

As far as I could tell during my extended listening test, Sony's TAE-5450 preamp did not affect the sound quality in any way. Signal to noise was excellent, and the tone controls and filters helped a great deal in shaping signal sources which were "off." While the controls did take a while to get used to, principally because of their great variety, I must say that this TAE-5450 is one of the most versatile preamps I have

yet tested—particularly with respect to the tape recording facilities and the large number of auxiliary inputs and outputs. Many enthusiasts will find the front panel jacks very convenient—they certainly save a lot of trouble.

As I mentioned earlier, I initially thought the unit was a bargain at \$450.00. After testing it for several weeks, I am still of the same opinion.

George W. Tillett

Check No. 91 on Reader Service Card

Marantz Model 510M Basic Amplifier



MANUFACTURER'S SPECIFICATIONS

Power Output: 256 continuous average watts per channel, both channels driven into 8 ohms from 20 Hz to 20 kHz with 0.05 per cent total harmonic distortion; 350 average watts per channel, with similar conditions except 4-ohm loads with 0.10 per cent total harmonic distortion, and 140 average watts per channel with similar conditions except 16-ohm loads with 0.10 per cent total harmonic distortion.

Intermodulation Distortion: Less than 0.1 per cent at or below rated power using SMPTE method.

One-Watt Frequency Response: -3 dB at 2 Hz and 120 kHz.

Input Sensitivity: 2.26 V rms for 256 watts into 8 ohms.

Input Impedance: 25 kilohms, not affected by gain control setting.

Slew Rate: ± 15 V/ μ S.

Hum and Noise: -110 dB below rated output, 8 ohms.

Damping Factor: Greater than 100 at 1 kHz, 8-ohm load.

Phase Shift: Leading 9 degrees at 20 Hz, lagging 10 degrees at 20 kHz.

Dimensions: 15-3/8 in. (39.04 cm) W by 6-1/8 in. (15.55 cm) H by 14 in. (35.56 cm) D.

Weight: 46 lbs. (20.7 kg)

Price: \$999.95; Model 510, less meters, \$899.95.

The Model 510 is one of Marantz's newest amplifiers in the medium to high power range, continuing their 500 series, and its styling is typical of recent products from this company. The front panel of the basic model contains two level controls, a power switch, and peak indicators; included in the "M" version we tested are two large, illuminated meters and a meter range switch.

The unit is well made and very compact, with a large encapsulated power transformer, two filter capacitors, and the cooling tunnel occupying the majority of the chassis interior. Inside the tunnel are 16 output transistors, each having a small staggered-fin radiator, across which cooling air is drawn from a temperature-controlled two-speed fan. Mounted on either side of the tunnel are the amplifier boards, which allows the transistor pins to solder directly to

the printed conductors, thereby saving both space and considerable chassis wiring. The top cover is perforated and has a foam air filter mounted to its underside to keep dust and other debris from being drawn into the box. Marantz recommends periodic cleaning; this is easily accomplished by vacuuming the top surface of the amplifier.

Mounting and installation of the unit is straightforward, with details in the owner's manual. Several inches should be allowed atop the amplifier installation for it to draw cool air, and an opening is similarly required behind the fan for warm air exhaust. All connections are made to the rear panel. Speaker jacks are the five-way binding post type, and inputs are 1/4-in. phone plugs. Provided with the amplifier are adaptors to convert the inputs to the more common RCA jacks.

