

## Harman-Kardon 730— An Outstanding Performer with Fast Reflexes

**The Equipment:** Harman-Kardon 730 stereo receiver in metal case. Dimensions: 17½ by 5½ inches (front), 13¾ inches deep, plus clearance for controls, connections, and ventilation. Price: \$419.95. Warranty: "limited," two years parts and labor. Manufacturer: Harman-Kardon, Inc., 55 Ames Court, Plainview, N.Y. 11803.

**Comment:** Sometimes, in testing a piece of equipment, we find that its behavior reminds us of a subtle but important point that had slipped away from our conscious attention. The Harman-Kardon 730 is such a case. Usually one thinks of a power amplifier simply as a device that turns out an amplified version of the input from the preamp to feed to the loudspeakers, which change it into a sound wave. But the amplifier has a more active role to play in its relationship with the speakers—it has to overcome their mechanical inertia and keep them under control. We found in our listening tests that the amplifier section of the 730 does this very well indeed. (It made our reference speakers sound much better than usual.) We will discuss this point further when we get to the lab tests.

In its appearance, the Harman-Kardon 730 can be described as mild-mannered and functional. It is pleasant enough to look at but could easily escape notice in a living environment. The upper section of the front panel is a smoked plastic window that obscures most of what is behind it until the power is turned on. At that time FM and AM dials and a logging scale spring into prominence (of which only the logging scale is well calibrated—complicating unnecessarily, we think, the process of tuning to a given frequency), flanked at the left by an unusual tuning meter. Superimposed on the rightmost end of the window are a large tuning knob and a small pushbutton that engages FM muting.

The lower section of the panel, which is a brushed metal plate, has a self-illuminating plastic pushbutton at the left end that doubles as an AC on/off switch and a pilot light. Just to the right of this is a headphone output jack, which is live for all settings of the speaker selectors. Then there are two vertical rows of pushbuttons. The first two each can connect a pair of speakers (8-ohm impedance, minimum if both sets are to be driven simultaneously). The next pair engage tape monitors 1 and 2, and the next high-cut and low-cut filters, respectively. Of the last two, one

switches in CONTOUR (loudness compensation), and the other converts the unit to L & R mono operation. Next are five knobs: tone controls (bass and treble), a balance control, a volume control, and a selector knob that chooses any one of six inputs: PHONO 1 and 2, AUX 1 and 2, FM, or AM.

The back panel holds the usual array of pin jacks, stacked, at the upper left, in stereo pairs with two pairs each for phono, aux, and tape-monitor inputs, plus two more pairs for tape-recording outputs. Joined to the panel at the center is a rotatable ferrite-rod AM antenna. Below this and slightly to the right are the reset buttons for the circuit breakers that protect the loudspeakers in lieu of fuses. At the lower left are a binding post for chassis ground and a small knob that adjusts the FM-muting threshold level. Further to the right are three binding posts, one for an external AM antenna and two for a 300-ohm FM antenna. If you want to use a 75-ohm antenna, the manual suggests a matching transformer at the input connections. Next is a set of preamp-out and main-in jacks. (They are supplied with the common, uninsulated, U-shaped jumpers—which, be it noted, can be shorted if they contact metal objects.) Spring-loaded connectors, engineered for bared-wire leads, are provided for two sets of loudspeakers. And there are switched and unswitched convenience outlets (one of each) rated at 200 watts apiece and the AC power cord.

In the lab tests at CBS and in our listening tests the 730 receiver scored very well. Curiously, we found that the FM section sounded a good deal quieter than the lab figures for stereo quieting would suggest. The explanation appears to lie in the figures for midband harmonic distortion, which—though they are below 0.5%—are high enough to

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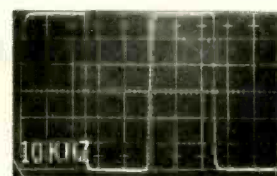
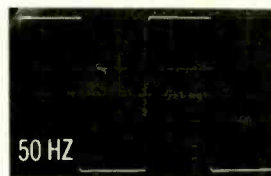
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# Harman-Kardon 730 Receiver Additional Data

