

Behind
The Scenes in
JAPAN

AUDIO

APRIL
1973 60¢

The Authoritative Magazine About High Fidelity ® A

23602



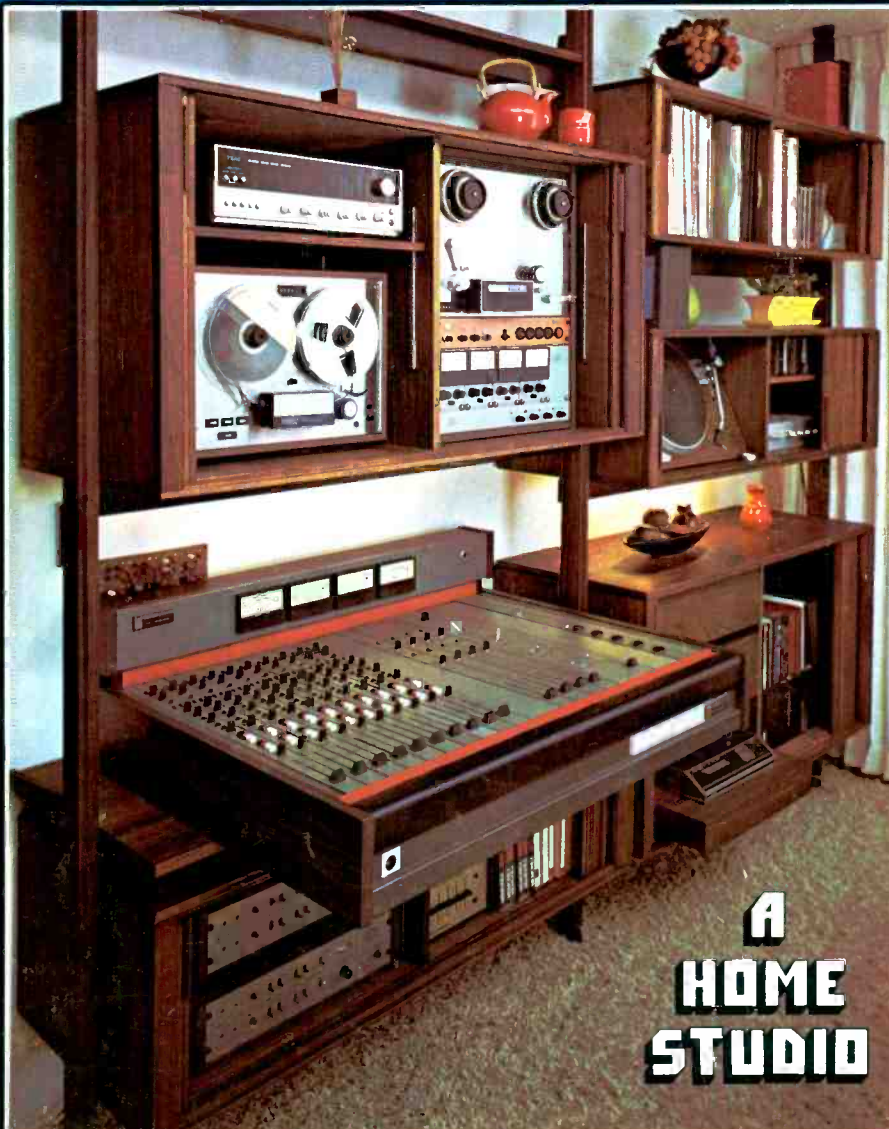
BUYERS GUIDE

TO OPEN REEL TAPE RECORDERS

PAGE 44

**Logic Control
of Tape Decks**

**Open Reel:
Changing
Product &
Market Trends**



**A
HOME
STUDIO**

Brilliant sound from a distinctive newcomer.

And the critics agree:

OPERA NEWS (Hans Fantel)

"The cadre of relatively low priced high-performance speakers has recently been augmented by a distinctive newcomer: Pioneer's R300, whose tonal characteristics have been tailored to the results of extensive preference-testing with large groups of listeners. The R300 has a quality of 'presence' and immediacy which made Salome's murderous ecstasies positively scary when I listened, and the massive sonorities of the Strauss score didn't faze this speaker a bit."

STEREO & HI-FI TIMES (Larry Zide)

"... This (R500) speaker will please many with its big, bright sound. The middle ranges... are most prominent, but there is more than enough good bass, too... The high end response is excellent; midrange and tweeter contribute to a smooth, wide range sound that goes well beyond audibility... It's time that we began to demand appearance along with performance. This, Pioneer is certainly giving us with this model, and they are to be commended for the effort... The R500 is a quality speaker and deserves your attention."

MODERN HI-FI & STEREO GUIDE (Robert Angus)

"There are some important differences between the R series... and most other bookshelf speaker systems on the market... The R500 is designed to make electronic rock music sound more dramatic... There's no doubt that with either folk or rock music, these speakers really produce brilliant sound... bass is remarkably clean and full under any circumstances... Sound is clean and undistorted up to 18,000 Hz... at the low end, clean frequency response is measurable down to 22Hz."



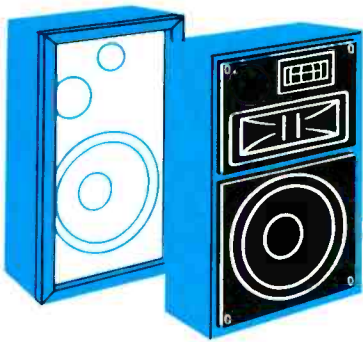
Too often these days superlatives are used to camouflage mediocrity. Let's just say you'll be excited with the magnitude of the achievement of the new Pioneer series R speaker systems, once you hear them. They represent the culmination of our more than six years of intensive research in every phase of speaker design on just this series alone.

We investigated, tested and evaluated every known area: frequency response, dispersion, distortion, transients, drivers, configurations, cabinetry — rejecting, accepting, improving until we were completely satisfied that we had the perfect combination. The sound most people would prefer when compared with the conventional speakers now available.

The story behind the grille

To achieve this exceptional sound reproduction, Pioneer has endowed the new series R with a host of meaningful refinements that have become the hallmark for our extensive collection of high fidelity components.

Flush mounting. Unlike other speaker systems on the market today, the R series' drivers are flush mounted to the face of the enclosure, rather than recessed. Combined with the advanced design of the individual speaker units, there is added vitality to the mid tones and wider dispersion.

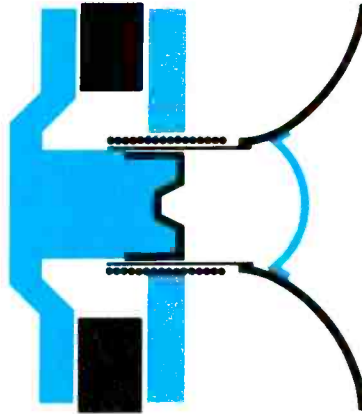


Conventional recessed speaker mountings.

New up-front flush mounting of Pioneer series R.

Exclusive FB cones assure robust bass, clear mid and high tones, improve damping, while keeping distortion at an absolute minimum. High input signals are handled with complete ease.

	R700	R500	R300
Speakers	12" woofer, midrange horn, multicell horn super tweeter	10" woofer, 5" midrange, horn tweeter	10" woofer, horn tweeter
Maximum Input Power	75 watts	60 watts	40 watts
Crossovers	750 Hz, 14,000 Hz	800 Hz, 5,200 Hz	6,300 Hz
Dimensions	15" x 26" x 13 $\frac{1}{16}$ "	13 $\frac{3}{4}$ " x 24" x 12 $\frac{1}{16}$ "	13" x 22 $\frac{1}{2}$ " x 11"
Price	\$229.95	\$159.95	\$119.95



Unique concave center pole design and pure copper cap/ring combination. The concave center pole of the drivers' magnetic structure is covered with a pure copper cap. Not only does this reduce the inductance of the voice coil, it also decreases the voice coil's intermodulation distortion generated by the magnetic field. The result: vastly improved bass and midrange transient responses. Another example of Pioneer's meticulous engineering detail.

Improved design horn tweeters of die-cut aluminum have completely replaced the more conventional (and less costly) cone and dome-type tweeters in the entire series. You can hear the difference with wider dispersion, and you gain all the advantages of horn drivers, such as high transient response and lowest distortion.

Crossovers are precisely designed in each model. In contrast to other speakers that rely on the capacitance method only, Pioneer has combined both inductances and capacitances for minimum intermodulation distortion. And you'll never hear bass tones wandering to the tweeters, or highs intruding on the woofers. You couldn't ask for better linear response.

The acoustically padded enclosures are sturdily built and faced with handsome two-piece, two-color, removable grilles. The staining process of the hand selected walnut requires ten steps alone, and utilizes an exclusive oil created by Pioneer. Each unit is produced as if it was the only one.

Sound-absorbing foam polyurethane surrounds the woofers of the R700 and R500 to reduce distortion even further. The three R series models each employ long-throw voice coils providing greater cone movement for higher excursions.

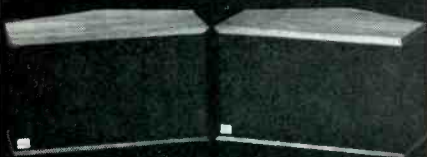


There are many technical reasons why you should buy a pair of the new Pioneer series R speakers systems. But, in the final analysis, when you compare them with comparably priced speakers at your Pioneer dealer, their absolute superiority in sound reproduction is why you will buy them.

U.S. Pioneer Electronics Corp.
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New Jersey 07072

PIONEER
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our
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*Prices slightly higher in south and west. Dealer inquiries invited.


**Linear
Design
Labs Inc.**

114 Wilkins Avenue, Port Chester, N.Y. 10573

AUDIO

APRIL 1973

Successor to **RADIO** Est. 1917

Vol. 57, No. 4

FEATURE ARTICLES

- | | | |
|----|---------------------------------------|-----------------------------|
| 8 | Studio in the Home | |
| 26 | Logic Control of Tape Recorders | <i>Ole Melvold</i> |
| 32 | The Changing Face of Open-Reel | <i>George Taylor</i> |
| 44 | Directory of Open-Reel Tape Recorders | |
| 38 | Canby ETC | <i>Edward Tatnall Canby</i> |
| 69 | The ZYX Phono System | <i>Professor I. Lirpa</i> |

EQUIPMENT PROFILES

- | | | |
|----|------------------------------|--------------|
| 52 | Design Acoustics Loudspeaker | <i>D-12</i> |
| 54 | Infinity Loudspeaker | <i>1001</i> |
| 61 | Shure Phono Cartridge | <i>M-91E</i> |

RECORD AND TAPE REVIEWS

- | | | |
|----|-------------------|-------------------------------|
| 64 | Classical Reviews | <i>Edward Tatnall Canby</i> |
| 70 | Off The Record | <i>Sherwood L. Weingarten</i> |
| 74 | Jazz & Blues | <i>Martha Sanders Gilmore</i> |

AUDIO IN GENERAL

- | | | | |
|----|--------------------------------------|----|-------------------------------------|
| 4 | Coming in May | 18 | What's New In Audio |
| 4 | Audioclinic <i>Joseph Giovanelli</i> | 20 | Behind The Scenes <i>Bert Whyte</i> |
| 6 | Tape Guide <i>Herman Burstein</i> | 56 | Advertising Index |
| 16 | Editors Review | 76 | Classified Advertising |



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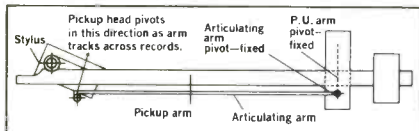
Sometimes high fidelity people lose sight of what it's all about: Sound.

The ultimate test of any piece of high fidelity equipment is what you hear.

That's why, of all the statements made by equipment reviewers about our Garrard Zero 100, the most significant were these:

"Using identical virgin records, and virgin styli in identical good cartridges, the Zero 100 on occasion sounded markedly 'crisper' than other turntables." *Rolling Stone*.

"A listening test proves to bring new life to many records, noticeably reducing distortion on the inner grooves." *Radio Electronics*.



"From about 7 in. diameter to runout, the Zero 100 delivers considerably less distortion and greater definition than with the same pickup mounted in a standard arm. The improvement in sound quality is notably impressive."

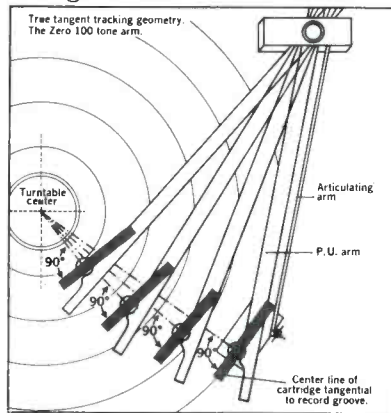
Elementary Electronics.

"The articulated arm of the Zero 100 produced less distortion, and therefore greater definition, on high-level, musically complex passages, from the inner grooves."

Hi-Fi Stereo Buyers' Guide.

That's what reviewers actually

heard when they tested the first automatic turntable with Zero Tracking Error. This is, to our knowledge, the first time a turntable has been given credit for making records sound better.



Cartridges and other components, yes. But never a turntable — until the Zero 100.

By this time you probably know how we achieve Zero Tracking Error. The principle of the articulating arm, continually adjusting the angle of the cartridge so it is always at a 90° tangent to the grooves, is a simple one. But the ingenious engineering and the development of the precision pivots to make the principle work, took several years.

But enough from us. Let's go back to what the reviewers say about the Zero 100.

"It probably is the best arm yet

offered as an integral part of an automatic player." *High Fidelity*.

"All of these features combined into one automatic turntable make news, even though some are found on other units. Only in the Zero 100 are they all put together." *Audio*.

When *Audio* talks about "all of these features" they're referring to such things as our magnetic anti-skating, variable speed control, illuminated strobe, viscous-damped cueing, 15° vertical tracking adjustment, patented Garrard Synchro-Lab synchronous motor and our exclusive two-point record support in automatic play.

But all of this gets back to our original point. It is the sound that makes the difference. After all, a \$200 record player should give you a really meaningful difference. And the high fidelity experts agree that people who own a Zero 100 will hear better than people who don't.

If you'd like to read the reviews in full detail, we'll send them to you along with a complete brochure on the Zero 100 and the Garrard line. Write to: British Industries Company, Dept. D 13, Westbury, N.Y. 11590.

GARRARD ZERO 100

The only automatic turntable with Zero Tracking Error.

Mfg. by Plessey Ltd. Dist. by British Industries Company

coming in May

A survey of the leading open-reel tapes.

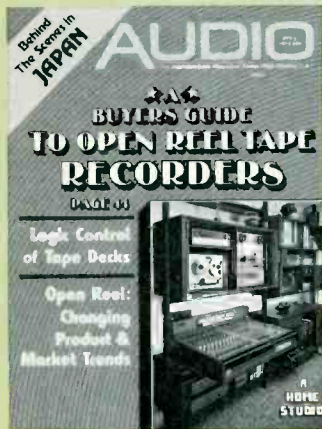
"The Language of High Fidelity" Part 10 of Martin Clifford's series for beginners.

Equipment Reviews include:

Dynaco A-35 loudspeaker

Marantz 1120 integrated amplifier

SAE Mk XII loudspeaker



About the Cover: This shows one wall of Arne Berg's studio described on page 8. In the cabinet on the extreme left are the two Tri-amps and electronic crossover, then on the right hand side of the door opening is a TEAC AG 600 receiver and a TCA 40 4-channel tape recorder. Next to that is a TASCAM Series 70 recorder, a Model 10 mixing console and two TASCAM prototype Dolby "B" units. The turntable is a CEC with a Stanton 681A cartridge and the cassette recorder underneath is an A24. The small unit on the right is a Metrotec Graphic Equalizer and hidden somewhere are the Madsen delay-line amplifiers. The various cabinets are all Barzilai and the whole installation is by permission of Mrs. Berg...

Audioclinic

Joseph Giovanelli

Frequency Response of Two Channels

Q. Can you tell me why there should be a difference in frequency response between one channel and another in any good amplifier? I have seen such differences mentioned in equipment reviews.—Michael Visser, Hatfield, Pennsylvania

A. It is possible for each channel of a stereo amplifier to have a bit different gain from its mate. That difference can cause the overall frequency response of one channel to be depressed or raised above that of the other channel. Further, because of differences in transistors and somewhat different component values, the outer ends of the frequency response (outside the audible range) can vary a bit from one channel to the other.

When I speak of differences in components values between the two channels, I refer to the fact that there is a certain amount of error in the value of a given component. There is a nominal value printed on a component, but there are manufacturing tolerances. These little variations in the actual value of the components and slight differences in gain of the transistors can and will affect the performance of an amplifier. As you will observe, however, these differences are too small to be heard. The use of large amounts of fuseback keeps such frequency errors to a very small minimum.

Interference From a Power Transformer

Q. I own a high-powered transistorized audio amplifier. It causes trouble because the power transformer buzzes audibly into the listening area and it radiates into the AM broadcast band loud enough to spoil AM reception.

I tried tightening the bolts on the transformer laminations, but with no improvement. I also tried line filters to keep the "hash" off the broadcast band, but again, with no success. Can you come up with a solution to the noisy, buzzing transformer or a solution to the buzzing "hash" which it produces on the AM band?—Dr. J. W. Welch, Wall Lake, Iowa

A. Power transformers can make noise which can be heard as mechanical vibration. These vibrations are often amplified by the cabinet in which the equipment is housed—because it acts as a sounding board. This aspect of your problem can often be relieved by mounting the equipment on some kind

of shock mount. The receiver should be floated on foam whose consistency is not such as to completely collapse under the weight of the equipment, but the foam should compress to some extent. Under these conditions, the vibrating chassis cannot make the cabinet in which the equipment is housed act as a sounding board.

The radio interference problem is something else again. I suggest that you feed the radio into some other amplifier and note if the interference is still heard. (Of course, if the radio is a portion of the amplifier that you are using, this is not practical.) If you do not hear the radio interference when the amplifier is turned off, but do hear it as soon as the amplifier is once again turned on, you will know that the amplifier is, indeed, generating the noise. This fact still does not mean that the power transformer is responsible. It is far more likely that the noise is produced by the diodes in the power supply as they rapidly switch on and off. Such switching transients can often be reduced by placing a capacitor across the terminals of each diode. These capacitors must have a voltage breakdown rating high enough so that they will withstand the full peak voltage which will appear across them when the diode is not conducting during half of each cycle. (This peak will equal the voltage stored in the filter system, plus that of the power transformer secondary, or secondary center to either end—depending on the nature of the power supply circuit employed.) I suspect you may need to use a 0.05 UF ceramic capacitor across each diode. Also, it is a good idea to use a 100 K ohm resistor across each diode, along with the capacitor. The wattage will depend on the conditions of the particular circuit, but 2 watts is an absolute minimum resistor value.

I see no way that a power transformer can produce this radio interference, at least not for long. Such radiation from a transformer would have to be the result of internal arcing which would ultimately cause a complete failure of the transformer. **AE**

If you have a problem or question on audio, write to Mr. Joseph Giovanelli, at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped self-addressed envelope.

FOR THOSE THAT CAN UNDERSTAND IT, THE SECRET OF EPI'S LINEAR SOUND:

Most people would have neither the understanding nor the inclination to read an ad like this.

But that doesn't make it a waste of our money. Because the few people that *would* read it are, by definition, the best prospects for our EPI loudspeakers.

The subject is linearity.

On a frequency response graph, an EPI speaker records a remarkably linear curve, measured from both on-axis and off-axis (60°) positions.

Why is that?

It has a lot to do with the kind of tweeter that goes into an EPI speaker.

EPI'S 1-INCH "AIR SPRING" TWEETER.

If you've never heard of an "air spring" tweeter, there's a very good reason for that: We made the name up.

We had to. EPI's tweeter is unlike any other made.

Our air spring tweeter has a concave diaphragm which is driven around its full circumference by a 1-inch voice coil. This is coupled with a 14,000-gauss magnetic field contained in a 9-ounce, permanently charged magnet and suspended in a conically-structured, air-sealed acoustic chamber, designed to create an equi-dispersed recoil effect.

The 1-inch diameter permits

radiation of a nearly perfect hemispherical sound pattern throughout the tweeter's entire frequency range, from 1800 to 18,000hz ± 3 db. And as

Stereo Review Magazine points out, wide dispersion at all levels is the major factor separating an excellent speaker from a merely good one. (*Stereo Review* placed our EPI 400 in the "superb" category.)

So, now that you know the secret of EPI's Linear Sound, all you need to know is where it comes from:

Out of eight great speakers, from \$55 to \$1000, made only by Epicure Products Inc., Newburyport, Mass. 01950.

THE LINEAR SOUND OF EPI.



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CROWN

ASK THE PRO WHO OWNS ONE

You may have puzzled about the rare availability of Crown tape recorders on the used market. Perhaps you even have a friend who refuses to part with his aging Crown at any price. Well, the typical Crown owner is not only a careful shopper, he knows when something is too valuable to lose. After all, why should he trade when his 4-year old Crown still turns out crisp, perfect recordings with greater fidelity than most brand new hi-fi tape decks?

One reason for this is that the Crown line is a professional line of tape recorders and players - that is, designed for audio pros who make their living by recording. Crown does not bow to the popular philosophy of "planned obsolescence", where the manufacturer automatically outdates last year's line by bringing out all new models each year. Indeed, since Crown first introduced modular solid state recording in 1963 (four years before any other manufacturer), the basic design has not been significantly altered - so advanced was its concept. State-of-the-art currency is maintained by incorporating new features into current models, only when they mean an advantage in either performance or price.

But even these are not the reasons a Crown owner would give for treasuring a venerable old model. He would say it's the sound - that matchless recording and playback fidelity that has become synonymous with the Crown name. For example, the SX724 4-track stereo deck at 7½ ips delivers a frequency response of +2dB 30-25,000 Hz, with hum and noise at -60dB, and maximum wow and flutter of 0.09%. (When comparing specifications, keep in mind that, unlike most hi-fi manufacturers, Crown guarantees its specs for minimum long-term performance; actual operation is often even better.)

For free product data on Crown professional stereo and quadraphonic tape decks and players, write Crown International, Box 1000, Elkhart, Indiana, 46514.



CROWN

Check No. 3 on Reader Service Card

Tape Guide

Herman Burstein

Tape Length

Q. I am writing you in regard to the different lengths of cassette tape. I use a Sony TC-160 cassette deck to record music, and was wondering if using a C-120 or C-90 cassette is advisable. I have been told that when using these cassettes the tape speed will slow down and the speed will be irregular, causing excessive wow and flutter. Can you advise me as to the best tape length to use?—Chuck Thurwachter, Lathrup Village, Michigan

A. Cassettes can hold more tape only by using thinner tape. With thinner tape come problems, such as squeal, print-through, and possibly increased wow and flutter (particularly flutter). For anything like good results, ½-mil tape is generally not recommended. My suggestion is that you try each of the tape lengths (tape thicknesses) and listen for appreciable differences, if any.

Guitar Recording

Q. I would like to make some sound on sound guitar recordings. Since I don't want any side-noise, I connected my guitar directly to the tape recorder input. This works, except that I cannot change the tone of my guitar while recording; it always comes out with too much bass and too little treble. Is there any unit I can build or buy which I can insert between the guitar and tape recorder to permit me to change the tone of the guitar?—Walter Weeler, Commack, N.Y.

A. In general, an audio preamp (without power amps) would meet your problem. Such preamps, with a good deal of bass and treble control, are still available. You can find a number of these described in the audio directories that periodically appear in *Audio*.

1⅞ ips vs 3¾ ips

Q. In your opinion, does the Tandberg at 1⅞ ips provide as good performance as other moderate quality tape decks do at 3¾ ips?—K. L. Ecton, APO San Francisco

A. So far I have seen no open-reel home machine which performs as well at 1⅞ ips as do "moderate quality tape decks" at 3¾ ips. On the other hand, some machines (such as the Tandberg) do remarkably well at 1⅞ ips.

Matching Outputs

Q. I want to use two tape recorders with a Dolby unit and need to match

their outputs. Unfortunately, neither one of these recorders has an output control. Can you suggest a simple attenuator network that will not cause impedance matching problems?—Mac Fitzsimmons, Shreveport, Louisiana

A. To reduce output of a machine without an output gain control, you could install such a control. Connect a pot across the output, and take the signal off the arm of the pot. The value of the pot should correspond to the load impedance recommended by the machine's manufacturer. If he does not supply a recommended load impedance, you might try a value that is about 10 times the rated output impedance of the machine. For example, if the rated output impedance is 2,000 ohms, use a pot of about 25,000 ohms.

Magnetized Head

Q. Recently I wanted to see what the signal coming right off the playback head of my deck is like so I could have something to compare against should I at some future date suspect the head of having gone bad. I connected the leads of my a.c. VTVM right across the head output without disconnecting the head from the machine's electronics. I then ran an Ampex alignment tape and I immediately noticed a very loud, gurgling hiss on the track that the meter was hooked to. By allowing the tape to run to the end, I managed to wipe out an entire (quarter) track of the tape. I ran a piece of scrap tape and noticed the same noise, so I degaussed the heads, and this cured the problem. One thing I didn't mention is that while the tape was running, one of the clip-leads slipped and momentarily shorted one of the head leads to the shell of the head. It seems that I somehow caused the head to become magnetized, and I'm hoping you can tell me why.—Harvey Geminder, West Orange, New Jersey

A. A sudden current change, particularly a strong one, can magnetize a head. My guess, and it is merely a guess, is that this happened when one of your clip-leads slipped and shorted one of the head leads.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

Albeit an expensive bargain, but a bargain nevertheless. For the Model Fifty-Four is without question the finest stereo receiver we have ever made. Indeed, it may well be the finest stereo receiver *anyone* has ever made. And if that wasn't enough, the Fifty-Four is also an absolutely incredible four-channel receiver. With 60 watts (RMS) per side in the two channel mode and 25 watts (RMS) per side in the four-channel mode, the Fifty-Four is an extraordinary power package. It's considerably more compact and sleeker than competitive models, yet it will outperform the biggest and bulkiest of

them with ease.

And it's so very easy to use.

All the controls are clearly indicated and conveniently located on the front panel. You can change from one format to another—two channel, Stereo 4, SQ, etc.—with the simple flip of a switch. In addition, there's a neat "joy stick" for absolutely perfect balance control.

The Fifty-Four also features an exclusive automatic power control circuit (patent pending) that turns the receiver on and off to coincide with the operation of your automatic turntable.

All in all, we think the Fifty-Four is

quite in a class by itself.

But don't take our word for it. Not for \$525.† Go listen for yourself. And if the price still seems a bit rich, consider this: Buy the Fifty-Four and you'll never have to buy another receiver again.

Now *that's* a bargain!

For more technical information, write to KLH Research and Development, 30 Cross Street, Cambridge, Mass. 02139. Or visit your KLH dealer.



KLH RESEARCH DEVELOPMENT CORP.
30 Cross Street, Cambridge, Mass. 02139

†Suggested retail price—slightly higher in the South and West.



The
new
**KLH-Model
Fifty-Four**
**Stereophonic/Quadraphonic
Dual Function Receiver.**
Our \$525 bargain.

Check No. 4 on Reader Service Card

STUDIO IN THE HOME (or home in a studio)



A home recording session at the Berg's. The draped wall behind the performers masks the speaker-studded wall discussed. The recorder/reproducer is a TASCAM Series 70, mics are Altec M-49's.

This is not a close look at a typical audiophile's equipment because neither this particular audiophile nor his installation is very typical. Arne Berg, formerly director of engineering at TEAC Corporation of America and now executive vice-president of TASCAM Corporation, has (with the kind permission of his wife) turned his living room into an experimental laboratory. What is unique about this experimental laboratory, however, is that it can easily be turned back into a living room. His equipment, much of it scratch built, prototypes, or production models of things he's had a hand in designing, is hidden in walls or behind Barzilay cabinets when not in use. Thus, your view of the room differs depending on whether you're from AUDIO or *Better Homes & Gardens*.

With almost 25 years in the audio industry, Arne has some exceptional accomplishments to his credit, among the most notable being the development of Reverse-O-Matic and the design of the first commercially available four-channel stereo tape recorder.

Recently we visited the Berg home near the mountains in Los Angeles. At the time the living room/lab was being

used for a home recording session. Later we talked to Arne about his system and some of the things he's currently working on.

AUDIO: *Let's begin with your speaker system. Obviously, you made your own. Did you incorporate some new ideas or did you just feel you could do better than manufactured units?*

BERG: I wasn't bent on outdoing the experts in this field. I built the system myself mainly because of a special, self-imposed problem. When I listen to music I don't like to see speakers. I find myself staring at them and they get in the way psychologically. I think that's true of most people. The sound just seems better when the speakers are out of sight. This is a living room as well as a listening room so drapes seemed to be the answer. The room is really too small to drape in front of manufactured speaker systems because I wanted a system that produces a lot of acoustic energy at the low end. That usually takes a large system. Instead I've utilized various drivers built into the wall.

AUDIO: *I presume then the woofers are baffled by the room behind the wall?*

BERG: Yes. The backs of the eight woofers "look into" the kitchen through the pantry via a series of holes. A crossover frequency of 100 Hz permits the otherwise peculiar location. The low cut-off is also important so my wife won't feel like she's making dinner inside a speaker cabinet.

The size limitations of the room also account for the arrangement of other speakers. I have a Madsen delay system, but instead of placing the speakers at the sides I put them in the ceiling. I have two rear speakers hidden behind the couch for regular quad and I've placed them so they reflect the sound off the bay window back into the room. The midrange units in the frontal system are arranged in column fashion which provides good dispersion. The space between the studs gives me adequate baffling down to 100 Hz. The tweeters are compression units and are also mounted in column pairs.

AUDIO: *What about the absorption effects of the drapes hung in front of the speakers?*

BERG: Well, of course there's always going to be a certain amount of attenuation through any material, but I spent a lot of time in careful selection of the material so it would have minimum attenuation and still have a visual masking effect. What little attenuation there is occurs at very high frequencies and I can easily make up for the loss with the equalizers.

AUDIO: *What kind of amplifier system do you have?*

BERG: All the power amplifiers are scratch-built and produce about 25 watts each. The up-front speakers are tri-amp systems and I use them for discrete frontal information.

AUDIO: *So you have 12 amplifiers for the frontal system, two for the Madsen delay line, and two for the rear system. That's a lot of money into amplifiers.*

BERG: It would seem so but the actual cost of the components is really quite low discounting the know-how and the labor involved. I don't remember the exact cost, probably less than \$200. The point is if you're willing to put in the time, the cost of the components themselves isn't prohibitive.

