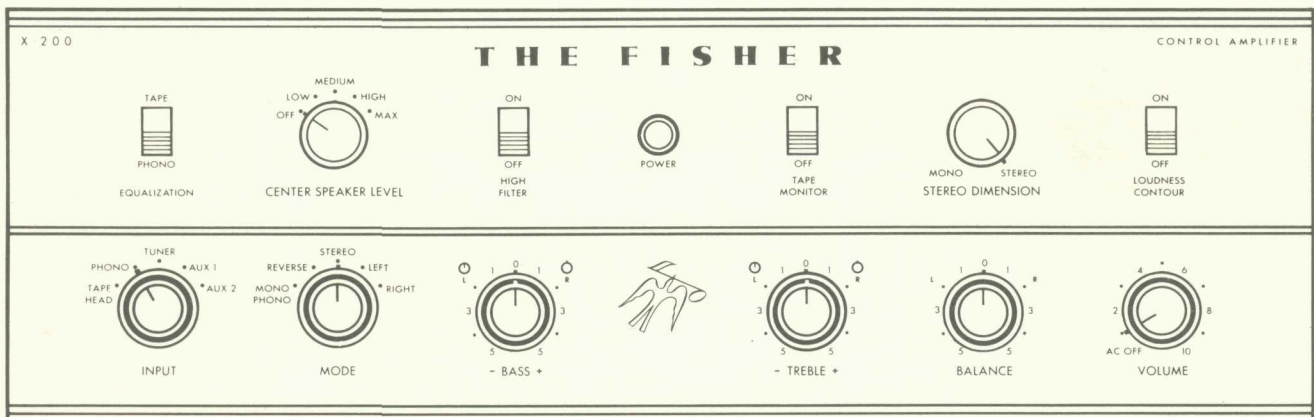
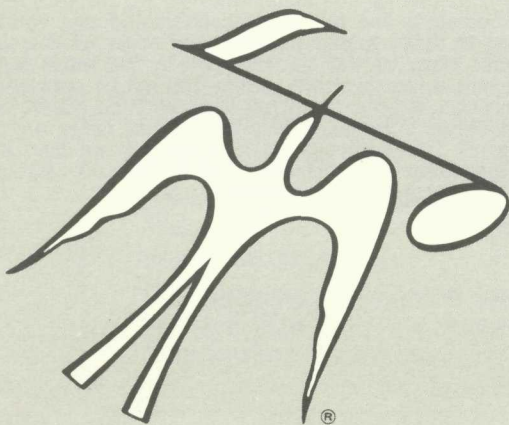


Service Manual

THE FISHER®



(1-4) FS 1393-A-H



X-200

CHASSIS SERIAL NUMBERS
BEGINNING 40001

PRICE \$1.00

FISHER RADIO CORPORATION • LONG ISLAND CITY 1 • NEW YORK

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.

EQUIPMENT AND TOOLS NEEDED

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

Test Instruments

Vacuum-Tube Voltohmmeter DC VTVM
Audio (AC) Vacuum-Tube Voltmeter (AC VTVM)
Oscilloscope (Flat to 100 kc minimum)
Audio (Sine-wave) Generator
Intermodulation Analyzer
Sweep (FM) Generator (88 to 108 mc)
Marker Generator
Multiplex Generator (preferably with RF output—
FISHER Model 300 or equal).

Miscellaneous

Adjustable-Line-Voltage Transformer or
line-voltage regulator
Load Resistors (2)—8-ohm, 50-watt (or higher)
Stereo source (Turntable with stereo cartridge
or Tape Deck)
Speakers (2) Full-range, for listening tests
Soldering iron (with small-diameter tip)
fully insulated from power line.

PRECAUTIONS

Many of the items below 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 many circuit components mounted on it. It is not the wattage of the iron that counts—it is the heat available at the tip. Low-wattage soldering irons will often take too long to heat a connection—pigtail leads will get too hot and damage the part. Too much heat, applied too long, will damage the printed-circuit board. 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 tipleths 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.

