axis in Fig. 2 represents time, so that you see the output of the speaker for the fraction of a second following the step input.) A speaker would require a flat response down to 0 Hz to accurately reproduce the step; the response of a typical speaker will instead drop back

THE BASSIS



A CIRCUIT TO CORRECT

to zero soon after the step is applied. If the speaker's Q_s is greater than 0.5, it is underdamped and begins to show ringing before returning to zero. The frequency of this ringing is close to the corner frequency. Depending on its severity, ringing can cause a subject-



AND EXTEND LOUDSPEAKER BASS RESPONSE

ive impression of muddiness or boominess in the bass region. Although comparatively few speakers have Q_s less than 0.5 (overdamped), those with Q_s between 0.5 and 0.7 are usually considered well damped and tend to sound tight and fast in the bass.

By comparing Figs. 1 and 2, you can see that tight bass is often prematurely falling or lightweight-sounding. The only way to simultaneously obtain good bass transient response and good bass frequency response is to ensure that your speakers' corner frequency is below the frequency range of your music.

BASSIS SPECIFICATIONS

Frequency Response: 5 Hz to 100 kHz, +0, -0.5 dB, with "Boost" at zero and Q_s equal to Q_b .

Harmonic Distortion: Less than 0.01%.

S/N Ratio: Greater than 110 dB, re: 10 V.

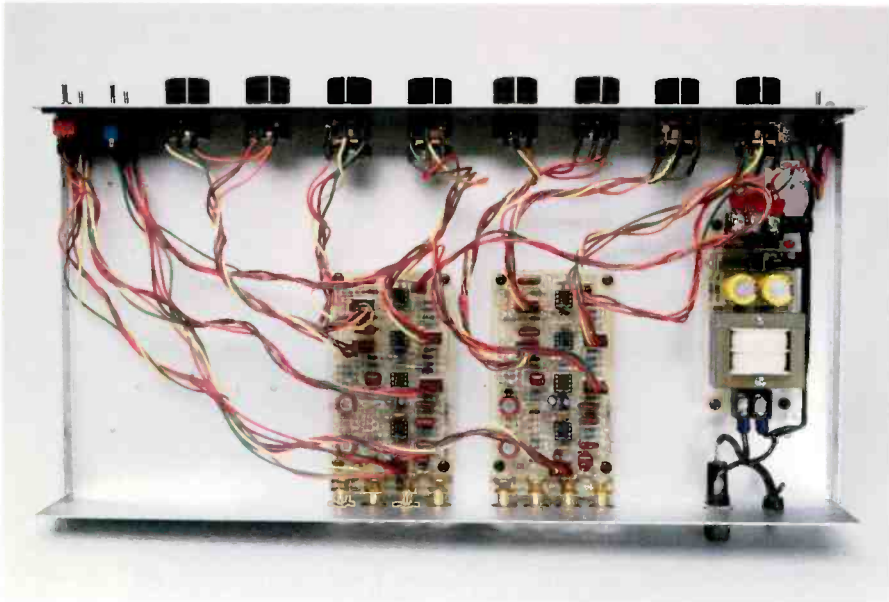
Bass Boost Range: 0 to 24 dB (zero to two octaves).

Net Q Range: 0.25 to 1.0.

Input Impedance: 80 kilohms.

Output Impedance: 10 ohms.

Dimensions: 17 in. W x 2¾ in. H x 8½ in. D (43.2 cm x 7.1 cm x 21.6 cm).



Here is where speaker designers get headaches, since there is a binding relationship between a given woofer's f_s , Q_s , and enclosure volume. The average bookshelf speaker winds up with a corner frequency around 60 or 70 Hz and a Q_s in the range between 0.5 and 1.4. The bass below 50 Hz is usually lacking, but equally important, the frequencies above 50 Hz may be depressed or may be elevated and peaky, depending on whether the designer feels that tight bass is all-important or that a boomy bass will give the subjective impression of lower bass extension.

It is possible, however, to electronically correct a speaker's response to give it the equivalent of a much lower, well-damped corner frequency. This method will *not* give you the kind of boost you get by turning up the bass control or pushing the loudness button on your preamp or receiver. Instead, if your speakers are somewhat underdamped, you will hear an improved

neutrality and openness in the mid-bass. If your speakers are well-damped or overdamped, you will hear an added weight to the music. With either type of speaker, and with recordings containing significant low bass information, you'll experience a "you are there" sense of impact.

Of course, many recordings have little musical energy below 40 Hz, and FM radio and cassette reproduction often reduces this even further. If your speakers have reasonably deep, tight bass to start with, you may have little need for electronic bass equalization. On the other hand, CD is putting a greater focus on the reproduction of low bass frequencies than ever before.

ENTER THE BASSIS

Correcting a speaker's bass response electronically requires a specialized parametric equalizer which can be adjusted to specific speakers' requirements. This led me to conceive the idea for such an equalizer, the Bas-

sis, which is designed to exactly compensate for an acoustic-suspension speaker's bass roll-off, yielding the same net response as a speaker with a deeper, well-damped corner frequency. (I'll show later how it may be applied to vented speakers as well.) Its effect is most dramatic with smaller speakers, but even some subwoofers can benefit from its use.

There are, obviously, practical limits to the bass extension that electronics

Underdamped speakers sound boomy or muddy. Well-damped speakers have fast and tight bass response but can sound lightweight.

can provide. Boosting low-frequency signals calls for more power from the amplifiers and greater excursion from the woofer cones. Too much boost will cause audible distortion from the amplifiers, the speakers, or both. If this distortion is ignored, and enough amplifier power is available, speakers can be permanently damaged. This is especially true of smaller speakers.

The device, which may be inserted in a tape loop or between preamp and power amps, is available fully assembled or in kit form from Marchand Electronics, who engineered the actual circuit. A version with balanced inputs and outputs is under consideration, should there be enough demand.

Figure 3 shows a theoretical example of the circuit's effect. As you can see from its unequalized response, the speaker shown here is underdamped (with a Q_s of 1.4) and has a roll-off at an f_s of 60 Hz. Through proper adjustment, the Bassis can provide a boost (dashed curve) that is the inverse of the speaker's curve, down to about 15 Hz. The equalized response to signals passing through the combination of equalizer and speaker then becomes identical in both frequency and transient response to that of an unequalized speaker whose -3 dB point is 15 Hz. Note that it is generally not possible to perform this sort of equalization with a conventional graphic equalizer, since the frequency bands affected by

each slider are too wide and are often centered at the wrong frequencies for a given woofer.

As seen in Fig. 3, one of the effects of the Bassis is a boost in the level of low-frequency signals, adjustable up to 24 dB. Every octave of bass extension requires 12 dB of boost. Fortunately, the amount of very low frequency energy in recordings and even live music is usually relatively low, with the exception of signals sometimes generated by record warps. (An infrasonic or "subsonic" filter helps eliminate that potential problem.) For this reason, many designers, notably Laurie Fincham of KEF, consider a moderate boost (up to about 12 dB) of the frequencies below about 50 Hz to have a relatively minor effect on amplifier and speaker power handling. Interestingly, it has been demonstrated that equalizing a woofer in a small enclosure to yield the bass it would have in a larger enclosure often results in *lower* bass distortion than could be obtained with the larger enclosure. This is because the suspension effect produced by the air trapped inside a small enclosure is usually more linear than the woofer's mechanical suspension. Naturally, it may be wise to reduce the amount of boost when listening to small woofers at high volume levels, particularly with a bass-heavy recording.

The Bassis also provides adjustable damping (Q_b) for the new bass roll-off. Figure 3 shows the net response with a Q_b of 0.7, but lower (better damped) values of Q_b are also possible. For example, Fig. 4 shows the response of the same speaker after being equalized with a Q_b of 0.25 and with the same 15-Hz setting for the new corner frequency (f_b). Now there is significantly less bass boost in the audio range, and the net response is gently falling. In effect, the roll-off of 12 dB per octave at 60 Hz is replaced by a roll-off of 6 dB per octave at the same frequency. Such a bass response has several advantages. First, bass is extended without introducing a drastic boost at low frequencies. Second, this extremely overdamped roll-off has no ringing and resembles the response of the highly regarded transmission-line form of bass loading, without its relatively large associated enclosure size.

If additional bass extension is not desired, the Bassis can be used with a zero-boost setting to effectively vary the woofer's damping while retaining the original corner frequency. This setting is useful for vented enclosures as well, to reduce the boominess of improper tuning. (It is generally unwise to apply a boost below the corner frequency of a vented speaker.) Of

Fig. 1—
How bass response of acoustic-suspension speakers varies with Q_s .

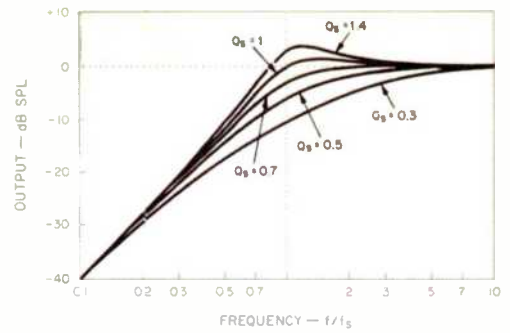


Fig. 2—
Step response of acoustic-suspension speakers for various values of Q_s .

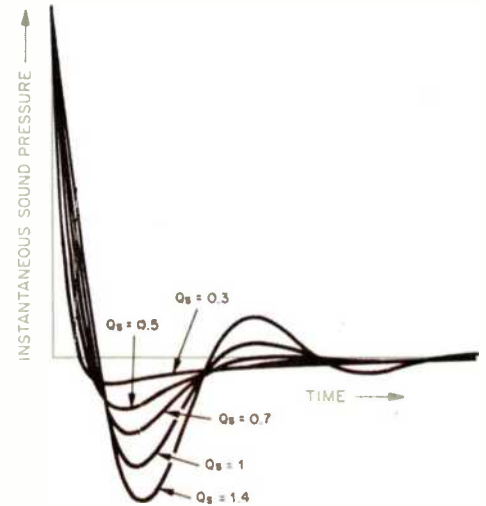


Fig. 3—
Effect of a 24-dB bass boost with corner frequency of 15 Hz and a Q_b of 0.7 on a speaker with a 60-Hz corner frequency and a Q_s of 1.4.

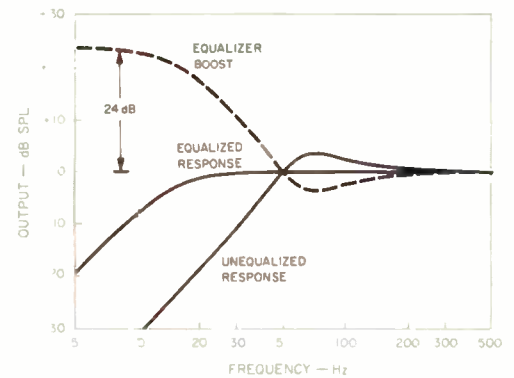
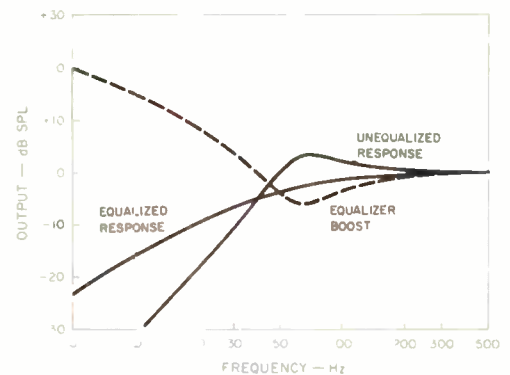


Fig. 4—
Effect of overdamped boost (Q_b equal to 0.25) on the speaker of Fig. 3.



OVERALL PARTS LIST

One required unless otherwise stated

Marchand WM8 P.C. Boards and Parts—Two sets required for stereo

± 15 V, 250-mA Power Supply (Marchand PS10)

Fuse-Holder

1-Ampere Fuse

SPST Switches—One for "Power," one for "Rumble"

DPDT Switches—One for "20 Hz Cut," one for "Tape Mon.," and one for "Bypass"

0.01- μ F, 1,000-V Ceramic Capacitor (for "Power" switch)

Line Cord

Line Cord Strain Relief

Panel Light Assembly

22 AWG Stranded Hookup Wire—12 inches each required in brown, red, and orange

Red (22- to 14-Gauge), Crimp-Style Spade Lugs—10 required

1/2-Inch, #6 Threaded Standoffs—12 required

1/4-Inch, #6 Screws—24 required

Knobs—Eight required

Potentiometer Keyhole Plate

Custom Cabinet

the desired new bass response. The new corner frequency is set by VR1 for values of f_b from f_s to one-fourth of f_s ; however, this control is labelled "Boost," and calibrated from 0 to 24 dB, because each octave of bass extension requires a 12-dB boost at low frequencies. The damping of the new bass response is set by VR4 ("Q_b") for values of Q_b from 0.25 to 1.

A parametric equalizer that can be matched to the characteristics of a speaker can extend the speaker's bass response.

course, you can plug the vent of a bass-reflex speaker and use the full range of equalization options. By doing this, you forego the vented design's advantages of efficiency (fewer amplifier watts required) and power handling. You also overdamp the speaker's bass, but after correcting for this with the Bassis, you gain accuracy and flexibility in bass response.

CIRCUITRY AND CONTROLS

The Bassis was developed to maximize flexibility and performance. The circuit contains high-speed op-amps and premium film capacitors and resistors. Hum, noise, and distortion have been reduced to inaudible levels. Each channel is mounted on a separate p.c. board to minimize interactions, though in practice a single well-regulated power supply may be shared by the channels. Since the Bassis uses one circuit board per channel, you need only a single board and a power supply for use with a single-channel subwoofer.

The equalization circuit is based on a standard four-amplifier biquadratic filter. Additional op-amps are used to allow independent adjustment of damping and corner frequency and to ensure isolation. Figure 5 shows the circuit diagram for a single channel. Op-amps IC1, IC2, and IC3 provide the equalization function, while op-amp IC4A is part of the warp filter. Op-



amp IC4B and transistors Q1 and Q2 ensure high-current drive capability to allow long cable runs.

Potentiometers VR2 and VR3 are used to match the Bassis to the characteristics of the speaker. Potentiometer VR2 (the "Q_s" control on the front panel) matches the speaker's damping, for speakers having Q_s of 0.4 to 1.6. Dual potentiometer VR3 (the "F_s" control) adjusts the frequency matching the speaker's corner frequency over the range from 30 to 130 Hz.

Potentiometers VR1 and VR4 are then used to set the characteristics of

Switch S1 ("20 Hz Cut") activates a high-pass infrasonic (or "subsonic") filter having a slope of 18 dB per octave below 20 Hz. This ensures that even with "Boost" set at maximum, there will be little or no boost of record warps, whose signals are below the audible range in the vicinity of 6 to 10 Hz. Switch S2 ("Rumble") combines the left and right channels at frequencies below the speaker's original corner frequency. Since the bass information on records is frequently summed to mono, S2 cancels the out-of-phase rumble components, which would otherwise

Fig. 5—
Schematic diagram
of the Basis;
one channel shown.

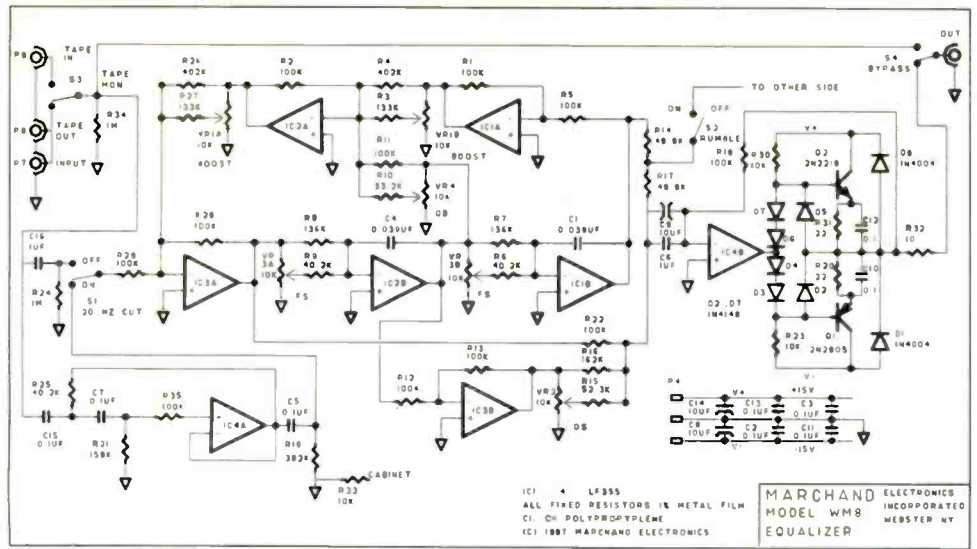


Fig. 6—
Circuit-board foil
pattern, actual size.

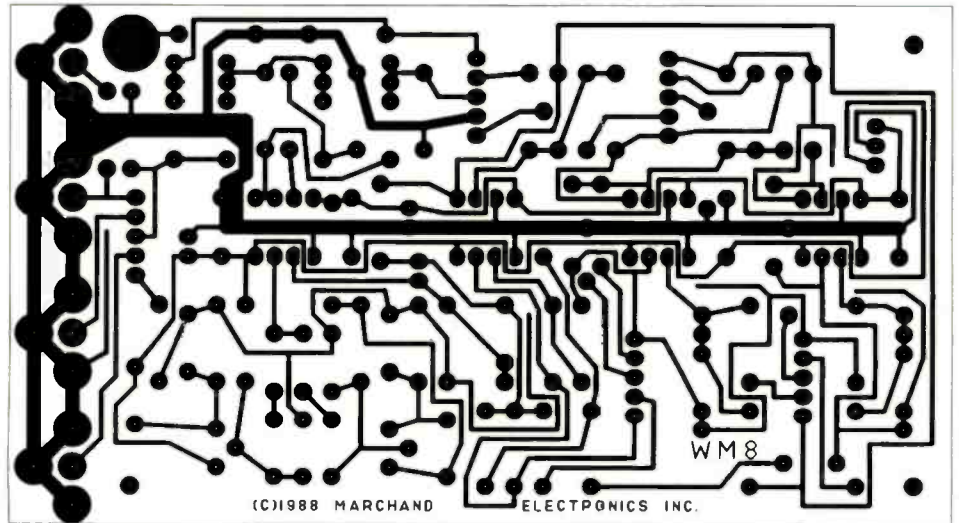
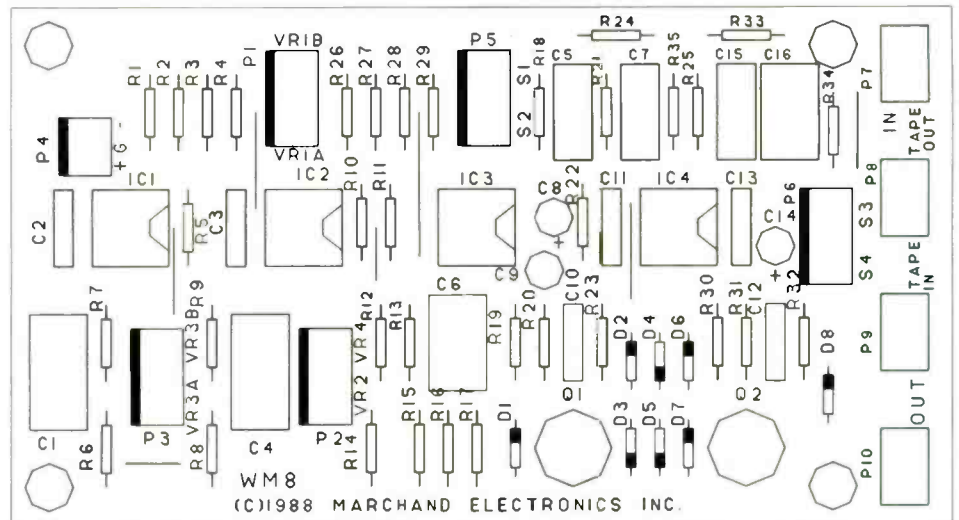


Fig. 7—
Parts placement
for circuit board.



P.C. BOARD PARTS LIST

Resistors

All are 1%, metal-film types; one required per channel
R1, R2, R5, R11, R12, R13, R19, R22, R28, R29, and R35—100 kilohms
R3 and R27—133 kilohms
R4 and R26—402 kilohms
R6, R9, and R25—40.2 kilohms
R7 and R8—137 kilohms
R10—33.2 kilohms
R14 and R17—49.9 kilohms
R15—52.3 kilohms
R16—162 kilohms
R18—392 kilohms
R20 and R31—22.1 ohms
R21—158 kilohms
R23 and R30—10 kilohms
R24 and R34—1 megohm
R32 and R33—10 ohms

Jumpers

Seven required per channel

Potentiometers

All are 10-kilohm, linear types; one required per channel
VR1 and VR3—Dual
VR2 and VR4—Single

Capacitors

One required per channel
C1 and C4—0.039 μ F, 2%, polypropylene
C2, C3, C10, C11, C12, and C13—0.1 μ F, ceramic
C5, C7, and C15—0.1 μ F, polyester film
C6 and C16—1.0 μ F, stacked film
C8 and C14—10 μ F, 50 V, aluminum
C9—10 μ F, 25 V, aluminum, nonpolarized

Diodes

One required per channel
D1 and D8—1N4004
D2 through D7—1N4148

Transistors

One required per channel
Q1—2N2905
Q2—2N2219

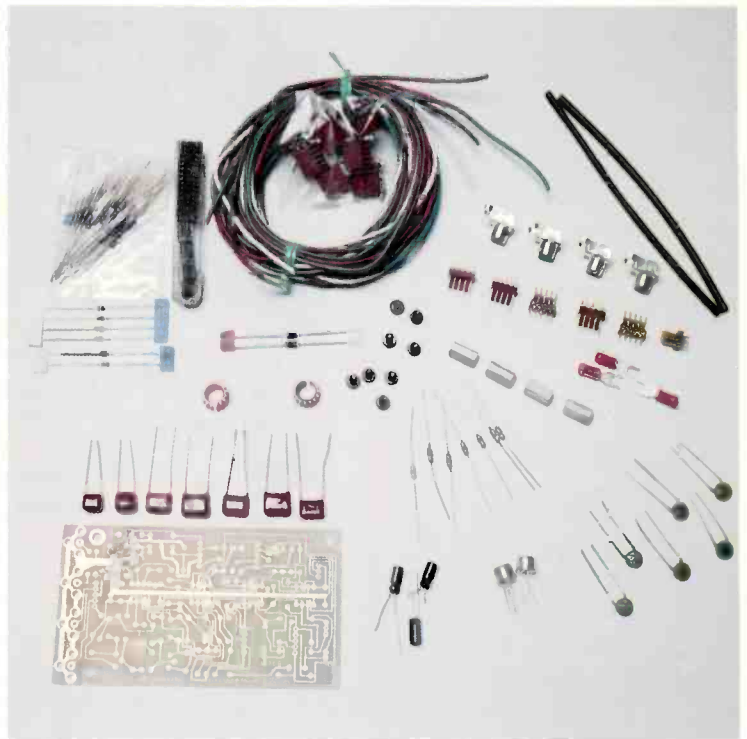
Integrated Circuits

One required per channel
IC1 through IC4—LF353N

Miscellaneous

Quantities listed are per channel
Eight-Pin IC Sockets—Four required
Three-Pin Molex Connectors—One male required, one female required
Five-Pin Molex Connectors—Five male required, five female required
Molex Terminal Pins—30 required
TO-5 Heat-Sinks—Two required
Phono Jacks—Four p.c.-board types required
22 AWG Stranded Hookup Wire—80 inches each required in brown, red, orange, yellow, and green
Heat-Shrink Tubing

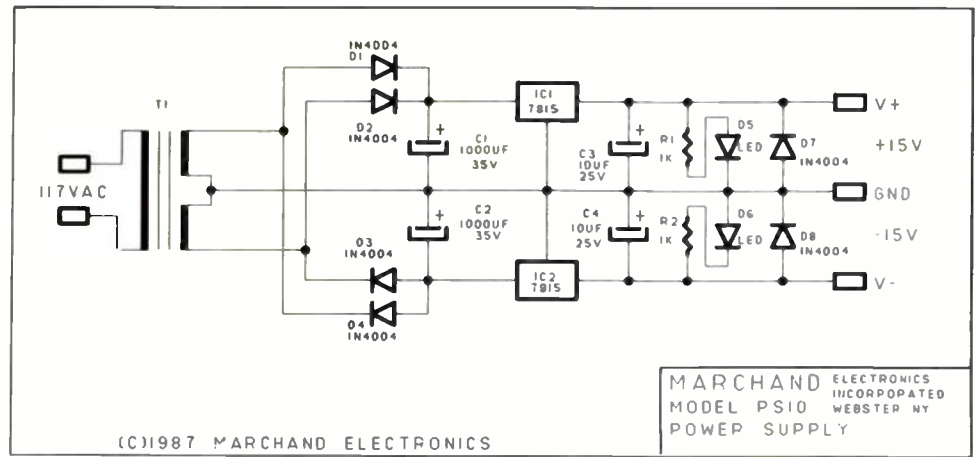
There are limits to the bass extension that electronics can deliver without causing woofer damage or distortion.



POWER SUPPLY PARTS LIST

- 2 1-kilohm, 1/4-watt resistors
- 2 10- μ F, 25-V capacitors
- 2 1,000- μ F, 35-V capacitors
- 6 1N4004 diodes
- 2 LEDs
- 1 7815, +15 V regulator
- 1 7915, -15 V regulator
- 1 117/36-V, center-tapped, 0.35-ampere transformer
- 1 A.c. line cord

Fig. 8—
Schematic of suggested
power supply.



be accentuated by the equalizer's boost, without cancelling the bass content of the music. Of course, it should not be necessary to use either switch when playing CDs.

Switch S4 ("Bypass") removes the equalizer from the signal path, and switch S3 ("Tape Mon") allows you to regain tape monitoring capability, in the event that the Bassis is used in the sole tape loop of a receiver or preamplifier.

If you are designing your own speaker system and enclosure, or know the values of your particular speaker's f_s and Q_s , you may choose to eliminate pots VR1, VR2, and VR3 by substituting fixed resistors which reflect your speaker's parameters and provide a fixed degree of boost. This allows one dual pot (VR4) to control the damping of both channels. Since the setting of Q_b influences the level of bass near the new cutoff frequency (compare Figs. 3 and 4), you retain control of the effective bass extension. (The formulas for calculating appropriate resistor values are given in the next section.)

ASSEMBLY

Figure 6 shows the p.c. board pattern for those who wish to build the circuit from scratch. Various kit versions, including drilled and etched boards and detailed instructions, are available, as is a fully assembled unit (see "Source").

Assembling the p.c. board is reasonably straightforward, requiring only a little prior experience with a soldering iron. Other useful tools include a wire cutter and stripper, needle-nose pliers, a desoldering bulb or solder wick, and a project holder such as Radio Shack's Helping Hands (#64-2093). A clean, well-lit working area will help minimize frustrations. Allow about two hours for each board (unless you are experienced) plus a few hours to wire the

potentiometers and switches and to assemble the enclosure.

Mount the jumpers, resistors, IC sockets, diodes, capacitors, transistors, phono sockets, and male Molex connectors on each p.c. board according to the layout diagram in Fig. 7 and the Parts List. Be sure to observe the polarity and orientation of the electrolytic capacitors, diodes, transistors, IC sockets, and connectors. Try to solder the transistors quickly to avoid damage. Don't forget to mount the TO-5 heat-sinks on the transistors and to orient the op-amps properly in their sockets.

