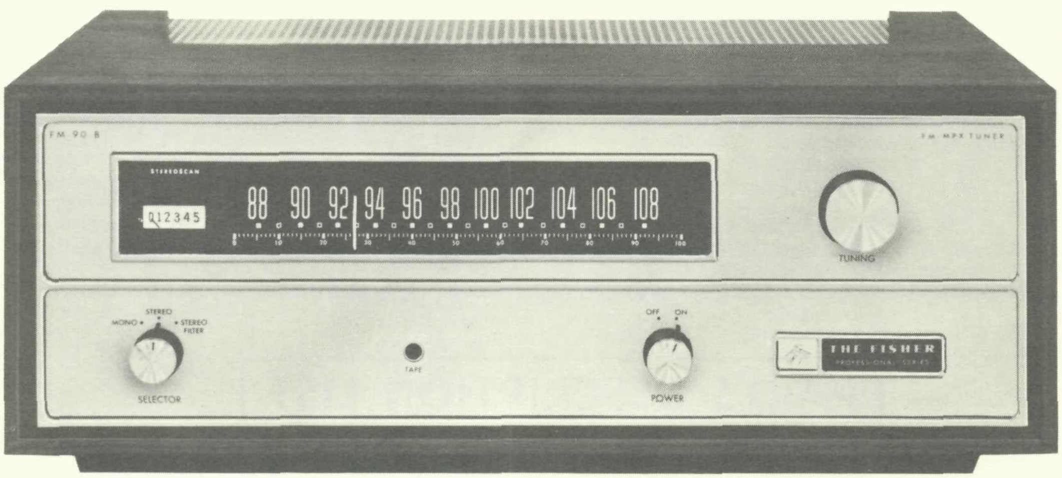
Serial Nos. Beginning 10000

Service Manual

THE FISHER®



FM-90-B

CHASSIS SERIAL NUMBERS
BEGINNING 10000

$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 this high-fidelity instrument.

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

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 tiplets 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 circut 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 Voltohmmeters (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.

PARTS DESCRIPTION LIST

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	Ceramic 21, 5%, N750, 1000V	C50070-32
C2	Ceramic 1000, GMV, 500V	C50089-2
C3	Ceramic 8, 5%, NPO, 1000V	C50070-45
C4	Ceramic, Trimmer	C662-123
C5	FM Variable	C966-109-1
C7	Ceramic, Trimmer	C662-123
C8	Ceramic 8, 5%, NPO, 1000V	C50070-45
C9	Ceramic 1000, GMV, 500V	C50089-2
C10	Ceramic 39, N1500, 1000V	C50070-17
C12	Ceramic 12, 5%, N080, 500V	CC20W120J5
C15	Ceramic, Trimmer	C662-123
C14	Ceramic 13, 5%, NPO, 500V	CC20CJ130J5
C15	Ceramic 24, 5%, N150, 1000V	C50070-8
C16	Ceramic 120, 5%, N1500, 1000V	C50070-44
C17	Ceramic, Feedthru, 1000, GMV	C592-187
C18	Ceramic 1000, 1000V	C50072-23
C19	Ceramic, Feedthru, 1000, GMV	C592-187
C20	Ceramic .02uF +80–20%, 100V	C50095-1
C21	Ceramic 5000, +80–20%, 500V	C50089-6
C22	Ceramic 2700, 1000V	C50072-17
C23, 24	Ceramic 5000, +80–20%, 500V	C50089-6
C25	Ceramic 2700, 1000V	C50072-17
C26	Ceramic 5000, +80–20%, 500V	C50089-6
C27	Mylar .22uf, 20%, 250V	C50575-3
C28	Ceramic, 2700, 1000V	C50072-17
C29	Ceramic 5000, +80–20%, 500V	C50089-6
C30	Ceramic .02uF, GMV, 1000V	C50071-6
C31, 32	Ceramic 330, 1000V	C50072-1
C33	Ceramic 330, 1000V	C50072-1
C34	Ceramic 5000, +80–20% 500V	C50089-6
C35	Electrolytic, 8uF, 50V	C629-138
C36	Ceramic .02uF, +80–20%, 100V	C50095-1
C37	Molded, .01uF, 20%, 600V	C2747
C38	Electrolytic, 4-section	C670-125B
	A–40uF, 300V	
	B–40uF, 300V	
	C–40uF, 250V	
	D–40uF, 250V	
C39, 40	Ceramic 500, +80–20%, 500V	C50089-6
C41	Ceramic 500, +80–20%, 500V	C50089-6
C42	Ceramic, Feedthru, 1000, GMV	C592-187
C43	Mylar, .022uF, 400V	C50574-8
C44	Mylar, .1uF, 400V	C50574-10
C45	Ceramic, 560, 1000V	C50072-14
C46	Mylar, .1uF, 400V	C50574-10
C47	Mylar, .022uF, 400V	C50574-8

RESISTORS AND POTENTIOMETERS

Composition, in ohms, 10% Tolerance, ½-watt unless otherwise noted. K=Kilohms, M=Meghoms

