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MAR 28 REC'D

SERVICE MANUAL



marantz

model 2240

Stereophonic Receiver

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INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service information for Marantz Model 2240 Stereo-phonics Receiver.

Service 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 the operation in the receiver.

The parts list furnishes information by which replacement parts may be ordered from the Marantz Company. A simple description is included for parts which can usually be obtained through local suppliers.

1. SERVICE NOTES

As can be seen from the circuit diagram the chassis of Model 2240 consists of the following units. Each unit mounted on a printed circuit board is described within the square enclosed by a bold dotted line on the circuit diagram.

1. FM Front End	Mounted on P.W. Board, P100
2. AM Tuner	Mounted on P.W. Board, P150
3. FM - IF	Mounted on P.W. Board, P200
4. MPX	Mounted on P.W. Board, P300
5. ANT-ATT. Muting UR	Mounted on P.W. Board, PU01
6. Dolby Level	Mounted on P.W. Board, PC01
7. Phono Amp	Mounted on P.W. Board, P400
8. Dial Lamp	Mounted on P.W. Board, PZ01
9. Monitor, SW	Mounted on P.W. Board, PT01
10. Function Lamp	Mounted on P.W. Board, PY01
11. Pre Tone Amp.	Mounted on P.W. Board, PE01
12. Filter, SP SW	Mounted on P.W. Board, PH01
13. Power Amp	Mounted on P.W. Board, P700
14. Power Supply	Mounted on P.W. Board, P800

2. AM TUNER

The AM TUNER portion of the 2240 is composed of one IC circuit (including RF amplifier, local oscillator, mixer, IF amplifier, and detector) and three transistors. One of them is a signal strength indication amplifier, while the other two are amplifiers for detected audio signals.

All components except Tuning capacitor and ferrite bar antenna are mounted on a printed circuit board P150.

The AM signals induced in a ferrite bar antenna are applied to the input of RF amplifier (pin 12) and amplified to the level required for overcoming the conversion noises, thus giving good S/N performance. The tuned circuits inserted in both output and input circuit of RF amplifier assure very high image and spurious rejection performance.

Thus amplified and selected AM signals are then applied to one input of Mixer section (pin 1). While the local oscillator voltage is injected to the other input of the section (pin 16) through a capacitor C157. Then both AM signals and oscillating voltage are mixed and converted into 455 KHz intermediate frequency. The resulting IF signal is applied to the IF transformer L153 consisting of one ceramic filter and two tuned circuits.

The output of L153 is led to the IF amplifier's input (pin 9) through a coupling capacitor C162 and amplified to the sufficient level to drive the detector. The detected audio signal derived from pin 7 is filtered and amplified and final audio output is obtained from the collector of H153 and applied to the TAPE OUTPUT jacks through the function switch.

3. FM TUNER

The FM Tuner section of Model 2240 is divided into four functional blocks: FM Front End, IF Amplifier and Detector, Muting Control, and MPX Stereo Decoding Circuit. FM signals induced by a FM antenna are led to FM antenna coil L101 through a balun coil. These signals are then applied to the FET RF amplifier which in turn applies its output to the next FET Mixer H102 through the double tuned high selective circuits. The FET Mixer convert its input signal into 10.7 MHz intermediate frequency and amplifies it at the same time. The H103 is a local oscillator and its output is injected into the source of the FET Mixer, the injection voltage is about 700 mV. The 10.7 MHz front end output is led to the next IF amplifier unit through a coaxial cable.

The IF amplifier unit consists of five stages of IF amplifier and one stage of AGC amplifier. Three pieces of dual elements ceramic filters are also used to obtain high selectivity, four stages of symmetrical diode limiters are also employed for the best limiting characteristics, improved capture ratio and good AM suppression.

A part of FM Front End output is applied to the AGC amplifier H201 and its rectified output is fed back to the gate of FET RF amplifier to decrease the gain with increased signal strength.

The IF signal sufficiently amplified through every stage of IF amplifier is finally applied to the detector amplifier. The detected audio output is led to the buffer amplifier H208 and its buffered output is led to; (a) noise amplifier H310 through resistor R378 and capacitor C333, (b) QUADRADIAL jack on the rear panel through resistor R379, (c) MPX stereo decoding IC (H321) through R301 and H301.

