

Sansui 4000 Stereo FM/AM Receiver

Fig. 1



MANUFACTURER'S SPECIFICATIONS:

TUNER SECTION (FM) IHF Sensitivity: 1.8 μ V. **S/N Ratio:** Greater than 60 dB. **Capture Ratio:** 1 dB. **THD (Mono):** under 0.6%. **Selectivity:** better than 40 dB @ 98 MHz. **Image Rejection:** better than 90 dB. **I.F. Rejection:** better than 95 dB. **Spurious Response Rejection:** better than 90 dB. **FM Stereo Separation:** better than 35 dB @ 400 Hz (AM). **Sensitivity:** 20 μ V @ 1 MHz. **AMPLIFIER SECTION: Total IHF Music Power:** 160 Watts @ 4-ohms; 120 Watts @ 8 ohms. **RMS Power/Channel:** 65 Watts @ 4 ohms; 45 Watts @ 8 ohms. **THD:** under 0.8% at rated output. **IM:** 0.8% at

rated output. **Power Bandwidth:** 20 to 30,000 Hz. **Frequency Response:** 20 to 40,000 Hz \pm 1 dB. **Hum and Noise:** Phono, better than 70 dB; Aux, better than 70 dB. **Input Sensitivities:** Phonos: 2.5 mV; AUX: 150 mV; Tape Monitor: 170 mV. **Tone Control Range:** Bass: \pm 13 dB @ 50 Hz; Treble: \pm 11 dB @ 10,000 Hz. **GENERAL: Dimensions:** 17 $\frac{3}{4}$ " W x 5 $\frac{1}{4}$ " H x 13 $\frac{1}{4}$ " D. **Price:** \$379.95 (includes metal case; optional wood cabinet, \$22.50).

Never one to skimp on control functions, the Sansui Electric Company has really out-done itself in designing this new, powerful, top-of-the-line solid-

state receiver. In power-handling capacity, it is outranked only by the company's model 5000. In FM performance and sensitivity, it is just about tops in its receiver class. But the most pleasant thing about the Model 4000 is the very liberal application of control features—if you are a control fancier!

Examining the front panel layout in Fig. 1 and "reading" the lower portion of this handsome gold-anodized and black panel, we come first upon the "push-push" power switch, followed by the usual stereo headphone jack. While most present-day receivers are equipped with speaker selector switches (usually enabling the use of two sets of stereo speakers systems separately or together), this next control, a speaker selector, provides for selection of *three* sets of stereo speakers—a logical move, since, as we shall see presently, the powerful pair of amplifiers can certainly drive two sets of speaker systems adequately. Care is

taken to avoid driving all three sets simultaneously (lest they be of the 8-ohm variety, which would lead to net impedances in parallel of a less-than-safe 4-ohm limit), so that the switch positions are A, B, C, A+B, A+C, but never A+B+C. There is also an "OFF" position for use when private headphone listening only is desired.

Low-and High-Filter switches in the form of push-push-to-release buttons come next, followed by friction-coupled, dual-concentric bass and treble controls. Channels can be tonally compensated together or separately (by defeating the clutch action) as desired. Master volume control and balance control come next, followed by another four push-buttons which control "loudness" compensation, reverse of stereo channels (haven't seen that one lately), mono-stereo switch, and tape monitor. The right-most control is the main selector switch and has positions for a pair of phono inputs, AM, FM Mono, FM Auto (Stereo) and Aux.

The upper portion of the panel is starkly black—until power is applied. In the radio positions, the long dial area becomes uniformly illuminated in green numerals and logging scale. The two tuning meters become similarly illuminated and, wonder of wonders, if you're listening to AM, the dial pointer *itself* is softly illuminated in a light orange color. Switch to FM, however, and the dial pointer now glows *red*.

The FM dial scale is absolutely linear. That is, the distance between 88 and 90 MHz exactly equals the distance between 106 and 108 MHz, a marvelous feature in our opinion, and one that is not as easy to achieve as might first appear. The two meters already referred to are signal strength (used in both AM and FM tuning) and center of channel (for FM tuning). They are highly effective and, more importantly, highly accurate and well coordinated. Above the tuning scale itself, located at about 89 MHz, the words *FM STEREO* light up whenever stereo transmission is tuned in. Switching to any of the non-radio positions causes the entire dial area to be darkened once more, except for tastefully illuminated words which appear in the dark area, denoting "Phono 1," "Phono 2" or "AUX." The operating manual advises that the word "Protector" would flash on if the output transistor circuitry were ever sub-

jected to excessive current flow, but, happily, we never observed this phenomenon during the course of our tests. To the right of the dial glass area are located a muting defeat switch and an MPX Noise Canceller (to be actuated when noisy, fringe area stereo reception is obtained). A large tuning knob coupled to a very effective flywheel completes the front-panel layout.

