

Audio

Scenes-
Digital Recording

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • FEBRUARY 1978 \$1.00

47425 

Build A Pre-Preamp For Moving-Coil Pick-ups

Heyser-Alternatives

A Visit to the Japan Audio Fair



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SX-850 RECEIVER. FOR PEOPLE WHO CARE ABOUT MUSIC.



*35 watts per channel minimum continuous power output at 8 ohms, from 20 to 20,000 Hz, with no more than 0.3% total harmonic distortion.

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If you're about to buy a good high fidelity receiver, Pioneer would like to suggest that you follow the advice of a highly select group of experts: music lovers.

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Mainly because this year, for the second year in a row, the SX 650 will offer better features, better sound, and better value than any similarly priced receiver.

PEOPLE WHO CARE ABOUT MUSIC WANT TO HEAR IT REPRODUCED PERFECTLY.

The goal of every hi fi receiver is to reproduce music with all the excitement and clarity of a live performance.

The SX 650 comes a lot closer to reaching this goal than some hi fi receivers costing hundreds of dollars more.

Take distortion, for example.

With some hi fi receivers, you're simply expected to tolerate a certain amount of distortion.

Not with the SX 650, however.

The 650 comes with an advanced power section designed to limit distortion at high volumes. Plus a pre-amp that features a phono overload level of 200 millivolts—enough to handle the loudest section of one of today's most dynamic records without distorting.

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Which brings us to the question of frequency response.

Where the average adult ear can *hear* music from approximately 40 to 14,000 cycles per second, the human body can *feel* music at much higher and lower frequencies.

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In other words, the chills that used to run up and down your spine at concerts can now run up and down your spine in the privacy of your own home.

POWER TO SPARE.

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Some receivers clip the signal and distort.

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AN FM SECTION THAT DOESN'T SOUND LIKE A RADIO.

At Pioneer, we've always believed that the FM section on the SX 650 sounded more lifelike than many \$600 separate tuners.

This opinion was recently confirmed in an article by Julian Hirsch in *Stereo Review Magazine* about our TX 6500 tuner. A tuner that features the same basic front-end as the SX 650's.

"For all practical purposes, the frequency response, channel separation, noise level, and distortion... are the equal of most tuners selling for two or three times its price."

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PEOPLE WHO CARE ABOUT MUSIC ALSO CARE ABOUT MONEY.

With a price of less than \$325,† we think the SX 650 offers an incredible value among today's medium priced hi fi receivers.

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Go compare the sound and value of the SX 650 to any other medium priced high fidelity receiver at your nearest audio dealer.

We think you'll find it's the perfect receiver for people who appreciate great value as much as they appreciate great sound.

High Fidelity Components
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ALL OVER AMERICA
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STEREO

TAPE MONITOR
1 2

FUNCTION

AM FM PHONO
AUX/MIC

MIC

DENON
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The actual platter speed is then clocked and made perfect—with a smooth-running AC motor.

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AC Direct Drive.

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Audio

February 1978 "Successor to ~~RADIO~~ Est. 1917" Vol. 62, No. 2

Feature Articles

Build a Pre-Preamp	36	W. Marshall Leach
Japan Audio Fair	42	George W. Tillett
Alternatives	50	Richard W. Heyser
Transmission Lines & Signal Distribution	54	M.J. Salvati

Equipment Profiles

Marantz 2500 Receiver	64	Leonard Feldman
B&W DM-6 Speaker System	74	Richard C. Heyser
Toshiba PC-3060 Cassette Deck	82	George W. Tillett
Spectro Acoustics 217 Preamplifier	86	Leonard Feldman
Beyerdynamic M500N (C) Mike	89	Jon R. Sank

Record Reviews

The Column	91	Michael Tearson & Joh Tiven
Jazz & Blues	98	John Lissner & John Diliberto
Classical	105	Edward Tatnall Canby

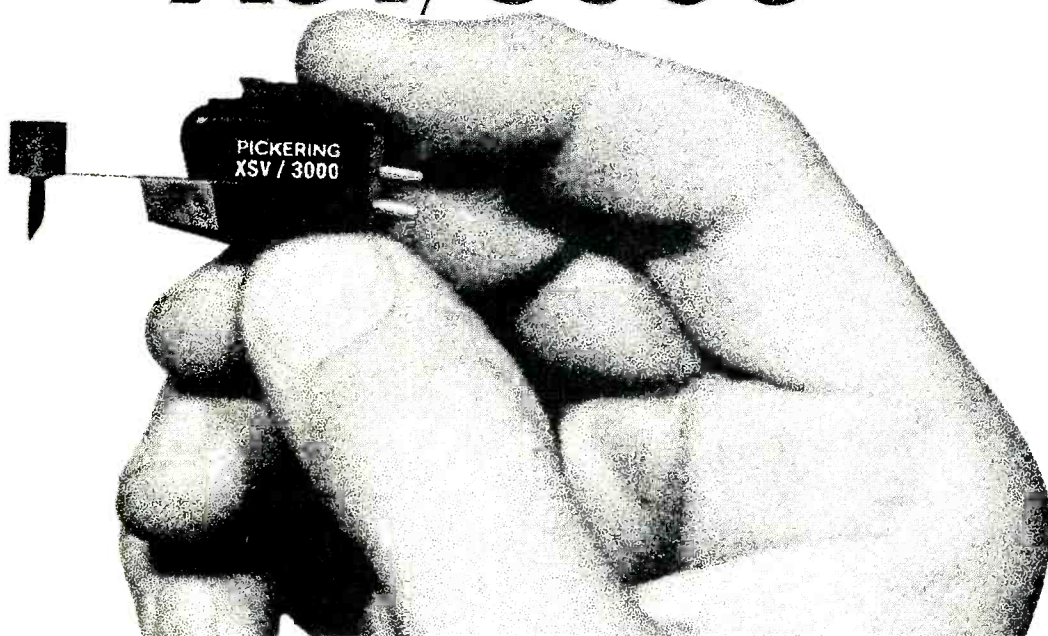
Audio in General

Tape Guide	6	Herman Burstein
Audio ETC	8	Edward Tatnall Canby
Behind the Scenes	16	Bert Whyte
Audioclinic	22	Joseph Giovanelli
What's New in Audio	26	
Dear Editor	30	
Bookshelf	32	
Classified Advertising	112	
Advertising Index	116	

About the Cover: A top quality amp is of primary importance to any good hi-fi system, when you want to reproduce all the dynamic range encased within the record grooves as Tom Rogers and Susan Swingle are doing.

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3

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Hirsch-Houck Laboratories. Stereo Review. February 1977

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High Fidelity. February 1977

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John Borwick. Gramophone. United Kingdom 1977

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Leader in editorial excellence

AUDIO • February 1978

Where superior technology makes the musical difference: Sansui's new DC integrated amplifier and matching tuner.

Sansui is proud to introduce the new AU-717 DC integrated amplifier and matching TU-717 tuner, designed for your greatest listening pleasure. We are proud of the superlative specifications that our sophisticated research has achieved. The finest available at any price.

But the best specs alone can't always mean the finest music reproduction. And so we are proud that our precision engineering and superior circuitry design create pure and brilliantly clear tonal quality that's distinctly superior.

Listen to what we offer. Frequency response of the AU-717 from main in, 0Hz to 200kHz (+0dB, -3dB), (the widest of any DC integrated amplifier available), gives you sharp, clean transients and greatly reduced phase shift problems. Total harmonic distortion is astoundingly low, less than 0.025%, from 10-20,000Hz, 85 watts/channel min. RMS, both channels driven into 8 ohms.

Dual independent power supplies provide true stereo separation and a large power reservoir. For uncolored phono reproduction equalization is within ± 0.2 dB (20-20,000Hz, extended RIAA curve). And the calibrated-

attenuator level control guarantees volume precision.

The matching TU-717 tuner features dual F-bandwidth to let you select for lowest distortion (0.07% mono, 0.07% stereo) or maximum selectivity (80dB). S/N is excellent: 80dB mono, 77dB stereo.

In addition, the AU/TU-717's are elegantly styled, offer rack mounting adaptors and are most attractively priced. Less than \$450* for the AU-717 and less than \$320* for the TU-717.

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Tape guide

Herman Burstein

House Rocker

Q. I have a Sony tape deck which is fed into a 35-watt Knight amplifier, and I have a problem of tape hiss whenever I make a recording from records or radio. I realize that my amp is only 35 watts, and I like to play my speakers loud with plenty of bass to really shake the foundation of the house. —Herbert Schoene, Chicago, Ill.

A. Part of the problem may simply lie in the fact that at exaggerated volume levels, you are also bound to get exaggerated noise. Part of the problem may also lie in your tape recorder, or the fact that you are recording at too low a level—either because you aren't careful to set recording gain to the maximum permissible level as indicated by the record level indicator, or because your record level indicator is miscalibrated. Can you borrow a tape deck of good quality from a friend and note whether you get comparable noise when recording and playing your friend's machine? If the noise is appreciably less with the borrowed deck, then your machine is apparently at fault. A Dolby noise reduction system could be of appreciable help if the problem lies in the tape deck.

Tape Deck Specs

Q. Could you please tell me the relative importance of the following three factors in tape recording: speed, tape thickness, and track width? For example, is it better to use double-play tape at 7½ ips, rather than standard-play tape at 3¾ ips? —Denis Browne, Greenwich, Australia

A. Higher tape speeds have the advantage of more extended treble response, higher S/N ratios, and lower wow and flutter. Thinner tapes have the advantage of more tape per reel and hence more recording and playing time per reel. However, they also have the disadvantage of lower output and greater susceptibility to print-through. Narrower tracks have the advantage of more playing time per reel and less

susceptibility to treble loss due to azimuth misalignment, but they also have the disadvantage of lower S/N and poorer averaging of dropouts. It is very difficult to compare the advantages in one respect with the disadvantages in another respect. Thus, I can't say that the advantages in using higher tape speed outweigh the disadvantages in using thinner tapes. I would, however, be very wary about using double-play tape which is "not recommended" by the NAB standards.

Open-Reel Fidelity

Q. Can one record music from records onto open-reel tape and get good fidelity at 1 7/8 ips? Would it matter if the tape is 1 1/2, 1, or 1/2 mil? —Robert Melson, Pasadena, Cal.

A. With high quality open-reel recorders and good tape, good results can be obtained out to 10,000 Hz at 1 7/8 ips with a decent signal-to-noise ratio and adequately low wow and flutter. While this isn't the utmost in high fidelity, it certainly isn't low fidelity. You should be able to obtain satisfactory results with either 1 ½ or 1 mil tape. However, it is generally advisable to stay away from ½ mil tape because of the physical problems and the likelihood of print-through.

Taping Opera

Q. My interest is in taping opera. I'm wondering whether I should consider the Dolby-B noise-reduction system, and whether to use 10½-inch reels instead of 7-inch ones? —John Sabritt, Phila., Pa.

A. There are a number of home recorders today which do a high-quality job at 3¾ ips with performance hardly distinguishable, if at all, from that of 7½ ips. If they include the Dolby B, then at 3¾ ips they may do a better job than other machines do at 7½ ips without Dolby. So the Dolby is advisable.

At 3¾ ips, a 7-inch reel provides 96 minutes of recording time in one

direction on 1 mil tape, which is, ordinarily, not enough to capture an entire opera. You are apt to get caught in the middle of an aria unless you choose intermission time to reverse reels, which may mean a substantial stretch of unused tape. But one way to get full use of your tape and avoid having to change reels is to obtain a machine that takes 10½-inch reels giving you a 192 minutes of recording time at 3¾ ips on 1 mil tape, or alternatively obtain a machine that reverses in RECORD as well as in playback.

8-Track Transfer

Q. I plan to put my collection of 8-track tapes on open reel. At what speed should I record to minimize noise? —Jack Rackley, Carnegie, Okla.

A. Lower speeds tend to result in more noise. Thus the signal-to-noise ratio at 3¾ ips is typically something like 3 dB poorer than at 7½ ips. However, in copying already recorded material which contains substantial noise, you may find that the lower speed (3¾ ips) produces no audible disadvantage.

Dolby Dubbing

Q. If I am dubbing a Dolbyized tape, is it necessary to use the Dolby process on both playback and recording, or can I record it straight and then play it back later using the Dolby unit? —Steve Adams, Babitt, N.Y.

A. If you are dubbing a Dolbyized tape, best results will be obtained by using the Dolby in both the record and the playback. Specifically, you would both record and playback through Dolby.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 401 North Broad Street, Philadelphia, Pa. 19108. All letters are answered. Please enclose a stamped, self-addressed envelope.

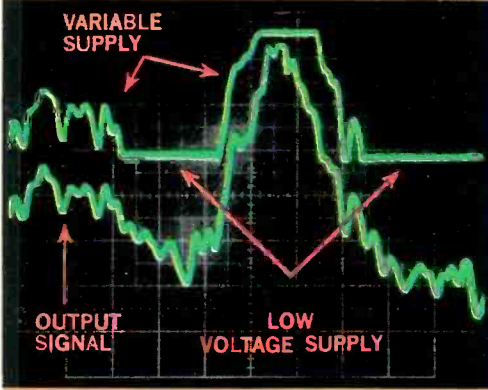
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SOUNDCRAFTSMEN'S NEW CLASS AMPLIFIER WAS INVENTED AND DESIGNED TO PROVIDE THE BEST PERFORMANCE, MOST-NEEDED FEATURES, GREATEST RELIABILITY AND ENERGY-SAVING EFFICIENCY, PLUS STATE-OF-THE-ART AUDIO REPRODUCTION. LIKE OUR PE 2217 PRE-AMP, THE MA5002 IS A MASTERPIECE OF COST-CONSCIOUS ENGINEERING — A \$1,000 VALUE FOR UNDER \$700.

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"Perfect reproduction of my own
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(QUOTE FROM DIRECT-TO-DISC RECORDING ENGINEER)



VARI-POROTIONAL SYSTEM[®] — TECHNICAL DESCRIPTION: A brief explanation of the VARI-POROTIONAL[®] SYSTEM is that its computer-like ANALOG LOGIC CIRCUITRY senses and calculates the amount of voltage required in accordance with the amplifier's rising or falling output power level, and it then directs the power supply to make available precisely the amount of voltage required, with no wasted energy. The 'scope photo illustrates this Patent Pending system by showing a loud rock music signal penetrating the upper voltage supply and also showing the supply VARIABLY increasing AHEAD of the signal.

- VARI-POROTIONAL[®] CIRCUITRY-BENEFITS:**
- enables 350 watts at 4 ohms, 250 watts at 8 ohms, at very low cost.
 - reduces AC line current requirement to save 1 kilowatt every 5 hours, yet provide full power whenever needed for high level output.
 - combined with ultra-fast output circuitry, provides extremely low T.I.M. for clear undistorted sound, with a SLEW RATE of better than 50 volts per microsecond, far exceeding most other amplifier circuits.

VARI-POROTIONAL[®] L.E.D.'s: When either channel's output level reaches approximately 50% of total power, the green L.E.D. will start to flash. It is indicating that the ANALOG LOGIC CIRCUITRY is actuating the second power supply, a VARIABLE high voltage supply, and the A.L.C. is controlling that supply's voltage IN ANTICIPATION of a potentially higher output level requirement. The L.E.D. will glow proportionately brighter, showing the voltage supply increasing, as the metered power output rises above approximately 50%. When the green L.E.D. is NOT ON, the low voltage power supply is in continuous operation, and the amplifier is operating in its most efficient mode, drawing very little AC line current and therefore saving energy costs (for example, you save approximately 1 kilowatt every 5 hours over a conventional Class B or AB amp, both operating at 1/3 power).

CLIPPING INDICATORS: The red L.E.D.'s, indicating clipping, are able to respond to signals much faster than meters can, and the clipping lights will flash dimly as clipping begins. When the clipping lights are bright, the amplifier is exceeding its rated power output. (Clipping will occur at varying power levels, from somewhat over 250 watts at 8 ohms, to over 360 watts at 4 ohms.)

3 models, Power Amp, Meter Amp, Amp-Equalizer, priced from \$599.00

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METER RANGE: When the meter range "times T" (X1) button is depressed, the meter will indicate approximate power output in percentage (100%=250 watts, assuming an 8 ohm load of the speaker output terminals).

MATCHING PREAMP-EQUALIZER



Now the PE2217 rated "State-of-the-Art" and "Best-Buy" in magazine Test Reports is available as the PE2217-R in rack silver-black form as a matching mate for our new amplifier. With the control flexibility of pushbutton-patching for tape monitoring and tape dubbing between two or three machines together with tape and program discrete-octave equalization, the PE2217-R is still the MOST POWERFUL and FLEXIBLE Preamp available at \$549.00

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Audio etc.

Edward Tatnall Canby

I'm waving my 10 pulsing digits in the air—digital audio is here with a loud undistorted bang and total silence in between.

True, it has been arriving for quite some years, as this department rather obscurely pointed out several years back. But this is different. This is the year of professional digital impact. (Home hi fi will have to wait a bit.) Pro digital tape recorder, not merely one but several, in different formats, all operational (if scarcely yet for sale) and all, as usual, incompatible with each other. At the AES they set up a special meeting to see if it is already too late. Haven't heard the result. Even more sensational, in the long run, and aimed at the home, was the first purely PCM disc, jointly developed by three important Japanese firms and surely the forerunner, at least, of the ultimate disc that will replace the ageing LP x years from now. It jumps quanta ahead. Two of these firms had the disc on hand with literature and demos, Teac and Mitsubishi. The thing was so new that a special extra technical session had to be added at the AES convention, conducted through a three-way interpreting arrangement that was slow but did not, in the least, diminish the intense interest of the audience.

The earlier digital sessions at AES were jammed far beyond the doors. I do not remember seeing such crowds on hand for a technical session, no matter what the subject. All of which provided a vast concentration of info and demo which in due time will disseminate out to all of us. The Soundstream digital recorder, the upcoming 3M, the Mitsubishi—it uses quarter-inch tape at 15 ips—and that company's even newer digital cassette audio recorder, a machine that uses

standard half-inch video cassettes for two hours of audio in one small package—every one of these was so incredibly removed from any previous analog recorder, even state-of-the-art, that one could only gasp in disbelief, then in due time, sigh with comprehension.

not go into *that*—it deserves a special article just in itself.

Finally, and significantly, the digital recorder can deliver a signal to your conventional cutting lathe that is in every respect as good as (or better than?) the direct-to-disc signals now rightly popular among hi-fi fans for their improved fidelity. All that and editing too.

Digital editing is tricky in the extreme and lends itself, typically, to the most advanced (and expensive) professional procedures. I really had to laugh when Soundstream demonstrated a perfect, single, classical "edit," two takes joined together between two trumpet notes, the precise micro-spot chosen via computerized calculation to a resolution of "less than 30 microseconds," matching wave forms for exact phase and continuity. Amazing, yes,

but a wee bit costly, all in all. They used two machines and a disc-type storage; alternatively one could use three recorders, which would be just fine for budgets in the hundred thou area. I laughed, because in the time it took to demonstrate Soundstream's one, single splice I could have hand-spliced a dozen of the same. Been doing it for years, and it doesn't cost a dime. (What do I do if my waveforms don't micro-match and there is a sonic bump? Put it back together and try, try again). Which is not to denigrate Soundstream's accomplishment, which without a doubt will have important usefulness in professional areas.

Conflicting Configurations

I am only mildly uneasy, in the face of all this, because of the disparity of approach and the incompatibility that has shown up in these operational digital systems. Nobody's matches anybody else's. I do hope that the AES



MIA HALTON

Yes, it can be done and is being done. Signal to noise at virtual infinity—there is no noise; 90 dB is the acceptable figure. Distortion down in the nil regions, NO IM, for instance (none that can be measured, anyhow). NO tape print-through (and is that a tremendous advance in a practical way). Even more important, due to the very nature of the digital coding, NO deterioration of signal from copy to copy. If you can retrieve all of the pulses, all of the numbers in the code, you have the total signal—and not a thing else. So you can, in the theory, mix down 32 tracks in a dozen succeeding generations and come out with a crispy signal and no noise! Enough to make the pop people swoon. You see what I mean.

To say nothing of the elaborate new audio techniques that are available via the digital approach, since digital, as Soundstream puts it, "is not necessarily linked to a fixed time-base." Let's

HIGH BIAS.

**These cassette deck manufacturers use SA
as their reference for the High(CrO₂) bias/EQ setting:**

AIWA • AKAI • CENTREX • JVC
KENWOOD • MERITON • NAKAMICHI
OPTONICA • PIONEER • ROYAL SOUND
SANSUI • SHARP • TEAC • TOSHIBA
UHER • YAMAHA

**And are joined by these
in recommending SA for use in their decks:**

BANG & OLUFSEN • DUAL • FISHER
HARMAN/KARDON • LAFAYETTE
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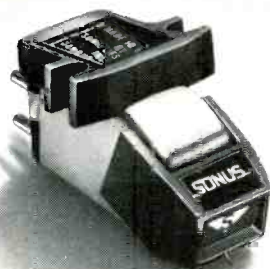
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meeting of minds explored modifications that just might bring these machines a bit closer to one another, but this is probably wishful thinking. However, one thing must be understood at the beginning, which changes a lot.

True, there are four or five different configurations for digital master tapes, and thus we may have gross incompatibility as between machines, where in present analog masters there is track for track interchangeability (with a bit of equalization plus Dolby, dbx, and such). But we have a vast and saving digital grace—copying. Since there is *no loss* in digital copying (not counting dropouts, a special problem), it will be simple, relatively, to play any master tape on its own tape recorder and make an appropriate virgin-perfect copy on some other machine, different specs. And if digital now debuts on two-inch, one-inch, half-inch-cassette, and quarter-inch tapes, at various speeds, scans, and basic digital coding systems (pulse coding being only one), then we also have a variety of analog tapes in as many sizes and speeds right now. All in all, not too bad a prognosis, within the pro area.

If & when the digital recorder gets to the consumer, it will be another story. Please, gents, ONE system, this time! Remember stereo.

I was fascinated by the already well worked out solutions to the problem of tape dropouts in digital recording. These can cause real chaos and would be doing so now, even with the best of tapes, if it were not for the ingenious correctives designed to cope with them. The details are for a technical article but I got the drift. It is a kind of redundancy, like making a safety tape as well as original, only this is built into a single channel, a lovely (and difficult) concept for the likes of me, involving "parity bits," extras carried along with the digital stream, a means whereby one or even several missing bits (dropouts) can be reconstructed for a perfect sequence. A scrambled order, in effect a micro time delay, seems to be a part of this technique if I get it right. (Phew, the things I have to learn these days, me a trained musician. Now, you ask me about augmented sixths and the Phrygian mode, I can whistle them to you. . . .)

Disc

Finally, the biggest sensation, if the furthest out—the digital PCM audio disc, Teac and Mitsubishi, which those of us could stay on for the extra AES session actually got to hear. Stunning. There is no better word. Once again,

those high dB figures—here it was—"better than 98 dB." That's the dynamic range. So you want an expander to expand *that*? There is no noise at all via this disc. Just signal. So you want a noise reduction circuit? There is no wow, no flutter, NONE. (Well, they say there is none and I didn't hear any.) As in all the digital machines, the disc speed is precisely crystal controlled. As for distortion, the specs sound just as crazy as those for the tape machines—preposterous, impossible. Did I say there was no IM? Probably. Nothing to inter-modulate. The THD and noise (if any) combine to less than 0.1 per cent, but this is just another one of those figures. Stop right there—all digital recording, any old kind, is this way when the designers want it to be.

Head room! Vast amounts of it in all technical directions. That is the thing we get via digital. Disc head room, too, just as in the digital light guide audio techniques of Ma Bell. The problem with the present 30-year-old LP is that we have systematically used up the last bits of its head room—indeed, in some aspects of four-channel sound we clearly went a dangerous step beyond. Now we see a new deal, a new disc generation, and head room suddenly opens up again. For audio it is nearly infinite in practical terms.

The PCM digital disc (not to be confused with the recent "PCM" LP records, cut from digital tape masters by Denon) is a laser beam record. The disc is plastic, 12-inch, inherently inexpensive to mass produce, and has no grooves. It uses the "pit" system, rows of tiny reflecting pits for the laser beam to scan digitally at high speed. The disc turns silently at a whopping 1800 rpm but even so it runs a half hour in the present configuration, two-channel stereo. Cryptic remarks in the fact sheet, however, imply that a much longer playing time is easily accomplished—"a whole set of symphonies" could go onto a single disc. And definitely there is multi-track capability—no physical alteration, only a different coding—up to 16 channels. How's that? Let's call it quad-squared, next time.

No stylus touches the playing surface. It isn't even on the surface. The pits are buried *inside the record* under a transparent protective layer. The back side is lightly mirrored. A four-way servo system does a number of improbable miracles, seemingly with success. 1) The speed is servo crystal controlled; 2) a tracking mirror system keeps the laser exactly on the middle of the endless spiral of tiny pits it is scanning, through the transparent sur-

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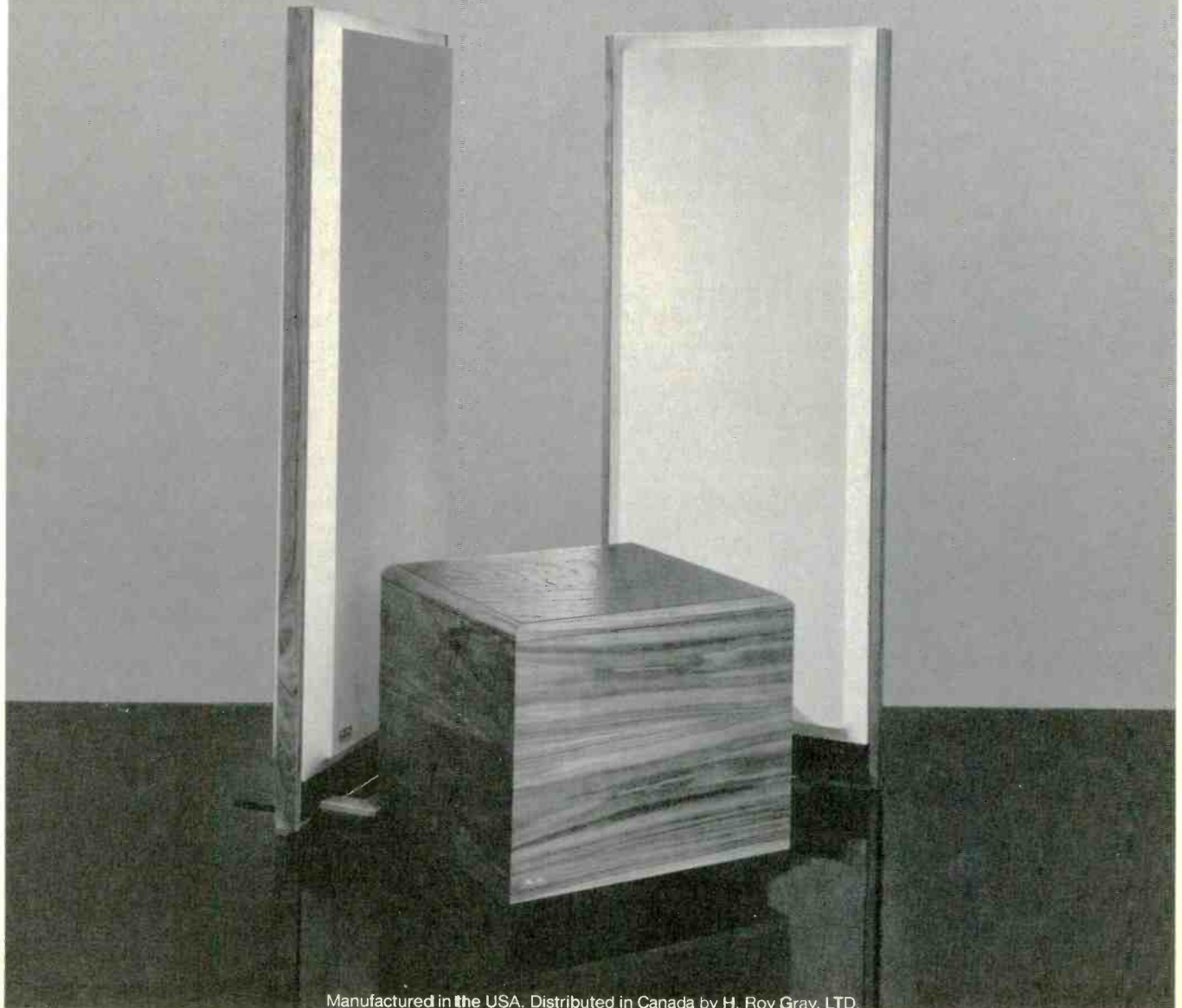
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face; 3) the grosser radial motion, sidewise, is also, of course, servo controlled; and 4), a crucial focussing system is servo controlled to change the laser's point of sharp focus in accord with vertical irregularities in the disc itself. The beam thus follows the disc both sidewise and up-and-down, wherever it may wander.

Distortion? Not Me!

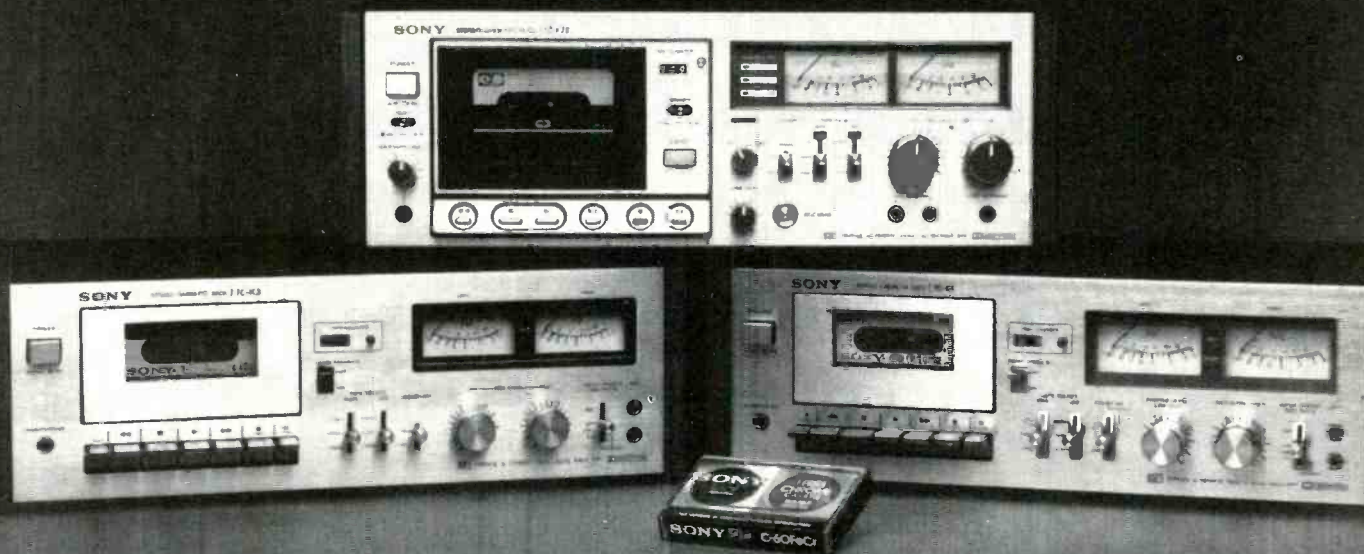
Ah—definitely important! One editor said that he heard a lot of shrillness at the demo, and felt that it could well be due to improper operation of the decode system. A slight warp, a deformation, and you are smearing your laser all over the lot. Or are you? A very big question. Frankly, I did not hear any distortion-type shrillness—but my ears are older.

Shrill or no, the laser beam disc demo was one of the most impressive I have ever heard, telling a concise story in a few minutes without a single word—just sound. Imagine it. The disc player, size of an ordinary record player more or less (it'll get smaller), is turned on—and nothing happens. Total silence. Is it working? Then some tiny little sounds, peeps, chirps, rustlings, and we gradually become aware of a faint woody scene in stereo. Far-off bird calls; you had to strain to hear them. Then suddenly *WHOOOOOOO*—like a thunderclap in volume, the LOUDEST steam railroad whistle I have ever heard, enough to knock you silly. Followed by the engine itself, which clanked, or I should say ROARED by us with huge snorts of escaping steam, bangs, thumps, at a level that was on the edge of pain. Distortion? I didn't hear any! Except one large loudspeaker that briefly bottomed into a death rattle. Now have you ever heard anything like *that*, from a disc?

More—but space is out. The modern music was an amplified solo flute, played with enormous steam-like hisses and stranglings—it is done quite a lot these days among the avant garde. Shrill—but distorted? I'd say no. Then a percussion piece, marvelously chosen to show transients via rows of fast bounces of the sticks on the drumhead, each tap totally discrete. . . . Now, do you want to hear the laser beam disc?

N.B. Not a single word about analog-to-digital converters, and back? Yes, they are vital but, at this point, mostly trade secrets. Questionings elicited a wide response of no comment, which I hereby pass on to you. There wouldn't seem to be major bottlenecks in this area, though, judging from results. They'll tell us—later. *AJ*

AUDIO • February 1978



We confess. We couldn't have done this without a 30 year head start.

Thirty years ago, other manufacturers didn't know where to begin making a tape recorder.

Sony not only knew where to begin, but was putting the finishing touches on its first tape recorder.

That's quite a jump to have or a very startled competitor.

Today, we're still keeping them jumping. Proof positive: our 3 new front-loading cassette decks. The TC-K7E, K4 and K3.

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The tape transport mechanism is perhaps the most important engineering challenge of a tape deck. Sony deals with it through a DC servo-con-

trolled motor. A frequency generator (found on the K7 and K4) emits a signal which is relayed to electronic circuitry, thereby controlling motor speed.

This insures accurate, stable tape movement.

Sony's intelligent design encompasses something as obvious as a servo-motor. And something as seemingly trivial as the best rubber compound for the pinch roller or the best oil for the flywheel bearing.

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can do when it comes to making heads?)

Other features of these cassette decks include a Dolby Noise Reduction System. Three-position bias and equalization switches for standard, ferrichrome and chromium dioxide tapes. Rec-mute for instant muting while recording.

As complex as these electronics are, that's how simple we've designed the controls to be. They're refreshingly logical. With a solid, responsive feel.

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Behind the scenes

I have been talking about the various aspects of digital recording since the 54th Audio Engineering Society Convention. I have described the prototype systems, given my evaluation of what digital tape playback demonstrations there have been and noted with the passing of subsequent conventions that we have been making slow but significant progress towards the realization of digital recording and the commercial availability of professional digital tape recorders.

At the 58th convention of the Audio Engineering Society, November 4 to 7, at the Waldorf in New York, it was apparent that it is finally safe to say that the era of digital audio has well and truly begun. I think this statement is justified in view of the exciting digital audio developments that were the highlight of the convention. How about a digital tape recorder capable of up to 32-channels, the result of a joint venture by the 3M Company and the British Broadcasting Corporation? How about a quadrasonic digital tape recorder from Dr. Tom Stockham's Soundstream Company? Perhaps you might be interested in a two-channel PCM recorder from Mitsubishi? How about an operational PCM cassette tape deck, also from Mitsubishi? To really put icing on the digital cake... how about operational PCM-encoded discs with laser beam playback from Teac and Mitsubishi? To use that old cliché... all this was mind-boggling, and then some! Now let's take a closer look at all these exciting new digital machines.

The 3M Company and the BBC held a joint press conference the day before the AES convention and described and demonstrated their digital audio mastering system. Essentially, the tape transport is a modified version of the 3M M-79 tape recorder. The M-79 in normal analog configuration can record 24 channels on two-inch wide tape. In the digital version, up to 32 channels can be recorded on one-inch wide tape. In addition to the main recorder, there is a smaller digital recorder, a "mix-down" unit, which can record four or two channels on quarter-inch tape. The recorders are

16-bit systems, with a sampling rate of 50,000 times per second at a tape speed of 45 inches per second. At this speed, 7200 feet of tape on a 12½-inch reel gives 30 minutes of recording. The main mastering recorder can be operated remotely, offers the usual overdub, and in-sync track-to-track facilities common to analog recorders. Both the 3M people and the BBC have been working independently on digital recording, but joined forces about two years ago. 3M contributed their ex-



TEAC PCM-Laser
Record Player

pertise in computer technology, and the BBC in the design of extremely linear analog-to-digital and digital-to-analog converters.

For some time now, the BBC has linked together a number of cities in England with digital transmission of FM, thereby gaining their experience in AD-DA converters. The master and the mix-down recorders claim a frequency response of ± 0.3 dB 30 Hz to 15 kHz and are -2 dB at 20 Hz and -3 dB at 20 kHz. Since frequency response is usually a little less than half the sampling rate (50K/sec), these specs seem reasonable. However, in light of this, I am a bit puzzled by statements made during the demonstration, that the system was "flat down to d.c."

Harmonic and intermodulation distortion is rated at less than 0.03% 20 Hz to 20kHz with input/output level of $+15$ dBm. As to signal-to-noise ratio, with a 16 bit system, with each bit handling about 6 dB, we have 96 dB, and that, friends, is *really quiet!* As with all digital recorders, wow and flutter, print-through, crosstalk, and modulation noise are unmeasurable. The recorder uses a special 3M tape,

and this combined with a sophisticated error-correction system (a lot of BBC input on this) essentially eliminates the problem of drop-outs.


How'd It Sound?

The demonstration tapes of some piano and big band music were very impressive (allowing for differing tastes in playback equipment)... very clean, with a lot of punch, superb transient response, and a total absence of tape hiss. Needless to say, all the virtues of digital recording are attractive to the typical recording studio, but one feature of this new recorder is especially important, its ability to overdub with absolutely no incremental build-up of noise. One can only hope that the producers don't go overboard on this point and make recordings so over-dubbed that they are texturally too thick! The master and the mix-down digital recorders are to be sold as a system, with an anticipated price of around \$150,000. 3M states that three such digital systems will be available in 1978, with delivery slated for July or August. 3M had a suite at the Waldorf and demonstrated their digital recording system throughout the convention.

Dr. Tom Stockham has been a pioneer in digital recording, as witness his interesting reconstructions of Caruso recordings, and his ongoing demonstrations of his Soundstream digital recorder for the past several years. At the Waldorf, he was demonstrating his new quadrasonic digital tape recorder (albeit with just the two front channels) with recordings of Arthur Fiedler and the Boston Pops playing Tchaikovsky's *Capriccio Italien* and Rimsky-Korsakov's *Capriccio Espagnole*. These were the result of simultaneous direct-to-disc and digital recording sessions for Crystal Clear Records, and I had the pleasure of being the recording engineer. I believe this was the first time a symphony orchestra was recorded digitally, and the recordings created a lot of interest and seemed to be well received. Dr. Stockham makes the particular point that his machine is a full 16-bit straight binary conversions and recording system, with no compression, expansion

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or floating-point being used. The sampling rate is 48K per second, and frequency response is rated as 0 Hz to 17 kHz $\pm 0.5/-1.0$ dB (another version has response to 22 kHz). Signal-to-noise ratio is better than 90 dB (unweighted). Harmonic distortion is said to be 0.03 per cent at any level below peak at all frequencies, while intermodulation distortion is 0.006 per cent with high impedance loads. Tape speed is 30 ips, which gives 30-minutes recording with a 10½-inch reel. It is interesting to note how much progress has been made in digital recording because Ampex is now supplying Type 460 tape, in this case, one inch wide which is specifically for digital recording, and is the tape used with the Soundstream recorder on the Boston sessions. The Soundstream recorder has an elaborate error correction system for the elimination of dropouts. The quadraphonic model of the Soundstream is expected to sell between \$60,000 and \$70,000, with delivery scheduled within the first quarter of 1978. I know a modest-sized recording company (who chooses to remain anonymous) that has just about decided to "go digital" and buy a Soundstream recorder!

Japanese Entry

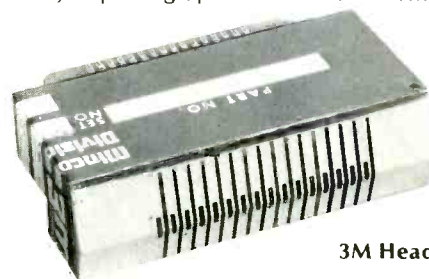
The Mitsubishi digital recorder that was shown at the convention is an update of the unit I described some months ago. It uses what is essentially a standard open-reel transport with quarter inch tape. The format is two-channel stereo, and it is a 14-bit system with a 48k per second sampling rate. Frequency response is claimed to be ± 0.5 dB from d.c. to 20 kHz with a signal-to-noise ratio of better than 85 dB, and harmonic distortion of less than 0.1 per cent at operational levels. Tape speed is 15 ips, and with a special circuit, monitoring of the digital signal is possible. Most unusual is the claim that conventional tape-splice editing can be performed with this recorder, although electronic editing is also possible with an adaptor. An error-correcting circuit for dropouts is used in this unit, but I note that they state that dropouts are "reduced below a detectable threshold," rather than eliminated.

Mitsubishi was also showing a PCM cassette tape deck. Now don't flip, fellas! This is NOT the Philips compact cassette. Rather it is a take-off on the video-recorder theme, a la Betamax. (Incidentally, no sign of Sony and their PCM unit, whatever the reason.) The unit is a helical-scanning rotary head recorder using the video-cassette and affording up to two hours recording.

For stereo, there are two PCM channels and one for bias. Frequency response is said to be ± 0.5 dB from d.c. to 20 kHz, S/N ratio 80 dB, and distortion less than 0.03 per cent. This is a 13-bit system, but uses logical compression. Sampling rate is 47.5 K/second, and dropout compensation (note, not elimination) is interpolation from previous value. What this all means is that theoretically this system should not have the quality of the open-reel PCM. However, from the samples of pop music played for me, the sound was of very high quality, with exceptionally good transient response.

Laser Discs

One of the most intriguing developments in digital audio at the convention was the demonstration by Mitsubishi and Teac of pulse code modulation discs. A joint venture of these two companies and Tokyo Denka, the technology of these discs admittedly is a take-off on the Philips MCA videodisc. (Reportedly Philips is busy adapting their videodisc to audio use.) A photograph in the Teac room



3M Head

showed the PCM discs being made inside a glass case under "clean room" conditions. On a metallized disc, a gas laser is pulsed by the input from a digital tape and "burns" tiny pits in the disc, only one thousandth of the width of an LP record groove. These pits are pulses or "bits" of information on the encoded audio signal. The playback unit consists of a turntable spinning at 1800 rpm, under the control of a quartz-crystal oscillator servo; a focusing servo system, which keeps the beam of a helium/neon gas laser exactly the right size and focussed perfectly on the pits on the disc; a tracking mirror servo which controls a mirror angle so that the laser beam is precisely in the middle of the pits, and finally a radial motion transport servo system that moves the entire optical assembly across the diameter of the disc. At present, the playing time for the disc is 30 minutes on one side. (Philips recently produced a laser disc that can be played on both sides.) However, with suitable modifications, it would be possible to store and playback all nine Beethoven symphonies! The frequency

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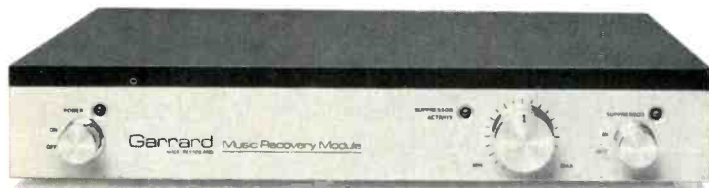
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the PCM disc is rated at +0.1/-0.5 dB 10 Hz to 20 kHz, S/N ratio and dynamic range better than 98 dB, THD less than 0.1 per cent, wow and flutter are quartz crystal accurate. With the laser beam playback, there is no record wear, no tracing distortion, no tracking error, no pinch effect, no acoustic feedback, and no surface noise. Really quite incredible! It is claimed that the discs can be duplicated in the same fashion as current LP records and for about the same cost. Some people at the convention

said they never heard these discs working properly. Anytime I went in, everything was in order. The principle is perfectly sound . . . it is only the accuracy and stability of the various servo systems that can cause problems. In any case, the sound from these laser discs was astounding. Shades of the old days . . . Teac was using a railroad train recording, and the dynamic range was truly startling, with the realism of the playback limited only by the quality and power of the speakers and amplifier. Music



3M Digital Mastering Unit

on the discs was super clean, open and transparent, and blissfully free of hiss. Projected cost of the playback system is around \$600.

I find all these digital developments very exciting. I will go out on a limb and state that this is the way the audio industry will progress, and that those die-hards who think that digital audio is still five or more years down the road are deluding themselves. Of course, we will still have the old "chicken and the egg" bit . . . we had it with binaural and stereo and many other developments. As always, it will be the dedicated audiophiles . . . the nuts, if you will . . . who will be first to embrace the digital technology and get the ball rolling. Ultimately, as it always has, the advancements will filter down to the lower echelons of audio and finally, to the mass market. To the apprehensive manufacturers of today's equipment, casting a wary eye at these developments, it should be obvious that with the hundreds of millions of record playing units in the world, there will be a market for turntables and arms, phono cartridges, and conventional records for a very long time to come.

As to the 58th AES convention, it behaved like a good AES convention should. Which is to say that attendance was up, there were more exhibits than ever, with the 10th floor of the Waldorf positively loaded with active audio demonstrations (and a great place for inquisitive audiophiles to roam). As usual, the technical sessions were well attended, and there was no dearth of eye-brow raising papers. As to new products, there were some interesting items which I will go into the details of next month. Lastly, on a personal note . . . I am very honored that the AES elected me a Fellow, and I received my award at the convention banquet. ▲

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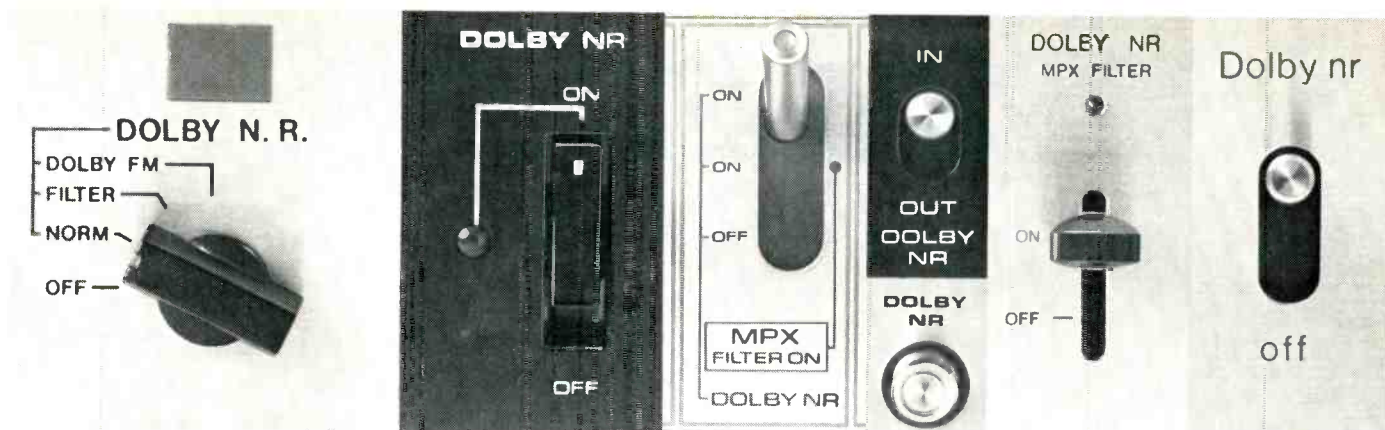


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The answer: a dbx II tape noise reduction unit. All of our models give you 30 dB of noise reduction at all frequencies, plus 10 dB extra recording level headroom. Without altering the sound of your music, either. The best that Dolby* B can offer is 7-10 dB of noise reduction. Besides, Dolby and other typical systems operate only at high frequencies, allowing low frequency noises to remain. And as experts know, they require level matching. dbx II doesn't require any level matching whatsoever, because its true mirror image compression/expansion operates linearly on all frequencies and your music's entire dynamic range.

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

This all means that the live performances, FM broadcasts and record albums you tape will have their full dynamic range preserved, with no audible tape noise added. So, if you're unhappy with the noise reduction system in your tape deck, consider a dbx II. We make 3 models: the 122, for two-channel tape noise reduction; the 124 for four-channel tape noise reduction, or simultaneous off-tape monitoring of the noise-reduced signal; and the 128 combination tape noise reduction system/dynamic range expander, which lets you make tape copies of your recordings that sound better than the original.

The dbx difference is the difference between some tape noise and no audible tape noise at all. Hear it at your dbx dealer soon.

21



dbx dbx, Incorporated
71 Chapel Street
Newton, MA 02195
617/964-3210

Enter No. 12 on Reader Service Card

Audioclinic

Joseph Giovanelli

Basic Audio

Q. I am a 16-year-old girl whose father is a "high fi nut." My problem is that I don't understand what is happening when I put a record on the turntable and put the "needle" on it. With my interest in music, I decided that it's about time I understood what goes on in the mechanics of it. I asked my father about it, but I got a long confusing explanation in another language. — Name withheld by request.

A. When I was a kid and heard someone reading the news on radio station WOR, I clearly remember going behind the radio to look for the person doing the talking, but he was nowhere to be found. That started my present career in sound.

With the phonograph cartridge, most modern cartridges employ magnetic principles which convert the motion of the stylus into electrical impulses, a tiny voltage. We now have a tiny amount of what we call "signal"—a tiny electrical voltage. In order for it to become useful, it must be made larger, and it is the job of the amplifier to build these tiny impulses into larger ones. But, unless something else is done with it, we cannot hear this large signal any more than we could hear the tiny signal produced by the phonograph cartridge. The final conversion of this signal into the sound we hear is done by the loudspeaker. Again, most speakers employ a magnet and a coil, just as the cartridge does. We now have the opposite operation from that which we had with the cartridge, as we change the electricity into motion of the loudspeaker cone. This signal is connected to the two wires which form the beginning and the end of the continuous coil of wire, and we have set up the relationship between the coil and the magnet which results in the coil being alternately attracted to and then pushed away from the magnet. The motion of the cone makes the air around it move because the cone pushes against the air. This moving air strikes your ear-

drums and you hear the sound as music.

