

service
manual

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marantz

model twenty three

Stereophonic Tuner

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INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service data for the Marantz Model 23 Stereophonic Tuner.

Servicing information and voltage data included in this manual are intended for use by knowledgeable and experienced technicians only. All instructions should be read carefully. No attempt should be made to proceed without a good understanding of the operation of the Tuner. A brief functional description and associated block diagram, furnished in the Operating Instruction Manual for the Model 23 Tuner, provides functional data about the Receiver as an aid in this understanding.

The parts list furnishes information by which replacement parts may be ordered from the Marantz Company. A 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 the Model 23 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 Unit mounted on PC board, P100
2. AM Front End Unit mounted on PC board, P200
3. AM IF Amplifier, FM IF Amplifier,
FM MPX Stereo Demodulator, and
FM Sub-IF Amplifier mounted on PC board, P500
4. FM Audio Amplifier, and FM Cen-
ter Tuning Meter Amplifier mounted on PC board, P700
5. Pre Amplifier mounted on PC board, P400
6. Main Output Amplifier, and Reg-
ulated Power Supply Unit mounted on PC board, P600
7. Protector Relay Driving Unit mounted on PC board, P980

2. AM TUNER

2.1 Circuit Description

The AM tuner consists of two units, a front end unit mounted on PC board P200 and an IF amplifier unit mounted on a part of PC board P500.

The front end consists of an RF amplifier and a converter. AM signals induced in a ferrite bar antenna are applied to the base of RF amplifier transistor H201 through coupling capacitor C201 and amplified to the level high enough to overcome the converter noise. The tuning circuits placed in the input and the output circuits of the RF amplifier provide very high image ratio and sufficient spurious rejection. Thus amplified and selected signal is applied to the base of converter transistor H202 through coupling capacitor C206. The converter forms a collector-emitter self-oscillation circuit and the local oscillation signal appears at

the emitter of H202. Both the signals are then mixed at the base-emitter junction and converted into 455KHz intermediate frequency. The IF signal obtained from the collector of H202 is applied to the first IF transformer L203.

Diode H203, reverse-biased by resistors R208 and R209, eliminates signal overload distortion without sacrificing any receiving sensitivity.

The IF signal output is led to the IF amplifier consisting of two stages (H510 and H511) through wiring pins J206 and J504, and amplified to high level. The amplified IF output is applied to diode H520 to detect audio signal. Then the detected audio signal is led to output pin J515 through filtering network. The DC component of the detected IF signal is used for AGC control which affects the emitter currents of H510 and RF amplifier transistor H201. A part of IF signal output is also applied to diode H521 through capacitor C562 and rectified into DC current for energizing signal strength meter M001.

2.2 Suggestions for Trouble Shooting of AM Tuner

Symptom: No AM Reception

First try to tune in to stations by rotating the flywheel tuning knob slowly and observe the AM signal strength meter whether it deflects or not. If the signal strength meter gives a deflection at several frequencies received, no failure exists in the stages at least preceding IF transformer L511. Next connect an oscilloscope to tuner output pin J515 and check audio signal. If the signal strength meter does not deflect, check the local oscillator circuit. Normal oscillation voltage at the hot end of the oscillator capacitor is 2 to 3 volts, varying with the tuning capacitor position. When measuring oscillation voltage use an RF VTVM, no circuit tester gives correct indication. If the local oscillation voltage is normal, check all voltage distributions in the tuner circuit by using a circuit tester and compare the measured values with those written in the schematic diagram.

3. FM TUNER

3.1 Circuit Description

The FM tuner section consists of three printed circuit boards, FM front end unit, IF amplifier/MPX stereo decoding unit, and DC meter amplifier/FM audio amplifier unit.

FM signals induced by an FM antenna are led to FM antenna coil L101 through an attenuator switch and a BALUN coil. These signals are then applied to an FET RF amplifier, the amplified output is applied to FET mixer H102 through a double-tuned circuit and converted into 10.7 MHz IF signals. H103 is a local oscillator transistor. The AGC voltage, obtained by rectifying a part of the first IF transformer, is applied to the gate of FET H101 through the network consisting of R110, R111 and R101. The converted IF signals are led to input pin J501 of the IF amplifier unit consisting of three ICs (H501, H502 and H503) and two ceramic filters

having sharp cut off characteristic. The selected and fully amplified IF signal is then applied to FM discriminator transformer L507 and demodulated into audible signal. The demodulated signal is then applied to the base of composite signal amplifier transistor H504 to obtain enough output power necessary to drive the stereo decoding circuit packaged in IC H505. The amplified output is applied to input pin 3 of the IC. Thus R and L channel stereophonic audio signals obtained are led to the R and L channel FM audio amplifiers respectively mounted on a half of PC board P700.

