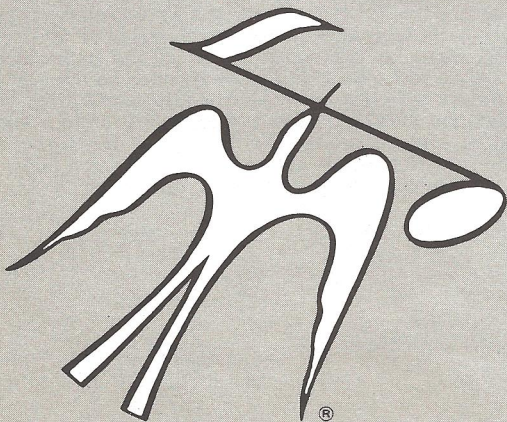
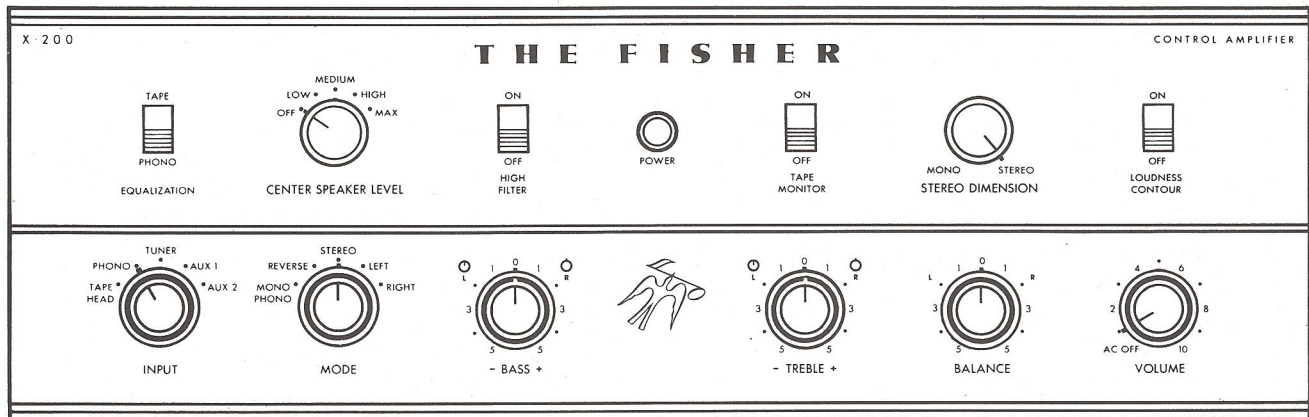


Service Manual

THE FISHER®



X-200

CHASSIS SERIAL NUMBERS
BEGINNING 40001

PRICE \$1.00

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.

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.

