Serial Nos. Beginning 48001

# Service Manual

# THE FISHER®


# 400

CHASSIS SERIAL NUMBERS
BEGINNING 48001

$1.00

FISHER RADIO CORPORATION · LONG ISLAND CITY 1 · NEW YORK

**CAUTION:** *This is a FISHER precision high-fidelity instrument. It should be serviced only by qualified personnel — trained in the repair of transistor equipment and printed circuitry.*

## EQUIPMENT AND TOOLS NEEDED

The following are needed to completely test and align modern high-fidelity instruments such as amplifiers, tuners and receivers.

### Test Instruments

Vacuum-Tube Voltohmmeter DC VTVM
Audio (AC) Vacuum-Tube Voltmeter (AC VTVM)
Oscilloscope (Flat to 100 kc minimum)
Audio (Sine-wave) Generator
*Intermodulation Analyzer*
Sweep (FM) Generator (88 to 108 mc)
Marker Generator
Multiplex Generator (preferably with RF output — FISHER Model 300 or equal).

### Miscellaneous

Adjustable-Line-Voltage Transformer or line-voltage regulator

Load Resistors (2) — 8-ohm, 50-watt (or higher)

Stereo source (Turntable with stereo cartridge or Tape Deck)

Speakers (2) Full-range, for listening tests

Soldering iron (with small-diameter tip). **Fully** insulated from power line.

## PRECAUTIONS

Many of the items below are included just as a reminder — they are normal procedures for experienced technicians. Shortcuts can be taken but often they cause additional damage — to transistors, circuit components or the printed-circuit board.

Soldering—A well-tinned, hot, clean soldering iron tip will make it easier to solder without damage to the printed-circuit board or the many many circuit components mounted on it. It is not the wattage of the iron that counts — it is the heat available at the tip. Low-wattage soldering irons will often take too long to heat a connection — pigtail leads will get too hot and damage the part. Too much heat, applied too long, will damage the printed-circuit board. Some 50-watt irons reach temperatures of 1,000° F — others will hardly melt solder. Small-diameter tips should be used for single solder connections — larger pyramid and chisel tips are needed for larger areas.

- When removing defective resistors, capacitors, etc., the leads should be cut as close to the body of the circuit component as possible. (If the part is not being returned for in-warranty factory replacement it may be cut in half — with diagonal-cutting pliers — to make removal easier.)
- Special de-soldering tiplets are made for unsoldering multiple-terminal units like IF transformers and electrolytic capacitors. By unsoldering all terminals at the same time the part can be removed with little chance of breaking the printed-circuit board.
- Always disconnect the chassis from the power line when soldering. Turning the power switch OFF is not enough. Power-line leakage paths, through the heating element, can destroy transistors.

Transistors—Never attempt to do any work on the transistor amplifiers without first disconnecting the AC-power linecord — wait until the power supply filter-capacitors have discharged.

- Guard against shorts — it takes only an instant for a base-to-collector short to destroy that transistor and possibly others direct-coupled to it. [In the time it takes for a dropped machine screw, washer or even the screwdriver, to glance off a pair of socket terminals (or between a terminal and the chassis) a transistor can be ruined.]
- DO NOT bias the base of any transistor to, or near, the same voltage applied to its collector.
- DO NOT use an ohmmeter for testing transistors. The voltage applied through the test probes may be higher than the base-emitter breakdown voltage of the transistor.

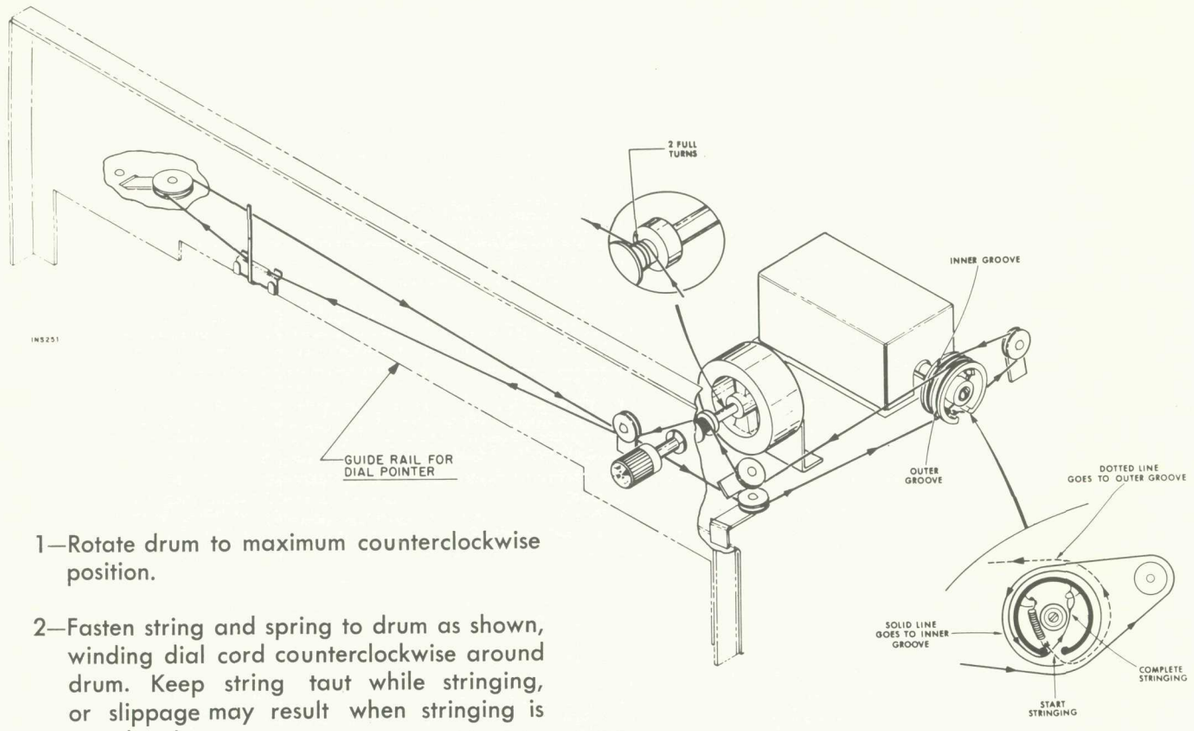
Output Stage and Driver—Replacements for output and driver transistors, if necessary, must be made from the same beta group as the original type. The beta group is indicated by a colored dot on the mounting flange of the transistor. Be sure to include this information, when ordering replacement transistors.

- If one output transistor burns out (open or shorts), always remove all output transistors in that channel and check the bias adjustment, the control and other parts in the network with an ohmmeter before inserting a new transistor. All output transistors in one channel will be destroyed if the base-biasing circuit is open on the emitter end.
- When mounting a replacement power transistor be sure the bottom of the flange, the mica insulator and the surface of the heat sink are free of foreign matter. Dust and grit can prevent perfect contact. This reduces heat transfer to the heat sink. Metallic particles can puncture the insulator and cause shorts — ruining the transistor.
- Silicone grease must be used between the transistor and the mica insulator and between the mica and the heat sink for best heat conduction. Heat is the greatest enemy of electronic equipment. It can shorten the life of transistors, capacitors and resistors. (Use Dow-Corning DC-3 or C20194 or equivalent compounds made for power transistor heat conduction.)
- Use care when making connections to speakers and output terminals. Any frayed wire ends can cause shorts that may burn out the output transistors — they are direct-coupled to the speakers. There is no output transformer — nothing to limit current through the transistors except the fuses. To reduce the possibility of shorts at the speakers, lugs should be used on the exposed ends — at least the ends of the stranded wires should be tinned to prevent frayed wire ends. The current in the speakers and output circuitry is quite high. Any poor contact or small-size wire, can cause power losses in the speaker system. Use 14 or 16 AWG for long runs of speaker-connecting wiring.