The signal from a tape machine starts out as a small signal, just as from a phonograph cartridge. The tape itself is a series of magnets which have varying amounts of magnetism that move past a coil in the tape head as the tape is pulled through the machine. Remember that a magnet moving in the vicinity of a coil of wire will cause a signal, or voltage, to be produced in the coil of wire. Once this voltage exists, the signal is amplified and fed to the speaker just as it was with the phonograph cartridge.

The FM tuner is, in many ways, similar. The waves coming from the broadcast station can be thought of as magnets moving past your antenna. Your antenna is nothing more than a coil of wire which happens to be in a straight line, rather than being wound in a circle. The moving magnetic waves cause a small voltage to be produced in the antenna. This voltage is then amplified and ultimately you hear the sound produced by this process. Again, this explanation is very much oversimplified.

Reversed Stereo Perspective

Q. I have noticed that the majority of my symphonic records seem to have the channels reversed. I can tell this because the violins are on the right and the cellos are on the left, the opposite from what one perceives viewing an orchestra in concert. All the connections in my audio chain are connected as labeled. Are the records recorded in mirror image, or are the jacks of my turntable mislabeled? — Andrew P. Guzie, Boise, Id.

A. It appears that somewhere along the line you have some channel connections reversed, most likely at the cartridge itself, rather than elsewhere. If your stereo perspective is normal when listening to FM, you can be assured that the amplifier, pre-amplifier, and loudspeakers are prop-

erly wired. I suggest that you recheck all connections, as it may just be some piece of equipment is mislabeled. With all of the add-on devices available, channel reversals are very possible unless extreme care is taken at each step of the installation process.

Turntable Construction

Q. Why do a lot of record changers which use ceramic cartridges have two-pole motors? — Robert Watson, Dover, Del.

A. Two-pole motors are cheaper to construct than four-pole motors. They can be used in changers that employ ceramic cartridges because these cartridges are not susceptible to hum pickup as magnetic cartridges are since two-pole motors radiate a tremendous amount of hum voltage.

Power & Tone Controls

Q. I connected a power meter to my receiver's speaker terminals as per the instructions. Why does the meter show an increase in the power whenever I add either bass or treble? I thought that the volume control determines the output power? — Aaron Holley, Pacifica, Cal.

A. The tone controls either add or subtract bass and treble, consequently the tone control is really a volume control that affects only a portion of the audio spectrum, rather than the whole, like the volume control. Any added signal, whether supplied by the tone control or the volume control, means that the amplifier must supply more power. In short, anything that alters the nature of the signal feeding your speakers will change the amount of power your amplifier provides, and this will be shown on your power meter.

If you have a problem or question on audio, write to Mr. Joseph Giovanelli, at AUDIO, 401 North Broad Street, Philadelphia, Pa. 19108. All letters are answered. Please enclose a stamped, self-addressed envelope.

Introducing the new TDK testing machines.

When TDK created a series of cassette test tapes, we approached them as integral components, with both tape and housing engineered as precisely as sophisticated test instruments.

You'd expect that from the makers of TDK SA, the High bias reference standard for most manufacturers of quality cassette decks.

TDK test tapes are loaded into the same Super Precision Cassette Mechanism as our well-known and respected SA and AD cassettes. That means they don't jam, and they're dropout-free. They're built to last under unceasing use. The audio lab critics, dealer service managers, cassette deck manufacturer quality control engineers, and discerning audiophiles who use them, demand that kind of precision and reliability.

To make absolutely sure they get it, each TDK test cassette is recorded one-to-one, in real time. We then test our test cassettes, one by one, to guarantee against slip-ups.

There's a TDK test cassette for any test or setup task: bias/EQ alignment; playback level calibration; Dolby calibration; head azimuth alignment; wow and flutter and tape speed and 11-, five- and three-point frequency characteristics tests.

You see, TDK is more than just another tape company. Our trend-

setting cassette tapes are the result of over 40 years history in the design, manufacturing and engineering of advanced electronic products, from the critical ferrite parts which make up your cassette deck, to audio tapes to test tapes to video tapes.

Check out the complete line of TDK test tapes. And if you haven't done so already, pick up our SA and AD cassettes next time you visit your audio dealer. You'll discover for yourself that the same TDK quality and reliability that goes into TDK test tapes applies all the way down the line.



TDK

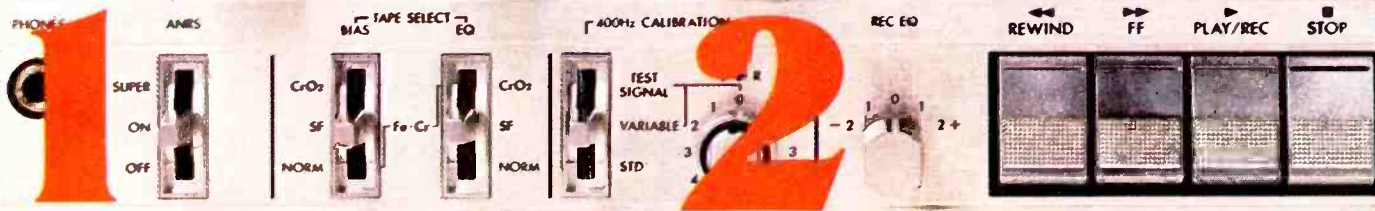
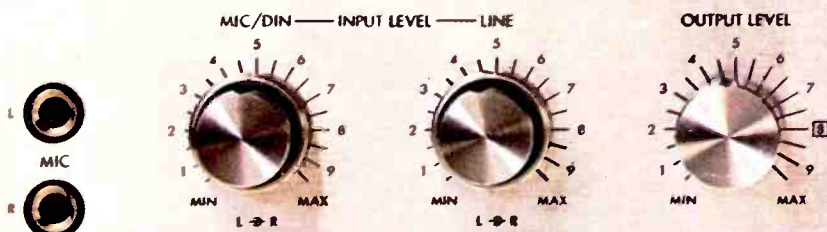
World leader in tape technology.

TEK Electronics Corp., 755 East Gate Boulevard, Garden City, New York 11530. (300) 635-3338

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We build the others

TIME RECORDING Super ANRS KD-95 STEREO CASSETTE DECK



KD 95



CD-S200



KD-75



KD-35

in what leave out.

JVC

Only JVC gives you improved recording with Super ANRS, Recording/EQ switch, 5 Peak Reading LED's and SA heads.*

The measure of fine cassette deck performance is the sound of the recordings you make. JVC's extensive line of high fidelity decks features these exclusive contributions to cassette deck technology.

1 Our Super ANRS gives you efficient noise reduction, with the added plus of extra-low distortion at high-level high frequencies. And you can switch to our regular ANRS for making recordings to be played using other noise reduction systems. **2** In addition, our extra Recording/EQ switch helps you to precisely adjust the high frequency response of your deck to match any tape you care to use.

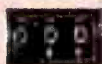
3 The entertaining LED's you see on our decks actually help you make better recordings. They're easier to read than VU meters by themselves, so you can record at higher levels without fear of tape saturation.

4 And our SA (Sen-Alloy) heads offer the sensitive performance of permalloy, plus the long life of ferrite in one design. These heads are so excellent in their performance and durability that other manufacturers are buying them from us to use in their decks.

There are a variety of other features to simplify your cassette recording. And our specifications are equal to or better than machines that cost much more.

Once you've seen the things we build in, you'll wonder why the others leave them out.

COUNTER



MEMORY

OFF → STOP → PLAY → AUTO →

EJECT

REC

PAUSE

POWER

ON
OFF

Enter No. 20 on Reader Service Card

*Not all features in all decks.



KD-15



CD-1770



CD-1636



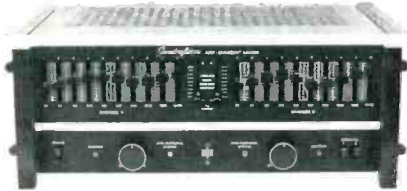
KD-2

JVC

What's new

Soundcraftsmen Amp-Qualizer

The Model EA-5003 is an octave wide 10-band equalizer with a ± 12 dB boost and cut capability, and 18 dB range zero-gain controls for each chan-



nel. This unit is a solid state amplifier-equalizer with fail-safe overload protection circuitry, non-limiting circuitry to eliminate limiter-caused distortion, switching for two speaker systems, and separate gain controls. The stated THD is 0.1 per cent, a damping factor of 100, and a frequency response of 20 to 20,000 Hz ± 0.25 dB. Price: \$849.00.

Enter No. 70 on Reader Service Card

Dayton Wright Preamplifier

The SPA preamplifier permits use of very low output moving-coil phono cartridges and has monitoring and cross-dubbing facilities for two tape recorders. The design uses integrated circuits augmented with discrete components, has no tone controls, and features wide open-loop bandwidth and fast rise time. Steady-state and



transient distortions are less than 0.001 per cent, while frequency responses are 1 Hz to 1 MHz for high level, 7 Hz to 500 kHz ± 1.5 dB for normal phono, and 16 Hz to 300 kHz ± 1.5 dB for moving-coil inputs. Rise time is specified as 700 nS, S/N ratio at 70 dB, and RIAA equalization is ± 0.3 dB. Price: \$1225.00.

Enter No. 71 on Reader Service Card

Wallace Auto-Shutoff System

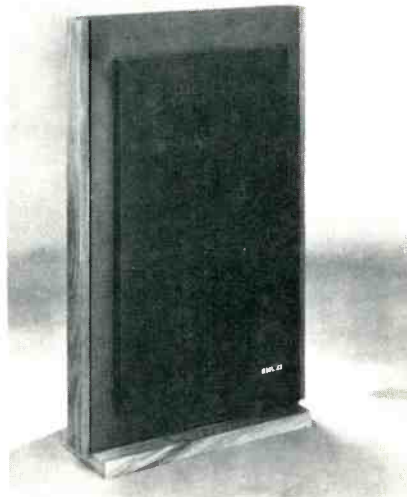
The Auto-Shutoff system automatically shuts down the a.c. power in

a stereo system whenever sound is discontinued from the loudspeakers or tape monitor terminal. It features a delay variable from 30 seconds to 20 minutes, adjustable sensitivity, LED indicator, solid-state switching, built-in timer for automatic preselected shut-down from 10 minutes to 2 hours, instantaneous reset, four easy-access outlets handling up to 1000 watts, heavy-duty 3-conductor power cord, low power consumption, and a RCA phono input jack. Price: \$49.95 kit, \$69.95 assembled.

Enter No. 73 on Reader Service Card

BML Loudspeaker

The Model 1001 planar column loudspeaker, with five loading chambers, uses an in-phase moderation and modulation action between the woofer and active base radiator, and a solid-state horn tweeter. The design eliminates the crossover network, important when the system is used in conjunction with



direct coupled amplifiers. The woofer and active base radiator are 7½ in., while the tweeter is 3½ in. Minimum recommended power is 20 watts rms, maximum power 150 watts rms, sensitivity 92 dB @ 1 meter on axis [1000 Hz], frequency response 35 to 23,000 Hz +3, -5 dB, and minimum impedance is 4 ohms. Price: \$299.95.

Enter No. 74 on Reader Service Card

Burwen Indirect Discs



This line of records is claimed to match the fidelity of direct discs. The master tapes recorded by Burwen Studios are made on specially designed tape machines using the Burwen Model 2000 companding audio processor which delivers a 100 dB dynamic range signal to a unique set of mixing equipment. Final equalizing and extreme low frequency blending, are accomplished immediately after the compressed tape signal is decoded for delivery to the disc cutter. The first release, *Misty*, played by the Petty Trio, includes *Feelings*, *Rhinestone Cowboy*, *Leroy Brown*, *Wild Flower*, and *Misty*. **This is The One**, jazz piano solos by Dick Wellstood, includes *Paganini's Thing*, *You are the Sunshine of My Life*, *The Steeplechase*, *Rosetta*, *Giant Steps*, and others. The East Bay City Jazz Band record, to be released in April, features Jane Campedelli as vocalist, and includes *Big Bear Stomp*, *Jelly Roll Blues*, *Dans Le rue d'Antibes*, and more. Price: \$15.00 via mail.

Enter No. 75 on Reader Service Card

CEI Catalog

The new, free, 36-page factory mail order catalog of electronic equipment and kits manufactured by Caringella Electronics, Inc., includes such items as a WWV Standard Time Receiver, panel mount digital clocks, with and without BCD outputs, and day-of-year calendar; a giant digital wall clock, audio compressors, and an electronic security alarm, etc. Each entry includes technical specifications, photo, application information, schematic diagram, and a description of operation.

Enter No. 76 on Reader Service Card



Music you never knew was there.

There are probably beautiful musical passages on many of your records that you've never heard. And you never will unless your cartridge is sensitive enough to clearly reveal all the subtle harmonics within the audio spectrum.

Today's sophisticated direct-to-disc technology has raised the quality of disc recording to a new state of the art. You need a cartridge that does justice to these fine recordings: an ADC cartridge. With an ADC cartridge, you will find the state of the art has been brought almost to the state of perfection.

Long known by audiophiles for incredibly pure sound reproduction, ADC cartridges have also proven their amazingly low record wear. This year, they have ever surpassed themselves.

First, there's the remarkable new ZLM with the unique ALIPTIC™ stylus. It combines the better stereo reproduction of the

elliptical stylus shape with the longer, lower wearing, vertical bearing radius of the Shibata shape. As a result, sound reproduction is completely transparent and clean. Individual instrument placement is more easily identifiable. And frequency response is ruler flat ± 1 dB to 20 kHz and $\pm 1\frac{1}{2}$ dB to 26 kHz. It tracks at $\frac{1}{2}$ to $\frac{1}{4}$ grams.

Then there's the new XLM MK II with the same reduced mass, tapered cantilever but with a true elliptical shaped nude diamond tip. It has 50% lower mass than our previously lowest mass XLM MK II. It tracks at $\frac{3}{4}$ - $\frac{1}{2}$ grams.

The OLM 36 MK II with the innovative Diasa elliptical nude tip also has excellent frequency response, wide separation, and an incredibly clean sound. It also tracks at $\frac{3}{4}$ - $\frac{1}{2}$ grams.

The OLM 34 MK III offers elliptical shape and tracks as low as

1 gram with flat response out to 20 kHz ± 2 dB.

The OLM 32 MK II is a 2-4 gram elliptical with great sound. It's one of the best budget ellipticals around.

And ideal for automatic changers, the OLM 30 MK III is a 3-5 gram conical stylus that's compatible with a wide range of stereo equipment.

The ADC cartridges. Think about it. You probably don't even know what you're missing.



A ESRE company
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Pickett District Road
New Milford, Conn. 06776

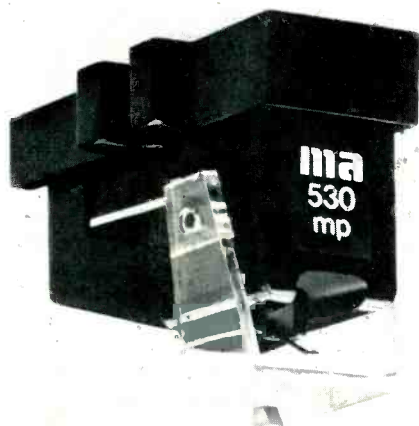
Nortronics Foam & Cleaner

The QM-85 Foam & Cleaner is a tape and rubber parts cleaning combination for audio, video, instrumentation, and digital recording equipment. The kit includes a liquid cleaner which loosens oxide and dirt accumulations without leaving a residue and reusable cellular foam swabs which are lint free and non-abrasive.

Enter No. 77 on Reader Service Card

Micro-Acoustics Phono Cartridge

The Model 530-mp phono cartridge features a twin-pivot design for transient ability, dual bearing construction, a built-in microcircuit, low mass design, and a V-groove lapped diamond stylus. Each cartridge has had an individual frequency response curve



which is packed with the unit. The frequency response is 5 Hz to 20 kHz ± 1.25 dB, a tracking force range of 0.7 to 1.4 grams, a cartridge weight of 4 grams, channel separation is nominally 30 dB @ 1 kHz and 15 dB @ 10 kHz, output voltage is 3.5 mV for each channel @ 5 cm/sec peak recorded velocity, and load requirements are from 10 to 100 k (not critical). Price: \$200.00.

Enter No. 78 on Reader Service Card

Sansui Preamplifier

The Model CA-2000 stereo control preamplifier features a separate headphone amplifier circuit, balance control, mode switch, and a 20 dB instant muting switch. In addition, two phono inputs are provided, one of which may be switched for 30, 50, or 100 kilohm impedance, and for either 2.4, or 8 mV sensitivity. Both feed a dual-transistor differential amplifier with current mirror that provides stability and transient response, together with overload capability of 1000 mV in the 8 mV sensitivity position. Stated RIAA accuracy is ± 0.2 dB. Provisions are made for a tuner, two auxiliary inputs, and two tape recorders, including a full reciprocal dubbing with or without

listening to the tape. A four-gang precision attenuator simultaneously regulates the gain of two stages in each channel. The bass and treble controls each have three switch-selected turn over frequencies, and two switch turn-over points are provided for the high- and low-cut filters. The specs are a frequency response of 10 - 80,000 Hz, $+0.5$, -1.0 dB; a THD of less than 0.03 per cent for nominal 1 V output and up to 12 V at 0.1 per cent THD; and an IHF hum and noise ratio greater than 75 dB in the phono position and greater than 90 dB on all other inputs. Price: \$440.00.

Enter No. 79 on Reader Service Card

Osawa Moving-Coil Cartridge

The Satin M-18X moving-coil cartridge designed for stereo and 4-channel operation, features a user-replaceable stylus and produces a 2.5 mV signal level for operation into a regular phono amplifier input. The cartridge covers the range from 10 Hz to 35 kHz and the recommended tracking force is 0.5 to 1.5 grams. Price: \$250.00.

Enter No. 80 on Reader Service Card

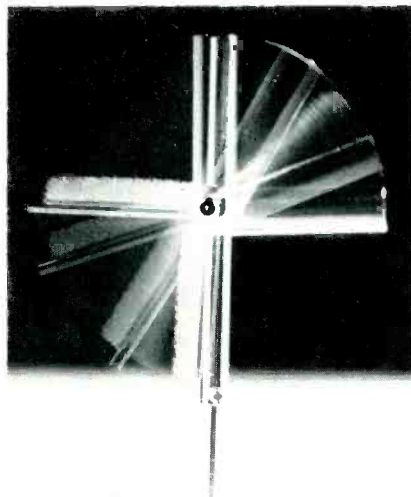
Audio-Technica Microphone Guide

The free 15-page instructional booklet *A Brief Guide to Microphones* explains all brands of microphones through use of the basic terms; dynamic, condenser, omnidirectional, unidirectional [or cardioid], proximity effect, feedback, impedance, and sensitivity.

Enter No. 81 on Reader Service Card

Monitor Audio Stylift

The Stylift, used with manual turntables, automatically lifts the tonearm off the record surface at the end of play to prevent undue stylus wear. Made of polished chromium steel, it lifts tonearms tracking at up to two

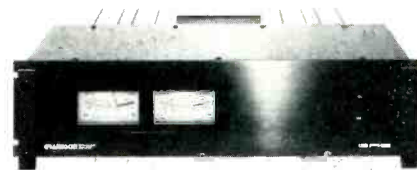


grams and has a counterweight attachment for heavier tracking tonearms. It requires a minimum of $1\frac{3}{8}$ in. (35mm) of height between tonearm and base, but no wiring is involved in the installation. Price: \$19.95.

Enter No. 82 on Reader Service Card

GAS Power Amplifier

The Grandson power amplifier features all complementary-symmetry, d.c.-coupled circuitry including a servo-control loop, an integrated circuit bias-current regulator, and thermal breakers to protect against overheating of the output semiconductors. The unit is rated at 80 watts per channel into 4 ohms, THD and I.M. distortions are 0.08 per cent from 15 Hz to 40 kHz, input sensitivity 0.7 volts rms for 80 watts into 4 ohms, rise time at full power and 20 kHz is 2 microseconds into 8 ohms, slew rate 20 volts per microsecond, TIM distortion 0.01 per cent, and noise (unweighted, wide band) 95 dB below full power output. Price: \$349.00.



Enter No. 83 on Reader Service Card

Ace Preamplifier

The Model 3100 preamplifier features a circuitry which uses both discrete operational amplifiers, and incorporates radio interference shielding with ferrite beads, IC power supply regulators, and IC phono circuitry. Phono input sensitivity is 1 mV for 1 V output, input impedance 47 K, harmonic distortion 0.01 per cent, equalization RIAA ± 0.5 dB, hum and noise -89 dBA. High level inputs for sensitivity is 0.1 V for 1 V output, input impedance is 33 K, IM distortion 0.01 per cent, flatness ± 0.1 dB 20-20 kHz, and the output voltage is 10 V. Price \$325.00.

Enter No. 84 on Reader Service Card

A.E. Corp. Function Generator

The Model 12 provides a voltage-controlled oscillator, output amplifier, sine shaper, level shifter, and power supply in a single package. The frequency range is 1 Hz to 1 MHz, 5 per cent accuracy, and 200 PPM/C stability. Output amplitudes are 20 V p-p in an open circuit and 10 V p-p into 100 ohms, TTL output is compatible with standard digital equipment. Price: assembled \$124.95, kit \$79.95.

Enter No. 85 on Reader Service Card

The new Auditor™ Series by Koss. Don't buy one unless your system is ready for it.

The pleasure of listening to unadulterated music is reserved for those who have carefully put together a system that delivers totally accurate reproduction. Now, for people who wish to explore and expand this realm of pure sound, Koss has designed their Auditor Stereo Headphones. Full, state of the art knowledge of perfect mechanical reproduction of music, and the psychoacoustics of the way the ear and mind respond to sound went into making these phones true to the most intense level of performance possible today.

The sound.

The Auditor Dynamic/10 features an expansive frequency response range of 10-20,000 Hz, while dazzling any ear attuned to the delicate musical balance of psychoacoustically pleasing sound, in a way no other dynamic phone can

duplicate. They are designed to deliver the full impact of letter perfect sound reproduction characteristic of the finest equipment.

And the fury.

On the other hand, for the most carefully designed and engineered excursion into sound ever, the Koss ESP™/10 Electrostatic Stereo Headphone is an unparalleled instrument of beauty. It is a perfectly articulated statement of technological and electronic genius so thoroughly sensitive it belongs in a recording studio serving as the last word in monitoring production. The ESP/10's almost boundless frequency response lays out the entire spectrum of sound for your scrutiny, bringing you every spark of timing, a deep, rich flood of bass, and a smooth, clear lake of treble, with every note balanced and defined.

So if you're content to live with the impurities in second best stereo, the

Koss Auditors aren't for you. Only the high-end connoisseur who has taken all the necessary steps toward putting together a system that is true to perfection will acknowledge and appreciate these precise products as breakthroughs in scientific musical development. The personal signature of John C. Koss says that these headphones are for the audiophile. So if you're ready for the best, and you think your system can measure up to the Sound of Koss, hear the headphones that are designed to put it to the test at a specialist in audio products near you. Or write to Fred Forbes, Audiophile Products Division, for more information on the new Auditor Series by Koss.



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Dynamic/10



ESP/10



auditor™ series by Koss

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Enter No. 22 on Reader Service Card

Dear editor

Tin-Foil Addenda

Dear Sir:

The following are errors which occurred in the article "Edison Tin-foil Phonograph" which appeared in the December, 1977, issue of *Audio*. On Pg. 60, "10.6 in. [27 cm] should be "12.0 in. [30.5 cm]." On Pg. 62, "December 6, '77" should be "December 7, '77". Finally, on Pg. 64, "Fig. 4" should be "Fig. 2"; "k is density, and 1 is" should be " ρ is density and σ is"; and "clamping" should be "damping."

Doing this project was a delightful and rewarding experience. I hope that the readership of *Audio* will enjoy reading about the machine that started it all.

Peter Hillman
Ithaca, N.Y.

Damaged Discs

Dear Sir:

30 May I add my comments to the enormous amount of vitriol spilled recently in the pages of *Audio* and elsewhere over poor disc quality? All of the blame for bad records has so far been placed where most of it belongs—on the people who make the things in the first place (and claim that they can, or will, do no better). However, no consumer can purchase a record directly from the manufacturer. We must depend ultimately on either a retail store or some form of demolition derby, such as the U.S. Mail.

Without discussing the mails, I am convinced that some of the problems experienced with poor discs have been caused by poor handling subsequent to manufacture. In other words, we are buying damaged discs, not poorly made ones.

Far too many record store clerks consider their merchandise only as something to be ordered, stacked, inventoried, and sold. I have seen bins stocked so full that the front records had to be bent in order to read the ones in back, and plenty of couldn't-care-less customers bending away, instead of removing a dozen or so and browsing through the rest in a more thoughtful manner. I have seen records stored book-shelf fashion with the end record flopped over and laying at a 45° angle!! (or, rather, !/). Clerks have tried to fill out a charge slip using my records as a desk.

Perhaps the worst thing I have seen occurred when an undisciplined brat, running unsupervised through a store, tripped and fell on a stack of records piled on the floor. He picked them up and ran on. Only he and I know that soon thereafter that store offered for sale 4 or 5 TJB albums that had literally been sat upon.

Here is an area where even a single record buyer can act directly to improve disc quality with no increase in price. Don't be afraid to ask to see the manager and complain whenever you are in a record store and see some predatory practice going on. The owner of a small store is much more likely to listen to a single customer than a multi-million dollar manufacturer. If he isn't, go elsewhere.

I ask *Audio* to run an article on the proper way to store records for sale, what to look for in a well-run shop, and how to complain when in a shop that isn't.

Bill Nabor
Azusa, Cal.

Renaissance Retort

Dear Sir:

In your September, 1977 issue I read a "Dear Editor" letter from Henry LeClair of San Diego. This "Audioophile's Renaissance" seems, instead, to be a return to the Dark Ages, due possibly to what I perceive to be a resistance to change on the part of Mr. LeClair. Since he may be harboring some misinformation, I thought I would venture a reply:

Dear Mr. LeClair:

If you are unfamiliar with modern stereo equipment, I suspect you might confuse "gimmickry" with "gadgetry," even though this distinction is often vague. For instance, properly designed high and low filters are very handy gadgets. Yet, sometimes, they are hastily added to amplifiers as sales "gimmicks" with little concern for an optimum cutoff frequency or rate of attenuation. Because of the countless varied components, accessories, and "gadgets" available today, "gimmicks" can easily travel in their guise. Then it's up to the intelligent consumer to sort them out.

Program sources have improved dramatically over the years, including

FM stereo and discs. I own many recently issued classical pressings, my only complaint being the occasional noisy disc, courtesy of recycled vinyl. Virgin vinyl is used in the new direct-to-disc recordings, the state of the recording art, so far. It is curious that I, as well as some of my friends, own several Command Classics recorded from 35 mm tape to disc, and they are all overly modulated into unbearable distortion. I have yet to hear of any tonearm/cartridge combination that can track them.

There has been a similar improvement in stereo equipment, especially in turntables, changers, arms, cartridges, and styli, as well as loudspeakers and outboard devices such as noise reduction units. One decade ago, a \$150.00 record changer with a 24-pole synchronous motor and belt drive was unheard of. Indeed, it would have offered state-of-the-art performance at a bargain price. Today, they've become commonplace. Not only are components improving, but they are becoming increasingly diversified, thanks to keen competition.

Lux (Audio Research, and others—*Ed.*) have made a strong case for using tubes instead of transistors in amplifiers, and their products are unquestionably excellent. Even so, an amplifier may be designed to meet any set of specifications using either transistors or tubes, so the decision as to which to use is, in itself, not a determining factor for the superiority or inferiority of the final product. Unfortunately, one can only lead a horse to water.

There seems to be no necessary correlation between cost and quality. The correlation is more apparent between cost and value—the higher the former, the lower the latter. It is entirely possible for a \$5000.00 system to sound inferior to a \$1000.00 system, especially if the purchaser is bent on buying status symbols, judging amplifiers by the weight of their heat sinks, and loudspeakers by the size of their cabinets. Those of us who choose to listen to our systems find that our fussiness, and consequently our needs, are a function not of what we listen to, but rather of how we listen to it.

Robert C. Kral
Berwyn, Ill.

Specification Miscalculation

Dear Sir:

It has come to our attention that the Parapalegic Equalizer, listed in your "Annual Equipment Directory" in the October 1977 issue of *Audio* carried the wrong specification size of a '77 Chevy. This could be a potentially serious mistake as a number of people are likely to begin to modify their living room walls in hopes of someday receiving their back ordered equalizer (delivery has been slow due to overwhelming demand). The Parapalegic is actually of a more traditional dimension—a '57 Chevy. This was felt to be a shape more suitable to our kind of customer.

We hope this notice will be of help to our potential customers, and so that those already hard at work, crowbar in hand, can begin to undo the damage.

Gerald Sindell
Rabid Audiophile Notions

dbx Lives

Dear Sir:

As a classical music lover and concert goer, I would like to know why today's disc does not sound as if one were present in the hall? No dynamic range is the answer. But there are records that do have it—namely, dbx II encoded discs. Your reviewers and testers have not explained this to the public . . . the purchase of a dbx II and a few records, when added to a good high fidelity system, can take the listener to the concert hall.

You have pushed four-channel high power amplifiers, low distortion, bi amps, etc. I have tried every way to make my system better to the tune of about \$4000.00. Nothing has satisfied but the few dbx II encoded recordings. I would gladly trade any five of my regular discs for one dbx II encoded disc.

Since I am a funeral director, I have nothing to push in sound reproduction except to hope that I may soon be able to purchase more dbx recordings.

Charles E. Hagen
Plymouth, Pa.

Radio Remembrances

Dear Sir:

I really enjoyed Mr. Stosich's article in the January, 1977, issue of *Audio*. He is a fellow enthusiast and collector of E.H. Scott radios. This is the first time that I have seen a thorough discussion on the technical aspects of these receivers. Of course, there are plenty of contemporary articles available, mostly in *Radio News*, but they seem to have a gee whiz attitude, which leads one to think that, perhaps, their reviews were colored a

bit. On the other hand, the receivers were very advanced for their day and so the attitude may be genuine.

I am currently restoring the tuner and amplifier chassis of a Berkshire, RCA's entry into the high-quality radio field in 1948. Apparently this unit was originally a built-in, as no cabinet for it has survived. Currently, the unit I have is operating extremely well on FM, but the AM bands (0.50 to 23 MC) need attention.

Did *Audio* ever do an Equipment Profile of this receiver around 1948?

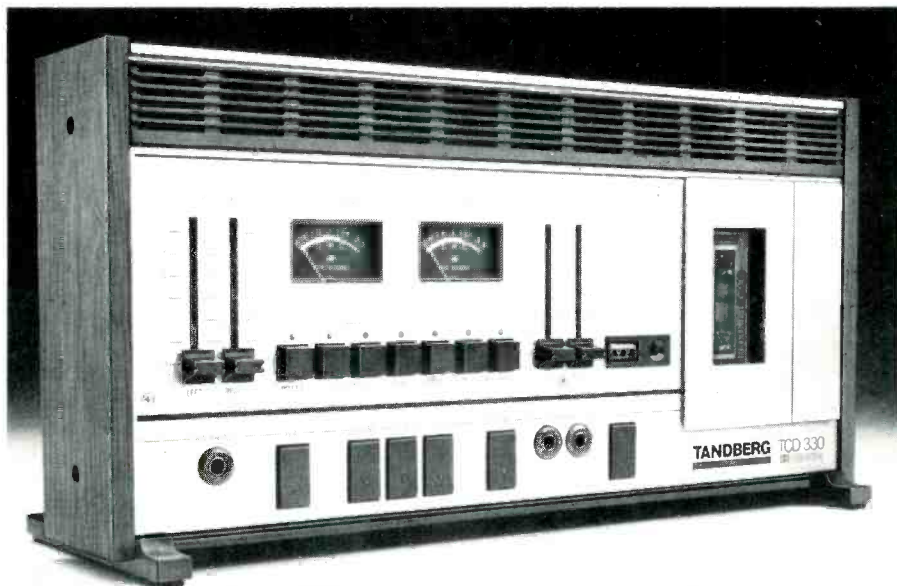
It is interesting to contrast, or compare, the features and operation of the

RCA and its contemporary at E.H. Scott, the 800B. It is my understanding that one or more ex-Scott personnel worked on the Berkshire. It would be interesting to hear from any old timers who worked on either the 'Berkshire' or the E.H. Scott as well.

Also, the members of the Classic Radio Club would like to know of any owners of these radios in your readership for our mutual benefit.

Bob Fabris
3626 Morrie Dr.
San Jose, CA 95127

(Editor's Note: The Equipment Profiles weren't started until 1952.)



TANDBERG ALONE OFFERS REEL-TO-REEL PERFORMANCE FEATURES IN A CASSETTE DECK

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These & other features found exclusively on Tandberg's TCD-330 make it not only the finest cassette deck, but also the cassette deck with performance exceeded only by the best reel-to-reel machines. Three separate heads for no-compromise recording & monitoring. A 3-motor, dual capstan closed loop transport, coupled with complete logic-controlled solenoid operation. Adjustable azimuth & built-in 10kHz tone generator, allowing the user to select the perfect alignment for each cassette, as well as spot dropouts and inferior tape. Equalized peak-reading meters. Automatic take-up of tape loops when cassette is inserted. Servo-controlled high speed winding. Vertical or horizontal operation, plus optional remote control & rack mounting.

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The bookshelf

Modification Manual For Vacuum Tube Electronics.

Audio Dimensions, Inc., Suite K, 8898 Clairmont Mesa Blvd., San Diego, CA 92123. Price \$25.00.

Are you an audiophile who builds, uses, or modifies tube equipment? If so, you may be interested in the **Modification Manual For Vacuum Tube Electronics**. The basic manual is a catalog of preamps, power amps, and their power supplies. A few other interesting schematics are presented here and there, including a dynamic expander and a nuvistor sub-preamp. As the title implies, most of the circuits are aimed at modifying commercially manufactured gear or kits.

The position taken by the author/editor of the manual contends that vacuum tube audio circuits are absolutely superior to transistor circuits for voltage and power amplification and electronic crossovers, while peripheral functions, such as equalization, companding, and noise suppression, are usually done better with solid state devices. The emphasis has been placed on the sonic performance, although the introduction states that the circuits' measureable performance has been "validated by the finest test equipment available."

Although the author expects many readers to be far more technically qualified than himself, he remarks that modern technology has neglected the vacuum tube, and that few engineers have been given more than a cursory look at tube theory. Unfortunately, readers will not find much in the manual to answer their theoretical questions, and those less familiar with the rigors of electronics may be misled by technical errors or unfounded generalizations. For example, when the author is discussing the difference between a tube and transistor power amplifier, he states: "This is usually attributable to the predominance of second harmonics, in the Eico's output, and to the fact that the output of a transistor is the logarithm of the input voltage, whereas the output of a tube is linear." (Fortunately, Nelson Pass wrote a letter, subsequently published, which rectified this erroneous statement for those not technically minded.)

Circuit modifications range in complexity from the simple addition of a bypass capacitor to the total replacement of all circuit components including external capacitors and transformers. Both power amp and preamp modifications are presented as a series of steps, each complete in themselves. It is left to the reader to decide how far he wants to go. Since the instructions are rarely stated in great detail, it must be assumed that the modifier has had sufficient technical experience to interpret and implement the text. A handy scheme is shown for checking the tracking of dual pots using a battery and a meter. The instructions involve observing fluctuations on the meter. Since no guidelines are given for the type of meter to use, or the sensitivity of that meter, the reader must either already know or must find out what response is acceptable. The easiest modifications to perform are those for the popular Dynakits because they are the most detailed. A typical step for a Stereo-70 mod goes: "The two red leads (perhaps faded to pink) from the transformer are connected to the unbanded ends of the first diodes. . . ."

Some judgment should be enlisted before digging into the more sophisticated projects, especially when not following the step-by-step instructions. Is the dual differential amplifier driver labeled the Perfect (?) Amplifier, going to blow away your Marantz 9 input and driver? Suppose that you build the nuvistor pre-preamp recommended by ADI but find it unusable in your system due to the microphonic problems with these tubes? What if you cannot stand 10 times the noise of your transistor pre-preamp? The manual too often skirts such possible limitations; allowing the reader to choose alternative circuits might be satisfactory for a particular use.

Nevertheless, the manual will provide a wealth of ideas to those interested. One may see a great cascode preamp front end, and try it with much success in an output stage. Most of the modifications do make good sense too. One often suspects that a manufacturer would have liked to put in those larger filter capacitors or some metal film resistors in place of

a less expensive type. Such practice is worth the few dollars and hours.

In addition to the basic Manual (with supplements 1 & 2), there are now at least three more supplements. The latest supplement includes Dahlquist speaker mods, reports on an unusual cartridge, and other varied and interesting data. It is encouraging to see that each supplement seems to be better than the previous.

So if you are interested in building or modifying for performance some tube apparatus, or you want to upgrade your system on a limited budget, you will want the Manual in your library. The cost is \$25.00 for the book and all previous supplements, and future supplements on a bi-monthly basis. In addition, those that buy the manual can consult ADI without charge if they encounter any stumbling blocks and need assistance. If all this appeals to you, contact ADI.

George Pontis

The Album Cover Album: Edited by Hipgnosis and Roger Dean. Dragon's World, softbound, 160 pages, \$10.95.

There's so much to like about **The Album Cover Album** that it's difficult to know where to begin.

This is one of the few books I've encountered which attempts to portray album cover artwork as an art unto itself, distinct from the music. (I'm not counting Roger Dean's **Views**, a one-man show which made no pretense to the overview that **Album** has. However, let me add that Dean's book is absolutely beautiful to behold and its success made the present volume possible.)

Cunningly assembled and designed by English record design wizards Hipgnosis, who deal primarily with photographic effects in their work, and Roger Dean, who is best known for the remarkable series of paintings he did for Yes, **The Album Cover Album** is obviously a labor of great love and affection. As a large-sized book—a foot square, nearly the same as your basic record album—and lavished with vivid color reproductions, **The Album** is a banquet for the eyes, with many fine, little, almost imperceptible touches. The covers on a given page have been coordinated to that page's mat color.

Nikko Audio Puts It All Together for Your Professional Component System

Nikko builds more than outstanding professional components and separates. And for good reason.

Firstly, we don't think stereo gear of any sort should be spread willy-nilly over the studio.

Secondly, we've created these designer-crafted hand-rubbed walnut veneer equipment racks. And in keeping with our professional attitude, two of the hardwood cabinets are 19-inch standard width.

Thirdly, we've made it possible for you to assemble three fantastic custom packages to fit the cabinet of your choice.

End of commercial on cabinets.

We now invite you to read about a few of Nikko Audio's newest electronic products.

As with every Nikko Audio product features abound in the NT-850 (far top), an AM/FM stereo tuner.

A switchable (normal/narrow) IF band and advanced circuitry are employed to insure low distortion, signal stability, maximum stereo separation and outstanding reception.

Below the tuner is the NA-850 integrated stereo amplifier. It delivers 60 watts, continuous power output, minimum RMS per channel, driven into 8 ohms from 20 to 20kHz, with no more than 0.05% THD.

Take a hard look at the cabinet below with the Gamma I stereo FM broadcast monitoring tuner. A simply remarkable product.

It has a switchable wide and narrow IF stage for low distortion, high sensitivity ($1.8\mu\text{V}$) and the ability to pull in distant stations with clarity.

Nikko Audio's ultra-slim stereo preamp, the Beta II, has both an input equalizer and amp circuit powered by independently regulated voltage supply to help eliminate interference distortion. There is no end to its professional features.

Each dual power supply on the Alpha II power



amplifier has dual filters to eliminate channel crosstalk and improve stereo separation. Exterior heat sinks keep the amp running cool, necessary when it delivers 110 watts per channel, continuous power output, minimum RMS into 8 ohms, from 20Hz to 20kHz, with no more than 0.03% THD.

The heavyweight of the new Nikko Audio professional gear is the Alpha I basic stereo power amplifier, shown in the bottom cabinet.

However, there is nothing really basic internally about the Alpha I. It uses a 3-stage Darlington direct-coupled OCL, pure-complementary quadruple push-pull circuit, rarely found on anything less than exotic amp circuits.

The Alpha I delivers 220 watts per channel, continuous power output minimum RMS per channel into 8 ohms from 20Hz to 20kHz, both channels driven. THD is 0.08%.

The revolutionary Beta I preamp's circuitry consists entirely of high-voltage FET's. It's a mate to the Alpha I and is DC and non-coupling for better frequency response.

The Gamma I stereo FM tuner also appears in the lower cabinet below the Beta I stereo preamplifier.

Now, that's enough product

and specs to satisfy the most discerning audiophile and professional.

Ask your Nikko Audio dealer for a definitive tour of the new Nikko product line.

Nikko Audio

For those who take their stereo seriously

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In Canada: Superior Electronics

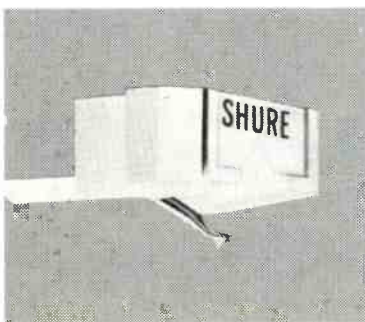


Needle in the hi-fi haystack

34

Even we were astounded at how difficult it is to find an adequate other-brand replacement stylus for a Shure cartridge. We recently purchased 241 random styli that were not manufactured by Shure, but were being sold as replacements for our cartridges. Only ONE of these 241 styli could pass the same basic production line performance tests that ALL genuine Shure styli must pass. But don't simply accept what we say here. Send for the documented test results we've compiled for you in data booklet # AL548. Insist on a genuine Shure stylus so that your cartridge will retain its original performance capability—and at the same time protect your records.

Shure Brothers Inc.
222 Hartrey Ave., Evanston, IL 60204
In Canada: A.C. Simmonds & Sons Limited



Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

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The mats themselves are arranged with sequential coloring that creates a real flow and pulse to the book. There are passages that subtly build, covers set in gradually increasing size and intensity until a full-page illustration explodes. Thus, the page designs vary consistently, giving the whole a life and verve few art books match.

In designing different parts of the book, and indeed individual pages throughout, Dean and Hipgnosis used an amazing number of clever hooks. The brief, illustrated design history at the front of the book effectively contrasts the garish pop music covers of the 50s with the cool designs of that era's jazz albums, which in turn opened valuable design frontiers that helped bring on the psychedelic explosion in designs of the late 60s. The bright tan mats of the earlier albums yield dramatically to softer tones in shades of grey for the 70s. There are page displays on ways to use an individual portrait, how to use a group, different expressions of couples. Surprising similarities strike you in the use of train images and especially in the use of automobile imagery. A page shows views inside cars, and another shows variations on the false impression of a wrapped package. One page deals with stylized logos, and another with variations on Chicago. A delightful two-page spread shows albums with covers painted by the recording artist (Joni Mitchell, Bob Dylan, Cat Stevens, and others).

Some pages just look nice together. A powerful four-page sequence has four portraits to a page; softly focused ladies opposite stylized and distorted men, followed by contorted, kinky females opposite male model-type portraits. Coincidentally, both Carly Simon and David Bowie appear twice in the four pages.

Record fans will appreciate the text pieces. The forward gives a concise illustrated history of record wrappings, while the afterward relates the path of a cover from the art director through execution to the completed and stuffed commercial product. Both pieces are clear and succinct, adding much to the book.

The big point is that **The Album Cover Album** is all anyone could have hoped it would be. If you carp about certain selections, there are doubtless 15 others that will surprise and even delight you. And it does make the perfect holiday gift this year. Try to get an extra copy for yourself if you can't con someone else into giving it to you, but make sure you get to see it, because all any other designer can hope to do now is to equal this indispensable volume. *Michael Tearson*

John Hammond on Record: Autobiography with Irving Townsend
Ridge Press/Summit Books, 416 pages, Hardbound, \$12.95.

No thrill in the process of recording music exceeds that of the man who hears something nobody else has heard before, then brings it to other people to hear, and watches a star being born before his amazed eyes. That kind of a thrill has not happened to anyone as often as it has to the legendary John Hammond. His discoveries include Billie Holiday, Count Basie, Teddy Wilson, Charlie Christian, Helen Humes, Aretha Franklin, George Benson, Bob Dylan, and Bruce Springsteen. Others he has championed include Pete Seeger, Leonard Cohen, Bessie Smith (who under his direction, late in her career, recorded *Gimmie a Pigfoot*), and Hammond's distinguished brother-in-law Benny Goodman.

I was previously acquainted with the man through the records that he has been instrumental in recording and the reissues he has assembled (there is a full discography included in the book). The autobiography begins his story in youth as a descendant of the Commodore Vanderbilt in a family of considerable wealth, and how, in spite of this, he forged an intense egalitarian spirit along with the mind of a reformer. Later, he served on the NAACP board for over 30 years, a side of his person previously completely hidden from me. Later, as a reporter, he covered the explosive and infamous Scottsboro trials for *The Nation*. Avoiding the easy way out, he enlisted during WW II, and the account of his private war with the Army is delightful.

The core of the book, naturally, is the recollecting of the 30s and Hammond's era of discovery, in which you get rare personal glimpses into many great musicians. Hammond's narrative is comfortable, like hearing him ramble on, sitting in front of a fireplace. He relates his thrill of making a discovery and the remarkable enthusiasm it would create in him. His greatest love (outside of his family, I'm sure he would hastily insert) is to be moved by great music, great performances, and great performers.

Hammond also mentions his failures. One eloquent example discusses his inability to properly capture Aretha Franklin on record only to watch Jerry Wexler of Atlantic make it all click. The autobiography also reveals plenty about company politics, as well as the opportunities offered by large companies like Columbia, and smaller outfits such as the early Mercury or Vanguard Records, labels which John worked for.

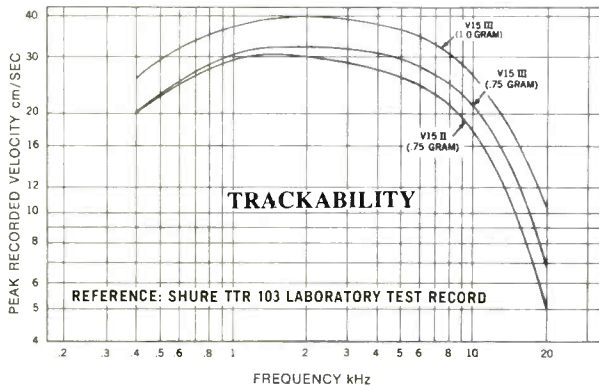
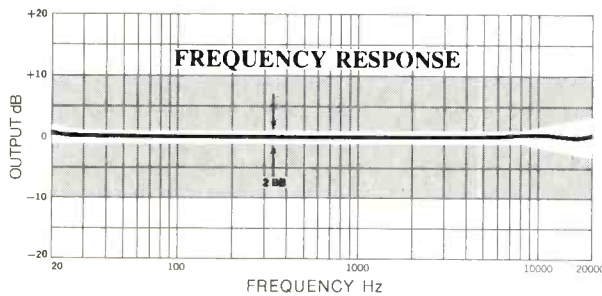
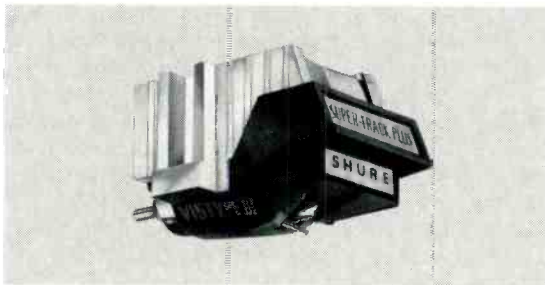
Michael Tearson

AUDIO • February 1978



fact: “off-the-shelf” Shure cartridges perform like Shure “critics’ samples”

Whether you purchase your Shure cartridge in Evanston, Illinois or Evanston, Wyoming, in Osaka, Sydney, London, Lima or Casablanca . . . you can be confident it will perform well within its stated specifications. Independent critics around the world buy Shure cartridges off dealers' shelves and subject them to rigorous tests. We have built our reputation on an unwavering uniformity and strict adherence to the high standards of our Master Quality Control Program.



OUR “BEST” IS OUR TYPICAL

Shure's painstaking Master Quality Control Program insures that every Shure cartridge and stylus will perform as well as our laboratory reference units. And each cartridge must meet or exceed its published specifications. All critical performance tests are imposed on 100% of all Shure V15 Type III cartridges and styli, including (a) frequency response for each channel, (b) output level, (c) channel balance, (d) crosstalk between channels, (e) trackability, and (f) anti-collapse assurance. Fact is, Shure quality control is state-of-the-art.

FREQUENCY RESPONSE:

Every Shure V15 Type III cartridge must display exceptionally flat frequency response over the audible spectrum. Each is individually tested to be within $\frac{3}{4}$ dB from flat frequency response for each channel. This limit is actually more demanding than the envelope shown. Those that fail this stringent frequency response test are rejected. And only those cartridges that pass Shure's intensive Quality Control Tests make it to your local Hi-Fi Store.

TRACKABILITY:

Shure pioneered the trackability concept over a decade ago in response to the need for a single relevant measurement of total cartridge and stylus performance. Trackability has been accepted by audio authorities as the definitive measure of how well a cartridge and stylus perform on today's increasingly "hot" recordings. Every Shure V15 Type III cartridge must pass extensive trackability tests.

