The Authoritative Magazine About High Fidelity

Audio

FEBRUARY 1983 • $1.75 • Ⓕ 06030

SHURE'S KOGEN ENGINEER/PRESIDENT

EXCLUSIVE!!!
FIRST TEST!!!
TECHNICS COMPACT DISC PLAYER

WORLD'S BEST FM-VIA SATELLITE

HOW RCA PUT STEREO ON ITS VIDI

TES RTS-
DEN ARGAIN
DF RECEIVER
SOU FTSMEN'S
HO EQUALIZER

582712 TRW 0046C099 14 6 MAY84
MR G TERWILLIGER
46A CORLIES AV
POUGHKEEPSIE NY 12601
02*0A

0 27100 06030

©1982 R.J. REYNOLDS TOBACCO COMPANY

CAMEL

Where a man belongs.

LIGHTS: 8 mg. "tar", 0.7 mg. nicotine av. per cigarette, FTC Report DEC. '81.
FILTERS: 15 mg. "tar", 1.1 mg. nicotine av. per cigarette by FTC method.

Experience the Camel taste in Lights and Filters.

Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.

Buff Stuff from TDK.

You, the audiophile, are the toughest critic we know when it comes to sound performance. You're very selective in deciding the perfect equipment for your recording and listening needs.

And you're just as selective in choosing your recording tape. TDK knows that. So we developed a line of high performance audio cassettes that meet your critical requirements.

We call it the TDK Professional Reference Series.

You're probably using TDK SA-X high bias cassettes now because of their superior performance characteristics. In addition, TDK has developed normal bias AD-X which uses TDK's famous Avilyn particle formulation and delivers a wider dynamic range with far less distortion than ever before. Plus, TDK's unique metal bias MA-R cassette which features high-energy performance in a one-of-a-kind unibody die-cast metal frame.

The TDK Professional Reference Series. .it'll sound impressive to your ears. So share the pleasure with your friends; they'll appreciate it.

TDK®

THE MACHINE FOR YOUR MACHINE

©1982 TDK Electronics Corp

Enter No. 33 on Reader Service Card

We thank all those who helped us bring our concept to reality.

All speaker designers share essentially the same goal: to recreate in the listening room the illusion of a live performance. But not all designers have taken the same direction.

It was our conviction that the most realistic and stable stereo images would come from radiation patterns that were uniform for all frequencies and that did not depend on restricted listening positions. And the direction we took was toward a new type of omni-directional speaker that simulated a single, sonically integrated source.

We explored that theory with 3,000 computer hours and several mathematical models which were verified by laboratory experiments at a leading university. Then we built some working prototypes for demonstrations at audio shows throughout the country.

We received many helpful critiques from acousticians, engineers, audio critics—and invaluable help from four of the many dealers who also auditioned our new concept.

These dealers demonstrated the speaker in their stores, suggested some further refinements and installed the modifications we sent them. And this is our first opportunity to thank them publicly.

They are Personalized Audio, Dunnelen, NJ; Lyric HiFi, New York City; Goodwin's, Cambridge, Mass.; and Audiocom, Old Greenwich, Conn.

If you'd like the complete story of our revolutionary speaker, please contact us and we'll respond by return mail.

Daniel Queen Laboratories

1635 Privado Road, Westbury, NY 11590
516-683-3000

Enter No. 8 on Reader Service Card

Audio

FEBRUARY 1983 VOL. 66, NO. 2

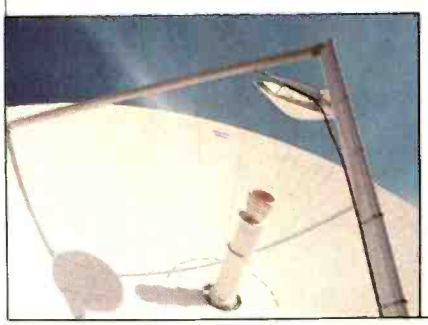
See page 84.

FEATURES

EQUIPMENT PROFILES

RECORD REVIEWS

DEPARTMENTS



See page 42.

MPA ABC

The Cover Equipment: Technics SL-P10 digital audio disc player.
The Cover Photographer: Robert Lewis.

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

Subscription Inquiries, (800) 525-9511; in Colorado (303) 447-9330.

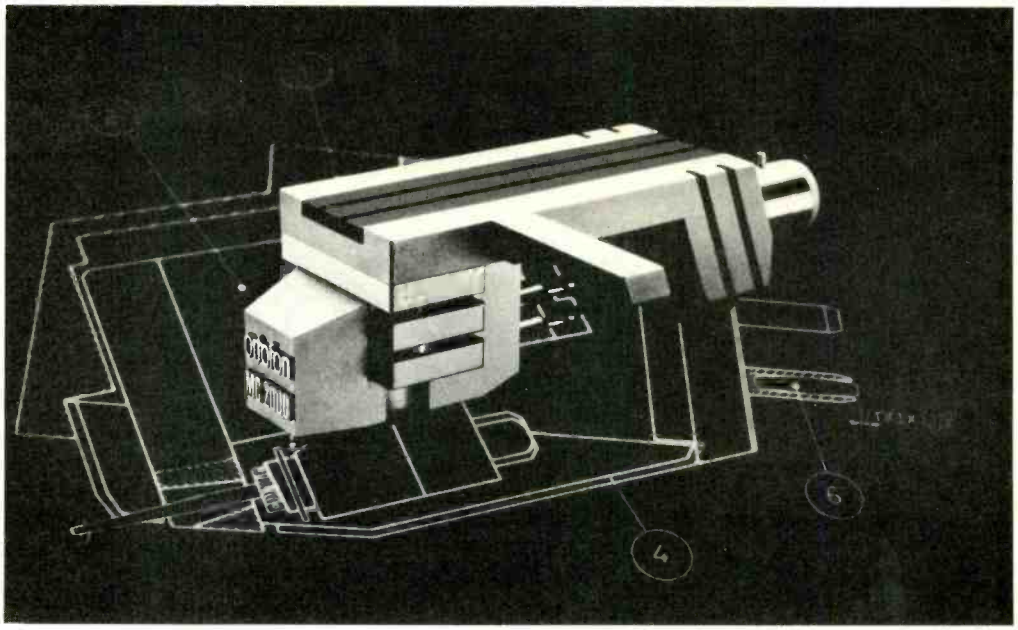
NEW!

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

A dramatic new way of evaluating performance has led to a design concept called Ortophase® and a new Ortofon moving coil cartridge. The MC2000 is the first cartridge ever designed on the basis of new understandings of the critical role of both amplitude *and phase response* in the performance of phono cartridges.

The result? We make only a modest claim for the new Ortofon MC2000.

Spectacular.



ortofon

122 Dupont Street, Plainview, New York 11803

Write to us for complete information.
See and hear the Ortophase-designed MC2000
at your Ortofon dealer now.

Enter No. 28 on Reader Service Card

No hangover!

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

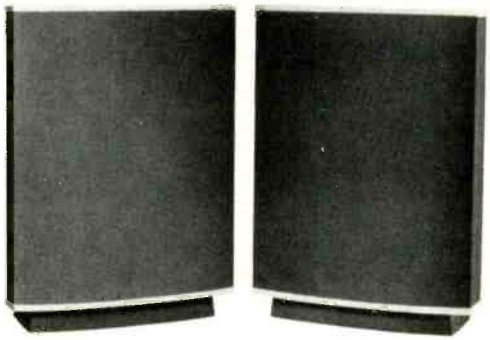
Take it away and there's a new world—the loudspeakers have nothing more to say—instead there's just the orchestra and the magic of the music.

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

Perhaps even something to celebrate about.

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

In Canada: May Audio Marketing Ltee, Ltd., Longueuil, Quebec J4G 1P8



QUAD

for the closest approach to the original sound

© 1982 QUAD

Audio

Eugene Pitts III
Editor

Art Director: Cathy Cacchione

Technical Editor: Ivan Berger
Assistant Editor: Kay Blumenthal
Editorial Assistant: Andrea Lynne Hecker

Associate Editors:
Edward Tatnall Canby, Bert Whyte
Senior Editors:
Richard C. Heyser, B. V. Pisha, Howard A. Roberson

Contributing Editors/Artists:
Tom Bingham, Herman Burstein, Ted Costa, John Diliberto, Leonard Feldman, Joseph Giovanelli, Edward M. Long, C. G. McProud, Jon Sank, Donald Spoto, Michael Tearson, George W. Tillett, Jon & Sally Tiven, Linda Zerella

Production Manager: Elaine S. Geiger

Charles M. Stentiford
Vice President/Executive Publisher
Marlene F. Jensen
Publisher

ADVERTISING

Advertising Director: Roman Beyer (212) 719-6335

Eastern Ad Manager: Stephen W. Witthoft (212) 719-6337

Western Ad Manager: Jay Martin (213) 487-5880

Classified Ad Manager: Laura J. LoVecchio (212) 719-6338

OPERATIONS

V.P./General Manager: Robert F. Spillane
Group Business Manager: John J. Miller
Associate Business Manager: James Slockbower
Advertising Promotion Director: John Brown
Advertising Research Director: Perry Grayson
Production Director: Karen L. Rosen

CBS CONSUMER PUBLISHING EXECUTIVE STAFF

President: Robert J. Krefting
Sr. V.P.: George H. Allen
V.P., Group Publisher: Peter G. Diamandis
V.P., Finance & Admin.: Laurence B. Glasberg
V.P., Editorial: Harold Hayes
V.P., Group Publisher: Patrick M. Linskey
V.P., Group Publisher: Michael J. O'Neill
V.P., General Manager: Thomas O. Ryder

George H. Allen
V.P., Special Interest Group Publisher

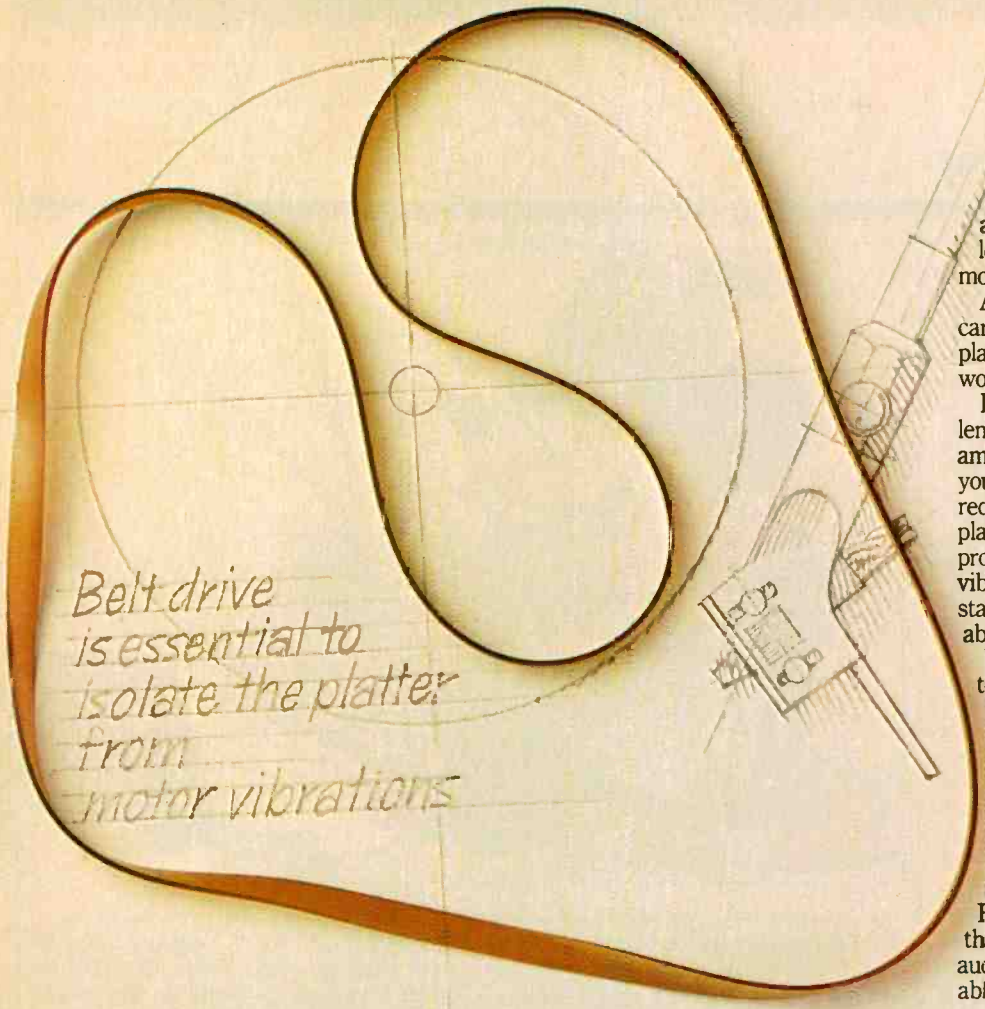
AUDIO (ISSN 0004-752X, Dewey Decimal Number 621.381 or 778.5) is published monthly by CBS Publications, The Consumer Publishing Division of CBS Inc., at 1515 Broadway, New York, N.Y. 10036. Printed in U.S.A. at Nashville, Tenn. Second class postage paid at New York, N.Y. 10001 and additional mailing offices. Subscriptions in the U.S., $15.94 for one year, $27.94 for two years, $37.94 for three years; other countries, add $6.00 per year.

AUDIO is a registered trademark of CBS Inc. ©1983, CBS Publications, The Consumer Publishing Division of CBS Inc. All rights reserved.

Editorial contributions are welcomed but should be accompanied by return postage. Submissions will be handled with reasonable care, but the publisher assumes no responsibility for safety or return of manuscripts, photographs, or artwork. The Publisher, in her sole discretion, reserves the right to reject any ad copy she deems inappropriate.

AUDIO Publishing, Editorial and Advertising Production offices, 1515 Broadway, New York, N.Y. 10036. Subscription offices, P.O. Box 5318, 1255 Portland Place, Boulder, Colo. 80322; (800) 525-9511, (303) 447-9330 in Colorado. Postmaster: Send change of address to P.O. Box 5316, 1255 Portland Place, Boulder, Colo. 80322.

Enter No. 21 on Reader Service Card



The purpose of a turntable is to remain quiet. It should contribute no noise or vibration to the sounds picked up by the cartridge.

That's why our new T-Series turntables all use belt drive.

The belt drive provides acoustic isolation from motor vibrations. It literally separates the motor from the platter and spindle. This avoids the noise problems inherent in direct drive, where the motor is connected directly to the platter.

A belt design, of course, requires more careful engineering to achieve a constant platter speed. But we considered it well worth the effort.

In fact, we went to great lengths to make the T-Series among the finest turntables you can buy. Doing so required using massive platters; wooden bases that provide isolation from room vibrations; as well as disc stabilizers and vibration-absorbent platter mats.*

We also used low-mass tone arms to handle warped records, and capacitance trim to electrically match your cartridge and receiver.

And even though Harman Kardon's new T-Series delivers features found only on the world's most expensive turntables, we haven't made ours expensive. Harman Kardon turntables start at less than $200. You can see them at quality audio retailers. But you certainly won't be able to hear them.

*Available on T40 and T60 models.

TO KEEP A TURNTABLE QUIET YOU HAVE TO GIVE IT A BELT.

harman/kardon

T20 T40 T60

BELT DRIVE TURNTABLES

For your nearest dealer, call 1-800-528-6050, ext. 870, or write Harman Kardon, 240 Crossways Park West, Woodbury, NY 11797-2057. In Canada, Gould Marketing, Montreal H4T 1E5.

EDWARD TATNALL CANBY

I WANT MY ATV

Times do change—or do they? Phase II of audio's "marriage" with video is upon us, those component systems, and nothing much is *that* different. Surround sound is spreading everywhere in numerous ways, none very new. The quadraphonic disc is alive and well and living in Virginia (*MCS Review*, published quarterly by Quad Incorporated, P.O. Box 19, Capron, Va. 23829), and did I hear something about Dolby movies with matrix sound all around? Even *Fantasia*! That first major surround-sound epic, now more than 40 years old, has gotten all-new audio to duplicate the sonic effects that bowled us over back in the early 1940s. (Leopold Stokowski, being unavailable in the flesh, was ghosted by another conductor though he's still there on the screen.) The fundamental Blumlein patents on stereo and related ambiances are now a half-century old. And, where even before Blumlein the silent screen was "marrying" its first audio, now our own sightless hi-fi is embracing the TV image—which isn't nearly as big, as sharp or as stable as those superb earlier pix even though it has color. 'Round and 'round we go. And hopefully, also upward.

That's the present problem for us in the early stages of ATV, short for the current "marriage" product. As per last month, we are in for a struggle with TV's traditional and monumental indifference to good audio, versus our own high preoccupation with the best. How can these two worlds be joined into one? They will be, they already have been. But the disparity still exists, and it won't go away easily.

As I see it, there are three major phases, present and upcoming, in this joining together of the video and hi-fi audio areas into a common sphere. We are only started, but that start is already Phase II.

Phase I, I should explain, is, strictly speaking, prenuptial. It is before the fact, the background from which ATV is taking off. It was my subject last month, this Phase I, and I purposely put aside many changes that are indeed going on inside TV today because the overall massive inertia of a giant industry is what matters for us. Things as they *are*. A lot goes on inside TV's world that isn't very much our concern as promoters of audio hi-fi and consumers of the same—the penetration of cable into the once unique world of TV broadcast, for instance. Or satellites, which have made their mark on what we see and hear, and on the rest of the world too. Audio is, of course, involved, but we are just the handymen who put the sound in. Nothing very fundamental.

Illustration: Rick Tulka

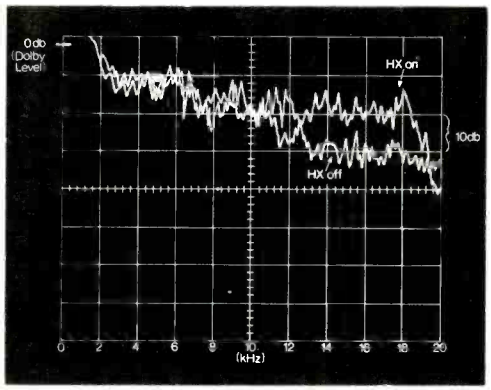
So if you turn on your TV these days, including component TV, you won't find anything radically different. TV, great big TV, huge, monolithic TV, marches on like Time itself and we are ants beside it, ATV or no ATV.

Yet as an industry with a long, separate history of special development, we are taking a very big step. We have opted into the middle of video, we are physically joining up our forces to it, piece for piece, bit by, er, byte. That is Phase II, whereby the newly launched and supposedly sensational TV components, replacing one-cabinet TV as ours in audio did more than 30 years ago, are bodily combined with our sort of thing into ATV home-component systems. If I can judge the blasts of publicity sent out to the mags and the other media these last months, all this will reach a crescendo about the time these words get into print. Read the ads (full-page color) and you'll think it's the Revolution itself, biggest thing in years. But no—that will be reserved for what I am calling Phase III. You won't see *that* in the ads for awhile longer.

Phase II, then, is not going to be a matter of radically new technology in either audio or video, nor of major new software, programming. Nor will there be anything very much new in our familiar ways of TV watching and hi-fi listening. This is merely an equipment shift, a consolidation of two major areas of home entertainment that maybe should have gotten together sooner—since they live in the same rooms and even go to bed together. (Mom watches the midnite movie, Pop's inside his Walkman phones.) We'll be doing the same old things we always do, with slightly different equipment, undoubtedly more convenient and versatile, good-looking without a question, a bit readier for future changes of a moderate sort. Stereo, for example, even though broadcast TV stereo is at the moment in paralysis (as of this writing, anyhow!) with no system yet authorized for the good old U.S.A. in spite of two-channel TV audio in Japan and Germany. Still, in these new component systems, stereo is a must for the audio-only aspect, our contribution to better living, and you can find it also in FM simulcasts, in videodiscs, in video-

Dolby® HX Professional

Dolby HX Professional is a program-adaptive bias technique which can significantly improve the quality of cassette recordings. High-level high frequencies can be recorded more accurately, without sacrificing signal-to-noise ratio, while such side effects of tape saturation as distortion are reduced. For both the home recordist and the duplicator of pre-recorded cassettes, Dolby HX Professional improves the performance of good conventional tapes to match that of costlier, more exotic formulations.



Spectral analyses of two high-speed (32 times) cassette recordings of the same selection of rock music show the highest levels accumulated over time at each frequency. Both recordings were made on conventional iron oxide tape of the type favored for commercial cassette duplicating; in this example, the high-frequency headroom improvement provided by Dolby HX Professional is as much as 10 dB.

The problem of self-bias

Even when a cassette deck is adjusted for the nominally optimum bias for a given tape, performance is nevertheless compromised under some signal conditions. In particular, music which is rich in high frequencies has what's called a self-biasing effect. The musical high frequencies act in and of themselves as recording bias on the tape, effectively adding to the external bias supplied by the recorder's bias oscillator. The net result under such signal conditions is momentarily too much effective bias, which leads to the familiar symptoms of tape saturation. The highest frequencies don't get recorded at all, and considerable IM distortion is generated at lower frequencies.

How Dolby HX Professional deals with the problem

Dolby HX Professional is a special circuit which constantly monitors the total effective bias—a combination of bias from the recorder's oscillator and self-bias contributed by the musical signal—while the recording is being made. If it senses the total bias increasing beyond the optimum level as a result of high frequencies in the music, it instantly compensates for the increase by lowering the bias from the recorder's oscillator, thus keeping the total effective bias constant. Even on music with a great deal of high-frequency energy, the tape remains optimally biased, and so tape saturation and its side effects are significantly reduced. The improvement in high-frequency headroom can be 6 dB or more, depending on the particular tape formulation.

Improve both the cassettes you make and those you buy

Dolby HX Professional, which was developed by Bang & Olufsen with the assistance of Dolby Laboratories, is provided along with Dolby noise reduction in home cassette deck models from Aiwa, B&O and Harman-Kardon. Just as important, Dolby HX Professional can be applied to high-speed cassette duplication, where its ability to improve good conventional tape formulations is economically, as well as sonically, significant. The first commercial duplicating facility has now been equipped, and the first pre-recorded cassettes made with Dolby HX Professional (as well as Dolby noise reduction) are expected in the near future.

For further information, including a complete technical explanation of Dolby HX Professional, contact Dolby Laboratories at the address below.

DOLBY HX PRO

Dolby Laboratories Licensing Corp., 731 Sansome Street, San Francisco, CA 94111, 415-392-0300. "Dolby" and the double-D symbol are trademarks of Dolby Laboratories Licensing Corp.
S82/4806

"Present TV is frozen into a system with inherent limitations that do not allow major, fundamental improvements."

cassettes, both the recorded kind and those you may try to make yourself if you acquire a camera. So there is double-channel sound in all this new equipment, though you'll hear the TV in two-channel mono.

There's a hidden aspect to the quality discrepancies between hi-fi audio and standard video. It's not only a matter of the quality of the sound. Even if we arrive at a workable basis for that problem, sound to satisfy the audio buff, to please the tube watcher, we have a problem in the picture. Is *it* hi-fi—in the sense we use for our best signals? Not in the U.S.A.

Consider our range of hi-fi sound equipment as it exists now. At the bottom of acceptability, we must live with a huge array of semi-cheapie stuff, so-so sound, strictly mediocre, decked out in shiny stereo systems in department stores and the like. They do fill a need, they satisfy a million customers who find the fi pleasing enough, and so we must count these items as legitimate, even if we disapprove. (That is perhaps a neutral viewpoint; I know exactly how much stronger the real buffs feel about it!) This is not too different from the situation in TV, where a million so-so TVs are sold and, generally, appreciated for what they can do, as per last month's discussion.

But now the differences begin. Above that lower grade of "hi-fi," we in audio produce, and consume, a very large upward range of genuine hi-fi, not only fancier, more versatile equipment in outward ways but in the actual sound, right up to the very top at an unbelievable price. This is, even in an uneconomic time, a viable and salable range of offerings, covering a vast scale. Can TV do this for its video, its pictures?

Unfortunately, no. In spite of the ads, video picture quality spans a relatively small range and a lot of that goes into mere size, though without the concrete benefits that size can bring, say, to our own loudspeakers.

Don't blame the engineers! Video electronics are agonizingly tricky and the good picture is far more difficult to achieve, in any case, than the good sound. But more important, our present TV is frozen into a system with inherent limitations that do not allow major, fundamental improvements and a wide range of picture quality—up to what could be called hi-fi as in the best still and cinema photography. Photography has proved much more flexible, open to real improvement and with a wider quality range, than electronic video in its present state can ever be. Our very best "commercial" video image is still far from the sharpness, stability, accuracy, lack of background "noise" that should constitute real picture hi-fi. High fidelity, remember. Not merely "the best we can do at the moment." You can't even pay for hi-fi TV. It does not exist. Not around these parts, anyhow, though else-

Audiophile, heal thyself!

OMNIDISC A COMPLETE SYSTEM CHECKUP FROM STYLUS TO SPEAKERS. TWO RECORDS PLUS INSTRUCTIONS. TEL-10073/10074 $29.95

Without test equipment of any kind except your two ears, and without prior experience, you can test and adjust your stereo system for optimum performance with the new OMNIDISC from Telarc.

Use Side 1 to insure correct mechanical alignment of your tone arm and cartridge in every plane. Then use the test tones on Side 2 to verify correct wiring, speaker placement, and control adjustments.

Side 3 tells you clearly how well your phono system tracks high level music, while Side 4 uses both popular and classical music to reveal stereo separation, imaging, and overall sonic accuracy.

An illustrated instruction manual leads you step-by-step through each test, explaining every detail. If you have a great system, OMNIDISC will prove it. And if you have a problem, or suspect one, OMNIDISC will find it and help you solve it.

TELARC DIGITAL

OMNIDISC from Telarc. Check it out today!

audio-technica.

AUDIO-TECHNICA U.S., INC., 1221 Commerce Dr., Stow OH 44224

Enter No. 26 on Reader Service Card

"On first trial of this state-of-the-art gear, I was cruelly disappointed. Not by the audio, but by the all-important picture."

where it is considerably better, as I have seen with my own eyes. [*Some* of the new component TV systems have noticeably higher than normal fi, but a true high-resolution system is still on the drawing boards.—*I.B.*]

I have become very intimate with this problem recently, in my usual way. I rented a brand-new 19-inch TV monitor to get the best picture I could, and acquired a new stereo (two-channel) VCR to go with it, complete with built-in TV tuner. My report on this will come later—all I can say is that on first trial of all this state-of-the-art gear I was cruelly disappointed. Not by the audio, oddly, which played back in reasonable stereo through my home system. It was the all-essential picture, as of that big fat monitor viewer, out of videocassettes (VHS), out of an associated video camera (stereo) and from regular broadcast.

Frankly, I found the picture just more of the same old thing, very marginally enhanced. Turn on the tube minus signal and you have the usual mass of wildly wriggling lines and squiggles, a bit sharper on the monitor (there is a blurring control but it also blurs the picture), maybe a bit brighter. With program added, there were the same old wavers and jiggles and slews we know so well, the ghosts, the distortions, straight lines in jittery jags, people with jumpy noses and egg-like heads, and the crudities of color, the usual purple or green faces in the commercials, a pale yellow cast of characters in a movie. Strictly normal! What good is hi-fi audio with that sort of a picture?

Don't blame the monitor. Don't blame the VCR. It's the System that is, for all our efforts, inadequate in terms of true, visible fi. That's where we are! *We do not have hi-fi video,* at any price.

To return to Phase II, I can think of some easy ways to distinguish between high-priced and low-priced ATV component systems, and I expect the manufacturers have got there before me. For semi-cheapie ATV systems, inflation-style budget, there is no problem. Our technology can provide moderately good sound at no great cost, stereo of course. A smaller picture, modest cabinetry of the plastic sort, and you'll have a good balance between acceptable audio and acceptable picture. Not hi-fi in either case, but plenty adequate for a lot of buyers. That's the big market, and it's okay if you aren't a purist.

But what to do with the expensive ranges of equipment in the combined mode? The audio (stereo) is easy. We have the complete range, and honestly so, from "acceptable" sound all the way to super-superb, and costs to match. But what do you do for the picture? There, the range of actual picture quality is small. (Some people, like myself, think the tiny color tubes give the best picture fi of all in the viewing.)

FOR THE SHEER LOVE OF MUSIC

The Linn SARA

The bookshelf speaker that outperforms most full sized models. As the final link in a chain of uncompromising audio components, it will reveal the music on your records as you have never before encountered it.

Linn SARA. It must be heard.

LINN SARA ISOBARIK

For further information contact:
AUDIOPHILE SYSTEMS LTD., 6842 HAWTHORN PARK DRIVE, INDIANAPOLIS, INDIANA, USA 46220
ALDBURN ELECTRONICS LTD., 50 ROLARK DRIVE, SCARBOROUGH, ONTARIO, CANADA M1R 4G2

Enter No. 5 on Reader Service Card

talisman

(tal' iz man) An object endowed with the ability to focus or concentrate power; a magical stone.

Technology unlocks magic. The new Talisman MC phono cartridges are as fundamentally superior to conventional moving coils as moving coils are to moving magnet cartridges.

Only Talisman uses the Direct Field Focus™ design, which locates the coils at the precise focusing point of a powerful Samarium Cobalt magnet. Extra magnetic components are eliminated. Transparency and coherence are improved.

TALISMAN S—Sapphire tube cantilever, laser-mountec line-contact stylus.
TALISMAN B—Boron tube cantilever, laser-mountec line-contact stylus.
TALISMAN A—Aluminum Magnesium cantilever, nuce-mounted elliptical stylus.

Talisman ... the jewel and metal object that unlocks the magic in your records.

talisman by SUMIKO, Inc., P.O. Box 5046, Berkeley CA 94705

Enter No. 31 on Reader Service Card

"Already there's a tubeless video camera, tiny and light; will the tubeless picture be next?"

Well, you simply have to finagle. What else? Here you have superb audio, worth a couple of thou, in some fancy system—The Patriarch? The Galactic? The Imperial?—and you need a picture. Well, it'll have to be a big one as a matter of course. Impressive, even though it may offer more problems than a small picture. Or projection—no fewer problems there. But you can do better than this.

For $$$, you offer (a) genuine high-quality audio, our very best stereo, and (b) genuine high-quality *furniture*. That'll do it! Put the TV into precious woods. Choice of Regency or French Provincial. In the minds of the money people that'll complement the high-quality audio to perfection. It always has. But there won't be a hi-fi picture.

Yes, there is a Phase III coming with absolute certainty in this joining together of audio and video. It will be far more radical and drastic than anything we can see now because it will depend on *the complete elimination of that universal transducer for the video image, THE TUBE.*

What—get rid of a billion of those useful glassworks with the vacuum inside? Unthinkable! Not at all. Developments are racing ahead. Remember the transistor, the chip, the microprocessor, LCD, quartz, remember Jupiter and Saturn? Already there's a tubeless video camera, tiny and light; will the tubeless picture be next? [The new Sony and Sinclair pocket sets have tubes, but flat ones.—*I.B.*]

When the tube bows out we will have the real revolution, and a hundred now-impossible new uses for the video image with sound. Anything from wristwatch TV to the 10-foot "picture wall" and, maybe, instant portable video home movies, also with sound. As they say, much, much more. It'll be a brave new age, I can tell you.

As I struggled with my bulky new Phase II equipment the other day, I suddenly put off that brave new age until at least the 21st century. Too much. But the very next day a knowledgeable friend said to me, "*No—five years! It'll be here in five years.*" And maybe it will. So down with the tube! Bring on the image processor, or whatever they'll call it!

All in due time, friends. Don't go overboard quite yet. *A*

RETAIL STORE SERVICE
AT MAIL ORDER PRICES
*NO DEPOSIT SAME DAY SHIPPING
*EXCLUSIVE NO-LEMON GUARANTEE
MORE THAN 130,000 CUSTOMERS COAST-TO-COAST - YOU PAY THE SAME PRICE DEALERS PAY!!
THOSE HARD-TO-GET NATIONAL ADVERTISED BRANDS OF
AUDIO-VIDEO
PLUS
COMPUTERS and PROGRAMS
FOR INFORMATION
CALL 1-301-488-9600
DAILY 9-9 SATURDAY 10-5
FOR ORDERS ONLY
CALL 1-800-638-8806

International Hi-Fi Distributors, Inc.
Moravia Center
Industrial Park
Baltimore, Md.
21206

Enter No. 11 on Reader Service Card

Excellence

HEYBROOK HB-3 SERIES II
imported from England by

D'Ascanio Audio

11450 Overseas Hwy.
Marathon, FL 33050
Tel.: 305-743-7130

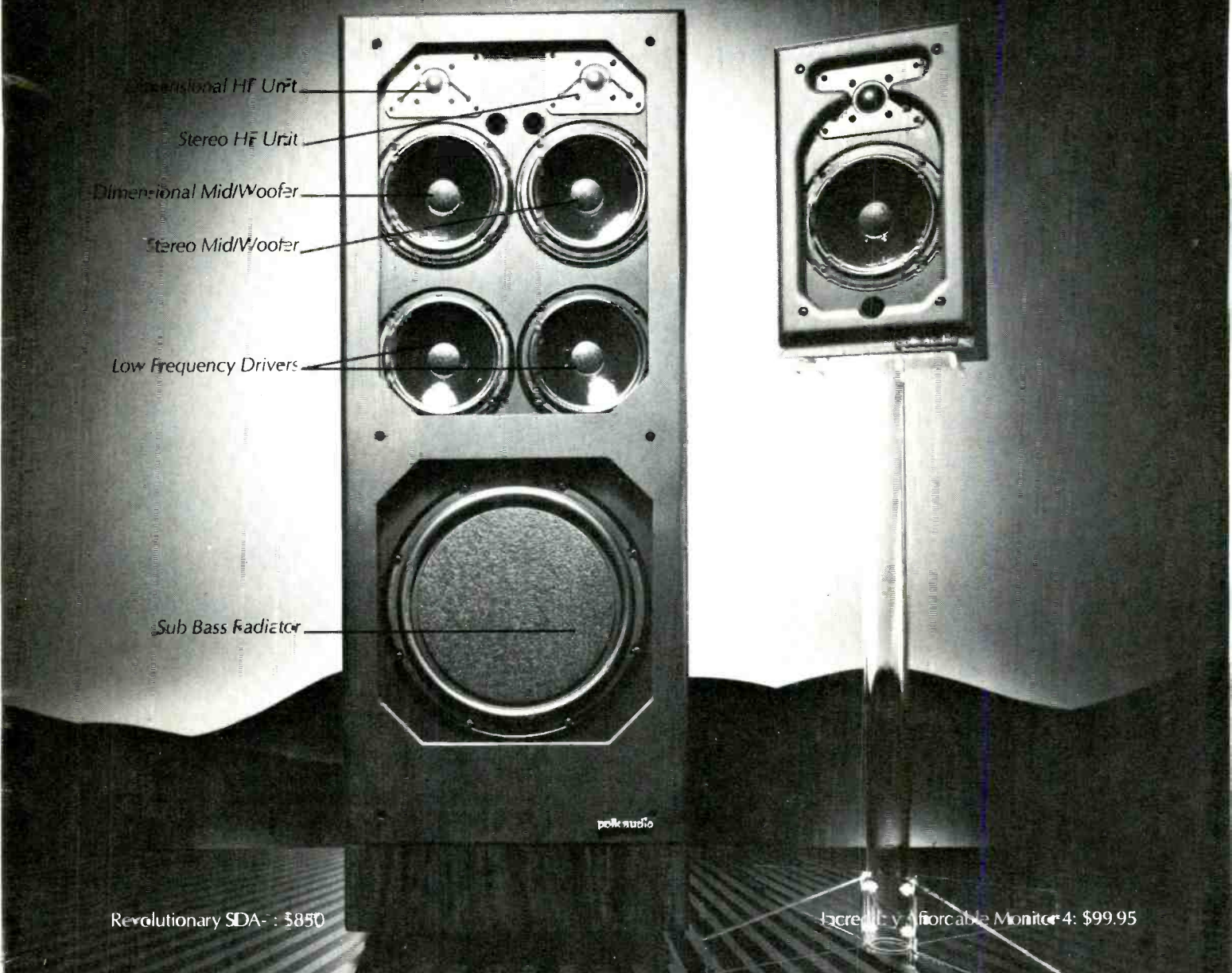
Enter No. 32 on Reader Service Card

"Polk reinvents the loudspeaker"

High Fidelity

"Literally a new dimension in the sound"

Stereo Review



Revolutionary SDA-1: $850

Incredibly Affordable Monitor 4: $99.95

"Astounding...Mind Boggling...Flabbergasting..." *High Fidelity*

The Critics Agree:

Stereo Review raved: "Hirsch Houk Lab's tests of the Polk SDA-1 speaker show that it does indeed add a new dimension to stereo sound . . . completely without any undesirable side effects . . . it borders on the spectacular . . . the result is always better than would be achieved by conventional speakers . . . quite literally a new dimension in the sourd . . . beautifully balanced . . . the speakers sound superb."

— *Stereo Review* Dec. 1982

All Rights Reserved

High Fidelity raved: "The SDA-1 loudspeaker represents an altogether unique rethinking of what a loudspeaker can and should do . . . devastatingly dramatic . . . mind boggling powers of sonic persuasion . . . depth and precision of the stereo image were astounding . . . flabbergasting . . . simply bowled us over . . . great good fun . . . sonic portrait so palpable in its left-to-right positioning and depth as to leave auditioners agog . . . will influence other designers for years to come." — *High Fidelity* Jan. 1983

Incredible Polk sound at every price

All 7 Polk Monitor systems share many of the sonic qualities and design features of the award winning SDA-1. Every Polk loudspeaker offers superb sound and superior value; quite simply the best sound for the money available on the market. One is the perfect choice to fulfill your needs.

Polk Audio, Inc. 1915 Annapolis Rd., Baltimore, MD 21230. In Canada, Evolution Audio. Use the reader's service or write for information.

polk audio
The Speaker Specialists

Enter No. 29 on Reader Service Card

BERT WHYTE

DISNEYLAND, FROM A TO D

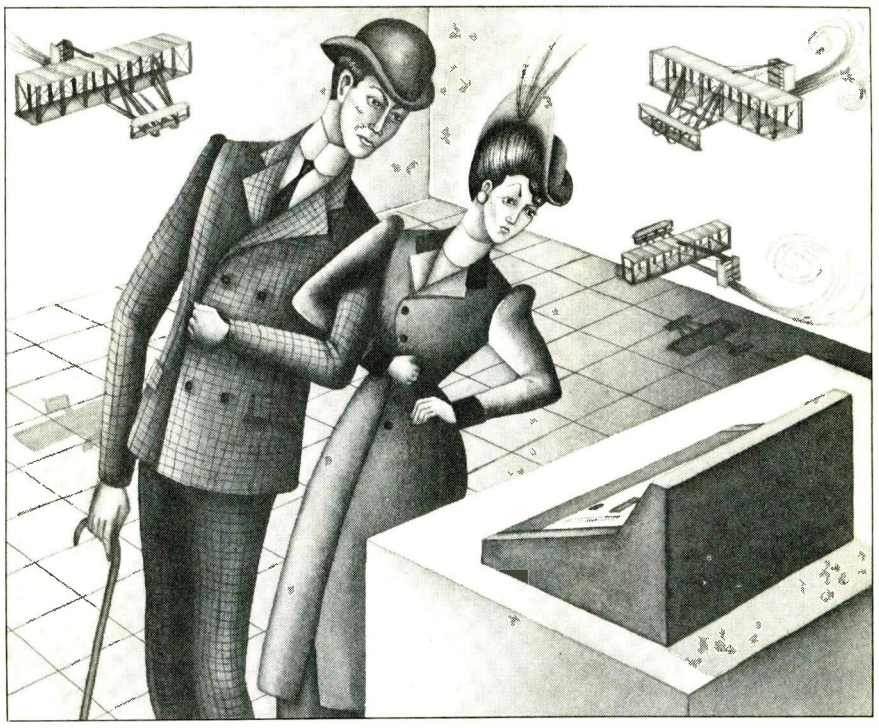


Illustration: Jennifer Skopp

Last month I outlined the structure of the "new era" Audio Engineering Society convention schedule. You may recall that the AES decided to cut back to two conventions per year, rather than the previous three. Not only was the frequency cut back, but the timing was changed: Instead of Los Angeles every May and New York City at the end of October, there is now only one U.S. convention per year.

Thus the 72nd AES Convention ran from October 23 to 27 at the Disneyland Hotel in Anaheim. There is a large convention hall next to the main hotel where equipment can be displayed. Trouble is, there are no demonstration rooms in the hall, so it was necessary to walk to two other hotel towers. These had limited numbers of demonstration rooms, though there were also some apartment-like "villas" where a few more demonstration rooms were set up by manufacturers.

In spite of the less than desirable venue, the 72nd AES Convention was a good one. Many interesting and provocative papers were presented, and there certainly was plenty of new equipment to be seen.

As usual, digital audio equipment occupied center stage and it was hard to pass any group where digital sound was not being discussed. In spite of this, an odd phenomenon was taking place among a number of (mostly local) recording engineers. Quite possibly because of the economic climate and the high cost of multi-track digital recorders, there was a sort of "whistling in the dark" in the oft-expressed idea that digital equipment is still "not fully developed" and really won't make any inroads in the recording studios for quite a few years. This was sometimes coupled with outright bad-mouthing of digital sound in general: "The sampling rates are too low," "Error correction isn't good enough," "Anti-aliasing filters exhibit bad ringing," etc. When someone would mention that the Compact Disc was even at that moment being introduced in Japan, and the concept was going to get a big push, everyone just looked uneasy. How well I remember the same sort of reaction when the LP and then stereo were introduced: "The LP just doesn't sound as clean as a good 78," "Stereo is hokey and has a poor low end," etc.

Obviously, there is always room for improvement—that is the name of the game. There is no doubt that the second- and third-generation digital recorders now coming on the market have been greatly improved in many parameters. There have also been advances in the operational and service aspects of some recorders.

JVC showed an unusually complete digital recording system. Their new second-generation DAS Series 900 system features the BP-900 digital processor. This unit is about half the size, weight and cost of the original BP-90 processor, and the two are fully compatible. The BP-900 measures 17 in. W x 6 in. H x 17 in. D and weighs in at 55 pounds. Extensive use of C-MOS Large Scale Integrated circuits made the size and weight reductions possible. Instead of the 14 modules of the BP-90, the new BP-900 has but six modules. This processor uses 16-bit linear quantization and has switchable sampling rates of 44.1 and 44.056 kHz. The availability of the 44.1-kHz rate obviously means it can be used for Compact Disc production. Along with the BP-900 is a new remote control unit, the RM-900, which permits location of correct tape position and controls signal level and time-code monitoring, as well as the usual functions.

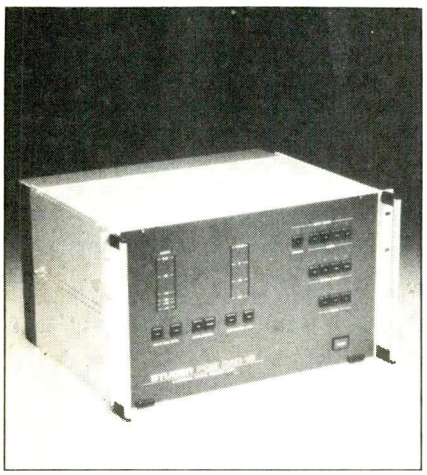
The AE-900 is the new JVC electronic editor, which features a 16-bit microprocessor and can edit to a precision of 180 microseconds! There is also a new Edit Controller with variable crossfade capability, equivalent to changing the gradient (angle of cut) in analog tape splicing. The system also has expanded memory for longer edit rehearsal and digital fading. A new item called the System Controller provides such things as auto tape location, signal-level monitoring and—would you believe—synchronization of two recorders for *four-channel* recording.

The JVC CR-8250 is a ¾-inch VCR for use with the BP-900. One of the most significant things about this BP-900 digital processor is that it can be used successfully with JVC's Model 6400 industrial VHS half-inch VCR. For the small studio that wants to go digital with professional quality, the BP-900 will cost about $21,000 and the 6400 VCR is just under $2,000. The studio can record with this combination, then have their tapes edited at a professional JVC facility for approximately $750 per eight-hour day. Incidentally, I and others who have used it consider this

JVC 6400 *the* VCR for optimum results with "consumer" digital processors such as the Sony PCM-F1.

Sony exhibited a production model of their long-awaited PCM 3324, a 24-channel fixed-head digital recorder, very imposing looking in a large console. The Record Plant, a major studio in Los Angeles, has taken delivery on one of these recorders and reportedly is very satisfied with initial results, even to razor-blade editing without problems. (Of course there is electronic editing as well.)

Mitsubishi had the innards of their big X-800, a 32-channel digital recorder, exposed. Its complexity was staggering, but nonetheless was very neat and tidy. They also proudly debuted their PCM-XE-1 electronic editor which can be used with both the two-channel X-80 recorder and the X-800. Some of the features of this editor are: Selection of cross-fade duration, rehearsal mode, auto location function, and a built-in SMPTE time-code generator. Here again is an editor/control unit that can synchronize two transports for four-channel digital recording. Are they trying to tell us something?



The DAD-16, Studer's 16-bit digital delay/preview unit for analog disc cutting.

Studer entered the digital wars with a very concentrated system approach. The first unit they were showing was the A808 PCM fixed-head, quarter-inch digital recorder. Based on their well-known A800 analog transport, the recorder features 48- and 44.1-kHz sampling rates, with 16-bit quantization. Surprisingly, Studer opted for quarter-inch tape, permitting up to eight channels of digital recording plus two analog channels for cueing and SMPTE time code. One would have thought that with the A800's capability of handling 24 channels, Studer would have decided on a digital recorder with

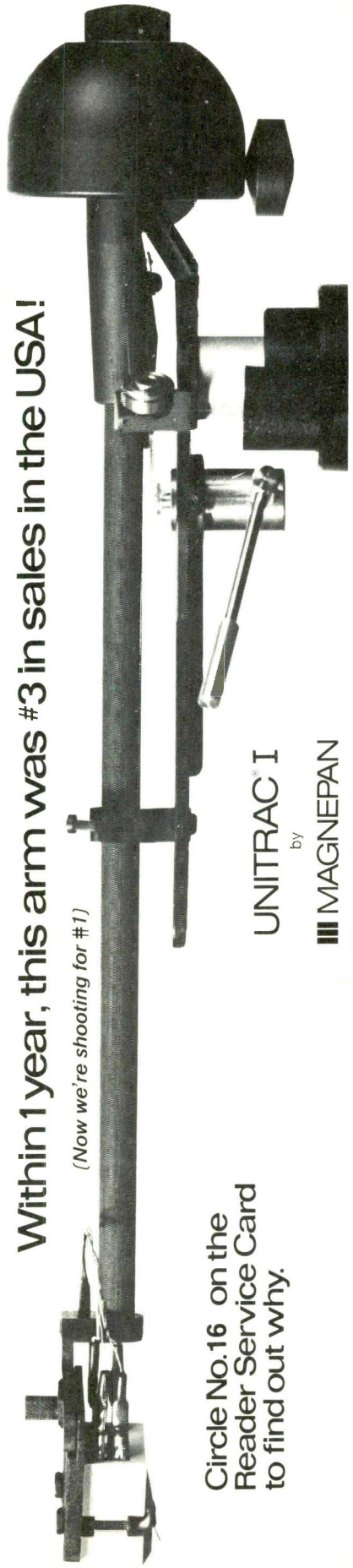
The Studer A808 PCM records eight digital and two analog channels.

that many channels. The use of 14-inch reels affords more than one hour of recording time. There are several remote control devices for use with the A808 PCM, and the unit is said to be compatible with both electronic and razor-blade editing.

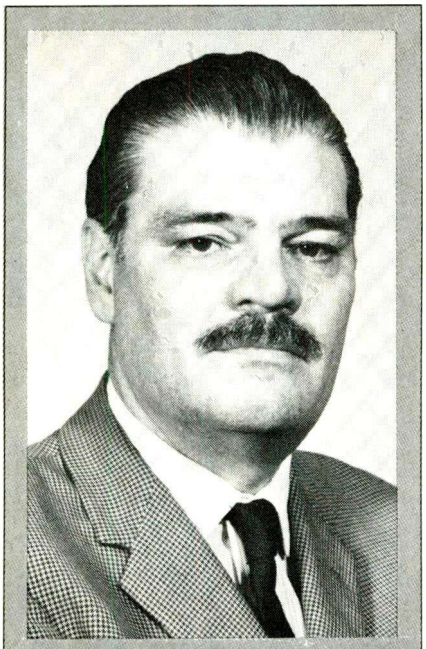
Studer augmented their digital line with the DAD-16 digital preview unit. This can be used with analog or digital masters, and can even be used with analog masters for half-speed cutting. The unit is compatible with all cutting lathes currently around. The DAD-16 is claimed to allow disc cutting without phase distortions.

Next in the Studer digital lineup was their unique SAE-16 Digital Sampling Frequency Converter. Just feed in any signal using current sampling rates from 44.056 to 50.4 kHz, and out comes 44.1 kHz for use in Compact Disc production.

Finally, a prototype model of the Studer/Revox Compact Disc player was shown, but not demonstrated. Studer also had a significant new analog open-reel recorder, the A810. I will report on that next month, along with other interesting new products.



CODA



GEORGE W. TILLETT
1913-1982

George W. Tillett, Editor of *Audio* Magazine from December 1969 to May 1973, died after being struck by an automobile on the evening of October 30. He was 69 years old and lived in Clearwater, Florida.

Born Oct. 24, 1913 in Norwich, England, Mr. Tillett's career spanned five decades. He was considered very knowledgeable in several areas of audio engineering and acoustic technology and held three patents, two on loudspeakers, his specialty, and one on phono cartridges. During his term as Chief Editor of *Audio*, he paid particularly close attention to speaker system developments and to the hi-fi industry's attempts to bring four-channel sound to fruition.

Mr. Tillett had a very subtle sense of humor, and proper understanding of his jests sometimes depended on knowledge of a foreign language—French, for example—or on some recent piece of news, often one that was important but not yet generally well known. Feeling that the audio industry was altogether too serious for its own good, he was the first to interview (invent?) the wildly improbable Prof. I. Lirpa, the middle European inventor and teacher whose eyebrow-raising, picaresque adventures have graced this magazine annually beginning with Mr. Tillett's write-up of the good Professor's invention of the Transpet device in the April 1971 issue.

Aside from his "Equipment Profiles" in *Audio*, Mr. Tillett was a regular contributor to *Stereo Guide Canada, Electronics Australia, Wireless World, Audio Digest* and *Hi-Fi News and Record Review*. Though he pretended that his own writings were not the product of hard work, he was diligent in his efforts. He began reviewing while he was still living in England, in 1956, for *Hi-Fi News*, for whom he helped produce eight yearbooks. His coverage of amplifiers for *Hi-Fi News* and for *Record News* was, he wrote, "a diversion which has lost me many friends."

He had a long-term relationship with the French; indeed, "fascination" might be a more accurate term for an intellect which collected bon mots unique to the French language. Written up in Gilbert A. Briggs' *Audio Biographies*, Mr. Tillett told a story about how, for him, the French language came to be bound up with electronics:

"At school my most precious possession was a crystal set built into a razor box, which normally lived inside my desk—underneath Euclid if I remember correctly. This tiny radio used to receive stations from as far away as Paris quite well but unfortunately one unhappy day it was confiscated by the French teacher—an act of treachery giving me a prejudice against the French which persisted for some little time."

A standard question in Briggs' book was "when and why started in audio," to which he replied, "In 1935 I became more and more interested in music and began to attend concerts regularly—particularly in the Albert Hall and the Queens Hall. As a radio engineer it was only natural that I should be interested in trying to improve the means of reproducing music in the home. In 1936 I began to design such equipment and I am still at it."

Mr. Tillett held various engineering posts with a number of firms over the course of his career. In 1931, after two years of medical training, he joined Ultra Electric, London; the firm made amplifiers, receivers, speaker systems, etc. By 1936, he was a partner in the firm of Crescent Radio, which was one of the earliest British casualties of World War II. In 1948, he joined Pye Telecommunications as Engineer in charge of VHF projects in London, which experience was to prove useful when FM broadcasting began in England some time later.

In 1951 Mr. Tillett joined Armstrong Wireless and Television as Chief Engineer and was appointed to the Board of Directors in 1953. In the following year he was named Chief Audio Engineer of Decca Radio and Television, where Arthur Haddy was working on a carrier system for stereo on disc recordings. In 1958 he joined the Heathkit division of Daystrom as Chief Engineer, spending eight years with the kit manufacturer before joining Wharfedale as Technical Director. Two years later, Mr. Tillett came to the United States as Chief Engineer at Fisher Radio's facility in central Pennsylvania, where he set up the firm's loudspeaker manufacturing plant. Later becoming Executive Vice President of Audio Dynamics Corp. in Connecticut, Mr. Tillett designed the 303-AX speaker system, which received very high ratings from reviewers both in and outside the audio industry.

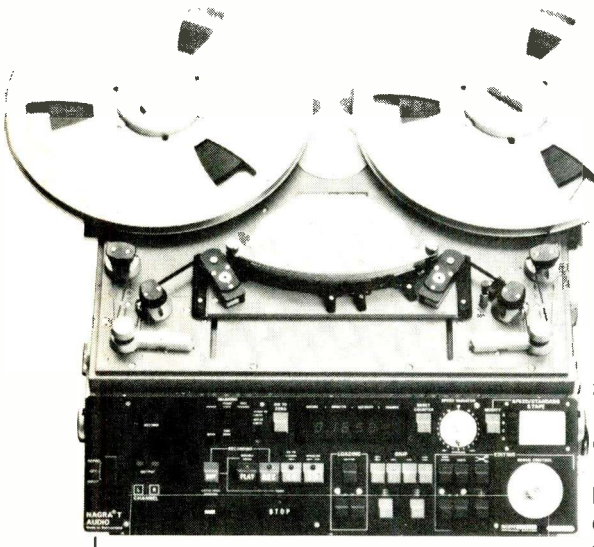
Following his stint in *Audio's* Editorial Chair, Mr. Tillett moved to Massachusetts as Vice President-Engineering for Epicure. In 1975, he moved to Florida, establishing himself as a hi-fi writer, "leaving behind the frustrations and worries of engineering."

He is survived by his wife, Pat, a daughter, Elizabeth, and a son, Richard.—*E.P.*

It is with great sadness I note the passing of my good friend George W. Tillett, former Editor of *Audio*.

George was a proper British gentleman, with the emphasis on "gentle." He had a sort of "Mr. Chips" flavor to his nature, as well as a wry sense of humor that endeared him to his friends. His abiding love of music, and his keen and perceptive ear, served him well in his design work on loudspeakers, and his lifelong involvement in audio. We will all miss him.—*Bert Whyte*

ACCENT ON EDITING



The Nagra T-Audio

Tape Decks at AES

Since I used to do a lot of live recording, tape decks always catch my eye at AES conventions. Several caught it at the one in Anaheim, last October.