3.1 Audio Muting and Stereo Mode Auto-Selecting Circuit

The muting circuit consisting of all solid-state electrical switching has been incorporated in the Model 2240. 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 of DC voltage obtained by rectifying a part of IF output signal from the H205 and H206 is applied to the base of H308 and turns on it, if the IF output is greater than predetermined level (muting threshold level). When the H308 is turned on the H309 is turned off, allowing the emitter-collector resistance increasing and the collector voltage rises about 9V. The increased collector voltage increases the gate bias voltage and turns on the switching FET H301, decreasing the source-drain resistance to near zero ohm and allowing the audio signal applied to the source to flow to the pin 2 of decoding IC through the source-drain path.

When the input signal is lower than predetermined level, the DC output obtained is small and can not turn on the H308 thus the H308 keeps its turn-off stage and this makes H309 turn on, decreasing the collector voltage and turning off H301. Thus no audio signals can pass through the FET. This is the fundamental principle of the muting operation but for more elaborate muting operation the second and the third inputs are necessary.

The second input is used to protect the muting operation and MPX stereo beacon lamps from misoperation due to undesirable noises. The high frequency noises included in the detected audio signals are separated by a small capacitor C333 and amplified by the noise amplifier transistor H310 and its output is rectified by the two diodes. The rectified DC output is proportional to the noise components in the audio signals.

When there are excessive noises in the audio signals such as obtained with a station incorrectly tuned in, the rectified DC output turns on the transistor H311, decreasing the emitter-collector resistance to zero. This means the collector of H309 is short-circuited to the ground, therefore the H301 is turned off and any audio signals having excessive high frequency noises can not go through the FET's source-drain path.

The transistor H317, also, turns off when transistor H309 or H311 turns on, and turns on the transistor H303 connected to pin 8 of the MPX stereo decoding IC. Pin 8 is therefore grounded equivalently to set the IC in the monaural mode of operation. This prevents misoperation due to undesirable noises when the FM tuner is out of tuning.

The third input is obtained from the FM discriminator circuit. The DC output so called "S" curve is applied to the gate of H312 through a resistor R273 and dividing network (R361 & R362). The DC output is zero with a station correctly tuned in, but will vary from negative to positive values or vice versa when the tuning point is deviated toward either plus or minus frequency from the correct tuning frequency.

When the DC output is increased to a greater level than that of predetermined, the increased source potential of H312 makes the transistor H315 turn on (this means the collector of H309 is short-circuited to the ground) ... H301 turn off, ... H317 turn off ... H303 turn on (This grounds pin 8 of the MPX stereo decoding IC, therefore the decoder is set in the monaural mode of operation and the stereo indicator lamp turns off). When the DC output is increased to the negative predetermined level, the decreased source potential turns off the H313 which in turn makes the H314 turn on (this means the collector of H309 is short-circuited to the ground). The subsequent changes are exactly the same as that just described above.

Thus when the tuning is shifted-or-deviated to the certain frequencies in which undesirable noisy side-audio signals are produced, both muting and MONAURAL/STEREO switching transistors H303 are operated automatically and open the circuits.

With the station correctly tuned in, the bias current of the FET H312 is adjusted so that both transistor H314 and H315 are not turned on, giving no effect on the transistor H308.

