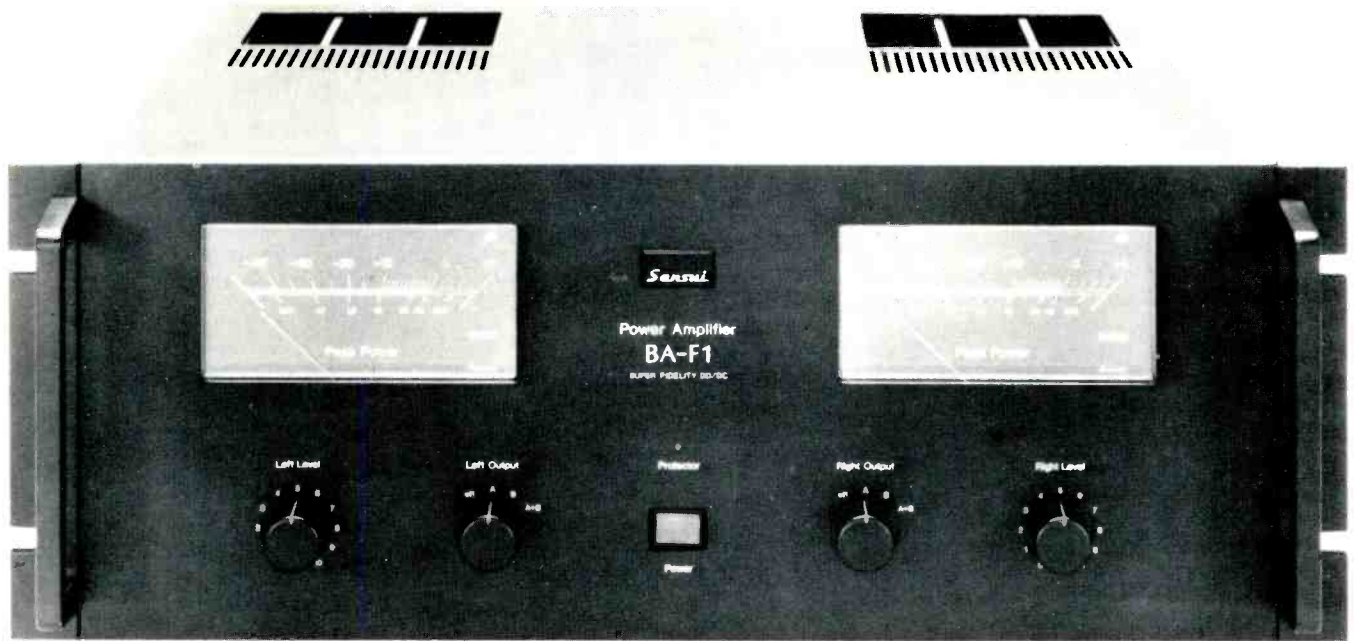


Sansui Model BA-F1 Stereo Power Amplifier



Manufacturer's Specifications

Power Output: 110 W per channel, 8-ohm loads, 5 Hz to 20 kHz.

Rated Harmonic Distortion: 0.008 per cent.

Rated SMPTE IM Distortion: 0.008 per cent.

Damping Factor: 100 into 8 ohms.

Frequency Response: D.c. to 600 kHz, +0, -3 dB.

Slew Rate: ± 200 V/ μ S.

Rise Time: 0.5 μ S.

Input Sensitivity for Rated Output: 1.0 V.

Hum and Noise (Referred to Rated Output): 125 dB.

Power Requirements: 120 V, 50/60 Hz, 470 W.

Dimensions: With rack mount adaptors, 19 in. (482.6 mm) W x 7 $\frac{3}{8}$ in. (187.3 mm) H x 17 $\frac{3}{4}$ in. (450.8 mm) D; less rack mount adaptors, 17 in. (431.8 mm) W x 7 $\frac{3}{8}$ in. (187.3 mm) H x 17 in. (431.8 mm) D.

Weight: Less rack mount adaptors, 44.1 lbs. (20.05 kg).

Price: \$665.00.

Sansui is a firm believer in the importance of fast rise time and high slew rate in audio amplifiers. Both terms describe the speed with which an amplifier can handle sharp transient signals such as occur in modern musical recordings and other music program sources. The company has also made a lengthy study of TIM and has, in fact, come up with their own distinctive method of measuring this audible form of distortion. Although their approach differs somewhat from the method proposed by Matti Ojala, it seems nevertheless to offer a valid relative method of TIM measurement.

