SERVICE MANUAL 125

marantz

model 125

Am / Fm Stereophonic Tuner

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INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service information for the Marantz Model 125 Stereophonic Tuner.

Servicing information and voltage data included in this manual are intended for use by the knowledgeable and experienced technician only. All instructions should be read carefully. No attempt should be made to proceed without a good understanding of tuner operation.

The parts list contains complete parts replacement information. Most replacement parts should be ordered from the Marantz Company. However, a simple description is included for parts which can be obtained locally.

The Marants Model 125 is a high quality tuner employing some of the latest advances in tuner technology: Dual Gate FET RF amplifier and mixer, phase linear IF filters, phase locked loop multiplexing, and 3 levels of muting based on signal strength., noise level and tuning. All muting functions are performed by a muting IC which replaces the discrete components employed in other Marantz tuners and receivers. A complete description of the muting circuit will be found on pages 8 and 9.

2. AM TUNER

The AM TUNER portion of the Model 125 is composed on one IC circuit containing an RF amplifier, local oscillator, mixer, IF amplifier, detector and three transistors. Transistor H154 is a field strength indication amplifier., while transistors H152 and H153 amplify the detected audio signals.

All components except the tuning capacitor and ferrite bar antenna are mounted on the P150 circuit board, see fig. 9.

The AM signals induced in a ferrite bar antenna are applied to the input of the RF amplifier pin 12 of H151; then amplified to overcome conversion noises. This results in a good S/N ratio at the output. The tuned circuits located in both the input and output circuits of the RF amplifier assure very high image rejection and spurious signal rejection characteristics.

The amplified and selected AM signal is then applied to pin 1 of the mixer section contained in the IC. Local oscillator voltage is injected into the other input of the mixer section at pin 16. The AM signal and oscillator voltage are mixed and converted into a 455 KHz intermediate frequency which is applied to the IF transformer, L153. It consists of one ceramic filter and two tuned circuits.

The output of L153 is directed to the IF amplifier input, pin 9, through coupling capacitor C162. Here it is amplified sufficiently to drive the detector stage within the IC. The detected audio signal derived from pin 7 is filtered, then amplified by H153. The final audio output passes from the collector of H153 to the output jacks through the function switch, OUTPUT LEVEL control, R002 and output amplifiers H401 and H402.

The DC component of the detected IF signal is used as an AGC voltage to control emitter current of the RF amplifier through the AGC amplifier contained in the IC. Part of this DC component is applied to the base of the signal strength indication amplifier, H154. Output from the collector of H154 is level adjusted by R178, then applied to the signal strength meter, M002.

2.1 AM TUNER TROUBLESHOOTING

First, check for a broken AM bar antenna; then try to tune in a station while observing whether the AM signal strength meter deflects or not. If the signal strength meter indicated signal at several frequencies, it is probable no failure exists in the stages ahead of the detector circuit. To test the detector circuit, connect an oscilloscope to test point B or J161 and check for audio signal with the tuning meter deflected.

If the signal strength meter does not deflect, check the local oscillator circuit. Normal oscillating voltage at the hot end of the oscillator tuning capacitor is about 1.5 to 3 volts, depending on tuning capacitor position. Because of its extremely high frequency, oscillating voltage must be measured with an FR VTVM. An ordinary AC VTVM will not provide an accurate measurement. If local oscillator voltage is normal, check for proper DC voltages in the AM circuit with a DC VTVM. Compare the measured values with those given in the schematic diagram.

2.2 AM ALIGNMENT PROCEDURE

2.21 AM IF Alignment

1. Connect a sweep generator to J153 and an alignment scope to the test point B.
2. Rotate each core of IF transformer L153 for maximum height and symmetrical response.

2.22 AM Frequency Range and Tracking Alignment

1. Set AM signal generator to 515 KHz. Turn the tuning capacitor fully closed (place the tuning pointer at the low end.) and adjust the oscillator coil L152 for maximum audio output.
2. Set the signal generator to 1650 KHz. Place the tuning pointer at the high frequency end and adjust the oscillator trimmer on the oscillator tuning capacitor for maximum audio output.
3. Repeat the step 1 and 2 until no further adjustment is necessary.
4. Set the receiver to a vacant spot around 600 KHz and tune the generator to the same frequency. Adjust the slug core of the AM ferrite rod antenna and RF coil L151 for maximum output, using the lowest workable output from the generator.
5. Set the generator to 1400 KHz and tune the receiver to the same frequency and adjust both trimming capacitors of Antenna and RF tuned circuit for maximum output.
6. Repeat the step 4 and 5 until no further adjustment is necessary.

Note: During tracking alignment reduce the signal generator output as necessary to avoid AGC action.

3. FM TUNER

The FM tuner section of the Model 125 is divided into four functional blocks: the FM Front End, the IF Amplifier and Detector, the Muting Control and the MPX Stereo Decoding Circuit.

