

The  
Authoritative  
Magazine  
About  
High Fidelity

# Audio

APRIL 1983 • \$1.75 • © 06030

**FANTASTIC RUSSIAN  
ONE-BRAND SYSTEM**

**SONY'S NEW 701  
PCM PROCESSOR**  
**DIGITAL COMES HOME**

**HI-FI FURNITURE**  
**A CABINETMAKER'S  
COMPARISON**

TELEPHONE  
**HI-FI CENTER**  
SHIPPING  
**MODEL 6010-CP**

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MR FRED B MAXWELL  
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**YOU'LL FOREVER WONDER,**

**IS IT LIVE,  
OR IS IT  
MEMOREX**





# Audio

APRIL 1983

VOL. 67, NO. 4



**PLUG IN  
THE #1  
CARTRIDGE!**

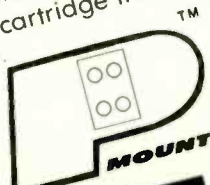


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P-MOUNT  
PHONO  
CARTRIDGES.**

A Shure P-Mount phono cartridge is the proven, easy way to upgrade the performance of any linear tracking or conventional turntable with a direct plug-in connection system.

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

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# HOW CAN SANSUI CLAIM THE D-970 IMPROVES EVERY TAPE YOU'LL EVER MAKE? SIMPLE. ITS HI-TECH FEATURES INCLUDE COMPU-TREC.

Sansui's remarkably innovative approach to microcomputer technology is the reason Sansui cassette decks have an unfair advantage over other cassette decks.

Sansui's new top-of-the-line D-970 full-logic cassette deck proves it conclusively.

### Compu-Trec fine tunes for best performance.

With its Compu-Trec microcomputer system, the D-970 automatically fine tunes itself for correct bias, recording level and equalization, for optimum high level performance from any tape on the market. And it does it in less than five seconds. That's faster than any other deck.

### Sansui's hi-tech features put more pleasure in recording.

As the most advanced deck Sansui has ever produced, the D-970 is packed

with features and refinements that let you transfer every nuance of sound onto tape — and actually monitor it while you're recording. The unique combination of the precision,



coreless FG-servo direct-drive capstan motor and the Dyna-Scrape filter with Hold-Back Tension servo, glides the tape smoothly over the three high-performance heads.

The result is 0.025% wow and flutter — less than the most expensive deck in the world. And Dolby C/B noise reduction is responsible for a superb 81dB signal-to-noise ratio. There's also a Dual Memory for repeat play on any section of

tape; a 4-digit counter that's also a timer and a real-time clock; 12 LED peak meters; and audio record mute. Sansui has made high-performance recording completely effortless.

### Great Sansui decks with the uncommon in common.

There's a lot of the precision and operating convenience of the D-970 in every cassette deck Sansui makes. So regardless which you choose, you're assured superb recordings every time — automatically.

Audition them all at your Sansui audio specialist, or write for full details today.



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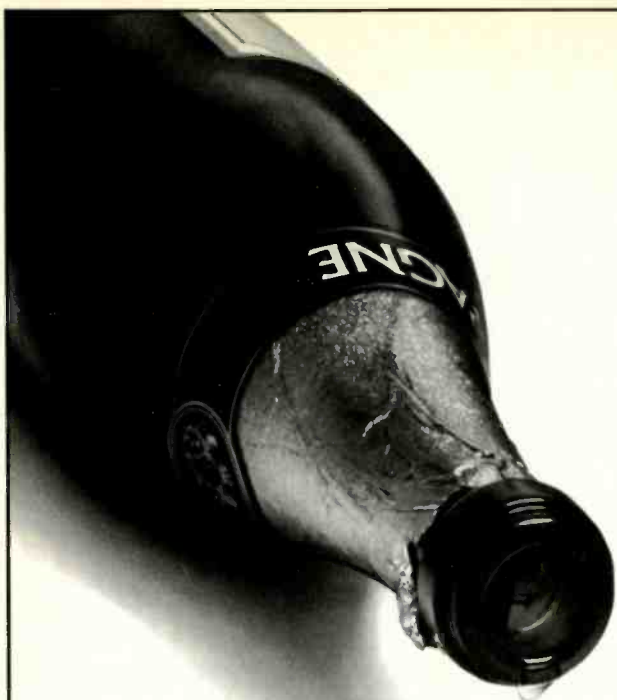
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Putting more pleasure in sound



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## No hangover!

Hangover—a rather loose term to describe the stored energy resonance in a loudspeaker, the principal cause of coloration that immediately tells you you're listening to a loudspeaker.

Take it away and there's a new world—the loudspeakers have nothing more to say—instead there's just the orchestra and the magic of the music.

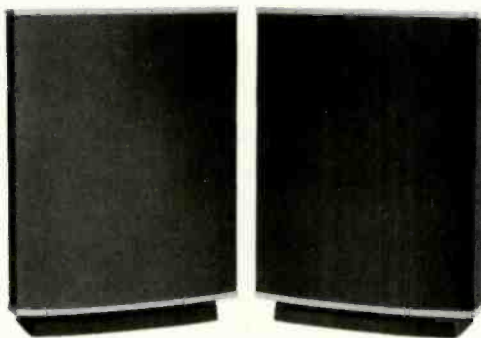
If music is an important part of your life, then a pair of ESL-63 loudspeakers could be the best investment you've ever made.



Perhaps even something to celebrate about.

For further details and the name and address of your nearest QUAD ESL-63 retailer, write: QUAD, 425 Sherman Avenue, Palo Alto, CA 94306.

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(212) 719-6337  
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# Achieve Mitsubishi in Tredia. The sedan that conquered time and space.

It's here. A sedan that has it all. Room and comfort. And performance, too.

The Mitsubishi Tredia.

Let's talk about space and comfort. Tredia gives you a surprising amount of room. Enough for five people. Tredia has front-wheel drive. And the transverse-mounted engine means there's more interior room to stretch out and relax. Tredia also offers a unique U-shaped rear suspension system that allows more rear leg room than you'd expect in a car this size. That same suspension system allows Tredia to have a generous trunk with almost 10 cubic feet of space.

Tredia gives you the kind of road-handling and quickness usually associated with more expensive European touring cars. It has a



Tredia L Instrumentation.

highly advanced fully independent suspension system. Up front, MacPherson struts provide handling and agility. In the rear, the U-shaped suspension system helps reduce roll and puts maximum tire tread on the road for better handling and a smoother ride.

The Tredia L and LS come with a 4+4 Transmission that gives you a choice of two driving modes.

There's also an ELC Automatic Transmission for the smooth crowd.



Tredia L Interior.

And then you have Tredia's engine.

A 1.8 liter, 4-cylinder, MCA-Jet engine. It may be a four but it feels more like a six, thanks to a Mitsubishi Motors innovation called Dual Engine Stabilizers that helps smooth out the vibrations usually found in 4-cylinder engines.

Tredia offers exceptional value. It comes in three models. The Tredia, the Tredia L (Luxury) and the Tredia LS (Luxury Sport).



Tredia L. Shown with optional wheels. \$250 extra.

It's just a question of how plush a life you want to live.

Test drive one and see if it doesn't give you that performance sedan feeling you've missed until now.

Call (800) 447-4700 for the Mitsubishi Motors Dealer nearest you. In Illinois, call (800) 322-4400.

**\$7,259\***  
**TREDIA L**

\*Manufacturer's suggested retail price for Tredia L. Actual prices set by dealers. Taxes, license, freight, options and other dealer charges extra. Prices may change without notice. Availability at dealers of vehicles with specific features may vary.

**24/24  
WARRANTY**

Under its 1983 Limited Warranty, Mitsubishi Motors will replace or repair most components of the Power Train, which prove to be defective, for 24 months or 24,000 miles, whichever comes first. See your Mitsubishi Motors Dealer for details.

**Mitsubishi  
takes you where  
you've never  
been before.**





## AMBIENCE CHASING

Joe Lesly has been an advertising and public relations executive in audio and related fields for years, and he's gained a unique perspective on the industry. Now, in conjunction with a think tank whose previous successes include quadraphonics and the El-caset, he's developed new recording and related processes which step in where companies like Angel fear to tread.

Lesly reports that he is now negotiating with Professor I. Lirpa over East European rights to these startling innovations. "The chief remaining problems," according to Lesly, "are the ruble exchange rate, redoing our logos in the Cyrillic alphabet, and settling Russian claims to have invented our systems first."

the sonic sense of being home. The HTS tape label will offer your favorite music mixed with the sonic background you're used to (cows, car horns, lawn mowers), an excellent aid to the homesick. For quiet rural backgrounds when you're in the noisy city, just turn the silence up louder.

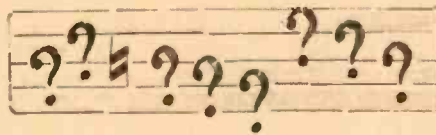
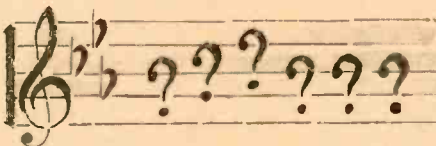
### The Minus Maestro System

An integrated system of components and special tapes (recorded from the conductor's vantage point) for those who like to conduct orchestras at home. When its podium is unoccupied, the system plays only the sounds of tuning up, plus audience rustles from the rear speakers. When you mount the podium, the orchestra is quiet, and applause is heard from the rear. A foot switch fades out the applause and starts the music. Laser



### Selective Hypno-Psychoacoustics

Ever wish you could recapture the thrill of hearing Beethoven's Fifth for the first time? Now you can. SHP group training will teach you to unlearn any music you've ever heard, to

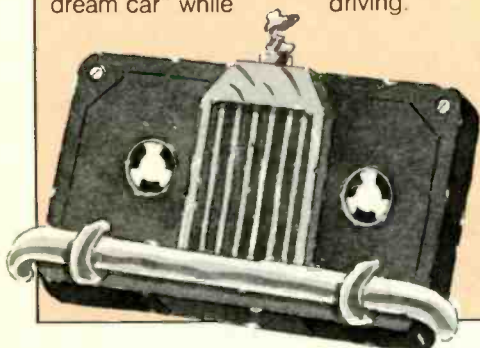


### Concert Seat Recordings

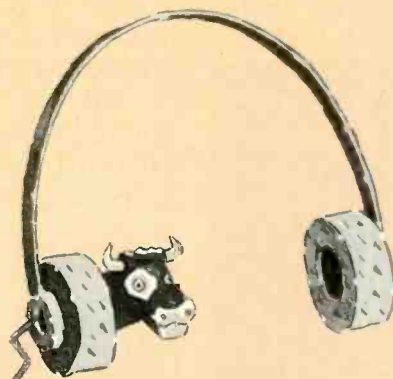
Today's records bring concert-hall realism only to those affluent enough to afford center-orchestra seats. On Lesly's CSR label, other listeners will be able to match *their* concert-hall experiences with recordings made from *their* location in the hall, be it even the far left corner of the upper balcony. This is the first use of advanced multi-track techniques (three 48-track recorders, slaved together) in live concert recording.

### Ego-Trip Tapes

On the ETT label, Lesly will produce prerecorded cassettes "with the authentic sonic backgrounds of such prestige cars as the Rolls, Mercedes or Maserati," so any car owner will be able to "enjoy the sound of his or her dream car" while driving.

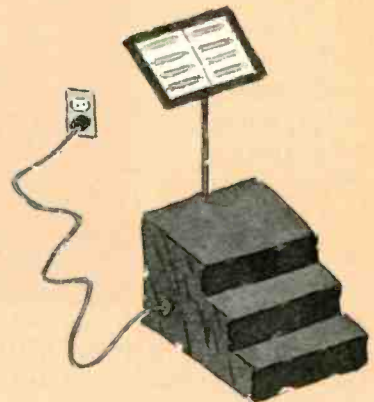


recapture the freshness of first hearing it. Be sure, however, to write down the names of what you are unlearning before you start the course; otherwise, you may not remember what you wanted to re-hear.



### Home-Town Sound

If you're used to walking around town with headphones on, you can already half-duplicate that experience when you're away by taking your tapes and player along. The missing half is the background ambience that leaks in through your headphones,



scanners in the podium "read" the maestro's hand movements, adjusting tempo, tonality, level and timing of the music as it plays.

### Late Lirpa Flashes

Lirpa Labs has just announced a unique acoustic oscillator and a digital record.

The oscillator is an acoustical resonator with a capacity of 32 ounces, excited by air flow over its mouth. Frequency is regulated by adjusting fluid-content level using frequency-calibrated level markings on the glass sides. For fine tuning, a calibrated syringe is supplied. "It is," says Lirpa, "the first *true* quart oscillator."

The digital record is playable on conventional analog phonographs. It contains the digits one to ten, recited by Prof. Lirpa in 17 languages.

Illustrations: Philip Anderson



# HOW WE PROVED THE TOP NAMES IN CASSETTE DECKS AREN'T ON TOP.



Frequency response is the single most important measurement of musical quality in cassette decks. The wider and flatter the response curve, the better the equipment sounds.

We were so confident that our decks would outperform the competition, that we challenged owners of other cassette decks to bring them in to their Harman Kardon dealers and test their frequency response against our CD401's.

Our test procedure was very simple: 1) Any cassette deck including those costing up to twice as much as our CD401 were eligible; 2) We cleaned and demagnetized the heads of the competing decks to assure fairness and maximum performance; 3) The testing was done by HK's independent manufacturer's representatives; 4) The CD401 to be tested was chosen at random from dealer stock and received no special adjustments.

The test results: Over 3000 consumers accepted the challenge, and in 98% of the cases, the CD401 had a wider, smoother frequency response than any other deck tested.

Here's another outcome which may surprise you even more. In comparing the test results from competitive decks to the performance available from our entire line, we found that all of our decks, from the CD91 at \$260\*\* to our CD401 at \$750,\*\* delivered a superior frequency response performance than did decks costing twice as much or more.

Of course, numbers don't tell the whole story. So now that you've seen our specs, you owe it to yourself to hear our decks.

**HK** harman / kardon

CD 401

ULTRAWIDEBAND  
CASSETTE DECK

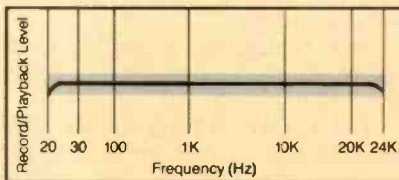
TEAC C-3RX

SONY TC-D5M

YAMAHA K960

PIONEER CT9R

NAKAMICHI LX-5



A frequency response out to at least 20kHz is necessary to accurately reproduce sounds within the audible spectrum.

Shaded area represents accuracy to  $\pm 3$ dB.

For the Harman Kardon dealer nearest you call toll free 1(800) 528-6050 ext. 870 or write, Harman Kardon, 240 Crossways Park West, Woodbury, NY 11797. In Canada, Gould Marketing, Quebec

\*For copy of test results write: Harman Kardon, 240 Crossways Park West, Woodbury, NY 11797-2057. In Canada, Gould Marketing, Montreal H4T 1E5.  
\*\*Manufacturer's suggested price.



## WHERE AMERICA SCHLOCKS

**F**ootprints in the sands of time. Here today and gone tomorrow. Am I in a cynical mood this month! Some of the great new ideas in componentry strike me as all too much like those footprints, and may they vanish in a hurry. They probably won't.



I have a picture in front of me which has been bugging me for weeks, out of an Annual Stockholders' Report from a giant conglomerate. Marriage of TV and hi-fi componentry, huh? You should see this. Grotesque. What I call a typical NOW product, dizzily incorporating every evanescent fad that its designers think might bring in some more cash. We'll soon have zillions, one in every living room.

I'm going to have to describe this still unlaunched NOW monstrosity (as of present writing) or I'll bust with irritation. But I will end up with some sober comment that might be useful and constructive. However, to save my soul, I'm going to have to use my ETC credit (i.e., the etc. in my title) to go further into footprints—for there's philosophy there that I find fascinating. There is a connection—isn't the very idea of NOW an ever-changing footprint in the flow of time?

Okay, here's how I got into this surprising mood. I get these Annual Reports every so often, even one from a gold mine (one share, a party favor at a hi-fi press conference). [Editor's Note: Ardent consumer advocates and the underground press should note that this penny stock has never declared a dividend and, indeed, has cost me more in Post Office forwarding fees and stamps for the proxy statements than the share is worth.—E.P.] Big glossy books (the bigger the corp., the glossier), full of color pix of giant machines, blue, red and yellow, towering oil rigs, ranks of smiling workers, triumphant annual meetings with banners aloft, the chairman of the board, beam-

ing and ruddy; the president, same. Plus a lot of figures that, oddly, always add up the same. (Accounting is one of the mysteries of my life.) Also—and particularly in the booklet I'm talking about—a confidential photo glance at the company's superb future products, so cannily designed (lab technician in white gown) for the benefit of every stockholder. . . .

That's where I jumped. Here was a picture of a Thing, un-nameable, under the heading of Recent Developments, with "futuristic looks and features," which for a second I could not believe. All sorts of zany images flashed through my mind. A dentist's work console, one of those things they wheel up to you just before the drill starts? An X-ray machine for major surgery?

An artificial kidney? But then it struck me that what it really reminded me of was a gas range. A big old-fashioned stove, squared-off 1920s Art Deco, with great overhanging upperworks above the cooking surface, maybe a smoke hood or even an overhead oven. Incongruously, down at the bottom were four big, black dolly wheels. I could just see pop towing this latest gadget stove behind him around the kitchen as the quiche cooked. Even now, at the 900th glance, the thing still looks like a gas stove. A gas range with wings, yet! Two tiny, square, angel wings up at the top that couldn't lift a fly, let alone a kitchen stove.

But, of course, it isn't a kitchen stove. It's Component TV with Component Hi-Fi.

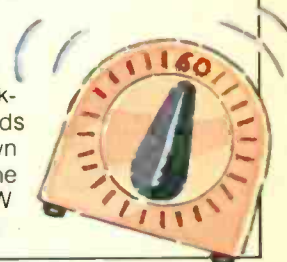
I've named this thing the Gas Range System and I hope it will fade away as soon as the next low tide. It is the purest example of NOW, shortsighted, ugly, ill-assembled, unthinking, and no doubt designed to sell fast. But this is a

big company and what it does for the millions, the others will do as well. I fear that it is a picture of our immediate audio future, if we persist in getting mixed up with video in a NOWish way.

Give me a breath, then—I have to talk about footprints before I give you the flashy details.

The footprint in sand is an age-old metaphor for the fleeting quality of all things human, and for the NOW that is forever a tiny moving instant in the great fourth dimension, the endlessness of time itself. It's odd, then, that real footprints are actually the oldest and most abundant record of ancient developed animal life, if by sheer accident—the preservation of a typically brief and immediate NOW, just like our own but displaced casually by thousands or millions of years. This is uncanny when you think about it. I can't forget that marvelous triple set of small barefoot human prints discovered a few years ago, three little hominids walking across a long stretch of squishy volcanic ash hundreds of thousands of years ago (I've mentioned them before), the whole episode maybe three or four minutes long. Was their sense of NOW at that moment really any different from ours today? *The present!* That's what always counts. Was it maybe the 19th of November at 2:38 p.m. in the year 469,742 B.C.? Or maybe 1,008,356? I forget the dating. They never knew, or cared. Why bother?

Then there was that great herd of dinosaurs, carnivorous monsters, that one day a good many million years ago charged simultaneously in a long line across a mud flat in the upper Connecticut valley, leaving great prints in packs? That seems to be the scientific message. But again the whole thing took maybe three or four minutes, a very vivid NOW, a spectacular sight if you had been there (and safely out of the way). But no dinosaur had the sense in his pea brain to look either backwards or forwards in time for his own good. For him the footprint of NOW must have been





# AUDIOPHILE FILE™ XL-S

## GREATER DYNAMIC RANGE

Maxell XL I-S and XL II-S are the ultimate ferric oxide cassette tapes. Precision engineered to bring you a significant improvement in dynamic range.

XL I-S provides exceptionally smooth linear performance characteristics with high resolution of sound and lower distortion.

While XL II-S has a greater saturation resistance in higher frequencies resulting in an excellent signal to noise ratio.

How did we achieve this?

### IMPROVED EPITAXIAL PARTICLES.

Maxell engineers have managed to improve the Epitaxial magnetic particles used on both tapes.

By developing a crystallization process that produces a more compact, smoother cobalt ferrite layer on the gamma ferric oxide core, they've been able to pack the particles more densely and with greater uniformity on the tape surface.

This increases maximum output level and reduces AC bias noise which in turn expands the dynamic range.

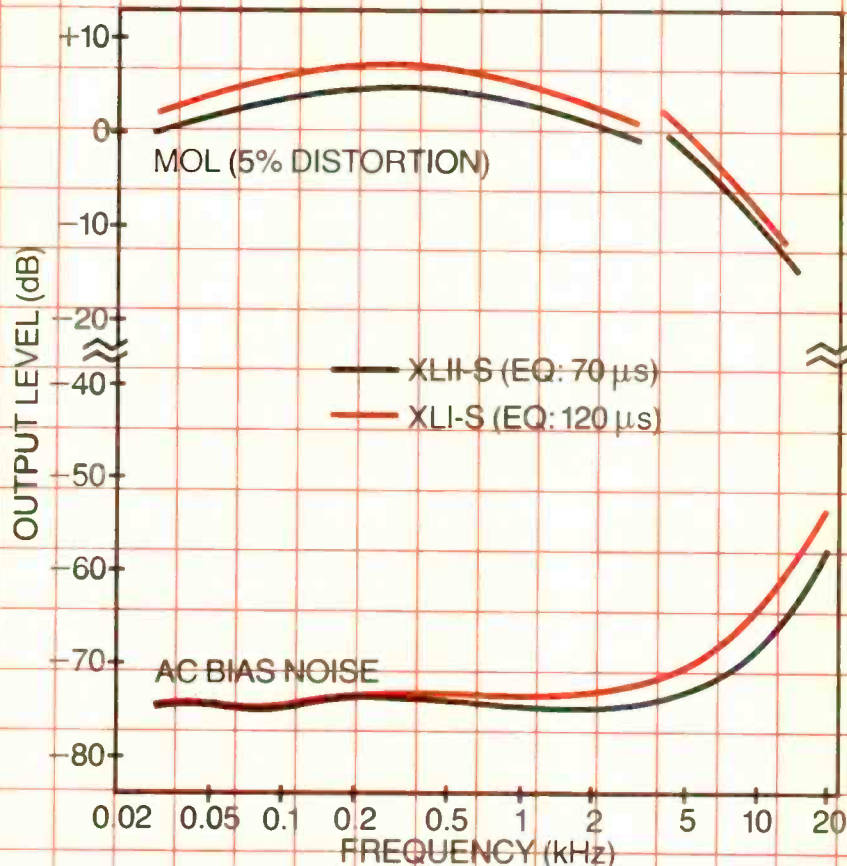
#### IMPROVED EPITAXIAL PARTICLE CHARACTERISTICS:

MORE UNIFORM COBALT-FERRITE LAYER      SMOOTHER PARTICLE SURFACE

GAMMA-FERRIC OXIDE

470Å

COATING THICKNESS: 10-11A (1A = 1/10,000,000 mm)



So you get a better signal to noise ratio, greater resolution of sound and higher output levels.

Of course, greater dynamic range isn't the only reason to buy Maxell high bias XL II-S or our normal bias equivalent XL I-S.

Both tapes have more precise tape travel and greatly reduced distortion levels.

You'll see both these improvements covered in detail in future Audiophile

Files. In the meantime, we suggest you listen to them.

For technical specification sheets on the XL-S series, write to:

Audiophile File, Maxell Corporation of America, 60 Oxford Drive, Moonachie, New Jersey 07074.



IT'S WORTH IT.

© 1983 Maxell Corporation of America, 60 Oxford Drive, Moonachie, N.J. 07074

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"The classics of audio design have shown a sense of a larger present, a bigger footprint on the super-highway of modern life."

almost instantaneous. Big animal in a small present.

Do we do any better? Sometimes. We have the brains. But mostly, NOW is just as shortsighted as ever.

Look at this ever-moving NOW, the present's imprint on time. Maybe a good figure of speech for today would

be, not footprints in the sand, but footprints on asphalt and concrete. "Footprint" is the proper term for the impact of an auto tire on a flat surface. A very small oval, shorter than a man's print but a bit wider.

When the car moves (which is its purpose and destiny), that small oval—

moving in time as well as space—becomes astonishingly like the NOW of the ever-changing present. It is there and measurable, yet never the same, continuously changing, just as our lives move in time. Nice concept!

What we can use, in both cases, is a bigger, broader, longer NOW for more traction. A better grip, on the road, and on our human destiny. Some of us have that grip, even some of our big corporations, though not the one which will perpetrate the Gas Range System. Our best audio equipment shows it, the bigger NOW. We can all name classics of audio design that have shown this sense of a larger present, a better awareness, a bigger footprint on the eight-lane superhighway of modern life.

The contact point, the NOW, of an idealized wheel on a flat surface is thus infinitely small, a point with no dimensions at all. That is the ultimate, instantaneous NOW! A present that is deprived of all sense and reality. Sometimes I think a few of us are that limited. We think like a point.

One more small step and I'll have my breath back. If we look again at the ideal wheel contact as an expression of the NOW, the present in the great expanse of time itself, then we must admit that not only is that theoretical NOW a point, but the wheel of time is infinitely large; on such a wheel you never get to see a repeat, always new wheel edge coming 'round the bend. Does time repeat? Not so you'd notice.

You know, the actual components of my Gas Range System, taken individually and each for its own proper place and function in the larger scene, really aren't bad, nor in any way unusual. It's the ghastly ensemble of this particular System that hurts, the mindlessly mis-directed clutter of incompatibilities, of a sort that we will soon see in a thousand other TV Component offerings, I am all too sure. *Matching components?* That's just what they are not.

Take them out and set them all in a line and you have the story. First, here, you have the cart, the dolly, a big, heavyweight substitute for a rack that might carry 500 pounds.

On the lower shelf, clearly removable, is what looks to be a VCR of current conventional, if bulky, format. It should be fairly standard, I expect, whatever the details. Also reliable and

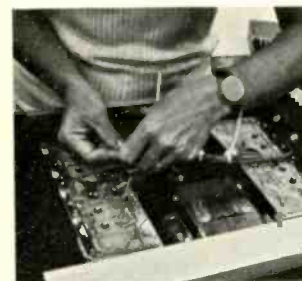
## "Now we know why Perreaux says so much about handcraftsmanship."



Each metal part, large and small, is hand-finished.



No robots are used in the Perreaux factory.



Hand-assembly from beginning to end by skilled technicians.

"Before we saw our first Perreaux amplifier, we heard about the Perreaux legend of handcraftsmanship.

"We heard about this man from New Zealand who for the past ten years has been designing amplifiers to be built by hand every step of the way—from metalwork through assembly to final testing.

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"We heard about the 100-plus quality control checks—including vibration, shock and 24-hour burn-in tests that would ruin most amplifiers.

"And that as a final test, Perreaux uses specially designed speakers that face each amp with brutal loads, rather than the usual simple resistive load.

"Now that we've actually seen and heard Perreaux's power amps and preamp, we invite you to come in and do the same.

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Lee Terrell

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**"It's the ghastly ensemble of the Gas Range System that hurts, the mindlessly misdirected clutter of incompatibilities."**

of good quality. VCRs do not come cheap (yet), and few of them are of the junky sort. Nature of the beast itself. By every indication, this is a quality example of a component that the video people have long since brought to maturity. It's probably as good as they come, but expensive.

On the upper shelf rests a large TV "monitor" of the latest sort, elegantly thin-framed, black surround, no doubt weighing plenty. (I could barely move the one I recently rented.) A fine unit on its own and, again, surely of state-of-the-art commercial quality. They don't really come cheapie, these big ones. I'd be glad to have this TV-set-without-the-works on any suitable support in my own living room, if I felt I needed a unit that probably should be viewed no nearer than three or four yards away.

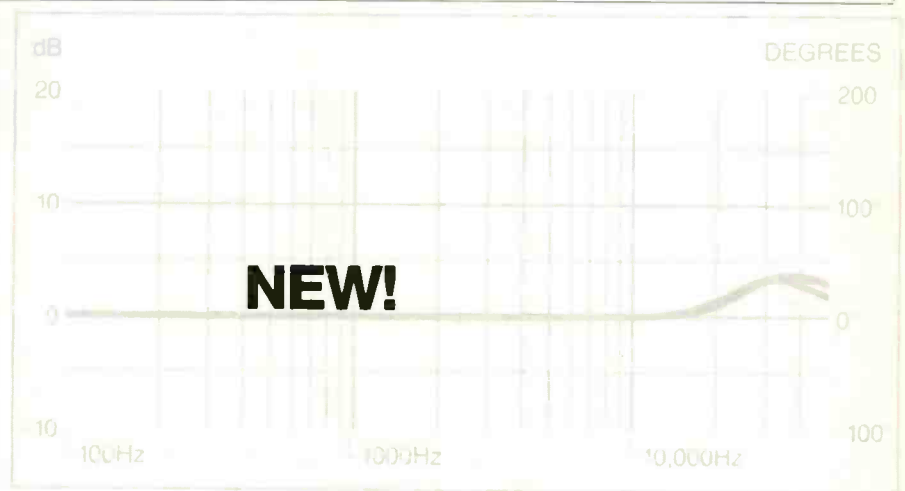
So there we have one-half of the Gas Range ensemble, two high-class and very classy video units, surely not far below the general top of the available range. But now we come to the other half of the "marriage," the audio.

Hanging just below the upper shelf that carries the monitor is a much slimmer component that is apparently the audio center. Details are not very visible in my photo, but there is a black strip to the right with what are clearly two peak-level indicators. We assume a power amp somewhere inside which could logically rate anywhere from 3 watts per channel up—but not very far. For one thing, there is no visible ventilation; the unit fits spang against the bottom of the upper shelf. Highly unlikely that it puts out 100 or 150 watts per channel! And if it did, what of the speakers? Get to them in a moment. On the left of this same audio unit there likely is an audio-cassette play/record, or a radio, or maybe both. Can't be sure. This is the usual. And all in the one unit. I could be wrong—it might be a \$1,000 Technics-type thin component with all sorts of marvelous goodies within. But again—the speakers.

Well, here comes absurdity. They are those two little "angel wings" that grace my gas range and couldn't lift a fly, let alone a stove. Two oblong excrescences attached on each side of the handsome video monitor, little boxes maybe seven or so inches tall and an inch or two deep. *That* is the speaker department of the Gas Range Sys-

tem! Heaven forbid, is all I can say. Does this tell plenty about the rest of the audio componentry? Yes, the mini-speakers are no doubt removable for stereo, but how desirable would that be? You'd better stick to your simulcasts and a genuine audio hi-fi component system if you want *real* stereo.

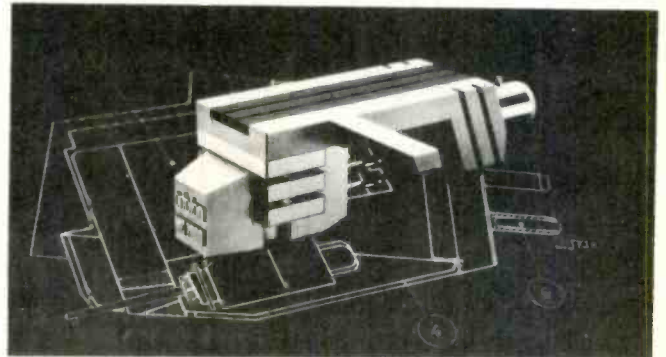
So there you have the Gas Range and some of its siblings to come. Mish-mash messes, hooking top-line expensive TV gear to bottom-line minimum audio (though better than what preceded it, perhaps). They should remove that monitor tube and put in a microwave oven. It would be more suitable. **A**



Every so often, a new development contributes so decisively to performance, that it re-defines the state-of-the-art. Such a development has taken place in the laboratories and listening rooms of Ortofon in Denmark.

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BERT WHYTE

## TALES FROM THE STRIP

Considering the bleak economic climate in general and the depressed state of the consumer electronics market in particular, the Winter Consumer Electronics Show, held in Las Vegas from January 6th through 9th, surprised many people with a record 78,126 attendees. Also surprising was the upbeat mood of the Show, with cautious but nonetheless good sales activity. It should be noted that much of this activity centered around video games and computers/calculators, with a strong showing by personal telephones. The three major trade papers publishing daily editions on Show activities were heavily oriented towards the aforementioned categories, both in their reporting and the advertising they carried. Audio components, whether exhibited in the Convention Center or at the demonstration rooms at the Riviera Hotel, got very short shrift indeed, with little more than token coverage. Let's not forget our roots, fellas—audio components got the CES off the ground 16 years ago, and with the dawning of the digital era, their star will rise again.

