

## Sansui Model 2000 AM/FM Stereo Receiver

**MANUFACTURER'S SPECIFICATIONS—**  
**Amplifier Section:** Power Output: Music Power (IHF): 100 watts (at 4 ohms), 85 watts (at 8 ohms). RMS Power: 36 watts/channel (4 ohms, both channels driven). Harmonic Distortion: 08% at rated output. Power Bandwidth (IHF): 20 to 40,000 Hz (8-ohm load). Frequency Response: 15 to 40,000 Hz  $\pm$ 1.5 dB. Damping Factor: Greater than 24 at 8 ohms. Tone Control Action: Bass: +12, -15 dB at 50 Hz; Treble: +12, -12 dB at 10 kHz.  
**Tuner Section:** (FM): Usable Sensitivity (IHF): 1.8  $\mu$ V ( $\pm$ 3 dB). Harmonic Distortion: Under 0.8%. Capture Ratio: 2.5 dB. Signal-to-Noise Ratio: Greater than 65 dB. Selectivity: Greater than 50 dB. Image Rejection: Greater than 80 dB. IF Rejection: Greater than 95 dB. Stereo Separation: 35 dB at 1000 Hz. (AM): Usable Sensitivity: Less than 15  $\mu$ V at 1 MHz.  
**General:** Dimensions: 16 $\frac{3}{4}$  in. W x 5 in. H x 13 $\frac{1}{4}$  in. D. Weight: 26 $\frac{1}{2}$  lbs. Price: \$299.95.

In the very popular just-under-\$300 price range, Sansui has come up with a most attractive all-in-one component receiver. Equipped with just about every feature you could hope for (and some that you might never even have thought of), the Model 2000 offers an elegantly designed exterior as well as a carefully conceived circuit arrangement to please component arrangement fanciers with modest pocketbooks.

The handsome gold and matte black panel, pictured in Fig. 1, contains a great many more controls than are immediately obvious because the arrangement has been functionally placed to prevent a "cluttered" look. The lower portion of the panel contains an independent power on/off push button switch at the extreme left of the panel. This is followed by a stereo headphone

jack and a speaker selector switch with positions for either one of two pairs of speaker systems as well as an "off" position which permits use of headphones exclusively. Next is a pair of momentary pushbuttons which actuate low- and high-frequency filters. These are followed by dual-concentric, clutch-type bass and treble controls which permit simultaneous or separate control of bass and treble of both stereo channels. The remainder of the lower section of the panel contains the usual balance control, volume control, and a six-position signal-source selector switch.

With the power turned off, the entire upper half of the dress panel appears matte black. When power is applied, the upper left area becomes illuminated with a legible dial scale (AM and FM), a peak-reading tuning meter, and the single, yellow word, "power." We wondered at the need for this "redundancy until we switched to one of the positions other than radio. To our surprise, the dial scale itself disappeared (including meter illumination) and only the word "power" remained, together with a newly appeared word such as "aux" or "tape" (depending on switch position selected). This provides a dramatic and pleasing visual effect. When you really stop to think of it, why do so many receivers illuminate the tuning dial needlessly when the function switch is in phono, tape, etc.?

The words "FM Stereo" also appear behind the dial glass area whenever a stereo broadcast is encountered, vanishing completely in the presence of a monophonic program. Although we never saw it light up, there is even a "protector" light, activated by an output transistor protection circuit which becomes illuminated if the output devices draw excessive current.

To the right of the dial area is the large tuning knob, whose "flywheel"

action is only moderately effective and a bit too noisy (mechanically) when spun hard. At its right are five in-line rectangular push-buttons. The first of these converts the volume control into a loudness-contour control. The next is a "muting" control for elimination of noise between stations in FM tuning. Next is a tape monitor switch (for interrupting the audio circuit to accommodate multi-headed tape recorders with monitoring provisions). This is followed by a switch which reverses the left and right channels. This control used to be quite popular in the early days of stereo, when "left" and "right" program source standardization was still a thing of the future. Today, cartridge outputs, tape head outputs and the like are all standardized as far as "left" and "right" program information is concerned, so this function is now only a frill.

