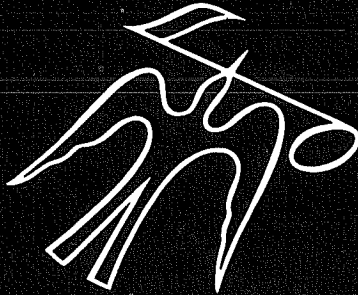


# SERVICE MANUAL

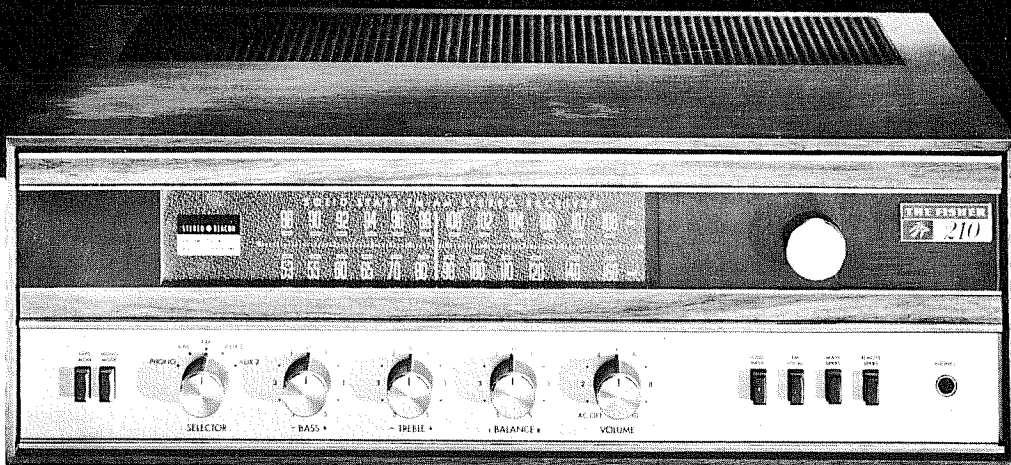
PRICE \$1.00

## 210-T

SERIAL NUMBERS  
BEGINNING 10001



# The Fisher<sup>®</sup> 210-T<sup>™</sup>



**WORLD LEADER IN HIGH QUALITY STEREO**

The following equipment is required to completely test and align modern high-fidelity amplifiers, tuners, and receivers.

Line Voltage Autotransformer or Voltage Regulator  
 DC Vacuum Tube Volt ohmmeter  
 Accurately Calibrated AC Vacuum Tube Voltmeter  
 Oscilloscope ((Flat to 100 kHz Minimum)  
 Low-Distortion Audio (Sine Wave) Generator  
 Intermodulation Distortion Analyzer  
 Harmonic Distortion Analyzer  
 2 — Load resistors, 8-Ohms, 100 Watt (Minimum Rating)  
 AM/FM Signal Generator

10.7 MHz Sweep Generator  
 Multiplex Generator  
 (preferably with RF output)  
 455 kHz Sweep Generator  
 Ferrite Test Loop Stick  
 2 — Full Range Speakers for Listening Tests  
 Stereo Source — Turntable, Tape Recorder, etc.  
 Soldering Iron with Small Tip, Fully Insulated from AC Line  
 Suction Desoldering Tool

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

Many of these items are included only as a reminder — they are normal procedures for experienced technicians. Shortcuts may be taken, but these often cause additional damage to transistors, circuit components, or printed circuit boards.

**SOLDERING:** A well-tinned, hot, clean soldering iron tip will make soldering easier, without causing damage to the printed circuit board or the components mounted on it. Regular use of a sponge cleaner will maintain a clean soldering surface. The heat available at the tip, (not the wattage of the iron) is important. Some 50-watt irons reach temperatures of 1,000° F, while others will hardly melt solder. Small-diameter tips should be used for single solder connections, pyramid and chisel tips for large areas.

Always disconnect the AC power cord from the line when soldering. Turning the power switch OFF is not sufficient. Power-line leakage paths, through the heating element of the iron, may destroy transistors.

**PARTS REMOVAL:** If a part is not being returned for in-warranty factory replacement, it may be cut in half (with diagonal cutting pliers) to make removal easier. Multiple terminal parts, such as IF transformers, or electrolytic capacitors, should be removed using special de-soldering tips made especially for this purpose. Removing solder from terminals, reduces the possibility of breaking the printed circuit board when the part is removed.

**ACCIDENTAL SHORTS:** A clean working area, free of metal particles, screws, etc., is an important preventive in avoiding servicing problems. Screws, removed from the chassis during servicing, should be stored in a box until needed. While a set is operating, it takes only an instant for a base-to-collector short to destroy a transistor (and others direct-coupled to it). In the time it takes for a dropped machine screw, washer, or screwdriver, to contact a pair of socket terminals (or terminal and chassis), a transistor can be ruined.

**SOLID-STATE DEVICES:** Integrated Circuits contain the equivalent of many circuit parts, including transistors, diodes, resistors, and capacitors. The preferred troubleshooting procedure requires isolating the trouble to one stage using AC signal tracing methods. Once the suspected stage is located, the DC voltages at the input and output leads are measured to give an accurate indication of the operating conditions of the IC. DO NOT use an ohmmeter to check continuity with the IC mounted on the printed circuit board. Forward biasing the internal junctions within the IC may burn out the transistors. Do not replace a defective IC until all external resistors, capacitors, and transformers are checked first, to prevent the replacement IC from failing immediately due to a defect in the connecting components. Solder and unsolder each lead separately using a pliers or other heat sink on the lead to prevent damage from excessive heat. Check that the leads are

connected to the correct locations on the printed circuit board before turning the set on.

Whenever possible, a transistor tester should be used to determine the condition of a transistor or diode. Ohmmeter checks do not provide conclusive data, and may even destroy the junction(s) within the device.

Never attempt to repair a transistor power amplifier module until the power supply filter-capacitors are fully discharged.

If an output or driver transistor becomes defective (opens or shorts), always check ALL direct-coupled transistors and diodes in that channel. In addition, check the bias pot., and other parts in the bias network, before installing replacement transistors. All output and driver transistors in one channel may be destroyed if the bias network is defective. After parts replacement, always check the bias adjustment for specified idling current.

In some applications, replacement of transistors must be made from the same beta group as the original type. The beta group is indicated by a colored marking on the transistor. Be sure to include this information when ordering replacement transistors.

When mounting a replacement power transistor, be sure the bottom of the flange, mica insulator, and the surface of the heat sink, are free of foreign matter. Dust and grit will prevent flat contact, reducing heat transfer to the heat sink. Metallic particles can puncture the insulator, cause a short, and destroy 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 transfer. Use Dow-Corning DC-3, or an equivalent compound made for power transistor heat conduction.

Use care when making connections to speakers and output terminals. To reduce the possibility of shorts, lugs should be used on the exposed ends, or stranded wire should be tinned to prevent frayed wire ends. Current in the speakers and output circuitry is quite high — poor contacts, or small sized wire, can cause significant power losses in the system. For wire lengths greater than 30 feet, 16 AWG, or heavier, should be used.

**VOLTAGE MEASUREMENTS:** All voltages are measured with the line voltage adjusted to 120 volts. All measured voltages are  $\pm 10\%$ . DC voltages are measured to ground with a VTVM, with no signal input unless otherwise noted. AC signal voltages are measured under the conditions specified on the schematic.

**ALIGNMENT PROCEDURES:** DO NOT attempt realignment unless the required test equipment is available, and the alignment procedure is thoroughly understood.