Symbol	Description	Part No.
R1	270	RC20BF271K
R2	100K	RC20BF104K
R3	Dep. Carbon, 1.2K, 5%, 1/8W	R12DC122J
R4	Dep. Carbon, 1K, 5%, 1/8W	R12DC102J
R5	Dep. Carbon, 150K, 5%, 1/8W	R12DC154J
R6	Dep. Carbon, 220K, 5%, 1/8W	R12DC224J
R7	3.9K, 1W	RC30BF392K
R8	4.7K	RC20BF472K
R9	150	RC20BF151K
R10	470	RC20BF471K
R11	27K	RC20BF273K
R12	1K	RC20BF102K
R13	150	RC20BF151K
R14	47K	RC20BF473K
R15	2.2M	RC20BF2225K
R16	1K	RC20BF102K
R17	Dep. Carbon, 47K, 5%, 1/8W	RC12DC473J
R18, 19	2.2M	RC20BF225K
R20	33K	RC20BF333K
R21	22K	RC20BF223K
R22	1K	RC20BF102K
R23	Dep. Carbon, 270, 5%, 1/8W	R12DC271J
R24	Dep. Carbon, 1K, 5%, 1/8W	R12DC102J
R25	Dep. Carbon, 1.5K, 5%, 1/8W	R12DC152J
R26	Dep. Carbon, 15K, 5%, 1/8W	R12DC153J
R27	Dep. Carbon, 33, 5%, 1/8W	R12DC330J
R28	470	RC20BF471K
R29, 30	220	RC20BF221K
R31	820K	RC20BF824K
R32	Glass, 560, 10%, 5W	RPG5W561K
R33	Wirewound, 820, 10%, 3W	RPG3W821K
R34	Glass, 2.2K, 10%, 3W	RPG3W222K
R35	Potentiometer, 500K, Output Level	R50103-6
R36	Dep. Carbon, 470K, 5%, 1/8W	R12DC474J
R37	Dep. Carbon, 1.8M, 5%, 1/3W	R33DC185J
R38	15M	RC20BF156K
R39, 40	Dep. Carbon, 100K, 5%, 1/3W	R33DC104J
R41	Dep. Carbon, 1.8M, 5%, 1/3W	R33DC185J
R42	Dep. Carbon, 470K, 5%, 1/8W	R12DC474J
R43	Potentiometer, 500K, Output Level	R50103-6
R44	15M	RC20BF156K
R45	Dep. Carbon, 1M, 5%, 1/8W	R12DC105J

COILS, CHOKES AND TRANSFORMERS

Symbol	Description	Part No.
L1	FM Antenna Coil	L966-113
L2	FM RF Coil	L1034-113
L3	FM Mixer Coil	L1034-113
LR	FM Oscillator Coil Assembly	AS1034-115
L5	Choke, 1.2 Microhenry	L50066-3
L6	Choke, .68 Microhenry	L50066-1
L7	Choke, 3.3 Microhenry	L50066-8
T1	Transformer, Power	T1126-115
Z1	FM-IF Transformer	ZZ50210-20
Z2	FM-IF Transformer	ZZ50210-39
Z3	FM Limiter Coil	ZZ50210-6
Z4	FM Ratio Detector	ZZ50210-9

MISCELLANEOUS

Symbol	Description	Part No.
F1	Fuse, 1 Amp., Slo-Blo	F692-132
I1, 2	Lamp, Dial	I50441-1
I3	Lamp, Meter, No. 18470F	I50009-8
I4	Stereoscan Indicator	I50621-3
S1	Switch, Selector	S1126-126
S2	Switch, Power	S50358-7
–	FM Dipole Assembly	AS50227-1
–	Insert, Dress Panel Screened (Upper)	AS1126-122
–	Insert, Dress Panel Screened (Lower)	AS1126-123
–	Drive wheel for variable	E50588
–	Knob, Selector, Power	E50562-1
–	Knob, tuning	E50566-2
–	Jack, Tape	J50545
–	Meter	M946-213
–	Dial Glass	N1126-107
SR1	Selenium Rectifier	SR50279-1

MULTIPLEX SECTION CAPACITORS

20% 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	Mylar, .027 uF, 5%, 100V	C50B574-6
C2	Polystyrene, 180, 5%, 500V	C50B634-1
C3	Polystyrene, 4700, 5%, 125V	C50B634-21
C4	Polystyrene, 220, 5%, 500V	C50B634-2
C5	Polystyrene, 4700, 5%, 125V	C50B634-21
C6	Ceramic, .02 uF, +80, −20%, 500V	C50089-4
C7	Ceramic, 2200, 20%, 1000V	C50183-10
C8	Ceramic, 100, 20%, 1000V	C50183-9
C9	Ceramic, 1200, 10%, 1000V	C50183-8
C10	Ceramic, 68, 10% NPO, 1000V	C50070-46
C11	Mica, 4700, 5%, 300V	C50332-7
C12	Ceramic, 5000, 20%, 500V	C50089-1

NOTE: For all other capacitors in multiplex section, see layout of printed circuit board.

