

Sherwood FM Stereo Receiver Model SEL 200



MANUFACTURER'S SPECIFICATIONS:

TUNER SECTION: IHF Sensitivity: 1.5 μ V. S/N: 70 dB. Capture Ratio: 1.7 dB. THD (Mono): 0.15%. Selectivity (Alternate Channel): 70 dB. Image Rejection: 80 dB. I.f. Rejection: 110 dB. Spurious Response: -100 dB. Stereo Separation: 40 dB @ 1 kHz.

AMPLIFIER SECTION: Power Output: 140 watts total IHF music power, 8-ohm load. RMS Power Output/Channel: 60 watts, 8-ohm load. THD: 0.2% at rated output. Power Bandwidth: 8 Hz to 35 kHz at 1% THD. Hum and Noise: (IHF): High Level Input: 80 dB. Phono: 65 dB. IM Distortion: 0.6% at rated output, 8-ohm load. Input Sensitivity: Phono: (variable) 1.6 mV to 7.2 mV. Tape Monitor and Aux: 200 mV. Frequency Response: Aux: 20 to 20 kHz \pm 1 dB. Phono: RIAA \pm 1.5 dB. Damping Factor: 40 at 8-ohm load.

GENERAL: Power Requirements: 115-125 V, 60 Hz, 30 to 300 watts. Cabinet: Oiled Walnut (included). Size: 19 $\frac{1}{8}$ " w. x 6 $\frac{1}{4}$ " h. x 14" d. Suggested retail price: \$599.00

Sherwood Electronic Laboratories ships their new SEL-200 Stereo FM Receiver with one of those familiar "fact-tags" attached, by a bit of string, to one of the control knobs. The front of the tag proclaims, in bold type, "Our Finest Receiver," and, after putting this rugged machine through our extensive tests and

equally extensive auditioning period, we are inclined to agree with the statement. In addition to long-recognized virtues and features, this receiver includes a few that are rarely seen on an integrated receiver, let alone separate tuners and amplifiers. In examining the heavy extruded gold and black front panel we were struck by the extremely well organized controls which, somehow, make this 19-inch-wide panel look smaller than it really is. The dark portion of the panel contains an expanded slide-rule dial which, because of its accuracy of calibration, provides no less than 5 calibration lines between every "MHz" from 88 to 108. What a pleasure to be able to set the pointer to 103.7 instead of "somewhere between 102 and 104" and to know that you are, in fact, tuned to 103.7. With this kind of marking, the serious user doesn't need a linearly divided logging scale which, in fact, this unit does not possess.

Above the left section of the dial calibration are two meters: one for zero-center tuning, the other for signal-strength indications. Why two meters? Because the zero-center one should be used for accurate center-of-channel tuning while the peak-reading meter is more useful for antenna orientation (for strongest signal). Unless r.f. and i.f. alignment are near perfect, most manufacturers are re-

luctant to supply both these meters since zero-center indication on the one does not always correspond with peak reading on the other as it should (and *does* in the case of the Sherwood SEL-200). Four colored lights are spaced above the remainder of the dial calibration area. These indicate stereo or mono broadcasts; and phono or Aux operation. Alongside the dial area are three massive solid turned-metal knobs. The tuning knob is coupled to a most effective flywheel. The Selector knob chooses PHONO, FM, or AUX program source and the Loudness knob sets desired level and also turns power on and off. The loudness control is calibrated in dB, from +8 to -60. While no mention is made anywhere of what "0" dB reference corresponds to, the markings are useful in utilizing the loudness-contour feature and in allowing easy resetability, once desired listening levels have been determined by the user.

