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FEBRUARY 1993

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INTERVIEW
EDDIE KRAMER**

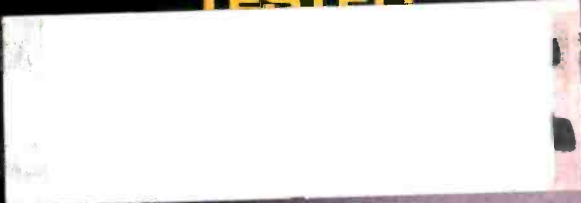
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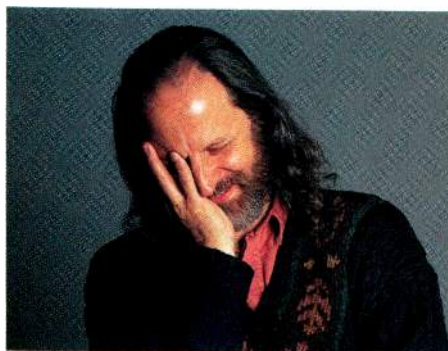
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The Cover Equipment: Sony MZ-1 portable MiniDisc recorder

The Cover Photographer: Carl Zapp



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Nº 30

REFERENCE DIGITAL PROCESSOR

PRIDE IN THE DETAILS . . .

Mark Levinson® components have earned a reputation for their rugged reliability, uncompromising fit and finish and, above all, superior sonics. We at Madrigal Audio Laboratories are understandably proud of this reputation.

The presence of "high technology" in our society has, for some, come to mean the absence of craftsmanship. Mass-produced look-alikes are everywhere, even in the realm of so-called high-end audio. The quality that you see and hear in a Mark Levinson component is not the result of automated mass production—rather, it is the result of painstaking attention to the details of design, and of pride in the art of craftsmanship.



Mark Levinson components are handcrafted in limited quantities and to exacting specifications. All who participate in their production share the feeling of pride that comes from knowing that they contribute to a product that defines quality.

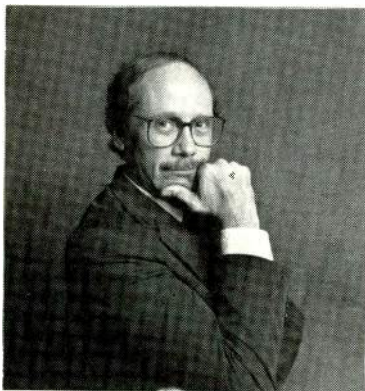
It is with great pride, then, that we introduce the Mark Levinson Nº 30 Reference Digital Processor. Five years of exhaustive research into digital audio yielded a processor worth waiting for, deserving of the Levinson marque.

The Nº 30 is a true reference: it neither adds to nor subtracts from the music. It brings to your home the accuracy as well as the essence of the performance. Finally, the promise of digital audio is fulfilled.

The Nº 30 is proof that state-of-the-art digital *and* analog technology can coexist with craftsmanship. The subject here, however, ultimately is music, and the heart of music is in the listening. To fully appreciate the quality of the Nº 30, we recommend that you visit your Mark Levinson dealer for a full audition.



mark
levinson



Well, you've seen the redesign of our magazine, one whole issue of it by now, and you've probably seen it for a month, in that most of you are subscribers. So it's time to extend kudos, formally and up-front in this column, to our Art Director Cathy Cacchione. She has done a truly superb job. Thanks, Cathy! And thanks, as well, to Associate Art Director Linda Zerella!

I thought the magazine design Cathy had done when we came north from Philadelphia to New York City a dozen years ago had been so good that we really didn't need to do another. At least, we didn't need to do a new one right now, even though I could see the competition gaining on us a bit. My thought was to save our ammunition, to wait until the "other guys" were nearly as good, and then do it to 'em.

After seeing what Cathy has done, and after living with the various parts of it for several weeks, I can see that I ought to have helped to get the redesign accomplished much earlier. All I can say at this point is that you live and learn—at least you try to learn, if you dare. Some of the other folks around the magazine had felt that we should have done the redesign earlier, that we had become somewhat too set in our ways, too predictable. There is more than a little weight to that argument, but I have felt throughout my term as Editor that the magazine should be

reliable, a steady beacon or lighthouse when the economic or technical seas got rough. Perhaps there isn't a significant difference between being predictable and reliable. In the end, I realized that there was nothing wrong with polishing up the lighthouse lens with a redesign.

There are a number of interesting things about the redesign; I'll mention a few, and I invite query letters about any others. The new logotype is a design that is a near relative of the one we started to use during the late '50s. We needed a new title at that time because the Audio Engineering Society had begun their Journal and we—under our old name *Audio Engineering*—were being confused with them. The identification line, "The Equipment Authority," in the bar beneath the logo proper, is new, but it recalls one we used for many years, "The Authoritative Magazine About High Fidelity."

There are some subtle shifts in our coverage of various types of equipment, as we are attempting to get around to more pieces of gear. I've often said that even if the four principal magazines in this field had some central computer to book coverage in reviews, there still would be many pieces of worthy equipment left undone. But that's one of the functions of reviews—to pick the best and leave the rest. One of the main shifts in the coverage has been to include more of the "Auricle" reviews, since we can get two of them into the space a full review takes up. And, too, for some types of equipment, the "Auricle" is the proper sort of report, both from the readers' and the writer's standpoints.

So let us know how you like the new design. We think it looks great.

AUDIO

THE EQUIPMENT AUTHORITY

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Remember the first time you heard a CD? It sounded so good, you hoped the music would never stop.

Which is the whole idea behind the CD changer.

Unfortunately most companies, in their rush to produce one, neglected to isolate the disc that's playing from the changer platform. A big mistake. (Not as big as the Hubble telescope, but pretty darn serious.)

One that transfers internal and external vibrations to the playing disc. Creates resonance. Distorts the sound. And defeats a primary reason for buying a CD player in the first place.

Fortunately Yamaha avoided this common problem by developing an entire line of CD changers that are

virtually vibration-free. A pretty amazing feat in itself.

How they do it is something called PlayXchange. A unique



Yamaha's PlayXchange System. The only carousel mechanism that doesn't transmit vibration to the playing disc. An important feature that permits four discs to be changed without disturbing the one playing.

And because you're supposed to spend your time listening to your CDs and not the machine that plays them, Yamaha's developed a new changing mechanism that's exceptionally quiet, quick and reliable.

But you can't judge a superior CD player merely by its changing mechanism. What makes the difference between a good player and a great one has to do with attention to details.



Or buy one of Yamaha's new CD changers.

Take Yamaha's new CDC-835 for example. With Yamaha's S-Bit Plus Technology, twin balanced D/A converters and Class A amplification at every stage, the CDC-835 outperforms most single disc CD players on the market.

S-Bit Plus

Its fluorescent display can be dimmed or set to automatically shut off during playback, eliminating any chance of interference.

And the CDC-835 is equally impressive in the convenience department.

Its TOC Memory memorizes the contents on each disc, speeding up access to specific songs, especially during random disc-to-disc play.

And to give your favorite kind of music even more presence,

there's a built-in equalizer with five digital presets.

In fact, the CDC-835 can remember your favorite songs on up to 100 discs and play them back in any sequence. It even remembers EQ settings.

Then there's 5-Disc Tape Edit. A useful recording feature that arranges the tracks you select so they fit neatly on two sides of your tape.

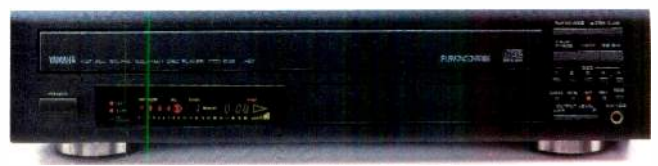


The CDC-835. The only changer with a five-mode digital equalizer.

By now, if you're not quite sold on the CDC-835, you only have two options. You can drop by your nearest Yamaha dealer and let your ears make up your mind.

Or you can buy another changer. Which when you stop to think about it, would be a total shock to your system.

YAMAHA



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Call 1-800-368-8883 for the Yamaha dealer nearest you.

Dynaco Stereo 70 Series II Review

Dear Editor:

Thank you for your review of the new Dynaco Stereo 70 Series II tube amplifier (November 1992). We disagree with Bascom H. King's conclusions in several areas, and with his methodology for listening tests, as noted below:

Regarding his comments about the stability network, we note that bench tests can be devised that any amp will fail. Since its introduction many years ago, the Stereo 70 has had numerous modifications suggested by everyone from Bill Johnson to Bob Carver. Upgrade kits abound from no fewer than 15 companies even today. Dynaco engineers have reviewed all of them and incorporated the time-tested and widely accepted Van Alstine mod into the new design. Others may have merit, but Bascom's claims of instability have not been realized in real-world applications.

Speaker/amp interface is important when doing listening tests. We noted that Bascom failed to mention which speaker he used to make this test, but anyone familiar with his reviews knows he uses the Win Research SM-10; at \$6,250 per pair, and very low sensitivity (minimum power of 50 watts rms), we think it was a poor choice. High-sensitivity speakers such as our own A-25 Series II reference monitor (92 dB SPL, 1 watt/1 meter) can be played at high levels with a modestly powered tube amp such as the Stereo 70 Series II, with no strain. Using a pair of monoblock amps three times more powerful and four times more expensive is not a fair or useful comparison.

Audiophiles on a budget, who are looking for a tube amp they can afford, learned nothing about how the Stereo 70/II competes with other amps, both tube and solid state, in its own price range. It should be noted that there are very few, if any, tube amps at \$995. We have very thoughtfully redesigned the best-selling tube amp of all time, and we make it here in the U.S.A. We back it with a three-year warranty and replace tubes free of charge for one year. As

with any product, the Stereo 70/II has its flaws and its virtues. We think that when it is used properly, the consumer who chooses the Dynaco Stereo 70 Series II will find it everything they were looking for, and at a price that will leave a smile on their face.

In closing, I would just like to say that our company appreciates any coverage we get from the editorial press. Some critics will like what we have done, and others will not. In all cases, we urge consumers to seek out the product and make their own judgment.

Bob Rapoport
Vice-President, Sales/Marketing
Dynaco
Hauppauge, N.Y.

Slightly Warped Solution

Dear Editor:

We have all run into the problem of slightly warped records. I am not talking about something you left on the package tray of your car last summer; my problem is with the records that are warped just enough that I cannot clamp them flat. In the past, I would set them aside or stick them in a tightly packed record rack and hope. Recently I decided to try an experiment, and it has worked far beyond my expectations.

I obtained two 12½-inch-square, ⅜-inch-thick glass plates. I preheated my oven to about 125°. I made sure the glass plates and the record were clean and then sandwiched the record between the plates and baked it for one hour. This accomplished, I turned the heat off and allowed the assembly to cool for several hours. I removed the record, ran it through the cleaner again, and stored it on a tightly packed record shelf. The next day I found the warps were gone. I tried this on other records and had equal success.

I am not sure all these steps are required. Since I did not know the softening point of vinyl, I set the temperature by feel. If it was too hot to hold the metal rack in the oven, I judged it too hot for the record. This led to

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Third in a series

THE COMPONENTS OF EXCELLENCE: LASTING VALUE

Before you buy a new stereo, consider why some people would rather own a used McIntosh than a new anything else.



Made in the USA

By now, most people realize that "new" stereo components often are introduced just to be new. In contrast, McIntosh designs and builds their outstanding high fidelity components incorporating the proven as well as the new, drawing on the McIntosh heritage of quality, performance and innovation.

This is why McIntosh products offer such a high level of intrinsic quality. And why they continue to be eagerly sought by

serious music lovers, virtually attaining the status of collectibles. Never intended to be "disposable", they have been built to deliver leading-edge performance on a foundation of timeless excellence. The lasting value of its products is just one of the components of excellence that has earned McIntosh its rightful title as builder of the world's finest audio components.

McIntosh[®]
Components of Excellence

my setting of about 125°; a higher temperature might have been better. Since the pressure applied to the record was on the label and outer edge, cleanliness may not have been critical, but I thought I should not take a chance on anything sticking in the softened vinyl. Ditto the post-cleaning. An hour in the oven seemed about right, but a shorter time might have worked. The gradual cooling was designed to allow any stresses to work out, which you need to do with glass but maybe not with vinyl. The final sandwiching between other records

was to try to insure against any memory in the vinyl, although there might not be any.

Others can try their own variations. This technique worked for me and has allowed me to enjoy a number of records I thought were lost.

Robert B. Pierce
Venetia, Pa.

Editor's Note: The type of oven in the average home utilizes bursts of heat followed by cooling periods. Though the average temperature may be low, peaks can

reach extremes—the degree varies from oven to oven. The object is to remove warps, not grooves. Extreme caution is advised. And don't put your CDs in the toaster.—K.R.

Go Forth and Record

Dear Editor:

I have been watching the DAT wars for as long as they have been a topic of controversy. Recently, talk of DCC and MD has consumed the editorial sections of many magazines, including *Audio*. I am looking forward to MD over DCC for the convenience and the fact that the MiniDisc is an optical device.

The record industry opposed DAT because there was fear of black-market production of CDs. I could never figure out why this argument was even entertained as a reason to keep a digital recording format off the market. Here's a current example: I buy a DCC or MD recorder at \$500. A recordable tape/disc costs \$4. The average commercial CD length is 60 minutes. I copy a commercial CD onto the recordable DCC/MD and sell it for \$8, which gives me 100% profit, not factoring in the cost of the recording device. If I work an 8-hour day recording, I make \$4/hour. If I have two recording devices, I increase my profit to \$8/hour. For every recording device I add, I have to invest an additional \$500. The majority of stores in my area sell CDs for about \$13. These stores usually promote new releases at about \$9. Most consumers, I would think, would rather buy from the store than from my little black-market scheme.

So, please, let digital recording for the consumer go forth, and allow all of us who love to tinker with recording as a hobby do so without limitations that have so long haunted the DAT.

Forrest E. Sealey
Houston, Tex.

Editor's Note: Unfortunately, a recording limitation on all consumer digital recorders—the requirement that they include the Serial Copy Management System—has indeed come to pass (or more precisely, has come to be passed by Congress), along with "taxes" on both recorders and blank media. See "Fast Fore-Word" in the December 1992 issue.—E.P.

IN THIS RELIGION, IT'S OKAY TO EXPRESS BASS DESIRES.



Brethren: witness ProSeries Subwoofers – the best way to add kick to any car system. There's the 8-inch 8.0LF, our small, powerful wonder. The 10-inch 10.0LF, which outperforms most other 15-inch subs. And the mighty 12-inch 12.0LF, that handles 700 watts, peak. Feel free to covet.

SATISFY MY BASS DESIRES.

Name: _____

Address: _____

City: _____ State: _____ ZIP: _____

Car make: _____ Model: _____ Year: _____

Send \$5 to Boston Acoustics, Dept. CSR-8, 70 Broadway, Lynnfield, MA 01940. In return, you'll get information on Boston subs. Plus a very cool CD, "The Boston Bass Disc" with music specially chosen to test subwoofer performance. All of your desires will then be satisfied. Well, almost.

Allow eight weeks for delivery. Offer good through June, 1993 or while supplies last.



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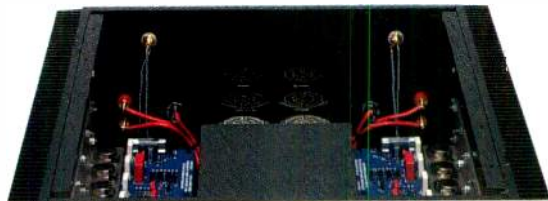
WHAT'S NEW

Etymotic Research Earphone

Unlike most high-end earphones, Etymotic's ER-4 'phones fit directly in the ear, for flatter frequency response and isolation from external noise. Frequency response is rated at ± 4 dB from 20 Hz to 16 kHz and ± 2 dB from 50 Hz to 10 kHz. Rated sensitivity is 108 dB SPL for 1 V in, and nominal impedance is 100 ohms. Two versions are available, with slightly different frequency



contours: The ER-4B, for binaural recordings, is designed for the closest possible match to the ear's diffuse-field response; the ER-4S, for stereo recordings, has a slight high-end roll-off to compensate for boosted highs in commercial recordings made for speaker listening. Price: \$330. For literature, circle No. 100



Counterpoint Amplifier

A solid-state amp from a company known for tube and hybrid designs, the Counterpoint Solid 2 delivers 200 watts per channel into 8 ohms and nearly double that into 4 ohms. The circuitry includes a Class-A FET input stage and a high-current bipolar output with adjustable bias. No negative feedback is used. Price: \$2,795. For literature, circle No. 102



Hughes Spatial Enhancer

A new IC version of the Hughes Sound Retrieval

like effects from a single pair of front speakers. The Retriever has all the control features of the

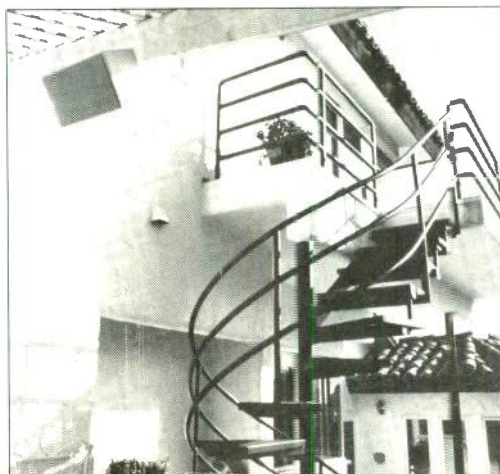


System (SRS) has allowed the introduction of a lower priced stand-alone SRS processor, the Retriever. The Sound Retrieval System produces surround-

more expensive Model AK-100 (which remains in the line) but does not have the original unit's LED display. Price: \$179. For literature, circle No. 101

Sonance Indoor/Outdoor Speaker

Available with a stainless steel or cloth grille, the MB30 features a 6½-inch woofer with polypropylene cone and 30-mm voice-coil, and a 1-inch soft-dome tweeter. Rated frequency response is 60 Hz to 20 kHz, ± 3 dB, and sensitivity is 91 dB. A nail-hanger bracket is provided with the speaker, and adjustable-mount stainless steel brackets are optional. The speaker is available in white or black, and it can be painted. Price: \$499 per pair. For literature, circle No. 103



No matter how good loudspeakers may sound in the lab, in a review column, or in a dealer's showroom—what really matters is how they sound when you get them home.

This is why KEF developed the Uni-Q® Driver... to help reduce the adverse effects of your room's boundaries. Uni-Q works as a point-source of sound, producing a precisely controlled, highly uniform dispersion pattern. This reduces the room reflections that can muddy the sound and destroy the spatial accuracy of the stereo image. The result? Freedom to place the speakers where they fit best, knowing they will also *sound* their best.

Uni-Q's realistic sound, accurate imaging and placement flexibility become especially valuable in home theater and surround sound applications, which require precise localization to effect cinematic realism.



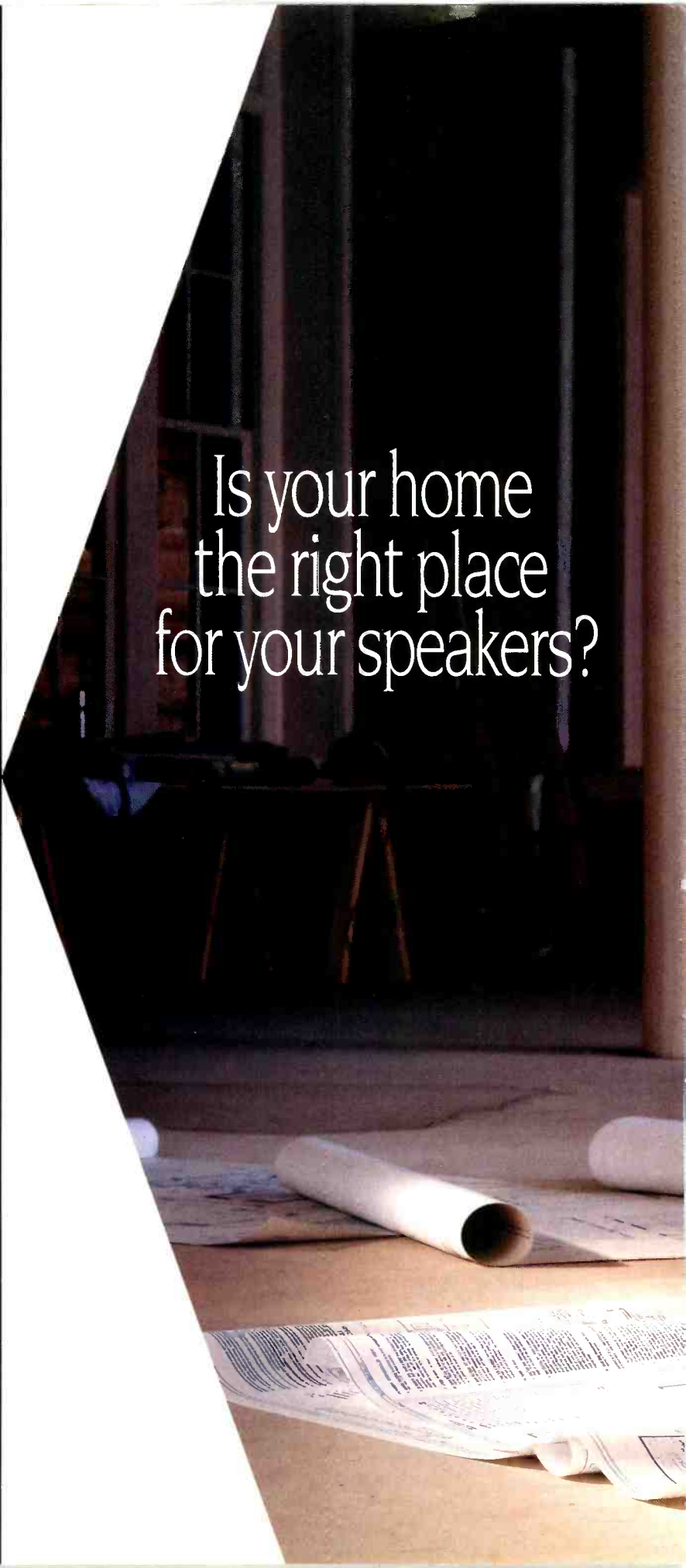
BY PLACING THE TWEETER AT THE CENTER OF THE WOOFER, KEF HAS CREATED THE UNI-Q, A VIRTUAL POINT SOURCE OF SOUND.

The Uni-Q Driver joins such other KEF scientific advances as the Coupled Cavity Bass system, which delivers deep bass from small enclosures; and Conjugate Load Matching, which makes it less strenuous for your amplifier to drive your speakers. Together these have earned KEF its international reputation for real-world performance.

For KEF, the world's finest loudspeakers are those that sound the best in your home.



The Science of Loudspeakers



Is your home
the right place
for your speakers?



KEF Electronics of America, Inc., 1701 Touchstone Road, Colonial Heights, VA 23834

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Differences in Signal Level

Q. *I have a system that includes a CD player and an FM tuner. I use their line out jacks and believe I have been accurate in following the instructions for connecting each of these devices. My problem is that there are huge differences in output between the two. I've had all my other components checked so I could exclude problems there, and all checked out fine. I wondered if impedance mismatches could be the problem and was assured that this was not a concern.*

In all events, running back and forth to adjust the volume control of my amplifier is very annoying and, in my opinion, should be unnecessary. My proposed solution is to use the loudspeaker output terminals on some of these devices rather than the line outputs, and then somehow match impedances using some kind of network. I'm hoping you can help me with that part of the problem.—Ray Willoughby, Naples, Fla.

A. There will always be differences in signal from one component to the next; there will even be differences in level between recordings heard through a single source component. Often, CD players have more output than other devices.

From what you say about your system, it sounds as if you have an integrated amplifier, with signal selection and switching. Some such amps have ways of setting the gain differently for each input, to cure exactly the problem you now have. If your amp doesn't have such provisions, you might consider replacing it with one that does or adding a preamp with separate level settings. (This feature is more common in preamps.)

If your components have output level controls, you can adjust them for roughly equal output levels. This is mostly a matter of turning down the louder components to match the quieter ones. You could also introduce fixed attenuators between the louder components and your amplifier. Such in-line attenuators are available from DB Systems (Main St., Box 460, Rindge Center, N.H. 03461) and probably from other companies as well.

While you would get increased signal level by using the loudspeaker outputs of components whose line output levels are low, you'd also get increased noise and distortion from the added circuitry in the signal path.

Serious FM Distortion

Q. *Although I live scarcely a mile from the transmitters of FM stations I listen to, I am only rarely able to receive these signals decently. Sonic problems include whooshing, rushing noises, high-pitched whistles, and outright static! Although most apparent in stereo, these problems sometimes are present in mono. Worst of all is the way the problems can return after painstaking antenna fiddling has seemed to defeat them. The slightest physical movements made by me or anyone walking through my apartment disrupts reception further.*

Having given up on wire dipole indoor antennas, I tried one of the powered directional units. There was no improvement, so I

**THE SIGNAL REACHING AN
INDOOR FM ANTENNA
FLUCTUATES AS PEOPLE
MOVE AROUND THE ROOM.**

tried connecting the tuner to the rooftop TV antenna. This improved the reception of some stations, but most stations remain hopeless. Do I give up FM?—John Fitzpatrick, New York, N.Y.

A. Your problem is twofold, a combination of both multipath distortion and front-end overload. Although the directional antenna might have helped reject multipath distortion, it made the overload condition worse.

The master TV antenna didn't help because, first of all, most such antennas are set up to reject signals in the FM band. Thus, the only signal received is via leakage in the shield of the coaxial cable connected to the tuner.

The movement of people about the room either cancels or reinforces the received signal, causing changes in the quality of reception.

I have often found that the best overall solution to problems like yours is to disconnect all conventional antennas from the tuner and attach a short length of wire (6 inches should suffice) to just one antenna terminal. Tune in your favorite station, and orient this antenna until you obtain the best reception. If the tuner is well located, reception will be much improved, and because the antenna is behind the tuner, it will be shielded from the effects of people moving around the room.

Editor's Note: As a city-dweller, I've encountered most of Mr. Fitzpatrick's problems. The best reception I ever got was with a rooftop directional antenna (a fringe-area TV type without an FM trap) mounted on a rotor and hooked to a switchable attenuator to prevent front-end overload. I usually got the cleanest, though not the strongest, signals by aiming the antenna away from the station, to some point where it could pick up one lone reflected signal. When aimed at the station, the antenna usually picked up a strong direct signal and a host of almost equally strong reflections.

Like Mr. Fitzpatrick, I live in an apartment, and as is the case with tenants in most apartment buildings, I'm not allowed to put an antenna on the roof. In my location, signal strength is no problem (I get better than 30 dBf on most stations with even the floppy wire dipoles that come with tuners), but multipath certainly is. Under these conditions, the best antenna I've yet tried is a simple rigid dipole, which can be aimed to exclude some of the signal bounces; a cheap rabbit ear will probably work just fine, though I'm using Magnum Dynalab's version—a bit more expensive but considerably more elegant.

Amplified antennas do cut multipath a bit, if they're sufficiently directional, but also add a bit of noise to the signal even if they have adjustable gain. (I suspect the

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signal overloads their built-in amplifiers a bit.) The tall pyramids made by Parsec and Terk are the most directional of amplified antennas. However, they only cut multipath if they're turned down on their side and aimed at the best signal, and, when you do that, the antennas look silly (guests keep setting them back upright again) and the problems of signals changing when people move around the room are exacerbated. Terk's disc-shaped Pi² amplified antenna (\$79.95) and square FM+ (\$19.95) work best for me when standing up (their more normal-looking position), which makes them very modestly directional. Their directionality is so modest that it doesn't much matter which way they're aimed—maybe the main effect is just to screen out some of the signal reflections. The FM+ is not only cheaper but quieter in strong-signal locations.

AudioPrism's new Model 8500 sounds promising, though I haven't tried it. It's a phased-array antenna, built into a cylinder about a foot thick and about 5 feet tall. As a phased array, it can be aimed by a remote control, so you can steer it to the cleanest signal when you're seated without worrying about the signal changing after the antenna has been aimed. Because it's big, the 8500 has enough inherent gain to do away with noisy amplifiers—it even has a switchable attenuator to prevent tuner overload. It is, however, more expensive than most indoor antennas (\$250). And despite its simple shape, its large size may make it too obtrusive in some rooms.

Using a 75-ohm antenna can also help a little, because a 75-ohm shielded line won't pick up additional, interfering signals as a 300-ohm twin-lead can.—I.B.

Radio Interference in Amplifiers

Q. *I have a problem with r.f. interference from police radios and CBs in my power amplifier. Is this interference picked up by the signal cables or by the amplifier itself? Can r.f. be picked up by the loudspeaker interconnecting cables and amplified via the feedback loop? In that event, can shielded speaker cables eliminate the problem?*—Donald Bisbee, Columbus, Ohio

A. I have not used shielded loudspeaker cables, but I have to think they would act as a deterrent to r.f. interference. The assumption that the feedback loop is the path

by which r.f. enters the earlier stages of the amplifier is probably correct. There is often a capacitor across the feedback resistor, and this capacitor is a fine gateway for r.f. Once r.f.i. gets into an early stage, the signal is demodulated and then amplified and passed along to the loudspeakers.

It is reasonable to expect that the shield will help, but it might not totally cure the problem. The shield, if it is to be effective, must be at r.f. ground. The low side of the speaker output circuit may be grounded as far as the audio is concerned but, because of inductance, may not be a good r.f. ground. Therefore, if the shield is separate from both of the conductors, ground this shield to the chassis, and run the two conductors to the appropriate loudspeaker connections. If you don't want to use shielded speaker cable, ordinary cable may work all right if you bypass each channel's speaker output terminals—both "hot" and low sides—to ground. Use a capacitor on the order of 0.02 μ F.

Sometimes r.f. can enter the power amplifier via its input signal leads, despite their being shielded. Some cables have intentionally poor shields in order to have the lowest possible capacitance across the amplifier's input.

The preamplifier, with its many inputs, is also a source of r.f. pickup. I have had lots of problems from phono cables picking up interference.

Although bypassing within the equipment can be successful, doing so could cause some high-frequency degradation. I recommend slipping ferrite beads over internal and external cables. These increase the cable's small inductance, effectively placing a series inductance in the path of r.f.i. The resulting reactance is high at r.f. frequencies but remains low in the audio band. Beads are available in different sizes and formulations, depending on the frequency of the signals causing the interference. Sources from which you can obtain ferrite beads include Palomar Engineers (Box 455, Escondido, Cal. 92033), Amidon Associates (2216 East Gladwick St., Dominguez Hills, Cal. 90220), and Fair-Rite (Box J, 1 Commercial Row, Wallkill, N.Y. 12589). Palomar Engineers has notes regarding the proper use and placement of ferrite beads, and Amidon Associates can provide many ferrite-coil forms. A



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Complexity and Perplexity

Q. *I hope you can help me with what seems to be a very complex problem. My husband recently began collecting stereo components, and I have become avidly interested in them. We had help connecting them all together, and I made a diagram of the connections but lost it during our last move. Now I am lost as to what I'm doing wrong, after consulting the instruction manuals, magazines, and audio dealers—all to no avail. My problem is that the system functions properly for playback, but not for recording from deck to deck or from microphones. The list of components is as follows: An integrated amplifier, a mixer, three tape decks, a turntable, an equalizer, two reverb units, a tuner, two dynamic range controllers, a dynamic noise-reduction unit, a transient-noise eliminator, and an impulse-noise reducer.*

The three tape decks are connected to three tape inputs of the mixer, and I have no trouble there. My problem is with all the filters, noise-reduction units, etc. When connected as specified in the manuals, namely in-line back to the amplifier, I can't get them to work on both playback and recording.—D. Berry, Kaweah, Cal.

A. If I understand your problem, it is that the various signal processors (for noise reduction, reverb, equalization, etc.) work only in playback and not in recording, so that you cannot put their results on tape. When you state that they are connected "in-line back to the amplifier," I guess that you mean they are connected between the output of the preamp section of the integrated amplifier and the input of the power section. If so, only playback can be subjected to signal processing.

In order for the signal processors to work in recording as well as in playback, they would have to be connected via the mixer between the tape out and tape in jacks of the integrated amplifier; the mixer would carry signals to and from the decks.