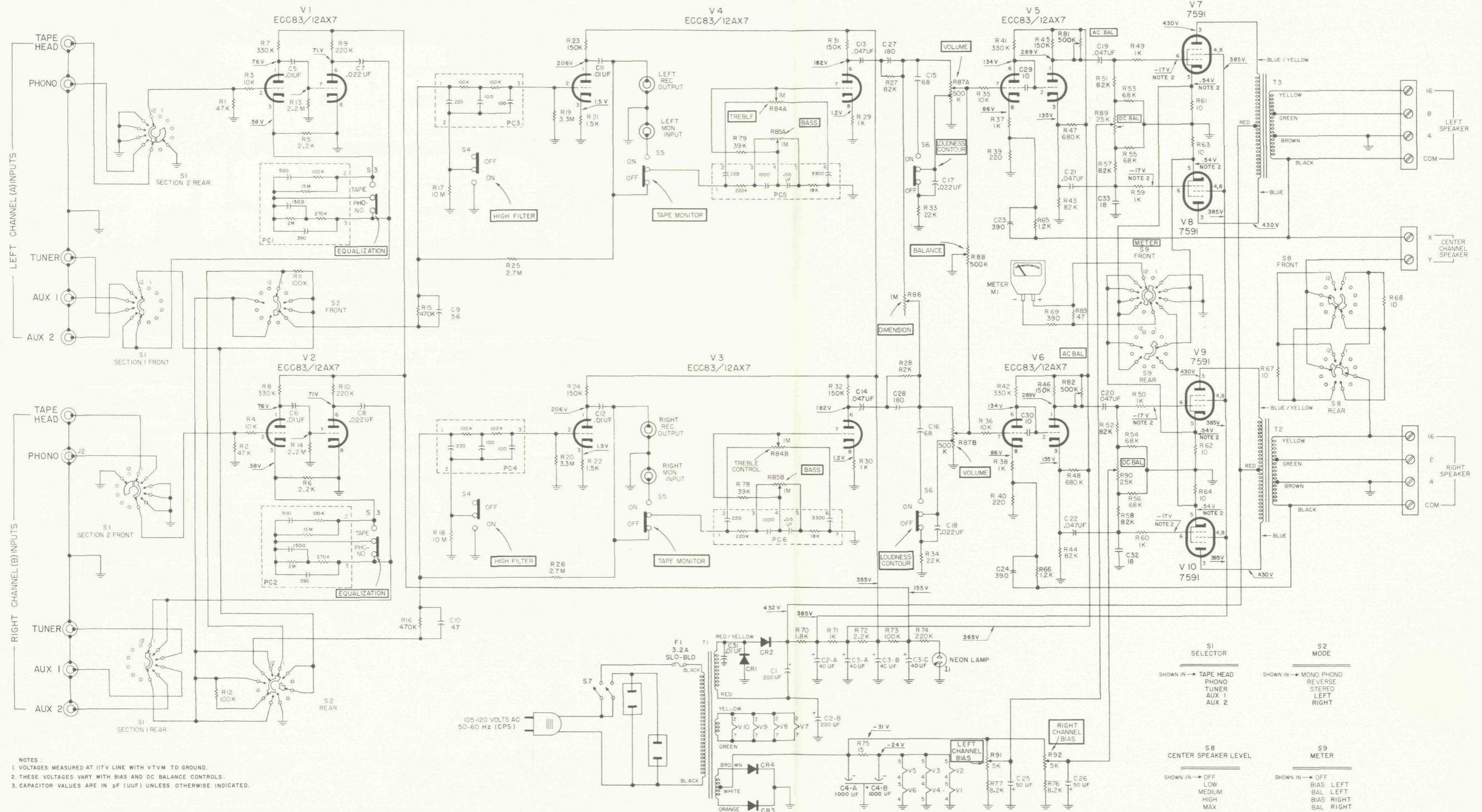
- Always disconnect the chassis from the power line when soldering. Turning the power switch OFF is not enough. Power-line leakage paths, through the heating element, can destroy transistors.