RESISTORS

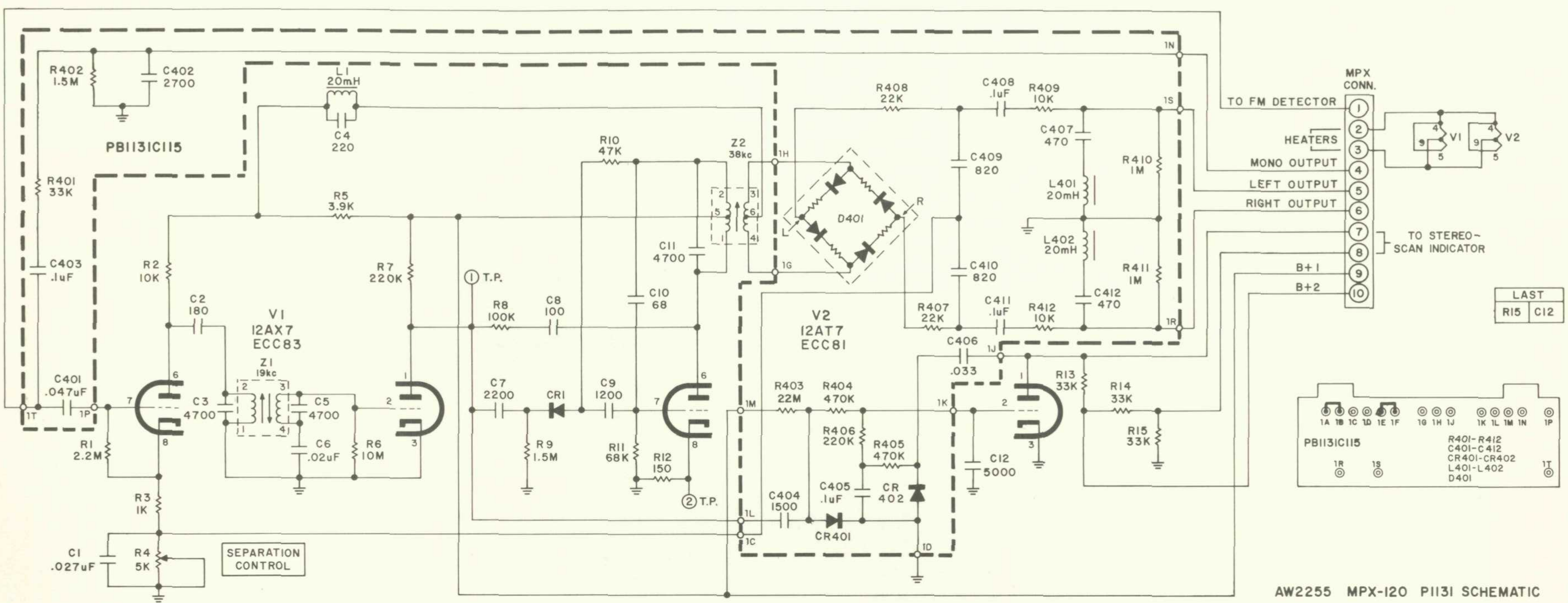
Symbol	Description	Part No.
R1	Dep. Carbon, 2.2M, 5%, 1/3W	R33DC225J
R2	Dep. Carbon, 10K, 5%, 1/3W	R33DC103J
R3	Dep. Carbon, 1K, 5%, 1/3W	R33DC102J
R4	Potentiometer, 5K Separation Control	R50150-11
R5	Dep. Carbon, 3.9K, 5%, 1/3W	R33DC392J
R6	Composition, 10M, 10%, 1/2W	RC20BF106K
R7	Dep. Carbon, 220K, 5%, 1/3W	R33DC224J
R8	Dep. Carbon, 100K	R12DC104J
R9	Dep. Carbon, 1.5M, 5%, 1/3W	R33DC155J
R10	Dep. Carbon, 47K, 5%, 1/3W	R33DC473J
R11	Dep. Carbon, 68K	R12DC683J
R12	Dep. Carbon, 150, 5%, 1/3W	R33DC151J
R13, 14, 15	Composition, 33K, 10%, 1W	RC30BF333K

NOTE: For all other resistors in multiplex section, see layout of printed circuit board.