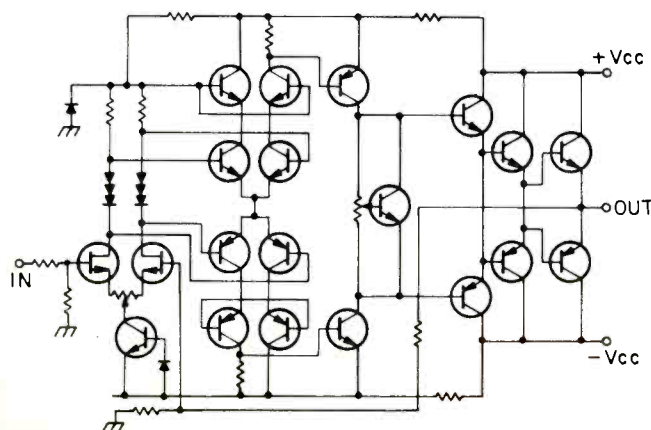
New circuitry and design techniques based upon these studies have been incorporated in Sansui's new BA-F1 power amplifier. A matching preamplifier/control unit, Model CA-F1, is available for use with this power amp and, according to

the maker, embodies some of the same d.c. design philosophy as in the BA-F1 amp. While the rated power output of the BA-F1 is not monumentally high (110 watts per channel into 8-ohm loads with no more than 0.008 percent total harmonic or intermodulation distortion), the sound quality delivered by this not inexpensive amplifier is simply superb.

Physically, the amplifier is a fairly large and heavy unit, measuring 19 inches in width by 7 $\frac{3}{8}$ inches high by 17 $\frac{3}{4}$ inches deep and weighing 45 pounds. Its front panel can be equipped with standard rack mounting adaptors and is finished entirely in black. Dominating the front panel are a pair of power output meters designed to read peak power over a very wide range from 0.01 watts to 220 watts per channel (well above clipping level of the amplifier). Calibrated in terms of both watts and dB, the 0 dB point corresponds to 110 watts output (the rated output of each channel); above that point, if the amplifier is driven to clipping or overload levels, a red bar of light integrated into the meter scales flashes almost instantly to denote clipping levels.

Below the meters, centered on the panel, is a rectangular power on/off switch which illuminates in a green color when power is applied. Above this switch is a "protector" indicator light which flashes on when power is applied (until power supplies are stabilized and the amplifier is operational) or if the built-in protection circuits are triggered for any reason. In addition to separate left- and right-channel level controls, each channel's output circuitry may be switched by means of separate front panel rotary switches to feed either of two connected speaker systems or both systems. This is one of the few basic power amplifiers we know of which offers this versatile speaker switching system.

Fig. 1—Partial schematic of Sansui BA-F1 circuitry.