	PAGE		PAGE
MECHANICAL DISASSEMBLY	3	TUNER	8-9
DIAL STRINGING	4	PREAMPLIFIER	10
HARMONIC DISTORTION TEST	4	PUSHBUTTON-SWITCH BOARDS	10
CHASSIS LAYOUT	5	CONTROL AMPLIFIER	10
POWER SUPPLY	6	POWER AMPLIFIER	11
MAIN CHASSIS	7	COMPONENT CONNECTIONS	12

## REMOVING DRESS PANEL

- (1) Unplug AC power cord.
- (2) Gently pull SELECTOR, BASS, TREBLE, BALANCE, VOLUME, and TUNING knobs from control shafts. Remove hex nuts from shafts and remove panel by pulling forward over shafts.
- (3) Reverse procedure for reassembly.

## REMOVING P.C. BOARDS

To remove a board from its nylon mounts, squeeze the loop of each mounting clip (using pliers), and lift each corner of the board. To remount the board, align the mounting holes over the clips, and press firmly.

To remove any of the three boards containing the front panel controls and switches, use the following procedure:

- (1) Remove dress panel. Refer to REMOVING DRESS PANEL procedure.
- (2) a. Remove CONTROL AMPLIFIER board by removing hex nuts from BASS, TREBLE, BALANCE, and VOLUME controls.  
b. Remove pushbutton mounting boards by removing the appropriate pushbutton knobs and the two screws holding the switch to the chassis.

## REPLACING STEREO BEACON AND METER LAMPS

**NOTE:** The compartmented lamp assembly (FR No. M21C604-2), mounted on the rear of the meter, contains the meter lamp and the STEREO BEACON lamp, and must be replaced as a complete unit.

- (1) Unplug AC power cord. Remove top cover.
- (2) Gently pull the four wires off the terminal pins on the top rear of the meter. Label each wire with its associated pin location to make replacement easier later.
- (3) Gently unsnap the lamp compartment from the top rear of the meter. Center the replacement assembly between the flanges and press firmly into place.

## REPLACING METER

- (1) Unplug AC power cord. Remove top cover.
- (2) Gently unsnap the lamp compartment from the top of the meter. It is unnecessary to remove the leads.
- (3) Gently pry the meter off the panel, and scrape off the residual adhesive.
- (4) Unsolder the two leads from the terminals on the rear of the meter and label each wire with its associated pin location for easy replacement later.  
**WARNING:** Damage to the meter may result from excessive heating of the meter terminals. Use a pair of pliers (as a heat sink) to hold each terminal when soldering or unsoldering leads.
- (5) Peel the backing from one side of the replacement adhesive mounting pad (FR No. E51A165), and affix it to the replacement meter (FR No. MC21609-1). Peel the backing from the remaining side of the adhesive pad, align the meter over the cutout, and firmly press the meter to the back of the panel.
- (6) Center the lamp compartment between the flanges and press firmly into place.

## REPLACING DIAL LAMPS

**NOTE:** Dial lamps are replaceable only as molded assemblies (FR No. AS21410-3).

- (1) Unplug AC power cord. Remove top cover.
- (2) Remove dress panel. Refer to REMOVING DRESS PANEL procedure.
- (3) Squeeze the sides of the assembly together at the back and press through the panel.

## REMOVING DIAL GLASS

- (1) Remove dress panel. Refer to REMOVING DRESS PANEL procedure.
- (2) Carefully remove the foam strips at the ends of the dial glass. Strips may be reused with the replacement glass.
- (3) Slide the retaining clips from the flanges by gently twisting a flat-blade screwdriver in each slot.

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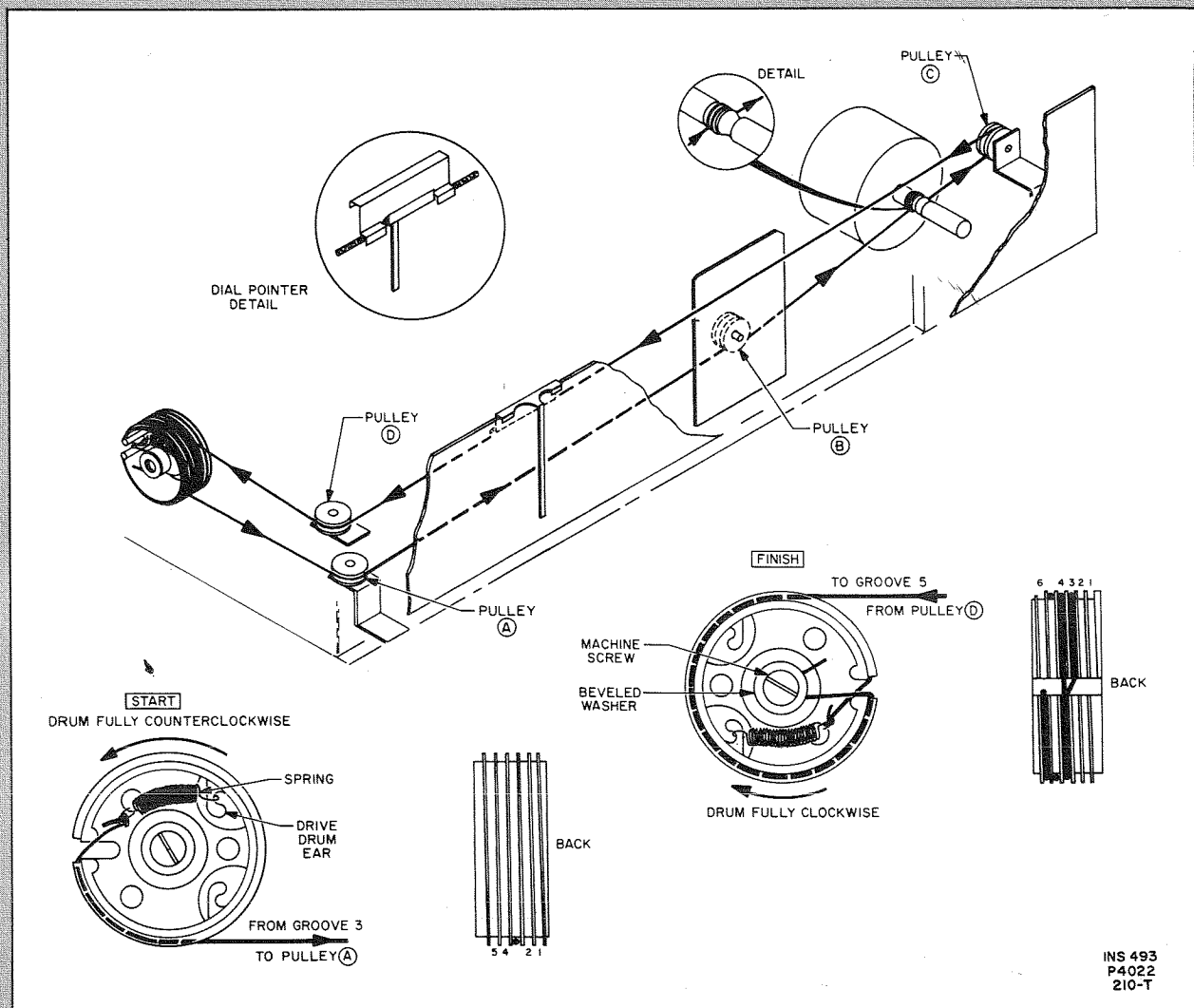
- (1) Unplug AC power cord. Remove top cover.
- (2) Remove pointer from old dial cord. Rotate tuning capacitor fully CCW. Loosen screw in center of drum and remove old cord.
- (3) Tie end of new cord to one end of dial spring. Hook spring on drive-drum ear (see illustration).
- (4) Run cord through rim slot, and wrap  $\frac{1}{2}$  turn CCW around drum inside groove 3. Guide cord around pulley "A", underneath pulley "B", and wrap 2 full turns CCW around tuning shaft.
- (5) Guide cord around pulley "C", and around pulley "D". Rotate drum fully CW, allowing cord to wind on drum, keeping cord taut. Run cord over top of drum (inside groove 5) around other side into rim slot.
- (6) Pull cord taut under washer and tighten screw.
- (7) Turn tuning shaft to rotate gang fully CCW and fully CW to distribute tensioning along cord.
- (8) Place pointer on rail and slip cord over and under tabs on pointer. Repeat steps (6) and (7) until spring is properly tensioned.
- (9) Turn tuning shaft fully CCW. Slide pointer to (0) on logging scale while holding tuning shaft fully CCW. Cement pointer to cord to prevent slippage. Allow cement to thoroughly dry. Check dial calibration.