MISCELLANEOUS

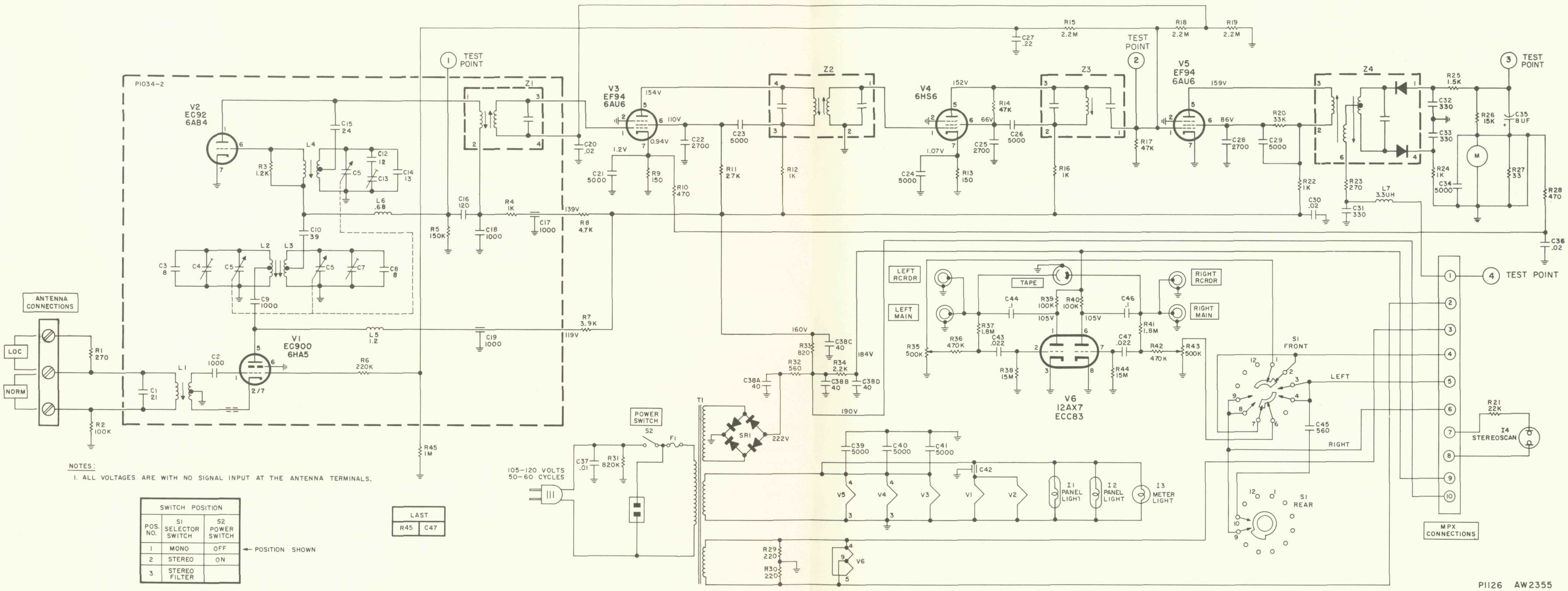
Symbol	Description	Part No.
CR1	Diode, Type 1112	V1112
L1	Coil, 20 uH	L503342
Z1	Transformer, 19 kc	ZZ50210-34
Z2	Transformer, 38kc	ZZ50210-54
R401	Resistor, Dep. Carbon, 33k 5%, 1/8W	R12DC333J
R402	Resistor, Dep. Carbon, 1.5m, 5%, 1/3W	R33DC155J
R403	Resistor, Composition, 22M, 10%, ½W	RC20BF226K
R404	Resistor, Dep. Carbon, 470k, 5%, 1/8W	R12DC474J
R405	Resistor, Dep. Carbon, 470k, 5%, 1/8W	R12DC474J
R406	Resistor, Dep. Carbon, 470k, 5%, 1/8W	R12DC224J
R407	Resistor, Dep. Carbon, 22k, 5%, 1/8W	R12DC223J
R408	Resistor, Dep. Carbon, 22k, 5%, 1/8W	R12DC223J
R409	Resistor, Dep. Carbon, 10k, 5%, 1/8W	R12DC103J
R410	Resistor, Dep. Carbon, 1m, 5%, 1/8W	R12DC105J
R411	Resistor, Dep. Carbon, 1m, 5%, 1/8W	R12DC105J
R412	Resistor, Dep. Carbon, 10k, 5%, 1/8W	R12DC103J
C401	Capacitor, Mylar, .047uF 10% 100V	C50B574-5
C402	Capacitor, Polystyrene, 2700 5% 125V	C50B634-20
C403	Capacitor, Plastic Film, .1uF 20% 250V	C50B633-1
C404	Capacitor, Cer. Disc., 1500, 10%	C50B576-4
C405	Capacitor, Plastic Film, 1uF 20% 250V	C50B633-1
C406	Capacitor, Plastic Film, .033uF 20% 400V	C50B633-20
C407	Capacitor, Cer. Disc, 470 pF 10%	C50B576-1
C408	Capacitor, Plastic Film,.1uF 20% 250V	C50B633-1
C409	Capacitor, Cer. Disc, 820 10%	C50B576-3
C410	Capacitor, Cer. Disc, 820 10%	C50B576-3
C411	Capacitor, Plastic Film, .1uF 20% 250V	C50B633-1
C412	Capacitor, Cer. Disc, 470 pF, 10%	C50B576-1
CR401	Diode	V1112
CR402	Diode	V50A260-15
L401	Coil	L50334-2
L402	Coil	L50334-2
D401	Ring Demodulator	V50A260-18
	Printed Circuit Bd.	PB1131B111
	Mini. Pin Term.	A50A577
	Sleeving 23-32" Lg.	E50A684-4

SCHEMATIC DIAGRAM • MULTIPLEX SECTION



AW2255 MPX-120 P1131 SCHEMATIC

SCHEMATIC DIAGRAM



NOTES:
1. ALL VOLTAGES ARE WITH NO SIGNAL INPUT AT THE ANTENNA TERMINALS.