Send for High Fidelity Catalog AL210T.

outperforms the best of the rest:



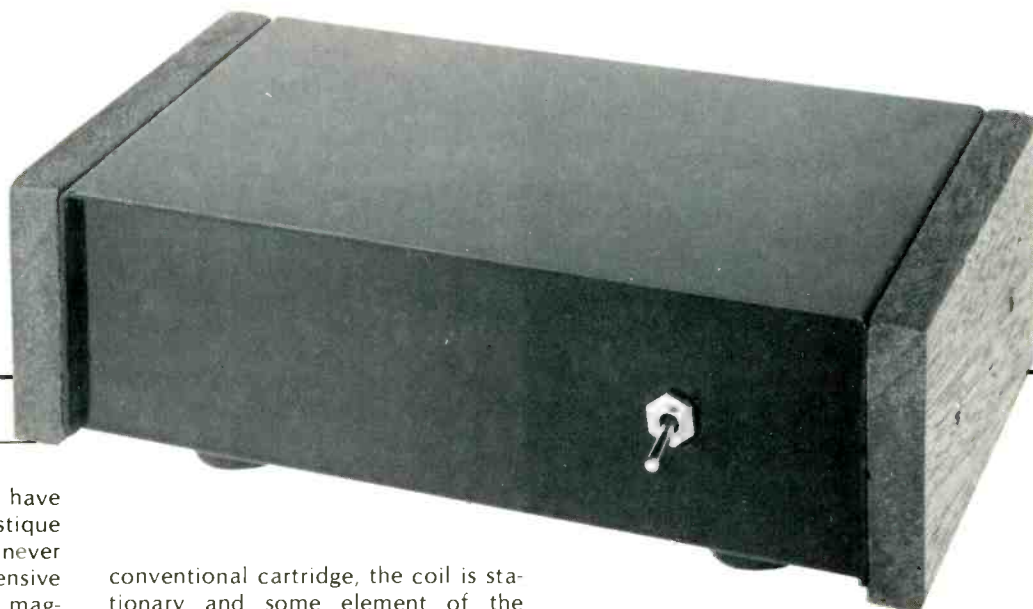
V15 TYPE III

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Build a pre- preamp

W. Marshall Leach*



36

Moving-coil phono cartridges have probably been regarded with mystique by most audiophiles who have never used them. Not only are they expensive when compared to a standard magnetic cartridge, but they require either an impedance-matching transformer or a pre-preamp which must be inserted into the reproducing chain between the cartridge and the RIAA preamplifier. Either of these necessary items can cost as much or more than the cartridge itself. Therefore, most audiophiles have probably never owned a moving-coil cartridge, and many have never even heard one.

The operation of moving-coil cartridges is based on the same laws of physics on which magnetic cartridges operate, that is, a mechanical force which is proportional to the groove modulation on a phonograph record is used to change the magnetic flux linkage in a coil of wire. The corresponding voltage induced in the coil is equal to the number of turns in the coil multiplied by the time rate of change (or time derivative) of the magnetic flux linkage through the coil. This voltage is then applied to the phono input of a preamplifier which performs three basic functions. The preamplifier must have adequate gain to boost the input voltage to a level that is sufficient to drive a power amplifier. It must correct for the time derivative response of the magnetic cartridge. Lastly, it must equalize for the RIAA recording characteristic used by the record industry today. With a moving-coil cartridge, a preamplifier can generally perform only the latter two functions.

The principal difference between a moving-coil cartridge and a conventional magnetic cartridge is the mechanical mechanism which is used to vary the flux linkage in the coil. In a

conventional cartridge, the coil is stationary and some element of the magnetic circuit is attached to the phono stylus. The motion of this element changes the flux linkage through the coil and generates the phono signal. Thus, we have moving magnet, variable reluctance, etc., cartridges. In contrast, as the name suggests, a moving-coil cartridge has the coil attached to the phono stylus. The motion of the coil itself changes the flux linkage and generates the phono signal. However, there is one major exception. The output signal from a moving coil cartridge is 20 to 30 dB less than the signal from a conventional magnetic cartridge.

The output impedance characteristic of moving-coil cartridges differs radically from that of conventional cartridges. In conventional cartridges, it is typically 2,000 to 3,000 ohms resistance in series with 500 to 1000 millihenries inductance. This very large inductance causes the output impedance at high frequencies to become very large. The input impedance to preamplifiers which have inadequate high-frequency loop gain can become capacitive at these frequencies. In combination with the cartridge output impedance, this can cause some weird frequency response aberrations. The cartridge inductance and preamplifier capacitance will generally cause a severe loss of high frequencies. Depending on the damping in the circuit, a resonant peak can exist in the high frequencies just below the rolloff frequency. This is one of the reasons that different cartridges can sound so different with a given preamplifier. The sound differences are caused by the interaction of the different cartridge output impedances with the preamplifier input impedance.

In order to eliminate all cartridge-preamplifier impedance interactions, two approaches can be taken. The first is to use a phono preamplifier which exhibits a very low input capacitance. The author has described such a unit which has no more than 20 picofarads input capacitance [1]. (R3 in this reference should have been 39 ohms and not 390 ohms.) Even with this low input capacitance, the phono cable capacitance in combination with the preamp capacitance can cause interactions with some cartridges. Thus, the second approach is to reduce the output impedance of the cartridge until it is low enough to drive a capacitive load with *no* impedance interactions. A moving-coil cartridge has this characteristic. (The particular cartridge used by the author will drive a 2 microfarad load with no measured loss below 12 kHz.) Unfortunately, the output signal is too low to drive a normal phono preamplifier stage directly.

There are two approaches to interfacing a moving-coil cartridge to a preamplifier. The first is to use a step-up transformer which steps up the voltage to a level sufficient to drive the preamplifier. Unfortunately, this is not always a good solution for two reasons. First, the transformer is very susceptible to hum pickup, a problem which has caused many to abandon moving-coil cartridges. Second, the output impedance characteristic of the transformer can be as bad or worse than that of a conventional cartridge.

Enter the pre-preamp. This is an active circuit which boosts the moving-coil cartridge output signal by 20 to 30 dB, while exhibiting a purely resistive output impedance in the range of the output resistances of conventional cartridges. Thus, the impedance interac-

*Georgia Institute of Technology
Atlanta, GA 30332

SPECIFICATIONS

Gain: 26 dB ($\times 20$) ± 1 dB with a 9-volt power source.

Input Impedance: 100 ohms.

Output Impedance: 2000 ohms.

Lower -3-dB Frequency: Less than 1 Hz.

Upper -3-dB Frequency: 150 kHz.

A-Weighted S/N Ratio: 85 dB referenced to a 1000 Hz, 1 mV input signal. Measured with an RIAA equalized preamplifier following the pre-preamp, and the pre-preamp input jacks

shorted. The figure is corrected for noise contributed by the preamplifier.

THD: Measured at 1000 Hz with a source impedance of 10 ohms: At 10 mV the second harmonic and third harmonic are both -73 dB. At 30 mV the second harmonic is -73 dB and the third harmonic is -70 dB. At 100 mV output the second harmonic is -73 dB and the third harmonic is -50 dB. Note: The limit of the spectrum analyzer is -73 dB.

tions are eliminated, and the hum problem can be virtually eliminated. Is there anything audible to be gained? The answer to this question depends a lot on the preferences of the listener and his system. However, a moving-coil cartridge and pre-preamp can reveal details in recordings that can be a surprise to hear. This is particularly true with recordings of voices and acoustic instruments. The bow of a violin, the plucked strings of a guitar, the sheen of brushes on cymbals all exhibit the detail, depth, and definition of a live performance. The reproduction can also become so clean that previously unheard distortion on a record will become audible. Even the tiniest dust ball on the stylus becomes annoying long before it would have on the stylus of a conventional cartridge.

This article describes the construction of a push-pull pre-preamp which is both inexpensive and simple to build. It has a gain of about 26 dB and a resistive output impedance of 2000 ohms. Since it uses no negative feedback, it cannot oscillate or exhibit slewing and TIM distortions. To

eliminate hum, it is battery operated. In addition, it is d.c. coupled to the cartridge for reproduction of the lowest recorded frequencies. An unusual feature of the circuit is its isolation of all d.c. bias current and voltage from the cartridge, even though the cartridge is d.c. coupled to the circuit.

Circuit Description

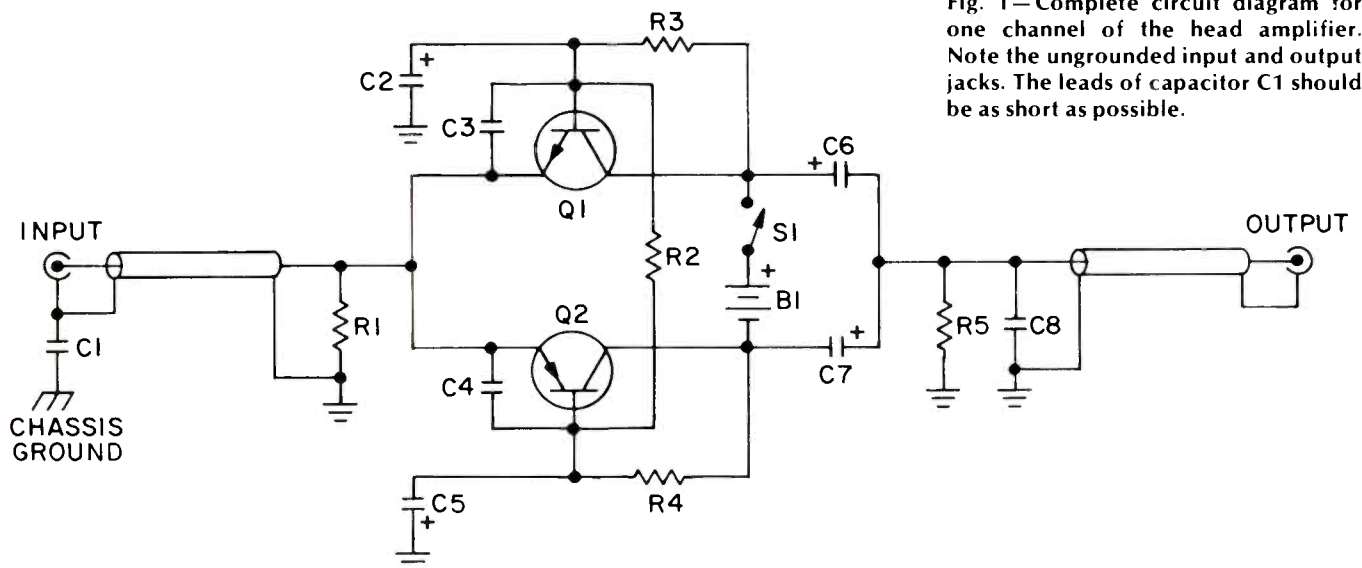
The first stage in the design of any circuit is that of deciding on a circuit configuration or topology which will, we hope, meet the design objectives. In the present case, the circuit must be designed to interface a moving-coil transducer which has a very low output impedance of 3 to 30 ohms to the high input impedance of a phono preamplifier. At the same time, the circuit must have a gain in the range of 20 to 30 dB. Some moving-coil cartridges have an output impedance higher than 30 ohms with a corresponding increase in output signal level. Thus, it is desirable that the circuit gain decrease with cartridge output impedance so that the phono preamplifier will not be

overloaded by the higher level moving-coil cartridges.

One transistor configuration which meets these requirements is the grounded-base amplifier. This circuit has a very low input impedance, operates with a current gain of unity and, thus, has an extremely wide bandwidth; its voltage gain can be easily set by varying its load impedance, and its input impedance characteristics can be adjusted so that its gain decreases for cartridges whose output impedance is greater than 30 ohms. However, there is one problem... the very low input impedance of a grounded-base amplifier requires very large input coupling capacitors for acceptable low-frequency response.

The requirement for an input coupling capacitor can be eliminated if there is no d.c. offset voltage at the circuit input. One way of achieving this is shown in the circuit of Fig. 1. This shows two complementary grounded-base amplifiers which are connected in parallel between the signal input and output. The circuit is powered by a single 9-volt battery which floats with

Fig. 1—Complete circuit diagram for one channel of the head amplifier. Note the ungrounded input and output jacks. The leads of capacitor C1 should be as short as possible.



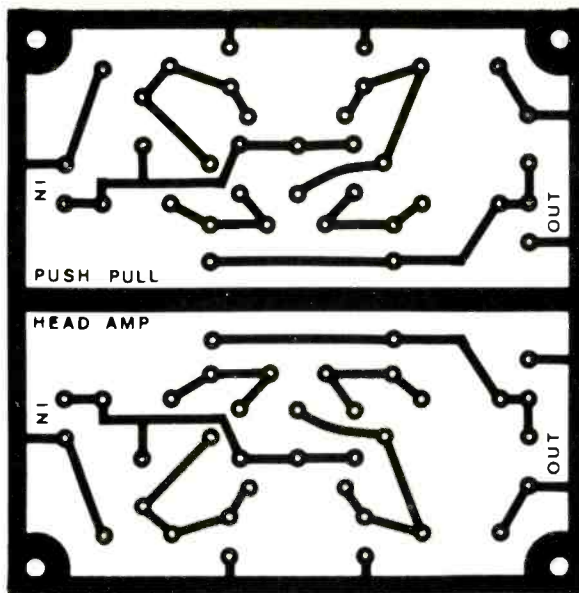


Fig. 2—Circuit board foil pattern for a two-channel head amplifier. This view is from the copper side of the board.

respect to ground. Thus, it is impossible for a d.c. current to flow through a cartridge connected to the signal input.

The operation of the circuit in Fig. 1 is very simple. Once switch S1 is closed, a current flows from battery B1 through resistors R3 and R4. This current slowly charges capacitors C2 and C5 until the base voltages of transistors Q1 and Q2 reach their cut-in voltage. At this time, Q1 and Q2 begin to conduct and the circuit will amplify. Quiescently, Q1 and Q2 conduct approximately 125 microamperes. This low current insures long life for the battery B1. To understand how the circuit amplifies, consider a positive-going input signal. Since Q1 is an n-p-n transistor, its current decreases. The current in Q2 increases since it is a p-

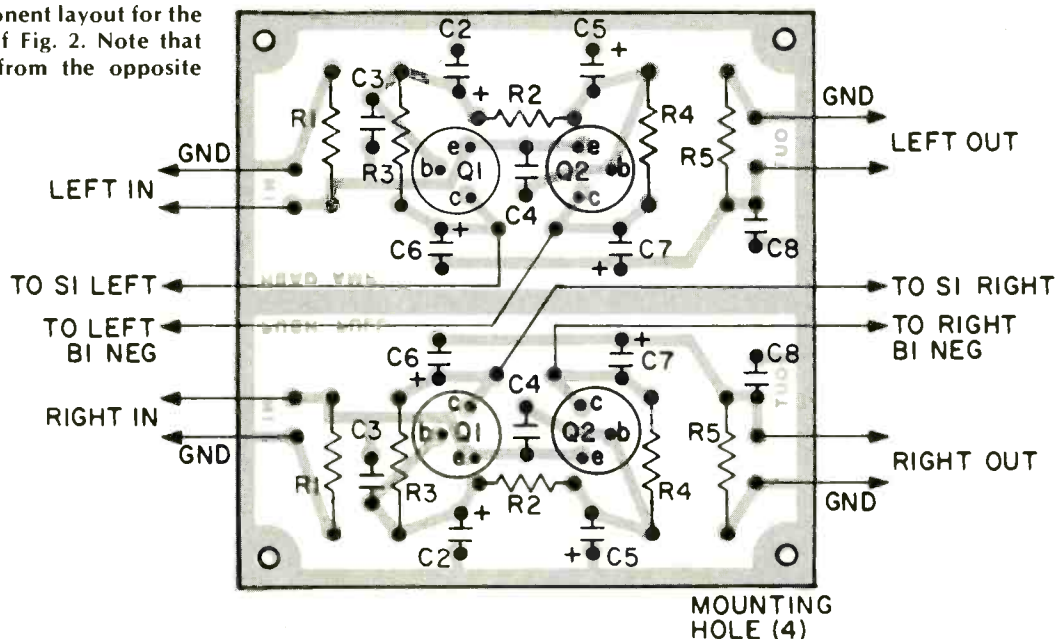
n-p transistor. This action unbalances the circuit and causes a signal current to flow through coupling capacitors C6 and C7, and to ground through resistor R5. This in turn generates an output voltage. A negative-going input signal causes an output voltage in a similar way.

Since an input signal always causes an increase in the conduction in one transistor and a decrease in the other, the circuit operation is true push-pull. This makes the distortion very low and eliminates the need for negative feedback for good linearity. SMPTE IM distortion measurements on the pre-amp in combination with a Crown IC-150 preamp show an IM distortion of 0.015 per cent and 0.017 per cent in the two channels at 1 V rms output from the tape output jack on the

preamp. These figures increase to 0.024 per cent in each channel at a 4 V rms output level. A 4 V rms 1M test waveform has a peak-to-peak value of 13.72 volts. This is far greater than any cartridge would produce. The Crown gain in each case was 40 dB at 1000 Hz.

Since the pre-preamp circuit is used to amplify very low signals on the order of one millivolt and less, r.f. interference suppression is an important consideration. Capacitors C1, C3, C4, and C8 in Fig. 1 serve this purpose. These capacitors are small enough so that they are open circuits for all audio frequency signals. However, they are low impedance elements to r.f. signals, which prevents radio, TV, ham, and CB transmissions from interfering with the circuit. Should r.f. interference be a

Fig 3—Component layout for the foil pattern of Fig. 2. Note that this view is from the opposite side of Fig. 2.





The Luxman 5T50

The Laboratory Reference Series tuner. A very remarkable component—by itself or as part of a complete LRS system.

Although the LUX Laboratory Reference Series was conceived—and introduced—as a completely new concept in systems, we believe you'll find the LRS tuner alone merits special consideration.

At a glance, the 5T50 is strikingly clean and elegant. The tuning display itself is digital, supplemented by what might be considered an advanced touch of nostalgia for the dial of old. One linear dial is calibrated in 1 MHz increments, and another provides for 200 kHz indication. However, instead of a pointer, LED's traverse the dials, giving linear readout of tuned stations.

Electronic tuning and memory.

Tuning is accomplished electronically, by a touch on either of two buttons. Station selection can be switched to either manual or automatic scanning mode, and tuning speed can be adjusted from slow to rapid. A further tuning option is provided through the tuner's C-MOS IC memory system, which stores seven stations in digital code. A touch of the appropriate button provides instant reception, with the station exactly center-tuned.

Tuning accuracy within 0.003 per cent.

Tuning is always exact, no matter how you select the FM station. Using a quartz crystal frequency synthesizer instead of a tuning capacitor and coil assembly, the 5T50 gives a degree of accuracy (within 0.003 per cent) and stability that cannot be found in conventional tuners. The station is received center-tuned and it remains that way—just as accurate and as stable as the FM transmitter frequency itself—which, for reasons of precision, is also referenced to a crystal.

But the utmost in design and performance doesn't stop here. From front end to output terminals, the 5T50 utilizes the best circuitry. For example, dual-gate MOSFET's in the RF amp and mixer. And a buffer circuit—which helps achieve outstanding image, IF and spurious response rejection—follows the crystal oscillator. In the IF section, a ceramic filter plus two pairs of 4-pole block filters provide for excellent

selectivity without sacrificing low distortion characteristics. A double-tuned quadrature detector also keeps distortion low, at the same time protecting against signal overload. And to assure excellent stereo separation (45 dB at 1kHz and at least 40 dB at high and low frequencies), the multiplex section employs a Phase-Locked-Loop circuit.

Special tuning refinements.

To help you take advantage of this advanced internal design—which includes a Dolby* decoding circuit for Dolbyized FM broadcasts—we've included a number of advanced external features. So tuner operation is just as precise as performance. For example, a multipath check button lets you detect multipath distortion audibly—no need for an oscilloscope. There's also an antenna attenuator for adjustment if signals are too strong in your reception area. For quick level adjustment when recording Dolbyized broadcasts, a 400-Hz test tone button is provided. The tuner output level is adjustable, along with interstation muting threshold. A digital display provides easy-to-read signal strength indication. And if incoming signals are weak, there's a high blend noise filter to assure low-noise stereo FM.

Other LRS components.

Of course, only you know if you're considering a new tuner at this time, or an entirely new system. If the latter, we'll simply advise you that the LRS system has carried the separates concept to "an extreme." That is, the preamplifiers have no tone controls—these are provided by the LRS graphic equalizer or separate tone control unit. The power amplifiers are available with or without meters—supplemented by a separate LED peak indicator. And if low distortion is important to you, the total harmonic and IM distortion of the LRS power amplifiers at rated power is no more than 0.008 per cent. That's double-0 eight.

However, if a superb tuner is really all that interests you at this time, that's fine. Chances are you'll see and hear it as part of the complete LRS system—where it will look and sound the most impressive. Suggested price: \$1,495.

*Dolby is a trademark of Dolby Laboratories, Inc.

LUX Audio of America, Ltd.

160 Dupont Street, Plainview, New York 11803 • In Canada: White Electronics Development Corp., Ontario

problem, ferrite beads can be installed around the center conductor of each input and output cable. These are sometimes hard to find, and a simpler solution may be to install a 0.1 mF capacitor across the phono input jack for each channel. Since the output impedance of a moving coil is so low, this will in no way interfere with the circuit.

Construction Details

The circuit construction is very simple and requires no special instructions. The pre-preamp cannot oscillate since no negative feedback is used, therefore, component layout is not critical. Figure 2 shows the recommended stereo circuit-board foil patterns. The corresponding component locations are shown in Fig. 3. The view in Fig. 2 is from the copper side of the board while that in Fig. 3 is from the component side.

For proper hum and r.f. interference rejection, the circuit board and associated components should be mounted in a shielded enclosure as is shown for the author's unit. The input and output phono jacks *must* have their grounds isolated from chassis ground if proper r.f. and hum rejection are to be realized. Phono jacks with floating grounds are available on the market. However, the unisolated ones can be easily isolated from ground by installing them into an appropriate size grommet between the phono jack and chassis ground. This was the case with the pictured author's unit. In this case, the lip on one side of the grommet was cut off to form an extruded washer, after which it was inserted into a proper size hole in the chassis. A flat metal washer was installed on the phono jack, and the jack was inserted into the grommet. A flat insulating washer and the signal ground soldering lug were then installed on the phono jack inside the chassis, and the mounting nut was used to secure the assembly.

Although it is not absolutely necessary, transistors Q1 and Q2 should have current gains that are matched within 10 per cent. This insures that the circuit will be balanced quiescently with respect to ground potential.

To insure good continuity between circuit board ground and chassis ground, the circuit boards should be mounted on metal standoffs with inside star lockwashers installed on each end. The mounting screws should be tightened securely so that the lockwashers will be firmly engaged. This will insure good continuity from circuit board ground through each stand-

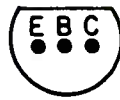
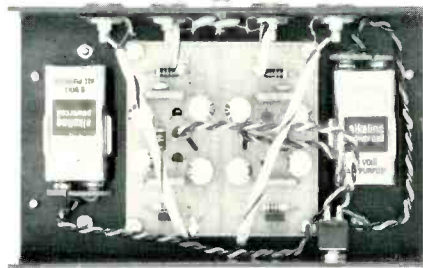


Fig. 4—Pin configuration for transistors Q1 and Q2. This view is from the end of the transistor to which the leads attach.

off to chassis ground. Capacitor C1 for each channel should be installed at the phono input jack. The leads to this capacitor should be as short as possible to prevent r.f. interference.



Final Circuit Checkout

Before using the pre-preamp the circuit should be inspected thoroughly to make sure that each component is correctly installed. In particular, Q1 and Q2 should be checked for proper lead connections. The polarized electrolytic capacitors C2, C5, C6, and C7 should be checked for proper polarity. If all visual checks are satisfactory, turn the unit on by closing switch S1. Wait two minutes, then measure the battery voltage. This should be between 9 and 9.5 volts. Next, measure the voltage at the collectors of Q1 and Q2. This should be within 0.5 volts of ± 4.5 volts, respectively. Voltages outside these ranges indicate a wiring error, a faulty component, or a bad match in the current gains of Q1 and Q2.

If the preceding tests are satisfactory, the unit can be turned off and installed between the cartridge and preamp. To minimize hum pickup problems, the connecting cable lengths should not be too long. A standard two to three foot phono cable should give no problems. Initially, the turntable ground lead should be connected to the main preamp grounding screw. Turn on the system and the pre-preamp. After 60 seconds, the unit will be fully operational and a record can be played. If hum pickup is a problem, the unit should be moved away from any nearby transformers or a.c. motors

to eliminate it. Connecting the turntable ground to the pre-preamp chassis ground may help, but in the author's experience, the turntable should be grounded to the main preamplifier.

There are no turn-on or turn-off thumps in the circuit, so no special precautions need to be observed in its use. When not in use, the power switch should be turned off to maximize battery life. A weak battery will cause a drop in gain. Therefore, batteries with an operating voltage less than 9 volts should not be used. Happy listening! Δ

Reference

1. W.M. Leach, "Construct a Wide Bandwidth Preamp," *Audio*, Vol. 61, No. 2, Feb. 1977, pp. 38-48.

Parts List

Parts listed are for one channel only. Metal film resistors are preferred. However, carbon film resistors are much easier to obtain and will give comparable performance. Q1 and Q2 should have current gains that are matched within 10 percent. *Do not* substitute parts.

- Q1—2N4401 Transistor.
- Q2—2N4403 Transistor.
- R1—100 Kilohm 5% Resistor.
- R2—510 Kilohm 5% Resistor.
- R3, R4—1 Megohm 5% Resistor.
- R5—2 Kilohm 5% Resistor.
- C1—0.1 Microfarad Ceramic Capacitor.
- C2, C5, C6, C7—100 Microfarad, 16 volt Electrolytic Capacitors (Radial Leads).
- C3, C4, C8—220 Picofarad Ceramic Capacitors.

Miscellaneous - DPST switch (serves two channels), 9 volt battery (alkaline cell preferable), battery mounting clips, battery terminal clips, phono jacks with floating grounds, 1/2 inch metal circuit board standoffs, No. 4-40 by 1/4 inch and 1/2 inch screws, No. 4-40 nuts, No. 4 inside star lockwashers, shielded cable, and No. 22 stranded hookup wire.

A complete kit of parts for the pre-preamp with anodized and silk screened box, metal film resistors, and matched transistors, excluding batteries and wooden side panels is available for \$70.00 plus \$2 shipping from Components, P. O. Box 33193, Decatur, Ga. 30033. Solder plated and drilled circuit boards are available for \$5 each. A matched n-p-n/p-n-p transistor pair is available for \$2. Shipping charge for circuit board and transistor orders is \$1.

WHY MOST CRITICS USE MAXELL TAPE TO EVALUATE TAPE RECORDERS.

Any critic who wants to do a completely fair and impartial test of a tape recorder is very fussy about the tape he uses.

Because a flawed tape can lead to some very misleading results.

A tape that can't cover the full audio spectrum can keep a recorder from ever reaching its full potential.

A tape that's noisy makes it hard to measure how quiet the recorder is.

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Fortunately, we test Maxell cassette, 8-track and reel-to-reel tape to make sure it doesn't have the



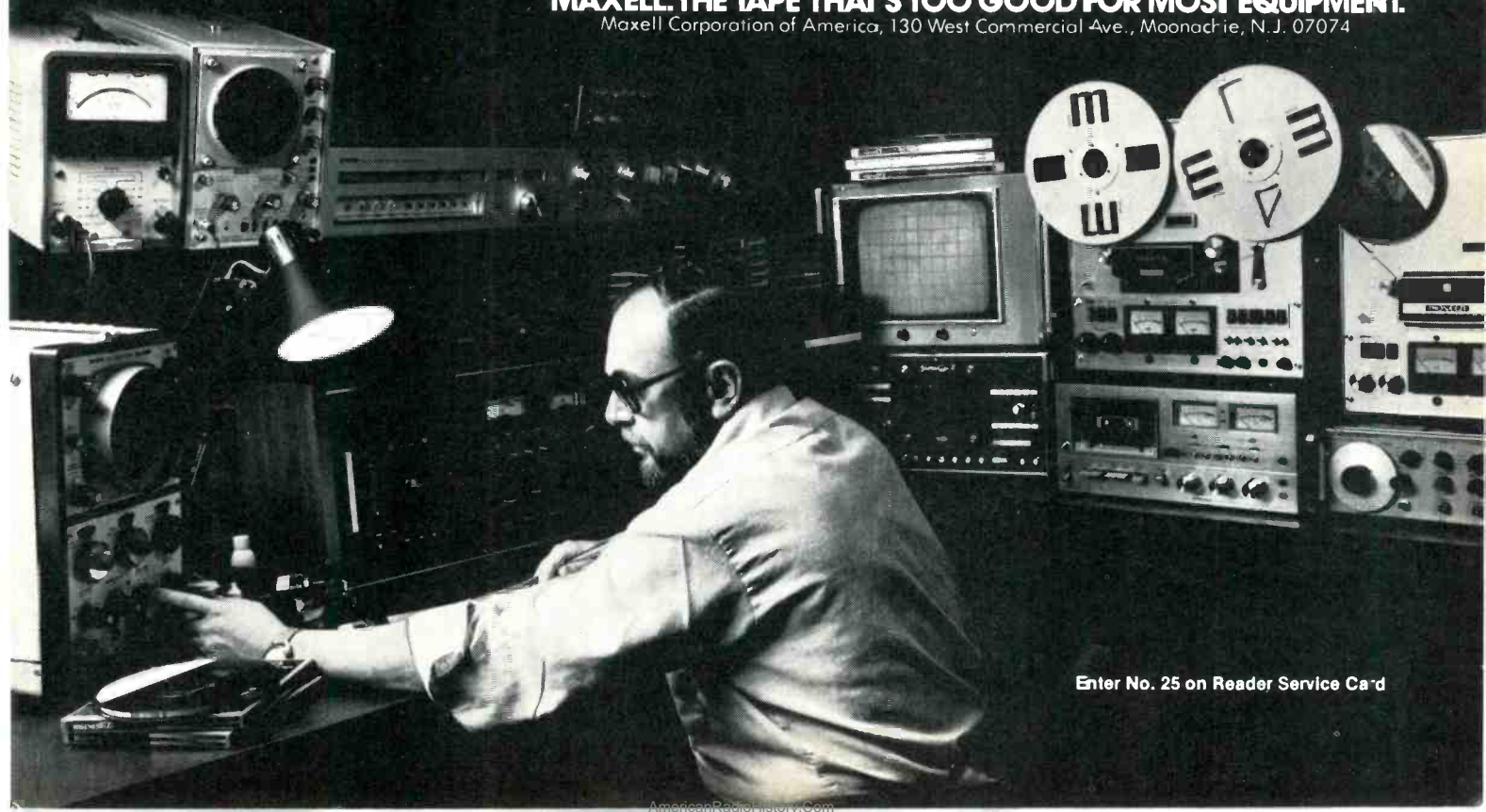
problems that plague other tapes.

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A VISIT TO THE JAPAN AUDIO FAIR

George W. Tillett

The Japanese "Audio '77" Show was held in the Harumi exhibition complex situated on the edge of Tokyo Bay where two hangar-type halls were occupied by more than 80 exhibitors, including several from the U.S. and Europe. The seven-day show attracted more than 200,000 enthusiasts who crowded into the demonstration rooms and booths to examine and tinker with the equipment on display. Unlike shows in the U.S. where "do not touch" signs discourage knob twiddlers, visitors to "Audio '77" were actually asked to use the equipment and participate in the various recording sessions. Companies such as Sansui, Optonica, Akai, and Yamaha had well-equipped studios in which the audience was invited to tape programs given by performers, and then keep the tape they had made. Some of these sessions were quite involved, and the performance might be preceded by talks on mike placement, mixing, reverb, and so on. Headphones were used for monitoring and playback, while the recorders were mostly cassette models.

Many new cassette decks were shown and, I'm sure, many of them will be released in the U.S. for the Winter CES in Chicago. However, there were two or three models which were particularly interesting. One was the Pioneer CT-700 which features variable bias, in addition to three meters... the third one indicating either the bias voltage or L & R dynamic levels. Sony introduced the Model TC-K8B which uses a very effective liquid crystal display for VU calibration in the form of horizontal green bars moving along a calibrated scale. A touch of the switch would freeze a small segment at the tip to give a maximum reading, much like a thermometer. The response is very fast and visibility excellent, so I'm certain that other companies will soon take up the idea. Sony also showed two new Elcaset decks, the EL-4 and the EL-D8... the former is a less expensive version of the EL-7, while the latter is a portable model expected to sell in the U.S. for around \$600.00. Hitachi also had a new Elcaset deck that is marketed in Japan by Hitachi's high-end company, called Lo-D. JVC was demonstrating a new model using a series of LEDs in place of the VU meters, and each LED

responds to a particular frequency band.

In the high price bracket, the majority of new models featured variable bias, monitoring, logic controls with displays, and most had provisions for timers and FM Dolby. Front-loading cassette decks outnumber other designs by about three to one, and the present trend is towards black styling, although some manufacturers are offering a choice of either black or silver.

There were a great number of new turntables at the show, especially direct drive models in all price ranges. I had a number of discussions with engineers and marketing managers at the various manufacturing plants, and the general opinion was that the belt-drive design gives better performance in the least expensive models than the direct-drive units. Naturally, there was some dissent on this point, but all seemed to agree that the quartz-controlled, direct-drive models represented the state-of-the-art performance at the present time. As far as the S-shaped tonearm controversy is concerned, there is unanimous agreement that other parameters such as cartridge compliance, choice of bearings, mass, and so on are far more important.

Two new TEAC models, the A-3300 and the A-2300, were shown; each has an automatic reverse facility and they have an SR suffix. A new model, the F-1, is a half-track machine with $3\frac{3}{4}$ and $7\frac{1}{2}$ ips speeds. Divided into two units with the electronics section underneath, it has a built-in test tone generator, variable bias and equalizer controls, plus separate equalizing for playback. The digital counter is in the form of a display calibrated in minutes and seconds, while the tape transport system is controlled by logic circuitry via feather-touch buttons. A dbx adaptor is an optional accessory on both units.

Akai also introduced a dual-unit recorder, but this one has only one speed, $3\frac{3}{4}$ ips. Nevertheless, the frequency response is claimed to be within ± 1 dB from 50 Hz to 20 kHz.

Loudspeakers

For me, the most interesting item at all audio shows, no matter where held, is loudspeakers. And so it was in

Tokyo, there were a number of exotic models to be seen and heard. In general, there seemed to be two trends... one towards the "linear phase" designs and the other towards the large horn-loaded systems. Sanyo was demonstrating several examples of linear phase speakers and the leaflets carried the usual explanations of "time delays" and "coherent sound." One model, a three-way system, has a $2\frac{1}{2}$ in. midrange dome, a $\frac{3}{4}$ in. tweeter, and a 10-in. woofer mounted so it projected out about two inches. All the diaphragms are made from metal with the woofer cone fabricated from porous metal.

A similar semi-staircase configuration is used in the three new Sony systems, the largest having a 15-in. bass driver which crosses over to a 4-in. cone at 550 Hz, and a $1\frac{1}{2}$ -in. dome tweeter at 4.5 kHz. This has a titanium diaphragm and works as a pressure unit with equalizer fins. I observed that care had been taken in the enclosure design in respect to dissimilar resonances for the side and back.

The Technics range of linear phase systems is well known here, but they were also showing a large floor-standing system using horn-loaded midrange and treble speakers. The system uses a 15-in. woofer and the two horns stand on top with the midrange projecting slightly from the front of the cabinet, which is curved to match the mouth of the horn. Classified as Japanese model number SB-1000, the speakers sell for over \$2000.00 each, which is an astronomical amount of yen! The Onkyo Sceptre 500 is another large floor-standing system in the same rarified price range, but the tweeter is mounted along with the midrange horn outside on the top of the unit. The tweeter is fitted with a multi-plate diffuser, and a small super tweeter extends the range at the high end.

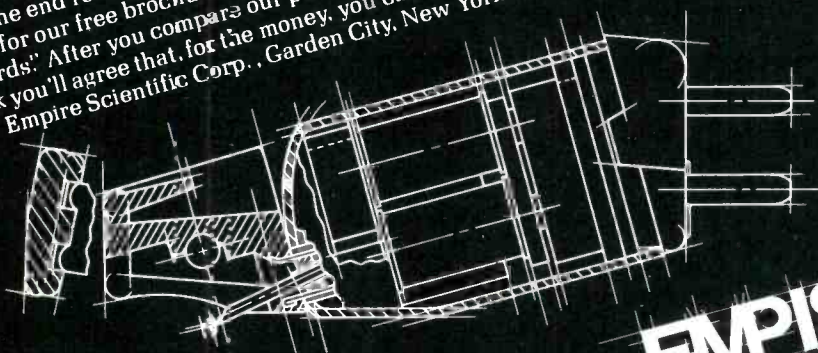
Another system using the external horn is the largest model in Pioneer's Excellence range. In this model, the 15-in. bass driver is horn loaded from the front, and the treble unit has a diffuser similar to the one used in the Technics model. Both NEC and Coral were also showing large systems using the horn loading bass drivers.

Empire's Blueprint for Better Listening--

No matter what system you own, a new Empire phono cartridge is certain to improve its performance. The advantages of Empire are threefold. One, your records will last longer. Unlike other magnetic cartridges, Empire's moving iron design allows our diamond stylus to float free of its magnets and coils. This imposes much less weight on the record surface and insures longer record life.

Two, you get better separation. The small, hollow iron armature we use allows for a tighter fit in its positioning among the poles. So, even the most minute movement is accurately reproduced to give you the space and depth of the original recording.

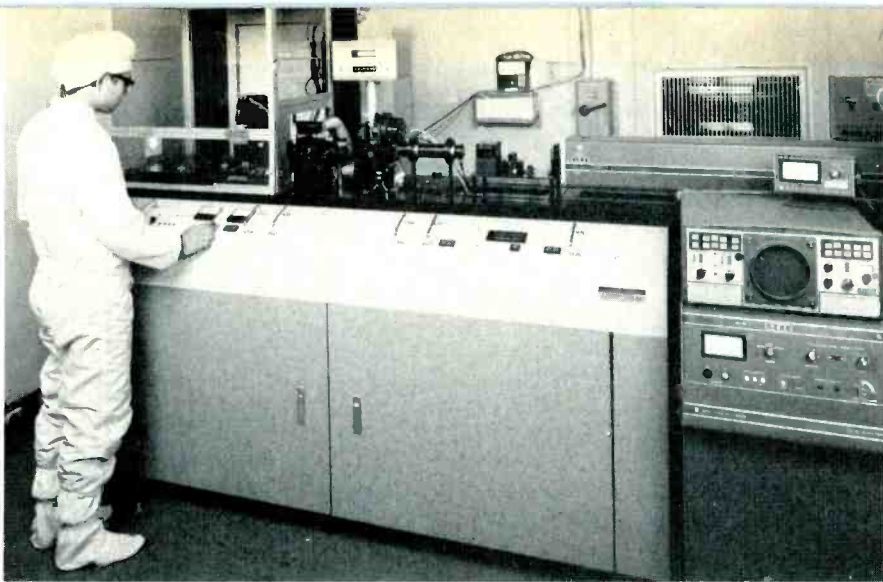
Three, Empire uses 4 poles, 4 coils, and 3 magnets (more than any other cartridge) for better balance and hum rejection. The end result is great listening. Addition one for yourself or write for our free brochure, "How To Get The Most Out Of Your Records." After you compare our performance specifications we think you'll agree that, for the money, you can't do better than Empire. Empire Scientific Corp., Garden City, New York 11530



EMPIRE

MODEL	4000 D/III	4000 D/I	2000Z	2000T	2000 E/III	2000 E/II	2000 E/I	2000 E	2000
FREQUENCY RESPONSE	10Hz-50kHz ± 3 dB	15Hz-45kHz ± 3 dB	20Hz-20kHz ± 2 dB	20Hz-20kHz ± 1½ dB	20Hz-20kHz ± 2 dB	20Hz-20kHz ± 2 dB	20Hz-20kHz ± 3 dB	20Hz-20kHz ± 3 dB	20Hz-20kHz ± 3 dB
TRACKING FORCE RANGE	¾-1¼ gm	1-1¾ gm	¾-1¼ gm	¾-1¼ gm	¾-1½ gm	¾-1½ gm	1-2 gm	1¼-2¼ gm	1½-3 gm
SEPARATION									
15Hz to 1kHz	28 dB	24 dB							
1kHz to 20kHz	23 dB	20 dB							
20kHz to 50kHz	15 dB	15 dB							
20Hz to 200Hz			20 dB	18 dB	20 dB	20 dB	18 dB	18 dB	16 dB
500Hz to 15kHz			30 dB	27 dB	28 dB	25 dB	23 dB	23 dB	21 dB
15kHz to 20 kHz			25 dB	22 dB	20 dB	18 dB	15 dB	15 dB	13 dB
I.M. DISTORTION @ 3.54 cm/sec	2% 2kHz-20kHz	2% 2kHz-20kHz	0.8% 2kHz-20kHz	0.8% 2kHz-20kHz	1% 2kHz-20kHz	1.5% 2kHz-20kHz	2% 2kHz-20kHz	2% 2kHz-20kHz	2% 2kHz-20kHz
STYLUS	2 mil bi-radial	2 mil bi-acial	2 x .7 mil elliptical	2 x .7 mil elliptical	2 x .7 mil elliptical	2 x .7 mil elliptical	2 x .7 mil elliptical	3 x .7 mil elliptical	.7 mil spherical
EFFECTIVE TIP MASS	.4 milligram	.4 milligram	.2 milligram	.2 milligram	.6 milligram	.6 milligram	.6 milligram	.9 milligram	1 milligram
COMPLIANCE	30x10 ⁻⁶ cm/dyne	30x10 ⁻⁶ cm/dyne	30x10 ⁻⁶ cm/dyne	30x10 ⁻⁶ cm/dyne	20x10 ⁻⁶ cm/dyne	18x10 ⁻⁶ cm/dyne	17x10 ⁻⁶ cm/dyne	16x10 ⁻⁶ cm/dyne	14x10 ⁻⁶ cm/dyne
TRACKING ABILITY	32 cm/sec @ 1kHz @ 1 gm	30 cm/sec @ 1kHz @ ½ gm	38 cm/sec @ 1kHz @ 9 gm	38 cm/sec @ 1kHz @ 1 gm	32 cm/sec @ 1kHz @ 1 gm	28 cm/sec @ 1kHz @ 1¼ gm	28 cm/sec @ 1kHz @ 1½ gm	28 cm/sec @ 1kHz @ 1¾ gm	32 cm/sec @ 1kHz @ 2 gm
CHANNEL BALANCE	within 1 dB @ 1kHz	within 1½ dB @ 1kHz	within ¼ dB @ 1kHz	within 1 dB @ 1kHz	within 1 dB @ 1kHz	within 1½ dB @ 1kHz	within 1½ dB @ 1kHz	within 1½ dB @ 1kHz	within 1½ dB @ 1kHz
INPUT LOAD	100k Ohms/channel	100k Ohms/channel	47k Ohms/channel	47k Ohms/channel	47k Ohms/channel	47k Ohms/channel	47k Ohms/channel	47k Ohms/channel	47k Ohms/channel
TOTAL CAPACITANCE	under 100 pF/channel	under 100 pF/channel	300 pF/channel	300 pF/channel	400-500 pF/channel	400-500 pF/channel	400-500 pF/channel	400-500 pF/channel	400-500 pF/channel
OUTPUT @ 3.54 cm/sec	3 mV/channel	3 mV/channel	3 mV/channel	3 mV/channel	4.5 mV/channel	4.5 mV/channel	7 mV/channel	7 mV/channel	7 mV/channel

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Making a PCM master disc at the TEAC facility.

Pulse Code Modulation

One of the sensations of the show was the appearance of several PCM (pulse code modulation) systems. Sony has employed a digital recording system for their Betamax Video player, and Denon has been making PCM recordings for a long time . . . but both of these systems use tape, not records. However, Denon makes records from the tapes after the signals are converted back into audio, thus losing most of the advantages. A consortium of three companies, TEAC, Mitsubishi, and Denka, have now developed a PCM record which has so many potential advantages that it will make our present system of recording obsolete. Imagine a record with a dynamic range 30 to 40 dB greater than our present discs with no wow, no flutter, no background noise, pops, crackles, or

scratches. It sounds too good to be true, but it must be admitted that at the present time there are snags like the high cost and the restricted playing time. However, these problems will be solved in time.

The master disc is made of glass having a thin film of gold alloy deposited on it, and laser records the digital signal in the form of a continuous line of holes, called "pits." This track width is extremely small, being only about 1/100th the size of the conventional record groove. The stamper is then made from the master in the usual manner, and the final discs are made from a transparent PVC material, plated with a metallic surface and then covered by a protective coating.

The playback system is made up of a turntable rotating at 1800 rpm, a laser with the associated optics, a servo

system, plus the PCM amplifier. The laser is mounted under the disc. Note that there are four servo systems: the quartz locked motor drive, the focusing servo that maintains a constant distance between the disc surface and the collecting lens, the tracking servo keeping the readout beam directly over the "pits," and, lastly, the radial feed system that moves the laser beam optics in the radial direction.

After amplification, the digital pulses are converted back into audio signals. The dynamic range of this system is more than 98 dB, with a frequency response of 10 Hz to 20 kHz, +0.1 dB, -0.5 dB and the total THD is claimed to be less than 0.1 per cent. The disc itself has a diameter of 12 inches with a thickness of 1/24th inch. Playing time is only 30 minutes, but I was told that development work is going on to increase this to one, or even, two hours. How did the laser disc actually sound? It was all I had expected, velvety quiet background with a tremendous dynamic range . . . rather like 30-ips tape with a Dolby "A" system.

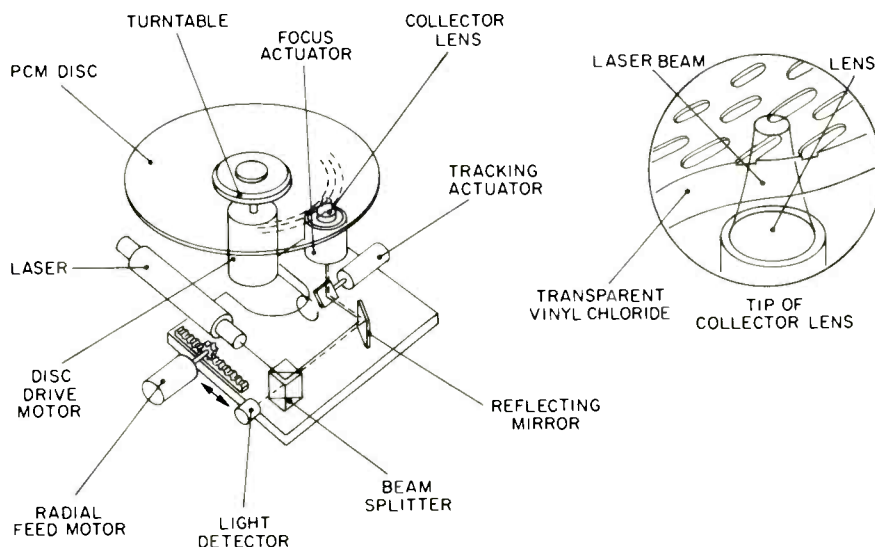
There are several other PCM systems in various stages of development which could pose a standardization problem. Fortunately those responsible are well aware of what happened with quadraphonic sound with CD 4, QS, and SQ.

As mentioned earlier, Sony uses a PCM system in their Betamax Video Player, but now they have developed a separate unit which permits PCM recording and playback which can be connected to any VTR system. The audio (analog) signals are converted into digital pulses, which in turn are converted into video signals that can be recorded. The theoretical range is 97.8 dB, but it stated that due to the problems of cost, a compromise was necessary and the range is held to 95 dB for playback and 85 dB in the recording mode.

The Denon PCM system has some similarities with the Sony system, but the sampling frequency is 47.25 kHz, instead of 41.25 kHz, and a two-inch tape is used. The dynamic range is improved by a pre-emphasis circuit . . . the final figure being 89 dB with less than 0.1 per cent THD and immeasurable wow and flutter. Denon (the parent company is Nippon-Columbia) has been making PCM tapes for some years now, and now they have a library of well over 200. Their records show a worthwhile improvement over ordinary discs in the S/N ratio. Further information may be obtained from their American distrib-

44

The laser sound disc player.



Para - Power

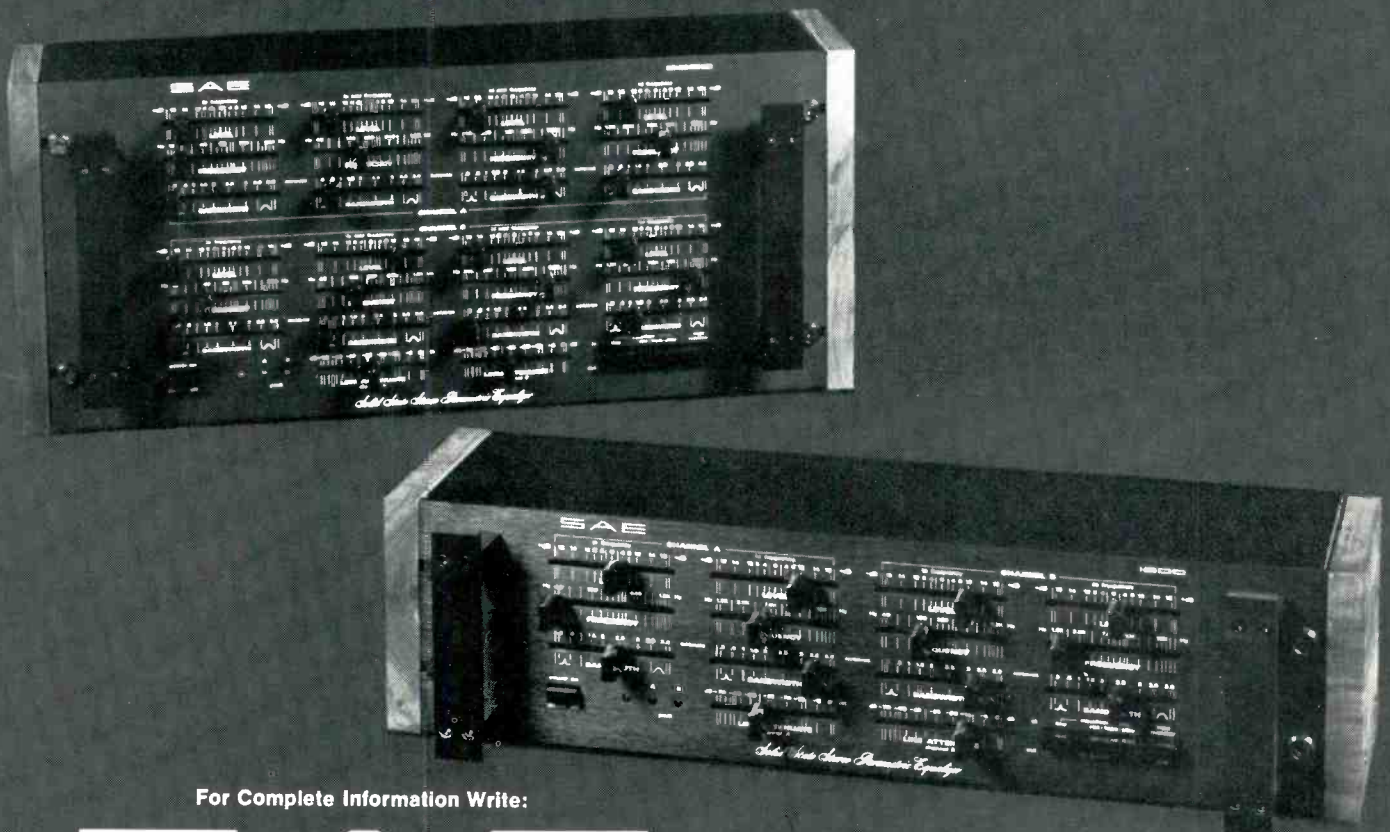
(Parametric Equalizers by SAE)

SAE has long been involved in the field of tone equalization. From our pioneering efforts in variable turn over tone controls to our more recent advancements in graphic equalizers, we have continually searched for and developed more flexible and responsive tone networks. From these efforts comes a new powerful tool in tone equalization — the Parametric Equalizer. Now you have the power of precise control.