The lower section of the panel contains a series of smaller control knobs, two banks of push-buttons (all of the push-to-make/push-to-disengage type), record out and monitor jacks (which parallel their counterparts on the rear panel, should a visiting tape recordist want to record from, or play through your system without having to get around to the back of your equipment cabinet) and the usual stereo headphone jack. A tiny knob at the extreme left of the panel is a "dimmer" control for front panel illumination. The mode switch knob offers STEREO, CHANNEL 1 (to both speakers), CHANNEL 2 (to both speakers) and MONO positions. Bass and treble control knobs provide tone compensation for both channels simultaneously and the balance control performs its usual function. The first bank of push-buttons includes an FM mute-control switch (which Sherwood prefers to call a "hush" control), a high-frequency cut-off filter, tape monitor switch, loudness-contour on/off switch and a "stereo only" switch. The latter button is an interesting, though not totally original

innovation. In the early days of stereo FM, a few manufacturers offered a switch setting which allowed *only* stereo FM broadcasts to be heard as you tuned across the FM dial. With so few stations broadcasting in stereo in those days, users became confused, thinking there was something wrong with the equipment. Today, with the dial literally "teeming" with stereo FM stations, it is nice to see this refinement restored by Sherwood.

The second bank of push-buttons activates main or remote speakers as well as a mono speaker connection, about which more in a moment. With all speaker buttons released, the stereophone user may listen in silence, via phones only. A front view of the receiver is shown in Fig. 1.

The rear panel contains the requisite number of input and record jacks at the left, above, the antenna terminal strip which is wired to accept 75- or 300-ohm transmission line. A grounding terminal is located in this vicinity for connection to other equipment. A three-position phono-sensitivity switch follows, enabling the user to adjust phono gain to match FM levels regardless of the cartridge he chooses. Remote and main speaker terminal strips follow.

One switched and one unswitched convenience a.c. receptacles are provided, flanking the 4-ampere line fuse. A "mono" speaker terminal strip allows connection of a single speaker system to which will be fed the sum of left-channel and right-channel program material. Such a third speaker might be used as a "fill" for widely spaced stereo speaker systems, or, as a complete (albeit mono) listening set-up in a third location besides the main and remote stereo locations. Just below this terminal strip is a "hush adjust" control which permits the user to adjust mute threshold level.

Structurally, the Sherwood SEL-200 is more reminiscent of professional or industrial equipment than of a "consumer" item. Chassis layout is faultless, and extra reinforcing braces and angles make it virtually impervious to deformation of any kind. The chassis is built to withstand the hazards of long-distance shipping via even the most thoughtless carrier! All circuit modules (and there are seven) are mounted securely in a manner which precludes the possibility of cracking and, as further proof of the reliability of this receiver, the printed circuits are built on a fibre-glass base material—the most costly, but the most dependable base material that can be used for printed circuitry. A totally shielded FM r.f. section constitutes an eighth "module," as can be seen in the top and bottom views of Fig. 2. We examined the components used in this