The one I fell in love with was the Nagra T-Audio, which I hadn't previously seen. For a 15-ips deck taking 10½-inch reels, it's very compact and comparatively light (about 50 pounds, with transport case). It has a real-time (hour/minute/second) tape counter. But what really got me were the editing facilities.

First, you have to find your edit point. For that, there are six "Skip" buttons, three for each direction. Pressing the single-arrow button makes the tape play (backwards, if you choose) at the normal speed (which can be anywhere from 3¾ to 30 ips). The double-arrow buttons play the tape at 30 ips, with a level drop of 6 dB to protect ears and tweeters. The triple-arrow buttons are conventional fast-forward and rewind ("conventional" means variable speed here). Release the "Skip" buttons, and the deck goes into play—useful, when editing.

Six more buttons and a knob make up the editing controls. One releases the brakes and motors so you can rock the tape over the heads; two more free one spool while leaving the other motor on at low power, for single-handed rocking. The rotary knob (more of a disc, actually) inches the tape backward and forward under capstan control. Another button spools discarded passages into the wastebasket. And the last one moves your chosen edit point directly over a built-in, manual scissors which cut the tape at a 45° angle.

Only one thing dissuaded me from carrying one home: Equipped as I've described it here, the T-Audio costs about $11,000. Oh, well . . . .

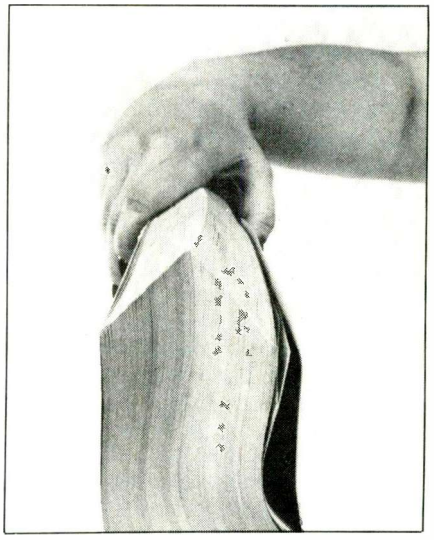
Inching knobs seem to be a coming trend. There was a similar servo control built into the head blocks of Tascam's new Series 50 decks. These decks also have digital tape-time displays, built-in splicing blocks, and heads whose geometry reduces "head bumps" to less than 1 dB, according to Tascam. The two-track Model 52 weighs a little over 70 pounds and costs about $3,500, with dbx optional at extra cost. The half-inch, eight-track Model 58, of course, costs more.

Otari's 5050B-II is lighter (60 pounds) and less expensive ($2,295). And while it does not have the Tascam's inching knob, it does have a real-time counter, built-in splicing block, a dump-edit control, and balanced microphone inputs. It also has front-panel recording calibration settings, with a built-in test oscillator.

Studer's new A810 is big-league stuff; at $6,200, it's out of most amateurs' league. What interested me about it was the bank of 12 buttons at the lower left, by the real-time tape counter. You can choose which functions five of those buttons command, by programming internal switches. Typical functions for these buttons include tape dump, memory locations, fast-wind speed control, remote-control activation, SMPTE time-code (optional), and a fader. Audio parameters such as level, equalization and bias are digitally controlled, which means that all of them can be reset remotely. You can even run a bank of 810s under computer control, with each deck independently controllable.

Digital Demo—Finger-Walkin' Good

Need visual aids when explaining digital sound to your friends and neighbors? Steve Hase of Pioneer showed an easy one at a recent press conference: Walk your fingers over to the phone book, then bend it about as shown. The resultant curve, like some audio wave-shapes, is obviously made up of numerous tiny steps, the directory pages. The "sampling rate" and curve smoothness will obviously be higher if you have a fat, metropolitan phone book like this to work with than if you live in a small town in mid-Idaho, but the principle should work with other books if your local directory's too thin.



U.S. Companies Enter Compact-Disc Field

CBS Records will probably be the first U.S. record company to manufacture digital Compact Disc recordings, beginning in 1984. They'll also be the first major U.S. record company to sell the discs here, importing CBS/Sony CDs from Japan, early next year.

Will CBS be first of any U.S. record company? Perhaps. Their projected CD sales date is "the first quarter of 1983," while M & K RealTime Records expects to deliver imported pressings (from M & K's own masters) by February, smack in the middle of that quarter.

Improving Our Analyzer

Dear Editor:

Robert R. Cordell's THD Analyzer (*Audio*, July-Sept. 1981) is an amazingly capable device, especially considering the modest parts cost. In building mine, I noted a number of useful design changes that I would like to pass along.

The Signetics 5534s that I used for most of the op-amps are of more recent manufacture than those in Cordell's prototype and appear to be more conservatively phase compensated. To get proper operation of the analyzer section up to 200 kHz, I recompensated as follows: C26 and C28 were changed to 18 pF, C25 and C27 to 4.7 pF, and C24 to 2.2 pF. Cordell has found similar values necessary when using T.I.'s 5534s. I also changed the oscillator compensation C2 and C3 to 18 pF, but similar performance can be achieved by fine tuning the lead compensation resistors in series with the 200-kHz range C(KM) and C(LN).

The dominant distortion mechanism in the mid-band of the analyzer is due to incomplete rejection of the second harmonics produced in the FET multipliers. I found that replacing R10, R11, R13, and R14 in the oscillator—and corresponding parts in the analyzer—with 1% tolerance parts (267Ω, 10k, 750k, and 10k, respectively) improved my distortion by 5 to 6 dB. To get this same improvement, 5% resistors can be selected for the proper ratio.

I have been unable to obtain proper operation of the oscillator at 200 kHz without replacing C12 with 0.0022 μF. The a.g.c. circuit is not adequately stable with the set of parts I used, due to the propensity of the circuit to go into slewing oscillations and the very marginal stability of the a.g.c. loop when changing frequency (D2 or D3 turns on and increases the loop gain by 100:1 at frequency change times). Bob Cordell has been unable to reproduce this failure on his prototype.

The dominant low-frequency problem is hum. I found that most of the injected hum was because of a floating top cover on the Ten-Tec enclosure both Bob and I used—removing some of the plastic covering material and screwing the case down to ground helped considerably, reducing the 50 Hz/1 V reading from 0.0018% to 0.00035%. Twisting cable E9-10 with E4-5 brings that down to 0.00023%.

The suggested trimmers, though economical, are probably of inadequate quality for so sensitive an instrument as this. I found a substantial improvement in the stability (lack of jumpiness) of the analyzer by replacing R59 and R62 with fixed resistors, and I would recommend using sealed trimmers everywhere.

The parts list is missing R159-1.5kΩ, C75-2 pF and IC21-LM318. With all these modifications, the analyzer reads no more than 0.0005% THD at 3 V from 20 Hz to 20 kHz; this is remarkable performance at any price. The highest distortion and greatest noise both occur at 20 kHz, each being about 109 dB below the fundamental (0.00035%).

Joe Gorin
Symmetric Sound Systems
Santa Rosa, Cal.

A Word from the Designer

Dear Editor:

My thanks to Joe for sharing the considerable improvements he's made to the THD Analyzer. I've confirmed all of his points, except the oscillator stability problem. In particular, ICs 1, 10, 11, and 13 are somewhat overcompensated due to a design error on my part (IC1 was not mentioned by Joe but can be compensated with 4.7 pF). Correcting the compensation will reduce the need for Q-enhancement compensation. A small capacitance in the range of 0.5 to 2 pF across R5 and R60 can also provide this improvement. A simple way to realize these capacitors is to attach a 1½-inch piece of solid insulated #22 or #24 AWG hookup wire to each end of the resistor and twist as necessary.

Joe and I have been unable to uncover the difference between our analyzers as far as high-frequency oscillator stability. However, I should point out that the oscillator was designed to be stable even with D2 and D3 permanently shorted; only higher quiescent distortion will result.

Several people have written with questions about substituting parts, particularly for the 5534 op-amps, the National 2N4091 J-FETs and the coaxial cable. I don't recommend op-amp or J-FET substitution under *any* circumstances. The coaxial cable is not critical and the capacitance per foot designated in the article is only a guideline. Sets of printed wiring boards are still available from Circuit Works, 1118 7th Ave., Neptune, N.J. 07753, for $35.20, postpaid. About 120 sets have been delivered to date and the feedback I've received indicates there are many highly competent *Audio* readers out there.

Bob Cordell
Tinton Falls, N.J.

"Harmonizer" Is a Trademark

Dear Editor:

In the November 1981 issue of *Audio*, page 31, column 3, in an interview, it is stated, ". . . if someone sings a note slightly out of tune, you can use the harmonizer to make it right."

"Harmonizer" is a registered trademark of Eventide Clockworks, Inc., U.S. No. 1,147,075. It has been the trademark for this pitch change product of Eventide ever since its introduction in the trade many years ago. We recognize the writers, Jon and Sally Tiven, may not have been aware of the trademark status of "Harmonizer," and, if terms of description are needed, we and our competition use "pitch change," "pitch shift," "pitch alteration," and "pitch transposer."

"Harmonizer" is a valuable right of Eventide, and it is our obligation to protect this property right and to prevent confusion in the trade.

Orville N. Greene
President
Eventide Clockworks
New York, N.Y.

Company Pride

Dear Editor:

I recently shipped for repair a four-year-old expander to dbx, Inc. I informed them that the unit was not covered by warranty. Dbx promptly repaired the unit and shipped it back to me at no charge for repair or shipping.

In this day and age, when so many companies are ripping off consumers, a company such as dbx, who obviously stands behind their product with pride, should be publicly recognized and commended.

Frank M. Wolfe
Cocoa Beach, Fla.

Blank Cartridges

Dear Editor:

I greatly applaud Peter Milton's clarification in your March 1982 issue of some of the functional differences between the various types of phono cartridges, as well as some of the structural differences. However, it seems to me that the enclosed quotes make claims contrary to a major thrust of Mr. Milton's article (i.e., that "as cartridges get better and better in measured results, the tonality differences become vanishingly small"). To quote Matti Otala, "With the present embodiment of these principles, I don't think that there is anyone who would prefer moving magnet." Or, quoting Mitch Cotter, ". . . . it would seem as though nature made it simpler to get us the orthogonality that we want with the moving coil, and to get more power from a given mechanical impedance."

A few further comments: The cartridges used in the National Research Council (of Canada) tests were not, to the best of my knowledge, the state-of-the-art contenders in their respective fields of moving iron and moving coil; I wonder to what extent the cartridges were aligned for lateral and vertical tracking, and I also wonder what types of ancillary equipment (speakers, electronics, etc.) were used. Finally, I observe that Mr. Milton mentions, but does not deal with, the issue of improved phase response.

Douglas Weinfield
Seattle, Wash.

Alive and Well

Dear Editor:

In your recent article, "Get the Most Sound from 78s" (June 1982), the author indicated that Lenco variable-speed turntables, which effectively play 78s, are "becoming rare." Quite the contrary, Lenco turntables are alive and well and being distributed by Benjamin Electroproducts, Inc., 75 Austin Blvd., Commack, N.Y. 11725. Three moderately priced units, B55, L75 and L78, can be purchased from many audio retail stores.

Tony Vespoli
Benjamin Electroproducts, Inc.
Commack, N.Y.

Frustrated Builder

Dear Editor:

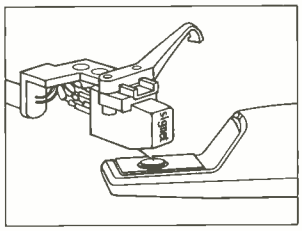
Over the years your magazine has given me insights, thought-provoking entertainment, humor, dependable product and record reviews and build-it-yourself projects. This last item is something I have looked forward to most eagerly. The Nelson Pass design Class-A amp drives my Klipsch corner horns quite nicely. The Marshall Leach pre-preamp has done justice to my Denon MC cartridge that the Denon AU 320 could not approach.

However, your unexplained and undesired discontinuation of this particular feature has definitely reduced its value to me.

Kenneth E. Gunnoe, Jr.
Los Angeles, Cal.

Signet SK305
Electronic Stylus Cleaner

In the miniature world of record grooves, even a speck of dust or dirt is a major obstacle to good reproduction. Which is why just about everyone tells you to clean your stylus regularly. But if you are like many people, dabbing away at a delicate stylus and cantilever is hardly your idea of fun.



Now Signet has made stylus cleaning easy, safe, and remarkably thorough. All it takes is our SK305 *Electronic* Stylus Cleaner and a few seconds of your time. Just moisten the super-dense nylon cleaning pad, switch on the solid-state pad vibrator, and lower the stylus gently on the cleaner. Seconds later your stylus is cleaner than you can achieve by hand, with no danger to your expensive stylus.

With valuable records, styli, and your listening pleasure all at stake, the SK305 Signet Stylus Cleaner may be the most valuable investment you can make this year. See a demonstration at your nearest Signet dealer. It's where music sounds better every day.

signet®

4701 Hudson Drive, Stow, Ohio 44224

Enter No. 5 on Reader Service Card

EDWARD TATNALL CANBY

CHAMBER MATES

Dvořák: Quintet in G, Op. 77; Two Waltzes. Sequoia String Quartet, Julius Levine, bass.
Nonesuch D-79012, digital, $11.98.

Sound: B+ Recording: C+
Surfaces: B–

Dvořák: Quartet in G, Op. 106. Guarneri Quartet.
RCA ARLI-4051, $9.98.

Sound: B+ Recording: B+
Surfaces: B+

As we all know, Dvořák was a composer of wonderfully mellow and moody orchestral music, expertly written for the medium. His chamber music is oddly different; it seems to try too hard and, especially in the strings, often becomes strident. As befits what he surely considered a more "intellectual" medium, compared to the (popular) symphony, the big tunes aren't as big nor as ear catching. In other words, you have to work a bit to get the sense out of his chamber music, such as these two recordings.

There is one overwhelming reason to go out and buy the RCA disc as fast as you can, if you are a Beatles collector. There they go! Across Abbey Road in London, the four of them, on the white pedestrian "zebra" crosswalk—only these are the Guarneri. Absolutely, totally irrelevant to the music as far as I can see, and quite delightful as a cover. You can play the disc okay but best thing is to lay down the album where everybody who goes by will instantly see it. Fun & games for all.

The trouble with the Nonesuch digital recording of the Quintet is another old, familiar phenomenon. The music is a bit scratchy on its own, as per above, but these players, typically, sit there and "play to the gallery," to a live audience, as they have been trained; the microphones, closer than any such audience, pick up a violent, hectic, basically unlovely sound. When will musicians and producers learn to get together on these things? Singers do the same, "projecting" like crazy towards a hypothetical rear balcony hundreds of feet distant, while the mikes, plain as day, are right there in front of them. It's a cultural discontinuity. Yet microphones have been around for over 50 years! (Earlier, recording *demanded* projection.)

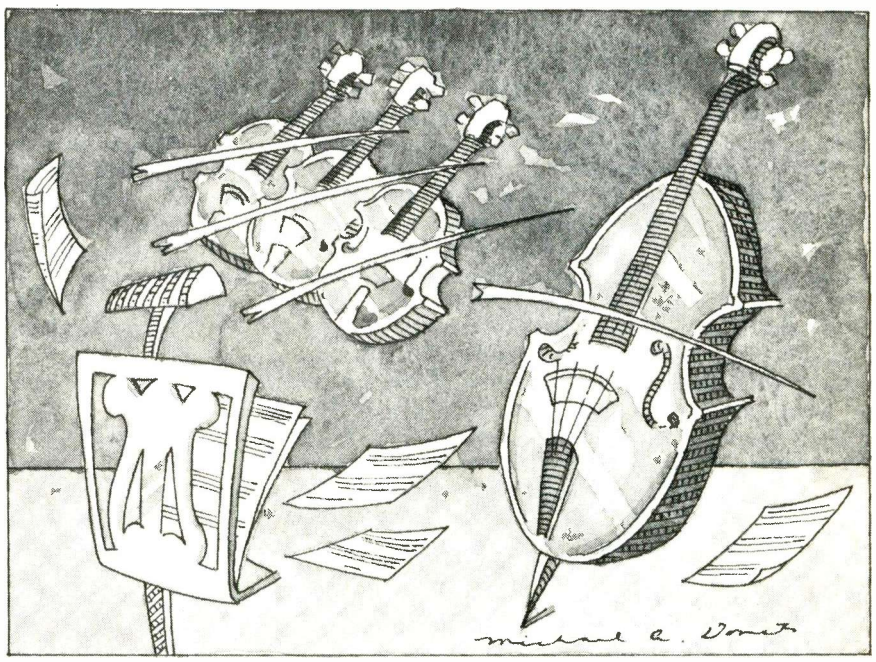


Illustration: Michael Donato

Taverner: Western Wind Mass; Mater Christi. Tallis: Votive Antiphons, Motets, Responds. Choir of New College, Oxford, Higginbottom.
Vanguard Bach Guild HM 78 SD, $5.98.

Sound: B– Recording: A
Surfaces: B–

It was very common before the late 16th century for church composers to produce full-scale music for the Mass based on well-known melodies, semi-folk-tune style, and not originally in any way "churchy." An equivalent today might be a Mass in which anybody who knew could plainly hear "I Ain't Misbehavin' " or "Tea for Two" or perhaps a Beatles song. "Westron Wynd," variously spelled, has enchanting words, an earlier "Greensleeves": *"Westron Wynde, when wyll thow blow, the smalle rayne down can rayne? Cryst yf my love were yn my armys, And I yn my bed agayne"* and at least three well-known tunes, all much alike—not surprising for a popular song, as witness the famed "Barbara Allen" in many versions. There is even a Western Wind performing group today going the concert rounds.

Thus the Taverner Mass (there are others by Tye and Sheppard) is in effect a set of splendid variations, some 30 or so, on this tune, which is never missing for a moment. You can compare with the Bach "Goldbergs," the Beethoven "Diabelli" Variations, and many more.

And in this performance (plus shorter works by Taverner and Tallis) the Mass is no less than superb. The "New" College Choir was set up in 1379 for 16 male singers, boys and men, and—typically—today after 600 years it has precisely the same number, boys and men; moreover, we can be wonderfully sure that this beautifully polished sound is the nearest thing to the exact sound of earlier times we will ever hear. Count on the British to keep it that way! Sticklers for tradition.

On the audio side, I noted in passing a nagging bit of distortion in the loudest parts and in the piercingly high tones of the small-boy sopranos (trebles) when they let out all they have. This could be my equipment. But note that overloading somewhere in the audio chain is an old, old phenomenon in recorded choral music, which includes astonishingly violent transients, acoustic TIM, as the many voices minutely clash around what is ostensibly the same pitch. In this case it could be my playback, not up to the clean but tough

Vanguard recording. Or it could be in the grooves as cut by Vanguard *or* in the original British tapes, any stage. Do not allow it to interfere with your enjoyment. It won't.

Organ Music from Robert Todd Lincoln's "Hildene." Edward Lawrence (live); assorted organ rolls. Aeolian residential organ, built 1908, restored. **Friends of Hildene H-1001,** $5.00. (Box 331, Manchester Village, Vt. 05254.)

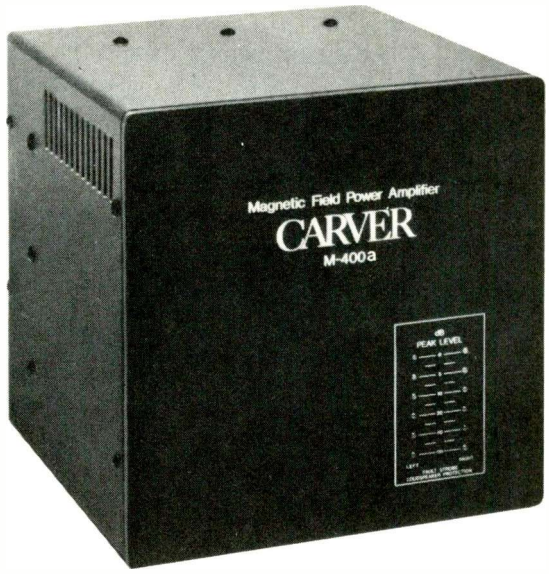
Now here's the sort of thing that recording can do with the utmost felicity! An Aeolian residential organ of 1908, restored in the mansion built in 1905 by Abraham Lincoln's only surviving son.

Robert Todd built his Vermont home in the manner of wealthy people of his day, 25 rooms, a grand, Federal-style hallway—and, on the landing of the glorious staircase, a residential organ. It was the thing to do, and his wife was a performer. He, too, would have liked to play with this fine toy and so he had an Aeolian organ-roll player mechanism installed, the finest of its day. The organ was big by residential standards, 17 ranks and 1,000 pipes. The organ rolls exploit even more of these than does the modern-day "live" player on side one of the disc.

You can guess the history involved. The organ died of slow death, along about the Terrible Twenties when all those wonderful mechanical instruments gave way to the phono and the radio. For 30 years it nurtured quantities of mice and no music at all. But lo! Times do change. The organ has now been well and wisely restored to perfect condition, both the "live" instrument and the accompanying roll player in all its pristine electrical complexity. Not a sound has been changed, nothing added, nothing removed; so the instrument's exactly as heard in 1908. All this thanks to the Friends of Hildene (the name of the Mansion), who seem to have both money and knowhow.

Side one is an interesting "live" program played by Edwin Lawrence, short works by four of the notable "first American composers" of the turn of the century, pretty much in their heyday in 1908: Horatio Parker of Yale

PURE GENIUS



The Carver Magnetic Field Power Amplifier M-400a

201 watts minimum continuous power per channel into 8 ohms, 20 Hz-20 kHz, with no more than 0.05% T.H.D.

Within this 7-inch, 9-pound cube is, quite possibly, the most powerful story in the history of high fidelity amplifier design.

The genius of a music loving physicist was turned loose and the result is an elegant technology that substantially reduces the massive bulk, weight, and cost of high power audio amplifiers. Conventional amplifier power supplies are very costly and inefficient because they produce a constant high voltage level at all times—irrespective of the demands of the everchanging audio signal—even when there's no audio in the circuit at all!

In sharp contrast the M-400a's power supply is signal responsive and highly efficient. It produces *exactly and only* the power the amplifier section needs from moment to moment to carry the signal with complete accuracy and fidelity.

Once the crudeness of conventional power supplies was overcome, a wholly uncompromised signal path was designed: Fully complementary topology from input to output; the latest, fastest, highest current transistors; direct coupling; linear metalized film capacitors; precision laser trimmed resistors; vapor-deposited 24 Karat gold connectors; and finally, an output inductor whose corner frequency is almost a quarter of a megahertz.

Audition the Carver M-400a and hear the difference: transparency, openness, detail. Without the clipping, distortion, and constraint of lesser amplifiers. With Carver the *pure* sound of music can be, very affordably, yours.

CARVER

Powerful • Musical • Accurate

P.O. Box 664 14304 N.E. 193rd Pl. Woodinville, WA 98072

Enter No. 7 on Reader Service Card

"This old organ's sound is eminently Victorian, a very proper dun color, elegant and creamy."

(Charles Ives' unwilling teacher); John Knowles Paine of Harvard; Arthur Foote, a Boston musical mogul and best of the lot in the long run, and Dudley Buck, sage of the Middle West, whose quantities of vigorous church music still reign supreme, as they say, in our musical heartland. You will surely enjoy all of these, with their sweet, almost sugary harmonies and stylishly academic fugues and counterpoint, after the best French and German models. And do rejoice in Dudley Buck's all-out "Variations of the Star Spangled Banner!"

On the player-roll side, the music is of similar dating, as it would have to be, but on a lesser scale of value. Robert Todd's taste was, shall I say, a bit nearer to Tom Edison's. The opener, "Grizzly Bear Rag," must have been daringly modern in 1908 but the rest is pretty sentimental, including that pale musical flower, "Narcissus" by the ineffably corny Ethelbert Nevin. Final item is the "Ride"—all the Valkyries you want and plenty of pyrotechnics for paper roll.

Alas, there is virtually no ambience around the organ itself, which is bad for recording, though inevitable and proper for the residential type of instrument which wasn't supposed to sound like church. The organ sound, too, is eminently Victorian, i.e. a very proper dun color, elegant and creamy. Not really for today's taste—but you will quickly adjust to its values, which are considerable, if in low relief. All in all, an unusual organ experience, neither "Mighty Wurlitzer," super-Baroque-authentic, nor cathedral French, but something quite different from all of these. Thanks to reader Craig Merz of Greensboro, N.C. for sending me a copy of the disc.

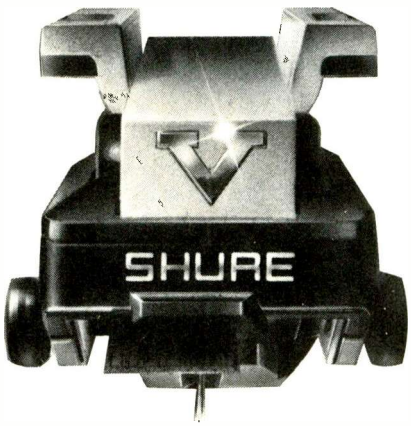
Beethoven: Quartet in F Major. (Original version of Op. 18, No. 1.) Pro Arte Quartet.
Laurel LR-116, $7.98. Also dbx encoded.

Sound: B+ Recording: B–

Speaking of casual listening, here's an interesting double-check. Lots of listeners know the familiar Op. 18, No. 1 quartet, which is played and recorded everywhere. Many an amateur string player gets his fiddle or viola or cello into the actual notes. Turns out that this first of all the published quartets with an opus number was rebuilt from an earlier version, as happened so often in Beethoven's remarkable musical workshop. This is the original try. It *is* the same work. But there are hundreds of modifications. Can you spot them by ear?

Not me. I tried, casually, just to see. Once in awhile I heard something that seemed vaguely different. But if you hadn't told me, I would not have realized this was another work. I suspect that even the most sophisticated of

AUDIO CRITICS RAVE ABOUT THE V15 TYPE V:



"Our tests show that the Shure V15 Type V not only lives up to the claims made for it, but in virtually every respect OUTPERFORMS the best cartridges we have previously tested....It is hard to imagine how the V15 Type V could be improved significantly. It offers the MOST PERFORMANCE in the most areas, plus the most convenience and safety in installation and operation."— **Julian Hirsch, Stereo Review, June, 1982**

"...(The V15 Type V) is definitely the FINEST pickup Shure has ever made, which makes it one of the finest ever made, period."— **High Fidelity, July, 1982**

"...In a world of audiophile discs with demanding tracking requirements, the Shure V15 Type V KEEPS AHEAD of the times."— **Rich Warren, Chicago Sun-Times, June 4, 1982**

"(The V15 Type V) REDEFINES its maker as a pioneer in cartridge design not only from the beginnings of microgroove technology but well into the future of the LP disc."— **FM Guide (Canada), June, 1982**

"...It may be safe to say that this cartridge's excellent tracking ability is NUMBER ONE in the world. Provides exquisite and elaborate sound."— **Swing Journal (Japan), May, 1982**

Find out why the critics are so excited: Send for free fact-filled brochure AL694A.

SHURE®

Call for the name of the dealer nearest you
800-323-6556. Ask for Dept. R15.
In Illinois: 800-942-6345. Ask for Dept. R15.

Shure Brothers Inc., 222 Hartrey Avenue, Evanston, IL 60204

Enter No. 24 on Reader Service Card

"I was bowled over by the 'Diabelli' Variations, knocked for a loop, transported, levitated, thrown into a holistic trance!"

non-quartet-playing listeners will have the same experience, though string players are more likely to catch the detailed changes.

The payoff is in the liner material. A beautifully organized comparison, with numerous examples, the old and the new, in side-by-side notation! You can see how extensive those differences are. Once looked at, and the excellent annotations read, the musical differences *can* be heard. So there's a lot of musical fun here for anybody with an inclination towards leisurely, detailed listening.

The current-day Pro Arte (an old quartet but with ever-new personnel) plays well but the recording is a bit close and scratchy for my ear—not distortion, just proximity. Needs a mellower sound.

Leonard Shure—Beethoven: 33 Variations on a Waltz by Diabelli, Op. 120; Piano Sonata No. 31 in A Flat, Op. 110.
Audiofon 2001, two discs, $23.96.

Since Gottschalk in the 1850s, just about all the really great pianists have been, so to speak, un-American and largely from Europe. I mean the *very* biggest, not only superb technicians but musically able to create piano drama on a Shakespearean level, in works that are far beyond the understanding of most otherwise-expert keyboard artists. Artur Schnabel, the great teacher, was one of the first to record the big works—his Beethoven Sonatas in the early '30s opened up a new era, just as the Budapest Quartet's recordings of the late Beethoven and Schubert string works did. But now —we have elder statesmen and really great pianists of this sort who are American. And Leonard Shure is one of the top examples.

The "Diabelli" Variations, Beethoven's last and enormous piano piece, is comparable to the Bach "Goldbergs," but bigger, more openly dramatic. Built, paradoxically, on a simple-minded little waltz by his publisher—who commissioned all sorts of composers to write things based on it in a hoped-for, profitable publishing venture. (No recordings in those days.)

Very few pianists dare tackle this incredibly huge drama in public. And most who do fall flat before the thing is over, dramatically, if not in the notes. Leonard Shure follows Schnabel, with whom he studied, and his version is as "big" in soul as Schnabel's, though quite different. I had not heard the piece for awhile; I was bowled over, knocked for a loop, transported, levitated, thrown into a holistic trance! Opus 110, one of the last few, very late, sonatas out of Beethoven's 32, is a perfect foil, in the same musical league but, of course, much smaller.

Fabulous piano recording, too, though there seems not to be a digit in sight. It can be done.

Revox B791
The Straight Line on Precision Engineering

First, a few words about our straight line tracking system. It's called Linatrack®, and it utilizes a low mass, incredibly short tonearm that's barely 1¾" from pivot to stylus tip. Tracking error is eliminated as Linatrack®, guided by an accurate infrared-interrupt servo circuit, moves straight across the radius of the disk. The tonearm mounts most popular cartridges, and the entire Linatrack® module pivots aside for quick record changing.

Precision engineering is at the heart of the B791. A quartz-regulated, Hall-effect direct drive motor assures absolute speed stability with no cogging effects. Even the vari-speed is quartz locked, with a front panel display to show both the nominal speed and the exact percentage of speed deviation.

The Revox B791 is solid, substantial, meticulously assembled, and handsomely finished. It is designed for maximum user convenience, exceptional reliability, and sonic accuracy. It is not inexpensive.

That's the straight line. Hear the full sound at your nearest Revox dealer.

STUDER REVOX

1425 Elm Hill Pike, Nashville, TN 37210 (615) 254-5651

Enter No. 27 on Reader Service Card

MICHAEL TEARSON
JON & SALLY TIVEN

HENDRIX REDUX

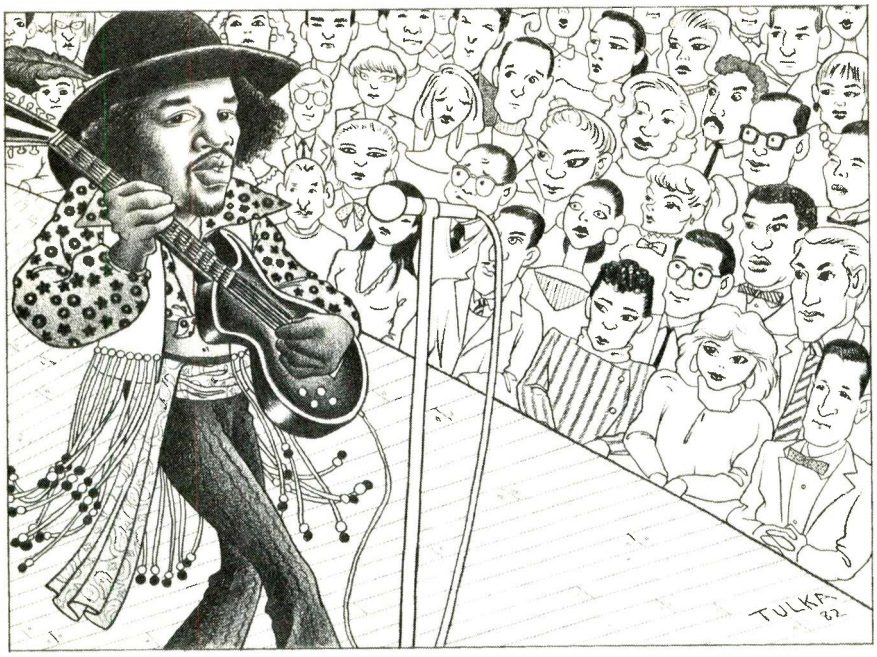


Illustration: Rick Tulka

The Jimi Hendrix Concerts
Reprise 22306-1, two discs, $14.98.
Woke Up This Morning & Found Myself Dead: Jimi Hendrix
Red Lightnin' RL0015, $8.98.
10 Years After: Jimi Hendrix
Record Man RM 911, $8.98.

Sound: Variable Performance: A

Thank the stars that there is still so much recorded work, be it studio outtakes or live performances, by the late Jimi Hendrix. The vinyl representation during his lifetime doesn't even begin to expound on his enormous talent. His mastery of the electric guitar, songwriting talent, and sheer musical presence are all outstanding when taken separately, but to think that one person was blessed with so much strength in all three of these areas boggles the mind. It also pleases the ears no end, and any newly released Hendrix albums are a wonder to behold. But the consumer should be apprised of what's available to suit his individual needs.

The official document, *The Jimi Hendrix Concerts*, is four sides of original Jimi Hendrix Experience (with Mitch Mitchell and Noel Redding, occasionally Billy Cox filling in for Redding) mostly from 1968 Winterland shows, and the playing is wholly remarkable (particularly on side three). Not only are these recordings all previously unreleased, but many of the songs have never been available in live versions. However, the inclusion of a teaser like the concert rendition of "Little Wing" just makes the listener anxious to hear more songs from the *Axis: Bold As Love* period, most of which have been neglected in this and other live albums. "Hey Joe" and "Wild Thing" could easily have been sacrificed for "Castles Made of Sand," but this is a relatively small point. These are fine and interesting performances, recorded extremely well, and much of the onstage banter and gaffes have been left in.

For those who don't care about hearing their favorite tunes and are willing to suffer through not-bad-but-hardly-perfect sound quality, *Woke Up This Morning and Found Myself Dead* is a far more revealing document. What we have here is a live jam between Hendrix, various members of The McCoys, and Johnny Winter, with Jim Morrison stumbling in halfway through and singing whatever comes to mind for two numbers. The playing is wholly unpredictable and some bum notes are hit from time to time, the songs seemingly made up on the spot. Some familiar songs are heard—John Lennon's "Tomorrow Never Knows," two Cream riffs, "Red House," and Elmore James' "Bleeding Heart"—but all of these are played in ways that are totally atypical of Hendrix performances. The sound quality isn't bad for a semi-bootleg, and the record's a lot of fun.

10 Years After is more your typical boot—a live document of one show from the early Hendrix Experience, hampered by somewhat shrill sound quality. There are some good and unusual performances here—"Day Tripper," "Love or Confusion," and an instrumental "Sunshine of Your Love"—but this is only for the truly hardcore Hendrix maniac. *Jon & Sally Tiven*

Rough Diamond: Bad Company
Swan Song 90001-1, $8.98.

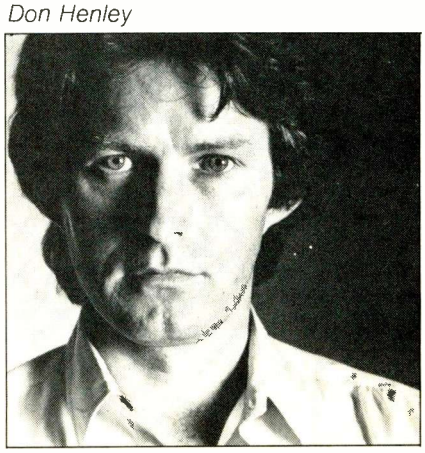
Sound: B Performance: C+

I Can't Stand Still: Don Henley
Asylum EL-60048, $8.98.

Sound: B+ Performance: B+

When looking back on the last decade, Free was perhaps the most brilliant of all the rock aggregates to emerge and The Eagles among the most dismissable. Both are now defunct, but the influence of these volatile combos pervades the music of most of today's chart-toppers. As for the survivors of the groups, Don Henley and Bad Company's Paul Rodgers were the lead singers of The Eagles and Free, respectively, and their latest offerings are at the least mild surprises. Bad Company is now playing the lamest cowboy rock/funk one could ever imagine, while Henley has kicked off

Don Henley



his boots and gotten down to some more-than-decent rock 'n' roll.

In the past, Bad Company's shortcomings have centered around the fact that they sound too much like Free and yet lack Free's soulfulness. Where Andy Fraser's loose bass runs held the rhythm section together by a slender thread, Boz Burrell plays the old reliable root of the chord and follows the bass drum most of the time. Fraser was, lest we forget, at least half of the writing team that came up with Free's best songs, and although Mick Ralphs should be given an A for effort, his work on guitar pales next to the late Paul Kossoff's (Free's distinctive guitarist). On *Rough Diamond*, Bad Company sounds virtually asleep, unable to come to grips with any of the changes in modern music or to achieve any sort of natural progression of their own. Mick Ralphs clearly has lost his place, at his best resembling a watered-down Kossoff on "Kickdown." More times than not, Ralphs plays second fiddle to Paul Rodgers' vocals—not to mention the fact that Rodgers takes the lead guitar credit on three tunes here. It's unfortunate that Bad Company has outlived its usefulness, but it was inevitable. Rodgers surrounded himself with those who were not musical equals, and at this point in time it seems he and Ralphs barely share the same musical tastes. Granted, the Paul Rodgers voice still has magic and can bring life to even the lamest songs, but *why*? Bad Company is over, and *Rough Diamonds* is a sad testament to their obsolescence, whatever talent each member may still possess.

Don Henley was better known for his ballad singing than for being a rocker, but on his solo album he really lets loose with some decent visceral tunes. Aided by Danny Kortchmar's guitar attack as well as L.A.'s finest musicians, he comes across as a strong talent whose only relationship with The Eagles sound is his familiar voice. Although he isn't the world's greatest lyricist, at least Henley's got an idea or two, and his pop sensibility has been so finely tuned by his years with The Eagles that he can get across what he wants to say. What could have been vaguely pleasant is an album that's almost stirring—not bad for an Eagle, you might say. *Jon & Sally Tiven*

GENUINE BARGAIN.

The GFA-2 is the high quality stereo power amplifier you've been looking for. Here's why:

It has 100 watts of power,* with less than 0.05% THD and 0.01% IM distortion. Individual power supplies and associated circuitry provide complete power consistency in each channel.

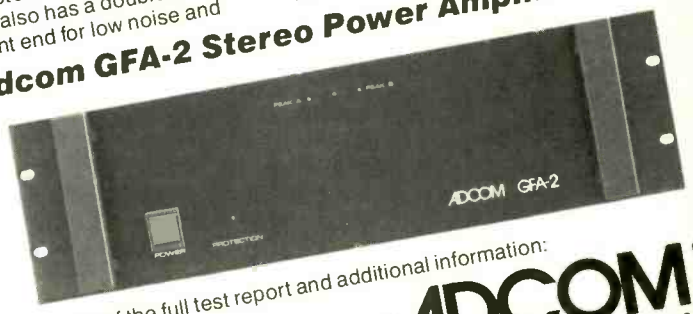
The GFA-2 has an auto reset multi-stage protection circuit to eliminate turn-on transients, prevent DC leakage, and protect against overheating.

The amp also has a double differential FET front end for low noise and extremely stable operation.

But, don't take our word for the GFA-2's fine performance and value. In a test report on the GFA-2, in the October 1982 *Stereo Review*, Julian Hirsch said, "...a genuine bargain**..."

"Most 100 watt amplifiers sell for a far higher price than this one. Therefore, in addition to being a top-quality product with state-of-the-art performance, fully protected against most common operating hazards, the Adcom GFA-2 is a genuine bargain in today's market."

The Adcom GFA-2 Stereo Power Amplifier.



Write for a reprint of the full test report and additional information:

ADCOM®

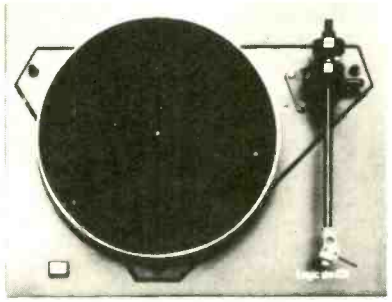
9 Jules Lane, New Brunswick, NJ 08901, USA (201) 828-8590

*RMS, 20Hz to 20 kHz, both channels driven into 8 ohms.
**Less than $400. All prices stated are manufacturer's suggested retail prices.

© 1982, Adcom

Enter No. 1 on Reader Service Card

BALANCED



LOGIC

Regardless of the vibrations in the room, a Logic DM101 Turntable provides a uniquely stable platform for both the cartridge and record. The chassis/platter is suspended from the plinth on a three point system using two tension springs at each point.

As a result, it is possible to reproduce the signals pressed into the record with utmost accuracy.

Logic

Made in England. Distributed in the U.S. by Meridian Audio of America, P.O. Box 653, Buffalo, N.Y., 14240. (416) 438-7484. In Canada by Remcron Electronics Ltd., Toronto. Members of the △△isobanke International Group.

Enter No. 15 on Reader Service Card

AUDIOCLINIC

JOSEPH GIOVANELLI

Local Power Generation And Audio Gear

Q. I live in a remote area which is not serviced by grid power. My options, therefore, are solar, electric or wind generation—with power in the form of 12-V d.c. I know that I can use most auto stereo gear, but is there 12-V d.c. equipment designed for home use?—Steve Verchinski, Albuquerque, N. M.

A. I know of no equipment made for home use and designed for 12-volt d.c. operation. There is probably little point at present for producing such products because there will be little call for them. While I have seen a trend toward the use of independently generated electrical power, I doubt that there is a real market out there for such products.

Fortunately, automotive audio products are quite good, so you can use them without sacrificing much. Of course, their mounting arrangements are not exactly suited for the living room.

When you have 12 volts, you have the means of obtaining 120-V a.c. You need a device known as a converter, which is designed to produce the desired 60-Hz, 120-V a.c. It is common for such converters to be used with small power plants—wind, solar, hydro, etc. This equipment may be a good option for you, because it will permit you to use standard audio products. I do not know how good the accuracy of the 60-Hz frequency is. Therefore, I suggest that the products you select should not be frequency-dependent. This means that you should use turntables and tape machines which employ servo-controlled motors. Digital clocks or timers must be of the sort which utilize their own internal crystal oscillators, rather than relying on the powerline frequency to supply the impulses which activate the counters in the digital clocks.

The power-handling capability of the converter must be somewhat greater than your total power demands.

[In my experience of using inverters in a 120-V d.c. dormitory, years ago, vibrator-type inverters have fairly accurate speed regulation and are okay for powering turntables, but their output waveforms are too spiky and noisy for use with amplifiers or other electronic gear. Motor-generator inverters are okay for amplifiers, but not for frequency-dependent turntables, as their speed varies with the load they're driving.—*I.B.*]

Three-Speaker Car Installation

Q. I recently helped a friend install a new cassette/stereo system in her car. She only had one front and two rear speakers, and her stereo unit did not have a fader. It did have three speaker leads, left, right and common.

I used an add-on fader, connecting both its common terminals to the stereo system's common. The rear speakers were connected normally, but I connected both of the fader's left and right "front" leads to the front speaker.

Is there any problem with this? If so, how can it be corrected without adding another front speaker?—John A. Richard, Baltimore, Md.

A. You have one definite and one potential problem. You will definitely lose stereo separation as you fade in the front speaker. And you might possibly damage the amplifier; consult the stereo system's manufacturer on that.

You could get the same results, without the problem, by connecting only one channel to the front speaker and switching the receiver to mono when listening to it.

If you don't have a stereo/mono switch or prefer stereo from the rear combined with a front center-channel, then install resistors in series with the front speaker. Try four or five ohms, but, again, consult the receiver maker. This will limit the loss of separation and protect the amplifier, but it will also lower the volume available from the front speaker as well as the power available to the system when the front speaker is in use.

Transformer and Pre-Preamplifier

Q. I have a moving-coil cartridge and a step-up transformer designed to be used with it. I also have a preamplifier. I plan to purchase a pre-preamplifier kit and use both the pre-preamplifier and the transformer at the same time. Is this all right?—Name withheld

A. If you purchase the pre-preamplifier kit, I see no need for the transformer, since the purpose of the pre-preamplifier is to render the use of a step-up transformer unnecessary. Using the new unit will show you, in all likelihood, that the transformer is not needed. If the new pre-preamp produces enough signal level to drive your system adequately, do *not* use the transformer, as that may overload either the pre-preamplifier or the preamplifier proper.

Sound Reinforcement

Q. A friend and I would like to combine our systems for use at various events. I have a 70-watt receiver which has jacks that let me use the preamplifier and power amplifier sections independently; my friend has separate components.

We considered using one preamplifier, routing the signal to the two power amplifiers by the use of two Y-shaped patch cords, and driving one pair of loudspeakers with each amplifier. Because we plan to play dbx-encoded discs at very loud sound levels, we would like to combine the outputs from the two amplifiers to drive one pair of speakers. How can we accomplish this?—William B. Walkup, Meadow Bridge, W. Va.

A. The use of Y-connectors is fine for driving two separate power amplifiers from a single preamplifier, provided each amp drives its own speakers.

The power increase which may be possible by combining two amplifiers to drive a single pair of speakers is only 3 dB at best. If the two amplifiers are from different manufacturers, have different power ratings and have no "bridging" arrangements, you probably cannot combine them in any way without risking damage to either or both.

I would suggest, therefore, that each amplifier should drive its own pair or pairs of speakers. If you arrange these speakers properly in the areas to be covered, this will permit listening at a somewhat lower sound level than might otherwise be possible if the listening area is to be fully covered by one speaker pair. This arrangement would enable those participating in your events to carry on conversation, if

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.

this activity is appropriate. I have attended all too many social functions where conversation would have been great except that the audio got in the way. I should have stayed home!

More on "Ground to Earth"

In reference to the question "Ground to Earth" (Audio, Nov. 1981) there is a word of caution you may wish to extend to your readers. Many high-gain, multi-component systems may exhibit excessive hum because of poor house ground, even if they have a three-wire a.c. system. Due to age or corrosion, the wire ground of a house may begin to float several ohms above true ground. This could cause a hum problem as well as a voltage difference which could be carried on the case of the component. Running a true earth ground, i.e. a waterpipe, may remedy the hum/voltage problem but inadvertently create a dangerous ground condition from a safety point of view. Because the component system ground would then be the best ground on the circuit, any large discharge on the circuit would ground through the stereo system! As you can see, this could be dangerous to the operator *as well as to the components themselves.*—Doug Leu, Minneapolis, Minn.

Frequency Range Of Program Sources

Q. Is it possible to check the frequency range of a tape or a disc with a gauge? Can this gauge be directly connected to the output of a tape recorder or preamplifier?—Rudolf Quaas, Pocatello, Idaho

A. A device known as a real-time analyzer will show you the frequency content of signals presented to it. An RTA shows signal level in each of several frequency bands. Most common for home use are 10-band models, with bands an octave wide, usually costing just over $200. Models with 31 or so bands, each ⅓-octave wide, are more informative but more expensive.

If you have a personal computer, you can possibly use it as the basis for a ⅓-octave analyzer. Radio Shack has a $20 analyzer cartridge for their Color Computer (limited to 12.5 kHz, alas); Eventide Clockworks, in New York, makes 31-band models for the TRS-80 Model I, Pet and Apple II.

THE SIMPLE SECRET OF MORE SOUND FROM LESS SPEAKER.

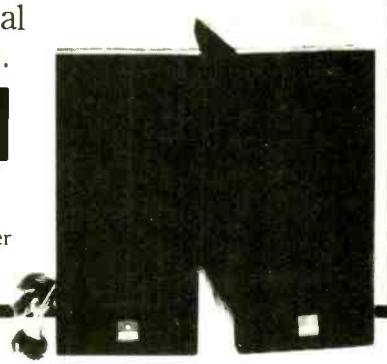
By building the power amplifier and associated electronics into the speakers themselves, Meridian eliminates the electronic barriers to sound fidelity inherent in conventional passive speakers.

A full range of sound performance is possible in one-eighth the volume required by passive speakers. The speakers can be made small enough to deliver sound patterns sized and shaped for the brain's hearing and interpretive centers.

Uniquely pure and detailed sound with extra ordinary fidelity to the original performance is now possible.

MERIDIAN©

Made in England. Distributed in the U.S. by Meridian Audio of America, P.O. Box 653, Buffalo, N.Y., 14240. (416) 438-7484. Member of the △△ isobanke International Group.



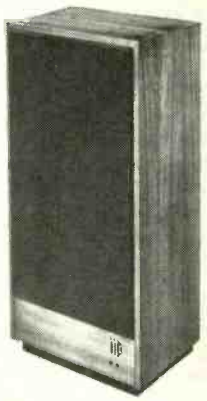
Enter No. 34 on Reader Service Card

FREE

McIntosh

STEREO CATALOG and FM DIRECTORY

Get all the newest and latest information on the new McIntosh stereo equipment in the McIntosh catalog. In addition you will receive an FM station directory that covers all of North America.



SEND TODAY!

McIntosh Laboratory Inc. A
East Side Station P.O. Box 96
Binghamton, N.Y. 13904-0096

NAME _____

ADDRESS _____

CITY _____ STATE ___ ZIP _____

If you are in a hurry for your catalog please send the coupon to McIntosh. For non rush service send the **Reader Service Card** to the magazine.

Enter No. 14 on Reader Service Card

TAPE GUIDE

HERMAN BURSTEIN

"Mis-Matched" VU Levels

Q. I have a problem with the response of the VU meters of my cassette deck. Before I record, I set the level in the record mode with pause engaged. When I have recorded the tape and play it back, the playback level shown by the VU meters is totally different from the level shown when recording. What is wrong?—William Sigrist, Dumont, N.J.

A. If a cassette deck is designed to read playback as well as record levels, this is done on the basis of a specific tape chosen by the deck manufacturer. However, tape sensitivity—which refers to the amount of signal output for a given amount of signal input—differs somewhat among tape types and brands. Therefore, if you are using a different tape than intended by the deck manufacturer, playback level may not agree with record level.

On some decks, the meter shows the deck's output level, not the tape's, in playback. Such readings will vary with the setting of the deck's output level control.

If the difference between recording and playback readings is only due to a difference in tape sensitivity, that difference should not be very great—perhaps no more than about 3 dB in typical cases, and probably no more than 6 dB at the outside. If your difference exceeds 6 dB, either the record-level adjustment or the playback-level adjustment may be incorrect. Many decks contain internal potentiometers for adjusting these levels. You can find out from the deck manufacturer or from the owner's manual what the situation is in your deck. If there are adjustment potentiometers, it is a simple matter for a qualified service technician to correct the reading of your VU meters. Such adjustment should be made when using the cassette of your choice. If you turn to a technician, you also might want him to optimize bias for the tape of your choice.

New vs. Old Level Meters

Q. After using a $300 cassette deck for some time, I recently purchased a $900 model. The recordings made by this machine are fine indeed, but decidedly noisier than those made by the old unit. I discovered this is due to the fact that I am now recording at a definitely lower level than before. When playing a tape made on the old deck on the new deck, or when playing a prerecorded tape, the level indicators on the new deck show very high peaks. Does this suggest the meters are inaccurate? Or is it more likely that the new deck is revealing the drawbacks of the inexpensive, peak LED indicators of my old deck?—Christopher Handy, Rockville, Md.

A. It seems to me that the meters on your new deck are calibrated differently, perhaps showing a higher level than they properly should. If the tapes made on your old deck, and prerecorded tapes as well, do not sound distorted when played on your new deck, this is confirmed.

Peak indicators—whether expensive or inexpensive, be they LEDs, meters, fluorescent bars, or other devices—are superior to average-reading devices (such as true VU meters) for optimum setting of record level by most home recordists. So don't put down the level indicators of your old deck, even though they are "inexpensive, peak LED indicators."

When using your new deck, increase the recording level until noticeable distortion is heard in playback—then back down a bit on level. If this causes your meters to pin (move all the way to the right and hold there for a brief moment or more), you will have to get the meters recalibrated by a competent technician for the type of tape you intend to generally use when recording.

Re-Dubbing Losses

Q. How much signal loss occurs when you record from phono disc onto cassette and re-record from the first cassette to a second one?—Philip Leak, Roseville, Cal.

A. On each dubbing there tends to be about 3 dB of deterioration in signal-to-noise ratio. When using high-quality cassette decks with S/N or 65 dB or better, such loss tends to be minimally noticeable for a single dubbing. However, if you make, say, three or more successive dubbings, the increase in noise tends to become appreciable.

In this connection it may be noted that prerecorded tapes tend to go through three, four, or even five "generations" before the final version reaches the consumer. That is why prerecorded tapes have had a problem in achieving high S/N unless they were recorded at levels so high as to produce audible distortion. With the advent of digital recording and duplication, which entails virtually no loss in dubbing, prerecorded tapes can provide very good S/N.

Doubling in NR

Q. I plan to purchase a cassette deck that incorporates Dolby B. I also plan to purchase a dbx unit. Can I use the Dolby in conjunction with the dbx to get extra noise reduction? If my cassette deck has Dolby HX, can I use only the HX feature in conjunction with a dbx in order to increase the tape's high-frequency headroom?—Michael Deutsch, Sherman Oaks, Cal.

A. The compressed signal presented by the dbx encoding will probably give the Dolby encoding circuit incorrect information on which to work, so I doubt the two will work satisfactorily together. Perhaps your audio dealer will let you try the combination.

As things stand, you cannot use only the HX (headroom extension) feature in conjunction with a dbx unit to increase high-frequency headroom. It *might* be possible to go inside the deck and disable the Dolby encoding so that only the HX processing remains, but this would require much technical expertise. (The Bang & Olufsen Beocord 9000's HX Professional system *can* be used independently, if you have that deck.)

Using HX also appears unnecessary if you are using dbx. The latter provides about 30 dB of noise reduction, bringing you into the area of about 85 to 90 dB signal-to-noise ratio. If you fear there is danger of tape saturation at high frequencies when recording at high levels, you can reduce the recording level substantially and still maintain an excellent S/N ratio. In other words, headroom extension is virtually unnecessary with the great amount of noise reduction provided by dbx.

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.

TILL HELL FREEZES OVER

Presenting High Bias II and the Ultimate Tape Guarantee.

Memorex presents High Bias II, a tape so extraordinary, we're going to guarantee it forever.

