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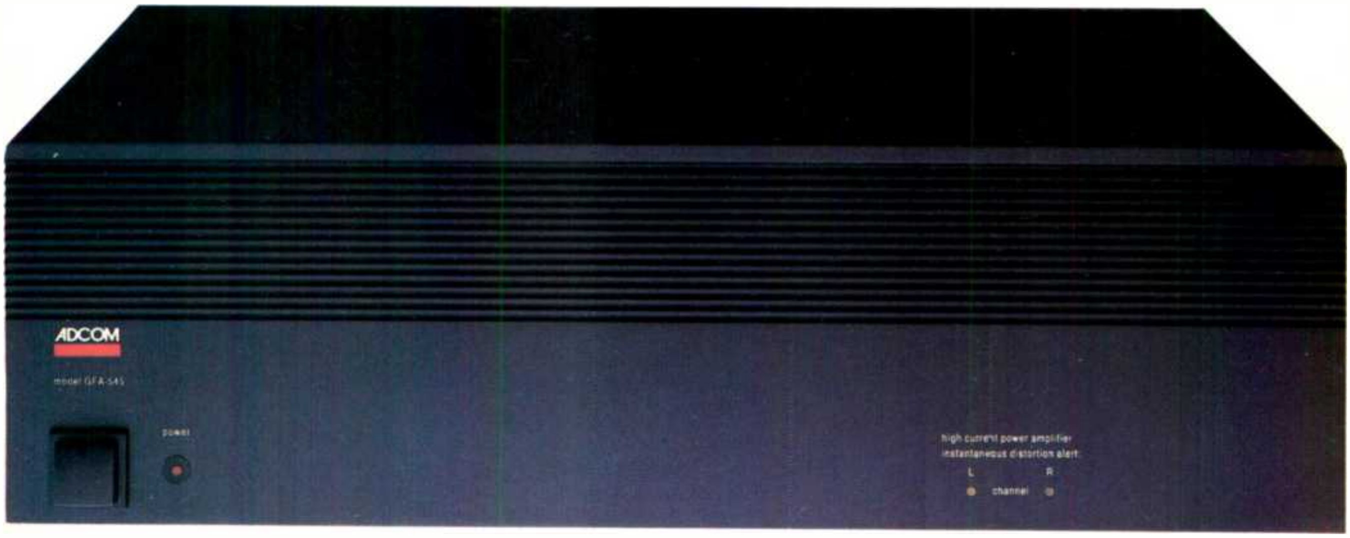

This new power amplifier from Adcom offers the same circuit topology as our GFA-555. And that's the amplifier independent test reports have found clearly superior to others priced two to three times higher.

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FEATURES

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C. G. "MAC" McPROUD

Charles Gilbert McProud, longtime editor, publisher and owner of *Audio* magazine, who more than any other single person shaped the style and position of the field's oldest publication, died of heart failure following surgery on April 17. Mr. McProud, widely known as "Mac" by friends, industry acquaintances and even audio hobbyists who would not have recognized him, was for over 30 years one of the most widely respected and influential persons in hi-fi.

In his recent book, *The Continuous Wave: Technology and American Radio, 1900-1932*, Hugh Aitken describes the "translator" who stands at the point of interaction among science, technology and the economy. In reading over Aitken's account of the establishment of the Radio Corporation of America, almost as a cooperative venture between General Electric and the U.S. Department of the Navy, together with American Marconi, Westinghouse and A.T.&T., I was struck by how well the concept of the translator fit Mac. I am proud to be able to follow the electronic path he blazed.

Mac was among the original group which founded the Audio Engineering Society in the early '50s. Indeed, the Society was founded largely as the result of a series of letters published in *Audio Engineering* (as this publication was known before the *Journal* was started by the Society). Mac was President of the AES in 1951-52, as well as a Fellow of the Society.

Born in Ottawa, Kansas, on October 21, 1904, Mac was awarded a B.S. degree in mechanical engineering from the California Institute of Technology in 1925. After a two-year stint as a construction superintendent with Union Oil Co. of California, Mac joined Paramount Pictures during the early days of talking movies and spent 13 years there. Working with audio and sound systems all day, he also found the technology fascinating as a personal hobby. During the early 1930s, he designed and installed music systems in the homes of many movie greats.

From 1942 through 1945, Mac worked for the National Research Defense Commission on the development of sonar for the Navy, later helping prepare maintenance manuals for this equipment. Immediately following the war he became managing editor of *Radio Maintenance*, and in 1947 was named managing editor of *Audio Engineering*, which was started in May of that year. In 1949, following the death of John H. Potts, who founded the magazine, Mac became editor, publisher, and part owner of *Audio Engineering*.

A life member of the IEEE, Mac was well known to both professional and amateur audiophiles around the world, having attended shows and visited factories in virtually every country where hi-fi equipment is played. During his tenure as editor of *Audio*, Mac was often referred to as "Mr. Audio." For several years he had a set of license plates for his car which read "Audio 1," underlining his vocation and hobby. Mac was also instrumental in establishing the Audio Fair as a vehicle for popularizing audio systems for home use.

McProud retired from active day-to-day work on *Audio* in 1971, but continued to contribute reviews and articles. He moved from suburban Philadelphia to Florida, where he started the Justimeter Corp. to manufacture and market two of his developments, a strip chart recorder for graphing response of phono cartridges and a device to simplify the preparation of justified text using an IBM Executive typewriter. Remarkably active for a person in his 70s, Mac revamped the sound system in the auditorium in Lehigh Acres, Florida, where he lived, and also gave technical assistance to the local cable TV system. Ever one to follow new developments, he caught the computer bug and spent much of his last few years "in conference" with his Radio Shack Model I, increasing its memory, adding peripherals, writing programs and just playing games.

He is survived by his wife Helen; his son, C. G. McProud, Jr., of Glendale, Cal., and his daughter, Joyce Lepore of Visalia, Cal. *Eugene Pitts*

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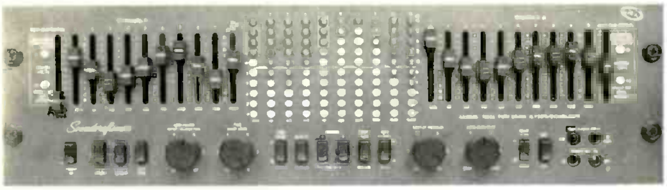

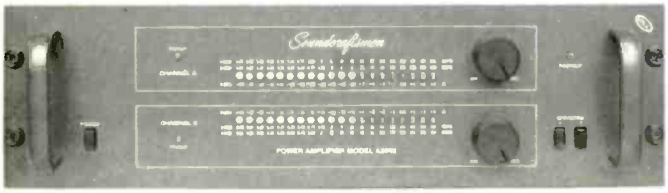

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SOUND IDEA
Houston
HOME ENTERTAINMENT
Hurst
SOUND IDEA
Midland
FOLGER'S ENTERTAINMENT

UTAH
Bountiful
INKLEY'S
Midvale
INKLEY'S
Salt Lake City
INKLEY'S
St. George
ARROW AUDIO

VERMONT
Brattleboro
SCIENTIFIC STEREO

VIRGIN ISLANDS
St. Thomas, U.S. and British Virgin Islands
ELECTRONICS UNLIMITED

VIRGINIA
Arlington
LERMA AUDIO
Falls Church
AUDIO BUYS
Richmond
GARY'S

WASHINGTON
Olympia
DESCO ELECTRONICS
Yakima
STEREO FIRST

WASHINGTON D.C.
AUDIO KRAFTERS

WEST VIRGINIA
Morgantown
THE SOUND POST
Princeton
THE SOUND POST

WISCONSIN
Appleton
AMERICAN TV
Glendale
SOUNDSTAGE
Madison
AMERICAN TV
Oshkosh
AUDIO PLUS
Sheboygan
GENE'S CAMERA & SOUND
Waukesha
AMERICAN TV

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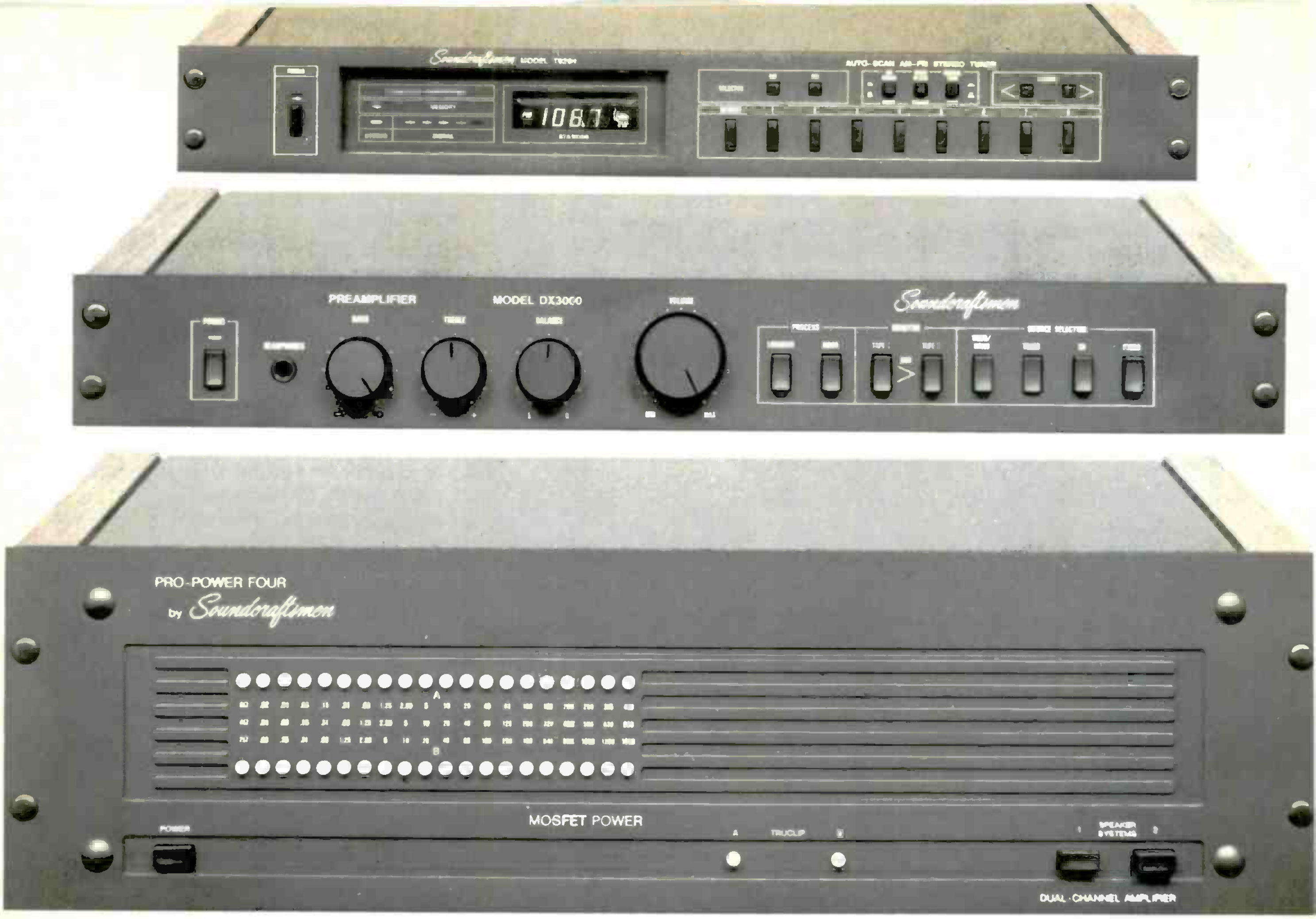

"EXPLOSIVE" MOSFET POWER... CLEARLY A BEST BUY

THE NEW Soundcraftsmen (MADE IN U.S.A.) "PRO-POWER FOUR" MOSFET AMPLIFIER IS YOUR BEST BUY, AND HERE ARE A FEW REASONS "WHY":

REASON #1: Dynamic Power to spare, up to 550 watts into 2 ohms.

REASON #2: High Current where it's really needed. 50 Amps per channel available for instantaneous peak output capability of 2500 watts per channel.

REASON #3: Pure tube-like sound... smooth, clean, no "edginess," through the superb—and costly—MOSFET fully-complementary power output stages. You MUST hear this rib-cage-rattling superb new Audio Amplifier... hear the MOSFET difference, so pure it out-performs even the "esoteric," "price-no-object" amplifiers!

REASON #4: Distortion-free performance, typically 0.02% THD and IMD, with TIM unmeasurable. Continuous FTC total power of 410 watts at 8 ohms, 20Hz to 20kHz, 205 watts channel, < 0.05% THD.

REASON #5: Precision-Calibrated 40-LED Power Meters, allowing continuous and accurate monitoring of each channel's performance at 2 ohms, 4 ohms, and 8 ohms.

REASON #6: It is guaranteed to improve and enhance your present receiver or Integrated Amplifier, with our $39.00 Power Coupler, the PC1. It enables you to plug in any Soundcraftsmen Amplifier to your existing stereo system, whether Receiver, or Integrated Amplifier.

REASON #7: The Pro-Power Four is an ideal "main component" for up-grading—or starting—a High Powered stereo system. It is capable of fully reproducing, with distortion-free, spine-chilling sonic clarity, all of the demandingly high dynamic peaks inherent in the new Compact Discs and Hi-Fi VCR's.

REASON #8: Full-size 19" Rackmount panel with dark charcoal off-black finish, is a standard feature, as shown, with optional hardwood side panels available.

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

REASON #10: It shares the outstanding Performance/Value rating of all 16 Soundcraftsmen Professional and Hi-Fi amplifiers, ALL designed AND manufactured right here in Santa Ana, California. Our 410-watt total FTC continuous power Basic Amplifiers start as low as $449.00, and a complete 410-watt system, including our AM-FM Tuner and Control Center Preamplifier shown above, has a list price of just over $1,000.00.

For a FREE 16-page FULL-COLOR, FULL-LINE BROCHURE with the Soundcraftsmen Story, and the Why's and How's of Equalization, plus details on our FREE 12" TEST RECORD offer and name of nearest Dealer, please phone our "Dealer Locator" operator at 714 556-6191—or write to us at 2200 So. Ritchey, Santa Ana, CA 92705. In Canada: Tri-Tel, 105 Sparks Ave., Ontario M2H 2S5.

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EDWARD TATNALL CANBY

RADIO REVELATIONS

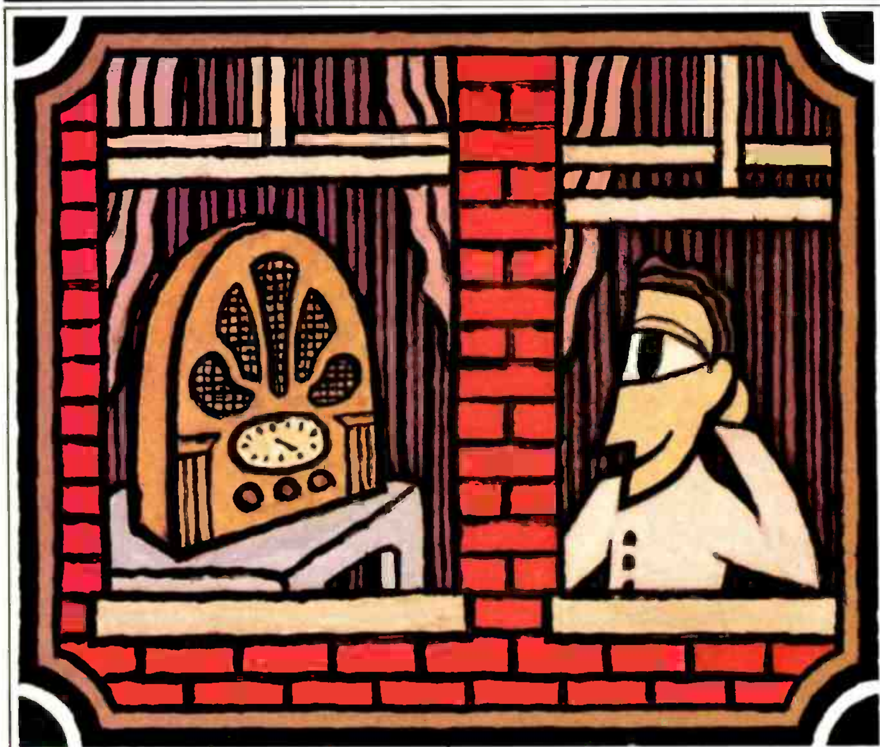


Illustration: David Reau Johnson

Somehow in my audiobio segments I have not yet told several FM stories, including the first time I heard hi fi via FM, referred to in April. I write too much, like the rest of our tribe, so I pulled that story out of the column before the Editor even had a chance to see it. Now I'll tell it, along with another one, maybe my favorite.

As I've said, I heard FM sound considerably before my stint at an FM station. Time flies—I had to go through a long calculation by calendar, remembering residences, jobs, world events, before I could fix a date. I came up with the autumn of 1941. That's a long way back—could I be wrong? No—though I didn't write down the date at the time.

It wasn't yet Pearl Harbor by a few months. Life went on outwardly on a peacetime basis, but do not think it was really that way. Since Munich, 1938, the axe had been poised to fall on us too, one way or another.

So in the autumn of 1941 I moved into a sort of emergency communal apartment in New York's Greenwich Village. It was a lovely little 18th-century brick house with four tiny floors, two rooms on each, the whole of which we rented for $100 a month. Nothing wrong with prices in those days. I shared a front room—*the* front room—on the second floor with my cousin, also in need of housing. We ate communally in the small basement dining room and had a Father Divine "angel" to cook us one glorious meal a day. She answered our phone with a loud "Peace!" instead of hello. My friends were baffled.

On the first floor (a half-flight up, in the New York manner) was the living room, a combined front and back parlor with large open doors between. I soon found a big console radio, a floor model, set up in one corner for our use. The very first time I heard that thing I realized it was quite peculiar. It didn't seem to make any of the familiar radio sounds—that muddy hiss of dirty white noise, the occasional burst of static, the faint but incessant interference from other stations in the background. And when the sound came on, it had none of the standard muffled texture—thick, mushy bass and no highs. The voices didn't sound like radio voices, which never had a trace of sibilant midrange. (Those effects would have attracted no attention, either mine or anyone else's. It was just normal radio.) But when the evening news came on *this* radio, things were weird. A man just began to talk, quietly, like one more person in the room. He was alive, right *there*. You didn't even have to turn him up. You could get everything he said even at low volume.

Even more peculiar—this is faithful to my memory of the time—the radio didn't seem to be turned on. It was dead. There was just this voice. When you turned the machine on during a moment of broadcast silence (there was plenty on experimental FM!), nothing happened. No sound. Was the wall plug loose? Did the on/off switch work? (I was soon trying the thing out when nobody was around.) You flipped the on/off back and forth, doubtfully. There would be nothing. Dead silence. You thwacked the cabinet, to see if that would make it start. No use. But the red "On" light was lit. How could it be?

Then suddenly this voice would start talking right beside you. You jumped. Ever so casually, he read you the news or announced the next feature in a low tone, right at your elbow. Out of a dead radio? It couldn't be. That was the impact of 1941 FM the first time you ever heard it, as other oldsters will agree.

This was the very earliest FM broadcasting, remember, regularly on the air though still experimental; it was low-band, mono, with a highly potent signal coming out of that original Armstrong station a few miles from the city. Everything in this FM was proto-commercial, and every detail, as I've noted in the past, was tailored and supervised by Major Armstrong himself, including the receiving equipment, which had to meet his standards whatever the brand. He was the licenser. The result was the purest mono signal, by far, that was available to the public, utterly unlike the usual reproduced sound. Though I've said all this before, I have to emphasize that the fi we take for granted today was *already there*—99% of it, at least—nearly a half-century ago.

Here was a fine example of how I fell into audio. I had simply stumbled onto FM, all unknowing. But that wasn't all.

The big FM radio in the living room, it turned out, belonged to a character named Waddy, a member of the household. I soon discovered why we had that radio when so few yet existed. Waddy worked at the station! That

The first FM broadcast I ever heard seemed quite peculiar. There was no muddy hiss of white noise, just a live-sounding voice out of dead silence.

was, again, W2XMN in Alpine, N.J., with its high, skeletal transmitting tower on the top of the cliffs across the Hudson River from upper New York City. I do not know just what Waddy did there but the station had only a few employees and things were informal. I suppose he was in daily communication with Major Armstrong in person, the very seat and source of FM, not to mention much else in radio history. Bullseye! Without lifting a finger of intent, I was a step away from the center of FM development, with a state-of-the-art FM receiver at my beck.

I already owned a good many 78-rpm records and was reviewing more, until the war stopped the supply of Oriental shellac. Waddy, discovering this, began to borrow them from me for the station. W2XMN had no record library; it was strictly experimental, just to keep a powerful FM signal on the air. But they had to use *something* in the way of listenable sound, and records were fine—as they still are.

So each morning Waddy would set off for work with an armful of my albums, and in the evening there they were, played back on FM. A cosy arrangement and surely the very first classical FM in the New York area! There was no program guide; we made up the "program" in the morning and it was aired the same evening.

Of course, I was not then hearing any *hi-fi* FM music. The only full-range sound we got was from the voices, speaking "live" from the station. The musical source, when and if, was the 78 disc in all its lo-fi glory, beautifully broadcast with excellent equipment but still no better than it was in itself. So Armstrong's FM music was not exactly hi-fi, though mostly it sounded better than on our home machines.

Not until two years later, when I moved into the FM station where I worked and broadcast throughout the rest of the war years, did I hear wide-range hi-fi *music*. By then, 1943, we had a real studio, if modest, with a grand piano in it for live broadcasts. There were also those remarkable rental ETs (electrical transcriptions) which I've described before: Big, 16-inch, semi-floppy vinyl discs played at 33 rpm, a half-dozen years before the LP and in many ways its professional prototype. Under the rental plan you could exchange the ETs you had for different ones. They came from several sources in both vertical and lateral formats. (Some 15 years later the two were combined in one groove for the stereo LP.) We could play either type, as well as 78-rpm records.

They were real, wide-range recordings on quiet surfaces, those discs, and of course they had me fascinated. Alas, most of them were the dreariest sort of nothing-music, what we now call "beautiful music" but even less worthy. (Sorry, folks, but them's my feelings. The continuity from then to now on FM is all too evident.) Even so, I went through dozens, just to savor their splendid, shiny new sound and the unbelievably quiet surfaces. To my joy, I discovered that, as if by accident, there were a few classical items of excellent musical quality—and lo! My first real musical high fidelity. I ate it up.

In no time I had those 16-inch classical items on the air on my own weekly program (with the dismal title *Mr. Canby Presents . . .*). These might rate as the very earliest classical hi-fi broadcasts on FM. But I couldn't go far. The small number of items didn't get me anywhere, and I continued to use the many 78 records we owned, FM or no. Later on, London's early 78 *ffrr* shellacs were a great help.

Indeed, we were briefly involved in London's beginnings, out of Decca in England, both in the discs and in the enormous home *ffrr* reproducer that the company was then promoting. We were desperately trying for commercial viability and London/Decca was one of our high hopes (along with the "Pickering pickerup" and the very different Zenith Cobra, unfortunately not hi-fi). So our management decided to put on a massive press party and demo for London's *ffrr* machine, right in our upstairs studio, the one with the grand piano. Our quarters had been converted from a two-story duplex penthouse apartment, and that studio (the ex-living room) even had a big fireplace.

We had put a small talk-back speaker in the fireplace, handily stowed behind the logs and what-not. Convenient and out of the way. Through that little speaker the control-room engineer could talk to the studio during rehearsals or (not on the air) when something went wrong during a broadcast. If a

CHALLENGING DESIGN.

HOW BOB CARVER CREATED A NEW MAGNETIC FIELD AMPLIFIER WITH THE SOUND CHARACTERISTICS OF A $3000 MODEL, SATISFIED SOME OF THE WORLD'S MOST HIGHLY TRAINED AUDIO EARS... AND HOW YOU CAN OWN HIS DESIGN FOR UNDER $500.

Bob Carver's newest Magnetic Field Amplifier is sending shock waves through the staid audiophile world. Because it won a challenge that no other amplifier designer could even consider.

The M-1.0t was judged, in extensive listening tests by one of America's most respected audiophile publications, to be the sonic equivalent of a pair of legendary, esoteric mono amplifiers which retail for over fives times as much.

A DESIGN FOR THE CHALLENGE OF MODERN MUSIC REPRODUCTION.

Before you learn the fascinating details of Bob Carver's unprecedented feat, let's consider the final product of that challenge. An amplifier design which stands on its own merits in any case, with astonishingly high voltage/high current output and exclusive operation features. An amplifier for the demands of compact digital discs, VHS Hi-fi and other wide dynamic range playback media.

THE M-1.0t:

◊ **Has a continuous FTC sine-wave output conservatively rated at 200 watts RMS per channel into 8 ohms from 20Hz to 20kHz with no more than 0.15% THD.**

◊ *Produces 350-500 watts per channel of RMS power and 800-1100 watts peak power for transients. (8 ohms and 4 ohms respectively).*

◊ *Delivers 1000 watts continuous sine wave output at 8 ohms in bridging mode without switching or modification.*

◊ *Employs Bass Phase Inversion circuitry that can essentially double current output at low frequencies.*

◊ *Has a -110dB signal-to-noise ratio and no need for noisy external fan, making it exceptionally quiet.*

◊ *Includes elaborate safeguards including DC Offset and Short Circuit Power Interrupt protection.*

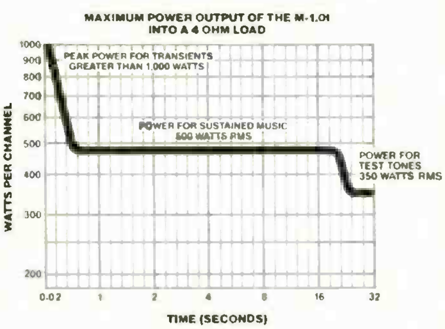
◊ *Is capable of handling unintended 1-ohm speaker loads without shutting down.*

◊ *Uses a power display capable of 1 millisecond peak response time and instant warning of clipping.*

Accurate to as little as 1dB, the M-1.0t's 2-color power meters respond within a millisecond of a transient impulse, identify momentary clipping and serve notice of protection circuit activation.

POWER FOR THE CHALLENGES OF MUSICAL WAVEFORMS.

The rating differences between the M-1.0t's FTC and Carver's continuous



The Carver M-1.0t delivers massive power at all important output levels.

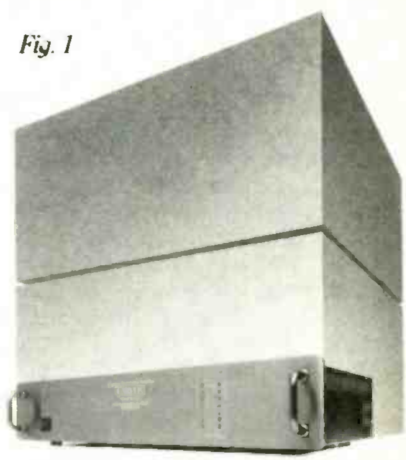
RMS power reserves represent Bob's insistence that electronic designs should address real world problems. He reasoned that the M-1.0t must excel at reproducing those types of power waveforms that are most essential to music's stunning impact and realism.

First there are the instantaneous peak transients – the sudden individual attacks of each musical note which demand a tremendous amount of amplifier power. While these waveforms last less than 1/100 of a second, they form the keen edge of musical reality.

Next come combinant musical crests of demand from multiple instruments and their harmonics. These longer-term power demands usually come and go in less than a second, yet can tax all but the most powerful amplifier.

Thus, even at 8 ohms and at extremely high output current levels, the Carver M-1.0t not only delivers over 800 watts of peak power for momentary musical transients, but can provide over 350 watts RMS of long-term power for demands lasting up to 20 seconds. More power, more current and more voltage than any other comparably-priced amplifier.

Fig. 1



Two distinctively different approaches to sonic excellence

THE MAGNETIC FIELD AMPLIFIER VS. CONVENTION.

Audiophiles, critics and ultimately other manufacturers have accepted the wisdom of Bob Carver's innovative approach to delivering power in musical terms. Yet only Carver has so elegantly translated theory into practice.

Figure 1 shows the new Carver M-1.0t Magnetic Field amplifier. It weighs 20 pounds and runs cool to the touch. Behind it is the outline of the *pair* of legendary mono amplifiers you'll read more about below. Even individually, they can hardly be lifted and demand stringent ventilation requirements. And yet, according to some of the most discriminating audiophiles in the world, Bob's new design is their sonic equal.

The ultimate secret lies in the patented Magnetic Field Coil (figure 2) employed in the Carver M-1.0t. Instead of increasing cost, size and heat output with huge storage circuits, Magnetic Field Amplification delivers its awesome output from this small but powerful component. The result

Fig. 2

A single Magnetic Field Coil supplants traditional heavy power supplies.

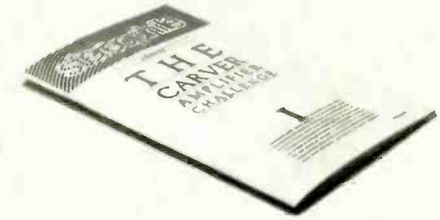
is a design capable of simultaneous high current and high voltage. A compact cool-running design that fills your room with sound, not bulk.

CARVER'S GREAT AMPLIFIER CHALLENGE.

On the merits of its enviable specifications and features alone, the M-1.0t could easily have become another industry benchmark of power, accuracy and economy.

But Bob is never satisfied. He felt that his fifth Magnetic Field Amplifier design should be even more remarkable.

So last year, he made a bold offer to the editors of *Stereophile Magazine*, one of America's most respected audiophile publications. He claimed that he could make special modifications to his new amplifier design which would enable it to sound EXACTLY like any high-priced, esoteric, perfectionist amplifier (or amplifiers) the editors could choose.



Moreover, his design work would not happen in his Lynnwood, Washington laboratory, but in a motel room near *Stereophile's* offices in New Mexico. And would match the M-1.0t's final sound to any contender in *48* hours!

As the magazine put it, *"If it were possible, wouldn't it already have been done? Bob's claim was something we just couldn't pass up unchallenged."*

Out of respect, ethics (and even a little bit of awe), neither *Stereophile Magazine* nor Carver will divulge the name of the legendary "world class" mono vacuum tube amplifiers that were selected as the M-1.0t's contender.

Suffice to say that what transpired in the next 48 hours is high fidelity history. It makes great reading in *Stereophile*, Vol. 8, No. 6, or in the reprint we'll send you on request.

MUSIC IS THE FINAL PROOF.

The *Stereophile* evaluation team was admittedly skeptical (*"We wanted Bob to fail. We wanted to hear a difference"*).

They drove both amplifiers with some of the finest components in the world. Through reference speakers that are nothing short of awesome.

But it was their ears and carefully selected music ranging from chamber to symphonic to high-impact pop that led them to write, *"... each time we'd put the other amplifier in and listen to the same musical passage again, and hear exactly the same thing. On the second day of listening to his final design, we threw in the towel and conceded Bob the bout. According to the rules... Bob had won."*

The inquiring audiophile can't help but wonder if M-1.0t production models will sound as good. Ask the man who designed it. "I promise they will sound exactly the same. And just as good. In fact, I stake my reputation and that of our company on it."

SHARE THE CHALLENGE AND THE VICTORY.

The real winner is you. Because you can own world class, superlative electronics at reasonable prices by visiting your nearest Carver dealer. Compare the new M-1.0t against any and all competition. Including the very expensive amplifiers that have been deemed the M-1.0t's sonic equivalent. But even if you can't make that comparison, you won't be surprised when the M-1.0t lives up to every other claim made in this ad.

What you will be surprised at is just how affordable this much power, musicality and accuracy can be.

SPECIFICATIONS: Power, 200 watts/channel into 8 ohms 20Hz to 20KHz, both channels driven with no more than 0.15% THD. *Long term, sustained RMS power,* 500 watts into 4 ohms, 350 watts into 8 ohms. *Bridged Mono RMS power,* 1000 watts into 8 ohms. *Noise,* -110dB IHF A-Weighted. *Frequency Response,* +0-3dB 10Hz-100KHz. *Slew Factor,* greater than 200. *Weight,* 20 lbs. *Finish,* light brushed anthracite, anodized.

CARVER Corporation, PO Box 1237, Lynnwood, WA 98046

POWERFUL MUSICAL ACCURATE

Distributed in Canada by Evolution Technology

Enter No. 10 on Reader Service Card

Back in 1941 we were not yet hearing hi-fi music on FM radio, because the source was the 78-rpm disc in all its lo-fi glory.

mike went dead and the announcer continued talking, all unknowing, out squawked a raucous voice from the fireplace—"*Use the other mike, for cripe's sake!*"—and the day was saved. It was no more than a cheapie, four-inch radio speaker but it sufficed. It played music cues to me when I broadcast, before my mike was opened up, and so on.

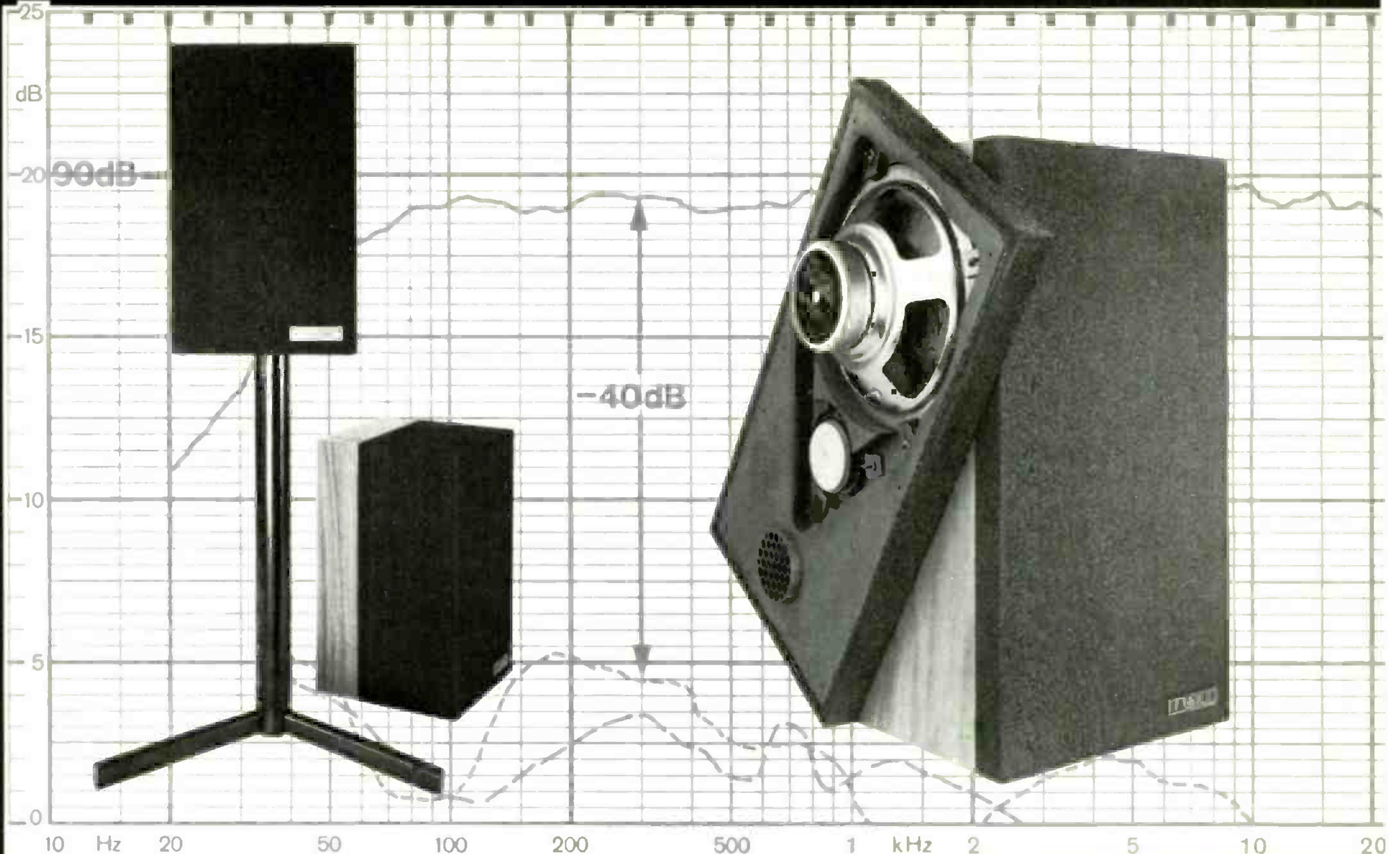
So—in came that enormous radio-phonograph with everything—London or Decca—on it, up the freight elevator and then laboriously up the studio stairs. No elevator there. Then the question: Where to put it? The piano was very much in the way. Well, of course, said the Boss, put it in front of the fireplace. We aren't burning any wood. And that is where it went. This, you must understand, was the Biggest Boss, the owner of the station, whose baby this London thing was. He wouldn't know we had a communications speaker in there and nobody was about to tell him. His word was law. So the fireplace disappeared behind the behemoth, which looked just fine taking up around half the wall.

This was our Biggest Boss indeed, a high-level merchandiser in several department stores of note and a general doer of Good Works that brought him plenty of notice. He was no radio man, just the big-shot owner. We didn't really think he cared a hoot for hi-fi, though he made much fuss about it in public. All in all, he was not a popular Boss.

