Service Manual

THE FISHER

200-T

FISHER RADIO CORPORATION • 11-46 45th ROAD • LONG ISLAND CITY, N.Y. 11101
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.

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

- Vacuum Tube Voltmeter (100-mV DC scale)
- Audio Vacuum Tube Voltmeter (10-mV AC scale)
- Oscilloscope (Flat to 100 kHz Minimum)
- Audio (Line-Wave) Generator
- Intermodulation Distortion Analyzer
- Harmonic Distortion Analyzer
- AM/FM Signal Generator
- Multiplex Generator (preferably with RF output — FISHER Model 300 or equal)
- 10.7-MHz Sweep Generator
- 455-kHz Sweep Generator
- Line Voltage Auto-transformer or Voltage Regulator
- 2 — Load Resistors, 4 or 8 Ohm, 50 Watt
- 2 — Full Range Speakers for Listening Tests
- Stereo Source — Turntable or Tape Recorder for Listening Tests
- Soldering Iron with Small Tip
- Fully Insulated from Power Line
- Section Desoldering Tool

PRECAUTIONS

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

Soldering — A well-tuned, hot, clean soldering iron tip will make it easier to solder without damage to the printed-circuit board or the many circuit components mounted on it. It is not the wattage of the iron that counts — it is the heat available at the tip. 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 pyramidal 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 tips 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 line cord and waiting until the power supply filters 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 color 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 mike insulator and the surface of the heat sink are free of foreign matter. Dust and grit can prevent perfect contact reducing 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. (Use Dow-Corning DC-3 or C23013 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. To reduce the possibility of shorts at the speakers, lugs should be used on the exposed ends or at least the ends of the stranded wires should be tinned to prevent frayed wire ends. The current in the speaker wire output circuitry is quite high. Poor contacts or small size wire can cause power losses in the speaker system. Use 14 or 16 AWG for long runs of speaker wiring.

Voltage Measurements — Voltage measurements are made with the line voltage adjusted to 117 volts and all readings are ± 10%. All voltages are DC; measured with a VTVM to ground, with no signal input unless otherwise noted. Indicates 4-kHz audio voltages, measured with an audio AC VTVM to ground at various points from the phone input to the power amplifier output.

Alignment Procedures — Replacement of transistors and components in the front end, IF amplifier and multiplex decoder will normally not require realignment of these circuits. Realignment of these circuits, unless absolutely necessary, is not recommended. Do not attempt a realignment unless the required test equipment is available and the alignment procedure is thoroughly understood.

BECAUSE ITS PRODUCTS ARE SUBJECT TO CONTINUOUS IMPROVEMENT, FISHER RADIO CORPORATION RESERVES THE RIGHT TO MODIFY ANY DESIGN OR SPECIFICATION WITHOUT NOTICE AND WITHOUT INcurring ANY OBLIGATION.
SERVICE PROCEDURES

DIAL STRINGING

(1) Disconnect AC power cord.
(2) Remove the screw which hold the top cover to the chassis and lift off the top cover.
(3) Gently pull all knobs off the control panel shafts. Remove the hex nuts from the control shafts and lift off the control panel.
(4) Remove the hex nut spacer which holds the dial glass panel to the brackets on the left side off the chassis.
(5) Remove the two sheet metal screws which hold the dial glass panel to the brackets on the right front of the chassis. Pull the dial glass panel to the left and tilt the panel down as far as the tabs allow.
(6) Remove the dial cord from under the tabs on the rear of the dial pointer and remove the pointer from the set.
(7) Rotate the tuning capacitor drive drum to its maximum counterclockwise position.
(8) Tie the end of the dial cord to the end of the small spring. Fasten the spring to the ear inside the bottom left of the drive drum (see start view).
(9) Run the dial cord through the slot in the drive drum and set the cord in the under side of groove B.
(10) Guide the dial cord over pulleys A and B and wrap 2 full turns of the cord around the tuning shaft (dial view).
(11) Guide the dial cord around pulleys B and C.
(12) Rotate the tuning capacitor drive drum to its maximum clockwise position, allowing the dial cord to follow the grooves in the drive drum.
(13) Pull the dial cord taut and place it in the underside of groove 5 of the drive drum (see finish view). Wrap 1 full turn of the cord around the drive drum.
(14) Run the dial cord through the slot in the drive drum and under the beaded washer. Tighten the machine screw to hold the dial cord.
(15) Replace the dial glass panel and secure with the hex nut spacer and two sheet metal screws removed previously.
(16) Place the dial cord over and under the tabs on the rear of the dial pointer. Replace the dial pointer on the top of the dial glass panel.
(17) Replace the control panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.
(18) Replace the top cover on the chassis and secure with the screws removed previously.

