

Audio

The
Authoritative
Magazine
About
High Fidelity

DECEMBER 1989 • \$4.50 • 6030

ANNUAL
INDEX

CHRISTMAS BUYING GUIDE

The New Power Meters



atching Receivers with g drastically reduce ou higher fidelity.

drift free. Once it electronically locks onto a broadcast signal, it holds it. So that anything that would normally interfere with the quality of your signal on conventional receivers is automatically eliminated by the SX-3900 and SX-3800.

You can be sure you'll get to appreciate our tuning section's specs, too.

Our digital quartz tuning systems give five digit readouts that exactly correspond to actual tuned frequencies. Our Fluroscan metering systems will let you see you're getting the most out of your speakers, as well.

Because the meter's usable range is over 50dB from .001 to 120 watts of power.

If you're beginning to think these receivers are like none you've ever seen or heard, you're right. That's why we suggest you get down to your nearest Pioneer dealer to see and hear the SX-3900 and SX-3800 receivers with Non-Switching Amplification.

You'll not only be impressed with what you hear, you'll be impressed with what you don't.

NON SWITCHING

PIONEER®

We bring it back alive.

Non-Switching Receivers.



SX-3900

Our new Non-Switching Quartz Lock Tuning eliminates switching distortion and give you

It seems like a simple enough premise. And it is.

Eliminate distortion and you clear the path for cleaner, crisper sound.

Unfortunately, many receiver companies have been more concerned about offering you a low price tag than they have been with offering you high fidelity.

But at Pioneer, we believe you shouldn't have to deal in high finance to get true high fidelity. And our new SX-3900 and SX-3800 receivers are proof of it.

The SX-3900 and SX-3800 eliminate the most significant form of audible distortion.

Switching distortion.

And although you may not have heard of it before, you probably have heard it on your hi-fi system. It's distortion caused by output transistors as they click on and off in response to music signals.

But we at Pioneer prefer to reproduce sound, rather than create it. That's why we've designed our new SX-3900 and SX-3800 receivers to completely eliminate switching distortion.

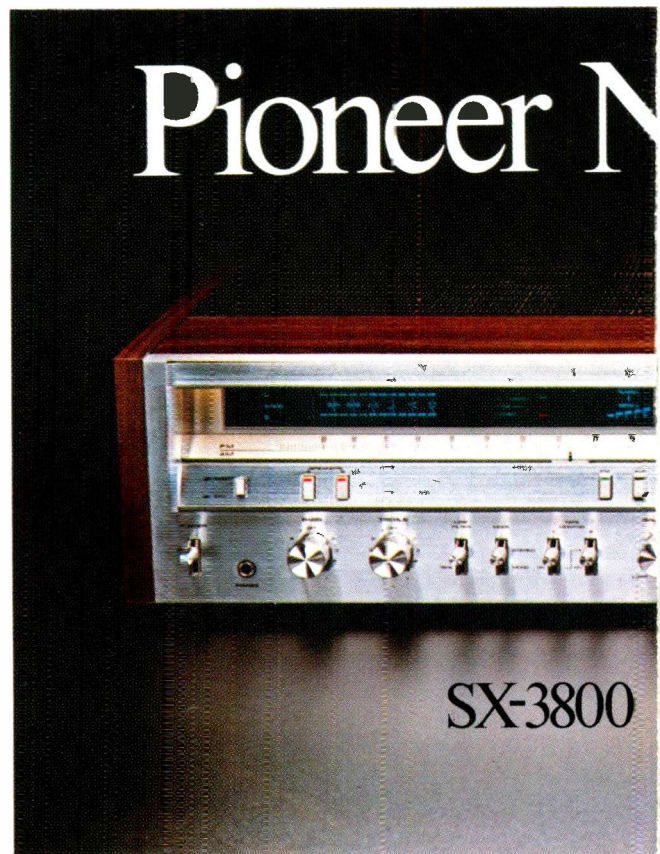
The Non-Switching SX-3900 and SX-3800 have revolutionary new amplifier circuitry that keeps output transistors from ever completely switching off. So they never have to click back on.

These transistors are exclusively ours. And you'll find they do as good a job of eliminating audible distortion at high frequencies as they do at greatly increasing frequency response.

The end result is that the SX-3900 and SX-3800 have Non-Switching Amplifier sections that deliver uncanny distortion levels of 0.005% THD at 20-20,000 hertz at 120 (and 60) watts per channel, both channels driven into 8 ohms.

**Our specs bring in compliments, but our receivers are best at bringing in something else.
Radio stations.**

The Pioneer SX-3900 and SX-3800 receivers also have our exclusive Quartz-Servo Lock Tuning System that's virtually





**LOWER
DISTORTION
MEANS
HIGHER
FIDELITY.**

0 Frequency in kHz 100 200

Distortion in dB -100

-120

-140

-160



DAVID 26 NOV 1952

Conventional Receivers.

Pioneer Non-Switching Receivers.

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400

500

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Inherently more active against record contamination. Inherently safe for record vinyl. Preferentially absorptive formula carries all contamination off the record.

NEW D4 FABRIC

Unique directional fibers preferentially remove fluid and contamination. D4 fabric results in clearly better cleaning, better drying and ultimately residue-free surfaces.

UNMATCHED VALUE

The Discwasher D4 System is enhanced by the durability and aesthetics of the hand-finished walnut handle. Included in the D4 System are the DC-1 Pad Cleaner and new instructions.

discwasher[®]
PRODUCTS TO CARE FOR YOUR MUSIC

1407 N. Providence Rd.
Columbia, Missouri 65201

December 1980

Vol. 64, No. 12

Audio

"Successor to **RADIO** Est. 1917"

Feature Articles

Christmas Buying Guide	28	
The New Level Meters	34	Ronald G. Ajemian
All That Data: FM Tuner		
Quieting and Distortion	68	Leonard Feldman
Annual Index	107	

Equipment Profiles

Threshold Stasis 3 Power Amplifier	38	Leonard Feldman
NAD 6040 Cassette Deck	41	Howard A. Roberson
Astatic MF-100 Phono Cartridge	45	B. V. Pisha
Fulton Nuance Loudspeaker	48	Richard C. Heyser
Vector Research VCX-600 Cassette Deck	58	Howard A. Roberson

Record Reviews

The Column	70	Michael Tearson & Jon Tiven
Jazz & Blues	77	John Diliberto & John Lissner
Folkbag	82	Tom Bingham
Classical Reviews	86	Edward Tatnall Canby

Audio in General

Audio ETC	8	Edward Tatnall Canby
Tape Guide	16	Herman Burstein
The Bookshelf	20	
Audioclinic	24	Joseph Giovanelli
Classified Advertising	90	
Advertising Index	93	
Behind The Scenes	112	Bert Whyte

About the Cover: Whether you're dashing through the snow or lolling under a palm tree this holiday season, consider the assortment of audiophile gift items we've assembled, beginning on page 28. Photo by Susanne Buckler.



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G-120A
10-Band Graphic
Frequency
Equalizer.

M-120A Duo-Beta
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Amplifier. 120
watts per
channel.
minimum RMS,
both channels
driven into 8
ohms from
20-20,000Hz with
no more than
0.008% Total
Harmonic
Distortion.



The best way to use negative feedback is to design an amplifier that doesn't need any. Manufacturers who start with the idea of feedback wind up with less design. And more correction.

That wouldn't be Lux-like.

Lux starts by designing the best DC amplifier possible. So you get exceptional bandwidth and reduced distortion. Then we add not one, but two negative feedback loops. We call it Duo-Beta™. Another first from the people where first is a way of life.

Too much feedback reduces THD. And increases T.M., which is worse. Too much can even destabilize an amplifier. That could mean blown speakers.

Too little feedback reduces the damping factor. Adds speaker-induced distortion. And increases THD. Makes rumble more obvious. Listener fatigue sets in more quickly.

Lux uses one negative feedback loop of about half the usual amount. Goodbye T.M. Listen to the brilliance of highs

and mid frequencies.

The Lux adds another loop. With just enough feedback for the subsonic frequencies to DC. At 5Hz or below, it even acts as a subsonic filter and kills DC drift. Listen to the tight bass and full tonal balance throughout the audible range.

By using precisely the right amount of feedback for each circuit path, you get the best of all audio worlds. Low THD. Unmeasurable T.M. Enhanced damping factor. Sensational sound from top to bottom. And fully dimensional sonic clarity beyond anything you can hear.

That's Lux-like. Design the best. Then make it better. A case where two negatives become positive.

Experience Duo-Beta perfection with Lux's C-5000A Stereo Preamplifier, suggested retail value of \$1395. And its companion piece M-4000A, at the suggested retail value of \$495.

Your senses will never have it so good.

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Our secret to tracking these fantastic grooves makes every record you own sound better!

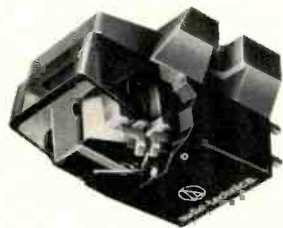
**New AT155LC
Vector-Aligned™
Stereo Cartridge**



Ⓐ There are perhaps a dozen reasons why the new AT155LC does so well tracking even the most explosive new digital records. An advanced new Line Contact stylus, our exclusive Vector-Aligned™ magnetic system, and new high-efficiency coil and core designs to mention just a few.

But it's our *sound*, not the construction that is important. And our capability to track even the tough records which benefits you every time you listen. Because even slight mis-tracking can quickly destroy any record, shortening both disc and stylus life dramatically.

Of course it's easy to claim "good tracking"... everybody says it. *Proving it is something else. Well, we guarantee that every new AT155LC will pass an objective test which easily exceeds the limits of most commercial pressings.* Specifically, at 1.2 grams the AT155LC clearly tracks the 80-micron band of a standard



DIN 45 549 or AT6607 equivalent test record. And at 1.6 grams it even tracks the severe 90-micron band without visible distortion.

Of course tracking is not the only virtue of the new AT155LC. Response is uniform from 5 to 35,000 Hz, separation is great, and efficiency is uncommonly high*. All claims we back up with specific tests any lab can duplicate.

But the most important test is a visit to your Audio-Technica dealer. Ask to hear the new AT155LC with your favorite records and with the new digital blockbusters. We promise a remarkable sonic experience. And audible proof that the new AT155LC can unlock the full potential of every other hifi component you own.

*Performance specifications available on request.

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The secret of Onkyo.

Let Onkyo transport you to a world beyond electronics . . . to a world of more perfect sound. Where you'll hear music of such stunning purity and sensual richness, that you'll forget you're listening to an audio system.

That's the secret of Onkyo . . . and Onkyo's dramatic success. The unique ability to take you several steps beyond pure technology . . . to experience more exciting sound. And you'll find it in all our components . . . including all four of our new stereo tape decks.

The Onkyo TA-2050 is an outstanding example. It goes further than other tape decks . . . to harness the full performance potential of new metal tapes. One reason is Onkyo's exclusive "Accu-Bias" control system, which guides you to far more precise tape bias adjustments. Brighter, cleaner high notes are the reward.

The Onkyo TA-2050 also utilizes a full logic direct drive motor transport for extremely high reliability with minimum wow and flutter. A second motor handles fast forward and rewind functions. A special Hard-Permalloy record/playback head . . . and a ferrite erase head . . . provide optimum performance

with all types of tape . . . both metal and conventional.

The Onkyo TA-2050 also provides a rich and important array of other high performance features . . . soft touch controls with IC logic . . . a Dolby* noise reduction system with switchable MPX filter . . . large, illuminated "peak-hold" meters for greater precision and convenience . . . a memory-stop/memory-play system . . . a timer mode selector . . . and full remote control capability when used with the optional RC-5 remote control unit.

Two valuable features of the TA-2050 are its instant muting and automatic fade in/fade out control systems . . . which permit far more professional recording effects. Musical passages can be "cut-in" or "cut-out" instantly . . . or "faded-in" or "faded-out" smoothly. And cassettes can be recorded right to the end . . . then rewound a short bit to overlay a professional "fade-out" effect.

Styling is superb. Brushed silver metal with elegant appointments . . . in a dramatically handsome new slim-line design.

And the TA-2050 is just one of four important new metal tape-compatible stereo cassette tape decks from Onkyo. Onkyo USA Corporation
42-07 20th Avenue
Long Island City, N.Y.
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*TM of Dolby Laboratories

The Onkyo TA-2050
A remarkably advanced stereo cassette deck
that harnesses the full potential of new metal tapes.

SONY

SONY
U80

LOUDNESS LEVEL

HIGH LAMP LEVEL

PHONO LEVEL



UNTIL NOW NO ONE WOULD DARE QUESTION THE AUDIBLE ADVANTAGES OF THE \$1400 SPEAKER.

If you want to listen to well-recorded Apollo moon launchings, or digitally recorded organ music with pedal notes down to 16 Hz, and you own a concert hall, then without question the \$1400 speaker has its advantages. In fact, for those purposes we'd recommend something even more impressive: the \$8000 Sony APM-8.

But, if you want to listen to Beethoven, who wrote notes as low as 32 Hz, or rock which usually ranges from 55 Hz on up, and you don't own a concert hall, then what you want is the first affordable speaker that legitimately questions the audible advantages of the \$1400 speaker: the Sony SS-U80.

NASTRAN STRUCTURAL ANALYSIS AND OTHER MIRACLES OF ENGINEERING.

If technology alone made a speaker great, then the U80 would be the unchallenged leader.

While other manufacturers are still using guesswork, Sony designed its low-frequency driver with the aid of a highly sophisticated NASA computer program called NASTRAN. With NASTRAN, Sony engineers could rapidly identify potential causes of distortion on literally hundreds of woofer configurations and evolve the optimum woofer. A woofer distinguished by tight, accurate sound, deep, authoritative bass response, and new lows in distortion.

On the direct-drive ribbon tweeter the engineering was no less impressive. We did away with the transmission system between the source of motion, the voice coil, and the object to be moved, the diaphragm. In fact, we did away with the separation of coil and diaphragm altogether.

So unlike cone or dome tweeters, the entire radiating surface moves as a unit for remarkably low distortion.

While the U80 is endowed with a whole host of other technological virtues, one not to be overlooked is a special "Sound Source Alignment" of the woofer, tweeter and midrange drivers. This ensures that when the sound reaches you its imaging is solid, stable and credible.

INNOVATIONS FROM BORROWED EARS.

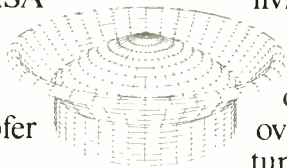
Truly superb loudspeakers cannot be designed by technology alone. Even the most sophisticated computer program cannot evaluate a speaker's sound quality. Even the most elaborate design theory cannot embrace all the nuances of music reproduction.

It is for these reasons that Sony subjected the U80 to hundreds of hours of listening tests throughout the United States with musicians and audio professionals. People who make their living with music.

What they helped us come up with were subtle refinements in the drivers, the baffle board and the crossover network. This is the kind of fine tuning that heretofore was only found in esoteric speakers produced by inspired audiophiles working out of their garages.

As a result, we at Sony are confident that the U80 offers the kind of clean, accurate, high-quality sound that will not only earn the respect of the most demanding music lover, but dare question the audible advantages of the \$1400 speaker as well.

SONY
High Fidelity



U80 FEATURES AND SPECIFICATIONS: 4-way floor standing acoustic suspension system/12" NASTRAN-Plus woofer/Direct-drive ribbon tweeter/Sound Source Alignment of the drivers/Level controls for low-mid, high-mid and high-frequency drivers/Recommended amplifier power 50 to 200 watts.

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Audio etc.

Edward Tatnall Canby

My audio life history seems to get slower; I meant to be back sooner but, at least, later is better than less, if you follow my dangling comparatives. You'll find Chapters I and II of the saga in our January and May issues. Herewith Chapter III.

I left you, I trust happily, on the middle of a moonlit lake listening (by proxy, courtesy of this magazine) from a motionless canoe to an early Canby phonograph concert as the sound of 78-rpm mono shellac discs spread out magically from a boathouse balcony. I looked again at that balcony a few weeks ago. It is basically unchanged, as is the lake, but now the sounds of thumping disco come forth loudly via the teenage swimming crowd. Volume may be up 70 dB or so but the effect is no better than mine was, emanating out of an early electric radio-phono console with one small speaker and a five-ounce horseshoe magnet in the pick-up to keep the needle from jumping grooves. (So we thought, anyhow.) Hi-fi, mind you, is great. I've been for it all my life. But the fi is not all. Which is my life message, if you wish.

Yes, there is the reproducing fi, slightly improved since that day, and which now serves as the *raison d'être* for this magazine. And there is the fi of the recording process, about which we have heard a great deal lately as we have progressed from direct-to-disc to digital-audiophile, and as we await the all-digital sound of our future. But there are other equally vital matters. Recording technique (or broadcast pickup — related, needless to say, but always different). And, still more important from my point of view, playback technique. So we are back to that moonlit lake.

Had you ever thought that a sheet of still water, a few smooth ripples here and there (sine waves?), overtopped by a warm body of very still air, makes for excellent playback? Quite free of standing waves and spurious resonances of all sorts, the sound gently diffused, perhaps even with an ultra-smooth sonic delay due to thousands of trees and millions of leaves around the nearby shore? Now that's

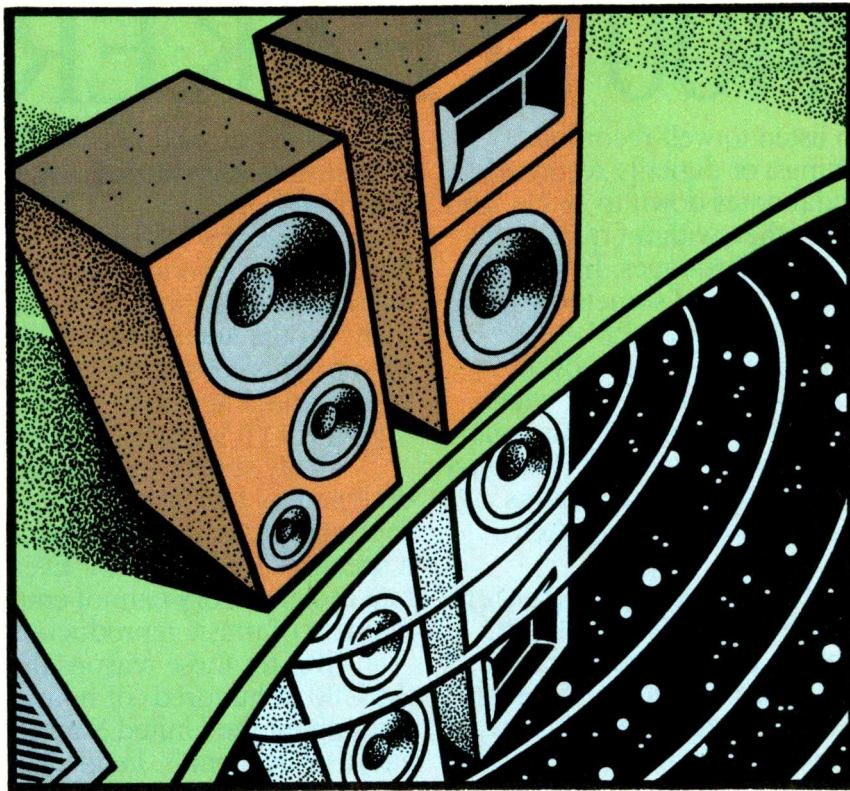
the water be covered solid from shore to shore. So they have to resort to less favorable and more costly expedients.

You know, I did get involved in the fi of things, even so. Don't imagine that I remained satisfied with a mere radio-phono console. An important step came when, still in console days, I was in my fifth year of college, getting an M.A. in music which, miraculously, I still have. It was 1934. That fall, a

gaudy mail-order catalogue reached my college mailbox and neatly trapped me. "Buy this super-incredible 16-tube ultra-radio by mail at a fraction of retail cost!"

Wow — SIXTEEN tubes! That was like a 16-cylinder Cadillac, also by odd coincidence an actuality of that vintage, if I remember correctly. I forewent the Cadillac but I fell for the radio. It had 29 shortwave bands and at least eight sets of colored lights, just like today, only not LED or whatever. It was terrific, in fact. Some of you ancient warriors will remember the breed: A Midwest Radio. I got Europe every night and listened, fascinated. Sixteen tubes! Well, I can tell you now that four of them were joint power-output tubes in parallel — this was just before the potent beam-power tubes appeared, the 6L6 in glass, for instance, together with the push-pull circuitry in which those later tubes were usually used. At least I had a lot of output, for that day, and I used it fully, just as soon as I had hooked up my separate-unit record player, the RCA with the horseshoe magnet and the two speeds — 78 and 33 for "LP," the RCA Program Transcription discs. (Playback-equipment specs: Wow, some; flutter, appalling. Pianos sounded like guitars.)

You see, I was already edging into separate components, ahead of most

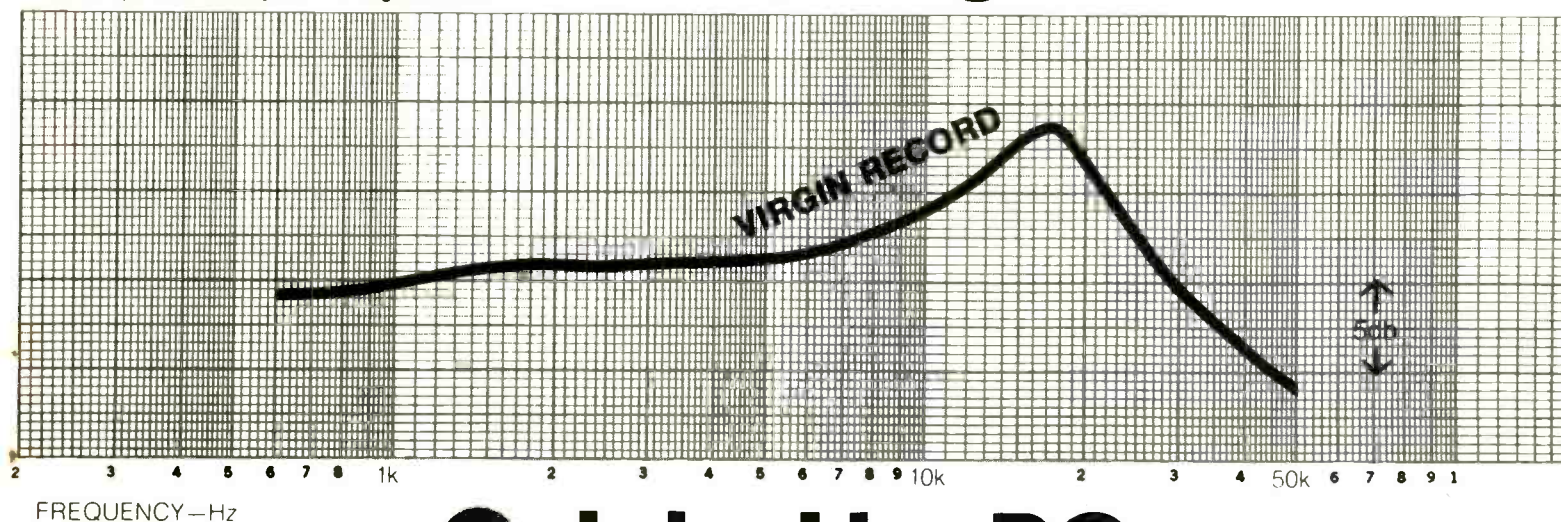


the kind of environment we need to make the most of our audio sound, though to be sure, there are other ways of getting results. I hear that Chicago's been trying an outdoor sonic listening space via batteries of delayed-sound speakers set up around the perimeter, no doubt at considerable expense. Well, I had you beat, Chicago, almost a half century ago. Trees are cheap and leaves are cheaper, at least in summer. Though I do like the idea of the Chicago experiment. An outdoor phantom concert hall! But then, put yourself in that canoe. . . .

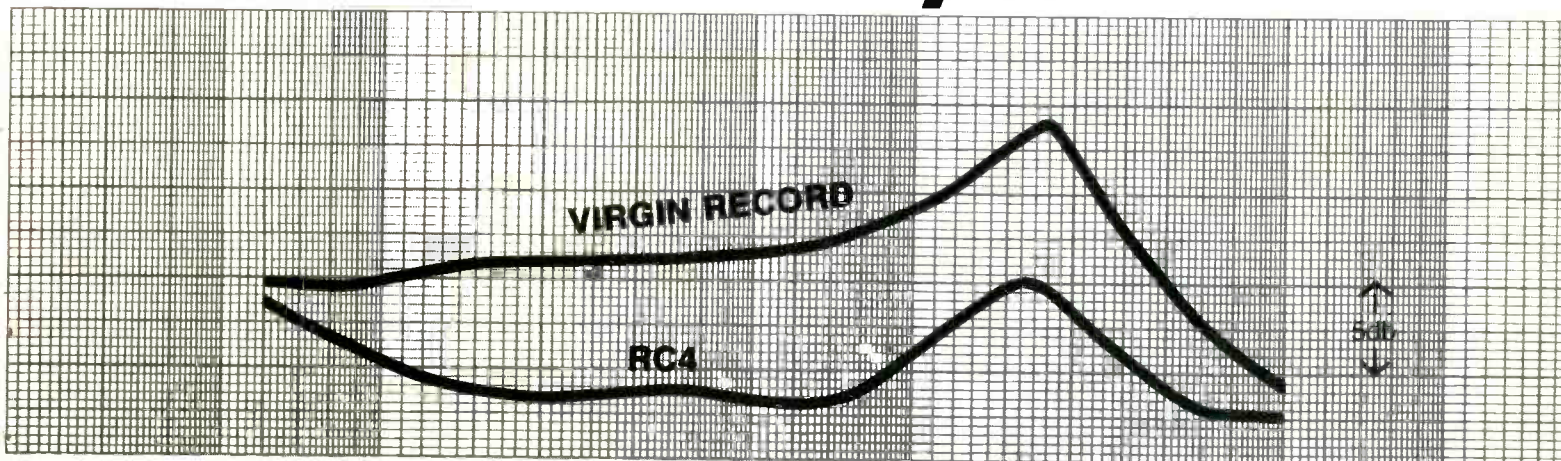
Of course if Chicago had a lake navigable via canoe (and no wind in the Windy City), there wouldn't be enough canoes to go around, though

Noisy virgin

Noise spectrum analysis of a virgin record



Quieted by RC4™



A quiet revolution in record cleaning

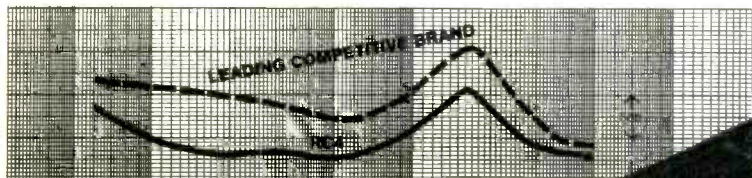
For years record collectors around the world have been searching for the ideal record maintenance program. A method that actually delivers a stated promise of continual protection of the faithful reproduction of the original recorded sound.

Now, supported by the most respected names in the audio field new RC4 and a companion stylus cleaning and inspection kit provide a new and dramatic improvement over every record care program available.

For example, the ultimate test of a clean record is a quiet record and RC4 quiets even a virgin record right from the sleeve. Result, a purity of sound, an absence of "pops and clicks" that brings new enjoyment to even well used and older records.

A companion stylus cleaning and inspection kit, complete with fluid, brush, magnifying glass and mirror, assures a record maintenance program in keeping with the ever increasing value of every record collector.

RC4 is 60% more effective than the leading competitive brand



made by Record Care, Inc. exclusively for

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"for those who can hear the difference"

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101 Sunnyside Blvd., Plainview, N.Y. 11803

people I knew. The idea of a big console radio with a separately attached player for my records was terrific and with the Midwest put me far ahead of the local competition in terms of sound — both quality and volume. My Midwest, as a phonograph, was the sensation of my college area. As already noted, I played whole evenings of music for my college friends, who flocked to hear the splendid machine with its special extra-cost speaker.

I fell further, you see, for that superb option. It cost me \$15 more (read \$75 today) but it was worth every megadollar. It was a heavy-duty 12-inch

Wright Decoster model, dynamic with electromagnet, of course. PM (permanent magnet) speakers, though on the market by that time, were weak things without much power handling capacity; the idea was good but the magnets were still feeble. With the huge electromagnet, out of a transformer that fed some 400 filtered volts, the thing was so amazingly better than anything I had ever before heard that I went around for days in a delirium of joy and practically never turned the machine off. That speaker served me for six years and more before the competition began to catch up and, as we shall

see, it survived the demise of the famed 16-tube radio to become the speaker department of my first genuine hi-fi system with separate amp.

Better Bass for Better Living . . . Through Physics

But there was an intermediate stage. After about two years, when I had moved on to my first job in another college, I got the bright idea of taking that speaker out of the Midwest console cabinet and mounting it separately on its own. What a sensational improvement!

No — it wasn't really my idea. As usual, I fell for something that seemed to be in the air at the time, via friends who kept telling me what I ought to do. The thing was to get your speaker into its own baffle. Out of the outdated open-back console cabinet. Better bass, they told me. And were they right.

I lived and ate my meals at the graduate dormitory in my new college. Everybody there sat at departmental tables and talked shop like crazy. There was no graduate music department, only the undergraduates that I was teaching ("music appreciation"), so perforce I had to try another field. First I sat at the English table — a disaster. Then I tried History and that was even worse. Not that I have anything against English or History. It was just the shop talk I couldn't take. Finally, by a fluke I ended up, of all places, at the Math and Physics table — considering that I knew no physics I hadn't picked up for myself and had flunked every sort of math course with dismal regularity.

To my astonishment, the conversation at this table was a delight, and in no time I was making new friends. These people liked music. Most physicists and mathematicians do. Einstein lived right around the corner from us, and one day I almost knocked him flat with my bicycle as I was coming around a corner in a hurry. He was the type too — he played the fiddle. My new friends also liked records a lot, and I was in charge of the college record library. Also, hardly a one of these wasn't an amateur or professional electronics man; hardly anyone there didn't occasionally walk off with some fancy lab equipment to make himself a nice li'l amplifier for musical purposes. They liked any sort of gadget, these brainy guys in the graduate school, and I sopped up a mine of delightfully useless information about everything in the Lord's scientific heaven, and all for a modest return outlay of musical info and the loan of a few records. It was fun.

There's a new sound out of Cambridge . . . and it's good enough for digital

The Cambridge 310 tweeter's moving mass of only 1/4 gram gives it flat response to a frequency well beyond human hearing, a sure guarantee that it will reproduce all the harmonics and overtones on your newest digital and direct-to-disk records.

And the 310 midrange with liquid cooling plays louder than you can tolerate, without a trace of audible distortion, as proven in tests by a well-known independent acoustical laboratory.

And if you like bottom end, the Cambridge 310 woofer's low frequency response extends a half-octave lower than competitive speakers to reproduce all the bass that's on the new audiophile discs.

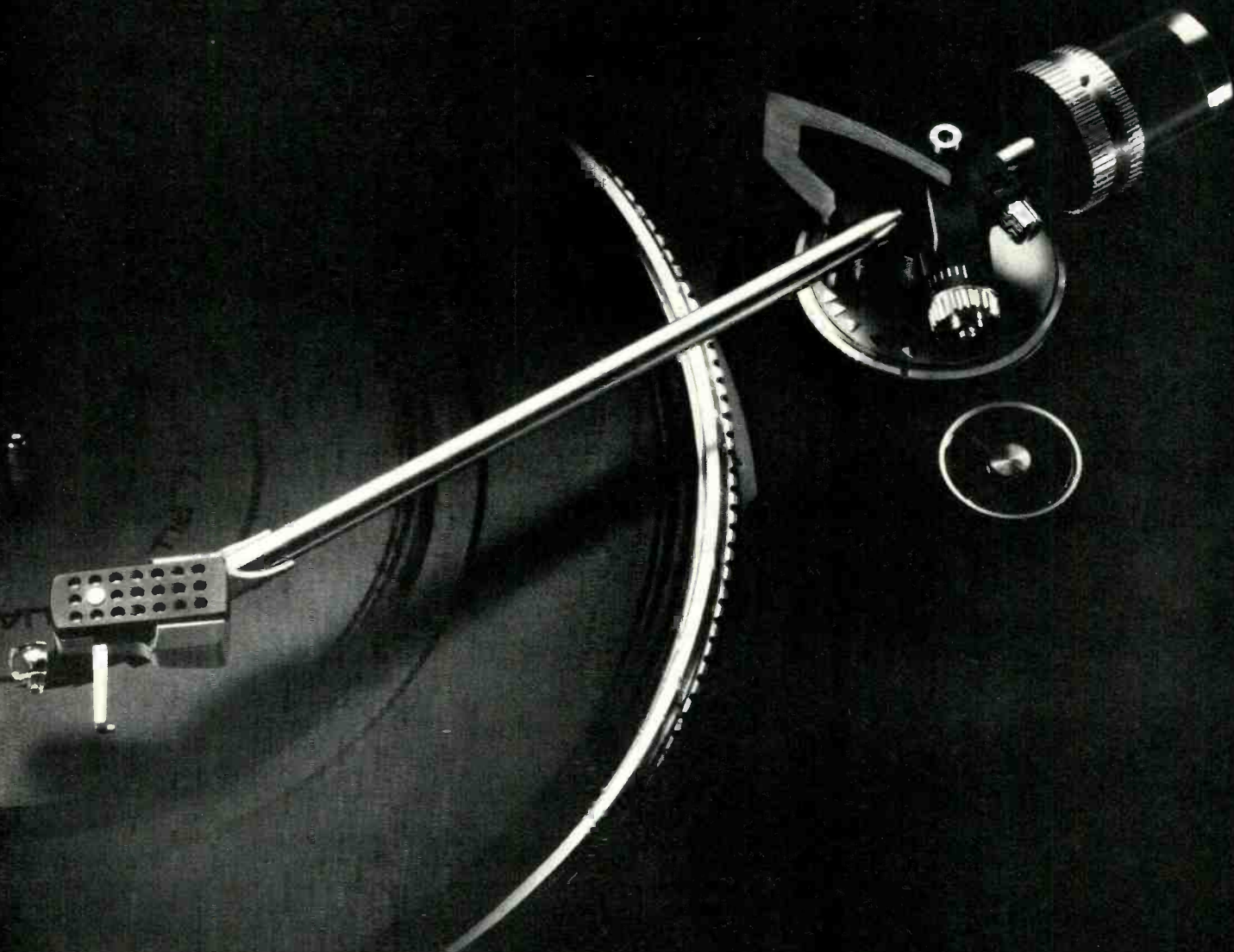
To hear the Cambridge sound that's good enough for digital, take your favorite high technology demo disk to your Cambridge dealer and ask him to A-B the Cambridge 310 against any other speaker he has in the house regardless of price. For the name of your nearest demonstrating Cambridge dealer, circle reader service number or write to us.



Cambridge

Cambridge Physics, 26 Fox Road
Waltham, Mass. 02154/(617) 890-1560

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The 731Q is the finest turntable Dual has ever made.

There is always a special attitude at Dual about the turntable that is to represent the most advanced thinking and accomplishments of Dual's designers and engineers.

The materials, the care in manufacturing, assembly and quality control must exemplify all that has made Dual precision and reliability so highly regarded throughout the world.

And in every measure of performance, this model must set the standard by which other fine turntables are judged. Even more, it must make a significant contribution to the art of record playback.

This year, the quartz PLL direct drive 731Q, with its ultra-low-mass (ULM) tonearm and cartridge system, expresses our attitude perfectly.

If your other components and your record collection warrant consideration of such a turntable, we invite you to visit your franchised Dual dealer. And if you have a record that is warped to marginal playability, but too valuable to discard, bring it with you.

That's all you will need to share our attitude and sense of pride about the Dual 731Q.

For the complete ULM story, please write directly to United Audio, 120 So. Columbus Ave., Dept. Q, Mt. Vernon, New York 10553.





Digitally mastered and audiophile recordings have added an exciting new dimension to the state of the audio art. Sonus cartridges are exceptionally well-suited to realize the full sonic potential of these new recording techniques.

This is especially true of the new Sonus Dimension 5. Its unique phase-coherent, integrated, stylus construction enhances still further the exceptional purity and integrity of reproduction found throughout the Sonus range of high compliance cartridges.

We believe upgrading your system by replacing your present cartridge with a Sonus will provide the greatest improvement in sound quality per dollar.

The finer your records the greater the difference a Sonus will make.



Sonic Research, Inc., 27 Sugar Hollow Rd.
Danbury, CT 06810 (203) 792-8822

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It was at this science-minded table that I heard one day of new experiments with something called U-235. Not a bomb, mind you, merely a chain reaction. This was in the late '30s and I never heard another word on that subject until August of 1945. These men were in the middle of things, whether fission power or amplifiers for music. How could I help it? I learned.

In no time at all a stout and genial genius called The Tuke, now extremely well known as Dr. John Tukey of Bell Labs, decided that my "system" should be improved — first via a baffle. A baffle, of course, he explained, kept the in-curving bass sound waves apart so they didn't cancel out, and the larger the baffle the more effective it would be, i.e., the lower the true bass. So out came the Wright Decoster speaker, dangling its impressive and slightly scary 400-volt complex of cables (four leads, two for signal and two for magnet power) to go into the middle of a perfectly enormous square of plywood. You never saw anything sillier. It took three of us to get it sideways through my door, and this superbaffle took up most of a diagonal corner of my room. But bass! I was astounded. A full-throated roar, a floor-shaking thump — something none of us had imagined. That old speaker had more virtues than I had known.

Have Baffle, Will Travel

Well, practicalities. Month by month, I was forced to saw off more and more of that plywood monstrosity to make room for non-sonic things in general. It ended up as a serviceable four-foot midget with hinges in the middle so I could fold it into my car when I moved around. I still had a lot more bass, and much less boomy (resonant) than I ever knew via any open-back console including the Midwest itself. For some years thereafter I made a practice of moving friends' radio speakers into flat baffles, to their delight. I was now the "expert" — I fell into being an expert, and no two ways about it. My accidental reputation was beginning to grow.

Best of all, somebody showed me the trick of standing the baffle board up against an unused fireplace with chimney. What a bass *that* gives! Though hardly exponential, the chimney is a sort of big horn, or if not a horn, then a tuned tube of enormous configuration. Some startling sounds came out of my surprised speaker the first time I tried that trick. Before the stereo age mandated two speakers with the proper separation, this sort of sonic manipulation could make the


difference between so-so sound and really superb music, even with all the limitations of our old equipment.

It was Dr. John Tukey, The Tuke, who persuaded me to try to build my own separate amplifier, of course under his tutelage. By now, the 16-tube radio-and-amplifier was considered a bit passe by the folks I had come to know. What I needed was beam power and push-pull. So I got the necessary parts and started to build, with The Tuke practically hovering over my shoulder.

I was no better then at construction than I am today. It just isn't my clumsy 10 thumbs. I had a terrible time, trying to bore holes in metal and ending up with bends and gashes and smashed fingers, soldering dozens of nonelectrical joints, hopelessly mismatching bolts and their nuts, wiring things backwards. I felt like a total fool among all those physical geniuses, but I guess I absorbed a bit of their radiation. In the end, my new amplifier with 6L6G tubes in push-pull actually worked, though it did look like a tin can opened with a blunt axe.

And thus, at last, I achieved a true component hi-fi system. Record player, radio tuner (the old Midwest), amplifier, and separately mounted speaker. Around 1937 — not bad, eh?

It was not for years that I made any basic improvements on that system, when, after the War, I finally ran into the then-sensational Electronic Workshop amplifier (Howard Sterling) and a big 15-inch Altec speaker, still mounted in a flat baffle, placed in front of a nice old New York fireplace in Greenwich Village. But meanwhile I had encountered something of hi-fi altogether in another and higher sphere, the enormous phonograph system, super-state of the art, that was provided to our college along with the gift of the Carnegie Collection of phonograph records.

This was in late 1936, soon after I arrived. That machine was incredible. Out of something called Federal Telegraph, whatever that might be, it had a huge 18-inch speaker and two tweeters — my very first — mounted in a massive enclosed and vented baffle box the size of a small elephant. I've written about this extraordinary monster before and so will leave it for a brief rerun in my next installment. The system was another crucial influence in my hi-fi life, though, and the consequences of its mere presence in our midst varied from tragic to ludicrous. Ahead of its time by many a year, it was an inspiration for me, who became its sole boss. 

Morning Concert



You've driven to the end of the world. Alone.
The engine is still warm.

Amid the roar of the waves and the cries of the gulls, you fire up your mobile high-fidelity system for a morning concert.

What will it be? Bach? Mozart? Perhaps some Keith Jarrett.