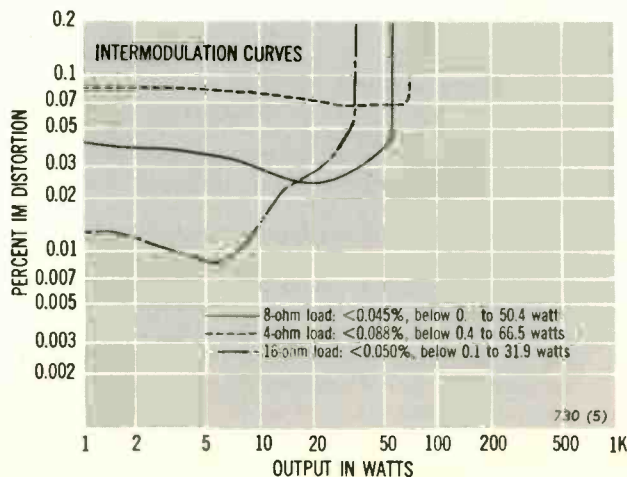
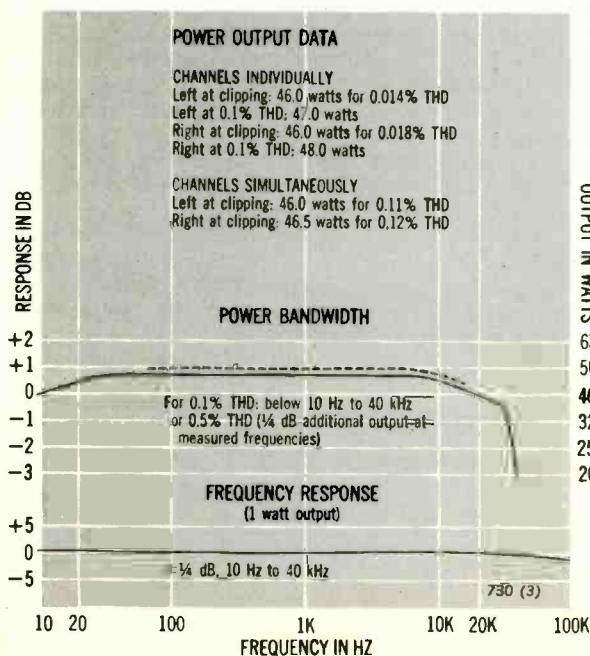
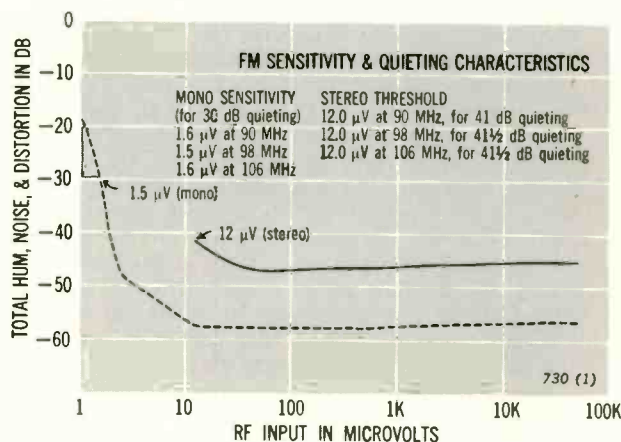
Tuner Section			
Capture ratio	1% dB		
Alternate-channel selectivity	81 dB		
S/N ratio	83 dB		
THD	Mono	L ch	R ch
80 Hz	0.13%	0.30%	0.58%
1 kHz	0.18%	0.40%	0.42%
10 kHz	0.14%	1.8%	1.4%
IM distortion	0.10%		
19-kHz pilot	-65½ dB		
38-kHz subcarrier	-68 dB		
Frequency response	mono +0, -1 dB, 20 Hz to 15 kHz		
	L ch +¼, -½ dB, 20 Hz to 15 kHz		
	R ch ±½ dB, 20 Hz to 15 kHz		
Channel separation	>40 dB, 20 Hz to 2.2 kHz		
	>30 dB, 20 Hz to 8 kHz		
Amplifier Section			
Damping factor	57 (see text)		
Input characteristics (for 40 watts output)	Sensitivity S/N ratio		
phono 1, 2	2.2 mV	73 dB	
tape monitor 1, 2	140 mV	88 dB	
aux 1, 2	140 mV	88 dB	
Total harmonic distortion	at 40 watts <0.085%, 20 Hz to 20 kHz		
	at 20 watts <0.034%, 20 Hz to 20 kHz		
	at 0.4 watts <0.12%, 20 Hz to 20 kHz		
RIAA equalization accuracy	+0, -1½ dB, 20 Hz to 20 kHz		
	+0, -¼ dB, 30 Hz to 20 kHz		

account for most of the hum, noise, and distortion that limits stereo quieting to 47 dB at best. More significantly, this quieting is reached at a mere 50-microvolt input. In mono, where the best quieting figure is an excellent 58 dB (at 500 microvolts), total hum, noise, and distortion is at least 50 dB down for any input greater than 3.0 microvolts, an excellent mark for other receiver designers to shoot at. Mono sensitivity is 1.5 microvolts (better than claimed); stereo switching occurs at 12 microvolts. FM frequency response is almost perfectly flat in both mono and stereo, and separation measurements ran off the bottom of the lab's strip-chart recorder throughout the bass and mid-range. Separation was checked at 1 kHz; it proved to be 47 dB in the left channel, 45 in the right. This represents extraordinary performance, especially for a receiver of this price class. Muting for FM is both adjustable and defeatable at the user's option.

The amplifier section too sounds better than the measured parameters—excellent though they obviously are—



Square-wave response



would suggest. Continuous power exceeds specifications by a comfortable margin, the less powerful channel (the left, in our sample) producing a 47-watt output with just 0.1% harmonic distortion—at 1 kHz. Harmonic distortion remains low throughout the power range, rising to slightly more than 0.1% only in the 0.4-watt tests (1% of rated power).