DC-Voltage Measurements—These basic tests of the transistor circuitry are made without the signal generator. Without any signal input measure the circut voltages — as indicated on the schematic. The voltage difference between the base and the emitter should be in the millivolt range — a sensitive DC meter is needed for these readings. A low-voltage range of 1 volt, full scale — or lower — is needed.

Audio-Voltage (gain) Measurements—The schematic and printed-circuit board layout diagrams are used. Input signals are injected at the proper points — found most quickly by using layout of the printed-circuit board instead of the schematic. An AUDIO (AC) VTVM connected to the test points should indicate voltages close to those values shown in the boxes on the schematic. Many of the signal levels in the input stages are only a few millivolts — they can not be read on the AC ranges supplied on most Vacuum-Tube AC/DC Volt-ohmmeters (VTVMs). Even with a 1-volt range a signal level of 100 millivolts (.1 volt) will be the first 1/10 of the meter scale. A reading of 1 millivolt (.001 volt) will hardly even move the meter needle.

# DIAL STRINGING PROCEDURE




DETAIL OF STRINGING OF DRUM

1—Rotate drum to maximum counterclockwise position.

2—Fasten string and spring to drum as shown, winding dial cord counterclockwise around drum. Keep string taut while stringing, or slippage may result when stringing is completed.

3—After completing stringing, set pointer to zero (0) on the dial logging scale, and glue pointer to dial cord.

If replacement parts are out of stock, locally, they may be obtained directly from the Parts Department of FISHER Radio Corporation. They will be shipped "best way", either prepaid or C.O.D. unless otherwise specified.

For instrument-operation information and technical assistance write Richard Hamilton, Customer Relations Department, FISHER Radio Corporation, Long Island City, New York 11101.

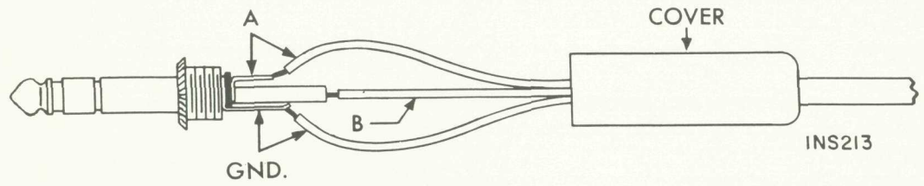
# PHASE INVERTER ADJUSTMENT

**LEFT CHANNEL**

**1** — Connect a 16-ohm load between the Left Speaker terminals. Connect the Left Impedance Selector to the "16" terminal.
**2** — Connect the input of the IM Distortion Analyzer across the 16-ohm load.
**3** — Connect the IM Distortion Analyzer output to the Left AUX input jack.
**4** — Set the Selector switch to AUX and adjust the Analyzer for 14 volts across the 16-ohm load.
**5** — Adjust the Left Phase Inverter Adjust control for minimum IM distortion.

**RIGHT CHANNEL**

**1** — Connect a 16-ohm load between the Right Speaker terminals. Connect the Right Impedance Selector to the "16" terminal.
**2** — Connect the input of the IM Distortion Analyzer across the 16-ohm load.
**3** — Connect the IM Distortion Analyzer output to the Right AUX input jack.
**4** — Set the Selector switch to AUX and adjust the Analyzer for 14 volts across the 16-ohm load.
**5** — Adjust the Right Phase Inverter Adjust control for minimum IM distortion.




CONNECT GND TO COMMON OR GROUND TERMINAL OF HEADPHONES; **A** TO HOT TERMINAL OF LEFT CHANNEL; **B** TO HOT TERMINAL OF RIGHT CHANNEL.

Headphone plug wiring

# TROUBLESHOOTING GUIDE

**Does not go on (pilot or dial lamps do not light).**

Check:
- Fuse F1.
- AC plug and line cord.
- Wall outlet.
- Power switch S6 (use test lamp in AC OUTLET on rear of chassis).

**Fuse blows as soon as replaced.**

Check:
- CR1, CR2, CR3; C56, C57C, C60, C63 in power supply.
- C43, C45, C47, C49, C62 filament bypass capacitors.

**Distortion Hum, Weak or No audio output** (both channels) **in any position of SELECTOR switch.**
- Set BALANCE, TREBLE and BASS controls to NORMAL.
- Remove plugs from rear-chassis RCRDR OUT and TAPE MON jacks.
- Remove plugs from SPACEXPANDER jacks and insert jumpers (a must).
- Remove plugs from rear-chassis PHONO, TAPE HEAD and AUX jacks.

Test:
- V10, V11 or substitute. (Filament leakage test for hum – gas test for distortion.)
- Supply voltage at: CR2, C56, R41; C56, C57C, R43; C57B, R42, R43; C57A, R42; C52D, R40, R41; C52C, R39, R40; C52B, R38, R39; C52A, R33, R38.
- Bias-supply voltages at: CR1, C60A, C60B; C42, R34, R35.
- DC Filament-supply voltage.

**Distortion Hum, Weak or No Audio output** **(LEFT channel only) in any position of SELECTOR.**
- Remove plugs from rear-chassis RCRDR OUT and TAPE MON jacks (left channel).
- Remove plug from SPACEXPANDER jack (left channel) and insert jumper (a must).

Check:
- Position of BALANCE, TREBLE and BASS controls (set to NORMAL positions).
- Position of PHASE INVERTER ADJ. (R107).

Test:
- V12, V14, V15 or substitute. (Filament leakage test for hum – gas test for distortion.)
- Voltages at sockets for V10, V11, V12, V14, V15.

**Distortion Hum, Weak or No audio output** **(RIGHT channel only) in any position of SELECTOR.**
- Remove plugs from rear-chassis RCRDR OUT and TAPE MON jacks (right channel).
- Remove plug from SPACEXPANDER jack (right channel) and insert jumper (a must).

Check:
- Position of BALANCE, TREBLE and BASS controls (set to NORMAL positions).
- Position of PHASE INVERTER ADJ. (R108).

Test:
- V13, V16, V17 or substitute. (Filament leakage test for hum–gas test for distortion).
- Voltages at sockets for V10, V11, V13, V16, V17.

**Distortion Hum, Weak or No audio output** **(LEFT channel only) PHONO and TAPE HEAD positions of SELECTOR.**
- Remove plugs from rear-chassis PHONO and TAPE HEAD jacks (for hum).
- Switch LEFT channel plug to RIGHT channel jack (for distortion, weak or no audio output).

Check:
- Jack, plugs and interconnecting cables.
- Phono cartridge, or tape head output.

Test:
- V8 or substitute. (Filament leakage test for hum–gas test for distortion.)

**Distortion Hum, Weak or No audio output** **(RIGHT channel only) PHONO and TAPE HEAD positions of SELECTOR.**
- Remove plugs from rear-chassis PHONO and TAPE HEAD JACKS (for hum).
- Switch RIGHT channel plug to LEFT channel jack. (for distortion, weak or no audio output).

Check:
- Jack, plugs and interconnecting cables.
- Phono cartridge, or tape head output.