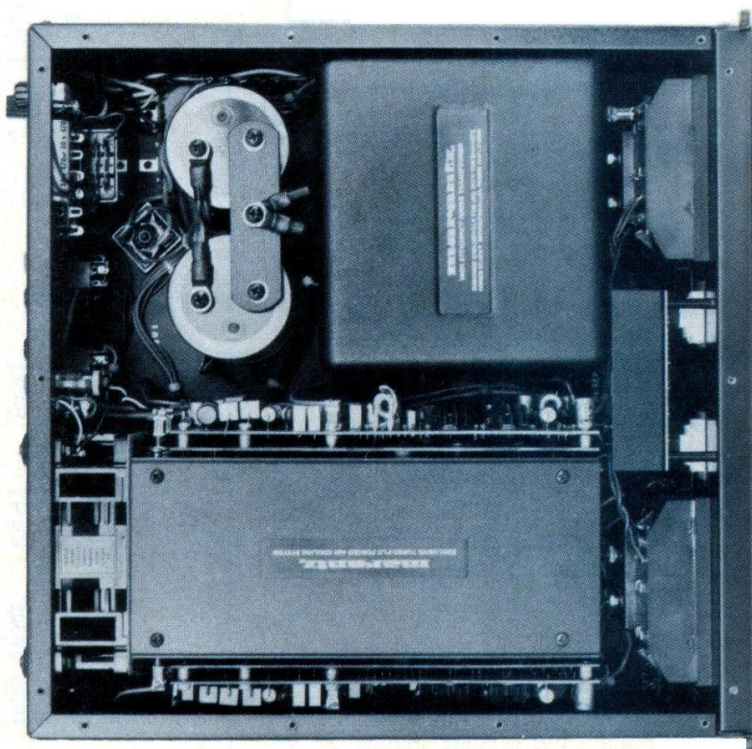


One fuse on the rear panel interrupts the a.c. line in case of amplifier failure, while external, in-line fuse holders are provided for speaker protection. In the owner's manual are diagrams showing the proper connections and guidelines for fuse selection. The use of these fuses is recommended.

The meters are calibrated to show full scale at +3 dB with sine wave inputs at 256 watts/channel, 8 ohms, and the meter switch in the +20 dB position. Also provided on the meter range switch are: *Off*, +10 dB, and 0 dB positions, with the latter two changing the full scale readings to 25.6 watts and 2.56 watts respectively. Internal calibration was provided for each meter, and their adjustment was found to be quite accurate after the amplifier warmed up for a few minutes. Worst case error proved to be about 1 dB which should be quite adequate for checking average power levels using musical program materials.

Short duration peaks are captured and held by front panel lamps and their associated circuitry. These were set to trigger at about 63 volt peaks (250 watts/channel at 8 ohms) or if the positive half cycle limiter is engaged. Peak-hold displays are certainly useful, though 510 users would be unnecessarily conservative if they were to always play music "soft" enough to entirely avoid lighting these peak indicators because the 510 doesn't clip or limit before pumping a healthy 347 watts into an 8-ohm load or 536 into 4 ohms, driving both channels at 1 kHz.

(Editor's Note: Marantz tells us their design intent on the peak load indication system was to indicate the *approach* of clipping on peak systems, rather than an actual clipping situation. Thus, the system should not be considered as indicating an overdrive situation, as the LEDs will light up before actual clipping. The system tracks the power supply voltage so it will always give the same warning margin that clipping is approaching, regardless of the a.c. power line variations. While the circuit turns on in microseconds, the "hold" portion of the circuit keeps the LEDs lit long enough so they can be seen by the eye. The system indicates an actual overload condition by staying on more or less continually. Thus, 510 users should consider occasional flashing of the LEDs as full use of the normal operating range.) On the amp submitted for review, a 3 dB difference was found in channel balance when both controls were set at 50 per cent mechanical rotation. When using these controls at less than maximum gain, it is recommended that the settings be made by the amp's meters or verified with oscillator and voltmeter if you wish precision in balancing.