The potentiometers and switches are connected by multi-colored wires to female Molex connectors; complete wiring instructions are given in the manual which accompanies each Bassis kit or board. If you are building the unit from scratch, follow the schematic (Fig. 5). A ± 15 V power supply, such as the one whose circuitry is shown in Fig. 8, is also connected to the p.c. board via Molex connectors.

As mentioned earlier, if you're building your own speaker system, you can also build a custom version of the Bassis, eliminating seven of the eight rotary controls. Leave out the Molex connectors which attach VR1 and VR3 to the p.c. board. Using Figs. 5, 6, and 7 for guidance, wire only that part of Molex connector P2 which attaches VR4 to the p.c. board. Now recalculate the values of resistors R7, R8, R16, R4, and R26 according to your particular speakers and the amount of boost desired, using the following formulas:

$$R7 \text{ or } R8 = \frac{1}{2 \times \pi \times f_s \times C1}$$

$$R16 = R19 \times Q_s$$

$$R4 \text{ or } R26 = R28 \times 10^{\frac{b}{40}}$$

where b is boost, in dB. Now you can use a dual, 10-kilohm linear pot to adjust the damping (Q_b) of the left and right channels simultaneously. Or, if you also want to eliminate the remaining rotary control, remove VR4 and recalculate R11 for the desired (fixed) value of Q_b :

$$R11 = R2 \times Q_b$$

Mount the p.c. boards on standoffs in the Bassis cabinet; next, mount the pots and switches. Double-check all the wiring and the orientation of the components. Make sure you've mounted all the jumpers onto the p.c. boards.

ADJUSTMENT AND USE

The Bassis may be inserted into a tape loop just like a cassette deck (make sure to press your system's tape monitor button to hear the effect) or between preamp and power amps if you own separates. If bi-amplification is desired, the Bassis may be used in conjunction with an active crossover, and may thus appear only in the signal path of the low-frequency drivers.

Upon turn-on, slowly advance your system's volume control (or your power amp's gain control) to make sure the unit is operating properly. If the power light of the Bassis fails to come on, if silence or distorted sound is produced, or if your woofer cones show visible displacement (which indicates a d.c. offset), unplug the Bassis and recheck its power supply and all of the wiring.

Four knobs per channel control the unit's operation: "Boost," " F_s " (speaker resonance), " Q_b " (damping), and " Q_s " (speaker damping). Before using the Bassis, you must set these controls for proper correction of your loudspeakers' response. Usually, you will set the controls for the left and right channels

SOURCE

The following components are available from Marchand Electronics (1334 Robin Hood La., Webster, N.Y. 14580) and come with a detailed assembly manual:

WM8-AA Fully assembled and tested Bassis equalizer, \$345
WM8-KK All parts for stereo Bassis equalizer (two boards, plus parts, power supply, cabinet, and hardware), \$225
WM8-A Fully assembled and tested WM8 single-channel p.c. board, \$84.95
WM8-K WM8 single-channel p.c. board and parts, \$59.95
WM8-B Drilled, etched, and silkscreened WM8 single-channel p.c. board, \$14.95
PS10-A Fully assembled and tested power supply, \$44.95
PS10-K Kit for power supply, \$39.95
PS10-B Bare board for power supply, \$12.95
WM8-C Cabinet, \$59.95

Add \$2.50 per order for shipping and handling; New York State residents, add 7% sales tax. Write to Marchand Electronics for more detailed pricing and a catalog of audio kits.

identically. If you own vented (bass-reflex) speakers, you must either leave the "Boost" control at zero or plug the vent to obtain acoustic-suspension operation. (Again, plugging the vent and applying equalization may give you more accurate and extended bass at the expense of efficiency and power handling. If you plug the vent, your speaker will probably have a relatively low, overdamped cutoff; e.g., an f_s of 50 Hz and a Q_s of 0.5.)

Referring to Fig. 1, you must estimate your speakers' corner frequency and damping. Most good acoustic-suspension speakers will have Q_s between 0.6 and 1.0. The more tight-sounding British speakers will be closer to 0.6, while heavy- or loose-sounding speakers will fall closer to 1.0. The setting of Q_s is not terribly crucial and, in any event, may be adjusted by ear to account for your tastes and the effects of your listening room. If in doubt, start with a setting of 0.7. Note that a Q_s setting which is too high will reduce the net bass response.

You can estimate f_s from the specs for your speakers' frequency response. These specs are usually of the form: "50 Hz to 20 kHz, ± 3 dB." This means the bass response may be reduced by anywhere from 3 to 6 dB at the lower stated frequency (depending on how conservative the specifications are). Suppose your speakers' -6 dB point is at 50 Hz. Look at the curve in Fig. 1 which corresponds to your esti-

mate for Q_s . Suppose the -6 dB point on this curve is at 0.7 multiplied by (f divided by f_s). Then an estimate for f_s would be 50 Hz divided by 0.7, or about 71 Hz.

If you don't have specs for your speakers, note that small speakers with poor damping (Q_s greater than 1) can often sound like they have more bass extension than they really do. Unless you are confident of your ability to distinguish lower bass from midbass, you may wish to use the following estimate for f_s : Most medium-size bookshelf speakers have f_s around 65 Hz; compact speakers (enclosures less than 14 inches high) usually fall closer to 80 Hz; large speakers may have f_s around 40 to 50 Hz. For those tiny die-cast speakers, such as Radio Shack's ubiquitous Minimus 7, try a value of 100 Hz or higher for f_s and around 0.8 or 0.9 for Q_s . Again, this latter setting is not crucial and can be readjusted later, if necessary.

The f_s and Q_s settings may never need readjustment. However, you can vary the boost and Q_b settings for your particular listening preferences. As mentioned previously, the "Boost" control determines the total amount of boost applied at frequencies below your speakers' natural corner frequency. Every 12 dB of boost extends the response one octave lower. For example, a setting of 24 dB will extend response from 60 Hz down to 15 Hz—if your amp and speakers can handle it.


The " Q_b " control allows you to set the damping of the new response. Low settings, as seen in Figs. 1 and 2, give a falling response with no ringing. When listening at high levels, it may be wise to reduce the amount of boost and/or to reduce the Q_b setting.

The Bassis must be used with care to avoid damage to your speakers. If you are using a phono source, set your system's volume control to your usual listening level, remove the grilles from

With the Bassis set for lower damping, an air-suspension speaker's bass curve looks like a transmission-line speaker's curve.

your speakers, and observe the woofers while playing the silent lead-in groove of a record. If you see a significant pumping action with "Boost" set at 24 dB, you may have to engage the "20 Hz Cut" switch. This filter attenuates frequencies below 20 Hz, where bass boost can emphasize signals generated by record warps. On some occasions, you may also choose to engage the "Rumble" switch to reduce the audibility of turntable rumble and to further reduce the effects of record warps. It is unwise (and unnecessary) to engage your system's loudness button or to turn up its bass control while using the Bassis.

Note that it is possible to introduce a peak in the midbass by setting Q_s too low for your speaker or by setting f_s too high. Although this may add an agreeable weight to some recordings, please be aware that there is likely to be much more energy present in music in this range than in the very low bass. Hence such an incorrect adjustment may cause greater stress to your amplifier and speakers than is caused by the sort of low bass boost for which the Bassis is intended.

When used properly, the Bassis can transform your speakers into truly wide-band transducers having ideal transient response, and it can help you match your speakers to the acoustics of your listening room. Further, the Bassis doesn't take up so much as 1 cubic foot of that room. 

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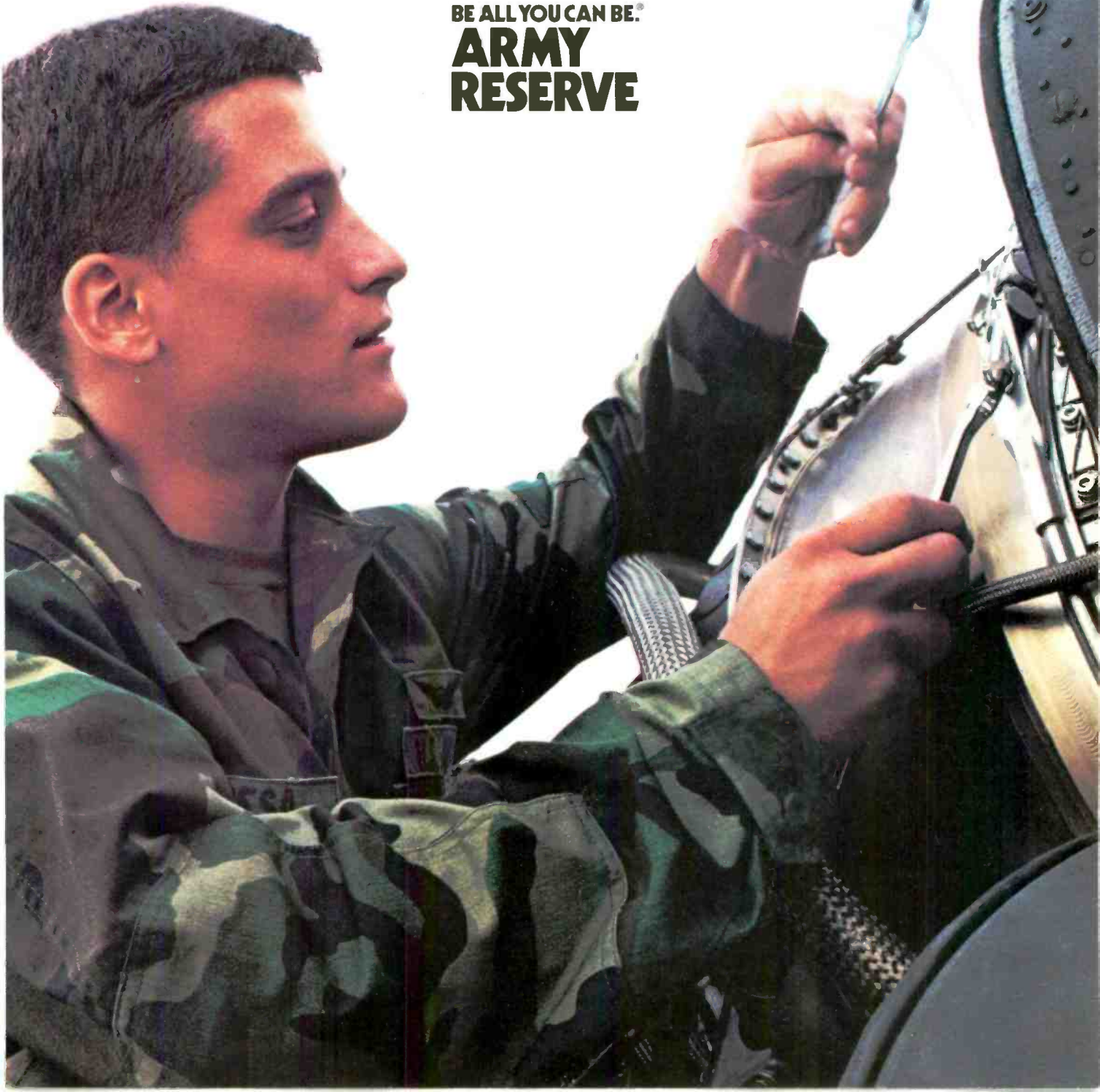
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SRS 1.2 tl

Two time Audio Video Grand Prix Winner

The ultimate expression of Polk technology, this limited production flagship model sets the industry standards for imaging, detail, dynamic range, and bass reproduction.

SRS 2.3 tl

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1. Patented SDA True Stereo Technology — The first and only speaker systems to maintain full stereo separation all the way from the source to your ears.

SRS speakers seem to disappear as musical images fill your listening room and seem to immerse you in a fully three-dimensional soundfield of startling realism.

2. Multiple Driver Arrays — The use of multiple drivers allows each separate element to work less hard and lowers distortion even at live concert levels. Power handling is increased to 1,000 watts per channel, providing a seemingly limitless dynamic range.

3. Time-Compensated Driver Alignment — Time-coherent driver placement insures that the entire spectrum of sounds reaches your ears at the same time. The sound is better focused, balanced and less fatiguing.

4. Wavelength Optimized Line-Source — Vertical driver arrays focus the sound waves into the room in a way which greatly reduces floor and ceiling reflections. Progressive reduction of the acoustical length of the arrays maintains constant vertical dispersion and eliminates “comb” filtering effects that limit other multiple driver systems. The result is extraordinary clarity and detail, great flexibility in room placement and precise stereo imaging from virtually any place in the room.

5. Planar 15" subwoofer — SRS bass performance is breathtaking. The use of small active drivers (eight in the SRS 1.2 tl, six in the SRS 2.3 tl) coupled to a huge sub-bass radiator achieves a bass response that is extraordinarily tight, fast (no boominess), deep and distortion free. In fact, the distortion at 25 Hz is lower than that of many audiophile-quality tube amplifiers.

6. Bi-amp Capability — The optional use of separate amplifiers for the high and low frequencies further improves clarity, lowers distortion and increases dynamic range.

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1

JEFF ROWLAND COHERENCE ONE SERIES II PREAMP AND MODEL 7 MONO AMP

Manufacturer's Specifications

Preamplifier

Gain: Phono stage, 61 dB; line stage, 19 dB.

Frequency Response: Phono, RIAA ± 0.15 dB from 20 Hz to 20

kHz, 3 dB down at 220 kHz; line, 0.06 Hz to 650 kHz, $+0$, -3 dB.

THD + N: Phono, less than 0.025% at 1 kHz, for 2.5 V rms output; line, less than 0.010% at 1 kHz for 2.5 V rms output.

Input Impedance: Phono, user-selectable (see text); line, 10 kilohms.

Output Impedance: Unbalanced, 300 ohms; balanced, 600 ohms.

Maximum Output Level: Phono, 10 V rms; line, 9 V rms.

Power Requirements: 100 to 240 V a.c., user-selectable; 50 watts at idle.

Dimensions: Preamplifier and power supply, each 19 in. W \times 1 $\frac{1}{4}$ in. H \times 13 in. D (48.3 cm \times 4.5 cm \times 33 cm).

Weight: 29 lbs. (13 kg).

Price: \$4,600.

Amplifier

Power Output: 350 watts into 8 ohms, 700 watts into 4 ohms, 1,100 watts into 2 ohms

Power Bandwidth: 1 Hz to 50 kHz, 3 dB down at 0.15 Hz and 160 kHz.

Slew Rate: 50 V/ μ S into 8 ohms at 100 V peak to peak.

THD + N (at 1 kHz into 8 Ohms):

Less than 0.015% at 20 watts, less than 0.045% at 100 watts, less than 0.06% at 200 watts.

Damping Factor (8 Ohms): Greater than 300 from 20 Hz to 20 kHz, greater than 90 at 100 kHz.

Output Current: 50 amps peak, continuous; 150 amps peak at 1 kHz for 20 mS into 0.1 ohm.

Overall Gain: 26.4 dB.

Sensitivity: 136 mV for 1 watt out into 8 ohms.

Input Impedance: Selectable, 100 or 20 kilohms or 300 ohms.

Common-Mode Rejection Ratio: Greater than 90 dB, 20 Hz to 20 kHz.

Power Requirements: 100 to 240 V a.c., user-selectable; 300 watts at idle.

Dimensions: 19 in. W \times 8 $\frac{3}{4}$ in. H \times 24 in. D (48.3 cm \times 22.2 cm \times 61 cm).

Weight: 141 lbs. (64 kg).

Price: \$9,800 per pair.

Company Address: P.O. Box 7231, Colorado Springs, Colo. 80933.

For literature, circle No. 90

The Model 7 mono power amplifiers are the largest and oldest of the current Jeff Rowland Design Group power amplifier product line. A smaller mono unit, the Model 3, and Model 5 and Model 1 stereo units complete the lineup. The Coherence One Series II is the updated version of the company's only preamp, but a less expensive unit is under way and may be out by the time this review is published. A number of other components are on the drawing board, and no doubt we will be seeing some of these soon.

The Jeff Rowland Design Group believes that electronic design of audio components, when applied with appropriate sensitivity and creativity, can channel life rather than merely reproduce sound. Right on! I believe that, too! Their designs are based on five fundamental principles: Musicality, quality, simplicity, reliability, compatibility with a diversity of equipment and cables, and beauty.

The pieces reviewed here, the Model 7 power amplifiers and the Coherence One Series II preamplifier, are certainly impressive. They are even packed impressively in wooden crates that really protect the equipment during transit. The power amplifiers are heavy, at 141 pounds each. I had to get a friend to help me lift and move these babies around.

The Coherence One has a separate power supply the same size as the preamp itself; in fact, the power supply is designed to be placed right under the preamp. The power supply is so well shielded that stacking the units does not cause hum pickup. The control layout is symmetrical. The central volume control is flanked by identical knobs for left- and right-channel gain trim. At the far left are a group of four





touch switches for input selection ("Phono," "Tuner," "Tape," and "CD") and a similar switch that inverts the polarity of all main outputs. The controls on the far right are a mirror image of these switches, with a single muting switch and a group of four selecting the signal to be fed to the tape deck ("Phono," "Tuner," "CD," or "Off"). Each touch switch has a built-in LED indicator, and they all control relays that perform the actual switching of the various signals. Found on the rear panel are pairs of gold-plated Tiffany female phono jacks for the inputs, a pair for tape cut, and a pair for

the positive and negative (inverted and noninverted) sides of each main output.

The Model 7 is large, heavy, beefy, and gorgeous! Centered in its massive (1/2-inch-thick), gold-anodized front panel is an alternate-action pushbutton with two levels of illumination to indicate the two states it controls, standby and active. In standby, the switch is softly illuminated and appeared as a light pink. When active, it was a bright amber. Two large handles grace the front panel and are kind on the hands when horsing the amp around.

The construction of both the amp and preamp is as beautiful as I've seen, and parts quality appears to be of the highest order.



On the rear panel are a number of things not found on the usual power amplifier. The output connectors are two 50-ampere barrier strips with #10 screws. The strips are connected in parallel by copper buses to permit both single and bi-wire cable configurations. This connection scheme is said to be sonically superior to five-way binding posts and is compatible with a wide variety of speaker cable terminations. On either side of the output barrier strips are the main power-supply fuses for the output stage. Just below the panel's center are the input connectors, two female Tiffany phono connectors ("Inverting -" and "Non Inverting +") with an XLR differential-input connector between them. Nearby is a four-pole, single-throw DIP switch that selects input impedance (low, medium, or high). A few inches to the right of the input connectors and impedance switch is a multi-pin DIN connector for remote control of the standby/operate switch. (This remote switch is available on special order.) At the bottom of the rear panel are the a.c. line cord socket, main power on/off switch, and line fuse. Located in the middle of the rear panel is a brass plate providing such information as input and output connector polarity, XLR pinout, input impedance as a function of switch setting, power-supply fuse size, etc. A pair of regular rack handles is mounted on the rear panel to assist in moving the amp.

Taking a closer look at the Coherence One preamp first, it can be seen in the photo that most of the interior space of the unit is taken up by a p.c. board which carries the majority of the parts. The signal in/out connectors are soldered directly to this board. Evident in the photo is the presence of three Penny & Giles rotary controls for left and right balance trim and for main volume. Each channel has four active circuit blocks, two in the phono section and two in the line output section. Related discrete parts surround each module.

An L-shaped bracket bent up to form a front subpanel is mounted to the bottom of the unit and serves as a mount for the three rotary controls on the front panel. This bracket also supports, via standoffs, the p.c. boards on which the touch

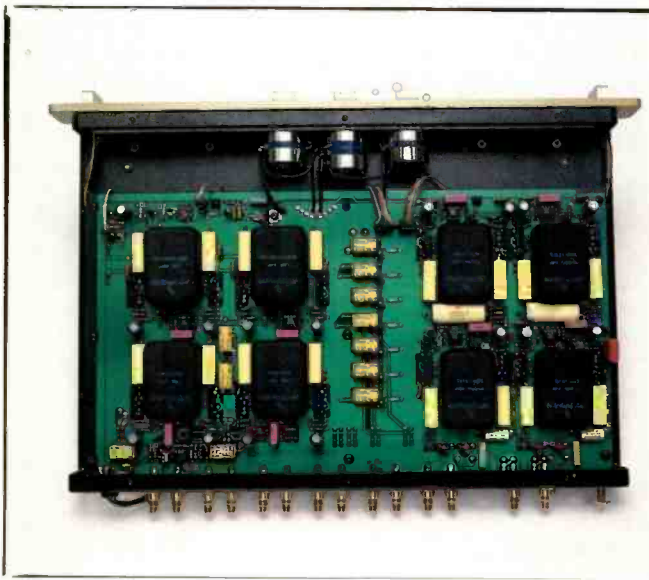
switches are mounted. The chassis metalwork is straightforward, consisting of a single piece bent up to form the rear panel, bottom, and front subpanel. The top of the front subpanel and rear panel and all side ends are folded over to make half-inch ledges that serve as mounting surfaces for the top cover. A separate piece, bent in the form of a U, forms the top cover. The main chassis pieces appear to be made of aluminum, and the top cover is made of steel for some magnetic shielding. A quarter-inch-thick front dress panel completes the enclosure. Parts quality and general aesthetic beauty of this unit are absolutely first-rate.

The power supply contains a potted toroidal power transformer and a large p.c. board with the main regulator circuitry on it. Five TO-3 power transistors on this board are mounted to a metal heat-sink that is also mounted to the rear panel to channel heat out of the unit. Located on the rear panel is a combination a.c. line plug socket, power switch, and fuse-holder and a seven-pin XLR connector for power connection to the preamp itself. As in the preamp, the top cover is made of steel, whereas the rest of the chassis is aluminum.

Looking inside the Model 7 is an experience in seeing how far the combination of functionality and beauty can be taken. The enclosure for the power transformer takes up about half of the interior area (as viewed from the top) and measures an awesome 6 x 9 x 9 inches. The remainder of the interior is taken up by a subchassis which supports the six main 22,000- μ F, 100-V filter capacitors.

The main signal circuitry is located on a vertical motherboard inside the rear panel, which carries the plug-in front-end module. The location of this board allows short, direct connections to the input jacks and the output stages while keeping the front-end as far as possible from the power transformers. The large, epoxy-encapsulated front-end module also carries the power-supply regulation and driver circuits.

The Model 7's output stage consists of 12 pairs of output devices and one pair of drivers, all metal-cased TO-3 de-



CYRUS

"In our personal judgement, the Cyrus 781 is one of the best-sounding speakers in its price range."

Julian Hirsch
Stereo Review
October 1989



From its Cyrus line of audiophile products, Mission Electronics brings you its latest triumph: The Cyrus 781 loudspeaker.

As with all Cyrus products, the 781 is attuned to the demands of the purist. As Julian Hirsch found in his recent test report, the 781 yields clear, extended bass, rapid transient recovery, and broad dynamic range. As you'll find when you listen, it produces music with astounding clarity and depth, and most importantly, total fidelity to the original recording.

The Cyrus 781 is a new and uniquely designed speaker capable of producing expansive sound from a relatively small enclosure. At the same time, it has evolved from speaker technologies pioneered by Mission, like mineral-loaded polypropylene woofers and elastiflex fabric dome tweeters. It features our "inverted drive unit geometry" — placing the woofer above the tweeter — which ensures phase linearity at cross-over frequencies.

Of course, the most astounding part about the 781 is its price: \$499 per pair. Or as Julian Hirsch put it, "It is always a pleasant surprise to find a modestly priced product... that manages to outperform its competition."

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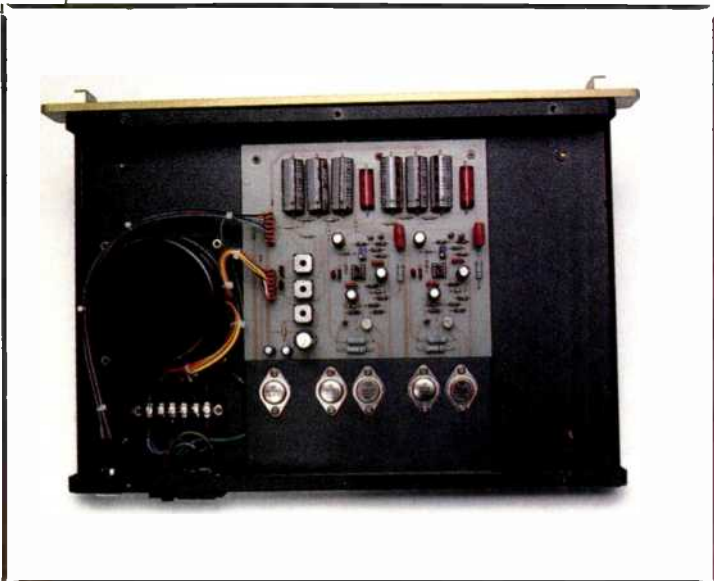
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The phono input's loading system is interesting and unusual. It can provide any load a given cartridge requires.



VICES. Physically, the output stage is split into two sections that correspond to the positive and negative half-waves. Each half has its own heat-sink on one side of the amplifier. A nickel-plated copper piece for each side of the amplifier is bent to form a horizontal ledge measuring $2\frac{3}{4} \times 18$ inches; the output devices and driver for each half of the output stage are mounted to these ledges. The main vertically oriented area of each copper piece is bolted to the inside of the heat-sink. This construction really helps transfer the device heat to the entire area of the heat-sinks. Printed circuit boards on top of these pieces interconnect the driver and output devices. Supply traces on the p.c. boards are reinforced with heavy bus wire, and output transistors are bused together via a 10-gauge wire which directly feeds the output connectors.

A fourth p.c. board, mounted to the inside surface of the left heat-sink, carries a potted toroidal power transformer, rectifiers, filter capacitors, regulator circuitry for the two bipolar power supplies that feed the front-end module, and a fifth supply for relay circuitry. Other functions on this board include detection circuitry for the amplifier's protective circuits, soft turn-on and turn-off circuitry (including the associated power resistors and relays, and the main rectifier bridge for the output stage supply; this bridge has its metal surface bolted to the heat-sink). A barrier strip for setting main power-transformer primary strapping for different voltages is mounted on the side of the transformer. A nice touch on this board is a set of five LEDs that show when the five auxiliary power supplies are operating properly.

Parts quality of the Coherence One and Model 7 appears to be of the highest order, and construction and build quality are first-rate, as beautiful as I've ever seen.

Circuit Description

The block diagram of the Coherence One Series II preamplifier, Fig. 1, shows the four encapsulated, plug-in gain blocks per channel. Adjacent to each module are local power-supply regulators and other passive components. In

the phono preamp section, the first block has a gain of about 46 dB at 1 kHz. In contrast to all the other gain modules in the preamp and power amp, this block has a non-differential, or single-device, first-stage topology which always yields the lowest possible referred input noise. A number of high-transconductance N-channel FETs are paralleled here, with the entire stage drawing about 30 mA of quiescent current—definitely the way to get low noise with low source impedances. The output of the second stage of this gain block has a very high dynamic output impedance, which means that the circuit's gain can be determined by the value of a shunt resistor across the output. Further, the correct value of shunt capacitance across this resistor will cause a high-frequency roll-off at 2,120 Hz, as required for the final part of the RIAA equalization curve. This network is lightly loaded by the following gain of one buffer, which in turn drives another passive RC network that generates the bass boost for the RIAA curve. The second gain block in the phono circuit is a flat post amplifier having 35 dB of gain. With an insertion loss at 1 kHz of about -20 dB in the passive bass-boost network and the combined active gain of 81 dB, we end up with a net phono preamp gain of 61 dB, which is appropriate for moving-coil pickups of low to medium gain. Moving-magnet cartridges are accommodated by exchanging the first gain blocks in each channel with optional low-gain modules.