Test:
- V8 or substitute. (Filament leakage test for hum–gas test for distortion.)

**Distortion Hum, Weak or No audio output** **(BOTH channels) all FM positions of SELECTOR.**
- Tune to other FM stations–watch tuning indicator.

Check:
- Antenna position and connections.
- IF and RF alignment.

Test:
- V1, V2, V3, V4, V5, V6 or substitute.
- (Filament leakage test for hum–gas test for distortion.)
- Voltages at sockets for V1, V2, V3, V4, V5, V6 and ratio detector.

**Distortion** **(BOTH channels) FM STEREO positions of SELECTOR only.**
- Tune to other FM-Stereo stations–watch tuning indicator.

Check:
- Antenna position and connections.
- MPX, IF and RF alignment.

Test:
- Voltages at sockets for V1, V2, V3, V4, V5 V6 and ratio detector.
- V100, V101, V102 or substitute. (Filament leakage test for hum–gas test for distortion.)
- Voltages at MPX-decoder tube sockets V100, V101, V102.

# MULTIPLEX DECODER ALIGNMENT

| STEPS | GENERATOR | | | INDICATOR | ALIGNMENT | | |
|---|---|---|---|---|---|---|---|
| | CONNECTION | AUDIO FREQUENCY | RF MODULATION | TYPE & CONNECTION | ADJUST | INDICATION | NOTES |
| 1 | Audio oscillator connected to lug 1 | 80 KC—1 volt | None | AC VTVM to junction of C210 and R228 | L100 (Use hex alignment tool) | Minimum voltage | |
| 2 | Multiplex generator audio output to lug 1 (See Note 1) | 19 KC (±5 cps) pilot tone, 100 mv | None | DC VTVM to T.S.P. 101 | Z100 top and bottom (Use hex alignment tool) | Maximum voltage | 1 |
| 3 | Same as Step 2 | 19 KC pilot tone, 50 mv | None | Scope horiz. input to 19 KC output of gen.; vert. input to junction of C216 and R209. External sweep | Z101 (Use K-tran alignment tool) | Stable 2:1 Lissajous pattern. Disregard phase of pattern | 1 |
| 4 | Same as Step 2 | 19 KC | None | Same as Step 3 | Vary generator 19 KC output from 50 to 200 mv | Lissajous pattern should remain stationary over the entire 150 mv range | 1, 2 |
| 5 | Same as Step 2 | 1000 cps on left (A) channel only, 1 volt rms (2.8 P-P) | None | AC VTVM and scope vert. input to channel A output lug. Internal sweep. DC VTVM to T.S.P. 101 | Z100 top (Use hex tool) | Maximum indication on AC VTVM. Clean 1000 cps waveform on scope | 1, 3 |
| 6 | Same as Step 2 | 1000 cps on right (B) channel only, 1 volt rms (2.8 P-P) | None | Same as Step 5 | MPX separation R215 | Minimum reading on AC VTVM should be at least 33 db below reading obtained in Step 5 | 1 |
| 7 | Same as Step 2 | Same as Step 6 | None | Move scope input and AC VTVM to channel B output lug | ———— | Note and record voltage reading on AC VTVM | 1 |
| 8 | Same as Step 2 | 1000 cps on left (A) channel only, 1 volt rms (2.8 P-P) | None | Same as Step 7 | ———— | AC VTVM reading should be at least 33 db below reading observed in Step 7 | 1 |
| 9 | Same as Step 2 | 8000 cps on right (B) channel only, 1 volt rms (2.8 P-P) | None | Same as Step 7 | ———— | AC VTVM reading should be the same as observed in Step 7 | 1 |
| 10 | Same as Step 2 | 8000 cps on left (A) channel only, 1 volt rms (2.8 P-P) | None | Same as Step 7 | ———— | AC VTVM reading should be at least 18 db below reading observed in Step 9 | 1 |
| 11 | Repeat Steps 9 and 10 with scope and AC VTVM connected to channel A output lug, but start with 8000 cps applied to left channel for first reading, then switch to right channel for second reading. | | | | | | |
| 12 | Multiplex generator RF output to 300-ohm antenna terminals | 1000 cps on left (A) channel only | 100% (75 KC Dev.) No pre-emphasis | Move scope input and AC VTVM to channel A output lug | ———— | Note and record voltage reading on AC VTVM | 4 |
| 13 | Same as Step 12 | 1000 cps on right (B) channel only | Same as Step 12 | Same as Step 12 | R215 | Minimum reading on AC VTVM should be at least 33 db below reading observed in Step 12 | 4 |
| 14 | Same as Step 12 | 8000 cps on left (A) channel only | Same as Step 12 | Same as Step 12 | ———— | AC VTVM reading should be 10 db below reading observed in Step 12 | 4 |
| 15 | Same as Step 12 | 8000 cps on right (B) channel only | Same as Step 12 | Same as Step 12 | ———— | AC VTVM reading should be 28 db below reading observed in Step 12 | 4 |

NOTE: The above procedure is based on the use of the FISHER Model 300 Multiplex Generator.

1 — In steps 2 through 11, the audio output of the Multiplex Generator should be connected to lug 1 of the multiplex sub-chassis through a 12,000 ohm, ½-watt, carbon resistor, and a 180 uuf capacitor should be connected between lug 1 and ground. The wiring from the MPX TEST jack on the main chassis to lug 1 must be disconnected during Steps 2 through 11.

2 — The vertical amplitude of the Lissajous pattern will increase slightly as the generator output is increased. This is a normal occurrence.

3 — If DC VTVM reading falls below —9 volts when maximum reading is obtained on the AC VTVM, readjust bottom of Z100, then repeat Step 5. Repeat this procedure until maximum AC VTVM reading is obtained with DC VTVM reading greater than —9 volts.

4 — Tune the FISHER to the RF output frequency of the Multiplex Generator.

# 1007 MULTIPLEX DECODER

## CAPACITORS

10% tolerance for all fixed capacitors, unless otherwise noted or marked GMV (guaranteed minimum value). All capacitors not marked uf are pF (uuf).

| Symbol | Description | Part No. |
|---|---|---|
| C200 | Ceramic, .01uf, +80 —20%, 500V | C50089-7 |
| C201 | Ceramic, 680, 1000V | C50072-2 |
| C203 | Ceramic, 220, 1000V | C50183-3 |
| C204 | Polystyrene, 470, 5%, 500V | C50394-1 |
| C205 | Ceramic, 82, 1000V | C50070-1 |
| C206 | Ceramic, 1000, GMV, 500V | C50089-2 |
| C207 | Ceramic, 5000, +80 —20%, 500V | C50089-6 |
| C208, 209 | Mica, 4700, 5%, 500V | C50332-5 |
| C210 | Electrolytic, 1uf, 350V | C50283-3 |
| C211 | Ceramic, 1000, GMV, 500V | C50089-2 |
| C212 | Ceramic, 5000, 20%, 500V | C50089-1 |
| | *Ceramic, .05uF, +80% —20% | C50073-2 |
| C214 | Mylar, 4700, 400V | C50197-25 |
| C215 | Mica, 3900, 5%, 500V | C50332-6 |
| C216, 217 | Ceramic, 1000, GMV, 500V | C50089-2 |
| C218 | Ceramic, .02uf, 20%, 500V | C50089-5 |
| C219 | Ceramic, 330, 1000V | C50183-5 |
| C220 | Ceramic, .02uf, 20%, 500V | C50089-5 |
| C221, 222 | Mylar, .047uf, 250V | C50197-52 |
| C223, 224 | Ceramic, 1000, 1000V | C50072-3 |
| C225, 226 | Ceramic, 2200, 1000V | C50072-5 |

