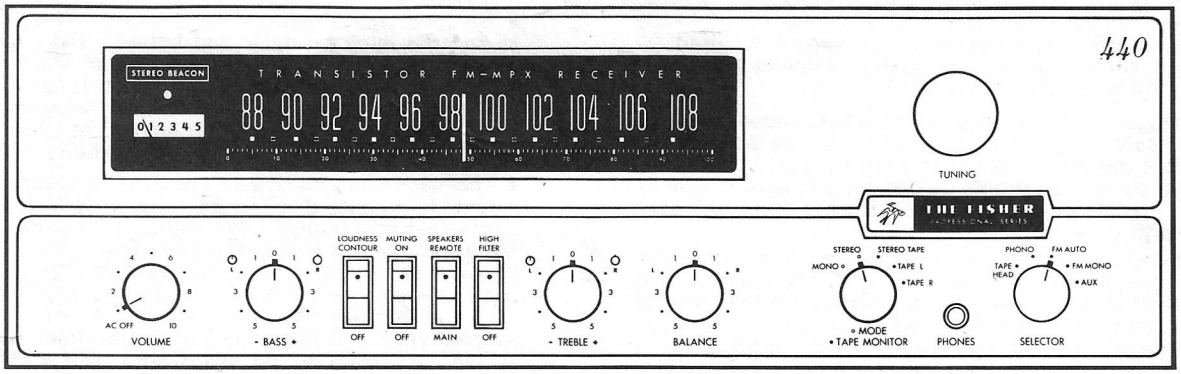
Serial Nos. Beginning 47001

Service Manual

THE FISHER®



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CHASSIS SERIAL NUMBERS
BEGINNING 47001

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 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.

Transistors—Never attempt to do any work on the transistor amplifiers without first disconnecting the AC-power linecord — wait 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. This reduces 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. Heat is the greatest enemy of electronic equipment. It can shorten the life of transistors, capacitors and resistors. (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. 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.

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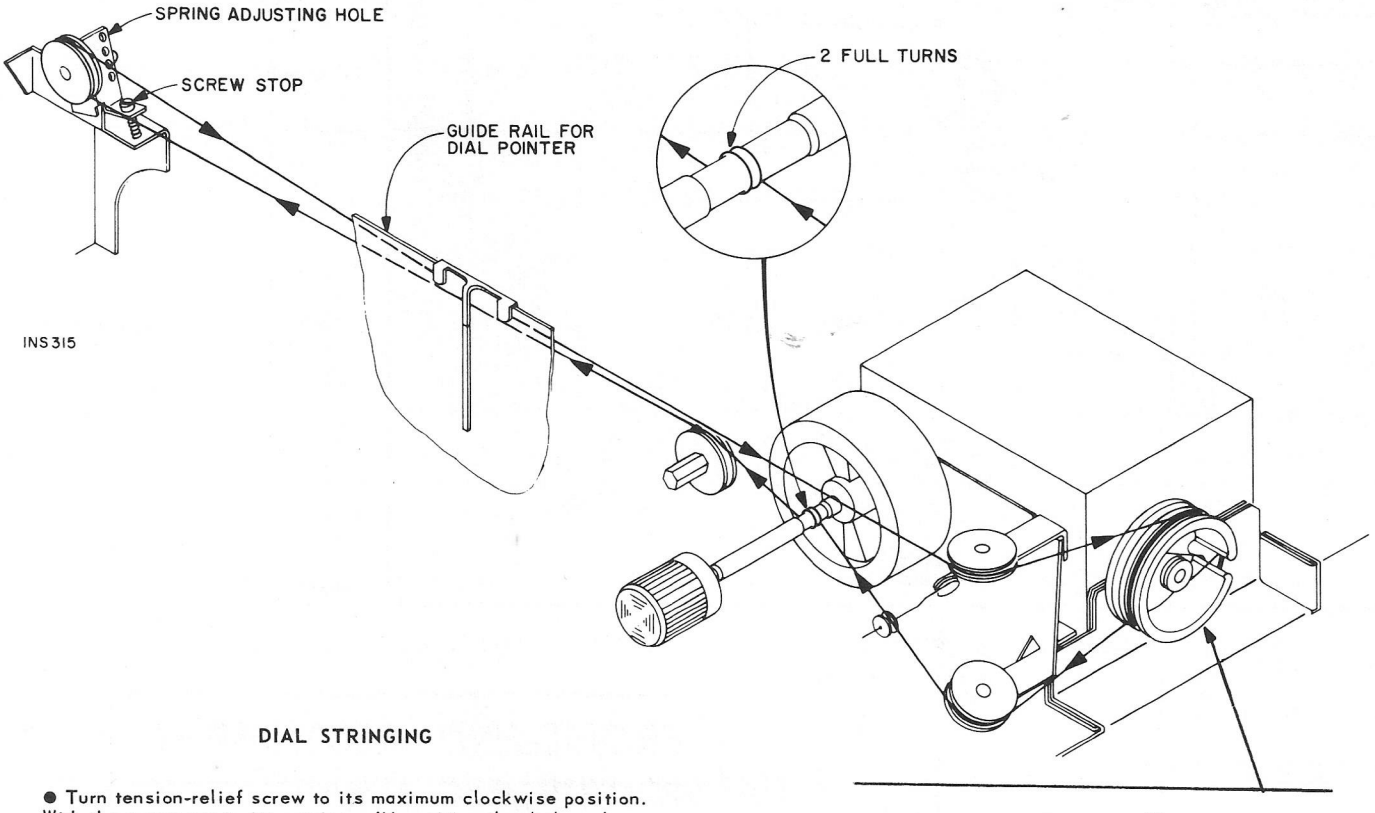
DIAL STRINGING PROCEDURE

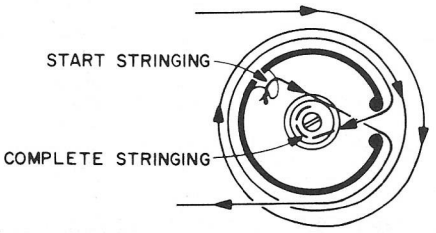


DIAL STRINGING

- Turn tension-relief screw to its maximum clockwise position. With the screw set to its maximum-IN position the dial cord may be pulled as tightly as possible (just before securing the loose end) without stretching the tension spring. *This is not an adjustment screw.* It is used only for easier dial-cord stringing.
- Rotate the tuning-capacitor drive-drum to its maximum clockwise position.
- Attach the dial cord to the ear inside the tuning-capacitor drive-drum as shown in detail drawing (lower right).
- Run dial cord through slot in rim of the tuning-capacitor drive drum.
- Set dial cord in INNER groove and guide it around the lower pulley, flywheel shaft and over guide pulleys.
- Position dial cord on other pulleys and over the top of the tuning-capacitor drive-drum.
- Pull dial cord taut and wrap two complete turns around the OUTER groove of the tuning-capacitor drive-drum.
- Run dial cord through slot in the rim of the drive drum.
- Wrap the end of the dial cord around the body of the machine screw in the hub of the drive drum and tighten. The dial cord goes under the flat washer.

CAUTION – *When securing the end of the dial cord the adjusting screw must be in contact with the screw stop.*

- Back out the ten sion-relief screw (turn it counter clockwise) to let the spring hold the dial cord under proper tension. The tension relief screw must clear the screw stop to allow free movement of the pulleys while providing non-slip drive.



DIAL STRINGING ADJUSTMENTS

- When the dial cord slips, where it is wrapped around the flywheel drive shaft, move the tension spring to a higher locating hole.
- If the flywheel does not rotate freely and smoothly, move the spring to a lower locating hole to reduce tension.

NOTE: Nylon pulleys generally do not need lubrication. If roughness or noise occurs during tuning, silicone or other high-temperature lubricant may be applied to the moving parts. Accumulations of dust should be removed before any lubricant is applied. Often cleaning will eliminate the need for lubrication.

MAIN CHASSIS PARTS DESCRIPTION LIST

CAPACITORS

Symbol	Description	Part No.
C1, 2	Ceramic, 47pF, 10%, N750, 1000V	C50070-4
C3	Ceramic, 2700pF, 20%, 1000V	C50071-5
C4	Electrolytic, 10uF, 35V	C50483-2
C5, 6	Ceramic, .02uF, +80–20%, 100V	C50095-1
C7	Mylar, .22uF, 20%, 250V	C50B575-3
C8	Mylar, .22uF, 10%, 250V	C50B575-2
C9	Molded, .01uF, 20%, 600V	C2747
C10, 11	Electrolytic, 500uF, 35V	C50483-17
C12	Electrolytic, 1000uF, 50V	C50180-80
C13	Electrolytic, 1500uF, 50V	C50180-84
C14, 15	Electrolytic, 200uF, 35V	C50483-7
C16	Ceramic, .02uF, +80–20%, 100V	C50095-1
C17, 18	Ceramic, 220pF, 10%, 1000V	C50072-20
C19, 20	Tant. Electrolytic, 1uF, 20%, 25V	C50B640-1
C21, 22	Ceramic, 120pF, 10%, 1000V	C50072-40
C23, 24	Electrolytic, 15uF, 15/18V	C50283-15
	or Electrolytic, 16uF, 15V	C50483-10
C25, 26	Electrolytic, 100uF, 25V	C50483-6
C27, 28	Electrolytic, 15uF, 15/18V	C50283-15
	or Electrolytic, 16uF, 15V	C50483-10
C29, 30	Electrolytic, 1500uF, 50V	C50180-84
C31, 32	Mylar, .33uF, 10%, 250V	C50B575-4
C33, 34	Ceramic, 330pF, 10%, 1000V	C50072-1
C35, 36	Mylar, .33uF, 10%, 250V	C50B575-4
C37	Electrolytic, 10uF, 35V	C50483-2

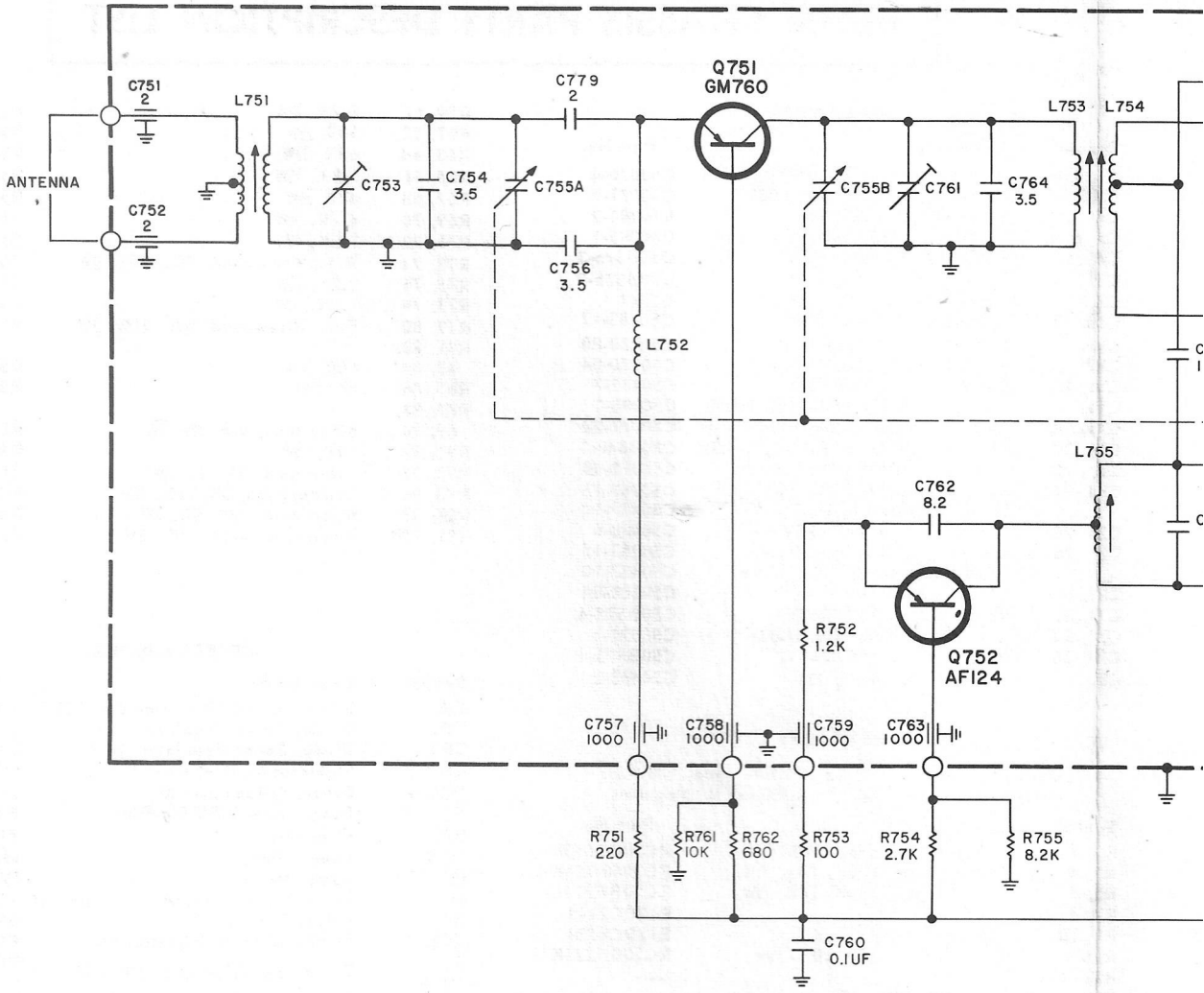
RESISTORS

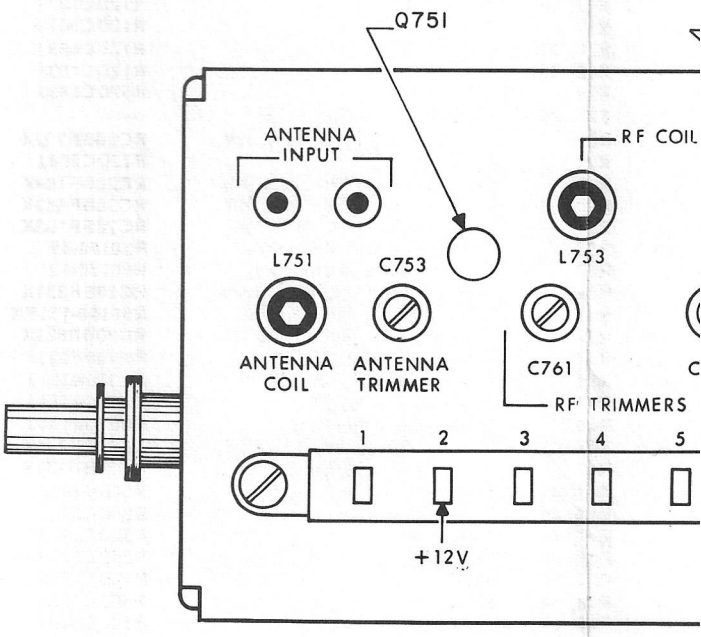
Deposited Carbon in ohms, 5% tolerance, 1/8 Watt unless otherwise noted. K=Kilohms, M= Megohms