- 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. There is no output transformer—nothing to limit current through the transistors except the fuses. To reduce the possibility of shorts at the speakers, lugs should be used on the exposed ends—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. Any poor contact or small-size wire, can cause power losses in the speaker system. Use 14 or 16 AWG for long runs of speaker-connecting wiring.

DC-Voltage Measurements—These basic tests of the transistor circuitry are made without the signal generator. Without any signal input measure the circuit voltages—as indicated on the schematic. The voltage difference between the base and the emitter should be in the millivolt range—a sensitive DC meter is needed for these readings. A low-voltage range of 1 volt, full scale—or lower—is needed.

Audio-Voltage (gain) Measurements—The schematic and printed-circuit board layout diagrams are used. Input signals are injected at the proper points—found most quickly by using layout of the printed-circuit board instead of the schematic. An AUDIO (AC) VTVM connected to the test points should indicate voltages close to those values shown in the boxes on the schematic. Many of the signal levels in the input stages are only a few millivolts—they can not be read on the AC ranges supplied on most Vacuum-Tube AC/DC Volt-ohmmeters (VTVMs). Even with a 1-volt range a signal level of 100 millivolts (.1 volt) will be the first 1/10 of the meter scale. A reading of 1 millivolt (.001 volt) will hardly even move the meter needle.

MAIN CHASSIS • SCHEMATIC



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.

MAIN CHASSIS • PARTS DESCRIPTION LIST

RESISTORS AND POTENTIOMETERS

Composition, in ohms, 10% Tolerance, 1/2 Watt, unless otherwise noted. K - Kiloohm, M - Megohm

| Symbol | Description | Part No. |
|----------|-----------------------------|------------|
| R1, 2 | Dep. Carbon, 47K, 5%, 1/3W | R33DC473J |
| R3, 4 | Dep. Carbon, 10K, 5%, 1/3W | R33DC103J |
| R5, 6 | Glass, 2.2K, 5%, 1W | R30G222J |
| R7, 8 | Glass, 330K, 5%, 1W | R30G334J |
| R9, 10 | 220K | RC20BF224K |
| R11, 12 | 100K | RC20BF104K |
| R13, 14 | Dep. Carbon, 2.2M, 5%, 1/3W | R33DC225J |
| R15, 16 | 470K, 5%, 1/2W | RC20BF474J |
| R17, 18 | 10M | RC20BF106K |
| R19, 20 | 3.3M | RC20BF335K |
| R21, 22 | 1.5K | RC20BF152K |
| R23, 24 | 150K | RC20BF154K |
| R25, 26 | 2.7M | RC20BF275K |
| R27, 28 | 82K | RC20BF823K |
| R29, 30 | 1K | RC20BF102K |
| R31, 32 | 150K | RC20BF154K |
| R33, 34 | Dep. Carbon, 22K, 5%, 1/3W | R33DC223J |
| R35, 36 | Dep. Carbon, 10K, 5%, 1/3W | R33DC103J |
| R37, 38 | 1K | RC20BF102K |
| R39, 40 | Dep. Carbon, 220, 5%, 1/3W | R33DC221J |
| R41, 42 | Dep. Carbon, 330K, 5%, 1/3W | R33DC334J |
| R43, 44 | 82K | RC30BF823K |
| R45, 46 | 150K | RC20BF154K |
| R47, 48 | 680K | RC20BF684K |
| R49, 50 | 1K | RC20BF102K |
| R51, 52 | 82K | RC20BF823K |
| R53, 54, | | |
| 55, 56 | 68K | RC20BF683K |
| R57, 58 | 82K | RC20BF823K |
| R59, 60 | 1K | RC20BF102K |
| R61, 62, | | |
| 63, 64 | 10, 5%, 1/2W | RC20BF100J |
| R65, 66 | Dep. Carbon, 1.2K, 5%, 1/2W | R50DC122J |
| R67, 68 | Wirewound, 10, 10%, 5W | R779-103 |
| R69 | Wirewound, 390, 5%, 1/2W | RC20BF391J |
| R70 | Glass, 1.8K, 10%, 4W | RP64W182K |
| R71 | 1K | RC20BF102K |
| R72 | 2.2K | RC20BF272K |
| R73 | 100K | RC20BF104K |
| R74 | 220K | RC20BF224K |
| R75 | Wirewound, 15, 10%, 5W | R719-106 |
| R76, 77 | 8.2K | RC20BF822K |
| R78, 79 | 39K | RC20BF393K |
| R80 | -Deleted- | - - - |
| R81, 82 | Pot., 500K, AC Balance | R50150-6 |
| R83 | Dep. Carbon, 47, 5%, 1/8W | R12DC470J |
| R84A, B, | | |
| 85A, B | Pot., Dual, 1M Bass, Treble | R50160-93 |
| R86 | Pot., 1M, Dimension | R50160-111 |
| R87A, B | Pot., Dual, 500K, Volume | R50160-92 |
| R88 | Pot., 500K, Balance | R50160-110 |
| R89, 90 | Pot., 25K, D C Balance | R50103-2 |
| R91, 92 | Pot., 5K, Bias | R50103-4 |