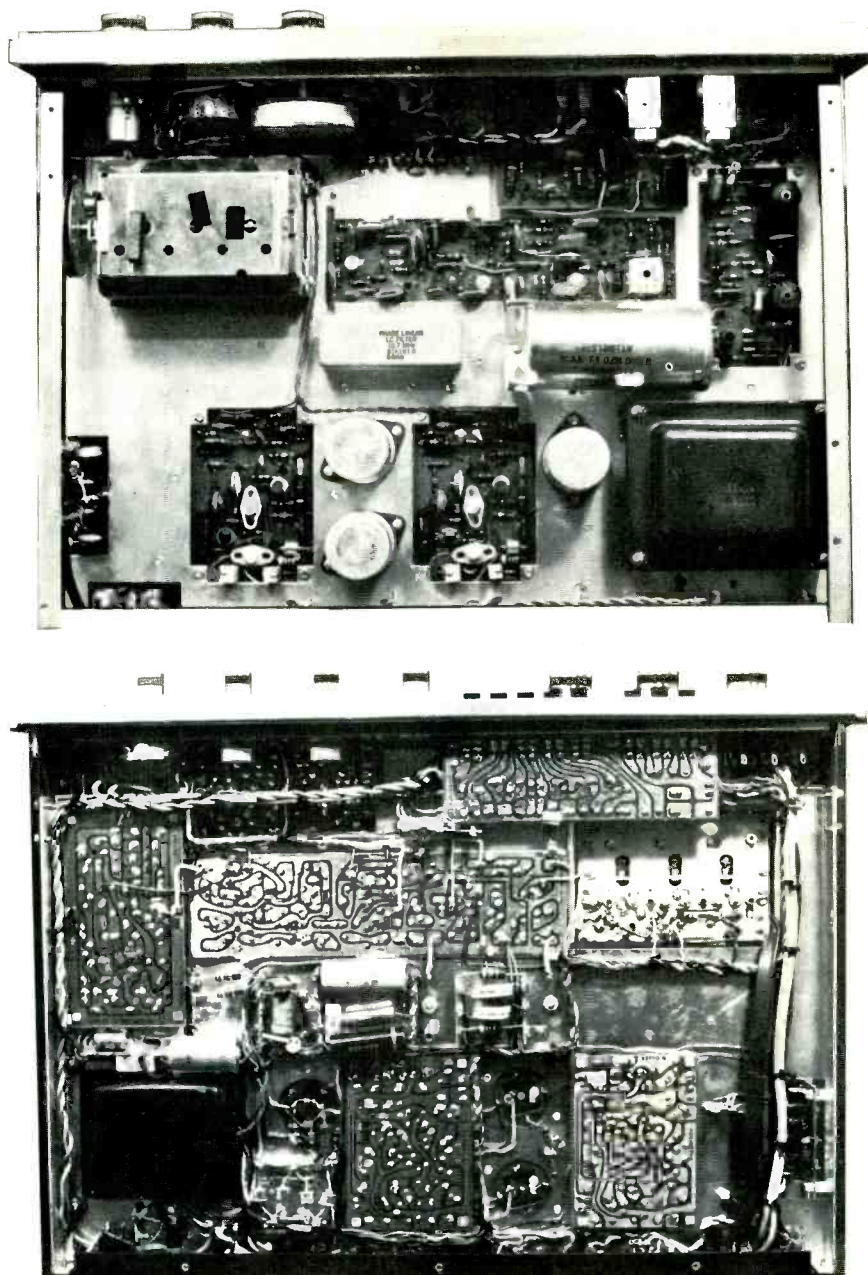


Fig. 2—Top and bottom chassis views

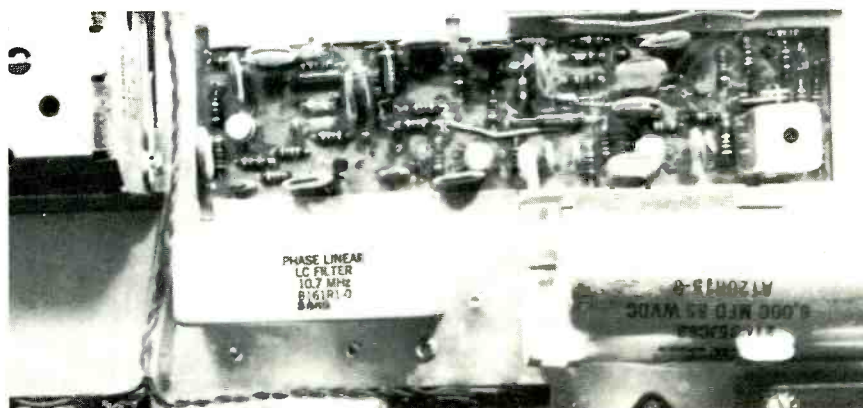


Fig. 3—Detailed view of FM section shows sealed phase-linear toroidal Butterworth band-pass filters. Only tunable item on I.F. strip is detector transformer at extreme right.

receiver and could find none but those manufactured by some of the most highly respected names in electronic component manufacture. Our conclusion was that Sherwood will not lose money in backing up its *three-year parts AND LABOR* warranty.