FM signal from the antenna (see fig.19) is directed to antenna coil L101 through attenuator switch SU01 and balun coil LU01. Then the signal is amplified by H101, a dual gate MOSFET amplifier, filtered through the triple tuned Butterworth tuned tank circuits and applied to H102,a dual-gate MOSFET mixer. Here, the FM signal is mixed with a 700mV local oscillator output from H103 to develop a 10.7MHz intermediate frequency. This output is directed through shielded cable to the IF stages on circuit board P200.

The IF board contains 9 IF amplifiers, 5 limiters, one AGC amplifier, and 4 phase linear block filters. The limiters assure excellent capture ratio and good AM supression. The phase linear filters are employed to obtain high performance of the stereo multiplex characteristics.

Part of the IF output from the Front End is applied to AGC amplifier H201. H201's output is rectified by diodes H212 and H213 then, fed back to the second gate of the MOSFET amplifier H101.

Depending on the amount of negative feedback from the AGC amplifier, voltage at the second gate of H101 will vary from +3.0VDC (no signal) to -0.5 VDC (when there is a strong 100kμV FM input).

The amplified IF frequencies are directed to the detector input. Here, the audio frequencies are detected and applied to buffer amplifier H211 impedance matching to later stages. Output from H211 splits into 3 paths: Path (a) goes to the Phase Locked Loop multiplex Decoder, IC H301; path (b) goes to noise amplifier H304 through capacitor C335 and resistor R328; and path (c) goes to the Quadradial Jack on the rear panel through resistor R347.

3.1 MULTIPLEX STEREO DECODING CIRCUIT (PW BOARD P300).

The stereo composite signal from the buffer amplifier is directed through an RC network consisting of R302 and C301 (R302 is one of the separation adjustment potentiometer).Then the stereo composite signal is applied to the input terminal (pin 2) on the MPX IC (H301), for separation into the two stereo channels.

Pin 4 of the multiplex IC is the left channel output; pin 5 is the right channel output. The decoded left and right channel audio signals are directed through low pass filters composed of L301 ~ L304; C308 ~ C317. Here, undesirable residual switching signals are eliminated. Next, the signal passes through a de-emphasis network (R312, R313, C318 and C319) to the audio signal amplifiers contained in the muting system IC H302 (pins 10, 11). The signals are amplified; then pass to J316 and J317, the multiplex board outputs. From these jacks, the audio is routed through the function switch and OUTPUT LEVEL control R002 to output amplifiers H401 and H402, where the signals are amplified and directed to the output terminals. Figure 2 is a block diagram of the Phase Locked Loop IC, H301. The input stereo composite signal input is amplified by the audio amplifier, then delivered to phase detectors PD-1 and PD-2. Part of the stereo composite signal is also applied to the stereo decoder section.

The VCO (Voltage Control Oscillator) produces a free running 76KHz square wave. Its time constant is determined by capacitor C303 and resistors R304 and R305, which are connected externally to pin 14. The 76KHz VCO output is reduced to 19KHz by the two frequency dividers, DIV-1 and DIV-2. Then this internally produced 19KHz frequency is directed back to phase detector PD-1.

This is the "loop" in phase locked loop. The PLL chip is designed so that the free running 76KHz VCO output will lock in phase with the incoming 19KHz pilot only when the 19KHz from the 2nd divider and the stereo pilot are 90° out of phase. Any other phase relationship results in a DC error voltage which is extracted by low pass filter LP-1 and applied to the control terminal of the VCO. The error voltage forces the VCO to lock phase with the incoming pilot signal.

With phase locked, the 1st frequency divider (DIV-1) will produce a properly phased 38KHz switching frequency for stereo decoding.

Phase detector PD-2, low pass filter LPF-2 and a Schmitt trigger close the stereo switch and activate the stereo beacon when phase is locked. PD-2 differs from PD-1 in this important respect: when 19KHz pilot is present, and when phase is locked, it must produce maximum positive DC voltage, rather than zero volts DC to activate the trigger. The 19KHz frequency from the 2nd divider can't be used because it is 90 degrees out of phase with respect to the incoming pilot signal during the phase lock condition. Therefore, a 3rd divider (DIV-3) is employed to develop an in-phase 19KHz signal from the 38KHz output of DIV-2.

19KHz from this 3rd divider is mixed with stereo pilot at PD-2. A low pass filter extracts the DC component which is of sufficient amplitude to activate the trigger when phase is locked. The trigger turns on the stereo beacon and closes the stereo switch. Now 38KHz can be applied to the audio signal composite for separation into the left and right stereo channels.

Switching from stereo to mono is performed by turning on transistor H306. It grounds the stereo switch (Pin 8) whenever FM signal drops below the level determined by the muting control setting. H306 is also turned on by depressing the MONO switch.

Transistor H303 controls the 76KHz VCO in the IC(Pin 14). When the FUNCTION switch is set to AM, H303 turns on, grounding out the 76KHz VCO frequency to prevent it from interfering with AM reception.

3.2 AUDIO MUTING AND STEREO MODE AUTO-SELECTION CIRCUITS

The muting circuit used for Model 125 consists of a muting system IC, noise amplifier transistor H304, Invertor transistor H305 and a gating circuit composed of transistors H308 and H309.