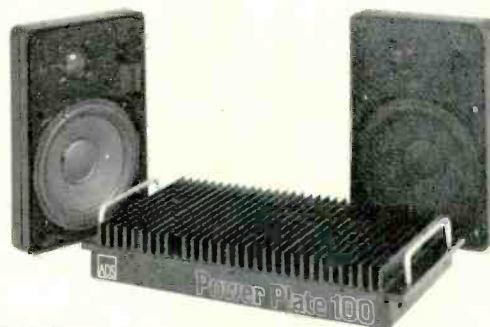
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Interface:C

Series II It sounds like music.

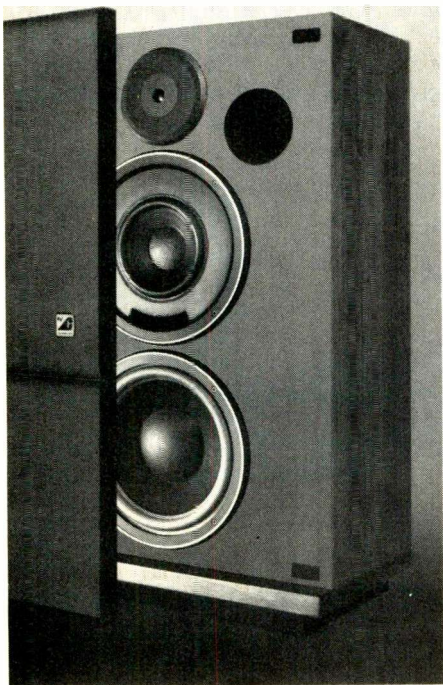
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Tape guide

Herman Burstein

Quarter vs. Half Track

Q. I am considering purchase of one of several high quality tape recorders, all of which come in either half-track or quarter-track versions. What are the advantages of a half-track system? — N.P. Ramsden, FPO, San Francisco, Cal.

A. The advantage of half-track operation is a moderate improvement in signal-to-noise ratio — about 3 dB. For home operation, where you usually encounter first-generation recordings, rather than a succession of copies, this is not a great advantage compared with the benefits of quarter-track. Moreover, use of the Dolby noise-reduction system can improve signal-to-noise ratios about 6 to 10 dB, more than making up for the 3 dB loss due to quarter-track operation.

Quarter-track affords twice as much recording time per reel as does half-track, assuming stereo operation. If one goes quadraphonic, of course, quarter-track is a necessity — half-track wouldn't be feasible then. Quarter-track has the advantage of reducing the consequences of azimuth misalignment. That is, for a given degree of azimuth misalignment, the amount of treble loss is smaller for quarter-track than for half-track. On the other hand, half-track has somewhat greater freedom from dropouts because these tend to average out (cancel out) to a greater extent for a wider track.

Bias By Us or a Dealer?

Q. Do I have to bring my tape deck to a dealer to have the bias adjusted if I change from one brand of low-noise tape to another? — Peter Klein, Providence, R.I.

A. I cannot give you a definite answer. Chances are good, however, that in going from one brand to another you will not encounter substantial difference in treble response with the same bias setting. If your machine has more than one bias setting via an external switch (some machines have as many as three settings), you will have flexibility in use of various tapes without having to make an internal adjustment of bias. The only way to find out

if you really need to have bias adjusted internally is to try the new brand and note whether there is an appreciable departure from flat response no matter which bias setting is used. If you decide to have bias adjusted, be careful because an inept technician may do more harm than good. Insist that the adjustment be made when the machine is operating with the tape you plan to use.

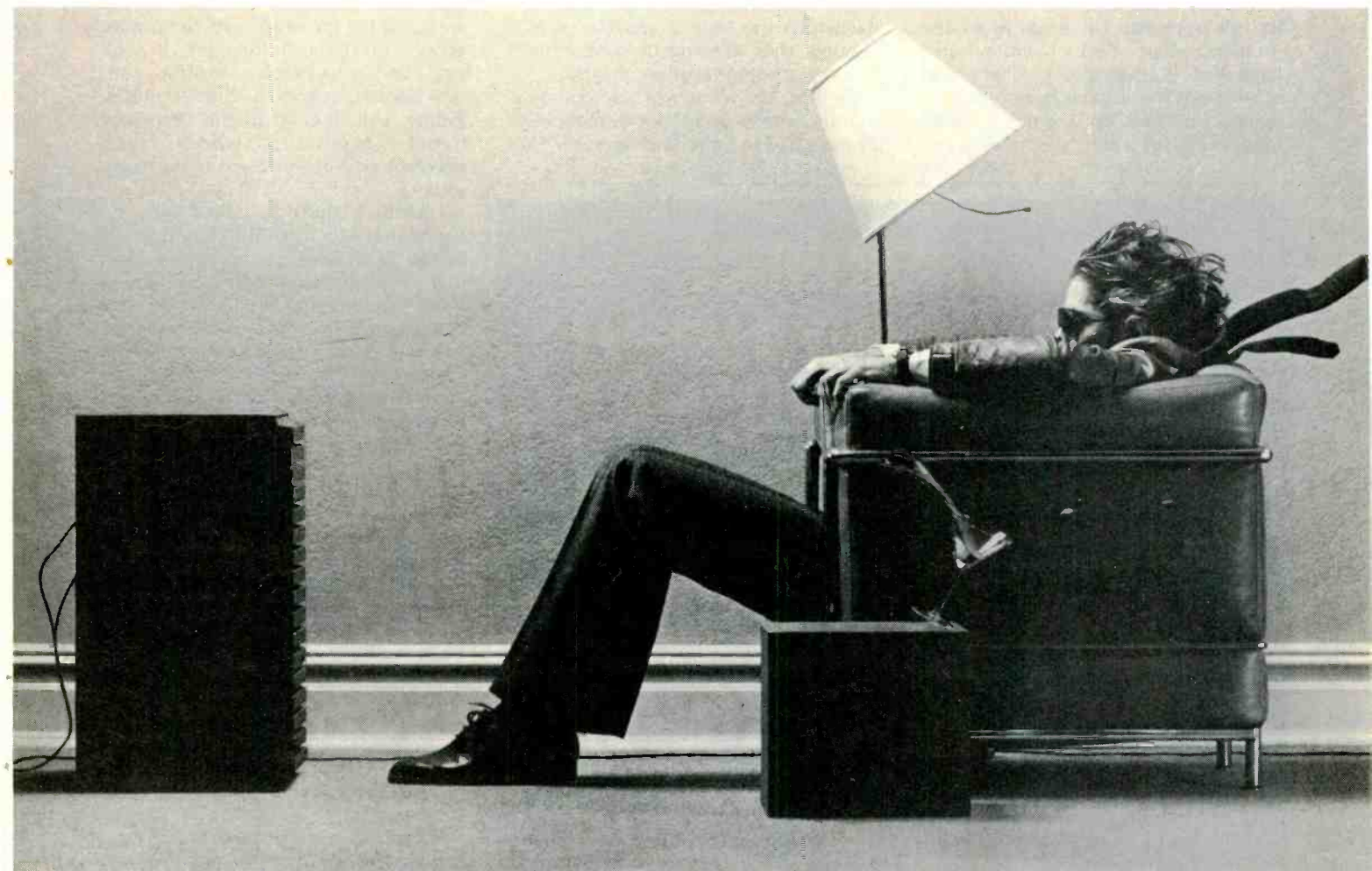
Performance of Metal Tape Decks

Q. What happened to the performance of metal tape decks? Manufacturers were predicting that cassette decks capable of handling metal tape would have an increase in signal-to-noise ratio of about 6 dB, plus greater recording headroom of about equal amount. Yet technicians I have talked to who have tested some top-quality decks have found an increase in S/N of only about 3 dB. It is my suspicion that the metal tape manufacturers have agreed to make a product below the full potential of such tape. It is logical to carry this theory one step further: Assuming that makers of metal tapes and decks are capable of an increased dynamic range of about 12 dB, they may have said to themselves, "Why release our best product at once?" By gradually improving the performance of metal tape over time, the conversion can be stretched over many years so that everyone can make more money — including me, for I'm a retail audio salesman. I would appreciate your response. — Name withheld.

A. In addition to your hypothesis, there are other possible explanations as to why the improvements attributable to metal tape are not quite earthshaking, although the improvements definitely exist. (As you point out, there is something like an improvement of 3 dB in S/N. And reviews of metal tape decks in various periodicals

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.

AFTER 500 PLAYS OUR HIGH FIDELITY TAPE STILL DELIVERS HIGH FIDELITY.



If your old favorites don't sound as good as they used to, the problem could be your recording tape.

Some tapes show their age more than others. And when a tape ages prematurely, the music on it does too.

What can happen is, the oxide particles that are bound onto tape loosen and fall off, taking some of your music with them.

At Maxell, we've developed a binding process that helps to prevent this. When oxide particles are bound onto our tape, they stay put. And so does your music.

So even after a Maxell recording is 500 plays old, you'll swear it's not a play over five.



IT'S WORTH IT.

show that at 0 VU recording level the decks provide more extended treble response with metal tape than with other kinds of tape; in other words metal tape does have more headroom.)

First, in all truth it must be recognized that metal tape has not reached its full potential. In response to the problems that deck manufacturers have had in developing record and erase heads that can cope with the demands imposed on them by metal tape — i.e. sufficient bias, audio, and

erase current — the tape makers have reduced these demands. Specifically, instead of metal tape having a coercivity of something like 1500 oersteds, the coercivity at the time this was written was generally being kept down to something like 1000 oersteds. The result is restriction of the amount of signal which the tape is capable of accepting, thus keeping dynamic range below the potential of metal tape.

Second, the history of audio shows that those responsible for its technology have had to fight hard for every 1 or

2 dB of improvement. Accordingly, an improvement of about 3 dB in S/N plus some improvement in headroom is nothing to be scoffed at — at least not by historical standards.

Third, it is rare that the full benefits of any technological advance are reaped immediately. Consider the example of the transistor, where promise greatly preceded fulfillment. It took years and years before transistor products became as good as tube products. (Some still feel that the transistor hasn't caught up; witness tube preamps and power amps being made today.)

Fourth, it must be taken into account that tape recording, particularly at the low speed of the cassette format, requires a compromise among three fundamental requirements: Low distortion, low noise, and extended treble response. It is possible to win an improvement in any one respect only by means of a sacrifice in one or both of the others. Accordingly, a tape deck manufacturer who already has a product with a fine S/N ratio may wish to take advantage of metal tape more in terms of low distortion and extended treble rather than in terms of a large increase in S/N.

Finally, it must be recognized that in order to achieve compatibility, the 70 μ S playback equalization that has been considered optimum or near-optimum for chrome, ferrichrome, and cobalt-modified tapes is also being used for metal tape. Quite possibly a lower time constant, perhaps around 50 μ S, would be optimum for metal tape and allow its benefits to be more fully realized.

Please do not misunderstand. I am not promising you that metal tape will inevitably do all that has been prophesied. I am simply trying to suggest that it is too soon to judge whether or not metal tape represents an unrivaled giant step forward.

Cheap or Inexpensive?

Q. There is a store in my area selling Scotch audio tape, 3,600 feet on 10½-in. reels that have been used once and bulk erased. The ad claims that this tape will perform like new. I wonder if this tape will provide adequate reproduction. It sells for only \$1.99, and I am a bit suspicious of tape this cheap.
— Thomas Williams, Baltimore, Md.

A. Offhand, it seems you might have a good buy, except for one possibility: That the tape contains splices. If there are only one or two splices in a 3,600-foot length, this is still a good buy, but not if there are many splices. Ask about this. In any event, you might buy one reel; you can't lose more than \$1.99 plus tax! **A**



"If you're shopping for stereo our advice is not to buy speakers until you've heard the Polks." Musician

"Polk Audio Monitor Speakers (are) so vastly superior to the competition in their price range we had to pass the information along... the design produces a remarkably well integrated and coherent sound that adapts itself ideally to all kinds of music... and produce the kind of open uncolored perfectly imaged sound we thought began at twice the price and required huge amounts of amplification... (The Polks) will benefit from state-of-the-art electronics but sound quite magnificent with a good mid-powered popular brand receiver... They make the popu-

lar speakers in their price range seem dim, colored, boxy, unmusical and just plain insufficient... If you're shopping for stereo our advice is not to buy speakers until you've heard the Polks" **MUSICIAN MAGAZINE**

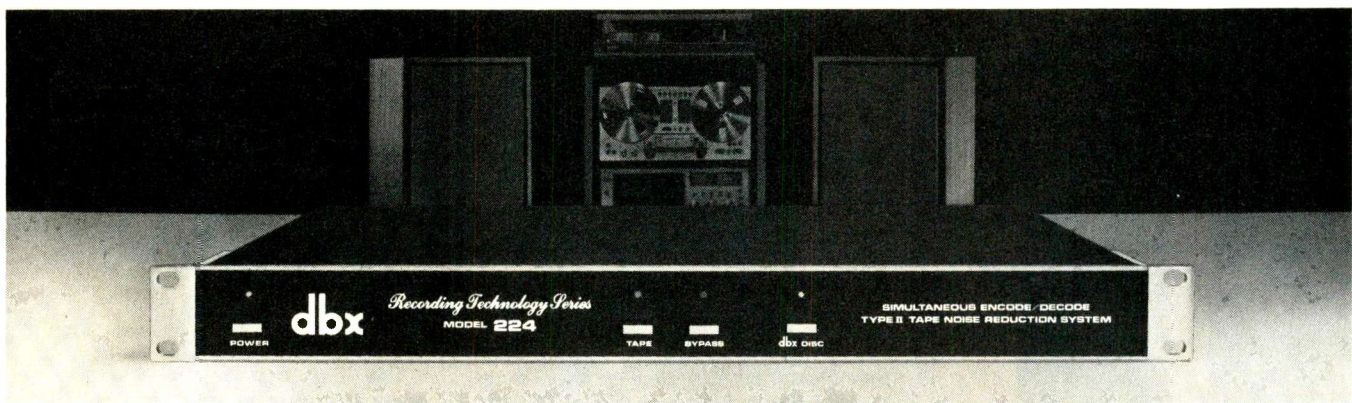
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INTRODUCING THE DBX RECORDING TECHNOLOGY SERIES MODEL 224.

THE BEST PERFORMANCE YOU CAN BUY FOR UNDER \$50,000.

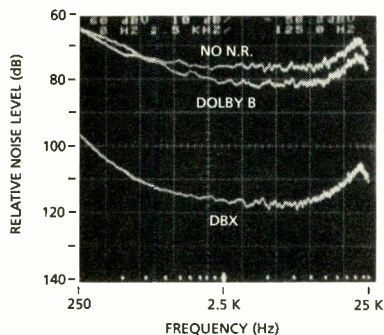
Digital recording means two things. No noise, and a full dynamic range of 90dB.

But until now, only recording engineers have been able to enjoy that incredible sound using studio recording systems costing \$50,000 or more.

Now, however, there's the new dbx Recording Technology Series Model 224, the state-of-the-art in home recording. It hooks right into your present tape system. And it lets you do almost everything you could do with a digital system, but for a whole lot less.

THE QUIETEST SOUND ON TAPE.

As for noise reduction, nothing on the market comes close to the Model 224.



Dolby reduces noise by only 10dB at best, and only in the high frequency range. dbx virtually eliminates tape hiss, reducing it by more than 30dB across the entire frequency range. (Unretouched laboratory photograph. Data from "The Importance of Dynamic Range," Audio Magazine, January, 1980. For a copy of the article, write dbx.)

The Dolby[®] system you've been putting up with certainly doesn't. It only reduces tape noise by 10dB at the most, and only in the high frequency range.

Compare that with the dbx Model 224, which reduces tape noise by more than 30dB across the whole frequency range. It virtually eliminates tape noise, without adding any audi-



ble distortion or changing the tonal character of the sound.

The result is a difference you can easily hear. In fact, you'll be able to record quiet music passages that would be lost in tape noise with any other system.

Conventional tape recorders limit dynamic range. With the dbx Model 224, you can get the dynamic range approaching that of a live performance.

DYNAMIC RANGE APPROACHING DIGITAL.

The Model 224 also gives you something else you've never heard before from a tape recorder: full dynamic range.

Dynamic range is the difference in volume between the loudest and quietest passages in a piece of music. It's just as important to the realism of music reproduction as flat frequency response, or accurate spatial perspective.

And although live performances – and digital master tapes – go up to 90dB of dynamic range, even the best home recordings have been limited to only about 50dB. So no matter how good your recorder is, you've been missing at least one third of your music's dynamic range.

Well, the Model 224 gives you the capability to record an unprecedented 85dB on open reel and 80dB on cassette.

So for the first time, you can make live recordings that capture virtually all the dynamic range of the original music.

In addition, the Model 224 is the only system that lets you tape fine audiophile records without losing any of their dynamic range.

And you can use the extra head room provided by the 224 to dramatically extend frequency response and minimize distortion during recording.

As if all that weren't enough, you can use the 224 to play dbx Discs, the Full Dynamic Range Recordings that deliver up to 90dB of music dynamics with negligible surface noise. Because the 224 includes the decoding system that makes your present stereo compatible with these phenomenal new discs.

HEAR IT TODAY.

The sound of digital recording really is here. Dynamic range approaching a live performance. Music heard against a background of virtual silence. And a purity of sound that's never been possible before in home tape recording.

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We think you'll agree with us. For \$299, you'd be crazy to pass it up.

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Original.

original *n*: that from which a copy, reproduction or translation is made. (Webster's Collegiate Dictionary)



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The bookshelf

Bob Dylan: His Unreleased Recordings by Paul Cable. Schirmer Books, \$5.95.

It's hard to believe that anyone would want to devote his life to collecting and cataloging Bob Dylan's bootleg tapes, bootleg records, and other studio dredgings, but that's exactly what Paul Cable has done. The fact that Schirmer Books actually published this compendium astounds me, and although there is a lot of information given, it isn't organized very well. There is little cross-referencing, no index, and nothing really illuminating except occasional confirmation that tapes rumored to exist actually do, sometimes in the author's possession. We would rather read A. J. Weberman's computerized lexicon of Bob Dylan's jargon, which claims to translate all of Dylan's code words into what they "really mean." But any real Zimmerman fan knows that you don't need to be a Weberman to know which way the wind blows.

Jon & Sally Tiven

The Rolling Stone Record Guide, edited by Dave Marsh with John Swenson. Random House/Rolling Stone Press, 1979, 631 pages, \$8.95.

The Rolling Stone Record Guide is a fat book that seeks to be a qualitative guide to what records exist in the rock/pop music field. It strives to be a reference book for the fan and novice alike. Records are listed by artist with separate sections each for jazz, blues and gospel plus "anthologies, soundtracks and original casts." Each record has been given a rating of from zero to five stars based upon relative merit. The book concludes with a list of all the five-star albums, a glossary, and a fine selected bibliography.

Given the size and scope of the project, it is not surprising that a small army of reviewers — 32 in all — were employed to contribute ratings and comments to the *Guide*. And each one is identified by initials with his entries. The very quantity of opinions is one of the limits on how useful the qualitative ratings throughout the book can be. Let's face it, relative merit is at best a subjective scale, by no means absolute. One man's five-star album would be another's three-star.

The *Guide* is relatively complete, considering the huge amount of material it attempts to cover. And, as opinionated as I am, I am somewhat amazed at how reasonable I find most of the ratings. The commentary shows admirable restraint and is for the most part cogent, if occasionally refreshingly cutting.

In his introduction Editor Dave Marsh says that out-of-print and deleted albums have been avoided except "when it served our purpose to do so." What this means is that, of the deletions included, an awful large number of them have commentary followed by the initials "D.M." I wish that Marsh had either opted to be more complete in documenting the dead vinyl or more consistent in omitting it. Out-of-print albums by artists still active or with albums still cataloged, artists like Aretha Franklin, Wilson Pickett or Otis Redding, could have been included with some kind of notation befitting their reduced availability. This would at once have given a more complete picture of their work.

The sections outside of the basic rock/pop A-to-Z are of varying value. The blues section is pretty complete while the gospel section is cursory at best. The jazz section is laughable. Hell, any complete listing of jazz in print that can't even get an accurate list of as "obscure" an artist as Miles Davis is worthless. Such seminal, eternally available Miles albums as *Sketches of Spain* and *Birth of the Cool* are not listed, and the entry for Miles is no longer than the one for Chick Corea, for instance.

Sprinkled all through the book are pictures of the covers of five-star albums, an excellent idea. But why not show covers of jazz albums in the jazz section?

Given its flaws, and they are significant, *The Rolling Stone Record Guide* is a fine and potentially valuable reference tool that I welcome. An updated second edition is sorely needed at this early date. And, you know, the flaws suggest a sort of ethnic joke: "How many record reviewers does it take to change a light bulb? Answer: 32. Two to edit and 30 to debate the social significance." Michael Tearson

TEAC TODAY: THE X-SERIES.

You're looking at four new machines that have more in common with data recorders than audio recorders. Together they are called the X-Series. And they bring a totally new kind of technology to the open reel format.

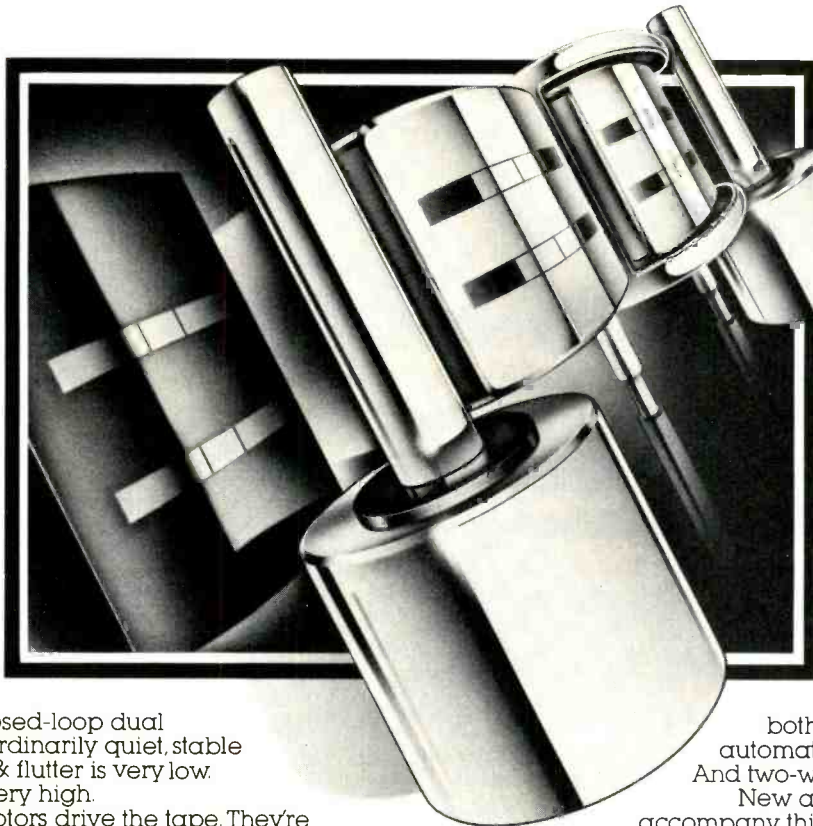
Each X-Series transport is an instrumentation mechanism. For 15 years, this TEAC design has stood the grueling test of time in computer installations where dependability is worth millions.

The basic configuration is closed-loop dual capstan. It's extraordinarily quiet, stable and precise. Wow & flutter is very low. Speed accuracy very high.

Three DC motors drive the tape. They're used to keep changes in motor temperature to a minimum under different loads so constant torque is maintained.

Our Magnefloat flywheel assembly, a completely new concept, uses magnetics rather than mechanics to eliminate problem-causing springs and pressure plates. Axial variations between the tape and capstans are prevented so proper tracking is assured. The result is highly accurate audio reproduction even after years of hard use.

The X-Series transport maintains ideal tape-to-head contact. Audible drop-outs, level and frequency losses are absolutely minimized. Frequency response is wide and flat. And signal articulation is unusually clear.



The brain behind the transport is our LSI control chip. It eliminates the need for mechanical relays so transport control is faster, more positive and reliable. The LSI also lets us provide full motion-sensing in the X-10 and X-10R.

Within the X-Series, machines have been specifically designed for bi-directional record and playback. Perfectly symmetrical head stacks (6 heads in all) assure top performance in

both directions. There's automatic reverse and repeat. And two-way cue monitoring.

New audio electronics accompany this new transport technology. Record and playback amplifiers are quieter and completely free of audible distortion. The sound is cleaner, more faithful to the source. The fidelity is unsurpassed.

For master quality recordings, dbx II* is available as an optional accessory for the X-10 and the X-10R. This remarkable noise elimination system adds 30dB to the already high S/N ratio, and provides up to 10dB more headroom.

If your audio perception is critical, your listening standards high, audition an X-Series recorder. The performance is flawless. The sound peerless.

TEAC.



*dbx is a trademark of dbx, Inc.

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SA2 POWER AMPLIFIER. 220 RMS watts per channel into 8 ohms 20 Hz-20 KHz, no more than .05% THD. On-board computers. Front panel LED's display peak and average output. Handles any impedance load.

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Receps for eight components.

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The Distinction Series was engineered for the dynamic range now available from direct-to-disc and digital recording.

The Crown Distinction components have S/N ratios that will complement the audio soon to be available from video-disc technology.

Your Crown Distinction system will drive any speakers, old or new, with plenty of reserve power for distortion-free sound, however inefficient the new speaker designs may be.

The Crown Distinction System is computer-compatible *now*.

A REVIEWER'S DELIGHT

Several years ago we asked our engineers to begin work on a new series of components that would be the best today and tomorrow, that would become the standards by which other components were judged in the 80's.

How well we succeeded is best expressed by what reviewers have said about the Crown Distinction Series.

"...workmanship and layout of the highest order."

"...solid...innovative."

"...can deliver prodigious power...without distortion."

"...virtual sonic perfection...utterly quiet...an exceptional product."

"better than the available test equipment."

"awesome control capability."

"the audio enthusiast...will simply fall in love with it."

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The Audio Critic announces a rather sensational change in its format.

Volume 2, Number 3 of The Audio Critic, which is expected to be off the press at approximately the same time as this ad, will be our ninth and last issue in the original magazine-like format. Starting in January 1981, the Audio Critic will be published biweekly—yes, every other week!—in the form of newsletter-size bulletins, featuring in-depth reviews of the very latest equipment as well as continuing updates of our top recommendations. With two issues skipped during the summer vacation, our frequency will be 24 bulletins a year.

Later in 1981, subscribers will also receive *The Audio Critic Handbook*, a book-length summary of everything the enlightened consumer of audio components ought to know (in our opinion) about rival design philosophies, engineering trade-offs, test methods, installation and alignment techniques, tape recording and disc-cutting problems, and just sound in general.

Together, the bulletins in their loose-leaf binder and the Handbook will read very much like a stack of The Audio Critic from 1977-80. Nothing will be different editorially. The celebrated writing style will be the same. As before, there will be no commercial advertising. Our reviews will still be based on a combination of sophisticated laboratory measurements and fine-tuned listening tests. The qualities that have raised The Audio Critic far above the "undergrounds" in the esteem of technically and musically educated audio practitioners will continue undiminished.

Only one thing will be different: the speed with which our readers will be informed about new developments. Instead of waiting for 35 or 40 reviews to accumulate before printing them, we will now publish our findings in a steady stream, as soon as they are firm. If we find out in March that a certain new phono cartridge is State of the Art, you will know about it early in April. What newsstand hi-fi magazine or underground journal can make that statement? Equipment reviewing will never be the same again.

Present subscribers to The Audio Critic will have their subscriptions fulfilled at the rate of six biweekly bulletins for each old-style issue due to them. The Handbook, when it comes out, will count as the equivalent of two old-style issues. *New subscribers* have the following two choices:

Our \$30 package. This includes the 24 biweekly bulletins to be published in 1981, starting in January, plus the Handbook when it is ready. If your subscription is postmarked no later than December 31, 1980, you will also get a handsome loose-leaf binder for your bulletins as a free bonus.

Our \$50 package. This includes the entire \$30 package, exactly as described above, plus the four magazine-size issues still in print: Vol. 1, No. 6 (cumulative reference issue with over 150 reviews) and Vols. 2, Nos. 1, 2 and 3, the last being the new issue with the much-awaited report of an important speaker development, among many other things. We strongly recommend that you get these issues in order to have a fuller understanding of what The Audio Critic is all about and a better foundation for reading the bulletins. Once the Handbook is out, all old-style issues will be allowed to go out of print. If you already own one or more of these, you may subtract \$5 from the package price for each one you do not wish to receive.

Send your check or money order in the correct amount (no Canadian dollars, \$6 extra for overseas delivery) to **The Audio Critic, Box 392, Bronxville, New York 10708.**

Audioclinic

Joseph Giovanelli

Noise Build-Up in Records

Q. Please explain how "popping" and "crackling" noises get onto presumably clean phonograph records. Can this situation be prevented? As an example, a new disc was free from noise the first time it was played. The third time it was played, however, there were many crackles and a few pops. — Mark M. Fencke, Chicago, Ill

A. It may be that your stylus is worn or perhaps you are tracking too heavily, which would be especially serious with a low-compliance cartridge. Either of these situations will cause rapid record wear.

Care should be exercised when raising and lowering the tonearm in those cases where you are doing this manually. Searching for a given band can be harmful to the record if you slide the arm across the disc. This is particularly true for low-compliance cartridges.

Another possible cause for the gradual build-up of noise has to do with the environment in which the records are kept between playings. For example, if the records are played and then not returned to their sleeves and jackets, dust will accumulate on their surfaces. This dust will produce noise.

Along these same lines, phonograph records may pick up dust as a result of accumulation of dust particles on the turntable mat. This mat should be kept clean, so remember to leave the dust cover closed whenever the turntable is not in use. Additionally, every disc should be wiped with an appropriate brush both before and after playing.

Judging from the low number of playings before the crackles developed, however, it appears that static attraction of dust is a major problem for you, and I would recommend that you try one of the systems specifically designed to reduce static.

Impact in His Compact

Q. The stereo effect from my home system is not as dramatic as that produced by my automobile stereo system. Why? Can I improve my home system's stereo impact?—Lee Talbot, Livermore, Cal.

A. I believe that the automobile environment provides enhanced stereo separation because the individual speakers are at wide angles and tend

to be beamed directly at the listener. The sound from channel A does not have the space to merge with that of channel B, as is true in your living room.

Another aspect of automotive stereo sound is that many cars are fitted with speakers in both front and rear. Thus, you are really surrounded by sound.

For added impact with your home stereo system, there are a number of things you can try, which include dynamic range expanders and add-on tweeters. The first of these won't affect the stereo image, but this may be a large part of what you're experiencing. I would also experiment with the placement of your home speakers, moving them further apart and perhaps angling them away from each other. Since much of the directional information is in the upper midrange band of frequencies, you might try using an equalizer to lift this band gently. I suspect, too, that much of your reaction stems from an accurate perception of the car's smaller closed environment versus your home's larger, more open listening area.

Noise During Changer Cycling

Q. I have a fully automatic turntable. Whenever a record is over and the arm is about to pick itself up, there is a "pop" sound, even on brand-new records. What is the cause of this? — Mark M. Fencke, Chicago, Ill.

A. It may be that the muting circuit, if you have one, never does short out the cartridge. Thus, the sound you hear is the stylus as it is lifted from the surface of the disc.

Perhaps this sound is that of a "click" on the disc itself. Very often there is a click at the point where the locked groove starts up from the run-out groove. Run-out grooves can often be noisy, but this is not true of all discs.

To determine which of these two conditions is the real cause of your problem will require that you locate a disc which you know to be free of

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



Single-play vs. multiplay: the argument is over.

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Two motors are better than one.

The BSR Pro III Series 300 and 200 models feature a direct response FG Belt Drive turntable with a quartz-locked control system that references the speed of the motor to that of the turntable. Additionally, there is an independent servomotor that drives the tonearm only during cycle changes. This unique two-motor design eliminates complicated cams, trip switches, etc. — all of which can interfere with optimum turntable performance.

Independent tonearm and turntable suspension.

BSR Pro III Series turntables utilize a floating suspension system to isolate both the turntable and the tonearm. Mounted together on a separate subplate, independent of base, cover and controls, this eliminates most causes of vibration and acoustic feedback.

Three-record umbrella spindle— short and sweet.

Unlike traditional six-record multiplays, the BSR

Pro III Series turntables are designed to play up to three records. The decreased height and weight of the record stack allows for a much more precise vertical tracking angle and overall turntable performance.

Digital readouts.

BSR Pro III Series turntables have a multifunction digital display, allowing you to determine both quartz-locked and variable turntable speed, elapsed time, stylus time and exact turntable leveling.

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The BSR Pro III Series has the only lateral cue control on a multiplay turntable. It provides fast and slow cueing in both directions, allowing for precise location of any portion of a record.

Remote control.

For total convenience, the BSR Pro III Series 300 has infrared remote control, which handles all major turntable functions, including volume control, from as far away as 40 feet.

Look at the look.

The BSR Pro III Series has a handsome low-profile design, with all electronic pushbutton controls conveniently placed outside the closed dustcover.

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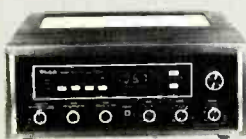
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clicks in both the run-out and the locked grooves. To make sure you do have such a disc, play it on a manual turntable so you can be certain to hear the complete run-out and locked grooves.

Play this disc on your turntable several times and note if there is a distinct click present each time the tonearm is about to lift. If it turns out that there are clicks present only occasionally, this probably indicates an intermittent condition in which the muting switch sometimes closes and sometimes does not. If the noise is heard all the time, this probably means that the muting switch never closes. If the sound never occurs, then it must be that the whole problem is the result of noisy run-out and/or locked grooves.

To Align or Not to Align

Q. I have a question about capacitors. My tuner is a comparatively old one. If I replace the capacitors in my tuner, will the tuner require realignment?—Darrel Babin, APO N.Y.

A. If you replace all of the capacitors in your tuner, including r.f. bypass and coupling capacitors, and i.f. bypass and coupling capacitors, realignment will be required. However, unless something is obviously wrong with your tuner, I see no need to change the various capacitors.

I can see where, with age, you may find it necessary to replace some power supply electrolytics as well as electrolytic interstage-coupling capacitors, emitter or cathode bypass capacitors, etc. There is usually no need to change the disc ceramic and mica capacitors found in the r.f. and stereo decoder portions of the tuner.

Name That Tuner

Q. It is my understanding that digitally synthesized tuners always automatically tune to the exact center of a station's assigned frequency and thus eliminate drift and tuning problems. However, is there such a thing as transmitter drift which could cause the center channel point to move away from its assigned (and tuner-synthesized) frequency, thereby foiling all listener attempts to achieve the best possible reception?—Greg Jones, Ann Arbor, Mich.

A. Synthesized tuners tune to the true center of an FM channel, provided that the tuner is properly aligned and provided that this alignment is checked periodically for changes. The stations themselves will not drift off their assigned frequencies. Because there are strict government regulations concerning frequency stability of FM broadcast transmitters, this should not normally be a cause for concern. **A**

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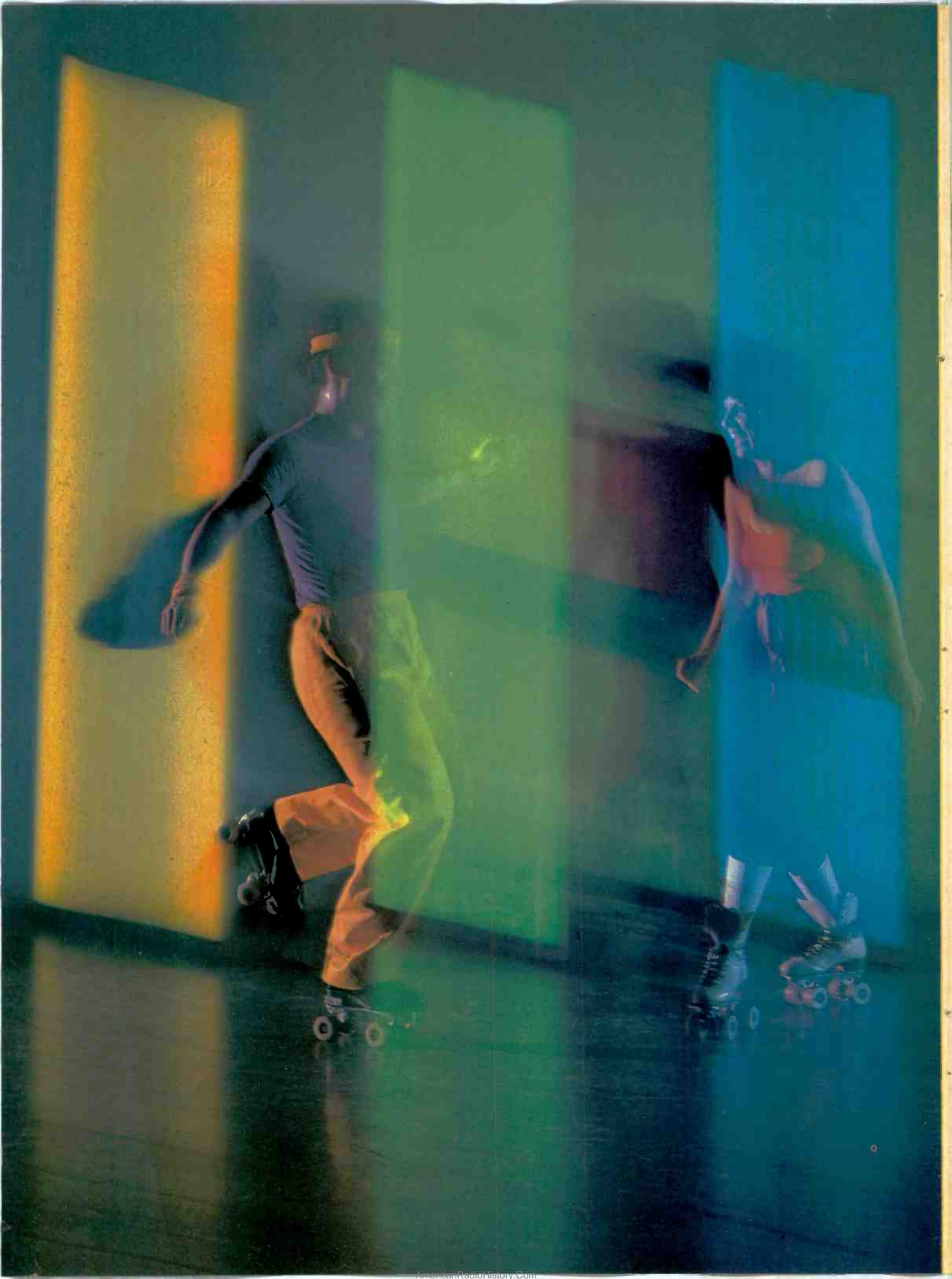
“The ORACLE turntable earns a Class 1 rating because it is a totally and thoroughly engineered product. It represents, in our professional judgment, the best product that can be reasonably achieved, as measured against the objective, permanent yardstick of what is possible in turntable design with today's technology. Our evaluation of the ORACLE's excellence (or any other product's) is based on its absolute quality, not merely its quality relative to its competition. Absolute quality endures, relative favoritism or fashion does not.”

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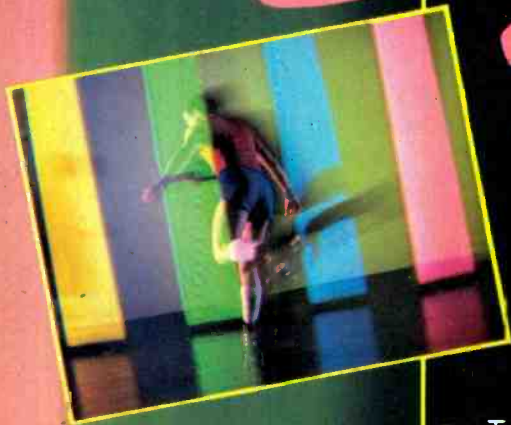


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Christmas Buying Guide



'Twas the night before Christmas
And throughout audio land
Not a system was tweaking
Not even an amp.

The children were nestled
All snug in their beds
With visions of cassette decks
With metal-capable heads.

Mama with her cartridge
And me with my taps
Had just settled down
To a long winter's nap.

The stockings were hung
By the receiver with care
With the hope that the speaker cable
Soon would be there.

When up on the turntable
There rose such a flutter
I hoped that Santa
Had brought me another.

Then what to my wondering eyes
Should appear
But *Audio's* Christmas Buying Guide
For all to cheer.

There's two speakers, a tape deck,
and one static gun
A cartridge, a cleaner, for aud ophile fun
A tonearm, a player, headphones, and stands
With the mat, the antenna — isn't it grand?

So skate with us now
Through the next several pages
These gift items should please
For ages and ages.