It is often considered undesirable to process signals to be recorded on tape, because there is danger of overloading the tape, particularly in the case of equalization. Sig-

nal processing, in general, is best done in playback. On the other hand, if you are making a tape to be played in a car or to be played by someone else, you may well want the benefits of processing the signal to be recorded. To do this, you will have to reorganize your system connections.

I suggest that you make a diagram of your present hookup so that you can at least get back to where you are now; to sim-

**YOU SHOULD DIAGRAM
YOUR SYSTEM'S
CONNECTIONS BEFORE
REARRANGING THEM.**

plify, show only one channel. Study carefully where you may have gone wrong. Or show the diagram to an expert, if you can find one. Mark indicated changes. Rewire your system according to the indicated changes; mark each end of each cable as to where it goes.

Disappearance of dbx NR

Q. *I am thinking about replacing my cassette deck, which has dbx noise reduction, but I have noticed that the number of cassette decks with dbx NR has declined. Will it totally disappear, and is now the time to buy a new deck?*—Name withheld

A. In home cassette decks, dbx noise reduction seems to have totally disappeared, as you can see for yourself from the Annual Equipment Directory in the October 1992 issue of *Audio*.

If you have valued tapes that have been recorded with dbx encoding, you should keep your present deck, regardless of whether you buy a new one (which in all probability will have only Dolby noise reduction). Otherwise, you won't be able to play these tapes satisfactorily, because Dolby decoding is not compatible with dbx encoding. At some point you may want to dub your dbx tapes, using the old deck to play them and a new one to record them (with Dolby encoding, of course).

Are Metal Tapes Abrasive?

Q. *In Eastern Europe, where I recently travelled, people were reluctant to let me play my metal tapes on their cassette decks, saying that such tapes ruin a deck's heads. I felt indignant, since my tapes are of top quality and are expensive. Please inform me on this matter.*—Valentin Fedorovich, Thousand Oaks, Cal.

A. To my knowledge, metal tape (Type IV) has no more adverse effect on tape heads than do the other types. Any adverse effect has to do with friction, and all high-quality tapes contain sufficient lubricant in their coating to minimize friction but not so much as to permit slippage when the tape is pulled by capstans and pressure rollers. Also, smoothness of the coating is a factor, and I have heard nothing to indicate that metal tapes are inferior in this respect.

Many years ago when chromium dioxide tapes (Type II) first appeared on the market, it was widely rumored, and too often believed, that they would wear the heads more quickly than other types. It took several years for the rumors to die.

Sound Quality of Digital Tape

Q. *Is it true that the quality and type of tape used in digital audio decks have no effect on fidelity?*—Scott H. Kalata, Flanders, N.J.

A. In a sense, you are correct. Digital recording involves only the transformation of sampled audio voltages into numbers made up of ones and zeros. Beyond digital recording's rather demanding minimum requirements, such factors as an individual tape's treble response, biasing, and sensitivity do not enter into the picture.

On the other hand, the tape's magnetic coating must be very smooth and resistant to wear, lest there be excessive dropouts. Some dropouts are inevitable, but digital tape systems are designed to compensate for reasonable dropout levels through error correction and concealment. Tapes in the DAT format must also meet exacting physical requirements so as to withstand the rigors of its rotating-head system. **A**

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1633 Broadway, New York, N.Y. 10019. All letters are answered. In the event that your letter is chosen by Mr. Burstein to appear in *Tape Guide*, please indicate if your name and/or address should be withheld. Please enclose a stamped, self-addressed envelope.

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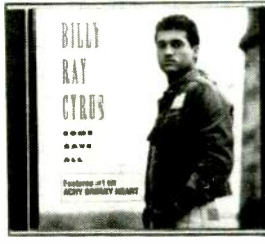
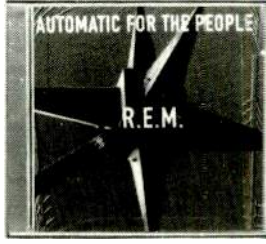
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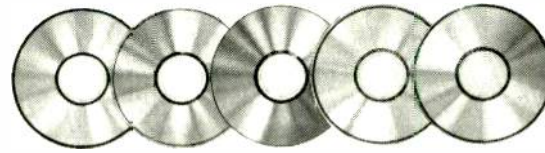
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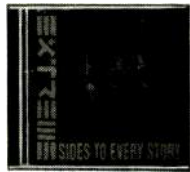
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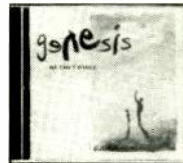
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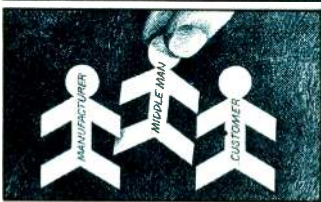
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in a configuration that will allow reasonably good performance; the less skilled must use trial and error. The typical listening environment imposes a number of constraints, such as room size and geometry, as well as the acoustical influence of furniture, drapes, carpeting, etc. Then there is the common situation of auditioning a speaker in a dealer's listening room and later hearing a very different sound quality when the same speaker is taken home.

These topics are explored in considerable depth, with quite complex statistical analysis, in "The Effects of Loudspeaker Placement on Listeners' Preference Ratings," Preprint No. 3352 (A-5), by Sean E. Olive and Peter L. Schuck, Institute for Microstructural Sciences, National Research Council, Canada, and Sharon L. Sally and Marc E. Bonneville, Canadian Audio Research Consortium. The abstract states:

Through the use of an acoustically adjustable listening room and a binaural record/reproduction system, "live" and "binaural" subjective evaluations were made of different loudspeakers placed in different room locations.

The experimental results from both tests show that listeners' preference ratings for different loudspeakers are significantly influenced by their location within the room. In fact, the positional effects can be larger than the subjective differences between the loudspeakers themselves. The binaural evaluations indicate listeners' preferences are significantly influenced by interactions between the loudspeaker, its location, and the type of program material auditioned. These secondary effects were less significant in the live tests, suggesting that traditional real-time listening tests may be inadequate for measuring or controlling these effects.

I find it meaningful that speaker placement was more of a factor than sonic differences between the loudspeakers. I am presuming that the evaluations were done with loudspeakers of similar type and price; I would be surprised if this hypothesis held true for a comparison between a B & W 801 dynamic cone speaker and a Quad ESL-63 electrostatic.

As D/A converters achieve ever more sophisticated levels of performance, wheth-

er they be multi-bit or bitstream units, some of these advances impose newly critical design factors that must be addressed. For example, the enclosure for the D/A converter has a direct bearing on jitter. All the audiophile tricks of using shock-absorbing feet, damping sheets and blocks, and various clamps are nothing more than bandages. The careful design and fabrication of the enclosure is now vital to achieve

**MANY DEVELOPMENTS
CHRONICLED IN AES
PAPERS EVENTUALLY
FILTER DOWN TO
THE AUDIOPHILE.**

top performance. An eye-opening paper on this subject is "Enclosure Detuning for 20-Bit Performance," Preprint No. 3440 (Q-5), by Don Moses of Wadia Digital. Moses analyzes such things as enclosure construction and material, wall thickness, structural integrity, cavity resonances of various types, and internal coatings (dielectric or conductive) and then discusses the corrective measures that have been used to ensure suppression of r.f., skin effects, and jitter.

It would be impossible to fully discuss here all 107 preprints from the 93rd AES Convention, so here is a rundown of some of the other papers that cover cutting-edge audio technology:

"Jitter: Specification and Assessment in Digital Audio Equipment," Preprint No. 3361 (C-2), by Julian Dunn of Prism Sound.

"Audio Power Amplifiers for Loudspeaker Loads," Preprint No. 3432 (N-6), by Eric Benjamin of Dolby Labs.

"Super Bit Mapping: Psychoacoustically Optimized Digital Recording," Preprint No. 3371 (D-9), by Makoto Akune, Robert M. Heddle, and Kenzo Akagiri of Sony Corporate Research Labs. A good companion for this paper would be "Compatible Improvement of 16-Bit Systems Using Subtractive Dither," Preprint No. 3356 (B-2), by Peter G. Craven and Michael A. Gerzon.

The prolific Gerzon, a technical consultant based in Oxford, England, has no fewer than six other papers of his own, all

reflecting his deep involvement with Ambisonics and other methods of surround sound:

"Problems of Upward and Downward Compatibility in Multichannel Stereo Systems," Preprint No. 3404 (J-6).

"Compatibility of and Conversion Between Multispeaker Systems," Preprint No. 3405 (J-7).

"Psychoacoustic Decoders for Multispeaker Stereo and Surround Sound," Preprint No. 3406 (J-8). Gerzon describes a new generation of Ambisonic decoders and other variants on which he has patents pending.

"Signal Processing for Simulating Realistic Stereo Images," Preprint No. 3423 (O-1).

"Applications of Blumlein Shuffling to Stereo Microphone Techniques," Preprint No. 3448 (S-1). This utterly captivating paper describes a new variation on the Blumlein Difference Technique (or Blumlein Shuffling), the oldest stereo miking method. This is a must read for practitioners of "purist" minimal stereo miking.

"Microphone Techniques for 3-Channel Stereo," Preprint No. 3450 (S-3). Virtually a primer on tomorrow's multispeaker stereo and HDTV sound, this paper includes fascinating, informative mike and speaker layouts.

For a related paper, see "A 3-1 Quadraphonic Microphone for HDTV," Preprint No. 3451 (S-4), by Akita Morita and Toshiro Haraga, NHK Science and Technical Research Labs, and Keishi Imanaga, Sanken Microphone. The Japanese companies NHK and Sanken have developed a single-point mike with four capsules to provide front left, front right, front center, and rear center audio channels for HDTV productions. No doubt the mike does its intended job, but with the emergence of the SMPTE discrete six-channel system and the similar method for Dolby SR-D film soundtracks, this mike may have to be modified to allow for discrete left and right rear channels.

History has shown that many of the developments chronicled in AES preprints of yesteryear have eventually filtered down to the audiophile, providing new levels of sonic realism. Preprints are \$5 each and can be obtained from the Audio Engineering Society, 60 East 42nd St., New York, N.Y. 10165.



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THE AUDIO INTERVIEW

There are some who were destined to be key witnesses and participants in important periods of history—without becoming household names. Eddie Kramer is one of those people. The British Invasion? Whether it was engineering a show for the seminal Radio Luxembourg, recording The Beatles, mixing The Rolling Stones, helping create the Led Zeppelin legend, Eddie was there. Woodstock? Eddie was the man who recorded it. Jimi Hendrix? Eddie was his great facilitator and alter-ego in the control room. Multitrack recording? Eddie built Hendrix's Electric Lady, the first studio with a board specifically designed for 24-track recording. Early on in a career spanning three decades, he was usually the engineer, not the producer, so his name sometimes didn't make it to the album cover. (Perhaps with the recent publication of *Hendrix: Setting the Record Straight*, his will become more of a household name. Another book from Kramer, *From the Other Side of the Glass*, is in preparation.) Later he became a producer for heavy rock acts from Anthrax to Whitesnake, but it is as the quintessential rock engineer that he first became known. That is primarily what our discussion here is concerned with.

T.F.



Eddie Kramer

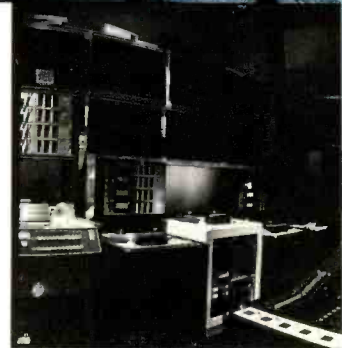
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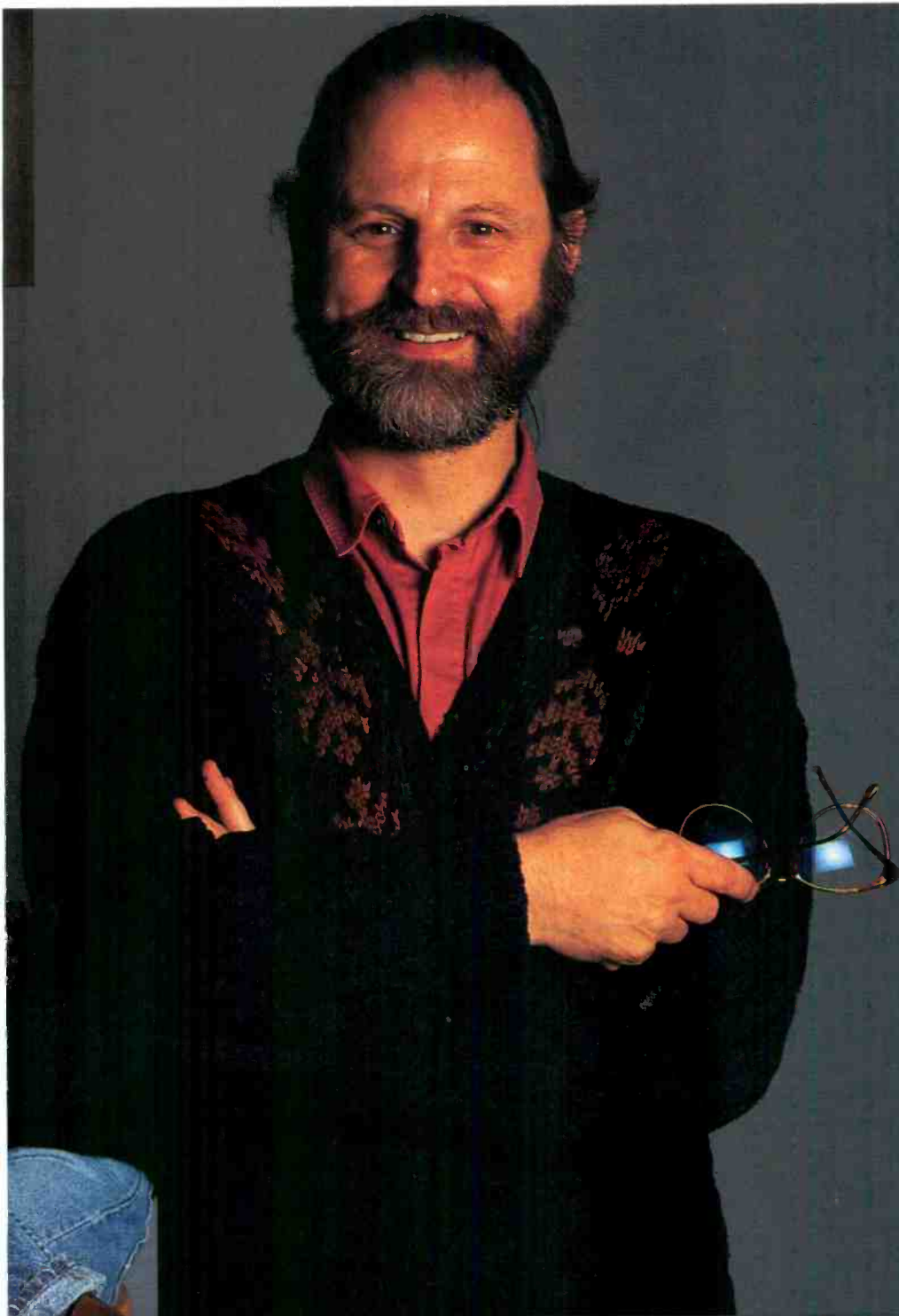
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AUDIO/FEBRUARY 1993

24





We were blown away when The Beatles came in

I am sure a lot of English bands in the early and middle '60s must have had very strange experiences working with engineers who had never done rock records before.

Yes, but I think I was fortunate enough that the studios I worked in were on the cutting edge. Pye Studios was the leading studio in the early '60s. Bob Auger was my first mentor. His connection to American recording techniques was unique in England because his friend in New York was Bob Fine, who ran Fine Recording. He was responsible for the Mercury 35-mm magnetic recording of classical music; he invented his own microphone and all sorts of stuff. So through Fine, Auger imported a lot of American gear back to England, making Pye radically different than any other studio in England. It also ran on 110 volts. They had these huge transformers so that we could run all the Ampex 300s, Ampex 350s, and Pultecs. Bob Auger loved the American sound and wanted to incorporate it into what was happening in England. Pye Studios was a branch of Pye Records, which was the distributing arm for Reprise and for Chess Records, so I got an early exposure to American R&B and blues records at Pye Studios. I became the engineer/DJ for a half-hour radio show on Radio Luxembourg, which transmitted pop music across the continent to England. We used to put in all these records from Howlin' Wolf and Chuck Berry and all the early Chess blues records. We were playing that music way before anybody else.

So while you were working at Pye, that same music was being broadcast over Radio Luxembourg. . .

. . . And influencing all the musicians who were on the scene. . . Here's another thing that was unheard of that we did at Pye: One of the very first sessions that I remember was Sammy Davis, Jr., and it was called for 11:30 p.m. This was unheard of, sessions going beyond midnight. This was 1963. The musicians' union was in a complete tizzy because a session had been called at 11:30 or midnight. History making! Sammy threw this big party in the studio. And