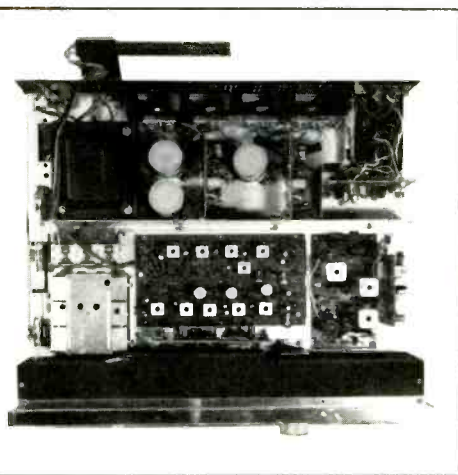
The final pushbutton of this grouping is a "mono-stereo" switch, used to parallel the left and right inputs to the amplifiers. Used in conjunction with the "reverse" switch, it is possible to connect either the left external inputs to both amplifier channels (by depressing *only* the mono switch) or the right external inputs to both amplifier channels (by depressing both the "mono" and the "reverse" switch simultaneously). For monophonic FM listening, a switch position on the main selector identified as FM Mono will defeat the stereo FM circuitry even in the presence of a stereo signal (FM). It is used when stereo FM signal strength is too weak to give noise-free stereo FM reception. With the main selector switch set to FM Auto, circuitry operates in either the FM mono or FM stereo mode, depending upon incoming signal. The FM Stereo light indicates presence of FM stereo even with the mode switch in the FM Mono position. This can be either a good or bad feature,



Fig. 1 — Front view of Sansui Model 2000 AM/FM stereo receiver.

Fig. 2 — Back-panel view of Model 2000.

Fig. 3 — "Inside" view of Sansui receiver with metal enclosure removed.



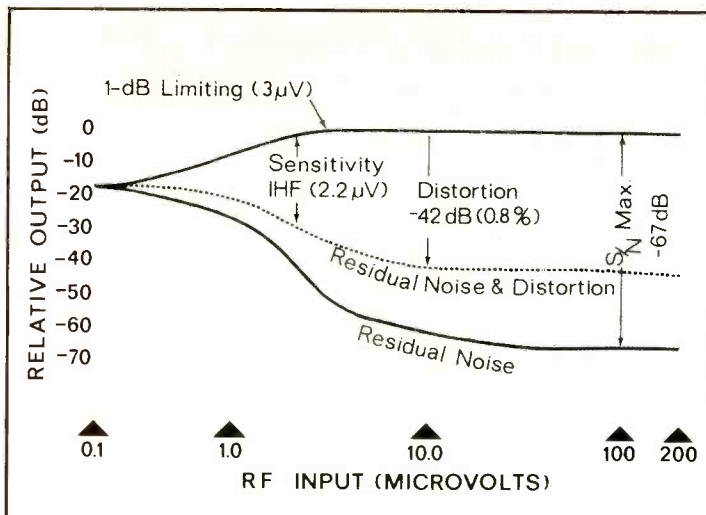


Fig. 4 - Various FM characteristics of Sansui 2000.

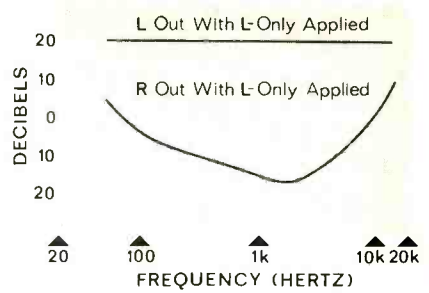


Fig. 5 - FM separation characteristics and 'scope displays of "L" and "R" outputs.

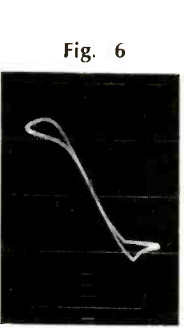
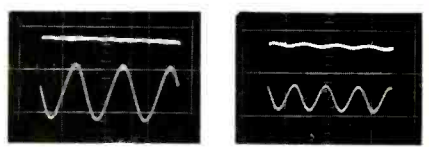


Fig. 6

Fig. 6 - Sweep alignment trace shows linear ratio-detector for over 400 kHz of 1 MHz total sweep.

Fig. 7 - Distortion vs. rms power.

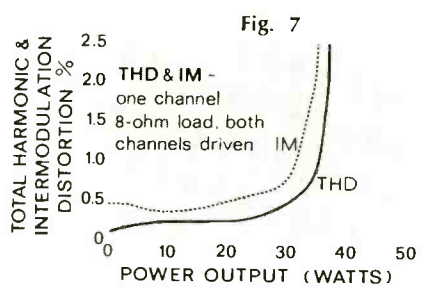


Fig. 7

Fig. 8 - (Far right) Tone control, loudness contour at -30 dB, and filter response.

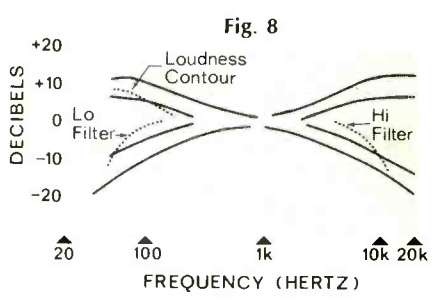


Fig. 8

depending upon your personal listening habits. We would prefer the light to be extinguished when in mono mode.