Although many people still view digital sound with a jaundiced eye, this WCES will be remembered as marking the introduction of digital sound as a consumer product. No longer a "blue sky" promise, but a reality in several digital formats. There were numerous models of compact digital audio disc players from Sharp, Sansui, Sony, Pioneer, Yamaha, Kenwood, Phase Linear, Magnavox, Denon and NEC. Certainly some of these units were prototypes, with deliveries quoted as "mid 1983" or "the last quarter of 1983." However, there were also production models demonstrated, and Sony's CDP-101 is slated for March delivery. As for the vital software, CBS, in conjunction with the introduction of the Sony player, is making an initial release of 16 Compact Disc digital recordings. The pop titles include Barbra Streisand's *Guilty*, Weather Report's *Night Passage*, Earth, Wind, and Fire's *Raise*, and Billy Joel's *The Nylon Curtain*. Although there may be some recordings derived from analog masters in this group, the classical releases appear to be all digitally mastered. Among them are Shostakovich and Prokofiev symphonies (Leonard Bern-



Sansui's Tricode PCM adaptor works even at slow VCR speeds.

stein conducting), Holst's "The Planets" (Lorin Maazel conducting), and "Also Sprach Zarathustra" (Zubin Mehta conducting). More software that apparently will be available around the same time are some of M & K's Real-Time Records, releases of the Philharmonia Hungarica. Possibly some Vanguard and Telarc digital recordings will appear as well. [And AudioSource will import CDs.—I.B.]

From all reports, the number of CD players and discs sold in Japan has far exceeded the most optimistic forecasts. Polygram, which presses CD records from the Philips, Deutsche Grammophon and Decca catalogs, among others, has a large share of this market. While they are obviously delighted, the strain on their production facilities may delay their release of CD records in this country. On a longer range basis, CBS has announced plans to build a CD processing plant in the U.S. by late 1983 or early 1984.

Let us not forget that Denon has been recording with digital sound for some years now and has over 600 digital records in their catalog. Denon demonstrated their DCD-2000 compact digital audio disc player in Las Vegas and announced their intention to release 10 Compact Discs every month. The first batch of releases will include the Beethoven Third and Fifth Symphonies, the Dvorak Ninth Symphony, and Vivaldi's "Four Seasons."

In other digital activity, Nakamichi surprised many by announcing they would produce a PCM digital mastering processor. Their first entry in the digital field, the DMP-100, embodies

all of the EIAJ digital specifications but also has 16-bit quantization, as in the Sony PCM-F1. In fact, up to now the 16-bit quantization in component-type digital processors has been the exclusive province of Sony. Methinks the DMP-100 may well originate as an OEM purchase. Nakamichi claims superior sound for this unit because of special, high-quality circuitry in the analog section.

Sansui demonstrated their unique PC-X1 Tricode PCM processor, which is capable of recording digital data at the slow, extended-play VCR speeds. Deliveries of the PC-X1 are expected by April, at a price of \$1,600.

Sharp really made a big splash in the digital field. In addition to their CD player, they caused quite a stir with the CX-3, a compact cassette PCM digital recorder. The CX-3 utilizes a unique, fixed, thin-film magnetic head with 18 tracks (16 audio, one control, one spare for future use). This head affords a very high recording density. Although the quantization is 14 bits, dynamic range is quoted as 90 dB. Interestingly, the sampling rate is 44.1 kHz, same as the CD player's. The 16 tracks afford great redundancy for error correction. The result is two-channel stereo recording, with a frequency response of 2 Hz to 20 kHz,  $\pm 0.5$  dB, a THD of 0.01% and the usual unmeasurable wow and flutter spec of digital recorders. Imagine inserting an inexpensive audio cassette into this unit and achieving these fabulous digital performance parameters! No price or marketing date as yet.

Sharp also introduced the RX-3 PCM



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shown below.

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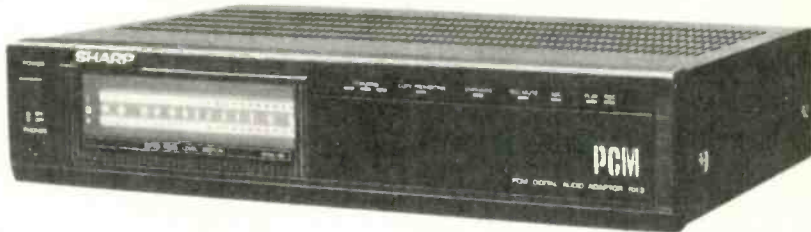
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"Considering the depressed state of the consumer electronics market, there was a surprisingly upbeat mood at the WCES."



Sharp's RX-3 PCM unit.

digital mastering processor, an EIAJ 14-bit linear quantization unit with a sampling rate of 44,056 kHz and the by-now-familiar performance specs of this format. Sharp claims their ADD (Automatic Data Detector) has fine adjustment circuitry that will automatically match the RX-3 to the characteristics of any VCR. Sharp also claims the RX-3 has a special memory function and anti-drop-out data input which guarantees 99.995% accuracy for drop-out correction! No price or availability information was provided.

Another new digital mastering processor is the Sony PCM-701 (reviewed elsewhere in this issue), which probably will be available by the SCES in June. Although almost half the cost of the deluxe Sony PCM-F1, it still features 14/16 bit quantization. All these digital developments are very exciting and, barring unforeseen problems, certainly have the potential to revitalize the audio industry.

There were a great deal of interesting new analog products at the WCES in every category. In order to report on as much of this new equipment as possible, my notes will be brief.

Sansui showed something unusual for them, a basic power amplifier. The Model B-2301 is a real brute, putting out 300 watts/channel into 8 ohms, with less than 0.003% THD. Using their patented Super Feedforward circuitry, TIM is claimed to be unmeasurable. Slew rate is a super-fast 300 V/μS, with a rise-time of 0.5 μS. The power supply uses a toroidal 1.3-kVA transformer. The price of this 81-pound amplifier is \$2,600.

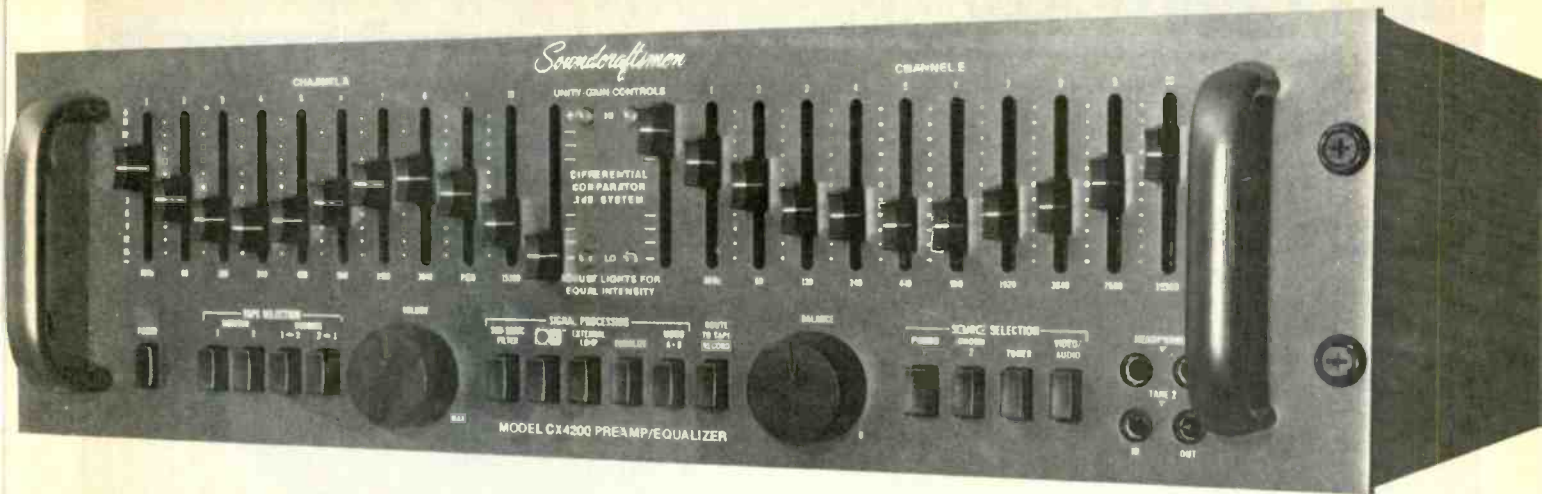
Audire had a most impressive array of new amplifiers. Their new Monarch 100 watt/channel pure Class-A amp is something to behold. It stands 3 feet high, 23 inches wide, but is only 5½ inches deep. All you see on the front of

the unit are the 3-foot vertical fins of the heat-sinks. The Monarch is contained within its own rosewood rack. It is claimed to be completely stable with any load and is said to drive 1-ohm loads "all day long" with an output of 750 watts! At one listening session, three pairs of Acoustats and a pair of Sequerra ribbon speakers were all hooked up in parallel and driven to levels over 100 dB SPL. According to Audire, there were no measured or audible anomalies. The Monarch will sell for \$6,000 per pair. A less imposing and less expensive (\$2,850) amplifier from this firm is the 100 watt/channel, 8-ohm, pure Class-A Parlando. This is a dual-mono unit on a single chassis, with 32 output transistors and 256,000 μF in the power supply. The Parlando is also claimed to be stable into a 1-ohm load, and at 2 ohms, output is 360 watts/channel.

Perreux is a new name in amplifier manufacturers, and would you believe it is headquartered in New Zealand? The first product of this company, the 2150B 200 watt/channel amplifier, has been well received in the U.S. Now they have introduced a 100 watt/channel model, the 1150B. Designer Peter Perreux emphasizes that all of his amplifiers are hand-crafted and hand-assembled, using only discrete circuitry; there are no ICs whatever. The 1150B uses a bipolar, transistor Class-A driver stage and a MOS-FET output stage (to eliminate the need for protective circuits). The amplifier is designed to provide 3 dB of dynamic headroom. Bridging for higher power can be accomplished with a rear-panel switch. The THD and IM distortion figures are stated to be no more than 0.009% at 4 and 8 ohms. The 1150B is of very rugged construction, with a patent pending on its special heat-sink configuration. Price is \$990.



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# VIDEO SCENES

BERT WHYTE

## BETA UNBLOCKED

**F**or all those kids addicted to video games, the WCES in Las Vegas would have seemed like Paradise, for video games were a mighty presence. Fortunately, there were quite a number of other interesting new video products as well. In fact, the introduction of one new product, Beta Hi-Fi, created quite a sensation.

Beta Hi-Fi is principally a Sony development but is supported by companies who will supply Beta-format VCRs. (The list includes Aiwa, Marantz, NEC, Sanyo, Sears, Teknika, Toshiba, Zenith, and newcomers Pioneer and Nakamichi.) As you know, in both the Beta and VHS video formats, video signals are recorded and played back with video heads mounted on a recording "drum" that revolves at a high rate of rpm. Known as "rotary slant-azimuth helical recording," this affords sufficiently high writing speed to record the 3.58-MHz NTSC-standard color video signals. The audio signals are recorded with a fixed audio head laying down a "longitudinal" audio track. In Beta Two, the slow speed and narrow track of this audio recording method yield sound of limited quality—at best a signal-to-noise ratio of about 40 dB, with a

frequency response of 50 Hz to 11 kHz, 3% distortion, and wow and flutter on the order of 0.3% wtd. rms. In the even slower speed, extended-play Beta Three mode, the audio signals are further degraded to a top of 8 kHz, distortion increases to 3.5% and wow and flutter is a dismal 0.4% wtd. rms. I have often commented in these pages about the poor quality of both Beta and VHS audio. Due to the wow and flutter, the "quavery-wavery" sound of fixed-pitch instruments, such as piano and bells, is particularly excruciating. In short, we can be charitable and sum up the audio quality of Beta Two and Beta Three modes as being limited or marginal.

With the introduction of Beta Hi-Fi, the audio performance of the Beta video format takes a leap forward. In a clever "why didn't somebody think of this before" technique, the high writing speed of the rotating video heads is utilized for audio, too. Stereo sound is frequency modulated and recorded (together with the video chrominance and luminance) by the video heads. In standard Beta video recording, chrominance and luminance overlap at about 1 MHz. In the Beta Hi-Fi system, the luminance is moved up to 2 MHz and the stereo audio signals are sandwiched between the chrominance at 1 MHz and the luminance at 2 MHz. The longitudinal monophonic audio track is retained, though, for compatibility with earlier Beta decks and tapes. Although this is a very simplistic explanation, that's essentially how the Beta Hi-Fi system works.

The results of this technique are spectacular in terms of audio performance. Beta Hi-Fi affords a dynamic range of more than 80 dB, a 20 Hz to 20 kHz frequency response, less than 0.3% harmonic distortion, better than 60 dB channel separation, and, glory be, wow and flutter of less than 0.005% wtd. rms! As you can clearly see, these specifications approach the quality of digital audio. It is ironic to note that



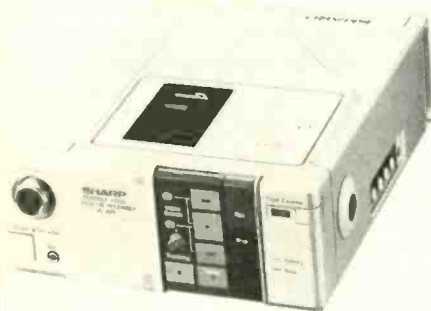
*Even with auto focusing, Sharp's QC-70 camera weighs just 3½ pounds.*

even the big professional video recorders, using quadruplex (perpendicular) or helical-scan video heads and with audio tracks recorded longitudinally at 15 ips, cannot compete with the sound quality of Beta Hi-Fi!

Beta Hi-Fi affords its superior audio qualities to both the Beta Two and Beta Three formats, and no special tape formulations are necessary. Beta Hi-Fi decks can be connected to TV sets with stereo audio inputs (not many so equipped) but obviously will work better with stereo systems and component TVs like the Sony Profeel.

The Beta Hi-Fi system can be used in many ways. Live musical events and sporting events are well-suited for Beta Hi-Fi recording. Taping TV/FM simulcasts, especially of programs like "Live from Lincoln Center," should provide superb sound. And Beta Hi-Fi will, of course, be ideal when stereo TV broadcasts are authorized by the Federal Communications Commission.

One of the major benefits of Beta Hi-Fi will be in prerecorded videocassettes, particularly motion pictures, and the system is already supported by Paramount Home Video, Thorn-EMI, MGM/UA, Warner Home Video and CBS-Fox Video. Beta Hi-Fi videocassettes will include movies like *Apocalypse Now*, *Star Trek II: The Wrath of*



*Sharp's VC-220 is the second VHS-C portable on the market.*



*Sony's SL 5200 is the first VCR to have the Beta Hi-Fi sound system.*



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*Khan, 2001: A Space Odyssey, Chariots of Fire, and Superman.* The special-effects sequences in the science fiction movies, with their stereo soundtracks, should be spectacular. Also on prerecorded Beta Hi-Fi videocassettes will be music programs such as Paul McCartney's "Rockshow" and Elton John's "Visions." I have private information on a number of these productions, one being the Lionel Hampton band with variety acts, taped in Las Vegas using 3M's 32-track digital recorder with video interlock.

Which brings up an important point. The near-digital recording quality of the Beta Hi-Fi system is only as good as the quality of the input signal. The Lionel Hampton tape should be superb. Simulcasts of live music could be great, depending on the microphone techniques employed. Stereo TV, when it comes, could be a mixed bag—ranging from adequate to spectacular with big musicals and variety shows. The quality of soundtracks will vary, with recent Dolby-encoded stereo soundtracks affording the best results. Obviously, Beta Hi-Fi will greatly enhance the integration of audio and video, and needless to say, the VHS people are hard at work on a similar system. Beta Hi-Fi videocassette decks are scheduled for availability this summer, with prices ranging from \$1,100 to \$1,500.

There was further activity in the Beta format at the WCES. Several attempts have been made to provide an integrated camera and VCR, notably by Sony and Matsushita.

Sanyo showed a prototype of their version of a single-unit camera/recorder, the Betamovie. Standard half-inch Beta videocassettes are used, and up to three hours of recording is possible in Beta Three mode using L-750 tape. The 5-pound Betamovie is a record-only unit, with playback through any standard Beta VCR. It has an optical viewfinder, a standard pickup tube and an f/1.8 3X zoom lens. No availability or price as yet.

Sanyo also showed an ultra lightweight, compact Beta-format portable VCR. Its weight of under 6 pounds is made possible by the use of an aluminum chassis, resin parts, pancake-type direct-drive motor, and modular electronics. The unit can record and

play back up to five hours in the Beta Three mode, using standard half-inch Beta videocassettes. This system also includes a compact tuner/timer. Introduction is planned for late this summer. No price announced.

Turning to other developments, that favorite fantasy of TV futurists, the flat-wall TV screen, may be getting closer to reality. Matsushita is said to be embarked on a program to develop it, with introduction perhaps as early as 1985!

In the January 1983 issue, I reported on the JVC VHS-C system, an ultra compact, lightweight VCR. Utilizing standard half-inch VHS tape in a videocassette slightly larger than a pack of king-size 100 cigarettes, the VHS-C affords 20 minutes of recording. A special adaptor enables the small VHS-C cassette to be played back on any standard VHS deck.

At the WCES, one of JVC's licensees, Sharp, showed their version of the VHS-C system. Sharp's Model VC-220 is approximately the same size as the JVC unit. Although incorporating much of the VHS-C technology developed by JVC, the Sharp unit has some interesting features of its own. One is an assembly editing system, which allows the synchronization of one scene's beginning with the end of the previous scene. Pushing the "Pause" button, causing a wait of approximately two seconds while the tape rewinds to the proper point, avoids picture blurring and even possible erasure of previous scenes. The VC-220's light-emitting controls are easy to see, even in the dark. As an accessory, there is an AA-220 a.c. adaptor with an r.f. converter to permit playback through a TV set. As a companion camera for the VC-220, Sharp introduced Model QC-70. Weighing only 3½ pounds, it has such features as auto focus control, automatic iris for exposure control, a 6 dB light boost sensitivity switch, a three-position color temperature switch, a remote start/stop trigger switch, an extendable boom microphone, and a through-the-lens optical viewfinder. With the VHS-C system VCR and a camera with automatic focusing and exposure control, we are getting nearer to the old Eastman Kodak Brownie movie camera aim-and-shoot philosophy. A



# ROCK/POP RECORDINGS

JON & SALLY TIVEN  
MICHAEL TEARSON

## TRANS-FORMATION

**Trans:** Neil Young  
**Geffen GHS 2018, \$8.98.**

Sound: B+ Performance: A-

*Trans* sounds like a hybrid of two former Neil Young albums. The first songs on either side ("Little Thing Called Love" and "Hold on to Your Love") are pretty standard, latter-day *After the Gold Rush*-sounding Neil Young. The finale, "Like an Inca," is a strong, extended cut where "Cortez the Killer" meets "Cowgirl in the Sand."

The real meat of the album, the real challenge, is found in the other six cuts. Together they are yet another total musical departure, even for Neil Young. He regularly tries to catch his listeners off guard by releasing music which meets none of the expectations that may await them. This time he has "modernized" the beat, making it closer to post-New Wave dance music. Far more startlingly, he has eliminated the very distinctive Neil Young voice, replacing it with computer-sounding vocal effects that never came from a human larynx. Fittingly, Young has written a cycle of songs that computers might sing as love ballads ("Computer Age," "Sample and Hold," "Transformer Man," and "Computer Cowboy"). "We R In Control" is the manifesto as the machine voice sings "We will prevail and perform our function."

There is also a remake of an early attack on fame, "Mr. Soul," from the 1967 *Buffalo Springfield Again*. This one serves as a transition from the flesh-and-blood Young to the silicon-chip edition. The computer-voice sound is used more as a special effect on a human voice and retains some human mannerisms.

This whole vocal approach is a nervy gamble on Young's part, one of his nerviest. The album's artistic success flows from the juxtaposition of the odd vocals with the instrumentation, which is surprisingly rock-band standard. Where you might anticipate beives of synthetic sounds, you find guitar, bass, drums, simple keyboards and only occasional synthesizer coloring.

The recording is uncommonly clear and clean, as befits the computer concept. Sound is bright and sparkly. The playing of Neil and the band is infectious and enthusiastic. Players include Nils Lofgren, who worked with Neil on



Illustration: Rick Tulka

*After the Gold Rush*; the reclusive Bruce Palmer, former Buffalo Springfield bassist; Crazy Horse stalwarts Ralph Molina, Billy Talbot and Frank Sampedro, plus percussionist handyman Joe Lala. Quite the historic lineup for a futuristic album.

I flat-out love *Trans*.

Michael Tearson

**Trans:** Neil Young  
**Geffen GHS 2018, \$8.98.**

Sound: B+ Performance: A-

If his only grace were his sense of humor, Neil Young would still be miles above his old compatriots in The Buffalo Springfield/CSNY circle of rock incest; however, he also just happens to be the most talented of the bunch. When Steve Stills' crew was antagonizing Elvis Costello, Young was collaborating with Devo, just to give you an inkling of Young's propensity for being current. *Trans* shows that Young, having absorbed the work of his neopeers, can do more than just regurgitate. Parts of the record are heavily in debt to the European synth/drum-machine movement (Human League, Soft Cell), but Young maintains his artistic integrity throughout. More importantly, he's writing his best songs since "My My Hey Hey," which is reassuring after

the lukewarm *Reactor*. His fascination for the new technology seems to have inspired much of this compositional creativity.

"Sample and Hold," named after one of the functions of a digital delay unit, is rather typical of the new Neil Young: Darth Vader voicings, a wall of synths, and repetition ad infinitum. He doesn't have to worry about getting a cooking band track anymore when he can do it all himself with a few buttons and floppy discs, and Neil Young is the kind of guy who works best in a vacuum. He mixes the future with the past and comes up with a stonemason reading of "Mr. Soul" (a Buffalo Springfield hit of some repute) for anybody who didn't get the point of what he was doing—that is, it's just a bunch of songs and the style he chooses to record in doesn't really affect the quality of the song itself. Unlike *Comes a Time*, where all the acoustic tunes were on one side and the Sex Pistols-out cuts on the other, he mixes and matches the band tracks with the self-made ones so the listener is totally unprepared for what he's about to be hit with.

Neil Young's not going to win over many converts from the Gary Numan camp, and many of his old fans could very well take offense at this record, but that's the kind of guy he is. *Trans*



# ANTICIPATION



isn't the best record he's ever made—*Everybody Knows This is Nowhere* is—but it seems more in the spirit of that album than anything he's done in recent times. *Jon & Sally Tiven*

**Long After Dark:** Tom Petty & The Heartbreakers  
**Backstreet BSR 5360, \$8.98.**

Sound: B Performance: A—

These days, when practically no album seems worthy of staying on the turntable for more than a month, Tom Petty's latest—while admittedly displaying no grand strokes or any kind of visible progression—at least stands as an effort of consistency and quality. It doesn't make compromises with current trends. Petty & The Heartbreakers have mapped out their territory somewhere in between The Stones and Dylan (some would argue The Byrds), and they execute their meaty songs in a distinctive way. In 1976, their style had them slightly to the left of contemporary radio; today it puts them dead center. Perhaps they could afford to drift a little more radically left, but in terms of having a band sound, rocking quotient and songwriting ability, Tom Petty & The Heartbreakers are living out the promises of people like Dwight Twilley, Alex Chilton and other potential classic rockers who have fallen by the wayside. It's hard to argue with this kind of integrity when it meets with commercial success.

*Long After Dark* is decidedly more uptempo than the last Petty offering,

Tom Petty &  
The Heartbreakers



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"Tom Petty's latest album, *Long After Dark*, displays consistency and quality, though no visible progression."

and the songs seem better conceived. The band hasn't rocked like "The Same Old You" since their second album, and the promise of "Refugee" is reactivated with "Change of Heart" and "You Got Lucky." Even guitarist Mike Campbell gets to stretch out a little bit (although, to be brutally frank,

he peaked on the group's first album). There are still major problems with the production, even though the arrangements are allowed to breathe a little freer this time, and we're still waiting for a Tom Petty & The Heartbreakers album *not* to feature tambourine. But these are minor quibbles considering

the group has withstood the inherent problems of success, personnel changes (Howie Epstein replaces Ron Blair on bass with no discernible shift), and record-company battles and remained intact. So what if Petty could do it in his sleep, as long as it's good? One of these days he'll make a great album, but compared to the output of his peers, *Long After Dark* approaches greatness. *Jon & Sally Tiven*

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**Upstairs at Eric's:** Yaz  
Sire 1-23737, \$8.98.

Sound: B+ Performance: A-

Of all the new synth/drum machine bands, Yaz comes across as the only one that doesn't seem too deeply in debt to Bowie/Ferry/Byrne/Eno, primarily due to the pipes of lead singer Alison Moyet. Ms. Moyet is an unknown British singer formerly associated with obscure white R & B bands, and to her credit she brings a musical sensibility to this genre that has more to do with Aretha Franklin than Ultravox. She also has the most appealing white femme voice since Chrissie Hynde. The other half of Yaz is Vince Clarke, former synthesist with Depeche Mode, who uses his command of the instrument to create memorable bass lines and relatively simple musical licks which, at their best, replace the usual disco instrumentation.

It is for these reasons—stunning vocalist, musical simplicity, and strong songs—that Yaz has found success on both an artistic and commercial level. Songs like "Situation," "Don't Go," and "Bring Your Love Down" are classic dance tunes which probably will be played in discos long after this fad passes. Clarke's more electronic experimentations, such as "I Before E Except After C" and the spoken passages of "In My Room," don't work quite so well. John Cage he's not, but we suppose Clarke can be afforded such diversions as long as he sticks to making pop music most of the time.

When you get down to it, Yaz is an excellent pop/R & B combo who can handle slower material with even greater finesse than simple rhythm stompers; witness "Midnight," a soul ballad of immense power, or "Only You," which owes much to the Small Faces school of white R & B. When they write





Yaz

for the sake of the song, which is most of the time, Yaz has immense success. When they get sucked into the trap of catering to the idiom they inherit—a rare occasion, thankfully—Clarke and Moyet expose their weaknesses.

*Upstairs At Eric's* raises a few questions, like what is Moyet doing singing in a synth band when she could obviously front whatever kind of act she wanted with great success. The issue of how committed she is to the synth/machine approach only comes up because she doesn't play on the record, yet her songs and musical direction are what matters here. Not to denigrate Clarke's contribution, but he is easily outshaded even though he wrote more than half the tunes and played all the instruments. We shall see what the future holds for Yaz, but more importantly, what it holds for Alison Moyet.

One quick note about the production: The record sounds very good, using pitch-changers and delay lines to the hilt, but the actual level is surprisingly low. Be forewarned—this is one album you may really have to crank your system up for. *Jon & Sally Tiven*

**Make My Home Where I Hang My Hat:** Johnny Copeland  
**Rounder 2030, \$8.98.**

Sound: B

Performance: A

If you thought all the great bluesers had passed on, Johnny Copeland's new album should change your mind. Word has it that Copeland and his band have been playing around for close to 20 years, and they certainly sound like it. This is one blues record on which the grooves are as potent as the vocals or guitar, an exemplary collection of tracks sounding both fluid and powerful. The arrangements are quite spacious, with much room for sax and piano solos, as Copeland limits

"Because of a stunning vocalist, strong songs and musical simplicity, Yaz has found commercial and artistic success."

most of his guitar work to slim but dramatic fills. When he does stretch out instrumentally, as in the title track and notably on "Honky Tonkin," Copeland shows off the technique, speed, and catalog of licks that prove exactly how far he's developed from his starting points of B. B., Albert, and Freddy

King. Copeland's playing is more advanced than that of the first two, and like Freddy he manages to get a tone from his guitar that's as noteworthy as any of the other components of his axe-wielding. Adding a touch more distortion to his guitar than most old-line bluesers, Copeland uses the pat-

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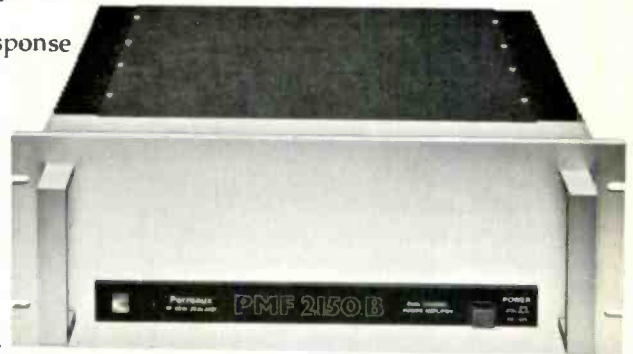
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Frank Glatt



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"Johnny Copeland is a great guitarist and vocalist who promises to keep the blues genre alive and kickin'."

ented blues-rock sound of the back guitar pickup, with the treble pushed up all the way, but the arrangements are much closer to swing music than to post Chuck Berry rock 'n' roll. Copeland is definitely a traditionalist.

Far from being just another collection of 12-bar shuffles, *Make My Home*

*Where I Hang My Hat* boasts a variety of material that is arranged for the sake of the songs (not for the vocal or any particular solo instrument) and conveys the six-stringed wizardry of a great guitarist and vocalist who promises to keep the blues genre alive and kickin'.

Jon & Sally Tiven



Johnny Copeland



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**Gone Troppo:** George Harrison  
Dark Horse/Warner Bros. 23734-1,  
\$8.98.

Sound: B+

Performance: C

George Harrison's latest album is a very pleasant effort, beautifully recorded with an uncommon clarity. What it isn't is compelling. George's songs here are unobtrusive and easy to take, but hard to notice. They just slip by effortlessly and all too forgettably.

Michael Tearson

**Records:** Foreigner  
Atlantic 80999, \$8.98.

Sound: B+

Performance: B

Welcome to the age of packaging, where a well-produced imitation can have far more impact than the raw-edged gems inspirations are drawn from. John Cougar makes his nicely crafted pop tunes into the best selling album of the year, while muse Springsteen doesn't even crack the top 10. Foreigner, who originated nothing save the phrase "corporate rock," seems to be one of the biggest, if not *the* biggest band on the planet, while Andy Fraser (who wrote "All Right Now") sits in semi-obscurity, writing great songs and trying to get a record deal.

However, releasing greatest-hits albums allows critics to vent their anger at pompous, stodgy rock 'n' roll millionaires. Which brings us to *Records*, a rather typical compilation package that has its place in many collections if only because Foreigner has never put together a complete album of consistent songs. Whatever your argument may be with them, when Foreigner hits the mark they're on the money, and when they don't, they still make the money. But they've yet to produce a *Fire & Water* or a *Highway*. When they do, we'll let you know. Jon & Sally Tiven



## MEMORY LAME



King Crimson

**In the Court of the Crimson King:**  
King Crimson  
**Mobile Fidelity MFSL 1-075, \$15.98.**  
**Chooglin':** Creedence Clearwater Revival  
**Fantasy Digital F-9621, \$10.98.**

Sound: B+      Performance: B

What we have here is a genuine late-'60s revival, since both of these groups are decidedly more influential upon the music made today than they were in their own time. As a result, these old masters were taken down from the shelves and made available once again in audiophile form, which should, for all intents and purposes, be perfect justice.

Except for one small problem: They weren't originally recorded particularly well, so instead of sounding more like records of the '80s, they merely reveal how dated the production techniques were. King Crimson's debut album had no real precedent, since it was the first actual merging of the rock genre with synthesized symphonic instrumentation (unless you want to count people like The Moody Blues, who failed to live up to the "rock" qualification). It was no wonder that the engineers really didn't know what to do with it; this was strictly avant-garde stuff, later to be blasted into the charts by Yes and Asia. The points of reference were, especially from a production point of

view, obscure. The drums on this album hardly sound phenomenal, but they are not as tinny and one-dimensional as they were on the original pressing. Be forewarned, however, that *In the Court of the Crimson King* is nowhere near the audio treat of their current albums, although the music holds up surprisingly well. The songs may, at times, drift off into the near-nebulous ("I Talk to Wind") but are by no means as outdated as the record-

ing style itself. This particular lineup of the group—Fripp, ex-Foreigner member Ian McDonald, Greg Lake, and Michael Giles—certainly was a strong songwriting team as well as fine players.