Kramer receives Platinum Music Networks' Lifetime Achievement Award from ex-Kiss guitarist Ace Frehley.

~~~~~

Kramer at Electric Lady in 1970.



STAR FILE

it was an all-American rhythm section, which was another big deal. It was the most terrifying thing. I had never been so scared in my life. I remember him coming into the control room; he had this cane with a silver top on it, and he laid it across the console and said, "Now let's get down, let's not have any shit." Then he laughed. Pye was a testing ground for me in a lot of ways.

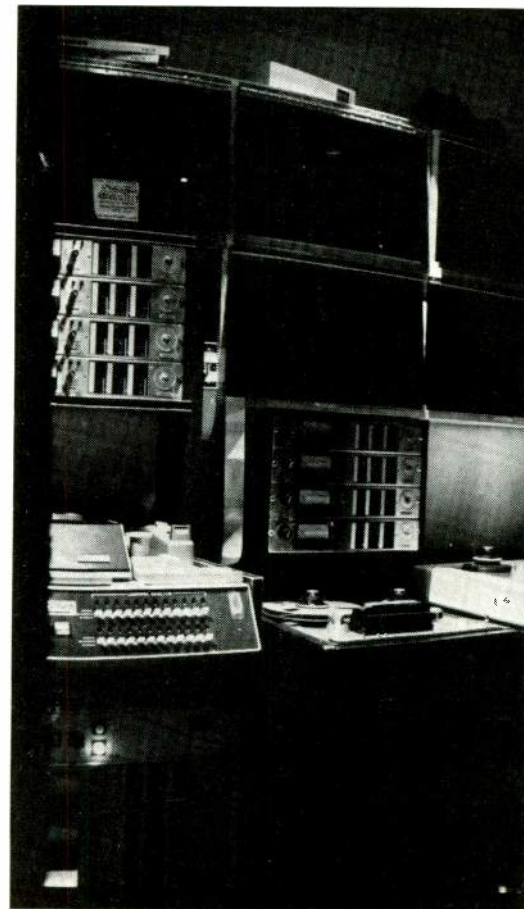
*It sounds like a great place to get started.*

Yes. But actually the very first studio that I worked for was Advision, which was basically a jingle and film house that did some work in recording, and they had a couple of mastering rooms as well. All the recording that I learned there was mono. I was there a year, then I heard about Pye opening, which was the hot studio. I always went to the new studio in town that I thought was the "cool" place where I would learn something. I learned the basics at Advision. I was also a delivery boy, a tea boy—the traditional ground-up education. I did a lot of blue beat at Advision. It was the precursor to reggae. They did a lot of recording there because it was so cheap. Those albums were cut for 10 or 15 pounds per session. I was

only making 3 pound, 50 a week, and I was living at home. But Pye was the place that really exposed me to so much. We used to do a lot of remote classical recordings. The mobile unit was very simple. It was a bunch of Vortexion mixers. They were like elevated Shure mixers; they had studded rotary pots and were sort of like something the BBC would have built. We would take one with a three-track Ampex machine and three Ampex speakers—little self-amplified 8-inch speakers encased in gel. I think acoustically some of these big halls we recorded in were better than the studios. The technique of recording an orchestra was imprinted in my brain.

*While you did classical at Pye, you were also doing groups like The Kinks.*

The Kinks were the first heavy rock session that I was on. Bob Auger saw The Kinks not as a bunch of noise, but as an opportunity to do something creative. Listen to those early Kinks records. They are amazing. He was just very creative with limiters,





# at Olympic— sessions a top independent studio with

## a point to prove.

and compression and distortion. I wasn't sure what was going on, but I absorbed a lot from Bob Auger.

*When did you go to work at Olympic Sound Studios?*

In 1966. Olympic had a very good reputation. Keith Grant was the chief engineer. I remember walking into this place, and it just freaked me out. It was an old movie house with 30-foot ceilings. It was unusual because it wasn't in the center of town, it was in the London suburb of Barnes. This was the new Olympic. I worked at the old studio, which was haunted. The place was built in the 1600s or something.

*Didn't you work on some Beatles sessions at Olympic?*

Yes, I did two. EMI was so busy, The Beatles could not get in there. We were very blown away that they were going to come in. Keith Grant says, "Look, we got to really show these guys up at EMI who's boss." There was a real rivalry. EMI was very stuffy, very proper, and had a great reputa-

tion. Olympic was the top independent studio, and we had a point to prove. Keith and I did the first Beatles session at Olympic, "Baby You're a Rich Man." The whole thing was recorded, overdubbed, and mixed in one night. The Beatles had this ability to be able to just get in there, concentrate, and just pound it out. George Martin sort of held the reins on them, and he and John Lennon played keyboards. Later on I engineered the basics for "All You Need Is Love." Martin asked, "Could you work it so that John could be in the control room?" So we figured out a way to hook up the talk-back mike so that it was wired directly into the studio and into their headphones. John sat next to me, and I was mixing, and he would sing. They would count off "one, two, three, four" and then [singing] "All you need is love." Then, as they got to the end of the song, he said, "Make sure you leave the tape running." As we got to the end of the song he went "one, two, three, four," and they would start

right off again without stopping for the length of one roll of tape. Then we would put up another roll of tape and would listen back after two or three rolls of tape.

*When did they put everybody else on that cut?*

I cut the basic track for that, and they took the tape and then they overdubbed the strings, etc. at EMI.

*What about the Stones sessions you did there?*

I was Glyn Johns' assistant on *Between the Buttons* and the *Flowers* album. During that period I was working with Traffic and Jimmy Miller, who later produced The Stones. Jimmy and I worked very closely together. He taught me so much in terms of production—how to get the best out of the music and get the band at it, and get that atmosphere going. Get them all excited. That was his vibe on the Traffic records. In the middle of a take, for instance, he would run out of the control room, grab maracas and a tambourine, and jump on

JOHN VELTRI





STAR FILE

Hendrix and his engineer were  
“breaking new ground every day.”

hand side, were two big double doors. There were all these cars outside—Rolls, Bentleys, and Aston Martins. The local constabulary came by to see what all the fuss was about. The front door to the building was left open by mistake, so these two motorcycle cops with the leather boots came upstairs and were standing in the doorway. Mick’s in the middle of this vocal. Now, in the control room there is every drug known to man. There was a fog of pot smoke hanging like a pall over the control room. I am the one who sees the cops first. So I said to Glyn, “The fuzz are here!” He doesn’t stop the take, but there is a button he can hit and talk through the headphones without talking through the studio speakers. He says, “Mick, the fuzz are behind you so just be cool.” In the meantime, there is something like a Chinese fire drill in the control room. Doors are opening to blow all the smoke away. [Producer] Andrew Loog Oldham’s little suitcase was like a walking pharmacy. And he had this sort of perfume spray that he was using around the control room to make it smell better. It was hysterical. We were just laughing and carrying on like nut cases. It was “hide all the drugs immediately,” because in those days The Stones were being marked. So Mick, without missing a beat, calls to the two cops, “Excuse me, come over here!” Then he says, “I am having a bit of a problem here with my headphones; would you mind holding them on for me?” There are these two big, burly English policemen with one finger on each headphone holding them while Mick was trying to sing, which is giving us time to clear the control room. Then Mick says, “Wind back to that middle bit, I have an idea. Can I borrow your truncheons?” They say, “All right,” so he takes the two truncheons and goes “click, click, click.” It sounded like claves. Eventually, after all this comes down, he asks, “Do you want to come in?” All they wanted

the stage. We would set up a stage at the end of the studio for Traffic. We were doing “Dear Mr. Fantasy” live. You can actually hear that on the record.

Jimmy Miller was asked to do The Stones, because they wanted to go from a slightly different direction. They liked the fact that he was American and an ex-drummer/comedian. I cut a lot of basic tracks for *Let It Bleed*. Also, “Jumpin’ Jack Flash” was mine, and so was “Parachute Woman” [from *Beggars Banquet*]. We cut the basic track for “Jumpin’ Jack Flash” on a cassette. We wanted to get that funky sound, so we cut it on Jimmy Miller’s

Wollensak. We put the band in a little circle. Just one little snare drum with brushes and an acoustic guitar. You can hear it if you listen to the beginning. You can hear the wow on the tape machine, because the machine was not very stable. We played that track back through a little speaker, and recorded it with a U-67 onto one track of the four-track, and that became the basic track.

*Tell me about the recording of “Let’s Spend the Night Together.”*

I was the assistant, Glyn was engineering, and Mick Jagger was in the studio singing. About halfway down the studio, on the left-



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# Vocals were very important to

was shy; I had to

Jimi, but he

construct gobos

so no one could see him.

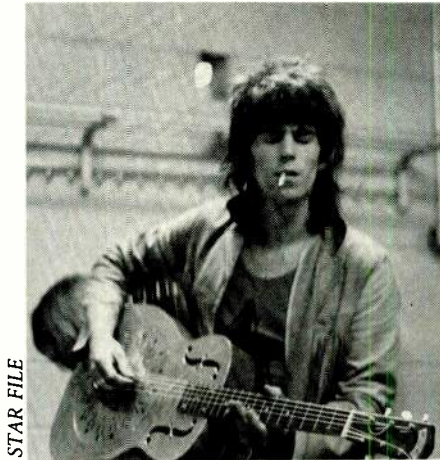
were autographs. So he brought them in and signed the autographs, and they went. *Some techniques that have become nearly ubiquitous in rock started at Olympic.*

My assistant, George Chkiantz had been experimenting since George Martin came in to do The Beatles' sessions. We had asked George [Martin] how he got that phasing sound. We called it flanging. And he told us, "It's pretty simple, and it is also in the BBC *Radiophonics Handbook* from 1949." George, my assistant, had done it on The Small Faces' "Itchycoo Park." I said, "We have to use this on Hendrix." Jimi had told me about this dream he had about being underwater and in this weird sort of space, and we said, "Aha, okay." We were doing the *Axis: Bold As Love* album, and I told Jimi we had a surprise for him. We played him the part of "Bold As Love" where the drums fall down. He could not believe it. He said, "That's exactly what I dreamed of."

*How did you first get involved with Jimi Hendrix?*

They had done "Hey Joe" and some B sides, three or four tracks, maybe 40% of the *Are You Experienced?* album. Jimi felt it could be a lot better. Chas Chandler [Hendrix's manager and producer] had heard of Olympic from Bill Wyman and Brian Jones of The Stones. He came in to look at the studio and thought it was really cool and then brought Jimi in. So I ended up remixing a lot of the stuff and cutting new tracks for the *Experienced* album. We hit it off. Jimi and I really enjoyed each other's work. I would do something on the console that would freak him out, and he would do something in the studio that would freak me out, and I would go, "Oh, yeah, well I can do this," and he would say, "Well I can do this." There was a constant sort of back and forth where we would just get excited about the way things were sounding. We were breaking new ground every day. Quite frankly, we didn't know what we were doing. We didn't think we were making something earth-shattering. It was just fun. Of course, Chas Chandler had to keep a

Keith Richards, circa "Jumpin' Jack Flash," a Kramer track.



STAR FILE

real tight hold on everything, but within that framework we were having a lot of fun. That's the thing that's missing today from records.

*Jimi never felt he was a great singer.*

His vocals were very important to him, but he was very shy about that. He thought he couldn't sing. I had to construct these gobos around him to make sure no one could see him while he was singing. He wanted to be very private, and that made him feel more confident. He really didn't like the way his voice sounded.

*How would he communicate with you?*

In the beginning you have to remember that Chas was very much in control. But by *Axis*, the second album, Jimi was very much expressing his own ideas. Mitch Mitchell, too. By the second album Mitch was very much into what we could get out of the drums and how we could make the drums sound better. There was a very open line of communication between me and Jimi and Mitch.

*Do you think you helped educate Jimi about what was possible to be done in the studio?*

I don't know if it was possible to say that I educated him. I certainly exposed him to a lot of the possibilities. The man was a genius. He picked up on what I was showing him very quickly, so I wasn't conscious-

ly teaching. I was enthralled with the fact that somebody was receptive to my ideas, and I think it was a two-way street because I was receptive to the way he was playing and what he was doing in the studio.

*He did a lot of amazing stuff—backward guitar . . .*

The backward guitar solos were something he practiced, and contrary to popular belief, Jimi was very prepared in the studio. Preproduction was done very carefully away from the studio in the apartment with Chas. He worked in the apartment with a little tape machine, turning the tape around and listening to it and practicing to it backwards. So when it came time for him to do a backwards solo, he knew exactly where he was at any moment on that tape. There was never a moment when he didn't know where he was, and he knew what his guitar was going to sound like when the tape was turned back the right way.

*It's been written that Keith Grant would lock up the good mikes when Jimi came in because he was worried about him blowing them up.*

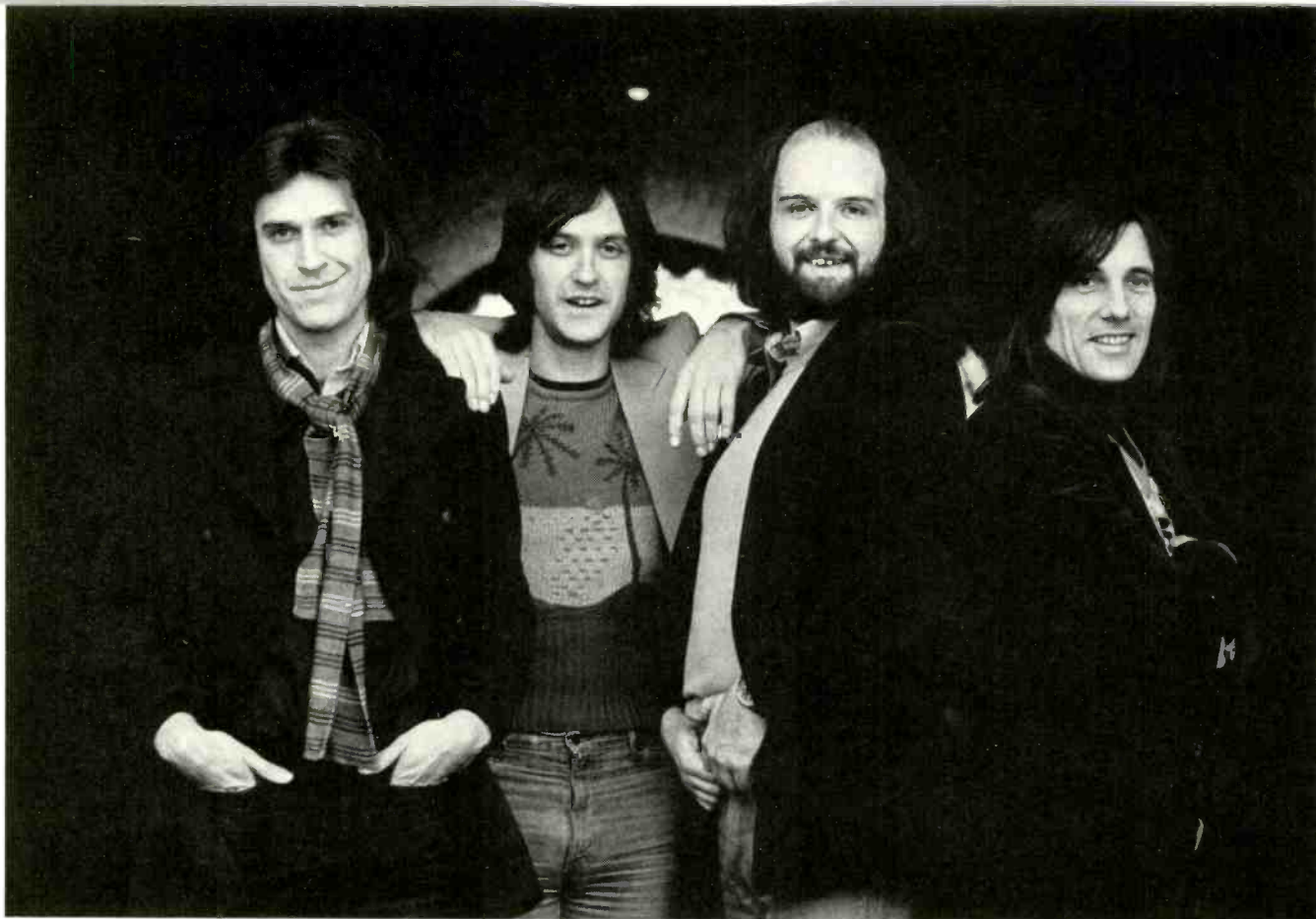
Never! Jimi was not rough on the equipment! If anything, he would have to accuse me of doing that. I don't think so, not from what I remember. As a matter of fact, I came up with what I felt was the best combination of mikes—the M160 on his vocal, which was like a telescope in terms of its front-to-back rejection; it's a ribbon mike, very warm-sounding. We used the normal condensers on the drums and M160s and U-67s on his guitar amps.

*Hendrix developed a tendency to do many takes and rework things incessantly. . . .*

Only later on! In the beginning he was very tight. First two albums, Chas wouldn't let him. *Electric Ladyland* was a different story. From *Electric Ladyland* on was when Chas was no longer there. Then it became much more of a thing that Jimi and I did together. Of course, he had much more freedom then and was very much looser—but still with me being there to make sure that things were going to be recorded right.

*Was that a source of friction with Chas?*

In a way. In retrospect I think it was a good



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thing, Chas being there as the person holding the reins forced Jimi into a situation where he had to be creative in a short period of time. I think some of his best work reflects that. It gave him very good training, very good input as to how a song should be structured. Chas was the one who helped him restructure his songs. Later, on *Electric Ladyland* and the stuff I did on *The Cry of Love*, it would be six, seven, eight, nine takes of guitar solo because we had the tracks. Then I would be left with this unenviable task of trying to figure out which was the best solo, and they were all great. Eventually he and I would sit together and pick the best bits, I'd bounce it down to one track, and that would be it.

*How long did the first two albums take to do?* Very short process. You have to think about the technique we were using: Four-track. In an evening we would cut two to three tracks. The album would be finished in a matter of two to three weeks. Four to fours and down to stereo, and that's it! All those little intermediary mixes had to be right, because in the early days the drums and bass were on two tracks. I changed that whole aspect of recording, by making the four-track a bed. The drums were in stereo,

the bass on one track, and there was a rhythm guitar track. We took that four-track and mixed that down to two tracks of another four-track machine, which gave him more tracks—one for solo, one for better vocals. Then sometimes we would do that again—go to a third four-track. The hiss buildup was enormous.

*How did you deal with that?*

You didn't deal with it! It was there! What're you going to do? You just load the tape up with a shitload of level and hope for the best!

*I think the Hendrix CDs sound great.*

Yeah? I don't know. One of these days it ought to be done properly. I don't think the CDs sound nearly as good as the original recordings!

*Well, a whole generation of people like me listened to that originally on garbage equipment, and there was a lot of stuff on those records that I never even heard because I was listening to it on crappy equipment.*

No question about it. But if you compare a pristine LP pressing from one of those German manufacturers or one of those audio research companies with a contemporary CD, the LP will blow it away. You can give me the finest rock recording done

in 1992 on an analog machine and compare it with a digital version, and the analog is going to blow it away! Digital sucks! I hate digital! It is horrible! It has no soul whatsoever. DAT is a great storage medium. Same with CD, same with digital. The 48-track Sony is a decent machine. It sounds pretty good. But it still doesn't sound as good as—I defy anybody, particularly with the stuff that I do—15 ips, 16-track, with a shitload of level on the tape. Now try to do that on a Sony 48-track. There is no way in hell that the drums are going to sound like anything. It can't! It's impossible! There is no saturation, no gradual amount of distortion in the curve. Who cares about the hiss in the background? I don't! I can see digital's point. I like digital for certain things. I certainly made a sweeping generalization about digital, but it is true to a large degree. It's essentially a cold medium, where you are converting music to numbers. Now, doesn't that say something? I think a lot of classical records today sound quite good, but I still think some of the older recordings . . .

Why is there such a fascination with this reissue stuff? Because the older stuff sounds better. When you said the Hendrix CDs



# The finest rock recording on an analog machine done in 1992 is going to blow the digital version away!

sounded better, in some instances you are probably right. There is not much tape noise; maybe they have done some EQing. This guy Joe Gastwirt, who did the Hendrix stuff, is good, but he is only as good as the gear is. And unless you know how the original stuff was recorded, how are you going to make a CD of an original quarter-inch 15-ips tape that I mixed sound better? You are going to have to know what I did! One of the mistakes these record companies make is they hire these guys to do this shit, and they are great engineers and all the rest of it, and sometimes they hit the mark, sometimes they don't. But what they should do is hire the guys who did the original, if they are around, to at least supervise and give input into that process. I did this with the Zeppelin CDs. Yves Beauvais, at Atlantic, and I went over the initial one. I said, "It is too harsh; what is Jimmy doing?" He said, "Yeah," and went back and re-equalized it, softening it up a little bit. You can get carried away! And CDs have a tendency to sound harsh anyway! I think a lot of the nuances from the original get lost. People in the business five or 10 years ago said, "That's it, the end of analog." Boy, we proved them wrong. There has been a shift away from digital and into analog because it does sound better, and you lock up your two machines and away you go. Dolby SR is amazing sounding. I love the way 15 ips sounds. I prefer 15 to 30, because the bottom end kicks you in the gut. *Let's move on to the recording of the Electric Ladyland album.*

I left England in April of '68. We had cut three or four sides for what was to be the *Electric Ladyland* album in England—"All Along the Watchtower," "Crosstown Traffic," and a couple of others. Chas had come over to America and started to work with Jimi already at the Record Plant. I was finishing up The Stones' *Let It Bleed* album. I was the new young engineer in town, brought over specifically because of my work with Jimi.

*Why did you decide to leave England and go to the Record Plant?*

The Kinks were Kramer's "first heavy rock session."

Steve Winwood: Kramer worked on Traffic's "Dear Mr. Fantasy."



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Chris Stone, who ran the Record Plant with Gary Kellgren, heard about my work in England with Jimi. And Tom Wilson, who was one of the founding members of the Record Plant—he produced Bob Dylan—worked with me at Olympic doing some Animals sessions. Gary had done one or two sessions in New York with Jimi, so they thought it would be really cool to get an English engineer, particularly since Jimi was going to live in the States. So eventually I came over and started working on the *Electric Ladyland* album. By the second or third session that I did, Chas was already not very happy with Jimi and the amount of people who were in the control room and the amount of drugs Jimi was doing. Chas just decided, "Sorry, see you later," so Jimi and I basically took over the whole project.

*What was the setup at the Record Plant then?*  
Ha! Very interesting. I had left England recording on four-track. All of a sudden I am

in the States, and it's 12-track. I skipped eight-track altogether. They had a Scully 12-track, an abomination of a machine. I can't imagine any machine worse than that. It was noisy, but it was the hip thing, 12-track, wow! Big deal! So all the four-track stuff that I had done in England was transferred to 12. Jimi now had eight more tracks to play with. But the 12-track didn't last that long, because it was so unreliable and so noisy. At that point the first 16-track machines were coming out, so all those 12-tracks that were filled up were transferred yet again to 16. So my "All Along the Watchtower," which started as a four-track in England, ended up on a 16-track machine and went through three generations—and yet it still sounds good. The Record Plant was a shitty studio, I thought. The control room windows and walls were very thin, and they leaked badly. When we cranked up these big Tannoys, we sometimes had feedback. It was very primitive. Gary was a brilliant engineer. I loved him. The board was a Datamix console, a horrendous-sounding console. Very noisy and had a weird EQ. But we worked through it. It wasn't a great studio, but we produced great records. Eventually the Record Plant did become a very good studio.

*Did your experience at the Record Plant contribute to thinking about Hendrix building his own studio?*

No. That came about because Jimi and his manager at the time, Michael Jeffrey, bought the Generation nightclub with the view to having a little tiny control room to record live gigs. When I was invited to come down to look at the possibilities, I told them, "You guys are out of your minds—what nightclub? Forget that. Let's make this the greatest studio in the world." It made them think, because they were going to run into a lot of problems getting liquor licenses and stuff like that. So the studio became the big thing. Jimi was spending a fortune, \$200,000 or \$300,000 a year in studio time, and wasting it.

*What was the original budget for the studio?*  
Half a million. It ended up twice that. Jimi



## The English groups had

was not involved in it except in a remote way. I knew what he wanted, and I wanted to make sure that it was going to be very comfortable since it was going to be his place. John Storyk was the architect. He had never designed a studio before. He was fresh out of college. So it was a novel experience for him and me. I knew what I wanted in terms of a console. Unfortunately we had to go with the same manufacturer, Datamix, since he was the only guy in New York who could do a custom board. But it was a lot better built than the Record Plant one. I laid it out and insisted that it be 24-track, because I knew that was the up-and-coming thing. We were the first studio in New York to have a board specifically designed for 24-track. I wanted to make sure the room acoustically was comfortable and that it was live enough. We were flying by the seat of our pants. We had a good acoustician, Bob Hanson. We were

very lucky that the studio sounded right, pretty much from the beginning. It was home for Jimi, with the white carpets on the walls and the theater lighting systems in the ceiling that could wash the walls in different colors. He felt very comfortable in there and loved to record in that studio. He was there early every night. Seven o'clock on the dot he was there, and sometimes before. I would be finishing up a session, and he would be there waiting to come in. It was so unusual. The year of '69 he had spent frittering his time away, doing long-winded jams at the Record Plant and Hit Factory and not really achieving much. So he really could not wait to get started.

*Let's talk about some of the other classic sessions you did. Led Zeppelin . . .*

I had known Jimmy Page briefly during the Olympic days when he came in to do the odd session as the heavyweight guitar player of the time. I recorded him doing a solo

on Donovan's "Hurdy Gurdy Man." I knew John Paul Jones, whose real name was John Baldwin. He was a session bass player who used to be in and out of Olympic all the time, and we became very good friends. Just before I left for the States in '68, he said, "I am putting this band together with Jimmy Page. Got this singer from the north and this bricklayer of a drummer. It's pretty heavy. It's called Led Zeppelin." He played me an acetate. It was amazing.

When I was in the midst of constructing Electric Lady—that was the year that I became an independent engineer—I mixed *Led Zeppelin II*. It was cut in various different studios. They were on the road, and they cut in Vancouver, in Texas, in England. And I had cut a whole bunch of stuff in New York at various studios, all kinds of weird, funky studios. These places were so funky and primitive. It was all eight-track stuff. Eventually we got all these tapes together, and the band came in to mix it with me and we had done overdubs, fixing up of this, editing that. Still, the entire album was mixed in two days in A&R Studios with a little 12-input Altec console with two pan pots. Now you go figure that!

*How did the Physical Graffiti sessions come about?*

Jimmy had a history of recording Zeppelin in weird places. They had heard that Mick Jagger had bought this house and wanted to rent it out. We hired The Stones' recording truck and pulled it up to the back of the house. Everybody stayed there—Mick's bedroom was off-limits. We had a great time. We cut eight tracks there. John Bonham was in the conservatory, beautiful-sounding room. He was very together during the sessions, very straight. But at night he would get blasted.

One lovely day we set up the mikes outside the house and recorded the acoustic guitar there, because I thought with no reverberation at all, it would have a nice presence. On "Black Country Woman" you can hear an airplane that flies overhead. We were doing a vocal overdub outside. You



a great  
sense of humor.

The American  
groups have  
the tendency  
to take  
themselves awfully seriously.

can hear the talk-back click, "Gonna get this airplane on. . . . And you can hear the response, "Nah, leave it, yeah!" That's the kind of accidental stuff I love.

*You became a producer. . . .*

In '71 or '72. It was after Electric Lady studios had been going for about a year, and I had started doing more of that kind of work. I did Carly Simon's first album and a whole bunch of stuff at Electric Lady. It was difficult, because I was running the studio at the same time and producing my own records. It was a natural thing because I was basically doing that anyway, and quite often the producer would sit there and ask me what I thought and what I wanted to hear. My opinion would be incorporated into the record. I had done the Voices of East Harlem for Elektra. Jac Holzman played me some of Carly's stuff, and we talked about it and hired various musicians that she wanted. It was an interesting album. It was tough in the end because she had something very specific that she wanted to hear, and I am not quite sure she heard it quite the way I did. In the end the album turned out great. "That's the Way I've Always Heard It Should Be" was the first single. To do a Carly Simon album was a good change for me.

*Let's talk about John Mayall's The Turning Point.*

I was in the basement of the Fillmore East with two eight-track machines supplied by the Fedco truck. That hall had the most fantastic acoustics, because the stage was pretty high and all wood and suspended. It was the only acoustic album he ever did. He lucked out with the various musicians that he picked. The audience was totally into what he was doing. I remember mixing it with him. He came in with the album cover completely designed and finished; he designed his own album covers. As we were mixing, we would time the cuts, and he would write on the jacket artwork with a pen what the final running order would be, and that would be it. They would send off the artwork. I had never seen an artist work like that.

Jimmy Page and Robert Plant:  
Led Zeppelin's landmark second LP  
was mixed in two days.

Kramer produced Carly Simon's  
debut.



©DAVID GAHR

*Perhaps your most memorable live recording was the Woodstock festival.*

It was five o'clock in the morning, and the sun was just coming up. I remember we could not drive any closer, because it was just too jammed and we had to walk about a mile from where we parked the car. I was working at the Record Plant. Jimi was going to perform. He was the big star of the thing. Because I was Jimi's engineer, the film people hired me to record the whole thing. I had no idea what I was getting into. In those days you just did what you did. It was, "This is going to be cool, fine." When I saw all the cars, I said, "This will be pretty hairy." We were in a trailer with an eight-track machine out of its box and sitting on an orange crate, and another eight-track machine was precariously slung together. Seven tracks were available for recording; the eighth track was 60-Hz pulse sync. We had a tiny handmade mixer with about eight channels and a stack of Shure mixers on top of that. It was a nightmare. Between each set, I would have to switch tracks and change things around, and the communication between the control room—where I was—and the stage was minimal at best. It