PHOTOS: ©CHRIS CALLIE



Christmas Buying Guide

... And a Cartridge in a Pear Tree

Astrion phono cartridges from ADC are hand-assembled and personally auditioned by craftsmen. Their laser-etched solid sapphire shafts, high "stiffness-to-mass" ratios, and pivot

systems with no restrictive armature wires are intended to help *recreate* rather than *reproduce* sound. Price: \$185.00. (Audio Dynamics Corp., 230 Pickett District Rd. New Milford, Conn. 06776.)



Clean the Decks

A head-cleaning solution, swabs, and a mini-mirror are offered by Sony in the KK-3-T Cleaning Kit for recorders and players. Even with frequent use, the C-1K-T Cleaning Cassette runs through a deck in a minute without causing head damage. Prices: KK-3-T, \$6.50; C-1K-T, \$1.50. (Sony Corp., 9 West 57th St., New York, N.Y. 10019.)



O Come, All Ear Faithful

Koss Corp.'s HV/X headphones feature contour cushions that fit around the ear. These stereo phones have unusual operating elements, combining the auditory aspects of closed-type dynamic phones with the free-field sound of high-velocity types. Prices: HV/X, \$69.95; HV/XLC, with volume-balance controls on each ear cup, \$79.95. (Koss Corp., 4129 North Port Washington Ave., Milwaukee, Wisc. 53212.)



Car and Drivers

The Model 5 car speaker from Avid may be either flush- or surface-mounted, and it comes complete with the parts necessary to perform either type of installation. This two-way system is part of the firm's "Expert Driver" series and is small enough to fit in most automobiles. Price: \$175.00 per pair. (Avid Corp., 10 Trippis Lane, East Providence, R.I. 02814.)

Player Up

The RS-J3, Panasonic's mini-cassette player with stereo headphones, weighs under two pounds. Supplied accessories include an a.c. adaptor and a carrying case; a car adaptor and rechargeable battery pack are optional. Price Range: \$129.95 to \$149.95. (Panasonic, One Panasonic Way, Secaucus, N.J. 07094.)



Deck the Halls

The Sansui D-100 cassette deck with Dolby NR handles the wide dynamic range and frequency response of metal-particle tapes — and can erase these tapes as well. Price: \$250.00. (Sansui, 1250 Valley Brook Ave., Lyndhurst, N.J. 07071.)

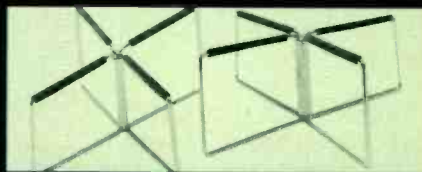


I'm Beaming of a White Christmas

The B•I•C/Avnet Beam Box eliminates multipath distortion and is available in three models (FM-6, FM-8, and FM-10), all of which are electronically directable FM antennas. Models FM-8 and FM-10 feature four-gang tuners, have selectable bandwidths, and also eliminate adjacent channel distortion. In the FM-10, extruded aluminum elements are visible through a clear acrylic top surface. Prices: FM-6 (pictured), \$29.95; FM-8, \$59.95; FM-10, \$99.95. (B•I•C/Avnet, S. Service Rd., Westbury, N.Y. 11590.)

Shelf-Defense

Thunderfoot speaker stands do a handsome job of lifting bookshelf-size speaker systems off the floor to maintain proper balance between bass and midrange output. Available in either smoked glass or chrome steel, these stands can also help keep unwanted bass from "rumbling" through floors and disturbing neighbors. Price: About \$20.00. (Thunderfoot Engineering, 915 North Mansfield Ave., Los Angeles, Cal. 90038.)



Speaker of the House

The Boston Acoustics A100 loudspeaker is a two-way acoustic suspension system that covers the frequency range from 39 Hz to 20 kHz, ± 3 dB. It has been designed to deliver optimum performance even when placed on the floor against a wall. Prices: \$170.00 with vinyl finish; \$200.00 with oak veneer. (Boston Acoustics, 130 Condor St., East Boston, Mass. 02128.)

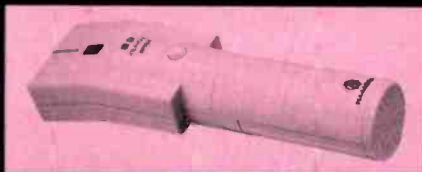
Omega My Heart

Sound Saver's Omega One turntable mat dissipates static charges to eliminate audible clicks and crackles. Its hole is slightly undersized, affording firm electrical contact with the spindle, while carbon-fiber construction provides damping characteristics to prevent distortion. Price: \$9.95. (Sound Saver, Transcriber Co., P.O. Box 478, Attleboro, Mass. 02703.)



Ready, Aim, ION!

Kilavolt, Osawa's battery-powered generator, releases positive ions that destroy static electricity on phono discs in a matter of seconds when it is held 10 to 12 inches from the disc's center. Price: \$44.95. (Osawa & Co., 521 Fifth Ave., New York, N.Y. 10017.)



Tonearmenclature

Magnepan calls its unique, radial-tracking tonearm the Unitrac I. Problems caused by cartridge compliance/mass factors have been averted through the use of non-resonant materials and distributing the tonearm's mass to reduce inertia. Price:



\$295.00. (Magnepan, 1645 Ninth St., White Bear Lake, Minn. 55110.)

Sansui "Z" Receivers give you a spectrum worth analyzing.

What frequency range does your favorite singer's voice most commonly fall into? What about your favorite instrument?

How accurately does your cartridge handle those frequencies? How about your tape deck?

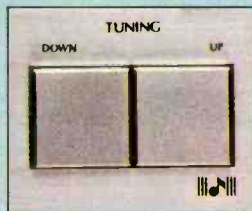
The newest Sansui "Z" Receivers all have an ingenious spectrum analyzer that answers these and other questions by letting you see exactly what you hear.



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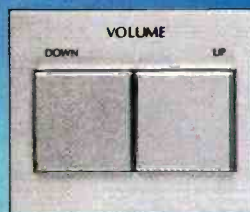
The digital difficulty ensures that every station received is automatically locked in for lowest possible distortion, with its frequency indicated both on a digital readout and by a LED indicator along an analog type dial.

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TOUCH VOLUME CONTROL & LED PEAK POWER LEVEL INDICATOR. The Sansui "Z" Receivers use a pair of touch-buttons to adjust the listening level. Relative volume control setting is indicated on a fluorescent display.

On most models actual peak power amplifier output is shown by 14- or 18-segment LED indicators.

And there's more. Instead of up/down tuning buttons, both the 9900Z and the 8900ZDB have tun-



ing knobs linked to a rotary "encoder" disc. As you turn the knob, the encoded disc works with

an LED and a photo transistor to generate electronic pulses to raise or lower the tuned frequency. In addition, the 9900Z, 8900ZDB, and 7900Z have ceramic buzzers which signal unobtrusively while you tune in a station. There are three speaker select switches on the 9900Z for driving any two of three connected speaker pairs and two switches on all the other "Z" receivers. Included are LED's for every important function. Two Muting Modes. Two tape deck connections with dubbing. And much more.

The full line of Sansui "Z" Receivers are at your Sansui dealer now. Visit him for a complete demonstration soon. He has just the right model for your pocketbook and power requirements.



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160 watts/channel, min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.015% THD.

8900ZDB

125 watts/channel, min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.02% THD.

7900Z

100 watts/channel, min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.02% THD.

5900Z

75 watts/channel, min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.03% THD.

4900Z

55 watts/channel, min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.03% THD.

3900Z

40 watts/channel, min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.03% THD.

Cabinet of simulated wood grain.



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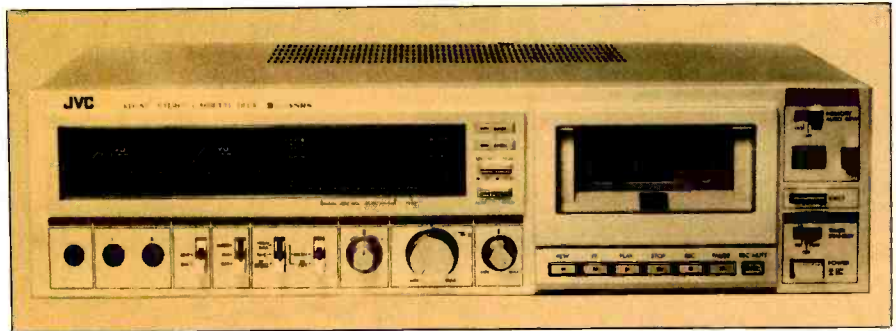
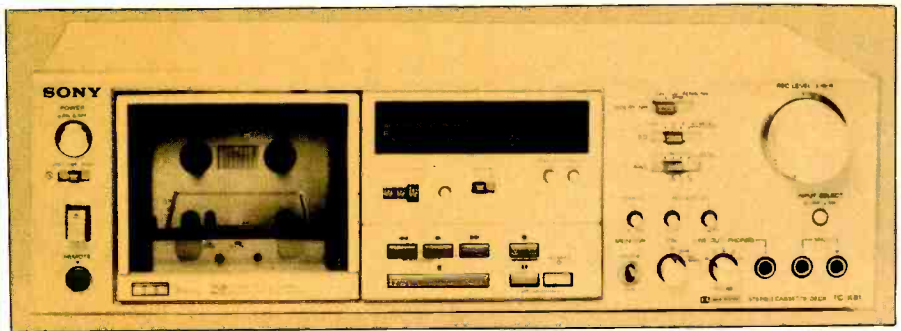
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THE NEW METER

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Introduction

Lord Kelvin, William Thomson, perhaps said it best, in the last century:

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science."

More succinct is the engineer's axiom: "To measure is to improve."

While it is not trivial to note that we must have some notion of what it is we are attempting to measure before we apply the calipers, since it's difficult to measure volume with a yardstick, we must also fit the scale to the subject — so that yardsticks are not applied to record grooves or to FM reception distances.

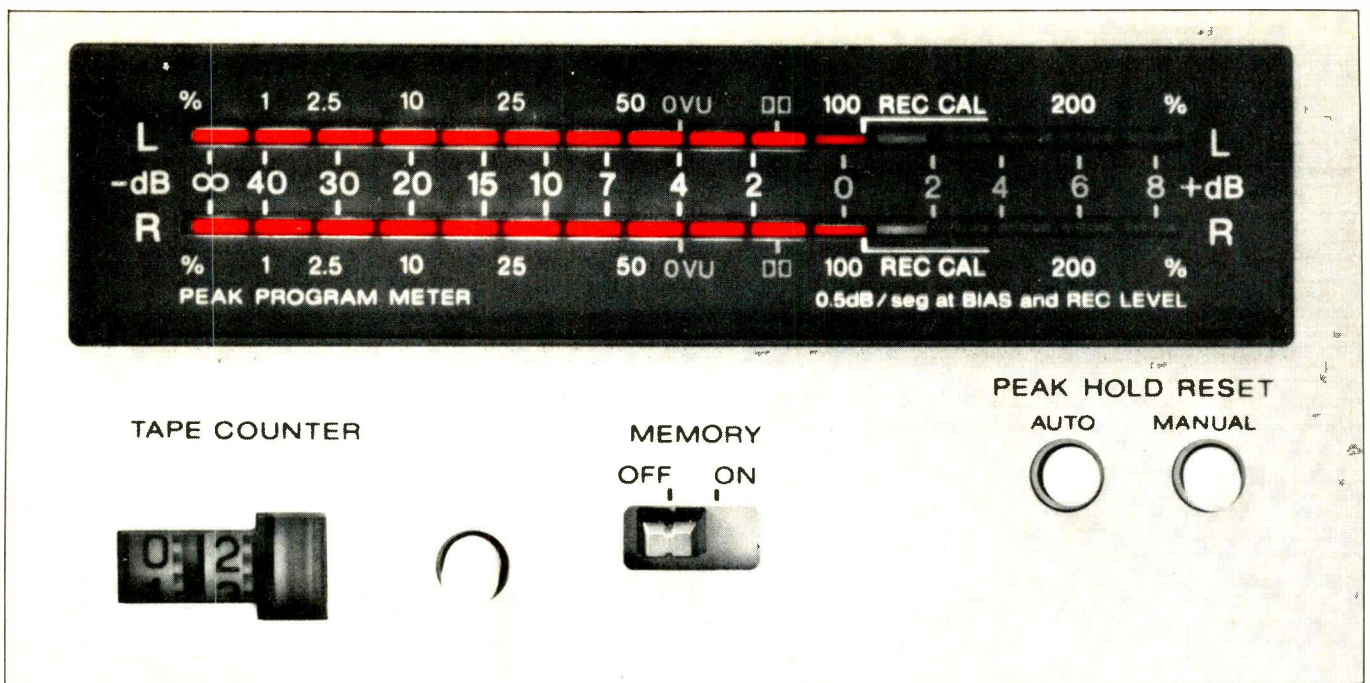
Thus, we come to the subject of this article, new techniques in metering circuitry, specifically Light-Emitting Diode (LED) and Vacuum Fluorescent (VF) types. I'll leave it to the author to explain how they work; I want to explain why these techniques are new and why they are important.

First of all, we should consider the older type of meter, the one with the swinging arm or needle. You can still find them in many, many pieces of electronic gear today, and they will probably be with us for at least another generation. When they are well made, they work well and, when proper for their application, should not be discounted in their excellence.

The way this meter works is fairly simple. It's similar to the grade school science teacher's experiment with the magnet and the paper of iron filings; remember how more filings stood up when the magnet was right under the paper than when it was further away. Swinging-arm meters work much the same way; the magnet moving closer to the paper is equivalent to more current being fed into the meter's electromagnetic coil. The trick is to make the meter proper for its application, and here we should distinguish between two basic types of meters — averaging and peak responding.

Perhaps the most common kind of averaging meter is the VU (volume unit) type, which is the basic meter found in recording, both on professional and amateur levels, and in broadcast, the two places where most current types of equipment got their start. While I personally suspect that the originators of the VU meter would have liked to have made their brain-child respond to peaks if they could have, this was probably mechanically impossible at the time. More important, however, was the problem a peak-reading meter would have caused an engineer in a recording or broadcast center — how in the world does one set a level so as to stay up off the noise floor and stay down out of system distortion when the meter needle is jumping around?

The answer is what is embodied in the VU meter, sluggish ballistics, but ones that can be duplicated by any competent manufacturer and that work off voltages and into impedances



common in the equipment and commonly agreed upon. (The 0 level on a VU meter corresponds to one milliwatt of power in a 600-ohm circuit, i.e. 0.775 volt).

The announced intent of the VU meter was to at least roughly match the ear's response to varying loudness, and it does so quite reasonably well, because the ear-brain combination tends to average out strong and weak sound pressure levels. The position of the VU meter's needle, therefore, seems to mimic one's subjective reaction to different loudness levels.

There are, however, other factors involved. With meter ballistics slowed down, engineers (as well as listeners at home) began to hear bursts of noise and distortion, even though the VU meter was staying relatively still. Usually, this was because the medium was being pushed up into distortion for short periods, and standard VU meter ballistics could not and were not intended to show these peaks.

Thus, engineers were confronted with a need for a meter or system that would show these peak values, which can easily be as much as 12 to 15 dB higher in level than the value shown on a VU meter. While compression and limiting circuits can do some of the work in adjusting signal levels, they too need an initial setup.

How slow is a VU meter? Well, it's pretty quick actually, taking about a third of a second to reach 99 percent of a standardized input. However, the ear is substantially quicker since it takes only about 15 to 30 milliseconds, one-tenth the time, before we begin to

recognize distinct notes or echoes. So it's no wonder that we can hear distortion on peaks that are missed by averaging meters.

Admittedly, I am shortchanging the meter makers, since they can make faster meters than the averaging type, of which the VU meter is an example. But the same basic problem of slowness remains, and there are other factors which deserve at least a passing mention. Obviously, the meter should respond to a broad range of frequencies, say 20 Hz to 20 kHz, but should the meter's relative response to different frequencies be tailored to an A-weighting curve following the ear's natural response? Or do we want the meter's response to show us something about system distortion at different frequencies, since that's what we're trying to get rid of (along with trying for high signal levels)? And there are polarity problems too. Some meters do not respond as well to a signal that starts off in the negative direction as they do to a signal that starts off positive.

One solution is in the electronic displays discussed in the other part of this article. Since they are electronic, they can turn on and off virtually with the speed of the signal they are tracking. But, and even better, these displays can be tailored to many, many uses, with infinite variety of refinement, through the use of timing networks and filters. They can have fast attack times to accurately follow peaks and, just as easily, have slow decay times so the eye has no trouble following the bouncing meter. And they can make

excellent spectrum analyzers — something not possible with meters.

But let's see how these new displays work. . . . *The Editor*

Currently we are seeing more and more Light Emitting Diode (LED) and Vacuum Fluorescent (VF) based audio power meters being employed in receivers, power amplifiers, tape decks, etc. These electronic displays usually give indications of clipping, which can cause distortion and damage to an amplifier or speakers, and they are also excellent devices for balancing a home stereo system.

Many manufacturers produce the integrated circuits for LED and VF display indicators. Their bar/dot displays are arranged either horizontally or vertically, while some scales are in a semi-circle format similar to those found in analog meters. A pointer moves along the analog (moving-coil) meter scales, but it is moving light that does the pointing in LEDs or VF meters.

Operation

National Semiconductor's LM3916, represented in Fig. 1, may be used to illustrate the operation of bar/dot VU-display drivers. This monolithic integrated circuit works on the comparator principle. The LM3916 contains an accurate precision 10-step voltage divider network connected to the positive inputs of the comparators, which scales to provide an electronic version of the conventional moving-coil meter. The circuit will illuminate 10

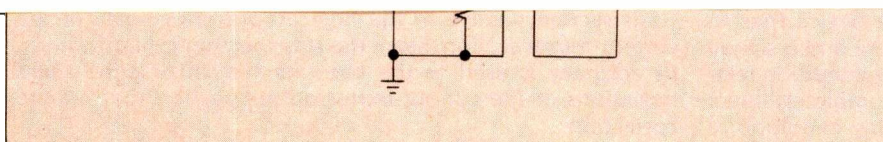
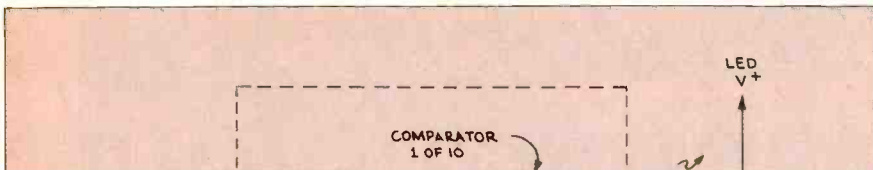


Fig. 4—Vacuum fluorescent level display with drive circuitry.



LEDs consecutively when the input level at pin 5 increases past the threshold points at -20, -10, -7, -5, -3, -1, 0, +1, +2, and +3 dB; it is also equipped with a stable adjustable reference.

The signal input at pin 5 has a low impedance buffer which is a nonlin-

Equipment profiles

Threshold Stasis 3 Power Amplifier



Manufacturer's Specifications

Rated Power: 100 watts per channel, both channels driven, 20 Hz to 20 kHz, into 8-ohm loads.

Rated THD: 0.1 percent.

Rated IHF IM: 0.1 percent.

Slew Capability: 50 V/ μ S.

Output Current Capability: Instantaneous, 20 amperes; continuous,

fuse governed, 5 amperes.

Maximum Voltage Swing: 100 volts peak to peak.

Input Impedance: 75 kilohms.

Gain Factor: 26.6 dB, 1.32 volts input for rated output.

Rise Time: 3 μ S.

Damping Factor: 60, from d.c. to 20 kHz.

Hum and Noise: 103 dB, unweighted, below rated output.

Minimum Load Impedance: 4 ohms, capable of operating into fully reactive loads.

Dimensions: 19 in. (48.26 cm) W x 7½ in. (19.13 cm) H x 13½ in. (34.29 cm) D.

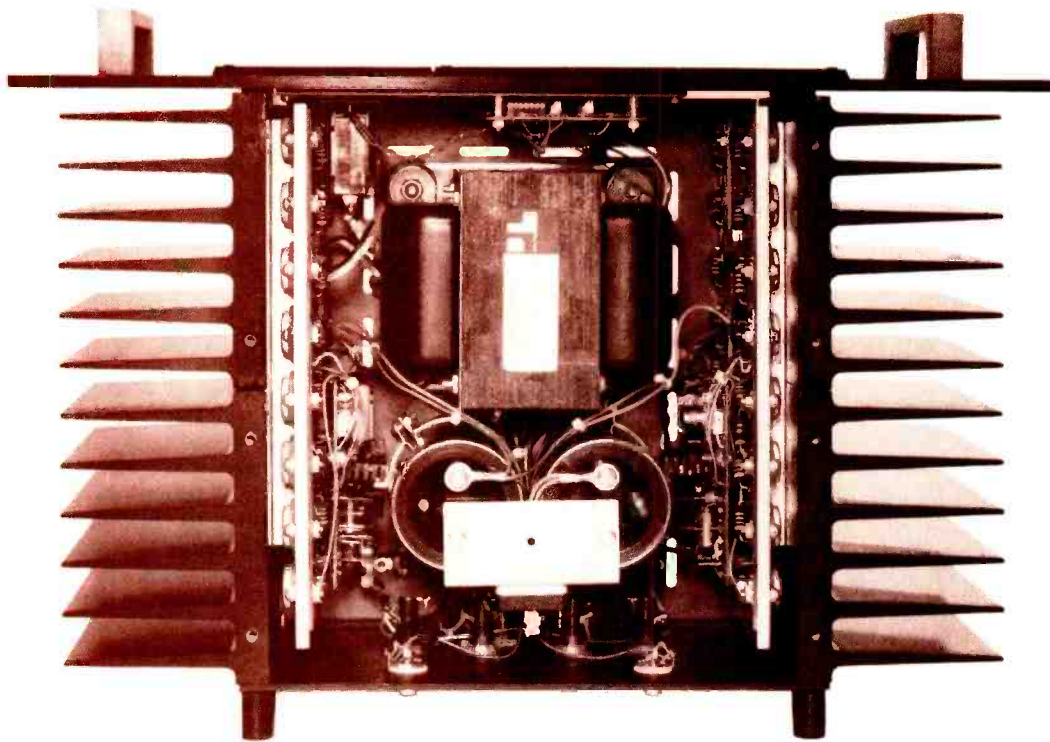
Shipping Weight: 53 lbs. (24.09 kg).

Price: \$1675.00.

With all of the variations of dynamic-biased "similar to Class A" circuits appearing in the audio marketplace from the various audio equipment manufacturing firms, one tends to forget that the idea for a dynamically biased "Class A" amplifier originated with the Threshold Corp. more than five years ago and resulted in the introduction by that company of their Model 800A in 1976. More recently, this same innovative company introduced a series of amplifiers which share the common term "Stasis," the dictionary definition of which is a form of quiescence or non-changing state. The design goal of the Stasis amplifiers was to achieve an output circuit in which the operating linearity of the transistors themselves could be improved to the point where the resulting circuit performance would eliminate the need for any overall loop negative feedback. All operational nonlinearities (distortion) in any amplifying device, such as a tube, transistor or FET, result from changing gain characteristics within the device. These, in turn, occur as a result of fluctuating voltage and current that takes place continuously as the device tries to track the frequency and changing levels of the audio signal. If a transistor could be held in an unchanging condition relative to voltage and current, it would exhibit completely linear or "perfect" operation. Unfortunately, in this condition, a

gain device would also be unable to perform any work, such as driving a loudspeaker.

The approach of Threshold in the Stasis group of amplifiers was to achieve a working system in which a nearly perfect constant-voltage, constant-current amplifier is required to do practically no work (supply virtually no power) but in which the linear-state Stasis amplifier dominates or controls the performance of a large power source. The performance of the Threshold Stasis models (including the Stasis 3 unit tested for this report) is determined by an amplifier operated under stasis conditions of suppressed voltage and current variations. It is this linear-state system which determines signal integrity and is connected directly to the loudspeaker load. This part of the circuit, however, "works" only to the extent that it is required to absorb the small nonlinearities appearing at the output of a current-mirror output stage functioning as an operational transconductance current source. Absorption occurs because of the very low output impedance of the stasis section relative to the high output impedance of the current-mirror section. Since the stasis section is highly linear, its accuracy is used as the basis for recognizing the slight deviations of the current-mirror output section that require correction.



With that somewhat lengthy circuit description out of the way, let us go on to examine the Stasis 3 amplifier itself. This is the least powerful of the three Stasis models (the Stasis 1 is a mono 200-watt amplifier, while the Stasis 2 offers 200 watts per channel in a two-channel configuration) and is nominally rated at 100 watts per channel, with both channels driven into 8-ohm loads for a rated harmonic distortion level of less than 0.1 percent at any frequency from 20 Hz to 20 kHz.

As can be seen from the photos of the unit, it is a rather hefty amplifier configured for standard 19-in. rack mounting and equipped with a pair of handles to aid in lifting its 50-lb. plus weight. Key elements of the front panel are a circuit-breaker type of on-off rocker switch at the right, along with a power-on indicator light and two vertical rows of LED peak-power-output indicators near panel center. The power indicators are calibrated from +3 dB to -40 dB, relative to the rated output of 100 watts per channel.

The physical layout of the Stasis 3 amplifier can be seen in the accompanying interior photo. Thirty-two output devices (16 per channel), each power-rated at 150 watts, consisting of extremely fast, single-diffused power transistors, make up the two output stages of the Stasis 3. The amplifier is powered by a single transformer having a power capability of 850 watts, and filtering is done by means of twin 18,000-microfarad, computer-grade electrolytic capacitors.

Two fast-blow fuses are located on the rear panel of the amplifier and are designated as "output" fuses. These are in series with the hot lead going to the loudspeaker load. Adjacent to each output fuse is a fast-blow fuse for the respective amplifier channel, and this is designated as a "rail fuse." These latter fuses are in series with the negative d.c. voltage supply of the applicable channel and are designed to disconnect the power supply from an affected channel should an abnormal stress condition occur. When the rail fuse is

opened by such a condition, the LED display of the corresponding channel will register full peak output as if the load for that channel were disconnected. An a.c. line fuse is located adjacent to the power line connector. The rear panel is equipped with two gold-plated phono-tip jacks for connection of program inputs. These inputs are electrically insulated from chassis ground. Equally isolated from chassis ground and from each other are the five-way binding posts used to connect output signals from the Stasis 3 to the loudspeaker loads. Dual banana-plug connectors are supplied with the amplifier for making speaker cable connections, but of course the wires may also be connected directly.

Measurements

The Stasis 3 power amplifier delivered 138 watts of audio power into a purely resistive 8-ohm load for its rated harmonic distortion level of 0.1 percent using an input signal frequency of 1 kHz. At the audio frequency extremes of 20 Hz and 20 kHz, power output for rated THD measured 133 and 134.5 watts respectively. The FTC rated power of this unit, therefore, would be 133 watts per channel as opposed to the 100 watts per channel rating supplied by the manufacturer. Power output versus harmonic distortion is plotted in Fig. 1 for 8-ohm operation. The amplifier was able to deliver its full rated power at its rated harmonic distortion level over a frequency range extending from 9 Hz to 40 kHz. Frequency response at nominal 1-watt output levels was flat within -1.0 dB from 5 Hz to 50 kHz and within -3 dB from 3 Hz to 87 kHz. Distortion versus frequency at rated 100 watts per channel output with both channels driven is plotted in Fig. 2. IHF Dynamic Headroom for the amplifier, driving 8-ohm loads, measured 1.4 dB referred to 100 watts per channel output.

Measurements were repeated using a 4-ohm load, and we found that the amplifier exhibited harmonic distortion levels

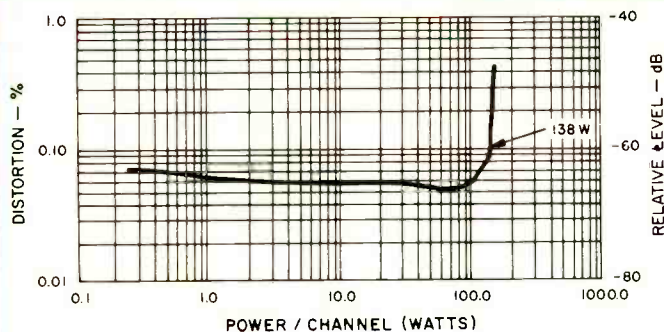


Fig. 1 — Power output vs. THD, 1 kHz, 8-ohm loads.

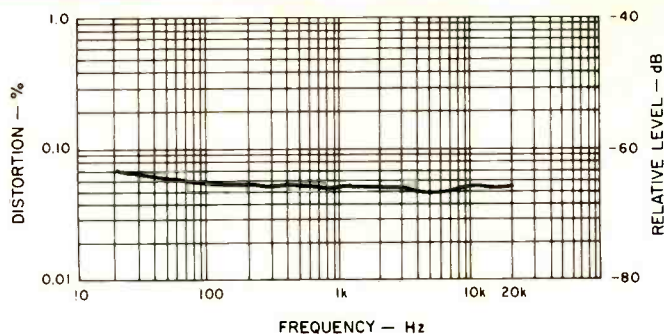


Fig. 2 — Distortion vs. frequency, which is almost constant throughout the audio band.

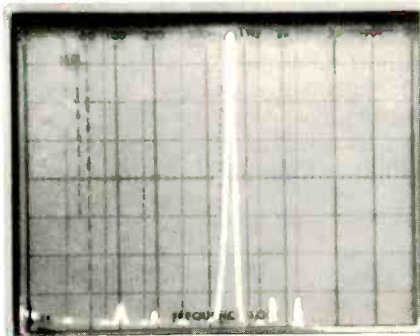
of 0.1 percent at around 100 watts per channel, rising slowly at 0.15 percent at 200 watts. SMPTE-IM distortion seemed a bit higher using 4-ohm loads than we had measured under the 8-ohm load condition. The amplifier was found to be unconditionally stable with reactive loads, as defined by the IHF Amplifier Measurement Standards.

IHF IM distortion, measured using the twin-tone IM method, was under 0.1 percent, as claimed, while maximum slew rate measured marginally higher than the 50 volts per microsecond claimed. Input sensitivity was 1.25 volts for 100 watts output into 8 ohm loads, and signal-to-noise ratio was 105 dB below rated output, using an "A" weighting network. Power consumption, when the amplifier delivers a constant 100 watts per channel into 8-ohm loads, measures 565 watts. We also found the LED display to be extremely accurate in terms of its dB markings relative to 100 watts output, referred to 8 ohm loads, even down to the -40 dB level.

The harmonic distortion components generated by a rated output signal driving 8-ohm loads is shown in the spectrum analysis photo of Fig. 3, using a 1-kHz reference signal. Nearly equal amounts of second- and third-order harmonic components are seen to the right of the fundamental at an amplitude of around -73 dB relative to the fundamental. If there are any higher order components, they are more than 80 dB below the fundamental. The two harmonic components visible in the display are equivalent to a total harmonic distortion of 0.031 percent, which is in good correlation with the value observed on our meter-type distortion analyzer.

Figure 4 represents a spectrum analyzer display of the fundamental and the distortion components when the Stasis 3 delivers 100 watts per channel into 4-ohm loads. The makeup of the distortion is somewhat different here, consisting primarily of third-order distortion at a level of around -65 dB relative to the fundamental 1-kHz test signal as well as some minute amounts of 5th- and 7th-order components.

Fig. 3 — Distortion components of a 1-kHz 100-watt signal into 8-ohm loads are second and third order, about 73 dB down relative to the fundamental, and total 0.031 percent.



Listening and Use Tests

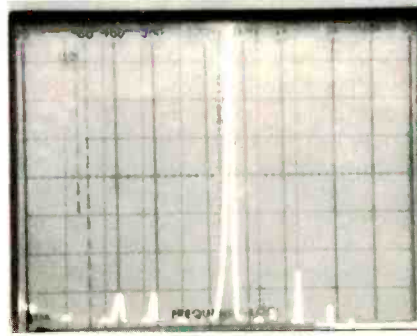
The absence of any overall loop feedback in this amplifier imparts an immediately recognizable quality which we found to be not only extremely pleasing during the reproduction of complex music signals but also extremely accurate in its musicality. In many ways, the sound of the Stasis 3 is reminiscent of what has been described by some as "tube sound" in that it is somewhat less harsh or dry than that we associate with typical transistorized designs using high levels of overall negative feedback. It is difficult to say whether it is the conservative power rating of the amplifier or its novel "stasis" design that gave us the impression the unit is capable of delivering much more power than its nominal rating suggests. However, in our listening environment, we never ran out of audio power even when feeding digitally mastered dbx-encoded, wide-dynamic range discs to our system as a program source with which to test the power limits of this Threshold amplifier.

The amplifier does run a bit warmer to the touch, even during musical reproduction, than we would have guessed in view of the extensive amount of heat-sink area and the multiplicity of high-rated output devices, but since the amplifier did not shut down during any of our vigorous tests, we would not be too concerned about this. While the performance-determining "stasis" section of the amplifier runs in true Class A with controlled voltage regulation, the actual power-output, current-mirror source is essentially operating Class AB and therefore makes for an efficient system in terms of power consumption. We suspect, though, that at its price, potential purchasers are not going to be too concerned over a couple of hundred watts of power consumption one way or another. The real merit of this amplifier is in the sonic quality it delivers and, in certain audio realms, that's something that defies pricing.

Leonard Feldman

Enter No. 90 on Reader Service Card

Fig. 4 — Analyzer display of 1-kHz, 100-watt signal into 4 ohms shows different distortion pattern, primarily third order at -65 dB.



NAD 6040 Stereo Cassette Deck



Manufacturer's Specifications

Frequency Response: 30 Hz to 15 kHz, to 16 kHz with CrO₂ tape, and to 18 kHz with metal tape.

Harmonic Distortion: 1.0 percent for 333 Hz at 0 dB.

Signal/Noise Ratio: 56 dBA, 59 dBA with CrO₂ tape; 66 dBA with Dolby NR/HX, 68 dBA with CrO₂ tape.

Separation: 40 dB.

Erasure: 70 dB.

Input Sensitivity: Mike, 0.25 mV; line, 60 mV.

Output Level: Line, 550 mV into 50 kilohms.

Flutter: 0.07 percent wtd. rms, 0.13 percent wtd. pk.

Speed Accuracy: ± 1.0 percent.

FF & RWD Times: 100 seconds for C-60.

Dimensions: 16.5 in. (420 mm) W x 4.5 in. (115 mm) H x 9 in. (230 mm) D.

Weight: 9.5 lbs. (4.3 kg).

Price: \$279.00.

This just-released NAD stereo cassette deck is certain to get a fair amount of attention because of its low price and its metal-tape compatibility, to say nothing about its peak-reading meters. The bigger news, however, is that the 6040 incorporates the recently developed Dolby HX headroom extension circuitry, along with the standard Dolby B NR. The only indication of this on the front panel is the *Dolby NR/HX* designation above one of the large, square push buttons. There are six other buttons in the same row for *MPX Filter*, *Memory* and tape-type selection — *Normal*, *CrO₂*, *FeCr* and *Metal*. Just a light touch is required for actuation, and there is a green LED indicator to show when Dolby NR/HX is on. The dual-concentric record-level pots are friction coupled, and the large knobs facilitate adjusting one channel relative to the other. There is a "Peak Reading" designation below the meters, though "VU" is actually printed on each face. By this time each manufacturer and, we hope, each reader should know that a meter meeting the VU standard is average responding. A true VU meter *cannot* read peaks — by *design*. A better label for non-VU meters would be simply, "dB." With the white scales and good illumination, everything was very legible, though the needles seemed a little thin.

The tape-motion controls are lever-type with medium force required for actuation. They are all of the same size, and the designations above, and other panel marking, were easy to read except in dim light. The cassette compartment door opened smoothly with a push of *Stop/Eject*. With slight attention to miss a step on the top, drop-in loading was simple. Access for maintenance tasks was very good with the door open. Just to the right are the tape counter and its reset button and the red *Rec* indicator. The push-button power switch and the jacks for headphones and left and right mikes complete the front panel.

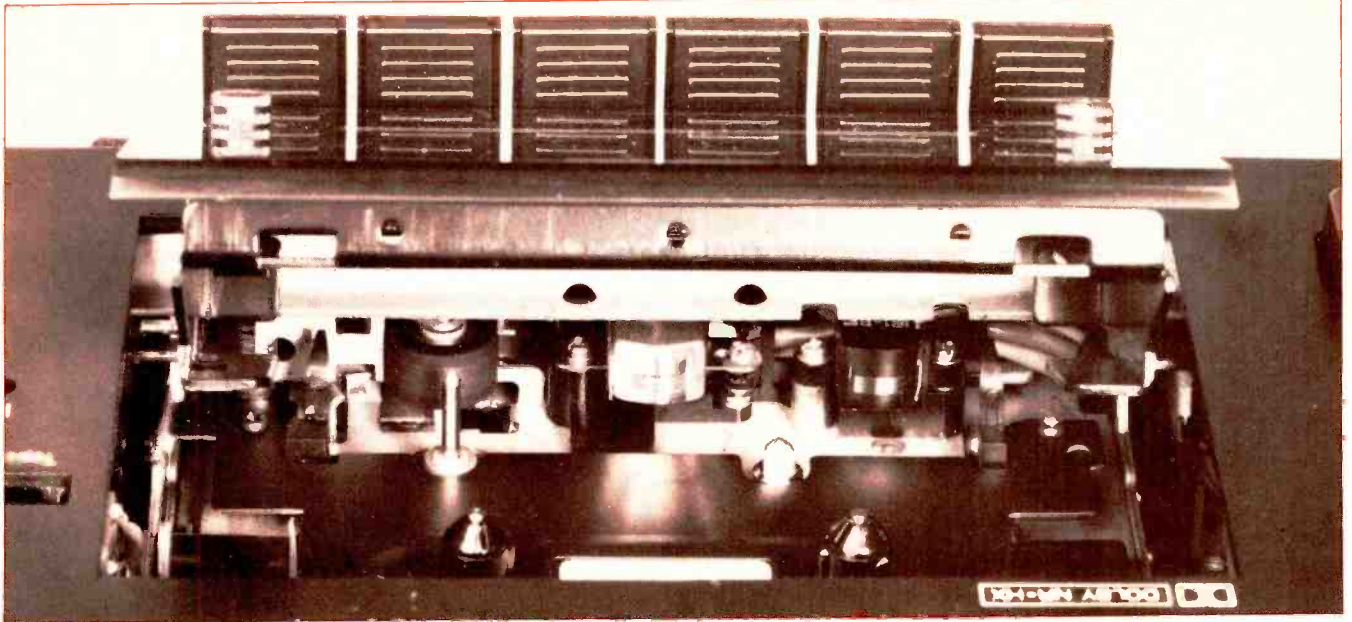
On the back panel are the line-in/line-out jacks and a DIN socket. Access to the interior was gained with the removal of the steel top and side cover and the hardboard bottom cover.

The soldering was very good in general, with some flux residue at external connection points of the single, large p.c. board. (Actually there were a couple of very small cards with small parts of the circuitry.) There was no identification of any of the parts, and the adjustments were not labeled. The single-motor drive was simple in construction, but it had fairly good rigidity. The power transformer was smaller than in many decks, but there was a lot less circuitry than in a logic-controlled unit, and a later check showed that in use the transformer became just warm to the touch.

Circuit Description

As most readers have probably not had the opportunity to read much material on the new Dolby HX scheme, we will include a brief discussion of it here. First, a review of the present situation shows that most of the decks in use have Dolby Type B noise reduction, just about essential for the cassette format to make it as a high-fidelity medium. (We're not forgetting other schemes such as JVC's ANRS, dbx II and Nakamichi's High-Com II, but they are not central to the story being told here.) With improvement in both tape formulations and the decks to use them, noise levels were reduced, MRLs became higher, and signal-to-noise ratios approached 70 dBA. A problem remaining, however, was a general limitation in the amount of high-frequency energy that could be recorded. Tape saturation, self-erasure, and excessive distortion were all involved. It can be seen that there would be an advantage in adjusting bias and equalization to match each type of music material for the best results, and that's what Dolby HX does dynamically — during the process of recording.

Follow the signal paths of Fig. 1 while you read this quotation from a Dolby brochure: "There is a way to get the best of both worlds, however; it involves, among other things, a signal-controlled *varying* bias. This is the main principle underlying Dolby headroom extension (Dolby HX), a technique



that alters the strength of the bias in accordance with the immediate requirements of the program material. Most of the time, when demands on the high-frequency signal-handling capability of the recording system are low or moderate, the bias is kept comparatively high for optimum performance at mid and low frequencies. But when large amounts of high-frequency energy are present, a control signal (which is derived from the Dolby B-type noise reduction processor) causes the Dolby HX circuitry to reduce momentarily the bias, going to the record head and also to make the necessary changes in the recording equalization to maintain flat frequency response. Thus, high-frequency headroom is significantly extended, exactly when it is needed and *only* when it is needed. With Dolby HX used in this way, it is possible to realize a headroom increase on the order of 10 dB at frequencies above 10 kHz before tape saturation occurs, and with no audible sacrifice of performance at other frequencies."