3.2 MPX Stereo Decoding Circuit

The stereo composite signal from the buffer amplifier undergoes a phase compensation by R301 and C301, is applied through the muting switching FET H301 to the input terminal, pin 2, of the MPX stereo decoding IC H321 on a PLL (Phase Locked Loop) basis, and decoded into the left and right stereo signals, which become available at pins 4 and 5 respectively. These decoded left and right stereo audio signals are introduced through a low pass filter composed of L301 to L304 and C311 to C320 for elimination of undesirable residual switching signal and through a de-emphasis network consisting of R325, R326, C321 and C322, into the npn-pnp direct coupled audio amplifier, where the signals are amplified to a required level for the output from J311 and J313. From these jacks, the audio signals are led to the TAPE OUTPUT jacks through the function switch. Figure 1 presents an internal block diagram showing the functions of the PLL basis MPX stereo decoding IC HA1156. The input stereo composite signal, amplified by the audio amplifier, is delivered to the phase detectors PD-1 and PD-2. A part of the stereo composite signal is also applied to the stereo decoder section. The VCO (Voltage Control Oscillator) produces a free run oscillation in the neighborhood of 76 KHz with the time constant determined by a capacitor C305 and resistors R311 and R312 set on the outside of pin 14. The VCO output has its frequency divided into 10 KHz through the two stages of the frequency divider (DIV-1 & DIV-2), and is reverted to the phase detector PD-1, which contains two input terminals designed to produce an output in proportion to the product of the two input signals. The signal applied to one of the inputs of PD-1 is the 19 KHz square wave formed through frequency division of the 76 KHz VCO output signal by the two stages of the frequency divider DIV-1 and DIV-2, and the 19 KHz pilot signal included in the stereo composite signal as a reference signal is applied to the other input. Therefore, the output of PD-1 which has passed through the low pass filter LPF-1 provides DC output voltage in proportion to the phase variance between the two inputs. This DC output voltage is amplified by the DC amplifier, and supplied to the 76 KHz VCO as a control voltage. This means that the output frequency and phase of the VCO have been phase-locked to the input pilot signal. The 38 KHz sub-carrier reproduced by PLL as stated above is delivered through the stereo switch to the stereo decoder section as a switching signal, thus driving the decoder section. One of the

inputs of PD-2 is given the 19 KHz resulting from the frequency division completed by DIV-1 and DIV-3, whereas the other input gets the 19 KHz output contained in the composite signal, and the output is provided with a DC output in proportion to the amplitude of the pilot signal. This DC output is furnished through LPF-2 to the trigger amplifier which drives the stereo indicator lamp and stereo switch. Therefore, insufficient supply of the pilot signal results in failure to light the stereo indicator and to turn on the stereo switch located in the path of the 38 KHz switching signal, thereby avoiding a wrong stereo operation. H303 attached on the outside of pin 8 is a switching transistor for automatic monaural-stereo switchover. When the intensity of an incoming signal from an FM station is weaker than a predetermined level, this H303 is turned on and pin 8 is grounded, thereby developing a condition for monaural reception. For a forced monaural operation, switch the MODE switch to "MONO", and H303 comes into an "On" condition with the positive bias voltage applied to the base, and pin 8 is grounded, thereby establishing monaural operation. The transistor H302 connected externally to pin 14 is intended to stop the 76 KHz oscillation of the VCO which interferes an AM signal during the reception of an AM station. When the function switch is set to "AM" position, a positive bias is charged on the base of H302, H302 is turned on, and pin 14 is grounded. Thus, the oscillation of the VCO is stopped, ending the interference with AM reception.

3.3 Suggestion for Trouble Shooting of FM Tuner

3.3.1 Symptom: No FM Reception

First turn on the power switch and try to tune FM stations. Rotate the fly-wheel tuning knob slowly and observe the FM signal strength meter. If the signal strength meter deflects at several frequencies received, the tuner circuits preceding the discriminator circuit may have no failure. When no reading is obtained in the meter, check FM local oscillator circuit, using a RF VTVM. The normal local oscillator voltage is one or two volts (rms) at the tuning capacitor, depending on the tuning capacitor position. If the local oscillator voltage is normal, next check all voltage distribution in the FM Front End and IF amplifier unit and compare them with those shown in the circuit diagram. When signal strength meter deflects but no sound is obtained, check audio circuits, using high sensitive oscilloscope.

3.3.2 Symptom: No Stereo Separation

First check the "MONO" switch is in normal out position. Connect a FM RF signal generator output modulated by a stereo-modulator to the rear FM ANTENNA terminals, and check the stereo beacon is turned on or not. If not turned on, check for 19 KHz VCO output signal (J310), using an oscilloscope and a frequency counter.

4. PHONO AND TONE AMPLIFIERS

Signals from the PHONO jacks are applied to the phono amplifier mounted on P400. The amplified and RIAA equalized phono signals and signals from the tuner section, AUX and TAPE MONITOR IN jacks are applied to the SELECTOR switch.

All signals selected by the SELECTOR switch (S001) are let to the balance and volume controls through the MONO switch.