Three inputs control the muting function. The first is related to signal strength, the second to the noise condition at the detector and the third is derived from the DC component of the detector output. These inputs are properly matrixed and gated to provide muting free from noise and transients.

The first input is DC voltage obtained by rectifying part of the IF signal output. It is fed to pin 6 of muting IC H302 through the gating circuit (H308 and H309). Pin 6 is connected internally to the base of the muting driver transistor Q19 through the IC's "Schmitt trigger and AND" circuit.

The collector of transistor Q19 is connected to pin 5 and pin 2 of IC H302 through the Muting Level Control Switch (S002), R319 and R316. Pin 2 is connected to muting switch transistors Q23 (for L channel) and Q22 (for R channel) in the IC. The collectors of the muting switch transistors are connected to pin 1 and pin 3 respectively. These pins are connected to left and right channel ouputs of MPX stereo decoding IC(H301) through the low pass filters. The output from the MPX stereo decoding IC (H301) is also directed to input pins 10 (L channel) and 11 (R channel) of the muting system IC. These pins are connected to the IC's built-in audio signal amplifiers, where the signal is amplified 20 dB. Pin 13 and pin 14 are the left and right channel signal outputs on muting IC H302.

Normally, the IF signal output is above the muting threshold level set by the Muting Level Control Switch, S002. The DC voltage that is obtained by rectifying this IF signal sample is directed through the trigger voltage rectifying circuit (H308, H309) to pin 6, turning on transistor Q19 in the IC. When Q19 is turned On, its collector potential drops, turning off muting switch transistors Q22 and Q23. Therefore, the output of the MPX stereo decoding IC is not grounded out, but instead passes through the low pass filter and the de-emphasis circuit to pins 10 and 11 of the muting sytem IC. The signal is amplified by the audio signal amplifiers and directed to pins 14 and 13, the audio outputs.

If IF signal output drops below the muting threshold, transistor Q19 shuts OFF. Its collector voltage (voltage of pin 5) rises to the B+ voltage level (12 VDC), turning on Q22 and Q23. These transistors ground the audio output of the MPX stereo decoding IC (H301).

The second muting input-high frequency noise is derived from the output of the detector. It protects the muting circuit and MPX stereo beacon lamps from misoperation due to undesirable noises. Any high frequency noise present in the detected audio passes through a small capacitor, C335; then is amplified by noise amplifier transistor H304. Diodes H310 and H311 rectify the output of H304. This rectified output is proportional to the noise components in the detector output.

When there is excessive noise in the audio signal (such as the noise caused by tuning the unit off-station), the rectified DC output turns on transistor H305 which conducts, activating the muting circuit through pin 6. This prevents audio from reaching the audio amplifier inputs on the muting IC.

The third muting input comes from J210 and J213 of the FM discriminator. It is applied to J318 and J319 of the P300 circuit board; then to pins 8 and 9 of H302. The inputs consist of reverse polarity "S" curves from the discriminator. When an FM station is tuned in perfectly, these S curves will have a DC component of 0 volts. Whenever the station is mistuned so the DC component of either "S" curve rises above 0.25 VDC the OPTIMUM SYNCHRONIZATION DETECTOR within the muting IC turns Q19 OFF. This turns Q22 and Q23 ON, grounding the audio signal.

When the mono switch is in stereo position, pin 5 of the muting IC is connected to the base of transistor H306. Whenever signal strength drops below the threshold set by the muting control, pin 5's voltage rises, turning on H306, which defeats the stereo switch. Now, only mono FM will pass to the output Jack J005.