Symbol	Description	Part No.
R1, 2	Composition, 68K, 10%, ½W	RC20BF683K
R3, 4	Composition, 120K, 10%, ½W	RC20BF124K
R5, 6	Composition, 220K, 10%, ½W	RC20BF224K
R7, 8	220K	R12DC224J
R9, 10	4.7K	R12DC472J
R11	Composition, 270, 10%, ½W	RC20BF271K
R12, 13	–Deleted–	---
R14	Pot., 1K, 30%, MPX, Separation Control	R50150-51
R15	82K	R12DC823J
R16	Composition, 15K, 10%, ½W	RC20BF153K
R17, 18	1K	R12DC102J
R19	560	R12DC561J
R20, 21	68K	R12DC683J
R22, 23	10K	R12DC103J
R24	68K	R50DC683J
R25, 26	–Deleted–	---
R27	Composition, 2.2K, 10%, ½W	RC20BF222K
R28	220K	R12DC224J
R29	Composition, 100K, 10%, ½W	RC20BF104K
R30	Composition, 6.8K, 10%, ½W	RC20BF682K
R31	Composition, 18K, 10%, ½W	RC20BF183K
R32	Pot., 500, 30%, Meter Adj.	R50150-69
R33	Pot., 5K, 30%, Muting Adj.	R50150-52
R34	Composition, 330, 10%, 1/2W	RC20BF331K
R35	Pot., 50K, Volume Control	R50160-151FX
R36	Composition, 820K, 10%, ½W	RC20BF824K
R37	Wirewound, 220, 5%, 2W	RW200W221J
R38	Wirewound, 330, 5%, 3W	RL300W331J
R39	Wirewound, 100, 2W	RW200W101J
R40	Wirewound, 100, 2W	RW200W101J
R41	Composition, 1.2K, 10%, ½W	RC20BF122K
R42	Composition, 120, 10%, ½W	RC20BF121K
R43, 44	180K, ½W	R50DC184J
R45, 46	3.3K, ½W	R50DC332J
R47, 48	2.7K, ½W	R50DC272J
R49, 50	22K, ½W	R50DC223J
R51, 52	220K	R50DC224J
R53, 54	18K, ½W	R50DC183J
R55, 56	56, ½W	R50DC560J
R57, 58	15K, ½W	R50DC153J
R59, 60	8.2K, ½W	R50DC822J
R61, 62	560, ½W	R50DC561J
R63, 64	68K, ½W	R50DC683J
R65, 66	6.8K, ½W	R50DC682J
R67, 68	470, ½W	R50DC471J
R69, 70	4.7K, ½W	R50DC472J
R71, 72	1.2K, ½W	R50DC122J
R73, 74	Pot., Wirewound, 500, 20%, 2W	R50160-142-4
R75, 76	2.2K, ½W	R50DC222J
R77, 78	1.5K, ½W	R50DC152J
R79, 80	Pot., Wirewound, 500, 20%, 2W	R50160-142-4
R81, 82, 83, 84	100, ½W	R50DC101J
R85, 86	68, ½W	R50DC680J
R87, 88, 89, 90	Wirewound, 0.5, 5%, 3W	RL300WR50J
R91, 92	68K, ½W	R50DC683J
R93, 94	Wirewound, 39, 5%, 3W	RL300W390J
R95, 96	Composition, 33, 10%, ½W	RC20BF330K
R97, 98	Wirewound, 330, 5%, 2W	RW200W331J
R99, 100	Wirewound, 0.15, 10%, 3W	RL300WR15K

MISCELLANEOUS

Symbol	Description	Part No.
CR1	Silicon Bridge Rectifier B40C 2200	SIB50B794-1
CR2	Diode, Zener Regulator, 12V	ZR50B793-1
CR3	Diode, Zener Regulator, 24V	ZR50921-1
CR4, 5	Stabistor Module, Dual Silicon	SIT50B843-2
CR6, 7	Diode, Silicon 2A100	SID50894
F1	Fuse, Line, 1.5A Slo-Blo	F684-143
F2	Fuse, 4A	F3319-4
I1, 2	Lamp, Dial	I50441-1
I3	Lamp, Meter	I50009-8
I4	Lamp, Stereo Beacon part of	A50B738-1
M1	Meter, Tuning	M946B213
PC1, 2	Printed Circuit, Equalization	PC50B187-29
Q1, 2, 3, 4	Transistor, Q36642 or TR1007	TR36642 or TR1007
Q5, 7	Transistor, TR1003 or S1784 or	TR1003 or S1784
Q6, 8	Transistor, TR0055 or TR1002	TR0055 or TR1002
Q9, 10	Transistor, TR1003 or S1784 or Q36643	TR1003 or S1784 or Q36643
Q11, 12	Transistor, 2N3638A	TR2N3638A-2
Q13, 14	Transistor, 2N4001	TR2N4001
Q15	–Deleted–	---
Q16, 17	Transistor, 2N2925	TR2N2925
Q18	Transistor, Q40245	TR40245
S1	Switch, Rotary, Selector	S1340C121
S2	Switch, Rotary, Mode/Tape Monitor	S1340C160
S3-6	Switch, Rocker, Loudness, Muting Speakers, Filter	S50C200-15-1
S7	Switch, Power part of	R50160-151FX
T1	Transformer, Power	T1340C115C
---	FM Front End	FE50D797B
---	Printed Circuit Board, MPX	P1242-1
---	Printed Circuit Board, Tone Control	P1278
---	Printed Circuit Board, Preamplifier	P1285
---	Printed Circuit Board, IF Amplifier	P1381
---	Antenna Dipole Assembly	AS50227-1
---	Dial Glass Screened	N1340B107
---	Dress Panel Assembly	AS1340D132
---	Knob, Tuning	E50B566-2
---	Knob, Volume, Balance, Mode/Tape Monitor, Selector	E50B562-1
---	Knob, Dual, Top, Bass, Treble	E50B563
---	Knob, Dual, Bottom, Bass, Treble	E50B564
---	Insulator, Transistor (Q1-Q4)	E50510
---	Tuning Capacitor Drive Wheel	E50C588
---	Jack, Phones	J50B545B



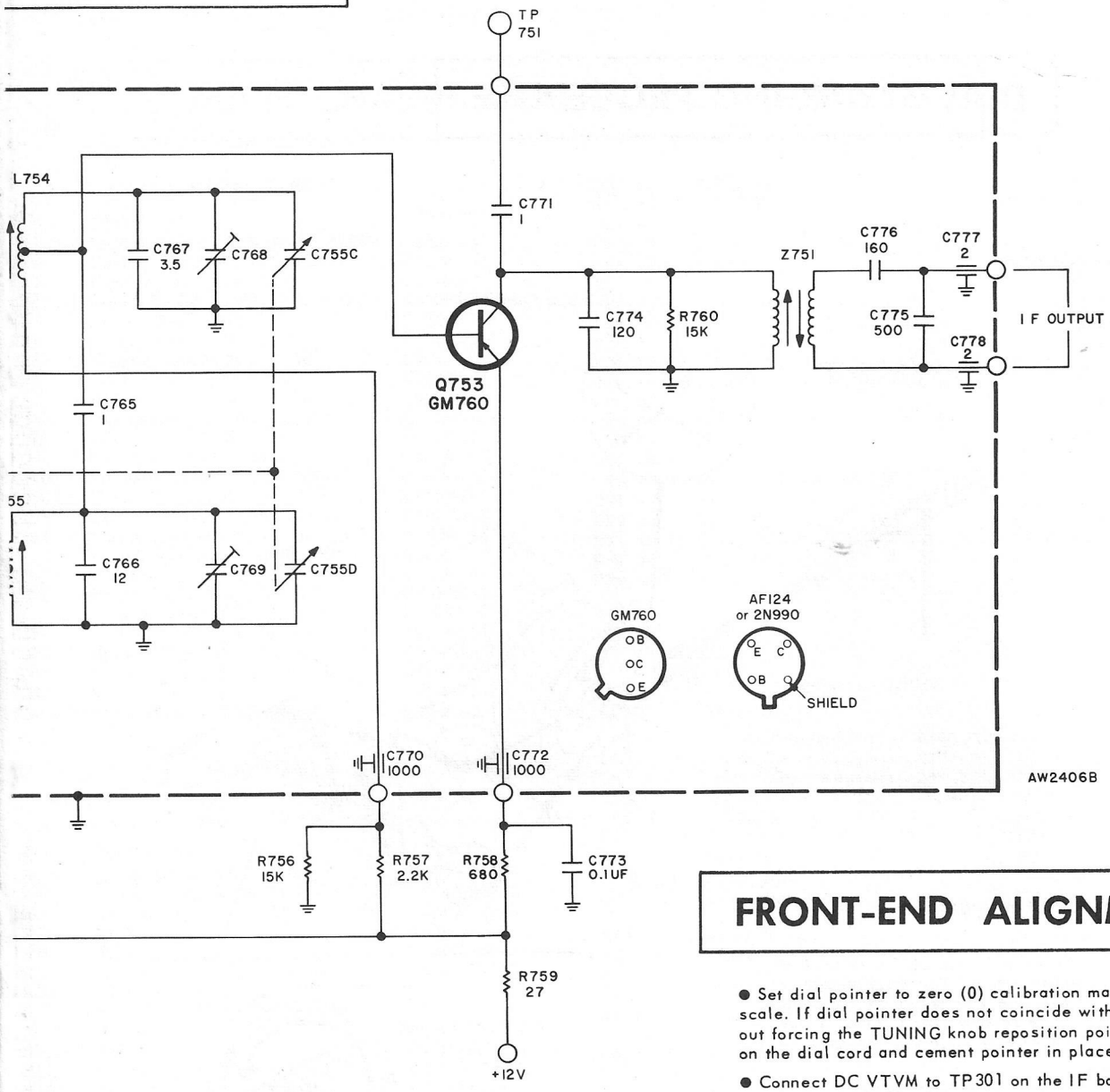


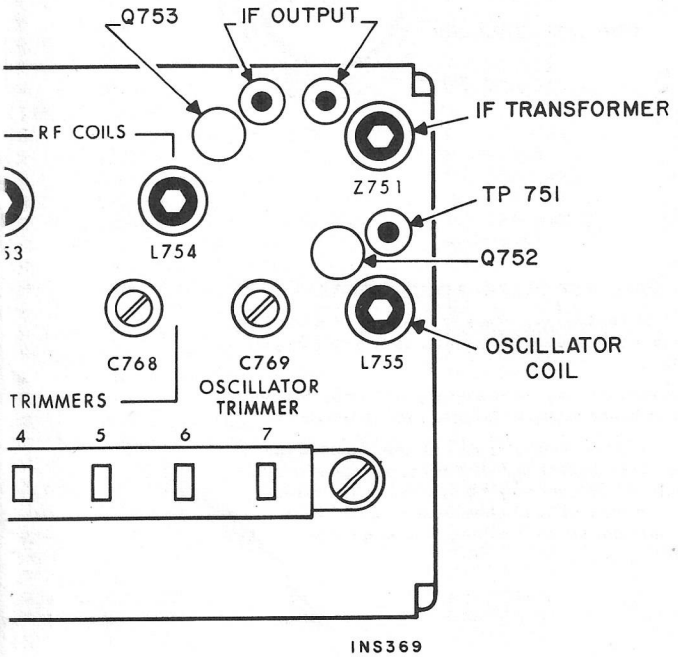
PARTS DESCRIPTION LIST

Symbol	Description	Part No.
C760, 774	Ceramic, .1uF +80–20%, 12V	C50331-6
R751	Dep. Carbon, 220, 5%, 1/8W	R12DC221J
R753	Dep. Carbon, 100K, 5%, 1/8W	R12DC104J
R754	Dep. Carbon, 2.7K, 5%, 1/8W	R12DC272J
R755	Dep. Carbon, 8.2K, 5%, 1/8W	R12DC822J
R756	Dep. Carbon, 15K, 5%, 1/8W	R12DC153J
R757	Dep. Carbon, 2.2K, 5%, 1/8W	R12DC222J
R758	Dep. Carbon, 680, 5%, 1/8W	R12DC681J
R759	Dep. Carbon, 27, 5%, 1/8W	R12DC270J
R760	–Deleted–	---
R761	10K, 5%, 1/8W	R12DC103J
R762	680, 5%, 1/8W	R12DC681J

With the exception of the above electronic components and normal realignment procedures, front-end service is not recommended. Should any defect occur that can not be remedied by realignment or by replacing one of the above electronic components the unit should be returned to the manufacturer.

7 FM FRONT END





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FRONT-END ALIGNMENT

- Set dial pointer to zero (0) calibration mark on logging scale. If dial pointer does not coincide with the 0 without forcing the TUNING knob reposition pointer assembly on the dial cord and cement pointer in place.
- Connect DC VTVM to TP301 on the IF board.
- Connect RF generator (with two 120-ohm composition resistors in series with the leads—Figure 1) to the LOC antenna terminals. DO NOT use modulation (AM or FM).
- Set generator frequency and tuning dial to 90 mc. Adjust the oscillator-coil core first—then adjust the RF and Antenna-coil cores for maximum VTVM reading.
- Set generator frequency and tuning dial to 106 mc. First adjust oscillator trimmer and then the RF and Antenna-coil trimmers for maximum VTVM reading.
- Repeat steps above several times until dial calibration is accurate when VTVM reading is maximum. Keep the output of the generator as low as possible during all adjustments.

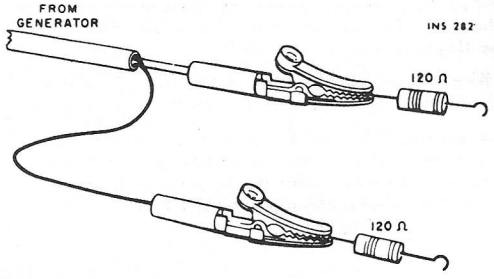
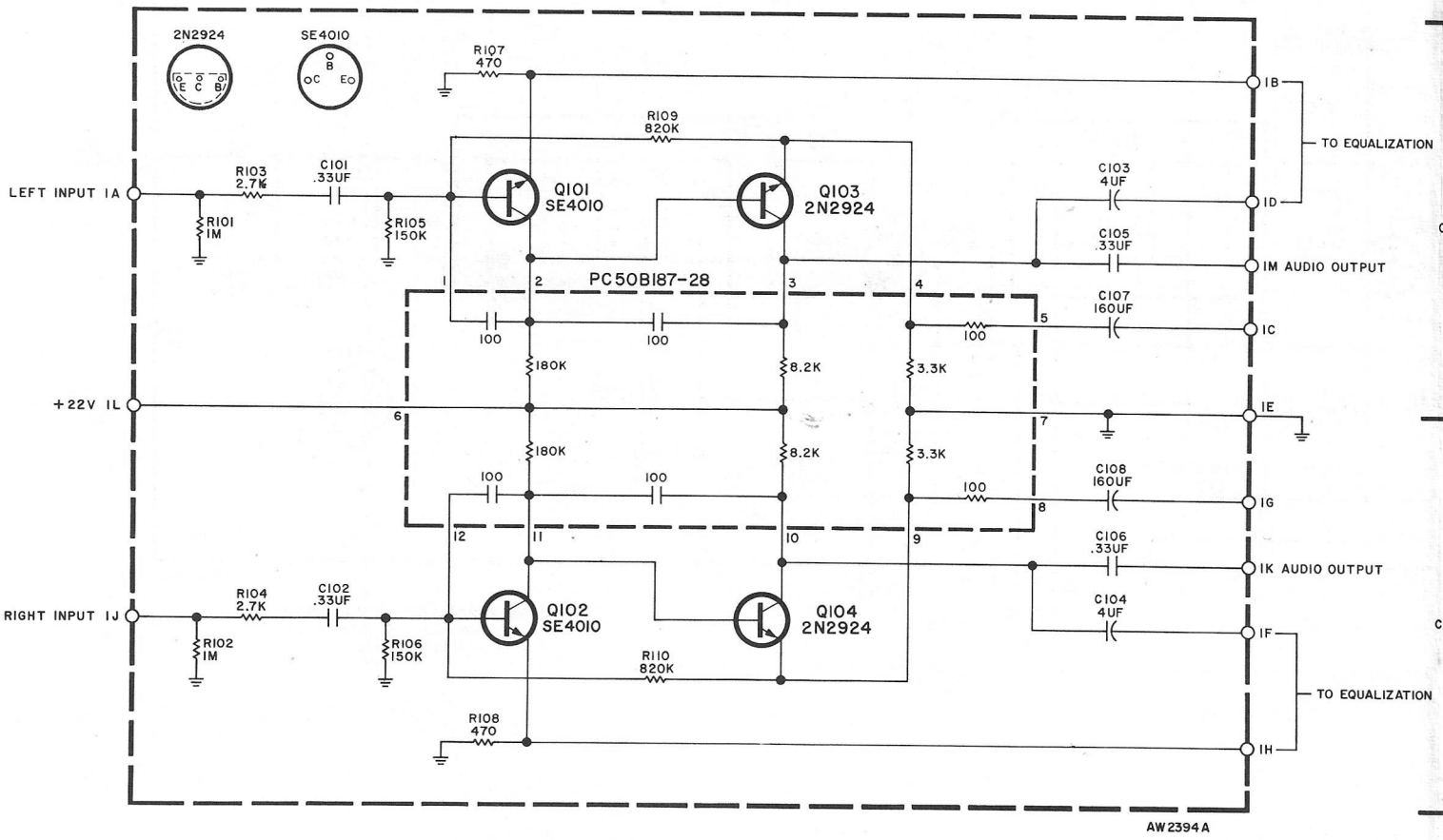


Figure 1. Generator connections to antenna terminals.