SWITCH POSITION			
POS. NO.	S1 SELECTOR SWITCH	S2 POWER SWITCH	
1	MONO	OFF	← POSITION SHOWN
2	STEREO	ON	
3	STEREO FILTER		

LAST	
R45	C47

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 Service Department, FISHER Radio Corporation, Long Island City, New York 11101.

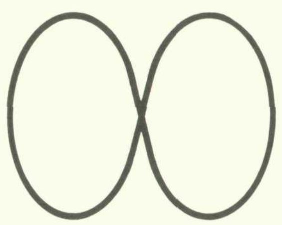


FIGURE 1. Lissajous pattern for MPX Oscillator alignment.

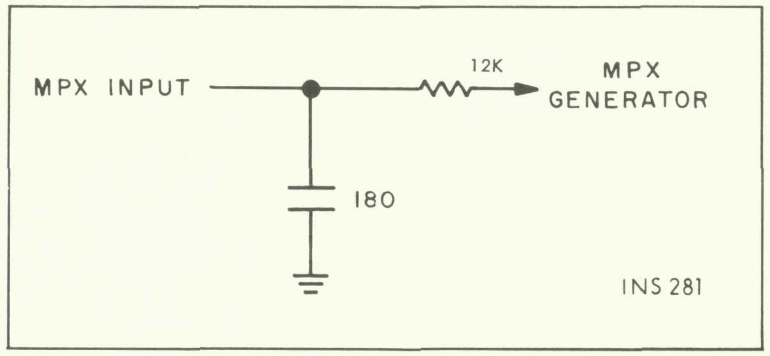
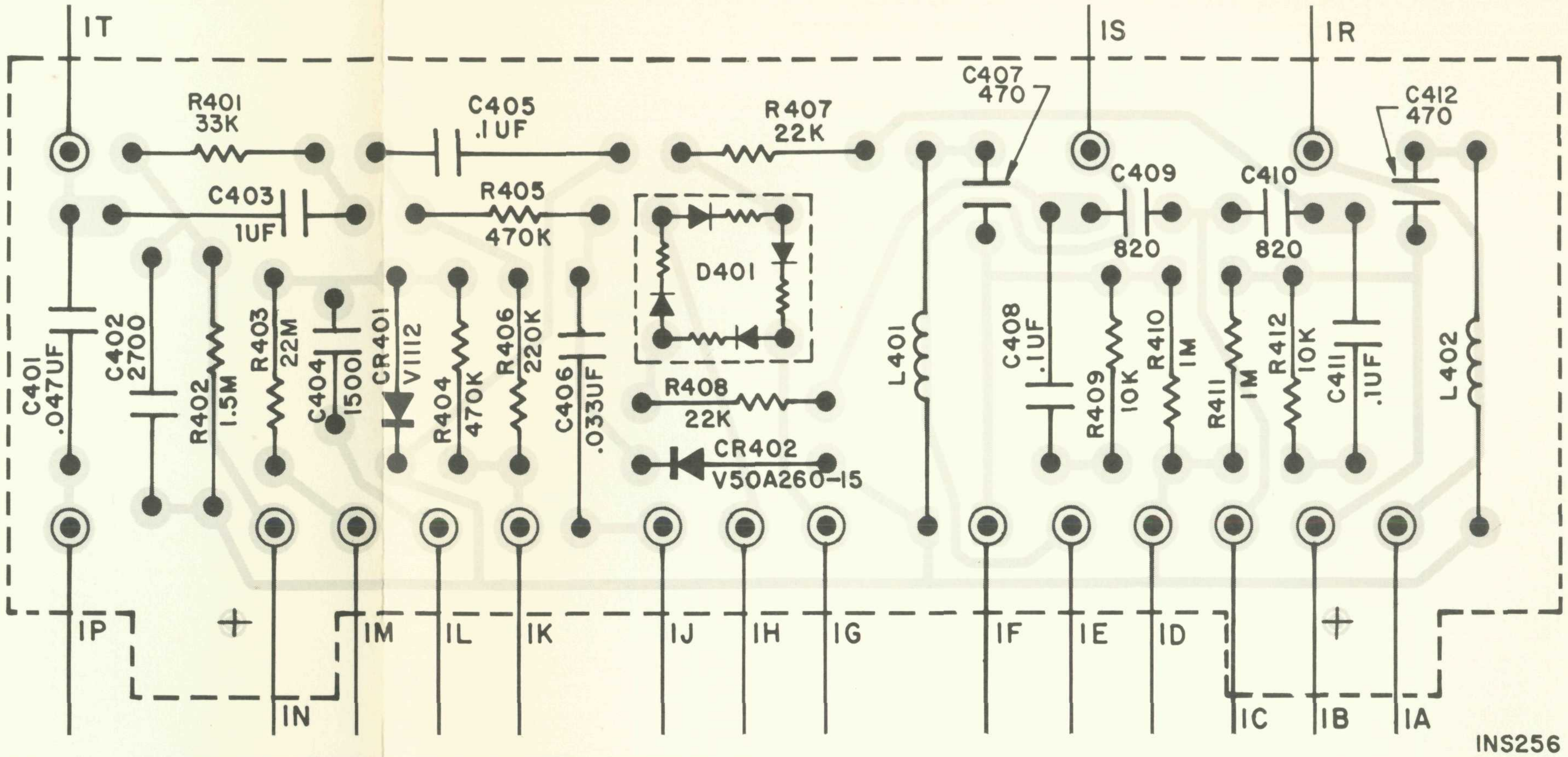


FIGURE 2. Multiplex-alignment hi-pass filter circuit.