AUDIO: *What about your divider network. Is that your design, too?*

BERG: It's a transistor redesign of a vacuum tube system that I've been

(Continued on page 12)

at \$169.95*, the Heathkit AR-1214 is more receiver than you bargained for!

Because the AR-1214 AM/FM Stereo Receiver is a kit, we can maximize on design, engineering and components and pass the savings along to you. And by following the simple but amazingly thorough instruction manual, you can build it, even if you've never seen a kit before. Besides being a lot of fun, the project pays off by letting you step up in quality without putting up more money.

The AR-1214 amplifier section produces a clean 25 watts IHF, 15 watts RMS, per channel into 8 ohms. Two integrated circuits and two ceramic filters in the IF give this receiver a selectivity greater than 60 dB and superior amplifying/limiting characteristics. The phase lock multiplex demodulator gives 40 dB typical channel separation at less than 0.5% distortion. The preassembled FM tuning unit provides 2 μ V sensitivity and a 2 dB sensitivity and a 2 dB capture ratio. The phono preamp section also uses integrated circuitry and has its own level controls so turntable volume can be set to coincide with tuner levels.

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AR-1214 SPECIFICATIONS — FM SECTION (Monophonic) — Frequency response: ± 1 dB, 20 to 15,000 Hz. Sensitivity: 2 μ V.* Selectivity: 60 dB.* Capture ratio: 2 dB.* AM suppression: 50 dB.* Harmonic distortion: 0.5%.* Intermodulation distortion: 0.5%.* Hum and noise: 65 dB.* Spurious rejection: 70 dB.* **FM SECTION (Stereo)** — Channel separation: 40 dB typical, 35 dB minimum. Frequency response: ± 1 dB from 20 to 15,000 Hz. Harmonic distortion: 1% @ 1000 Hz with 100% modulation. **AM SECTION —** Sensitivity: Less than 100 μ V per meter.* Selectivity: Greater than 40 dB (alternate channel). Harmonic distortion: Less than 2%. Hum and noise: 35 dB.* **AMPLIFIER —** Dynamic power output per channel (music power rating): 25 W (8 ohm load).* 30 W (4 ohm load). 14 W (16 ohm load). Continuous power per channel: 15 W (8 ohm load). 20 W (4 ohm load). 10 W (16 ohm load). Power bandwidth for constant 0.5% total harmonic distortion: 5 Hz to 30 kHz. Frequency response (1 W level): ± 1 dB, 7 Hz to 100 kHz. Harmonic distortion: Less than 0.5% from 20 Hz to 20kHz @ 15 W output. Intermodulation distortion: Less than 0.5% with 15 W output, using 60 and 6000 Hz mixed 4:1. Damping factor: Greater than 50. Input sensitivity: Phono: 2 mV. Tape: 190 mV. Tape monitor: 190 mV. Hum and noise: Phono (10 mV reference) —65 dB. Channel separation: 55 dB. Phono & Tape. Output impedance: 4, 8 or 16 ohms. Dimensions: 3 $\frac{7}{8}$ " H x 17" W x 13" D.

*Rated IHF (Institute of High Fidelity) Standards **Record Industry of America

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(Continued from page 8)

using for more than 12 years now. We're looking at this one for possible inclusion in our product line.

AUDIO: Anything special about it?

BERG: Its feature is the complimentary splitting of the filter circuits using differential amplifiers. When the divided outputs are summed and then measured, there's a preservation of square wave response that you don't get with the usual low pass/high pass units. I'll resist the controversial arguments right now concerning the benefits of phase integrity, but it sure feels good when a summed divider can measure just like a broadband amplifier. Recently, I've seen this approach theorized and discussed in some technical papers but as far as I know, such a system has not yet been made commercially available.

AUDIO: Twenty-five watt amplifiers seem rather meager by today's standards.

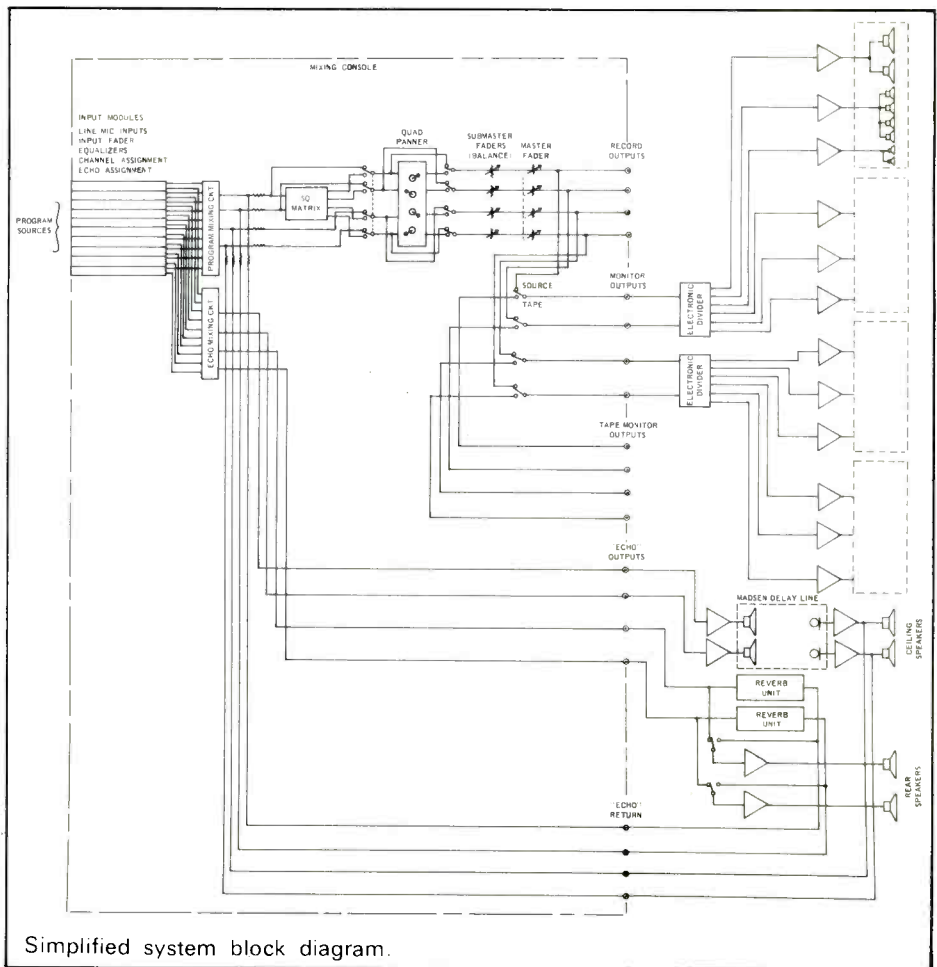
BERG: To be sure. But in this case, a lot of 25 watt amplifiers, each with their own power supply and each taking their narrow band of divided spectrum in stride, adds up to quite a reasonable acoustic level. And, of course, there's no wasted power drained away by speaker dividing networks.

AUDIO: That's one way to get around the horsepower race going on in the amplifier market today.

BERG: Right. I have no particular quarrel with high power systems, at least within some reasonable limits. I think my approach is just another way of doing it. Besides, if you came here next week you might find a Phase Linear patched in.

AUDIO: You said before you use the four channel system up front for discrete local information. Does that mean you dislike quadrasonic sound?

BERG: First of all, if quadrasonic in this context means a quad speaker geometry, I have to say I don't always like to be surrounded by an orchestra. It's not a real experience. But I'm not adamantly against quadrasonic. A lot of old pro audiophiles have discarded the whole idea of four channel because they feel insulted by so-called "surround sound." But I say forget about being surrounded. If you don't like it, take this same program material, put it up front, and get stereo-times-two. The more discrete slices you can get out of the original recording environment the more accurate the stereo information's going to be. I think this is especially valid with respect to how recordings are made today. It's com-



Simplified system block diagram.

pletely flexible and you get something a lot better than you have with two channels. So why be stuffy about it? I find that most material which in quad sounds like double ping-pong, comes off with a beautiful frontal stage impression when played in-line. Some gross quad panning effects can't be defeated, but we've always had to live with a certain amount of exhibitionist recordings anyway.

AUDIO: So you just disagree with quadrasonic program material?

BERG: Not entirely. Quadrasonic can still provide spatial information which opens a new door to fidelity. The problem is that when quad was introduced a lot of companies wanted to get into the act fast. So they just went back to their multi-track masters and mixed down to four channels instead of two. We got a tremendous amount of "surround sound" and a lot of people like it, so it shouldn't be denied. But if I'm listening to an orchestra with conventional instrumentation—as contrasted to a synthesizer, let's say—I don't expect to hear that orchestra surround me. I expect a frontal presentation. But more and more tapes are being created for surround listening. A great example is Buffy Sainte-Marie's

"Illuminations" on Vanguard tape. It's a dynamic rather than static experience. Instruments themselves move, sounds are created to be listened to from four different directions.

AUDIO: Then you're admitting that it's getting harder and harder to separate music from electronics.

BERG: There's nothing wrong with that. It's been that way for a lot longer than most people realize. Originally, recordings were trying to faithfully reproduce the prototype, namely the concert situation. The reproduction on that record or tape was good or bad depending on its fidelity to that prototype experience. Today, for the most part, records and tapes are no longer attempting to imitate a concert. They are an art form in themselves. Much, if not most modern musical experience, is not the concert hall but the living room. The record itself, or perhaps the control room, is the prototype. So tapes like Buffy Sainte-Marie's achieve their own validity. Buffy couldn't do "Illuminations" in a concert hall even if she wanted to. Most pop recordings can't be performed live. The same sound can't be performed live because in a great many cases performers double up on instruments or simply aren't



A Sony turntable for the lazy perfectionist

If you're a perfectionist, you wince at the thought of stacking records, naked and defenseless, or dropping them onto each other. So you wind up with a single-play component turntable, and hold your breath to raise and lower the arm gently and perfectly.

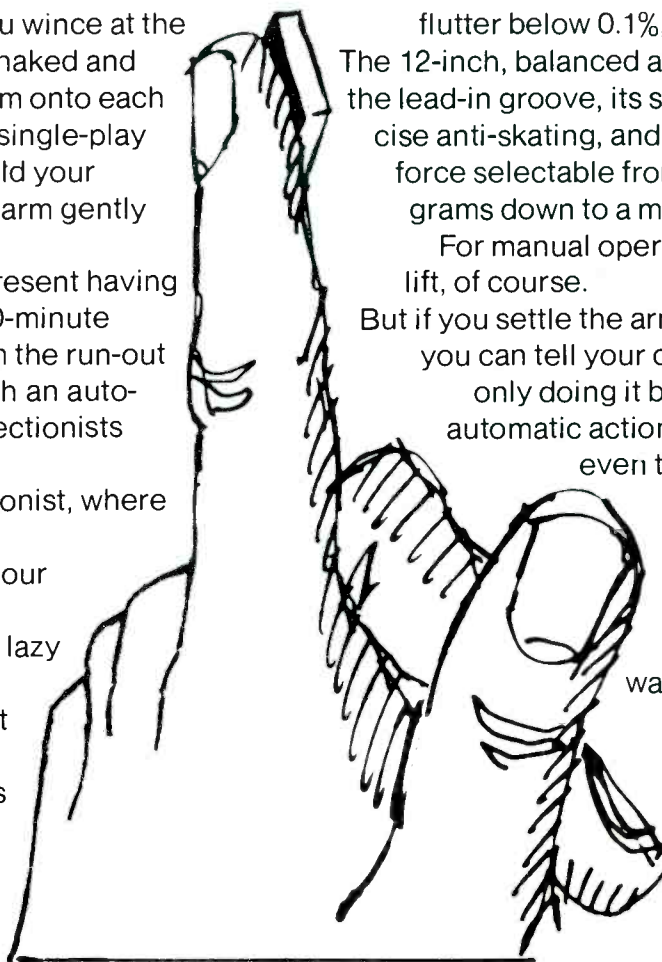
If you're lazy, though, you resent having to dash across the room at 20-minute intervals to lift the stylus from the run-out groove. And you wind up with an automatic turntable. (Which perfectionists still call "changers.")

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together in the studio on the same day.

So that's why quadrasonic sound has a validity all its own and I think many purists refuse to recognize it simply because they've denied themselves the experience. I want to appeal to this guy not to put down four channel material created for quad listening. Play it up front.

AUDIO: *I'm interested in the method you used to achieve the Madsen delay line.*

BERG: I took a very brute force approach to this thing. I have a crawlspace between the ceiling and the roof and I simply take the signals coming out of the board from two of the echo busses, put it through amplifiers and drive small cheap speakers in the crawlspace. At the distance required for the time delay there are microphones which send the signals to the speakers in the ceiling. A Metrotech graphic stereo equalizer makes the whole thing sound pretty good. I get some blend between the two channels but it's not enough to destroy the effect of ambience recovery which we owe to Mr. Madsen.

AUDIO: *How about using the copper tube idea of Duane Cooper's. You remember we published an article on this last year.*

BERG: As a matter of fact I tried something like that. Since I had the space I used a series of straight fibre pipe I got at the hardware store. It was a closed system and it kept out extraneous noises, but as you know, the trouble with any pipe is that it introduces severe frequency limitations, among other problems. So I gave that up in favor of the system I've got now. In the meantime, Duane Cooper took the initiative to solve most of the problems associated with the coiled hose. I'd like to install one of his Time Cubes in the future. As soon as I find where my wife hid my tools.

AUDIO: *Maybe she hid them under the turntable. Or is there some special reason for having it positioned at that angle?*

BERG: Frankly, it's just a glamorous thing. It doesn't add anything to the performance but it's a lot easier to operate. You can find the spindle faster and it simplifies finding the groove. I did this in an earlier system because I didn't have room for a big transcription table in the cabinet I had.

That isn't a problem with these Barzilay cabinets but I prefer the angle rather than installing slides. And I like to put people on by looking astonished when they ask me why the turntable is at such a funny angle. "It is? No wonder the damn thing doesn't work!"

AUDIO: *How did you solve the mechanical decoupling problem in adapting the motor suspension?*

BERG: The motor suspension originally relied on gravity to hold it by some very viscous coupling members and I had to jury-rig some springs to change that. Otherwise the only thing I had to do was carefully balance the tone arm in all places so that the only force is what the pressure adjusting spring applies to the arm. The dynamic balance has to be watched closely or it exaggerates the wear problem.

AUDIO: *Let's talk about this TASCAM mixer. Do you really use it in your system?*

BERG: For sure. I helped design it and work for the company that makes it. Part of my job requires an absolute hands on familiarity with the board in all its applications. As you saw, I'm a home recording nut but the mixer is also here as a test bed so I can see, for instance, how it works as a pre-amplifier for a home quadrasonic system as well as a home studio.

AUDIO: *Home recording is a little different from studio recording, isn't it?*

BERG: It is in this house. With a dog and four daughters and their friends running in and out it gets to be like Dagwood Bumstead's house sometimes. Still, when I'm recording something important they're pretty good about it. I make a lot of demo tapes for the company and they (the children, that is) understand being locked in the garage.

AUDIO: *Besides recording, what else are you using the board to experiment with?*

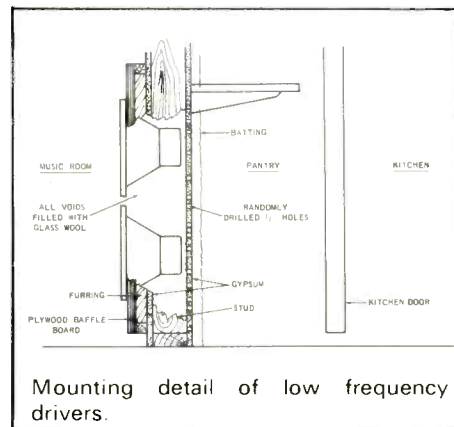
BERG: Well for instance, this particular model has a quad panner module. I use it to test various channel orientations of quad and it's great because I can move any channel to any part of the room with a flick of the wrist. I can also produce phantom images with the quad panner and I'm exploring the possibility of taking advantage of that phantom image in a quad system to make the listening area more flexible.

AUDIO: *If there's a common problem with quadrasonic sound, that's it. How do you propose to solve that X-marks-the-magic-spot difficulty?*

BERG: I haven't concluded anything here yet, but as you know, producing identical program material between two speakers at the same level results in an apparent sound source between the two speakers. A phantom image. When the person standing between the two speakers moves, the image moves, too. As you said, one of the problems with quadrasonic sound is that you really have to be

in the right spot. I'm hoping that by producing phantom images between all four speakers there'll be a balance maintained, so that as you move around the images move with you. The board also lets me instantly reorient the channel assignments and the A + B phantoming to the speakers.

AUDIO: *But for home quad use the board is just an extremely expensive control center.*



Mounting detail of low frequency drivers.

BERG: Ah, but I also have effectively the equivalent of four more outputs on the board by virtue of the echo send circuits. Using the four extra outputs from the echo busses I can distribute recovered ambience information to the Madsen delay system in the overhead speakers, to the reverb'd two speakers in the rear, or both. And the echo circuits can still function for reverberation being sent back into the board for recording and copying purposes. This way I can play double ping-pong sources in frontal perspective and still get ambience in the rear or from above, or both. Mostly, I get flexibility from the controls and it allows me to experiment in a lot of ways. Incidentally, there's a matrix decoder that you can't see because I had to build it into the board. Externally mounted I would have had a rat's nest of patch cords. Anyway, I can switch in or out and make a really honest A-B of two channel versus four channel, discrete versus matrix, and so on.

AUDIO: *While we're on the subject, where do you stand on the controversy between matrix and discrete four channel?*

BERG: I wouldn't touch that question with a 10-foot mic boom. The last time I said something on that subject, I got a mountain of hate mail. One letter was in crayon. Unsigned.

AUDIO: *I understand your point. Maybe what we ought to do is wrap it up and just listen to some music.*

BERG: That's what this room is all about.

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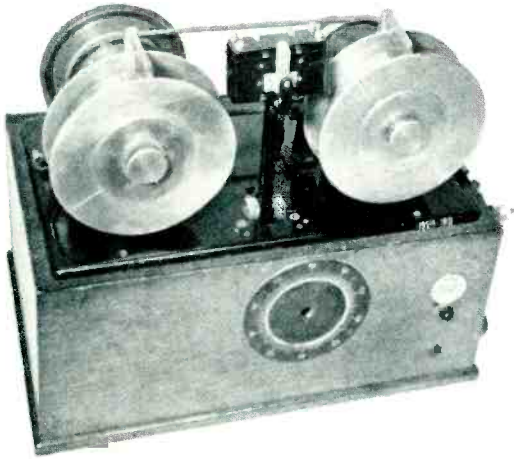
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Editor's Review



Not so long ago, the real Hi Fi enthusiast used 15 ips or even 30 ips tape to get the best results. Then about three years ago, he changed to 7½ ips and more recently many have accepted 3¾ ips as a possibility. I am often asked: if I buy a top quality recorder like a Revox A77, Tandberg 9000, Sony 650 or TEAC 7030 or any other machine in the \$600 to \$800 class, is a Dolby unit worth the extra expense? Adrian Horne answered that one (AUDIO, February) by saying “can anyone afford to throw away 10 dB of noise reduction?” In practice, of course the gain is not so great as it is with cassette units which are not really Hi Fi *without* a Dolby or similar system. How about that 15 ips facility—is *that* worth the extra cost? If you are just recording off the air, or from records, you are throwing your money away. However, if you are making direct recordings, with top-quality microphones then the extra expense might be justified. Even so, the difference for most recordings would be very slight and for some purposes even 3¾ ips would be perfectly adequate. Such is progress The photograph (courtesy, Science Museum, London) shows the first tape recorder—the Poulson Telegraphone, circa 1899. *Tape* recorder is really a misnomer as this machine like many others that followed after used steel wire.

Hi Fi at Washington

The Washington Hi Fi show was held in the Hotel Washington—just a determined stone’s throw from the White House. It seemed to be very successful in spite of complaints from some exhibitors who were not exactly pleased at the number of local dealers with demonstration rooms. Many exhibitors had to work far into the small hours to set up their equipment as the rooms were not

available in good time. Still and all, it was a well attended show with an estimated 29,000 people tramping up and down the corridors. Biggest crowd-drawers were McIntosh with a spectrum analyser demonstration using a bass drum expertly hit by Jimmy Carroll (who, unfortunately was not wearing the traditional leopard skin) the AR room with the new AR-7, the new Empire plastic speaker enclosure and the ESS Heil system. I listened to this unusual device for some time and was quite impressed. The EPI room was always crowded and the main attraction here was the 400 minitowers. The Fisher Sound Panels attracted a lot of attention and the Pioneer, Sansui and Bose rooms were filled with milling crowds most of the time. JVC were demonstrating their 4-channel system using a large ‘scope display to prove that the channels were really separated. As always, the Garrard, Dual, Koss and JBL displays were well designed and most attractive. Next IHF show is at San Francisco from April 11 to 16 and one is scheduled for Philadelphia in October.

Recording Basics from 3M

This very popular guide to recording has now been revised. It covers all formats—open reel, 8-track and cassettes and explains the differences between the various kinds of tapes, describes tape editing techniques and has a well-written glossary. All told, there are 50 pages and single copies can be obtained from 3M dealers or direct from 3M Magnetic Products, Dept. Ma 3-8, Box 33600, St. Paul, MN. 55133.

Synthesizers

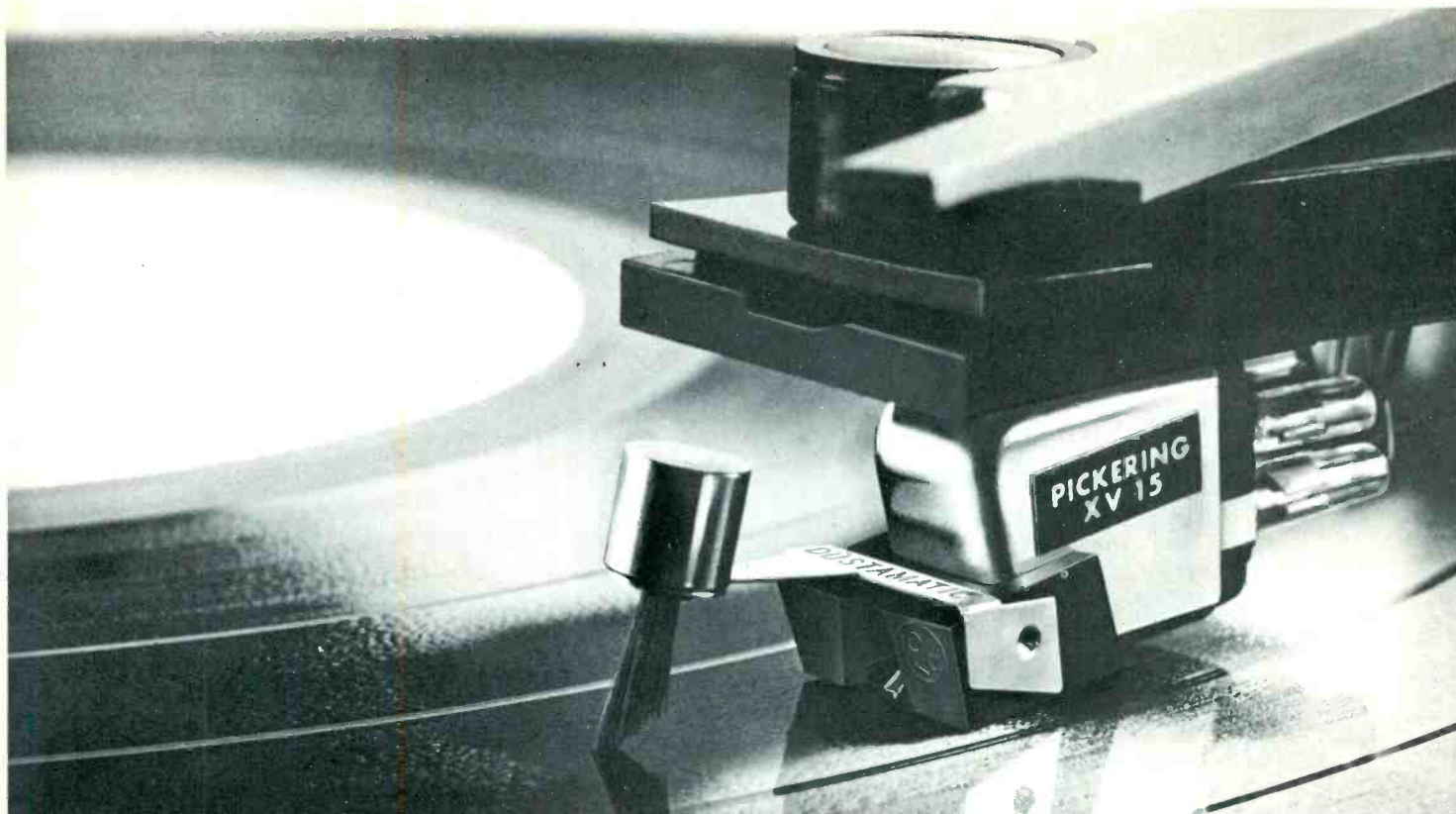
Interested in synthesizers? The Boston School of Electronic Music has a handy brochure entitled “How to buy a Synthesizer” and it costs only \$1.00. The address is: BSEM, 285 Beacon Street #3, Boston, Mass. 02116.

Ghosts

According to a UPI report, a witch doctor, an Indian mystic and a Buddhist monk were called in to exorcise evil spirits from the General Electric plant in Singapore. Many of the female employees said they saw ghosts—and promptly downed soldering irons. I am told that ghosts have been seen in various plants over here but it turned out that they were buyers for mail order discounters!

Price Increases

Owing to the devaluation of the Dollar, some of the prices quoted in the advertisements will not be correct. Sorry about that, but it’s not our fault!



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All Pickering cartridges are designed for use with all two and four-channel matrix derived compatible systems.

What's New in Audio



Unique dynamic microphone

Sennheiser has announced a new dynamic microphone with some unusual features including a five-position bass switch, brilliance switch, and a special double isolating housing to reduce mechanical noise. It has a super-cardioid directional pattern and the sensitivity is given as 0.2 mV/ubar at 200 ohms. Frequency response is claimed to be 40 to 20,000 Hz + 2 dB. Price: under \$230.00.

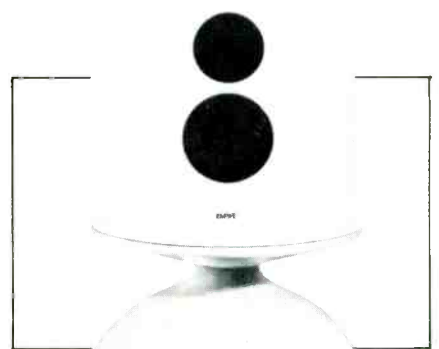
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Sony Decoder

A new low-cost decoder is now available from Sony. It features a front-to-back logic circuit, a front-back balance control and push-button selection of SQ decoding, ordinary matrix and 4-channel discrete from tape. Tape-out and in jacks are provided on the rear panel as the unit is intended to connect to the tape outlets on the receiver. Harmonic distortion is said to be less than 0.2% at 250 millivolts input and signal/noise is 80 dB. Price: \$99.50.

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New Empire Loudspeaker

This is the "Jupiter 6500" housed in a white, contemporary styled enclosure made from Uniroyal Rubicast. It is fully waterproofed and suitable for indoor and outdoor use. Three speakers are used, a 12 inch bass unit facing downwards, a 3 inch mid-range and a 1½ inch tweeter. It is 17¼ inches in diameter and stands 25½ inches high. Price: \$139.95.

Check No. 50 on Reader Service Card



Yamaha Mixing System

The new Yamaha mixing systems offer full control of six channels for guitar, mikes, combo organs, tapes and so on. Features include continuous volume, bass and treble controls, A, B, and stereo speaker selector on each channel, built-in tuning (A-440) and monitor headphone jacks. The model shown is the EM-90 with two ES-90 loudspeakers, other models are also available-including the 900 with automatic rhythm and reverb unit.

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Sound West Loudspeakers

Sound West of Los Angeles have a range of round, octagonal and square speakers. The enclosures are made of white plastic and there is a choice of green, blue, gold, black or white expanded polystyrene grilles. They are said to be weatherproof and so are most suitable for outdoor use. Price: \$14.95.

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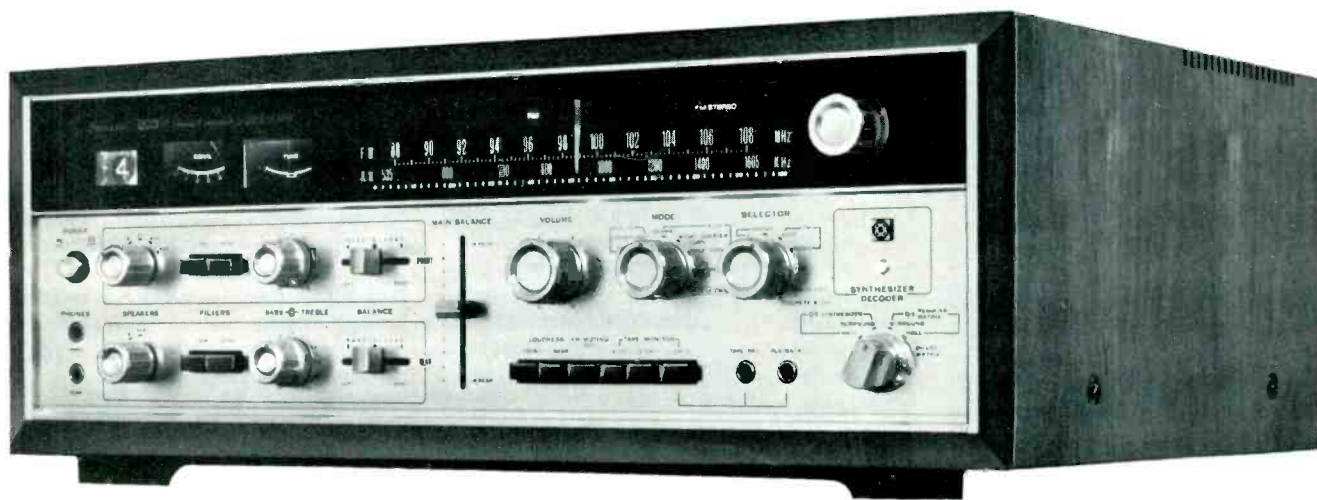


Sony Electret Microphone

Shown is the new ECM-65P which is a uni-directional type having a very low distortion. It can be powered by an internal battery or external supply. Frequency response is quoted as 70 to 20,000 Hz ± 3 dB and the output impedance is 250 ohms balanced. Output is given as 54 dB (0 dB=1 volt/10 microbar). Price: \$175., complete with 20 ft. cable.