The measurements of intermodulation distortion are sterling: All are well below 0.1% throughout the power range, as shown in the accompanying graph. This suggests that the power amp section of the 730 behaves well when called upon to deliver extremes of voltage or current, which the reactive loads presented by loudspeakers often demand. As one would expect in a Harman-Kardon amplifier, the power bandwidth (0 dB at 10 Hz to -3 dB at 40 kHz) and 1-watt frequency response ( $\pm 1/4$  dB, 10 Hz to 40 kHz and only -1 dB at 100 kHz) are superb. This is confirmed by the extraordinary square-wave response at both ends of the audio band.

The controls of the receiver do not have the feel of luxury, but they are straightforward and simple to use. The low-cut filter (-3 dB at 70 Hz with a 12-dB-per-octave slope) is very effective against rumble; the high-cut filter (-3 dB at 3.6 kHz, 6-dB-per-octave slope) is less useful.

The FM tuning meter is a special bright spot. It indicates the point at which the quietest signal can be received, a point that does not necessarily coincide with the center of the channel. Since quieting—instead of signal strength—is indicated, the meter is tuned for minimum instead of maximum indication. This may take a little getting used to. More important, the meter, unlike one for channel centering, does not indicate which direction the tuning knobs should be turned to improve tuning. This still is a minor point. For AM the meter shows signal strength.

The "fast reflexes" to which we allude in this receiver refer to its excellent transient response, which it not only has in and of itself, but can impose on a set of loudspeakers. Why and how it is capable of doing this is not entirely clear to us, but we suspect that it results from the frequency response, current and voltage capabilities, and damping factor, which though modest at something less than 57 (the output circuit breaker trips when this is measured on a continuous basis) is sufficient and appears to hold up well to extremes of frequency. But speculation aside, the Harman-Kardon 730 is one truly fine receiver, and it is available at what is, in our opinion, a very attractive price. To us, it looks like a real winner.

CIRCLE 144 ON READER-SERVICE CARD

## The Marantz Studio-at-Home Cassette Deck

**The Equipment:** Marantz Model 5420, a stereo Dolby cassette deck with built-in four-input mixer, in wood case. Dimensions: 17 $\frac{1}{4}$  by 12 $\frac{3}{4}$  inches (top), 6 $\frac{1}{2}$  inches high at tallest point. Price: \$399.95. Warranty: three years parts and labor. Manufacturer: Marantz Co., Inc., 20525 Nordhoff St., Chatsworth, Calif. 91311.

**Comment:** This is a top model in the tape equipment recently added to the Marantz components catalogue. As the company is quick to point out, it is no newcomer to tape equipment, since its parent (Superscope, Inc.) is the longtime U.S. distributor of all Sony-made tape units. And while the 5420 bears little obvious similarity to any Sony model, it's difficult to believe that Marantz could have crammed so many desirable features into a deck without such a solid background of experience.

One striking idea is apparent as soon as you unpack the deck: It has a metal bracket built into its underside so that it can be angled upward, making it easier to use as a mixing console during live recording. Even with this bracket folded back against the underside, the meter panel is still angled, the remainder of the top parallel to the surface on which the deck rests.

The meters are large and boldly styled. The area below 0 VU lights up in blue, the area above in red. The meters themselves are the averaging type; there are peak indicators—one for each channel—between the meters, along with a mode indicator for recording. A long row of indicators for other functions extends to the left of the meters.

Below these indicators, but still on the angled meter panel, is the counter (which appears to conform to the 2X standard that has been proposed for educational cassette equipment) with RESET and MEMORY rewind buttons. To their right are eight more pushbuttons. The first group of



four controls Dolby processing. The ON button cuts in the circuit in the normal way—for encoding during recording and decoding during playback. The EXTERNAL button allows you to use the built-in Dolby processor with a second, non-Dolby deck attached to the appropriate jacks at the back of the 5420. The last two switch a Dolby-FM function (in which a Dolby recording can be made from a Dolby-encoded incoming signal while it is heard, Dolby-decoded, from the output jacks) in or out and can be used as well for copying Dolby cassettes from another deck with only the monitoring signal decoded. The next three buttons control bias and recording equalization. There is one each for NORMAL (ferric), CrO<sub>2</sub> (chromium dioxide), and FERRIC (ferrichrome). The lab tested these with Sony tapes: UHF, CrO, and Ferrichrome cassettes respectively. The final button switches a limiter (for tape-overload protection when signal levels cannot be predicted or cannot be compensated for—as in unattended recording) in or out.

The cassette well has a removable lid—important for head cleaning and demagnetization. In front of it are the usual transport levers: EJECT, REC, REW, PLAY, FF (fast forward), STOP, and PAUSE. The motion controls (REW, PLAY, FF, and STOP) have no interlocks; the user can choose them in any sequence. The EJECT lever will not activate until the

tape has been stopped. The PLAY lever will not activate unless the inner cassette-support platform has been pressed down into play/record position. The RECORD lever will lock down when the tape is stopped so that you can preview recording levels. This is, in sum, a carefully thought-out transport-control system.