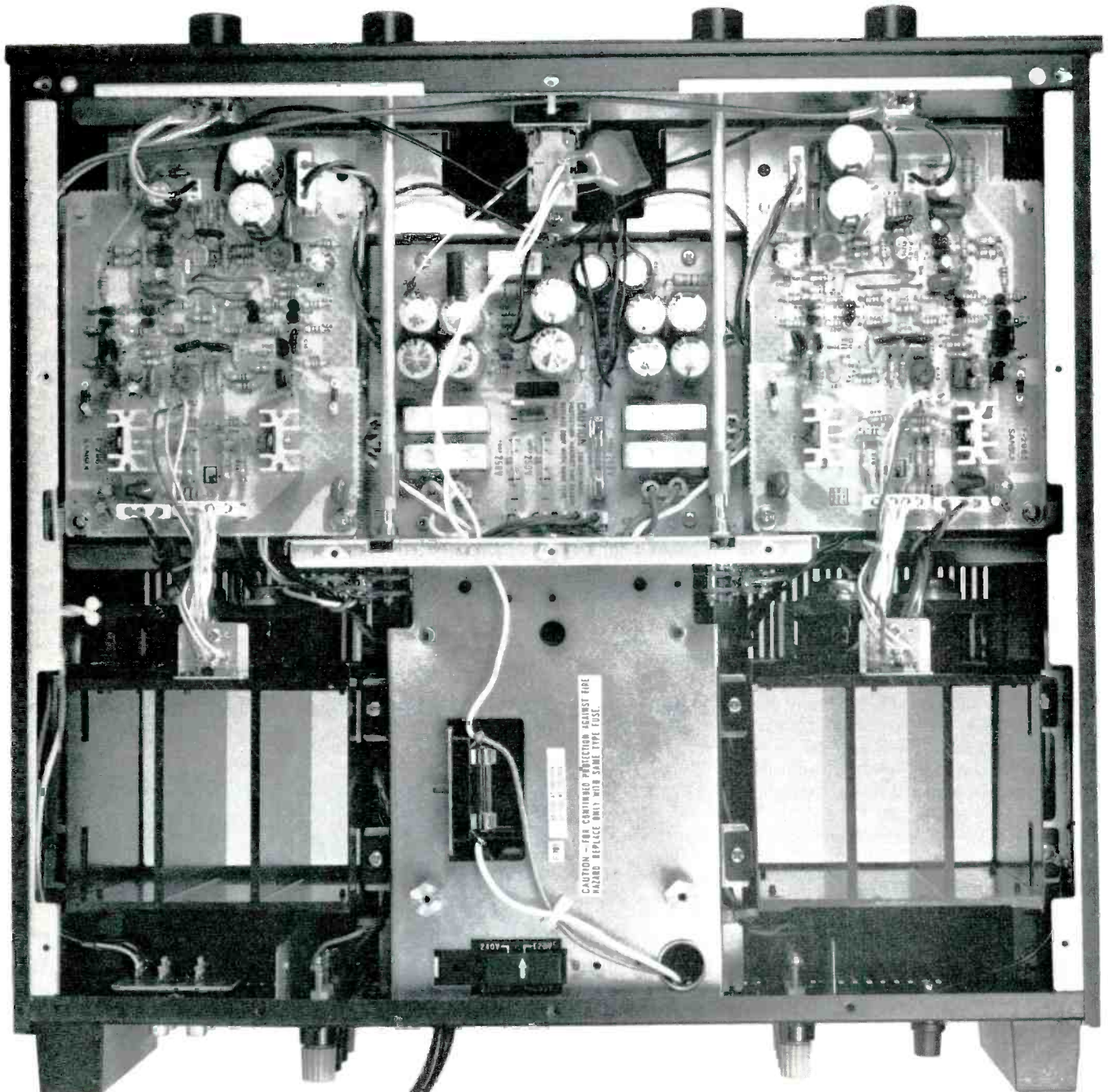
The rear panel of the amplifier has the required color-coded speaker connection terminals to accommodate four speakers (two pairs) as well as two pairs of paralleled input jacks, a line fuse holder, and a switched and an unswitched convenience a.c. receptable.

Circuit Description

Sansui uses what they have dubbed a Diamond Differential DC Circuit in this power amplifier. Essentially, this circuit makes certain that there is always adequate driving current, no matter how demanding or pulsive the input signal. While a detailed schematic of the DD/DC Circuit is not disclosed (ostensibly because of patents pending worldwide), the company does offer the representational schematic diagram of Fig. 1. The circuit would appear to be basically a dual complementary differential circuit with push-pull output formed of two pairs of PNP-NPN transistors. As the partial

schematic indicates, the input signal is voltage amplified by two separate pairs of transistors. These symmetrical differential pairs feature excellent common-mode rejection ratio. When an input signal demands a greater power output, the upper and lower pairs of transistors work as a current differential amplifier to achieve high drive current.

There are two protection circuits in the BA-F1, a d.c. detector and an overload current detector. These, together with a relay circuit, offer protection for the power transistors (which are configured as a three-stage Darlington-connected, parallel push-pull circuit) and connected speakers. Circuitry of the left stereo channel is completely independent of that of the right channel. Although there is only one massive power transformer in the unit, it has secondary windings which are separate for each power amplification channel, and completely separate capacitive filtering is used for each channel. Massive "chimney type" heat sinks are used for housing the output transistors of each channel.



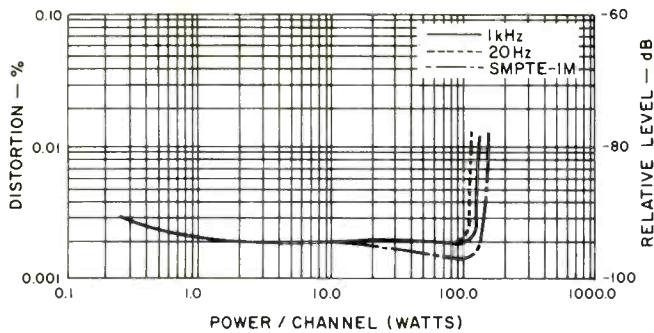


Fig. 2—Distortion vs. power output, 8-ohm load.