*Model 400 only

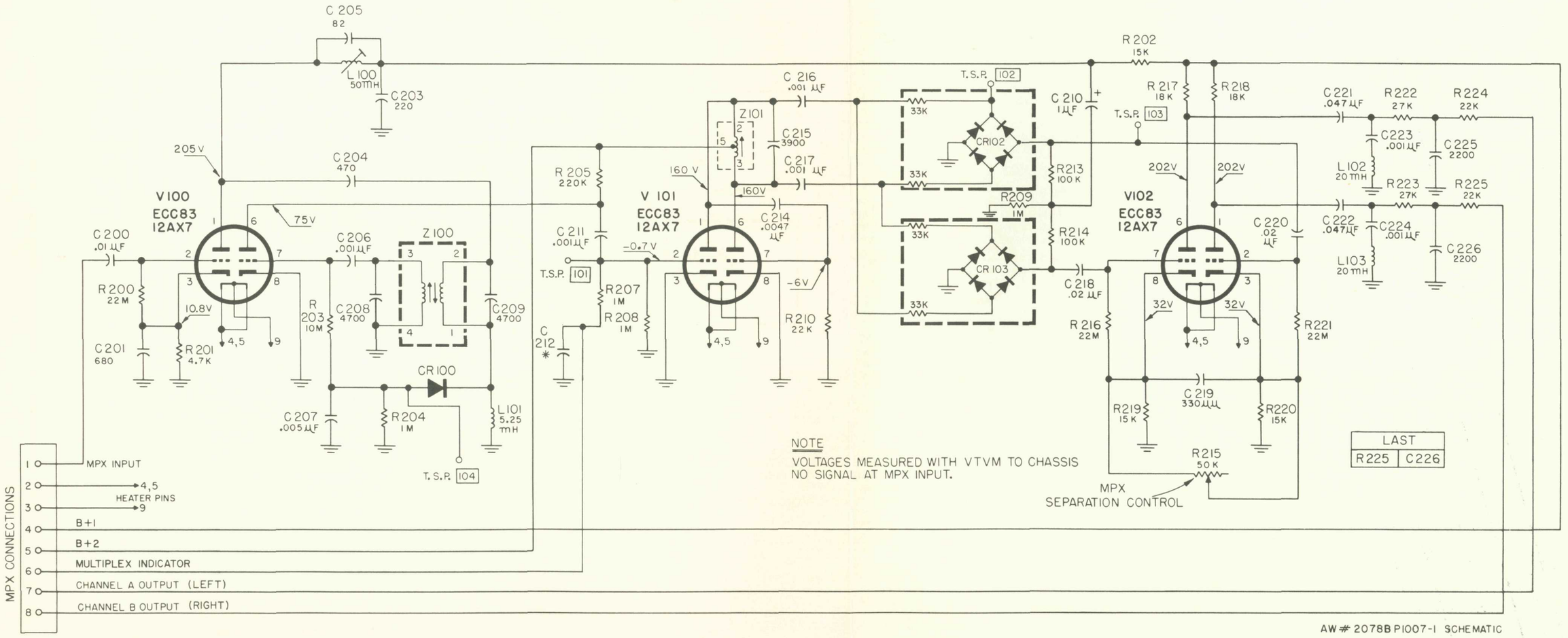
## RESISTORS

In ohms, 5% tolerance, 1/8 W unless otherwise noted. K=Kilohms, M=Megohms.

| Symbol | Description | Part No. |
|---|---|---|
| R200 | Composition, 22M, 10%, 1/2 W | RC20BF226K |
| R201 | Composition, 4.7K, 1/2 W | RC20BF472J |
| R202 | Composition, 15K, 1/2 W | RC20BF153J |
| R203 | Composition, 10M, 10%, 1/2 W | RC20BF106K |
| R204 | Dep. Carbon, 1M | R12DC105J |
| R205 | Dep. Carbon, 220K, 1/3 W | R33DC224J |
| R206 | —Deleted— | — — — |
| R207, 208 209 | Dep. Carbon, 1M | R12DC105J |
| R210 | Dep. Carbon, 22K | R12DC223J |
| R211, 212 | —Deleted— | — — — |
| R213, 214 | Dep. Carbon, 100K | R12DC104J |
| R215 | Potentiometer, 50K, MPX Separation | R50150-4 |
| R216 | Composition, 22M, 10%, 1/2 W | RC20BF226K |
| R217, 218 | Dep. Carbon, 18K, 1/3 W | R33DC183J |
| R219, 220 | Dep. Carbon, 15K, 1/3 W | R33DC153J |
| R221 | Composition, 22M, 10%, 1/2 W | RC20BF226K |
| R222, 223 | Dep. Carbon, 27K | R12DC273J |
| R224, 225 | Dep. Carbon, 22K | R12DC223J |
| R226, 227, 228, 229, 230, 231 | Dep. Carbon, 1M | R12DC105J |

## MISCELLANEOUS

| Symbol | Description | Part No. |
|---|---|---|
| CR100 | Diode, Type 1112 | V1112 |
| CR102, 103 | Diode Bridge | V50260-13DX |
| L100 | Coil, low pass | L50210-30 |
| L101 | Coil, 5.25MH | L50334-1 |
| L102, 103 | Coil, 20MH | L50334-2 |
| Z100 | Transformer, 19Kc | ZZ50210-34 |
| Z101 | Coil, 38Kc | ZZ50210-33 |




AW # 2078B P1007-1 SCHEMATIC
MPX 65

* SEE PARTS LIST

1-2FS(1007-1-AK)H

# MAIN CHASSIS • PARTS DESCRIPTION LIST

## CAPACITORS

10% Tolerance for all fixed capacitors, unless otherwise marked or noted GMV (guaranteed minimum value). All capacitors not marked uF are pF (uuF).