Our 2800 Dual Four-Band and 1800 Dual Two-Band Parametrics offer you controls that not only cut and boost, but also vary the bandwidth and tune the center frequency of any segment of the audio range.

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With either of these equalizers, you have the power to correct any listening environment or overcome any listening problems that you are faced with. Whether you need a third octave notch filter, tailored bandwidth to resurrect a vocalist, or a tailored cut to bury an overbearing bass, the control flexibility of Parametric Equalizers can fill these needs and many more. And of course, as with all SAE products, they offer the highest in sonic performance and quality of construction.



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Plant Tours

A number of manufacturers invited me to visit their production and research facilities. I was pleased to have the opportunity to study the different philosophies and methods of doing things, and then compare them with our Western ideas. Although the Japanese society is highly industrialized, the people as a whole, not just the elite, have a high regard for art and culture. The TV programs devote

considerable time to art appreciation, and in the theater . . . both the traditional and modern are very much alive.

At the Kenwood plant, I noticed a number of girls coming back after the production lines had shut down. I enquired whether there was a second shift. As it turned out, these girls were going to flower arrangement lessons (Ikebana) which, as most people know, is a special Japanese art.

At the Pioneer facility, I was surprised to find a complete recording studio with a Quad Eight mixing unit, Neumann lathe cutter, a separate mix-



Assembly line at the Sansui operation showing the lifting cradle.

"AWESOME"

and other comments from audio critics about Ohm F loudspeakers:



Comments from The Complete Buyer's Guide to Stereo/Hifi Equipment:

"The Ohm F is an extraordinary loudspeaker. It has only one driver, which acts as a pulsating cylinder.... What this means in terms of sound quality is remarkable. It may well be the finest speaker on the market and is certainly without a doubt among the top few"

Comments from Stereo Review:

"The tests we have made all tended to confirm the

claims made for the Ohm F.... In our simulated live vs. recorded test it rated A to A+...with one of the larger power amplifiers...the sound began to warrant the use of such words as 'awesome'... it is easily one of the best." (©Ziff-Davis Publishing Co., 11/73, all rights reserved. Reprinted by permission.)

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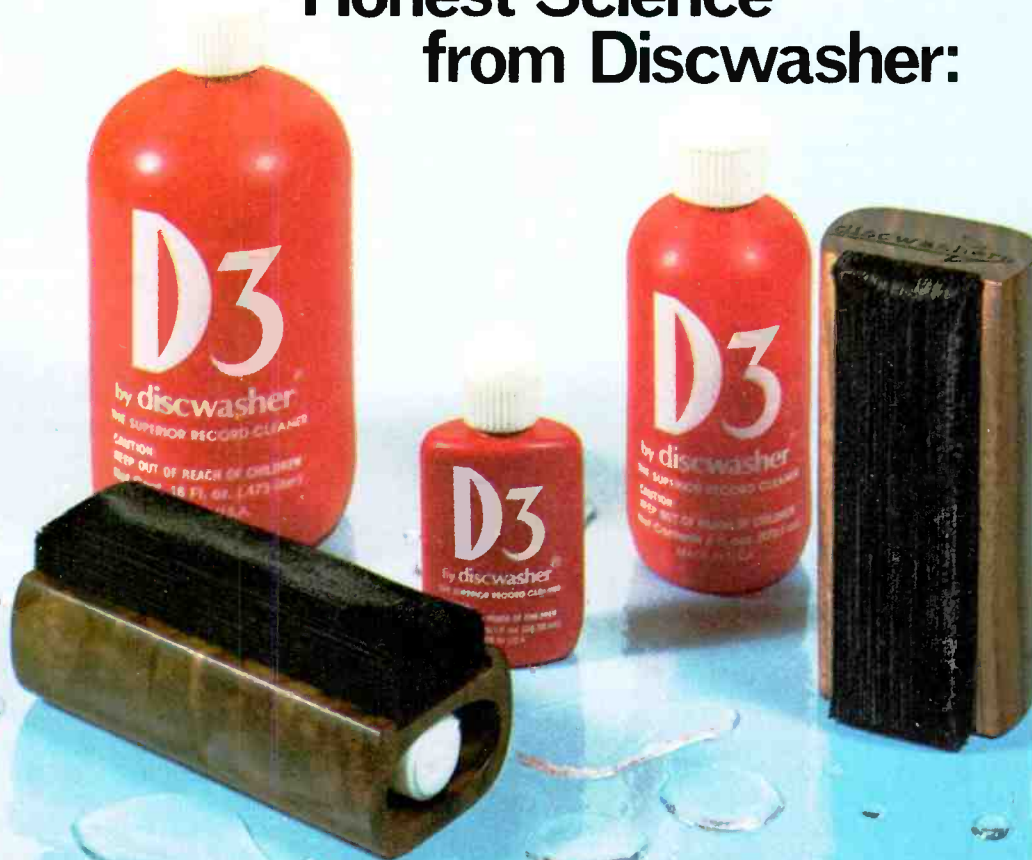
down room, and several listening rooms. Recently, a number of direct recordings have been made which have been, mainly, for demonstration purposes although some are marketed under the name "Lobster." A large studio is used for loudspeaker evaluations and provision is made for feeding signals directly from the recording studio, or vice versa.

Most Japanese houses are furnished in the traditional style with a minimum of furniture and the floors are covered with special rush mats called *tatami*. These rooms are often quite small and the acoustics are rather different from Western style rooms, so all the plants I visited had both Western and *tatami* listening rooms.

The Nakamichi plant now boasts a small theater and during the Audio '77 show period, groups of 50 to 100 people were invited to listen to a piano or harpsichord recital. Tapes were recorded on an impressive-looking bank of Nakamichi 600 cassette decks, and tapes were given out to the audience at the end of each recital. At the session I attended, the program consisted of piano works by Brahms, Schumann, and Chopin. The harpsichord was a beautifully-made reproduction of an 18th century French instrument finished in an orange lacquer with a decorated lid. Behind the theater is a control room, a mixing room, and a large recording studio . . . and, of course, there are several Western and *tatami* style listening rooms.

Sansui's plant was notable for the clever way in which the maximum amount of space is utilized in the production area. Conveyor belts operate on three levels, just like the Tokyo expressway. This particular plant on the outskirts of Tokyo turns out nearly 500 amplifiers and receivers a day, with a total of 350 employees.

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The next day I visited the Sony research facility and audio development labs, which are all housed in one large building completed in 1972. Here I found not one, but two anechoic chambers—the larger one with a cubic volume of 528 meters. It extends through three ordinary stories and the structure floats independently from the main building. Next to it is a reverberation room with a 10-second period, and nearby are a number of Western and *tatami* listening rooms. There is also a very large auditorium and a special room for “psycho-acoustical experiments” which has to

do with four-channel sound, not rock music.

The following evening, I was invited to the home of Masura Nagami, the Sony General Manager, to listen to his super audio installation. The speakers featured four 12-in. bass drivers, coupled to a pair of horns extending about 10 feet above the listening area, with the mouths being some four feet square. At 220 Hz the signals are handled by a horn-loaded midrange unit built into the wall, and at 1 kHz a smaller horn driver takes over. High frequencies are handled by a small pressure unit working from 5 kHz up.



Operation of the automatic printed board assembly line at the Technics plant.

Each speaker has its own amplifier (class A or V-FET), which is preceded by an electronic crossover, and a Sony preamp (incidentally Nagami was the designer of the famous Sony 2000F preamp). The phono cartridge was their new moving-coil model, the XL55 (one of the best cartridges I have yet tested), and it was connected to a low-noise HS-55 head amplifier. As you might expect, the reproduction was most impressive, especially at the low end.

Other trips took me to the Yamaha facility at Hamamatsu and the Technics plant in Osaka. At both places much time was spent in discussions with the engineers about future products, design trends, and so on. I was particularly impressed with the automation on the Technics production lines. Specially designed machines inserted components onto the boards, soldered them, and then passed them onto an automatic alignment machine. Banks of trimming tools came down and made the adjustments, while colored lights and readouts indicated faults. Joints that were not dip soldered were individually soldered by irons that moved upwards and downwards like robots. Final tests were carried out by technicians in soundproof rooms, and the test equipment was designed so that faults could be located almost immediately. Overall quality control was very thorough.

Trade has to be two way, and there is a considerable market for certain American-made audio products in Japan. Both JBL and BSR had booths at Audio '77. In the British contingent, Celestion, Quad, and five other manufacturers were represented there. Many other companies had representatives there and all reported that business was good.

Another potential Asian market will be the Republic of China (Taiwan). Already the second most prosperous country in Asia, it is presently going through a period of tremendous construction and expansion. A

48



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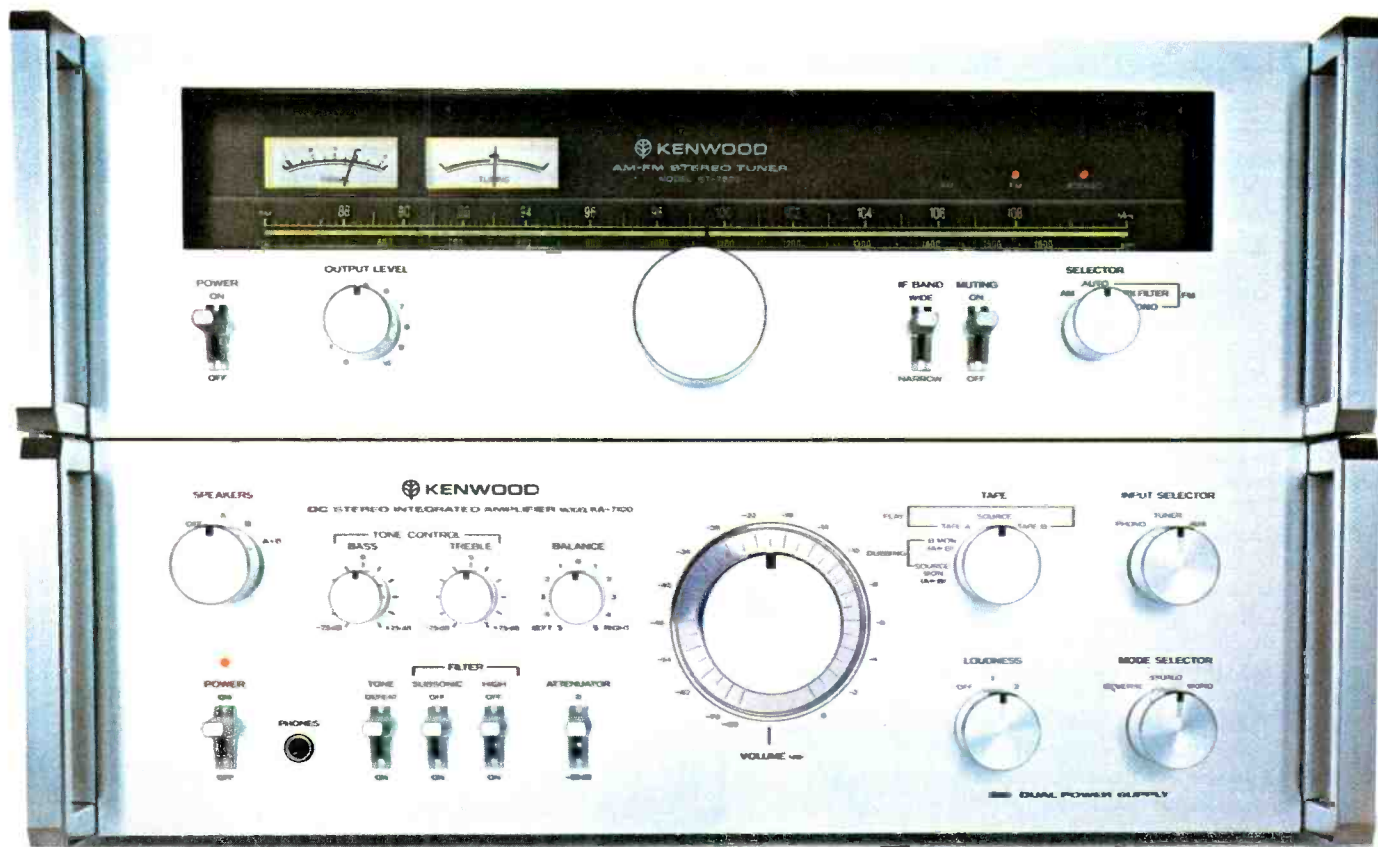
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ALTERNATIVES

A fascinating and most gratifying thing happened recently. I wrote two articles—highly technical articles—that discussed the proper meaning behind the words “time” and “frequency” as we use those words in audio. I wrote those articles with the intention of stretching the mind, my own as well as the reader’s. This mind-stretch seems to have aroused favorable interest, and a great many readers took the time to write and encourage us to continue with more such articles. Very well, I will try.

The Dilemma Of Perception

So there is no misunderstanding, let me state what it is I am doing and how it differs from tradition. I am conducting an exercise in thought by taking a wholly different approach to our present technology. I choose to form no *a priori* conclusion about the truth or falsity of the mathematical relationships which we now use. Instead, I am attempting to come up to those relationships from a different level of conceptualization. I feel that we should try to find out “why” as well as “how” nature appears to do the things it does. If you wish to call that a philosophical base, then I do not object.

The reason I search for “why” is simply that right now we have an intense dilemma confronting us whenever we attempt to correlate our physical measurements with human subjective perception. It is no laughing matter that what we measure does not always correlate with what we “hear.” It is a disgrace which no amount of finger pointing will eliminate.

I start from the conviction that nature does not solve equations. If we are going to use math, then I want to know why that math should work. It is necessary to start from some primal base. The primal base I present in these articles is that through the study of relationships we can infer which exist within any structure of allowable description. The fancy name is abstract geometry.

It obviously derives from my interest in the subjective/objective problem, since one structure of description can be that of perceptual concepts, while another structure can be that of objective measures of the ingredients of that perception. Can we link the structures? That is my interest.

Richard C. Heyser

Alternatives

A few years ago I published a theoretical concept which I call the Principle of Alternatives^[1, 2, 3]. It introduces alternatives as a geometric concept. Alternatives are defined as those equally valid descriptions expressed in different frames of reference and corresponding to alternate spaces of representation. Geometrically, alternatives are different ways of looking at the same thing, and the set of all alternatives forms a universe of allowable descriptions.

What this principle asserts is that there is no preferred way of describing anything, either from the standpoint of dimensionality or units of expression. And therefore, there are an infinity of alternatives for any description we might make.

Abstract? You bet, but very powerful, because we can consider all known classes of description, including those in which all we can determine is the probability with which assignment of properties can be made within a particular frame of reference (“fuzzy” alternatives).

In the previous *Audio* articles I used this principle to give a new interpretation to the concepts of time and frequency and to the Fourier transform which defines them. Namely: the “time response” is one of the alternatives to the “frequency response” and the Fourier transform is that map which converts from one alternative to another.

In this discussion, I would like to carry this mind-stretching exercise a little further and ask you to think about the inner meaning which this brings to some relationships common to audio as well as other branches of science. Again I state my caveat: Do not blindly accept everything I state, think about them, mull these things over in your own mind. I believe it is far more important to convince oneself of the reasonableness of such things than to accept as dogma that which might later be overturned. Besides, once one becomes accustomed to thinking about such things in the abstract, it is going to be much easier to consider the deeper waters I would eventually like to discuss on the implications this brings to reconciliation of the “meter” and the “ear.”



Euclid, Hilbert, and Audio

In the previous article I pointed out that “waviness” and “placeness” are possible alternatives of each other. If, for example, we have set up a description in terms of any frame of reference, then it is possible to recast that description into another alternative frame of reference in which each place in the first becomes a wave extending over the whole of the second. One of the infinite number of ways of performing this conversion is that map which we call the Fourier transform.

Very well, let us turn this around. When two descriptions are related to each other through the Fourier transform, then these descriptions are alternatives of each other.

What special things might we infer about these particular alternatives? One of the first things we can infer is that the number of dimensions will be the same for each of them. There is no way that a three-dimensional description can be related by Fourier transformation to a two-dimensional alternative, for example. There are maps which connect three-dimensional alternatives with two-dimensional alternatives, but the Fourier transform is not one of these.

Let us now consider that special type of geometric framework in which everything obeys the laws of Euclidean geometry. All the postulates of Euclid, including the parallel line postulate, hold. A very little thought about the geometric basis for the Fourier transform, which I gave in the previous article, will reveal that each of the alternatives joined by Fourier transformation are Euclidean in nature. So a Euclidean space is transformed into a Euclidean space.

Let me pause right here and reveal a bit of where we can use this in much-later analysis. I contend that the thing we call distortion in audio, both objective and subjective, can be regarded as a warping of the geometry within a given frame of reference. The effect of distortion is to convert a Euclidean representation into a non-Euclidean representation, for example. This warping may possibly be handled as curvature tensors at some later time. But right now I want to point out that this talk of Euclidean spaces is very important to audio, and it is not part of a “snow job.”

If what we are describing has a limit to its total energy, as all practical audio measurements do, then we can state that the proper sum of all energy components is finite. Many of the things we measure are such that their squared value is proportional to en-

ergy. Sound pressure is such a parameter; so are air particle velocity, voltage, and current. Not obvious now, unless you are into math, but the appropriate sum of the magnitude of such parameters squared is known as the Lebesgue square measure, denoted by the symbol L^2 .

In striving to find some possible deep-seated meaning to properties, whether of perception or physical observation, we are led to search for the most general possible statements about those properties. Statements which are not dependent upon special objects of description, but determined by abstract relations. If we are really successful, our reward is the discovery that we have no words with which to adequately convey those abstract impressions. So we must often double up on the use of certain descriptive terminology which can invoke some appropriate mental analogies. The term geometry, as I use it, in these discussions, is one such word.

each of the alternatives joined by Fourier transformation are Euclidean in nature

Another such word is “space.” In the abstract, the word space refers to a set of defined elements together with some agreed upon rules for combining those elements into the analog of a structural configuration. A multi-dimensional Euclidean space is a readily identified example. In this case, “space” means what we normally mean by the word space.

But there are other ways of defining elements and putting them together to form other “spaces.” Another way of saying this is change the frame of reference. An example is what mathematicians call the Hilbert space L^2 , the infinite-dimensional analog of Euclidean space.

Thus, one alternative for expressing finite energy signals is a space we can identify as a finite-dimensional Euclidean framework. Volts as a function of time is an example which uses the one-dimensional coordinate measured in units of time with the amount of volts at each moment of time being the number representing

the signal at that particular coordinate location. Another alternative is the infinite-dimensional Hilbert space L^2 in which each possible form of signal which has finite energy is one of the coordinates, and “how much” of that signal is the position along that coordinate. Sure, it is abstract, but that is what Shannon brought into engineering and was the start of that very practical endeavor which we now call Information Theory.

As a technical point, we can thus observe that alternatives can be infinite-dimensional as well as finite-dimensional. As a mind-stretch, we should prepare ourselves to grasp the conception of infinite-dimensional spaces. The reason is that in the early parts of this century, mathematicians really began to develop tools for infinite-dimensional representations under the general name of Functional Analysis. There is a great wealth of knowledge to tap here, as Shannon did.

To give you some idea of how we might use it in audio consider this question: What is melody, or even a melodic contour? Stretch the mind a bit. If each allowable tone is assigned as a dimension, then certain groups of tones, bearing particular relations to each other, define subspaces of finite-dimensionality. These subspaces may be combinable in a different manner so as to form characteristic patterns which have *extremum* metric properties relative to subspaces formed from random combinations of tones. That is, the preferred subspaces are more densely packed with less distance separating members of the subspace. I do not know how that would work out on a number cruncher, or whether it may prove to be a silly idea. But the conceptual “distance” between certain notes, and I do not mean where they are on the musical scale but whether they seem to “fit” together, seems to form an attractive way of discussing chords and how they might fit together in the various combinations we might think of as melodies.

And tweak your imagination with this: Might it be possible that such a primal framework, which we could call a gestalt base of analysis, is also tied to other perceptual-observational disciplines, such as psycho-linguistics? Is there an analogy with Noam Chomsky’s Theory of Transformational Grammar such that the perception of sound has a deep structure as well as a surface structure?

These are indeed important considerations, but discussion of these things lies well ahead of us. And we must get

back to the fundamentals I wish to present in this brief article. With the definition of terms cited above and the appreciation for the geometric role that is involved, we can see that the Fourier transform defines a way of changing one representation into another in a special form-preserving manner. In contemporary mathematical language, the Fourier transform defines an isomorphism of the Hilbert space L^2 onto itself.

The consideration I want to place before you is that whenever we run across two types of description, both of which define a Hilbert space and are linked by Fourier transform, then these are alternate descriptions. They both describe the same thing. The coordinates of these two alternatives are versions of each other and can never be considered completely independent.

Observer-Observed

We may have thought, with deepest conviction, that we were assembling a description of an event (or process, or thing) in which there were two types of parameters, both of which were required for a complete characterization. But, if along the way, we discover that these parameters are linked by Fourier transformation, then nature is telling us that they are alternatives.

Should we persist and try to combine both parameters in a common description, we will discover that there is no way we can codetermine an infinitely accurate "place" on both of them. After all, a "place" on one of them is a "wave" on the other; that is what the Fourier transform means.

Those who believe in the adverse perversity of fate—the butter-side-down philosophy—might point out that somehow our attempt to measure one of them causes us to lose clarity in the other. Whenever we set up an experiment to determine one of them, our apparatus depends upon the other one to such an extent as to blur complete knowledge of both of them. The effect is stated correctly: We cannot measure one without calling the other into play, that is because they are different versions of the same thing. But we should never confuse effect for cause.

In audio we want very much to say that frequency and time are both needed to specify a tone. If we try to measure a complex tonal structure with a narrow bandwidth filter, we find that as the bandwidth gets narrower and narrower, the time response of the filter smears out to such an extent that we can no longer say when that

frequency component occurs. To a pessimist it might seem that our very attempt at gaining precision in frequency was befouled by nature so as to lose precision in time. The instrument with which the observation was made seems to react with the signal in such a way as to disturb what we are observing.

In other words, if one were not aware of alternatives, it would be very easy to presume an observer-observed limitation to our knowledge. Any attempt at disproving such an interpretation would be doomed to failure on any grounds that attempted to show there was, even conceptually, the possibility of a true infinite accuracy of codetermination of the parameters joined by Fourier transformation. After all, we got into the trouble by the definition which we originally gave these terms plus the assumption we made that they were wholly independent. Therefore, every possible counter experiment we might propose that provides indefinitely accurate joint parameter codetermination will get destroyed when properly analyzed.

What happened? What is wrong? Is nature mad at us because we tried to mix time and frequency? No, nature does not give a darn what frame of reference we choose to use. Nature does its thing whether we are looking or not. Based on this principle of alternatives, I offer the following suggestion: In our subjective evaluation we do indeed perceive properties that are frequency-like and time-like, and they do coexist. But the dimensionality of this alternative is higher than that of the alternative we use to model some of our simpler objective evaluations.

This does not in any way mean that time and frequency form subspaces in a higher-dimensional perceptual space. What I mean is that it is possible to map a one-dimensional space upward to a four-dimensional space if we so wish. Nothing appears in one space that does not also appear in some fashion in the other space. They are alternatives of each other.

A discussion of the mathematical relations for changing from one frame of reference to another when they have a different number of dimensions lies far beyond the points I wish to raise in this discussion. We will eventually get to that problem. But right now I offer this as a suggestion of a way out of the observer-observed dilemma when the properties we think should be independent are actually related by the Fourier transform. There may not be anything whatsoever wrong with the frame of reference, except that the

properties are not what we think they are, belonging as they do to a lower-dimensional alternative.

Fifty Years Of Uncertainty

I leave you with this important fact to ponder. Exactly 50 years ago, Werner Heisenberg made use of the Fourier transform relationship between descriptions in momentum and descriptions in position, the Dirac-Jordan transformation theory, and he discovered a most puzzling fact. The narrower one made the region of confinement of a description in position, the broader became the region of confinement of a description in momentum. The complete derivation can be found at the bottom of page 180 in his now-famous paper.⁽⁴⁾

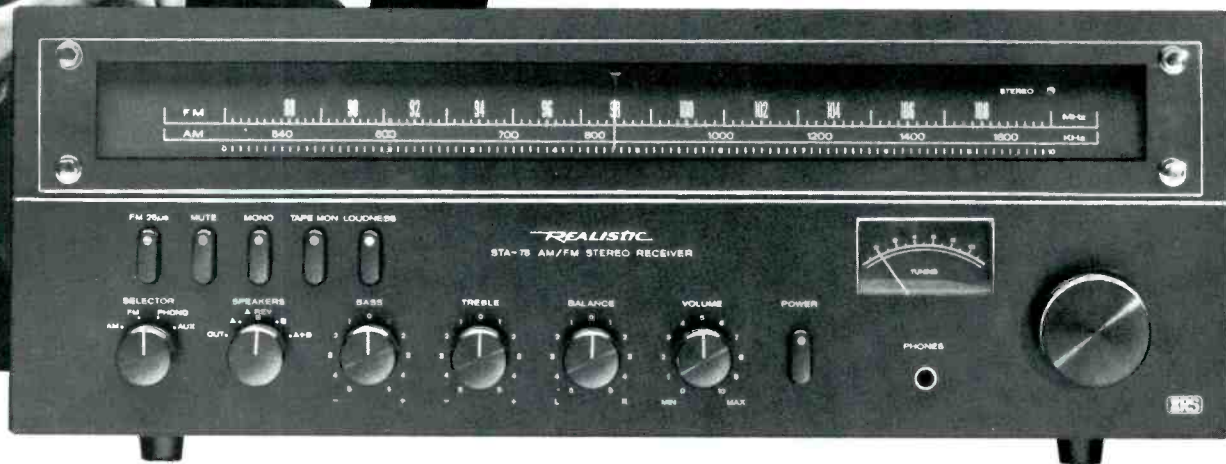
This particular relationship, which we now call the uncertainty principle, is, of course, absolutely correct for the reasons we have discussed. Surprisingly, little recognition seems to have ever been taken of the role played by the Fourier transform or of the implications which this brings to the interpretation of the inner meaning of that relationship.^(5, 6, 7, 8) The inner meaning that the parameters which this relationship ties together are nothing more than different ways of describing the same thing. A

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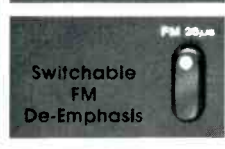
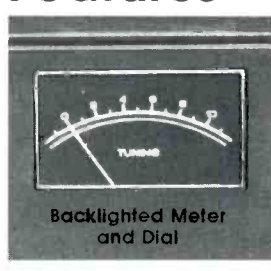
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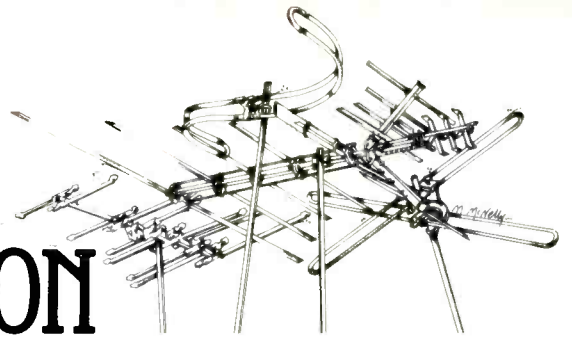
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ANTENNAS - PART II

TRANSMISSION LINES & SIGNAL DISTRIBUTION



M. J. Salvati

THE IDEAL TRANSMISSION LINE

Something has to connect the antenna to the tuner, so after selecting your antenna you must select the transmission line. The basic choice is between twinlead and coaxial cable. Twinlead must be installed so it is held several inches from metal objects, does not run parallel to other wires or metal pipes, and does not come closer than one-inch to non-metallic structures. Coaxial cable can be taped to the antenna mast, run along drain pipes and rain gutters, through and between walls, etc. Twinlead as commonly installed is susceptible to picking up extraneous signals, such as CB interference and impulse noise. Coaxial cable (particularly the foil-shield variety) is virtually immune to r.f. pickup. The low line losses generally attributed to twinlead are obtainable only when the line is new, dry, and perfectly installed. Wet standard twinlead has far greater loss than even ordinary coax, and the impedance irregularities and other aberrations introduced by practical installation requirements increase the line loss of twinlead in any weather. Coaxial cable, on the other hand, has the same loss regardless of weather or surroundings.

Table 1 shows the price/loss relationships between the various types of

twinlead and coaxial cables. (For valid price comparisons, only Belden cables are listed in this table.) Notice that every type of coax has lower losses than wet standard twinlead. Shielded twinlead (Belden 8290) is not affected by weather or surroundings, but costs twice as much as coax (Belden 9283) with the same loss figures. The RG6-type coax being compared against the high-performance shielded twinlead also has the advantages of far lower wind resistance and high flexibility.

A final advantage of coax: Most high performance signal distribution components (which will be covered later) are made only in 75-ohm impedance models. Clearly, coaxial cable is the ideal transmission line for most FM installations regardless of signal strength.

Coaxial Cable

Nearly any standard (RG59U type) coax is a big improvement over most twinlead, but the newer foam-dielectric cables are preferred because they have even lower losses. Foam-dielectric cables with copper-braid shields (upper cable in Fig. 1) are sold in precut lengths with connectors attached and are widely available in electronic-parts stores and from audio dealers. However, if you want the very best in terms of electric field shielding (for absolute minimum noise pickup), use cable with an aluminized-mylar foil shield and aluminum-braid cover-

ing (lower cable in Fig. 1). Although somewhat "rarer" in consumer outlets, this cable is actually less costly than copper-braid coax (Belden 8241 for example). Recommended RG59U-sized foil-shield cables are Belden 9275 and 9282, Jerrold CAC-59, and Winegard CL-2700. It is very easy to install F-connectors on this type of cable. However, if you do not want to bother with this easy job, you can obtain the Winegard CX-series of cables. These are available in precut 25, 50, 75, and 100-foot lengths with connectors installed! This cable (Fig. 2), like the others just mentioned, has a No. 20 inner conductor and foam dielectric, so losses are quite low.

If the transmission line is very long, and the desired signal is very weak, an RG6-type cable is indicated. This cable is slightly larger in diameter than the RG59U types, but is still small enough for easy consumer installations. It also has a foam dielectric and foil-and-braid shield, but has a No. 18 center conductor for lower losses. Recommended cables are Belden 9283, Jerrold CAC-6, and Winegard CL-2800. These cables, and all of those mentioned in the preceding paragraph, were personally tested by the author and found to have better-than-rated performance and excellent mechanical quality.

Twinlead

If a non-rotated antenna is feeding a single tuner, certain types of twinlead are suitable under certain circumstances.

For locations very far from both the FM transmitter and interference sources, and which are also located in very-dry climates (a vacation home in the Arizona desert, for instance), tubular twinlead with No.20 conductors has the potential for delivering maximum signal to the tuner. The round cross-section of this line holds dust, pollutants, and moisture away from the most intense part of the electric field, thus minimizing dielectric losses. I recommend Belden 8275 (Fig.3) because it is available in

TABLE 1
Transmission Line Performance & Cost Data * *

Type of Line & Conductor Size	Belden Number	Cost (per ft.)	100 MHz Loss (per 100 ft.)	
			Dry	Wet
300-ohm standard twinlead, No. 22	*	2.5¢	1.5 dB	7.6 dB
300-ohm standard twinlead, No. 20	8225	3 ¢	1.1	6.0
300-ohm tubular twinlead, No. 20	8275	6.1¢	1.0	2.6
300-ohm shielded twinlead, No. 26	9090	9.4¢	3.6	3.6
300-ohm shielded twinlead, No. 22	8290	13.2¢	2.2	2.2
RG59U solid-dielectric coax, No. 22	8241	7.1¢	3.4	3.4
RG59U foam-dielectric coax, No. 20	9275	5.1¢	2.6	2.6
RG6U foam-dielectric coax, No. 18	9283	6.9¢	2.1	2.1

* Not manufactured by Belden

* * Prices are for comparison purposes only.

The new Bose® Model 501. It shapes the sound to fit your living room and your music.

The new Bose Model 501 Direct/Reflecting® speaker captures the realism of live music by using room-wall reflections to recreate the balance of reflected and direct sound you hear at a live performance.

At the same time, the ex-

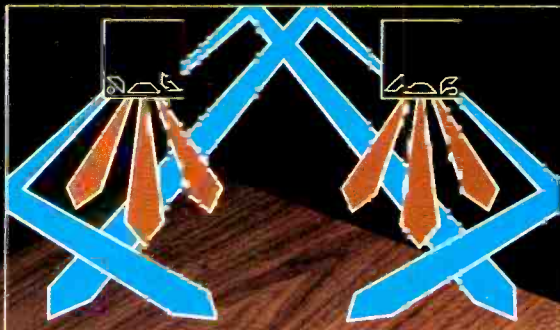
clusive Bose Direct Energy Control lets you adjust the radiation pattern of the outward-firing tweeter for the size and shape of your room, and for your music. Broader, for the sweep of a symphony, or tighter, for the intimacy of a vocalist.

Two extended-range, 3-inch tweeters deliver crisp, clean highs, while the high-performance 10-inch woofer produces very deep, powerful bass with practically no distortion. And an innovative Dual Frequency Crossover™ network lets tweeters and woofer play simultaneously over more than an octave, for smooth, open midrange.

Hear the new Model 501, the speaker that shapes the sound to fit the way you listen to music, at Bose dealers now.



The Direct Energy Control lets you adjust the radiation pattern of the outward-firing tweeter.



The Model 501 speaker is designed to create a life-like balance of reflected and direct sound.

BOSE
Better sound through research.

For a detailed description of the Model 501 and the technology behind it, send \$1.00 to Bose Corporation, Dept. PVN, The Mountain, Framingham, Mass. 01701. You will receive a full-color Model 501 brochure, a 12-page owner's manual, and a copy of Dr. Amar Bose's article on "Sound Recording and Reproduction," reprinted from Technology Review. Cabinets are walnut-grain vinyl veneer. Patents issued and pending.

True four-point gimbal centers and pivots tonearm mass where vertical and horizontal axes intersect. The four needle-point pivots are tempered and honed to produce microscopically smooth surfaces. Each pivot is matched to a ball-bearing race only 0.157 inches in diameter.

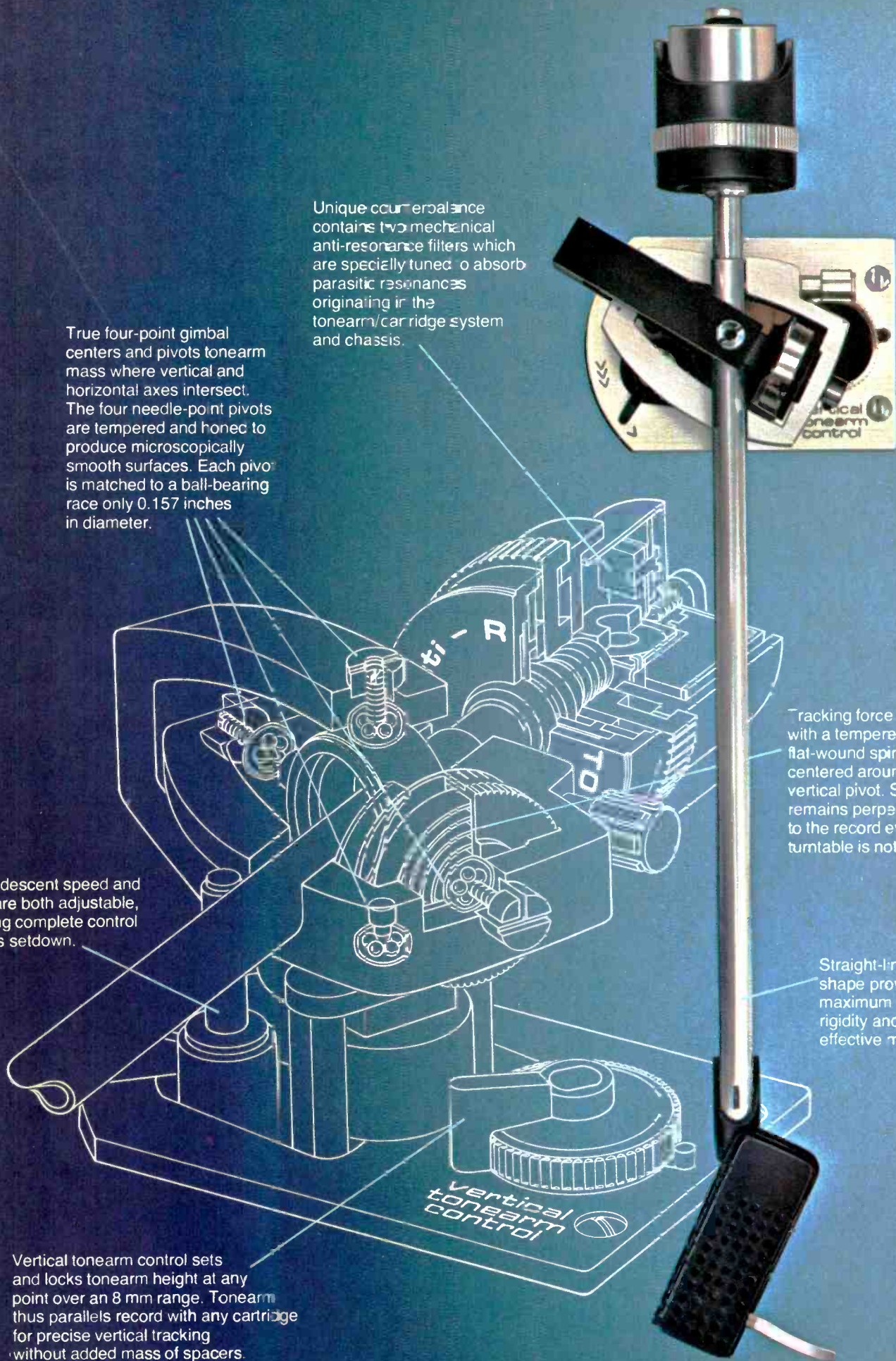
Unique counterbalance contains two mechanical anti-resonance filters which are specially tuned to absorb parasitic resonances originating in the tonearm/carriage system and chassis.

Cueing descent speed and height are both adjustable, providing complete control of stylus setdown.

Vertical tonearm control sets and locks tonearm height at any point over an 8 mm range. Tonearm thus parallels record with any cartridge for precise vertical tracking without added mass of spacers.

Tracking force is applied with a tempered, flat-wound spiral spring, centered around the vertical pivot. Stylus force remains perpendicular to the record even if the turntable is not level.

Straight-line tubular shape provides maximum torsional rigidity and lowest effective mass.



How to identify the world's finest tonearm.

When one tonearm—among all those available—is described as "the world's finest," some controversy may be anticipated. Fine, we welcome that possibility. There is far too little discussion about tonearms—considering the critical difference they make in how records sound and how long they last.

Simply stated, the tonearm's function is to provide the correct cartridge-to-groove geometry and to allow the stylus to trace the groove contours freely, precisely, and with the lowest practical tracking force.

Dual's engineering approach to tonearm performance makes us feel confident of the outcome of any comparisons.

The basic geometry.

The shape of the Dual tonearm is a straight line from pivot area to tonearm head, the shortest distance between those two important points. Curved tonearms may look sexier, but contribute extra mass, less rigidity and a tendency to lateral imbalance. That's hardly consistent with good engineering.

Every Dual tonearm is mounted in a true, four-point gimbal. The tonearm mass is centered, balanced and pivots precisely where the vertical and horizontal axes intersect.

Identical pairs of low-friction needle-point pivots and miniature ball bearings are used in both axes. The precision and quality control standards applied to their manufacture and assembly are usually found only in aerospace and allied technologies.

Settings for your cartridge.

The vernier-adjustable counterbalance lets you set zero-balance with micrometer-like precision so that tracking force can then be set accurately. A tempered, flat-wound spring applies tracking force directly at the vertical pivot, and this force remains perpendicular to the record even if the turntable

chassis is not level. Anti-skating is applied around the horizontal pivot, directly counter to the skating force, and it adjusts automatically to the varying skating force encountered by the tonearm as it moves across the record.

Another Dual refinement, not available on any other integrated tonearm, is the Vertical Tonearm Control. A vernier height adjustment over an 8mm range allows paralleling the tonearm to the record without cartridge spacers. Tonearm mass remains as low as possible, and mounting and changing cartridges are simplified.

Another Dual exclusive: tuned anti-resonance filters.

The counterbalance contains two specially tuned mechanical filters that absorb parasitic resonances originating in the tonearm/cartridge system and chassis. The result: flawless tracking stability maintained even in the presence of external shock and vibration whether caused by acoustic feedback, record warps or dancing feet.

About all Dual tonearms.

The tonearm shown and described here is part of our higher-priced turntables. But many of its features are found in our lowest-priced model: the four-point gimbal, the straight-line design, and the precise mechanisms for balance, tracking force and anti-skating adjustment.

In fact, we'd be willing to match the performance of our lowest-priced tonearm against anyone else's highest-priced tonearm. But one argument at a time is enough.

Now that you've been "armed" with the facts, we invite you to visit your audio dealer to examine the tonearms you find there—separate and built in—and decide for yourself which one is indeed the finest.

No one can argue with that suggestion.

Dual[®]



United Audio, 120 So. Columbus Ave., Mt. Vernon, NY 10553

As appearing in all leading audio publications.

Enter No. 14 on Reader Service Card



Fig. 1—Typical standard coaxial cable with copper-braid shield at top. The foil-shield coaxial cable with aluminum overbraid is at bottom.



Fig. 2—Winegard CX-series prefabricated cable is available in lengths of 25, 50, 75, and 100 feet.



Fig. 3—Belden 8275 tubular twinlead.

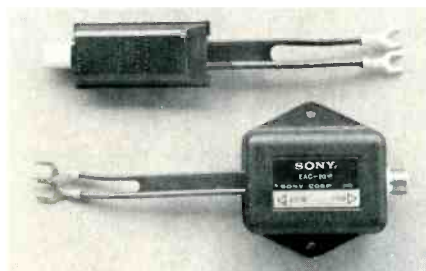


Fig. 4—Quality indoor baluns.

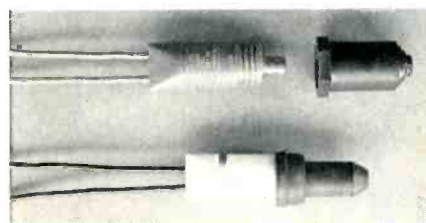


Fig. 5—Outdoor baluns.

precut lengths of 50, 75, and 100 feet with connectors installed, and is filled with foam to keep dirt and occasional moisture from entering the cable ends. Its round cross-section gives it less wind resistance and better electrical performance after weathering than the "foam-filled" flat twinlead sold by many manufacturers.

In weak-signal areas subject to frequent rain and/or interference, low-loss shielded twinlead is ideal. Belden 8290 (which has losses comparable to RG6-sized coax) becomes cost effective at lengths of 50 feet and under, since baluns need not be purchased. For strong-signal areas, Belden 9090 is ideal; it is cost effective for lengths of 75 feet and under. Because of the foil shield, these lines have nearly as much immunity to electric fields as foil-and-braid coax, because they are balanced lines which cannot be unbalanced by proximity effects they also have high immunity to the magnetic-field component of radiated interference. Both the 8290 and 9090 are available at consumer outlets in pre-cut lengths of 50, 75, and 100 feet with terminals installed.

Connecting the Cable

Most high-quality receivers of recent manufacture have a 75-ohm input connector. In this case, all that is needed is to attach an F-connector to the cable end and screw it on the receiver. If your receiver is either a low-cost or older model, the only input terminals will most likely be 300 ohms (balanced input). In this case, an input transformer is required. This device, popularly called a "balun," performs both the unbalanced-to-balanced conversion, and the required impedance transformation (75 to 300 ohms). These devices (Fig. 4) are low-cost and available at nearly any electronics parts store. Nearly any model will work satisfactorily for FM, although the very best indoor baluns are the RMS Electronics MA-730B, Sony EAC-20W, and Channel Master 7281. These baluns have losses below 0.5 dB and an SWR below 1.2 over the FM band.

Since nearly all FM antennas are designed to feed 300-ohm balanced line, a balun is also required at the antenna. Here the choice of baluns is much more critical. Since the antenna balun is exposed to the elements (pun intentional), the balun must obviously be waterproof. Moreover, it must also be physically compatible with the terminals of the FM antenna you select. Some antennas have widely-spaced terminals or have an obstruction between the terminals. The only type of balun capable of interfacing with any FM antenna made is one having long (4-inch) leads of No. 18 solid-conductor wire at its 300-ohm end. Suitable baluns are the RMS Electronics ATR-375, Lafayette 40347, and Channel Master 0090. All of these baluns have low loss (0.4-0.7 dB) over the FM band and are encapsulated in plastic and supplied with a rubber boot to cover the cable connection (see Fig. 5). The rubber boot supplied with Winegard CX-series of prefabricated cables also fits these baluns.

If a Jerrold antenna (QFM-9 or VU-series) is used, their STO-82 balun can be used. But this superb outdoor balun will only mount on Jerrold antennas.

Operating Several Tuners From One Antenna

In many locations the desired FM signal levels are many times higher than needed for high-quieting reception. In this circumstance, one antenna can operate several tuners, providing the proper devices are used to divide the signal while maintaining high isolation between the tuners and impedance matching throughout the system. There are two ways of doing this, directional couplers and splitters.

Directional Couplers

When the signal strength is extremely high, the best way is with directional couplers. These devices are simply connected in series along the line distributing the signal (Fig. 6). A 75-ohm terminating resistor connected to

TABLE 2
Performance Characteristics of RMS Directional Couplers

CA-1090 Series 1 tap	Tap Atten.	9	12	16	20	dB
	Isolation	30	30	30	35	dB
	Insertion Loss	1.2	0.7	0.5	0.4	dB
CA-2014T Series 4-taps	Tap Atten.	10	15	20	25	dB
	Isolation*	30	30	35	40	dB
	Insertion Loss	3.5	1.2	0.7	0.5	dB

* To line; 30 dB between taps

It's time for everybody else to start playing catch-up. Again.

From the very beginning, experts have acclaimed the performance and feature innovations of Yamaha receivers as nothing less than spectacular.

But now, we've outdone ourselves.

Yamaha is introducing a new line of receivers with such unprecedented performance, it's already changing the course of audio history.

Real Life Rated™ While traditional laboratory measurements provide a good relative indication of receiver performance, they simply don't tell you how a receiver will sound in your living room in actual operation. So Yamaha developed a new standard for evaluating overall receiver performance under real life conditions. It's called **Noise-Distortion Clearance Range (NDCR)**. No other manufacturer specifies anything like it, because no other manufacturer can measure up to it.

We connect our test equipment to the phono input and speaker output terminals, so we can measure the performance of the entire receiver, not just individual component sections like others do. We set the volume control at -20dB, a level you're more likely to listen to than full volume. We measure noise and distortion together, the way you hear them.

On each of our new receivers, Yamaha's Noise-Distortion Clearance Range assures no more than a mere 0.1% combined noise and distortion from 20Hz to 20kHz at any power output from 1/10th watt to full-rated power.

Four receivers, one standard. On each of our four new receivers, Yamaha reduces both THD and IM distortion to new lows—a mere 0.05% from 20Hz to 20kHz into 8 ohms. This is the kind of performance that's hard to come by in even the finest separate components. But it's a single standard of quality that you'll find in each and every new Yamaha receiver. From our CR-620 and CR-820 up to our CR-1020 and CR-2020.

What's more, we challenge you to compare the performance and features of our least expensive model, the CR-620, with anybody else's most

expensive receiver. You'll discover that nobody but Yamaha gives you our incredibly low 0.05% distortion and -92dB phono S/N ratio (from moving magnet phono input to speaker output).

You'll also discover that nobody else starts out with such a variety of unique features. Independent Input and Output Selectors that let you record one source while listening to another. A Signal Quality Meter that indicates both signal strength and multipath. The extra convenience of Twin Headphone Jacks. Or the accurate tonal balance provided at all listening levels by Yamaha's special Variable Loudness Control.

More flexibility. It's consistent with Yamaha's design philosophy that you'll find the same low distortion throughout our new receiver line. Of course, as you look at Yamaha's more expensive models, it's only logical that you'll find the additional flexibility of more power, more functions, and more exclusive Yamaha features.