We'll guarantee life-like sound.

Extraordinarily flat frequency response at zero dB recording levels, combined with remarkably low noise levels, means music is captured live. Then Permapass,™ our unique oxide-bonding process, locks each oxide particle—each musical detail—onto the tape. So music stays live. Not just the 1st play. Or the 1000th. But forever.

We'll guarantee the cassette.

We've engineered every facet of our transport mechanism to protect the tape. Our waved-wafer improves tape-wind. Silicone-treated rollers insure precise alignment and smooth, safe tape movement. To protect the tape and mechanism, we've surrounded them with a remarkable cassette housing made rigid and strong by a mold design unique to Memorex.

We'll guarantee them forever.

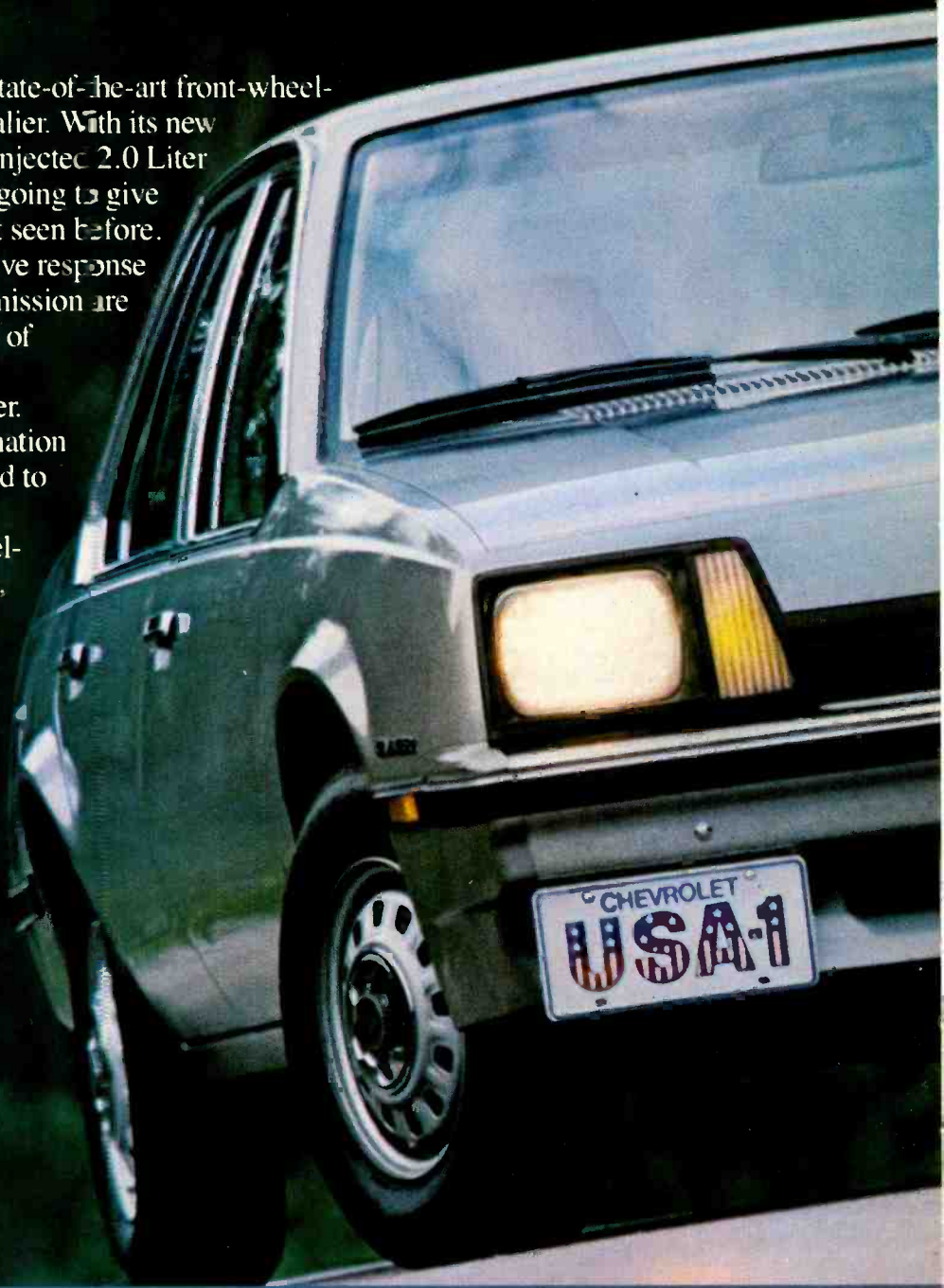
If you ever become dissatisfied with Memorex High Bias II, for any reason, simply mail the tape back and we'll replace it free.

YOU'LL FOREVER WONDER,

IS IT LIVE, OR IS IT MEMOREX

Enter No. 23 on Reader Service Card

THE NEW CHEVROLET CAVALIER. FUEL-INJECTED ENGINE WILL MAKE SO WILL ITS NEW LOWER PRICE.



Chevrolet is utilizing advanced state-of-the-art front-wheel-drive technology in the new Cavalier. With its new high-torque, electronically fuel-injected 2.0 Liter engine and new lower price* it's going to give imports competition they haven't seen before.

Cavalier's front-wheel-drive response and available new 5-speed transmission are designed to offer you a new level of driving pleasure.

The new 2.0 Liter Cavalier. Powered by Chevrolet's determination to put Cavalier on top. And priced to keep it there.

See and drive the new fuel-injected Cavalier Wagon, Coupe, or Sedan. From America's sales leader. With all that Cavalier offers today, if you haven't seen your Chevy dealer, you're not ready to buy.

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

*Based on a comparison of Manufacturer's Suggested Retail Prices for 1982 and 1983 Cavalier models. Level of standard equipment may vary.

GM

USA-1 IS TAKING CHARGE

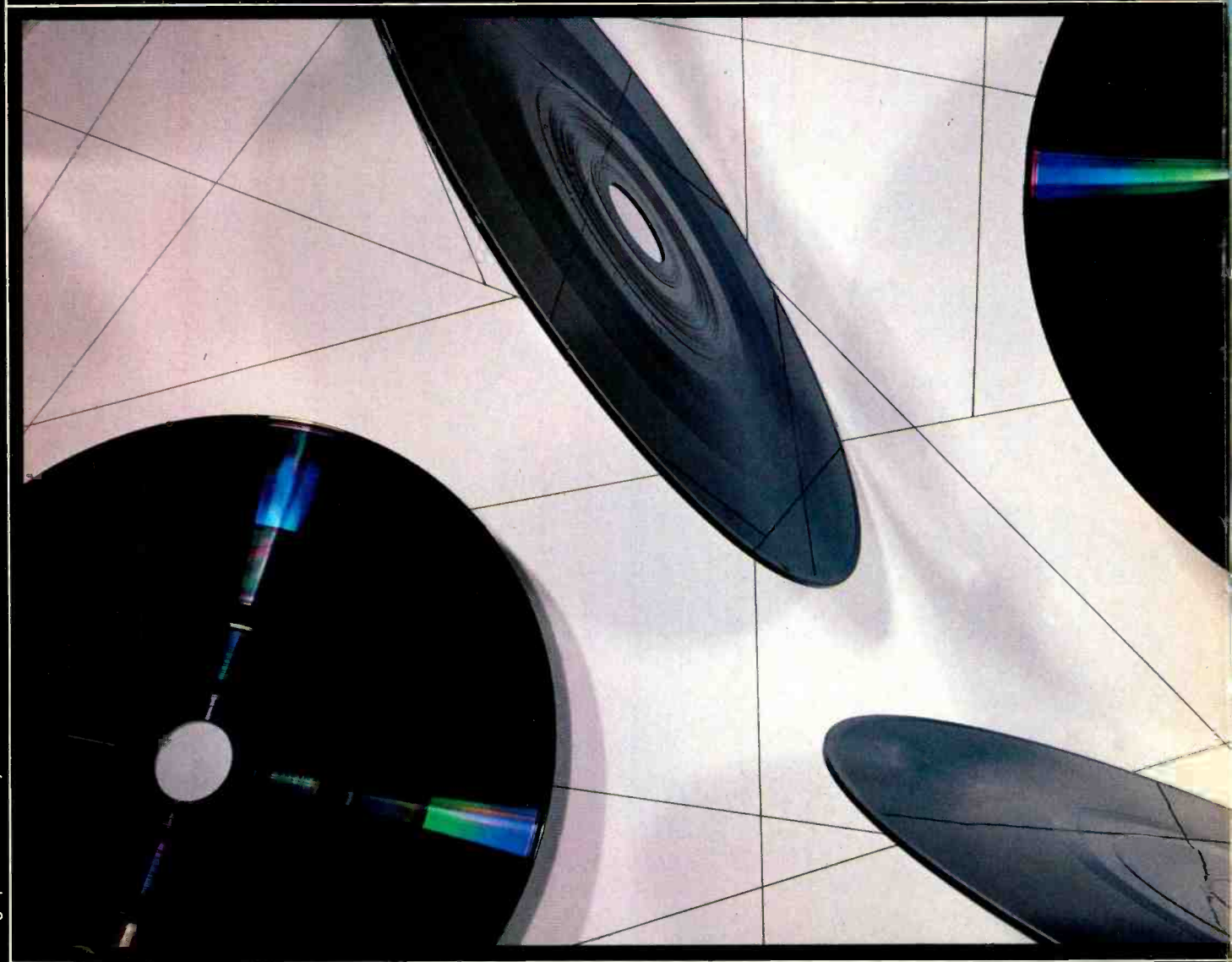
CAVALIER · CELEBRITY · CHEVETTE · CAMARO · CITATION · MALIBU · MONTE CARLO · CAPRICE · CORVETTE

ITS NEW HIGH COMPRESSION IT GO QUICKER.

Front-wheel-drive Cavalier Sedan

Chevrolet

THE RCA



Photograph: James Wojcik

VIDEODISC GETS STEREO

CHARLES REPKA, ED FREEMAN, and GOPI MEHROTRA

RCA's SelectaVision CED (Capacitance Electronic Disc) videodisc system, which originally appeared in a monophonic version, is now available in a two-channel version suitable for both stereo and independent-channel bilingual use. In addition, its sound capacity has been enhanced to levels comparable with those of high-quality audio-cassette reproducers. [For an explanation of the basics of RCA's mono SelectaVision system, see *Audio*, March 1980.]

Because of the basic purpose of the system, the design had to satisfy several constraints simultaneously. For example, the system had to give good audio reproduction on typical home stereo component systems. The system had to produce acceptable monophonic audio on a typical television system. Stereo discs and existing monophonic discs had to be forward and reverse compatible. The system had to be able to reproduce two independent audio channels for bilingual or special-purpose programs.

System Design

To ensure compatibility with mono players, the stereo signal is fed through an L + R, L − R matrix. This allows mono players to recover the compatible sum signal from stereo discs, while stereo players decode the sum and difference signals back into their original left and right components. When playing a mono disc, a stereo player behaves the same as a standard mono player (it does not apply the decoding matrix). For bilingual applications, the encoding matrix and the decoding matrix are bypassed and the two channels are recorded independently.

For adequate reproduction of high-quality stereo programs through a home system, stereo system goals included a minimum audio bandwidth of 15 kHz, distortion levels of less than 2%, and a dynamic range of at least 60 dB. Satisfying these demands required optimization of the audio-noise performance of the CED system.

The audio channels on the videodisc are recorded on FM carriers. The first channel, at about 716 kHz, is used for the sum or monophonic signal; a second channel, at about 905 kHz, is used for the difference signal (Fig. 1). As in any FM system, the demodulated signal-to-noise ratio is a result of the composite effects of the deviation, the deemphasis characteristics, the carrier

Charles Repka, Ed Freeman and Gopi Mehrotra are engineers at RCA.

Reprinted from RCA Engineer, *July/August 1982. Copyright © 1982, RCA Corporation.*

"System goals included audio bandwidth of 15 kHz, distortion levels under 2%, and dynamic range of at least 60 dB."

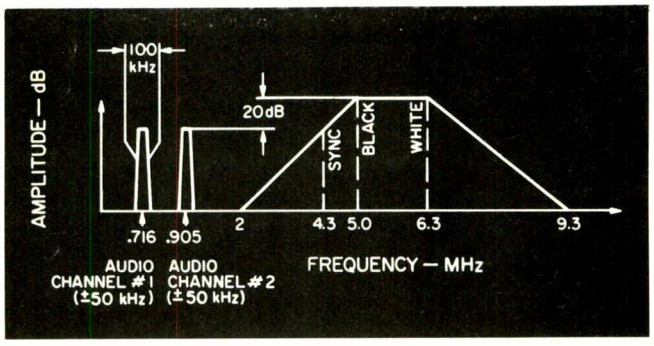


Fig. 1—Spectrum assignments for the CED stereo videodisc system. Channel 1 is the sum channel, and channel 2 is the difference channel.

levels, and the magnitude of phase-noise sources.

The requirement for reverse compatibility with monophonic players and the tight frequency-division multiplexing of the audio and video FM signals severely restrict the choice of these parameters.

Reverse compatibility defines the maximum deviation on the sum channel as the same ±50 kHz defined for the monophonic signal. Consequently, changes in deviation large enough to affect signal-to-noise ratio are impractical.

Another direct way to improve audio S/N is to increase the level of the audio carriers on the disc. However, too great an increase produces proportional "sound beats" in the video luminance signal. A correction circuit in all CED players cancels these beats by adding an inverse beat [1]. Extensive measurements of the sound-beat signal and the practical performance of correction circuits showed that audio-carrier levels could be safely raised 4 dB at the outer disc radius and 1 dB at the inner disc radius. Stereo substrates are cut with a linear "amplitude taper" that decreases toward the inner radius, and reflects the available increases.

Additional margin has been gained by improving the performance of the basic disc compound, partly as a consequence of manufacturing gains made during the initial year of monophonic production, and partly from formulation changes. The gains made using the above techniques apply to the noise attributed to the carbon in the disc. This noise is conveniently approximated for the audio channel as white noise, band limited by the FM-demodulation systems. It is uncorrelated from channel to channel.

The performance improvements with respect to this noise source were sufficient to unmask another type of noise in the disc, displacement noise. Displacement noise arises when variations in the position of the disc surface with respect to the stylus electrode displace the estimates of zero crossings on the FM carrier. Such displacements can arise from surface roughness of the disc or vibration of the stylus. The underlying mechanisms cause this noise to be correlated in both carriers. When matrixed by the stereo decoder, they reinforce one another in the left channel, and nearly cancel in the right channel.

Control of these noise sources proved extremely difficult. Cancellation of these noise components was potentially possible (the behavior of the right channel providing tangible evidence of this possibility), but fundamentally required adding random noise back into the system along with the cancelling information. Because of this trade-off, it was desirable to reduce the main contributors of such noise below detectable levels. A resonance in the cartridge was damped by a design change, reducing its contribution by about 10 dB at 10 kHz, and disc surfaces were improved by process changes. These improvements successfully lowered the "left-channel" noise back into balance with the "right-channel" noise.

To further improve stereo performance, noise-reduction systems were investigated. After evaluation of several systems, the newly developed CBS CX system was selected over competing alternatives. Although some other systems promised more noise reduction, CX encoding was attractive for several reasons:

It was possible to foresee that the masking of noise by high-level signals could be made adequate on the disc, thus assuring acceptable performance of the CX system.

The CX system had been designed with a primary emphasis on compatible play of unexpanded material. This not only assured reverse compatibility of stereo discs on monaural players, but also solved the problem of presenting adequate dynamic range to stereo inputs, while restricting dynamic range on television r.f. inputs. Only the compressed material is fed out the TV r.f. modulator, while the expanded material drives only the stereo outputs.

The CX system generally reduced

Fig. 2—CX compressor and expander input/output curves.

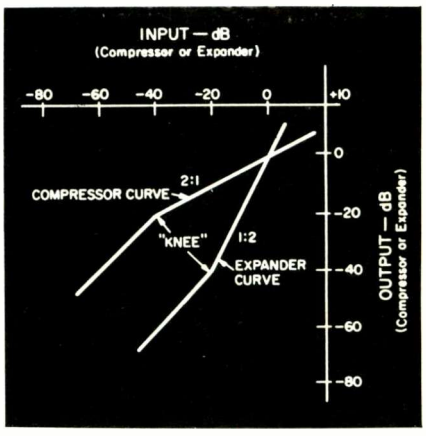
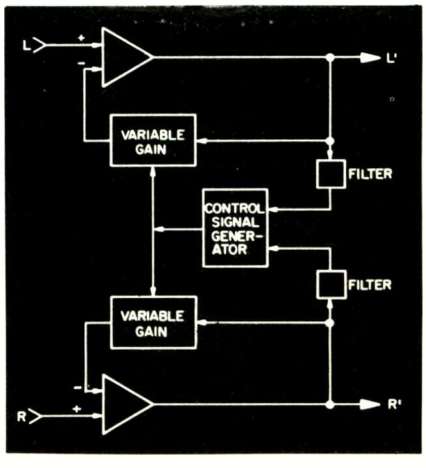


Fig. 3—CX stereo compressor. The CX noise-reduction system contributes to the videodisc's stereo dynamic range.



"Displacement noise from surface roughness or stylus vibration is reinforced in the left channel, and nearly cancelled in the right."

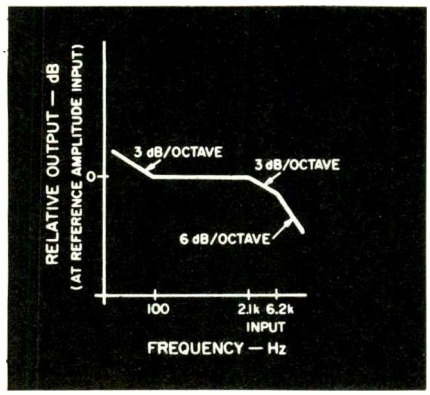


Fig. 4—CX signal compression vs. frequency characteristic (sine-wave input only).

the audibility of "ticks" and "pops"; some other systems exaggerated their effect.

A variety of economical circuit executions with interchangeable component sources are possible with CX.

Only inaudible waveform distortions arose from forcing the CX-encoded signal through an FM system which has a limiter.

A bonus arose from the decision to use the pre-emphasized signal in the CX control loop. Dynamic range in any basic FM system diminishes at a rate of 6 dB per octave beginning at the pre-emphasis break frequency. However, the action of the CX system reduced this to 3 dB per octave for steady-state signals. This characteristic suggested that additional pre-emphasis could be added in mastering, while still maintaining greater than benchmark dynamic range. Empirical work on a variety of program tapes confirmed this effect with complex audio waveforms, and a second breakpoint was added at 6.1 kHz (25 μS). Subsequent de-emphasis in the player contributes significant noise margin to the system (approximately 3 dB, A-weighted S/N).

CX Noise-Reduction System

The CX process provides up to 20 dB of noise reduction by means of a complementary compansion process. Audio signals are compressed by a 2:1 factor (on a dB scale) during the disc-mastering process. During playback, the demodulated audio signals are expanded by a 1:2 factor (Fig. 2).

A simplified block diagram of the CX compression system is shown in Fig. 3. Voltage-controlled amplifiers in the feedback loops of the left and right channels are adjusted by a control signal derived from the left- and right-channel outputs. Unlike other compansion systems (for example, Dolby or dbx), compression takes place with no spectral alteration. This characteristic permits playback of the compressed signal without an expander for compatible reproduction.

Compression occurs at a 2:1 characteristic only for signals greater than −40 dB with respect to a reference. All signals below −40 dB retain a 1:1 characteristic. For the CED system, the reference operating level is defined as ±25 kHz deviation of the FM sum-channel sound carrier, with a 1-kHz sinusoidal modulating signal applied to both left and right inputs in phase.

Audio signals below 100 Hz are attenuated by 6 dB per octave before being applied to the control-signal generator. This prevents gain pumping that can be caused by strong subsonic signals. System pre-emphasis is added to the audio signal before it is applied to the control-signal generator. This improves system headroom (margin from standard signal level to maximum signal level before significant nonlinearity occurs), and noise-reduction characteristics, at high frequencies. The resultant compression-frequency response for single-channel steady-state sinusoidal-input signals is shown in Fig. 4. (Note that this response curve applies only to the effect of the compressor and pre-emphasis on individual sine-wave signals. Response with mixed-frequency signals, such as music, would essentially remain flat.)

Fig. 5—CX encoder control-signal generator.

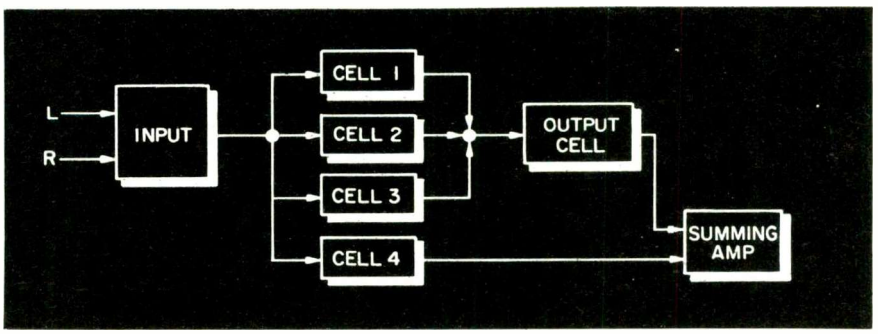
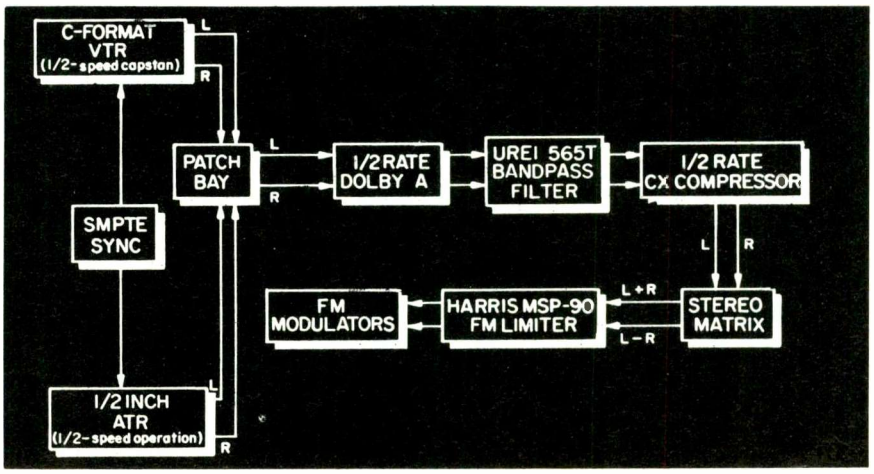


Fig. 6—Audio signal path in the CED stereo mastering system.



"CX noise reduction presents adequate dynamic range to stereo inputs, while restricting it on television r.f. inputs."

The transient response of the control-signal generator is nonlinear and has been designed to minimize audible side effects. A block diagram of the control-signal generator is shown in Fig. 5.

Filtered left and right signals are fed to the input cell where they are passed through ideal full-wave rectifiers to produce absolute-value-level signals. In addition, a minimum signal-level reference is generated. The largest of the level signals or the minimum level reference is rectified and passed through a complex network that generates control responses for rapidly rising, rapidly falling, or slowly changing audio-signal levels. The compressor and expander are the inverse of one another.

The Stereo-Mastering System

The audio portions of videodisc mastering systems have been redesigned to accommodate stereo quality levels. Figure 6 shows the audio block diagram of a videodisc mastering system. Stereo audio programs can be supplied either on tracks 1 and 2 of the one-inch C-format tape or on a separate half-inch audio tape. Because of the limited audio performance of C-format VTRs (wow and flutter, especially at half speed, stereo signal phase tracking, and distortion), half-inch audio tape is the preferred format. Video and audio are synchronized by using the SMPTE time code, recorded on the videotape and on track 4 of the half-inch audio tape.

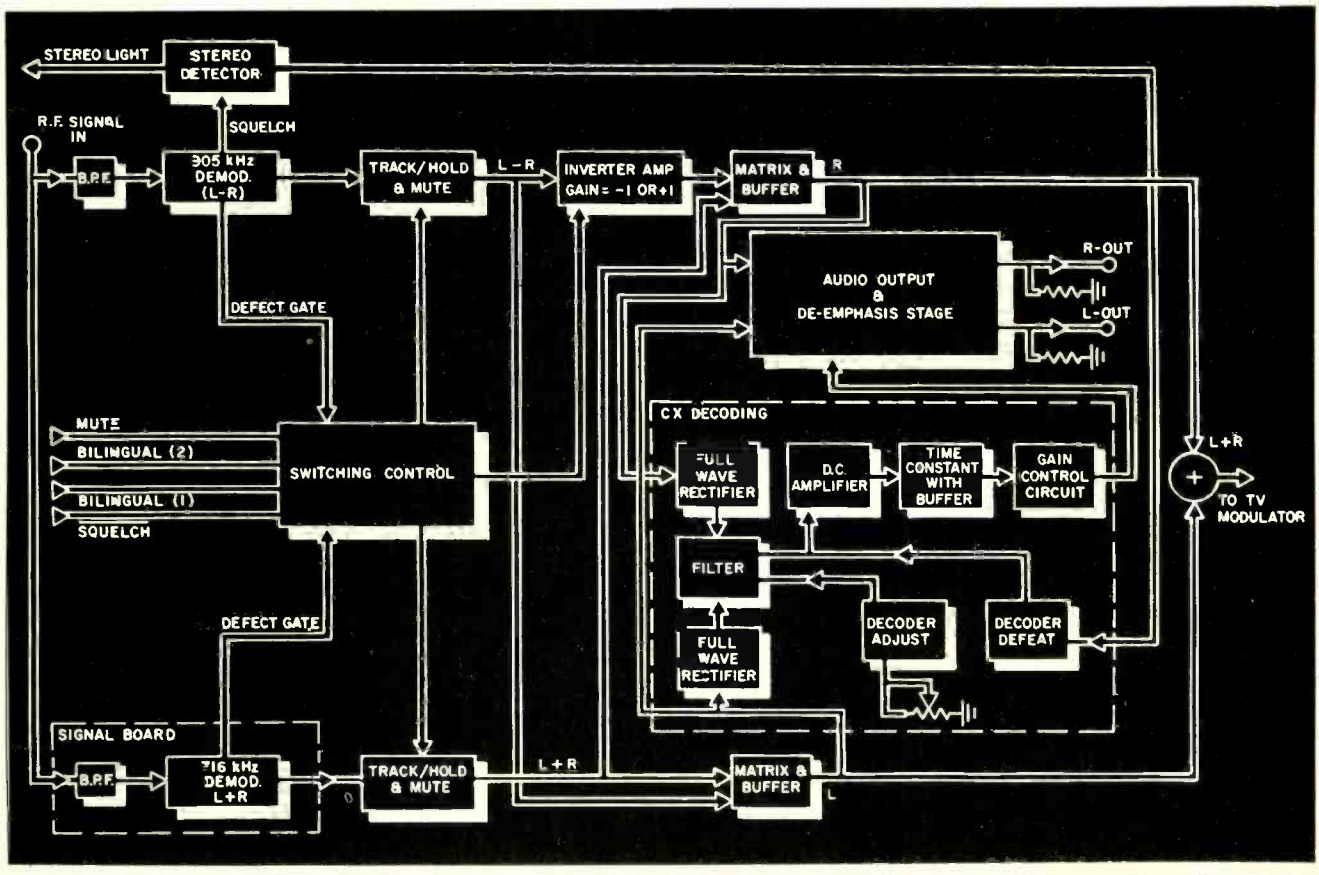
The mastering process takes place at half speed. The appropriate scale-factor modifications have been made to all tape machines, equalization networks, and time constants within the audio-signal path. From the tape machine, the audio signal is fed through a Dolby A decoder. (To ensure the highest possible quality, all stereo-program master tapes are Dolby A-encoded.)

Following the Dolby A is a filter set. The filter can be used to optimize the bandwidth of the audio chain to match the bandwidth of the program material. Many film sound tracks, for example, have a bandwidth of only 8 kHz. By optimizing the audio chain to fit the program, system S/N can be improved by 2 to 3 dB. For high-quality programs with low source noise and wide bandwidth, the filters are set for a 16-kHz bandwidth. The filters can also be used as notch filters to remove single-frequency spurious tones from program sources.

After bandpass filtering, the signal is CX-encoded. The CX encoder used in the signal chain incorporates equalization circuits within the control loop that cause the encoder to compress the audio signal as if it were pre-emphasized. Actual pre-emphasis takes place later in the signal chain.

After CX encoding, the left and right stereo signals are added and subtracted in the stereo matrix to form sum and

Fig. 7—Audio signal section of the RCA SGT 200 stereo CED player.



"Mastering takes place at half speed. For highest quality, all stereo master tapes are Dolby A-encoded."

difference signals. The sum and difference signals are then pre-emphasized and limited to peaks equivalent to 100% (±50 kHz) deviation. Audio program material can have a peak-to-average ratio greater than 10 to 12 dB, which means that some form of signal limiting must be applied to prevent overmodulation. Limiting is applied to the sum and difference signals. This permits a higher average signal level before limiting as compared with conventional left/right limiting.

The limiter is a two-channel unit with the highest input to either channel controlling the limiting action on both channels. This prevents changes in stereo separation when the limit circuits are active. Limiting is by means of gain reduction (rather than clipping) as much as possible, thus avoiding obvious distortion of extreme peaks.

The output of the limiter drives the audio modulators whose output is then summed with the FM-modulated video signal. The composite signal is amplified and used to drive a piezo-electric cutting head that scribes the signal onto a copper substrate [2 to 4].

The CED Stereo Player

The RCA SGT 200 stereo player is similar to the SFT 100 and SGT 100 monaural players in many respects. The video circuitry, control circuitry and playback mechanism are identical on the three players. The only visible differences in the stereo player are the stereo-indicator light on the front, and the bilingual switch and audio/video output jacks on the back.

The main blocks of the complete stereo signal section consist of two demodulators, mute/track-and-hold circuits, and matrix and CX decoder circuits (Fig. 7). The 716-kHz L + R carrier is demodulated by circuitry on the main circuit board. The 905-kHz demodulator and other circuits are located on a stereo-board subassembly. The stereo player uses the same custom-designed phase-locked loop IC used in the SFT 100 player to demodulate the audio and video signals [5]. However, the voltage-controlled oscillator gain has been reduced, and output amplifier gain reduced by a similar amount, to improve the audio S/N. The loop filter has been modified to increase the audio bandwidth.

The 905-kHz demodulator functions the same way as the 716-kHz demodulator with the exception of squelching capability when the carrier is missing. With mono discs (no 905-kHz carrier), the 905-kHz demodulator IC puts a "low" on the squelch line and this function is used to turn off the stereo light and disable the decoder and CX expander. The above three functions are also disabled whenever the bilingual switch is moved from normal position to select either channel 1 or channel 2.

Defect gates within each demodulator are triggered by disruptions in the FM carrier signal which could cause undesired disturbances in the audio output. Such disruptions may sometimes include phase disturbances, amplitude dips or dropouts, and excessive noise.

When triggered, these gates signal the switching control circuit, which in turn triggers a track-and-hold circuit that follows each demodulator's audio output. This T/H circuit then maintains the audio signal level until the defect passes. There is some signal discontinuity when the hold is released, but far less than if the audio signal had dropped to zero or suddenly peaked at the defect.

This technique is very effective in reducing ticks and pops. However, if high frequencies are present in the software, a track-and-hold circuit can degrade the tick-and-pop performance. To avoid this, the track-and-hold circuit has a charging time constant of approximately 98 μS which limits the hold function to frequencies below 1.6 kHz while allowing the circuit to track the signal at frequencies above 1.6 kHz. A C-MOS quad-switch (CD4016) is used for this function. These switches are also used for muting the player or selecting any language by muting one channel at a time.

The left and right signals are recovered by adding (L + R) to (L − R) and (L + R) to −(L − R) respectively. An inverter amplifier is used to invert the gain of the (L − R) signal. When independent audio channel 2 is selected, the gain of this amplifier is changed to +1 to get in-phase signals at each output. Left and right signals from matrix output are also added back to get an (L + R) signal for the TV modulator.

The CX decoder is designed using low-cost, commonly available ICs. Two CA324-type operational amplifiers and one LM13700-type transconductance amplifier are used. The function of the CX decoder is to provide complementary expansion of the previously compressed signal.

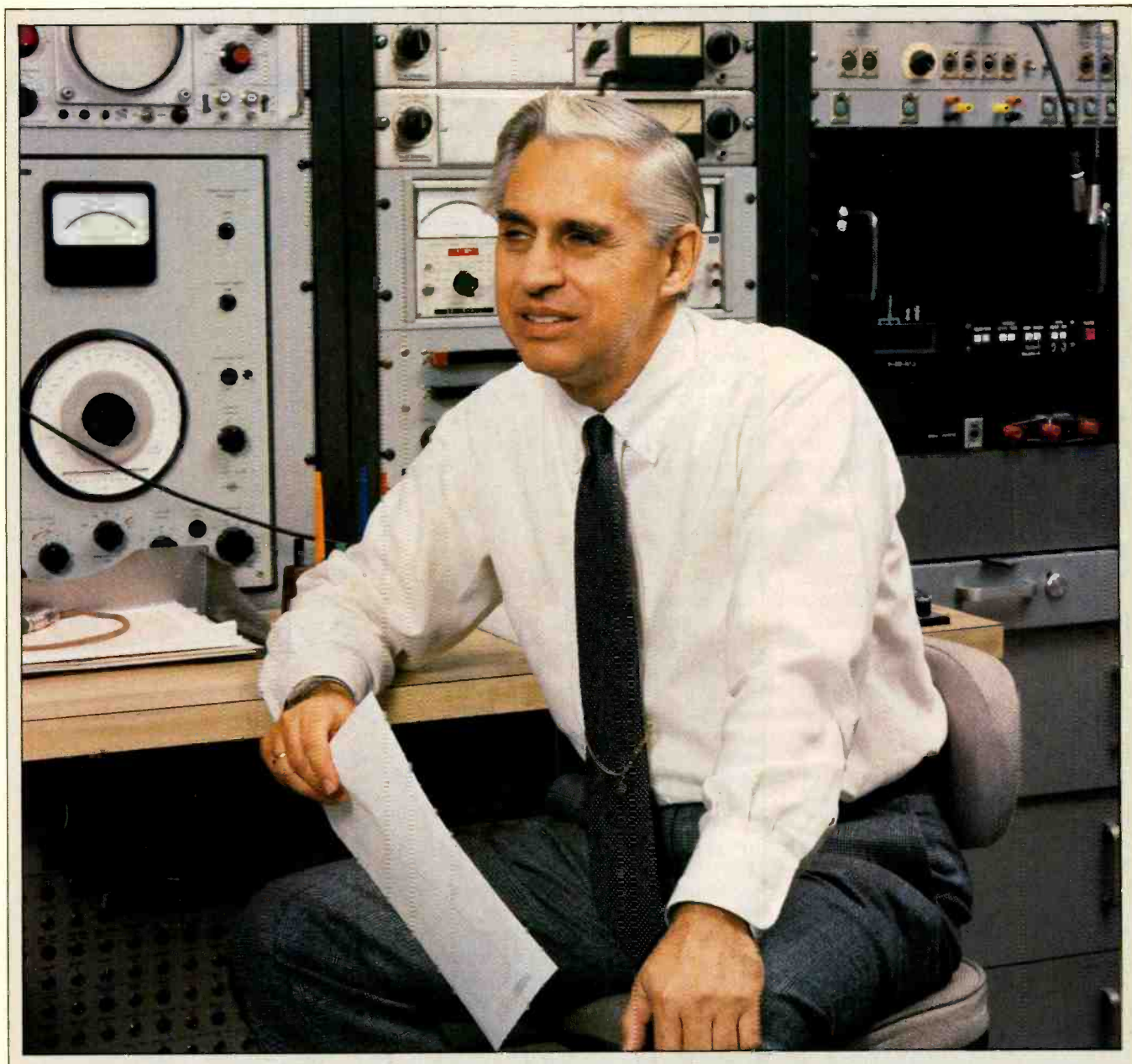
The decoder consists of a full-wave rectifier for each channel and a filter/peak-detector that gives a d.c. output corresponding to the peak signal from both channels. This d.c. is amplified to the right level for proper dead-band operation. This d.c. voltage goes to a time-constant circuit and finally controls the current of the transconductance amplifier, thereby changing its gain. A precision limiter is used to adjust the knee of the −40 dB break point. A single-pole RC network is used at the output of the transconductance amplifier to provide necessary de-emphasis at 25 μS. The L and R expanded signals are then connected to the output jacks through the buffer stage and given an additional de-emphasis of 75 μS.

Acknowledgment

We thank our colleagues at the David Sarnoff Research Center in Princeton, and RCA SelectaVision VideoDisc Operations in Indianapolis, for the opportunity to be their spokesmen.

References

1. Gibson, J. J., F. B. Lang and G. D. Pyles, "Nonlinear Aperture Correction in the RCA VideoDisc Player," *RCA Engineer*, Vol. 26, No. 9, Nov./Dec. 1981.
2. Weisberg, H., "Manufacturing the VideoDiscs: An Overview," *RCA Engineer*, Vol. 27, No. 1, Jan./Feb. 1982.
3. Kell, F. D., G. John and J. Stevens, "VideoDisc Mastering: The Software to Hardware Conversion," *RCA Engineer*, Vol. 27, No. 1, Jan./Feb. 1982.
4. Brandinger, J. J., "The RCA CED VideoDisc System," *RCA Review*, Vol. 42, No. 3.
5. Pyles, G. D. and B. J. Yorkanis, "VideoDisc's Video and Audio Demodulation, Defect Detection, and Squelch Control," *RCA Engineer*, Vol. 26, No. 9, Nov./Dec. 1981.



"The process of designing the V15 Type V was not necessarily so simple. We took the time to develop a simple solution."

DAVID LANDER

JIM KOGEN: The Engineer as President

That Jim Kogen is President of Shure Brothers provides an important key to understanding that company, for many years a leader in the phono cartridge and microphone fields. Kogen is an engineer—not, as one might expect of a chief operating officer, someone who cut his corporate teeth on the fundamentals of marketing, sales or finance. He came to Shure as Chief Engineer 20 years ago, bringing with him more than a decade of experience in application and development engineering. It is perhaps surprising that his only audio experience at that time came from owning "a minor hi-fi system," but, not surprisingly, Kogen's interest in audio grew quickly. His superiors allowed him to indulge other interests and to test his skills in a number of areas. He moved from engineering to manufacturing and production control, then to data processing and finance. After serving a stint as Operations Manager, he was named President in 1981. Kogen's thoughtful manner reflects his engineering background. He is clearly proud of Shure's technical achievements but in no way boastful, totally in keeping with the low profile the company has kept over the years. A smallish, trim man with a handsome head of gray hair, the affable Kogen seemed shy, almost out of place in his large corner office as he greeted guests from Audio, *drew up a chair on the visitors' side of his desk and prepared to answer questions about himself, his company, and the products he has helped bring into the world.*

Why has there been such a marked difference between the so-called list prices and the actual selling prices of phono cartridges, even relatively new high-end units like your V15 Type V?

I don't see any sense to it. We know a product's worth. We are distressed because it demeans the product.

Why the high list prices in the first place? It's often said a cartridge contains very little in the way of materials.

If you take it down to raw material, I suppose that could be the case. The labor in producing a phonograph cartridge, depending on the quality, can be very high. We put a tremendous amount of highly skilled, technical labor into a phonograph cartridge. For example, with the V15 V a very big percentage of what we produce never gets out of the building because it doesn't meet the quality standard. It's a very difficult thing to manufacture.

Why?

Because it's so small, for one thing. For example, most steps in production have to be carried out under a microscope or magnifying glass, such as forming beryllium with the incredible thinness of the stylus shank, putting a hole in it, and putting on a tip.

Did you develop the processes for doing these things?

We developed the process for making the beryllium shank on the V15 V. It took us several years just to learn how.

It seems ironic that we can put a man on the moon, yet to store music we encode it in grooves on a vinyl disc, then make a cumbersome-looking device to spin these discs, attach an arm to that, and hang another strange device from the end of that to follow the wiggles in the grooves. Isn't the technology somewhat primitive?

Well, I think your use of the word "primitive" is wrong, because what we're really doing is seeking perfection. Most developments are exponential. You can achieve 90% of the desired performance fairly quickly. Then to perfect the product takes a lot longer and a lot more effort, and I think that's what we're into with a V15 V. We are looking for perfection, and we're selling to people who want the best quality. You're really asking if the phonograph medium is obsolete. Today it is not. Twenty years from today it may be, but it certainly isn't now.

Where will Shure be if the medium becomes obsolete? Are you taking steps to deal with that possibility?

Yes. We'll be around.

How long did it take you to develop the Type V?

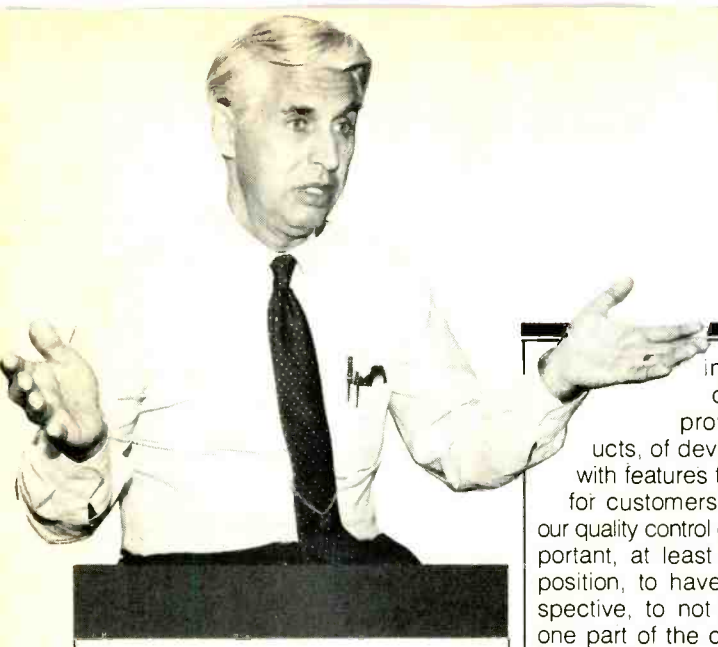
We were working on it about the time we finished the IV. We use the word "develop" in the sense of engineering development, making prototypes, and then in the sense of the manufacturing development, developing the tools and techniques. The two of these combined took four years.

What does the fact that you—an engineer—could become President of Shure tell us about the company?

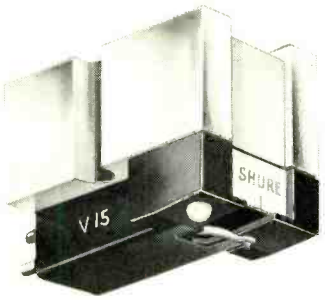
In some companies, I suppose only people in the sales department could be considered for president. Here, I think we were looking for someone who had a good understanding of the total business. We have a very fine sales department. I'm not trying to demean that at all. It's just that apparently, at this point in time, I'm in a position to see that all of the things we want to do are carried out.

Do you think your technical background gives you any particular advantage as chief operating officer?

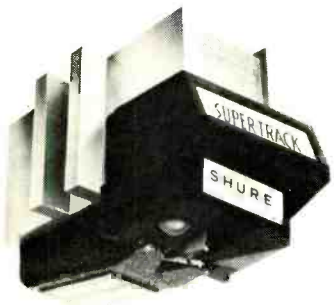
It definitely helps me in terms of mak-



> "Developments are exponential. You achieve 90% performance quickly. Then, perfecting the product takes a lot longer, a lot more effort."



Original V15



V15 Type II

ing certain that we continue our policy of providing quality products, of developing new products with features that are advantageous for customers, of making sure that our quality control continues. I think it's important, at least for somebody in my position, to have a good overall perspective, to not just be interested in one part of the company or the other. I'm not the kind of an engineer that spent all his time in the lab.

What are the most interesting projects you've worked on in your years here?

I found the development of the V very fascinating, but I guess the thing that I find extremely interesting is to look back on where we were 20 years ago, when I started with the company, and how we have progressed in that period of time. I remember one of the first things that I questioned was the frequency response curves we used to run on the CBS test record. We were used to having a big, high-frequency peak at about 14 kHz, and that affected the tracking. Being new with the company and not having been in the business, I was able to ask a lot of dumb questions. And I was fascinated by the fact that we didn't have all the answers.

I think the first big contribution was when we started promoting the concept of trackability. At that time the most popular criteria for cartridges were compliance and frequency response. Of course, all products had high compliance and a response of 20 to 20,000 Hz—and we weren't even tracking the records properly. Today, specifications are much more comprehensive. And then looking back on those days—some of the dreams we had and some of the questions, and being able to say we have answered so many questions and solved so many of the problems.

How close to perfect is the V?

Well, I would never claim perfection, but it's come a long way. The frequency response is as flat as you could get it. The distortion and the things that cause distortion are getting to the point where they're insignificant, and we've paid a lot of attention to the practicalities of life, with the Dynamic Stabilizer and its ability to reduce low-frequency resonance. You're probably going to ask me when we'll have the VI and what it will do, and I don't think I'm prepared to talk about that yet. We're still in the process of digesting the V. We're very proud of the V.

How do you feel about the difference between the audio industry of 20 years ago and the way things are today?

I'm a little disturbed about the trend I see in some areas of taking away features. I understand the desire to standardize and to reduce costs by making common parts, but I don't want to get to the point where hi-fi is like Henry Ford's concept that you can have any color you want as long as it's black. I like to have some adjustments on my hi-fi equipment. Now, I know there is a big segment of the audio market that wants to buy a package, turn it on, put a record on it, and play it. In the old days with packaged sets, that's the way it was. In the last 20 to 25 years, hi-fi has grown. It's a business in which people buy components, put them together, and make their own adjustments. Now we see signs of reversing that approach, where packages are provided all predigested for you with fewer adjustments to make and fewer knobs to turn. That may be good for part of the audio public, but it is not good for the rest of us. For example, I like to be able to adjust the tracking force on a tonearm. Another thing I dislike is the move away from changers. I like the idea of a high-quality record changer. Now that may sound sacrilegious . . . .

But isn't that a contradiction? Record changers require less of your attention, not more.

Well, I want to have my cake and eat it too. I want to have a good tonearm, a good playing system, but there are a lot of times when I have people to dinner and I want to play my hi-fi set and I don't want to get up every 15 minutes to change the record.

Are you also bothered by the fact that a number of one-brand systems have inferior cartridges? Or is this an opportunity for Shure?

Yes, it is an opportunity. I guess I'm bothered by false claims. I'm not making accusations, but any time somebody comes in and says here's a super product and it isn't, it bothers me.

Many of us in the audio industry—not to mention people outside it—have of-

ten been bothered by the difficulty in mounting cartridges, the fact that there's no standardization in terms of mounting procedures or hardware, for instance.

I think if we can standardize, that will be wonderful—provided that we don't slow down development and improvement and progress. I agree with you. We put a whole bagful of screws and nuts in with our cartridges to try to handle that situation.

But have you tried to make the mounting process simpler?

Oh, yes. We put a lot of effort into that. It is something that concerns us very much.

You provide an alignment device with the V15 Type V. What led you to do that?

We felt that if we were providing the top cartridge in the world we ought to make sure it gets mounted properly, and with the help of a little needling from people like [*Audio* Senior Editor] Barney Pisha, we said, yes, that's a good idea and we ought to be certain that everybody who buys the cartridge has the capability of mounting it correctly. So what we've done is supply tools that are really quite simple to use. I was very amused with the invention of our gauge. We assigned the project to Joe Kehl, one of our top design engineers, and asked him to develop a gauge to provide an easy way of mounting the cartridge and adjusting the overhang. He worked on it for a while and later came in and said, "Well, I think I've got a way, but I'm not sure I know why it works." Then Joe sat down with Roger Anderson, who is one of our top men in Development Engineering, and they spent several hours going through the calculations to prove to themselves that it really worked.

Was it a complex thing to design, or is it something so simple nobody ever thought of it before?

The process of design was not necessarily so simple, but in a sense it was analogous to Guy de Maupassant's comment that, "I didn't have time to write a short letter." We took the time to develop a simple solution.

There's a lot more competition in the cartridge field than ever before. What's your response to that?

We're becoming a lot more aggressive, marketing-wise. The market *has* changed. At one time we had half a dozen competitors, and now there are probably 40 in the cartridge field. Incidentally, a significant portion of our business is with microphones and other products.

Just how does your business break down?

We don't discuss percentages, although I don't want to leave the impression that our only product line is phonograph cartridges. We are a major supplier of microphones and circuitry products throughout the world. In the microphone field we do quite a bit in recording and broadcast studios. We have a significant business in mobile microphones. Of course, we sell a lot of microphones to music stores, and through them to professional musicians and vocalists. Sound contractors buy a lot of our microphones. There's a great diversity of applications.

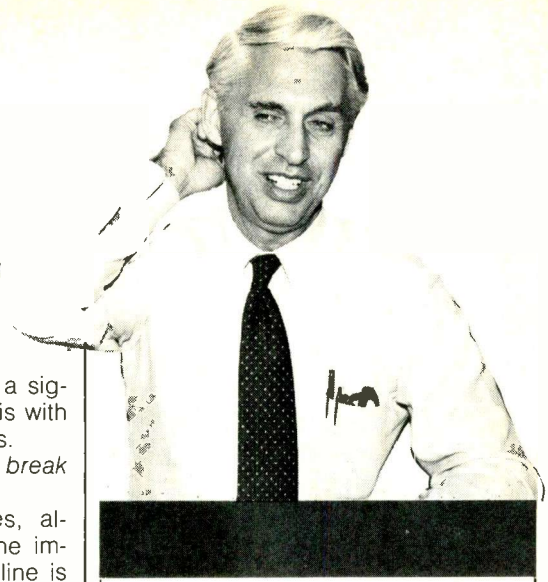
With hi-fi you think primarily of selling a phonograph cartridge to a consumer. In the microphone field, there are so many applications—for example, in sound reinforcement alone there are many subdivisions such as churches, hotels, auditoriums, restaurants, and industrial users. Designing products for those uses requires a great deal of application knowledge as well as design skill.

Is this more of a meat and potatoes business, whereas the phono cartridge business is more exotic, a kind of nouvelle cuisine, *if you will?*

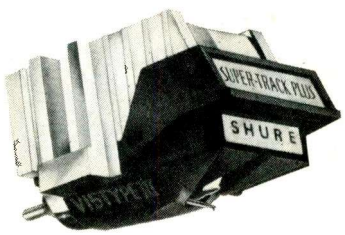
I don't know if I'd use those words. Yes, there are a lot of meat and potatoes aspects to the microphone business. You don't come out with a basic new microphone every year or two. In the phonograph business we have to keep coming out with new products. We brought a V15 V out four years after a V15 IV, but in the interim we brought out dozens of new designs and variations. Some of our best-selling microphones were developed over 20 years ago—and they are still among the best in the market. Why? First, people become accustomed to the microphone and, second, the field isn't changing as rapidly as it is in hi-fi.

Then there's less of a model-year syndrome among professionals than home audio buyers?

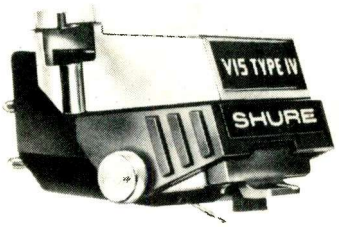
Oh, by all means. There are recording engineers who still use the old RCA



"Joe Kehl developed the V15 Type V's mounting gauge, and said 'I think I've got it, but I'm not sure I know why it works."



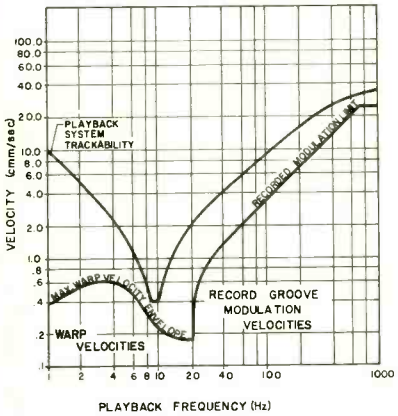
V15 Type III



V15 Type IV

"A cartridge should not change the information on the record. If you think it should be like a musical instrument, that's a different ball game."

V15 Type V



Trackability refers to a cartridge-arm system's ability to handle anything on the disc, even warps.

ribbon microphones. They just like the sound of them. For example, we thought of putting a new microphone cartridge inside our Unidyne II—something more modern which had certain features—and we talked to people and they said, "Absolutely not. If it sounds one bit different, we won't buy it."

In Japan, a lot of amateurs are fond of recording—not off the air or from discs, but with microphones. Why has this never caught on in America? Do you have any insight into that?

No, I really don't. I've thought about it on occasion. I've thought of uses where I might have some fun with recording. For example, I just took a trip to the Southeast and heard all kinds of different accents. It occurred to me it might be fun just to record those different accents, you know. But it's just never become that popular here. It may become much more popular with video recorders.

But will it? I often wonder how many 35-mm SLR cameras or home movie outfits spend the better part of their lives in the closet. I've professed an interest in photography for years, but I never use my SLR or the four lenses I own for anything other than business purposes.

When my children were little, I took a lot of 8-mm movies. Bell & Howell brought out a sound system which used a cassette recorder, and I bought one of those and took about seven or eight pictures and stopped using it. I found that it was great for taking pictures of little kids, because you just wanted to record what they were doing. But when they started growing up, you would say "Now do something"—and they never knew what to do. Then, when you said "Now say something"—they couldn't. That was the only way I ever found to make them stop talking.

I'd like to get back to phono cartridges for a moment and pursue that idea of "primitive technology." Don't you think that further development of the cartridge as we know it is a little like trying to build the perfect stone wheel?

If you want to characterize it like that, that might be true; but if you don't have anything better than stone to make wheels out of, then I guess you make the best stone wheel. For right now, I think we ought to continue improving the phonograph.

What are the chief problems left to be solved?

Certainly noise and record wear are significant problems. That's something we feel rather keenly about, and that's why we try to optimize our cartridges for lower tracking forces.

I don't normally think of a cartridge as producing noise.

But cartridges damage records, and that produces noise. You can track a record at a higher tracking force and achieve efficient tracking capability, but you wear the record faster. We could make a 2-gram tracking force cartridge that would track fantastically well but, of course, that's not the objective. We're trying to get a concept across with our total trackability index—TTI—because, to us, the really difficult job is to make a cartridge that tracks very well at a low tracking force.

Somebody in the business once said that most ½-gram cartridges are actually 1½-gram cartridges. Is this true?

Well, it's not true for Shure Brothers. I'll guarantee that.