**CAUTION:**

- (A) Measure the power of one channel at a time.
- (B) Limit measurements to 10 minutes.
- (C) Use a load resistor with a minimum rating of 50 watts.

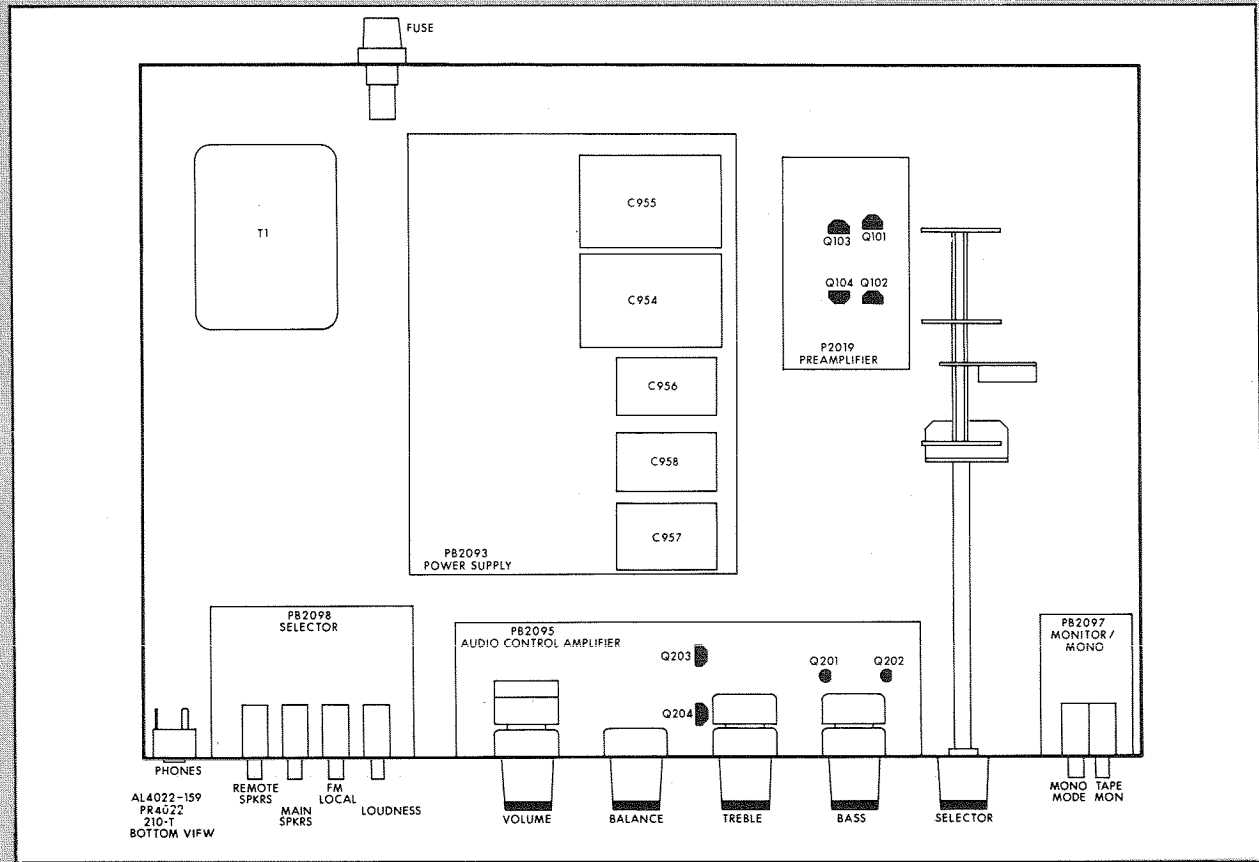
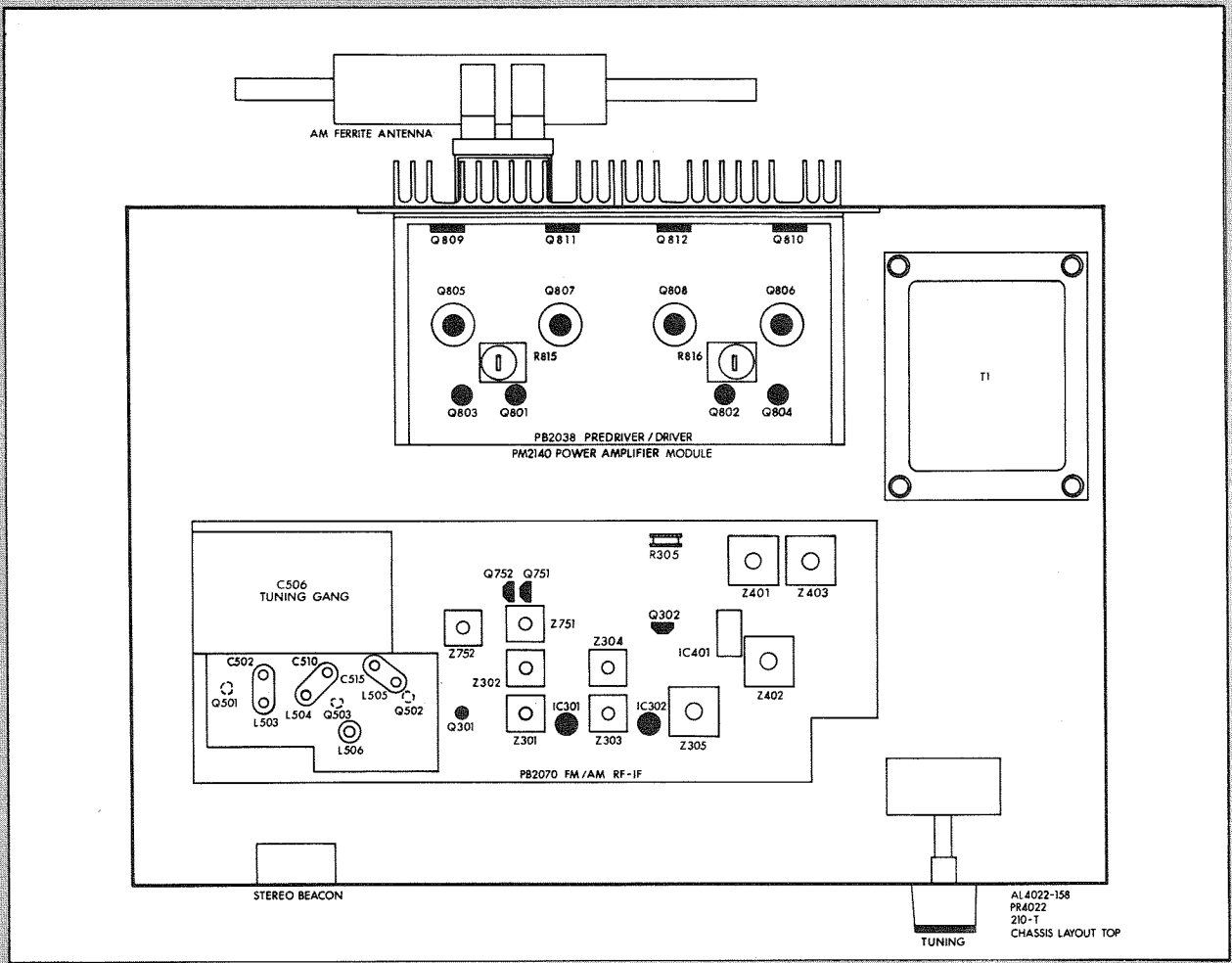
Set BASS and TREBLE controls to NORMAL. Set SELECTOR switch to AUX 1. Depress MAIN SPKRS switch. Unplug AC power cord.