An FM audio amplifier consists of NPN and PNP transistors H705 and H707. The emitter to H705 is coupled to its counterpart in the other channel by separation control resistor R024. The FM audio amplifier amplifies low level FM audio signals to comparable level to those of AM and cancels out undesirable crosstalk in R and L channel signals. The output of the FM audio amplifier is led to the mode switch.

The DC current caused at point E in the FM discriminator circuit is used as a direct current source for driving the FM center tuning meter M002. First the direct current is led to the base of differential amplifier transistor H701 through R514 and antenna tuning switch S004. The amplified differential DC output obtained across the emitters of H703 and H704 drives the center tuning meter. R704 is the trimming resistor for null adjustment of the meter.

Stereo decoding IC H505 is also equipped with an audio muting circuit and an automatic stereo-monophonic switching circuit. Activating signals required for these circuits are obtained from the FM sub-IF amplifier unit consisting of two transistors H506 and H507. The amplifier unit obtains its input signal from the second FM IF amplifier stage through small coupling capacitor C511 and amplifies it. The amplified output is then applied to diode H517 and H518 and rectified into direct current. A part of the DC current is supplied to signal strength meter M001 through resistor R539 and rotary switch S001-2. The other part is applied to the DC amplifier consisting of H508 and H509, and its output is then fed to the muting control pin of IC H505 through muting switch S002 and resistor R518. R004 is a variable resistor for muting level control. Stereo-monophonic automatic switching signal is also obtained from the rectifier circuit and applied to pin 4 of IC H505 through resistors R565, R021, diodes H516 and H515.

The model 23 is equipped with a multipath antenna tuning system for the best FM reception. A simplified principle of the tuning is given as follows. Multipath propagation of an FM signal causes amplitude and phase distortion which deteriorates not only tonal quality but channel separation. The multipath antenna tuning system is employed for the purpose of finding out the optimum antenna direction to reduce the multipath distortion.

A 10.7MHz FM IF signal is applied to the sub-IF amplifier and the amplified output is then rectified by diodes H517 and H518 as explained above. The rectified output is not a precise direct current but includes many amplitude modulated components caused by multipath propagation.

These amplitude modulated components are separated from DC component by C552 and rectified into DC by diode H519 and led to the antenna tuning (FM center tuning) meter amplifier through antenna tuning switch S004. The greater the deflection of the antenna tuning meter, the greater the distortion of signal.

3.2 Suggestions for Trouble Shooting of FM Tuner

3.2.1 Symptom: No FM Reception

First turn on the power switch and try to tune in to FM stations. Rotate the flywheel tuning knob slowly and observe the signal strength meter and the FM center tuning meter. If the FM center tuning meter deflects at several frequencies, the tuner circuits preceding the discriminator circuit may have no failure. When the signal strength meter deflects but no deflection is obtained in the FM center tuning meter, there must be some defects between the final FM IF amplifier H503 and the discriminator circuit. When no reading is obtained in both meters, check the local oscillator circuit by using an RF VTVM. Normal local oscillation voltage is about, 1 to 2 volts at the hot end of the tank circuit. If the oscillation voltage is normal, check all the voltage distributions and compare them with those shown in the schematic diagram. When both meters deflect but no FM station is obtained check the following points by using a high sensitivity oscilloscope; collector of composite amplifier transistor H504, multiplex stereo output pin J507 or J508 and FM audio output terminal J711 or J713.

3.2.2 Symptom: No Stereo Separation

First check the mode switch is in FM stereo position. Connect an FM RF signal modulated by a stereo signal to the FM antenna terminals and check the stereo beacon lamp is turned on or not. When the lamp is not turned on, connect an oscilloscope to the test point F and observe 38KHz stereo sub-carrier is correctly generated or not.

4. FM AND AM TUNER ALIGNMENT

The following alignment requires many precision measuring equipments shown in P-10. No alignment should be performed in the field unless the service man has these equipments and enough knowledge in solid state amplifier components, since all the units are factory aligned and not become misaligned by themselves.