CAPACITORS

10% tolerance for all fixed capacitors, unless otherwise noted, or marked GMV (guaranteed minimum value). All capacitors not marked uF are pF (uuF).

| Symbol | Description | Part No. |
|---------|---|-------------|
| C1 | Electrolytic, 200uF, 250V | C50180-20 |
| C2 | Electrolytic, 2-Section A-40uF, 500V B-200uF, 250V | C50180-19 |
| C3 | Electrolytic, 3-Section A-40uF, 300V B-40uF, 400V C-40uF, 450V | C50180-26 |
| C4 | Electrolytic, 2-Section A-1000uF, 35V B-1000uF, 35V | C50180-37AX |
| C5, 6 | Ceramic, .1uF, 20%, 500V | C50089-3 |
| C7, 8 | Mylar, .022uF, 400V | C50197-28 |
| C9 | Ceramic, 56, N750, 1000V | C50070-50 |
| C10 | Ceramic, 47, N750, 1000V | C50070-4 |
| C11, 12 | Ceramic, .01uF, 20%, 500V | C50089-3 |
| C13, 14 | Mylar, .047uF, 400V | C50197-30 |
| C15, 16 | Ceramic, 68, N750, 1000V | C50070-16 |
| C17, 18 | Mylar, .022uF, 10%, 250V | C50197-49 |
| C19, 20 | Mylar, .047uF, 630V | C50197-101 |
| C21, 22 | Mylar, .047uF, 400V | C50197-30 |
| C23, 24 | Ceramic, 390, 1000V | C50072-6 |
| C25, 26 | Electrolytic, 50uF, 70V | C50283-2 |
| C27, 28 | Ceramic, 180, 1000V | C50072-23 |
| C29, 30 | Ceramic, 10, NPO, 1000V | C50070-11 |
| C31 | Molded, .01uF, 20%, 600V | C2747 |
| C32, 33 | Ceramic, 18, N470, 1000V | C50070-13 |