The cartridge loading system for the phono input is unusual and interesting. By moving one end of a red jumper in each channel of the preamp, you can select variable load, a user-set fixed load, or a 47-kilohm load. In its variable-load position, the load-select jumper bridges the phono input with a variable resistor which can be adjusted for any value from 0 to 200 ohms; this resistor is adjusted through a hole in the rear panel by using a special adjustment tool supplied with the preamp. To use the fixed-load position, you must not only set the jumper but solder in a resistor of whatever value is desired. In the last jumper position, the input is bridged by an internal 47-kilohm load resistor.

The manufacturer suggests that you use the variable load only to determine the loading which sounds best with your cartridge, after which the fixed-load position should be used, with an appropriate resistor (preferably a high-quality metal-film type) soldered to the internal terminals.

As Fig. 1 shows, the 47-kilohm resistor remains in the circuit for all positions of the load-select jumper. It is therefore possible to add capacitance to the load for a moving-magnet cartridge (with the appropriate low-gain blocks in place) by soldering a high-quality capacitor to the internal terminals and setting the jumper to the fixed-load position.

Each gain block in the Coherence One has a pair of local voltage regulators that, according to the manufacturer, do not use negative feedback. Technically it is not possible to have a regulator with no negative feedback. A regulator, as such, usually senses the output and compares it to a reference, and the difference drives a series-pass element in order to maintain output at the desired value. Another common type of regulator, however, is an emitter-follower with a regulated source (such as a zener diode) for its base input. This type of regulator has no obvious feedback, as it doesn't sample the output and compare it to the input, but the

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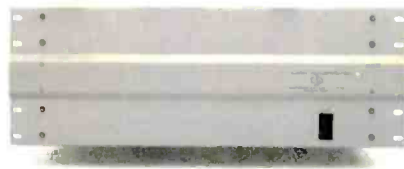
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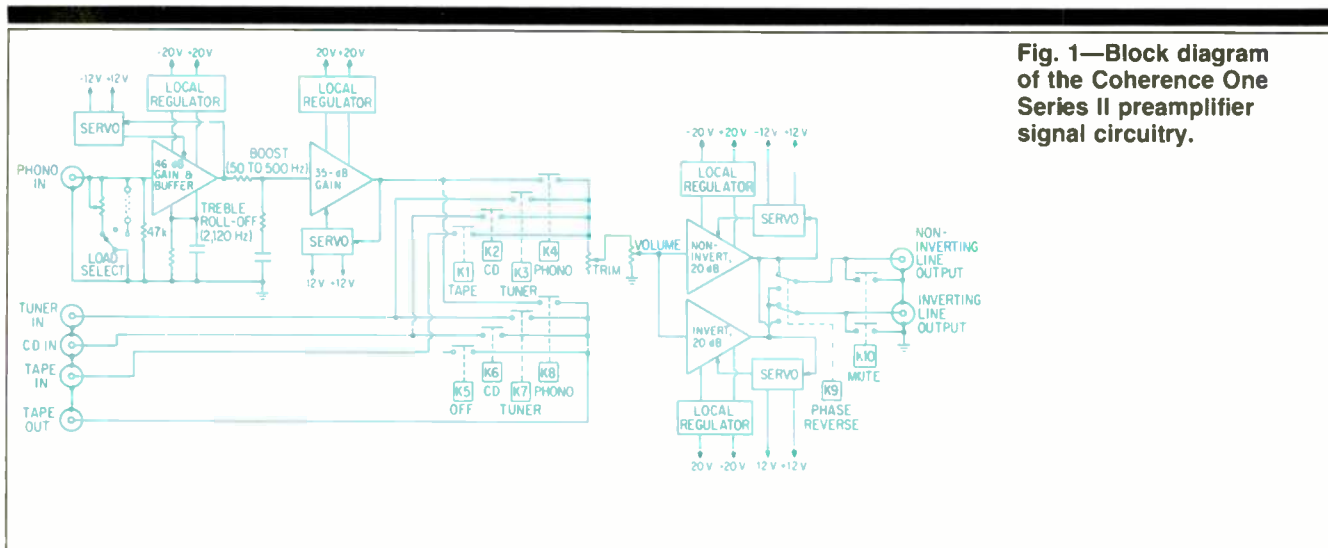


Fig. 1—Block diagram of the Coherence One Series II preamplifier signal circuitry.

topology has its own inherent feedback—100% current feedback, to be precise. In the Jeff Rowland regulators, the follower is made up of a compound-connected pair of transistors of opposite sex, a different topology than the usual emitter-follower configuration. We will see this compound connection in a number of other places as we go through the circuitry.

Signal selection in the Coherence One is accomplished by relay switching. Front-panel switches feed into the push-button logic, which ultimately applies power to the appropriate relay coils to make the appropriate signal connections. There are two selector systems, one for what is listened to and the other for what is sent to tape out for recording or other signal processing. The problem of how to prevent input-to-output feedback in connected tape recorders or external processors is neatly solved here by not connecting the tape-in signal to the tape-out circuitry at all.

Whatever signal is selected passes into the balance-trim potentiometers for each channel, each of which is hooked up as a rheostat in series with the volume control. With this arrangement, the high-level instant impedance changes as the balance trims are changed. The highest input impedance (about 20 kilohms) is obtained with the balance trims almost fully counterclockwise; rotating either trim control fully counterclockwise will completely disconnect the respective channel's signal through a switch.

Output from the volume control feeds two separate output amplifier modules, one noninverting and one inverting. Input impedance for both modules is high, since no feedback returns to the input circuitry—there is no audio signal feedback at all. The circuit transfer characteristics are the same for these modules' positive and negative inputs, so any even harmonics the modules generate should largely cancel in the differential output. A double-pole, double-throw relay connection at the output of these modules permits both output phases to be inverted by the "Phase Rev" switch on the front panel.

Signal circuitry inside the modules (with the exception of the phono input circuit) is, in principle, like that of the power amplifier's front-end, which can be seen in Fig. 2A and will

be further explained later. Servo circuitry around each module block keeps d.c. offset low at each output/input coupling point.

The external power supply produces one bipolar supply of +20 V and -20 V for the main signal circuitry and a +12 V supply to power the servo op-amps and switching relays. For the servo op-amps, -12 V is derived from the incoming -20 V on the preamp board by a three-terminal -12 V regulator. The technique used for the 20-V supplies is interesting in that the two circuits are the same, using same-sex devices in the same circuit positions. Separate transformer secondary windings feed full-wave capacitor-input filters and then feed the regulator circuits. The two circuits are stacked up on each other or connected in series at the outputs, with the midpoint between them being the common point for the load circuitry. This is good, in that the two supplies have a much better chance of sounding the same when they are the same, as opposed to the usual practice of using complementary devices in two complementary mirror-image circuits which are then fed from one transformer secondary winding.

A brief comment or two on how the Series II version of the preamp differs from the original is probably appropriate at this point. The servo op-amps have been removed from their sockets and placed inside new modules. Main regulated power-supply voltages have been reduced from ± 50 V to ± 20 V; consequently, the Series II version runs considerably cooler. The a.c. line draw is down to about 0.32 ampere as compared to 0.52 ampere. With a considerably higher supply voltage for the module, the original version of the preamp could put out more voltage at the onset of clipping, both at the main output and the phono output. However, the Series II can drive 600-ohm loads to a higher level than the original. I'm not aware of what specific changes have been made in the line-amp modules, other than the inclusion of the d.c. offset servos. The earlier phono circuit had three different user-selectable gain settings to allow the use of moving-coil and moving-magnet pickups. As mentioned, the Series II phono circuitry's gain is set by exchanging front-end modules; the unit I tested was optimized for mov-



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The Coherence One's output amp is no slouch for speed. I got good square waves from it at a blistering 200-kHz frequency.

Fig. 2A—Block diagram of the Model 7 amplifier signal circuitry. The pots marked "Low Freq." and "High Freq." adjust common-mode rejection; I_0 is quiescent current.

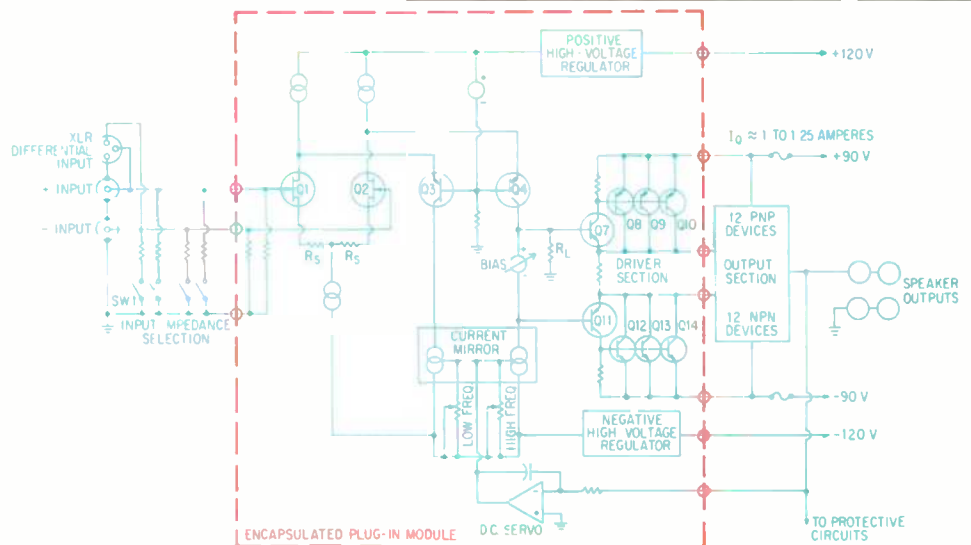
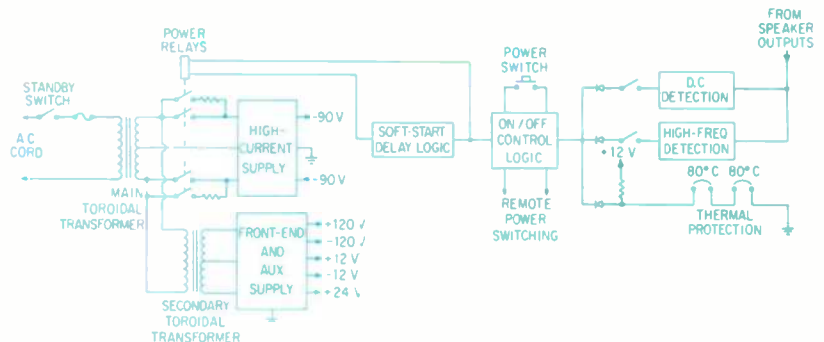


Fig. 2B—Block diagram of the Model 7 power supply.



ing-coil pickups of low to medium gain. The gain distribution between the three circuit blocks constituting the phono circuitry, and the method of high-frequency roll-off, were different in the Series I.

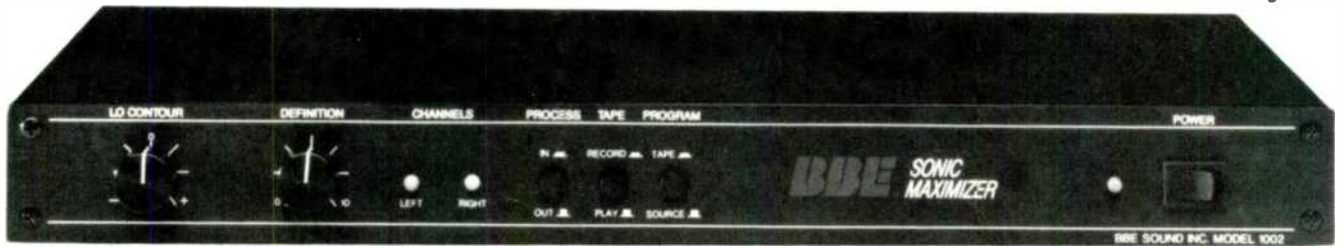
Turning our attention to the circuitry of the Model 7 power amp, Fig. 2A offers a simplified schematic/block diagram of the beast. As can be seen, the input circuit is a junction-FET differential amplifier in which both inputs are brought out to the input connectors. The input impedance selector operates on both input polarities, and it shunts the normally high input impedance of 100 kilohms down to two selected lower values. The reason for offering this lower input impedance, by the way, is the manufacturer's belief that lower load impedance makes interconnect cables sound better by virtue of their being terminated with a resistance closer to their characteristic impedance.

Output of the first stage is direct-coupled to the emitters of a PNP bipolar differential second stage. This set of devices is connected in the common-base mode, providing low input and high output impedances. This is an interesting

topology—a sort of inverse cascode arrangement. Usually a cascode first stage couples into the cathode, emitter, or source of the upper device of the cascode, and that device is the same sex as the lower device. At any rate, the collectors of this second stage are coupled down into a current-mirror circuit which sums both differential phases into the collector circuit of Q4, producing a signal that drives the output buffer circuit. This current-mirror circuit comprises five transistors and has provision for trimming the circuit's common-mode rejection over and beyond the audio frequency range. In this circuit, R_L loads down the output of the last voltage amplifier circuit and, in conjunction with R_S , sets the voltage gain of the entire amplifier. These critical resistors, R_S and R_L , are Vishay "bulk-metal" precision types for ensuring maximum signal integrity (and are said to cost about \$5 apiece). A bias-spreading regulator performs the usual functions of biasing the buffer amplifier and the following output stage to the desired quiescent currents, and of providing temperature compensation to keep these currents stable.

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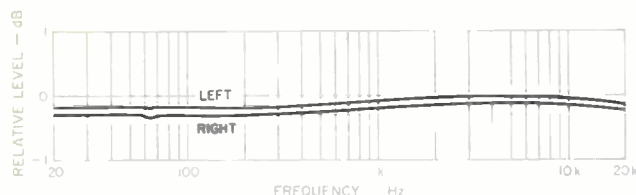


Fig. 3—RIAA equalization error of Coherence One Series II.

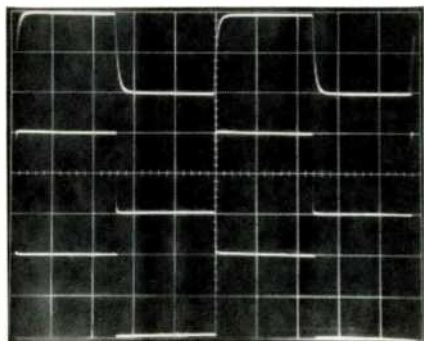


Fig. 4—Response to square waves, with instrument load, through the phono section of the Coherence One Series II for, top to bottom, 1 kHz, 10 kHz, and 40 Hz. (Scales: Vertical, 0.5 V/div.; horizontal, top to bottom, 20 μ S, 200 μ S, and 5 mS per div.)

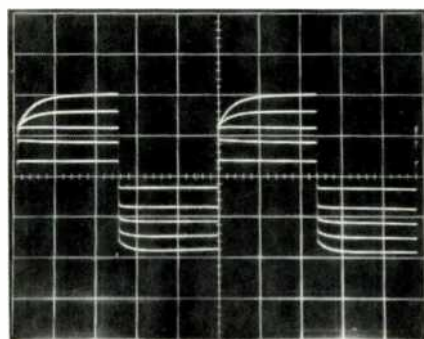


Fig. 5—Overload test of phono circuit, using pre-equalized 1-kHz square waves at increasing output levels; see text. (Vertical scale: 2 V/div.)

Another unusual and innovative feature of this circuit is the way the d.c. output offset servo operates by controlling the current mirror rather than the more common method of affecting the input differential amplifier. This puts the output offset-correction servo more truly out of the signal circuit than is usual.

Another example of using compound-connected devices in a unity-gain follower can be found in the driver circuit. This circuit provides low driving impedance for the output stage, which itself is also topologically just like the driver circuit shown, a compound circuit with unity voltage gain. Of course, the number of output devices is a bit greater—like, 12 pairs—and the outputs and driver are all TO-3 heat-sink-mounted types.

Apparent in Fig. 2A is the absence of any overall loop feedback in the Model 7. As can be seen, the front-end circuit is powered by local "feedbackless" regulators, as described in the preamp circuitry. Also, as previously mentioned, the circuit topology of the preamp gain blocks is very much like this power amplifier's front-end module.

The main power-supply circuit in the Model 7 (Fig. 2B) is somewhat different than that of your usual power amplifier. For example, the main power transformer is always on when the unit is plugged in and the rear-panel power switch is turned on—the normal mode of operation in the Model 7. Connected off the main secondary winding in the main power transformer is the primary of another, auxiliary transformer. Its purpose is to continuously power the front-end module, whether the amplifier is powered up for use or not. Control of the amplifier's operating state is by the front-panel pushbutton. When normal amplifier operation is desired, this pushbutton is pressed, initiating the soft start-up sequence. The energizing of this relay coil closes a pair of relay contacts, which connect the main power transformer's secondary to the rectifier bridge and filter capacitors through two series power resistors. These resistors reduce a.c. in-rush current and preserve power switch contacts while bringing the output stage supply up to some large fraction of its normal voltage. After an appropriate interval of a few seconds, another relay coil is energized which, in effect, shorts out these series resistors and applies full energy to the main power supply. Since the front-end is always powered up, there is no turn-on/turn-off surge, and the amp's sonic warm-up time is greatly reduced. Good trick!

This on/off control logic is also influenced by the dictates of the amplifier output d.c. and excess high-frequency detector circuits and by the state of the thermal sensors on the output stage's heat-sinks. If any of these circuits and sensors detect conditions that are considered unsafe, the on/off logic circuitry shuts off the power supply by opening the control relays. I might mention that this scheme of controlling and turning on the amp could have been done in the primary circuit of the main transformer, with the auxiliary transformer always powered from the incoming a.c. line. Because this approach would not pass some of the world's tougher safety standards, the way described is the more intelligent way to go.

All in all, the circuitry in the two Jeff Rowland Design Group components looked at here is very original and innovative. Let's see how these units performed.

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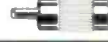
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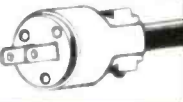
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Frequency response at the equivalent of 1 watt into 8 ohms was very independent of load, from open circuit down to 4 ohms.

Table I—Gain and sensitivity for Jeff Rowland Coherence One Series II preamp. Volume, balance, and trim pots were all set to their full clockwise positions.

	GAIN, dB			
	Left Channel		Right Channel	
	Instr. Load	IHF Load	Instr. Load	IHF Load
MC Phono to Tape Out	61.7	61.6	61.5	61.4
MC Phono to Main Out	80.5	80.4	80.7	80.6
AUX to Tape Out	-0.09	-0.35	-0.09	-0.35
AUX to Main Out	18.9	18.8	19.0	18.8

	IHF SENSITIVITY	
	Left Channel	Right Channel
	Instr. Load	IHF Load
MC Phono to Tape Out	418.0 μ V	430.0 μ V
MC Phono to Main Out	47.0 μ V	48.0 μ V
AUX to Tape Out	518.0 mV	518.0 mV
AUX to Main Out	57.5 mV	57.0 mV

Table II—Noise of MC phono section, referred to input, and IHF S/N ratio in MC mode, vs. source impedance.

Bandwidth	Source Impedance, Ohms	Referred Input Noise, mV	
		Left	Right
Wideband	0	300	250-300
20 Hz to 20 kHz	0	160	160
400 Hz to 20 kHz	0	47.5	46.5
A-Weighted	0	48.5	47.5
Wideband	100	300	275
20 Hz to 20 kHz	100	200	180
400 Hz to 20 kHz	100	80	78
A-Weighted	100	82	80
		IHF S/N Ratio, dB	
	100	75.7	75.9

Table III—MC phono overload vs. frequency. Results were about the same for instrument or IHF loading; clipping occurred in the positive half-wave first.

Frequency, Hz	Left Channel		Right Channel	
	Input, mV	Output, V	Input, mV	Output, V
20	0.97	10.1	0.97	10.1
50	1.38	10.1	1.34	10.1
100	2.1	10.1	2.1	10.1
300	4.8	10.1	7.9	10.1
1k	9.0	10.1	9.2	10.1
3k	15.2	10.0	16.0	10.1
5k	23.0	10.0	24.0	10.1
7k	31.0	10.0	32.0	10.1
10k	45.0	10.0	45.0	10.1
15k	61.0	9.5	68.0	10.1
20k	82.0	9.5	88.0	10.1

Measurements

Preamp gains and sensitivities are enumerated in Table I. Phono equalization error is shown in Fig. 3. (The phono input in the preamp I tested was, you'll recall, MC only.) The equalization is, in general, very accurate, with a very slight emphasis in the upper midrange. Related to this frequency response are 'scope photos of pre-equalized square waves going through the phono preamp (Fig. 4).

Table II shows both noise, referred to input, and IHF signal-to-noise ratios for the phono section. Noise levels are quite good with the 0-ohm source when measured with A-weighting or with a bandwidth of 400 Hz to 20 kHz. Since most good MC pickups are closer to 0 than to 100 ohms in impedance, actual system S/N with this preamp should be excellent.

Crosstalk between channels for the phono circuit was outstanding—down by more than 80 dB at frequencies up to 400 Hz, increasing to about -78 dB at 20 kHz, and quite symmetrical in both directions. Since the amount was so far down at high frequencies, it was difficult to determine the phase of the interchannel crosstalk, so I'll have to call it indeterminate.

Phono overload versus frequency is listed in Table III for both channels. As can be seen, the left channel's performance was slightly inferior to the right channel's, in that the output attainable in the last octave of the audio range was lower for the left channel. The results shown are for instrument loading, as IHF loading (10 kilohms in parallel with 1,000 pF) only changed the input levels for output overload by 1% to 2%. This circuit behaved in a near ideal fashion, as its output clipping level was constant with frequency. The output overload point for this circuit was at the onset of clipping on the positive half-cycle of the output waveform. However, some d.c. level shifting took place as I varied the input signal amplitude in the last octave of the audio range. Pushing the phono circuit to higher output levels with a pre-equalized 1-kHz square wave resulted in some high-frequency compression and asymmetrical behavior (Fig. 5). As phono circuits go, this one behaved pretty well on this test. The input acceptance, 9 mV at 1 kHz, was more than 20 dB higher than most good MC pickups will put out at standard cutting level (3.54 cm/S per channel, 5 cm/S lateral velocity). Furthermore, this margin of more than 20 dB extended over the whole frequency range. My criteria for input acceptance are certainly met in this design.

Phono circuit THD + N is shown as a function of output voltage for two test frequencies, 1 and 20 kHz, in Fig. 6. Distortion at lower frequencies was lower than shown for 1 kHz, but hum pickup in my setup prevented accurate measurement of this.

In the line amplifier, rise- and fall-times at ± 5 V output were tested as a function of balance and volume control settings, for both instrument and IHF loading. With volume and balance both at maximum, rise- and fall-times were 240 and 480 nS for instrument and IHF loading, respectively. With volume at maximum and the channel trim turned down for a 6-dB reduction in gain, rise- and fall-times lengthened to 680 and 800 nS for instrument and IHF loads. With the channel trim at maximum and volume turned down 6 dB, rise- and fall-times were 300 and 480 nS with the respective

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*BassCase houses system for transportation
and doubles as cabinet for subwoofer.*

*Includes storage area for portable CD
or cassette player and tapes or CDs.*

*When closed, BassCase forms air-tight seal necessary
for acoustic suspension woofer.*

The Cambridge SoundWorks Model Eleven™ is the world's first *transportable* full-range, high performance component music system. It consists of a powerful, sophisticated 3-channel integrated amplifier and a pair of "satellite" mid/high-frequency speakers—all packed in a rugged "BassCase"™ that, when empty and closed, serves as the system's subwoofer cabinet. Model Eleven's performance, when coupled with your portable CD or tape player, rivals that of the most expensive component systems. And because we market it directly from our factory, it costs hundreds less than it would in stores.

The Compact Disc combines small size, ease of handling, immunity to noise build-up, superb sound and a player mechanism that can be both small and reasonably priced. Compared to the alternatives, it is an ideal portable source of recorded music. All in all, the portable CD player is unique—and invites a new, equally unique form of playback system.

So thought Henry Kloss not long ago as he prepared to go on a vacation. He wanted to enjoy his favorite music on CDs while he was away. But he didn't want to be restricted to headphones, or by the limited fidelity of a boom box. So he packed up a portable CD player and a pair of small amplified speakers.

This small system, while it did fit into a largish suitcase, was not really all that easy to take along. More importantly, it just didn't sound good enough to satisfy a serious,

demanding listener. In particular it lacked the really wide range—most noticeably the deep bass—of a high quality home stereo system.

While still on his vacation, Henry began to think about how to create an easily transported music system that would sound good enough to satisfy him and, by extension, other serious music listeners. Not something just to make noise at the beach or a party—but something that could do justice to the demanding classical CDs that he most enjoys.

The last transportable music system that, in its day, filled a similar need was the popular KLH Model 11 "stereo phonograph in a suitcase," which Henry himself had designed and built in the early 1960s. Could he do something equivalent—but with considerably higher performance for the era of the CD?

BassCase™ (Part One)

Our first, vital observation was that a pair of small amplified speakers and a portable CD player—when all packed together—would use about the same volume required for an acoustic suspension woofer enclosure to reproduce low bass effectively. Acoustic suspension design requires a small, sealed enclosure which traps a carefully-calculated volume of air to act as the restoring force on a suspended bass speaker cone. But when the speaker is

not being played, that air is just so much empty space (other than some required damping material).

Therein lay the idea for BassCase, the key to the new Model Eleven by Cambridge SoundWorks: a *single bass speaker enclosure that doubles as a carrying case for the other components of a music system*. Bass frequencies below about 120 Hz are essentially non-directional, so it is not critical to the stereo effect where they emanate from in a room (or boat, van or recreational vehicle). The rest of the music range and the stereo effect are reproduced by a pair of very small, two-way "satellite" speakers which reproduce frequencies from the mid-bass region and upwards.

In addition to saving space—vital to Model Eleven's transportability—the satellite concept has a further advantage. You can place the low-bass speaker in the room to take advantage of locations which acoustically support bass, such as in a corner, on the floor or against a wall. Such optimum locations are also unobtrusive, often even out of sight entirely. However, they are usually just where you *don't* want the upper frequencies to



Bass frequencies are essentially non-directional, so it is not critical to the stereo effect where they emanate from in a room. The rest of the music range and the stereo effect are reproduced by a pair of small, "satellite" speakers which reproduce frequencies from the mid-bass region and upwards.

come from. So you place the separate satellites elsewhere for best distribution of the upper frequencies. You can't separate the bass units from the high frequency units with conventional speakers, so a compromise between bass response and upper-range clarity and stereo effect is almost inevitable with these single-cabinet designs.

The three-piece, or satellite, stereo speaker system idea is not new. Indeed, we thoroughly investigated the concept when developing Ensemble® a four-unit variation on the theme. Ensemble, being an all-out home speaker design, actually uses two low-bass speakers, which increase power handling and enable maximum flexibility in speaker placement. However, the ultimate in neither loudness nor placement flexibility were thought vital to the scaled-down Model Eleven—while a high degree of performance and transportability was. Therefore, staying with the single bass speaker of more conventional satellite designs made the most sense.