Check No. 51 on Reader Service Card

All quadraphonic systems are not created equal... Sansui has created the QS vario matrix.



QRX-6500

Here at last is the development that once and for all will lay to rest the dispute over discrete vs. encoded recordings. The Sansui vario matrix—a technological extension of the QS Regular Matrix—provides unbelievable front-to-back separation, to a degree never before possible with matrix recordings—separation so great that engineers have hailed it as the “discrete matrix.”

Two new units in the Sansui four-channel lineup—the QRX-6500 (\$699.95) and the QRX-4500 (\$599.95) contains this outstanding new decoder. These full-featured four-channel receivers have high power output (280 watts and 240 watts IHF), superb FM sensitivity, and are loaded with special features to make quadraphonic listening a totally trouble-free and fulfilling experience.

The new decoder includes a position for Phase Matrix recordings, and both “Hall” and “Surround” positions for the QS Regular Matrix and for the synthesizer section, for accurate decoding of any current matrix as well as creating enhanced 4-channel sound from two-channel recordings.

Other special features include a sound-field rotation switch, linear balance controls for front/rear and for left/right, and the capability to drive up to 10 speakers—all front-panel switch-selected.

Treat your ears to a demonstration today at your nearest Sansui dealer. Your listening will never be the same again.



QRX-4500



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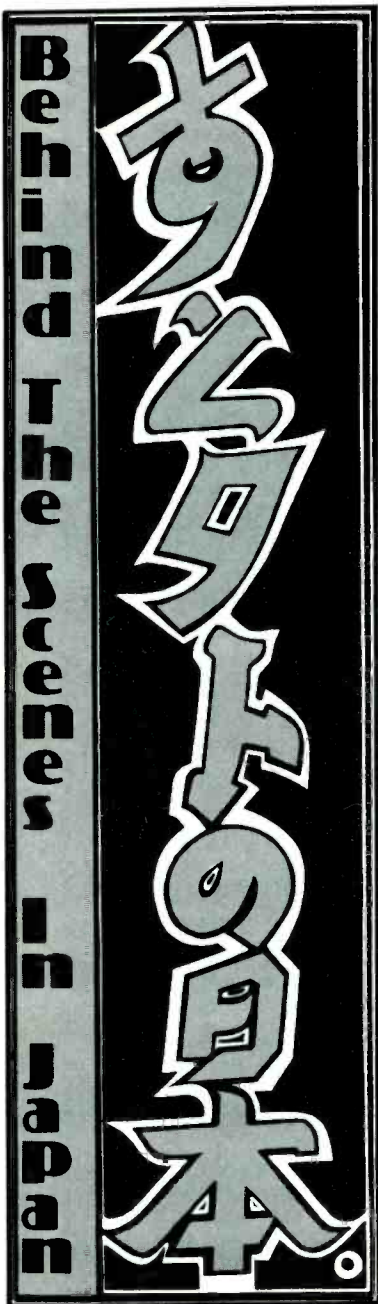
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Research Center



Bert Whyte

BEHIND THE SCENES

The proponents of the various quadraphonic disc systems have always been co-operative, indeed anxious, to present their points of view to members of the audio press corps. Quite naturally, each company is prejudiced in favor of its particular system and needless to say puts its best efforts forward in trying to convince us of the superiority of its system. As a consequence of this, we all have had interesting "behind the scenes" presentations on the respective merits of the CD-4 discrete system, the Sansui QS system and the EV/Columbia SQ system. Some of the demonstrations I have attended were very modest, and some quite elaborate. Whatever the scale of effort, all of them have been helpful in clarifying many details of the quadradisc systems and in influencing our opinion of their relative worth.

Last November, JVC and Panasonic decided that it was time to thoroughly brief members of the international audio press corps on the intricacies of their CD-4 quadraphonic discrete disc system. To this end, they arranged for one of the most spectacular press junkets in hi-fi history . . . a week in Japan visiting their laboratories and plants, and meeting the scientists and engineers involved with the CD-4 system. Thus on Nov. 19th the European contingent of 13 editors and writers and the 5 members of the American group descended on Tokyo. The Europeans represented audio publications in Belgium, France, Germany, Holland, Sweden and Great Britain. The American representation was Larry Klein of *Stereo Review*, Bill Tynan of *High Fidelity*, Claude Hall of *Billboard*, Bob Angus of *Audio Times* and yours truly. Bob Angus and I flew in on a 747 and after nearly 11 hours from Seattle to Tokyo, we were dragging a bit. Thus we were not at our sprightliest when we stepped into a milling throng at the airport lobby, where some beaming Japanese held up JVC and Panasonic flags and banners proclaiming welcome. Next thing we knew a pretty kimona-clad girl presented us with a huge bouquet of flowers and posed with us as flashbulbs went off. Real VIP treatment! Begad, we felt like we had just returned from Tranquility Base or some such thing.

The open-handed generosity and the gracious hospitality of the Japanese are legendary. This is especially true if you are a guest of an electronics manufacturer. I had been to Japan under those circumstances a few years ago, and I

knew what to expect. I think most of my companions were a bit stunned by the warmth of their reception and the overall lavishness of the entertainment laid on by our hosts. Of course we were in Japan for business too, and the next morning we had a meeting at our hotel where JVC executives introduced us to the basics of the CD-4 system. I should explain at this point that while in Tokyo we dealt mostly with JVC people, while in Osaka we were in the capable hands of Panasonic personnel. I must also note that Panasonic is the American brand name for products of Matsushita Electric Industrial Co. Ltd. In Japan, the same products are sold under the National brand name. JVC, or Victor Company of Japan, is a separate corporate entity, whose products are often in head-to-head competition with those of National/Matsushita. Yet JVC is owned by Matsushita and is part of their industrial empire. Matsushita has often been referred to as the "General Electric" of Japan. And indeed, they manufacture a tremendous range of products, from TV sets and refrigerators and other home appliances, to x-ray and other electro-medical equipment, ultra-sophisticated industrial equipment, lighting equipment, and electronic gear for communications and aero-space. And of course, they have their comprehensive line of receivers, speakers, amplifiers, tape equipment, etc. Under the "Technics" name, Matsushita markets a line of specialized very high quality audio products, which ultimately will be on the American market. JVC is more oriented to consumer electronics and has extensive lines of what we call "sets" or Consoles in this country. They also make a broad line of audio components sold in the U.S. under the JVC and Nivico brand names. The "Victor" in the corporate name refers to an affiliation with RCA Victor that began somewhere around 1911, and today Victor Company of Japan is one of the largest manufacturers of phonograph records and recorded tapes in all formats in Japan. They are also extensively involved in basic audio and acoustic research, and from these activities the CD-4 system evolved.

Well, enough of this digression and back to the activities of our group. Just after lunch on the 20th, we were taken to Victor's Aoyama Studio to observe a quadraphonic recording session and inspect the studio facilities. The studio itself is quite large . . . I would estimate that a 60-70 piece orchestra could be recorded without crowding. The room was acoustically treated with both reflective and absorptive materials and forms, much in the same fashion as in



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Listening room

studios of a few years ago in our country. The control room was equipped with a typical multi-channel mixing console, that looked as if it was a 24 input/16 output unit, similar to the type built by Rupert Neve for Vanguard Record Studios in New York. It had pan pot facilities, but I didn't see any "joy-stick" type of control for this function. The session was being recorded on a 16-channel 3M machine, and there were 4 and 8 channel Ampexes and Scully machines in evidence. Monitor speakers

were similar to Altec A-7's in the character of their sound, with perhaps a slightly heavier bass end. On the session, it was a pleasure to see some 35-40 musicians on a pop date, something increasingly more difficult to find in our studios because of the staggering recording costs. The musicians were disposed around the studio in groupings quite similar to the usual practice in U.S. studios, for quadraphonic recordings. Isolation of a particular instrument or group of instruments was via the



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Listening Room

usual gobos, distance (when possible) and close miking with cardioids. The forest of microphones featured many condenser-type Sonys (which is to be expected) and I spotted various types of Neumann and AKG, along with some EV (looked like RE15's) and a Shure or two. Later in the afternoon we were given a mini-tour of Tokyo, taking in the Imperial Palace grounds (from the outside!) and winding our way back to our hotel, where Victor and Matsushita hosted an elaborate "Welcome Dinner Party" for our "Audio Editorial Group", which is what the Japanese called our assemblage.

The next morning we were driven to Victor's Audio Engineering Research Center on the outskirts of Tokyo. I think it is safe to say that our group was as impressed with this magnificent installation as anything else we saw on this trip. The facilities available encompass almost every aspect of audio and acoustics. The equipment is the best available from Japan, and such things as Hewlett Packard scopes and generators, Bruel and Kjaer frequency spectrum analyzers and B&K calibrated microphones with frequency response beyond 100 kHz! Ampex 440-4 quadraphonic tape machines were used for A/B comparison of discrete four-channel tapes versus the same program on the CD-4 disc. The center has one of the largest anechoic chambers in the world. The construction is the usual fibreglass wedges, with open steel mesh for flooring. The entire room floats on rubber cushioning and is essentially

(Continued on page 72)

A short discourse on 4-channel sound.

By MICHAEL MARCUS

Technical Editor, and former Audio Columnist of Rolling Stone Magazine

If you accept as the purpose of high fidelity recordings and home music systems the traditional goal of accurately reproducing a live concert, a 4-channel system can provide *higher* fidelity to the original than can a stereo recording and playback system, because it can reproduce *more of the sounds* present in the concert hall, with a more "live" feeling because those sounds can be reproduced as coming from the *proper directions*.

One of the most dramatic aspects of live music—in fact *the* aspect that distinguishes the sound of a performance in one concert hall from an identical performance in another—is reverberation, the successive waves of indirect sound that reach the listener from behind, after being reflected from the rear wall and balconies of the concert hall.

This reverberation, or "hall ambience" as it is called, has been considered a vital ingredient of the best recordings since long before quadrasonic sound became a reality.

Besides telling the listener whether he is in Lincoln Center, San Marco or the Hollywood Bowl, reverberation provides a sense of space, a warmth and lushness, a surrounding soft aura of music that seems to perfectly complement the sharper sounds beaming directly from the instruments and singers on stage.

Some record producers set up extra microphones in the rear of concert halls to pick up real reverberation and others, taping in small acoustically "dead" studios, have resorted to electronic or mechanical "delay lines" to manufacture reverberation. And at least one record company cleverly embellished their sound by passing it through a long staircase on its way to the final tape.

On the playback end, audiophiles also used synthetic reverberation devices (often the spring-type used with electric guitars), and the hobby magazines have offered plans for home-made delay lines using aquarium air tubing or garden hose.

Synthetic reverberation can come pretty close to matching the *sound* of the real thing, but when mixed with direct sound for playback through the same speakers it loses the *live feeling*. Reverberation from the rear is lush and lively, and reinforces the music. Reverberation from the front is muddy and dulls the music.

A few years ago some bright guy got the idea that since studios were taping reverb separately on multi-track recorders anyway, it might be good to keep the reverberation separate all the time, even to the home listener for playback through new speakers added in the rear of the room. This directional difference would enable the listener to separate the indirect and direct sound, to get all the lushness without the mud.

This was born quadrasonic sound.

A little later some other bright guy, probably a rock-and-roller, figured that if the studios were set up for multi-tracking anyway, and homes were going to be set up for 4-channel, it would be a terrible waste to use the rear channels just for reverberation. They'd be more useful and much more fun, he decided, for carrying additional *direct* sounds.

So he put a guitar in front-left and a piano in front-right, drums in rear-left and bass in rear-right, centered the lead singer between the front speakers, spread a chorus across the rear, sprinkled a bit of reverb here and there, dropped the listener in the middle, the music went 'round and 'round, and he said "wow!"

The classical folks, touting their proverbial "concert hall realism," didn't like it. "No listener," they argued, "sits in the middle of the performers. Rock music corrupts the whole idea of high fidelity."

The rockers replied that with their music there was no live performance to be faithful to. Music was *made* in the control room, not performed on the stage. And even "live" recordings are doctored up later.

So why shouldn't music be recorded to take best advantage of the home environment, where most people do their listening? And if music sounds good coming from the rear *and* the front, why shouldn't it be so?

That's pretty much where 4-channel stands now. For classical music fans it can better reproduce the concert hall. For rock freaks, it lets their favorite groups create new kinds of sound. The choice is yours.

BSR Metrotec 4-channel equipment will play any of it.

For audiophiles with piles of cast-off hardware, BSR Metrotec makes the model SDW-Q universal/SQ matrix decoder, which you can mate with a resurrected amplifier and speakers.

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BSR—Metrotec SDW-Q
Universal/SQ Decoder

This discourse concerns itself only with the evolution of 4-channel sound. There are different means of achieving it. BSR has a booklet that explains techniques in more detail.



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LOGIC CONTROL OF TAPE RECORDERS

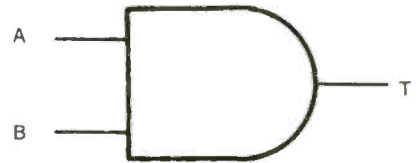


Fig. 1—Symbol for logic circuit controlled by DC voltage levels

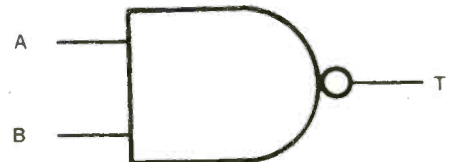


Fig. 2—Symbol for NOT-AND (NAND) gate

*Ole Melvold

The seemingly simple process of transporting tape across the electronic magnetic heads in a tape recorder, so that signals can be recorded on and played back from the tape, relies upon a complex and often critical relationship between the electrical portion of the recorder and its mechanical parts.

The mechanical portion of this process is often complicated and is usually the source of the majority of malfunctions and failures in any recorder.

The problem faced by the designer is, then, to simplify this mechanical operation and, if possible, to replace as many purely mechanical functions by electrical ones to obtain greater reliability. The use of purely electronic controls will not only yield greater reliability but, of course, will provide faster, more convenient operation including all the tape handling processes, start, stop, wind, etc. Electronic, "finger tip" activated controls can, therefore, be used to go directly from any wind mode directly to a play mode without manually engaging the conventional "stop" function and with no additional stress imposed upon the tape, and with greatly reduced acoustical and electrical noise. The tape recorder lends itself to electronic pulse control which, in turn, facilitates new applications besides the preservation of audio signals. Recorded signals can be used

*Senior Engineer, Tandberg, Norway.

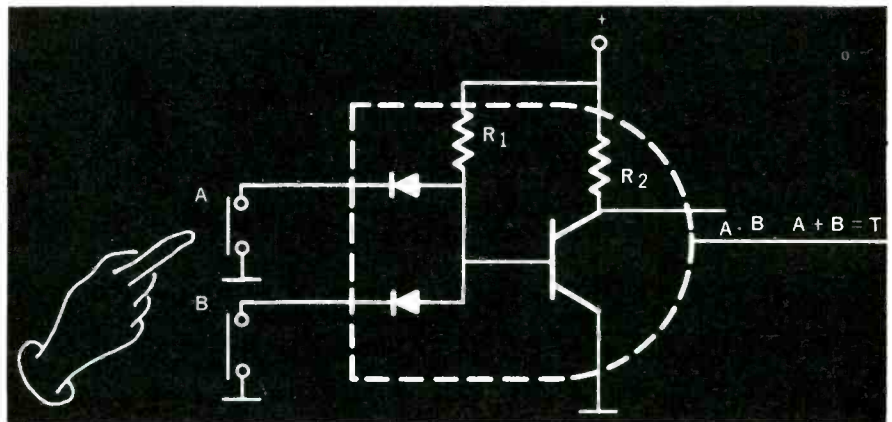


Fig. 3—Circuit using NAND gate

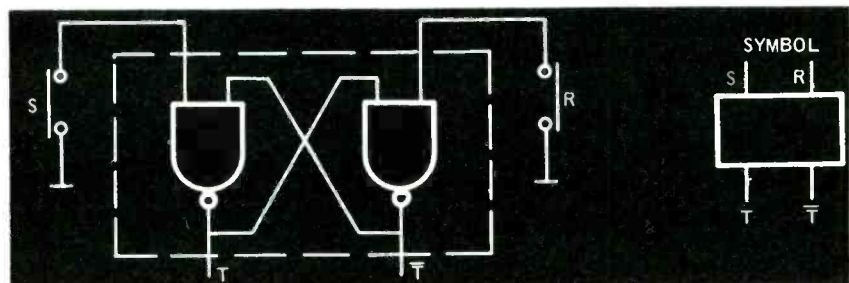


Fig. 4—Memory circuit

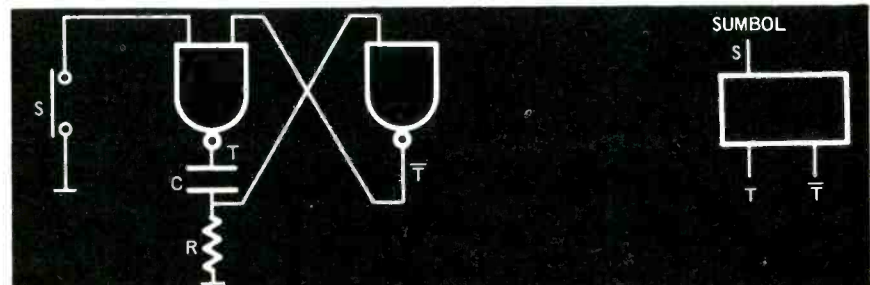


Fig. 5—Memory circuit with automatic re-set

to control other electronic units and processes; remote control becomes available.

Electrical units can be used to replace many mechanical parts and eliminate purely manual operation of pinch roller, brakes, etc. Clutches can be replaced by motors whose speed in winding and braking can silently and easily be electronically controlled. Solenoids can be used for operating the pinch roller, brakes, etc.

All this assumes, however, some reliable form of control. The application of logic circuits in integrated form for control purposes can produce many advantages. The so-called High-level, specially integrated logic circuits lend themselves particularly well to tape recorder control, and this circuitry will be largely immune to possible electrical noise within or from a source close to the recorder. Control signals will originate essentially

from the operating push buttons. By carefully analyzing the desired functions, it will be possible through couplings algebra to formulate these to a mathematical formula that can be realized by electronic circuits.

For newcomers to this technique, some explanation may be needed. A logic circuit is an electrical model of a logic function which tells us that certain conditions must be present for a change of condition (or for no change).

One symbol for a logic circuit controlled by DC voltage levels can be seen in Figure 1.

With high levels on both inputs A and B, output T will be high level, expressed $A \cdot B = T$.

Conversely, when either A or B is low, T will be low, expressed $\overline{A \cdot B} = \overline{T}$. Additionally, $A \cdot \overline{B} = \overline{T}$ or $\overline{A \cdot B} = \overline{T}$. The symbol \cdot means in couplings

algebra (Boolean Algebra) AND. The symbol + means OR. \overline{A} may be called negation of A.

The connective AND indicates that T is high if, and only if, both A and B are high (conjunction).

The connective OR symbolizes that T is high if, and only if, either A is high or B is high or both are high (disjunction).

In electronic logic circuitry terminology, circuits as above may be described as AND-gates and OR-gates. As one in logic mathematics refers to a two-basic statement, true or not true, in electronics we refer to two levels, high or low (1 or 0). The conversion from one level to another is symbolized by a ring (NOT), as seen in Figure 2.

The practical logic circuit in Figure 2 is named a NAND-gate (NOT-AND-gate). When A and B represent high levels, T will represent a low level, $A \cdot B = \overline{T}$, $T = \overline{A \cdot B}$. To improve the understanding as to how a NAND-gate functions, we can look at Figure 3, where such a gate is visualized with discrete components.

The circuit is designed so that the transistor will be in saturation when neither A nor B are connected, which means that the level T is low. If the base current disappears, caused by connecting A or B to ground, the level T will become high. The circuit works then as an OR-gate with a converted output. One single NAND-gate cannot maintain any given information (when the finger in Figure 3 is removed, the high level will disappear). In order to obtain memory we have to use two circuits, as shown in Figure 4. A low level on the set-input will make T remain high. The circuit resets with a low level on reset-input. By adding a RC network, the reset can be automatic, as seen in Figure 5.

A Description of the Logic Circuit System in the New Tandberg Series 9000X

In the design of Tandberg Series 9000X, efforts were made to take maximum practical advantage of this sophisticated type of control, through the use of integrated logic circuitry.

As in any tape deck, the rotation and radius of the capstan shaft will determine the tape speed. The tape is transported by the pinch roller (engaged by the pinch roller solenoid) moving toward the capstan. See Figure 6. Forward winding is caused by a strong torque on the right side motor (counter-clockwise), and a low torque for braking on the left side motor (clockwise). Rewinding will be established conversely.

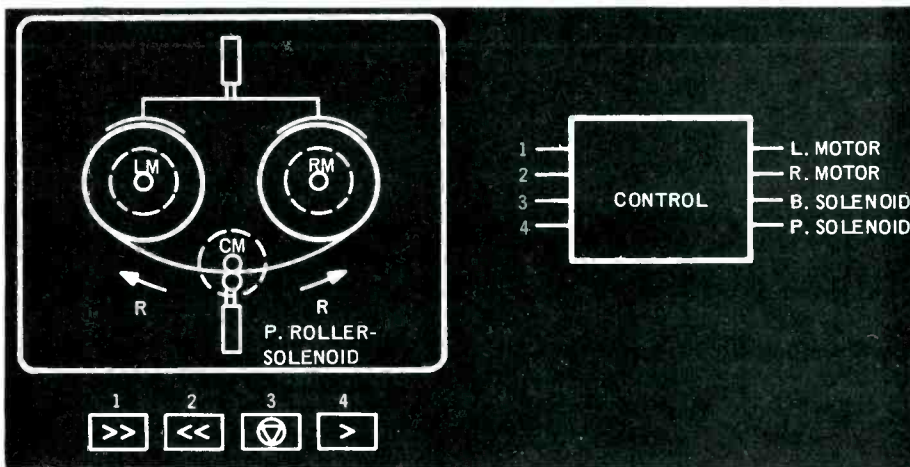


Fig. 6—9000X layout

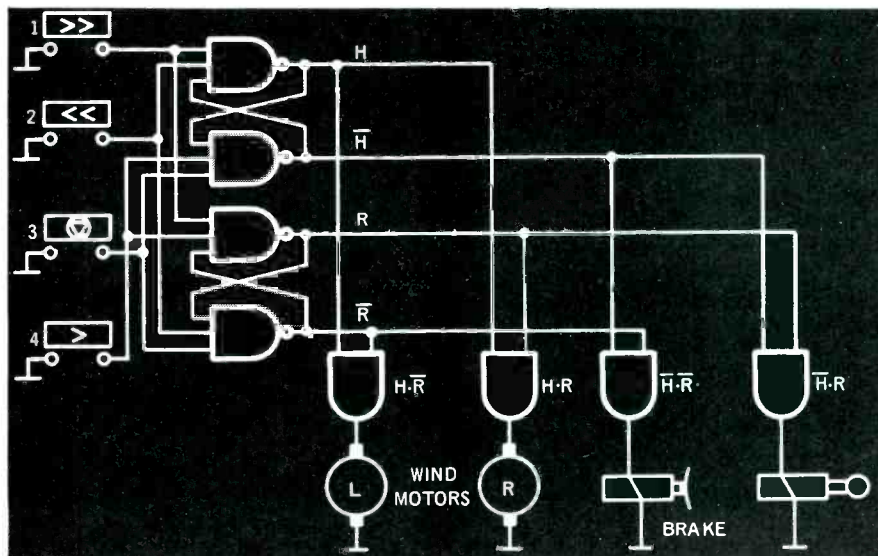


Fig. 7—Control circuit

In establishing the mathematical criteria for these functions, we will designate:

- Tape movement to right as \bar{R}
- Tape movement to left as R
- Winding speed as H
- Play speed as \bar{H}

The following conjunctions can then be formed:

- Winding speed to right as $H \cdot R$
- Winding speed to left as $H \cdot \bar{R}$
- Stop as $\bar{H} \cdot \bar{R}$
- Play speed to right as $\bar{H} \cdot R$
- Two bistable circuits must accommo-

date four function criteria. The first circuit shall represent the speed H and \bar{H} , the second circuit shall represent the tape movement. The diagram relating directly to the operating buttons on the recorder can be seen in Figure 7.

This simplified control is, of course, not sufficient in a practical functional circuit design. Additional circuitry to operate the solenoid will be necessary, besides a memory to distinguish between playback and record. Further, there has to be a trigger network included to allow for braking time after

completing winding before a play condition is set.

In addition to the mechanical braking, there was a requirement for electrical braking. Additionally, electronic end-stop pulses and stop-signal pulses, when turning on and off the AC switch (power-up reset-circuits), were also found necessary to eliminate the possibility of tape spillage. To prevent accidental erasing, the recording function was also given certain conditions that had to be met before becoming established.

As mentioned earlier, these functions can be formulated through couplings algebra. With a realization of this, one arrived at a solution as shown in Figure 8. This diagram fulfills the foregoing requirements.

Circuit 11 in this diagram is basically the two bistable circuits providing the information that shall control the four tape conditions.

Circuits 12 and 13 are monostable and necessary for the control of, respectively, the brake and pinch roller solenoids.

Circuit 8 is bistable and has to distinguish between recording and playback modes.

The triggering Circuits 4, 6 and 7 control the braking phase when the tape mode changes from a wind position to a play position.

Circuits 9 and 10 shall make triggering of Circuit 13 feasible by Circuit 12.

Circuit 14 shall eliminate this possibility when stop condition is set.

Circuits 2 and 3 prevent the tape deck from being set in record mode prior to the presence of the stop condition.

Circuit 1 shall be a Schmitt-trigger that gives end-stop pulse.

Circuit 5 is a "power-up" reset-circuit.

Circuits 15 and 17 transfer the information to the winding motors of their respective relays.

Circuits 16 and 18 give electrical braking during the braking phase.

Conclusion

The use of logical analysis to determine a logically correct engineering solution for a consumer tape deck opens many possibilities. Besides excellent electronic and mechanical specifications, safe, fast and easy operation are just some of the advantages. This type of logic control system can be applied toward timed and sequential automatic operations, remote controls, etc., even in environments with extensive electrical noise.

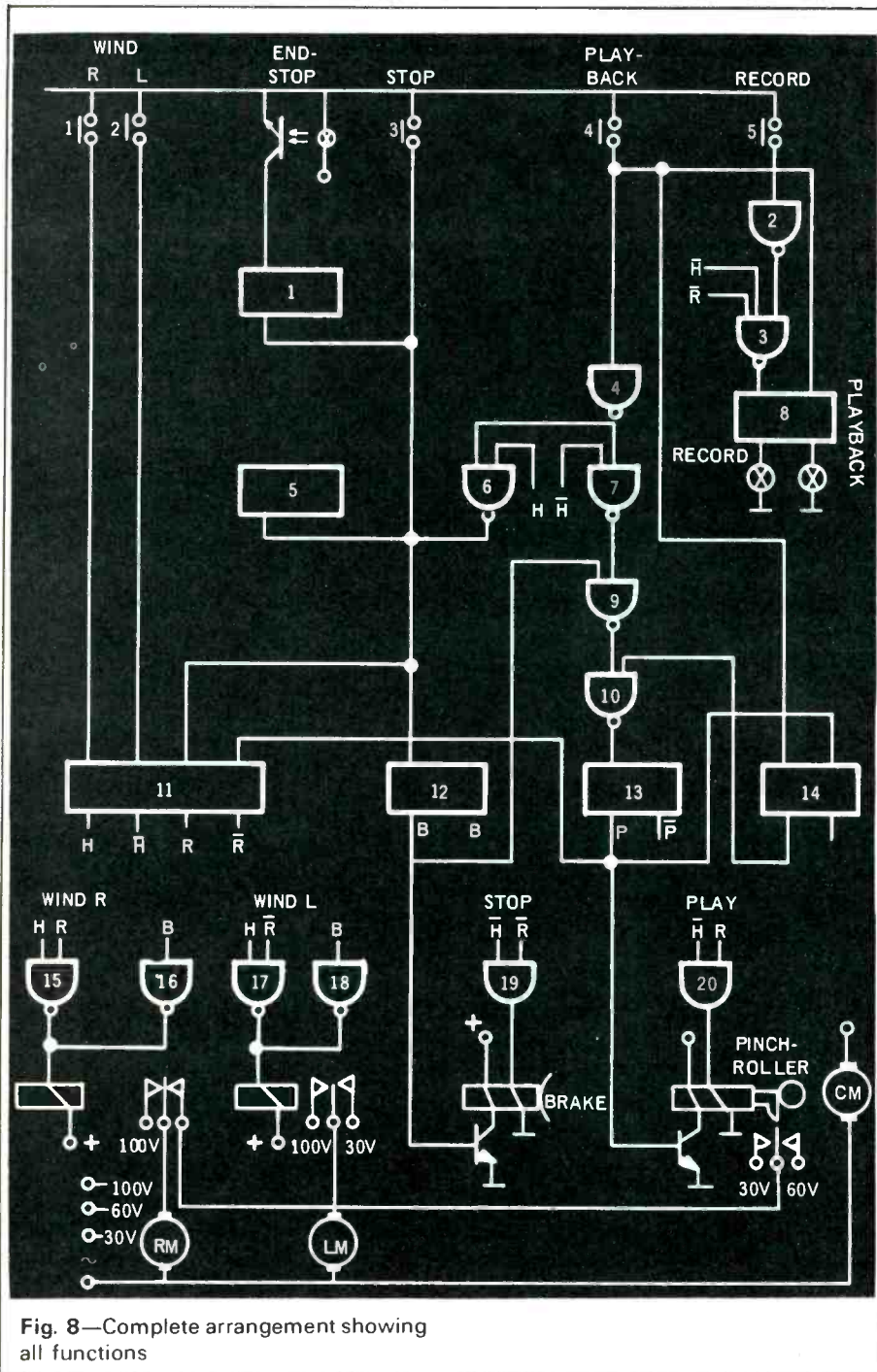


Fig. 8—Complete arrangement showing all functions

Ampex, Media Sound, and the AR-LST.