The front-right portion of the top panel is occupied by the input level/mixing controls, which are unlike those of any other deck we've tested. There are four mixer/faders, each with its own signal-selector button: left MIC-1/LINE-1, right MIC-1/LINE-1, left MIC-2/LINE-2, and right MIC-2/LINE-2. This means that a maximum of four mikes plus four line inputs can be handled sequentially, with a total of four in use simultaneously. To the right of these faders is a fifth one that controls over-all output to the recording amplifier. But that's not all. At the front are two large pan-pot knobs. A pushbutton to their left switches them in or out of the MIC-2/LINE-2 circuits. The left knob "moves" the left input anywhere in the stereo perspective—from fully left to fully right; the right knob does the same for the right input.

The manual does a very good job of explaining the multitudinous features and necessary Dolby-alignment procedures when the FM or external-deck features are used. The instructions are complete and couched in simple language with few of the philosophical asides that can confuse the novice. The approach is simply, "If you want this, do that." A knowledgeable user may, in some cases, find variant procedures that work better under certain circumstances; but the manual is written, as it should be, with the unknowledgeable in mind.

And the manual is indispensable when you confront the back panel. There are two pairs of input pin jacks, one for LINE 1 or FM, the other for LINE 2 or an EXTERNAL deck. To the right of these jacks is a pair of screwdriver level adjustments for Dolby alignment of incoming FM signals, plus a switch to equalize the Dolby FM signal for the difference between the de-emphasis of a normal FM tuner (75 microseconds) and that needed for correct reproduction of decoded Dolby broadcasts (25 microseconds). This switch is left at the FLAT position for all situations except the decod-

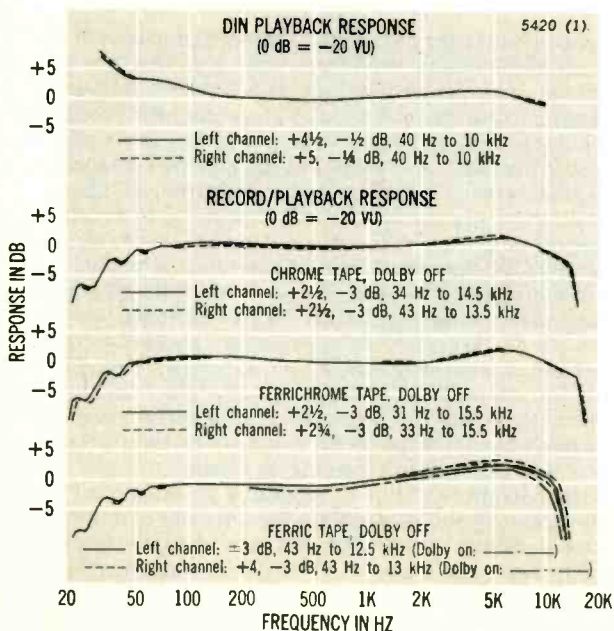
ing of Dolby broadcasts from a non-Dolby tuner. To the left of the jacks is another pair of screwdriver adjustments, this time for Dolby alignment of signals coming from a second deck and availing themselves of the EXTERNAL feature in the Dolby switching. Next is yet another pair of screwdriver controls, which set levels at the regular line-output jacks next to them. There also is a second pair of output pin jacks (without level controls) to feed back to the external deck. (Level adjustments, when recording on the external deck, are made at that deck, as explained in the manual.) And there is a chassis ground connection. The four mike inputs (phone jacks) and a stereo headphone output are on the front panel just below the pan pots.

This is a whopping list of features, all of whose ramifications are beyond our power to catalogue within the confines of a test report. Inventive readers will surely conceive some that neither we nor the writer of the manual have thought of. If you already own an FM tuner or receiver and a tape deck—both non-Dolby—this unit will, at one swoop, add dubbing, Dolby for your existing equipment, and mixing versatility that otherwise would be unobtainable without investing in a fairly elaborate outboard unit.

All this for under \$400, and good performance, too! The response curves show some rise in the high frequencies, but it is not severe—not severe enough, for example, that we could fault the deck on this ground in listening tests. The response numbers, incidentally, seem to fall a little short of those in the Marantz specs. This appears to be because, although Marantz references its specs to -20 VU (many manufacturers appear to measure at -30 VU, though they may not state this fact, making "the numbers" look very attractive), their measurements are keyed to the unit's meters, whose 0 VU is approximately 5 dB

### Marantz Model 5420 Additional Data

Speed accuracy	0.03% fast at 105, 120, & 127 VAC	
Wow and flutter	playback: 0.09% record/play: 0.12%	
Rewind time (C-60 cassette)	91 sec.	
Fast-forward time (same cassette)	94 sec.	
S/N ratio (re 0 VU, Dolby off)		
playback	L ch: 51 dB	R ch: 49½ dB
record/play	L ch: 49½ dB	R ch: 48½ dB
Erase (333 Hz at normal level)	67 dB	
Crosstalk (at 333 Hz)		
record left, play right	42 dB	
record right, play left	42½ dB	
Sensitivity (re DIN 0 VU)		
line inputs	L ch: 1.0 V	R ch: 1.1 V
mike inputs	L ch: 0.40 mV	R ch: 0.42 mV
Meter action (re DIN 0 VU)		
	L ch: 4 dB high	R ch: 4½ dB high
Total harmonic distortion (at -10 VU)		
L ch	<1.8%, 50 Hz to 10 kHz	
R ch	<1.8%, 50 Hz to 10 kHz	
IM distortion (record/play, -10 VU)		
L ch	5.0%	
R ch	4.5%	
Maximum output (re DIN 0 VU)		
L ch	1.2 V	
R ch	1.2 V	