4.1 AM Front End

Local Oscillator and Tracking Alignment

- 1) Set an AM signal generator to 600KHz, 400Hz 30% modulation. Tune the receiver to the same frequency and adjust oscillator coil L202 until the dial pointer coincides with the 600KHz marking on the

dial.

- 2) Set the AM signal generator to 1400KHz. Tune the receiver to the same frequency and adjust the trimming capacitor mounted on the tuning capacitor until the dial pointer coincides with the 1400KHz marking on the dial.
- 3) Repeat procedure 1 and 2 until no further adjustment is necessary between the low end and the high end.
- 4) Set the generator to 600KHz. Tune the receiver to the same frequency and adjust antenna coil L001 in a plastic case and RF coil L201 for maximum output.
- 5) Set the generator to 1400KHz. Tune the receiver to the same frequency and adjust each antenna trimming capacitor and RF trimming capacitor mounted on the tuning capacitor for maximum output.
- 6) Repeat procedure 4 and 5 until no further improvement is obtained.

4.2 AM IF Amplifier

For aligning the AM IF amplifier, a sweep generator with marker generator combined is necessary.

- 1) Connect a sweep generator across pin J205 and common ground, connect an oscilloscope to test pin J527.
- 2) Turn each primary and secondary core of IF transformers L203, L501 and L511 for maximum and symmetrical response.

4.3 FM Front End

4.3.1 Local Oscillator Adjustment

- 1) Measuring instruments connection
Connect an FM signal generator to the FM antenna terminals. Connect a VTVM or an oscilloscope to the output jack.
- 2) Set the FM signal generator to 90MHz, 400Hz 100% modulation. Tune the receiver to the same frequency and adjust oscillator coil L104 until the dial pointer coincides with the 90MHz marking on the dial.
- 3) Set the FM signal generator to 106MHz. Tune the receiver to the same frequency and adjust trimming capacitor C119 until the dial pointer coincides with the 106MHz marking on the dial.
- 4) Repeat procedure 2 and 3 until no further adjustment is necessary between the low end and the high end.

4.3.2 FM Tracking Alignment

- 1) Set an FM signal generator to provide about 5uV at 90MHz. Tune

the receiver to the same frequency and turn each core of L101, L102 and L103 for maximum output.

- 2) Set the FM signal generator to 106MHz. Tune the receiver to the same frequency and adjust trimming capacitors C104, C110 and C112 for maximum output.
- 3) Repeat procedure 1 and 2 until no further improvement is obtained.

4.4 FM IF Amplifier

To align the IF amplifier, connect an FM signal generator to the FM antenna terminals and set the generator to 98MHz, 400Hz 100% modulation with its output level about 5uV. Tune the receiver to this frequency and turn each core of IF transformers, L105 and L519 for maximum output. To align the discriminator transformer L507, increase the FM signal output level to about 2KuV and connect a distortion meter to the output jack.

- 1) First, tune the receiver off station to only the interstation noise is heard, then turn the secondary core of L507 so that the pointer of center tuning meter indicates its center.
- 2) Tune the receiver to a 98MHz FM signal again with the center tuning meter in its null position, then turn the primary core of discriminator transformer L507 so that minimum distortion is obtained.

4.5 FM Stereo Demodulator

A stereo multiplex and RF FM signal generator is required to make the separation adjustment on this circuit.

Perform the following adjustments in sequence.

- 1) Set an FM signal generator to 97MHz, 2KuV output level. Tune the receiver to the same frequency, be sure the pointer of center tuning meter is at the center position, and the mode switch is in its FM stereo position.
- 2) Connect an oscilloscope probe to pin J526 and turn each core of L514, L512 and L513 for maximum stereo carrier wave on the CRT.
- 3) Turn the core of L514 again to obtain equal stereo separation in both of R and L channels.
- 4) Adjust trimming resistor R024 for maximum and equal stereo separation in both channels.

Note: In early units no trimming resistor is provided.

4.6 FM Sub-IF Amplifier Alignment

To align the sub-IF amplifier, tune the receiver to an FM signal and turn each core of L508 and L509 so that the signal strength meter reads maximum deflection.

5. PRE AMPLIFIER

A signal selected by the mode switch is led to the pre amplifier via volume control potentiometer R007. The pre amplifier makes use of two transistors H401 and H403 in a connection similar to the FM audio amplifier except utilization of a bootstrap configuration for high input impedance and elimination of separation control resistor. The amplified signal is then led to the main output amplifier.