The great day arrived, along with press and dignitaries. There were speeches by London people and a longer speech by Biggest Boss, who had a way of taking over. Here was the most revolutionary High-Fidelity Reproducer ever built, and here was FM, the miracle of radio, et cetera, on and on. (As a matter of fact it *was* a good machine.) At last, with a dynamic wave of the hand, or similar, he motioned for the actual demo to begin. And it did. He beamed. Wonderful! Didn't I tell you? Following his lead, everyone else acted mightily impressed. Decca/London looked merely a bit confused but said nothing. We on the staff looked at each other—and said not a thing. I knew *something* was wrong, but I pretended not to notice. If the Boss liked it, so did I.

Do you know where every bit of sound for that momentous demo was coming from? Out of that little speaker in the fireplace, *behind* the big machine, believe it or not. I don't know how it happened. Somebody was either stupid or devilishly clever, making one of those mistakes-on-purpose, and I think I know who. For 40 years I have chortled at the thought. Some people just need to have their bubbles pricked—like, perhaps, the Biggest Boss? I think London knew, but they were ever so gentlemanly. Not a word. Poker faces. The Boss never knew the difference, but *we* did. A hi-fi milestone, you'll admit.

MISSION 70 MISSION 700.2



Mission 70

1984's "Loudspeaker of the Year" in Britain; HI FI CHOICE "Best Buy"; winner of "Decibel d'Honneur" in France; acclaimed "Wunderkind" in Austria, the Magnificent 70 is an extraordinary state-of-the-art product.

The design objective was to manufacture the most compact loudspeaker system which was nevertheless capable of reproducing the extremities of the audible frequency range. This resulted in a true hi-fidelity speaker system capable of handling musical materials with exceptional dynamic range, including digital master tapes, and remaining linear at all listening levels. Here we should point out that many loudspeakers can only create the excitement and dynamics of music when played at loud levels. In fact, it is a tragedy for the consumer that most hi-fi systems sound no better than a transistor radio when played at low levels. Indeed, this is why cheap amplifiers offer a "loudness" control to artificially compensate for these inherent weaknesses, and it requires dedicated manufacturers to avoid such complex pitfalls.

The 70 is manufactured of sandwiched construction to dampen and distribute enclosure resonances and uses sculptured MDF for the baffle board. The bass unit is a high quality 7" Mission product with a unique cone design and a quality 19mm ferrofluid damped dome tweeter. The filter is a full multi-component design incorporating Mission's own electrolytic capacitors and low saturation inductors. The driver geometry is inverted in the novel Mission style resulting in superb three dimensional stereo stage. The total design is carefully integrated to result in a wide bandwidth system free of unwanted resonances, distortions, frequency response anomalies and colorations.

As far as measurements are concerned we would briefly touch on the objective performance of the 70. Whereas the competition for the 70 has an irregular frequency response often as poor as ± 5dB, the 70 measures flat to within ± 2dB! When measured off axis it exhibits no mid band cancellations and at 30° off axis the response is still ruler flat. The modulus of impedance is very smooth, does not drop below 6 ohms and does not suffer difficult phase angles, which in turn makes the loudspeakers very easy for any amplifier to drive. Measured at 90dB, 2nd, 3rd and all other harmonic distortions remain below 0.5% – approaching amplifier specifications! and some 10 times better than most other loudspeakers on the market! The efficiency is 89dB.

The 70s are recommended for use on bookshelves or stands and with amplifiers ranging from 20W to 75W per channel.

Mission 700.2

The 700.2 is an updated version of Mission's famous 700 model – acclaimed as the world's finest compact speaker system by the technical press throughout Europe and America.

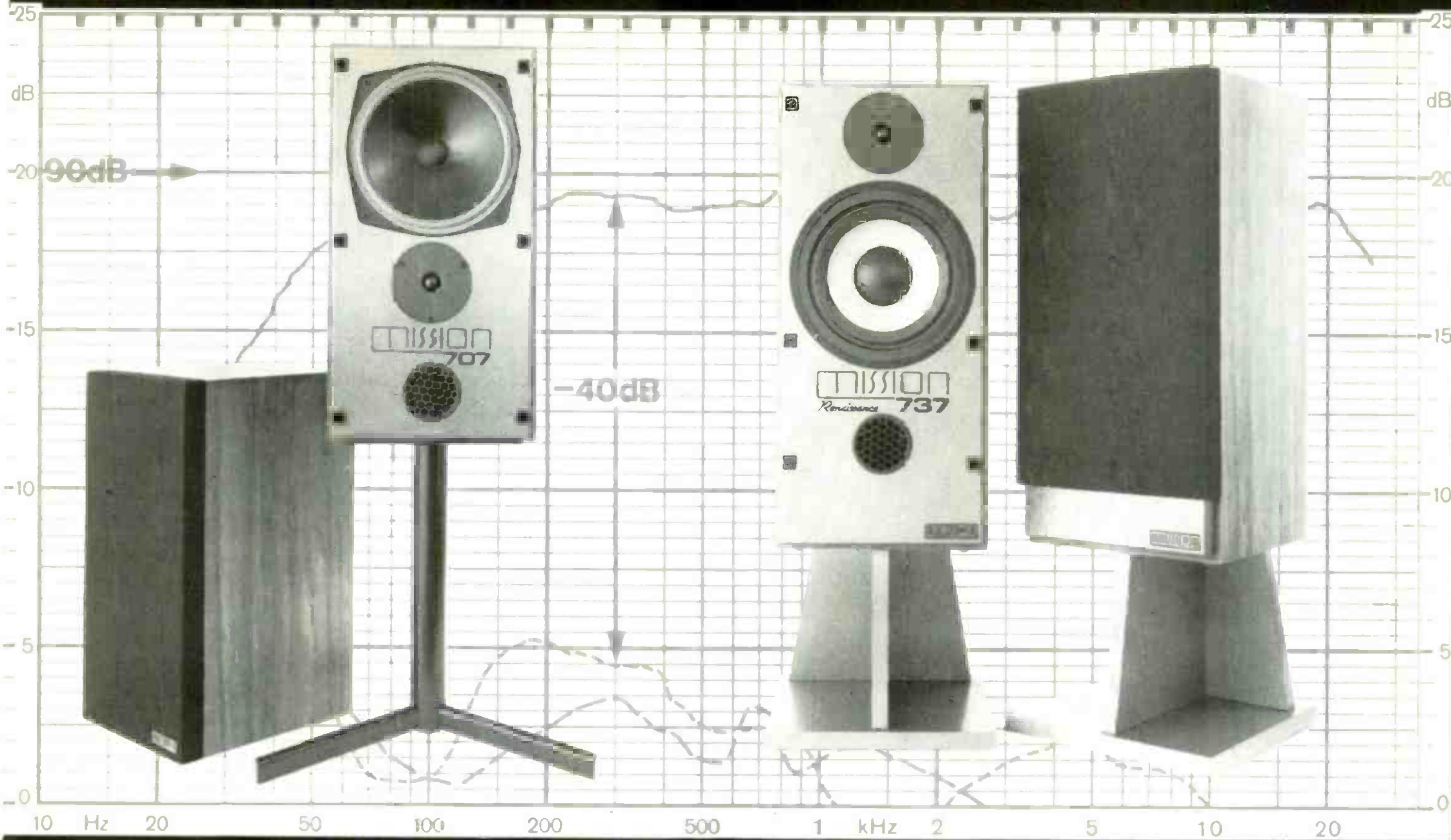
The unusual drive unit geometry first designed by Henry Azima in the Mission 700 ensures equal "path lengths" to the ear when the speakers are conventionally positioned. This is an ingenious engineering principle which makes time aligned and phase-arrayed geometries unnecessary. The effect of such a design is that at the crossover frequency point the radiation lobe is directed towards the listener rather than down to the floor. The proven 700 bass drive unit has been further refined incorporating a much more powerful motor system to ensure improved power handling and sensitivity. The frequency response is now even more linear at different power levels and the highly refined ferrofluid dome tweeter offers greater headroom before saturation than the old 700. The drivers are carefully aligned and mounted in a 32mm thick front baffle board. The direct and rigid coupling of the drive unit chassis to such a baffle board design minimises relative accelerations and displacements between the two structures ensuring exceptional transient response. The cabinet itself now offers the unique Mission construction method of multi-folding, which ensures exceptional rigidity without increasing fundamental wall stiffness. The objective here is to lower the resonant frequency of the cabinet so that it is not set off in the important mid band region.

The 700.2 is a very high performance system offering a rare combination of accuracy, low coloration, extended dynamic range and a high power handling. It is recommended for use on bookshelf or stands and with amplifiers ranging from 20W to 100W per channel.

SPECIFICATIONS	MISSION 70	MISSION 700.2	MISSION 7
FREQUENCY RANGE:	35Hz–20KHz	35Hz–20KHz	30Hz–20KHz
FREQUENCY RESPONSE:	60Hz–20KHz ± 3dB	55Hz–20KHz ± 3dB	50Hz–20KHz ±
IMPEDANCE NOMINAL:	8 ohms	8 ohms	8 ohms
RECOMMENDED AMPLIFIERS:	20W–75Watts/Channel	20W–100Watts/Channel	20W–100 Watt
SENSITIVITY, SPL at 1M, 1W:	89dB	91dB	92dB
TWEETER:	19mm Polymer Dome – Ferrofluid	19mm Polymer Dome – Ferrofluid	19mm Polyme
WOOFER:	175mm Plastiflex Cone	200mm Carbon/Paper Cone	210mm Plastif
CROSSOVER FREQUENCY:	2.2KHz	2.1KHz	2.2KHz
GRILLES	Fixed	Fixed	Removable
TERMINAL CONNECTIONS:	4mm plug or wire	4mm plug or wire	4mm plug or w
EFFECTIVE VOLUME:	12 litres	24 litres	25 litres
CABINET DIMENSIONS: (H x W x D)	350 x 210 x 210 mm	470 x 250 x 270 mm	470 x 250 x 27
FINISH:	Walnut/Black	Walnut/Black	Walnut/Black

MISSION 707

MISSION 737 *Renaissance*



Mission 707

The 707 is a brand new addition to the Mission range. It offers the inverted drive unit arrangement first used in the 700 (for reasons see 700.2). The 707 incorporates Mission's unique multi-folded cabinet construction and sophisticated injection moulded baffle board manufactured from polypropylene and natural minerals – the formula not being made public by Mission. This configuration offers optimum rigidity for accurate transient bass response with controlled and minimal resonances in the mid band region. The tweeter is our proven ferrofluid 19mm polymer dome and the overall results are optimum integration and excellent off axis performance, resulting in quite exceptional stereo stage.

Here we must point out that there is a fundamental design conflict between the efficiency and low frequency performance of a loudspeaker. In the majority of cases efficiency is achieved at the direct expense of bass extension, and frequently high efficiency systems suffer very high coloration. Not so with the new generation of Mission designs. The exceptional motor systems combined with high quality cone materials and precision manufacturing processes have enabled us to offer extraordinary sensitivity and bass extension whilst preserving the mid band magic of classical Mission speakers. Our speakers have always been acclaimed for low coloration, neutrality and transparency in the mid band. This is now coupled to bass extension, with control and articulation. Careful attention is paid to the linearity of both frequency response and distortion at different power levels. Consequently the dynamic headroom is so great that the loudspeaker system will not suffer "saturation" and "compression" at high listening levels.

The 707 offers 92dB efficiency for 1W input measured at 1 metre and can be used with amplifiers ranging from 20W to 100W per channel. Rigid, sand-filled metal Mission stands are available for use with this model, or under special circumstances the 707 may be bookshelf mounted.

Mission 737 Renaissance

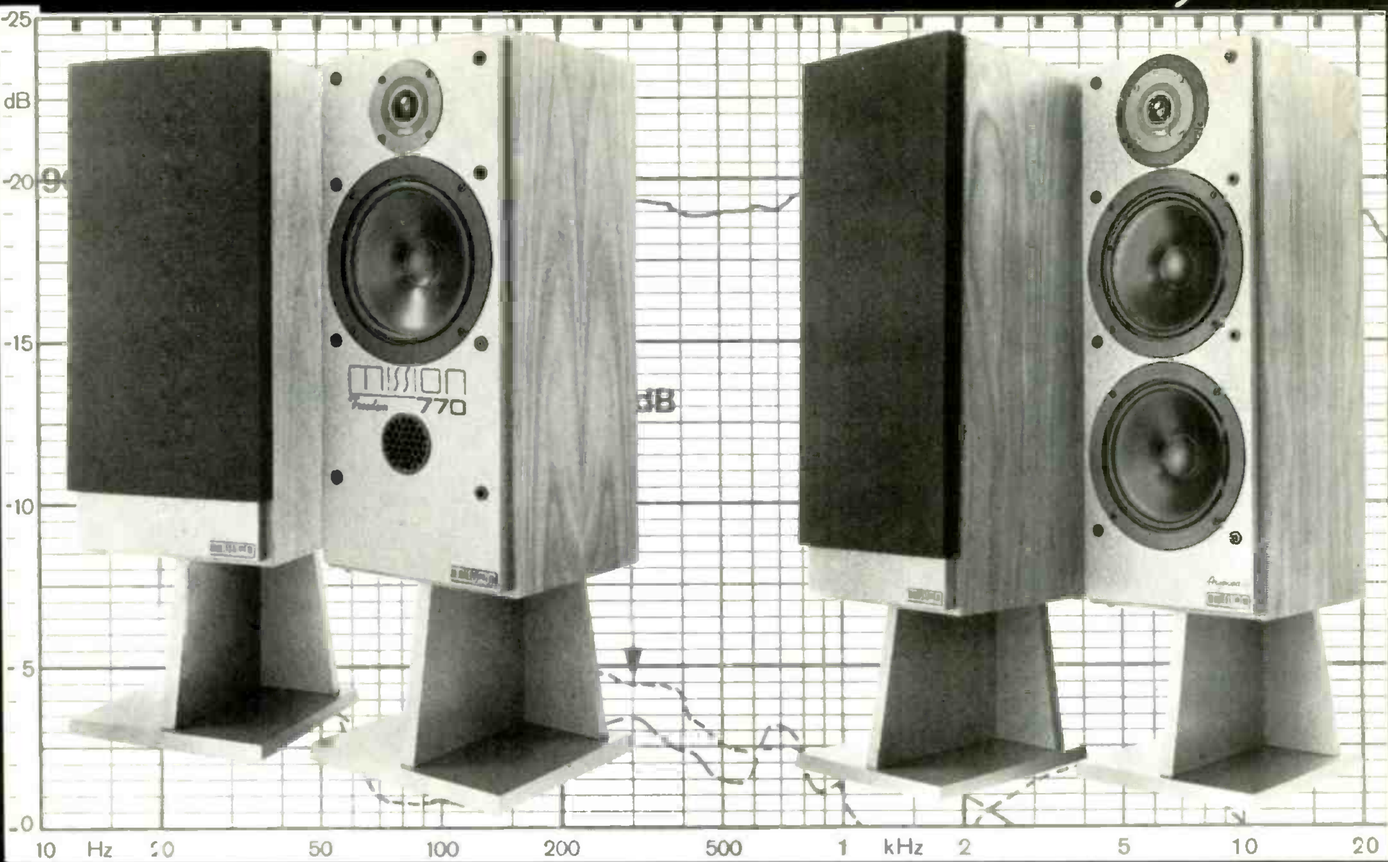
In 1978 when polypropylene as a cone material was in its development stages at the research laboratories of the British Broadcasting Corporation, and other manufacturers were carrying on with conventional materials, Mission were negotiating the patent rights for the coming technical revolution. Around the same time Mission became the first licencees in the world for this British patent. Mission's pioneering research in this area resulted in one of the most advanced loudspeakers – the 770. Since then most other manufacturers have attempted to copy the Mission design with varying degrees of success.

At Mission we have continued to move on. After many years of evolutionary refinements the most advanced version of the 770 drive unit is now designed into our new model 737 Renaissance. The cone membrane for this model offers a unique combination of rigidity, lightness and acoustic opaqueness. The drive unit is manufactured into an esoteric die-cast magnesium chassis to improve rigid coupling. The acoustic properties of the cone are such that they do not allow for internal reflection and standing waves to come out of the cabinet and reach the listener out of phase. Furthermore a solid block of Mission acoustic foam is built into the inside of the cabinet to attenuate such standing waves. The Renaissance cabinet is of precision multi-folded construction, visco-elastically damped and incorporates our special MDF baffle board. The total system is reflexed using the Mission resistive port and resulting in extended low frequency and power handling performance. The Renaissance now possesses many attributes of its predecessor but at substantially lower cost.

For this model, as well as the 770 Freedom and the 780 Argonaut, special Mission stands are available which lock into the loudspeaker and are offered as an optional extra. The Renaissance is recommended for use with amplifiers ranging from 30W to 120W per channel.

/	MISSION 737 RENAISSANCE	MISSION 770 FREEDOM	MISSION 780 ARGONAUT
	30Hz–20KHz	20Hz–25KHz	20Hz–25KHz
db	40Hz–20KHz ± 3dB	35Hz–20KHz ± 3dB	30Hz–20KHz ± 3dB
	8 ohms	8 ohms	4 ohms
/Channel	30W–120 Watts/Channel	30W–150 Watts/Channel	50W–200 Watts/Channel
	90dB	92dB	94dB
Dome – Ferrofluid	19mm Polymer Dome – Ferrofluid	25mm Polymer Dome – Ferrofluid	25mm Polymer Dome – Ferrofluid
x Cone	215mm Polypropylene Cone	215mm Homopolymer Cone	2 x 215mm Homopolymer Reinforced Cones
	2.4KHz	2.0KHz	1.8KHz
	Removable	Removable	Removable
re	4mm plug or wire	4mm plug or wire	4mm plug or wire
	30 litres	40 litres	50 litres
mm	540 x 250 x 270 mm	610 x 270 x 300 mm	710 x 270 x 300mm
	Walnut/Black	Walnut/Black	Walnut/Black

MISSION 770 *Freedom* MISSION 780 *Argonaut*



Mission 770 Freedom

We are confident that the 770 Freedom is a worthy successor to our legendary 770. Our objective in replacing the 770 was to improve on that model in certain specific areas. Firstly, we wanted to ensure that the frequency range was even more extended. Secondly, our design team felt that the bass response could be tighter and with greater transient attack. Thirdly, we wanted to increase the available headroom so that at high power levels the system did not go into saturation. Finally, we wanted to increase efficiency for the era of digital master tapes.

For the mid/bass drive unit a brand new cone was developed made of an advanced homopolymer material impregnated with certain minerals (the formula not being made public by Mission) to offer optimum mass, rigidity, Q and sonic opaqueness – a further advance on polypropylene. The voice coil is manufactured using high temperature aluminium former and is carefully ventilated to increase power handling. The motor system is exceptionally powerful for the amount of magnet we have used and this has been achieved by careful geometric design of the pole piece which in turn is brass plated. This arrangement results in minimal magnetic flux wastages into stray fields. The driver is assembled into a sophisticated rigid magnesium die-cast chassis. The high frequency unit is carefully designed for extreme power and exhibits exceptional power/frequency response linearity and no major saturation at high levels. It is further oil cooled to avoid temperature related performance aberrations and for increased saturation thresholds. The cabinet construction is based on Mission's unique multi-folded geometry ensuring rigidity for low frequency transient attack without coloring the very open and transparent mid band. The cabinet walls are visco elastically damped to control and attenuate resonances and minimise stray acoustic output to ensure minimal acoustic phase distortion. The Freedom's low frequency behaviour is totally unusual for a reflex loudspeaker and this has been achieved by careful integration of the drive unit Qs in relation to the 37 litres of internal volume and the use of the Mission resistive reflex port.

On measurement the Freedoms are capable of exceptionally smooth, highly integrated off axis frequency response as well as the least amount of distortion we have measured in any other loudspeaker. Indeed, driven at 90dB mid band distortion is close to 0.1%!

The Freedom is a powerful expression of Mission's experience and technology. Subjectively, and when used in conjunction with good quality ancillary equipment, the results are exhilarating and most realistic. The Freedom has optional stands as pictured above and is recommended for use with amplifiers ranging from 30W to 150W per channel.

Mission 780 Argonaut

The 780 Argonaut is a brand new Mission product. It is important to point out at this stage that by the nature of its design the Argonaut presents amplifiers with both complex and difficult loads. That is to say, the characteristic impedance at certain frequencies can drop to around 3.5 ohms and even though the phase shift angles are kept to a minimum and for the most part the impedance is purely resistive, nevertheless this can present problems for ordinary amplifiers. This means that only exceptionally well designed amplifiers should be used to drive the Argonauts otherwise the sound quality will be poor and the amplifier could suffer damage. Many good British and American amplifiers, however, are designed to deal with such loads and all Mission designed amplifiers, including the little Cyrus I, are perfectly capable of driving the Argonauts.

The Argonauts are truly exceptional speakers unmatched by any other model at any price. Firstly, for 2.83V of input a single Argonaut produces approximately 94dB of output measured at 1 metre. Secondly, whereas speakers of such sensitivity always lack deep bass, the Argonauts are extremely well extended in low frequencies. Thirdly, whereas nearly all ultra high efficiency speakers use light paper for their cone material and suffer the associated colorations, the Argonaut uses modern polymer based engineering materials and has no significant audible or measured colorations or distortions. The whole speaker is manufactured from MDF rather than conventional chipboard and the walls are visco elastically damped.

The Argonaut has many common features with the 770 Freedom. It parallels up two of its 8" drive units (see 770 Freedom) for mid/bass frequencies and the tweeter takes over at 1.8 KHz to handle the high frequencies. Such low crossover frequency combined with excellent dispersion characteristics of the tweeter result in breathtaking stereo stage such that when the speakers are correctly positioned there is no audible evidence of point source left and right channels. Rather, the system achieves the true definition of stereo – a solid three dimensional stage with tremendous front to back imaging (without any tunnel effect) and no interrupted left to right sound stage. When this happens the speakers effectively "disappear". Such 3-D musical stage is then combined with the Argonaut's awesome dynamic range to produce what Mission designers call Magic!

Special optional stands are available from your dealer which fix into the 780 and we would recommend these speakers for use only with very high quality British and American amplifiers.

Cyrus Electronics

Design Philosophy

The design of a good amplifier remains more obscure and more complex than the design of any other component in the high fidelity chain. In recent years the requirements for the operation of a good amplifier have been the subject of extensive research by academics and manufacturers alike, resulting in a new understanding of some of the more important parameters. The problem is somewhat compounded by the substantial improvements made to front-end inputs such as advanced 'turntable–arm–cartridge' combinations, digitally synthesised FM tuners and, of course, the advent of quality compact disc players such as the Mission 7000. Additionally, modern loudspeakers have become far more complex in terms of load factor than their predecessors making the job of the amplifier increasingly more difficult. Hardly any amplifier designed in the 1970s is capable of driving such sophisticated loudspeakers as the Mission Argonauts. Indeed, you will find that the small Cyrus One drives complex speaker loads better than many amplifiers with ten times the power output and sometimes costing ten times as much! The secret lies in appreciation of fundamental design parameters, as well as intuitive, somewhat inspirational application of 'black art'.

You see, there are serious differences between live music and hi-fi. At first people thought these could be dealt with by improving 20 or 30 simple specifications, but as these improved many listeners became more aware of the shortcomings and less satisfied with hi-fi. Indeed, improvements made to certain specifications have ironically turned out to be detrimental to the ability of the amplifier to reproduce music. A prime example of this is the power output specification. For the last 20 years Japanese companies and other commercial designers have been obsessed with giving you more 'Watts' for less money – and always at the expense of the current capability of the amplifier! That is to say, for any given power supply you have a 'see-saw' relationship between power output and current drive. For example, we could at no extra cost to you or ourselves, have designed the Cyrus One with power output in excess of 100 Watts per channel, and of course at the expense of the current capability of the amplifier. In fact, this is exactly how commercial manufacturers satisfy the irrelevant and superficial specifications drawn up by their marketing departments – who have little or no interest in the sonic excellence of their products. Amplifiers with poor current delivery are simply not capable of driving the modern loudspeaker, and unfortunately the problem doesn't just stop there.

Whereas years ago, using poor front-end inputs and highly distorted loudspeakers, people could not hear the subtle and, at the same time, important differences between equipment, today such differences are being noticed by a great many. Whereas years ago we were obsessed with such superficial problems as distortion, colouration and power output; today we have the sophistication to research into musical notes themselves. The coherent reproduction of music is a function of such subtle and ethereal qualities that many listeners find hi-fi gives a different, somewhat disembodied interpretation of the original live performance.

For example, music may sound detailed and 'open' but nevertheless sterile and lacking in feeling. At the first encounter with such ideas the less knowledgeable reader may find the phenomena non-scientific and even absurd. However, through careful research carried out by the designers of Cyrus Electronics we can demonstrate both scientifically and musically the validity of these phenomena. For instance, the above mentioned problem of amplifier 'sterility' is associated with, among other causes, amplifier hysteresis due to poor circuit design, incompetent topology, or the use of low-grade components. Take a musical note with a given decay characteristic. One high fidelity system would shorten the decay, cutting the continuity of the note, whilst another would over decay to such a degree that it would cause transient response delay to the leading edge of the next note. The net effect of either aberration would be music which although not muddied, coloured and distorted, nevertheless may sound uncommunicative, incoherent and disembodied. You see, whereas in the 1970s we placed great emphasis on detail and information retrieval, today we have moved on beyond such simplistic concepts and are investigating the true art of the reproduction of music.

If we review another area of subjective performance our explanation will become more lucid. Take two amplifiers, one with uncontrolled, overblown, rather boomy bass and the second with over-damped, rather restricted bass. The subjective difference between these two amplifiers is that the first sounds rather slow and sluggish whilst the second initially sounds fast and impressive. However, both of them, in the long run will sound quite boring and non-musical. The subjective reason here is simply that neither amplifier is capable of reproducing the musical time correctly. The first slows down the subjective beat and tempo in the music resulting in a tired and sluggish performance, whilst the second hastens the subjective musical time to such a degree that the reproduction loses elegance and majesty.

The important issue here is that music in itself is abstract, intangible and immeasurable, and the high fidelity chain extremely complex. The fundamentals of processing music signals through such a cumbersome series of components, materials, interfaces, conversion of energies etc are not clearly understood. Laboratory designs, mathematical models and conventional measurements appear to be totally inadequate. To design on subjective grounds alone would also be dangerous. Therefore what is needed is a design that satisfies both criteria, and more importantly introduces the musical dimension.

The genius of Cyrus designs lies in their ability to transcend the classical pedestrian ideas of dealing in simplistic specifications, meet the stringent requirements of the musical community, and incorporate music's spiritual and emotional dimension. In a tired world dominated by commercialism, consumerism, designed obsolescence and so much mediocrity your Cyrus amplifier will touch your mind and bring you breathtaking musical experience for many years to come.

Cyrus I

A British critic wrote "... the stunned look on the face of people who first heard the Cyrus One amplifier ..."; a leading Dutch reviewer went on to say: Cyrus One is probably the best amplifier at any price; a most respected American reviewer added: the more subtle qualities of Cyrus One can only be matched by the finest of American tube amplifiers; and the French critics simply awarded Cyrus with 'Decibel D'Honneur'. Since then we have continued to read extraordinary independent test-reports from critics all over the world on this genius of a product. We have learned of astonished music critics replacing their costly 'super-amps' with the little Cyrus One. One can therefore only conclude that in its short history, since its introduction, the Cyrus One has become both a Reference and a living legend.

The Cyrus One is based on a revolutionary circuit design philosophy, details of which are beyond the scope of this brochure and in any case well guarded secrets. The design is then implemented with careful attention to circuit topology in order to minimise the number of components in the signal path and reduce their harmful effects. This 'straight-line' design is then manufactured to the very highest standards using components and materials beyond the reach of most competition. The power transistors, for example, are military grade, ultra-fast and very linear devices especially manufactured for Cyrus Electronics. The driver transistors are equally products of a British military semiconductor manufacturer. World class German produced passive components have been selected including extravagant polypropylene capacitors, polystyrene capacitors, and metal film resistors. The casing for the amplifier is precision injection moulded from a 'non-magnetic', 'non-electroconductive' metal substitute produced by Space Division of American General Electric.

All spurious and harmful stages, such as tone-controls and filters, headphone and loudspeaker switching, protection circuits and balance controls have been eliminated to make the amplifier a 'straight-line', no compromise, state-of-the-art design. The quality control standards are amongst the highest in the industry where every amplifier is tested along nearly 100 parameters on the most sophisticated Hewlett-Packard CAD-CAM systems available. The result is an extraordinary achievement called the Cyrus One integrated amplifier, elegant in appearance, without gimmicks, and capable of producing a breathtaking and spectacular sound stage when used with quality ancillary equipment.

Cyrus Two

The Cyrus Two is an even more sophisticated amplifier with a similar philosophy to that of the Cyrus One. The major differences between the two amplifiers are in the area of greater power output and even more importantly, superior current delivery capabilities. Furthermore, Cyrus Two incorporates one truly exceptional moving coil stage with emphasis on noise and hysteresis factors. Indeed, the MC stage is designed to work with esoteric cartridges often costing many times the price of Cyrus Two. Another unique feature of Cyrus Two is its ability to accept the PSX optional outboard power supply (not available for use with Cyrus One) and, when configured with the PSX, Cyrus Two is capable of competing directly with the finest and most esoteric American 'super-amps'. Independent test reports have frequently suggested that the only problem with Cyrus Two is its modest price tag, which may prejudice the most discerning of audiophiles who tend to look only at very expensive equipment. We suggest that you audition the Cyrus Two, possibly combined with the PSX, against the world's most esoteric equipment before you make your final decision.

Cyrus PSX

Given that the circuit philosophy is capable of reproducing magic and that really is what music is all about, and given that as we have already stated, Cyrus Two uses state-of-the-art components and manufacturing techniques throughout, there is only one other area of potential improvement – and that is in enhanced power supply capabilities.

Whereas the Cyrus Two has a superb internal power supply of its own, capable of unbelievable current delivery of 60 amps peak-to-peak, nevertheless the addition of the PSX can only improve things further. The PSX is manufactured in a similar case to the Cyrus Two, and plugs into the back of the Cyrus Two via an umbilical cord terminated with an XLR connector. The PSX transformer has been the subject of two years research and development and is the ultimate in toroidal transformer technology. The power supply reservoir capacitance is substantial and again the finest available components have been used. We are confident that the discerning music lover will not be able to better the performance of the Cyrus Two, using optional PSX outboard power supply, at any price.

Cyrus Tuner

The advent of digitally synthesised tuners has substantially improved the reception quality of FM broadcasts. A few problems however continue to persist in the design of most FM tuners. The most serious of these problems we consider to be sibilance in high frequencies and poor low-frequency performance. It is common knowledge that the low-frequency performance of tuners lacks authority, control, definition, and articulation – especially when compared to the latest generation CD players.

The objectives of Cyrus Electronics have been to produce an outstanding tuner where the FM section does not suffer the nagging problem of 'spitting' sibilance, and to give bass notes their rightful and necessary musical weight, tempo, and authority. The Cyrus Tuner is manufactured in a case of identical dimensions and appearance to the rest of the Cyrus range, and will suit the requirements of the perfectionist audiophile who owns either a Cyrus One or a Cyrus Two.

The design is based on microprocessor controlled digital frequency synthesised tuning, and provides 19 FM and 9 MW presets with C-MOS memory back-up. The unit provides variable speed up/down scanning, automatic search, as well as manual tuning. Automatic FM mute is provided to eliminate irritating interstation noise. Quartz-locked tuning system is adopted for ultimate tuning accuracy and minimal frequency drift. An informative Fluorescent Tube Display electronically generates digital frequency readout, 'Tuning' indication, 'Stereo' reception and, when selected, preset channel number. For finest reception quality under adverse signal conditions the Cyrus Tuner has FET front-ends (dual-gate with automatic gain control on FM). The FM mixer oscillator is buffered to ensure high immunity to interference, and Ceramic filters are incorporated for high selectivity on both AM and FM wavebands. The Cyrus Tuner offers 'Sliding Stereo' decoder maintaining full channel separation on strong signals, and changing gradually to mono for fullest noise suppression on weak signals. PLL decoder circuitry produces a stable audio signal with optimum channel separation, and an SISC filter cuts out interference on stereo broadcasts.

Note: As mentioned earlier the products of Cyrus Electronics exclude harmful protection circuitry to ensure maximum signal integrity. Please be extremely careful not to short the speaker outputs on installation.

Note: Combinations of any two Cyrus products produce the standard rack width of 430mm to match your other equipment.

MISSION ELECTRONICS

The Mission DAD 7000 is an advanced third generation compact disc player and the first of its kind from a quality specialist manufacturer. In the light of great controversy concerning both the absolute standard of reproduction from CD players as well as tremendous variations between the machines from different manufacturers, Mission Electronics hung fire until the fundamentals of the technology had settled and until their own extensive research programme had resulted in what promises to be the world's most advanced CD player.

The Mission DAD 7000 is a 4 times over sampling machine with 16 bit resolution. The machine offers full facilities including motorised front loading tray with anti-jamming protection, studio class access time of average 2.5 seconds, full programmability of up to 99 tracks and in any sequence with repeat capability, queuing to within one second accuracy, automatic disc read after loading the CD, high speed forward or backward music search plus fine step adjustments. The Mission DAD 7000 also offers user-friendly ergonomics and full infra-red remote control.

Other technical features of the Mission DAD 7000 include two separate digital to analogue converters for true stereo reproduction, the unique Philips digital transversal pre-DAC filter as well as Mission's own patented post-DAC filtering. This sophisticated two stage filtering system combined with high sampling frequency results in a perfect audio band frequency response without phase shifts and other aberrations and with mathematically near-perfect impulse response and the associated transient performance. Here it must be noted that most machines on the market suffer from severe inter channel phase shifts or absolute phase shift, and in most cases both. The laser read system is a single focus design eliminating the dangers of manufacturing alignments or subsequent field disturbances. Unlike most inexpensive designs the Mission DAD 7000 is manufactured into a most sophisticated set of pressure die-cast chassis and structures to ensure total stability and integrity of the fragile transport system and a subsequent reduction in reproduced errors. The machine is precision manufactured to the highest standards using high grade components to offer the best sound quality and long term user satisfaction.

Above all, Mission has a worldwide reputation for state-of-the-art in high fidelity and our design team are confident that the DAD 7000 meets Mission's stringent requirements for the ultimate in sonic performance.

Call Mission North America: Tel: (416) 673 3777

JOSEPH GIOVANELLI

Connecting a Power Amp To a Tape Loop

Q. I own an integrated amplifier that has two tape monitor loops. I would like to add another power amplifier and connect it to the integrated amplifier. Can I connect it via the tape monitor?—Keith Ling, Dunwoody, Ga.

A. You should not connect a power amplifier to your integrated amplifier via the tape monitor output jacks. The reason is that the integrated amp's volume and tone controls would be inoperative as far as the second power amplifier is concerned. Unless there is a set of pre/main connections on your integrated amplifier, I cannot think of a convenient way to connect the power amplifier to it.

Inner-Groove Distortion

Q. Please shed light on the problem of inner-groove distortion, its causes, and how to get rid of it. I have observed this problem with two turntables and three cartridges.—Brent Jarvis, Colchester, Vt.

A. Since a record turns at a constant number of rotations per minute, the groove's linear speed (in inches per second) is greater at the outside of the disc than at the inside, because the groove's circumference is greater at the outside. This means that the signals at the inner groove are crowded more closely together, which makes them harder to track. At the same time, the inner groove's more sharply curved radius makes it more critical that the stylus be exactly tangent to the groove than is the case at the outer grooves. If you listen to classical music, you'll find that many pieces come to loud, crashing climaxes. This places the most heavily cut signals, which are hardest to track, at the inner grooves.

Finer edged styli, such as the hyperelliptical, MicroRidge, van den Hul or similar types, can track the closely packed inner-groove details a bit better than other types. If your current cartridge does not have such a stylus, perhaps you could get one for it.

Aligning the cartridge so that the stylus is tangent to the groove at or near the inner grooves is crucial, especially with these newer stylus types. Some cartridge makers, such as Shure and AKG, supply alignment gauges with their higher priced models. Your turntables probably came with alignment gauges too, though many such gauges are rudimentary and hard to use. There are also a number of good alignment gauges on the market, such as Mobile Fidelity's Geo-Disc Telarc's Omnidisc, and Dennesen's Soundtracktor. Or perhaps your dealer might check and adjust your turntable's cartridge alignment for you.

Destroying Loudspeakers

Q. I keep "knocking out" the diaphragms in my tweeters and destroying the passive radiators in my woofers. My speakers are highly efficient. Dealers have told me my problem is that I don't have "clean" power and that I need a high-powered amplifier. What are your thoughts?—Fred R. McCarroll, Harriman, Tenn.

A. Your problem is that you are listening at such a high level that you are damaging your speaker systems, either by directly overdriving them or because your power amplifier is driven to clipping. Clipping will likely damage tweeters, but it cannot be suspected as the "instrument of destruction" of your passive radiators, since these will be damaged only by severe mechanical motion.

You say your speakers are rated as being highly efficient. Thus, you must be listening at extremely loud levels indeed. I do not think that "cleaner" amplifier power is the answer; the cure for your problem is to listen at sound levels which will save both your loudspeaker systems and your ears.