The above statements are certainly impressive, and there was particular interest to see how much extension was obtained and whether the bias and EQ changes were matched well enough for flat responses. The results of a number of tests are reported below.

Lab Measurements

With TDK 120- μ S test tape, the play responses were very close with the exception of fringing effects at 40 Hz and below. Dolby-level playback was right on the meter reference at "-2." Tape play speed was about 0.3 percent fast. Tests with pink noise and a $\frac{1}{3}$ -octave RTA showed that very good responses were obtained with Ampex Grand Master I and MPT, Maxell UD XL-I and UD XL-II, Memorex High Bias, RKO Broadcast I, Scotch Master II, Sony HFX, SHF, FeCr and EHF, TSI (Agfa), and TDK D, SA and MA-R. The usual battery of tests were conducted with Maxell UD XL-I, Sony EHF, and TDK MA-R. Swept record/playback responses were plotted at Dolby level and 20 dB below that, both with and without Dolby NR/HX. The results in Figs. 2 to 4 and Table I show immediately, and obviously, the improvements gained with the HX design.

First of all, it is important to note that in each and every case, the high-frequency response extends *further* with NR/HX than without, except for metal tape where NAD has not applied the HX circuitry. In the past, we have all become

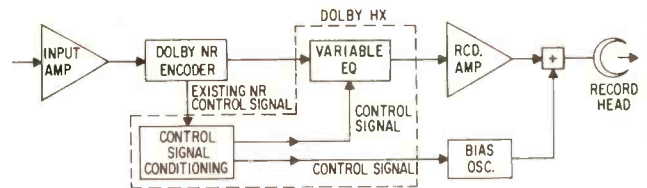


Fig. 1 — How Dolby HX is incorporated into a deck equipped with Dolby Type B noise reduction.

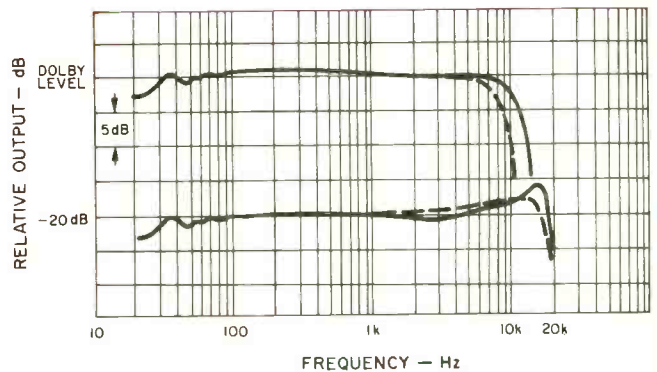


Fig. 2 — Frequency response with and without (---) Dolby HX/NR using Maxell UD XL-I tape.

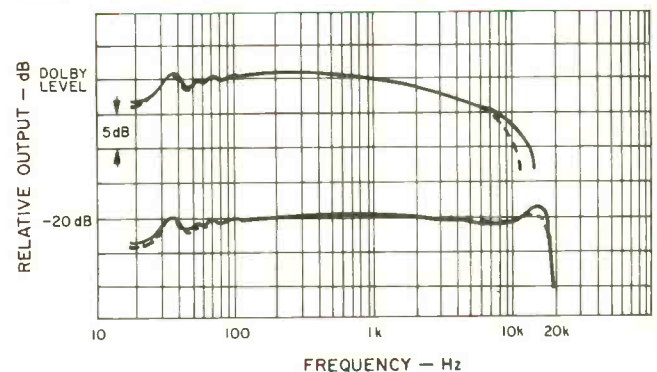


Fig. 3 — Frequency response with and without (---) Dolby NR using Sony EHF tape.

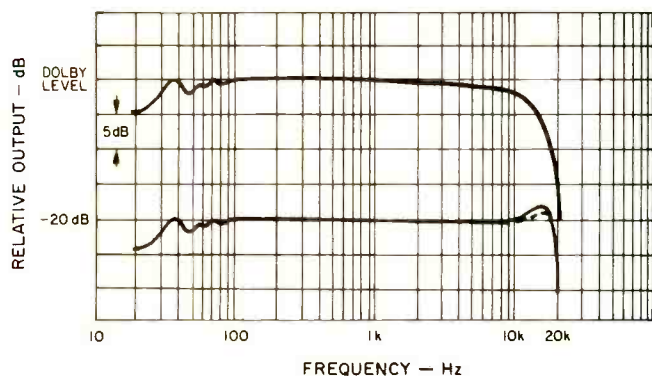


Fig. 4 — Frequency response with and without (---) Dolby HX/NR using TDK MA-R tape.

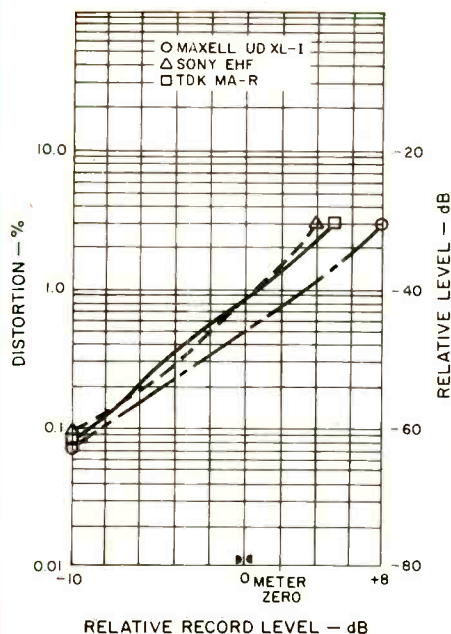


Fig. 5 — Third harmonic distortion vs. level in Dolby HX/NR mode at 1 kHz with Maxell UD XL-I, Sony EHF, and TDK MA-R tapes. (Note: NAD does not use HX circuitry on metal tape.)

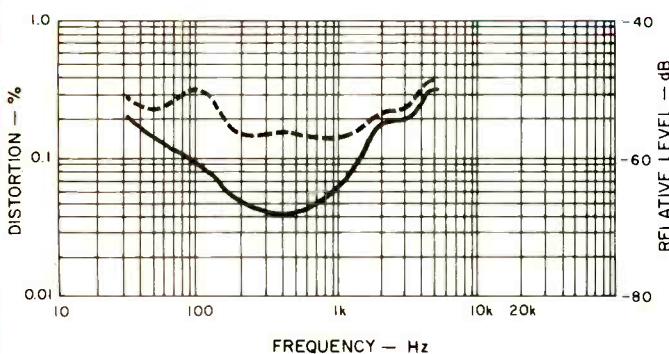


Fig. 6 — Third harmonic distortion vs. frequency with and without (---) Dolby NR/HX mode at 10 dB below Dolby level using Maxell UD XL-I tape.

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

Tape Type	With Dolby NR				Without Dolby NR			
	Dolby Lvl		-20 dB		Dolby Lvl		-20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Maxell UD XL-I	20	10.9	20	19.7	20	8.0	20	18.1
Sony EHF	23	5.0	25	18.3	23	5.0	26	17.7
TDK MA-R	26	12.0	26	19.0	26	12.0	26	19.0

quite accustomed to seeing the reduction in the high-end limit with NR switched in. The improvement with NR/HX is most impressive with UD XL-I at 0 dB, where the limit was extended from 8.0 to 10.9 kHz — a significant change. With the more music-like pink noise as the source and a meter level of “+3,” or 5 dB above Dolby level, the response with NR/HX was better by these amounts: 3 dB at 8 kHz, 5 dB at 10 kHz, 8 dB at 12.5 kHz, 12 dB at 16 kHz, and 13 dB at 20 kHz. The NR/HX display was flat to 16 kHz, even with this very-high level. The responses were generally quite flat in the important 100-Hz to 10-kHz region, though the 16.5-kHz peak with Maxell UD XL-I at -20 dB is a bit much, and the general droop at higher frequencies at Dolby level with Sony EHF and other Type II tapes indicated a recorder limitation.

Phase jitter in the playback of a 10-kHz tone was 40 degrees, typical for a cassette deck. The multiplex filter was 3 dB down at 16.4 kHz and a good 32.7 dB at 19 kHz. Bias in the output during recording was very low. Separation between tracks of the stereo pair was an excellent 56 dB at 1 kHz, and crosstalk and erasure at the same frequency were down more than 80 dB, also excellent results. Erasure at 100 Hz with metal tape was more than 65 dB, one of the better results to date.

The third harmonic distortion level was measured for each of the tapes at 1 kHz in Dolby NR/HX mode from 10 dB below Dolby level to the point of three-percent distortion. The curves in Fig. 5 are fairly linear, but there were some reversals in slope, with causes unknown. HDL₂ was quite low, and HDL₅ was very low at each point checked. The distortion levels without NR/HX were about twice as high, a greater difference than measured at any time in the past. It would appear that the new scheme was “better-than-ever” in reducing distortion. Then, a look was given at HDL₃ at -10 dB from 30 Hz to 5 kHz with UD XL-I tape, with and without Dolby NR/HX. Figure 6 tells an interesting story. First of all, the distortion without Dolby is quite good across the band. The addition of NR/HX, however, reduces the distortion at each point, especially the region around 100 Hz to 1 kHz, with just 0.04 percent HDL₃ at 400 Hz — an excellent figure!

The signal-to-noise ratios were measured with both IEC A and CCIR/ARM weightings, and the results are listed in Table II. Note that the highest figures with IEC A weighting go with Maxell UD XL-I and TDK MA-R, but with CCIR/ARM weighting Sony EHF is the leader. As all of the results are excellent, tape choice would be based upon other factors normally. Input sensitivities were 87 mV for line and 0.20 mV for mike. Input overload was about 31 V for line and 16.1 mV for mike. Output clipping occurred at +14 dB relative to meter zero. The line input impedance was 40 to 68 kilohms over most of the range, falling slowly to 28 to 37 kilohms at 20 kHz, with the lowest impedances at each frequency with the input pot fully CW. The pot itself showed tracking within a dB for the two sections from maximum down 60 dB — excellent. Line output was 750 mV into the rated 50 kilohms, falling to 605 mV with the IHF 10-kilohm load. Headphone drive was 40 mV with 8-ohm loading, which generated a good volume with each of the phone sets tried.

The meter scales were very accurate from “-3” to “+4.” The lowest part of the scale was about a dB in error, and there was a deflection limit at “+4.5,” just shy of the last marking, “+5.” The meter frequency response was 3 dB down at 17 Hz and 20.7 kHz. The dynamic response of the meters was checked against IEC Standard 268-10 for peak program meters. With a 3-mS burst, the response was just 3 dB down, meeting the standard. With a 10-mS burst, the -2.3 dB indication was just below requirements of the standard. The 20-dB decay time was 1.5 S, within the standard. Deflection increased with positive d.c. shift added to the tone burst, but

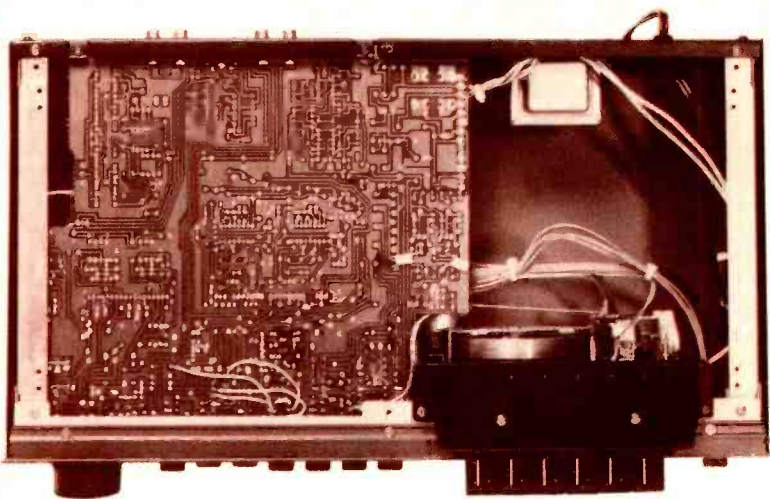


Fig. 7 — Tape play speed vs. line voltage, and wtd. rms and wtd. pk. flutter (three trials each).

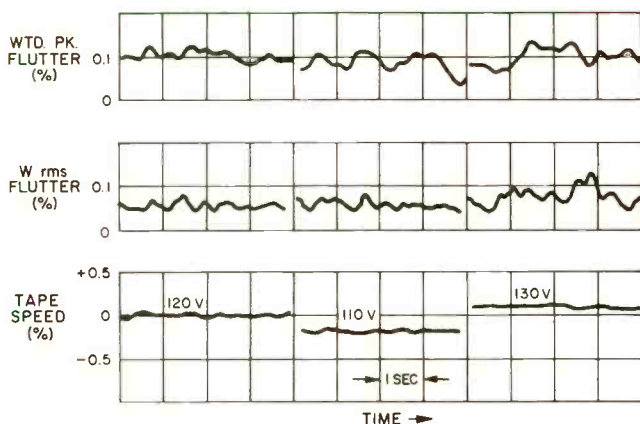


Table II—Signal/noise ratios with IEC A and CCIR/ARM weightings.

Tape Type	IEC A Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby NR		Without NR		W/Dolby NR		Without NR	
	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%
Maxell UD XL-I	61.3	67.5	53.6	59.8	58.9	65.1	48.9	55.1
Sony EHF	63.2	66.3	55.5	58.6	63.3	66.4	53.2	56.3
TDK MA-R	63.5	67.5	54.6	58.6	61.4	65.4	51.4	55.4

only very slightly with a negative shift added. Overall, the meters were classified as true peak reading, with minor deficiencies.

A 3-kHz tone was recorded with the line voltage at 120 V. In playback, tape speed was measured at that voltage, and then at 110 V and 130 V. With the lower voltage, speed dropped about 0.2 percent, and the higher voltage caused an increase of 0.1 percent. These changes would not normally be significant (a semi-tone equals ± 5.9 percent), but might have some importance to a user in an area with poor line-voltage regulation. There were three trials each for measuring wtd. rms and wtd. pk. flutter. Typical figures were 0.065 percent wtd. rms and 0.095 percent wtd. pk. Wind times were 105 seconds for a C-60, slower than most decks, but the wind was smooth. The time from run-out to stop was about 4 seconds in wind and 2 seconds in play. It was pleasantly surprising to find that it was possible to go from any mode to any other *without* going through *Stop*. This was definitely differ-

ent from the interlocking tape-motion controls in other decks of lever/key design. For example, it was quite easy to do flying start recording. All you do is hold down *Play* and push down *Rec*.

Use and Listening Tests

Some time was spent switching from one transport mode to the other, ignoring all the rules about going through *Stop* when using a deck with direct mechanical actuation. No jams occurred, and it was noticed that the transport effectively went through *Stop* in all the combinations tried, even though that lever was not used. Loading and unloading cassettes, cleaning and demagnetizing were all easily performed. The push-button switches were easy to use and completely reliable. I would have preferred a slightly different layout: With *Memory* to the left under the counter, and the Dolby NR/HX status light near its selector switch. The level meters were easy to use, but would have been more so with thicker needles and less lag between music peak and maximum needle deflection. The instruction manual was in draft form, and the illustrations could not be checked. The text, however, had considerable detail with many pertinent comments with excellent maintenance instructions.

Listening checks were made primarily with record sources, direct discs including Buddy Spicher's *Yesterday and Today*, dbx-encoded discs such as John Williams' *The Empire Strikes Back* and others, and pink noise. Most everything sounded very good, although it was possible to hear little subtle losses when using the dbx-encoded discs. Increased noise was one of the changes noted regularly. The results with Type II tapes (CrO₂ types) weren't very good — dull at higher levels. The metal tape was excellent at high levels; that was expected. The surprise was how excellent the ferric tapes sounded at high record levels — a definite contribution from Dolby NR/HX. Noise from *Rec*, *Pause* and *Stop* was very low in each case, with a little "click" out of tape noise with *Stop*. The unit generated very little heat, which might be of interest to some users.

The NAD 6040 deck offers excellent responses, even with ferric tapes at Dolby level, low distortion, high signal-to-noise ratios, high separation, and peak-responding meters. A good part of such success is due to the successful incorporation of Dolby NR/HX. With a price of \$279.00, this deck is certainly a good value, with performance comparable to some decks selling at much higher prices.

Howard A. Roberson

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Astatic MF-100 Moving Flux Phono Cartridge



Manufacturer's Specifications

Type: Moving Flux.

Output Voltage: 3.5 mV at 1 kHz, 5 cm/S.

Channel Balance: Within 1 dB or less at 1 kHz.

Frequency Response: 10 to 40,000 Hz; 10 to 20,000 Hz \pm 1 dB.

Channel Separation: 25 dB or more at 1 kHz.

Inductance: 90 mH.

Static Compliance: 50×10^{-6} cm/dyne.

Tracking Force: 1.25 grams \pm 0.25.

Load Impedance: 47 kilohms at 100 pF.

Stylus Tip: Parabolic (Shibata shape).
Replacement Stylus: N1725-Qd (Black).

Price: \$267.50.

The 50-year-old Astatic Corp. is known throughout the world as a pioneer in the manufacture of OEM phono cartridges and, in particular, replacement styli. It's hard to believe that 50 years have gone by since this reviewer first used an Astatic replacement stylus — time doth march on! At any rate, with today's trend towards various magnetic phono cartridge designs, rather than ceramic types, Astatic has developed the recently patented Moving Flux principle for their new line of magnetic phono cartridges.

When asked to review this cartridge, the first question was, what in the world is a Moving Flux magnetic cartridge? Careful reading of the United States patent covering this new magnetic principle supplied the answer.

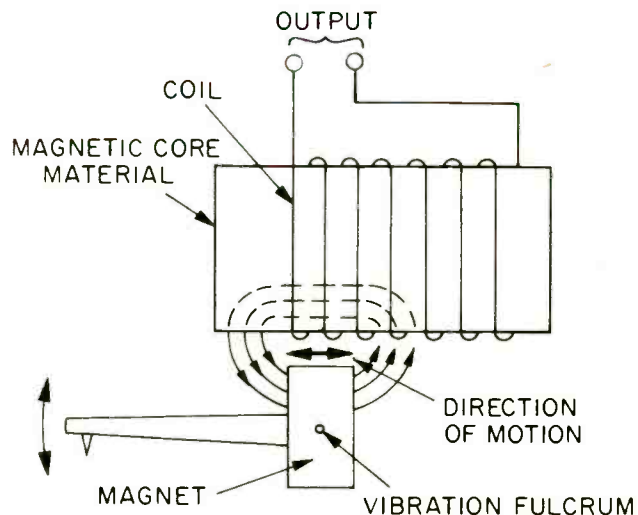
Moving Flux phono cartridges apparently incorporate all the advantages of both moving-coil and moving-magnet cartridges without the usual disadvantages. Specifically, this means achieving the linearity of the conversion system used in the moving-coil cartridge, which converts the mechanical signals into electrical signals, along with the high output efficiency of the moving-magnet cartridge's vibration system, which is composed simply of the magnet and cantilever.

The principle of the Moving Flux cartridge's generation of a signal voltage is shown in Fig. 1, with one channel illustrated. Note that a coil is wound around a magnetically permeable core material and that the coil is placed in close proximity to a magnet which is attached to the stylus cantilever. When motion from the record groove is transmitted by the cantilever to the magnet, the magnet undergoes clockwise and counterclockwise motion. However, the center of the flux generated by the magnet moves along the coil, aided by the core material's permeability, and the voltage induced in the coil remains essentially linear. High efficiency is achieved because the magnet's lines of flux cut the coil at 90 degrees.

After reading all the patent claims for the Moving Flux principle, we wondered if the phono cartridge really worked and was as good as claimed. The answer is a resounding "yes" to both queries.

The MF-100 has its Shibata-type parabolic diamond stylus mounted directly to what appears to be an aluminum cantilever. This stylus shape is claimed to provide a stylus-groove contact area four times greater than an elliptical or conical tip. A transparent plastic flip-down stylus guard is located on the front of the cartridge, which comes with a screwdriver, mounting screws, stylus brush, and instructions in a simple plastic case enclosed in a plain black cardboard box. The stylus is user replaceable and is a high-compliance type. Because the cartridge body hides the stylus when viewed from the usual top-front angle, cueing can be a bit difficult. It would have been helpful if the manufacturer had incorporat-

Fig. 1 — Layout of major components used in Moving Flux cartridges, one channel shown.



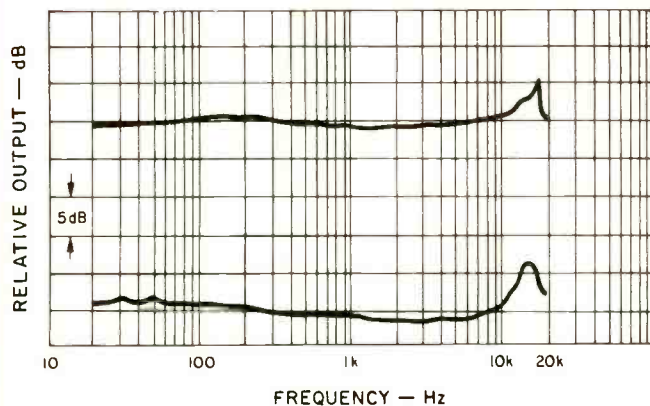


Fig. 2 — Frequency response and separation using B&K's QS-2009.

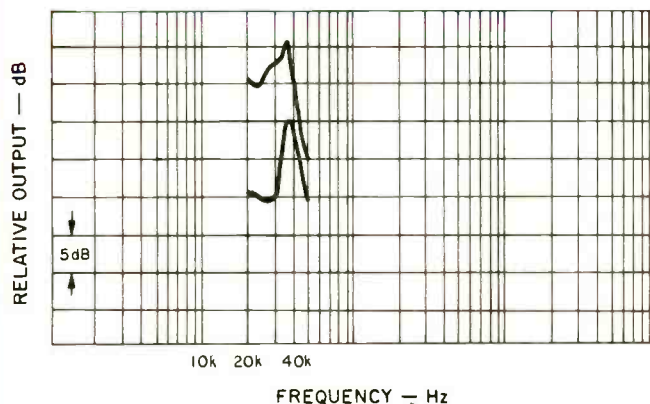


Fig. 3 — Frequency response and separation using JVC's TRS-1005.

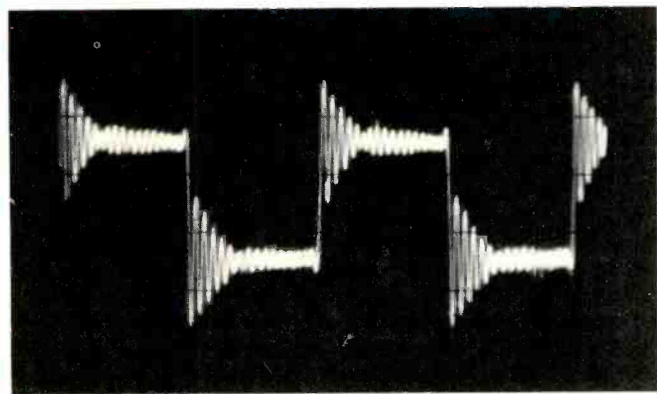


Fig. 4 — Response to a 1-kHz square wave from CBS STR-112.

ed a more highly visible vertical index mark on the front of the cartridge, in line with the stylus, for use in cueing.

Measurements

The Astatic MF-100 was mounted in an Audio-Technica AT-S headshell in the Technics EPA-100 tonearm mounted on a Technics SP-10 Mk II turntable. The cartridge was oriented in the headshell and tonearm with the Dennesen Geometric Soundtracktor. Laboratory tests were conducted at an ambient temperature of 76° F. $\pm 1^\circ$ (24.4° C) and a relative humidity of 64 percent ± 3 percent. The tracking force for all reported tests was at 1.25 grams, with an anti-skating force of

1.6 grams. A cartridge load of 47 kilohms and 100 pF capacitance was used for all tests; the cartridge did not appear to be capacitance sensitive. As is our practice, measurements are made on both channels, but only the left channel is reported unless there is a significant difference between the two channels, in which case both channels are reported for a given measurement.

Frequency response, using the B&K QR-2009 and the JVC TRS-1005 test records, is ± 1 dB from 20 Hz to 7 kHz, +1.5 dB at 10 kHz, +3.5 dB at 15 kHz, +6 dB at 18 kHz, and +1 dB at 20 kHz. In the high-frequency region the response is +2.5 dB at 30 kHz, +7.5 dB at 39 kHz, +2 dB at 40 kHz, and -10 dB at 50 kHz. Separation is 25 dB at 1 kHz, 25.5 dB at 10 kHz, 22 dB at 15 kHz, 23 dB at 20 kHz, 18.5 dB at 30 kHz, 6 dB at 40 kHz, and 5.5 dB at 50 kHz — all truly remarkable. From these data, it is evident that the MF-100 has an excellent frequency response and a most satisfactory high-frequency separation.

The 1-kHz square-wave response shows quite a large overshoot, almost to the full amplitude of the square wave, followed by ringing that decayed rapidly. This is probably due to a relatively undamped stylus resonance at about 34 kHz. The cartridge-arm low-frequency lateral resonance is at about 9 Hz and the vertical resonance is at about 10 Hz, both measured with the Technics EPA-100 tonearm.

The following test records were used in making the reported measurements: Shure TTR-103, TTR-109, TTR-110, and TTR-115; Columbia STR-100 and STR-112; B&K QR-2009; JVC TRS-1005; Deutsches Hi-Fi No. 2; Nippon Columbia Audio Technical Record (PCM) XG-7002, and Ortofon Direct-Cut Pickup Test Record 0001.

Wt., 5.34 g; d.c. res., 1688 ohms; ind., 111.6 mH; tracking force, 1.25 g; anti-skating force, 1.6 g; output, 1.02 mV/cm/S; IM distortion (4:1): +9 dB lateral, 200/4000 Hz, 1.8 percent; +6 dB vertical, 200/4000 Hz, 4.8 percent; crosstalk (using Shure TTR-109), 28 dB; channel balance, 0.5 dB; trackability: high freq. (10.8 kHz pulsed), 30 cm/S, mid-freq. (1000 + 1500 Hz, lat. cut), 31.5 cm/S, low freq. (400 + 4000 Hz, lat. cut), 30 cm/S; Deutsches Hi-Fi No. 2 300-Hz test band was tracked cleanly to 77 microns (0.0077 cm), lateral at 14.5 cm/S at a level of +8.70 dB, and 43.1 microns (0.00431 cm) vertical at 8.12 cm/S and a level of +3.64 dB.

The Astatic MF-100 played all the test bands except for level 5 of the violin, where some distortion was evident, on the Shure Obstacle Course — Era III. On the Shure Obstacle Course — Era IV, the cartridge passed all test bands without a problem except for the harp test band level 5, where just a hint of mistracking was heard. This constitutes very good performance.

Use and Listening Tests

As usual, we performed many hours of listening tests both before and after measurement. On listening it was impossible to ascertain whether you were listening to a moving-coil or moving-magnet cartridge, for at one time it sounded similar to an MC and at other times like an MM, all depending upon the type of music being played. The cartridge acquitted itself very well, with first-rate sonic clarity, excellent transient response, and a well-defined and tight bass. Badly warped records were tracked without apparent difficulty. The MF-100 introduced no apparent coloration nor audible distortion to the music being played. The human voice was reproduced rather well and applause definition was excellent. The overall musical response is very clean. All in all, the MF-100 phono cartridge scored very high marks. After an extended period of listening, we feel that the Astatic MF-100 phono cartridge certainly merits serious consideration by all music lovers.

B. V. Pisha

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Evaluation Equipment and Records

The following equipment was utilized in the listening evaluation of the Astatic MF-100 phono cartridge: Technics SP-10 Mk II turntable, Technics EPA-100 tonearm, Nikko Beta 1 preamplifier, Crown IC-150A preamplifier, Audionics of Oregon Space and Image Composer, Audire DM-700 power amplifier, Audio Innovations LED 2C Dynamic Power Display, and a pair of stacked Duntech DL-15B speakers in each channel. Each pair of speakers was connected to the Audire DM-700 power amplifier with Monster Cable. The turntable was equipped with the Hiraoka Disk-SE 22 turntable mat.

The following records were among those used to aurally assess the performance of the Astatic MF-100 cartridge:

Stereo

Supertramp, Crime of the Century— Mobile Fidelity Sound Lab. MFSL1-005.
 John Williams: *Close Encounters of the Third Kind*, Mehta, Los Angeles Philharmonic Orchestra — Mobile Fidelity Sound Lab. MFSL1-008.
 Mahler: *Symphony No. 4*, Karajan, Berliner Philharmoniker — Deutsches Grammophon 2531 205.
Virtuose Kammermusik, Wolfgang Schulz, Querflöte — Telefunken 6.42364AP.
 Bach: *Die Dreifaltigkeitssorgel zu Ottoburen*, Ton Koopman, organ — Telefunken 6.35375DX.
 Indianapolis Symphony Orchestra, *Fifty Colorful Years* — RCA DPL2-0432.
Parnassus Ensemble — Accent Acc 7806.
 Kabi Laretei, piano, *Close-ups*, the film music of Ingmar Bergman — Proprius Prop 7829.
 Mozart: *Requiem*, The Stockholm St. Jacob Choir, Stefan Skold — Proprius Prop 7815.
 Pavarotti, *O Sole Mio*, Favorite Neapolitan Songs — London OS 26560.
 Mendelssohn: *Symphonien No. 4 & 5*, Bernstein, Israel Philharmonic Orchestra — Deutsches Grammophon 2531 097.
 Handel: *Organ Concertos*, George Malcolm, organ — Argo ZRG 888.

Direct to Disc

Space Organ, Jonas Nordwall, organ — Crystal Clear Records CCS 6003.
 Laurindo Almeida, *New Directions* — Crystal Clear Records CCS 8007.

Blockbuster— East World (Toshiba-EMI) EWLF-98002.

Naima— East World (Toshiba-EMI) EWLF-98004.

Montgomery and Lytle, *Ragtime Piano for Four Hands*— Sonic Arts Laboratory Series No. 6.

Woofers, Tweeters and All That Jazz (binaural) — Sonic Arts Laboratory Series No. 7.

Beethoven: *Piano Sonata No. 23 in F Major, Op. 57 "Appassionata"*, I. Kamiya, pianist playing the Bosendorfer Imperial piano — RCA (Japan) RDC-4.

Vivaldi: *Four Seasons*, M. Hayakawa, Vivaldi Ensemble, Tokyo — RCA (Japan) RDCE-501-2.

New Baby, Randi and Quest — Sheffield Lab. 12.

Introducing Bosendorfer (Imperial) and Kimball (Professional): The State of the Art in Recording Pianos — Kimball Piano & Organ Co., Jasper, Ind. 47546.

Pulse Code Modulation (PCM) Digital to Analog

The Tip of the Weisberg — Nautilus NR 7.

John Williams Works — Denon SX-7006.

Digital Spectacular, Stanley Black, His Piano and Orchestra — London LDP 30001.

Mozart: *Symphony No. 38 in D Major "Prague" and Symphony No. 36 in C Major "Linz"*, Suitner, NHK Symphony Orchestra — Denon OX-7156-ND.

Famous Classical Music on Screen — Denon OX 7146-ND.

Beloved Screen Music — Denon SX-7008.

Screen Music for Lovers — Denon SX-7007.

Schubert: *Sonata in A Minor for Arpeggione and Piano*; Vieuxtemp: *Sonata in B-flat Major for Viola and Piano* — Denon OX-7154-ND.

Proprius and Accent records are distributed by AudioSource, 1185 Chess Drive, Suite G, Foster City, Calif. 94404.

East World (Toshiba-EMI), Sonic Arts Corp., and RCA (Japan) direct-to-disc records are distributed by Audio-Technica, 1221 Commerce Drive, Stow, Ohio 44224.

Denon records are distributed by American Audiopoint, Inc., 1407 N. Providence Rd., Columbia, Mo. 65201.



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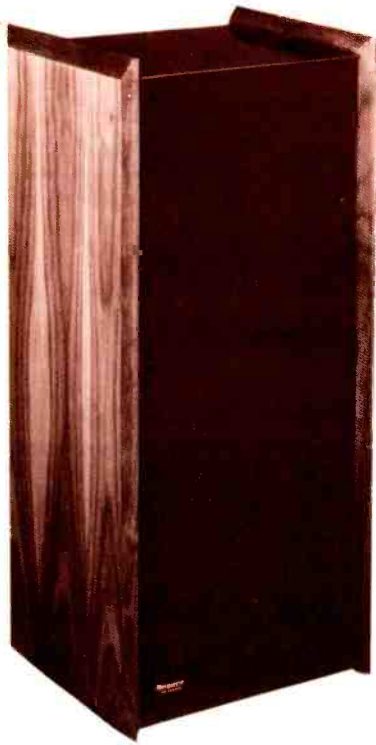
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Fulton Nuance Loudspeaker

Manufacturer's Specifications

System Type: Four way, full range.

Woofer: 10 inch.

Frequency Range: 35 Hz to 42 kHz.

Crossover Points: 760 Hz, 6.5 kHz, and 15 kHz.

Nominal Impedance: 8 ohms.

Suggested Amplifier Power: 35 watts and up.

Level Controls: One bass, one mid-range, and one tweeter.

Dimensions: 34 in. (86.4 cm) H x 14 in. (35.6 cm) W x 13 in. (33 cm) D.

Weight: 75 lbs. (34.1 kg).

Price: \$947.50.

The Nuance, by Fulton Musical Industries of Minneapolis, Minnesota, is a four-way, full-range loudspeaker system. Standing 864 mm (34 in.) high, this sealed-enclosure system houses a 254-mm (10 in.) woofer which covers the frequency range from 35 Hz to a crossover at 760 Hz. A 127 mm (5 in.) midrange carries the range up to 6500 Hz, a midtweeter handles the next band up to 15 kHz, and a super tweeter takes the response upward to a stated limit of 42 kHz. These individual drivers are staggered back from the front of the enclosure in the now-familiar manner which corrects for the individual time delay of each driver so that a nearly coherent wavefront is present for axial sound.

Connection to the system is interesting in that the user may choose either normal wiring, with all speakers driven from a single amplifier, or bi-amplification of woofer separately from midrange and tweeters. The terminals and connecting straps are available on the rear of the enclosure and a well-illustrated owner's manual explains details of this setup. Three level controls (woofer, midrange and tweeter) are provided for user adjustment of speaker balance to suit various room acoustic situations and individual sound preference. Two user-replaceable fuses are provided, a 2-amp woofer fuse and a 1-amp tweeter/midrange fuse.

The enclosure is of walnut veneer, and there is an interesting accent decoration which is utilitarian as well as attractive. A dark glass plate, with vibration isolators, is placed on the top of the enclosure. The Nuance is just tall enough to be a suitable place on which to set a drink at a party or place a lamp. The glass plate can be readily wiped off, whereas an unprotected walnut top could be ruined. I wish more manufacturers would recognize that speakers get kicked, tipped over, and have drinks placed on them, just as other pieces of fine furniture do. If it's worth this kind of money, it's worth protecting.

The owner's manual is thorough, and most persons should have no difficulty successfully following its instructions to get proper performance from the Nuance.

Measurements

Impedance, measured at the terminals of the Fulton Nuance, versus frequency for two of the equalizer positions is shown in Fig. 1; the designations MAX and MID refer to equalizer settings. The low bass resonance rise at 40 Hz accounts for the highest impedance, with a second impedance peak around 1 kHz. Above this 1-kHz peak, the impedance drops with increasing frequency, showing no absolute minimum value within the audio range. It drops to 5 ohms at 20 kHz and could possibly indicate amplifier problems if its phase were such as to represent a large capacitive reactance load. Figures 2 and 3 are the polar impedance plots corresponding to the two equalizer positions of Fig. 1. It is evident from the polar plots that the Nuance's impedance, while still dropping at 20 kHz, presents a load that is principally resistive. This speaker system should, for all intents and purposes, be considered an 8-ohm system and should present no load problems to any good amplifier.

The anechoic frequency response, measured at one meter on axis with a drive level of constant voltage corresponding to one average watt into 8 ohms, is shown in Figs. 4 and 5; Fig. 4 is the amplitude response and Fig. 5 is the phase response. The phase response is corrected for an air-path delay of 3.328 milliseconds. The amplitude response shows reasonable smoothness up to 8 kHz, where there is a drop in sound energy; two Nuance units were measured and the responses were essentially identical. The equalizers on the speaker were set to their mid position for these measurements. Although the high-frequency performance in this measurement could be improved by repositioning the measuring microphone directly in front of the tweeter, the one-meter, axial location is the reference position used for all *Audio* speaker tests and is a position which can be accurately duplicated by any acoustic laboratory. The system is essentially minimum phase below the cutoff of 8 kHz but departs from this condition above that frequency.

Figure 6 is the result of our three-meter room test. The

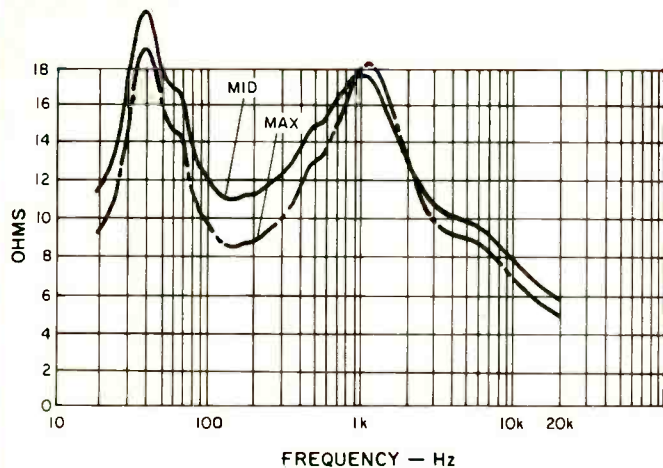


Fig. 1 — Impedance at the terminals of the Fulton Nuance with two equalizer settings.

off of the higher frequencies due to the narrower directivity pattern of the tweeters. The vertical dispersion pattern is less smooth and shows the effect of housing the time-delay staggered configuration of individual speakers in an enclosure which extends past the units to form a planar front surface for grille mounting. The result is a lobed pattern in the vertical plane. The Fulton Nuance should never be positioned, according to this measurement, such that the left channel of a stereo pair is at a height different than that of the right channel.

Harmonic distortion measurements for pure tones of 41.2 Hz (E_1), 110 Hz (A_2), and 440 Hz (A_4) are shown in Fig. 9. This loudspeaker is capable of handling robust power levels with quite low harmonic distortion, even on the low bass.

The IM test, Fig. 10, measures the extent to which a higher musical tone, A_4 , is modulated by the presence of the lower musical tone, E_1 . Both tones are mixed at equal level, and the rms value of the sidebands on A_4 is shown as a percentage of the acoustic level that A_4 would have if the lower tone were not present. The data are plotted as a function of average power in watts referred to 8 ohms. Below 1 watt the modula-

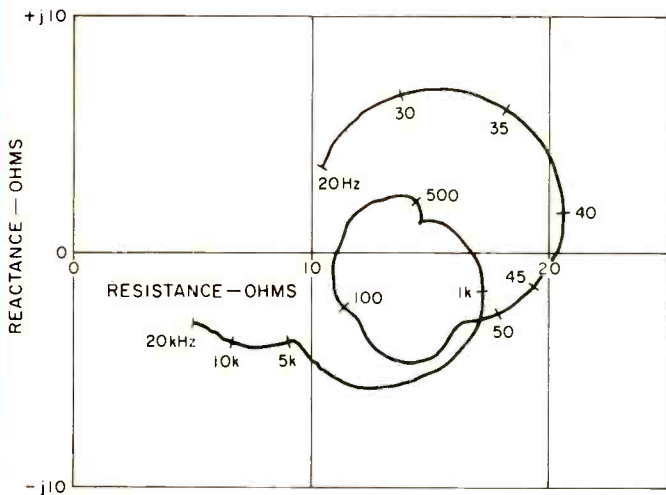


Fig. 2 — Complex impedance (reactance vs. resistance) at the terminals with all equalizer pots in the "Mid" position.