*Chooglin'* not only is somewhat of a bastardization of Creedence Clearwater Revival's work, but it misses the point entirely of the group's sonic thrust. They were aimed toward AM radio and three-inch speakers from the word go, and their recordings reflected this through and through. When you bring in the missed frequencies, it only weakens the sound. The shrill distortion on the guitars, trashy snare, and thudlike bass sound that Creedence managed to achieve was absolutely perfect for the songs they were trying to get across. Juicing it up by mastering the recordings digitally on virgin vinyl doesn't do any great service to the music, although the original pressings were not done on the greatest vinyl, either. But beyond that basic mistake, what is assembled on *Chooglin'* is a best-of collection that reads more like a worst-of: Five of Creedence's longest tunes, when everybody knows their strength was in three-minute singles. Only "Pagan Baby," one of their last recordings, really belongs here, because CCR was then concentrating on albums and paying more attention to such things as stereo spread.

Jon & Sally Tiven

Creedence Clearwater Revival



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**Max Reger: Serenade, Op. 141a, for flute, violin and viola; Suite, Op. 103a.**

**Gasparo GS-224**, \$8.98.

Gasparo is a relatively new, Nashville-based classical label whose catalog consists largely of chamber music. Two of the discs reviewed here are CX-encoded; that is, the program has been compressed during the disc transfer operation so that the bulk of the program (from "zero" level to 40 dB below) occupies only 20 dB of dynamic range. When played back through a CX decoder, the signal is expanded, the original dynamics are restored and the inherent noise level of the disc is improved by some 20 dB. The claim is made that CX records are compatible with normal, nondecoded playback, so it is fair enough to review them undecoded.

So often, performances on old instruments are an occasion for humdrum playing and poor intonation. Not so with the Oberlin Baroque Ensemble. The playing is authentic, vital, and eminently musical. Had the record been made without CX, or if I had a decoder, the disc would be a joy. But hearing it in its compressed mode, the way the vast bulk of listeners will hear it, it comes across as a good disc might be heard over an FM station using a program compressor too generously. In particular, pauses and rests between musical sections are filled with "breathing," the rise and fall in the original noise level of the source. The effect is particularly bothersome in the "Sonata for Viola da Gamba," with its somewhat more declamatory writing.

The Humperdinck-Haydn disc is less obviously CX-ed. It has another problem, channel imbalance. I had to raise the right channel some 6 dB(!) in order to right things. When this was done, the array of images across the stereo stage was quite natural. The

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"Two of these Gasparo releases are CX-encoded, and neither gains much from the process. The third is of rarely played works by Max Reger."

sustained nature of so much of the writing minimized the effect of compression, and I was aware of it only at the ends of phrases, where both the breathing of the players and the source noise level rose.

On the basis of what has just been stated, one may wonder if CX is really compatible with undecoded playback. This is clearly in the ear of the beholder, not to mention the record producer. Compatibility is of course a subjective thing, and it undoubtedly varies from record to record. It certainly is a function of the playback apparatus; the higher the resolution of a system, the more likely it will bare the encoded compression.

In my opinion, neither of these releases stands to gain much from CX encoding—even with proper decoding. There is obviously, again in my opinion, more to be lost through the undecoded process. I sincerely recommend that Gasparo consider who their audience really is, and, even more important, consider the present state of CX in the hardware marketplace.

The third record of the set treats us to more fine playing from Oberlin faculty members; this time, rarely played works of Max Reger featuring the flute of Robert Willoughby.

I am grateful for small labels such as Gasparo. Without them, so much good but obscure music routinely ignored by the majors would go unrecorded. All three of these releases are well packaged, and the album notes are first-rate.

*John M. Eargle*

**Chopin: Sonata No. 3; Prokofiev: Sonata No. 7.** Anthony Di Bonaventura. **Dbx SS 3030**, dbx-encoded, \$9.00.

The dbx process generally works well with piano recordings because it allows levels on the disc to be brought down and ending diameters to be fairly large. The playing times of these two sides (27- and 28-plus minutes) dictate that the ending diameters be quite small, and as a result, the toccata finale of the Prokofiev, a noisy enough piece, has to be heard through a bit of tracing distortion. Overall, however, the disc is excellent in terms of sonic cleanliness.

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"Side one of this Chopin disc is afflicted with enough decentering to make the largo third movement unlistenable."

ips, specially modified, 3M analog tape recorder, and the noise level is effectively as low as a digital recorder's; you hear no hiss.

While the dbx process can transform the standard stereo disc into a much better medium than it normally is, there is one area where it cannot help. "Wow," a once-around time-base instability due to an off-center stamper, may be all the more annoying against a noiseless background than with a conventional disc. Side one of this record is afflicted with enough decentering to make the largo third movement of the Chopin almost unlistenable.

The piano sound is brisk, and it is well suited to Di Bonaventura's electrifying playing of the Prokofiev. Both the instrument and the intense style of the player rob the Chopin of some of its essential lyricism.

All things considered, this is an excellent recording—but watch that off-center problem (though not all pressings will have it). *John M. Eargle*

**Led Zeppelin II: Led Zeppelin Mobile Fidelity MFSL 1-065, \$15.98.**

Sound: A- Performance: A

If one record were picked as the classic heavy-rock album, *Led Zeppelin II* would have to be it. Well out of the starting gate and on the road to superstardom, Jimmy Page was to utilize his years of studio experience and frustration to create the loudest, raunchiest, and most rip-roaring rock phenomenon the world had ever laid ears upon. While the first Zeppelin album retained a thread of his Yardbirds approach—resembling the four-man rock group with the exception of a superior drummer and singer—*Led Zeppelin II* saw Page exploring territory no man had dared traverse previously. Maniacally orchestrated guitar passages (often in unison or octaves), a meticulously produced vocal sound aided by pre- and post-delay lines, the beginnings of the awesome drum ambience heard on

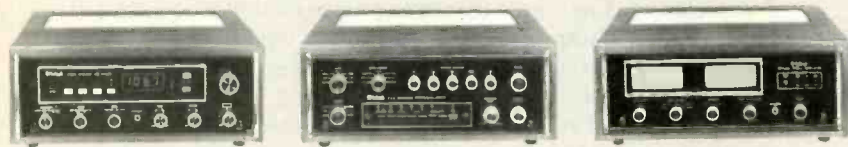
most contemporary records, and attention paid to every detail made this album a classic unsurpassed even today by Foreigner, Boston, or any of the pretenders to the heavy-metal throne.

But there was a problem with *Led Zeppelin II*—the mastering and pressing of the disc were strictly horrendous, although the record company had no excuses (they virtually sat on the album for six months). We went through three copies before finding one that would track properly. Friends who owned record stores complained about returns, as the last track on the album, "Bring It On Home," skipped on every other copy. Mobile Fidelity has remedied the problem with their edition. While not as souped-up and trebly as its antecedents, it delivers the full bandwidth in a form any stylus can easily digest without chewing, choking, and spitting-up the contents.

The big revelation was hearing the tape edits throughout Page's unaccompanied guitar solo in "Heartbreak-

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"There's so much here for the rock 'n' roll audiophile to go wild about, it boggles the cranium."



Led Zeppelin

er"; no wonder he never played it like the record in a live performance. But there's so much here for the rock 'n' roll audiophile to go wild about, it boggles the cranium. To hear clearly what each of the guitars is doing should make most guitar players (a high percentage of whom have learned many of these songs note for note) go back and study what they missed the first time around. Even the drum solo on "Moby Dick"—the riff of which is nicked from The Yardbirds' "I'm Not Talking"—provides new fire and thrills. You even get a sound-effects record thrown into this audiophile package, the middle section of "Whole Lotta Love." It's nice to see that Mobile Fidelity is truly on their toes A&R-wise, and perhaps soon we'll see them work their magic on the first Zeppelin album (originally mastered to perfection by Page, but after the original mother was worn, subsequent pressings turned out quite badly) or some Motown albums.

Jon & Sally Tiven

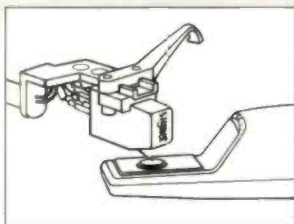
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EDWARD TATNALL CANBY

## WILD & WANTON WOODWIND

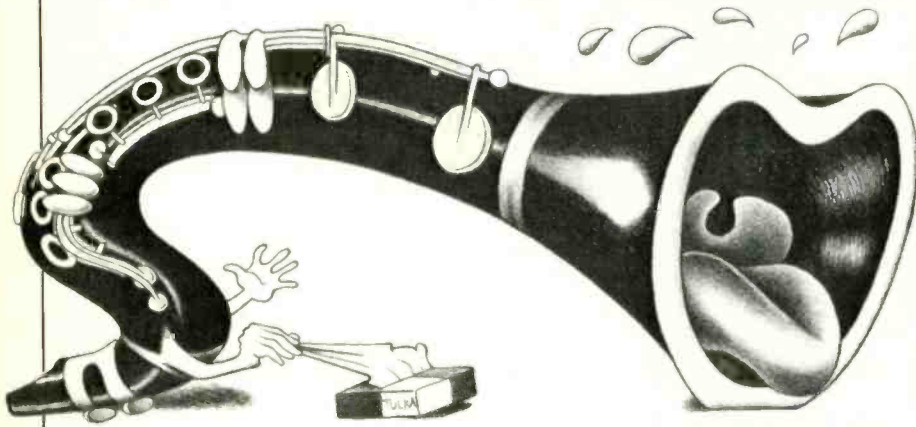


Illustration: Rick Tulka

**Weber: Quintet in B Flat for Clarinet & Strings; Seven Variations; Grand Duo Concertante.** David Shifrin, clarinet; Sequoia String Quartet; William Doppmann, piano.  
**Nonesuch D-79017**, digital, \$11.98.

Sound: A- Recording: A Surfaces: B+

**James Campbell, clarinet; John York, piano.** Lutoslawski, Pierné, Gade, Debussy.  
**Crystal S336**, \$8.98.

Sound: B+ Recording: B Surfaces: B+

What an extraordinary instrument is the clarinet! For much of the early part of this century it was tamed in its classical guise to a smooth, suave, elegant sound with Impressionism ("Afternoon of a Faun") as its base—but at the same time it burst out in its other personality as jazz. Now we begin to understand that this was the original clarinet sound, wild, screaming, honking, or mysteriously soft, a very emotional instrument. I like to call this earlier authentic character the Benny sound, for Goodman was right and so was Gershwin. The clarinet, even in "classical," can be raucous as well as suave. And should be.

Accordingly, you will find this early 19th-century Weber Quintet ever so wonderfully of the Goodman school (or name your own jazz great). The clarinet shrieks, warbles, groans, swoops, soars, whispers very much as it has been made to do in jazz. David Shifrin, the soloist, has the right idea and Nonesuch's engineers the same—I have never heard a more dramatic clarinet sound. (The second side, clari-

net and piano, is much more docile in the recording but still okay by a lot.)

James Campbell's clarinet disc, sporting a string of unlikely composers' names, is musically a pleasure too, beautifully tailored for smooth continuity, the music all of a French persuasion except for the Dane, Neils Gade, who nevertheless fits his pretty music very well into the picture. The Debussy is the big music here; the rest is lesser conservatory stuff, but very swank and elegant to listen to. Why not? It's gorgeous sound. If you have played the Nonesuch disc, you will note that only Debussy, a big man, offers some decidedly Benny clarinet moments. He knew.

Look closely at Nonesuch's Weber pressing. Mine is astonishing, the disc itself at least a quarter-inch off center but the spiral right on the button. I heard an odd intermittent burbling in the clarinet's first notes—what? Stylus problems? Digital problems? An actual nervous burble from the instrument itself? I could not tell. Only for a moment or two; the rest is perfect.

**Offenbach: Gaité Parisienne; Saint-Saëns: Danse Macabre; Dukas: Sorcerer's Apprentice.** Orchestre National de France, Maazel.  
**CBS 35843.**

Why do big record companies put out so-so recordings like this? No doubt because (a) the contents are "safe," standard and conventional, (b) the artists are well-publicized big-time, and (c)—? I trust CBS will take it as constructive comment when I suggest

that any one of these ultra-familiar works can be found in a dozen or so much more pleasing recordings. Why bother? Well, I do not possess the sales figures so I could be wrong.

I turned to the record because of the French orchestra—we've heard this familiar Offenbach in many a version *not* from France; how do the French themselves do it? Might be interesting. But then, there's Lorin Maazel, who is one of those achievers. You can hear it. I don't really know whether the French orchestral players on their own would drive, *driven*, like Datsun, at such rigidly over-fast and steely tempi—I doubt it. But who's to talk back to the Maestro? They play the way he conducts, and it is not good. If you want Offenbach with teeth grating, okay, here it is. As for the old "Danse Macabre," I can't even remember how it sounded. Instantly forgettable. Only the Dukas "Apprentice" suddenly seemed to come to some life. Who knows why? It wasn't half bad, as I listened. But not by any means more than average.

Moreover, the recorded sound is just plain ugly, thin, lacking in bottom, narrow, shrill, at an unpleasant distance. Why? Presumably, this is the French engineers' doing. The music could be so much more friendly, mellow, relaxed, sparkling.

If you don't believe me, go out and try it.

Lorin Maazel





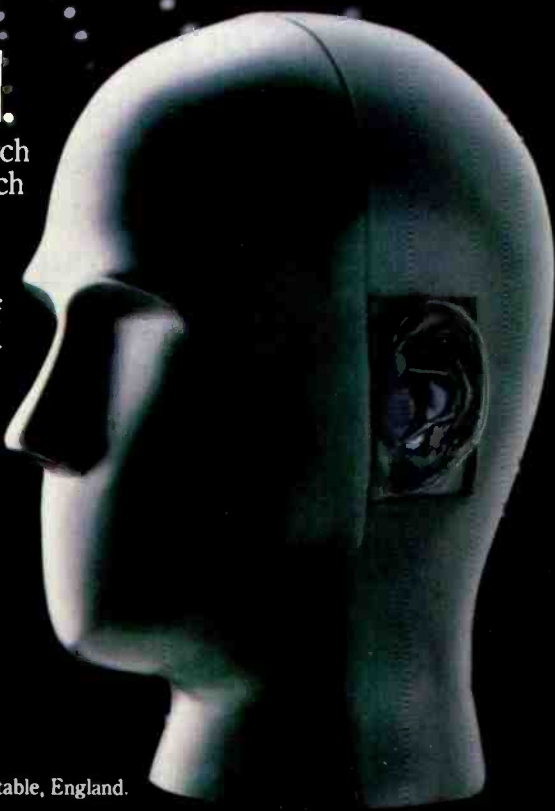


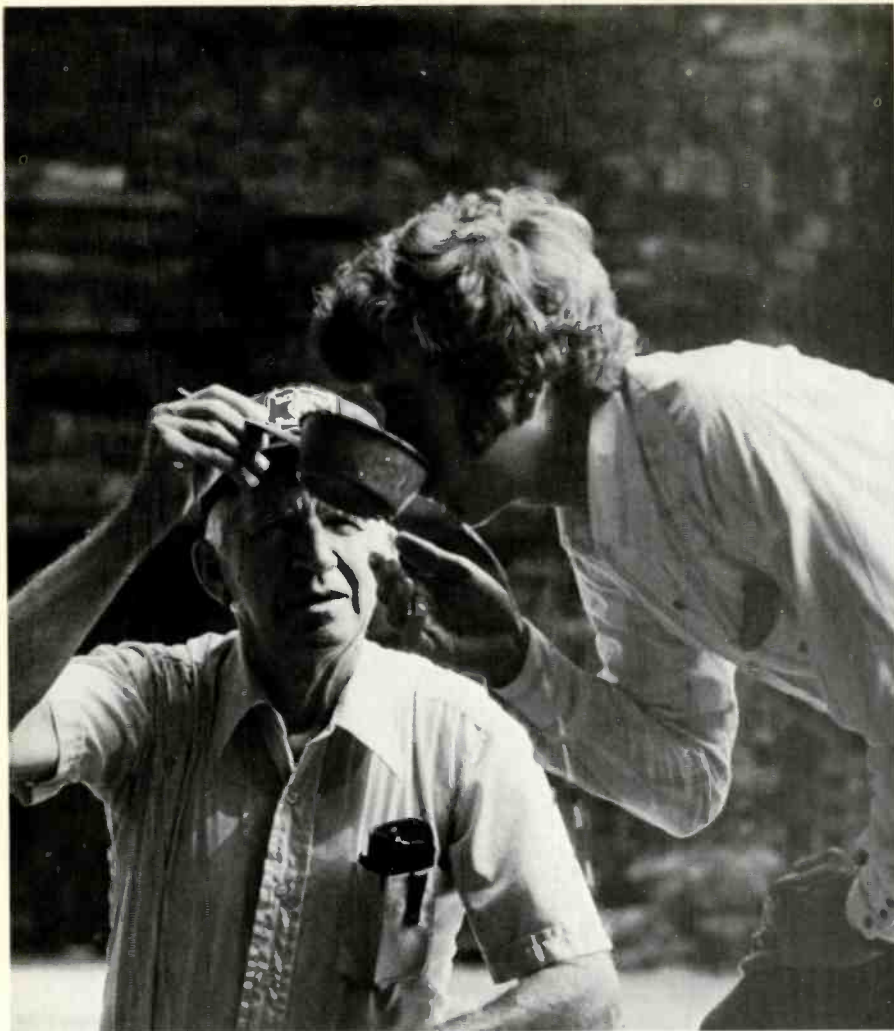
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BY DROP

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Sound: B+ Recording: B Surfaces: A-

The tradition of four-hand piano music, two people sitting at one piano, is an immensely honorable one, going back past Mozart into the days of the harpsichord. In the 19th century, before phono and radio, the general educated populace learned much of its music at home, through four-hand arrangements of everything from string quartets to symphonies and opera, and in particular through the many fine original works composed for this curious medium—so ungainly in modern concert form. (Two grand pianos neck-to-neck make a fine display, but the wide bottoms of two people sitting on one narrow piano bench definitely do not.) This record should be welcome, recording being the ideal modern form for such music (the players invisible!), and the music this husband/wife team plays is first-rate, too.

But they do not rise. They are simply pianists and what we hear are the notes of the piano, from 20 fingers well coordinated. Everything is meticulously in time (too much so), properly shaped and phrased, a model for any student. But there is an astonishing lack of understanding of the music itself, which is done correctly but superficially, both Schubert and Ravel, two major composers for the medium. This music surely soars to much more profound beauties than these players know, four hands or not.

I played through the big Schubert works on one side and began the Ravel on the other—same thing, different music. Just no "poetry!" Mostly, this is a matter of significant timing, as one times a famous line of Shakespeare for its maximum impact. The timing tells all—for instance, a sudden crucial and mysterious change of harmony, in all truth soul-shaking. Not here! It wouldn't rattle a teaspoon. These pleasant people either do not hear these things or are unable to convey them in piano terms. Plenty are. Have they heard Schubert, Ravel, in other than piano form? That is how one learns, or one way to do it.

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**When +3 = -2**

*Q. Tapes recorded at a maximum of -2 VU on my cassette deck register over +3 VU on most other decks. Could my deck have more headroom than other decks? Are the meters off on my deck?—William Armistead, Stone Mountain, Ga.*

*A.* If anything, your deck provides less headroom than the others. To provide headroom, a deck's meters are adjusted to provide a higher reading than the actual level of a steady signal. This more or less compensates for the fact that on brief, sharp signals (transients) the meter cannot fully follow the signal and therefore understates its level. It could be that your deck's meters respond so rapidly (approximating a peak-reading device) that less headroom is necessary.

Further, you may be using a tape with high sensitivity, so that for a given signal input you are obtaining a relatively high signal output, as indicated by the other decks.

**Input Distortion**

*Q. When I record discs from my turntable on my eight-track deck, in playback the drums, cymbals, hand-claps, etc. are distorted. The background has a raspy quality, and there is a terrible swooshing sound. However, when I record from my cassette deck onto the eight-track deck, the recording is fine. Therefore, to avoid distortion I first have to record discs on cassette, and then record them from cassette to eight-track. Nobody can seem to figure out what the problem is. One service technician told me he thought that somehow the output impedance of my turntable doesn't match the input impedance of my eight-track deck.—Bill Schuh, Scottsdale, Ariz.*

*A.* Others have run into a problem such as yours. The answer seems to be that the record electronics of the offending deck (in your case, the eight-track one) are unable to handle all frequencies presented to them at high or even moderate levels. Most probably, the deck is unable to handle the warp frequencies presented by most discs and therefore by the phono pickup and phono preamp. The warp frequencies are inaudible to the human ear. But they exist, often in con-

siderable strength. Further, they are greatly amplified by the bass boost supplied by the phono preamp, and also by the overall gain of the preamp. Presented with such a signal, the electronics of a tape deck may block, distort, and/or oscillate.

However, it appears that your cassette deck can accept the warp frequencies without going into aberrant behavior. Below 20 Hz or so, the output of your cassette deck drops sharply so that there is very little of the warp frequencies remaining in the signal fed to your eight-track deck. And, therefore, your eight-track deck then works satisfactorily.

You may be able to eliminate the problem by introducing a sharp, low-frequency filter between the tape output of your audio system and the eight-track deck.

**Taping Backwards**

*Q. If you are familiar with the later phono discs of The Beatles, you may know that there are a number of backward sections, especially in band 9. How can I tape these backward passages so that they come out forward? What I did in the past was to tape the backward passage in the normal way on open reel and turn it over so that the shiny side of the tape contacted the heads in playback. However, this gave very poor fidelity and weak sound. Can you suggest a better way of taping the backward passages?—Gary Teresi, Greece, N.Y.*

*A.* One method that occurs to me is the following. Try to rent or borrow (perhaps from a local audio store) a half-track open-reel recorder. Record the backward phono passages onto tape. Turn the tape over (flip the reels) and play, at the same time dubbing the output onto a tape recorded by your deck.

**Hidden Computers**

*Q. Lately the word microprocessor has been used. What is this?—Terry Vey, West Bend, Wisc.*

*A.* This is in effect a miniature computer. In a sophisticated tape deck, a microprocessor might be used to automatically adjust bias, equalization, and other parameters in order to obtain optimum performance with a given tape as well as for such functions as pro-

gramming tape selections, converting tape counters to read in minutes and seconds, and in some decks even acting as built-in clock-timers.

**Turnover Frequency**

*Q. In the November 1981 issue, you stated that 70- $\mu$ S equalization corresponds to a turnover frequency of 2,274 Hz. Please give the formula for this relationship.—William Flanagan, New Windsor, N.Y.*

*A.* The simplest equalization network consists of one resistor and one capacitor. The time constant, in microseconds, of such a network is given by the formula  $T = CR$ , where time is in seconds, capacitance in Farads, and resistance in ohms. This corresponds to the time it would take the capacitor in the network to charge to 63.2% of its maximum voltage.

A capacitance of even 1 F would, however, be far too large for tape equalization. Hence, the capacitance is usually given in  $\mu$ F, and time, therefore, in  $\mu$ S; the figure would also be in  $\mu$ S where C was in pF and R in megohms. (For a network using an inductor and resistor, incidentally, the formula would be  $T = L/R$ , where L is inductance in Henries.)

The relationship between the time constant and the turnover frequency (the frequency at which response is 3 dB above or below "flat") is given by the formula:  $f_{3dB} = 1/(2\pi T)$ .

**Static Pops**

*Q. Recently I began hearing loud static discharges, about every 10 or 15 seconds, on two of my cassette tapes. All of my other tapes are working well. What could the problem be?—Adrian Iwachin, Toronto, Ont., Canada*

*A.* Some tapes, depending on their oxide formulation, are more prone to static discharge than are others. As conditions of humidity vary, a tape that was giving no trouble may suddenly act up. If you are having trouble with a particular cassette, a stratagem that might work is to rap it sharply against a hard surface—but, of course, not hard enough to damage the shell. **A**

**If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.**

## Passive Radiators

*Q. In a loudspeaker system, what is a passive radiator?—Gary J. Arnold, Elk Grove, Cal.*

A. A passive radiator is a speaker cone, with a difference. Normal speaker cones are driven by power from the amplifier, applied to their voice-coils. Passive radiators have no voice-coils, or other motor parts, but are moved by the back wave from a driven cone, usually the woofer (though there are some midrange passive radiators). This makes it less an extra driver than a substitute for a vented enclosure's reflex port; its advantages over an open port include the elimination of possible wind noises and pipe resonances, plus some additional control of port loading through the mass and compliance of the passive cone. The passive radiator is also sometimes referred to as a drone cone in this country, and is known as an auxiliary bass radiator (ABR) in Britain.

## S/N with Shorted Inputs

*Q. Why do manufacturers measure amplifier signal-to-noise ratios with the amplifiers short-circuited?—Bob Robinson, Warrensville Heights, Ohio*

A. The source impedance of the device driving a power amplifier is not known. Therefore, to make it possible to repeat a measurement by techni-

cians located in any laboratory, such measurements have been standardized so that all signal-to-noise measurements are made with the input of the device short-circuited. This will make the signal-to-noise ratio higher than it would be with an open circuit at the input. Most devices which ordinarily feed into the input of a power amplifier have such low output impedances that they can be considered as virtual short circuits.

## The Rack that Hummed

*Q. I have secured my system's components in a metal rack, using round-head bolts. One of my amplifiers hums in this setup, the amount of hum depending on how tight the bolts are! If the amplifier is removed from the rack, the hum also disappears. Is this magic? Why does it occur with only one of these amplifiers? And why does reversing the a.c. plug reduce this hum somewhat?—Steve Kandell, Santa Monica, Cal.*

A. Do you mean a physical hum coming from the rack, or an electrical hum heard through the speakers? From your description, I'd say you had some of each.

A physical hum is usually caused by a loosely assembled or mounted power transformer. If the rack resonates at the 60-Hz a.c. power-line frequency or

some multiple thereof, it will amplify these vibrations and help radiate them into the room. The more tightly the amplifier is coupled to the rack by its mounting bolts, the better its vibrations will be transmitted to that rack. Try tightening the bolts which hold the transformer together, and those holding to the amplifier chassis.

If it's an electrical hum, you probably have a ground loop between the amplifier and some other component, conducted partly through signal cables and partly through the rack. Insulating the humming amp from the rack may help. So might disconnecting the shields at the preamp end of the cables feeding signal to the power amp.

## Equalizer Hazards

*Q. I am very interested in an equalizer, but I have read that equalizers can damage a power amplifier by the excess power demand at the boosted frequencies. Is this true?—John S. Burwell, APO San Francisco, Cal.*

A. An equalizer, in and of itself, cannot damage an amplifier. But you can use it in such a way as to damage your amplifier or speakers, by overdriving them. This will not happen, of course, at frequencies where you're using the equalizer to reduce the system's output. But trouble can occur if you're using a lot of boost.

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One common use for equalizers is to make up for insufficient bass output from the speakers, by boosting bass with the equalizer. If overdone, this can damage the amplifier or speakers (though you'll generally hear signs of distress, such as bass "doubling" or distortion, before permanent damage is done). Boosting of the lowest equalizer band is more likely to affect the speakers than the amplifier, as there is rarely enough musical content in the bottom octave or two to make the amplifier overheat; it will have time to cool between bass passages.

You're unlikely to cause amplifier damage by boosting mid and upper frequencies, as there's little power there. You can, however, damage some tweeters by over-boosting the treble.

The same cautions hold true, to some extent, when boosting the frequency extremes with conventional bass and treble controls.

#### Off-Center Pressings

*Q. Occasionally I encounter a disc with an off-center spindle hole. I even have one record with an off-center hole on only one side. I would think that this would not occur if the stampers for the two sides were simply made concentrically during the record molding. Why hasn't this problem been solved before now?—Don Lewis, Sunnyvale, Cal.*

*A. Off-center spindle holes are produced before the molding process. The condition is created during the production of the stampers used to press records. When making stampers from master lacquers, the concentric lock groove (cut beyond the outer edge of what will be the finished disc) should be perfectly aligned, using a microscope mounted on a special table and then aligned for zero motion as the table is turned. Next, a punch produces a hole which is supposed to be at the exact geometrical center of the stamper's grooves. When the maker of the stamper is careless, we have off-center spindle holes.*

I recently had a master blank which

had such a large center hole that the disc, when cut, was not centered. I would not have given much thought to such a circumstance, knowing that the stamper-maker should not refer to the existing center hole but, rather, to a concentric groove. However, because of the maker's carelessness, the final

disc got as far as a "test-pressing" before it was rejected and all necessary work redone.

If the stamper-maker does his job for one side of a disc and is careless with the manufacture of the other side, the result will be a disc with an off-center hole on only one side. A

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Ariston RD11 Superieur shown here with SME 3009R tonearm

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## IN-DASH INNOVATIONS

There is a lot to say, these days, about car stereo. The equipment is becoming as sophisticated as that for the home. And the sound quality of car stereo is improving faster than that of home stereo—for the simple reason that it's starting from a lower base. The car is still a harsh environment for sound equipment, and a poor environment in which to listen; this will require still more sophistication in equipment and installation.

And since there is so much to say about the subject, we'll be saying it, from here on in.

Welcome to Roadsigns.

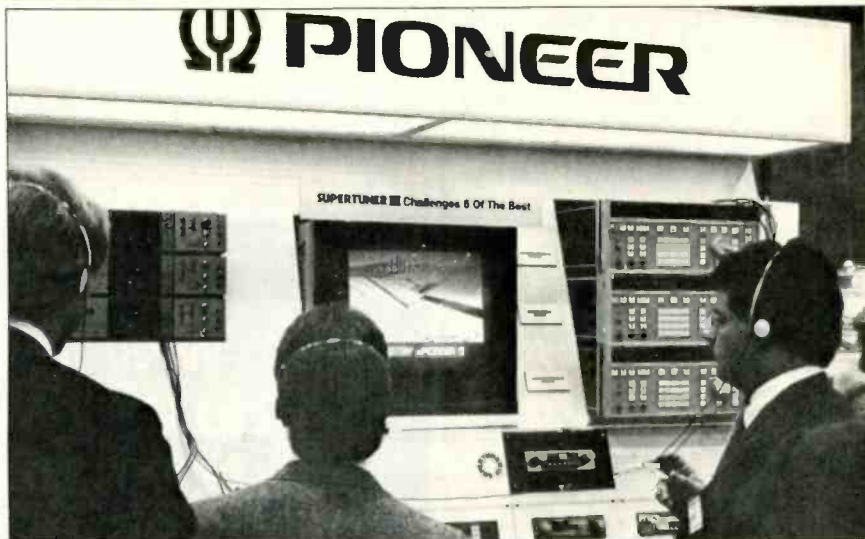
**W**hile the problems endemic to the car keep car-stereo sound from catching up to that of equivalently priced home systems, car-stereo technology is catching up—and fast.

The best and biggest sign of this comes from Nakamichi's TD-1200, a car-stereo unit incorporating the NAAC automatic azimuth-correction circuitry just now appearing in the Dragon home deck (which we'll report on soon). Still further confirmation comes from Pioneer, Proton and Carver.

At the Winter Consumer Electronics Show, Pioneer showed their Supertuner III, the car-stereo embodiment of their new Direct Stereo Decoder, the subject of a paper at last October's AES Convention, and of an impressive demonstration at WCES. Claimed advantages of the system include lower noise and increased stereo separation, especially at the higher frequencies, greater spurious-response rejection, and up to 20 dB more adjacent-channel selectivity.

Pioneer's AES paper explained the gains in S/N and separation but not (to me, at least) the improvements in adjacent-channel selectivity and spurious-response rejection. Their demonstration did, however, show off those improvements dramatically—along with improved FM sensitivity and multipath rejection, which were not claimed in the AES paper and might be due to other circuit elements.

The demonstration coupled a computer with three FM signal generators, a voice synthesizer, a graphics display screen and a panel of the latest, hottest tuners from Pioneer and its major



Pioneer's computer-controlled display comparing the new Supertuner III with six competing units.

competitors. All seven stereo units were tuned to the frequency of one generator, which was being modulated by a music signal. The other two generators were modulated with two different voice signals and were set to higher r.f. output levels.

The computer then set up three basic listening situations—city, suburban, rural—with varying signal levels. For each situation, the computer would set up the appropriate signal level on the generators, throw an identifying picture on the screen, and then play each tuner through headphones on the display panel while announcing (by voice synthesis and on screen) each situation and tuner. Presumably, Supertuner III will be available later this year.

Proton's introduction at WCES was a new version of the Schotz detector, described in our review of the NAD 4150 tuner (*Audio*, March 1983). Proton had earlier announced models using this technology, but the new Models 207 (with Dolby C NR) and 212 (with four low-powered amp channels, plus Dolby B) use a more advanced, "Phase III" version.

Carver made a brief announcement of the TX-A, an automotive add-on version of the asymmetrical charge-coupled FM detector in their TX-11 tuner (*Audio*, December 1982). It would be intriguing too see how a Proton with Schotz III or a Pioneer Supertuner III and the Carver attachment would work

together—and if Carver will bring out a home version.