Of course, I am assuming that your system is located in a typical listening room. If you are operating your equipment in a large theater or hall, that puts a different light on the matter. Under those conditions, I think you should use a second power amplifier and additional loudspeakers. By so doing, you can reduce power input to each loudspeaker and distribute the sound more evenly throughout the listening area.

Impulse-Noise Reduction

Q. Please explain how effective impulse-noise limiters are.—Skip Tillinghast, Fredonia, N.Y.

A. Impulse-noise reducing devices are highly effective if you want to remove only *transient* sounds, such as pops or ticks. It is the nature of such sounds which makes it possible for the device to recognize the difference between them and the music. Not even sharp, percussive music has the steep attack that a pop has. If, however, your problem is steady-state background sound, the device will be of no use. Steady-state background noise is usually removed by introducing a fixed, high-frequency roll-off, or by introducing a variable roll-off which is dependent on the instantaneous amplitude of the program. I have heard of some esoteric comb filters and computer-aided techniques which have been developed for dealing with this problem, but, to my knowledge, these schemes have not found their way into any consumer audio equipment.

Groove Hopping

Q. When using my turntable, I set the stylus down ever so carefully, using the table's damped cueing lever, in the grooved portion of a record. I nevertheless notice that the tonearm jumps in and out of three or four grooves before finally settling down. I hear the hops as rapid clicks coming from my speakers. The same thing happens when lifting the tonearm, again via the cueing lever. I am concerned that this will damage both my stylus and my records.—Name withheld

A. If the clicks you hear from your loudspeakers really indicate that your stylus is groove hopping, I believe you have a problem with the cueing lever. If the cam which lifts and lowers the tonearm is not parallel to the turntable or if the anti-skating adjustment is seriously off the tonearm may drift rather than rise and fall straight as it is supposed to.

It is also possible that what you hear from your loudspeakers is the result of overdriving your system because of the strong, low-frequency pulse which can be produced when the cartridge touches the surface of the disc. Overdriven components can produce unwanted sound from the system as an artifact of the overload.

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

Matthew Polk's New Generation of Revolutionary TRUE STEREO SDAs

Matthew Polk's new generation of revolutionary TRUE STEREO SDA Loudspeakers fully realize the astonishingly lifelike three-dimensional imaging capabilities of stereophonic reproduction.

"The Genius of Matthew Polk Brings You A New Generation of Extraordinary Sounding SDAs"

"Mindboggling...Astounding...Flabbergasting"

High Fidelity Magazine

The result is alway better than would be achieved by conventional speakers."
Stereo Review Magazine

Polk's critically acclaimed, Audio Video Grand Prix Award winning SDA technology is the most important fundamental advance in loudspeaker technology since stereo itself. Listeners are amazed when they hear the huge, lifelike, three-dimensional sonic image produced by Polk's SDA speakers. The nation's top audio experts agree that Polk SDA loudspeakers always sound better than conventional loudspeakers. Stereo Review said, "Spectacular ...the result is always better than would be achieved by conventional speakers." High Fidelity said, "Astounding...We have yet to hear any stereo program that doesn't benefit." Now the dramatic audible benefits of Polk's exclusive TRUE STEREO SDA technology are available in 5 uniquely superb loudspeaker systems, the SDA SRS, SDA SRS 2, SDA-1A, SDA-2A, and the SDA CRS + .

"They truly represent a breakthrough"
Rolling Stone Magazine

Without exaggeration, the design principals embodied in the SDAs make them the world's first true stereo speakers. When the big switch was made from mono to stereo, the basic concept of speaker design was never modified to take into account the fundamental difference between a mono and stereo signal.

What is the difference between a mono and stereo speaker? The basic concept of mono is that you have one signal (and speaker) meant to be heard by both ears at once. However, and basic concept of stereo is that a much more lifelike three-dimensional sound is achieved by having 2 different signals, each played back through a separate speaker and each meant to be heard by only one ear apiece (L or R). So quite simply, a mono loudspeaker is designed to be heard by two ears at once while true stereo loudspeakers should each be heard by only one ear apiece (like headphones). The revolutionary Polk SDAs are the first TRUE STEREO speakers engineered to accomplish this and fully realize the astonishingly lifelike three-dimensional imaging capabilities of stereophonic sound.

How Polk SDAs Achieve True Stereo

Polk SDA technology solves one of the greatest problems in stereo reproduction. When each ear hears both speakers and signals, as occurs when you use conventional (Mono) speakers to listen in stereo, full stereo separation is lost. The undesirable signal reaching each ear from the "wrong" speaker is a form of acoustic distortion called interaural crosstalk, which confuses your hearing.

The Polk SDA systems eliminate interaural crosstalk distortion and maintain full, True Stereo separation, by incorporating two completely separate sets of drivers (stereo and dimensional) into each speaker cabinet. The stereo drivers radiate the normal stereo signal, while the dimensional drivers radiate a difference signal that acoustically and effectively cancels the interaural crosstalk distortion and thereby restores the stereo separation and imaging lost when you listen to normal "mono" speakers. The sonic benefits are remarkable.

SDA Signature Reference System (SRS) – $1395.00 ea.
AudioVideo Grand Prix Winner
The finest speaker that Polk manufactures. This limited production flagship model combines patented SDA TRUE STEREO technology with phase-coherent focused line-source multiple driver topology to achieve new levels of state-of-the-art imaging, detail, coherence, dynamic range and bass reproduction.

New SDA-SRS 2 – $995.00 ea.
This new scaled down version of the SRS incorporates virtually all its innovations without significantly compromising its awesome sonic performance.

SDA 1A – $695.00 ea.
AudioVideo Grand Prix Winner
A beautifully styled, full size floor-standing system combining Polk's state-of-the-art components with exclusive TRUE STEREO technology for extraordinarily lifelike sound. It is now available in vinyl at a new lower price. High Fidelity said "the Polk SDA 1 Loudspeaker provides startling evidence of the audio industry's essential creative vitality."

New SDA 2A – $499.00 ea.
AudioVideo Grand Prix Winner
The new SDA 2A is a full size floor standing system which incorporates many of the latest refinements in SDA technology developed for the SRS models. It represents an extraordinary value which combines spectacular SDA performance with a remarkably affordable price. High Fidelity said listening to the SDA 2 is "an amazing experience."

New SDA CRS + – $395.00 ea.
AudioVideo Grand Prix Winner
The new SDA CRS + is the world's best sounding bookshelf loudspeaker and now incorporates many of the latest refinements in SDA technology developed for the SRS models. It combines the extraordinarily lifelike three-dimensional sonic performance of Polk's patented SDA technology with a handsome enclosure (stand or shelf mountable) of attractively modest proportions. Stereo Review said the CRS is "an impressive achievement".

"Breathtaking...a new world of hi-fi listening"

Stereo Buyers Guide

"Mindboggling...astounding...flabbergasting"
High Fidelity Magazine

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KEN POHLMANN

AN INTERIORESTING SUBJECT

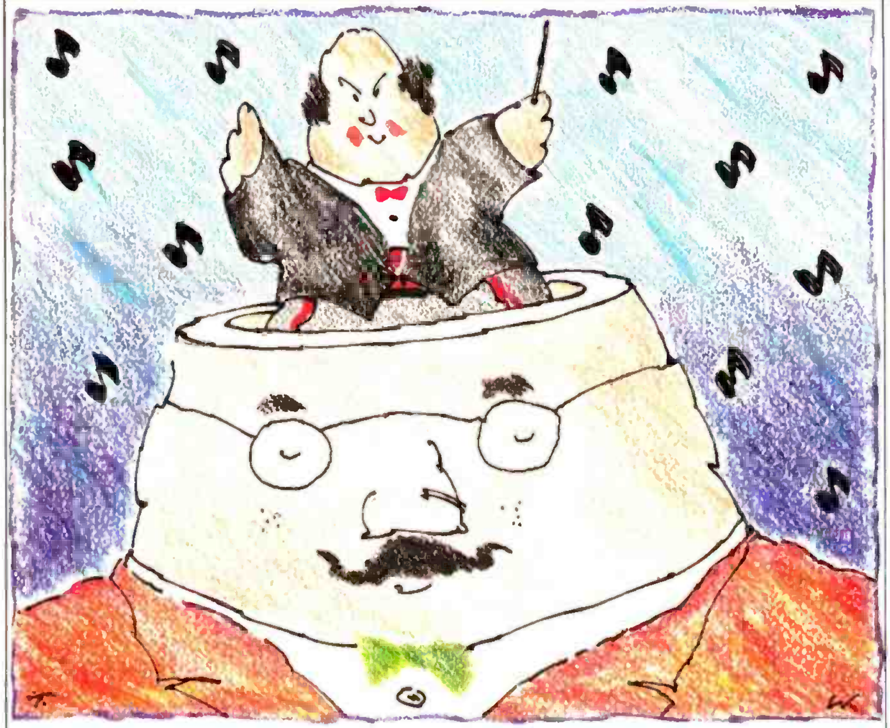

Illustration: Thomas H. Waters

What ties together left and right hemispheres, pairs of ears, phantoms, loudspeakers, and your head's shadow? The answer is psychoacoustics. What does psychoacoustics have to do with digital audio? Increasingly a lot, as the mysteries of this largely unexplored area are being revealed and exploited by the signal-processing clout of digital audio techniques. Let's define psychoacoustics and consider specific examples of its principles in action, a side trip in preparation for understanding digital signal processing's eminent impact on psychoacoustics.

Despite all the talk about pressure functions, velocity of propagation, and colliding molecules, the real business of sound takes place inside our heads at the ear/brain interface. Until they are perceived, all sounds are merely academic concepts. Acoustical perception explains our subjective response to anything we hear; it is the ultimate arbitrator in acoustical matters because it is only our response to audio which fundamentally matters. Psychoacoustics seeks to reconcile acoustical stimuli—and all the objective scientific and physical properties which surround them—with the psychological responses which they evoke in individual listeners.

The ear is a very sensitive organ. The mental judgments which result when it is coupled to the interpretive powers of the brain form the basis for all the enjoyment we experience from sound and music. Compared to the physical properties of sound, psychoacoustics presents formidable opportunity for basic research into such factors as aural associations, the effect of musical training, attentional ability, and organization of memory for musical information. In addition, while many responses are common to all listeners, any single listener's overall response to what he or she hears is a unique reflection of individual experience.

The basis of psychoacoustics and all aural perception is the ear/brain system, composed of two ears and two brain hemispheres. It is a wonderfully complex machine, and while some of the simple mechanisms are fairly well understood, the system itself is still largely a mystery. Normal left and right ears do not, as far as we know, differ physiologically in their capacity for detecting sound, but their respective right and left brain halves certainly do. Each of us has one brain (more or less), but the two halves loosely divide the brain's functions.

Interestingly enough, and also mysteriously enough, the connections from the ears to the brain halves are crossed—the right ear is wired to the left brain half and the left ear to the right brain half. There is some overlap in the connections, but the primary links are crossed. That leads to an interesting question. It has been found that the left cerebral hemisphere processes most of our speech (verbal) information. Thus, the right ear is perceptually superior for spoken words. On the other hand, it is mainly the right temporal lobe which processes melodic (nonverbal) information. Therefore, we are better at perceiving melodies heard by the left ear. Should Congress pass a law placing music on the left loudspeaker, and lyrics on the right? Nobody really knows—aspiring Nobel Prize recipients, take note.

All of this raises many questions, including one of basic design. Specifically, why do people have two ears? With one good ear we can fully perceive amplitude, frequency, loudness, and timbre. But primeval man needed two ears for localization—that is, to know what direction the man-eaters were coming from. Today, of course, modern man still desperately needs two ears—otherwise his headphones would fall off.

Localization provides a fine subject for demonstrating psychoacoustics in action, and for showing both the sophistication and the simple-mindedness of the ear/brain system. The ear/brain uses four main cues to localize sound: Relative intensity, time of incidence, phase, and complexity of waveform. Provided that two ears are available (and two *are* needed for localization), relative intensity difference is perhaps the most important cue. A sound from one side will have greater intensity at the near ear because of the inverse-square law, which dictates that sound attenuates as it propagates. Intensity is also influenced by the head's acoustic shadow; high frequencies will be blocked by the head, and will thus be further attenuated at the far ear. This effect is important at frequencies above 1 kHz but is insignificant at lower frequencies because long wavelengths tend to bend around the head.

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If you have two ears, you are a bona fide spatial localization expert, with a marvelously complex decoding machine beneath that $8 haircut.

The second cue, time of incidence, exercises the brain's computational power; the brain rapidly calculates time differences of less than a few ten-thousandths of a second between one ear and the other. The ear nearest to the sound receives the sound first, a cue to its direction of origin. This cue would be ineffective for a steady-state continuous tone, but is highly useful for any changing waveform.

The other two cues are near relatives of the first two. With continuous tones, the brain seems to compare the phase between the two ears. The greater the calculated phase difference, the further to one side the sound's origin appears to be. Of course, this cue is frequency-dependent, occurring only where the path length between the two ears is a wavelength or less. In addition, there is some evidence that the ear is not sensitive to phase information outside the midrange band.

Finally, the complexity of the waveform plays a part. The head attenuates high-frequency components and not lower ones, and the brain perceives the resulting timbre differences between the ears—the more distant ear hears less high-frequency information.

Thus, lower frequencies are localized primarily by time of incidence or phase between the two ears, while high frequencies are localized by amplitude difference. The shape of the outer ear helps to determine front/back localization. Slight head movements which shift the ear/brain's placement in the sound field also help in deciphering the cues.

A pair of loudspeakers (or headphones) provides a perfect laboratory to study the psychoacoustics of localization. When sound is produced from the left speaker, our ear/brain uses the four cues to determine the left-hand direction of origin; likewise for the right speaker. But when equal sound is produced from both speakers, a fairly amazing phenomenon takes place: Instead of localizing sound at the left and right speakers, our highly-evolved ear/brain decides that the sound is coming from the empty space between the speakers, even though other sensory organs such as our eyes clearly show that nothing is there. (However, localization *is* sharper in a darkened room.) Each ear receives the same information, and that information is stubbornly decoded as coming from straight ahead. Our interpretation of the cues leaves us no choice. We have created a phantom image.

The ear/brain's gullibility in creating phantom images is the keystone of stereo reproduction. When the correct spatial information is recorded along with the music, the ear/brain decodes it to recreate the panorama of a sound stage. As some die-hards enjoy pointing out, stereo is nothing more than two-channel monaural. The rest is purely interpretive.

The principal device used to accomplish stereo encoding is a panning potentiometer, or pan pot. By varying the information of the localization cues, phantom images may be placed anywhere along the line between two speakers. A pan pot functions somewhat like the balance control on a home stereo; when rotated, it varies the relative amplitude of the signal between two channels. The ear/brain subsequently uses those amplitude cues to determine localization, and presto—the image appears to move. It's only an illusion, but a pretty good one. Of course, it works best with sounds that fit the ear/brain's amplitude-cue criteria. As we've already noted, high frequencies are the best candidates; low frequencies are more difficult to localize. Stability of placement is also dependent on the timbre of the waveform, the interaction with other signals present in the individual loudspeaker, the effects of listening-room acoustics, and, of course, listener placement.

But amplitude is only one of the cues the ear/brain uses to determine localization. What about time of incidence? Indeed, time cues may also be used to create phantom images. If equal-amplitude signals are supplied to our loudspeakers at the same time, the phantom image appears in the middle. But if a time delay of up to 2 mS is introduced to one speaker, the sound will appear to come from the earlier speaker and the later speaker perceptually disappears. This nifty bit of psychoacoustics is known as the Haas Effect; it states that the ear/brain is drawn to the earlier source, ignoring the later one. The effect is good for delays up to about 40 mS. With longer delays, the ear/brain has time to realize the trick, and perceives the two sounds as discrete impulses. Delays as short as 2 mS shift the sound partway between sources. So, by playing with such short delays, we may move the phantom image along the line between our two sound sources, our ear/brain obediently using time-of-incidence cues to create the phantoms.

Of course, localization cues can also be obtained the old-fashioned way. When a pair of spaced-apart omnidirectional microphones is placed in front of an orchestra, the orchestra's spatial information is encoded free of charge. For example, the sound of the violins will be picked up by both microphones, but the violins are closer to the left microphone than to the right, so their sound output will be louder at the left microphone and will arrive there earlier.

When the two channels are reproduced, the amplitude and time-of-incidence information encoded along with the music will cause our ear/brain to place the violins on the left. Likewise, the rest of the orchestra members will seem to be seated in their respective chairs between our loudspeakers. In addition, combinations of cues such as amplitude, time of incidence, hall reverberation, and high-frequency attenuation create information of depth, placing the woodwinds behind the cellos and the percussion behind the woodwinds.

If you've got two ears, you are a bona fide spatial localization expert. Specifically, what you have underneath that $8 haircut is a marvelously complex decoding machine, obedient to many kinds of aural cues. Of course, when listening to a recording, you are largely constrained by the accuracy of the aural cues that it presents—to the degree that they are imperfect, they limit your psychoacoustic enjoyment of the recording.

Enter DSP—Digital Signal Processing. With high-speed number-crunching techniques performed in the digital domain, the caliber of those cues can be greatly improved, as we'll see next month. Meanwhile, consider this problem: If your stereo system supplies all the acoustical cues of a concert hall, are you listening at home or in the concert hall?

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BERT WHYTE

DELAY DELIGHTS

Yamaha DSP-1 Digital Sound Field Processor

The latest Summer Consumer Electronics Show in Chicago marked the 20th anniversary of the CES. The occasion was noted with appropriate fanfares and celebrations, but a concatenation of unfortunate circumstances cast something of a pall on the festivities.

First, an attendance record would have been a nice anniversary present, but this didn't happen. Second, all through the show there was an undercurrent of unease and apprehension. Dealers, having endured rather flat sales during the first part of the year, were confused and concerned about the apparently ongoing dollar/yen crisis. With the yen rising better than 30% against the dollar, the price structure of Japanese-made equipment has been chaotic, with virtually no stability. It is an unsettling situation, to say the least, that most certainly put a damper on what should have been a really upbeat event.

To add to the muddled state of affairs, JVC and Sony traded barbs in support of their respective VHS-C and 8-mm camcorder formats. Several product categories in which new technology might have given a lift to the market didn't surface, notably R-DAT and CD-I (interactive CD). Sony did privately preview an R-DAT recorder, but no concrete plans to market it were put forth.

However, in spite of the lack of industrywide new technology, the show did feature significant advances embodied in a number of audio products, with a polite bow to video technology as well.

About a dozen years ago, Bob Berkovitz, a very clever fellow who had been with Dolby Labs, was working for Acoustic Research in Canton, Mass. There, he came up with an absolutely fascinating concept. Bob got some of the bright young people at nearby MIT to do an acoustic analysis of Boston's Symphony Hall, and to store in computer memory the early reflections and other acoustic parameters characteristic of that famed concert hall. Then, at an AES convention in Los Angeles, Bob set up a room with 16 very small AR speakers placed around its perimeter. Tape recordings of music were played and processed through the computer's acoustic "model" of Symphony Hall. The results were sensational, presenting a degree of realism and an illusion of true concert-hall presence never before achieved in the reproduction of music. Unfortunately, the powers that be at AR didn't think the idea could be developed into a saleable product—and I guess in retrospect it was something whose time was yet to come. The concept of concert-hall synthesis would have to wait until advances in computer technology made it feasible.

Well, friends, the time is now—it has arrived! One of the hits of this SCES was Yamaha's DSP-1 Digital Sound Field Processor. In some ways, this fascinating new product was made possible by CD technology and by the burgeoning interest in Dolby Surround Sound processing for encoded videocassettes and videodiscs.

The DSP-1 uses VLSI chips that were developed by Yamaha, and 2 megabits of ROM memory capability is built into the unit. High-density memory is necessary, for in the DSP-1 are stored the acoustic characteristics of 16 different listening environments. This includes concert halls, churches with moderate and long reverberation periods, nightclubs, discos, etc.

Yamaha developed a single-point, four-microphone analysis technique to determine the acoustic parameters of concert halls, most specifically the early reflections between 10 and 100 mS. Using a starter's pistol to create a pressure wave in the hall, the special microphone array and associated equipment can pick up and record reflected energy out to 22 early reflections. Yamaha analyzed the acoustic "personalities" of famous concert halls and other sites throughout the world, and stored this mass of data in the DSP-1's ROM chips. Operating at the same 16-bit quantization and 44.1-kHz sampling rate as the Compact Disc, the VLSI chips can provide up to 88 early reflections.

With the DSP-1, the optimum playback setup for concert-hall synthesis requires a six-speaker array: The primary stereo pair in the normal frontal position, plus another pair of speakers flanking the primary pair and a third pair at the rear of the listening room. (Of course, the two extra pairs of speakers require amplification, and Yamaha has a new four-channel amplifier, the M-35, which provides 20 watts to each of the four outputs.)

In use, the DSP-1's wireless remote control—but not the front-panel controls—can be used to choose any of

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As reviewed in the June '86
StereoReview

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"This ties in with the primary goal American Acoustics has set for its Digital Series speakers: accurate reproduction at both very high and very low levels, to cope with the extraordinary dynamic range available on the best Compact Discs.

". . . in short, this (the D-8500) is especially suitable for those who want to be able to play their music loud without coloration or distortion and without having to buy a huge amplifier. If you're in that category, you certainly should give the D-8500 a serious listen."

As reviewed in the June '86
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Though there were no broad-based leaps in new technology at the SCES, individual products did show significant advances.

the 16 listening environments stored in memory; the acoustic characteristics of the original halls will then be synthesized from the stored data and presented through the two extra pairs of speakers. In addition, each hall's basic parameters (such as room size) can be modified with the remote control according to the desires of the listener.

Needless to say, the extra quotient of realism provided by the DSP-1's concert-hall synthesis was wowing everyone at the Yamaha demonstration. Delivery of the DSP-1, which also is a superior device for Dolby Surround processing, was slated to get underway at just about the time this issue goes to press, at a price of $850.

I have always been a staunch supporter of the use of time delay in increasing the spatiality and dimensionality of music reproduction. I have been using the Benchmark system for years, and in my opinion it certainly was the best of the so-called "bucket brigade" or charge-coupled, analog time-delay devices. Many audiophiles are on a constant quest for these long-out-of-production Benchmark units.

Well, they can save their energy and satisfy their desire for a time-delay unit with Sony's superb new SDP-505ES. This unit combines time delay with a Dolby Surround processor. Both use PCM digital technology, with the same 16-bit quantization and 44.1-kHz sampling rate as that used by Compact Discs; thus the SDP-505ES is said to achieve the same high quality of sound in respect to frequency response, distortion, wide dynamic range and signal-to-noise ratio.

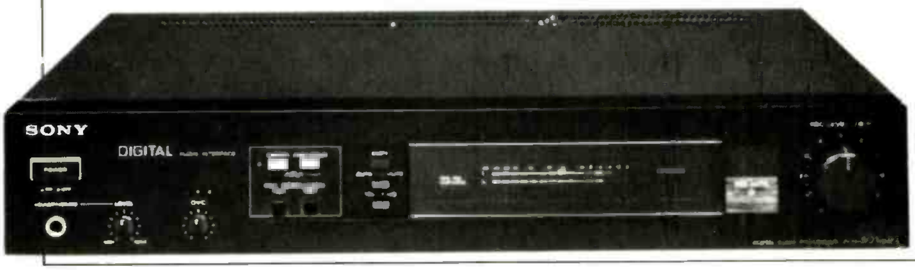
With individual controls for left and right channels, the SDP-505ES provides stereo delay of 0 to 90 mS, adjustable in 0.1-mS increments. There is also a preset "hall" mode which has a 30-mS delay plus added reverberation. There are three memory positions which can be programmed with selected delay parameters. The unit's Dolby Surround processing is wholly digital, with delay adjustable from 10 to 30 mS, and there is a built-in pink-noise generator for setting Dolby mode and the level of front and rear speakers. A surround-sound level control is provided, as is a master control for all channels. A 15-watt-per-channel stereo amplifier is built in for powering side- or rear-channel delay or Dolby Surround speakers.

I have been using a prototype of this SDP-505ES and can tell you that the stereo delay line is absolutely top-rate. It is dead quiet, has extremely low distortion, and is exceptionally smooth. I use it with speakers reflecting off the walls on each side of my listening position, and the illusion of concert-hall lis-

B & W Matrix 1, Matrix 3, and Matrix 2 loudspeakers.

Sony SDP-505ES Digital Surround Processor

Sony PCM-601ESD Digital Audio Processor

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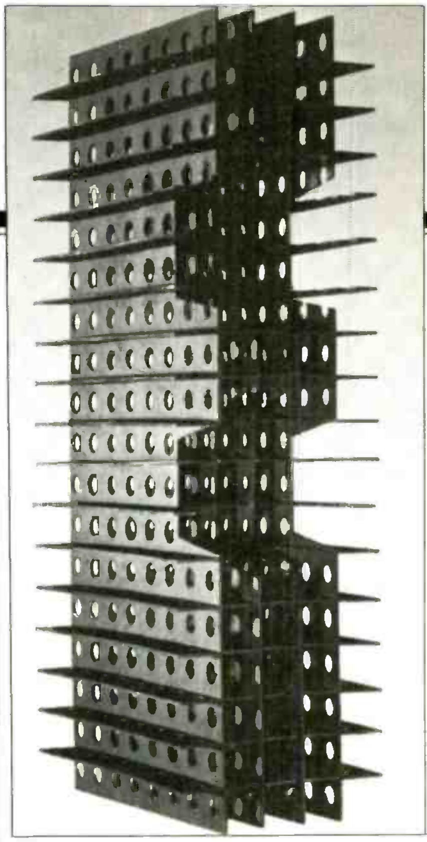
Sony's SDP-505ES stereo delay unit is absolutely top-rate—very quiet and smooth, with extremely low distortion.

tening is dramatically increased. The SDP-505ES will be available by the time you read this, at $700.

Sony also introduced a significant new PCM digital processor, the PCM-601ESD. This has all the features of the F1 portable PCM processor, plus a digital input/ouput interface which enables the unit to communicate with Sony 1610 or 1630 PCM recorders and, with an accessory board, to be used for digital editing. In other words, this processor can be used for remote location recording, and since the optional interface board will permit editing, it can be used for regular commercial recording.

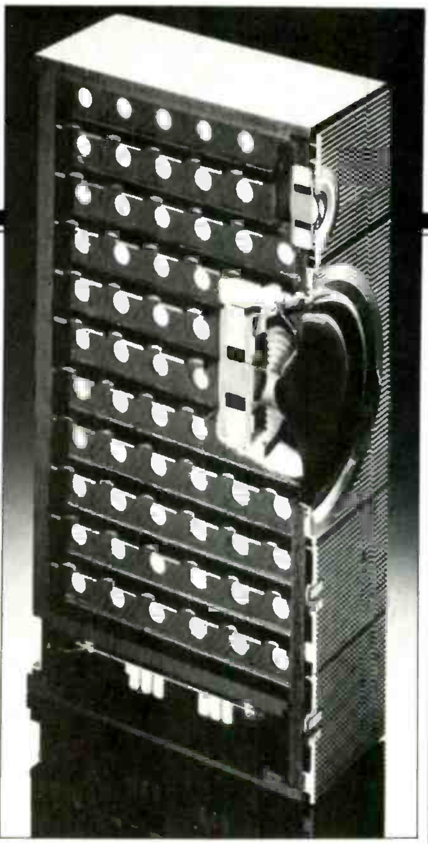
In this respect, another important feature of the PCM-601ESD is what Sony calls an OVC (optimum video condition) control. This system constantly "reads" the output signal of the companion VCR recorder; if any error conditions are detected, an adjustment corrects the data flow for maximum performance and stability. The PCM-601ESD will be available as you read this, at a price of $1,400.

B & W celebrated its 20th anniversary with one of the most dramatic and significant advances in speaker technology in many years. They have introduced three new loudspeakers, each of which uses what B & W calls a Matrix enclosure. Long-time readers know that I have discussed the deleterious effects of enclosure resonance numberless times. I certainly endorse any form of anti-resonant cabinet treatment that will attenuate the coloration which so degrades music signals. The engineers at B & W have always been acutely sensitive to this problem of resonant coloration, which has proven so recalcitrant over the years. About three years ago, they undertook a research program to address this problem. With the use of laser interferometry, all manner of enclosure materials, from complex laminates to concrete, were investigated and found wanting in various respects. Like many great inventions,



A cellular insert is used to stiffen B & W's Matrix cabinets. The cells are then filled with acoustic foam.

The material that B & W uses to enclose its new Matrix speakers is said to far surpass any other in terms of rigidity and freedom from resonance.



Inside the Matrix enclosure, the cellular insert's cross-members are bonded to grooves in the inner wall.

B & W's solution to the problem of enclosure resonance turned out to be a basically simple idea. Simple, but oh so elegant!

The Matrix enclosure, conceived by B & W engineer Laurence Dickie, is made of a rigid material with high damping qualities. The material is fashioned into a series of interlocked, perforated pieces that form a cellular honeycomb. The cross-members forming the cells have many vertical and horizontal planes, and the end sections have a high degree of stiffness. These cell ends or "planes" are fitted to corresponding grooves on the inner walls of the high-density particleboard enclosure panels, then bonded in place. The many cells of the honeycomb are filled with acoustic foam. The result is a remarkable loudspeaker enclosure that, according to laser interferometry and accelerometer measurements, far surpasses any known enclosure material in rigidity and freedom from resonance.

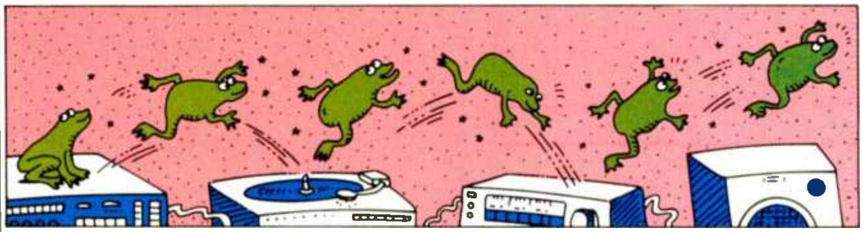
At the press conference where the three Matrix speakers were demonstrated, I rapped on the enclosures and they seemed to be as solid, unyielding, and inert as a block of granite. In playing music of the type which features Fender bass, plucked acoustic bass, or bass synthesizer tone, all of which tend to excite enclosure panels into boomy reasonances, the absence of such effects in the Matrix speakers was dramatic, and the sheer cleanness of the reproduction was a revelation.

There is much more to the Matrix story—for instance, they incorporate new drivers with special cones and baskets, and new crossovers. I will soon have the Matrix 1 (the smallest) and Matrix 3 (the largest) speakers, and will bring you a fully detailed report. The Matrix 1 is $499 each, Matrix 2 is $699, and Matrix 3, $999.

Next month—more significant new examples of audio technology seen at the SCES. A

IVAN BERGER

PLAYING ON THE LINKS



Quality Leapfrog

In an audio system, where do you spend the bulk of your money? In the long run, it's probably the speakers. In the short run, it may be something else.

Our first systems are likely to be of even quality, with no component much better or worse than any other. Our ultimate systems are likely to be that way too, only at a much higher quality level.

In between these stages, it's quality leapfrog. If you upgrade your amp and speakers, the effect is heard on every signal source you play—but any defects in those signal sources become more audible too. If you upgrade your turntable well past the quality level of your speakers, the audible difference may be small, for now, but massive once those speakers are replaced. The next set of speakers may reveal unsuspected deficiencies in the tape deck . . . and so on.

In real-life systems, during those long years of transition from beginning to ultimate, there's always a quality imbalance; something's always out of whack. It doesn't pay to upgrade any component unless the upgrade will yield an audible improvement, and upgrading everything at once is probably too expensive, especially as the system's general quality level rises.

The people who advocate paying most attention to the speakers have a point. Speakers affect the sound of every signal source, and it's easier to hear the difference made by changing speakers than the difference made by changing anything else—unless that something else was woefully below the system's general quality level to begin with.

The people who advocate paying most attention to the turntable (or whatever your prime signal source may be) have a point too. Any details or nuances lost at this stage cannot be recaptured by superior equipment later in the chain, and noises and distortion entering the chain at this stage usually can't be eliminated later.

So which part of your system do you upgrade first? Its weakest link—whatever that may be at the moment. Once that becomes the strongest link, you go on to upgrade something else.

Some of us are lucky enough to reach a plateau where everything sounds right and we are not yet bankrupt. We stay there for a few years, then start upgrading again as old equipment shows its age or as new equipment offers sufficiently better sound or handier features to be worth the money.

Others of us are happiest if the leapfrog never ends; these are the audio hobbyists, for whom the pursuit of good sound is as much fun as the listening.

Applephile Edition

Wouldn't you know it? John Sunier's *Audiophile Audition* radio show (see December '85 "Spectrum") finally has gotten an outlet in New York—but only after my appearance on the show. Metropolitan-area audiophiles who don't care what I sound like (and I bet there are a lot of them) can catch the show on WFUV-FM, 90.7, on Tuesday nights at 6:00 p.m. *Audiophile Audition* has also picked up new stations in Seattle, Wash.; Detroit, Mich.; Elkhart, Ind.; Baltimore, Md.; Honolulu, Hawaii; San Francisco, Cal.; Eugene, Ore., and Troy and Schenectady, N.Y. Consult your local paper for time and station. With luck, TV listings won't have crowded out the radio schedules entirely.

Seduction by Speciousness

I got a letter recently from a reader who was using the Hafler/Dynaquad rear-channel system to increase his audio setup's ambience, and thought he'd found a way to use it to reduce noise as well.

For those of you who don't remember it, the Hafler/Dynaquad was the world's simplest, least expensive surround-sound hookup. It involved connecting one speaker (or two speakers in series) between the positive terminals of a stereo amplifier's two channels. The added speaker (or speakers) would automatically reproduce only the difference (L − R) signal. Most or all of that signal would be ambience, but any singers or instruments that had been recorded out of phase would magically appear in the "rear" channels also. A rheostat or L-pad wired between the Hafler hookup and either amp channel could be used to reduce ambience to realistic levels.

Reader Art Hilgert had noted that, when playing mono records, the Hafler channels contained only noise, with the music cancelled out. Could one, he wondered, route that noise back into the front outputs, out of phase, to cancel out the noise?

My first reaction was that this wouldn't work because of the difficulty of cancelling an uncorrelated signal by phase reversal. My second reaction was that it *might* work if one could pass the L + R signal through a delay line that precisely matched the delays that the noise-only signal would encounter during the L − R subtraction and the subsequent phase inversion. I then passed the idea on to *Audio* contributor Richard Kaufman to see if it could be turned into a workable project.

It turns out my first reaction was closer to the truth; the idea won't work, though not for the reasons that had first occurred to me. The problem is that the L + R and L − R signals contain different noises. In the case of a phonograph record, the L + R includes all noise picked up by the stylus' horizontal motions, while the L − R signal includes all noise picked up by its vertical motions.

Sorry, Mr. Hilgert—all we can cancel is the idea.

Illustration: Teresa Anderko

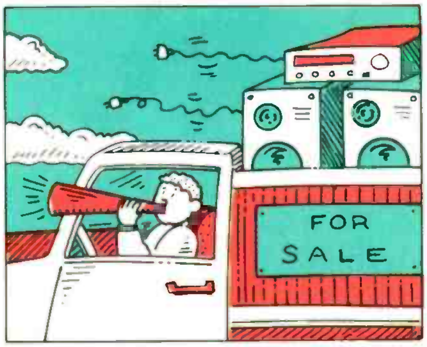
What to do with your old equipment? You can trade it in for newer gear, sell it, give it away, or just hold onto it.

Selling Used Equipment

If you like to upgrade your system from time to time (and don't we all?), then you're often faced with the problem of what to do with the old stuff that you've replaced.

Some dealers will accept trade-ins, which is the quickest, simplest way to handle things. Unfortunately, dealers can't pay you top dollar because they have to resell the equipment at a profit, and because they face the expense of checking it over—and possibly making repairs—before reselling it.

If your dealer does check, repair and guarantee the used equipment he resells, you might consider trading your old gear in for newer, but still used, equipment. In that case, the dealer may make a smaller trade-in offer, but it should still cost you a lot less than new components. Some stores do a lot of business with impatient audiophiles who seem to trade in every six months or so—great



hunting grounds, for the more patient shopper.

If you're going to sell your old equipment privately, consider free media, such as neighborhood bulletin boards (and computerized ones) or word-of-mouth. If you purchase an ad, remember that publications which charge a percentage of the selling price (as many local shopping guides do) are usually most economical for low-priced items, while those which charge fees based on ad length are usually a better buy if you're selling a whole system or expensive components.

Consider the medium's audience too. A low-priced phonograph would probably sell best in your local paper, with its wide general audience; an audiophile amp would probably move faster in the classifieds of such specialized magazines as this one. If you do advertise in a national magazine, though, be prepared to ship the equipment to its eventual buyer; I suspect few Oregonians would drop by your house in Atlanta to pick up a pair of Klipschorns. Consider the cost of shipping when you set your selling price.

If you sell through classifieds, you'll probably sell your equipment quicker if you include your phone number. That's especially true if your ad runs in national or regional magazines—out-of-towners can't look you up in their local phone books. It may speed things up if you include your work

Illustrations: Teresa Anderko

Even when no equalization is needed, some listeners like to tweak response in ways that are pleasant, if not always realistic.

number, as well (be sure to specify which number is which), but be sure that getting a bunch of personal calls won't cause problems for you at work.