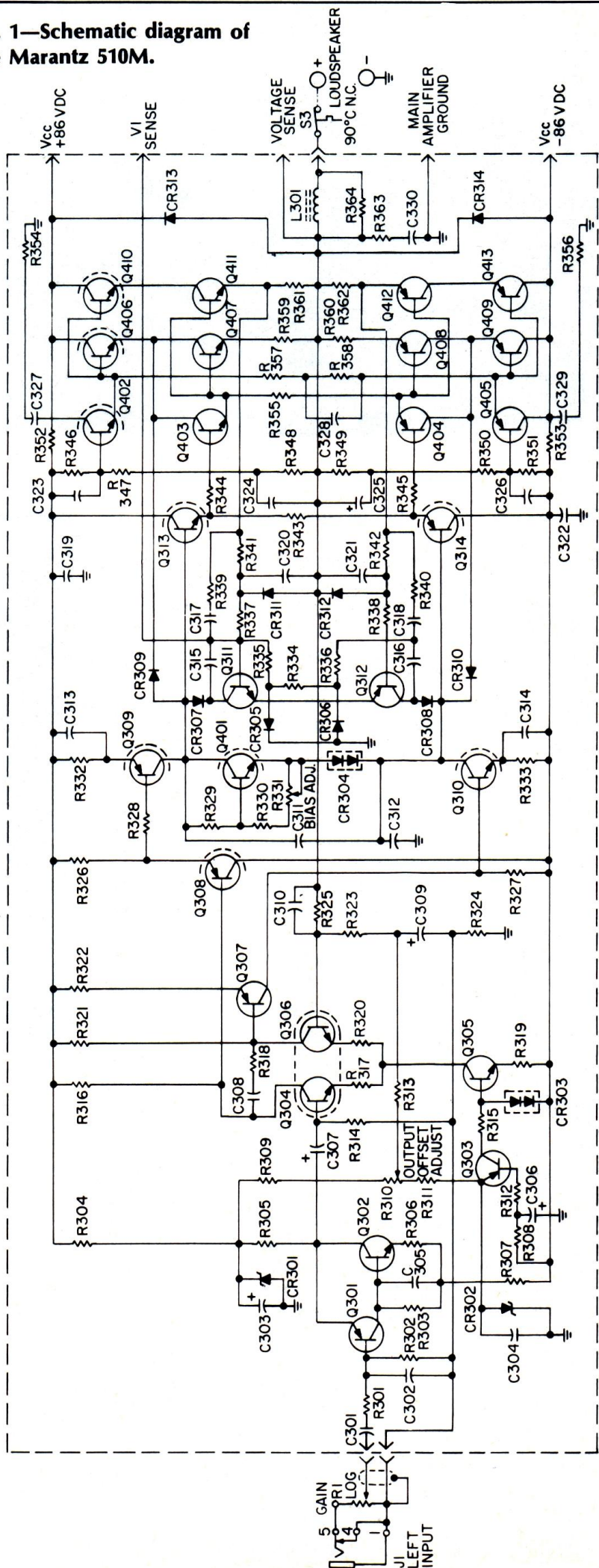


Circuit Description

Suitably attenuated input signals are a.c. coupled to the unity gain buffer amplifier, which uses Q301 and Q302 in a circuit often called an amplifier emitter follower. This stage exhibits a high input impedance which minimizes the loading on the gain control and the preamplifier. Minimum input impedance for the 510 is approximately 31 kilohms, so preamp manufacturers' specifications should be checked to ensure compatibility, especially if vacuum tube preamp models are used.

Capacitor C307 couples the buffer amplifier to the non-inverting input of the differential amplifier Q304 and Q306, and feedback is applied as usual to the inverting input. Marantz has used an uncommon but simple circuit to combine both phases of output signal from the input stage, while also getting the ability to pull the driver stage hard in either the positive or negative direction. Transistor Q307 is the key to this circuit; it is connected as a common emitter amplifier to get the necessary signal inversion and voltage translocation, but degenerated to a gain slightly less than 1,

Fig. 1—Schematic diagram of the Marantz 510M.



in order to match its characteristics to its mate, Q308, connected as an emitter follower. It can be shown that the driving signal at the collectors of Q309 and Q310 will be relatively free of even harmonics by nature, if the transistors are chosen carefully and the resistors involved are properly balanced.

The output stage and its drivers are straightforward, being similar in design to those of other high quality amplifiers currently in production. Eight output transistors are used per channel in a complimentary, series-parallel arrangement. Such a design allows the use of low voltage epitaxial base devices, giving the composite stage a very good safe operating area (especially important with reactive loads such as electrostatic speakers) and good current linearity as well.

V-I limiting is employed for protection, but its action is not instantaneous, so short duration transients will not trigger unnecessary limiting. Capacitors C315 and C316 are used to accomplish this effect. Figure 2 shows the amplifier forced into limiting with 2-ohm, 2- μ F series R-C network, in parallel with 8 ohms and the amplifier output. Note that limiting action is symmetrical and without spurious glitches or oscillation.

Measurements

The 510 was first asked to deliver one-third rated power into four ohms, both channels driven with a 1 kHz sine wave, for an hour, as per FTC requirements. Being close to the maximum internal power dissipation point, the exhaust air quickly heated up and the high speed switch for the fan turned on in less than 30 seconds. The amplifier ran continuously for about 15 minutes, and then the two thermal switches, set to 90° C., opened and closed alternately for the remainder of the test. It took about seven cycles of thermal cut-out and 1 hour, 20 minutes to accumulate a total of one hour running time.