MISCELLANEOUS

| Symbol | Description | Part No. |
|-------------|--|-------------|
| CR1, 2 | Diode, Silicon | SR50411-1 |
| CR3, 4 | Diode, Silicon | SR50472-1 |
| F1 | Fuse, 3.2 Amp., Slo-Blo | F3319 |
| I1 | Lamp, Neon | I557-144 |
| M1 | Meter | M908-119 |
| PC1, 2 | Printed Circuit, Equalization | PC50187-18 |
| PC3, 4 | Printed Circuit, High-Filter | PC50187-2 |
| PC5, 6 | Printed Circuit, Tone Control | PC50187-4 |
| S1 | Switch, Input Selector | S908-113 |
| S2 | Switch, Mode Selector | S908-118 |
| S3, 4, 5, 6 | Switch, Slide | S50200-5 |
| S7 | Switch, Power | Part of R87 |
| S8 | Switch, Center Speaker Level | S908-111 |
| S9 | Switch, Meter | S908-117 |
| T1 | Transformer, Power | T908-115 |
| T2 | Transformer, Output (R Channel) | T908-116-2 |
| T3 | Transformer, Output (L Channel) | T908-116-1 |
| - - - | Dress Panel | A1393C108 |
| - - - | Knob, Dual, Bottom, Bass, Treble | E50221 |
| - - - | Knob, Dual, Top, Bass, Treble | E50323 |
| - - - | Knob, Dummy Dual, Input, Mode, Bal., Vol. | E50324 |
| - - - | Knob, Center Speaker, Dimension | E50325-1 |

If replacement parts are out of stock, locally, they may be obtained directly from the Parts Department of FISHER Radio Corporation. They will be shipped "best way", either prepaid or C.O.D. unless otherwise specified.

For instrument-operation information and technical assistance write Richard Hamilton, Customer Relations Department, FISHER Radio Corporation, Long Island City, New York 11101.

(No test instruments required)

- Set all front-panel controls to the following positions:

| | | | |
|--------------------------|-----------|----------------------|-----------|
| INPUT SELECTOR | to TUNER | EQUALIZATION | to PHONO |
| MODE SELECTOR | to STEREO | CENTER SPEAKER LEVEL | to OFF |
| BASS (inner and outer) | to NORMAL | HIGH FILTER | to OFF |
| TREBLE (inner and outer) | to NORMAL | TAPE MONITOR | to OFF |
| BALANCE | to NORMAL | STEREO DIMENSION | to STEREO |
| MASTER VOLUME | to AC OFF | LOUDNESS CONTOUR | to OFF |

- Set the BIAS and BALANCE controls to the following positions:

| | |
|--------------------------|---|
| BIAS L – Fully clockwise | BAL L – Approximately in center of rotation |
| BIAS R – Fully clockwise | BAL R – Approximately in center of rotation |

- Position the amplifier chassis so that the meter can be read easily.
- Turn the X-200 ON—rotate the MASTER VOLUME control clockwise until the switch just clicks. DO NOT rotate the knob any further clockwise than is necessary to actuate the ON-OFF switch—keep the control to its minimum volume position.
- Set the METER SWITCH to the BIAS L position – use a screwdriver. The slot in the METER SWITCH shaft acts as a pointer.
- Turn the BIAS L control shaft counterclockwise until the meter pointer lines up with the BIAS line on the meter face.
- Set the METER SWITCH to the BAL L position and adjust the control shaft until the meter pointer is at the BAL line. (Rotate the control completely through its range to be sure it is adjusted properly. The final position of the control should *not* be near the end of its rotation. When near the ends of its rotation the meter pointer will be unstable – jiggle slightly.)
- Set the METER SWITCH to the BIAS R position and adjust the BIAS R control until the meter pointer lines up with the BIAS calibration line.
- Set the METER SWITCH to the BAL R position and adjust the BAL R control until the meter pointer is at the BAL calibration line.
- Set the METER SWITCH back to the BIAS L position. The pointer may have moved off the BIAS line—this is normal. Simply repeat the entire Bias and DC balance adjustment procedure one or more times until the meter needle remains in position.

DO NOT RESET THE BIAS ADJUST CONTROLS TO THEIR EXTREME CLOCKWISE POSITIONS WHEN REPEATING THE ADJUSTMENT PROCEDURE. Bias must be readjusted when installing new output tubes. Output tubes should be replaced in pairs (both right- or both left-channel), if one becomes defective, because it may be difficult to obtain (and maintain) balance.