However you're selling your old equipment, clean it up so it looks good, and give any noisy controls a spray of control cleaner. You want the equipment to look and sound its best, to command top dollar.

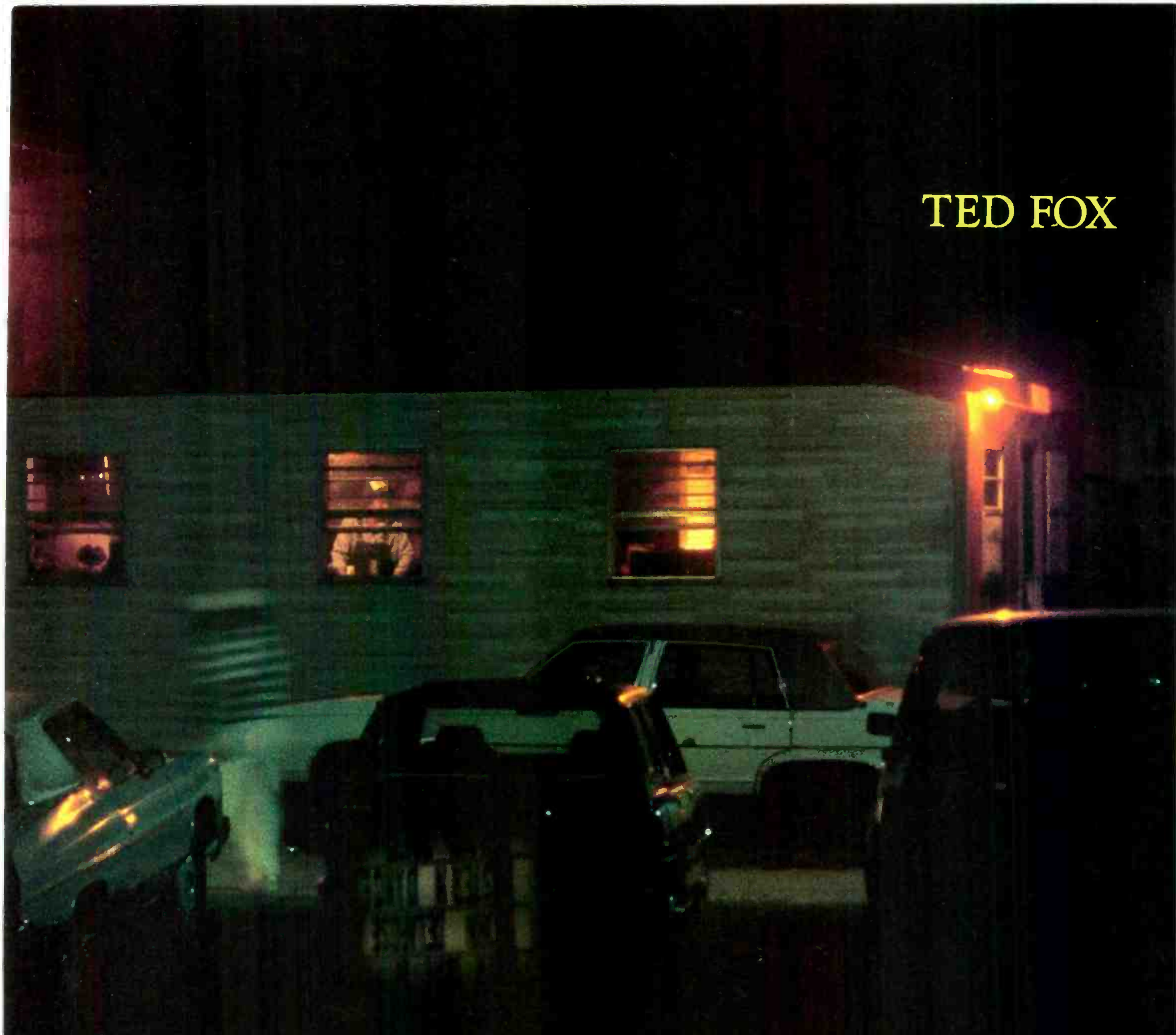
And consider not selling it at all. You might find alternate uses in your home or family—moving that old amp to the video room, using the old speakers for surround sound or as extensions in another room, sending your old cassette deck off with your kid to college. Or you might find a charity that can sell it profitably, while you get a good feeling and a tax deduction. (In that case, be sure you can document the value you're deducting by checking classified ads, blue books, or other sources. Charitable organizations will no longer assign a value for you.)

Customized Curves

I've seen a few Japanese equalizers recently with built-in curves recommended for use with various kinds of music. I always thought the object of high fidelity was to record and reproduce the music so well that no equalization was required (you get none at live performances, after all), but I've also long known that people liked to tweak response in pleasant, if not always realistic, ways. So I was intrigued to see that there are three such curves in the Technics SH-8066 equalizer. The "Vocal" curve has a 4-dB dip at 500 Hz and a 4-dB peak at 2 kHz; the "Jazz" curve has the same 500-Hz dip plus a 6-dB peak from 50 to 100 Hz and another at about 8 kHz; the "Rock" curve has (naturally!) a 12-dB boost from 50 to 100 Hz, a fairly flat midrange (200 Hz to 2 kHz), and then a gradual rise to an 8-dB peak from 8 kHz on up. If you're not a purist, all three curves make some sense, the "Vocal" curve causing voices to be more prominent and cutting down a bit on tubbiness, the "Jazz" curve boosting the bass line a bit (though I don't see a reason for the midrange dip and treble hump), and the "Rock" curve adding lots of thump and moderate screech—the way a lot of people set their equalizers anyway.

At any rate, you can always shut these EQ curves off—or bypass your equalizer altogether when it isn't really needed.

ZYDECO MUSIC: *Hot as a Pepper*



TED FOX

Richard's Club, on Route 190 in Lawtell, Louisiana, is the quintessential Cajun-country dance hall. In the midst of Cajun Lapland, where Louisiana Cajun country "laps over" into Texas, surrounded by cane fields and looking like a run-down Grange hall, the long, narrow, low-slung wood structure is faced with tacky gray fake-brick siding and rests on cinder blocks. On weekend nights, Richard's is packed with cane farmers, housewives, oil-field roustabouts, secretaries, and their offspring, who gather to hear the zydeco or Cajun music they love. Cars and pickup trucks jam the dusty parking lot, where a rickety back-lit sign announces the band, but not the name of the club.

John Delafose

Photos: ©1985, Philip Gould

Canray Fontenot

Photo: C. Cacchione

Framed in the screened window of one of the twin front doors, lit from below by a single small lamp, is the face of the man checking admissions. The face breaks into a smile as you pay your four bucks, get your hand stamped with invisible fluorescent ink for readmission, and walk in—right onto the dance floor. The ceiling is low, just eight feet high. On the sides, it slopes down so low that most people sliding into seats at the tables against the wall have to duck their heads. There are more tables in front of the bandstand at the other end of the room. Two bare overhead bulbs serve as stage lights. Next to the bandstand the back door is propped open, and in each of the half-dozen windows, fans whir furiously.

The crowds at zydeco clubs like Richard's are virtually all-black, and they are there to dance, like their white counterparts in the many similar Cajun clubs. On this Saturday night the heavily rhythmic band of John Delafose is getting them up on the dance floor, although some of the patrons complain that his style is too limited. Most of the patrons just get right into it, however.

This night's festivities, a "Western dance," are sponsored by a horseback-riding club. Most people, including the band, are decked out in Western gear. Every time Delafose picks up his accordion and launches into a number, dozens of black "cowboys" and "cowgirls" saunter up to the dance floor and kick up their heels, two by two. Most couples dance together, executing fancy spins and dips in a furious two-step, or moving cheek-to-cheek on the slow numbers. There is very little rock-style individual boogieing. After each number the dance floor clears, as the band takes a short break. People catch their breath at tables spread with bottles of mixers, fifths of Crown Royal, and plastic buckets of ice.

Until quite recently the people of Cajun country were unusually isolated. There wasn't even a bridge across the Mississippi River into the bayous until 1928. In the 17th century the Cajuns' French ancestors settled in Nova Scotia, which they called Acadia. Expelled by the British in 1755, the Cajuns found their way to the backwaters of Louisiana over the next decade. Their music drew upon the French music of their ancestors, as well as elements of the other cultures present in southern Louisiana—Spanish, American Indian, Caribbean, and German.

The resulting amalgam of music and culture is sometimes difficult for outsid-

In their music, the Cajuns have drawn from their French ancestry as well as the cultures they found in Louisiana: Spanish, Caribbean, American Indian and German.

Travis Leger Photo: ©1985, Philip Gould

Illustration: Philip Anderson

ers to understand. Blacks and whites work together, often play music together, and are friendly, their musics intimately entwined. Yet each group sees itself as separate. Whites call themselves Cajuns; blacks usually refer to themselves as Creoles.

Cajun music is usually played by whites, although some of the great practitioners of this music, such as Canray Fontenot and Alphonse "Bois Sec" Ardoin, are black. Zydeco is the music of the Creole blacks, although many young, white Cajun performers play it too. (It is generally thought to take its name from a creolized version of the French term for snap beans, *les haricots*, in the old tune "L'Haricots Sont Pas Sale"—the snap beans aren't salted.) Zydeco is a close relative of traditional Cajun music with a modern R&B beat and a heavy dose of the blues. While the accordion is always the lead instrument in zydeco, the fiddle tends to dominate Cajun music.

In a land blessed with an abundance of great cooking, it's hard to resist using a food metaphor to describe similarities between Cajun music and zydeco. "It's like a gumbo," says Barry Ancelet, a folklorist and ethnomusicologist who teaches at the University of Southern Louisiana. "You can make it with a roux base—with flour—or you can make it with an okra base. It makes a similar gumbo, but with a different basis."

Strangely enough, discrimination bound the two groups together. When the discovery of oil near Jennings, Louisiana, in 1901 finally opened the land to outsiders, Cajun and Creole French culture was suppressed. French was banned and English became compulsory in the state's schools in 1916. For years the language, culture and music of the Cajuns and Creoles were stigmatized in their own communities.

Ancelet recalls, "I remember the summer after I graduated high school in 1969, I got together with some friends of mine, all French-speaking people, for a crawfish boil at my house. I put on an Iry Lejune album and everybody loved it. But it's not something that we would have ever admitted to doing on the school grounds. In fact, the social climate was such that in 1974, when we started the Tribute to Cajun Music Festival (now part of the Festivals Acadiens), we could have looked all year long for a *young* Cajun musician and never found one. There were none."

Stanley "Buckwheat" Dural, who leads one of the best zydeco bands, has similar memories. "Our parents wouldn't speak French to us," he recalls. "English, that's it. Let me tell you something, I never spoke French in my life until '79. None of my friends would talk it. The only time I would talk French was when I went to the country. Now some of my generation surprises me because they talk French. I had never heard them speak French in their lives! It was amazing. I said, 'I didn't know you could speak French.' And they said, 'Well, I didn't know *you* could speak French!' "

Gradually in the late '60s a Cajun-pride movement began among the whites of Acadiana. Ancelet and his colleagues started presenting Cajun music to the public in 1974 under the auspices of CODOFIL (Council for the Development of French in Louisiana). "The Cajun music festival eventually played a very important part in encouraging young people to come back to the music of their own culture," says Ancelet. "What happened was it held people like Dewey Balfa, Nathan Abshire, and Clifton Chenier up on a four-foot-high stage—or pedestal—and made culture heroes of them, and in the same motion made them available to the crowd. Lots of young musicians saw that these people were wonderful

Clifton Chenier (above) and his brother Cleveland (right) during a recent appearance at New York's Lone Star Cafe.

Photos: ©1986, Joseph A. Rosen

Stanley "Buckwheat" Dural (above) and Rockin' Dopsie (right), zydeco's crown princes, have gained many fans outside Louisiana.

Photos: ©1986, Joseph A. Rosen

and said, 'Wow, these guys live right here in Eunice or Basile or Mamou. I want to learn this stuff.' " Now there are heroes aplenty playing zydeco and Cajun music.

Zydeco even has a king—Clifton Chenier. Indeed, for years Chenier performed with a crown atop his head, a prop that has been copied by many other pretenders to his throne. Born in 1925 on a sharecropper's farm near Opelousas, he worked the fields; then, in 1947, he headed for Port Arthur, Texas, with his brother Cleveland, who still plays the *frottoir* (rub board) in Clifton's band.

Like many other zydeco and Cajun musicians to this day, playing music was a part-time thing for the brothers Chenier while they made their living driving oil-refinery trucks. They were discovered by black talent scout J. R. Fulbright, who recorded them on his Elko label in 1954 and later sold the masters to Imperial. Clifton signed with Art Rupe's Specialty label in 1955 and had an immediate hit with the rocking "Ay-Tete-Fee" ("Eh Tite Fille"). The record brought Clifton and zydeco national attention. He toured the country with rhythm-and-blues artists like Lloyd Price, The Clovers, The Cadillacs, and The Dells, and also blues stars like Etta James, Jimmy Reed, and Lowell Fulsom. Combining zydeco with R&B or blues in concert was natural because much of Chenier's sound was directly based on these influences.

Indeed, Chenier will often play in a straight blues vein, a style he feels his audiences often prefer to zydeco or "French music," as he calls it. It's a puzzling attitude for someone who is proud of his title of "King of Zydeco," but it should be understood in light of the long stigmatization of French-style music, and of the strong ties Chenier has to the blues—his cousin was married to Lightnin' Hopkins. Chenier thus established the mix for all the other zydeco performers who have followed in his path.

By the early '60s Chenier's career had faltered, and he retreated to the local scene. In 1964 Arhoolie released Clifton's first LP, *Louisiana Blues and Zydeco*. His appearance at the 1966 Berkeley Festival once again brought him to national attention as he rode the crest of the blues resurgence. Assured of steady work, he released a series of superb zydeco records on Arhoolie. Today, Chenier, although seriously ill with diabetes which requires regular dialysis, is still performing and still ruling the growing throng of contenders for the zydeco king's crown.

Rockin' Dopsie, whose real name is Alton Rubin, is not shy about staking his claim to be the crown prince of zydeco. "My buddy Clifton's health is going," says Dopsie. "Somebody has got to stand in for him, and I'm the next man in line."

Although he didn't make his first recording until 1968, Dopsie (pronounced Dupe-see), who was born near Lafayette in 1932, has been performing as a musician, and otherwise, for more than 30 years. "When I was 13 years old, before I started playing music, I used to be a great jitterbug dancer," he recalls. "There was another older dancer named Dopsie. He must

With an R&B beat and a dose of the blues, zydeco is a close relative of Cajun music. But it's the accordion, not the fiddle, that's at the heart of zydeco.

Wayne Toups

Photo: ©1985, Philip Gould

have been in his 20s. I started dancing like him and people said, 'Boy, you're better than Dopsie!' So they used to call me Little Dopsie. Then a couple of years later I decided I was going to start in music because my daddy was a musician."

Dopsie's great band, The Twisters, is a dynamo literally and figuratively, towered over by John Hart, who used to be Clifton Chenier's tenor sax player. At a recent gig at New York's Lone Star Cafe, The Twisters had everyone dancing wildly—something not often seen in this cramped club. Getting people moving seems to be a specialty of Dopsie's. "I was doing a concert in New Iberia," he recalls. "A young lady in a wheelchair was in front of the bandstand. I started doing a little zydeco and she just stood up from her wheelchair and grabbed her friend and rocked the whole song."

Stanley "Buckwheat" Dural, 37, the other man who would be king, is an accomplished musician who has played piano and organ behind Little Richard and Barbara Lynn. He developed his zydeco chops playing in Chenier's band for two years. In the early '70s he formed Buckwheat and The Hitchhikers, a rock-oriented band that was locally popular in Lapland, but in the late '70s rediscovered his zydeco roots. "I guess we didn't realize what we had that was ours," he says. "As a matter of fact, when I started playing zydeco they thought I was crazy—jumping from rock music, hard stuff, up-tempo funk music. They couldn't understand what I was doing."

Buckwheat and his Ils Sont Partis band (which takes its name from the call that starts each race at Evangeline Downs—it means "they're off") should probably get the lion's share of credit for the resurgence of zydeco among young people in Louisiana. He is young enough to know their tastes and musical prejudices, and he is hip enough to have made his band not simply a superb zydeco unit, but also one of the best soul groups today.

"To get the younger generation you have to give them something of what's happening today," he says. "That's what made me mix the traditional and the more modern beat. That's one reason why the younger generation is still coming out for this. You give them 50% and they give you 50% and you can't go wrong."

Fernest Arceneaux, born in 1940, remembers when Buckwheat, too, was skeptical of the zydeco sound. "Buckwheat thought it was old-fashioned music," he says. "When he had The Hitchhikers, a rock 'n' roll band, my pal Buckwheat came around and listened, and laughed. He found it funny that I was playing accordion."

Arceneaux and his group, The Thunders, played zydeco part-time for years, while Arceneaux worked as an auto mechanic. He put out a few locally successful singles, playing dances on the weekends. His 1979 Blues Unlimited album, *Fernest and The Thunders*, was well received, and since then he has played all over the world.

Lawrence "Black" Ardoin and His French Zydeco Band, in many ways, bridges the gap between zydeco and Cajun music. His musical lineage is impeccable. Amadie (Amèdè) Ardoin, a cousin of Lawrence's father, was the first black French accordionist to record. Lawrence's father, Alphonse "Bois Sec" Ardoin, is another important French accordionist and Canray Fontenot, related by marriage, is considered the master of French-style fiddle. Born in 1946, Lawrence still plays with his father and Fontenot on their occasional gigs, and is obviously drawn to their old-time sound.

Dancing at the Bon Ton Roulet Club (above); Fernest Arceneaux (right).

Photos: ©1985, Philip Gould

Bebe Carrier (above) and Marc Savoy (right) during an appearance at Slim's Y-Ki-Ki, a typical roadhouse outside New Iberia.

Photos: ©1985, Philip Gould

With his own band he has managed to keep one foot in both worlds. "I wanted to be traditional, but if you stay traditional these days, you don't stay in business," says Ardoin. "You have to do what the people want. We do Cajun and zydeco, also country and western, disco, and blues, depending on what's called upon."

As Clifton Chenier is the hero of all younger zydeco musicians, fiddler Dewey Balfa is the hero of the new generation of Cajun musicians. Born near Mamou to sharecroppers, he and his brothers Will, Harry, and Rodney started playing together as The Balfa Brotherhood in the '40s. On their own recordings and on records led by Nathan Abshire, which they made for Floyd Soileau's Swallow label, The Balfa Brotherhood produced some of the most important traditional Cajun records. Like Abshire, who worked in the Basile town dump, Balfa never anticipated making a living from his music, and he still runs Balfa's Discount Furniture Store in Basile.

In 1964 the musicologist Ralph Rinzler "discovered" Balfa and brought him to play the 1964 Newport Folk Festival, where he and the other Cajun musicians he performed with were a surprise hit. Three years later Dewey returned to Newport with The Balfa Brotherhood, meeting with even greater success. This led to a string of college and festival dates to play traditional Cajun music, and increasing demand for his more modern Cajun music on the local nightclub circuit.

Marc Savoy and Michael Doucet are the two primary keepers of the flame on the Cajun music scene today. They have played with older traditionalists like Balfa, together in their Savoy-Doucet Cajun Band along with Savoy's wife Ann, on their own, and, in Doucet's case, with his band Beausoleil.

Savoy, born in 1941, is a traditionalist. He rarely plays with other musicians in public, preferring to think of his music in the time-honored Cajun sense, as an enjoyable communal diversion and a tradition worth preserving, not as a commercial thing. Asked why he was not playing at the Festivals Acadiens, he replied: "I just took my kids to the zoo last week. Why would I want to go again?"

Still, if anyone can be said to have made Cajun music his life, it is Marc Savoy. In addition to being an excellent musician, preservationist, and forthright critic, he created his "Acadian" accordion based on the old German diatonic accordions which were the instruments originally introduced into Cajun culture. It may be hard to find him performing in public, but he is often seen jamming with other Cajun musicians at his Savoy Music Center and Accordion Factory east of Eunice.

Savoy explains the difference between his smaller button accordion and the more familiar piano accordion: "See how easily I handle this beer can? It weighs maybe two ounces. I can do all kinds of tricks with this little beer can. I can waltz along with it on my head; I can flip it from one hand to the other. But now suppose you had a five-gallon can in your hand instead, and you tried to do the same things with it. It would be pretty cumbersome.

A dichotomy exists in Cajun music today, between traditionalists who want to preserve the old sound and progressives who are aiming for a wider, younger audience.

Michael Doucet Photo: C. Cacchione

You cannot get the shuffle, the triplets, the choppy back-and-forth action out of a 35-pound keyboard accordion that you can out of a five-pound button accordion."

Michael Doucet, a fiddle player 10 years younger than Savoy, loves the traditional Cajun music of heroes like Dennis McGee, Balfa, and Fontenot, but he feels the music must also move in a more progressive direction. "I recorded three albums with Marc," he says. "I feel the way Marc feels very strongly. We're both sticklers for playing traditional things. We'll play 10 or 12 bars just like somebody used to, but after that it's up to us. You put your own feelings into it. If you play exactly like somebody did years ago, you're not playing yourself. That's not an evolution of the music, that's a decadence of the music, and I think Marc agrees with me."

Doucet's band Beausoleil plays a unique selection of sounds from their culture. "We've found old songs that date back to the 12th century that Acadians sang in France," says Doucet. "We also play all the influences of Louisiana—Spanish, Indian, Creole, African. We play the accordion music of the '20s, and some string-band sounds of the '30s and '40s. Then we go into a more progressive sound because we're products of the '60s."

Zachary Richard is the man arousing the most controversy among Cajun music enthusiasts. The controversy centers on whether or not he plays Cajun music. Born in Lafayette in 1950, Richard learned to play accordion by listening to Aldus Roger and The Lafayette Playboys on records. From the beginning, his path was different though. "Marc Savoy and I have always been at two different ends of the spectrum," he says. "Marc is very traditional and I'm anything but. I played rock 'n' roll 10 years before I started to get into Cajun music. I was in New York under contract to Elektra records. With the advance from my first album, I bought my first accordion. I sort of sneaked in through the back door."

Richard returned to Louisiana and in 1975 became a militant leader of the nascent Cajun pride movement, going so far as to refuse to speak English. This helpec make him a star in Quebec during the heyday of that province's separatist movement. He earned a Canadian gold record for an album he describes as rock, *Migration*, then moved to Paris. No longer an angry young man, he recently released his first album in English in 10 years.

According to Richard, all music must move forward. "If people cannot accept the growth that an artist is obliged to put upon himself, then as far as I'm concerned they can forget about me," he remarked backstage at last year's Festivals Acadiens. "If it wasn't so dusty, and they didn't take an hour to set up, I'd have my synthesizers here. If you're going to be on the edge of the wave, I think you have to try to exploit all the possibilities."

Perhaps the two newcomers to watch most closely are Terrance Simien and Wayne Toups. Simien, 20, has already broken out of the Louisiana scene to play New York and record with Paul Simon. "Young teens are really getting off on our music," he says. "They see a young band like us, and it shows them that it's cool."

Wayne Toups, 26, cites as influences such emotional performers as Iry Lejune and Otis Redding, and he plays his "zydecajun" music with a fervor that sometimes brings him to tears. As he says, "I'm trying to show young people and old that the music can be put together and enjoyed by both sides." **A**

Photo: ©1986, Joseph A. Rosen

Terrance Simien, playing at Tramps, a New York nightclub (above); part of the audience at the Festivals Acadiens (right).

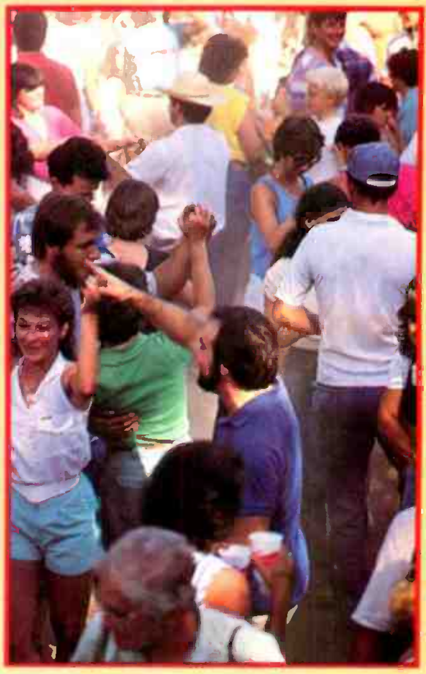


Photo: C. Cacchione

THE FILTERS IN OUR EARS

NOWHERE IN AUDITORY THEORY OR IN acoustic psychophysiological practice is there anything more ubiquitous than the critical band. It turns up in the measurement of pitch, in the study of loudness, in the analysis of masking and fatiguing signals, in the perception of phase, and even in the determination of the pleasantness of music. And likely, in one way or another, it will be a part of the final understanding of how and why we perceive anything that reaches our ears. Students of vision have no such omnipresent entity to worry and console them. The other senses lack the mysteriousness of this unseen—perhaps nonexistent—but pervasive auditory filter.*

F. ALTON EVEREST

*Jerry V. Tobias, Foundations of Modern Auditory Theory, Vol. 1.

Illustration: Bob Scott, after A. M. Cassandre


TOP SECR

Could the noise of shrimp affect the course of a war? The Navy thought so, which led to interesting data about human hearing and the filters in our heads.

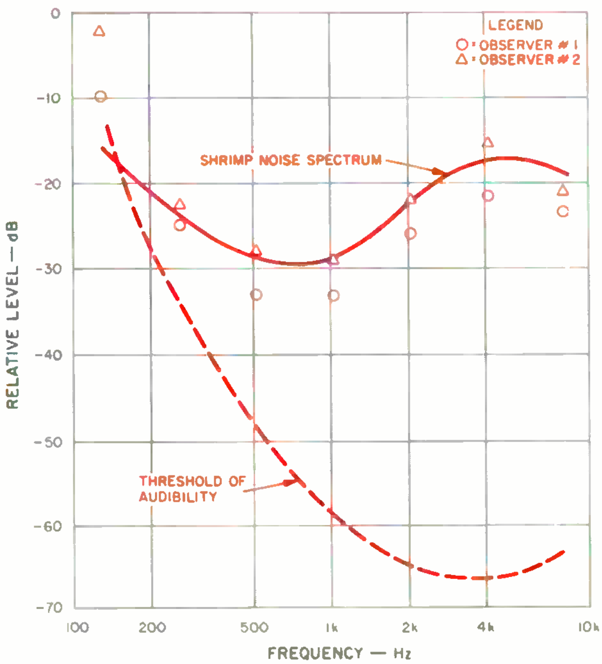


Fig. 1—*Masking of pure tones by shrimp noise. The solid curve represents the critical-band spectrum of shrimp noise recorded off Point Loma. The circle and triangle points represent 50% recognition, by two observers, of pure tones in the presence of shrimp noise. Note how closely the noise spectrum can be approximated using only the auditory filters of the observers. An arbitrary 0-dB reference point has been selected for convenience. (2)*

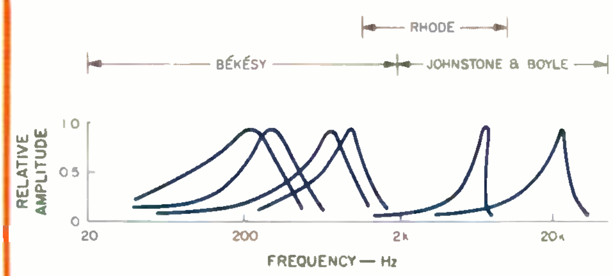


Fig. 2—*A comparison of the shapes of "tuning curves" of the basilar membrane obtained by three different sets of researchers. Each curve was obtained by measuring the amplitude of vibration at a particular point on the basilar membrane for a given frequency of stimulation. Békésy's early measurements were made on dead animals at excessively high sound levels. The sharper and more reliable curves of later investigators were taken on live animals at modest sound levels. (10)*

The crowd noise was deafening. In fact, *how* deafening was the subject being investigated. The occasion was the return of Col. Charles Lindbergh to New York after his historic solo flight across the Atlantic in 1927. New York City was in the process of giving this hero a ticker-tape welcome of a magnitude only New York could offer. As the aviator arrived at the southern tip of Manhattan, boat horns added to the din of the crowd.

Three-quarters of a mile up Broadway, at an open fifth-floor window, a very busy man seemed to be paying little attention to the excitement in the street below as he puttered with various pieces of equipment. Occasionally he leaned out the window to check the progress of the parade, only to lose himself once more in deep concentration over the equipment.

He was measuring the noise of the parade, using the filters in his head. The telephone receiver he pressed to his ear carried a warble tone. An offset cap on the receiver let the crowd noise flow unimpeded into his ear, mixing acoustically with the warble tone from the diaphragm. A calibrated attenuator in the warble-tone circuit was adjusted until the tone was just masked by the noise. Comparison of this attenuator setting to a setting obtained previously under very quiet conditions gave a measure of what this investigator called the "deafening effect" of the noise. Today we would call this a "masking effect." Only those components of noise near a tone are effective in masking that tone, as will be more fully described later.

Lindbergh's triumphant procession along Broadway was certainly an historic event, but so was what was happening at that open fifth-floor window that day. The Bell Laboratory scientist, Rogers H. Galt, described his novel acoustical experiment in the first volume of the journal of the newly organized Acoustical Society of America [1]. Galt was measuring noise and recording noise audiograms of various stages of the parade. He found the "deafening effect" of the noise during a lull in the parade to be 40 dB in the region of 750 Hz to 1.5 kHz; this increased to 70 dB as Lindbergh passed close by. The sound of the boat horns almost a mile away was very intense at low frequencies, yielding a 55-dB "deafening effect" in the region of 250 to 750 Hz. As Galt adjusted the warble tone until it was just audible in the crowd noise, he was actually using his own aural critical band centered on the tone to measure the masking effect of the noise at the tone's frequency.

For me, this idea of auditory filters stirred up hazy memories of World War II, when I was engaged in undersea acoustical research under a University of California contract with the National Defense Research Committee at what is known today as the Naval Ocean Systems Center in San Diego. For assistance in recalling those evanescent memories, I sought out Robert S. Gales, an associate in my wartime work, past president of the Acoustical Society of America and now a consultant in acoustics in San Diego. He replied by sending a copy of a report, "The Effect of Shrimp Noise on Audibility of Underwater Sounds" [2], a product of his psychoacoustical laboratory efforts during the war. The "Confidential" stamps on the report had "Void" stamped over them as evidence of declassification. The reason for my hazy memories was then disclosed, as I saw my own name on the distribution list!

What could a tiny shrimp do that might affect the course of a world war? Studies of underwater sounds in the sea off Point Loma had disclosed areas dominated by intense crackling and sizzling sounds associated with rocky sea bottoms. Scientists at the Scripps Institution of Oceanography found that populations of millions of inch-long shrimp make this noise by repeatedly snapping their tiny claws together [3, 4].

The U.S. Navy became very interested in the effects of such noise on detectability of ship and submarine sounds and echo-ranging systems. This is where Bob Gales' listening experiments came in. In a typical test, he presented to the listener, through headphones, typical shrimp noise at a constant, comfortable level of 60 phons. The level of a tone of a given frequency was then adjusted by a calibrated attenuator until it was just masked by the shrimp noise. This was repeated at different frequencies and with different listeners. The circles and triangles of Fig. 1 show the results of one such test. The solid line of Fig. 1 is an analysis of the shrimp noise used in

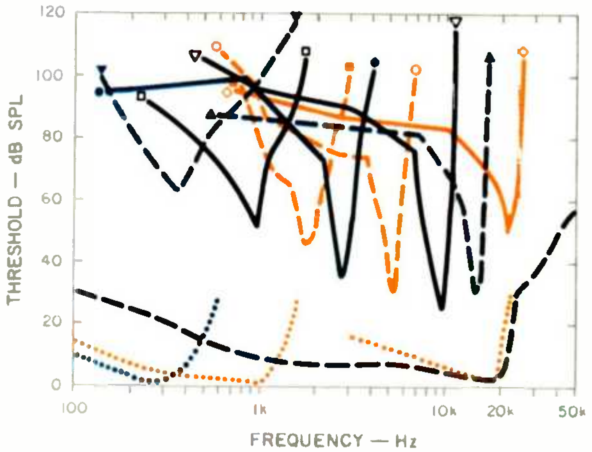


Fig. 3—*A sample of threshold tuning curves of single nerve fibers in the auditory nerves of an anesthetized cat. For each fiber, the threshold is plotted as a function of the stimulating frequency. The dotted and dashed curves at the bottom show corresponding measurements from the basilar membrane. The sound level required to produce a constant amplitude of vibration at a particular point on the basilar membrane is plotted as a function of frequency. The position of these curves on the ordinate is arbitrary; they have been shifted downward for clarity. (9; reprinted by permission of Grune & Stratton, Inc. and the author.)*

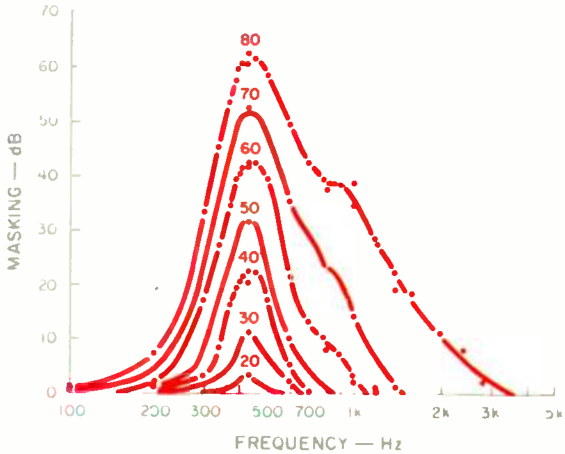


Fig. 4—*Masked audiograms for a 90-Hz band of noise centered on 410 Hz. Each curve shows the elevation of pure-tone threshold as a function of frequency for a particular level of the masking noise. (18; reprinted by permission of the authors and JASA.)*

Low-to-high masking is stronger than the reverse. This tends to reduce perception of higher tones that are needed in music.

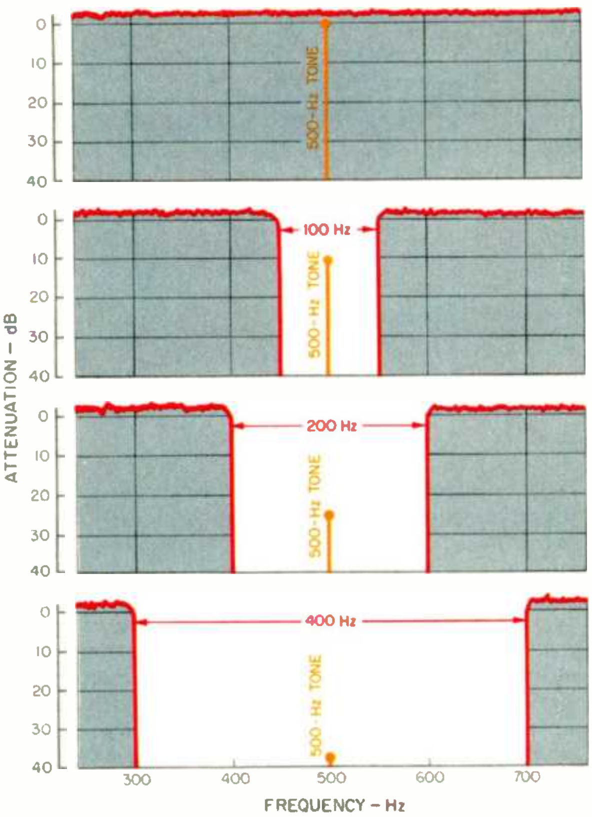


Fig. 5—The "notched-noise" method of determining the bandwidth of auditory filters. The tone, which is represented by the line at 500 Hz, is taken to be just audible at the levels shown. These values are plotted in Fig. 6.

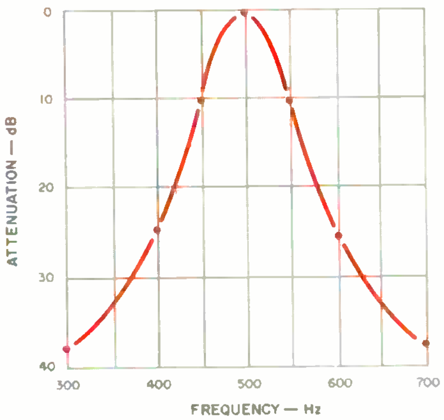


Fig. 6—Auditory filter shape derived from the notched-noise method illustrated in Fig. 5. This method minimizes the effect of adjacent critical bands and assumes a symmetrical shape.

The critical bands of human hearing are about as wide as ⅓-octave filters, but the ear's critical bands are continuous, with filters for *every* audible frequency.

the test, made with an analyzer having a 50-Hz bandwidth. The 50-Hz values were then corrected to commonly accepted critical-bandwidth values to make them comparable to the psychoacoustical results of the experiment. It is seen that there is quite close agreement between the analysis made by the auditory filters of the two observers (circles and triangles) and the spectral analysis made by the 50-Hz filter adjusted for critical bandwidths. Taking into account the inevitable variation in critical bandwidths from one observer to another, as well as the usual variables of subjective measurements, the agreement between the two systems of spectral analysis is surprisingly good—except at 125 Hz, where poor ear sensitivity was the limiting factor. This demonstrates that the spectral shape of a noise may be at least roughly estimated with no other filters than those in the observers' heads.