P1131-2 MULTIPLEX DECODER



ALIGNMENT INSTRUCTIONS • MULTIPLEX SECTION

GENERAL

The preferred alignment procedure, in table 1 below, uses a multiplex generator with an RF output, like the FISHER Model 300. Optimum performance will be obtained only when the multiplex decoder is connected to the FM detector with which it will be used. Check IF alignment first—poor alignment can prevent proper multiplex decoder operation.

TEST EQUIPMENT REQUIRED: MULTIPLEX GENERATOR, AUDIO (AC) VTVM, 100 KC OSCILLOSCOPE WITH EXTERNAL SWEEP JACKS, ALIGNMENT TOOL.

TABLE 1

STEPS	GENERATOR			INDICATOR	ALIGNMENT	
	CONNECTION	MODULATION	RF DEVIATION	TYPE AND CONNECTION	ADJUST	INDICATION
1	Multiplex generator RF output to antenna terminals	19 kc pilot only	±7.5 kc	VTVM to TP 1	Z1 top and bottom	Maximum reading on VTVM
2	19 kc output of generator to oscilloscope horizontal input; generator not connected to MPX section	———	———	Vertical input of oscilloscope to TP 2; set oscilloscope for external sweep	Z2	Set frequency of free-running oscillator as close as possible to 38 kc. Lissajous pattern (see figure 1) should be as slow-moving as possible.
3	Same as Step 1	Composite MPX; 1000 cps on left channel only	±75 kc	VTVM and oscilloscope vertical input to right channel output lug (terminal 1R)	Z1 top	Maximum reading on VTVM; clean 1000 cps sine wave on oscilloscope
4	Same as Step 1	Composite MPX; 1000 cps on right channel only	±75 kc	Same as Step 3	MPX separation control (R4)*	Minimum reading on VTVM should be at least 33 db below reading obtained in Step 3
5	Same as Step 1	Same as Step 4	±75 kc	VTVM and oscilloscope vertical input to)right channel output lug (terminal 1S)	———	Same VTVM reading as obtained in Step 3 ± 2 db; clean 1000 cps sine wave on oscilloscope
6	Same as Step 1	Composite MPX; 1000 cps on left channel only	±75 kc	Same as Step 5	MPX separation control (R4), if necessary*	Minimum reading on VTVM should be at least 33 db below reading obtained in Step 5.

* If adjustment is required, adjust for best compromise readings in Steps 4 and 6.

ALTERNATE ALIGNMENT PROCEDURE

For multiplex generators without an RF output

When using this alignment procedure, it is necessary to disconnect the ratio detector from the multiplex decoder at the point where the generator is connected. Unsolder point 1T carefully. The generator input must be through a simple low-pass filter—a 12 K resistor between the multiplex generator and the MPX input with a 180 pF capacitor from the MPX input end of the resistor to ground (Figure 2, on schematic).

TEST EQUIPMENT REQUIRED: MULTIPLEX GENERATOR, AUDIO (AC) VTVM, 100 KC OSCILLOSCOPE WITH EXTERNAL SWEEP JACKS, ALIGNMENT TOOL.

TABLE 2

STEPS	GENERATOR			INDICATOR	ALIGNMENT	
	CONNECTION	AUDIO	LEVEL	TYPE AND CONNECTION	ADJUST	INDICATION
1	Composite output of MPX generator to input of MPX demodulator (Point 1)	19 kc pilot only	100 mV RMS (280 MV P-P)	AC VTVM to TP 1	Z1 top and bottom	Maximum reading on VTVM
2	19 kc output of generator to oscilloscope horizontal input; generator not connected to MPX section	———	———	Oscilloscope vertical input to TP 2	Z2	Set frequency of free-running oscillator as close as possible to 38 kc. Lissajous pattern (see figure 1) should be as slow-moving as possible.
3	Same as Step 1	1000 cps on left channel only	0.7 V RMS (3.92 V P-P)	AC VTVM and oscilloscope vertical input to left channel output lug (terminal 1R)	Z1 top	Maximum reading on VTVM; clean 1000 cps sine wave on oscilloscope
4	Same as Step 1	1000 cps on right channel only	0.7 V RMS (3.92 V P-P)	Same as Step 3	MPX separation control (R4)*	Minimum reading on VTVM should be at least 33 db below reading obtained in Step 3
5	Same as Step 1	Same as Step 4	0.7 V RMS (3.92 V P-P)	VTVM and oscilloscope vertical input to right channel output lug (terminal 1S)	———	Same VTVM reading as obtained in Step 3 ± 2 db; clean 1000 cps sine wave on oscilloscope
6	Same as Step 1	1000 cps on left channel only	0.7 V RMS (3.92 V P-P)	Same as Step 5	MPX separation control (R4), if necessary*	Minimum reading on VTVM should be at least 33 db below reading obtained in Step 5.