- The following table will simplify BAL and BIAS adjustments:

| STEP | METER SWITCH | Adjust | Meter Pointer |
|------|--------------------------|----------------|---------------|
| 1 | BIAS L | BIAS L Control | BIAS |
| 2 | BAL L | BAL L Control | BAL |
| 3 | BIAS R | BIAS R Control | BIAS |
| 4 | BAL R | BAL R Control | BAL |
| 5 | Repeat steps 1 through 4 | | |
| 6 | OFF | | |

IMPORTANT NOTE: When the AC-line voltage is too low it is not possible to adjust the BIAS controls to make the pointer line up with the BIAS calibration line as indicated in the steps above. Under these conditions set the BIAS controls to a point where the meter pointer rests at the left edge of the red portion of the meter scale near the BIAS line.

If a BAL indication cannot be obtained in the BAL L (or BAL R) position one of the output tubes may be weak or defective. A simple, and quite positive test is to interchange one output tube from each channel. If the defective tube has been switched the balance problem will be in the other channel. If the balance problem remains it is probably caused by the tube that was not switched. For a positive test switch that tube too.

WARNING: Turn the MASTER VOLUME to AC OFF and the METER SWITCH to OFF before unplugging any amplifier tubes.

REMEMBER: After completing the bias and balance adjustments return the METER SWITCH to the OFF position.

PHASE INVERTER ADJUSTMENTS:

Test instruments required: AC (audio) VTVM 4-ohm, non-inductive load resistor
IM Distortion Analyzer (35-watts rating, minimum)

WARNING: DO NOT use the C (common) speaker terminals as ground terminals – they are not grounded (the 4-ohm terminals are grounded). Never ground the C terminals either directly or, accidentally, through the common-ground leads of test instruments.

Left Channel

Connect a 4-ohm load between LEFT SPEAKER terminals marked C and 4.
Connect IM Distortion Analyzer output to Channel L TUNER input jack.
Connect IM Analyzer-input ground lead to the LEFT SPEAKER 4-ohm terminal.
Connect IM Analyzer-input "hot" lead to the LEFT SPEAKER C terminal.
Set the INPUT selector switch to TUNER.

Set the MODE selector switch to STEREO.

Adjust the IM Analyzer for 9.0 volts across the 4-ohm load.

Adjust the Channel L Phase-Inverter control (under the chassis near the socket for V5) for minimum reading on the IM Distortion Analyzer.

(continued on next page)

Right Channel

Connect a 4-ohm load between RIGHT SPEAKER terminals marked C and 4.

Connect IM Distortion Analyzer output to Channel R TUNER input jack.

Connect IM Analyzer-input ground lead to the RIGHT SPEAKER 4-ohm terminal.

Connect IM Analyzer-input "hot" lead to the RIGHT SPEAKER C terminal.

Set the INPUT selector switch to TUNER.

Set the MODE selector switch to STEREO.

Adjust the IM Analyzer for 9.0 volts across the 4-ohm load.

Adjust the Channel L Phase-Inverter control (under the chassis near the socket for V6) for minimum reading on the IM Distortion Analyzer.

TROUBLESHOOTING GUIDE

Does not go on (pilot lamp and tubes do not light).

- Check: ● Fuse F1.
● AC plug and line cord.
● Wall outlet (use test lamp in AC OUTLET on rear of chassis).

Test: ● Power switch S7 (part of R87).

Does not go on (pilot lamp does not light – tubes light).

Check: ● Neon lamp (I1) or substitute.

Test: ● Voltages at: CR1, CR2, C1, C2-B; R70, R71, C2-A; R71, R72, C3-A; R72, R73, C3-B; R73, R74, C3-C.

Fuse blows as soon as replaced.

Check: ● CR1, CR2, CR3, CR4, C1, C2, C4 and T1, T2, T3.

Distortion Hum, Weak or No audio output (both channels) in any position of INPUT selector switch.

- Set TAPE MONITOR to OFF position.
- Set BALANCE, TREBLE and BASS controls to NORMAL position.
- Set DIMENSION control to STEREO position.
- Remove plugs from rear-chassis REC OUTPUT and MON INPUT jacks (for hum).
- Remove plugs from rear-chassis TAPE HEAD, PHONO, TUNER and AUX jacks (for hum).