was chaos! It was a miracle that stuff was recorded. I stayed up for three days and nights with vitamin B-12 shots. Slept on the floor for a few hours. It was definitely exciting. The thing that was a disappointment for me was the Hendrix performance, which I thought was awful, except for the odd song.

*You talked about how the fun has gone out of making records. . . .*

The English rock 'n' roll bands of the '60s and '70s, and even part of the '80s, always had a tendency not to take themselves seriously, and they had a great sense of humor. It was all a big joke. The American groups have the tendency to take themselves awfully seriously: "If I can't get this 64th note, the world is going to come to an end!" I think that is so much horseshit! And that takes a lot of the fun out of it. In the old days the prevailing attitude was that we are here to make music and to have a blast. We were experimenting all the time, breaking new ground every day. Maybe those records stand up so well today because of that, and because of the fact we had to fight very hard to make them sound good.

*Maybe the music was just better?*

Well, people have said that. There is nothing new under the sun.

*Is it harder for you to work with groups that are so obviously derivative of classic rock bands?*

It is harder in one sense because I have already done it. Some kid will say, "Give me that John Bonham drum sound." "If you were John Bonham, you would get that John Bonham drum sound, wouldn't you?" He was unique. How can you recreate that? Even his son can't! Jason is a very good drummer in his own right, but he is not his dad. Maybe he shouldn't try to be his dad!

Now, some 20 odd years later, where are the Hendrixes? Where are the Zeppelins? And where are the Santanas of today? But I still love making records. I still get excited making records even if I know that the band is a problem. A

# The Uneasy Truce Between Music & The Room

No matter how pure and clean the sound leaving the loudspeaker, the sound falling on the listener's ears can be quite different. Sound is borne from the loudspeaker to the listener by the acoustics of the room. An understanding of the sound field of a room can be of great practical help in optimizing the listening environment.

In this article, I will discuss acoustic coloration of low-frequency sound up to an arbitrary 300 Hz; a future installment will look at the band above 300 Hz. There is a very logical reason for this division. In terms of the wavelength of sound, our listening rooms are acoustically "small" for low frequencies and acoustically "large" for higher audio frequencies. This requires emphasis on *sound waves* for the low frequencies and *sound rays* for the high ones.

Out in free space, sound travels on and on—unimpeded, unreflected, unrefracted, undiffracted, and unabsorbed. The addition of walls, floor, and ceiling introduces a whole new set of rules for sound in an enclosed space.

In Fig. 1 a sound source is located between two plane, parallel reflecting surfaces. The sound reflected from one surface travels toward the other surface and is then

reflected back. Two waves travelling in opposite directions are superimposed, and, at a certain characteristic frequency, a "standing wave" is set up. This is essentially a condition of resonance that prevails when the excitation frequency of the source is equal to the speed of sound divided by twice the distance between the surfaces:

$$\text{Frequency of resonance} = \frac{1,130 \text{ feet per second}}{(2) (\text{Distance between surfaces})} \quad (1)$$

For example, with a spacing of 15 feet, the frequency of resonance is 1,130 divided by 30, or 37.7 Hz. The (2) is in the denominator of Equation 1 because a round trip is needed to sustain the standing wave.

Let us examine the resonances to be found in the rectangular room in Fig. 2, which has a length of 23.3 feet, a width of 16.0 feet, and a ceiling height of 10.0 feet. The reasons for these particular dimensions will be revealed later.

Taking first the longest dimension, the length of 23.3 feet, and applying Equation 1, we find a frequency of resonance of 1,130 divided by 46.6, or 24.2 Hz (rounded off to the nearest 0.1 Hz). This frequency, associated with the greatest dimension of the room, is the lowest frequency to receive resonance support. For frequencies lower than this, sound will be just like it is





*Paper Sculpture: Ian Colliety*

*Photograph: Bill Milne*

outdoors with no reflecting surfaces. A graphical representation of the 24.2-Hz lengthwise resonance is shown in Fig. 3A. This is the first brick in the acoustic structure of this room, and we are impressed by all the blank space out to 300 Hz.

Now comes an interesting fact: The 23.3-foot distance between the two reflecting surfaces (the ends of the room) is just as resonant at 2, 3, 4, 5... times 24.2 Hz as it is at 24.2 Hz. This makes sense, as multiple round trips of the sound between the two surfaces result in the same travelling wave

interaction as a single round trip. These two end surfaces result in resonance frequencies of 24.2, 48.5, 72.7, 97.0... Hz, as shown in Fig. 3B. Ah! The acoustics of this space are beginning to fill out! Any sound in the room will be boosted at these particular frequencies—but there are sizable spaces yet to be filled in.

The width of the room is 16.0 feet, so the fundamental resonance of these two side walls (from Equation 1 and rounded off) is 35.3 Hz. This is plotted in Fig. 4A. Integral multiples of 35.3 Hz give harmonic reso-

nances at 70.6, 105.9, 141.3, 176.6... Hz and are plotted in Fig. 4B.

The distance from floor to ceiling, 10.0 feet, resonates at 56.5 Hz (Fig. 5A), with multiples (harmonics) at 113.0, 169.5, 226.0, 282.5... Hz (Fig. 5B). All of the resonances considered to this point are called axial modes, because the wavefronts travel perpendicularly to the three axes of the room. Other names for these resonances encountered in the literature are normal modes, eigentones, characteristic frequencies, and natural frequencies.

# The ideal room would not many of them,

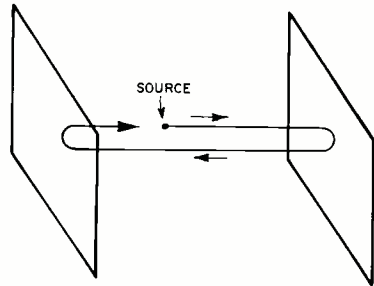


Fig. 1—Standing wave resonance can be established between a single pair of plane, parallel reflecting surfaces.

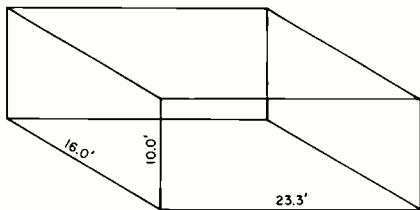


Fig. 2—An enclosure such as a listening room is acoustically resonant at many frequencies determined by its dimensions.

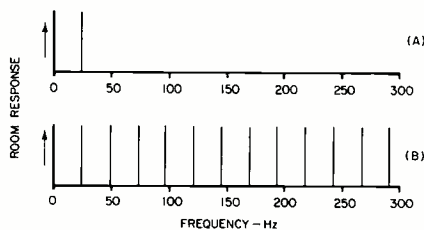


Fig. 3—The space between the two ends of the room of Fig. 2 is resonant at 24.2 Hz (A) as well as at integral multiples of 24.2 Hz (B).

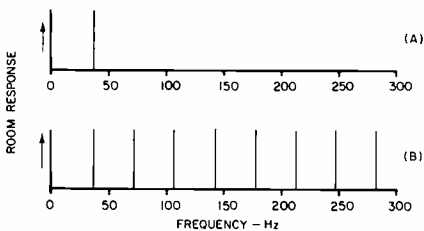


Fig. 4—The space between the two side walls of Fig. 2 is resonant at 35.3 Hz (A) as well as at integral multiples of 35.3 Hz (B).

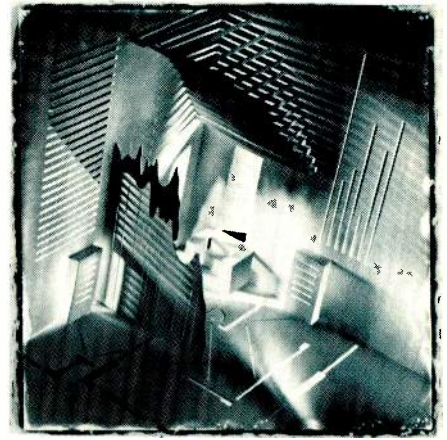
The three sets of resonances for the rectangular room all function simultaneously; they have been considered singly for clarity. All three sets of resonances are combined in Fig. 6 and listed in Table I as our picture of the acoustics of the room continues to grow. The combination of all the resonance peaks of all the axial modes begins to fill up this “frequency space” from 0 to 300 Hz.

### Tangential and Oblique Modes

We still do not have the full picture of the low-frequency acoustics of this enclosed space. There are other resonance modes than the axial that tend to fill in between the resonances of Fig. 6. Figure 7A illustrates the paths of sound constituting the axial modes. These are the easiest to visualize, but there are also tangential modes (Fig. 7B) and oblique modes (Fig. 7C) as well. The air in an enclosed space can resonate in these three different ways with equal facility, and do so simultaneously. The axial modes involve only two surfaces; the tangential and oblique modes involve four and six surfaces, respectively.

It is harder to visualize tangential and oblique resonances being set up with all those multiple reflections on a single round trip around the room. For our purposes, I suggest that you just take them as a matter of faith. For inquisitive readers not satisfied with this, a perusal of the appropriate solution of the wave equation in any standard acoustics text will be convincing.

These modal resonances are the acoustics of the room in the low-frequency region. The response curve of the space is made up by superimposing the individual modal resonance curves. The separation of the individual modes determines the smoothness of the room response. Excessive gaps between them lead to dips in the room’s low-frequency response. A number of these resonances clumping near a certain frequency could result in a peak in the low-frequency response of the room at that frequency. All such superimposing is vectori-



al, involving both amplitude and phase angle rather than simple summation. In our desire to achieve a relatively uniform room response, we must pay attention to the spacing of modes to avoid “coincidences” (resonances appearing at the same frequency) and excessive gaps.

### Designing for Mode Distribution

The dimensions of 23.3 × 16.0 × 10.0 feet were carefully selected for the above example to distribute these resonances as uniformly as possible. If the room were cubical, the three sets of axial frequencies

Table I—Axial modes for room of 23.3 × 16.0 × 10.0 feet.

| LENGTH | Axial Modes, Hz |        |
|--------|-----------------|--------|
|        | WIDTH           | HEIGHT |
| 24.2   | 35.3            | 56.5   |
| 48.5   | 70.6            | 113.0  |
| 72.7   | 105.9           | 169.5  |
| 97.0   | 141.3           | 226.0  |
| 121.2  | 176.6           | 282.5  |
| 145.5  | 211.9           | 339.0  |
| 169.7  | 247.2           |        |
| 194.0  | 282.5           |        |
| 218.2  | 317.8           |        |
| 242.5  |                 |        |
| 266.7  |                 |        |
| 291.0  |                 |        |
| 315.2  |                 |        |

would coincide and result in exaggerated spacings. Rectangular rooms of other proportions can also have their problems. For example, a room that is 10 × 15 × 30 feet would have many coincidences because of the 2-to-1, 3-to-1, and other ratios that lead to many pileups and large gaps. Utilizing optimum dimensional ratios in new construction is a major step toward satisfactory low-frequency response of a room.



# *lack resonances but would have not spaced too close or too far apart.*

For existing rooms, you have to live with what is provided and treat the resulting problems.

The inevitable presence of tangential and oblique resonances in the room is somewhat beneficial, but their effect is limited. They do add resonances between the adjacent axial resonances for a minor effect.

**Table II**—Axial, tangential, and oblique modes for room of 23.3 × 16.0 × 10.0 feet, for the range from 50 to 100 Hz.

| Modes, Hz |            |         |
|-----------|------------|---------|
| AXIAL     | TANGENTIAL | OBLIQUE |
| 56.43     |            |         |
|           | 59.86      |         |
|           | 61.39      |         |
|           | 66.55      |         |
| 70.54     |            | 70.80   |
| 72.55     |            |         |
|           | 74.32      |         |
|           | 74.57      |         |
|           | 80.67      |         |
|           |            | 82.27   |
|           | 85.53      |         |
|           | 90.33      |         |
|           | 91.92      |         |
| 96.74     |            | 93.51   |
|           |            | 98.45   |
|           | 101.19     |         |

## Modal Bandwidth and Energies

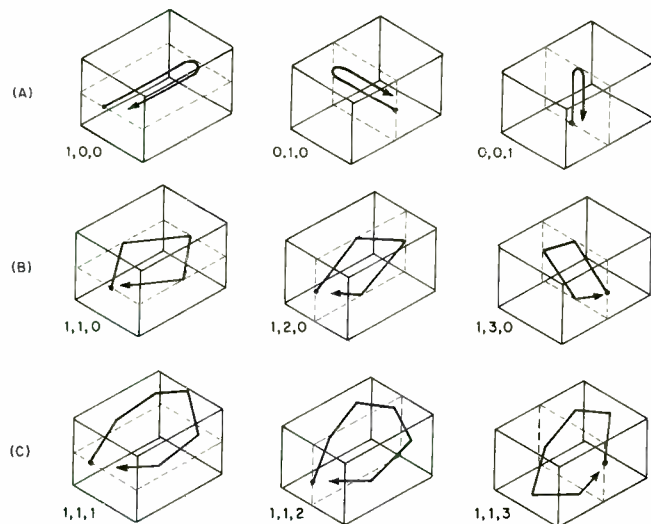
In Figs. 3 to 6, modal resonances are represented by narrow lines. Actually, each resonance has a finite bandwidth determined by the amount of absorption in a room. For the average listening room, this bandwidth is about 5 Hz (Fig. 8). A resonance curve of this bandwidth is presented in Fig. 9 for each of the axial modes in the region from 50 to 100 Hz.

In their classic 1944 paper "Sound Waves in Rooms" [1], Morse and Bolt point out that axial, tangential, and oblique modes are not created equal: For a given pressure amplitude, an axial wave has two times the energy of a tangential wave and four times the energy of an oblique wave. In other words, the energy levels of tangential modes and oblique modes are 3 dB and

6 dB less than that of the axial modes, respectively. Energy level in Fig. 10 is indicated by the height of each line.

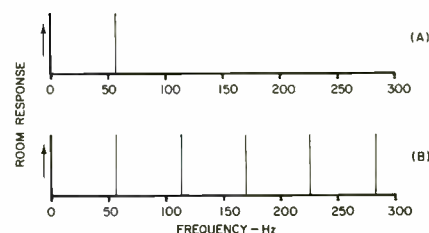
What would be lost in our evaluation of our listening room by considering only the axial modes? In the stretch between 50 and 100 Hz in Fig. 10 (also see Table II), only four axials raise their pointy heads, while interspersed are 10 tangentials and four obliques. (Note that the computer calculation forming the basis of Fig. 10 and Table II was carried out only as far as mode 4,4,4.) The more potent axial modes dominate in shaping the acoustics of the listening room. Gilford [2] states: "... the axial modes are therefore the only ones likely to become individually significant. An exception to this rule is that a few tangential or oblique modes of low frequency may possibly be audible owing to their high initial intensities or wide spacings."

**Fig. 7**—Axial modes involve reflections from two surfaces of the room (A), tangential modes from four surfaces (B), and oblique modes from six surfaces (C). The energy levels of tangential modes and oblique modes are 3 dB and 6 dB below that of the axial modes, respectively. This means that axial modes dominate the acoustics of a room.

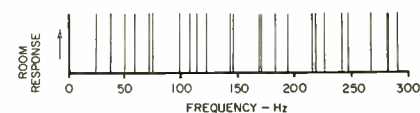


## Sound Transmission Measurements

To the average audio person, the most familiar sources of signal coloration are irregularities in the frequency response of amplifier, loudspeaker, etc. This approach fails miserably in room acoustics. Figure 11 shows a typical acoustic response of a well-designed studio. As the frequency of the sinusoidal signal is slowly varied, the rela-



**Fig. 5**—The space between the floor and the ceiling of Fig. 2 is resonant at 56.5 Hz (A) as well as at integral multiples of 56.5 Hz (B).



**Fig. 6**—The length, width, and height resonances of Figs. 3, 4, and 5 combined. These are the axial modes of the room of Fig. 2.

tive sound pressure level picked up in another part of the room shows wide fluctuations. Similar wild fluctuations will be seen if the frequency is held constant and the distance between the microphone and the loudspeaker is slowly varied. Extensive study of this effect has led to the conclusion that such frequency irregularity in room response has no significance in describing

# Even in well-designed rooms, vary wildly

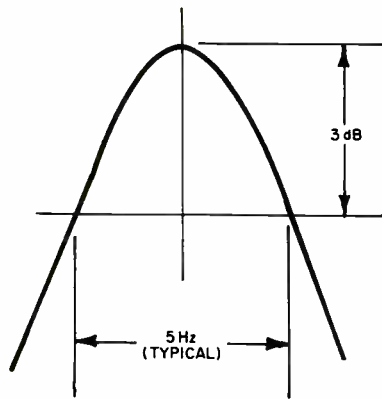
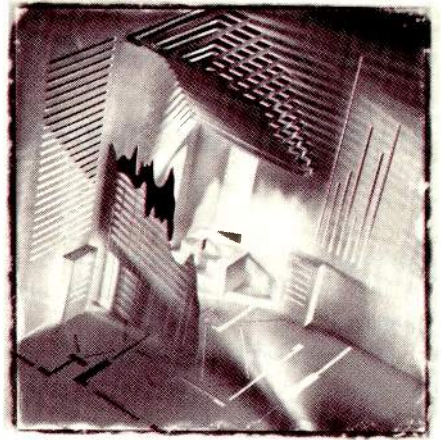


Fig. 8—Each resonant mode is effective over a narrow band of frequencies. This bandwidth is determined by the amount of absorption in the room and is about 5-Hz wide for typical audio rooms.

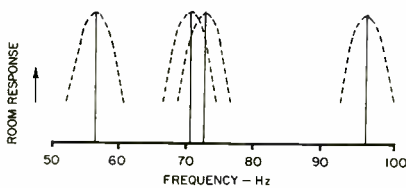


Fig. 9—In the example room of Fig. 2, the frequency range from 50 to 100 Hz contains four axial modes. Their 5-Hz bandwidths leave sound energy at many frequencies unsupported by room resonance. Tangential and oblique modes tend somewhat to fill in such spaces.

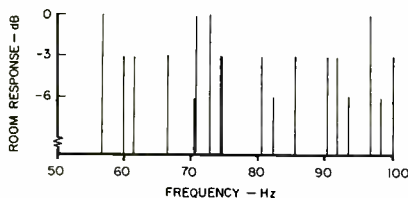


Fig. 10—Axial, tangential, and oblique modes of the example room for the range of 50 to 100 Hz are plotted at their respective energy levels.

the acoustical quality of a room. This is a steady-state measurement, and speech and music signals are transient in nature. In addition, our hearing mechanism is unable to perceive the changes such rough steady-state response variations impose on the signal. Then why worry about mode spacings and coincidences? Because they still constitute the acoustics of the space and are active on a transient basis.

## Low-Frequency Sound Colorations

What is there about room resonances that results in coloration of speech and musical sounds?

Colorations of sound have been directly traced to adjacent modes that are either too far apart or too close together. Gilford describes BBC experience in the design and measurement of 120 talk/news studios and 160 monitoring/listening rooms whose volumes range from 1,000 to 4,200 cubic feet (the volume of our example is 3,728 cubic feet). He confirms that coincidences are the source of problems and concludes that spacings greater than 20 Hz should be avoided.

The constantly changing low-frequency energy of the musical sound radiated into the listening room sets the room resonances to vibrating. A given resonance may be highly or lightly excited, depending on the signal energy at that particular frequency at that particular moment. The excitation level of a given resonance is constantly changing, with a small but finite time required for the build-up and the decay.

A strong signal component may force one or more closely adjacent modes into vibrating at the excitation frequency. However, as soon as the exciting force is removed, the adjacent modes decay at their natural frequencies, beating together during the decay. This beat may be audible.

During the decay period, new frequencies are radiated into the room that were not present in the exciting signal. For example, assume that an axial mode of 50 Hz is adjacent to another axial mode of 53 Hz. A strong 50-Hz signal component excites

the 50-Hz mode and also forces the 53-Hz mode to vibrate at 50 Hz. When the exciting component of the signal is removed, both modes decay at their natural frequencies of 50 and 53 Hz, both returning energy to the room. There is a momentary coloration of the signal during this transient decay, as 53-Hz energy (not in the original exciting signal) is radiated into the room. This amounts to a brief change of pitch.

The four axial modes of the region from 50 to 100 Hz are shown in Fig. 9 with their respective bandwidths. The tangential and oblique modes are neglected for the moment because of their secondary importance. Only a rough room response can be derived from the 5-Hz-wide resonance curves of these four axial modes. There is a 24-Hz gap between the 72- and 96-Hz modes that will certainly result in a significant dip in the response. The six tangential and two oblique modes in this gap may help the situation somewhat but will surely not eliminate the effects of the gap. The 14-Hz gap between the 56- and 70-Hz axials probably will result in a shallower room response dip than the one between 72 and 96 Hz. The two axial modes near 70 Hz could result in a peak and beat together at 2 Hz as they decay.

Several possibilities for audible colorations come from the action of the room resonances, among them transient pitch shifts, beats, and irregularities of room response resulting from coincident modes, clumping of modes, and/or spacings of axial modes greater than 20 Hz.

## Audibility of Low-Frequency Modal Effects

Ears are required to answer the vital question of how audible low-frequency modal effects really are. These ears may be



# frequency characteristics with position and source distance.

those of test subjects in a formal psychoacoustic test; better yet would be critical and informed listening by the person who uses the space. The complexity of the problem is due both to the spectral complexity of the music and to the modal complexity of the space's acoustics. Transients are the name of the game!

Coloration of sound depends on: The bandwidth of modes, the degree of excitation of modes, the separation of modes from strongly excited neighbors, the frequency content of the source, and the position of loudspeakers and listener.

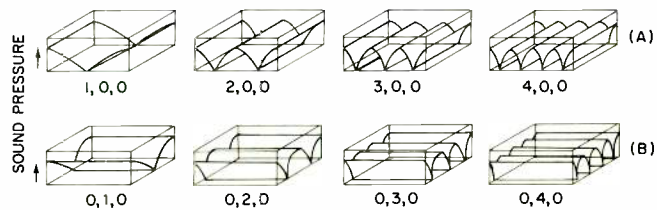
## Modal Pressure Distribution

The first requirement is to understand that the low-frequency transient sound field of the listening room is made up of a bewildering array of room resonances responding to the excitation influences of the signal. We must appreciate the steady-state sound pressure variations in the room resulting from these resonances. Let's concentrate first on the axial modes. Figure 12A illustrates the pressure distribution between the ends of our example room (1,0,0), and Fig. 12B shows the pressure distribution between the two side walls (0,1,0). (We neglect for the moment the vertical mode 0,0,1.) The axial mode sound pressure is always maximum at the reflecting wall surfaces, giving rise to the standing waves. In the case of the 1,0,0 mode, the pressure null (nominally zero) lies midway between the two end walls. This is not a line of zero pressure on the floor; rather, the pressure is at its minimum from floor to ceiling at this midplane. Figure 12 also shows the pressure patterns for multiples of the 1,0,0 and 0,1,0 modes out to the fourth harmonic.

The lines of nulls are more sharply defined than the regions of pressure maxima. For this reason, only the nulls are plotted on the floor plan of our room (Fig. 13). Only the length and width modes are included for simplicity, although the room is obviously three-dimensional, and the height mode is very much a part of the

room acoustics. Lines of pressure maxima would make a similar pattern. Figure 13 begins to reveal the great number of sound pressure minima distributed throughout the room, (assuming all modes are fully excited). The individual modes, of course, continuously rise and fall in response to the spectral distribution of energy in the speech or music signal. How beautiful would be the shifting pattern of room sound pressure in response to music if we

Fig. 12—Representation of sound pressure patterns for the long-axis modes of the example room (A) and for the side-to-side axis modes (B).



had magic glasses that would make sound pressure changes visible in color!

Even though they play a minor role in our listening room, tangential and oblique modes have some effect on the room's sound pressure pattern. Figures 14 and 15 show how tangential and oblique modal energy appears in corners.

## Identifying and Correcting Colorations

- The first step is to evaluate the acoustical quality of your listening room by an intensive series of listening tests. Select several CDs of music rich in low-frequency energy. Start with your present loudspeaker arrangement. Listen throughout the entire room, not just in your customary position, listening intently and critically for regions of loudness consistently above or below the normal level. This is a rough test for uniformity of room response.

- Listen for distortions, including those repeatedly appearing at a fixed frequency coincident with pulses of signal energy. Such distortions may be easier to detect with speech than with music. These distortions could be the result of serious coincidences of room modes.

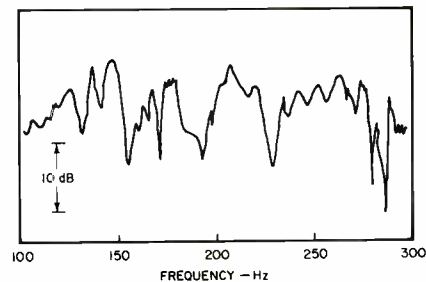


Fig. 11—Typical "frequency response" of a room up to 300 Hz; see text.

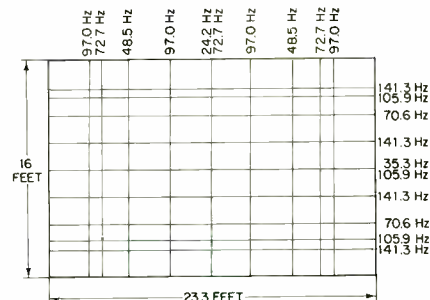


Fig. 13—Floor plan of room 23.3 × 16.0 × 10.0 feet, showing lines of null pressure corresponding to the steady-state excitation frequencies shown.

- Perhaps the most difficult listening test will be that for detecting momentary frequency shifts during the brief time sounds die away. The shifts could be either up or down in frequency as modes forced into excitation begin to decay at their normal frequency when the excitation force is removed.

- Measure the length, width, and height of your room and calculate the corresponding series of axial resonance frequencies. Tabulate them as in Table I, evaluating

# Where you place your speakers helps determine just which room resonances will be excited.

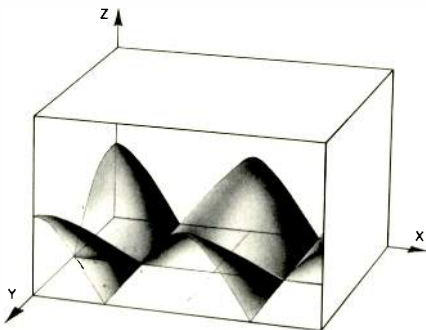


Fig. 14—Pressure plot of the tangential 2,1,0 mode, showing the concentration of pressure in the corners, unlike that of the axial modes. (Courtesy of Brüel & Kjaer.)

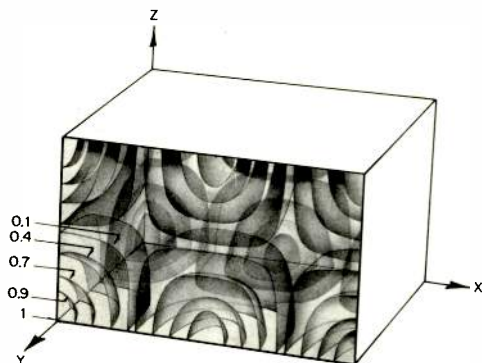


Fig. 15—Pressure plot of the oblique 2,1,1 mode. Note the scale, which indicates the highest pressure at the intersection of the three planes, decreasing farther from the corner. (Courtesy of Brüel & Kjaer.)

coincidences and spacings and remembering the 5-Hz bandwidth. Once you've estimated the frequency at which a distortion is heard, you may be able to relate it to a specific mode. That specific mode may be treated with an absorber effective at that frequency and positioned at a high-pressure region for that mode (see next step). For the average listener and the average listening room, it may make more sense to "overkill" by positioning wideband absorbers where they will be most effective for all

modes—that is, in the corners—so that the flaw disappears.

- If the goal is to reduce the effect of a particular axial mode, the only useful location for an absorber for that frequency is where the sound pressure of that particular mode is high. For example, assume that a coloration in our room of  $23.3 \times 16.0 \times 10.0$  feet is traced to about 50 Hz. A glance at Table I shows a second harmonic of the length mode, at 48.5 Hz, which is suspect and should be reduced. The 2,0,0 mode of Fig. 12 shows high pressure at the end walls and in the middle of the room; here is where an effective absorber could be located. An important fact to remember is that *all modes terminate in corners*—that is, all modes have high pressure in corners. Figures 12, 14, and 15 support this statement. If the desire is to reduce the magnitude of all modes, placing absorbers in the corners is effective.

- Porous absorbers such as glass fiber are relatively ineffective below 300 Hz unless extreme thicknesses are used. A 6-inch thickness of normal 3 pound/cubic foot glass fiber is required for 100% absorption at 125 Hz, but it is insufficient an octave lower. Absorption with glass fiber can be improved with an air space, but valuable space is required.

Reactive absorbers, such as Helmholtz resonators, can be tuned for good absorption at the low frequencies. The construction of such absorbers with perforated or slat facings is not difficult. Complete design data may be found in [3].

Proprietary absorbers effective at low frequencies are also available, such as Korner Killers from RPG Diffusor Systems, RoomTunes, Tube Traps from Acoustic Sciences Corp., and others. These suppliers also provide information on the use of their products.

The walls, floors, and ceilings of frame-construction homes are good low-frequen-

cy absorbers. They act like diaphragms that vibrate freely at low frequencies, absorbing sound by flexure and friction. It is therefore important to establish a true need for more low-frequency absorption before adding it. Music listening conditions suffer if the space is too dead.

## Colorations and Speaker Placement

Loudspeakers are relatively nondirectional at low frequencies. This means that nearby reflecting surfaces radically affect their low-frequency output, which can be lifted 6 to 12 dB or more in typical rooms. This bass rise can be readily equalized, but first its existence must be recognized. It must not be confused with the room resonances previously discussed.

The location of the loudspeaker also determines which modes are excited and which ones are not. If a specific coloration has been detected, experimentation with changes in loudspeaker and/or listening position is a logical corrective action.

In a future issue, we'll move on from how wave effects in rooms affect low frequencies to how rooms affect high frequencies, which act as rays. A

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2. Gilford, C.L.S., "The Acoustic Design of Talks Studios and Listening Rooms," *Proceedings of the I.E.E.* (1959, Vol. 106-B, pp. 245-258); reprinted in the *Journal of the Audio Engineering Society* (1979, Vol. 27, No. 1/2, pp. 17-31).
3. Everest, F. Alton, *The Master Handbook of Acoustics, Second Edition*, Tab Books (Blue Ridge Summit, Pa., 1989), especially Chapter 10.



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# SONY MZ-1 PORTABLE MINIDISC RECORDER



Photograph: ©Carl Zapp

I was fortunate to receive the first production MiniDisc portable recorder sent to any U.S. reviewer, although I was only able to have it in my lab for one day—others were clamoring to get their hands on it! Yet that one day was enough to convince me that the MiniDisc is the portable music carrier of the future—and the future is *now!*

The MZ-1 has so many features that I hardly know where to begin. When recording discs, you can encode 16-character titles, as well as the date and time of recording, for display during playback. The tracks

on user-recorded discs can be numbered manually or automatically and can be erased. For shock-resistant playback, data from the disc is read into a buffer memory, or storage chip, that feeds the data out again even when the laser has been temporarily jarred off its track. The one-megabyte, 3-S buffer originally announced for the system has now been replaced by a four-megabyte buffer that stores 10 S of digital data. (See "The Mechanics of Sony's MiniDisc" in the December 1992 issue.)

Many of the features common in today's Compact Disc players are in this MiniDisc

recorder, including fast random access, multiple playback modes (shuffle play, repeat, etc.), 10-key direct access to individual tracks, and programming of up to 21 specific tracks to be played in any desired order. The MZ-1 also has switchable dynamic bass boost, which is common in CD portables. There are, of course, both digital and analog outputs—but unlike a CD player, this recorder has analog and digital inputs as well.

## SPECS

**Frequency Response:** 20 Hz to 20 kHz,  $\pm 1.0$  dB.

**Record/Playback S/N:** 80 dB using analog input, 88 dB using digital input.

**Record/Playback THD:** 0.08% using digital input.

**Channel Separation:** 90 dB at 1 kHz for recordings made via digital input.

**Analog Input Level:** Line, 245 mV; mike, 1.38 mV.

**Analog Line Output Level:** 1 V rms for 0-dB reference level.

**Channel Imbalance:** Analog input, 1 dB.

**Wow and Flutter:** Below measurement level.

**Power Consumption:** 4 watts.

**Dimensions:** 4½ in. W × 1¼ in. H × 5½ in. D (11.4 cm × 4.3 cm × 14 cm).

**Weight:** 1½ lbs. (0.69 kg) including rechargeable battery.

**Price:** \$749.95.

**Company Address:** Sony Dr., Park Ridge, N.J. 07656.

For literature, circle No. 90