(1-1) FS-50-D797-SH



PARTS DESCRIPTION LIST

CAPACITORS

Symbol	Description	Part No.
C101, 102	Mylar, .33uF, 10%, 250V	C50B638-10
C103, 104	Electrolytic, 4uF, 35V	C50B637-1
C105, 106	Mylar, .33uF, 10%, 250V	C50B638-10
C107, 108	Electrolytic, 160uF, 6V	C50B637-3

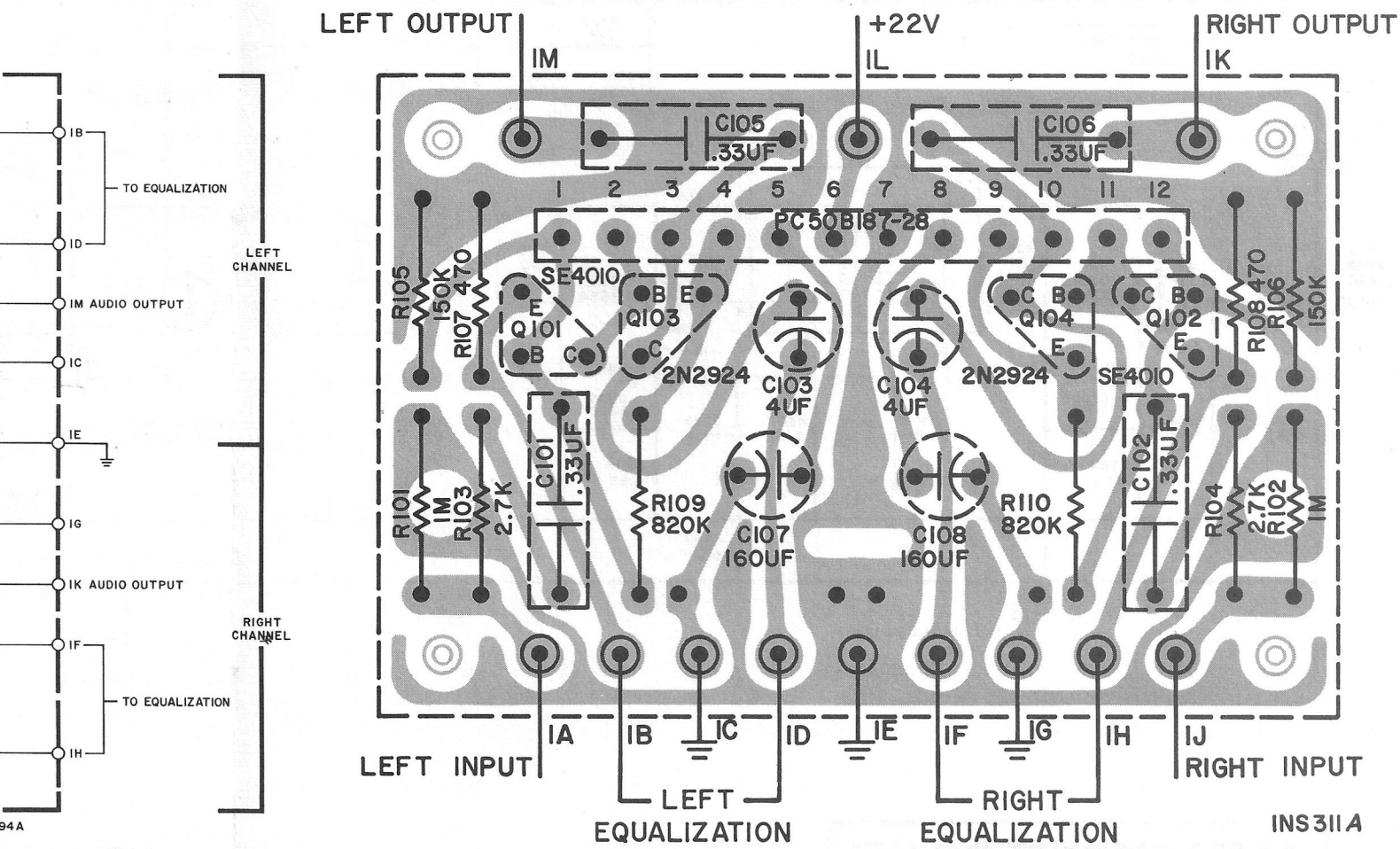
RESISTORS

In ohms, 5% tolerance, 1/8 watt unless otherwise noted.
K = Kilohms, M = Megohms.

Symbol	Description	Part No.
R101, 102	Dep. Carbon, 1M	R12DC105J
R103, 104	Composition, 2.7K, 10%, ½W	RC20BF272K
R105, 106	Dep. Carbon, 150K	R12DC154J
R107, 108	Dep. Carbon, 470	R12DC471J
R109, 110	Dep. Carbon, 820K	R12DC824J

MISCELLANEOUS

Symbol	Description	Part No.
–	Printed Circuit Board	P1285
–	Printed Circuit	PC50B187-28
–	Socket, Transistor	X50B779-2
Q101, 102	Transistor, SE4010	TR4010-2
Q103, 104	Transistor, 2N2924	TR2924-18



INTERMODULATION DISTORTION TEST

Set BALANCE, BASS and TREBLE controls to their center positions. Set MODE/TAPE MONITOR switch to STEREO and SELECTOR switch to AUX. LOUDNESS CONTOUR and HIGH FILTER switches to OFF and SPEAKERS switch to MAIN. Unplug AC power cord.

- Connect a 4-ohm, 50-watt resistor across the LEFT MAIN speaker terminals. In parallel with the load resistor, connect the input leads of an IM(Inter-Modulation) distortion analyzer and the leads of an AC VTVM capable of reading 0.1 volts with accuracy.
- Connect IM-analyzer generator output to the LEFT AUX INPUT.

NOTE: Speaker common terminals are not at ground potential. IM distortion analyzer ground should be connected to AUX INPUT ground only.

- Apply AC power and rotate VOLUME control to its maximum clockwise position—full volume.
- Increase IM-analyzer generator input to amplifier for 25 watts output (8.2 VAC across 4-ohm load resistor). AFTER ONE FULL MINUTE OF WARM UP TIME, PROCEED TO NEXT STEP.

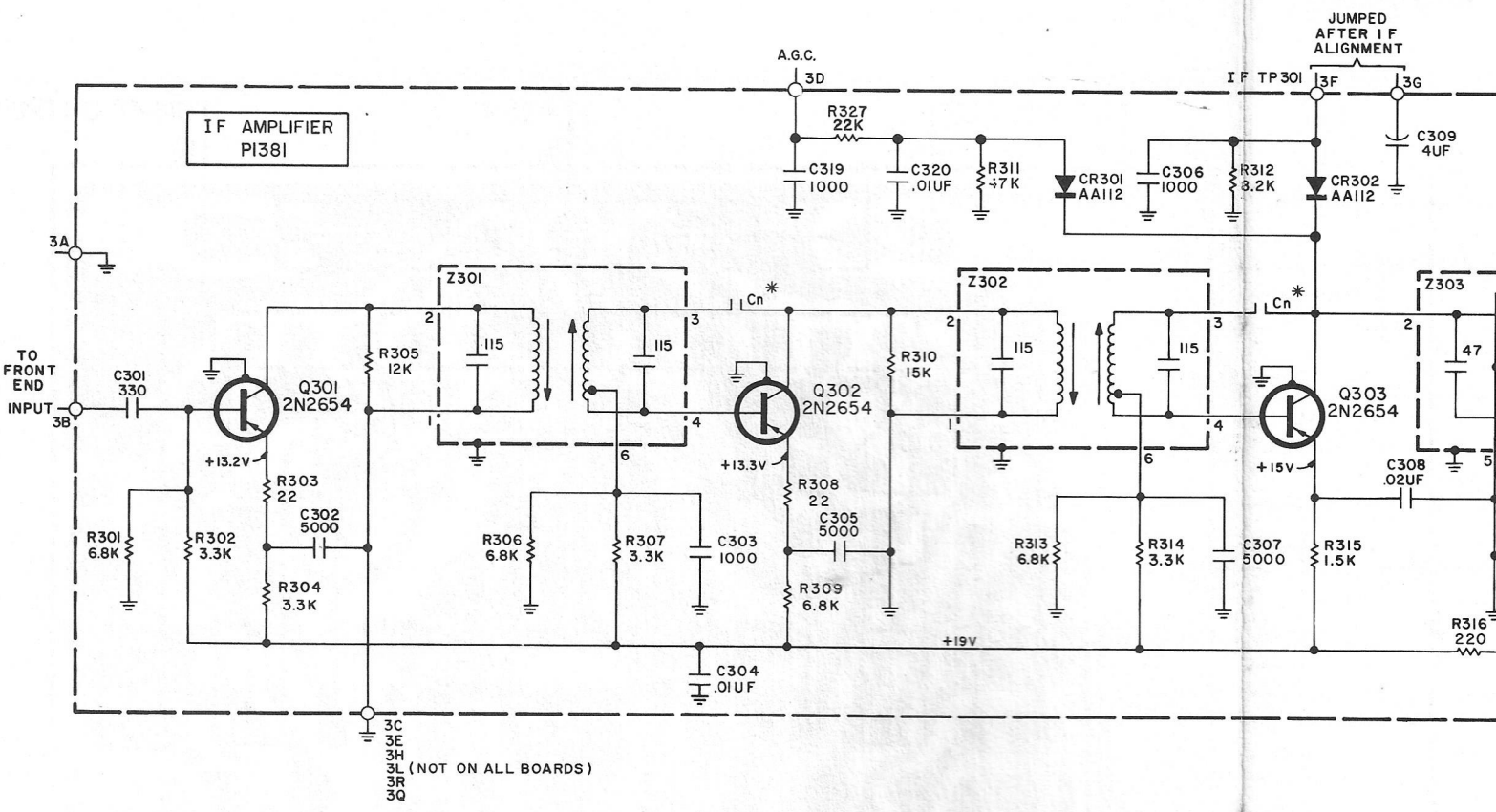
NOTE: Warm up time is very important in obtaining proper readings. The characteristics of transistors change slightly as their internal temperature rises. Once the transistors are warm, the tests should be completed without delay—before they can cool off.

- Reduce IM-analyzer generator input to amplifier for 5 watts output (3.65 VAC across 4-ohm load resistor). IM meter reading should be 0.5% or less.
- Repeat above steps for right channel.

NOTE: If any of the above instructions are different from those supplied with the IM analyzer instruction manual, it is best to follow those in the manual. If a load resistor of 50-watt rating is built into the IM analyzer, a separate load resistor is not required. For best results, the IM range switch should be set to give a reading in the center to full-scale portion of the meter scale for greater accuracy.

RC20BF272K
R12DC154J
R12DC471J
R12DC824J

Part No.
P1285
PC50B187-28
X50B779-2
TR4010-2
TR2924-18



PARTS DESCRIPTION LIST

CAPACITORS

Symbol	Description	Part No.
C301	Ceramic, 330pF, 10%, 1000V	C50B569-1
C302	Ceramic, 5000pF, 20%, 500V	C50B567-2
C303	Ceramic, 1000pF, 10%, 1000V	C50B569-3
C304	Ceramic, .01uF, +80–20%, 500V	C50B570-1
C305	Ceramic, 5000pF, 20%, 500V	C50B567-2
C306	Ceramic, 1000pF, 20%, 1000V	C50B569-4
C307	Ceramic, 5000pF, 20%, 500V	C50B567-2
C308	Ceramic, .02uF, +80–20%, 100V	C50B570-2
C309	Electrolytic, 4uF, 35V	C50483-1
C310	Ceramic, 100pF, 10%, N1500, 1000V	C50B568-3
C311	Ceramic, .01uF, +80–20%, 500V	C50B570-1
C312	Ceramic, 5000pF, 20%, 500V	C50B567-2
C313	Ceramic, 3pF, 10%, NPO, 1000V	C50070-28
C314	Ceramic, 5000pF, 20%, 500V	C50B567-2
C315	Ceramic, .01uF +80–20%, 500V	C50B570-1
C316, 317	Ceramic, 330pF, 10%, 1000V	C50B569-1
C318	Electrolytic, 10uF, 35V	C50483-2
C319	Ceramic, 1000pF, 20%, 1000V	C50B569-4
C320	Ceramic, .01uF, +80–20%, 500V	C50B570-1

RESISTORS

Deposited carbon in ohms, 5% tolerance, 1/8 watt, unless otherwise noted. K=Kilohms, M=Megohms.

Symbol	Description	Part No.
R301	6.8K	R12DC682J
R302	3.3K	R12DC332J
R303	22	R12DC220
R304	3.3K	R12DC332J
R305	12K	R12DC123J
R306	6.8K	R12DC682J
R307	3.3K	R12DC332J
R308	22	R12DC220J
R309	6.8K	R12DC682J
R310	15K	R12DC153J
R311	47K	R12DC473J
R312	8.2K	R12DC822J
R313	6.8K	R12DC682J
R314	3.3K	R12DC332J
R315	1.5K	R12DC152J
R316	220	R12DC221J
R317	1K	R12DC102J
R318	12K	R12DC123J
R319	6.8K	R12DC682J
R320	4.7K	R12DC472J
R321	1.5K	R12DC152J
R322	100	R12DC101J
R323, 324	1K	R12DC102J
R325, 326	6.8K	R12DC682J
R327	2K	R12DC223J

MISCELLANEOUS

Symbol	Description	Part No.
CR301, 302	Diode, AA112	V50260-16
Z301, 302	Transformer, I. F.	ZZ50C210-71
Z303	Coil, Limiter	ZZ50C210-70
Z304	Transformer, Ratio Detector	ZZ50C210-68
Q301, 302, 303, 304	Transistor 2N2654	TR2N2654
	Transistor Mtg. Pads	A50618
	Printed Circuit Board	P1381

FIGURE 1.