Until now, most parameters of the recording art have been significantly better defined than has loudspeaker performance. A quantitative standard for the monitoring of recordings has therefore been lacking. Recently Ampex and other recording companies have turned to the AR Laboratory Standard Transducer, a speaker system that represents the efforts of Acoustic Research to come to grips with this problem.

Flat energy capability

The AR-LST's flat energy output curve — as flat, we think, as the state of the art permits — provides the industry with its first accurate standard for recording and mix-down monitoring.

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neer to tailor the sound of the AR-LST to any special requirements he may have — to compensate for spectral aberrations in a tape, for example. These various energy output characteristics are accurately known (they are printed in the AR-LST's instruction book) and are available at the turn of a switch.

The AR-LST is now being used in a number of recording studios. In the picture above,

James Frey of Ampex and Bob Hinkle listen to a playback of



The finished product.

Bob's album "Ollie Moggus" recently completed at Media Sound Studios in New York.

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Some infrequently-frequency response

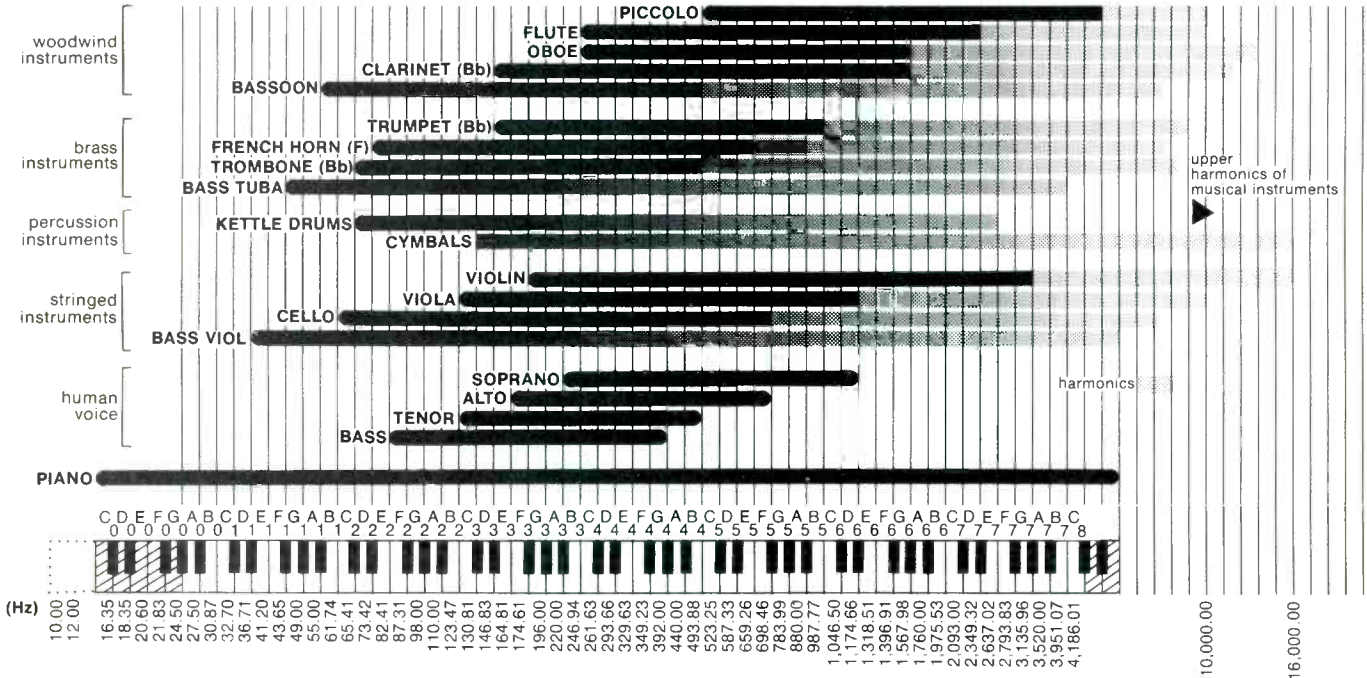


Chart 1. Frequency ranges of musical instruments and the human voice.

Chart 2.

An approximation of "pressure levels" of various types of orchestral music.

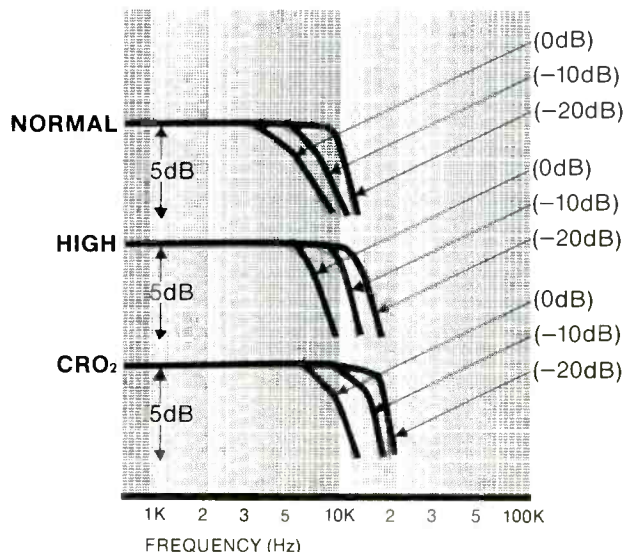
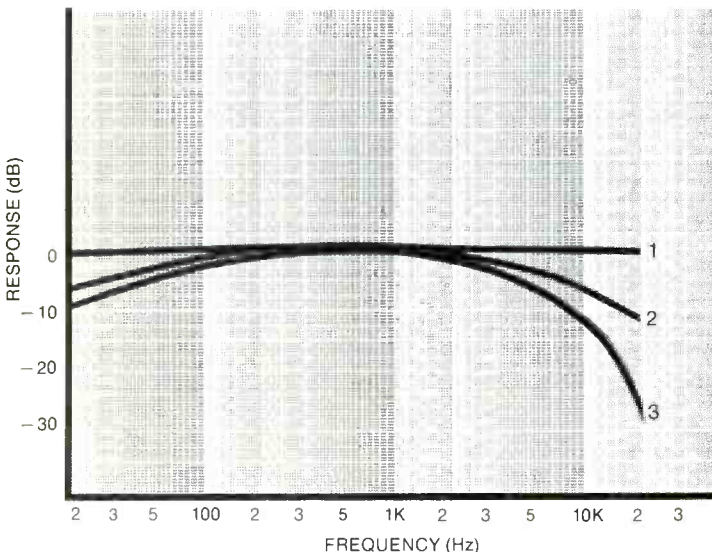
(This is a guideline chart, naturally subject to variables of orchestration, micing and mastering equalization.)

1. Electronic music (rock, underground and synthesized)
2. Semi-electronic music (pop-rock, some country-western and contemporary jazz)
3. Average "normal" acoustic orchestra (classic, semi-classic, "easy-listening" and jazz)

Chart 3.

Showing high-end frequency-response loss at various dynamic levels, and comparing this phenomenon for different tape formulations.

(Note: Tape response characteristics will vary somewhat from brand to brand, and machine to machine.)



known facts about

Audio buffs are discovering that even with increasingly sophisticated equipment, their recordings sometimes lack high-end frequency response. Despite your careful attention to recording levels, as shown on the meters, this high-end roll-off can occur with all decks—reel-to-reel and cassette—and at all recording speeds. However, it is more evident in cassette recording. It results from a phenomenon of tape called “saturation.”

Once you understand the cause, the cure is simple.

High-end frequency-response losses occur when the head is unable to impress on, or retrieve from the tape's oxide particles the shorter wave lengths of the signal. In other words, when the wave length is actually shorter than the gap in the playback head, the head is simply unable to detect the signal. Increasing the record levels past this point demands more of the oxide particles than their magnetic properties permit, and distortion and saturation occur. However, this phenomenon, while somewhat due to the limitations of tape, is to a great extent a function of speed.

To put it another way: tape can only take so much high-end at high levels before losing response. Let's look at some reasons.

7½ is longer than 1⅞

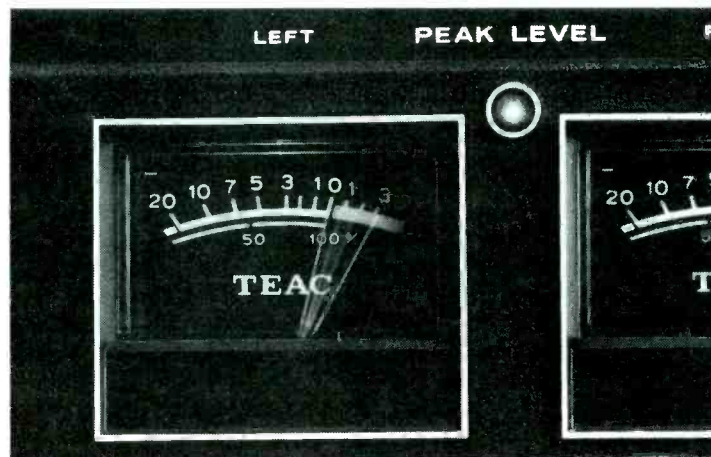
With reel-to-reel, all the information in one second of time is distributed over 7½ inches of oxide particles. In the case of cassettes, this identical amount of information must be contained within 1⅞ inches of oxide particles. Thus, cassette tape flowing slowly at 1⅞ is more vulnerable to revealing distortion and high-end saturation. Reel-to-reel tape flowing at 7½ ips is much more “forgiving;” the magnetic fields are longer, and these aberrations of the signal tend not to be revealed.

How music differs from music.

Most “normal” music—that is, classical and jazz recorded with acoustic instruments—is well within acceptable levels, and there is little danger of saturation. However, rock and the “new music” recorded with electronic instruments are loaded with high frequencies at excessively high levels. Look out. This is where a cassette

transfer made at a “normal” -4 to 0 VU will saturate. Back off to around -8 to -4.

Chart 2 shows the “pressure levels” of various types of music. A normal acoustic orchestra shows normal pres-



sure levels, with a “natural” rolloff at the high end. (Natural harmonics at 15 kHz are generally down over 20 dB). This orchestra acts as a natural filter, and high-end loss will not be a problem.

However, look at the contours of pop and electronic music; these high-frequency, high-level signals will saturate quickly at 1⅞. So back off to a level that will give you a satisfactory compromise between frequency response and signal-to-noise. Remember, contemporary music puts extraordinary demands on cassette decks, so keep cassette limitations in mind. To help you avoid high-frequency loss, TEAC suggests you consider some not-so-evident facts:

Level meters and TEAC's LED: guides, not gods.

Any type of meter is a limited instrument. It cannot respond accurately to transient highs—those sharp, high-level sounds that last a fraction of a second, just long enough to saturate your tape. For this reason, TEAC has a Light Emitting Diode (LED) as featured on our top-of-the-line stereo cassette decks, to help you avoid tape saturation. TEAC's LED will supplement the meters by giving you an instantaneous peak-level indicator. When the LED flashes, you're saturating—regardless of what your meters

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are telling you. The LED should be your overriding guide; if it is flickering and your music characteristically has high frequencies at high levels, back off 2 to 5 dB on your meters. However, with “normal” music an occasional LED flicker is tolerable. Remember, your meters and LED are indicators, not controls. Look at Chart 3 showing high-end droff at various levels. You'll not that chromium dioxide tape resists saturation, somewhat more than the new ferric oxides which saturate at a lower level, and normal ferric oxides saturate at a lower level yet.

The ultimate input: your own creativity and judgement.

There are compromises to be made all down the line, and your personal taste is the final arbiter. If you're not getting good frequency response, analyze the elements we've discussed. Then experiment. Make a test recording, backing well off on your meters to keep your LED from flickering (but not so far that on playback level you bring up “hiss” and suffer signal-to-noise loss). Regardless of what the ads say, even the finest equipment has limitations. Learn them.

Remember, saturation isn't normally caused by your tape deck—it's caused by a combination of the music, the tape and your judgement.

TEAC's LED is one guide we've developed to help you enjoy your equipment. Like every new TEAC feature, it was designed as a problem-solver—an extension of the TEAC leadership philosophy. (And if you want any other information on improving your recording

techniques, write us. We'll be happy to discuss them with you).

Enjoy your tape deck. And remember—use your wrist. It's good for your ear.

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THE CHANGING FACE OF OPEN-REEL

market and product trends

*by G. L. Taylor

Once it was thought that the magnetic tape had a strong chance of replacing the vinyl record in the hearts and collections of music lovers. Today some probably still hold that hope—or fear—but their numbers are few. A glance into almost any current publication devoted to audio arts will reveal the continued prevalence of Record Power.

Yet, magnetic tape does hold an important place in the audio industry, due to its special capabilities which no record on the market today can equal.

The electronics industry is a fast-changing one. Innovation follows innovation; new products appear, old ones fade away. As products change, they attract new and different markets. Conversely, as the markets change, the products must change to accommodate them. This importance of market, then, is a primary concern in the study of trends in open reel tape recorders.

A strong demand for the versatility and high performance standards of open reel tape will always exist in the professional audio industry: broadcasting studios, recording studios, production companies, tape duplicators, wherever a high-quality master is necessary. These same characteristics continue to make open reel an invaluable part of computer operation and the sciences.

As an example of the latter, in a major motion picture, a bank of open reel tape decks is used in a program to translate the speech of dolphins. As with all good fiction, this movie has its feet planted firmly in fact: the ability of dolphins to communicate and their high level of intelligence long ago intrigued real-life scientists sufficiently enough for them to initiate similar programs at marine laboratories and universities around the world.

More importantly, the same qualities that keep open reel

*Sony-Superscope Inc.

an entity in the professional market will serve it well in the consumer market, for a variety of reasons.

1. Increasing sophistication of music lovers. There are those who demand the best simply because it is the best. Others have weighted cassettes and cartridges in the balance and found them wanting. Many have started out with cassettes or cartridge units and are ready to step up. All of these people recognize and salute the well-deserved superior status of open reel.

2. Versatility of open reel. Cassettes and cartridges have as their principal advocates those whose primary interest is listening to music. For them, versatility is likely to be the ability to cut out commercials when recording off the air—if indeed they're interested in recording at all.

However, those whose interests extend to creating their own source material often demand more: three heads for editing and monitoring; special effects capabilities, such as echo, sound-on-sound, sound-with-sound, mic-line mixing. These are functions of open reel units.

3. Transition of music from vicarious listening experience to gut-level participatory experience. It used to be that composing and performing were arts that look incredible talent and many years to develop. Consequently, direct participation was limited to a relative few. No longer. Today music has become a more direct, personal expression of raw emotion open to nearly everyone with the urge to express. It is a trend characterized not so much by talent as by sincerity. This is evidenced by soaring sales of musical instruments in the past decade and by the tremendous outgrowth of new musical groups, each performing its own music. The fact that some have hit fantastic success almost overnight has encouraged countless others to leap on the music bandwagon.

An open reel tape recorder is vital for any group of burgeoning composer-musicians hoping to succeed. For creative

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Example: We specify FM sensitivity of 2.7 uv for 50 db signal to noise ratio; Hirsch-Houck Labs measured 2.3 uv.

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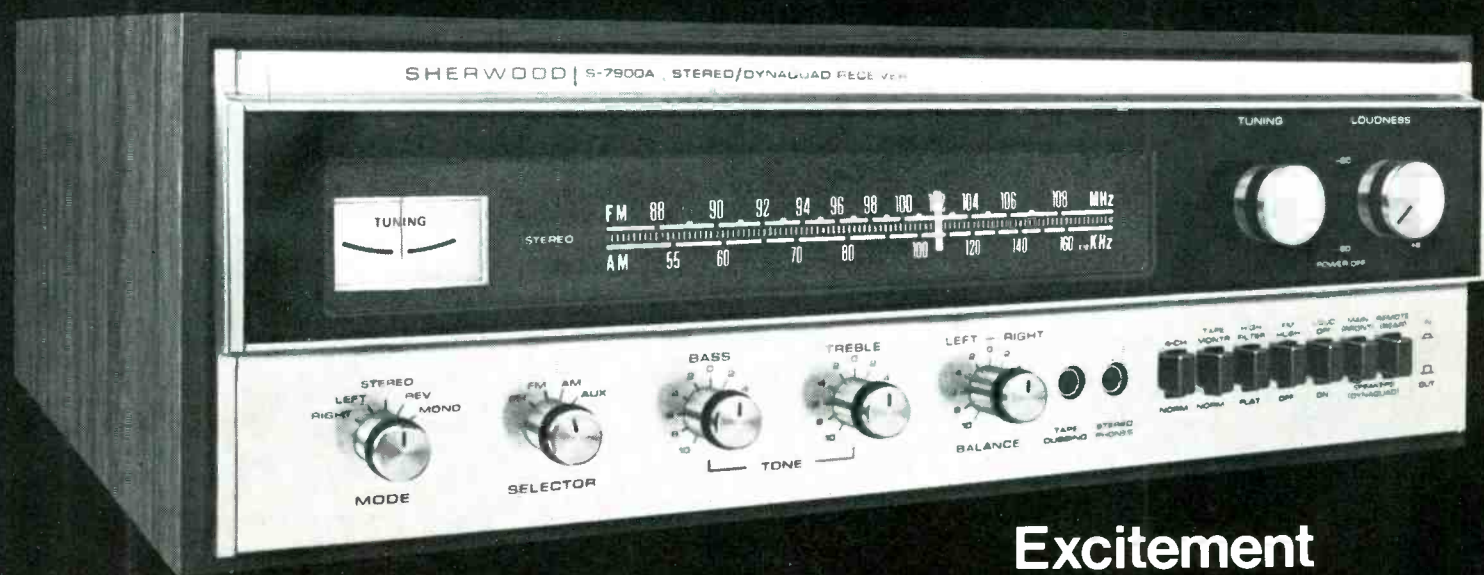
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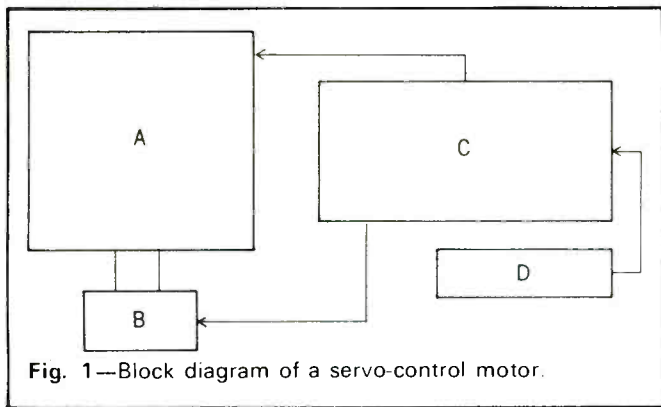
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editing and special effects are as much a part of this music as electric guitars, earnest vocalists and arcane lyrics.

4. Money to spend. All of the foregoing market trends would be worthless in an indigent society. People can pay more for open reel equipment simply because they have more to spend. Despite unemployment and inflation, disposable income seems to be on the rise.

These changing market trends have naturally had their effect upon products. But the situation is not without a certain irony, for open reel, in its increasing sophistication, seems to run counter to the prevailing trend toward simplicity in tape recorders today.

For dozens of years, a prime objective of the tape recorder industry was miniaturization, heralded in by the transistor and the integrated circuit. This trend was reflected in May 1967, in a series of prognostications published by AUDIO MAGAZINE on the occasion of its 20th anniversary. Tape recorders, said industry leaders, would get smaller and start using slower speeds, with better results than the higher speeds of older models.

Coincidentally (?) the same issue of AUDIO carried an article on the Phillips cassette and two rival forms of the tape cartridge: Fidelipac, a standard of the broadcast industry, and Lear-Jet, created by that manufacturer of personal jet aircraft in conjunction with Ford Motor Company. In 1967, none of these configurations were viable competitors for either the record or open reel tape. Their FI was admittedly far from HI: the article considered them adequate for automotive use, but not "sonically attractive enough to warrant the attention of the serious audio buff."

Today, of course, that's all changed. Serious audio buffs by the hundreds are buying cassette and cartridge units—and not just for their cars. Technological advances have apparently fulfilled the prophecies of the industry's augurs. Innovations such as Dolby and chromium dioxide tape coatings have put cassette performance, even at 1 7/8 ips, on a par with records. Four-channel sound and a wide selection of software have made cartridge units a force to contend with in the home entertainment field. Ultimate miniaturization is nigh. Already palm-sized cassette units exist that give better performance than behemoth open reel models of yesteryear. At least one of these, SONY's TC-55, features a select switch that enables the unit to capture music with adequate, though not high, fidelity. Further refinements will undoubtedly follow.

So the cassette and cartridge are now respectable. Anyone with doubts can check prices, for one thing in this ever-changing industry remains constant: good performance still costs more than mediocre performance. The result is that cartridge and cassette tape units have taken over the market previously held by low- and medium-priced open reel units.

Consequently, as cassette and cartridge units become more

compact and convenient, open reel units have been forced to become more complex and versatile. Features designed to provide professional-quality performance are finding their way more and more into consumer models.

1. Higher speeds. Paradoxically, as one faction of the industry moves toward the slower speeds predicted in 1967, another faction seems intent on defying destiny. Units with 15 ips speed settings are on the increase—corresponding to demand for the wide frequency response that's a function of these higher speeds.

2. Large reel capacity. To circumnavigate the reduced playing time that results from using higher speeds, an increasing number of recorders are being designed to accommodate 10 1/2 inch reels. In addition, large reel capacity at the lower speeds can be useful to provide greatly extended continuous play.

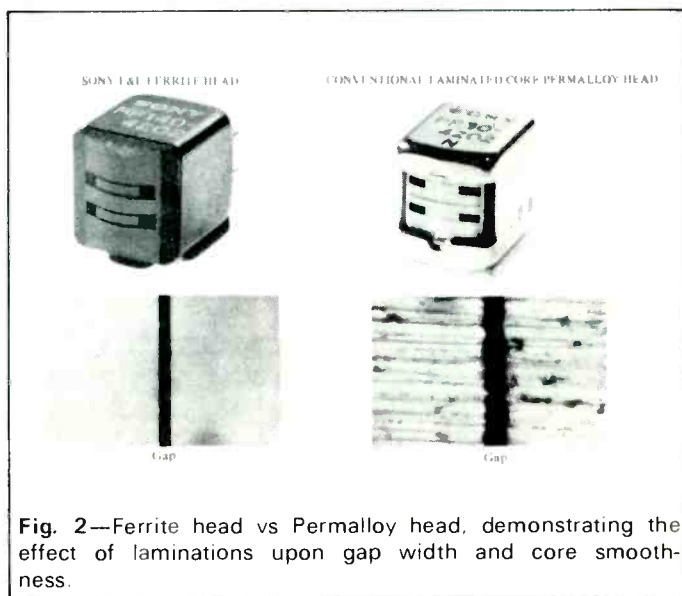
3. More sophisticated drive systems. Uneven tape motion has long been a bugbear of the tape recorder. Now the sophisticated audiophile can reduce it and its attendant ills—wow-and-flutter and poor tape-to-head contact—with any of a growing number of 3-motor tape decks on the consumer market.

Innovative motor design is also helping to solve the problem of uneven tape motion. Typical is the servo-control motor, which prevents capstan speed variations due to normal voltage or load changes. (Figure 1.)

Connected directly to the capstan motor (A) is a frequency generator (B), whose frequency is dependent upon the motor RPMs. The frequency generated is relayed to a servo control board (C) which compensates for variations in the speed of the capstan motor by either increasing or decreasing voltage (D). The result is highly accurate motor speed and consequently, consistent tape motion.

Further sophistication can be found in yet another feature previously restricted by cost to the professional, but now making its way to the consumer: closed loop dual capstan tape drive.

In this system, two capstans isolate the tape from external vibration and abnormal reel movement by forming a "closed loop" of tape around the head assembly. Two current 3-motor tape decks featuring the system, SONY models TC-854-4S and 850, can attest to its efficacy with extremely low wow-and-flutter specifications of 0.03%. (Figure 2.)



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5. Ferrite heads. Much has been written concerning the hardness of the ferrite head and its resultant ability to resist abrasion. There are other advantages. For example, the higher internal resistance of the ferrite material used in their manufacture allows ferrite heads to be molded of one solid piece of material. By contrast, the permalloy head must be built up of laminations in order to cut down eddy current losses.



Fig. 3—Sony Model 850, a professional quality 3-motor deck.

The single surface of the ferrite head material can be lapped to a sharper, more precise edge than can the laminations of the permalloy, permitting more even pole pieces, and ultimately a narrower head gap. (Figure 3.) The effect on frequency response is obvious.

Natural stereo and 4-channel separation is virtually dependent upon even pole pieces and straight headgaps to prevent sound drop-outs from phase shifting. It's not surprising, then, to see the ferrite head making an appearance on the more sophisticated open reel units.

What else does the future hold? Knowing that the tendency is toward professionalism, we can make educated guesses—or think wishful thoughts. Chromium dioxide tape for reel? Why not, at least at the slower speeds. Refinements in ferrite heads will certainly aid the cause. So will special lubricants to reduce friction, and its resultant abrasion.

Abrasion is one of tape's most insistant drawbacks. Hopefully, the time will come when it's eliminated altogether, or at least reduced to a nominal level. A more efficient method of reading the magnetic pattern on tape would help—especially one that does not depend on tape-to-head contact. As incentive, consider the recently developed phono cartridge that uses a photo cell instead of a needle.

This is a transitory period for open reel. It has lost sales to cassette and cartridge simply because its new identity and market are not yet firmly established. That time is coming.

To be sure, the market for the sophistication provided by open reel is smaller than that for the convenience of its plastic-enclosed cousins. But price differential minimizes that problem—and furthermore, each purchaser of a cassette or cartridge unit is a potential step-up to open reel.

One thing is certain: no matter how far cassettes and cartridges progress, open reel is still the ideal they're measured against. As long as that's true, open reel will remain an important factor in the consumer audio industry.

as perfect as a circle



TRI-PLANNER I



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It is with great regret that we have to announce the death of Betty McProud. The McProuds were married in 1962 and Betty was a familiar figure at Audio Shows and conventions until Mac's retirement nearly two years ago. Early in 1972, Betty was found to be suffering from cancer and given a year or so to live. So, in September, the McProuds moved down to Florida to enjoy a few months of happiness.

All our sympathy goes to Mac in his bereavement.

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AUDIO ETC

Walking Pan Pot

I'll tell you one thing about working with the new semi-pro hometype four-channel tape recorders. You must keep yourself bodily orientated. At all times and without deviation! Otherwise you are lost. I should know. You have to turn yourself into a sort of animated pan pot, ready to move front right, rear left or what have you, in a fraction of a millisecond.

It's like the points of the compass, diagonally. Imagine those four loudspeakers out there, NW, NE, SE, SW, surrounding you. You read the controls on your orientated machine the way you read a road map to chart the road ahead, but even more rigidly. You do not "drive" your tape machine in any direction except straight ahead and forward, looking towards the front.

I once knew a city boy who could not read maps in a car except when we were driving North. When we went South he had to turn the map upside down in order to figure where we were going. I laughed at him and he was furious. But he still turned the map upside down. It's like that only worse if you try driving your new four-channel recorder in any way except in the one correct orientation, facing FRONT. And I say this, knowing that many an advanced recording engineer will not even recognize a front or a back in his four-channel work. Even so, one must face somewhere, somehow or other, and I say that one should orientate one's self, one's thinking and one's machine to a common directionality—whatever you choose to call it.

Turn yourself around, or your machine, and in moments all is directional chaos. You'll grab the wrong control for the wrong channel—and it's back to the beginning and try, try again.

You must think orientation, and act it. You do it directly in space, whether actual or projected in the mind. Ignore the fancy channel terminology! It's deadly, and must be translated into action—which takes thought. It's a tangle of nonsense at this stage—LF, RR, L1, L3, Channel Four, Two, A, D, B—a nightmare. You'll never get anywhere if you think in these terms while you are actually working with tape. (Fine for the algebraic theorists on paper.) Instead, what you do is simply to point. Don't call your channel anything. Just look at it.

Point out diagonally with your left hand. That's the front left channel, yes? On your machine it will be the upper left hand VU meter in the cluster of four. Right? No label needed. Just a spatial correspondence. So also with the controls, visible and tactile. Every one of them for that same channel must be the upper left in a clump of four. And the same with the all-important signal lights. Record that channel, and a red light goes on in the upper left corner of the clump of four. (Well yes, the space isn't quite literal, UP being forward. But you can make it literal by tipping your machine over to the horizontal, or halfway, if you really need to.) And so it goes. No *thinking*. No translation.

Oh, so you must plug in a cable for that left front channel? Ah, yes. The inputs are in back. So you get up and go around for a look—STOP! Stay put. Instead, reach over, or around, and do your plugging from your same orientated position. On the two TEAC machines, as previously noted (the 2340 and 3340), the backside inputs and outputs are laid out to correspond to your up-front orientation, so you can in fact stay put, facing front, and do your plugging by feel exactly as you read your controls and "see" your speakers. It's a good idea. I cannot vouch for the Sony four-channel recorder, not having examined its rear, but I can definitely say that this useful orientation should be adopted by all forthcoming semi-pro four-channel equipment with backside plug boards.

If you defy me and look directly at the TEAC's rear, thus reversing your spatial field, you will find everything laid out backwards. Left, you will see, is to the right, and vice versa. Good! Serves you right (left).

Let's call it Canby's Rule. In all four-channel work, stay orientated. Line up your body, your thoughts and your machine with the ultimate playback and keep them that way. Canby's Rule applies to four-channel space as the Canby Constant (AUDIO, May, 1972) applies to the fourth dimension, time.

Since my last piece on the new home-ish semi-pro four-channel taping, I have found myself in some new and interesting configurations. What does one do, for instance, with a four-channel machine on a public stage? (Take note of this, you professionals.)

I gave a lecture/demo at the University of Oregon, part of a Festival of the Two Visions, more commonly known, after C. P. Snow, as the two cultures. The arts and the sciences. As always, I found myself just halfway between the two and that is why I was there. Predictably, my subject was "Toward One Culture". I never did think there were two. Also predictably, I put on a four-channel demo, which took place in a large and properly reverberant auditorium in the Music Department. With still further predictability, I filled that saintly musical space with outrageous sounds not normally listed as music, all grossly amplified at 150-foot spacing (more or less) out of four enormous Voices of the Theatre, kindly provided by the management. It may not have been a musical evening but it most certainly was sonic.