The Satellites

Each of Model Eleven's satellites is a true two-way system, with a 3" midbass/mid-range driver, a ¾" copolymer dome tweeter and a complex, 10-element crossover network (bi-amplification allows for the use of an electronic crossover for the single bass unit). These speaker drivers (as well as the bass unit's 7" acoustic suspension woofer) are no-compromise, high-performance components. They are far costlier than the one or two quasi-full-range units used in some satellite speakers which cost more than the entire Model Eleven system. We can afford to include such relatively expensive components in Model Eleven as a direct result of our selling it factory-direct.

The satellite cabinets, measuring 4½"×6½"×3" deep, consist of an outer shell of heavy ABS reinforced with cross-panel bracing, and with panel-stiffening and damping materials.



More About Model Eleven's Speaker Design

Model Eleven has been designed to subjectively equal Ensemble's sound. It covers the same range, including low bass, and has been engineered just as thoroughly to achieve a seamless room response with tonal balance nearly identical to Ensemble's. What it gives up for the sake of transportability is

BassCase (Part Two)

Loudspeaker enclosures contribute as much to the performance of a speaker system as the drivers themselves. They must be free of resonances which could color the sound. Furthermore, in the case of Model Eleven's speaker design, they must also be airtight. Therefore, considerable effort has gone into the design of Model Eleven's enclosures, including breaking new ground in both materials and design for the dual-purpose BassCase (patent pending).

The BassCase, because it doubles as an enclosure for the bass speaker driver and as the system's carrying case, required a new approach. It is called upon to reconcile light weight, rigidity, durability and acoustical inertia. Cambridge SoundWorks has developed and manufactures for the BassCase a new composite material consisting of an inner ¾" rigid foam core layer and outer layers of high-strength, luggage-grade plastic. This stretched-skin sandwich construction combines durability with appropriately light weight and the necessary acoustical properties. The geometry of the case's curvature helps to ensure high stiffness, abetted by cross-braced steel struts and an extruded aluminum valance fitted to both halves of the case. The valance acts both as a central strengthening rib and forms an airtight seal when the case is closed with heavy-duty, toggle-locking latches.

The BassCase, which measures 19½"×16½"×6¼" is filled with a soft foam chosen



The key to Model Eleven is the BassCase: a single bass speaker enclosure that doubles as a carrying case for the other components of a music system.

for its low-frequency damping properties. The foam is also ideal for protecting system components when transporting Model Eleven. Cutouts for the satellites and amplifier are provided, along with a third cutout sufficient to hold a portable disc or tape player, and CDs or cassettes. Extra foam pieces are provided so that you can customize this third cut-out for your particular equipment and needs.

The Amplifier

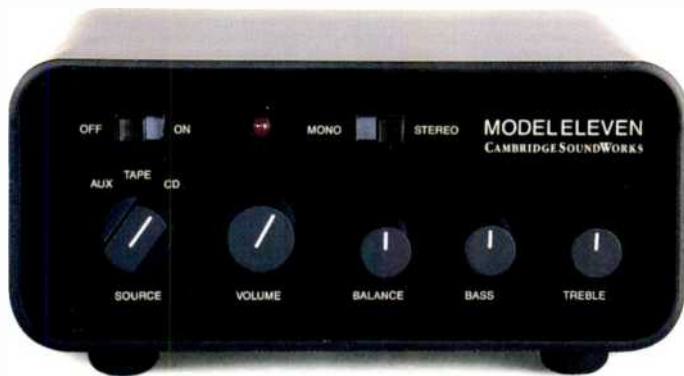
Because each satellite speaker and the low-bass unit must be powered separately, Model Eleven required a fresh, new amplifier design. Built by Cambridge SoundWorks, the amplifier has three channels, each consisting of two amplification stages in a bridged configuration for high power output. In addition, unlike powered speakers and other products designed for casual use with portable tape players, the amplifier uses no automatic gain circuits which vary frequency response and/or musical dynamics as a function of input level. Model Eleven's amplifier, like other high quality component amplifiers and receivers, reproduces the program's source signal exactly, in true linear fashion.

Starting with a clean slate for the amplifier has made it possible to match amplifier performance to speaker requirements precisely, which not only enables higher performance of the system as a whole, but also reduces the number (and cost) of speaker crossover components required. Moreover, making a fresh start has enabled us to take advantage of modern, high-density electronics packaging technology to keep the amplifier small and transportable (it measures just 7" wide by 5½" deep by 3" high). Powering low bass separately from the upper ranges, a technique called bi-amplification, contributes to Model Eleven's ability to play loudly.



The loudspeakers in a stereo system have the most difficult job of all audio components: to transform the electrical signals from the amplifier accurately into soundwaves in the air. Henry Kloss has been designing speaker systems that do that well for 35 years. While at Acoustic Research (AR) he was responsible for the production engineering and manufacturing of the very first acoustic suspension loudspeakers. And then, at KLH and later at Advent, he was responsible in toto for the design and manufacturing of the best-selling loudspeakers of the 1960s and 70s. In 1988 he introduced Cambridge SoundWorks' Ensemble, which in a very short time has become one of today's best sellers.

its ability to play as loudly as Ensemble when combined with a high-powered amplifier or receiver, and your ability to fine-tune speaker placement as precisely. But Model Eleven's speaker system and amplifier work together in a way that minimizes the real-life consequences of these trade-offs.



Unlike powered speakers and other products designed for casual use with portable tape players, Model Eleven's amplifier uses no automatic gain circuits which vary frequency response and/or musical dynamics as a function of input level. Like other high quality component amplifiers and receivers, it reproduces the program's source signal exactly, in true linear fashion.

Bass frequencies can require many times more power than mid and high frequencies, and with most music it is in the bass where an amplifier "runs out of steam" first. When an amplifier is called upon to deliver more power in the bass than it can, a condition known as "clipping" occurs. Clipping generates spurious high frequencies which are audible as distortion. But with a bi-amplified speaker system like Model Eleven's, when the bass amplifier is momentarily overdriven, the spurious high-frequency distortion generated by clipping

cannot be heard. It cannot be reproduced by the low-bass driver itself, nor by the upper-range satellites, which are powered by separate amplifiers unaffected by what's going on in the bass. In other words, bi-amplification lets you play the system louder than the same amplifier power would permit in a conventional full-range configuration.

We believe that most listeners will be pleasantly surprised, if not downright astonished, by the sheer volume of clean sound Model Eleven produces.

Controls And Connections

In keeping with the design goals of transportability, high performance and affordability, only necessary and worthwhile controls are provided. Flashing lights, digital displays and switches that look impressive but have little to do with music listening have been avoided. What's more, the controls are located *on the amplifier*, which can be placed conveniently near the listener. Unlike many amplified speakers, with Model Eleven there is no need to get up and cross the room to make adjustments, or to sacrifice proper speaker placement for convenient control access.

Model Eleven's amplifier provides volume and balance controls, an input selector to choose among three line-level program sources, and unusually useful bass and treble controls. These controls affect only the extremes of frequency response, allowing the listener to make subtle adjustments to deal with variations between recordings, without creating any ill effects in the midrange. Unlike many elaborate stereo component systems, Model Eleven also provides a mono/stereo switch, of particular value with portable stereos that include FM tuners: switching to mono greatly improves the "listenability" of weak stereo FM signals.

Model Eleven can be used virtually anywhere in the world—a switch on the rear of the amplifier selects between 115- or 230-volt, 50 or 60 Hz AC. It can also be powered by a car, RV, van or boat with a 12 volt DC system (a high-current, heavy-duty 12-volt connector is provided, as is a cigarette lighter adapter cable). In addition, a 9-volt output

jack and convenient cord are provided for powering your portable CD or tape player. Finally, an adapter cable is provided for connecting the amplifier to the headphone jack of a portable CD or tape player that doesn't have individual line outputs.

The speaker connectors have been designed both for ease of connection and to minimize confusion between the satellites and the bass unit. 15-foot speaker cables are provided which connect to screw terminals on the satellites, and to positive, two-terminal DIN connectors on the amplifier. A similar 20-foot cable for the bass unit is also provided; however, to avoid confusion with the satellite cables, it connects to screw terminals on the amplifier and a two-terminal DIN connector on the bass unit. In both cases, one end of the cable is bare wire, which makes it easy to shorten or lengthen the cable to suit individual needs.

Three stereo pairs of standard phono jacks are provided on the amplifier for using Model Eleven with three line-level program sources such as a CD player, tape player, FM tuner or stereo TV monitor. Like professional studio equipment, balanced input circuitry is used to reject common-mode noise. If your Model Eleven will be mostly staying at home, it can also be used to play conventional phonograph records by adding a simple phono preamplifier of the type readily available from electronic supply stores. However, if you plan to use it primarily as a transportable system you may prefer to tape favorite records to play on a cassette portable through Model Eleven.

Everything Scaled Down But The Performance

The approach to engineering Model Eleven is a form of miniaturization in the best sense of the word: each component is scaled down in size, but not quality. That approach, combined with the synergistic effect of loudspeaker and amplifier working together, means that nothing is missing for the demanding listener. All the range, smoothness and tonal balance of the most serious component system have been maintained. In general, all that is given up to achieve that performance in a fraction of the space and weight are the elaborate controls and the ultimate loudness of such systems. Given the myriad of places Model Eleven will go, let alone its lower cost, we believe you will find those sacrifices inconsequential. Best of all, we think you will find Model Eleven to be one of those rare audio products which sound better in real life than on paper.

Model Eleven's extraordinarily high performance also provides the listener with a hedge against obsolescence. Changing technology tends to affect program sources more than reproduction methods. While subject to constant refinement, amplifiers, loudspeakers and the like are not subject to the kind of breakthrough exemplified by the application of digital technology to the CD. Model Eleven, with its uniquely imaginative application of state-of-the-art technology and design techniques, will therefore be capable of satisfying reproduction of any likely future program sources.

Cambridge SoundWorks' Direct Sales Policy And Model Eleven

Model Eleven would most probably not exist without the CD having been established as an ideal transportable program source. It definitely would not exist without Cambridge SoundWorks having its own manufacturing facility, and having established from the outset a policy of selling products directly to the consumer.

This policy not only enables us to pass on considerable savings. It also enables us to develop products like Model Eleven which we believe have significant consumer appeal, but which the rest of the audio industry might consider too unconventional. Convincing many layers of the industry's distribution networks of the validity of a product like Model Eleven would be very costly, if indeed possible at all. By offering Model Eleven directly to its potential purchasers we are able to bypass an attitude geared more toward following fads than creatively establishing significant new product categories.

“Cambridge SoundWorks May Have The Best Value In The World. A Winner.”

David Clark—*Audio Magazine*, Sept. '89

Ensemble is a speaker system that can provide the sound once reserved for the best speakers under laboratory conditions. It virtually disappears in your room. And because we market it directly, it costs hundreds less than it



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

Beware of imitators.

Unlike seemingly similar systems, Ensemble uses premium quality components for maximum power handling, individual crossovers that allow several wiring options and cabinets ruggedly constructed for proper acoustic performance. We even gold-plate all the connectors to prevent corrosion.

At only \$499†—complete with all hardware and 100' of speaker cable,—Ensemble is the value on today's speaker market. *Esquire* magazine describes them by saying, "You get a month to play with the speakers before you either return them or keep them. But you'll keep them." *Stereo Review* said "It's hard to imagine going wrong with Ensemble." For literature, reviews or to order, write us at the address in the coupon, or call 1-800-AKA-HIFI*

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Like all Cambridge SoundWorks products, Model Eleven is sold only factory direct. This allows you to save hundreds of dollars, and audition our products the *right* way—in your home for 30 days, with no risk, no sales person hovering nearby. At \$599† we know of no music system near its price (transportable or not) that approaches its sound quality.

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would in stores.

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

Your listening room works with Ensemble, not against it.

No matter how well a speaker performs, at home the listening room takes over. If you put a conventional speaker where the room can help the low bass, it may hinder the upper ranges, or vice-versa. Ensemble, on the other hand, *takes advantage* of your room's acoustics. The ear can't tell where bass come from, which is why Ensemble's bass units can be tucked out of the way—on the floor, atop bookshelves, or under furniture. The satellites can be hung directly on the wall, or placed on windowsills or shelves. No bulky speaker boxes dominate your living space, yet Ensemble reproduces the deep bass that *no* mini speakers can.



Ambiance™ by Henry Kloss.

Ambiance is an ultra-compact speaker that proves high performance, small size and low cost need not be mutually exclusive. *Stereo Review* described Ambiance as "...beautifully balanced, delivering a full-size sound image with not a hint of its origin in two small boxes...very few small speakers we have heard can match the overall sound of Ambiance, and we know of none that surpass it." In Nextel or primed for painting for \$109† each, or in solid oak for \$129† each, direct from Cambridge SoundWorks. For information and reviews, or to order, write us at the address in the coupon or call 1-800-AKA-HIFI*

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Common-mode rejection below 7 kHz was -85 dB or better and was -81 dB at 20 kHz. These are good numbers, especially at 20 kHz.

loads. Both positive and negative output phases gave essentially identical results.

Oscilloscope photos of the line amp's square-wave performance are shown in Fig. 7. The top trace is for a blistering 200 kHz, with instrument loading at ± 5 V output. In the middle trace, the effect of the 1,000-pF capacitance of the IHF load shows in the lengthening of the rise- and fall-times. (No slouch for speed, the Coherence One's output amp!) The excellent low-frequency response is clearly seen in the 20-Hz trace (bottom); tilt is virtually absent here.

In setting up to measure volume control tracking, I wondered why the gains of the output amp were different when both gain trim pots were turned counterclockwise. I think the intention is for the two trim controls to be fully clockwise in normal operation and, if balancing needs to be done, for the lower channel's trim pot to be turned down.

I had reason to use the preamp with its trim controls in the counterclockwise position. This made the preamp's line-level input impedance about twice as high as it would otherwise be, which reduced bass attenuation and loaded my tube CD player or other tube sources less.

With both the trim controls clockwise, the gains of the two channels were virtually identical. With them both counterclockwise, left- and right-channel gains were down 6.7 and 5.4 dB, respectively. This is too much channel imbalance for equal control position, in my opinion. I measured the resistance value of the balance pots and both gangs of the dual volume control and discovered what I consider to be an excessive resistance variation for controls which are otherwise fabulous in quality. For the trim controls, I measured 10.38 kilohms for the left-channel pot and 8.8 kilohms for the right. For the volume controls, I measured 8.73 kilohms for the left channel and 9.96 kilohms for the right. This distribution of resistances completely accounts for the difference in channel attenuation with the balance controls turned down.

With the trim controls fully clockwise, tracking between the left- and right-channel halves of the volume control was within 1 dB at gain settings from full clockwise down to 60 dB of attenuation. Below -60 dB, the attenuations diverged, reaching a difference of 3.6 dB when the control was turned down to -75 dB.

Harmonic distortion plus noise was measured for both output phases at output voltages of 1, 3, and 5 V rms. IHF loading didn't materially affect the results. In general, distortion was low and simple in nature, and was 0.01% or less for output voltages of less than 3 V. Distortion rose with frequency above about 5 kHz. At 5 V out, distortion was in the range of 0.01% to 0.03%.

Onset of clipping was about 10 V for instrument or IHF loading. With a 600-ohm load, clipping started at about 8 V. The Coherence One could put out 3.8 V into 100-ohm loads before clipping set in. The aforementioned clipping levels are per output phase; each figure cited would be doubled when the preamp is connected for balanced output, with the same load impedance between each half of the output and ground. To see how well even-order distortion cancelled out in the differential, or balanced, output, I first measured the performance of both the positive and negative unbalanced outputs at 1 kHz and 20 kHz. Then I hooked up both output jacks in a balanced configuration and measured the distor-

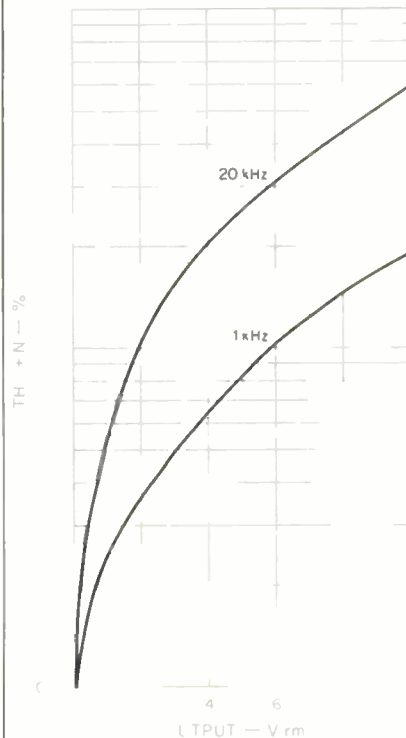


Fig. 6—THD + N of phono section as a function of output voltage, for two frequencies.

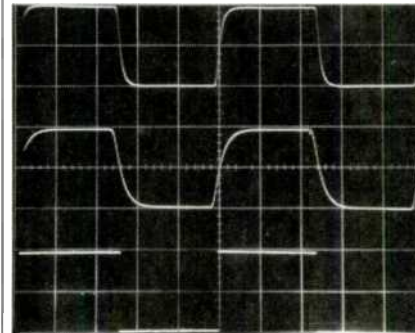


Fig. 7—Response to square waves through line inputs for, top to bottom, 200 kHz with instrument load, 200 kHz with IHF load, and 20 Hz with instrument or IHF load. (Scales: Vertical, 5 V/div.; horizontal, 1 μ S/div. for 200 kHz, 10 mS/div. for 20 Hz.)

Both dynamic and clipping headroom were impressive. The Model 7 amp is a very powerful beast, indeed.

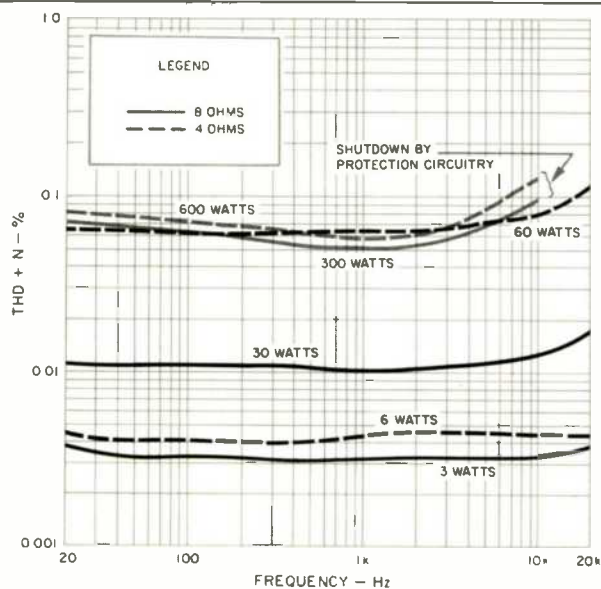


Fig. 8—THD + N of Model 7 amplifier as a function of frequency and power output for 8- and 4-ohm loads.

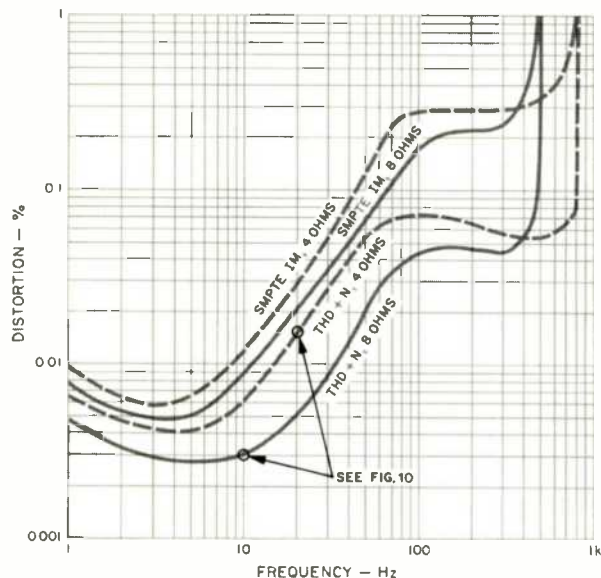


Fig. 9—SMPTE IM and THD + N vs. power for 8- and 4-ohm loads. THD + N is for 1-kHz signal. Distortion residues at circled points are shown in Fig. 10.

tion at the same two frequencies. The results in Table IV show that a good part of the individual-phase distortion cancels out in the balanced connection.

Interchannel separation was better than 90 dB from 20 to 400 Hz, decreasing to 88.6 dB at 1 kHz, 75 dB at 5 kHz, and 63 dB at 20 kHz. Results were virtually identical in the two directions. This is very good behavior.

Lastly, referred input noise was measured for both phase outputs and for both channels (Table V). Noise did not vary much as the volume and balance controls were rotated away from maximum by perhaps 0.5 to 1 dB.

A final comment on the preamp. Its main power-supply regulators held their output voltage, down to about 100 V a.c. line input.

Voltage gain of the Model 7 amplifier was $20.8 \times$, or 26.4 dB, with the positive or negative input fed. If fed a balanced signal, the differential gain would be the same, *provided* that the signal between input phases were the same as the input signal level when fed an unbalanced signal.

Total harmonic distortion plus noise as a function of frequency, power, and load is shown in Fig. 8. Figure 9 shows 1-kHz THD + N and SMPTE-IM distortion as functions of power and load. The Model 7's output stage dissipates a lot of power at idle—the a.c. line draw is about 4 amperes. With 8-ohm loads, the line draw stays constant up to 50 to 60 watts out. Beyond this general power range, the output stage reverts to Class AB, with the output devices starting to cut off for an increasing part of the signal cycle. Distortion generally starts to rise in any amplifier when the output stage goes from Class-A to Class-AB operation. This is because the gain in each half-cycle decreases when the opposite device cuts off and no longer contributes to the output movement. Of note with the Model 7 is the fact that this transition occurs at a high power level, so that the amplifier is in Class-A mode during most music listening and just the peaks reach through the transition. Distortion products for this design are mostly odd-order, as can be seen in Fig. 10, which shows 1-kHz THD residue for 10 watts into 8 ohms and 20 watts into 4 ohms. The predominance of odd-order distortion products shows that the circuit's symmetry in handling the positive and negative half-cycles of the signal is good, as the even harmonics are mostly balanced out. The Model 7's distortion stays reasonably constant across the audio range; it does not rise much at high frequencies, as it does in most other power amplifiers. This constancy is a desirable characteristic.

The frequency response at 2.83 V out (corresponding to 1 watt into 8 ohms) was very independent of load, from open circuit down to 4 ohms. This is due to the lack of an output-buffering RL network and to the low impedance of the output stage at 100 kHz. Response at the high-frequency end was down about 0.7 dB at 100 kHz. Low-frequency response was still at reference level at 10 Hz. Related to frequency response is square-wave performance (Fig. 11). In the top trace, the frequency is 10 kHz with an 8-ohm load. A 2- μ F capacitor has been shunted across the 8-ohm load in the middle trace. Excellent low-frequency extension is seen in the bottom trace, which is at 40 Hz.

Damping factor versus frequency, referred to an 8-ohm load, is plotted in Fig. 12. As can be seen, damping factor is

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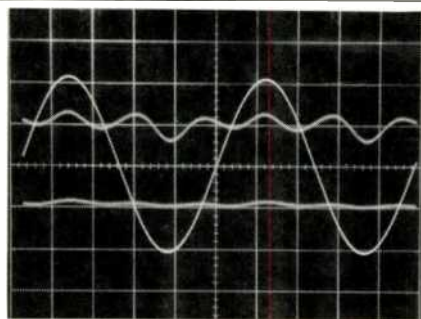


Fig. 10—Distortion residues and 1-kHz signal. For 10 watts into 8 ohms (bottom trace), THD measured 0.003%; for 20 watts into 4 ohms (top trace), distortion was 0.015%.

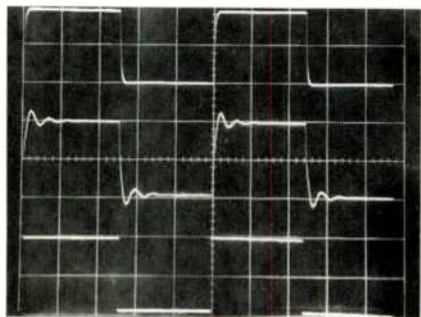


Fig. 11—Amplifier square-wave response. Top trace is 10 kHz with 8-ohm load, middle trace is 10 kHz with 2- μ F capacitance across the 8-ohm load, and bottom trace is 40 Hz into 8 ohms. (Scales: Vertical, 5 V/div.; horizontal, 20 μ S/div for 10 kHz, 5 mS/div. for 40 Hz.)

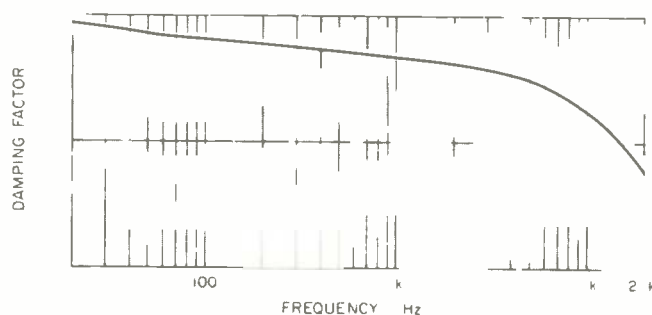


Fig. 12—Damping factor vs. frequency for 8-ohm load.

relatively high and doesn't fall off very much with increasing frequency, as it does in most other power amps. What is interesting is having so high a damping factor in an output stage without overall loop feedback. I don't understand why this curve slopes gently over much of the audio range without being flat at any point, but this is a designer's puzzle rather than a performance problem.

The Model 7's output noise and IHF S/N ratio are listed in Table VI. In the wideband mode and with the bandwidth of 20 Hz to 20 kHz, noise is dominated by 120-Hz ripple of the capacitor-input type. The amount of this ripple-type hum is satisfactorily low, however, and is not audible.

To measure common-mode rejection, I used a test signal whose amplitude produced 10 V output when fed to either input, then measured how far down the output was when both inputs were fed with the same signal. From 20 Hz to 1 kHz, the output was down in the noise, at -86 dB; it increased to -85 dB at 7 kHz and to -81 dB at 20 kHz. These are good numbers for this test, especially at 20 kHz.

Tests of dynamic and clipping headroom yield some pretty impressive numbers for the Model 7. Rated power is 350 watts into 8 ohms and 700 watts into 4 ohms. For dynamic power, I obtained 484 and 925 watts into the respective loads, for dynamic headroom figures of 1.4 and 1.2 dB, respectively. Clipping occurred at 470 and 840 watts, for clipping headroom values of 1.3 and 0.8 dB. The amp was able to deliver ± 78 amperes into a 1-ohm load at the clipping point. All these tests were for a constant 120 V a.c. line. These Model 7s are very powerful beasts indeed!

Use and Listening Tests

Equipment used to evaluate the Model 7s and the Coherence One Series II included as signal sources an Oracle turntable fitted with a Well Tempered arm and a Spectral Audio MCR-1 Select cartridge, a Nakamichi 250 cassette deck, a Technics 1500 reel-to-reel recorder, a California Audio Labs Tempest CD player, and a Nakamichi ST-7 tuner. Other preamps on hand during the testing were a Vendetta Research SCP 2A, the Mark Levinson No. 25 with the No. 26 phono section, and my reference preamp, which combines a tube phono stage with a selector switch and a passive, switched attenuator (think of it as a preamp without an active line stage). Other power amps used were a pair of EAR 519s and a Counterpoint SA-20. All of the listening was done through Siefert Research Magnum III speakers and Stax SR-X/Mk3 'phones using a Stax SRD-7 Pro adaptor.

As I usually do when reviewing equipment, I tried different combinations of gear at different times and got various results. I tried the Jeff Rowland preamp with different amps and the Model 7 amps with several preamps. I also had the opportunity to listen to two Coherence Ones, the original version and the Series II.