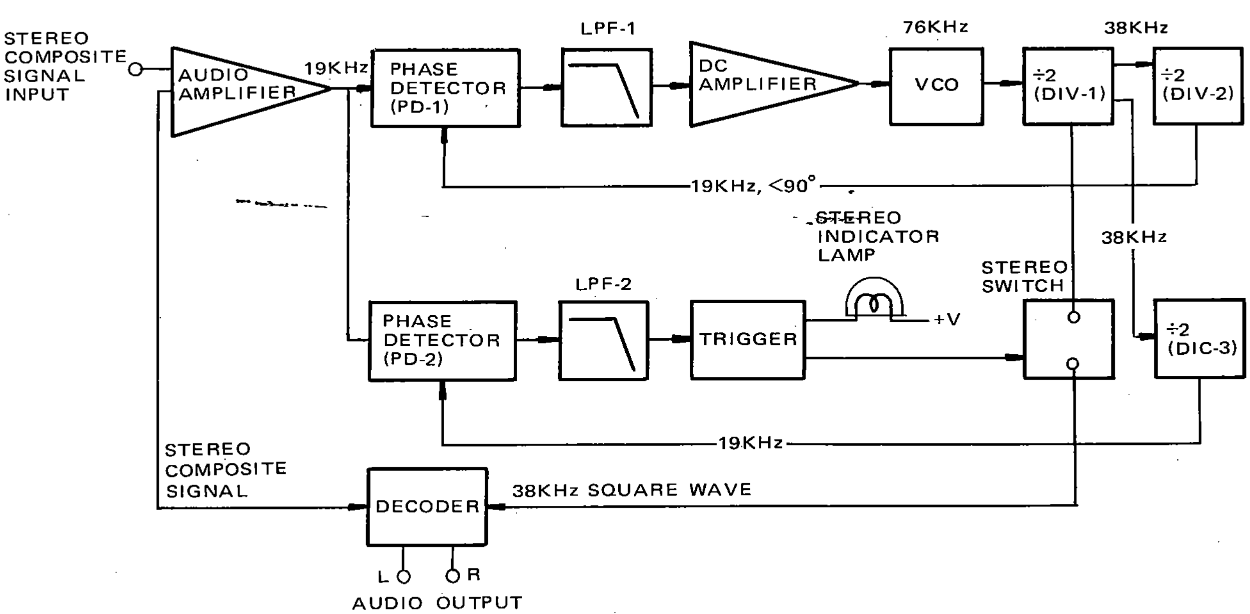

Figure 1. Block Diagram: Phase Locked LOOP IC H301

6. TEST EQUIPMENT REQUIRED FOR SERVICING

Table 1 lists the test equipment required for servicing the Model 125 Tuner.

Item	Manufacturer and Model No.	Use
AM Signal Generator		Signal source for AM alignment.
Test Loop		Used with AM Signal generator.
FM Signal Generator	Less than 0.2% distortion.	Signal source for FM alignment.
Stereo Modulator	Less than 0.2% distortion.	Stereo separation alignment and trouble shooting.
Frequency Counter		MPX oscillator Adjustment (VCO).
Audio Oscillator	Weston Model CVO-100P, less than 0.02% residual distortion is required.	Sinewave and squarewaves signal source.
Oscilloscope	High sensitivity with DC horizontal and vertical amplifiers.	Waveform analysis and trouble shooting.
VTVM	With AC, DC, RF range.	Voltage measurements.
Circuit Tester		Trouble shooting.

Figure 2. Test Equipment Required for Servicing

SYMPTOM: TOTAL OR PARTIAL LOSS OF STEREO SEPARATION

First, measure separation. Total separation loss could be caused by:

1. Sticking Mono Control
2. Shorted Stereo-Mono Switching transistor (H306).
3. Open resistor R337.
4. Defective Muting Control Circuit Board (PW01)
5. No Vcc voltage to IC's H301, H302.
6. Defective capacitor C306.
7. Defective Selector Switch PS01.

Partial Separation Loss could be caused by misaligned spearation controls.

SEPARATION ADJUSTMENT:

1. Connect tuner to FM antenna. Tune to vacant spot between stations around 98MHz.
2. Replace antenna leads with FM signal generator leads. Inject a 1000uV FM signal modulated by 1KHz. Match FM frequencies until the tuning meter needle is centered.
3. Turn off audio modulation from the signal generator and connect a frequency counter to test point (R311). Adjust R304 until the frequency generator reads exactly 19KHz.
4. Modulate the FM signal with L channel signal only; then add 9% stereo pilot.
5. Adjust trimmer resistor R302 for maximum left-to-right channel separation.
6. Repeat steps 4 and 5 while injecting R channel signal only. Right-to-left channel separation should match left-to-right channel separation. Adjust R302 until it does.

SYMPTOM: POOR FM SENSITIVITY

First measure IHF usable sensitivity. If it is extremely poor-1000uV for example there is usually a defective component or a cold solder joint in the front end or IF section.

When usable sensitivity is only slightly below specification, the front end might be misaligned. Proper FM alignment requires a screen room and special testing equipment for optimum results. However, here is a good procedure which requires only an FM signal generator and a distortion analyzer.

SYMPTOM: EXCESSIVE DISTORTION

Measure Total Harmonic Distortion. A defective discriminator transformer or discriminator component is the chief cause of high distortion in FM tuners. Naturally, the Front End and IF semi-conductors, as well as the possibility of cold solder joints should be checked out. But check the discriminator stage first.

When THD is only slightly below specification; the front end and/or discriminator might require realignment.

SENSITIVITY AND DISTORTION – FRONT END ALIGNMENT:

1. Connect an FM antenna to the antenna inputs; a distortion analyzer to the output.
2. Tune the tuner to a vacant spot between stations at the low frequency end of the dial. Replace antenna with an FM signal generator. Adjust FM generator to same frequency, centering the tuning meter needle. Decrease signal generator output until the audio output level decreases with decreasing generator output, (Just below limiting). Modulated 100% by 400Hz audio.
3. Working from antenna to output, adjust antenna coil L101 RF coils L102, L103, L104 and IF transformer L106 for minimum distortion.
4. Tune to a vacant spot at the high frequency end of the dial. Adjust FM generator to same frequency, centering the tuning meter needle.
5. Working from antenna to output, adjust capacitors C101, C102, C103 and C104 for minimum distortion.
6. Repeat hi and low end adjustments until sensitivity and distortion are optimized.