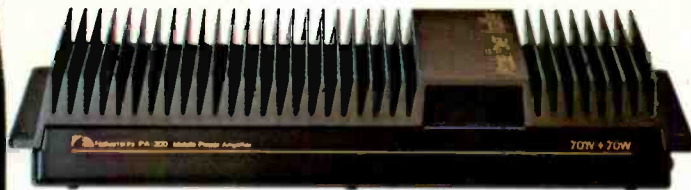
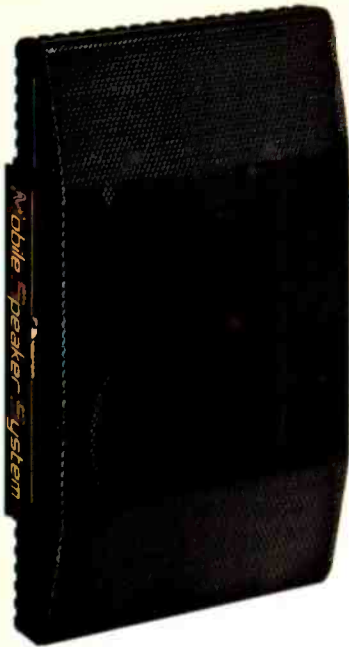
Nakamichi's TD-1200 has some interesting tuner technology, too: If a station is entered in the tuner memory while the Dolby B NR is on, then the Dolby system (including 25- $\mu$ S pre-emphasis) will automatically switch on whenever that preset is selected.

The TD-1200's big news is the NAAC alignment system. Nakamichi has long offered models whose record azimuth could be adjusted, but that only assured correct response when playing back tapes made on those decks. NAAC automatically aligns the playback head to match whatever alignment is recorded on the tape, so it helps all tapes. The basic principle is simple. The playback head is split horizontally into two separate cores and coils. Comparing the phase response from the halves yields an error signal that controls a head-positioning motor. (Our Dragon report will cover this in more detail.) The deck also has Dolby B and C noise reduction.

The tone controls are also interesting. In addition to conventional bass and treble controls, there is a mid-range control which boosts or cuts by 10 dB at 200 Hz, a frequency where many installations have problems.

GM's Delco Radio division has selected the Motorola AM stereo system, which might therefore be available in some 1984 GM cars. It had been wide-





PA-300 Mobile Power Amplifier

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Imagine no more! The system you've been dreaming about is waiting for you at your Nakamichi Mobile Sound System dealer. Take your favorite cassettes along and ask for a demonstration. Or, write for more information to Nakamichi U.S.A. Corporation, 1101 Colorado Avenue, Santa Monica, CA 90401.

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 Nakamichi

"It was predicted that once Delco picked an AM stereo system, radio stations would follow suit. So far, there's little sign of this."

ly predicted that once Delco, probably the world's largest car-radio manufacturer, picked a system, America's radio stations would follow suit. So far, there's little sign of this. Most broadcasters still seem to favor the Kahn or Harris systems, and most receiver manufacturers which have announced

a choice are mumbling support for the Magnavox system.

Sansui, meanwhile, exhibited a tuner for the car that can automatically receive "all approved" AM stereo systems. It worked fine at its demonstration and seems to work well on the road, too: Marvin Collins, Chief Engi-

neer of KFI/KOST in Los Angeles, reports that it worked well both on his station (Harris system) and on KHJ (Kahn-equipped). The new ST-7 tuner is due on the U.S. market before June, as part of a circa-\$1,100 system including amp, tuner and cassette modules, plus boxed rear-deck speakers.

Panasonic has a new Hypertuner circuit, with little information yet available, save that it's billed as doubling FM sensitivity and reducing noise pickup. One Hypertuner unit, the CQ-S788, also has a Daily Priority Station feature, which automatically switches to a pre-designated station at a preselected time.

Panasonic's Ambience circuitry, introduced in their car stereos last year, is now available in at least one new portable stereo, the RX-F40. In car stereos, the Ambience circuitry moves the left-channel image to a ghost position outboard of the car so that the driver feels centered in the stereo stage; hok-ey, but enjoyable. In the RX-F40, the object is to make listeners feel surrounded by stereo throughout a room.

American Autosound has announced an in-dash TV set with a 2-inch black-and-white screen. When the car's ignition is on, the TV picture goes off, though passengers can still listen to TV sound (as well as FM, AM and cassette, of course). This safety feature can be circumvented for use in a car's back seat. Price of the ET-9000TV will be about \$1,495.

A few other in-dash innovations merit comment: Alpine officially introduced the 7347, a \$600 unit with dbx, Dolby B and Dolby C noise reduction available by pressing corners of a rectangular rocker switch. Kenwood's new KRC-7100 now holds the in-car record for the greatest number of station preselects, with 24 (6 AM and 18 FM). Pioneer was the previous champion, with 15 stations (10 FM, 5 AM).

Cybernet, in the meantime, has joined Mitsubishi and Fujitsu Ten in offering a marine model. The CMS-3000 comes in a weatherproof case, with waterproofed circuit boards, O-rings around control shafts, and a double-door cassette insertion port for protection against the wet. The \$499 unit has typical car-stereo features—plus a three-way speaker selector and a headphone jack.

# ANALYZE

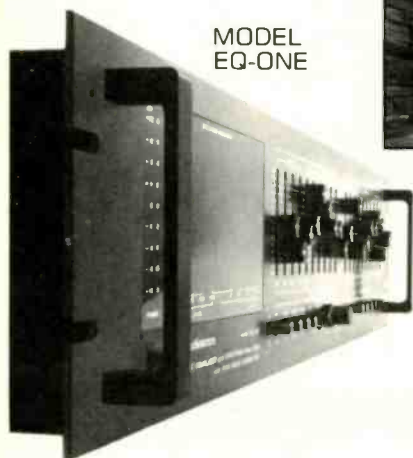
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SX-5 \$149.95	SA310 \$189.95	STR-UX22 CALL FOR PRICES
SX-202 \$159.95	SA410 \$229.95	STR-UX33 CALL FOR PRICES
SX-303 \$159.95	SA424 \$259.95	STR-UX4 CALL FOR PRICES
SX-6 \$199.95	SA626 \$349.95	STR-UX6 CALL FOR PRICES
SX-7 \$329.95	SA828 \$519.95	
SX-8 \$489.95		

### TURNTABLES SPECIALS

#### Technics

TECHNICS SL-10 \$129.95	TECHNICS SL-20 \$149.95	TECHNICS SL-30 \$169.95	TECHNICS SL-40 \$189.95	TECHNICS SL-50 \$209.95	TECHNICS SL-60 \$229.95	TECHNICS SL-70 \$249.95	TECHNICS SL-80 \$269.95	TECHNICS SL-90 \$289.95	TECHNICS SL-100 \$309.95	TECHNICS SL-110 \$329.95	TECHNICS SL-120 \$349.95	TECHNICS SL-130 \$369.95	TECHNICS SL-140 \$389.95	TECHNICS SL-150 \$409.95	TECHNICS SL-160 \$429.95	TECHNICS SL-170 \$449.95	TECHNICS SL-180 \$469.95	TECHNICS SL-190 \$489.95	TECHNICS SL-200 \$509.95
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### CASSETTE DECKS

PIONEER	SONY	Technics
CASSETTE DECKS	CASSETTE DECKS	CASSETTE DECKS
CT-4 \$109.95	WE-FX33 \$119.95	RSM205 \$99.95
CT-5 \$119.95	WE-FX44 \$129.95	RSM224 \$119.95
CT-6 \$129.95	WE-FX55 \$139.95	RSM233 \$139.95
CT-7R \$139.95	WE-FX66 \$149.95	RSM242 \$159.95
CT-8R \$149.95	WE-FX77 \$159.95	RSM251 \$179.95
CT-9R \$159.95	WE-FX88 \$169.95	RSM260 \$199.95
	WE-FX99 \$179.95	RSM269 \$219.95
	WE-FX100 \$189.95	RSM278 \$239.95
	WE-FX110 \$199.95	RSM287 \$259.95
	WE-FX120 \$209.95	RSM296 \$279.95
	WE-FX130 \$219.95	RSM305 \$299.95
	WE-FX140 \$229.95	RSM314 \$319.95
	WE-FX150 \$239.95	RSM323 \$339.95
	WE-FX160 \$249.95	RSM332 \$359.95
	WE-FX170 \$259.95	RSM341 \$379.95
	WE-FX180 \$269.95	RSM350 \$399.95
	WE-FX190 \$279.95	RSM359 \$419.95
	WE-FX200 \$289.95	RSM368 \$439.95
	WE-FX210 \$299.95	RSM377 \$459.95
	WE-FX220 \$309.95	RSM386 \$479.95
	WE-FX230 \$319.95	RSM395 \$499.95
	WE-FX240 \$329.95	RSM404 \$519.95
	WE-FX250 \$339.95	RSM413 \$539.95
	WE-FX260 \$349.95	RSM422 \$559.95
	WE-FX270 \$359.95	RSM431 \$579.95
	WE-FX280 \$369.95	RSM440 \$599.95
	WE-FX290 \$379.95	RSM449 \$619.95
	WE-FX300 \$389.95	RSM458 \$639.95
	WE-FX310 \$399.95	RSM467 \$659.95
	WE-FX320 \$409.95	RSM476 \$679.95
	WE-FX330 \$419.95	RSM485 \$699.95
	WE-FX340 \$429.95	RSM494 \$719.95
	WE-FX350 \$439.95	RSM503 \$739.95
	WE-FX360 \$449.95	RSM512 \$759.95
	WE-FX370 \$459.95	RSM521 \$779.95
	WE-FX380 \$469.95	RSM530 \$799.95
	WE-FX390 \$479.95	RSM539 \$819.95
	WE-FX400 \$489.95	RSM548 \$839.95
	WE-FX410 \$499.95	RSM557 \$859.95
	WE-FX420 \$509.95	RSM566 \$879.95
	WE-FX430 \$519.95	RSM575 \$899.95
	WE-FX440 \$529.95	RSM584 \$919.95
	WE-FX450 \$539.95	RSM593 \$939.95
	WE-FX460 \$549.95	RSM602 \$959.95
	WE-FX470 \$559.95	RSM611 \$979.95
	WE-FX480 \$569.95	RSM620 \$999.95
	WE-FX490 \$579.95	RSM629 \$1019.95
	WE-FX500 \$589.95	RSM638 \$1039.95
	WE-FX510 \$599.95	RSM647 \$1059.95
	WE-FX520 \$609.95	RSM656 \$1079.95
	WE-FX530 \$619.95	RSM665 \$1099.95
	WE-FX540 \$629.95	RSM674 \$1119.95
	WE-FX550 \$639.95	RSM683 \$1139.95
	WE-FX560 \$649.95	RSM692 \$1159.95
	WE-FX570 \$659.95	RSM701 \$1179.95
	WE-FX580 \$669.95	RSM710 \$1199.95
	WE-FX590 \$679.95	RSM719 \$1219.95
	WE-FX600 \$689.95	RSM728 \$1239.95
	WE-FX610 \$699.95	RSM737 \$1259.95
	WE-FX620 \$709.95	RSM746 \$1279.95
	WE-FX630 \$719.95	RSM755 \$1299.95
	WE-FX640 \$729.95	RSM764 \$1319.95
	WE-FX650 \$739.95	RSM773 \$1339.95
	WE-FX660 \$749.95	RSM782 \$1359.95
	WE-FX670 \$759.95	RSM791 \$1379.95
	WE-FX680 \$769.95	RSM800 \$1399.95
	WE-FX690 \$779.95	RSM809 \$1419.95
	WE-FX700 \$789.95	RSM818 \$1439.95
	WE-FX710 \$799.95	RSM827 \$1459.95
	WE-FX720 \$809.95	RSM836 \$1479.95
	WE-FX730 \$819.95	RSM845 \$1499.95
	WE-FX740 \$829.95	RSM854 \$1519.95
	WE-FX750 \$839.95	RSM863 \$1539.95
	WE-FX760 \$849.95	RSM872 \$1559.95
	WE-FX770 \$859.95	RSM881 \$1579.95
	WE-FX780 \$869.95	RSM890 \$1599.95
	WE-FX790 \$879.95	RSM899 \$1619.95
	WE-FX800 \$889.95	RSM908 \$1639.95
	WE-FX810 \$899.95	RSM917 \$1659.95
	WE-FX820 \$909.95	RSM926 \$1679.95
	WE-FX830 \$919.95	RSM935 \$1699.95
	WE-FX840 \$929.95	RSM944 \$1719.95
	WE-FX850 \$939.95	RSM953 \$1739.95
	WE-FX860 \$949.95	RSM962 \$1759.95
	WE-FX870 \$959.95	RSM971 \$1779.95
	WE-FX880 \$969.95	RSM980 \$1799.95
	WE-FX890 \$979.95	RSM989 \$1819.95
	WE-FX900 \$989.95	RSM998 \$1839.95
	WE-FX910 \$999.95	RSM1007 \$1859.95
	WE-FX920 \$1009.95	RSM1016 \$1879.95
	WE-FX930 \$1019.95	RSM1025 \$1899.95
	WE-FX940 \$1029.95	RSM1034 \$1919.95
	WE-FX950 \$1039.95	RSM1043 \$1939.95
	WE-FX960 \$1049.95	RSM1052 \$1959.95
	WE-FX970 \$1059.95	RSM1061 \$1979.95
	WE-FX980 \$1069.95	RSM1070 \$1999.95
	WE-FX990 \$1079.95	RSM1079 \$2019.95
	WE-FX1000 \$1089.95	RSM1088 \$2039.95

### HARMON/KARDON AM/FM STEREO RECEIVERS

CALL FOR PRICES

- HR-330 \$144
- HR-350 \$184
- HR-460 \$219
- HR-470 \$239
- HR-580 \$259
- HR-680 \$379

### J.V.C. AM/FM STEREO RECEIVERS

CALL FOR PRICES

- R-K10 \$144
- R-K20 \$184
- R-K40 \$219
- R-K60 \$239
- R-K80 \$259
- R-K100 \$379

### Sansui AM/FM STEREO RECEIVERS

CALL FOR PRICES

- 2-3000 \$144
- 2-5000 \$184
- 2-7000 \$219
- 2-9000 \$239

### PIONEER TURNTABLES

CALL FOR LOWEST PRICES ON DIME TURNTABLES & CARTRIDGES

Call for lowest prices on turntables and cartridges

### Sansui CASSETTE DECKS

CALL FOR PRICES

- D-590MS \$119.95
- D-770S \$139.95
- D-990S \$159.95

### JVC CASSETTE DECKS

CALL FOR PRICES

- MD-010 \$99.95
- MD-020 \$119.95
- MD-030 \$139.95
- MD-040 \$159.95
- MD-050 \$179.95
- MD-055 \$199.95

### HARMON/KARDON CASSETTE DECKS

CALL FOR PRICES

- CD91 \$119.95
- CD101 \$139.95
- CD201 \$159.95
- CD301 \$179.95
- CD401 \$199.95

### AKAI AM/FM STEREO RECEIVERS

CALL FOR PRICES

- AA-R22 \$169
- AA-R32 \$229
- AA-R42 \$309

### marantz AM/FM STEREO RECEIVERS

CALL FOR PRICES

- SR220 \$119.95
- R1000 \$139.95
- R2000 \$159.95
- SR 620 CX \$209.95
- SR-7100 DC \$349.95
- SR-8100 DC \$409.95

### NIKKO AM/FM STEREO RECEIVERS

CALL FOR PRICES

- NR-320 \$119.95
- NR-520 \$139.95
- NR-700 \$159.95
- NR-800 \$179.95
- NR-1000 \$199.95

### PIONEER TURNTABLES

CALL FOR LOWEST PRICES ON DIME TURNTABLES & CARTRIDGES

Call for lowest prices on turntables and cartridges

### marantz CASSETTE DECKS

CALL FOR PRICES

- SD225 \$119.95
- SD320 \$139.95
- SD420 \$159.95
- SD510 \$179.95
- SD510 \$199.95
- SD900G \$359.95

### AKAI CASSETTE DECKS

CALL FOR PRICES

- CS-F12 \$109.95
- CS-F14 \$119.95
- CS-F16 \$129.95
- CS-F18 \$139.95
- CS-F20 \$149.95
- CS-F22 \$159.95
- CS-F24 \$169.95
- CS-F26 \$179.95
- CS-F28 \$189.95
- CS-F30 \$199.95
- CS-F32 \$209.95
- CS-F34 \$219.95
- CS-F36 \$229.95
- CS-F38 \$239.95
- CS-F40 \$249.95
- CS-F42 \$259.95
- CS-F44 \$269.95
- CS-F46 \$279.95
- CS-F48 \$289.95
- CS-F50 \$299.95
- CS-F52 \$309.95
- CS-F54 \$319.95
- CS-F56 \$329.95
- CS-F58 \$339.95
- CS-F60 \$349.95
- CS-F62 \$359.95
- CS-F64 \$369.95
- CS-F66 \$379.95
- CS-F68 \$389.95
- CS-F70 \$399.95
- CS-F72 \$409.95
- CS-F74 \$419.95
- CS-F76 \$429.95
- CS-F78 \$439.95
- CS-F80 \$449.95
- CS-F82 \$459.95
- CS-F84 \$469.95
- CS-F86 \$479.95
- CS-F88 \$489.95
- CS-F90 \$499.95
- CS-F92 \$509.95
- CS-F94 \$519.95
- CS-F96 \$529.95
- CS-F98 \$539.95
- CS-F100 \$549.95

### BLANK TAPES

30K SAC-90 \$2.45 each  
 MAXELL VHSII C-90 \$2.49 each (MINIMUM 10 TAPES)

### VIDEO

PANASONIC, R.C.A., J.V.C., QUASAR, AKAI, MARANTZ, SONY, ZENITH, OLYMPUS, CANON, MINOLTA, PENTAX. CALL FOR LOWEST PRICES AND SAVE

### AM/FM CASSETTE CAR STEREOS IN DASH

PIONEER	JENSEN	SONY	CONCORD
CAR STEREO	CAR STEREO	CAF STEREO	CAR STEREO
PP1500 \$69.95	RE-530 \$319.95	XR 15 \$119.95	NPL-101 \$119.95
PP2000 \$79.95	RE-530 \$319.95	XR 15 \$119.95	NPL-112 \$119.95
PP2500 \$89.95	RE-530 \$319.95	XR 15 \$119.95	NPL-118 \$119.95
PP3000 \$99.95	RE-530 \$319.95	XR 15 \$119.95	NPL-119 \$119.95
LMP5200 \$139.95	RE-530 \$319.95	XR 15 \$119.95	NPL-120 \$119.95
LMP5500 \$149.95	RE-530 \$319.95	XR 15 \$119.95	NPL-121 \$119.95
WE-3100 \$159.95	RE-530 \$319.95	XR 15 \$119.95	NPL-122 \$119.95
WE-3100 \$159.95	RE-530 \$319.95	XR 15 \$119.95	NPL-123 \$119.95
LKE-3100 \$179.95	RE-530 \$319.95	XR 15 \$119.95	NPL-124 \$119.95
LKE-7100 \$259.95	RE-530 \$319.95	XR 15 \$119.95	NPL-125 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-126 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-127 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-128 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-129 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-130 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-131 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-132 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-133 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-134 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-135 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-136 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-137 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-138 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-139 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-140 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-141 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-142 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-143 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-144 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-145 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-146 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-147 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-148 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-149 \$119.95
	RE-530 \$319.95	XR 15 \$119.95	NPL-150 \$119.95

### 35mm CAMERAS

## Canon NIKON

Canon	NIKON
AE-1 with 50mm 1.8 FD Lens \$179.90	NIKO 4 FE BODY \$199
AE-1 PROGRAM w/50mm 1.8 FD Lens \$219.95	NIKO 4 FG BODY \$179
A-1 w/50mm 1.8 FD Lens \$26	

# MORE THUNDER FROM THE THE PERFORMANCE WORLD



## **USA-1 TAKING CHARGE**

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# CHEVY THAT TOOK BY STORM.

## INTRODUCING THE NEW 5-SPEED, 5-LITER Z28.

It's been quite a year for Camaro Z28. First, it became *Motor Trend* magazine's 1982 "Car of the Year." Then, the official Indianapolis 500 Pace Car.

And now, it looks like the competition is in for some more rough weather. With the introduction of the new 5-speed, 5-liter Camaro Z28.

More power and more gears than last year. To take you from zero to 50 MPH with lightning-like response.

And that, of course, is in addition to all of the advanced engineering features that helped make Camaro the hottest-selling 2 + 2 sport coupe on the road today.\* Like road-hugging Ground Effects technology. A cockpit designed with the latest advances in ergonomics. And a shape so sleek, only its shadow can match it.

The new 5-speed, 5-liter Camaro Z28. It's going to be nearly impossible for the competition to steal any of its thunder.

Some Chevrolets are equipped with engines produced by other GM divisions, subsidiaries, or affiliated companies worldwide. See your dealer for details.

\*Source: Ward's Automotive Reports, Specialty Subcompact Segment, October, 1982.

Let's get it together... buckle up.



Chevrolet

## ЛИРПА ДИ-ИИ-ИСК4 СИСТЕМ



Photograph: Carl Wallizer Construction: Jim Wilson

It has been some time since Professor Igor Lirpa last introduced an audio product that he was willing to share with the rest of the world. I recently found out why. The Professor has moved his entire research and production facilities to the center of Moscow, and it has taken him and his associates all this time to organize and man/woman the new headquarters. The move was prompted by some correspondence that the good doctor received from the Justice Department, the Federal Trade Commission and the Internal Revenue Service, not to mention some special tax abatement inducements offered by the Moscow Chamber of Commerce. Examining his first one-brand system to be exported to this country, I can only say that it

was worth the wait. In fact, I would have been willing to wait another year or two, if necessary.

Let's examine the cabinet first. It is constructed of Siberian Pine and finished in bright red. The turntable dust cover is in the form of a dome or spire, vaguely reminiscent of the spires of the Kremlin, which is within a stone's throw of the new Lirpa offices. Three upper shelves house the audio components. The lower shelf is stocked with Vodka and a small electrically operated samovar for making hot tea. The samovar plugs into the amplifier output jacks, along with the speakers. When a recording of Comrade Andropov is played, enough hot air is generated to heat the tea and activate the speakers at the same time.

As everyone knows by now, the chief advantage of one-brand systems is the fact that the components are designed to work optimally with each other. This is especially true of the Lirpa. Mounted below the turntable is a four-blade fan, connected by a belt to the direct-drive motor of the platter. When playing a record, the spinning turntable causes the fan blades to revolve, thereby providing needed ventilation for the amplifier just below. The only disadvantage I could see in this arrangement is that you must keep the turntable spinning (45 rpm is preferred) even when listening to the tuner or to the tape deck, but this is a small price to pay for adequate thermal dissipation. Furthermore, the noise of the fan helps to mask tape hiss (in the case of tape deck play-



back) and static caused by transmitter jamming (in the case of trying to pick up shortwave broadcasts of the Voice of America).

The tuner covers all frequencies from long-wave through medium wave, FM, and VHF and UHF TV. A special

jack mounted prominently on the front of the tuner is labelled "Multiplex." Dr. Lirpa informs me that very soon now it will be possible to broadcast stereo over a single FM transmitter, and when that happens, the Lirpa tuner will be ready for any outboard adaptors that

come along. Meanwhile, a switch labelled "Echo" provides a sort of synthesized stereo effect; whenever a high-level Politburo member addresses the nation, his words are automatically echoed by the rest of the presidium. Scientists in Moscow are said to be working on a system for AM as well as FM stereo, but because they have come up with five different systems, the project has been shelved. After all, how would the Soviet Union be able to explain to the Western world their inability to come up with a single, agreed-upon system?

While the amplifier failed to deliver its rated power by a rather significant margin, it did offer many features not found in either U.S., Japanese or other European amps. Rather than suppress turn-on "thumps" with signal-impairing relay-contacts, when the switch is turned on, a fluorescent indicator lights up with the message, "GET READY FOR THE THUMP!" The thump itself follows almost immediately. As for the preamplifier, instead of hiding its less-often-used controls behind hinged doors, these controls were put on the rear panel. Since this took up most of the space of the rear panel, the input and output jacks were moved to the front. To be sure, this means that there are cables draped across the front of the system but, on the positive side, should you ever have to remove this component for servicing, you won't have to reach around to the back of the unit to disconnect all those cables.

We come, now, to the cassette deck, perhaps the most ingeniously designed component of the entire system. Dr. Lirpa, being the universal man that he is, heard that there was some problem in the U.S. with people taping copyrighted programs onto cassettes. Recognizing that any royalty collection and distribution system would be too cumbersome to implement, the Professor came up with a better idea. The GL-1-TCH cassette deck is equipped with a prominently positioned coin slot, not unlike those found atop most public phones. When you want to record a copyrighted program, you simply drop a few kopeks—er—quarters into the appropriate slot. This opens the cassette compartment and allows you to insert a cassette and begin recording. Basically, this operates on the honor

## ONE-BRAND SYSTEM RATINGS

**Manufacturer:** Lirpa Mfg. Co. Ltd., Inc., S.A. **Model:** A11-1N-1SKY  
**Company Address:** Leningradsky prospect 47, Moscow 125167, U.S.S.R.  
**Cabinet Dimensions:** 0.23 rods H x 7 hands W x 0.3 chains D.  
**Price:** 900 rubles (at black-market exchange rate, \$54.95).  
 For literature, use a library.

Component & Specification	Claimed	Measured	Rating
<b>Power Amp Section (PA-KGB-2)</b>			
Power/Channel, watts	1000.8	15.8	Vetoed
Rated THD, %	$0.1 \times 10^{-36}$	$0.1 \times 10^{-37}$	0
<b>Preamp/Control Section (CP-D01T)</b>			
Freq. Response, Phono	RIAA, ± RIAA	RIAA, ± EIA	♪♪♪¼
Phono S/N, dB	130 (re: 1 V in)	70 (re: 1 mV in)	♪ × 0.5
<b>FM Tuner Section (AM-COM-FM)</b>			
50-dB Quieting, Stereo, dBf	-30 (w/Muting)	Confirmed	♪♪♪♪
S/N, Stereo, dB	90	40	♪ or ♪
THD, Stereo, 1 kHz, %	0.0008	8.0000	♪ × 8
Separation, 1 kHz, dB	Painful	Temporary	See Below
Alt. Channel Selectivity, dB	Impartial	Partially Impartial	See Above
<b>Turntable/Cartridge Section (SP-1-N)</b>			
Freq. Resp., Hz-kHz, ± dB	Flat	Hilly	Diagonal
Separation, 1 kHz, dB	Trial	Permanent	Messy
Rumble, DIN B, dB	-100, @ 0 rpm	Confirmed	♪♪ to ♪ × 20
Wow & Flutter, % wtd. rms.	0.12Percent	Hard to measure	Wow
<b>Cassette Recorder Section (GL-1-TCH)</b>			
Freq. Resp., Hz-kHz, ± 3 dB			
Normal Tape	0-500	See Text	♪¾
Chrome & Glass Tape	See Above	See Above	♪♪¾
Metal Tape	See Above	Shiny	♪♪♪♪½
S/N, Best Tape, dB (with NR)	110	110 Next Door	Shhh!
Wow & Flutter, % wtd. rms	Negligible	More or less	.3-2.50

### Rating System

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

### General Comments (Actually made by a Lieutenant General)

**Power Amplifier:** Sounded best when playing music of Shostakovich, Borodin and Stravinsky. Deteriorates badly when reproducing decadent Western rock music. Distortion tends to rise when played in warmer-than-Siberian environment. **Turntable & Cartridge:** Plays best when switched to a higher number of revolutions. Cartridge will appeal to the lower masses; as for pickup, could benefit from arm's reduction (in mass, that is). **Speakers:** Seemed flat enough, but I detected some radiation all the way up to the microwave region.

**Overall Rating:** I give it a unanimous vote of approval, ♪♪♪♪.9 (nobody's perfect!).

"After examining the Lirpa, I can only say it was worth waiting for. In fact, I could have waited even longer."

system, but to take care of any dissidents or hooligans who might attempt to thwart the process, a special remote-control cable plugs into your phone jack, which is tapped by ... well, you get the idea.

Speaking of remote control, the A11-1N-1SKY system is equipped with a floor-standing wireless remote-control unit. While this accessory is, admittedly, somewhat larger than the system itself, Dr. Lirpa explains this as follows: "The remote-control cabinet is where we had to mount the parts that wouldn't fit into the regular components. We didn't want to make those components so big that they wouldn't fit into the typical Moscow or New York apartment, so we reduced the size of the component cabinet and added a second cabinet for the remote-control functions and all those left-over p.c. boards and other stuff." It's a reasonable solution to a problem that other designers have never faced as realistically. In one installation of the system that Dr. Lirpa showed me, the six-foot-high remote unit was mounted flush to the ceiling, so as not to take up additional floor space. A five-foot rod (optional) allows the user to reach up and poke the desired function buttons on the remote-control unit. Longer "pok-ers" (as they are called) are also available so that the listener can reach the remote-control cabinet from almost anywhere in a typical living/listening room. Because of its rather large size and the number of components inside, the remote-control unit is powered from an ordinary 12-volt car battery, which fits neatly inside the remote-control cabinet, out of sight. Battery recharging is easily accomplished within two or three days. (Batteries are not included; cells are, however, readily available throughout the U.S.S.R.)

When I turned on the Lirpa A11-1N-1SKY, I couldn't help thinking about the trials and tribulations of its designer, Igor Lirpa. Whether the importance of this novel system from the U.S.S.R. will reduce tensions between our two countries (by giving us something other than nuclear weapons to get angry about) is impossible to tell at this early juncture. One thing is perfectly clear about Lirpa, though. You can't keep a good man down—no matter how hard you try!