If I had never heard the amp and preamp hooked up together, I might have had the following comments on the separate pieces: The amplifier has an ease of presentation that is probably a partial result of its being so powerful but is also due to the amp's circuitry and to the way the unit is built. Soundstaging is very good; tonal balance is a bit on the soft side for upper mid and high frequencies, which appeals to my listening biases. The preamp, however—

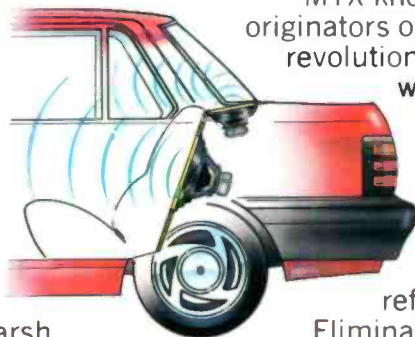


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Table IV—Distortion comparison of Coherence One line-amp outputs in unbalanced and balanced modes; see text.

Output Mode	Output Level	THD, %	
		At 1 kHz	At 20 kHz
Unbalanced, Positive	3 V	0.0069	0.019
Unbalanced, Negative	3 V	0.0088	0.019
Balanced	6 V	0.0028	0.0039

Table V—Line-amp section noise of Coherence One, and IHF S/N ratio, for unbalanced operation. Volume and balance trims were set to maximum clockwise positions.

Bandwidth	Referred Input Noise, μ V			
	Left, +	Right, +	Left, -	Right, -
Wideband	6.9	7.0	7.1	7.1
20 Hz to 20 kHz	2.42	2.5	2.55	2.85
400 Hz to 20 kHz	2.20	2.22	2.3	2.2
A-Weighted	2.1	2.15	2.16	2.08
	IHF S/N Ratio, dB			
	88.7	88.7	88.5	88.7

Table VI—Output noise of Jeff Rowland Model 7 mono amplifier with a source impedance of 1 kilohm. The IHF S/N ratio, with the same source impedance, was 91.6 dB.

Bandwidth	Output Noise, μ V
Wideband	272.0
20 Hz to 20 kHz	180.0
400 Hz to 20 kHz	72.0
A-Weighted	73.0



especially the original version—is not that exciting in my setup. It is musical and smooth sounding but doesn't quite sound as convincingly real as my own reference tube preamp or the Vendetta SCP 2A. In these regards, I think the Series II preamp is substantially better than the original.

When the Jeff Rowland units are hooked up as a pair, things get much better. Playing CDs through the combination produces a magnificent bass that sounds easy and extended—definitely very nice! The rest of the range sounds very good too, with good space, dimensionality, depth, and tonality. Records sound good and musically involving with the combination.

The preceding comments are based on using my usual 20-foot interconnect cables. I then tried a pair of 6-meter AudioQuest Live Wire Lapis cables that were provided by *Audio* for use with balanced equipment; these cables have a pair of RCA male phono plugs on one end and an XLR connector on the other. I heard a subtle improvement in the sound with these cables, and all subsequent listening was done with them.

Jeff Rowland has a notion that loading down interconnect cables with lower impedances than normal power amplifiers present helps the sound. I gather he suspects that by driving greater current through the wire (due to the low load impedance), possible nonlinearities such as magnetostriction and dielectric absorption in the cable materials might become a lower percentage of the total signal. At any rate, the Coherence One Series II that I reviewed has "build-out" resistors in series with its output stage, so its output resistance per phase was on the order of 150 ohms. Mr. Rowland suggested that I load down the receiving end of the cable with 150 ohms per phase and see if I could hear a difference in the sound after raising the volume control's setting to overcome the approximate 6-dB loss in level caused by this loading. Since the Model 7s have RCA jacks for each input phase as well as a balanced XLR connector, this was easy to do. I soldered 150-ohm, 1/4-watt, metal-film resistors into four high-quality male RCA plugs and inserted them into the positive and negative RCA jacks, while feeding the signal in through the XLR connector. I'll swear that the load resistors made the system sound better. Resolution seemed to improve, and the irritation I had felt on one particular recording seemed to decrease very noticeably! One might wonder what had changed: The characteristics of the interconnect cable or the sound of the preamp output amplifiers with the lower impedance loading? Further research would be needed to find out. Suffice it to say, I liked what happened better with the low-impedance loading. Loading preamps down with hundreds of ohms is not generally recommended, as most preamps can't begin to drive such low impedances. The Jeff Rowland Coherence One, however, had no trouble driving many volts into this load at low distortion.

Summing up, I found the sound of the Jeff Rowland equipment to be very good. I certainly enjoyed listening to the Coherence One Series II and the Model 7 and having their beauty grace my environs. For those with the wherewithal to consider equipment in this class, I certainly recommend giving the Jeff Rowland Design Group's components a serious audition.

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SMPTE-IM Distortion: Less than 0.02% at rated power.

Frequency Response at 1 Watt: MM phono, 20 Hz to 20 kHz, ± 0.02 dB; CD, 0 Hz to 125 kHz, +0, -3 dB.

Input Sensitivity: MM phono, 2.5 mV; MC phono, 160 μ V; high level, 150 mV.

Input Impedance: MM phono, 47 kilohms; MC phono, 100 ohms; high level, 47 kilohms.

Line Output Level: 150 mV into 47 kilohms at 1 kHz.

S/N: MM phono, 86 dB; high level, 110 dB.

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Frequency Response: 4 Hz to 20 kHz, ± 0.5 dB.

S/N: 100 dB.

Dynamic Range: 98 dB.

Harmonic Distortion: 0.003% at 1 kHz.

Signal Level: 0.5 V peak to peak.

Input Impedance: 75 ohms.

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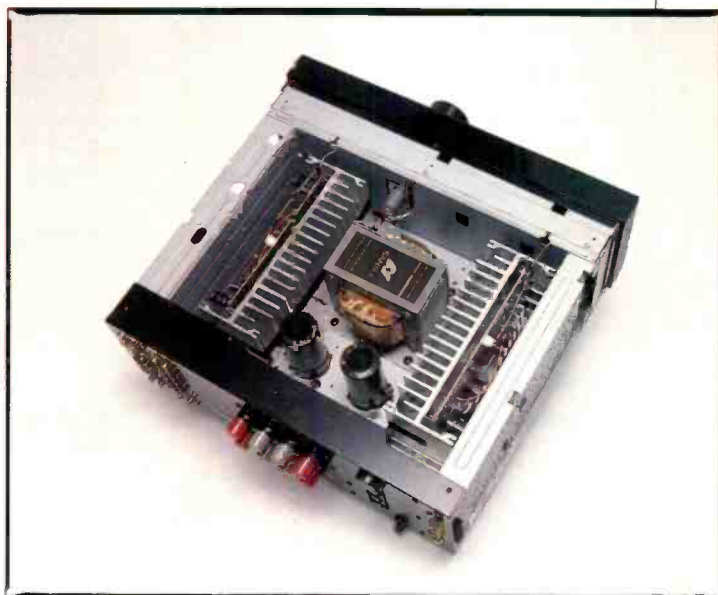


As a member of Sansui's premium Vintage Line, the AU-X911DG is a flagship model for the company. In basic description, it's similar to other companies' flagship integrated amps from earlier in the digital era: A preamp section with a moving-coil pre-preamp, a more than minimal power amp, a D/A converter with both coaxial and optical digital inputs, a switching scheme that allows reproduction of digital sources with minimal analog processing intervention, and every fondly crafted detail the company is proud of. This amp is impressive, no doubt about it.

I have to point out right up front, however, that though this Sansui may outpoint competing models in certain key areas, the whole genre should be considered as just one step toward the digital future. The format is logical for 1990, when analog signals are the rule and digital signals the exception. Once digital equalizers and ambience processors become commonplace, the AU-X911DG and its rivals will still be useful—the Sansui, perhaps, more so than most. But by the turn of the century, they'll be competing against products designed for an even more digitally oriented era.

The most important single aspect of this amplifier's design is digital, however: The Linear and Direct D/A Conversion System (LDCS), or so-called one-bit D/A converter. Sansui appears to have been the first company to offer and promote one-bit technology in the U.S. By now, several months after this amplifier's introduction, the basics of this technology are shared (under many names, and with considerable variety of possible implementation) by other companies; it will probably become the standard in short order, because of its potential for both lower price and finer performance, compared with even the fanciest multi-bit conventional processors.

The difference lies in using precise digital arithmetic to replace the often sloppy analog modelling provided by resistors in conventional D/A converters. For perfect linearity, the resistors would have to achieve phenomenally pre-



cise values. The 16-bit data stream is passed through an oversampling filter and then converted into a pulse-width-modulated (PWM) signal. The process is called one-bit because the converter has only a single output (which is either off or on), as opposed to the 16 simultaneous bits necessary to define one instant of amplitude in the original data stream.

This PWM signal is digital in the sense that it is either full-off or full-on, but analog in that the width (duration) of each on or off half-cycle is an analog of the instantaneous signal as represented by the original data stream. In determining the width of each pulse, the converter counts cycles of its internal clock, which is routinely far more precise than any resistive ladder. The PWM signal is then smoothed by a low-pass filter, transmuting the pulse widths into the instantaneous amplitudes of a regular analog signal.

While much of this may be familiar to readers who have been following digital audio, Sansui claims proprietary advantages in some areas. While acknowledging the importance of the so-called Multi-Stage Noise Shaping (MASH) technology (developed elsewhere but licensed to Sansui), Sansui's multi-stage feedforward circuit is said to reduce noise in the audio band still further. And, to control jitter in the signals arriving from unknown digital sources, the clock circuit D/A converter uses a lithium-tantalate oscillator said to achieve both the frequency accuracy of a crystal and the controllability necessary to adjust frequency for the available sampling rates (32, 44.1, or 48 kHz).

There are (need I say it?) separate power-supply transformers to isolate the digital domain from the analog; also, the two channels of amplification have independent circuit boards toward opposite ends of the chassis, whose heavy heat-sinking isolates these boards from the central power supply. Surrounding the circuit boards is a ring of shielded subchassis for the controls at the front, the low-level circuitry (including the D/A converter) at the sides, and the input and output switching (driven electrically from the front) at the



There was no measurable distortion in the output at any frequency, either at 1 watt or at rated output.

Table I—Output impedance vs. frequency.

Frequency	Output Impedance
1 kHz	20 milliohms
5 kHz	36 milliohms
10 kHz	62 milliohms
20 kHz	120 milliohms

Table II—Input and tape output characteristics.

Parameter	Line ("CD")	MM Phono	MC Phono
S/N Ratio	90.75 dB	79 dB	71 dB
Sensitivity	15.4 mV	0.26 mV	31 μ V
Input Overload	>10 V	220 mV	26 mV
Input Impedance	14 kilohms	49 kilohms	100 ohms
Input Capacitance		150 pF	
Tape-Out Level	500 mV	280 mV	240 mV
Tape-Out Impedance	(Direct)	930 ohms	930 ohms

Table III—Linearity error of D/A converter.

Nominal Signal Level	Error with Undithered Signals	Error with Dithered Signals
0 to -80 dB	± 0.1 dB	± 0.1 dB
-90 dB	± 0.3 dB	± 0.1 dB
-100 dB		-1.16 dB

back. The digital connections are all on the left side of the chassis; those for analog signals are at the right, with two sets of heavy-duty speaker terminals between them.

Control Layout

The analog input layout comprises jack pairs for phono ("MM/MC" is selected via the front panel), tuner, CD, and line, and loop sets for three tape decks plus an outboard processor. Of the three coaxial digital inputs, only the third is marked for DAT; there is an optical input as well, plus a

coaxial digital output. According to the manual, the latter will not function with signals containing a copy-inhibit code or with data streams using the 44.1-kHz sampling rate of CDs. A front-panel indicator shows the current "Sampling Frequency" when digital inputs are in use.

That the designations for the line inputs are to be accepted or ignored, as you will, is made plain, both by the owner's manual and by the presence of a video-in and a video-out jack among the analog connections. Since none of the audio jacks are specifically marked as being for use with video soundtracks—and since the video jacks don't seem to do anything but hand the signal off to some other component—you are encouraged to consider how the jacks work rather than how they're marked.

The basic selectors are arranged in two banks. The top bank chooses the four digital sources via the built-in D/A converter, and the bottom bank chooses the four analog sources. Signal routing is further refined by a three-position "Source Direct Operation" switch: "Off" (normal operation), "Source" (a simplified signal path), and "Digital Direct" (input from the D/A converter to the power amp). In the "Source" position, the balance control, infrasonic filters, and muting (20-dB nominal attenuation) are bypassed; the "Digital Direct" option bypasses all of these plus the tone and loudness controls and the processor loop.

The "Source Direct Operation" switch is, oddly, interposed on the front panel between the monitor buttons for the analog decks and the recording selector. The latter has positions for "Tuner" and "CD" analog inputs (whose signals can therefore be recorded even while you're listening to something else), "Source" (whichever of the eight main buttons you have selected for listening), "Off" (so the recorders can't load the listening feed), "Tape-1" (dubbing to tape 2 and tape 3), and "Tape-2" (dubbing to tape 1 and tape 3).

When the "Digital-3" (coaxial) source is selected, there is no output to the "Tape-1" (analog) connections, and the manual suggests use of these two sets to prevent accidental feedback if you want both digital and analog connections to the same DAT deck. There is no provision for monitoring from the output of a digital deck while it is recording, even if the deck itself has that capability.

The remote is very simple. It offers the eight selector buttons and four monitor buttons, plus up and down controls for volume. That's it—but that's sufficient. If you're serious enough about your audio to want the other options, you're probably enough of an activist about it to prefer a hands-on approach anyway. I do.

Measurements

Diversified Science Laboratories (DSL), who performed all of the laboratory tests on the Sansui AU-X911DG, measured clipping at 123 watts into an 8-ohm resistive load, a comfortable 0.9 dB above rated power, and at 132 watts (another 0.3 dB higher) into 4 ohms. Dynamic headroom measured +2.1 dB (162 watts, as opposed to the 100-watt continuous rating). Dynamic power into 4 ohms was 1 dB higher yet, at 205 watts. With 2-ohm loads, dynamic power dropped somewhat, to 170 watts, and showed what could be interpreted as signs of instability. Still, this represents, at



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The main point to be made about the D/A converter is that its linearity is exceptional, unmeasurably low in many of the tests.

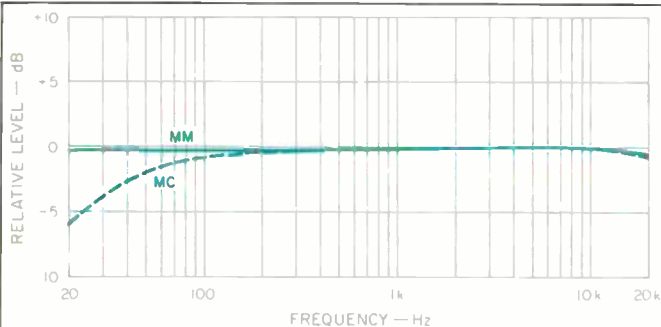


Fig. 1—Frequency response via the phono inputs.

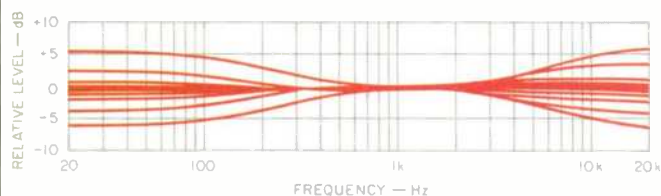


Fig. 2—Bass and treble control range, including effects of intermediate settings.

worst, average behavior for an amplifier section rated at 100 watts a side.

The output section's damping factor was 400 at 50 Hz, into an 8-ohm load, representing an impedance of 20 milliohms at that frequency. Output impedances at other frequencies are given in Table I.

In measuring frequency response, DSL followed the IHF-A-202 Amplifier Measurement Standard (now published by the EIA, which absorbed the IHF some years ago). This specifies a "standard" volume setting designed to simulate a working setting when the unit under test actually is used for listening purposes. In the AU-X911DG with analog sig-

nals, this resulted in a setting of "31"—that is, with the volume knob set at the point calibrated as 31 dB below maximum gain. (A second calibration scale is used with the D/A converter.) These measurements were made from the power terminals—again, as called for in A-202—to exercise the entire signal chain.

The results showed a distinct though mild roll-off in the treble. Response was down less than 0.25 dB to at least 10 Hz in all these tests, but it dropped by that much at 13.8 kHz, to -0.5 dB at 18.9 kHz, to -1 dB at 29.1 kHz, and to -3 dB at 60.3 kHz. These figures aren't what one might expect from Sansui's specs, which may have been measured with a reduced input signal level and with the volume pot full open, a technique many companies use in their published specifications. Accordingly, DSL tried increasing the test level in 10-dB steps. At "21" (21 dB below maximum), the output was down 0.25 dB at 19.2 kHz and 3 dB at 80.4 kHz; at "11," it was down 0.25 dB at 33.8 kHz and 3 dB at 143 kHz.

This satisfies Sansui's spec, but it also proves the wisdom of the Standard's insistence that frequency response be measured "as used." In DSL's report, Edward J. Foster noted, "As you can see, treble response improves as volume is raised. This suggests that the input capacitance of the amplifier following the [volume] control is forming a low-pass filter with the impedance of the control. (Note how well calibrated the control is, however.)"

With no measurable distortion at any frequency, either at 1 watt or at rated output, only one other point need be made about the lab data on the amplifier section. An error of about 0.5 dB in channel balance showed up, regardless of whether the centered balance control was included in the signal path or excluded via the "Source Direct Operation" option.

Frequency response of the MM phono section was very flat, as Fig. 1 demonstrates. The curve shows only the subtlest of treble rises and an equally subtle roll-off in the lower range. The curve for MC phono has a similar treble rise, to about 8 kHz, but then response rolls off to -0.7 dB at 20 kHz. The gentle downward slope of the low treble continues into the midrange, gradually becoming steeper as it goes. Response is down 0.1 dB (relative to 1 kHz) at about 400 Hz, 0.7 dB at 95 Hz, and 3 dB at 35 Hz—an unacceptable loss of deep bass. The suppression of unwanted infrasonics by this characteristic may be partial compensation if an MC cartridge must cope with warped records. Response of the MC phono section was down 16.5 dB at 5 Hz, whereas that of the MM section was down only 2 dB at 5 Hz. The infrasonic filter helped on warped discs, with a fairly vigorous slope of 12 dB per octave, though its low turnover point of 15 Hz limited its effectiveness to some extent.

In perusing the lab data of Table II, keep in mind that these results all were obtained following the IHF/EIA Standard. In some cases, disparities between the results shown and Sansui's specs probably can be attributed to a difference in technique. All are unexceptionable, in any event.

The tone controls were quite well behaved and gentle in operation. As can be seen in Fig. 2, the bass control shelves below 100 Hz, reaching maxima of about +5 and -5 dB, and treble runs to about the same maxima at 10 kHz. The



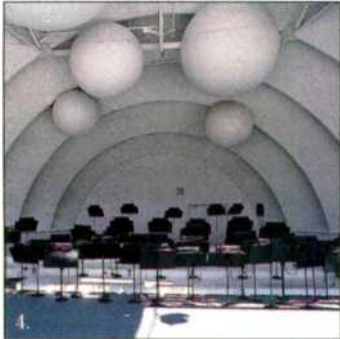
Ralph's house.



Ralph's house.



Ralph's house.



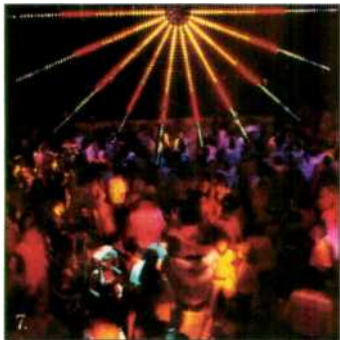
Ralph's house.



Ralph's house.



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The AU-X911DG couples an outstanding D/A converter to an analog design that is beyond complaint in almost all respects.

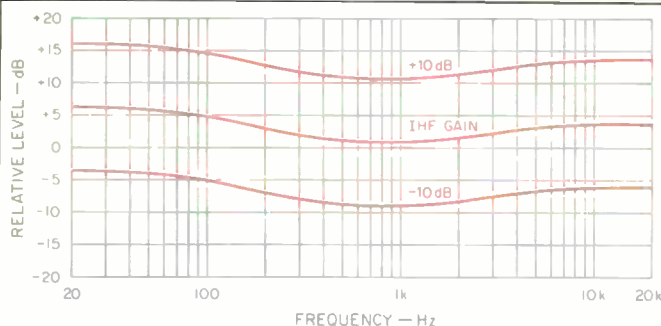


Fig. 3—Loudness compensation; see text.

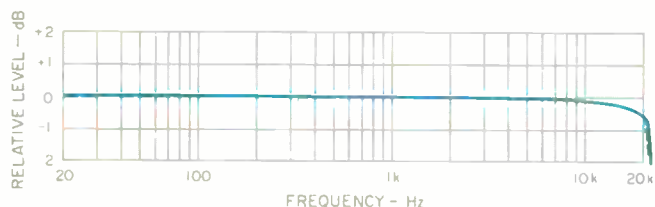


Fig. 4—Frequency response of D/A converter for left channel (solid curve) and right channel (dashed).

loudness (Fig. 3) adds about 3 dB of treble above 5 kHz and 5 dB of bass below 100 Hz; it is unaffected by the volume setting over the 20-dB test range. Whether this fixed equalization deserves to be called loudness is a moot point. It may be preferable to the volume-dependent variety, unless the latter can be calibrated to actual listening levels—which can vary widely in practice with so powerful an amplifier.

The main point to be made about the D/A converter is that its linearity was exceptional. The linearity errors indicated as " ± 0.1 dB" in Table III were significantly smaller than this figure, which represents the resolution limits of DSL's instruments under the given test conditions; in most cases, non-linearity was, in fact, unmeasurably low. This is superb

performance, in what is probably the most relevant of all D/A converter bench tests, by comparison to even the most elaborate multi-bit converter sections.

The D/A converter's frequency response had the usual slight roll-off at the top end, by about 0.5 dB without de-emphasis (Fig. 4) and about 1 dB with de-emphasis. Channel balance was within ± 0.2 dB, and A-weighted S/N, measured with respect to a 10-watt output (again, an average-listening maximum consistent with the IHF Standard) was 105.75 dB. Channel separation measured 84.5 dB at midband and was still all of 61.5 dB at 16 kHz—far better than is required for good stereo imaging.

In a word, DSL's bench tests paint a picture of an outstanding D/A converter coupled to an analog preamp/switching/power amplification design that is beyond complaint in almost all respects. Curiously, both of the exceptions are in the most fundamental of all considerations, frequency response—of the power amp at listening levels and of the MC phono section.

Use and Listening Tests

The listening focused—as, indeed, does the design itself—on the D/A converter. Sansui lent me a CD-X711 CD player to drive the AU-X911DG's digital inputs. With this player feeding both "Digital-2" and the CD (analog) jacks, I was able to compare the sound via the Sansui's D/A converter with that from the player's own. That I could discover no significant difference is not surprising when you consider the Sansui player is billed as containing the same LDCS D/A converter as the amp.

More revealing was a comparison between a conventional ladder decoder in another CD player and the LDCS decoder in the AU-X911DG. The Sansui did seem significantly smoother and freer from the harshness I've come to associate with certain discs. However, because the CD player I used for comparison had no digital output, I was unable to make direct A/B comparisons as I had when using the CD-X711, so my judgments involved sonic memory—never an altogether trustworthy investigative tool. So while I question my own methods, I am satisfied that this Sansui amp offers a subtle but significant advantage over conventional designs.

Both sources were played through the AU-X911DG's power amp, of course, so any subtle warming of the top end by its inherent roll-off at my listening levels (through fairly sensitive speakers) applied equally to both. The sound, in fact, struck me as excellent, even taking that slight roll-off into consideration.

Among the best aspects of the design may be the switching. At first acquaintance, it seemed rather complicated, but the longer I used it, the more I became convinced that of all the products of this sort that I've worked with, this is the model best calculated to prove satisfactory in a true digital system—when such a system is available. It still doesn't allow for digital processor loops—you'll have to apply whatever digital legerdemain you want before feeding the signal to this Sansui amp—but neither does any other digital/analog integrated amp I've worked with. And no model in that category can match Sansui's superb D/A converter.

Robert Long with Edward J. Foster

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3

PROTON CR-560 CAR STEREO

Manufacturer's Specifications

FM Tuner Section

Mono Usable Sensitivity: 8.1 dBf
(1.9 μ V at 75 ohms).

50-dB Quieting Sensitivity: 13.2 dBf (3.0 μ V at 75 ohms).

Alternate-Channel Selectivity: 60 dB.

S/N Ratio: 62 dB.

AM Suppression: 55 dB.

Capture Ratio: 1.5 dB.

Stereo Separation: 35 dB at 1 kHz.

Local/Distant Attenuation: -20 dB, \pm 5 dB.

AM Tuner Section

Usable Sensitivity: 35 μ V at 1 MHz.

Cassette Section

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

S/N Ratio: With Dolby B NR, 65 dB.

Stereo Separation: 40 dB at 1 kHz.

Wow and Flutter: 0.18% wtd. rms.

Amplifier Section

Power Output: 16 watts per channel into 4 ohms at 1 kHz, with 8% THD.

Line-Level Output Voltage: 900 mV/1 kilohm at 1 kHz, with 0.1% THD.

Frequency Response: Preamp out, 30 Hz to 20 kHz, \pm 3 dB.

Bass Control Range: \pm 8 dB at 100 Hz.

Treble Control Range: \pm 8 dB at 10 kHz.

Loudness Control Range: +6 dB at 100 Hz, +4 dB at 10 kHz.

Speaker Impedance: 4 ohms.

General Specifications

Dimensions: 7½ in. W \times 2¼ in. H \times 7¾ in. D (19 cm \times 5.8 cm \times 18.6 cm).

Weight: 3.85 lbs. (1.75 kg).

Price: \$369.

Company Address: 5630 Cerritos Ave., Cypress, Cal. 90630.

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The Proton CR-560 receiver/cassette player conforms to European (DIN) mounting standards and is easily installed in most European cars. American and Japanese cars use a somewhat different cutout, for which Proton supplies an accurate template. Like so many modern car stereo units, this one slides into an installation case which is first mounted in the dashboard, enabling you to easily remove the receiver to prevent theft. A multi-pin connector carries the speaker output, power leads, and the remote lead.

The CR-560 provides standard output jacks for connection to a more powerful stereo amplifier, if needed. There are also input jacks for connection of a CD player or any other program source. If you own a portable CD player, it can be connected via a mini-jack on the front panel. Since this receiver is basically a stereo unit with only left and right speaker output leads, the preamp output jacks may be used to feed external amplifiers for driving rear-mounted full-range speakers.



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For strong signals, S/N measured 70 dB in mono and 66 dB in stereo, both considerably better than Proton's published specs.

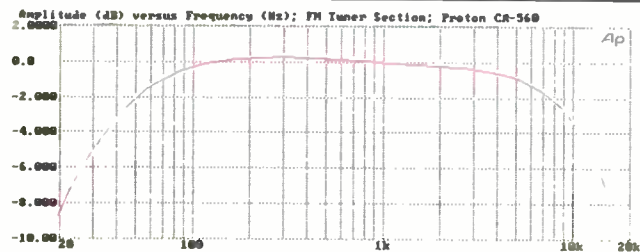


Fig. 1—Frequency response, FM tuner section to amplifier output.