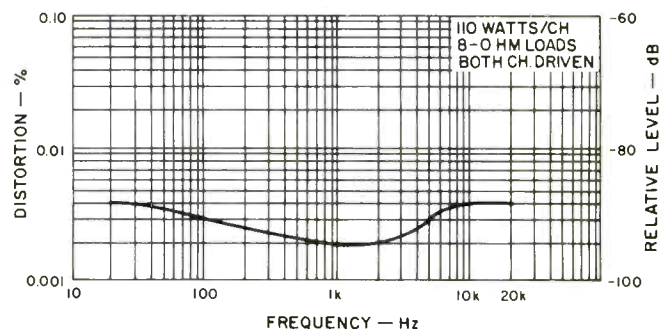


Fig. 3—Harmonic distortion vs. frequency.

Laboratory Measurements

The Sansui BA-F1 amplifier delivered 120 watts per channel with both channels driving 8-ohm loads for its very low rated distortion level of 0.008 percent, using a 1-kHz test tone. Power output versus harmonic distortion and SMPTE-IM distortion are plotted in Fig. 2. Even at the frequency extremes of 20 Hz and 20 kHz, output power available was well above the 110 watt rating assigned by Sansui, with a worst-case reading of 117 watts (at 20 Hz). For a constant 110 watts output, power bandwidth extended from 5 Hz to 30 kHz, as shown in Fig. 3, with rated THD (0.008 percent) reached only at those frequency extremes. Frequency response (for a -3 dB roll-off) extended from d.c. ("zero Hz") to an incredibly high 1.0 MHz! Dynamic headroom was 1.02 dB, while damping factor, measured at 50 Hz, was a high 100, as claimed.

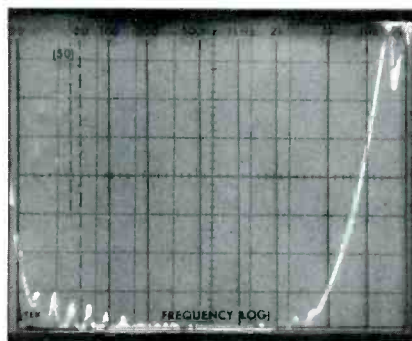


Fig. 4—Two-tone IM measurement of the Sansui BA-F1 amplifier using 19- and 20-kHz input signals.

In order to differentiate between the performance of an amplifier such as the Sansui BA-F1 and more conventional a.c.-configured amps, we applied some additional bench tests before subjecting the unit to musical listening tests. Using a two-tone IM measurement method (19 kHz and 20 kHz, at equal amplitudes), we examined the output signal by means of a spectrum analyzer for evidence of a 1-kHz beat (CCIR IM Distortion) as well as any other spurious products (IHF IM). The 1-kHz product observed measured a low 0.017 percent, while the total of all spurious beats produced added up to the equivalent of less than 0.03 percent, or 70 dB below rated output. A photo of the spectrum analyzer 'scope face displaying these results is shown in Fig. 4.

Slew rate, or the ability of the amplifier to handle rapidly changing voltage levels with great speed, was measured using a 10-kHz square wave adjusted for a peak-to-peak output of 50 volts.

In the 'scope photo of Fig. 5, we have superimposed the input and output waveforms to show the minute slope of the rising wavefront of the output signal compared with the input signal. That slope measured $200 \text{ V}/\mu\text{s}$, based upon the horizontal sweep rate we used, which was $2 \mu\text{s}$ per horizontal division. A slew-rate of $200 \text{ V}/\mu\text{s}$ is far greater than would be required from any known program source played through the amplifier.

Use and Listening Tests

To our ears, the Sansui BA-F1 offered about as clean sound reproduction as it has ever been our pleasure to hear. Bass was extremely tight at all listening levels short of overload, and highs as well as midrange tones were clear and completely devoid of any audible IM distortion, notch distortion, or transient distortion. Those few diehards who maintain that a solid-state amplifier cannot produce sound that is as pure as that produced by vintage tube-amp designs might do well to compare the sound of an amplifier such as the Sansui BA-F1 with any of their favorite tube amps — as we in fact did. With certain types of program material such as some of the new direct-to-disc recordings, the solid-state BA-F1 in combination with the companion Sansui CA-F1 preamp actually provided tighter and more pleasurable sound, at least to our ears.

To the purist who seeks the proverbial "straight-wire-with-gain" power amplifier, the Sansui BA-F1 comes about as close to meeting that elusive goal as anything we have heard in recent months. Of course, it is not an inexpensive amplifier and you can purchase 110 watts of power for a lot less. But that never stopped a dedicated audiophile from seeking out the best — regardless of cost.

Leonard Feldman

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Fig. 5—Superimposed display of 10-kHz square wave input and output signals observed in measuring the slew rate of the BA-F1 amplifier.