For example, there's a sophisticated tuner, with unique negative feedback and pilot signal cancellation circuits (patents pending), that makes FM reception up to 18kHz possible for the first time on a receiver. Plus other refinements like a Built-In Moving Coil Head Amp, Fast-Rise/Slow-Decay Power Meters, and Yamaha's own Optimum Tuning System.

Now's the time to give us a listen. Our new receiver line is another example of the technical innovation and product integrity that is uniquely Yamaha. And your Yamaha Audio Specialty Dealer is an example of uncommon dedication to faithful music reproduction and genuine customer service. It's time you heard them both.

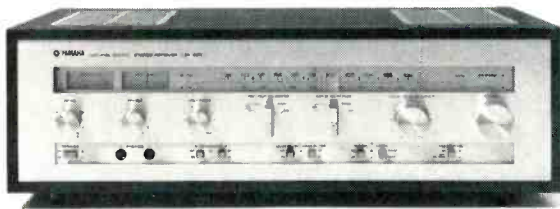
If your Yamaha Audio Specialty Dealer is not listed in the local Yellow Pages, just drop us a line.



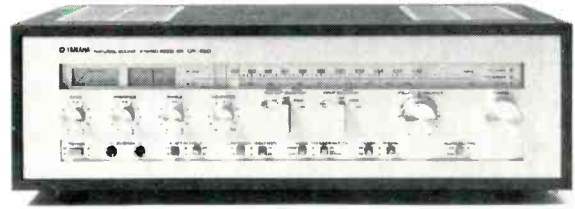
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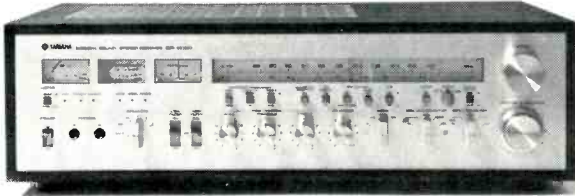
CR-620 0.05% THD 0.05% IM



CR-820 0.05% THD 0.05% IM



CR-1020 0.05% THD 0.05% IM



CR-2020 0.05% THD 0.05% IM

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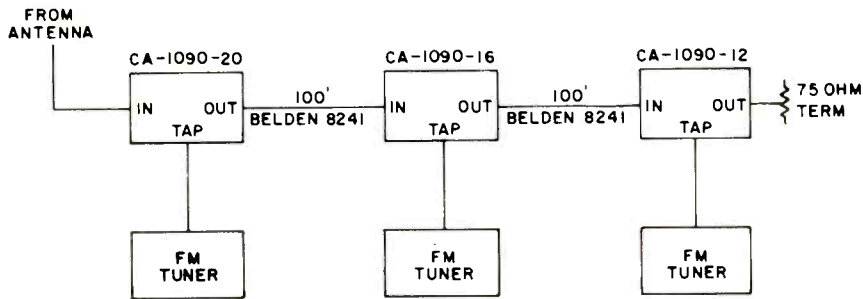


Fig. 6—Series connection of FM tuners by means of single-tap directional couplers.

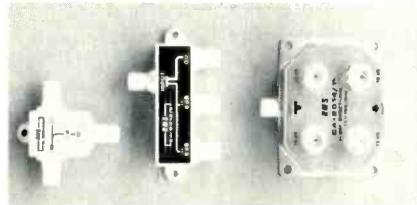


Fig. 7—One-, two-, and four-tap directional couplers.

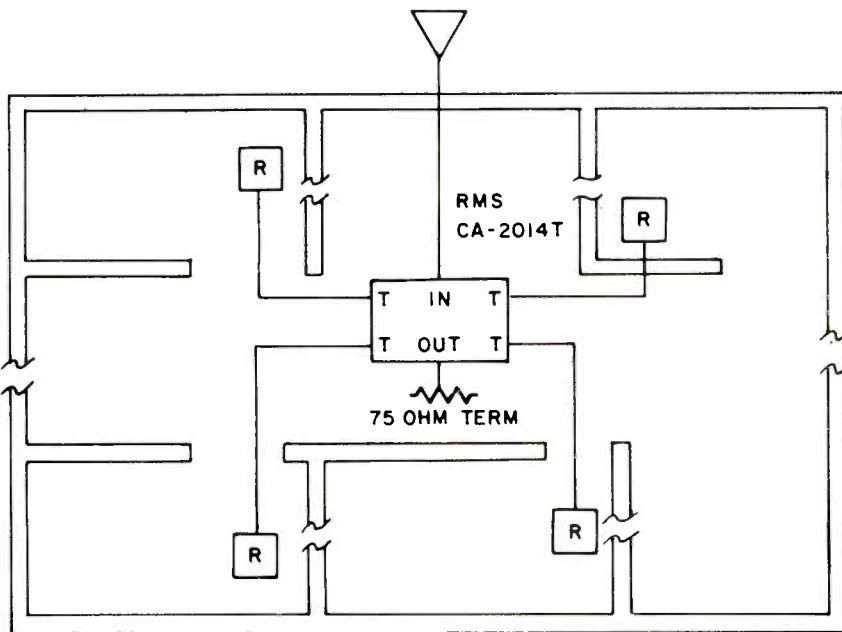


Fig. 8—Application diagram of a four-tap directional coupler.

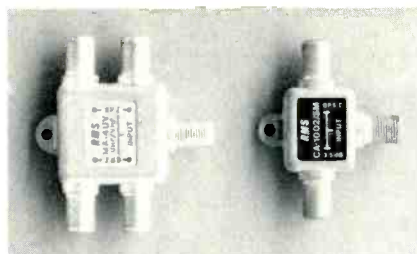


Fig. 9—Four-way and two-way splitters.

the output port of the last coupler in the line completes the system. Impedances remain matched throughout the system even if a tuner is disconnected from a tap (tuner output port). Another unique feature of a directional coupler is that the signal loss in the reverse direction (called *isolation*) is very much higher than the signal loss in the forward direction (called *tap attenuation*). This is shown in Table 2. Hence, oscillator radiation from one tuner cannot get into the distribution system in sufficient strength to cause interference with the other tuners. Remember, a receiver tuned to 90 MHz is generating a 100.7 MHz oscillator signal. Although modern receivers have very little leakage of their oscillator radiation into their antenna terminals, enough may get out to cause trouble in some circumstances.

Directional couplers are available with 1, 2, or 4 taps (see Fig. 7). Depending on where the antenna lead enters the building and the layout of the rooms, it may be more convenient to use a multitap directional coupler as shown in Fig. 8, rather than the series technique of Fig. 6.

Each series of directional couplers offers several different values of tap attenuation. This allows the system designer to compensate for cable losses from one end of the distribution system to the other. For example, if a 100-foot length of solid-dielectric RG59U cable is used between each tap, the values shown in Fig. 6 will provide approximately equal signal to each tuner.

Splitters

A signal-distribution system using directional couplers can be quite expensive, since one directional coupler is needed for each tuner when the series technique of Fig. 6 is used. A multiple-tap directional coupler will reduce the system cost somewhat, but the high-level signal requirement of the directional coupler remains.

A rather inexpensive technique, and one better suited to moderate signal levels, uses a signal splitter (Fig. 9). These devices operate with far lower signal loss to each tuner since they simply divide the signal into 2, 3, or 4 equal parts (Fig. 10). The disadvantage of the signal splitter is that the isolation between tuners is not as dependably good as when directional couplers are used; to achieve maximum isolation each splitter output must be kept terminated. If a splitter output is not properly terminated, reflections will result that can affect every part of the system with effects similar to that of multipath.

TABLE 3
Signal-Splitter Characteristics

Splitter	Outputs	Impedance	Measured Loss	Performance Isolation	SWR
RMS CA-1002/SM	2	75	3.0 dB	35 dB	1.10
Jerrold 1592B	2	75	3.0	34	
RMS CA-2004/SM	4	75	6.3	32	1.08
RMS MA-4UV	4	75	6.7	30	1.10
Jerrold 1597A	4	75	6.4	40	1.35
RMS CA-2003/SM	3	75	5.0	31	1.10
RMS C-2UV	2	300	3.1	18	—

If the signal level is high (as in metropolitan areas), a splitter offers a third alternative to the methods described last issue for operating TV sets and FM tuners from the same TV/FM antenna. The splitter would simply replace the DCS cable switch in Fig. 1-14, eliminating the need for manual switching.

Fig. 10—Application of a two-output signal splitter.

Some excellent 75-ohm splitters with 2, 3, and 4 outputs are listed in Table 3. The performance data in this table are not taken from manufacturers' literature, but are the results of measurements made by the author at 100 MHz. For those diehards who insist on using twinlead, a good and readily-available 300-ohm splitter (the RMS Electronics C-2UV) is included. Notice however, that the isolation of this splitter (the best 300-ohm unit available) is nowhere near that of the 75-ohm splitters.

The Audio Critic is growing.

By the time this ad is first seen in print, the fifth issue of The Audio Critic should be on its way to more than 6000 paid-up subscribers. Every day of the week, 15 or 20 and occasionally even 30 new subscriptions come in from serious audio enthusiasts all over the world. Since The Audio Critic didn't even exist a little over a year ago, there must be a reason for this explosively affirmative response.

There are, in fact, several reasons. One of them is undoubtedly the basic editorial format of The Audio Critic: the longest, toughest, most persnickety equipment reviews in the business, illuminated by in-depth explanatory articles and uninterrupted by advertising of any sort. Since The Audio Critic derives no advertising revenue from either manufacturers or dealers, no one can stop it from puncturing the most inflated balloons or from limelighting deserving newcomers that rock the boat.

A further reason is The Audio Critic's unique combination of hypercritical listening evaluations and sophisticated laboratory tests. For example, a recent survey of 15 speaker systems showed an undeniable correlation between impulse response and audible accuracy. Another survey delved deeply into the cartridge/arm/turntable relationship and analyzed the astonishing difference made by even slightly incorrect and 100% correct playback geometry. Detailed instructions to achieve the latter were given.

And then there's The Audio Critic's special writing style, which substitutes large doses of irreverent humor for the usual cultist pomposity.

The Audio Critic is published at intervals averaging two to three months (that's twice or three times the actual frequency of the "undergrounds") and is available by subscribing to six issues for \$28, first-class mail only. (No Canadian dollars, please!) For overseas airmail, add \$5. No single copies are sold for any reason whatsoever, but the unused portion of canceled subscriptions is refundable on request.

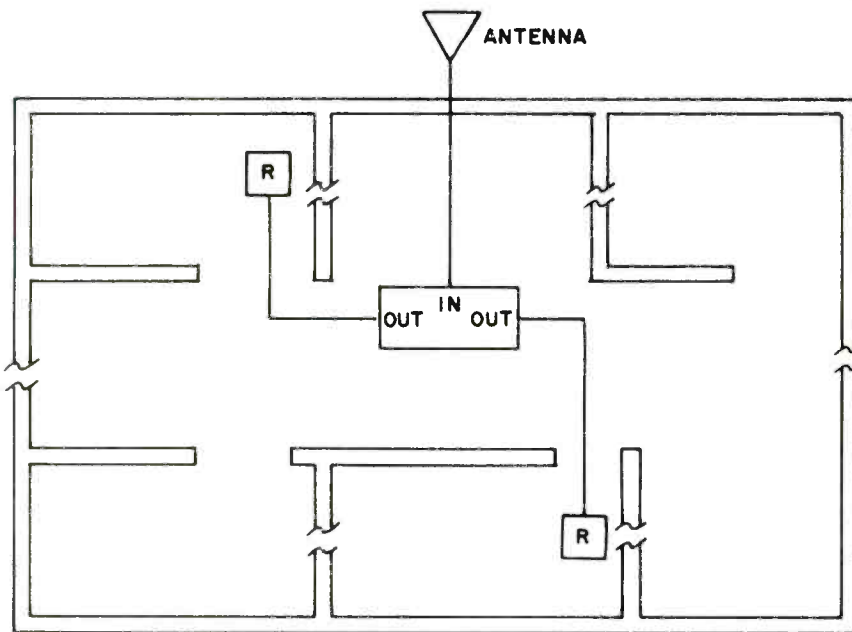
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Send \$28 for your first six issues today to The Audio Critic, Box 392, Bronxville, New York 10708.

The Audio Critic

61



MANUFACTURER'S DIRECTORY

If you cannot purchase the desired signal-distribution component from your local electronics supply store, write to the manufacturer at the address below for ordering information:

Channel Master
Ellenville NY 12428

Belden Corp
Box 1331
Richmond IN 47374

Jerrold Electronics
Box 487
Hatboro PA 19040

Lafayette Radio Electronics
111 Jericho Turnpike
Syosset NY 11791

RMS Electronics
50 Antin Pl.
Bronx NY 10462

Winegard Co.
3000 Kirkwood St.
Burlington Iowa 52601



One great sound



leads to another.

The new Koss PRO/4 Triple A.

The famous PRO/4AA is a tough act to follow. After all, its wide dynamic frequency response with a deep rich bass and crystal clear highs made it the world's most asked for stereophone. But our audio engineers had a few innovative ideas on how to develop a whole new pro. One that sounded so fantastic, you'd almost think your old records and tapes had turned into a whole new music library. And one that was so comfortable, you'd never want your records or tapes to end.

The result is a totally new standard in stereophones: the PRO/4 Triple A. Because the new Koss PRO/4 Triple A

expands the realm of pure sound with a freshness and life-like intensity every music lover will want to hear. Indeed, with a frequency response from 10 Hz to 22kHz, the Triple A offers a full bandwidth dynamic Sound of Koss that makes every note blossom to its fullest harmonic growth. Add to that the human-engineered, contoured, Pneumalite® earcushions that provide both comfort and a flat, low bass response to below audibility, and you've got a whole new state-of-the-art stereophone. And while the new Triple A's extra large voice coil, and oversize diaphragm mix the music in

your head, its extra light construction and unique Pneumalite® suspension dual headband let you float, hour upon hour, unconfined through your private realm of listening pleasure.

Ask your favorite Audio Dealer to show you the new Koss PRO/4 Triple A. And write c/o Virginia Lamm for our free full-color stereophone catalog. But if you really want to see how great the new Triple A is, take your favorite records or tapes with you to your Audio Dealer and listen to them thru the new Koss PRO/4 Triple A. The difference you hear is why we say: "hearing is believing".

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 **KOSS® stereophones**
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Equipment profiles

Marantz Model 2500 Stereo FM/AM Receiver



MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

IHF Usable Sensitivity: Mono, 8.75 dBf (1.5 μ V).

50-dB Quieting: Mono, 12.1 dBf (2.2 μ V); stereo, 33.2 dBf (25 μ V).

S/N @ 65 dBf: Mono, 82 dB; stereo, 75 dB.

THD: Mono, 0.1 per cent @ 1 kHz, 0.15 @ 100 Hz and 6 kHz; stereo, 0.2 per cent @ 1 kHz, 0.35 @ 100 Hz, and 0.3 @ 6 kHz.

THD @ 50-dB Quieting: Mono and stereo, 0.4 per cent.

Frequency Response: 30 Hz to 15 kHz, +0.2, -1.0 dB.

Capture Ratio: 1.0 dB.

Alternate Channel Selectivity: 85 dB.

Spurious, IF, and Image Rejection: 120 dB.

AM Suppression: 60 dB.

Subcarrier Rejection: 75 dB.

Stereo Separation: 50 dB @ 1 kHz, 45 dB @ 100 Hz, and 42 dB @ 10 kHz.

AM Tuner Section

Usable Sensitivity: 10 μ V (external antenna).

S/N: 55 dB.

THD @ 30 Per Cent Modulation: 0.4 per cent.

Alternate Channel Selectivity: 50 dB.

Image, Spurious, and IF Rejection: 80 dB.

Amplifier Section

Power Output: 8 ohm loads, 250 watts continuous, 20 Hz to 20 kHz; 4 ohms, 330 watts, 20 Hz to 20 kHz per channel.

THD: 8 ohms, 0.05 per cent; 4 ohms, 0.08 per cent.

IM Distortion: 8 ohms, 0.05 per cent; 4 ohms, 0.08 per cent.

Damping Factor @ 20 Hz: 60.

Frequency Response: 20 Hz to 20 kHz, ± 0.2 dB.

Preamplifier Section

Input Sensitivity: Phono, 1.8 mV, High Level, 180 mV.

S/N: Phono, 80 dB (re: 7.75 mV input); High Level, 98 dB (re: 0.775 V input).

Phono Input Overload @ 1 kHz: 200 mV.

Frequency Response: Phono, RIAA, 20 Hz to 20 kHz, ± 0.2 dB.

General Specifications

Power Consumption at Rated Output: 920 W, 120 V, 60 Hz.

Dimensions: 19 $\frac{1}{4}$ in (48.9 cm) W x 7 in (17.8 cm) H x 17 $\frac{1}{4}$ in (43.8 cm) D.

Weight: 59.4 lbs (27 kg).

Price: \$1750.00

This year's title-holder in the receiver power race is unquestionably Marantz, with their Model 2500 AM/FM stereo receiver. Whether the introduction of a 250-watt-per-channel receiver (330 watts with 4-ohm loads) will end the competition for power once and for all remains to be seen, and we will discuss our thoughts regarding receiver power a

bit later on. We should mention, at the outset, that in addition to ultra-high power, Marantz has succeeded in offering a feature-laden all-in-one piece of electronics that may be attractive even to the affluent audiophile who had been leaning towards separate components because of power requirements and control flexibility.

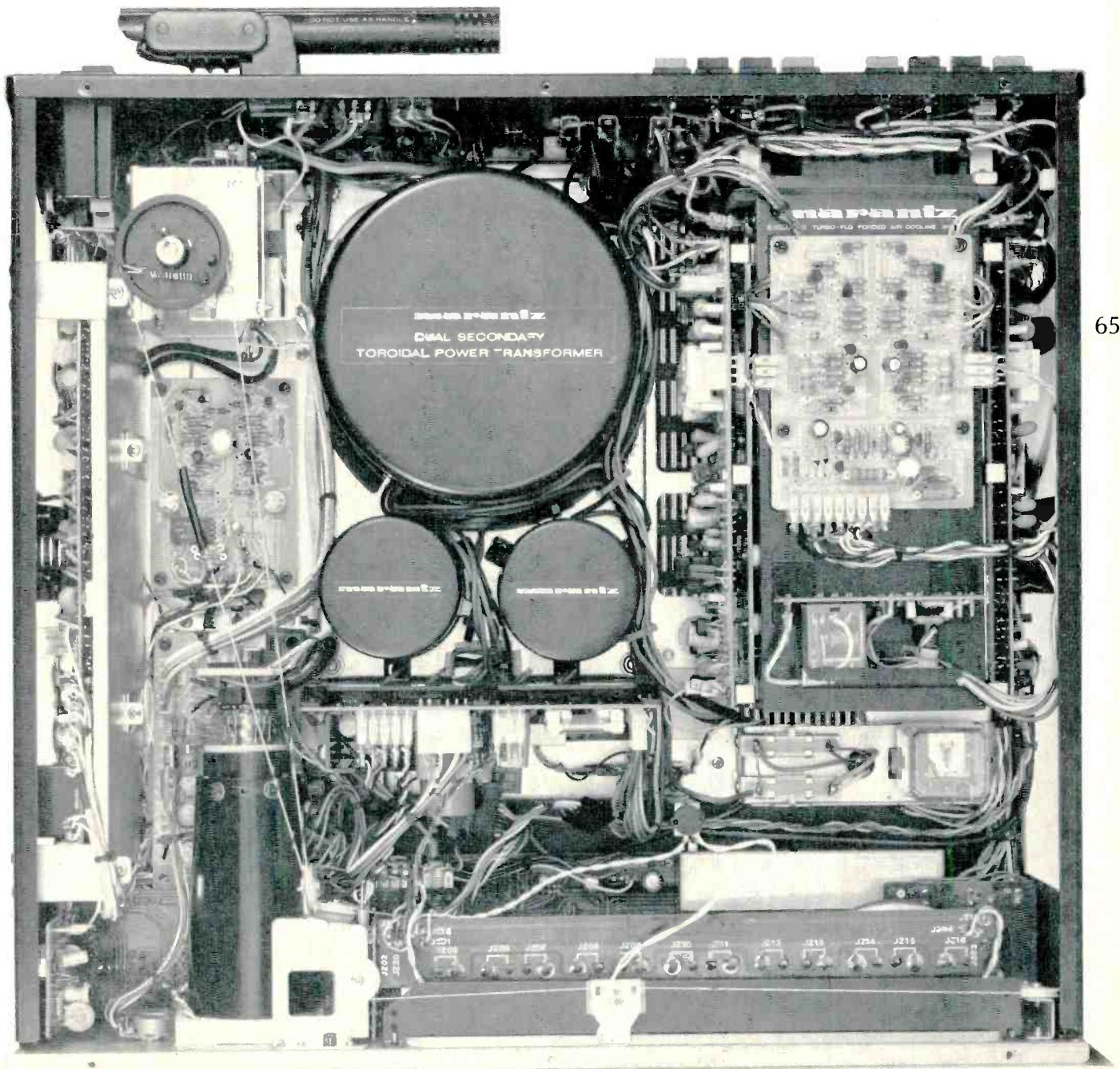
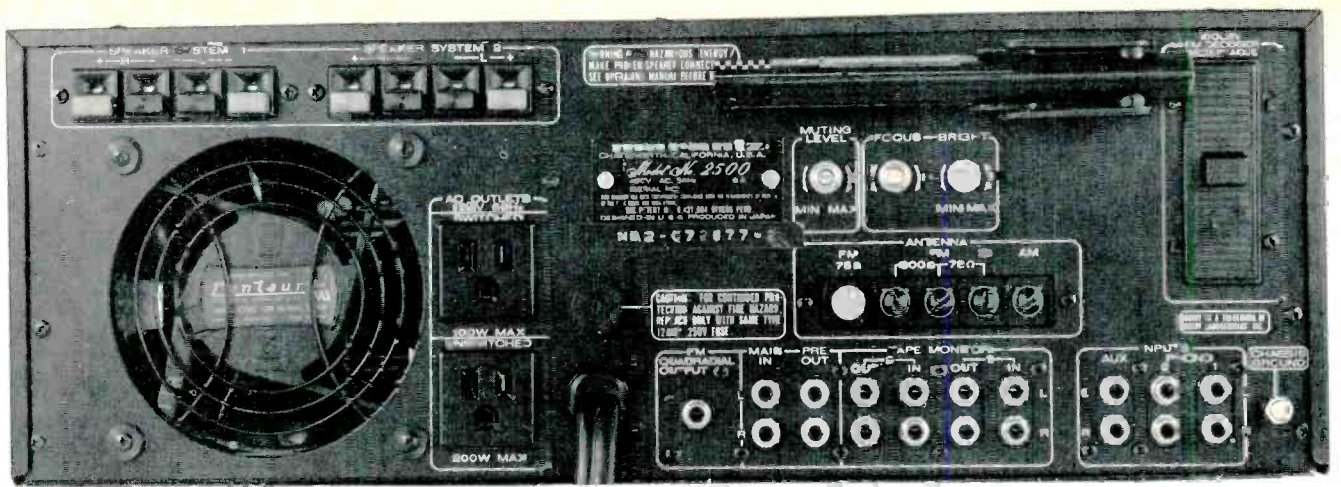
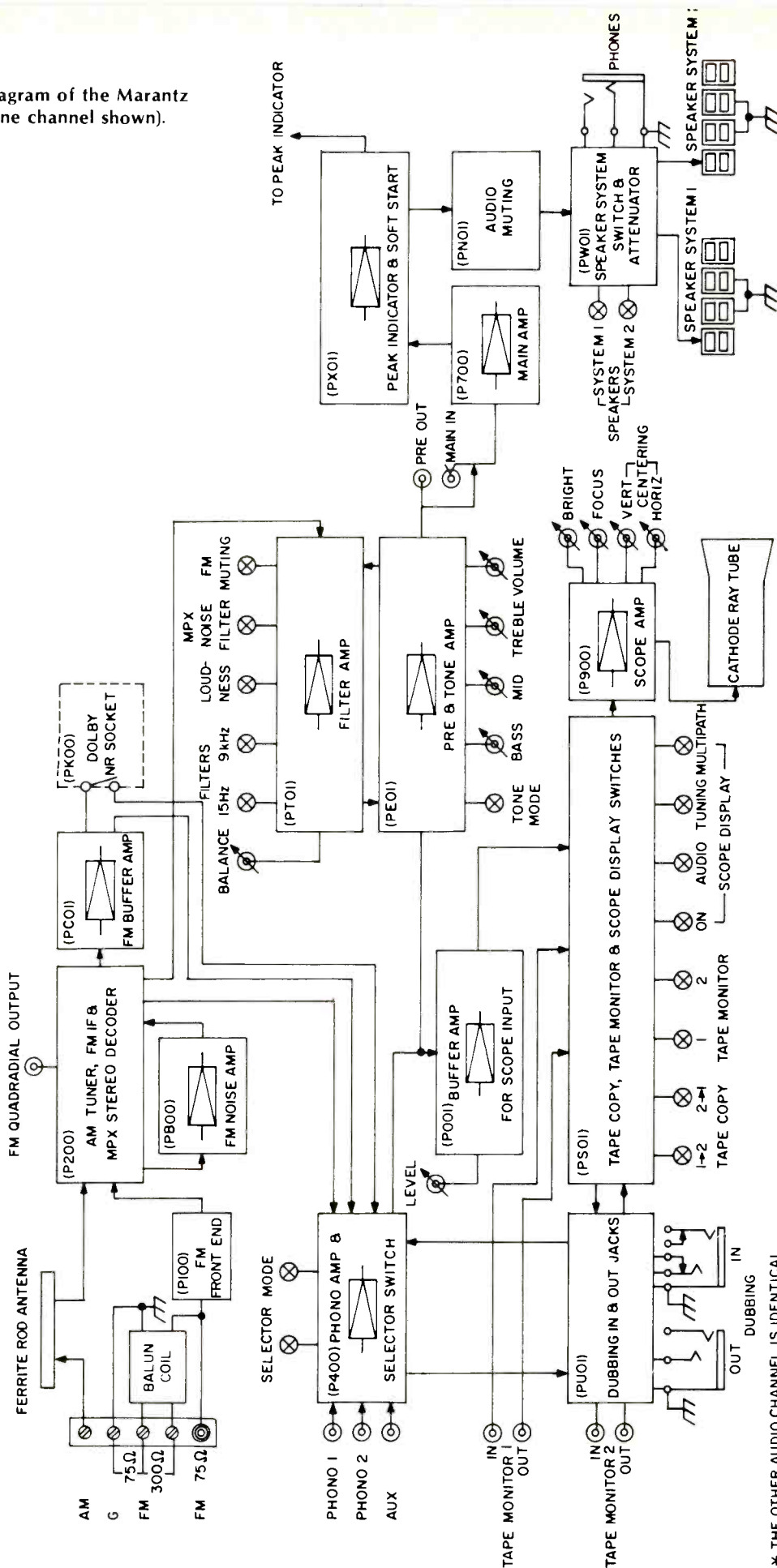


Fig. 1 — Block diagram of the Marantz 2500 receiver (one channel shown).



* THE OTHER AUDIO CHANNEL IS IDENTICAL

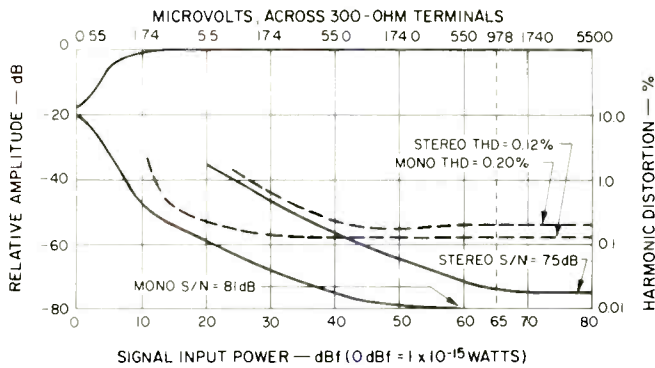


Fig. 2—Mono and stereo quieting and distortion characteristics for the FM section.

The dominating feature on the front panel of the 2500 receiver is, of course, the cathode ray oscilloscope which older Marantz fans will find reminiscent of the 'scope facilities contained in the original Marantz 10-B tuner. There are horizontal and vertical centering controls, as well as 'scope level or gain control. Pushbuttons below the 'scope tube area associated with CRT display include an *On* button as well as buttons for selecting audio display, tuning display, or multipath display. Depressing the tuning display button provides a vertical "blip" on the 'scope face which is useful for center-tuning and signal strength indications during both AM and FM listening.

Additional pushbuttons beneath the 'scope area include a pair of tape-copy switches (Tape 1 to Tape 2 and vice versa), and two tape monitor switches. A horizontally oriented slide-control serves as a channel balance control at mid-panel and to the right of it are a cluster of five more pushbuttons (high and low-cut filters, loudness switch, MPX noise filter, and FM muting) and a separate pair of speaker selector switches. The FM and AM frequency scales are somewhat shortened because of the area required by the cathode ray tube display and its controls, but the FM scale is linearly calibrated with markings at every 200 kHz. The familiar stereo indicator light is located in the dial scale area.

Marantz's well executed "gyro touch tuning" knob is located at the right of the panel, beneath the dial scale area and, just to its left are a pair of peak indicator lights which will become illuminated if the amplifier sections are driven beyond overload. A series of indicator lights to the left of the peak indicators denote program source selection including tape.

Fig. 4.—Separation vs. frequency with the 75 μ S deemphasis.

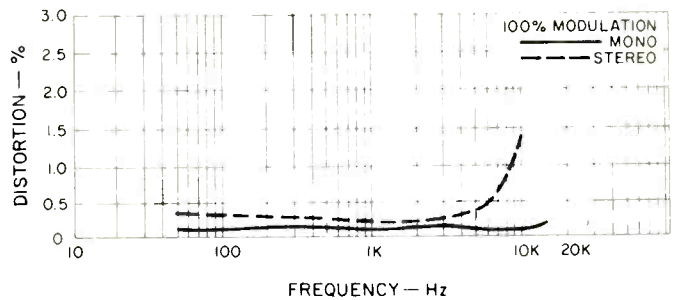
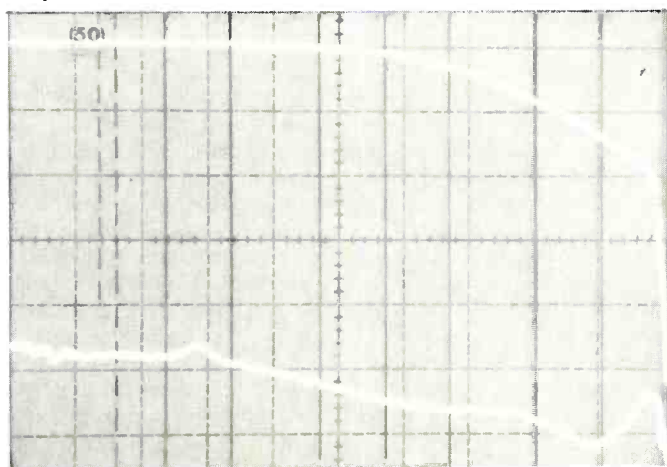


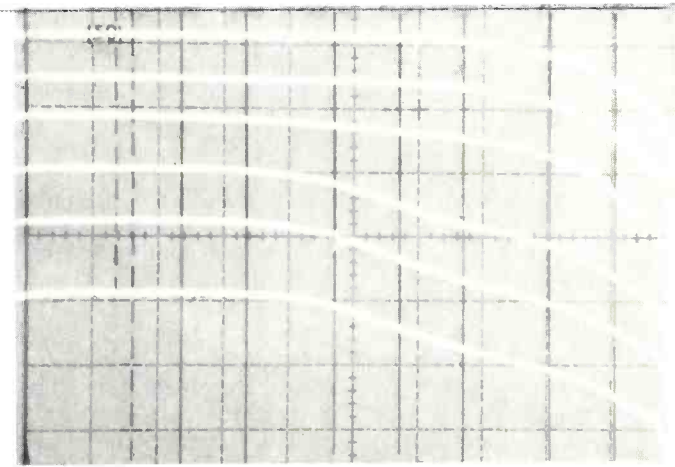
Fig. 3—Distortion vs. frequency for the FM section.

The lower section of the panel features seven rotary controls for program selection, *Mode*, *Tone Mode*, *Bass*, mid-range, *Treble* and master *Volume*. The *Mode* control offers *Stereo*, *Reverse*, *L + R*, *L-only*, or *R-only* listening, while the tone-mode switch defeats the tone controls entirely or provides alternate bass and treble turnover frequencies of 100 Hz and 10 kHz, singly or together. The master volume control is a step-attenuator type calibrated over most of its range in 2-dB steps. The power *On/Off* switch, stereo phone jack, and tape out/tape in jacks which over-ride the rear panel tape 2 jacks.

Readers viewing our photograph of the rear panel of the Model 2500 may be surprised to learn that the circular vented area at the lower left is the exhaust area of a ventilating tunnel, which includes a ventilating fan built right into the unit. Not an uncommon feature of high-powered separate amplifiers, the presence of a cooling fan in a receiver is rather unusual. The two-speed cooling fan operates very quietly under normal use and is thermostatically switched to its higher, noisier speed only if dissipation causes temperatures to exceed safe limits. In the case of our sample unit, high speed fan operation only occurred during static, high-power testing and not under any musical listening conditions.

Above the fan exhaust area are piano-key, spring-loaded speaker terminals for the two sets of speakers which can be connected to the 2500. Alongside the fan area are switched and unswitched convenience a.c. outlets. Muting threshold level, 'scope focus, and brightness controls are located just beneath the pivotable ferrite AM external bar antenna at the right of the rear panel, while just below are screw terminals for 75-ohm, 300-ohm, and external AM antenna connections

Fig. 5—Action of the optional Dolby FM decoder.



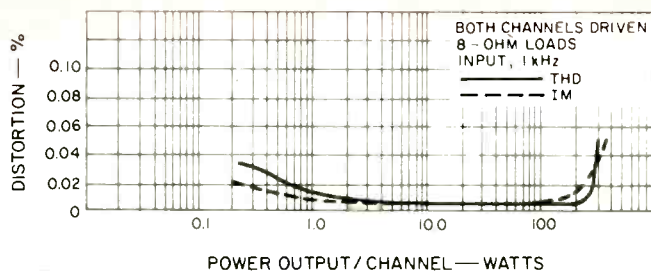


Fig. 6.— Harmonic and IM distortion characteristics with both channels driven into 8-ohm loads.

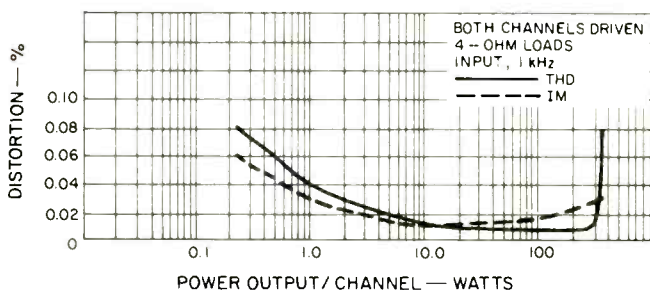


Fig. 7— Harmonic and IM distortion characteristics with both channels driven into 4-ohm loads.

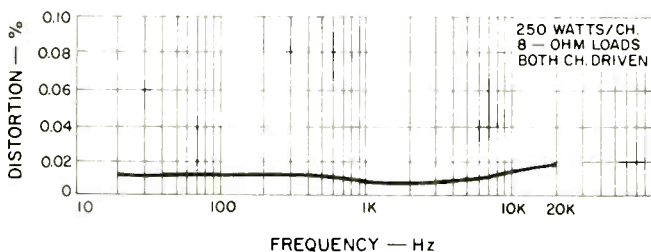


Fig. 8— Distortion vs. frequency with both channels driven into 8-ohm loads.

as well as a coaxial 75-ohm connector. Two pairs of phono inputs, aux inputs, tape in and out jacks, preamp-out/main amp in jacks, an FM detector output jack (which Marantz calls a "quadradial output" in anticipation of future four-channel applications), and a chassis ground terminal are located at the lower right of the rear panel. Just to the right of the AM bar antenna is a compartment, covered by a removable plastic plate, which is designed to accept a plug-in Dolby FM Module (Marantz Model DLB-1). When this module is used (our sample included the module), switching the front panel selector switch to the Dolby FM position (identified on the front panel as "FM 25 μ S") introduces proper FM Dolby decoding as well as the required 25 microsecond de-emphasis characteristics. Without the separate module, this position provides 25 microsecond de-emphasis only and a separate outboard Dolby decoder can be used with the 2500.

Construction and Circuit Highlights

The huge toroidally wound power transformer, visible in the internal chassis photo of the Marantz 2500, features separate secondary windings for the power amplifier sections of each receiver channel.

The r.f. FM tuner section uses dual gate MOS-FETs in the r.f. amplifier, r.f. interstage, and mixer stages. A five-gang tuning capacitor is employed. The i.f. amplifier consists of six stages of amplification—three discrete stages plus three multistage ICs, two of which serve as limiters. There are five dual-element filters, and a phase-locked-loop circuit is used in the MPX decoder section. The FM muting circuit consists of

10 transistors (including one FET) employed as d.c. amps, switches and comparators, plus a reed relay which serves as the actual muting switch.

The 2500 phono circuit has two complementary-input differential amplifiers and dual complementary drive to the second voltage-gain stage. The output stage is a complementary emitter-follower which isolates the gain stages from the RIAA equalization networks.

The power amplifier is a full complementary-symmetry, quadruple paralleled-array, direct-coupled circuit. Energy sensing protection circuitry is designed to protect the amplifiers and connected speakers without affecting audio signal quality. To further protect speakers, relay protection is used which also disconnects the speakers during turn-on stabilization periods. The relay will also disconnect if the d.c. offset at the output rises to too high a level or if high amplitude sub-sonic frequencies below 5 Hz appear at the speaker output terminals.

For all its high power capability, the Marantz 2500 is relatively light in weight. The output devices are mounted on the inside surface of the heat dissipation tunnel which is fan-cooled. Mounted onto each output transistor is an individual heat sink having a circular group of vertical fins. There are four thermostats in the heat sink tunnel; one pair controls fan speed and the other pair, activated at high temperatures, disconnects the speakers from the output transistors. When temperatures return to normal levels, normal operation is resumed automatically. A complete block diagram of the Marantz 2500 is shown in Fig. 1. Only one channel of audio is depicted in this diagram, since the other channel is identical.

FM Performance Measurements

Usable mono sensitivity was 10.3 dBf (1.8 μ V), while stereo sensitivity was a function of the auto-switching which occurs at around 19.2 dBf (5.0 μ V). The 50-dB quieting point occurred with an input signal of only 10.8 dBf (1.9 μ V); a very low 33.2 dBf (25 μ V) in stereo. S/N in mono, at 65 dBf, reached 81 dB, while in stereo, S/N for the same signal strength was 75 dB, both as claimed. Distortion, at 1 kHz, decreased to 0.12 per cent in mono for strong signals, while in stereo, it measured 0.2 per cent at a 65-dBf level. We noted, however, that stronger signals, above the 65-dBf level, caused a further reduction in THD, down to a low of 0.14 per cent in stereo. These characteristics are all plotted in Fig. 2, while in Fig. 3 we have graphed the distortion of the FM mono and stereo tuner sections as a function of frequency. THD is extremely low and uniform in mono over the entire audio band; slightly higher in stereo, rising to 0.46 per cent at the 6 kHz high frequency test point. Figure 4 is a plot of desired-channel output and opposite channel separation in stereo FM, from 20 Hz to 20 kHz, using the normal 75-microsecond de-emphasis setting. Specific points measured disclosed a very high separation capability of 57 dB at 1 kHz, 50 dB at 100 Hz, and 40 dB at 10 kHz.

The curves of Fig. 5 illustrate the response of the FM section with 25-microsecond de-emphasis included and, in addition, the lower-level traces show the added treble attenuation introduced by the Dolby decoding section using the optional plug-in board. Muting level threshold was variable from 20 dBf (6.0 μ V) to 39.2 dBf (50 μ V). Sub-carrier product rejection was excellent, with readings of 75 dB. Capture ratio measured 1.0 dB as claimed while the three major forms of rejection capability (i.e., image, and spurious) were all beyond the 100 dB limits of our test setup. Frequency response in stereo was off by 1.5 dB at 15 kHz, with reference to the standard 75-microsecond de-emphasis characteristic as against 1.0 dB claimed. Selectivity measured 87 dB, somewhat better than claimed, while AM suppression was exactly 60 dB as claimed.

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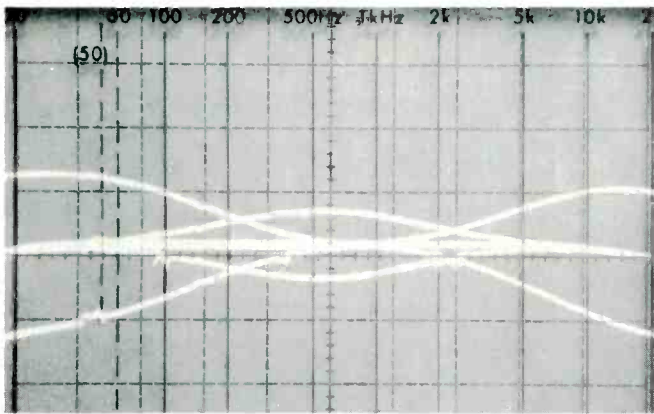


Fig. 9—Range of bass, treble, and midrange tone controls.

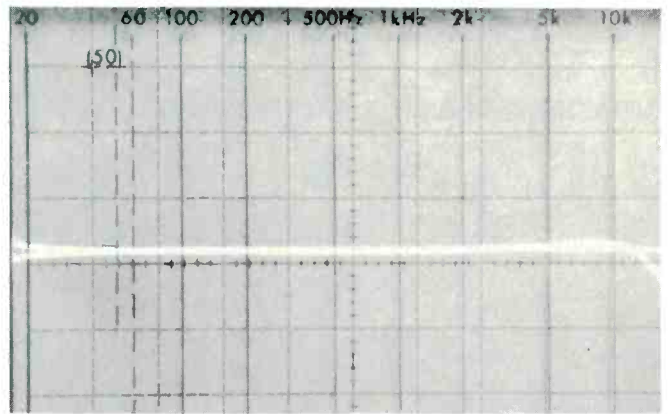


Fig. 11—Response of the high-cut filter (sub-sonic filter is below range of this sweep).

AM Tuner Section Measurements

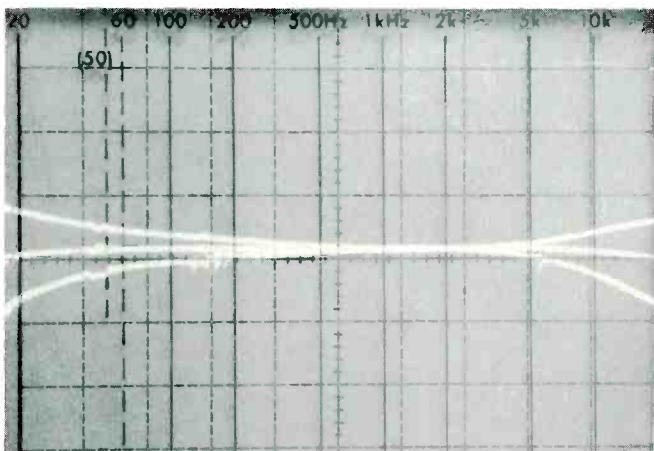
Usable sensitivity of the AM section measured $15 \mu\text{V}$ at 1 MHz using an external dummy antenna connection while with signal injected into the internal antenna via a standard loop, sensitivity was $330 \mu\text{V}/\text{meter}$. Best signal-to-noise ratio obtained was 53 dB while THD, for 30 per cent modulation, was a comparatively low 0.5 per cent. Listening tests conducted later confirmed that the tuner's AM section was of higher-than-usual quality and the good alternate channel selectivity of the circuit (which, incidentally, uses a 3-section tuning capacitor) makes the AM worth listening to

Power Amplifier Section

Since Marantz chose to rate the power output of this receiver for both 8- and 4-ohm loads (most manufacturers refrain from making 4-ohm power claims because of problems encountered during FTC one-third power output preconditioning), we measured power output capabilities for both load conditions as well. With a 1-kHz test signal and 8-ohm loads the amplifier delivered just over 300 watts per channel before THD rose to rated 0.05 per cent. Rated IM Distortion of 0.05 per cent occurred with a power output of 330 watts per channel. At rated output of 250 watts per channel (8-ohm loads), THD measured 0.0045 per cent while IM distortion was 0.014 per cent. These results are plotted in Fig 6.

With 4-ohm loads, for a rated THD of 0.08 per cent, the amplifier produced 341 watts per channel; 356 for a rated IMD of 0.08 per cent. Power versus THD and IM using 4-ohm

Fig. 10—Action of bass and treble controls when set to alternate (100 Hz and 10 kHz) turnover frequencies.

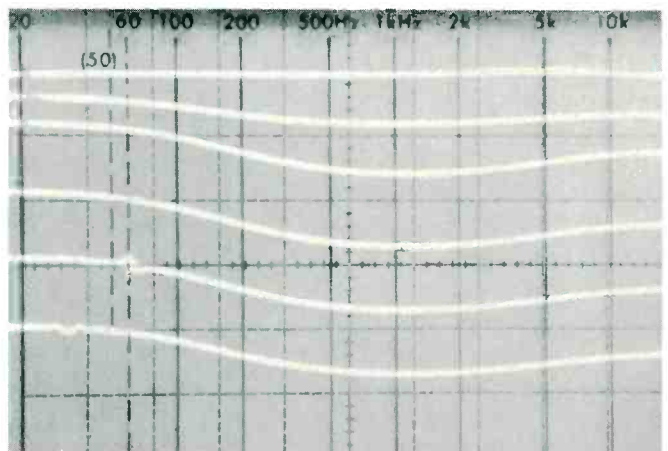


loads is plotted in Fig. 7. Distortion versus frequency was measured at several test frequencies for the 8-ohm load condition. We refrained from making these extended measurements using 4-ohm loads because of a cautionary note provided by Marantz regarding such extended static tests using the lower impedance loads—a condition which Marantz correctly points out would not be likely to occur under actual music listening conditions. Results of the 8-ohm load distortion versus frequency tests for rated output (250 watts per channel, both channels driven) are plotted in Fig 8. Even at the frequency extremes, THD remains well below the rated 0.05 per cent—in itself an impressively low rated-THD figure. In fact, Marantz might well have rated the power output of the 2500 as 292 watts per channel and still conformed with FTC power rules, had they chosen to be less conservative. On the basis of the 250-watt-per-channel rating, power bandwidth extended all the way from below 10 Hz to 32 kHz, as compared to the 20 Hz to 20 kHz power band claimed.

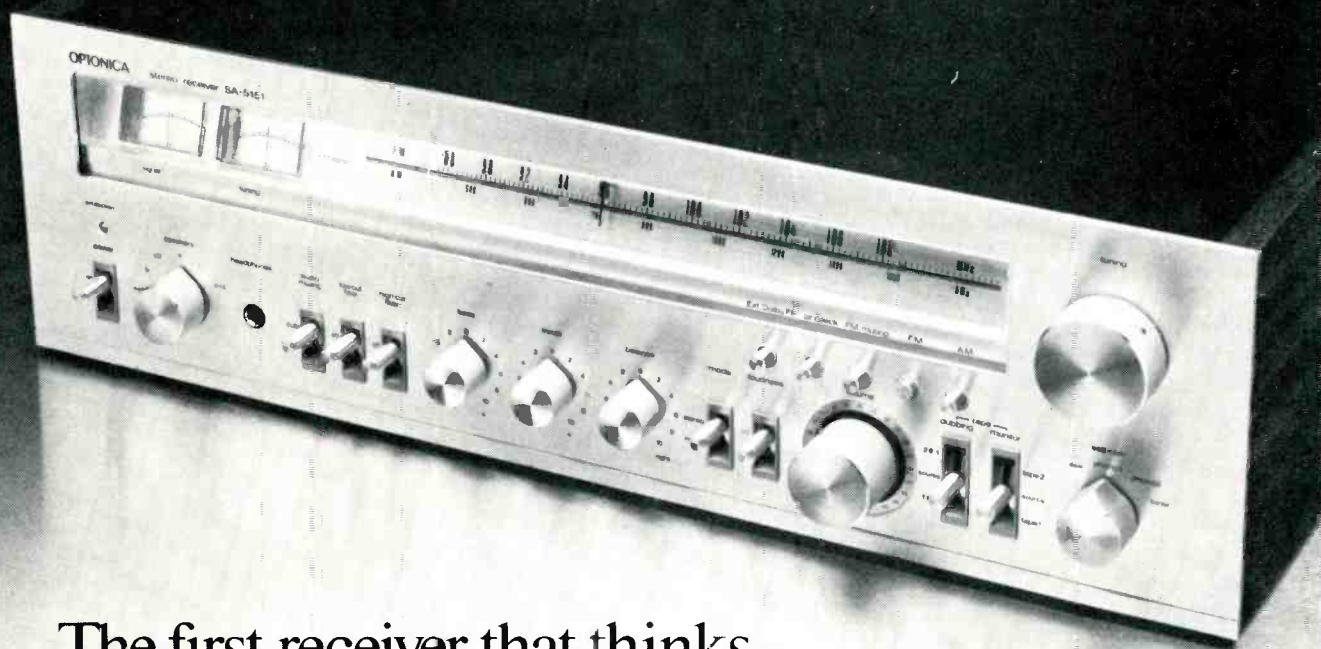
Preamplifier Section Measurements

Phono sensitivity of the Marantz 2500, for both sets of phono inputs, was 1.7 mV and overload capability was 220 mV, or 20 mV better than claimed. Marantz quotes their signal-to-noise specifications in rather an odd way. They refer the low level S/N measurements to 7.5 mV (*not* actual rated input sensitivity and *not* the more commonly used 10 mV). In any event, referred to actual sensitivity, the phono S/N

Fig. 12—Response at various settings of master volume control with the loudness switch activated.



