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 circuit.

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 (50-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 500 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 — Forl 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. Short-cuts 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 small 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 linecord and waiting until the power supply filter-capacitors have discharged.

- Guard against shorts—it takes only an instant for a base-collector short to destroy that transistor and possibly others direct-coupled to it. If a time it takes for a dropped machine screw, washer or even the screwdriver, to plance 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-5 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 directly 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 wire can cause power losses in the speaker system. Use 14 or 16 AWG for low 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. Indications 1-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 those 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.
**REMOVING MOTORBOARD**

To gain access to the chassis for servicing, remove the motorboard using the following procedure:

1. Disconnect AC power cord.
2. Uncrew the two shipping screws (near the left rear and right-front corners of the turntable baseplate) fully out to lock the chassis to the motorboard.
3. Remove the four screws in the motorboard (two on each side) holding the board to the wooden side panels. Lift the motorboard at the front, and unscrew the two audio cables and power plug from the underside of the chassis.
4. Remove the motorboard from the top of the chassis.
5. To reinstall the motorboard, reverse the procedure. Be sure to reconnect the audio cable with the red plug to the changer phono jack labeled Right.

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**REMOVING DRESS PANEL**

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

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**DIAL STRINGING**

1. Disconnect AC power cord.
2. Remove motorboard. Refer to REMOVING MOTORBOARD procedure.
3. Remove dress panel. Refer to REMOVING DRESS PANEL procedure.
4. Remove the dial pointer from the dial board.
5. Pull the dial cord on its left side. Remove the right wood side panel by removing the two slotted screws near the feet on the right side.
6. Locate the AM antenna bracket locking screw (see Figure 1) and lift antenna bracket away from drive drum.
7. Rotate the tuning capacitor drive drum to its maximum CW position. Loosen the machine screw in the center of the drum and remove the old dial cord.
8. Tie end of new dial cord to one end of dial spring. Fasten to top right end inside drive drum. See Figure 1.
9. Run the dial cord through the slot in the rim of the drum and set up in the bottom of the outside groove. Guide the dial cord around pulley "A" and underneath the tunnel shaft. Wrap 3 full turns CCW (viewed from back) around the tunnel shaft.
10. Guide the dial cord over pulley "B", across the front, around pulley "C", and back around pulley "D". Keep the dial cord fast during this procedure.
11. Rotate the drive drum to its maximum CW position, allowing the cord to wind onto the drive drum. Keep the dial cord fast during this procedure.
12. Run the cord over the top of the drive drum to the center of the motorboard. Attach the cord to the drive drum end and place the cord under the beveled washer.
13. With the machine screw loosened, pull the dial cord out and tighten the screw.

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**REPLACING DIAL LAMPS**

1. Disconnect AC power cord.
2. Remove dress panel. Refer to REMOVING DRESS PANEL procedure.
3. Remove the defective lamp (with its metal shade) from its bayonet base by pressing the lamp in, and rotating 1/8 turn CW. Slide the metal shade off the lamp, install the replacement lamp by pressing in, and turning CW 1/8 turn. Slide the shade onto the lamp and adjust it to direct the light towards the edge of the dial glass.
4. Reinstall the dress panel.

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**REPLACING STEREO BEACON LAMP**

1. Disconnect AC power cord.
2. Remove motorboard. Refer to REMOVING MOTORBOARD procedure.
3. Unscrew the two leads from the terminals on the rear of the STEREO BEACON lamp assembly. WARNING: Damage to the nylon lamp holder assembly may result from excessive heating of the terminals. Use a pair of pliers (as a heat sink) to hold each terminal when soldering or unsoldering leads.
4. Gently pry off the nylon lamp holder assembly. Press the replacement assembly into the mount and reseat the leads removed previously.
5. Reinstall the motorboard.

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**REPLACING METER LAMP**

1. Disconnect AC power cord.
2. Remove motorboard. Refer to REMOVING MOTORBOARD procedure.
3. Remove the defective meter lamp (with its metal shade) from its bayonet base by pressing the lamp in, and rotating 1/8 turn CCW. Slide the shade off the lamp. Install the replacement lamp by pressing in, and turning CW 1/8 turn. Slide the shade onto the lamp and adjust it to direct the light towards the back of the tuning meter.
4. Reinstall the motorboard.