The excellent selectivity of the Sherwood SEL-200 is due, in great part, to the unique design embodied in the 10.7 MHz i.f. section, a close-up of which is shown in Fig. 3. Note that the i.f. module itself contains only one conventional "transformer" at the extreme right end of the board, and that is the detector transformer. Just below the left end of the module is a sealed multi-element phase-linear toroidal Butterworth type i.f. filter having 9-pole selectivity. Besides being "permanently aligned," this filter is absolutely symmetrical. The i.f. selectivity curve is flat within about 2 dB at 100 kHz removed from center frequency, and is 30 dB down 200 kHz away from desired 10.7-MHz center frequency. At 400 kHz away from center (the point which determines alternate-channel selectivity), attenuation is in excess of 70 dB. No conventional i.f. transformer arrangement could duplicate this response and few, if any, crystal or ceramic filters we have run across do as well either.

Other measurements associated with the FM performance of the Sherwood SEL-200 are equally impressive. As disclosed in Fig. 4, IHF sensitivity is exactly $1.5 \mu\text{V}$, as claimed. This excellent figure is maintained across the entire FM band, from 88 to 108 MHz. Full limiting (1 dB) is achieved at $1.6 \mu\text{V}$. At $3.5 \mu\text{V}$, signal-to-noise ratio has already reached a very listenable 50 dB and THD (Mono) has already been reduced to approximately 0.5%—a figure considered to be excellent as the ultimate figure (measured at $1000 \mu\text{V}$,) not 3.5 as was true in the case of this remarkable tuner section. As for *ultimate* performance figures, the THD gets down to an incredible 0.15% and stays there at all signal input levels above $20 \mu\text{V}$. Signal-to-noise ratio reaches 70 dB at $50 \mu\text{V}$ and even goes beyond that to an ultimate value of 72 dB. The ultimate THD (0.15%) is the *best* we have recorded for *any* complete receiver and we know of only one *tuner* component that does as well!

Stereo FM separation is plotted in Fig. 5 and exceeds 40 dB from around 100 Hz to 3 kHz, and 30 dB of separation is achieved at all frequencies from 50 Hz to 10 kHz.

The amplifier section of this receiver is conservatively rated, as can be seen from the IM and THD curves of Fig. 6. At rated distortion (0.2%), we read 61 watts per channel, using an 8-ohm load. If we were to reference power output to