6. MAIN OUTPUT AMPLIFIER

A signal from the pre-amplifier is applied to the base of H601 through coupling capacitor C601. High input impedance is provided by a bootstrap configuration utilized with H601. The output signal from H601 is led to the base of driver transistor H603 providing the voltage amplification necessary to drive the output stage consisting of H605 and H607 which are operated in a complimentary-symmetry configuration. The combined operation of PNP transistor H605 and NPN transistor H607 provides single ended push pull output across loading resistor R636. This output is applied to output terminal J003 through R009.

Potentiometer R638 placed across the inputs of R and L channels is for balance setting. Usually it is set at its mechanical center and seldom needed realignment.

To maintain overall stability and linearity, negative feed back is utilized throughout the amplifier. This feedback is also necessary to reduce distortion to be well under the specified limits. R620, C621 and R609 condition the feedback signal for application to the emitter of H601.

7. SUGGESTIONS FOR TROUBLE SHOOTING OF AUDIO SECTION

7.1 Symptom: No Output for Both Channels

Check for defective power supply circuit and protector relay circuit.

7.2 Symptom: No Output or Distorted Signal for One Channel

1) Check for shorted or open transistors H401, H403, H601, H603, H607 and H605 or their counterparts in the channel being concerned.

2) Check all the voltage distributions and compare them with those shown in the schematic diagram.

Note: Connecting an audio signal generator to the TAPE OUT jack and checking input and output of each stage will be helpful to find out a bug in the audio section. For example, if the signal at the base of H601 is all right but no signal or distorted signal is obtained at the collector of H601, there must be a bug around H601.

8. PROTECTOR RELAY CIRCUIT

8.1 Circuit Description

The protector relay circuit mounted on PC board P980, prevents the system from developing any loud "POP" sound. The relay driving circuit makes use of two transistors H982 and H983. The circuit is designed so as to short circuit the output jacks and the tape out jacks for the first several seconds after the power switch is turned on by the time constant of capacitor C982 and resistor R984.

8.2 Suggestions for Trouble Shooting of the Protector Relay Circuit

8.2.1 Symptom: No Output Signal at All Times

- 1) Check for shorted capacitors, C982 and C983.
- 2) Check for open transistors, H982 and H983.
- 3) Check for open resistors, R984 and R986.
- 4) Check for open diodes, H003 and H004.
- 5) Check for open relay, L005.

8.2.2 Symptom: "POP" Noise Appearance

- 1) Check for open or low value capacitor, C982.
- 2) Check for shorted transistors, H982 and H983.
- 3) Check for shorted resistor, R984.
- 4) Check for defective relay, L005.

9. REGULATED POWER SUPPLY

9.1 Circuit Description

The regulated power supply unit consisting of transistor H617 and zener diode H611 mounted on a part of PC board P600 supplies its regulated DC current to each unit of main output amplifier, FM audio amplifier, and pre-amplifier. The base of transistor H617 is well fixed at 30V by zener diode H611 and H617 regulates its output voltage at about 29V. Regulator transistor H617 also works as a ripple filter in conjunction with C618. Any short-circuit of the 29V DC output line may damage transistor H617. Be extremely careful not to make a short-circuit.

9.2 Suggestions for Trouble Shooting of Regulated Power Supply

9.2.1 Symptom: No Output

Check for

- 1) Open transistor H617.
- 2) Shorted capacitors C009, C616, C617, C618 and C619.
- 3) Open power transformer L004.
- 4) Open resistor R635.

9.2.2 Symptom: Excessive Output Voltage

Check for

- 1) Shorted transistor H617.

- 2) Open zener diode H611.
- 3) Shorted resistor R634.

9.2.3 Symptom: Inadequate Output Voltage, Excessive Ripple

Check for

- 1) Open or low value capacitors C009, and C619.
- 2) Defective diodes H613, H614, H615 and H616.

10. CENTER TUNING METER AMPLIFIER

A differential amplifier consisting of four transistors H701, H702, H703 and H704 is used to drive center tuning meter M002. The input current to the differential amplifier is obtained from the FM discriminator through resistor R514 and antenna tuning switch S004. The null adjustment of this meter amplifier is achieved by adjusting potentiometer R704 with the mode switch placed in the AM position.