| Symbol | Description | Part No. |
|---|---|---|
| C1 | Ceramic, 21, 5%, N750, 1000V | C50070-32 |
| C2 | Ceramic, 8, 5%, NPO, 1000V | C50070-45 |
| C3 | Ceramic, Trimmer | C662-123 |
| C4 | Ceramic, 1000GMV, 500V | C50089-2 |
| C5, A, B, C | Variable, FM Tuning | C966-109-1 |
| C6 | Ceramic, 39, N1500, 1000V | C50070-17 |
| C7 | Ceramic, 24, 5%, N150, 1000V | C50070-8 |
| C8 | Ceramic, 1000, GMV, 500V | C50089-2 |
| C9 | Ceramic, 12, N080, 5%, 500V | CC20LJ120J5 |
| C10 | Ceramic, Trimmer | C662-123 |
| C11 | Ceramic, 8, 5%, NPO, 1000V | C50070-45 |
| C12 | Ceramic, 13, NPO, 5%, 500V | CC20CJ130J5 |
| C13 | Ceramic, 120, 5%, N1500, 1000V | C50070-44 |
| C14, 15, 16, 17 | Ceramic, Feedthru, 1000 | C592-187 |
| C18 | Ceramic, .02uF, +80 –20% | C50095-1 |
| C19 | Ceramic, 2700, 1000V | C50072-17 |
| C20 | Ceramic, 560, 1000V | C50072-14 |
| C21, 22 | Ceramic, 5000, +80 –20%, 500V | C50089-6 |
| C23 | Ceramic, 2700, 1000V | C50072-17 |
| C24 | Ceramic, 5000, +80 –20%, 500V | C50089-6 |
| C25 | Ceramic, 24, 5%, 1000V | C50070-8 |
| C26 | Ceramic, .02uF, +80 –20%, 100V | C50095-1 |
| C27 | Ceramic, .02uF, GMV, 1000V | C50071-6 |
| C28 | Ceramic, 2700, 1000V | C50072-17 |
| C29 | Ceramic, .02uF, GMV, 1000V | C50071-6 |
| C30 | Ceramic, 5000, +80 –20%, 500V | C50089-6 |
| C31 | Ceramic, 18, N470, 1000V | C50070-13 |
| C32 | Mylar, .1uF, 125V | C50435-7 |
| C33 | Ceramic, 1000, 1000V | C50072-3 |
| C34 | Ceramic, .02uF, +80 –20%, 500V | C50089-4 |
| C35 | Ceramic, 2700, 1000V | C50072-17 |
| C36 | Ceramic, .02uF, GMV, 1000V | C50071-6 |
| C37 | Ceramic, 5000, +80 –20%, 500V | C50089-6 |
| C38 | Ceramic, 1800, 1000V | C50072-8 |
| C39, 40 | Ceramic, 330, 1000V | C50072-1 |
| C41 | Electrolytic, 8uF, 50V | C629-138 |
| C42 | Electrolytic, 100uF, 25V | C50483-6 |
| C43, 44 | Ceramic, .02uF, +80 –20%, 500V | C50089-4 |
| C45, 46, 47, 48, 49, 50 | Ceramic, 5000, +80 –20%, 500V | C50089-6 |
| C51 | –Deleted– | – – – |
| C52 | Electrolytic, 4-Section<br>A– 20uF, 300V<br>B– 40uF, 400V<br>C– 40uF, 450V<br>D– 40uF, 500V | C50180-49 |
| C53, 54, 55 | –Deleted– | – – – |
| C56 | Electrolytic, 100uF, 300V | C50180-43 |
| C57 | Electrolytic, 3-Section<br>A– 50uF, 250V<br>B– 50uF, 250V<br>C– 200uF, 300V | C50180-51 |
| C58, 59 | –Deleted– | – – – |
| C60 | Electrolytic, 2-Section<br>A– 1000uF, 35V<br>B– 1000uF, 35V | C50180-38 |
| C61 | –Deleted– | – – – |
| C62 | Ceramic, Feedthru, 1000 | C592-187 |
| C63, 64 | Molded, .01uF, 20%, 600V | C2747 |
| C65, 66 | Ceramic, 100 GMV, N1500, 1000V | C50070-5 |
| C67, 68 | Ceramic, .01uF, 20%, 500V | C50089-3 |
| C69, 70 | Mylar, .047uF, 400V | C50197-49 |
| C71, 72 | Ceramic, 120, N1500, 1000V | C50070-9 |
| C73 | Ceramic, 18, N470, 1000V | C50070-13 |
| C74 | Ceramic, 24, 5%, 1000V | C50070-8 |
| C75, 76 | Ceramic, 1000, 1000V | C50072-3 |
| C77, 78 | Ceramic, .02uF, 20%, 500V | C50089-4 |
| C79, 80 | Ceramic, 56, 5%, N1500, 1000V | C50070-38 |
| C81, 82 | Mylar, .047uF, 400V | C50197-30 |
| C83, 84 | Ceramic, 560, 1000V | C50072-14 |
| C85, 86 | Ceramic, 68, N2200, 1000V | C50070-12 |
| C87, 88 | Ceramic, .02uF, 20%, 500V | C50089-5 |
| C89, 90 | Ceramic, 2 , NPO, 1000V | C50070-23 |
| C91, 92 | Ceramic, 560, 1000V | C50072-14 |
| C93, 94 | Mylar, .047, 630V | C50197-101 |
| C95, 96 | Mylar, .047, 400V | C50197-30 |
| C97, 98 | Ceramic, 18, N470, 1000V | C50070-13 |
| C99, 100 | Ceramic, 330, 1000V | C50072-1 |

## RESISTORS & POTENTIOMETERS

Deposited Carbon, in ohms, 5% Tolerance, 1/8 watt, unless otherwise noted. K=Kilohms, M=Megohms.

| Symbol | Description | Part No. |
|---|---|---|
| R1 | Composition, 270, 10%, 1/2W | RC20BF271K |
| R2 | Composition, 100K, 10%, 1/2W | RC20BF104K |
| R3 | 1.2K | R12DC122J |
| R4 | 220K | R12DC224J |
| R5 | 150K | R12DC154J |
| R6 | 1K | R12DC102J |
| R7 | Composition, 4.7K, 10%, ½W | RC20BF472K |
| R8 | Composition, 3.9K, 10%, 1W | RC30BF392K |
| R9 | Composition, 68, 5%, ½W | RC20BF680J |
| R10 | Composition, 27K, 10%, ½W | RC20BF273K |
| R11 | 39K | R12DC393J |
| R12 | Composition, 1K, 10%, ½W | RC20BF102K |
| R13 | Composition, 150, 10%, ½W | RC20BF151K |
| R14 | Composition, 47K, 10%, ½W | RC20BF473K |
| R15 | Composition, 15K, 10%, ½W | R12DC153J |
| R16 | Composition, 68K, 10%, ½W | RC20BF683K |
| R17 | 2.2M, 1/3W | R33DC225J |
| R18 | 820K | R12DC824J |
| R19 | Composition, 82K, 10%, 1/2W | RC20BF823K |
| R20 | 15K | R12DC153J |
| R21 | 100K | R12DC104J |
| R22 | 3.3M, 1/3W | R33DC335J |
| R23 | 4.7M, 1/3W | R33DC475J |
| R24 | 47K | R12DC473J |
| R25 | 68K | R12DC683J |
| R26 | 470K | R12DC474J |
| R27 | Composition, 270, 5%, 1/2W | RC20BF271J |
| R28 | 47K | R12DC473J |
| R29 | Composition, 1.5K, 5%, 1/2W | RC20BF152J |
| R30 | Composition, 1K, 5%, 1/2W | RC20BF102J |
| R31, 32 | 6.8K | R12DC682J |
| R33 | Composition, 100K, 10%, 1/2W | RC20BF104K |
| R34 | 2.2K, 1/3W | R33DC222J |
| R35 | 1K, 1/3W | R33DC102J |
| R36, 37 | Composition, 220, 10%, 1/2W | RC20BF221K |
| R38 | Composition, 22K, 10%, 1/2W | RC20BF223K |
| R39 | Composition, 2.2K, 10%, 1W | RC30BF222K |
| R40 | Composition, 1.2K, 10%, 1W | RC30BF122K |
| R41 | Glass, 1.2K, 10%, 7W | RPG7W122K |
| R42, 43 | Glass, 330, 10%, 3W | RPG3W331K |
| R44 | Composition, 820K, 10%, 1/2W | RC20BF824K |
| R45, 46 | 220K | R12DC224J |
| R47, 48 | 150K | R12DC154J |
| R49, 50 | 68K | R12DC683J |
| R51, 52 | 100K | R12DC104J |
| R53, 54 | 10 | R12DC100J |
| R55, 56 | 10K | R12DC103J |
| R57, 58 | Glass, 2.7K, 5%, 1/2W | R20G272J |
| R59, 60 | Glass, 330K, 5%, 1W | R30G334J |
| R61, 62 | 4.7M, 1/3W | R33DC475J |
| R63, 64 | 220K, 1/3W | R33DC224J |
| R65, 66 | 330K | R12DC334J |
| R67, 68 | 82K | R12DC823J |
| R69, 70 | 330K | R12DC334J |
| R71, 72 | 470K | R12DC474J |
| R73, 74 | 1.5M, 1/3W | R33DC155J |
| R75, 76 | 2.7M, 1/3W | R33DC275J |
| R77, 78 | 120K, 1/3W | R33DC124J |
| R79, 80 | 1K | R12DC102J |
| R81, 82 | 680K | R12DC684J |
| R83A, B | Pot., 500K, Dual, Treble | R50160-136-1 |
| R84A, B | Pot., 500K, Dual, Bass | R50160-136-2 |
| R85, 86 | 120K, 1/3W | R33DC124J |
| R87, 88 | 1K | R12DC102J |
| R89, 90 | 220K | R12DC224J |
| R91, 92 | 2.7M, 1/3W | R33DC275J |
| R93, 94 | 47K | R12DC473J |
| R95 | Pot., 500K, Balance | R50160-135 |
| R96, 97 | 22K | R12DC223J |
| R98A, B | Pot., 500K, Dual, Volume | R50160-104 |
| R99, 100 | 47K | R12DC473J |
| R101, 102 | 390K | R33DC394J |
| R103, 104 | 1.2K | R12DC122J |
| R105, 106 | 220 | R12DC221J |
| R107, 108 | Potentiometer, 500K | R50150-6 |
| R109, 110 | 47K, 1/3W | R33DC473J |
| R111, 112 | 120K, 1/3W | R33DC124J |
| R113, 114 | 2.7K | R12DC272J |
| R115, 116 | 150K, 1/3W | R33DC154J |
| R117, 118, 119, 120 | 330K | R12DC334J |
| R121, 122, 123, 124 | 1K, 1/3W | R33DC102J |
| R125 | 4.7K, 1/3W | R33DC472J |
| R126, 127 | Wirewound, .25, 10%, 5W | R688-117 |
| R128, 129 | 2.2K, 1/3W | R33DC222J |
| R130, 131 | Composition, 330, 10%, 1/2W | RC20BF331K |
| R132, 133 | 470K | R12DC474J |
| R134, 135 | Composition, 1K, 10%, 1/2W | RC20BF102K |
| R136 | 470K | R12DC474J |
| R137 | Composition, 1.8M, 10%, 1/2W | RC20BF185K |
| R138 | Wirewound, 15, 10%, 5W | R719-106 |

