

service, the power-level LED's did not operate. We assumed that they were defective until an examination of the receiver turned up a barely visible switch in the rear, marked "PEAK IND," which had been accidentally moved to its off position during unpacking of the unit. Although this switch is shown on the control identification picture in the manual, its purpose is barely mentioned in the text, with no hint provided as to why one might wish to blank the display.

The only significant functional omission that we could find in the design of the R-1120 was the absence of separate preamplifier outputs and power-amplifier inputs, which we would have expected in a receiver of this quality and price.

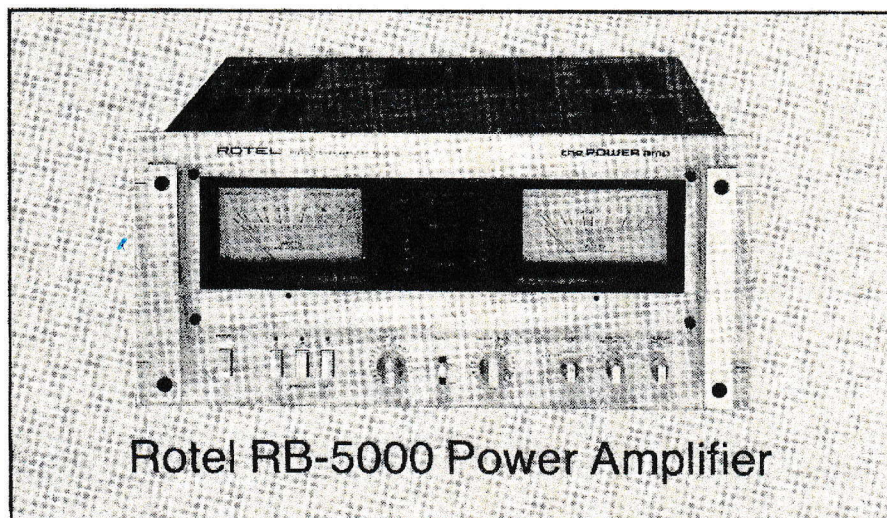
We were impressed by the simplicity and functional beauty of the front-panel control layout, whose styling makes the little-used

controls almost invisible except under close examination. Except for the power switch, the operation of the receiver will normally be restricted to the few knob controls along the lower edge of the panel. However, we would have appreciated greater visibility for the markings that show the settings of the input and speaker-selector switches.

Overall, we had a strongly favorable reaction to the appearance, "feel," and sound of the Luxman R-1120. It shares with all the other Luxman products we have used the smoothness, elegance, and basic good taste that distinguish this brand from most of its competition. From the silky feel of the tuning control to the rich rosewood grain of the cabinet finish, this is a receiver meant to be seen, heard, and enjoyed. It is expensive, to be sure, but one is buying really first-rate performance plus some less tangible properties.

We have limited tolerance for products that behave in unexpected or undesirable ways (such as noises when switching, noise bursts when tuning across the FM band, vague or downright inaccurate FM-dial calibrations, and so forth). We are happy to report that the Luxman R-1120 was completely free of such anomalies. In spite of its occasional concessions to styling (the dial is calibrated only at 1-MHz intervals, for example), function has not really been sacrificed. The FM tuning was so accurate that we had no difficulty reading the station frequencies to the nearest 200 kHz directly from the dial. The sound of the R-1120, from both FM and phono sources, was impeccable—essentially determined by the quality of the program source rather than by any property of the receiver itself.

*Circle 105 on reader service card*



**Rotel RB-5000 Power Amplifier**

**N**ot long ago, power amplifiers capable of delivering more than 200 watts per channel were a rarity; today, they are almost commonplace. However, the ranks of the super-power amplifiers thin out rapidly above 300 watts or so, and there are only a few in the 500-watt class. One of the most impressive of these giants is the new Rotel RB-5000, rated to deliver 500 watts per channel to 8-ohm loads from 20 to 20,000 Hz with no more than 0.009 per cent total harmonic distortion.