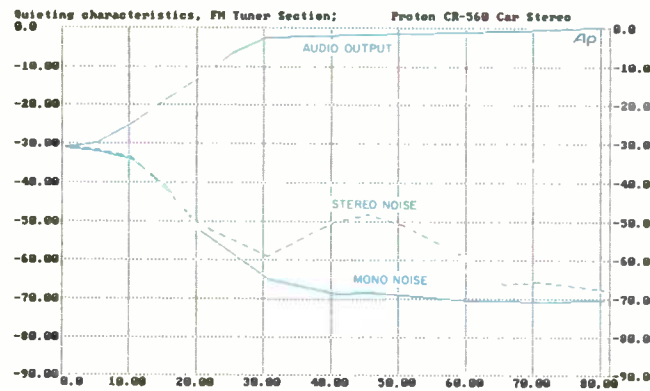


Fig. 2—FM quieting characteristics.

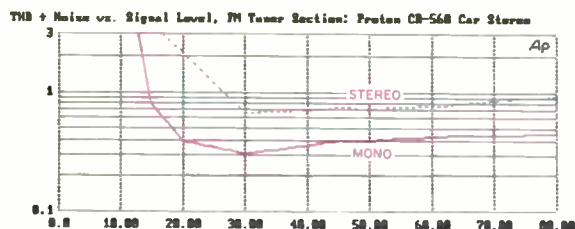


Fig. 3—THD + N vs. signal strength, FM tuner section.

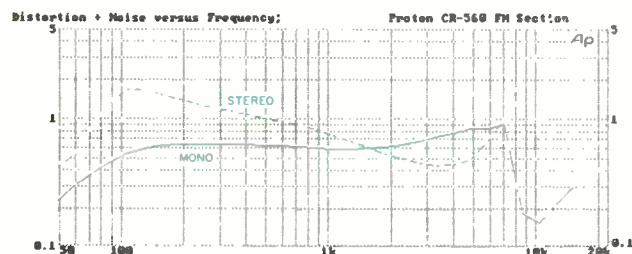


Fig. 4—THD + N vs. frequency, FM tuner section.

Control Layout

A description of the front panel layout will also illustrate some of this head unit's features. Power is applied to the receiver when the volume control, located at the panel's lower left, is turned clockwise. Pulling out the volume knob operates the balance control. A rotating tab operates the fader, which is concentrically mounted with the volume/balance control. The fader adjusts the relative output between the front and rear outputs. Both amplified (speaker-level) and preamp-level outputs are provided for the front channels, but only preamp-level outputs are provided for the rear.

Above these concentric knobs are smaller bass and treble controls, which can be pressed into the Proton's front panel once any necessary adjustments are made, so they won't be moved inadvertently.

An LCD area at the center of the panel shows time, tuner frequency, tape direction, and most operating modes. When the unit is turned off or a tape is playing, the time is displayed. When the radio is used, the frequency is shown for 5 S each time a new frequency is selected, then the display reverts to the time. A switch labelled "C/F" (clock/frequency) lets you display the tuned-to frequency at any time for 5 S. The cassette insertion slot is above the display area. To its left is the eject button, and to its right are fast-forward and rewind buttons. A tuner "Seek" and "Scan" rocker is to the left of the display; to its right is a rocker for manual up and down tuning.

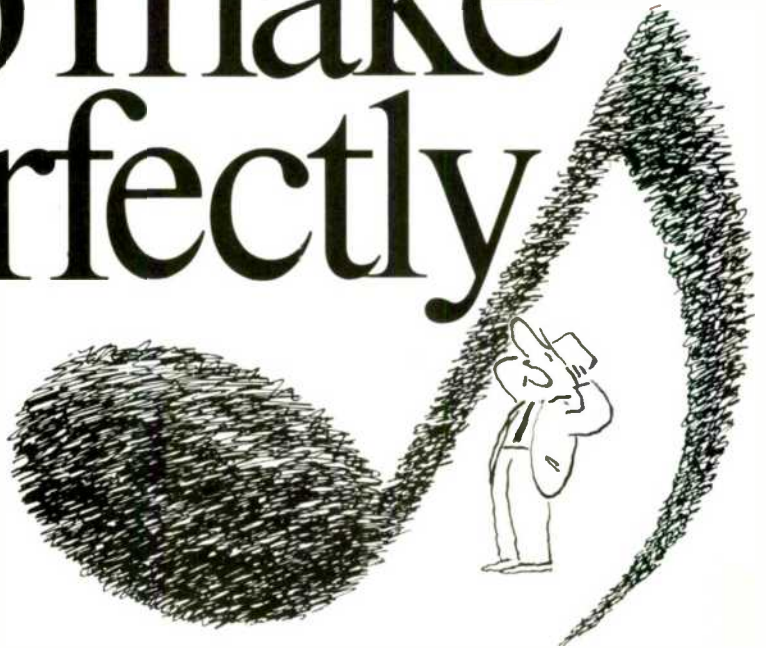
Six preset buttons are beneath the display area, as is a memory button used to store frequencies in those preset numbered locations. A "Band" switch cycles through one AM and two FM bands, so the total number of presets that can be stored is 18—six each for the two FM band settings and six more for the AM band. There are four ways to tune the radio section: Manually, using "Seek" or "Scan," and using the preset buttons. On the right of the front panel are an "APS" (automatic program search) button for finding succeeding sections on a tape, a loudness control button, a button that attenuates the r.f. input in case incoming signals are strong enough to overload the unit, the band switch (for selecting FM1, FM2, or AM), the clock/frequency switch, and a dual-purpose switch that selects mono or stereo during radio reception or Dolby B noise reduction when playing a tape. Finally, at the lower right corner of the panel is the mini-jack for external connection of a portable CD player or other signal source, plus a button that selects this alternative signal input.

As I'm sure Technical Editor Ivan Berger will agree, the number of controls is certainly adequate, but some of the labels are so difficult to read that a driver not totally familiar with the panel layout will have a difficult time operating this unit while driving. Some control designations are actually embossed black letters on a black background. Further, some of the buttons are so close to each other and so small that many may find it difficult to hit the right one—especially when driving.

Measurements

Figure 1 shows the frequency response of the FM tuner section, as measured at the amplifier outputs with 4-ohm

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—Lewis Lipnick, *Stereophile*, Vol. 11 No. 4, April 1988.

Recommended accessory in *Stereophile*, Vol. 12 No. 4, April 1989.

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The ACE-515 also protects your valuable equipment from harmful high-voltage spikes and surges. And, its sequential turn-on/turn-off control circuit guards your speakers from disturbing, damaging thumps.

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"Electronic equipment (especially digital audio gear) is vulnerable to both annoying and catastrophic power-line problems. Your stereo gear should have line spike and surge protection, with hash filters thrown in too. Line protection—you can pay a little for it now, or you can pay a lot for it later."

—Ken Fohlman, *AUDIO*, November 1987.

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details you can hear

Playback response extended from about 60 Hz to 17 kHz with Type I tape—excellent for a car unit—and had the same limits with Type II.

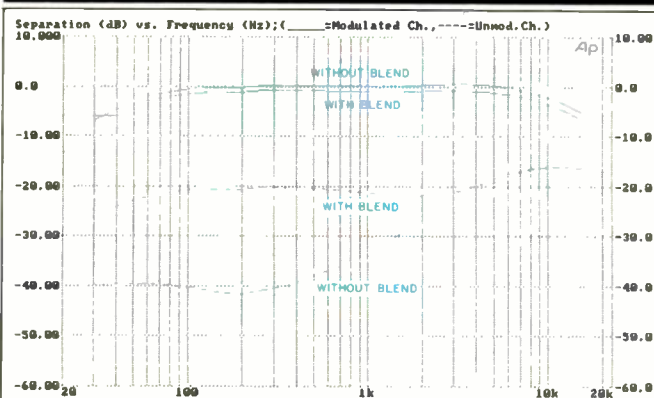


Fig. 5—Frequency response and stereo separation, FM tuner section; see text.

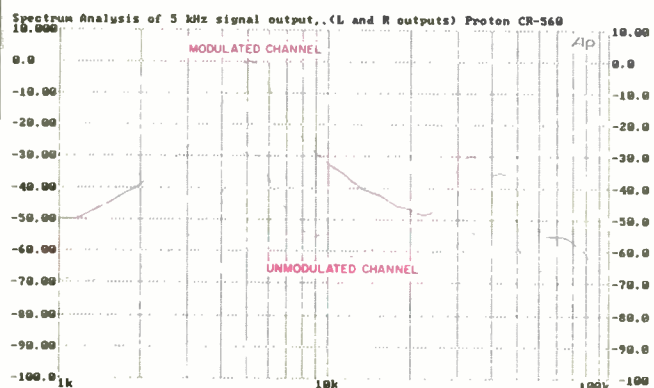


Fig. 6—Separation and crosstalk components for a 5-kHz modulating signal.

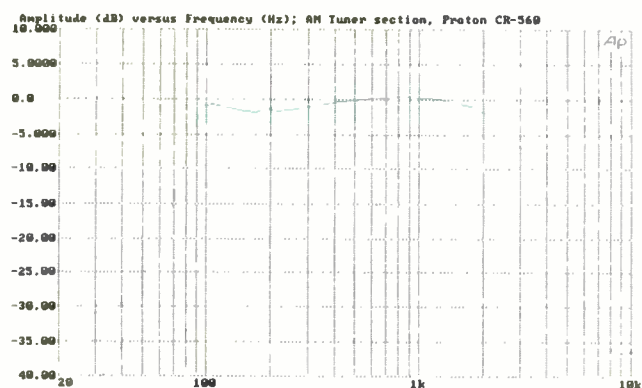


Fig. 7—AM frequency response.

loads. Response was down 3 dB at 42 Hz and at 9.5 kHz. At 15 kHz, the upper end of the FM frequency range, response was off by a full 7 dB. As I learned later, this rather poor response is caused by the amplifier section of the receiver and not by the tuner circuitry itself.

Figure 2 shows the mono and stereo quieting characteristics of the FM tuner section. Mono 50-dB quieting sensitivity measured 18 dBf. For stereo, actual 50-dB quieting required an input signal of 48 dBf. Best S/N ratio with strong signals measured exactly 70 dB in mono and 66 dB in stereo. Both figures are considerably better than Proton's published claims.

On the other hand, as shown in Fig. 3, mono usable sensitivity was a bit disappointing. The 3% combined THD + N level that defines usable sensitivity was reached with the signal strength adjusted to 13 dBf. In stereo, usable sensitivity was reached for inputs of 17 dBf. Distortion at strong signal levels was 0.45% in mono and 0.9% in stereo for a 1-kHz test signal.

Figure 4 shows how THD + N varied with frequency for strong received signals. At 100 Hz, mono THD + N measured 0.54%, while in stereo, THD + N at that frequency was 1.7%. At 6 kHz, the other test frequency that must be measured and reported to conform to EIA measurement standards for FM tuners, mono THD measured nearly 0.9%, while in stereo, THD + N was actually a bit lower, or 0.72%.

Stereo separation was measured both for strong signal levels and at 45 dBf, in order to show the blending action of the stereo decoder circuitry in the presence of weaker signals (Fig. 5). For strong signals, separation measured 33 dB at 1 kHz, just about 40 dB at 100 Hz, and about 15 dB at 10 kHz. When signal strength was lowered to 45 dBf, mid-frequency separation decreased to just over 20 dB—a not unexpected result—and separation at 100 Hz became a bit less than 20 dB. At 10 kHz, however, separation was only about 1 dB less than it was for strong signal levels. Normally, the purpose of blending in weak-signal environments is to reduce upper-midrange and high-frequency separation in order to cancel some of the background noise associated with weak-signal stereo reception. The Proton, however, blends its upper frequencies even when signals are strong and reduces separation at the lower frequencies when signals weaken. This would seem to defeat the purpose of blending.

I next increased signal strength to 65 dBf and ran a spectrum analysis of the left and right outputs, with a 5-kHz signal modulating the r.f. generator to 100%. As shown in Fig. 6, the desired output is represented by the 5-kHz peak in the solid curve, while sideband components on either side of the 38-kHz suppressed carrier can be seen and have amplitudes ranging from -30 to -36 dB, relative to 100% modulation. At the output of the unmodulated channel, you can see a rather high level of 19-kHz pilot carrier output, measuring about 48 dB below 100% modulation levels. There is also evidence of crosstalk components at the second and third harmonics of the 5-kHz modulating frequency.

Alternate-channel selectivity for this FM tuner section measured just over 60 dB, AM suppression was 55 dB, and capture ratio measured 2.0 dB.



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FM reception in the suburbs and the country was good, and the controls could be used to improve it further.

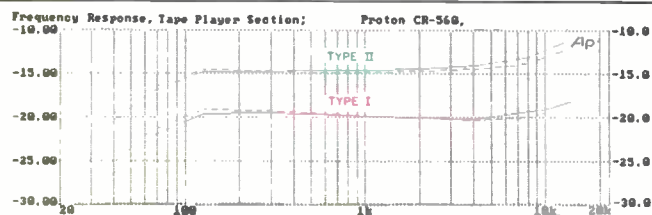


Fig. 8—Frequency response for playback of Type I and II test tapes. Type II display has been moved up 5 dB for clarity.

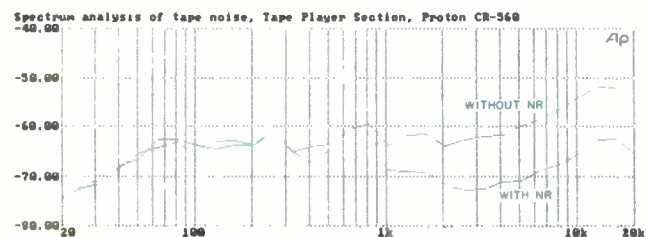


Fig. 9—Spectral distribution of tape noise, with and without Dolby B NR.

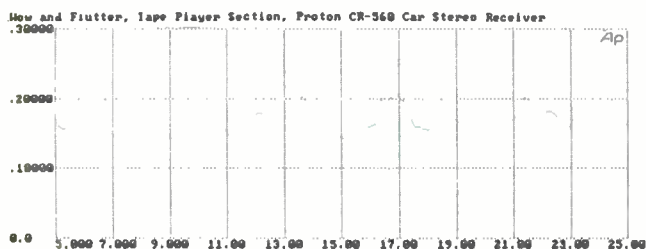


Fig. 10—Wow and flutter, showing measurements from 0 to 5 S; these are integrated into the beginning of the curve. The curve does not explicitly show measurements from 0 to 5 S; these are integrated into the beginning of the curve.

The frequency response of the AM tuner section is shown in Fig. 7. While much of the low-frequency roll-off is actually in the amplifier's response, the AM circuitry also seems to contribute somewhat to this roll-off. A comparison of the response curves of Figs. 1 and 7 with the middle curve (tone controls flat) of Fig. 11 seems to confirm this suspicion. At the high-frequency end of the curve in Fig. 7, response was down 6 dB at just under 3 kHz.

Next, I measured the performance of the cassette section. Using calibrated test tapes supplied by BASF, I obtained the response curves in Fig. 8 for Type I (normal bias) and Type II (high bias) tapes. Output is referenced to a level of 250 nWb/m. The Type I tape response extended from about 60 Hz to 17 kHz, which is an excellent result for a car unit. With Type II tape, the low-frequency response was again down 3 dB at around 60 Hz and 17 kHz, with a slight response peak at about 12 to 13 kHz.

Signal-to-noise ratio for the tape section, using a previously recorded "no signal" Type I tape, measured between 47 and 48 dB without Dolby B noise reduction. With Dolby B NR turned on, S/N improved to around 56 dB. Figure 9, a spectrum analysis of tape noise, shows the effect of using Dolby B NR with this tape player. Finally, wow and flutter was measured over a period of 25 S, and the results were plotted in Fig. 10. Wow and flutter varied between about 0.15% and 0.2% wtd. rms.

Figure 11 shows the maximum boost and cut range of the CR-560's bass and treble controls. The middle curve represents the "flat response" position of the tone controls, as measured at the unit's speaker output terminals. Notice the steep roll-off at the bass end of the spectrum, a roll-off that showed up in the FM and AM response curves shown earlier. Figure 12 depicts the action of the loudness control at various volume settings from maximum (0 dB) to -40 dB.

Signal-to-noise ratio for the amplifier section, with signals applied to the CD input, measured between 72 and 75 dB (depending upon the channel measured) with respect to 1 watt output. Figure 13 shows how distortion varied with power output for test signals at 100 Hz, 1 kHz, and 10 kHz. At the two higher frequencies, maximum power output for 8% THD was about 14 watts per channel. With 100-Hz test signals, THD was very high at all power levels, exceeding 10% at any level above 10 watts per channel.

Listening tests in a home environment really mean very little when it comes to car audio components, so Technical Editor Ivan Berger took this head unit on the road for his usual hands-on evaluation. I'll let him give you his impressions of the Proton CR-560.

Leonard Feldman

Behind the Wheel

When you're first using a car stereo unit, you depend on your sight to show you which controls are which. As you get used to it, you depend more on touch and keep your eyes on the road. This makes the Proton CR-560 hard to use at first but reasonably easy to operate once you've learned it: Its black-on-black control markings, dim display, and tiny button legends make it tough to tell by sight which controls do what, but the major controls' shapes and positions are easily distinguished by feel. Still, I spent more time with this unit's instructions than I usually need to.



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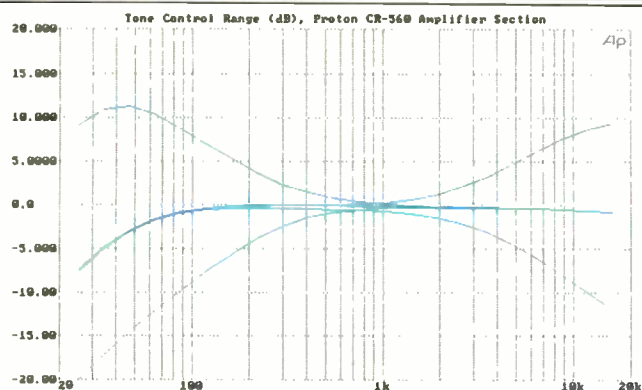


Fig. 11—Bass and treble control range; see text.

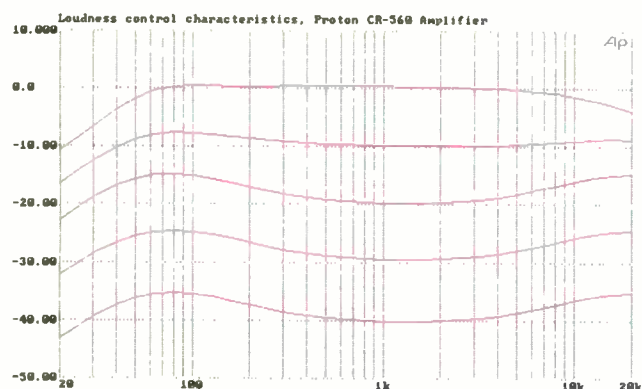


Fig. 12—Loudness compensation curves for volume control settings from 0 to -40 dB.

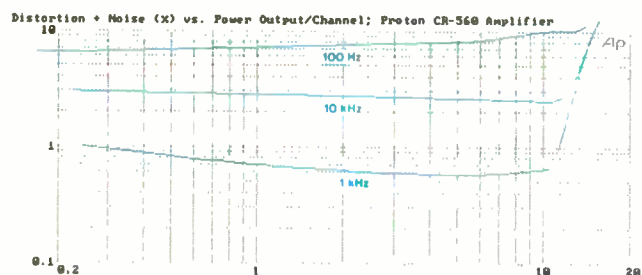


Fig. 13—THD + N vs. amplifier power output per channel, for 4-ohm loads.

Once learned, though, the arrangement is quite logical: Audio knobs on the left, radio controls on three sides of the dial, and tape controls flanking the tape slot. The minor controls at the far right are the only ones that are really hard to learn. I liked having the CD input selector—which can double as a muting switch when no CD player is plugged in—next to the CD input but would have liked it better had there been a warning light to show when it was engaged. Having to press the "C/F" button to have the display show what station was tuned in instead of the time made me unhappy. However, it wouldn't bother someone who listens to the same few stations nearly all the time and would please anyone whose car lacks a functioning clock. (Proton might have provided a switch to be set at the installation time that would select either time or station as the default display.)

The display was very low in contrast and brightness. By night, only the station frequency and time were easy to read, and in daylight, even those were difficult. I couldn't read minor indications such as tape direction, Dolby NR, stereo, mono, and the frequency band; they could only be distinguished by position. This is a common problem (even on my reference Soundstream), but it's more difficult with the Proton's low display contrast. Tall drivers can't see the top of the display because of it being so deeply recessed that the tops of numbers are cut off—I couldn't distinguish between 93.1 and 93.7.

With seven buttons in one row along the bottom, finding preset stations without looking is difficult, which is a pity since there are plenty of preset memories. I wound up using "Seek" and "Scan" when I was driving; they're both on a handy rocker at the driver's end of the display. The manual up/down tuning rocker at the display's other end was helpful when I accidentally scanned past a station I liked (5 S per station didn't give me enough time to make decisions, especially when driving). The CR-560 tunes in half-channel, 0.1-MHz steps instead of the usual 0.2-MHz, full-channel ones, which I prefer. While too small a jump for easy tuning, that's too big a jump for deliberate detuning to avoid strong-signal interference.

In the suburbs and the country, FM reception was good. In Bloomfield, Conn., for example, the Proton pulled in most stations about as well as, or only very slightly worse than, my reference set. It also pulled in three stations noticeably better than my reference, but the reference was considerably better on four stations. Both sets received 24 stations that were more or less listenable.

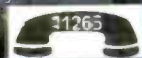
The Proton's controls can be used to work around its performance limitations. While WFCR in Amherst, about 30 miles away, was noisier on the Proton than on the reference set, switching the Proton to mono (which isn't possible on my Soundstream) made the Proton the quieter of the two. This is even more true—and more necessary—in urban areas. At my favorite "multipath corner" on New York's Upper West Side, a quick check showed that the Soundstream received four of my six preset stations noticeably better than the Proton, while the Proton did a better job on two of the six. Switching to mono improved performance on four of the six, and switching to local tuner mode, which attenuates incoming r.f. signals, improved three of the six without reducing them to mono. So if you're willing to work



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All in all, the Proton's performance was creditable on cassette and more than acceptable on radio.

the buttons, you can get some pretty good urban FM performance.

The Proton's sound on FM was a bit less warm than the reference unit's, which made the CR-560 seem clearer on some programs but thinner on others. I found the reference set's sound more likable, but I can't say for sure that it's more accurate.

On AM, neither the Proton nor my reference unit were that great. The Proton's limited frequency response gives it a warmer tone and takes the edge off static, but there's still too much buzz with the engine running. On some stations, the Proton gets more birdies but less static, for a slight net improvement over the reference unit. Setting the local/distant switch to "Lo" either fades the signal out or clarifies it slightly, apparently depending on signal strength.

Inserting and ejecting cassettes took more effort than I like, but it was about what I'd expect in this low price range. You can't turn on the tape section without turning on the tuner, so you'll hear some radio sound when you eject a tape. Luckily, Proton did not make the radio much louder than the tape, so you won't be blasted. There's no key-off eject, which would worry me if I lived in a hot climate; cassettes that warp in the sun are hard to remove from a stereo. The tape transport lacks logic circuits, so you must keep track of the tape's actual direction of play to figure out

which fast-wind button will rewind the tape and which will fast forward it. That's common on moderately priced units such as this, but because the tape-direction display is so hard to read, it made the unit difficult for me to use.

When playing Oscar Peterson's "You Look Good to Me" (dubbed from *We Get Requests*, Verve 8100047-2), the drums had good snap, but the cymbals sounded a bit tinny, with less clarity and warmth than on my reference unit. On an aria sung by Elly Ameling, the reference set put a slight edge on her voice but also a faint, warm bloom; with the Proton, the edge moved down, becoming a slight bulge in the midrange notes. On Telarc's *Ein Straussfest* cassette (CS-30098), the Proton had a bit less sparkle than my reference set, with some slight breakup on the loud passages of "Explosions Polka." On the other hand, with the cassette of *La Bohème* (London 417335-4), the Proton gave Renata Tebaldi's voice more air and breathiness and made her sound somehow more soprano-like. I heard some sporadic flutter on potholes, but none on ordinary roads.

All in all, I found cassette performance to be creditable and radio performance to be more than acceptable but less than endearing. The ergonomics—especially those of the display—are not as good as those on Proton's best units, but they are acceptable considering the \$370 price level of the CR-560.

Ivan Berger

"The M-200 power amplifier is a smashing success by any standard, and an absolute steal at the price."

Kent Bransford

Hi-Fi Heretic, Autumn 1989

Highlights of the review:

Over the years, B & K Components, Ltd. has become one of America's leading manufacturers of affordable, high-quality audio electronics. B & K has done an admirable job of providing musical, reliable preamplifiers and power amplifiers within the budget of virtually any music lover.

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"I was floored by the M-200's sense of pace and drive."

Internal construction is most impressive—a massive, shielded toroidal transformer centrally sited within the steel chassis. Four filter capacitors offer nearly 70,000 mfd of

storage capacitance. The input and driver circuits are carried on a single glassfibre board that sits atop the power supply caps. A gold-plated premium input jack is included, with gold-plated 5-way binding posts handling speaker cable connection.

"I was bowled over by its combination of smoothness (a B & K hallmark) and detail."

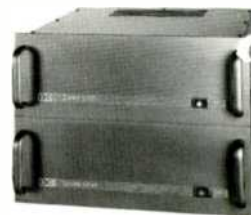
All too often extremely powerful amps excel on bombastic symphony works, but fall down when it comes to conveying the subtlety and nuance of "smaller" music. The M-200 proved to be a glorious exception. Yes, the massed brass and great whomping bass drum shots in "Uranus, the Magician" were appropriately startling, but equally satisfying were the quiet flute and violin passages. Delicate instrumental shadings and nuances that are so important in communicating the emotion of the music were never glossed over or homogenized. The M-200 had that essential

ability to draw me further and further into the music, rather than hurling it in my face. Equally impressive was the M-200's soundstage width and depth.

While offering the tonal naturalness that characterizes all B & K products, the M-200 goes far beyond previous B & K amps in its outstanding bass quickness and definition, as well as its excellent retrieval of low-level detail and recording acoustic.

The M-200 power amplifier is a smashing success by any standard, and an absolute steal at the price.

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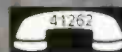
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LIRPA LABS VCDRS CD PLAYER

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The VCDRS is similar in concept to Prof. I. Lirpa's most-imitated design, his VDRS (Vehicular Disc Reproduction System) for LP records (*Audio*, April 1978). While this is still one of the company's best sellers, its rate of sales is declining, leading Prof. Lirpa to update the design for the age of the Compact Disc. (As he quaintly put it: "I could read the graffiti on the wall.") The performance of the VCDRS, as usual with the products of Lirpa Labs, is enough to make seasoned listeners gasp. (Or groan, as the case may be.—E.P.)

As with the earlier model, the VCDRS scans a stationary disc, eliminating the vibration problems which affect systems having moving discs. The scanning device (originally a bus-oriented design, but revised for faster lap times) tracks the disc, transmitting the data it reads to external electronics. Several changes from the earlier design were, however, necessary.

