Service Manual

THE FISHER

105™
CHASSIS SERIAL NUMBERS BEGINNING 10001

110™
CHASSIS SERIAL NUMBERS BEGINNING 50001

PRICE $1.00

FISHER RADIO CORPORATION • LONG ISLAND CITY • NEW YORK 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 Voltohmeter (100-mV DC scale)
- Audio Vacuum-Tube Voltmeter (10-mV 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

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.

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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. Pull the loop tight on the dial cord and lift it off the tuning shaft.
4. Rotate the tuning capacitor drive drum to its maximum clockwise position.
5. 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).
6. Run the dial cord through the slot in the drive drum and set the cord in the underside of groove 2 (see finish view).
7. Place the dial cord around pulley A. Wrap 3 full turns of the dial cord around the tuning shaft.
8. Guide the dial cord around pulley B, C, D and E.
9. Rotate the tuning capacitor drive drum to its maximum counterclockwise position, allowing the dial cord to follow the groove in the drive drum.
10. Place the dial cord over the top of the drive drum and into groove 2 (see finish view).
11. 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.
12. Replace the flywheel on the tuning shaft and tighten the set screw.
13. 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.
14. 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 itself at either end of the dial glass. Gently push in on the lamp and turn it counterclockwise to disengage it.
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 edge of the dial glass.
5. 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 lamp holder. Place 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.

CAUTION: Do not attempt to remove dial glass from the chassis.
4. Replace the front panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.

WARNING: Use only plain lukewarm water and a ‘dry’ lint-free cloth to clean the front control panel.

CLEANING FRONT PANEL

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 of the dial glass with a soft, dry, lint-free cloth. If you wish to clean more thoroughly use only plain lukewarm water.

CAUTION: Do not attempt to remove dial glass from the chassis.
4. Replace the front panel and secure with the hex nuts removed previously. Replace the knobs on the control shafts.
MULTIPLICATION ALIGNMENT

Two methods of aligning the multiplexer decoder are given. The preferred procedure uses a multiplexer generator with RF and 10 kHz inputs and with 1 kHz IF modulation, such as the FISHER Model 300 Multiplexer Generator. The alternative procedure uses 10 kHz inputs only and IF stages are also checked through the use of this procedure. An alternate procedure for use with multiplexer 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 output of multiplexer generator to the KM4000N antenna terminals. Set TUNING dial pointer to RF frequency of multiplexer generator.
2) Connect output of audio generator, set for 1 kHz (Ic), to the external modulation input of multiplexer generator and to the external sync input of an oscilloscope. Connect the vertical input of the oscilloscope to the composite output of the multiplexer board and adjust the output of the multiplexer generator for 1.4 volts peak-to-peak composite multiplexer input (see Figure 1).
3) Connect ground connection 4C on the multiplexer board to the chassis. (5) IM meter reading should be 1.0% or less.
6) Repeat preceding steps for right channel. NOTE: If any of the preceding instructions are different from those supplied with the IF analyzer instruction manual, it is best to follow those in the manual. If a load resistor of 20-ohm rating is built into the IF analyzer, a separate load resistor is not required.

HARMONIC DISTORTION TEST

Set BALANCE, BASI, 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-ohm, 20-watt resistor across the LEFT MAIN SPEAKERS terminals. In parallel with the load resistor, connect the input leads of an IF analyzer (see page 159) to measure distortion analyzer and the input leads of an AC VTMX capable of reading 0.01 Vrms with accuracy. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
2) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
3) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
4) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
5) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
6) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.

POWER OUTPUT MEASUREMENT

The output amplifier of this unit is designed to deliver its full-rated power with program material (i.e., music) and load resistances of 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 RFM 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 5 minutes with a load resistance of 4 and 6 ohms.
3) Connect the load going to connection 48 on the multiplexer board. Connect the output of the multiplexer generator through a 15k ohm resistor to connection 48 on the multiplexer board. Connect ground connection 4C on the multiplexer board to the chassis. (10) IM meter reading should be 1.0% or less.
6) Repeat preceding steps for right channel. NOTE: If any of the preceding instructions are different from those supplied with the IF analyzer instruction manual, it is best to follow those in the manual. If a load resistor of 20-ohm rating is built into the IF analyzer, a separate load resistor is not required.