The RB-5000 is as imposing physically as it is electrically. The 8¾ x 19-inch satin-gold-finish front panel, styled to match other Rotel audio components, is slotted for rack mounting and fitted with a pair of appropriately robust handles. On the panel are two large meters calibrated in watts from 0.5 to 1,000. Behind a "blackout" window between the meters are two vertical rows of LED peak-power indicators (the meters respond to average power levels). The lights are calibrated at 3-dB intervals from -18 to +3 dB (0 dB is the amplifier's rated output). Between these rows are other LED's indicating **STANDBY** (the interval after power is first applied, during

which the outputs are muted to protect the speakers), **PROTECTION** (which lights when the amplifier's protective circuits are activated), and **OVERLOAD** (which indicates that the amplifier is being overdriven).

Across the bottom of the panel are a number of operating controls. Pushbuttons switch the power and connect the three pairs of speaker outputs (individually) through heavy-duty relays. Any two of the speaker buttons can be engaged simultaneously, but they are electrically interlocked so that pressing a third button will have no effect (a red LED above each button indicates that its speaker output is being driven). Under the center indicator panel are two level-control knobs and a lever switch that completely removes the input signal when it is operated. The level knobs, which are lightly detented, provide up to 21 dB of attenuation in 1-dB steps.

At the lower right of the panel are three knob controls. The **FILTER** switch has positions marked **LAB TEST**, **NORMAL**, and **LOW FILTER**. These provide three degrees of low-frequency rolloff for different applications. The **METER SENSITIVITY** switch in-

creases the sensitivity of the meter (and LED) displays by ten or one hundred times (10 and 20 dB); in the latter position, the lowest reading on the meters is only 5 milliwatts and a full-scale reading corresponds to 10 watts. The last switch is the **LIMITER**, which reduces the maximum output capability of the amplifier to either 25 or 50 per cent of the normal 500 watts.

The active circuits of the RB-500 are completely symmetrical (push-pull) from input to output and are direct-coupled, with the exception of a single blocking capacitor. The internal negative-feedback loops are completely direct-coupled as well. The only exception to the DC design is in the special balanced-input stage used with the Cannon connectors in the rear of the amplifier for interface with professional equipment having balanced signal lines. The balanced input of the RB-500 is electronic, employing FET's, instead of being transformer coupled. When the standard phono-jack inputs are used (as in any home system), a switch in the rear of the amplifier removes the balanced-input stages from the circuit. (It is interesting to note that the phono jacks on the RB-5000 are gold plated for reliable, corrosion-free contacts.)

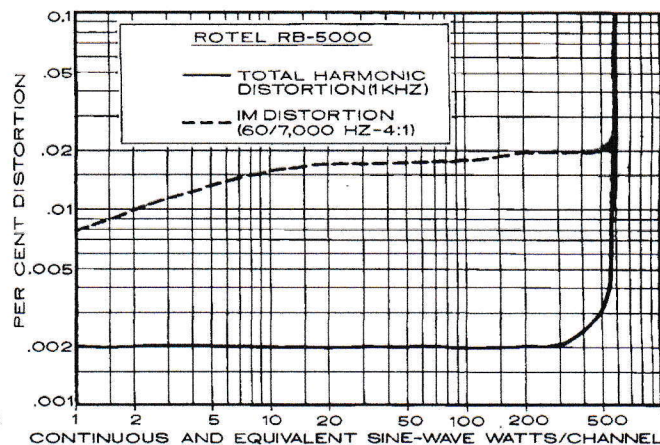
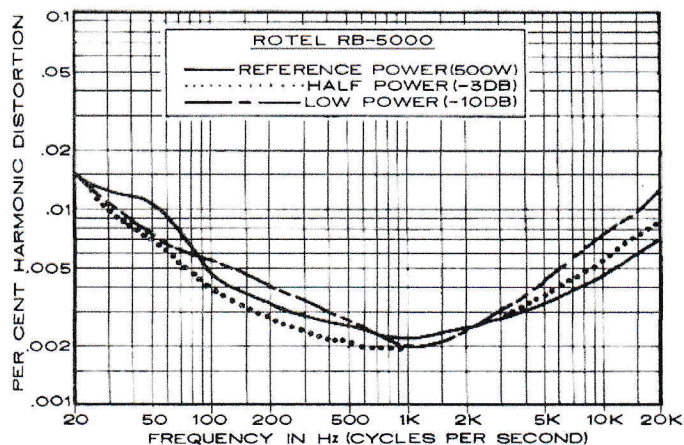
The output stages operate in class AB. At power outputs up to 3 watts, they are biased for class-A operation, giving the lowest distortion. As the power increases beyond 3 watts, the operating conditions make a smooth transition to class AB.