The rear-panel layout of the Sansui 4000 is pictured in Fig. 2. At the left are the usual input and output jacks, plus a DIN Tape Recorder socket (for direct connection to many foreign-brand tape recorders), an output level adjust (to cut overall gain of the amplifier if it is to be used with high-efficiency speaker systems), and a muting threshold adjustment.

By far the cleverest innovation for speaker and antenna connection is that found on the Sansui 4000. Instead of the usual screw-terminals, barrier-strip terminals, or even knurled-or thumb-screw terminal posts, there are a series

of spring-loaded plastic push-buttons which resemble a miniature piano keyboard. When each button is momentarily depressed, a small hole is exposed. The hole is just the right size for the neatly stripped ends of stranded wire cable to be inserted. The key is then released, and the wire is tenaciously held by spring action. No screwdriver required *and* not the slightest possibility of a short-circuit caused by exposed and loose strands of wire. To avoid phasing confusion, positive "keys" are colored red, while common, or negative keys are colored black. Since provision exists for the connection of six loudspeaker systems (three stereo pairs), there are twelve such "keys" for speaker connection, as well as six more for FM and AM antenna connections.

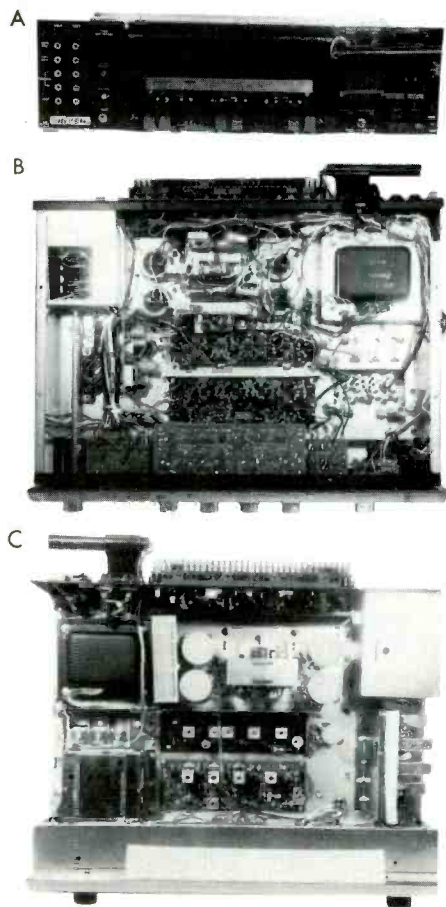
In the case of FM antenna connection, pairs of keys are provided for 72- or 300-ohm use (no links to remove, shorts to make, or jumpers to confuse and short out). Speaker line fuses, a power line fuse, switched and unswitched convenience outlets and a built-in ferrite AM antenna, plus convenient "ground" post terminals (a pair) complete the back-panel layout. There's no doubt that you could hook up six speakers with this arrangement in less time than it takes to hook up a single pair with more conventional terminal-strip methods.

Circuitry

The top and bottom views of the Sansui 4000 chassis shown in Fig. 2 disclose the neat, modular circuit board construction of this well-laid-out receiver. No less than 11 circuit boards (some of them of the plug-in variety) plus a minimum of neatly harnessed interwiring and a fully shielded FM front end contain the 44 bi-polar transistors, 1 Field-Effect Transistor (FET), 4 integrated circuits (ICs), 28 diodes, 2 Zener (regulating) diodes and 2 silicon-controlled rectifiers.

The massive power transformer, by the way, has taps which enable using this instrument with power sources as low as 100 VAC, all the way up to 250 VAC. When purchased in the United States, however, there is nothing to do here, for the units are supplied for direct connection to 117 VAC. The one FET mentioned is used as an r.f. amplifier in the FM front end, which is equipped with three additional tran-

Fig. 2A—Rear-panel layout of Sansui 4000 receiver. Fig. 2B and 2C—Bottom and top views.