* If adjustment is required, adjust for best compromise readings in Steps 4 and 6.

ALIGNMENT INSTRUCTIONS

Read these instructions very carefully *before* attempting alignment.

Set the SELECTOR switch to the MONO position.

Set tuning dial to the extreme low-frequency position. (Dial pointer should line up with the calibration mark at the low-frequency end of the dial scale. Reset the dial pointer if necessary.)

Warm up the chassis and the test equipment for at least 15 minutes.

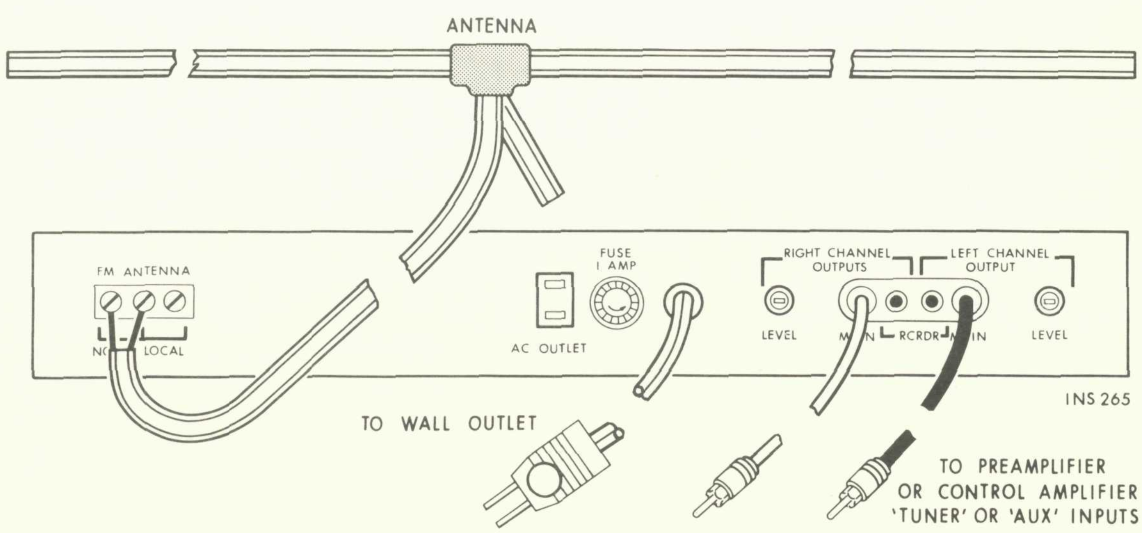
Adjust line voltage (power input to chassis) for 117 volts AC 50 to 60 cycles.

(Use only the proper, fully insulated, alignment tools.) Reduce signal generator output during alignment to keep VTVM reading below that specified for step 1.

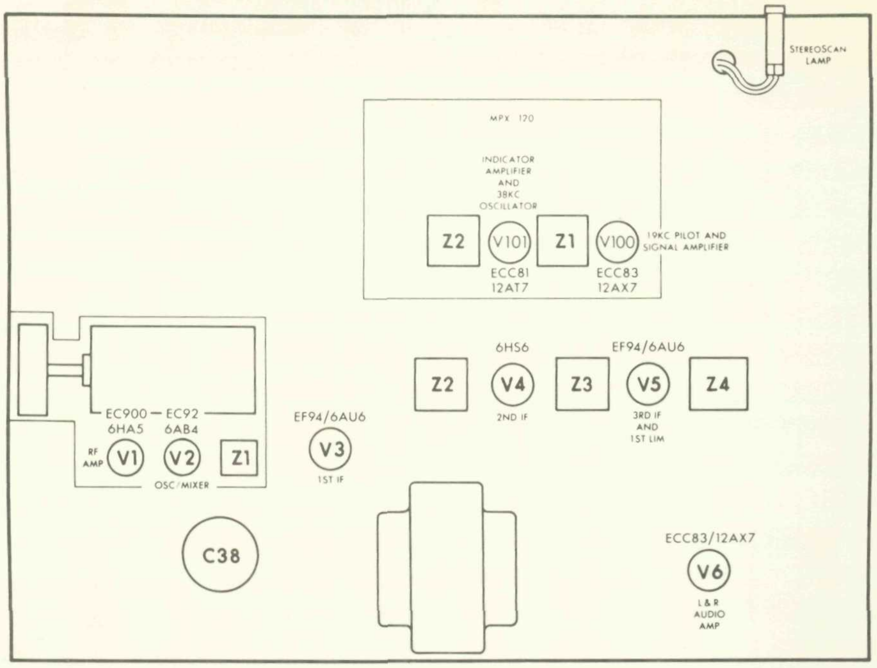
Repeat steps 4 and 5 to obtain proper dial calibration and maximum sensitivity.

