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SANSUI AU-D11 INTEGRATED AMPLIFIER

Manufacturer's Specifications

Power Output: 120 watts per channel, 8-ohm loads, 10 Hz to 20 kHz.

Rated THD: 0.005%.

SMPTE IMD: 0.005%.

Overall Frequency Response: 0 to 300 kHz, –3.0 dB, high level.

Phono Response: RIAA within 0.2 dB.

Damping Factor: 150 into 8 ohms at 1 kHz.

Rise Time: 0.8 µS.

Slew Rate: ±350 V/µS.

Input Sensitivity: MC phono, 100 or 200 µV; MM phono, 2.5 mV for rated output; high level, 250 mV.

Phono Overload: MC, 16 mV at 1 kHz; MM, 200 mV at 1 kHz.

S/N Ratio: MC, 74 dB; MM, 90 dB; high level, 110 dB.

Bass Control Range: ±8 dB at 50 Hz (selectable turnover at 150 or 300 Hz).

Treble Control Range: ±8 dB at 15 kHz (selectable turnover at 3 or 6 kHz).

Subsonic Filter: –3 dB at 16 Hz (6 dB/octave).

High-Cut Filter: –3 dB at 20 kHz.

Muting Action: 20 dB.

Power Requirements: 120 V, 60 Hz a.c., 600 watts (rated).

Dimensions: 17-9/16 in. (44.61 cm) W x 6-7/16 in. (16.35 cm) H x 17½ in. (44.45 cm) D.

Weight: 38.5 lb. (17.37 kg).

Price: $1,000.00.

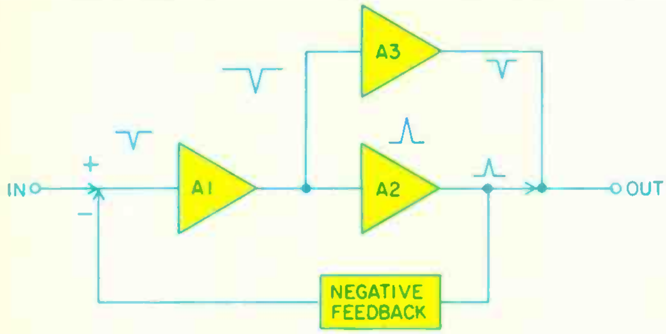

Fig. 1—Simplified block diagram of Sansui's SuperFeedforward circuitry found in their AU-D11 amplifier.

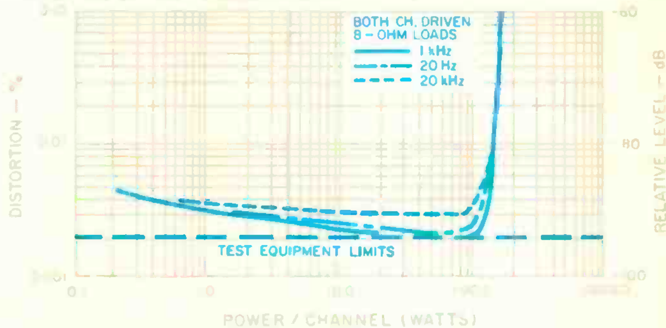

Fig. 2—THD vs power output, Sansui AU-D11.

Sansui has always been a company dedicated to researching new approaches to audio product design and construction. In their AU-D11 integrated amplifier they have incorporated a practical embodiment of an idea that has actually been around longer than the concept of negative feedback. The concept is called "feedforward," and Sansui's version of it in their AU-D11 is called "SuperFeedforward." It is a combination of the conventional negative feedback concept and the old, but never practically executed, "feedforward" idea. Figure 1 is a simplified block diagram of the SuperFeedforward idea. Distortion, generated in A_2 is fed back to the input, reversed in phase, where it is added to A_1. This reverse-phased signal is then amplified by A_1 and sent on to A_2. In this way, distortion is reduced at the output of A_2. So far, what we've described is ordinary loop negative feedback. In the SuperFeedforward system, however, an additional out-of-phase signal at the output of A_1 is also fed to an error-correction amplifier, A_3, where it is amplified and fed on to the *output* (rather than the input) of A_2. In this way, the feedforward circuit eliminates or greatly reduces what little distortion the negative feedback loop has failed to eliminate. While no direct claims are made for the SuperFeedforward circuit relative to certain dynamic forms of distortion (such as TIM, IM, etc.), Sansui's earlier-developed Diamond Differential DC circuitry (which results in an ultra-fast rise-time and a high slew rate) is, according to Sansui, directly responsible for the reduction or elimination of these other forms of audible distortion.