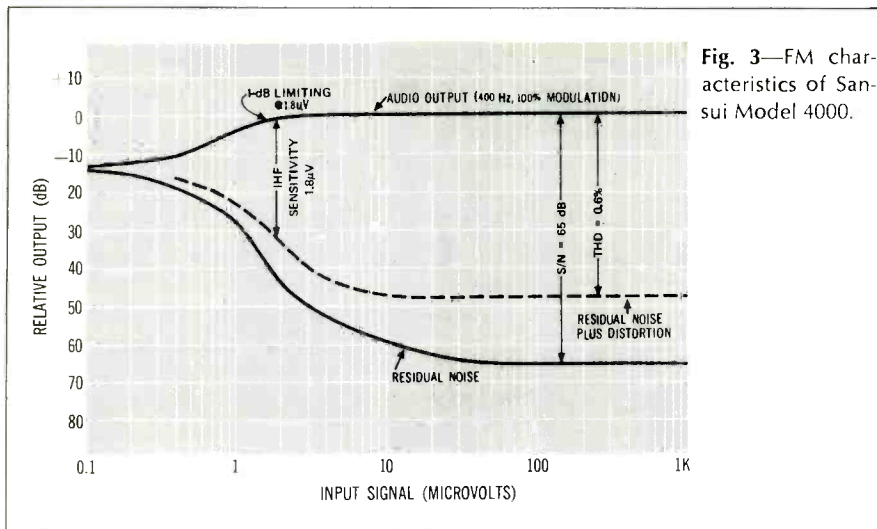


Fig. 3—FM characteristics of Sansui Model 4000.

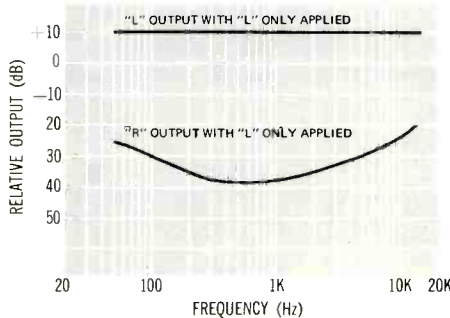
sistors. The four ICs mentioned provide the gain and limiting in the FM i.f. strip.

The AM circuit is conventional and adequate in performance, but seemed to be a bit deficient in bandwidth compared to some of the AM circuits now found in better-grade solid-state receivers. All audio modules, from pre-amplifier through output stages, were excellently conceived, engineered and produced, particular attention being paid to the use of precise parts for such functions as equalization and tone control. Tracking of volume controls was found to be accurate to at least -60 dB (within 2 dB). The output "protector" circuit is a current, rather than a heat-sensing device. As such, it would be expected to act more rapidly and more effectively in protecting the output transistors from damage.

Measurements

Figure 3 presents some of the more important FM performance characteristics in graphic form. IHF sensitivity exactly equalled the 1.8 μ V claimed. S/N measured 65 dB, bettering the 60 dB claimed. Total harmonic distortion

Fig. 4—Stereo FM separation.



(THD) equalled the 0.6% claimed, and did as well in stereo mode, for which no specification was given by the manufacturer. Notice that quieting and limiting are extremely "fast," such that the "1-dB limiting point" is reached at slightly less than 2 μ V. At the same signal strength, noise has already receded to 45 dB below full output. The claimed 1-dB capture-ratio figure was actually reached at a signal input of only 50 μ V, and was somewhat better than specified at higher input signal levels.

As shown in Fig. 4, stereo FM separation was excellent at mid-band and low end, but was somewhat deficient at the more difficult high end, dropping to 20 dB at 15 kHz, the end of the usable audio spectrum.

Audio performance, too, was excellent, with 0.8% distortion reached at 50 watts continuous power (rms) per channel, instead of 45 watts as claimed (see curve of Fig. 5). Like many solid-state amplifiers, however, distortion seemed to rise at low power levels as well as high. At no point, however, did it exceed 0.5% at lower power levels. In this respect, IM characteristics, also displayed in Fig. 5, were actually better, staying at an insignificant 0.2% all the way up to 40 watts and reaching the predicted 0.8% at about 48 watts per channel.

Tone-control range, loudness action (at -30 dB from top volume), and low and high filter curves are all displayed in the graphs of Fig. 6, while power bandwidth is shown in Fig. 7. We found the power bandwidth a bit better at the low end (15 Hz) than stated by the manufacturer, and exactly equal to claims at the high end.

Typical square-wave responses taken at 100 Hz and 10,000 Hz are shown in the photos of Fig. 7, while Fig. 8 demonstrates symmetrical clipping when the amplifier is subjected to overload.

Both in measurement and in listening, we found the action of the low and high filters excessive, cutting out too much program material too "early" because of their 6 dB per octave (rather than 12 dB) construction. Loudness control action was, for a change, useful, thanks to the presence of the additional gain control for pre-setting levels to match our speaker systems. This feature enabled us to set up the master volume in such a way that when it was at 9 o'clock the level was truly low and was enhanced by

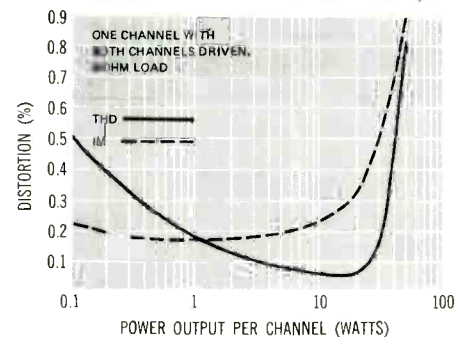


Fig. 5—Total harmonic distortion and intermodulation distortion.