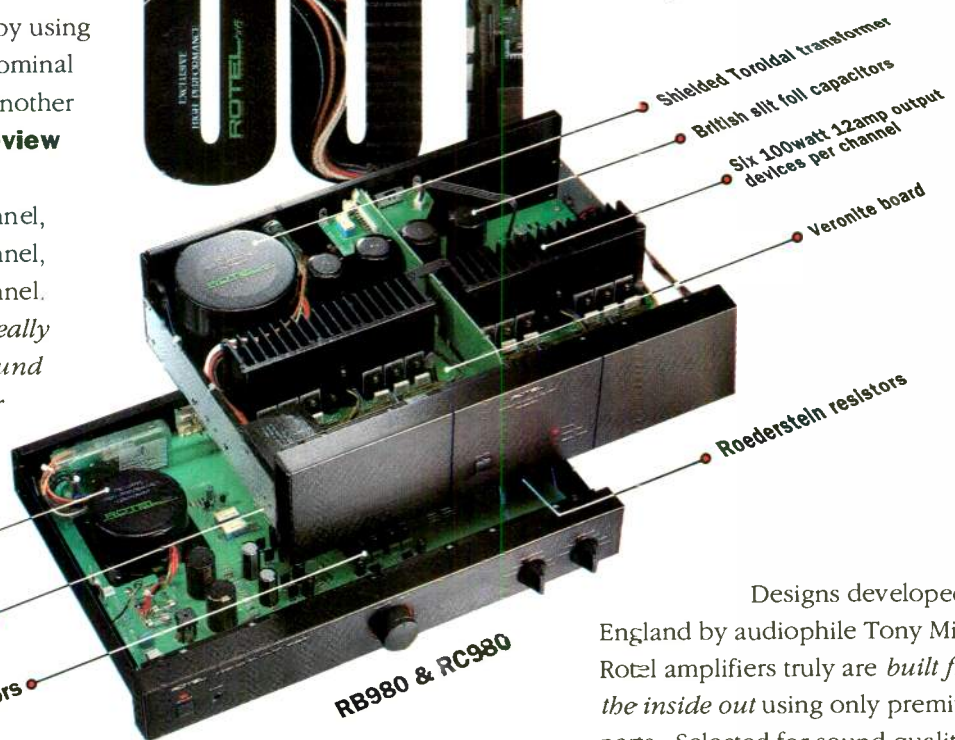


For most, the benefits of a pre/power amplifier set-up is rarely considered as many combinations cost thousands of dollars—most are discouraged well before a demonstration. Rotel, winners of **What Hi-fi?** "Best product of the year 1991 and Best System" has an affordable solution. Rotel introduces the 360watt 8ohms (Bridged Mono) amplifier that can be bought in stages.

Aclaimed by **Audiophile** (11/91), the RB980 can form the heart of your audio system, it can grow as your system grows. Begin by using one RB980 with 120watts nominal per channel and then add another when you need. **Audio Review** (2/92) measured the RB980; 137watts @ 8ohms per channel, 267watts @ 4ohms per channel, 388watts @ 2ohms per channel. **Audio Review** noted, "a really great performance. The sound quality is extraordinary for products in this price range."

# BUILT FROM THE INSIDE OUT

**Rotel CD** players. They have received worldwide acclaim. **Hi-fi Choice** (11/91) Rotel CD player RCD965 'Best Buy' "produces the sort of sound that many highend products wouldn't have a hope of achieving." **Hi-fi World** (11/91) RCD965 "effortless sound quality..." **CD & Hi-fi Buyer** (12/91) again reviewing the RCD965 "bass is tight, deep and where appropriate, thunderous, always well under control. High frequencies are sweet and clear..."



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Shielded Toroidal transformer  
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Six 100watt 12amp output devices per channel

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RTC950  
RCD965  
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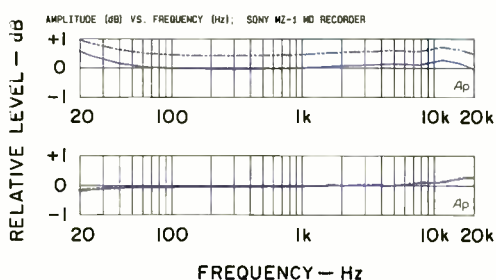
Designs developed in England by audiophile Tony Mills; Rotel amplifiers truly are *built from the inside out* using only premium parts. Selected for sound quality, resistors and capacitors come from Germany and the UK, while special semiconductors originate in USA. If you're on a budget then consider the Rotel RB960 power amplifier, its of dual mono design and capable of 60watts per channel in stereo. By bridging a pair of amplifiers you can feed your speakers with a stunning 180watts. **What Hi-fi?** (3/92) says, "a thoroughly commendable performance. Great sound quality for price."

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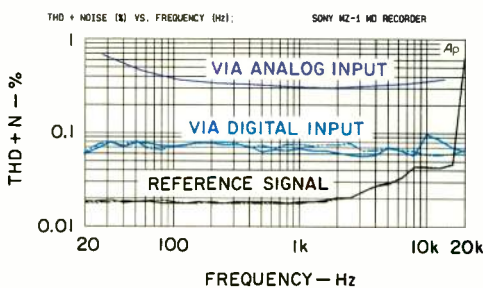
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The MZ-1's nickel-cadmium batteries can power it for about 1½ hours of recording or about 2 hours of playback. One feature I really appreciated became evident when I hooked the unit to the charger and a.c. supply provided with it. Since the battery I was trying to recharge was not completely discharged at the time, the MZ-1's display showed the word "Refreshing." I learned from the instruction manual that the MZ-1 was actually discharging the bat-



**Fig. 1—Frequency response for recordings made via analog input (A) and digital input (B).**



**Fig. 2—THD + N vs. frequency; see text.**

tery completely before beginning the recharge cycle, to ensure that the battery would be fully charged. (Otherwise, the so-called "memory" effect common in nickel-cadmium batteries would reduce the battery's life and charge capacity.) A separate lithium battery maintains the time and date for "date stamping" of user-recorded discs, and it lasts about six months. The MZ-1 can also be powered from an optional car battery cord, and the microphone input provides d.c. "phantom" power for some Sony electret condenser mikes.

#### Control Layout

Despite its small size, the MZ-1 sports a great many controls, logically arranged on

the top, side, and front surfaces. Discs are inserted in a slot on the front surface of the MZ-1; this turns the unit on. Adjacent to the slot is the eject button. On the top surface, beneath a backlit LCD, are 10 numbered buttons for instant track access. During disc or track labelling, they are used to enter letters and spaces as well as numbers; pushing a button sequentially selects from three characters (A, B, or C for button 1, etc.). While labelling can be a bit tedious, it works well, and I now have a recorded MiniDisc identified as "Lens First MD Disc" (there's no apostrophe available). An "Enter/Repeat" button, adjacent to the alphanumeric keys, is for programming selections or for bringing up the playback repeat mode. Controls along the right side of the top surface are the usual play, pause, and forward and reverse fast-search and track-select buttons. Also found here are buttons for "Stop/Charge," "Date," "Disc Name," and "Track Name."

Audio signal connections are on the left side of the MZ-1. These include a microphone input, and input and output jacks that each handle connections for both coaxial analog line and optical digital hookups. Sony offers adaptor cables for digital hookups (at \$34.95 each), with special plugs at the MZ-1 end and the now-standard Toslink connectors at the other. On the same side of the unit are the "Record Level" control and a mike-attenuator switch. If you prefer not to bother setting levels when making analog recordings, an automatic gain control ("AGC") just above the level pot will handle that for you. (When recording from a digital source, there is no need to control recording levels, of course.)

On the front panel, below the disc slot, are slide switches for "Rec Mode" and "Edit." The "Edit" switch, which works only in record/pause mode, is used when naming the track or disc and when you delete, combine, or divide tracks. Deleting a track does not actually erase its contents but modifies the User Table of Contents (UTOC) to show that the track should be ignored, and all subsequent track numbers

are decreased automatically. Subsequent track numbers will also be decreased if you combine two tracks into one, since they will now share the first track's number. If you divide one track into several, subsequent track numbers increase.

The space occupied by "deleted" tracks doesn't go to waste. Normally, every new track you record starts right after the last recorded track. But when the MiniDisc has been recorded to its end, the MZ-1 will go back and reuse the spaces left by track deletions. If you try to record a seven-minute song on a disc that is full except for two four-minute spaces left by previously deleted tracks, the MZ-1 will put the first four

**THE MZ-1 SHOWED ME  
THAT MINIDISC IS  
THE PORTABLE  
MUSIC CARRIER  
OF THE FUTURE.**

minutes of the song in one space and the last three minutes in the other. In playback, you'll hear all tracks in their numbered order—even if their locations on the disc are not sequential—and will hear no break in the middle of songs that are split between two or more locations. These tricks are possible only because this is a disc system, whose laser can make shortcuts from one place to another without having to wind past all the spots in between, and because of the memory buffer mentioned earlier.

A recordable MiniDisc's track numbering (and normal playback) order can be permanently changed by using the "TOC Edit" mode. For temporary reordering, however, it's simpler just to program the track order you want at playback.

The right side of the MZ-1 carries a mini headphone jack, its associated level control,





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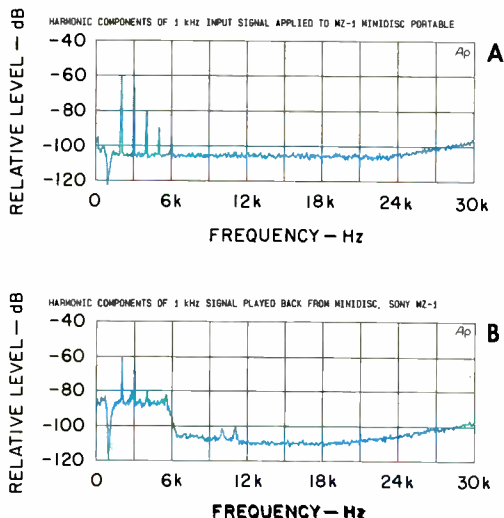
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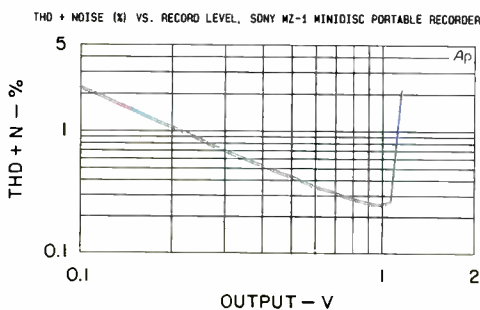
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a three-position switch for adding bass boost during playback, a "Play Mode" button, and switches for "Resume" and "Hold" plus the rechargeable-battery compartment. The "Play Mode" button sequentially selects normal, random, or programmed play. The other two take a bit more explanation.



**Fig. 3—Spectrum analysis of 1-kHz signal (A) and of signal recorded and played back (B); see text.**



**Fig. 4—THD + N vs. recording level.**



The "Resume" feature is rather unusual. In playback, if you set this switch before you press "Stop/Charge" or remove the disc, play will resume from the same spot as soon as you replace the disc and restart (some Sony Discman CD portables do this too). When recording, if you set the switch while still in record/pause mode and then press the control for play, the MZ-1 will play back the last track you recorded. You can therefore decide whether you want to keep or replace it and what you want to record next. Naturally, you could also stop and resume from the same point by pressing the pause button, but since the MZ-1 consumes nearly as much power in pause mode as in full operation, you'll get more from your batteries if you use "Resume" during long interruptions. The "Hold" switch locks all controls so they won't be accidentally activated when this portable is carried around.

The d.c. input is on the rear surface of the recorder. Underneath the unit is a small hole into which a ballpoint pen can be pushed to activate the date and clock-setting function.

The LCD display incorporates a bar-graph level meter for use when recording from analog inputs. The scale is very short, however, with the "-12" indication followed quickly by a bar indicating maximum level and then an "Over" indicator that shows when input levels exceed the maximum. Other items in the display include track number and the status of such functions as repeat play, table-of-contents edit, record, play, and pause. The display also has a low-battery warning. Track and disc titles, and the recording date and time, are shown when called up by the appropriate controls.

#### Measurements

The MZ-1 provides only its proprietary optical jacks for digital input and output. This kept me from transcribing test CDs to MiniDisc, as the CD players available to me that day had optical outputs that weren't compatible with the MZ-1's Toslink adap-

tor cable or had no optical outputs at all. As a result, my testing was confined to analog and digital signals derived from my Audio Precision equipment. While these certainly exercised the capabilities of the MZ-1, I had wanted to record some special signals available only from some of the test CDs to assess the action of the MiniDisc format's ATRAC bit-rate reduction scheme. A more complete exploration of these facilities will have to wait for another report at some future date.

Using an analog sweep-frequency signal from the Audio Precision test equipment, I

**LINEARITY WAS  
VIRTUALLY PERFECT  
DOWN TO AT LEAST  
-100 dB, WHICH FEW  
CD PLAYERS MATCH.**

plotted record/play frequency response via the MZ-1's analog inputs and outputs (Fig. 1A). Response is virtually flat from 20 Hz to 20 kHz, with less than +0.6 dB of deviation at 20 Hz and less than +0.2 dB of deviation at the treble end of the sweep. There is, however, a channel imbalance of approximately 0.5 dB; this could not be compensated for in playback, since the MZ-1 does not have a balance control. (Of course, if you use the MZ-1 with a stereo component system, that system would have a balance control.)

As expected, frequency response was even better when a digital sweep signal from the Audio Precision system was applied to the recorder via the optical digital input (Fig. 1B). Channel balance is perfect, and deviation from flat response is no more than +0.15 dB at 20 kHz and is negligible at the bass end.

Next, I plotted THD + N versus frequency for signals at maximum recording level. For reference, I first measured the signal passed directly from the digital input to the digital output (bottom curves in Fig. 2); this signal had not been subjected to the ATRAC data-reduction processing. Over the bass and most of the midrange, THD + N is just under 0.02%, increasing to 0.043% at 10 kHz and rising further above 16 kHz to 0.6% at 20 kHz. Since the second harmon-



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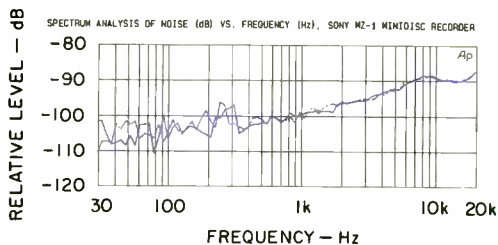
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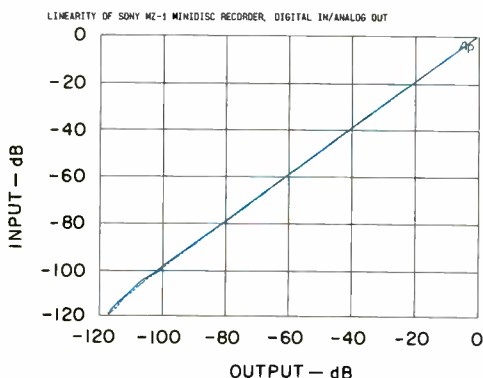


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**Fig. 5—Spectrum analysis of residual noise on “no-signal” recording.**



**Fig. 6—Linearity.**

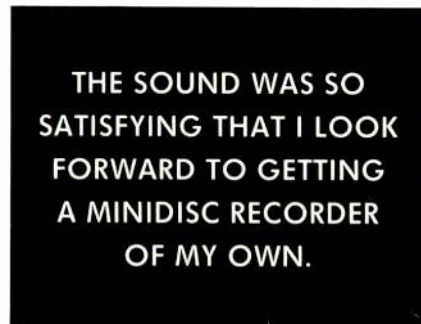
ics of signals above 16 kHz start at 32 kHz, these harmonics would be too high to hear. MiniDisc’s ATRAC processing (whose purpose is to save bits by omitting the inaudible) cuts them out, as seen in the top and middle curves. This processing does, how-

ever, add a small amount of distortion and/or noise over most of the spectrum. For a recording made via the digital input, the readings increase to between 0.07% and 0.08% at most frequencies—a numerically significant increase but certainly not an audibly objectionable one, as I found out during my subsequent listening tests. And

for signals recorded through the analog inputs, THD + N increases to just over 0.3% over much of the audio frequency range. This level is still quite acceptable, especially for a recorder intended primarily for portable use.

I wanted to analyze the nature of the THD + N to determine how much of the reading represented true harmonic distortion and how much was noise contributed by the ATRAC processing or other sources. Figure 3A shows a spectrum analysis of the 1-kHz analog signal I used for this test. Note that it has major harmonic components at -60 dB, -68 dB, -80 dB, and so on. All harmonics but the second have little bearing on the overall distortion percentage, which I calculated as around 0.1%. But when I recorded and played back the 1-kHz analog signal, the spectrum analysis (Fig. 3B) revealed two aspects of the ATRAC

system. First, the higher order harmonics seen in Fig. 3A have disappeared. They were of such low amplitude that they fell below the threshold of human hearing or would be masked by other signal components. So, in accordance with the ATRAC



Using the MZ-1’s analog input and output facilities, I measured an A-weighted signal-to-noise ratio of 81 dB when I played back a “no-signal” MiniDisc recording I had made. This is far better than I have obtained from any analog cassette deck, let alone a portable. When I repeated the measurement for a “no-signal” track recorded via the optical digital input of the MZ-1, A-weighted signal-to-noise ratio increased to an impressive 91.8 dB! A spectrum analysis of the residual noise as a function of frequency, using a third-octave bandpass filter, is shown in Fig. 5.

Finally, I applied a digital signal of gradually decreasing level to the optical digital input of the MZ-1, recorded it, and played it back to determine linearity of the system. Results are shown in Fig. 6. Linearity remains virtually perfect from maximum recording level down to at least -100 dB. Few CD players (all of which use linear PCM encoding, of course) can deliver this degree of linearity!

#### Use and Listening Tests

I wish I could have performed additional tests on this MiniDisc recorder, such as recording and playback of impulse waveforms, to further illustrate the action of the ATRAC coding and decoding. As I mentioned, the inability to hook up the digital outputs of any of my CD players to the digital input on the MZ-1 prevented my doing



**The initial group of MDs released by Rykodisc includes several strong pop/rock titles.**

algorithms, they did not need to be recorded. Second, note how the noise floor below 6 kHz has been elevated from around -105 dB in the original signal to about -85 dB. This is also a result of the ATRAC system, though any of the bit-rate reduction schemes now used for audio and video formats would do the same thing.

ever, add a small amount of distortion and/or noise over most of the spectrum. For a recording made via the digital input, the readings increase to between 0.07% and 0.08% at most frequencies—a numerically significant increase but certainly not an audibly objectionable one, as I found out during my subsequent listening tests. And

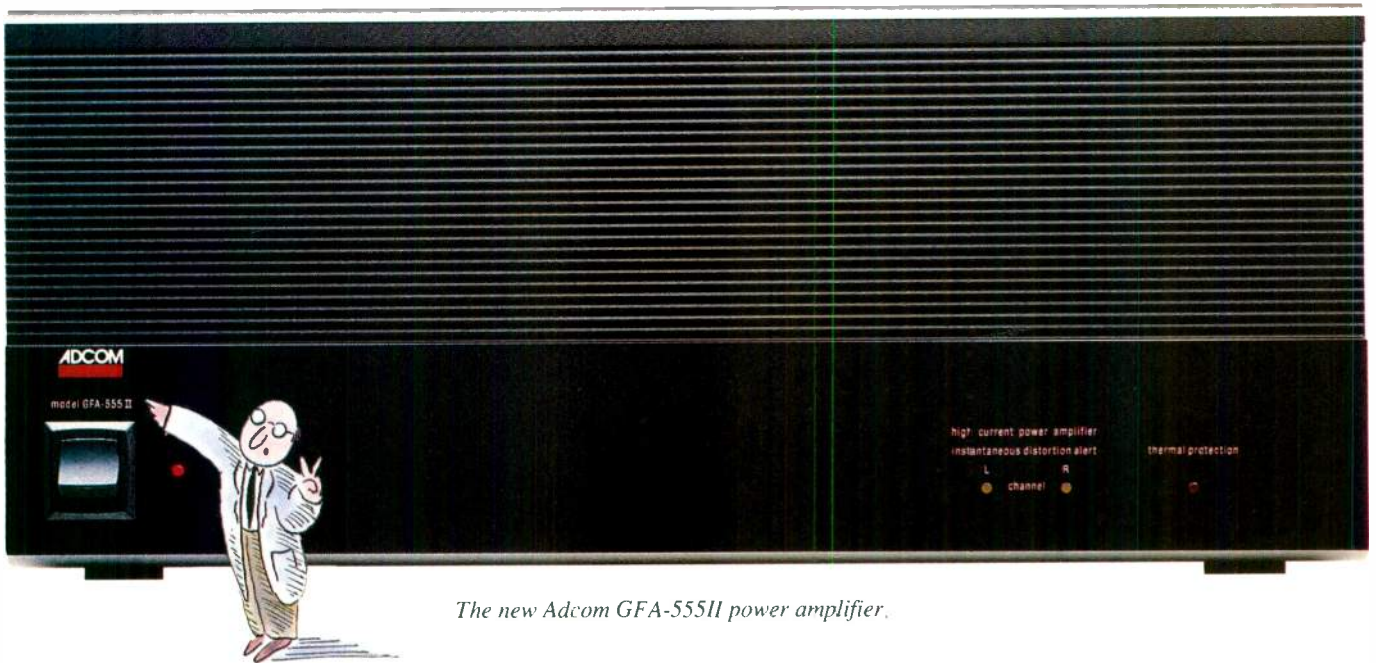


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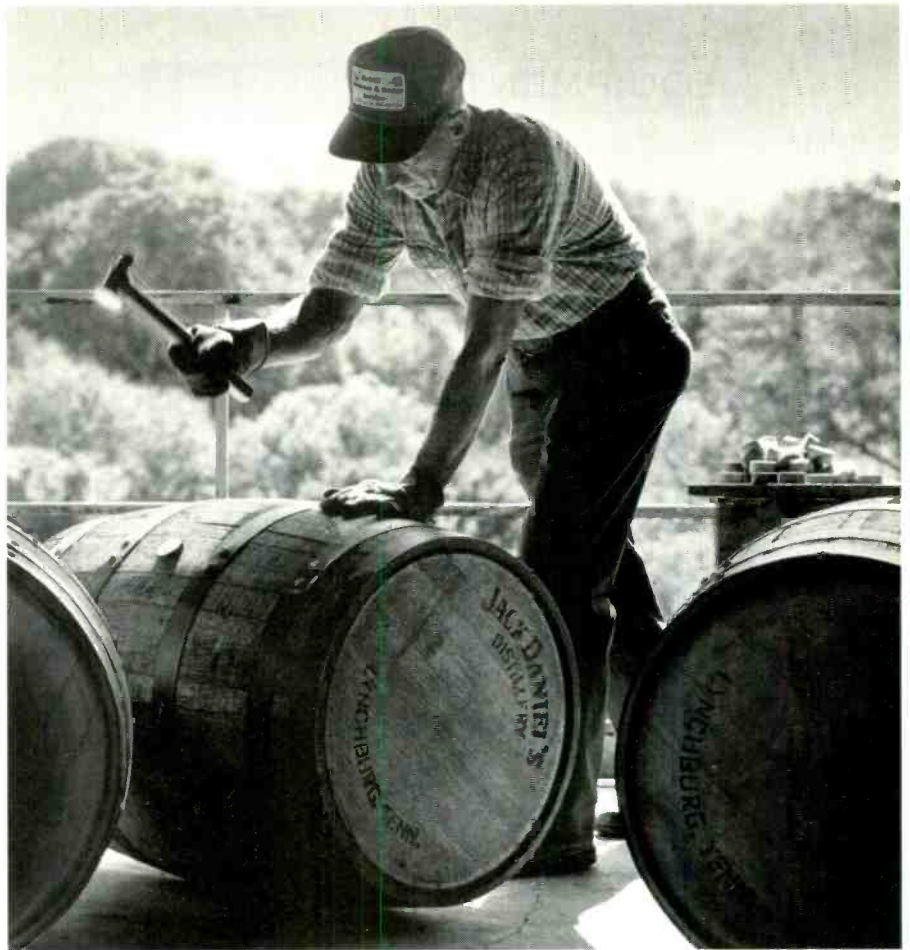
this. I therefore turned off the test equipment and began listening to some prerecorded MiniDiscs provided by Sony. I also spent a fair amount of the remaining time I had with the unit learning how to make recordings and how to utilize all of the available features. Many of the operations are almost intuitive, and you should find that the MZ-1 is fairly easy to work with.

In my listening tests, I was unable to make direct A/B (or A/B/X) comparisons with equivalent CD software. Yet this much I can say with a fair amount of certainty: Prerecorded MiniDiscs provide superb sound, without any of the artifacts I had feared might arise from ATRAC's extreme data reduction. One of the discs I listened to was a remastered version of Willie Nelson's *Stardust*, on Columbia. The country singer's unique vocal quality came through beautifully and was smoother than my recollection of the "original" CD. Based on my measurements, I attribute this added smoothness to expert remastering of the original recording rather than to any alteration caused by ATRAC. On another Columbia MiniDisc release, Natalie Cole's rendition of "Our Love Is Here To Stay" was also reproduced with excellent fidelity and no loss of stereo imaging (another artifact that I feared might result from extensive data reduction).

At test time, I did not have any prerecorded classical music on MiniDisc, so I used the analog input of the MZ-1 and recorded a few minutes of one of my favorite classical CDs. In this case, I was able to do an A/B test of the sound of the CD (Mozart's Clarinet Quintet in A Major, Denon DC-8098) with that of the recorded MiniDisc version. In this admittedly nonsynchronized comparison test, I honestly could not detect any differences in sound quality or musical texture.

Interestingly, Sony does not claim that the differences between CD and MD are undetectable, suggesting only that MiniDisc sound quality "approaches CD's dynamic range, frequency response, and low distortion." That conservative position notwithstanding, I found the sound of MiniDisc to be totally satisfying—so much so that I look forward to owning a MiniDisc recorder and amassing my own collection of MiniDisc software.

*Leonard Feldman*



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**T**he Convergence, a large floor-standing three-way tower, is next to the top of Legacy's lineup of loudspeaker systems and subwoofers. The Legacy line is made and distributed by Reel to Real Designs. Bill Dudleston, one of Reel to Real Designs' founders (in 1983), is the chief architect of the Legacy line and brings to the company a rich background in engineering, math, and chemistry. Reel to Real Designs is known for exotic and elaborate cabinet construction, and the Legacy line is available in many woods and finishes, from teak to ribbon mahogany (the systems I reviewed were supplied in this wood).

Dudleston's primary goals in designing the Convergence were uniform lateral coverage, wide bandwidth, high efficiency (sensitivity), and low distortion. When optimizing the crossover and driver-to-driver relationships, he considers overall power response to be just as important as on-axis response. After all, he states, "Our ears are mounted on the *sides* of our heads, right?" After much experimentation with driver spacings, tweeter offsets, and polar patterns, he ended up with a tweeter halfway between two identical vertically stacked midranges, similar to the D'Appolito configuration (named after Joseph D'Appolito, a contributing editor of *Speaker Builder*,

who first gave a detailed description of it). The major benefits of this configuration include higher vertical directivity (which reduces floor and ceiling reflections), symmetrical up/down polar response, greater acoustic output capability, and lower distortion. Because his implementation of this configuration does not follow some of D'Appolito's guidelines, such as odd-order Butterworth slopes and driver spacing less than one wavelength at crossover, Dudleston prefers not to call his a D'Appolito configuration but rather names his technique Field Optimized Convergent Source technology. The output of the system is optimized for seated listeners.

In addition to the front-mounted midranges and tweeter, the Convergence has

### SPECS

**System Type:** Three-way, floor-standing, vented box.

**Drivers:** Two 12-in. cone woofers, two 6½-in. cone midranges, and two 1-in. aluminum-dome Ferrofluid-cooled tweeters.

**Frequency Response:** 21 Hz to 20 kHz, ±3 dB.

**Sensitivity:** 98 dB at 1 meter with 2.83 V rms applied.

**Crossover Frequencies and Filter Slopes:** 180 Hz (second-order high-pass, third-order low-pass) and 4 kHz (second-order high-pass and low-pass); both crossovers yield third-order slopes, acoustically.

**Impedance:** Nominal, 4 ohms; minimum, 2.6 ohms; maximum, 18 ohms.

**Dimensions:** 51 in. H × 15⅞ in. W × 13¾ in. D (129.5 cm × 40.3 cm × 34.9 cm).

**Weight:** 150.3 lbs. (68.2 kg) each.

**Price:** \$3,400 per pair; optional bass-alignment filter, \$450; available in walnut, oak, cherry, mahogany, teak, rosewood, or black finish with black, brown, gray, tan, maroon, or off-white grille fabric.

**Company Address:** c/o Reel to Real Designs, 3021 Sangamon Ave., Springfield, Ill. 62702.

For literature, circle No. 91



SONY



THIS IS IT!

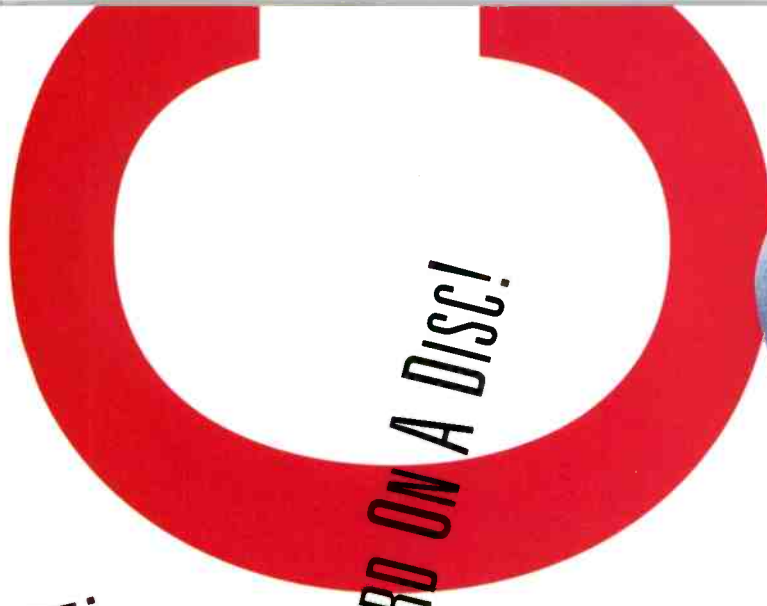






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two husky, low-resonance 12-inch woofers with rubber surrounds, in a rear-ported vented box. The four ports are in a two-by-two array on the top rear of the cabinet. Dual woofers were chosen to increase maximum acoustic output capabilities and to lower distortion. An optional high-pass bass-alignment filter/equalizer further extends response and decreases distortion due to elimination of below-band energy in the program material.

The French-built Focal midranges have cast frames, polyglass cones, and a stationary bullet-shaped diffuser (or phase plug) in the center that is said to improve off-axis response. The front-mounted Ferrofluid-cooled dome tweeter, sourced from Vifa of Denmark, is recessed by about 1/4 inch. According to Dudleston, this creates a quasi-horn-loaded configuration that smoothes off-axis response, increases output above 5 kHz, and simplifies crossover design. An additional, switch-selected tweeter is on the top rear of the cabinet. It provides additional energy to fill out the system's high-frequency power response, compensating for the way the front tweeter's coverage narrows with rising frequency.

The overall impedance of the Convergence is deliberately on the low side to take advantage of the high current capability typical of high-end amplifiers. This lets the audiophile tap into some of the unused capability of these amplifiers that sometimes goes to waste on higher impedance systems. However, Dudleston points out that, because the Convergence speakers have a relatively high sensitivity, they actually require substantially less current for a given

sound pressure level than most systems, which have lower sensitivity.

The woofers of the Convergence operate up to 180 Hz, where the midranges start operating. The midranges are used up to about 4 kHz, where the tweeter takes over. The crossover of the Convergence contains 11 resistors, nine inductors, and six capacitors, not counting paralleled units. Three rear-mounted switches control the midrange and front tweeter levels and also defeat the rear tweeter. High-quality parts are used throughout, including audiophile-type wire. The crossover is hand-wired on two hard-board panels mounted behind the woofers. Two pairs of gold-plated Tiffany double-banana binding posts on the rear panel provide for straight or bi-wire operation.

Most of the cabinet is constructed of medium-density fiberboard, 1 inch thick. The inside of the cabinet is strengthened quite well, with braces running up the sides and rear of the enclosure and two internal cross partitions (called Q-braces by the manufacturer). Tubes of PVC, 6 inches in diameter, form sub-enclosures for the midranges and connect the front and rear of the cabinet. White polyester fiber is used for internal damping.

#### Measurements

The on-axis and 20° horizontal off-axis anechoic frequency responses of the Convergence are shown in Fig. 1, taken without the bass-alignment filter and with all the rear switches in their normal (up) position. Measurements were taken 2 meters from the cabinet's front, at the height of the

tweeter. A voltage of 5.66 V rms was applied and the measurement referenced back to 1 meter. The response below 1 kHz was derived from 2-meter ground-plane measurements, and the input was reduced to 2.83 V rms to compensate for the ground plane's 6-dB boost. The 20° off-axis response corresponds approximately to what a centrally located listener would hear with the systems pointed straight ahead, as the manufacturer recommends, rather than toed in at him.

**THE SENSITIVITY OF  
THE CONVERGENCE IS  
THE SECOND HIGHEST  
I HAVE MEASURED.**

Although somewhat rough overall, the response fits a fairly tight window of 6 dB between 40 Hz and 20 kHz. Above 2 kHz, the response is significantly smoother at 20° off axis but rolls off somewhat at higher frequencies. Above 20 kHz (data not shown), the response had a high-Q dip of 20 dB at 24.2 kHz followed by a sharp 6-dB peak at 25.5 kHz, presumably due to the tweeter's metal-dome resonance. The response rolled off very rapidly above 30 kHz. Separate measurements (not shown) revealed that the unmarked rear-panel switches controlling the midrange and front-tweeter levels attenuated their respective drivers' output by about 1.5 dB each.

Averaging the response over the range from 250 Hz to 4 kHz yielded a sensitivity figure of 92 dB, significantly less than the manufacturer's rating of 98 dB but still the second highest I have measured, surpassed only by the KEF 105/3 (reviewed in the June 1991 issue).

The Convergence's grille caused fairly severe interference effects (not shown) in the on-axis response above 1 kHz, with irregularities of up to +2 and -4 dB. I suggest leaving the grille off for serious listening; the speaker looks quite good without it. Above 100 Hz, the right and left systems matched within a close  $\pm 1$  dB, which ensures stable lateral imaging.

A conspicuous aspect of the bass response, seen in Fig. 1, is an octave-wide



peak at 62 Hz, followed by a depression between 85 and 170 Hz. This trough coincides with the crossover between the woofers and the midranges. Separate ground-plane measurements of the woofer and mid/high sections, with the bi-wire straps removed, revealed that the two sections were slightly out of phase in this trough region and thus summed to a lower level. Connected separately, the woofer response peaked at 62 Hz and then rolled off at higher frequencies, although it did so quite slowly from 200 Hz to 1 kHz.

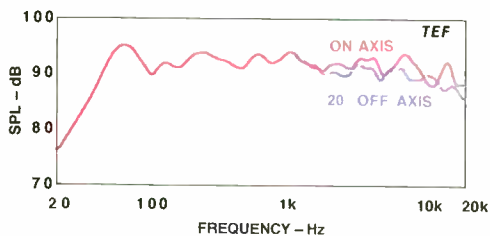


Fig. 1—On-axis frequency response.

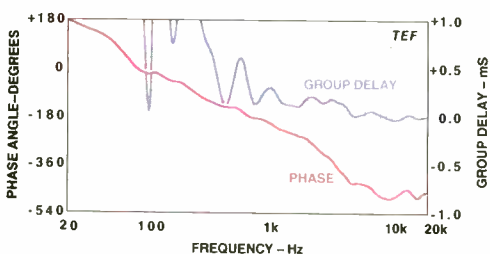


Fig. 2—Phase response and group delay.

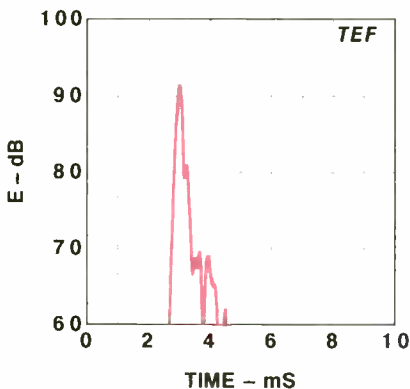


Fig. 3—Energy/time response.

Reversing the polarity of the mid/high section raised the level between 80 and 180 Hz by about 2 dB but decreased the level by about the same amount in a broad range from 180 Hz to 1 kHz. The reversed mid/high connection also added an extra 180°

to the overall phase response. Clearly, the normal polarity connection is preferable. The moderate changes in response with normal and reversed mid/high polarity indicate that the two sections are approximately 90° out of phase with each other through the lower crossover range.

The bass-alignment filter provided a standard second-order high-pass response at 21 Hz with a peak of 5.4 dB at 24 Hz (response not shown). The filter changed the system's overall low-frequency response from a vented-box fourth-order high-pass into a sixth-order high-pass. This was accomplished by the filter's boosting of the response at and above the box resonance frequency, where the power handling is high, and rapidly rolling off the response at lower frequencies, where the power handling capability is much lower.

The sixth-order loudspeaker alignment provides a good combination of high acoustic output and resistance to potential intermodulation from below-band power in the program material. It was first described by A. N. Thiele in his pioneering paper "Loudspeakers in Vented Boxes, Parts 1 and 2" (*Journal of the Audio Engineering Society*, May and June 1971, also reprinted in *Loudspeakers*, the first of two anthologies of speaker articles from the *JAES*. Incidentally, I recommend these anthologies highly.)

I also investigated the phase relationships between the tweeter and midranges by reversing the tweeter's polarity (measurements not shown). The output actually went up by about 2 dB between 1.5 and 3.2 kHz but decreased by about 5 dB between 3.5 and 4.7 kHz. These level changes confirm that the tweeter and midranges are neither in phase nor completely out of phase through the crossover region, but are halfway between, about 90° out of phase. This does not, however, increase the speaker's lobing, because the D'Appolito configuration minimizes this problem.

Figure 2 shows the phase and group-delay responses of the Convergence, referenced to the tweeter's arrival time. Between 1 and 20 kHz, the phase curve rotates a sig-

nificant 280°, due to a combination of the crossover's design and the offset between the acoustic centers of the tweeter and midranges. Between 1.2 and 4 kHz, the midrange output lags the tweeter by about 0.23 ms. The dips in the group delay at 100 and 170 Hz coincide with dips in the axial response at the same frequencies, which indicates a possible minimum-phase aberration. If the response were equalized flat in this region, the phase and group delay response would also be much smoother.

