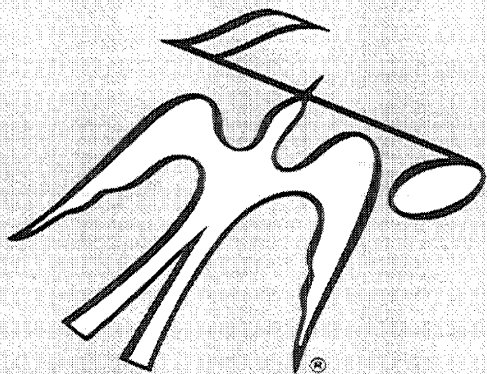
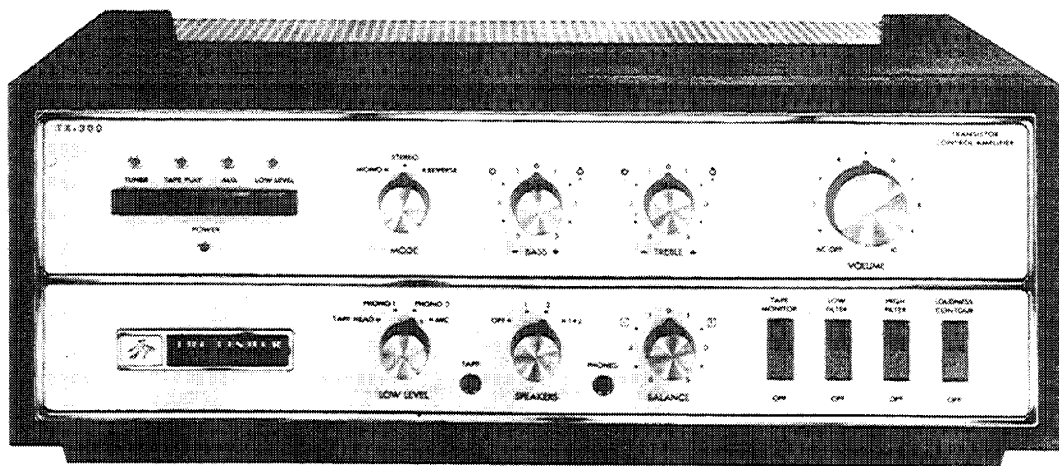


# Service Manual

# THE FISHER®



# TX-300

CHASSIS SERIAL NUMBERS  
BEGINNING 10000

\$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 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 tiptets 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.)