*Lenin Feldmanovich*

# Where to reserve seventh row, center. Forever.

**ARIZONA:**  
Audio Emporium—Tucson

**ARKANSAS:**  
Walloch's—Little Rock

**CALIFORNIA:**  
Audio Services—North Hollywood  
Eber Electronics—San Francisco  
Pacific Stereo—Los Angeles  
Pacific Stereo—San Diego  
Pacific Stereo—San Francisco  
Paris Audio—Santa Monica  
Roger Sound Labs—Valley Store  
The Good Guys—San Francisco  
Tokyo Electronics—San Francisco

**COLORADO:**  
Listen Up—Denver

**FLORIDA:**  
Sound Advice—Miami  
Sound Components—Coral Gables

**GEORGIA:**  
Back Door Stereo—Atlanta

**ILLINOIS:**  
Audio Dimensions—Moline  
Good Vibes Sound—Champaign  
Mills Recording—Chicago  
Pacific Stereo—Chicago  
Stereo Systems—Aurora  
United Audio—Chicago

**IOWA:**  
The Audio Room—Cedar Rapids

**KENTUCKY:**  
Stereo Shoppe—Lexington

**LOUISIANA:**  
Alterman Audio—New Orleans

**MARYLAND:**  
Audio Buys—Gaithersburg  
Gramophone Ltd.—Baltimore  
Professional Products—Bethesda

**MASSACHUSETTS:**  
Audio Studio Stereo Lab—Brookline  
Sound & Music—Northampton

**MICHIGAN:**  
Peerless Electronics—Detroit

**MINNESOTA:**  
Sound Center—Minneapolis

**MISSOURI:**  
Sound Enterprise Stereo—Kansas City

**NEBRASKA:**  
Stereo West—Omaha

**NEVADA:**  
Q Audio—Reno  
The Upper Ear—Las Vegas

**NEW JERSEY:**  
The Audio Lab—New Brunswick

**NEW YORK:**  
Charos Custom Sound—Long Island  
Lyric HiFi—NYC/White Plains  
Park Avenue Audio—NYC  
Sound Chamber—Rochester  
Stereo Chamber—Buffalo

**NORTH CAROLINA:**  
Sound Ideas—Raleigh

**OHIO:**  
Golden Gramophone—Akron  
Phil Reddish Audio—Cleveland  
Stereo Lab—Cincinnati/Columbus

**OKLAHOMA:**  
The Turntable—Enid

**OREGON:**  
Chelsea Audio—Beaverton  
Fred's Sound of Music—Gresham

**PENNSYLVANIA:**  
Chestnut Hill Audio—Philadelphia  
Sassafras Audio—Montgomeryville  
Stereo Barn—Ephrata  
The Sound Store—Pittsburgh

**SOUTH CAROLINA:**  
Read Brothers—Charleston

**TENNESSEE:**  
Audio Systems—Nashville

**TEXAS:**  
Electronic Service Center—Odessa  
Pacific Stereo—Dallas  
Pacific Stereo—Houston  
Recorder Center—Dallas  
Sheffield Audio—Houston  
Sound Climax—Dallas  
Stereo International—San Antonio

**UTAH:**  
HiFi Shop—Ogden  
Standard Audio—Salt Lake City

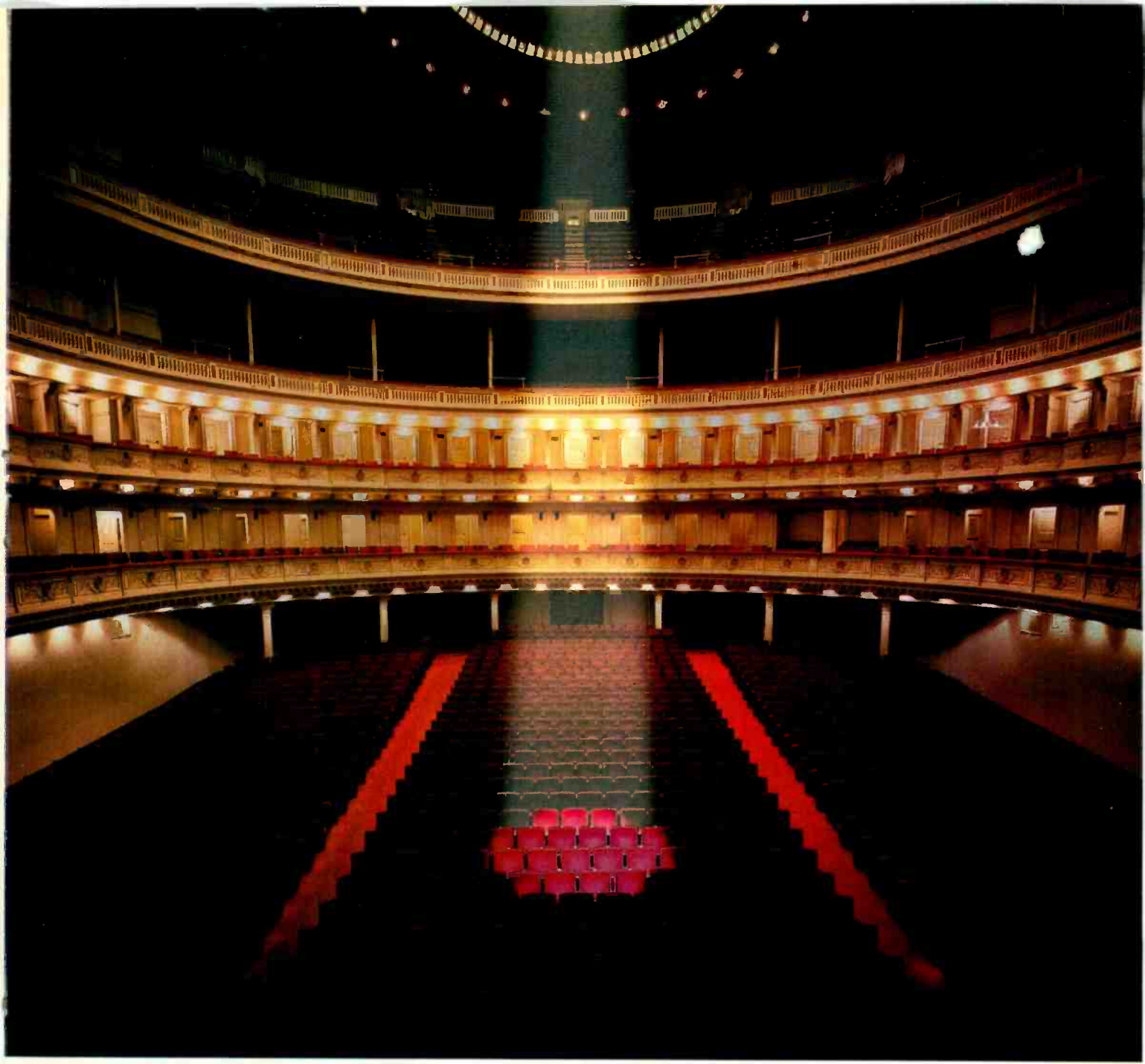
**VIRGINIA:**  
Sound World—Virginia Beach

**WASHINGTON:**  
Magnolia HiFi—Seattle  
Pacific Stereo—Seattle

**WISCONSIN:**  
American TV—Madison  
Sound Stage—Milwaukee  
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# A Cabinetmaker's C

by JOHN BASINSKI

Photography by SUSANNE BUCKLER

Time was when the consumer would cart a new receiver, turntable and tape deck home, pile up some cinder blocks, span them with board shelves, and the new system was ready to roll. As the equipment has gotten more sophisticated, so has the taste of the consumers who buy it. You're probably all familiar with the inexpensive cabinetry distributed by the discounters—wood-grained vinyl on a flakeboard base with all the structural integrity of a house of cards. On the following pages, I'll discuss products that seek to match the quality and styling of the audio components they house.

The major feature cited by the manufacturers covered here is the use of wood. One manufacturer calls his product "Realwood," another "Woodmore." You get the picture. Wood is an alluring material, and many people feel that solid wood is superior to plywood, which is sometimes perceived as a cheap or inferior substitute. This is not at all true, and a consideration of the structure of wood will explain why.

Wood is composed of cellulose fibers, shaped like common drinking straws, which absorb available water. Like a sponge, the walls expand when wet and contract when dry. Curiously, while the fibers expand and contract in wall thickness and diameter, they remain virtually constant in length. When live trees are cut, the lumber may contain more water than wood. Soon after being cut, the wood loses its moisture to the atmosphere until an equilibrium point is reached. During this process, sometimes misleadingly called "seasoning," moisture content will drop to an average of about 10%. A board that was 6 inches wide and 1 inch thick when "green" may shrink 1/4 inch in width and 1/16 inch in thickness but remain unchanged in length. Once

dried, the wood will absorb or lose moisture in response to changes in humidity. During high summer humidity, the moisture content of the wood inside a home in the mid-Atlantic states may reach 12%; during the winter, unhumidified central heat may drop it to 7%. In the process, a solid wood table top 30 inches wide may easily expand and contract 1/8 inch.

This property presents some difficulties in dealing with solid wood. First, if a solid wood table top is firmly attached to a wood framing member whose length crosses the top's width, stress will be induced. The tendency of the top to change dimensions as humidity changes will be opposed by the dimensional stability of the framing member. The joint may fail, or the solid top may split to relieve this stress. Joints between solid panels and framing members must be flexible enough to allow this dimensional change. Additionally, the expansion and contraction does not take place uniformly in all directions in wood. Most boards, over time, will distort or "cup" across their width. The wider the board, the greater the potential for this. The art of cabinetmaking revolves around taming and controlling these unruly traits.

Plywood offers a clever solution to dimensional stability problems—an arrangement of wood in successive layers, with the fiber or grain direction alternating between them. Strong glue bonds between the layers help the dimensional stability. Particleboard or flakeboard, sometimes used as a core between layers of wood veneer, attains stability using a different approach. Particleboard consists of wood chips, carefully sized and manufactured, which have been mixed with glue and pressed into sheets under enormous pressure. Since there is no consistent fiber direction and the individual fibers are quite small, what little dimensional change there is occurs uniformly in all directions. The resulting panel is denser than standard, veneer-core plywood and makes a stable core resistant to denting.

The major drawback of plywood



*John Basinski, an award-winning cabinetmaker, owns Basinski Wood Studio in Philadelphia, where he specializes in custom-built executive furniture. He is also current president of the Society of Philadelphia Woodworkers.*



# Comparison





concerns its edges. Not inherently attractive, they require a veneer or solid edging for a presentable appearance. Plywood is, however, a dimensionally stable product offering an opportunity to match patterns on its faces and achieve visual effects impossible to duplicate in one-piece or solid wood. And remember, aside from its glue content, plywood is all wood.

Furniture of good quality typically

combines both plywood and solids. Using solid wood in itself doesn't assure superior quality, since the seeds of self-destruction are inherent in the material unless it's used properly. By the same token, plywood is in no way synonymous with inferior quality or longevity. Good design and quality construction depend upon carefully matching the appropriate material with a suitable method of construction.

sary. The back is in four sections and requires some finagling to insure that the case is squared up and held in position while pilot holes are spotted and drilled for the attaching screws. This is a nuisance, and I had my helper hold the unit square while I drove home the screws with an electric screwgun, obviating pilot holes. If Barzilay provided a recess for the back and pre-drilled the holes, this would be a breeze and the finished assembly would be more attractive.

Mounting the doors was easier than on any other cabinet requiring it. Both doors are trimmed top and bottom with oak strips which combine shaped pulls, magnetic catches, and pre-mounted and threaded inserts for hinge attachment. Nicely done.

Once assembled, the GR-11 stands 51¼ inches high, tallest of the units reviewed. While one might expect a KD unit so tall to be less than Gibraltar-like, this one's good and solid. Fixing the sides together at four levels and affixing the back produces a cabinet with good resistance to both lateral racking and circular twisting, normal stresses for a caster-equipped unit.

Barzilay clearly intends the top compartment for a turntable, and the hinged lid gives access to the front and half of the top of the compartment. The turntable shelf's height of 42¼ inches is comfortable for the average adult. A light with adjustable reflector is supplied, but I don't find it especially attractive. Given the ample access, I'd probably omit installing it if the unit were mine. All shelves have usable dimensions of 21 inches wide x 16 inches deep, and the turntable compartment has 7½ inches of available height. It'll take most, if not all, turntables and changers.

In the lower compartment, one fixed and two adjustable shelves provide additional equipment platforms. The fixed shelf is set 13 inches above the bottom to provide record storage, and there's 23 inches of usable vertical space for three pieces of equipment. Owners of open-reel tape decks will find that the GR-11, like all other cabinets reviewed, will probably accept reel-to-reel decks only in the horizontal position; 10-inch reel units probably won't fit. This is the one drawback of the hinged-top design, since an unusually large piece of equipment can't be placed on top. Cassette-deck owners should find the shelves ample for their equipment, though. Owners of

## Barzilay Company Model GR-11

**Suggested Retail Price:** \$458.00

**Address:** 18737 South Reyes Ave.,  
Compton, Cal. 90221

**A** hinged-top highboy with a friendly look, the GR-11 comes "knocked down," that is, packed flat and ready for assembly. The rectilinear form is softened by rounded corners at the top and a similarly curved, smoked-plexiglass turntable access door. It reminds me, fondly, of an old Wurlitzer jukebox. Mirror-imaged, shaped oak pulls on the lid and doors invite touching. Side panels are glued up of narrow oak strips, with an informal, butcherblock look. The interior shelves covered in black leatherette vinyl are very low-key and focus attention outward rather than inward. All the hardware except for the piano hinge on the top is concealed. The net result is a refined appearance that's not overly slick. Like most of the units reviewed, the GR-11 sports an oiled finish. Here it's generally a "starved" or dry-looking one. Barzilay is obviously aware of this, since they include sandpaper, liquid wax, and instructions for achieving what they call a "premium quality finish."

This cabinet comes in a single crate that scales in at 139 pounds. It's a load, so ask an able-bodied friend to help move it. Instructions are well-illustrated. Exploded drawings give a clear picture of the component parts and their assembly. Detailed illustrations show how to connect the knock-down fittings holding the case together, insert the record dividers provided, attach the back, install the casters, and hang the partially framed glass doors. Generally excellent, the only shortcoming I find with the directions is a failure to list together the tools needed for assembly. These tools include a slotted screwdriver to open the crate, a #2



(medium) Phillips screwdriver, an adjustable wrench to tighten the caster stems, and a drill with a 5/64-inch bit or an awl to make pilot holes for some of the attaching screws. (To speed assembly, I used an electric screwdriver.) Finally, a mallet or hammer is needed to install record dividers.

Assembly took two people half an hour. The knock-down (KD) fittings, shown with the disassembled top in the detail photo, fit well and lock securely. One shelf at a time can be positioned and tightened to the first side, but four shelves need to be aligned simultaneously to fit the other side. Screwdriver in hand, this called for two more hands than I have (nobody's perfect), so a helper is neces-



Pins on Barzilay lid engage holes in cabinet sides. Threaded rod is Naiad's compression fitting.



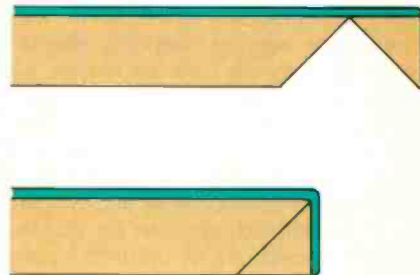
wide components should note that the glass doors limit horizontal clearance to 18 inches, so such equipment should be placed inside the cabinet before door installation. Shelves adjust on 2-inch centers, with recesses in the undersides of the edges to receive 1/8-inch steel pins. The pins are sturdy, fit nicely, adjust easily, and are invisible when installed. They do, however, position the shelves flush against the back, which has only one slot for ventilation and wiring. Owners of hefty amps (especially Class-A models) might do well to make additional holes for heat dissipation. Recessed casters raise the unit only 1/4 inch off the floor, which is visually appealing but does restrict mobility on thickly carpeted floors a bit.

The GR-11 is one of three units surveyed with solid oak side panels. At a thickness of 1 inch, Barzilay's are the heaviest, and they're glued up of strips no wider than 2 1/2 inches. These two facts are likely to ensure that they'll be stable and reliable, and Barzilay treats the panels with a chemical stabilizer to prevent end-checking and splitting. Both fixed and adjustable shelves are flakeboard, covered with black-vinyl leatherette on the top and front edge. As I pointed out in the introduction, improper joinery between a composite material like this and solid panels can cause trouble. Using knock-down fittings, as done here, is a very appropriate method since KD fittings hold firmly (but not immovably) and allow for expansion and contraction in the solid panels. Proponents of the all-wood look may object to vinyl-covered shelves, but while their edges may damage more easily than solid oak ones, vinyl is certainly an easy surface

to clean. These shelves are produced by a process called miter folding, where a V-shaped piece is removed from the core. The vinyl covering then acts as a hinge, and the remaining piece is folded over and glued. From a consumer's point of view, this assures a heavier than usual vinyl because the process demands it.

Barzilay is one of the oldest manufacturers of consumer-electronics cabinetry in the business. The GR-11 demonstrates this experience by combining a pleasant appearance with spaciousness, flexibility, and intelligent engineering. It's a very competent offering, and a good value.

Barzilay's shelves are made by miter folding. The core is scored, then folded, using the vinyl covering as a hinge.



## Custom Woodwork & Design

### Woodmore Lowboy Model KD 600

**Suggested Retail Price:** \$475.00

**Accessories Reviewed:** Audio-cassette drawer, \$70.00; turntable slide-out shelf, \$70.00; stacking frames, \$60.00 (kit)

**Address:** 7447 South Sayre Ave., Bedford Park, Ill. 60638

**C**ustom Woodwork & Design's Woodmore lowboy has a very contemporary look, with uncluttered lines and frameless smoked-glass doors accentuated by chrome hardware. An oak center divider and two pairs of doors provide a rhythmic vertical counterpoint to a hori-

zontal profile, and its essentially boxy quality is softened nicely by rounded edges on the top, bottom and end panels. Door hardware is similar to that used by Lepper and Naiad, but here it's well-finished chrome. Even the casters have chrome-metal hoods. (Other cabinets have all-plastic casters.) The KD 600's finish, a dark oak stain under a well-rubbed penetrating oil and wax coating, is very well done; excellent quality.

The unit comes knocked down in a single crate which weighs in at 120 pounds, so proud owners should have a strong friend handy to help cart it home. Accessories are separately packed and quite manageable. Instructions are well illustrated and clear, but if you're prone to anxiety attacks when faced with the prospect of assembling a bicycle, this cabinet could give you a case of hives. Twenty-four





different types of parts are used in assembly, which took me about an hour and a half to complete. In fairness to CWD, I should point out that all really sturdy knock-down units suffer this problem to varying degrees. Pre-assembled cabinets are expensive to ship, but the manufacturer and, ultimately, the consumer save money when the knock-down approach is used. The problem is in designing a piece that is demountable and is solid when assembled, yet can be put together successfully by untrained people. Although CWD has done an excellent job of designing for solidity, the trade-off is an assembly procedure which, frankly, will be difficult for some. For them, I'd recommend dealer assembly.

Tools required include #1 (small) and #2 (medium) Phillips screwdrivers, a large slotted driver, a mallet, and a bar of soap or candle stub. A Yankee-type ratchet screwdriver or electric screwdriver with a #1 Phillips tip is very handy for installing the back. The basic case assembles with knock-down fittings which consist of metal dowels that screw into pre-mounted inserts in one panel. The dowels then slide into pre-drilled holes in the mating panel, where they are engaged by metal cams. After tightening with a flat-bladed screwdriver, the metal discs are covered with color-coordinated plastic. The side panels are solid oak and, as solid panels are occasionally wont to do, arrived slightly cupped across their width. I had to bend the metal dowels gently with a hammer to align them with their mating holes, but, once aligned, they pulled everything together firmly and flat. Two record dividers also fit snugly, and in tapping the first end home I inadvertently drove it through the bottom. Chastened and determined to be careful, I nonetheless managed to repeat the error on the other divider. After repairing the admittedly invisible damage, I avoided a repeat performance by enlarging the holes slightly with a 13/64-inch drill. The back rests in a recess. Positioning is simple, but pilot holes are not pre-drilled for it. Lubricating the screws with soap or candle wax makes them easier to drive, but a ratchet-type screwdriver simplifies the job considerably. The glass doors mount with pivot hinges which attach to the unframed glass by compression screws. They mount easily but require some fiddling to align properly.

Once assembled, this cabinet is a rock. The 1/2-inch thick back screws firmly into place and makes the rectangular geometry rigid. A fifth caster, placed under the very center of the unit, prevents any tendency to sag in the middle. The doors use magnetic touch latches and pop open when a chrome strike is pushed. They work nicely. The four shelves adjust on 1 1/4-inch centers on 1/8-inch wire frames that plug into matching sets of holes in the cabinet sides. A slot in the edge of the shelf receives the frames, so they are invisible when installed. The mounting holes are small and unobtrusive. Since shelves must be installed before mounting the glass doors with this system, plan your configuration carefully at this step.

The Woodmore lowboy also has solid oak end panels, which are glued up of strips averaging 3 inches wide, and the manufacturer stress-tests each panel before shipping. Like Barzilay, CWD uses both particleboard cores in shelves and KD fittings that should allow adequate flexibility for dimensional changes in the solid side panels. Top, bottom, and shelves have solid oak front edges, which will wear very well. Oak veneer encases the edging top and bottom, so the shelves appear to be solid oak. Nice touch, and it doubly ensures the structural integrity of the joint between shelf and edging. My one complaint about CWD's materials is their use of rotary-cut veneers for the top of the cabinet. Rotary cutting is the process a pencil sharpener uses, peel-

## Raymond Lepper Works Xylophile Model XP 48

**Suggested Retail Price:** \$625.00

**Accessories Reviewed:** Sliding turntable shelf, \$97.50; audio-cassette drawer, \$97.50; interior light, \$18.80

**Address:** 2269 Old Middlefield Way, Mountain View, Calif. 94040

**M**odel XP 48 is a no-nonsense, rectilinear highboy featuring smoked-glass doors and very low-key black hardware. This unit is neither high-tech nor designer chic, and its understated functional lines will harmonize with most environments. An extended base platform supports side and top panels of oak-veneered particleboard. These panels are 1-inch thick and have chamfered, solid-oak edges. Veneer patterns are nicely book-matched and centered, and both side panels are pattern-matched. Casters lift the platform base 1 3/4 inches off the floor; this gives an odd, levitated look to the cabinet, so I would be inclined to remove them. The XP 48 has a medium-dark oak finish which I'd rate best in show. Lepper uses Watco oil finishes, like many other manufacturers, but the company carefully and very thoroughly sands and rubs to produce an exquisite surface.

Lepper packs the XP 48 knocked down in a single crate weighing 100 pounds and requiring two people to transport. Accessories are individually packed in comfortable sizes and weights. Instructions are well illustrat-



ed but have been updated by an addenda sheet which I found distracting and potentially troublesome. The type of hinge detailed in the original instruction sheet has been changed, and following the original instructions without noting the addenda could result in broken glass doors. Lepper goes to the trouble of providing all the tools needed for assembly as well as a container of finish for touch-up purposes. They do themselves a disservice by not reprinting their directions.

A screwdriver and pliers are needed to open the crate. These are the only tools you'll need to supply, for Lepper



ing off thin continuous slices from a log. When veneer is cut this way, the grain or figure pattern is coarse and wild looking.

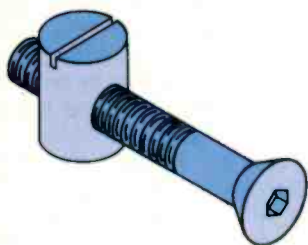
Adjustable shelves measure 16½ inches deep × 22½ inches wide, and the two interior compartments offer a total of 55 inches of shelf height. If space on top is included, this lowboy offers as much as twice the usable space on twice as many shelves as any of the upright models. All save gargantuan turntables will fit inside, and an accessory slide-out shelf for this purpose was supplied with the unit reviewed. The accessory shelf suffers from a design flaw: When the sliding part was pulled out, the supposedly fixed base slid on its wire mounts until it collided with the glass doors. Shim-

ming with wood veneer could wedge the base into position, or a ½-inch-long wood screw could trap the back mount; neither were provided. I'd put a turntable on top anyway, at a more comfortable working height. Virtually all cassette decks will fit inside, and the accessory cassette-storage drawer is quite satisfactory. It runs smoothly on full-extension ball-bearing slides, with dividers to separate rows of cassettes. Reel-to-reel fans can place large decks on top of the cabinet. Six large openings in the back provide good ventilation, and the shelves stop 1 inch from the back to allow both air circulation and wireways within the cabinet. Given the space in the KD 600, I'm a bit surprised CWD only provides record dividers for one side, but

an extra pair can be purchased separately. Another option is a pair of oak frames in kit form to replace casters and allow two units to be stacked. At \$60, this kit seems overpriced to me; consisting of eight pieces of prefinished oak and some drywall screws for mounting, it omits levelling feet, which I consider mandatory for fixed installation. A levelling base for three or more units is available, as is a videocassette drawer, a video-game drawer, and even a wine rack.

The KD 600 is an unusually well-designed, spacious, and well-finished cabinet. But why waffle; assembly's a pain. Yet, though suffering from a few relatively minor flaws, it nonetheless offers the best value of the units reviewed.

provides a #1 Phillips screwdriver and two Allen wrenches. Assembly took me 1¼ hours. This unit is a bit simpler to assemble than the CWD Woodmore lowboy, but since it was the first unit I put together, my progress was slower than with subsequent cabinets. This was partly because of curiosity. As I was screwing the casters to the base, I noticed some screw heads in the top that didn't seem tight. Grabbing a flat-bladed screwdriver, I began turning them, against no apparent resistance. I scanned the directions and soon realized these were anchor points for the knock-down fittings, and that I had now misaligned them. The system itself consists of pre-inserted rods with threaded holes and countersunk mating bolts (see sketch), which are very unobtrusive, extremely strong and easy to assemble.



Bolt and rod used to anchor the XP 48's knock-down fittings.

Lepper uses composite materials in the XP 48. Side and top panels are 1-inch thick, composed of a particle-board core banded with ¾-inch solid oak, and veneered with matched oak skins. The panels are massive, attrac-

tive, and structurally stable. Solid edging is encapsulated between the outer veneers for extra strength, avoiding the visual distraction of typical, "glued-on" edging. The shelves are of veneer-core plywood with solid front edges. Lepper uses a premium 9-ply panel instead of the 7-ply construction of less expensive plywoods. The back is ½-inch oak-veneer plywood, finished to match the cabinet front and back. In short, premium materials are used.

Material selection mates with thoughtfully conceived engineering. The knock-down fittings work on a compression principle, and the fittings all mount in particle-core panels which have excellent resistance to compression crushing. Veneer plywood shelves are light but strong. Lepper, alone among the makers of KD units reviewed here, has very carefully designed a highly versatile system around his adjustable shelving hardware, using it for accessory slides and drawers as well as for shelves. However, he apparently presumes that the cabinet won't be reconfigured often, for one must remove and remount the doors to adjust shelf positions.

The cabinet normally comes with three shelves. Two mount with the same type of ½-inch wire-frame base as CWD uses. But the third mounts between cleverly designed brackets which screw into the adjusting holes, designed so the shelf locks snugly to them. This helps keep the cabinet sides from bowing and assures a very positive, snug fit for the adjustable shelves as well as for the back. Fur-



From top: Lepper/CWD system, Naiad shelf with Naiad/Barzilay support pins, Sonrise shelf and pins, Lepper/CWD/Sonrise door hinge pins, and Lepper KD fitting.

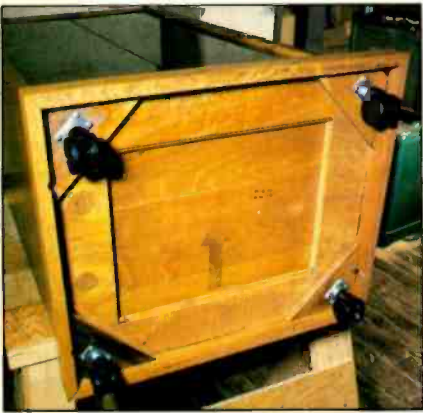
thermore, the shelves can be quickly, easily and solidly screwed to the back, where there are holes level with each set of adjustment holes; mating pilot holes are drilled into each shelf.

The accessory turntable-slide mounts between a shelf (resting on wire brackets) and the slightly smaller platform bearing the turntable. Only the platform slides out; the shelf stays in place when the slide is extended.

The accessory cassette drawer runs on oak guides that can be screwed into any set of adjusting holes. The drawer holds up to 68 cassettes, with dividers to keep the tapes from falling over when the drawer is opened or closed. The wood at the front bearing edge of the right-hand drawer guide was crumbly with decay, and would wear out quickly—but that was a lonely quality-control slip.

The base of the unit, seen in the photo (next page), also deserves a word. First, it's very well structured. A





Oversize, stable base of XP 48 has reinforced caster mounts.

tongue-and-groove-joined subframe is glued together, reinforced with triangular corner blocks, then stapled and glued to the oak plywood base panel. A solid oak skirt with mitered corners thus has a gluing surface 2¼ inches wide at each corner for maximum strength. Second, Lepper provides for both vertical and horizontal bolts between the base and cabinet sides, for extra-rigid connection. Finally, the base is both wider and deeper than the cabinet itself. Since all highboy

units are inherently top-heavy, this extended footprint improves the cabinet's stability. Some may have aesthetic complaints about the visual look of the base, but structurally it's a rock.

Fixed-top design offers four usable component platforms plus record storage (four record dividers are provided). Interior shelves measure 21 inches wide x 16 inches deep, with a 19¾-inch clearance between glass doors when open. The three standard shelves in the cabinet offer 39¾ inches of usable interior height. When the turntable slide and cassette drawer are installed, this drops to 34¼ inches of headspace. Ventilation comes from three large openings in the back, and cutouts at the backs of the shelves provide for interior air circulation or wire routing. Lepper thoughtfully provides adhesive anchors for cables as well as cable ties.

The Lepper Works XP 48 is a well-designed, solidly structured, and beautifully finished cabinet. With a suggested retail price of \$625.00, it clearly is not intended for a mass market. On the other hand, given the high levels of engineering and execution, I'd say Mr. Lepper has earned his price.

(supplied). The company fails to mention a mallet or hammer to install record dividers, and I found an electric screwgun (or ratchet-type screwdriver) with a #2 Phillips tip useful when installing the back. Assembly is straightforward and took two people 25 minutes. (By this time I was getting proficient.) Threaded rods and brass end fittings compress top and bottom between side panels. This works well, but lacks positive positioning references for the top and bottom. I discovered this while installing the glass doors, which use the same compression-type pivot hinges as CWD and Lepper. The doors wouldn't fit on the right side, and we had to loosen and reposition the top. Then we discovered that two of the four sockets for the hinge pivots were missing. The back is of ½-inch masonite pieces, which overlay the sides and lack pilot holes for attaching screws. By now the electric screwgun was warmed up, but the lack of pilot holes was still a nuisance.

All the panels in the 470R are ¾-inch thick, with a particleboard core. Given particleboard's good resistance to compression, the compression-type assembly system, together with the fixed back, produces a unit of adequate if not overwhelming solidity. Side panels feature plain-sliced walnut veneers on both sides, with walnut-veneer edge banding. While adequate, this type of edging does not suffer abuse well. All horizontal panels are black leatherette vinyl (one side) over a particleboard core, with solid walnut accents on the fixed top and bottom shelves. Adjustable shelves (three are provided) are also vinyl-clad on top, with walnut-veneer front edges. These are attractive and easily cleaned, and since the shelves are behind glass, veneer edging is more appropriate here. Adjustments are made by positioning ½-inch steel pins in pre-drilled holes in the sides. As in the Barzilay, these pins are sturdy, well-fitted and easy to readjust. But Naiad's shelves, unlike Barzilay's, sit directly on top of the pins, which are thus visible.

Interior space is ample, with shelves measuring 16 inches deep x 21¾ inches wide. There is 35¾ inches of usable interior height. Clearance through the doors, at 20¾ inches, is generous. The fixed-top design is clearly intended for a turntable, though no turntable slides or interior lights are offered for this cabinet. Interior configuration is very flexible and easily

## Naiad Products Profile 470R

**Suggested Retail Price:** \$349.95

**Address:** P.O. Box 1840, 121 Roy Blvd.,  
Brantford, Ont. N3T 5W4, Canada

**N**aiad's Profile 470R offers a flat-out high-tech look in a knock-down, highboy format. Also available in natural oak, the reviewed unit features walnut-veneer sides, a black-vinyl fixed top with walnut accents, walnut-edged black-vinyl adjustable shelves, and the ubiquitous smoked-glass frameless doors. Darth Vader's got nothing on this cabinet. Even the shelf pins and record dividers are black. Side-panel veneers are book-matched walnut, nicely centered and unobtrusively oiled.

Packaged in an 80-pound carton, the 470R is among the more manageable units sampled. Instructions begin with an exploded drawing, concisely demonstrating the overall assembly, and a list of the required tools thoughtfully follows. This list includes a small slot screwdriver, a #2 Phillips screwdriver, and a 5/32-inch Allen wrench





changed without removing and re-mounting the doors. Most components, save vertical reel-to-reel tape decks, should fit. A large opening in the top section of the back provides good ventilation and easy wiring access. The 470R comes without casters; although a casterless cabinet is more stable than its mobile cousins, access to the back becomes more arduous, so be forewarned. Door catches are magnetic touch latches, similar to both CWD's and Lepper's. I preferred Naiad's black latches to Lepper's, because the magnets are shaped so as not to chip the paint on the catches, as Lepper's tend to do. Three black-wire

record dividers tap into pre-drilled holes in the bottom shelf and round out the hardware.

With a suggested retail price of \$349.95, the Profile 470R is at least \$100 less than any other model reviewed. For the price, Naiad produces a cleanly styled, nicely finished, functional unit. Frills like drawers, slides, and lights have been omitted. But for roominess, accessibility, ventilation and flexibility, this cabinet is the equal of any of the others. While not a timeless example of the cabinetmaker's art, the Profile 470R is competent, well-designed, and suitable to many requirements.

are inherently more susceptible to distortion from changes in temperature and humidity. Sonrise uses relatively wide boards (only three boards for each 16½-inch panel), and this gives the panels visual appeal. On the other hand, the wider the boards, the more likely they are to warp. At 11/16-inch thick, they are also thinner than Barzilay's or CWD's, and thin panels warp more easily. Maintenance oiling helps keep this to a minimum, and a conscientious maker will facilitate that maintenance.

Sonrise emphasizes craftsmanship, and their craftsmen do a good job. Grain patterns in the solid side panels are nicely matched. Shelves are 9-ply, veneer-core oak plywood with plain-sliced face veneers (good stuff) generously edged with solid oak. Front doors are oak framed, and the adjacent center frame members of each door are cut from the same board. This is a pleasing touch because the pronounced grain pattern is continuous between the two frames, a clear sign that an unusual amount of care went into assembly. The hinged top features pleasantly sculpted finger grips which I find very attractive. Solid-oak door handles are pleasing and visually unobtrusive. Slots carved in the sides allow the lower back to be removed for access without tools.

The potential is here for a really outstanding unit, but it's less than fully realized. My biggest complaint focuses on the back. While this may seem an odd place for concern, the Crestwood is more susceptible than the other cabinets to "racking." That is, its shape changes from a rectangle to a bit of a parallelogram when the cabinet is moved on its casters. The doors have a tendency to pop open. And even when the cabinet is at rest, nudging it changes the spacing between the carefully hung doors and the case.