The Concept of Critical Bands

Anatomical and physiological methods dominated the search for the secret of the ear's analyzing ability for almost a century before the introduction of psychoacoustical methods. In 1924, Wegel and Lane [5] reported on the masking of a tone fixed in frequency and amplitude by a second tone of adjustable frequency. When the two tones were close together, "beats" occurred which distorted the results.

To avoid such beats, Fletcher in 1940 [6] used white noise, which has energy uniformly distributed throughout the audible spectrum. He measured the ratio between the level of the white noise and the level of a tone just audible in that noise, and he found this ratio to vary with tones of different frequencies. Fletcher made two assumptions which had far-reaching consequences: First, that only a narrow band of noise surrounding the tone contributes to the masking of the tone, and second, that when the noise just masks the tone, the power of the noise in this band (the critical band) is equal to the power in the tone.

The first assumption proposes the critical band concept, and the second opens up the possibility of estimating the width of the critical bands. Noise power is expressed in terms of the power in a band 1 Hz wide; this is called the spectrum level. If a distributed noise measured with an analyzer having a 50-Hz bandwidth gives a sound pressure level of 60 dB, the spectrum level of the noise at that frequency is:

60 − 10 log 50 = 43 dB.

The overall level of a pure tone is identical to that in a 1-Hz band, as the width of the tone is very narrow compared to 1 Hz. Fletcher easily obtained the spectrum level of the white noise by simple measurement. The ratio of the spectrum levels of the tone and the white noise then yielded a bandwidth, which Fletcher called the critical band, that was effective in masking the tone. The bandwidths so determined, as time went on, were found to be about 2.5 times narrower than those determined by more direct methods. Researchers labelled Fletcher's bands "critical ratios" to preserve the integrity of the more basic term "critical band."

In Fletcher's second assumption, the signal-to-noise ratio in the critical band of a tone at threshold in white noise is 0 dB. If this is changed to −4 dB (10 log 2.5), critical ratios become equal to critical bands. The genius of Fletcher's work is that it gave new understanding of, and appreciation for, the "filters" of the auditory system.

An avalanche of psychoacoustical studies of critical bands followed Fletcher's 1940 report. There was a continuation of work on the masking of one tone by another tone, but this approach was plagued by the distortion of results by beats created when the frequency of the masking tone approached that of the masked tone. This problem was eliminated by employing a narrow band of noise with an exploratory tone. Various combinations of paired tones were also used by some experimenters, while others used "notched noise," which will be considered later.

At this stage, one might be tempted to jump to the conclusion that the critical bands of the human auditory system are similar to the set of filters in a real-time analyzer. Although critical bands are somewhat comparable in width to ⅓-octave filters, the similarity ends there. The ear's critical bands are continuous, in that a tone of any audible frequency presented will find a critical band centered on it. It is not a matter of adjacent bands overlapping at the −3 dB points, as is common in filter sets, requiring about 30 filters to cover the audible range. Our ears have literally thousands of critical-band filters standing ready to respond to test tones or to fundamentals, harmonics, and partials of complex signals.

Frequency Selectivity

Nobel prizes are given only to those who have made outstanding contributions in their fields. One such prize was given to Georg von Békésy, a Hungarian scientist, for his work on the hearing mechanism. One of his numerous experiments involved standing waves in the ears of animals. Using a microscope and stroboscopic illumination, he measured the amplitude of these waves on the basilar membrane of each animal's cochlea as its ear was stimulated by tones of various frequencies. He measured the envelopes of vibration patterns, which showed peaks distributed along the basilar membrane according to the frequency of the tone falling on the ear. High frequencies created peaks toward the oval window (to which the stapes is attached), and low frequencies created peaks toward the opposite end, the apex of the cochlea. Békésy demonstrated that the cochlea was a sort of Fourier analyzer.

Tuning curves derived in this manner gave rise to the so-called "place theory," which states that the frequency selectivity of the ear results from the mechanical vibrating system associated with the basilar membrane. Different frequency components of an impinging sound, thus sorted out, were thought by some to be the final answer to the analyzing ability of the ear. The tuning curves obtained by Békésy are illustrated at the left in Fig. 2.

In science, wrong answers are sometimes as valuable as right answers, as they raise new questions and stimulate the formation of new models. Békésy's experiments served to focus the attention of many researchers on the problem. However, the tuning curves he obtained were too broad to explain ear selectivity as revealed by other experiments.

The techniques of Békésy were refined by others. Stroboscopic illumination was replaced by an approach employing the Mössbauer effect, in which a tiny speck of material emitting gamma rays was fixed to the basilar membrane. Changes in the velocity of the gamma rays, produced by motion of the membrane, could be detected by a Doppler shift method. This yielded a tremendous increase in test sensitivity. Békésy was forced to use sound levels of 140 dB to get measurable basilar membrane amplitudes, but with the Mössbauer principle, sound levels of 70 to 80 dB could be used. As shown in Fig. 2, such experimenters as Johnstone and Boyle [7] and Rhode [8], using the new method on live animals, found much sharper tuning curves than Békésy found with dead animals. This sharpening of the tuning curves is attributed to the use of normal sound levels and the presence of metabolic processes [10]. The slopes of Békésy's tuning curves range from about 6 dB/octave on the low-frequency side to 20 dB/octave on the high-frequency side. The corresponding slopes reported by Johnstone and Boyle for live animals [7] are 13 and 105 dB/octave. Such measurements made on the cochlea of small animals cannot be equated to those made on humans, but in general the auditory systems of all mammals are strikingly similar.

A Second Filter

The improvement in observed frequency selectivity, while interesting, was still not enough to soften the cry for the existence of a "second" filter; the far greater selectivity revealed by other types of experiments required more than basilar-membrane activity. For example, humans are able to distinguish between tones of 1,000 and 1,004 Hz, a difference of only 0.4%. It was recognized that basilar-membrane action excites the hair cells which are connected to the auditory nerve bundle. It was reasoned that any further filtering action following the mechanical filtering of the basilar membrane would have to be found in the hair cells associated with the membrane, in the nerve fibers making up the auditory nerve bundle, or in the auditory cortex of the brain.

By inserting a microelectrode in an individual fiber of the auditory nerve and noting the pattern of neuron firings as the ear is stimulated by tones of varying frequency, beautiful tuning curves were obtained. Figure 3 shows such tuning curves of single nerve fibers in the auditory nerves of an anes-

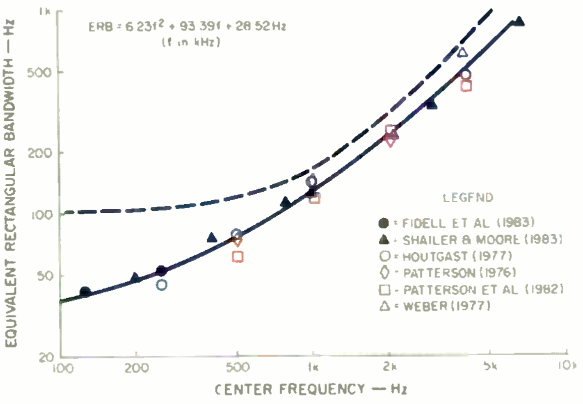


Fig. 7—*The symbols indicate measurements of the equivalent rectangular bandwidth (ERB) of the auditory filter at various center frequencies, taken from the results of the researchers indicated. The curve fitted to the data is specified by the equation in the figure. The dashed curve is the classical critical-band function. (14)*

By plotting what several adjacent filters contribute to perception of a tone, we see that symmetrical filters can yield asymmetrical results.

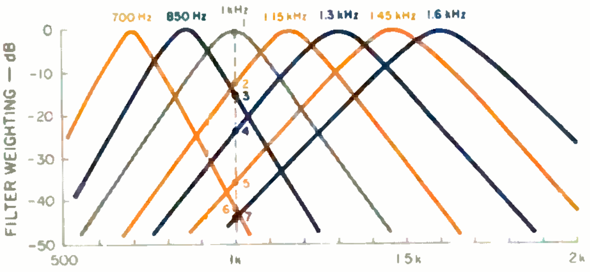


Fig. 8—*Simplified filter shapes at several center frequencies. These are calculated according to Moore and Glasberg's equation, with the filter shapes assumed to be symmetrical.*

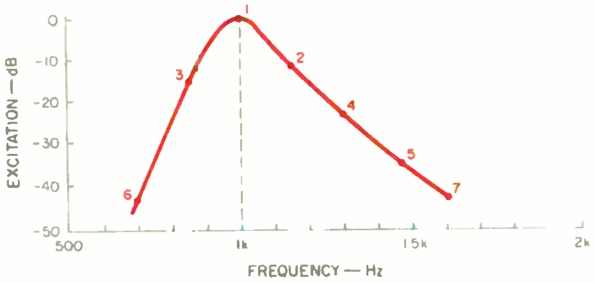


Fig. 9—*The excitation pattern for a 1-kHz tone, derived from the filter shape in Fig. 8. The pattern is obtained not only from the 1-kHz auditory filter but also from the contributions of the adjacent filters' skirts. (14)*

thetized cat [9]. The sharpness of nerve-fiber response is in stark contrast to the basilar-membrane response shown in the lower part of the figure. (The basilar-membrane responses of Fig. 2 are vibration amplitudes measured along the membrane when it is excited by sound of different fixed frequencies. Those in the lower part of Fig. 3 show the sound level required to produce constant amplitude of vibration at a particular point on the membrane, as a function of frequency.)

The tuning curves of individual auditory nerve fibers are obtained by counting nerve impulses. The fibers show a certain spontaneous firing rate with no sound stimulation; each fiber shows frequency selectivity of the type shown in Fig. 3 by an increase in firings above the spontaneous firing rate. Fibers also show phase-locking to a tonal stimulation: A given neuron does not always fire on every cycle of the stimulating tone, but when it does, it fires at the same phase of the stimulating waveform. Above about 5 kHz, such phase-locking is replaced by a "jitter" which smears the firings over each cycle. An interesting observation is that the nerve fibers' characteristic frequencies (frequencies of peak response, as in Fig. 3) are distributed throughout the auditory nerve bundle in an orderly manner. Fibers responding to higher frequencies are found nearer the surface, and lower frequency fibers nearer the center of the nerve bundle.

Each nerve fiber has a certain "dynamic range," limited by a "noise level" (spontaneous firings without excitation) at lower levels and by a saturated region at higher levels. As this range is only about 20 to 50 dB, we must look elsewhere to explain the much greater overall dynamic range our ears exhibit. Measuring neuron firings has been a most productive approach, but it tells us nothing about the pattern of distribution of firings over different neurons, an important Pandora's box yet to be opened.

The Shape of Critical Bands

For measuring convenience, Fletcher assumed that critical bands were rectangular in shape, but he did not really think they were. Schafer and Gales, in their masking experiments reported in 1950, had reasonable success in fitting simple resonance curves to their critical-band data. It is very interesting that they used the universal resonance curves straight out of Terman's book *Radio Engineering* [11]. Convinced that some sort of rounded top to the tuning curve would be eventually vindicated, other experimenters tried fitting the Gaussian bell-shaped curve to their data. The masked audiograms of Fig. 4, also reported in 1950, show rounded tops, although allowance must be made for the 90-Hz band of noise involved in their determination.

A distinctive feature of the masked audiograms of Fig. 4 is that the slopes are steeper on the low-frequency side of the peak than on the high-frequency side. This is especially pronounced at the higher sound levels, which suggests that at higher levels, responses of adjacent critical bands come into play. How can the shape of an individual critical band be examined without adjacent, overlapping critical bands affecting the result? One way is to make observations at low levels, closer to threshold. Those audiograms of Fig. 4 taken at low levels are more symmetrical than those at higher levels, but detail is limited.

Patterson, in 1976, used a "notched-noise" method of obtaining masked audiograms [12]. Figure 5 illustrates the general principle involved, although not necessarily the mechanics. First, the threshold of audibility of a 500-Hz tone in wide-band noise is determined. Let us say that this tone level is 0 dB. A notch is then cut into the white noise with filters having very sharp boundaries at 450 and 550 Hz. The tone level is again adjusted until it is just extinguished and is found to be at a level of −10 dB. The notch is widened to 400 and 600 Hz, and the tonal threshold is found to be −25 dB. Widening the notch in the white noise to a total width of 400 Hz further reduces the masking effect, to −38 dB. These masking values are plotted in Fig. 6; of necessity, a perfectly symmetrical critical-band shape emerges. What has been accomplished is that the subject being tested is forced to attend to a single critical band rather than listen for the best S/N ratio.

Using the notched-noise or other similar method, remarkably consistent results have been obtained by numerous researchers, as shown in Fig. 7. In this figure, the "equivalent rectangular bandwidth" of the human auditory filter is plotted against frequency. The solid curve, computed from the equation indicated, fits the experimental points closely. The dashed-line curve is the classical critical-band function. The most striking revelation is that critical bandwidth derived this new way continues to decrease below 500 Hz.

Once symmetry is attributed to individual auditory filters, the next logical step is to calculate their shapes. Moore and Glasberg [14] have derived such an equation which fits experimental data well within 25 to 30 dB of the peak (which, after all, is the most important part). A series of such auditory filter shapes is shown in Fig. 8. It is now possible to explore the effect of adjacent filters. In Fig. 9, an "excitation pattern" (as contrasted to a filter shape) at 1 kHz is built up by including the contributions of adjacent filters. The filter centered on 1 kHz contributes the response indicated by point 1, but the other filters shown in Fig. 8 contribute, too: The filter centered on 1.15 kHz contributes response point 2, the one centered on 850 Hz contributes point 3, and so on. By plotting each response contribution at the peak frequency of the filter giving rise to the response, as is done in Fig. 9, the shape of the excitation pattern is revealed. This shows how continuous symmetrical auditory filters can yield a masked audiogram that is asymmetrical, even on a linear frequency scale.

There is some slight feeling that critical-band auditory filters might not actually exist. Some researchers believe that when more is known of neural activity in the inner ear, the auditory nerve, and the auditory cortex, the filtering effect may possibly be explained in another way. However, there is no uncertainty that some sort of filtering agent is very active in most of our hearing functions. This being the case, one might wonder what sort of practical effect such auditory filters exert.

Ear Damage

Much has been written about nerve damage to the inner ear resulting from mixing sound at excessively high levels, listening to reproduced music at high levels with headphones or loudspeakers, or even working around noisy machinery. Loss of high-frequency sensitivity due to such exposure has been well documented. Another consequence of nerve damage to the inner ear is that the auditory filters become broader and less selective [13]. Such broadened filters result in deterioration of every type of listening activity in which critical bands play a part. For example, when we try to detect a desired sound in the presence of noise, we unconsciously attend to the auditory filter which gives the best signal-to-noise ratio. The increased width of that particular filter in the impaired ear would pass more noise and yield a poorer signal-to-noise ratio. The broader critical bands of the impaired ear result in difficulty of hearing in noisy environments, picking out one voice in the presence of other voices, and evaluating differences in the timbre of music and the spectral composition of sounds.

Timbre, Consonance, and Dissonance

Timbre involves the perception of the quality of a complex sound. This, of course, is related to its spectrum, including its fundamentals, harmonics, and partials. The spectrum is measurable with sound analyzers, but timbre is strictly a subjective phenomenon, requiring psychoacoustical measuring procedures.

Tones that are separated by an octave (a 2:1 frequency ratio) have a certain essential similarity which sounds pleasant to our ears. The musical fifth has a 3:2 ratio, the major third a 5:4 ratio, and the minor third a 6:5 ratio. Musical notes played in these ratios are also pleasant to our ears; we call them consonant (although trained musicians are inclined to distinguish between the terms pleasant and consonant). Certain modern composers have deviated slightly from these ratios, resulting in music that is dissonant, but enjoyed by many.

Critical bands play an important role in determining whether certain combinations are consonant or dissonant. Simple tonal intervals are evaluated as consonant if their frequency difference is greater than a critical band. If two tones fall within a critical band, beats occur; if the beat frequency exceeds about 20 Hz, a sensation of roughness

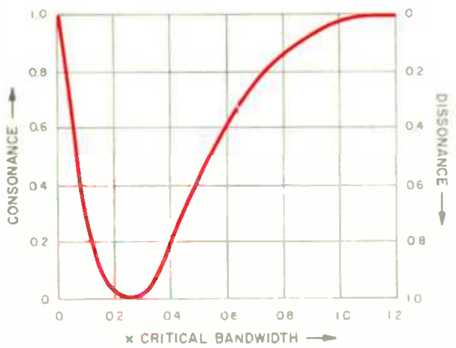


Fig. 10—*The pleasantness (consonance) of two simple tones with varying frequency difference, expressed in terms of fraction of a critical band. The curve is obtained from many specific experimental studies. The consonance and dissonance scales are arbitrary. (15)*

The ear's critical bands play an important role in determining which tone combinations are heard as being musical.

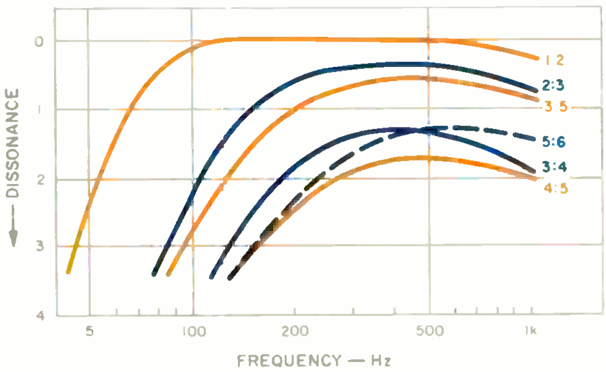


Fig. 11—*Illustration of the way in which consonance of some intervals with simple frequency ratios depends on the frequency of the lower tone. Both complex tones used have six harmonics. (15)*

sets in which persists up to a beat frequency of 150 to 200 Hz. This roughness is sensed as dissonance. Figure 10 summarizes the results of many listening tests [15]. The most dissonant intervals are those associated with frequency differences of about one-fourth of a critical band.

The degree of consonance or dissonance is nearly uniform over a wide frequency range, as shown in Fig. 11. The curves for the different ratios each tend to fall below some critical frequency, where they tend to become more and more dissonant. This is due to the bend in the critical-band curve below 500 Hz (see Fig. 7). The increase in dissonance at lower frequencies explains the musical practice of avoiding thirds at low frequencies and using octaves or greater intervals.

The curve for the octave relationship (1:2 ratio) of Fig. 11 shows a dissonance of zero up to the sixth harmonic, and all spacings between these harmonics are greater than the applicable critical band. This explains why complex tones with strong higher harmonics sound sharper than tones having only six harmonics. Curiously, we are catching up with von Helmholtz, who pointed out this fact 100 years ago!

Masking

There is a great debate among experimental psychologists as to whether masking results from a "swamping" of the neural activity of the signal, the suppression of neural activity by the masker, or a combination of the two. In fact, not too much is known about the coding of nerve impulses which describes the signal. It seems to be more than just a matter of how many neural discharges take place; it is strongly suspected that there exists some time pattern of discharges.

First off, masking is more a critical-band channel effect than a simple level effect. Only the noise energy in the critical band surrounding a tone contributes to the masking of that tone. As we've seen, the shapes of the masked audiograms of Fig. 4 reveal that the slopes on the low-frequency side, ranging from 80 to 240 dB/octave, are much steeper than those on the high-frequency side. If the level of a low-frequency masker is increased by a given amount, say 10 dB, the masking threshold of a high-frequency signal would be raised considerably more than 10 dB. One can, therefore, generalize that in any speech or music signal, low frequencies mask high frequencies, but not the reverse. This "upward spread" of masking tends to reduce the perception of higher frequency signals that are so important in the intelligibility of speech and the brightness of music. Also, the masking effect is greater at higher signal levels, which explains why, in sound-reinforcement systems, very high levels of reproduction tend to reduce the intelligibility of speech.

Loudness

The loudness of a sound is determined by the summation of the sound energy over the critical bands involved. This may be illustrated by the age-old observation that commercials on radio and television often seem much louder than the program material. Presumably, someone (or some automatic equipment) up the chain is riding gain and holding it in line with a VU meter as reference. In spite of this, complaints pour in that the commercials are the loudest thing on the air. There is a great chasm that exists between VU meter readings and loudness summation of the human hearing mechanism.

To bridge this chasm, loudness-level meters have been developed. Early work in this field was done by the late Ben Bauer and his colleagues at the CBS Technology Center [16, 17]. The ideal loudness meter might use 30 adjacent critical-band filters, but practical loudness meters utilize only eight. The outputs of the eight filters are linearly rectified and given a 10-mS attack and 200-mS decay characteristic to follow the time constants of the ear. These are then integrated and fed to an LED indicator. Basically, the signals in individual channels have been changed to loudness level (in phons) and then to channel loudness (in sones). The sones of each channel are then added to give an indication of overall loudness. Verification tests have indicated that loudness readings by this meter fall within 1 or 2 dB when commercials, music and songs, and male and female speech are compared to a standard noise. Note that the design of this loudness meter starts with critical bands.

Sometimes it is necessary to derive loudness from a series of sound-level meter readings in industrial situations. Several tedious programs have been devised to do this, and they are all based on the critical band. Sound-level meter readings alone are not of much help because they yield physical, not psychophysical, data. However, wide-band, A-weighted sound-level meter readings of two noises can give a rough approximation of relative loudness. For a rough-and-ready evaluation of the relative loudness of two sounds, comparing dBA readings is the way to go.

Have you ever wondered why a seriously distorted signal sounds louder than the same signal in undistorted form? This phenomenon is rather simple to understand when auditory filters are taken into consideration. The distortion products (harmonics) fall in other critical bands than that of the fundamental, hence their power adds to that of the fundamental.

Phase

The famous AM/FM experiment is often cited as evidence that the human hearing system is *somewhat* sensitive to phase. If an audible carrier tone is amplitude-modulated by another tone, three frequencies result—the carrier, and upper and lower sidebands. The same is true in frequency modulation, except that there is a difference in the relative phase of the components. If identical frequencies are used, the two types of modulated waves should sound the same if the ear takes no note of the phase difference. If all three components fall within a single critical band, AM is more easily detected than FM; if they don't, FM and AM sound the same. Other experiments throw some questions on this conclusion, and further work is needed. *A*

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BRYSTON .5B PREAMPLIFIER AND TF-1 TRANSFORMER

Manufacturer's Specifications

Preamplifier

Frequency Response: High level, 20 Hz to 20 kHz, within 0.1 dB; phono, RIAA 20 Hz to 20 kHz, within 0.1 dB.

S/N Ratio: High level, 95 dB, A-weighted, re: 500 mV input at 1 kHz; phono, 80 dB, A-weighted, re: 5 mV at 1 kHz.

Maximum Rated Output: 10 V rms.

Distortion (IM or THD): Less than 0.005%, any frequency or combination of frequencies from 20 Hz to 20 kHz, at or below maximum rated output.

Dimensions: 19 in. W × 7¼ in. D × 1¾ in. H (48.3 cm × 18.4 cm × 4.5 cm).

Weight: 8 lbs. (3.6 kg).

Price: $600 in U.S., $795 in Canada.

Transformer

Gain: 22.5 dB; 16.5 dB optional.

Cartridge Impedance Range: 5 to 35 ohms or 40 to 250 ohms, set by dealer.

Frequency Response: 5 Hz to 30 kHz, ±0.5 dB; 1 Hz to 50 kHz, ±3.0 dB.

Dimensions: 4¼ in. W × 4¼ in. D × 1¾ in. H (10.8 cm × 10.8 cm × 4.5 cm).

Weight: 3 lbs. (1.4 kg).

Price: $450 in U.S., $465 in Canada.

Company Address: 57 Westmore Dr., Rexdale, Ont., Canada M9V 3Y6. (U.S. office: R.F.D. #4, Box 2255, Montpelier, Vt. 05602.)

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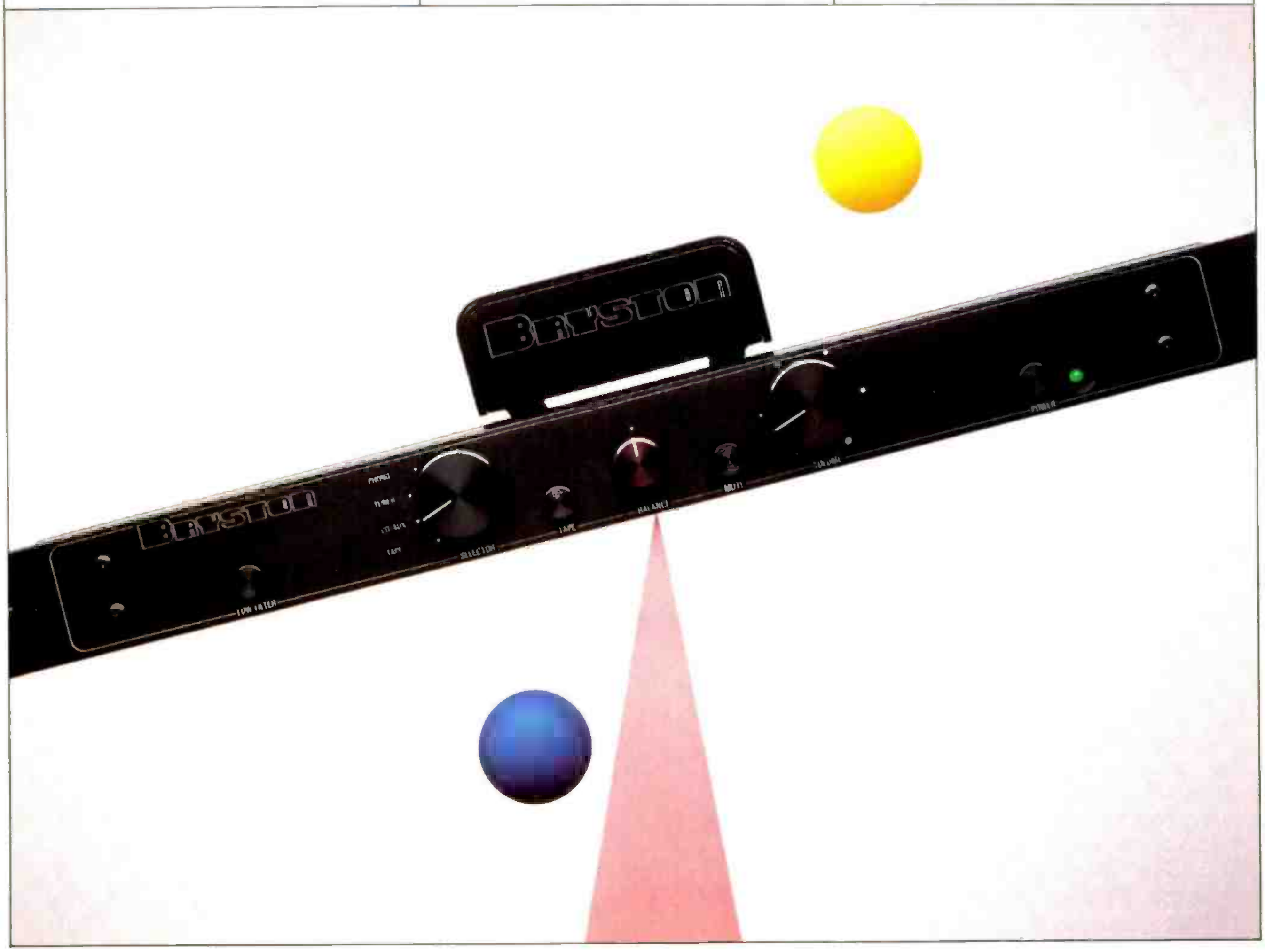

Photograph: Carl Zapp

The Bryston Model .5B is a very basic preamplifier with switching and facilities for a simple but high-quality sound system including phono, tuner, tape deck and CD/auxiliary inputs. The rather unusual model designation stems, no doubt, from the well-developed sense of humor possessed by the principals of this respected Canadian manufacturer. Until recently, they made a larger, more elaborate preamplifier known as the Model 1B (since replaced by the 11B and 12B). Since the preamp I tested is smaller and less expensive than the 1B—though perhaps not exactly half as small nor half as expensive—it was assigned a model number just half as large as its larger cousin's. According to the folks at Bryston, the .5B has the same low noise, low distortion, and exceedingly accurate frequency response as the 1B. The savings, they say, has been derived by reducing the number of inputs and by using simpler switching arrangements and connector layout.

The .5B uses such precision components as a laser-trimmed volume control, hand-tested and -selected transistors in all amplification stages, and metal-film resistors and polystyrene capacitors matched to within 1% tolerances. This preamplifier is guaranteed for five years, including parts, labor, and one-way transportation.

Audiophile preamplifiers such as the .5B are often used with moving-coil phono cartridges, but the .5B doesn't have an MC input stage. Because Bryston feels that transformers have less noise and distortion than active MC input stages, they therefore offer an MC transformer, the TF-1, which I also tested for this report.

Circuit Highlights

Figure 1 is a complete signal-flow and switching diagram for one channel of the .5B preamplifier. The phono equalizer section, at the diagram's lower left, is of particular interest. The basic problem with most RIAA phono equalization circuits arises from the great difference in gain required between the lowest audio frequencies (from around 20 to 50 Hz) and the highest frequencies (in the area of 15 to 20 kHz). The ratio of gain requirements from one frequency extreme to the other is around 40 dB, or 100:1. The reactive components used in phono equalization circuits—whether in feedback loops or as direct loads in passive or "losser" circuits—exhibit impedance curves that match this 100:1 ratio from one end of the audio spectrum to the other. Amplifier circuits cannot be optimized to drive such a wide range of impedances. As a result, many conventional phono equalization circuits, while working fine at mid-frequencies, run into problems at either end of the spectrum. These problems may stem from excessive gain at low frequencies or from excessive, improper loading at high frequencies.

To counter these problems, the Bryston .5B divides the phono equalization circuit into two parts. The first part accomplishes the low-frequency modification, while the other adjusts high-frequency gain characteristics. Each amplifier has a mid-band gain of only about 20 dB rather than the 40 dB required for the single gain stage of conventional phono equalization circuits; this is said to yield lower distortion.

Between the stage labelled "50 Hz & 500 Hz" in Fig. 1 and the stage labelled "2120 Hz" is a low-cut filter that can be switched in and out. Its cutoff frequency is 31.7 Hz; this rather odd frequency was chosen because it corresponds to the lowest signal frequencies likely to be found in conventional LP records, and also because it corresponds to a suggested revision to the RIAA recording curve. This revision came from, and has been adopted by, the IEC (International Electrotechnical Commission) but has never been formally accepted by the RIAA itself. The low-filter circuit has a 6-dB/octave slope, and affects only signals connected to the phono inputs. Despite its gentle slope, it attenuates rumble frequencies in the main troublesome region of 2 to 5 Hz by about 20 dB.

The .5B's single tape-monitor loop can be used for connecting either a tape deck or any signal-processing device such as a noise-reduction unit or an equalizer.

The Model .5B contains an output-shunting relay with a 3-S delay at turn-on. This delay permits any transient "thumps" to decay. The relay also opens instantly when the preamp is switched off, to prevent power-supply decay thumps and other noises from appearing at the output. The relay contacts are not in the signal path when the preamplifier is actually operating.

Control Layout

The control panel of the Bryston .5B couldn't be simpler. There are only three rotary controls, positioned near the center of the standard 19-inch rack-mountable panel, and four pushbuttons. The rotary controls include an input-selector switch, a "Balance" control, and a "Volume" control. The four pushbuttons are used to activate the low-cut filter, switch in the tape loop, turn power on and off, and mute audio levels by 20 dB. The "Mute" switch performs the additional function of connecting the two stereo channels together for mono operation; this is a useful feature when you are adjusting the balance control for proper imaging or determining whether speakers are in phase. The rear panel is equipped with pairs of inputs corresponding to the selector switch settings ("Phono," "Tuner," "CD/AUX," and "Tape"), a pair of tape-out jacks, the main output jacks, and both switched and unswitched a.c. receptacles.

As for the TF-1, its external design is simple, with only the Bryston logo on its front panel (there are no controls) and input and output jacks on the rear.

Preamplifier Measurements

Frequency response for the high-level inputs was absolutely flat from 20 Hz to 20 kHz. I could not detect a deviation of as little as 0.1 dB throughout that frequency range. The 1-dB roll-off frequencies were 7 Hz and 185 kHz, and the −3 dB cutoff points occurred at 3 Hz and 250 kHz. Input sensitivity for the high-level inputs measured 65 mV for 0.5 V output. Signal-to-noise ratio, referred to 0.5 V input and 0.5 V output, was 89 dB, A-weighted. Though this falls short of Bryston's claim of 95 dB, I suspect the manufacturer may have measured S/N with respect to 0.5 V input but with the volume control set to its maximum point. Under those conditions, I read an S/N ratio of 104 dB, A-weighted. At minimum volume-control settings, S/N measured 93 dB, again referred to 0.5 V output.

Total harmonic distortion was measured for several output levels. At 3 V output, THD at mid-frequencies was an almost

The preamp's high-level frequency response was absolutely flat, and its phono equalization was one of the most accurate I've ever measured.

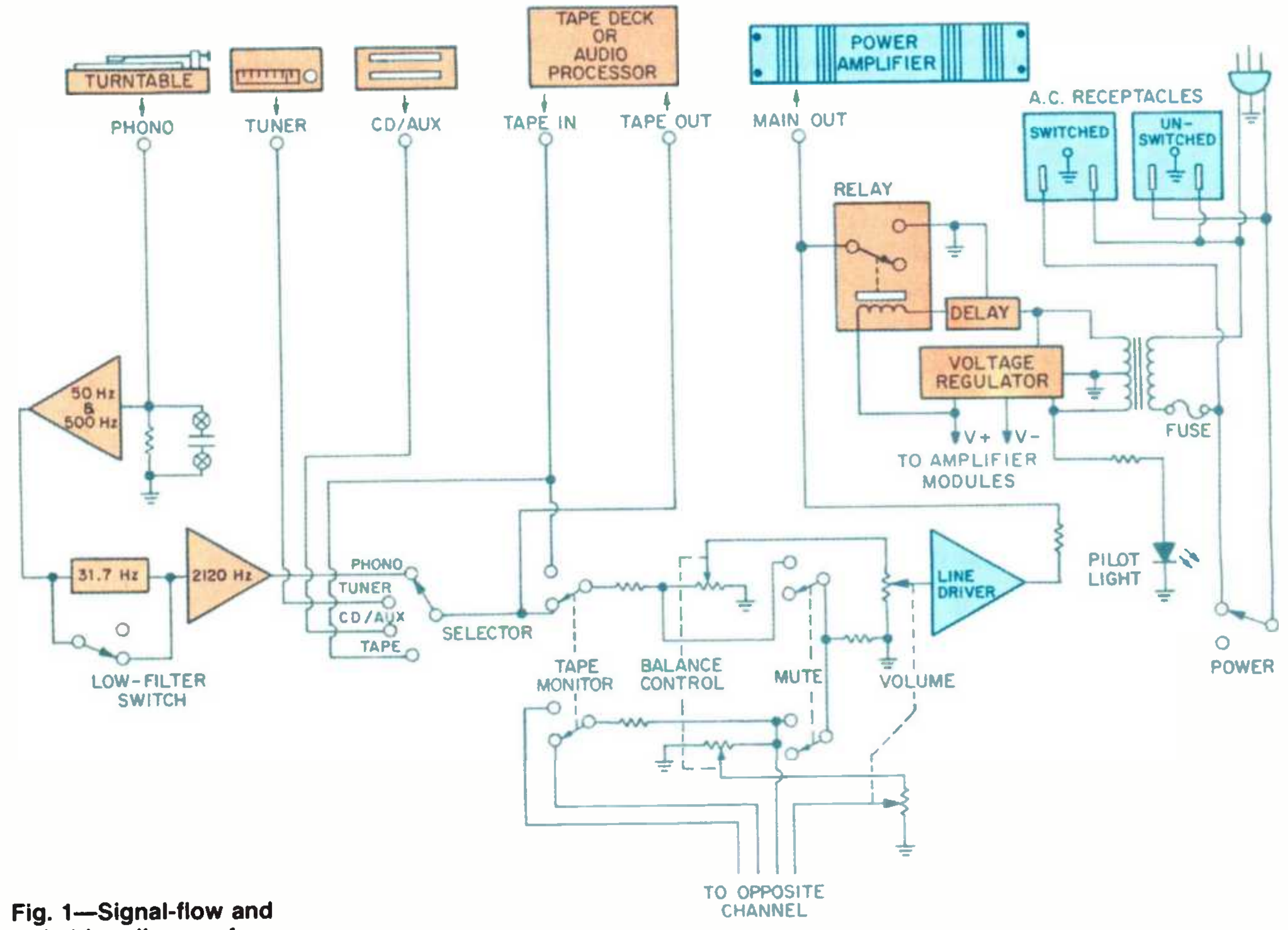

Fig. 1—Signal-flow and switching diagram for one channel of the .5B preamplifier (see text).

unmeasurable 0.003%, rising to a still minuscule 0.0045% at the low and high frequency extremes. At 10 V output—more than you are ever likely to need to drive any power amplifier I know of—THD remained a low 0.003% at mid-frequencies. SMPTE-IM distortion measured 0.004% for 3 V output and 0.005% at 10 V out. The preamplifier began to clip when input levels were increased so as to produce an output of 14 V rms. The CCIF (twin-tone) IM measured 0.0065%. My instrumentation was not sensitive enough to detect any measurable IHF IM.