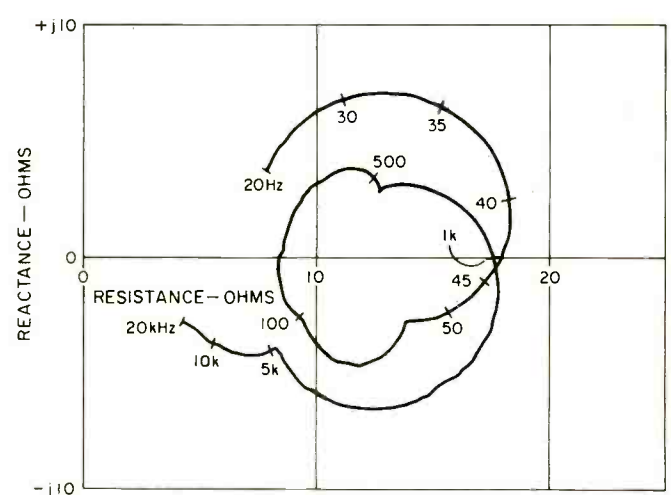


Fig. 3 — Complex impedance with all equalizer pots in the "Max" position.

loudspeaker was placed in its recommended room position and the microphone was placed at a typical listening location, one meter off the carpeted floor and three meters in front of the loudspeaker. The frequency spectrum of the first 13 milliseconds of direct sound from the Nuance is shown in this measurement. Two listener-speaker geometries are shown: A 30-degree off-axis position corresponding to a stereo left-channel speaker situation, and a direct on-axis situation. The two curves are displaced 10 dB for clarity of presentation. This measurement shows a considerable departure between 13-millisecond early sound and the anechoic response of Fig. 4; upper register differences appear due to midrange energy which reflects off floor and ceiling. A more balanced sound will be presented to the listener if the speakers are rotated toward the listening location, according to this measurement, and it may prove helpful to pull up the highest registers by means of preamplifier equalization.

The measured horizontal and vertical dispersion patterns are shown in Figs. 7 and 8 for the MID setting of all equalizers on the speaker. Horizontal response is uniform within 15 degrees of center position, but begins to drop off smoothly for larger off-axis angles. This is principally caused by the fall-

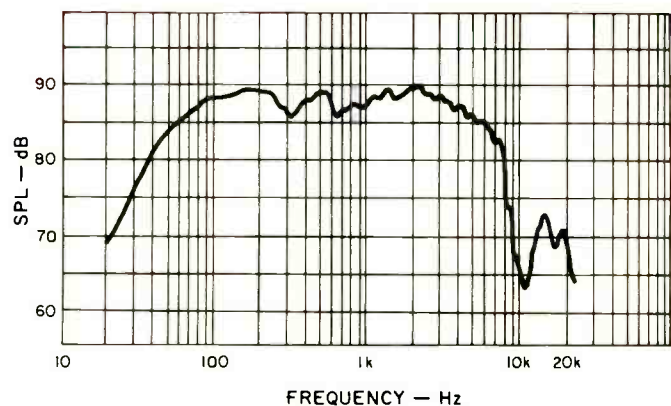


Fig. 4 — Anechoic frequency response taken at one meter on the center axis with a constant voltage drive level corresponding to one average watt into 8 ohms; equalizers are in "Mid" positions.

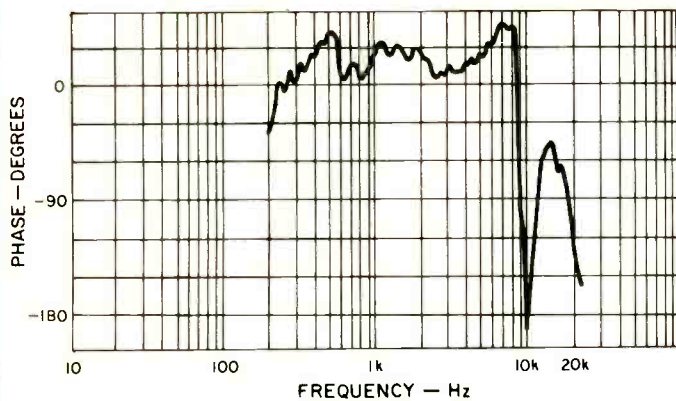


Fig. 5 — Anechoic phase response at one meter on axis with "Mid" equalizer settings.

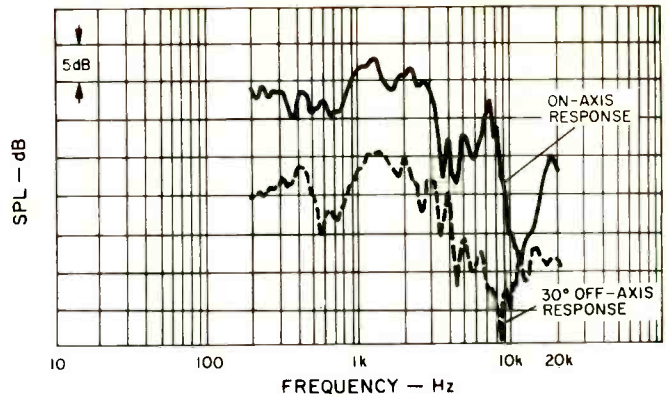


Fig. 6 — Three-meter room test.

tion is essentially an amplitude variation on A_4 , with increasing amounts of angle modulation appearing with increases in power level, until at 40 watts there is 10 percent p-p amplitude modulation and 10 degrees p-p angle modulation. At the highest power levels, a small average migration of the acoustic center of sound toward the listener suggests that a small amount of depth and lateral image shift of certain orchestral voices may be experienced at heavy levels of low frequency content, such as kick drum reproduced at high intensity.

Acoustic transfer uniformity is another measure of a loudspeaker's ability to handle program dynamics. In this test, the ratio of sound pressure to driving voltage should remain constant for any tone at any power level within the system's normal range of reproduction. If this ratio changes with drive level, then we can expect both musical timbre and image localization to alter with sound intensity. Four musical tones, C_2 (65 Hz), A_2 (110 Hz), Middle C (262 Hz), and A_4 (440 Hz) were used to check the Nuance. These are tone-burst tests in which a tone is applied for a short duration simulating a staccato passage. The low bass tone of C_2 was handled up to 100 average watts with less than a 0.1 dB departure from perfection. Middle C and A_2 were essentially perfect up to 2 average watts, then the ratio of acoustic output to applied voltage began to diminish at higher levels. A_2 was down 1 dB at 20 average watts while Middle C was down 0.3 dB at this level. A_4 was down 1.4 dB at 20 average watts (all referenced to an average power of 0.1 watt). This implies that

strongly played musical chords will have a mild tendency to dull since the acoustic output of the higher partials will diminish faster with increasing power than that of the lower tones. One might also expect a lateral shift of stereo imaging for sudden, high intensity passages of sound. To place this in perspective, it should be pointed out that these subjective effects will begin to take place above sound pressure levels in the order of 100 dB at one meter from the speaker, a moderately robust level.

Another form of distortion of program dynamics is checked by what we call the crescendo test. A low-level tone is measured for sound level change when a broad-band incoherent noise is superimposed at an average level 20 dB above that of the tone. The intent of this test is to determine the extent to which an orchestral inner musical voice is modified by a sudden swelling of sound from nearby instruments. The Fulton Nuance does quite well in this test. Less than half a dB of tone change is induced by peak incoherent signals of 300 watts. This means that orchestral shimmy, where solo instruments are blurred and shifted in the stereo illusion by sudden high-intensity ensemble bursts, is essentially nil.

The energy-time curve is a measure of percussive impulse response; the measured curve for the speaker is shown in Fig. 11. The microphone is placed one meter from the front surface of the loudspeaker and along the geometric axis. The first sound commences at 3.200 milliseconds and has a broad peak in the 3.25 to 3.35 millisecond time range. The series of events occurring with periods of around 1.4 milliseconds are

Fig. 7 — Horizontal polar energy response.

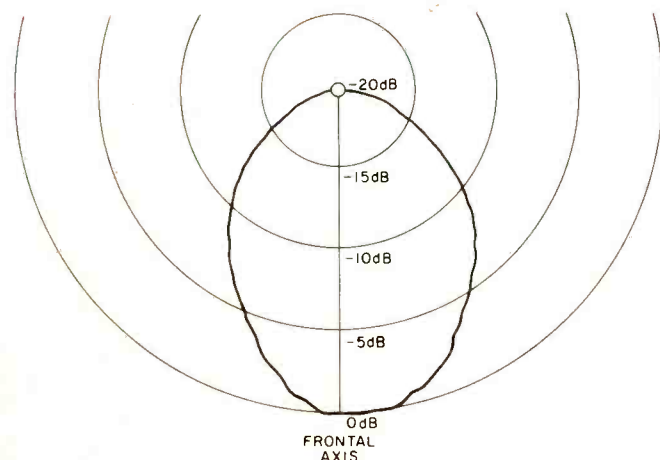
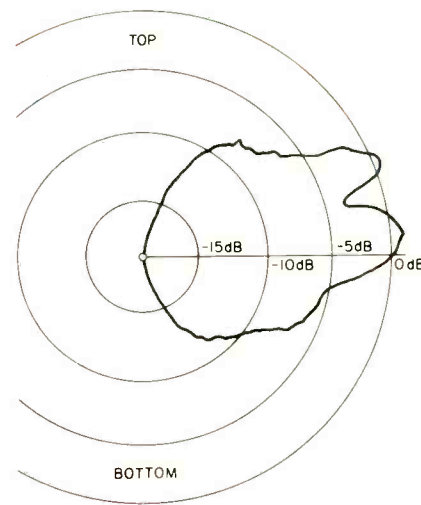


Fig. 8 — Vertical polar energy response.



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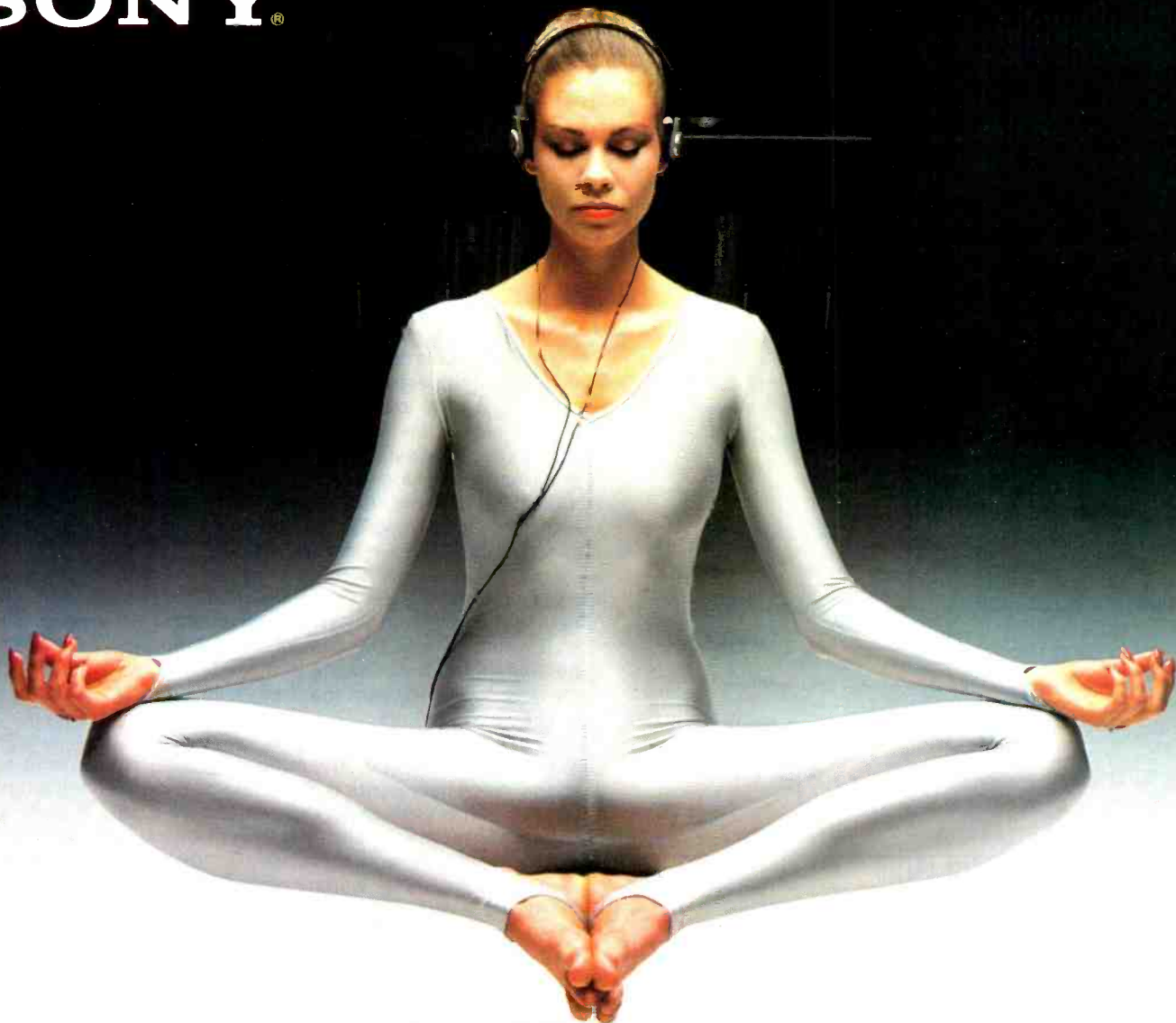
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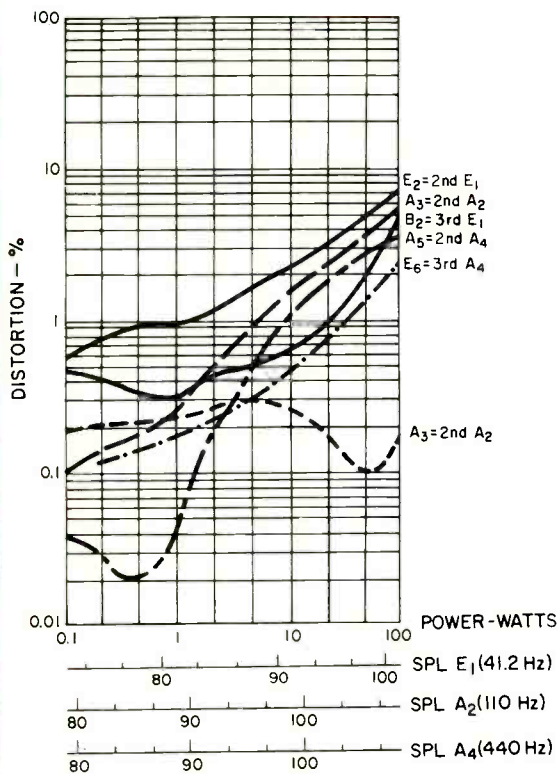


Fig. 9 — Harmonic distortion for the musical tones E₁ or 41.2 Hz, A₂ or 110 Hz, and A₄ or 440 Hz.

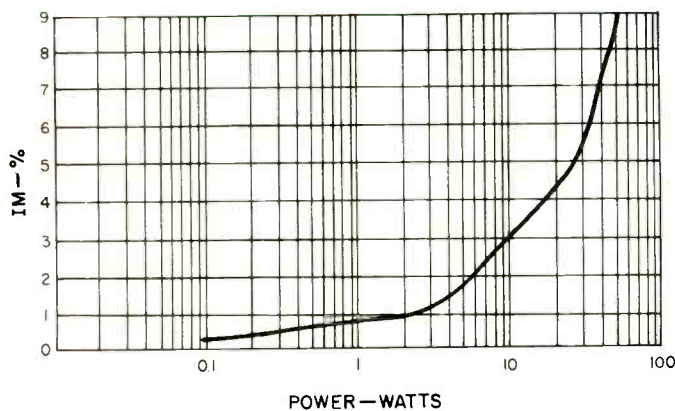


Fig. 10 — IM distortion on A₄ (440 Hz) by E₁ (41.2 Hz) when mixed in a one-to-one ratio.

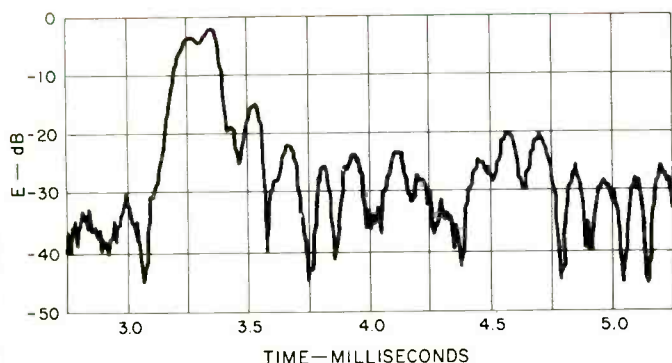


Fig. 11 — Energy-time curve.

repetitive time-domain echos corresponding to the drop off in frequency response above 7.5 kHz (Fig. 4). This is an effect dictated by the relationship between the time domain and the frequency domain: Namely, sharp edges in frequency response mean sideband ripples in the time response, and conversely. It would be my interpretation of this energy-time measurement that impulsive sounds may have a coloration corresponding to an apparent spectral dominance (or, perhaps, hangover) in the 7- to 8-kHz range, even though the net sound energy was not peaked in this range.

Listening Test

After experimenting with a variety of room locations for the Fulton Nuance, I settled on a reasonably conventional position, slightly away from a solid wall and enclosing a 60-degree angle relative to the listener. This configuration appeared, to my ears, to give the most accurate sound. I also preferred the sound which I got when the Nuances were rotated toward the listening position, which brings up the high-frequency response and seems to improve stereo lateralization of percussive instruments.

Low-frequency performance of these speakers is quite good, and one can get a substantial amount of gut-thumping bass without distortion. The lower midrange is smooth and well balanced with this bass response, though I felt the upper midrange (commencing in the octave above Middle C) is down in level and, from that frequency range upward, not as satisfactory.

There are three level controls on the Nuance — woofer, midrange and tweeter. The midpoint, or 12 o'clock location, is the reference position for these screwdriver adjustable controls. One difficulty I experienced in setting these controls for best timbre balance is caused by irregularities in the vertical response, and there seemed to be no one control setting where there weren't some listening positions that didn't have difficulty in the upper partials. This creates a blurring of the stereo illusion on orchestral strings and causes a stridency in piano and human voice. On material with extremely fast percussion, such as *Hot Stix* (M&K RT 106), I used a 4-dB boost in preamplifier equalization at 9 kHz to restore what, to me, was a proper sense of snap. All of this, of course, is a very personal subjective impression. Others may find the Fulton Nuance as well balanced in midrange to treble as I did the bass to midrange.

In several other respects, such as the ability to handle large orchestral dynamic range without evidence of strain and delivery of clean, low distorted solo instrument voices at robust as well as soft levels, the Fulton Nuance is an excellent performer.

Richard C. Heyser

(Editor's Note: Fulton informs us that Nuance speaker systems produced since submission of this pair are wired with some 25 feet of Fulton's high-technology Brown Series wire, which results, they tell us, in a "startling improvement in inner detail of mids and highs. Complementing this is a new higher order crossover, designed to have greater speed," says Fulton, "which provides up to 3.5 dB more energy in the 200 to 800 Hz range, as well as above 7 kHz.")

Terminal impedance of the Nuance, Fulton also said, is now smoother, a minimum of 7.6 ohms at 20 kHz and above, so that the system is compatible with virtually any amplifier or receiver. The particular nature of the vertical dispersion was an important design goal, says Fulton, in that a properly controlled shape for the vertical polar pattern insures good depth and perspective in the sound field, good sense of height in the stage presence, and proper placement of instruments in their correct size.—E.P.)

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The continuing story of TDK sound achievement.

Parts Five and Six.



The guide roller and spindle pin are the turning point in a TDK cassette. It's there the tape takes on a sudden surge of tension. The winding angle changes sharply to 75°, causing great stress. The slightest imperfection, even a microscopic speck, will cause serious output fluctuations in sound.



TDK guide roller and spindle pin in cassette.

TDK engineers began by analyzing existing molding techniques. They knew many manufacturers used a low cost, inferior split-die process. This turned out rollers with seams, which disturb tape travel. Spindle pins were no better. Merely convenient mold extensions with pullout tapers which allowed rollers to slip up, wear out and wrench the tape off the track.

Part Five, the TDK guide roller, is flared and absolutely seamless. Made from a low-friction precision

molded plastic, it's created in one piece through an expensive forced-injection mold technique. Its flared edges provide perfect tape guidance while its six spokes maintain rigidity and perfect circularity. The tape flows through the mechanism and past the head gap in true vertical alignment. There's virtually no tracking variation or loss of high frequencies. Sixty checkpoints during the manufacturing process guarantee it.

For *Part Six*, the TDK spindle pin, our engineers chose stainless steel. Machined to size and aligned to a perfect 90°, it's designed without a taper. Micro-polishing and a silicone coating cut down friction. The TDK spindle pin is far more resistant to heat and cold than plastic. It won't bend out of shape

and wear down the spindle. Tape is assured safe passage with virtually no flutter or channel loss.

In a TDK cassette, the parts are much like the instruments of an orchestra. All equally important. Music is an outcome of the perfect interplay between them. In the end, that's what's so distinctive about TDK.

Music is the sum of its parts.

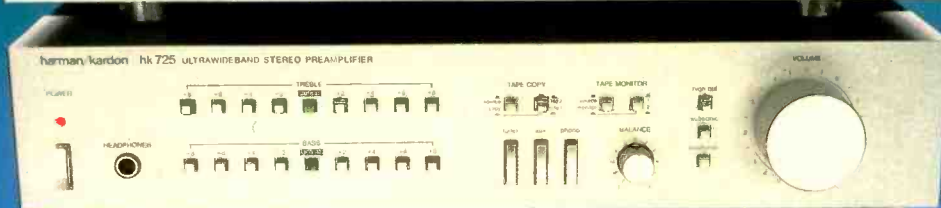


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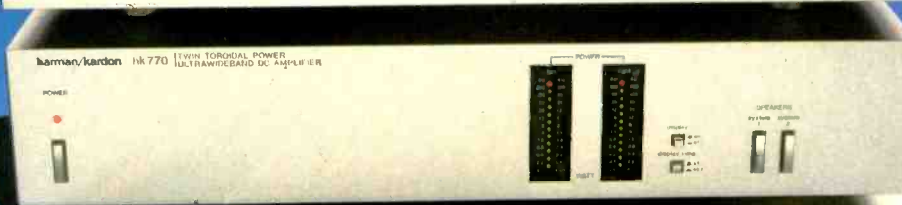
Our first low negative feedback components were designed for the audiophile.



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The hk770 High Technology 65 watt per channel power amplifier.



The hk710 High Technology phase locked analog tuner.



The new hk750 High Technology 45 watt per channel integrated amplifier.

Last January, we introduced our 700 series High Technology Separates. The first moderately priced separates designed with low negative feedback.

Negative feedback?

It's a form of electronic compensation used in virtually every preamplifier, amplifier and receiver. Used judiciously, negative feedback can improve frequency response and THD

distortion characteristics. Unfortunately, most manufacturers try to reduce THD to lower and lower levels by adding more and more negative feedback – typically 60-80 dB. This excess negative feedback results in a new form of distortion called Transient Intermodulation Distortion (TIM), which does far more to degrade music than THD. In fact, according to a listening survey, TIM in music is detectable at

levels just 1/10 the detectable levels of THD.

By keeping negative feedback to 30 dB or less in all Harman Kardon electronics, we've eliminated the harsh, metallic, grating effects of TIM produced by conventional equipment with high negative feedback. You'll hear startlingly clean, clear, open sound.

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Vector Research VCX-600 Stereo Cassette Deck



Manufacturer's Specifications

Frequency Response: 30 Hz to 16 kHz, to 18 kHz with CrO₂ tape, to 20 kHz with metal tape.

Signal/Noise Ratio: 56 dBA, 65 dBA with Dolby NR.

Separation: 33 dB.

Crosstalk: Down 63 dB.

Erasure: 65 dB.

Input Sensitivity: Mike, 0.25 mV; line, 60 mV.

Output Level: Line, 580 mV.

Flutter: 0.06 percent W rms.

FF & RWD Times: 90 seconds for C-60.

Dimensions: 17 $\frac{1}{8}$ in. (440 mm) W x 5 $\frac{7}{8}$ in. (142 mm) H x 14 $\frac{3}{4}$ in. (375 mm) D.

Weight: 22 lbs. (10 kg).

Price: \$750.00.

The Vector Research VCX-600 cassette deck offers a combination of generally excellent performance and several worthwhile convenience features. The three-head design aids in achieving good responses and provides simultaneous monitoring of playback while recording. Access to the heads and capstan for maintenance purposes is very easy, particularly with the clear cover removed. A light in the back of the cassette well facilitates checking tape usage. Tape motion is controlled with light-touch bar switches, and there are useful status lights for each function, save Stop. The logic used allows making any desired change in function, including adding Record to Play (the desirable flying start). If rewind or fast-forward are pushed while in Play, however, the deck goes into review or cue — sampling the signal on the tape — for as long as the switch is held in. It is convenient to have a cueing feature, and the Vector Research approach is a good one. To go to regular fast winds it is necessary to push Stop first. Rec Mute is a momentary-contact bar switch with its own red indicator, just below Record — a good design.

Memory-type functions in the VCX-600 include rewind to stop at "000" and rewind to play at "000." Pushing Music Search while in Play results in a flashing indicator; pushing RWD or FFWD will then shift the deck into a fast wind. As soon as a break in the program is detected (four seconds play time minimum), the wind stops, and the deck starts

playing. There is also programmable Music Search which allows making any combination of up to eight selections. It can be used at any time when in play to fast wind to later pieces, as chosen, skipping any of those not selected. This scheme is perhaps not as flexible as some in other decks, but it is easy to understand and has the play-skip capability needed.

Lever switches with good snap action allow selection of Tape/Source monitoring, Out/in/In-with-MPX Dolby NR, Fe/Co/Metal bias, and 120/70/70 μ S EQ. There is a useful bias trim pot, which has a worthwhile center detent. The input and output level pots are of multi-step design with good-sized knobs. Friction between the two sections of the input pot was on the high side, making interchannel level adjustments slightly difficult. The meters consist of horizontal LED ladders with yellow segments from "-20" to "0" (also Dolby level), and red above that — easily seen at all levels of lighting. On the other hand, panel designations were not so easily read in dim lighting. The power and eject buttons and the jacks for microphones and headphones complete the front-panel features. It was odd to find that the output pot did not control the level to headphones, which is desirable. For the novice, there is a handy block diagram on the top cover of the deck.

The line-in/line-out phono jacks are on the rear panel, as is a line fuse and a socket for the optional remote control. After

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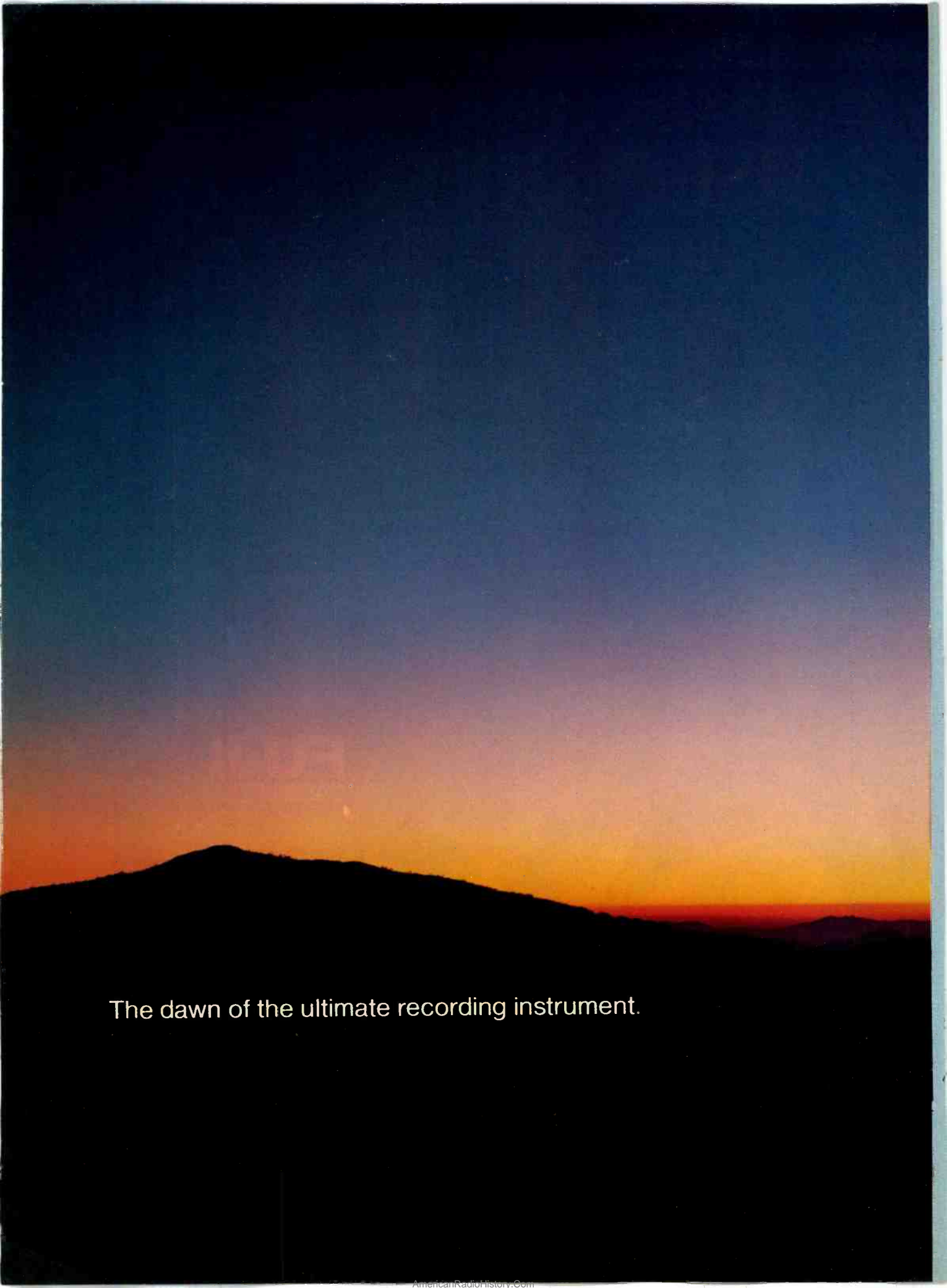
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Once a decade, a unique recorder is created.
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Harnessing the power of two computers,
it becomes the Absolute Reference.
Automation that defies obsolescence.
A recorder to cherish for years to come.
1000ZXL Computing Cassette Deck.
The Ultimate Recording Investment.

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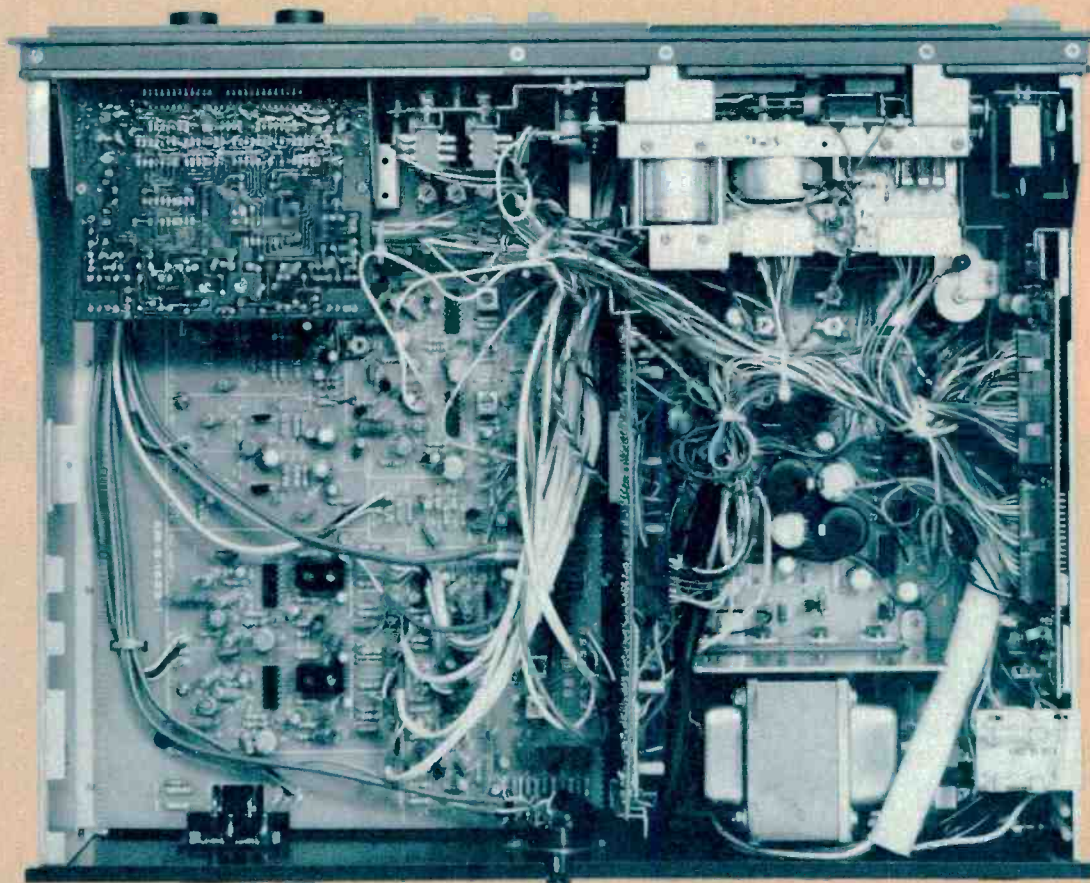
removal of the top and side cover, inspection was made of the internal construction. The soldering on the p.c. boards was excellent, with substantially no flux residue. The five boards were interconnected primarily with multi-pin cables and plugs, though there was some wirewrap. Parts were identified on the cards, as were most adjustments. There were two power-supply fuses in clips, readily accessible. The chassis construction was of box-type, and it was quite rigid.

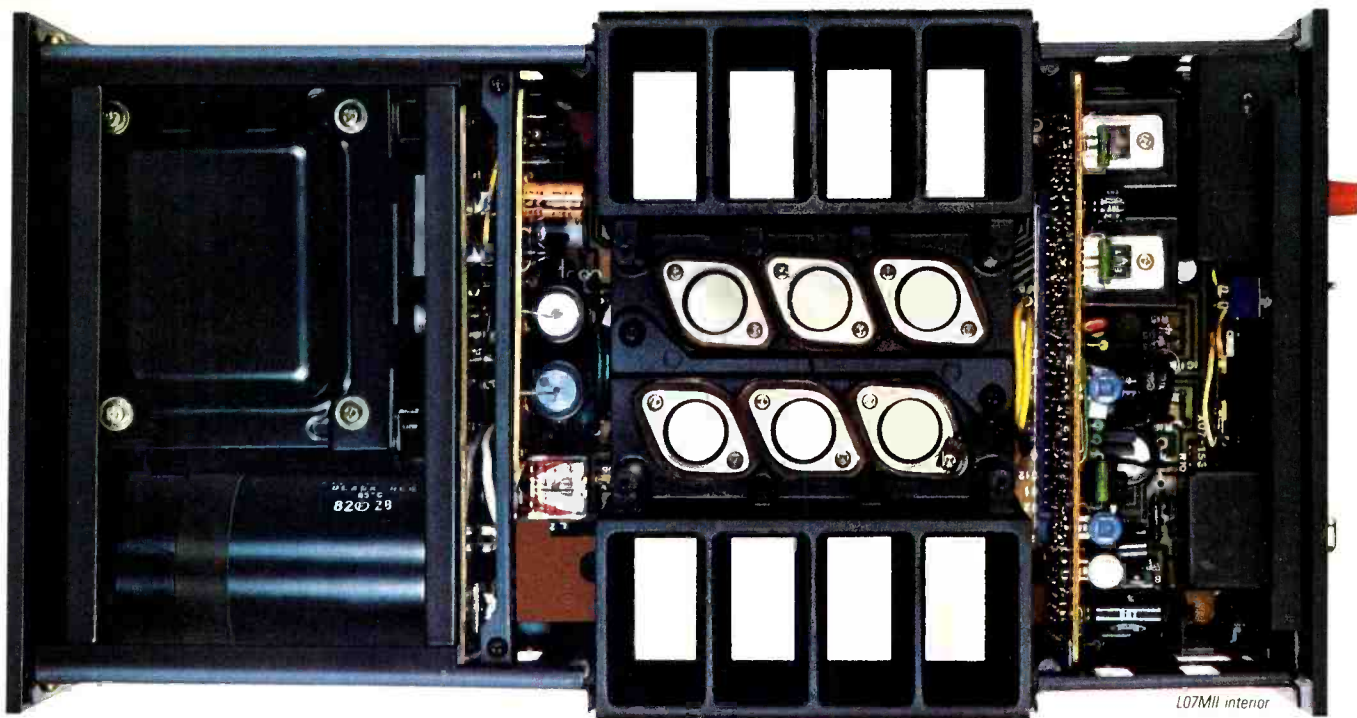
Performance

The playback responses obtained with standard alignment tapes were quite flat, with the exception of just over 2 dB

droop at the highest frequency for each equalization. Play speed was 0.65 percent fast, and meter level indications were within a dB for both channels.

A pink-noise source and a 1/3-octave RTA were used to check about 20 different formulations for the best match to the VCX-600. The adjustable bias added some tapes to the "good" list, but the deck needs a record-sensitivity adjustment to get the best out of some other tapes while in Dolby mode. TDK AD, Maxell UD XL-II and Luxman XM-IV were selected for all additional tests, but the results were quite close with Maxell UD XL-I, Sony SHF, TDK OD, Luxman XM-II, TDK SA and SA-X, Ampex MPT, and TDK MA-R. Swept-





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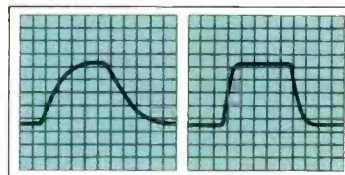


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Even more remarkable is the inclusion of Kenwood's exclusive high speed circuitry. By allowing the amplifier to react faster to dynamic changes in the musical input, Hi-Speed produces a more accurate sound. This is especially critical in the mid-to-high frequency transients where conventional amplifiers lose their imaging and detail. The L07MII separates individual string players in a symphony orchestra with equal ease.

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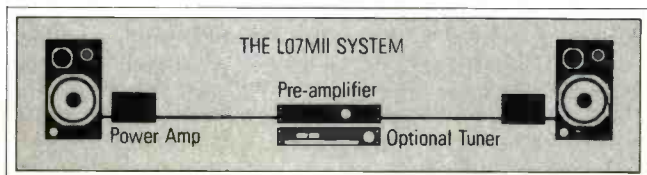
innovations requires much more space than is available here. Please write for full technical data at the address below. Or better yet, audition this remarkable amplifier system at a Kenwood Audio Purist Group dealer. If you have the ears to appreciate what the Kenwood engineers have accomplished, the L07MII system will take your breath away.



Typical "square" pulse waveform of conventional amplifier.

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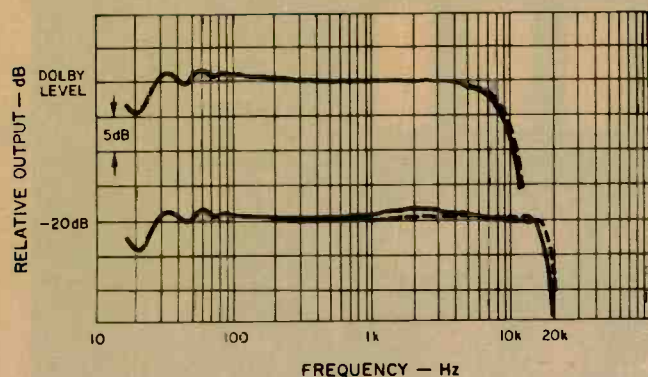


Fig. 1 — Frequency responses with and without (---) Dolby noise reduction with TDK AD tape.

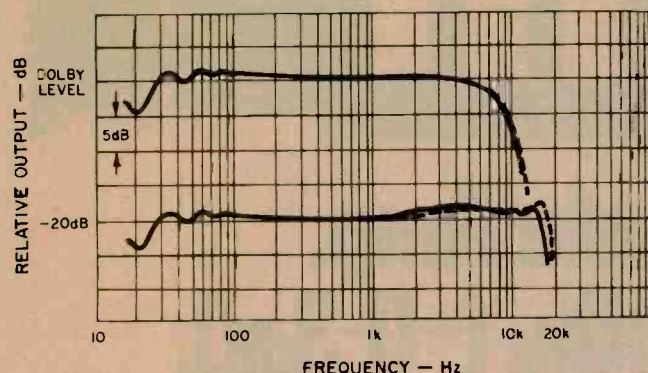


Fig. 2 — Frequency responses with and without (---) Dolby noise reduction with Maxell UD XL-II tape.