The Convergence's energy/time response is shown in Fig. 3. The test parameters were chosen to accentuate the system's response from 1 to 10 kHz, which includes the upper crossover region. Except for a slight perturbation about 10 dB down from the peak, the response decay is well behaved. Lower level delayed reactions, some 24 dB down from the peak, are exhibited.

**THE CONVERGENCE'S  
BASS OUTPUT EXCEEDS  
THAT OF ANY SPEAKER  
—OR SUBWOOFER—  
I HAVE TESTED.**

Figure 4 shows the horizontal off-axis responses of the Convergence. The bold curve at the rear of the graph is the on-axis response. The horizontal coverage is quite good, because the on-axis response aberrations are carried over quite appropriately into the off-axis curves. The output of the rear-mounted tweeter shows up in the 180° curve at the front of the display. The rear tweeter operates above 10 kHz, at about the same level as the front tweeter.

In Fig. 5, the vertical off-axis responses, the bold curve in the center of the graph (front to rear) is on axis (at a right angle to the front of the cabinet). Not clearly seen in the graph is the fact that only the -5° to +5° curves are reasonably flat. The response at higher and lower angles exhibits dips in the crossover region from 3 to 6 kHz. This means that to hear the flattest response, the listener should be sitting down; a standing listener is about 10° to 14° above the axis. The relatively high vertical directivity of the Convergence is due to its use of two comparatively wide-spaced midranges, coupled



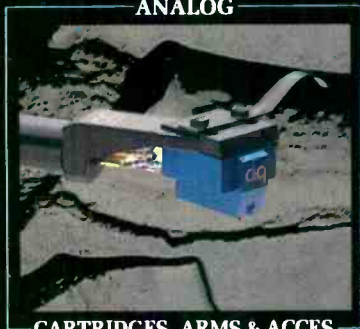
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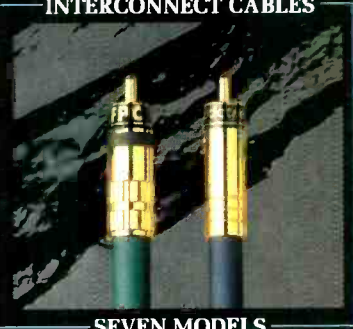
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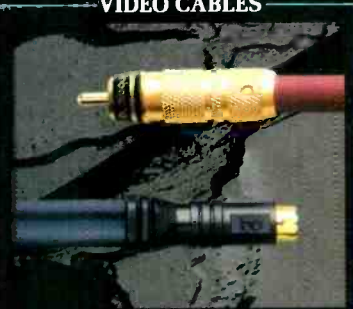
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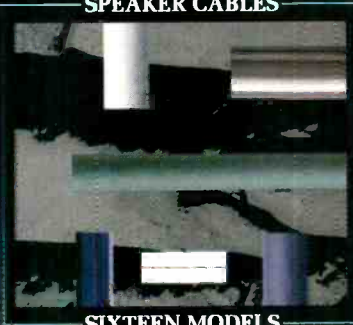
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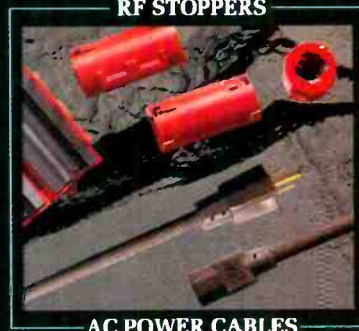
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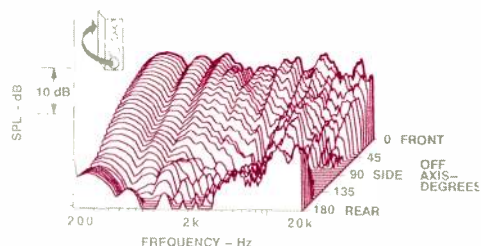


Fig. 4—Horizontal off-axis responses.

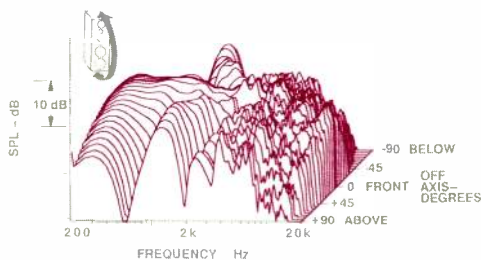


Fig. 5—Vertical off-axis responses.

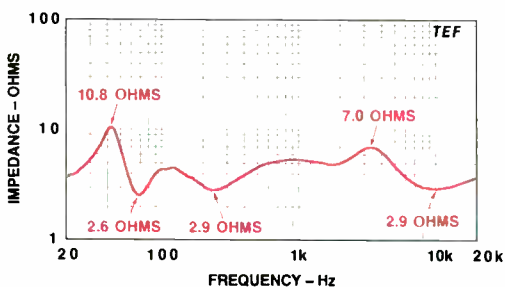


Fig. 6—Impedance.

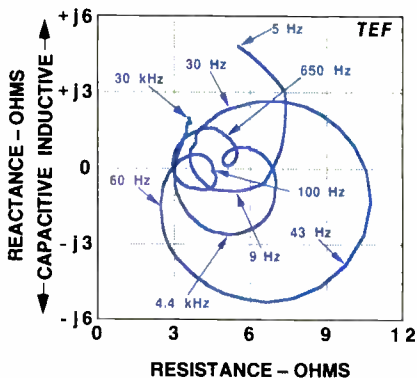


Fig. 7—Complex impedance.

with its relatively high, 4-kHz crossover frequency. The vertical off-axis curves exhibit up/down symmetry that is an inherent characteristic of the D'Appolito configuration.

The Convergence's impedance magnitude is shown in Fig. 6. A minimum impedance of 2.6 ohms occurs at 65 Hz and a maximum of 10.8 ohms at 42 Hz. Below 20 Hz, a minimum impedance of 3.7 ohms was reached at 18 Hz (near the vented-box tuning frequency), and the maximum was 8 ohms at 6 Hz (the lower anti-resonance impedance peak of the vented-box system). The curve in Fig. 6 has a pass-band max/min variation of about 4.2 to 1, so the Convergence will be somewhat sensitive to cable resistance. Cable series resistance should be limited to a maximum of about 0.04 ohm to keep cable-drop effects from causing response peaks and dips greater than 0.1 dB. For a typical run of about 10 feet, 14-gauge (or larger) low-inductance wire should be used. Smaller diameter wire can be used but will result in higher peak-to-dip variations in response.

Figure 7 shows the complex impedance of the Convergence, plotted over the range from 5 Hz to 30 kHz. The large circle in the plot is the upper vented-box impedance peak. The overall curve is quite energetic and exhibits five complete clockwise loops as frequency increases! The passband impedance phase (not shown) reached a maximum angle of  $+25^\circ$  (inductive) at 30 Hz and a minimum of  $-50^\circ$  (capacitive) at 54 Hz. Although the phase angles are not excessive, the low minimum impedance of the Convergence (2.6 ohms) requires that an amplifier with low output impedance and high current capability be used.

When the speaker was subjected to a high-level low-frequency sine-wave sweep, no significant cabinet resonances were evident. The ports reduced the woofer excursion over

a broad range from 19 to 35 Hz, with a minimum excursion at 23 Hz, the system's vented-box tuning. (I would have preferred to have the effective box tuning at the minimum excursion point for large signals, rather than at 18 Hz, the impedance minimum for small signals, where the designer put it.) The vent reduced the excursion to about 50% of its maximum excursion above box resonance, which occurred at 54 Hz. Even at levels above 20 V rms near box resonance, the port turbulence was quite low. On high-level low-frequency sine waves, the Convergence always sounded very clean and effortless.

The maximum excursion of the woofers was a healthy 0.7 inch, peak to peak, with a

**DISTORTION WAS VERY LOW AND OUTPUT VERY HIGH, A DYNAMITE COMBINATION.**

linear excursion of about 0.5 inch, peak to peak. The woofers overloaded very gracefully and exhibited no dynamic offset problems. The speaker could handle levels up to 30 V rms (225 watts into 4 ohms) at frequencies all the way down to 10 Hz without making any bad noises whatsoever (although my whole lab was shaking above 18 Hz)! This is the highest sine-wave power handling in the low-frequency range that I have measured on any system.

Figure 8, the 3-meter room response of the Convergence, includes curves for both raw and sixth-octave smoothed data. The speaker was in the right-hand stereo position, aimed straight ahead (not at the listening position), and the test microphone was at ear height (38 inches), at the listener's position on the sofa. The system was driven with a swept sine-wave signal of 2.83 V rms (corresponding to 2 watts into the rated 4-ohm load). The direct sound and 13 mS of the room's reverberation are included. Above 1 kHz, the curve is fairly smooth but exhibits roll-off above 7 kHz. Repeating the test with the speaker aimed at the microphone revealed less roll-off but much less smoothness. Excluding the room-effect dip at 400 Hz and the 600-Hz peak, the averaged curve fits a window of 8 dB ( $\pm 4$  dB) from 100 Hz to 13 kHz.



# Pick up a copy at your local AQ dealer.

(The good stuff is on the inside)

Fall 1992

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New Products For 1992.....3

New Crystal Cable Debuts.....4

## Audio Quest

### The Low-Down

**E**xpo 92, Seville, Spain: Yes, it was worth waiting two hours to get into the Canada pavilion here at the Worlds Fair. The reason for this most gruesome wait is simple--the word was out that the new 48 frames per second high-definition IMAX film was "something to see."

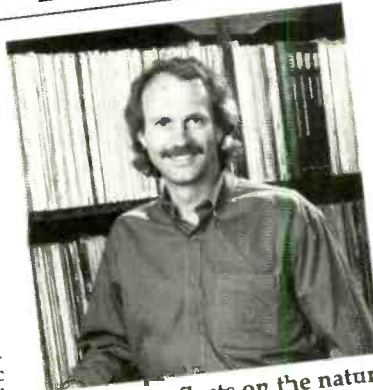
The movie screen was a staggering 19m x 26m (62 ft. x 85 ft.); the definition and detail -- the tremendous amount of information -- made a 70mm print of your favorite epic movie look like a 19" TV. All this fantastic hardware and software offered an incredible glimpse into lives and places we can't go ourselves.

The viewing experience was fantastic, it was fun. Unprecedented visual accuracy was used to inspire human emotion, and yet, for all the power and might projected by an Artic ice-breaker coming straight at you, it was not believable. No one turned and ran for fear of getting crushed. The unbelievability of the experience didn't stop the film from being a complete success. The two million people who stood in line for two hours or more enjoyed what the film did for them; there was no reason to dwell on the limitations.

"So what does this have to do with audio?"

The phenomena I have tried to describe is that accuracy is a means more than an end. By using an extraordinary level of technical accuracy, the high-definition IMAX system enhances its ability to trigger human emotion. Its ultimate failure to truly represent reality was never an issue in the viewers mind.

Audio systems also employ varying degrees of accuracy in their attempt to allow the listener to appreciate the emotion and sensuality of music. Accuracy in



Bill Low reflects on the nature of music reproduction

an audio system is the most predictable means of executing this noble task.

In some significant ways a reasonable audio system is more believable than the image on an IMAX screen, and yet such believability does not guarantee audio satisfaction. The absolute facts are that an audio system is never perfect -- enter subjectivity and compromise.

**"The purpose of an audio system is ... to carry your emotions where you want to go."**

"Why is everybody in audio saying something different?"

Mankind has constructed various philosophies as a means of coping with phenomena which do not conform to physical absolutes. Some audio thinkers believe that audio does not require a philosophy because there is an absolute reality we are trying to reproduce. They are correct about the absolute goal, but wrong about the need for a philosophy

Since perfection in audio does not exist there must be an audio philosophy which helps us cope with imperfection.

*Audio philosophy is understanding the role of subjectivity in prioritizing imperfections, in accepting compromises wisely.*

Some audio thinkers believe any opinion is as good as any other -- that it is all subjective -- they are wrong! Since there is an absolute goal of ultimate accuracy the role of subjectivity must be confined to a path (or a million lane freeway) which points toward this ultimate goal.

"So what does all this really mean?"

*The purpose of an audio system is to be a vehicle to carry your emotions where you want to go -- no matter what type of music you enjoy.*

For the audio manufacturer, this means that scientific method must be employed in order to facilitate awareness of all possible imperfections (distortions) and to reasonably control and choose (juggle) the imperfections in order to arrive at a mixture that does the least harm. Scientific method means gathering all possible empirical data -- especially from listening!

For the audio listener, this means: don't think about the equipment, don't second guess the technology of a specific product -- just listen and judge its performance in the only way that counts -- are you having fun?

So go out and have some fun! Look for stores that listen to equipment: before they buy, look for products whose existence is based on their audio qualities and not their marketing or packaging, and look for salespeople who will sit down and listen to you while they really try to help you get a handle on equipment values, and look for equipment that is a neutral, honest vehicle for your music. Then forget the equipment and enjoy some music!

A Quarterly Update on AudioQuest

**audioquest**

State of the Art Music/State of the Art Sound

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The spectra of single-frequency harmonic distortion versus power for the musical notes of  $E_1$  (41.2 Hz) and  $A_2$  (110 Hz) are shown in Figs. 9 and 10. As with most large speakers I've tested lately, distortion for the 440-Hz tone was too low to present, only about 0.5% second harmonic rising above the floor of my measurement gear at full power. The power levels were computed using the rated system impedance of 4 ohms. A high maximum power level of 200 watts was set as the upper limit, the highest I have ever used for these tests. Even with this power level, the Convergence always sounded quite clean.

The  $E_1$  (41.2-Hz) harmonic distortion data is shown in Fig. 9. At maximum (200-watt) power level, the distortion only reaches 6% second harmonic and 3.4% third. The higher harmonics were mostly

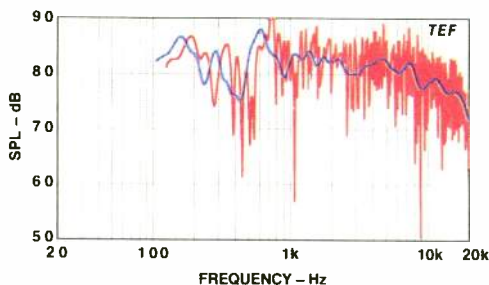


Fig. 8—Three-meter room response.

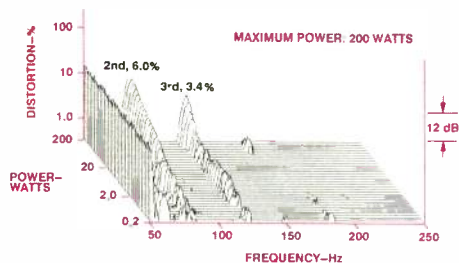


Fig. 9—Harmonic distortion products for  $E_1$  (41.2 Hz).

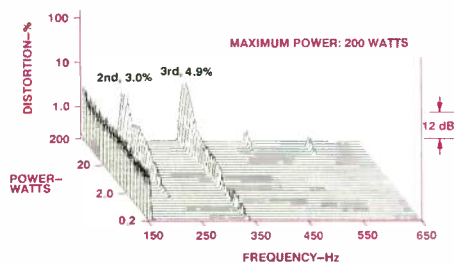


Fig. 10—Harmonic distortion products for  $A_2$  (110 Hz).

below the floor of my measuring gear. At 200 watts, the system generates a very loud 100 dB sound pressure level at 1 meter at 41.2 Hz.

Figure 10 shows the harmonic data for  $A_2$  (110 Hz). The second harmonic reaches only 3% at 200 watts, and the third harmonic reaches 4.9%. Higher harmonics are very low. At 110 Hz with an input of 200 watts, the Convergence generates a very loud 113 dB SPL at 1 meter.

Figure 11 displays the IM distortion created by tones of 440 Hz ( $A_4$ ) and 41.2 Hz ( $E_1$ ) of equal input power. The IM distortion rises only to the low value of 4% at full power. The Convergence's lower crossover, at 180 Hz, separates the two IM test tones and thus minimizes the distortion.

Figure 12 shows the speaker's short-term peak-power input and output capabilities, measured using a 6.5-cycle tone burst with third-octave bandwidth. Due to the high input and output capabilities of the Convergence, the scales for this graph were increased by one division, so that the top of the SPL scale is 140 dB (rather than 130 dB, as in previous reviews) and the input power starts at 10 watts (rather than 1 watt). The peak input power was calculated by assuming that the measured peak voltage was applied across the rated 4-ohm impedance.

The input power starts very high, at about 1 kW at 20 Hz (the highest I have measured in the range from 20 to 70 Hz!), and then fluctuates as frequency increases. Between 63 and 100 Hz, the input was limited because the output waveshape changed to a triangle, presumably due to crossover-inductor saturation. A power limitation occurs between 170 and 400 Hz, where the wave became quite rounded and sounded hollow at higher levels. A maximum peak input of 10 kW (200 V!) is reached between 1 and 5 kHz. The reduction of input power above 6 kHz was not caused by the Convergence, but by my test amplifier because of the speaker's low impedance in this range!

The upper curve in Fig. 12 shows the maximum peak sound pressure levels the system can generate, at 1 meter on axis, for the input levels shown in the lower curve. Also shown is the "room gain" of a typical listening room at low frequencies, which adds about 3 dB to the response at 80 Hz and 9 dB at 20 Hz.

The peak acoustic output rises with frequency up to 55 Hz, then flattens out, and continues to rise above 400 Hz. Between 800 Hz and 8 kHz, the level actually exceeds an ear-shattering 130 dB! These levels are high enough to keep up with the peak SPLs of live percussion instruments. With room gain, the maximum output exceeds 110 dB above 18 Hz and 120 dB above 30 Hz, the lowest frequencies I have measured for these SPL points! The Convergence's low-frequency maximum output exceeds any of the systems I have tested for *Audio*, including the four subwoofers I measured for the November 1992 issue—and this for a single system! A stereo pair of Convergence speakers can reach even higher low-frequency levels with bass material common to both channels.

#### Use and Listening Tests

The appearance and the fit and finish of the Convergence are superlative. As stated before, the finish of my review samples was ribbon mahogany, which reminded me of majestic old-time console radios. These speakers are large and heavy (150 pounds apiece), and one person can only move them by walking them with a side-to-side

**ON SOFT AND DELICATE  
CHAMBER MUSIC, THE  
CONVERGENCE SOUNDED  
SMOOTH, DETAILED,  
AND NEUTRAL.**

rocking motion. The speakers are supplied with molded plastic rails that are screwed to the bottom of the cabinet for stability. Cone spikes are also supplied. Connections are made through heavy-duty double-banana jacks on the cabinet's bottom rear. Each speaker is supplied with two short cables with spade lugs to be used as jumpers when the speaker is under normal (not bi-wired) operation.



SONY



## LISTEN TO YOUR HEAD.

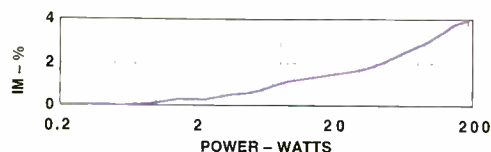
The new Sony Studio  
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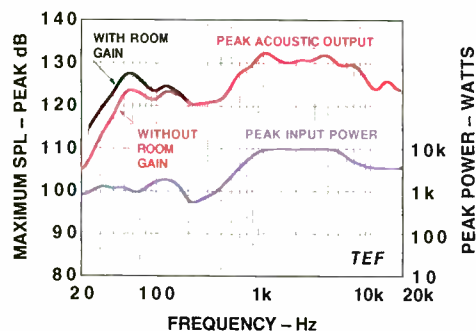


The thorough 10-page instruction manual covers such topics as speaker placement, connections and cabling, fine tuning (with the systems' level-adjustment switches), amplifier and power requirements, and bi-wiring and bi-amplification. Additionally, Reel to Real Designs will even supply custom passive resonance-trap filters to use with the bass section. These may help solve some typically troublesome room and placement problems.

As discussed previously, Legacy states that the optimal listener position is actually 20° off the horizontal axis and recommends that the speakers fire straight into the room rather than being toed in. For best results,



**Fig. 11—IM distortion for 440 Hz (A<sub>4</sub>) and 41.2 Hz (E<sub>1</sub>).**



**Fig. 12—Maximum peak input power and sound output.**

the listener's ear should be at the same height as the tweeter. All my listening was done with the speakers facing straight ahead and not aimed at my listening position. I placed them 8 feet apart, 10 feet from my sofa, and about 5 feet from the wall behind them.

I used an Onkyo CD player driving the Briston 0.4B preamp, coupled with balanced Straight Wire cables to the Crown Macro Reference power amplifier. Straight

Wire Maestro speaker cables were used to connect the Convergence systems to the amps. About half my listening was done with the Legacy's optional bass-alignment filter inserted in the tape loop of the preamp. When the bass filter was used, I also used it when listening to my reference B & W 801 Matrix Series 2 speakers because of its close similarity to the filter supplied with the 801s.

First listening disclosed that the Convergence has considerable bass impact, very wide dynamic range, and a clean and open sound. No matter how loud I played these speakers with demanding bass material, they always sounded quite clean and effortless. At seated listening positions, the tonal balance and overall sound were quite close to my reference speakers'. Only when I stood up did the Legacy systems differ tonally in the upper midrange from the references. When I was standing, the tonal differences often sounded like a general reduction in level rather than a spectral aberration.

Some one-note bass character was noted on acoustic bass lines. Subsequent speaker and room measurements revealed that the 60-Hz bass hump of the Convergence coincided with a 60-Hz mode in my listening room, thus emphasizing notes in this range. My reference speakers also excite this room mode, but the Convergence systems were consistently louder when a bass note fell in this range.

On third-octave, band-limited pink noise, the Convergence's low-frequency maximum output significantly exceeded my reference systems' in the bands from 20 to 40 Hz. Particularly impressive was the output in the 20- and 25-Hz bands, which made everything in the room vibrate! The high sensitivity of the Convergences enabled them to play significantly louder and cleaner than my references when turned up to the point where the power amplifier occasionally clipped. (The Crown amp has very useful LED level and overload indicators.) The bass drum at 1:08, 1:10, and 1:31 on track 1 of *Winds of War and Peace* by the

National Symphonic Winds (Wilson Audio WCD-8823) was truly awesome when played at high level.

Of course, I had to get out my assortment of sound-effect CDs to try, including the jets and steam locomotives on *Sonic Booms* (Bainbridge BCD6276). The Convergences didn't even whimper when subjected to this material played through the very powerful Crown amplifier, the same amp I use in my peak power tests! These speakers also did considerable justice to various rock 'n' roll tracks, easily creating full concert levels, including bass.

When Bach's *The Art of the Fugue* by the Juilliard String Quartet (Sony Classical S2K 45937) was played, the Convergences demonstrated a fine capability to re-create soft and delicate chamber music with smoothness, a detailed and neutral sound, and good instrument placement and stereo focus. Male speaking voices sounded natural and well controlled. Compared to my references, the Legacy systems had a more forward sound that was less influenced by my listening room. I attribute this to the Convergence's greater directivity in the important mid-frequency range. Tambourines, cymbals, and other high-frequency percussion exhibited a crisp and well-balanced sound with extended response.

Overall the Convergences did a commendable job on most program material. Only rarely were the speaker's limits reached, and even then it overloaded quite

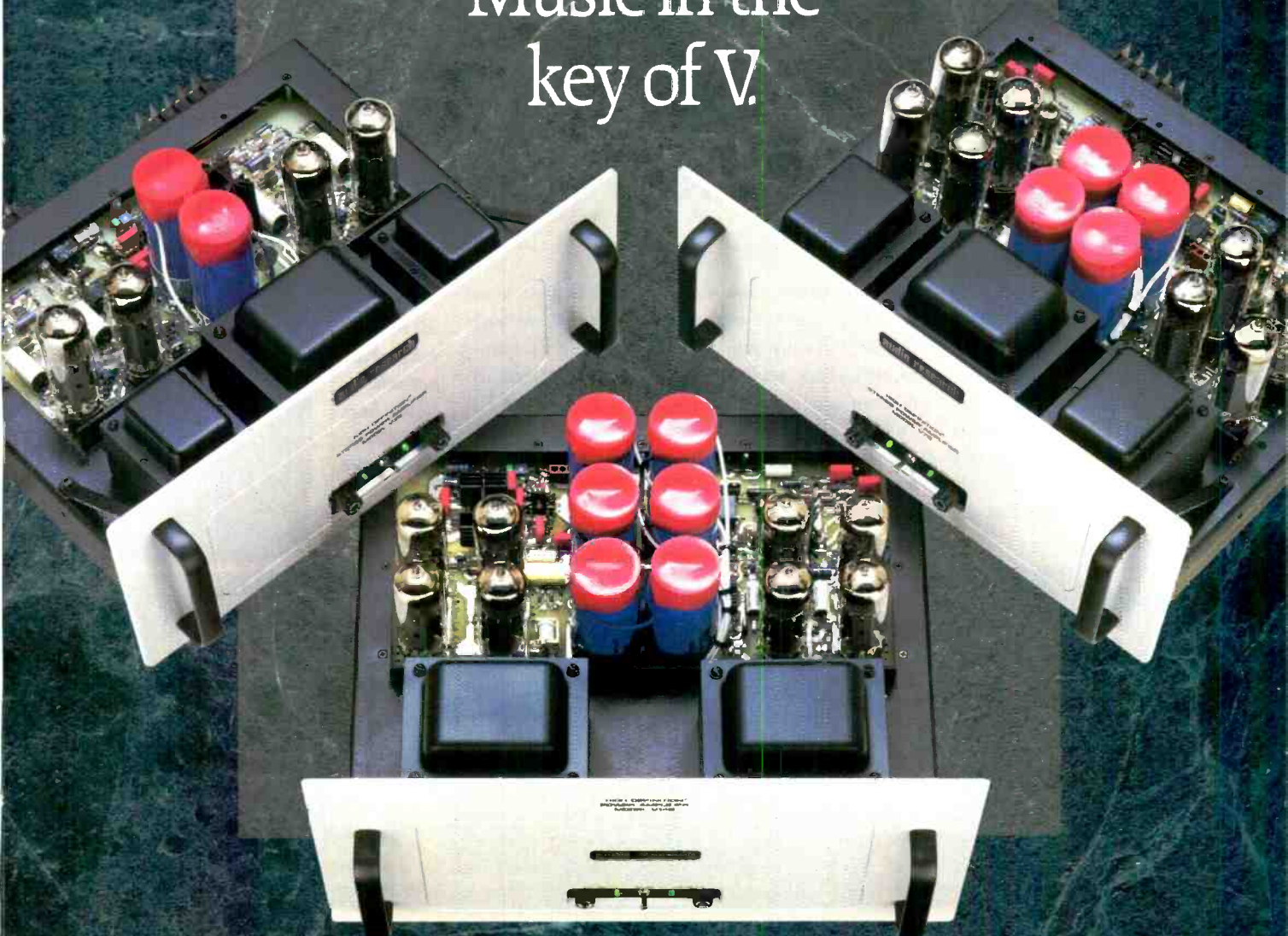
**STEAM LOCOMOTIVES?  
JETS? THE LEGACY  
CONVERGENCE DIDN'T  
EVEN WHIMPER.**

gracefully. Particularly impressive were its wide dynamic range capability, high sensitivity, powerful bass response, and very high power-handling capabilities. Its smoothness, frequency range, and imaging capabilities were also first-rate. No subwoofers are required with this system! If you are prepared to part with about \$3,500, the Convergence would be a very good choice.

D. B. Keele, Jr.



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## ALPINE 7980 CAR CD CHANGER AND TUNER

The black "3D Shuttle" magazine jutting out from the front of the 7980 holds three CDs: Alpine has managed to cram a full-featured, three-disc changer and a full set of AM/FM tuner controls into a head unit that fits a standard DIN dashboard cutout. (The tuner circuitry, however, is in a half-DIN black box that gets tucked out of sight.)

which stops only at the strong stations stored in memory. An automatic memory feature automatically stores the six strongest stations on any band as presets. A mode called Direct Access Preset (D.A.P.) stores both AM and FM stations together, so you can receive both without needing to press the band selector. A total of 24 station frequencies can be preset, six each for FM1, FM2, D.A.P., and AM. There are also

zine. Just below are the preset scan button and a dual-purpose switch for tuning and CD display modes. The knob below controls volume but also becomes, with successive presses, the control for treble, bass, balance, fader, and back to volume. The control also reverts to volume mode if not touched for 5 S. The "Up/Down" rocker

When you change CDs, the three-disc 3D Shuttle magazine extends slowly from the 7980's loading slot.



The CD section employs a digital filter with eight-times oversampling as well as a dual D/A converter system. Alpine's 20-bit hybrid interpolative D/A converter, which

switches for forced mono reception and local/distant seek sensitivity.

A feature called Source Tone Memory automatically memorizes settings of the bass and treble tone controls separately for CD and tuner. The unit is equipped with front and rear preamp outputs and a fader. A separate analog electronics box houses tuner and analog signal circuits, isolating them from the CD servo and digital circuits for optimum noise-free performance. An audio interrupt lead is available for those who have a cellular phone in their vehicles. Finally, the entire chassis is mounted in a quick-release bracket so that it can be removed from the vehicle to prevent theft.

### Control Layout

A button for disc selection and local/distant sensitivity is at the upper left of the front panel. Adjacent to it are the buttons for "Mono" and for ejecting the CD maga-

further to the right is used for controlling radio tuning, CD track selection, and CD track scanning.

When the multifunction knob is in use, the display beneath the CD slot shows its current function and setting. Otherwise, it shows the radio band, frequency, tuning mode, and preset number or the CD mode and track number or elapsed time.

The six buttons to the right of the display are used in the tuner mode for preset station selection or, in CD mode, to control such functions as random play ("M.I.X."), "Repeat" of a track or disc, "Scan," program erasure ("Clear"), and programming ("P.T.M."). The three buttons at the far right are the "DAP" band selector, "Tuner" (which selects the other bands and switches from CD to radio), and "Disc" (which starts or pauses CD play).

A remote control the size of a thick credit card, supplied with the 7980, handles

**ALPINE HAS CRAMMED  
A THREE-CD CHANGER  
AND A GOOD TUNER INTO  
AN IN-DASH UNIT.**

they call I-DAC, combines one-bit technology for excellent low-level linearity with a multibit converter for high dynamic range, low distortion, and low noise. The section's features include six-selection programming, random and repeat play, and scanning of the first 10 S of each track.

As for the tuner section, its most unusual feature is probably Intelligent Preset Scan,



such major control functions as volume, radio band selection, and 20-dB muting (available only from the remote) and also selects tuner or CD mode, tuner presets, and CD tracks. This remote's slim configuration mandates the use of a lithium disc battery (CR2025 or equivalent) similar to the batteries that run the calendar clocks in camcorders.

When installing the 7980, it's important to allow space in front of the unit. The magazine projects 8 cm (a bit over 3 1/8

inches) when changing discs, and a full 14 cm (over 5 1/2 inches) is required for easy insertion and removal of the magazine. Interference could occur between the CD magazine and some cars' stick shifts.

### Tuner Measurements

Figure 1 shows the frequency response of the Alpine 7980 in the FM tuner mode. Response is down some 1.3 dB at 15 kHz. Figure 2 shows the mono and stereo quieting characteristics of the FM tuner section.

Mono 50-dB quieting requires a signal input of only about 15 dBf. By the time signal strength is sufficient to switch the tuner into the stereo mode, signal-to-noise ratio reaches over 60 dB. Maximum S/N with strong signals is 70.3 dB for mono reception and 67.5 dB for stereo.

Figure 3 shows harmonic distortion plus noise versus modulating frequency. At 1 kHz, THD + N measures 0.21% for mono and 0.38% for stereo. At 100 Hz, THD + N is 0.082% for mono and 0.4% for stereo, while at 6 kHz, it measures just over 0.4% for both mono and stereo modes. Figure 4 shows how THD + N varies with input signal level. From this plot, I determined that mono usable sensitivity, 13.0 dBf, is actually better than Alpine's claim. Notice that although stereo THD + N tends to rise for signal levels below 60 dBf, the mono/stereo switching threshold is reached at some point between 30 and 40 dBf. Below this level, THD + N in the stereo mode is substantially the same as for mono, since the circuitry is then operating in mono despite the presence of a stereo modulating signal from my generator.

Channel separation (not shown) was far better than suggested by the manufacturer's conservative specification, measuring 53 dB at 1 kHz and 40.5 dB at 10 kHz. Only above about 4.5 kHz did it fall below the rated 35 dB, falling to 27.6 dB at 10 kHz. As is true of nearly all car FM tuners, little was done to suppress stereo subcarrier

components in the output signal. Residual 19-kHz pilot carrier was suppressed by about 60 dB relative to maximum audio modulation level, but the difference-signal sidebands surrounding the 38-kHz subcarrier reached levels of -20 dB, with only 42-dB suppression of the subcarrier itself. (Of course, only your dog will be able to hear these tones; in home equipment they're suppressed so they won't interfere with tape recording using Dolby NR.) Other FM performance measurements yielded an al-

## SPECS

### CD Player Section

Frequency Response: 5 Hz to 20 kHz, +0, -1 dB.

THD: 0.006% at 1 kHz.

Dynamic Range: 95 dB.

S/N: 95 dB, A-weighted.

Channel Separation: 85 dB.

D/A Converter: 20-bit Hybrid I-DAC.

Oversampling Rate: Eight times.

### Tuner Section

FM Usable Mono Sensitivity: 16.3 dBf.

Mono 50-dB Quietening Sensitivity: 15.2 dBf.

Alternate-Channel Selectivity: 80 dB.

Mono S/N: 65 dB.

Channel Separation: 35 dB.

Capture Ratio: 2.0 dB.

AM Usable Sensitivity: 22.5  $\mu$ V.

### General Specifications

Bass Control Range:  $\pm$ 15 dB at 30 Hz.

Treble Control Range:  $\pm$ 12 dB at 10 kHz.

Output Voltage (Into 10 Kilohms): 500 mV.

Power Requirement: 14.4 V d.c. (11 to 16 V allowable).

Dimensions: Main chassis, 7 in. W  $\times$  2 in. H  $\times$  6 in. D (17.8 cm  $\times$  5.1 cm  $\times$  15.3 cm); tuner chassis, 7 in. W  $\times$  1 in. H  $\times$  6 in. D (17.8 cm  $\times$  2.5 cm  $\times$  15.3 cm).

Price: \$880.

Company Address: 19145 Gramercy Place, Torrance, Cal. 90501.

For literature, circle No. 92

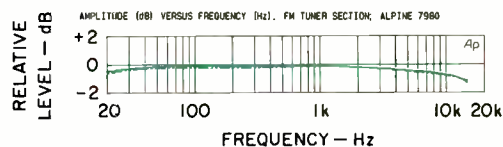


Fig. 1—FM frequency response.

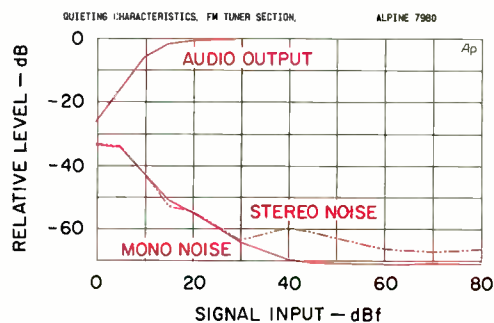


Fig. 2—FM quieting characteristics.

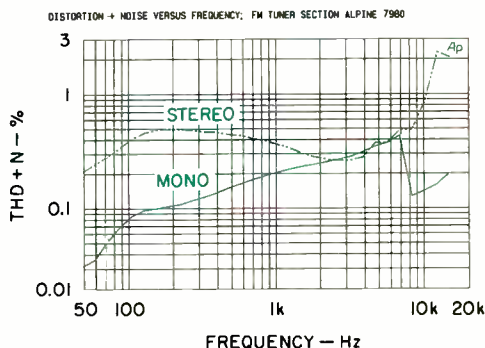


Fig. 3—FM THD + N vs. frequency.

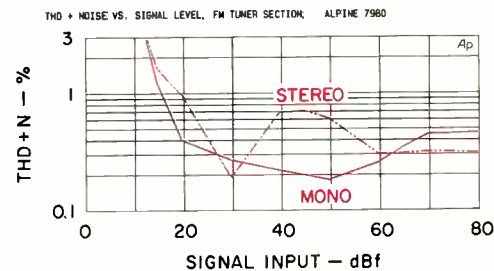


Fig. 4—FM THD + N vs. signal level.

ternate-channel selectivity of 83 dB and a capture ratio of 2.0 dB.

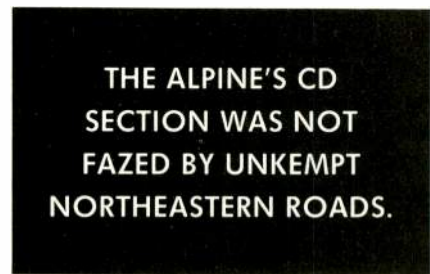
The AM tuner section's frequency response, though not entirely conforming to the NRSC standards, is far better than that of most car AM tuners and, for that matter, of most home tuners and receivers. AM response (Fig. 5) extends to around 4.2 kHz before reaching an attenuation of 6 dB. Usable sensitivity measured 22  $\mu$ V, just about as specified.

### CD Measurements

Figure 6 shows the frequency response of the CD player section, with tone controls at their flat settings. Response is down 0.3 dB at 20 Hz and at 20 kHz is up about 0.2 dB for the left channel and 0.25 dB for the right.

Figure 7 shows how THD + N varies as a function of frequency for signals recorded at maximum level. Over most of the audio frequency range, THD + N is between 0.025% and 0.03%. To maintain this low level of distortion, however, it was necessary to operate the 7980 with its volume

control at about 10 dB below its maximum setting. If this was not done, the 7980's voltage amplification stages (following conversion) went into overload. I can appreciate the fact that the CD player section can produce a far higher output level (more than 20.0 V) than either the AM or