INTERMODULATION DISTORTION TEST

Set BALANCE, BASI, 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-ohm, 20-watt resistor across the LEFT MAIN SPEAKERS terminals. In parallel with the load resistor, connect the input leads of an IF analyzer (see page 159) to measure distortion analyzer and the input leads of an AC VTMX capable of reading 0.01 Vrms with accuracy. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
2) Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
3) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
4) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
5) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
6) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.

PREDRIVER/DRIVER OUTPUT ADJUSTMENT

Set BALANCE, BASI, 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-ohm, 20-watt resistor across the LEFT MAIN SPEAKERS terminals. In parallel with the load resistor, connect the input leads of an IF analyzer (see page 159) to measure distortion analyzer and the input leads of an AC VTMX capable of reading 0.01 Vrms with accuracy. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
2) Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
3) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
4) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.
5) Connect AC power cord and rotate VOLUME control to its maximum clockwise position—full volume. Connect an audio sine wave generator, set for 1000 Hz (Ic), to the L AUX IN jack.

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Table 1: MULTIPLEXER ALIGNMENT

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<tr>
<td>Composite MPX signal monitored with 1 kHz (Ic) on left channel only.</td>
<td>DC VTMX to Test Point 403.</td>
<td>Adjust</td>
</tr>
<tr>
<td>Same as Step 1.</td>
<td>AC VTMX to left channel RCDR OUTPUT jack.</td>
<td>DC VTMX to Test Point 402.</td>
</tr>
<tr>
<td>Same as Step 3.</td>
<td>Same as Step 3.</td>
<td>DC VTMX to left channel RCDR OUTPUT jack.</td>
</tr>
</tbody>
</table>

Note: If equal readings cannot be obtained in Steps 1 and 2, readjust Separation Control to make both readings approximately the same and 30 dB below the readings in Steps 2 and 4. *
**FM FRONT END ALIGNMENT**

**NOTE:** FM IF alignment must be performed before starting service procedures.

Set SELECTOR switch to FM AUTO (Model 110 or FM Model 105) and MUTING switch to OFF (Model 110 only).

1. Set TUNING dial to pointer to 0.1 calibration mark on the face of the dial. The pointer does not coincide with the line at the extreme end of the knob rotation, reset the pointer assembly on the dial cord and cement the pointer in place to prevent slippage.

2. Align top and bottom core of 2Z01 on IF amplifier for maximum gain and symmetry (see Figure 2).

3. Connect scope's vertical input to pin 7Q on the meter and muting board. On Model 110, disconnect feed from pin 7Q before connecting scope.

4. Align core of 2Z01 on meter and muting board for maximum gain and symmetry (see Figure 2).

5. Connect scope's vertical input to pin 7Q on the meter and muting board. On Model 110, disconnect feed from pin 7Q before connecting scope.

6. Adjust SELC. on the front end of the AM grid and cement the point in place to prevent slippage.

7. Connect scope's vertical input to pin 7Q on the meter and muting board. Connect scope and AC VTMV to L or R RCDR OUT jack, set generators for AM IQ (Figure 2).

8. Adjust top and bottom core of 2Z02 on IF amplifier for maximum gain and symmetry (see Figure 4).

9. After alignment, reconnect Test Point 501 on front and ground to Model 110, reconnect lead to pin 7Q on meter and muting board.

**FM TUNING METER CALIBRATION**

Set SELECTOR switch to FM AUTO (Model 110 or FM Model 105) and MUTING switch to OFF (Model 110 only).

1. Connect an FM generator to the FM NORM antenna terminals. Use a 120-ohm composition resistor in series with load from the generator (see Figure 1).

2. Connect a scope and an AC VTM to the either the L or R RCDR OUT jack.

3. Set FM generator frequency and TUNING dial pointer to 90 MHz (Mc). Modulator generator with 490 Hz (1.25 kHz) deviation. Use as low a generator output as possible.

4. Align FM oscillator coil (L502) core first—then align the FM RF coil (L503) and the FMM coil (L503) core for maximum reading on AC VTMV and maximum waveform amplitude and symmetry.

5. Disconnect FM generator and TUNING dial pointer to 106 MHz (Mc). Set TUNING dial pointer to zero 0.1 calibration mark on the logging scale. If the dial pointer does not coincide with the line at the extreme end of the knob rotation, reset the pointer assembly on the dial cord and cement the pointer in place to prevent slippage.