DISTORTION – DISCRIMINATOR ALIGNMENT:

1. Connect FM signal generator to antenna inputs; a distortion analyzer to the output.
2. Tune the tuner to a vacant spot around 98MHz. With no signal applied, adjust the secondary (upper) core of discriminator transformer L201 until the tuning meter needle is centered.
3. With a 1000uV signal applied at the same frequency, and meter centered, adjust the primary core (lower) for minimum distortion.

NO FM OUTPUT

Connect unit to an antenna, audio amplifier and speakers. Switch to AM. If there is still no output, check H401 and H402, the audio pre-amps.

If There is AM Output, switch to FM and try tuning in an FM station. If the tuning meter needle won't deflect, the trouble is in the Front End (P100) or IF section (P200 Board). Check both boards for proper supply voltage and check their semi-conductors for proper DC operating voltages.

If the tuning meter will deflect when FM stations are tuned in, the trouble is in the discriminator or muting circuits. Inject a 400Hz audio at J303 in the P300 Board. If it is heard through the loud-speakers, the P300 Board is OK, and the trouble is in the discriminator circuit. Check discriminator transformer L201 and the semi-conductors.

If signal injection proves the P300 board is defective, check for proper voltage at the pins of the muting IC H302. It might be grounding audio signal constantly. If any voltage reading differs greatly from the schematic voltage, check and outboard components connected to the IC pin. If they're OK, replace the IC.

Sometimes, signal injection is the best troubleshooting approach. It requires an audio oscillator, FM signal generator and an 10.7MHz sweep generator. Test signals to be injected into the various inputs are:

Front End: 1000uV FM carrier 100% modulated by 400Hz audio at antenna inputs.

IF Amps: 10.7MHz 100% modulated by 400Hz audio at J201. (Short local oscillator output at local oscillator capacitor C115).

Discriminator: Increase 10.7MHz signal level and inject it at the base of H210.

Multiplex Section: Inject 400Hz audio at J303.

MISCELLANEOUS ADJUSTMENTS

SIGNAL STRENGTH METER ADJUSTMENT:

1. Connect an FM signal generator to the antenna inputs. Tune the tuner to a vacant spot between stations around 98MHz. Then tune the FM generator to match frequencies. Generator output should be 100,000 microvolts.
2. Adjust R340 on the multiplex board until the signal strength meter reads 90% of full scale deflection.

MUTING LEVEL/STEREO THRESHOLD LEVEL ADJUSTMENT:

1. Connect tuner to an FM antenna. Tune to vacant spot between stations around 98MHz.
2. Replace antenna with an FM generator. Modulate FM signal with 1000Hz audio, 100%. Match FM frequencies until tuning meter needle is centered. Set signal strength at 150 microvolts.
3. Switch MUTING LEVEL CONTROL on tuner to HIGH. Adjust RW03 until audio is just above muting threshold.
4. Decrease FM generator signal strength to 30 microvolts. Switch MUTING LEVEL CONTROL to MID. Adjust RW04 until audio is just above muting threshold.
5. Remove 1KHz modulation and adjust output to 12.5uV. Add 9.0% stereo pilot. Switch MUTING LEVEL CONTROL to OFF. Adjust RW05 until stereo beacon just lights up.

FM DOLBY LEVEL ADJUSTMENT:

1. Connect tuner to FM antenna. Connect AC VTVM to tuner output. Tune the tuner to vacant spot between stations around 98MHz.
2. Replace antenna with an FM signal generator. Match frequencies until tuning meter needle is centered. Inject a 1000 microvolt FM signal mono modulated 50% by 400Hz audio.
3. Depress FM DOLBY push switch. Adjust RW01 and RW02 for 580mV output at left channel and right channel tuner outputs.