FM tuner section, but it seems to me that the designers should have made it possible for the preamp voltage stages to handle CD output signals at any setting of the volume control.

The tendency of the preamp stages to overload was also evident when I plotted THD + N (referred to 0-dB recorded level) versus signal level (not shown). Although THD + N remained very low (around -90 dB) at levels below -20 dB, with 0-dB signals it rose to nearly -70 dB (around 0.03%), even with volume reduced somewhat below its maximum. Had I increased volume to maximum, the output would have been severely clipped. A spectrum analysis of harmonics generated by a maximally recorded 1-kHz signal (again, with volume setting lowered somewhat) revealed that the primary harmonic component was at 2 kHz (the second harmonic of the recorded signal), with higher order harmonics of lesser amplitude evident.

The A-weighted S/N was an impressively high 96.5 dB—unusually good for a car CD player.

Separation at 1 kHz measures 86.5 dB for the left-to-right crosstalk and 84 dB for crosstalk from right to left (Fig. 8). As you can see, separation decreases substantially at higher frequencies but at 10 kHz is still a more than adequate 68 dB for the left-to-right direction and 66 dB from right to left.

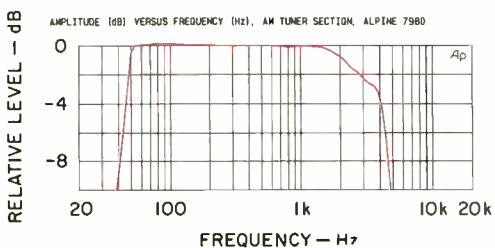
Figure 9 shows deviation from perfect linearity. For undithered

signals in the range from 0 to -90 dB, the Alpine's deviation at the lowest signal level approaches +4 dB. With dithered signals from -70 to -100 dB, deviation again amounts to about +4 dB at -90 dB, increasing substantially for signals below that level. The fade-to-noise test results (Fig. 10) confirm the 7980's low-level linearity and also reveal that the EIA dynamic range of this player was approximately 103 dB. The more stringent EIAJ dynamic range was 93.8 dB. Frequency accuracy of the player section was extremely good; I found the error to be an insignificant 0.0002%.

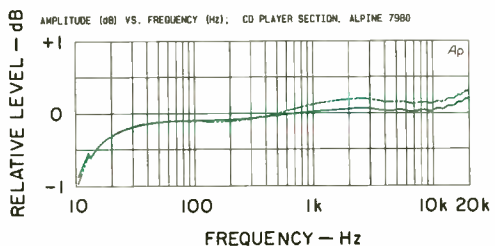
Finally, I measured the ability of the CD player section to correct for disc defects such as scratches, missing data, or opaque surfaces caused by dust or dirt. The player successfully corrected or interpolated for missing data 1.5 mm in length. After intermittently muting a few times, the system was even able to interpolate for missing data 2.4 mm long, a larger gap than a great many home CD players can handle. Furthermore, the Alpine is very resistant to external vibration and shock—extremely important for a car CD player.

There would be little point in my addressing the 7980's sound quality and ease of use from my test bench or even from my reference listening room. Only a "test drive" can properly reveal the merits (or demerits) of any car audio system. So, I leave it to Technical Editor Ivan Berger to detail his experiences of putting this tuner/CD changer through its paces. From my own point of view, I have to commend Alpine for coming up with a DIN-sized unit that can handle three CDs at a time. While disc changing takes longer than it does with separate in-the-trunk CD changers, it's a small price to pay for the convenience of having three hours or more of continuous music available from an in-dash head unit.

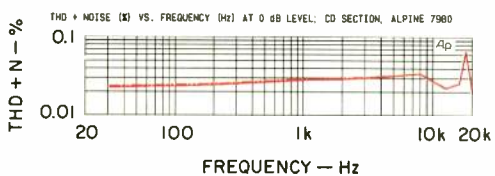
*Leonard Feldman*



**Fig. 5—AM frequency response.**



**Fig. 6—CD frequency response.**



**Fig. 7—CD section THD + N vs. frequency.**



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## CELESTION

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pop them in as needed. If I keep this Alpine in my dash (and I'm actively considering it as my next reference unit), I'll get some extra magazines and label them with big code letters ("J" for jazz, and so on) so I can quickly match the musical genre to my mood.

Some aspects of the changer take a bit of getting used to. Seeing the magazine ooze out of the unit while the disc is changed is a bit surprising at first. The cycle takes about 20 S: "Slower than a trunk-mounted changer," admitted an Alpine engineer who has a 7980 in his car, "but a lot quicker than changing discs by hand." And during the eject cycle, the magazine must come out twice, once to re-ingest the disc that was last played and a second time to pop itself out; instinctively grabbing the changer magazine when you're ejecting it just stops the process and forces you to run through the whole eject cycle again. Patience! The magazine won't fall out.

The biggest drawbacks of the changer aren't big at all. The middle disc is hard to

remove from the magazine. Unless the 7980 is mounted unusually high in the dash, the magazine's overhang obscures the tops of the display's "Mono" and "DAP" indicators, though you can still see their bottom edges. And putting the magazine in upside down disables the radio as well as the changer for some reason, but only until you take the magazine out or reinsert it properly.

**THE 7980, WHILE NOT QUITE THE UNIT OF MY DREAMS, MAY BE MY NEXT REFERENCE.**

Overall, the ergonomics are rather good. Pressing any button will turn the unit on, so you only need the small "Power" switch to turn it off. As the 7980 turns on, the volume ramps up to the last setting, so you have a few seconds to turn it down again if someone left it blasting. The controls are all

placed conveniently and, for the most part, logically. Some, but not all, buttons perform similar functions for both radio and CD. The rocker switch just to the left of the display, for instance, is used to move both up and down the radio dial and up and down through the current disc's tracks—but the button for scanning a CD is not the one used for scanning tuner presets. The controls are nicely differentiated by feel (though I'd have liked a slightly less smooth finish on the "Up/Down" rocker). As usual, Alpine has illuminated its station preset buttons and has put them in a convenient, 3 × 2 array instead of one long line. (The display's preset number indicators are set up in a matching matrix.) And, as usual for Alpine, the functions the buttons perform in CD mode ("Mix," "Repeat," "Scan," "Clear," and "P.T.M") are printed in thin white letters, making them easy to read by day but hard to make out once the buttons are illuminated.

The all-in-one control is a near-universal feature on car stereos

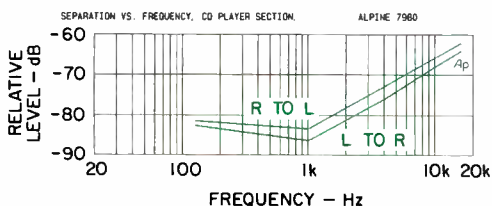
these days, though I'm glad Alpine made it a knob instead of a rocker. This arrangement saves space, but it's hard to know without looking exactly which function you're actuating once you get past volume. It would be helpful to have beeps signal when you go to a new function (or return automatically to volume) and when you reach the center points of the bass, treble, balance, and fader adjustments. On the other hand, thanks to the 7980's Source Tone Memory, which automatically saves tone settings separately for each source, you don't need to use these controls often. Night illumination was good, and the dial was reasonably easy to read by day.

On the road, the CD section was unfazed by typically unkempt Northeastern roads. The difference in clarity between CD and tape was unmistakable and welcome. There was none of the harshness of some early car CD units, yet there was still a faintly overbearing quality to the sound that I couldn't quite put my finger on. I found it helped to roll off the treble just a hair and (though it made the sound boomy when the car stood still) to boost the bass a little. Thanks to Source Tone Memory, I could do this without altering the FM response. With these tone settings, the response was less flat than shown in the lab measurements but probably still flatter than I get from tape.

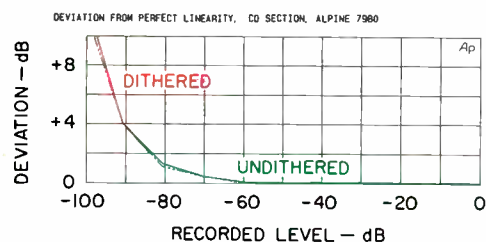
On FM, performance was just about perfect. I heard touches of picket-fencing on only the most distant stations, and sensitivity seemed to be just about equal to that of my reference Soundstream. The latter might squeeze out about a half-mile advantage on a fading station, but the Alpine's easy-to-reach "Mono" button can be used to eke out even more range. In fact, this "Mono" button was far more effective than most in cutting interference; this surprised me, once I'd seen Fig. 2 and realized that this tuner collapses to mono at higher signal levels than most tuners do.

Reception on AM was reasonably good. It wasn't static-free, but its frequency response was audibly flatter than the lackluster norm.

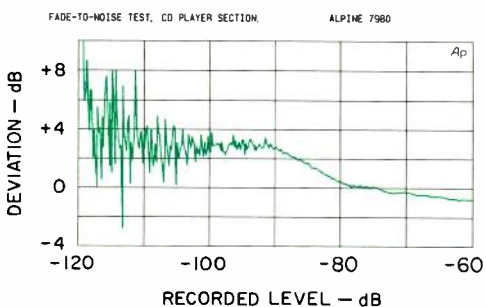
The Alpine's automatic memory system picks up and memorizes the six strongest local stations, as claimed. (Some other units' automatic memory systems just pick up the first strong stations they find, which can be an advantage if you prefer listening



**Fig. 8—Separation, CD section.**



**Fig. 9—Deviation from linearity.**



**Fig. 10—Fade-to-noise test.**



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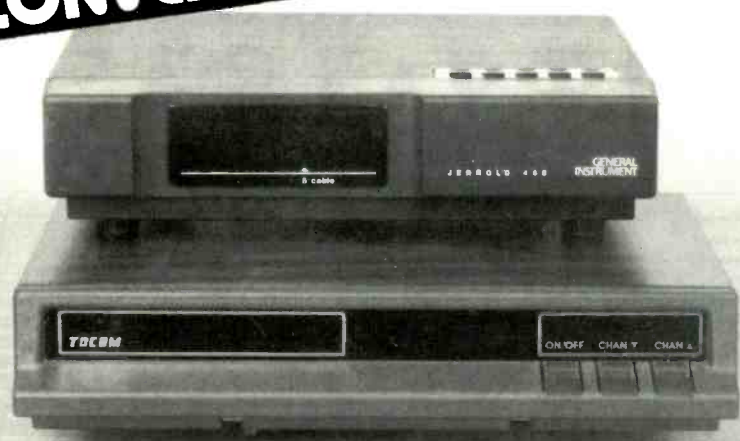
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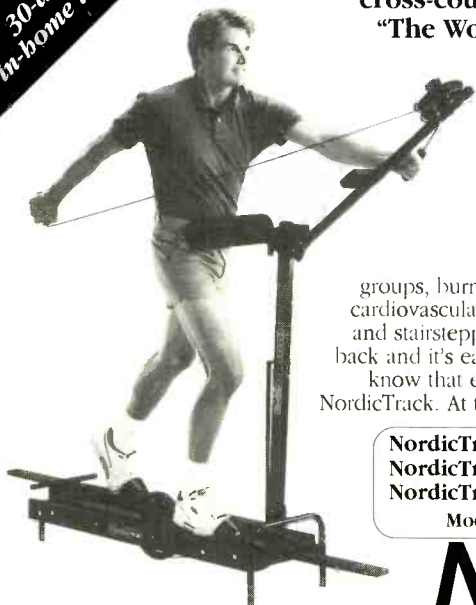
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to the college and public radio stations at the bottom of the dial.) While the system can be used on the D.A.P. band, which can store both AM and FM stations, it only memorized FM frequencies when I used it. Unlike some other auto-preset systems, the 7980's does not store your original station settings for later recall. However, with four six-memory bands to use, you should be able to find one not already taken up by local stations.

The Intelligent Preset Scan worked very well. On FM, it scans both bands of presets but only stops at the stations that are coming in strongly at the moment. This let me set one FM band to New York stations, another to stations in Connecticut, and to scan in either location without stopping at frequencies where the signal had long since been replaced by noise.

The six-button remote control is handy for use by back-seat passengers. This was not one of the select few remotes having enough beam coverage and power to work when attached to a steering wheel for easy operation by the driver; that's a pity, as its wafer-thin body would not get in the way.

The pull-out chassis was a little bit harder than most to lock back in. I would have preferred a removable front panel so I wouldn't have to cart the entire unit around when I parked. It was not possible to put the separate tuner chassis in my dash for this temporary installation, so it had to sit exposed on the side of the console; for security, I draped a map or newspaper over it each time I parked.

Even though my CD library is far larger and better organized than my library of cassettes, I've long resisted replacing my Soundstream radio/cassette unit with a CD player. It was just too difficult to find a CD player that could match the Soundstream's great combination of tuner performance, human engineering, features, and sweet and clear sound. The 7980, while not quite the unit of my dreams, has me reconsidering. Its tuner is just about a match for my reference unit's. Its features and ergonomics are good. And its CD sound, while not as good as the best home units I've heard, is still better than I've yet heard from cassette. Now if my installers at Stratford Sound can find a way to mount both chassis where I want them, the 7980 just might make me switch at last.

Ivan Berger

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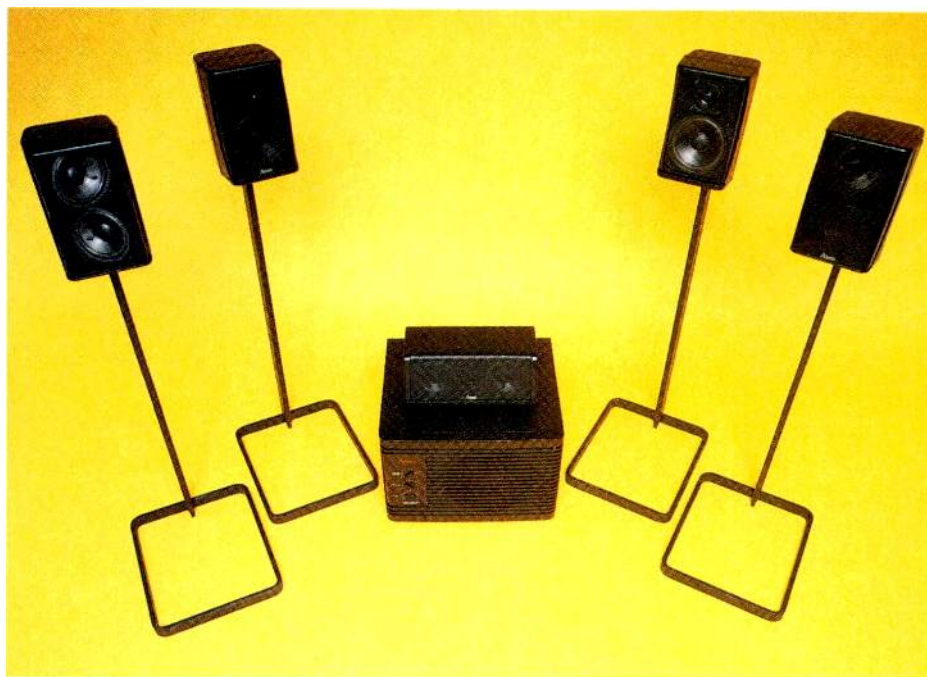
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## ATLANTIC TECHNOLOGY SYSTEM 150 HT SURROUND SPEAKERS



**A**lmost from the moment I unpacked this complete home-theater speaker system, I realized that Atlantic Technology's objective in creating it was total flexibility. The speakers in the system—a pair of Model 151 LR two-way front speakers, a Model 153 C center-channel speaker, a pair of Model 154 SR surround speakers, and a Model 152 PBM amplified subwoofer—are all available separately and in various combinations designed for specific needs. System 150 A (\$599) is a basic three-piece satellite/subwoofer system intended for stereo use. System 150 C-SR (\$249), designed for those who want to add surround to

their existing stereo setup, includes a pair of surround speakers and a center channel; System 150 S (\$699) adds the subwoofer to this. And the System 150 HT, reviewed here, is an \$849 setup that includes all these components.

The Model 152 PBM powered bass module (available separately for \$499) includes an 8-inch polypropylene long-throw woofer with a -3 dB point of 80 Hz, a crossover, and an amplifier. Atlantic Technology calls it a "power-directed" amp, because you can set it to deliver 70 watts to a single speaker or 30 watts each to three separate speakers. Accordingly, this module can be used as the foundation for a powered three-piece speaker system or for providing the channels of surround amplification missing from a lower priced Pro-Logic receiver. With its built-in amplifiers operating in bridged mode, for example, all 70

watts can be used to power the subwoofer alone. In an alternative home theater setup, the amplifier can channel 30 watts to the subwoofer and 30 watts to each of two satellite speakers. Another alternative would involve directing power to the often omitted but critical center-channel speaker. The 152 PBM has two switchable crossover points: 80 or 120 Hz (24 dB/octave low-pass, 12 dB/octave high-pass). In my listening tests, I found that the 80-Hz setting was preferable when the 152 PBM was used with the rest of this system. The 120-Hz setting delivered a boomy, Johnny-one-note bass that might appeal to rock 'n' roll fans, but seemed out of place with the source material I used.

The 153 C magnetically shielded center-channel speaker (\$139) has two 3½-inch woofers that flank a ½-inch dome tweeter. These drivers are closely spaced, avoiding a seldom discussed flaw of center speakers: A comb-filtering effect caused by the use of widely spaced multiple drivers. This effect often makes dialog shift or lose its precise positioning. With the 153 C, however, dialog remained precisely where it should be in all my listening tests. This 8-ohm speaker can handle up to 110 watts of power and, like the other speakers in this system, has a relatively high sensitivity of 89 dB. This means that the system won't soak up a lot of power from external amplifiers or from an A/V receiver. Therefore, you will be able to use an entry-level audio/video receiver of limited wattage per channel without sacrificing the dynamics demanded of a home theater system.

Atlantic refers to the 154 SR surround speakers (\$149 per pair) as "spatially enhanced," because their two 3½-inch long-throw drivers (rated at 120 Hz to 12 kHz) are angled 105° away from each other in a cabinet designed to avoid diffraction despite the unusual driver configuration. Also, the two drivers are wired with opposite polarities. The purpose of all this is to match the

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diffuse sound that theater listeners get from the multiple surround speakers located behind and above them. Sure enough, the result is surround sound having good ambience without specific localization.

The Model 151 LR satellite speakers (\$149 per pair) are designed for use as the main front speakers of a home theater system or as stereo satellites. Like the center speaker, they are magnetically shielded: If they are placed adjacent to (or even atop) a direct-view TV set, the drivers' magnets will not cause colors of the TV picture to be

degraded. Response of these satellite speakers is unusually broad, extending down to 80 Hz (the point at which the powered subwoofer can take over) and up to 20 kHz, with a tolerance of only  $\pm 3$  dB. All of the separately driven speakers in this system have a nominal impedance of 8 ohms, while the driver in the powered subwoofer has a 4-ohm nominal impedance.

I wanted to use all the elements of this system in my listening tests and needed a good audio/video receiver equipped with a Dolby Pro-Logic decoder. I chose the On-

kyo TX-SV909PRO, since it had been a winner in a recent survey I conducted for *Audio* of seven A/V receivers (December 1992). As it turned out, I could have done with a much less powerful unit. (The Onkyo can deliver 110 watts of continuous power to the front main speakers and 30 watts per channel to the rear/surround units.) Of several possible hookups, I chose to drive the front satellite and the surround speakers directly from the receiver. The

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*Bob Bottman Sensible Sound, Summer 1992*

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A LOT TO THE VERSATILE  
AMPLIFIER IN ITS  
SUBWOOFER MODULE.**

Onkyo's line-level center-channel output was connected to one of the inputs of the subwoofer module, and the center-channel speaker was powered by the amplifiers in the subwoofer—as was the subwoofer itself. Thanks to the high efficiency of all the speaker modules, I never had to turn up the volume control on the receiver beyond about the 11 o'clock setting. The subwoofer's amplifiers have their own volume, bass, and treble controls, all of which are active when the subwoofer is used in the powered mode, as was the case in my installation. One of the advantages of this particular configuration is that for program material demanding extra bass (such as the sound of thunder, planes flying overhead, and the like), the receiver's bass control can be left at its mid-position. This way, there's less possibility of overloading the receiver if its output power is low. Any bass enhancement needed can be obtained by turning up the bass control on the subwoofer module, which can add as much as 8 dB of boost at 50 Hz. If treble enhancement is needed for the center channel, the range is  $\pm 12$  dB at 10 kHz.

The first movie I watched with this system was a LaserDisc of *The Loves of Emma Bardac* (Sony Classical SLV 46 370), which features dual pianists Katia and Marielle Labeque in a series of musical fantasies about the lives and music of Claude Debuss-

*Continued on page 84*



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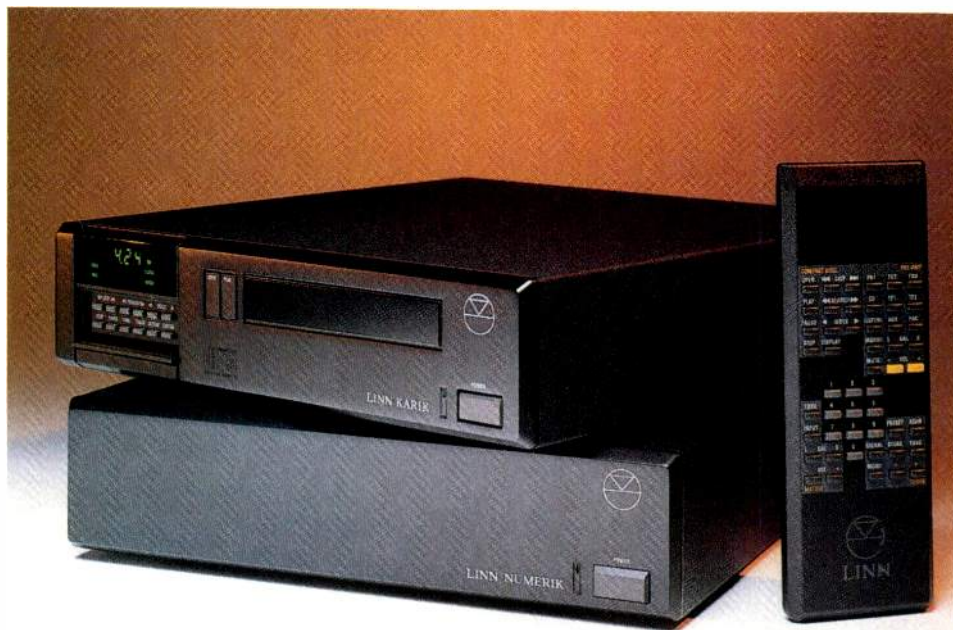
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AUDIO

Stereo Review



## LINN KARIK CD TRANSPORT AND NUMERIK D/A CONVERTER



**A**s many audiophiles know, Linn, based in Glasgow, Scotland, is one of the pioneering firms in high-end audio. In an era when few audiophiles paid attention to the differences between turntables, Linn provided convincing demonstrations that turntables did indeed sound different, and that the differences mattered. The company pioneered in treating the turntable, tonearm, and cartridge as a front-end system, and for many audiophiles, Linn is synonymous with phono.

Company Address: c/o Audiophile Systems, 8709 Castle Park Dr., Indianapolis, Ind. 46256.

For literature, circle No. 94

Linn was also one of the first firms to criticize the sound of early CD players. At a time when CD's flat frequency response, low distortion, and excellent signal-to-noise ratio led many listeners to ignore what was often hard or irritating sound, Linn launched a virtual crusade in defense of what they found to be superior sound from analog records. It also made a commitment that it would not market a CD player until it had developed one that it felt could compete with analog sound.

Now, roughly a decade after the birth of CD, Linn is marketing such a system. It consists of the Karik CD transport and the Numerik D/A converter, and sells for \$5,790, including remote control. Originally, the price was split evenly between the Karik and Numerik, at \$2,895 each. Now, however, the Karik

comes with a built-in, one-bit D/A converter (the circuit that came out second in Linn's tests to the one used in the Numerik) for \$3,395—and with a \$500 credit applicable to the purchase of a Numerik. You can therefore buy the Karik to use as a stand-alone CD player, upgrade by adding the Numerik later, and spend no more than if you had purchased the Numerik and the older Karik. (The Karik I tested did not have the built-in D/A section but is otherwise identical to the new version.) The \$5,790 price tag puts the Linn system in the upper echelon of CD systems, and it is definitely a high-end product with distinctive styling, technology, and sound.

The Linn Karik and Numerik are far more compact than most recent American high-end CD transports and D/A converters. Both units are the size of large books, measuring about 12¾ inches wide × 12½ inches deep × 3⅙ inches high. The two units' total weight is about 23.4 pounds, and they stack conveniently. Both have minimal controls on their front panels, although this apparent simplicity is misleading.

The Karik has a cover over its front-panel controls and an excellent remote that can command an entire Linn system of electronics. The display shows disc number and the user's choice of either elapsed or remaining time for the current track or the entire disc.

The back panel has an unusual mix of output connections. These include a Toslink (EIAJ CP340) fiber-optic jack, a 75-ohm electrical output with BNC connectors, and an RCA sync input jack for connection to the Numerik. (Linn says that the optical jack handles data at a rate of 20 megabits per second, as opposed to the more usual transfer rate of 6 megabits/S in Toslink connections, but recommends the use of the electrical connection.) There is also a diagnostic output connector that allows Linn dealers to use Linn software to do quick computer checks of performance.



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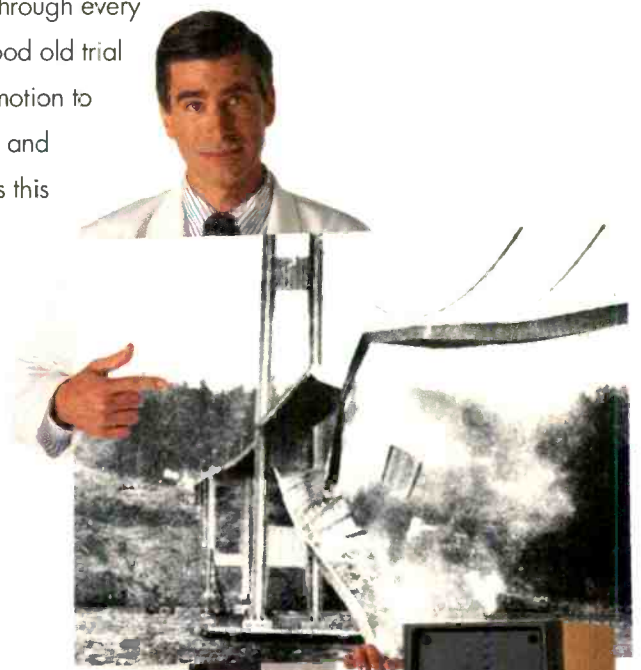
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Linn takes an unusual approach to getting the Karik's master oscillator or clock signal. The transport does include a conventional master oscillator to set the unit's clock, but it is optimized for clock signals from a voltage-controlled oscillator in the Numerik, delivered by the sync jack. This allows the Karik to get its clock signal from a master oscillator near the D/A converters in the Numerik. Linn feels this minimizes the jitter found in some other systems of separate transport and D/A units while keeping the separate units' benefit of greatly improved control over r.f. interference from the digital circuitry.

Unlike many high-end CD decks, the Karik does not use a transport mechanism purchased from an outside company. Linn has designed and made its own four-motor mechanism, the MEKK 001. Using a top clamp, it is one of the quickest and most precise-loading CD transport mechanisms I have ever encountered. It was completely reliable during weeks of testing. I never had a disc jam, fail to load, or skip.

The laser pickup is a Japanese-made three-beam type, mounted on a sled rather than a swing arm. The unit has a sophisticated and carefully regulated power supply. Linn makes a point of the fact that it can be rapidly serviced at a dealer and that the entire transport mechanism can be replaced in 30 minutes. The laser can be replaced in only 15 minutes, and its life is rated at 5,000 hours.

From the front, the Linn Numerik looks like just another black box. There is an off/on switch and a pilot light, and that's it. Once again, however, appearances are deceiving. The Numerik has two coaxial BNC inputs. The first input is automatically selected if it is receiving a signal; otherwise, selection defaults to the second input. A BNC-to-RCA adaptor will allow the use of DAT recorders or other digital sources.

Each of the BNC coaxial inputs has a sync output to allow the clock signal from the Numerik to be fed to the Karik or any other unit designed to accept it. (Though the Karik has an optical output that can be used with other D/A converters, the Numerik has no optical input.) There are also indicator lights on the back panel to allow you to check whether the Numerik is in sync to the Karik, whether a digital signal is locked in, and whether you are receiving a 44.1- or

48-kHz signal. There are two stereo pairs of analog output jacks with a 75-ohm impedance and a rated output of 2.1 V.

While Linn may have analog origins, its D/A converter uses cutting-edge digital devices and circuitry. The Numerik has Burr-Brown DF 1700 digital filters with eight-times oversampling, 25-bit internal word length, and an output word length of 20 bits. The converter chip is the Burr-Brown PCM63P, which is capable of excellent low-level linearity. A fifth-order Bessel output filter is used, and passive de-emphasis is switched by J-FETs. While the unit uses a

**LINN HAS KEPT ITS  
COMMITMENT NOT TO  
MAKE A CD PLAYER  
UNTIL IT COULD MATCH  
ANALOG QUALITY.**

single p.c. board for the signal circuitry, a great deal of attention is paid to grounding and to controlling r.f.

In spite of the Numerik's small size, it has a comparatively sophisticated power supply with a large toroidal transformer and filter capacitors. It has dual full-wave bridge rectifiers, and the analog and digital power is supplied by separate transformer windings. Trim pots allow precise adjustment of the reference voltages to the D/A converters, and each rail for each stage is buffered with an emitter follower.

The inside of the Numerik shows that very careful attention has been given to internal layout and design and parts quality. The Karik and Numerik are built like consumer products, not semi-professional equipment, but construction appeared to be rugged and parts quality was excellent.

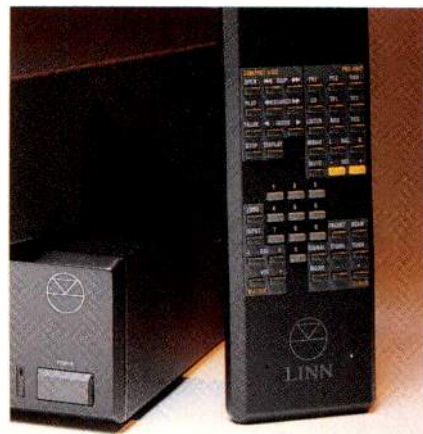
During the last year, high-end CD systems have evolved to the point where listeners no longer experience the kind of breakthroughs in sound quality heard in transports and converters of the first, second, or third CD generations. The best new products still make very real sonic improvements, but the days when demanding audiophiles were feverishly searching for the next "great" combination of transport and D/A converter that would deliver the full promise of CD are long over. You no longer need accept, with such CD benefits

as low noise and flat frequency response, such flaws as problems in handling low-level passages, loss of harmonic detail, poor musicality of the upper octaves, unrealistic dynamics, and nonmusical bass.

The Linn Karik and Numerik do, however, provide a level of sound quality that is very competitive with other top-echelon, high-end digital systems. Low-level resolution is excellent and very realistic. Some other units call the ear's attention to an artificial highlighting of sonic detail rather than to the flow and emotional impact of the music. The Karik and Numerik get very good detail out of even the softest or most complex passages of the latest 20-bit CDs, but they do so in ways that involve the listener in the music.

The bass is tight and detailed, not full or high powered. With a good jazz or classical CD, you will hear all the bass, but you will never hear the Karik and Numerik add bass to a relatively bass-light recording like *Jazz at the Pawnshop* (from Proprius). The transition from bass to lower midrange is very good in terms of detail, with perhaps just a touch of leanness.

The upper midrange and treble are consistent with the sound of the lower octaves, and the Karik/Numerik combination provides an overall response that is very smooth and musical. You do not get the level of detail and dynamic energy you get in the Mark Levinson No. 30 or the Theta



Digital Balanced DS Pro, but you will get very much the kind of smoothness you would hear in a live musical performance. This difference is hard to describe, but it means that the Linn system may appear to sacrifice some information on naturally recorded CDs, such as most Dorian recordings. At the same time, it enhances the mu-



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sicality of most of today's overly bright and close-miked CDs. In fact, if the sound of strings, solo piano and guitar, and the upper brass in some CD players bothers you, the Linn Karik and Numerik may well be your ideal units.

I was also struck by the ability of the Karik and Numerik to place the listener in what seemed to be a realistic listening position. These units produce an overall sound whose timbre, imaging, soundstage, and

**OVERALL RESPONSE IS  
SMOOTH AND MUSICAL,  
WITH PLENTY OF DETAIL  
BUT NO HARSHNESS.**

dynamics bring you very close to the experience of sitting slightly to the rear of center in an older or relatively soft concert hall. The Karik and Numerik have a slight tendency to narrow the image and apparent soundstage and to place the apparent center of the performance slightly behind the speakers. This works very well with smaller musical groups, but it may not be ideal if you want the feeling of sitting in the first six rows near the orchestra or want a wide, dynamic soundstage. At the same time, there was none of the roll-off or almost deliberate softening of detail that I have heard from several mid-priced units having tube output stages.

In saying this, I should stress that these judgments involve matters of nuance. The Karik and Numerik are not euphonic like some high-end CD players and D/A converters that are obviously designed to reproduce the circuit designer's view of what music should sound like rather than what is on the recording. Further, no apparent attempt has been made to make the Karik and Numerik sound like a Linn phono system. What Linn has done is keep the promise it made when it validly criticized the initial sound of CD. The Karik and Numerik are obviously the product of both high technology and a great deal of listening, and they have an outstanding ability to deliver the music. It is this ability to involve you in the music that I regard as their most outstanding feature, and the one I suggest you listen for when you audition these units.

*Anthony H. Cordesman*

*Continued from page 78*