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**REPLACING METER**

1. Remove motorboard. Refer to REMOVING MOTORBOARD procedure.
2. 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.
3. 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.
4. Gently pull the meter retainers away from the rear of the tuning meter and lift out the meter.
5. Slide the replacement meter behind the retainers and fit meter into panel cutout. Reinstall the meter leads removed previously.
6. Reinstall the motorboard.

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**CLEANING FRONT PANEL**

WARNING: Use only plain lukewarm water for cleaning the front panel control panel.

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**REMOVING P.C. BOARDS**

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

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**SERVICING INTEGRATED CIRCUITS**

Integrated Circuits are used in this unit to approach the theoretical maximum of AM suppression and noise limiting. These IC's contain the equivalent of many circuit parts, including transistors, diodes, resistors, and capacitors. These integrated circuits are not repairable. Service should only be attempted by authorized repairmen.
POWER AMPLIFIER CENTER VOLTAGE TEST

Turn VOLUME control to minimum. Set SPEAKERS switch to MAIN on pushbutton models, or MAIN SPKR switch to MAIN. (1) Connect an 8-ohm load resistor across the LEFT SPKR MAIN terminals and an 8-ohm load resistor across the RIGHT SPKR MAIN terminals. (2) Connect 2 or 3% resistors in series across capacitor C603 (1500 uF). Connect the common lead of a DC voltmeter to the junction of the two resistors. (3) Connect the right channel of the DC VTVM to Test Point BS (junction of R385 and R381) on left channel of dual-channel power amplifier module. Meter should read 0 volts (±1.5 volts). (4) Connect the left channel of the DC VTVM to Test Point RD (Junction of R386 and R382) on right channel of dual-channel power amplifier module. Meter should read 0 volts (±1.5 volts). (5) Disconnect the two 10k resistors.

HARMONIC DISTORTION TEST

Set BALANCE, BASS, and TREBLE controls to their center positions. Set SELECTOR switch to AUX. Set LOUDNESS switch to OFF and MODE switch to STEREO (on pushbutton models, MONO MODE and LOUDNESS pushbutton switches should be released to the out position). Set SPEAKERS switch to MAIN on pushbutton models, or MAIN SPKR switch to MAIN. (1) Connect an 8-ohm, 25-watt resistor across the LEFT SPKR MAIN 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. (2) Connect a low-distortion audio sine-wave generator, set for 1,000 Hz, to the Left channel AUX input. (3) Connect AC power cord and rotate VOLUME control to maximum. (4) Increase audio level generator for 14 watts output (10 V RMS across 8-ohm load). HD meter should read 0.5% or less. (5) Repeat preceding steps for right channel.

POWER AMPLIFIER IDLING CURRENT ADJUSTMENT

NOTE: Power amplifier center voltage test should be performed before starting the following procedure. Turn VOLUME control to minimum. (1) Connect DC VTVM across resistor R385 (8.8-ohm) on left channel of dual-channel power amplifier module. Meter should read between 10 mV and 20 mV. (2) If necessary, adjust R225 OUTPUT BIAS ADJUST pot on predriver/driver board for reading between 10 mV and 35 mV on DC VTVM. Optimum amplifier performance will be achieved with 15 mV setting. (3) Connect DC VTVM across resistor R385 on right channel of dual-channel power amplifier module. Meter should read between 10 mV and 25 mV. (4) If necessary, adjust R225 output pot on predriver/driver board for reading between 10 mV and 35 mV on DC VTVM.