The Rotel RB-5000 is really a "dual-mono-phononic" amplifier in that each channel has its own power supply, including a large toroidal transformer (about 6½ inches in diameter) and extensive regulator circuits. In addition, there is a third completely separate power supply for the amplifier's elaborate protective and display circuits. The RB-5000 is cooled by a slow-running, silent fan that operates at all times, automatically speeding up to provide the necessary extra cooling if the output-transistor temperature should rise excessively.

As might be expected, the Rotel RB-5000 is a very large, heavy amplifier (most of its weight, as well as its bulk, is associated with

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the huge power supply). It extends some 17½ inches behind the front panel (including four large rubber feet on the rear apron that make it possible to stand the amplifier on its back without damaging the speaker terminals). The speaker connectors are large, heavy-duty binding posts able to grip any gauge of speaker wire securely. The heavy-duty power cable has a molded three-wire plug. It should be noted that this amplifier cannot be switched from any preamplifier since it draws a maximum of 3,200 watts (!) from a 120-volt power line. In addition, it cannot even be powered from a standard home-lighting circuit (rated at 15 or 20 amperes) if one expects to use its full power capability.

Rotel has cleverly included a pair of small caster wheels under the rear of the amplifier, next to the bottom rubber feet. By lifting up slightly on the front-panel handles, one can roll the amplifier easily on the casters—a feature we greeted with hearty approval in view of the unit's 117-pound weight. Suggested retail price of the Rotel RB-5000 is \$2,650.

● **Laboratory Measurements.** Since the Rotel RB-5000 draws too much power from the a.c. line to be operated with both channels running simultaneously at full power, we made all of our measurements with only one channel driven. Because of the use of separate power supplies for the two channels, this is a perfectly valid test procedure. However, the unit was given the required FTC preconditioning period, with both channels driven at one-third power (167 watts) into 8-ohm loads for one hour. The amplifier became only moderately warm, and the fan remained in its low-speed mode.

The 1,000-Hz output at the clipping point, into an 8-ohm load, was 595 watts. The 4- and 16-ohm outputs were 900 and 302 watts, respectively. The IHF clipping headroom (8 ohms) was 0.76 dB. With the prescribed 20-millisecond tone-burst signal, the IHF dynamic headroom was 1.1 dB. This confirms the excellent regulation of the power supplies of the RB-5000, since the clipping output for a tone burst was only 625 watts, as compared with the 595-watt continuous output.

The 1,000-Hz total harmonic distortion (THD) was unmeasurable over most of the amplifier's operating power range. It read the residual 0.002 per cent distortion of our test instruments from 0.1 watt to more than 300 watts output before climbing slowly to 0.004 per cent at 500 watts and 0.089 per cent at 600

watts, the clipping point. The IM distortion was less than 0.01 per cent in the vicinity of 1 watt and about 0.02 per cent up to 500 watts output.