A lot of the moving-coil cartridge people recommend 2-gram tracking. Do you suppose part of the moving-coil mystique originates in the fact that a moving-coil pickup might track better and sound better—at least the first 10 times a record is played?

First of all, moving-coil cartridges don't track better than our V or even our IV. So it's not tracking. If people have decided they like a particular kind of frequency response and a moving coil provides it, then they like a moving coil. Our position has been that a phonograph cartridge should translate the information that's in the record into electricity. It should not change that information in any way. It should not add distortion; it shouldn't change the response. If you take the position that a phonograph cartridge should be like a musical instrument and actually change the character of the information that's on the record, then it's a completely different ball game. Now you've got to employ an Antonio Stradivari who knows how to fine-tune the cartridge, and we just don't feel that's the place of a cartridge manufacturer. The point I want to make is that we feel a phonograph cartridge should have no sound. It should be as transparent as a window glass.


Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health.
LIGHTS: 9 mg. "tar", 0.9 mg. nicotine, LIGHTS 100's: 10 mg. "tar", 0.8 mg. nicotine av. per cigarette by FTC method.
You've got what it takes.
Salem Spirit
Share the spirit.
Share the refreshment.
Light, fresh Salem Lights.
MENTHOL FRESH
Salem
LIGHTS
100s
© 1982 R.J. REYNOLDS TOBACCO CO.

WFMT: Satellite Superstation

RICH WARREN and DANIEL QUEEN

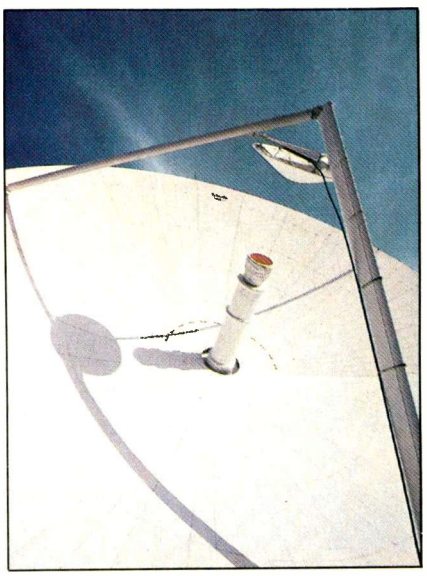
What can you hear in Kodiak, Key West and Chicago that you can't in New York? The answer is WFMT, Chicago, widely considered the nation's best FM station.

The station's nationwide coverage has nothing to do with its transmitter power. It's due, instead, to United Video (UVI), the company that transmits WFMT's signal to more than 126 cable companies, in 36 states, via an RCA Satcom communications satellite. That satellite link made WFMT the country's first radio superstation—except to Chicago listeners, to whom it's been a superstation all the time.

The WFMT Difference

WFMT is in its 31st year of broadcasting a "fine arts" format of classical music supplemented by drama, poetry, discussion (it's the home of Studs Terkel), and folk music. The station records and syndicates programs by the Chicago Symphony Orchestra, the Milwaukee Symphony Orchestra, and Chicago's Lyric Opera; the Lyric's opening nights are broadcast live. WFMT accepts a limited amount of commercial advertising, but refuses prerecorded commercials and jingles, a unique policy in commercial broadcasting. A piece of music is never interrupted except for a news bulletin.

Rich Warren, a staff producer at WFMT, writes the audio column for the monthly magazine Chicago *and a nationally syndicated column on audio. Daniel Queen is acoustical consultant to WFMT and heads Daniel Queen Associates, an acoustical consulting firm in Chicago.*



Photographs: Robert Lewis

Contrary to the expectations of radio pundits, the policy has paid off handsomely in listener loyalty and profitability. The station proudly possesses numerous Armstrong, Peabody and Ohio State programming awards, as well as a number of commendations for technical quality from engineering journals, the popular press and audio equipment manufacturers.

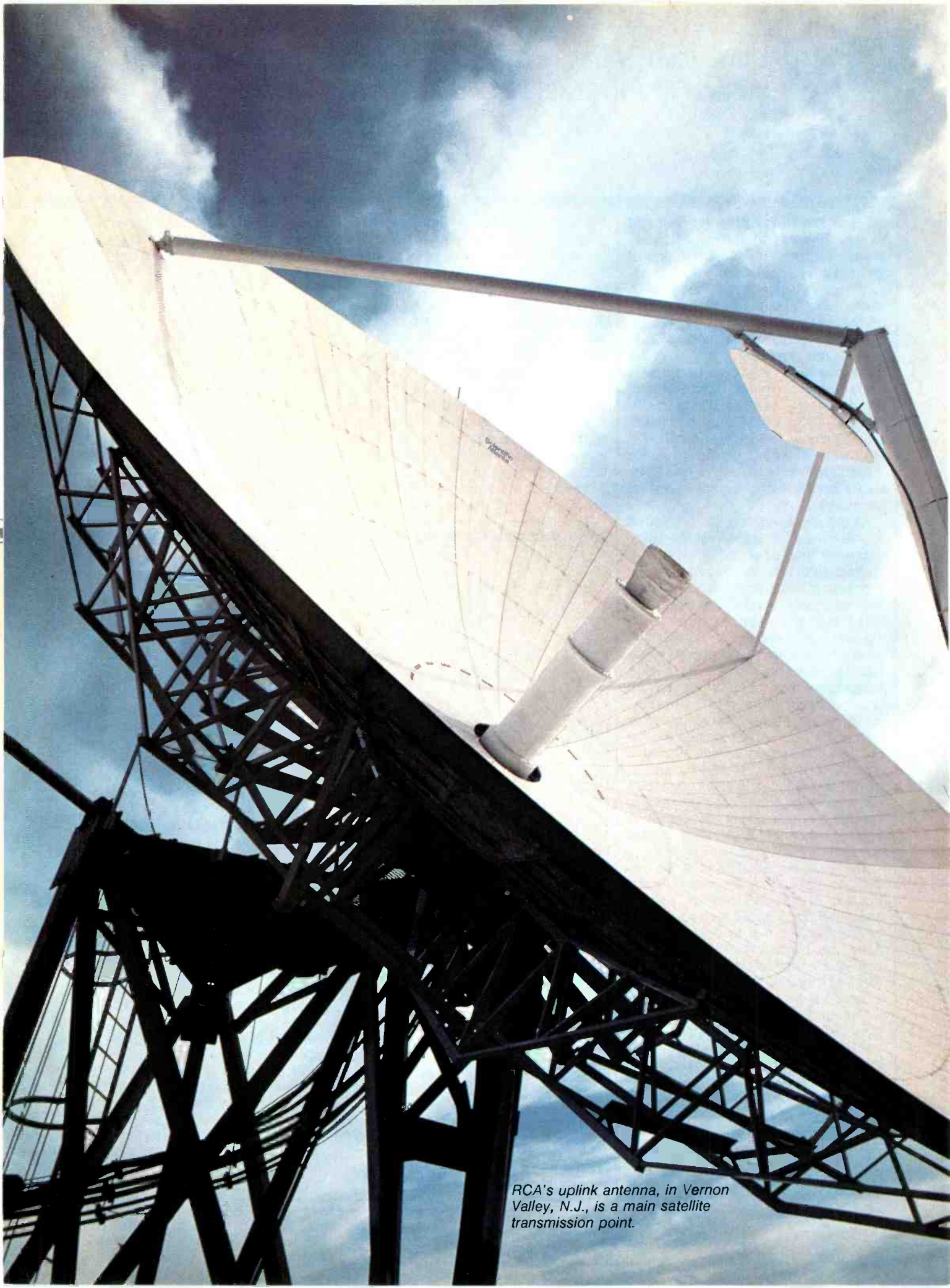
Less obvious than its programming, but equally audible to listeners, is WFMT's unparalleled technical quality. Broadcasting from the John Hancock Center in Chicago, with an antenna height of 1,175 feet, WFMT uses an RCA BTF-20E-1 transmitter and a two-bay, circularly polarized Alford Engineering antenna, for an effective radiated power (ERP) of 15.5 kilowatts. The Harris MS-15 exciter and stereo generator were custom modified and built for WFMT by Harris, guaranteeing a signal-to-noise ratio (referenced to 100% modulation) of better than 82 dB.

Since FCC regulations forbid overmodulation, and conventional limiting is anathema to classical-music lovers, an integral part of the transmitter system is a modulation controller designed and built by WFMT's Chief Engineer, Alfred Antlitz. Dubbed Moduplex I, the device's several detectors continuously analyze the input and apply multiple corrections to it. This "smart" device avoids the audible pitfalls common in broadcast limiters.

"The purpose of the Moduplex I is to avoid overmodulation, with a minimum of side-effects—more difficult with the wide dynamic range of classical music," says Antlitz, "than with other music which has already been processed." Its multiple corrections are applied in a hierarchy, "because these corrections are beneficial in some circumstances but detrimental in others.

"For example, high-frequency transients (such as record clicks) are simply clipped, because that's the least objectionable correction. When the peak lasts too long, or it is too low in frequency to be clipped inaudibly, a peak limiter (which reads the pre-emphasized signal) lowers the system gain at a carefully timed rate, then restores it. The peak limiter and clipper prevent overmodulation, and the peak limiter also keeps the clipping below audibility.

"To keep the peak limiter's action from being heard, Moduplex also has a broadband limiter section. It's deliberately sluggish, to keep its own action



RCA's uplink antenna, in Vernon Valley, N.J., is a main satellite transmission point.

"Programs from what is arguably the country's finest FM station are available in 36 states via satellite."

as inaudible as possible. It also limits to well under 100% modulation, to leave headroom for the dynamics of the musical performance.

"A compressor stage performs a similar function to the broadband limiter, but over an even longer time frame. Both the broadband limiter and compressor are gated by changes in the music's level. If the loud passage is followed by a gradual decrescendo, the limiter and compressor gradually release. If it's followed by a sudden drop to a quiet passage or a pause in the music, these stages don't release immediately but do begin releasing, slowly and at separate times, several seconds later."

All these stages work hierarchically, so that if the a.g.c. section of any stage is greater than or equal to that of the stage before, that previous stage stops processing. Moduplex reads the signal both after pre-emphasis (for peak limiting) and before it (for broadband limiting and compression), so it can compare the emphasized and non-emphasized signals and see how much high frequencies are contributing toward potential overmodulation. If necessary, and only after all the other stages have tackled the job, a final section will roll off these high frequencies, up to a maximum of 6 dB at 15kHz, and in lesser amounts at lower frequencies down to 5 kHz. This is used primarily to reduce the amount of peak limiting needed, since that is the most audible correction which Moduplex applies.

These are not actually separate corrections, applied by separate circuits, but a list of the ways in which a single circuit will apply correction, depending on the signal it has to deal with. Despite the system's intelligence and complexity, Antlitz takes pride in the fact that it's doing nothing to the signal most of the time.

The studios, about a mile from the Hancock Center, are connected to the transmitter by telephone lines having better than 95 dB of signal-to-noise ratio, and minimal phase error between the two channels. The John Hancock building, site of many transmitters besides WFMT's, is in line of sight with the station, bathing it in r.f. interference. The studio/control-room complex has therefore been completely shielded—enclosed in copper shielding, with telephone lines, power wires, plumbing and ventilation ducts electronically filtered to keep stray r.f. from degrading the S/N.

Perhaps the best examples of WFMT's commitment to advanced technology and audiophile sound are the mixing consoles, designed and built by Antlitz. Four of these are used, one in the main on-the-air control room and three in production control rooms. There's provision for up to 23 input modules and three independently assignable stereo-program outputs. Digital logic and control are employed extensively throughout.

These transformerless consoles have summing, push-pull, balanced mixing busses which cancel out the effects of cable capacitance and crosstalk. This allows the use of ribbon cable with mass-terminated connections: " 'Plunk!' and you've made 50 connections in no time flat," says staff engineer Gordon Carter.

Signal switching is done by Siliconics solid-state analog switches, capable of handling signals up to 30 volts peak-to-peak. Analog switches can be interfaced directly to solid-state control logic, with no need for driver circuits. The capacitance of analog switches can cause clicks when switching, but differential circuitry eliminates this common-mode problem.

Extensive use of voltage-controlled

Studio By Design

"In our new studio, the musician must experience the concert hall, yet the microphone pickup must be natural and uncolored. We want a 20-piece orchestra to rehearse fortissimo while the announcer reads the news in the adjacent on-the-air control room. The sound of an announcer's voice must not vary, and the ambience of the monitored sound must not change from room to room. But our announcers must not have a dead room sound. We must be able to conduct interviews of as many as nine persons while barely touching a control, but without background noise or off-mike sound. We will use the main studio for small orchestras, chamber groups, pianists, singers, and folk musicians, even an occasional dramatic production. We use minimal distant miking techniques to pick up the full sound of an instrument, so we cannot tolerate background noise."

Those were WFMT's requirements for its new studios, as articulated by Norman Pellegrini, Jim Unrath and Ray Nordstrand, respectively the station's Program Director, Production Manager and General Manager. But that wasn't all: "We have found a superb location," they added, "suitable for our offices and studios. It's on the eighth floor of a new, 30-story office building—next to Chicago's busy Lake Shore Drive, on air rights over the Illinois Central Gulf Railroad."

To determine the acoustic characteristics demanded by these requirements, Pellegrini measured some typical performance spaces that had been sites of successful broadcast recordings. Not only were the sites available for direct measurement, but the recordings could be analyzed as well. The problem was that, to simulate a desirable space, the sound of a relatively large hall had to be duplicated in a relatively small studio.

Of the many characteristics of a hall, one that can be "transported" is the ratio of early-to-late sound. Using this ratio as a parameter, absorption coefficients can be selected for the small room, based on those measured in the large room. Table I shows a range of absorption coefficients and corresponding early-to-late ratios found in one such large room. By aligning them with the calculations in Table II for a studio-sized room and using the coefficients thus indicated, a similar range of ratios is achieved in the studio. In the same manner, the requirement for consonance of speech and monitor sound in all control and production rooms is

"WFMT records and syndicates the Chicago Symphony, the Milwaukee Symphony and Chicago's Lyric Opera."

amplifiers (VCAs) gives the console low noise and extremely broad control range. "But the main point," says Carter, "is simple and versatile control." The console's faders do not carry audio signal, but merely the d.c. voltage controlling the VCA's gain. This allows control of both stereo channels by one monophonic fader for perfect tracking between channels, allows multiple channels to be linked for control by a single fader, and reduces noise.

Linking is not the only special function available. Custom circuitry between the linear faders and the logarithmic VCAs can reshape the control curve. This can be used for such purposes as pan-potting, with lowered control sensitivity at the center of the range, for smoother panning. The VCA design also switches softly, ramping the audio quickly up and down to eliminate the "clickiness" of instantaneous switching.

As the fader in each signal channel is brought down, it decreases the voltage to the VCA. When that voltage falls below the point where the VCA cuts off, logic circuitry trips the analog switches to remove that channel from the mixing buss, preventing any possible crosstalk and removing unnecessary noise sources from the buss.

These control features, and user-oriented design, make the console easy to use. "One reason we built our own," says Carter, "was human engineering. No commercial console was adequate. We copied ideas from everyone, because no one design had it all."

The console was designed for sonic transparency as well. Its A-weighted noise floor is −103 dBm, and its maximum output is +27 dBm, for an overload-to-noise ratio of 130 dB, with less than 0.0025% total harmonic distortion and no crosstalk.

The broadcast chain preceding the consoles includes Technics SP10 Mk II turntables with Signet XK50 tonearms, Shure V15 Type V cartridges and Apt/Holman preamplifiers. Studer A80R and B67 tape machines equipped with Dolby A are used for all tape recording

Photograph: Jess Broadnax

met by adjusting the absorption in each room to maintain the early-to-late ratio from room to room.

When using such a technique, a necessary assumption is that the sound fields in the rooms are diffuse and uniform. In a good small performance hall, this condition is not far from reality; however, good diffusion in small rooms is more difficult to achieve. Concentrations of standing waves in small rooms cause one resonance in one spot with a different resonance in another. Furthermore, concentrating absorption materials on one room surface, such as the ceiling, causes the sound to flow toward that surface instead of distributing itself evenly.

To reduce the nonuniformity of standing waves at lower frequencies, room proportions must be carefully controlled. A technique frequently employed is the use of nonparallel walls. However, it can be shown mathematically that nonparallel walls shift standing waves only about one-third octave lower in frequency in most cases—seldom justifying the ensuing difficulty in room layout. At

Fig. 1—Each room in WFMT's new studio complex (shown here under construction) is built as a box on its own concrete slab, floating on rubber springs. Note the copper screening surrounding the entire complex.

"The console's A-weighted noise floor is −103 dBm, and its maximum output is +27 dBm, for 130 dB overload-to-noise ratio."

and playback. Standard announce microphones include the AKG D202E and Shure SM81. Apt power amps drive B & W and Celestion monitor speakers, which seem to be the current staff favorites, although KEF, Dahlquist, AR and Infinity speakers have their niches on the premises.

Control Room C, which operates the Music Performance Studio, also uses all Studer machines plus a recent addition, the Sony PCM-F1 digital processor. The nerve center is a Neotek Series III custom-built console, with a Lexicon 224 digital reverberation unit. Neumann, AKG, Schoeps and Shure microphones are used for recording sessions and live broadcasts. The studio itself (see sidebar) is used for live, 90-minute classical concerts on Tuesday nights. Many musicians have also recorded albums here, including folksinger Tom Paxton and Russian-born pianist Dmitry Paperno.

Gordon Carter designed and built advanced, solid-state monitor, intercom, and switching systems. The monitor system uses parallel data address technique, controlling C-MOS analog switches that route signals and control levels between the three studios, three control rooms, three production control rooms, the shop and the equipment room. This monitor system can be controlled from 14 locations, each of which can pick up any of eight stereo sources. It uses 124 balanced stereo cross-points and integrates muting, warning lights and telephone control. Eight-digit displays spell out which sources are being monitored.

The switching system gives any console access to any of eight stereo sources originating in that studio or control room, and 24 stereo sources originating elsewhere at WFMT or coming in as remote signals. The LCD readouts spell out which input is selected. Phase and channel reverse are also provided for. The tape/satellite facility room is hooked into this system, allowing any of its six open-reel and six cassette decks to record from any source in the system.

Table I—Range of absorption coefficients (alpha), reverberation times (T_{60}), and early-to-late ratios observed in a 3,000 cubic-meter recital hall.

Alpha	T_{60}	Ratio (dB)
0.174	1.88	−3.30
0.192	1.69	−2.74
0.211	1.52	−2.17
0.232	1.36	−1.57
0.255	1.22	−0.947
0.281	1.09	−0.294
0.309	0.975	0.395
0.340	0.867	1.13

Table II—Range of absorption coefficients for WFMT main studio to match the early-to-late ratios of the recital hall in Table I.

Alpha	T_{60}	Ratio (dB)
0.0985	1.89	−2.89
0.108	1.71	−2.35
0.119	1.54	−1.80
0.131	1.39	−1.22
0.144	1.26	−0.633
0.159	1.13	−0.0195
0.174	1.02	0.620
0.192	0.918	1.29

WFMT, walls are parallel except where interrupted by beam and column housings and equipment racks.

Standing waves in a rectangular room are governed by a simple equation:

$$f(n_l, n_w, n_h) =$$

$$(c/2)[(n_l/l)^2 + (n_w/w)^2 + (n_h/h)^2]^{1/2}$$

where c = velocity of sound; l, w, and h are the length, width, and height of the room; the "n"s are the mode numbers, the lowest mode number (n = 1) representing the lowest frequency resonance appearing due to that dimension, and higher "n"s representing higher frequency resonances.

To calculate the frequency of a standing wave along one axis of the room, one sets the "n" values for the other two axes to zero. For example, if n_l = 1 and the others are zero, the formula will yield the lowest frequency standing wave along the length of the room. When two terms are non-zero, the formula measures oblique standing waves, parallel to one of the walls but at an angle to the other two. When all three are non-zero, the standing waves are tangential, that is, they are never parallel to any of the walls and bounce about all six walls billiard-ball style. To obtain uniformity, the tangential waves are most desirable, the oblique next, and the axial waves least desirable. Thus, by using this equation, one can adjust room dimensions to give the most even spacing of axial standing waves together with a preference for tangential waves, thereby providing the greatest uniformity in frequency.

Nevertheless, even with the best-proportioned room, there will be a frequency below which there will be no resonances, making the production of sound difficult for most instruments. That frequency will be determined by the longest dimension of the room. In addition, there will be a frequency below which there will only be a few widely spaced resonances, making production of sound between them difficult. That frequency will be determined by the shortest dimension of the room. To provide a room that can be used sufficiently low in frequency for piano and chamber music, the minimum dimension, usually the height, has to be at least 14 feet, in contrast to the 8-foot ceiling usually available in office buildings.

Thus, it was necessary that WFMT find a site in a desirable location where two stories could be acquired for the main studio, with sufficient adjoining space for the three control rooms, three production rooms and two other studios to be properly proportioned and located around it. The site finally selected is located at the junction of two three-level roadways, next to one of Chicago's busiest expressways, along the barge entrance to the Chicago River and the terminus

"The studio is used for live, 90-minute classical concerts on Tuesday nights. Many musicians have also recorded albums here."

The 14-station intercom system, by comparison, looks simple. However, it has such niceties as lights to show who's calling and to show which stations cannot be reached because they're recording, they're on the air, or they're busy.

For remote recordings, WFMT uses a pair of Nagra IV-S portable recorders with Dolby A (now being supplanted by the Sony PCM-F1 digital system) and Studer 169 and 269 portable consoles.

WFMT's attention to audio quality led Sony to work with the station in presenting the world's first broadcast of the Philips/Sony compact digital disc system, on June 8, 1982. The broadcast got a positive response—not just from local listeners, but from one in Portland, Oregon, proclaiming that he could, indeed, hear the difference between analog and digital. That he could hear it was due not only to WFMT's audio quality but to that of the satellite link between the station and the Portland cable system.

The Satellite Connection

This combination of programming and technical excellence created a demand for WFMT outside its local coverage area, from migrating Chicagoans and those familiar with the station by reputation. Prior to 1979, WFMT was being carried on cable systems in Illinois, Indiana, Wisconsin, Michigan, Ohio and Iowa either off the air or by microwave link. With the advent of advanced communications satellites in the late 1970s, there were new horizons. United Video, Incorporated (UVI), created as a common-carrier microwave company in 1965, leased space on RCA's Satcom I in 1978 in order to sell cable systems video programming. UVI selected WGN in Chicago to become one of the nation's three TV superstations (the others being WTBS in Atlanta and KTVU in Oakland). WFMT's uniqueness and proximity to WGN-TV offered UVI an unexpected opportunity to supplement its

Continued on page 87

for the Illinois Central Gulf Railroad. The available 8th and 9th floors of the building are in the direct path of a lobe from the principal commercial television antenna, providing an r.f. level that could peg a VU meter.

The result is that the WFMT studios are built in enclosures which are heavily shielded both from sound and vibration and from electromagnetic radiation up to 2 gigahertz (Fig. 1). The background noise levels achieved by making every room a box floating on its own suspension are better than Noise Criterion Curve 15 (the lowest curve specified according to one common architectural standard), corresponding to levels of about 17 dB SPL, A-weighted.

To achieve sound field uniformity in the individual rooms, a variation of an older technique, scattered absorption, is used. In this technique, various-sized absorption panels are placed on the walls and ceiling of the room. The total number, sizes, and types of panels are determined by the analysis of early-to-late ratios, earlier described. The panels are not randomly scattered, in the conventional fashion. Instead, they are placed by means of a computer-aided analysis which locates the last reflection for a beam of sound as it travels from the source to the receiver. Last reflection points are calculated using all combinations of left-speaker positions to console-operator positions plus right-speaker positions to operator positions. Additional combinations of probable listening positions are also calculated. Because the rooms are used for announcing, reflections are calculated for announcers as sources and microphones as receivers, so all points yield a matrix of locations on all surfaces over which panels are placed (Fig. 2). Thus, the reflected sound that is attenuated is only that which has had room coloration and confusing directional cues added to it.

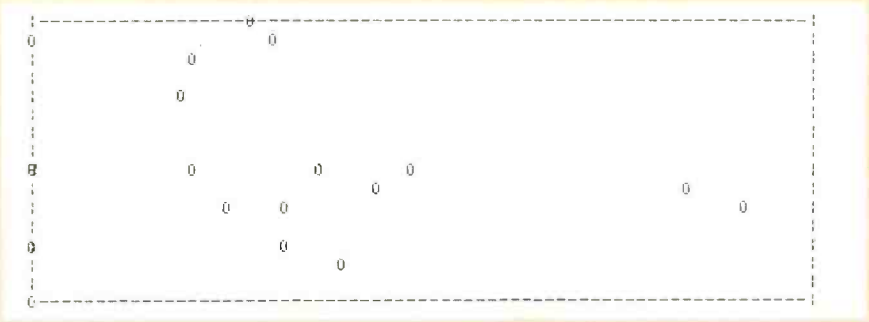


Fig. 2—A plot of final reflection points on a studio wall, for a single source and receiver.

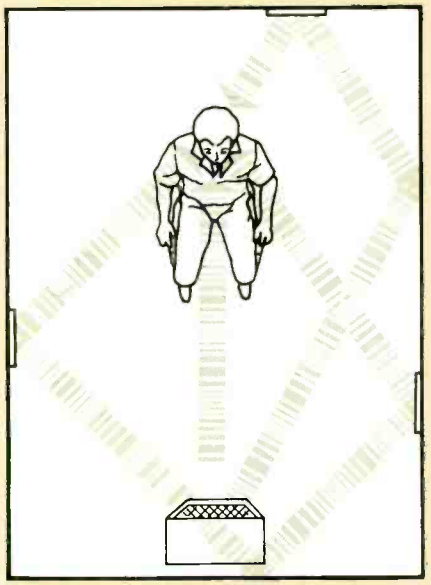


Fig. 3—Absorption panels are placed at the points where sound rays last encounter surfaces before reaching the listener.

In some ways this approach resembles the fashionable technique of using absorption at the loudspeaker end of the room and diffusion at the

Continued on page 87

1

TECHNICS SL-P10 DIGITAL AUDIO DISC PLAYER

Manufacturer's Specifications
Frequency Response: 4 Hz to 20 kHz, ±0.5 dB.
Dynamic Range: More than 90 dB.
S/N Ratio: More than 90 dB.
Channel Separation: More than 90 dB.
Harmonic Distortion: Less than 0.004% at 1 kHz, 0 dB.
Wow and Flutter: Unmeasurable.
Line Output Level: 1.5 volts, maximum (variable).
Output Impedance: 22 ohms.
Required Load Impedance: Greater than 5 kilohms.
Power Consumption: 48 watts.
Dimensions: 17 in. (43 cm) W × 5¼ in. (133 cm) H × 12½ in. (315 cm) D.
Weight: 22 lbs. (10 kg).

Price: Not determined.
Company Address: One Panasonic Way, Secaucus, N.J. 07094.
For literature, circle No. 90

Photograph: Robert Lewis

Now that the compact digital disc player is a commercial reality in Japan (you can buy players and a growing assortment of discs at almost any audio shop in Tokyo), it is only reasonable to expect that we, too, will soon be able to add this component to our audio systems. It's no surprise, therefore, that just about every major manufacturer of audio equipment has come up with his own version of a CD player. Having already discovered that not all CD players are alike (and that they don't perform identically), I am now embarked upon a long-term project of evaluating and testing these incredible machines, one by one, as they become available. This month, it's the Technics SL-P10, which is configured in what can best be described as a cross between the earlier reviewed Sony CDP-101 and Hitachi DA-1000 players.

At first glance, the SL-P10 looks a bit like a front-loading cassette deck. When the power switch at the lower left of the front panel is turned on and the open/close key above it is depressed, a hinged disc-holder swings open, much like the familiar cassette-compartment doors on modern tape decks. Drop a compact digital disc in the slot, and the entire door closes smoothly and silently. Without further action by the operator, the disc begins to spin while the laser pickup quickly scans the disc's surface. A tiny red indicator light moves across a calibrated scale visible through the disc-compartment door, showing the laser pickup's position relative to the radius of the disc. In less time than it takes to describe, the major display area to the right of the disc compartment displays total playing time of the record, the number of separate musical selections contained on the disc, and the approximate playing time of each selection. This information is conveyed in the form of small vertical marker lines, set against a fluorescent time-display calibrated from 0 to 80 minutes, in 5-minute increments. The lower right portion of the display shows the track number being played as well as the time elapsed for that track.

Six light-touch buttons below the display area control the motion of the laser pickup head. These keys are for repeat, backward search, stop/clear, play, forward search, and pause. The forward and backward search keys advance the laser pickup in either direction at two rates of speed. Touch either key lightly, and the pickup moves in the desired direction fairly slowly. Touch the search key with more pressure, and the search speeds up, traversing a one-hour disc in approximately 10 seconds. Music is not heard during the search operation, but the highly informative displays described above keep you posted as to where you are. The repeat button causes a disc to be played from beginning to end, over and over again. Pressing the repeat button a second time releases this command. Pause, play and stop buttons operate much as they do in a cassette deck.

Of the 14 remaining small touch-buttons, 10 are numeric keys for programming selections in any desired order. Of the remaining four keys, one is marked with an asterisk and will cause the laser pickup to return to the start of the current selection or, if pushed twice, to the start of the selection immediately before it. A "Recall" key, when pressed and held, causes sequential display of all selected program numbers. An "Enter" key is used to memorize the desired selection numbers, while a "Clear" key erases programmed instructions. If the program feature is not used and the regular "Play" button is depressed, the unit will play the entire disc, from start to finish. The test disc I used contains 39 individual test bands, but that was not too many for the SL-P10's programming feature, which can handle as many as 63 steps of programmed playing! The rear panel of the player is equipped with a pair of line output jacks and an output level control.

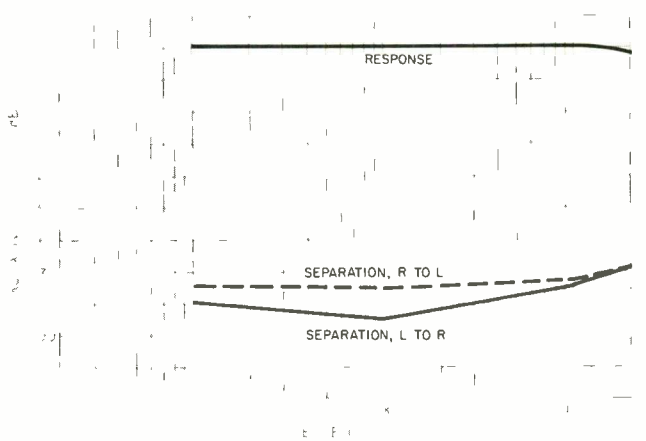


Fig. 1—Frequency response and channel separation.

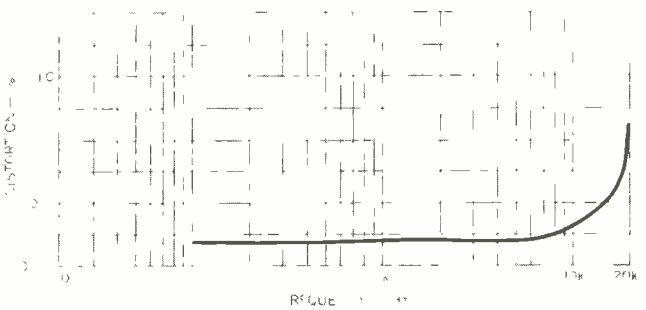


Fig. 2—Distortion vs. frequency.

Measurements

All tests for the Technics SL-P10 were conducted with the same special test disc (Sony YEDS 2) I used for measuring the performance of other CD players. Frequency response was flat within 0.1 dB from 100 Hz (the lowest test frequency provided on the test disc) to above 10 kHz. It was down by 0.2 dB at 16 kHz, 0.5 dB at 18 kHz, and 0.9 dB at 20 kHz. A

"The lowest test band was already in the noise floor. But linearity was *perfect* all the way down to −80 dB!"

plot of response and stereo channel separation is shown in Fig. 1. The slight roll-off exhibited at 20 kHz is certainly not worth criticizing and is probably due to the anti-aliasing filter tolerances in this particular sample.

Separation was excellent, too, though left-channel separation (as measured at the right-channel output) was somewhat better than right-channel separation. For example, at 1 kHz, I measured a separation of 85 dB "left to right" and 75.5 dB "right to left." Since there is no reason for this discrepancy within the digital domain, I suspect that the slight (and certainly negligible) decrease in separation on the "poorer" channel was a function of post-D/A conversion capacitance-leakage effects. This is further confirmed by the fact that separation also decreased at the top audio frequency tested (20 kHz). At that frequency, I still obtained separation figures of 69.5 and 69.0 dB from the left and right channels respectively.

Harmonic distortion versus frequency, at 0 dB (maximum) output level, is plotted in Fig. 2. It ranges from an extremely low 0.004% at mid-frequencies to 0.015% at 18 kHz. At 20 kHz, I noted some nonharmonically related beats appearing at the output of the player. These cause a "THD" reading of 0.24%, though in fact the reading was not truly harmonic distortion.

The test disc offers 1-kHz test tones at varying levels from 0 dB (maximum) all the way down to −90 dB. These are used to check linearity of the system. While I could not get down to the lowest of these test signals (it was already in the noise floor), I was impressed with the fact that linearity was *perfect* (not deviating by even as little as 0.1 dB) all the way down to −80 dB! Would that my loudspeakers were as linear!

Signal-to-noise ratio, A-weighted, measured 96.5 dB. Without the weighting network, S/N measured 86.1 dB be-

DESIGN FEATURES

Technics has developed eight new ICs and four LSIs for digital signal processing in the SL-P10, one of which is an IC for servo control of laser pickup tracking. The player utilizes a semiconductor laser pickup which employs a three-beam tracking system. An expanded operational diagram of the laser optical system is shown in Fig. B1. The optical deck (as Technics calls it) of the SL-P10 consists of the optical head, the spindle motor and a traverse stepping motor. All of these devices are servo-controlled, as shown in the block diagram of Fig. B2. The servo-control circuit of the optical head uses seven bipolar ICs developed for this product. The device identified as AN7675 controls laser power; AN7670 produces the r.f., tracking-error, and focus-error signals from the photo detector built into the optical head. The AN7673 takes care of signal processing, such as amplification and equalization, while AN7671 drives an actuator. The AN7672 handles auto-focus lock-in, and the AN7674 handles what Technics engineers call the "Trickplay" control of the actuator—a term not fully explained in the AES paper they delivered on

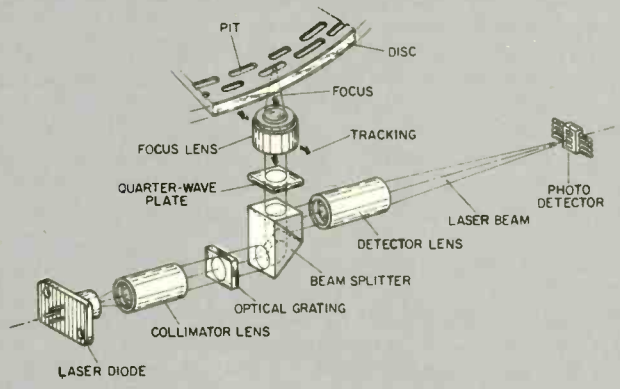


Fig. B1—Optical system used in Technics SL-P10 CD player.

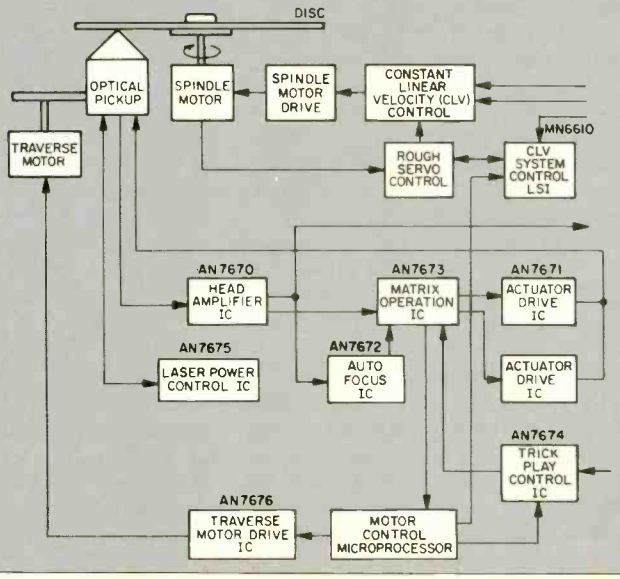


Fig. B2—Block diagram of servo-control systems.

"Voice and orchestral sounds were so utterly clean that we had to look up and confirm that this heavenly music came from loudspeakers."

low the maximum output-level reference of 0 dB. SMPTE IM measured 0.009% at 0 dB output level, increasing to 0.02% at a −10 dB level. The test disc contains a pair of twin tones at 19 and 20 kHz, and this band was used to measure so-called CCIF-IM levels as well as the more complex IHF-IM levels. Results for CCIF IM (the 1-kHz beat produced between these closely spaced test tones) were 0.0021% at 0 dB and 0.003% at −10 dB. Values for IHF IM were not much greater and were therefore impossible to measure using my spectrum analyzer, whose range is limited to 80 dB. (Lowest possible reading would have been 0.01%.)

De-emphasis tests included in the test disc enabled me to verify accuracy of the de-emphasis characteristic built into the SL-P10 player. The precise readings which should be obtained are −0.37, −4.53 and −9.04 dB at test frequencies of 1, 5 and 10 kHz respectively. I measured −0.35, −4.6 and −9.2 dB, which I would say is close enough!

Use and Listening Tests

Along with this player, I was loaned several new Compact Discs. Some of these were produced on behalf of Technics and were supplied as samplers of both popular (mostly recorded by Japanese musical groups) and classical music. Musically, the less said about the pop samplers the better, though, of course, from a dynamic range and noise-free surface point of view they were magnificent. I just can't abide having good jazz classics such as "Take the A Train" corrupted by a Muzak-like rhumba (or was it samba?) beat! The classical sampler, by contrast, offered an excellent variety of musical fare, from the "Allegro (Spring)" of Vivaldi's *Four Seasons* to a Boston Pops medley from *Fiddler on the Roof*. Happily, most of the items on this disc were obviously transcribed from digital master tapes, so no tape noise intruded on the music.

After completing the bench tests on this player, my assistant the subject of this player a few months ago in California.

A block diagram of the player's signal-processing elements is reproduced as Fig. B3. The main functional elements of the signal-processing system are data slicing, clock regeneration, EFM (Eight to Fourteen Modulation) decoding, CIRC error correction, and D/A conversion. A new 16-bit chip for D/A conversion developed for the system (AN6806) is said to have extremely good linearity, thermal stability and high-speed response. Output nonlinearity claimed for the device is less than 0.003% at 0 dB, as shown in Fig. B4.—*L.F.*

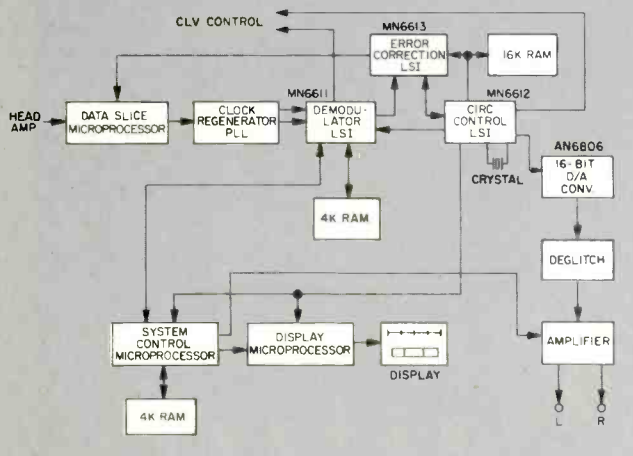


Fig. B3—Block diagram of signal-processing system.

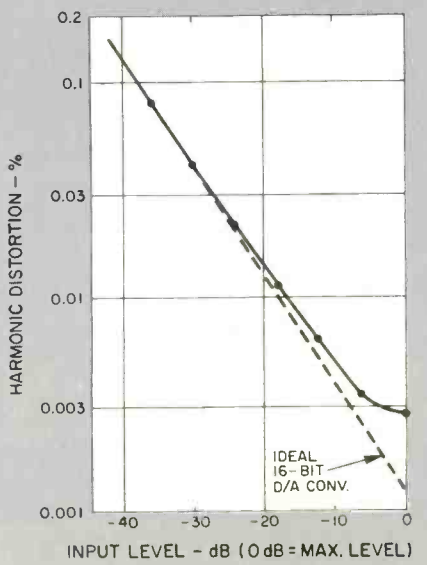


Fig. B4—Linearity performance of D/A converter. Input frequency is 1.05 kHz, and sampling frequency is 44.1 kHz.

"If extra weight and size are what I have to pay for the SL-P10's features, reliability and programming features, I am perfectly willing."

tant and I had another product (analog) to measure. We decided to hook up the SL-P10 via our reference listening system and simply audition the remaining records while we continued working with the analog unit. Among other things, we listened to Mozart's entire *Great Mass in C Minor* on a Deutsche Grammophon release, with the Berlin Philharmonic conducted by Herbert von Karajan. Voices and orchestral sounds were so utterly clean and lifelike that every once in a while we just had to pause, look up, and confirm that this heavenly music was, indeed, pouring forth from a pair of loudspeaker systems. As many times as I've heard this noise-free, wide dynamic-range sound, it's still thrilling to hear new music reproduced this way.

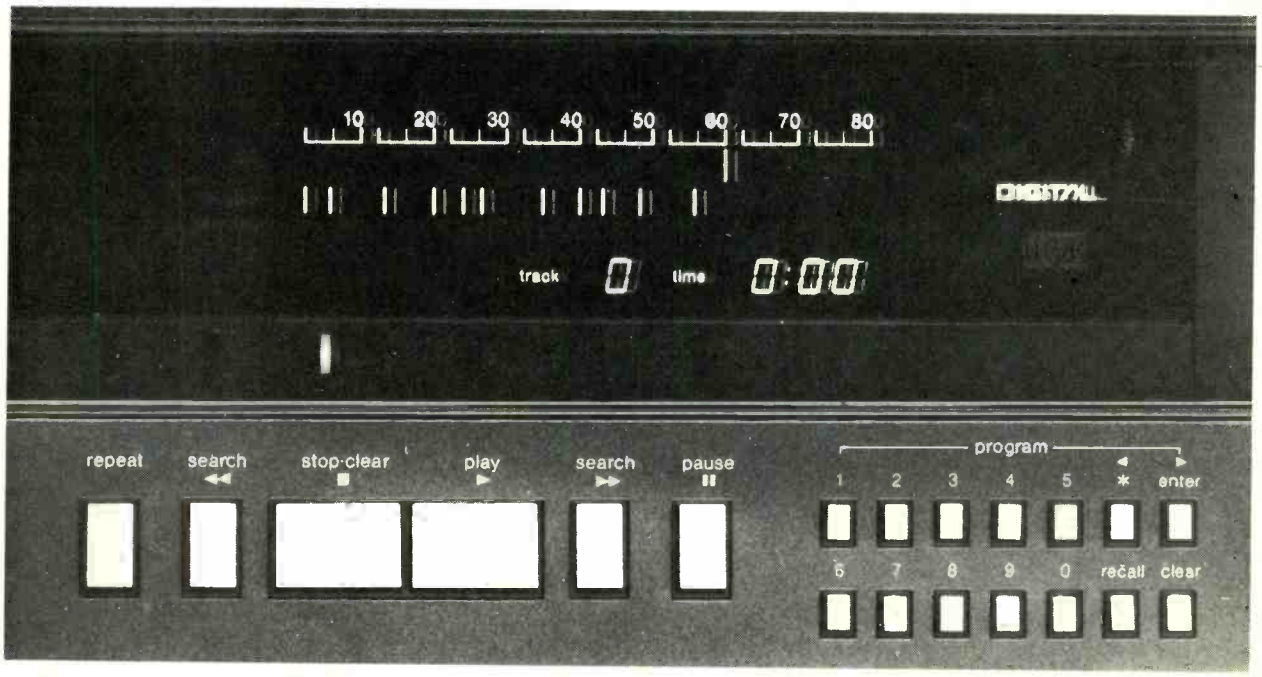
There were also two Denon discs that I hadn't seen or heard before. One consisted of a medley of popular violin solo pieces by such diverse composers as Chausson, Sarasate, Saint-Saëns, Ravel and Beethoven. The soloist was Jean-Jacques Kantorow, playing with the New Japan Philharmonic. The other disc was an old war-horse, Beethoven's Fifth, with Otmar Suitner conducting the Berlin Staatskapelle. It may be of interest to note that both of these discs carried retail prices of 3800 yen which, at current rates, works out to be about $14.00. Not bad for an hour's worth of the cleanest, most inspiring sound you have ever heard in your home. (I recently learned from a U.S.-based executive of Polygram Records that once the CD format is introduced here, his company intends to maintain a $14.00 to $15.00 price for the discs.)

The programming features of the SL-P10 worked flawlessly, though the laser pickup head does seem to take a fair amount of time "finding" the bands it's asked to play. There were a couple of times when we heard momentary interruptions of sound, as the player muted during obviously severe dropouts. These were traced to the discs rather than to the machine, since repeat play of the particular selection caused the same momentary interruption of sound. Until disc production quality improves, if there are going to be such occasional severe dropouts, I would rather have them occur as momentary mutes, the way Technics has arranged their player, than as crashing noise bursts of the type I heard on early PCM tape processors.

Never one to lavish total praise without raising a negative point or two, I am puzzled about one thing: The rather heavy weight and bulky dimensions of the SL-P10. When I was first shown the concept of the CD disc by Sony and Philips (it seems like centuries ago, though I realize that it's only been a couple of years), a big pitch was made for the possibility of having CD players in cars. I'm in no hurry to stuff a CD player into my compact automobile, but if I were of a mind to do so, I can't see getting this 22-pound player behind, in, or under the dash! Considering the number of ICs and LSIs specifically designed for this unit, I would have thought that it could be made a bit more compact.

I suspect it's not the electronics that increases the bulk and weight, but the mechanical elements (motors, servo systems, tracking systems, etc.). If that is indeed the case, and if extra weight and size are the prices I have to pay to achieve the features, reliability and programming capabilities of the Technics SL-P10, I am perfectly willing to make that sacrifice in return for the kind of sound and the level of performance that this magnificent CD player delivered.

Leonard Feldman



...and then came Super Feedforward.

Not many years ago a "high fidelity" amplifier delivered 5 watts with 5% harmonic distortion. Today, distortion levels of 0.05% —or even 0.005%—in amplifiers with hundreds of watts and a much wider frequency range are almost routine.

Reducing harmonic distortion has usually been achieved by using negative feedback. But too much negative feedback can introduce a new kind of distortion, TIM (Transient Intermodulation Distortion) that audibly degrades the musical sound.

To reduce TIM and other forms of residual distortion, Sansui developed its DD/DC (Diamond Differential/Direct Current) drive circuit. Then, to eliminate the remaining vestiges of high-level, high-frequency distortion in the amplifier's output stage, Sansui engineers perfected a unique circuit which, though proposed years ago, has now been realized in a practical amplifier design. Super Feedforward, the new Sansui technique, takes the leftover distortion products present in even an optimally-designed amplifier, feeds them to a separate, error correcting circuit that reverses their polarity, then combines them so they cancel themselves out against the regular audio signal. What's left is only the music, with not a trace of distortion.

While Super Feedforward circuitry puts Sansui's AU-D 11 and AU-D 9 amplifiers in a class by themselves, all our amplifiers are renowned for their musicality, versatility, and respect for human engineering. Add a matching TU tuner to any of Sansui's AU amplifiers and you'll appreciate the difference 35 years of Sansui dedication to sound purity can produce.

For the name of the nearest audio specialist who carries the AU-D 11 and AU-D 9 or other fine components in Sansui's extensive line of high fidelity products, write: Sansui Electronics Corp., 1250 Valley Brook Avenue, Lyndhurst, NJ 07071.

SANSUI ELECTRONICS CORPORATION
Lyndhurst, New Jersey 07071, Gardena, CA 90248
Sansui Electric Co., Ltd., Tokyo, Japan

Sansui

Enter No. 35 on Reader Service Card

2

ONKYO TX-61 TUNER-AMPLIFIER

Manufacturer's Specifications

FM Tuner Section

Usable Sensitivity: Mono, 10.3 dBf; stereo, 17.2 dBf.
Fifty-dB Quieting Sensitivity: Mono, 14.7 dBf; stereo, 37.2 dBf.
S/N: Mono, 75 dB; stereo, 70 dB.
Stereo Separation: 40 dB at 1 kHz; 33 dB from 100 Hz to 10 kHz.
Alternate Channel Selectivity: 70 dB.
Capture Ratio: 1.3 dB.
AM Suppression: 55 dB.
Image Rejection: 80 dB.
I.f. Rejection: 90 dB.
Spurious Rejection: 90 dB.
THD: Mono, 0.12%; stereo, 0.2%.
Frequency Response: 30 Hz to 15 kHz, within 1.5 dB.
Stereo Threshold: 17.2 dBf.
Muting Threshold: 17.2 dBf.

AM Tuner Section

Usable Sensitivity: 30 μV.
Image Rejection: 40 dB.
I.f. Rejection: 30 dB.
S/N: 40 dB.
THD: 0.8%.

Amplifier Section

Power Output: 60 watts per channel, 8 ohms, both channels driven, 20 Hz to 20 kHz.
Rated THD: 0.025%.
SMPTE IM: 0.025%.
Damping Factor: 50 at 8 ohms.
Frequency Response: High level, 20 Hz to 30 kHz, within 1.0 dB; phono, RIAA ±0.5 dB.
Sensitivity for Rated Output: High level, 150 mV; MM phono, 2.5 mV; MC phono, 350 μV.
Phono Overload: 200 mV.
S/N: High level, 80 dB; MM phono, 76 dB.
Tone Control Range: Bass, ±12 dB at 100 Hz; treble, ±10 dB at 10 kHz.
Subsonic Filter: 15-Hz cutoff, 6 dB/octave.
Loudness, −30 dB: +9 dB at 40 Hz, +5 dB at 20 kHz.

General Specifications

Power Requirements: 120 V a.c., 60 Hz.
Dimensions: 19-11/16 in. (500 cm) W × 5-9/16 in. (141 cm) H × 17¾ in. (450 cm) D.
Weight: 28.6 lbs. (13 kg).
Price: $540.00.
Company Address: 200 Williams Dr., Ramsey, N.J. 07446.
For literature, circle No. 91

Onkyo's top-of-the-line TX-61 stereo receiver deserves the alternate description which the company prefers to use, a tuner-amplifier. Indeed, this receiver offers so many control features, both internally and externally, that few separate tuner and amplifier combinations could compete with it on that basis. There is, for example, the built-in CX decoder which allows you to play CX records without having to hook in a separate CX decoder. The CX discs (an invention of the CBS Technology Center and CBS Records) offer as much as 20 dB of signal-to-noise improvement over conventional analog records and noticeably improved dynamic range in reproduced music.

As is true of most recent receivers, the tuner section uses frequency-synthesized tuning and incorporates eight FM and eight AM station presets which can be directly accessed at the push of a button. This receiver has provision for connection of an extra signal-processing system in addition to being able to connect up to two tape decks with tape monitoring facilities. A record selector function permits you to listen to another source while dubbing tapes or recording from phono.

The front panel of the Onkyo TX-61 is so "busy" and crammed with controls, switches and indicators that we'd better get right to its description. At the extreme left are the usual power switch and associated indicator light. Moving across the bottom section of the panel, to the right, are rotary bass, treble and record-selector controls. Tiny windows above each of these controls inform the user as to degree of tone-control compensation and the status of the record selector, using clever, easy-to-understand pictographs in the case of the record selector. Small switches for speaker selection, mode, and cartridge selection are found above the larger tone- and record-selector controls. This receiver not only accommodates both moving-magnet and moving-coil cartridges directly but, recognizing the fact that some recent MC pickups produce output levels that are almost as great as those typically obtained from MM cartridges, provides two switch positions for MC pickups. One has a sensitivity of 350 μV for rated output, while the other reduces the gain of the input until it is nearly the same as for MM cartridges while maintaining a proper, lower loading impedance for MC pickups.

Secondary-function pushbutton switches are located at the top right of the panel, and include switches for such functions as CX noise-reduction (decoder) on/off, preamp-out/main amp in (for extra signal-processing device connection), loudness control on/off, and audio muting. Slightly separated from these switches are a 25/75 μS FM de-emphasis switch (for the few FM stations that are still broadcasting Dolby B) and an FM mute/stereo on/off switch.

Near panel center are five program-source buttons. The tuner button is augmented by an AM/FM button. Indicator lights tell the user what's been selected. Nearby are the eight preset keys and their indicator lights, while still further to the right are a memory key and its indicator (for programming favorite station frequencies), auto- and manual-tuning selector buttons and a rocker-bar manual-tuning switch for up- or down-scale tuning. A balance-control slider is located at the lower right corner of the front panel.

Just above the balance control is a unique, multiple-

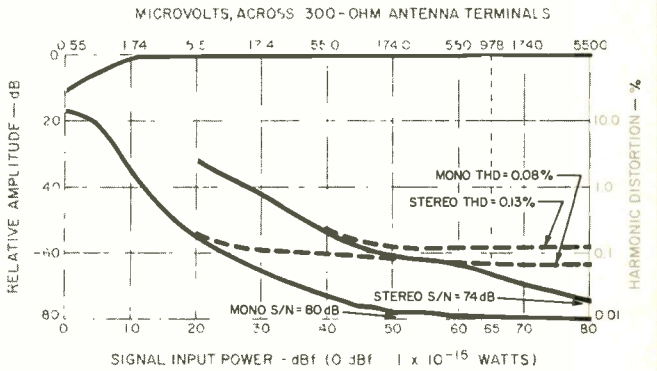


Fig. 1—Mono and stereo quieting and distortion characteristics, FM section.

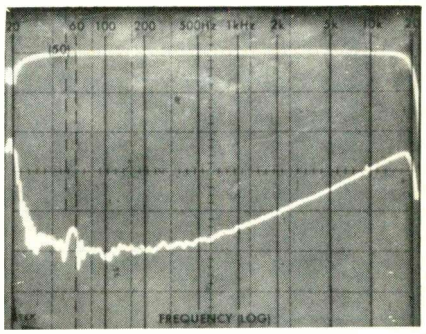


Fig. 2—Frequency response (upper trace) and separation.

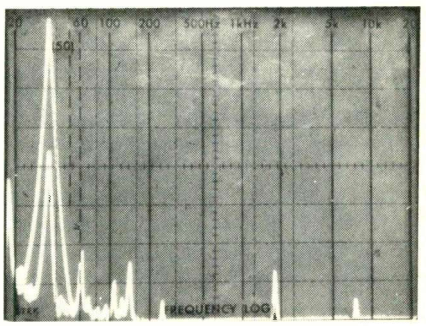


Fig. 3—Separation and crosstalk components at 5 kHz, FM section.