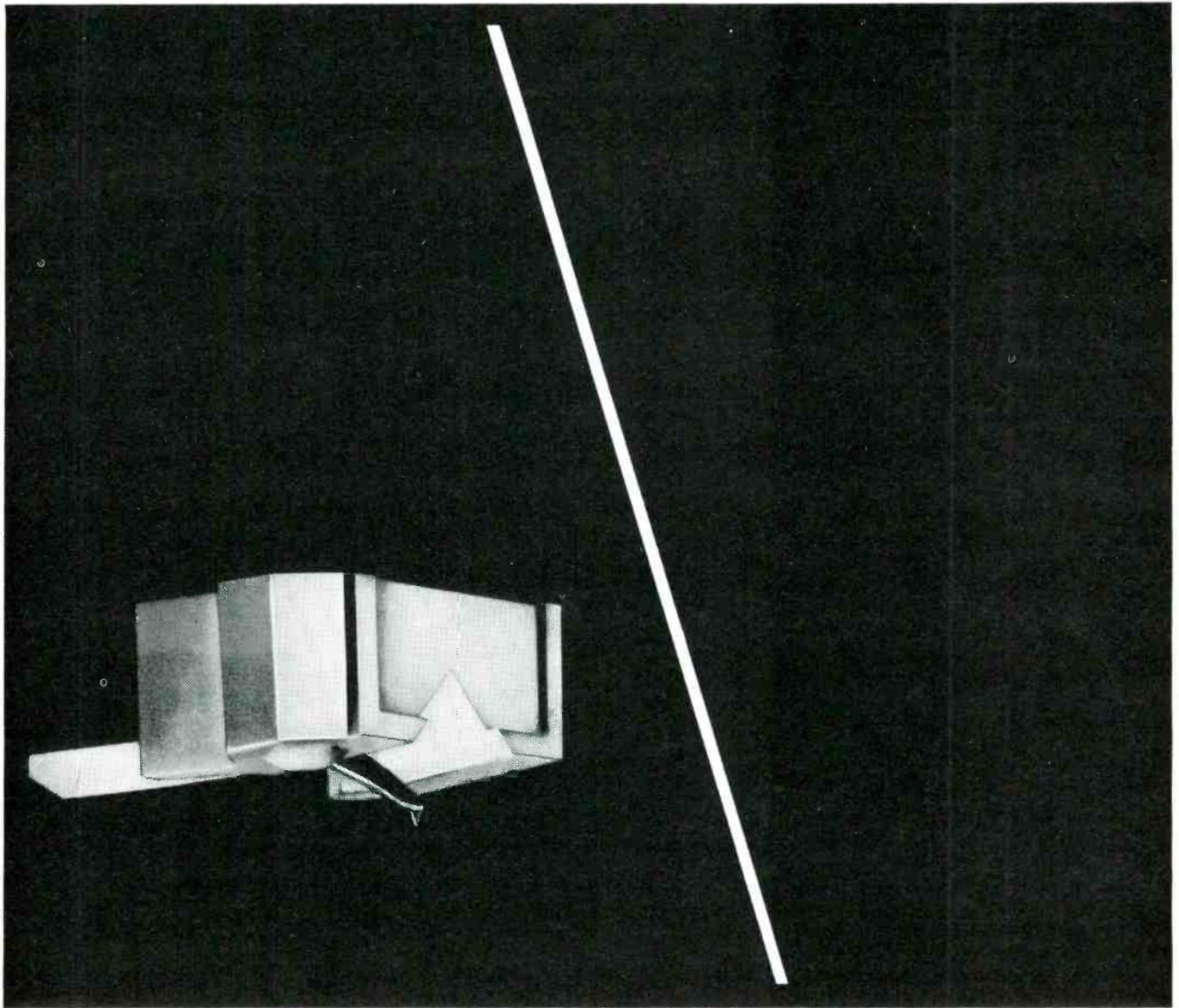
Now wasn't it nice that the management also provided me with a TEAC 3340, its four-way controls identical with those on my more inexpensive TEAC 2340 at home. In all that strange space, I was thankful for the familiarity under my fingers. Came my rehearsal time and there it was, hooked right up to the four monster speakers and neatly set out on a table next to my lectern so I could talk to the audience and have it close by for the demo—but hey! It was backwards. And come to think of it, so was I. Facing rear.

For a moment my head whirled. A whole evening (for me) in reversed quad? Canby's Rule screamed NO.

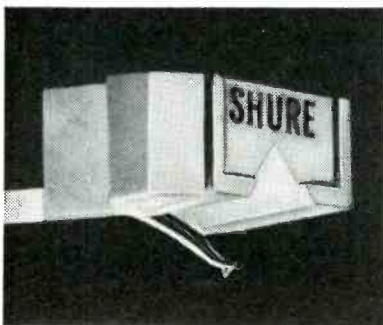
The lecturer, after all, must face his audience and therefore he looks towards the rear of the hall. And at the rear speakers. Everything is reversed. Right channels are left, back channels are front.

Well, actually, I had faced this problem elsewhere. I'm a choral conductor, you will remember. In chorus concerts I face the audience to talk about the music we will sing. But when it comes to conducting the singers, I turn my back like any proper conductor. (That's why conductors—though not me—wear tails. They look so nice from the rear. And, incidentally, they let your shoulders and arms move. That does help, I'll admit. I have a special suit coat with knee action, for my own arms.) So, as you can quickly guess, I "conducted" my four-channel machine. I set it up behind me, as I faced the audience, and during playback I monitored gain on the big speakers with my backside to.

I had to. It was absolutely essential that my own physical orientation line up with the normal directionality of the reproduced sounds, so that my



The three-dollar bill.



The stylus shown above is phony. It's represented as a replacement stylus for a Shure-cartridge, and although it looks somewhat authentic, it is, in fact, a shoddy imitation. It can fool the eye, but the critical ear? Never! The fact is that the Shure Quality Control Specialists have examined many of these impostors and found them, at best, to be woefully lacking in uniform performance — and at worst, to be outright failures that simply do not perform even to minimal trackability specifications. Remember that the performance of your Shure cartridge *depends* upon the stylus, so insist on the real thing. Look for the name SHURE on the stylus grip (as shown in the photo, left) and the words, "This Stereo Dynetic® Stylus is precision manufactured by Shure Brothers Inc." on the box.

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hands on the level controls would react automatically, left, right, front, rear. Be warned if *you* ever run four channels from a stage.

By the way, in that large, reverberant hall my demo was restricted to specially selected four-way sounds, and no regular quad music: though as always the temptation to put on a quadrasonic spectacular (with such enormous speakers!) was strong. I cannot say too often that public demos of recorded music in big halls are an unmitigated waste of time, creating more confusion than sense; and it's no different with quadrasonic. The normal recording is designed for home reproduction in a small enclosed area, the traditional living room. (Or maybe inside a car.) There, it re-creates a large space inside a small, intimate surround, and that is the entire rationale of the acoustics involved. (This applies as well to the synthetic space of the modern pop disc.) Play your recording, however, into a second large space, a big hall, and you have acoustic chaos, one big-hall sound inside another and a disastrous double liveness. With rare exceptions, the sound is dismally bad and the recording is much better left unplayed.

The only normal music I used, therefore, was a Canby Singers stereo tape (as made last year on the Nagra IVS), which I copied off on the spur of the moment through a just-arrived Electro-Voice EVX 44 decoder, thus making four channels out of two. Good idea. Make your own quadrasonic tapes from stereo. It worked in playback, in this case, because being church music the sound was actually improved by the double liveness—a fine “cathedral” effect. It was a brief anthem by Thomas Morley (of “My Bonnie Lass She Smileth” and “Now is the Month of Maying”), sung by only ten singers, and as it soared voluminously out of those four big Voices of the Theatre I wondered to myself what old Thomas M. would think. I expect, prosaically, that he would not even recognize his branchchild. But I thought it sounded fine. I am, so to speak, a child of today, and this is the way we “translate” older art, older music, into the modern media languages for our present ears. It's all right! as the Beatles say.

“Henry”, a few years back, was my first mixed media show in multiple, done with three channels of pictures and four of sound, the latter distributed via two separate stereo tapes; for we had no semi-pro four-channel equipment then. For my Oregon demo I copied off the two original “Henry”

tapes onto one common four-way tape via the TEAC, and it was a pleasure, so utterly easy after more than three years of hit-or-miss coordination via two entirely separate tape machines. The old two-tape system worked OK, but it was a pain in the neck, requiring two operators what with the necessary gain riding for public presentation. (I could never manage both machines by myself. I'm too scatterbrained.) So to get the whole thing onto one tape, securely tied down and synced to perfection, the levels correct and nothing but one button to push, was a thing to be thankful for. I must say once again that this new four-channel sync technique is superbly useful for the home tape experimenter, and for the pro who uses his own semi-pro equipment. There's no end to the useful things you can do.

For those who are not pros, here's the way it's done, or I did it. No, you don't have to play all your sources simultaneously. Copy them off one at a time. I started with the front-speaker tape for “Henry”. It had been made on my big two-track stereo machine at 7½ ips and I played it on the same, copying conventionally onto tracks 1 and 3 (the front tracks) of the TEAC tape. Without the second tape to bother me, I was able to concentrate on the right levels for this material, making good corrections as I went through it. Then—reel back to the beginning and start once again.

The back “Henry” tape wasn't even compatible with the front. It had been assembled from assorted four-track recordings made mostly on a battery portable machine at 3¾ ips (and not bad in sound, considering), a montage of all sorts of persuasive noises, from crickets and katydids to rushing automobiles around a small-town traffic circle, double-speed, and running-water Niagaras, half speed, out of my kitchen faucets. To get this onto my TEAC tape I set up a different machine, four-track, and fed it into tracks 2 and 4. Our original arrangement required periodic re-cueing of this tape, at points marked by white leader, while the front tape played on continuously. So it had to be re-cued in the copying. Problem? Not a bit. You can stop and start your four-channel sync machine anywhere during recording without a trace of a click or a thump. So—copy the first segment, stop the tape, re-cue, go on with the second, and so on, and no editing needed.

For the sync operation I switched the front channels, 1 and 3, into sync playback via the top two of four little slide switches right on the front of the

TEAC heads, in the proper orientation. Then flip the front-channel RECORD switches—same orientation—to OFF, and the rear channels, the bottom two, to ON. Now when motion starts the back channels will record and the front pair play back through their recording heads, in sync with the incoming signals. You hear the whole works, just as it will sound when the finished tape is played. And you can monitor the gain on the two recording channels, while listening to the playback of the other two. (You could copy without sync, of course, by putting all four channels into normal playback since this is a “three head” recorder, four channels to each head. But you would not be able to monitor the levels on the incoming signal except via the playback, which would of course be delayed. Chancy. Or if you listened directly to the record input signal the sound would be out of step with the playback of the rest.)

When all is ready and all switches double-checked, you shift the transport lever into PAUSE, the center position, and push the RECORD button. Nothing moves. But two bright little red lights, the bottom two of four, go on. Once again, the correct spatial alignment, for instant seeing. You are ready to record the back two channels.

First you must jack up the playback volume on the synced playback, the front channels, already recorded. Sync playback on the TEAC machines is “way down in level as compared with normal playback through the playback heads. An annoyance but presumably necessary for economy in this complex but inexpensive machinery. I have it roughly calibrated; you move the play volume up about two and a half notches for sync playback, to read approximately accurate levels on the meters. (I plan to do a more exact calibration by trial and error, and I suggest that TEAC might recommend a figure in its literature. Also, they just *might* be able to incorporate some extra amplification, which would automatically compensate for the difference. It would be very useful.)

And so you are off. Flip the lever from PAUSE to PLAY and the recording/playback begins, just as you have pre-set it. Now you can (and I did) concentrate on the proper levels for the second recording, while listening against the front playback. I use headphones, by the way. They bring you all four channels, two for each ear, and you can flip to front channels only, or back channels, to see what each is doing. Almost easier than working with four actual speakers.



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If anything goes wrong, you can always reel back and start again. Anywhere. No clicks, no pops.

In my most recent show, produced on the TEAC machine last summer, I ran into some horrendous mixing problems (horrendous for a non pro, at least . . .) trying to assemble my four-way montages of pre-recorded voices, plus music via SQ decoding, sometimes one signal to a channel, sometimes in pairs front/rear, or even diagonally like an X. With all this complexity, every single "take" required total orientation, plus a check-through of dozens of switches, meters, cable connections, to be sure all was set right. It was here that my strong conviction grew that one must line one's self up

and directly *sense* the four channels, minus intervening terminology, for any sort of efficient operation. I worked out all sorts of odd refinements on the idea, to help myself.

For instance, when I wanted to record in diagonal pairs of channels, I would place a highly visible piece of sticky tape right on each of the two meters I would be using for one diagonal, and another set onto the relevant volume controls. I could then see my diagonals at a glance. Say, upper-left-to-lower-right. Left front to right rear, that is. I would even go so far as to hold my hand out at a diagonal slant in front of me—it goes *that way*, I would soundlessly mutter to myself. Then, the first diagonal

safely down on the tape, I would reel back and set things up for the opposite diagonal, including all the switches and those pieces of sticky tape, which would now read very visibly "upper-right-to-lower-left". It really helped.

In putting together the more complicated spoken ensembles I even went so far as to stick people's names on the corresponding meters and level controls. David front right, Mary at left rear, Dorothy up front on the left. There they stood, or their names stood, in the very configuration in which they would speak, via the playback speakers! Sounds silly, but my work went much faster after I had put this Canby's-Rule system into effect. Instant orientation by direct, visible-tactile means, and no terminology at all. It's the only way when you are supposed to think of a dozen things at once.

I don't know how the pros work in their hundreds of thousands of dollars' worth of quad studio space, but I'll guess that they have long since worked out more sophisticated versions of my own sticky-tape system. I'm sure that the more buttons and meters and levers you have to play with, the more quickly must you learn instant operation, minus thought. Every good control console I have seen is expensively laid out in patterns, for this very sort of work.

Well, 'nuff said. It's a brand new technique, this sync thing, for us amateur recordists, but I'm here to say that it should spread, and spread fast, as more four-channel sync machines appear to supplement TEAC and Sony, the first to hit the market. In a way, it plays straight into the home tape user's hands—for *there is no editing*. Most tape machine owners are notorious for their lack of editing know-how. They won't touch it. Now they don't have to. Everything is done by levers.

Imagine it. I myself have spent more than twenty-five years becoming a very expert tape editor, via hundreds of assembled radio tapes and plenty more of my own choral recording sessions, assembled by the classic joining of different "takes" into finished wholes. I must have put down a hundred million white splices in my day. And now—a whole four-channel extravaganza under my belt and not a single splice! I don't know whether to laugh or cry. Better a good laugh, I guess. I'm having fun with this non-editing and in the process I'm getting so orientated that I'm practically a walking pan pot, LF, RF, RB and, er, Channel Four. A good feeling.



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That's the way Stereo Review described our XLM. High Fidelity head-lined their review, "Superb new pickup from ADC" and went on to say, "...must be counted among the state of the art contenders." And Audio echoed them with, "The ADC-XLM appears to be state of the art."

With the critics so lavish in their praise of the XLM, there's hardly any necessity to add anything. Far better to let the experts continue to speak for us.

Frequency response The CBS STR-100 test record showed less than ± 1.5 dB variation up to 20,000 Hz. *Stereo Review*
... response is within ± 2 dB over the entire range. *Audio*
Frequency response is exceptionally flat. *High Fidelity*

Tracking This is the only cartridge we have seen that is really capable of tracking almost all stereo discs at 0.4 grams. *Stereo Review*
The XLM went through the usual torture test at 0.4 grams (some top models require more than a gram). *High Fidelity*
The XLM is capable of reproducing anything found on a phonograph record. *Audio*

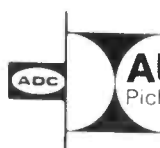
Distortion Distortion readings ... are almost without exception better than those for any other model we've tested. *High Fidelity*

The XLM has remarkably low distortion in comparison with others. *Audio*
At 0.6 grams the distortion was low (under 1.5 per cent). *Stereo Review*

Hum and noise The XLM could be instrumental in lowering the input noise from the first stage of a modern transistor amplifier. *Audio*
The cartridge had very good shielding against induced hum. *Stereo Review*

Price This would be a very hard cartridge to surpass at any price. *Stereo Review*
We found it impossible to attribute superior sound to costlier competing models. *High Fidelity*
Priced as it is, it is a real bargain in cartridges. *Audio*

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ADC-XLM \$50.**



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OPEN REEL TAPE RECORDER DIRECTORY



AKAI 280D-SS



Crown SS822



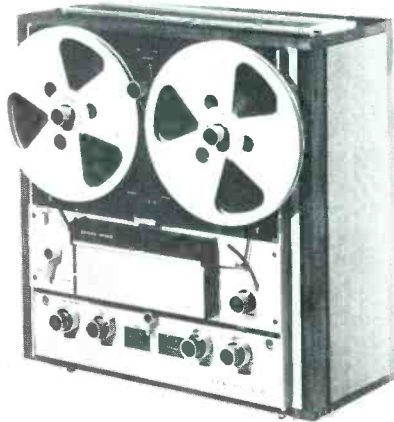
Dokorder 7500

MANUFACTURER	MODEL	Speeds (see letter code)	Power amp(s) built in?	Max. reel size, in.	No. of heads	No. of tracks	No. of motors	Drive motor type	Drive to capstan	Frequency response* Hz to kHz, ± dB	Wow and flutter, %	Signal-to-noise ratio, dB*	Fast wind, 1/200 fl., sec.	Mic. input Z, ohms	Rec'ing level indicator type	Dimensions, W x D x H, in.	Weight, lbs.	Price	SPECIAL FEATURES
AKAI	GX400D	E	No	10½	4	4	3	Servo	Direct	20-27k ±3	0.04	55		10k	2 Mtrs.			899.95	Auto Distortion Reduction sys.; auto stop/off; SOS; SRT tape sel. swit.; line mic mixing; playback vol. contl.; dual capstan; rev. rec. & playback.
	GX365D	G	No	7	3	4	3	Hys.	Belt	30-28k ±3	0.04	55	75	10k	2 Mtrs.	16¼ x 11¼ x 18½	56	549.95	Auto pause/off; comput-o-matic; SRT button; mag. brake; reverse-o-matic; cont. play; auto stop; SOS; SWS; S over S.
	GX260D	B	No	7	4	4	3	Hys.	Belt	30-22k ±3	0.1	48		10k	2 Mtrs.			474.95	Rev. in record & playback; rear panel playback vol. contl.; line mic mixing; SOS; SRT tape swit.; auto stop.
	GX280D	B	No	7	3	4	3	Servo	Direct	30-24k ±3	0.08	50	60/75	10k	2 Mtrs.	17 x 18 x 10	44	499.95	SOS; tape selecting; auto off/stop; line mic mixing; pause.
	X1800SD	A, G (with kit)	Yes	7	4	4	3	Ind.	Belt	30-23k ±3	0.12	50		10k	2 Mtrs.	13½ x 15 x 9½	34.4	399.95	Reel/cartridge combo; transfer sys.; auto off/stop; tk selector; two lever sys.
	GX220D	A	No	7	3	4	3	Hys.	Belt	30-24k ±3	0.1	48	75	10k	2 Mtrs.	17.2 x 17 x 9.2	41.8	399.95	Auto off/stop; pause w. start button; tape swit.; SOS.
	1730D-SS 4-chan.	B	No	7	4	4	3	Hys.	Belt	30-22k ±3	0.12	50	75	10k	4 Mtrs.		33	349.95	2/4 chan.; auto off; pause control; tape lifter.
	GX280D-SS 4-chan.	B	No	7	4	4	3	Servo	Direct	30-22k ±3	0.1	50	60	10k	4 Mtrs.	17½ x 20¼ x 10	37¼	649.95	2/4 chan.; auto/cont. rev. PB; lo-noise tape swit.; SOS; remote contl.; glass & crystal ferrite head.
	4400	B	Yes	7	3	4	1	Ind.	Belt	30-22k ±3	0.15	50		10k	2 Mtrs.	16.3 x 14 x 7.6	30	299.95	Convert-a-deck; front panel deck; conv. button; SOS; SWS; sound mixing; pause contl.; auto off.
4440D	B	No	7	3	4	3	Hys.	Belt	30-24k ±3	0.12	50		10k	2 Mtrs.	17 x 18 x 9¼	42	299.95	Tape sel. swit.; dual monitoring; SOS; SWS; sound mixing; auto off/pause; built-in speakers.	
ASTROCOM	407A	B	No	7	4	4	3	Hys.	Idler	30-20k ±3	0.06	60	45	10k	2 Mtrs.	21 x 14½ x 10½	40	459.95	Auto rev.
	711 4-chan.	B, F	No	10½	4	4	3	Hys.	Idler	30-20k ±3	0.03	65	60	Lo	4 Mtrs.			Under 2000.00	Headphone amps; mixing.
BRAUN	IG 1000 4-chan.	A	No	8¾	4	2	3	D.C. servo	Belt	20-25k ±1.5	0.04	60	30	1k	2 Mtrs.	17¼ x 12½ x 5¼	44	749.50	Elect. tape tension contl.; peak read mtrs.; 4-chan. PB; remote contl.; opt. auto rewind.
CONCORD (BENJAMIN)	Mark VIII	A	No	7	2	4	2	Ind.	Belt	50-12k	0.1	45			2 Mtrs.	16¼ x 17¼ x 8¼	40	329.95	Has built-in 8-tk. deck.

Speeds Indicated by letter code:

	A	B	C	D	E	F	G	H
15					X	X	X	
7½	X	X	X		X	X	X	
3¾	X	X	X		X	X	X	
1½	X	X	X		X	X	X	
¾			X					

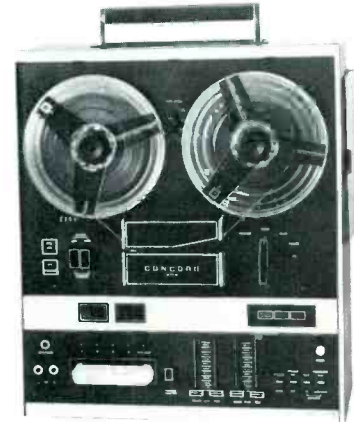
*at the highest speed of the machine



Ferrograph Series 7



JVC 4RD-1401



Concord Mark VIII

MANUFACTURER	MODEL	Speeds (see letter code)	Power amps built in?	Max. reel size, in.	No. of heads	No. of tracks	No. of motors	Drive motor type	Drive to capstan	Frequency response* Hz to kHz, ± dB	Wow and flutter, %*	Signal-to-noise ratio, dB*	Fast wind, 1200 ft., sec.	Mic input Z, ohms	Rec'ing level indicator type	Dimensions, W x D x H, in.	Weight, lbs.	Price	SPECIAL FEATURES
CROWN	SX724	B	Opt	10½	3	4	3	Hys.	Belt	20-25k -2	0.09	60	45	350k	2 Mtrs.	19 x 9 x 15¼	45	995.00	Dual mic, line mixing; 5-in. VU mtrs.; also in ½ track.
	SX824	B; F	Opt.	10½	3	4	3	Hys.	Belt	20-25k -2	0.09	60	45	350k	2 Mtrs.	19 x 9 x 15¼	48	1495.00	Complete logic; Wal. cab.; counter opt.; also in 2 track.
	CX822	E	Opt.	10½	3	2	3	Hys.	Belt	30-30k -2	0.06	60	45	250 bal.	2 Mtrs.	19 x 9 x 17½	53	1790.00	As above. Also in ¼ track or 4 chan.
	SX744	B	Opt.	10½	3	4	3	Hys.	Belt	20-25k -2	0.09	60	45	350k	4 Mtrs.	19 x 9 x 21	60	1895.00	8 mic inputs.
DOKORDER	9100/1	B	No	7	6	4	3	Hys.		40-21k -3	0.06	55	65	10k	2 Mtrs.	17¼ x 20 x 15¼	55	699.95	Bi-directional rec./PB; auto repeat.
	7200	B	No	7	4	4	3	Hys.						2 Mtrs.				469.95	Auto PB repeat; auto off; adj. reel height; SOS; SWS; echo; lock; pause contl.
	6020	B	No	7	4	4	3	Hys.		20k-20k	0.12	55	45	10k	2 Mtrs.	14½ x 7½ x 15¼	36¼	279.95	Bi-directional rec./PB; auto repeat; auto off.
	7500	B	No	7	6	4	3	Hys.		40-23k -3	0.08	55	65	10k	2 Mtrs.				579.95
FERROGRAPH (ELPA)	704 AW	E, G	No	8¼	3	2; 4	3	Ind.	Idler	30-17k -2	0.08	60	60	10k	2 Mtrs.	14¼ x 16 x 8¼	37.5	649.00	Model 704 ADW, Dolby, \$850; 724 ADW, \$900. *Available by special order only from ELPA.
JVC	4RD 1401 4 chan.	B	No	7	3	4	1	Ind.	Belt	30-20k -3	0.1	53	160	600	4 Mtrs.	16 x 8 x 18	27	449.95	2/4-chan.; lo noise & mon. swt's; retract. pinch roller.
	RD-1553 4 chan.	B	No	7	3	4	3	Hys.	Belt	20-24k -3	0.1	53	80	600	2 Mtrs.	16 x 8 x 18	33	429.95	2/4-chan.; lo noise & mon. swt's; retract. pinch roller.
	RD-1552	B	No	7	3	4	3	Hys.	Belt	20-24k -3	0.1	52	80	600	2 Mtrs.	16 x 8 x 18	33	329.95	Solenoid buttons; SOS; flip up head cov.; retract. pinch roller.
	RD-1450	B	No	7	3	4	3	Ind.	Belt	30-20k -3	0.1	52	160	600	2 Mtrs.	16 x 7 x 13	21	199.95	Tape/Source swt.; auto stop; flip-up head cov.; retract. pinch roller.
	RD-1695	A	No	7	2	4	1	Ind.		30-20k -3	0.13	52	190	10k	2 Mtrs.	7½ x 15¼ x 12¼	19.4		SOS; SWS
	4RD-1405 4 chan.	B	No	7	2	4	1	Ind.		30-18k -3	0.1	52	160	10k	4 Mtrs.	7¼ x 16 x 13½	22		Auto stop; auto tape cleaner

OPEN REEL TAPE RECORDER DIRECTORY



Nagra IV-S



Panasonic RS-736



Pioneer T-600

MANUFACTURER	MODEL	Speeds (see letter code)	Power amp(s) built in?			Max. reel size, in.	No. of heads	No. of tracks	No. of motors	Drive motor type	Drive to capstan	Frequency response* Hz to kHz, - ? dB	Wow and flutter, g*	Signal-to-noise ratio, dB*	Fast wind, 1200 ft., sec.	Mic input Z, ohms	Rec. ng level indicator type	Dimensions, W x D x H, in.	Weight, lbs.	Price	SPECIAL FEATURES
			7	4	4																
MAGNAVOX	1K8982	B	No	7	4	4	1	Ind.	Idler	50-15k -5	0.15	45	180	10k 50k	2 Mtrs.	14½ x 16½ x 7				Auto rev. rec./PB.	
	1K8877	A	No	7	3	4	1	Ind.	Idler	50-15k -5	0.1	45	150	10k 50k	2 Mtrs.	15½ x 13¾ x 7				Auto noise supp., std./lo-noise bias swit., echo; SOS.	
	1K8981	A	No	7	2	4	1	Ind.	Idler	50-15k -5	0.15	45	180	10k 50k	2 Mtrs.	12¾ x 15¼ x 7				SOS.	
	1K8980	A	No	7	2	4	1	Ind.	Idler	50-15k -5	0.15	45	180	10k- 15k	2 Mtrs.	12¾ x 15¼ x 7					
NAGRA	4.2	E	No	7	4	1				30-20k -2	*	70		100k	Mtr.	12½ x 8.7 x 4.3	11½	1735.00		*0.1% speed varia.; D-cell powered; film sync.; AGC.	
	SD	E	No	7	3	2				30-18k -2	*	70		50- 200	Mtr.	12½x8.7 x 4.3	11½	1985.00		*0.1% speed varia.; features as above, but film sync. \$400 extra.	
	SN	H°	No	**	3	1				10-15k -2	0.1	60		200	Mtr.	5.8x4 x 1	1.3	1295.00		**Plus 15/16; **special, supplied.	
PANASONIC	RS736	E	No	7	3	4	1	Hys.		30-23k -3	0.09	53		20k	2 Mtrs.	18 x 17 x 8½	33	329.95		Built-in mixer; SOS; SWS; hot pressed ferrite heads; 10 yr. warranty on HPF heads.	
	RS714	B	No	7	4	4	3	Hys.		30-23k -3	0.09	53		20k	2 Mtrs.	20 x 17 x 7½	49	499.95		Mic Z swit.; SOS; SWS; hot pressed ferrite heads; 4 dig. counter; solenoid contl.; remote avail.; 10 yr. warranty on HPF heads.	
	RS715	B	No	7	4	4	3	Hys.		30-22k -3	0.09	53		20k	2 Mtrs.	20 x 17 x 7½	49	549.95		Auto rev.; bias swit.; hot pressed ferrite heads; solenoid contl.; remote avail.; 10 yr. warranty on HPF heads.	
	RS740 4-chan.	B	No	7	3	4	1	Hys.		30-22k -3	0.09	53		20k	4 Mtrs.	20 x 17 x 7½	28	449.95		2-chan./4-chan. rec. & PB; 2 phone jacks; hot pressed ferrite heads; 10 yr. warranty on HPF heads.	
	RS1030	F	No	10	4	4	3			30-22k -3	0.08	55	60	20k	2 Mtrs.	17 x 7½ x 22	60	849.95		4-chan. playback; bias swit.; mic Z swit.; 4 dig. counter; built-in mixer; hot pressed ferrite heads; solenoid contl.; remote available. 10 yr. warranty on HPF heads.	
PIONEER	T-8800	B	No	7	6	4	2	Hys.	Belt	40-15k	0.08	55		330k	2 Mtrs.	22 x 16½ x 9½	50	549.95		Rec./PB auto rev.; bias select.; SOS; remote pause contl.	
	T-6600	B	No	7	4	4	1	Hys.	Belt	50-15k	0.12	55		330k	2 Mtrs.	17¼ x 17 x 7¼	28	299.95		REC/PB auto rev.; pause contl.	
	T-6100	B	No	7	4	4	1	Hys.	Belt	50-15k	0.12	55		330k	2 Mtrs.	16 x 15 x 7	26	249.95		PB auto rev.	
	QT-6600 4-chan.	B	No	7	4	*	1	Hys.	Belt	30-20k	0.12	55		330k	4 Mtrs.	18¾ x 17 x 8¾	37	599.95		4-chan. rec/PB auto reverse; pause control.	