Test: ● B-plus voltages at: CR1, CR2, C1, C2-B; R70, R71, C2-A; R71, R72, C3-A; R72, R73, C3-B; R73, R74, C3-C.
● Bias and DC Filament-supply voltages at: CR3, CR4; R75, C4-A, C4-B; R91, C25, R92, C26.

Distortion Hum, Weak or No audio output (LEFT channel only) in any position of INPUT selector switch.

- Set BALANCE, TREBLE and BASS controls to NORMAL positions.
- Set TAPE MONITOR to OFF position.
- Remove plugs from rear-chassis REC OUTPUT and MON INPUT jacks (for hum).
- Remove plugs from rear-chassis TAPE HEAD, PHONO, TUNER and AUX jacks (for hum).

Check: ● Speaker connections
● BIAS voltage adjustment (R91).
● BALANCE adjustment (R89).

Test: ● V4, V5, V7, V8 or substitute (filament leakage test for hum—gas test for distortion).

Distortion Hum, Weak or No audio output (RIGHT channel only) in any position of INPUT selector switch.

- Set BALANCE, TREBLE and BASS controls to NORMAL positions.
- Set TAPE MONITOR to OFF position.
- Remove plugs from rear-chassis REC OUTPUT and MON INPUT jacks (for hum).
- Remove plugs from rear-chassis TAPE HEAD, PHONO, TUNER and AUX jacks (for hum).

Check: ● Speaker connections
● BIAS voltage adjustment (R92).
● BALANCE adjustment (R90).

Test: ● V3, V6, V9, V10 or substitute (filament leakage test for hum—gas test for distortion).

Distortion Hum, Weak or No audio output (LEFT channel only) PHONO and TAPE HEAD position of INPUT selector switch.

Test: ● V1 or substitute (filament leakage test for hum—gas test for distortion).
● Voltages at socket of V1.

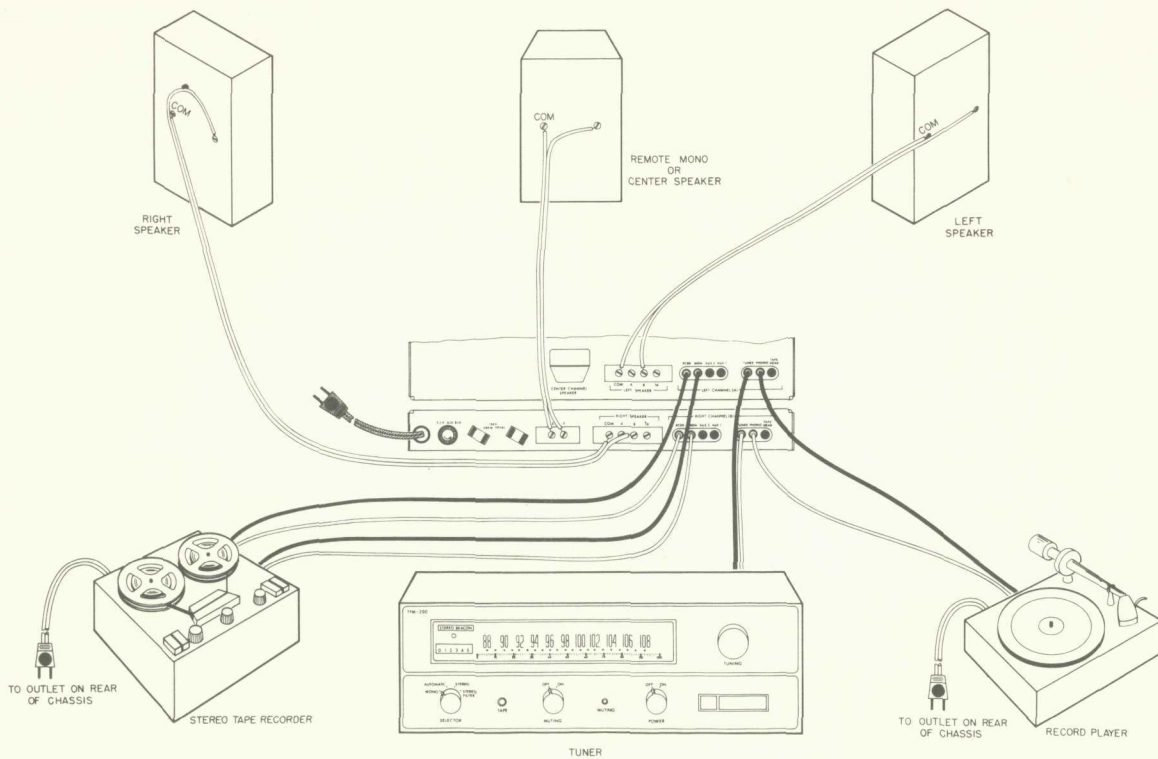
Distortion Hum, Weak or No audio output (RIGHT channel only) PHONO and TAPE HEAD positions of INPUT selector switch.