- (1) Connect a low-distortion sine-wave generator to the LEFT AUX 1 IN jack. Set generator frequency to 1,000 Hz, and output level to minimum.
- (2) Connect an 8-ohm load resistor between the LEFT SPKRS MAIN and COMMON terminals. In parallel with the load resistor, connect the input leads of an HD analyzer and the input leads of an accurately calibrated AC VTVM.
- (3) Connect AC power cord and rotate VOLUME control to maximum.
- (4) Increase generator level for 32 watts output (15.9V RMS across 8-ohm load). HD Meter should read 0.5% or less.
- (5) Repeat preceding steps for right channel.

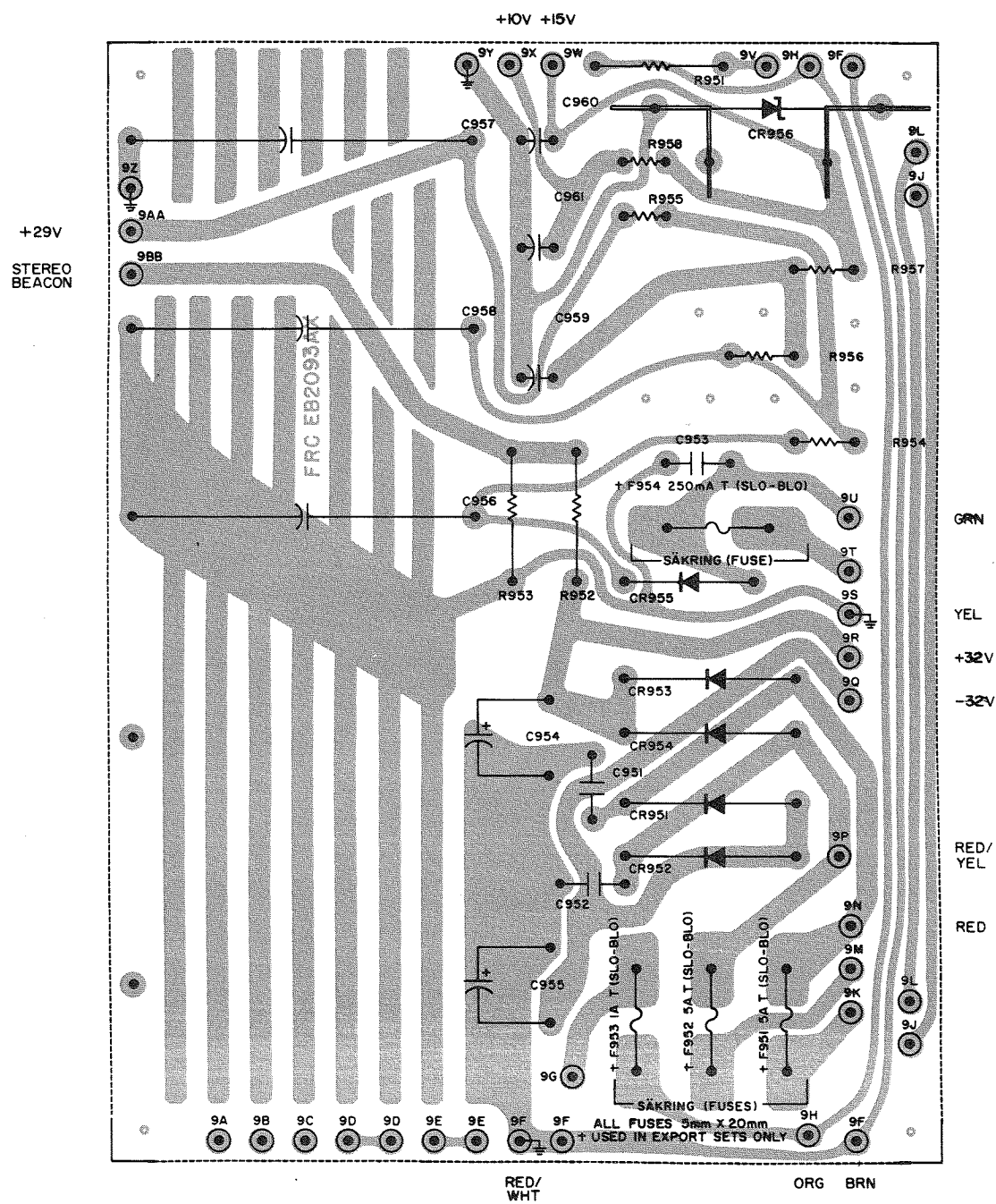


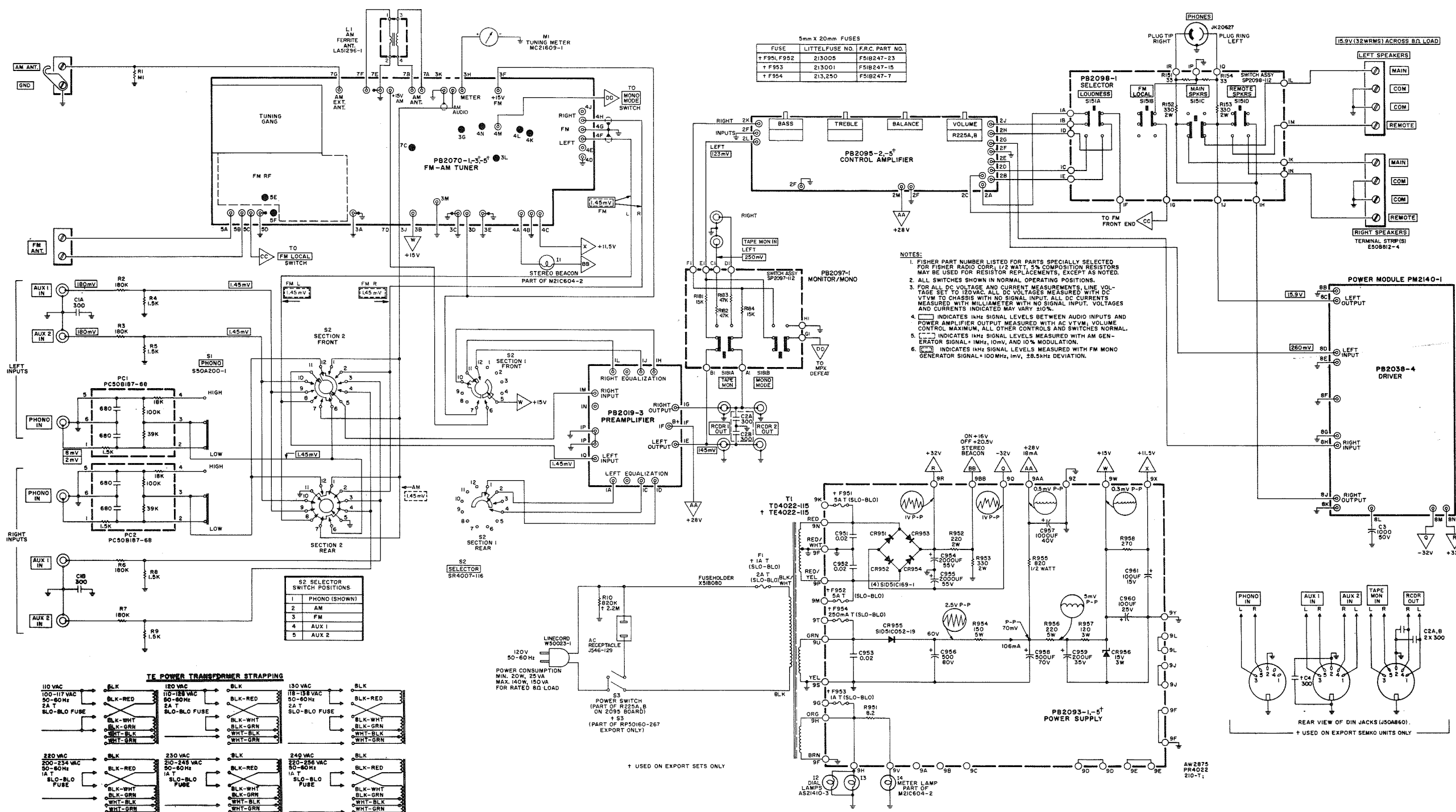


TOP VIEW

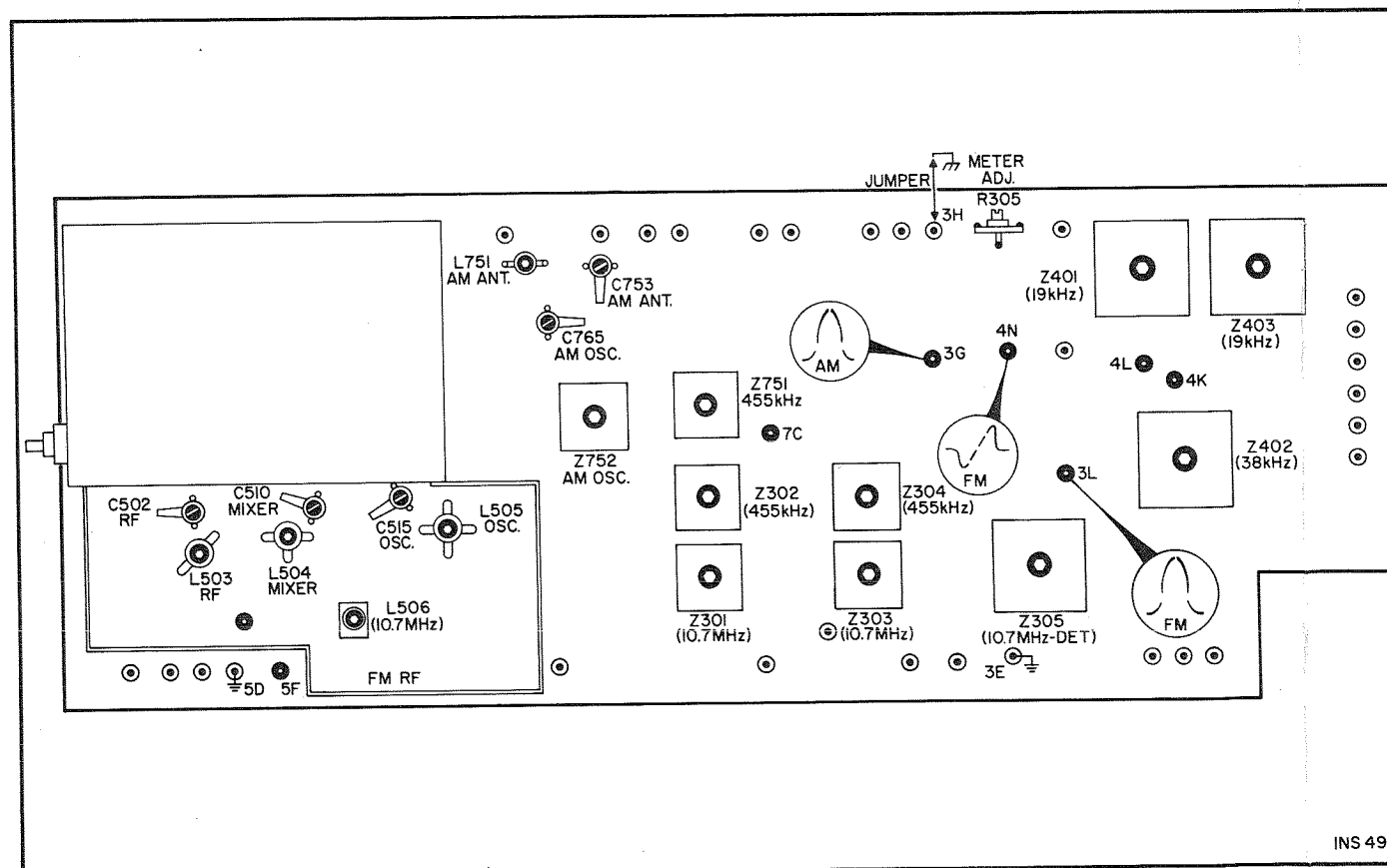
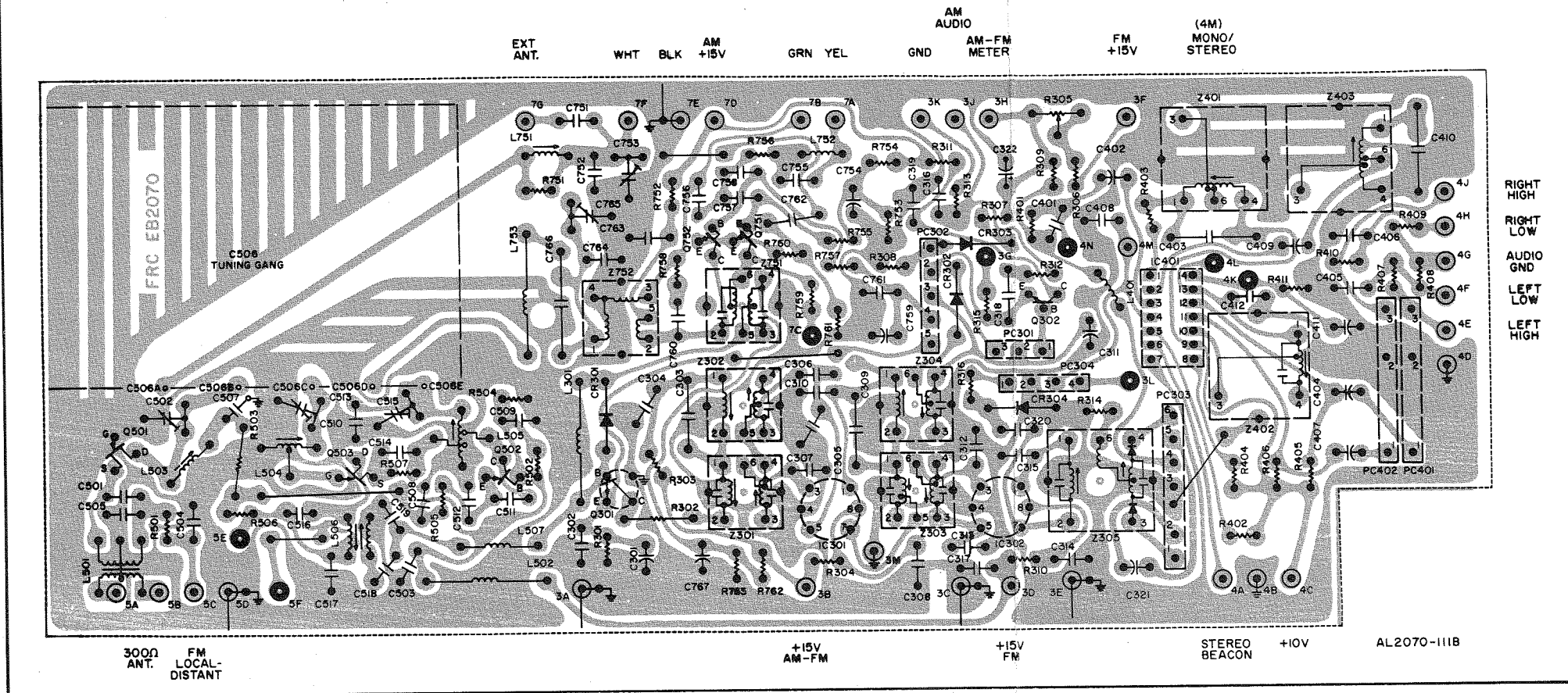