INTERMODULATION DISTORTION TEST

Set BALANCE, BASS and TREBLE controls to their center positions. Set SELECTOR switch to AUX. Set LOUDNESS switch to OFF and MODE switch to STEREO (on pushbutton models, MONO MODE and LOUDNESS pushbutton switches should be released to the out position). Set SPEAKERS switch to MAIN on pushbutton models, or MAIN SPKR switch on AC-VTVM models. (1) Connect an 8-ohm, 25-watt resistor across the LEFT SPKR MAIN terminals. Connect the input leads of an IM distortion analyzer and the input leads of an accurately calibrated AC VTVM. (2) Connect IM-Analyzer generator output to the Left channel AUX input. (3) Adjust IM-Analyzer generator for 300 mV output. (4) Connect AC power cord and adjust VOLUME control for 12 watts output (7.95 V RMS across 8-ohm load). AFTER ONE FULL MINUTE OF WARM-UP, PROCEED TO NEXT STEP. (5) IM meter reading should be 0.5% or less. (6) Repeat preceding steps for right channel. NOTE: If any of the preceding instructions differ from those in the IM-analyzer instruction manual, it is best to follow those in the manual. If a load resistor of 50 ohm rating is built into the IM-analyzer, a separate load resistor is not required.

FM IF AND DETECTOR ALIGNMENT

Set SELECTOR switch to FM. Turn VOLUME control to minimum. (1) Connect the jumper lead from FM Test Point 30 (pin 3N on AM/FM IF, MF board) and connect vertical input of scope to Test Point 301. Connect ground lead of scope to nearest chassis ground. (2) Connect an 8k resistor across scope input and set scope input for AC. Adjust scope vertical sensitivity to approximately 100 microvolts per inch. (3) Connect 10.7 MHz sweep generator to Test Point 501 (pin 5F on RF board). Connect ground lead of generator to pin 5G. Adjust generator level and sweep to observe IF response curve. (4) Adjust top and bottom cores of CS05, CS04, and CS02 (on AM/FM IF, MF board) for symmetry and maximum gain. (5) Adjust top and bottom core of CS05 (on RF board) for maximum gain and symmetry. Repeat alignment until maximum gain and symmetry are obtained (see Figure 2). (6) Increase generator level to full output (approximately 100,000 V/m²), if necessary, slightly readjust top core of CS05 to centered 10.27 MHz (see side view Figure 3). (7) Reconnect the jumper lead to FM Test Point 301 (pin 3N on AM/FM IF, MF board) removed previously. (8) Connect the 82k resistor across scope input connected previously. (9) Reduce generator sweep to zero (sweep off). Adjust FM METER ADJ, pot. R328 (on AM/FM IF, MF board) for front panel tuning controls to minimum. (10) Connect vertical input of scope to Test Point 301 (pin 3N on AM/FM IF, MF board). Use same scope sensitivity setting (100 mV/m²). (11) Adjust generator level and sweep to observe detector "S" curve. Adjust bottom core of CS06 first, then top core for maximum gain and symmetry (see Figure 4). (12) Connect DC VTVM to Test Point 30. Use 1.5 VDC meter scale or lower. (13) Readjust top core of CS06 for zero 10 reading (within ±0.2 volt on DC VTVM).
**SERVICE PROCEDURES**

**TUNING METER CALIBRATION**

**MULTIPLEX ALIGNMENT**

Two methods of aligning the multiplexer decoder are given. The preferred procedure uses a multimeter generator with 19 kHz output and 19 kHz output, both with 1 kHz output, as well as the FISHER 200 Multiplex Generator. This is the better method of alignment because the front end and IF stages are also checked during the use of this procedure. An alternate procedure for use with multiplexers not having an RF output is also given.

**PREFERRED ALIGNMENT PROCEDURE**

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

**PREFERRED ALIGNMENT PROCEDURE**

NOTE: Meter calibration should be performed after AM IF and RF alignment.

Set SELECTOR switch to FM. Turn VOLUME control to minimum.

(1) Connect an FM generator to the FM ANTenna terminals. Use a 120-ohm composition resistor in series with each lead from the generator to the front end. See Figure 5.

(2) Set generator frequency to some frequency as receiver. Set generator RF output level to full output (approximately 100,000 volts) with audio modulation off.

(3) Adjust generator frequency for peak tuning meter reading.