REPLACING STEREO BEACON LAMP

(1) Disconnect AC power cord.
(2) Remove the screws which hold the top cover to the chassis and lift off the top cover.
(3) Pry the plastic lamp holder from the lamp mount. Unsolder the leads from the lamp holder. Solder the leads to the rear terminals on the new lamp holder. Place the new lamp holder in the mount.
(4) Replace the top cover on the chassis and secure with the screws removed previously.

REPLACING METER LAMP

(1) Disconnect AC power cord.
(2) Remove the screws which hold the top cover to the chassis and lift off the top cover.
(3) Gently push in on the lamp and turn it counterclockwise to disengage it. Remove the metal lamp housing.
(4) Place the new lamp in the socket, push in gently and turn it clockwise to lock it in place. Slide the metal lamp shade onto the lamp so that the unshaded portion of the lamp faces the meter.
(5) Replace the top cover on the chassis and secure with the screws removed previously.

REPLACING DIAL LAMPS

(1) Disconnect AC power cord.
(2) Gently pull all knobs off the control panel shafts. Remove the hex nuts from the control shafts and lift off the control panel.
(3) Snap out the defective lamp from the spring clip. Place the new lamp in the socket making sure that the unplated side of the lamp faces the edge of the dial glass.
(4) Replace the control panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.

CLEANING DIAL GLASS

(1) Disconnect AC power cord.
(2) Gently pull all knobs off the control panel shafts. Remove the hex nuts from the control shafts and lift off the control panel.
(3) If there are foam cushion strips located at the ends of the dial glass, carefully remove them from the clips.
(4) Loosen the screws which hold the retaining clips to the dial glass. Swing the clips aside and lift off the dial glass. NOTE: The glass is held behind by adhesive rubber strips; use a gentle prying force at the ends to free the glass.
(5) Remove dust with a dry cloth. If you wish to clean more thoroughly, use only plain lukewarm water; any stronger cleaning agent may damage the markings on the glass.
(6) Replace the dial glass and position it down and towards the left of the chassis front. Swing the retaining clips back into place and tighten the retaining clips screws. Replace the foam-cushion strips, if removed previously.
(7) Replace the control panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.

CLEANING CONTROL PANEL

WARNING: Use only plain lukewarm water and a finely laundered, soft lint-free cloth to clean the control panel.
MULTIPLE ALIGNMENT

Two methods of aligning the multiplex decoder are given. The preferred procedure uses a multiplex generator with RF and 19 kHz (I) output and with 1 kHz (Q) modulation, such as the FISHER Model 300 Multiplex Generator. This is the better method of alignment since the front end and IF stages are also checked through the use of this procedure. An alternate procedure for use with multiplex generators not having an RF output is also given.

PREFERRED ALIGNMENT PROCEDURE

Set SELECTOR switch to FM, MODE switch to STEREO and MUTING switch to OFF. (1) Connect RF output of multiplex generator to the FM ANT, antenna terminals. Set TUNING dial pointer to RF frequency of multiplex generator.

(2) Connect output audio generator, set for 1 kHz (I), to the external modulation input of the multiplex generator and to the external sync input of an oscilloscope. Connect the vertical input of the scope to pin 48 on the multiplex board and adjust the output of the multiplex generator for 1.4 volts peak-to-peak of composite multiplex output (see Figure 1).

(3) Ground pin 4C on the multiplex board to the chassis.

(4) Follow procedures given in Table 1 below.

NOTE: Check the alignment of the IF amplifier before aligning the multiplex decoder. Poor IF alignment can make proper multiplex adjustment impossible.

ALTERNATE ALIGNMENT PROCEDURE

Set SELECTOR switch to FM, MODE switch to STEREO and MUTING switch to OFF. (1) Connect output of audio generator, set for 1 kHz (I), to the external modulation input of the multiplex generator and to the external sync input of an oscilloscope. Connect the vertical input of the scope to pin 48 on the multiplex board and adjust the output of the multiplex generator for 2 volts peak-to-peak of composite multiplex output (see Figure 11).