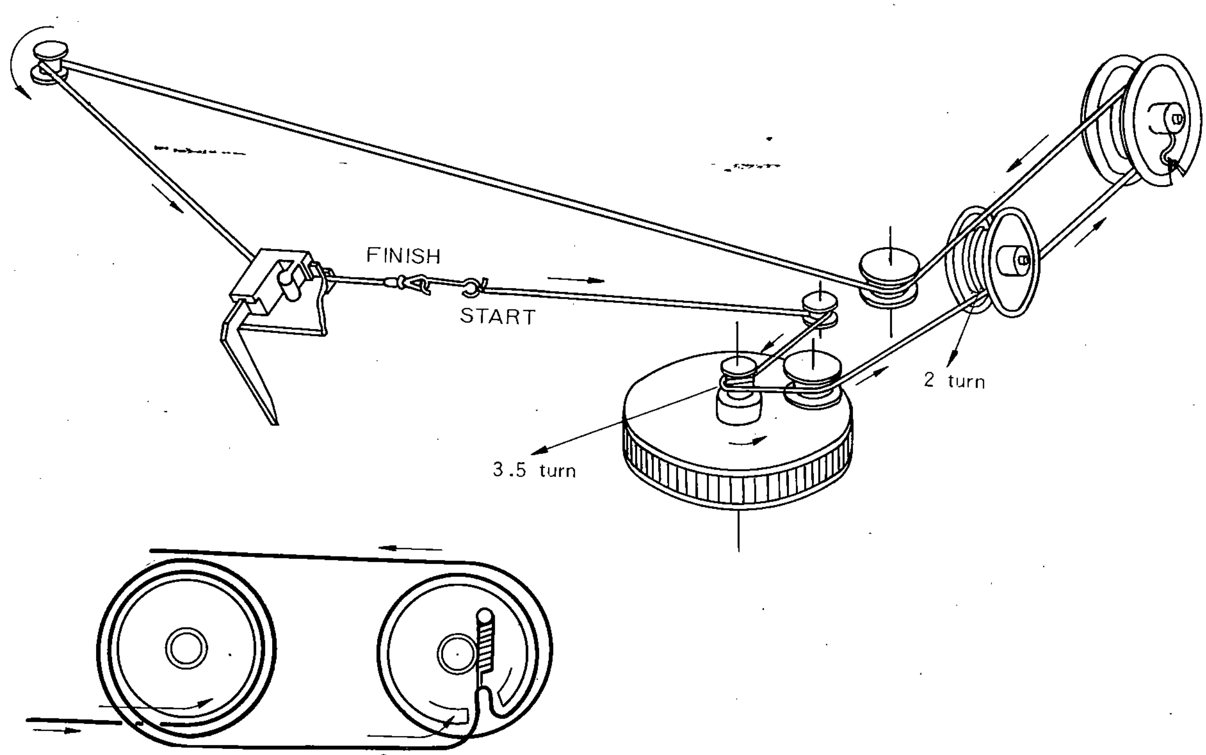

Figure 3. Dial Stringing

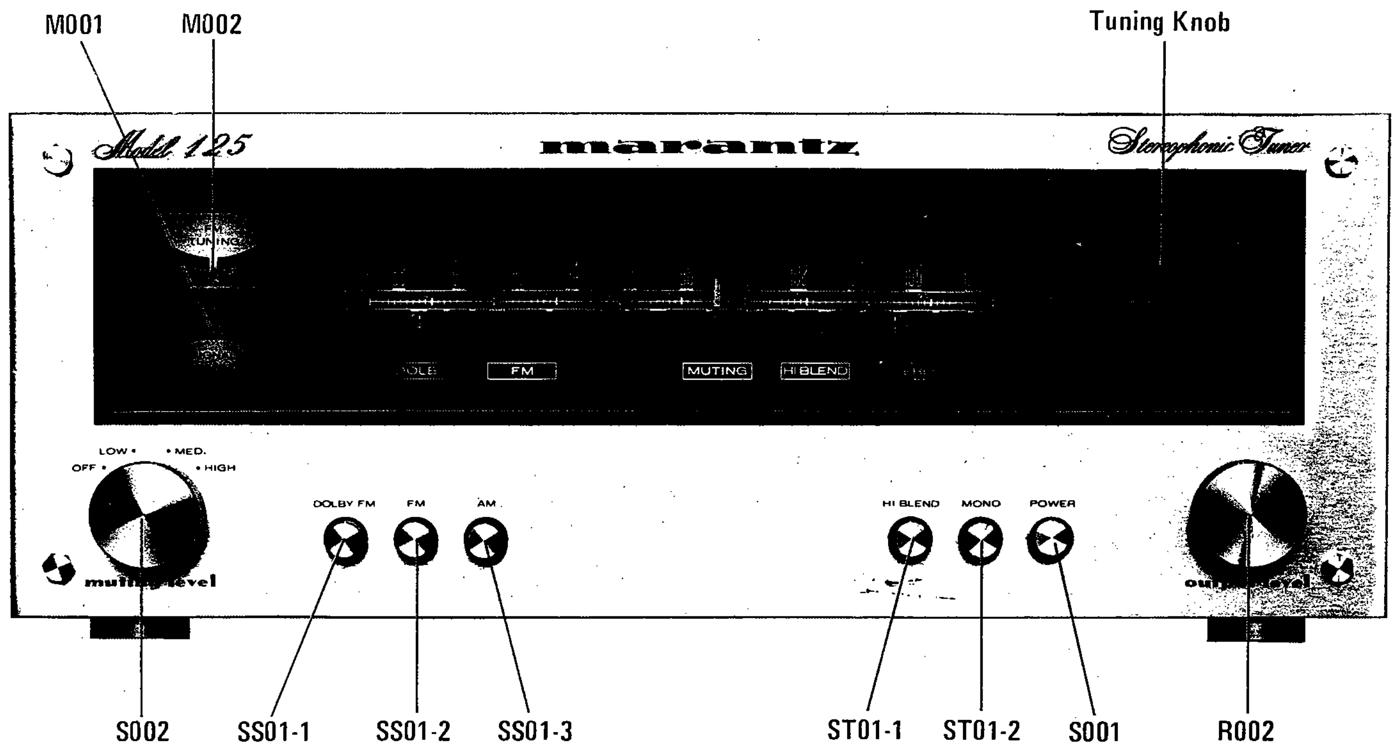

Figure 4. Front Panel