**NOTE:** Moving dial pointer will make realignment of FM front end necessary.

6. Connect an AM generator through a 270-ohm resistor to pin 59 on the AM RF board; generator ground to chassis.

7. Connect a scope and an AC VTM to the either the L or R RCDR OUT jack.

8. Adjust AM generator frequency and TUNING dial pointer to 600 kHz (Mc). Use 300 modulation with 490 Hz (0.75 kHz) deviation and keep the generator output as low as possible during the alignment procedure.

9. Adjust AM oscillator coil (Z502) core for maximum reading on AC VTMV and maximum waveform amplitude and symmetry.

10. Disconnect AM generator and TUNING dial pointer to 1400 kHz (Mc). Adjust AM oscillator trimmer (C511) for maximum reading on AC VTMV and maximum waveform amplitude and symmetry.

11. Remove all components and be sure accurate dial calibration and maximum gain are obtained.

**NOTE:** To adjust the antenna coil, melt the wax holding the small coil to the end of the ferrite loop antenna. Shift the coil back and forth for maximum audio indication. To secure the coil in position, ream the wax.

12. Set the AM generator frequency and TUNING dial pointer to 1400 kHz (Mc).

**AM RF ALIGNMENT**

**MODEL 110 ONLY**

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

Set SELECTOR switch to AM.

1. Connect SELC. on the front end of the AM grid and cement the point in place to prevent slippage.

2. Connect scope's vertical input to pin 7Q on the meter and muting board. Connect scope and AC VTMV to L or R RCDR OUT jack, set generator for AM IQ (Figure 2).

3. Align top and bottom core of 2Z01 on IF amplifier for maximum gain and symmetry (see Figure 4).

4. After alignment, reconnect Test Point 501 on front and ground to Model 110, reconnect lead to pin 7Q on meter and muting board.

**AM RF ALIGNMENT**

**MODEL 110 ONLY**

1. Connect an FM generator to the FM NORM antenna terminals. Use a 120-ohm composition resistor in series with load from the generator (see Figure 1).

2. Connect a scope and an AC VTM to the either the L or R RCDR OUT jack.

3. Set FM generator frequency and TUNING dial pointer to 90 MHz (Mc). Modulator generator with 490 Hz (1.25 kHz) deviation.

4. Adjust generator output until tuning meter reads 1.8.

5. Connect TUNING dial pointer to 90 MHz (Mc). Use 300 modulation with 490 Hz (1.25 kHz) deviation.

6. Adjust generator output until signal respond on scope; tuning meter should read between 2 and 3. Generator output should be between 8 and 30 uV.

**AM RF ALIGNMENT**

**MODEL 110 ONLY**

1. Set SELECTOR switch to AM.

2. Connect short jumper wire between pin 59 on AM RF board and ground.

3. Connect short jumper wire between pin 601 on the RCDR OUT jack and a 470 cmf inductor.

4. Adjust generator output voltage and frequency to ob- serve IF response curves. Use as low a generator output as possible.

5. Align top and bottom core of 2Z01 and 2Z02 and core of 2Z03 for maximum reading on AC VTMV similar to Figure 2.

6. Reset alignment several times until accurate dial calibration and maximum gain are obtained. Keep the generator output as low as possible during all adjustments.

**AFR ALIGNMENT**

**MODEL 110 ONLY**

1. After alignment, disconnect jumper between pin 59 and ground.

**SERVICING INTEGRATED CIRCUITS**

Integrated circuits are used in the tuner portion of this unit to provide simplified servicing of AM suppression and tuning circuits. The AM suppression and tuning circuits used in the 1.05 MHz FM IF amplifier and in the meter and muting circuit contain the same integrated circuits as used in the TRB0513 integrated circuit used in the 1.05 MHz amplifier. Each of these ICs is available separately as a device and a translator. The pre- pared troubleshooting procedure to first isolate the trouble to one stage using AC signal tracing methods. Once the suspected stage is located, the integrated circuit can be checked using the DC voltages at the input and output of each of the integrated circuits using a V.U. VTC. These DC voltages are the most accurate indications of the operating condition of the integrated circuit.

**WARNING:** Do not use an abbreviation to check continuity with the integrated circuit on the printed circuit board; for- ward biasing the internal junctures within the integrated circuit may burn out the transistors. When replacing an integrated circuit, the following precautions should be observed:

1. Do not remove the integrated circuit until the cause of the trouble is found. All external resistors, capacitors, and transformers can 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 exces- sive heat.

3. Check that the leads of the replacement integrated circuit are connected to the correct locations on the printed circuit board before turning the set on.