## COILS, CHOKES, TRANSFORMERS

| Symbol | Description | Part No. |
|---|---|---|
| L1 | Coil, FM Antenna | L966-113 |
| L2 | Coil, RF | L1034-113 |
| L3 | Coil, FM Mixer | L1034-112 |
| L4 | Coil, FM Oscillator | AS1034-115 |
| L5 | Choke, 1.2 Microhenry | L50066-3 |
| L6 | Choke, .68 Microhenry | L50066-1 |
| L7 | Choke, 3.3 Microhenry | L50066-8 |
| T1 | Transformer, Power | T1020-124 |
| T2 | Transformer, Output | T1020-116-1AX |
| T3 | Transformer, Output | T1020-116-2AX |
| Z1 | Transformer, FM IF | ZZ50210-20 |
| Z2 | Transformer, FM IF | ZZ2987 |
| Z3 | Transformer, FM IF | ZZ50210-2 |
| Z4 | Coil, FM Limiter | ZZ50210-61 |
| Z5 | Transformer, FM Ratio Detector | ZZ50210-9 |

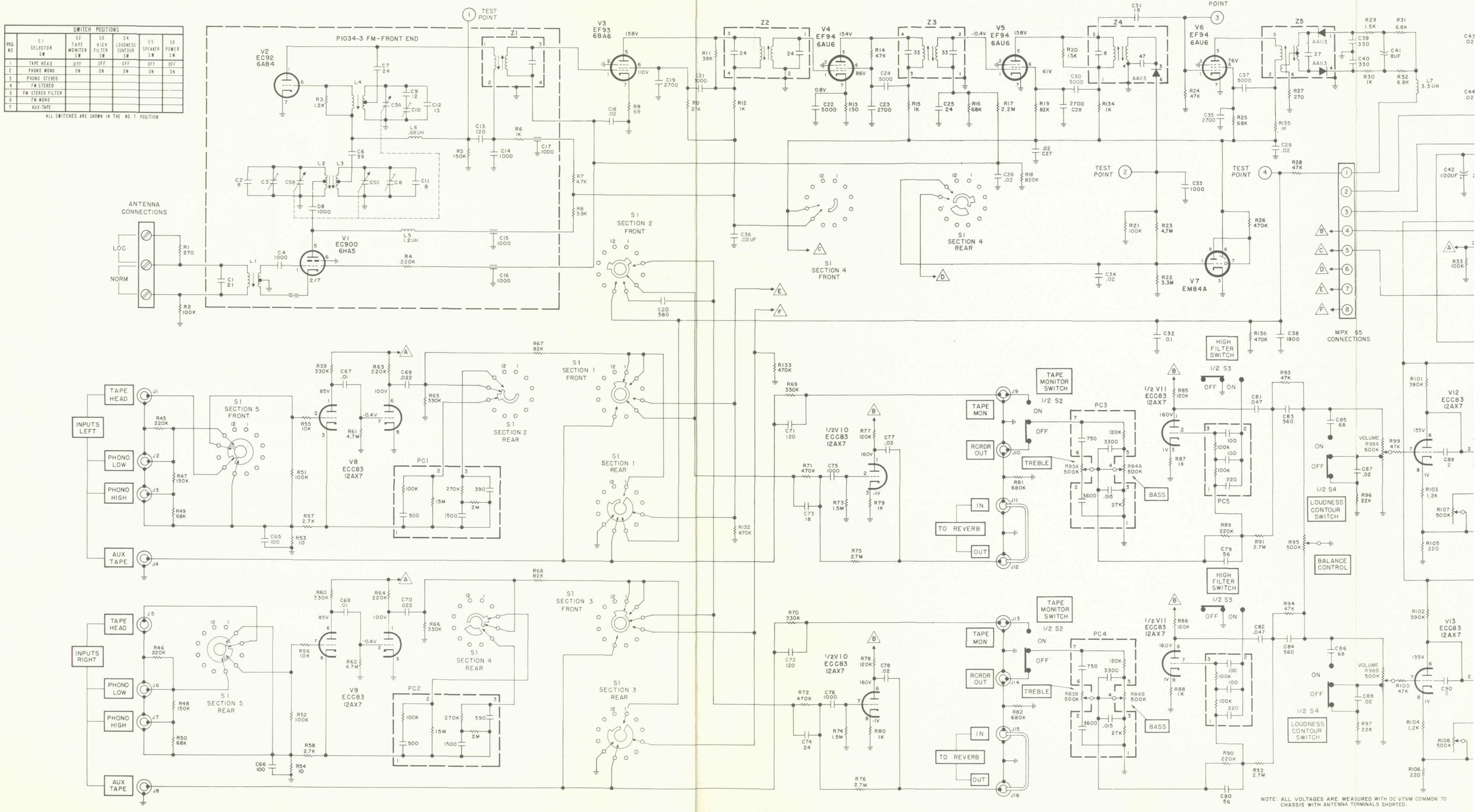
## MISCELLANEOUS

| Symbol | Description | Part No. |
|---|---|---|
| CR1 | Rectifier, Silicon Bridge | SIB50B794-2 |
| CR2, 3 | Diode, Silicon | SR50411-1 |
| F1 | Fuse, 3.2 AMP, Slo-Blo | F3319 |
| I1, I2 | Lamp, Dial | I50411-4 |
| J20 | Jack, Earphone | J846-120-1 |
| PC1, 2 | Printed Circuit, Equalization | PC50187-3 |
| PC3, 4 | Printed Circuit, Tone Control | PC50187-9 |
| PC5, 6 | Printed Circuit, High Filter | PC50187-2 |
| S1 | Switch, Selector | S1020-119 |
| S2, 3, 4, 5 | Switch, Slide | S50200-5 |
| S6 | Switch, Power | Part of R98 |
| – – | Dress.Panel, Screened | AS1020-108 |
| – – | Antenna, FM Dipole | AS50227-1 |
| – – | Knob, Dummy Dual | E50324 |