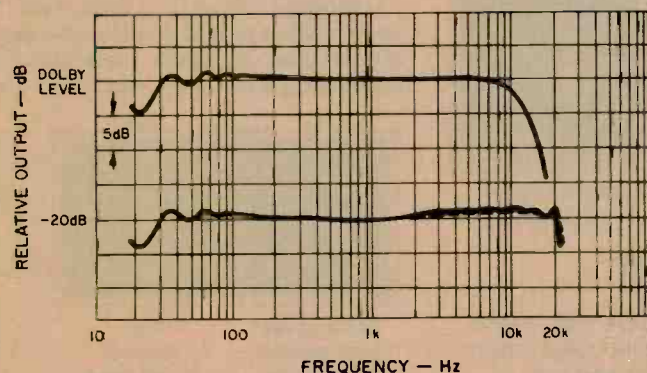


Fig. 3 — Frequency responses with and without (---) Dolby noise reduction with Luxman XM-IV tape.

frequency responses were run with the three selected tapes (Figs. 1, 2 and 3) at Dolby level and 20 dB below that, both with and without Dolby. As the plots and the listings in Table I show, the results were very good, and there was very close agreement between modes, except at the very highest frequencies.

Playback of a recorded 10-kHz tone showed B channel lagging A by just 45 degrees, much better than most recorders with similar head designs. The relative phase jitter was slow in nature and just 15 degrees, close to the best ever observed. Output signal polarity matched that of the input: In other words, positive peaks in the music being recorded remained positive peaks. The bias control had a range of -2.0 to +1.2 dB for Maxell UD XL-II with a 10-kHz tone. The multiplex filter was 3 dB down at 16.2 kHz, 33 dB down at 19 kHz. Bias in the output during recording was satisfactorily low. Separation between channels was 55 dB at 1 kHz, and crosstalk between adjacent tracks of opposite play direction was down at least 80 dB — both excellent figures. Erasure of a 1-kHz tone was fine, over 80 dB, while erasure of a 100-Hz tone with metal tape was 62 dB.

A spectrum analyzer was used to get data on HDL₃ (third-harmonic distortion level) in Dolby mode at 1 kHz for the three tapes, from 10 dB below Dolby level to the point where HDL₃ equalled three percent. The results are plotted in Fig. 4, which shows the superiority of the ferric tape for low distortion. The levels of the second and fifth harmonics were very low with this Vector Research deck. Without Dolby, HDL₃ at

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

Tape Type	With Dolby NR				Without Dolby NR			
	Dolby Lvl		-20 dB		Dolby Lvl		-20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
TDK AD	23	7.9	25	16.3	23	8.1	23	18.0
Maxell UD XL-II	24	8.0	24	17.0	24	8.1	24	17.4
Luxman XM-IV	25	11.0	24	21.1	25	11.0	24	22.0

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

Tape Type	IEC A Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby NR		Without NR		W/Dolby NR		Without NR	
	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%
TDK AD	61.4	66.2	52.6	57.2	59.9	64.7	50.0	54.3
Maxell UD XL-I	62.4	65.3	52.1	57.4	61.6	64.9	51.8	55.1
Luxman XM-IV	63.9	67.7	55.4	59.2	62.6	66.4	52.9	56.7

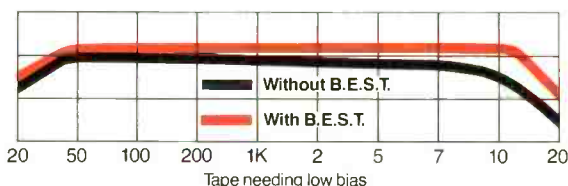
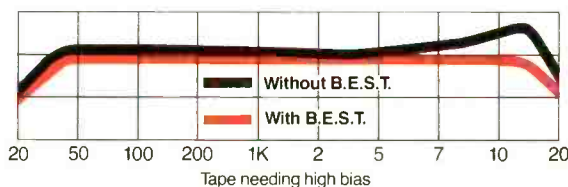
the 1-kHz test frequency was somewhat higher, in general, than with the noise reduction. HDL₃ vs. frequency was measured from 30 Hz to 7 kHz in Dolby mode with Luxman XM-IV tape at 10 dB below Dolby level. The results were quite good at mid and high frequencies (Fig. 5), though HDL₃ was higher at the low end of the band. The excellent signal-to-noise ratios, referenced to Dolby level and to the 1-kHz 3% distortion points, are listed in Table II for both IEC "A" and CCIR/ARM weightings, both with and without Dolby NR. The metal tape does have the best figures, but not by that much. The Dolby-level frequency-response plot in Fig. 3 more aptly shows the new formulation's superiority: Better response at high frequencies at high record levels.

Input sensitivities were 0.24 mV for mike and 53 mV for line — good figures and slightly better than spec. Input overloads occurred at 40.3 mV with mike and about 31 V for line, both excellent. The output clipped at a level equivalent to

The balance between bias and EQ is too delicate to be handled by switches. We use a computer.

For every tape on the market, there's an ideal balance of bias and equalization which yields flattest response combined with least distortion.

Unfortunately, even among presumably standardized formulations, this optimum balance varies widely from brand to brand. So deck designers shoot for approximate values, which you select with a switch, hoping the deck's pre-set values match your tape.



(—70 dB S/N ratio), it also extends high-frequency headroom. So trumpet blasts, cymbals crashes and other "hot" sounds come out clear and lifelike instead of dull and distorted.

For transport accuracy, there's our 2-motor, independent-drive system. It keeps wow and flutter down to 0.04% WRMS, which is

lower than you'll ever hear. While our Sen-Alloy heads® make the most of Sendust's low distortion and superb durability. They'll give you clean recordings through years of use.

And for all this, you don't have to sacrifice convenience and operating ease. The KD-A66 gives you logic-governed, solenoid controls. Auto-rewind and play. LED peak-level indicators. And optional remote control.

But with the B.E.S.T.* computer system included in our new KD-A66 deck, bias, EQ and even noise-reduction levels are all determined from tests the computer actually performs *on your tape*. The result isn't a designer's best guess. It's precise. So you'll hear accurate recordings with virtually any tape. Because the B.E.S.T. system creates conditions that let every tape perform to its optimum.

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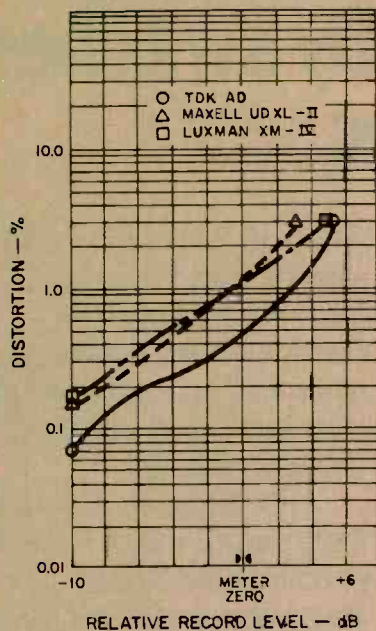


Fig. 4 — Third harmonic distortion vs. level in Dolby mode at 1 kHz with TDK AD, Maxell UD XL-II and Luxman XM-IV tapes.

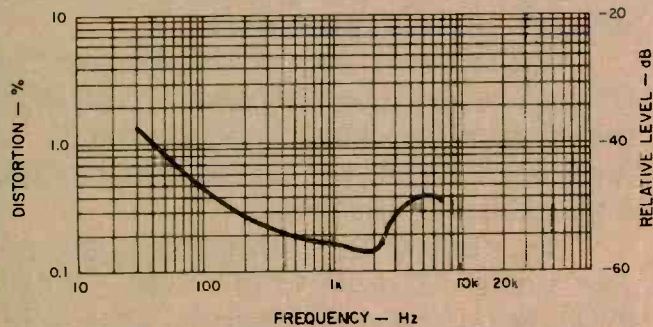


Fig. 5 — Third harmonic distortion vs. frequency in Dolby mode at 10 dB below Dolby level with Luxman XM-IV tape.

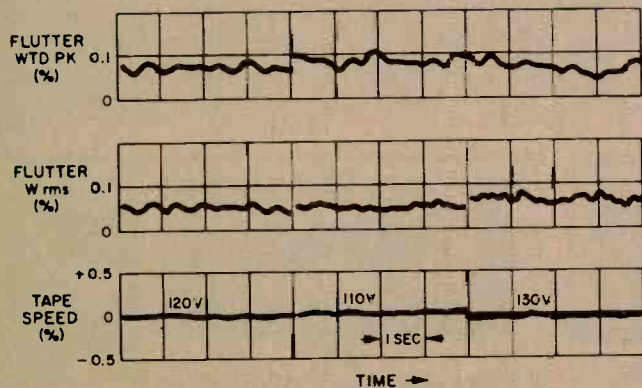


Fig. 6 — Tape play speed vs. line voltage and wtd. rms and wtd. peak flutter (three trials each).

+17 dB relative to meter zero, 3.87 V actual. The two sections of the input pot tracked within a dB from maximum down almost 60 dB — excellent! The output pot wasn't quite as good, but it nonetheless kept to the same tolerance for 45 dB — good performance. The line output levels averaged 572 mV for meter zero indications. The headphone output to 8 ohms was 32 mV, which was satisfactory for most phones but too low a level for others. The LED-ladder type meters have a total of 12 segments each, with finer steps around zero. The thresholds were reasonably accurate, though the increments around meter zero were less than marked: "-3" and "-1" were -2 and -0.6 dB actual, for example. The tone burst tests showed that about 150-mS duration was required for full response, and also that single-polarity bursts were not detected for their actual shift in peak level. The meters, therefore, could be called "fast response" in comparison with VU meters, but not "peak level." The frequency response of the meters was down 3 dB at 18 Hz and 21.8 kHz.

A 3-kHz tone was recorded with the line voltage exactly at 120 V. On playback, the flutter meter's drift output was recorded with three line-voltage settings. Fig. 6 shows that there are some perturbations at 120 V, that there is a very slight increase in speed with the voltage reduced to 110 V, and that there was a somewhat greater decrease in speed, perhaps 0.05 percent, with line voltage raised to 130 V. Flutter tests were conducted at the normal 120 V to get both W rms and wtd. peak values. There were three trials for each standard, introducing some change, such as some fast winding, before the next measurement. The flutter was quite low, better than most decks. The average wind time for a C-60 was 88 seconds, perhaps a little on the slow side. Changing modes usually took less than a second.

Use and Listening Tests

Cassette loading and removal and maintenance tasks were all easily accomplished. All controls and switches were completely reliable, and operation was aided by the complement of status lights. The owner's manual has good text, but it could benefit from more detail on some of the many logic combinations. Schematics are shown for the five major p.c boards, and there's also the block on the top of the unit. A separate, single-sheet, stiff-paper "Operation Guide" has a handy summary of the basic instructions for all of the various functions.

A variety of sources were recorded for a listening assessment of the VCX-600 performance. Discs included Acoustic Research's "The Sound of Musical Instruments," Mahler's Eighth Symphony with Solti and the Chicago Symphony Orchestra, and recent Virgil Fox records. Pink noise was also used with particular attention to changes with Dolby NR in/out switching. Setting levels seemed to be fussier than expected. The conclusion was that greater resolution in the metering would have been of some aid.

In general, the results were excellent. Record, pause, and stop sounds were all very low, down in the tape noise. While setting levels to obtain maximum recorded signal on the tape together with low distortion seemed fussier than expected, longer experience with these meters would have effectively minimized any difficulty in setting up to handle such wide dynamics as occur with the soprano voices in the Mahler.

The Vector Research VCX-600 cassette deck has very good to excellent performance in the majority of important areas. Priced at \$750.00, this really isn't an inexpensive deck, though there are decks costing twice as much. Coupling a number of convenience features with the deck's good basic performance should make the VCX-600 appeal to a goodly number of audiophiles.

Howard A. Roberson

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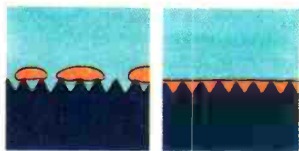
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Super-wetting action deep-cleans grooves.



Discwasher D3[®] solution (left) beads up on the grooves. Sound Life (right) with super-wetting action deep-cleans grooves.

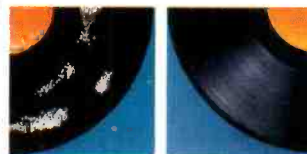
If your present cleaning solution beads up on the record surface, it may not be getting the job done.

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Even though your record surface is clean, it's generally the electrostatic charge that gets it dirty again. An anti-static gun is just a temporary treatment.

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(Left) Styrofoam beads are attracted to static charge left on record after cleaning with Discwasher D3[®].

Same record (right) after one treatment with new Sound Life fluid.

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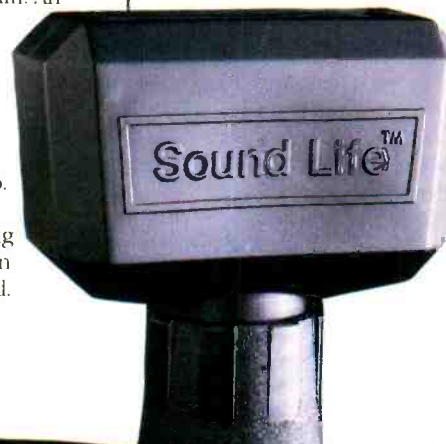
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All That Data: FM Tuner Quieting And Distortion

Leonard Feldman

The following is the first in a series of background notes to the graphs accompanying our Equipment Profiles, this one on FM tuner quieting and distortion characteristics, which is usually Fig. 1 in Len Feldman's tuner and receiver reviews.

The purpose of these notes is to provide the novice with a reasonably non-technical explanation of how the charts serve to provide a great deal of information in a relatively small space. While each reviewer has been asked to assume a certain level of technical understanding on the part of the reader, we will appreciate feedback as to whether the notes are too technical or not technical enough.

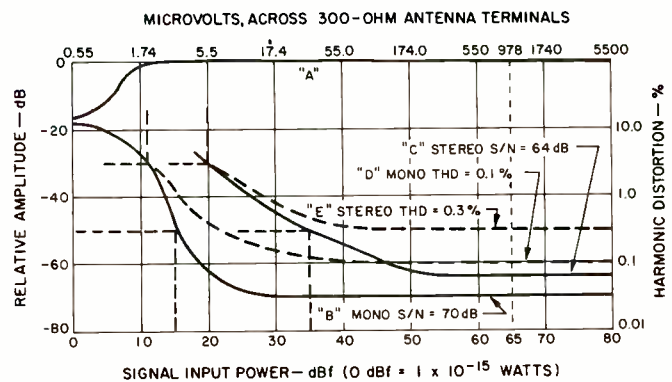
We presently plan to include an "All That Data" note in each issue in which space is available and to change the subject of the note with each succeeding installment, e.g. tuners this month, cassette decks next time.—*The Editor*.

Whether we measure the tuner section of a complete receiver or a separate component tuner, *Audio Magazine* always publishes test results in the form of charts and graphs in addition to the brief verbal comments that we make regarding those measurements. One chart or graph we use to depict some of our tuner measurements can, if interpreted fully, tell you, our readers, a great deal about the performance of the tuner or tuner section under investigation. A sample of that chart is reproduced in Fig. 1 and, for those unfamiliar with it, we would like to explain the information that can be gleaned from it.

dBf vs. Microvolts

You'll notice that at the top of the chart, running horizontally, are some rather odd numbers, beginning 0.55,

Fig. 1—Mono and stereo quieting and distortion characteristics of a typical good FM tuner section.



1.74, Along the bottom of the graph, also running horizontally, are a more regular series of numbers, beginning 0, 10, 20, The upper set of numerals describes increasing signal strength (from left to right) in microvolts, or millionths of a volt, while the lower numbers also describe increasing signal strength, but in power terms, or dBf. dBf stands for decibels referred to 1 femtowatt, and a femtowatt, for those who don't know (and that's probably most everyone), is 1×10^{-15} watts! If that kind of notation troubles you, you can think of that very tiny quantity of power as 0.000000000000001 watt!

Since the performance of an FM tuner usually gets better with increasing signal strength, we use dBf or microvolts (abbreviated μV) to describe that changing signal strength. Why two types of notation? dBf is the newer and preferred form, simply because it is free of any possible ambiguities. You see, power is defined as the square of the voltage divided by the load impedance. Now, some tuners

have a 75-ohm antenna load impedance but most have a 300-ohm antenna load impedance. If you choose to talk about voltage, instead of power, when describing signal strength reaching the antenna terminals of a receiver, then 2 microvolts arriving at the 300-ohm terminals of a tuner produces exactly the same power as only 1 microvolt intercepting a 75-ohm antenna input to another tuner. The ambiguity arises because the maker of the tuner with the 75-ohm antenna might well claim a sensitivity of 1.0 microvolt, while the maker of the tuner having a 300-ohm input would call his sensitivity 2.0 microvolts. In fact, both tuners require the same amount of power to achieve the same reception. No such ambiguity can exist when we use dBf, since then we are talking about power — and that's the same for any tuner, regardless of its antenna input impedance.

For the sake of "old timers" who still think microvolts, the upper scale in Fig. 1 correlates "old" microvolt values in terms of new dBf readings. But from

tuner. In our example, the ultimate signal-to-noise ratio (usually measured at a signal strength of 65 dBf) turns out to be 70 dB below the program level, for monophonic reception.

Distortion

The dashed curve "D" has also been plotted downward with increasing signal strength. This curve shows the distortion level of a 1-kHz signal at maximum modulation (maximum loudness permitted by the FCC) for varying signal strengths. Again, once the signal strength gets to around 65 dBf, further decrease in distortion results with further increases in signal strength. So, the distortion measured at 65 dBf is reported in the test results.

In our example, it is 0.1 percent for mono performance. Notice that here we normally use percentages, but we could just as easily quote distortion as being "so many dB" below the desired program level, in this case 60 dB. The curve shows us the distortion characteristics of a 1-kHz signal. We could have chosen any other frequency which is broadcast over FM. In fact, widely accepted standards require that distortion be quoted at three frequencies — 100 Hz, 1 kHz and 6 kHz. However, our graph would get too cluttered if we tried to draw curves for all of these frequencies, so we simply report the other two in the text of our test reports.

How About Stereo Performance?

You can pretty well accept as a general rule that, in any tuner, stereo performance is somewhat inferior to mono performance. Since most listening these days is to stereo FM, it is therefore essential that the tests we have been describing and the measurements we have plotted in Fig. 1 be repeated for stereo operation of the tuner. That's where curves "C" and "E" come in.

Curve "C" is the quieting characteristic of the tuner when it is in the stereo mode, while curve "E" tells us what happens to distortion of 1 kHz in the stereo mode. In case you are wondering why curves "C" and "E" don't start at the left of the graph, as did curves "A," "B," and "D," the answer is that the circuitry in our sample tuner cannot switch into the stereo mode until a signal strength of at least 18 dBf is reached, so that's the signal level at which we start our plots.

As we suggested, usable sensitivity (the signal strength at which noise and distortion are 30 dB lower than program level) is poorer for stereo than it

is for mono, about 20 dBf (or 5.5 microvolts). Following curve "C" along downward and to the right, the 50-dB quieting sensitivity for stereo is also much poorer (higher amount of signal required) than it is for mono. Results for this tuner are 35 dBf for 50-dB quieting — a not untypical value for a good tuner. And, to complete the quieting story in stereo, ultimate signal-to-noise ratio, often abbreviated S/N, for stereo is only 64 dB as compared with our earlier result of 70 dB for mono.

Finally, curve "E" tells us what happens to distortion of a 1-kHz signal in stereo with increasing signal strength. Here again, we find that even with a strong signal (65 dBf is usually the reference signal strength for this measurement), distortion only drops down to around 0.3 percent or 50 dB below program level. How do I know that 50 dB is equivalent to 0.3 percent? Simply by remembering a couple of dB relationships. A change of 6 dB represents a doubling or halving. Thus, 6 dB above 0.1 percent is 0.2 percent, while 6 dB below 1.0 percent is 0.5 percent, etc. On the other hand, 10 dB represents a 3-to-1 increase or decrease (approximately), so, since curve "E" settles in at 10 dB below 1 percent (or 10 dB below 40 dB), its percentage value is roughly 0.3 percent.

All That Data

The five curves in Fig. 1 have told us a great deal about our sample tuner. To review, just from curves "A," "B," "C," "D," and "E," we are able to determine all of the following:

1. Mono usable sensitivity (in microvolts and dBf);
2. Stereo usable sensitivity (in microvolts and dBf);
3. 50-dB quieting sensitivity, mono;
4. 50-dB quieting sensitivity, stereo;
5. Signal-to-noise ratio, mono;
6. Signal-to-noise ratio, stereo;
7. Distortion, 1 kHz, mono, for strong signals;
8. Distortion, 1 kHz, stereo, for strong signals;
9. Stereo switching threshold, and
10. FM limiting characteristics (when program level reaches its maximum).

Clearly, presentations such as these save audio testers and reviewers a great many words (if not the proverbial thousand that a picture is supposed to be worth). And as far as this audio tester is concerned, that's all to the good, especially since our esteemed editor does not base his payments upon word count alone. A

noise level, changes drastically with increasing signal strength. This curve represents the background noise level relative to the audio level. And since we are expressing one value with respect to another, we can use the handy decibel notation (the scale at left) or, if you prefer, the percentage notation (the scale at the right of the graphs). As signal strength increases, noise is reduced. Curve "B" represents that noise level, during monophonic operation of the tuner, while curve "D" represents distortion for mono operation. Note that for a short while, curves "B" and "D" are identical. The signal strength required for the noise and distortion to decrease until their sum is 30 dB lower than the program output is known as the usable sensitivity. For curve "B" (and "D"), that occurs when signal strength is 11 dBf.

50-dB Quieting Sensitivity

While a knowledge of the usable sensitivity of a tuner is of some interest, it is useful only in that it tells us the minimum signal strength required to get a marginally listenable (but hardly satisfactory) signal. For high-fidelity listening that is reasonably noise free, we need to have a signal which can drive the noise down until it is about 50 dB below the program level. If you follow curve "B" along to the right, beyond the usable sensitivity level, you will note that with a signal input of 15 dBf the noise is now 50 dB lower than the desired program level. This signal strength is therefore defined as the mono 50-dB quieting sensitivity. Following curve "B" even further we see that when signal gets strong enough, here about 30 dBf, the curve levels off and noise level remains constant with further increases of signal. This level of noise defines the ultimate signal-to-noise ratio of

Michael Tearson

Jon Tiven

The column



Heartattack and Vine: Tom Waits
Asylum 6E-295, stereo, \$7.98.

A shift from setting novellas to music, back to writing songs, makes **Heartattack and Vine** one of Tom Waits' best albums. He has lost none of his peculiarly seedy charm but has focused it with the tightest material he's delivered in years. As ever, he looks out over the seamy side of life to find a colorful cast of shady characters.

The album is a well-balanced mix of Waits' boozy, melancholy, very melodic ballads (which someone should introduce to Sinatra) and his more beat,

squinty story-songs. The two chunkiest tunes, *Downtown* and *'Til the Money Runs Out*, both chronicle the highlife of deadbeats. Waits' knack for capturing fully blown characters in very few words has never been keener. Try for size this one from *Downtown* — "Sally's high on crank and she's hungry for some sweets/She's fem in the sheets but she's butch on the streets." Or from *Til the Money* — "I sold a quart of blood and bought half a pint of Scotch." Then there's the sordid story of *Mr. Siegel* (Bugsy perhaps?) with a melody line nicked from *Stagger Lee*.

Illustration: Rick Tulka

The ballads here are among Waits' most haunting ever. With its "sah la la" refrain, *Jersey Girl* obviously tips the Waits lid to Mr. Bruce Springsteen, a fellow who has chronicled the highlife of lowlifes some himself. This vision of decaying, neon-lit New Jersey shore nights would be right down his alley. And only Waits would turn out a tender love song called *Saving All My Love for You* with lines like "I paid fifteen dollars for a prostitute/with too much makeup and a broken shoe/but her eyes were just a counterfeit." And never has Tom written so heartbreaking a song as *Ruby's Arms*. And only as evocative as *On the Nickel* which he wrote as the title song for the film by Ralph Waite.

For good measure Waits showcases his snappy combo with an instrumental piece called *In Shades* which uses some funny saloon ambience.

Waits' long-time producer, Bones Howe, has not recorded this Tom Waits album strictly live in the studio as he has usually done before. Howe has clearly imposed greater discipline on Tom's singing than at any time since **The Heart of Saturday Night** so long ago. This new album benefits from the focus on the emotional wallop in Waits' ideosyncratic croak. Now discipline for Waits doesn't necessarily mean the same thing it might for everybody. His mike technique is technically awful. He gets too close and gets a lot, a whole lot, of mouth noise, but he makes his non-technique work. A so-called flaw like that off-mike moan in *On the Nickel* is just delicious.

At his best, and I am relieved that much of **Heartattack and Vine** is at his best, a Tom Waits song will stop me dead in my tracks and rivet my ears to the sound. This album's like that. M.T.

Sound: B+

Performance: A

One Step Closer: The Doobie Brothers
Warner Bros. HS 3452, stereo, \$8.98.

One Step Closer only helps confirm my suspicion that there are actually two Doobie Brothers bands: One emerges when Michael McDonald is lead singer for his own songs, and the other is a group democracy.

Since **Minute By Minute**, there have been some crucial personnel changes:

Revox B760. One touch tunes it. Perfectly.



Now there's a tuner that works as accurately as a radio transmitter and as easily as a car radio.

You can tune the B760 manually in increments of 25 or 50kHz, or program up to 15 stations in memory for instant selection. Just touch a button for the station you want, and in less than a second the muting light goes off and the digital readouts and tuning meters confirm your station selection.

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The B760's CMOS memory is so sophisticated that it can automatically direct an antenna rotator toward each memorized station, and even has a battery pack to pro-

tect the memory if you unplug the tuner or lose AC power.

Other features include an optional plug-in Dolby circuit board, oscilloscope outputs to help you minimize multipath distortion, selectable 25, 50 or 75 microsecond FM de-emphasis, adjustable-threshold interstation muting, a headphone jack with level control and a high-blend switch to optimize reception of distant stations.

It's all put together with attention to detail and durability for which the Studer Revox company is so well known. With things like plug-in circuit boards, RF shields plated to resist oxidation and even a coaxial delay line to maintain proper phase, everything is made just a bit better than it has to be. Because we want everything to be perfect.

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STUDER REVOX

Drummer and founder John Hartman has been replaced by Chet McCracken, and John McFee replaces the inimitable Jeff "Skunk" Baxter on lead guitar. Though the effect on the band is minimal, with the music showing no change in direction at all, McFee just can't duplicate the electricity of Baxter's dexterously imaginative solo work.

A pair of songs with the familiar McDonald aching, churning soulfulness, *Dedicate This Heart* and the hit *Real Love*, kick off the album. Next is the less gripping *No Stopping Us Now*,



co-written by McDonald and guitarist Patrick Simmons with Chris Thompson — a good soulful tune that pales with Simmons singing lead after McDonald. Then comes hornman Cornelius Bumpus' *Thank You Love*, a monumentally banal love song.

On side two, the title cut opens with a joint effort by drummer Keith Knudsen, McFee and Carlene Carter. Set over a lazy shuffle it is a catchy, sophisticated and involving song, the best thing on the album that is not written by Mike McDonald. Next is McDonald's characteristic *Keep This Train A-Rollin'*. Simmons' *Just in Time* successfully negotiates the territory McD has led the band into, and it's one of Simmons' better efforts. The in-

strumental *South Bay Strut* is a pleasant groove tune. The finale by percussionist Bobby LaKind and McDonald, *One By One*, appropriately concerns caution, the one thing that best describes this album. Good as it is — and it is really good — the fire is missing.

Thus *One Step Closer* is a worthy successor to the breakthrough album *Minute By Minute*. A classy, safe venture through known territory. Ted Templeman's production is characteristically slick and smooth, the archetype of that cool L.A. sound. It's fine this time, but the next album could deliver more of a punch. M.T.

Sound: A- Performance: B

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Metro Music: Martha and The Muffins
Virgin VA 13145, stereo, \$7.98.

This fresh breeze from Toronto is made up of two Marthas and four Muffins. Their music is airy and intriguing, sounding like nothing so much as a down-to-earth streamlined version of early Roxy Music. Clearly art school stuff.

Their most appealing song, *Echo Beach*, comes first, an appropriate opener that relates an office clerk's favorite daily escape from her boring job. Then *Paint by Number Heart* is a curious non-love song. *Saigon* romantically recalls the exotic city before the war ravaged, the "bastard of the East and West." *Indecision* bristles with its insistent refrain, "I wish that I could be decisive/Then I'd understand where life is going/for me." The grand finale, the mostly instrumental *Cheesies and Gum*, is a personal fave with its literate and witty solo breaks, especially those of sax player Andy Haas. His tone particularly recalls Roxy's Andy Mackay.

The two Marthas, Lady and Johnson, most often sing in counterpart instead of intricate tapestries. With the tick-tick-ticking rhythm that the band

seems to fancy most, this works very well in reflecting the yearning and anxiety that bind the songs as a whole.

Metro Music is not an album that grabs you by the throat. It is, however, one of the year's small masterpieces as Martha and The Muffins display charm enough to go the distance.

The one flaw I am compelled to mention is that the record has not been mastered hot enough. Though The Muffins' sound is clean, it is too polite. M.T.

Sound: C+ Performance: B+

The Nighthawks
Mercury SRM 1-3833, stereo, \$7.98.

America's premier rhythm and rocking bar band finally has a major label album after a string of goodies on tiny Adelphi. Best of all, The Mercury debut is smoking from end to end, put down in Muscle Shoals, Alabama. For pure drive and good times, nothing has come close to **The Nighthawks** all year. M.T.

Sound: B+ Performance: A

There are 300 voices
in the Mormon Tabernacle Choir.
This tiny diamond tipped sapphire
enables you to hear every one.



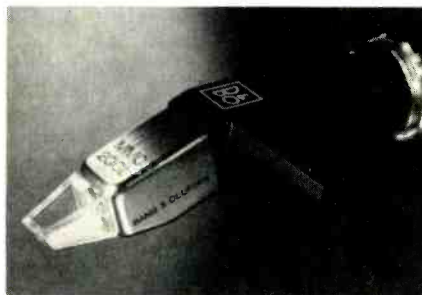
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What you see above is the diamond stylus/sapphire crystal cantilever of the Bang & Olufsen[®] MMC 20 CL Phono Cartridge.

We chose sapphire because it is one of the most rigid materials on Earth. So there is no audible tip resonance. No distortion of the music. Even when subjected to the 10 G forces which cantilevers encounter when tracking today's records.

And while sapphire may seem like overkill, the fact is that your cartridge, though dwarfed by the rest of your system, has an overwhelming influence on the reproduction quality you achieve. Which is why we go to great lengths to achieve optimum performance where it counts in our cartridges.

Another place the MMC 20 CL excels is its stylus. A Contact Line nude diamond. Super-polished to shun contaminants and reduce record wear. It



tracks the groove like a train on a rail.

Then there is the Moving Micro Cross, heart of the patented B&O[®] cartridge for years. Now highly refined, it maximizes stereo separation and minimizes effective tip mass (ETM). For extended record life, and unsurpassed trackability.

Since inductance is low, induced noise is negligible. And output is constant, regardless of cable or preamp capacitance.

Bang & Olufsen's other three cartridge models are the MMC 20 EN, MMC 20 E, and MMC 10 E. They are produced to the same exacting stan-

dards as the MMC 20 CL. And offer almost equivalent performance.

The top three models each come with their own computer-generated test report showing output voltage, channel balance, channel separation, and tracking ability. The MMC 20 CL is also supplied with its own individually plotted frequency response graph.

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In this series we are discussing the various aspects of preamplifier performance which vitally affect the overall sound of your high-fidelity music system.

The fourth of these is the fact that many tape recorders and other accessories designed for connection to the tape monitor loop of your preamplifier have highly non-linear input impedances when their power is turned off. The problem with this is that you do not disconnect your tape machine from the tape outputs when you want to listen to a record. And you don't want to run the tape machine all the time, causing wear on its' mechanical parts. So the result is added distortion when listening to records: the tape machine non-linearly loads the phono preamp, to which it is connected, even if you're not thinking about it.

Also, most preamplifiers simply take the output of the selected source, e.g. a tuner, and send it directly to the tape machine. This means that the source impedance from the tape out is a function not of the preamplifier, but of the tuner. Thus the use of short cables is dictated by the facts of the situation: many tuners have too high an output impedance to drive any but short cables.

The Apt/Holman Preamplifier contains six individual buffer amplifiers for its' tape monitor and external processor loops to overcome these system problems. These buffers drive long cables exceedingly well since their output impedance is about 1 ohm, while totally preventing non-linear loading effects by isolating the tape outputs from the main signal path.

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- For a set of six preamp papers, please send \$2 (\$3 foreign).

Name _____

Address _____



Shadows and Light: Joni Mitchell
Asylum BB-704, 2 discs, stereo, \$13.98.

When Joni Mitchell hit the road to support her **Mingus** album and took along a band that included Pat Metheny and his keyboardist Lyle Mays plus Jaco Pastorius, Michael Brecker and Don Alias, it figured to be one of the season's major musical events. Add *The Persuasions*, that great a cappella group, as the support act, and you know that tickets had to be hard to come by.

Shadows and Light documents that tour at its Los Angeles stop. Surprisingly, though the album has some very tasty playing, it lacks the special spice of excitement. All the Mitchell material here, save *Free Man in Paris* and *Woodstock*, is off her recent albums

from the period after **Court and Spark** when Joni turned away from rounded melodies in favor of jazzy, more introspective sounds and ideas. True, some songs are beautifully done—*Amelia* and *Furry Sings the Blues* for two. The *Persuasions* join in for two selections — the title song and the oldie *Why Do Fools Fall in Love*, which sound terrific. Yet nothing is definite or magical in the rendering. Pleasant, pretty, plenty soothing, yes . . . but not the spark this combo is capable of.

The recording itself is somehow distant and thus disappointing, not even as good as Joni's earlier live set **Miles of Aisles**. Subdued is the best word this time around. M.T.

Sound: C-

Performance: C+

One Trick Pony: Paul Simon
Warner Bros. HS 3472, stereo, \$8.98.

Paul Simon possesses an incredible immunity to trends, which in itself astounds the imagination. Oh, there are those artists who sequester themselves and their families in the wilderness where radio stations don't exist and punk rockers fear to tread, and they do all right in avoiding fads and fashion, but Simon listens to all of that stuff and still all of his albums sound almost exactly alike (we personally saw him at CBGB's watching Television unfazed). The soundtrack to his movie **One Trick Pony** is not noticeably different from any of his previous work, although his predilections for relying upon percussion might be somewhat more incessant this time around.

Simon makes flawless-sounding records, and this is no exception — the cream of New York's session men and jazz diddlers make their contributions

here, from Eric Gale to the indispensable Steve Gadd, Mr. Sessions himself Hugh McCracken, the reliable Tony Levin, and well-respected residents of 7th Avenue South such as Hiram Bullock, Richard Tee, John Tropea and Ralph McDonald. Only on *Ace in the Hole*, where Richard Tee vocalizes, and the title blues track (my favorite), where Mr. Gale wails, do any of these names get to demonstrate why they are paid so much. It's Simon's show all the way. He's a clever songwriter who occasionally engages in self-plagiarism (*Oh Marion* sounds awfully familiar), but if you've heard one Paul Simon song you know pretty much what this album is about. And if you haven't, you've got to be purposely avoiding him, and nothing we could say could make you like **One Trick Pony**. We rest our case. Jon & Sally Tiven

Sound: A-

Performance: B+

I Just Can't Stop It: The English Beat
Sire SRK 6091, stereo, \$7.98.

Now it's like this. There's a West Coast band called The Beat who released an album just about the same time that a completely different Beat in England released its first single. Thus both to avoid confusion and for legal reasons, the Beat from England became The English Beat.

Their first single was *Tears of a Clown/Ranking Full Stop* and was released on the very hot Two-Tone label, home of The Specials and their associate bands Madness and The Selecter. All four bands hatched huge hits in such short order that the whole thing took on the aspect of a phenomenon with the ska beat, the element common to their sounds, looking like some new Big Thing.

The album is a joy, especially the steaming first side. *Mirror in the Bathroom*, a bachelor's lonely love song to himself, has an unbelievable hot sax part for a hook. *Hands Off* and *Twist and Crawl* are each hot enough to make you sweat profusely sitting still. *Two Swords* is the fourth consecutive

smash for the band in England and no surprise. The closest their ska beat gets to reggae is on the album's mellow moment, a cover of *Can't Get Used to Losing You* that, sadly, nearly drowns in the perilous wash of reverb.

Adding the British smash *Tears of a Clown* (here pronounced closer to *Tears of a Clone*) to the first side is akin to throwing gasoline on a raging fire. The whole side is a rocking affair, a virtual Best of The English Beat with all of the hits. *Ranking Full Stop* is strong enough to be sent into the fray as the new opening song of side two. And that side needs the infusion, for it is the softer side, and the band's best down the line is their hopping stuff.

Before them, neither The Specials, Madness nor The Selecter have exactly set the American charts on fire which, of course, does not bode well for the chances of The English Beat. But they deserve to be heard for they have as fresh and joyous a sound as anything that's come out. And of the ska bands they are the rockgest. M.T.

Sound: C+

Performance: B+



Wild Planet: B-52's
Warner Bros. BSK 3471, stereo, \$7.98.

The second B-52's album is every bit a match for their compelling debut. Their quirky sound has become a trademark that has not so much evolved as it has been refined a bit. There might not be a *Rock Lobster* or a *Planet Claire*, but their heir surely exists in *Private Idaho* (a great title).

Ya gotta remember one thing . . . these guys and dolls can't be totally serious, as funny as the songs are. Hey, they're singing about how their car needs to be exorcised of the devil, about their runaway green miniature poodle named Quiche Lorraine, about

making love under a strobe light and other equally world-shattering issues.

This stuff is pure party music — some of the best dance music happening. The B's grab onto a beat and hold it for dear life. Producer and engineer Rhett Davies got a bit bigger-sounding record out. Even if the songs don't grab like the first album, they are more consistent with less dead spots.

What **Wild Planet** proves is that the B-52's are no fluke and no one-shot and they are not going away. They plan to dance their lunacy around for a while to come. M.T.

Sound: B

Performance: B+

4

Series 2, Number 4

Load Drive Capability (continued)

In this series we are discussing the various aspects of power amplifier performance which vitally affect the overall sound of your high-fidelity music system.

The fourth of these is that safe-area limiters, employed in many designs to prevent self-destruction of amplifiers when driven too hard into too difficult a load, do not work as expected. In fact, they even make the amplifier *less* reliable rather than more.

The problem is if, for example, the amplifier should be supplying current flowing into an inductive load and the safe-area limiter decides to cut back the drive, nothing can be done instantaneously to stop the current—the limiter is up against the laws of physics in trying to do so.

But many designs nonetheless try: the results are large, tweeter destroying voltage spikes as the voltage seeks the level that will maintain the current. And the output stage safe-area capability is extremely stressed: in one modern design we found spikes of several thousand watts in the output stage! The Apt 1 Amplifier, on the other hand, has unconventional protection which, while examining the output stage for the same voltage, current, and time conditions as a safe-area limiter, does not attempt to limit the output stage drive, but instead disconnects the load by means of an extremely fast relay. Such protection obviates all of the problems of conventional protection circuits while still providing thorough protection to the amplifier, and the large safe area of the output stage prevents annoying frequent shutdowns.

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Name _____

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apt 1-4

Audio 12/80



Clues: Robert Palmer
Island ILPS 9595, stereo, \$8.98.

Despite his vocal integrity, Robert Palmer has a penchant for experimenting with musical genres that prevent his work from displaying any outright artistic ownership. He doesn't buy styles, he rents them, ya see. Luckily, the man's got a voice so sexy, phrasing so apt and delivery so gutsy, we wouldn't care if he were singing jingles! As it is, a certain number of albums could always be sold on the basis of his *Esquire* male model looks.

Palmer's career as a solo artist is a history of pop hybridization. From a starting point as an English r&b singer, the transplanted Nassau-ite let Caribbean music infiltrate his early LPs. On *Secrets* Palmer decided to be more pop- and rock-oriented and the result

was one huge hit with a cover of Moon Martin's *Bad Case Of Lovin' You*.

On *Clues*, Palmer has finally found a genre that allows him room to stretch out vocally as well as instrumentally. Believe it or not, Palmer treats some progressive-rock compositions to a soulful interpretation and comes out with more adventurous music than any of his previous endeavors. Gary Numan's *I Dream of Wires* and the similarly futuristic sounding *Looking for Clues*, *Found You Now* and *Johnny and Mary* feature lots of synthesizer and vocals with unpredictable or monotonal melodies. (What sounds like a Gregorian chant when performed by Gary Numan is fascinating when Palmer lets his estrogen-stirring vocals counter a coldly cerebral instrumental track.)

Never one to miss a trend without trying to produce a hit out of it, Palmer offers a couple of cruder rock numbers as his back-to-basics repertoire. *Sulky Girl*, *What Do You Care*, and a nice version of the Lennon/McCartney *Not a Second Time* are his New Wave contenders. They're just as strong as the odder-sounding stuff and contribute some simple fun to an interesting record.