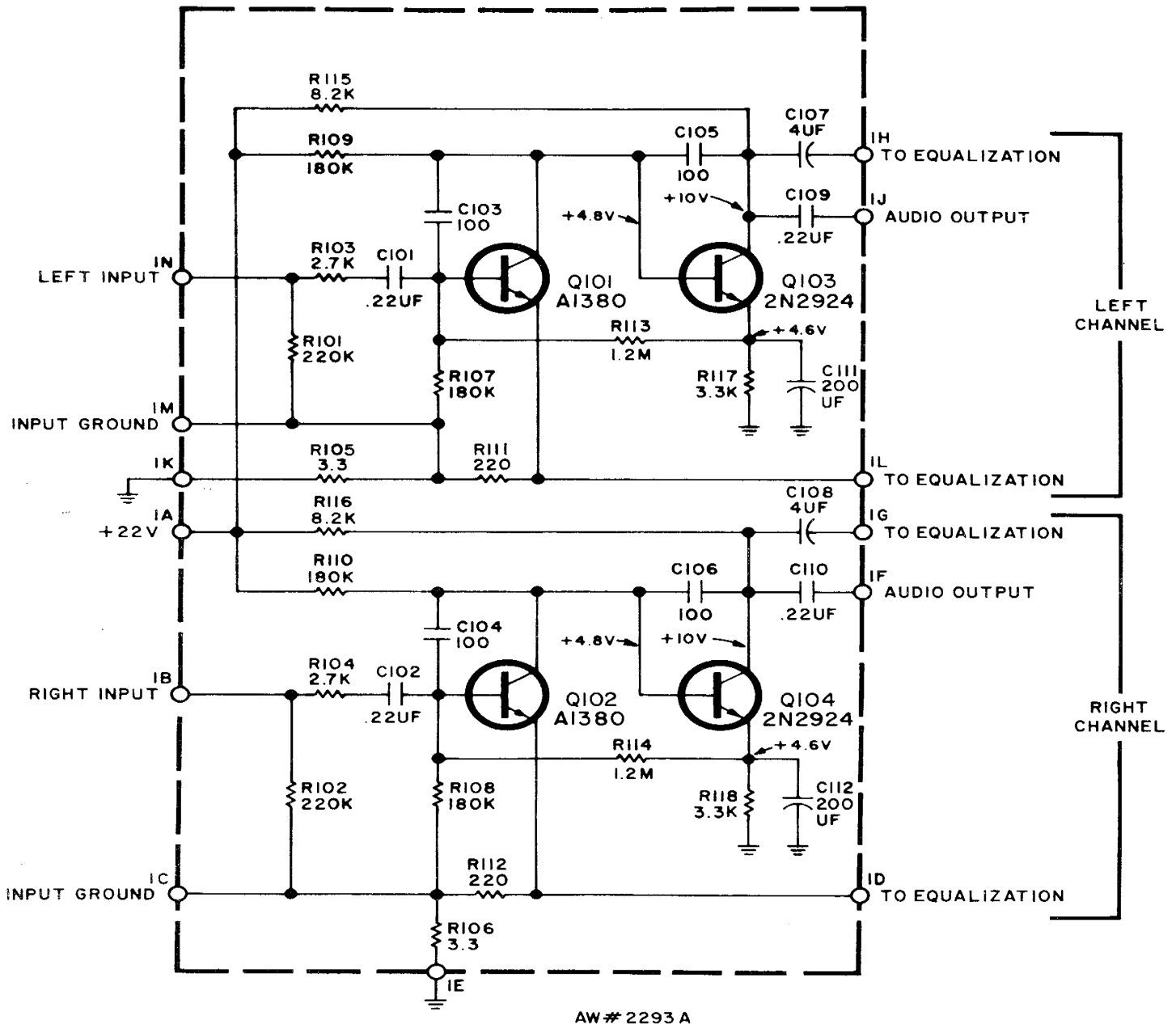
- Use care when making connections to speakers and output terminals. Any frayed wire ends can cause shorts that may burn out the output transistors—they are direct-coupled to the speakers. There is no output transformer—nothing to limit current through the transistors except the fuses. To reduce the 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.

# P1240 PREAMPLIFIER

## SCHEMATIC DIAGRAM

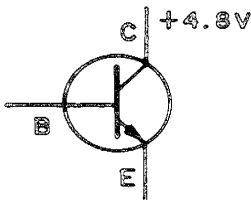


If replacement parts are out of stock, locally, they may be obtained directly from the Parts Department of FISHER Radio Corporation. They will be shipped "best way", either prepaid or C.O.D. unless otherwise specified.

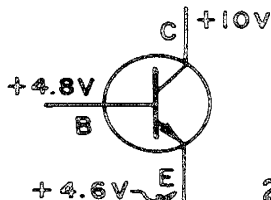
For instrument-operation information and technical assistance write Richard Hamilton, Customer Service Department, FISHER Radio Corporation, Long Island City, New York 11101.