lower than the DIN 0 VU that CBS references its data to in testing. Hence tape saturation begins to affect the upper end of our curves before it affects those provided by Marantz at the lower level. (The level to which the meters are keyed is, incidentally, under consideration as a new cassette standard in Europe—presumably in recognition of the fact that the original standard allows insufficient headroom for recording typical music with conventional averaging meters. This is why few decks today have meters keyed to the DIN 0 VU.)

The speed accuracy is—thanks, undoubtedly, to the servo-DC drive system—topnotch at 0.03% fast, with no variation as line voltage is changed in the CBS tests. Wow and flutter, too, is excellent. With ANSI/IEEE weighting, the playback figure is 0.09%. (Marantz lists 0.07% but

does not specify its weighting. The difference is, under any circumstances, inconsequential.) Harmonic distortion is not quite as low as that in some decks we've measured, though it is within Marantz's 2% spec. Noise, erasure, and crosstalk measurements all are good to excellent.

While some other decks at similar prices may do a little better in this measurement or that, we have yet to examine a unit that offers anything like the 5420's encyclopedic features plus this performance class at the price. When you consider the cost of a good mixer—to say nothing of the extra Dolby features, which cannot be bought in an outboard add-on that will perform the same functions—the \$400 price seems a steal. The 5420 is one heck of a deck.

CIRCLE 142 ON READER-SERVICE CARD

## A Fine \$100 Turntable from Garrard

**The Equipment:** Garrard Model 125SB, a two-speed (33 and 45 rpm) automatic single-play belt-drive turntable assembly with tone arm, base, and dust cover. Dimensions: 16½ by 15½ inches (base); 8½ inches high, 16 inches vertical clearance needed to open cover without removing it. Price: \$109.95. Warranty: one year parts and labor, shipping prepaid. Manufacturer: Garrard, England; U.S. distributor: Garrard Div., Plessey Consumer Products, 100 Commercial St., Plainview, N.Y. 11803.

**Comment:** This is a very attractive product for what must figure as a modest price. Garrard's formerly luxury-product-only Synchro-Lab motor design plus belt drive deliver quiet, accurate performance; the arm design includes a full complement of adjustments; the base and cover allow better than average flexibility of placement. To achieve all this at the price, Garrard has had to dispense with automatic-changer operation and some of the finer details of finish that can be found in its highest-priced turntables. The tradeoffs seem well chosen for the cost-conscious audiophile.

The speed-change (33 and 45) lever is to the left of the platter, the main motion-control lever (off/manual/automatic) is to the right. In addition, there is a single-play/repeat lever near the tone-arm mounting and a size-indexing lever (12/10/7-inch) to the right of the tone-arm support. You can play—once or repeatedly—any type of micro-groove disc either manually or fully automatically: that is, with automatic arm setdown and return. There is a cueing lever, of course. It is mounted near the arm pivot and has damped descent.

Other adjustments at and near the pivot include the vertical tracking force (VTF) knob on the counterweight, a dual-scale (for conical and elliptical styli, with the former—surprisingly—recommended for CD-4 styli), antiskating bias lever at the far right corner of the top plate, and screws (all built into the pivot assembly) that trim automatic setdown point, automatic lift-up height, manual cueing height, and a vertical arm-swing stop. The speed-change belt guide (accessible through the platter once its mat is removed) can be adjusted, but this should never be necessary if your sample—like ours—was set correctly at the factory.

The cartridge is fitted (using supplied screws) to a clip that automatically makes contact with the arm harness when it is inserted into the "shell," actually little more than a guide for holding the clip in place. If you want to use



more than one pickup, you can get extra clips. The clip's wires have the normal four-color coding. The output—via low-capacitance cables suitable for CD-4 and terminated in pin plugs—is coded gray and black. There is a grounding wire as well.

Another optional extra is the adapter for large-hole 45s. With this one possible exception (depending on whether you own and play 45s), the 125SB is virtually ready to install in your system as delivered. Not only is there minimum work to unpacking and setting up, but both the base and dust cover are supplied. The cover is as cleverly designed as it is unelaborate: a simple plastic shell with no back. What normally would be the back portion is permanently attached to the base. The whole cover can be tilted up—just as though it were on hinges—until it rests against this back member in the up position, or it can be slid forward and removed. The latter option reduces vertical clearance required for the entire assembly to little over 8 inches; the former makes the cover self-storing while you are starting or removing a record.