| – – | Knob, Dual, Top | E50323 |
| – – | Knob, Dual, Bottom | E50221 |
| – – | Knob, Tuning | E50324-1 |
| – – | Dial Glass, Screened | N1020-107 |
| – – | Fuse Holder | X563-151 |

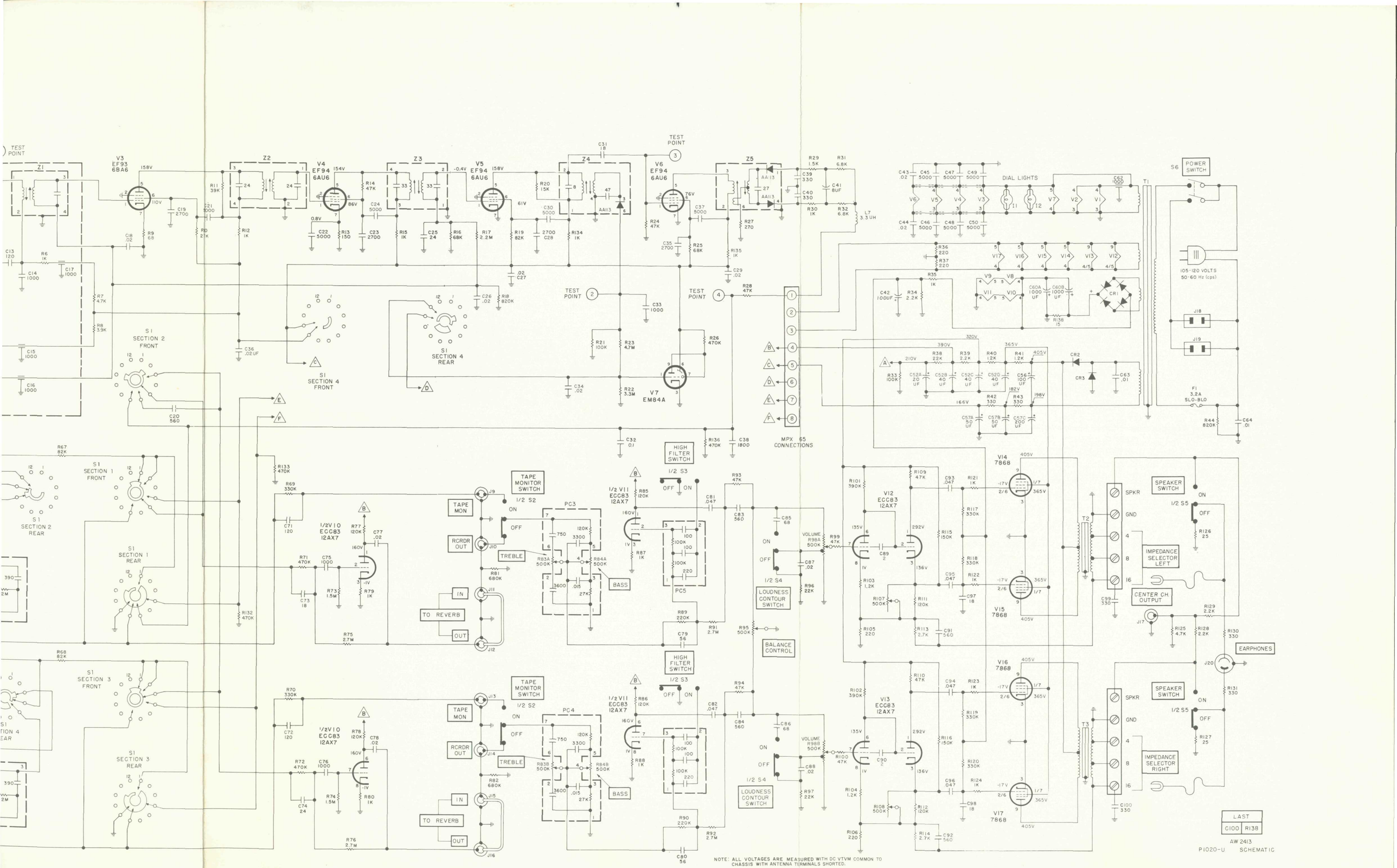
# RECEIVER • SCHEMATIC

| SWITCH POSITIONS | | | | | | | |
|---|---|---|---|---|---|---|---|
| POS. NO. | S1 SELECTOR SW | S2 TAPE MONITER SW | S3 HIGH FILTER SW | S4 LOUDNESS CONTOUR SW | S5 SPEAKER SW | S6 POWER SW |
| 1 | TAPE HEAD | OFF | OFF | OFF | OFF | OFF |
| 2 | PHONO MONO | ON | ON | ON | ON | ON |
| 3 | PHONO STEREO | | | | | |
| 4 | FM STEREO | | | | | |
| 5 | FM STEREO FILTER | | | | | |
| 6 | FM MONO | | | | | |
| 7 | AUX-TAPE | | | | | |

ALL SWITCHES ARE SHOWN IN THE NO. 1 POSITION.




NOTE: ALL VOLTAGES ARE MEASURED WITH DC VTVM COMMON TO CHASSIS WITH ANTENNA TERMINALS SHORTED.




S THE RIGHT TO MODIFY ANY
SATION.

# SERVICE NOTES

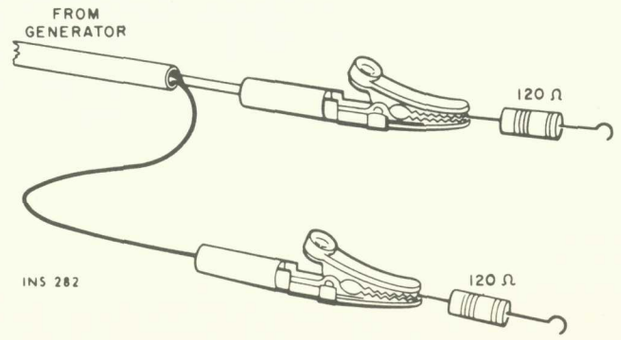
# ALIGNMENT INSTRUCTIONS

- Set the SELECTOR switch to the MONO position for the entire alignment procedure.
- Rotate the TUNING knob to its maximum counterclockwise position. (Dial pointer must line up with the zero (0) calibration mark at the left-hand end of the logging scale without forcing—reset dial pointer if necessary.)
- Warm up the receiver and the test equipment for at least 15 minutes before beginning alignment.
- Adjust the line voltage for 117-volts, 50– to 60–Hz (cps) AC.