ny, Gabriel Fauré, and Georges Bizet. Sounds were relatively quiet in this somewhat surrealistic telefilm, but the added impact of ambience, especially in the concert scenes, tended to involve me in the music to a degree that I could never experience with an ordinary two-speaker stereo system. The surround speakers, when properly adjusted relative to the main satellites and the subwoofer, did, as promised, offer wide dispersion so that I could not pinpoint their location. That is as it should be. The center-channel speaker kept what little dialog and narration this film contained securely positioned on screen.

The serene scenes of this feature offered little opportunity for the subwoofer to display its capabilities, so I switched to a LaserDisc of the film *Mad Max: Beyond Thunderdome* (Warner Home Video 11519LV). The thunderous background music and special sound effects in this sci-fi flick were reproduced flawlessly by the Atlantic Technology speakers, with sounds around me seeming to add to the size of my 32-inch TV screen. (I've noticed this effect before when viewing blockbuster films on a TV augmented by a properly configured surround system.) Through much of this film there was an underlying rumbling sound that enhanced the tension and excitement of the plot.

Finally, I capped off my viewing and listening experience by playing a LaserDisc of excerpts from such blockbuster films as *Top Gun* and *Star Trek IV: The Voyage Home*. Had I not been aware of the small size of the modules in this system, I would have been ready to swear that I was listening to speakers having far larger cabinets and drivers. The seamless integration by a single manufacturer of all the speakers required for a home theater has paid off in terms of overall audio imaging and in surround sound effects. This 150 system certainly puts to rest the notion that a good home theater installation has to cost \$20,000, \$30,000, or more. Here, for under a thousand dollars, is a six-module system that provides all of the speakers required for a superb home theater setup (though not Dolby Pro-Logic) and also reduces the expenditure that would be needed for extra amplifier channels beyond the normal stereo pair.

*Leonard Feldman*



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# CLASSICAL RECORDINGS

## KARLHEINZ STOCKHAUSEN ..... MICHAELS REISE



**Karlheinz Stockhausen:  
Michaels Reise  
(Michael's Journey)  
Solo Version**

ECM NEW SERIES 437 188-2,  
CD; 49:04

**K**arlheinz Stockhausen is familiar to most of us as a longtime and remarkably radical, as well as illustrious, German avant-garde composer. His massive output more often than not involves complex works within works within still other works, often "in progress," ad infinitum. This "Journey Around the World," with cities named en route, is described as the second act of an opera, *Thursday* (are there operas for Monday, Tuesday, Wednesday?), which in turn comes from a larger mega-work, *Light*, which for all I know may last forever.

Stockhausen crosses every uncrossable line and in doing so, cryptically, manages to produce a kind of forbidding persona, enough to discourage some (and fascinate others). One says, "Oh yes, Stockhausen," and takes a long breath.

When the chaste white CD jewel box fell from the package, I did just that: A single blue cross with circles on the cover and an all black-and-white interior. Designed by Stockhausen, of course. Liner notes by Karlheinz Stockhausen. There are three Stockhausens in the group of performers: The lead character, Michael, is the trumpeter Marcus Stockhausen: Simon Stockhausen plays a synthesizer, and there is Karlheinz Stockhausen himself. No, not as conductor: He is the soundman, "sound projection."

I tell you all this merely to establish a Stockhausen atmosphere. The digital mixdown for the CD was done in Oslo by that well-known audio engineer Karlheinz Stockhausen. The recording director, by the way, was Karlheinz Stockhausen. You get the drift.

All the performers, from basset horn to synthesizer, are required to prance around the stage in costume while playing the music by memory. Wait'll you hear what they have to play. This applies even to the "quasi-concert" touring version recorded here.

Somehow, accounts of Stockhausen's works always seem to come to this! *Before you even begin to listen,*

you are swamped with data, digestible and otherwise.

P.S. So what does the music sound like? Not so bad, if you don't mind some factual obscurities. The CD has no coding whatsoever for the various "stations" or cities around the world on the theoretical journey, so you are lost at once. The track indicator never moves from No. 1, nor does the sound really pause. The opening is 15 seconds of silence; just as I was about to check my equipment, the music began with a barnyard full of huge grunting pigs, oinky and basso. Okay—good sonics! Then Michael appears with a few notes of high trumpet and a wah-wah *miaow*. Cute. Long-held tones, extended by endless reverb, follow the trumpet. The sound gets more complex and more interesting, I admit. There are all sorts of flutters, tweaks, shivers, grunts, mostly out of the "live" instruments, not electronic. Don't worry about the meaning, just listen. Through the colorful din you occasionally hear a distant, very angry voice, a German lady apparently hissing out curses.

Marcus S., the hero Michael, has the makings of a jazz horn in him. Did Papa write the jazz, or did Michael just improvise it?

So the piece rises to an enormously complex climax of colorful sounds, then very slowly fades down to a quiet ending after 40:00. Apparently we have been around the world. Who would ever guess?

*Edward Tatnall Canby*

Illustration: Rick Tulka



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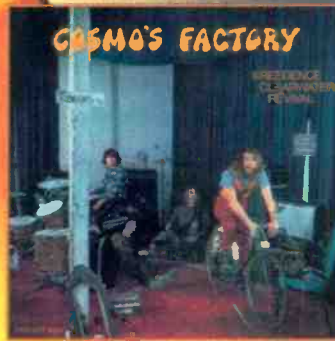


### PAUL McCARTNEY & Wings:

#### Band on The Run

CD: GZS-1030

Considered to be McCartney's greatest album, *Band On the Run* really put Paul on the map, establishing him as the most popular solo Beatle. It features the title track, *Band On The Run* plus *Jet*, *Bluebird*, *Let Me Roll It*, *Helen Wheels* and many more.



### CREEDENCE CLEARWATER REVIVAL:

#### Cosmo's Factory

CD: GZS-1031

This landmark album released in 1970 was their best selling. It yielded 3 top ten Double-Sided Singles. It features *I Heard It Through The Grapevine*, *Travelin' Band*, *Who'll Stop The Rain*, *Up Around The Bend*, *Run Through The Jungle*, *Lookin' Out My Back Door* and *Long As I Can See The Light*.

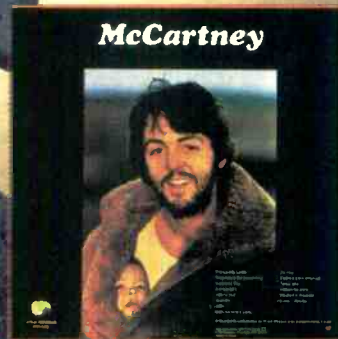


### BOB SEGER & The Silver Bullet Band:

#### Night Moves

CD: GZS-1028

*Night Moves* was originally released in 1976. This multi-million selling album features the famous *Night Moves* plus several of the now standard favorites such as *Rock And Roll Never Forgets*, *The Fire Down Below*, *Mainstreet*, and *Mary Lou*.



### PAUL McCARTNEY: McCartney

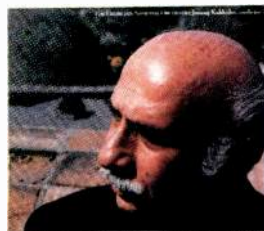
CD: GZS-1029

Recorded when Paul was still a Beatle, this album was released early in 1970 and shot to #1 on the charts. Featuring classic tracks such as *Maybe I'm Amazed*, *Ever Night* and *Teddy Boy*, this album will make an historic gold release.

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**GIYA KANCHELI****Giya Kancheli:****Symphonies Nos. 4 and 5**

*Georgian National Orchestra,  
Jansug Kakhidze*

ELEKTRA NONESUCH 79290-2,  
CD; 51:42

Although recorded by Melodiya in Georgia in 1978, the appearance of these works now is surely due to the major changes in Russia and Georgia. Giya Kancheli sees himself as a composer of sacred music—serving truth, good, and honesty

against the society of lies in which his people have lived (and continue to live in many ways).

Kancheli's longtime desire to protest the evils that have always existed takes the musical form of extreme dynamic contrasts. He says such loud and soft contrasts are also found in the scores of Beethoven, Schubert, and others, but they are seldom performed that way. The opening of his Fourth Symphony, for example, is guaranteed to get any audience's full attention. The Fifth (dedicated to Kancheli's parents) opens with an innocent-sounding, plodding little harpsichord melody that is shortly crushed by the high-decibel iron boot of a brassy orchestral onslaught. Very slow tempos are another attribute of these works—

both marked "Largo." Kancheli refers to "dynamic stasis," where the music seems to be standing still, yet is moving.

The influences of Dmitri Shostakovich and of Orthodox church singing are heard here. Bell-like sounds frequently appear. The quite-quotable Kancheli states that he thinks you have to equally love tradition and despise it.

These are undoubtedly important, very moving, and sonically brilliant modern symphonies that shouldn't have cooled their heels in Melodiya's vaults for 15 or so years, but now we have them to appreciate. The analog tapes are free of the excessive artificial reverb most Soviet orchestral recordings of this period exhibit.

*John Sunier*

**Giya Kancheli sees himself as a composer of sacred music—serving truth, good, and honesty against the society of lies in which his people have lived.**

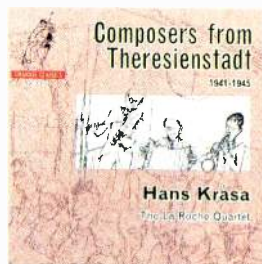
### Composers from Theresienstadt, 1941-1945

Pavel Haas: Four Songs to Texts  
of Chinese Poetry

Karel Berman: Four Songs for Bass  
and Piano; Suite for Piano Solo,  
1939-1945

*Karel Berman, bass; Alfréd Holočák,  
piano; Prémysl Charvát, piano*  
CHANNEL CLASSICS CCS 3191,  
CD; 48:20

Hans Krása: Quartet; Tanz;  
Three Songs for Baritone,  
Clarinet, Viola, and Cello; Theme  
with Variations for String Quartet  
*La Roche Quartet; Klemens Słowiozek,  
baritone; Ivar Berix, clarinet*  
CHANNEL CLASSICS CCS 3792,  
CD; 42:52



These are two more of the planned six volumes of *Composers from Theresienstadt, 1941-1945*. This series is dedicated to the unique creative spirit of composers incarcerated in the Nazi concentration camp during the Holocaust. Theresienstadt was a deception to mask the existence of the gas chambers with a so-called "Paradise Ghetto" for the Jews, where many of Europe's most gifted musicians, artists, and writers made up an active cultural community. (The first of the CDs presented music by Gideon Klein and Viktor Ullmann.)

Unlike most of the other composers, Karel Berman survived the camp he had entered at 23 years of age, and he even lived to make this 1985 recording of both his song cycle and one by his former campmate Pavel Haas. (Berman retired in 1991 as professor at the Prague Academy of Music.) Both cycles are sung in Czech.

Haas' setting of Chinese poems expresses in subtle fashion the mood of the inhabitants at the concerts—while bypassing the Nazi censorship of their cultural activities.

Since Theresienstadt, Berman made changes in his Suite for Piano, 1939-1945,

which is now undisguised in its horror due to new titles and the addition of sections more graphically reflecting the composer's life. Some of the eight movements are optimistic, such as Youth and Family-Home, but Factory-Germany has the machine feeling of Mosolov's Iron Foundry, and Corpse Factory and Typhus are two of the most shocking subjects for piano pieces in the history of music. The suite ends in a major key with the movement New Life.

The Hans Krása CD is even more of a testament to the courage of these musicians because of the scintillating humor that pervades this Czech composer's music. He admired contemporary French composers as well as Stravinsky, Bartók, Janáček, and the Schoenberg school. Koussevitzky even conducted one of his symphonies in 1926 in Boston. The string quartet piece on this disc shows some of these influences, yet is fresh-sounding and full of irony and humor. The Three Songs use texts by Arthur Rimbaud, as Krása broke away from his former German literary ties. Tanz (Dance) is a joyous piece for string trio, its brevity illustrating another of Krása's laudable characteristics.

The Krása disc is an all-digital production, unlike the Haas/Berman 1985 session, but all Channel Classics releases boast the highest sonic standards.

*John Sunier*



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**Lou Harrison: Concerto for Violin and Percussion Orchestra; Concerto for Organ with Percussion Orchestra**  
*Eudice Shapiro, violin; David Craighead, organ; Los Angeles Percussion Ensemble, William Kraft, conductor*  
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While studying with innovative composer/teacher Henry Cowell, Lou Harrison became intrigued with unusual musical sounds. Unlike fellow student John Cage, Harrison pursued this interest in his many works while retaining traditional structure and tonality. Because of this approach, he was snubbed by the academic world of serial music, but this also opens a renewed accessibility to his music today.

A variety of unusual items—auto brake drums, washtubs, coffee cans, and flower pots—are incorporated as instruments into the standard percussion orchestra, but both concertos are attractive and often lyrical works. The influence of world music can be heard in the single-line violin melody accompanied by rhythmic percussion, as in East Indian music. In the tone-colorful organ concerto, Harrison bridged the organ's sustaining tone to the percussion's unspecific pitches by adding an intermediate group of fixed-pitch instruments including piano, vibes, celeste, and chimes made from large gas cylinders.

*John Sunier*

**Tuba! A Six-Tuba Musical Romp**

*Gerhard Meinl's Tuba Sextet*  
 ANGEL CDC 7 54729 2

This many-tuba-ed splendor is a smooth blend of top virtuosi on their ungainly instruments in a wonderfully varied program that is captured in terrific sonics. The producer was Gerhard Meinl, fourth-gen-

eration scion of a German tuba-manufacturing family.

As with many other similar-instrument groups, the listener often is amazed by not only the pitch ranges possible but also the tremendous variety of music that can be successfully performed. It includes transcriptions of Mozart, Bach, and Gabrieli plus several originals. Enrique Crespo re-



versed the tubas' normal part in a Bruckner symphony, as his Bruckner Etude tries to accommodate the whole orchestra's sound in the six tubas. The program ends with what you'd probably expect from tubas—two traditional Bavarian polkas.

*John Sunier*

**Telemann: Six Quartets for Flute, Oboe, Bass, and Basso Continuo; Quartet in D Minor from Tafelmusik II**

*European Baroque Soloists*  
 DENON 81757 9613-2, CD; 59:03

**Telemann: Suite in B Minor for Flute, Oboe, Bassoon, and Basso Continuo; Concerto for Flute, Oboe d'Amore, and Basso Continuo;**

**Six Canonic Sonatas for Flute and Oboe, Op. 5**  
*European Baroque Soloists*  
 DENON 81757 9614-2, CD; 43:57



If you are into the baroque sound, as many of us (still) are in spite of Mozart, which do you choose, Vivaldi or Telemann? These were the two leading titans of the early 18th century, both far better known than old Bach and, one must add, much more prolific. Enormous quantities of music! And both composers' works just as competently written as Bach's too, with immense profes-

sional expertise, but not with Bach's penetration into the depths and heights of human emotion. Instead, both had a wary eye for sheer, polished entertainment. That is why we like them today in recorded form; the "entertainment" includes ideal sonics for the recorded medium, which indeed is why baroque has been so popular.

Most late baroque music was easily interchangeable, with expert minor modifications, as between a host of different instruments of the moment. That, too, works very nicely for this present-day ensemble, which just happens to feature a pleasant contrast of solo sounds from flute, oboe, violin, viola da gamba, oboe d'amore, and continuo with harpsichord plus the big violone, alternative to the double bass or bass viol. It's all lovely music, colorful and expressive if not ultra-profound—what more do you want? Including a preposterous solo bit for the violone, dancing like an elephant. Even the two-part canons have the same genial, big, expressive impact. They are technical masterpieces, but they don't sound it at all (as Johann Sebastian's always do!).

The Telemann sound, then, is richer than Vivaldi, if less sturdy. This music is certainly something to try if the thought appeals.

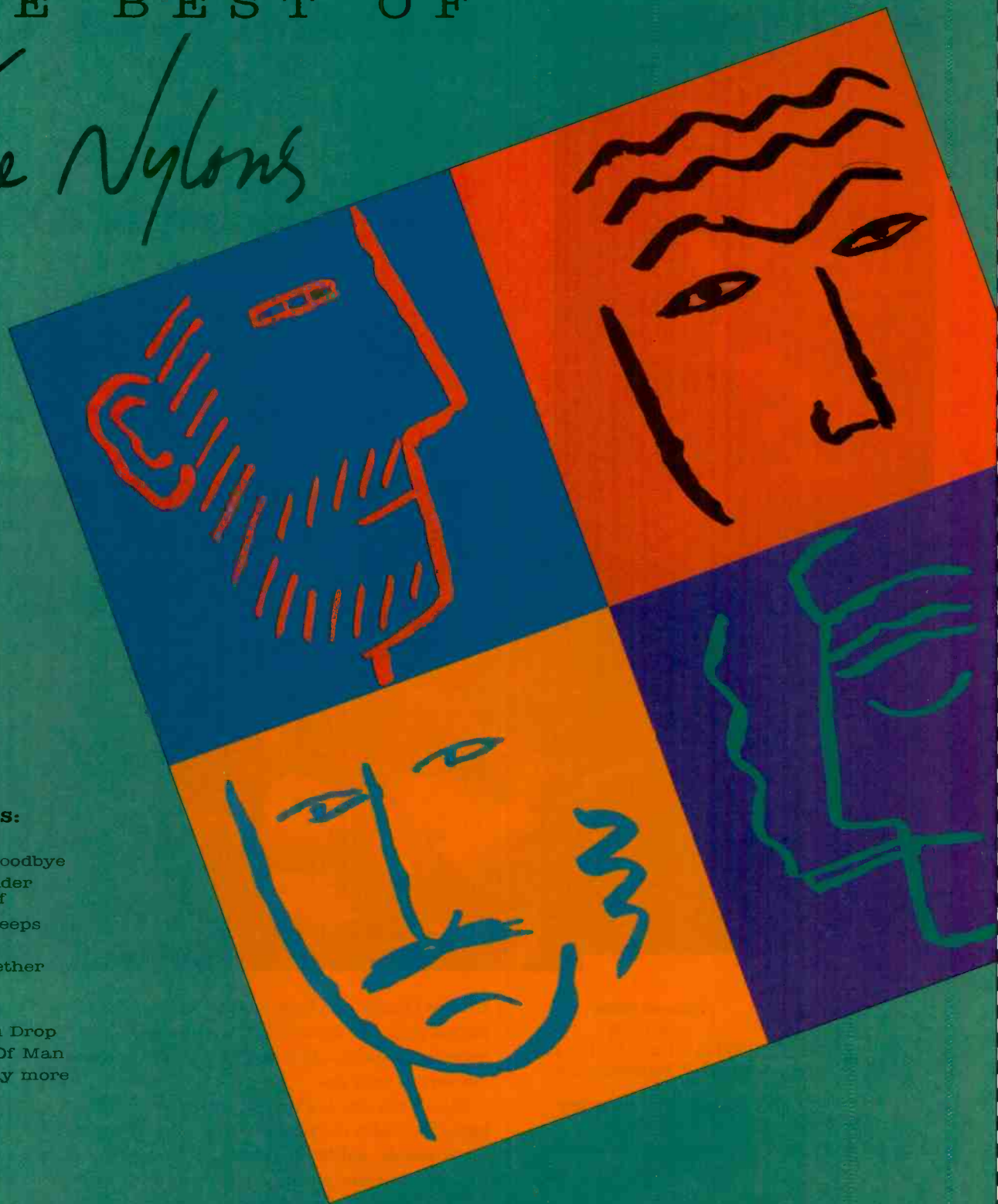
*Edward Tatnall Canby*

**Although Telemann composed with great expertise, he also had an eye for sheer, polished entertainment.**



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# ROCK ~ POP RECORDINGS

## NEIL YOUNG HARVEST MOON

.....

## BOB DYLAN GOOD AS I BEEN TO YOU



### Harvest Moon

Neil Young

REPRISE 9 45057-2, CD; 51:59

Sound: B, Performance: A-

### Good As I Been to You

Bob Dylan

COLUMBIA CK 53200, CD; 55:32

Sound: B, Performance: B+

**S**omehow, coincidentally, Neil Young and Bob Dylan have come full circle at the same time. On *Harvest Moon*, Young returns to the personnel and vocabulary of *Harvest*, his biggest success and arguably his definitive statement, while on

*Good As I Been to You*, Dylan revisits the solo guitar and harmonica, playing as he did on his very first album just over 30 years ago.

Dylan's new one is a lark, an album of one-takes of traditional folk songs, ballads, and blues. The biggest surprise is how good a guitarist Bob is, especially on blues like "Step It Up and Go" and "Sittin' on Top of the World." His singing is another pleasant surprise, as he actually hews closely to the melodies—something he has been loath to do, particularly in recent live performances. On richly detailed ballads like "Jim

Jones," "Canadee-I-O," and "Arthur McBride," his voice is disarmingly tender and moving.

As always, Young is a bit thornier. *Harvest Moon* reunites him with The Stray Gators, who played with him on *Harvest* and sporadically since. As is the rule on Young's country-flavored albums, lyrics predominate over guitar riffs, tight songwriting over extended soloing. Vocal harmonies by Linda Ronstadt, James Taylor, Nicolette Larson, Astrid Young, Ben Keith, and Larry Cragg in varying combinations play pivotal roles throughout.

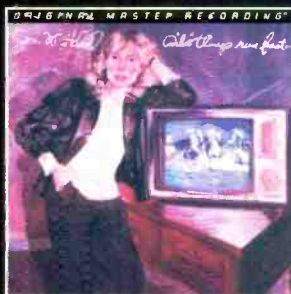
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The album's opener, "Unknown Legend," sets the tone and pace in a portrait of a small-town waitress who's had her good times and now has two kids to show for them. The song's leisurely tempo, sparse instrumentation, and Ronstadt/Keith harmonies mark it as vintage Young. "From Hank to Hendrix" is a plea to a love that's on the road to "divorce California style." It is desperate, a bit confused, and lonesome. "You and Me" is also sad, its melody a close cousin to that of "Old Man," with Neil and Nicolette backed only by Young's acoustic guitar. "Harvest Moon" is gentle and cheerier—thankfully so at this point. It's an invitation to a soft, slow dance,

something Vince Gill or Patty Loveless could make into a big country hit. "War of Man" is the album's anti-war preacher, an eloquent one with another familiar melody, this time recalling both "Heart of Gold" and "Words."

"Dreamin' Man" is where Young confronts the toll of *Harvest Moon's* introspection, recognizing it as valid and necessary. It's a kind of "clearing of the decks" for the album's finale, "Natural Beauty." This last song is part concert performance, part studio recording, seamlessly interwoven. Larson's haunting harmonies, Kenny Buttrey's striking percussion, Spooner Oldham's eerie marimbas and pipe organ, and

sounds of a rain forest converge in this moving song about greed and nature in opposition. Its 10 minutes float by effortlessly.

While the Dylan recording couldn't be more basic, *Harvest Moon's* mixes are simple and subtle, failing only with the grand string arrangement on "Such a Woman." What makes both of these albums so valuable, however, is the grace brought to bear by the artists. Each in different ways is trying to make peace in public, with his own history. Fittingly, each seems to reach some sort of personal rapprochement that we as listeners and fans should feel lucky to witness.

Michael Tearson



**Floored Genius:  
The Best of Julian Cope  
and The Teardrop Explodes  
1979-91**

*Julian Cope/The Teardrop Explodes*  
ISLAND 314-512 788-2, CD; 78:07  
Sound: A-, Presentation: A

**Jehovahkill**

*Julian Cope*  
ISLAND 314-514 052-2, CD; 70:18  
Sound: A, Performance: A-

Who is Julian Cope? You may well ask. Despite making a splash 14 years ago with *The Teardrop Explodes* and subsequently releasing eight solo albums, Cope remains a

mousehole word. Of course, a scarcity of hits, a gap or two between albums, infrequent tours, indulgent trips ("Out of My Mind on Dope & Speed" goes an old song), and nutty musical/personal behavior ("out of his tree" echo some observers, as reported by his liner-note biographer) all have a way of limiting one's acclaim to a cult. But if you're concerned by the prospect of Elvis Costello crooning in front of a string quartet, it's time you met Julian and rediscovered how it feels to be provoked by rock.

In fact, with the CD release of 2½ hours of new and retrospective material, there's never been a better time for Copious submersion. Wade in with *Floored Genius*, a brilliant chronology of 20 tracks. The range of pop—infectious ("Sunsports"), artful ("Charlotte Anne"), and fully hard ("World Shut Your Mouth")—will drop your jaw before you're finally left awash in "Safesurfer," the guitar extravaganza from *Peggy Suicide*.

That 1991 album, named for Cope's vision of Mother Earth, was a panoramic view of the world and its troubles. Now, in a profound lament over the loss of Mother as an elemental influence and the loss of woman as a balance for the male self,

Cope turns severely inward on the fascinating *Jehovahkill*. Attacking the authority of Christian doctrine and imagery, he points specifically to the cross, a shape he means to reclaim for all mankind in "Akhenaten": "This is the lesson I've learned/I'm not afraid of the cross/And now whenever the sun shines/I stretch my arms way out." Ah but bless him, he still can mock himself later on: "She walks up to me, makes the sign of the cross/She says, 'Julian H. Cope, you're a real dead loss.'"

After the album's forbidding first part, which culminates in the primal therapy of "Know (Cut My Friend Down)" ("Please, get my ass back to the egg"), Cope travels through warped tunes ("Slow Rider," "Fa-Fa-Fa-Fine"), drum machines along the dancefloor ("Poet Is Priest . . ."), and a glorious rock cry ("Fear Loves This Place"). This leads to "The Tower," Cope's epic of being born "in a prehistoric time, beside a sacred shrine," where he becomes "an accepted elder of a female tribe" before succumbing to the "war of the genders." Paranoid whispers, distant howls, seductive bass lines, rough acoustic/electric climaxes—refreshing audacity—this is Julian Cope. Which is where we came in.

Ken Richardson

**It's time you met Julian and rediscovered how it feels to be provoked by rock.**



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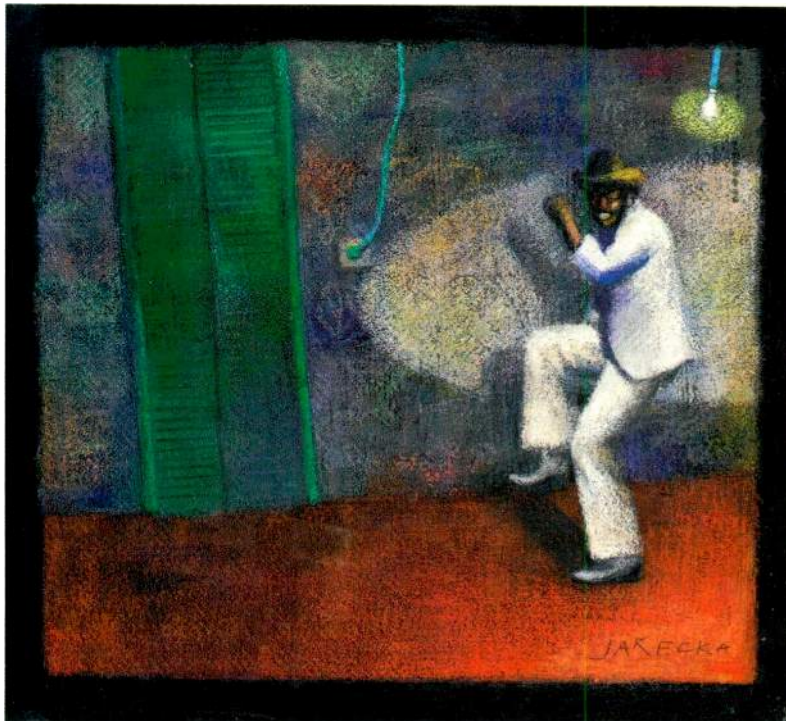
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# JAZZ ~ BLUES RECORDINGS

## DEEP BLUES VARIOUS ARTISTS



### Deep Blues

Various Artists  
ATLANTIC 7 82450-2  
CD; 73:51

Sound: B+, Performance: B+

Successful musicians always seem to find unique ways to honor their inspirations. If you're Dave Stewart, formerly of the pop group Eurythmics, you launch a record label (Anxious) with a CD and a movie that strive to capture the blues of the Mississippi Delta.

Stewart wisely enlisted the aid of writer/musicologist Robert Palmer, who showed his love of the music in his insightful book *Deep Blues*. Stewart gave Palmer use of a 24-track analog mobile studio, Stewart's own state-of-the-art studio for mixing, a generous budget, and a quest: Find the "real" blues. Palmer's jour-

ney is a high-tech equivalent of the field trips made by record companies in the late '20s to record local heroes. The *Deep Blues* CD is the soundtrack to the filmed chronicle of Palmer's trip.

You can easily take issue with Palmer's key theory: The real blues can only be found when musicians perform for their friends and neighbors. He's right, though, when he claims that live performances are a breed apart from studio work. Given the right setting, the flow of energy between artist and audience can become a communal experience hard to find outside church.

The album is balanced between live solo acoustic and band performances. The music is not that different from that heard in blues clubs around the country. Radio and records have linked all bluesmen since

the '20s. If *Deep Blues* is short on innovation, it's long on the passion and commitment that are central to the blues.

David "Junior" Kimbrough's "Jr. Blues" best illustrates Palmer's point. Once guitarist Kimbrough and his band hit a groove in this brooding, loosely structured song, he and his responsive audience jointly decide where it will lead. You can't imagine an identical performance the next night.

Lonnie Pitchford delivers stirring interpretations of two Robert Johnson classics. Roosevelt "Booba" Barnes and band knock out an energetic reworking of Little Milton's "Heartbroken Man." Big Jack Johnson and Frank Frost, long-time partners in local favorites The Jelly Roll Kings, split four tracks between them.

This album will probably make little difference in the lives of these bluesmen and women. Yet *Deep Blues*, with Anxious' wide distribution through Atlantic Records, should spread the message that the blues is alive and well in its heartland. Dave Stewart's done the right thing.

Roy Greenberg



### Give Me Time

Magic Sam  
DELMARK DD-654

Time ran out for bluesman Magic Sam on December 1, 1969, when he was felled by a heart attack at the age of 32. His influence far exceeds his small recorded output. Everyone from Son Seals to Robert Cray owes him a debt. The classic *West Side Soul* (Delmark DD-615) is the best introduction to his powerhouse guitar.

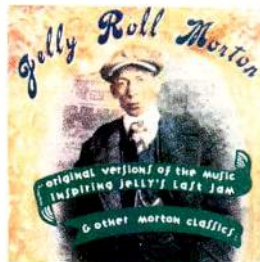
*Give Me Time* was casually re-

Illustration: Danuta Jarecka



corded by a friend in Sam's living room in January 1968, as the relaxed performer entertained friends and family with his electric guitar. The recording quality is mediocre, background noises interrupt sporadically, and the material is familiar, but Sam's sheer artistry is overwhelming. Maybe he just never knew how to give less than his best. His distinctive, soaring vocals are as warm and strong as ever, while his intensity rivals that of such gifted street-corner performers as Ted Hawkins. These haunting sides explain once again why he'll always be a legend among blues fans.

Roy Greenberg



**Original Versions  
of the Music Inspiring  
Jelly's Last Jam  
& Other Morton Classics**  
Jelly Roll Morton  
BLUEBIRD/RCA 66103-2

Due to the popularity of the Broadway musical *Jelly's Last Jam*, Morton's music is suddenly mainstream stuff. Yet unlike the original cast album, this collection of 18 classic songs lets us hear the breakthroughs in jazz composition that Morton spearheaded some 70 years ago.

The tracks date from 1926 through 1930 and are drawn from the Orrin Keepnews-produced three-CD Bluebird boxed set of two years ago, using the NoNoise process to freshen up the sonics. For those not jazz historians, the single CD is preferable since it omits the multiple takes of the boxed set.

John Sunier

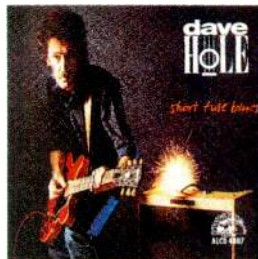
**To Bird with Love**  
Dizzy Gillespie  
TELARC CD-83316

For Dizzy's 75th birthday celebration, Telarc recorded the maestro at New York's Blue Note, accompanied by some of the many players whom he has nurtured and influenced, as he paid tribute to Charlie Parker and their co-invention: Be-bop.



A partial list of participants includes Benny Golson, Clifford Jordan, Paquito D'Rivera, Jackie McLean, Antonio Hart, and George Mraz. Bobby McFerrin was only an audience member, but when the mike was handed to him during "Oo Pa Pa Da," he brilliantly continued Diz's clowning scat vocal. Pianist Danilo Perez is a standout through all five major tracks, which include "Billie's Bounce," "Ornithology," and "Anthropology." Diz may not emphasize the stratospheric notes of his youth, but he still swings madly, communicating as much joyous glee as ever.

John Sunier



**Short Fuse Blues**  
Dave Hole  
ALLIGATOR ALCD 4807

When Chicago's Alligator Records signs its first foreign act, you can bet it's somebody special. Dave Hole never got the message in his native Australia that slide guitar blues-rock has gone out of fashion. So on cut after cut he chooses raw energy over subtlety, and swings for the rafters with flamboyant licks that stop just short of overkill. Hole's frenzied electric slide is caught in a time warp somewhere between the original Allman Brothers and early Rory Gallagher. If at times he seems more intent on creating a joyous racket than delivering a song, take it as a nod to the spirit of Hound Dog Taylor. *Short Fuse Blues* is pure Dave Hole and band without compromise. The album was originally produced for and released on his own label. Hole is a contender. Miss this one at your own risk.

Roy Greenberg

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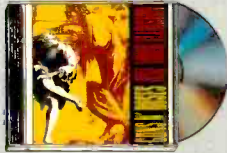
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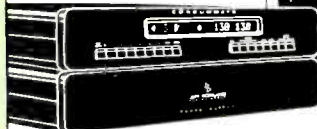
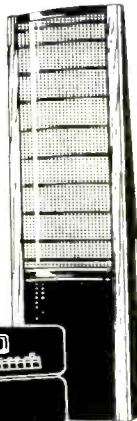
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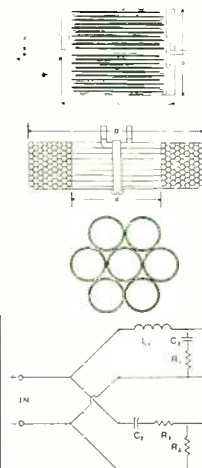
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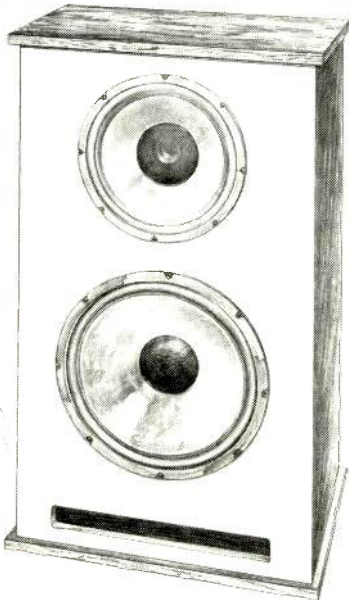
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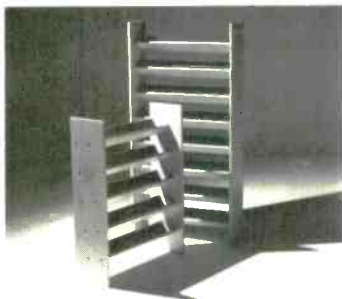
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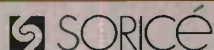
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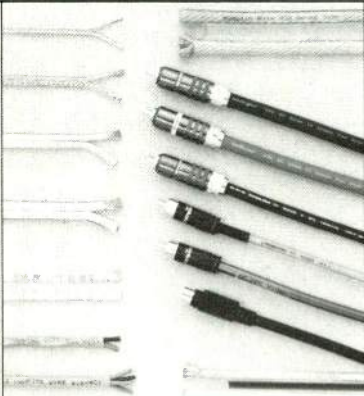
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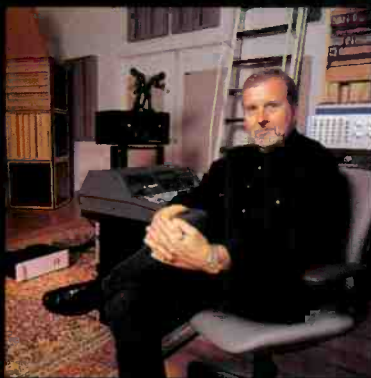
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