The .5B's volume control is calibrated by six equally spaced marks around its perimeter. I checked the tracking accuracy of the two sections and found that even at the next-to-last counterclockwise mark, the output levels were within 0.2 dB of each other. That control setting was more than 60 dB down with respect to maximum.

Phono equalization was one of the most accurate I have ever measured. Deviation from the standard RIAA curve was never more than 0.2 dB at any frequency from 30 Hz to 20 kHz. The low-cut filter, effective only in the phono circuit, exhibited its −3 dB roll-off point at 26 Hz. At 10 Hz, the filter's attenuation amounted to 9 dB. Phono input sensitivity measured 1 mV for 0.5 V output. Phono signal-to-noise ratio, referred to 5 mV input and with the volume control adjusted for 0.5 V output, measured 80 dB, A-weighted. Maximum input to the phono terminals before noticeable overload measured 200 mV for a 1-kHz input signal.

Transformer Measurements

The separately supplied TF-1 step-up transformer for moving-coil cartridges came configured for a nominal gain of 22.5 dB and an impedance range of 5 to 35 ohms. For higher impedance moving-coil cartridges, it can be rewired for 16.5 dB of nominal gain and for an impedance range of 40 to 250 ohms. (Bryston does not recommend that the user attempt to rewire the TF-1 for the alternate gain/impedance option. It should be modified either by the dealer or by the factory.) Measured separately, frequency response of the transformer itself was flat to within 1.0 dB from 6 Hz to 28 kHz. I connected the transformer to the .5B and measured a

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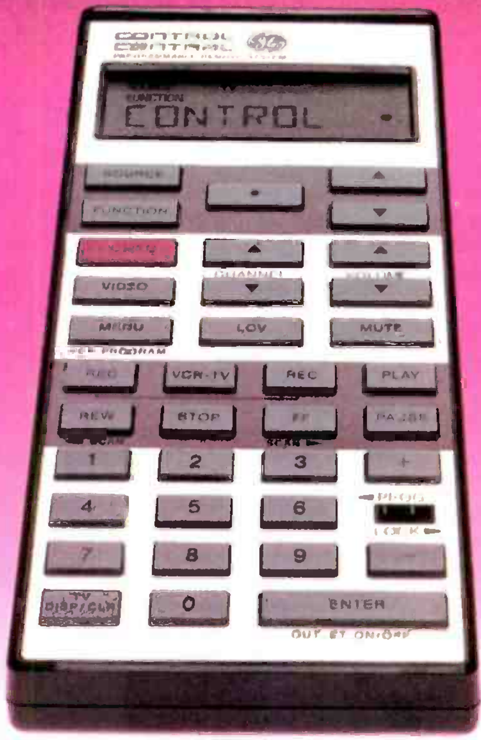

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combined signal-to-noise ratio of 75 dB referred to a 500-µV (0.5-mV) input signal and with the preamp's volume control adjusted to produce 0.5 V of output. Transformer gain measured 20.75 dB, but I should point out that the source impedance of my signal generator is 50 ohms, which probably accounts for a measured gain slightly lower than that specified. I could not measure any increase in the overall system's distortion when the preamplifier was used with the TF-1 transformer.

Use and Listening Tests

For some years, now, my preferred method of evaluating a high-quality preamplifier's high-level stages has been to conduct a series of A/B comparisons between that preamp and nothing at all. To do this, I connect high-level program sources to the inputs of my reference preamplifier and connect the preamp under test, with its volume control set for unity gain, to the reference preamplifier's tape in/out jacks. Then I alternately listen to the program source through my reference preamplifier alone and with the test preamplifier switched in. Ideally, if the preamplifier under test is close to the ideal "straight wire with gain" in its signal-handling capabilities, I should hear no difference when switching back and forth between these two listening modes. That's exactly what happened when I conducted these tests using the Bryston .5B.

Of course, this sort of A/B test does not check out the unit's most important function—its effectiveness as a preamplifier. For those tests I used my reference phono cartridge, a Shure V15 Type V-MR, mounted in the tonearm of my old reliable Thorens TD126 MKII turntable. Although this turntable has never suffered from severe rumble, I did notice that there was a definite tightening of reproduction in the deep bass when I introduced the preamp's low-cut filter into the signal path. Overall tonal balance of the system was beyond reproach, and I was particularly pleased with the clean, smooth reproduction of high frequencies. Bryston's two-stage equalization system does provide a noticeable improvement in this region of the audio spectrum compared to conventional preamp/equalizer stages that resort entirely to negative feedback to create the required RIAA playback response curve.

I have long been a fan of Bryston products—ever since I tested their Model 4B power amplifier some years ago. Having now tested these two more recent additions to their line of audio components, my impression of this relatively small Canadian design and engineering firm remains unchanged. They have maintained their tradition of offering completely honest and well-designed products for the more discriminating audio enthusiast who wants superior sound but doesn't want to take a second mortgage to achieve it.

Leonard Feldman

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2

SOUNDSTREAM TC 308 CAR STEREO

Manufacturer's Specifications
Tuner Section
Usable Sensitivity: Mono, 17 dBf.
50-dB Quieting Sensitivity: Mono, 20 dBf.
Frequency Response: 30 Hz to 15 kHz, ±3 dB.
S/N: Mono, 67 dB.
Capture Ratio: 2.0 dB.
I.f. Rejection: 78 dB.
Stereo Separation: 35 dB.
AM Sensitivity: 45 µV.

Cassette Section
Frequency Response: 30 Hz to 18 kHz, ±3 dB.
Wow and Flutter: 0.1% wtd. rms.
S/N: 53 dB; 62 dB with Dolby B NR; 68 dB with Dolby C NR.
"Playtrim" Control Range: ±5.0 dB at 15 kHz (see text).
Stereo Separation: 37 dB.

Preamplifier Section
Tone-Control Range: Bass, ±10 dB at 50 Hz; treble, ±10 dB at 18 kHz.
Loudness Compensation: +10 dB at 50 Hz, +5 dB at 15 kHz, for −30 dB volume setting.
Frequency Response: 20 Hz to 50 kHz, ±1 dB.
CD/AUX Input Sensitivity: Adjustable, 60 mV to 300 mV.
Output Level: 800 mV.

General Specifications
Power Requirements: 11.0 to 16.0 V d.c.
Dimensions: 7⅛ in. W × 2¼ in. H × 6⅞ in. D (18.1 cm × 5.8 cm × 17.5 cm).
Weight: 4 lbs., 9 oz. (2.1 kg).
Price: $599.
Company Address: 2907 West 182nd St., Redondo Beach, Cal. 90278.
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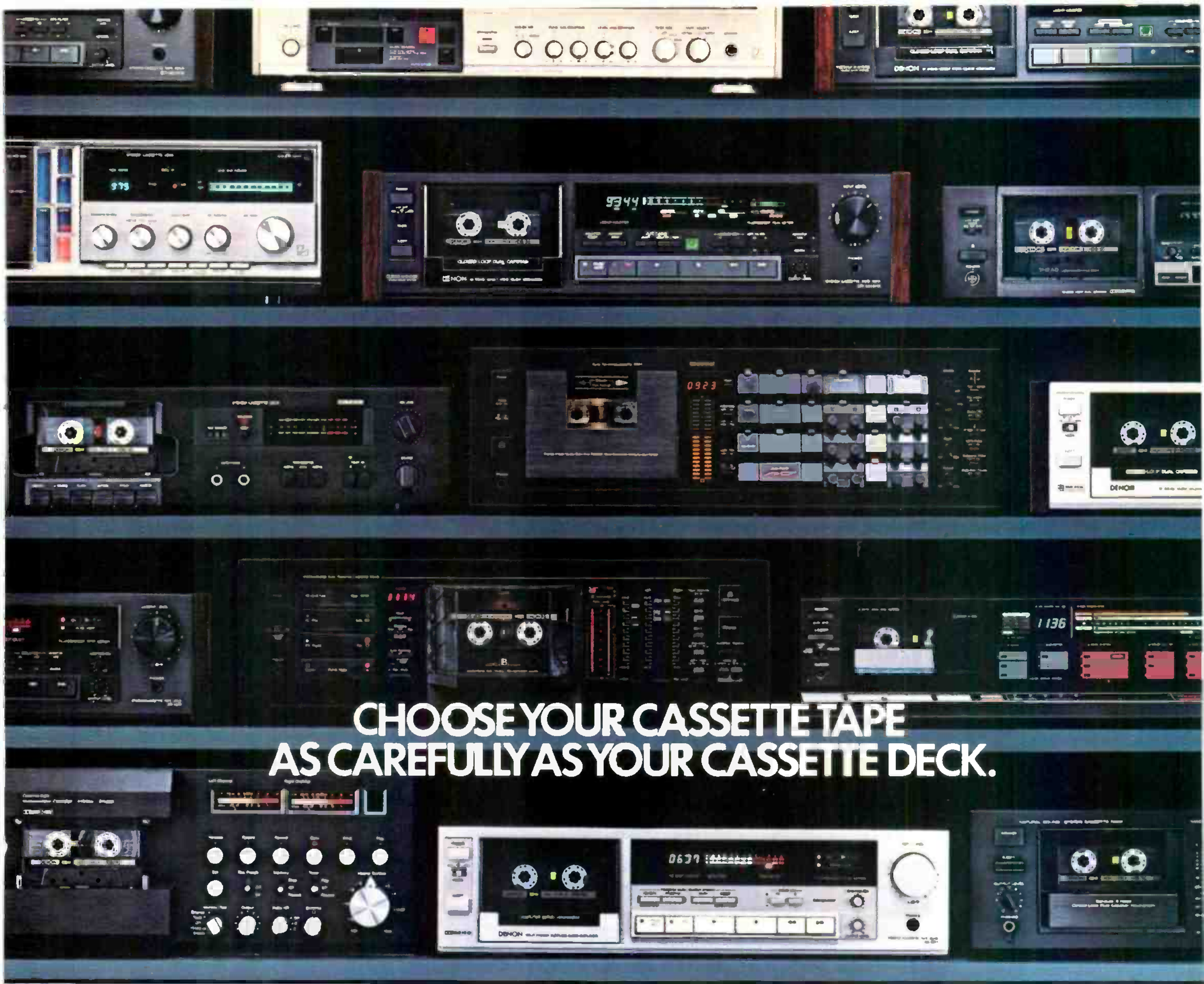
If the name Soundstream strikes a familiar chord, it's because it once belonged to Dr. Tom Stockham, one of the true pioneers in digital audio research. Soundstream Technologies, the company whose excellent car-stereo head unit I have just finished testing and evaluating, comes by the name "Soundstream" through a series of transactions and transfers that I won't get into here, except to say that there is a sort of "distant cousin" relationship between the old and the new Soundstreams. One thing the two companies do have in common is innovative design and high-quality engineering. Once again, the name of my esteemed friend Larry Schotz pops up. It was he who collaborated in the design of this car stereo's FM tuner section. The TC 308 employs a quartz phase-locked loop synthesizer circuit for accurate and stable tuning. Six FM and six AM stations can be preset for pushbutton recall. Auto-scan tuning samples each receivable station for 5 S; of course, manual tuning is also possible. Depending upon the condition of the incoming FM signal, left/right channel blend and a high-cut filter are activated as required. If signal conditions become really



If you own a deck like one of these, you were obviously concerned with low wow and flutter, extended frequency response, smooth tape transport and wide dynamic range. When it comes to choosing cassette *tape*, why behave any differently?

Denon's new High Density HD8 formulation is the finest high-bias tape you can buy. Its "High Technoroum" dispersion and binding plus its metal hybrid formulation guarantee digital level performance on the widest range of cassette decks (including yours). You can keep an eye on things through Denon's new giant window. And enjoy your music knowing HD8 is guaranteed for a lifetime.

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The front panel of this unit is good-looking and uncrowded, but it still manages to have just about all the necessary features.

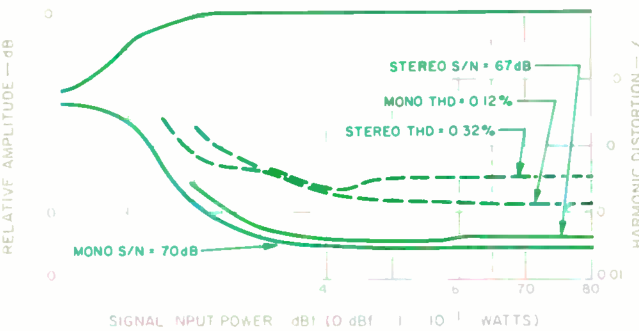

Fig. 1—Mono and stereo quieting and distortion characteristics, FM section.

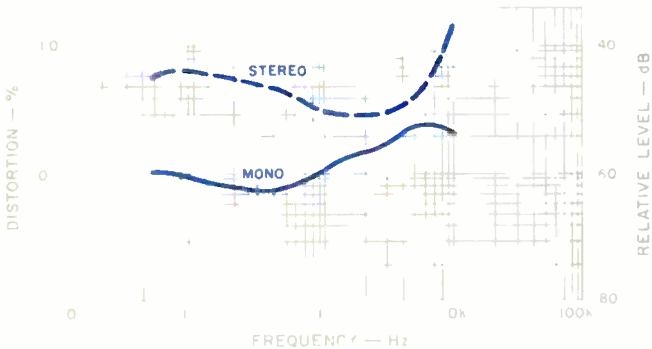

Fig. 2—THD vs. modulating frequency, FM section.

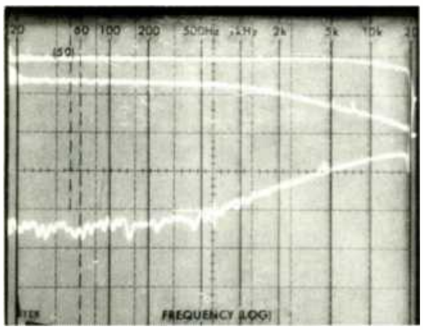

Fig. 3—FM frequency response (top trace), and separation for weak (middle trace) and strong (bottom trace) signals.

bad, a soft-muting circuit gradually reduces volume while maintaining a natural aural impression.

The FM tuner employs two AGC stages which operate together to maintain optimum front-end gain. Interference and intermodulation in areas of high field strength, as well as the familiar "picket-fence" effect, are significantly reduced in this way, according to the designers of the set. I'm sure that Technical Editor Ivan Berger will be able to comment on that last point when he puts the unit through its paces on the highway and in the difficult car-stereo environment of mid-Manhattan. The FM section also employs a three-stage ceramic filter, a low-distortion demodulator circuit in the FM detector stage, a pilot-cancelling circuit in the FM stereo decoder, and a noise-reduction circuit to block ignition noise.

In the tape-playback section something new has been provided called "Playtrim." In effect, this circuit is an extra treble control that operates independently of the preamp section's treble control and functions only during cassette playback. Playtrim allows the user to restore proper treble response to tapes that may have been recorded with relative azimuth errors, or errors in record equalization or high-frequency response. Most important, the Playtrim circuit is positioned *ahead* of the Dolby NR decoding circuitry, preventing Dolby mistracking. As I was soon to discover, this feature, together with a superbly constructed tape transport, makes for an auto-reverse deck with excellent playback frequency response in *both* directions of play, a characteristic I've encountered before only in much more expensive car-stereo systems.

The preamplifier section incorporates a separate auxiliary input for connecting the line output of a portable CD player or any other high-level signal. The sensitivity of this external input is adjustable. Overall, the TC 308 conforms to DIN dimensions and seems fairly easy to install. The supplied installation housing can be secured in most car mounting slots with no alterations of the dashboard required. A handle, Model SH-30, is available from Soundstream Technologies as a $20 option. When this handle is attached, the TC 308 can easily and quickly be removed from the car for safekeeping.

Other useful features found on the TC 308 include a "music sensor" which permits playback from the beginning of the present or the next tape selection, motor-assisted cassette loading, key-off eject, power antenna control, and even remote power amplifier on/off switching when the TC 308 is turned on or off.

Control Layout

By making many controls perform multiple functions, Soundstream has managed to come up with an uncluttered, easy-to-operate front panel whose simple, black elegance blends with a car's interior. Two dual-concentric rotary controls are found at the left end of the panel. The upper one takes care of power on/off, volume and channel-balance adjustment, and front-rear fading. The lower one handles bass and treble tone settings, the previously described Playtrim adjustment, and station scanning.

To the right of the rotary controls are up/down manual tuning buttons, cassette fast-forward and rewind buttons,

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Several key items tested better than spec: Mono sensitivity and 50-dB quieting on the tuner, and the tape section's S/N, flutter, and response.

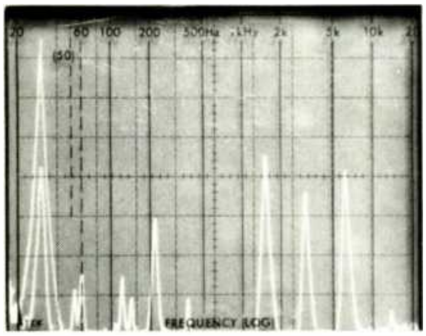

Fig. 4—FM stereo crosstalk and distortion components for a 5-kHz signal.

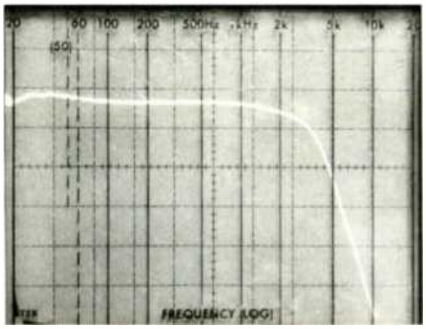

Fig. 5—AM frequency response.

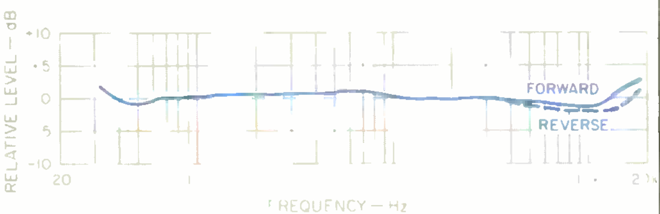

Fig. 6—Frequency response, cassette section, with Type I test tape.

and a button that doubles as a cassette-eject switch and a selector for the external CD/AUX input. Six station-preset bars are located below the cassette insertion slot, and to the slot's right is a button which reverses tape direction. An LCD display window at the far right indicates tape direction, which type of Dolby noise reduction has been selected (B or C), and which type of tape equalization has been chosen (70 or 120 µS). During tuner use, indications for tuned-to frequency, FM or AM band, stereo reception, and "LO" (for local tuning mode) appear in the display, as appropriate. Eight small pushbuttons below the display area handle selection of Dolby noise reduction, tape equalization, AM or FM, local or DX reception, memorization of preset stations, loudness compensation, and tape music sensor.

Stereo output jacks are, of course, provided for connection to front and rear power amplifiers. All necessary cables for power, antenna input, AUX input, and all outputs emanate from the supplied housing. When the TC 308 chassis itself is inserted in the housing, necessary connections are automatically made via appropriate connectors.

Tuner Measurements

Figure 1 shows how noise and THD at 1 kHz vary with FM input signal strength. Usable sensitivity in mono measured 14 dBf, considerably better than claimed by the manufacturer. The same held true for mono 50-dB quieting sensitivity, which occurred with an input of only 16.5 dBf as opposed to 20 dBf claimed by Soundstream. The relationship between the two S/N curves in Fig. 1 may, at first, seem strange. Normally these curves start out, at the left, at least 20 dB apart. That's because stereo inherently degrades S/N at low signal strengths by as much as 20 to 23 dB. In the case of the TC 308, however (and, for that matter, with many other car stereo FM tuners), a good deal of blending is already taking place at signal strengths of less than 40 to 50 dBf. So what you're really looking at in Fig. 1 is a stereo S/N curve that's almost mono. The strange-looking dip in the stereo THD curve of Fig. 1 can be attributed to the same blending effect. Only when the test signals reach higher levels do mono and stereo performance figures begin to diverge significantly. At 65 dBf, S/N in mono measured 70 dB; in stereo, the noise was 67 dB below 100% modulation. THD for a 1-kHz signal in mono measured 0.12%, and in stereo it was 0.32%.

Figure 2 shows how THD varies with modulating frequency for mono and stereo FM reception. The steep rise in apparent THD for stereo FM (dashed curve) at higher frequencies is not really THD at all, but is the result of a high level of unfiltered 19- and 38-kHz subcarrier products appearing at the output of this unit. Most car-stereo makers don't bother to filter out these ultrasonic subcarrier components, and Soundstream Technologies is no exception. The reasoning, I suppose, is that no one is ever going to try to *record* from a car FM tuner, so the presence of large amounts of 19- and 38-kHz subcarrier components will not mess up Dolby encoding or other vital, level-dependent tape-deck circuits.

Figure 3 is my usual plot of stereo FM frequency response (top trace), separation at strong signal levels (bottom trace), and separation when heavy blending occurs due to low

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The auto-reverse tape deck has excellent response in both directions, something usually seen only in the most costly car stereos.

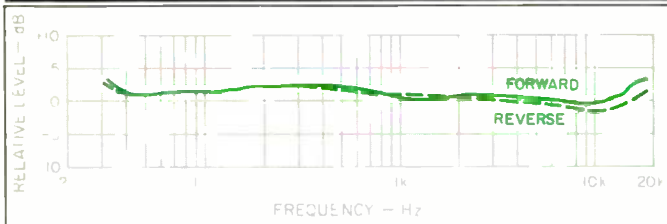

Fig. 7—Frequency response, cassette section, with Type II test tape.

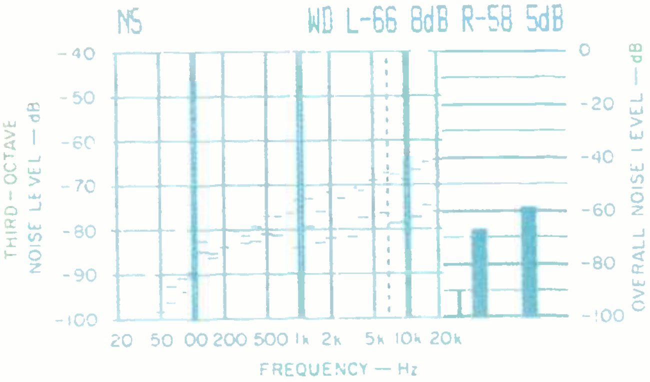

Fig. 8A—Tape S/N analysis, A-weighted, without noise reduction (upper trace and "R" readout at top) and with Dolby B NR (lower trace and "L" readout).

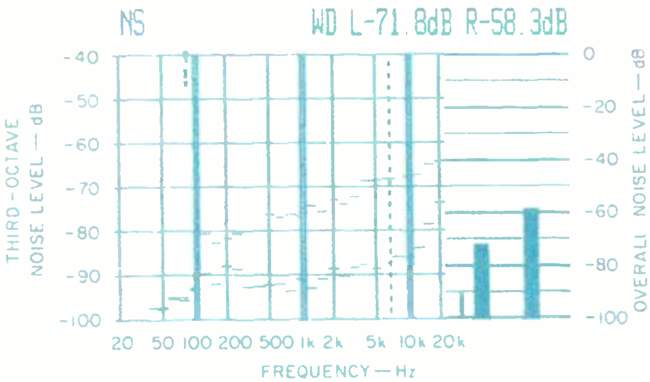

Fig. 8B—Same as Fig. 8A but without NR (upper trace and "R" readout) and with Dolby C NR (lower trace and "L" readout).

signal strengths (middle trace). Mid-frequency separation at strong signal levels measured 40 dB for the sample I tested; separation at 100 Hz and 10 kHz measured 22 and 24 dB, respectively.

Figure 4, a spectrum analysis of separation and crosstalk for a 5-kHz signal, provides further evidence of the high level of subcarrier products present at this tuner's output during stereo FM reception. The tall spike at the left corresponds to a 5-kHz signal modulating the left channel only. The shorter spike contained within the taller one is the amount of 5 kHz appearing at the output of the right (unmodulated) channel. The next major output component, only some 45 dB lower than the 100% modulation point in this spectrum analyzer 'scope photo, is the 19-kHz pilot signal appearing at the output. The three tall spikes at the right of the photo represent 38-kHz subcarrier output, and upper and lower sidebands of the 5-kHz modulating signal which appear at 33 and 43 kHz. None of these rather large components are likely to interfere with your FM stereo listening pleasure. However, considering that a "pilot canceller" circuit has been incorporated by Soundstream into the tuner decoder design, I expected considerably less of this spurious ultrasonic output.

Capture ratio for the FM tuner section measured 1.7 dB, a bit better than the 2 dB claimed. I.f. rejection measured 80 dB, and alternate-channel selectivity (for which no spec was provided) measured 68 dB. AM suppression was a bit better than 55 dB, and image rejection was a very satisfactory 85 dB.

Figure 5 is a plot of the AM tuner section's frequency response. It was a bit better than average, but nevertheless not what you would call "high fidelity" response. The −6 dB roll-off point, referenced to 1 kHz, was at about 3.5 kHz.

Cassette Player Measurements

It's been obvious to me for some time that the sweep-frequency test tapes I've been using with my Sound Technology tape tester have less-than-perfect azimuth alignment. As readers of earlier car-stereo test reports may have noticed, I've been apologizing for the dubious frequency-response results obtained with those tapes. Well, I'm happy to report that no more apologies will be necessary. I now have two brand-new standard frequency response reference tapes for Type I (120-µS equalization) and Type II (70-µS equalization) playback measurements. Both were kindly supplied by BASF, the IEC's official "keepers" of standard Type I and Type II reference tape batches. I'm glad that these tapes arrived in time for me to use them with the TC 308, for, as you can see in Figs. 6 and 7, the playback frequency response of the unit's cassette-deck section was superb for both types of tape. Since the BASF tapes supply spot frequencies rather than a continuous sweep, I had to plot the response curves by hand, and will have to do so in the future for all playback-only frequency response measurements.

I should note that the "Playtrim" control was set to its middle (neutral) point for these frequency response measurements. Had I chosen to, I could have "trimmed" that slight rise at the high end and attained almost perfectly flat response within 1 dB or so from below 40 Hz to above 18

"Playtrim" is really worth having, especially in a car-stereo cassette deck, which always plays tapes made on other machines.

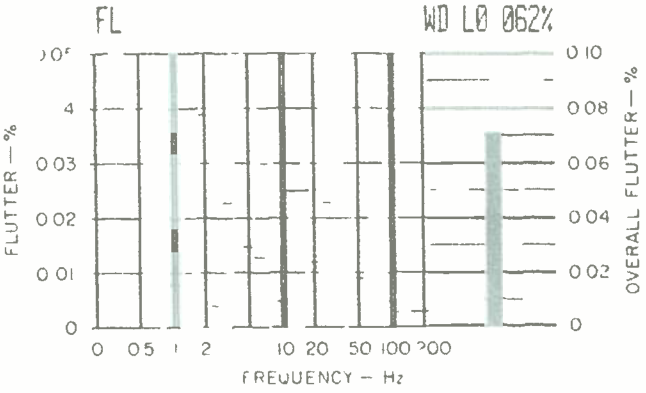

Fig. 9—Analysis of wow and flutter.

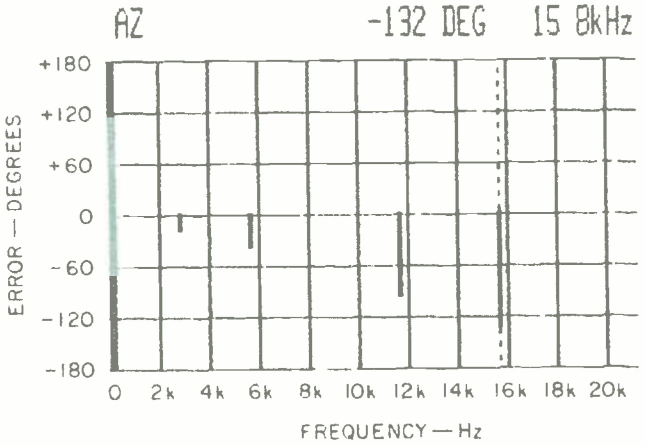

Fig. 10A—Playback-head azimuth error, forward tape play.

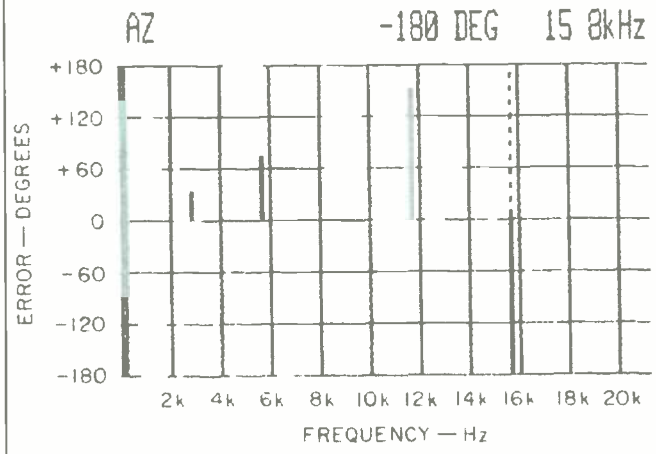

Fig. 10B—Playback-head azimuth error, reverse tape play.

kHz. Notice, too, that the plots for forward and reverse tape direction are virtually identical. This is the first auto-reverse tape player without a separate azimuth control for which I've measured such excellent frequency response regardless of direction of tape travel!

Figure 8A shows A-weighted tape-playback S/N measured without and with Dolby B NR, using ultra-low-noise TDK SA-X tape; overall S/N readings were 58.5 and 66.8 dB, respectively. These results are far better than the figures claimed by the manufacturer. The tests were repeated for Fig. 8B, this time comparing no Dolby NR with Dolby C NR (for which the reading increased to 71.8 dB).

Figure 9 shows wow-and-flutter components of the tape drive mechanism. The overall wow-and-flutter reading of 0.062% was, again, considerably better than the conservative rating of 0.1% offered by Soundstream. Figures 10A and 10B show the expected reversal of azimuth error that takes place when a test tape is run, first in the forward direction and then in reverse. Despite the apparently large angular errors shown for a 15.8-kHz signal, overall frequency response did not seem to suffer at all, as evidenced earlier by the response plots of Figs. 6 and 7.

For Fig. 11 I did revert to my "inaccurate" sweep-frequency test tape, not to plot frequency response but to show the range of control provided by that innovative Playtrim feature. Two plots were made, the first with the "Playtrim" control rotated fully clockwise (maximum setting) and the second with the control rotated fully counterclockwise (minimum setting). Using the sweep-frequency test tape (which is known to have an azimuth error that affects high-end response), the maximum boost at 10 kHz amounted to +3.6 dB, and the maximum cut at that frequency was −4.5 dB. It is obvious that even with this faulty tape, I could have easily adjusted the "Playtrim" control to yield perfectly flat response out to at least 20 kHz. Since many of the prerecorded tapes you buy or own are likely to suffer just as much (if not more) from inaccurate azimuth alignment, this feature is really worth having, especially in a car-stereo cassette player, which always plays tapes made on other decks.

The tape-transport mechanism exhibited a tape speed error that differed according to tape-play direction. In the worst case (which, surprisingly, occurred when the tape was operated in the forward direction), the speed error amounted to only 0.362%—hardly anything to be concerned about. In reverse, speed accuracy was very nearly perfect.

Figure 12 shows the maximum boost and cut range of the bass and treble tone controls. In the bass, I measured a range of +6.2, −7.0 dB at 100 Hz; in the treble, +9.2, −9.6 dB at 10.5 kHz.

Use and Listening Tests

I can speak with some strength about the excellent control layout and action of the TC 308. It's as easy to use as it is elegant to look at. As for its sound quality and tuner pulling power, I almost wish that my test bench and lab were on wheels so that I could go spinning down a highway while checking out this obviously well-designed unit; I have an intuitive feeling that it is going to be a winner when tested in an automobile environment. Unfortunately the lab is an-

The TC 308's FM section ran rings around my reference set's, but the AM section was plagued by noise from the engine.

chored, so again I leave the final conclusion to Ivan Berger. I'll be mighty surprised, though, if he doesn't mark this one as high as I do. *Leonard Feldman*

Behind the Wheel

It's a juggling act, designing a car-stereo head unit to look good, have all the necessary features, and still be easy to use. The result is always a compromise—and Soundstream's compromise is a good one. The TC 308 is about the best-looking head unit I've seen. It has one very desirable control ("Playtrim") found on no other head unit, plus such desirable but uncommon features as switchable loudness compensation, Dolby C NR, and a CD/AUX input.

Despite its uncrowded panel, comparatively few of the controls I'd like to see are missing. I'd have very much liked a "Mute" button, I hankered a bit for two-way instead of one-way scan tuning, and I wouldn't have minded the addition of a clock. The TC 308 is also without a stereo/mono switch; however, the Schotz tuner circuit just about eliminates the need for one.

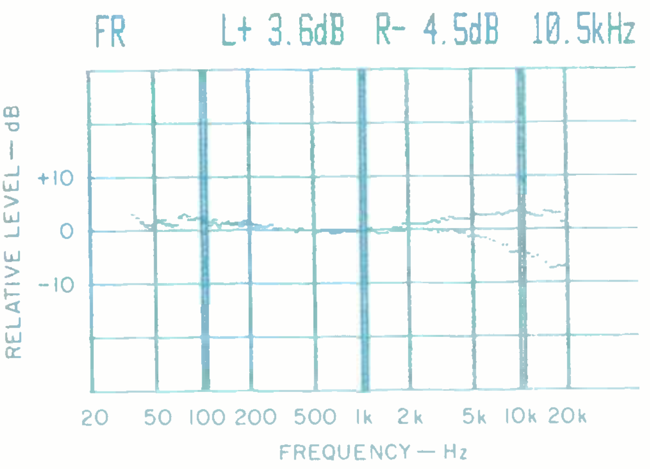

Fig. 11—Action of "Playtrim" circuit during tape playback.

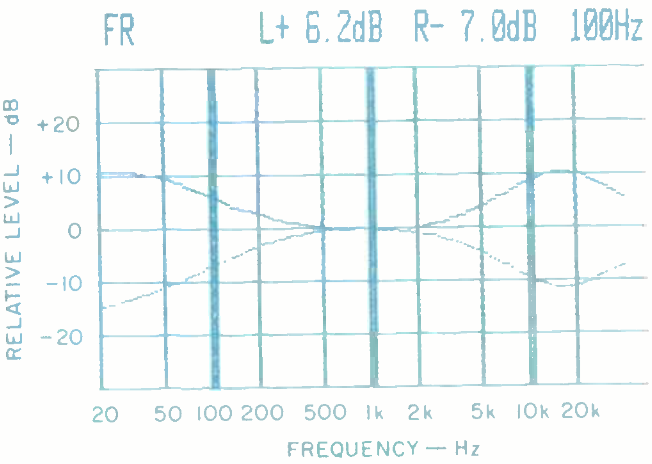

Fig. 12—Tone-control range.

The rounded control bars and buttons were easier to find by touch than the usual, closely spaced flat ones, and just as good-looking. Having the big, round "Playtrim" knob double as the station-scan pushbutton was intelligent. On the negative side, I found the volume control a bit too small, considering the amount of use it gets, and too close to the fader control. The AM-FM button was all but lost in the eight-button array at the far right. Also, the CD input was too easy to select by accident.

Soundstream conveniently puts the fader and bass on control rings while using pull-and-twist controls for treble and balance. Using one type of control for bass and treble and another type for balance and fader might take less getting used to, but Soundstream's way makes the two more often-used controls (fader and bass) more accessible.

The TC 308 lights up whenever it gets power—you needn't search for a switch. All controls and the tape slot are illuminated, and activated buttons glow amber instead of green. Control designations are not lit, however.

Playtrim did its job very well on a wide variety of tapes. Setting it isn't quite as easy as setting a true azimuth-adjustment control. instead of stopping when treble is at its maximum you must judge when the treble sounds best. Tape performance was fine, and (as usual for good units nowadays) there was no flutter on bumpy roads.

In FM performance, the TC 308 ran rings around my reference unit. The Soundstream sounded better on virtually all stations. It also picked up more listenable stations than the reference unit: In one location, the TC 308 picked up 16 stations better and the reference unit did better on five; in another location, the TC 308 was better on 11 stations versus six for the reference unit. On the road, New York FM stations did not fade out until I was nearing Philadelphia. There was no picket-fencing, but that, too, is commonplace on good units today. On FM, the local/distant switch affected only station-scan sensitivity, not input sensitivity. An input sensitivity switch helps a tuner deal with multipath and signal overload—but this one didn't seem to need it.

Performance on AM was another story. Here, the reference unit picked up more listenable stations: In one location it received 12 stations better, versus five better on the TC 308; in another spot it did better on 13 stations, versus six for the Soundstream. The Soundstream sounded better on the AM stations it picked up well, in part because of its more extended treble response. If it had been better able to reject alternator whine and other motor noise, it might have scored far better in the listenable-stations test; an installer putting the Soundstream in a car for keeps might well be able to reduce or eliminate this problem. On AM, the local/distant switch did change input sensitivity, for protection against strong-signal overload, and that protection did prove to be necessary.

Overall, the TC 308 proved an excellent performer. It worked very well on tape and FM, and a good installer could probably make it work pretty well on AM too. It's very attractive and reasonably easy to use. Best of all, it *sounded* very good—cleaner and clearer than most car stereos I've auditioned. *Ivan Berger*

If you can't afford it, spare yourself the heartache of listening to it.