Signals properly attenuated by the volume control are applied to the tone amplifier and subjected to the tone control networks such as bass, mid, treble control and high and low cut filters.

Thus controlled audio signals are then led to the PRE OUT jacks on the rear panel.

5. POWER AMPLIFIER

Differential amplifier consists of the transistors H702 and H703 to provide satisfactory D.C. stability.

The transistor H707 drives the inverter transistors H714 and H715 which, in turn, drive the power stage consisting of H001 and H002. Transistors H710 and H711 are current limiter

operating as a power transistor protection circuit.

Excessive current flow in the power output stage is detected by the resistors R725 and R726 and the resultant variation is applied to the transistors H710 and H711 and make them turned on. This decreases the base biasing current for H714 and H715. In this way the current flow in the power output stage (H001 and H002) is restricted within a safe predetermined value.

6. POWER SUPPLY UNIT

The power supply unit consisting of transistors H801, H802 and H803, which operates as an automatic voltage regulator provides +35V DC to all of the audio amplifiers except power amplifiers, and H804 which operates as the voltage regulator provides +14V DC to the tuner section, and H805, H806 and H807 which operates as the speaker protector to relay circuit.

7. SPEAKER PROTECTOR RELAY CIRCUIT

The speaker protection circuit consisting of H808, H809, H810, etc protects the speaker systems against any loud "pop" sound developed. This circuit is so designed that no sound is heard for the first three or five seconds after the power switch is turned on by the time constant circuit consisting of C809 and R813. This circuit also protects the speaker systems against some troubles due to DC off balance between the speaker system terminals by instantly operating the relay and cut off the speaker systems from the circuit. When DC off balance voltage (positive) is developed between speaker terminals by possible defects such as broken power transistor, short-circuits, or broken potentiometer R707, as the base of H805 is connected to the speaker terminal, the transistor H805 is turned on by this offset voltage developed and this makes the transistor H806 and H807 turns off, thus cutting off the relay and disconnecting the speaker from the output circuit. When negative offset voltage is developed, this voltage directly turns off the H806 and H807, thus speaker is cut off from the circuit and protected.

The circuit also protects the speaker systems from the possible damage when the amplifier is over-driven by very low frequencies such as 7 or lower cycles.

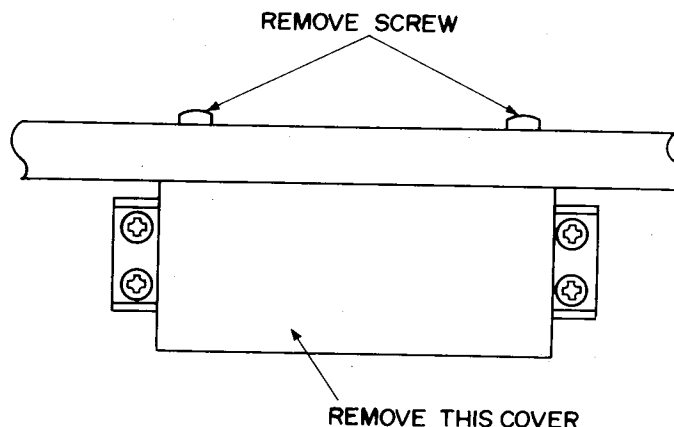


Figure 2. Remove the Terminal Cover

8. SUGGESTIONS FOR TROUBLE SHOOTING OF POWER AMPLIFIER

8.1 Excessive Line Consumption

- a. Check for shorted rectifiers H007, also check C004 and C005.
- b. Check for shorted transistors H714 and H715, H001 and H002, or check H005 and H006. Check for open control R719. Check L004 for short.

CAUTION: BECAUSE THE DRIVER AND OUTPUT STAGES ARE DIRECT COUPLED COMPONENTS MAY FAIL AS A DIRECT RESULT OF AN INITIAL COMPONENT FAILURE. IF A SHORTED TRANSISTOR OR ZENER DIODE IS FOUND, OR CONTROL OR BIAS DIODE, BE SURE TO CHECK THE REMAINING DRIVER AND OUTPUT COMPONENTS FOR SHORT OR OPEN CIRCUIT BEFORE RE-ENERGIZING THE AMPLIFIER.