The front panel of the AU-D11 has a matte-black finish and highly legible off-white control designations. A rotary speaker selector switch and a power switch are at the extreme left of the panel. Nearby, we find the usual phone jack plus calibrated bass and treble controls, each augmented by two pushbuttons which select the crossover frequency for each of these tone controls (300 or 150 Hz for the bass control; 3 or 6 kHz for the treble). Tone defeat, high-cut and subsonic filters, muting switches and associated indicator lights occupy the center section of the panel. To the right are a passive, accurately calibrated, step-type master volume control and a smaller, center-detent channel bal-

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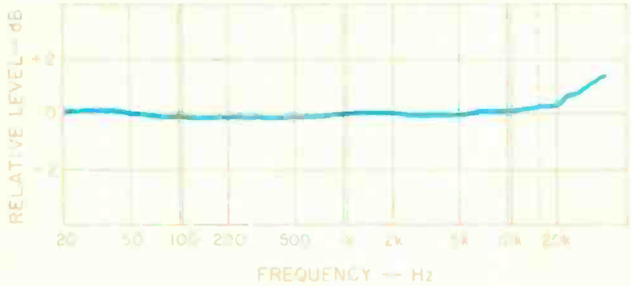

Fig. 3—Equalized RIAA response, AU-D11 amplifier. Maximum deviation from RIAA was +0.2 dB at 15.5 kHz.

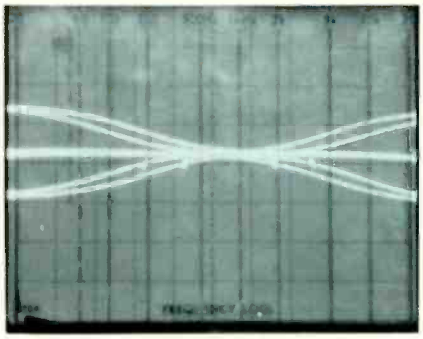

Fig. 4—Bass and treble control range for each turnover frequency.

ance control. The two tape monitor circuits of the AU-D11 are controlled by means of two slim switches with indicator lights, and next to these is a record selector switch which allows you to feed one program source (such as tuner or another tape deck) to your recording deck while listening to any other source. Above this switch are a pair of tiny pushbuttons which select either MC or MM phono preamplification and, if MC is selected, a choice of two gain levels (sensitivities of either 100 or 200 µV for rated output). Finally, the main input selector switch, replete with tiny indicator lights, is located at the upper right corner.

The rear panel of the AU-D11 contains the usual array of phono-tip input and tape-out jacks, two pairs of color-coded speaker terminals, and a total of three a.c. convenience receptacles (one switched, two unswitched). There are no external fuses or circuit breaker reset buttons accessible to the user at the rear panel.

Besides the pre-preamp for MC cartridges, there are basically only two amplifier sections in the AU-D11, the phono equalizer and the power amp. When the tone controls are defeated, the output of the equalizer section goes directly to the power amp and then on to the speaker systems without encountering any coupling capacitors in the signal path.

The equalizer is of the high-gain d.c.-servo type. It features a differential input formed of a dual FET, followed by Sansui's previously mentioned DD/DC circuit and a true complementary single-ended push-pull output. As for the power amplifier section, in its driver stage a pair of differential circuits in a symmetrical design are connected to each other as dual-complementary differentials. The power output stage has a differential input, fed with a constant current source, formed by a low-noise, high current dual FET.