In ordinary players, the CD rotates clockwise relative to the listener but counterclockwise relative to the laser optical system below the disc. This means the VCDRS scanner must circle the disc clockwise, the opposite of LP practice. Also, the rotational speed for CD play is variable, and considerably faster than the constant $33\frac{1}{3}$ rpm of the LP. The scanner must make 500 laps per minute (LPM) at the innermost tracks, where the recording begins, gradually slowing to 200 LPM at the periphery. The increase in LPM for the CD version vastly increases the centrifugal force on the scanner. Miniaturization reduces the scanner's mass, reducing the effects of this force somewhat. However, since the CD's ungrooved surface provides little traction, more complex tracking control systems were developed for the VCDRS (Fig. 1).

The first of these systems is a central capstan to which the scanner is teth-



ered by fine wires. Each lap around the disc unwinds the wire, letting the scanner read the farther tracks. This provides only gross tracking control; fine control is implemented by extremely small capstan rotations (usually fractions of a degree) which shorten or lengthen the wire tether just enough to position the scanner directly over the track. The scanner's own steering gear then provides ultra-fine course corrections, on the spot. The servo motor that twists the capstan for fine tracking control also rewinds the tether at the completion of play (or under manual con-



trol—this is the first CD player with a rewind button). Track advance is accomplished by a rapid unspooling of the capstan; the servo motor hauls the tether back in to return the scanner to earlier tracks.

Enthusiastic owners of the LP version (whose crayoned letters cram Lirpa's files) especially enjoyed being able to read the stationary disc's label during play. This cannot easily be done with the version for CD, as a CD's label and playing surfaces are on opposite sides; an optional stand is offered, which eliminates this problem. The stand (Fig. 2) raises the disc so that an angled mirror (A) can reflect the disc's label information. Since this mirror reverses the image of the label, making it difficult to read, the image must be viewed via a second mirror (B). The latter can be adjusted to reflect upward or to the front of the stand, whichever the user desires.

The front panel resembles that of a conventional CD player, minus the disc drawer, with an antenna added for communication with the disc scanner. Audiophiles still searching for the perfect interconnect wire will appreciate the advantages of this wireless system.

Recognizing that the tide is shifting from 18-, 20-, and even 22-bit D/A converters to 1-bit systems, Lirpa Labs

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TOTAL SONIC INTEGRITY All Luxman receivers incorporate massive power supplies to deliver high dynamic power. In fact, the R-117 measures over **700 watts** of dynamic power per channel (2 ohms) to ensure distortion-free transients. The pre-amplifier section of all Luxman receivers combine several proprietary Luxman circuit designs to optimize sonic accuracy, and the AM/FM stereo tuners are sonically the finest in the world. In all, Luxman receivers provide the purity and musical warmth of the original source, plus the high dynamic power output necessary to ensure total sonic integrity at all volume levels.

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It was surprising to hear rumble from a CD player, but some attention to the tires and the suspension should cure this.

Fig. 1—Tracking control system. Servo motor used for fine tracking corrections is also used for rewind; see text.

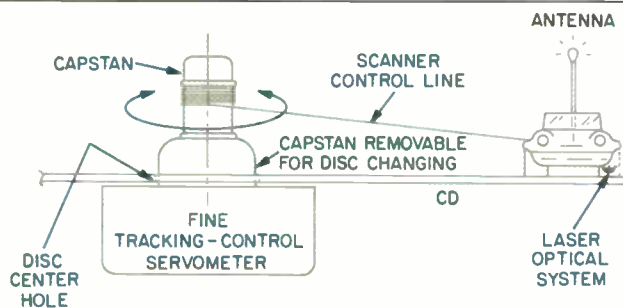


Fig. 2—With this optional stand, listeners can read the CD's label during play, a Lirpa exclusive.

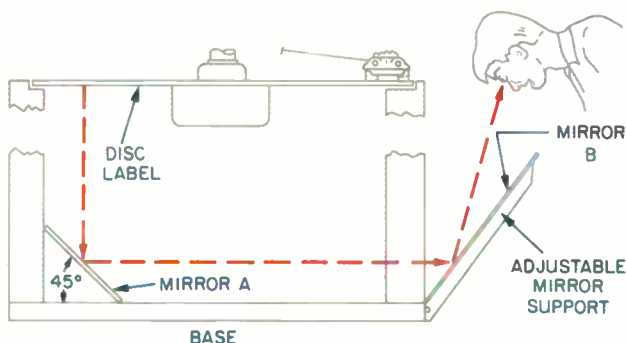


Fig. 3—THD + N vs. frequency; see text.

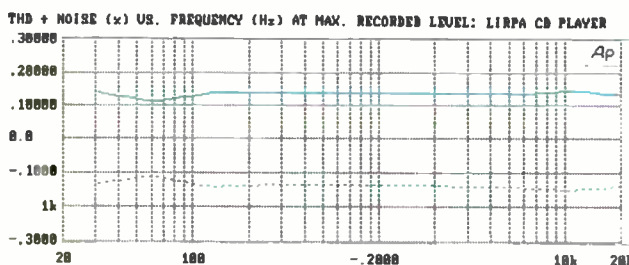
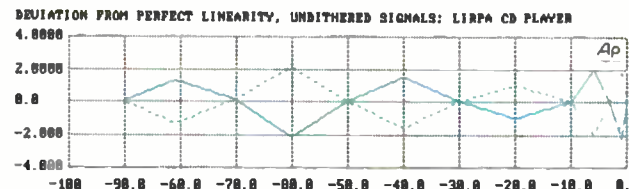


Fig. 4—Deviation from linearity, using unditherable signals.



has jumped in front of the train of events with a 0.01-bit system. "My system has the precision of a calibrated eyedropper in comparison to the ungainly bit buckets used by others," Prof. Lirpa says, "which is why I call it the Bitdropper."

One's appreciation of the resultant sound quality pales in comparison to the massive quantity of technical inno-

vation involved, but let us soldier on. Listening to the VCDRS opened my ears to what CD sound could and should be, in a way no conventional player has ever done for me.

The complaints that analog fans make about conventional CD players most emphatically do not apply to the Lirpa system. There were no excessive highs, though this may have something

to do with the brief, 15-kHz tone burst at 110 dB which the VCDRS emits when first turned on. This, Prof. Lirpa says, serves to warm up the tweeters and, indeed, mine were smoking. Musical notes that faded out to silence did not end abruptly but wafted into an airy glow of "analog dither," resembling the natural background hiss we all remember from analog tape masters. Imaging was not as specific as some listeners may like, but to my mind, this was more than made up for by the glorious sense of spaciousness.

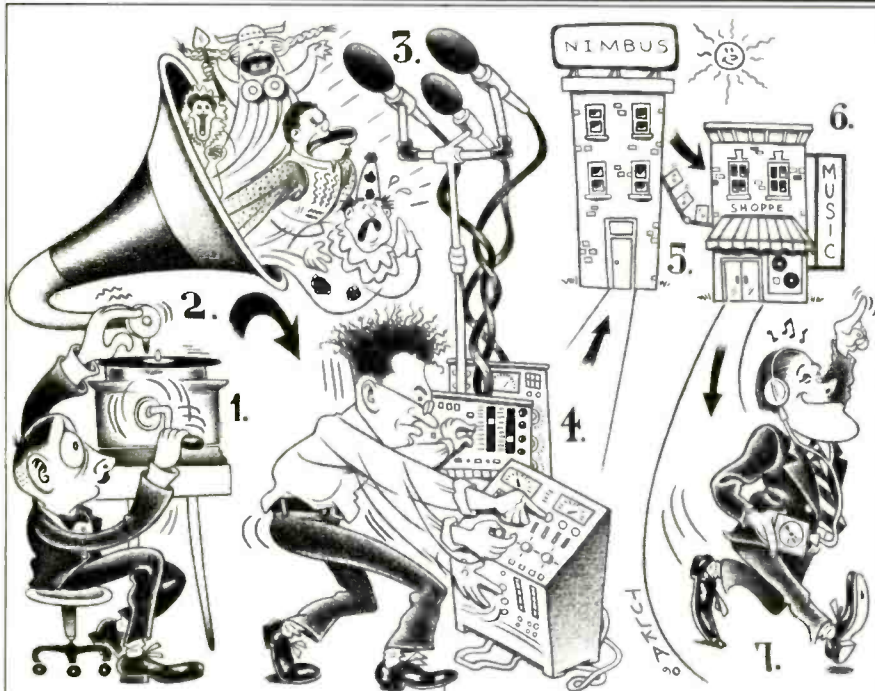
The player's Interchannel Asymmetry System (IAS) may have contributed to this. Since it is impossible to build truly perfect circuitry, Lirpa has ensured that any imperfection in one channel be matched with a precisely equal and opposite imperfection in the other. This can be seen in the graphs of THD + N versus frequency (Fig. 3) and deviation from linearity (Fig. 4); the latter echoes, on a smaller scale, the frequency response measurements. With IAS, all errors cancel out when the signal is switched to mono. According to Prof. Lirpa, IAS is included because monophonic program material usually comes from older sources, "which have problems of their own, and need all the help they can get." This information, by the way, comes from a brochure I found in the Lirpa display at my neighborhood A & P, as can be clearly seen from the logo in the upper right corner of each graph.

There were some minor problems, however. The early production sample I auditioned did have surprising rumble for a CD player, but Lirpa has traced the problem to poor tread and suspension design and claims to have solved the problem in current production samples. Pending a factory recall, VCDRS owners can reduce the problem somewhat by adjusting tire pressure. Like many imports, the Lirpa was not completely compatible with Motown offerings, though it took The Beach Boys' "Little Deuce Coupe" in stride and seemed very much at home with The Cars.

With the VCDRS, Prof. I. Lirpa once more exhibits the audacity which has caught the attention of audiophiles and law-enforcement systems around the world. Beyond question, Lirpa has done it again!

Regreb Navi

ENCORE! ENCORE!



Great Singers: 1909-1938.
Nimbus NI-7801, CD; ADD; 75:12.

Divas: 1906-1935.
Nimbus NI-7802, CD; ADD; 77:02.

Enrico Caruso.
Nimbus NI-7803, CD; ADD; 75:02.

Giovanni Martinelli, 1885-1969.
Nimbus NI-7804, CD; ADD; 76:32.

Rosa Ponselle, 1897-1981.
Nimbus NI-7805, CD; ADD; 76:42.

If you can't stand listening to music through a slight veil of scratches and other imperfections of earlier sonic eras, please skip this review. If, on the other hand, you accept the fact that it's impossible to separate this art from its originally limited, unsophisticated medium, and you assert, as I do, that this is a very small price to pay for being able to listen to sounds and inspiration from almost a century ago, then by all means read on.

What if someone came up with a supremely simple means of heaving a lot of the old noise and horn resonances right out the window without compromising the rather startling realism many early 78-rpm discs have? It has happened, thank heavens. Nimbus Records' Natural Ambisonic Transfer System, to give its slightly pretentious name, is about as uncompli-

cated as it's possible to get. We are dealing with modern digital recordings of "performances" by a fine old phonograph in a room with good acoustics. In view of Nimbus' decision to effect as natural a transfer as possible, some very simple but radical steps were taken. Let me describe those steps in the order in which they occur before any consideration of the musical artistry of Galli-Curci, Lehman, Ponselle, Caruso, Martinelli, Tetrizzini, McCormack, Melba, Muzio, Tauber, Patti, and others.

The most expensive and time-consuming part of this whole process starts with record collector and 78-rpm archivist Norman White, who is collaborating closely with Nimbus on this, the Prima Voce series of transfers of historic vocal recordings. Not only does White haul discs from his own encyclopedic collection, but he and Nimbus producer Adrian Farmer scour city, town, and shire in their search for common and rare recordings that are unplayed or nearly so. (This is no simple task, considering the justly earned reputation for curmudgeonliness and eccentricity some members of the 78 community have.)

Once the best pressing is selected, it is placed atop a modern turntable with variable speed (78 rpm was not much more than a nominal standard,

by a good long shot). Down comes the needle, out comes the sound—but what a needle and what sound!

As many readers already know, Wales-based Nimbus has been doing some of its more intimate recording at home—home being a marvelous English country house 25 miles, as the curlew flies, north of Bristol and the Severn estuary. The large music room there enjoys live, pretty acoustics of an almost uncolored quality. Within this light and airy room stands . . . an anachronism. On a judiciously chosen spot, away from room-reverberation nodes, there rests a great, whopping, varnished papier-mâché horn, its case, and its acoustic pickup. Yes, *acoustic!* The horn is as unlovely as a post-war Humber limo and happens to be the best-sounding acoustic horn anyone has devised. It's the "Ginn Hand-Made Gramophone," the "Expert" Model of 1930 or so; it cost a great deal back then and continues to be an expensive collector's item today. As the original promotional blurb states, it "will live (without any alterations) just as long as Musicians and Music Lovers have a Critical Ear."

The needle used acts as an astonishingly effective *mechanical* noise filter. The six-decade-old Ginn, an audio dinosaur (a *shellacosaurus?*), makes use of a hard thorn—not a steel needle or cantilevered gemstone—culled from stumpy blackthorn trees in southern Africa. The thorn is sufficiently hard to serve as a rigid stylus and limber enough to soften the sudden transient impulses of nonmusical information in and around the dancing 78 grooves. As with an oboist's reed, the quality of each thorn will affect the resulting sound startlingly, so experimentation is necessary. Further, as Adrian Farmer wryly notes, each thorn is good for just one playing, and some especially rambunctious cuts require three needles during their course. (Digital editing subsequently assembles such incomplete "takes" seamlessly.)

Such "thorny" problems aside, once the playback speed has been chosen and the needle selected, the horn and stylus coax the sounds—surprisingly vivid, quiet, and imbued with life—from the ancient grooves.

Just off-center from the horn and close enough to capture presence is

Illustration: Rick Tulka

UNIVERSAL APPEAL...



Deborah Henson-Conant
"Caught In The Act"

Rippingtons
"Kilimanjaro"

Don Grusin
"Raven"

Patti Austin
"Love Is Gonna Getcha"

Eddie Daniels
"Nepenthe"

Kevin Eubanks
"Promise Of Tomorrow"



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Rather than try to further polish the reputations of Muzio, Ponselle, and the rest, let's just say these are stunning performances.

poised a single-point three-mike array of the type Nimbus employs in all its recordings (see "Spectrum," in the February issue). The room sound provides a lovely, natural ambience—and in stereo. And because even a very good acoustic horn is not perfect, the mono source appears to have more

softness, depth, and directional character than one would expect.

The use of actual room acoustics and stereo has already been subject to some contention in the British press. Cries of "not faithful to the original," "tampering," and so forth will doubtless continue to be uttered, but so will

sighs of appreciation. Compared to any of the electric transfers I have heard, this is very real, relatively scratch-free, transparent sound.

Caruso recorded right at the start of flat-disc development, so his can be some of the rawest sound. But here, allowing for such artifacts of surface noise and horn resonance as do come through the "Expert" horn, his sound is vital and true. The subtle support of the slight reverberance of Nimbus' quiet, neutral music room effectively dispels the cramped boxiness of the wretched studio sonics on the original discs. In short: It works, and well.

One does not hear Nellie Melba or Giuseppe Martinelli in stereo. This is not that awful travesty called rechanneling. Only the live acoustics are in modern audio perspective. The marriage of the old and the new audio is seamlessly done with exceptional taste. The results are musical, listenable, real—something I'll wager you have not come close to unless you own a Ginn machine or a good approximation of the same—and the CDs are generous, all over 75 minutes.

Others have commented more eloquently on the music-making of Tauber, Muzio, Ponselle, and the rest, so I will not try to further polish their magnificent reputations. Suffice it to say that these are stunning performances, often of a startlingly informal and theatrically communicative nature. Nimbus serves them out of the Ginn horn in unprocessed, naturally ambient form. You have a considerable treat in store if you choose to acquire any or all of these moderately priced acoustic transfers. *Christopher Greenleaf*

Tchaikovsky: The Seasons; Chopin: Ballade No. 3; Kymlicka: Four Valses. Antonin Kubalek, piano. **Dorian DOR-90102**, CD; DDD; 55:50.

My first listening priority in this disc was the hall: A reported gem, recently rediscovered, that occupies the top five floors of the Troy Savings Bank in Troy, N.Y., where this recording was made in December 1986. Although it is within concert-going distance of my home, I have yet to get down there. And on the basis of this recording, it does sound excellent—mellow but alive.

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The Berlin winds have been, arguably, the act to beat in this repertoire for two generations, and they play superbly on this Orfeo CD.

I hope Mr. Kubalek can forgive my priority. He is an excellent pianist (again, on the basis of this one recording) and deserves better. He also deserves better repertory than he affords himself here. The rather obscure Tchaikovsky suite (which might more aptly be called "The Months") is interesting but not especially fine. The Chopin is fine, but it doesn't make a very good companion piece for the Tchaikovsky. The waltzes by Milan Kymlicka—a fellow student of Kubalek's at the Prague Conservatory and, as it turned out, a fellow emigré—make better companions for the Tchaikovsky but, as miniatures, don't seem all that comfortable with the Chopin. I actually enjoyed them more than anything on the disc.

But the point is, this recording's contents are merely miscellaneous; they don't make a whole that can be played continuously and yield a satisfactory ensemble. Perhaps there is no reason they should do so. Perhaps the CD is merely a storage medium, and each listener should assume the role of programmer. I happen to think otherwise.

Robert Long

winds: Just a hair too reverberant to let you savor the chamber group in all its transparency. It comes off sounding more like a chamber orchestra. Offsetting these relatively minor cavils, two rare adagios for winds are included as makeweights. The one in B Flat, variously identified as K. 411 or K. 484a, is

played by two clarinets and three basset horns. The unfinished F Major Adagio, K. Anh. 94 or K. 580a, as completed by Marius Flothuis, is played by clarinet and three basset horns. Neither is in the same class as the serenade, but they're nice to have.

Robert Long

Mozart: "Gran Partita," K. 361. Winds of the Berlin Philharmonic Orchestra. Orfeo C-188891-A, CD; DDD; 61:51.

It used to be called the "Serenade for 13 Wind Instruments." Though the 13th is usually played (as it is here) on a string bass instead of a contrabassoon, the term is more apt than "Gran Partita," which is written in another hand on Mozart's score. Under whatever name, it's a justly beloved piece, a miracle of delicious inventiveness.

The Berlin winds have been, arguably, the act to beat in this repertoire for two generations, and they play superbly here. Occasionally, they are a little too slick, perhaps, at the expense of the melting loveliness that is the hallmark of their finest hours. The theme-and-variations movement, in particular, suffers from some touches of almost affected rubato—evidently attempting to break stride with the deliberate tread of the tempo (a true andante, as marked, rather than the traditional, slightly brisker gait).

The sound, too, is slightly less ingratiating than I'm used to with the Berlin

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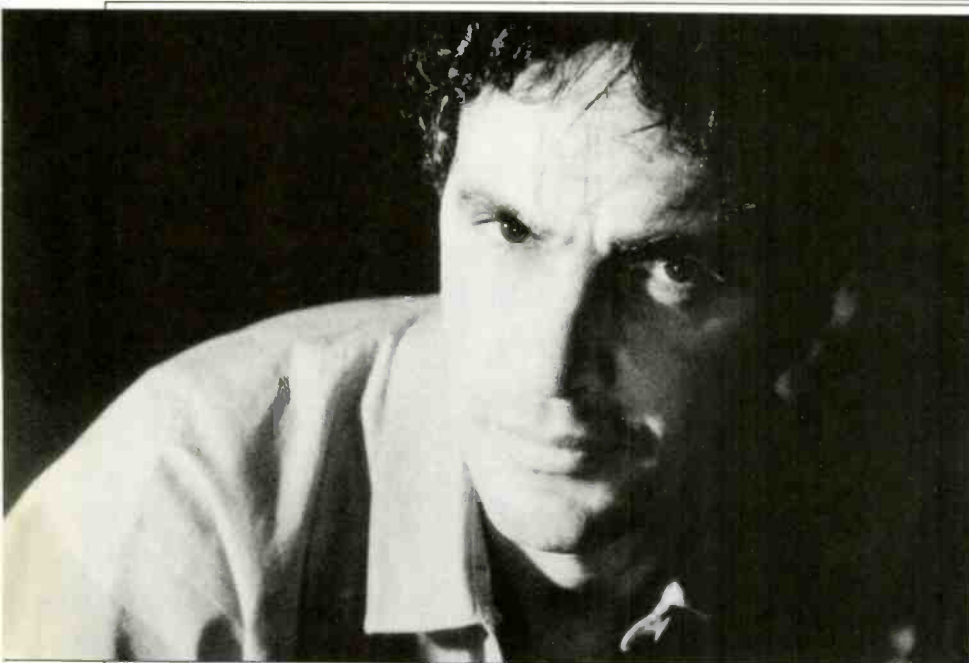
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SURREAL THING



Estrangeiro: Caetano Veloso
Elektra/Musician, CD; ADD; 39:16

Sound: B- Performance: B

The music press is filled these days with news and reviews of Brazilian doings. This is a result of pop music celebs "discovering" Brazilian artists and then, in their own vain manner, enlightening the rest of us as to what's hip. No sense in complaining, I suppose—if not for these savior-celebs, music from abroad might never make it here. The truth is, however, music in Brazil is doing quite nicely, thank you.

Brazil is an unusual country, where highly diverse cultures have freely melded to create some of the world's most innovative music. Singer/songwriter Caetano Veloso is one of the people responsible for those innovations. Never afraid to mix styles to see what comes of it, Veloso is credited with helping to create "Tropicalismo," a musical movement that combined American and English technique and instrumentation with traditional Brazilian forms. (The move so angered the repressive Brazilian government of the late '60s that Veloso was actually exiled for nearly four years.) Although he has recorded well over 20 albums, only a few have made it to the U.S. The latest, *Estrangeiro*, showcases Veloso's undefinable style.

Produced by guitarist Arto Lindsay and keyboardist Peter Scherer (who make up the New York avant/punk duo Ambitious Lovers), this album merges the textures of the samba and bossa nova with American rock. "Egad!" you scream, imagining some cloning of Motley Crüe and Astrud Gilberto. Not to worry. The rock instrumentation is supportive—neatly, sometimes surprisingly, tucked away in the arrangements. Traditional Brazilian instruments—acoustic guitar, African drums, Caribbean percussion—take precedence; electric guitars and electronic keyboards and drums generally stay in the background, where they manage to provoke a musical tension. Arto Lindsay (who, incidentally, grew up in Brazil) handles his guitar the way parents handle a newborn—coaxing ugly burps and contented sighs from it. He is certainly responsible for much of the tense juxtaposition of old and new.

Critical to the record's success is that Veloso is not a slave to the electronics. He doesn't use it simply because it's there, nor just to be different; he intelligently combines sounds to underscore or musically restate what he has said lyrically.

Just what that is, however, isn't always easy to comprehend. Caetano Veloso is, first and foremost, a poet, and his words can often be dense,

somewhat inaccessible. His lyrics contain quotes from little-known poets and stream-of-consciousness lines like "I hear the voices/Of two that tell me/In a double sound/Like they've been sampled by a Synclavier/The hour of someone's reeducation has arrived...." You figure it out.

Nine of the 10 songs are in Portuguese. There are translations for each number, but it is difficult to translate such wordplay. Much of its essence lies in the original tongue, so listeners without a working knowledge of Brazil or its language will find it difficult (but not impossible) to nail down a frame of reference.

In *Estrangeiro*, Caetano Veloso gives us a perfect representation of what he is: A progressive poet/musician unafraid to upset musical traditions. Listeners willing to take the time will be well rewarded. Those not so willing will find this album like a blindfold walk in a forest after midnight. Take the time. This ain't no foolin' around.
Hector G. La Torre

Party of One: Nick Lowe
Reprise 26132, LP

Sound: B+ Performance: B-

Somewhere in the universe exists the frat party of the gods. Nick Lowe wants to play there. This is his audition.

It's not a bad one, though it sometimes descends, as party music tends to, into silliness for its own sake. Nick and his merry band play right on that thin line they make you walk when they think you're drunk. The guys teeter and wobble a bit, but mostly they play straight and rousing and occasionally reflectively, tossing out a mixture of electric blues, rockabilly, country rock, and folk rock.

This admirable mixture is, unfortunately, mixed. The bittersweet, electric-folk singalong of "Rocky Road" is obviously and powerfully heartfelt; if I didn't know better, I'd swear the Homestead Act settlers of 1862 sang it while they sawed and nailed their houses and new lives into existence. But then the rockabilly toss-off "Who Was That Man?" comes off almost (were it not for nicely dirty guitar chords) like the kitschy theme song to *Young Johnny Appleseed* or some other, thankfully imaginary, '50s TV show.

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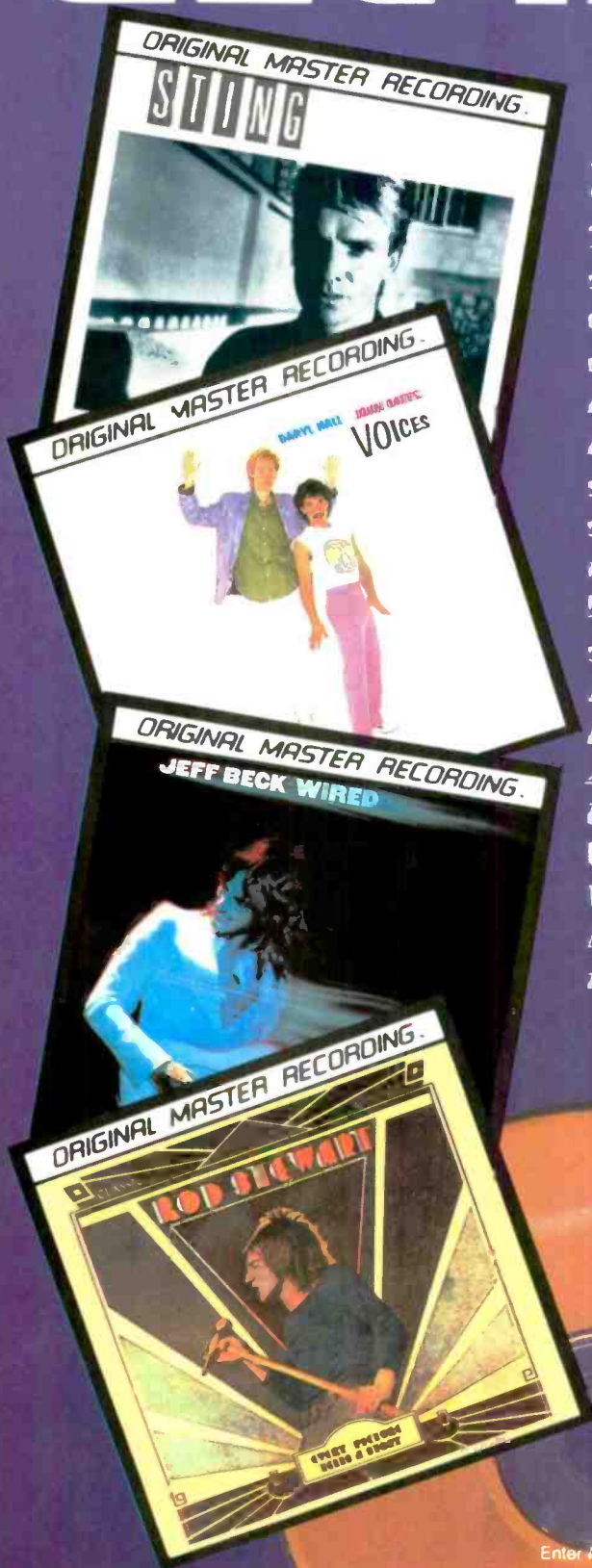
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Somewhere in the universe exists the frat party of the gods. Nick Lowe wants that gig, and here's his audition.