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(unweighted) measured 68 dB—a figure which translates to 81 dB using the 7.5 mV reference—and a bit better than claimed. In the case of the high level inputs, they chose to refer the hum and noise to a 0.775 volt input, or nearly 13 dB higher inputs than the actual input sensitivity which we measured as 175 mV. Be that as it may, we obtained a superb S/N of 95 dB referred to actual input sensitivity and if you want to add 13 dB more to that to do it the same way that Marantz does, feel free to do so.

RIAA equalization was extremely accurate, deviating by no more than 0.2 dB from 30 Hz to 15 kHz.

Figure 9 is a composite 'scope photo illustrating the range of the bass, treble, and mid-range controls, when the bass and treble controls are set to operate at their conventional "hinge points." The useful mid-range control provided on the 2500 has been wisely restricted in its action to approximately ± 5.0 dB, with maximum boost or cut occurring at around 500 Hz (a bit too low for good presence control, in our opinion). Flexibility of the bass and treble controls is enhanced with the inclusion of alternate turnover settings and, when these are selected, mid-frequency response is unaffected by these controls whose range then becomes restricted to the frequency extremes, as shown in the 'scope of Fig. 10.

The sub-sonic filter of the Model 2500 provides attenuation below 15 Hz and its action was therefore not evident in the sweep-frequency scope photo of Fig. 11 (which only extends from 20 Hz to 20 kHz). The action of the 12 dB/octave high-cut filter is clearly discernible, however, with attenuation beginning at around 10 kHz—perhaps a bit on the high side for effective scratch and hiss removal. Figure 12 depicts the usual non-calibratable loudness compensation curves introduced at various settings of the master volume control.

Summary, Listening Tests, and Comments

The FM tuner section of the Marantz 2500 performed very well and we still feel that the oscilloscope display, as an aid in tuning, is the next best thing to full frequency synthesis. In terms of multipath minimization, there is nothing that beats the scope observation method. The Dolby module is a clever approach in that it does not penalize the purchaser of the receiver if he or she has no Dolby FM broadcasts presently available. Background noise in FM is extremely low, and the steep quieting slope of the tuner section makes weak-signal reception listenable for a number of stations that are otherwise unsatisfactorily received in our listening region.

The enormous power capability of the 2500 is, happily, not of the "brute force" type which, in many competitive products, offers lots of watts without regard to musical accuracy, transient response, and the more subtle aspects of high SPL reproduction. The amplifier is extremely stable, even when subjected to some of our trickier load conditions, and musical reproduction was open and tight, even at levels approaching clipping. The peak indicators, in our listening test, were a bit of frosting on the cake, since we were not able to make them flash at any listening levels with any of the speaker systems employed, though there are, no doubt, some very low efficiency speakers which would justify the peak as well as the power indicators incorporated in the Model 2500. Marantz has, quite obviously, incorporated the most-wanted control features on this top-of-the-line receiver, and certainly, they did not trade off features for power in the 2500.

In the last analysis, we must confess that if a 250-watt-per-channel receiver is what the world is after, we are happy that a company like Marantz took up the challenge, rather than some company who might have sacrificed basic good performance for sheer high power.

Leonard Feldman

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Twin pivots insure superior transient ability, enabling the 2002-e to accurately follow even the most complex waveforms. And dual bearings maximize tracking ability, so that even difficult high-level passages can be accurately tracked at very low stylus forces.

Beryllium cantilever. The 2002-e's precisely-formed cantilever is made of beryllium—an exotic space-age substance that is 35% lower in mass than conventional stylus bars. As a result, the cartridge boasts far lower moving mass, contributing further to its superior transient ability and unusually 'transparent' sound. By dramatically reducing moving mass, the 2002-e also reduces record wear to vanishingly low levels.

Low cartridge body weight. More and more tone arm designers are discovering the importance of cartridge weight, especially in tracking warped

records. Since over 95% of today's records are warped to some degree, a lighter cartridge means more effective tracking at lower stylus forces. At less than half the weight of most high-end cartridges, the 2002-e enables you to enjoy records that couldn't be tracked by other cartridges.

The mismatch problem: solved. Until now, an exact match between phono cartridge and preamp (or receiver) input impedance was required for flat frequency response. The 2002-e's built-in passive microcircuit eliminates mismatch problems by automatically controlling output impedance. This microcircuit also makes the cartridge immune from the effects of cable capacitance, so the 2002-e may be used with all types of tone arms—even those lacking low-capacitance cables.

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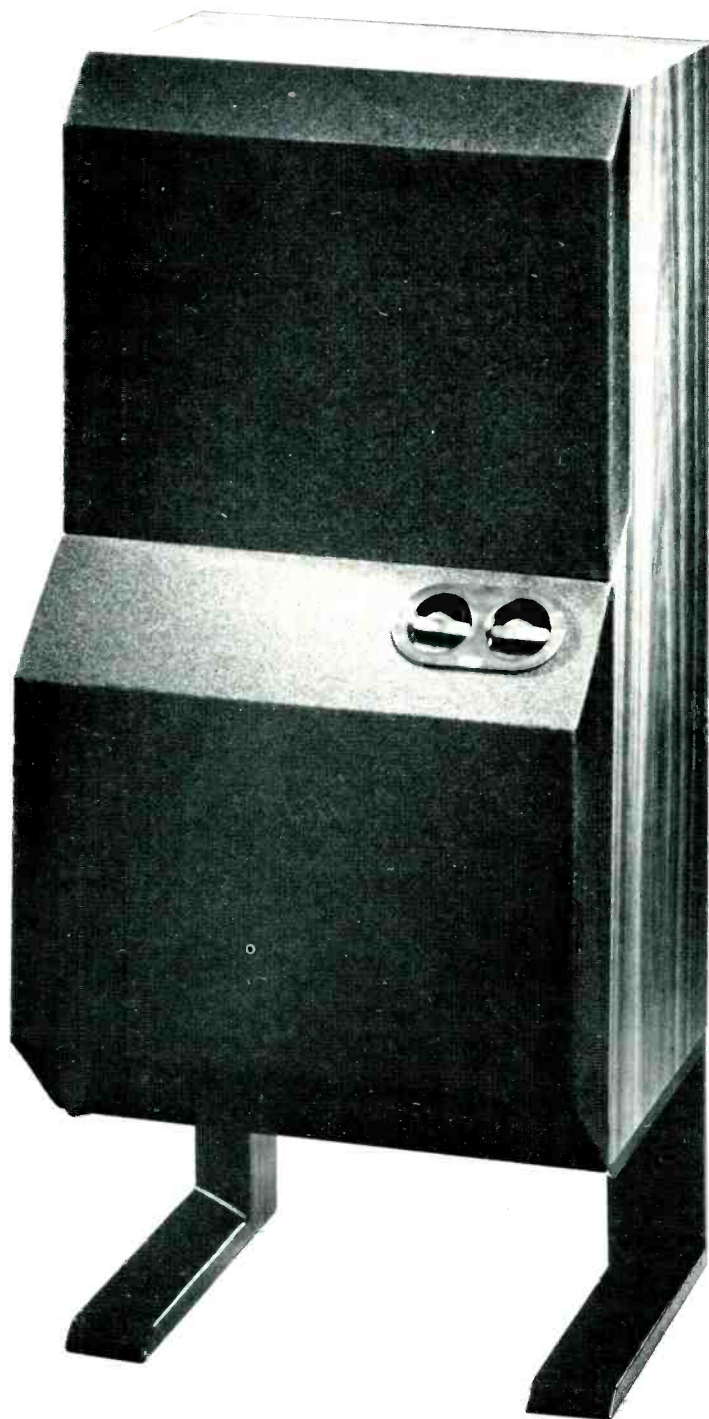
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B & W DM-6 Speaker System



MANUFACTURER'S SPECIFICATIONS

System Type: Linear phase dynamic.

Speaker Complement: 10 in. (25 cm) woofer; 6 in. (15 cm) midrange, and $\frac{3}{4}$ in. (2 cm) dome tweeter.

Crossover Frequencies: 500 Hz and 5 kHz.

Impedance: 8 ohms, nominal.

Dimensions: 36 $\frac{3}{4}$ in. (93.1 cm) H x 16 $\frac{1}{2}$ in. (41 cm) W x 15 in. (38 cm) D.

Weight: 79 $\frac{1}{2}$ lbs. (36.1 kg).

Price: \$625.⁰⁰, with limited five-year parts and labor warranty.

The DM-6, made by B & W Loudspeakers Ltd., West Sussex, England, is one of the newer breed of time delay equalized loudspeakers. The tweeter, midrange, and woofer are physically offset relative to each other in such a way as to compensate for the differential time delay for the sound from each of them. The midrange speaker is mounted above the woofer and placed on a panel offset 84 mm behind the woofer panel. The tweeter is similarly placed above and 36 mm back from the plane of the midrange speaker.

A two-piece fabric covered metal grille protects the loudspeaker cones from damage. Some user assembly is required, as two metal feet are provided to raise each DM-6 system above floor level, and these must be attached by the use of the bolts and allen key which is supplied. The DM-6 uses sockets for electrical connection to the rear of the loudspeaker. Two 4-mm plugs are supplied with each unit, which are to be attached to the speaker wires by the user and then plugged into the DM-6.

When assembled, the DM-6 can readily be moved from one position to another by use of the smooth metal stands. However, I caution that these speakers should not be placed where there is moderate foot traffic which could cause them to be bumped or where toddlers may be tempted to push them over. The DM-6 is definitely top heavy and the diminutive feet do not, in my personal opinion, provide sufficient stability against tipping over when severely bumped.

When assembled, these speakers stand 93 cm (37 in) high, are 41 cm (16 in) wide, and 39 cm (15 in) deep. Finished in walnut with black trim, these speakers are quite attractive, although I must admit that standing rigidly at attention on their metal feet, with the pot belly protuberance caused by the woofer housing, I could not help but think of them as the 'droid R2D2 from "Star Wars."

Three equalizer controls are provided for adjustment of response level, each control having three switch positions. A *LF CONTOUR* control mounted on the rear tapers the response below 400 Hz. A *CONTOUR* control mounted on the front changes the signal level in the 500 Hz to 5 kHz band by about 2 dB per position. While a *HF ENERGY* control, also on the front, varies the frequency response by about the same amount above 5 kHz.

An excellent instruction book is supplied which can be easily followed for best setup by the user. In addition, each loudspeaker comes with a calibration certificate. This is an individual ink recording of the frequency response of that particular loudspeaker. Unfortunately, the response curve did not specify where the test microphone was placed, which dB scale was applicable, or whether third octave or continuous tone sound was used to generate the curve. A small point perhaps, but after all B & W did go to a lot of bother to use the highest quality B & K test equipment for that response curve. [Editor's Note: We have been informed that the scale on the graph is in 2 dB increments. The microphone was placed at three meters, on axis, and aligned with the center of the listening window (approximately the tweeter). A third octave sound source was used to generate the curve.]

Technical Measurements

There are 27 possible combinations of equalizer positions on the DM-6, each of which changes the terminal impedance by some small amount. Figure 1 is the magnitude of impedance for two of those positions, nominal equalizer settings and the settings giving the lowest impedance at 10 kHz. This latter condition occurred when both the contour and energy control were set to the plus position.

The lowest value of impedance within the audio band is around 4.5 ohms and occurs at 12 kHz. The polar impedance plot is shown in Fig. 2, which reveals that a lagging phase

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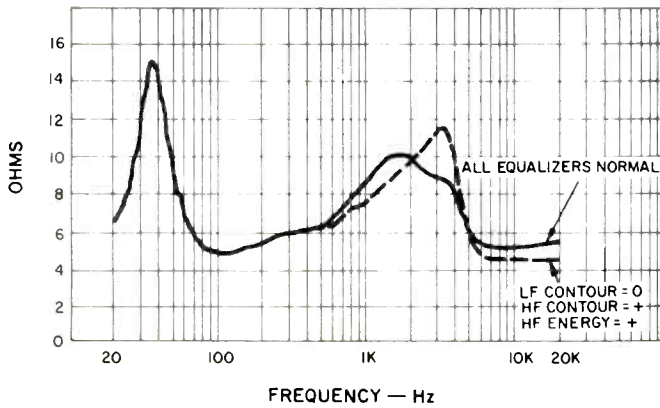


Fig. 1— Magnitude of impedance for nominal equalizer setting and also for worst-case amplifier load equalizer setting.

angle of almost 45 degrees occurs at 4.5 kHz. I consider that this highly capacitive reactive load is a potentially more serious source of difficulty from the standpoint of amplifier distortion than the 4.5 ohm resistive load at higher frequencies. To minimize the possibility of amplifier distortion for strong sibilant peaks, such as might occur with female vocals, I recommend the use of a high-quality amplifier for the DM-6 with a peak power capability of at least 50 watts. (*Editor's Note: B&W notes that the current DM-6 no longer has the shelving-type tone control using a transformer and thus should not exhibit reactive loading of the amp.*)

76 The amplitude of the anechoic frequency response, measured axially at one meter and with one-watt average drive for a nominal 4 ohm load, is shown in Fig. 3. This curve is taken with all equalizer positions set to their indicated nominal conditions. Since this curve deviates in substantial detail from the measured frequency response supplied by B & W, the measurement came as quite a surprise. Extensive experimentation revealed the following observations: the dip at 5.8 kHz occurs for the one meter axial position and extensively changes its properties with microphone position, particularly elevation angle relative to the axial position. At an angular depression 5 degrees below this position, the dip moved to 5 kHz, while a 5 degree upward angular position

Fig. 2— Polar plot of impedance for worst-case amplifier load at high frequencies.

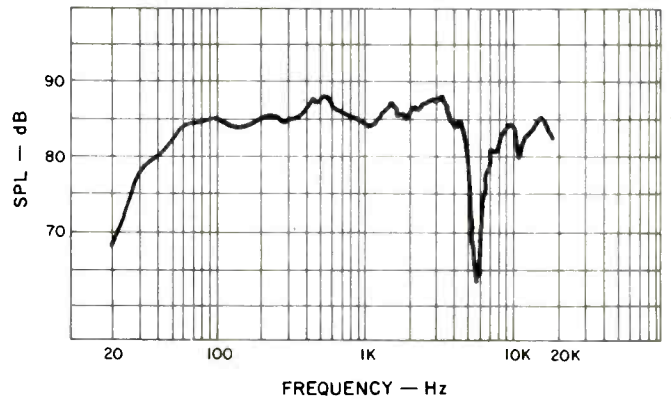
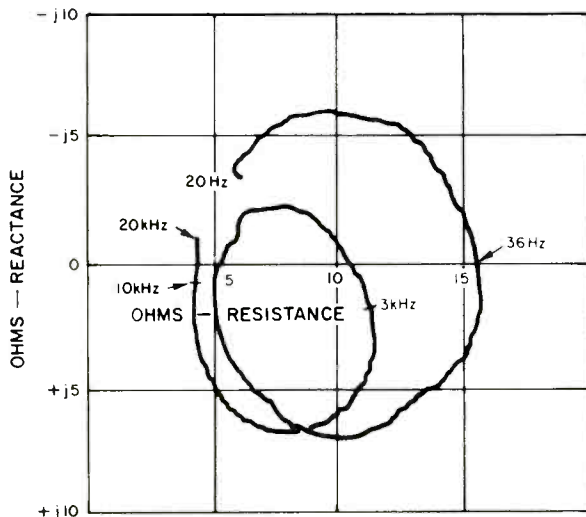
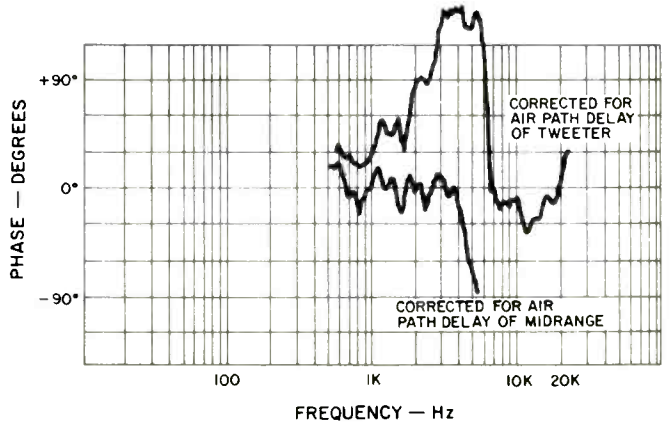


Fig. 3— One-meter-axial anechoic amplitude response for constant voltage drive corresponding to one-watt average power in a 4-ohm resistor, with equalizer settings at nominal.

removed the dip completely and gave a curve more nearly like that supplied by B & W. (Thus the perils of measurement.—*Ed.*) This higher elevation angle places the microphone more nearly in line with the tweeter. Other measurements, not presented here, show that the high frequency energy control provides a nominal 2 dB variation above and below the standard setting for frequencies above 5 kHz, as B & W states, with a similar verification of the 2 dB contour effect between 500 Hz and 5 kHz. (*Editor's Note: In subsequent conversation, B&W stated that their measurement position was at three meters on axis with the tweeter. This position and distance, they feel, are much more normal for a listening position, and the speaker was designed to provide optimum frequency and phase response at or immediately beyond three meters.*)

The phase response for the one meter axial position is shown in Fig. 4. Two curves are shown, one corrected for the time delay of components above 6 kHz and the other corrected for the time delay of components below 4 kHz. At this, the axial position, the tweeter sound arrives approximately 0.14 milliseconds after the midrange signal. The acoustic position of the tweeter lies approximately 4.5 cm behind that of the midrange driver for the one-meter axial position. Raising the microphone brings the two into closer time alignment,

Fig. 4— One-meter-axial phase response corrected for air path delay of tweeter and midrange.



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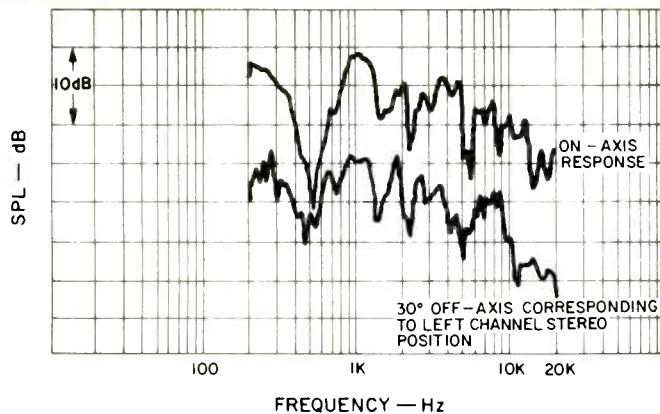


Fig. 5—Three-meter "room" response for the DM-6 braced against the back wall with all equalizers set to the nominal position.

which explains the response aberration at around 5 kHz. This means that a better transient response will be evident for the DM-6 if the location of the listener is elevated 5 to 10 degrees above the axial position.

The DM-6 tweeter has an outstanding frequency response. It goes out to over 35 kHz on axis, but the grille, while both attractive and supplying physical protection to the midrange and tweeter, is a source of internal multiple reflections which can color the response above 6 kHz in a way strongly dependent upon angular position. In the frequency response, this shows up as 3-dB ripples on an otherwise uniform characteristic. The most uniform response is obtained when the grille is removed entirely. The DM-6 is principally minimum phase throughout most of its frequency range.

The three-meter room response of the DM-6 is shown in Fig. 5 for a frontal position and 30-degree stereo-left-channel position. The responses are displaced 10 dB on this chart for clarity of presentation. The equalizer controls were all set to their nominal position for this test, and the speaker was placed against a wall as recommended in the instruction manual which comes with this speaker.

It is apparent that the room response of the DM-6 is not strongly dependent on the azimuth angle for direct sound. However, substantial floor and ceiling scatter of sound is evi-

dent in this measurement. Because of this, I recommend that the DM-6 not be placed on a hard floor. The average response drops slightly with increasing frequency, but the peaks and dips about this average are stronger than I would have liked to see on such an otherwise high-quality system.

The polar energy response for the three positions of high frequency energy equalizer are shown in Figs. 6 and 7. The azimuth response is quite uniform within the normal stereo angle ranges, and there is no left-right asymmetry to cause stereo concern. The vertical response is stronger at positive launch angles but does have indication of some slight vertical beaming. Because of the strong energy for vertical angles up to 45 degrees, the DM-6 should definitely not be placed immediately under projecting shelves or surfaces that can cause reflected sound to interfere with the more uniform direct sound.

Harmonic distortion for the tones of E₁ (41.2 Hz), A₂ (110 Hz), and A₄ (440 Hz) is shown in Fig. 8. The second harmonic distortion is stronger than the third harmonic distortion at almost all sound pressure levels, and the distortion rises in a uniform fashion with increasing drive. These properties, as well as the generally low value of distortion, are a sign of clean sound. The DM-6 does, however, have a problem handling very low bass at high sound levels, and care should be taken to prevent overdrive on strong low frequency signals. This speaker is not a window rattler and should not be driven as such.

This is also evident in the intermodulation distortion measurement shown in Fig. 9. In this case we are measuring the crossmodulation of A₄ (440 Hz) by E₁ (41.2 Hz) when both are mixed at equal level. Distortion is moderately low for power levels below 10 watts average, but rises rapidly above that power level. The nature of this crossmodulation is such that there is principally a phase modulation of the 440 Hz together with an average drop of sound level compared to what it would be without the low tone. At 100 watts average, this phase modulation amounts to about 3 degrees peak to peak in the 440-Hz tone. There is, in addition, a slight retardation of arrival time with increase in drive level.

The transfer characteristic of the DM-6 is such that there is a one-half dB drop of gain at 20 watts average power relative to the gain at 1 watt. There is a similar drop in gain with random noise, but the crescendo limit on this speaker is still

Fig. 6—Horizontal polar energy response.

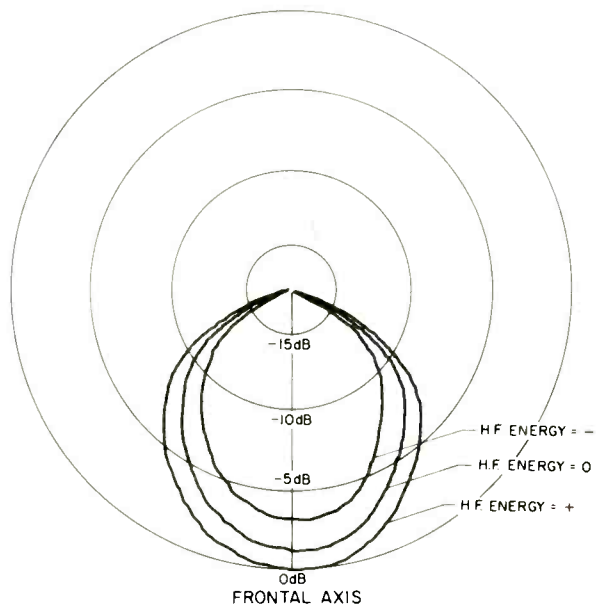
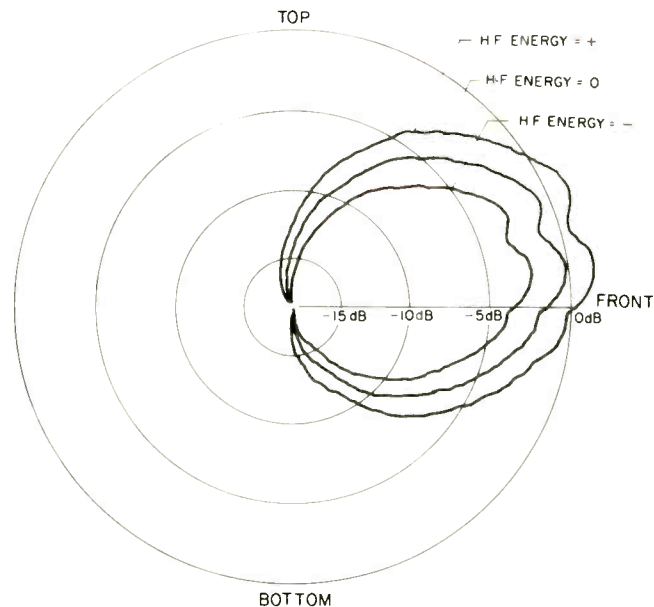


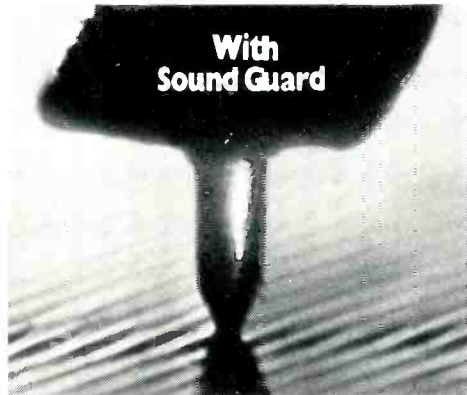
Fig. 7—Vertical polar energy response.



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quite high at around 500 watts peak for momentary noise spikes. This measurement confirms the listening evaluation that there was some midrange ducking at high sound levels.

The energy-time curve of Fig. 10 shows that the impulse response has a few problems. These problems are principally related to the separation in arrival time of the midrange and tweeter sound, and to the internal reverberation from the grille in front of these drivers. This data is taken one meter axially. The first peak at 3.06 milliseconds is due to the midrange driver and the second peak at 3.2 milliseconds is due to the tweeter. Subsidiary peaks at 3.5, 3.9, 4.4, and 4.8 milliseconds are due to the grille. If the grille were removed the transient response would be much better. (Editor's Note: B&W tells us that the current models have the following improvements: The baffle board has been changed into an irregular surface, and V-shaped foam has been added around the tweeter. The combination, says B&W, substantially reduces distortion at high levels due to standing waves between the front baffle board and the metal screen.)

Listening Evaluation

The DM-6 was auditioned in several different room positions during the listening tests performed before the measurements. In my opinion, the best position for realism of the stereo illusion was obtained when the speakers were placed flat against a wall and facing directly outward. I did not find that there was any reasonable improvement to be obtained with these speakers angled either toward or away from the listening position. Of course, rooms and taste differ, so experimentation may be worthwhile for each individual setup.

In my opinion, the extreme low bass end of the spectrum is down in level in the DM-6. I preferred the balance obtained when the rear-mounted bass contour equalizer was set to its zero, or maximum, position; the contour control set to the

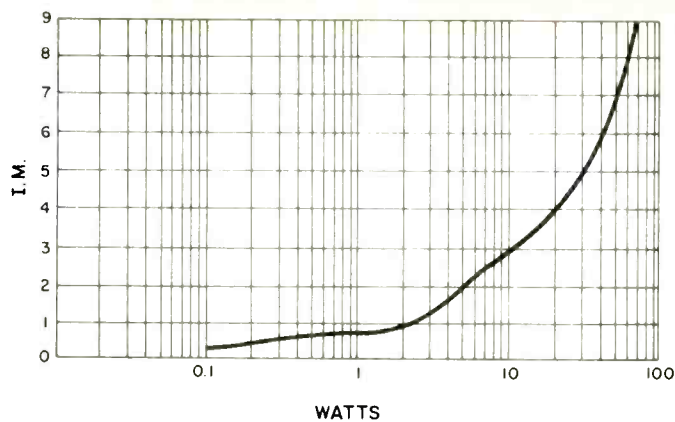
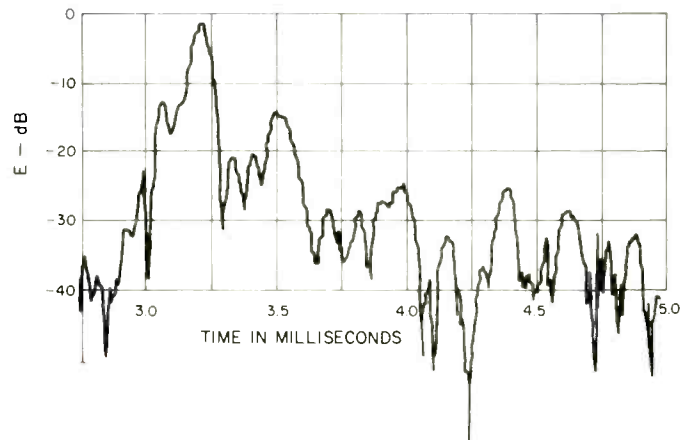


Fig. 9— Intermodulation distortion of A₁ (440 Hz) by E₁ (41.2 Hz), mixed one-to-one.

Fig. 10— Energy-time response.



plus position, and the HF energy control set to minus. These may be weird settings, but that is what I preferred for best subjective realism.

The top end response was clean as far as discernible distortion at moderate levels, but had a crispness which indicated some mild response peaks in the highest register. At high sound levels I sensed some midrange ducking, or compression, and there was a form of distortion which sounded much like cone cry, or cone breakup. This occurred on the brightest transients of material such as the new Sheffield **King James Version** recording. Unless you like to break leases, I do not suspect you would subject the DM-6 to the levels where this becomes apparent.

Stereo imaging is extremely good for lateralization and moderately good for depth. Kick drum and pipe organ sound thin, to my ears, on the DM-6. Piano music is crisp but lacks a bit on the lower registers. Vocals sounded reasonably accurate, if a bit sibilant.

Since the DM-6 is one of the first speakers I have tested in which the tweeter, midrange, and woofer are physically offset to provide proper transient arrival time, I was considerably more critical in my evaluation of its transient capability. Generally, I felt there was an improvement in articulation of orchestral voices over several other speakers I have tested in this price range. But in honesty, I cannot say that my impressions might not be due to the fact I knew an attempt had been made to make it more accurate. In other words, it did not jump out at me as a "wow" impression. It was better, but just better. In sum, I think the DM-6 is a good sounding speaker.

Richard C. Heyser

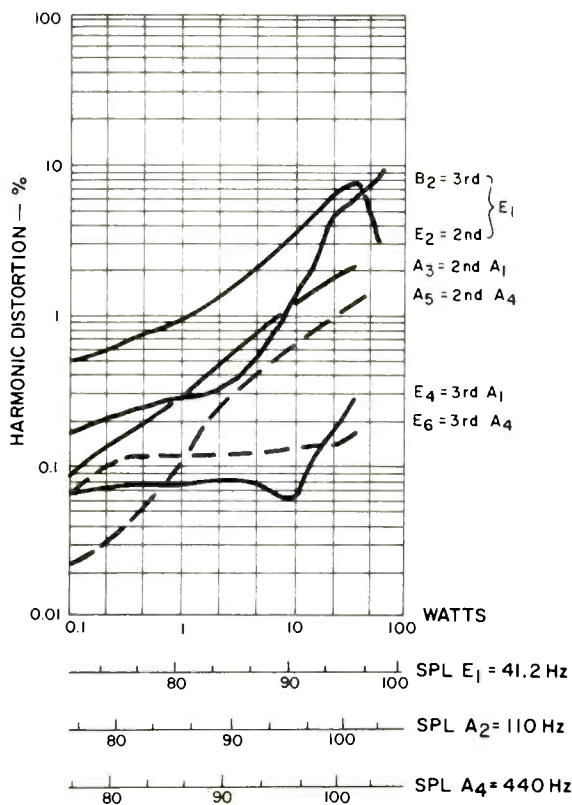
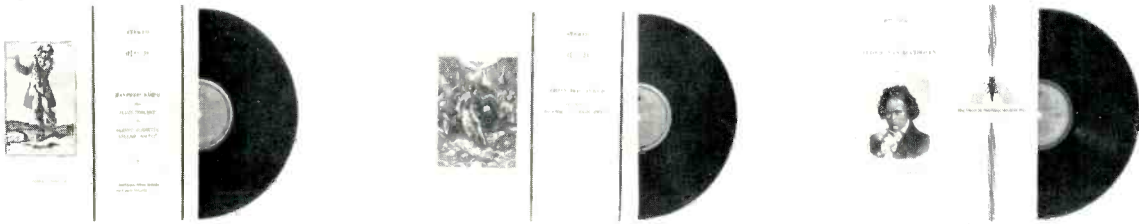


Fig. 8— Harmonic distortion for the tones E₁ (41.2 Hz), A₂ (110 Hz), and A₄ (440 Hz).

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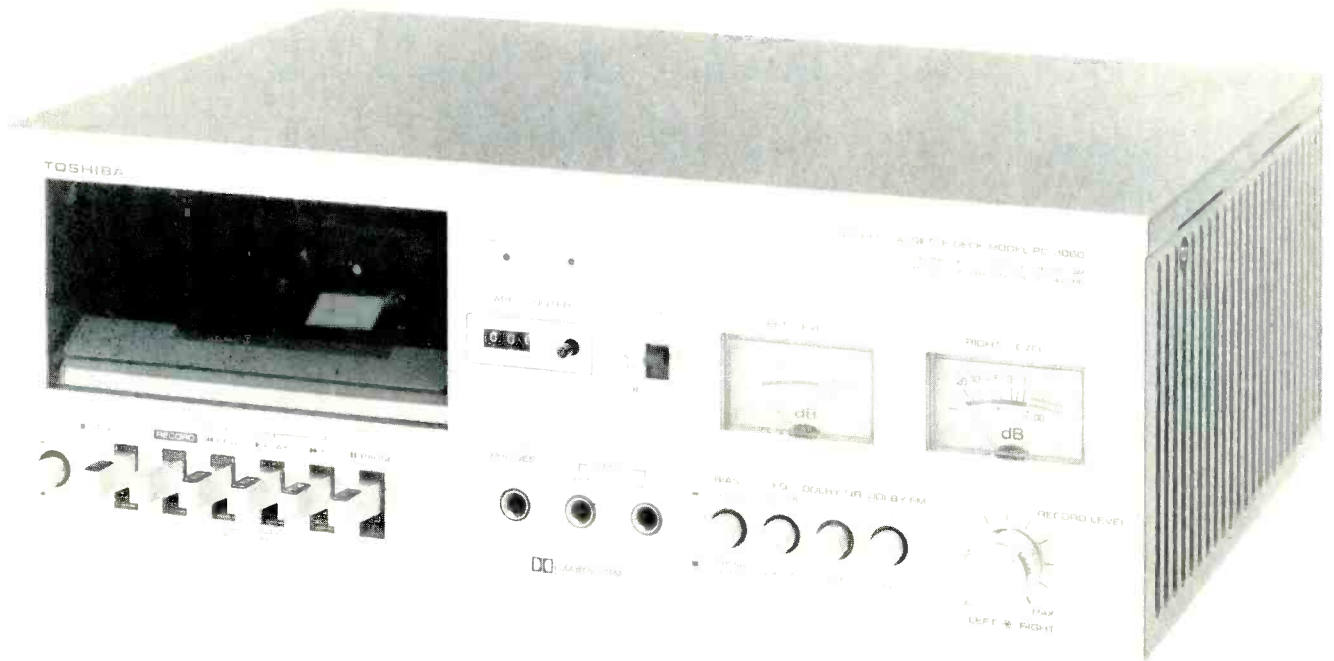
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Underneath there is the usual row of tape control levers, and next to these are the headphone and microphone sockets (standard 1/4 inch). Above these is a digital counter and two tiny indicator lights for *Dolby* and *Record* with the timer switch. Just underneath these two VU meters are a group of four pushbuttons: the first two are for the selection of bias and equalization, the third is the Dolby switch, and the fourth

is depressed when you record from FM using the Dolby system. On the extreme right is a dual-rotary control and at the extreme left is a pushbutton *On/Off* switch.

The standard RCA-type input and output sockets are located in a small recess at the rear of the unit, and just above them are the Dolby calibration controls with the 25 and 75 μ S de-emphasis switch. The separate bias and equalization switches allow Ferric Oxide, CrO₂, and Ferrichrome tapes to be used. There is also a timer switch that will permit the deck to be switched on via the timer in either the *Record* or *Playback* mode. The motor is a d.c. servo type, fed from a 12 V supply, and the majority of components are mounted on one large circuit board. There is a total of 20 transistors and eight ICs.

Measurements

Figure 1 shows the playback response from a standard test tape, and Fig. 2 shows the Record/Replay response at 0 and -20 VU using Maxell UD tape. The 3-dB-down point was at 14.5 kHz, and it will be seen that the output shows a slight rise

Fig. 1—Playback response from a standard test tape.

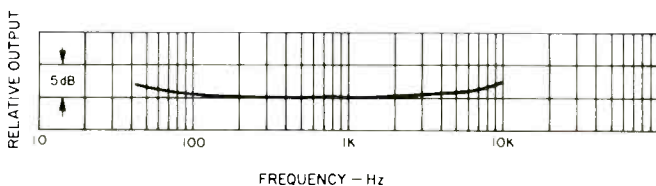
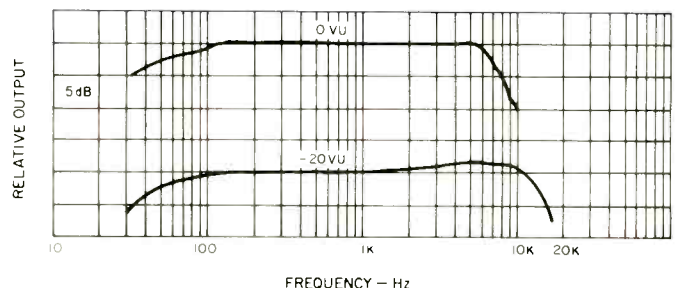


Fig. 2—Record-Replay response with the Maxell UD tape.



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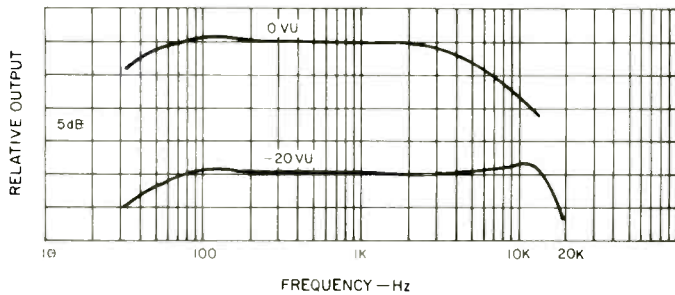


Fig. 3—Record-Replay response with the TDK SA tape.

above the 3 kHz point. Next a TDK SA tape was tested using the CrO₂ switch position as recommended and the results can be seen in Fig. 3. It can be seen that the high frequency rise is slightly steeper and the 3-dB-down point of 14 kHz is followed by a more gradual rolloff. In both cases, the low frequency response is well maintained and free from "fringing" effects. The third tape tested was the Sony Ferri-Chrome, and this cassette extended the high frequency response to 16 kHz with a small frequency peak. Note, also, that the 0 VU saturation curve of the Sony tape has a different characteristic than the other two.

The next test was for distortion at 1 kHz using the three different tapes (see Fig. 4) and all of them showed less than 1.6 per cent THD at 0 VU. Then distortion measurements were taken in the range from 40 Hz to 6 kHz at the 0 VU level—a drastic test that is more revealing than the -10 VU figure usually used.

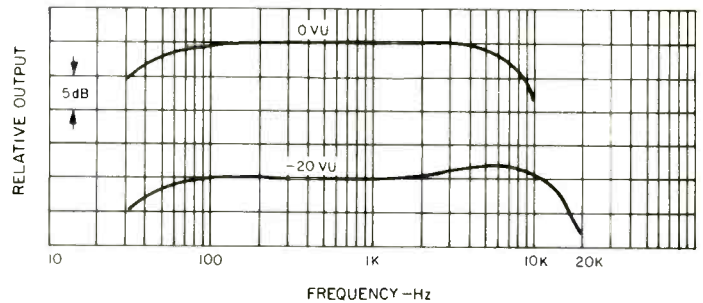
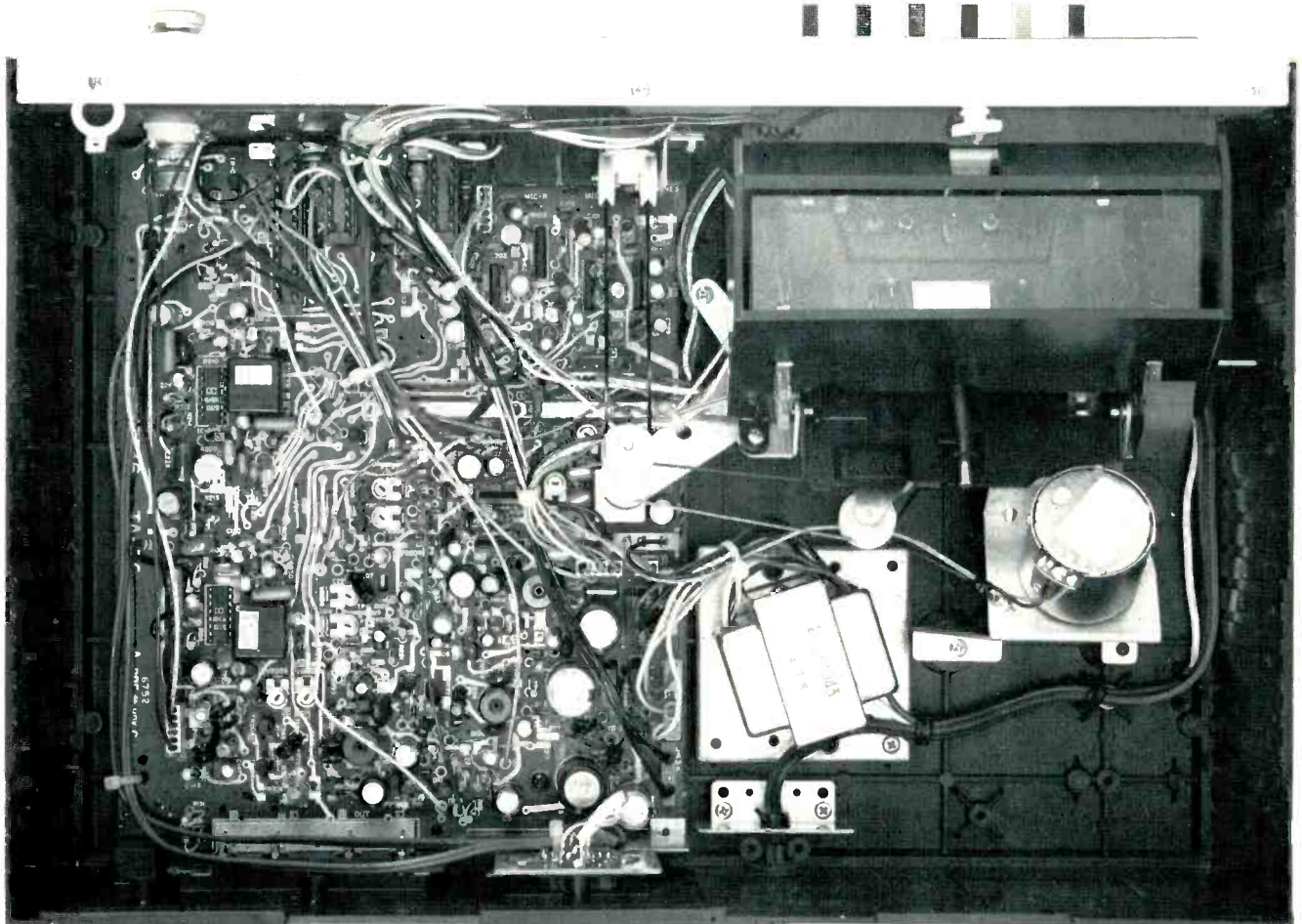


Fig. 4—Record-Replay response with the Sony Ferri-Chrome tape.

The signal-to-noise ratio measured 57 dB with the Sony FeCr tape, 56 with the Maxell UD cassette, and 57 dB with the TDK SA. With the Dolby system in operation, the figures were 66 dB, 65 dB, and 67 dB respectively (ref. 3 per cent THD, "A" weighting). The input required for 0 VU was 75 mV, and the output was then 320 to 500 mV depending upon the type of tape used. Microphone sensitivity was 0.58 mV which is somewhat lower than average. There is no separate microphone input control, and insertion of the microphone plug disconnects the line input. Noise in this mode increased by 5 dB. Crosstalk measured 47 dB, and the erase efficiency came out at over 60 dB.

Wow and flutter was 0.09 per cent (DIN), better than specified. The rewind time was 155 seconds for a C90 cassette, and the speed was just under 0.5 per cent slow. Finally, the Dolby system was checked and the tracking error was found to be less than 1.5 dB down to -40 dB.



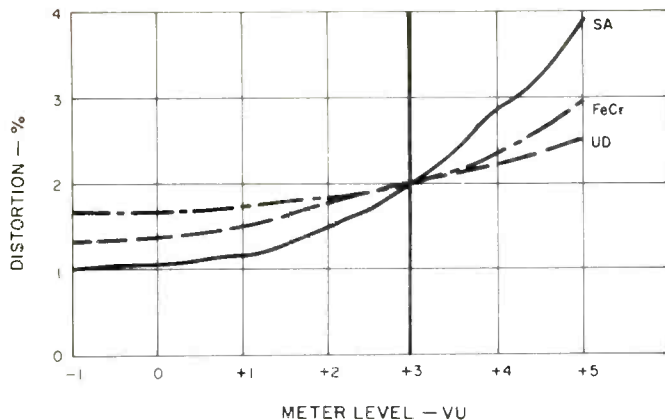


Fig. 5—Distortion at 1 kHz.

Listening Tests

It can be seen that the Toshiba PC-3060 is not all that inferior to cassette decks in the \$400.00 class. Wow and flutter is marginally higher than you would expect from an expensive machine, and the frequency response is not quite as extended or linear—but that's about all. The extra \$150.00 or \$200.00 would buy you larger VU meters with calibrations below -20 dB, microphone input controls, a pair of variable or preset output controls, possibly a memory switch, a limiter, plus a peak-average switch for the VU meters. As the maximum output is over 700 mV, there is a chance of overloading the input stage of some preamplifiers unless, of course, input

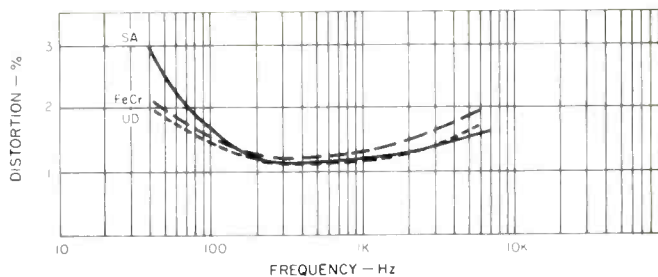


Fig. 6—Distortion vs. frequency at 0 VU.

controls are fitted. I used a Sony 2000F which has preset controls for each program source.

During the operation of the deck I found that if either the *Fast Forward* or *Rewind* lever was depressed while the tape was playing, it did not lock in and as soon as the finger was removed, the tape reverted back to the playback mode. I found this feature useful for fast indexing, and when I read the instruction booklet, I saw that Toshiba had designed it for this purpose. This proves that you should always read the instruction booklet first!

So, for those who want a reasonably priced cassette deck with good basic performance, you will not be disappointed with the PC-3060—especially if you can take advantage of the FM Dolby feature. At the present time, there are more than 145 broadcast stations equipped with Dolby encoders and more are joining the ranks each month. *George W. Tillett*

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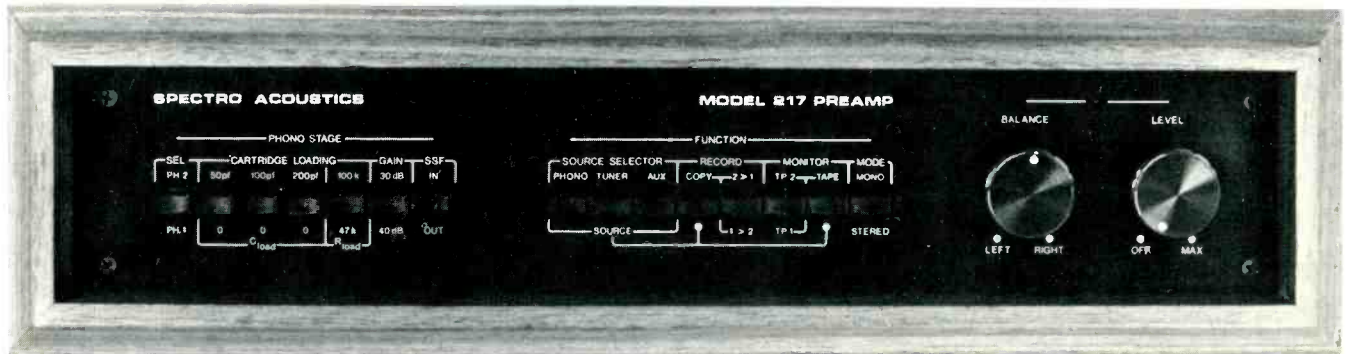
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Spectro-Acoustics Model 217 Preamplifier



MANUFACTURER'S SPECIFICATIONS

Rated Output: 2.0 V rms into 10 kilohm load or greater.

Max. Output: 10 V rms.

THD: Less than 0.05 per cent at rated output, 20 Hz to 20 kHz.

IM Distortion: Less than 0.0075 per cent at rated output (SMPTE).

S/N: Phono, 74 dB, unweighted below 10 mV input; high level, 90 dB below rated output.

Frequency Response: Phono, RIAA

within 0.5 dB, 20 Hz to 20 kHz; high level, 20 Hz to 20 kHz, within 0.1 dB, 10 Hz to 100 kHz, within 1.0 dB.

Gain: Phono, 30 or 40 dB, selectable; high level, 15 dB maximum.

Input Overload: Phono, 100 mV or 300 mV (depends on gain setting), high level, 10 V rms.

Input Impedances: Phono, see test; high level, 50 kilohms, shunted by 20 pF.

Main Output Impedance: Less than 600 ohms, resistive, direct coupled.

Power Requirements: 105 to 125 V a.c., 50/60 Hz, 14 W.

Dimensions: 17 in. (43.2 cm) W 3½ in. (8.9 cm) H 7 in. (17.8 cm) D. Model 217R available for 19 in (48.3 cm) rack mount.

Weight: 4.5 lbs. (2 kg) and rack version, 4.9 lbs. (2.2 kg).

Price: \$250.00.

The Spectro-Acoustics Model 217 preamplifier/control is another in that class of preamplifier units which has come to be called "straight line" preamps. Devoid of such control frills as bass and treble controls, high and low cut filters, and the like, the chief points stressed by Spectro-Acoustics in designing their little preamp-control unit center around the phono preamplifier section which includes 16 permutations of resistive and capacitive cartridge loading, selectable gain, a switchable sub-sonic filter, and a choice of two separate sets of phono inputs.