Power Amplifier Measurements

The AU-D11 delivered 136 watts per channel before clipping. At rated output (120 watts per channel, 8 ohms), harmonic distortion and SMPTE-IM distortion were both equal to 0.002% or lower (that level of distortion being the limit imposed by the signal generating source itself). Power output versus harmonic distortion for signal frequencies of 1 kHz, 10 Hz and 20 kHz are plotted in Fig. 2. Damping factor, referred to 8-ohm loads and using a 50-Hz test signal, measured 140. I also measured CCIR-IM distortion, using a variety of twin-tone test signals of equal amplitude equivalent to rated output (each of the two twin tones is 3 dB below rated output so that their combination adds up to the rms voltage equivalent of full rated output). Worst-case results for this form of IM distortion measured 0.0029%, or barely measurable. The twin-tone IM measurement method was extended to include an IHF-IM measurement. This involves taking into consideration any and all IM components that appear within the audio spectrum, from 20 Hz to 20 kHz. The analysis is made on the basis of a spectrum analyzer display whose dynamic range is limited to 80 dB. I can therefore report only that the IHF-IM for this amplifier was less than 0.01%, as low as I am able to measure in my lab. Slew factor, as specified in the EIA Amplifier Measurement Standards, was greater than 5 (the highest I can measure) and is, in my opinion, a more easily measured (and, therefore, more meaningful) specification than slew *rate* or square-wave rise-time.

Preamplifier Measurements

Input sensitivities for the various input terminals of the AU-D11 were measured with respect to 1-watt output (as prescribed in the EIA Amplifier Standards), putting them approximately 21 dB lower than specified by Sansui, who still refers these measurements to rated output. Input sensitivity for MM phono measured 0.24 mV, while for the two settings (high and low gain) of the MC phono inputs, I measured 9 and 18 microvolts respectively. The high-level (tuner, AUX, tape) inputs required 27 millivolts of input to produce 1-watt output with the volume control set to maximum.

Phono overload in the MM phono mode measured 200 millivolts for a 1-kHz signal, while in the MC mode it measured 18 millivolts, or a bit better than the 16 mV claimed by Sansui. My signal-to-noise results are not directly comparable to those published by Sansui since, again, I am using the method endorsed in the EIA Amplifier Measurement Standards (a fixed input of 5

As for sound quality, I can't think of anything Sansui might have done to make the AU-D11 any better.

mV to the MM phono, 0.5 mV to MC, and 0.5 volt for high-level inputs, with the volume control adjusted to produce *one watt* of output from the amplifier). In this case, no direct comparison can be made with Sansui's published specs. MM phono S/N measured a very high 86 dB, while the MC inputs offered a signal-to-noise ratio of 72 dB. Signal-to-noise for the high-level inputs measured 88 dB, while hum and noise of the power amp section alone (with the master volume control turned down to minimum) measured 96 dB. This last figure *can* be translated to Sansui's type of S/N measurement by simply adding 21 dB to my result, to obtain a figure of 117 dB relative to rated output.

By using a highly accurate inverted RIAA signal fed to the phono section of this amplifier and with the record-out terminal connected to a Sound Technology 1500 audio analyzer, I came up with the "almost ruler flat" phono response curve shown in Fig. 3. The plot is from 20 Hz to 20 kHz, and vertical sensitivity of the display has been expanded to *2 dB per division*. The "cursor" (vertical dotted line) has been set to the "worst" deviation from RIAA, which occurred at 15.5 kHz and amounted to no more than +0.2 dB error.

Particularly pleasing was the action of the bass and treble tone controls of the AU-D11. As you can see from Fig. 4, even when the "inner" turnover points of 300 Hz and 3 kHz are chosen, the midrange frequency area remains relatively unaltered. In my view, this is an arrangement that is far preferable to having the controls "hinged" about a common point at 500 Hz or 1 kHz. Since both the subsonic and the low-pass filter circuits of the AU-D11 are set at or beyond the audio range extremes (16 Hz for the subsonic filter, 20 kHz for the high-cut circuit), it was not possible to graphically illustrate their action. Suffice it to say that both filters began to cut response exactly as specified and at the slope specified by Sansui.

Use and Listening Tests

It is difficult to say whether or not Sansui's unique Super-Feedforward and DD/DC circuitry actually contributes directly to sound reproduction. However, the AU-D11 delivered totally transparent and accurate sound reproduction when hooked up to reference speakers and fed with a variety of source material from my latest collection of digitally mastered classical and jazz discs. Actually, aside from being curious about such possible correlation, the question becomes academic. The Sansui AU-D11, in my opinion, does everything that a top-grade integrated amplifier should do and does it as well as any product I have ever tested. A few more frills might have been incorporated on the back panel, such as selectable MM phono input loads (choice of capacitance values, etc.), but these are matters that the knowledgeable audio enthusiast can easily take care of externally. As for *sound* quality, I can't think of anything that Sansui might have done to make the AU-D11 any better.

Leonard Feldman

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