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Tandberg's brilliant new 3300X will set a new standard of excellence in the medium price field. A slightly less sophisticated version of the 9000X, it features a rugged new transport, with improved Tandberg Crossfield recording. Its record/playback response and signal/noise ratio are better at $3\frac{3}{4}$ ips than most other recorders at twice the price and at *twice the speed*. The 3300X features easy to use illuminated peak reading meters to eliminate guesswork, slide potentiometers, echo, sound on sound, mixing, front panel headphone jack and monitoring facilities with photoelectric end-stop. All for just \$399.80

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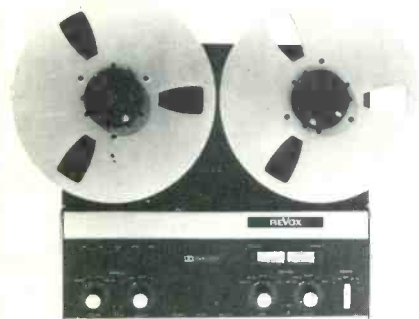


OPEN REEL TAPE RECORDER DIRECTORY

Speeds indicated by letter code:

	A	B	C	D	E	F	G	H
15					X	X	X	
7½	X	X	X		X	X	X	
3¾	X	X	X		X	X	X	
1½	X			X			X	X
¾				X				

*at the highest speed of the machine



Revox A77



Sansui SD7000



Sony/Superscope 580

MANUFACTURER	MODEL	Speeds (see letter code)	Power amp(s) built in?	Max. reel size, in.	No. of heads	No. of tracks	No. of motors	Drive motor type	Drive to capstan	Frequency response* Hz to kHz, -1 dB	Wow and flutter, %	Signal-to-noise ratio, dB*	Fast wind, 1200 ft., sec.	Mic. input Z, ohms	Reeling level indicator type	Dimensions, W x D x H, in.	Weight, lbs.	Price	SPECIAL FEATURES
RADIO SHACK	494 4-chan.	A	No	7 3/4	4	1	Ind.	Belt	50-18k	0.13	48	160	10k	4 Mtrs.	14 1/4 x 6 1/2 x 16	27	299.95	Two or four chan.	
	999B	A	No	7 3/4	4	1	Ind.	Belt	40-20k	0.2	47		10k	2 Mtrs.	13 1/4 x 7 3/4 x 15	20	179.95		
	909B	A	Yes	7 1/2	2	4	1	Ind.	Belt	50-18k	0.25			2 Mtrs.	24 1/4 x 14 x 7 1/2	26	199.95	Detach. Spkrs., with 2 dyn. mics.	
REVOX	A77	B	Opt.	10 1/2	3	2, 4, 3	Servo	Direct	30-20k -2-3	0.08	58	60	Hi. lo	2 Mtrs.	16 x 14 x 5	34	749.00	A77-HS, 7 1/2 & 15 ips, 849.00; A77D, Dolby, 979.00.	
SANSUI	SD7000	B	No	7 3/4	4	3	Hys.		20-20k -2	0.06	60	66	600 50k	2 Mtrs.	17 1/2 x 10 1/4 x 21 1/4	59 1/2	679.95	Auto reverse, repeat, rewind, off; multi mic mix.; opt. remote; tension adj.; phone jack w. vol. contrl.	
SONY/SUPERSCOPE	TC-854 4S 4 chan.	E	No	10 1/2	4	3	Servo		30-25k -2	0.03	59	130	Lo	4 Mtrs.	17 1/2 x 22 x 10	61 1/4	1795.00	Syncro-Trak; mic-line mix.; opt. remote contrl.	
	TC-850	E	No	10 1/2	4	3	Servo		30-25k -2	0.03	57	130	Lo	2 Mtrs.	17 1/2 x 19 3/4 x 10	57 1/4	895.00	Opt. 2 or 4 tk. head assy.; opt. remote contrl.	
	TC-654 4 4-chan.	B	No	7 3/4	4	3	Hys.		30-22k -2	0.04	57	60	Lo	4 Mtrs.	16 3/4 x 20 x 9 3/4	48 1/2	875.00	Mic-line mix.; plug-in head blocks.	
	TC-650	B	No	7 3/4	3	4	3	Hys.	Belt	30-22k -2	0.04	59	90	Lo	2 Mtrs.	16 3/4 x 17 1/4 x 9 1/2	46	499.95	Opt. remote contrl.; Opt. plug-in head assy.
	TC-580	A	No	7 3/4	3	4	3	Servo	Belt	30-25k -3	0.06	56	60	Lo	2 Mtrs.	17 1/2 x 18 x 8 1/4	37 1/4	499.95	*6 head function; auto off; mic-line mix.; select rev.
	TC-366 4 4-chan.	B	No	7 3/4	3	4	1	Ind.	Idler		0.09	55	120	Lo	4 Mtrs.	17 x 18 1/2 x 9 3/4	28 1/4	499.95	Mic-line mix.; servo contrl. tension.
	TC-630	A	Yes	7 3/4	3	4	1	Ind.	Idler	30-22k	0.09	50	150	Lo	2 Mtrs.	17 1/2 x 20 x 11 1/4	40 1/4	419.95	SOS, auto off.
	TC-640	B	No	7 3/4	3	4	3	Hys.		20-25k ±3	0.07	55	90	Lo	2 Mtrs.	14 1/2 x 15 1/2 x 9 1/2	33	379.95	SOS; mic-line mix.
	TC-277 4 4-chan.	A	No	7 3/4	2	4	1	Ind.	Idler	50-18k -3	0.12	0.12	150	Lo	4 Mtrs.	15 1/2 x 15 1/4 x 9 1/2	23 1/4	339.95	SOS; auto off; pause.
	TC-377	A	No	7 3/4	3	4	1	Ind.	Idler	30-25k -3	0.09	55	120	Lo	2 Mtrs.	15 1/2 x 16 1/2 x 8 1/4	22	289.95	Mic-line mix.; auto off; servo-contrl. tension.
TC-800B	C	Yes	5	2	2	1	Servo	Idler	20-22k	0.09	56	180	Lo	Mtr.	12 1/4 x 10 1/4 x 4 1/4	11 1/4	239.95	Built-in cond. mic; ALC with defeat; a.c./d.c.	
TC-106AV	A	Yes	7 3/4	2	2	1	Ind.	Idler	40-18k	0.15	47	140	Lo	Mtr.	16 1/2 x 12 x 7	17 3/4	189.95	Auto off; pause; ALC with defeat.	

The Quietest Revox

One of the most compelling reasons for buying a Revox is the sounds it doesn't make.

No spurious pops or clicks. No wavering, fluttering tones. No distracting hum. And best of all, virtually noise-free electronics.

Take our new A77 Mk III for example. We manufacture it to such close tolerances and with such exacting attention to detail, that it is generally regarded as one of the quietest tape recorders ever made.

Unfortunately, no matter how quiet our electronics are, there is still the inherent problem of tape hiss.

And that's where our new Revox A77/Dolby B recorder comes in.

By now, the virtues of the Dolby Noise Reduction system are too well known to require any elaboration on our part.

Suffice it to say, for all practical

purposes the last major stumbling block to quality, noise-free recording has finally been eliminated.

Listening to tapes on the new, Revox/Dolby B is a revelatory experience. Tape hiss is virtually non-existent. The music seems to emerge from a background of velvety silence. And at 3-3/4 i.p.s. the absence of extraneous noise is truly startling.

But no mere description of the

Revox/Dolby B can adequately convey the experience awaiting you the first time you listen to a tape made on this remarkable machine.

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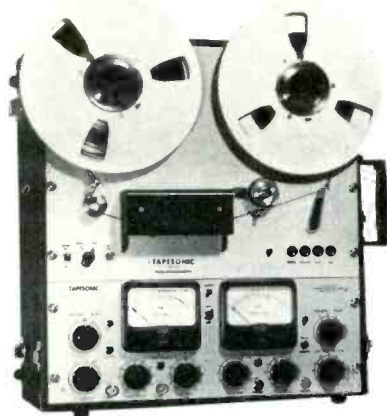
for you. Once you've heard it, you'll understand why we say...

Revox delivers what all the rest only promise.

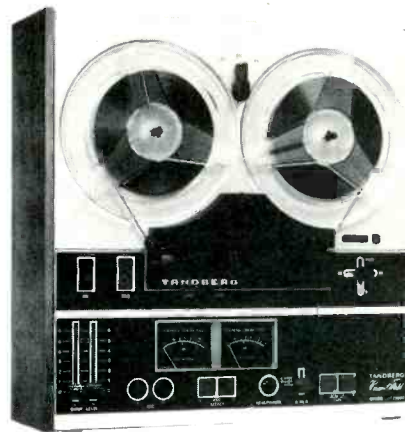
The Revox/Dolby B



OPEN REEL TAPE RECORDER DIRECTORY



Tapesonic 70A-TRSH

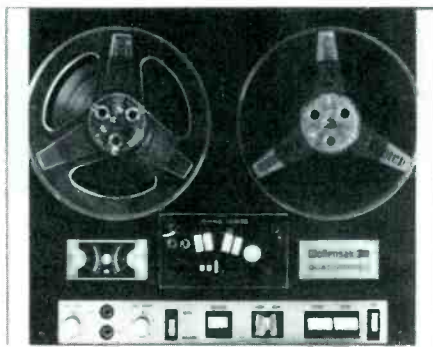


Tandberg 3300X

MANUFACTURER	MODEL	Speeds (see letter code)	Power amp(s) built in?	Max. reel size, in.	No. of heads	No. of tracks	No. of motors	Drive motor type	Drive to capstan	Frequency response* Hz to kHz, ± 7 db	Wow and flutter, %	Signal-to-noise ratio, db*	Fast wind, 1200 ft., sec.	Mic. input Z, ohms	Rec'ng level indicator type	Dimensions, W x D x H, in.	Weight, lbs.	Price	SPECIAL FEATURES
TAPESONIC (PREMIER)	70A TRSH	E	No	10½	3	2	3	Hys	Direct	35-26k ± 2	0.08	56	30	50k	2 Mtrs.	19 x 8½ x 21	69"	675.00**	*With case. **less case; also in ¼ tk., Model 70A-TRSQ.
TANDBERG	9000X	A	No	7	4	2/4	3	Hys.		40-22k ± 2	0.07	65		200	2 Mtrs.	15¼ x 7 x 16½	34.5		Remote contr.; SOS; echo; opt. 4-chan. quadrasonic playback.
	3300X	A	No	7	4	2/4	1	Asyn.		40-22k ± 2	0.07	64		200	2 Mtrs.	15¼ x 7 x 16½	20.2		Auto stop; SOS; echo; opt. 4-chan. quadrasonic playback.
	6000X	A	Yes	7	4	2/4	1	Asyn.		40-20k ± 2	0.07	62			2 Mtrs.	15¼ x 6½ x 12½	21		SOS; echo; opt. 4-chan. quadrasonic playback; add-a-track.
	4000X	A	Yes	7	4	2/4	1	Asyn.		40-20k ± 2	0.07	60			2 Mtrs.	15¼ x 6½ x 12.7/16	23		Remote stop/start; SOS; add-a-track; opt. 4-chan. quadrasonic playback.
	3000X	A	No	7	4	2/4	1	Asyn.		40-20k ± 2	0.07	60			2 Mtrs.	15¼ x 6½ x 12.7/16	20		SOS; echo; opt. 4-chan. quadrasonic playback.
TEAC	1230	B	No	7	3	4	3	Hys.	Belt	40-18k ± 3	0.08	55	90	600	2 Mtrs.	17 x 8 x 15	37	359.50	2 position bias sw.; adj. turntable hght.
	1250	B	No	7	3	4	3	Hys.	Belt	40-18k ± 3	0.08	55	90	600	2 Mtrs.	17 x 8 x 15	37	459.50	same as 1230 plus reverse play. Combination erase/rec head plus 2 play heads.
	4010GSL	B	No	7	4	4	3	Hys.	Belt	40-18k ± 3	0.08	55	90	600	2 Mtrs.	18 x 10 x 18	45	599.50	auto reverse/play; Ferrite heads; EQ/Level switch. Dual level bias switch.
	4070G	B	No	7	4	4	3	Hys.	Belt	30-20k ± 3	0.07	58	90	600	2 Mtrs.	18 x 9 x 18	51	599.50	Bi-Dir. rec and play; Ferrite heads; EQ/Level switch. Dual Level bias switch.
	3300-10	B	No	10½	3	4	3	Hys.	Belt	30-20k ± 3	0.07	58	90	600	2 Mtrs.	17 x 9 x 17	45	499.50	"quik-loc" reel hldrs.; dual level bias switch.
	3300-11	F	No	10½	3	2	3	Hys.	Belt	30-22k ± 3	0.05	60	90	600	2 Mtrs.	17 x 9 x 17	45	499.50	"quik-loc" reel hldrs.; dual level bias sw.; half track rec/play
	3300-12	B	No	10½	3	2	3	Hys.	Belt	30-20k ± 3	0.07	60	90	600	2 Mtrs.	17 x 9 x 17	45	499.50	"quik-loc" reel hldrs.; dual level bias sw.; half track rec/play
	2340	B	No	7	3	4	3	Hys.	Belt	40-18k ± 3	0.08	55	90	600	2 Mtrs.	17 x 9 x 19	46	759.50	Four channel rec/play. Simul-sync monitor sw.; dual level bias sw.
	3340	F	No	10½	3	4	3	Hys.	Belt	30-20k ± 3	0.05	55	90	600	2 Mtrs.	17 x 9 x 21	50	849.50	Four channel rec/play. Simul-sync monitor sw.; dual level bias sw.
	6010GSL	B	No	7	4	4	3	Hys.	Belt	30-20k ± 3	0.07	58	90	600	2 Mtrs.	18 x 8 x 21	47	799.50	auto reverse/play; ferrite heads; dual EQ/level switch; dual bias level switch.
	7010GSL	B	No	10½	4	4	3	Hys.	Belt	30-20k ± 3	0.07	58	90	600	2 Mtrs.	18 x 9 x 21	62	999.50	auto reverse/play; ferrite heads; dual EQ/level switch; dual bias level switch.
	7030GSL	F	No	10½	4	2/4	3	Hys.	Belt	30-22k ± 3	0.05	60	90	600	2 Mtrs.	18 x 9 x 21	62	949.50	2 & 4 trk play heads; ferrite heads; dual EQ/level switch; dual bias level switch.
TELEX	2001	B	No	8¼	3	4	3	Hys.	Belt	45-18k ± 2	0.08	52		HiZ	2 Mtrs.	19½ x 14½ x 8		799.95	Die cast mainplate; tape/source swit.
	433	A	No	7	3	4	3	4-p	Belt	40-18k ± 3	0.2	54	70	50k	2 Mtrs.	15¼ x 8¼ x 14½	34	394.95	Wal base
	2300SRP	B	Opt.*	7	4	4	3	Hys.	Belt	40-16k ± 2	0.2	52	60	150	4 Mtrs.	19 x 10½ x 8	22	671.00	with 2RP 120 preamps, \$1647.00.
WOLLENSAK (3M)	6154	A	No	7	3	4	2	Ind.	Idler	35-20k ± 3	0.12	54	90	2.2k	2 Mtrs.	16½ x 13½ x 6½	18	299.95	4-chan. PB; 2-chan. rec./PB
	6150	A	No	7	2	4	2	Ind.	Idler	35-20k ± 3	0.12	54	90	2.2k	2 Mtrs.	16½ x 13½ x 6½	18	219.95	Bias swit.; tape/source mon.



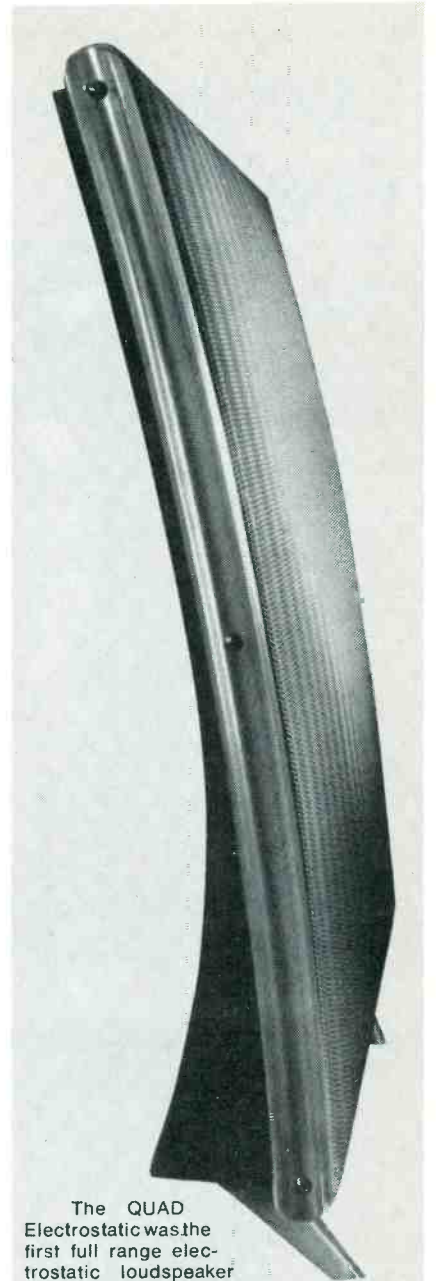
TEAC 3340



Wollensak 6154



Telex 2001



The QUAD Electrostatic was the first full range electrostatic loudspeaker produced commercially and is still the standard by which all others are judged. Using closely coupled moving elements some two hundred times lighter than the diaphragms of moving coil loudspeakers and being entirely free of cabinet resonances and colouration, this loudspeaker overcomes the usual major problems of loudspeaker design and provides remarkably natural reproduction of sound. This explains why the QUAD electrostatic loudspeaker is used by broadcasting and recording organisations all over the world, in applications where quality is of prime importance, and as a standard of reference by the majority of loudspeaker manufacturers.

QUAD for the closest approach to the original sound.

QUAD

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Equipment Profiles

Design Acoustics D-12	52
Infinity 1001	54
Shure M91E	61

MANUFACTURER'S SPECIFICATIONS:

Bass unit: 10 inch, high compliance. **Mid-range:** 5 inch. **Treble:** 9-2½ inch, closed back type. **Frequency response:** 30 to 15,000 ± 2 dB. **Crossover points:** 800 Hz and 1500 Hz. **Size:** 22 inches diameter, 30 inches high with pedestal. **Weight:** 45 lbs. **Price:** \$325 each.

Some speaker designers believe a pulsating sphere to be the ideal type of reproducer and there is no doubt that the D-12 comes near to that concept. It is actually a twelve-sided system—a dodecahedron and a total of 11 speakers are used. The bass unit is a 10 inch type and it faces the floor. A 5 inch mid-range speaker faces upward and 9 treble units are mounted on the sides or facets. These are 2½ inch cone types having closed backs. The enclosure itself is a reflex with a tube vent tuned to 27 Hz. System resonance is 43 Hz.

Terminals with shorting links enable the high frequencies to be attenuated and a similar arrangement inserts a resistor in series with the bass unit—as well as a parallel resistor to maintain damping. This is an unusual feature but very much worthwhile as the bass may be over-emphasised in some corner locations. The enclosure is very well made with an attractive stand which is available in black steel or chromium plate. There is also a choice of four grille cloths—avocado, gold, mandarin or ivory. There is also provision for suspending the units from a ceiling and the enclosure can be had in standard walnut, black or white lacquer finishes.

Measurements

Figure 1 shows the frequency response measured with one-third octave pink noise. A was taken on a horizontal axis and B at 30 degrees off the vertical axis. The dotted curve at A shows the effect of the high frequency attenuator. Ten

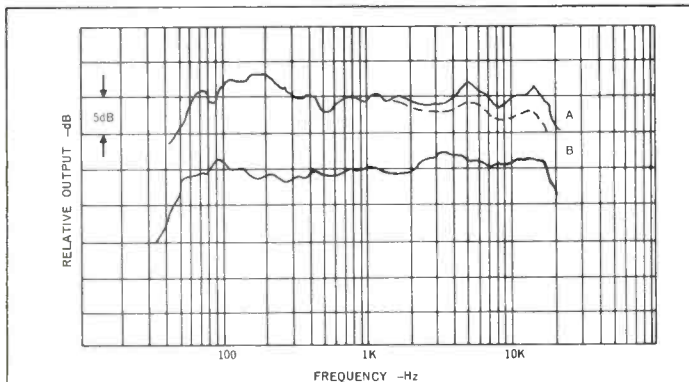
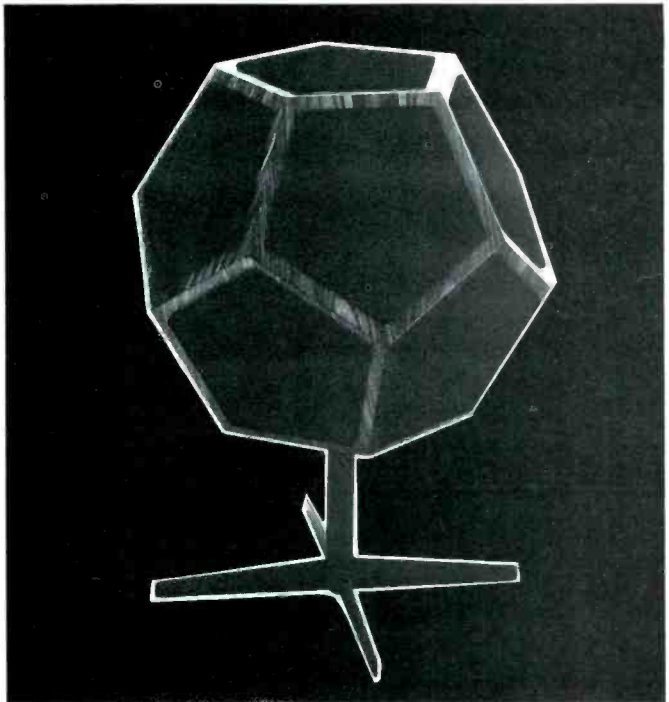


Fig. 1—Frequency response taken with one-third octave pink noise. A was measured on a horizontal axis and B at 30 degrees off vertical. The dotted curve at A shows the effect of the high frequency attenuation adjustment.

other measurements were taken and, as expected the variations were quite small. Figure 2 shows the low frequency THD and some SPL figures. The system would take an input of 37.5 watts, continuous power, at 40 Hz without distress, 99 watts at 60 Hz and 133 watts at 100 Hz. Tone-burst responses at 100, 1,000 and 5,000 Hz are shown in figure 3.

Figure 4 shows the impedance characteristics and it will be seen that the lowest point is about 5 ohms. The peak at



Design Acoustics D-12 Loudspeaker System

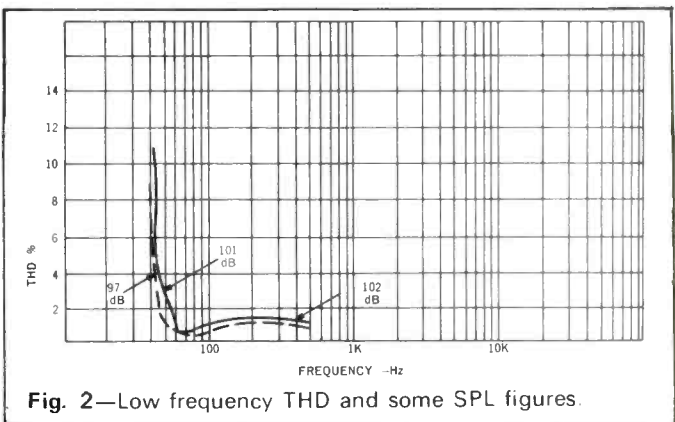


Fig. 2—Low frequency THD and some SPL figures.

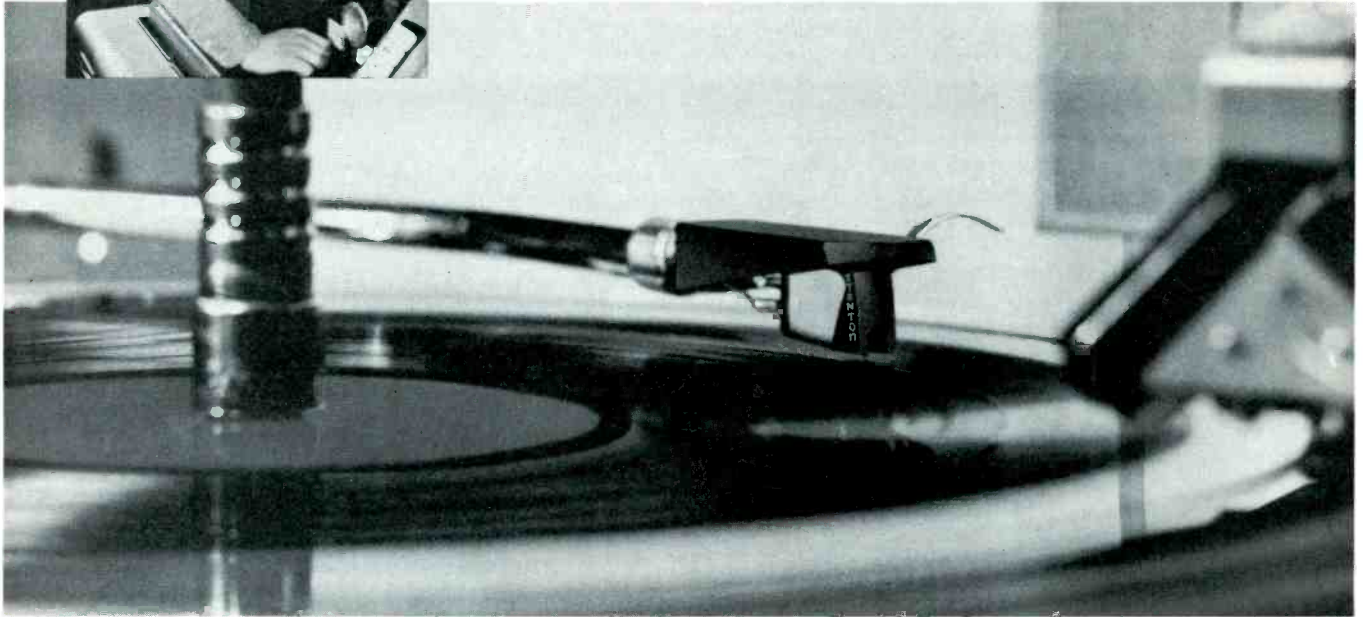
system resonance falls from 45 ohms to 8 ohms when the bass attenuating network is used (see lower curve). White noise indicated a slight coloration in the lower midrange—not judged serious.

Listening Tests

The subject of omni-directional versus directional radiation was dealt with at some length in our March issue. It is sufficient to say here that experts do not agree as to the best dispersion pattern for domestic listening. Omni-directional speakers have the merit of giving a larger listening area at the price of a more diffused stereo image. This is partly due to the random reflections and so extra care is necessary in finding best positions in the room—especially for quadraphonic sound. We found the best places for the D-12's was near the corners, immediately in front of some heavy drapes;



Stanton. Benchmark for an Industry.



Stanton's 681 Series is the Calibration Standard to recording engineers such as Robert Ludwig.

Whatever the requirements for recording and playback, Stanton's Series 681 cartridges are the Calibration Standard. And there is a 681 model engineered specifically for each of these critical applications. That's why Stanton is truly the Benchmark for the industry.

The Stanton 681A—For Cutting Head Calibration. With Stanton's Model 681A, cutting heads can be accurately calibrated with the cartridge, for it has been primarily designed as a calibration standard in recording system checkouts. Frequency response is factory calibrated to the most rigid tolerances and the flattest possible response is assured for precise alignment of recording channels.

The Stanton 681EE—for Critical Listening.

Stanton's Model 681EE is designed for low-distortion tracking with minimum stylus force, regardless of the recorded velocity or the distance of the groove from the disc center. High compliance, low mass and low pressure assure perfect safety even on irreplaceable records.

All Stanton Calibration Standard cartridges are guaranteed to meet the specifications with exacting limits. Their warranty comes packed with each unit—the calibration test results for that individual cartridge.

For complete information and specifications write Stanton Magnetics, Inc., Terminal Drive, Plainview, L.I., New York.



All Stanton cartridges are designed for use with all two- and four-channel matrix derived compatible systems.

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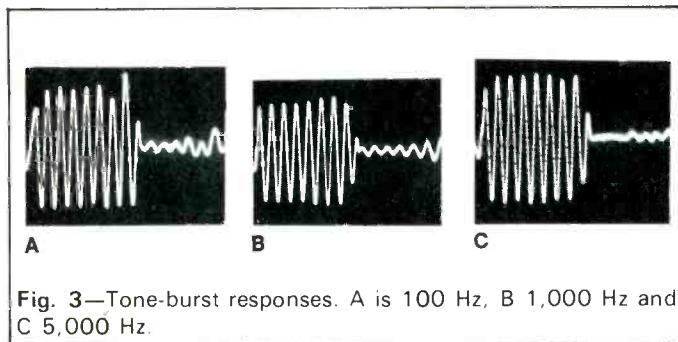


Fig. 3—Tone-burst responses. A is 100 Hz, B 1,000 Hz and C 5,000 Hz.

this way we had a good stereo image without losing a sense of spaciousness. Overall sound quality was excellent with a solid bass and smooth treble. Some organ recordings were played—including a new Power Biggs “Organs of Holland and Northern Germany” and a record called “Organ Music from Westminster” (The Westminster is the Presbyterian Church in Minneapolis and the organist is Dr. Berryman). There was no doubt that the bass response is well maintained considering the relatively small size of the enclosure.