The only rotary controls present on the black front panel of the 217 are a detented, center-click balance control and a dual element volume control, both of which are silicone damped for smooth rotary operation. The volume control turns off power in its counterclockwise setting. Seven identical looking pushbuttons clustered at the left of the panel relate to the phono section; included are the phono 1/phono 2 selector, three buttons used for capacitive loading of connected phono cartridge (with individual buttons providing 50, 100, and 200 pF of capacitance, but capable of being used in combinations for up to 350 pF in addition to the 18 pF residual loading capacitance) and a button which chooses either 47 kilohm or 100 kilohm resistive loading of the cartridge. Another button selects 30 dB or 40 dB gain for the phono stages while the last button in this cluster introduces an 18 dB per octave sub-sonic filter. An additional group of eight pushbuttons located near the center of the panel handle program source selection (phono, tuner, or aux), tape copying (from either of two tape decks to the other,

tape monitoring of up to two connected tape decks and mono/ stereo mode. A small LED indicator light above the two rotary controls glows red when power is turned on.

The rear panel of the 217 contains a total of 18 phono-tip jacks corresponding to the input, tape output, and main output facilities already described. Switched and unswitched a.c. receptacles are also provided on the rear panel, as are individual chassis ground terminals below the pairs of phono input jacks.

Circuit Configuration

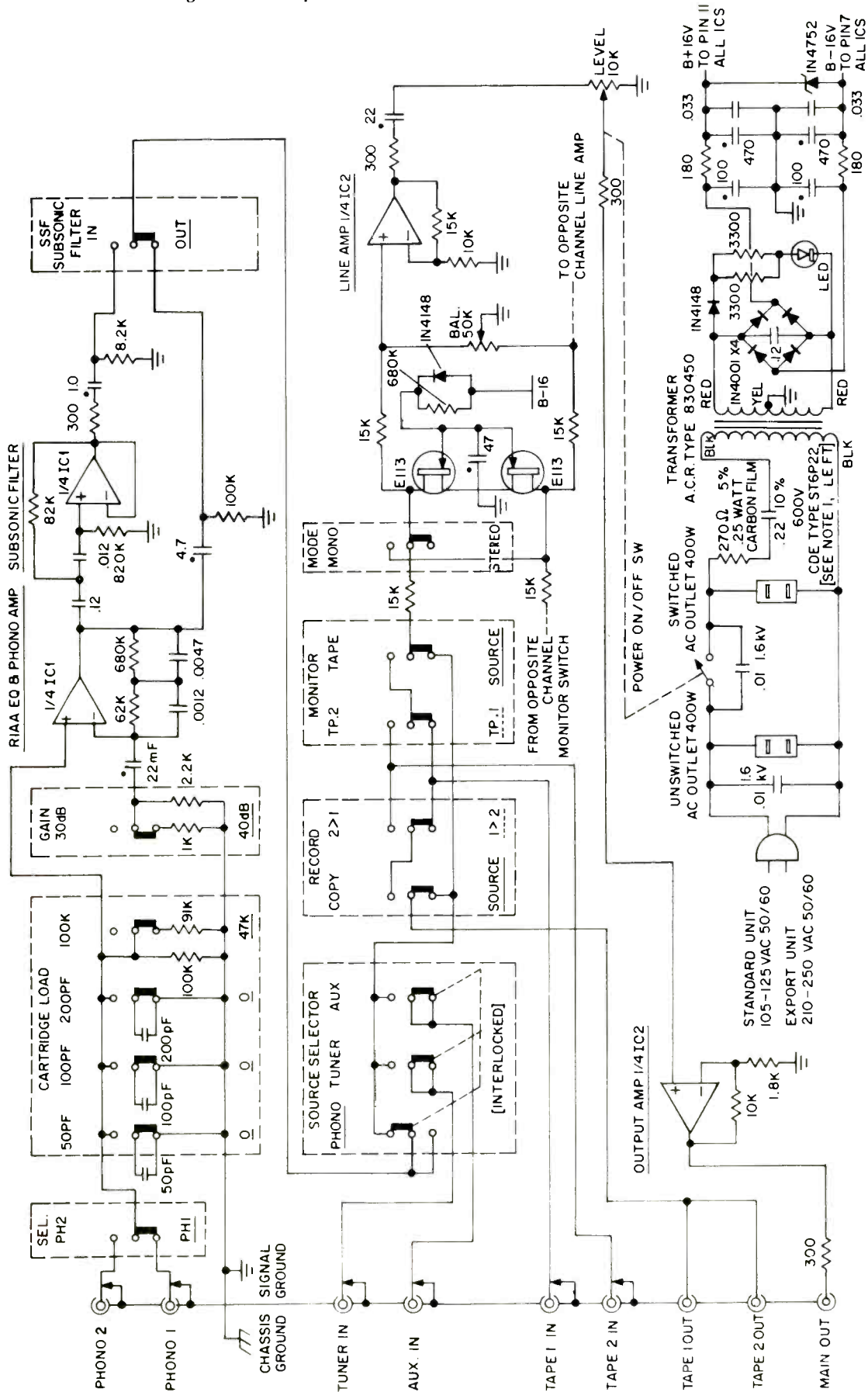
A complete circuit diagram of the Spectro-Acoustics Model 217 is reproduced in Fig. 1. Only one audio channel is shown, since both channels are identical in circuitry. By using monolithic IC op-amps with isolated feedback and signal input points, the phono amp stage is afforded a high degree of isolation between the RIAA feedback network and the signal input point. The 4136 devices used contain four gain and phase-matched op-amps and offer an open-loop bandwidth of 3 MHz, 105 dB of isolation between the four stages, and a 0.1 microsecond rise time. The same IC sections are used for the line amp and the output amp of the 217. The ICs are powered from regulated supplies of ± 16 volts.

Performance Measurements

Measurements of the effect of different loads on a variety of cartridges could not, of course, be made in our static

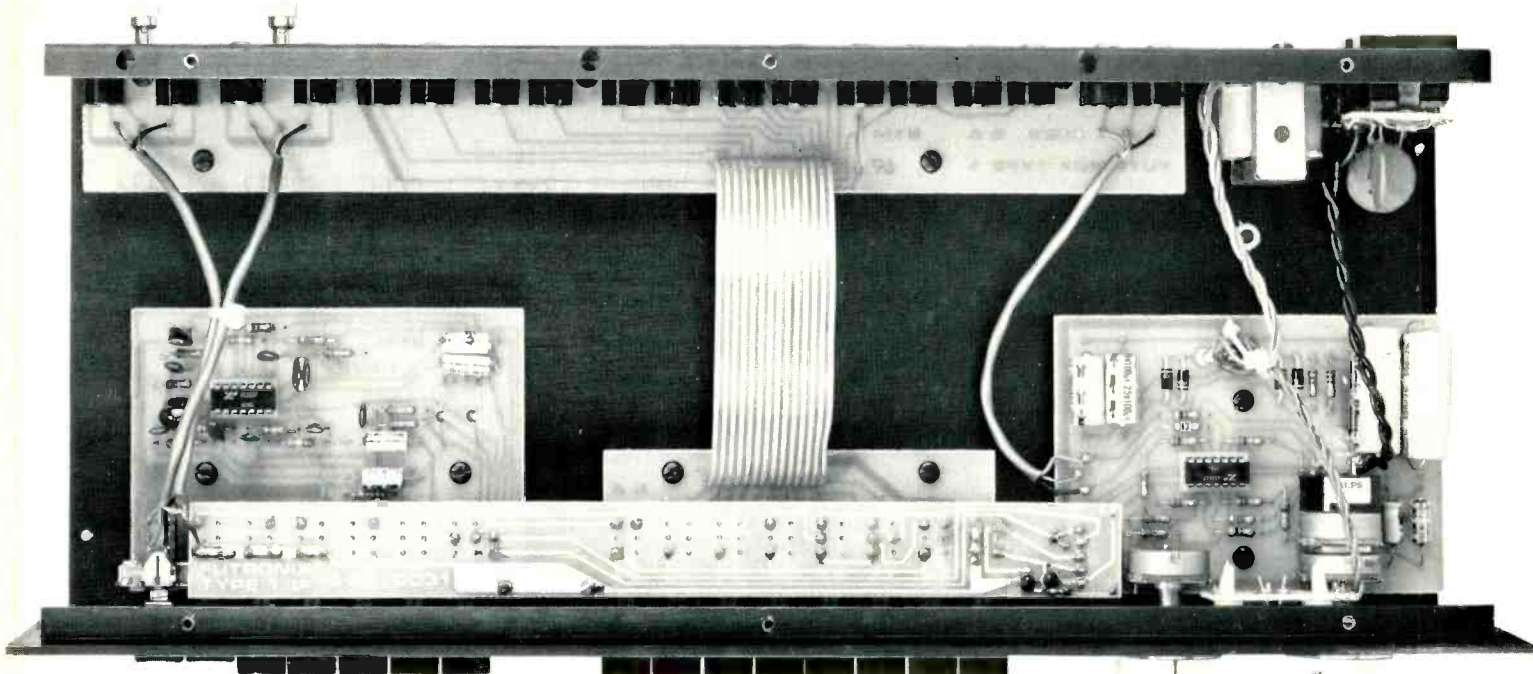


Fig. 1—A complete circuit diagram of the Spectro-Acoustics Model 217 Straightline Preamplifier.



NOTE 1: 270Ω, 5%, 25 WATT CARBON FILM RESISTOR IS A FUSE LINK. USE EXACT REPLACEMENT ONLY. THIS RESISTOR IS USED IN BOTH STANDARD 105-125V UNITS AND EXPORT 210-250V UNITS. BOTH VERSIONS USE SAME TRANSFORMER - DO NOT SUBSTITUTE!! THE 22MF CAPACITOR IS AN AC CURRENT-LIMITING DEVICE USED ONLY IN 210-250V UNITS. THIS IS A SPECIAL U.L. APPROVED TYPE - DO NOT SUBSTITUTE!! TO CONVERT 210 - 250V UNIT TO 105-125V UNIT REMOVE THIS CAPACITOR AND WIRE-BRIDGE THE TERMINALS.

NOTE 2: ALL IC'S TYPE 4136 EXAR OR FAIRCHILD - ALL RESISTORS ARE .5 WATT 5% UNLESS NOTED - ALL CAPACITORS GIVEN IN MFD UNLESS NOTED - ONE CHANNEL ONLY IS SHOWN HERE.



bench tests but will be discussed later. Maximum output of the 217 measured 11.6 V rms before noticeable clipping occurred. For rated output of 2.0 Volts, phono input sensitivity measured 2.2 mV (in the 40 dB gain position) and 7.0 mV (for the alternate 30 dB gain setting). Signal input of 250 mV at the high level inputs was required to produce rated output of 2.0 V. At the 2.0 volt output level, THD measured 0.009 per cent for a 1-kHz signal, 0.009 per cent at 20 kHz, and 0.027 per cent at 20 Hz. IM distortion was 0.007 per cent for the same equivalent rated output voltage. Overload in phono, for the high-gain setting was 82 mV, a bit short of the 100 mV claimed, but of course, in the lower gain mode, overload capability increased to 250 mV. RIAA phono response accuracy was within 0.1 dB from 30 Hz to 20 kHz. With the sub-sonic filter activated, over all phono response came close to the newly recommended RIAA playback curve which calls for a roll-off beginning at 31.5 Hz. Unweighted S/N in phono was 66 dB below actual input sensitivity which, translated to a 10 mV reference works out to 79 dB, or 5 dB better than claimed by the manufacturer. For the lower phono gain setting, measured S/N was 71 dB with respect to a 7.0 mV input. Frequency response via the high level inputs was flat from 3 Hz to 145 kHz for 1 dB roll-off and from 2 Hz to 175 kHz for the -3 dB points.

Listening and Use Tests

If you ever had any doubts about the importance of correct cartridge loading in a hi-fi system, you have only to connect a cartridge—almost any cartridge—to the Spectro Acoustics 217 and start playing with those front panel switches to realize that much of the so-called “difference” between cartridges that is ascribed by some “experts” to the engineering differences between pickups is, in reality, a function of cartridge loading. Shure cartridges, for example, require much higher capacitive loading than do some other competitive brands; 450 pF is typical for most Shure Models. With audio cable manufacturers still featuring low-

capacitance cables as a “plus” feature (a throwback to the days when CD-4 cartridges were being sold for discrete quadraphonic playback), you would have to have a cable some five meters long or so to come up with the correct capacitance for these pickups. Insufficient capacitance results in audible high-frequency stridency in such pickups. The 350 pF plus of capacitance available at the input of the 217 makes the problem much easier to solve.

But the clean sound we heard when reproducing discs via the Spectro-Acoustics 217 was, we feel, more than just the result of proper cartridge impedance loading. The people at Spectro-Acoustics seem to have figured out the right sort of interface between a magnetic cartridge and its required associated low-level electronics. The sub-sonic filter *really* makes a difference, too, regardless of how low you think your turntables’s rumble is. Without in the least affecting low-frequency musical content, the steep sub-sonic filter when activated resulted in an audible “cleaning up” of mid-range and even high-frequency musical content which then seemed totally devoid of annoying intermodulation products.

Certainly, the 217 was designed for optimum phono performance with little concern for other tone controlling facilities. It does lend itself well, however, for connection of graphic equalizer, such as Spectro-Acoustics Model 210. Tape switching is sufficiently flexible to permit using this, or other equalizers, either before the inputs of connected tape decks (for making pre-equalized tapes) or after tape machine outputs to facilitate equalization during listening, monitoring, or tape copying, depending upon the settings of the associated equalizer switches.

For those audio buffs who are concerned with phono reproduction and care less about extra control frills, the Spectro-Acoustics 217 offers excellent value at its suggested price. Construction is professional, both in appearance and in terms of parts and circuit board quality. The little unit tends to dispel the myth that really superior separate preamp-control units have to cost a small fortune. *Leonard Feldman*

Beyerdynamic Model M500N (C) Microphone



MANUFACTURER'S SPECIFICATIONS

Operating Principle: Pressure gradient.
Frequency Response: 40-18,000 Hz within 2.5 dB of nominal curve; individual chart record supplied with each microphone.
Polar Pattern: Hypercardioid (also known as "supercardioid").
Output Level @ 1 kHz:
Open Circuit Voltage: 0.9 mV/Pa (-60 dBv/Pa).
Power Sensitivity: -60 dBm.
EIA Sensitivity Rating: -153 dB.
Electrical Impedance: 200 ohms.
Load Impedance: 1000 ohms, min.
Diaphragm (Ribbon): Pure aluminum, 21.6 mm (0.85 in.), weight, 0.34 milligrams.

Case: Aluminum.
Case Finish: Matte black anodized (aluminite process).
Dimensions: 7.44 in. (18.9 cm) L × 2.22 in. (5.65 cm) × 0.95 in. (2.4 cm) conical shaft diameter.
Net Weight (Less cord): 8.5 oz. (240 grams).

Built-in Male Connector: Switchcraft M3M, or equivalent.

Special Features: Integral windscreen and a four-stage "pop" and blast filter.

Swivel Mount: MKV6 Quick release clamp supplied.

Cable: MVK N(C), 42cm (16.5 in.), 2-conductor shielded, black rubber jacket. Switchcraft A3F connector on microphone end.

Price: \$169.95 with leatherette carrying case. There are a full line of optional accessories available such as gooseneck, table and floor stands, and cable transformers.

Note: Specifications are listed for the 200-ohm model, but a 500-ohm model is also available.

The M500N (C) is a unidirectional ribbon microphone with a rising frequency response characteristic, and thus is a good choice for "pop" vocalists and instruments. A detailed selection chart, available from Beyer, lists 24 applications for which the M500N has "outstanding performance," plus an additional 24 for which it has "good performance." The list includes banjo, guitar, sitar, and theorbo (which the cognoscente will recognize as a doublenecked form of lute for which no music has been written since 1732.) This is the most detailed application data we've seen on microphones, and we appreciate the effort Beyer has made to ensure correct application of their products.

Many English-speaking readers may be confused by the association of the trade name Beyerdynamic with a ribbon mike. We were surprised to find that this "stick and ball" microphone, prominently marked Beyerdynamic, contains a ribbon transducer. The justification for this apparent contradiction is that both ribbon and moving-coil transducers operate by the electrodynamic principle, where voltage is induced into a conductor that is moving in a magnetic field.

From the Beyer literature, we learn that they have been making microphones for about a half-century. However, until very recently, Beyer microphones were relatively little known in the U.S., and our old catalog sheet on the M500 (three to five years old) shows it was available only with a Tuchel connector. Now, the line has been Americanized with Cannon-type connectors and quite readable English language data sheets. At present, Beyer microphones, headsets, transformers, and accessories are being actively marketed in the U.S. by Hammond Industries.

Most of the Beyer ribbon microphones have flat frequency

response characteristics and are best suited to applications with high-grade audio components that include variable equalizers. The tailored, rising response of the M500N eliminates the need for external equalizers for the pickup of "pop" vocal and instrumental music. The response characteristic is also suited to high intelligibility speech reproduction in sound reinforcement systems.

The specifications include some parameters of the Beyer ribbon. Having designed some RCA ribbon microphones, we were able to make some comparisons. The Beyer ribbon is 21.6 mm long and weighs 0.34 mg, while the RCA BK-5B ribbon is 25.4 mm long and weighs 0.2 mg. The difference in mass is not the significant point, as high electro-acoustic efficiency requires a narrow range of foil thickness in order to match the air load. The significant difference is that Beyer, using a ribbon of similar size, has developed a magnetic structure and acoustical resistance termination of greatly reduced size and weight compared to the RCA mike. The sensitivity of the M500N is only 3 dB less than the BK-5B.

The blast filter feature of the M500N, which is said to protect the ribbon from breath blast, is not new. (The BK-5B has a filter which, tests have shown, protects the ribbon from the blast of .38 caliber blank cartridges.)

Laboratory Tests

Figure 1 is the impedance vs. frequency curve. Ribbon resonance is about 130 Hz, and the familiar "third harmonic" is about 450 Hz. Good response is obtainable to about an octave below the fundamental resonance, as shown in Fig. 2. The high resonance of the M500N makes it more suited to voice or other than bass instruments. The literature hints that this mike has less proximity effect than other unidirectional

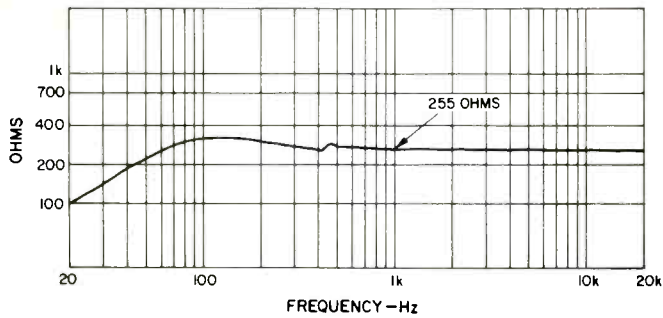


Fig. 1—Impedance of the Beyerdynamic M500N(C) microphone.

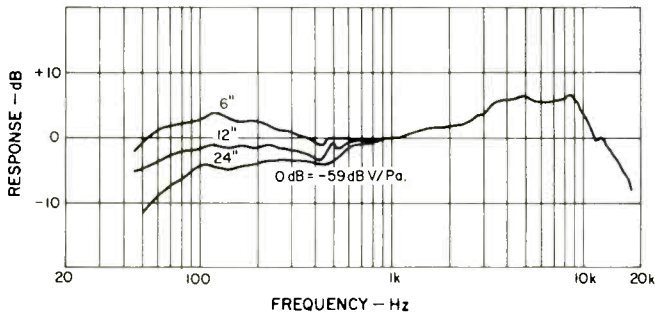


Fig. 2—Frequency response vs. distance.

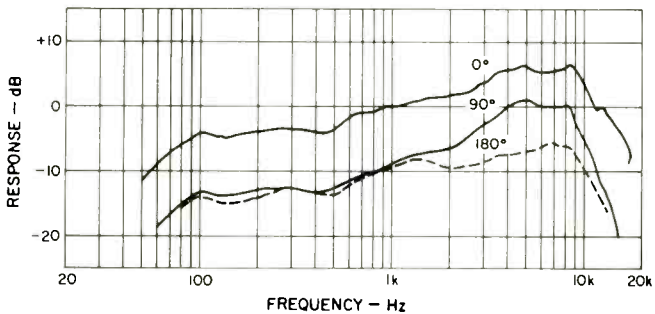


Fig. 3—Frequency response vs. angle.

mikes. The curves of Fig. 2 show that the Beyer will sound just as "boomy" as the others at close distances. This problem is not severe because Beyer has adjusted the distant response (see 24-in. curve) to be rising at a rate of about 5 dB per decade of frequency. We immediately noticed that the M500N is similar in the voice range to the Shure 548, 565, etc. series. These Shure mikes are favored for their clarity on vocalists, and the M500N should be equally as good. However, the M500N has more response in the lowest and highest octaves, compared to Shure, so it will be superior on certain high- and low-pitched instruments. Of course, you must pay more to obtain this performance. Note that the frequency response curves have a "glitch" at the ribbon harmonic of 450 Hz. This is characteristic of ribbon transducers, even though this sometimes smoothes out with age.

Our 24-in. curve agrees with the curve supplied with the microphone, ± 1 dB above 1000 Hz and ± 2 dB below 1000 Hz. We are pleased with this excellent correlation with a foreign lab. (Following a recent review of a Shure mike, we conducted a correlation test and found we agree ± 1 dB with their lab.)

The directional frequency response curves are shown in Fig. 3. These compare favorably to the published polar response graph. The hyper- or supercardioid is characterized

by a null at 120° to 135° , but we were content merely to check 90° and 180° . From $0^\circ \pm 90^\circ$, the pattern is essentially independent of frequency, so there will be little change in sound quality within the useful pickup angle of $0^\circ \pm 45^\circ$. (A cardioid mike has a useful range of $0^\circ \pm 60^\circ$.) The hypercardioid is ideal for the pickup of one or two vocalists. Where the loudspeakers are placed to the side, feedback will be less of a problem than with a cardioid. For pickup of larger groups of vocalists or instruments, a cardioid is to be preferred. Our experience with figure-eight (bidirectional) microphones, which have a 90° pickup angle, is that sometimes individual talkers or vocalists will position themselves more than 45° off axis, resulting in a low audio level.

It should be noted that ribbon transducers have asymmetrical directional characteristics. In the plane normal to the ribbon, the pattern is superior at high frequencies to a transducer with a round diaphragm. In the plane of the ribbon, the pattern is degraded at high frequencies, similar to a round diaphragm of equivalent dimension. Most ribbon mikes are designed to be used with the ribbon vertical because most sound sources are disposed in the horizontal plane. Beyer gives no clue as to the plane of the ribbon in the M500N, so it's possible the user might noticeably improve the off-axis sound by rotating the mike.

Hum sensitivity is as low as our BK-5B, and this should be no problem with the M500N. The wind and "pop" sensitivity was slightly greater than with the BK-5B, though in order to obtain this result we used a large four-inch diameter wind-screen on the BK-5B. Vibration noise was a little greater with the M500N than with the BK-5B, but much less than a Shure 548, for example.

Dynamic moving-coil cardioids have exceedingly high vibration sensitivity due to the "seismic" effect on the massive coil and diaphragm. For many applications, this feature alone may justify the purchase of the Beyer mike.

Phasing is pin 2 positive, in agreement with the proposed EIA revised standard.

The anodized finish is hard and durable, but will show scuff marks. The "ball" is much less rigid than that of the Shure 565-SD, and can be deformed by finger pressure. The spring-mounting clip is poor and has no threaded metal insert with the stand. The swivel from the Shure 548 works very well, and the user is advised to use this swivel.

It is very important to use caution when checking continuity of the mike cabling—ribbons are usually destroyed by the d.c. current pulse of most ohmmeters.

Listening & Subjective Tests

The M500N sounded much crisper on voice than our BK-5B with V2 (voice) compensation, and it sounded identical to a Shure 548 mike. A 4-dB higher gain was needed to match the Beyer to either of the comparison mikes.

Only pop music was used for testing. The Beyer sounded more "tipped up," "present," or "brighter" than the BK-5B (M) (without voice rolloff). The M500N sounded similar to the Shure 548, except more overtones of strings were heard. Sometimes high-frequency distortion and noise, as from recorded sources, would be reproduced by the Beyer's extended response, though this would be filtered out by the more restricted response of the Shure.

For many less critical voice and pop music applications, the Beyer has no performance advantage compared to the much less expensive moving-coil cardioid mikes, such as the Shure 548 or 565 SD. However, the M500N (C) is an excellent choice for more demanding applications and for any pop application where economics permit the choice of a high-grade mike. Many professionals will welcome the availability of a ribbon in a pop musician style package. *Jon R. Sank*

Enter No. 104 on Reader Service Card

The column



In City Dreams: Robin Trower
Chrysalis CHR 1148, stereo, \$7.98.

Robin Trower has grown into one of rock's most eloquent guitarists. His explorations with slower-paced music have directed him towards economy rather than dazzling velocity for its own sake. His vision first emerged in his farewell tune to Procol Harum *Song to a Dreamer* from his final album with them **Broken Barricades**. That song was dedicated to Jimi Hendrix with whom Robin's early solo efforts were compared. The ethereal atmosphere he generates is certainly inspired by Jimi's stuff, but Trower has grown and developed his own vocabulary along the way. His band has been a power trio, guitar, drums, and bass/singer. Jim Dewar, the band's voice, also brought along the less chronicled influence of Free. That defunct band also played at often excruciatingly slow tempi. Another feature was the amazing voice of Paul Rodgers who has achieved his measure of fame with Bad Company, and Dewar at his best rivals those pure smoky tones. The resemblance between the bands is clearer nowhere than on the slow shuffle *Sweet Wine of Love* or *Falling*

Star which has lyrics that echo Hendrix's *If Six Was Nine*.

With the new album a lot of press ink has gone into explaining how adding a bass player to free Dewar to concentrate on singing only changes the band's sound. The new player, a fellow name of Rustee Allen, gives Trower a kick that is felt in the snappy side-openers, *Smile* and the explosive *Somebody's Calling*. The real difference between guitar, drums, bass/singer and guitar, drums, bass, and singer is just a bit better music. Those loping rhythms and washes of guitar are all very much present, especially on the title track, a song very much in the tradition of *Bridge of Sighs*.

In City Dreams has been nicely recorded, solid drum sound, thick bass, the guitar an over where it belongs except for the apparent concert recording of the blues *Further on up the Road* which is noticeably hissy. The review disc suffered from an unacceptable pressing of the first side which had irritating surface noise that obliterated portions of a soft song like *Bluebird*. Side two played better. *M.T.*

Sound: B— Performance: B

Seconds Out: Genesis
Atlantic SD 2-9002, stereo, \$11.98.

That Genesis would solidify after the departure of lead singer Peter Gabriel was an unlikely outcome, but it's happened. Whether they will similarly survive guitarist Steve Hackett's leaving after they cut this live album remains to be seen. In any case, **Seconds Out** is one of the year's most delightful releases.

As an ensemble Genesis has always been very solid. This is historically their greatest strength since their material is not oriented toward solos. It is the total picture that most interests them. Their concert album naturally emphasizes post-Gabriel material like *Afterglow*, *Dance on a Volcano*, *Squonk*, and *Robbery Assault and Battery*. However Gabriel's spectre doesn't intimidate them from doing songs associated with his considerable presence, and the band does very well indeed. *Carpet Crawlers* and *I Know What I Like in my Wardrobe* never sounded better. Why, even the epic-length *Supper's Ready* which covers all of side three loses nothing. Their wit is never more evident than in the unlikely medley of *The Lamb Lies Down on*

capital letters. Metro's members, Peter Godwin, Duncan Browne, and Sean Lyons take things seriously, even their humor and wit. After all, anyone who does a song called *Mono Messiah* must have a sense of humor somewhere.

Musically Metro is a light opera Genesis who utilizes all sorts of special effects and plenty of sudden time changes. Though their material is engaging, phenomenal it isn't, pleasant it is. On the odd shot, *Black Lace Shoulder* for one, they verge on powerful. Then it is Graham Presket's searing solo violin that propels them.

The album is plagued by noisy recording embodied by a constant hiss which forces too much cymbal and hi-hat. The soft passages which are crucial to a group like Metro are rendered downright annoying. When I rolled off the highs at home much of the music's sparkle left as well.

Keep watching Metro. Ambition like theirs deserves encouragement. *M.T.*

Sound: C — Performance: C +

Midnight Wind: The Charlie Daniels Band

Epic PE 34970, stereo, \$6.98.

Playing that solid Southern rock 'n' roll Charlie Daniels and the boys have become the form's leading exponents. They play with fire and the determination of an evangelical. **Midnight Wind** contains 10 new songs of modest size, steering clear of the epic proportions of *Saddle Tramp*. A straight-ahead approach results, that is most effective on the good-timey stuff like *Sugar Hill Saturday Night* and *Redneck Fiddlin' Man*. The slower songs tend to drag, needing a more expressive voice than Charlie's to work best.

Sound and production are uncluttered and, save the surprisingly distant rhythm section, are just fine.

Midnight Wind may not save your soul, but I doubt you'll mind, and it won't hurt in any case. *M.T.*

Sound: C Performance: B —

Eddie Money

Columbia PC 34909, stereo, \$6.98.

Here's a sleeper for you. Eddie Money is an unknown from out of the pile whose opening song *Two Tickets to Paradise* is hook city. It grabs hard with bars on the hooks so they won't let go. A smashing start.

From there Eddie moves through yet another cover of Sam Cooke's *You Really Got A Hold on Me*, a good one, too, and then to *Wanna Be A Rock 'n'*

Roll Star just so you can't mistake his intentions. Strong stuff this. And the album maintains its pace all the way through.

Money's songs are happy rock 'n' roll celebrations with melody and hooks. The musicians are pros who turn in solid performances. Bruce Botnick who produced it is yet another pro, and his touch streamlines the Money music into something rewarding, fresh, and urgent.

Eddie Money is young and hungry. He sings as if he means it, and he just might. *M.T.*

Sound: B Performance: B +

The Boomtown Rats

Mercury SRM-1-1188, stereo, \$7.98.

Call 'em New Wave if you like, but this new Irish band is a fine, crackling rock and roll band. Robert John Lange, a busy fellow, produced the Rats' album. While they are no Graham Parker & the Rumour (whom Lange produced on **Heat Treatment**) there are similarities. Both play urban rock with a strong roll and lots of street savvy. Take the Rats' *Lookin' After No. 1* which has the sound of an anthem. *Joey's on the Street Again* tells a story with scope and the cinematic dynamics of a Bruce Springsteen at his best with a super sax part by Albie Donnelly of Supercharge. Some is just loud and raucous, *Never Bite the Hand that Feeds You* for one.

Lange's production is very basic, loud, and fuzzy. There is a good deal of hiss that only loud rock can mask. The music's scope ranges from *Joey's* intricacy to the just plain dumb. Since the lads don't take it all too heavily with their obvious sense of fun, it's easy to take the stupidity as it comes.

Maybe it all boils down to this: if the Boomtown Rats put you off, it may just be that you've finally outgrown basic rock & roll and its raw, young energy. Me, I still need that occasional bucket of cold water in my face. *M.T.*

Sound: D + Performance: B —

Slowhand: Eric Clapton

RSO RS-1-3020, stereo, \$7.98.

Resurrecting a nickname from over a decade ago, Eric Clapton's newest is another of the low-key albums he has made for the 70s. This time he even takes a guitar solo or two. Produced again by Glyn Johns, the sound is rich and bell-clear with exceptional bass presence and the drums way out front, perhaps a bit too far.

The album has a warm, easy tone indicated by the selection of non-

ALLISON: THREE *Press comment:*



STEREO

Vol. 10
No. 2
Spring
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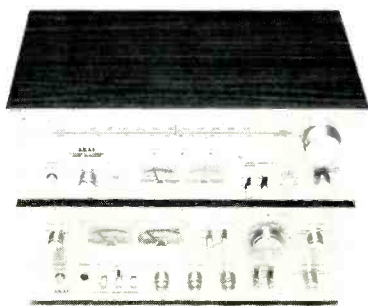
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original material. *We're All the Way*, one of Don Williams' country tunes, John Martyn's lovely *May You Never*, and J.J. Cale's *Cocaine* all receive fine renditions, nearly up to the originals. The blues *Mean Old Frisco* has a Mississippi Fred McDowell feel to it with its parallel guitar and voice lines. Eric's new songs are pleasant enough, especially *Lay Down Sally* and *Next Time You See Her*. It's also good to hear Eric stretch out as he does on *The Core* which really features Mel Collins on sax.

Credits are a bit hazy. It's tough to tell a George Terry solo from a Clapton. But the overall amiability carries the day. *M.T.*

Sound: A- Performance: C+

Night After Night: Nils Lofgren
A&M SP-3707, stereo, \$9.98.

Nils Lofgren's two-disc live album is pretty ordinary. Though he's a crowd-pleaser who can rock out strong or caress a softer one as well, he remains his own biggest question mark. His musical posture is so detached as to occasionally make him appear to be bored with his own show. His band is solid yet spare. Not a knock-out unit, though one of the best line-ups Nils has had, they seem content to try to win it by decision. Thus the set contains no new material, no real surprises. Songs like *Keith*, *Don't Go*, *Back It Up*, *Cry Tough*, *Like Rain*, and the Goffin-King favorite *Goin' Back* are mainstream Lofgren.

The live recorded sound isn't terribly distinguished. Generally it is adequate enough, but side two has a serious hiss problem. *M.T.*

Sound: D+ Performance: C

Dance Band on the Titanic: Harry Chapin
Elektra 9E-301, stereo, \$11.98.

Dance Band on the Titanic following a double-pocket, live album is Chapin's second two-record set in a row. A studio collection of new songs this time, it is his most ambitious work to date.

Brother Steve Chapin again acts as producer, and his work is as fully wrought as possible. Harry is an engaging guy who sometimes overreaches with his ideas and buries them beneath their own weight when that happens. However, on the most difficult numbers, the title track and the nearly sidelong *There Only Was One Choice*, Harry delivers the goods with fascinating thoughts and images

brought out by the lavish musical ideas.

In between are highs and lows. The highs include the sardonic *Bluesman* and a number of tender moments, *I Do It for You*, *Jane* and the whole of side three.

Harry Chapin is a serious guy, dedicated to his music and to his work for "World Hunger Year." His conscience is alive and well. His song-stories are a special breed that requires full attention to really matter to you. **Dance Band on the Titanic** is a double album that mostly holds together. *M.T.*

Sound: B+ Performance: B

Young Men Gone West: City Boy
Mercury SRM-1-1182, stereo, \$7.98.

Call it clever rock if you must, but that's what City Boy is about. Their sound, lyrical intent, and content are strongly influenced by 10cc. The songs are sharply conceived around bent ideas. This, their third album, is a heavily crafted one, marked by sharp, bright sound, and disarming presence and energy.

Their second album, **Dinner at the Ritz**, edged the group toward sweeping panoramic tableaux with disappointing aesthetic and economic results. So this time they've returned to a self-contained song format in which eight of the 11 songs are under four minutes with only one over four and a half.

Much of **Young Men Gone West** concerns late '70s sexual mores and opportunities, marital, extra, and single. *Bordello Night* and *She's Got Style* cover the sporting scene. The title song and *One After Two* hit on the singles/lost-weekend situation. *Honey-mooners* is a funny mix or match story. *The Runaround* and *Bad for Business* cover the extras, while *The Man Who Ate His Car* and *Millionaire* hit the human interest angles.

City Boy is full of angles, all of them sharp. If their records weren't so well-made, their own cleverness could undo them. Instead they are just good enough to be really dangerous. *M.T.*

Sound: B- Performance: B+

Love You Live: Rolling Stones
Rolling Stones COC 2-9001, stereo, \$11.98.

A two-record set with three sides recorded in Paris and the fourth at Toronto's El Mocambo club, this release is exactly representative of latter day Stones, no more, no less. The sound quality and mix leave plenty to be desired. The album is very muddy indeed. Occasionally even Mick Jag-

ger's vocals get totally lost. The Paris sides capture the Stones at their most average with that special spark somehow missing. The El Mocambo side is an experiment in which the Stones re-explore their blues band roots and early scuffling club days. Though the air is alive, it only proves you can't go home again. What once was rough-hewn now appears only sloppy. Surrounding it all is Andy Warhol's ugliest record cover ever. *M.T.*

Sound: C — Performance: C

Weekend Rendezvous: Racing Cars
Chrysalis CHR 1149, stereo, \$7.98.

These Racing Cars guys have spunk. Back with a second album only half a year after their first, a goodie that slipped by most of you, they continue to make fresh, interesting music. Their songs are clever and thoughtful, and played with distinction by a strong band led by their expressive singer/writer, Morty.

This is a no-nonsense British band developing confidence. Even on their slower material they play hard and true, and melodiously. Their recording style is refreshingly uncomplicated, using precious little overdubbing and no extra string or horn sections.

Racing Cars deserve a listen. They are becoming something special. *M.T.*

Sound: B — Performance: B

Show Time: Ry Cooder
Warner Brothers BS 3059, stereo, \$6.98.

Except for the opening track **Show Time** is a live recording of the amazing Tex-Mex band Cooder toured with last winter. It featured accordion legend Flaco Jimenez. As ever, Cooder presents a joyously eclectic experience on the disc.

The opener is a Gary U. S. Bonds oldie, *School is Out*, which was released as a single at the start of summer and sank without a trace. It is a bright, fun calypso-tinged number.

The live show opens with a rousing *Alimony* from Cooder's first album, a spirited romp. *Jesus Is On the Mainline* is next. This standard of his repertoire gives Ry a chance to stretch out on some of his patented acoustic bottleneck work. Cooder lets his backing singers Eldridge King, Terry Evens, and Bobby King take lead vocals on *Dark End of the Street* while he plays some bone-tingling, eerie electric bottleneck leads as the whole band slides back in.

Flaco shines on the medley that opens side two. *Seguin* written by his father is a standard showdown number in Flaco's natives circles in the South-

west and his is the current definitive version. The quirky jump *Seguin* has leads into Woody Guthrie's *Do Re Mi*. Excellently played, the segue is still somewhat forced. *Volver, Volver* is a Cajun piece followed by a surprisingly somber reading of Alfred Reed's *How Can a Poor Man Stand Such Times and Live*, another Cooder standard. The album closes with a smoking *Smack Dab in the Middle*.

Ry produced Show Time himself. The sound is good if not exceptional. The music is spirited and fun, slightly

stronger on the first side. Most of all, though, it is true to Cooder's own special vision and identity in a Big Mac world. *M.T.*

Sound: B — Performance: B

Say It in Private: Steve Goodman
Asylum 7E-1118, stereo, \$6.98.

Steve Goodman is one of my favorite performers. Live and armed with his acoustic guitar, he can galvanize a room full of people as no one else. In



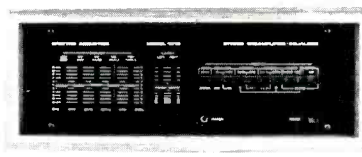
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transferring his personal electricity to vinyl, he has had varied artistic success and constant public indifference. The record company obviously wanted something more "commercial" this time, so they enlisted Joel Dorn to produce **Say It in Private**.

The result is an over-produced album, particularly on the first side. Six of the album's 10 songs, including all five on the first side, have lush string arrangements that hinder as much as help. Sometimes, on *Video Tape* for instance, they enter too quickly for the song to establish. In Smokey Robinson's *Two Lovers* they cancel any funky feel that artist and producer may have intended. Throughout side one the strings awash leave room for very little of Goodman's best work to surface.

Side two is purer and closer to home. His excellent guitar aided only by Jethro Burns' hot mandolin make *Is It True What They Say About Dixie* infectiously joyous. Hank Williams' *Weary Blues from Waiting* soars behind Saul Broudy's fine harmonica. *Daley's Gone*, the best new Goodman composition, parodies the traditional *Delia's Gone* with sardonic tribute to the late mayor of Chicago, Steve's home town.

Say It in Private is, alas, not Steve Goodman's best. The problems are heavy-handed production and inconsistent, occasionally maudlin writing. Don't count the kid out, though. When he connects, he's superior. *M.T.*

Sound: C - Performance: C +

Romance 76: Peter Baumann
Virgin PZ 34897, stereo, \$6.98.

Peter Baumann is one of the three members of Tangerine Dream, the German electronic ensemble. His first solo album is not too far afield from Dream's space, but it is a more colorful tapestry than the group's last few albums. **Romance 76** is more melodic and sonically expansive than T. Dream's *Stratosfear*, for example. The recording is of excellent quality; even the softest notes and passages are pure and audible.

The never-ending regularity of the electronics is hypnotic to even the casual listener, much as Dream is at their best. *Bicentennial Present* is like the July 4th sparkler you hold in your hand and wave around. *Romance* is simply a lovely theme in light colors with voices added. *Phase by Phase* is darker, more menacing. The whole sec-

ond side is a suite, the two parts of *Meadow of Infinity* bridged by *The Glass Bridge*, cleverly enough. Part one of *Meadow* stands out from the rest of the album with its use of members of the Munich Philharmonic Orchestra. The instruments and voices are joined by sonorous percussion in the *Bridge* while part two is a grand restatement of the opening theme.

Electronic music albums are often spartan and cold, others graceful and melodic, some compelling. **Romance 76** is memorable and gripping, with grace and melody to boot. *M.T.*

Sound: A Performance: B +

Swingtime in Springtime: Lew London
Philo 1032, stereo, \$6.98

Time-warped out of the swing and Western swing of the 30s and 40s comes Lew London. The kid is a mind-boggling guitarist with dazzling speed, precision and control.

Swingtime in Springtime is fun, a romp through 14 songs. They are mostly period-piece originals by Lew with some standards like *Nagasaki*, *Lady Be Good*, Jon Hendricks' *Gimme Some Wine*, and the cowboy oldie *Home in San Antone*. The sound has the stan-

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dard Earth Audio clarity and presence. The support crew includes some of the Philo regulars, Winnie Winston's superb pedal steel, Jay Unger's fiddle, and Mary McCaslin for harmony vocals. Other guests include Jeff Gutcheon, piano; Tony Markellis, electric bass; Steve Burgh, electric guitar, and Steve Mosely, drums. And the other two thirds of Lew's trio, Mark Josephs and Jim Tullio, acquit themselves with honor.

London is also a fine singer with a warm, smooth voice. And, as I said above, his guitar is beyond belief. This is an auspicious debut. *M.T.*

Sound: B+ Performance: B+

Captain Lockheed & the Starfighters:
Robert Calvert

Import IMP 1011, stereo, \$6.98.

This is a member of the endangered species called Concept Albums. They have gotten a bad name for pretense and lesser music.

Against all odds, this one works pretty well. It's the story of the disastrous Lockheed Starfighter which became better known by names like "Widow Maker" and "Flying Coffin." They kept crashing.

Songs alternate with little vignettes acted out by Calvert and friends including Traffics's Jim Capaldi and Bonzo Dog of yesteryear Vivian Stanshall. Calvert sings most of the songs, although Crazy Arthur Brown makes an impressive cameo. Calvert's mates in Hawkwind play most of the music which comes in steely metal throbs. *Ejection* is extra-strong.

Captain Lockheed is a scary album. The story is not diluted by romance, the horror is not hidden. *M.T.*

Sound: B- Performance: B

Jethro Burns

Flying Fish 042, stereo, \$6.98.

Though Jethro Burns is best known for his many, many years as half of Homer and Jethro, he has a heavy rep as a mandolin player, especially on swingtime material. Thus, this is primarily an instrumental showcase, with vocals present only on the two dusted-off Homer and Jethro numbers and on *Don't Get Around Much Anymore*, where Diane Holmes is perhaps a bit over-strong. Beside the traditional sources, material comes from the likes of Fats Waller, Duke Ellington, Django Reinhardt, Stephane Grapelli, and Cleanhead Vinson.

Jethro's instrumental support comes from some powerful pickers. The other principal soloist is Vasser Clements, Mr. Superbow himself. The rhythm crew is solid enough, but they are a bit muted in the mix.

Jethro Burns is an album that doesn't hide behind masks. The liner notes and credits make the intentions clear. This one is for anyone who considers himself an aficionado of serious country pickin'. *M.T.*

Sound: C+ Performance: B

Playmates: Small Faces

Atlantic SD 19113, stereo, \$6.98.

Never would I have believed that perhaps the greatest group of all time would be able to make one of the most vacuous recorded statements ever put to disc. Without one good song, a single bold move musically, and anything else worth waiting a decade for, **Playmates** stands as a blemish upon an otherwise spotless career. If this is what the Small Faces got back together to do, may they split again shortly and let us live with our memories. *J.T.*

Sound: D Performance: F



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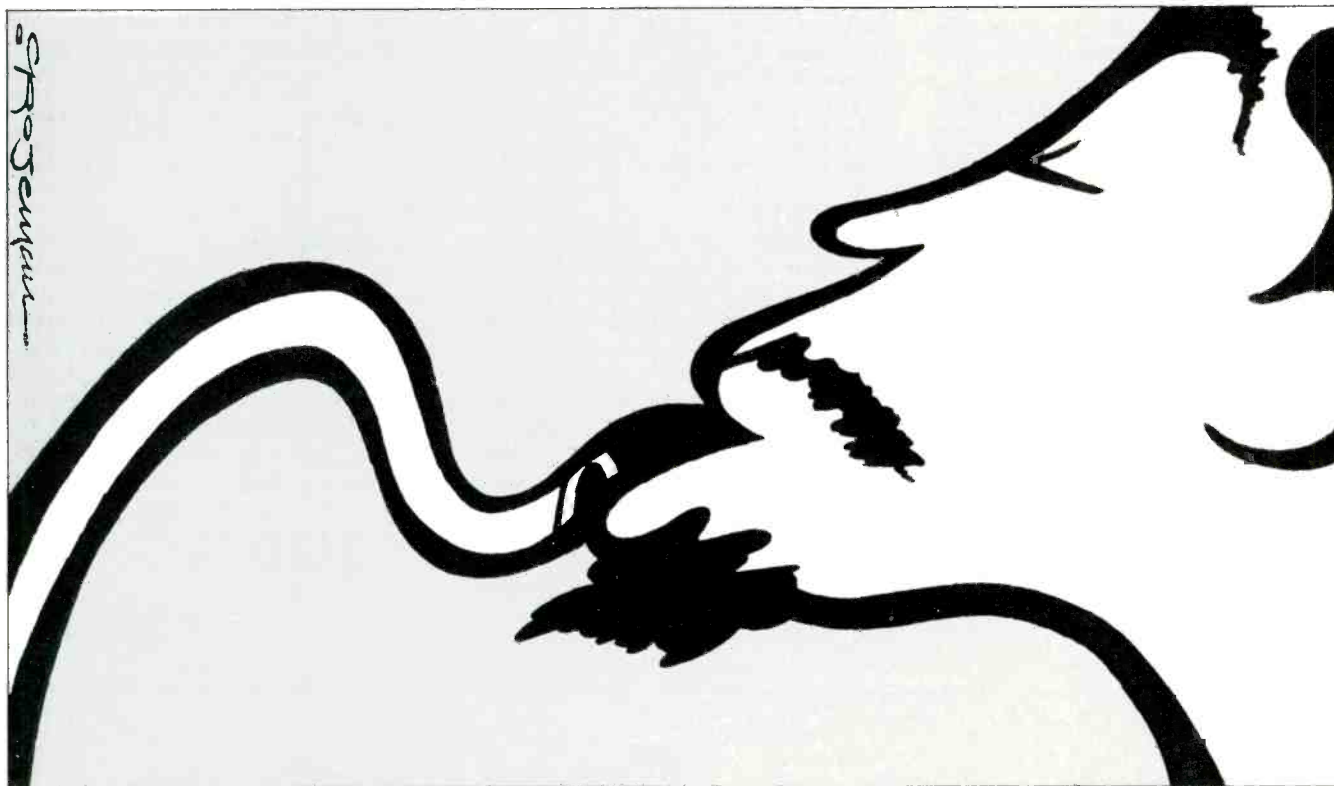


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Jazz & blues



98

Status: Eric Dolphy
Prestige P 24070, Stereo, \$7.98.

Eric Dolphy, an important player identified with the jazz avant garde of the 60s, died in June of 1964 in Europe. He was in his early 30s and had gone abroad to find an audience for his music. Dolphy was a musician of remarkable talents who played alto, became a virtuoso on the flute, and achieved distinction on the bass clarinet. He can be heard on all three instruments on this Prestige Collection, and interested jazz listeners, even those whose tastes do not run to the experimental, will find much to admire here.

Many jazz writers have drawn parallels between Dolphy and Ornette Coleman (Coleman's records far outsold Dolphy's, Ornette being the recipient of a high powered PR job, which gave him some recognition while Dolphy languished in obscurity). Both favored an emotionally-charged intonation on the alto and a wild, free flight of ideas that account for these comparisons. And though there was some similarity of harmonic con-

ception, I have always found Dolphy's musical message far more coherent. Indeed, as heard on *Status* (record one, side one, track one), Dolphy's playing seems to link the Charlie Parker be-bop era with New Wave jazz. The title track *Status*, recorded live at the Five Spot, the legendary East Village jazz club, is impressive not only for the searing, emotional expressionism and immense physical power of Dolphy's alto playing, but for the swing and drive of the rhythm section (Richard Davis, bass; Mal Waldron, piano, and Ed Blackwell on drums) which enables Dolphy to ride along on a virile, supercharged trajectory of sound.

In contrast, *God Bless the Child* (record one, side one, track two), also taken from the Five Spot date, is an elegant, almost elegaic unaccompanied solo on bass clarinet, a tour de force for Dolphy who explores the rich, resonant harmonic resources of the instrument. These two Five Spot cuts are worth the price of this doubleset.