At rated or lower power levels, the THD reading was at its minimum of 0.002 per cent at 1,000 Hz, rising at lower frequencies to 0.015 per cent at 20 Hz (this is the residual of the test equipment at that frequency, so it may be assumed that the distortion of the amplifier was much lower). At higher frequencies, the distortion also rose, to 0.007 per cent at 20,000 Hz and full power. It was slightly more (0.0085 per cent) at half power, and the measurement of 0.013 per cent at one-tenth power and 20,000 Hz was the highest bona fide distortion reading we obtained during our test of the amplifier!

The input sensitivity of the RB-5000 was 66 millivolts (mV) for a reference 1-watt output at maximum gain and 750 mV at minimum gain. The unweighted noise level was 73 dB below 1 watt at maximum gain and -64 dB at minimum gain (we did not subject our active A-weighting network to the possibility of accidental damage by connecting it to the output of the amplifier).

The IHF intermodulation distortion was measured with two tones of equal amplitude, 1,000 Hz apart, over a frequency range of 2,500 to 20,000 Hz. The difference-tone distortion was -76 dB relative to a 500-watt equivalent single-tone output at the highest frequency and -81 dB at 7,500 Hz and lower frequencies. The third-order distortion components were -67 dB at 20,000 Hz and -86 dB at 2,500 Hz, also referred to 500 watts of equivalent sine-wave power.

The frequency response of the RB-5000 was flat over the audio range and considerably beyond it. With the FILTER switch at its LAB TEST setting, the response was down 0.4 dB at 10 Hz and 1 dB at 5 Hz. With the NORMAL setting, the lows were down 0.6 dB at 20 Hz, 2.5 dB at 10 Hz, and 6.5 dB at 5 Hz. The LOW FILTER setting gave only slightly less output: -1.2 dB at 20 Hz and -9.7 dB at 5 Hz. In all the filter conditions, the high-frequency response was the same, down 0.2 dB at 50,000 Hz and 1 dB at 135,000 Hz. The amplifier rise time was 1.5 microseconds, and its slew rate was 30 volts per microsecond. It was completely stable with capacitive loads as large as

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"... But then when I offered to put on a video cassette, she turned down  
 Blondes in Black Lace, Hard Bargain, and Every Inch a Lady and chose . . . Patton!"



2 microfarads in parallel with the 8-ohm resistor load. When we drove the amplifier into overload with square waves, its protective circuits shut it down. It was necessary to turn the power off and on again to restore the amplifier to operation when this occurred.

When we investigated the operation of the POWER LIMITER, we found that it caused the amplifier to clip at the indicated levels (125 or 250 watts). In effect, it reduced the amplifier power rating to those values, since it did not allow short signal bursts to pass through at higher levels.

The power-meter calibration was quite accurate—within a few per cent except at the lowest readings. The LED peak indicators were almost as accurate. Their relationship was fixed in relation to the meter readings, so that they were also controlled by the meter-range switch.

● **Comment.** Our first reaction to the Rotel RB-5000 was, "Who would use an amplifier like this in a home music system?" Clearly, its major application must be in very high-quality sound reinforcement and discotheque service. Nevertheless, there will surely be some people who will use it in a home music system, and we can assure this limited group that they will be using one of the most refined and overwhelmingly impressive power amplifiers we have seen.

Little need be said about its electrical performance, which is well beyond the ability of available test equipment to measure with any accuracy. We were always aware that we were dealing with a device that could easily destroy any home speaker system if not treated with respect. In our use tests, in fact, it demolished some supposedly "burnout proof" speakers, solely through our own foolhardiness in trying to see how loud 500 watts "sounded."

Considering the power of this amplifier, which can deliver close to 1,000 watts per channel to 4-ohm speakers for an indefinite period (certain to be set by the speakers rather than the amplifier), it runs amazingly cool. It has one of the most effective cooling systems we have seen, and it never became more than mildly warm in our tests—and not even that in normal operation. Best of all (for those who will insist on using it at home), the fan cannot be heard under any conditions. We could not believe that it *had* a fan until we placed a hand over the output-transistor heat sinks and felt a gentle, warm breeze. Since the fan never went into its high-speed mode, we cannot comment on its ultimate loudness, but it is a safe assumption that the sound of the program would mask it effectively in that unlikely event.