Sensitivity is about average—which means an amplifier of at least 20 watts per channel is required. We used a Pioneer 727 which puts out 50 watts per channel—also a Fisher 504 which delivers a total of 180 watts. Both gave

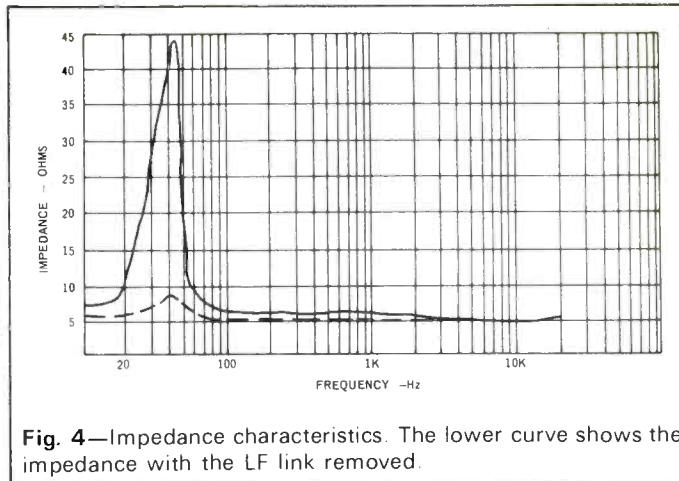


Fig. 4—Impedance characteristics. The lower curve shows the impedance with the LF link removed.

more than adequate power for a fairly large room.

Summing up then: the Design Acoustic D-12 can be recommended to the attention of those who require a system with better than average performance and particularly to those who like a spacious kind of sound. But be prepared to experiment to find the best room positions.

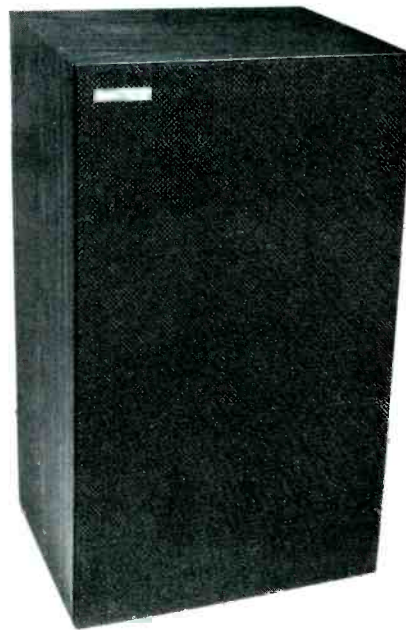
T.A., G.W.T.

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MANUFACTURERS SPECIFICATIONS:

Bass unit: 12 inch. **Treble:** Two 2 inch cone types. **Crossover:** 1,300 Hz, (mechanical) **Frequency response:** 30 Hz to 21 kHz \pm 4.5 dB. **Nominal impedance:** 6 ohms. **Size:** 25 by 14 by 12 1/4 inches deep. **Price:** \$139.00.

The infinity 1001 is a rather unusual system on two counts: one, it employs a 12 inch bass unit crossing over at 1,300 Hz and two, it uses two 2 inch tweeters—one front mounted and the other “firing” at the rear. Usual crossover point for a 12 inch woofer is around 400 Hz because of the difficulties in controlling response irregularities at higher frequencies. Infinity solve that problem by using a plug at the cone apex which also functions as mass loading to reduce the system resonance. The upper roll-off is so smooth that no crossover inductance is used with the bass unit. System resonance is 44 Hz, lower than usual for this size enclosure. The object of the rear firing tweeter is to use wall reflections to give the effect of a larger sound source—the front unit is said to be the *transient* speaker and the rear is called the *ambience* speaker. A H.F. level control is provided. The enclosure itself is a resistance loaded reflex which Infinity call a terminated line. The walnut cabinet is solidly constructed with an unobtrusive black grille cloth which will harmonize with any decor.



Infinity 1001 Speaker System

Measurements

Figure 1 shows the response measured with one-third octave pink noise. A was taken on-axis at 3 positions of the HF control, B was taken at 30 degrees off-axis and C at 60 degrees. Under normal room conditions, the frequency response will be modified by wall reflections from the rear speaker. Figure 2 shows low-frequency distortion with some SPL figures. Tone burst characteristics at 100 Hz, 500 Hz and 5,000 Hz are shown in Figure 3 and the impedance curves are given in Figure 4. Lowest point was 4 ohms with the tweeter control at maximum. White noise tests showed very little coloration. Sensitivity was around average for this kind of system and an amplifier power of at least 20 to 25 watts per channel is recommended.

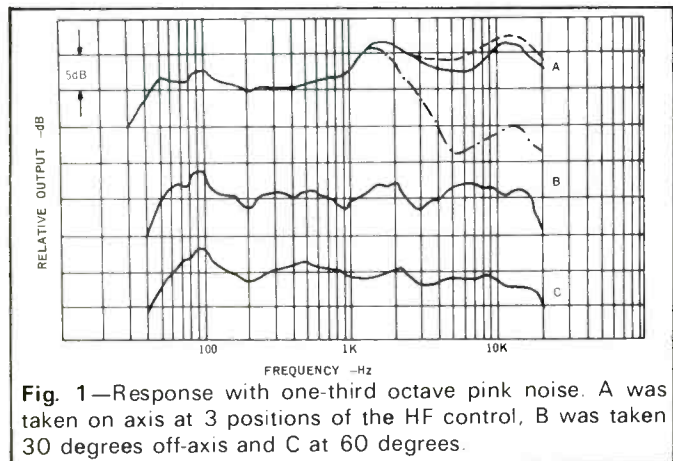


Fig. 1—Response with one-third octave pink noise. A was taken on axis at 3 positions of the HF control, B was taken 30 degrees off-axis and C at 60 degrees.

Your records represent a major investment. Does your record player protect it?

According to surveys by the major music magazines, the average music lover owns more than 200 records.

If you're typical, a little math will tell you that your record collection has already cost you over a thousand dollars. And will cost even more as you continue to buy records.

With that much money involved, it's certainly worth your while to consider how to protect that investment. Especially since the soft vinyl record is so vulnerable to permanent damage from the unyielding hardness of the diamond-tipped stylus.

What can do the damage.

As soon as the stylus touches down in the groove, a running battle begins. The rapidly changing contours of the record groove force the stylus to move up, down and sideways at great speeds. To reproduce a piccolo, for example, the stylus must vibrate about fifteen thousand times a second.

The battle is a very uneven one. If the stylus can't respond easily and accurately, there's trouble. Especially with the sharp and fragile curves which produce the high frequencies. Instead of going around these peaks, the stylus will simply lop them off. The record looks unchanged, but with those little bits of vinyl go the lovely high notes.

It's all up to the tonearm.

Actually, no damage need occur. Your records can continue to sound new every time you play them.

It all depends on the tonearm, which is to the stylus as the surgeon's hand is to the scalpel.

Basically the tonearm has just three jobs to perform. It must apply just the right amount of pressure to the stylus, keep this pressure equal on both walls of the groove, and follow the stylus without resistance as the groove spirals inward.

Today's finest cartridges are designed to track optimally at very low pressures (one gram or less). So you can appreciate how important it is for the tonearm settings to be accurate and dependable. And for the friction in the bearings to be extremely low.

Yet the difference in cost between a turntable with a precision-balanced tonearm and one with a less refined tonearm can be as little as \$50. (The cost of only a dozen records.)

Dual: The choice of serious record collectors.

For these reasons and others, Dual automatic turntables have long been the choice of serious music lovers.

And for years, readers of the leading music magazines have bought more Duals than any other make of quality turntable.

We think these are impressive endorsements of Dual quality. But if you

would like to know what independent test labs say about Dual, we'll send you complete reprints of their reports. Plus an article on what you should look for in record playing equipment.

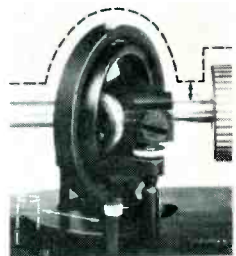
Or, if you feel ready to invest in a Dual, just visit your franchised United Audio dealer for a demonstration. The dividends will start immediately.

How Dual protects your records.



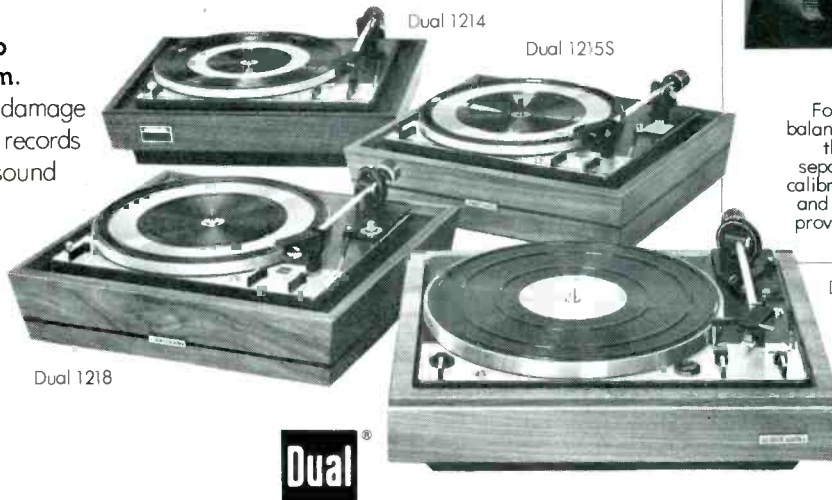
The tonearms of the Dual 1218 and 1229 are mounted in gyrosopic gimbals, the best known scientific means for balancing a precision instrument that must remain balanced in all planes of motion.

Unlike conventional tonearms, the 1218 and 1229 track records at the original cutting angle. The 1229 tonearm parallels single records; moves up to parallel changer stack. In the 1218, a similar adjustment is provided in the cartridge housing.



In all Dual models, stylus pressure is applied around the pivot, maintaining perfect dynamic balance of the tonearm.

For perfect tracking balance in each wall of the stereo groove, separate anti-skating calibrations for conical and elliptical styli are provided on all Duals.



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Check No. 20 on Reader Service Card		ANRS Brochure		Check No. 9 on Reader Service Card	
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Check No. 7 on Reader Service Card		Model Fifty-Four Receiver		Write Direct to Advertiser	
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Zero 100 Turntable		North American Philips Co.	71	Mail Order Discounts	
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Broadcast Electronics, Inc.	70	Check No. 36 on Reader Service Card		Southwest Technical Products Corp.	74
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Columbia Magnetics	69	Check No. 15 on Reader Service Card		Stanton Magnetics, Inc.	53
Blank Recording Tape		Phase Linear Corp.	22	681A Cartridge	
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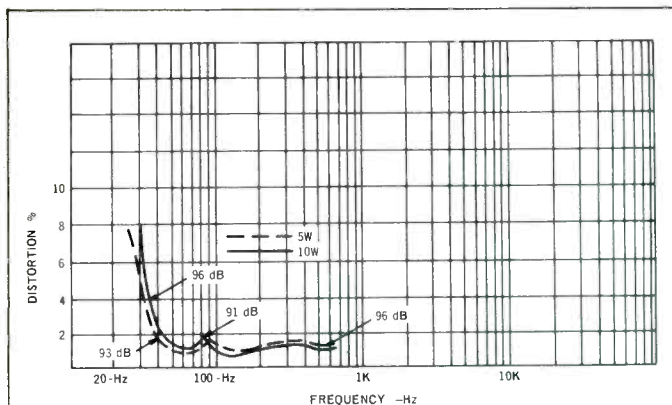


Fig. 2—Low frequency distortion and some SPL measurements.

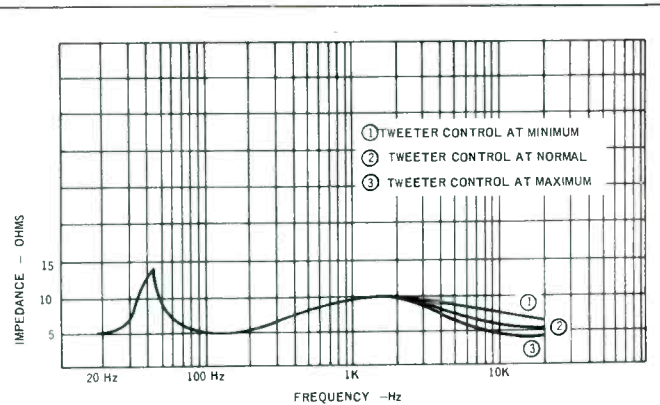


Fig. 4—Impedance characteristics.

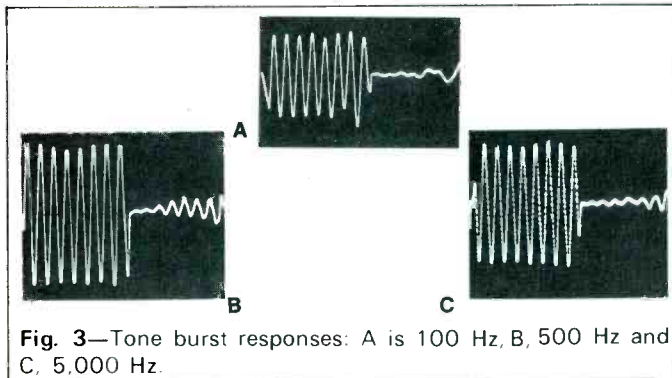


Fig. 3—Tone burst responses: A is 100 Hz, B, 500 Hz and C, 5,000 Hz.

Listening Tests

Overall sound was very good with a clean, solid bass which would put many larger systems to shame. Because of the low coloration, the sound had a transparent quality—in other words, the 1001 did not sound too much like a loudspeaker! The open quality is partly due to the rear radiation and it is recommended that the systems be placed four to six inches from the wall for best results. As mentioned earlier, it is quite difficult to design a good system having such a high crossover point for a 12 inch bass unit but Infinity have certainly succeeded with the 1001. Especially since the price is only \$139. . . .

T.A., G.W.T.

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Shure M91E Stereo Phono Cartridge

MANUFACTURER'S SPECIFICATIONS:

Frequency range: 20 to 20,000 Hz. **Separation:** greater than 25 dB. **Output:** 0.7 mV/cm/sec. **Recommended Stylus Force:** 3/4 to 1 1/2 grams. **Stylus:** Elliptical, 0.2 x 0.7 mil radii, user replaceable. **Weight:** 5 grams. **Price:** \$49.95.

This is one of a new series of high-trackability stereo cartridges made in the same general pattern as the V-15 Type II Improved, which is the leader in the Shure line. The latter is intended for use on highest-quality turntables, whereas the M91 is perhaps slightly sturdier, and for use on good turntables, both manual and automatic. In any case, the performance is nearly equal to the more expensive model.

We made all the usual measurements on the cartridge before ever listening to it, as is our custom, and found that the output was somewhat higher than specifications, being of the order of 1.75 mV/cm/sec—that is, an output of 6.2 mV for the 1000-Hz modulation of 3.54 cm/sec on a test record. Frequency response, as shown on the curve, is within ± 2 dB from 20 to 20,000 Hz, showing a slight rise at 19,000 Hz with our normal cable capacitance of 250 pF. However, Shure recommends a higher cable capacitance, so further curves were run with additional capacitances of 220 and 470 pF, with the results shown on the curve. Separation measured 23 dB at 1000 Hz, slipping only to 18 dB at 20,000 Hz, which is exceptionally good. At 10,000 Hz the separation continued at 23 dB. From these observations, it would appear that a total cable capacitance of 350 to 400 pF would give the flattest response, since the additional 220 pF across the cable capacitance of 250 pF showed a slight droop at 20,000 Hz, and considerably more with the addition of 470 pF. It is noted, however, that the M91E is not as susceptible to the high-frequency peaking with less-than-recommended cable capacitance as is the V-15 II Improved, which does show a noticeable peak at 19 kHz unless the capacitance approaches



the recommended value of 450 pF.

The d.c. resistance of the M91E measured 590 ohms per coil, with an inductance of 890 mH, which is about normal for modern stereo cartridges. Measurements of IM distortion, using the CBS STR 111 record, gave figures of 1.8 per cent for the lateral signal consisting of 200 and 4000 Hz at +9 dB, and of 3.9 per cent for vertical modulation of the same frequencies at a level of +6 dB—the two frequencies and levels on which we report, after making the complete series of sixteen measurements. All of these values are within the normal range for modern stereo cartridges.

Using the CBS BTR-150 Broadcast Test Record, the tracking capability was observed. The frequency of this test cut is 300 Hz, with amplitudes referred to 1.12×10^{-3} cm, and cuts of +6, +9, +12, and +15 and +18 dB with respect to the reference in the lateral mode, with amplitudes of +6, +9, and +12 with respect to the same reference in the

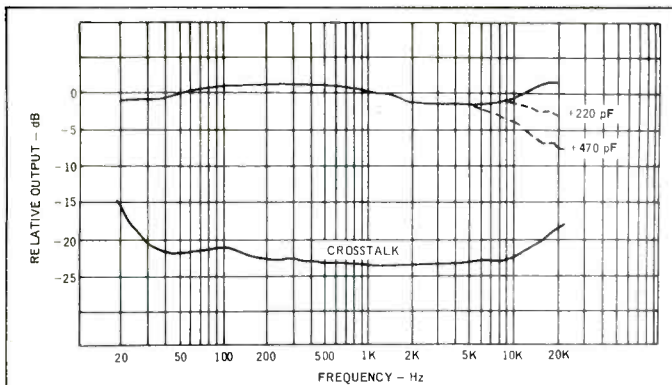


Fig. 1—Frequency responses and separation curves as made from the B & K QR-2009 sweep-frequency test record. Note the differences in top-end response with change in cable capacitances. Apparent optimum flatness should be obtained with a total cable capacitance of about 300 to 350 pF.

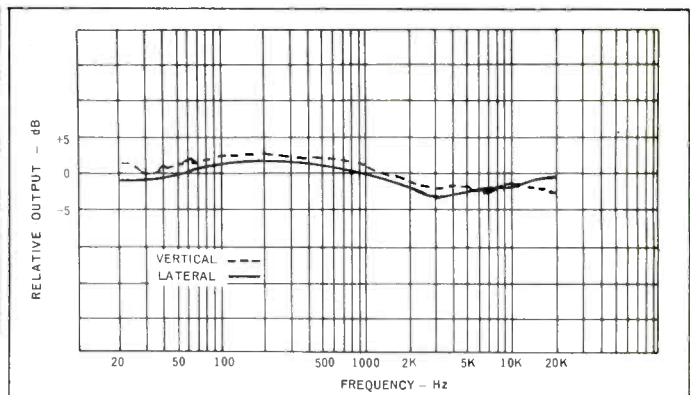


Fig. 2—Comparison of response of Shure M91E cartridge to lateral and vertical sweep bands of the test record. Note consistency of the responses to the two modes—a condition rarely encountered in stereo cartridges.

vertical mode. The M91E tracked all cuts perfectly with the exception of the +18 band, lateral, in which some mistracking was observed. Remember that this test is made at 300 Hz, which is in a range of constant amplitude recording, so it is a very rigorous test.

The final proof of the performance of a stereo cartridge is determined by listening to records that are familiar to the observer, and by playing the Shure demonstration record—the Obstacle Test for stereo cartridges. Naturally, the M91E performed flawlessly on this record, as would be expected, since the company must make their cartridges show us well on their own demonstration record. But when we played a number of our old favorites, we could still find no fault with the M91E. It is clean, free from any peaks, and particularly from the “wiriness” often found with stereo cartridges. The absence of any peaks in the response curves should tell this story, just as well as the listening does, but most of us do not use cartridges to satisfy measuring equipment—only our ears. And in this category, the Shure M91E does a most creditable job.

One thing that we noticed in the measurement procedure was that the response curves made from the lateral and vertical sweeps of our standard sweep cord—B & K QR-2009—were remarkably similar, a condition that we have never observed before in a stereo cartridge. In most cases, the vertical response drops off appreciably above 10,000 Hz, and is likely to show considerable variance from “flat” response in the range below 100 Hz. However, in the case of the

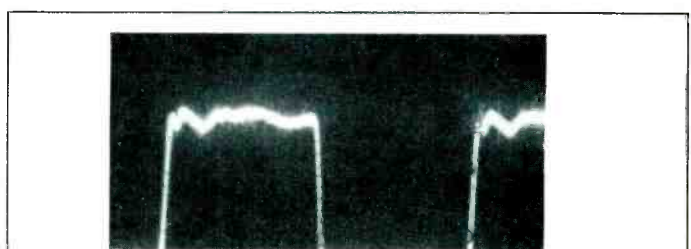


Fig. 3—Scope pattern of response of Shure M91E stereo cartridge to 1000-Hz square wave band of CBS STR-111 test record.

M91E, the two responses varied no more than 1 dB from each other throughout the entire range from 30 to 15,000 Hz, with an increase to about 2 dB difference at 25 Hz and at 20,000 Hz. We do not have a wide experience with this particular test, but we shall certainly include it in future cartridge examinations. This observer has long believed that the reason two amplifiers—or systems, or whatever—measured alike but sounded different was that there was some parameter we were just not measuring. In amplifiers, we would expect it to be phase difference, but so far no one seems to have come up with any reliable data showing the comparisons of phase response. Perhaps the measurement of lateral and vertical responses may help to show why cartridges sound different even though they may appear to measure alike.

C. G. McProud

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What's Watts—a correction

Our printer must have a rooted objection to square root signs because they were all missing from Peter Meisinger's article which appeared in our February issue. Thus the equation at the top of page 26 should read:

$$\text{Average power} = \frac{\text{Peak voltage} \times \text{peak current}}{2} = \frac{E_{\text{peak}}}{\sqrt{2}} \times \frac{I_{\text{peak}}}{\sqrt{2}}$$

In figure 1:

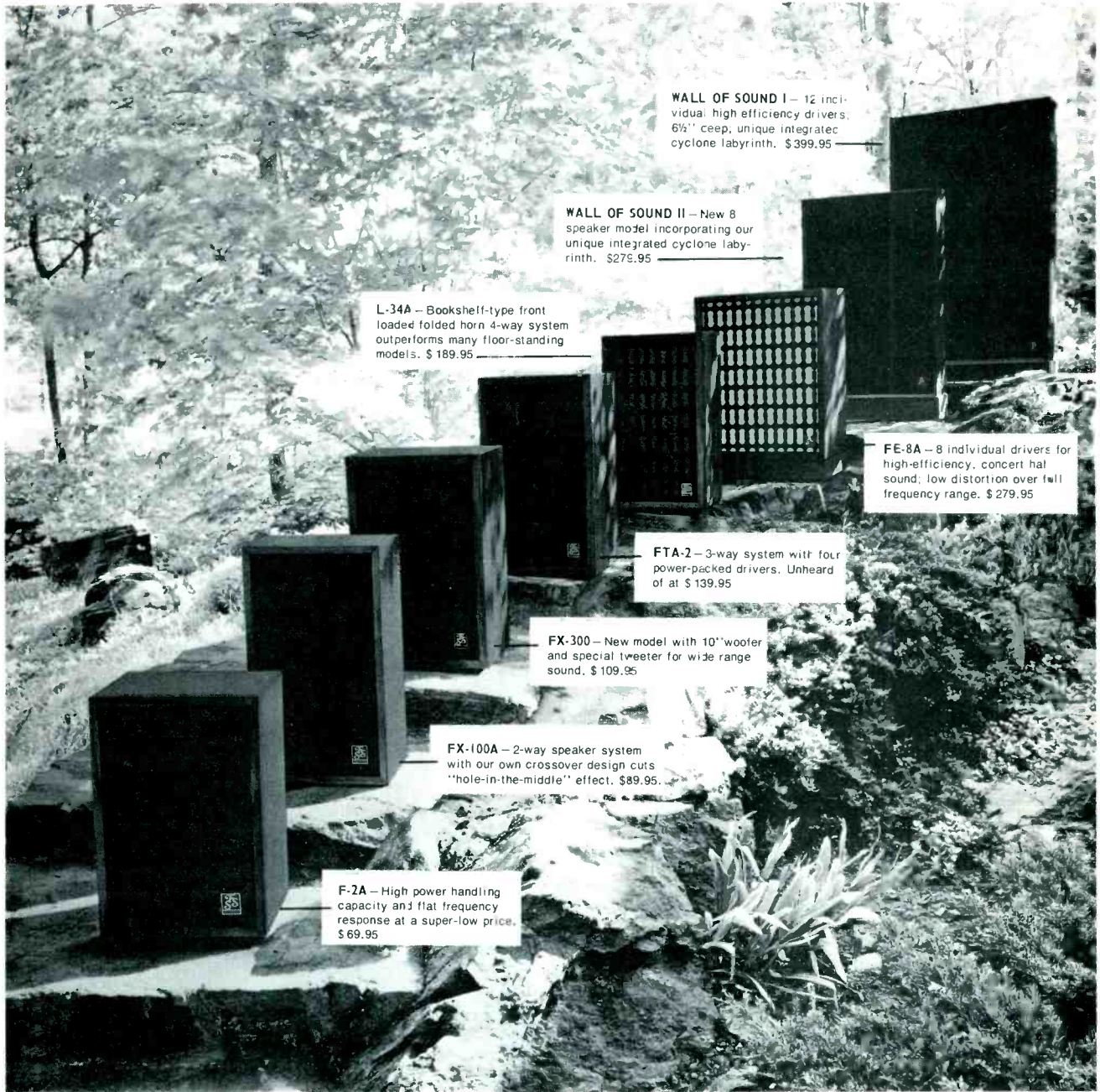
$$\frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} = .707 \times .707 = 0.5 \text{ watts average power}$$

$$I_{\text{rms}} = \frac{I_{\text{peak}}}{\sqrt{2}} = \frac{1}{\sqrt{2}} = \frac{1}{1.4} = 0.707 \text{ of the peak value}$$

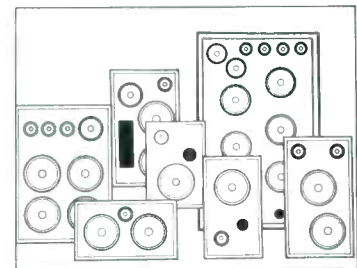
At the bottom of the page, the expression: 0.5, or .707 should read $\sqrt{0.5}$ or .707. The .375 in line 13 from the top right hand side should read therefore $\sqrt{.375}$.

Finally, please insert the square root signs on the 0.5 (col. 3) and .375 (col. 4) at the bottom of table 1 on page 28.

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Classical Record Reviews

The Fabulous Philadelphia Sound Series. Philadelphia Orchestra, Ormandy. Columbia, stereo, discs, \$5.98 ea.

The above will have to stand for a veritable flood of good looking, good sounding recordings that Columbia has let loose, one on the heels of another, over many months' time—all of them, if I once more am right, actually made several years and more ago, before RCA took over the orchestra. RCA's newer recordings of the Philadelphia Orchestra seem scarcely a trickle in comparison. A strange situation! It is one more example of that curious timelessness which is a quality of recording, and so much a part of our communications age in many other ways. As soon as Lyndon B. Johnson was dead, his voice began to flood our air waves as it had not for years—he was back. So it is with extinct recording contracts. No sooner departed than revived. With no orchestra to work with, Columbia seems to be dominating the Philadelphia Orchestra as never before.

The product is good, always, but predictable. Performances are as fault-

less as is ever likely in a first quality orchestra, interpretations are impeccably standard, for an old fashioned standard repertory, neither outstanding nor in any way under par. The emotions, the excitements, are well simulated and conveyed, one can often believe that they are genuine, on Mr. Ormandy's part as on that of the players. And yet—such a polished blandness. I find myself groaning every time still *another* Philadelphia recording turns up. There is so little I can find to say. Mr. Ormandy is the perfect headwaiter and maître d' of an ineffable musical eatery. But Michelin, in France, would not give him four stars. That is for the totally all-out, dedicated maître, with passion.

Performances: B. . N Sound: B+ . . N

Rossini: Sonatas for Strings Nos. 1-4. 1 Musici. Philips 6500 243, stereo, \$6.98. **Mendelssohn: Die Frühen Symphonien (The Early Symphonies).** Amsterdam Kammerorchester, Voorberg. Telefunken SKB-25074-T/1-4, 4 discs, stereo, \$23.94.

Here is a five-disc bonanza of youthful string music by two well known

composers, though the works, composed by both in their early teens, are not exactly well known. (The Rossini Sonatas turned up in, of all places, Washington, D.C. in the 1950s, the Mendelssohn early Symphonies are still not all published, these recordings having been made in part from direct copies of the manuscripts.

They are in major respects remarkably of a similar "school", one Italian, the other German; the two men were outstanding natural technicians and stylists who could write perfectly tailored and proportioned music from their first beginnings. That is the clear message of all these many gems of gorgeously idiomatic string writing.

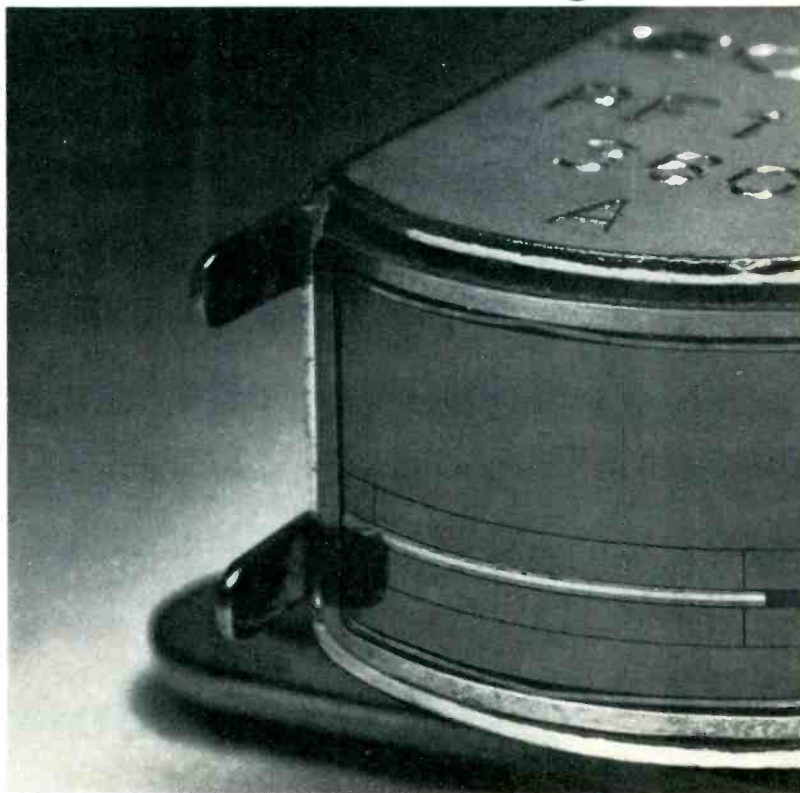
The Rossini Sonatas, dating from 1804 (and his twelfth year) are brilliant, brittle, showy little pieces, all post-Mozartean (as we would say, though not as the Italians might put it), already clearly Rossini in manner, almost operatic in the scintillating first violin parts and the constant subordination of the fluent lower strings into a lively accompaniment. There is nothing of the Romantically profound here nor any very radical individuality—why should

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there be? Like all good young geniuses, Rossini was busy absorbing and mastering the musical language he found at hand. Best to play two or three at a time, no more. Too much alike.