Although there are two distinct musical directions evident on *Clues*, the production lends a very modern sound to the entire record. Sonic consistency is better than none at all, and Robert Palmer should be congratulated for turning out a highly enjoyable LP that sounds one step ahead of contemporary.

Jon & Sally Tiven

Sound: A-

Performance: A

24 Carrots: Al Stewart
Arista AL 9520, stereo, \$8.98.

I thought that the milk-smooth sound of *Time Passages*, the previous Al Stewart album, dictated some sort of change next time out of the shoots. Evidently Stewart and his Svengali Luke O'Reilly agreed, for they ditched the services of Alan Parsons who had produced the last several opi in his ultrasmooth perfection style. Instead, on *24 Carrots* Al Stewart produces himself with Engineer Chris Desmond. They stripped some of the lushness out of the sound to allow the band, now awarded their own name as Shot in the Dark, some room for personality. But they didn't ditch the basics.

It seems that the '80s are going to be very demanding on its troubadors. The songs must carry the weight. Fortunately the new collection discards the insipid self-reflection of *Time Passages* in a conscious effort to return to strengths. As in the historical narrative told in parallel *Murmansk Run/Ellis Island*; also the exotic tableaux of *Constantinople* and *Merlin's Time* and the folk-like balladry of *Rocks in the Ocean* featuring Robin Williamson, late of the Incredible String Band, with his Merry Band.

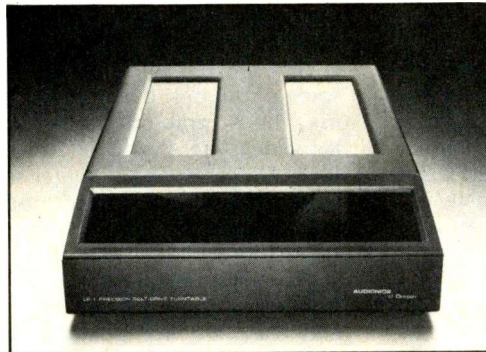
Some of the songs are simply dull (*Mondo Sinistro*) or silly (*Paint By Numbers*). But at least *24 Carrots* tries to avoid the sameness trap laid out so insidiously by *Time Passages*. The album's risks are its strengths.

Incidentally, the copy I received is one of the worst mastered albums I've heard all year. The surface noise is embarrassingly persistent. M.T.

Sound: D+

Performance: C+

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Jazz & blues

Giants of Jazz

Louis Armstrong, STL-J01; Duke Ellington, STL-J02; Billie Holiday, STL-J03; Bix Beiderbecke, STL-J04; Benny Goodman, STL-J05; Coleman Hawkins, STL-J06; Jelly Roll Morton, STL-J07; Jack Teagarden, STL-J08.

Time-Life Records, three mono discs and booklet per boxed set, \$19.95 per set plus shipping; \$21.95 for cassettes or 8-tracks.

The recordings reviewed here are contained in the first eight sets of the **Giants of Jazz** series produced by Time-Life Records. These discs are of great interest and worthwhile owning for a number of reasons. First of all, these sets are *not* just one more collection of copies of 78-rpm originals. Time-Life Records worked with critics, collectors, and discographers to generate lists of the most desirable recorded performances. Then they secured the best originals of a number of different labels for the transfers to tape. The sophisticated efforts made by CBS Records engineers add up to another reason for acquiring these discs. All varieties of noise reduction, equalization, filtering and tape editing were used to obtain the best end result for listening.

For those who don't know that much about Louis, Duke, Billie or the others, these sets are an ideal place to start. The careers of each are spanned with many selections, and the accompanying booklets have excellent biographies and detailed discussion of each selection. Those ordering the first set (Armstrong) will also receive John Chilton's *Who's Who in Jazz*, 370 pages worth of biographies, about 300 of them. Each set also includes a full-color reproduction of a specially commissioned portrait.

In my own collection of 78-rpm records I have many of the selections included in the series. I had already copied quite a few of them using my own filtering schemes, so I was doubly interested in the results. The more I listened to and compared the Time-Life discs with my collection, the more I became convinced that there was a lot on the original masters I had never heard before. There was no doubt whatsoever that the surface noise was much lower in the majority of cases. The timbre of individual instruments



had become a real thing, and the backgrounds to the solos were so much cleaner. For example, on Armstrong's *Savoy Blues*, the bass of the piano was no longer muddy, and the guitar work stood out clearly. I also noticed a point where Sonny Greer (Duke Ellington) changed his cymbal technique, something that I had missed listening to my own 78s.

There were similar improvements in all of the selections, which included personal favorites such as Armstrong's *Georgia Bo Bo* and *Potato Head Blues*, Ellington's *Ring Dem Bells* and

Cottontail, Holiday's *What a Little Moonlight Can Do* and *Miss Brown to You*, Beiderbecke's *Copenhagen* and *I'm Coming, Virginia*, Goodman's *King Porter Stomp* and *Down South Camp Meetin'*, Hawkins' *Hop Off* and *Body and Soul*, Morton's *Dead Man Blues* and *Shreveport Stomp*, and Teagarden's *The Sheik of Araby* and *St. James Infirmary*. It's impossible to list all of the excellent tunes in this series.

I do prefer the version that I have of Ellington's *East St. Louis Toodle-Oh*, but it's a matter of taste, and the one

in the set certainly has superior sound. I missed some of my favorites, such as Armstrong's *Struttin' with Some Barbecue*, but there was no basis to fault the choices made, and there were a number of new excitements provided.

My overall assessment of these **Giants of Jazz** records is basically the same for each set. The selections included are excellent choices, and the sound is quite superior to what has appeared before or the originals that some of us may have. There was obvious benefit from the fact that Time-Life Records sought out originals from many different labels, instead of sticking to just one label with the obvious

limitations. The monaural sound might seem a limitation to some who don't have older records, but I support the decision made not to gimmick something up for so-called "stereo." The LPs supplied for review were on a par with other discs, with very few ticks or other defects.

The packaging of the boxed sets is excellent, with the well-written booklets fitting alongside the records. The \$19.95 price (plus shipping) for each set seems quite reasonable for what is delivered. (It's \$2.00 more for cassettes or 8-track.) The **Giants of Jazz** sets should be of interest to all who would like the best sampling available of

these great recordings from the past. For those with 78s, you can also say goodbye to records that slip or won't drop, to say nothing about surface noise and cracks in the shellac. (Time-Life Records, 541 N. Fairbanks Court, Chicago, Ill. 60611.)

Howard A. Roberson

Sound: A-

Performance: A+

Creole Gumbo: The Dukes of Dixieland

Sandcastle SCR 1035, stereo, \$7.98.

This is a ripe, rambunctious album from the rejuvenated Dukes of Dixieland, a traditional jazz group that attempts to touch base with today's music. The Dukes have had a complete change in personnel in the past few years, and the younger men who have taken over are injecting new life into the band's repertoire. This Sandcastle release is basically Dixieland, but also includes blues, Swing, as well as interpretations of pop standards, show tunes — even a disco-oriented TV commercial!

The fine band plays with tremendous spirit, with flair, and the six members create solid, driving ensembles on tunes like *Mississippi Mud*, *Dippermouth Blues*, *Sweet Georgia Brown*, *St. Louis Blues* and *That's a Plenty*. The rhythm section of Mike Vreeland (piano & banjo), Al Bernard (bass), and Barry Miller (drums) is positively buoyant, and the frontline solos are expert and exciting. Clarinetist Otis Bazzon plays with fire and authority, and with the long, sweeping lines that adhere to the New Orleans tradition. Trumpeter Mike Vax blows with a keen, open tone, crisp intonation and inventive phrasing. Trombonist Bob O'Rourke adds some rousing moments to the ensemble interplay. Producer John Shoup, who also manages The Dukes, has turned out a splendid disc that should revive the spirits of those who love traditional jazz. The stereo sound is full, clean and clear. *John Lissner*

Sound: A

Performance: A

Kings of Mali: Chico Freeman
India Navigation 1035, stereo, \$7.98.

Chico Freeman, the highly regarded young player who is making a name for himself amongst the post-Coltrane tenor saxophonists, is a contemporary jazz artist who seems determined to have instant rapport with his listeners. Within the fierce, hard-edged Coltrane context, Freeman has developed a warm, communicative approach. Instead of hacksawing his way through a series of abrasive solos, Freeman does

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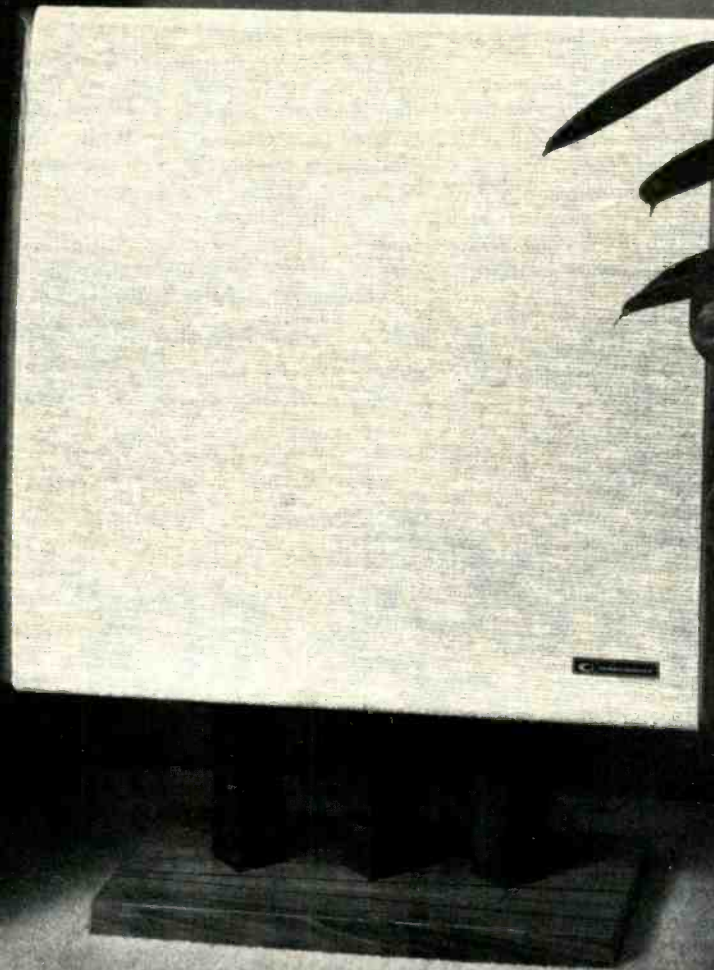
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not hesitate to win the listener over with lyrics, rich harmonic textures, and melody. His music on **Kings of Mali** is accessible and often swinging.

Kings of Mali features Freeman as a powerful solo voice within four meticulously arranged pieces. His excellent, cohesive band — Don Moye on percussion, Cecil McBee on bass, Anthony Davis, piano and Jay Haggard, vibraphone—offers subtle interplay with the vibraphone and piano blended in a most intriguing way.

Freeman's Coltrane influence is evident on the tension-and-release and the voracious bite of his attack on Illas

and Minstrel's *Sun Dance*; he serves up chortling soprano sax licks on *Look Up*, and his *Kings of Mali*, the title selection, boasts an intriguing arrangement with percussion, bass and flutes dubbed over a background of bail-phones (an African instrument). Chico Freeman is one of the new generation of avant garde jazzmen producing compelling, creative music. **Kings of Mali** is, indeed, an interesting musical statement from a talented young player/composer with tremendous potential.

John Lissner

Sound: A

Performance: A

By Myself: Abdul Wadud Bisharra BR 101, stereo, \$7.98.

Cellist Abdul Wadud has attracted widespread attention on recordings by Arthur Blythe, Julius Hemphill, and Frank Lowe. Wadud's first solo album is precisely that — an album of unaccompanied cello music.

Wadud is a virtuoso cellist with an awesome pizzicato facility, an equal dexterity with the bow, and absolutely no hangups about what is supposed to be played on the instrument. The six Wadud compositions which make up this album are all in different styles and are clearly the work of an original musical thinker. Wadud's pieces are not just technical showpieces, but fully thought-out models of clear, logical structure and impressive thematic development. There's no sure way to tell exactly what is written and what is improvised, but each of the six pieces hangs together very cohesively.

The opening *Oasis* uses thick-textured multi-stops to conjure up the effect of an entire Arabic ensemble. Indeed, the melodic line sounds uncannily like an oud taqsim. *Kaleidoscope*, which demonstrates Wadud's bowing and plucking techniques to their fullest, is more abstract yet expressively emotional. A masterpiece of peerlessly timed phrasing, *Camille* is as funky a blues as you're likely to hear on a solo cello. *Expansions* is an open-form examination of the instrument's range, featuring some intensely deep-felt bowing as well as pizzicato arpeggios which could possibly be taken as an evocation of a Gambian kora. *In a Breeze* is a lyrical midtempo piece played primarily in the upper register, showing Wadud's impeccable timing and fine intonation. *Happiness* opens with insect-like arco harmonics which soon lead to an African-inspired rhythmic pattern played with a slapping bounce off the strings. This eventually shifts to an appropriately happy dance tune couched in a faster tempoed but similar Afro-rhythm.

The variety of styles and playing techniques presented here, not to mention the imaginative and thoroughly musical uses Wadud makes of them, insures that **By Myself** easily transcends the quality of sameness common to many solo albums by contemporary improvisers. Two more volumes are planned, both of which are intended to investigate further uses of the cello. These two records are most eagerly awaited. (Bisharra Music and Productions, P.O. Box 749, Newark, N.J. 07101.)

Tom Bingham

Sound: B-

Performance: A

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Tune Up: Miles Dav s

Prestige P 24077, 2 discs, mono, \$8.98.

This Prestige double set, which has been sitting on the bottom of a pile of review records for some time, is an important jazz package. Indeed, **Tune Up**, a reissue of Miles' definitive mid-'50s sessions, is an essential part of any library that focuses on post-Swing modern jazz.

Davis, who was then emerging from his earlier "cool" period, runs a wide gamut of expressiveness from fierce, hard-driving fast tempos to ballads that have an ethereal serenity. His playing is lucid and beautifully controlled, and his unique style with its sparse, briefly ejaculated phrasing is fully developed.

Perhaps the most significant selections in the collection are the superb *Walkin'* and *Blue N' Boogie* with muscular tenor solos by Lucky Thompson, and the explosive, trip hammer piano of Horace Silver. Silver also appears as pianist on *Four, Old Devil Moon, Solar, You Don't Know What Love Is, I'll Remember April*, and *But Not For Me*. Thelonius Monk is the pianist on *Bag's Groove*, while John Lewis displays his skill and finesse on *When Lights Are Low and Tune Up*.

The monaural sound quality of the

Prestige set is impressive, thanks to the sensitive engineering on the originals by Rudy Van Gelder and the excellent remastering at the Fantasy studios by David Turner. *John Lissner*

Sound: A+ Performance: A+

Tales of Captain Black: James Blood (Ulmer)

Artists House AH7, stereo, \$8.98.

By the time you read this the whole punk/funk-jazz scene from which **Capt. Black** springs will have transmogrified into something more clearly defined and realized. Even by late 1978, when this album was recorded, **Capt. Black** had already been dated by guitarist Ulmer himself.

James Blood Ulmer (he sometimes drops the Ulmer) came to prominence as part of Rashied Ali's early '70s quintet after paying dues in several R&B groups during the '60s. But Ulmer's newest direction takes its cue from Ornette Coleman's recent outings into electric jazz with his group Prime Time. Ulmer is an on-again off-again member of this group and has absorbed Ornette's Harmolodic Theory of Improvisation. With Ornette's

Dancing in Your Head as his precursor, Ulmer has created a music that is rhythmically propulsive like disco while retaining the jagged energy of the New Wave in rock. All this serves as a basis for essentially free jazz improvisation.

Ulmer's recorded sound is thin and ascetic. His lines cut splintered arcs around Jamaladeen Tacuma's constantly modulating bass. He's matched in many sections with Coleman's ascerbic alto. They both seem episodic and choppy in their solos, never developing a line of exploration but rather several small areas of disrupted thought. Denardo Coleman's drums keep things busy and moving, but there is a feeling of incompleteness that permeates this recording.

Subsequent live performances by Ulmer bear out the idea that this album was recorded before he was fully secure in his concept. His live sound is a full-bodied and unchained electric storm. But until he offers a new chronicle, **Tales of Captain Black** serves as an interesting skeleton of shapes to come. (Artists House Records, 40 West 37th St., New York, N.Y. 10018.)

John Diliberto

Sound: B Performance: C+

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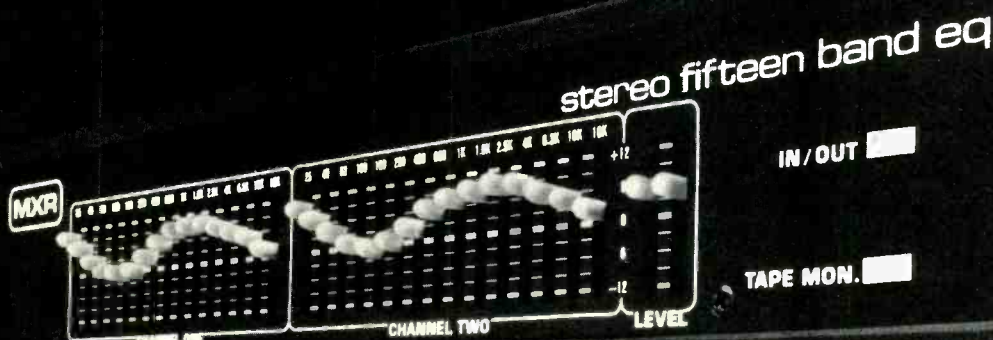
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Tom Bingham



These Days: Crystal Gayle
Columbia JC 36512, stereo, \$7.98.

Crystal Gayle has never been an easy performer to classify. Her early United Artists albums were too pop-influenced to be "pure" country, yet too Nashville-oriented to be out-and-out pop. Even so, "crossover" seemed too mercenary a label for her.

Then came Crystal's breakthrough album, **We Must Believe In Magic**, which instantly rendered all attempts at categorization futile. Since that time, she has flirted with virtually ev-

ery idiom one could list under the rubric "popular music," from Vegas ballads to bluegrass, occasionally experimenting with intriguing hybrids with striking results. **These Days** has few experiments per se, but it's hardly less eclectic, offering a healthy dose of r&b and progressive-blues (including a couple recent B.B. King tunes, *Same Old Story* and *I Just Can't Leave Your Love Alone*), adult-contemporary (the single *If You Ever Change Your Mind*), country-rock (*Too Many Lovers*), quasi-jazz (*Lover Man*), swing (*What*

A Little Moonlight Can Do), and a country song in a chamber-music setting (*Help Yourselves To Each Other*).

What distinguishes Crystal Gayle records, and **These Days** in particular, from more pretentious attempts at "tearing down the walls" is the sheer restraint of Allen Reynolds (indeed, restraint has become a Reynolds trademark). There's no muss or fuss, just first-class rhythm tracks, consistently strong and suitable material, and typically low-key string backing by Charles Cochran, who seems to be the only arranger in Nashville who uses strings for musical support rather than for goey commercial sweetening (as witness also his work for Don Williams).

But what really sells the album is some of Crystal's finest singing ever. Since the cool detachment of **Don't It Make My Brown Eyes Blue**, she has learned to use that distinctive, instantly recognizable catch in her voice to inject totally convincing emotion into her singing. If there's anything intrinsically "country" about Crystal Gayle, it's the unaffected feeling she puts into even the most sophisticated songs.

To be sure, not everything on the album works equally well. *I Just Can't Leave Your Love Alone* tries to capture the Dixieland feel of B.B.'s original, but there's rather too much restraint to the instrumental backing, which lacks a certain lithe bounce. *What A Little Moonlight Can Do* has the bounce, but Cochran's piano comes off rather corny. Both cuts remain listenable, however, if only for Crystal's vocals.

Followers of the contemporary music scene are becoming increasingly aware that "recorded in Nashville" no longer necessarily implies country. Crystal Gayle is virtually a symbol of the creative and stylistic freedom now found in Music City. **These Days** is a most encouraging demonstration of how that freedom is being exercised.

Tom Bingham

Sound: A-

Performance: A-

Horizon: Eddie Rabbitt
Elektra 6E-276, stereo, \$7.98.

Having found considerable success as a country-pop balladeer with *Every*

Illustration: Rick Tulka

Which Way But Loose and *Suspicious*, Eddie Rabbitt tries his hand at rockabilly on side one of **Horizon**.

Rather than go the normal route of reviving old rockabilly favorites, Rabbitt and regular collaborators Even Stevens and David Malloy have written five original songs. They may not be strict 1956 rockabilly, but four of the five stand up very well by comparison.

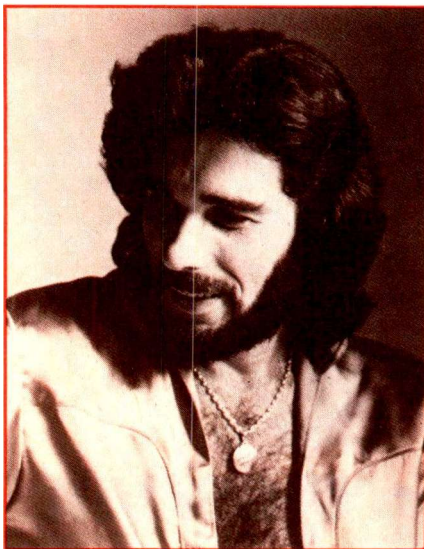
747 bears what is certainly not a coincidental resemblance to the Junior Parker/Elvis standard *Mystery Train*, though the chord progressions are considerably updated. The smash single, *Drivin' My Life Away* (from **Roadie**), owes more to John Fogerty's late-'60s Americana vision of neo-rockabilly than to the original style, but that's hardly a cause for complaint. *Rockin' With My Baby* is the least successful song on the side, since it lacks the vitality which easy-beat rockabilly ballads need to rise above mediocrity. On the other hand, *Short Road To Love*, with its Sun-like echo, and *I Love A Rainy Night* are two of the finest specimens of 1980 rockabilly I've yet heard.

Side two finds Rabbitt back in his accustomed country-pop territory. Indeed, the two sides of the album share virtually nothing in common aside from personnel. Personally, I don't know many rockabilly fanatics who would sit through side two's formula country-pop. Or is it that Rabbitt and producer Malloy are hoping there are a lot of adult-contemporary fans (who will doubtless find side two to be uniformly delightful) who are closet rockabilly cats? Regardless, side two is pleasant, tastefully arranged and produced, well-sung (except for some glaring high-note strain on *So Deep In Your Love*), and eminently forgettable.

Tom Bingham

Sound: B+

Performance: B+



New York Town: Johnny Paycheck
Epic JE 36496, stereo, \$7.98.

I confess I've always had mixed feelings about Johnny Paycheck. Is he actually the unrestrained good-ol'-boy his image projects or an ingenious con man? Like any good con man, he can be thoroughly ingratiating one moment and just as thoroughly obnoxious the next. And like any good con man, if he gets lucky and snares enough suckers with a big score (in Paycheck's case, *Take This Job and Shove It*), he'll turn around and pull another scam just like it, camouflaged by only a few minor adjustments (*Me and the I.R.S.*).

One thing's for certain, he knows how to rouse a crowd in true huckster fashion. The audience on this LP, recorded live at New York's Lone Star Cafe, eats up everything the man does. Listen to the title song, where the mere mention of the term "rock'n'roll" sets off a round of whoops and hollers. But then, as a regular listener to the syndicated "Live At The Lone Star" radio broadcasts, I'm convinced that Lone Star patrons voraciously gobble up *anything* thrown at them with equal relish. Real urban yahoos, this crowd.

Tom Bingham

Sound: B-

Performance: B-

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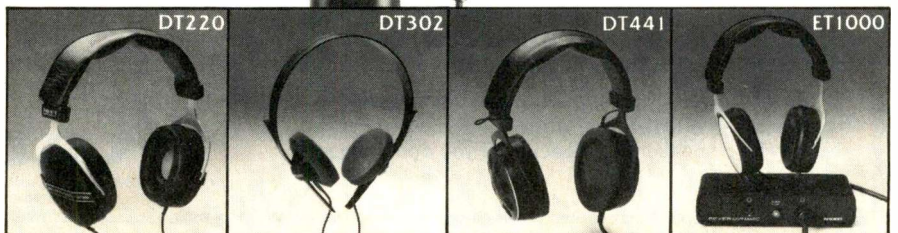
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Your Body Is An Outlaw: Mel Tillis Elektra 6E-271, stereo, \$7.98.

For most of the '70s, Mel Tillis was one of the standard-bearers of hard country purism. On his last few MCA albums, however, he "went pop." While he didn't do a bad job of it, he never really seemed comfortable in his new role of nightclub-style ballad singer.

With this album, Mel returns to country music, an event to which his hard-core fans have accorded a significance somewhat akin to the Second Coming. This observer, though, isn't quite so hasty to applaud. To be sure, the Western Swing cuts are top-notch and *Steppin' Out* is a jaunty honky-tonker. On the other hand, *Whiskey Chasin'*, *A Thing Called Sadness*, *Love Up A Storm*, and *She's Just Being A Woman* (the latter two come perilously close to crossover territory) are, to be blunt, dreadful bores. (Some people may argue that boring country has more integrity than boring pop, but that doesn't make it any less boring.)

But don't dismiss the entire album on the basis of these four cuts. Mel is backed by his touring band, The Statesiders, perhaps the finest all-around country ensemble on the road today.

The Statesiders boast a precise, highly disciplined, yet still straight-ahead country-fiddle quartet (four appears to be the maximum number of fiddles you can have before they become violins); a tight, versatile horn section, and a rhythm team which plays nearly as clean and tastefully as a Nashville studio combo. The arrangements are top-flight even on the duller cuts, but they're especially imaginative on the Western Swing tracks.

There are four Swing cuts here, including two Bob Wills favorites. *Stay A Little Longer* is given a clever intro and tag with what might be termed a "fife-and-drum fiddle-tune" flavor. The other Wills classic, *Cherokee Maiden*, is arranged in a more orchestral manner than Merle Haggard's looser, jazzier remake of a few years back. *Sweet Little Miss Blue Eyes* is a rather hokey song, though it's boosted by smooth fiddling and ear-catching multiple-guitar passages. The best of the Swing cuts is the single, *Rain On My Parade*, with a catchy barroom melody, solid punching rhythm work, and effective obligatos behind Mel's animated vocal.

Tom Bingham

Sound: B+

Performance: B+

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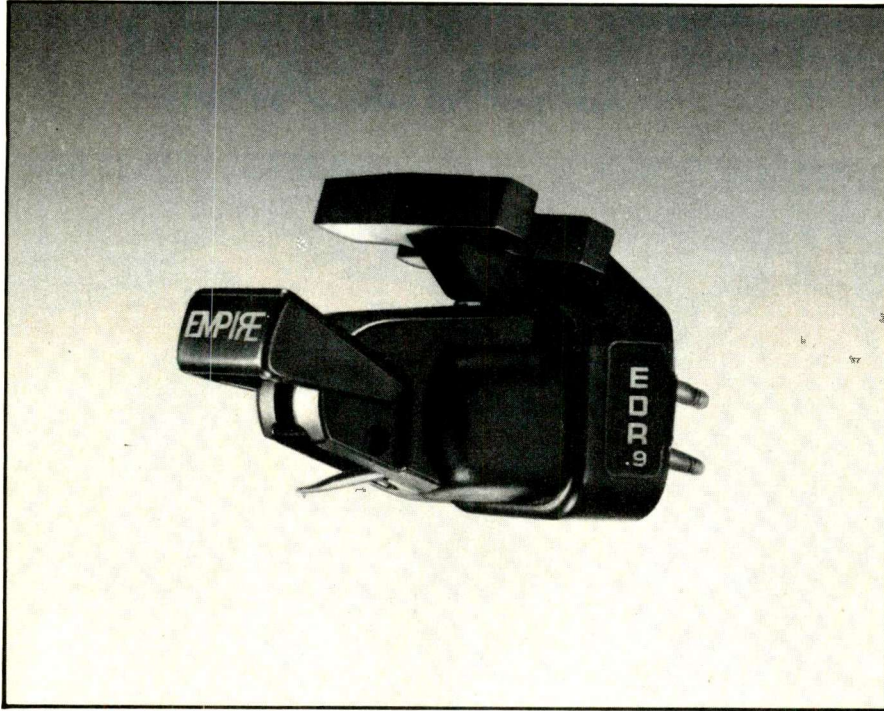


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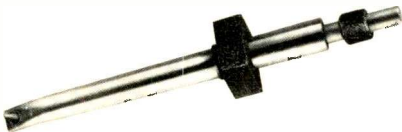
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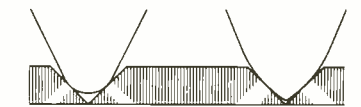
1. _____



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2. _____



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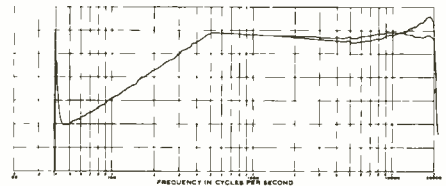
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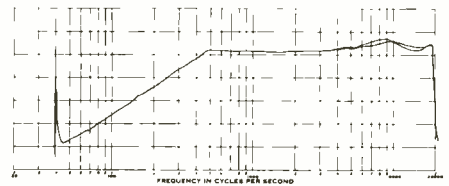
3. _____

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A conventional cartridge's frequency response changes when connected to different preamps.



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Classical reviews



The Play of Daniel. The Clerkes of Oxenford, David Wulstan. Nonesuch N-87003, stereo, \$9.98.

It is good to have Nonesuch back to its earlier policy of unusual imports re-released, but in other respects the present N series is thoroughly modern: The quality is super-excellent (though not designated audiophile) and the price is steep. Just like everybody else's. (Much of the original catalogue, going back to the early '60s, still sells at a lower and bargain price.)

"The Play of Daniel" made its modern reputation, after perhaps 700-odd

years, via the New York Pro Musica under the enterprising Noah Greenberg. This is a different and earlier "production," the first in modern times, recast by the present Director, David Wulstan, and here brought to records in Oxford as of 1975. The ancient manuscript has relatively fluent stage directions for the sacred drama, which amounts to a medieval opera produced within the church. But as in all early music there is much to be worked out and guessed at and arranged for practical performance; this version is less flamboyant but also far

more musical, to my memory, than the old Greenberg offering (still available on disc as **MCA 2504**).

The music is almost entirely unaccompanied, solo voices and various monodic choruses (that is, singing in unison), and these performers accomplish miracles of pitch accuracy as is abundantly clear when the occasional and tastefully sparse instrumental bits appear, notably a fine trumpet announcement. Best of all, the modern urge to sing everything like 19th century Italian opera, particularly rife in the old Pro Musica, is minimized; the male solos, high and low, sing clearly and modestly, the choruses are precisely blended and accurate in rhythm and diction, and the instruments play without hysteria. The fact that the production is redolent of the English church is hardly surprising; even though the original came from Beauvais in France (before the famed tall cathedral in that town was built). Complete Latin text and stage directions are paralleled by an easy to follow translation, so that the familiar story of Belchazzar and the handwriting on the wall, followed by Daniel in the lion's den and the prophecy of the birth of Christ, is pleasant and dramatic in the unfolding.

Why for an audio audience? The 1975 recording, first, is excellent and

the pressing superb, the only mild flaw a few faint pre-echoes in the frequent pauses of silence. Second, the acoustic effect of the singing is also marvelous, the stereo a pleasure to hear. What more can you ask?

Sound: A- Recording: A Surfaces: A-

John Cage: The Seasons (1947); Charles Wuorinen: 2 Part Symphony. American Composers Orchestra, Dennis Russell Davies. **CRI 410**, stereo, \$7.95.

For my ear, much the most interesting of these two symphonic works is on side 2, Wuorinen, but the "big name" gets the side 1 plum. The Wuorinen, composed a couple of years ago, is a mature and ripe work of its sort, whereas the Cage is an early piece, before that enigmatic composer began his later and more celebrated essays into the challenge of prepared pianos, happenstance (aleatoric) music, and other provocative mayhems. Including that famous work which consists mainly of total silence. I always enjoy the later Cage—he has to bring a smile to your face, he is so ingeniously outrageous, and so obviously enjoys being so. In this early work, side 1, he writes merely very expert, if derivative, "conventional" contempo-

rary music for a plain old ordinary orchestra. (Still—if the piece were by itself I think I'd be impressed. It is a very original derivation, so to speak.)

Wuorinen is one of those persistent names you see every other day if you live around New York and have gotten yourself onto local music mailing lists. The contemporary music "overground" (often shading into underground) is intensely active in the city, even if it must support itself via gifts and grants and commissions plus an "in" group of dedicated ticket buyers. These people really work for their money, though. Maybe I had never heard a note of Wuorinen before this disc, simply because, like a persistent TV ad, his name had pestered me too often. An eager beaver, I was sure, but probably deadly serious in some obscure, mole-like way, writing obstinately difficult "modern" stuff that I probably couldn't abide to hear. . . . That's what too much publicity can do. Wrong, wrong!

To be sure, the man is very modern, if that is the word. His expertly controlled orchestra spits out blats and bleats and screeches of the most dissonant sort, beginning to end, with a distinctly "cereal" configuration, those 12 tones again—though oddly enough the work is in C major. Occasional sweet consonances are almost a shock,

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like reverse dissonances. But all this is familiar enough to the hi-fi ear and will not really bother. What counts, in a general way, is the sonic impact, and here this music excels. First, Wuorinen is a marvelous writer for the large orchestra, and original too. He tends to write in what I might call tone clumps, not so much melodies as tonal compounds, acid shrieks of string, blats of dissonant brass, unexpected little jazzy bits of xylophone and the like, all crystal clear and highly contrasted in color, and never a trace of dissonant mud. Second, unlike many a composer

who has adopted those 12 tones as a framework, this man is strongly developed in his rhythm, a sort of neo-neo-classical jaggedness of beat that will immediately appeal where the more draggy non-rhythms of many a contemporary composer pall.

As usual, CRI has two excellent recordings here and beautifully pressed. The sound is remarkably good, considering that these are from live performances with audience. Interestingly, both come from the same concert (Alice Tully Hall, New York) but Cage was recorded by a Public Radio team,

Wuorinen by David Hancock, who is definitely not Public Radio, if I am right. The Hancock, for my ear, has the better presence and immediacy.

Sound: A- Recording: B+, A- Surfaces: A-

Harvey Pittel Saxophone Quartet. With Shelly Manne, drums and Monty Budwig, bass. **Crystal S 155**, stereo, \$7.98.

I continue to be astonished at how often Crystal's product is of interest to outsiders like us, not merely the specialists who perform. Like this disc. Really excellent. First — a sax quartet? Enough to rouse the curiosity. Remember that the sax was invented in France in the mid-19th century as a strictly classical instrument. Only very much later was it taken up by American popular musicians, until in the '30s no big band or any other band lacked the ubiquitous sax sound. Now, with jazz going classic and third-stream music galore, the sax is moving its base back, as this young and astonishingly able group shows.

Even the tired Bach *Little G Minor* fugue sounds fresh and stylish, as does Scott Joplin a couple of selections down. There is original music for sax quartet by four early-twentieth composers, naturally in French style (the French never forget...), the only familiar name being that mellifluous Russian, Glazunov. My favorite is the really interesting piece by one Jean Rivier, b. 1896, a sort of post-Ravel bit, full of color and verve. Then with hardly a hair turned, the players are into "big-band" music (with Manne and Budwig) in absolutely impeccable style. You'll be amazed. But best of all, I think, is the sound of the sax quartet and the incredibly fleet musicianship of these four players. It's memorable. You'll enjoy.

Sound: A- Recording: B+ Surfaces: A-

The Western Arts Trio, Vol. 3. Turina: Trio No. 2, Op. 74. Tcherepnin: Trio, Op. 34. Copland: Vitebsk Study on a Jewish Theme (1929). Marcelle de Manziarly: Trilogue. Laurel LR-109, stereo, \$7.98.

Herschel Gilbert, producer for this series, trumpets "Beaux Arts Trio, move over!" in a publicity letter to me. Well, if you know the much acclaimed Beaux Arts, veterans of dozens of big-time recordings notably on Philips, you will indeed find a similarity in this group—though the repertoires of the two Trios are very different, the Beaux Arts going in for Brahms, Beethoven

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and Mozart. Both groups—violin, cello and piano, the classic chamber-music medium for 200 years—are what I can best call microgenic, putting out an astonishing musical charisma via the recorded medium. It is a pleasure to listen to the Beaux Arts as they play before the mikes, and the same goes for these three musicians, who seem to love and savor every minute of it. Important for us who listen! Many a musician or musical group, though OK in the flesh and live, somehow manages to come through in recording like a pile of dead fish.

In contrast to Beaux Arts, this Western Arts offering hits a more Latin American theme. The colorful Turina, maraschino cherry flavor, is balanced by Russian-French sounds from Tcherepnin and Ms. Manziarly, both of approximately 1900 vintage; Tcherepnin (French spelling) somehow managing to anticipate back in 1925 the sounds of Shostakovitch and Kabalevsky and the like of later years. Manziarly, at nearly 80, writing remarkably acerbic and strong music of a glassy dissonance. And in between, good old Aaron Copland in his salad days as a fierce-eyed young revolutionary! You'll be amused at how easily the smooth, later Copland peeps out here and there from this stark stuff of 1929. In all of these diverse works the Beau—pardon me, the Western Arts players are full of enthusiasm and interest in their music. You'll enjoy, and the recording is excellent too.