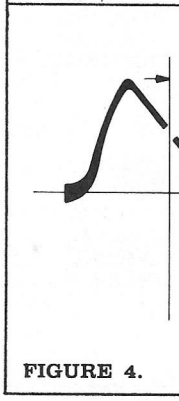
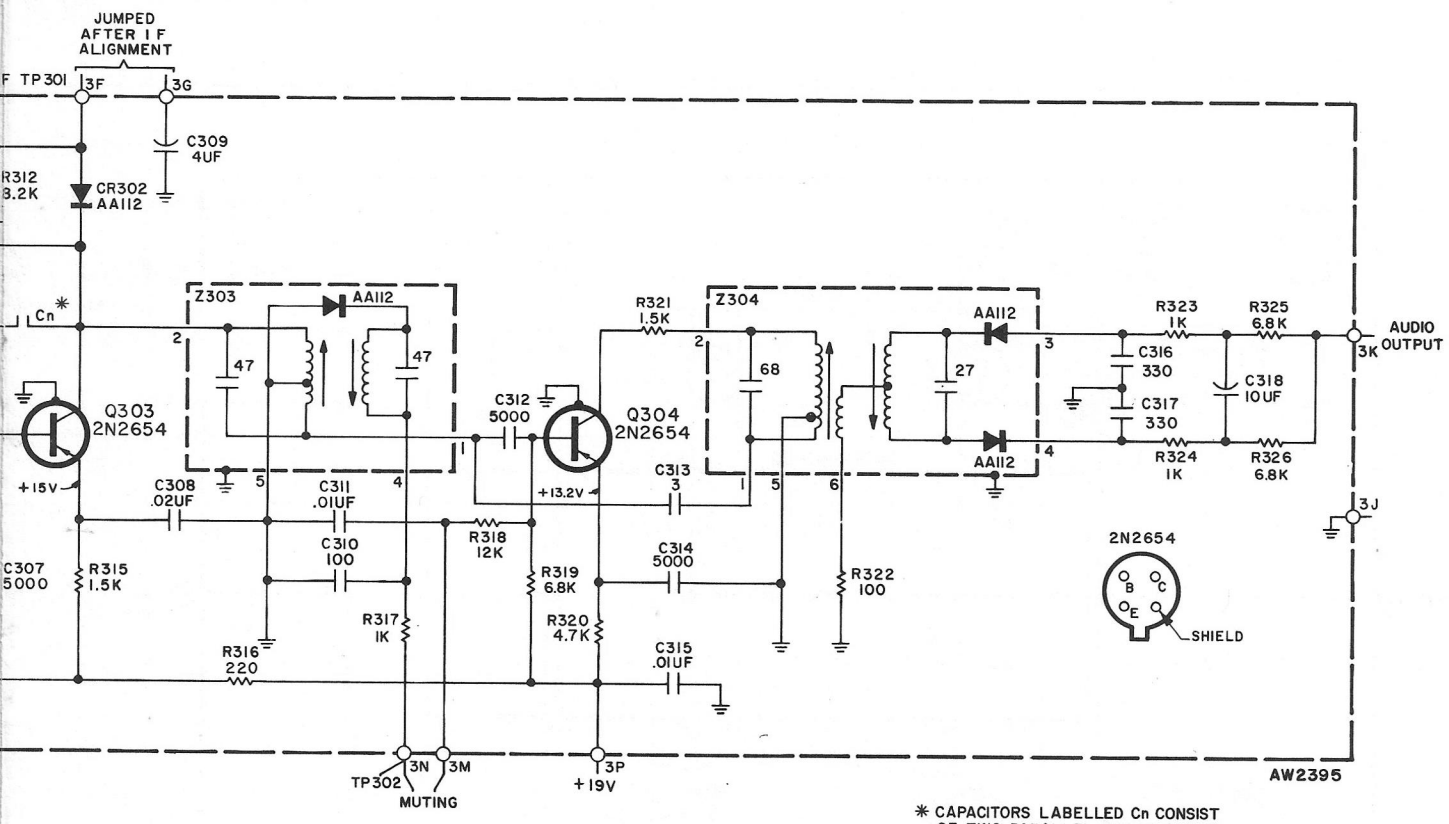


FIGURE 4.

IF AMPLIFIER



* CAPACITORS LABELLED Cn CONSIST OF TWO PARALLEL STRIPS ON THE PRINTED CIRCUIT BOARD.

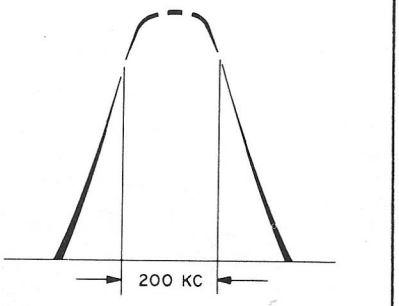


FIGURE 1.

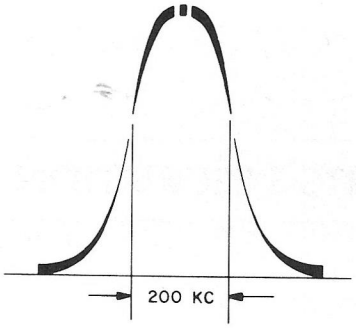


FIGURE 2.

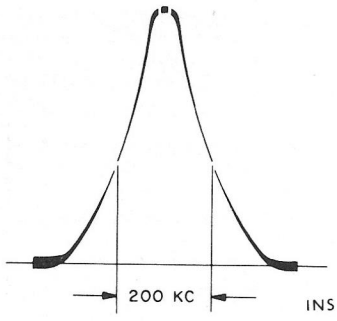


FIGURE 3.

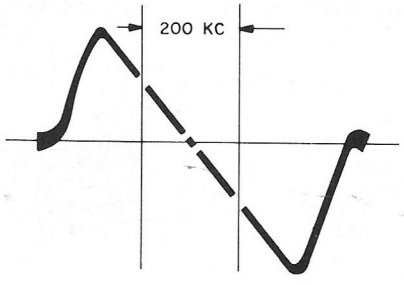
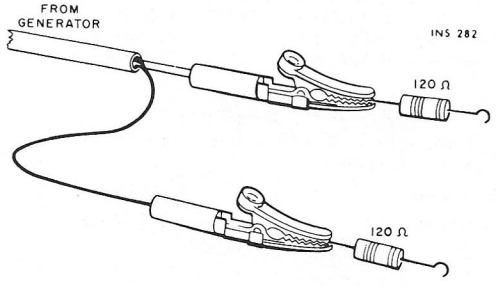
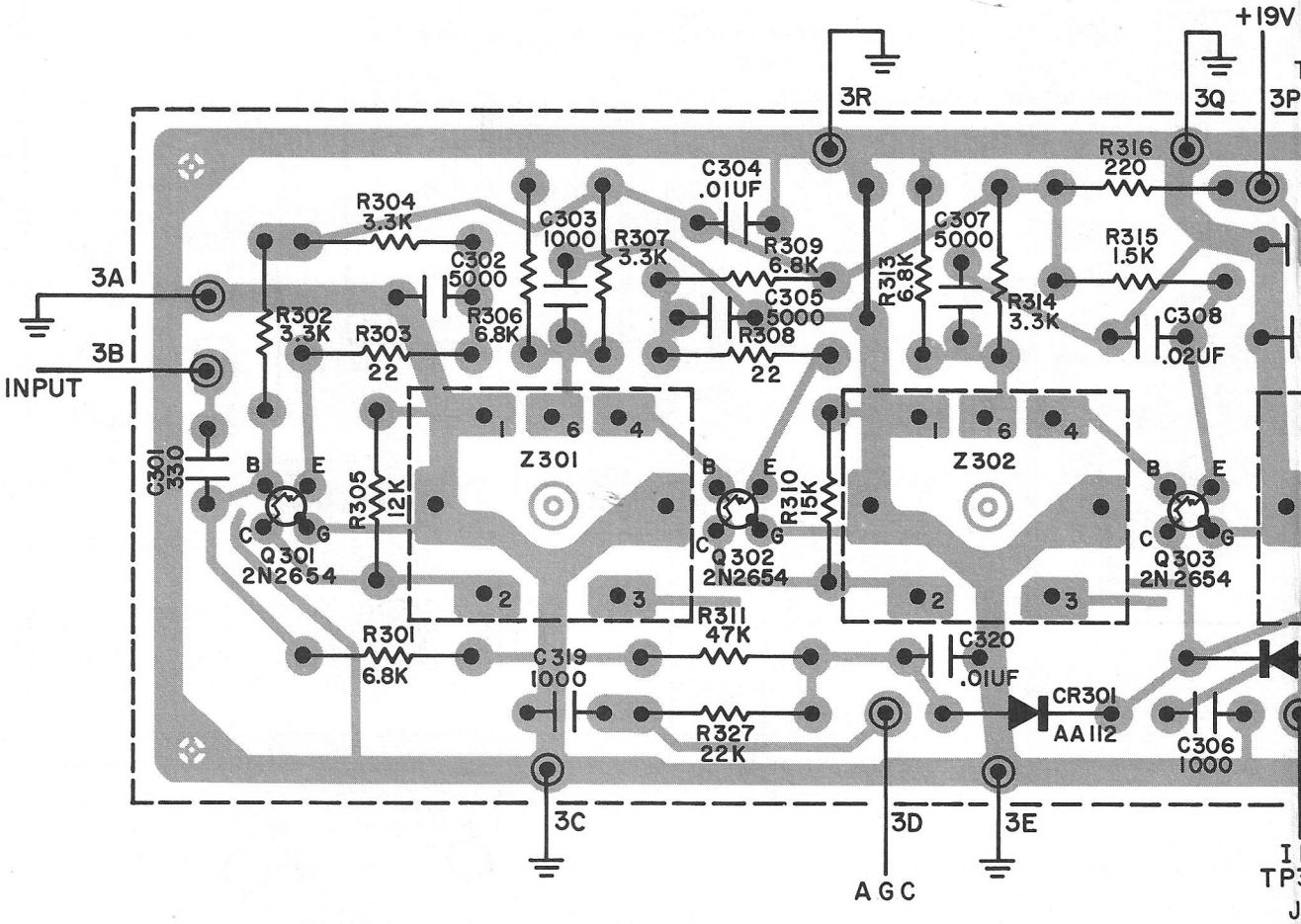


FIGURE 4.



Generator connections to antenna terminals

(1-2) FS-1381-SH



IF ALIGNMENT

● Connect 10.7-mc generator output lead to the collector of Q302. DO NOT use modulation (AM or FM).

● Connect DC VTVM across C318 (ratio-detector filter). Use 100K resistor in series with each lead—DO NOT ground VTVM.

● Adjust Z303 (bottom core) and Z304 (top and bottom cores) for maximum DC VTVM reading. Readjust generator output, during alignment, to keep DC VTVM reading between 4 and 5.5 volts.

● Connect DC VTVM and scope leads (through 100 K resistors) to TP301. Disconnect jumper between 3F and 3G on printed-circuit board.

● Connect sweep generator to point 3B of IF amplifier board. Adjust top and bottom cores of Z301 and Z302, and bottom core of Z303 for maximum gain and a symmetrical response curve (Figure 1) on scope. Adjust generator output during alignment to keep DC VTVM reading between −0.5 and −2.0 volts.

● Connect sweep generator output lead to TP751 (front end). Adjust top and bottom cores of Z751 for maximum gain and a symmetrical response curve on the scope. Generator output must be adjusted during alignment to keep DC VTVM reading between −0.5 and −1.5 volts. The IF response curve should now be like that in Figure 2.

● Disconnect lead to connection 3N on the IF board.

● Connect scope vertical input to point 3N on the printed-circuit board and adjust the top core of Z303 for maximum gain and a response curve like that in Figure 3.

● Reconnect jumper between connections 3F and 3G on the IF board. Reconnect lead to connection 3N on the IF board.

● Connect scope vertical input to the left or right REC OUT jack. Ratio-detector response curve should be like that in Figure 4.

FM

● Connect FM g
minals through
nected in seri

● Set FM generat
MHz (MC).

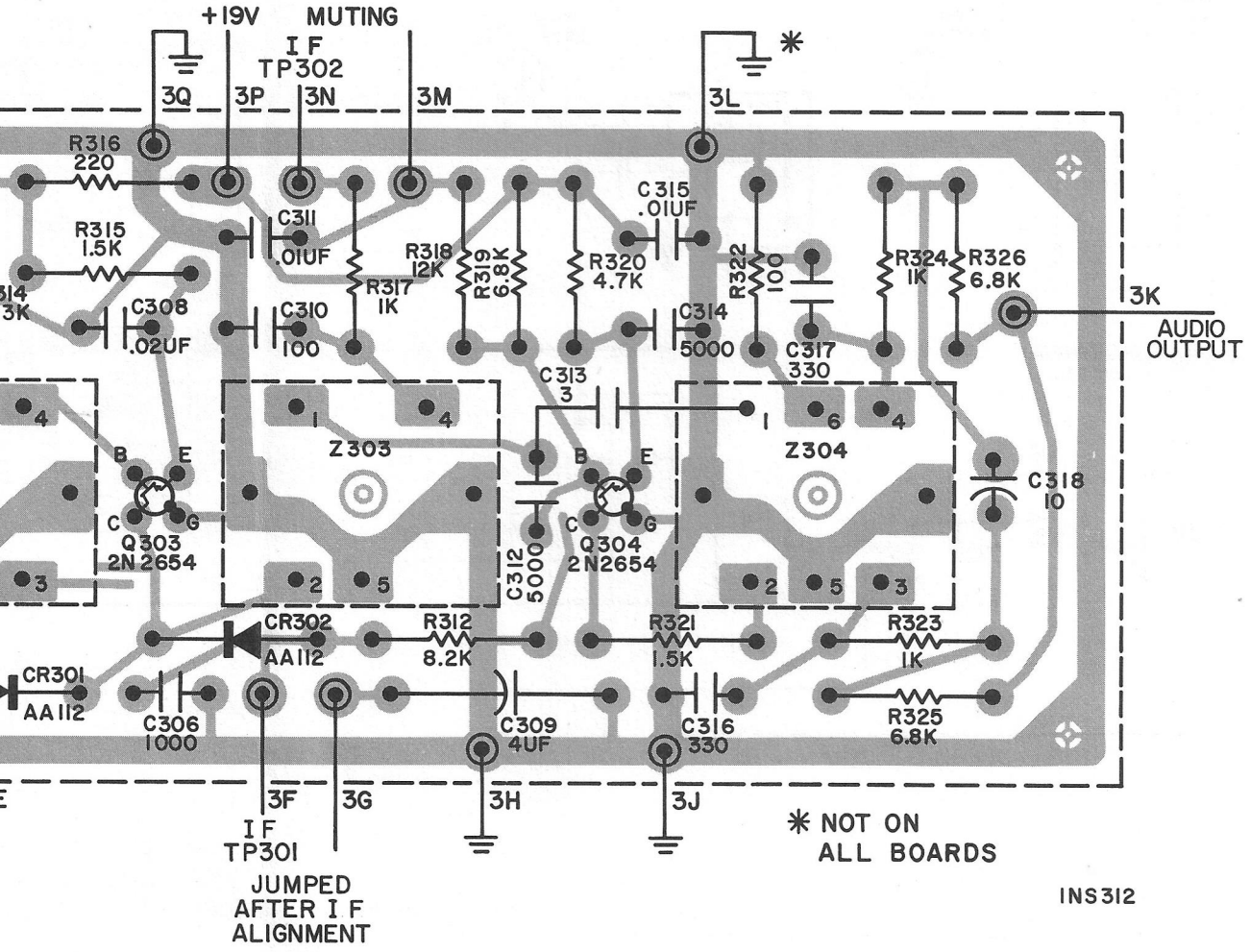
● Set FM generat
400 Hz (CPS).

● Adjust Meter A

FM M

● Connect FM g
minals through
nected in seri

31 IF AMPLIFIER

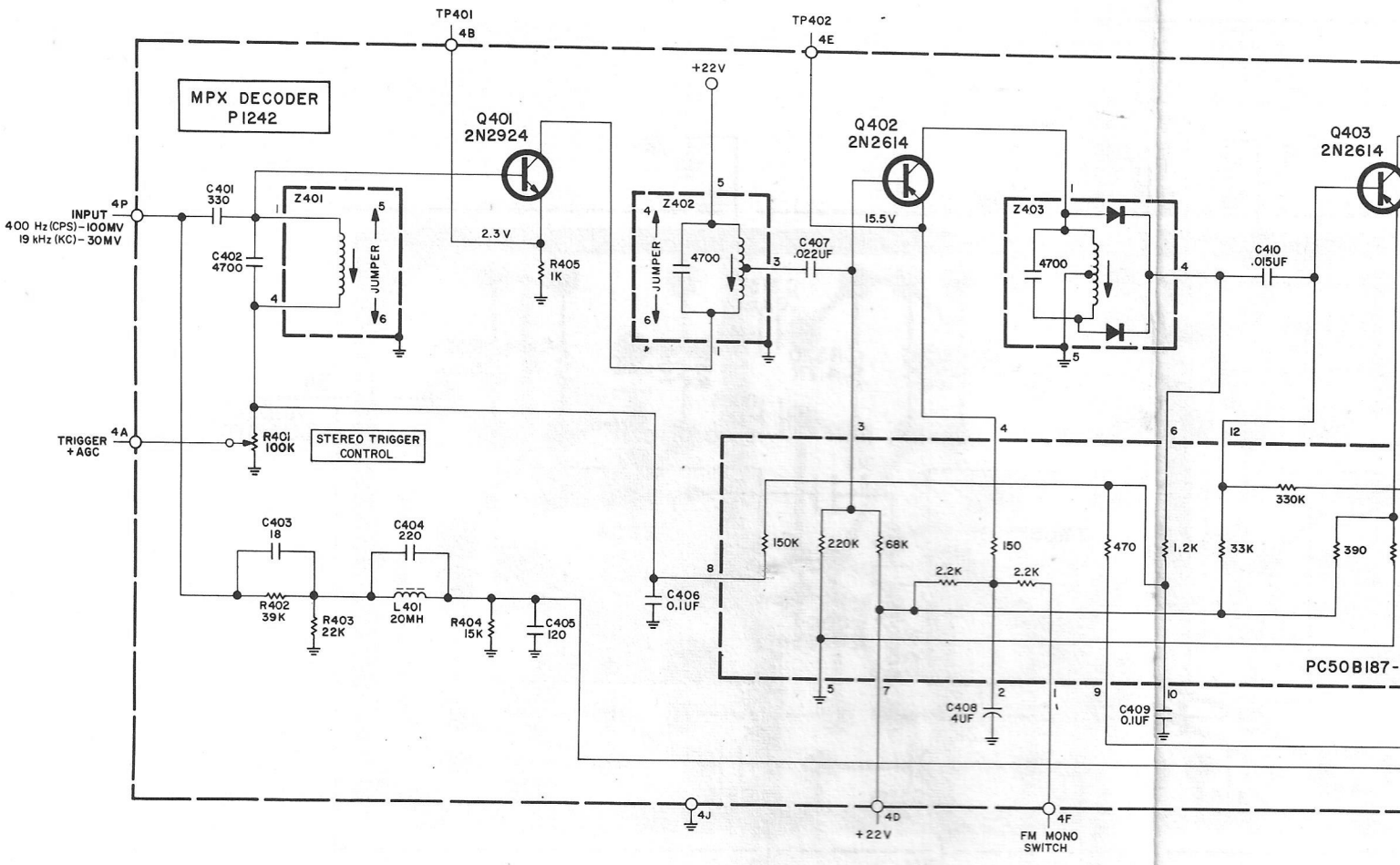


FM TUNING METER CALIBRATION

- Connect FM generator output leads to the LOCAL antenna terminals through two 120-ohm composition resistors—one connected in series with each lead.
- Set FM generator frequency and FM TUNING dial pointer to 90 MHz (MC).
- Set FM generator output to 100 mV, ±22.5 kHz (KC) deviation at 400 Hz (CPS).
- Adjust Meter Adjust pot. R32 for a meter reading of 4.