Adjustment and Component Locations

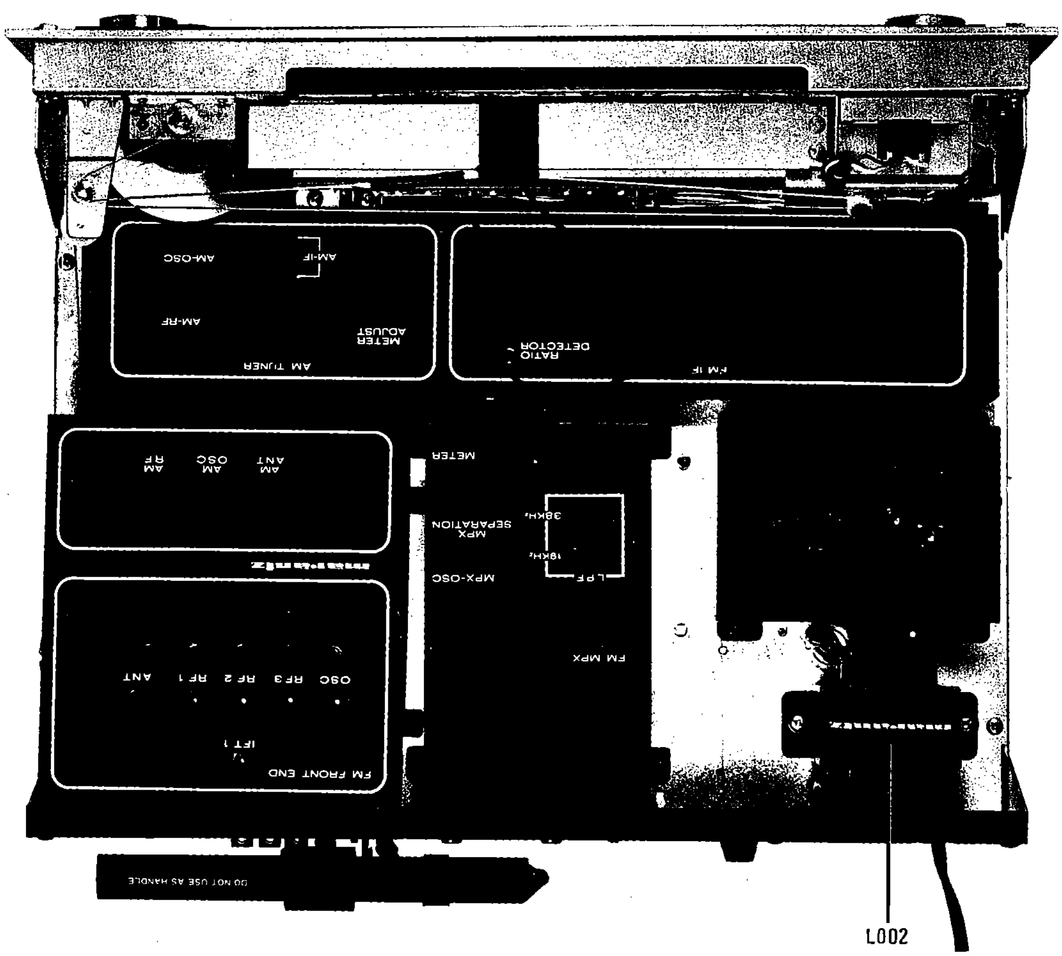

Figure 5. Main Chassis Component Locations (Top View)