(4) Adjust FM Meter ADJ pot, R328 on AM/FM IF, MPX board for tuning meter reading of 4.5.

**ALTERNATE ALIGNMENT PROCEDURE**

Set SELECTOR switch to FM, and VOLUME control to minimum. Set MODE switch to STEREO (pseudobuftrion models, release MONO MODE pbushtron switch to out position).

(1) Disconnect the jumper lead going to pin 4A (on AM/FM IF, MPX board) and connect the output of the multiplexer through a 1k resistor to pin 4A.

(2) Connect DC VTMX to Test Point 400 (on AM/FM IF, MPX board). Connect the vertical input of the scope to pin 4A.

(3) Set MPX generator for 19 kHz pilot carrier output only. Adjust pilot level for approximately 120 mV peak-to-peak input at pin 4A. 

(4) Adjust cores of Z401 and Z402 (on AM/FM IF, MPX board) for maximum gain on DC VTMX (2.5 to 4 VDC). 

(5) Connect output of audio generator, set for 1 kHz, to the external modulation input of MPX generator and to the external sync output of an oscilloscope. Adjust audio generator level for 1.2 volts peak-to-peak composite MPX input (10% pilot, 90% audio). See Figure 6. Module right channel only, proceed with steps (5) through (10) of PREFERRED ALIGNMENT PROCEDURE.

(6) Reconnect the jumper lead going to pin 4A (on AM/FM IF, MPX board) removed previously.

**AM 1F ALIGNMENT**

Set SELECTOR switch to FM, and VOLUME control to minimum.

(1) Connect generator ground to pin 7C. 

(2) Connect vertical inputs of scope to Test Point 302 (pin 3Q on AM/FM IF, MPX board). Connect scope ground to pin 3Q. Set scope vertical input sensitivity to approximately 200 mV/cm.

(3) Adjust generator level and sweep to observe IF response curve. Set generator output as low as possible.

(4) Adjust top and bottom cores of Z303, Z301 (on AM/FM IF, MPX board), and Z701 (on RF board) for maximum gain and symmetry. Repeat alignment until maximum gain and symmetry are obtained (see Figure 9).

**AM RF ALIGNMENT**

NOTE: AM 1F alignment must be performed before starting this procedure.

**SELECTOR switch to either the Left or Right RCDR output jack.**

**=a**

Set SELECTOR switch to AM, and VOLUME control to minimum.

(1) Set TUNING dial pointer to zero (0) calibration mark on the log scale. If dial pointer does not coincide with the (0) at the extreme end of knob rotation, reposition the pointer assembly on the dial cord and cement the pointer in place to prevent alignment.

**NOTE:** Repositioning the dial pointer may require alignment of all FM RF board for correct FM station calibration.

(2) Open the AM ANTenna GND link at the antenna terminals. Connect an AM aligner to the AM ANTenna and GND terminals.

(3) Connect a generator to AC VTMX to either the Left or Right RCDR output jack.

(4) Set AM generator frequency and TUNING dial pointer to 600 kHz. Use 3% modulation with 600 Hz. Set generator output as low as possible.

(5) Align oscillator coil C701 (on AM RF board) for maximum reading on AC VTMX and maximum waveamplitude and symmetry.

(7) Repeat alignment several times until accurate dial calibration and maximum gain are obtained. Keep the generator output as low as possible during all adjustments.

(8) Reset AM generator frequency and TUNING dial pointer to 1400 kHz. Adjust the position of the small coil on the ferrite loop antenna for maximum reading on AC VTMX and maximum waveform amplitude and symmetry.

(7) Repeat steps (8) and (9) several times until maximum gain is obtained. Keep generator output as low as possible during all adjustments.
SCHEMATIC SHOWN ON MAIN CHASSIS DIAGRAM

BOARD VIEWED FROM COMPONENT SIDE

RIGHT AUX OUT
LEFT AUX OUT
RIGHT PHONO OUT
LEFT PHONO OUT

T= TERMINAL LUG USED FOR EASE IN WIRING.

2044-1 AUDIO INPUT

CHASSIS LAYOUT