FM MUTING ADJUSTMENT

- Connect FM generator output leads to the LOCAL antenna terminals through two 120-ohm composition resistors—one connected in series with each lead.
- Set FM generator frequency and FM TUNING dial pointer to 90 MHz (MC).
- Set FM generator output to 16 uV, ±25 kHz (KC) deviation at 400 Hz (CPS).
- Connect AC (audio) VTVM to the left or right RCDR OUT PUT jack.
- Set MUTING to OFF position and make note of the AC VTVM reading.
- Set MUTING switch to ON position and adjust Muting Adjust pot. R33 for an AC VTVM reading 1 to 5 db lower than that previously noted.
- Reduce FM generator output to zero—no signal (400 Hz modulation) or noise should be present at the RCDR OUTPUT jacks.
- Increase FM generator output to 30 uV. Reading on AC VTVM should now be approximately the same as the reading obtained with MUTING in the OFF position.



PARTS DESCRIPTION LIST

CAPACITORS

Symbol	Description	Part No.
C401	Ceramic, 330pF, 10%, 1000V	C50B569-1
C402	Mica, Silver, 4700pF. 5%, 100V	C50B571-2
C403	Ceramic, 18pF, 5%, 1000V, P100	C50B568-15
C404	Polystyrene, 220pF, 5%, 33V	C50B636-3
C405	Polystyrene, 120pF, 5%, 33V	C50B636-8
C406	Mylar, .1uF, 10%, 250V	C50B638-7
C407	Mylar, .022uF, 10%, 250V	C50B638-3
C408	Electrolytic, 4uF, 35V	C50B637-1
C409	Mylar, .1uF, 10%, 250V	C50B638-7
C410	Mylar, .015uF, 10%, 250V	C50B638-2
C411	Electrolytic, 1uF, 70V	C50B637-2
C412, 413	Polystyrene, 1000pF, 5%, 33V	C50B636-9
C414, 415	Polystyrene, 1500pF, 5%, 33V	C50B636-24
*C416	Mylar, .1uF, 20%, 250V	C50B575
C417	Ceramic, 33pF, 10%, N750, 1000V	C50070-15

RESISTORS AND POTENTIOMETERS

In ohms, 5% tolerance, 1/8 watt unless otherwise noted. K = Kilohms, M = Megohms.

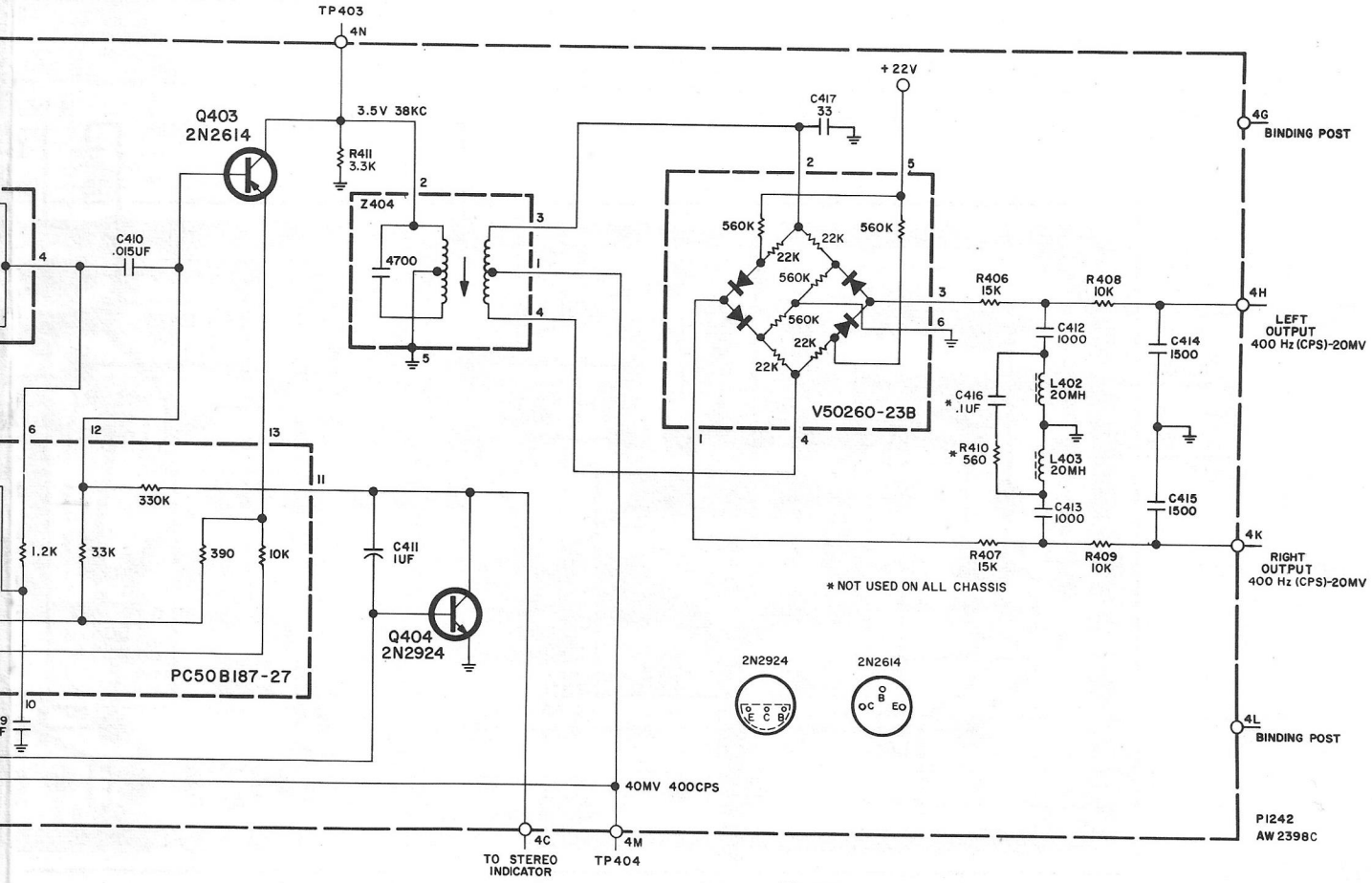
Symbol	Description	Part No.
R401	Potentiometer, Trigger Control 100K, 30%	R50150-65
R402	Dep. Carbon, 39K	R12DC393J
R403	Dep. Carbon, 22K	R12DC223J
R404	Dep. Carbon, 15K	R12DC153J
R405	Composition, 1K, 10%, ½W	RC20BF102K
R406, 407	Dep. Carbon, 15K	R12DC153J
R408, 409	Dep. Carbon, 10K	R12DC103J
*R410	Dep. Carbon, 560	R12DC561J
R411	Dep. Carbon, 3.3K	R12DC332J

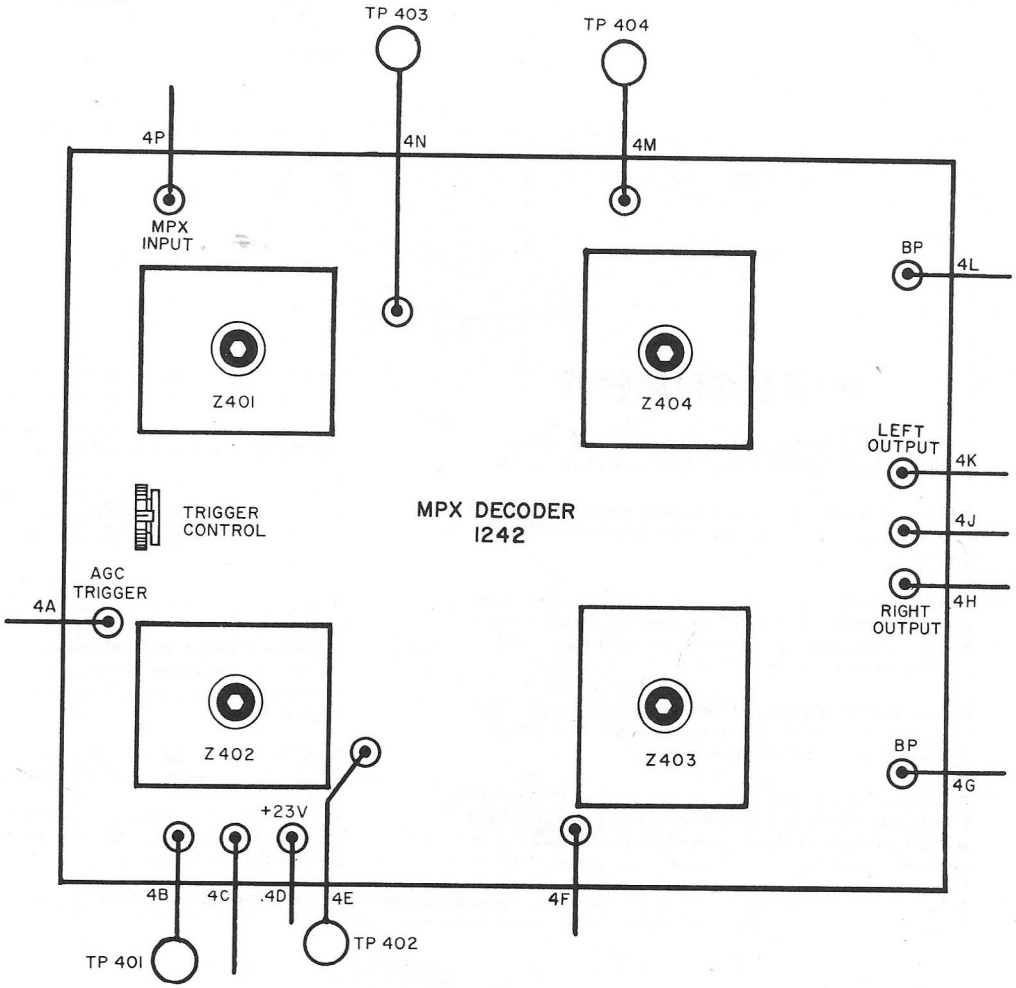
*Not used in all chassis

MISCELLANEOUS

Symbol	Description	Part No.
–	Printed Circuit Board	P1242
–	Printed Circuit	PC50B187-27
–	Socket, Transistor	X50B779-2
–	Ring Demodulator	V50260-23
L401, 402, 403	Choke, Coil, 20mh	L50334-6
Q401, 404	Transistor, 2N2924	TR2N2924-18
Q402, 403	Transistor, 2N2614	TR2N2614
Z401	Transformer, 19kc	ZZ50B210-80
Z402	Transformer, 19kc	ZZ50B210-76
Z403	Transformer, 19kc	ZZ50B210-74
Z404	Transformer, 38kc	ZZ50B210-75

MULTIPLEX DECODER





R12DC393J
R12DC223J
R12DC153J
RC20BF102K
R12DC153J
R12DC103J
R12DC561J
R12DC332J

Part No.
P1242
PC50B187-27
X50B779-2
V50260-23
L50334-6
TR2N2924-18
TR2N2614
ZZ50B210-80
ZZ50B210-76
ZZ50B210-74
ZZ50B210-75

(1-2) FS-1242-1-FB

MULTIPLEX DECODER TESTS

- Modulate FM generator with 19 kc, ±6.5 kc deviation. (Use external modulation if necessary.)
- Connect the FM generator output to the antenna terminals of the unit under test.
- With the FM generator set for an output of 25 uV at the antenna terminals the stereo indicator should light up. If the generator output is reduced to 5 uV, at the antenna terminals, the indicator light should remain ON.
- Reduce FM generator output to zero and the indicator light should go OFF.
- If the stereo indicator light does not respond properly to the tests above, readjust the trigger control (R401) until the stereo indicator lamp just turns ON with a 4 uV signal applied to the antenna terminals.

PREFERRED ALIGNMENT INSTRUCTIONS

(Using multiplex generator with RF and 19 kc outputs and with 1 kc modulation)

In Table 1, below, a multiplex generator with an RF output is used. This is the better method of alignment since the multiplex circuitry is connected to the tuner with which it will be used. Check the alignment of the IF stages before making multiplex adjustments. Poor IF alignment can make proper multiplex operation impossible.

TEST EQUIPMENT: Multiplex Generator, Audio (AC) Vacuum-Tube Voltmeter (RMS type preferred). Vacuum-Tube Voltohmeter (DC VTVM), Oscilloscope (100 kc minimum) with external sweep input.

WARNING: Use only the proper alignment tool to prevent core breakage.