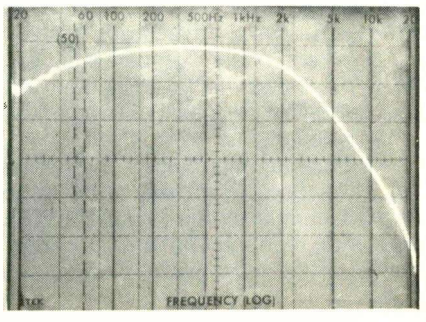


Fig. 4—Frequency response, AM tuner.

"The TX-61 not only accommodates both MM and MC cartridges, but provides two switch positions for MC input sensitivity."

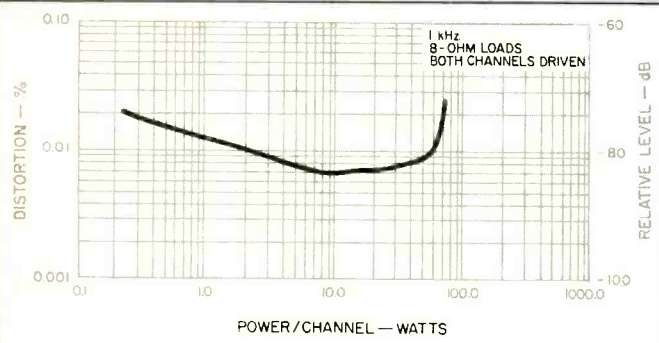


Fig. 5—Power output vs. THD.

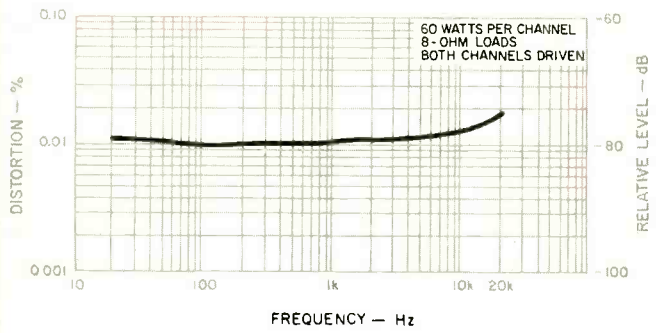


Fig. 6—Amplifier distortion vs. frequency.

function volume control arrangement. A large pad surrounds a fluorescent indicator resembling a vertical thermometer bar. When the upper part of this pad is depressed, sound volume increases slowly, and relative volume is indicated on the thermometer-like indicator. Pressing the bottom section of the pad reverses the process. Pressing a smaller pushbutton, just below the indicator bar, causes volume to fade slowly even when you let go. If nothing further is done, volume will fade to zero. If, however, you touch any portion of the larger pad while this fade is taking place, volume will stabilize wherever it was when you touched the larger pad. Pretty elaborate, I must say. I'm not exactly sure what advantages this complex volume control arrangement offers compared to the good ol' big rotary knob, but it sure was fun to sit there and watch that indicator rise and fall all by itself as I kept adjusting the volume levels up and down!

A signal-strength meter in the form of LEDs arranged in a sort of bar-graph is located at the upper center of the panel, as are the usual stereo indicator LED and the digital station-frequency readout. The familiar phone jack at the upper left corner of the front panel completes this rather elaborate layout.

The rear panel of the Onkyo TX-61 is equipped with the usual array of FM and AM antenna terminals (both 75- and 300-ohm connection points are provided), a ground terminal, CX adjustment controls, an indicator light (used during the adjustment process), and the usual input and output jacks. A rotatable AM loop antenna, rather than the usual bar or loopstick, is provided as well. Two sets of speakers can be connected to the receiver via easy-to-use, color-coded screw terminals. Two a.c. receptacles (one unswitched and one switched) are located just below the speaker terminals.

I was rather surprised to find that there are no auxiliary, high-level inputs on this otherwise thoughtfully designed receiver. If you want to connect any additional high-level program source, such as the stereo audio outputs of a VCR or videodisc player, or even the audio outputs of soon-to-be-available compact digital disc players, you must use one of the two tape-monitor input pairs. But this, of course, rules out the ability to dub from tape deck to tape deck without having to go 'round to the back of the receiver each time and change the cable connections. What it would have taken to avoid this, of course, would be another program source button on the front panel and an extra pair of jacks at the rear.

Circuit boards within the chassis of the TX-61 (I counted a dozen of them, but may have missed a few small ones) are neatly arranged. Although parts density is fairly great, the layout seemed safe and not likely to generate thermal problems, potential shorts or other mishaps which could result in the need for frequent servicing. From the back of the owner's manual I learned that the receiver utilizes six FETs, 56 transistors, 23 ICs and 102 diodes. I've always wondered what possible use the consumer will make of this information, and why some manufacturers publish this data in owner's manuals. Perhaps it's a throwback to the good old days of vacuum tubes, when the number of tubes in a "radio" had some small bearing on the product's quality.

In terms of actual circuit features, there isn't much I can tell you other than the fact that Onkyo uses their Super Servo amplifier circuitry (other companies call it by other names) which, as I recall, is a low overall feedback loop in the power amplifier section plus a parallel higher feedback loop, operative only at subsonic frequencies, for improved bass damping factors and improved d.c. stability. Another feature of the amp section is called "linear switching" which, I suspect, means the avoidance of Class-B or Class-AB switching and notch distortion. Again, we've all seen variations on this theme from a number of companies. I'm certainly not criticizing these circuit refinements, for they all contribute in some small way towards better sound at all listening levels. I simply don't want you to get the idea that Onkyo (or any other receiver manufacturer) has an exclusive on these refinements.

FM Measurements

Usable FM sensitivity in mono measured a satisfactory 11.2 dBf (2.0 μV across 300 ohms). Stereo usable sensitivity was 18 dBf, just slightly above the stereo switching threshold, which is the way good FM stereo tuners should be designed. Fifty-dB quieting required signal levels of only 15

"Total harmonic distortion remained extremely constant at all frequencies, which speaks well for the overall design of this power amplifier section."

dBf in mono; this quieting point was reached with signal inputs of 36 dBf in stereo. With strong signals, quieting approached 80 dB in mono and 74 dB in stereo. Quieting curves and distortion versus signal strength for a 1-kHz modulating signal are shown in the graphs of Fig. 1. Strong-signal THD in mono decreased to a level of 0.08%, well below the claimed 0.12%. In stereo, THD measured 0.13%, also well below the published figure of 0.2%.

Figure 2 is a 'scope photo of a spectrum analysis sweep from 20 Hz to 20 kHz, with the upper trace representing the frequency response at the output of the modulated left channel and the lower trace showing the crosstalk output from the opposite, unmodulated channel. I measured separations of 45.5 dB at 1 kHz, 49 dB at 100 Hz, and just under 30 dB at 10 kHz. (Vertical sensitivity of this, and all other 'scope displays of this type in this report, is 10 dB per division.)

In Fig. 3 I applied a fixed 5-kHz signal to the left-channel input of the FM signal generator at 100% modulation. The tall spike at the left represents the desired output signal. A second sweep was then made, with the analyzer connected to the output of the unmodulated channel. The shorter spike, which appears to be nestled inside the taller one, therefore represents the 5-kHz crosstalk, while other components at higher frequencies represent distortion, subcarrier and other crosstalk products. In this display, the frequency sweep is linear, rather than logarithmic, and extends from d.c. to 50 kHz, at 5 kHz per linear horizontal division.

Capture ratio measured slightly better than the 1.3 dB claimed; alternate-channel selectivity was 73 dB, also somewhat better than the published specs. Spurious and i.f. rejection both met spec at 90 dB, while image rejection was a bit better than claimed, measuring 82 dB. I measured AM suppression at its rated 55 dB. While Onkyo quotes only one harmonic distortion figure for mono and stereo (I presume the figure applies to a 1-kHz modulating signal), IHF tuner measurement standards require that distortion be quoted at three frequencies: 100 Hz, 1 kHz and 6 kHz. At the 100-Hz and 6-kHz test frequencies, I measured harmonic distortion levels of 0.047% and 0.03% in mono and 0.23% and 0.18% in stereo, respectively.

Figure 4 is a plot of frequency response for the AM section of the receiver. As is unfortunately true of so many "high fidelity" stereo receivers, not too much attention has been paid to the AM circuitry, so I didn't bother with it either, after seeing this response curve.

Power Amplifier and Preamplifier Measurements

The power amplifier section of the Onkyo TX-61 receiver delivered 72.6 watts of power per channel at mid-frequencies for its rated distortion of 0.025%. At 20 Hz, 67 watts per channel was available at rated THD. At 20 kHz, the amplifier exceeded its published power ratings of 60 watts per channel by just over 10 watts, delivering 70.8 watts per channel for rated THD. Figure 5 is a graphic plot of distortion versus power output, using 8-ohm loads with a 1-kHz test signal. Figure 6 shows how distortion at rated output varies with frequency. In fact, the total harmonic distortion level remained extremely constant at all test frequencies, which speaks well for the overall design of this power amplifier section. I normally expect to see distortion rising at the frequency extremes in this kind of plot.

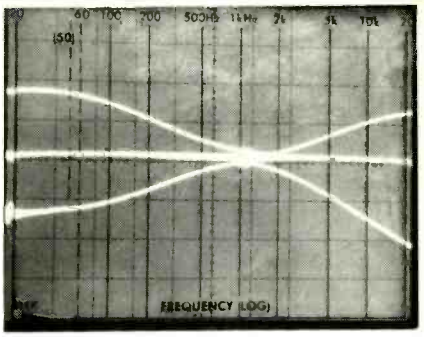


Fig. 7—Tone control boost and cut range.

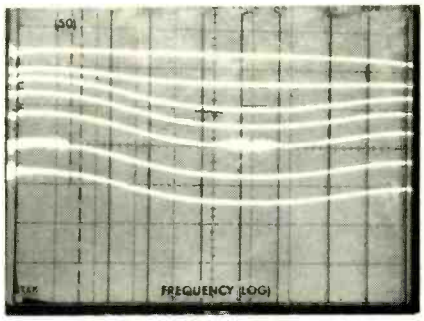


Fig. 8—Loudness compensation characteristics.

Damping factor at 50 Hz measured exactly 50, as claimed. Dynamic headroom was 1.4 dB above continuous rated power output. The SMPTE-IM distortion was a bit poorer than claimed, measuring 0.03% at rated output but quickly decreasing to rated levels of 0.025% or lower when output levels were decreased to 50 watts per channel or lower. Power bandwidth extended from 12 Hz to 35 kHz for rated output at no more than rated THD. The figure for CCIF IM (twin-tone method of measurement) was 0.0073%, while IHF-IM distortion, which also uses twin tones separated by 1 kHz, measured 0.022% at rated output.

Figure 7 is a plot of the maximum boost and cut characteristics of the bass and treble tone controls of the TX-61. Turnover frequency seemed to be set a bit higher than normal, at around 1.3 to 1.5 kHz; this may not suit the tastes of some listeners who prefer the bass and treble turnover point to be set closer to around 500 Hz. Figure 8 is a plot of the loudness compensation characteristics when the loudness switch is activated. Onkyo chose to boost both bass and treble in their loudness circuit, though treble boost is clearly not as great as the bass boost.

"The CX decoder worked well. What we all need are more CX records, but that is neither Onkyo's nor my problem."

Input sensitivities of the high-level and phono inputs, as measured in accordance with the new IHF/EIA standards, will not agree with Onkyo's published sensitivity figures, since the measured results in the lab are referred to 1-watt output while the Onkyo specs are referred to rated output. If you are not handy with log and dB tables, you can simply multiply my results by a factor of 7.75 to see how close this unit came to Onkyo's published sensitivity figures. In any event, I measured a phono-input sensitivity for the MM input of 0.3 mV for 1-watt output. In the high-gain MC mode, sensitivity was 0.04 mV for the same 1-watt output level. High-level inputs (tape 1 or 2) required an input of 20 mV to deliver 1 watt into 8-ohm loads at the output terminals. Phono overload measured 220 mV for the MM phono mode and 37 mV when the switch was thrown to the high-gain MC mode.

In quoting signal-to-noise ratios, Onkyo *did* elect to use the newer measurement approach, so the figures I measured lend themselves to direct comparison with Onkyo's published specifications. I measured a signal-to-noise ratio of 78 dB in MM phono, 68 dB in MC phono, and 83 dB for the high-level inputs. All of these results are better than the published claims.

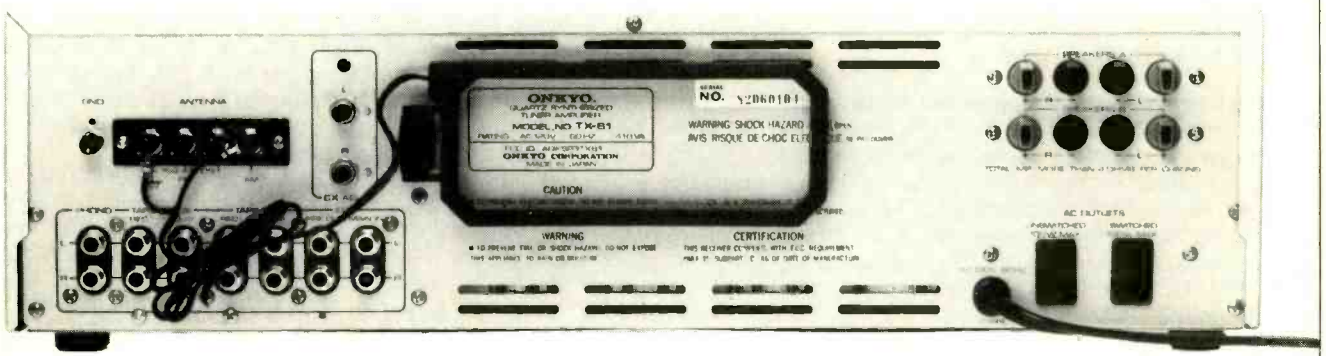
Phono equalization was very accurate from 1 kHz all the way out to 20 kHz, with deviations never exceeding 0.1 dB. At the bass end, however, I noted a slight rising characteristic, so that deviation was a full 1.5 dB from the standard RIAA curve at 30 Hz. I would recommend using the subsonic filter when playing records through the preamp section as a matter of practice. Even if your turntable has great, low rumble specs, warped records can still deliver damaging subsonic signals to your speakers. This being the case, I found that with the subsonic filter activated, RIAA deviation was partially corrected and amounted to no more than an error of 0.5 dB at 30 Hz.

Use and Listening Tests

Once you familiarize yourself with that elaborate front panel (the LED pictographs actually do help), the Onkyo TX-61 proves to be a very "friendly" receiver to use. Tuning of FM and AM stations is easy and extremely accurate. Batteries, to be implanted beneath the surface of the unit (and supplied in the carton so you don't have to rush out and buy them as you do with so many products these days), preserve the memorized preset frequencies even if the set is unplugged or there is a temporary power outage. The tuner section was certainly as sensitive as some of the better, separate FM tuners that have passed through my lab in recent months. On some of the more troublesome signals in my area, I would have wished for a bit higher AM suppression, but a good, properly oriented antenna tied to the receiver should eliminate all but the trickiest multipath and interference problems.

The amp and preamp sections behaved well, both in bench testing and during phono and tape listening tests. For high-level source tests, I used a compact digital disc player, having found that listening to true digital compact discs is a great way to separate sonic software problems from sonic equipment problems. These discs also put amplifiers to a real test with respect to dynamic range and available headroom. The amp section of this receiver did relatively well in these tests though, of course, 60 watts, while adequate for most program source material currently available, cannot be expected to drive low-efficiency speaker systems to the peaks demanded by wide dynamic-range digital discs.

I have always had a high regard for Onkyo's audio products and living with their latest receiver has not altered my opinion. The CX decoder worked as well as any separate CX decoder I have checked and was easy enough to calibrate. Using the standard CX calibration record, the whole process takes only about a minute and requires no test equipment. What we all need, of course, are more CX records to make this feature more worthwhile, but that is neither Onkyo's nor my problem. I would suggest that if this kind of receiver appeals to you, you would do well to spend an hour or so with it at an Onkyo dealer. This is the kind of product that requires some hands-on auditioning and control manipulation. No amount of third-person praise such as mine can give you the required feel for this unit; it's definitely worth checking out if an all-in-one stereo receiver is what you want for your home audio system. *Leonard Feldman*



Soundcraftsmen

MADE IN U.S.A.

...FOR THE EIGHTIES

AMERICA'S FINEST LEADING-EDGE TECHNOLOGY

Knowledgeable Audio Critics always specify separate Power Amps, Preamps and EQ's for the finest sound available...Soundcraftsmen builds, in the finest American Tradition, coordinated separates for a superbly matched stereo system...or, as individual components to upgrade your existing system...

WORLD'S MOST ACCURATE REAL-TIME ANALYZER/EQUALIZERS

Soundcraftsmen's Differential/Comparator® 0.1dB System and Professional Full-Coil Passive Inductor Circuitry make the AE2000 the most accurate, lowest-distortion, quietest Real-Time Analyzer/EQ available. The ultimate in Audio measurement and EQ adjustment for demanding audiophiles and professional applications, combines the DC2215 ($399.00) and AS1000 Analyzer ($549.00) on one compact chassis. Two ScanAlyzer Models, from $499.00.

DIFFERENTIAL/COMPARATOR EQUALIZERS

World's first Graphic Equalizers designed for compatibility with new wide-dynamic-range recordings. Accurate Unity-Gain adjustments to 0.1dB with LED Readout, for maximum headroom. DC2215 has Professional Full-Coil Passive Inductor circuitry, phenomenal 114dB S/N ratio, up to 22dB gain/cut each octave...Four Equalizers, from $249.00.

WORLD'S MOST VERSATILE PREAMPLIFIERS

CX4200 Preamp/EQ on one compact chassis: superb dual-mono phono preamps with −97dB S/N, Moving Coil inputs, adjustable 50 to 800 picofarad capacitance and 100/47K impedance, level controls and CX circuitry. Three tape inputs with cross dubbing, signal processor loop, headphone amplifier and subsonic filter. Equalizer section features Professional Full-Coil Passive Inductor Circuitry and exclusive Differential Comparator® 0.1dB Unity Gain System for maximum headroom, lowest noise and distortion...Three Preamp Models, from $419.00.

REVOLUTIONARY CLASS "H" AND POWER MOSFET AMPLIFIERS

World's first "signal-tracking" power supply with Auto-Buffer® for continuous 2-ohm operation. No current limiting, for the ultimate in sonic purity. Calibrated dual 20-LED power displays, True Clipping LED's. 250 watts at 8 ohms, 375 watts at 4 ohms. Our smaller 125-watt amp has outstanding dynamic headroom, up to 544 watts per channel at 2 ohms, for new wide-dynamic range records...Eight Amplifiers, from $549.00.

DIGITAL QUARTZ AM-FM STEREO TUNER

14-Station Micro-Processor Memory with long-term retention, 3-way scanning (scan-hold, manual scan, auto-scan), 5-digit readout, variable output level controls, multi-path meter, signal-strength meter. Excellent performance and versatile features make the T6001 an outstanding value at $469.00.

Amplifier power ratings: 20Hz–20KHz, less than .09% THD

Enter No. 30 on Reader Service Card

Write For Free 16-Page Color Brochure Featuring "WHYS and HOWS of EQUALIZATION"

Includes **TEST REPORTS**, complete specifications, Class "H" amplifier **ENGINEERING REPORT, EQ COMPARISON CHART**, and the **"WHY'S & HOWS"** of equalization—an easy-to-understand explanation of the relationship of acoustics to your environment. Also contains many unique **IDEAS** on "How the Soundcraftsmen Equalizer can measurably enhance your listening pleasures." How typical room problems can be eliminated by Equalization," and a **10-POINT "DO IT YOURSELF" EQ** evaluation checklist so you can **FIND OUT FOR YOURSELF WHAT EQ CAN DO FOR YOU!**

FREE! $19.95 EQ-EVALUATION KIT, includes 1-12" LP Frequency Spectrum Analysis Test Record, 2-sets of Compotone Charts, 1-Connector Cable for comparison test, 1-Instruction folder...**JUST CIRCLE READER SERVICE CARD #30, and we'll send you SPECIAL OFFER DETAILS.**

SOUNDCRAFTSMEN, INC., 2200 S. Ritchey, Santa Ana, CA 92705

TELARC OMNIDISC TEST RECORD

Disc Data: Telarc DG-10073/74, two discs, $29.95.
Company Address: c/o Audio-Technica, 1221 Commerce Dr., Stow, Ohio 44224.
For literature, circle No. 92

"As is usual for Telarc, the pressings are spotless, and there is nary a bit of groove echo on the vocal announcements."

Under the name *OmniDisc*, Telarc has produced one of the most useful consumer test records I have ever had the privilege of reviewing. The two-record set is well packaged, and the enclosed notes are detailed and informative. Let's take it side by side.

Side one does not play. It has engraved on its surface a graduated radial line useful for determining tonearm and cartridge alignment. It works with either pivoted or straight-line tonearms. There are strobe bands on the label for determining turntable speed. I was able, with this side, to put the finishing touches on my own straight-line tracking system.

Side two contains the more usual types of signals—but what a useful array! There are pink-noise signals for determining channel assignment and polarity. Panned noise signals let you hear how clearly, or ambiguously, your system images across the stereo stage. An absolute polarity test lets you check whether or not the entire system is poled according to convention. (A mono signal on the disc moving out from the center should result in both woofer cones moving out into the room.) Low-frequency swept signals help identify tonearm resonances.

An especially useful, mixed-frequency signal in the range of 1 kHz increases in level up to quite high velocities and helps both to determine the maximum tracking ability of a cartridge, and to identify anti-skating alignment problems. This particular signal devastated every phono cartridge in the house except one: The Pioneer PC-1000-II, a superlative Japanese moving-magnet model not sold here. Nonetheless, I would question whether or not this band actually reaches its indicated velocity of 46 cm/S.

The side ends with a series of ⅓-octave noise bands starting at 20 kHz and working on down to 20 Hz. These should be played in mono for best tracking with any cartridge. Although the signals are recorded about 14 dB below RIAA reference level, at extremely high frequencies, tracing distortion is inevitable. Mono playback cleans it up nicely. These signals are useful for overall system equalization when used with a ⅓-octave equalizer and a sound level meter.

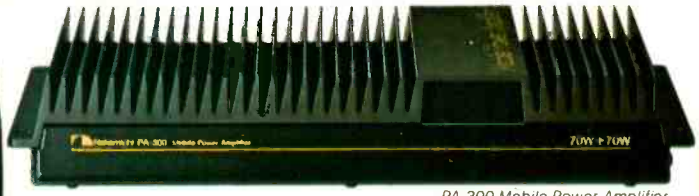
Side three presents a set of musical tracking tests. Five difficult sections from previous Telarc releases are presented four times each, with a level increase of 2 dB each time. Thus, the last sample of each set will be 6 dB higher in level than the first. In just about every case, the last two examples represent levels that would rarely be encountered—even on a Telarc disc! These useful sets of excerpts allow you to test your cartridge to its limit. Levels on this side peak out on a VU meter anywhere from +3 to +10 relative to RIAA reference level. Normal stereo disc product will have VU peaks not much in excess of +3.

Side four presents a voice-at-a-time version of the fugue from Benjamin Britten's *Young Person's Guide to the Orchestra*, followed by the complete fugue. Next on this side is a zany version of the old "Good Vibrations," which The Beach Boys made famous back in the '60s. It's done pretty much in Beach Boys style—until all hell breaks loose about halfway through. A low-frequency, synthesized signal, about +10 dB in level, comes barreling through just when the voices have all but faded out. This will really wipe out a system that hasn't got the electrical or acoustical headroom to handle it. You might think of it as this year's answer to the "1812 Overture."

As is usual for Telarc, the pressings are spotless, and there is nary a bit of groove echo on the vocal announcements.

Most of the technical credit for this set goes to Richard Donaldson, the engineer who has designed so much of the disc transfer system at IAM in Irvine, Cal., where Telarc cuts its master discs. But really, we should give credit to anyone who was connected with the venture at all. *John M. Eargle*

N a k a m i c h i



PA-300 Mobile Power Amplifier

TD-1200
Mobile Tuner
Cassette Deck

SP-400 3-Way Mobile Speaker System

The Wait Is Over.

- *20–22,000 Hz ±3 dB[1]*
- *±0.045% WRMS Wow & Flutter*
- *70 dB S/N with Dolby* C NR*
- *70 Watts per Channel[2]*
- *Less than 0.003% THD[3]*

Finally, an audio system for your car that will do justice to your best cassettes—the Nakamichi Mobile Sound System. It's here now, and it delivers performance well worth the wait.

Investment Protection: Engraved on your key is a unique personal code which "unlocks" the system and brings it to life. Without the code, your TD-1200 is absolutely inoperable and of no use or value to anyone.

The incredible TD-1200 Mobile Tuner/Cassette Deck is DIN-sized to fit virtually any dashboard. Its precision transport glides out to meet your hand and handles your tapes with characteristic Nakamichi gentleness, smoothness, and steadiness. Of course, the TD-1200 incorporates legendary Nakamichi head technology, EQ selection, and both Dolby B and C noise reduction.

But the pièce de résistance is NAAC—Nakamichi Auto Azimuth Correction—a remarkably clever servo system which automatically aligns the play head using only the audio signal already on the tape. The result: optimum response in both tape directions regardless of any cassette housing asymmetry.

You can also listen to the air waves in style with the TD-1200's superb AM/FM quartz-PLL synthesizer tuner. It has 10 station presets (5 AM, 5 FM), manual and seek tuning modes, programmable Dolby FM, and special circuitry to minimize interference of all kinds.

Because the chain of sound should have no weak links, the Nakamichi PA-300 Mobile Power Amplifier has generous power reserves and the lowest distortion among automotive amplifiers. Similarly, the SP-400 3-Way Mobile Speaker System uses a die-cast frame, precision drivers, and a sophisticated crossover network. It reproduces a broad frequency range with uniformity, clarity, and power handling not possible with simpler designs.

The system you've been waiting for is now waiting for you at your nearest Nakamichi Mobile Sound System dealer. Take some of your favorite cassettes with you, and ask him for a demonstration. Or write for more information: 1101 Colorado Avenue, Santa Monica, CA 90401.

*TM Dolby Laboratories Licensing Corp. [1]play response with Nakamichi test tape Available in February [2]at 4 ohms, both channels driven [3]at 1 kHz, 10 watts

Nakamichi

Enter No. 25 on Reader Service Card

4

DENON DRA-400 AM/FM RECEIVER

Manufacturer's Specifications

FM Tuner Section

Usable Mono Sensitivity: 10.3 dBf.
S/N Ratio: Mono, 75 dB; stereo, 72 dB.
THD at 1 kHz: Mono, 0.1%; stereo, 0.2%.
Capture Ratio: 1.2 dB.
Image Rejection: 45 dB.
AM Suppression: 60 dB.
Stereo Separation, 1 kHz: 50 dB.
Frequency Response: 10 Hz to 15 kHz, +0.2, −1.5 dB.

AM Tuner Section

Usable Sensitivity: 15 dBμ.
S/N Ratio: 55 dB.

Amplifier Section

Power Output: 40 watts per channel, 8 ohms, 20 Hz to 20 kHz (50 watts, 1 kHz, 4 ohms).
THD: 0.02%, 8 ohms.
Damping Factor: 80, 1 kHz, 8 ohms.
Input Sensitivity: MM phono, 2.5 mV; MC phono, 0.25 mV; high level, 150 mV.
Maximum Phono Input Level: MM phono, 200 mV; MC phono, 20 mV.
Frequency Response: Phono, RIAA ±0.5 dB; high level, 20 Hz to 20 kHz, ±0.5 dB.
S/N Ratio: MM phono, 80 dB; MC phono, 62 dB; high level, 96 dB.
Tone Control Range: ±10 dB at 50 Hz and 10 kHz.
Subsonic Filter Cutoff: 18 Hz, 6 dB per octave.

General Specifications

Power Consumption: 130 watts.
Dimensions: 17.1 in. (43.4 cm) W × 4.4 in. (11.2 cm) H × 16.1 in. (40.8 cm) D.
Weight: 19.8 lbs. (9.0 kg).
Price: $399.95.
Company Address: 61 Law Dr., Fairfield, N.J. 07006.
For literature, circle No. 93

As so often happens with advances in audio technology, new features are first incorporated in top-of-the-line separate components which are beyond the reach of all but the most affluent of audio enthusiasts. Later on, these features filter down to high-powered, high-priced all-in-one receivers, where a larger audience is potentially available. Finally, they are incorporated into relatively low-cost, medium-powered receivers that just about anyone interested in good sound can afford. The Denon DRA-400 is a good example of a receiver which has benefited from technology first found in higher priced units.

This receiver employs crystal-controlled, frequency-synthesized tuning for accuracy and has a five-station preset capability with battery-operated memory backup. Not only does the phono preamplifier section incorporate *both* moving-magnet and moving-coil inputs (the latter at an input impedance of 100 ohms), but the phono preamp-equalizer section has a direct-coupled input. The power amplifier section employs a nonswitching biasing circuit for the elimination of so-called switching and notch distortion at the output stages. These refinements would have been found only on more expensive components just a few years ago.

The front panel of the Denon DRA-400 is neatly divided into highly functional upper and lower sections. The upper section contains the power on/off switch, a numeric display of station frequency, a stereo indicator light, a signal-strength LED indicator, up and down tuning buttons, the five preset buttons and their "memory" switch, program selector pushbuttons, and a large, rotary master-volume control. The signal-strength indicator takes the form of a "go-no-go" indicator, rather than a signal-strength meter: It lights when the incoming signal strength is deemed "adequate" and does not light when weaker signals are received—an interesting approach but not very useful.

Controls in the lower section are normally covered by a swing-down hinged door, since they are used less frequently than those just described. Behind the door panel are a stereo headphone jack; a pair of speaker selector buttons; bass, treble and balance controls; a three-position monitor/copy switch; a subsonic filter switch; a stereo/mono switch (associated with FM reception); an MM/MC phono switch, and a loudness on/off switch.

The rear panel of the DRA-400 is equipped with the usual 75- and 300-ohm FM antenna terminals, phono and high-level input terminals, two pairs of tape in/out jacks, two pairs of color-coded speaker connection terminals, a chassis ground terminal, and a pair of a.c. convenience outlets (one switched, one unswitched). Instead of the usual AM loopstick antenna, a more elaborate, true AM loop antenna is packed with the receiver as a separate item; its *two* leads must be connected to the appropriate AM and ground terminals on the back of the set. The pivotable loop antenna is best snapped into an antenna holder during receiver installation so the antenna can still be rotated for best AM reception. Since this loop antenna forms part of the input-stage tuned circuit, the owner's manual suggests that even if an outdoor AM antenna is used (because of inadequate signal strength), the loop antenna's leads should remain connected to their appropriate terminals, in parallel with the outdoor antenna leads.

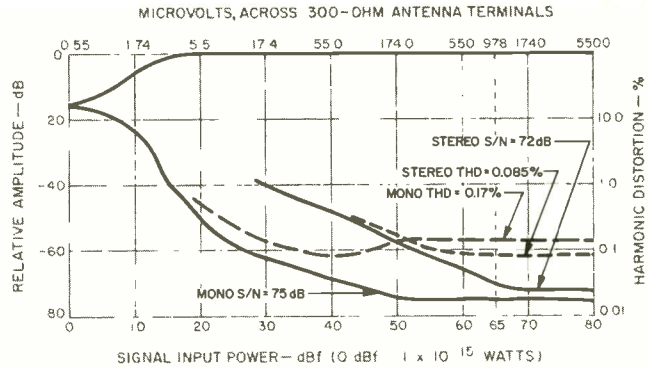


Fig. 1—FM quieting and distortion, mono and stereo.

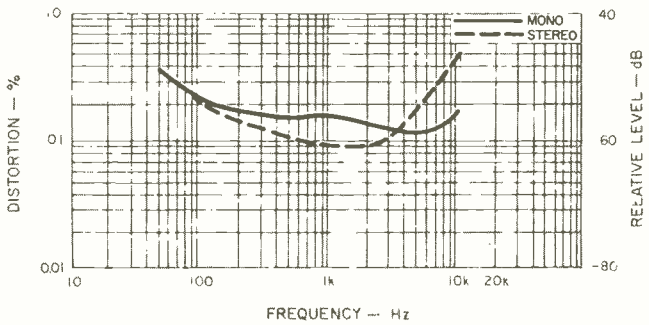


Fig. 2—Distortion vs. frequency for stereo and mono FM.

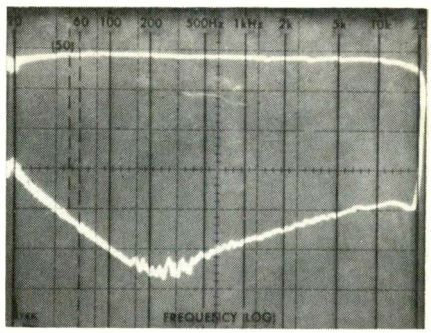


Fig. 3—FM frequency response and separation vs. frequency.

"The Denon DRA-400 is a good example of a receiver benefiting from technology originally found in higher priced units."

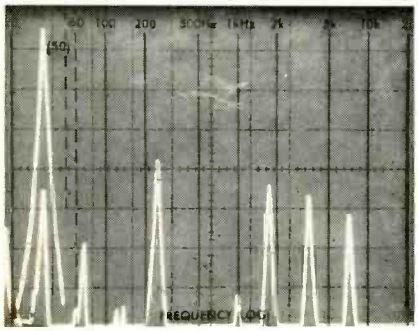


Fig. 4— Stereo FM crosstalk for 5-kHz modulation.

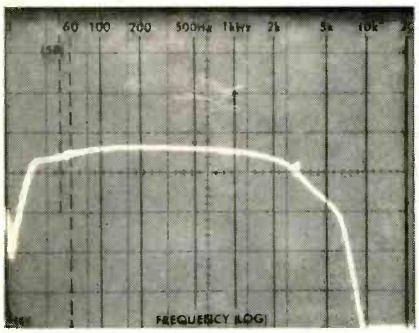


Fig. 5— AM tuner frequency response.

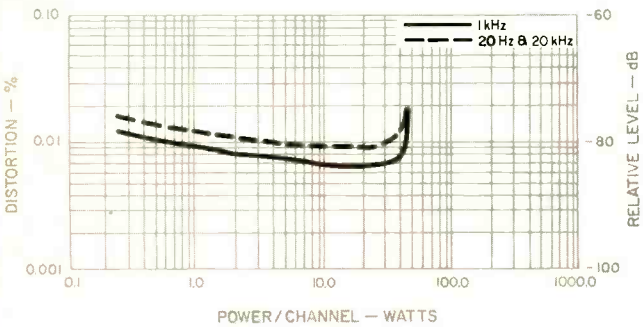


Fig. 6— Power output vs. distortion, 8 ohms.

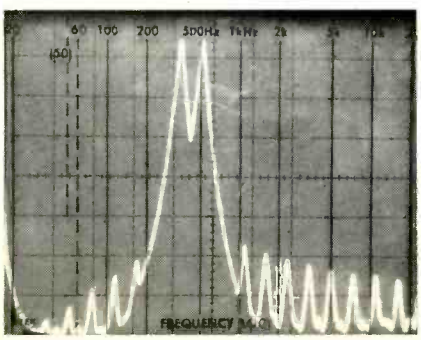


Fig. 7— IHF-IM analysis at rated output, with 9- and 10-kHz twin-tone test signal.

Tuner Measurements

Usable mono FM sensitivity fell short of published claims, measuring 16 dBf (3.47 μV across 300 ohms). In stereo, sensitivity was limited by muting and stereo thresholds, which were set to 32 dBf (21.9 μV). For 50-dB quieting in mono, an input signal strength of 19.5 dBf (5.2 μV) was required; for stereo, a signal strength of 42 dBf (69.2 μV) was needed. Plots of quieting and distortion (at 1 kHz) versus signal strength are shown in Fig. 1. Signal-to-noise in mono, at 65 dBf of input signal, measured 75 dB as claimed; in stereo it was 72 dB, also exactly as claimed.

Harmonic distortion in mono measured 0.17% for a 1-kHz signal, modulating the r.f. carrier by 100%. Total harmonic distortion actually decreased to 0.085% in stereo for the same signal and modulation levels. Distortion in mono and stereo for other audio modulating frequencies is shown in Fig. 2. Although measured distortion was low at high frequencies in stereo and mono, I must point out that these figures were obtained using a bandpass filter with a steep roll-off above 15 kHz (the highest broadcast program frequency). Without the filter, subcarrier products were only some 42 dB below 100% modulation levels.

Figure 3 is a multiple frequency versus amplitude plot, using a spectrum analyzer swept over a frequency range from 20 Hz to 20 kHz. The upper trace represents modulated channel frequency response, which was down some 1.5 dB at 15 kHz. The lower trace represents output from the unmodulated channel output, or stereo FM separation. At 1 kHz I measured a very high stereo separation of 59 dB. At 100 Hz, separation was 44 dB, and at 10 kHz it was still a very acceptable 35 dB.

Figure 4 is another spectrum analyzer dual plot. This time, frequencies are linearly displayed from 0 Hz at the left to 50 kHz at the right. The tall spike at the left represents a 5-kHz output from the modulated channel. Contained "within" this spike is the lower amplitude output (5 kHz) from the unmodulated channel, while to the right are various distortion and subcarrier output products observed at this output. The tallest spike in this second trace (about a third of the way across the screen) is the inordinately high level of 19-kHz subcarrier output mentioned earlier. Capture ratio for this tuner section measured 1.4 dB, close to the 1.2 dB claimed; image rejection and AM suppression measured 48 dB and 61 dB respectively, both somewhat better than claimed. Alternate-channel selectivity measured 60 dB.

AM frequency response, though not outstanding, was better than that normally encountered on medium- or even high-priced stereo receivers. A plot of AM response is shown in Fig. 5, and if you are willing to apply a tolerance of ±6 dB, you could say that it extends out to nearly 5 kHz.

Amplifier Measurements

The power amplifier section of the Denon DRA-400 delivered 46.5 watts of power per channel into 8-ohm loads over a frequency bandwidth of 20 Hz to 20 kHz, with no more than its rated 0.02% total harmonic distortion. Distortion as a function of power output is shown in Fig. 6. At the rated output of 40 watts per channel, THD measured 0.0075% for mid-frequency signals, 0.015% at 20 Hz, and 0.017% at 20 kHz. The SMPTE IM at rated output measured 0.019%, CCIF

"In my location, FM reception was quite satisfactory, while an MPX filter was needed for best tape recording."

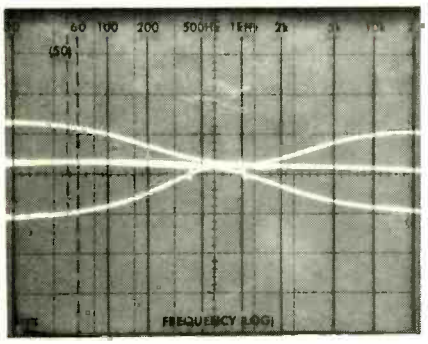


Fig. 8—Tone control range.

twin-tone IM at rated output was 0.0041%, while IHF IM was a rather high 0.6%. The IHF twin-tone IM figure was calculated from the spectrum analyzer display of Fig. 7. The two tall spikes represent 9- and 10-kHz signals at amplitudes equivalent to full rated output. Spurious components on either side are the IM signals generated by this twin-tone test. Vertical sensitivity is, as in all the spectrum analyzer displays of this report, 10 dB per vertical division and sweep was *linear* from 0 Hz to 20 kHz. Dynamic headroom for the amplifier was a rather high 1.9 dB, suggesting that short-term music-signal peaks as high as 62 watts could be reproduced without severe clipping.

Figure 8 is a plot of the range of the bass and treble controls of the Denon DRA-400. Phono input sensitivity was 0.36 mV for the MM inputs (referred to 1-watt output at the speaker terminals), 0.036 mV for the MC phono inputs, and 23 mV for the high-level inputs. Phono signal-to-noise measured 80 dB for the MM inputs (referred to 5-mV input and 1-watt output) and 70 dB for the MC input (referred to 0.5-mV input and 1-watt output). High level S/N measured 80 dB referred to 0.5-V input, 1-watt output. At minimum volume settings, hum and noise was 82 dB below the 1-watt reference output. Volume-control tracking accuracy was within 2.0 dB to −50 dB below maximum setting.

RIAA equalization was extremely accurate above 1 kHz, deviating by no more than 0.1 dB out to 20 kHz. Measured from input to speaker outputs, there was a slight boost of about 0.9 dB at all frequencies below about 60 Hz, which was introduced not so much by the phono preamp stage as by the high-level amplification stages and/or tone control circuits (in their flat positions) which follow the phono stage. Interestingly, when the subsonic filter was activated, it offset this slight boost at the offending frequencies in addition to performing its steep roll-off function below 20 Hz.

Use and Listening Tests

The Denon DRA-400 receiver sounds best when it is played at listening levels below its full rated output level, thereby avoiding some of the IM distortion generated by complex musical signals at higher levels. In my location, FM reception was quite satisfactory, and the usual number of stereo stations was received with low background-noise levels. I tried making some cassette recordings of FM stereo broadcasts and, as I suspected, the presence of high levels of subcarrier output products required that I activate an MPX filter on the cassette recorder. I would recommend that anyone using the receiver for this purpose do likewise. Phonograph record reproduction was very good, and the MC inputs did provide enough gain so that they could be used even with low-level MC pickups. There was enough overload capability such that newer, higher output MC cartridges didn't run into any problems either.

While the Denon DRA-400 lacks some of the circuit sophistication and feature refinements of more expensive, higher powered receivers and separates, it is capable of reproducing program sources well enough to qualify as the central component of a modestly priced, but good-quality stereo component system. At its price, one could not ask for much more.

Leonard Feldman

5

SOUNDCRAFTSMEN MODEL DC2214 GRAPHIC EQUALIZER

Manufacturer's Specifications
Harmonic & IM Distortion: 0.01% at 2 volts.
S/N Ratio: 106 dB at 10-V output.
Control Range: Each section, ±12 dB; unity gain controls, 18 dB.
EQ In/Out Matching: 0.1 dB.
Dimensions: 19 in. (483 mm) W × 3½ in. (89 mm) H × 8¾ in. (222 mm) D.
Weight: 18 lbs. (8.1 kg).
Price: $299.00.
Company Address: 2200 South Ritchey, Santa Ana, Cal. 92705.
For literature, circle No. 94

The Model DC2214 is one of the recent additions to the Soundcraftsmen line of octave-band graphic equalizers featuring their proprietary differential comparison circuit. The Differential/Comparator is used with a pair of balancing LEDs for each channel to obtain close-to-exact matching of overall levels between EQ in and out, to preserve headroom. This is an improvement over the helpful, well-performing earlier schemes of the same general design.

On the DC2214, the unity-gain controls and indicating LEDs are to the right of the left-channel filter-section vertical sliders and to the left of the right-channel sliders. The filter sliders have a range of ±12 dB, and the unity gain controls have a total range of 18 dB. Each of the sliders has a definite detent at the center of its travel, clearly indicating the position for zero effect on the response, and a helpful center index line. The front of each slider is knurled, but I suspect that most users will make adjustments by grasping the knob top and bottom with a thumb and forefinger.

There are four push-on/push-off switches for "Power," "EQ Defeat," "EQ Tape Record" and "Tape Mon." "EQ Defeat," of course, facilitates removing the effect of any EQ setting by a simple push of one switch. "EQ Tape Record" inserts the EQ section before the feed to a recorder connected to the back panel. "Tape Mon" loops the recorder output through the DC2214 to its line-out jacks, and EQ can be added to the playback. The switching is really quite simple, but many other equalizers do not offer all these choices.

The front-panel designations are white on a black background, and they are easy to read in any normal lighting. The unit can be installed directly in a standard 19-inch rack. Press-on feet are supplied for surface mounting, and optional wooden end pieces are available.

Four sets of phono jacks on the rear panel handle line in/out connections to a preamp or receiver, and in/out connections for a recorder or other equipment.

Removal of the top and side cover showed that the bottom chassis was a single piece, folded up on all sides, which made for considerable rigidity. The single p.c. board had good soldering with little flux residue. There were four quad op-amps in each channel, all mounted in sockets,

which would facilitate replacing any that might fail. None of the parts were identified, but the layout was open, and servicing would be easy with simple guidelines. Although the transformer was small, it did not run hot, so there was no capacity problem. There was one fuse in a clip. Most of the interconnections were made with wirewrap.

Measurements

The frequency response was measured for both EQ in and out. The −3 dB points were at about 3 Hz and 155 kHz with EQ in, and at less than 1 Hz and greater than 1 MHz with EQ out. Figure 1 shows the swept-frequency responses for each of the filter sections, with maximum boost and maximum cut, and the results with all sections in zero detent and at maximum cut. The effect with all filters at maximum boost was very similar, but the plot would have been above the graph. The filter shapes were all quite similar, and the spacing was quite regular—both desirable. Swept responses were also taken with the 60-, 1,920- and 3,840-Hz filters set successively from "−12" to "+12" in steps of 2 dB, as marked on the front panel. With reference to the zero-detent position, the 60-Hz steps were actually low for ±2 and ±4, a bit high for ±6 and ±8, and quite high for ±10 dB. There was no additional boost or cut in going to ±12 dB. The coupling between the two higher filters caused somewhat different results, but with "+10" getting the same boost as "+12." There was a difference between "−10" and "−12," as the plots show. These results are closer to the indicated settings than with some equalizers, and a number of trials demonstrated that any desired boost or cut could be set within a small fraction of a dB.

Soundcraftsmen uses center frequencies that are displaced 4% below the ISO preferred freqencies, but this is of no particular import when using an equalizer to adjust the response of a system, or to improve the sound with a listening judgment. Most of the actual frequencies were within ±2.5% of the designations, with the total spread within +7.9%/−7.0%—close enough for high-fidelity purposes. The maximum boosts were +12.9 dB, ±0.7 dB, and the maximum cuts were −13.5 dB, ±0.5 dB—both quite consistent. The octave-bandwidth point (Q = 1.4) was at +11.1 dB, and Q = 1 (a practical maximum boost) was reached at +8.8 dB, higher than many equalizers.

Previous Soundcraftsmen equalizers had a good scheme for in/out matching, so I was particularly interested in how well the new differential comparison circuit would perform. The first checks were made using a sine-wave source, decreasing the amplitude with each set of in/out checks to see how well the unity-gain control had been adjusted. Down to 0.3 V, the readings showed agreement within 0.1 dB quite consistently. At 0.1 V and below, the accuracy fell off to a possible error of 1.0 dB, but this still would be a very acceptable matching in most cases. Even with a 60-watt desk lamp shining on the LEDs, it was possible to get within 0.1 dB at 0.3 V or above—demonstrating the good "snap-action" of the circuit to show out-of-balance conditions. Unity-gain matching within ±0.3 dB was possible with pink noise and various combinations of filter settings, but it was not possible to *prove* the accuracy of the matching because of meter fluctuations from the pink noise itself.

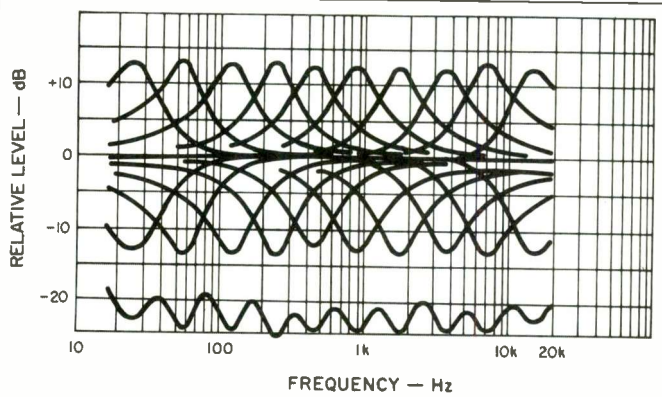


Fig. 1—Swept-frequency responses of each filter section at maximum boost and maximum cut, and with all sections at maximum cut.

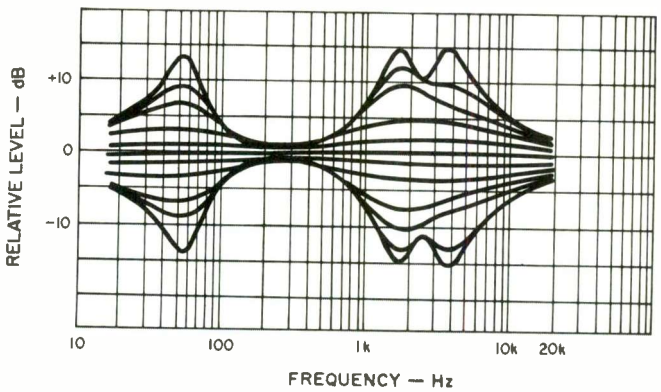


Fig. 2—Swept-frequency responses with 60-, 1,920-, and 3,840-Hz filters set successively for steps of 2 dB from −12 to +12 dB.

The maximum output was very close to 7.5 V across the band, dropping to about 7.3 V with a 10-kilohm load. The polarity of the output was the same as the input with EQ in or out. The line input impedance was 50 kilohms in the low and middle part of the band. It fell slowly at the highest frequencies, but it was still a quite satisfactory 18.6 kilohms at 20 kHz. The output impedance was a low 230 ohms or less at all points, and it would not be loaded down by any normal termination.

The DC2214 evidenced very low distortion, 0.003% or less, although the figures at the high end were above that, to 0.008% at 20 kHz. The distortion did not reach 0.1% anywhere in the band until 4.5 V, excellent performance. The IM distortion (SMPTE) was less than 0.003% at lower levels, and it did not reach 0.01% until 3-V output. There was no slew-rate limiting noted in any of the sine waveforms until getting to the combination of 100 kHz and 2 V, a most unlikely duo. The A-weighted noise in the output (with 1-kilohm terminated inputs) was 11 μV. Thus, the signal-to-noise ratio with a 0.5-V reference was 93 dBA, an excellent figure. With a 10-V reference (Soundcraftsmen's unrealistically high specification), the figure would be 119 dBA,

"The switching on the DC2214 is really quite simple, but many other equalizers do not offer all these choices."

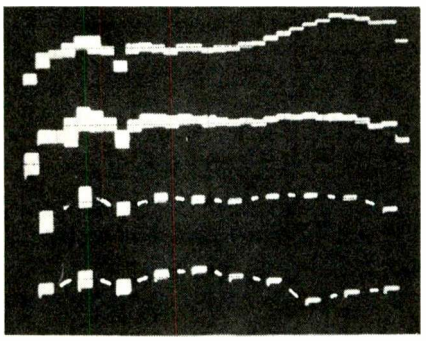


Fig. 3—Record/playback responses of tape recorder, from top: Without record EQ, with EQ, equalized response on octave-band basis, and actual EQ inserted to flatten response. Vertical scale, 5 dB/div.

actually much higher than the manufacturer's figure of 106 dB. There was an increase in noise with certain EQ adjustments, so in-use figures would probably be closer to 110 and 84 dBA for the 10- and 0.5-V references, respectively.

Use and Listening Tests

As is normally the case with Soundcraftsmen equalizers, the DC2214 was supplied with a test record having reasonably detailed instructions on equalizing a sound system with the bands of noise on the record. A sound-level meter would aid in the process, as suggested in the notes; an octave-band RTA would be even better. The instructions also explain how to set the unity-gain controls, make connections, and select functions. The text is a bit out of date, however, and fails to mention that EQ can be used to modify tape-recorder playback. In general, most users would benefit from greater detail on equalization applications and techniques.

Soundcraftsmen makes possible a form of EQ memory by supplying "Computone" charts which can be cut to match all of the equalizer slider settings, including the unity-gain controls. This eliminates the need for lots of notes on different desired combinations, such as rock-music EQ, classical-music EQ, or tape-playback EQ.

All of the controls and switches worked with complete reliability. The action of the sliders was quite smooth, and the center detents were helpful. The DC2214 improved the listening of a variety of sources, in addition to the general smoothing of the system response. The unit also improved the overall record/playback response of a cassette deck which showed (Fig. 3) too much boost around 6 kHz. The response was easily smoothed, and the corrections made could not have been achieved with simple tone controls.

The Soundcraftsmen DC2214 octave-band equalizer offers very low distortion and noise, good filter properties, and an excellent in/out unity-gain scheme—all at a very good price.

Howard A. Roberson

Audio CLASSIFIED ORDER FORM

For your convenience, to place a classified ad in Audio, simply type or print your ad in the space provided below, complete the order form and return to:

Audio Magazine
P.O. Box 1790V
Greenwich, Ct. 06836

NOTE: PAYMENT BY CHECK OR MONEY ORDER MUST ACCOMPANY YOUR ORDER.

I would like to run the following ad in the _____ issue(s) of Audio:

RATES:
PERSONAL: 70¢ per word, $5.00 Min. per line.
BUSINESS: $1.00 per word, $7.00 Min. per line.

For further rate information see Classified Advertising Rates on opposite page.

(type or print)

Deadline: Orders must be received by the 1st of the month, two months prior to cover date (allowing approx. 8 weeks from receipt of order to publication).
Ads received after the closing date will be held for the next issue unless otherwise stated.

No. of words _____ @ _____ per word. Total cost of ad $_____ Amount of check encl. $_____

Name _____ Address _____

Phone No. ( ) _____
Area Code

A/283

CLASSIFIED ADVERTISING RATES

EFFECTIVE JANUARY 1983 ISSUE

BUSINESS ADS—$1.00 per word, minimum charge $7.00 per line for spaced ads specifying five or less words per line. First line set in bold face type at no extra charge. Additional words set in bold face type $1.10 extra per word. One point ruled box, extra charge $9.00. **ORDERS WILL NOT BE PROCESSED WITHOUT ACCOMPANYING CHECK OR MONEY ORDER FOR FULL AMOUNT**

NON-BUSINESS ADS—70¢ per word, minimum charge $5.00 per line for spaced ads specifying five or less words per line. First line set in bold face type at no extra charge. Additional words set in bold face type $1.10 extra per word. One point ruled box, extra charge $9.00. **ORDERS WILL NOT BE PROCESSED WITHOUT ACCOMPANYING CHECK OR MONEY ORDER FOR FULL AMOUNT.**

FREQUENCY DISCOUNTS—3 times less 5%, 6 times less 15%, 12 times less 20%. These discounts apply to line ads only. Ads submitted for a three time frequency are unchangeable. Frequency discounts not fulfilled will be short rated accordingly.