BOTTOM VIEW









Turn TUNING knob fully CCW. If pointer is not centered on (0), reposition and cement pointer. Except as noted, maintain generator level as low as possible during alignment.

### FM ALIGNMENT

- (1) Set SELECTOR switch to FM. Turn VOLUME control to minimum. Depress FM LOCAL and MONO MODE pushbuttons.
- (2) Connect 10.7MHz sweep generator to pin 5F, cable ground to pin 5D. Connect DC (vertical) input of scope to pin 3L, cable ground to pin 3E.
- (3) Adjust bottom core of Z305; then top and bottom cores of Z303, Z301, and L506 for maximum gain and symmetry. See FM IF illustration.
- (4) Reconnect scope input to pin 4N. Connect DC VTVM to pin 4N. Temporarily connect a jumper between pin 3H and chassis ground. Adjust top core of Z305 for maximum symmetrical amplitude. See FM DETECTOR illustration.
- (5) Reduce generator sweep to zero (SWEEP OFF). Set DC VTVM to lowest (most sensitive) range. Readjust top core of Z305 for 0 VDC. Disconnect test equipment and jumper.
- (6) Tune receiver to point of non-interference (noise only). Adjust pot. R305 for exact center-of-scale reading on receiver's tuning meter.
- (7) Connect an FM signal generator to the FM ANTenna terminals through 120-ohm composition resistors, one in series with each lead from the generator. Release FM LOCAL pushbutton switch. Connect scope and AC VTVM to the

LEFT RCDR 1 OUT jack.

(8) Set generator frequency and dial pointer accurately to 90MHz. Modulate generator with 400Hz,  $\pm 75$ kHz deviation. Adjust oscillator coil L505 for center-of-scale reading on receiver's tuning meter, and maximum audio on AC VTVM.

(9) Set generator frequency and dial pointer accurately to 106MHz. Adjust oscillator trimmer C515 for center-of-scale and maximum audio meter readings.

(10) Repeat steps (8) and (9) for accurate dial calibration and maximum audio.

(11) Set generator frequency and dial pointer to 90MHz. Reduce generator output until noise interference is visible on sine wave. Adjust generator frequency to center noise interference on positive and negative half-cycles. See SYMMETRICAL TUNING illustration. Adjust mixer coil L504 and RF coil L503 for maximum audio.

(12) Set generator frequency and dial pointer to 106MHz. If necessary, readjust generator output until noise interference is visible on sine wave (see SYMMETRICAL TUNING illustration). Adjust mixer trimmer C510 and RF trimmer C502 for maximum audio.

(13) Repeat steps (11) and (12) for maximum audio. Increase generator level to 10mV.

(14) Connect MPX generator composite output to FM signal generator EXTERNAL MODULATION input. Modulate composite signal with 1kHz,  $\pm 72$ kHz deviation (96% audio); and 19kHz carrier,  $\pm 3$ kHz deviation (4% pilot). Modulate right channel only.

(15) Tune receiver accurately to generator frequency. Connect DC VTVM to pin 4K. Connect vertical input of scope to pin 4L.

(16) Adjust Z401 and Z403 for maximum DC voltage at pin 4K. Note meter reading. Adjust Z402 for maximum AC voltage (on scope) at pin 4L. Reconnect vertical input of scope to LEFT RCDR 1 OUT jack.

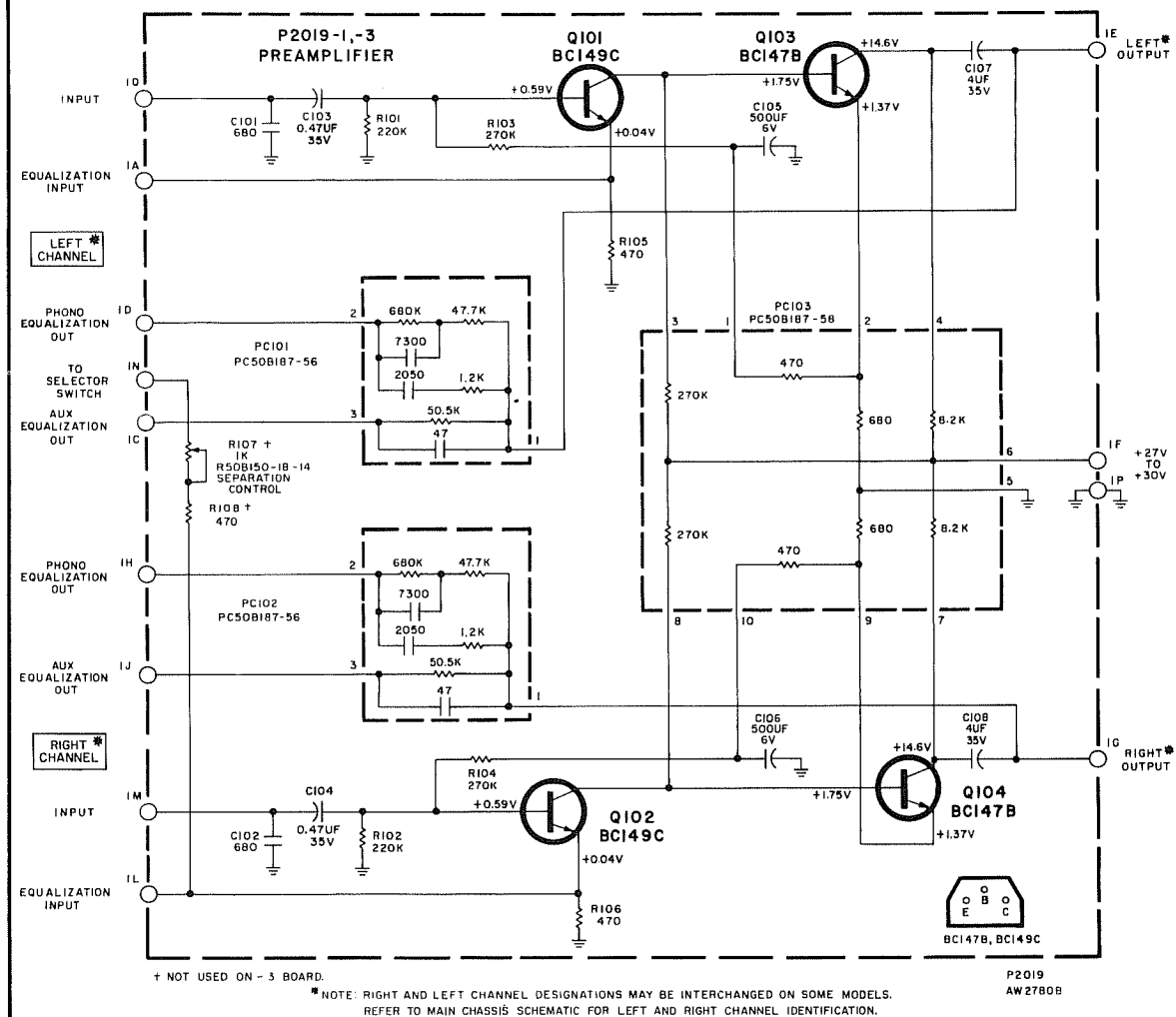
(17) Detune Z401 (rotate core CCW) until DC voltage at pin 4K decreases 10%. Increase 19kHz carrier deviation to  $\pm 7.5$ kHz (10% pilot). STEREO BEACON lamp should be fully on. Readjust Z402 for minimum amplitude on scope (maximum separation).

