Service Manual
THE FISHER

105™ 110™
CHASSIS SERIAL NUMBERS BEGINNING 10001
CHASSIS SERIAL NUMBERS BEGINNING 60001
PRICE $1.00

FISHER RADIO CORPORATION • LONG ISLAND CITY • NEW YORK 11101
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-nV AC scale)
- Oscilloscope (Flat to 100 kHz Minimum)
- Audio (Sine-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 Autotransformer 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
- Suction Desoldering Tool

PRECAUTIONS

Many of these items 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 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 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 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 linecord and waiting 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 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 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. 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 speakers and 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 1-kHz audio voltages, measured with an audio AC VTVM to ground at various points from the phono 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. Prop the unit on its rear edge. Remove the four screws which hold the chassis to the cabinet, disconnect the audio and power cables from the record changer, and lift the chassis out of the cabinet taking care to lift the flywheel over the end of the ferrite loop antenna (Model 110 only).
3. Remove the dial cord from under the tabs on the rear of the dial pointer and remove the pointer from the set.
4. Remove the tuning capacitor drive drum and lift it off the tuning shaft.
5. Replace the tuning capacitor drive drum to its maximum clockwise position.
6. Tie the end of the dial cord to the end of the small spring. Fasten the spring to the ear inside the top of the drive drum (see start view).
7. Run the dial cord through the slot in the drive drum and set the cord in the underbride of groove 5 (see start view).
8. Place the dial cord around pulley A. Wrap 3 full turns of the dial cord around the tuning shaft.
9. Guide the dial cord around pulley B, C, D and E.
10. Release the tuning capacitor drive drum to its maximum counterclockwise position, allowing the dial cord to follow the groove in the drive drum.
11. Place the dial cord over the top of the drive drum and into groove 2 (see finish view).
12. Pull the dial cord taut. Run the dial cord through the slot in the drive drum. Make a loop in the end of the dial cord and slip the loop over the ear inside the bottom rear of the drive drum (see finish view). Pull the loop tight to hold the dial cord taut.
13. Replace the flywheel on the tuning shafts and tighten the set screws.
14. 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.
15. Connect the audio and power cables to the record changer. Replace the chassis in the cabinet taking care to lift the flywheel over the end of the ferrite loop antenna (Model 110 only). Secure the chassis with the four screws removed previously.

REPLACING DIAL LAMPS

1. Disconnect AC power cord.
2. Gently pull all knobs off the front panel control shafts. Remove the hex nuts from the control shafts and lift off the front panel.
3. Remove the metal lamp shade from the lamp holder and place it on the lamp and turn it counterclockwise to disengage it. 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 edge of the dial glass.
4. Replace the front panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.

REPLACING STEREO BEACON LAMP

1. Disconnect AC power cord.
2. Prop the unit on its rear edge. Remove the four screws which hold the chassis to the cabinet, disconnect the audio and power cables from the record changer, and lift the chassis out of the cabinet taking care to lift the flywheel over the end of the ferrite loop antenna (Model 110 only).
3. Pry the plastic lamp holder from the lamp mount. Unscrew the leads from the lamp holder. solder the leads to the rear terminals on the new lamp holder. Replace new lamp holder in the mount.
4. Connect the audio and power cables to the record changer. Replace the chassis in the cabinet taking care to lift the flywheel over the end of the ferrite loop antenna (Model 110 only). Secure the chassis with the four screws removed previously.

CLEANING DIAL GLASS

1. Disconnect AC power cord.
2. Gently pull all knobs off the front panel control shafts. Remove the hex nuts from the control shafts and lift off the front panel.
3. Remove dust from the front surface of the dial glass with a soft, dry, lint-free cloth, if you wish to clean more thoroughly use only plain lukewarm water.
4. Replace the front panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.

CLEANING FRONT PANEL

WARNING: Use only plain lukewarm water and a 'greaseless' laundered, soft, lint-free cloth to clean the front control panel.