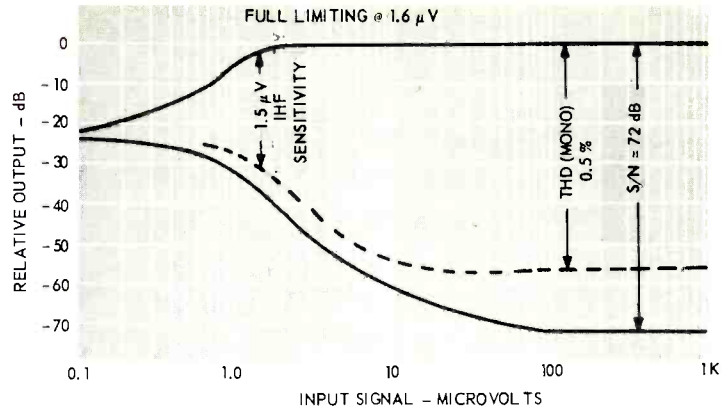


Fig. 4—FM characteristics

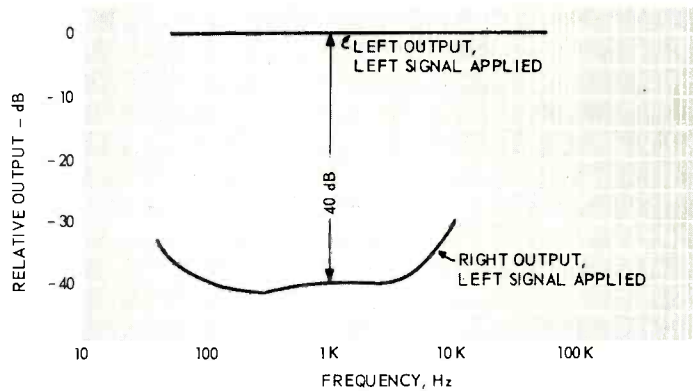


Fig. 5—Showing channel separation

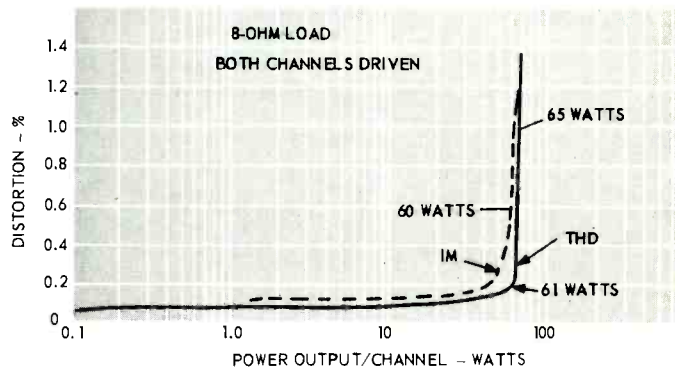


Fig. 6—IM and THD curves

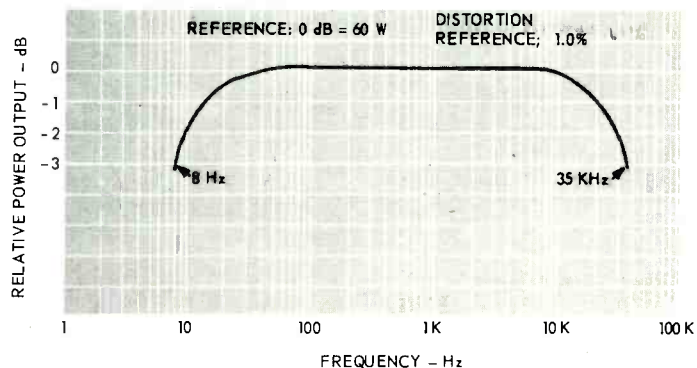


Fig. 7—Power bandwidth

1.0% THD (as do many other manufacturers) we would have to rate this amplifier at 65 watts per channel. IM distortion reached 0.6% at an output of 60 watts, and both THD and IM decrease progressively at lower power outputs, with no tendency to rise at very low power output levels. Clipping is symmetrical when the amplifier is driven far into overload. Power bandwidth was measured using a distortion reference of 1.0% and a power output reference (0 dB) equal to 60 watts. End points are at 8 Hz and 35 kHz, as shown in Fig. 7. Tone-control range is plotted in Fig. 8, and the tone-control circuitry is of the variable-crossover feedback type. The high-frequency cut-off filter, whose response is plotted in Fig. 8, has a 12 dB per octave slope which makes it effective in reducing high-frequency noise and record scratch.

Listening Tests

We must admit that although the Sherwood SEL-200 stands up very well when used for phonograph record and tape listening (we particularly welcomed the variable phono-input sensitivity which enabled us to equate phono and tape levels with FM level), we spent by far the major part of our listening time with the selector switch set to FM. It is the outstanding FM performance of this instrument which separates it from many of its competitors. While it is true that in our location we have logged as many listenable stations in the past (49 with indoor antenna, 58 with outdoor, fixed-orientation 4-element Yagi), listenability needs to be more closely defined to understand the excellence of the SEL-200. Our criterion has been ability to discern the program material with reasonably low distortion content and with noise level some 30 dB down or better. The amazing thing about this receiver is that every station that we were able to receive (even those that barely moved the signal-strength meter and therefore had to be of less than 5- μ V intensity) seemed to "bury" the background noise at least 45 to 50 dB below program level. The tuning action (despite the absence of AFC, which is hardly ever used these days on good tuners and receivers) "feels" as if AFC is present in that stations "pop" in and out without undergoing that "borderline" area so typical of slightly de-tuned FM sets. All indications point to the outstanding selectivity and overall i.f. characteristics discussed earlier as being responsible for this tuning ease and precision.