Test: ● V2 or substitute (filament leakage test for hum—gas test for distortion).

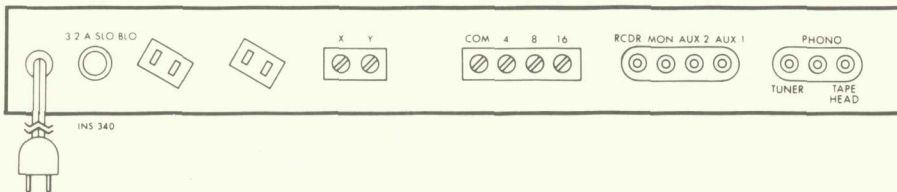
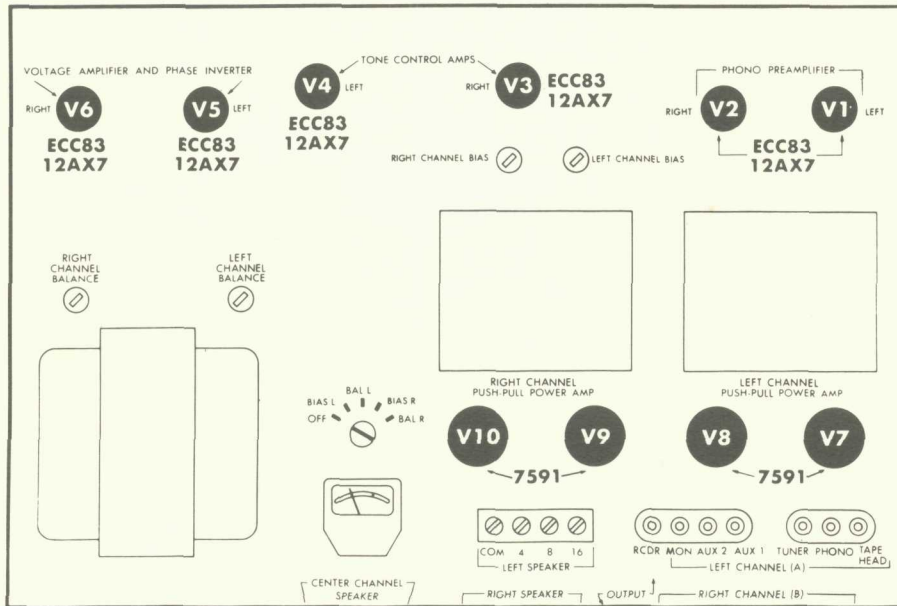
Distortion Hum, Weak or No audio output (either channel) only one position of SELECTOR.

- Reverse (interchange) LEFT and RIGHT channel plugs—first at rear-chassis jacks; then at component output jacks

COMPONENT CONNECTIONS



CHASSIS LAYOUT



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