REPLACING METER LAMP

1. Disconnect AC power cord.
2. Prop the unit on its rear edge. Remove the four screws which hold the chassis to the cabinet, disconnect the audio and power cables from the record changer, and lift the chassis out of the cabinet taking care to lift the flywheel over the end of the ferrite loop antenna (Model 110 only). Secure the chassis with the four screws removed previously.
MULTIPLEX ALIGNMENT

Two methods of aligning the multiplex decoder are given. The preferred procedure uses a multiplex generator with RF and 10 kHz inputs, and with 1 kHz I/f modulation, such as the FT-900 Model 300 Multiplex Generator. The alternate procedure uses a 1 kHz I/f generator 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 AUTO (Model 110) or FM (Model 108) and Muting switch to OFF (Model 110 only).
1. Connect the output of the multiplex generator to the FM NORM antenna terminals. Set TUNING dial pointer to RF frequency of multiplex generator.
2. Connect output of audio generator, set for 1 kHz (60), to the external modulation input of multiplex generator and to the external sync input of an oscilloscope. Connect the vertical input of the scope to the composite output of the multiplex board and adjust the output of the multiplex generator for 4 volts peak-to-peak composite multiplex output level (see Fig. 1).
3. Ground connection 40 on the multiplex board to the chassis.
4. Follow procedures given in Table 1 below.
5. IM meter reading should be 1.0% or less.
6. Repeat preceding steps for right channel.
7. Note: If any of the preceding instructions are different from those supplied with the IM analyzer instruction manual, it is best to follow those in the manual. If a load resistor of 20 ohms is used, the IM analyzer, a separate load resistor is not required.

HARMONIC DISTORTION TEST

Set BALANCE, BASS and TREBLE controls to their center positions. Set MODE switch to STEREO, LOUDNESS switch to OFF, SPEAKERS switch to MAIN and SELECTOR switch to AUX. Unplug AC power cord.
1. Connect a 4-kH, 25-watt resistor across the LEFT MAIN SPEAKERS terminals. In parallel with the load resistor, connect the input leads of an IM (Intermodulation) distortion analyzer and the input leads of an AC VTMV capable of reading 0.1 volts with accuracy.
2. Connect an audio sine wave generator, set for 1000 Hz (60), to the L AUX IN jack.
3. Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume.
4. Connect IM-analyzer generator output to the L AUX IN jack.
5. Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume.
6. Connect output of audio generator to the composite output of the multiplex board. In parallel with the load resistor, connect the vertical input leads of an oscilloscope and harmonic distortion analyzer.
7. Connect an audio sine wave generator, set for 1000 Hz (60), to the L AUX IN jack.
8. Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume.
9. Set IM meter reading should be 1.0% or less.
10. Repeat preceding steps for right channel.

POWER OUTPUT MEASUREMENT

The output amplifier of this unit is designed to deliver its full rated power with program material of tone or music into 4- to 8-ohm loads for an indefinite period of time. When a constant audio tone is used as a signal to measure the continuous RMS output power, the following precautions must be taken:
1. Measure the power output of one channel at a time.
2. Limit the measurement period to 1 minute with a load resistance between 4 and 16 ohms.

WARNING: If the power output of both channels must exceed the maximum continuous output, use a load of 4 to 8 ohms per channel. In all other cases, the measurements to a period not longer than 3 minutes for a 4-ohm load and not longer than 5 minutes for an 8-ohm load.

INTERMODULATION DISTORTION TEST

Set BALANCE, BASS and TREBLE controls to their center positions. Set MODE switch to STEREO, LOUDNESS switch to OFF, SPEAKERS switch to MAIN and SELECTOR switch to AUX. Unplug AC power cord.
1. Connect a 4-kH, 25-watt resistor across the LEFT MAIN SPEAKERS terminals. In parallel with the load resistor, connect the input leads of an IM (Intermodulation) distortion analyzer and the input leads of an AC VTMV capable of reading 0.1 volts with accuracy.
2. Connect IM-analyzer generator output to the L AUX IN jack.
3. Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume.
4. Connect IM-analyzer generator output to set for 5 watts output (12.5 VAC across 8-ohm load resistor), after ONE FULL MINUTE OF WARM-UP TIME, PROCEED TO NEXT STEP.