Yet even there, as throughout, Lowe and his band—including Dave Edmunds, Ry Cooder, and Bill Kirchen on guitar and Jim Keltner on drums—are never less than absolutely confident. The bouncing tom-toms of the opener, "You Got the Look I Like," announce the semi-serious mood to follow, and

Lowe delivers what he promises. "All Men Are Liars," "(I Want to Build a) Jumbo Ark," and the urgent "Shting-Shtang," with its irresistible nonsense chorus, are good clean fun. And the slow, timeless lament of "What's Shakin' on the Hill," with its lovely descending guitar runs and half-sad observations on the elusiveness of pop stardom, is a beautiful counterbalance.

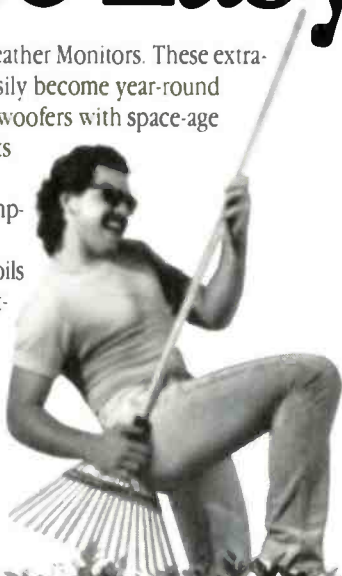
Thankfully, the songs most off the deep end of silly are never offensively so (except "Gai-Gin Man," which, however intended, comes off like a sop to the Japanese record market). But all in all, *Party of One* gives a lot more than just seconds of pleasure.

Frank Lovece

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Think Like a Hero: Alias Ron Kavana **Chiswick 88**, CD; AAD; 54:27. (Available from Chiswick Records, 48-50 Steele Rd., London NW10 7AS, England.)

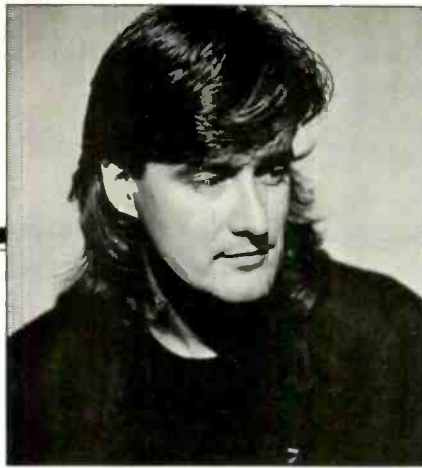
Sound: B Performance: A

If there's a musical melting pot these days, it's in Europe, which is combining international styles into some very tasty new recipes for entertainment. A four-star example can be found on the import disc *Think Like a Hero*, by multi-instrumentalist, writer, and London underground legend Ron Kavana, who performs as Alias Ron Kavana.

Digesting a wild diversity of influences, Kavana's cooked up an exotic Irish stew that's quite compelling: Folk rock for the global village. For example, on the instrumental "Soweto Trembles (The Jo'Burg Jig)," Afrobeat transmogrifies into an Irish jig. In fact, everything here comes out Irish. There's Irish country ("Midnight on the Water"), Irish reggae ("This Is the Night"), Irish calypso ("Gone Shopping"), Irish western à la Marty Robbins ("Felice"), even an Irish spaghetti-western soundtrack ("Four Horsemen"). And, of course, some Irish Irish ("Caoimhneadh Roisin/Tre Ceathar A Hocht"). The highlight is "Rap 'n' Reel," a funky Irish Motown rave-up!

Kavana's music is heavily spiced with American flavors, and his lyrics, too, cast curious transatlantic reflections, with critical comments on consumerism ("Everyman Is a King (in the US of A)") and the border politics of drugs ("Four Horsemen"). Not that he

On *Dig*, Rob Mounsey hasn't dug deeply enough; he's thrown all his influences into one album without fully exploring any of them.



ignores the Isles, calling for an end to Ireland's strife with the lovely ballad, "Reconciliation." Kavana's voice, while not impeccable, is versatile, ranging from a Bob Seger-ish rasp to gentle crooning. Occasionally, his primarily acoustic ensemble errs a little on the side of too much reverb; otherwise, production is straightforward and invisible. If you like mixing up your musical tastes a bit, Alias Ron Kavana's *Think Like a Hero* is a treat worth seeking out.

Michael Wright

Dig: Rob Mounsey & The Flying Monkey Orchestra

Sona Gaia 62761, CD; ADD; 45:38.

Sound: A- Performance: C

You've heard keyboardist Rob Mounsey without knowing it, playing behind hundreds of TV ads as well as on recordings by Madonna, Donald Fagen, and Billy Joel and on Paul Simon's *Graceland* (that booming synth on "The Boy in the Bubble," among other cuts).

In the current glut of New Age and fusion, Mounsey is given an opportunity to step out from session-musician anonymity. He released a well-received album of evocative duets, *Local Color* (Denon), with guitarist Steve Khan a couple of years ago. *Dig* is his solo follow-up. It's a recording of environments and concatenations, with Mounsey pulling out the synthesizer stops, giving us exotic percussion samples in a smorgasbord of styles. You can hear Weather Report in the childlike tribal dance of "Mr. Graffito," the cycles of Balinese gamelan music in "We Swam the Blue Water," and echoes of Henry Mancini's *Hatari* soundtrack elephant walking through "Sway Way Back."

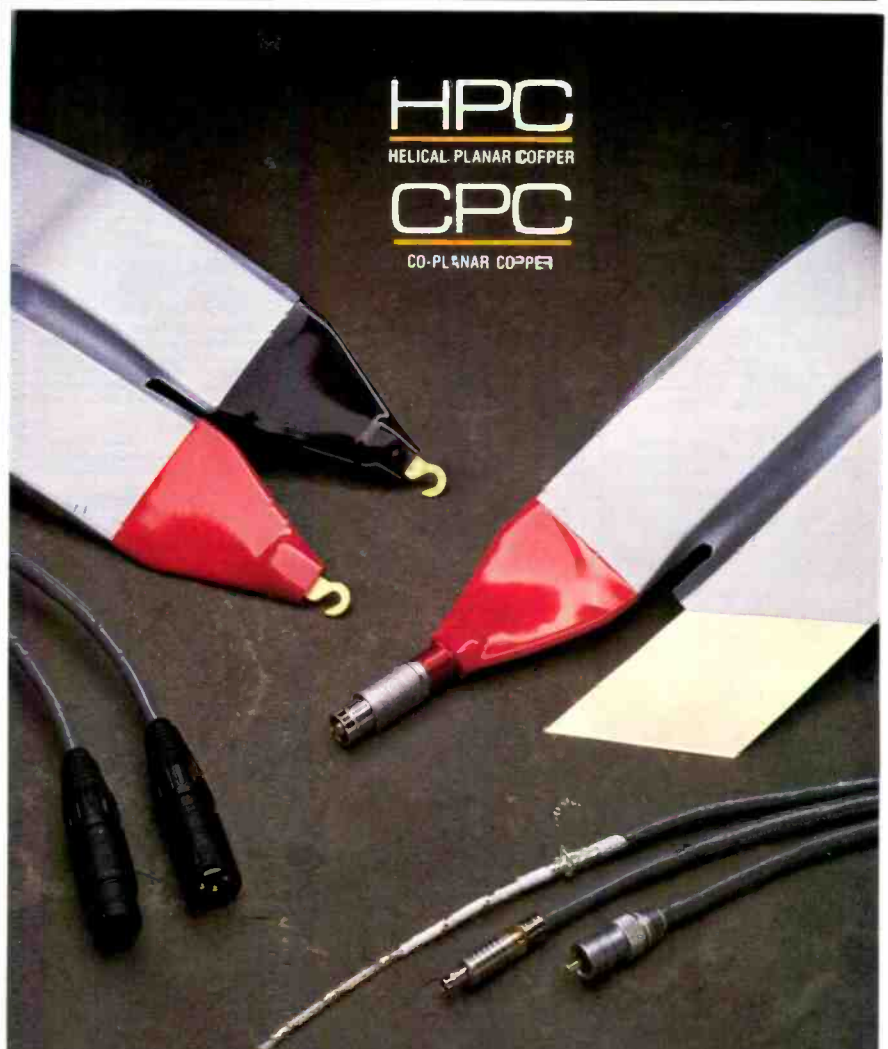
But Mounsey is undercut by his own obvious skills as a player and synthesist. He's thrown all of his influences into this one album without investigating any of them deeply enough to come up with anything more than superficial sketches. There's a lot of flash and sonic punch; there are great stereo headphone mixes that almost sweep you into the American Indian/African themes of "3 Moons" and the Spike Jones chaos of "Take the Pink Bus." But Mounsey needs to dig beneath the surface.

John Diliberto

Porcelain: Julia Fordham
Virgin 91325, CD; AAD; 47:17.

Sound: A- Performance: A

When Julia Fordham's debut crossed my ears in late '88, I wasn't ready for it. Expecting some Madonna or Paula Abdul knockoff, I was sur-



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Julia Fordham sings in a cooing alto-sax voice with a luscious low register, and *Porcelain* is a thoroughly sexy album.

prised by Julia's very adult, sophisticated, sexy songs. On that first listening they whistled right past me, but in the next several months the album kept jumping back onto the playing platform, slowly becoming a treasured favorite. Catching an accidental glimpse of this charming and witty Britisher one

night on the Letterman show only heightened my appreciation.

Porcelain is Fordham's second album, and it's confirmation that this is one special singer. Like her debut, *Porcelain* was produced by the artist and her keyboardist, Grant Mitchell, and mixed by Hugh Padgham (whose



credits include Genesis, Peter Gabriel, and XTC). The new album shows Fordham's maturation as both songmaker and singer. The songs continue to sound like combat reports from front-line conflicts between the sexes.

The title song begins with the very modern statement, "I am very, very much in like with you/I hope that it's enough 'cause it's all I can do." "Manhattan Skyline" is about a fling with an American that just didn't work out. Her wordplay here, translating the situation into elaborate geographical metaphor, is worthy of Cole Porter. So is the steamy Julie London-ish torch song "For You Only for You." "Did I Happen to Mention?" happens at the aching moment of betrayal that transforms a lover into a former lover. "Genius" combines love song with ecological commentary, all set to a classy, swinging Brazilian beat. When the first verse repeats, it's in Portuguese.

Fordham sings in a cooing alto-sax voice with a luscious, startlingly sensual low register. On *Porcelain* she gets more into the pure sounds she sings and pares down her lyrics. While her debut contained occasional exuberant word-bursts, here she is more restrained, displaying a writerly control of her words. Fordham clearly is an evolving songwriter whose range extends from sunny pop to chilly *angst* to jazzy cool. She knows what she's doing.

Porcelain is a thoroughly sexy album. Despite the recurrent theme of relationships breaking apart, this is an album that makes an excellent soundtrack for falling in love.

Michael Tearson

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STILL FRESH

Photograph: Chuck Stewart



Brownie: The Complete EmArcy Recordings of Clifford Brown
EmArcy 838 306, ten CDs; ADD; 43:30 to 73:56.

Sound: A— Performance: A

Where do you begin examining such an undertaking as this—producer Kiyoshi Koyama's monumental effort to research and compile ten Compact Discs' worth of material (some previously issued but a measurable amount not) from the one and only Clifford Brown? I don't know what's more difficult: To believe that Brown was this mature and developed (not to mention influential) by the time he died at 25 in a Pennsylvania Turnpike car wreck, or to imagine just how far he might have come had he lived. How much better could he have been than he is here, for Pete's sake? Though it spans just three years, 1954 to 1956, *Brownie* is overwhelming.

Absorbing all this music, it becomes clear why Brown's jointly led quintet with Max Roach is widely considered the seminal ensemble of the '50s and one of the most important groupings ever. Forty percent of this set (the first two and last two discs) is dedicated to Brown-Roach, Inc. It's hard to find a weak spot, a poor take, a missed note, or anything less than fascinating and entertaining, right through the last three energetic takes of "Love Is a Many Splendored Thing." Harold Land's tenor sax work, well represent-

ed here, is easily his best ever. Sony Rollins' slightly gruff, sometimes blunt tone on tenor (Rollins replaced Land in the group) is heard on three cuts; Rollins was indeed the perfect foil for Brown's smooth, clear trumpet. No matter that Richie Powell is less celebrated than his brother Bud; his piano playing seems effortless. And co-leader Roach, who celebrated his 65th birthday months ago, was vital to young musicians' careers then and remains so today. His piercing, driving, plentiful drum solos are a delight. Yet Roach exemplifies jazz's cooperative spirit. The percussionist, who took Brown under his wing when he offered the younger player an equal share in the quintet, knew exactly how great a talent he was becoming involved with.

The Brown-led all-star sessions that cover discs three and four are no less impressive. Kenny Drew's piano on the three takes of Johnny Coles' "Coronado" (particularly on the last, a nearly 20-minute excursion) is stunning—bluesy and swinging throughout. His 2½-minute solo intro to the 17-minute ballad "You Go to My Head" is so good it deserves repeat listenings; it stands that tall on its own. Both Curtis Counce's bass and Joe Maini's alto sax impress greatly, as does altoist Herb Geller, on a 21-minute reading of "Autumn in New York."

There's a truckload of music here. There are series of brief, multiple takes; there are two- and three-minute

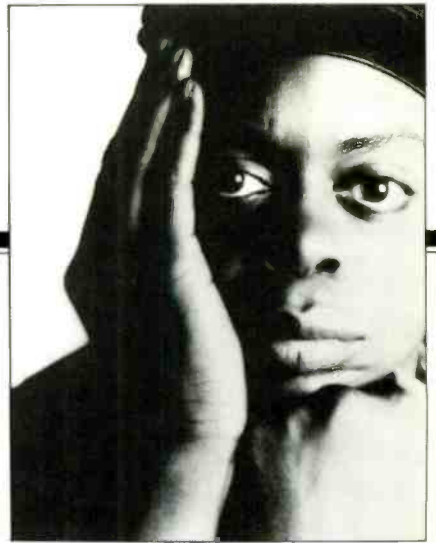
affairs. There's an August 1954 all-star jam session, "Clifford Brown with Dinah Washington" (discs five and six), that includes both Powell and Junior Mance on piano, Keter Betts and George Morrow on bass, and a trumpet section (in addition to Brown) of Clark Terry and a coherent Maynard Ferguson. Disc seven is devoted to Sarah Vaughan and features Herbie Mann on flute, Paul Quinichette on tenor, and the delightful pianist Jimmy Jones. Disc eight puts Brown in larger group and string contexts, including orchestras led by Quincy Jones and Neal Hefti. Vocalist Helen Merrill is heard on seven of the disc's 19 compositions; of note here is the clarity of her voice on "Falling in Love with Love" and the ballads "Don't Explain," "Born To Be Blue," and "What's New." The 12 selections with strings that close out this disc—all instrumental—are perhaps the least memorable entries—classically overbearing, intrusive in one way or another. Still, there are all those Brown solos to listen to, and even if they're not all great, they each contain something worth hearing. As does virtually every selection in this ten-hour trove. *Jon W. Poses*

A Vision's Tale: Courtney Pine
Antilles 8746, CD; AAD; 69:06.

Sound: B— Performance: C+

One of the old criticisms of avant-garde jazz musicians was that they

Courtney Pine and team so concerned about honoring The Tradition that Pine misplaces his fine energy and strength.



couldn't play be-bop or find their way around standards. Most of them ignored the criticism or, in the case of the Art Ensemble of Chicago and Anthony Braxton, blistered it with hell-bent, hair-raising renditions of bop standards like "Donna Lee." Others, like the World Saxophone Quartet, just

waited out the critics before they tackled Ellington and made him their own. British saxophonist Courtney Pine has faced the same criticism on this side of the Atlantic, where he's panned as a Coltrane clone, but without Trane's tradition-laden background. *A Vision's Tale* is an attempt to remedy

that, but it looks through a rearview mirror, using the retro-perspective of the Marsalis clan—in this particular instance, producer Delfeayo Marsalis and pianist Ellis Marsalis.

Pine, a fiery, soul-searing player, is still seeking his own voice in a search that's proven as exciting as the goal on his previous recordings, *Destiny's Song* and *The Jazz Warriors*. But here he sounds tentative and stiff negotiating the changes of "Just You, Just Me," "No Greater Love," and "Sky-lark." Pine and this team seem so concerned with paying obeisance to The Tradition that Pine misplaces the energy and strength that make him an interesting player.

It's on some of the barnstormers that Pine shows his stuff, scurrying through bop changes on "A Ragamuffin's Stance." (Is that like a Buffalo Stance?) Pine weaves through and skirts the floating pulse of drummer Jeff Watts and bassist Delbert Felix, both Marsalis acolytes. This trio format seems to suit Pine's freewheeling style more than the chordal boundaries set by Ellis Marsalis on "No Greater Love."

Pine really doesn't hit his stride until the final three cuts, the self-penned "Our Descendants' Descendants," Ellington's "C Jam Blues," and the album closer, Coltrane's "Giant Steps." You can almost hear the sigh of relief from Pine as he releases a torrent of melodic invention on the Coltrane classic.

Delfeayo Marsalis has opted for a flat recording style, claiming to have used no mike equalization. Unfortunately, this means the sound is often flat, and while instrument definition is clean on Felix's bass, Pine often sounds like he's being miked from across the room.

Courtney Pine can play the jazz tradition, but he's got his own, different perspective to offer. It's seen only rarely in *A Vision's Tale*. *John Diliberto*

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When Gatemouth Brown's at his best, his music swings with the precise cool of be-bop and the wicked force of a Basie ensemble.

Standing My Ground: Clarence "Gatemouth" Brown

Alligator 4779, CD; AAD; 36:40.

Sound: B+

Performance: B

"Born in Louisiana, grew up on the Texas side" is a phrase from guitarist/fiddler Gatemouth Brown's autobiographical "Born in Louisiana" that aptly describes the musical content of *Standing My Ground*. Brown, a lyrical player, embodies the Southwest guitar tradition of Charlie Christian and T-Bone Walker, which he blends with the hard energy of a swamp hoedown. So Brown's newest roars from a funky, revived version of "Got My Mojo Working" through Texas-to-California migratory shuffles to the snappy stomp of "Louisiana Zydeco." Though this is his most consistent album in years, Brown truly does stand his own ground rather than break any new. In a sense, that's all to the good, because early on with his Peacock/Duke recordings, Gatemouth Brown established a level of excellence that didn't need to be tinkered with. When Brown is at his best, his music swings with either the clipped, precise cool of be-bop or the wicked force of a Basie ensemble. On *Standing*, Brown is nearly at his best most of the time.

With tunes anchored in low-slung, minor-key arrangements, Brown's music hunches along with the lubricious ease of a smokin' organ combo under his raspy vocals. His guitar lines, elegantly phrased single-note figures, are prickly and weepy. Brown can snap off a phrase like the crack of a whip or float a nicely rounded note like a sweet vibrato rolling out of a horn's bell. This helps to make for an edgy, slinky feel

that's satisfying if not revelatory. So without extending the blues form or performing cover tunes, Gatemouth Brown achieves an equally valuable goal—he breathes new life into familiar themes. His new arrangement of "She Walks Right In" recalls both Gene Ammons and Joe Turner, while "Leftover

Blues" evokes a B. B. King lament. But there are moments, such as on "She Walks" and the soulful ballad "What Am I Living For," that the time creeps or drags. And since *Standing My Ground* is more about musical swing than catharsis, these are gnawing imperfections. *Don Palmer*

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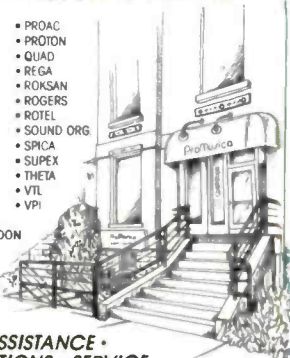
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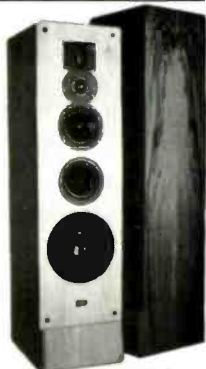
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3. Understand the product's warranty. Is there a manufacturer's warranty, and if so, is it from a U.S. or foreign manufacturer? Does the seller itself offer a warranty? In either case, what is covered by warranty, how long is the warranty period, where will the product be serviced, what do you have to do, and will the product be repaired or replaced? You may want to receive a copy of the written warranty before placing your order.

4. Keep a copy of all transactions, including cancelled checks, receipts and correspondence. For phone orders, make a note of the order including merchandise ordered, price, order date, expected delivery date and salesperson's name.

5. If the merchandise is not shipped within the promised time or if no time was promised, 30 days of receipt of the order, you generally have the right to cancel the order and get a refund.

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7. If you have a problem with your order or the merchandise, write a letter to the seller with all the pertinent information and keep a copy.

8. If you are unable to obtain satisfaction from the seller, contact the consumer protection agency in the seller's state or your local U.S. Postal Service.

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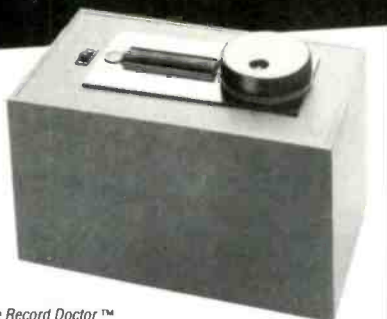
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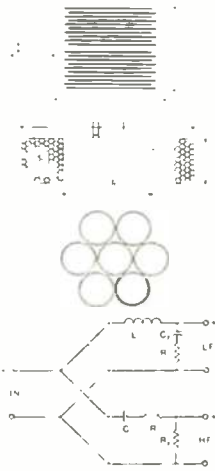
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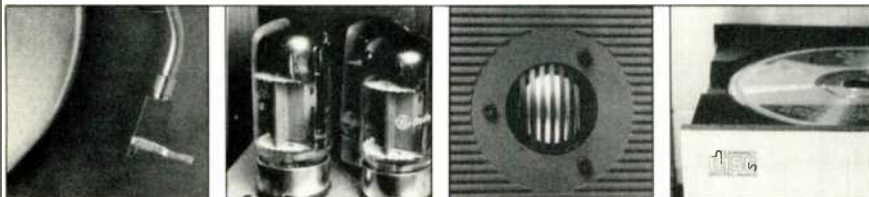
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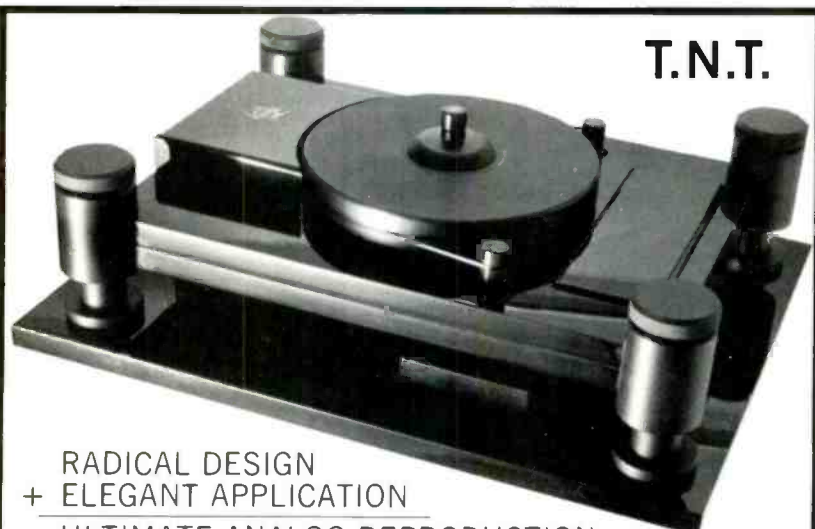
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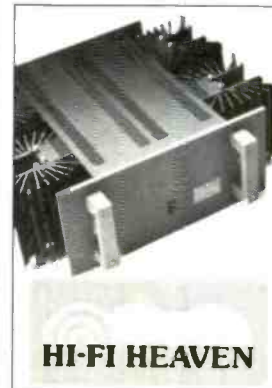
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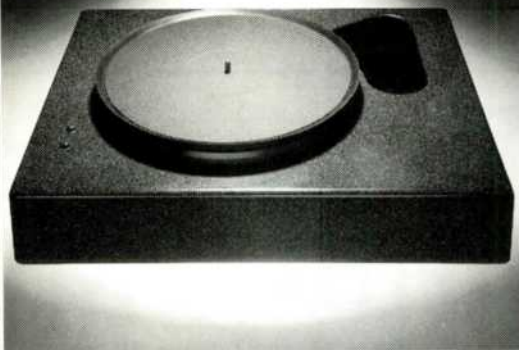
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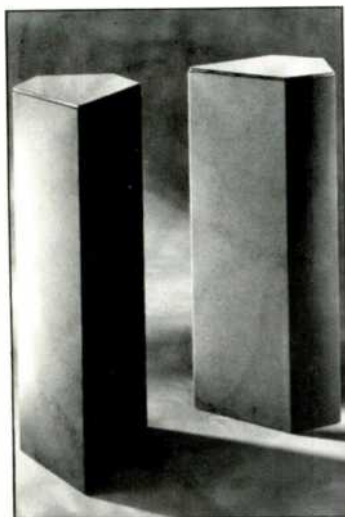
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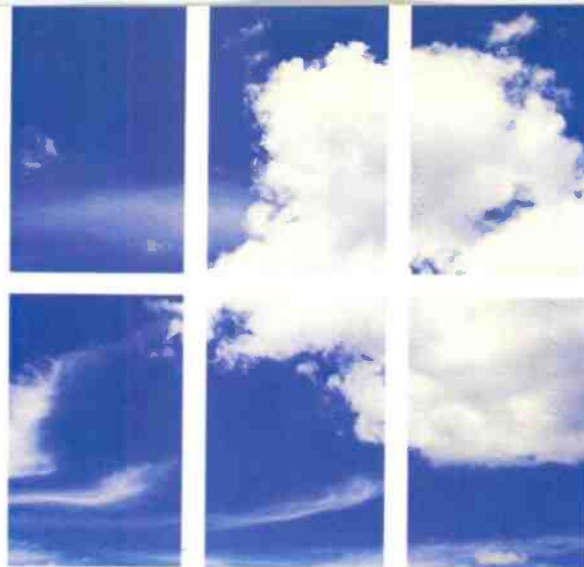
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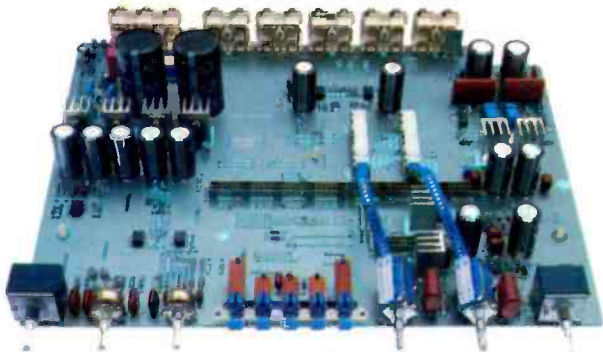
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Adcom stereo components have a reputation for sounding superior to others costing two and three times more. Keeping faith with this tradition, Adcom took the path of least resistance. Why not do the same? Ask your authorized Adcom dealer for a demonstration of this remarkable stereo preamplifier. Please write or call for a fully detailed brochure. You'll discover the best value in high performance preamplifiers.

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