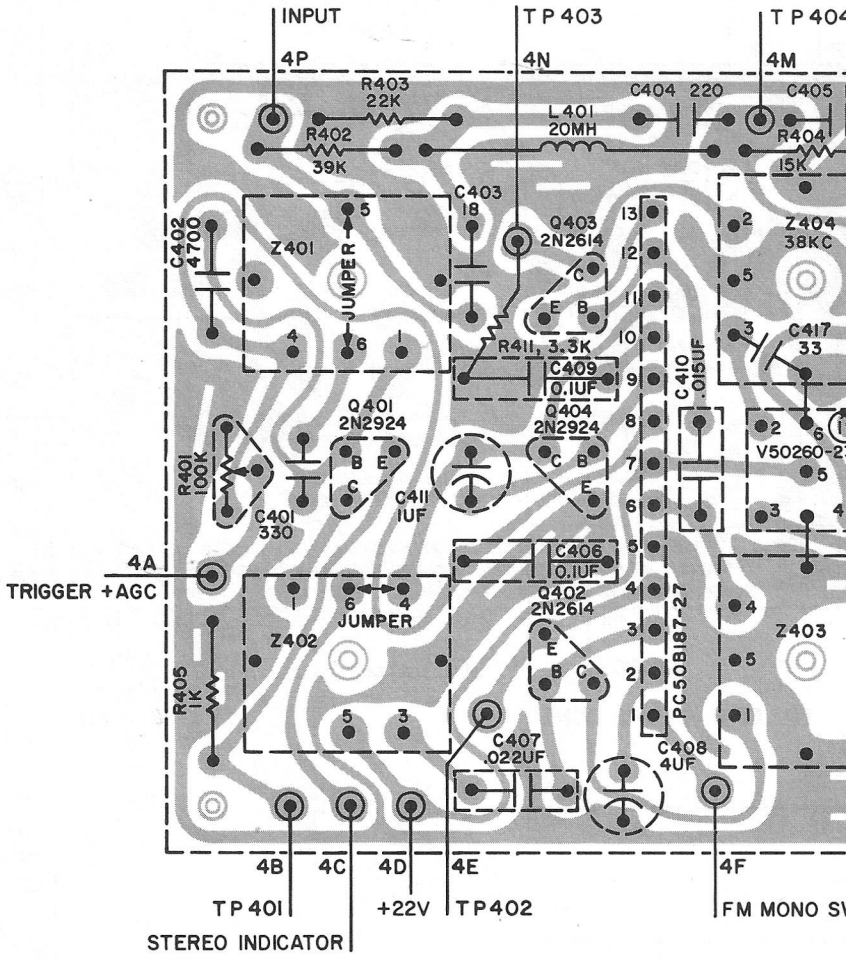
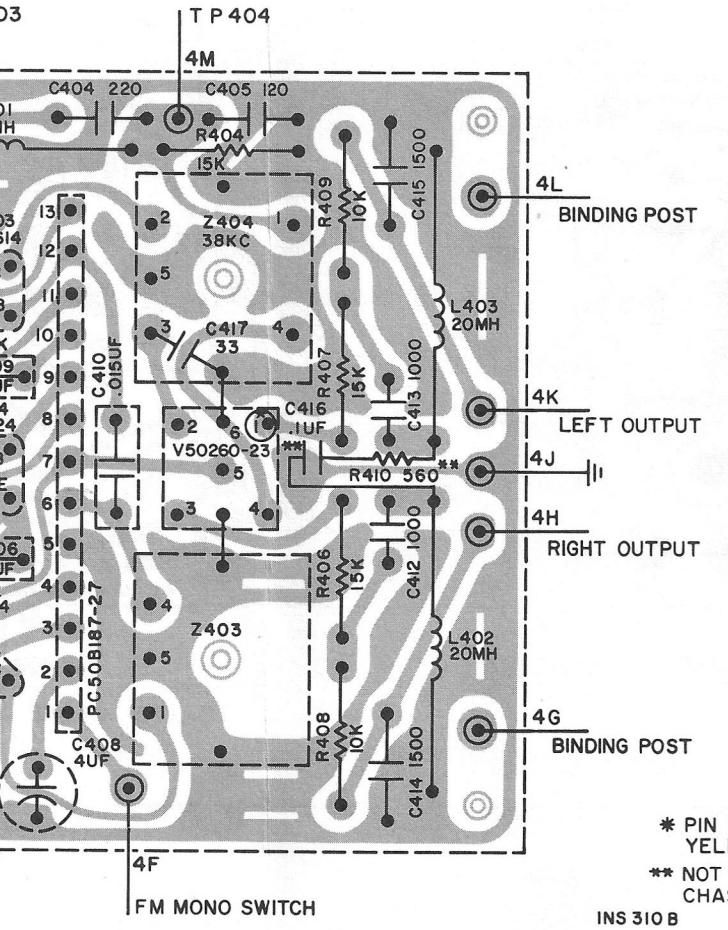


TABLE 1

MULTIPLEX-GENERATOR RF OUTPUT CONNECTED TO ANTENNA TERMINALS

STEP	GENERATOR MODULATION	RF DEV.	INDICATOR TYPE AND CONNECTION	ALIGNMENT	
				ADJUST	INDICATION
1	70 to 76 kc (connect external audio generator to SCA input of multiplex generator.)	±25kc	Audio (AC) VTVM input to TP404 with 10-pF capacitor in series with test lead.	--	Read minimum AC voltage between 70 and 76 kc..
2	19 kc pilot only	±6.5	AC VTVM to TP403	Z401, 402, 403 and 404	Maximum AC voltage (38 kc)
3	Composite MPX signal 1 kc on left channel only	±75kc	Audio (AC) VTVM and oscilloscope vertical input to left channel output lug (4H)	Z402	Maximum AC voltage with clean 1 kc sine wave on oscilloscope
4	Composite MPX signal 1 kc on right channel only	±75kc	Same as Step 3	MPX Separation Control (located on chassis).	Minimum reading on Audio (AC) VTVM--should be at least 35db below reading obtained in Step 3.
5	Same as Step 4	±75kc	Audio (AC) VTVM and oscilloscope vertical input to right channel output lug (4K)	--	Same Audio (AC) VTVM reading as obtained in Step 3 (±2db); clean 1kc sine wave on scope.
6	Same as Step 4	±75kc	Same as Step 5		Minimum reading on Audio (AC) VTVM should be at least 35db below reading in Step 5.

MULTIPLEX DECODER



* PIN NO.1 MARKED BY YELLOW DOT.

** NOT USED IN ALL CHASSIS

INS 310 B

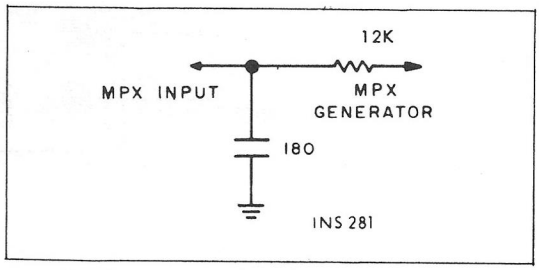


FIGURE 1. Multiplex-alignment pass filter circuit.

ALTERNATE ALIGNMENT INSTRUCTIONS

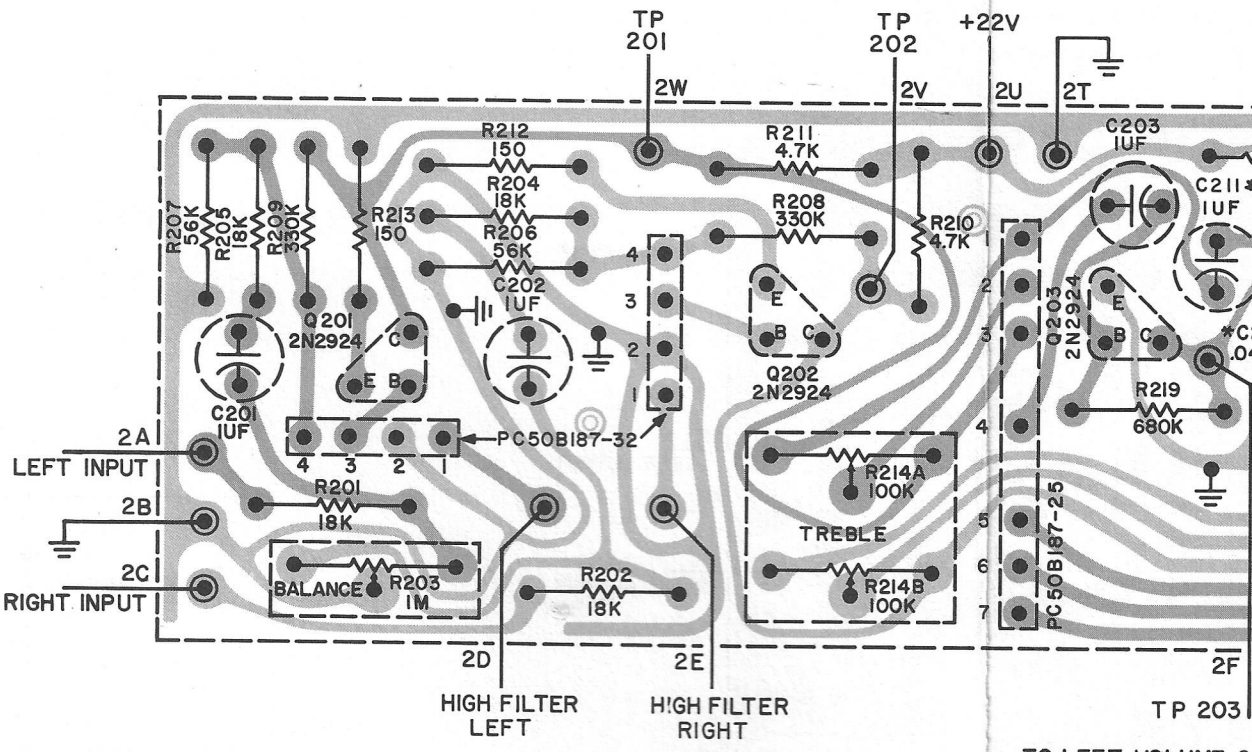
(For multiplex generators without an RF output)

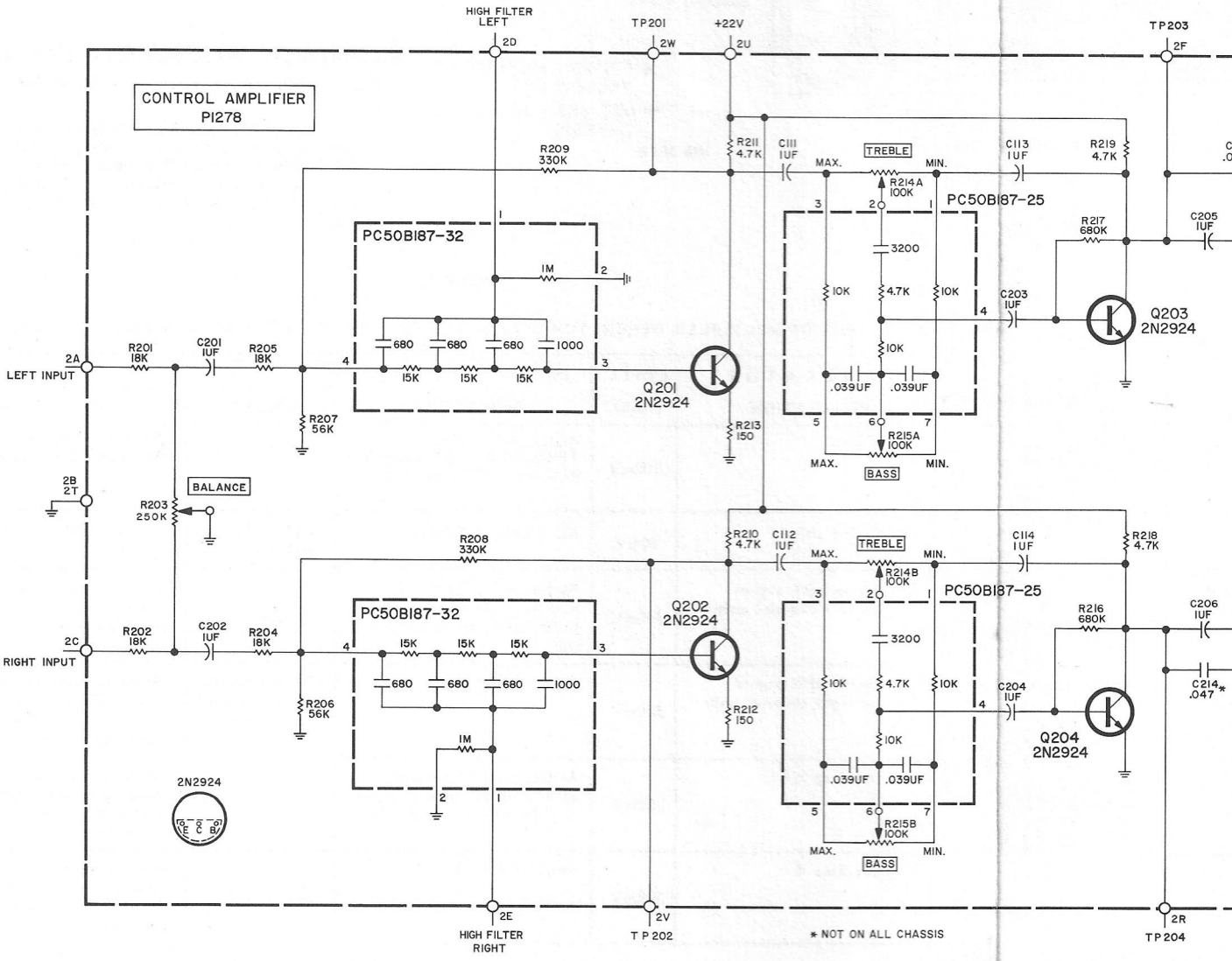
Disconnect the ratio detector from the multiplex unit before using this procedure. A low-pass filter (Figure 1) is used between the MPX generator output and the input to the multiplex circuitry. It has about the same loading effect as the output of the ratio detector in the tuner.

TABLE 2

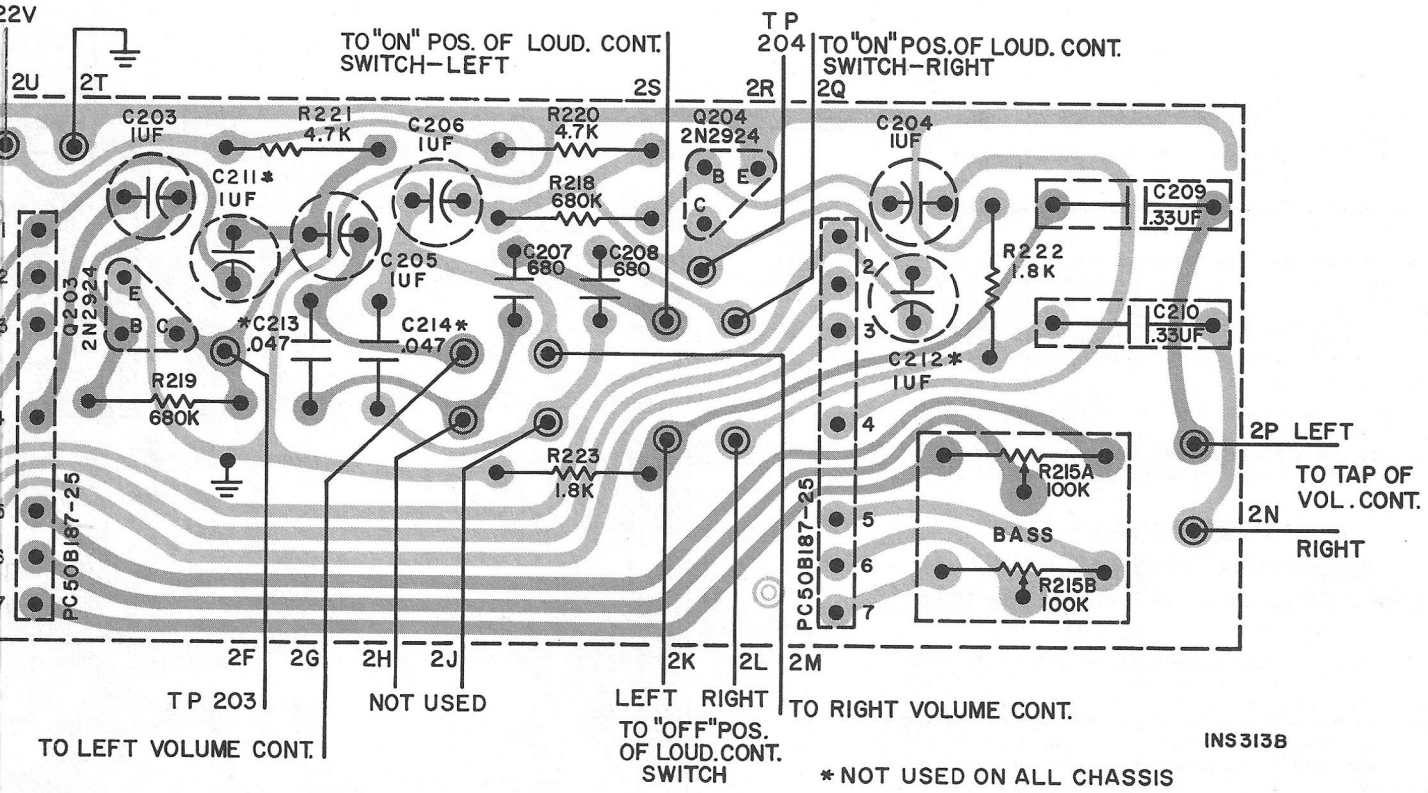
COMPOSITE OUTPUT OF MULTIPLEX GENERATOR CONNECTED TO INPUT OF MPX DECODER THROUGH LOW-PASS FILTER

STEP	GENERATOR MODULATION	LEVEL (RMS)	INDICATOR TYPE AND CONNECTION	ALIGNMENT	
				ADJUST	INDICATION
1	70 to 76 kc.	100mV	Audio (AC) VTVM input to TP404 with 10-pF capacitor in series with test lead.	—	Read minimum AC voltage between 70 and 76 kc.
2	19 kc pilot only	50mV	AC VTVM to TP403	Z401, 402, 403 and 404	Maximum AC voltage (38 kc)
3	Composite MPX signal 1 kc on left channel only	300mV	Audio (AC) VTVM and oscilloscope vertical input to left channel output lug (4H)	Z402	Maximum AC voltage with clean 1 kc sine wave on oscilloscope
4	Composite MPX signal 1 kc on right channel only	300mV	Same as Step 3	MPX Separation Control (located on chassis).	Minimum reading on Audio (AC) VTVM--should be at least 35db below reading obtained in Step 3.
5	Same as Step 4	300mV	Audio (AC) VTVM and oscilloscope vertical input to right channel output lug	—	Same Audio (AC) VTVM reading as obtained in Step 3 (±2Jb); clean 1kc sine wave on scope.
6	Same as Step 4	300mV	Same as Step 5	—	Minimum reading on Audio (AC) VTVM should be at least 35db below reading obtained in Step 5.