PREDRIVER/DRIER OUTPUT ADJUSTMENT

Set BALANCE, BASS and TREBLE controls to their center positions. Set MODE switch to STEREO, LOUDNESS switch to OFF, SPEAKERS switch to MAIN and SELECTOR switch to AUX. Unplug AC power cord.
1. Connect a 4-kH, 25-watt resistor across the LEFT MAIN SPEAKERS terminals. In parallel with the load resistor, connect the vertical input leads of an oscilloscope and harmonic distortion analyzer.
2. Connect a sine wave generator, set for 1000 Hz (60), to the L AUX IN jack.
3. Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume.
4. Set IM meter reading should be 1.0% or less.
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 MPX signal (1 kHz) (60) on left channel only.</td>
<td>DC VTVM to Test Point 403.</td>
<td>Adjust</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Indication</td>
</tr>
<tr>
<td>2</td>
<td>Same as Step 1.</td>
<td>AC VTVM to left channel RCDR OUTPUT jack; scope thru voltage divider probe (see Figure 2) to Test Point 402.</td>
<td>2403, 2402</td>
</tr>
<tr>
<td>3</td>
<td>Same as Step 1.</td>
<td>AC VTVM to right channel RCDR OUTPUT jack.</td>
<td>Maximum reading on DC VTVM: approximately 3 VDC. Stereo balance should light.</td>
</tr>
<tr>
<td>4</td>
<td>Composite MPX signal (1 kHz) (60) on right channel only.</td>
<td>Same as Step 3.</td>
<td>Same reading 2 dB on AC VTVM as recorded in Step 2.</td>
</tr>
<tr>
<td>5</td>
<td>Same as Step 4.</td>
<td>AC VTVM to left channel RCDR OUTPUT jack.</td>
<td>Same reading 2 dB on AC VTVM as recorded in Step 3.</td>
</tr>
</tbody>
</table>

*NOTE: If equal readings cannot be obtained in Steps 3 and 5, adjust 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. Set SELECTOR switch to FM AUTO (Model 110) or FM (Model 105) and MUTING switch to OFF (Model 110 only). (1) Set TUNING dial pointer to zero (0) calibration mark on the face of the tuning dial (if the dial pointer does not coincide with the 0 on the extreme end of the knob rotation, repeat the pointer assembly on the dial core and cement the pointer in place to prevent slippage.)

(2) Connect an FM generator to the FM NORM antenna terminals. Use a 120-ohm composition resistor in series with lead from the generator (see Figure 1). (3) Connect a scope and an AC VTVM to either the L or R RCDR OUT jack. (4) Set FM generator frequency and TUNING dial pointer to 90 MHz (Mc). Modulator generator with 900 Hz (0.975 kHz) deviation. Use low generator output as possible. (5) Align FM oscillator trimmer (LS207) first—then align the FM RF trimmer (LS620) and the mixer trimmer (LS628) for maximum reading on AC VTVM and maximum waveform amplitude and symmetry. (6) Repeat alignment several times until accurate dial calibration and maximum gain are obtained. Keep the generator output as low as possible during all adjustments.

---

**FM TUNING METER CALIBRATION**

Set SELECTOR switch to FM AUTO (Model 110) or FM (Model 105) and MUTING switch to OFF (Model 110 only). Set MODE switch to MONO. (1) Connect an FM generator to the FM NORM antenna terminals. Use a 120-ohm composition resistor in series with lead from the generator (see Figure 1). (2) Connect scope and an AC VTVM to either the L or R RCDR OUT jack. (3) Set FM generator frequency and TUNING dial pointer to 90 MHz (Mc). Modulator generator with 900 Hz (0.975 kHz) deviation. Set generator output voltage to 20 V. (4) Increase deviation to 180 kHz (kHz); noise interference should be visible on waveform. (5) Adjust generator frequency for equal amount of noise on both sides of the zero calibration mark on the scope waveform. See Figure 2. (6) Increase deviation to 225 kHz (kHz) and increase generator output to 90 V. (7) Increase generator output to 2000 V. Adjust FM Modulator output (RT02) until maximum reading on tuning meter. (8) Adjust generator output voltage to observe IF response curves. Use low generator output as possible.