(2) Disconnect the lead going to pin 48 on the multiplex board. Connect the output of the multiplex generator through a 10k ohm resistor to pin 48 on the multiplex board.

(3) Ground pin 4C on the multiplex board to the chassis.

(4) Follow procedures given in Table 1 below.

After alignment is complete, disconnect multiplex generator and resistor, and reconnect the lead going to pin 48 on the multiplex board. Disconnect pin 4C from the chassis.

POWER OUTPUT MEASUREMENT

The output amplifier of this unit is designed to deliver its full rated power with program material (rock and music) into 4- to 16-ohm loads for an indefinite period of time. When a constant audio tone is used as a signal to measure the continuous RMS power output, the following precautions must be taken:

(1) Measure the power output of one channel at a time.

(2) Limit the measurement period to 10 minutes with a load resistance between 4 and 16 ohms.

WARNING: If the power output of both channels must be measured simultaneously, use a load of 4 to 8 ohms per channel and limit measurements to a period not longer than 2 minutes for a 4-ohm load and not longer than 5 minutes for an 8-ohm load.

IP: 100 FULL MINUTE OF WARM-UP TIME, PROCEED TO NEXT STEP.

(5) IM meter reading should be 0.8% or less.

(6) Repeat preceding steps for right channel.

HARMONIC DISTORTION TEST

Set BALANCE, BAS and TREBLE controls to their center positions. Set SELECTOR switch to AUX and SPEAKERS switch to MAIN. Set MONITOR switch to ON, MODE switch to STEREO and LOUDNESS switch to OFF. Unplug AC power cord.

(1) Connect a 4-ohm, 50-watt resistor across the LEFT SPKRS MAIN terminals. In parallel with the load resistor, connect the input leads of an IM (InterModulation) distortion analyzer and the input leads of an AC VTM to cap of reading 0.1 volts with accuracy.

(2) Connect a low-distortion audio sine wave generator, set for 1000 Hz (I), to the L AUX HIGH jack.

(3) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume.

(4) Increase audio sine generator output until sine wave on scope just starts to clip. Adjust Center Voltage Adjust Pot. R813 on the left predriver/decoder for the positive and negative half cycles of the signal with minimum reading on the harmonic distortion meter.

(5) Repeat preceding steps for right channel.

SERVICE PROCEDURES

Table 1. Multiplex Alignment

<table>
<thead>
<tr>
<th>Step</th>
<th>Multiplex Generator Modulation</th>
<th>Indicator Type and Connection</th>
<th>Alignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Composite MXS signal modulated with 1 kHz (I) (Q) on left channel only.</td>
<td>DC VTM to Test Point 403.</td>
<td>2401, 2402, 2403</td>
</tr>
<tr>
<td>2</td>
<td>Same as Step 1.</td>
<td>AC VTM to left channel RCDR OUTPUT jack; scope this voltage output (see Figure 2) to Test Point 402.</td>
<td>2401, 2402, 2403</td>
</tr>
<tr>
<td>3</td>
<td>Same as Step 1.</td>
<td>AC VTM to right channel RCDR OUTPUT jack.</td>
<td>2401, 2402, 2403</td>
</tr>
<tr>
<td>4</td>
<td>Same as Step 2.</td>
<td>Same as Step 3.</td>
<td>Same as Step 3.</td>
</tr>
<tr>
<td>5</td>
<td>Same as Step 4.</td>
<td>AC VTM to left channel RCDR OUTPUT jack.</td>
<td>Same as Step 3.</td>
</tr>
</tbody>
</table>

*NOTE: If output readings cannot be obtained in Steps 2 and 3, repeat Separation Control to make both readings approximately the same and 30 db below the readings in Steps 2 and 4.
**SERVICE PROCEDURES**

**FM FRONT END ALIGNMENT**

NOTE: FM IF alignment must be performed before starting this procedure.

1. **Set SELECTOR switch to FM, MODE switch to STEREO and MUTING switch to OFF.**
2. **Connect an FM generator to the FM ANT, antenna terminals. Use a 120-ohm composition resistor in series with each lead from the generator (see Figure 1).**
3. **Adjust frequency if necessary and monitor the output on an AC VTM and maximum waveform amplitude and symmetry.**
4. **Repeat alignment several times until maximum accuracy and maximum gain are obtained. Keep the generator output as low as possible during all adjustments.**

**FM IF ALIGNMENT**

Set SELECTOR switch to FM, MODE switch to STEREO and MUTING switch to OFF.