The rear connection panel of the Model 2000 is shown in Fig. 2. Left and right input jacks are arranged in pairs, along with tape recorder output jacks and a 5-pin DIN socket, the latter intended for inputs and outputs for many tape recorders manufactured in Europe and Asia.

Speaker terminals (for two pairs of stereo speaker systems) are provided on rugged barrier strips to prevent accidental shorting of adjacent speaker leads. Two 2.5 ampere, quick-acting fuses protect the output (speaker) lines, while a 3-ampere line fuse protects the rest of the receiver. Two convenience outlets (one switched, one unswitched) are available for connection of auxiliary powered equipment—phonograph turntable, tape recorder, and the like. Terminals for properly matched connection of 300-ohm or 75-ohm FM transmission lines are grouped with a pair of AM antenna and ground terminals, where an external AM antenna is required. The built in AM ferrite antenna (loopstick), is mounted so that its physical position may be oriented in two planes for best reception.

There remains one little feature

which we saved for last in discussing the rear panel, largely because we take issue with its presence as a "customer" control. This is an externally mounted "separation" control. The control can reduce separation from an excellent 35 dB to as little as 10 dB, but since it is not a setting which can be optimized by ear it would be best to hide it on the interior part of the chassis, away from a user's itchy fingers.

Removal of the metal enclosure of the Model 2000 discloses a well laid-out chassis which includes nine individual printed circuit modules, plus a separate, sealed front end and hand-wired power-supply and power-output sections. A total of 50 transistors (including a new MPF-102 FET device used as an FM r.f. stage), 36 diodes (one of which is a Zener diode), one thermistor and one SCR (Silicon Controlled Rectifier) constitute the "active" devices in this carefully assembled receiver. There is ample evidence of good quality control practice in both the workmanship of assembly and in the individual component selection. The more-than-adequate power supply (including the large power transformer which can be seen in the photo of Fig. 3) runs quite cool, even after eight hours of continuous use at high power levels.

## Performance

Published specifications conformed with measured performance. IHF usable sensitivity was measured as 2.2 microvolts. In the published specifications, however, this spec was given as  $1.8 \mu V \pm 3 \text{ dB}$ , a most unorthodox way of stating IHF least usable sensitivity. Still, if we add 3 dB to  $1.8 \mu V$ , we come up with about  $2.6 \mu V$ , so the receiver's  $2.2 \mu V$  is well within specifications. What we'd like to see is the production set that comes out on the "minus" side of the spec, for that would mean a sensitivity of  $1.3 \mu V$  IHF! Other FM-related data are illustrated in the curves of Fig. 4. Ratio-detector bandwidth is at least 600 kHz, with about 400 kHz of that being very linear, as shown in the S-curve display of Fig. 6, in which end-to-end deviation is approximately 1 MHz. FM stereo separation is plotted in Fig. 5. The photos confirm the fact that separation is excellent at midband frequencies (better than 35 dB at 1 kHz), but falls off fairly rapidly at the low and high ends. Separation at 10 kHz is confirmed visually as the 20-dB separation figure shown in the curve of Fig. 5.

As for amplifier performance, maximum power output measured 35 watts r.m.s. per channel with both channels



## Equipment Profiles (continued)

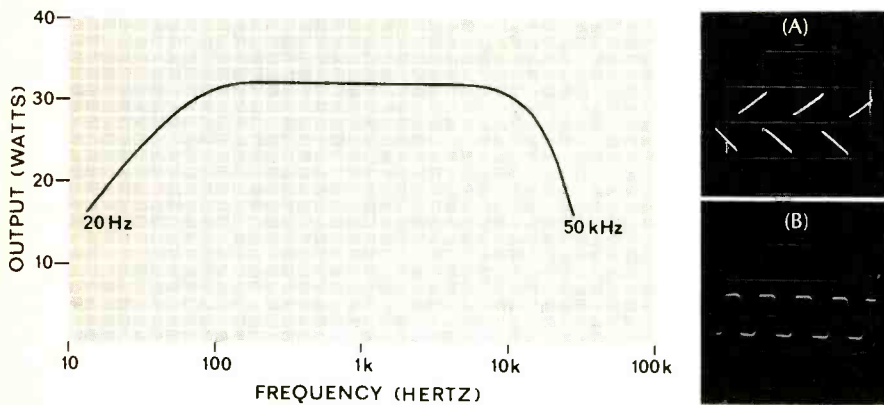


Fig. 9—Power bandwidth of Sansui 2000 with 8-ohm load. Also, square-wave response at (A) 100 Hz and (B) 10 kHz.