Classified ads are payable in advance BY **CHECK OR MONEY ORDER ONLY.** (Sorry, we cannot accept credit cards or bill for line adv.). All orders should be mailed to:

AUDIO MAGAZINE
P.O. Box 1790V
Greenwich, CT 06836

DEADLINE—1st of month two months preceding the cover date. If the first of the month falls on a weekend or holiday, the closing date is the last business day preceding the weekend or holiday.

ADS RECEIVED AFTER THE CLOSING DATE WILL BE HELD FOR THE NEXT ISSUE UNLESS OTHERWISE STATED.

BLIND ADS—Audio box numbers may be used at $5.00 extra for handling and postage.

GENERAL INFORMATION—Ad copy must be typewritten or printed legibly. The publisher, in his sole discretion, reserves the right to reject any ad copy he deems inappropriate. **ALL ADVERTISERS MUST SUPPLY:** Complete name, Company name, Full Street address (P.O. Box numbers are insufficient) and telephone number. Classified LINE ADS are not acknowledged and do not carry Reader Service Card Numbers. **AGENCY DISCOUNTS** do not apply to line advertising. **FREQUENCY DISCOUNTS** not fulfilled will be short rated accordingly. For any additional information contact Laura J. Lo Vecchio, Classified Adv. Mgr., 1515 Broadway, New York, NY 10036 . . . Direct Dial (212) 719-6338.

CLASSIFIED DISPLAY RATES

1 col × 1"	$195.
1 col × 2"	$350.
1 col × 3'	$450.
2 col × 1"	$390.
2 col × 2"	$700.

For larger display ads and frequency discounts call (212) 719-6338.

DISPLAY ADVERTISERS MUST SUPPLY COMPLETE FILM NEGATIVE READY FOR PRINTING OR VELOX. PRODUCTION CHARGES WILL BE ASSESSED ON ANY AD REQUIRING ADDITIONAL PREPARATION.

DISPLAY ADVERTISERS must make a space reservation on or before the closing date. Ad material (film or velox) may follow by the 10th.

FOR SALE

HOW TO ANSWER BOX NUMBER ADS
When replying to an Audio Box Number Ad, please use this address Box No. ___ c/o Audio, 1515 Broadway, New York, N.Y. 10036

1-313-471-3076 OR 1-313-553-0508
B&K IMPORTS—"BETTER PRICES". QUAD, B&W, CELESTION, CONRAD JOHNSON, DYNAVECTOR, PRECISION FIDELITY, KEF, LINN, MERIDIAN, MISSION, PINK TRIANGLE, ROGERS, SRYINX, WALKER, ARC, ARISTON, A&R CAMBRIDGE, BEAM, CHARTWELL, GRACE, JR, M&K, RAM SUPEX, ACCUPHASE, PRO-AC, OSAWA, HAFLER, ESOTERIC AUDIO RESEARCH OR ALMOST ANYTHING ELSE! THE COMPETITION KNOWS US YOU SHOULD TOO! VISA, MC, COD, CHECKS, CASH. 24160 TWIN VALLEY CT., FARMINGTON, MI 48024

1-319-365-1324 STEREO SHOP — CLOSE-OUT LIST Nakamichi, Audio Research, Infinity, Crown, Conrad-Johnson, Soundcraftsmen, Luxman, B&O, others. Call/write. 1209 First Ave SE, Cedar Rapids, Iowa 52402

25% TO 60% SAVINGS on Prestige Audio products from Europe and Japan. Our prices often better than other overseas suppliers. Products not sold in U.S. available. Ship worldwide For information and price list send $1 to: Audiophile Exports Co., 507 Dragon Seed Building, 39 Queens Road Central, Hong Kong. Run by audiophiles.

58,000 MICROFARAD 75V CAPACITORS for super capacitor bank! Update your amplifier (DH200 Ideal) with an outboard capacitor bank for low cost sound improvement. Normally $60 each, limited supply available at $10 each, or four for $32 postpaid U.S. only. Satisfaction guaranteed. Robert Wattieworth, 7798 Embassy Drive, Canton, Michigan 48187

AAAAAAGH! SONY WALKMAN at Hong Kong prices! Write: Mailmart, G.P.O. Box 10506, Hong Kong.

FOR SALE

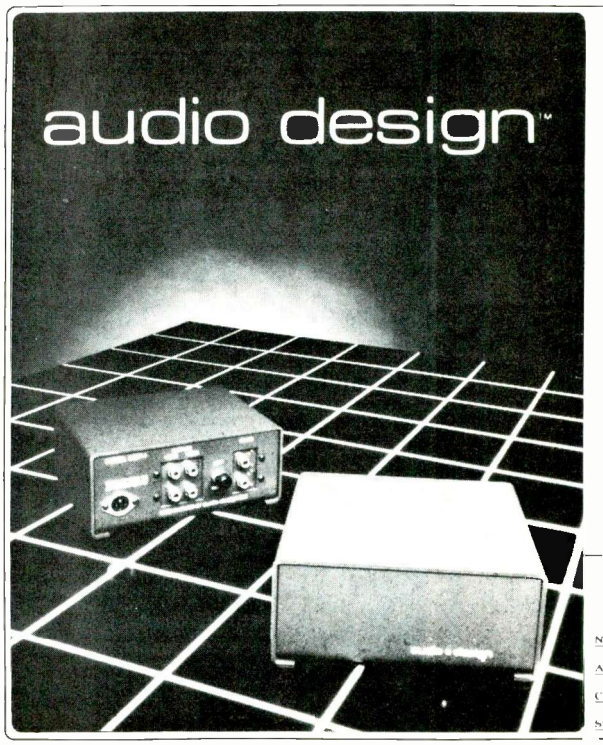
1-800-245-6000
TAPE WORLD

TDK: MAR-90	6.79
TDK: MA-90	4.49
TDK: SAX-90	3.29
TDK: ADX-90	3.19
TDK: SA-90	2.19
TDK: SA-60	1.89
TDK: AD-90	1.89
TDK: D-90	1.29
TDK: T-120HG	12.99
TDK: T-120, L-750	9.99
MAXELL: XL I or IIS-90	3.65
MAXELL: UDXL I or IIC90	2.69
MAXELL: UDC 90	2.19
MAXELL: UD35-90	5.35
Maxell: T-120, L-750	9.99
Maxell: T-120HGX, L-750HGX	12.99
MAXELL: XL-I-35-90B	6.49
Sony: UCXS-90	2.99
TDK: HD-01 (Head Demag.)	13.99
LORAN	CALL

WE WILL HONOR ANY COMPETITORS PRICE OF THE TOTAL ORDER. $3.75 Shipping any size order in US. Visa, MC, no extra charge. COD add $1.50. Orders shipped within 4 days by UPS. Personal checks 1 week delay. PA add sales tax.
220 Spring St., Butler, PA 16001, 412-283-8621

AAAAAAAAAAMUSTSELLFASTAAAAAAAAAA
LEVINSON ML-1, A-4E, #3293, complete update, PLS-151, oah case & 3pr. camac/RCA, mint, $1150. **KOETSU** arm (1 mo.) $535., w/**DENON** 103D $650. **VERION** MK-I hd. amp w/camac $125. All 4 $1650!!! Collect JR-808-955-4040, 947-1312

ACCUPHASE INTEGRATED AMP E-202, wood cabinet ($100 value) $250. Accuphase T-101, $200. Sell together for $425 + shipping. V.G.C. Call John at 313-827-7223 days, 313-471-7289 nights.



Typical warranty card comments:

"Unbeatable at the price"
E. Croydon, England

"A very good product Reasonable and affordable"
Agincourt, Ontario

"An excellent value"
Berkeley, California

"It has an unlimited and uninterrupted pleasure in listening that surpasses other products at twice the price"
Vancouver, British Columbia

For more information, please mail coupon.

audio design limited
Box 12501 Ills Station
Niagara Falls, N.Y. 14303-0260
Tel: (416) 756-4868 Telex 061-8284

Name _____
Address _____
City _____
State _____ Zip _____

FOR SALE

5 YEARS AND GROWING STRONG! featuring the renowned Strathearn ribbon, available with solid hardwood frames, crossovers, complete systems. Dynaudio, Dalesford, Panasonic leafs, Wonder caps, Wesco, Shadow Engineering electronics. A full line of esoteric but affordable kits, AC acoustic foam for cost effective room treatment. Guaranteed lowest prices, instant shipping, technical assistance. MC/Visa. Noon to 6:00m-f. (608) 788 0366 Detailed catalogue $2. **AUDIO CONCEPTS** 1919 S. 19th LaCrosse, Wi. 54601

AAAAAAH AUDIOPHILES—FINALLY FOUND YOU! We are an **AMERICAN** enterprise specializing in the direct sale of **JAPANESE** cartridges • tonearms • transformers • cables • interconnects (yes—BANSEI available) • accessories • etc. All manufacturers-lowest prices. Advise your requirements—we'll quote immediately. **INTERSONICS,** PO Box 113, Toyohashi 440, JAPAN.

AAA-ASTOUNDING CARTRIDGES: Finest in the World at Shamefully Low Prices. Accuphase, Denon, Dynavector, Grace F9E's, F9E Ruby's, Koetsu, etc. NEW, 100% Quality Control, Warranties, COD Available. No Price List. "We Will Not Be Undersold". AudioWorkShop (206) 323-4987 24hrs.

AAA AUDIO DISCOUNTS OFFERS THE FINEST lines of audio components **(INCLUDING THE ESOTERICS)** at **DISCOUNT PRICES.** If you're in the market for speakers, receivers, cassette decks, to the best in separate components including amps, pre-amps, turntables, cartridges etc. or a new CAR STEREO our knowledgeable sales staff will be glad to assist you. For more information Monday thru Saturday **PLEASE CALL 301-593-8224—301-593-8244** or write to **AUDIO DISCOUNTS,** 1026 McCeney Avenue, Silver Spring, MD 20901. We honor VISA-MC and COD for your convenience.

AAA SELECTION OF ESOTERIC AND QUALITY COMPONENTS, speakers, cartridges, tonearms, turntables, accessories, or whatever. Write or call, you'll be glad. Ask for specials list. Many surprises. Audio Unlimited, 1798B Technology Drive, San Jose, CA 95110 408/279-0122 1-6pm M-Th

AAA-TOP PRICES PAID for Audio Research, Marantz, McIntosh, and Western Electric Equipment, AudioWorkShop (206)323-4987

AAAUDIOPHILES—INFINITY ServoStat-I rosewood panels $450., LUXMAN 3045 tube amps $425. extras; BEDINI 25/25A amp boxed $495.; KLYNE headamp L/N $395.; TECHNICS leaf tweeters 10TH1000 $425.; QUAD ESL late blk. pr. $850.; INFINITY quantum 3 $400.; FLUKE 8024B DMM 11-function $175. Nick-212-996-2252

AAAUDIOPHILE SPEAKER BUILDER? JORDAN MODULES exclusive importer. STRATHEARN midribbon, Polypropylene Drivers, EMIT Tweeters, Domes, IBM Computerized Designs, Capacitors, Low DC Coils, Crossovers. (Dealers inquire on letterhead) CATALOG $2.00 U.S. Soundbox, 841A-A S. American Street, Philadelphia, 19147

AAH, NEEDED URGENTLY. LARGE SUPPLY OF WESTERN ELECTRIC TUBES, NEW & USED. MAURY 713 7284343

ABARGAIN: Cartridges 40% to 50% off retail: Grace F9E, F11L $189.; Koetsu Black; Accuphase AC-2; Denon DL-103D; Promethean; Dynavector DV-23R, DV-17D, 100R/23R stylus replacement $120.; Tone Arms: Grace 707 MKII $149., 747 $189.; Linn Ittok LV-II $430.; Technics EPA-100 $289.; Koetsu SA-1100D $495; All unused (212) 784-2939 (evenings)

ABARGAIN: Dynaco 416 amp + C-100 energy storage unit $500. Michael M. Gehring, Rt. 1, Box 49, Whitewater, KS 67154

ABARGAIN: Grace F9E ruby & stylus; Linn Basik LV-X; want Hasselblad; (212) 784-2939 evenings

A BETTER WAY TO BUY YOUR AUDIO AND VIDEO COMPONENTS. Consider the following—DIRECT SOUND MARKETING can provide you with virtually any brand of audio or video components (including the esoterics) at extremely competitive pricing, on an in-stock basis. Moreover, we maintain a complete service facility to handle any service problems. So, if you're looking for a price, selection, fast shipments, in-house service and competent advice we have it all, and more. Before you buy anything please call us at (404) 233-9500 for more information.

Or write to DIRECT SOUND MARKETING, 3095 Bolling Way N.E., Atlanta, GA 30305. For your convenience use your Mastercard, Visa, or Amex for fastest service. Sales tax is charged to Georgia residents only.

FOR SALE

ABARGIN: SPICA SC-50 loudspeakers. Mint condition $325 or B.O. (617)491-2216

ABSOLUTE AUDIO: AMBER, ASTATIC, ORACLE, CONRAD JOHNSON (INCLUDING PREMIERS), DYNAVECTOR, MISSION, NAD, OHM, RGR, SNELL, THIEL, VPI, WALKER, ETC. Audio File, 1202 South Congress, Austin, Texas 78704, (512) 443-9295

ABSOLUTELY THE BEST? low direct Tax free price. reviewed November 82 'Gramophone' "indeed the combination of Mayware MKIV tonearm $125 and MC-2V 'Vital' stylus $79 + T-24 transformer reproduced my sequence of Test records with unusual accuracy and tonal naturalness. World's best lousdpeaker manufacturer says" combination performs extremely well and cures mistracking which occured with SME." Just released "The Cartridge" $135 VISA/MC accepted info $1 bill. Mayware P.O. Box 58, Edgware, Middx. England.

ABSOLUTELY THE FINEST IN AUDIO!
Featuring the superb Conrad-Johnson Premier Two preamp (Absolute Sound's #1 preamp), $1585, and the awesome Premier One amplifier (200 watts/channel), $3900.

KRELL	PS AUDIO	HAFLER
AMBER	DENON	NAD
DENNESSEN	GNP	REGA PLANAR
ROGERS	GRACE	BOSTON ACOUSTICS
DYNAVECTOR	ASTATIC	SYMMETRY
QLN	GRADO	NITTY GRITTY

FREE SHIPPING ANYWHERE IN USA.
COMPLETE EXPORT FACILITIES.
REFERENCE AUDIO SYSTEMS
18214 DALTON AVENUE, GARDENA, CA 90248
(213) 398-4205

ACCURATE, QUALITY HOME/CAR AUDIO AFFORDABLY PRICED!! Denco Audio, P.O. Box 6104-U, El Monte, CA 91734. (213) 961-6158 eveninrs, weekends. STAMP BRINGS SPECIALS SHEET. M/C, VISA ACCEPTED!

ACC-U-SOUND means CLEANER SOUND, DEEPER BASS, FOCUSED MIDRANGE, AIRY HIGHS, attaches to all turntable setups, $15.00. Dealers Wanted, LaPine Labs, 6731 Bissonnet, Houston, Texas 77074

ACES OVER EIGHTS SYSTEM

(ABOUT $8000)

Turntable:	LINN SONDEK LP-12
Tonearm:	LINN ITTOK
Cartridge:	GRACE F9-E W/RUBY CANTILEVER
Tuner:	ADCOM GFT-1A
Preamplifier:	THRESHOLD FET TWO
Amplifier:	THRESHOLD S-300
Speakers:	SNELL TYPE A'S OR SYMDEX SIGMA/OMEGA

SOUND BY SINGER

227 Lexington Avenue
New York, NY 10016
(212) 683-0925

ACOUSTAT 2 + 2—The affordable reference standard. BETTER SOUND CONCEPTS, 3281 West Liberty, Pittsburgh, PA 15216, (412) 561-3312

ACOUSTAT III SPEAKERS, off-white & oak, mint, $1000. (+ shipping) (212) 454-3205

ACOUSTAT MODEL II, II & II. Call Terry 402-391-3842

ACOUSTAT PRODUCTS AVAILABLE AT GENE RUBIN AUDIO (213) 571-1299 (PAC)

ACOUSTAT SPEAKERS—SUPERB!
Free Shipping! Fast Service! READ BROS STEREO, 593 King Street, Charleston, SC 29403, (803) 723-7276. Also Sony PCM-F1.

CROWN QUALITY AMPLIFIERS, TUNERS, PRE-AMPLIFIERS. CALL FOR PROFESSIONAL CONSULTATION. BEST PRICES — PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

LEGENDS AS USUAL.

These highly respected names can be found at Chestnut Hill Audio: Acoustat, Adcom, Amber, Apature, Apres, Audio Pro, B&W, Berning, Cabasse, Cotter, Dahlquist, Dayton Wright, Dennesen, Denon, Discwasher, Dynavector, Fidelity Research, Fourier, Gilmore, Grace, Grado, Hafler, Impulse, Janis, Kenwood Purist, Leach, Marcof, Mariah, Monster Cable, Mordaunt-Short, NAD, Oracle, PS Audio, Quad, R G R, Rogers, Signet, Spendor, Stax, Symmetry, Tandberg, Theta, 3D Acoustics, Thorens, Threshold, VPI, Vandersteen
311 Cherry Street, Philadelphia, Pa 19106 (215) 923-3035

CHESTNUT HILL AUDIO LTD.

Sidereal Akustic™

At Sidereal Akustic we believe that **all** elements of a loudspeaker design should be carefully considered. Wire is an often overlooked component. After extensive listening tests we have chosen an 8ga., 99.99% pure copper, oxygen free litz type wire for our loudspeaker systems.

As a result the Sidereal Akustic Model Four loudspeaker system will present the beauty and excitement of live music in a size and price range that is easy to live with.

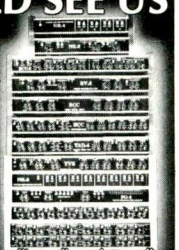
Write or call for free literature and information. *Dealer Inquiries Invited*

Sidereal Akustic™
Audio Systems Inc.
4035 Oceanside Blvd. Unit G-57
Oceanside, CA 92054 (619) 726-3150

A SINGER'S DREAM!

REMOVES VOCAL FROM MOST STEREO DISCS
The Thompson Vocal Eliminator can actually remove most or virtually all of a solo vocalist from a standard stereo record and yet leave most of the background music untouched! Not an equalizer! We can prove it works over the phone. Write or call for a brochure and demo record below. COST: $349.00

YOU SHOULD SEE US



For:
- **Time Delay/Ambience**
- **Studio Echo/Reverb**
- **Tape Noise Reduction**
- **Parametric Equalization**
- **Electronic Crossovers**
- **Compressor/Expanders**
- **Mic Preamp/Mixers**

We manufacture a full line of high quality audio and recording equipment. You will probably have to pay twice as much elsewhere to obtain comparable quality. Only Direct Sales make our prices and quality possible. Write or call for a 24 page brochure and demo record.
Write to: LT Sound, Dept. AU, P.O. Box 338, Stone Mountain, GA 30086, Phone (404) 493-1258

FOR SALE

ADCOM GFW-1 WALNUT SUBWOOFER, factory sealed closeout sale, list $290., now $159. postpaid USA. Bear Sound, Box 4121, Sylmar, CA 91342

DENON RECEIVERS, AMPLIFIERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

ADIRONDACK AUDIOPHILES—Northern New York State House of Hi-Fi is now open with McIntosh, Denon, Polk Audio, Nakamichi, NAD, Apt Holman, Hafler, Marcoff, Sota, Alpine, Sonex, Harman Kardon, RG Dynamics, JBL, Mariah Acoustics, Shahinian Obelisk, DCM Time Windows, Sony, Fidelity Research, Conrad Johnson, Monster Cable, Peerless. Mail or Phone inquiries promptly answered. HOUSE OF HI-FI, Route 9-Miller Road, Glen Falls, New York 12801, (518) 793-6639.

AFFORDABLE AUDIO—FREE SHIPPING USA
Esoteric Audio Research, Conrad Johnson, Hafler, Audire, Spica, Vandersteen, DCM, Quad ELS 63's $2695., Beard Doxa amp, Pink Triangle, CJ Walker, Mas arm, Luxman, Spendor, many more. PERFECTIONIST AUDIO, 1610 James, No. Mankato, Minnesota, 507-345-7186

HARMAN-KARDON SEPARATES, RECEIVERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; (213) 840-0878.

ALL QUAD ELS OWNERS obtain improved accuracy, definition & extended bass with proven update. $140/pr. No risk, 30 day trial. For information send **SASE** to John Koval, Linear Acoustics Labs, 11521 Cielo Pl., Santa Ana, CA 92705. (714) 838-6555.

AMBER SERIES 70 POWERAMP and preamp—NEW Call Terry 402-391-3842

In New England...

No hyperbole — just the kind of knowledge, creativity and dependability you expect from a dealer who represents these manufacturers.

Acoustat	LAST
Apt-Holman	Magnepan
Audel	Marcof
Audio Pro	M&K
Boston Acoustics	Monster Cable
Bryston	NAD
Carver	Nakamichi
Dahlquist	Nitty Gritty
Denon	Oracle
DCM	Proton
Dynavector	Pyramid
Fidelity Research	Signet
Gem	Supex
Grace	Threshold
Hafler	Vandersteen
Keith Monks	VPI
KEF	Win Labs
KLH	& more . . .

5 listening rooms . . . New England's largest Audiophile record dealer . . . Keith Monks record cleaning . . . In-store service . . . All shipments pre-paid and insured in the continental U.S.

TAKE 5 AUDIO

105 Whitney Ave., New Haven, CT
(203) 777-1750
Mon., Tue., Wed., Fri. 10-6, Thurs. 10-8, Sat. 10-5

FOR SALE

AMAZING? ISN'T IT

The amount of nonsense that gets thrown around in the audio world. If you are sick of being treated like a 5-year-old child by shoe salesmen masquerading as audio experts, you owe it to yourself to give us a call. Our opinions are based on a solid foundation of experience with the components we sell as well as those sold by our competitors. Most importantly we don't simply sell the finest audio equipment available, we arrange it in complementary systems designed to extract the greatest benefit from your audio dollars chosen from among the following lines we represent:

ACOUSTAT • ADCOM • ASTATIC • AUDIONOTE • AUDIO DESIGN • AUDIO INTERFACE • AUDIO RESEARCH • AUDIONOTE IO TYPE II • **BEARD** • **BERNING** • BRB SYSTEMS • **COUNTERPOINT** • DCM • DYNAVECTOR • FOSTEX • **FUSILIER** • GRACE • HAFLER • ITC • JANSZEN • **LINN SONDEK** • LIVEWIRE • MICRO-SEIKI • MONSTER CABLE • MORDAUNT-SHORT • NAD • **NITTY GRITTY** • **PINK TRIANGLE** • **PRECISION FIDELITY** • PREMIER • QUICKSILVER • **REGA** • **ROGERS** • **SNELL ACOUSTICS** • STAX • SUMIKO PHONO AMP • SUPEX • 3D ACOUSTICS • **THRESHOLD** •

SOUND BY SINGER

227 Lexington Avenue
New York, NY 10016
(212) 683-0925
We ship anywhere!!

AMERICAN AUDIOPHILE FINDS SOTA
"Your last turntable"? The **SOTA SAPPHIRE** combines American value, sonic superiority, and rugged construction to justify its position as the New American Reference Standard. Still at $750, the **SOTA** is a steal! In Valley Stream, NY (561-7114) and Manhattan (751-9733).

NAKAMICHI CASSETTE DECKS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

FOR SALE

Andy Singer sez: **PREMIER's LMX** moving coil cartridge sounds more musical than any other moderately priced moving coil I've auditioned. And the "cutter analogue" stylus not only has superb detail and imaging; it will track anything. Worth climbing stairs for. **SOUND BY SINGER,** 227 Lexington Ave., New York, NY 10016.

ARC D79B, mint $2750., Benchmark ambience system, new $750—Wanted FMI 80's, 60's—209-998-7326

AR D-76 AMP $625 or B/O, Rogers LS 3/5a's $375/pr., Verion MK I step-up transformer $280., Citation 12 amp $150. Alan Prichard, P.O. Box 407, Lemont, PA 16851 (814)238-7489 eves.

ROGERS No magic or mystique, just music, all new speakers on demonstration, Audio Dimensions, 794 N. Woodward, Birmingham, MI (313) 642 6383

ROGERS SPEAKER Hearing is believing, Audio Den, Smith Haven Plaza, 2021, Nesconset Hway, Lake Grove, NY (516) 360 1990

A&S SPEAKERS has raw drivers, high-end kits and auto speaker systems. Audax, Dalesford, Dynaudio, Jordan, SEAS, JVC, Philips, Becker, Falcon-Acoustics, Pyle, Peerless. Featuring the "Bill Reed" Signature Kit and Jordan Module. Free price list. A&S SPEAKERS, Box 7462A, Denver, CO 80207. (303) 399-8609.

THE MICHELL GYRODEC geometrically and technically correct. Alternative Audio, 5207 Holston Drive, Knoxville TN (615) 974 9655

ATTENTION, WANTED: MCINTOSH TUBE & SOLID STATE, MARANTZ, WESTERN ELECTRIC, ARC, BERNING, TUBE EQUIPMENT. JBL HARTSFIELD & EV PATRICIAN, THORENS 124, EDISON VICTROLA. 713 7284343, MAURY CORB 11122 ATWELL HOUSTON, TEXAS 77096

HERE'S WHAT HAPPENS WHEN YOU GIVE THE WORLD'S FINEST AUDIO ENGINEERS CARTE BLANCHE.

The team of engineers that developed Sony Esprit was not asked to work within the narrow confines of a budget.

Nor were they asked to adhere to the compromising deadlines of some production timetable. Or to the arbitrary figures of a spec sheet.

They were asked, quite simply, to develop components that would approach, to the closest possible degree, perfect sound.

There is no gimmickry in Esprit components; only those technological improvements that contribute to sound quality were considered meaningful.

There are no question marks either. For the Esprit engineers fully research their equipment before production. Not afterward.

For more information write Sony Esprit, 2300 Peachford Rd., NE, Suite 1150, Atlanta, Georgia 30338.

SONY ESPRIT

ALTERMAN AUDIO
3213 17th Street
Metairie, LA 70002
(504) 834-7772

D S AUDIO
545 Penn Avenue
West Reading, PA 19611
(215) 376-4917

PARIS AUDIO
12401 Wilshire Blvd.
Los Angeles, CA 90025
(213) 820-2578

PARK AVENUE AUDIO
425 Park Avenue South
New York, NY 10016
(212) 685-8101

PROFESSIONAL PRODUCTS
AUDIO CENTER
4964 Fairmont Avenue
Bethesda, MD 20014
(301) 657-2141

RECORDER CENTER
2003 North Henderson
Dallas, TX 75206
(214) 826-8700

THREE PHASE AUDIO
104 Foreman Drive
Lafayette, LA 70503
(318) 981-4951

© 1982 Sony Corp. of America. Sony and Sony Esprit are registered trademarks of the Sony Corp.

FOR SALE

THE MICHELL GYRODEC setting higher standards of sonic excellence. Audio Excellence, 425, Washington St., San Francisco CA (415) 433 1335 and 1081 Saratoga/ Sunnyvale, San Jose, CA (408) 446 4998

AUDIO CONNECTION
IN NORTHERN NEW JERSEY

ASTATIC	GRACE GRADO	PS AUDIO
BELLES RESEARCH	HEYBROOK	ROGERS
BENCHMARK	LINN PRODUCTS	SPICA
DENON	MAGNUM 95 FM	VANDERSTEEN
ELECTROCOMPANIET	NAIM AUDIO	VPI
FUSELIER	PROMETHEAN	AUDIOPHILE DISCS

615 Bloomfield Avenue, Verona NJ 07044
201-239-1799

FOR SALE

ATLANTA WELCOMES SOTA SAPPHIRE
Perhaps we're conservative. Neither fads nor fancy words stay at our door. We have long waited for an audiophile turntable which delivers what it promises. The **SOTA SAPPHIRE** does it—in spades! Nothing approaches its performance, construction, value, set-up. Welcome the new classic at Lee Kramer's High Fidelity SSS (404) 237-6336.

AUDIO ELITE IN WISCONSIN
Just one of the fine products we represent in P.S. Audio. Come listen to the entire P.S. Audio line in a laid back refreshing atmosphere. Audio Elite, 221 Main Street, Menasha, WI 54952, (414) 725-4431

FOR SALE

At last, available to you now!

WONDER CAPS

You will not believe the sonic improvement that Wonder Caps™ make to **every** audio component in your system! See our advertisement in October Audio, p.114. Write for **FREE** application suggestions and order forms.

IAR Dept. WCB
2449 Dwight Way, Berkeley CA 94704

AT LAST! Upgrade the sound of any system to that of a $2,000 pre-amp for 1/10 the cost. PLAYBACK ONE, the latest innovation from POWER FACTOR INC., is a high-definition phono preamplifier that extracts more sound than any design available. This state-of-the-art phono EQ circuit with IC-regulated AC power supply connects between the turntable and any auxiliary input. The wide-bandwidth circuit is virtually unclippable (35 volts output at 150 Khz). Even direct-to-disc or the new digital albums cannot distort the waveform. Works with all magnetic and high-output moving coil cartridges. To order with 30-day money-back guarantee send $198.95 (Cert. check or M.O.) to POWER FACTOR, INC., BOX 99560, CLEVELAND, OHIO 44199 (Ohio residents add local state tax). (Send for more information).

ATTENTION DEALERS: DECCA IS ALIVE AND WELL and making immediate shipments of the best-selling Decca "Zerohm" Record Brushes. Contact Andy at Audio Access, P.O. Box 385, Whitestone, N.Y. 11357. 212-767-4958

ATTENTION DYNA AND HAFLER OWNERS:
Frank Van Alstine can rebuild most Dyna units and Hafler DH-200 amps with all new internal circuits. We transform Dyna St-80, St-120, ST-150, ST-300, ST-400, ST-416, SCA-80Q, and Hafler DH-200 amps into state of the art quality rugged POWER MOS-FET amps with new PC cards, precision parts, mos-fet output circuits, huge low inductance power supplies, shielded ground plain construction, totally free of transient distortion. We install new circuits in PAT-5, PAT-4 and PAS-3 preamps, complete with precision controls, exact RIAA equalization, matched precision parts, and achieve complete freedom from transient overload, even on Digital source material. *Audiogram* says our complete new circuits for the FM-5 & AF-6 make the world's best sounding FM tuner. We offer a 30 day satisfaction guarantee or your money back on our $99 super phono cartridge. Why pay for expensive new equipment when we can make your Dyna units better than new, for much less than new prices? We ship worldwide and have new 120 volt and 240 volt equipment available. Write or call us for our descriptive catalogue.

JENSENS STEREO SHOP
2202 RIVER HILLS DRIVE
BURNSVILLE, MINN. 55337, (612) 890-3517

ATTENTION NY—NJ!!!

• ACOUSTAT	• DCM	• MUSIC REFERENCE
• ACOUSTIC ELECTRONICS	• DENON	• NAD
• AUDIO RESEARCH	• FUTTERMAN	• ORACLE
• B&O	• HAFLER	• PETERSON
• BOSTON ACOUSTICS	• WIN MC-10	• RGR
• B&W	• KENWOOD AUDIO PURIST	• SNELL
• CARVER	• LINN PRODUCTS	• SUMO
• C J WALKER	• MONSTER	

• DAHLQUISTand more only at

CSA AUDIO

The Audio Professionals since 1972. Only knowledge and experience equal superior sound and service. Discover high performance stereo with complete customer satisfaction. For orders and information (serious inquiries by phone only):

201-744-0600
VISA, Master Charge Accepted
CSA AUDIO
193 Bellevue Avenue
Upper Montclair, NJ 07043

Sound system consultations to home music lovers, professional theatrical arts and the audio industry.

A TURNTABLE FOR ALL SYSTEMS
We enthusiastically represent the **SOTA SAPPHIRE** not simply because of its price ($750.), which is an amazing achievement. Nor simply for its good looks, astounding isolation, or ease of set-up. The **SOTA** is the **most** revealing turntable in the world—and not by just a little. We know, we have had them all (Linn, Oracle, Win). AUDIO ONE, Hermosa Beach, CA (213) 372-8888.

NY METRO AREA

ADS, AGI, APT, Astatic, Audio Control, Audionics, Audio Pro, Audio Research, Audio Technology, Beyer, Blaupunkt, B&O, Burwen, B&W, Carver, CAT, Cotter, CWD, Dahlquist, DCM, Denon, Dynavector, EV, Fidelity Research, Grace, Grado, Hafler, Janis, KEF, Koetsu, Linn Sondek, Live Wire, Lustre, Nakamichi, Pyramid, Quad, Queen Labs. Revox, RG Dynamics, RGR, RH Labs, Rogers, Snell, Stax, Symmetry. Tandberg, 3D Acoustics, VPI, Yamaha

Audiocom
high technology audio

SERVICE ON PREMISES • CUSTOM INSTALLATIONS
THREE LISTENING ROOMS ON TWO LEVELS
LARGE INVENTORY • PROMPT DELIVERY

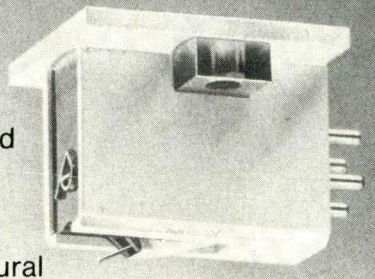
INFORMATION LINE 203-637-3621

177 Sound Beach Avenue, Old Greenwich, CT 06830
Major credit cards honored. Open 10 AM-6 PM Mon-Sat.

MOVING COIL CARTRIDGES

ARGENT

SUPERB MUSICALITY



The Argent Diamond produced the warmest, cleanest sound that ever emerged from my equipment. Highs are bright, but not shrill, the lows clearly defined, the textural middle strands noticeably separated. But perhaps the most amazing feature is that the attacks of the various instrumentalists are discerned as if in "live" performance.

Paul Turok
(Composer, Record Reviewer)

ARGENT DIAMOND **ARGENT RUBY**

MC110 **MC300** **ES1CE**

DIRECT SOUND CORP., 150 FIFTH AVE., SUITE 516, NEW YORK, N.Y. 10011 (212) 807-1598

FOR SALE

ATTENTION SOUTHERN AUDIOPHILES: Nakamichi, Bang & Olufsen, Polk Audio, Dahlquist, Carver, V.P.I., Ortofon, Jensen, Fulton, Proton. Mail orders welcome. Free shipping. Sound Advice, Village Plaza, Ruston, LA 71270. 318-255-8000

ATTRACTIVE PRICES; DYNAVECTOR, DENON, GRACE, FULTON, KOETSU, LINN, FR, BRB SYSTEMS, STAX, CJ WALKER. ALSO SOTA SAPPHIRE, QUAD 63. COD SHIPPING. SASE QUOTES. 713 7284343, MAURY CORB 11122 ATWELL HOUSTON, TEXAS 77096.

AUDIONICS SPACE & IMAGE COMPOSER, $700 CC-2 Amplifier, PZ3 amplifier, GAS Grandson. Call Shane 402-483-4511

AUDIOPHILE CASSETTE INSERT CARDS
20 cards $3.50 (Ca. residents add 6½% tax). Or send SASE for free sample.
RECORDING INDEX SYSTEMS
BOX 1624, LAFAYETTE, CA. 94549

AUDIOPHILE START UP SYSTEM

(ABOUT $700)

Turntable: NAD 5025
Cartridge: ASTATIC IM-10E
Receiver: NAD 7120
Speakers: 3D ACOUSTICS "THE CUBE"

SOUND BY SINGER

227 Lexington Avenue
New York, NY 10016
(212) 683-0925

AUDIO RESEARCH D100A—$550, D350—$1450. Call Terry 402-391-3842

AUDIO RESEARCH
NEW AND DEMO UNITS ALL WITH FULL FACTORY AND WARRANTY.
SP-6C-1 $1350, SP-8 $975, SP-7 $750, D-90(B) $1495, D-120 $1350. Sound World, Ltd., 4574 Pembroke Meadows S/C Virginia Beach, VA 23455 PH: 804-499-8555

AUDIO RESEARCH
SP6B, D-150, ALSO SCARDINA B&O WITH GRADO 3A. (714) 925-3729

We have the superb **MICHELL GYRODEC** on demonstration. Audio Alternative, 1124 E. Elizabeth, Ft. Collins, CO (303) 221 2268

BANG & OLUFSEN PLUS—Finally, audiophile sound quality coupled with elegant styling. Made in Denmark, you can have European craftsmanship at very affordable prices. **PLUS** quality control to assure optimum performance. Shipping anywhere in the continental U.S., DESIGNATRON'S STEREO STORES INC., 260 Old Country Road, Hicksville, NY 11801, (516) 822-5277.

BARGAIN HUNTERS BEWARE. Anyone trying to represent a Grace F-10L as being identical to an **F-11L** is either misinformed or lying. It took us two years of R & D to develop the **F-11L** from the old F-10L. Get the whole story before investing your bucks. Joe Abrams, Sumiko Inc. **415-843-4500.**

BEAM ACTIVE AND PASSIVE SYSTEMS ARE NOW BEING IMPORTED AND DISTRIBUTED BY B&K IMPORTS! DEALERS INQUIRIES WELCOME. B&K IMPORTS, 24160 TWIN VALLEY CT., FARMINGTON, MICH, 1-313-471-3076, 1-313-533-0508

ELECTRO-VOICE INTERFACE SPEAKERS—QUALITY IN EVERY PRICE RANGE. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

BEST SOUND IN THE NORTHWEST
Once I built my own turntable. Now, I offer the **SOTA SAPPHIRE,** simply the best table I've ever heard. Sound is relaxed, smooth, transparent. The **SAPPHIRE** is so good that all detours to Portland, OR will be well worth it! Truly State of the Art. Gilbert Audio, 503-232-5552.

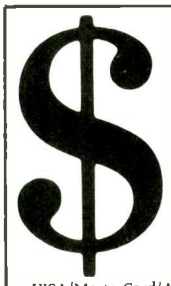
BOSE SPEAKERS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

FOR SALE

BEST TRADES OFFERED. We carry **ACOUSTAT, BERNING, COUNTERPOINT, FUTTERMAN,** P.S., THIEL, REGA, SOTA, VPI, AMBER, DYNAVECTOR, etc. Audio Doctor, 5731 North Pine St., Davenport, Iowa 52806. 319-386-8794.

BEVERIDGE RM1/2 PREAMP $1200. Ampzilla $350. Coloney Air Bearing T.T. new $1200 or b/o. R.E.L. Tuner b/o over $300. AR SP3-1a $550. N.B. 2 hd. amp. $300. Yamaha A1 $285.; 3020 Receiver $725. Ohm F's $625. Denon AU320 $60. Optonica RT6905 $550. Acoustat X $650pr. FR14 arm $115. Magnapan mod. 1672P $325pr. Revox A77 ¼ tk. $400. Sansui 9700 $495. B&O 4002 T.T. $385. Kenwood KT7000 $120. Rabco SL8 $75. P.L. 1000 $60. KLH 17 rec. $125. Scott 296 amp b/o. Scott: 272 $125.; 350B $115.; T335 Tuner $250. Marantz: 3800 $175.; mod 19 rec $595.; 500 amp $525.; SLT12U $150. Fisher: mod 500b, 500c, 800-b/o. Fisher SA100 $75 ea. X202C $125.; X101 $100. Mac. C11; C22 b/o. Trades Considered. (212) 377-7282.

BIPOLAR 850 POWER AMP, $950; van den Hul-modified Yamaha MC1x (plug-in) MC cartridge, $350; Ortofon T-30 MC transformer (switchable impedance), $300; Michel Gyrodec turntable, $700; Modjesky RM4 head amp, $375; Len Hupp-modified Linn Ittok tonearm, $395. All perfect. (415) 526-5736 eves.



The Best Doesn't Mean the Most Expensive.

Low prices on a huge selection of name brand hi-end. All units are new with full warranty. Let our experts guide you to the best sounding system for your dollar. Call for information or write for a free catalog.

VISA/MasterCard/American Express

The Audio Advisor, Inc.
Box 6202. Grand Rapids MI 49506 616-451-3868

FOR SALE

BEVERIDGE RM-½ PREAMP, $2495; Audio Research SP3A1, $550, D100B, $695; Nestrovic 4 Speakers, $1295; Klipsch K Horns, Rosewood, $2100; B&W DM12 Speakers, $595; Technics SP-10 Turntable, $295; Breuer Arm $595. (509) 946-1529 evenings West Coast.

BOSTON ACOUSTICS PLUS—Dollar for dollar, one of the most exceptional speaker lines to come along in years. Boston Acoustics delivers unbelievable performance at very reasonable prices. All models in stock. DESIGNATRON'S STEREO STORES, INC. 260 Old Country Road, Hicksville, NY 11801 (516) 822-5277.

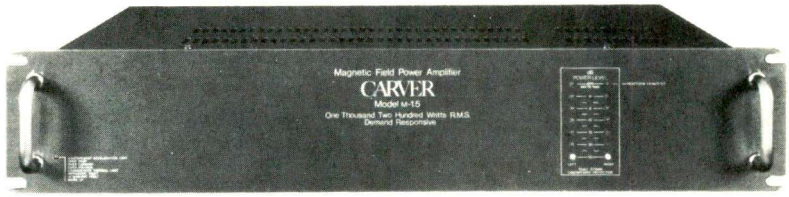
BOULDER SOUND GALLERY REPRESENTS Acoustat, Accuphase, Bang & Olufsen, B & W, Boston Acoustics, Denon, Hafler, Luxman, NAD, Pyramid, Quad, RH Labs, Tandberg, Threshold, and more. The only store in the Rocky Mountain West where you can hear the Koetsu, Fidelity Research, Denon, Grace, Signet, Accuphase, and Dynavector cartridges. 1200 Pearl Street, Boulder, Colorado, 80302, 303-444-2626.

CABLE TV DESCRAMBLERS AND CONVERTERS. Plans and parts. Build or buy. For information send $2.00. C&D Electronics, Inc., P.O. Box 21, Jenison, MI 49428.

• WE WILL •
NOT BE BEAT!
SUPER SELECTION• FULL WARRANTY• FAST DELIVERY
• HI-FI, HIGH END & VIDEO •

VISA **CALL (203) 934-5291 NOW!** MAC
★ AUDIO PEOPLE ★
1000 Orange Ave., West Haven, CT 06516

Bob Carver and Monster Cable.



Innovators at Work.

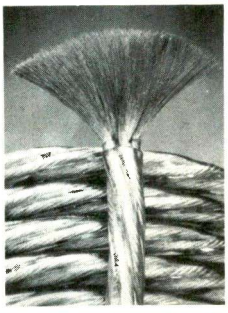
Squeezing 750 watts of power into a small 16 lb. package is no small feat. But that's what Bob Carver has done with his new M 1.5 amplifier.

Bob Carver is an innovater when it comes to designing state of the art components. And Bob recognizes innovation when it comes to speaker wire. That's why he recommends Powerline by Monster Cable for all amplifiers.

"Powerline provides a more direct coupling between the amplifier and the speaker. The results are dramatic, especially with the M 1.5." Powerline's unique 4 conductor configuration allows the magnetic fields traveling in opposite directions to cancel themselves, dramatically reducing dynamic distortion.

The Result?

Smooth, easy to listen to highs. Tight, well articulated bass, precise imaging, and dynamic impact that rivals the original musical event.



Powerline will bring out the best in ANY amplifier regardless of cost or design.

Including your Carver.

And that's innovation at work.

Monster Cable Products Inc.,
101 Townsend St., San Francisco
CA 94107 (415) 777-1355

POWERLINE
by MONSTER CABLE USA

FOR SALE

BRB SYSTEMS

Model 1B Moving Coil Amplifier—Finally, a truly state-of-the-art moving coil amplifier at a reasonable price. Class A design, Class A sound. Ultra quiet. Battery life of 2500 hours. 200kHz bandwidth. Adjustable gain and load impedance. Steel enclosure for magnetic as well as electrostatic shielding. Auto-biasing; no trimpots to adjust. Retail price $139.00.

Model 10 Preamplifier—A full function preamplier based on the use of custom linear modules for the amplification of moving coil, moving magnet, and high level signals. All Class A circuitry using dual differential stages for maximum power supply rejection. Fully regulated power supply. Semitoroidal transformer. Quasi-complementary outputs for exceptional current drive capability under the most demanding conditions of load and drive. Ultra high speed, low noise circuitry. $539.00.

Model 120 and Model 200 Reference Amplifiers—Finally, Class A performance has been achieved without compromising efficiency, reliability, and high power output. The BRB Reference Amplifiers operate Class A up to rated output and have low TIM, low static distortion, high slew rate, and are unconditionally stable when driving the most difficult speaker loads. They run cool to the touch. These are the only amplifiers that eliminate Transient Thermal Debiasing Distortion (TTDD), a major cause of transient crossover distortion in ANY design that is not PURE Class A. $669.00 and $949.00. Slightly higher in the East.

To find out more about the full line of products from BRB Systems, send for full product information and the name of the dealer nearest you. Dealer inquiries welcome. BRB Systems, P.O. Box 2235, Sunnyvale, California 94087. (408-730-1363).

CARVER QUALITY AMPLIFIERS, PRE-AMPLIFIERS, TUNERS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

FOR SALE

BRB SYSTEMS
Dealer Listing
Ears Nova—Great Neck, New York
Sound by Singer—New York, New York
Eardum—Nanuet, New York
CSA Audio Design—Upper Montclair, New Jersey
Q Audio—Cambridge, Massachusetts
Village Multi-Track—Rochester, New York
Audio Alternative—Fort Collins, Colorado
Musical Images—Fresno, California
Nevada Audio—Gardnerville, Nevada
Hi Fi Gallery—Indianapolis, Indiana
Audio Insight—Fort Lauderdale, Florida
Maury Corb—Houston, Texas
Paragon of Sound—Bethesda, Maryland
The Sound Center—Woodland Hills, California
The Mountain Ear—Carbondale, Colorado (Aspen)

BRYSTON & WALKER AT
KEITH YATES AUDIO 916-441-0443

CALL HI FI BUYS (ATLANTA) for Acutex, Adcom, Aiwa, Apt, AR, B&O, Carver, DCM, Dynavector, Hafler, Harman Kardon, JVC, Linn, Mirage SM-1, Mission, Mitsubishi, NAD, Nakamichi, Onkyo, Oracle, RGR, Sony, Thorens, 3-D Acoustics, Vandersteen, and more. Free shipping, fully insured, in the Continental U.S. Just call 404-261-4434 for more information.

CANLEN's answer to the high price of high performance cartridges: the new **PREMIER LMX** delivers the kind of resolution, tracking, and detail you'd expect from other moving coils costing $400-$600. At $200, it's unbeatable. Hear it for yourself at **CANLEN AUDIO,** 612 W. Broad St., Bethlehem, PA 18018.

CANTON ERGO $2,500 PR. Call Terry 402-391-3842

FOR SALE

CROWN QUALITY AMPLIFIERS, TUNERS, PRE-AMPLIFIERS. CALL FOR PROFESSIONAL CONSULTATION. BEST PRICES — PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

CENTRAL AND SOUTH TEXAS AUDIO ENTHUSIASTS: Audition the finest in home music systems—LINN, NAIM, REGA, SPENDOR, GOLDRING, KEITH MONKS SERVICE. By appointment. Third Ear, (512) 327-2937, evenings, weekends.

HARMAN-KARDON SEPARATES, RECEIVERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; (213) 840-0878.

Chicago area music lovers . . . if you thought a $200 moving coil had to be a compromise, listen to **PREMIER'S** new **LMX.** Acclaimed by the "undergrounds" for superb musicality, the **LMX** tracks like a champ and peels off the veils. Now playing at **COLUMBIA AUDIO VIDEO,** 1741 Second St., Highland Park, IL, 60035.

CLEARANCE, ONE-OF-A-KIND—Audiostatic ES-240 Speakers-$1350/pair, McIntosh 2205 Amplifier-$1200, Kenwood LO7D Turntable-$1100, Crown Distinction Components—(Call), Kenwood LO7MKII Amplifiers-$500/pair, Kenwood 600T Tuner-$270, Nakamichi 530 Receiver-$550, Nakamichi 680ZX Cassette Deck—$1100, Fried Model T Subwoofer-$600. All subject to prior sale. DESIGNATRON'S STEREO STORES, INC., 260 Old Country Road, Hicksville, NY 11801, (516) 822-5277.

CLOSEOUT BARGAINS—ADVENT, DUAL, KENWOOD, MXR, MARANTZ. FREE LIST. SCC, BOX 551, DUBLIN, OHIO 43017

NAKAMICHI CASSETTE DECKS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

COLLECTOR'S ITEMS. HIGH FIDELITY, Vol. 1 No. 4 Spring 1952, Vol. 3 No. 1 Mar-Apr 1953, Vol. 3 No. 2 May-June 1953. AUDIO May 1962, 15th Anniversary Issue (includes biographies of audio pioneers). RADIO MASTER ENCYCLOPEDIA, Special Reprint, FIRST EDITION 1935-36. $250. or best offer. Box 573 Williamstown, MA 01267

CONCERT SOUND BRINGS THE FINEST AUDIOPHILE PRODUCTS TO SOUTH TEXAS—Acoustat, Amber, Berning, Citation, Harman/Kardon, Linn, Mission, OHM Walsh 2, Polk Audio, Quicksilver, Rega, Sota, Thorens, C.J. Walker, Vandersteen, Dynavector, Grado, Promethean, Kimber Kable, Nitty Gritty, Namiki, Marcof, Peterson, Ultrawire. 6104 Broadway, San Antonio, Texas 78209, (512) 822-1224

CONTENDER OR NEW CHAMPION?
The most prestigious English journal calls the **SOTA SAPPHIRE** the American "contender to the Linn Sondek Crown." We think the **SOTA** is CLEARLY better—more neutral, better built, superior isolation, and a **much** better value. Long live the New King! In Milwaukee, hear **SOTA** at Sound Investments, 7419 W. Bradley (414) 354-4030.

ROGERS MONITORS The masters of imaging. The Sound Chamber, 2584, Ridge Road West, Rochester, NY (716) 225 8660 and 2930, Monroe Ave, (716) 381 9348

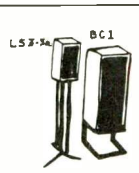
ROGERS. No magic or mystique, just music. All new speakers on demonstration. Custom Stereo, 1391 S. Hamilton Road, Columbus OH (614) 235 3531

ROGERS SPEAKERS A reference standard. Chestnut Hill Audio, 311 Cherry St, Philadelphia, PA (215) 923 3035

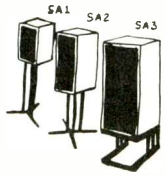
CROWN PL-1-SL-1, $600, DL-2, $1,899. Call Shane 402-483-4511

CROWN SP744 4-channel player, 15, 7½, 3¾ IPS; **CROWN** recorder parts; **RUSSOUND** QT-1 4-channel switching/patching center, VS-1 speaker switchbox w/ phone monitor, MP-2 amplifier switchbox w/volume controls, TMS-1 recorder switchbox; **KLH** DNF-1201A dynamic noise filter; new **DBX** #122 and #118; other components avail.; Used absolutely mint at best offer. 912-764-9335.

THE MICHELL GYRODEC musically and aesthetically stunning. Audio by Caruso, 13831 S. Dixie Hwy, Miami, FL (305) 253 4433



SPENDOR
BBC Standard Equipment
RCS Audio International Inc.
1055 Thomas Jefferson Street NW
Washington, D.C. 20007



plateau™
SPEAKER STANDS

Plateau speaker stands are the easiest and least expensive way to dramatically improve the performance of your audio system. The speaker is acoustically decoupled and positioned so that bass is tighter, midrange is clearer and stereo imaging is more precise. Complete your system with Plateau.

FOR MORE INFORMATION, PLEASE MAIL COUPON

NAIAD PRODUCTS INC
BOX 1250 FALLS STATION
NIAGARA FALLS, N Y 14303-0260
TEL. (519)756-4860. TELEX 061-81284

Name _____
Address _____
State _____ Zip _____

• ACOUSTIC ELECT • AUDIO STATIC ESL
• B&W • THE DAVID BERNING CO.
• CRAMOLIN • DENON • DYNAVECTOR
• ELITE FURNITURE • ENERGY LOUDSPEAKERS • FULTON • GOLDMUND • GRACE
• GRADO • HAFLER • HILL PLASMATRONICS
• JANIS • KEITH MONKS • KOETSU • LAST
• LINN SONDEK • LIVE WIRE • LUSTRE
• MARCOF • MEGASONICS • MONSTER CABLE • MUSIC REFERENCE • NAD
• NAKAMICHI • NITTY GRITTY • PENTAGRAM
• PLATTER MATTER • PSE • POLK AUDIO
• PRECISION FIDELITY • PROMETHEAN
• PYRAMID • SIGNET • SNELL ACOUSTICS
• SPICA • STAX • SUMO ELECTRIC • SUPEX
• TANDBERG • THETA ELECTRONICS • VPI
• C.J. WALKER

the listening room
590 Central Park Avenue
Scarsdale, N.Y. 10583
Mon, Thurs, 10-9 PM
Tues, Wed, Fri, 10-7 PM/Sat 10-6 PM
Credit Cards Accepted
We ship FREE Anywhere in the Continental U.S.A.
914-472-4558

FOR SALE

THE MICHELL GYRODEC a step ahead in the art of disc reproduction. Audio Consultants, 1014 Davis St., Evanston, IL (312) 864 9565

THE MICHELL GYRODEC already becoming a legend. Chestnut Hill Audio 311 Cherry St., Philadelphia, PA (215) 923 3035

DAHLQUIST DQ-10 UP-DATE

DRT-1 RIBBON TWEETER KIT	$249.00
PRC-1 POLYPROPYLENE CAPACITOR KIT	$169.00
MB-1 MID BASE KIT	$159.00
DF-2 FELT KIT	$15.00

Send for our Dahlquist DQ-10 catalog. Postage paid in U.S. Visa, M.C., money order or check.
RANDALL RESEARCH, (714) 760-1539
719 Fernleaf, Corona Del Mar, Ca. 92625

DB SYSTEMS AUDIOPHILE ACCESSORIES INCLUDE: DBP-2JAU Switch Box with gold jacks $54.95, DBP-6 Phono Equalization Kit and DBP-6MC Resistive Loading Kit $34.95, DBP-10 Phono Alignment Protractor $21.95, DBP-12 Audio Cable—10 meter, 400 pF $65.95, DBP-CK Cramolin Audio Kit $12.95. GOLD PLATED CONNECTORS (eight pack) DBP-13J (¼") Phono Jacks $12.95, DBP-13JR (⅜") Phono Jacks $15.95, DBP-13P Phono Plugs $7.95, DBP-14 Spade Lugs $5.95 DBP-9AU Banana Plugs $14.95, DBP-9J Dual Banana Jacks (two pack) $15.95. For complete information write: DB SYSTEMS, Main St., Rindge Ctr., NH 03461 (603) 899-5121. Orders under $45 add $2.50 Handling. Dealer inquiries invited.