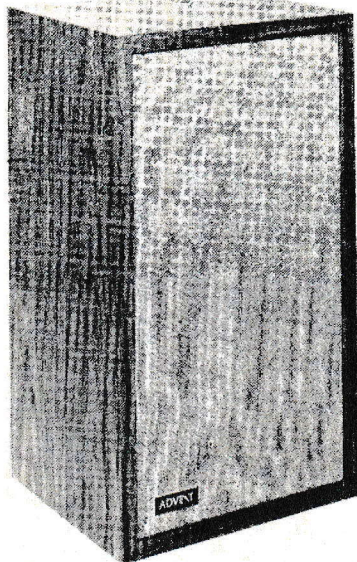
Although it is obvious that the Rotel RB-5000 is meant for heavy-duty commercial

service, it is just as obviously *styled* for home use, despite the fact that its size, weight, cost, and power consumption rule it out for almost all home installations. If its power limiter had been designed to pass full power for some short period, such as a few milliseconds, before clamping the power output to a safe value, we would have a different view of this feature. As it is, the limiter is merely a means of converting the RB-5000 into the world's largest, heaviest, and most expensive 125- or 250-watt amplifier!

Nevertheless, Rotel has demonstrated very dramatically how a state-of-the-art super-power amplifier can be designed to be attractive, reasonably compact, and apparently utterly immune to damage or destruction. (A number of amplifiers in the past have not fared so well under the conditions to which we exposed the RB-5000.) It is too bad that it still takes two men to lift it, but that, too, should be no problem in a fixed, commercial installation. At one time the word "heavy" was used among rock fans to indicate that someone or something had special desirable, significant, or awesome properties. If the expression has faded from use, we think it is worth reviving if only for the RB-5000, a product that is "heavy" in every sense of the word!

Circle 106 on reader service card

## Advent/1 Speaker System



**T**HE Advent/1 is roughly the size of the Smaller Advent Loudspeaker that preceded it, with overall dimensions of 22 x 13¼ x 9¼ inches and a weight of 29 pounds, and it is also a two-way acoustic-suspension system. Beyond that, it is completely different from the Smaller Advent. Its bass driver

(which is identical to that used in the larger Advent speakers) has a 10-inch cone treated and stiffened to minimize "breakup" effects in the upper part of its operating frequency range. The in-box resonance is 52 Hz in the Advent/1, as compared with 43 Hz in the New Advent and Powered Advent speakers, and

hence its frequency response is down slightly at the lowest bass frequencies (about 2.5 dB at 32 Hz) compared with these larger Advent speakers.

At 1,500 Hz there is a crossover to a newly designed tweeter. Its center dome, about ¾ inch in diameter, radiates at the highest frequencies, but the doughnut-shaped surround increases the effective diameter to 1¾ inches at the lower end of its frequency range. The new tweeter (which is also identical to that used in the larger Advent speakers) has been designed for high efficiency, low distortion, and increased power-handling ability. To this end, its magnetic gap is filled with magnetic fluid (ferrofluid) that helps to conduct heat away from the voice coil, which is wound on an anodized-aluminum bobbin for better heat conduction. The ferrofluid also helps damp the tweeter resonance. The new tweeter has more than twice the power-handling ability of its predecessor, as well as being twice as efficient. As a result, it can deliver about 6 dB more output (a four-fold increase) than the tweeter that was used in the original Advent speakers.

The Advent/1's woofer response is allowed to roll off naturally at the higher frequencies, although there is a small inductor (0.3 millihenry) in series with it to shape its response in the crossover region. The low-frequency tweeter output is rolled off at 6 dB per octave by a single series capacitor to minimize phase shift and make a smoother blend of sound through the crossover region. The levels of the tweeter and woofer are internally matched, and there are no external user-adjustable controls. (Continued on page 54)