We are all aware that, money aside, it is an easy matter to upscale our quality of life, but difficult to lower it. In this regard, ignorance is bliss, and strict abstinence is sometimes better than a taste of something finer that we can't have. So it is with the concord HPL-550 Tuner/Amplifier/Tape Deck. One listen could ruin you.

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PCA Frequency Response: 30 Hz to 20 kHz, ±0.5 dB.
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Low-Frequency Output Range: ±12 dB.
Crossover Slope: 18 dB/octave.
Crossover Frequency: 90 Hz; programmable with plug-in module (see text).
Dimensions: 19 in. W × 2½ in. H × 9¼ in. D (483 mm × 64 mm × 235 mm).
Weight: 7.7 lbs. (3.5 kg).
Price: $259.
Company Address: P.O. Box 3199, Lynnwood, Wash. 98036.
For literature, circle No. 92

The Audio Control Phase Coupled Activator has a name that does not immediately convey its function, but the additional designation on the front panel, "digital fundamental restoration system with subsonic filter," is impressive and gives some hints. This unit is the result of Audio Control's effort to introduce a product that would restore the low bass frequencies that are rolled off in the process of recording and making records, tapes, and some (mainly analog-mastered) CDs.

There are a number of ways to boost the lower frequencies, of course, including tone controls, equalizers, and subharmonic synthesizers. Tone controls affect much too broad a range for the correction desired (below 80 Hz or lower), and raise the level of noise and very low frequencies that can be destructive, not just distracting. A few equalizers can provide a fairly good compensating boost, but it is difficult to achieve, and the technique can add noise and perhaps unwanted boosts. Many listeners would agree with Audio Control's contention that subharmonic synthesizers typically generate unmusical sounds.

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Audio Control's aim was to introduce a product that would restore the low bass that is rolled off during the making of LPs and tapes.

According to Audio Control, the Phase Coupled Activator "looks for signs that there are missing fundamentals and digitally reconstructs them." The PCA also includes a crossover for use with a subwoofer. The company has applied for a patent on the unit's circuitry. Details are not yet available, but the following elements are included: A "music discriminator," "artifact detectors," spectral analyzers, "digital fundamental reconstructors," digital smoothing processors, and "logic-controlled activators." The PCA has switchable inputs for high-fidelity stereo or for the audio content of a videotape, either monaural or stereo.

The crossover section is configured normally, with a stereo input and low- and high-frequency stereo outputs. As supplied, the crossover is at 90 Hz, but a simple exchange of one plug-in module for another, available from dealers, obtains another frequency, if desired. The low-frequency output level can be varied over a range of ± 12 dB, relative to the high-frequency level.

The Phase Coupled Activator would normally be inserted in the tape monitor loop, and it has a switchable external loop available, inserted before the PCA-section circuitry—the best place for it to be. This way, rolled-off tapes can be corrected.

Control Layout

The Audio Control unit has a neat-looking front panel with gray designations on a charcoal background, quite easy to read in most lighting. At the left is the very large, center-detented "Detection Ratio" knob. Normal PCA action is obtained at its center position, minimum effect with a counterclockwise rotation to the "−200%" setting, and maximum effect with a clockwise rotation to "+200%." I expect that most users won't pay much, if any, attention to the percentage scale; most will use the center position as a starting point and turn up or down for the desired sound.

Located to the right, along an inset panel, are four pushbutton switches: "Digital Restoration," "Input Circuit Select" ("Hi Fi/Video Audio"), "External Processor Loop," and "Low Frequency Output." To the right of this last switch is the subwoofer "Low Frequency Level/Hi-Low Balance" control, a good-sized, slotted-button knob, easily turned with a coin or thumbnail. The center of rotation ("0") is detented for easy setting at the same level as the high-frequency output. The minimum subwoofer level (−12 dB) position is labelled "−" and the maximum (+12 dB) point is marked "+." A small red "Power" indicator just to the right of this control turns on with use of the rocker-type "Power" switch located at the upper right of the front panel.

The unit is rack-mountable, and there are handles which can be of help. It is just under two EIA Standard rack spaces high (3½ inches), but the mounting holes are not standard for that height, actually matching the single-space (1¾-inch) dimension. Audio Control says the unit is designed to mount in the middle of a 3½-inch space, so it won't get in the way of other components. However, on two of my three racks, the hole spacing makes the unit extend into the rack spaces both above and below, which could be inconvenient when it's mounted with other equipment having EIA Standard hole spacings.

Along the back panel are the input and output jacks. The labelling for the stereo jack pairs making up the "Main PCA Connection" is unusual but very helpful: Labels above the jacks name the source of termination of the cables, and those on the bottom give the designations for the unit's inputs and output. Along the top row, labels are: "From Main Hi Fi Tape Output/From Video Audio Output/To Tape Input." Along the bottom, they are: "Main Input/Video Audio Input/PCA Output." I wish that more manufacturers would provide such guidelines to help prevent hookup errors. There are also stereo pairs of jacks for "Tape/External Processor Loop" ("Input/Output") and "Independent Electronic Crossover" ("Input/Hi Out/Low Out"). An unswitched a.c. outlet is also on the back panel, to replace whatever outlet is used by the Phase Coupled Activator.

Removal of the top cover revealed that all circuitry, with the exception of the power transformer, is contained on one large p.c. board, about two-thirds the size of the chassis. The soldering on the bottom of the board was very good to excellent. No parts were identified, and the markings were rubbed off all of the ICs—indicative of the manufacturer's desire to protect its design. There was a rectangular black box labelled "Precision Phase-Coupled Discriminator" and bearing a warning that removal would void the warranty. I noted the small resistor-network module in the crossover section, plugged into a 14-pin DIP socket. The transformer was mounted at an angle on the inside

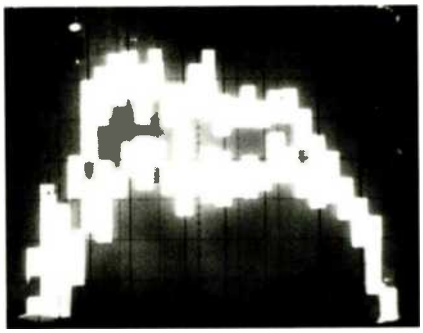

Fig. 1—A comparison of L + R (upper trace) and L − R (lower trace) signals from an FM pop/rock station shows definite stereo separation down to very low frequencies. (Vertical scale: 5 dB/div.)

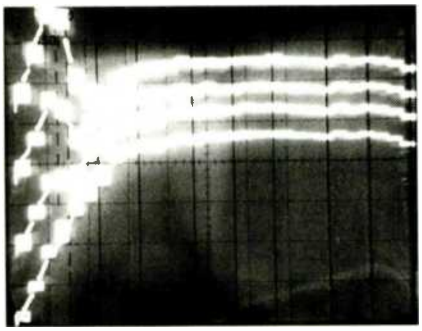

Fig. 2—Effect of Activator on broad-band noise with bass rolled off (see text). From top to bottom: With restoration control at maximum, with control at center detent, with control at minimum, and with restoration switched out. Traces have been shifted vertically to separate bottom-end responses. (Vertical scale: 5 dB/div.)

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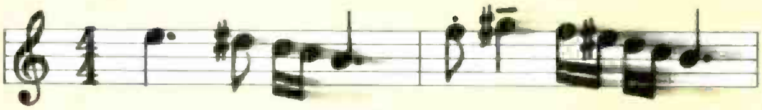

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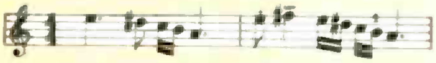

Their sound is crystal clear, uncolored and more natural than ever.

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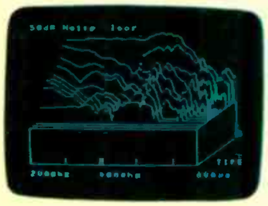

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Even at minimum setting, there is some boost from the PCA circuit. Maximum boost seems a bit much, but it could be worthwhile for certain speakers.

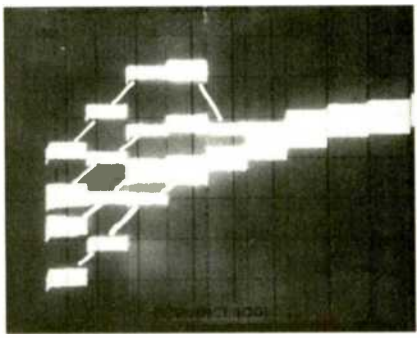

Fig. 3—Close-up of Activator's action from 25 to 160 Hz using pink noise rolled off 12 dB/octave below 80 Hz. From top to bottom: With restoration control at maximum, with control at center detent, with control at minimum, and original signal with restoration switched out. (Vertical scale: 5 dB/div.)

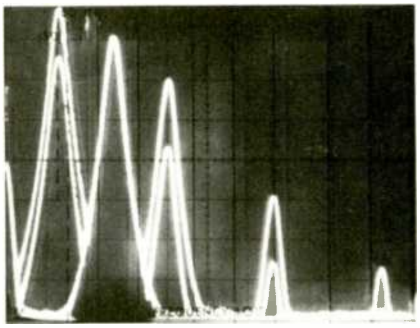

Fig. 4—Generation of harmonics for a 55-Hz tone input. Traces show results without Activator (55-Hz tone alone), and with Activator set at minimum and maximum. See text. (Scales: Horizontal, 0 to 200 Hz, 20 Hz/div.; vertical, 10 dB/div.)

of the back panel—for minimum hum, no doubt—and a line fuse in clips was next to it.

Measurements

To start off, I wanted to listen to what the Phase Coupled Activator might do. My system was already set for FM, so I patched as needed and switched the restoration circuit in and out. There was no effect that I could hear with FM, so I tried a record, and the extension of lowest bass was immediately apparent. My confusion and frustration ended when I gave my tuner a second look and noticed that it was set for mono. I went back to FM, in stereo mode this time, and then the PCA became operational. Apparently, the circuits do not work with monaural signals at the hi-fi inputs.

Since the manual did not mention this, I experimented further. First, I checked to see how much stereo information was available from FM and records. I compared the L + R and L − R signals from several FM stations and quite a few LPs, feeding both signals to a ⅓-octave RTA. Figure 1 shows the results of this test for an FM pop/rock station. Over most of the RTA's bands, the spread between the sum and difference signals averages about 8 dB. (The vertical spreading in each of the band levels shows variations in the music's frequency content over the time the sample was taken.) Examination of other stations and of LPs yielded similar results. My general conclusion was that most sources of reasonable quality have a strong stereo component down to low frequencies.

Next, I tried various combinations of in-phase and reversed-polarity noise signals at both the hi-fi and audio/video inputs. From this, I confirmed that the restoration system required stereo signals only when the hi-fi inputs were used but would work with either mono or stereo signals on the audio/video inputs.

A low-end roll-off of a broad-band pink-noise source was added with the use of a Tascam PE40 equalizer, using both the 60-Hz, 18-dB/octave filter and the 160-Hz, 6-dB/octave filter. Figure 2 presents, from bottom to top, the responses resulting with restoration off, with restoration on at minimum setting, with restoration on at center position, and with restoration on at maximum setting. The traces were purposely shifted vertically to separate the bottom-end responses.

A change was made to a UREI 562 feedback suppressor, and its 12-dB/octave high-pass filter was set to 80 Hz. Figure 3 shows a close-up of the PCA effects, covering just the bands from 25 to 160 Hz. It can be seen that even at minimum setting, there is some boosting from the system. The maximum boost seems a bit much, but this could be worthwhile depending on the particular speakers in use. It should be noted here that part of the PCA design is a 36-dB/octave high-pass filter at 25 Hz to prevent the generation of unwanted—and possibly damaging—very low-frequency components.

A swept-frequency run from 0 to 200 Hz proved that there is no simple boosting of individual tones. Figure 4 shows, however, the effects of digital restoration on a 55-Hz (A_1) tone: There is no change in the 55-Hz level, whatever the restoration-control setting. There is, however, generation of a 27.5-Hz subharmonic, which becomes the new fundamental (A_0), as it were. Thus, 55 Hz becomes the second harmonic, 82.5 Hz is generated as a new third harmonic, 137.5 Hz is generated as a new fifth harmonic, and 192.5 Hz is the new seventh harmonic. The even harmonics are not generated, since these would already be present in a real musical 55-Hz note. The levels of all the newly generated components *do* go up and down with the setting of the restoration control. Figure 5 demonstrates the similar relationships with a 45-Hz test tone. The synthesized 22.5-Hz level is lower than that for 27.5 Hz in the previous test, primarily because of the sharp 25-Hz roll-off.

Response to a 55-Hz, 350-mS tone burst with the detection-ratio control centered is shown in Fig. 6. The top trace is the test signal, and the bottom trace reveals that two cycles of 55 Hz were required to generate the 27.5-Hz component. About five cycles at the lower frequency were required to dissipate the stored energy. These illustrations help to give a general understanding of what PCA does, but such a circuit must pass the listening tests—which will be covered later.

Harmonic distortion was only 0.0028% or less from 50 Hz up, and just slightly higher than that at 20 kHz. The signal-to-noise ratio was 117.6 dBA referred to the maximum nonclipping output, 6.7 V. Relative to 1 V, it was 101 dBA. Performance of the crossover section was on a par with the above. Close examination with a spectrum analyzer indicated that switching in the restoration caused a

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In music listening, PCA generated no sounds that I'd call unmusical, but there was a need to vary the exact setting for best results with each source.

very slight increase in noise, but only at the lowest frequencies, and with no effect on dBA readings.

Output impedances were all quite low: 152 ohms for main, 168 ohms for the crossover's low-frequency output, and 153 ohms for the high-frequency output. Input impedances were satisfactorily high; they measured 95 kilohms, 86 kilohms, and 21 kilohms for the main hi-fi input, the video-audio input, and the crossover input, respectively. The PCA-section frequency response was down 0.5 dB at 30 Hz, 0.1 dB at 20 kHz, and 3 dB at 106 kHz. The subsonic filter's roll-off was 1 dB at 28 Hz, 3 dB at 24 Hz, 10 dB at 18 Hz, and 15 dB at 15 Hz.

The low-frequency output of the crossover was 3 dB down at 1.4 and 85 Hz, and the high-frequency output was 3 dB down at 86 Hz and 71 kHz. The responses were down 0.4 dB at 20 Hz and 0.3 dB at 20 kHz. Figure 7 shows the responses of the crossover in series with the PCA circuit, the subsonic filter of which causes the very sharp low-frequency roll-off. The low-frequency responses are shown at matched gain/maximum low-frequency output (+13.5 dB) and at minimum gain (−13.8 dB). The specified 18-dB/octave slopes are confirmed in this figure, which looks a bit different from usual because the frequency scale that was used is linear (20 Hz/div.) rather than logarithmic.

With a sine wave fed to both inputs (L + R), external voltage addition of the low- and high-frequency outputs resulted in a voltage rise in the crossover region, to a maximum of +3 dB right at the crossover point. With a pink-noise test signal, the summed response was flat on the RTA. These results indicate that there might be a relatively higher sound pressure level at the crossover point in the direct wave from the speaker system, but that the power response is flat for that one-third octave.

Use and Listening Tests

The owner's manual continues Audio Control's humorous approach to informing and guiding the user. I find this tell-it-like-it-is attitude refreshing, and there is little confusion in the well-detailed text. The illustrations serve the purpose, but they are just adequate.

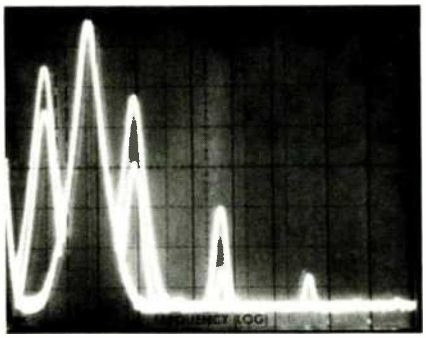


Fig. 5—Same as Fig. 4 but with 45-Hz tone input. Note the lower level of the generated fundamental and the consequently lower level of generated harmonics. See text.

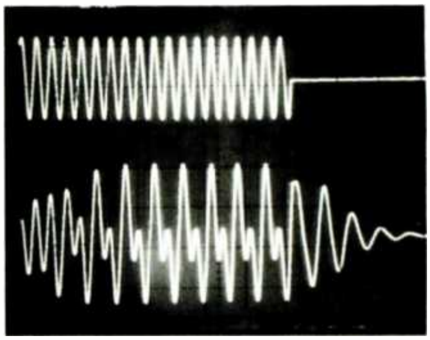


Fig. 6—Response of the PCA circuit (medium setting) to 55-Hz, 350-mS tone burst. See text. (Horizontal scale: 50 mS/div.)

All of the controls were completely reliable during use, and their arrangement seemed quite logical.

My regular loudspeakers, JBL 4411s, have a good low-end response, but I added a Triad HSW-300 subwoofer with built-in amplifier to aid the assessment of the Phase Coupled Activator. I tried all possible configurations: Biamping, using the crossover to feed the highs to my Hafler amplifier and the JBLs, and the lows to the Triad; full range to the JBLs and the low-frequency output to the Triad; and full range from the Hafler to both the JBLs and the Triad, with the subwoofer's own high-cut filter providing its high-frequency cutoff. I used the last combination the most, as it was the most convenient both for subwoofer positioning and connections and for keeping the subwoofer's relative volume the same, whatever the overall volume.

Listening is an emphatic requirement for assessing such combinations, and I tried many types of material over a considerable period of time. At first, it was all too easy to try settings that generated exaggerated bass, but the results remained quite musical, particularly for pop and rock, in the opinion of a number of listeners. With the subwoofer turned completely off and the "Detection Ratio" control set at its center position, the changes in the character of the music were judged to be pleasurable and musical. With the subwoofer volume turned up, there was a period of trial and error needed to find the combinations of digital restoration and subwoofer volume which gave the best sound for various types of music. I ended up setting the restoration ratio at about −60% to −20% for pop and rock music and −150% to −60% for classical music, and adjusting the subwoofer level to blend well with the main

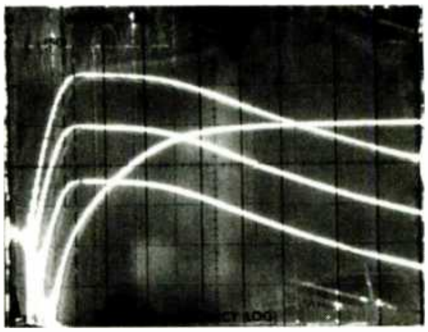
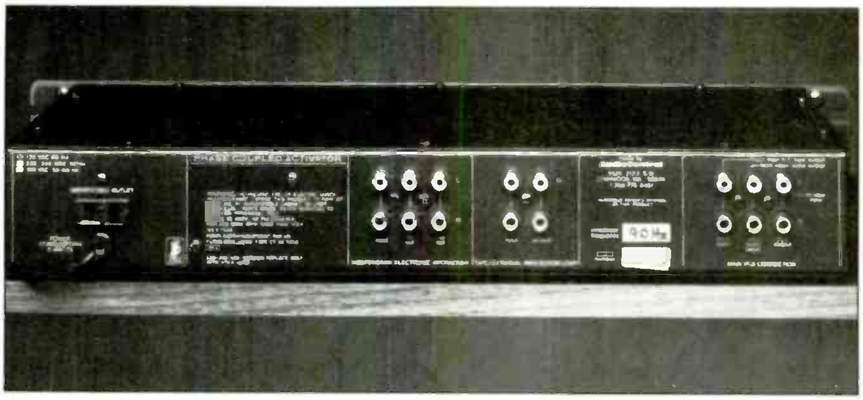


Fig. 7—Swept-frequency responses of crossover high- and low-frequency outputs (restoration circuits inactive). Low-frequency response (three traces at left) shown with maximum gain (top), matched output (middle), and minimum gain (bottom). Fourth trace, intersecting the others, is high-frequency response. See text. (Scales: Same as Fig. 4.)

The cost of this unit is very reasonable for its restoration of the bottom 1½ octaves, whose absence is obvious with PCA off.

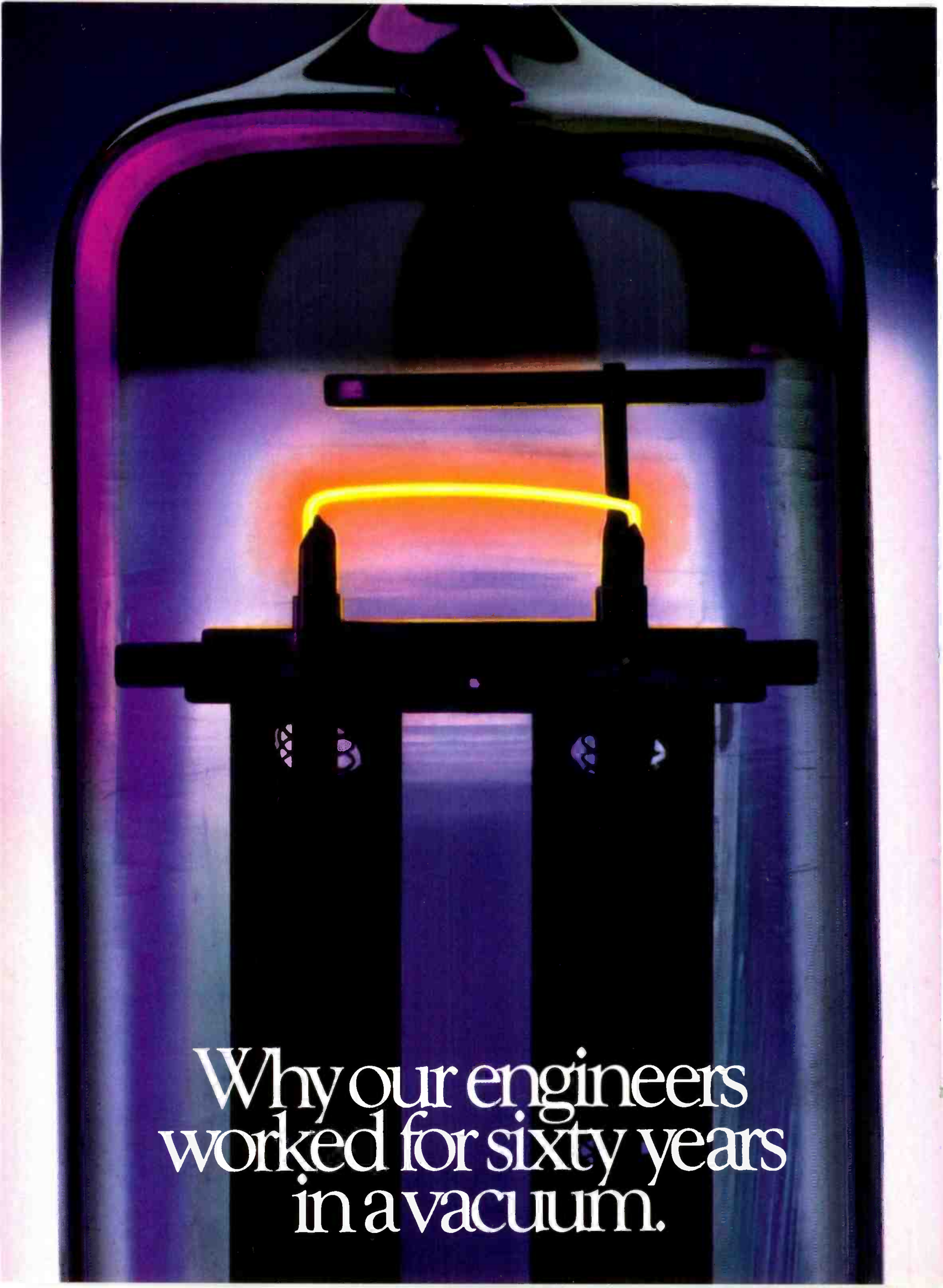


The rear-panel labelling of jacks is unusual in its detail, but very helpful in preventing hookup errors.

speakers when the restoration was turned off.

In all of the music listening, there was no generation of anything that I immediately thought of as unmusical, but there was a need to vary the exact setting from source to source to get the most satisfying results. This showed the considerable variation that exists from record to record, for example, in the amount of roll-off applied to the original. But rarely did I detect unlikely low bass added to the main musical sound. A more common, but still infrequent, negative effect was a low-pitched "groan" that appeared during some talk programs with low-pitched male voices. If it was more than momentary, I switched the restoration off.

I *did* like hearing the low growl from double basses, notable for its absence from most classical recordings when the PCA circuit is not used. Many pop/rock selections, too, became much more concertlike in character with PCA. With its well thought-out "Detection Ratio" control, this unit provides a wide range of compensation for the limited low-frequency energy of many sources. It can, to a considerable extent, compensate for loudspeaker roll-off, but a subwoofer would be in order in many cases to take the most advantage of what PCA does. Just to make that easy, Audio Control includes a crossover with a helpful low-frequency output control. Even if this facility is not used, the cost of the Phase Coupled Activator is very reasonable for its restoration of the bottom 1½ octaves—the loss of which is obvious when PCA is switched off. *Howard A. Roberson*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COLLIDING WITH MULTIPATH DISTORTION.

By its very definition as a moving reception point, a car's FM tuner constantly falls prey to signal reflections from hills, skyscrapers, bridges and even other vehicles. These extra phase modulating signals trick conventional tuners into producing audible sounds we call multipath.

Startling outbursts of clicks, pops, "picket fencing" and other rude and indescribable sounds.

The trouble is, by its very nature, multipath distortion cannot be cured by conventional circuit "improvements." In fact, the better an autosound tuner is, the more faithfully it is deceived into converting phase modulation into ghastly-sounding interruptions in your favorite station.

COMPUTER LOGIC-CONTROLLED DIVERSITY ANTENNA SWITCHING DRIVES AROUND MULTIPATH.

One way to get temporary relief from interference at home is to move the antenna around slightly. That is in effect what the Carver TX-Seven and TX-Nine do with sophisticated circuitry in your car. Instead of physically moving one antenna, they turn your rear defroster into a second *separate antenna,* 180 degrees out of phase with the first. When multipath occurs, a special smart circuit automatically switches (at the speed of light) to the other antenna, automatically correcting phase and eliminating the multipath before you ever hear it. In serious cases, the circuit actually uses both antenna inputs at once, deriving a signal through sum and difference principles.

ASYMMETRICAL CHARGE-COUPLED FM DETECTION CIRCUITRY BRINGS IT ON HOME.

What little multipath distortion gets through the TX-Seven and TX-Nine's unique smart antenna system runs headlong into the remarkable tuner innovation *High Fidelity Magazine* described as "distinguished (by) its ability to pull clean, noise-free sound out of weak or multipath-ridden signals."

It specially treats the critical, multipath-prone left-minus-right (L-R) signal with a Charge-Coupled circuit that detects "dirty mirror image" signals and cancels them before they can reach your ears. Then the Leading Edge Detector circuit processes the final 5% of the L-R and interleaves it with the tuner's receiver matrix.

Alone, without antenna diversity switching, the TX-Seven and TX-Nine's Asymmetrical Charge-Coupled FM Detection Circuit delivers *a net noise and distortion reduction of 92.9%*. Together, they set a new standard for clear, clean FM autosound reproduction.

THE MULTIPATH MARATHON: REAL WORLD CONFIRMATION IN THE MISTS OF THE NORTHWEST.

Bob Carver is both a theorist and a practical inventor. Circuits that work on paper get exhaustively tested in the field before release.

So he assigned a hapless engineer to map out the ultimate multipath-ridden route for confirmation of the TX-Seven and TX-Nine's special circuitry. With mountains, hills, huge evergreen trees, skyscrapers, large steel bridges, good robust traffic jams and a few assorted six-story-tall Boeing hangars, it didn't take long to map out a 6-mile course that could regularly deliver at least *287 separate multipath occurrences.*

Engaging the Asymmetrical Charge-Coupled FM Detection circuit and automatic antenna switching reduced occurrences to an average of *two* during the same 6-mile course while listening to the same stations!

Although results may vary in your locale, the same 90+% reduction in multipath has been confirmed in other widely diverse portions of the U.S.: The TX-Seven and TX-Nine work, and work well.

OTHER REMARKABLE TUNING FEATURES, TOO.

First, the TX-Seven and TX-Nine also receive Long Wave and Short Wave stations. And of course, both tuner/cassette decks have plenty of random presets...you can tune any fifteen AM, FM, SW or LW stations quickly for instant recall. Plus auto-scan and manual tuning.

But they also have a system that makes setting up all fifteen presets virtually instantaneous. Just press the button marked BEST and the tuner's logic circuitry will *automatically select* the fifteen cleanest, strongest signals and lock them in on the presets!

And that's *in addition* to your fifteen individual random presets.

As with all Carver products, the TX-Seven and TX-Nine do not sacrifice ease of use for useless, complicated frills. Instead, they answer every possible need without resorting to elf-sized buttons or glitzy flashing light displays.

Their metal-compatible, Dolby® NR, auto-reverse cassette sections rival any in the world. Both the TX-Seven and TX-Nine have separate bass, treble, balance and loudness and four-way fader controls and a full-function LCD display with night illumination.

All operations are signaled with a gentle "beep" that keeps your eyes on the road, not on the compact, ergonomically-styled deck.

There's even a security code system that renders the TX-Seven or TX-Nine inoperable to anyone but you (and a window sticker to impart this discouraging information to others).

Or, if you prefer, use the quick removal system that slips out your TX-Seven or TX-Nine in seconds for storage in trunk or house.

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Out of the hundreds of tuner/cassette models currently available, only the TX-Seven and TX-Nine deliver home-stereo quality FM in your car. They achieve it with unique technology. And they are built to outlast your car, no matter what kind of climate you live in.

Coupled with a clean amplifier, such as The Carver M-240 Car Amplifier and state-of-the-art speakers, your ability to transform your car into a concert hall is almost unlimited.

We urge you to audition the TX-Seven and TX-Nine at your Carver dealer soon. They can put you in the driver's seat of a unique, interference-free musical experience.

THE TX-SEVEN AND TX-NINE

TUNER ◊ Asymmetrical Charge-Coupled FM Stereo Detector ◊ Automatic Computer-Controlled Diversity Antenna Switching ◊ AM, FM, Long Wave and Short Wave Bands ◊ 15 Random Presets ◊ BEST Circuit for Auto-Selection of 15 Strongest Stations (in addition to 15 individual presets) ◊ Preset Frequency Auto-search ◊ Auto-scan Tuning ◊ Manual Tuning ◊ LCD Frequency Read-out.
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William Z. Johnson and Audio Research, the company he heads, have helped define the state of the art in high-end audio for as long as I can remember. Johnson, perhaps more than any other single man, has been responsible for creating the renaissance in tube electronics. His preamplifiers and amplifiers have long ranked as some of the best equipment available, and virtually every experienced high-end audiophile has owned or coveted at least a single piece of Audio Research gear over the years.

Johnson's new SP-11 preamp is both Audio Research's latest attempt to maintain their pre-eminence and an effort to redefine the state of the art. A no-holds-barred product which costs $4,900, the SP-11 is a departure for Audio Research in that it is not a pure tube design but a hybrid which uses both tube and FET transistor technology. Johnson feels that this hybrid provides more linearity, higher gain, and a better signal-to-noise ratio than he has been able to achieve in pure tube designs, and still allows him to preserve the transparency and sweetness of the best tube circuits. Judging from the sound, Johnson achieves these objectives. Further, the hybrid technology gives the SP-11 freedom from most of the problems rising from tube wear and sensitivity to microphonics.

The SP-11 is well styled and physically impressive. It consists of two identically sized, rack-mountable units, available in silver gray with black lettering or in black with white lettering. One unit contains the power supply and has a.c. power switching for the preamp, for the power amp, and for other electronics in the system. The power-supply unit uses a high-grade toroidal power transformer to minimize its hum field and solid-state components. It is fused, and, like the rest of the SP-11, looks more like an expensive piece of defense electronics than a piece of consumer gear where cosmetics was the designer's primary concern.

The power unit is connected by a heavy plug-in power cable to the preamp unit, which has virtually every feature the most demanding high-end audiophile could desire. The SP-11 has exceptionally high-quality gain, level, and balance controls; among its switching features are a mode switch with a full range of options (including mono and stereo reverse) and an input switch with one phono and four high-level inputs. There is also a switch to vary loading of phono cartridges (47,000, 100, 30, 10, and 3 ohms), a phase-reversal switch, a mute control, full facilities for two tape recorders, and a subsonic phono filter switch.

Unlike most equipment, the SP-11 even has an interesting rear panel. For all audio inputs and outputs, it uses Tiffany phono jacks that make their "ground" connections before the "hot" connections are made. This feature, a potential system-saver, eliminates the risk that destructive bangs will occur if you pull a cable out by accident. The range of inputs is well thought out and should meet virtually every system need. The unique range of outputs includes two main outputs (for systems with multiple amplifiers), a phase-inverted output (which is useful for some biamped systems), and a direct output which comes directly from the line buffer and bypasses the toggle switches.

This direct output is part of a whole series of options, including a complex mix of gain controls and bypass facilities, which allows the user to decide how many—or how few—controls are in the signal path. The SP-11 is the first preamp to be designed to let the user make all the choices, either striving for perfect transparency at the cost of convenience, or opting for all the controls he needs for the very most complex system.

As always, it is the sound that counts, and the SP-11 is an outstanding performer in every respect. This is a preamp that takes a full day of warm-up to reach its best, and should be left on at all times. Once it is warmed up

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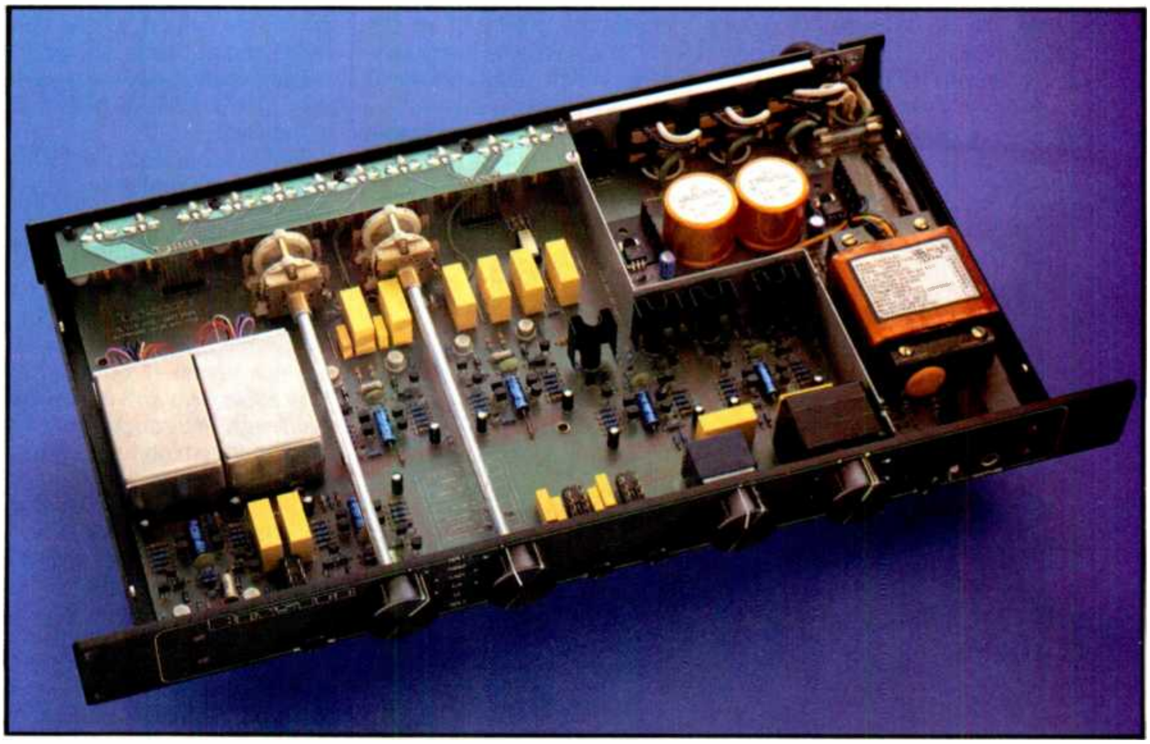

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Bryston's unique and innovative circuitry has been even further refined for greater signal-to-noise ratio, closer adherence to equalization standards, and headroom which cannot be exceeded by any commercially available signal. The result is a further advance of Bryston's high standard for lucid transparency and clarity of musical reproduction.

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The SP-11 is a hybrid design combining tubes and transistors. The intent is to yield higher gain and better S/N while still preserving transparency.

and left on, the SP-11 performs so well that there is very little sound character to describe. As is the case with each major step forward in audio electronics, one is not aware of coloration but rather the fact that the SP-11 consistently reveals more musical information than virtually all of its competitors.

The SP-11's specifications are impressive—±0.2 dB RIAA phono equalization accuracy, distortion levels ranging from 0.001% to 0.005%, bandwidth from 0.2 Hz to greater than 250 kHz—but these tell only part of the story. The SP-11 also meets every subjective test for which reviewers have adjectives: Transparency; imaging, depth, and sound-stage height and width; treble, midrange and bass transient response, and sweetness. The only way to say something meaningful about the sound of the SP-11 is to make comparisons, and only two other preamplifiers I have yet heard are rivals. One is the Krell KRS and the other is the Cello.