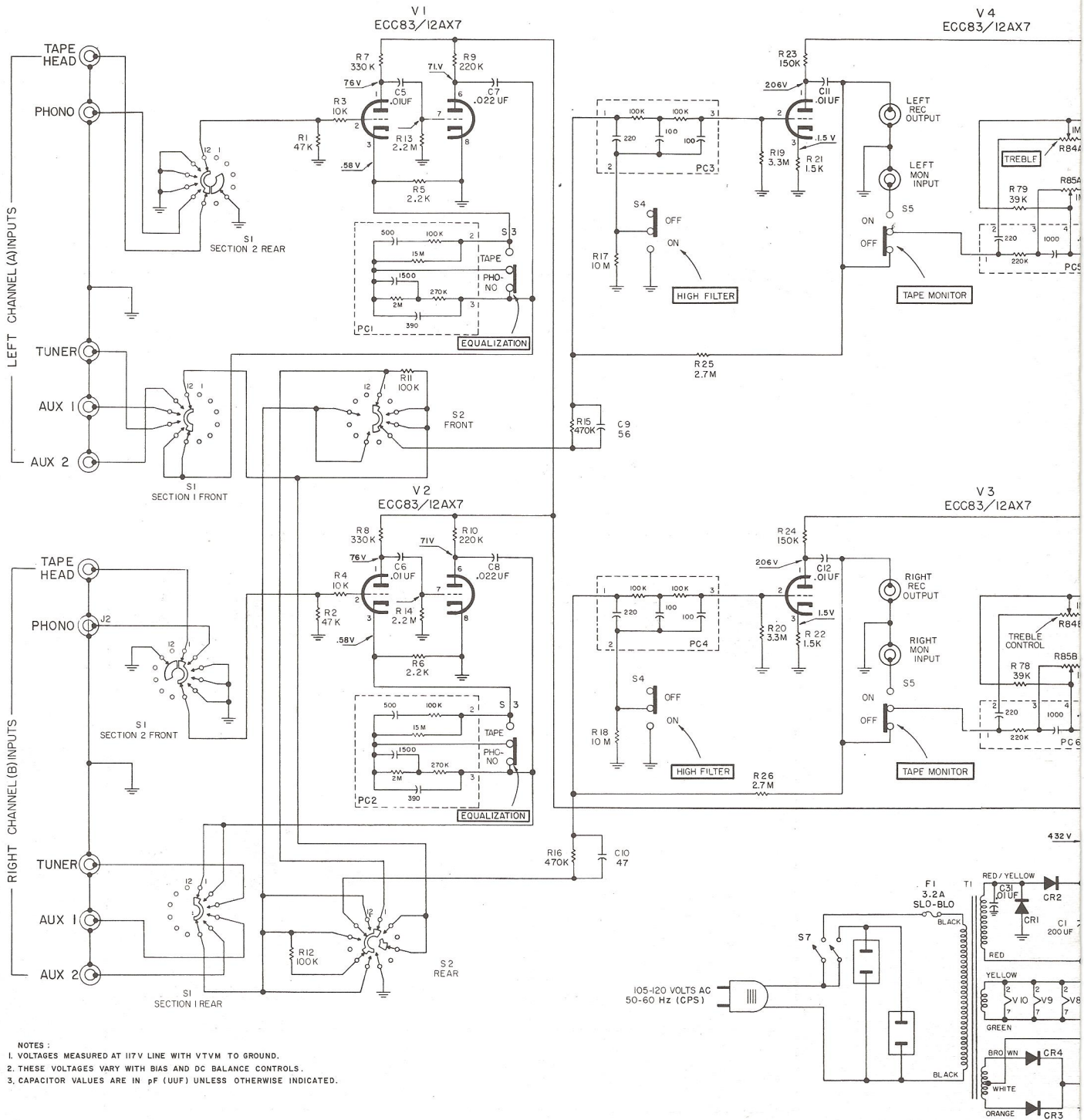
Distortion Hum, Weak or No audio output (RIGHT channel only) PHONO and TAPE HEAD positions of INPUT selector switch.