8.2 No Line Consumption or Zero Bias

- a. Check line cord, fuse, transistors H001, H002, H003 and H004, bias diode H005 and H006.
- b. Check for open rectifier H007, or open L004.

8.3 No DC Balance

- a. Check R707 and Zener diodes H701 and H704.

10. TEST EQUIPMENT REQUIRED FOR SERVICING

Table 1 lists the test equipment required for servicing the Model 2240 Receiver.

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 0.3% distortion	Signal source for FM alignment.
Stereo Modulator	Less than 0.3% 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 squarewave signal source.
Oscilloscope	High sensitivity with DC horizontal and vertical amplifiers.	Waveform analysis and trouble shooting and ASO alignment.
VTVM	With AC, DC, RF range	Voltage measurements.
Circuit Tester		Trouble shooting.
AC Wattmeter	Simpson, Model 390	Monitors primary power to Amplifier.
AC Ammeter	Commercial Grade (1-10A)	Monitors amplifier output under short circuit condition.
Line Voltmeter	Commercial Grade (0-150V AC)	Monitors potential of primary power to amplifier.
Variable Autotransformer (0-140V AC, 10 amps)	Powerstat, Model 116B	Adjusts level of primary power to amplifier.
Shorting Plug	Use phono plug with 600 ohm across center pin and shell.	Shorts amplifier input to eliminate noise pickup.
Output Load (8 ohms, $\pm 1\%$ 100W)	Commercial Grade	Provides 8-ohm load for amplifier output termination.
Output Load (4 ohms, $\pm 1\%$ 100W)	Commercial Grade	Provides 4-ohm load for amplifier output termination.

Table 1. Test Equipment Required for Servicing

11. AM ALIGNMENT PROCEDURE

11.1 AM IF Alignment

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

11.2 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 in 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 generator to 600 KHz and tune the receiver to the same frequency and adjust a slug core of AM ferrite rod antenna and RF coil L151 for maximum output.
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.

11.3 AM Signal Strength Meter Alignment

Set an AM signal generator to 1000 KHz at 5 K μ V, and adjust R178 so that the signal strength meter may read 90% of the full scale.

12. AM ALIGNMENT PROCEDURE

1. Connect a FM signal generator to the FM ANTENNA terminals and a oscilloscope and an audio distortion analyzer to the TAPE OUTPUT jacks on the rear panel.
2. Set the FM SG to 87 MHz and provide about 3 to 5 μ V. Place the tuning pointer at the low frequency end by rotating the tuning knob and adjust the core of oscillator coil L104 to obtain maximum audio output.
3. Set the FM SG to 109 MHz and provide about 3 to 5 μ V output. Rotate the tuning knob and place the tuning pointer at the high frequency end and adjust the trimming capacitor C106 for maximum output.
4. Repeat the step 2 and 3 until no further adjustment is necessary.
5. Set the FM SG to 90 MHz and tune the receiver to the same frequency. Decrease signal generator output until the audio output level decreases with the decreasing generator output. Adjust the antenna coil L101, RF coil L102 and L103 and IF transformer L105 for minimum audio distortion.
6. Set the FM SG to 106 MHz and tune the receiver to the same frequency. Adjust the trimming capacitor C102, C104 and C105 for minimum distortion.
7. Repeat the step 5 and 6 until no further adjustment is necessary.
8. Adjust the secondary core (upper) of discriminator transformer L201 so that the center tuning meter pointer indicates its center at no signal applied. Set the FM SG to 98 MHz and increase its output level 1 K μ V and tune the receiver to the same frequency so that the center tuning meter pointer indicates its center.
Adjust the primary core (lower) of L201 for minimum distortion.
9. Set the FM SG to 98 MHz at 100 K μ V, and adjust R374 so that the signal strength meter may read 90% of the full scale.

13. STEREO SEPARATION ALIGNMENT

1. Set the FM SG to provide 1 K μ V at 98 MHz. Tune the receiver to the same frequency so that the center tuning meter pointer indicates its center.
2. Turn the FM SG modulation off (with the pilot signal turned off), connect a frequency counter to test point J310, and adjust R311 so that the frequency counter may precisely read 19 KHz.
3. Modulate the FM SG with stereo composite signal consisting of only subchannel signal (of course a pilot signal must be included).
4. Adjust the trimming resistor R301 for maximum and same separation in both channels.

