The Audio Critic®

Rotel RB-990BX

Rotel of America, P.O. Box 8, North Reading, MA 01864-0008. RB-990BX stereo power amplifier, $1100.00. Tested sample on loan from manufacturer.

This unit turned out to be the big surprise in this survey. In most respects it performed almost as well as the state-of-the-art designs by Boulder and Bryston, but it costs only $1100. Unlike those amps, the Rotel is a conventional design. Complementary differential pairs biased by current sources form the first stage. The differential pairs are not degenerated. The second stage is a complementary common-source amplifier with emitter degeneration. As in the Bryston, there are no circuit additions to reduce the effect of the nonlinear base-emitter junction capacitance of the second gain stage. No novel circuit tricks to reduce this effect can be seen in the schematic. The second stage is followed by a pair of complementary source-follower predrivers. The final output stage consists of complementary source followers, with the active stage realized by five bipolar devices in parallel. The triple Darlington output stage offers excellent isolation of the second gain stage from the load and does not have the stability problems associated with output stages that have local feedback loops. The disadvantage of the stage is that it has higher distortion than other triple output stages [Bongiorno 1984]. The output of this stage is connected directly to the amplifier output terminal without a series inductor. This keeps the high-frequency damping factor from declining but at the risk of reduced amplifier stability into high-frequency loads. The five paralleled transistors on each side of the output stage are biased by a single-transistor V_{BE} multiplier. No *I-V* current limiting is used. Total transistor count per channel, including paralleled devices, is 23. Compensation is principally accomplished by creating a dominant pole at the second gain stage with a single capacitor to ground. A 100 µF electrolytic capacitor is used in the ground-return path of the main feedback loop (capacitor C_2 in Figure 6). Another 50 µF electrolytic capacitor is used at the input (C_1).

The amplifier is protected by supply-rail fuses. During one of our large-signal tests the fuses were blown in one channel. After they were replaced, the amp was fully functional. The fuses alone thus appear adequate to protect the amplifier. The downside of this approach is that the unit must be physically opened to replace the fuses after a fault condition. There is also the danger that both fuses will not blow simultaneously. If this condition occurred, the result could be significant damage to the amplifier. The input of the amplifier is shorted by a relay if the heat sinks go above a preset temperature limit. The relay is also closed on device power-up.

A single, very large, shielded, toroidal transformer is shared by both channels. Separate full-wave rectifiers and filter caps are used for each channel. Each supply rail has 15,000 µF of capacitance across it. Construction quality of the unit is not up to the standards of the much costlier Boulder and Bryston. The cabinet is made of relatively thin metal. It is held together with cheap sheet-metal screws. Component quality is not always mil-spec, but no component appears to be underspecified. Single-sided PC boards are the most glaring but not the only sign of mass-market assembly techniques. Copper bus bars can be seen on the PC board; they are a kludge to reduce trace resistance.

From the above circuit analysis we expected the amplifier to exhibit more distortion than a more complex topology, such as that of the Boulder 500AE or the Bryston 4B. The results below show that this turned out to be the case but just barely; the distortion levels are still very low. Into an 8-ohm load the RB-990BX reaches a minimum THD-plus-noise level of –82 dB at 200 watts with a 1 kHz input. Into 4 ohms the minimum THD-plus-noise level at the onset of clipping (310 watts) is also –82 dB. The distortion curves are dominated by noise below 100 watts. Above 10 watts the 20 kHz distortion curve flattens out at a level of –74 dB and stays there until clipping into 8 ohms. Into a 4-ohm load the 20 kHz distortion curve flattens out at 10 watts at a level of –70.5 dB and stays at that level until clipping. The PowerCube system measured a dynamic output voltage of 47 V (276 watts) into 8 ohms. This closely corresponds to the steady-state power of the amplifier at 1% distortion; thus the amplifier has very little dynamic headroom at 8 ohms. The PowerCube showed that the maximum voltage output of the amplifier declined by only 12.5% into 2 ohms and by 25% into 1-ohm noninductive loads. The dynamic power into a 1-ohm resistive load measured 1220 watts. Driving heavily inductive loads did have some effect on power output. Driving a 1-ohm load with a +60° phase angle resulted in a 38% loss of voltage relative to a resistive load. The reason for this behavior is unclear to me, although I am told it has been seen before by the designers of The PowerCube. The amplifier apparently does not like such a highly inductive load. The result is increased amplifier distortion or oscillations, causing the PowerCube to stop the test. Even though the amplifier has no inductor in series with its output, the 10 kHz continuous-time square-wave response into a 6-ohm load with a capacitive component of –45° was reassuring, the amplifier showing good stability into this load. Peak current output was 211 amps, almost twice the value of any other amplifier in this survey!

To use the term coined by *Consumer Reports*, this is a Best Buy. It puts out huge amounts of power with little distortion. To achieve the $1100 price, some things had to be compromised. Construction quality is more than adequate but it is not at the same level as in the Boulder or Bryston. The circuitry is less complex. Protection circuits are not as sophisticated and balanced line inputs are not included. For the vast majority these compromises will be entirely acceptable.

This review, reprinted with the permission of the publisher, appeared in Issue No. 20 (Summer 1993) of *The Audio Critic* as part of a power-amplifier survey. The survey covered numerous other amplifiers and included a technical introduction to which references are made in each review. If you wish to subscribe to the magazine, send $24 for four quarterly issues to The Audio Critic, P.O. Box 987, Quakertown, PA 18951-0978.