- 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.

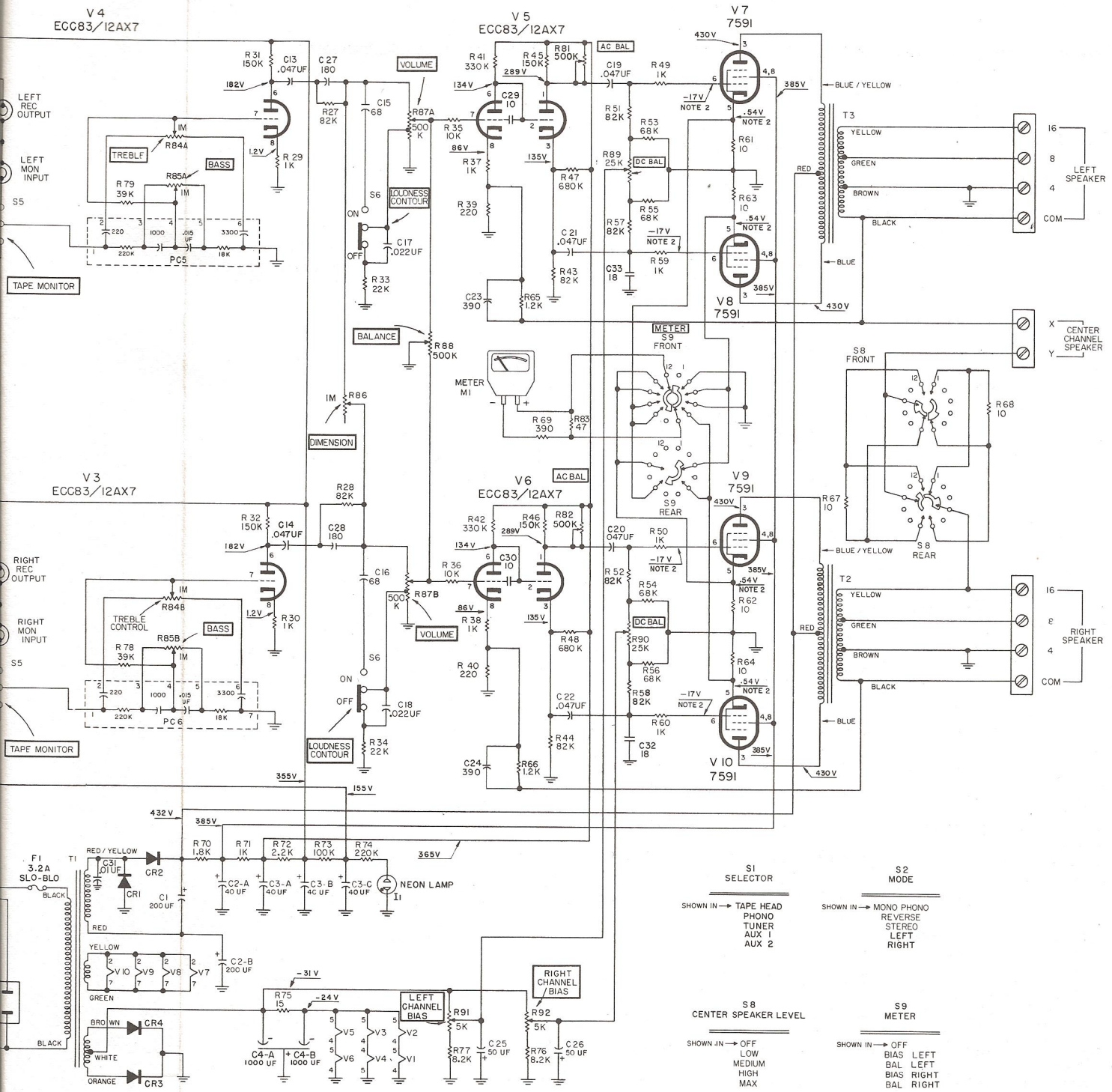
- Reverse (interchange) LEFT and RIGHT channel plugs—first at rear-chassis jacks; then at component output jacks