Perhaps the best test of the SP-11's outstanding performance is of its high-level stage. The rise of the CD player is gradually redefining the role of the preamp. For years, all that most high-end audiophiles really cared about was the performance from phono input to preamp output. The use of CD players has revealed, however, that many very expensive and much-praised preamplifiers introduce sufficient coloration in their high-level stages so as to sound noticeably worse than when CD players are used to drive a power amplifier directly. To attack this problem, a few CD players—notably the new Discrete Technology—provide gain controls that allow you to eliminate the preamp entirely.

The SP-11 is the only preamplifier—at any price—that I have yet heard with an active high-level stage that does not add audible coloration to the audio chain, compared to the use of a passive stage or the use of no preamplifier at all. In many cases, it will do even better. The SP-11's superb ability to handle gain and balance so as to match the CD player's dynamics to the amplifier's often yields even better subjective sound performance than could be obtained if one bypassed the preamp.

This level of performance is likely to be the new standard for preamplifiers regardless of whether it is CD or DAT that wins the world's sweepstakes as the premier post-analog signal source. At the same time, the SP-11 also defines the state of the art as a phono preamplifier. With the exception of the Krell KRS and the Cello, it clearly outperforms any other preamplifier I have heard in two important ways. First, it reveals more detail and information through its phono inputs than competing preamps do. Second, over very extended listening, it is consistently more musically convincing, in many small ways, with a wide range of mate-


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The superb performance of this Audio Research unit sets new standards for preamps. One is not aware of coloration but of how revealing the SP-11 is.

rial. The SP-11 consistently reveals more of what is actually on the record—good, bad, or indifferent.

This superiority may not show up in casual listening in a dealer's showroom or when the SP-11 is used with other than the best high-end gear. It *will* show up, however, if you take the time to really listen to the differences between components with several favorite records, using electronics and speakers as revealing as the state of the art allows. In fact, the SP-11 tells the listener more about the components used with it than about its own sound. It is more a reviewer's preamplifier than a preamplifier to be reviewed. Put extremely simply, the SP-11 is *accurate*.

There are, however, some caveats that I must apply to this praise. First, the SP-11 is a hybrid system, and it does not have sufficient phono gain to get the best out of the lowest output moving-coil cartridges. It works perfectly with most top moving-coil contenders, including those from Clearaudio, Monster Cable, Koetsu, Kiseki, etc., but it lacks the gain to provide a properly open and dynamic sound with the lower output Ortofon, van den Hul, and Audionote cartridges. You do need to match your cartridge to this preamplifier.

Second, you cannot simply plug the SP-11 into your system and expect to hear it at its best. It does need several days of initial warm-up and break-in, and then should be left on continuously. Fortunately, its design makes tube performance noncritical and allows long tube life, so this should not be a problem. You will need to pay attention to fine details, such as your choice in interconnects; you will also have to experiment with the gain and level controls, to get the best mix of settings for your system and to find out how many control features you want to bypass. My advice is to try to set the level control so your usual gain setting is between 10:00 and 2:00.

I also would caution you about too much purism in bypassing the SP-11's control features. High-end audiophiles sometimes fall so much in love with detail and transparency that they forget about dynamic realism and the sound stage. Very few systems and very few recordings are so well balanced that you do not need to make at least slight adjustments to the balance control to lock in the sound stage and get a truly natural mix of imaging and dynamic contrasts from right to left. Phase controls serve a purpose, and some material—although not very much—benefits significantly from reversing absolute phase. Sacrificing signal-to-noise ratio in order to get added purity at medium and high levels is a trade-off that should not always be made. The SP-11 exists so you can enjoy music, not sound. Ignore your tweakier friends and use this preamp accordingly. *Anthony H. Cordesman*

SAX TRACKS

Photo: ©1981, Ebet Roberts

Seven Standards 1985, Volume II: Anthony Braxton
Magenta MA-0205, $9.98.

Sound: B– Performance: B

The '80s have been a time of retrenchment and rediscovery for many of the most brilliant iconoclasts of jazz. The revolutionary Archie Shepp has been playing blues and ballads for years, Sun Ra has danced off the rings of Saturn doing the "King Porter Stomp," and young lions like Chico Freeman and David Murray play bop with the freshness of new invention. Add to their numbers one of the music's most acerbic and theoretical minds, Anthony Braxton.

Braxton's music has ranged from twisting solo performances for multiple reeds to works for three orchestras. His ensembles and big bands were rife with freewheeling improvisations and complex arrangements that quoted Bird and 'Trane as freely as they did Cage and Stockhausen. Yet works like *New York, Fall 1974* and *Creative Orchestra Music 1976* were suffused with exuberance and taut emotions that remain vibrant more than a decade later.

In 1985, however, as this album reflects, Braxton dug into a bag of jazz standards with a mainstream rhythm section composed of pianist Hank Jones, bassist Rufus Reid, and drummer Victor Lewis. To be sure, Braxton has always been cognizant of jazz's past, having used march forms in *Creative Orchestra Music* and taken a blowtorch to Charlie Parker's "Donna Lee." *Seven Standards 1985, Volume II* finds him in a more deferential mood, but there's no mistaking the Braxton touch. He discovers hidden nooks and crannies in Coltrane's "Moment's Notice," scurrying like a squirrel, worrying phrases, gnawing at rhythm changes with his alto sax. The same goes for Parker's "Yardbird Suite," with Braxton riding the deft rhythm changes with knotty thrusts and spins. His cover of Thelonious Monk's "Ruby My Dear" is respectful, but he intentionally falls all over the Horace Silver ballad, "Nica's Dream." Breathy lines smolder as if he's in a lounge band playing the last song for the last drunk.

Produced by veteran Michael Cuscuna, *Seven Standards* is clean and to the point. Although Magenta is a subsidiary of Windham Hill, it has none of that label's patented sheen. *Seven Standards* is as good an "I told you so" as Braxton could've devised for his detractors. Who said the avant-garde can't swing? Now get back out into the vanguard, Anthony. *John Diliberto*

I Will Survive: Little Milton
Malaco 7427, $8.98.

Sound: B Performance: B

Grits Ain't Groceries: Little Milton
Stax MPS-8529, $5.98.

Sound: B– Performance: B+

Bluesman Little Milton Campbell can go toe-to-toe with a platoon of sidemen and still emerge in charge of his material. Like his major influences, B. B. King and Bobby Bland, his gospel-rooted voice is just too big to bury in overblown arrangements.

Despite a string of hits on the Stax label, Milton's fortunes waned after the company folded in the mid-'70s. Now

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Little Milton's producers wisely exercise restraint in pairing this big-voiced blues singer with a small accompanying orchestra.

he's back with a set that finds him at his peak, as the Jackson-based Malaco label seeks to follow Stax's trailblazing footsteps.

Unlike most bluesmen, Milton has been quick to embrace lavish arrangements more common to urban funk than to electric blues. His producers understand that the key to pairing a bluesman with a small orchestra is restraint. If an arrangement were to climax on each line while Milton wrestled the nuance from every word, the result wouldn't be high drama but a stifling, exhausting ponderousness.

I Will Survive features a parade of sidemen, but rarely do they try to smother Milton. Moreover, the producers even leave room for his agile guitar work. The lack of spontaneity in the denser tracks is offset by such bouncing numbers as "It Just Goes to Show," in which the melody is carried by a sprightly electric piano as a female trio deftly chimes in on each chorus.

Milton's fans should enjoy comparing this disc with *Grits Ain't Groceries*, a live club set cut in 1972 for Stax, but only recently released on that label as part of Fantasy's budget series. Backed by his touring band and covering familiar ground, Milton packs an emotional wallop equal to his best studio work. The necessarily minimal arrangements let you fully hear what a wonderful voice he has, while the horn-dominated band, led by his own guitar, more than makes up in immediacy and energy what it lacks in polish.

Roy Greenberg

Reunion: Scott Cossu
Windham Hill WH-1049, $9.98

Sound: C+ Performance: C

Scott Cossu orchestrates crystalline designs of sound from his acoustic piano. But like a filigree of frost on the windowpane, as soon as the afternoon sun comes along, the intricate patterns are dissolved, and one would be hard-pressed to remember what they were.

Reunion consists of melancholy tone poems that flutter somewhere between Pachelbel's cycles and Satie's simplicity. Accompanied by cellist Eugene Friesen and others from the Windham Hill stables, Cossu's liquid piano flows effortlessly through these gentle compositions. The reflective mood is only occasionally broken by enraptured soloing from Shadowfax's flamboyant violinist, Charles Bisharat, on "Moira" and on "Wedding at Jenny Lake," which almost erupts into spontaneous vamping before the fade-out.

Muted atmospheres dominate *Reunion*. The percussion seems to emanate from some distant shore, muffled by the breeze of Friesen's cello on "Sanibel." The overdubbed cello choirs on "Gwenlaise" form a mist for Cossu's dreamy lullaby, but like most dreams, it's forgotten once it's over.

Scott Cossu has made some interesting recordings, notably *Islands*, but

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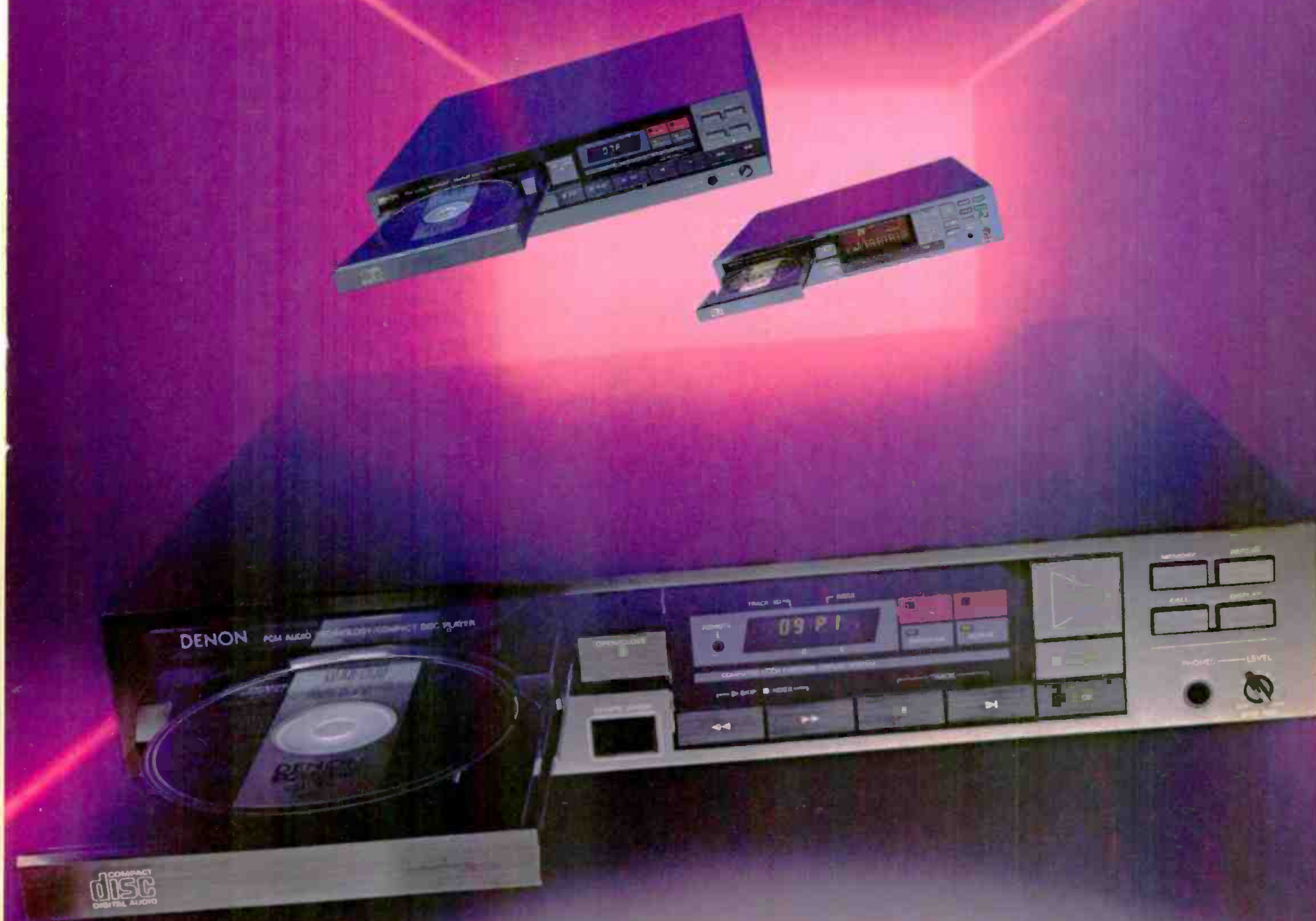

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Remarkably good sound, emotive playing, and novel sonic textures combine to make *Parallel Galaxy* more than just a curiosity.

he seems unable to make the definitive statement that will lift him above the crowd of New Age ramblers. *Reunion* is pleasant, but interchangeable with numerous other recordings. No artist should want that for his music.

John Diliberto

Parallel Galaxy: Emmett Chapman
Back Yard Records BYR1, $9. (Available from Back Yard Records, 8320 Yucca Trail, Los Angeles, Cal. 90046.)

Sound: B+ Performance: A−

Gurgling inventions and exotic sounds glide by as you float into *Parallel Galaxy*, the self-produced LP by guitarist, astrologer, and inventor of The Stick, Emmett Chapman. Chapman's Stick, heard on albums by King Crimson, Peter Gabriel and Dire Straits, is a stereo guitar of sorts, actually a 10-stringed neck with five treble and five bass strings. Melody, bass and chords are fingered simultaneously by both hands, using the pickless "tapping" technique popularized by players like Eddie Van Halen and Stanley Jordan.

What makes this album more than a curiosity is excellent, emotive musicianship coupled with novel sonic textures and remarkably good sound. This was recorded "live" in the inventor's home studio without multi-tracking

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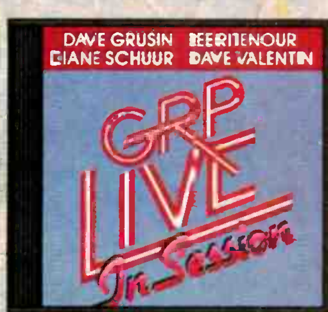

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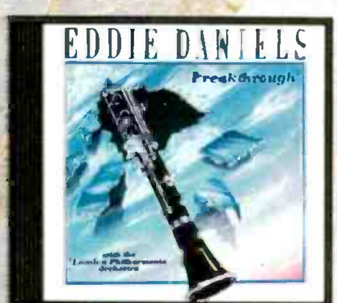

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Kazumi Watanabe performs aggressive instrumental jazz, rich in variety and subtle tonal coloration, and his ensemble really plays *together*.

(electronic effects were played in real time); therefore, what made it onto vinyl was the second-generation mix.

I guess these new sounds are jazz, although they bring to mind another guitar pioneer, Les Paul. Chapman's solo work on "Gypsy," "Margueritas in the Waves" and the title cut is first-rate aural entertainment. Accompaniments by Josh Hanna's treated voice on nifty covers of "Eleanor Rigby" and "Waltzing Matilda," Bruce Gary's drumming on "My Favorite Things," and Dan Chapman's blues harmonica on "Back Yard" add pleasant variety to the tonal palette.

Parallel Galaxy can be found in major-market record stores or ordered by mail. If you mail-order, be sure to request the informative biographical and musical notes which go with the recording. *Michael Wright*

Mobo Splash: Kazumi Watanabe
Gramavision 18-8602-1, $9.98.

Sound: B+ Performance: A+

Synthesizing bebop, rock fusion, funk, rap scratch and an occasional echo of Japan, *Mobo Splash* shows us guitarist Kazumi Watanabe clearly running some distance ahead of his own musical legend.

Here, Watanabe composes aggressive instrumental jazz, rich in musical variety and subtle tonal coloration. His guitar shifts with ease from superb rhythmic comping behind the mean sax on "Crisis III" to furious soloing on the relentless "Busiest Night." He also plays noteworthy keys on "Splash" and the delightful Yellow-Magic-Orchestra-meets-rap of "Gourd-Top-Mouse."

But what makes *Mobo Splash* stand out most is the focus on ensemble playing and stunning musicianship. Watanabe's group Mobo III (plus David Sanborn and Michael Brecker) plays *together*, with tight arrangements complemented by production that cleanly defines each instrument's sound and space throughout.

Kazumi Watanabe's *Mobo Splash* strikes a remarkable balance between coherence, intensity, and interesting diversity. *Michael Wright*

Asia: Kitaro
Geffen/Shizen GHS 24087, $9.98.

Sound: B– Performance: B+

Kitaro's music is located where the reflective nature of New Age music meets the grandeur and scope of Pink Floyd.

Asia is the newest of the six albums released stateside by Geffen Records in association with the Japanese label Shizen. The music was recorded at concerts in Shanghai, Kuala Lumpur and Kota Kinanel.

The all-instrumental music of Kitaro (the man and the group) comes at a measured, loping pace that you might call stately. Much like Pink Floyd, Kitaro's ensemble consists of his own battery of synthesizers, two drummers, two keyboardists, and a guitarist. Together they merge for a sound symphonic in effect. Often a big, big beat is fused to a placid melody, and it feels bigger than life with the quieter passages surrounding.

The record has a cavernous sound that illustrates how well Kitaro works in the stadium settings he sells out through much of the Orient. Surprisingly, the production is not as high-tech as I expected; there is more ambient hum than there should be. I hope that this will be corrected on *Asia*'s Compact Disc release.

In any case, what with Pink Floyd inactive, the music of Kitaro might help fill that void. It surely is excellent music to zone out with. *Michael Tearson*


To Peggy
Love Buddy
"If you knew Peggy Sue,
Then you'd know
why I feel blue.
About Peggy,
Bout my Peggy Sue;
Oh, well, I love you, gal,
Yes, I love you, Peggy Sue;
I love you, Peggy Sue,
With a love so rare and true,
Oh, Peggy, My Peggy Sue;
Oh, well, I love you, gal,
Yes, I want you, Peggy Sue." *
PEGGY SUE
Buddy Holly


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THE GLITTERATI SET

Photo: ©1984, Ebet Roberts

Ice on Fire: Elton John
Geffen 24077-2.

The master of razzle-dazzle is back, resplendent in outrageously elegant evening clothes on the cover of this Compact Disc, and glittering in gorgeous sonic raiment within. Elton John's most recent album, *Ice on Fire*, is a sterling example of recording art, as music and technical finesse combine to create a totally satisfying audio experience in which balance is the operative word.

First, the music. John and producer Gus Dudgeon have juxtaposed sharp, uptempo tracks like the opener, "This Town," with dreamy, floating cuts like "Cry to Heaven," to create a program that moves along smoothly and swiftly. Dynamic balances are exquisite; the restrained guitar work on "Soul Glove," for instance, is pulled way into the background, yet retains its identity and clarity while a hugely thumping drum makes its presence known in no uncertain terms. There are wonderful textural balances as well. I particularly like the contrast of the vibes' sweet and mellow tones against the blaring horns in "Candy by the Pound."

In the lyrics department, longtime John collaborator Bernie Taupin tries to balance social consciousness ("This Town," "Nikita," "Tell Me What the Papers Say") with more standard love songs ("Shoot Down the Moon," "Too Young"). Taupin's lyrics are always interesting, if sometimes pretentious or just silly ("Love bites like a satellite"? C'mon, Bernie), and they are always crisply audible.

Highlights to listen for: The melting, yearning acoustic piano on "Cry to Heaven" and "Shoot Down the Moon," the neat percussion moving from right to left channels in "Nikita," George Michael's almost-soprano vocal contribution on "Wrap Her Up," the little spacey synthesizer swirls on "Satellite," and Millie Jackson's powerhouse vocal exploding over a maelstrom of gunfire in the marital battleground created by "Act of War."

Don't let the razzle-dazzle man pull one over on you, though, much as you may love this disc. The front cover of the CD jacket says this is "a digital recording," but look at the small type inside. You will discover that this little beauty was recorded and mixed on analog equipment and then *remixed* digitally, as are most pop CDs at this stage of the game. Nevertheless, this elegantly dressed Compact Disc belongs on your shelf, and I strongly suggest you wrap it up and take it home.

Paulette Weiss

The Outfield
Columbia CK 40027.

The Outfield's debut recording screams for a review chock-full of baseball imagery (or cricket imagery—after all, these three boys are Brits), but I'm going to refrain from falling into that error—er, trap—and simply rave about this disc straightforwardly. No pussyfooting around here; I *love* this album.

Oh, I know this stuff is derivative, but who gives a damn when it sounds so *terrific*? Vocal harmonies here may well remind you of Men at Work—remember them? Lead singer Tony Lewis' slightly nasal, almost strained vocals are eerily reminiscent of those of Colin Hay. There are spots on the disc that may make you think of The Beatles circa *Sgt. Pepper*, especially a short stretch of vocalise on "Everything You Cry" and some guitar work on "61 Seconds." And *someone* here seems very familiar with John Waite's "Missing You" period.

The trio—Lewis, John Spinks, and Alan Jackson—have created such a big, vibrant, all-American sound that it's difficult to accept the fact that they

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The Outfield's restrained synthesizers, echoing vocal overdubs, and big-bottomed bass have been blazingly clarified by the digital reprocessing.

really are British. Their countrymen seem to agree. This disc is popular only here in the States; it has been thoroughly neglected back in its native England.

A great, rich, pop/rock sound is churned out of basic guitar/bass/drum arrangements, with occasional keyboards provided from outside The Outfield. Although Lewis' distinctive vocals are the focal point of this 10-cut album, John Spinks is the mastermind behind it all. The gorgeous, chiming electric guitar that ripples and rocks throughout is his, and so are the songs, impressive in structure and melody, with knockout lyrics to boot. The first big hit, "Your Love," is unforgettable, a cynical little vignette of a sleazy affair. "61 Seconds" contains the artfully telling line "61 seconds is all it takes/For the nine-to-five man to be more than one minute late." In fact, *every* cut on this Compact Disc has something attractive, interesting, or downright compelling going on.

The recording is splendid, with the digital remastering of the original analog revealing just how spectacular the original production job was. The CD's dynamic range does full justice to the great, rolling drums of which The Outfield is so fond, and many other recorded elements demand high praise as well: Contrasting textures, echoing overdubs on vocals, big-bottomed bass notes, shifting patterns of restrained synthesizer accents are all blazingly clarified by digitalization.

All this and bright, beaty rock you can sink your teeth into. I said it before and I'll say it again: I *love* this album.

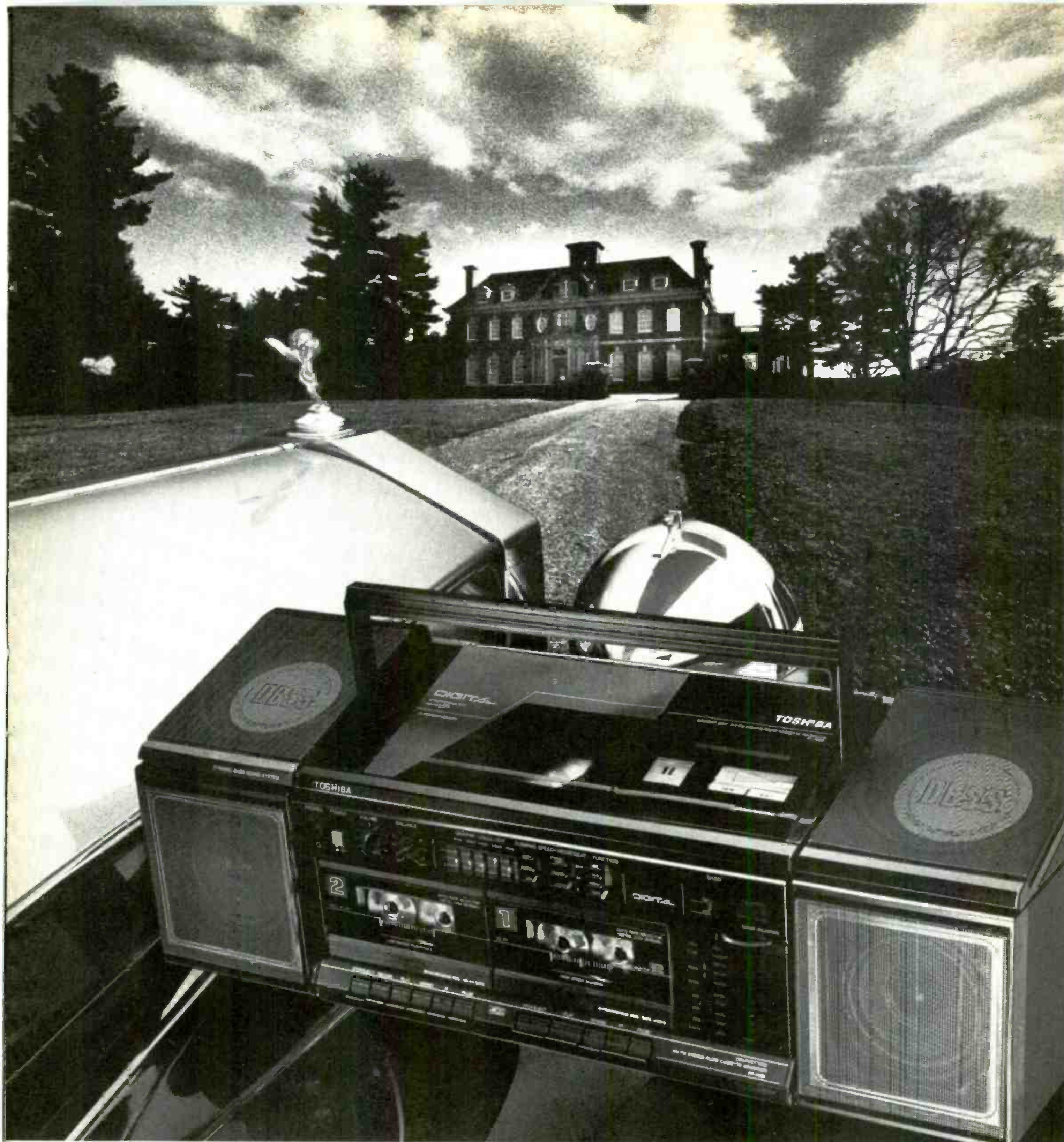
Paulette Weiss

Organ Music of Bach, Messiaen, Dupré, Widor and Franck. Michael Murray, organ.
Telarc CD-80097.

This outstanding recording was made on the new Ruffatti organ in San Francisco's new Davies Symphony Hall. With over 7,300 pipes and 132 ranks, this instrument is said to be the largest concert-hall organ in the United States.

Although the designers of the hall had all the resources of modern acoustic science at their disposal, the general opinion seems to be that the acoustics of this hall make it more successful as a recording venue than as a concert hall. I have yet to attend a live concert in Davies Symphony Hall, but on the basis of the two Telarc recordings made there thus far, the hall would seem to have most of the desirable acoustical characteristics for successful recording. Telarc's first recording in this hall, the Jongen "Symphonie Concertante" for organ and orchestra (reviewed in *Audio*, June 1985), certainly was a convincing demonstration that it is indeed a superior recording locale.

On this CD, we hear a solo organ recital by Michael Murray. Most great organs are installed in large acoustic



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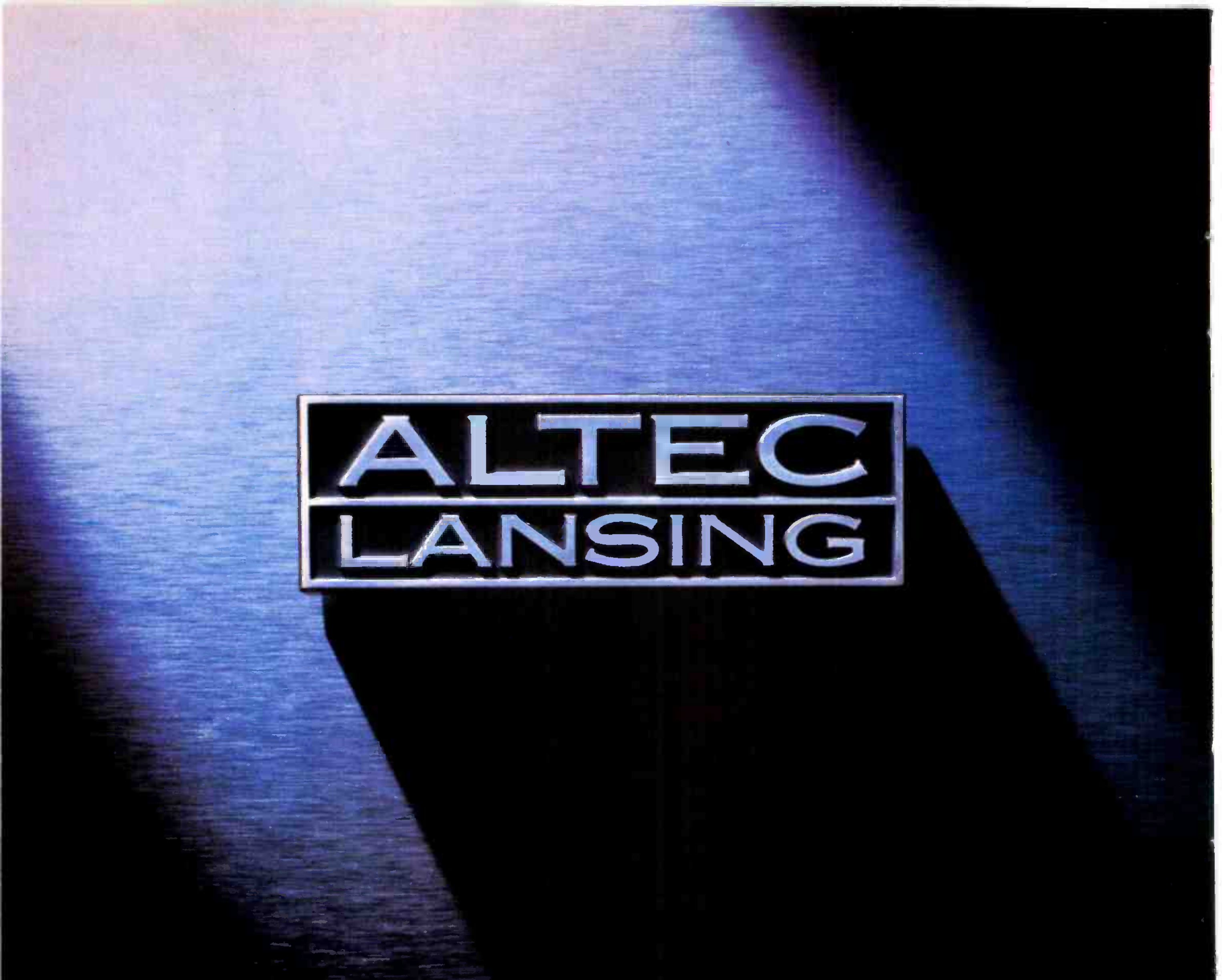
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A 2-second reverberation time gives the organ a very detailed and delineated sound while still allowing ample sonority.

spaces having reverberation periods of 3 to 6 seconds, but in a concert hall organists must contend with shorter reverberation times. In the case of Davies Symphony Hall, this is just slightly over 2 seconds. An advantage of this situation is that the organ sound is very articulate, highly detailed and delineated. Still, there is sufficient reverberation to give the organ sound its traditional, full-bodied sonority.

Murray begins his recital with some nicely structured but not overly inspired performances of some of J. S. Bach's chorale preludes. He follows these with rather freewheeling and exuberant performances of some of the flashier showpieces of the French organ literature.

Murray displays his redoubtable technique in a dazzling performance of Olivier Messiaen's "Dieu Parmi Nous." Messiaen, a fairly prolific composer of organ music, quite often tries to imbue his works with a sort of otherworldly, rather mystical quality. The work recorded here shows a very different type of scoring, as it has violent dynamic contrasts. It opens with huge fortissimo fanfares from the full organ, followed by some quiet, introspective passages, only to have more high-level fanfares burst forth again. The finale features a crescendo of massive chords of ever-increasing intensity, culminating in a sustained passage of thunderous power.

Murray next offers a good performance of the well-known Dupré piece, "Prelude and Fugue in G Minor." He is particularly effective and exciting in the dance-like rhythms of the "Fugue." Then follows the majestic adagio from Widor's "Symphony No. 6."

The last piece on this disc is a triumphant tour de force for both engineer and performer. The César Franck "Final in B Flat, Op. 21" is a veritable orgy of great, exciting organ sound. There are monumental sonorities from huge pedal notes probing the subterranean limits of this great organ. There are massive chords and blazing fanfares. In the tumultuous finale, there is a concatenation of sounds from the full organ, ending in an ad libitum fortissimo of awesome power. Obviously, this music dictates caution in setting playback levels. For organ aficionados, this CD is a must! *Bert Whyte*

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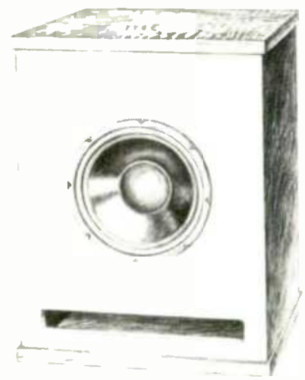

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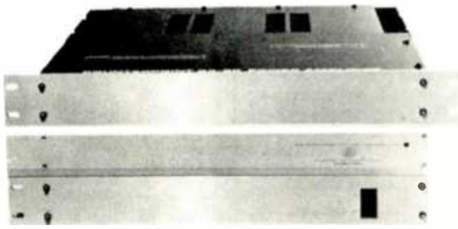

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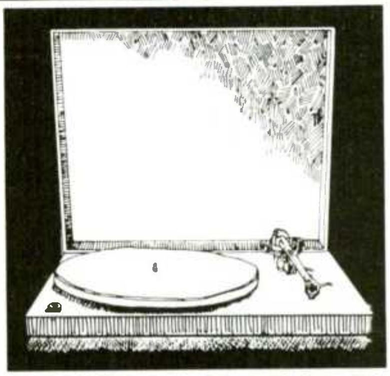

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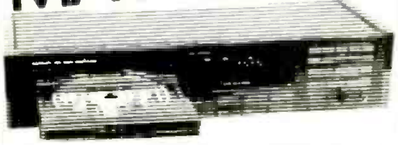

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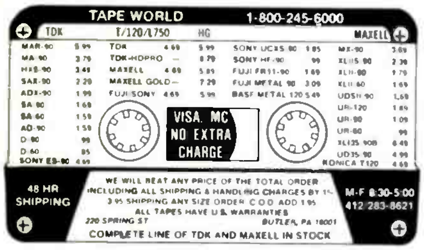

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AD INDEX

HOW YOUR ROOM LOOKS TO YOUR SOUND SYSTEM.

AND WHY YOU NEED AN ADC SOUND SHAPER.

"My stereo doesn't sound the same at home as it did in the store! How come?"

It's usually not the fault of your system. Chances are, your components are excellent. But...

EVERY LISTENING ROOM, IN EVERY HOME, IS DIFFERENT.

Every room has its own pattern of reflective and absorptive surfaces.

Carpets and drapes swallow up sound. Walls and windows bounce it around. Speaker placement can dramatically amplify certain frequencies and diminish others.

As the result, some of Stanley Clarke's bass notes seem to "boom" unnaturally. The full-throated Rob McConnell brass section sounds uncharacteristically off-mic. Some piccolo passages in the *Firebird Suite* could drill a hole in your ear.

WHAT'S THE CURE?

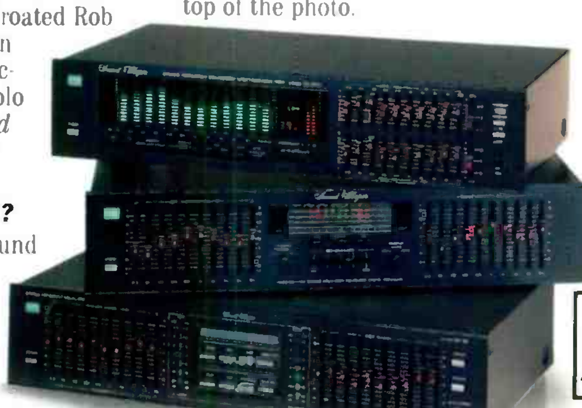
Simple. ADC Sound Shapers let you adjust or "equalize" the sound output of your stereo system to help compensate for the acoustic peculiarities of your room.

Quickly and easily, octave by octave, from 20 to 20,000 Hz, the sliders help you fine-tune your room to achieve the smooth frequency response your music system is capable of delivering. And to achieve the sound balance that satisfies your own musical taste.

A display of lights shows you what the room "hears," the adjustments you make, and the adjusted frequency levels of the music as it is being played.

10 SOUNDSHAPERS 10.

We have four EQs with real-time analyzers and pink-noise generators, like the SS-412X shown at the top of the photo.



There's an equalizer with spatial expander, too: the SS-117EX, pictured in the middle. You'll hear the dramatic difference when you switch in the expander, to spread the stereo image.

Our brand-new 12-band SS-525X offers precision, computerized equalization—automatically; narrow-band bass settings; EQ memories with electronic call; and remote. The slim-line SS-100SL has an RTA for even greater value.

The SS Memory VIII (bottom) takes the guesswork out of equalization—giving fine-tunable preset curves for playback.

ADC: AFFORDABLE TECHNOLOGY.

A few years ago, sophisticated controls such as these were found only in professional recording studios. Now, for surprisingly little, any one of the ten ADC Soundshapers will bring your music system—and your room—up to optimal performance, whether you're shaping the sound of today's compact discs or yesterday's 33s, 45s and 78s.

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