---

**FM MUTING TEST**

Set SELECTOR switch to FM AUTO (Model 110) or FM (Model 105) and MUTING switch to OFF (Model 110 only). Set MODE switch to MONO: (1) Connect an FM generator to the FM NORM antenna terminals. Use a 120-ohm composition resistor in series with lead from the generator (see Figure 1). (2) Connect scope and an AC VTVM to either the L or R RCDR OUT jack. (3) Set FM generator frequency and TUNING dial pointer to 9000 kHz (Mc). Modulator generator with 400 Hz (0.4 kHz) deviation. (4) Adjust generator output until tuning meter reads 1.5. (5) Select TUNING switch to AM (Model 110) or MUTING switch (Model 105). Set generator output until signal on scope-tuning meter should read between 2 and 3. Generator output should be between 8 and 30 V.

---

**AM RF ALIGNMENT**

**MODEL 110 ONLY**

**NOTE:** AM IF alignment must be performed before starting this procedure. Set SELECTOR switch to AM. (1) Set TUNING dial pointer to zero (0) calibration mark on the logging scale. If the dial pointer does not coincide with the 0 on the extreme end of the knob rotation, repeat the pointer assembly on the dial core and cement the pointer in place to prevent slippage.

(2) Moving dial pointer will make realignment of FM front end and necessary. (3) Connect an AM generator through a 200-ohm capacitor to pin 9 on the AM RF board; generator ground to chassis. (4) Connect a scope and an AC VTVM to either the L or R RCDR OUT jack. (5) Set FM generator frequency and TUNING dial pointer to 600 kHz (kHz). Use 200 Hz modulation with 400 Hz (0.4 kHz) deviation and keep the generator output as low as possible during the alignment procedure. (6) Align AM oscillator coil (Z502) core for maximum reading on AC VTVM and maximum waveform amplitude and symmetry. (7) Adjust generator output until audible dial calibration and maximum gain are obtained. (8) Disconnect AM generator and reconnect to AM antenna terminals; generator ground to chassis. (9) Set TUNING switch to FM (Model 110) or MUTING switch to pin 900 kHz (kHz). (10) Align AM mixer trimmer (LS501) and adjust the position of the small coil on the end of the ferrite loop antenna for maximum reading on AC VTVM and maximum waveform amplitude and symmetry. (11) Adjust AM generator output until tuning meter reads 1.5. Insulate 283A. (12) Connect an AM generator to the FM antenna terminals and set TUNING switch to FM (Model 110) or MUTING switch to pin 900 kHz (kHz). Use 200 Hz modulation with 400 Hz (0.4 kHz) deviation. (13) Reposition several times until accurate dial calibration and maximum gain are obtained.

---

**SERVICING INTEGRATED CIRCUITS**

Integrated circuits are used in the tuner section of this unit to provide the necessary functions of AM suppression and frequency synthesis. If the IF and IF amplifiers are used in the 10.7-MHz FM IF amplifier and in the meter and muting circuits contain the same type of integrated circuit, the TRB0073 integrated circuit used in the 10.7-MHz amplifier contains the equivalent of 7 diodes, 3 disc type capacitors, and one resistor. Both the 10K50A and the TRB0073 integrated circuits have high-reliability devices and should require a minimum of servicing. However, in the event that you should require servicing of these devices, such devices, if desired, may be used instead of the TRB0073. These DC voltages are used as the test points for the inter-electronic components of the operating condition of the integrated circuit.

**WARNING:** Do not use an ohmmeter to check continuity with the integrated circuit printed on the circuit board. Forbidding the inter-electronic junctions within the integrated circuit may burn out the transistors. When replacing an integrated circuit, the following procedures should be observed:

(1) Do not replace the MIN119 integrated circuit until the cause of the trouble is found. All external resistors, capacitors and transformers must be replaced first to prevent the replacement integrated circuit from failing immediately due to a trouble in the connecting components.

(2) Solder and solder all leads 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 circuit are connected to the correct locations on the printed circuit board before turning on the set.