All these symptoms could be cured by one easy change in the design: Replace the removable, partial back with a full-length, fixed back. The only diagonal bracing in the back is a 6-inch fixed piece at the top; it's not enough. To stiffen the unit, Sonrise has fixed a shelf 13¾ inches from the bottom, allowing record storage.

Since solid side panels are joined to plywood shelves, they are screwed but not glued, which allows inevitable dimensional change to take place peacefully but adds little to lateral stability. And since both the bottom and

## Sonrise Audio Systems Crestwood Model SK 3 GT

**Suggested Retail Price:** \$496.00

**Address:** 13622 NE 20th St., Suite F, Bellevue, Wash. 98005

The glass-topped Crestwood is a fully assembled, hinged-top highboy with several likable features. Visually, it's a pleasant compromise between the severe sleekness of some units and the slightly overfed chunkiness of others. Solid oak-framed top and front doors lend a homey softness, while the flat-panel style keeps the look clean. Sonrise has clearly worked hard to produce an appealing product with an emphasis on craftsmanship, which in many ways is outstanding. Unfortunately, a series of design shortcomings hampers the effort.

The cabinet comes pre-assembled in an 86-pound crate. Setup requires opening the crate with a knife, attaching molded wood handles to the pre-hung doors with a #2 Phillips screwdriver, adjusting the spring tension for the top with the same tool, and plugging the adjustable shelf pins into the desired positions. Two sets of instructions are enclosed on separate cards. The first clearly and concisely details the procedure for fine-tuning the tension of the spring that holds the lid open and keeps it from slamming when you close it. The second card details maintenance procedures for the solid-oak side panels. Sonrise points out, quite correctly, that the solid side panels will adjust to local temperature and humidity conditions for a period of time, and very wisely recommends periodic application of oil finish during this time to prevent splitting.



This is good advice and should be followed. Unfortunately, Sonrise does not provide the oil. They recommend tung oil which, like boiled linseed oil, is used in many penetrating oil finishes. Any oil finish (such as Watco, Waterlox, Minwax and Tungseal) is an adequate alternative. I don't mean to belabor the subject, but keeping the wood properly oiled is important.

While Barzilay and CWD also employ solid panels, the Sonrise panels



top shelves are fixed, they limit the interior configuration's flexibility. Only one adjustable shelf is provided for the 18 $\frac{1}{8}$  inches of space between the two fixed shelves. The defined space is more than required for two components, but probably not quite enough for three. If Sonrise gave the cabinet a fixed back for lateral stability, the lower fixed shelf could be made adjustable, and four equipment platforms would then be feasible. Sometimes small things mean a lot.

Sonrise recommends using the top shelf for either a turntable or a VCR. All shelves measure 22 inches wide x 14 $\frac{1}{8}$  inches deep, and the top shelf has 5 $\frac{1}{4}$  inches of usable height. This should be adequate for many turntables, but record changers and larger VCRs may not fit. An accessory slide-out shelf for the lower compartment (\$45, not reviewed) is available if this is a problem. The top compartment is eminently accessible through the hinged top and front doors. A wireway is provided through the back. The partial back does allow excellent ventilation and easy wiring access in the lower compartment. Drawers for (audio or video) cassette storage are additional options (\$70 each, not reviewed). The full length of the cabinet is accessible since regular pin hinges are used for the doors. One of the hinges was slightly loose, probably from indelicate handling during shipping. It would've been an easy matter to retighten, except the hinges are mounted with Robertson-head screws, which require a special square-headed screwdriver. (Every once in a great while, even I don't have the right tool.) Casters are garden-variety, brown-plastic hooded-wheel types. Catches are magnetic and could be a shade stronger to keep the doors closed when the unit is rolled around. Although a lower compartment is designed for record storage, no dividers are provided; use bookends if you can't fill the compartment. Shelf pins are tan plastic and are serviceable, if somewhat bulky.

The essence of craftsmanship is attention to detail. Sonrise illustrates this well with its matching of materials in doors and side panels. This is why I'm a bit mystified at their finish. After taking the trouble to carefully match grains, plug screwholes with oak plugs, and individually hang and true doors, they finish the cabinet with what appears to be a single coat of pigmented oil finish. The result, while ade-

quate, has dry patches and random splotchiness where excess stain has bled out of the open grain of the oak. With a light sanding followed by another coat of oil, this cabinet would *sing*.

I really like the looks of the Crest-

wood. An unusual amount of care has been taken in making it, and I'd love to be able to rave about it. Sonrise has gone 95% of the way toward producing an outstanding product. Now, if they'd just take care of that last 5%...



## EL Manufacturing Realwood Model 2001

**Suggested Retail Price:** \$700.00

**Address:** 215 South Tyler St., Dallas, Tex. 75208

Unlike the other units, the Realwood 2001 specifically dedicates half its space to video components, with flexible audio-component space in the remaining half. Also unique is the combination fixed/hinged top of this fully assembled lowboy. Half of the top is hinged to provide enclosed storage with both top and front access, while the other half can be used as an additional platform for large or frequently used components. The 2001 has a medium-dark walnut finish on oak; the Realwood Model 2000 has a natural-oak finish.

The styling is reminiscent of traditional-country kitchen cabinetry. Doors are oak-framed, overlay types with clear glass in place of raised panels. The drawers appear to have solid oak sides, assembled with glue and staples, and have attached oak fronts with beveled edges. Hinges and knobs are kitchen-cabinet standbys. If you like the look of a traditional kitchen, this is your cabinet. It arrives pre-assembled, in a carton 30 inches high x 50 inches long x 21 inches deep, and tips the scale at 120 pounds. Final assembly is duck soup. Uncrate by slitting the tape

on the cardboard shipping box, slide the box off, then use a slot screwdriver to remove the knobs inside the doors and drawers and install them on the outside. Unwrap the two adjustable shelves, plug in the adjusting pins, and you're all set. I only review this in detail because the manufacturer provides no owner's manual or other information whatsoever. Thinking that a brochure might have been omitted by oversight, I checked with EL Manufacturing and was told that assembly is so straightforward they felt no explanation was necessary. As their finish requires no routine maintenance, they make no mention of any. Fair enough, but omission of maintenance, adjustment, and warranty information left the impression that I'd just taken in a foundling.

Realwood models are made of just that—no vinyl here. Like most commercial furniture, the 2001 is made of a variety of materials. Tops are rotary-cut oak plywood, with a characteristically coarse grain pattern, edged with wide strips of  $\frac{3}{4}$ -inch-thick oak, shaped along the perimeter. Case parts are oak plywood, chosen for dimensional stability. Face frames are oak solids, glued and screwed together. Such frames are rugged and resist damage well. Door frames are oak solids, joined with glue and self-clamping metal fasteners. Clear door glass is set in brown silicone rubber for cushioning and to lend an attractive appearance. In line



with standard practice, drawer bottoms are ¼-inch oak plywood, as is the case back. Adjustable shelves are ¾-inch oak plywood with oak veneer edging. I noticed that veneer was chipped out on the underside ends of the shelves, indicating either improper sawblade selection by the manufacturer or poor glue-line quality from their plywood supplier. Since some other units surveyed had unfinished or mismatched undersides, it would be unfair to be too critical of this minor flaw.

The cabinet itself is exceptionally solid. Joinery is generally more than adequate. Door frames, although joined with metal plates that I instinctively distrust, should hold up well. Because the door glass has been literally glued in place, it becomes a structural part of the door assembly, reinforcing it. Construction of the drawers is standard industry practice, which holds up well in use, and they run on full-extension ball-bearing slides which are convenient and hefty. The top operates on spring-loaded hinges which can be adjusted to hold the top open for easy access. A glass door folds down to give unobstructed access to the front of this compartment as well. The other glass doors mount on antique-finished hinges to hold doors fully open, and use spring tension to hold doors closed, obviating catches. Knobs are die-cast and antique finished. No casters are supplied.

The 2001's configuration has some unavoidable limitations. The left side, with a top platform accessed from top and front, offers a shelf 23 inches wide × 15 inches deep, with headroom of 9¼ inches. The 15-inch depth in itself will not accommodate the largest turntables or VCRs, and the hinges for the front access door further restrict usable depth to 14¼ inches. Potential buyers should check this carefully against current or anticipated components. I don't mention tape decks because the two drawers beneath this compartment measure 19 inches wide, 12¼ inches deep, and 6¾ inches high. They're too big for efficient storage of audio cassettes and too small for 7- or 10-inch reels. Clearly ticketed for videocassettes, the drawers hold up to 40 each, but have no dividers to keep your cassettes from clattering around when the drawer is opened and closed. An alternative design offers record storage in place of these two drawers. Tape fanciers, though, won't find the 2001 their best choice.

The right side of the cabinet offers more options in equipment placement. A fixed top offers a convenient turntable platform; at 25 inches wide × 17 inches deep, it will house most anything this side of a Lincoln. The cabinet's traditional design places some constraints on utilizing all the interior space. Two interior shelves measure 14⅞ inches deep and 22-9/16 inches wide, and adjust easily on 1½-inch centers by use of well-fitting metal pins. Face framing, while contributing to the structural strength of the cabinet, reduces accessible width to 19¾ inches and accessible height to 22 inches, if both adjustable shelves are used. Storing records inside may leave room for only one component. The wood framing of the doors visually cuts enclosed components in half, and the clear glass accentuates this. Owners of infrared remote-controlled components should check sensor positions to avoid blocking by wood frames. Interior ventilation is very good, provided by generous openings in the back.

Unlike all other companies discussed here, EL Manufacturing does not use penetrating-oil finishes. Instead, they use a more typical furniture-industry system of a wiping stain protected by a sprayed synthetic lacquer-type finish. Environmental-protection statutes now require many firms to replace older, solvent-based finishes with water-based alternatives, and EL has complied. Modern water-based finishes have demonstrated excellent durability, with water and alcohol resistance, but from a manufacturer's point of view, their biggest drawback is extended drying times compared to their solvent-based predecessors. The longer the drying time, the greater the likelihood of stray dust particles being incorporated in the finish as small nibs or bumps. To overcome this problem, some manufacturers bake the finish to accelerate drying while others rub out (sand out, really) the offending flaws. The literature about Realwood proclaims a hand-rubbed finish. The two units I examined, with numerous surface imperfections, clearly had not received this treatment. The finishes are acceptable commercial quality. They'll provide tough, low-maintenance protection superior in a number of ways to the oil finishes used by the other manufacturers. But this is the most expensive cabinet of the lot. The gentleman is solidly built, but he needs a more finely tailored coat.

## EL Manufacturing Realwood Model 2090 Video Cart

**Suggested Retail Price:** \$200.00

**S**tyling, construction, materials and finish of the 2090 are similar to the 2001, its mate in the Realwood media-center product line. This model is a caster-equipped platform for a television, with an enclosed, slide-out shelf to accommodate a VCR. Overall dimensions are 16 inches deep × 25 inches long, and the unit stands 18 inches tall. The enclosed shelf measures 14¾ inches deep × 23½ inches long, with usable headspace of 9¼ inches. Solidly structured, it rolls easily on four dark-brown plastic casters. The slide-out shelf operates smoothly on a ball-bearing slide, but lack of proper cushioning left the front corners of the shelf scarred from its journey. The fit of shelf through door opening is tight, as the shelf hits the doors unless they're opened fully. An ample, T-shaped cut-out in the ¼-inch plywood back provides ventilation and wiring access. Though lacking in tape storage, the 2090 could be a handy unit for the videophile. The Realwood modular concept offers a variety of largely single-purpose units with a strong video focus to allow custom tailoring a system. The audiophile who updates equipment on a regular basis may find this approach lacks flexibility once he owns specific units.

**A**s the dust settles, one impression lingers. Technology in the furniture business looms larger all the time, as labor and material costs increase. One of its most notable impacts has been in finishing, where huge efforts have succeeded in enhancing cheap materials. Many manufacturers are thus able to mix injection-molded plastics, any number of woods and carefully engineered, machined-flakeboard components into products that look like well-finished solid wood—all due to a few thousandths of an inch of high-tech coatings. Without exception, the manufacturers reviewed have shunned this approach. They all use low-tech finishes that straightforwardly present honest materials. The results, to be sure, are varied and I've been pretty tough in my criticism. Still, I come away impressed with the overall effort. **A**

# HOW COULD A CASSETTE DECK WITH TWO HEADS BE SO HARD TO GET?

The Kyocera D-801 Cassette Deck is hard to get because so much more is built into it. For example, it has five circuit boards where most decks have only one or two. But that's only the beginning.

## It more than meets the ultimate tape deck challenge.

The challenge is to move tape across the heads at as nearly a constant speed as possible. Variations in speed, of course, come out in your speakers or headphones as wow and flutter.

Many decks claim a wow and flutter figure of 0.05% WRMS—trouble is, speed variations of 0.05% are clearly audible with piano music (one of the most revealing tests you can give a cassette deck—try it on the D-801 and marvel!).

The D-801 by Kyocera comes through with a remarkably low wow and flutter figure of 0.02% WRMS—and that is derived from a unique, three-motor, dual capstan drive mechanism. Two capstans are driven by a direct drive motor. A beltless/clutchless simple DC motor drives the feed and takeup reels, while a third motor is used as a head-position assist drive (it greatly prolongs head-to-tape azimuth accuracy). The dual capstan system provides that sensationally accurate tape travel, maintaining proper tension between capstans to eliminate external shock source modulating noise.

## It more than meets the needs of the audio perfectionist.

The D-801 goes above and beyond even the fussiest audiophile's needs with 3-position bias/equalization selection (with fine bias adjustment), 400 Hz calibration tone, Automatic Program Mute Recording, automatic search, and electronic 4 digit display, including counter, elapsed time and time remaining functions.

The D-801's noise reduction systems were built for the audio purist. It has *two*—Dolby\* B & C—Dolby B for music material of limited dynamic range, Dolby C for music of the widest dynamic range, so noise reduction can be tailored to program material.

Finally, the specs everyone wants: frequency response of 30-20,000 Hz  $\pm$  3 dB using metal or CrO<sub>2</sub> tape, and a S/N ratio of 78 dB with metal tape in Dolby C NR mode.

If you have any trouble finding a Kyocera dealer, contact: Cybernet International Inc., 7 Powder Horn Drive, Warren, NJ 07060 (201) 560-0060.



\*Dolby is a registered trademark of Dolby Laboratories, Inc.

Enter No. 7 on Reader Service Card



# SIDE BENEFITS AND SIDE EFFECTS

HOWARD A. ROBERSON

**D**olby B noise reduction was a vital factor in the acceptance of the cassette format. But as tapes, records and the rest of the audio chain improved, audiophiles felt the need for even greater noise reduction. Dolby C noise reduction, now available on many decks, reduces noise by 20 dB, twice as much as the 10 dB of Dolby B NR. The dbx II NR system, with as much as 30 dB of noise reduction and increased headroom, has been available for several years in outboard processors and has recently been built into decks from several manufacturers.

While everyone knows that these systems reduce noise, their effects on frequency response, distortion and other aspects of system performance are less common knowledge. This article examines these factors, with some suggestions as to how one can best take advantage of each system's characteristics.

## Responses and Tracking

The investigation utilized the normal collection of test equipment plus a Nakamichi NR-200 for the Dolby C processor and a dbx 224 for the dbx II processing. A Nakamichi 582 cassette deck was used for the record/playback tests. First, the processors themselves were tested to make sure their encoding and decoding were exactly complementary. Figure 1 shows the 20 Hz to 20 kHz swept responses of both

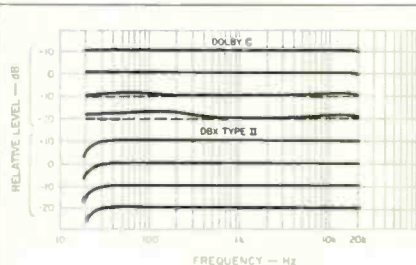


Fig. 1—Swept-frequency responses, 20 Hz to 20 kHz, of Dolby C and dbx Type II NR systems, simultaneous encoding and decoding. (Dashed lines in lower Dolby curves are left channel.)

channels, in steps of 10 dB from +10 to -20 dB. Although normal calibration procedure was followed, there was a rise of 2 dB or so around 100 Hz at -20 dB with Dolby C NR for one channel. This deviation indicates the need for accurate adjustment with this system. The dbx II responses were perfectly flat at all levels except for the roll-off of 3 dB or so at 20 Hz.

Figure 2 shows a similar set of responses, but they are of the encoder section only. We can see that, with Dolby C NR, there is no compression at the lowest frequencies, but from 100 Hz up there is increasing compression as overall level is reduced. The decoder, of course, has mirror-like responses; by expanding the lower levels, it restores signals to their correct level

but reduces noise. Because the curve shapes change with level below zero, level-matching errors will cause at least some frequency-response deviation.

The dbx Type II encoder responses are in steps of 5 dB because of the 2:1 compression. The curve shapes, however, are exactly the same, and the matching (mirror-image) curves of the decoder also do not change with level. Thus, dbx II does not require level matching to maintain normal response. Since dbx also compresses signals above zero, it appears logical that there should be increased headroom. The decoder not only "corrects" the response, but it expands the signal 1:2 relative to zero, back to its correct levels, thereby reducing noise.

What follows immediately is basically a deliberate demonstration of how improper testing methods can make a product look bad. The test signal consisted of the swept sinusoid fed through an MXR  $\frac{1}{3}$ -octave equalizer with the filters purposely set to simulate the response of a poor recorder. The equalizer was inserted in the NR loops, and swept responses were taken. As Fig. 3 shows, Dolby C NR matched quite well at the two levels tried. Dbx II, however, doubled the deviations from flat. It would seem that this demonstrates a failing in the dbx II scheme, but it's really an example of a poor test. Figure 4 shows what happened when I repeated the test but used pink noise,

# "Both the Dolby and the dbx II noise-reduction systems lower distortion—but for different reasons."

## NOISE - REDUCTION

instead of a swept sine wave, as the source. All three traces look alike, including that for dbx II (bottom). The dbx system's gain varies with overall signal level, not with the level in just one frequency band. A swept sinusoid of varying amplitude appears as just another varying-amplitude signal to the dbx II system, which acts accordingly. Since the variations in the test were introduced after the encoder but before the decoder, the deviations were doubled in the expansion. With wide-band signals such as pink noise or music, frequency irregularities have less effect on overall level and so are not expanded.

Figure 5 shows Dolby C NR responses at  $-20$  with the Nakamichi 582 record/playback in the loop. The topmost response was made with a low-pass filter at 25 kHz. The second trace of Fig. 5 was the result of moving the filter out to 50 kHz. The third trace was obtained after switching in the multiplex filter. The highest frequencies were rolled off by that filter, but the smoothing of the overall response is very obvious and certainly desirable. Dolby Laboratories does recommend that the multiplex filter be used as a general practice to prevent mistracking due to energy above 20 kHz—as might come from a synthesizer, for example. The other traces in Fig. 5 show the effects from calibration errors and a rolled-off response from excessive bias.

Figure 6 shows the dbx II responses over a range of the higher levels. The system showed no sensitivity to above-band energy or recorder-response deviations over a very broad range of levels. (Part of the dbx II design is a 10-kHz roll-off in the level-detector loop and a 27-kHz roll-off in the signal loop.) In the top set of four traces, the unity-gain point was set at  $-5$  input/record level, and the input level was increased in steps of 4 dB above that, to a maximum of  $+7$ . It can be seen that a roll-off appeared at  $+3$  input level, which was actually  $-1$  on the recorder because of the encode compression. In the bottom four traces, unity gain was set at zero with input levels of  $-8$ ,  $-4$ ,  $0$  and  $+4$ . Notice that there is some roll-off at  $-4$ , which was

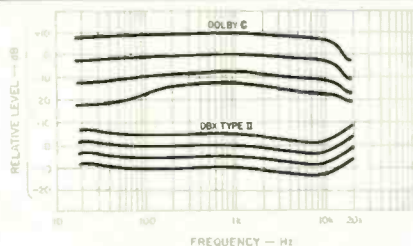


Fig. 2—Swept-frequency responses of Dolby C and dbx II encoders only.

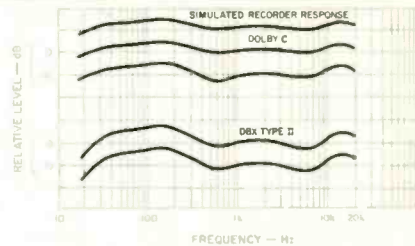


Fig. 3—Response of NR systems with poor "recorder" response, using swept sine-wave signals.

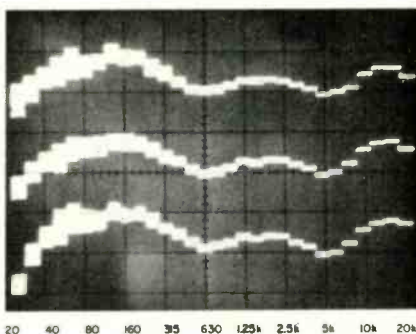


Fig. 4—Response of NR systems to same poor "recorder" response, using pink-noise test signals: "Recorder" response (top trace), with Dolby C NR at  $-10$  dB (middle), and with dbx II NR at  $-10$  dB (bottom). Vertical scale: 5 dB/division.

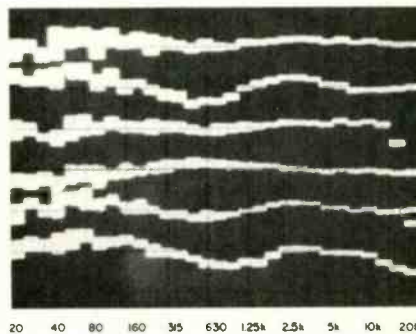


Fig. 5—Effect of high-frequency energy on Dolby C tracking, at  $-20$  dB with tape deck in loop: Pink-noise response with 25-kHz low-pass filter on source (top trace); response with 50-kHz low-pass filter (second); response with multiplex filter added (third); response with Dolby calibration control at  $+1$ , multiplex filter out, and 25-kHz filter in (fourth); same, with calibration at  $-1$  (fifth), and response with excessive recorder bias, rolling off at high end, calibration at zero (bottom). Vertical scale: 5 dB/division.

actually  $-2$  on the recorder. In this case, with the high unity-gain point, levels were actually pulled up by the encoder compression, leading to the high-frequency loss. The dbx Type II unity-gain point should be set 5 dB or so below the recording level where high-frequency saturation first appears; that will give 10 dB of headroom, with the 2:1 encoder compression.

### Distortion and Noise Reduction

As a first step, let us discuss some of the basic characteristics of distortion in the recording process. In analog recording with high-frequency bias, the primary distortion components are third-order, even with complex tones. Over the entire range of recorded levels, the absolute level of the third harmonic is a cubic function of the level of the fundamental. The relative level of



# “The dbx Type II system is appealing when you’re making live recordings and can’t stay near the recorder’s controls.”

## NOISE - REDUCTION

the distortion, as a percentage of the fundamental, varies as the square of the signal level. This means the distortion will increase 2 dB for each 1 dB increase in record level. Therefore, excessive recording levels can cause very high levels of distortion: At 3 dB above the 3% distortion point, HDL<sub>3</sub> would be about 6%.

Part of the appeal of noise-reduction systems is that by reducing noise, they give some leeway in setting maximum record levels, so there's less chance of distortion. Even when recording levels aren't excessive, both the Dolby and dbx II NR systems lower distortion—but for different reasons.

In the Dolby system, distortion is reduced, like noise, during decoding. That's because distortion, like noise, is added to the signal after encoding and because the Dolby systems' sliding-frequency bands concentrate the decoding on the upper (and, with Dolby C, the middle) frequencies, where undesired harmonics appear. This is why, in tape-recorder "Equipment Profiles," I regularly comment that "distortion without NR was 30% higher."

The dbx Type II system, on the other hand, reduces distortion across the audio band at higher input levels, since its compressing action reduces the actual recording level. (There is no response shaping with any significant effect on distortion.) Below the dbx system's unity-gain point, signal compression increases the recording level, which increases distortion; but the distortion here is low enough to be acceptable, in most cases even with the compression.

Multiple-tone distortion tests (more like music than single-tone signals) confirm this. When the signal was recorded with an input level of +5, tapes made with dbx II (Fig. 7) showed less distortion than tapes made with Dolby C (Fig. 8)—up to 10 dB less, especially for the highest level components. But this is only due to the dbx compression, which reduces the actual recording level to 0 dB. When the input to the dbx system is raised to +15 dB (for a recording level of +5 dB, after compression), record distortion is almost exactly that of a tape recorded at +5

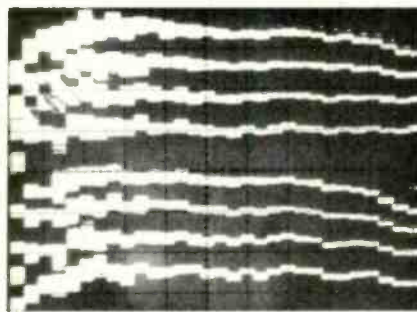


Fig. 6—Effects of dbx II unity-gain setting and input level on frequency response. Upper four curves: Responses at (top to bottom) +7, +3, -1 and -5 dB, with unity gain set at -5 dB; note roll-off in upper two curves. Lower four curves: Responses at (top to bottom) +4, 0, -4, and -8 dB, with unity gain at 0; note the earlier onset of roll-off. Vertical scale; 5 dB/division.

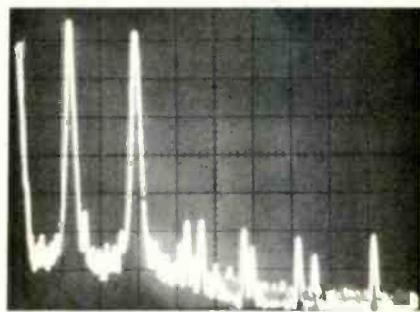


Fig. 7—Record/playback spectrum with test signal of 400, 1,100 and 2,000 Hz, at +5 dB input level, with dbx Type II NR. Scales: Horizontal, 0.5 kHz/division; vertical, 10 dB/division.

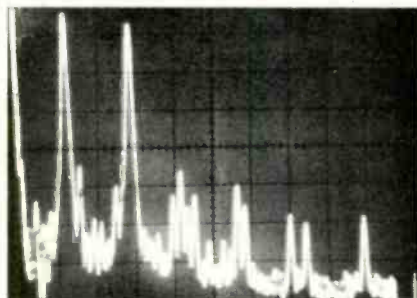


Fig. 8—Same as Fig. 7, with Dolby C NR. Note greater distortion (see text).

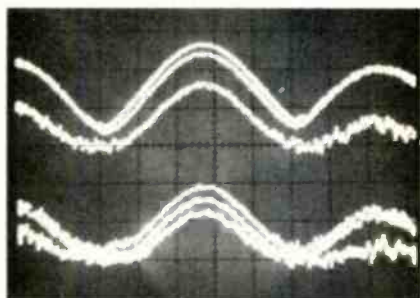


Fig. 9—Distortion components around 2.6 kHz, with same three-tone source. Upper set of curves at +5 dB input level: Without NR (top), with Dolby C NR (middle), and with dbx II NR (lower). Lower set of curves same, but at 0 dB input level. Scales: Horizontal, 20 Hz/division; vertical, 10 dB/division.

with Dolby C—or of a tape made at +5 without NR, for that matter.

A series of spectrum-analyzer scans indicated that the changes in all distortion-component levels with reducing record level could be measured by examining any selected component. The analyzer was tuned to the 2.6-kHz product ( $2f_2 + f_1$ ), and a narrow scan (20 Hz/div.) was used to get the required detail. Figure 9 shows the re-

sults at +5 input level (zero record level for dbx II) and at zero input level (-2.5 recorded level for dbx II). In both cases, the highest distortion level is without noise reduction, the middle level is with Dolby C NR, and the lowest level is with dbx II NR. Note that the dbx II trace appears to be noisier.

Figure 10 plots HDL<sub>3</sub> versus input level at 400 Hz for the two NR systems and for a signal without NR. It can be

# “Dolby C sounded more musical in one comparison, perhaps from lower noise at higher levels or lower distortion at low levels.”

## NOISE - REDUCTION

seen that Dolby C NR reduced distortion for all levels shown. This distortion reduction over a wide level range is a benefit of the sliding-band design of the Dolby C compressor and expander. However, as the level approaches the 3% distortion point, there is less advantage.

It is very evident that the compression in the dbx II encoder around the -5 unity gain point produced a great reduction in distortion at the higher levels. Note, however, that its curve crosses the Dolby C NR curve at -3, and that the distortion below -3 is relatively higher, noticeably so at -10.

If dbx II offers 30 dB of noise reduction to Dolby C's 20 dB, it may seem paradoxical that, in Fig. 9, the high-level signal trace with dbx II was noisier than that with Dolby C. But, as Fig. 11 also shows, output noise at higher levels with Dolby C NR is less than with dbx II. This proves that the Dolby C sliding-band scheme can reduce noise even at higher signal levels. At low recording levels (Fig. 12), noise with dbx II was lower, particularly at the higher frequencies.

### Making Choices

Among the advantages of Dolby C NR are its inclusion in many manufacturers' products, very good noise reduction at lower signal levels, some noise reduction even at high levels, and distortion reduction at all normal recording levels. Dolby C also sounded, to my ears, more musical in one comparison where levels could be set as desired. (This may have been from such factors as Dolby C NR's lower noise at higher signal levels and/or from lower distortion at low levels. I did not have the opportunity to correlate the sonic judgment with any test results.) If you're running pink-noise tests or recording synthesizers (which would include energy above 20 kHz), make sure the signal's high end is rolled off *before* the Dolby C encoding, to prevent mistracking. If in doubt, use your multiplex filter.

The advantages of dbx Type II NR include increasing availability (even in open-reel recorders), excellent noise reduction at lower signal levels, greatly

Fig. 10—Third-harmonic distortion vs. record level, at 400 Hz: Without NR (top), with Dolby C NR (middle), and with dbx Type II NR (bottom).

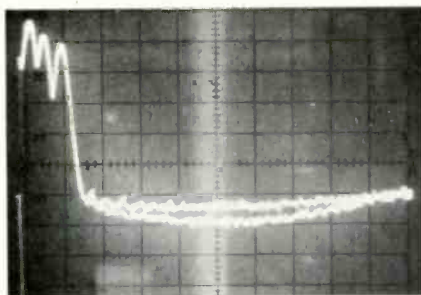
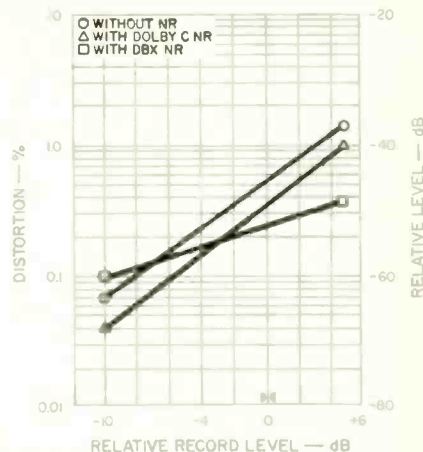


Fig. 11—Three-tone source at -5 dB input level, 20-kHz spectra. Noise levels are higher for dbx II than for Dolby C NR. Scales: Horizontal, 2 kHz/division; vertical, 10 dB/division.

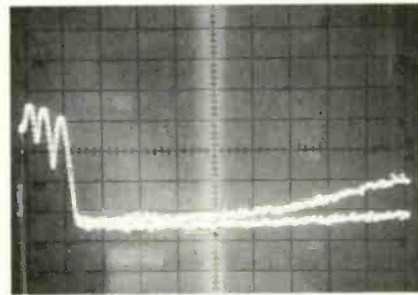


Fig. 12—Same as in Fig. 11, but with -40 dB input level (and analyzer input gain increased). Noise level is now higher with Dolby C than with dbx Type II NR.

reduced distortion across the band at higher input levels, no requirement for level matching, and insensitivity to above-band energy. This system is particularly appealing when you're recording live performances and can't stay by the recorder to adjust levels manually. The encoder's 2:1 compression gives you a lot more leeway in setting the input level.

Dolby C's disadvantages are, primarily, its need for accurate level calibration and its sensitivity to above-band energy. In practice, however, accurate calibration is quite simple and direct with good units, and above-band energy can be eliminated by using the multiplex filter, with substantial no loss in music content.