MAIN CHASSIS • SC



NOTES:
 1. VOLTAGES MEASURED AT 117V LINE WITH VTVM TO GROUND.
 2. THESE VOLTAGES VARY WITH BIAS AND DC BALANCE CONTROLS.
 3. CAPACITOR VALUES ARE IN pF (UUF) UNLESS OTHERWISE INDICATED.

HASSIS • SCHEMATIC



MAIN CHASSIS • PARTS DESCRIPTION LIST

RESISTORS AND POTENTIOMETERS

Composition, in ohms, 10% Tolerance, 1/2 Watt, unless otherwise noted. K - Kilohm, 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	RPG4W182K
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 (uF).

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.

PHASE INVERTER ADJUSTMENTS (Cont.)

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 (both channels) in any position of INPUT selector switch.

Hum, Weak or No audio output

- 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 (LEFT channel only) in any position of INPUT selector switch.

Hum, Weak or No audio output

- 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 (RIGHT channel only) in any position of INPUT selector switch.

Hum, Weak or No audio output

- 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 (LEFT channel only) PHONO and TAPE HEAD position of INPUT selector switch.

Hum, Weak or No audio output

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

Distortion (RIGHT channel only) PHONO and TAPE HEAD positions of INPUT selector switch.

Hum, Weak or No audio output

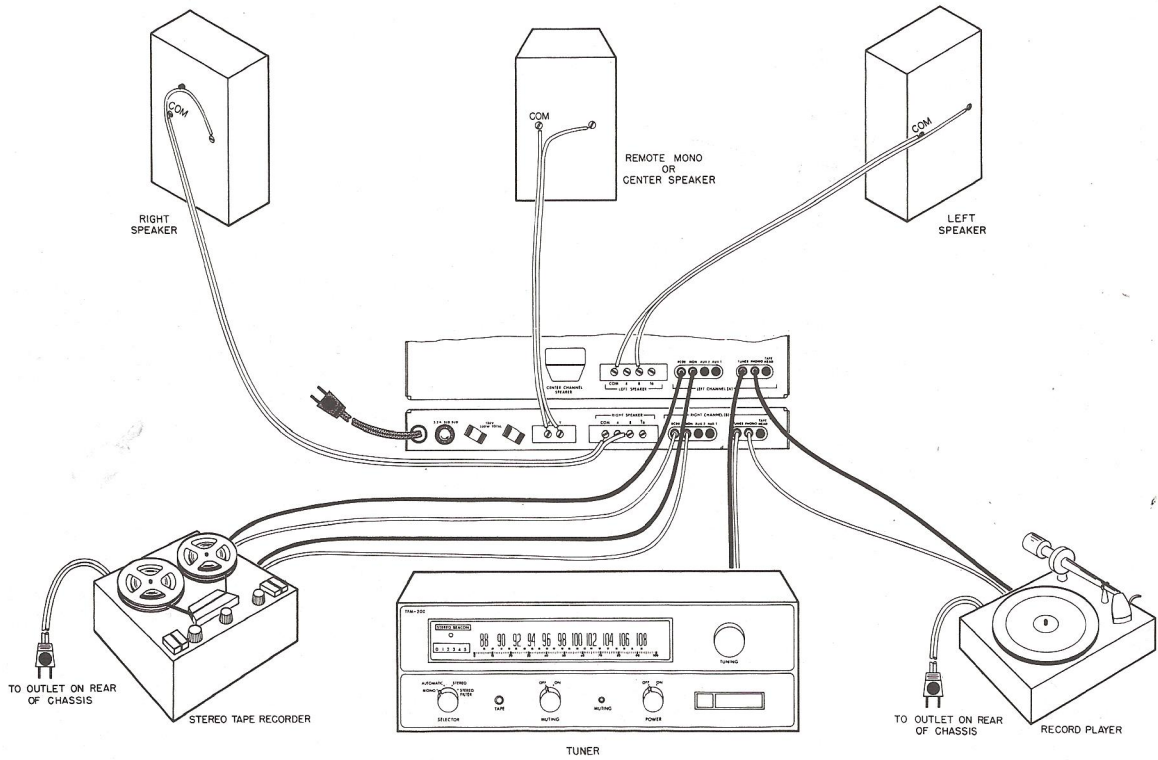
- Test:
- V2 or substitute (filament leakage test for hum—gas test for distortion).

Distortion (either channel) only one position of SELECTOR.

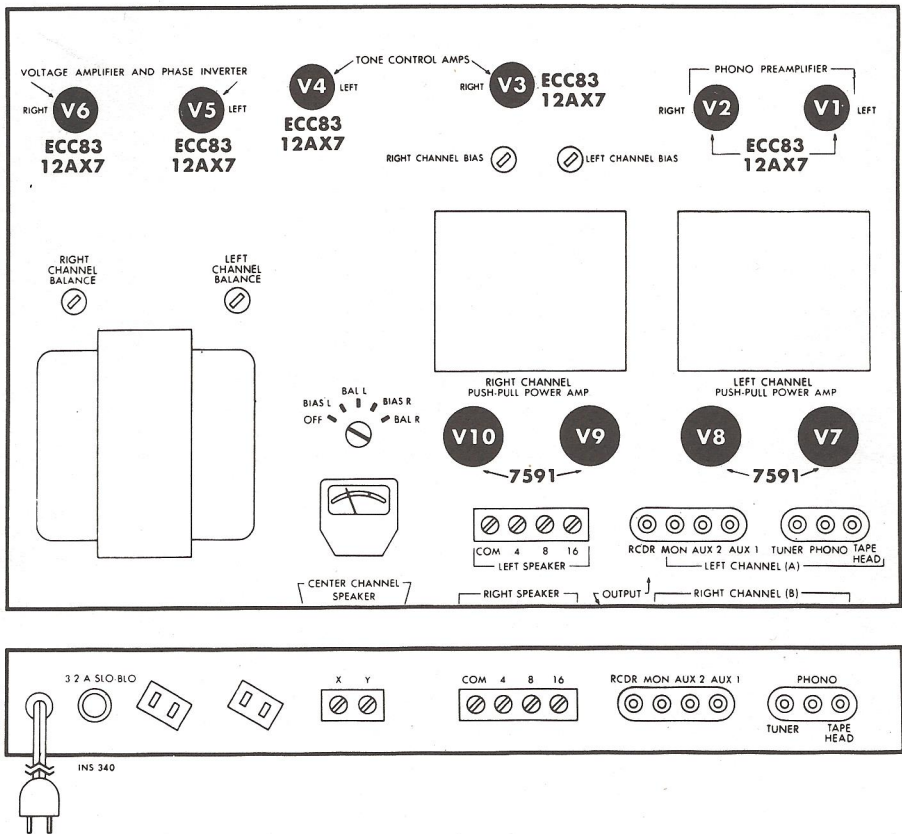
Hum, Weak or No audio output

- 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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