1. **Disconnect Test Point 501 on front end from ground.**
2. **Connect 10-MHz (Mc) swtch generator to Test Point 501 on the front end. Connect scope's vertical input to Test Point 501 on the 10-MHz (Mc) IF amplifier board.**
3. **NOTE: Connect ground lead of generator to ground.**
4. **Connect scope's ground to ground.**
5. **Adjust generator output voltage and frequency to obtain IF response curve. Use lowest generator output possible.**
6. **Align core of core LO transformer L501 on front end for maximum gain and symmetry (see Figure 2).**
7. **Align top and bottom cores of Z301 and Z302 on IF amplifier board for maximum gain and symmetry (Figure 2).**
8. **Connect scope to L or R RCDR jack.**
9. **Align core of core LO transformer L501 on IF amplifier board for maximum gain and symmetrical response (see Figure 3).**
10. **Set generator to 10.7 MHz (Mc) with no swtch.**
11. **Increase generator output voltage to 200 mV. Adjust FM Meter Adjust Pot. R702 on meter and muting board for maximum reading on tuning meter.**
12. **Set generator to 10.7 MHz (Mc) and connect scope to L or R RCDR jack.**
13. **Increase generator output to 50 mV and adjust FM Meter Adjust Pot. R702 on meter and muting board for meter reading of 5.**

**FM TUNING METER CALIBRATION**

Set SELECTOR switch to FM, MODE switch to STEREO and MUTING switch to OFF.

1. **Connect an FM generator to the FM ANT, antenna terminals. Use a 120-ohm composition resistor in series with each lead from the generator (see Figure 1).**
2. **Connect scope and AC VTM to L or R RCDR jack.**
3. **Set FM generator frequency and TUNING dial pointer to 90 MHz (Mc).**
4. **Modulate generator with 400 Hz (cp) ±35 kHz (Mc) deviation; set generator for 1 mV output.**
5. **Tune for maximum audio output on AC VTM.**
6. **Slightly readjust top and bottom cores of Z303 on IF amplifier board for reading of 0 VDC on AC VTM.**

**FM MUTING TEST**

Set SELECTOR switch to FM, MODE switch to STEREO and MUTING switch to ON.

1. **Connect an FM generator to the FM ANT, antenna terminals. Use a 120-ohm composition resistor in series with each lead from the generator (see Figure 1).**
2. **Connect scope to L or R RCDR jack.**
3. **Set FM generator frequency and TUNING dial pointer to 90 MHz (Mc).**
4. **Modulate generator with 400 Hz (cp) ±25 kHz (Mc) deviation; set generator for 1 mV.**
5. **Observe audio signal on scope and slowly reduce FM generator output until audio signal just disappears from scope. Tuning meter should read between 3 and 4.**

**SERVICING INTEGRATED CIRCUITS**

Integrated circuits are used in the tuner section of this unit to provide the minimum necessary of A8 suppression and limiting. The uA703E integrated circuit used in the 10.7-MHz FM IF amplifier and in the meter and muting circuit contains the equivalent of 5 transistors and 2 resistors. The TR8073 integrated circuit used in some models of the 10.7-MHz amplifier contains the equivalent of 10 transistors, 7 diodes and 11 resistors.

Both the uA703E and the TR8073 integrated circuits are high-reliability devices and should require a minimum of servicing. However, troubles may occur that will require servicing of these devices. In such an event, the integrated circuits should be serviced as soon as possible at a transistor. The preferred troubleshooting procedure is to first isolate the trouble to a single stage using AC signal tracing methods. Once the suspected stage is located, the integrated circuit can be checked by measuring the DC voltages at the input and output pins of the integrated circuits using a DC VTM. These DC voltages are the most accurate indications of the operating conditions of the integrated circuit.

**WARNING:** Do not use an ohmmeter to check continuity with the integrated circuit on the printed circuit board; forward biasing the internal junctions within the integrated circuit may burn out the transistors.

When replacing an integrated circuit, the following precautions should be observed:

1. Do not replace a defective integrated circuit until the cause of the trouble is found. All external resistors, capacitors and transistors should be checked first to prevent the replacement integrated circuit from failing immediately due to a trouble in the connecting components.
2. Solder and unsolder each lead separately using a pliers or other heat sink on the lead to prevent damage from excessive heat.
3. Check that the leads of the replacement integrated circuits are connected to the correct locations on the printed circuit board before turning the set on.