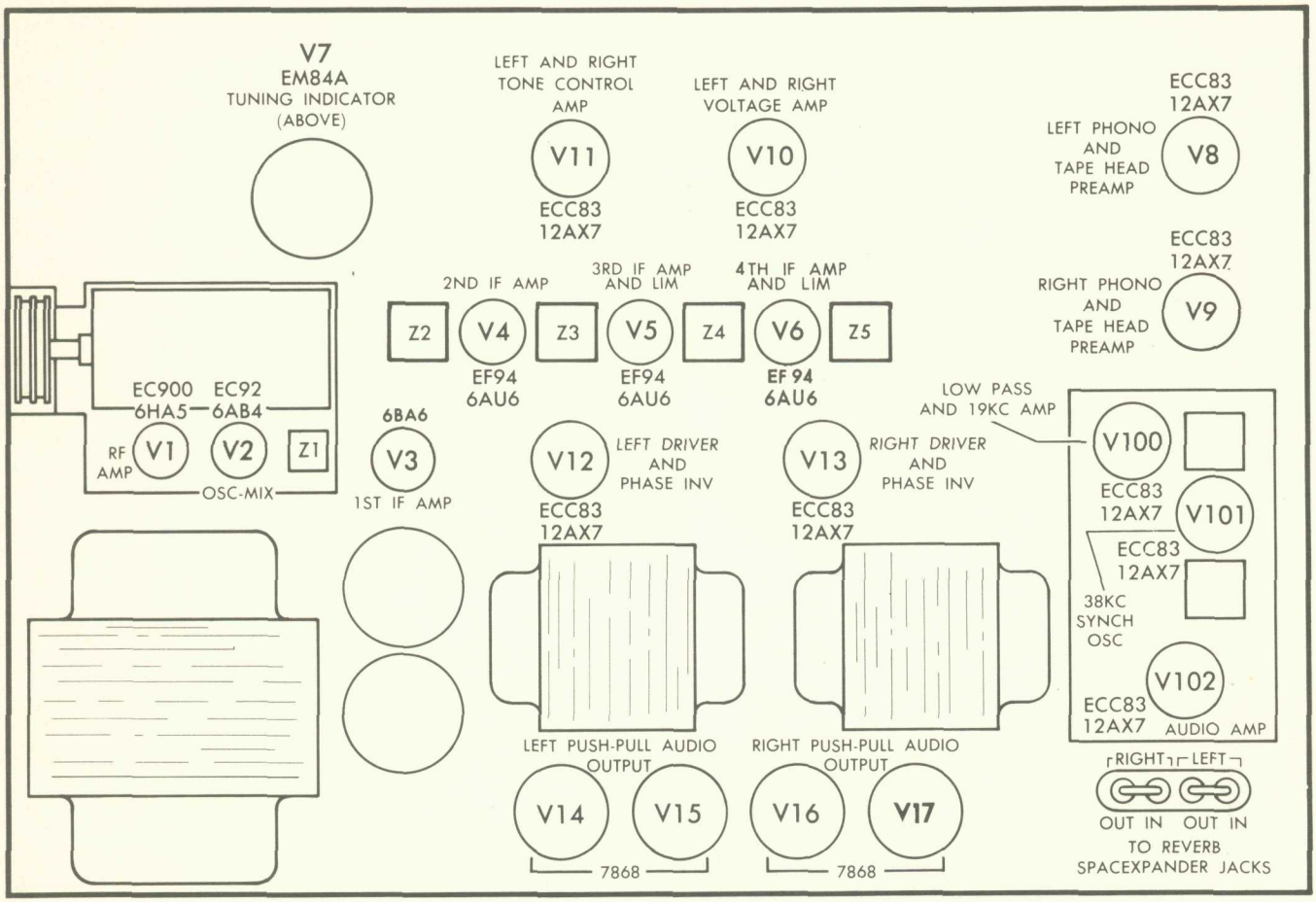
WARNING: Only use the proper, fully insulated, alignment tools to prevent breakage or damage to the adjustable circuit components.

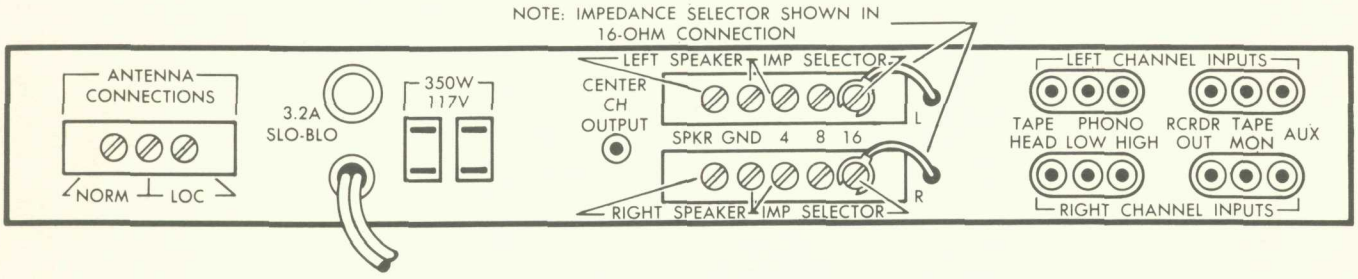
NOTE: Reduce signal-generator output during alignment to keep VTVM readings below the specified voltages.

| STEP | DIAL | SIGNAL GENERATOR | | | DC VTVM | ADJUST | INDICATION |
|---|---|---|---|---|---|---|---|
| | | GENERATOR COUPLING | FREQ. | MOD. | | | |
| 1 | Set dial pointer for extreme C.C.W. position. | Ungrounded tube shield of V2 | 10.7 MHz (MC) | None | TEST POINT 3 | Z1, Z2, Z3 top and bottom; Z4 bottom | Maximum negative voltage (below –5 volts) |
| 2 | | | | | – – – | Z4 top | Maximum indication on TUNING INDICATOR |
| 3 | | | | | Across C41 | Z5 bottom | Maximum indication (below –20 volts) |
| 4 | | | | | Hot lead of DC VTVM to TEST POINT 4; Common lead to ground | Z5 top | Zero indication on zero-center dial. |
| 5 | 90 MHz (MC) | Two 120-ohm carbon resistors in series with generator leads to the Normal antenna terminals. | 90 MHz (MC) | ±22.5 kHz (KC) deviation at 400 cps | Through 100K resistor to TEST POINT 2 | L4, L3 and L2 | Adjust for maximum negative voltages and check for sine wave-form, with scope at Left or Right RCRDR output. |
| 6 | 106 MHz (MC) | | 106 MHz (MC) | ±22.5 kHz (KC) deviation at 400 cps | Through 100K resistor to TEST POINT 2 | C10, C8 and C3 | |
| 7 | 98 MHz (MC) | | 98 MHz (MC) | ±22.5 kHz (KC) deviation at 400 cps | Through 100K resistor to TEST POINT 2 | L1 | |
| 8 | Repeat steps 6 and 7 for proper dial calibration and maximum output. | | | | | | |



# CHASSIS LAYOUT

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