The Sherwood SEL-200 boasts 85 watts of power (r.m.s.) per channel when driv-

ing a 4-ohm load. Thus, with *two* sets of stereo speaker systems connected (each speaker being of the 8-ohm variety), there is fully 42.5 watts of power per speaker available—and that was more than enough for *our* four speaker systems—though all four were low-efficiency bookshelf air-suspension types. In fact, we then connected a fifth speaker for monophonic listening, just to see if that would overload the capacity of the receiver. It didn't!

The excellence of Sherwood's FM tuner products has earned that company a long-standing enviable reputation among experts over the years. Now, Sherwood has successfully combined tuner excellence with amplifier power to suit the most power-hungry listener in a product that is fully worth its price.

L. F.

Check No. 44 on Reader Service Card

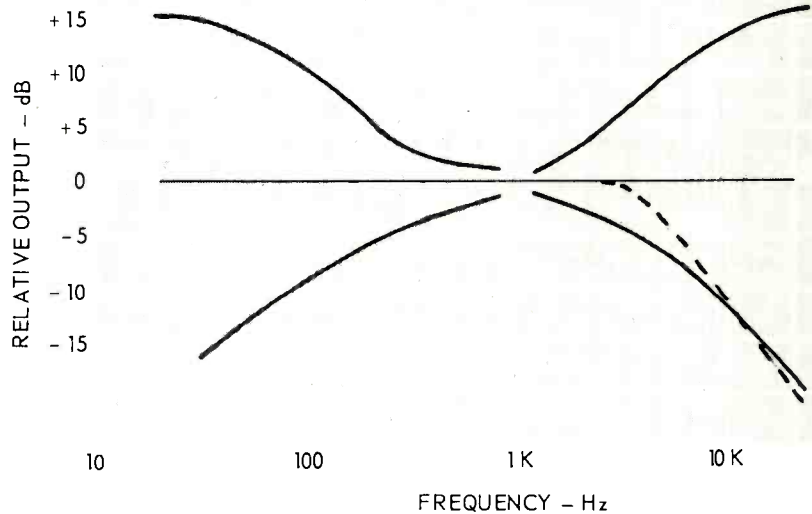


Fig. 8—Tone-control characteristics

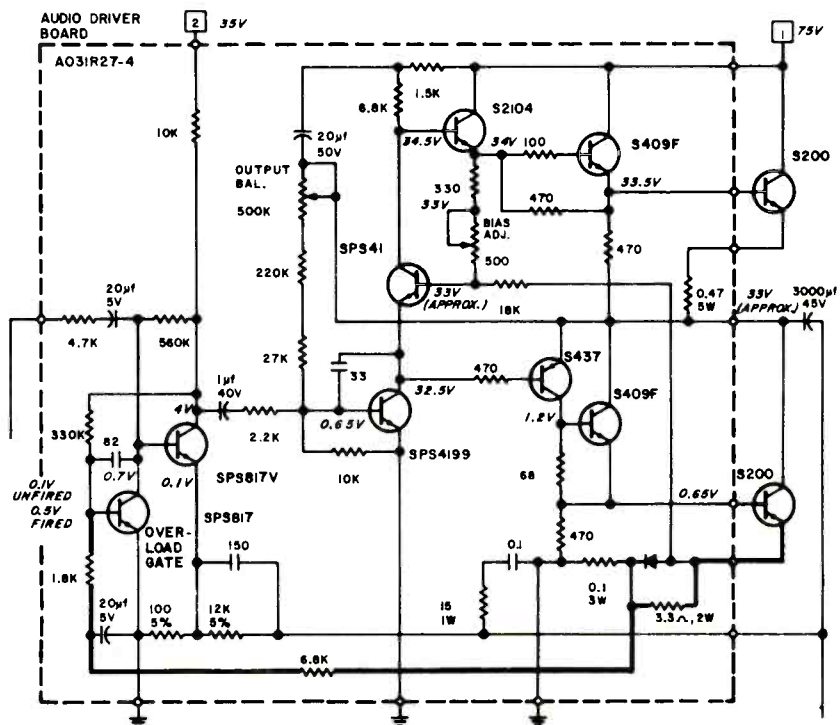


Fig. 9—Driver and output stages showing overload protection