After a very brief cooling-down period, the amplifier was then connected to a suitably large set of 4-ohm non-inductive load resistors and a Sound Technology 1700A THD analyzer. The right channel of the amplifier showed more distortion at high frequencies than the left, reaching 0.10 per cent THD at full power into 4 ohms, while the left channel remained at or below 0.03 per cent up to 20 kHz. Figure 3 shows THD for both channels at full power with 4 and 8 ohms as a function of frequency. This rise in distortion with increasing frequency reflects the drop in amplifier open-loop gain, thereby reducing the negative feedback available to correct the amplifier's internal non-linearities, and these effects are common to the large majority of tube and transistor power amplifiers. Figure 4 shows a sample of the nulled THD residual and the amplifier output at 10 kHz and 100 watts output into an 8-ohm load.

An attempt to measure IM distortion with respect to power output was made using a Crown IMA. Starting at 256 watts per channel into 8-ohm loads, the figures measured with 0.006 and 0.001 per cent for the left and right channels respectively. As power was decreased in 10-dB steps, both channels fell rapidly into the noise, with no measurable increase in IM products on the way down. No figures are presented for the sum of 5th and 7th harmonics as this amp was unmeasurable with this test and the available equipment, i.e. measurements were at the residual of the test equipment, 0.001 per cent, at or below rated power, both channels driven into 8-ohm loads.

Frequency response, as shown in Fig. 6, is a plot of the measured values with the gain control full up and the signal generator set for an amplifier output of 1 watt at 1 kHz with

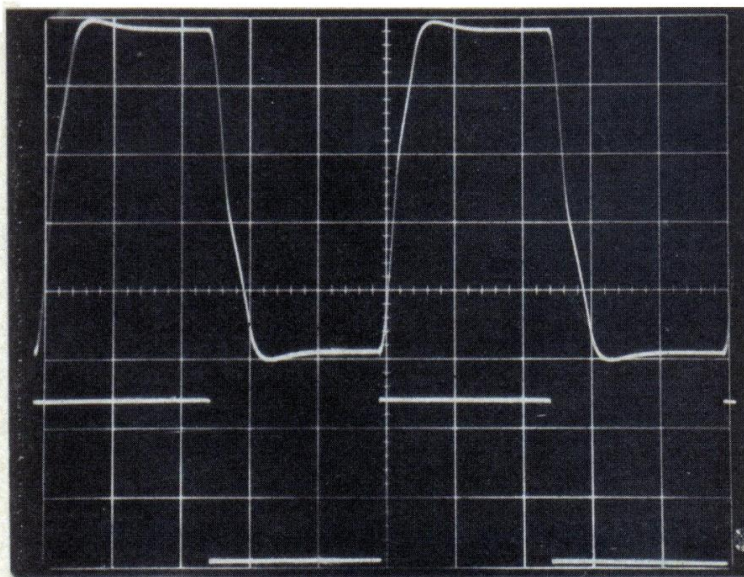


Fig. 2—Top, amplifier forced into limiting with a load composed of 8 ohms paralleled with a series R-C network of 2 ohms and 2 μ F. (Traces: top, 20 V/div. & 20 μ S/div.; bottom, 2 V/div. & 20 μ S/div.)

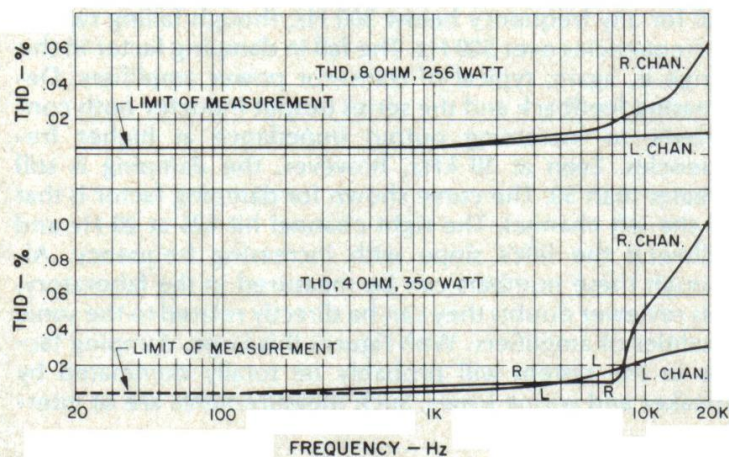


Fig. 3—Frequency vs. THD at full power into 4- and 8-ohm loads.

Fig. 4—Nulled THD residual of 10 kHz, 100 watts into an 8-ohm load; residual is 0.012 per cent. Upper trace is input; 20 V/div. & 20 μ S/div.