### AM ALIGNMENT

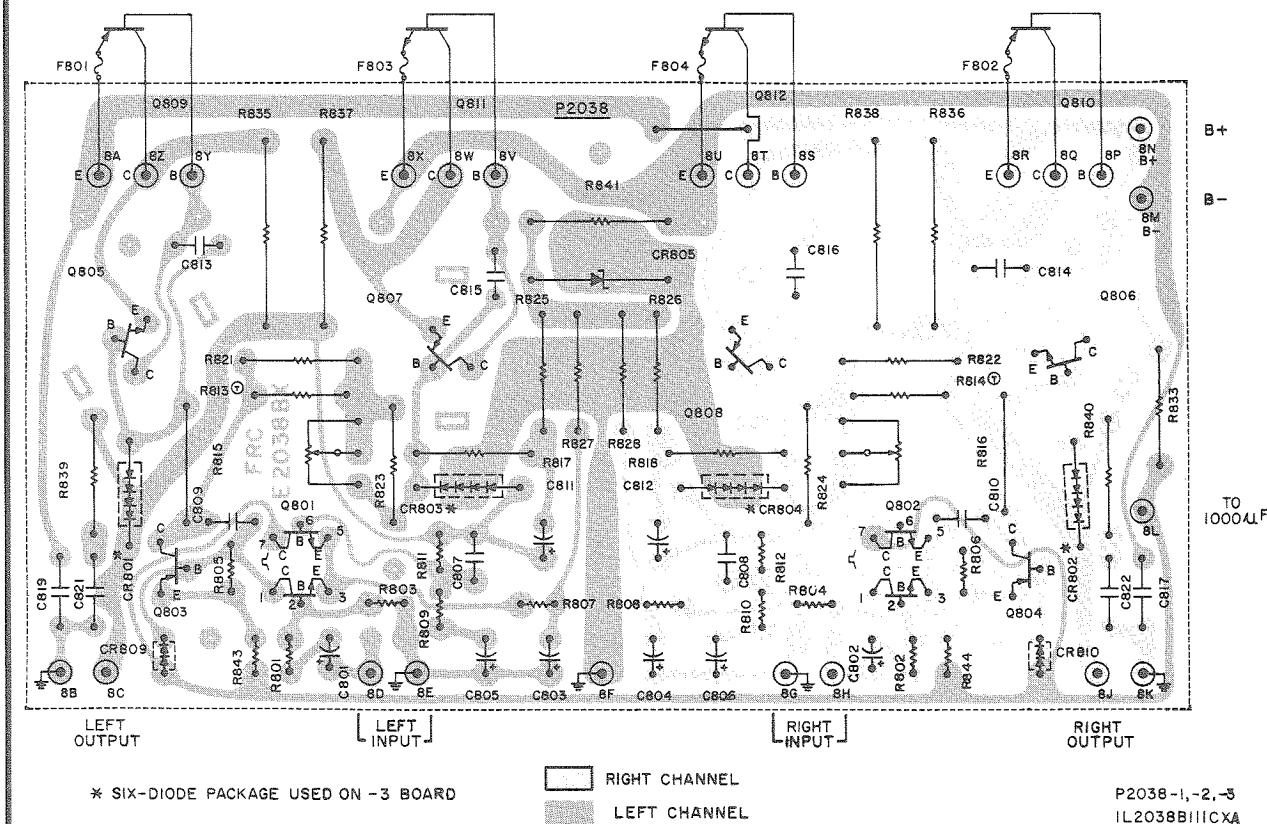
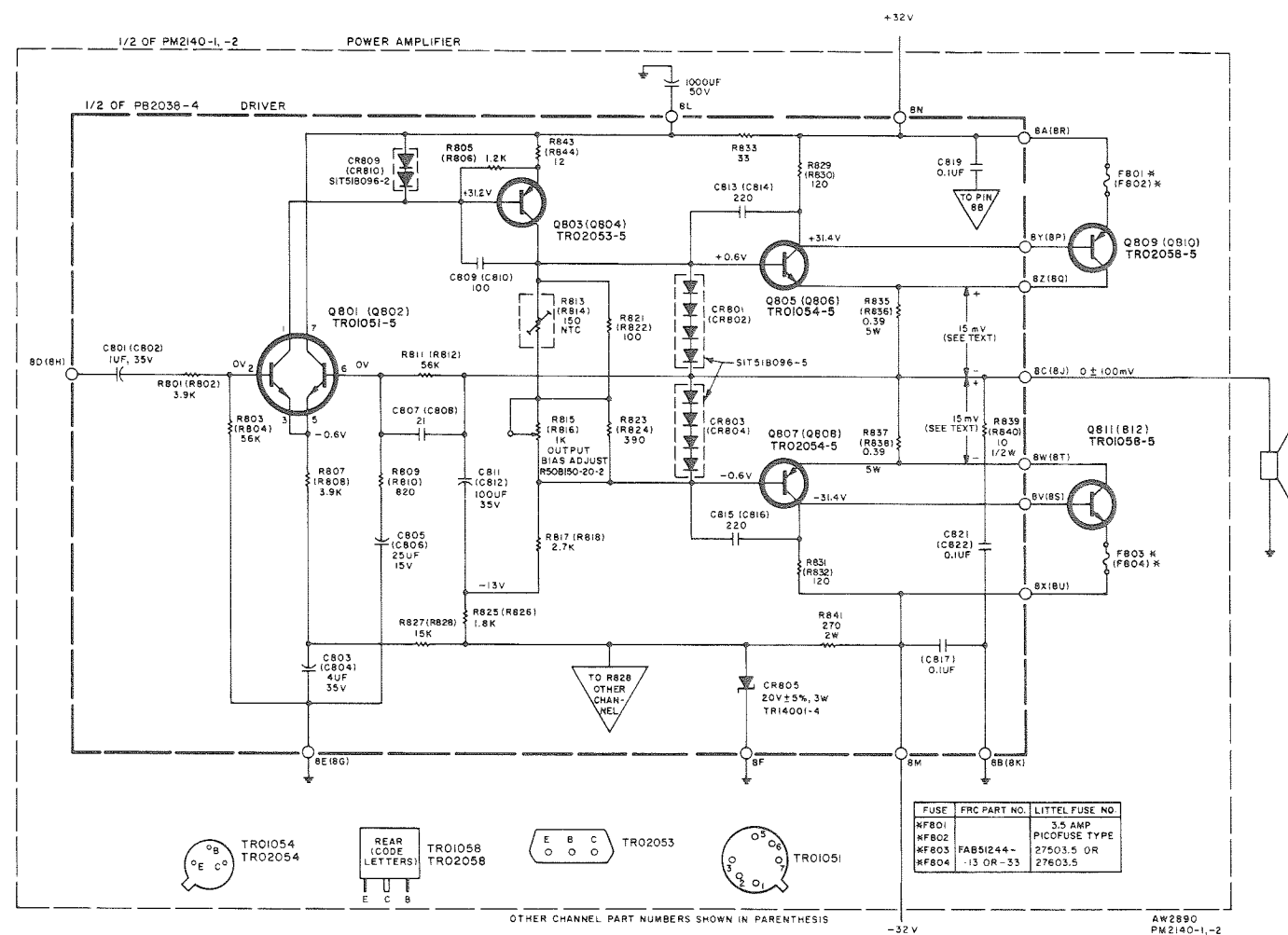
- (1) Set SELECTOR switch to AM. Turn VOLUME control to minimum.
- (2) Connect 455kHz sweep generator through 0.1 $\mu$ F to pin 7C. Connect scope input to pin 3G, cable grounds to chassis.
- (3) Adjust top and bottom cores of Z304, Z302, and Z751 for maximum gain and symmetry. See AM IF illustration.
- (4) Disconnect test equipment. Open shorting link between AM ANTenna terminals. Connect AM signal generator through 220pF to antenna terminals. Connect scope and AC VTVM to LEFT RCDR 1 OUT jack.
- (5) Set generator frequency and dial pointer accurately to 600kHz. Modulate generator with 400Hz, 30% modulation. Adjust oscillator coil Z752 for maximum audio.
- (6) Adjust generator frequency and dial pointer accurately to 1400kHz. Adjust oscillator trimmer C765 for maximum audio.
- (7) Repeat steps (5) and (6) for accurate dial calibration and maximum gain.
- (8) Set dial pointer accurately to generator frequency at 600kHz. Adjust antenna coil L751 for maximum audio.
- (9) Adjust dial pointer accurately to generator frequency at 1400kHz. Adjust antenna trimmer C753 for maximum audio.
- (10) Repeat steps (8) and (9) for maximum gain.