The Mendelssohn Symphonies are on a somewhat larger scale though not much—just thicker and more Germanic to a degree. In practice, that means an inevitable, and attractive, degree of interesting counterpoint, so that the first violins do not do all the work here; second, it means a German songfulness of the most grateful nature, if always elegant and aristocratic. Third, and even more Germanic, is a striving for profundity in outward expression; these are by no means just brilliant little entertainments. And indeed they get longer and longer from the first to the thirteenth. Composed mainly around 1823, when Mendelssohn was about 14, they are no less than extraordinarily advanced and mature, easily rivaling the work of Mozart but—age for age—perhaps even more profound, at least in the outward expression. Maybe the comparison is not fair: for Mozart at 14 lived in a very different musical world. Even so, 14 against 14, Mendelssohn could win the honors in prognosis for future potential. That he did not live up to Mozart, in his equally abbreviated life, is one of the personal

tragedies of German music.

It is interesting that neither of these two sequences of string works, composed squarely in the midst of the great Beethoven years, shows so much as a trace of Beethoven influence. All the works are essentially out of the older elegant, aristocratic tradition though Mendelssohn's more passionately extended expression shows that he was very much aware of new directions in music. As you listen here, note that the Beethoven Ninth Symphony was performed only months later and the Seventh had been public property in Vienna for ten years. You'd never know it.

The pure blending tones of the small I Musici string group are ideal for the Rossini, and the Dutch string performers, a similar small group, play the Mendelssohn with an equal expertise and liveliness, a somewhat richer body of sound. Both performances are just about perfect.

Performances: A, A Sound: B+, B

Wanda Landowska—Bach: The Well-Tempered Clavier, Books I, II. RCA VCM 6203, 6204, 3 discs each, mono, \$17.94 ea. Book.

Wanda Landowska, the pioneer modern harpsichordist, began opera-

tions back around the turn of the century. She made notable 78 recordings in Paris between the Wars, many of which are now available on LP; they are generally her very best, in her late prime, and include uniquely powerful interpretations of the Bach Goldberg Variations, albums of French harpsichord music—Couperin—and a splendid set of Scarlatti sonatas. For years, these recordings so far surpassed any few others in, shall I say, sheer charisma on the harpsichord, that Landowska was that instrument. She had such a sense of drama, such marvelous feel for rhythm, for color in registration, plus a then astonishing grasp of the older ways of ornamentation, only now generally observed by musicians (and still by few pianists!). I grew up on Landowska. She was a phonographic paragon in a class all her own.

RCA caught Mme. L. in this country in her last years, when she settled in Lakeville, Connecticut (a few miles from my own home). The RCA recordings were made there, after the grand old lady had given up an active concert life. This was, if I remember, in the early fifties, alas before stereo but, luckily, after tape. And so RCA can still transfer the originals with improved disc quality into these up to date sets—the entire “forty-eight” preludes and

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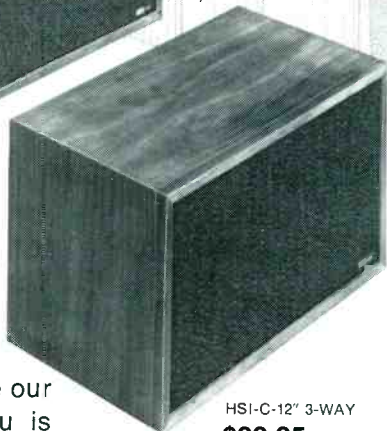
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fugues in interpretations that still to this day are arresting, original and wholly creative. Pianists who haven't heard her may well be shocked out of their black-key-white-key complacency! Other harpsichordists (and harpsichord listeners) will merely be amazed, though most will understand that Landowska plays as of her own time, in a remarkably Romantic fashion with unusually thick registration, lots of doubling (more than most harpsichordists use today) and a freedom from rigid tempi that is no less than astonishing.

The harpsichord sound will strike most listeners as inexplicably wiry and thin. This is not by any means entirely the recording, though the signal is not as clean as it might be today if newly done over. The explanation is in part the mic placement but much more the French type of harpsichord which Landowska always used, a modern instrument with just this relatively wiry sound, very brilliant in the highs.

I heard Landowska once in Carnegie Hall, solo. The stage was dark, the audience late. Dramatic tension!—no Landowska. No lights. Suddenly, a perfectly huge single pink lamp on a tall stand on stage went on all by itself, virtually the only light in the hall. Electric! And then the great lady appeared. It was a show worthy of the Rolling Stones. During the (unamplified) soft passages not a sound could be heard in the high upper balconies. Neither was there the ghost of a sound from the packed audience. Absolutely weird—just that super-dramatic crouching figure, far down below, with the classic forward nose, sharp as a razor, the startling black hair and the erupting "pony tail" bun jutting rearwards. And total silence.

Up close, via the recording mics, you will find the same drama but a hundred times louder. It's an experience, I assure you.

Performances: A, A Sound: B-

Scarlatti: 23 Sonatas. Anthony di Bonaventura, piano. **Connoisseur Society CS 2044**, 2 discs, stereo, \$11.96.

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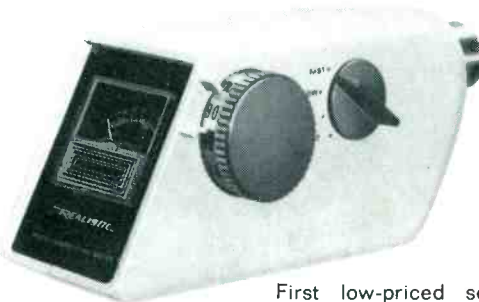
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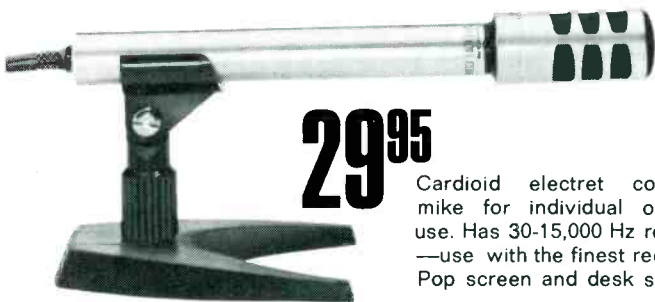
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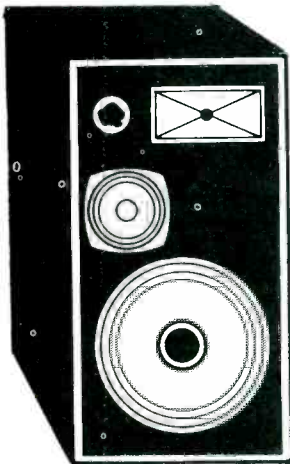
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the piano, the Sonatas have become increasing favorites for their easy, tuneful brilliance, as well as their frequent colorful suggestions of Spanish guitar music—they were composed in Spain in the early Eighteenth century.

Yes, pianists still play them. They always have had a selected few in their repertory of "old" music. But normally they are, for pianists, no more than delicate (and wrongly delicate) little antiques, to show how beautifully the piano thunderer can do miniatures, on the tiny points of his fingers. Not generous towards poor Scarlatti, who was a major musician, and the practice is happily declining, I am glad to note.

This album is altogether another kettle of, er . . . sonatas. No pianist merely going in for flashy programming would do twenty-three of the works! Instead, this is a major translation of the Scarlatti repertory into piano terms, and an honest one, with every respect due to an important composer. I have not heard piano Scarlatti for years that so earnestly and accurately redefines the musical marvels of these little works into terms of piano tone, so different from harpsichord. I highly recommend the album, for just plain listening and perhaps for comparison, too, with equivalent harpsichord recordings.

Performances: A Sound: B+

Frans Bruggen—17 Recorders (17 Blockfloten). Solo and with Accompaniment. **Telefunken SMA 5703-T/1-3**, stereo, 3 discs, \$17.94.

Frans Bruggen is young enough to sport very long hair—and to consider the recording art equal to that of the concert; he goes in for both, plus extensive teaching. The man is the first modern genius of the recorder. With that plain old "chair leg" of an instrument, minus keys, furnished merely with finger holes, he plays music that is just beyond belief. Especially if you are one of the millions who have tried that "easy" instrument. Easy to blow like a whistle, yes! But very difficult to play well. After all, the modern improvements are mainly towards easier playing in such parallel instruments as the flute and oboe.

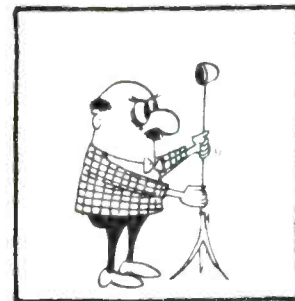
But most astonishing of all is the fact that every note of these often incredibly difficult works was composed hundreds of years back and committed to paper. That implies, of course, that there were in fact recorder geniuses back then too, who could produce these same notes.

I often wonder what happens to the potential geniuses of this and that—

tennis, chess, relativity, piano, automobile mechanics, anything you can name—who were born before their time. Or after it, like the non-existent recorder geniuses of the Nineteenth century. No doubt about it, it takes the gift *and* the right moment to produce a functioning genius. Here is one.

In these recordings Bruggen plays seventeen different recorders, both old and new. The art of building the instrument has, of course, also found its modern geniuses. One recorder, here, was made in the year of Bach's birth, 1685 in Amsterdam. The music ranges far and wide over the Seventeenth and Eighteenth centuries; perhaps the most remarkable works are the virtuoso Fantasies for solo recorder, a half dozen scattered through the six sides. If you play recorder, you simply will not believe them.

Performances: A Sound: A-



THE ZYX



PHONO SYSTEMS

Professor I Lirpa of Bucharest (Whom God Preserve) has now come up with a new invention for records which he calls the ZYX system. As the title implies, the concept is a reversal of our present technique. Said the good professor (we were talking over the transatlantic phone), "Most orchestral climaxes occur at the end of the work, so they are at the end of the record where tracing distortion is highest." "Right," I said. "Mine invention turns the record inside out, so we start in the middle and work towards the outside. This means that the pickup is near the rest position at the end of the record." "What about *Also Sprach Zarathustra* and *Borodins* . . ." "Bah," said the professor, "Who plays them? I must tell you about the second part of mine idea, it is even more revolutionary, teh—I shouldn't use that word. Look, the record stops still and the pickup moves round." There was silence for a moment broken only by the faint metallic screaming of a miniscule Frenchman many miles away and then a tiny snuffling noise. I said, "What's the advantage of this rid. er—this idea?" "So," replied the professor. "I guessed you'd ask that. Look, a record goes round and round and what does it do—it gathers dust and makes static. You hear cronkling noises. Yes, a *Dust Beast* . . ." "Bug," I said. "Bug, Beast—ach, what difference? Sure it stops some noise but mine invention is better. Doesn't need anti-skating and has a simple rotating mechanism." "How does it work?" I asked, a little wearily. "On a single pivot, like an American Yo-Yo." "Send me a drawing," I suggested. "Yes, yes, a liddle difficult because . . ." his voice dropped to a whisper. "they won't let me have a pencil, nothing sharp and besides . . ." There was a burst of static and the line went dead.

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Weingarten: Off The Record

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Poetic majesty.

That's what Richard Harris' new recording, **SLIDES** (Dunhill-ABC, DSX 50133), provides. So if you're the type who wants his music and words spoon-fed, forget it. For this one, you really have to listen.

Harris remains the perfect thespian, dramatically phrasing things with such potency that he wrings the emotions from the audiophile. What his singing voice lacks in quality, it easily makes up in poignancy. As in *Gin Buddy*, a beautiful tone poem. As in *Roy*, a bluesy, exciting number powerful in its quietness.

The stress is on understatement, pastoral loveliness in life and nature. Until the end, with *There Are Too Many Saviors on My Cross*, which leaves the listener limp, numb, drained of everything but reaction to the dramatic reading set to music.

It all starts serenely, like a Spring day with just the right touch of breeze. And it continues that way through most of the dozen cuts, all but one of which were penned by producer Tony Romeo. But then you hit the title item, a combination song-narrative that almost invokes tears by its reality, its sad-happy recall of a life.

Yet somehow all of it sets you up for the final outing, . . . *Saviours* . . . which Harris wrote and delivers with passion. By far the best single cut on any album in months, it is a plea from Jesus himself. Its message, its worth, its incisive strength cannot be adequately captured in a review; to say that it deals with war and other true blasphemies that man commits in God's name doesn't begin to say enough. But if there's one line that can be used as a summation, perhaps it is this:

"Our Father Who art in Heaven, *sullied by Thy name.*"

For all six minutes and fifteen seconds of the piece, Harris has the listener firmly clasped in his palm; his long-ago success with an elongated song, *MacArthur Park*, pales in comparison, even though that innovative number opened the door to records that broke the air-time barrier and allowed artists to think about creativity instead of the clock.

Harris enjoys a theatrical reputation of excellence; it is based, mainly, on sterling performances in such films as *This Sporting Life*, for which he was nominated for an Oscar; *Mutiny on the Bounty*, though he was overshadowed by Marlon Brando's publicity, and *Camelot*.

The 40-year-old, who was born in Limerick, Ireland, started by attending the Royal Academy of Dramatic Art; where he'll go from here is anybody's guess. Certainly, . . . *Saviours* . . . is going to be very difficult to surpass, but if his track record is any indication, there must be new vistas awaiting him.

LADY LOVE (United Artists, UAS-5635), an electronically adapted disc that simulates stereo, brings into focus nine of Billie Holiday's greatest songs. The sound is better than most of her recordings, with surface noise minimal though noticeable, and her voice is as bluesy as anyone could ask. Part of the Alan Douglas Collection, the album is highlighted by *Billie's Blues*, an elongated tear-jerker, plus *Blue Moon*, *My Man*, *All of Me* and *What a Little Moonlight Can Do*. She's backed by jazz greats Buddy DeFranco, Red Norvo, Red Mitchell and Sonny Clark, among others. The series also includes **THREE BLIND MICE** (UAS-5633), showcasing the drive of drummer Art Blakey and The Jazz Messengers on six cuts; **MONEY JUNGLE** (UAS-5632), which provides seven Ellington tunes performed by Duke on piano, Charlie Mingus on bass and Max Roach on drums; and **COLTRANE TIME** (UAS-5638), with John Coltrane blowing up his usual storm on four tracks.

WHITER SHADE OF PALE (A&M, SP4373) is a reissue of the first Procol Harum record, proving that the public takes a while to catch up with quality. Electronically reprocessed for stereo, the LP is highlighted by the Bach-derived title tune, a repeat hit (it originally broke onto the charts in 1967), and the original version of *Conquistador*.

MERMAN SINGS MERMAN (London, "Phase 4 Stereo," XPS-901) covers a dozen new versions of old hits by

the screamer. Things by Cole Porter, the Gershwins, Irving Berlin such as *You're the Top*, *I Got Rhythm*, *Alexander's Ragtime Band*, *There's No Business Like Show Business*, *It's D'Lovely*, and *I Get a Kick Out of You*. Ethel provides nostalgia and verve simultaneously; she's one of a kind, and if you like the kind, it's great.

WILL THE CIRCLE BE UNBROKEN (United Artists. UAS 9801) is a three-record extravaganza from Nashville. There are 37 countrified winners, with the Nitty Gritty Dirt Band merging so well it almost gets lost in the wake of music from Maybelle Carter, Earl Scruggs, Doc Watson, Roy Acuff and others. The gig is informal, with a lot of chatter squeezed before many cuts; the result is that you feel totally comfortable. The album, split between vocals and instrumentals, starts with *Grand Old Opry Song* and ends with *Both Sides Now*. Sandwiched between are such masterpieces as Scruggs pickin' away at his banjo on *Nashville Blues*, Watson's lead guitar work on the drivin' *Black Mountain Rag*, and the joint excitement of the title tune, with Mother Carter, Jimmy Martin and Acuff performing one verse each.

JOE COCKER (A&M, 4368) shakes up the musical world again with a voice that exudes sorrow and joy simultaneously. Backed by the Chris Stainton Band and the Sanctified Sisters, he has put together material covering the three years since his *Mad Dogs and Englishmen* tour. *St. James Infirmary*, a live performance, is a show-stopper no follower of modern music should miss; you can easily visualize his contorted face, his gyrating hands and bent fingers going all at once. Remain still while listening? Impossible!

PAT BOONE AND THE FIRST NASHVILLE JESUS BAND (MGM-Lamb & Lion, SE-4877), showcasing a dozen pop cuts in the religious vein, treated with a country flavor. Best are *I Saw the Light*, *Turn Your Radio On* and *Tramp on the Street*.

MORE HOT ROCKS (BIG HITS & FAZED COOKIES) is a smashing double-disc outing from the Rolling Stones. If you've never really tasted the rock 'n' rock band before, here's a chance for an extraordinary repast. The album (London, 2 PS 626/7) includes 25 cuts, with eight never before released in the U.S. The remainder touch hit singles, flip sides of single chartbusters and three from other LPs. The new material includes two Jagger tunes and two by Chuck Berry.

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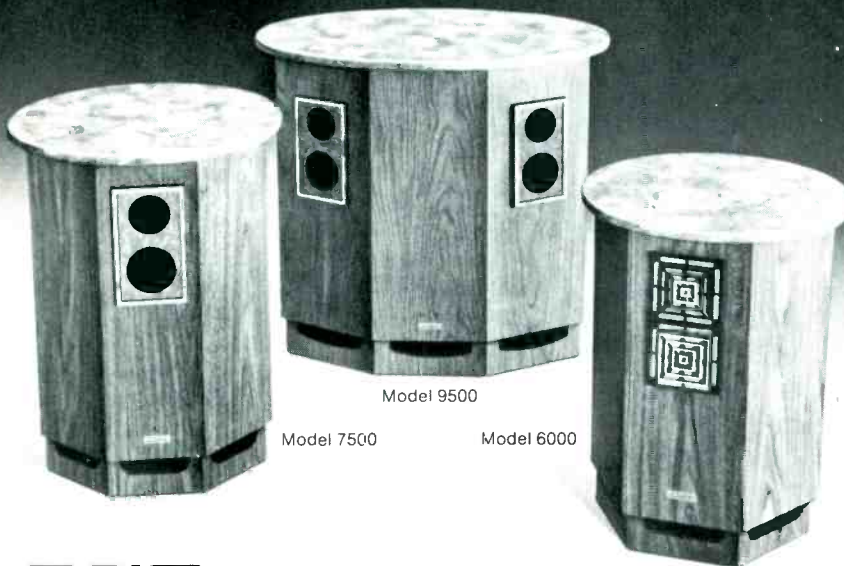


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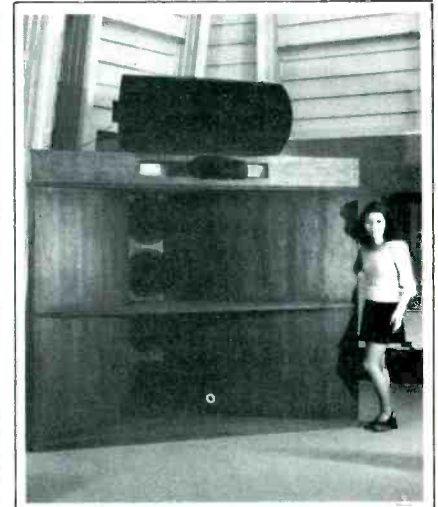
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(Continued from page 22)

vibration-free. The chamber is big enough to allow frequency response testing down to 100 Hz. As an old recording man, the most fascinating facility at the center was their experimental recording studio. Since it has a stage and seating area it also doubles as an auditorium. The walls of the stage area are divided into 3 sheets, each of which can be positioned to give either a reflective or absorptive surface. The sheets of reflecting board which make up the ceiling of the stage, can be raised or lowered or changed angularly by electricity. In the studio section, the side walls are arranged in panels in sort of "concertina", or corrugated fashion and slope inward 7 degrees from vertical. Each vertical panel is divided into six horizontal panels. At



All-horn 4-way speaker system (in recording studio)

the touch of a button, these reflective panels can be raised or lowered, revealing behind them absorptive fibreglass batts. Each of the panels moves independently and allows a various "mix" acoustically so that the reverberation period of the studio ranges from 0.6 to 1.6 seconds. At each corner of the studio was an absolutely gigantic 4-way all-horn loaded speaker system. When I say big . . . I mean that two large types like Bob Angus and me were able to stand in the mouth of the horn! The sound was quite impressive from these brutes, but we didn't hear any music which really revealed their full capabilities. In between the speakers, on the stage, was a king-sized four-channel oscilloscope, with a screen about the size of a 25 inch TV set. Just to make things more interesting it was a color scope with the traces appearing in red, green and blue. This was used of course, to verify the "discreteness" (or lack of it) in the musical programs presented to us.

AUDIO • APRIL 1973

Ranged along the right hand wall was tape and disc playback equipment and scads of measuring equipment all designed to illustrate audibly and visually the differences between the "discrete" CD-4 system and the matrix systems. I must say that in spite of slight difficulties with language, the lecturer and his engineering associates presented a most thorough and lucid explanation of the CD-4 system. There are many other interesting parts to the Victor research complex, including such things as a very hard reverberation room, and a model or "idealized" listening room. The latter has walls made up of approximately 14 inch square panels, which can be either reflective or absorptive. Here again as in the studio, a "mix" of these panels can create differing acoustic environments. The panels are easily installed on a lattice-type arrangement with hook hangers. They are as attractive as they are efficient, and there is some thought of marketing them in the U.S.

Aside from the purely technical aspects of the CD-4 system, which was shown to us at the Audio Research Center, we were given an insight into the quadrasonic marketing situation in Japan. There was discussion of the penetration of the market by the "discrete" versus the matrix systems. I won't go into all that, but it is significant that there are some 130 CD-4 recordings, both pop and classical, actually in the Japanese record and hi-fi stores. A hint as to the relative acceptance of the overall concept of four-channel stereo between the U.S. and Japan, was the statement that virtually all sets (consoles or speakers plus control center) above 300 dollars in Japan are quadrasonic models.

After lunch, our group was privileged to visit the Japan Victor record pressing plant. This was a very impressive facility and they are justly proud of their installation of completely automated presses. It was quite fascinating to watch them in operation. A "biscuit" of vinyl was deposited on the bottom half of the stamper, then the top stamper descended on the vinyl and with the right combination of heat and hydraulic pressure the record was pressed. Then the record is revolved to trim the "flash" (excess vinyl) and then neatly stacked on a spindle. The plant has many regular manual presses too, and at full output, monthly production is several million records.

On Wednesday the 21st, our group flew to Osaka where we would inspect the Matsushita (Panasonic and Technics) facilities. Our first stop was the Science and Engineering Exhibition

Hall. Now by this time in my life I have become fairly blasé about technical exhibitions. Thus I was expecting the usual "pat-on-the-back" layout. But I was literally stunned by one of the most visually dramatic displays I have ever encountered anywhere. The place was huge, ultra-modern in decor, with beautiful carpeting and superb lighting. There was an utter profusion of gleaming machines and devices, reflecting every aspect of Matsushita's involvement in science and electronics. Many of the units were commercial products. Others were for illustration of various scientific principles. The variety was mind-boggling. There was a new device, that in essence was a TV set with an attachment on which there is a platen upon which you place a special sensitized sheet of paper, press a switch, and in a few seconds, by thermal development, you can get a picture of what was appearing on the TV screen when you pressed the button! Model railroad buffs would flip over the entirely computerized layout with 4 or 5 trains all running at once, crisscrossing over various tracks, stopping and starting at signals and "grade crossings", etc. There was a fascinating new type of electronic organ, with every conceivable kind of rhythm automation and many other special effects. Laser technology was demonstrated in many ways. An automated, computerized kitchen was a possible glimpse into the future, which would certainly delight the women's lib types. Of immediate interest to our group was a display of the Technics brand of stereo equipment. There were CD-4 demodulators, a variety of pre-amps and amplifiers, receivers, integrated amps . . . all of them sleekly styled and beautifully finished. I think this line will be very well received in the U.S.

After we had recovered from the marvels in the exhibition hall, the group had a welcoming lunch in the very impressive executive dining room. Our host was Mr. M. Matsushita, president of Matsushita Electric Industrial Co., who made a very gracious speech, thanking us for coming so far for a technical symposium and tour. After lunch, Mr. Matsushita personally presented each of us with a lovely gold and pearl pendant for our ladies.

Thus far the trip had been a wonderful experience. Our European counterparts turned out to be delightful and knowledgeable companions. As for our friends in JVC and Matsushita, they had been unfailingly helpful and unstinting in their hospitality. The second half of the trip will be reported in detail next month.

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JAZZ & BLUES

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Stan Kenton: The Creative World of Stan Kenton—Stan Kenton and His Orchestra Live at Brigham Young University.

Musicians: Mike Vax, Garry Pack, Joe Marcinkiewicz, Jay Saunders, Dennis Noday, trumpets; Dick Shearer, Fred Carter, Mike Jamieson, Mike Wallace, Graham Ellis, trombones; Quin Davis, Richard Torres, Kim Frizell, Willie Maiden, Chuck Carter, saxophones; John Von Ohlen, drums; Ramon Lopez, latin; Gary Todd, bass; Stan Kenton, piano.

Songs: *Malaga; Theme from Love Story; Kaleidoscope; A Step Beyond; What Are You Doing the Rest of Your Life?; Bogota; April Fool; Hank's Opener; Rhapsody in Blue; Macumba Suite.*

Creative World Quadrifonic ST-1039

Stanley Newcomb Kenton, better known to his numerous fans as Stan Kenton, has been a pioneer and innovator in jazz circles for over three decades. Composers, arrangers, and instrumentalists have gained confidence and stature in the ever-changing Kenton workshop which is here comprised of nineteen notable musicians.

Easily recognizable for its titillating trombone riffs, plethora of tempo changes, and pervasive percussion, especially of the Latin variety, the Kenton sound is what one at one time would have termed dissonant and discordant but is now easily assimilated into the current-day musical milieu. Just shows how far we have advanced in the last thirty years. Kenton's charts are exploratory and experimental on this two-record set recorded live at Brigham Young University in the De Jong Concert Hall at the Harris Fine Arts Center. The maestro seeks out such talented arrangers as Bill Holman, Willie Maiden, a member of the current Kenton entourage, Hank Levy, coach of the Towson State College Band, and the very imaginative Ken Hanna. "A driving force in jazz educa-

tion in America", according to Dr. Herb Wong's notes, Kenton makes some of his challenging charts available to schools and music educators.

This is the first Quadrifonic release by Creative World, Kenton's very own mail-order recording company, another courageous pioneering effort and attempt by a musician to better control his creative output. It produces sound delivered by special equipment flown in to Utah specifically for the concert which is part of the Fifth Brigham Young University Audio/Recording Seminar. My only gripe is that the solo instruments are not picked out very well over the tutti.

The razzle-dazzle, restless, relentless Kenton sound has always been one of my favorites since I first heard its bold brassiness at the Blue Note in Chicago some years ago. Kenton is still hale and hearty although he has recently had to take some time out from the road for health reasons.

Kenton commands a vividly textural ensemble that can both carry off a ballad of symphonic proportions and swing! Take for example Levy's ear-opener, *Hank's Opener*, a saucy, hard-driving, muscular whip-cracker that has the band swinging high as against the very moody, complex, and programmatic *Macumba Suite* by Ken Hanna which takes up a complete side. Hanna was inspired by a film documentary in the four-part suite which ominously portrays a religious rite in the favelas, a slum area of Brazil. The Kenton Band has always been excellent with effects and tempera and is prone to a mysterious exoticism. In *Macumba*, one hears bird calls, jungle sounds, sirens, instrumental sighs, whines, and groans, frenzied rhythms, and a kind of Berlioz-like *March to the Scaffold* motif in *Procession to the Terreiro*.

Believe it or not, the band can slow down and play quietly as in Francis Lai's lovely *Theme from Love Story* whose swelling tide of sonorities lap over tempo changes which in turn made way for an interesting duet by

Willie Maiden on baritone saxophone and Quin Davis on alto.

Kenton himself plays some provocative piano in Michel Legrand's *What Are You Doing the Rest of Your Life?*, carving out a charming cache of changes which only cause one to wish he'd play more.

Ken Hanna's *Bogota* is one of the most successful vehicles for the band in which John Von Ohlen's various drum pitches are clearly discernible against Gary Pack's tremendous trumpet work which is stronger on technique than intonation. Unfortunately, *April Fool* is labored and doesn't flow, but when you get to *Rhapsody in Blue* hold on to your hats for Chuck Carter's baritone saxophone excursion: magnificent tone and sheer artistry in yet another Bill Holman arrangement which never lacks luster. *Kaleidoscope*, a Willie Maiden composition, juxtaposes colorful tonalities that swirl in about one another and occasionally collide. Listen for the surprise ending.

So enter into Stan Kenton's Brave New World. Sample this Kenton collection. It's an outrageous good thing! The address:

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Sound A- Performance A-

Delaney & Bonnie: "The Best of Delaney & Bonnie"
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Certainly not the best of Delaney & Bonnie although entitled *The Best Of* . . . , this is a spotty cross-section of their soul-rock style with minimal inferences to jazz through the use of brass riffs that remain only that. And it is a shame that the sound quality is so poor, more noisy than musical and not doing them justice. They do well however, as writers, Bonnie's *We've Got To Get Ourselves Together* is together indeed as she sings out in her half shouting, moaning, raspy voice. *The Love of My Man* again speaks well for her, a convincing gospel-flavored song with a fine arrangement. And Delaney's *Never Ending Song of Love* is a tuneful ditty with genuine star quality, happy and much preferable to some of their heavier numbers. Redemption comes most in a purely acoustic medley, enhanced by Duane Allman's slide guitar and with smooth transitions from *Come On In My Kitchen* to *Mama, He Treats Your Daughter Mean to Goin' Down the Road Feeling Bad*.

By and large this is an attempt to generate excitement that fails, but it has its good moments.

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