14. MUTING CIRCUIT ALIGNMENT

1. Connect a VTVM across the resistor R363 and adjust the resistor R363 until the meter reads 0.75V DC at no signal.
2. Set the FM SG to provide 1 K μ V at 98 MHz and tune the receiver to the same frequency correctly.

3. Turn on MUTING pushswitch. Shift the FM signal generator frequency to plus and minus and note both plus and minus shifted frequencies at which undesirable audio side responses are muted out. Adjust the R363 so that the same shifted frequencies mute the undesirable side response.
4. Adjust R362 for proper frequency shift at which the muting circuit operates.

15. DOLBY FM TAPE OUTPUT SETTING

1. Set the modulation of FM SG to 400 Hz, 40% (± 30 KHz Dev.)
2. Set the FM SG to provide 1 K μ V at 98 MHz. Tune the receiver to the same frequency so that the center tuning meter pointer indicates its center.
3. Turn on DOLBY FM push switch. Set the semifixed resistors RC01 and RC02 so that the output of the TAPE OUTPUT terminals R and L become 580 mV at VT. VM.

16. AUDIO ADJUSTMENT

1. Voltage adjustment
Connect a DC voltmeter between pin terminal 804 and 805, and adjust the trimming resistor R806 for 35V DC.
2. Main Amplifier DC off-set alignment
Connect a DC voltmeter with 0.5 or 1V range between the speaker terminals and adjust the trimming resistor R707 for "zero" DC output on the meter.
Repeat the same procedure for the other channel.
Note: During this alignment no load should be connected to the speaker terminals.
3. Idle-current adjustment
Connect a VTVM between pin terminals 708 and 710. Next, adjust the trimming resistor R719 for the VTVM reads 8mV DC. Repeat the same procedure for the other channel.
4. Check DC off-set voltage aligned in the procedure 2 and if any DC output is observed on the DC voltmeter, adjust the R762 again for "zero" output.
5. Phono-amplifier adjustment
Connect a oscilloscope to the TAPE OUT jacks and an audio signal generator to the PHONO jacks. Place the selector switch in the PHONO position. Increase 1 KHz audio signal gradually until a slight clipping on top of the sine-wave is observed on the oscilloscope. Adjust the trimming resistor R708 for equal clipping level.
For the other channel adjust R709.