### CENTER VOLTAGE TEST

Turn VOLUME control to minimum. Depress MAIN SPKRS switch.

(1) Connect DC VTVM across LEFT MAIN SPKRS terminals. Meter should read OVDC ( $\pm 100$  mV).

(2) Connect DC VTVM across RIGHT MAIN SPKRS terminals. Meter should read OVDC ( $\pm 100$  mV).

### IDLING CURRENT ADJUSTMENT

Turn VOLUME control to minimum.

(1) Connect ground of DC VTVM to pin 8C and probe to pin 8Z. BE CAREFUL TO AVOID SHORTING ADJACENT PINS. Set BIAS ADJUST pot. R815 for 15 mVDC.

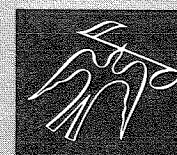
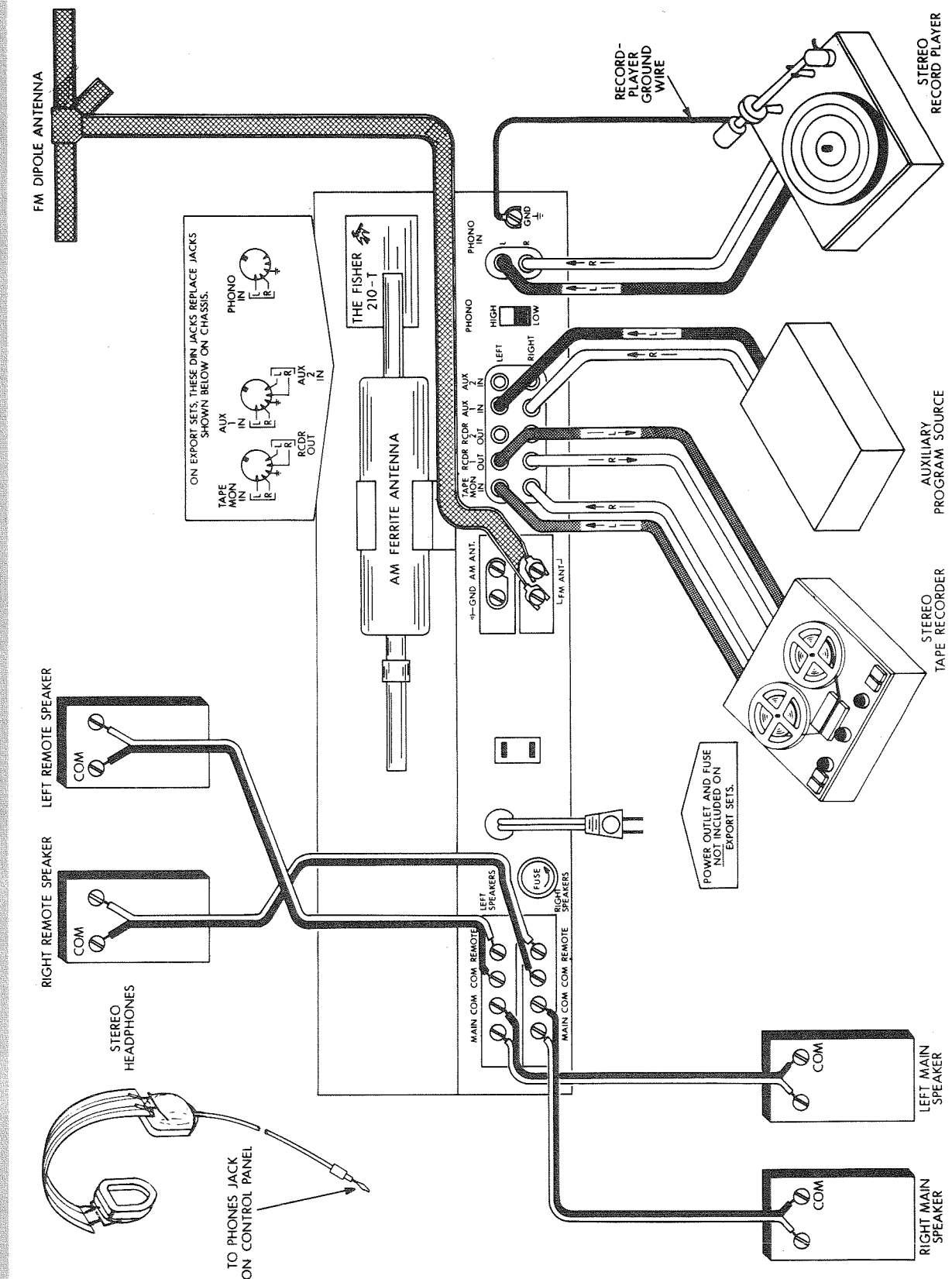
(2) Connect ground lead of DC VTVM to pin 8J and probe to pin 8Q. BE CAREFUL TO AVOID SHORTING ADJACENT PINS. Set BIAS ADJUST pot. R816 for 15 mVDC.

**NOTE:** Idling current will increase and stabilize as amplifier temperature normalizes.

(3) Allow unit to warm up 15 minutes. Repeat steps (1) and (2), resetting BIAS ADJUST pots. for 15 mVDC.



COMPONENT CONNECTIONS



FISHER RADIO • LONG ISLAND CITY • NEW YORK 11101