Most of the remaining cuts are taken from a Copenhagen concert with a Danish rhythm section that does not

appear to be totally in sync with Dolphy; the well-meaning Danes often sound ill at ease when Dolphy ventures beyond conventional be-bop rhythms and harmonics. Nevertheless, the Copenhagen concert does produce a meditative Dolphy flute solo on *Don't Blame Me* (two takes are included on record two and they are worth hearing). There is more masterful flute work on a Dolphy original called *April Fool* recorded on April 1, 1960, in Rudy Van Gelder's Hackensack, N.J. studios. Van Gelder also taped the two Five Spot tracks and his sensitive engineering techniques enhance these tracks. This is as good an introduction as any to Dolphy's challenging work.

John Lissner

Sound: A — Performance: A —

Exodus: Byard Lancaster
Philly Jazz 1, stereo, \$6.98.

In the mid 60s Byard Lancaster came out with his debut recording *It's Not Up To Us* on Vortex, a label that also spawned early recordings by Keith Jarrett, Sonny Sharrock, and Chick Corea.

AUDIO • February 1978

Unlike these musicians who have attained varying degrees of fame and status as innovators on their instruments, Byard has remained in active obscurity. In the 10 year interim since **It's Not Up To Us** he has recorded a handful of albums on the Palm and Dogtown labels and was a sideman on many of the BYG/Actual recordings, all with little recognition. With the release of the Douglas **Wildflower** series this year, Byard has found a place in the critical consciousness as part of the New York loft jazz scene. On the albums he is a featured soloist with Sunny Murray's Untouchable Factor alongside the rising star of tenor saxophonist David Murray.

With this new impetus behind him Byard has put out his first American album in years on the new Philly Jazz label. On **Exodus** Byard's concept has changed little but his playing is clearer and more defined. He still plays alto with a hint of Albert Ayler's wailing tone and favors the turbulent rhythms of late period Coltrane. But he's also ingested the influences of the AACM school. *Something Children Can Do* is a rhythmless, wandering piece that explores the shadings and colors of small instruments like wood-flutes, bells, and small percussion. It picks up energy when Byard switches to tenor and after a brief focusing moves into a brisk rendition of Coltrane's *Mr. P.C.* The second side consists of the title track and *Philly Jazz* segued together in live performance. The ensemble playing is tested here. Though drummer Harold E. Smith is innervating, moving intuitively with Byard from intense scrambling to soulful moans, bassist Skip Parnell barely keeps afloat.

In a trio setting Byard is open to closer scrutiny than the blitz of Sunny Murray's ensemble. Given his own head he tends to be serious to the point of humorlessness. This tendency allows for such aimless indulgences as the vocal on *All of My Life*. Byard rarely loosens up on his intensity but the honesty of his performance is unmistakable. It is captured here with a boomy ambience that doesn't obstruct the performance but makes the edges a little bit fuzzy. For now **Exodus** is only a new first step for Byard Lancaster.

Philly Jazz LP's are available for \$5.00, plus \$.50 postage and handling from Philly Jazz, Inc., P.O. Box 8167, Phila., PA 19101. *John Diliberto*

Sound: B — Performance: B

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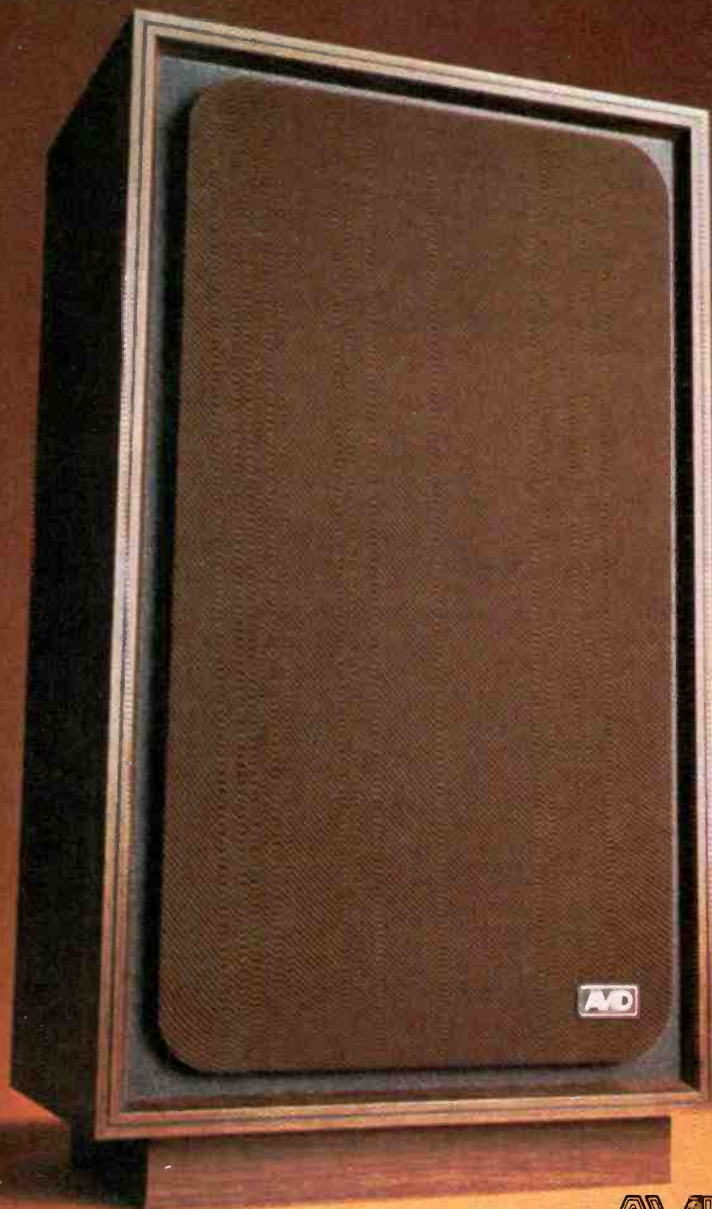
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From Rag Time To No Time: Beaver Harris' 360 Degree Music Experience **360 LP 2001**, stereo, \$6.98.

In: Sanity: 360 Degree Music Experience

Black Saint BSR 0006/7, stereo, two discs, \$13.98.

The 360 Degree Music Experience, founded and led by drummer Beaver Harris, under the musical direction of pianist Dave Burrell, is a floating ensemble of improvising musicians who are not beholden to any jazz style. Instead, they perform any and all subclasses of jazz-based music, the personnel adjusted to fit the needs of the moment. Their aim is not necessarily to fuse or otherwise unify different modes of expression, but rather to leave themselves open to all forms of music without any artificially imposed categories.

Thus, side one of **From Rag Time To No Time** finds Harris, Burrell, and Ron Carter in the company of mainstream jazz veterans Herb Hall (clarinet), Doc Cheatham (trumpet), Marshall Brown (valve trombone, euphonium, and arrangements), and singer Maxine Sullivan. Though Burrell's perky *A.M. Rag* is more backalley barroom than pure ragtime, *It's Hard To But We Do* is a marvelous swing jam with well-developed horn solos. Two ballads are sung with much feeling by Sullivan, whose voice is beginning to show the ravages of time.

Side two has totally different personnel (aside from Harris, Burrell, and Carter) and a totally different concept. The 23-minute *Round Trip* incorporates melodic and rhythmic influences from the Mideast, the Caribbean, Africa, Brazil, India, and avant-garde jazz into a kaleidoscopic, harmoniously coordinated panoply of sounds and colors. Performers range from reedman Howard Johnson, flautist Keith Marks, and bassist Cecil McBee to Trinidadian steel drummer Francis Haynes and sitarist Sunil Garg, plus a complement of Afro-percussionists and Leon Thomas-influenced singer Bill Willingham. A fascinating record all around.

The recording has a metallic bite which enhances the horns, but gives the rhythm section (especially the drums) a tinny sound. The increased activity of side two is accompanied by several muddled passages, blurring many of the percussion parts.

In: Sanity operates from a different perspective in which set personnel (seven contributors to *Round Trip* joined by reedman Hamiet Bluiett and Azar Lawrence) explore different

styles of contemporary improvised music.

The short pieces are the most totally successful. Burrell's *Tradewinds* has an atmospheric theme over a camel-caravan rhythm impeccably carried by McBee and Harris. Lawrence's fluent tenor solo isn't terribly original, but it's just right for the context. Bluiett's *Full, Deep and Mellow* is perfectly described by its title. On *Sahara*, the ensemble is joined by a steelband (six pans plus iron) under Haynes' direction. The pans play an irresistibly rhythmic calypso-like melody which the other instruments (including Garg's sitar!) then take up in turn, resulting in a veritable Caribe-jazz Bacchanal.

The half-hour title suite is similar to *Round Trip* in its eclecticism and use of "outside" elements, but closer to contemporary jazz in its thematic and arranging concepts. Harris, McBee, Garg, and Bluiett in particular all play exceptionally well. Side three is devoted to a trio improvisation, *Open*, by Bluiett, Burrell, and Harris. Unfortunately, their inspiration dissipates long before their energy level; their relentless, themeless, and formless thunderings wear thin less than halfway through.

360 is the group's own label, while *Black Saint* is an Italian import. Both are easily obtainable through the New Music Distribution Service, 6 West 95th Street, New York, N.Y. 10025.

Tom Bingham

From Rag Time To No Time

Sound: C — Performance: A —

In: Sanity

Sound: A Performance: B — to A

America's Musical Roots: Various Artists

Festival FR 1008, stereo, \$6.98.

Any album with 18 of the best tracks from the Chess/Checker vaults is bound to be tasty. This blues feast serves up representative, if familiar, cuts by Little Walter, Howlin' Wolf, Muddy Waters, Sonny Boy Williamson, Lowell Fulson, John Lee Hooker, Bo Diddley, Chuck Berry, Memphis Slim, and Elmore James. The liner notes alternate between enlighteningly useful and downright silly. Credits should have been given more often and consistently. However, the music's all there. Sound quality on these same cuts is often superior on Chess reissues, but it is generally decent.

Michael Tearson

Sound: C Performance: A

Supertrios: McCoy Tyner

Musicians: Tyner, piano; Ron Carter, bass; Tony Williams, drums; Eddie Gomez, bass; Jack De Johnette, drums.

Songs: *Wave*, *Blues on the Corner*, *I Mean You*, *The Greeting*, *Prelude to A Kiss*, *Moment's Notice*, *Hymn Song*, *Consensus*, *Four by Five*, *Stella by Starlight*, *Lush Life*, *Blues for Ball*.

Milestone 5503, stereo, \$8.98

Supertrios documents an aspect of McCoy Tyner's playing which has gone underexposed in recent years—that is Tyner's performance of standards in a trio setting. **Supertrios** affords Tyner the opportunity to play over tunes with decidedly more changes than the modal and suspended sounds which characterize the tunes his regular groups have recorded. To hear Tyner unleash his powder keg of pentatonic, fourth, and modal ideas in the context of tunes heavily laden with chord changes, is the audible realization of a musically symbiotic relationship. Tyner's high energy, multi-inspirational approach unmask certain internal aspects of standard tunes, ordinarily not laid bare. Similarly, the tunes force Tyner to take certain routes and forks in the road, exposing his playing in ways seldom heard.

Additionally, the presentation of Tyner in the company of two different bass-drum superstar combinations is an impressive change of pace. Each of these uniquely identifiable bass-drum combinations harbors such strong musical influences that the positive variables ornament and frame Tyner's keyboard escapades in sunlit brilliance.

The first disc of this two record set features Carter and Williams. *Wave* opens up with a drum solo by Williams, quickly storming into Tyner's sea of high energy vamps of suspensions and pedal tones and finally into the meat of this Jobim bossa-nova. Energized fills and contrapuntal excursions highlight this composition, which rarely receives such dynamic treatment.

Blues on the Corner is a lively theme that jumps and pivots around inside you. Originally recorded on **The Real McCoy (Blue Note BST 84284)**, this tune has developed into a jazz standard, typically Tyner.

Coltrane composed the magical *Moment's Notice* at the last minute, during the legendary **Blue Trane** session which occurred a few years before he formed the classic quartet with Tyner. Consequently, this is Tyner's first recording of the tune and the performance is nothing less than brilliant. The Tyner-Carter-Williams chemistry

ignites to spew forth a starburst of new moods.

One minor point of dissatisfaction concerning this first disc is the sound of Williams cymbals and drums. His drums have a very dead and ordinary rock sound, such as is found on a myriad of rock and jazz-rock albums including his own. This is especially disappointing in light of Williams' past taste in cymbals, tuning of drums, and employment of subtleties with Miles Davis, Herbie Hancock, et. al. This is the same brown-shoes-with-a-black-tuxedo type of playing as Billy Cobham dropped on Tyner's *Fly With The Wind* album.

Sides three and four feature Gomez and De Johnette. The first and immediate difference between this group and the one on the first disc, is the more listening type of approach taken by De Johnette and Gomez. Williams, so caught up in the role he plays with his own fusion band, that volume, power, and technique dictate more of a rock milieu to this acoustic session. De Johnette, however, sounds like the complimentary drummer, shading melodies and harmonies with rhythmic colors and implying various moods with tingling subtleties on cymbals.

Four by Five allows space for Gomez to display his amazing technical skills in a rhythmic bass solo, delicately buoyed by De Johnette's rhythmic threads. While De Johnette does not solo per se on this cut, his brilliant polyrhythms track Tyner's movement and pick up on Gomez' ideas. His uncanny ability to convert these signals into sound, while weaving in and out of his companions' musical interactions, indeed show De Johnette as soloing throughout. In essence, he is a live pencil transcribing other musicians' ideas simultaneously into sound.

The tranquility of Strayhorn's *Lush Life* and the up-tempo transience of *Stella* round out a magnificent second session by Tyner. **Supertrios** is one of the most worthwhile releases of 1977. In light of the excellent recording and fine music, don't neglect to listen to this one.

Eric Henry

Sound: B

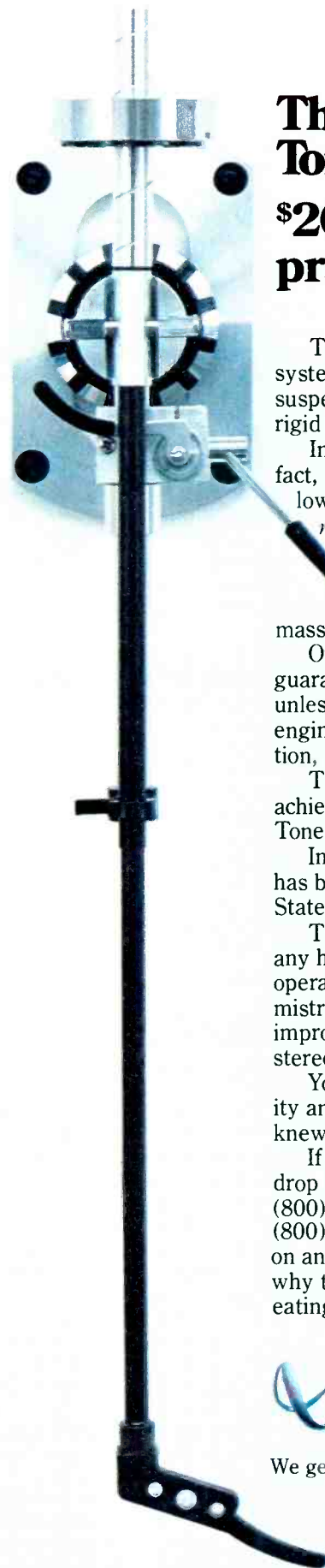
Performance: A

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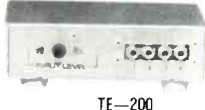
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So a live recording gives the listener a chance to apprehend the compositional and intuitive abilities which go into a performance of the Cecil Taylor group without succumbing to sonic overkill.

Taylor is a composer who happens to improvise. *The Second Act of A* is the 110-minute composition on this record which goes through a number of movements marked by different groupings of the quartet. It opens, after a brief squalling intro by the horns of Sam Rivers and Jimmy Lyons, with an extended duet between Taylor and his long-time drummer Andrew Cyrille. Taylor's playing here is angular and economic. He doesn't play melodies but hints at them with fragments, brief phrases, and repetition. Andrew Cyrille is so sympathetic it's almost supernatural. He follows every turn of Taylor's attack as if he's living inside his head. He rises up out of his churning bottom to accentuate and complement the piano clusters, washes, and stark staccato runs of Taylor's integrated barrage.

The ensemble playing is particularly amazing. The group races headlong into a feverish display of interweaving horns with Taylor's fractured counterpoint and Cyrille's manic drums driving the piece along. It's here and on the fifth side that Taylor's arranging talents are evident. The unit devolves into different combinations with different members coming to the fore. Taylor and Cyrille combine, then Rivers comes in followed by Lyons while Rivers drops out. But the piece is constantly in motion, regenerating itself.

Cecil's compositional approach is also evident in the many moods that surface on the album. It shifts from the furious intensity of the collective unit to a shimmering cascade by Taylor. The reeds move from Lyons' high energy riffing to Rivers, sinewy snake charming, punctuated by bursts from Cecil and Lyons over Cyrille's off-center eastern drum rolls.

Side 5 winds the composition down with a series of unison segments and exchanges through which each musician makes a brief surge over the others in a condensed summation of the performance. The final side, an encore, is still considered by Taylor as one with the whole performance. So it acts as a coda which reintegrates all that's gone before into a concise movement.

The Great Concert was recorded in Paris in the summer of 1969 and is unfortunately the only recording issued by this particular unit. It suffers from some audio surprises like bumped

microphones, some off-mike playing by the reed-men and a distractingly over-mixed tambourine in some sections. But it's a powerful and impassioned performance and the closest recorded approximation of Cecil Taylor live.

John Diliberto

Sound: C+ Performance: A-

Coast to Coast: Cannonball Adderley Milestone M 47039, stereo, \$7.98.

The late Julian "Cannonball" Adderley together with his brother Nat, led an extremely successful jazz combo in the late 50s and early 60s that popularized the hard bop-gospel-soul-funk kind of jazz. These Adderley groups included such musicians as pianists Bobby Timmons and Joe Zawinul, tenor man Yusef Lateef, bassist Sam Jones, and drummer Lewis Hayes. Adderley exhilarated the jazz world with his first Riverside LP, *At the Jazz Workshop*, and followed up with such best-sellers as *The Cannonball Adderley Quintet in San Francisco* and *The Cannonball Adderley Sextet in New York* (each of these albums sold about 70,000 copies—big sales for a jazz recording in those days). This Milestone double-set consists of excerpts from these three Riverside albums. In retrospect, one must ask, in all good conscience, what the shouting was all about. There is, alas, much that is trite and tiresome here.

Like most of his contemporaries, Adderley started out as an admirer and imitator of Charlie Parker, but the essence of Parker's breath-taking, flowing, flashing style consistently escaped him. Instead, Adderley's neo-Parkerisms on alto sax became increasingly heavy-handed and bombastic as the years went by. The truth is that Adderley, one of the most intelligent, charming, and best-liked men in the business, a musician who was successful because he was outstandingly articulate, and had fine leadership and organizational abilities, was not a particularly good player. On these tracks, culled from his best-selling days on Riverside, there is nothing in his playing that can justify the breathless adulation heaped on him at the time.

The 12 minute *This Here*, which opens the Milestone double-set, was one of Adderley's biggest numbers. This live cut from San Francisco's Jazz Workshop is nothing but shrill, dull superfunk. It's use of waltz time and constant repetitive phrases is monotonous; only Bobby Timmons' springy, swinging piano, churning out a sparkling blues chorus, saves the performance. Track two on the opening side,

AUDIO • February 1978

Spontaneous Combustion, is 11½ minutes long, and fails to sustain interest for more than three minutes. Pianist Timmons starts out splendidly on the third cut from the **Jazz Workshop** performance, Randy Weston's *Hi Fly*, (side two) with the group swinging along decently until Timmons solo degenerates into quotes from *I'm Beginning to See The Light* in a way that reaches the lowest levels of banality. Side two also offers a previously unissued version of Monk's *Straight No Chaser*, which has a pulsing aggressiveness and respectable solos; there's also an original by Adderley called *You've Got It*, played in classic bop style in which the players climb to rather exciting peaks; Adderley is at his best here with a well constructed emphatic, urgent solo.

The **Cannonball Adderley Sextet** sides recorded in New York in 1962 at the Village Vanguard take up the second record of the double-set. Many of the tracks have the same faults as the San Francisco quintet performances— heavy-handedness and long solo runs devoid of ideas. But there are two great improvements from the San Francisco days—the addition of Yusef Lateef's immensely powerful tenor sax and exotic flute tonal colorations, and the replacement of Timmons with the

consistently inventive pianist Joe Zawinul. Lateef's work sparks the group, particularly on numbers like a Lateef original called *Planet Earth* which turns into a driving, boiling ensemble effort, paced by a virile, highly-charged Lateef solo. The tenor man's withering tone and tremendous drive generate a momentum that seems to pull the Adderley ensemble and rhythm section along in its wake. Cannonball has a robust, shouting chorus, and the rhythm section jumps in with a driving fury. Throughout these performances in both San Francisco and New York, bassist Sam Jones and drummer Lewis Hayes provide consistently invigorating support. Too bad so much of the Adderley's brothers music was so mediocre. The live recorded sound from both the Jazz Workshop and Village Vanguard performances is clear and sharp, and David Turner's remastering job at the Fantasy studios is first rate.

John Lissner

Sound: A Performance: B-

Cosmos: Sun Ra
Inner City IC 1020, stereo, \$6.98.

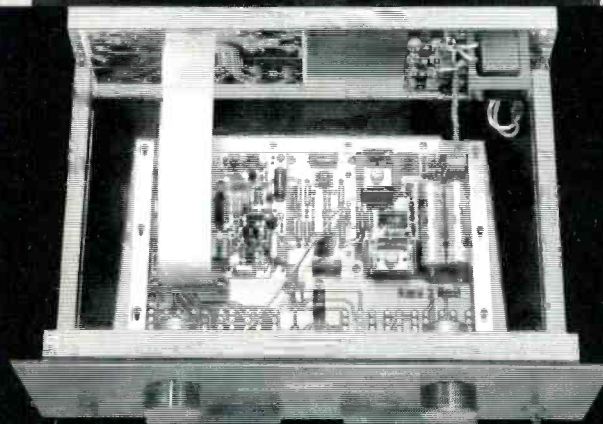
One of the most intriguing aspects of the avant-garde has been its strong sense of tradition. Players from the

AACM in Chicago, to Cecil Taylor, and Leo Smith are steeped in the history and stylings of past jazz eras, and it is the essence of all their work. No one better exemplifies this aspect than Sun Ra. Perhaps because he is a part of that tradition having played and arranged for the Fletcher Henderson bands of the late 40s. But his music stretches even further back. A typical Ra performance includes tunes by Jelly Roll Morton, Count Basie, and Duke Ellington as well as the space master himself.

Cosmos is the latest collection of tunes from Ra and is one of his most mainstream recordings. Divested of all his instruments except the hybrid rocksichord Ra still travels the spaceways. *Interstellar Low-Ways* is one of Ra's hymns to Egyptian Gods, with extensive use of stops and phasing to create an exotic texture. *Journey Among the Stars* is a spacial cakewalk and *Moonship Journey* exhorts you to join them with the chant "Prepare yourself for the moonship journey. Journey on the Moonship."

These tunes are set in bas relief by the straight-up Ellington-style vamps that provide room for John Gilmore's muscular tenor sax attacks. Danny Davis steps out on *The Mystery of Two* with one of those "eyes-back-in-the-

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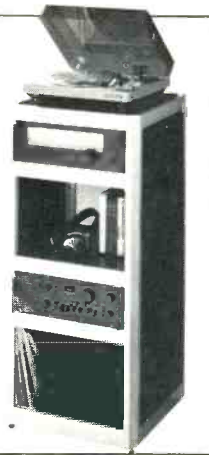
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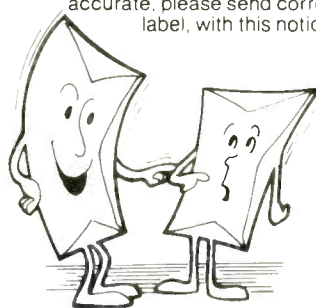
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socket" solos where he literally hammers at the sax keys. The final piece, *Jazz from an Unknown Planet* sounds like it was lifted for the bar scene in "Star Wars."

While the return of Sun Ra to a major label is welcome, the recording still has the quality of Ra's own Saturn releases. The mix is generally muddy and at times it's a strain to hear the



soloing instruments. But every gift from Ra is welcome. *Cosmos*, while drawing on the traditions of jazz, is timeless because it transcends those traditions with a newer synthesis. But no matter how far into the void he travels, his number is still listed in the telephone directory under Ra.

John Diliberto

Sound: B-

Performance: B+

**Solo Piano: Sun Ra
Improvising Artists IAI 37.38.50,
stereo, \$6.98.**

In a long strange career Sun Ra has never before cut an album of solo piano, a personal excursion into his vision. Indeed he includes a traditional spiritual *Sometimes I Feel Like a Motherless Child* and a Jerome Kern standard *Yesterdays* as landmarks on the path. The other four pieces are Sun Ra original musings. *Cosmo Rhythmic* is the bridge between the two covers on side one. It is a spacy thumper as the title suggests. The wholly original second side is more meditative, culminating in the touching blues *To a Friend*.

Solo Piano is an unusually close glimpse at one of the most imposing of personalities, and one of the most misunderstood on jazz. Stripped of shenanigans, Sun Ra emerges as a serious fellow, and an excellent musician.

Though the recording, done in a single day, lacks something in presence and brightness, **Solo Piano** is a fascinating disc. *Michael Tearson*

Sound: C+

Performance: B+

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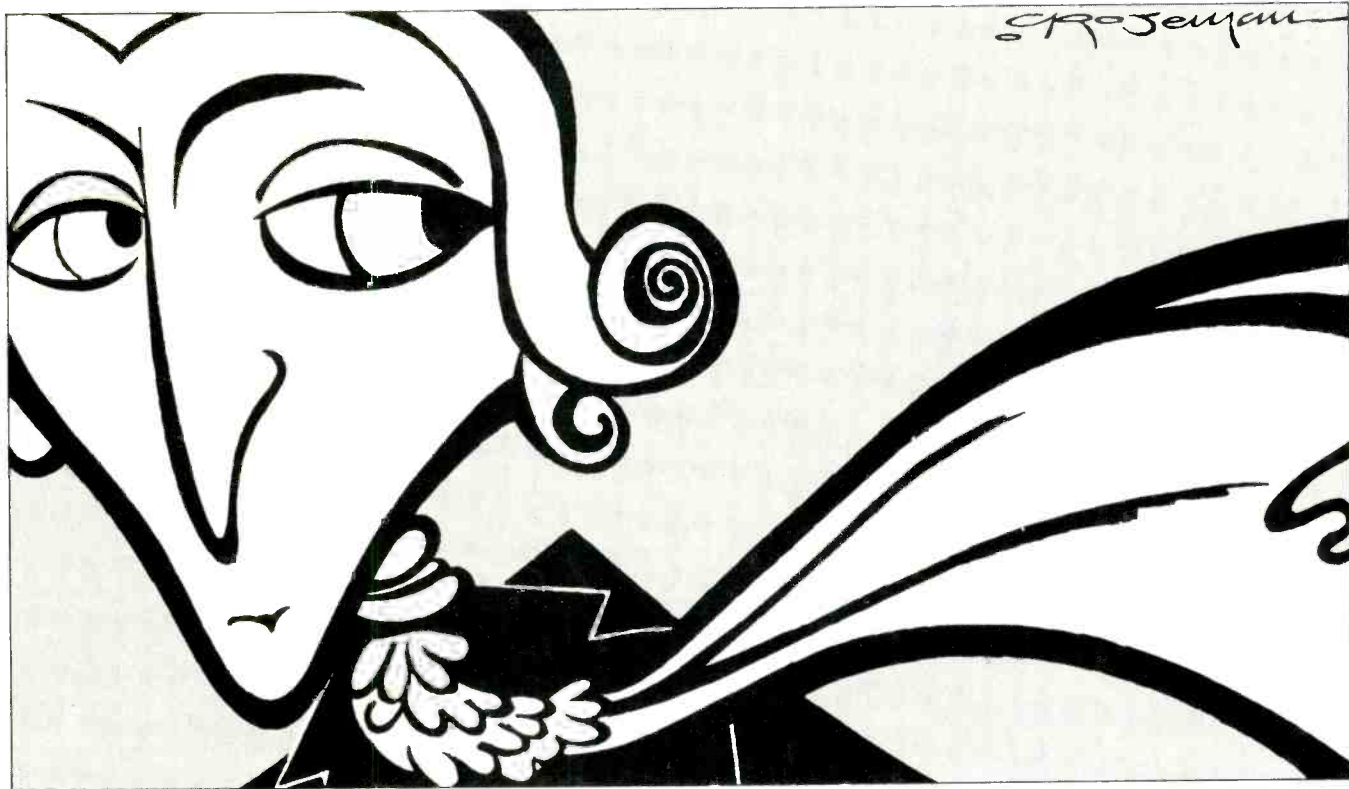
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Classical reviews

Edward Tatnall Canby



105

Haydn: Symphonies #43, "Mercury"; #59, "Fire." Academy St. Martin-in-the-Fields, Marriner. **Philips 9500 159**, stereo, \$7.95.

Haydn: Symphonies #100, "Military"; #103, "Drum Roll." Academy St. Martin-in-the-Fields, Marriner. **Philips 9500 255**, stereo, \$7.95.

Haydn's 104 accredited symphonies make endlessly good material for recording, not only because they are perfectly suited to the recording medium but also because, unlike some others, all of these are worth the listening, even the very earliest. Styles change, breadth, scope, size, but never inherent musical quality and, hence, listenability.

This new series from England has a casual if useful gimmick—the symphonies that have well-known subtitle names. Entirely arbitrary, the unnamed being just as good, but it helps the process of elimination and also provided nice material for covers, jacket notes, and generally memorable publicity. So—OK. I like the fanciful hand-painted covers, all matching.

More important, the playing is exemplary, as is the recording. This medium-sized orchestra, technically a "chamber orchestra," is right for Haydn and is augmented to larger size in the late symphonies, as #100 and #103 here, works, incidentally, which were first performed in England in the 1790s. A nice sense of proportion, good tempi, accurate and sensitive phrasing, a keen understanding of Haydn's often whimsical exterior, which never failed to hide the most profound and economical expression underneath. On top of this, there is the suave and polished sound of Philips recording and the smooth silence of Philips discs.

You could check the older Dorati Haydns on London, beautifully played in Hungary, and the still older Jones series on low-cost Nonesuch from England (dozens of these), good bargains indeed. The celebrated-conductor and/or celebrated-orchestra versions tend to be overblown and fraught with too much Significance, the orchestra's usually too big and thick in sound, out of the Nineteenth century symphonic tradition. Not good

for Haydn, especially on records, where the volume isn't any louder, but the texture is muddier.

Mozart: Sonatas for Piano and Violin, K. 380 in E Flat, K. 526 in A. Alain Planes, piano, Jean-Jacques Kantorow, violin. **Denon PCM OX-7090-ND**, stereo, \$12.00. (Available from Discwasher dealers.)

Notice that the piano is listed first? Correct. These sonatas, and even those of Beethoven and to an extent Brahms, make the most of the piano's ability to lead in a group. This French-based team plays with fine musicianship and excellent ensemble, the pianist properly a bit more forceful than the violin, as the music demands. The violinist is rather gentle, with an occasional quavering tone and no harshness whatsoever. The recorded volume balance is exactly right but, curiously, the violin is quite close while the piano is somewhat more distant. This leads to an anomaly—one wants to turn up the volume but that makes the close violin sound false. Best listening level, then,

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is fairly low, a small-room sound. Which is, of course, appropriate for the music.

I found that the best effect here is via around-the-corner listening (while I was typing)—at that distance the playing seems realistically right there in your other room. The clean PCM sound certainly has to do with it; many a recording sounds unimpressive at a distance.

This disc came with a double-fold insert of program notes, four pages. All in Japanese script. One page, alas, describes the PCM tape recorder in great detail (by the looks of it). The picture of the recorder, at least, is interesting, with associated controls. Four channels in use, if the meters mean anything, with a scope face—signal traces?—and a peak level indicator, if I guess right, plus 24 sliders side by side, the whole business on rollers. Impressive.

Schumann: Papillons; Romanzen, Kinderszenen, Blumenst—uck. Op. 19. Claudio Arrau, pf. Philips 6500 395, stereo, \$7.98.

There is no pianist in the older generation who can compare with Arrau for piano Schumann, though some of the youngest pianists have their own new and good ways to play this elusive and difficult composer. Here is the toughest assignment of all, a batch of the simplest of the Schumann works including the thrice-familiar *Scenes from Childhood*. No major technical problems—just how to put over convincingly a kind of childish music, almost simple minded, which is nevertheless the work of a musical genius.

My first job, 'way back, was teaching music appreciation and the very first assignment I recieved was to "teach" this very music to a batch of hard boiled young college students. I can see the stony faces, as I attempted to explain the cutey-pie references to childish imagining and that final oh-so-artistic *The Poet Speaks*, so soulfully Romantic. Under-play it and you have nothing at all. Overdo the effect and it's instant bathos. A very special world indeed.

The fact is, as you can so easily hear in Arrau's relaxed and wonderfully objective approach, that Schumann was a child in essential ways well known to modern psychologists, a manic depressive who tried suicide and ended up, too young, as a human vegetable in an asylum. A genius, too whereby every childish banality is transformed into sweetness of expression. *Provided* you—the performer—can do the expressing. That's always the rub. You must be a bit genius yourself.

I don't know what Philips does to produce such consistently gorgeous piano sound, more like the real instrument than any other I can think of.

There is no pianist in the older generation who can compare with Arrau for piano Schumann, though some of the youngest pianists have their own new and good ways to play this elusive and difficult composer. Here is the toughest assignment of all, a batch of the simplest of the Schumann works including the thrice-familiar *Scenes from Childhood*. No major technical problems—just how to put over convincingly a kind of childish music, almost simple minded, which is nevertheless the work of a musical genius.

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Kalinnikov: Symphony No. 1 in G Minor. State Academic Orch., Svetlanov. Columbia/Melodiya 34523, stereo, \$6.98.

This huge and expansive Russian symphony dates from 1895 and would seem to have incorporated just about every expertise developed by the Russian school of the time, from Tchaikovsky to Borodin, Rimsky-K. and on to Glazounov and a hundred others of second rank. It's a grand big symphonic windbag, if you ask me. But, of course, well set down for big orchestra and thus full of a lot of impressive noises.

The trouble is, it doesn't really stand much serious listening—nor will it do for background music, being too big and impressive in sonics. If you use it

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for foreground hi fi, you may have something. And you'll maybe like the juicy melodies that come along, suggesting plenty of movie scores of later vintage.

Technically the recording is above fault, though I would not put it in top rank. There is a peculiar Russian sound to the whole—a kind of dry, fine-grained sandiness. Mikes? Cutter characteristics—not that; this would be cut by Columbia. I am wondering if it could be the microphones over there. Not all unpleasant and not really "grainy"—just different. Also, the Russian microphone technique tends to sound a bit old fashioned, with rather prominent solo-close-up sounds, louder and closer than is now common to the Westwards.

Grieg: "Peer Gynt" Suites Nos. 1 & 2; Norwegian Dances. English Chamber Orchestra, Leppard. **Philips 9500 106**, stereo, \$7.98.

In Norway, Grieg is everywhere, like Mozart in Salzburg or maybe J. Strauss the Younger in Vienna. He is the Norwegian Beethoven, they think. The English like him, too, and Raymond Leppard's superb little orchestra (not so little here) plays the Grieg dances—mostly—with all the sunny/cloudy Scandinavianism you could possibly want. The usual Philips recording, which means almost better than possible sound, is beautifully conservative in the mike treatment.

Tuba Quartet—"Tubby's Revenge". (Schuller, Heussenstamm, Purcell, Walter Ross, J. Stevens, Charlie Parker.) New York Tuba Quartet. **Crystal S221**, stereo, \$6.98.

If you want an antidote to Crystal's **Sonic Boom** for percussion, this is probably it. Such a serious-minded bunch of tubophiles! They play, or rather grunt, everything from light-hearted Purcell of the 17th century, turned elephant, to a batch of original works written directly for tubas. Imagine it. ALL tubas. Mammoths and mastodons.

Best I can say, and it's a lot, is that the record is far from dull, nor monotonous, nor is the music dull, whether arranged for these elephants or written for them. But I couldn't help visualizing one of those African safari films with the big beasts sort of ambling around waving their trunks and looking menacing. And no matter that elephants mostly squeal through their long noses!

It's the elephant picture you see with your mind's eye that matters. I couldn't get away from it.

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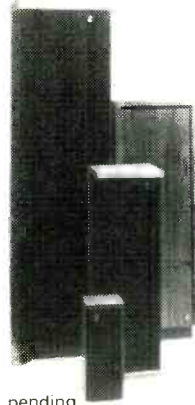
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Theater music

Donald M. Spoto

Wild About Eubie: The music of Eubie Blake performed by Joan Morris, mezzo-soprano; William Bolcom, piano, and guest artist Eubie Blake, piano.

Columbia 34504, stereo, \$7.98.

Whatever the reason for the sudden revival of interest—and it may largely be due to the Scott Joplin craze which has washed over the country in recent years—this new disc Columbia has released in celebration of Eubie Blake is a welcome toast to a significant talent. Now 93, ragtime composer-

The musical simplicity of his songs is deceptive; here's *I'm Just Wild about Harry*, with its elegant syncopation all muted and the original freshness restored. And the lyrical, evocative *Goodnight, Angeline* with its scent of smoky backrooms and late night card games, still overridden with genuine human sentiment. But *I'd Give a Dollar for a Dime* is new to me, and what a wondrous song—an aria, really! It reminds me of the best of Ruth Etting's songs, especially in Joan Morris' velvety, faintly shimmering mezzo; and has she listened to a great deal of Helen Morgan? She has that unselfpitying pathos in the middle range.

Blake wrote the sort of music for piano that made of the instrument a whole orchestra; the *Boogie Woogie Beguine* is enough to accompany a silent film, its syncopations as rich as anything in Joplin, and its chasing crescendi in fact more sophisticated. Bolcom's playing is magically clean in all the others, but Blake's here is uncanny!

You'll like *My Handyman Ain't Handy No More*, unless you're a hopeless Victorian prude. Its "double entendres" are wickedly funny. The record, which concludes with *Eubie's Classical Rag* and *Dixie Moon* (the composer playing both), sticks in the mind long after you've snapped off the tuner-amplifier.

Columbia, which ordinarily produces excellent records, has allowed some muddiness and impurities in the trebles in the final mixing here. It's not enough to spoil the enormous fun of this quite welcome song cycle.

Donald Spoto

Sound: B

Performance: A

Lost Horizon: The Classic Film Scores of Dimitri Tiomkin: Charles Gerhardt and the National Philharmonic Orchestra with the John Alldis Choir
RCA Red Seal ARD 1-1669, quadraphonic, \$6.98.

Come on, guys, let's slow up on this re-recording of film scores just a bit.

When all this started about three years ago, RCA came up with a fine idea and put out some very welcome new orchestrations of old scores. It was good in those more discriminating days, to have, for example, the Bogart and Davis scores; vintage scores by Korngold (of special relevance since his opera *Die Tote Stadt* has been revived in New York), and some of Bernard Herrmann's early work. These and other discs are important, not only for admirers of the individual composers' works, but also for students of film and film music history. But now things are getting arcane—worse than arcane, we're tilting over into some dreadful abyss of banality.

Dimitri Tiomkin won several Oscars and wrote over 150 scores. But his music is of a big, unsubtle, and not very imaginative sort. Studios (Warner Brothers, especially) thought film music was good and supportive of the action if, in fact, the music overwhelmed the action, drawing out every nuance that script and performance could not. No one filled their demands better than Tiomkin; his hand was heavy. He was sort of the composer's Otto Preminger.

This record is an anomaly, for it is the canonization of the mediocre. The score for *Lost Horizon* takes up one entire side and alternates from the soupy (*Entrance into Shangri-La*) and the stereotypically martial (*Riot in Baskul* and *Mob Scene at the Refueling Station*) to the just plain plodding dull (*Bell Sequence* and *Escape*). Frank Capra's film, in spite of its Hollywood look and naive feeling, had a little more class than the score. Really, Franz Waxman and even the lesser known Jerome Moross ("The Big Country") were better at these large sounds.

On the other side, brief selections from "The Guns of Navarone" an admirable film, not at all helped by Tiomkin's casual score; "The Big Sky"; "The Fourposter," which does have a nice melody lurking under-



pianist Blake still turns up (on Merv Griffin's show, for example) reminiscing about Baltimore in the 1890s, where he played piano in saloons and bordellos; about the historic shows he composed during and after World War I (*Shuffle Along* and *The Chocolate Dandies* and *The Blackbirds of 1930*). But most of all he still delights his audience when he sits down to the keyboard.

neath, and, what is probably his most memorable tune from a lovely film, a section of the love theme from "Friendly Persuasion," William Wyler's gentle story of the Quakers. The record concludes with an agonizingly jejune choral finale from an entirely forgettable Cinerama film made by Lowell Thomas, "Search for Paradise."

I don't ordinarily like to take up this valuable space with an unrelievedly negative review, but I hope RCA will think a bit more before proliferating this series. If we had to have a Tiomkin disc, where is the love theme from "I Confess" or a synthesis from "Shadow of a Doubt" or "Portrait of Jennie"?

The production of the record is big, loud, and clear and stresses Tiomkin's predilection for bass tones. But who, really, will care a year or two from now?

Leonard Sillman's New Faces of 1952: Original Cast Album (Re-released master)

RCA Red Seal CBM 1-2206, mono, \$6.98.

Twenty-five years? A quarter of a century since this glorious, wry, zesty musical revue delighted theatergoers? Is it possible? Of course, it's possible, silly. And the anniversary is a sufficient reason for reissuing the original cast album. Those who saw and/or heard these multileveled, inventive numbers in the early fifties can study them more closely, revive memories, regret the disappearances of their favorite performers, and celebrate the later successes of others.

Here's smoky-voiced Eartha Kitt singing *Monotonous* and *Bal Petit Bal* in her flawless French; Alice Ghostley and June Carroll in *Time for Tea* (not released on the original disc, but unearthed from the master, thank goodness, as it's a delicious, wistful, gently sad duet for two old maid sisters); Alice Ghostley's now legendary rendition of *Boston Beguine*, which was the work of Sheldon Harnick, and *Love is a Simple Thing* sung by Rosemary O'Reilly, Robert Clary, Eartha Kitt, and June Carroll.

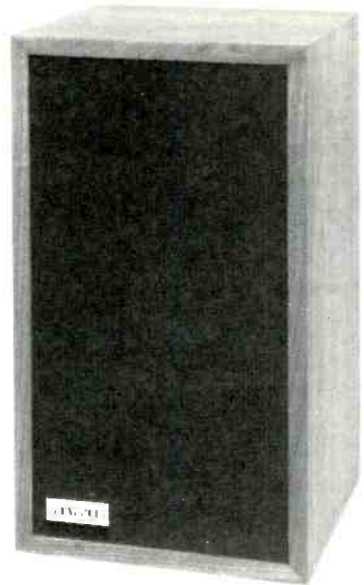
Others associated with this production are not represented on the record because their contributions were not vocal, Mel Brooks, Paul Lynde, and Carol Lawrence (who danced in those days).

This is a welcome addition to the growing list of legendary Broadway shows, revived through the miracle of redusted masters. The recording is splendid; it sounds as if it were done on the most modern equipment.

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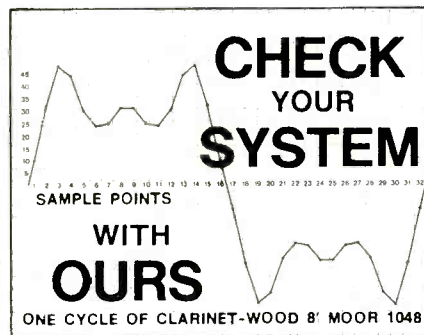


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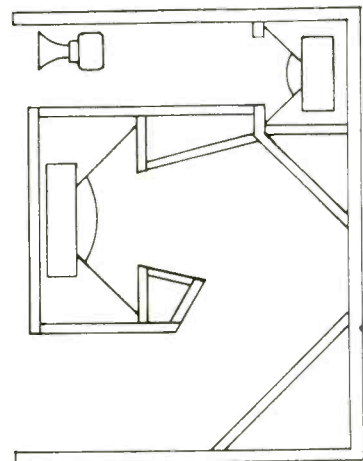
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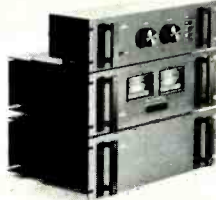
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Advertiser	Page	Advertiser	Page
ADC Hi-Fi Components Write Direct to Advertiser	35	Decoursey Electronic Crossovers Write Direct to Advertiser	123
Ace Kits Write Direct to Advertiser	114	Definitive Systems Audio Store Write Direct to Advertiser	122
Acoustical Engineering Loudspeaker Systems Enter No. 1 on Reader Service Card	109	Discount Music Record Club Write Direct to Advertiser	121
Acoustical Mfg Hi-Fi Components Enter No. 2 on Reader Service Card	72	Discwasher Turntable Write Direct to Advertiser	2, 47
Advanced Speaker Loudspeaker Systems Enter No. 3 on Reader Service Card	109	Record Care Products Write Direct to Advertiser	
Akai Hi-Fi Components Write Direct to Advertiser	94	Dixie Hi-Fi Audio Mail Order Enter No. 13 on Reader Service Card	106
Allison Loudspeaker Systems Enter No. 4 on Reader Service Card	93	Dual (United Audio) Tonearm Enter No. 14 on Reader Service Card	56, 57
Apt Preamplifier Write Direct to Advertiser	113	Empire Phono Cartridge Enter No. 15 on Reader Service Card	43
Audio Critic Publication Write Direct to Advertiser	61	Fantasy Audio Store Write Direct to Advertiser	123
Audio General Hi-Fi Components Enter No. 5 on Reader Service Card	103	Garland Audio Audio Store Write Direct to Advertiser	126
Audio Reference Hi-Fi Components Write Direct to Advertiser	116	Garrard (Div. of Plessey Consumer Products) Hi-Fi Components Enter No. 36 on Reader Service Card	19
Audio Systems Hi-Fi Components Write Direct to Advertiser	112	H&H International Loudspeaker Systems Write Direct to Advertiser	124
Audio-technica Demo Record Enter No. 6 on Reader Service Card	4, 96	Hammond Hi-Fi Components Enter No. 17 on Reader Service Card	18, 104
Phono Cartridge Enter No. 8 on Reader Service Card		Hi-Fi Components Enter No. 60 on Reader Service Card	
Audio Views Publication Write Direct to Advertiser	124	Henry's Audio Store Write Direct to Advertiser	127
Audire Hi-Fi Components Write Direct to Advertiser	114	IAR Publication Write Direct to Advertiser	113
Avid Hi-Fi Components Enter No. 9 on Reader Service Card	99	Infinity Tonearm Enter No. 18 on Reader Service Card	101
B&F Speaker Kits Enter No. 59 on Reader Service Card	92	Innotech Loudspeaker Systems Write Direct to Advertiser	112
Ball Record Preservation Kit Write Direct to Advertiser	79	J&R Music Audio Mail Order Enter No. 19 on Reader Service Card	106
Bang & Olufsen Turntable Enter No. 10 on Reader Service Card	14	JVC Hi-Fi Components Enter No. 20 on Reader Service Card	24, 25
Bose Loudspeaker Systems Write Direct to Advertiser	55	KEF Loudspeaker Systems Enter No. 21 on Reader Service Card	85
Chestnut Hill Audio Audio Store Write Direct to Advertiser	115	Kenwood Hi-Fi Components Write Direct to Advertiser	49
Crown Int. Hi-Fi Components Enter No. 11 on Reader Service Card	20	Koss Headphones Enter No. 22 on Reader Service Card	29, 62, 63, 75
DBX Hi-Fi Components Enter No. 12 on Reader Service Card	21	Headphones Enter No. 23 on Reader Service Card	
		Headphones Enter No. 24 on Reader Service Card	

Advertising Index

Advertiser	Page	Advertiser	Page
Lux Tuner Write Direct to Advertiser	39	Sharp Receiver Enter No. 43 on Reader Service Card	71
Marantz Amplifiers Write Direct to Advertiser	Cov. IV	Shure Phono Cartridge Enter No. 44 on Reader Service Card	34, 35
Maxell Magnetic Tape Enter No. 25 on Reader Service Card	41	Styli Enter No. 45 on Reader Service Card	
McIntosh Catalog Enter No. 26 on Reader Service Card	14	Sonic Research Hi-Fi Components Enter No. 46 on Reader Service Card	12
MCK Audio Mail Order Write Direct to Advertiser	121	Sony Corp. Hi-Fi Components Enter No. 47 on Reader Service Card	15, 128
Mobile Fidelity Sound Lab Recordings Write Direct to Advertiser	125	Help Wanted Write Direct to Advertiser	
Musical Heritage Society Records & Cassettes Enter No. 27 on Reader Service Card	81	Soundcraftsmen Hi-Fi Components Enter No. 48 on Reader Service Card	7
Nikko Hi-Fi Components Enter No. 28 on Reader Service Card	33	Speakercraft Speakerkits Write Direct to Advertiser	116
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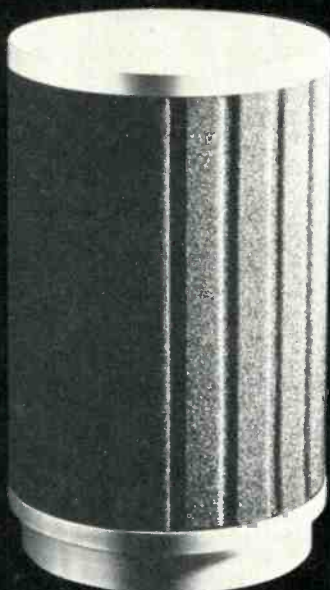
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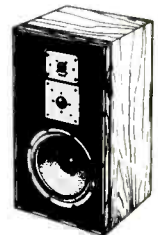
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