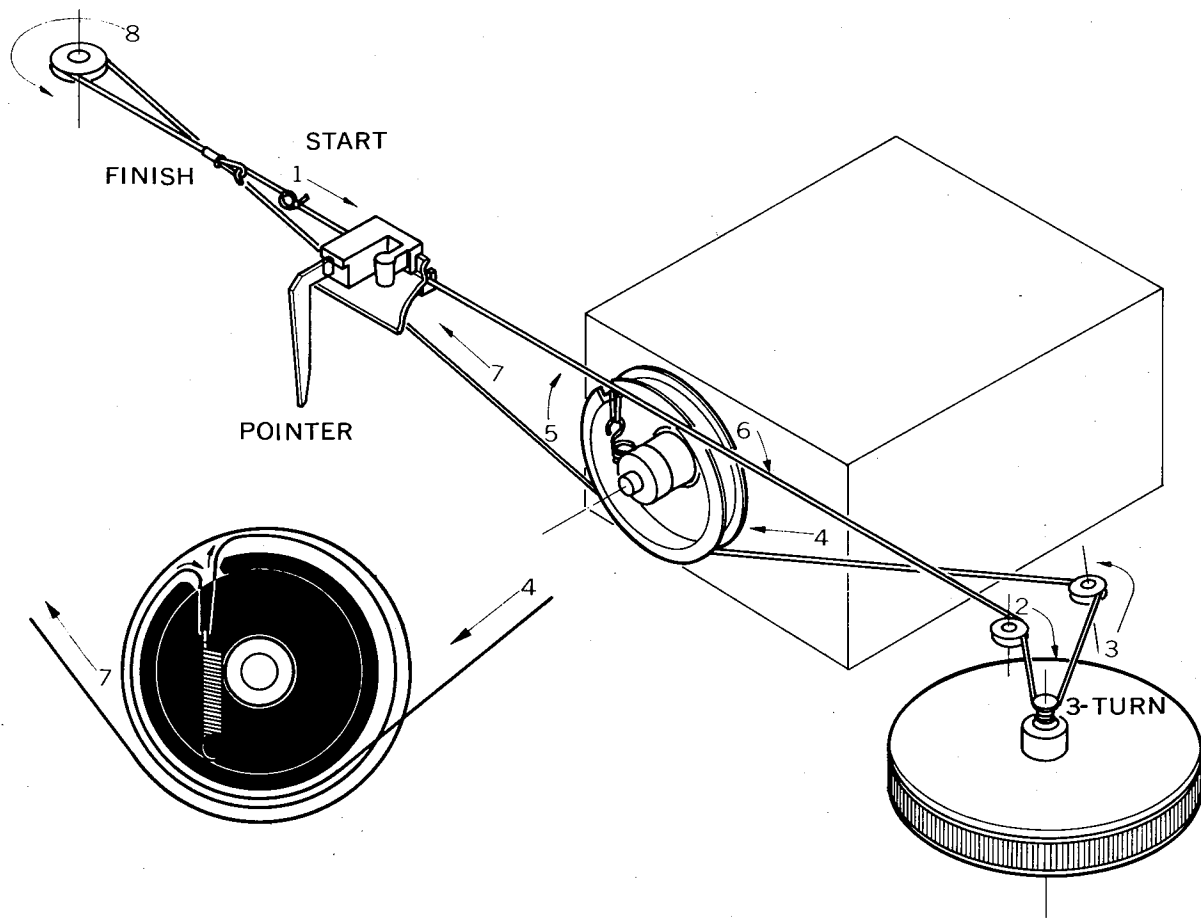


Figure 3. Dial Stringing

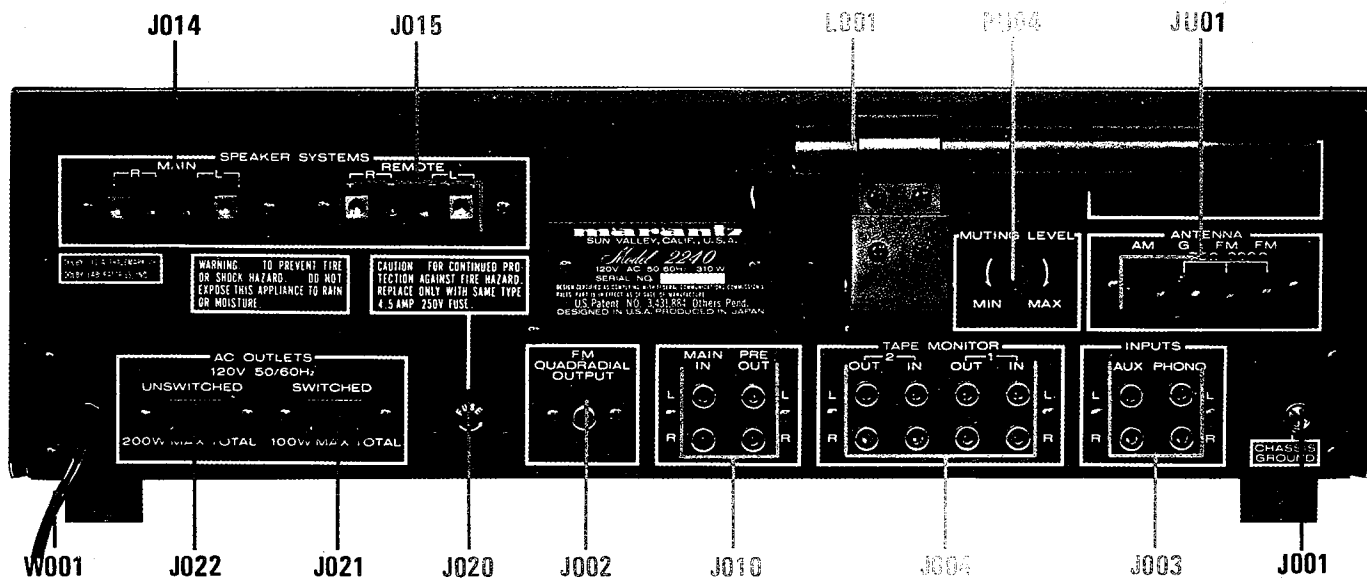


Figure 6. Rear Panel