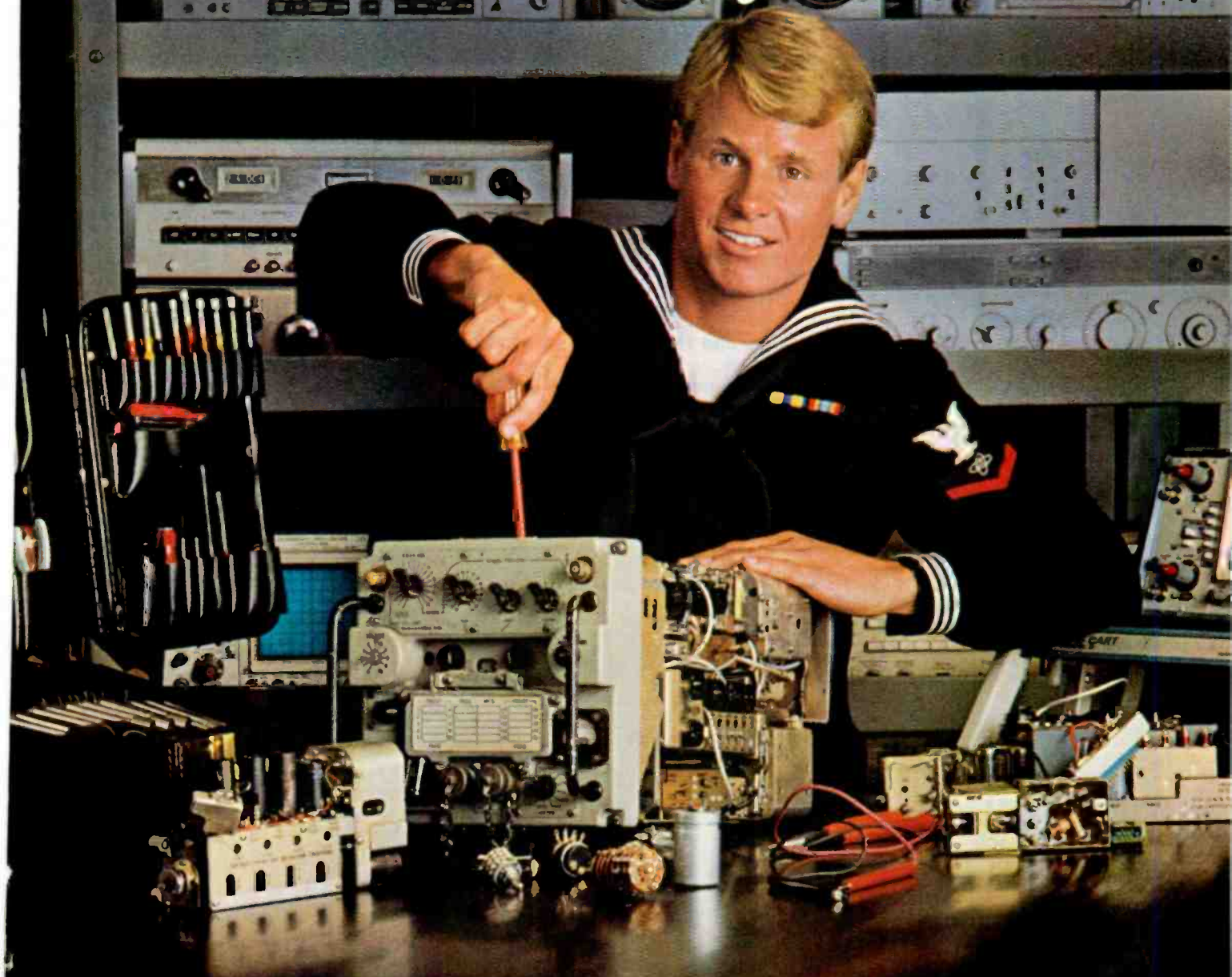
The drawbacks of dbx Type II NR are affected by the choice of the unity-

gain point. If too high a level is picked, noise levels for medium-high signal levels will be increased, there will be little improvement in headroom, and distortion will be higher than without NR for anything but high levels. If too low a unity-gain point is selected, noise levels for high signal levels will increase, and there may be some loss of noise reduction at low signal levels. I have occasionally experienced noise modulation with dbx, though only at odd times between movements or when audience applause was dying out, never during the music itself.

I hope the reader accepts that both Dolby C and dbx Type II noise-reduction systems can provide great benefits to their users, and that this article helps you to understand and to apply them wisely.



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# 1

## SONY PCM-701 DIGITAL AUDIO PROCESSOR

### Manufacturer's Specifications

**Signal Format:** NTSC TV Standard.

**Encoding Format:** EIAJ Standard (14 bit), or 16 bit.

**Sampling Frequency:** 44.056 kHz.

**Quantization:** 14- or 16-bit linear.

**Frequency Response:** 10 Hz to 20 kHz,  $\pm 0.5$  dB.

**Harmonic Distortion:** 0.007%, 14-bit mode; 0.005%, 16-bit mode.

**Dynamic Range:** 86 dB, 14-bit mode; 90 dB, 16-bit mode.

**Wow and Flutter:** Below measurable limits.

**Input Sensitivity:** 77.5 mV for 0 dB record level.

**Video Input and Output Levels:** 1 V peak-to-peak.

**Monitor and Copy Output Levels:** 1 V peak-to-peak.

**Headphone Output Level:** Variable, -24 to -48 dB.

**Power Requirements:** 100 V (see text), 50/60 Hz, 35 watts.

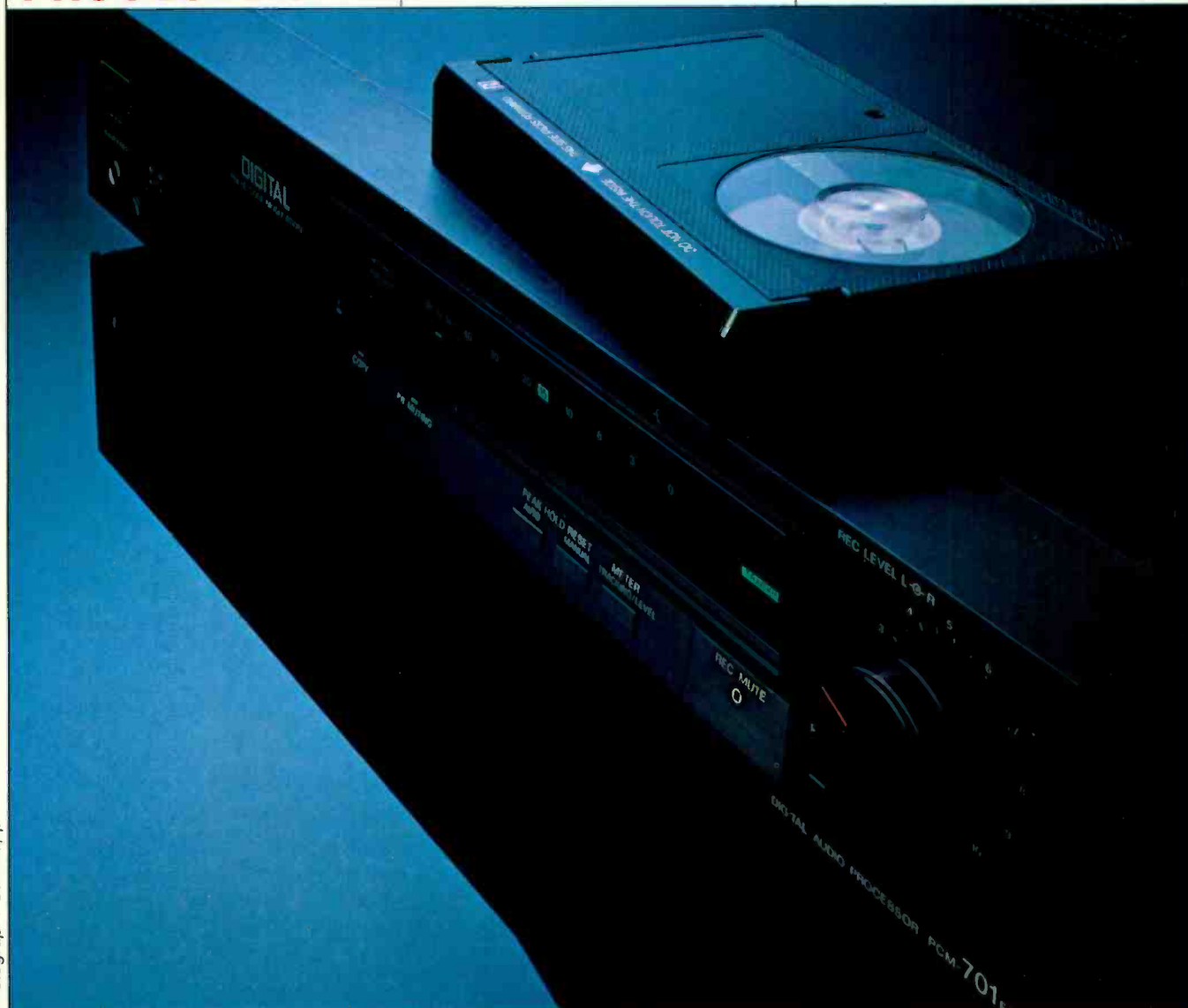
**Dimensions:** 16.9 in. (43 cm) W x 3.15 in. (8 cm) H x 14.75 in. (37.5 cm) D.

**Weight:** 18.25 lbs. (8.3 kg).

**Price:** \$1,100.00.

**Company Address:** Sony Drive, Park Ridge, N.J. 07645.

For literature, circle No. 90



Photograph: Carl Zapp



It is barely a year since I examined Sony's remarkably compact PCM-F1 digital audio processor. Since then, that PCM processor has found its way into applications which its creators probably never dreamed about. The PCM-F1 has, for example, been doing yeoman's duty at Chicago's classical music FM station, WFMT, where it has been used as part of a remote master recording system to record live performances of Chicago Symphony Orchestra concerts which are then fed by satellite to a number of cable TV/FM services (see *Audio*, February 1983). I am certain that a great many serious audio enthusiasts as well as small recording studios are using the PCM-F1 for a wide variety of on-location and studio recording assignments. At its suggested price of \$1,900.00, I considered the PCM-F1 to be a very good value, and evidently many users agreed with me.

That being the case, at \$1,100.00, Sony's newest PCM digital processor, the PCM-701, is an even more incredible bargain. In terms of performance, it does every bit as well as the earlier PCM-F1. To get the price down to this level, its designers had to leave some things out, of course. But what's been left out has nothing whatever to do with performance. There are no microphone inputs this time, but frankly, most of the people I know who use the PCM-F1 aren't using its mike inputs anyway; they're invariably using a separate mike mixer with the device. The other omission is d.c. or battery operation, as the PCM-701 operates on a.c. only. When I was asked to test this unit, together with the Sony SL-2000 portable VCR and AC-220 power adaptor, the only production model available was one intended for the Japanese domestic market, where standard household voltage is 100 volts. This posed no problem; I was able to lower the 120-V supply in the lab to the required 100 V by means of a Variac. Obviously, units intended for sale in the U.S. will be configured for 120-V, 60-Hz a.c. operation.

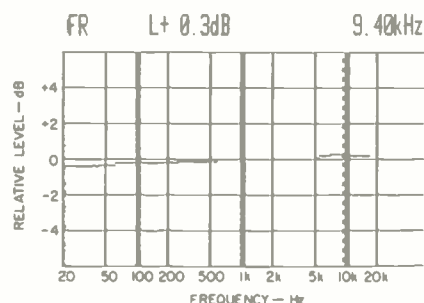
### Control Layout

Just about all of the front-panel controls on the PCM-701 perform the same functions as those on the earlier portable PCM-F1. At the left is a power on/off switch. Below are a headphone attenuator and a stereo headphone jack for monitoring material being recorded as well as tapes being played back. A large display window, to the right of panel center, features a pair of expanded-scale LED record/playback level meters, calibrated from -50 to 0 dB. An over-record level indication flashes in red when record levels reach unacceptable limits.

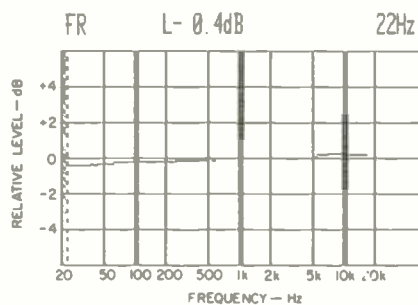
Several helpful back-lit words show up under appropriate circumstances just to the left of the level scales. "Copy Prohibiting" is for tapes which have been encoded with a special signal to prevent their being copied, "Res 14-bit 16-bit" indicates which type of digital encoding is being used or played back, "Emphasis" tells you whether the tape being played has been pre-emphasized for greater noise reduction, and "PB Muting" tells you the status of the similarly marked switch on the front panel. This switch is normally kept "on" to guard against possible drop-out noise bursts which, if left unquenched, might cause amplifier or speaker damage.

Additional illuminated words to the right of the record/playback level scales include "Rec Mute" and "Tracking,"

**Fig. 1—Record/play frequency response. The cursor is set to show maximum deviation at treble frequencies (A) and low frequencies (B).**



A



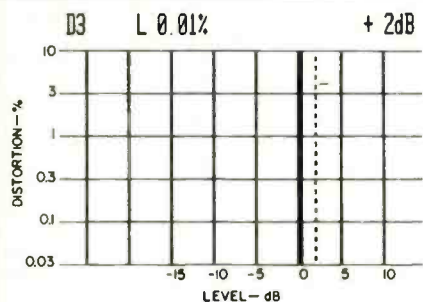
B

which indicates that the meter function has been switched from its usual level-indicating function to that of a tracking adjustment meter.

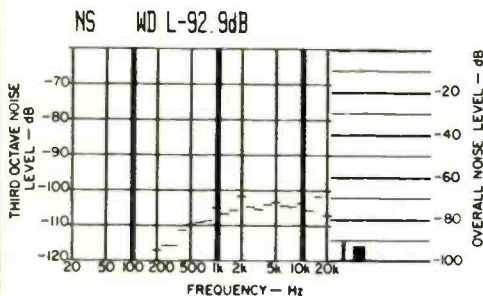
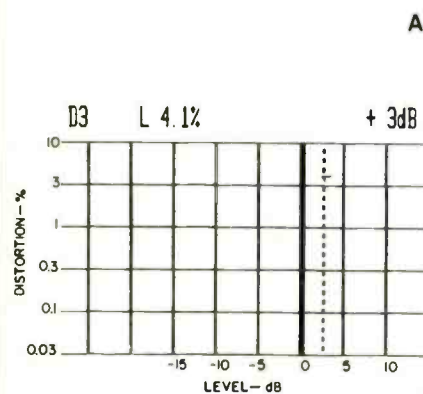
Controls along the lower edge of the front panel include a "Copy" button, the "PB Muting" button, touch switches associated with the meter's functions (peak hold auto, manual and tracking/level), and record mute. When the "Copy" switch is activated, an error-corrected digital signal is made available at the "Copy Out" terminal on the rear panel, for copying from one digital tape to another. The 14- and 16-bit selector buttons are located near the right end of the panel, just below a concentrically mounted pair of left/right record-level controls. With the aid of a friction-clutch arrangement, these level controls may be operated as a single control or as individual left and right level controls.

The rear panel is equipped with line-in and line-out jacks which accept and yield regular audio signals. The video-in and video-out jacks, as well as the copy-out jacks, all deal with a digitally encoded signal—essentially an NTSC video signal with the 14- or 16-bit word "samples" suitably positioned within the standard "lines" of the NTSC video format used in the U.S. and Japan. A monitor jack containing the composite signal is also found on the rear panel, and output from this jack may be connected to a TV monitor, should you

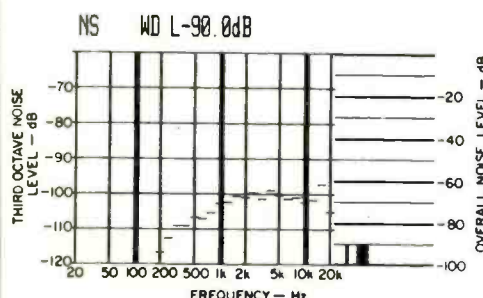
"With the capability inherent in PCM digital processors, what we have to worry about now is the quality of the sources we record."



**Fig. 2—At +2 dB record level, third-order distortion during playback was 0.01% or lower (A); see text. At +3 dB record level, distortion climbed quickly to 4.1% (B).**



**Fig. 3—A slight decrease in S/N is observed when switching from 16-bit operation (A) to 14-bit mode (B). Overall S/N figures at top of each display are A-weighted.**



wish to watch the billions of "bits" form interesting black-and-white patterns on the screen. I suspect that, sooner or later, those of us who get deeply involved with this type of equipment will be able to learn something by observing these hypnotic patterns while we listen to the music they represent. As of now, I find them absolutely fascinating to watch but completely useless in terms of my product evaluation activities.

### Measurements

Not only was the sample I tested built for Japanese line voltages, but the owner's manual supplied with it was written in Japanese as well. Since my fluency in written Japanese is limited to being able to identify the pictograph for a men's room, the symbol for exit and the up and down buttons for elevators, I cannot tell you much about the circuitry of this latest Sony PCM processor. For that matter, I'm not even sure that the manual delves into circuit descriptions. Based upon measurements I made in the lab, I suspect that the substantive circuitry of the PCM-701 is very much like that of the PCM-F1. My report concerning that earlier unit goes into some detail about the LSIs used in the circuit, and you may want to refer back to it (*Audio*, March 1982, p. 48). For this current report, I treated the PCM-701 as a "black box" and simply measured its performance when it was used with a Sony SL-2000 portable Betamax VCR as its tape transport.

Figure 1 is a plot of frequency response, from 0 Hz to 20 kHz, for the entire record/play cycle. I should point out that as sophisticated as the PCM-701 is, it does not offer the equivalent of "tape monitoring" facilities. Signals must be recorded using the level meters as a guide, and results can only be heard after a rewind of the tape and playback. In this sense (and only in this sense), PCM processors such as this correspond to "two-head" rather than "three-head" tape decks. In Fig. 1A the vertical-line cursor has been positioned to show maximum deviation from perfectly flat response at the treble end of the spectrum (+0.3 dB at 9.4 kHz), while in Fig. 1B, the same response curve is shown but the cursor has now been positioned to show maximum deviation at the low end (-0.4 dB at 22 Hz). Both degrees of deviation from flat response are within Sony's claim of  $\pm 0.5$  dB.

Figure 2 analyzes third-order distortion in a tape recording system. The couple vertical line represents 0 dB record level, and it is clear from Fig. 2A that Sony has provided a bit of safety margin above that arbitrary level. At +2.0 dB, third-order distortion is still lower than the residual distortion of the test instrument, which shows up as a reading of 0.01% (or, for greater accuracy, -76.8 dB below reference level). When I increased recording level by only 1 additional dB, third-order distortion rises quickly to 4.1% (see Fig. 2B)! This is one of two so-called "brick wall" effects common to digital recording. If you try to exceed levels that can be represented in the 14- or 16-bit codes available, the system "runs out of bits" and you have the equivalent of very hard clipping—and rapidly rising distortion percentages. As it happens, Fig. 2 was plotted for the 14-bit mode. In theory, the 16-bit mode will yield slightly better distortion results when you stay below the over-record level, but since my test instrument can't read below 0.01%, there was no point in



"The high-power amp proponents were right all along; they simply needed the right program-source dynamics to prove their point."

trying to resolve the difference between Sony's claimed 0.007% (for the 14-bit mode) and 0.005% (for the higher-resolution 16-bit mode).

I was able to measure differences in signal-to-noise ratio between the 14- and 16-bit recording modes. In Fig. 3A, S/N was measured using the 16-bit mode relative to 0 dB recording, and I obtained a reading of 92.9 dB. With the same A-weighting curve and the same reference level, overall S/N decreased to exactly 90.0 dB using the 14-bit mode (Fig. 3B). If you want to apply the same methodology I normally use when measuring S/N in analog tape decks, I suppose you would have to add 2 dB to both of these figures, since third-order distortion doesn't exceed 3% until you go to a +2 dB record level, as mentioned earlier.

Channel separation is plotted in Fig. 4. At 16.0 kHz, I measured a separation capability of 73.3 dB (Fig. 4A); at mid-frequencies, separation measured 88.2 dB (Fig. 4B). The slight decrease in separation at the high end is probably a function of capacitive coupling between audio channels in the post-digital-to-analog stages of the processor, since there is no reason for separation to be any less at high frequencies than it is at mid or low frequencies while the signals remain in the digital domain.

Just for the record, I tried to analyze and measure the wow and flutter of this recording system. As expected with a PCM processor, my efforts remained unrewarded. You can see in Fig. 5 that wow and flutter, if any, was simply too low even for the sensitive test instrument.

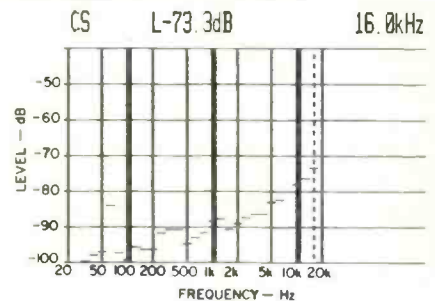
### Use and Listening Tests

Hallelujah! My frustration at not having any program material suitable for PCM processors is over. My lab is now equipped with the Sony CDP-101 compact digital disc player, reviewed in these pages last November and January. This gave me the opportunity to experimentally transcribe a few CD discs onto a Beta-format videotape, using the PCM-701. Let me clarify that this was not a digital-to-digital exercise. The CD player does not have a digital output, only left and right decoded audio outputs for connection to a stereo system. So, the signals fed to the PCM-701/VCR combination were audio signals not unlike those you would feed to the AUX inputs of your stereo system if you were playing a new CD disc.

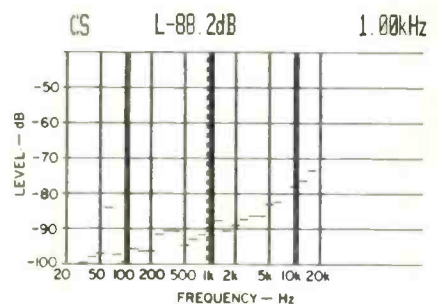
I conducted a series of A-B tests using this approach, coming as close as possible to synchronization of musical passages from the disc with those being reproduced from the PCM digital tape. Very frankly, neither I nor my panel of listeners could detect any difference between the two. Now, it could be argued that imperfections can be heard in CD disc reproduction. Those arguments still persist, even though CD sound is whole orders of magnitude better and cleaner than any program source we've had up to now, in my opinion. (No nasty letters, please!) The only point I'm trying to make is that the PCM-encoded tape using the Sony PCM-701 provided, to my ears and those of my friends, an exact replica of the audio signals fed to it from the decoded CD discs.

With this capability inherent in PCM digital processors, what we have to worry about now is the quality of the program sources that we record onto videotape—the mix-

Fig. 4—Channel separation of PCM-701/VCR combination, with cursor set to 16 kHz (A) and 1 kHz (B).

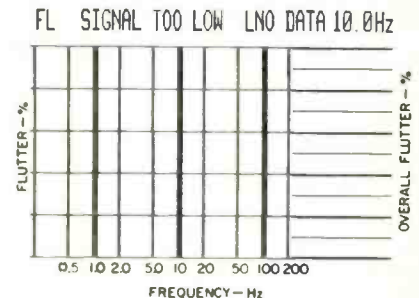


A



B

Fig. 5—Wow and flutter registered too low for the test instrument.



ing consoles, the microphones and all those other elements that come before the final mastering. In playback, much the same thing holds true. We need to concern ourselves with amplifier dynamic range, speaker power handling, and overall dynamic headroom. I was amazed (but not terribly surprised) to note that at what I would normally consider to be moderate loudness levels, the peak-reading meters on my amplifier were coming very close to clipping levels (100 watts per channel), while average levels were no higher than a watt or two. The high-power amplifier proponents were right all along; they simply needed the right program-source dynamics to prove their point. Sony's new PCM-701 provides those dynamics, along with generally excellent sonic performance and a price that's hard to beat, for a product that's hard to resist.

*Leonard Feldman*

## 2

## CROWN POWER LINE FOUR AMPLIFIER

### Manufacturer's Specifications Stereo Specifications

**Power Output:** 165 watts per channel, 8 ohms, 1 Hz to 20 kHz; 265 watts per channel, 4 ohms, 1 Hz to 20 kHz.  
**THD:** 0.05%.

**SMPTM IM:** 0.01% at rated output, 8 ohms.

**Damping Factor:** Greater than 400, d.c. to 400 Hz, 8-ohm loads.

**Slewing Rate:** 16 V/ $\mu$ S.

**Output Impedance:** Less than 7 milliohms in series with less than 3  $\mu$ H.

**Voltage Gain:** 20.6,  $\pm$ 2%.

**Input Sensitivity:** 1.76 volts for 165 watts into 8 ohms.

**Frequency Response:** D.c. to 20 kHz within 0.1 dB; d.c. to 100 kHz within 1.0 dB.

### Monaural Specifications

**Power Output:** 330 watts per channel, 16 ohms, 1 Hz to 20 kHz; 530 watts per channel, 8 ohms, 1 Hz to 20 kHz.

**THD:** 0.05%.

**SMPTM IM:** 0.01% at rated output, 16 ohms.

**Damping Factor:** Greater than 400, d.c. to 400 Hz, 16-ohm load.

**Slewing Rate:** 32 V/ $\mu$ S.

**Output Impedance:** Less than 15 milliohms in series with less than 6  $\mu$ H.

**Voltage Gain:** 41.2,  $\pm$ 2%.

**Input Sensitivity:** 1.76 volts for 330 watts into 16 ohms.

**Frequency Response:** D.c. to 20 kHz within 0.15 dB; d.c. to 60 kHz within 1 dB.

### General Specifications

**Hum and Noise:** 112 dB below rated output.

**Phase Response:**  $+0^\circ$ ,  $-15^\circ$ , d.c. to 20 kHz at 1 watt.

**Input Impedance:** 30 kilohms,  $\pm$ 20%.

**Power Requirements:** 100/120/200/220 or 240 V (selectable), 50 to 400 Hz, a.c.; 40 watts at idle, 560 watts at 330 watts output.

**Dimensions:** 19 in. (48.3 cm) W  $\times$  7 in. (17.8 cm) H  $\times$  10 $\frac{1}{2}$  in. (25.7 cm) D from front panel; handles extend 2.38 in. (6 cm) from front panel.

**Weight:** 55 lbs. (24.9 kg).

**Price:** \$1,199.00.

**Company Address:** 1718 West Mishawaka Rd., Elkhart, Ind. 46517.

For literature, circle No. 92





The Crown Power Line Four amplifier is a single- or dual-channel, high-power unit. It has a power output capability of 165 watts per channel into 8-ohm loads in stereo and of 330 watts into 16 ohms when bridged and operated as a single-channel, mono unit.

Front-panel controls include a power switch and its associated amber indicator lamp, a pair of detented input-level controls, indicator LEDs for Crown's Input/Output Comparator, and three color-coded LEDs per channel for a frequency-analyzing display. Each LED of this frequency display responds to a particular portion of the audio spectrum (lows, mids and highs). This is less significant in analyzing program content (which should be audible) than in noting differences between program content and what is heard. For example, if the high-frequency LED lights normally; yet the highs sound abnormally soft, the problem will be in the speaker (a blown tweeter, or tweeter level turned too low) and not in the program material. A front-panel output-monitor jack is provided, not only for headphone use but to provide access from the front panel to an additional output after the unit has been installed in a rack.

Conventional unbalanced phono-tip jacks are used as input terminals for the amplifier. These jacks are located on the rear panel, along with standard, color-coded, five-way MDP banana jacks, mounted so as to facilitate stereo and bridged-mono connection of output cables.

### Circuit Highlights and Analysis

The output transistor circuitry of the Power Line Four functions as a Class-A circuit at low listening levels, switching to Class A + B at medium-power levels and to Class AB + B at high levels. Protection against shorted and low-impedance loads is incorporated with V-I limiting. Overload protection is also provided for the power supplies, and against input and high-frequency overloads. A thermal circuit automatically places the unit in the standby mode should overheating occur due to inadequate ventilation. To prevent annoying pops or thumps at turn-on, there is a built-in, 4-second mute-delay circuit. A low-frequency interrupt circuit offers additional protection against accidental d.c. being fed through the amplifier and possibly damaging or destroying connected speakers.

At the input of the main amplifier is Crown's Input/Output Comparator (IOC) circuitry which works in conjunction with the error-correcting signal of the main op-amp. Whenever a small "nonlinearity" exists, an error signal appears at the output of the main op-amp, via the feedback loop of the unit. This produces an abnormally high voltage value, exceeding the established "window" of the IOC and illuminating the front-panel LED. Since transient overload can occur very rapidly, a pulse-stretching circuit is added so that the observer can detect that the LED is lit.

A pair of gated switches follow, and provide a means for controlling the signal path through the unit. When a signal is obtained from the control stage, these switches allow it to pass through. However, should the delay, thermal or low-frequency interrupt circuits become activated, the control stage opens these switches, blocking the signal to the output stages.

The current-amplification circuitry, which Crown calls their

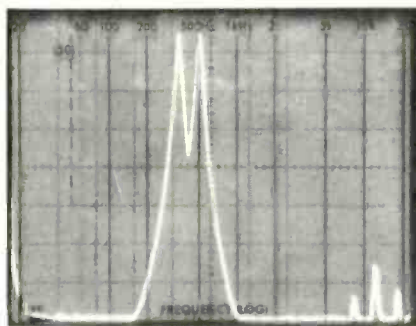


Fig. 1—Twin-tone HF-IM distortion test. Test signals (9 and 10 kHz) at center, distortion products (0.065%) at right.

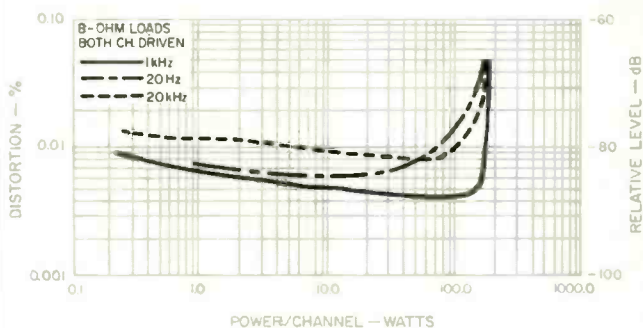


Fig. 2—Distortion vs. power output per channel.

Multi-Mode circuit, consists of the pre-driver, the driver and the output transistor stages. With low-level signals, the circuit has been designed to function in Class A, with pre-drivers always biased "on." As signal levels increase, the circuit changes first to "Class A + B" mode, in which the pre-drivers continue to operate in Class A and are always on while the drivers move smoothly into Class B. Finally, at highest output levels, the pre-drivers and drivers move into the AB mode, with the output devices operating in Class B to develop the higher required power. The protection circuitry is activated when a predetermined amount of voltage and/or current is drawn across the output-stage sensing resistors. A protection signal is then fed back to the limiting circuit, which limits any increase in the bias servo voltage to the power-output devices.

The output signal is also applied to the frequency analyzing display circuitry. Whenever a signal greater than about 0.25 V rms is monitored, one or more of the frequency-analyzing LEDs will light, depending upon the frequency content of the output signal. A portion of the channel-1 output is also sent to the stereo/mono switch located on the rear panel, where it feeds the input of channel 2 when the amplifier is switched to the bridged or mono mode.

**"Any way you figure it, the Power Line Four has an inaudible amount of residual background noise or hum."**

The power supply of this Crown amplifier is a continuous-duty type. The main d.c. supplies are full-wave, capacitor-input types with heavy-duty diodes heat-sunk to the chassis. Main amplifiers, thermal protection and other supplementary circuits are powered by zener-regulated power supplies.

#### Measurements

The Power Line Four delivered 175 watts per channel into 8-ohm loads at a test frequency of 1 kHz for its rated harmonic distortion of 0.05%. At 180 watts per channel, THD rose to 0.1%; beyond that the distortion climbed rather quickly, and the IOC indicators informed me that I was beyond the unit's distortion-free range. The low-frequency end of the spectrum was the determining factor in establishing the "FTC rated power" for this Crown amplifier at a nominal 165 watts per channel with 8-ohm loads. However, using an SMPTE-IM test signal, I was able to pump as much as 180 watts per channel of continuous power (equivalent) into 8-ohm resistive loads before reaching an IM distortion level of 0.01%.

When loads were switched to 4 ohms, the Power Line Four easily delivered its rated 265 watts at mid-frequencies, with SMPTE IM remaining a low 0.018%. Under these load conditions, both bass (20 Hz) and treble (20 kHz) steady-state signals produced the rated 0.05% harmonic distortion when the amplifier reached its rated output levels.