The Synchro-Lab motor was unaffected by voltage changes in the lab tests at CBS, remaining 0.3% fast at 33 and 0.7% fast at 45 for all test voltages. Average weighted (ANSI/IEEE) peak flutter measures an excellent 0.07%, with a maximum instantaneous value of 0.14%. These values are typical of those we are seeing on belt-drive turntables today—meaning that they are notably better than those we would have expected on a unit at this price (where idler drive was the rule) only a few years ago. The platter weighs in at 20 oz. Rumble, measured by the CBS-ARLL standard, is an excellent -63 dB. Performance in this respect exceeds not only the best turntables of only a few

years ago, but also Garrard's own specs, though they are written to the less-critical DIN B standard.

The tone-arm resonance (using our regular Shure V-15 Type III cartridge—though at a minimum recommended VTF of 1.5 grams, the 125SB presumably is engineered for somewhat less deluxe pickups) shows a rise of only 1.5 dB at 7.5 Hz. Arm friction proves too low to measure; 0.45 gram is needed for tripping of the automatic arm return. Vertical tracking force is exact for all calibrations (from 0.5 to 3.5 grams, measured in half-gram steps. The gauge actually is calibrated in quarter-gram steps and can be set for VTFs above 4 grams, which coincides with the zero calibration so that each full rotation of the control adds an additional 4 grams). Antiskating bias is within the normal

range. There is no appreciable side drift to the cueing; automatic cycling time is 12 seconds.

All told, this is splendid performance. We could find no fault with the unit's operation or with its presumable design intent. There are several things it is not: a record changer, a piece of machinery that dazzles by its sophistication of appearance and finish, and an appropriate vehicle for the mounting of the very best pickups. It is an inexpensive (and relatively uncomplicated) device of attractive appearance that, fitted with a good cartridge, will hold its own sonically with just about any player on the market in terms of rumble and wow. It should, in our estimation, find a ready market.

CIRCLE 145 ON READER-SERVICE CARD

## Electro-Voice Interface B: The Loudspeaker as a Filter



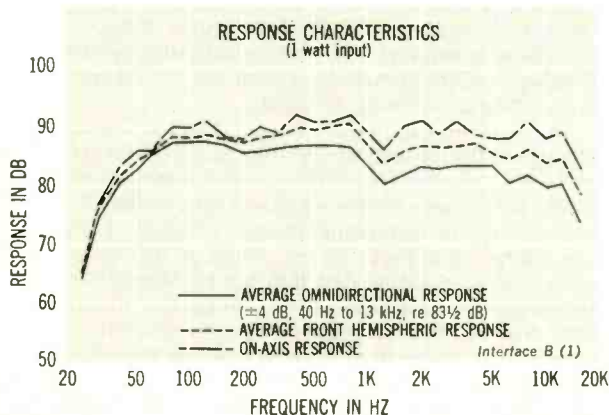
**The Equipment:** Electro-Voice Interface B loudspeaker system, supplied as stereo pair with matching equalizer. Dimensions: 14 by 23 inches (front), 9¼ inches deep. Price: \$325. Warranty: five years parts and labor on loudspeakers; three years parts and labor on equalizer. Manufacturer: Electro-Voice, Inc., 600 Cecil St., Buchanan, Mich. 49107.

**Comment:** The Electro-Voice Interface B is a spinoff of the earlier Interface A (HF test report, February 1974) and is

designed to display most of the advantages of that system at a somewhat reduced cost. In addition, the efficiency has been raised by about 2 dB on the reasonable premise that a lower-priced loudspeaker is likely to be used in conjunction with a lower-powered amplifier.

The low-frequency design of the Interface systems is based to a large degree on the work of A. N. Thiele, who developed a theoretical analogy between the low-end cutoff of a loudspeaker and that of a high-pass filter. Looking at the problem in this way, Thiele was able to relate enclosure volume, cutoff frequency, and conversion efficiency. Electro-Voice has chosen to optimize this system for high efficiency, medium size, and moderately low cutoff.

Snapping the grille cloth (secured by the usual Velcro fasteners) away from the front panel of one of these speakers reveals what *appear* to be a large woofer, a large midrange driver, and a small tweeter. They are in fact a small woofer, a small tweeter, and a large passive radiator. This last component, essentially a woofer cone with no voice coil and magnet, acts in a manner similar to the port of a conventional bass-reflex system in that it derives its energy from the back wave of the woofer. But it differs in having more easily adjustable parameters that allow more leeway in designing for a desired response. According to Electro-Voice, the system in conjunction with its equalizer uses a sixth-order Butterworth characteristic (one of the high-pass characteristics investigated by Thiele), a frequency response that remains quite flat to the cutoff frequency and then "falls off a cliff" at 36 dB per octave. Lab measurements made at the CBS Technology Center confirm that the omnidirectional anechoic response curve has this general shape and show that it is within  $\pm 4$  dB from



### Electro-Voice Interface B Harmonic Distortion\*

Output Level (dB)	Frequency			
	80 Hz		300 Hz	
	% 2nd	% 3rd	% 2nd	% 3rd
70	0.07	0.15	0.06	0.05
75	0.30	0.20	0.09	0.13
80	0.45	0.40	0.13	0.15
85	0.73	0.65	0.11	0.13
90	1.1	1.0	0.24	0.15
95	2.0	1.8	0.47	0.11
100	6.8	6.2	1.5	0.27
105			3.0	0.65

\*Distortion data are taken on all tested speakers until distortion exceeds the 10% level or the speaker produces the spurious output known as buzzing, whichever occurs first.