Adjustment and Component Locations

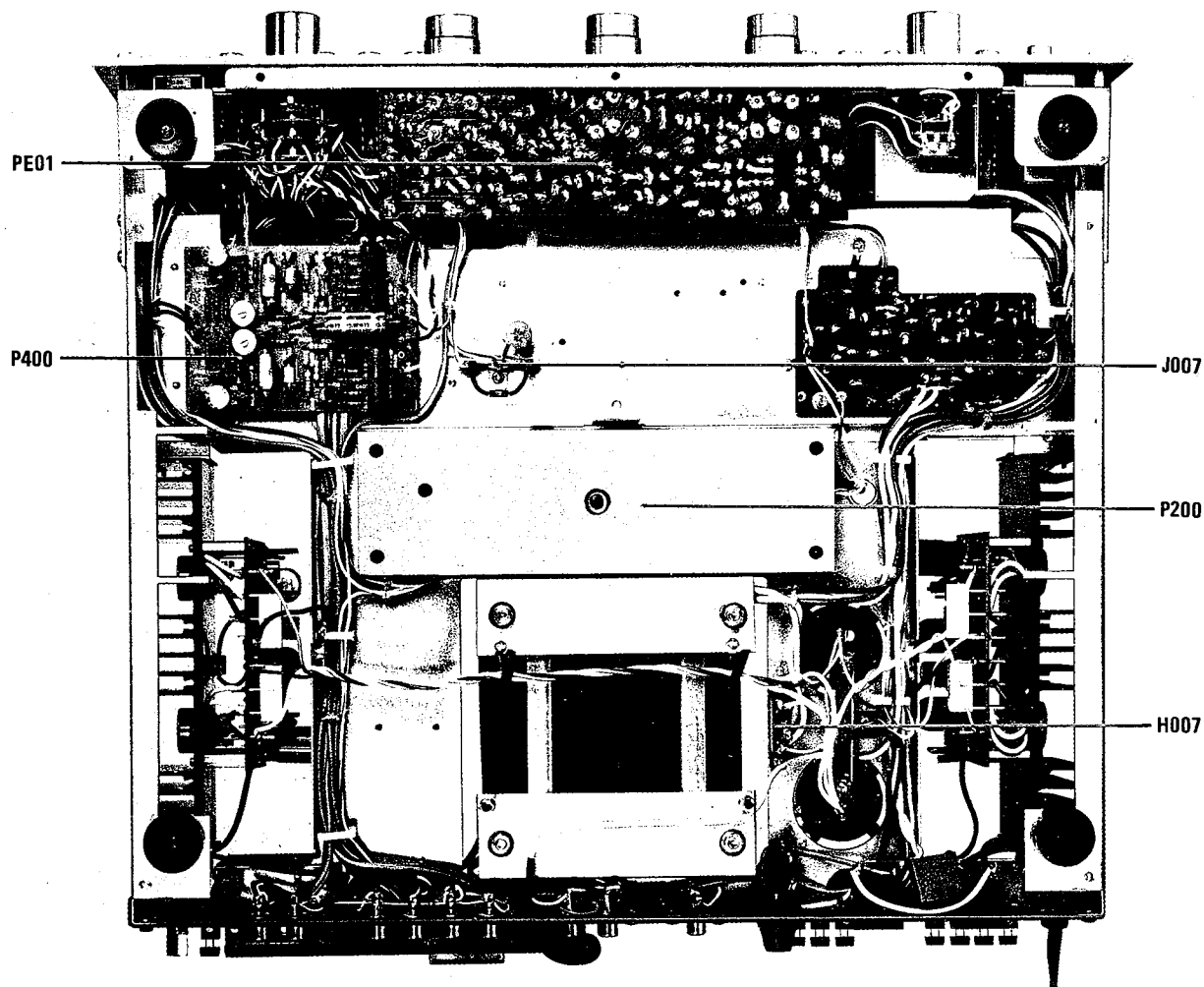


Figure 7. Main Chassis Component Locations (Bottom View)