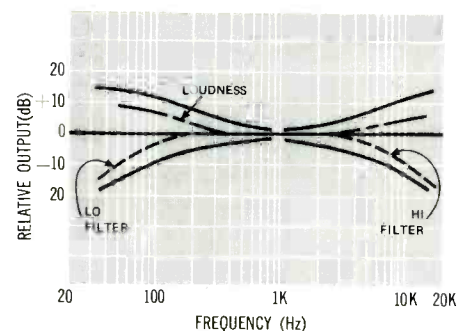
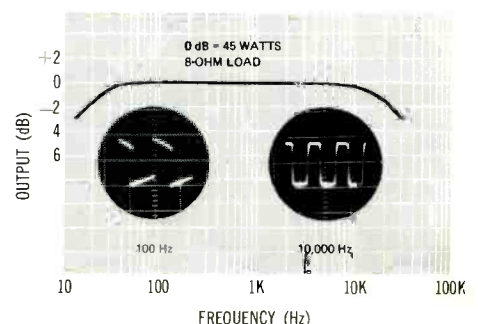


Fig. 6—Tone, filter, and loudness-compensation characteristics.

Fig. 7—Power bandwidth and square-wave response.

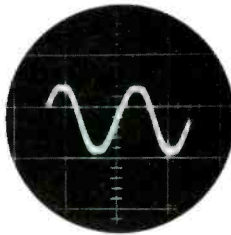


the use of loudness contouring. Most receivers only have a single point at which to adjust level—namely the volume control. Levels are often quite loud when the control is one-quarter way open, so that use of loudness controls over-exaggerates the bass when such accentuation is hardly required. Unfortunately, the instruction manual fails to take advantage of this desirable feature, and mentions level setting only in relation to speaker efficiency.

Performance

With an indoor di-pole on "first floor level" we pulled in 42 "listenable" FM signals, 15 of them in stereo. Changing to a well-oriented outdoor FM antenna increased the "yield" to 52, as good as we ever get in our location (which has excellent reception). Some of the weaker stations which we have identified in the past were noticeably quieter with this receiver, due in large part to the steepness of the quieting slope, discussed earlier. The signal-strength meter had been calibrated by us during our signal generator tests (it

Fig. 8—When driven beyond ratings, the Sansui 4000 receiver exhibits perfectly symmetrical clipping—evidence of good circuit design.



is useful as a strength indicator up to about 100 μV), and anything received at better than 10 microvolts was so quiet as to be indistinguishable from signals of 100 or even 1000 μV strength. This, to us, is the mark of a fine FM tuner section, all other things being equal.

We purposely hooked up *two* sets of stereo speaker systems (in the same room) to test the power capability of this rugged unit (and to prepare for four-channel stereo which looms). Both sets of speakers were acoustic-suspension, low-efficiency types, but the Model 4000 didn't seem to mind at all, putting out dynamic levels exceeding

anything likely to be demanded of it under normal listening circumstances. As mentioned earlier, this hook-up resulted in four-ohm impedance across each set of speaker outputs, and yet, the "protector" light never came on at all. Despite the profusion of front panel controls, handling was extremely easy and we felt at home with the equipment after about five minutes—a measure of the excellent control layout or "human engineering," if you please. We could detect no dips or peaks in response with tone controls set flat, nor were any measured by instrumentation. Hum and noise in Phono were all but inaudible, and equalization seemed perfect.

In all, if you favor "total control"—control not unlike that obtained with more expensive separate tuner, pre-amp, amplifier components, \$379.95 seems like a very modest price for this receiver. And a handsome, metal, black wrap-around enclosure is included in the price (an optional wood cabinet costs \$22.50).

Check No. 72 on Reader Service Card



utah PRESENTS

Cascade

MOST POWERFUL, MOST EPIC PRODUCTION EVER!

This is the one you will want to see and hear. It is the most powerful die-cast High Fidelity speaker series ever produced by Utah. Its name is CASCADE... the totally new co-axial speaker line. It has the largest magnets ever and larger voice coils to handle more power for a longer time. Cloth rolls enhance bass performance. The rigid die-cast frame is designed for maximum structural strength, and it can be mounted to either the front or rear of the baffle board. Your choice of 2-way or 3-way models in 8" and 12" sizes, some with co-axially mounted compression tweeters. Your ticket to the powerful CASCADE performance can be hurried along by writing us for complete information.




HUNTINGTON, INDIANA 46750