driven, as compared to the claimed 32 watts, all at 0.8% THD. Distortion at this and lower power levels, as well as IM distortion, are plotted in Fig. 7. Tone control action is plotted in Fig. 8, and from the plot it is evident that the preferred form of feedback, or variable-crossover tone-control circuit, has been incorporated in this receiver. Loudness compensation has been plotted on this graph as well, for a setting of about  $\frac{1}{3}$  volume clockwise, and is close to the recommended compensation for a  $-30$ -dB contour. While high-frequency filter action is effective in reducing record scratch and other high-frequency noise, the low-filter cuts excessively into desired bass pro-

gram material, attenuating the response by fully 10 dB at 50 Hz. Filter action, both low and high, is also plotted in Fig. 8.

We used the Sansui Model 2000 with a great deal of pleasure for nearly two weeks and learned to appreciate its many features. A minor criticism involves the volume-control curve, particularly on FM. The control could not be advanced above  $\frac{1}{2}$  before the volume became excessive. A moderate reduction in "gain" or a changed volume-control taper would seem to be in order.

Muting worked very well, introducing virtually no added distortion at the threshold point, which was at about 10 microvolts. While tuning meter indica-

tions meant little in relation to signal strength—the meter went to full scale for everything above 50 microvolts—the meter was sensitive enough to serve as an accurate center-of-channel indicator even though it was of the peak-reading type, and is active on AM, as well as on FM.

Audible hum and noise are extremely low in "Phono" and "Tape Head" settings. With a magnetic cartridge connected there is practically no "transistor hiss" in evidence.

Square-wave response at 100 and 10,000 Hz is typical of that found in receivers with this range of power bandwidth, as shown in Fig. 9. Transient response was excellent at all power levels, and a recent live broadcast of Shostakovich's 10th Symphony could do nothing to break up this hardy performer.

As part of the receiver's comprehensive package of instructions and service material, a clever idea in the form of an abbreviated instruction chart is included. The short-form chart, printed on a huge, long-lasting plastic card, serves as a "painless" instruction booklet for those who are just too lazy to read the longer text. Functions of all controls are indicated pictorially.

At under \$300.00, the Sansui Model 2000 surely represents great value. It is rugged, handles well, has most of the features of sets costing \$100 to \$200 more, and has plenty of power for at least two sets of speaker systems.

Check No. 70 on Reader Service Card

## Acoustic Research Model AR-3a Speaker System

**MANUFACTURER'S SPECIFICATIONS—**Impedance: 4 Ohms. Crossover Points: 575 Hz and 5 kHz. Size 14" x 25" x 11 $\frac{3}{8}$ " deep. Weight: 53 lbs. Price: Glossy walnut, oiled walnut, cherry, oiled teak: \$250; Mahogany, birch: \$240; Unfinished pine: \$225. Factory conversion of an AR-3 to an AR-3a: \$90.

In 1954 Acoustic Research, Inc. demonstrated with their Model AR-1 speaker system that clean bass could be reproduced with a bookshelf-sized speaker system, using the acoustic suspension principle. As applied by AR, this principle required that the air inside the enclosure act as the "spring" against which the speaker cone worked, rather than the pleated cloth or paper ring normally seen around the circumference of the cone. In 1959 AR developed hemispherical dome devices for the mid-range and high end

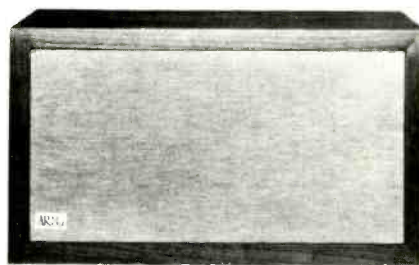


Fig. 1—AR-3a speaker system. Three speakers are revealed when front grille is removed.



which complemented their excellent woofer, and out came the AR-3, a fine and popular speaker system. A point of criticism leveled against the AR-3, however, has been a slight roughness at mid range. It is this portion of the audio spectrum to which AR appears to have focused its attention in developing the AR-3a.

The AR-3a, then, is the most recent of a series of speaker systems derived from the original acoustic suspension design introduced in 1954. Three drivers are used in the AR-3a: A 12-inch bass unit in a 1.7-cubic-foot sealed enclosure that is filled with loosely packed glass wool; a hemispherical mid-frequency radiator, 1 $\frac{1}{2}$ " in diameter; and a  $\frac{3}{4}$ " hemispherical radiator which handles high frequencies. The output levels of the smaller radiators are independently adjustable by controls on the rear panel of the enclosure. The AR-3a's cabinet is identical in size to the AR-3; externally, only