3 CONTROL AMPLIFIER

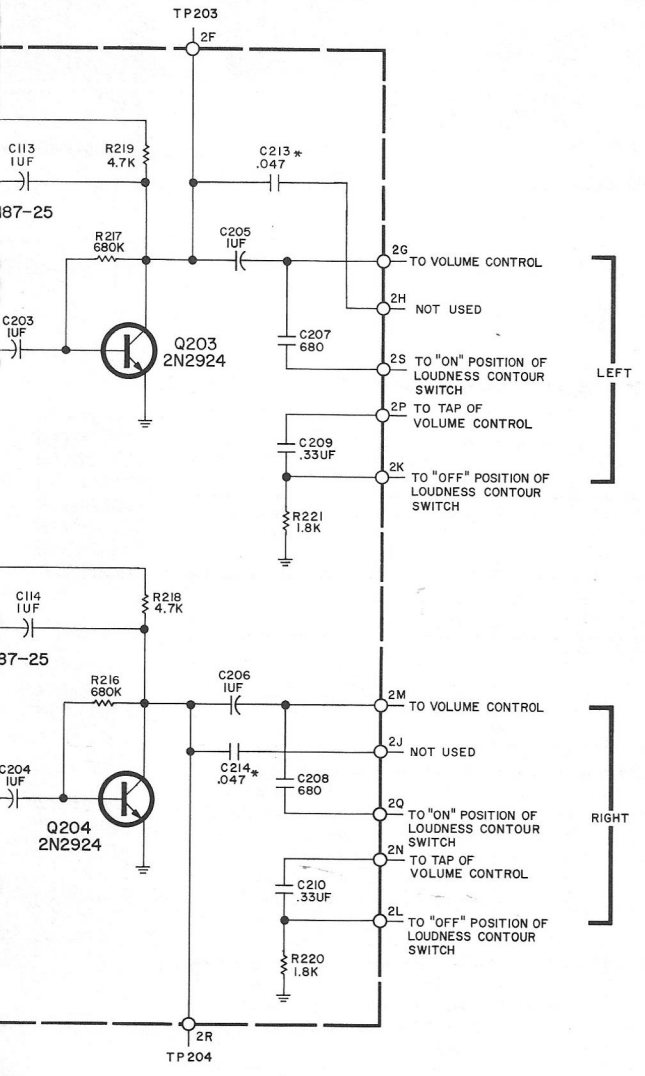


INS3138B

* NOT USED ON ALL CHASSIS

LEFT CHANNEL

RIGHT CHANNEL AND GROUND



P1278
AW2400B

PARTS DESCRIPTION LIST

CAPACITORS

Symbol	Description	Part No.
C201, 202, 203, 204, 205, 206	Electrolytic, 1uF, 70V	C50B637-2
C207, 208	Ceramic, 680pF, 10%, 1000V	C50B569-2
C209, 210	Mylar, .33uF, 10%, 250V	C50B638-10

* C211, 212, 213, 214 Tantalum Electrolytics, 1uF, 25V, C50B640-1, connected to lugs on tone controls

RESISTORS AND POTENTIOMETERS

In ohms, 5% tolerance, 1/8 watt unless otherwise noted. K=Kilohms, M=Megohms.

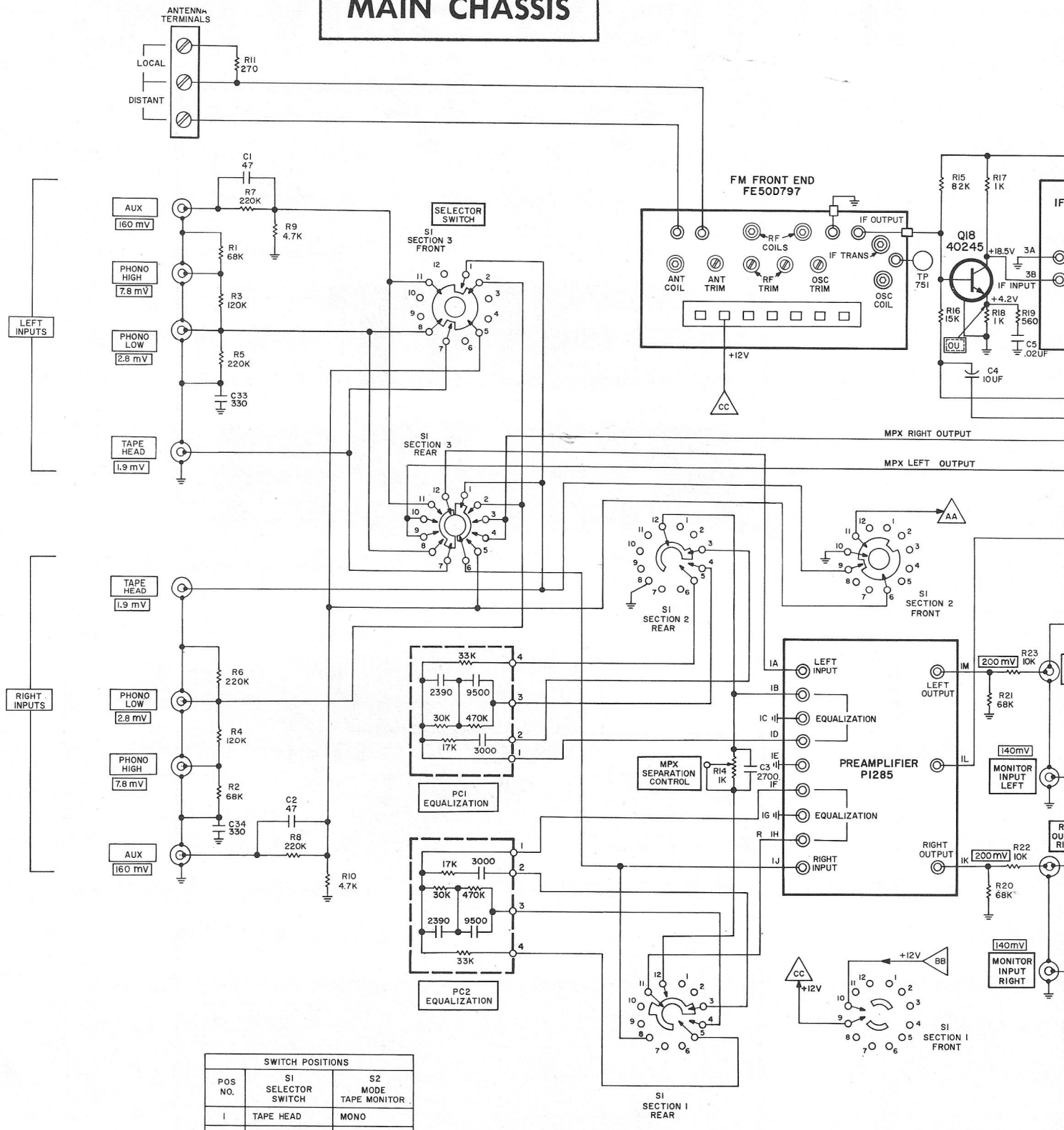
Symbol	Description	Part No.
R201, 202	Dep. Carbon 18K	R12DC183J
R203	Pot., 1M, Balance	R50160-182
R204, 205	Dep. Carbon, 18K	R12DC183J
R206, 207	Dep. Carbon, 56K	R12DC563J
R208, 209	Dep. Carbon, 330K	R12DC334J
R210, 211	Composition, 4.7K, 10%, 1/2W	RC20BF472K
R212, 213	Dep. Carbon 150	R12DC151J
R214, 215	Pot. 100K, Treble, Bass	R50160-183
R216, 217	Dep. Carbon, 680K	R12DC684J
R218, 219	Composition, 4.7K, 10%, 1/2W	RC20BF472K
R220, 221	Composition, 1.8K, 10%, 1/2W	RC20BF182K

MISCELLANEOUS

Symbol	Description	Part No.
- - -	Printed Circuit Board	P1278
- - -	Printed Circuit, Tone-Control	PC50B187-25
- - -	Printed Circuit, High-Filter	PC50B187-32
- - -	Socket, Transistor	X50B779-2
Q201, 202, 203, 204	Transistor, 2N2924	TR2N2924-18

(1-1) FS-1278-1S

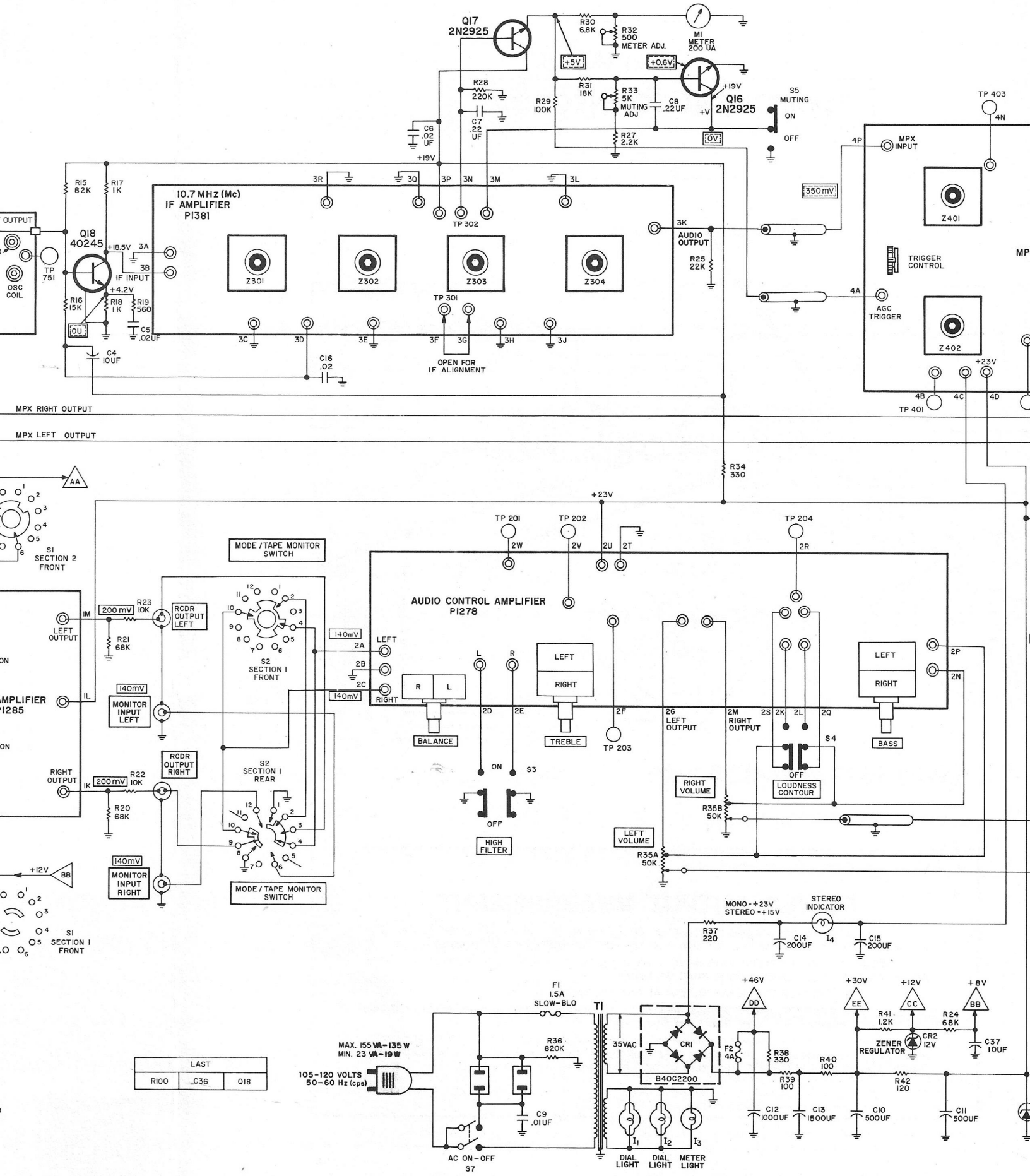
MAIN CHASSIS



SWITCH POSITIONS		
POS NO.	S1 SELECTOR SWITCH	S2 MODE TAPE MONITOR
1	TAPE HEAD	MONO
2	PHONO MAG.	STEREO
3	FM – AUTO	STEREO TAPE
4	FM – MONO	MONO TAPE
5	AUX	

NOTES:
1. FOR ALL VOLTAGE AND CURRENT MEASUREMENTS LINE VOLTAGE = 117 VAC.
2. DC VOLTAGE MEASURED WITH DC-VTVM TO CHASSIS, UNLESS OTHERWISE INDICATED, WITH NO SIGNAL INPUT.
3. USE AC VTVM FOR 1kHz SIGNAL TRACING: VOLUME CONTROL MAXIMUM CLOCKWISE, FILTERS OFF, ALL OTHER CONTROLS NORMAL.
4. ▭ INDICATES 1kHz SIGNAL LEVELS FROM PHONO INPUT = 4.2 mV TO PA OUTPUT = 11.6V ACROSS 4Ω LOAD (1 kHz = 1kc)
5. ▭ INDICATES SIGNAL LEVELS WITH SELECTOR SWITCH SET TO FM MONO AND 100mV ±75 kHz DEVIATION AT 1kHz.