STEP	DIAL	SIGNAL GENERATOR			DC VTVM	ADJUST	INDICATION
		GENERATOR COUPLING	FREQ.	MOD.			
1	Set dial pointer for extreme low-frequency position.	Ungrounded tube shield of V2	10.7 MC	None	Test Point 3	Z1, Z2, Z3, Z4 top and bottom	Maximum negative voltage (below 20 volts)
2		Ungrounded tube shield of V2	10.7 MC	None	Hot lead of DC VTVM to TEST POINT 4. Ground lead of DC VTVM to junction of two series-connected external resistors (47K 5%), wired between TEST POINT 3 and ground.	Z4 top	Zero indication on zero-center dial.
3	90 MC	Two 120-ohm carbon resistors in series with generator leads to the NORMAL antenna terminals (Figure 1).	90 MC	±22.5 KC deviation at 400 cps.	Through 100K resistor to Test Point 2	L4, L3 and L2	Adjust for maximum negative voltage and check for sinusoidal waveform, with scope, at LEFT or RIGHT RCRDR output.
4	106 MC		106 MC	±22.5 KC deviation at 400 cps.	Through 100K resistor to Test Point 2	C13, C7 and C5	
5	98 MC		98 MC	±22.5 KC deviation at 400 cps.	Through 100K resistor to Test Point 2	L1	

COMPONENT CONNECTION

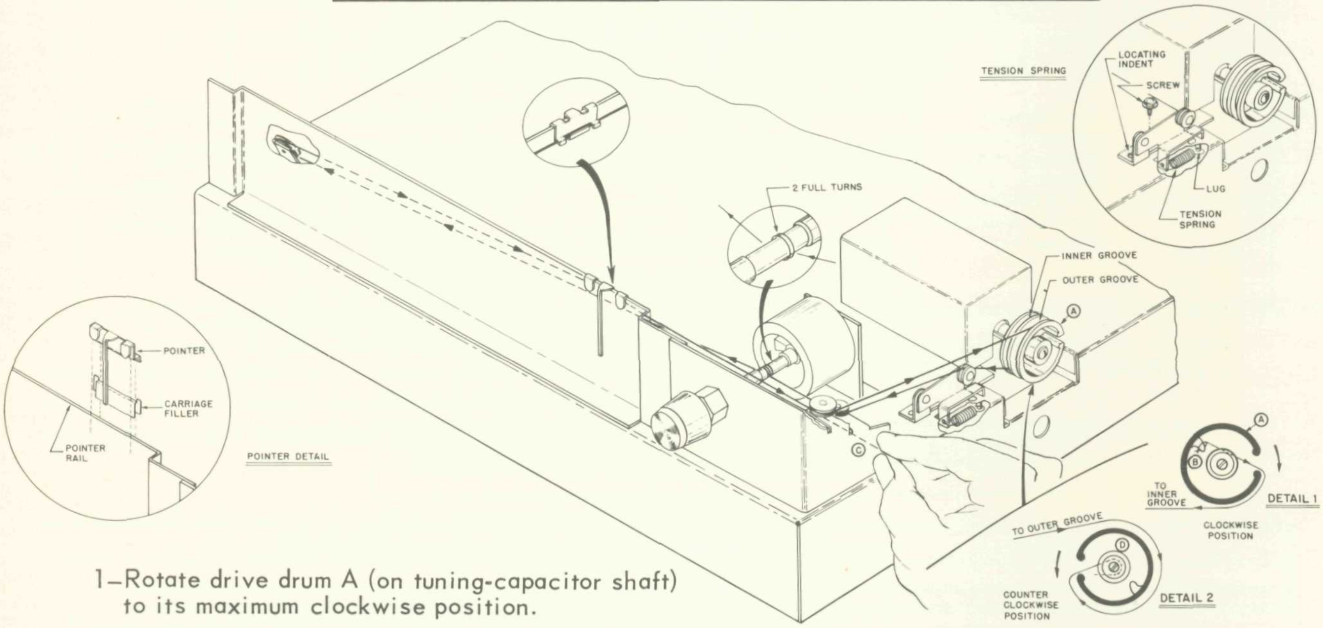


TUBE LAYOUT



INS 267

DIAL STRINGING PROCEDURE



1–Rotate drive drum A (on tuning-capacitor shaft) to its maximum clockwise position.

2–Tie dial cord to ear B (inside drum A) as shown in Detail 1.

3–Run dial cord through slot in rim of drum A.

4–Set dial cord in INNER grove and over tension-spring pulley.

5–String dial cord, as shown, to point C.

6–Hold dial cord taut with left hand.

7–Wind drum A to maximum counterclockwise position (with right hand).

8–Wrap loose end of dial cord around drum A, in outer groove, as shown in Detail 2 (using right hand).

9–Secure loose end of dial cord under machine screw and washer (D) in the center of the drive drum.

FISHER RADIO CORPORATION · NEW YORK