40 Hz to 12 kHz (with respect to a sound pressure level of 83½ dB).

The equalizer section of the system is active—it requires its own power connection—and is designed for connection into the amplifier via the tape-monitor facilities. (The tape monitor connections are duplicated on the back panel of the equalizer so that this useful function is not lost.) The job of the equalizer is threefold: It boosts the low-frequency response in the neighborhood of 39 Hz, rolls off response rapidly below 36 Hz to guard against woofer damage due to subsonic signals, and, by means of a three-position switch, allows the upper end of the system response to be tailored to the listening environment. This last function it performs extremely well—far better than the usual balance controls—allowing almost exactly equal increments in high-frequency level (approximately 4 dB at 13 kHz) for each change of switch position. We find connection of the equalizer via the tape monitor somewhat problematical, however, in view of its protective function. Murphy's law virtually assures that sooner or later the tape-monitor switch inadvertently will be turned off.

Capable of producing a sound-pressure level of 94 dB (at 1 meter on axis, 250 to 6000 Hz) with 2.65 watts of input power, Interface B is above average in efficiency. The unit will accept a steady drive of 40 watts at 300 Hz for an output of 105 dB before buzzing sets in; pulsed input at the same frequency reaches 163 watts average (326 watts peak) before excessive distortion occurs. The peak sound level produced (114 dB) bespeaks good dynamic range.

Lab measurements reveal a rather uneven impedance curve that rises above 16 ohms at three frequencies; more important, it approaches 4 ohms between 100 and 300 Hz and between 30 and 40 Hz, just the region in which the

equalizer delivers maximum boost. Thus, despite the fact that the instruction manual indicates that two of these systems can be driven by a single amplifier (and with just one equalizer, incidentally), we advise caution in making such a connection. The impedance rating based on the lab findings is 4.9 ohms—well under the 8 ohms at which Electro-Voice rates it. (Use of any other kind of speaker in parallel with this one would, of course, require disconnection of the equalizer, which Interface B cannot tolerate.)

In our listening tests, we found that fundamental bass tones remain audible to about 38 Hz. High frequencies are there up to about 17.5 kHz and are well dispersed, remaining audible to about 45 degrees off axis. White noise is reproduced cleanly and smoothly with just a hint of heaviness in the bass. The sound of the system in playing music is pleasantly warm, with a transient response that can be called graceful, rather than incisive or extremely precise. That is, the Interface B's way of blurring transients is not the common-garden sort that tends to cause fatigue.

Over-all, we would characterize Interface B as a loud-speaker system that is pleasant and friendly—and in several ways. It produces a well-blended sound—such as one might hear from halfway back in a concert hall—rather than the sharply etched sound that some listeners prefer. But this characteristic makes it a forgiving speaker that will tolerate or even ameliorate minor foibles of other equipment or the program material, rather than expose them with uncompassionate accuracy. This is not, in other words, intended as a speaker system for the superfussy audiophile. It is, rather, capable of making a modest audio system rise to new heights—and, when all is said and done, at quite an attractive price.

CIRCLE 141 ON READER-SERVICE CARD

## The "Phase 2000"—A Solid Preamp with Some Surprises



**The Equipment:** Phase Linear Model 2000, a stereo preamplifier/control center, in metal case with optional walnut case. Dimensions: 5½ by 19 inches (front panel), 6 inches deep, plus clearance for controls and connections. Price: \$299; walnut case, \$37. Warranty: three years parts and labor. Manufacturer: Phase Linear Corp., 20121 48th Ave., W. Lynnwood, Wash. 98036.

**Comment:** While the Phase Linear Model 2000 could not be accused of hiding its light (it does have one, a light-emitting diode pilot) under a basket, the unit has an unusually laconic front panel in the context of today's feature-waving. But in its substantial if subtle way this

preamp has features aplenty. There is one—ambience recovery—we cannot recall seeing elsewhere. The optional walnut case adds a measure of warmth to the almost bland brushed gold of the faceplate.

Near each of the four corners of the front panel there is a large knob. The one at the upper left is marked SELECTOR and has positions for PHONO, AUX, TUNER, TAPE 1, and TAPE 2. At the lower left is a knob labeled AMBIENCE (about which more later). The respective positions at the right side are occupied by a combination power on/off switch and volume control and by a balance control. Four smaller knobs arranged in a row between the selector switch and volume control represent the tone controls—left treble, left bass, right treble, right bass. These are detented, each having five positions of boost and five of cut. Halfway between the left and right channel controls is the pilot light.

Centered below the tone controls is a row of rectangular pushbuttons. The leftmost two of these are source/tape monitors for tape 1 and tape 2. The next chooses stereo or mono operation. Then there is one that (partly) defeats the ambience function, followed by another that engages a low-frequency equalizer. The last three relate to the tone controls: the first to move the treble turnover point from 5 to 2 kHz; the next to move the bass turnover from 50 to 150 Hz; the last to defeat the tone controls entirely. This—like many pushbutton arrays we've seen—is not the most convenient arrangement for keeping track of which functions are engaged and which are not. Though it is well

thought-out for average purposes, it falls short of the unequivocal labeling possible with levers, for example.