Sound: B+ Recording: A- Surfaces: B+

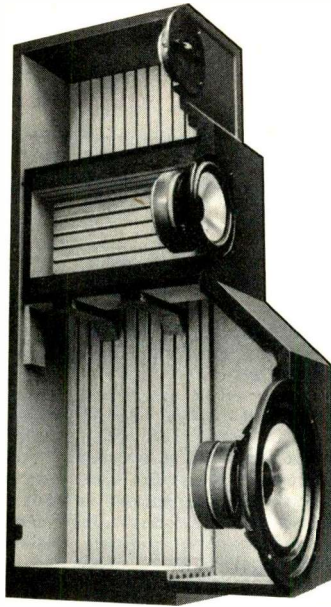
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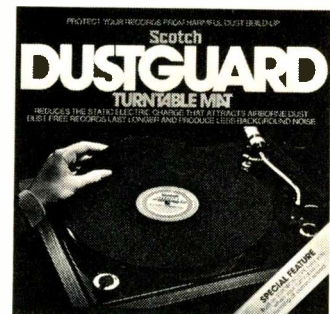
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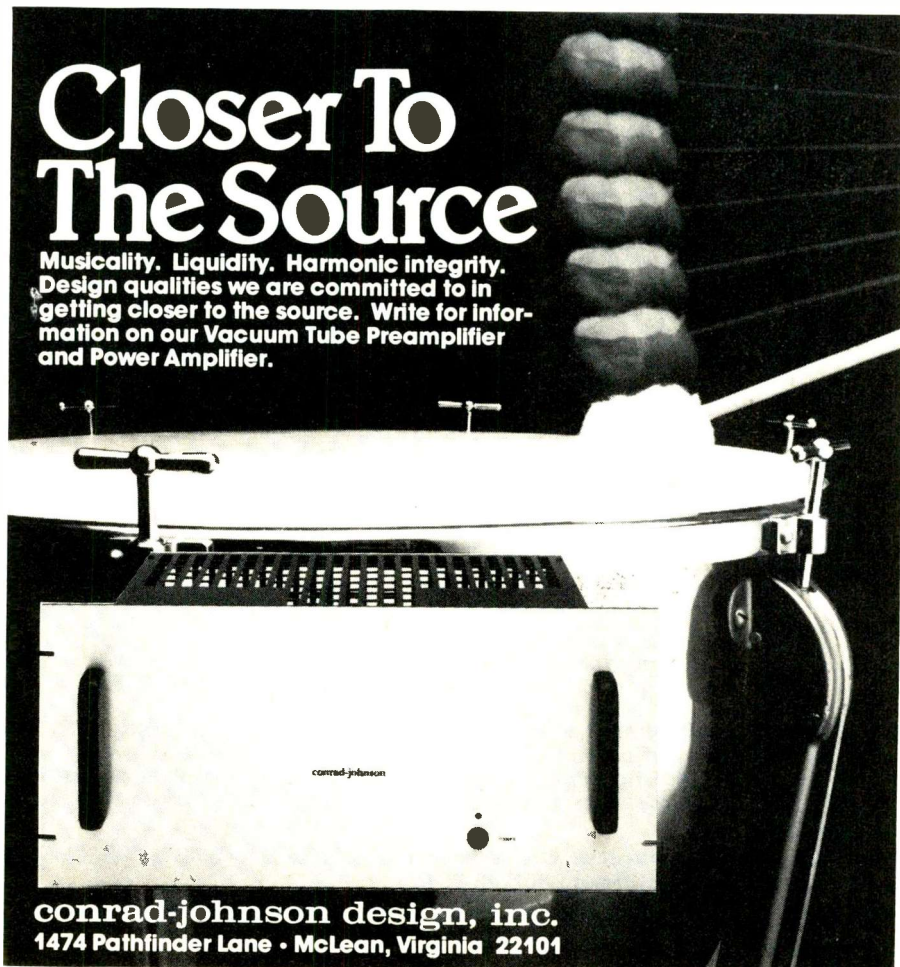
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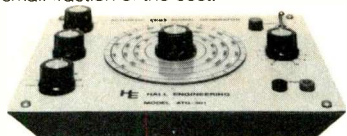
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Advertising Index

Firm (Reader Service No.)	Page
ADC (1)	113
ADS	15
Allison	20
Apt (2, 3)	74, 75
Astatic (4)	116
Audio Critic	24
Audionics (5)	76
Audio-Technica	4
Bang & Olufsen(6)	73
BSR (7)	25
Beyer Dynamic (8)	83
Cambridge Physics (9)	12
Celestion (10)	80
Crown	22 & 23
dbx (11)	19
Dahlquist (12)	79
Discwasher	2
Electro-Voice	16
Empire (40)	85
Fuji	59
Harman/Kardon	56 & 57
IMF (41)	89
JVC (13)	65
KM Labs (14)	26
Kenwood	63
Lux	3
3M (15,16)	67, 89
MXR (17)	81
Maxell (18)	17
McIntosh (19)	26
Nakamichi (20)	60 & 61
Onkyo	5
Osawa (21)	84
Pickering (22)	11
Pioneer (23)	Cov. II & 1
Polk (24)	18
Primo (25)	72
Radio Shack	117
ReVox	71
SME (27)	118
Sansui (28)	32 & 33
Sennheiser	78
Shure (50)	114
Siare (29)	89
Signet	87
Sonic Research (34)	14
Sony (30, 31, 32)	6 & 7, 53, 111
Soundcraftsmen (33)	47
Sound Guard (26)	88
Studer ReVox	71
TDK (35)	55
TEAC	21, 86
Technics (36)	Cov. IV
Trans Audio Mktg. (37)	27
United Audio	13
Yamaha	115

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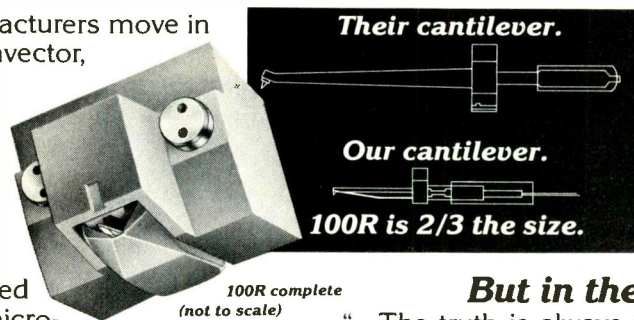
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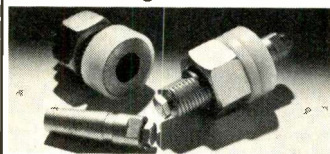
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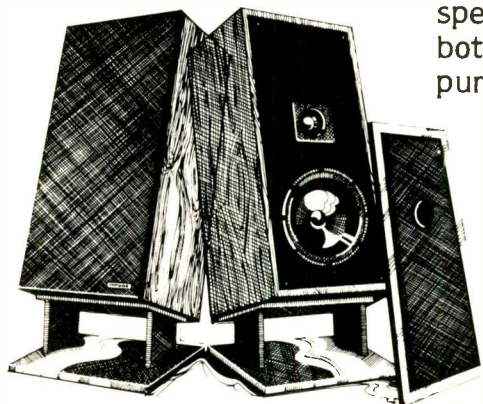
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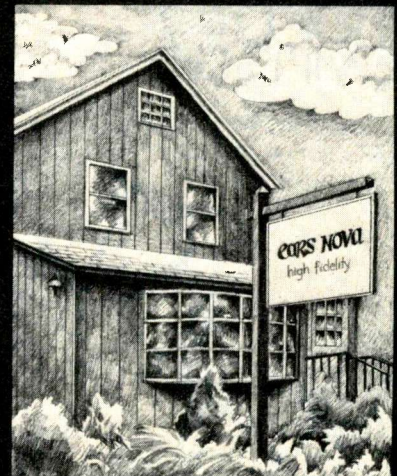
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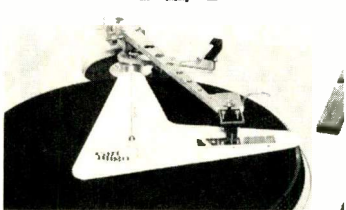
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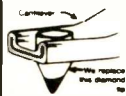
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Addenda

- Crown RTA-2 Real Time Analyzer (Workbench Profile, Nov. 1979, 106), Jan., 30.
Ortofon MC-30 Moving Coil Cartridge (Equipment Profile, Nov. 1979, 98), Jan., 30.

Amplifiers

- Build a Double-Barreled Amplifier*, W. Marshall Leach, Jr., *Part I*, April, 36; *Part II*, May, 44.

Antennas

- Kill FM Interference with Two Antennas*, Richard Modafferi, Jan., 68.

Book Reviews

- Born To Run: The Bruce Springsteen Story*, Nov., 50.
The Concerts, Aug., 63.
The Preservation & Restoration of Sound Recordings, Aug., 63.
The Illustrated History of Rock Album Art, Nov., 50.
The Rolling Stone Record Guide, Dec., 20.
Bob Dylan, His Unreleased Recordings, Dec., 20.

Car Stereo

- Car Stereo Manufacturers Directory*, July, 28.
Car Stereo Directory — Radios/Tape Players, July, 29.
Car Stereo Directory — Speakers, July, 35.
Car Stereo Directory — Amps/Equalizers, July, 44.
Great Cars! Great Sound!, Gary Stock, July, 52.
Keep Your Car Stereo Safe, Bob Curtis, July, 60.

Christmas

- Christmas Buying Guide*, Dec., 28.

Construction

- Build a Double-Barreled Amplifier*, W. Marshall Leach, Jr., *Part I*, April, 36; *Part II*, May, 44.
Build An Energy Storage Bank, Walter G. Jung, Aug., 38.
Build A Headphone Crossfeed Circuit, Charles Repka and Paul Berkowitz, May, 32.

Digital Recording

- Digital Techniques In Sound Reproduction*, Daniel Minoli, *Part I*, April, 54; *Part II*, May, 34.
Dr. Thomas Stockham — On The Future of Digital Recording, Gary Stock, Feb., 8.

Directories

- Car Stereo Directory*, July.
Directory of Manufacturers, 28; Radios/Tape Players, 29; Speakers, 35; Amps/Equalizers, 44.
Annual Equipment Directory, Oct.
Directory of Manufacturers, 158; Amplifiers, 20; Preamplifiers, 32; Tuners, 40; Receivers, 44; Turntables, 50; Tonearms, 58; Phono Cartridges, 62; Loudspeakers, 67; Microphones, 103; Cassette Decks, 108; Equalizers, 113; Open-Reel Tape Decks, 116; Headphones, 118.
Directory II, Nov.
Directory of Blank Tape, 64; Noise Reduction & Filter Systems, 68; Ambience & Time-Delay Units, 70; Compressors/Expanders, 72; Directory of Manufacturers, 74.
1979 Equipment Directory Addenda, Jan., 33.
1979 Car Stereo Directory Addenda, Jan., 41.

Distortion Theory

- Another View of TIM*, Robert R. Cordell, *Part I*, Feb., 38; *Part II*, March, 39.
Picking Capacitors, Walter G. Jung and Richard Marsh, *Part I*, Feb., 52; *Part II*, March, 50.

Dynamic Range

- The Importance of Dynamic Range*, Jerome E. Ruzicka, Jan., 52.

Equipment Profiles

- ADC Sound Shaper Two Mark II Equalizer, Feb., 73.
Alpine Car Stereo 3002 Main Amplifier, April, 70.
Alpine 7307 Car Stereo, April, 70.
Apt/Holman Control Preamplifier, Feb., 76.
Astatic MF-100 Phono Cartridge, Dec., 45.
Audio-Technica Lifesaver Record Care System, Feb., 64.
Bang & Olufsen MMC 20CL Phono

Cartridge, March, 78.

- B•C T-4M Cassette Deck, Feb., 68.
Carver M-400 Power Amplifier, Nov., 30.
Connoisseur BD2A Turntable, July, 74.
Crown FM-1 Tuner, May, 66.
DB Systems DB-6 Basic Amplifier, Jan., 102.
Dennesen Geometric Soundtracktor & Vertical Tracking Angle Gauge, March, 75.
Denon DL-103D Phono Cartridge, Sept., 70.
Denon DA-307 Tonearm, Sept., 70.
Denon AU-320 Transformer, Sept., 70.
Dual CS 731Q Automatic Turntable, May, 70.
Dual C-820 Cassette Deck, Sept., 67.
Dynavector DV/Karat Diamond Cartridge, July, 71.
Dynavector DV-6A Transformer, July, 71.
Fisher CR-4029 Cassette Deck, April, 66.
Fisher MT-6250 Turntable, June, 88.
Fried Products Model Q Loudspeaker System, June, 93.
Fulton Nuance Loudspeaker, Dec., 48.
JVC A-X9 Amplifier, July, 68.
Lirpa 5 Kg Tonearm & Cartridge, April, 62.
Luxman K-12 Cassette Deck, April, 74.
Mitsubishi M-A01 (Micro) Amplifier, Jan., 90.
Mitsubishi M-P01 (Micro) Preamplifier, Jan., 90.
Mitsubishi M-F01 (Micro) Tuner, Jan., 90.
Mitsubishi DA-R20 Receiver, Aug., 50.
NAD 7020 Receiver, June, 76.
NAD 6040 Cassette Deck, Dec., 41.
Nakamichi 680ZX Cassette Deck, Sept., 56.
Nakamichi High-Com II Noise Reduction System, Sept., 62.
Optonica RT-6905 Cassette Deck, June, 83.
Phase Linear 8000 Series II Turntable, Nov., 40.
Pioneer PL-630 Turntable, Jan., 98.
RG Dynamics RG D-3 Preamplifier, May, 74.
Sansui BA-F1 Power Amplifier, March, 72.
Sansui CA-F1 Preamplifier, June, 90.
Sherwood S-32CP Tuner, Jan., 106.
Shure SM-81 Microphone, Aug., 57.
Sony PCM-1 Digital Adaptor, March, 64.

Soundcraftsmen SP 4001 Preamplifier-Equalizer, Nov., 44.
 Technics ST-C01 Tuner, April, 79.
 Threshold Stasis 3 Power Amplifier, Dec., 38.
 Vector Research VCX-600 Cassette Deck, Dec., 58.
 White 4220 Passive Equalizer, March, 76.

Future Trends

Doug Sax On Current Record Technology and Music Systems of the Future, Gary Stock, March, 30.
Dr. Thomas Stockham — On the Future of Digital Recording, Gary Stock, Feb., 8.
Trends For The Future, Gary Stock, April, 28.

History

Edwin Armstrong: Genius Inventor, Gary Stock, Nov., 52.
Mechanical Marvel, C.F. Kerry Gaulder, Nov., 58.

Loudspeakers

Alternative Speaker Technologies, Gary Stock, Aug., 32.

Measurements

Which Is The Real Tape Playback Curve? — Tape Guide II, Herman Burstein, May, 20.
The New Level Meters, Ronald G. Ajemian, Dec., 34.
All That Data: FM Tuner Quieting and Distortion, Leonard Feldman, Dec., 68.

Obituaries

Robert M. Schmetterer, June, 40.
 John E. Volkmann, Nov., 12.

Personality Profiles

Fiedler, Arthur — *Just Call Me Maestro*, Bert Whyte, Jan., 48.
 Klipsch, Paul — *Arkansas Speaker Maker*, Bob Browne and Gary Stock, Aug., 26.
 Sax, Doug — *On Current Record Technology and Music Systems of the Future*, Gary Stock, March, 30.
 Stockham, Dr. Thomas — *On the Future of Digital Recording*, Gary Stock, Feb., 8.

Records and Record Care

How Records Are Made, Gary Stock, June, 42.
In The Groove: Close-Up View of Record Wear, Walter Davies, Sept., 38.

Tape

BASF DIN Calibration Cassettes, Howard A. Roberson, Feb., 82.
Blank Tape Directory, Nov., 64.
37 Cassette Tapes Tested, Howard A. Roberson, Sept., 44.

Tonearms

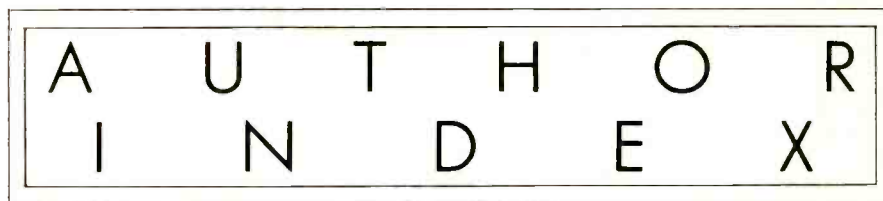
Tonearm Geometry and Setup Demystified, Martin D. Kessler and B.V. Pisha, Jan., 76; *Addenda*, April, 26.
Understanding Tonearms, S.K. Pramanik, June, 52.

Video

RCA Shows SelectaVision Video Disc, Gary Stock, March, 44.

Workbench Profile

BASF DIN Calibration Cassettes, Howard A. Roberson, Feb., 82.



Ajemian, Ronald G., *The New Level Meters*, Dec., 34.

Berkowitz, Paul and Charles Repka, *Build A Headphone Crossfeed Circuit*, May, 32.

Browne, Bob and Gary Stock, *Profile: Paul Klipsch, Arkansas Speaker Maker*, Aug., 26.

Burstein, Herman, *Tape Guide II — Which Is The Real Tape Playback Curve?*, May, 30.

Cordell, Robert R., *Another View of TIM, Part I*, Feb., 38; *Part II*, March, 39.

Curtis, Bob, *Keep Your Car Stereo Safe*, July, 60.

Davies, Walter, *In The Groove: Close-Up View of Record Wear*, Sept., 38.

Feldman, Leonard, *All That Data: FM Tuner Quieting and Distortion*, Dec., 68.

Gaulder, Kerry C. F., *Mechanical Marvel*, Nov., 58.

Jung, Walter G., *Build An Energy Storage Bank*, Aug., 38. With Richard Marsh, *Picking Capacitors, Part I*, Feb., 52; *Part II*, March, 50.

Kessler, Martin D. and B.V. Pisha, *Tonearm Geometry and Setup Demystified*, Jan., 76; *Addenda*, April, 26.

Leach, Marshall W., Jr., *Build A Double-Barreled Amplifier, Part I*, April, 36; *Part II*, May, 44.

Marsh, Richard and Walter G. Jung,

Picking Capacitors, Part I, Feb., 52; *Part II*, March, 50.

Minoli, Daniel, *Digital Techniques in Sound Reproduction, Part I*, April, 54; *Part II*, May, 34.

Modafferi, Richard, *Kill FM Interference with Two Antennas*, Jan., 68.

Pisha, B.V. and Martin D. Kessler, *Tonearm Geometry and Setup Demystified*, Jan., 76; *Addenda*, April, 26.

Pramanik, S.K., *Understanding Tonearms*, June, 52.

Repka, Charles and Paul Berkowitz, *Build A Headphone Crossfeed Circuit*, May, 32.

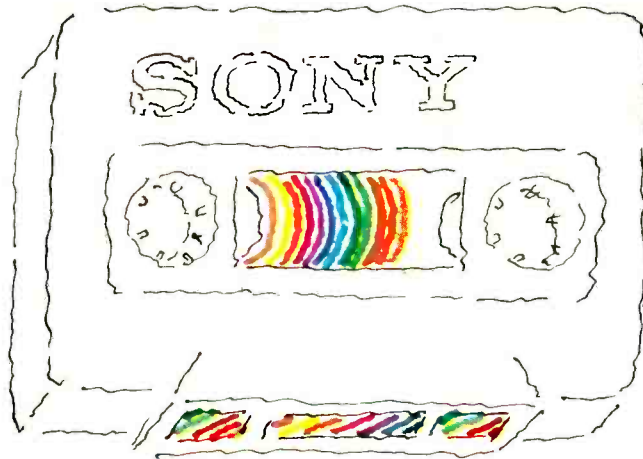
Roberson, Howard A., *37 Cassette Tapes Tested*, Sept., 44.

Ruzicka, Jerome E., *The Importance of Dynamic Range*, Jan., 52.

Stock, Gary, *Dr. Thomas Stockham — On The Future of Digital Recording*, Feb., 8; *The Audio Interview with Doug Sax*, March, 30; *RCA Shows SelectaVision Video Disc*, March, 44; *Trends For The Future*, April, 28; *How Records Are Made*, June, 42; *Great Cars! Great Sound!*, July, 52; *Alternative Speaker Technologies*, Aug., 32; *Edwin Armstrong: Genius Inventor*, Nov., 52. With Bob Browne, *Profile: Paul Klipsch, Arkansas Speaker Maker*, Aug., 26.

Whyte, Bert, *Just Call Me Maestro*, Jan., 48.

Inside Full Color Sound.



There's more to Full Color Sound than meets the ear.

There is a story of experience and technical achievement that no other tape manufacturer can tell. Fact: Sony produces both high fidelity audio and video tape and the high quality equipment that plays it. In fact, Sony pioneered magnetic tape recording, and has been producing tape and tape equipment for over 30 years.

Because of this vast and unique experience, we believe Sony knows more about producing high quality recording tape than anyone else. Sony know-how goes beyond exclusive magnetic particles and binders, or our exceptionally smooth SP transport system, or superb MOL and frequency response.

What Sony does in its own unique way has to do with *balance*. The fine-tuning of all the elements that go into making a tape, so that each complements the other, and together—in balance—deliver the finest recording that is humanly and technically possible to achieve.

It is this balance that is the secret of Full Color Sound. It isn't really difficult to make one particular element extraordinarily superb. So when some tapes boast about a particular feature,

we are not impressed. And neither should you be.

The true test of a tape is to balance these superb elements, some of which actually work against each other. For example, high sensitivity (so vital for MOL and S/N ratio) can produce print-through. Another example: increasing the volume of magnetic particles on the tape improves sensitivity. However, this would decrease tape durability.

Some of the factors that we consider important to tape performance are: MOL, frequency response, S/N ratio, sensitivity, uniformity of output level, print-through, erasability, and such physical attributes as runability, shedding, head wear, resistance to temperature and humidity.

This is where the genius of Sony comes in. To take all these elements and balance them so they work with, instead of against each other.

Balance. It's why Sony audiotapes are so superb. The fact is, the more expensive your audio equipment, the more you'll appreciate Full Color Sound. Listen to Sony SHF (normal bias), EHF (high bias), FeCr or Metallic tape yourself. Listen to the balance. It's the secret of Full Color Sound.

SONY.

Behind the scenes

Bert Whyte

In the early days of audio, when a bright fellow with good ears decided to build a loudspeaker, the usual recipe called for a teaspoon of knowledge and theory, a pinch of intuition, a dash of black magic (cone doping and the like), and a fervent hope that the results would be well-seasoned with good luck. There were some very respectable loudspeakers which resulted from such empirical design methods as these.

Nowadays, there is an ever-increasing use of such exotic instrumentation as digital computers, laser interferometers, and holographic analysis in the design of loudspeakers. B&W and KEF are two highly research-oriented British manufacturers which have always pioneered the use of these new design techniques. Some months ago, when B&W and Anglo-American Audio (B&W's agent in North America) invited the audio press corps to visit the B&W plant and research laboratories, I eagerly grasped this opportunity to see firsthand these interesting developments in loudspeaker technology.

The B&W plant is located in the village of Worthing in West Sussex, not far from the famous seaside resort town of Brighton. The facility is actually a complex of buildings, and our gracious host, Managing Director John Bowers, guided us through the various fabrication and laboratory areas. B&W is a relatively small company, with about 80 employees. However, they have twice won the Queen's Award for Export and now make eight different models of loudspeakers, including the new DM 11, DM 12, and 802. These three speakers have been designed with the benefit of the experience gained from computer-assisted research that resulted in the develop-

ment of B&W's premier loudspeaker, the Model 801, which subsequently was designated as the "official monitor speaker" for EMI and Decca classical music recording.

The pride of B&W's research department is their laser interferometer installation; a separate room is devoted to this equipment. A massive cement pier or test bed about eight feet long and 28 inches high is used as the

ferometer is interfaced with B&W's in-house Digital Equipment Corp. PDP-11/35 computer, which has a 96k byte core store and 20M byte disc store. Long-term storage is on 9-track digital magnetic tape. Hard-copy printouts and graphs are available, and a visual display unit is incorporated in a Tektronix T 4010 interactive graphics terminal.

By feeding appropriate voltages into the voice-coil of the speaker under test, the velocity at a selected frequency at selected points on the diaphragm surface can be investigated. In B&W's own description, "The computer has been provided with facilities for converting analog signals into digital form for storage and processing. By exciting the speaker driver with a narrow rectangular voltage pulse, the velocity impulse at each point on the diaphragm surface can be stored in the computer and subsequently converted to frequency response data using the Fast Fourier Transform." The measurement of these impulse re-

sponses can be used to determine the amplitude and phase of the velocities generated at the selected points on the diaphragm surface. With this data stored in the computer, it can then calculate what effect the motion of any part or the whole surface of the diaphragm has on sound pressure output.

Driver Design

The bass, midrange, and tweeter drivers of the Model 801 were designed with the aid of the laser interferometer/computer combination. Without this instrumentation coping with the vast number of variables involved in the selection of the speaker diaphragms would be well-nigh impossible. Consider that there are three



mount for the laser projector. This pier must weigh several tons, and its great mass is used to minimize — if not eliminate — any structure-borne vibrations which might cause a deflection of the laser beam from the target object. A specimen holding device is at one end of the pier, opposite the laser projector. A speaker driver can be mounted on this device, and an electric motor drive can rotate the speaker on its axis as well as move the speaker so the scan is across the driver's diameter. In this manner, the fixed-frequency laser beam with a 0.3-mm spot diameter can be focused on any area of the speaker cone, dust cap, the cone surround, or even the metal rim of the speaker basket. The laser inter-

Illustration: Leo Pando

AUDIO • DECEMBER 1980



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Introducing the new hand-crafted Astrion.[™] How do we achieve such unparalleled musical excellence? One by one. Piece by piece. All by hand. Each and every Astrion component is hand inspected, hand selected and finally hand assembled by our most skilled craftsmen. Like you, they look beyond specifications. That's why they personally audition every Astrion they build.

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Its exceptional purity creates a new standard for transient response.

In keeping with that high standard is Astrion's exclusive hand polished "extended contact" elliptic diamond tip. It's the smallest nude diamond tip we've ever made.

Our engineers also developed a unique pivot suspension system for the Astrion. The Orbital Pivot System.[™] Unlike other systems there are no restrictive armature wires, adhesives or governors. Instead each armature is micro-machined to form a perfect fit with the Astrion's S-4 suspension block. It's that simple. It's also that much more compliant in all signal directions.

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ADC ASTRION

speaker drivers in the Model 801, and ideally each must operate in the most linear fashion within its prescribed frequency range. Should the speaker cone be made of paper, felted paper, Bextrene, or one of the new polypropylenes? What should the mass of the cone be? What about its density? Should the cone be thick near the dust cap and taper to a thinner cross-section at the surround, or vice versa? What material should be used for the surround suspension and what should its compliance be?

In a series of tests relating to the

low-frequency section of the Model 801, B&W decided to use a closed-box enclosure rather than the vented-box type, since the former has a shorter effective reverberation time. Other tests revealed that the low-frequency driver should be able to maintain linear response with voice-coil displacements up to 6 mm. The BW300 woofer designed for the Model 801 uses long-throw suspensions and a voice-coil overhang of 6 mm on both sides of the magnet pole piece. To compensate for fault conditions in amplifiers which might cause voice-coil excursions

greater than 6 mm, a special magnetic assembly is used and the restraining action of the inner suspension prevents "bottoming" of the voice-coil against the magnet back plate. The BW300 woofer has an effective diaphragm diameter of 270 mm, the cone has the near-ubiquitous Bextrene coating with PVA damping compound, and the long-throw outer suspension is formed from plasticized PVC. The BW300 additionally has a two-inch voice-coil wound on Nomex formers to permit higher working temperatures. (It is interesting to note that the coveralls worn by race-car drivers are also made of Nomex, to reduce the danger from fire in crashes.)

The midrange driver required more research and tests than did the woofer and tweeter, since most of the music signal spectrum — from 400 to 3500 Hz — lies in its operating range. Many materials were tried for the midrange cone and, though Bextrene appeared promising, an exotic new material, Kevlar, a woven matrix of aromatic polyamide fibers, was selected.

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B&W's premier loudspeaker, the Model 801.

While all the drivers used in B&W loudspeakers are made in the factory, the cones and speaker baskets are supplied by vendors to B&W specifications. In the case of the MK100 midrange, the speaker cone is made in the B&W plant on a purpose-built die press. The Kevlar diaphragm is resin-bonded and simultaneously heat treated and formed to the desired configuration under great pressure. The result is a cone with low mass and high strength, and it is said to have "low energy storage" characteristics affording superior transient response. The laser interferometer revealed good vibrational modes for cones made with the Kevlar material, and the final de-

"...an outstanding product on any absolute scale of measurement without regard to price." -STEREO REVIEW



Read more of what Stereo Review magazine had to say about the Yamaha CR-840 receiver:

"The harmonic distortion of the CR-840 was so low that without the most advanced test instruments it would have been impossible to measure it."

When speaking of the OTS (Optimum Tuning System), an easy-to-use Yamaha feature that automatically locks in the exact center of the tuned channel—for the lowest possible distortion, Stereo Review said, "The muting and OTS systems operated flawlessly."

Among Yamaha's most significant features is the continuously variable loudness control. By using this control, the frequency balance and volume are adjusted simultaneously to compensate for the ear's insensitivity to high and low frequency sound at low volume settings. Thus, you can retain a natural-sounding balance regardless of listening level. As Stereo Review states, "...another uncommon Yamaha feature."

And there's more. Like the REC OUT/INPUT SELECT feature. These separate controls allow you to record from one program source while listening to another program source. All without disturbing the recording process. Stereo Review's comment was, "...the tape-recording functions of the CR-840 are virtually independent of its receiving functions." One could not ask for greater flexibility.

In summing up their reaction to the CR-840, Stereo Review said, "Suffice it to say that they [Yamaha] make it possible for a

moderate-price receiver to provide performance that would have been unimaginable only a short time ago."

And the CR-840 is only one example in Yamaha's fine line of receivers. For instance, High Fidelity magazine's comment about the Yamaha CR-640 receiver: "From what we've seen, the Yamaha CR-640 is unique in its price range."

And Audio magazine has remarks on the Yamaha CR-2040 receiver: "Without a doubt, the Yamaha CR-2040 is the most intelligently engineered receiver that the company has yet produced, and that's no small feat, since Yamaha products have, over the last few years, shown a degree of sophistication, human engineering, and audio engineering expertise which has set them apart from run-of-the-mill receivers."

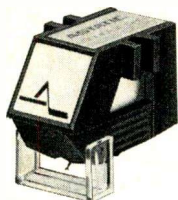
Now that you've listened to what the three leading audio magazines had to say about Yamaha receivers, why not listen for yourself? Your Yamaha Audio Specialty Dealer is listed in the Yellow Pages.

To obtain the complete test report on each of these receivers, write: Yamaha International Corp., Audio Division, P.O. Box 6600, Buena Park, CA 90622.

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Who says a "moving coil" is the best?



Compare the new choice: Moving Flux MF™

Until now, you've had the choice of the superb sound and high price tag of a moving coil cartridge, or the economy and adequate performance of a moving magnet or other magnetic cartridge type. Astatic now makes the choice easier.

The Moving Flux MF™ cartridge.

Astatic's patented moving flux design combines the fine performance of moving coil and the economy of moving magnet cartridges.

Like a moving coil...

Musical detail is more clearly reproduced because the moving flux design eliminates a built-in source of phase distortion inherent in moving magnet types. This phase distortion results from magnetostriction (magnetic time delay).

Dr. H. G. Barkhausen discovered over 80 years ago that iron, because of its variations, becomes magnetized in discrete steps rather than in a smooth linear manner.

In the pole pieces of magnetic cartridges this nonlinearity translates into distortion and less than full fidelity sound.

Moving Flux cartridges, like a moving coil, eliminate pole pieces and magnetostriction for undistorted, clean, transparent sound reproduction.

Like a moving magnet...

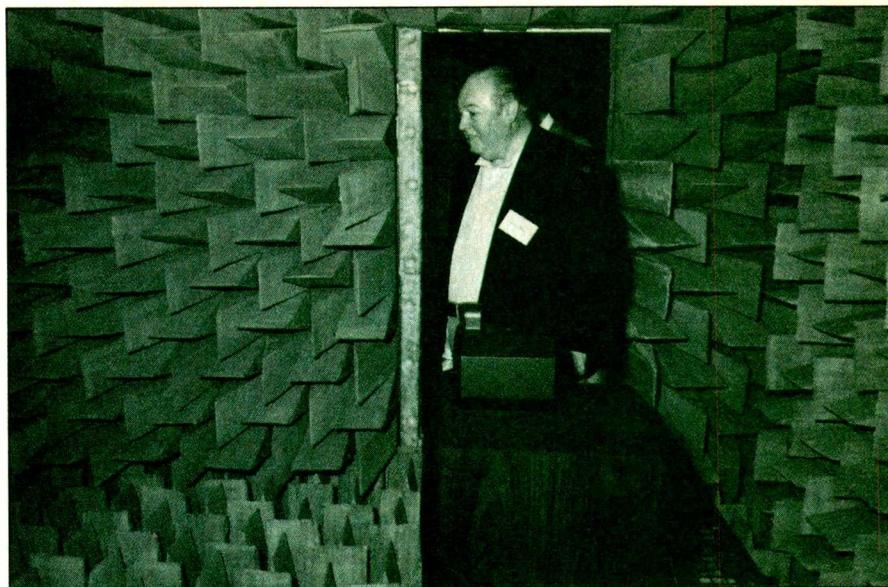
Astatic's MF cartridges offer the economy of moving magnet cartridges. Competitively priced, moving flux also has high output, eliminating the need for expensive preamps or transformers. And unlike most moving coil cartridges Astatic's moving flux stylus is user replaceable.

The choice is clear: Moving Flux MF™

The Astatic Corporation, Conneaut, Ohio 44030.



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Bert Whyte "behind the scenes" in B&W's anechoic testing chamber.

sign was a 100-mm cone with a one-inch voice-coil phenolic-bonded on an aluminum former and a PVC cone surround suspension.

The design of the B&W TS26S tweeter is also derived from laser interferometer and computer-aided research. A 25-mm dome, made of woven polyester filaments, is driven from its outer edge by a 26-mm high-temperature epoxy-impregnated voice-coil. A high-energy nickel cobalt center-pole magnet is used to keep the dimensions to a minimum for good directional characteristics.

The crossovers of this speaker are fourth-order networks with frequency points at 400 Hz for low/mid and 3500 Hz for mid/high. B&W has a proprietary method of "numerical optimization" using computer synthesis to derive the network parameters. The networks are built in the B&W plant with vendor-supplied p.c. boards, to which the appropriate values of close-tolerance components are added.

Cabinet Colorations

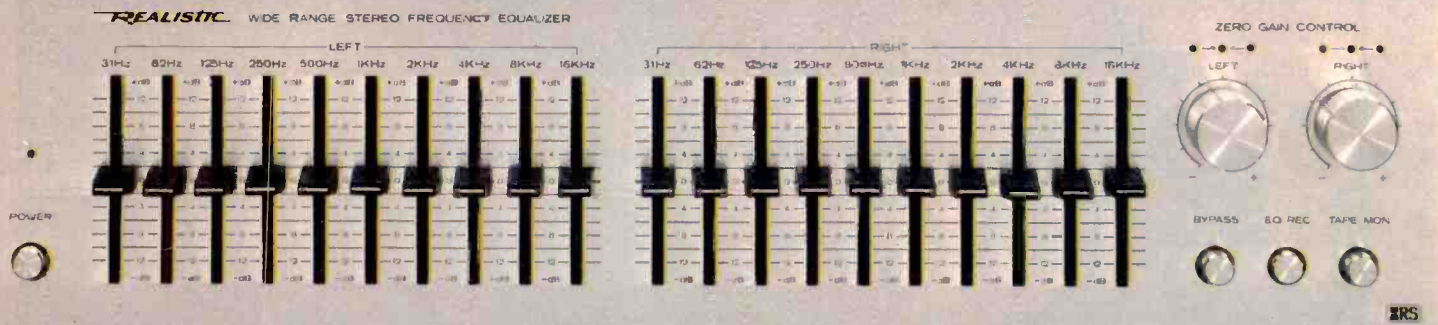
The bass enclosure for the Model 801 is, as previously noted, of the closed-box acoustic-suspension type, with internal volume of 100 liters. Because cabinet panel resonances superimposed on reproduced sound cause unpleasant colorations and diminish overall clarity, many schemes have been devised to damp these resonances — including highly impractical cast-concrete or brick enclosures!

During the investigation of cabinet resonances, B&W found that high levels of vibration were occurring near the woofer, which was mounted on

the front speaker panel, and were probably due to mechanical transmission of the driver vibration. The use of a thick rubber gasket between the woofer and the front panel, plus mounting screws isolated from the woofer chassis with damping material, afforded a significant 12 to 14 dB reduction of vibration. The midrange driver and the tweeter are mounted in separate enclosures, with the tweeter atop the midrange unit. This mid/high assembly is affixed to the top of the bass enclosure with a circular rubber vibration isolator between them. To reduce high-frequency reflections from the top of the bass enclosure, it was covered with an acoustic absorbent foam.

The tweeter, midrange and bass drivers are in a staggered vertical alignment for minimum time delay. The Model 801 is to be driven by an amplifier of 50 watts minimum, with no upper limit on power input. Its unusual overload-protection circuit senses the voltages supplied to the voice-coils of the three speaker drivers, and compares each voltage with a pre-set threshold voltage assigned to each speaker. If the threshold voltage is exceeded, a relay cuts off the input. A red signal light on the top of the bass enclosure illuminates when there is no voltage input, and a button resets the relay and restores the input. A battery powers the circuit, and current drain is said to be so low that the circuit can be permanently connected.

All the speaker components produced in the B&W plant are individually tested for various parameters and then digitally compared to a reference



Five Important Reasons Why You Should Own This New Realistic® 10-Band Equalizer.

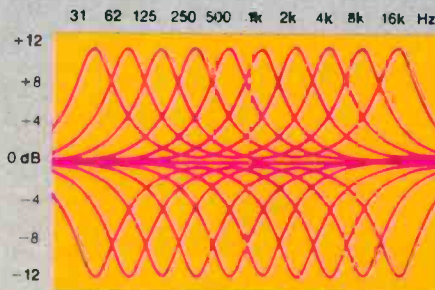
1. Matches your system to any room.

Some rooms are acoustically "dead" due to thick carpeting and tons of overstuffed furniture. Some are acoustically "live" because of tile floors and hardwood paneling. Either environment will murder your music by altering the sound you hear by 6 decibels or more. Ordinary *broadband* bass and treble controls can't compensate for these imbalances because they alter far too much of the audio spectrum. But the Realistic wide-range equalizer, with 10 *narrow bands* and 10 controls for each channel, gives you total command from 31 to 16,000 Hz. You can add to or subtract from the music by up to 12 dB for a complete, creative control range of 24 dB.

2. Improves records, tapes, FM.

Remove annoying record scratches from old LPs and 78s without removing the music. Just reduce the audio level at 8 and 16

kHz. Rumble is eliminated with the 31 and 62 Hz controls but the bass remains intact. Substandard audio from careless radio stations can be cleaned up by a little re-equalization on your part.



Graphic display of narrow band boost and cut action.

Bands: 31, 62, 125, 250, 500, 1000, 2000, 4000, 8000 and 16,000 Hz. Frequency Response: 5 to 50,000 Hz. Tone Control Range: ± 12 dB. THD: .02%. 20-20,000 Hz. Dynamic Range: Up to 10 volts RMS, flat setting. Total Gain: 0 dB, flat setting. Electrical: 120VAC. 15 watts. U.L. listed. Size: 4 $\frac{3}{8}$ x16 $\frac{1}{2}$ x10 $\frac{1}{4}$ "

3. Improves your speakers.

Moving a speaker 6" out from a wall can degrade bass response by

8 to 10 dB. But sometimes you have to. This equalizer restores the lost performance. And you can enhance the sound of the best speakers even when they're perfectly placed. Electronic equalization is the only way you can extend the response of a speaker.

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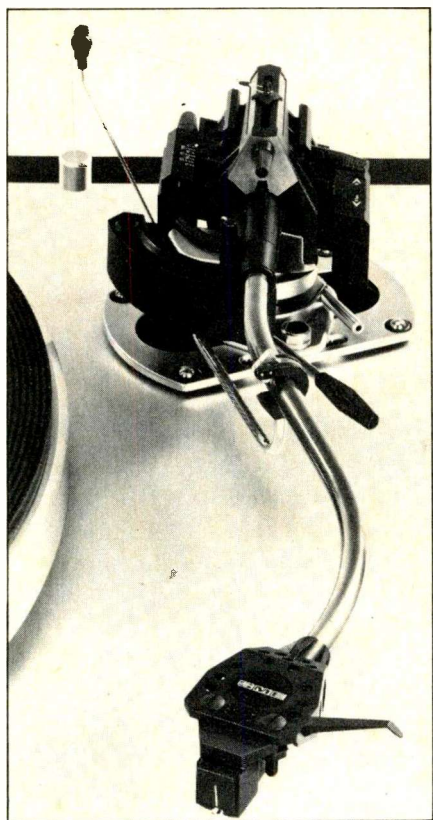
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The Tektronix T 4010 interactive graphics terminal used by B&W in its research department.

standard driver. A computer matches response of pairs of drivers within $\pm\frac{1}{4}$ dB! Each speaker system is tested in B&W's anechoic chamber and furnished with its own calibration certificate. In the anechoic chamber, the transient performance of a loudspeaker is measured via the energy versus time response method pioneered by Audio's own Richard Heyser. A Bruel and Kjaer 2031 spectrum analyzer is interfaced with a Hewlett-Packard 9825A desk-top computer for this procedure.

The specialized instrumentation — laser interferometers, digital computers, spectrum analyzers, etc. — are unquestionably of great value in developing B&W speaker systems. But however good the instruments tell us these speakers are, it is still the human ear and the reproduction of music that are the final arbiters of loudspeaker quality. Happily, John Bowers and his associates are in complete agreement with this philosophy. Mr. Bowers has a sensitive ear and an abiding love of music, so his purpose-built listening room at B&W is often where the ultimate assessment of speaker quality is decided.

At Home with the Range

I have listened to the Model 801 for many months now with every conceivable type of music. It certainly has a smooth, clean response throughout the frequency spectrum, though there is a little coloration, apparent only at very high levels, above 108 to 110 dB. Transient response is especially good, with little evidence of overhang. With its -3 dB point of 37 Hz, bass response is clean and solid, although this is not sufficient to reproduce the lowest fun-

damentals of the pipe organ. But then, very few speakers can handle this range. On the subject of bass response, some people have remarked that the Model 801 sounds "tubby" and a bit "over-resonant." This could be a function of several things: The listening room may be "peaky" and have standing waves; perhaps the 801 is placed too close to rear or side walls or, worse, in a corner. With the speakers about 3 feet from the rear wall and $2\frac{1}{2}$ to 3 feet from the side walls, I have not encountered any tubbiness. The amplifier used to drive the speakers can often have a significant effect on bass quality. One with a high damping factor, and output in the 150 to 200 watt range, helps considerably. By all odds, the most seductive quality of the 801s is their accuracy in producing a stable stereo image and depth perspective. At its best, the speakers simply "disappear" — you cannot isolate individual sound from each speaker. The illusion of a panoramic stage image is startling, and even the most severe critics of the 801s admit that in this respect they are without peer.

There is a problem with the 801s when played at very high levels, say from 105 to 110 dB. There is no sign of stress or distortion per se, yet the superb imaging qualities of the speaker are considerably diminished, the sound field is compressed, and instrumental positioning is not as accurate. Outside of this, the 801 can handle the dynamic range of most digital/hybrid recordings without distress. In general, it is one of the least fatiguing speakers I have ever encountered, thus encouraging extended listening. Δ



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