11. TEST EQUIPMENTS FOR SERVICING

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
Audio Oscillator	Less than 0.02% residual distortion is required	Sine wave source for modulating AM or FM Signal Generator, or trouble shooting
Stereo Modulator	Less than 0.3% distortion	Modulating FM Signal Generator for Separation Alignment and trouble shooting
Oscilloscope	High Sensitivity	Wave form analysis and trouble shooting
VTVM	With RF probe	Trouble shooting
Circuit Tester		Trouble shooting
Sweep Generator	For 455KHz and 10.7MHz IF alignment	AM and FM IF alignment
Line Voltmeter	0 - 150V AC	Line voltage monitor
Variable Auto Transformer	0 - 140V, 10 A	Line voltage adjuster

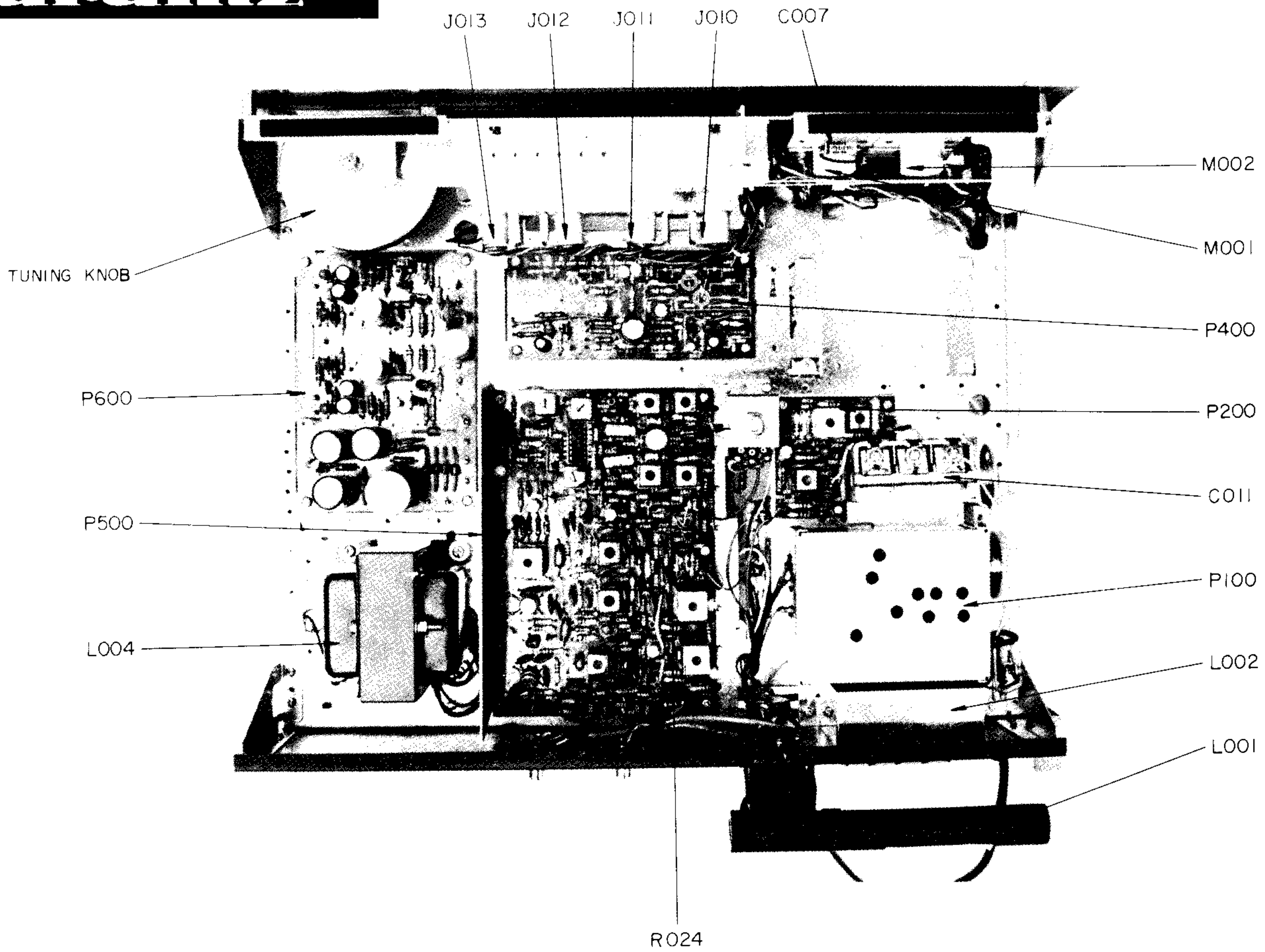


Figure 1 Main Chassis Component Locations Top View

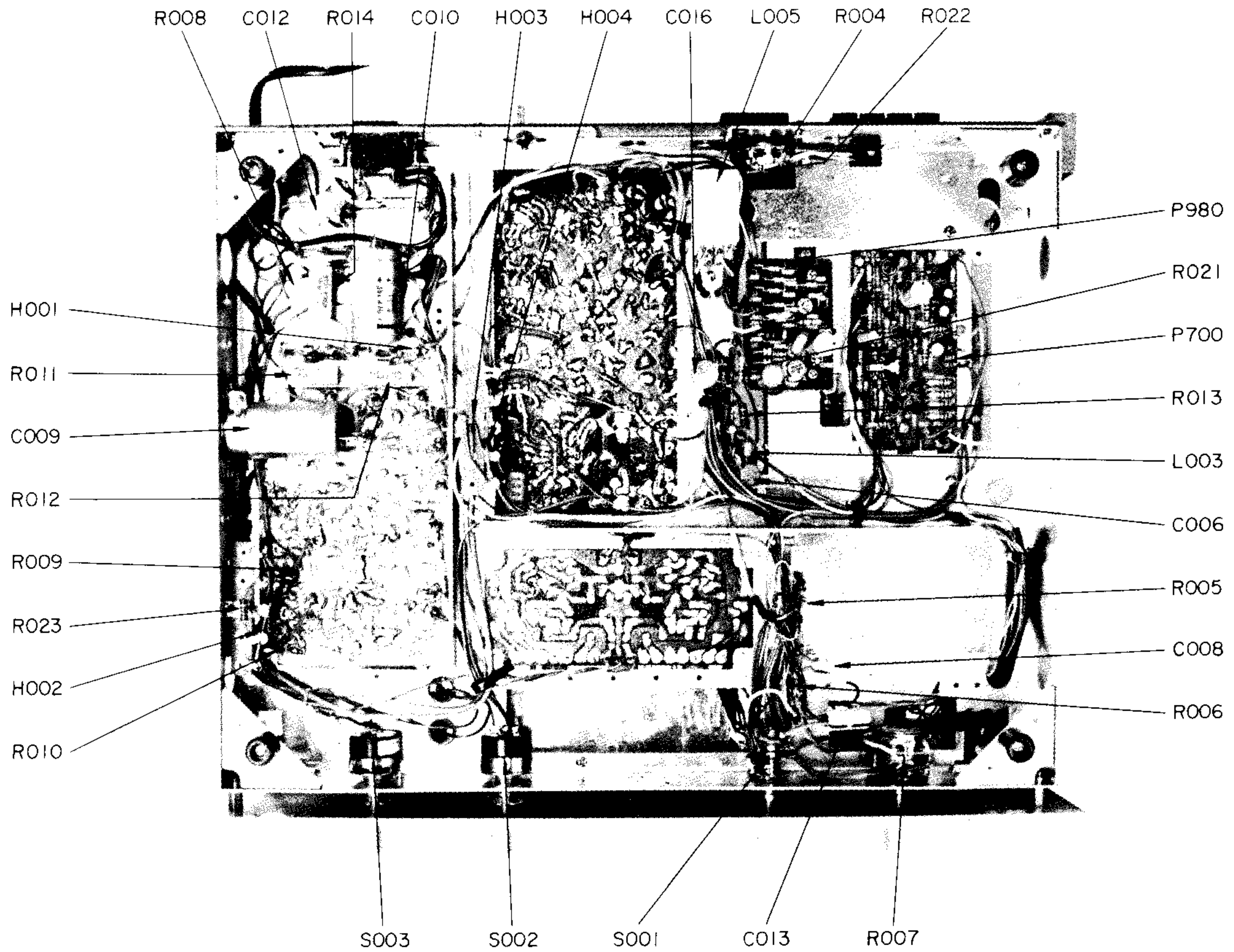


Figure 2 Main Chassis Component Locations Bottom View