DCM QUALITY SPEAKERS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

DENON RECEIVERS, AMPLIFIERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

DELUX MARANTZ 2265 AM/FM 65 watts receiver, new condition, $350. 601-634-0145

DELUX MARANTZ 3250 PREAMP, rack mountable, excellent $245. 601-634-0145

DQ-10 REBORN
Modified Panasonic Leaf Tweeters, brackets, instructions. Dramatic improvement, $150.00. Literature and catalog $2. New York Acoustics. 578 Nepperhan Avenue, Yonkers, N.Y. 10701. (914) 476-4900

FOR SALE

DIAMOND NEEDLES and STEREO CARTRIDGES at DISCOUNT PRICES for SHURE, PICKERING,STANTON, EMPIRE, GRADO, AUDIO TECHNICA, ORTOFON, SONUS and ADC, send S.A.S.E free catalog. LYLE CARTRIDGES, Dept. A., Box 69, Brooklyn, NY 11218. For fast COD service Toll Free 800-221-0906. N.Y. State (212) 871-3303. 9AM - 8PM except Sunday.

DIRECT DISC, DIGITAL RECORDS and selected audio components below cost. Send $2.00 for catalog. 1162 Brookwood Dr., Elkhart, IND 46514

DYNACO OWNERS: 60,000 LBS PARTS/ACCESSORIES! Complete Kits: PAT5 BI-FET preamp, $169; SE10 equalizer, $177; ST150 power amp, $179; 200/200W power amp, $289. FREE catalog. SCC, Box 551, Dublin, Ohio 43017; (614) 889-2117.

DYNACO ST-400 (VanAlstine modified) with meters and fan. Dynaco PAT-5 (Upgrade to FET) and FM5 (recently aligned). Best offer. Call (201) 386-4579.

DYNA STEREO 70 AMPLIFIERS (PAIR), w/tubes. Inquire or offer. Box A-283.

ELECTRO-VOICE INTERFACE SPEAKERS—QUALITY IN EVERY PRICE RANGE. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

ELECTROCOMPANIET Preampliwire/Ampliwire II at Audio Connection. Call 201-239-1799

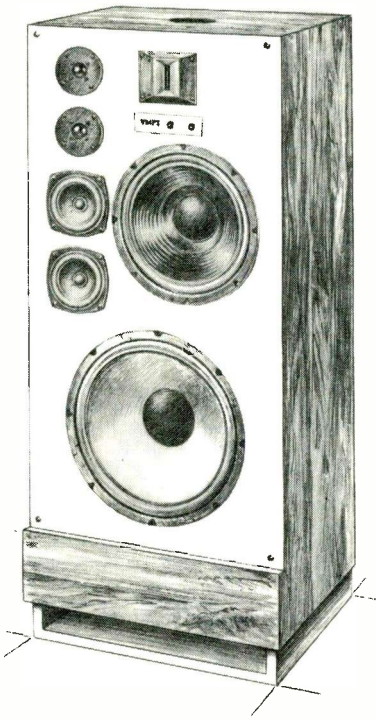
ELECTRONIC X-OVERS: 6, 12 AND 18DB/OCTAVE. Kits from $106.50. Also Transient-Perfect Crossover model 6000-6, $175.00. Filters. Free folder w/reviews. ACE AUDIO CO. #532-5th Street, E. Northport NY 11731-2399. (516) 757-8990.

EMT & THRESHOLD AT
KEITH YATES AUDIO 916-441-0443

EPA-100, TECHNICS MC-305 CARTRIDGE, Dynavector ruby, Dayton Wright preamp (SPA), Watson-10, Dunlop Clark-1000, Threshold 4000, Fulton gold cables. 201-991-6311

FREE CATALOG. Gadgets for television, stereos, telephones and speakers. Creative Electronics 10043 Gothic Ave. Sepulveda, Ca. 91343

STILL LOWER LOUDSPEAKER DISTORTION



The VMPS Super Tower/R, $679ea kit, $969ea assem in rosewood or satin walnut. 50x18x18" (HxWxD), 140 lbs. Sold in mirror-image pairs. Portrait by Keith Criss, Oakland, CA. Attaboy Keith.

The VMPS Super Tower/R is a magnificent nine-driver, six-way ultra-low-distortion loudspeaker with neutrality of response, wide bandwidth, and high output level capacities to please the most demanding audiophile.

Total harmonic distortion with one Watt drive does not exceed 0.5% (22Hz-30kHz). Exclusive features such as minimum phase response, single amp or biamp operation **without** an external crossover, internal wiring with Monster Cable, mylar/polypropylene crossovers, no resonances whatsoever within the audio range, and now mirror-image, dual line-source baffle design combine to afford you, the listener, with music reproduction of astounding realism second only to our highly acclaimed, 6½ft tall Super Tower IIa/R system.

Hear the Super Tower/R at the dealers listed below, or write us for full information on all the VMPS floor-standing systems including the **Mini-Tower II** ($309ea kit, $439ea assem), **Tower II** ($419ea kit, $599ea assem), and **Super Tower IIa/R** ($999-1199ea kit, $1499-1699ea assem).

All prices include **free shipping** in USA and kits are supplied with cabinets fully assembled. Full reviews and test reports from Bert Whyte, B.V. Pisha, Hifi-News & Record Review, and Hifi Buyer's Guide also available on request.

VMPS AUDIO PRODUCTS
div. Itone Audio
1016 Contra Costa Drive, El Cerrito, CA 94530
(415) 526-7084

Hear VMPS at: The Listening Studio, Boston, MA; Mike Hilliard Audio, Shreveport, LA; Odin Sound, Longmont, CO; Mainline II, Johnstown, PA; Wallace Brown Audio, Oklahoma City, OK; The Long Ear, Big Bear Lake, CA; Woodland Stereo, Woodland Hills, CA; Sounds Unique, San Jose, CA; The Listening Post, San Francisco, CA; Itone Audio, El Cerrito, CA; A-Vidd Electronics, Long Beach, CA.

CLASSIC

Music lovers from all over Northern California journey to beautiful Sausalito for personalized service, and expert advice in selecting "classic" audio components. There must be a reason!

Some of our "classic" components... Audio Research, Vandersteen, Oracle, Quad, Snell, Thiel, Counterpoint, Electrocompaniet, Rega, QLN, Shahinian, Pyramid, PS Audio, NAD, Hafler, Spica, Koetsu, Accuphase, and many more. **MUSIC by DESIGN 107 Caledonia St, Sausalito, CA (415) 332-2142**

THE IMPOSSIBLE TAKES A LITTLE LONGER.

TATE II SURROUND STEREO SYSTEM

UNPARALLELED ABILITY TO TRANSPORT YOU TO THE LIVE PERFORMANCE.

INCORPORATING MORE THAN **10 YEARS RESEARCH** AND **5-PATENTS** (OTHERS PENDING) THE MODEL 101A CAN VIRTUALLY RECREATE A MUSICAL EVENT IN ITS NATURAL PERSPECTIVE FROM ANY GOOD TWO CHANNEL STEREO OR VIDEO SOURCE MATERIAL. DIMENSION AND SPACIOUSNESS ARE INCREDIBLE, REACHING BEYOND THE WALLS IN ALL DIRECTIONS. SOUNDS ARE SUSPENDED IN SPACE ALL AROUND THE LISTENER, EVEN UP AND DOWN WITH IMAGING AND OPENNESS NEVER HEARD BEFORE. NOTHING ARTIFICIAL HAS BEEN ADDED OR TAKEN AWAY FROM THE ORIGINAL SIGNAL. NO AUDIBLE DISTORTION, NOISE, OR CHANGE IN TONAL BALANCE. INTRODUCTORY PRICE $474.95. WRITE OR CALL 602-445-6999 FOR FREE INFORMATION.

FOSGATE RESEARCH INC
714 CLUBHOUSE DR. PRESCOTT, ARIZONA 86301

AMERICAN AUDIOPHILE

These are some of the quality products we carry:

B & W	NOVA
COUNTERPOINT	P S AUDIO
DCM	RGR
DENON	SOTA
DYNAVECTOR	TAMANTON
JANIS	TANDBERG
LEACH	TRIAD
MARIAH	VANDERSTEEN
NAD	VPI

AR TURNTABLE modifications

AMERICAN AUDIOPHILE
716 Madison Ave. New York, N.Y. 10021
(212) 751-9733
5 Sunrise Plaza, Valley Stream, N.Y. 11581
(516) 561-7114

All shipments prepaid and insured
FREE throughout continental U.S.

MASTER CHARGE & VISA ACCEPTED

FOR SALE

ROGERS SPEAKERS Everyones reference standard, Audio Excellence, 425 Washington St. San Francisco, CA (415) 433 1335 and 1081, Saratoga/Sunnyvale, San Jose CA (408) 446-4998

EV SENTRY III authentic studio monitors, $900./pr. 601-634-0145

FREE SPEAKER CATALOG!
Woofers, mids, tweeters, hardware, crossovers, grille cloth, plans, kits, information, much more. Discount Prices! UNIVERSAL SOUND, Dept. AO, 2253 Ringling Blvd., Sarasota, Fla. 33577 (813) 953-5363.

FREE SPEAKERKIT CATALOG 17 proven designs. Also, 200 drivers' specifications, JBL + polypropylene Thiele data, $3. GOLD SOUND, Box 141A, Englewood, CO 80151. (303) 789-5310.

FRIED M/2 SPEAKERS; $1000. 412-339-1845

FRIED SPEAKERS & KITS
State-of-the-art sound. Try our prices! Fast, free shipping. READ BROS. STEREO, 593 King St., Charleston, S.C. 29403. (803) 723-7276. Also Hafler, NAD, Carver, Nakamichi, Sony PCM F-1.

FUSELIER MODEL 3 loudspeaker: Hear it impeccably demonstrated at Audio Connection, 201-239-1799

FUTTERMAN OTL AMPLIFIERS
There are 6 models of the world's only tube amplifier that needs no output transformer, including a special model for the Quad speakers. For a complete set of technical papers and historical documents send $4.00 to New York Audio Laboratory, Inc. 33 North Riverside Ave., Croton-on-Hudson, N.Y. 10520

AAA POLYPROPYLENE CAPACITORS New TRW SMFD 200VDC ± 10% $4.50 each, any quantity 1 to 1,000+. Electro Magnetic Corporation, 5949 Hilltop Drive, Carmichael, CA 95608 (916) 334-6040

FOR SALE

GAS

FACTORY SEALED—LIMITED QUANTITIES

- THALIA II PREAMP $225
- GRANDSON 40 W/CH AMP $225
- GOLD PLATED CABLES (5FT PAIR) $10
- SLEEPING BEAUTY CARTRIDGES $150
- SUPER ELLIPTICAL CARTRIDGE $100
- SPHERICAL CARTRIDGE $75

ALSO AUDIO METRIC HEAD AMP $80

SHIPPED FREE IN CONTINENTAL U.S.
VISA—MASTER CHARGE—MONEY ORDERS

THE SOUND CENTER
8033 SUNSET BLVD., SUITE 194
WEST HOLLYWOOD CA 90046
OR CALL
(213) 650-0060

GENERAL RADIO AUDIO FILTER #1952 tunable 4-60kHz, 30dB/oct hi, lo, band pass & reject (617) 473-6025

GRACE G-707 AND G-747 OWNERS: SUMIKO's new VTA-7 allows you to dial in vertical tracking angle adjustment during play. Indispensible for van den Hul/cutter analogue/extended line contact styli. Now at your **GRACE** dealer or call (415) 843-4500 for name of nearest dealer.

GRACE—RUBY CANTILEVER FOR F9 SERIES
We offer the Grace 747, 707MK2, 704, F11L, F9E and RUBY. Visa and MC. FREE SHIPPING IN US AND PR. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

FOR SALE

GRACE F9E's and F9E Rubys's, New With Warranties. "We Will Not Be Under Sold". (206) 323-4987

HAFLER DH-220K, DH-110K $550.00 BOTH, DH-355 $325.00pr, FUMIG C-1000, M-1000 $550.00 both, HARMAN-KARDON CD-401 $585.00, CD-301 $435.00, HK-580i $390.00, HK-680i $500.00, RADIO SHACK MODEL 3 COMPUTER, 48K, TWO DRIVES $1725.00. SONY PCM-F1 $1450.00, TC-K555 3 head cassette $350.00, 203-777-1476

HAFLER ELECTRONICS & SPEAKERS
We are now stocking: DH-101K $199.95, DH-101A $299.95, DH-102 $55.00, DH-110K $299.95, DH-110A $399.95, DH-112 $74.95, DH-160K $299.95, DH-160A $399.95, DH-220K $349.95, DH-220A $449.95, DH-220KE $359.95, DH-220AE $459.95, DH-355 $400.00 per pair (speakers), DH-500K $599.95, DH-500A $749.95, DH-500KE $619.95, DH-500AE $769.95. 101, 200 and 220 accessories. FREE SHIPPING IN US AND PR. WORLD-WIDE EXPORTING. Visa and MC. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

HAFLER IN THE SOUTH!
In stock, the superb Hafler DH-110 pre-amp and DH-220 & DH-500 amplifiers, Immediate. FREE shipping. Also Fried, Carver, Sony PCM-F1 Acoustat, NAD, Nakamichi, Audire, PS, Klipsch, more. READ BROTHERS STEREO, 593 King Street, Charleston, South Carolina 29403, (803) 723-7276

HAFLER IN THE WEST! REFERENCE AUDIO SYSTEMS (213) 398-4205.

HAFLER PLUS—The new Hafler DH220 power amplifier—replacing the DH 200, reinforces David Hafler's commitment to quality in every product he designs. We carry the full Hafler line, available in either kit or factory assembled. Own some of the finest audio equipment! Now at extra savings! **PLUS-FREE** shipping anywhere in the continental U.S., DESIGNATRON'S STEREO STORES, INC., 260 Old Country Road, Hicksville, NY 11801, (516) 822-5277.

HCM RECOGNIZES SOTA
We specialize in phono systems and we spent hours modifying turntables because none was exactly right. Until we came upon the **SOTA SAPPHIRE,** our reference. This is how a turntable should be built and how it should sound. The first really professional American turntable. In Chico, CA, (916) 343-0558.

HAFLER AMPLIFIERS PRE-AMPLIFIERS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

HARMAN-KARDON SEPARATES, RECEIVERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; (213) 840-0878.

ROGERS NEW SPEAKERS incredible detail and resolution, Hi Fi Gallery, 811 Broadripple Ave., Indianapolis, IN (317) 253 5141

GALA SOUND

A NEW STANDARD OF EXCELLENCE

Many serious listeners have been misled by certain well intentioned but musically and technically incompetent "audiophile" publications.

Thousands of dollars have been spent on poorly engineered products acclaimed in these publications whose expertise lies in journalism, not audio. The goal of improved reproduction of music is not well served in this manner.

Pianist James Gala has established a unique audio salon in Rochester, New York.

GALA SOUND sells correctly engineered and musically accurate audio components. We are involved in the recording—both analog and digital—of philharmonic orchestras, have a continuing dialogue with the world's preeminent audio engineers, and Mr. Gala performs in concert regularly.

We fly our customers round trip at our expense from anywhere in the continental U.S. to our store for the selection of an audio system of $5,000 or more.

Phone (716) 461-3000 today and ask for Mr. Gala. If music is important in your life, then you deserve a stereo system from GALA SOUND.

650 MONROE AVE. ROCHESTER, NEW YORK 14607

GALA SOUND

INDUSTRY BLUE BOOK

- Over 32,000 products
- 10th year, 500 pages
- Hardbound, $85.00

ORION PUBLISHING CORP. 1012 Pacific A-1
San Luis Obispo, CA 93401 805-544-3851

ACTIVE ELECTRONIC CROSSOVERS

STEREO BI-AMP $139
STEREO TRI-AMP $230

Level controls and sub-sonic filters, summers, optional. Filters, regulated power supplies, equalizers, are also available.

Free catalog and price sheet

DeCoursey **Eng. Lab.**
11828 Jefferson Bl. Culver City, CA 90230
PHONE (213) 397-9668

FOR SALE

In N.J. when ROGER ISELE SPEAKS . . .
Even I was silenced by the **SOTA SAPPHIRE.** After 20 years in the audio business, I'm proud to say that the high-end turntable has come of age. You can now buy American—the **SOTA** does it all. Frazier Associates, Upper Saddle River, (201) 327-2153.

In pursuit of excellence. If the rest of your system has the resolution ability, you'll appreciate the improvement made by **THE ARM.** Designed by David Fletcher, this is perhaps the finest pivoted tone arm in the world. Audition by appointment please. **FRAZER ASSOCIATES,** Upper Saddle River, NJ 07458 (201) 327-2153.

IN STOCK! Audio Research, Thorens, RGR, Hafler, Onkyo, Technics, B&W, Meridian, E.V., Vandersteen, Dynavector, Snell, Tascam and more . . . For information: P. K. Audio, 4773 Convention Street, Baton Rouge, LA 70806 or (504) 924-1001.

Is −84db RUMBLE S.O.T.A.?
That's the weighted rumble figure **AUSTRALIAN HI-FI** calculated for the **SOTA SAPPHIRE** in a recent survey. It topped all comers. $750. in oak, $850. in Koa wood. In Honolulu, Sound Originals, now at Century Center (808) 941-8873. Also new: the SOTA RIAAL, the ultimate step-up!

It's more than a Breakthrough; it's a revelation. The breakthrough is the detail and image resolving quality of the **PREMIER LMX.** The revelation is that this level of performance is available at around $200. **PREMIER's** new **LMX** moving coil phonocartridge now at **AUDIO BREAKTHROUGHS,** 1534 Northern Blvd., Manhasset, NY 11030.

JANIS WOOFERS & INTERPHASE CROSSOVER/AMP
The Janis bass systems are the finest universal subwoofer systems available. FREE SHIPPING IN US AND PR. Visa and MC. WORLDWIDE EXPORTING. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

JANSZEN Z412-HP. Also Janszen Z210. Best offer. Call (201) 386-4579.

JBL RECONED WOOFERS, MIDS, TWEETERS—Mostly older models with Alnico. Limited supply priced to move. SCS, 870 Commonwealth, Boston, Mass. 02215, 617-277-4640/4600

J.B.L. SPEAKER SYSTEMS AND COMPONENTS bought, sold and traded. 1-313-229-5191 or 5115 Red Fox, Brighton, MI 48116.

JRM POWER TOWER AMPS; 3PBP Electronic Crossovers; Transparency Loudspeakers. Jerry Martin, 3716 Broadway NE, Knoxville, Tn. 37917 (615) 688-6501.

ROGERS SPEAKERS Your ears should be so good!! Jannen Systems, 214, W. 21st St, Hazleton, PA (717) 459 5722

DISCOUNT WORLD

TDK SAC90	2.50	Maxell UDXL2C90	2.95
TDK MAC90	4.75	Maxell UDXL2SC90	3.75
Technics Receiver SA104	125.00	Technics Receiver SA203	139.00
Technics Cass. Deck RSM205	99.00	Technics Cass. Deck RSM224	119.00
Sony Receiver STRVX1	159.00	Sony Receiver STRVX22	179.00
Sansui Receiver R606	209.00	Sansui Cass. Deck D77FB	159.00
Pioneer Car Stereo KP4500	119.00	Pioneer Car Speakers TS106	33.00
Pioneer Car Stereo KP5500	129.00	Pioneer Car Speakers TS108	45.00
Pioneer Car Stereo KP8500	139.00	Pioneer Car Speakers TS1622	40.00
Pioneer Car Stereo UKP4200	129.00	Pioneer Car Speakers TS1644	60.00
Pioneer Car Stereo UKP5600	169.00	Pioneer Car Speakers TS168	80.00
Pioneer Car Stereo UKP7600	189.00	Pioneer Car Speakers TS411	49.00
Pioneer Car Stereo UKE3100	189.00	Pioneer Car Speakers TS694	55.00
Pioneer Car Stereo KE5100	209.00	Pioneer Car Speakers TS695	80.00
Pioneer Car Stereo KE6100	239.00	Pioneer Car Speakers TSX6	75.00
Pioneer Car Stereo KE7100	289.00	Pioneer Car Speakers TSX11	199.00
Sony Car Stereo XR25	149.00	Sony Car Stereo XR50/50B	209.00
Sony Car Stereo XR35	179.00	Sony Car Stereo XR70/70B	289.00
Sony Car Stereo XR55	239.00	Sony Car Stereo XME7	139.00
Sony Car Speakers XS101	39.00	Sony Car Speakers XS301	59.00
Sony Car Speakers XS102	49.00	Sony Car Speakers XS66	99.00
Jensen Car Stereo RE518	259.00	Jensen Car Speakers J1069	45.00
Jensen Car Stereo RE512	239.00	Jensen Car Speakers J2033	99.00
Jensen Car Stereo R210	129.00	Jensen Car Speakers J2037	69.00
Blaupunkt Car Stereo CR2002	209.00	Blaupunkt Car Stereo CR2010	269.00
Concord Car Stereo HPL101	149.00	Concord Car Stereo HPL112	169.00
Panasonic Car Stereo CQS900	319.00	Panasonic Car Stereo CQS756	189.00
Clarion Car Stereo 7500R	209.00	Clarion Car Stereo 3150R	79.00
Clarion Car Stereo 5550R	149.00	Clarion Car Stereo 300E0B3	125.00
Clarion Car Stereo 5150R	119.00	Clarion Car Stereo 100E0B4	65.00
Altec Car Speakers 6X9 4C	85.00	Altec Car Speakers SK2	69.00
Whistler Rad. Det. Q1000	209.00	Fox Superfox Remote	229.00

DISCOUNT WORLD, P.O. BOX 191, MINEOLA, N.Y. 11501 516-294-6136
Shipping charges are $4.00 per order to continental U.S.A. We accept money orders, cashiers or certified checks. Personal checks - 3 week delay. Write for FREE catalog. N.Y.S. Res. add sales tax

FOR SALE

DENON RECEIVERS, AMPLIFIERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

KLH MODEL NINE ELECTROSTATICS. Mint condition. Two pair. Best offer. Floriani 24 D Street Seaside Park 08752

LINN DISC SYSTEM ALWAYS IN STOCK! GENE RUBIN AUDIO (213) 571-1299 (PAC).

LINN PRODUCTS, MODIFICATIONS & NAIM
We are pleased to offer the complete line of Linn and Naim products: turntable, cartridges, arms, speakers, electronics, NIRVANA & VALHALLA MODIFICATIONS FOR LP12. Visa and MC. FREE SHIPPING IN US AND PR. OXFORD AUDIO CONSULTANTS, INC. Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

LINN PRODUCTS & NAIM ELECTRONICS . . . now available at Audio Connection, 201-239-1799

LINN-SONDEK, DAYTON WRIGHT PREAMP (SPA), Fontek earphones, Fulton gold cables, Luxman T110, 609-667-7123

LINN SONDEK NOW IN SAN ANTONIO, ALONG WITH OTHER FINE DISC PLAYING EQUIPMENT (Rega Planar, Sota, Thorens and C.J. Walker). Exclusively at Concert Sound, 6104 Broadway, San Antonio, Texas 78209, (512) 822-1224

ROGERS MONITORS Reference loudspeakers from a reference hi fi dealer, Lyric Hi Fi, 1221, Lexington Ave., New York, NY (212) 535 5710 and 146, E. Post Road, White Plains, NY (914) 949 7500

LUX M4000 POWER AMP $795. Lux T12 FM Tuner $350, Ram 512 Power Amp $595, Ram 200 Pre-amp $495, Phase Linear 2000 Pre-amp $175. Call (814) 536-8531.

FOR SALE

LOW NOISE AUDIO TUBES
12AX7, 6FQ7, 12AU7, - $3.99; 12AT7, - $4.75; 6L6GC, 6CA7, - $7.99; 6550, - $8.95; KT88, - $79.00PR; KT77, - $69.00PR.
Plus many other current and discontinued types available. $25.00 minimum order, N.Y.S. residents add tax. Check or money order. Add $2.00 for shipping.
JSA ELECTRONICS
P.O. BOX 202
Middlevillage, New York 11379

LUCKY 16 SYSTEM

(About $1600)

Turntable:	REGA PLANAR 2
Cartridge:	ASTATIC MF 300
Receiver:	NAD 7150
Speakers:	SNELL TYPE J'S

SOUND BY SINGER

227 Lexington Avenue
New York, NY 10016
(212) 683-0925

MACINTOSH. 75's tubes. Rabco SL8E. Mel, 212-881-2455 evenings.

MAGNEPLANER TYMPANI III with Typani bass speakers. Excellent cond., will ship U.S.A. $1300 or best offer. 201-850-8226 anytime.

MANUFACTURER'S ORIGINAL SERVICE MANUALS: 15,000 available. many long out of print computerized list. Martin Gasman 779 Worcester Street Wellesley, MA 02181 617-CEL-TICS

MARANTZ 8B WITH CASE. Absolutely mint $400. 412-361-6665

The PENTAGRAM® P-10
Full Range Loudspeaker

We call our model P-10 a "full range" loudspeaker because unlike most other loudspeakers, it accurately reproduces the full frequency spectrum from below 25Hz to 20 kHz. Most loudspeakers fail to meet the requirements of a "full range" system, mainly because of their inability to reproduce extended low frequencies at realistic amplitudes. Many loudspeakers are advertised with such euphemisms as "usable response to 30 Hz". That is a sure indication that a subwoofer will be needed to properly reproduce low frequencies. A sub-woofer is not necessary with the P-10. We state unequivocally, that our combination of non-parallel walls in the P-10 enclosure, specially modified "mid-woofer" and patented linear compliance 15" dynamic damper will afford bass reproduction down less than 3 dB at 25 Hz. With the P-10, you will enjoy the thunderous sonorities of organ pedal and the visceral punch of 31 Hz bass drums, reproduced with unprecedented clarity and a singular lack of "boominess" or "overhang".

You can audition the Pentagram P-10 at these fine dealers:

Audio Den	Stonybrook, N.Y.
CSA Audio	Upper Montclair, N.J.
Digital Sound	Virginia Beach, Va.
Harmony House	New York, N.Y.
Landes Audio	Chester, N.J.
The Listening Room	Scarsdale, N.Y.
The Mountain Ear	Carbondale, Colo.
Stereo Lab	New London, Conn.
Woodbridge Stereo	Woodbridge, N.J.
21st Century Audio	Philadelphia, Pa.

PENTAGRAM Inc.
"A Labor of Love"

207-19 35 AVENUE BAYSIDE, N.Y. 11361
(212) 746-6193 (212) 423-3923

"The Pentagram does an excellent job of capturing and delineating ambiance...Levy has clearly done well matching the ribbon tweeter and dome mid-range...The deep bass was taut and powerful..."
Greenhill, Audio Alternatives

"The sound is very clean, with excellent imaging and exceptionally good bass response."
Bert Whyte, Audio 10-82

FOR SALE

MARK LEVINSON AT
KEITH YATES AUDIO 916-441-0443

MAYWARE MKIV WORLDS BEST TONEARM, CARTRIDGE. 'A Steal', direct from Manufacturer. Info SI Mayware, P.O. Box 58, Edgware, Middx. England.

McINTOSH BOUGHT, SOLD AND TRADED. 1-313-229-5191 or 5115 Red Fox, Brighton, MI 48116.

McINTOSH C27, MC2200, MC2100, XR-14. Call Shane 402-483-4511

MCINTOSH, MARANTZ, ARC, WESTERN ELECTRIC, TUBE EQUIPMENT WANTED. MAURY 713 728-4343

MCINTOSH MR71 $450, 2100 $475, MA230 $300. Teac AL700 elcaset originally $1,100 sealed, magnificent performance $349, MB20 meter bridge $120. Ferrichrome elcaset tape. Sony EL-4 sealed $139, AC148 $120, TC10 preamp out. $65. Advent 100A $135. NAD 2140 $165. Audire preamp $150. Allison subwoofer $125. Accoustat preamp $500. ReVox A77MK3 $650. Crown SS1444 mint $2,000. Marantz #6 $200, 7c $500. B&O stereo ribbon mic $500. Scott 130 preamp tube $200. Mullard 12AX7 $5.95. Stax MK3 sealed $200 Adcom GFA-1 $250 Denessen Antares-Cetus $450. Ortofon STM72 $35 Thorens 125MK2 $225. Panasonic 3433 audio scope $300. GAS Thoebe $325. Tannoy / Royale 85's $650. Martin Gasman 779 Worcester Street Wellesley, MA 02181 617-CEL-TICS

ROGERS SPEAKERS Legendary performance, Main Street Music, 315, E. Hyman Ave #208, Aspen, CO (303) 925 2921

MUSICALITY? Keith Yates, a trombonist and member of the Board of the Sacramento Opera, has an "odd" reference system: Live Music. Keith Yates Audio can help you achieve the musical results you seek. Authorized Dealer for Mark Levinson, Linn, Threshold, EMT, Bryston, Acoustat, Walker, much more. Prepaid Shipping. 916-441-0443.

NAKAMICHI: NEW DECKS Sold as USED, LX-3, LX-5, ZX-7, ZX-9, ETC. COD Shipping. Audio Workshop (206) 323-4987

FOR SALE

MCINTOSH PLUS—McIntosh instruments are the Laboratory Reference Standard for the world. McIntosh designs their equipment for a long life with low maintenance and high quality performance. *PLUS*-FREE test report on your new McIntosh equipment, on request, FREE shipping anywhere in the Continental U.S., Prompt delivery, Credit cards accepted. DESIGNATRON'S STEREO STORES, INC., 260 Old Country Rd., Hicksville, N.Y. 11801 (516) 822-5277

MERRILL AR MODIFICATIONS
SUB CHASSIS KIT—$69.00 Designed to deaden the AR turntable and allow replacement of original tone arm. Consists of acoustically dead replacement sub chassis and new bearing.
SPRING KIT—$8.00 Allows use of wide variety of tone arms, platter pads, record weights, and other accessories.
REPLACEMENT HIGH TORQUE MOTOR—$45.00
OAK REPLACEMENT BASE—$135.00 Beautiful solid oak base with lead lining for extra deadness.
LEAD COATING SERVICE—$10.00, REPLACEMENT SPINDLE — $25.00
PLATTER BALANCING SERVICE—$10.00
Underground Sound, 2125 Central, Mphs, TN 38104, (901) 272-1275.

HARMAN-KARDON SEPARATES, RECEIVERS, CASSETTE DECKS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; (213) 840-0878.

MITCHELL A. COTTER PSC-2. NFB-2, PW-2, moving coil transformer Mk-1, $1200.; Pioneer C-21, $200.; Phase Linear 400, $250. Call after 7:30 PM (201) 238-8468

MODIFIED PANASONIC LEAF TWEETERS
Ultra-fast, smooth response to 85KHZ. $120.00 per pair. Literature and catalog $2.00. New York Acoustics, 578 Nepperhan Avenue, Yonkers, N.Y. 10701, (914) 476-4900.

NAKAMICHI 500 CASSETTE DECK, New heads & transport, $250. Headamps: Powerlight MC-4e $200., Audible Illusions $125. 707-938-1131, evenings (Calif.)

FOR SALE

GNP LOUDSPEAKERS
THE NEXT GENERATION

For the past year we have given you a brief description of who we are, and of the innovative and imaginative thinking that has been instrumental in the development of our complete line of loudspeakers.

In this column we would like to discuss with you our loudspeaker systems on an individual basis, with special emphasis on the improvements we have made to our least expensive models.

The **GNP SYSTEM THREE** offers a real price and performance breakthrough for the audiophile and music lover on a limited budget. Consisting of a pair of **SM-P1** satellite/mini-monitor modules and a pair of **W-100** woofer modules, the **SYSTEM THREE** employs most of the advanced technology that went into designing our acclaimed **LEAD CYLINDER** (Pat. Pend.) system, but at a more modest price.

The **SM-P1** is a minimal diffraction, phase aligned, phase/polarity coherent design. Its first order (phase and polarity coherent) crossover networks assure near instantaneous rise time at the onset of music transients. And its low diffraction, nonresonant cabinet construction ensures rapid decay time after a music transient has been reproduced.

The **W-100** is a free standing, acoustic suspension design bass box, featuring the latest in polypropylene driver technology. The woofer is mounted in a rigidly braced, high density cabinet for fast, tight, non-boomy bass. The built-in 150 Hz high pass filter allows the woofer module to be used with any **GNP** (or other) satellite/mini-monitor speaker to create a three-way design.

These design features (and more) account for the **SM-P1** and **W-100**'s musically natural sound.

In many ways the **SYSTEM FOUR** represents one of our proudest achievements. Consisting of a pair of **SM-P1** speakers operating as two-way mini-monitors, their small size clearly belies their performance capabilities. First time listeners are startled when they hear the clarity, resolution and focus of this speaker, and are amazed by its deep, taut, flat bass response. With the addition of a pair of **W-100** woofer modules, the **SYSTEM FOUR** can easily be upgraded into our three-way **SYSTEM THREE**.

GNP loudspeakers . . . destined to become a reference standard against which all other speakers will be compared.

For further information, see your local audio specialty dealer or write:

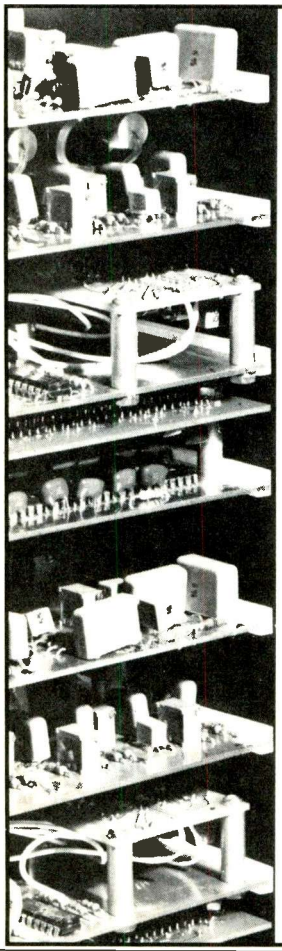
GNP Loudspeakers, Inc.
1244 E. Colorado Blvd.
Pasadena, CA 91106
(213) 577-7767

Dealers: See us at our Riviera exhibit during Winter CES.

NAKAMICHI PLUS—Featuring the incredible BX-1 cassette deck. Now you can have Nakamichi performance for under $300. We also carry the full line of Nakamichi products. **PLUS-FREE** calibration and bias adjustment, on request, **FREE** shipping anywhere in the continental U.S. DESIGNATRON'S STEREO STORES, INC., 260 Old Country Road, Hicksville, NY 11801, (516) 822-5277.

N.C.A.S.
THE NORTHERN CALIFORNIA AUDIO SOCIETY is the country's fastest growing, most active organization for audio professionals and hobbyists. Hear what the leading experts have to say, learn about the latest equipment and kits, read about the results of our listening panels and much more. Members receive our information packed monthly newsletter and our journal with in-depth articles. Send $22.00 for one years membership to N.C.A.S., P.O. Box 14156, San Francisco, Ca. 94114 or write for more information.

NAKAMICHI CASSETTE DECKS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.



THIS IS A SPEAKER AD.

We all know what speakers are. Mostly round things of paper or plastic driven by coils of wire, or ultra-thin plastic sheets propelled by electrostatic or electromagnetic forces. Unfortunately, the laws of physics dictate that it is impossible for any speaker, no matter how constructed, to recreate the sound of real musical instruments without adding a substantial noise of its own (Spurious Simple Source Emissions or 3SE for short). If you are interested in further details about it, send for a short dissertation.

At BSC we deal in the exact reproduction of the sounds of music. **Rather than attempt to rewrite the laws of physics** we have designed an analog microprocessor to match each speaker with its surrounding acoustic environment. **The net result is music** in all its clean-etched clarity without the annoyance of a background hoot added by the speakers themselves. If you are interested in hearing this sound as well as reading about it, ask us for the address of your nearest dealer.

bsc™ compusound® SPEAKER SYSTEMS

BENNETT SOUND CORPORATION POST OFFICE BOX 565
RESEDA, CALIFORNIA 91335 • TELEPHONE (213) 345-1608

FOR SALE

NAD IN PITTSBURGH—BETTER SOUND CONCEPTS
3281 W. Liberty Ave., 15216, (412) 561-3312

NOISE REDUCTION—DOLBY DECODERS. Tape and FM. Kits include encoding facility; also assembled. Reviews. Integrex, Box 747, Havertown, PA 19083.

"NOW APPEARING LIVE" AT AUDIO-AUDIO

AUDIO CONTROL	ELECTRO VOICE
BLAUPUNKT	CELESTION
ORTOFON	PREMIER
THORENS	LUXMAN
LUSTRE	ALPINE
GRACE	BEYER
AIWA	LAST
DNR	QED
DUAL	SONY
KOSS	TEAC
AMBER	SUPEX
NAIAD	NIKKO
AUDIO-PRO	OPTONICA
DYNAVECTOR	3D ACOUSTICS
VAMPIRE WIRE	MONSTER CABLE
& OTHERS	**110-220 VOLTS**

REALISTIC SOUND REPRODUCTION
WITH AFFORDABLE ESOTERICA.
Open 7 Days, 11am-6:30pm EST.
42 Canal St., New York, NY 10002
(212) 925-5868, Mastercard & Visa

ROGERS SPEAKERS A growing legend, all new models on demonstration. North County Stereo, 131-B El Camino Real, Encinitas, CA (619) 753 3546

ROGERS SPEAKERS Capture the magic in music. Newport Audio, 1000, N. Bristol, Newport Beach, CA (714) 851 0112

THE MICHELL GYRODEC Engineering artistry, a sonic and visual delight. Newport Audio, 1000 N. Bristol, Newport Beach, CA (714) 851 0112

THE MICHELL GYRODEC nothing beats it for isolation and beautiful styling. North County Stereo, 131-B El Camino Real, Encinitas, CA (619) 753 3546

PAIR WESTERN ELECTRIC 555 DRIVERS with RCA and Altec horns b/o. Peter Miccolis 7107 Wayne Avenue, Upper Darby, PA 19082

PLANS, CIRCUIT BOARDS, AND KIT PARTS (author approved) for M. Leach's construction projects. Power amps, preamps, pre-preamps, and loudspeakers. Send SASE for information. Custom Components, Box 33193, Decatur, GA 30033.

POLK AUDIO SDA-1 Now in San Antonio. Exclusively at Concert Sound, 6104 Broadway, San Antonio, Texas 78209, (512) 822-1224

POLK SPEAKERS BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST (213) 840-0878.

PORTABLE EQUIPMENT: UHER, Sony, Sennheiser, AKG, Audio-Technica. Send SASE (Specify Model). Carpenter Sound, Box 1321, Meadville, Pa. 16335-0821

PREMIER LMX at **HI FI HAVEN.** Audition the new moving coil cartridge that breaks all the barriers for tracking, focus, definition in a reasonably priced moving coil. The **PREMIER LMX** with "cutter analogue" stylus. At **HI FI HAVEN**, 28 Easton Ave., New Brunswick, NJ 08901.

PREMIER LMX & RS-9 ruby stylus for F9E used (1) hour 150.00 each or 275.00 both 301-687-4678

PS AUDIO AND REFERENCE AUDIO INTRODUCE . . . THE "ELITE"INTERGRATED: incredible performance in an elegantly-styled 19" rack; 55 watts/channel, bridgeable to 200, built-in PS IV, MC input, remote supply. Only $699. TWO C AMPLIFIER: Slim, new 19" rack-mounting to match the PS IV; increased power to 55 watts/channel. $380. PS IV preamp now has VIDEO and TWO tape inputs. Fast, prepaid shipping. Literature available upon request. **REFERENCE AUDIO SYSTEMS:** 18214 DALTON AVENUE, GARDENA, CA 90248. (213) 398-4205.

PROMETHEAN—new at Audio Connection, 201-239-1799

FOR SALE

PS AUDIO AND REFERENCE AUDIO PRESENT . . . The best buy in American audio under $1,000: The Elite Integrated—combining PS IV's famous state-of-the-art phono section ($625.) plus the awesome Two C amplifier (55 wpc, 200 mono, $399), 19" rack-mount, plus beautiful aesthetics for only S$699. Literature available upon request. REFERENCE AUDIO SYSTEMS. 18214 Dalton Avenue, X Gardena, CA 90248. (213) 398-4205.

PS AUDIO—FANTASTIC!
In stock! Fast, free shipping. READ BROTHERS STEREO, 593 King Street, Charleston, South Carolina 29403, (803) 723-7276. Also Acoustat, Nakamichi, Fried, Klipsch, Sony PCM-F1

PS AUDIO's complete line of superb electronics in New Jersey at Audio Connection. 201-239-1799

PS AUDIO = SUPERB VALUE
GENE RUBIN AUDIO (213) 571-1299.

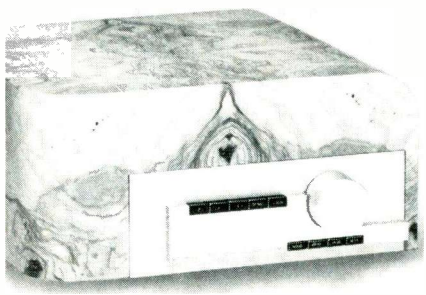
QUAD 405 MODIFICATION. We've compared this beauty with the finest amplifiers (stock and modified) and walked away smiling. Surprise . . . It's a knock-out! Solid-state authority combined with tube sweetness and musicality. THE MOD SQUAD, 144 Athena Street, Leucadia CA 92024 (619) 436-6455.

QUAD OWNERS CLUB
Is designed for those owners of what we consider the best speaker. We want to trade set-up info, electronics, mods and share your wisdom. Send for info to Quad Owners Club, 33 North Riverside Ave., Croton-on-Hudson, N.Y. 10520.

REGA PLANAR TURNTABLES IN STOCK!
GENE RUBIN AUDIO (213) 571-1299 Pac.

P.S. AUDIO ELECTRONICS at Audio Elite (414) 725-4431, Wisconsin

COTTER SYSTEM 2



The most-exciting and long-awaited Mitchell A. Cotter System 2 audio preamplifier is now on demonstration at dealers worldwide. The completion of System 2 came with the introduction of the CM-2 Control Module, and combined with the PSC-2 Phono Signal Conditioner, NFB-2 Noise Filter Buffer and MK-2 MC Cartridge Transformer forms a "triaxial" shielded preamp of uncompromising clarity and versatility. Cabinetry of unique design as well as a rack-mount complete the System 2.

MITCHELL A. COTTER Sales Corp.
201 E. Rosemary St.
Chapel Hill, NC 27514
(919) 929-2037

AT YOUR DEALER NOW!

FOR SALE

CROWN QUALITY AMPLIFIERS, TUNERS, PRE-AMPLIFIERS. CALL FOR PROFESSIONAL CONSULTATION. BEST PRICES — PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

REGA, ROGERS, AUDIRE, CLARKE SYSTEMS, ADCOM, GRACE, GRADO, HARMON KARDON, KENWOOD PURIST, MICROSEIKI, PSE, SAE, SATTERBERG, SHERWOOD, THORENS, Many accessories!!! E.A.R.S. (213) 961-6158 evenings, weekends. P.O. Box 658-U, W. Covina, CA 91790. M/C, VISA. MONTHLY SPECIALS LIST.

RODGERS LS3/5A $400.00 PR. J. JONES 147 SAN JOSE AVE. SAN FRANCISCO, CA. 94110

ROGERS LS3/5A MODIFICATION. You can keep the characteristic "Rogers" sound while cutting back on distortion and beaming. Want more smoothness, tighter bass, and a cleaner high end? Contact THE MOD SQUAD, 144 Athena Street, Leucadia CA 92024 (619) 436-6455.

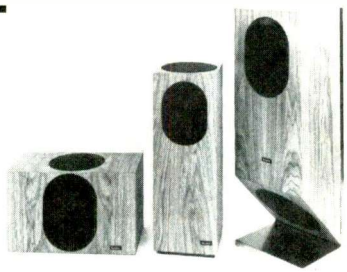
Luxman
ADS
M & K
Hafler
Tandberg
Wharfedale
Thorens
3-D Acoustics *Grace*
Audio Control *Denon*
NAD *Hitachi*
Ortofon *Onkyo*
AIWA *SME*
Revox *MXR*
Kenwood *Sherwood*
Mitsubishi *& Many More!*

Get it Free!

We Deliver FREE Anywhere in the Continental USA

the SOUND Approach
6067 Jericho Tpke., Commack, N.Y.
Charge it...Call 516-499-7680 Ext-82

Striking



Allison Models Seven, Eight, and Nine are strikingly contemporary in appearance. Their simple geometric shapes are beautifully executed in fine oak veneers and finished in hand-rubbed lacquer. One critic has called the Allison:Nine the best-looking loudspeaker system ever produced in America.

For literature and information call (800) 225-4791 [in MA (617) 237-2670] or send coupon

ALLISON ACOUSTICS
Seven Tech Circle/Natick, MA 01760, U.S.A.

Name _____
Address _____
City _____ State _____ Zip _____

FOR SALE

REFERENCE RECORDINGS
Announces the long-awaited release of two fabulous new 45 rpm, Keith Johnson Direct-To-Tape recordings! On RR-9, "IN FORMATION," The Kronos Quartet plays original American compositions with jazz and popular flavors. Recorded in St. Mary's Cathedral, the depth of the natural string tone is amazing. RR-11, Berlioz' "SYMPHONIE FANTASTIQUE" captures a grand performance of the Utah Symphony Orchestra conducted by Maestro Varujan Kojian. In order to transfer to disc the awesome dynamics of this performance, we chose to issue it on three sides. Side Four contains a *bonus* copy of the exciting Fourth and Fifth movements. Order RR-9 at $15 postpaid or RR-11 at $25 postpaid directly from: Reference Recordings, Box 77225X, San Francisco CA 94107. (408) 289-1462. Visa MC welcome. Dealer inquiries invited. FREE catalogs.

REVOX A77 7-½ 3-¾ Mint $550. 2 sets KOSS K 4DS reverb w speakers, original cartons, never used. $225 each 714-485-9366

REVOX B77 DECK, USED 1000 HOURS. With remote control, NAB adapters. New $2000, asking $1000. 616/965-8541 evenings (BATTLE CREEK, MI)

REVOX QUALITY TAPE DECKS, AMPLIFIERS, TUNERS, TURNTABLES. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

FOR SALE

START WITH SEPARATES SYSTEM 1

(About $2600)

Turntable:	REGA PLANAR 3
Cartridge	ADCOM HCE-1
Preamp:	ADCOM GFP-1
Tuner:	ADCOM GFT-1A
Amplifier:	ADCOM GFA-2
Speakers:	SNELL TYPE E'S

SOUND BY SINGER

227 Lexington Avenue
New York, NY 10016
(212) 683-0925

SACRAMENTO/N. CALIFORNIANS: Keith Yates Audio offers Levinson, Linn, Threshold, KEF, Michell, Walker, Bryston, Shahinian, Meridian, Koetsu, Denon, NAD, Acoustat, Audio Design, Dynavector, Pyramid, more. Appointments: 916-441-0443. Info: stamped envelope to Box 161152, Sacramento 95816.

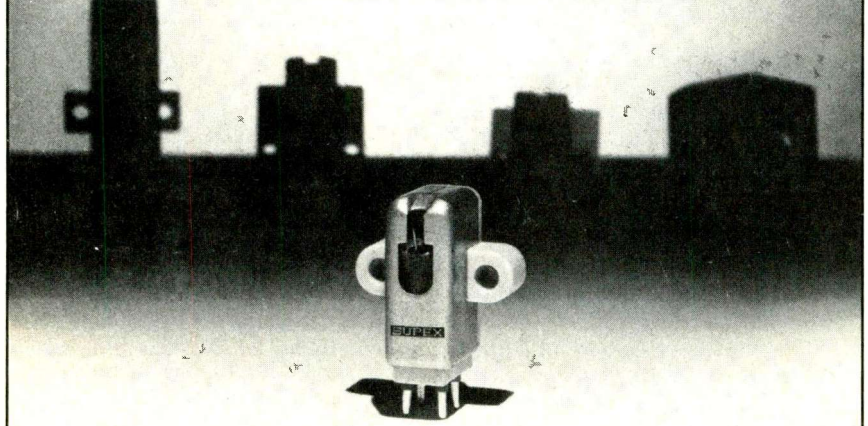
Park Avenue Audio

425 Park Avenue South
at 29th Street
New York, N.Y. 10016
212 685-8101/8102

We respect our customers;
you can make your own choice from among:

Sony Esprit • Sony PCM-F1 • McIntosh • Nakamichi • SAE-X • Black Koetsu • Denon • Mitsubishi • Spendor • Quad • B&W • Bang & Olufsen • Tandberg 3000 Series • Kirksaeter • Obelisk* • Shahinian Acoustics • Sequerra Pyramid • Accuphase • ADS • Mordaunt Short • Signet • Supex • Benchmark

OF THE FIVE FINEST SOUNDING PHONO CARTRIDGES, ONLY ONE NEEDS NO STEP-UP DEVICE . . .



THE SUPEX SDX-2000 BORON HIGH OUTPUT

Calling it the best high-output moving coil in the world isn't enough. Sonically and technologically the Supex SDX-2000 Boron High Output is the equal of (or superior to) the very finest cartridges in existence.

Transient speed? Supex's proprietary generating technology increases the SDX-2000 Boron's output while decreasing rise time to a level matched only by a handful of the top-echelon moving coils. Supex tempers the cutting edge of today's technology (boron pipe cantilever, Samarium Cobalt magnets, grain-oriented Vital diamond) with a transcendant love of music and achieves what used to be impossible: the no-compromise high-output moving coil.

sumiko, Inc. P.O. Box 5046, Berkeley CA 94705.

FOR SALE

SANSUI AU DII AMP, $450., TUS9 TUN $150., RG DYN Pro 20 Proc $200. (215) LO7-4626

SANSUI TUNER TU-999 $75.00 (212)651-2251

SAVE 75%, BUILD YOUR OWN SPEAKERS. Crossovers, Woofers, Mids, Tweeters Instructions. HI-FI, Pro, Auto. Send $2.00 for catalog-refundable. DKI Audio, Davis, Il. 61019

CARVER QUALITY AMPLIFIERS, PRE-AMPLIFIERS, TUNERS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

DCM QUALITY SPEAKERS, BEST PRICES—PROMPT DELIVERY, EAST: (904) 262-4000; WEST: (213) 840-0878.

Series 20—unused: PLC-590 turntable w/Signet XK-50 tonearm, list over $1000, $350. F-26 tuner w/wood case, list $1000, $350. (212)595-7494.

HAFLER AMPLIFIERS PRE-AMPLIFIERS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

SHEFFIELD MISSING LINC, 2 SEALED. Mayorga Lab 1, 3 sealed. Call 717-455-5110 evenings.

SILVER + TEFLON + GOLD + SWL'S QUICKSILVER INTERCONNECT CABLE. Fine strand silver coated copper cable with teflon dielectric and outer jacket. Low capacitance, hi cond. & propagation vel. High quality machined heavy gold plate RCA plugs. Available in ½, 1, & 2 meter stereo sets ($25, $30, $45 respectively. Add $2.50 S&H. TX res. add 5% sales tax). Custom lengths, connectors, bulk cable, speaker cable. Dealer inquiries invited. Send SASE for catalog. VISA & MC by phone. STEPHEN WORSHAM LABS 3720 Maplewood Dr., Dallas, TX 75205, Ph. 713-763-6061.

SONY PCM-F1 DIGITAL
A breakthrough—The ultimate in audio recording! Record digital audio PLUS video. Compare! Portable. In stock. Free shipping. READ BROS. STEREO, 593 King St., Charleston, SC 29403, (803) 723-7276

SOUND WORLD, LTD.
SERVING TIDEWATER AND THE MID-ATLANTIC SEABOARD

ADS	DENON	MONSTOR CABLE
ARC	GENESIS	NITTY GRITTY
AUDIO CONTROL	GRADO	REVOX
B&O	HAFLER	SIGNET
CELESTION	KEITH MONKS	SONY
C.J. WALKER	KLIPSCH	SOUNDCRAFTSMAN
CROWN	LUXMAN	STAX
DAHLQUIST	LAST	TANDBERG
DBX	MAGENPAN	YAMAHA
DENNESEN	MCINTOSH	

Serving VA, MD & NC since 1972 with quality sound systems, experience, service and customer satisfaction.

SOUND WORLD, LTD.
4574 Pembroke Meadows Shopping Ctr.
Virginia Beach, VA 23455
804-499-8555
Call or write for futher information

SOUTHERN CALIFORNIA AUDIOPHILES. We proudly announce the opening of an extraordinary audio salon. Auditions of selected high-end products and hand-built components available by appointment only. Call MUSIC BY THE SEA (619) 436-6455.

SPENDORS ARE SPLENDID
Excellent loudspeakers. reasonably priced: SA1, SA2, SA3, BC1, LS3/5a and Prelude. Visa and MC. FREE SHIPPING IN US AND PR. WORLDWIDE EXPORTING. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

ROGERS FABULOUS new speakers, from $450 to $6,600/pr. The Sound Mill, 115, Main St., Mount Kisco, NY (914) 241 1230

ROGERS SPEAKERS Playing music forever. The full range on demonstration. Audio House, 4304 Brayan Dr., Swartz Creek, MI (313) 655 8639

FOR SALE

ROGERS MONITORS By far the best value in British speakers. The Sounding Board, 75, Franklin Ave., Ridgewood, NJ (201) 445 5006.

ROGERS . . . Our favorite speakers. Shimeks, 505, W. 6th Ave., Anchorage, AK (907) 277 3223

ROGERS SPEAKERS Amazing clarity and incredible imaging. Soundscape, 406, W. Coldspring, Baltimore, MD (301) 889 1134

ROGERS STUDIO ONE: exquisite tonal quality + precise image + tremendous dynamics = a Winner. Sound Components, 2710 Ponce de Leon Blvd., Coral Gables, FL (305) 446 1659

STAX SR-LAMBDA, $225. Mint. Tom, (414) 961-8819

THE MICHELL GYRODEC for music lovers only, Sounds. 502, Kaaahi St., Honolulu HI (808) 847 0104

THE MICHELL GYRODEC musically neutral, superior isolation, engineered to perfection, beautiful and affordable. The Sound Mill, 115, Main Street, Mount Kisco, NY (914) 241 1230

SUBWOOFER SYSTEM—Hartley 24" in transmission line. Excellent with Mognaplanors & Electrostatics. Tacoma 206-857-6635.

SYMDEX LOUDSPEAKERS

We are pleased to introduce the further improved Symdex Sigma and the new companion subwoofer, a three-way system of unparalleled accuracy and low coloration. This reference system, which sets new standards for definition and transparency, is a result of thorough optimization of all design factors plus construction and components of a quality never before used in loudspeakers. The sonic results of this effort have been described by listeners as a redefinition of the state of the art of dynamic loudspeakers.