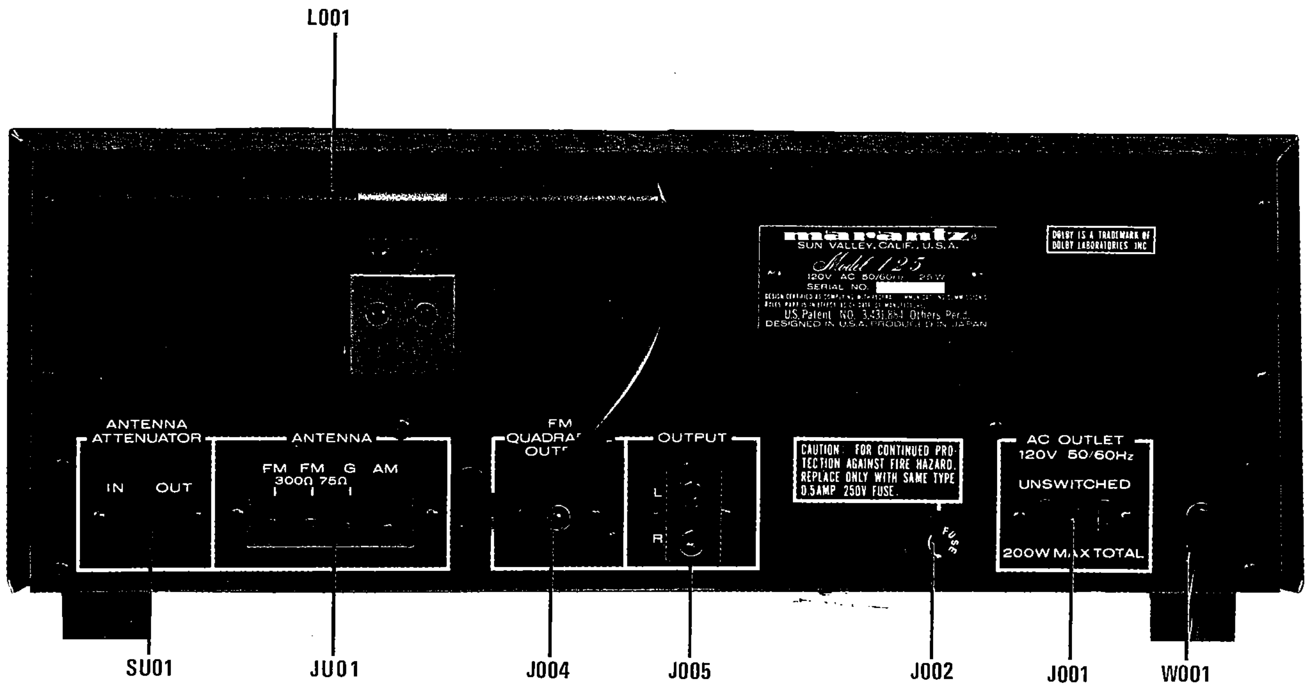

Figure 6. Rear Panel Adjustment and Component Locations

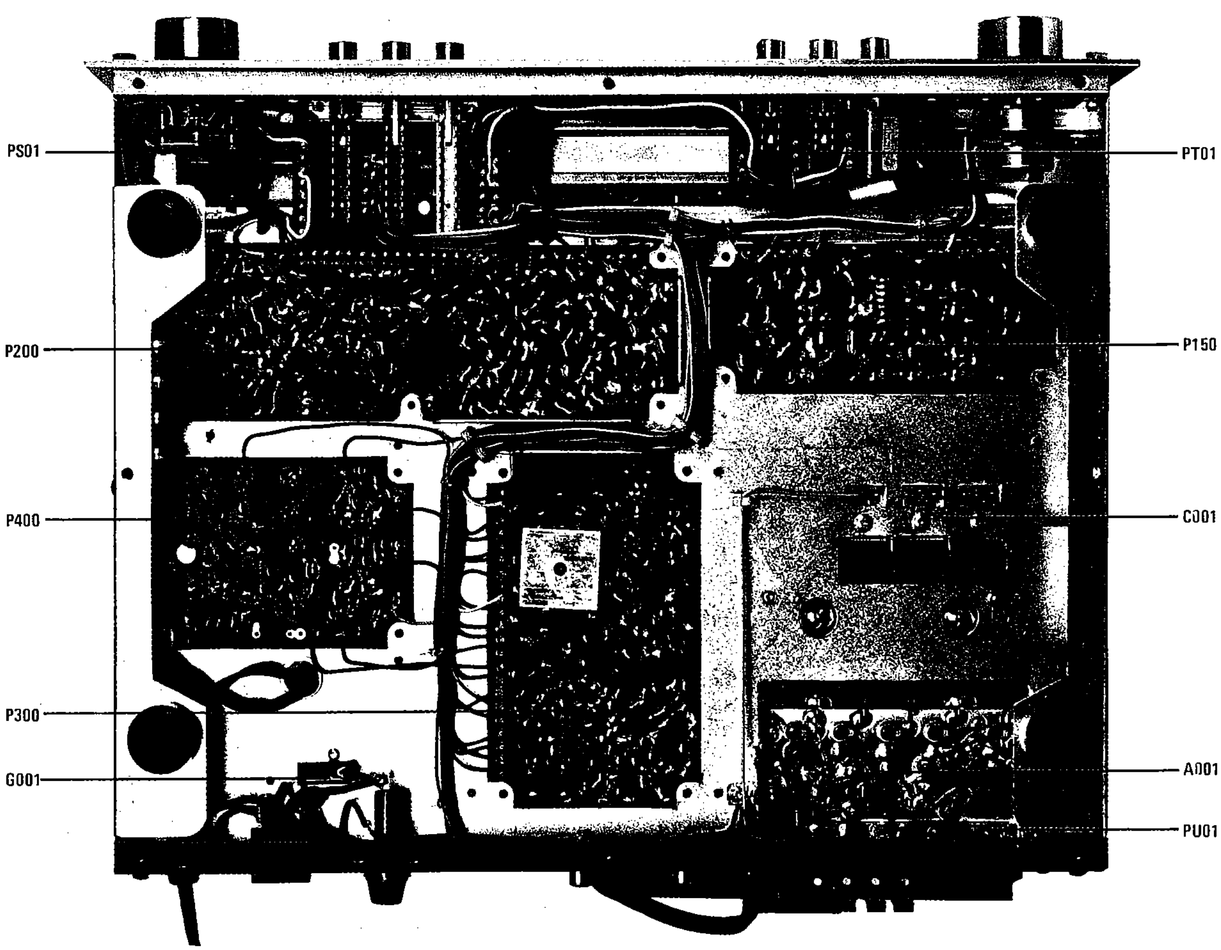

Figure 7. Main Chassis Component Locations (Bottom View)