Crown obviously preferred to use a rather stiff power supply in this high-powered amp, for I measured a dynamic headroom of only 0.63 dB with 8-ohm loads. I would emphasize again that dynamic headroom figures are *not* to be taken as an indication of amplifier quality. Different designers approach power-supply stiffness from different points of view and, in my opinion, "soft" or "stiff" supplies each offer advantages and disadvantages to the listener. Soft or relatively unregulated supplies yield high dynamic headroom readings. They reproduce short-term peaks or transients without noticeable clipping, even when those bursts drive power levels well beyond nominal FTC power ratings. Audibly, this lends a feeling of crispness to the sound, especially in the treble and upper midrange regions. Stiff power supplies, on the other hand, can support long bursts of power at or slightly above rated power output levels without allowing the supply voltage to collapse. This lends some tightness to the reproduced sound, especially in the bass.

Twin-tone CCIF-IM distortion measured a very low 0.0041%. IHF-IM distortion was also extremely low, with an integrated reading of only 0.065%. This value is obtained from evaluating the dB levels of the IM components generated in the amplifier when it is fed with two tones, 1 kHz apart, as shown in Fig. 1. The unwanted IM components are "summed" by taking the square root of the sum of the squares of all significant components found in the audio band, expressed as a percentage.

As nearly as I could measure it, damping factor at 50 Hz, with 8-ohm loads, did exceed Crown's claimed minimum value of 400, but it takes a mighty short and heavy cable, connected between the output terminals of the amp and a voltmeter, to come up with that figure. Even a couple of feet of 14-gauge wire will have enough resistance to distort the

amplifier's true damping factor figure when we are dealing with such high numbers.

The amplifier's output proved to be unconditionally stable with both inductive and capacitive loads. A 2- $\mu$ F capacitor placed across the output terminals when they were also connected to 8- or 4-ohm resistive loads did not upset the amplifier's stability or significantly alter the appearance of tone-burst or square-wave input signals.

Figure 2 is a plot of power output versus harmonic distortion. While this figure does not include power output in the bridged or mono mode, I did measure this and can report that the amp delivered 345 watts of power into a 16-ohm load and 550 watts into a load of 8 ohms, using the test-signal frequency of 1 kHz for both.

Frequency response of the Crown Power Line Four amplifier extended essentially from d.c. (0 Hz) to 60 kHz for a -1.0 dB roll-off, and out to 110 kHz for an attenuation in response of 3 dB. Input sensitivity referred to 1-watt output measured 137 mV, which corresponds almost exactly to Crown's stated input sensitivity of 1.76 V referred to rated output. Signal-to-noise ratio, referred to 1-watt output with an input level of 0.5 V, measured 106 dB (A weighted). Translated to rated output and a wide-open input-level control, this works out to around 117 dB, or fully 5 dB better than claimed. Either way you figure it, the Power Line Four has an inaudible amount of residual background noise or hum.

#### Use and Listening Tests

Because of a rather heavy backlog of products being tested and evaluated in my lab, the Crown Power Line Four has been available as a reference amplifier in my permanent listening setup for nearly two months now. This has given me ample opportunity to subject the unit to all sorts of demanding and challenging program sources, including program material on digital (PCM) tapes. So long as I stayed at levels that did not cause clipping shown by illumination of the IOC indicators on either channel, sound quality of the Crown (hooked up to my reference KEF 105.2 speakers) was absolutely beyond reproach. Bass was tight, and there was no evidence of phase distortion when mid or high frequencies were dominant in the program material. When I exceeded safe levels, however, clipping was rather harsh sounding; that's no great surprise in view of the tight power-supply design and the hard-clipping approach favored by the designers of this amp. I certainly don't want to imply that this condition prevailed under normal listening conditions. With the more than 165 watts of power available per channel at 8 ohms, I really had to push program-source levels to produce any kind of overload and, even with my relatively low-efficiency KEFs, the resulting loudness levels are not anything I'd tolerate for more than a few moments.

If you are planning to use an amp such as this in any sound-reinforcement applications (and many Crown units intended for home use have found their way into such applications over the years), I'd make sure that the IOC indicators do not flash more than once in a great while. If they do, sounds will become audibly distorted and your best solution then would be to operate the Power Line Four in the bridged mono mode—so buy yourself a pair of these if you need two-channel reproduction. *Leonard Feldman*



3

## SHERWOOD S-6010CP TUNER

### Manufacturer's Specifications

#### FM Section

**Usable Sensitivity:** Mono, 10.3 dBf.

**50-dB Quieting Sensitivity:** Stereo, 36.5 dBf.

**S/N:** Mono, 80 dB; stereo, 75 dB.

**Alternate Channel Selectivity:** 80 dB.

**Capture Ratio:** 1.0 dB.

**THD:** Mono, 0.09%; stereo, 0.09%.

#### AM Section

**Sensitivity:** 200  $\mu$ V/meter (bar antenna).

**S/N:** 45 dB.

**Selectivity:** 55 dB.

#### General Specifications

**Power Consumption:** 10 to 12 watts.

**Dimensions:** 17 $\frac{3}{8}$  in. (44 cm) W  $\times$  2 $\frac{1}{4}$  in. (5.5 cm) H  $\times$  15 $\frac{1}{2}$  in. (35 cm) D.

**Weight:** 10 $\frac{3}{8}$  lbs. (4.7 kg).

**Price:** \$249.95.

**Company Address:** Div. of Inkel Corp., 17107 Kingsview Ave., Carson, Cal. 90746.

For literature, circle No. 91



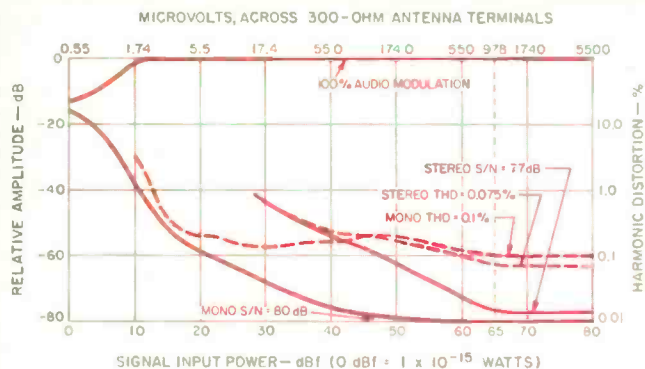
How times change! Over the years I have watched the fortunes and rank of Sherwood alternate between being a top-flight component manufacturer and an almost forgotten pioneer in the field. However, whatever their position in the scheme of things, it does seem reasonable and fitting that Sherwood should at this time come up with as fine an FM/AM tuner as they have in this very moderately priced gem of a frequency-synthesized unit.

If you are a long-time reader of *Audio*, you probably remember when Sherwood introduced (and we tested) a tuner called the Micro/CPU-100. It had been designed by Larry Schotz, the same gentleman who designed the recently reviewed NAD 4150 tuner, about which we had so

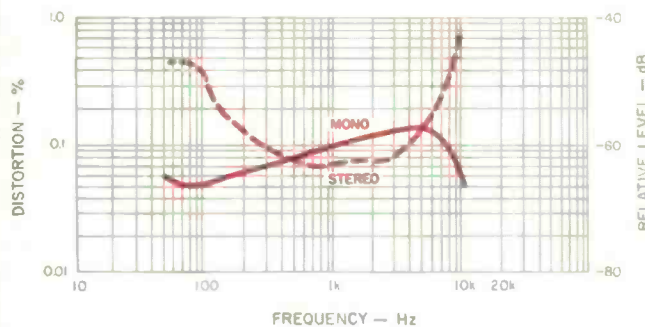
many good things to say. But that early Sherwood unit (it was way ahead of its time, technically speaking as well as in its performance capabilities) cost over \$2,000! The new unit, at not much more than one-tenth that price, does not, of course, have all the features of the early Sherwood masterpiece, but its performance leaves very little to be desired. Certainly, the S-6010CP is worthy of the venerable Sherwood name.

The low-profile front panel houses a power switch at the extreme left, FM and AM selector buttons, eight station-preset buttons (with which you can "memorize" the frequencies of eight favorite FM plus eight AM stations for instant recall), a memory button for "storing" those frequencies, an

"I measured subcarrier rejection of better than 74 dB and SCA rejection over 75 dB. Such numbers are rarely seen for a tuner at any price."



**Fig. 1—Mono and stereo FM quieting and distortion characteristics.**



**Fig. 2—Harmonic distortion vs. frequency, FM section, with 15-kHz bandpass in measurement circuits.**

FM mute/mode switch which combines interstation noise reduction with stereo operation in one position and no noise reduction with mono in the other, an "Auto/Manual" switch, and "Up" and "Down" tuning buttons. When the "Auto/Manual" switch is set to "Auto," the tuning buttons cause the tuner to seek out the next usable signal on the dial. When the "Manual" mode is used, depressing the "Up" or "Down" buttons advances the tuning (either higher or lower) by 100-kHz increments.

A fluorescent display occupies the left section of the panel and shows tuned-to frequency, while signal-strength LED indicators, calibrated in five steps, and a stereo indicator light are located nearby.

The rear panel of the Sherwood S-6010CP has provisions for connecting either a 75-ohm coaxial antenna cable or the flat, twin-lead 300-ohm type of transmission line. A rotatable AM bar antenna is also provided, and if it is inadequate in your listening area, there are terminals for connecting an outdoor AM antenna.

### Circuit Highlights

The tuner circuitry is contained on three well-designed p.c. boards. The major board contains all of the basic AM and FM/stereo circuitry, while the remaining two boards carry components relating to the fluorescent display and other front-panel functions. The r.f. amplifier in the front-end employs a dual-gate MOS-FET and a four-section varactor tuning system. The i.f. section employs three pairs of linear-phase ceramic filters and a double-tuned, quadrature FM detector. A PLL multiplex demodulator with 19- and 38-kHz filters decodes the composite stereo FM signal.

While an FET r.f. amplifier is used in the AM section, the rest of the circuitry is rather minimal (as with most "hi-fi" AM/FM tuners), employing a two-section varactor tuning system and a single wideband ceramic filter.

Here's an unusual twist! A lithium battery is supplied inside the S-6010CP as a backup for the memorized preset station frequencies. And—are you ready for this?—in case of a power failure or if you unplug the set when leaving for a vacation, the battery will keep your favorite frequencies memorized for at least 10 years! (Who has such long vacations—or power failures, for that matter?)

### Measurements

I measured a monophonic usable sensitivity of 10.0 dBf (1.7  $\mu$ V across the 300-ohm input), an impressive figure for such a low-cost tuner. The 50-dB quieting point in mono was reached with a signal strength of only 12.7 dBf (2.4  $\mu$ V across 300 ohms), while in stereo the 50-dB quieting signal requirement was 37 dBf (38.9  $\mu$ V across 300 ohms). Muting threshold was set at about 29 dBf (15.5  $\mu$ V), and since the muting feature always works when the tuner is in the stereo mode, this determined both the stereo threshold and the effective usable stereo sensitivity. By the time the stereo signal causes the tuner to switch to the stereo mode, quieting is already a respectable 44.0 dB, and distortion at that low signal strength is already down to only 0.7%.

Increasing the signal strength to the nominal level of 65 dBf, S/N in mono reached a very fine 80 dB. In stereo, S/N measured 77 dB, better than the manufacturer's claim by 2 dB. These results are plotted in Fig. 1 as a function of signal input level, along with distortion curves for mid-frequency, 100% modulating signals. Figure 2 shows how harmonic distortion varies with frequency, for both the mono and stereo receiving modes. At mid-frequencies, THD in mono was 0.1%, just slightly poorer than claimed, but in stereo harmonic distortion was actually better than claimed, measuring only 0.075%. Distortion remained low at the other test frequencies of 100 Hz and 6 kHz. In stereo, where "beats" usually contribute to the "distortion" reading (they're not, strictly speaking, harmonic distortion, but they certainly are audible), this tuner still gave a reading of only 0.19% of combined THD + beats.



"Notice how uniform the stereo separation is, even at the frequency extremes, as opposed to the 'concave' curve we usually see."

Frequency response, with the tuner operating in the stereo mode, is plotted as the upper curve in the spectrum analysis photo of Fig. 3. The plot extends from 20 Hz to 20 kHz (logarithmically swept), and vertical sensitivity of the display is the usual 10 dB per division. Maximum measured deviation from "flat" response in the range from 30 Hz to 15 kHz was never more than +0.4 dB (at 5 kHz) or -0.5 dB (at 30 Hz). The lower curve in Fig. 3 is the plot of crosstalk, or stereo separation. Notice how uniform the separation is even at the frequency extremes, as opposed to the "concave" separation curve we usually see for most low-cost tuners. Separation was between 42 and 45 dB (depending upon the channel measured) at 1 kHz, between 43 and 45 dB at 100 Hz, and a perfectly aligned 38 dB at 10 kHz on both channels (right-to-left or left-to-right).

Figure 4 analyzes crosstalk distortion products for a 5-kHz modulating signal. In this 'scope photo, frequencies are now linearly displayed (5 kHz per horizontal division), from d.c. to 50 kHz. The two spikes at the left (one within the other) represent the "desired" and "undesired" 5-kHz output signals from the two tuner channels. Notice how low in amplitude the other "spikes" at harmonics of 5 kHz and at subcarrier frequencies are; that's the result of the excellent subcarrier (19 and 38 kHz) filtering in this tuner's multiplex decoding circuits. I measured subcarrier rejection of better than 74 dB and SCA rejection of better than 75 dB. Such numbers are rarely, if ever, obtained from any tuner, regardless of its price.

Capture ratio was a bit over 1.0 dB. Selectivity measured a very satisfactory 79 dB, while AM suppression was in excess of 60 dB. Image, i.f. and spurious response rejection all hovered around the 90 dB mark.

Figure 5 is the usual disappointing presentation of the tuner's AM frequency-response characteristics. Response is falling fast, above 2.0 kHz, and I won't belabor the point any further!

### Use and Listening Tests

The Sherwood S-6010CP is a real "sleeper" of a tuner! It tunes simply and easily and, of course, there's absolutely no detectable drift, as with all frequency-synthesized tuners. It pulled in fully as many stations with acceptable listening quality as tuners costing two and three times as much, and I would strongly urge you to use a directional antenna with this tuner to avoid multipath problems and other forms of interference. Frequency allocations in this country have simply *not* kept up with tuner and receiver technology, so it's not unusual for a tuner such as this to actually be "too good" for certain FM signal environments. Again, a good outdoor directional antenna (with a rotator, if needed in your area) can help tremendously here, since you can "block" offending interfering signals by pointing the antenna away from them.

There are only a very few situations in which an FM listener would require a better tuner than this one, considering the state of affairs in the band of frequencies between 88 and 108 MHz. I, for one, am glad to see Sherwood back with the quality of product which earned the original Sherwood Laboratories their great reputation in the '60s and '70s. Welcome to the '80s, Sherwood! *Leonard Feldman*

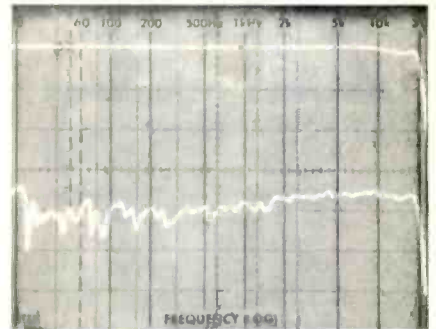


Fig. 3—FM frequency response (upper trace) and stereo separation vs. frequency (lower trace).

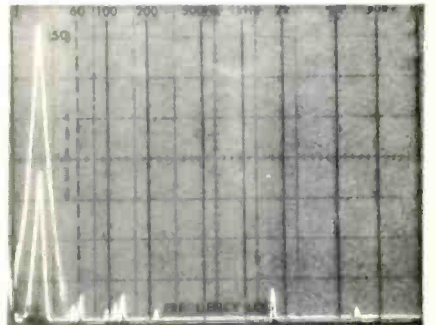


Fig. 4—Analysis of 5-kHz separation and crosstalk.

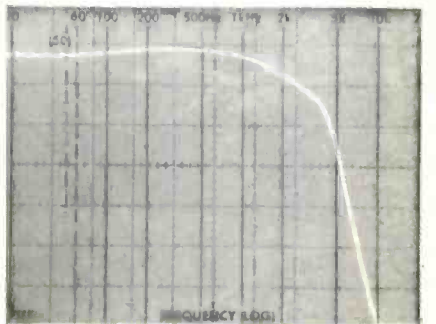


Fig. 5—Frequency response, AM section.

4

**HAFLER  
DH-160  
OCTAVE-  
BAND  
EQUALIZER**

**Manufacturer's Specifications**

**Frequency Response:** 4 Hz to 80 kHz, +0, -3 dB.

**Equalizer Range:**  $\pm 12$  dB.

**Band Spacing:** Octave intervals from 32 Hz to 16 kHz.

**Overall-Level Control:**  $\pm 8$  dB.

**Harmonic Distortion:** 0.004%.

**Hum and Noise:** 115 dBA below 8 V.

**Rise-Time:** 2.5  $\mu$ S.

**Output Impedance:** Less than 600 ohms.

**Channel Separation:** Greater than 55 dB at 20 kHz.

**Input Sensitivity:** Line monitor, 80 mV to 8 V; microphone, 1.8 mV.

**Dimensions:** 17 in. (435 mm) W  $\times$  3 $\frac{3}{4}$  in. (96 mm) H  $\times$  9 $\frac{3}{4}$  in. (250 mm) D.

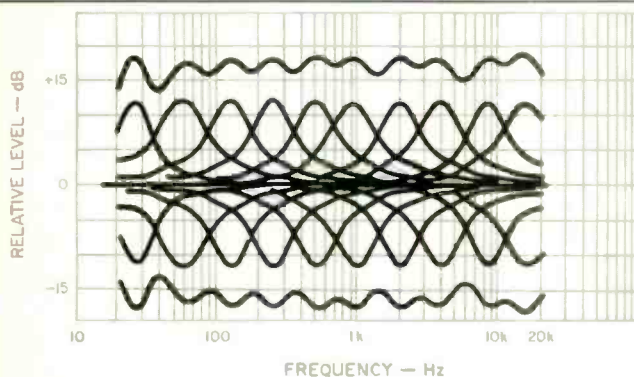
**Weight:** 8.7 lbs. (3.9 kg).

**Price:** \$399.95; kit, \$299.95.

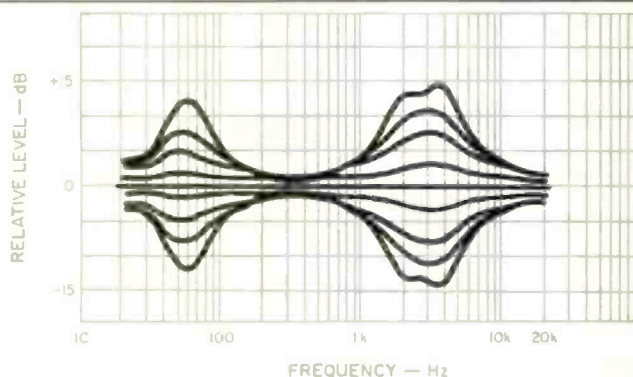
**Company Address:** 5910 Crescent Blvd., Pennsauken, N.J. 08109.  
For literature, circle No. 93







**Fig. 1—Swept-frequency response for each filter section at maximum boost and cut and for all sections at maximum boost and cut.**



**Fig. 2—Swept-frequency response curves for 64-Hz, 2-kHz and 4-kHz filters, set successively at +12, +7, +4, +1, 0, -1, -4, -7 and -12 dB.**

The Hafler DH-160 is a stereo octave-band equalizer with built-in level metering and flexible switching. The metering is provided by an LED ladder-type display with yellowish segments from  $-20$  to  $-1$  dB and red from  $0$  to  $+3$  dB. There is a meter-gain control on the back panel for setting the zero reference level for either mike or line inputs, which are switch selectable. The two line inputs are summed together for the feed to the single-column metering display. This approach appears to be a limitation in those cases where the user needs to balance channel levels. Immediately adjacent to the level display are the overall-level sliders for the left and right channels, each with a range of  $\pm 8$  dB. They have good zero detents, and level changes near the zero points are quite gradual, both good design features. (Hafler states that the effects near zero are purposely kept small to facilitate making fine adjustments.)

The 10 equalization-band sliders for each channel are of similar design with zero detents, but they have ranges of  $\pm 12$  dB. There are four equally spaced graduations above (boost) and below (cut) zero, labelled  $\pm 1$ ,  $\pm 4$ ,  $\pm 7$ , and  $\pm 12$  dB.

Four pushbutton switches on the right-hand side of the panel control power, "Bypass" of the equalization, "Monitor" of the output of the connected tape recorder, and insertion of EQ in the feed to the connected tape deck for "Record" purposes. Thus, the flexibility of the unit is increased, without the need to make and break the connections for a change in equalizer use. The "Power" and "Bypass" buttons both have small, red indicators which are somewhat necessary for operation in low to medium lighting since the buttons and the panel are both dark colors. All of the panel designations are white, and they are easily read even in dim lighting.

On the rear panel are the meter-gain control previously referred to, the microphone/line input selector switch, the phono-jack pairs for line and tape in/out, and a phono jack

for an accessory microphone (which Hafler states will be available, together with a test record, in the near future). There are also two handy, unswitched a.c. convenience outlets with a total power limit of 90 watts, which would be plenty for a preamp and another signal processor.

The metal wraparound top and side cover was removed for an examination of the interior. Nearly all the circuitry was on a single, glass-epoxy p.c. board. All of the components were of excellent quality, definitely superior to those used by most manufacturers. The many 5532 dual, low-noise op-amps and the other ICs were mounted in sockets. The soldering was excellent, and the holes for component leads were plated through, another example of high-reliability design. Parts were not identified, but the open layout would make service easy. The power transformer was mounted at an angle on the rear panel, to minimize hum, and there was one fuse in a clip. The metal chassis construction was rigid even with the cover removed, and rack mounting with the adaptors provided should be no problem.

#### Measurements

The first checks of the Hafler equalizer were of frequency responses, both with EQ in and bypassed. In the latter mode, there is no active circuitry in the signal path since the connection is basically direct. The measured response was flat from 0 Hz (d.c.) to nearly 2 MHz. With EQ in, but with all sliders at zero, the response was 3 dB down at 1.8 Hz and 77.5 kHz, and it was almost perfectly flat from 20 Hz to 20 kHz. Figure 1 shows the swept-frequency responses of each of the filter sections when set to each extreme, and the results with all sliders set similarly. The filter shapes and spacings are fairly consistent, although some variations can be seen.

The filters' designated center frequencies were to ISO standards. Actual filter frequencies were within 4% of designated values, except for the 64- and 32-Hz filters, which

"Harmonic distortion was less than 0.035% in mid-band. IM was close to the test meter's residual distortion of 0.002%."

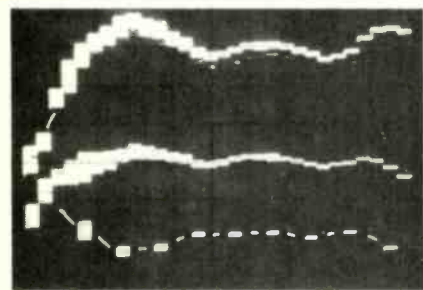


Fig. 3—Effect on simulated three-way loudspeaker response curve: Top, simulated response; center, after correction with DH-160

(both curves with analyzer in  $\frac{1}{3}$ -octave mode); bottom, response curve of DH-160 (analyzer in octave mode).

were 6% and 8% low, respectively. These values were well within the nominal 10% tolerance specified by some manufacturers, but not within Hafler's 5% specification. With the 1-kHz filter, an octave bandwidth ( $-3$  dB at 707 and 1,414 Hz) was reached with a boost of 9.7 dB, evidencing broader response than many octave-band equalizers. For a practical, non-ringing limit of  $Q = 1$  (bandwidth = center frequency), the maximum boost was 8.0 dB.

In "Bypass" the output was exactly the same level as the input, with a 0.00 dB meter indication. With all of the sliders at their center (zero) detents, the left output with EQ in was 0.08 dB below the input, while the right output was 0.36 dB low. These figures are very good, and they were also very consistent even when the sliders were moved out of and back into detent. The right- and left-channel level-adjust sliders had a range of  $\pm 8.3$  dB, and the gain changes were satisfactorily close to the scale markings.

To check the calibration of the filter sliders and to look more closely at filter shapes as a function of level, swept-frequency response plots (Fig. 2) were made with the 64-Hz, 2-kHz, and 4-kHz filters set successively from maximum cut at  $-12$  to each scale marking. It can be seen that the deviations from zero for the 64-Hz filter are close to the scale figures. As is true of most home equalizers, the combining action of adjacent bands, such as the 2- and 4-kHz filters, results in boosts and cuts that are noticeably greater. Boosting or cutting any one filter's response also raised or lowered level across the entire audio band; this reduced the effective spectral changes, particularly with small slider offsets from zero. This is a characteristic of most graphic equalizers, and the Hafler DH-160 is roughly average in this respect.

The input impedance was about 65 kilohms over much of the band, and it was a quite satisfactory 16.2 kilohms at 20 kHz. Output impedance was very close to 600 ohms across the entire band, low enough to ensure an absence of any possible problems with normal loading. The output polarity matched the input with EQ in or bypassed. The level meter's zero setting could be adjusted to any point from less than 80

mV to 8 V on the line input, and from 1.8 mV to about 2 V on microphone. The display's " $-20$ " indication was accurate, but the " $-15$ " light did not turn on until the level reached an actual  $-10.8$  dB. Fortunately, the errors were much less for steps closer to zero. The meter response was 3 dB down at 5 Hz and 24.0 kHz, and its dynamics were to the VU-meter standard. The meter display is turned off in "Bypass" as might be expected, but its usefulness would be increased considerably if it could be used for level matching before switching in selected equalization.

Maximum levels before clipping were at least 9.8 V open-circuit and 9.3 V with a 10-kilohm load, anywhere from 20 Hz to 20 kHz. No slew-rate limiting was observed even with 2 V at 110 kHz. The measured rise-time was  $4.3 \mu\text{s}$ , which was consistent with the 77.5-kHz roll-off (rise-time in  $\mu\text{s}$  equals 350 divided by bandwidth in kHz). Although about half as fast as the specified figure of  $2.5 \mu\text{s}$ , the discrepancy is judged to be unimportant.

Harmonic distortion was less than 0.0035% in mid-band, with some rise at the frequency extremes. With noise included and a 2-V reference, THD + N was 0.03% or less across the band, which is very good. The IM (SMPTE) distortion was very close to the residual 0.002% of the test meter. Output noise was less than  $10 \mu\text{V}$ , A-weighted, indicating that the signal-to-noise ratio was at least 100 dBA relative to 1 V (or 118 dBA referred to 8 V, as Hafler specifies it). The 0.5-V reference called for in the EIA amplifier standard is more realistic, and that would yield an S/N figure of 94 dBA, still excellent. The measured separation between channels was 77 dB at 1 kHz, decreasing evenly to 47 dB at 20 kHz. These figures are not up to specification, but they are very good nonetheless.

#### Use and Listening Tests

The owner's manual provided with the Hafler DH-160 was an 8-page preliminary version, and though somewhat abbreviated in spots, it had a good approach overall. There were worthwhile cautions on pre-recorder equalizing. The manual also contained good advice on the care of the sliders, which all had a smooth, high-quality feel that is lacking with most graphic equalizers.

To put the unit through its paces, a loudspeaker response was simulated with pink noise and an MXR  $\frac{1}{3}$ -octave equalizer. The topmost trace of Fig. 3 shows that response, as detected by an Ivie IE-30A real-time analyzer. The sliders of the DH-160 were adjusted to smooth the response, generally trying to remove the peaks. The resultant middle trace has much less deviation, and the noise had a much smoother sound than it did at first. The bottom trace shows the response of the Hafler unit, with the RTA set to octave-band mode. Although a number of the sliders were a few dB from zero, the average was quite flat (except for the 32-Hz filter, which might be boosted too much for a particular amplifier/speaker combination).

The Hafler DH-160 worked very well, and it *did* enhance the sound in many ways. An improved manual and the promised microphone and test record would make the unit still more useful. The electrical and mechanical performance of this equalizer commends its consideration by audiophiles and professionals alike. *Howard A. Roberson*



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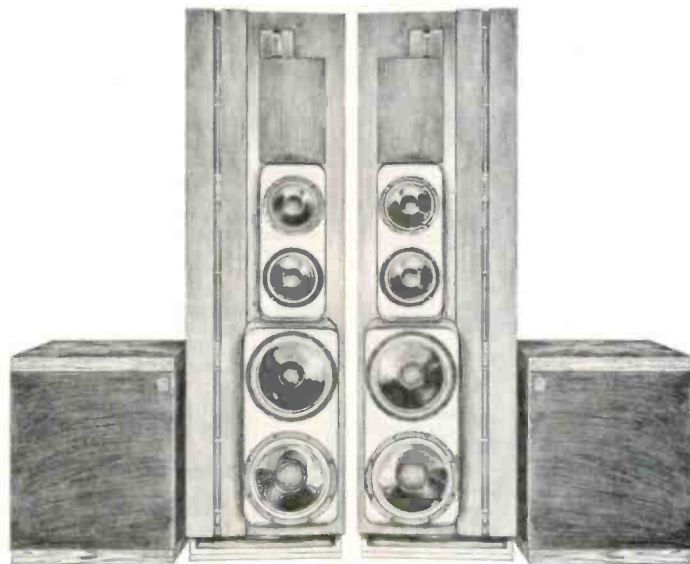
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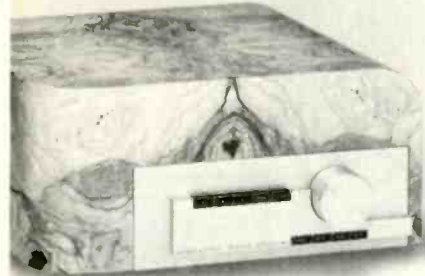
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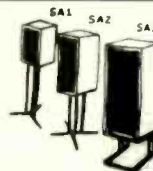
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# ADVERTISING SUCCESS STORY

Robert S. Smith, Ph.D.  
President  
Oxford Audio Consultants, Inc.  
Oxford, Ohio



"Since we started advertising in Audio in 1978, our business has experienced more than a sixfold increase, most of it attributable to our advertisements in Audio."

Robert opened his doors in 1976, expecting to draw customers from nearby Cincinnati and Dayton, and to attract a few customers through mail-order sales.

Unsatisfied with high advertising costs per order, he surveyed his customers to learn what magazines they were reading—and found that Audio magazine headed the list.

When asked why OAC advertises exclusively in Audio, Robert says, "Because that's where the buyers are."

Today OAC reaches customers throughout the United States and all over the world—making the vast majority of all its sales from mail, phone and telex orders.

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In 1982 Audio carried 175 classified ad pages. Stereo Review carried 32. High Fidelity 31.

Oxford Audio Consultants, Inc. specializes in accurate high quality audio components. Demonstrations are by appointment only. OAC offers products by AKG, Dennesen, Denon, Grace, Hafler, Janis, Linn, Lustra, Naim, Rega, Rogers, Spondor, Supex, Theta, Vandersteen and Walker. Orders for items which are in stock are shipped by the next business day, and OAC pays for surface shipping and insurance on orders shipped to any address with a U.S. zip code.

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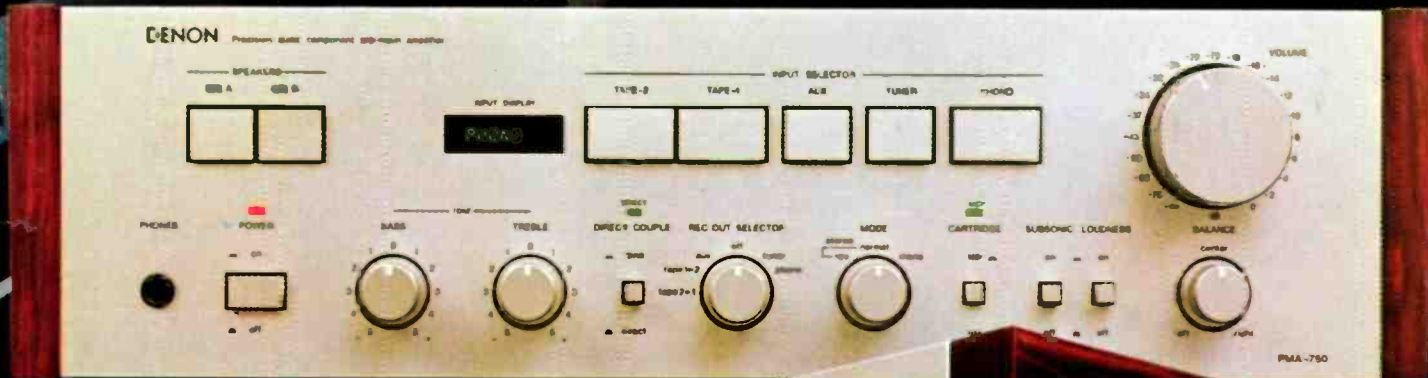
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