For further information, contact: Symdex Audio Systems, Inc., P.O. Box 8037, Boston, MA 02114, 617-938-8180.

Current Symdex owners note that factory updates are available.

TELEFUNKEN, APMPEREX, GENALEX and other top quality audio tubes available. Contact S.J. Wallace, 1203 Success St., Pittsburgh, PA 15212.

"THE BEST SOUNDING AMPLIFIER EVER MADE. PERIOD."—Harry Pearson, Editor. The Absolute Sound, Sept, 1982

CONRAD-JOHNSON'S PREMIER ONE—THE ULTIMATE, $3850. Conrad-Johnson's Premier Two is their reference preamplifier, $1585. Their PV-2a-r comes close and is untouchable at $685.

NEW STOCKING STUFFERS!
NAD 7120 digital receiver, $250.
Amber Model 17 preamp and improved Series 70 amp. Stylast
Audiophiles throughout the US trust our friendly, knowledgeable staff to help them through the maze of high-end audio. Call us and you'll see why.

Happy Holidays to all our friends!

We proudly represent:

PS AUDIO	AMBER	HAFLER
KRELL	DENON	NAD
ADS	BOSTON ACOUSTICS	ROGERS
ADCOM	DCM	DENNESSEN
STAX	DYNAVECTOR	TANDBERG
GRADO	ASTATIC	GRACE
VPI	3D ACOUSTICS	NITTY GRITTY

Fast, free shipping. MC/VISA

REFERENCE AUDIO SYSTEMS
18214 Dalton Avenue
Gardena, CA 90248
(213) 398-4205

THE MICHELL GYRODEC Redefining the state of the art. Stereo Horizons, 3760-11 Sports Arena Blvd., San Diego, CA (619) 223 2424

THIEL LOUDSPEAKERS AT GENE RUBIN AUDIO (213) 571-1299 (PAC)

NAIM AUDIO AVAILABLE AT GENE RUBIN AUDIO (213) 571-1299.

FOR SALE

SUBSONIC FILTER KIT $50

Rejects subsonic and most audible low frequency noises: warps, rumble, often even acoustic feedback. Kit instructions: $2.50 (refundable); kit $50; assembled: $85 postpaid. Free catalog. SSS, 856A Lynnrose Ct., Santa Rosa, CA 95404

THRESHOLD AUDIO is offering Conrad Johnson, Dynavector, Pyramid, PS Audio, Grado, Sony, Marantz, Infinity, Stax, VPI, YSL, and more. Stax DA 80M Power Amp; Retail $1500, SELL $295. 409 S. 22nd ST Street, Heath, Ohio 43055, (614)522-3762 or 522-3520.

Tom Houghton on David Fletcher's **THE ARM:** Impressive. I've never before seen this level of integrity in construction. Matches perfectly to a broad range of today's best cartridges. **THE ARM** is the best pivoted tone arm available today. On demonstration at **AUDIO THRESHOLD,** 36633 Gratiot St., Mt. Clemens, MI 48043.

TWEETER OF THE MONTH CLUB!

High frequency masterpieces from all over the world, picked at the point of perfection and delivered to your door. A gift to delight the audio gourmet. **WHERE ELSE BUT . . . MADISOUND** Box 4283, Madison, Wisconsin 53711 608-767-2673

Twin Cities' **HI FI SOUND ELECTRONICS** invites you to hear a remarkable new moving coil phono cartridge, the **PREMIER LMX** with the "cutter analogue" stylus. Remarkably musical, remarkably coherent at a remarkably reasonable price. **HI FI SOUND ELECTRONICS,** 1226 Harmon Pl., Minneapolis, MN 55403.

UNDERSTANDING TUBE ELECTRONICS

In our opinion tube electronics are the only aesthetically satisfying way of reproducing music. Our 65 page book is a simple explanation of how tube circuits work, and is a complete set of technical papers on tube amps, preamps and head amps, and must reading for the serious music lovers. Send $4.00 to New York Audio Laboratory, Inc., 33 North Riverside Avenue, Croton-on-Hudson, NY 10520

MOVE OVER MARK LEVENSON!
The RADIANCE PREAMPLIFIER is here

Ultimate sound, exclusive technology, hand crafted, superior value. Send for detailed brochure. RADIANCE SYSTEMS 2A, 90 Riverside Dr., NY, NY, 10024

THE SOURCE
Direct free-port pricing
American International Audio Video
745 Alexander Rd., Princeton, N.J. 08540
1-609-452-7500
CALL OR WRITE FOR YOUR FREE BROCHURE

FOR SALE

THORENS NEW TD160IIIB, TD126SME. Call Shane 402-483-4511

VANDERSTEEN-DIMENSIONAL PURITY

We offer the remarkable 2C's at $990 per pair (stands $75). Visa and MC. FREE SHIPPING IN US AND PR. WORLDWIDE EXPORTING. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

VANDERSTEEN II A with stands asking $675 or best offer; Polk mini monitors asking $175 or best offer. (914) 962-9011.

VANDERSTEEN in New Jersey! No introduction needed . . . Audio Connection, 201-239-1799

VMPS Super Tower II a/R, walnut, one year old, perfect. $2000/pr. E. McDade. 7805 Saranac Court, Orlando, FLA 32811. 305-293-8466

ROGERS MONITORS All new models available at Victors Stereo, 8, E Erie St., Chicago IL (312) 642 6349 and 5701. Dempster, Morton Grove, (312) 966 5590

VTA ADJUSTMENT FOR YOUR TONE ARM. SUMIKO's new vertical tracking angle adjustment devices allow you to dial in correct VTA during play. **VTA-7** for **GRACE** G-707/G-747; **VTA-U** for most other separate tone arms. Now at your **GRACE** dealer or call (415) 843-4500 for nearest location.

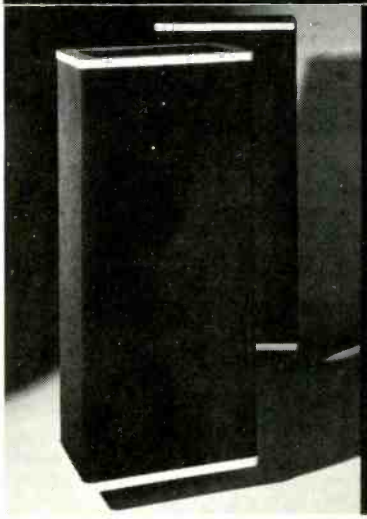
WHOLESALE PRICES: Pioneer, Concord, Sanyo, Technics, JBL, Bose, Savard, Rich Acoustic. Call 205-792-0706 for quote or write Savard Sound, Mail Order Dept 260, 2413 Ross Clark Circle, Dothan, ALA. 36301—Visa-MC-COD.

Eliminate Your "Patchcord Headaches"

If you have more components than places to hook them up, we have a switching system for you. For complete information on switch boxes for your tape decks, signal processors, and speakers, WRITE OR CALL TODAY.

niles audio
Dept. A, P.O. Box 160818
Miami, Florida 33116 (305) 238-4373

VANDERSTEEN AUDIO DIMENSIONAL PURITY



MODEL 2C

Vandersteen Audio was founded in 1977 with the commitment to offer always the finest in music reproduction for the dollar. Toward this goal there will always be a high degree of pride, love, and personal satisfaction involved in each piece before it leaves our facilities. Your Vandersteen dealer shares in this commitment, and has been carefully selected for his ability to deal with the complex task of assembling a musically satisfying system. Although sometimes hard to find, he is well worth seeking out.

Write or call for a brochure and the name of your nearest dealer.

VANDERSTEEN AUDIO
116 WEST FOURTH STREET
HANFORD, CALIFORNIA 93230 USA
(209) 582-0324

FOR SALE

WALKER CJ55 & LINN BASIC LV-V
This is a most agreeable, attractively priced, complete disc system. Visa & MC. FREE SHIPPING IN US AND PR. WORLDWIDE EXPORTING. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

NAKAMICHI CASSETTE DECKS. BEST PRICES—PROMPT DELIVERY. EAST: (904) 262-4000; WEST: (213) 840-0878.

WISCONSIN HAS P.S. AUDIO
Audio Elite, 221 Main St., Menasha, WI 54952 (414) 725-4431

MISCELLANEOUS

IDEAS, INVENTIONS, NEW PRODUCTS WANTED! Call 1-800-528-6050. Arizona, 1-800-352-0458. X831.

SERVICES

AUDIO PULSE REPAIR SPECIALISTS. Modification Kits available for Model One's. WALT'S AUDIO SERVICE, 398 Granada Street, Rialto, CA 92376, (714)-875-0776.

CUSTOM RECORDING SERVICE, Tapes, discs, and cassettes. Stereo and mono Live and copies. Editing. Masters and pressings. High quality at reasonable rates. Joseph Giovanelli, Audio-Tech Laboratories, 1158 Stewart Avenue, Bethpage, NY 11714. (516) 433-0171

DON'T REPLACE THAT BLOWN SPEAKER!!! Have it reconed for little as $2.00 inch! Guaranteed Work. Call (315) 468-4031 or write A&TRC, 527 Charles Avenue, Solvay, NY 13209

SERVICES

NASHVILLE RECORD PRODUCTIONS WILL PRESS HIGH QUALITY PURE VINYL RECORDS FROM YOUR TAPES. SEND FOR SAMPLE RECORD AND PRICE LIST. ALSO FINEST DISC MASTERING. 469 CHESTNUT ST., NASHVILLE TENNESSEE 37203

RECORDING ENGINEERING 30 WEEK COURSE—Multi-Track Professional Workshop Studio. Certificate, Tape Resumé, Job Opportunities. Licensed by New York State Audio Recording Technology Institute 516 454-8999

TAPE HEADS RELAPPED. $20. each. E. Maher, 5 Evans Place, Orinda, CA 94563.

WANTED TO BUY OR TRADE

AAH, TUBE EQUIPMENT WANTED: MCINTOSH (TUBE & SOLID STATE) MARANTZ, ARC, WESTERN ELECTRIC, BERNING, ETC. 713-728-4343. MAURY CORB 11122 ATWELL, HOUSTON TEXAS 77096

A BETTER DEAL for your McIntosh, Marantz tube components. 713-772-4653 or 713-726-9070.

MARANTZ MODELS 2, 3, 6, 7, 8, 9 & 10B; McINTOSH C-22, MC240, MC275 & MC3500. Sam Aberst, P.O. Box 5455, Beverly Hills, CA 90210 (415) 889-7729.

MCINTOSH 2300, SERIALS, 5Y553, 4Y426, 2200 amplifiers. Pasiecznik, 52 Crest, Murray Hill, NJ 07974

PLEASE CALL ME LAST for **MCINTOSH** or **MARANTZ** tube type amps, tuners-10B. **WESTERN ELECTRIC** tubes, amps, mixers, networks, microphones, tweeters, drivers, speakers, horns, transformers, parts, literatures. **TURNTABLES: EMT** 927DST, 930St. **THORENS** TD-124, **GARRARD** 201, 301, 401. **RCA** victrola credenza. **EDISON** opera. Tel: 213/576-2642 David Yo PO Box 832 Monterey Park, Ca. 91754

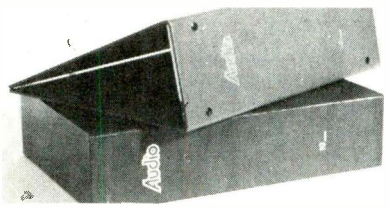
Audio® BACK ISSUES/ BOUND EDITIONS/ BINDERS

BACK ISSUES

Single copy back issues of AUDIO for 1981 and 1982 are available. (NOTE: Jan-Aug '81 issues are in limited supply.) **$5.00 per issue postpaid.**

BOUND ISSUES

A ready reference for audiophiles! A full year of AUDIO is carefully hard-bound for easy reference. Complete volumes for the years '77, '79, '80, '81 and '82 are available. **$40.00 each plus $2.50 for postage and handling.**



BINDERS/ SLIPCASES

Maintain your AUDIO collection in these top quality binders or slipcases. **Binders $9.00 each, 3/$26.00, 6/$50.00. Slipcases $7.65 each, 3/$22.00, 6/$40.00. $2.50 per order handling and postage.**

TO ORDER Indicate issue/book/binder/slipcase. Include proper amount for postage and handling. California residents must include 6% sales tax. Allow 4 weeks for delivery. **$15.00 MINIMUM CREDIT CARD ORDER.** Make checks/ money orders payable to: **Old Del Mar Emporium (ODME), P.O. Box 1621, Spring Valley, CA 92077. FOR CREDIT CARD ORDERS CALL TOLL FREE 1-800-854-2003 EXT. 835 In CALIF. CALL 1-800-522-1500 EXT. 835.**

AD INDEX

WANTED TO BUY OR TRADE

QUADRAPHONIC RECORDS, TAPES, EQUIPMENT. Robin, 120 Atlanta Pl., Pittsburgh, PA 15228, (412)-341-1686

WANTED: Old "Better" "Raw" speakers, coaxials, triaxials only. B. Kalish, Box 52, Redlands, Calif. 92373. (714) 792-0220. Ask, write friends.

YAMAHA TC 800GL CASSETTE DECK, Crown CX stereo tape decks or CX electronics only, prefer later vintage. Alan Prichard, P.O. Box 407, Lemont, PA 16851 (814)238-7489, 237-2873

SPEAKERS

ELECTRO-VOICE INTERFACE SPEAKERS—QUALITY IN EVERY PRICE RANGE, BEST PRICES—PROMPT DELIVERY EAST: (904) 262-4000; WEST: (213) 840-0878.

KUSTOMIZED SPEAKER SYSTEMS HARDWOOD VENEER SPEAKER CABINETS with grill, and complete **SPEAKER KITS.** Fine quality **LOUDSPEAKERS,** also drive units. **AIR CORE INDUCTORS, MYLAR CAPACITORS, CROSSOVER NETWORKS.** Choose from famous manufacturers like **EMS,** SEAS, PHILLIPS, PEERLESS, MOREL, JVC, DYNAUDIO and AUDAX
Send $3.00 for design, reprints, plans and catalog. **KUSTOMIZED SPEAKER SYSTEMS** 260-A Glenn Circle; Powell, TN 37489. (615) 945-3138

RECORDS

NEW 1982-83 DIRECTORY for Collectors of Recordings. Over 3,000 sources for recordings you want. Covers 78s, LPs, tapes; worldwide; 80 page book $12.95. Kastlemusick, 901 Washington, Wilmington, DE 19801.

AUDIOPHILE RECORD GALLERY discounts on ultra sound direct disc, half mastered, digital, Japanese Imports, more! We specialize, only the finest fidelity recordings. Catalog $1.00 P.O. Box 1073, Vienna, VA 22180

COMPLETE 72 PAGE JAZZ/CLASSICAL CATALOG. Imported & domestic recordings, books, gifts. $1.00 (refundable). MUSICAL CONCEPTS, Box 53AA2 Cedarhurst, NY 11516.

MERIDIAN RECORDS. Critically acclaimed natural recording, superbly pressed, a must for serious listeners. (714) 438-1282.

MOBLE FIDELITY, RARE, Steely Dan "Katy Lied". Pristene. Best Offer. D. Powell, 210 Green St., Syracuse N.Y. 13203, (315)472-8298

PROTECT YOUR LPs. POLY SLEEVES FOR JACKET 12¢. SQUARE BOTTOM INNER SLEEVES 7¢. POLY LINED PAPER 15¢. WHITE JACKETS 35¢. POSTAGE $2.00. HOUSE OF RECORDS, HILLBURN, NEW YORK 10931.

RECORD-TAPES! Discounts to 73%; all labels; no purchase obligations; discount dividend certificates; 100% guarantees. Free details. Discount Music Club, 650 Main St., P.O. Box 2000, Dept. 14-0283, New Rochelle, New York 10801.

REFERENCE RECORDINGS newest releases available now! "The Tempest," $15.00. The Kronos Quartet, "In Formation," $15.00. Berlioz "Symphonie Fantastique," 2 discs, $25.00 Free catalog. VISA/Mastercard, check, money order. For The Record. . . , Box 21201X, Columbus, Ohio 43221.

SHEFFIELD S-10 "MISSING LINC" $750., Lab 5 Dave Grusin $400., unopened, stored upright. 601-825-9003 after 5.

THE URBAN AUDIO SOCIETY. Free membership & benefits! Write: Box 9717, Phoenix, Arizona 85068.

THOUSANDS OF LIKE NEW LP's and prerecorded tapes. Catalogue—$2.50. House of Records, Hillburn, New York 10931.

BUSINESS OPPORTUNITIES

BECOME a part time Sales Representative and make money while you build a career! Sell audio equipment . . . video computers. The 3 newest and biggest markets in home entertainment and business aids for the 80's! If you have a working knowledge of any of these 3 products, we'll help you build exciting part time income and possibly an entire new sales career. We furnish you with leads, advertising material, price lists, and information on how to sell. CALL TODAY FOR INFORMATION TOLL FREE 800-638-8806 or 1-301-488-9600
ELECTRONICS INTERNATIONAL
Moravia Center Industrial Park
Baltimore, Md. 21206

OWN YOUR OWN COMPUTER BUSINESS. Compu-Dyn, 51763 St. Rd. 19N, Elkhart, IND. 46514

TAPE RECORDINGS

DIRECT-TO-TAPE RECORDINGS: REAL TIME DUPLICATED REELS (2/4 track, Dolby B/C, TypeX), CASSETTES (Dolby B/C, TypeX), and DIGITAL CASSETTES from MASTER TAPES. FREE CATALOG. Direct-to-Tape, 14-R Station Ave., Haddon Heights, NJ 08035.

LIVE OPERA TAPES, CASSETTES. Incredible selection since 1930's. Worldwide. Free Catalogue. Live Opera Box 3141. Steinway Station. L.I.C. N.Y. 11103.

TAPE AND TAPE RECORDERS

A TRUCKLOAD AMPEX AUDIO TAPE SALE
High quality open reel 1800' or 2400' on 7" reels, used once, unboxed. Case of 40, $45.00. Cassettes available. Valtech Electronics, Box 6-A, Richboro, Pa. 18954

TAPE AND TAPE RECORDERS

CROWN RECORDERS. We upgrade SX-824 with installation of DBX-150. Gives lower distortion and 90dB SN. Permits use of Crown mixer. Full tape monitor. Crown service our speciality. Ideal Acoustics, 110 Willow Road, Starkville, MS 39759. 601-324-1020 anytime.

FREE HEAD CLEANER TAPE WITH ORDER, Case of twenty, Premium Quality, blank cassettes. C-60 24.95, C-90 29.95 Plus 2.00 S/H. Send payment to Image, Dept A, Box 9, Pequannock, New Jersey 07440

OPEN REEL TAPES from studio masters. Philips, Argo, Telefunken, Vanguard, Unicorn, MHS. Catalogue $1.00. Barclay-Crocker, Room 1470-A, 11 Broadway, NYC 10004.

REEL TO REEL TAPES—mostly Ampex, used once, unboxed, 1800'. 50 Reels $48.00; Sample Reel $2.00. Prices include shipping. Free boxes while supply lasts. COD orders accepted. Paragon Sales, Inc. P.O. Box 2022, Joliet, IL 60434, 815/725-9212.

From the worlds oldest and largest speaker kit manufacturer, SPEAKERLAB. Save up to 30% on the speaker designs critics rave about. From tiny bookshelf speakers to slender, floor-standing models to massive folded corner horns. PLUS the latest in state-of-the-art car speakers. All in Speakerlab's 1983 catalog. Send for it today. (Allow 4 - 6 weeks for delivery. Send $1.25 for faster, first class postage.)

speakerlab
Dept. A32, 735 N. Northlake Way
Seattle, Washington 98103

Do Your Friends Believe . . .

- The more drivers the better?
- The lighter the tracking force the better?
- The more strands the better?
- Weighted rumble figures?
- Lots of watts?

If you've risen above the petty mythology of mass-fi and just want good sound and the best value — then AudioQuest products are for you.

audioquest
Premium quality high and low output moving coils with hollow sapphire cantilevers.

GrooVDancer.
High output moving coils & induced magnet cartridges.

LIVE WIRE™
Pure copper & litz speaker cables.
True litz interconnecting cables & tone arms cables.

For more information please write AUDIOQUEST
3857 Birch Street, #610, Newport Beach, CA 92660

BERT WHYTE

LASERVISIONARIES

Illustration: Philip Anderson

In the August 1981 issue, I concluded my review of the Pioneer VP-1000 LaserDisc player by stating that I found this unit to have generally good performance but that the software was not very reliable and frequently exhibited various forms of glitches on the TV image.

Since that time, there has been a reshuffling of the various organizations that were producing the LaserDiscs. Some companies left the field altogether, others drastically modified their manufacturing procedures, and Pioneer's LaserDisc plant in Kofu, Japan made a significant increase in production. With better production technology, the reject rate for LaserDiscs is now said to be acceptably low.

This availability of better, more reliable LaserDiscs has proven to be quite a stimulus to sales of the LaserVision system. Now the sales picture is even brighter, as Pioneer has introduced several new models. Couple new technology with lower prices, and you'll always have a winning combination.

The LD-1100, Pioneer's new top-of-the-line LaserDisc player, differs cosmetically from the VP-1000. All controls and indicators are on the front, with the indicators illuminated on a black glass panel. The LD-1100 has a full-function, infrared remote control, and various refinements have been incorporated into the instrument itself. A more positive disc-locking clamp centers the disc more accurately, while more precise tangential and tracking mirrors afford improvements in the stability of laser-beam scanning.

The most notable improvement, however, is in the LD-1100's audio system rather than its electro/optical system. This advance is in the form of a built-in CX decoder which, when used with CX-encoded stereo LaserDiscs, affords a signal-to-noise ratio greater than 70 dB. The reduction in noise permits a cleaner sounding stereo presentation. Although CX has not fared too well in the consumer audio market, even its most vocal critics agree that it seems to work quite well with videodiscs (as evidenced by its performance on LaserDiscs and on the RCA SelectaVision videodiscs). The LD-1100 performs all of its functions just a bit better than the earlier VP-1000, with an ease of use afforded by some well-thought-out human engineering. The big difference is in the high quality of the CX stereo sound and the superior performance of current LaserDiscs. My opinion of this whole system has been greatly improved by recent experience with some of these new discs.

While there is little doubt that videodisc players are mostly used to view motion pictures, many new and exciting alternative applications are beginning to emerge. Not the least of these is the availability of operas, ballets, and classical music on LaserDiscs. For these we must be grateful for the vision and foresight of the late Bernie Mitchell of Pioneer. It was Bernie who formed Pioneer Artists, an organization which was set up to buy, lease, and ultimately even produce programs suitable for the LaserDisc format.

Ponder this for a moment. There are many people who live out in the hinterlands, far removed from the great cities and cultural centers of this country. Their relative isolation doesn't mean they have no interest in cultural events. We certainly admit the paradox of those who own elaborate, high-end component audio systems (or even modest hi-fi systems) who love classical music and opera but who have never been to a live concert or opera! It goes without saying they have phonograph records and tapes and can listen to radio broadcasts. But when it comes to the visual media, television rarely carries classical music programs and not much has been offered on videocassettes. Thus, many people are denied the pleasure of the selectivity they enjoy from purely audio sources. So Pioneer's introduction of LaserDisc recordings of complete operas in stereo sound really fills a need. And Pioneer Artists "did it up brown"—including productions of the Royal Opera House, Covent Garden, no less, with conductors of the stature of Sir Colin Davis and artists such as Placido Domingo and Jon Vickers. Currently available, and all with CX-encoded stereo, are *Aida, The Tales of Hoffman, Samson & Delilah, Peter Grimes,* as well as the *Swan Lake* ballet.

The operas are actual Covent Garden productions, with all the colorful, elaborate costuming and sets for which this opera house is so famous. Picture quality is quite good, but I think more expert cameramen might have given us clearer, better lit pictures. (The production is by BBC television, which usually does an outstanding job.) However, I must say the stereo sound on these opera discs was quite good, although there was some tendency to up-close miking. For example, in the opening scene of *Peter Grimes,* where the coroner raps his

LaBELLE Camera & Stereo of Maine

155 MAIN STREET
BIDDEFORD, MAINE 04005

TO ORDER CALL TOLL FREE 1-800-341-0783
CALL IF YOU NEED ASSISTANCE MAINE 207-283-1401
VISA, AMERICAN EXPRESS, MASTER CHARGE, MONEY ORDERS OPEN 9:00-8:00 SUN. THRU FRI. CLOSED SAT.

• CALL/WRITE FOR SHIPPING & HANDLING CHARGES • ASK FOR RAIN CHECK • LIMITED QUANTITIES •

• ALL MERCHANDISE BRAND NEW • MASTERCHARGE, VISA, AMERICAN EXPRESS, MONEY ORDERS & CERTIFIED CHECKS ACCEPTED •

• THESE PRODUCTS ARE FOR MAIL & PHONE ORDERS ONLY • PLEASE CALL & RESERVE YOUR ORDER IF YOU PLAN TO BUY & PICK-UP AT STORE • THESE PRICES SUPERCEDE ALL PREVIOUS ADS •

SONY

WALKMAN 4 CASSETTE STERO
$49.95
Complete Set

SONY WALKMAN 5	$78.95
SONY WALKMAN 7	$119.95
SONY PROFESSIONAL DD-6	$229.95

SONY

FM STEREO CASSETTE
FM-1
$79.95
COMPLETE SET

SONY FM-2	$119.95
SONY WA-33	$119.95
SONY WA-55	$129.95

TOSHIBA

FM STEREO CASSETTE
KT-S3
$69.95
Complete Set

TOSHIBA KTR-2	$89.95
TOSHIBA KT-VS1	$89.95

SANYO

$59.95
MG-30
AM/FM STEREO CASSETTE

SANYO MG-9	$29.95
SANYO MG-1	$69.95
SANYO MG-2	$89.95

AIWA

COMPLETE SET
AM/FM STEREO CASSETTE
w/Recording & Auto Reverse
HS-J2
$129.95

AIWA CS-J1	$109.95

AM/FM STEREO RECEIVERS

PIONEER

AM/FM STEREO RECEIVER

SX-4	$109.00
SX-5	$144.00
SX-6	$189.00
SX-7	$319.00

Technics

SA104	$119.00
SA203	$149.00
SA206	$159.00
SA222	$179.00
SA424	$259.00
SA626	$349.00
SA828	$519.00

SONY

AM/FM STEREO RECEIVER

STR-UX1	$159
STR-UX22	$189
STR-UX33	$219
STR-UX4	$269
STR-UX5	$349
STR-UX6	$419

HARMON/KARDON

AM/FM STEREO RECEIVERS

HK-330i	$169
HK-350i	$199
HK-460i	$249
HK-570i	$309
HK-580i	$349
HK-680i	$459

J.V.C.

AM/FM STEREO RECEIVERS

R-K10	$144
R-K20	$184
R-X40	$219
R-X60	$299
R-X80	$379

Sansui

AM/FM STEREO RECEIVERS

Z-3000	$259
Z-5000	$329
Z-7000	$519
Z-9000	$619

TURNTABLES SPECIALS

Technics

TECHNICS SLB-10	$62
TECHNICS SLB-20	$84
TECHNICS SLB-30	$99
TECHNICS SLD-20	$84
TECHNICS SLD-30	$119
TECHNICS SLD-20	$124
TECHNICS SLD-30	$145
TECHNICS SL-5	$119
TECHNICS SL-5	$179
TECHNICS SL-D L5	$139

PIONEER

PIONEER PL-2	$64
PIONEER PL-4	$88
PIONEER PL-5	$94
PIONEER PL-7	$109
PIONEER PL-800	$259
PIONEER PL-88F	$259
PIONEER PL-44F	$179

CALL FOR LOWEST PRICES ON OTHER TURNTABLES & CARTRIDGES

CALL FOR BEST PRICES ON EARTH

CASSETTE DECKS

PIONEER

CASSETTE DECKS

CT-3	$99
CT-4	$109
CT-5	$157
CT-6R	$187
CT-7R	$269
CT-8R	$369
CT-9R	$430

SONY

CASSETTE DECKS

TC-FX33	$139
TC-FX44	$169
TC-FX500R	$209
TC-FX66	$239
TC-FX77	$279
TC-FX1010	$439
TC-K555	$289
TC K777	$609

Technics

CASSETTE DECKS

RSM205	$99
RSM224	$119
RSM226	$139
RSM228X	$159
RXM240X	$169
RSM255X	$239
RSM258R	$249
RSM275X	CALL

Sansui

CASSETTE DECKS

D-55MS	$139
D-77FS	$169
D-77RS	$219
D-99DS	$249

JVC

CASSETTE DECKS

KD-D10	$99
KD-D20	$119
KD-D30	$139
KD-D40	$189
KD-D50	$219
KD-D55	$249

HARMON/KARDON

CASSETTE DECKS

CD91	$179
CD101	$219
CD201	$269
CD301	$359
CD401	$499

AKAI

AM/FM STEREO RECEIVERS

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

maranz

AM/FM STEREO RECEIVERS

SR220	$119
SR1000	$179
SR2000	$199
SR520	$239
SR 620 CX	$309
SR-7100 DC	$349
SR-8100 DC	$409

maranz

CASSETTE DECKS

SD225	$119
SD320	$169
SD420	$219
SD3510	$189
SD5010	$229
SD9000G	$369

AKAI

CASSETTE DECKS

CS-F12	$109	GX-F71	$297
CS-F14	$129	GX-F91	$487
CS-F21	$165	GX-F95	$529
CS-F31	$209	CS-F39R	$259
GX-F51	$245	GX-F44R	$327
		GX-F66RC	$384

BLANK TAPES

TDK SAC-90	$2.45 each
MAXELL VDXLII C-90	$2.49 each

MINIMUM 10 TAPES

VIDEO

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

AM/FM CASSETTE CAR STEREOS IN DASH

PIONEER

CAR STEREO

KP1500	$69.95
KP5500	$119.95
KP7500	$169.95
UKP5200	$139.95
UPK5600	$159.95
KE-5100	$179.95
KE-6100	$219.95
UKE-3100	$179.95
UKE-7100	$259.95

JENSEN

CAR STEREO

RE-530	$319.95
RE-520	$259.95
RE-518	$239.95
RE-512	$219.95
RE-508	$179.95
R210	$119.95
R200	$89.95
JR-115	$139.95
JR-110	$119.95

SONY

CAR STEREO

XR-15	$129.95
XR-25	$139.95
XR-35	$179.95
XR-50	$199.95
XR-55	$209.95
XR-70	$249.95
XR-75	$269.95
XR-77	$309.95

CONCORD

CAR STEREO

HPL-101	$149.95
HPL-112	$179.90
HPL-118	$249.90
HPL-118F	$279.95
HPL-119	$319.50
HPL-130	$339.80
HPL-508	$239.95
HPL-515	$289.95

35mm CAMERAS

Canon

AE-1 with 50mm 1.8 FD Lens	$179.90
AE-1 PROGRAM w/50mm 1.8 FD Lens	$207.00
A-1 w/50mm 1.8 FD Lens	$269.90
SURE-SHOT 35M w/Case	$109.95
SUPER SURE-SHOT w/Case	$159.95
LENS FOR SURE-SHOT	$39.95
POWER WINDER FOR CANON	$49.95
CAMERA CASES FOR CANON	$15.00

CALL FOR LOWEST PRICES ON ALL CANON ACCESSORIES

NIKON

NIKON FE BODY	$199
NIKON FG BODY	$179
NIKON EM BODY	$78
NIKON F3 BODY	$369
NIKON 50mm 1.8E	$57
NIKON 50mm 1.4	$129
NIKON MD-12	$129
CASES FOR NIKON	$15

ALL NIKON CAMERAS AND ACCESSORIES AVAILABLE AT DISCOUNT PRICES

PENTAX

PENTAX K1000 w/50mm f2	$119
PENTAX ME SUPER w/50mm f2	$159
CASES FOR PENTAX	$15

MINOLTA

MINOLTA XGM w/50mm f2	$169
MINOLTA X700 w/50mm f2	$219
MINOLTA XG-1 w/50mm f2	$149
POWER WINDER FOR	$49
CASES FOR MINOLTA	$15

Clarion

CAR STEREO

5100R	$99.95
5150R	$134.95
5300R	$134.95
5550R	$129.95
5700R	$169.95
7500R	$179.95

maranz

CAR STEREO

CAR-301	$139.95
CAR-302	$149.95
CAR-322	$179.95
CAR-330	$179.95
CAR-340	$199.95
CAR-310	$139.95

SANYO

CAR STEREO

FTU-96	$129.90
FTU-88	$118.50
FT-240	$129.95
FTC-24	$69.95
FTC-12	$99.90
FTC-1	$49.95

LENS SPECIAL

FAMOUS MAKER
FOR
- CANON
- NIKON
- MINOLTA
- YASHICA
- PENTAX
- OLYMPUS
- KONICA

80-200mm ONE TOUCH ZOOM
$77

WE STOCK COMPLETE LINE OF 35mm CAMERAS AND LENSES. CHOOSE FROM VIVITAR SIGMA • SOLIGOR • TOKINA KIRON • ROKINA • TAMRON • BULLET LENS •

800-341-0783

In continental U S Puerto Rico and Virgin Islands
In Maine call 207-283-1401

☐ Send me your free catalog by Third Class mail

☐ Rush me your free catalog I m enclosing $1 for First Class mail

Name

Address

City

State Zip

LaBELLE 155 MAIN STREET BIDDEFORD ME 04005

155 MAIN STREET • BIDDEFORD, ME 04005 OPEN MON-FRI AND SUNDAY - 9:00 AM - 8:00 PM CLOSED SATURDAY

the perfect combination...

The musical accuracy of Bryston components is a revelation. Every note emerges with perfect clarity from a background of silence, then vanishes. The progression of musical events seems real, tangible, almost visual in its presentation....

Bryston believes there is a need for reference standards of musical accuracy. That is why we designed our Models 2B, 3B and 4B power amplifiers, and our Model 1B preamplifier. Their only reason for existing is to provide the most faithful electronic rendition of a musical signal possible within the bounds of available technology. Write to us and we'll tell you how we do it, and where you can listen to our perfect combination.

IN THE UNITED STATES:
BRYSTON VERMONT
RFD #4, Berlin, Montpelier, Vermont 05602
(802) 223-6159

IN CANADA:
BRYSTON MARKETING LTD
57 Westmore Dr., Rexdale Ont., Canada M9V 3Y6
(416) 746-0300

Enter No. 6 on Reader Service Card

THIS MONTH'S SPECIALS

TECHNICS Direct Drive Turntable (list $150) ..... $ 77.00
ONKYO TA-2010 3-Head Accu-bias Cassette Deck (list $470) $219.00
SONY 12" Color TV (list $500) $279.00
HITACHI Straight Tonearm Semi-Automatic Turntable (list $100) ..... $ 59.00
TDK SA90 Audio Tape (list $5.00) ..... $ 2.29
CERWIN VEGA 12" 3 way Loudspeakers (list $280 ea.) ..... ea. $139.00
FAMOUS BRAND Video Tape T-120 or L750 ..... $ 7.99
BLAUPUNKT CR 2010 ..... CALL OR WRITE

DIRECT FREE-PORT PRICING VIA "THE SOURCE"

CREDIT CARDS AND COD'S WELCOMED

TRADE-INS

THE FINEST IN STEREO AND VIDEO EQUIPMENT

CALL OR WRITE FOR YOUR FREE BROCHURE TODAY.

American International Audio Video
DEPT. A3
745 Alexander Rd., Princeton, NJ 08540
609-452-7500

Enter No. 2 on Reader Service Card

FOR INFORMATION AND ORDERING (800) 221-8180
IN NEW YORK CALL: (212) 732-8600

DEALERS/INSTITUTIONAL INQUIRIES CALL: (800) 221-3191

J&R MUSIC WORLD

THIS MONTH'S SUPER SPECIALS!

HI-FI

TECHNICS SA-424 (Receiver)	$279.95
TECHNICS SA-828 (Receiver)	$519
TECHNICS SL8-10 (Turntable)	$69.95
TECHNICS SL0-20 (Turntable)	$89.95
TECHNICS RSM-205 (Cassette Deck)	$99.95
TECHNICS RSM-224 (Cass. Deck)	$124.95
PIONEER PL-4 (Turntable)	$89.95
PIONEER PL-44F (Turntable)	$169.95
PIONEER PL-88F (Turntable)	$269.95
PIONEER CT-4 (Cassette Deck)	$119.95
PIONEER CT-9R (Cassette Deck)	$429
SANSUI Z-9000 (Receiver)	$599
AKAI CFS-14 (Cassette Deck)	$149.95
SONY PSX-600 (Turntable)	$269.95
SONY STRVX-33 (Receiver)	$219.95
SONY TCFX-1010 (Cass. Deck)	$419
MARANTZ 8100 (Receiver)	$479
TEAC V-44C (Cassette Deck)	$179.95
KLH 510 (Speakers)	$149.95/Pair*
JENSEN 1030 (Speakers)	$189.95/Pair*

*SPEAKERS SHIPPED FREIGHT COLLECT

EQ/MIXERS/MIKES

MXR-15 (15 Band EQ)	$228.95
AUDIOSOURCE EQ-1 (10-Band)	$279
ADC SS3010 Band EQ	$239.95
NUMARK DM-1800 (Mixer)	$269
GLI PMX-9000 (ED. Mixer)	$319
SHURE SM58 (Unidirectional)	$124.95
SHURE SM-77	$95
SHURE 515SAC (High impedance)	$44.95

CARTRIDGES

SHURE V15 Type V	$134.95
SHURE V15 LT (Linear)	$87.95
SHURE M97HE	$54.95
STANTON 881S	$77.95
PICKERING XLZ-7500S	$129.95
MICRO ACOUSTICS 3002	$94.95
EMPIRE EDR.9	$114.95
EMPIRE 800/FR	$89.95
PICKERING XSV3000	$57.95

ACCESSORIES

DISCWASHER DiscKit	$33.99
DISCWASHER D-4 System	$9.99
DISCWASHER DiscSet	$17.95
DISCWASHER GOLDENS	
½ meter	$6.95
1 meter	$7.95
2 meter	$8.95
SOUNDGUARD	
Total Record Care System	$14.95
Record Preservation Kit	$8.95
6-oz. Preservation Refill	$10.95

CAR STEREO

PIONEER KE-6100 (Receiver)	$254
JENSEN RE-520 (Dig. Tuning)	$269
CLARION-5700R (Dig. Tuning)	$209
SONY XR-55 (20W, Auto Rev)	$239
BLAUPUNKT 3002 (Auto Rev)	$209
UNCO BOX TL-3000 (Car Alarm)	$229
JENSEN J-2033 6x9 Triax II	$84.90/PAIR
JENSEN J-1069 6x9 Coax	$49.90/PAIR
JENSEN J-1065 6x9 Triax	$69.90/PAIR
PIONEER TS-696 6x9 Triax	$98.90/PAIR
PIONEER TS-695 6x9 Triax	$83.90/PAIR
PIONEER TS-168 6½ Triax	$73.90/PAIR

STEREO-TO-GO

SONY WALKMAN V (Cass Stereo)	$85
AIWA HSJ02 (Cass/FM/Ster/Rec)	$135
SANYO MG-9 (Cass/Stereo)	$34
TOSHIBA KTR-1 (AM/FM Ste/Cas/Rec)	$75

HEADPHONES

SENNHEISER HD420	$53.95
SONY MDR-B07 (Micro)	$54.95
PIONEER SEL-5	$39.95
KOSS PRO-4X	49.95

AUDIO TAPES

MAXELL UDXL I or UDXL II C-90	$2.48	TDK SA C-60	$1.99
MAXELL UDXL I or UDXL II C-90	$2.95	TDK SA C-90	$2.48
MAXELL XLII S C-60	$2.99	TDK SAX C-90	$3.95
MAXELL XLII S C-90	$3.95	TDK DX 35-90B	$7.99
MAXELL XLII S or XLIII C-90	$5.95	TDK SA 35-90	$9.99
MAXELL MX-90 (Metal)	$6.99	SONY UCXS C-90	$2.99
MAXELL XLI 35-90B	$7.49	SONY HFC C-90	$2.89
MAXELL XLI 35-180B	$10.99	FUJI C90FRII	$2.99
MAXELL XLII 35-90	$11.99	BASF PRO II or III C-90	$2.79
MAXELL XLII 35-180	$29.95		

5% DISCOUNT ON 100 OR MORE ASSORTED TAPES MINIMUM ORDER 12 TAPES

HOW TO ORDER BY MAIL: FOR PROMPT AND COURTEOUS SHIPMENT SEND MONEY ORDER, CERTIFIED CHECK, CASHIER'S CHECK, MASTERCARD/VISA (include card number, interbank No., expiration date and signature). DO NOT SEND CASH. PERSONAL AND BUSINESS CHECKS MUST CLEAR OUR BANK BEFORE PROCESSING. $25 MINIMUM ORDER. Shipping, Handling & Insurance Charge is 5% of Total Order with a $3.95 minimum. We Ship To CONTINENTAL U.S., ALASKA, HAWAII, PUERTO RICO, AND CANADA ONLY (Canadian Orders Add 10% Shipping, with a $7.95 minimum charge.) For shipments by air, please double these charges. SORRY, NO C.O.D.'S. NEW YORK STATE RESIDENTS PLEASE ADD SALES TAX. ALL MERCHANDISE SHIPPED BRAND NEW, FACTORY FRESH AND 100% GUARANTEED.

23 PARK ROW, DEPT. A2, NYC NY 10038
SEND FOR FREE 240 PAGE AUDIO/VIDEO CATALOG

Enter No. 12 on Reader Service Card

"For operas, ballets and classical music on LaserDiscs, we must thank the late Bernie Mitchell of Pioneer."

gavel for attention, the sound is like loud pistol shots. Also in this opera, Benjamin Britten's tempestuous storm music makes quite an impact with its percussion and close-miked brass. *Aida* was staged in an outdoor arena in Verona, Italy, with some spectacular sets. Although its principals are not world-class artists, they do a most creditable job. Being outdoors, the close-in miking is understandable.

All in all, the opera productions are very well done, both sonically and visually. Defeating the CX decoding brings a 10 to 12 dB rush of noise, which quite vividly proves the worth of CX. All of these operas are on CLV (constant linear velocity) extended-play discs and, as such, do not permit any of the freeze-frame, slow-motion, and other assorted effects of the CAV (constant angular velocity) standard-play disc. However, fast-forward and fast-reverse scanning *are* available.

Other LaserDiscs offered are concert performances of the Czech Philharmonic Orchestra playing Dvořák's *New World Symphony No. 9* and Smetana's *Ma Vlast*. This latter work's title means "My Fatherland," and it is a very stirring and dramatic piece. (I made the first stereo recording of it, with Rafael Kubelik conducting the Chicago Symphony Orchestra, in 1952.) These are not static productions, merely showing the orchestra playing on a stage. There is some use of this visual, but mainly we see a sort of musical travelog of various scenes in the country that are, as often as possible, relevant to the music. During the opening passages of "Die Moldau," probably the most familiar part of *Ma Vlast*, the camera takes you to the upper reaches of that famous river. A similar technique is used throughout the various sections of the work.

The LD-1100 is a fine second-generation LaserDisc player, easy to use and apparently quite reliable. Best of all, the LaserDiscs of the operas, ballets and classical concerts I viewed were, for all practical purposes, free of glitches. I did notice a very slight tearing of the corner of some video images and transient wave ripples across the picture a few times. These were minor, and if Pioneer can maintain their LaserDisc quality at this level, they have a most viable system. A

"The studio's absorption panels are not randomly scattered, but placed by means of a computer analysis."

WFMT:
SATELLITE SUPERSTATION
Continued from page 47

video service at marginal extra cost. In May 1979, UVI selected WFMT to be the first radio superstation.

WGN and WFMT were originally received off the air north of Chicago and microwaved to RCA's uplink in Lake Geneva, Wisconsin, where WFMT was then multiplexed as an audio subcarrier on WGN and piggybacked on Transponder 3 of Satcom I. Initially this was accomplished by a special FM multiplexer, built by Leaming Industries of California and utilizing deviation enhancement (tripling the standard 75 kHz) for an acceptable S/N.

Since September 1, 1981, however, United Video has used its own earth station (in Frankfort, Illinois, about 30 miles southwest of WFMT's transmitter) to relay the WGN-WFMT signals to RCA's Satcom 3. There, the off-the-air signal is received with a Yamaha T-7 tuner. Instead of the original Leaming multiplexer, the signal is now fed to one built by Wegener Communications, of Atlanta. The Wegener system can carry more audio services, and by companding signals above 4 kHz, it provides better S/N. The multiplexed signal is sent up to the satellite with the WGN TV signal, much as SCA music signals are transmitted on some FM broadcast channels.

The Wegener compansion system achieves a 20 dB improvement in S/N, resulting in proof-of-performance measurements of 68 dB, as measured at UVI's Tulsa downlink using a 12-foot dish. (With smaller dishes, S/N is lower.) The system's frequency response is 50 to 15,000 Hz, ±2 dB, with a total harmonic distortion of less than 1%. That's more than respectable for a signal that's first travelled 30 miles over the air from its transmitter, then gone more than 47,000 miles through space.

Tom Kenzie of UVI states that the ultimate sound quality is in the hands of the individual cable operator, and that's the weak link. Although with some effort and expense a cable system could deliver close to the 68 dB of S/N available from the satellite, it's more than likely the average cable

Fig. 4—WFMT's Control Room C. The apparently random array of acoustic panels is carefully calculated. Author Queen is at left, WFMT Assistant Production Director Larry Rock at right, with visitor Bob Berkovitz (then Research Director of Acoustic Research) at the Neotek console.

Fig. 5—WFMT Studio One. Note the adjustable absorber panels. The panels are rotated to vary the absorption-vs.-frequency curve. Additional panels, full studio height, can be placed as needed, on barely visible runners. The soffit shown spans most of two walls and houses support beams and the ventilation muffler system.

Photographs: E. Michael James

listening end, in that the shorter path, higher level sound rays encounter absorption (Fig. 3). However, it is less susceptible to the spectral colorations of varying absorption front walls and the directional confusion of the relatively unvarying reflective rear walls. It also better accommodates unavoidable obstructive features, such as control-room windows and equipment racks, which may be factored into the placement of sources and receivers.

The result (Fig. 4) is a Mondrianesque array of panels and frames, both sonically and aesthetically pleasing. However, the probable positions of sources and microphones cannot be easily determined in the main studio. Instead, a means is provided for varying the number and positions of panels as well as their reflective characteristics (Fig. 5). Thus, the acoustics have been optimized for performances which may vary from single pianists to 21-piece string ensembles.

This approach to the acoustical design has made possible a production-oriented layout of rooms, centered equally around the on-the-air control room and the main studio; it is well suited to WFMT's dual function as a broadcaster of live and recorded fine-arts material of high sonic quality and as a syndicator of such material to other stations throughout the world.—*D.Q.*

"The radio station gets no royalties for its cable connection—but the station's advertisers benefit."

subscriber will only get S/N of 55 dB, unless the listener is located near the head end of the system.

Since a satellite distribution company can't control who receives its transmissions, any individual with a dish and receiver can eavesdrop on its nonscrambled TV superstations, and on WFMT. Wegener sells its companders to any interested buyer for about $1,400 ($1,500, if other stations in addition to WFMT are desired). Some of the newer, more sophisticated satellite receivers may be able to receive and decode the radio signal. But without the companding system, there will be no noise reduction, and rather unnatural dynamics.

Any cable company capable of receiving WGN can carry WFMT. (They don't even have to provide the TV station to their subscribers if they just want to carry the FM.) The cost to a cable company of adding WFMT is 1¢ per subscriber, up to a maximum of $300, plus the cost of the Wegener equipment (provided free by UVI to cable systems which had previously bought the Leaming equipment), whereas the TV station costs 10¢ per subscriber. On cable systems, WFMT won't necessarily show up at the same 98.7 frequency as it does in Chicago; cable operators may assign it any available dial position.

Since the TV baseband provides additional subcarriers (originally intended for slow-scan pictures, facsimile, cue channels and TV stereo audio), other audio channels are piggybacked onto WGN's signal. These include: WMBI, the Moody Bible Institute's FM station specializing in religious programming; the Satellite Music Network; the Bonneville Beautiful Music Service, and the Seeburg Music Service.

RCA envisions a continuing series in its American satellite communications system. Since the lifespan of the original, 12-transponder Satcoms is limited, 24-transponder Satcoms will replace them as they fail, providing additional service and reliability. RCA predicts a minimum of eight years of service for the satellite.

Larger launch vehicles and deployment by the Space Shuttle permit greater payloads for future Satcoms, meaning slightly higher transmitter power for better S/N and increased reliability. Thus, as the technology improves, signals can be received by smaller dishes. RCA's contour map shows 34 dBW coverage over the Midwest from border to border, 33 dBW over the Rockies and Middle Atlantic states, and 32 dBW over New England, California and the Pacific Northwest, with a 35 dBW lobe covering Alaska. Many of the initial Satcom channels were devoted to Alaskan communities isolated from conventional radio, TV and communications coverage.

In the Western Hemisphere, the geosynchronous orbit positions for stationary communications satellites are looking more and more like a Manhattan street in rush hour, monopolized heavily by the United States and Canada. Each satellite occupies a separate longitude, so a cable system or individual should have separately aimed dishes for each satellite, or a single dish must be re-aimed with some difficulty to choose programming from the various satellites. A special multi-beam, spherical antenna such as Satcom Technology's Torus receives several satellites at once. The most popular satellites include the RCA Satcoms, AT&T's Comstar, Western Union's Westars, and Canada's Aniks. Obviously, there are a great number of cable channels and an equal number of entrepreneurs eager to exploit them.

Several music services already take advantage of satellite distribution, both as cable-system offerings and for direct home broadcasting. One company, The Home Music Store, actually sells subscribers digitally-transmitted record albums for recording, on five stereo listening channels. Other services sell advertising, just as if they were national networks or local stations. However, as Ted Turner is discovering with his Cable News Network, cable penetration is dismal compared to the number of sets receiving standard broadcasting. Thus, those satellite broadcasters depending on advertising for existence had better be well capitalized to withstand the long wait for profitability.

The WFMT-UVI connection is unique in that it nationally offers programming of exceptionally high caliber unavailable anywhere else. But WFMT is not financially dependent on cable coverage. There is no business connection between WFMT and UVI. The radio station receives no royalties for its cable connection; in return, the cable companies may not tamper with its commercials. Local Chicago advertisers (such as the Musicraft stereo stores and Rose Records) having large mail-order departments are taking advantage of the bonus superstation status with "800" numbers and other attractions for cable listeners. Even out-of-town advertisers use the superstation. Billy's Bar and Restaurant, in Key West, Florida, advertises both because many Chicagoans vacation in cable-equipped homes and hotels in Key West and because WFMT is the only alternative to rock and country programming in the region.

WFMT's programming also helps UVI attract new cable systems, which in turn attract new subscribers with it. Some households subscribe to cable solely for access to WFMT. Warner Cable ran full-page advertising in the *Altoona Mirror* announcing the addition of WFMT to its service, and festivities were held featuring the director of the local symphony. Local press has been extremely favorable in support of WFMT's entering new markets.

An interesting illustration of cable's significance is in Aspen, Colorado. The Aspen Music Festival has been carried live nationally by both National Public Radio and commercial stations. Unfortunately, no station in Aspen carries the broadcasts, so local residents and music-festival participants hear the concerts on WFMT via Aspen's Canyon Cable Company. Once, when NPR's own satellite failed, the technical crew in Aspen was alerted to the problem only by hearing WFMT announce an interruption in the concert's transmission.

UVI boasts of WFMT's audio quality as delivered to cable systems. It feels the Wegener system is as good as an analog transmission can get and that future improvements will have to be in the digital realm, which isn't out of the question.

Someday WFMT's cable audience may be greater than its hometown audience. Interestingly, Chicago is one of the few major cities without a cable television system. So if you're ever in Key West, stop by Billy's and tell him WFMT sent you.—*R.W.*

DESIGN INTEGRITY:

The same pick-up technology developed for our $1,000. DL-1000 Low Mass Moving Coil Cartridge...

...can be found on our Boron-cantilevered $275. DL-207...

...and on our split-cantilevered $100. DL-300 MC Cartridge.

The perhaps ultimately low effective tip mass of Denon's most expensive cartridge establishes new standards for cartridge tracing and minimal record wear (the recommended stylus force is a mere 0.8g). Yet the basic design configuration of the DL-1000 is common to many Denon cartridges.

For example, an amorphous deposition Boron cantilever (with the highest rigidity/weight ratio known) is also used on Denon's new DL-207, as is Denon's original dual damping mechanism, which effectively cancels resonances in the two critical portions of the musical bandwidth.

More amazing, perhaps, is the fact that Denon's *least* expensive cartridge, the DL-300, benefits from much of the technology that has made Denon Moving Coil Cartridges the world's reference standard for years. Like the DL-1000, it features a cross-coil armature (for better stereo separation and imagery), a poleless magnetic structure (for vastly reduced weight), and a single-point cantilever suspension system (for maximum compliance *and* strength).

Denon products share more than name alone.

DENON

Imagine what we'll do next.

Denon America, Inc., 27 Law Drive, Fairfield, N.J. 07006

Prices shown are for comparison purposes only.

Enter No. 9 on Reader Service Card

Only technology this advanced can achieve music reproduction this pure. The Technics Digital Cassette Recorder.

No tape hiss. No wow and flutter. Not even head contact distortion. With the digital technology in the Technics SV-P100 Cassette Recorder, they no longer exist.

Utilizing the Pulse Code Modulation (PCM) digital process, the SV-P100 instantaneously translates musical notes into an exact numerical code, stores them on any standard VHS cassette, then "translates" them back into music on playback. Duplicate tapes are exactly the same as the original. Thus, every recording and every copy is a "master."

The revolutionary size of the Technics SV-P100 Cassette Recorder (17"x11"x10") is the result of state-of-the-art semiconductor technology. The built-in videotape transport mechanism brings the convenience normally associated with conventional front-loading cassette decks to a digital application. Tape loading is completely automatic. And, frequently used controls are conveniently grouped on a slanted panel with LED's to confirm operating status.

Despite its compact size, the SV-P100 Recorder offers performance beyond even professional open-reel decks. Since the digital signal is recorded on the video track, the space usually available for audio can therefore be used for editing "jump" and "search" marks. The unit employs the EIAJ standard for PCM recording. And, in addition, editing and purely digital dubbing are easily accomplished with any videotape deck employing the NTSC format.

The Technics SV-P100 Digital Cassette Recorder is currently available at selected audio dealers. To say that it must be heard to be appreciated is an incredible understatement.

Technics
The science of sound.

Enter No. 37 on Reader Service card.