The back panel of the Phase Linear 2000 is fitted with the usual pin-jack input and output connections. The common practice of stacking stereo jack pairs with the left channel above the right is not followed here; the connections are side by side, with the left channel at the left as one faces the back of the unit. At the left of the panel are four stereo output pairs. The first two, labeled MAIN, provide driving signals for left back and right back (for the ambience effect), left front and right front. Then there are, continuing toward the right, two stereo sets of tape outputs. Next are stereo input pairs for TAPE 2, TAPE 1, TUNER, AUX, and PHONO. Below the phono jacks is a binding post for chassis ground, and there are three convenience outlets just below the tape outputs. Two are unswitched and rated at 400 watts; the other is switched and has the same rating, with the total of all three not to exceed 850 watts.

Before going on to the laboratory measurements, an explanation of the ambience function and the back outputs is in order. The ambience signal is derived by matrixing the left and right signals so that L-minus-R and R-minus-L are available. These appear, respectively, at the left back and right back outputs at a level controlled by the AMBIENCE knob on the front panel. These signals also are injected into the front channels (L-minus-R into L, R-minus-L into R), the level of the injected signal being controlled by this same knob. The ambience pushbutton defeats injection into the front channels only. Once the rather complex operation of this system is learned, it can be used to create a pleasant quasi-quad effect, although in fairness one must say that some of the complexity arises from the addition of ambience to the front channels. But this allows use of this function (at least in part) without extra power amplifiers and loudspeakers. For reproduction of the straight difference signals at the back outputs, of course, a second pair of amplification channels and speakers is required.

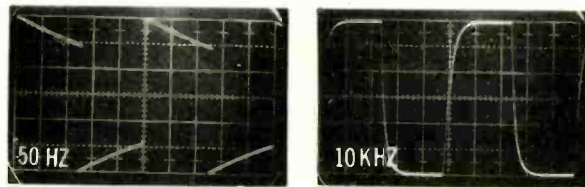
In measurements made at CBS, the Model 2000 proved itself a strong performer. In neither channel did output clipping occur at less than 12.2 volts, whether driven singly or together. At an output level of 2 volts (more than enough for full output from most power amps), harmonic distortion was less than 0.02% in all cases—well below Phase Linear's 0.1% spec. And if we ignore as inaudible all harmonics above 20 kHz, harmonic distortion is no more than 0.0066%. Intermodulation distortion (less than 0.002% for a 2-volt output) likewise is very low. While fre-

quency response does not exhibit the nearly perfect flatness found in some preamps, the largest deviation in the range from 20 Hz to 20 kHz is a mere 1/2 dB. Inaccuracy in the RIAA curve also is minor; it is down 3 dB at 20 Hz.

Reference output (2 volts at 1 kHz, into 100,000 ohms shunted by a capacitance of 100 picofarads) is produced by a 360-millivolt drive at any of the high-level inputs; the phono input is 20 dB more sensitive, requiring just 3.6 millivolts to achieve the same output. Hence we foresee no problems in matching the preamp to other equipment. Among the other measurements shown in the "Additional Data" table, noise figures also are good—though they don't precisely confirm Phase Linear's specs, presumably because of differences in measurement technique. Note that our reference level is 2 volts. If you wish to translate for a reference level of 1 volt, a not uncommon practice, simply subtract 6 dB from the numbers shown. This still leaves 60 dB of signal-to-noise ratio in the phono input with the gain control wide open—standard (and worst-case) testing procedure at CBS.

The Model 2000 is as super in the listening as it is smooth in the handling. Once one has become used to the controls, they are convenient to operate and satisfying to touch. The extra flexibility in the tone controls (the separate knobs for each channel, as well as the variable turn-over points) delivers worthwhile options. We find the ambience recovery feature a decided plus, particularly if extra power amps and speakers are available for the back channels. The unit does not dazzle; it offers instead solid performance—and for not too many dollars at that.

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Square-wave response

### Phase Linear 2000 Preamp Additional Data

Frequency response (at 2 volts)  
 + 1/2, -1/4 dB, 20 Hz to 20 kHz  
 + 1/2, -3 dB, below 10 Hz to 40 kHz

Output, channels driven individually  
 Left at clipping 12.2 V for 0.023% THD  
 Right at clipping 12.2 V for 0.025% THD

Output, channels driven simultaneously  
 Left at clipping 12.2 V for 0.023% THD  
 Right at clipping 12.2 V for 0.025% THD

Harmonic distortion (2 volts output)  
 L ch <0.0140%, 20 Hz to 20 kHz  
 <0.0053%, 20 Hz to 10 kHz  
 R ch <0.0190%, 20 Hz to 20 kHz  
 <0.0066%, 20 Hz to 10 kHz

IM distortion <0.002% (at 2 volts)

Input characteristics (for 2 volts output)		
	Sensitivity	S/N ratio
phono	3.6 mV	66 dB
aux, tuner	360 mV	83 dB
tape 1, 2	360 mV	83 dB