(2-4)FS-1340-HS



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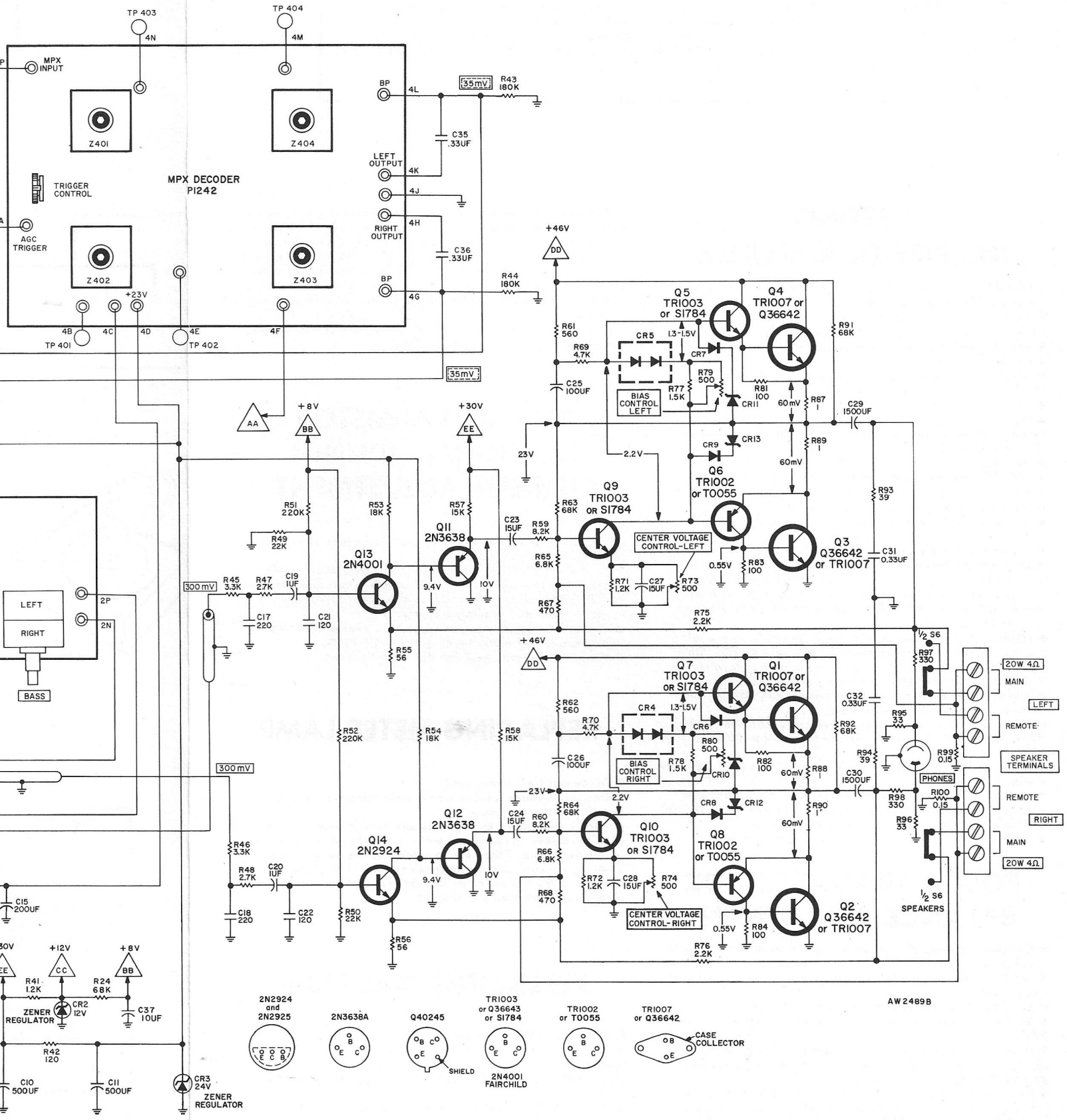


WARNING

DO NOT use uninsulated clips on any connection except to the chassis. Always use miniature, insulated clips when connecting to component leads, socket lugs and terminal strips – it takes only a fraction of a second to destroy a transistor with an accidental short curcuit. Make sure metal-cased instruments are not touching the chassis directly or through other instruments and common-ground leads.

TESTING THE POWER AMPLIFIER

WARNING: Disconnect chassis from power line while removing or inserting transistors.

- Remove transistors Q1 to Q14 from their sockets. Label each transistor with its location in the unit.
- Set VOLUME control to minimum position (extreme counterclockwise).
- Set line voltage (through an adjustable transformer) to 117 VAC.
- Connect common lead of DC VTVM to the chassis.
- Measure voltage across filter capacitor C12 or at the B+ terminal of the bridge rectifier; reading should be between 43.5 and 50 VDC.
- Measure voltage at junction of resistor R41 and zener diode CR2; reading should be between 12.3 to 17.7 VDC.
- Measure voltage at junction of resistor R42 and zener diode CR3; reading should be between 22.8 to 25.2 VDC.
- Insert left channel predriver transistors Q11, Q13 (Q12, Q14–right channel) in their sockets.
- Measure voltage at emitter of Q13 (Q14–right channel); reading should be between 6 to 10 VDC.
- Insert left channel voltage driver Q9 (Q10–right channel) and measure voltage at the collector. Adjust left channel center voltage pot. R73 (R74–right channel) for collector voltage of 23.5 VDC.
- Measure voltage from base to base terminals of the left channel power driver transistors Q5, Q6 sockets (Q7, Q8–right channel). Adjust left channel output stage bias pot. R79 (R80–right channel) for reading of 2.4 VDC.
- Insert left channel power driver transistors Q5, Q6 (Q7, Q8–right channel) in their sockets.
- Measure voltage at junction of resistors R87, R89 (R88, R90–right channel); reading should be between 20 to 26 VDC.
- Insert left channel power transistors Q3, Q4 (Q1, Q2–right channel).
- Measure voltage at junction of resistors R87, R89 (R88, R90–right channel); reading should be between 20 to 26 VDC.
- Repeat the above steps for the right channel.
- Perform Power Transistor DC Balance Adjustment.

POWER TRANSISTOR DC BALANCE ADJUSTMENT

- Connect a 4-ohm, 50-watt load resistor to the left channel speaker terminals LEFT MAIN (right channel–RIGHT MAIN).
- Set VOLUME control to minimum position (extreme counterclockwise).
- Set BALANCE control to the center of its rotation.
- Set line voltage through an adjustable transformer to 117 VAC.
- Measure voltage across filter capacitor C12 or at the B+ terminal of the bridge rectifier; reading should be between 43.5 to 50 VDC.
- Measure voltage at junction of resistors R87, R89 (R88, R90– right channel). Adjust left channel center voltage pot. R73 (R74–right channel) for one-half (±3%) of the voltage noted in the previous step.
- Repeat the above steps for the right channel.

NOTE: Precise meter reading and the half-voltage calculation can be eliminated by connecting two 1.5K, 1% resistors across the +46 VDC supply (see connections above) and connecting the common lead of the DC VTVM to the junction of the two resistors. Set the DC VTVM meter pointer to the zero-center position with the zero adjust control. (If such a scale is not provided, align the meter pointer with any scale calibration point and use this as a zero mark even if it is not the center of the scale.) Then adjust the center voltage pot. for a zero reading on the VTVM.

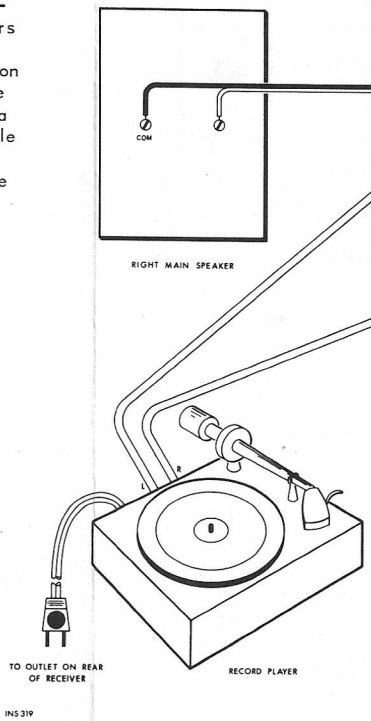
POWER TRANSISTOR NO-SIGNAL (IDLING) CURRENT ADJUSTMENT

NOTE: This adjustment is to be performed only after completing DC Balance Adjustment.

- Connect DC VTVM, set for 60-mV reading, across left channel resistor R87 or R89 (R88 or R90–right channel).

NOTE: VTVM must have a .25-volt or lower full-scale range to make this reading properly.

- Adjust left channel output stage bias control R79 (R80–right channel) for meter reading of 60 mV ±20%.
- Repeat the above steps for the right channel.



REPLACING METER LAMP

- Disconnect AC power cord.
- Remove the nine screws which hold top cover to chassis and lift off the top cover.
- Gently push down on the lamp and turn it counterclockwise to remove. Remove the metal lamp shield and place it on the new lamp. Place the new lamp in the socket, push down gently and turn it clockwise to lock it in place.
- Replace the top cover on the chassis and secure with the nine screws removed previously.

REPLACING DIAL LAMP

- Disconnect AC power cord.
- Gently pull all knobs off the front panel control shafts.

Remove the hex nuts from the VOLUME, MODE/TAPE MONITOR and TUNING control shafts and lift off the front panel.

- Snap out the defective lamp from the spring clip. Place the new lamp in the socket and gently push down until it snaps into place.
- Replace the front panel and the control knobs.

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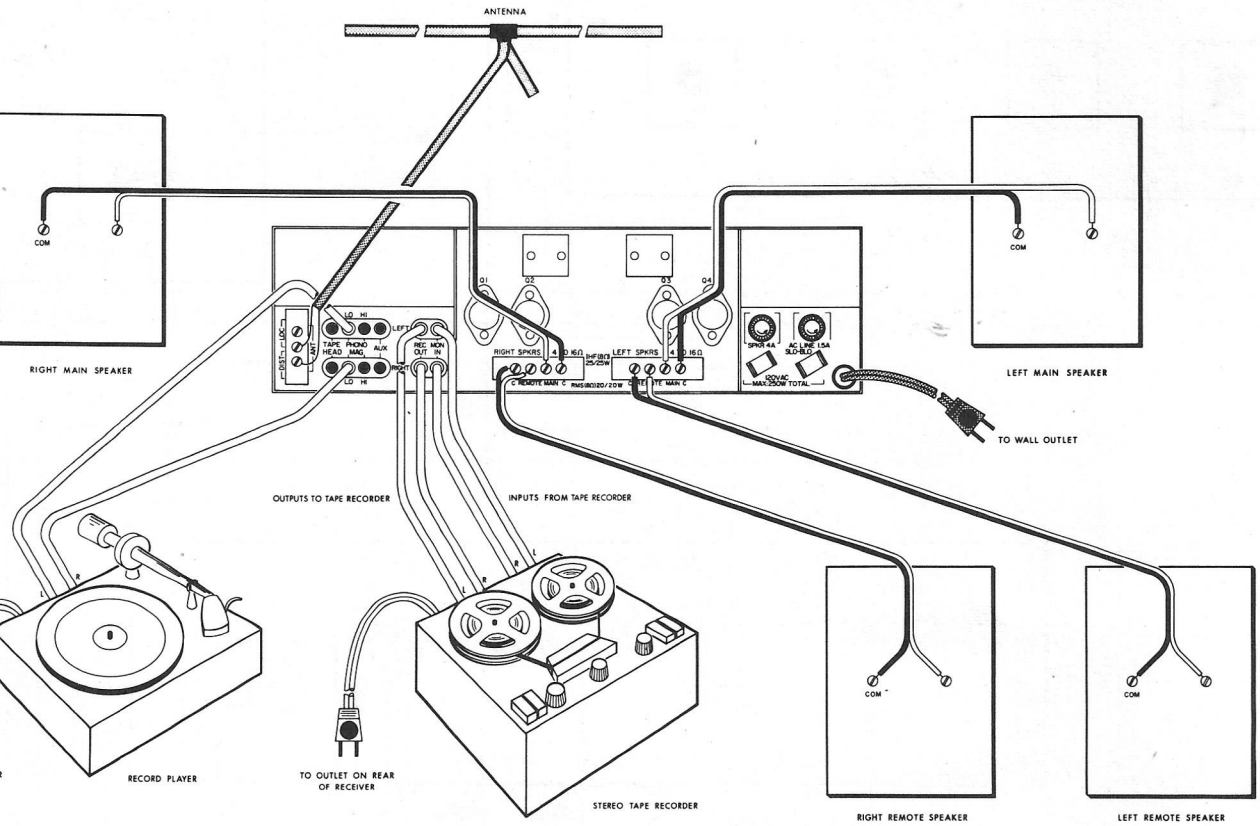
COMPONENT CONNECTIONS



POWER OUTPUT MEASUREMENT

The power-output stage of this unit is designed to deliver its full-rated power with program material (voice or music) into 4-to-16-ohm loads for indefinite periods.

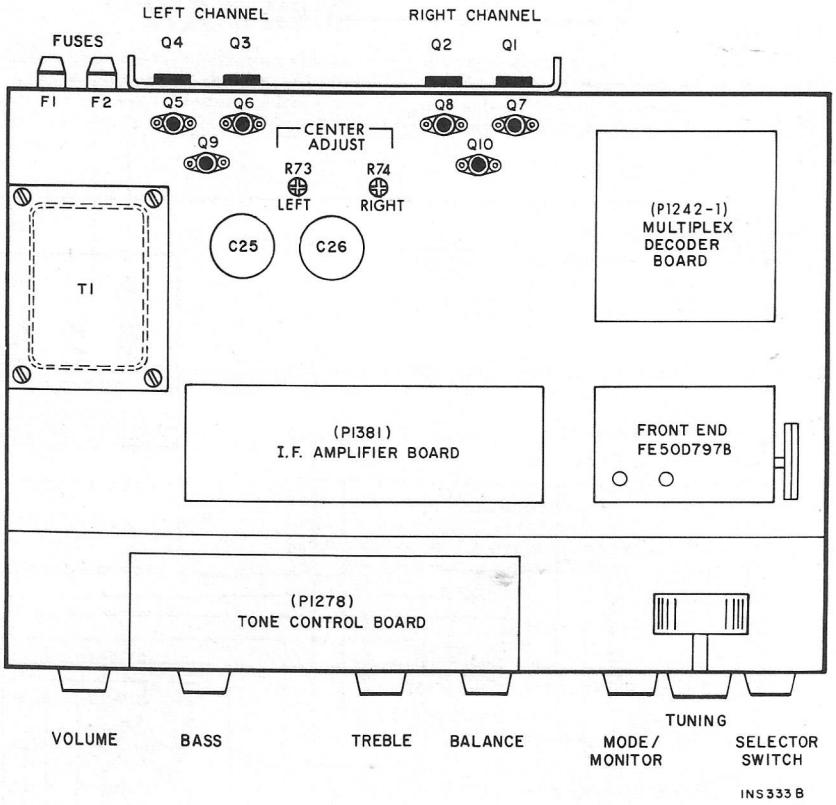
When a constant audio tone is used as a signal to measure the *continuous RMS power output* certain precautions must be taken.

- Measure the power output of one channel at a time.
- Limit the measurement period to 10 minutes (with a load resistance between 4 and 16 ohms).

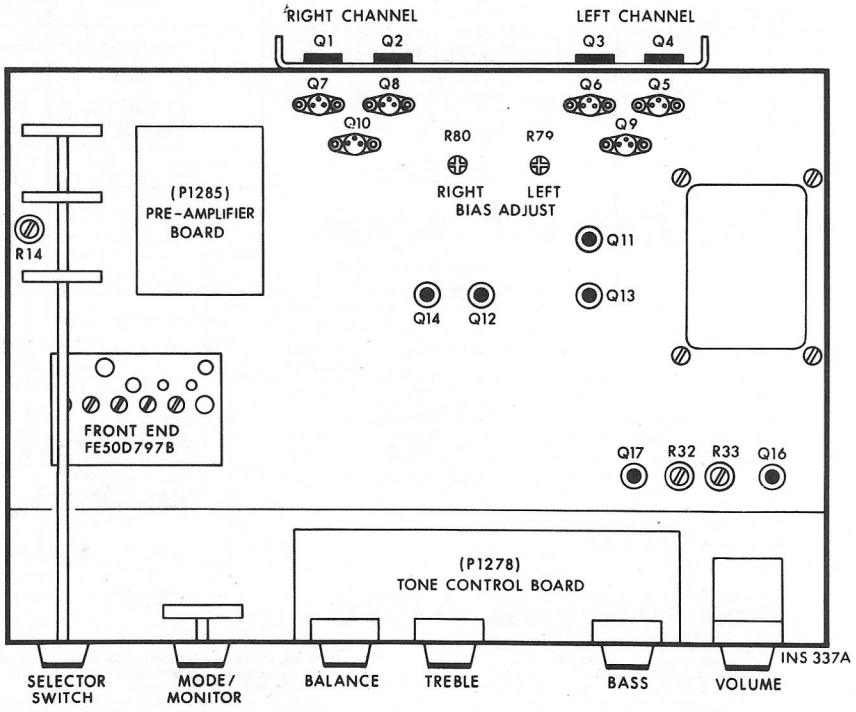
Should it ever be necessary to measure the power output of *both channels simultaneously*, use a load of 4 or 8 ohms (per channel), limit measurement to a period *not longer than 1 minute* for a *4-ohm* load or to *5 minutes* for an *8-ohm* load.

CHASSIS LAYOUT

TOP



BOTTOM



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