# P 1240 PRINTED-CIRCUIT LAYOUT

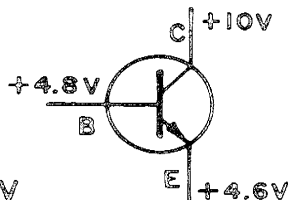
**Q101**  
A1380



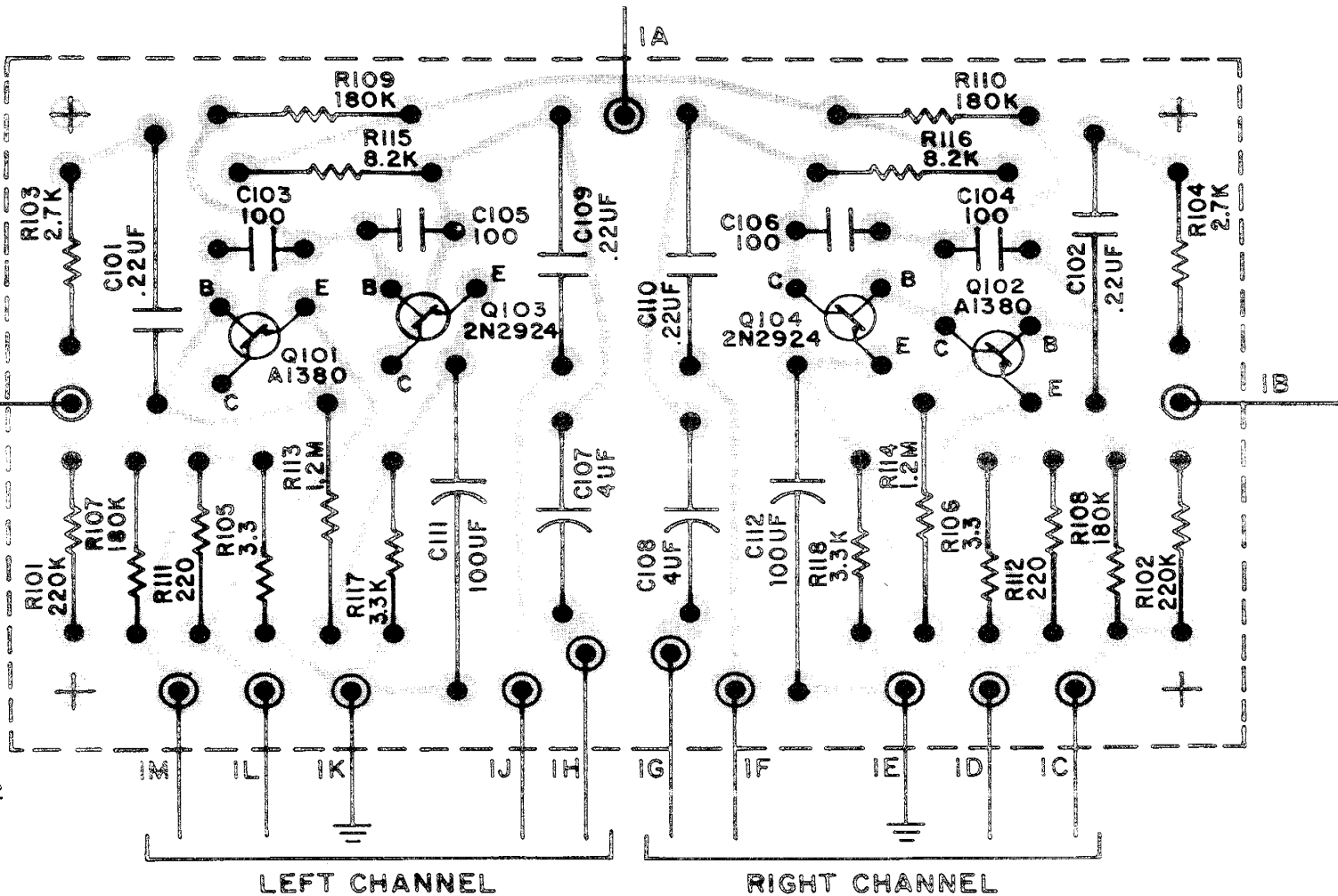
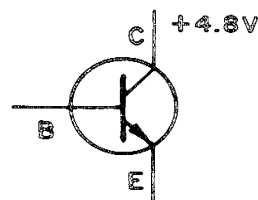
**Q103**  
2N2924



**Q104**  
2N2924



**Q102**  
A1380

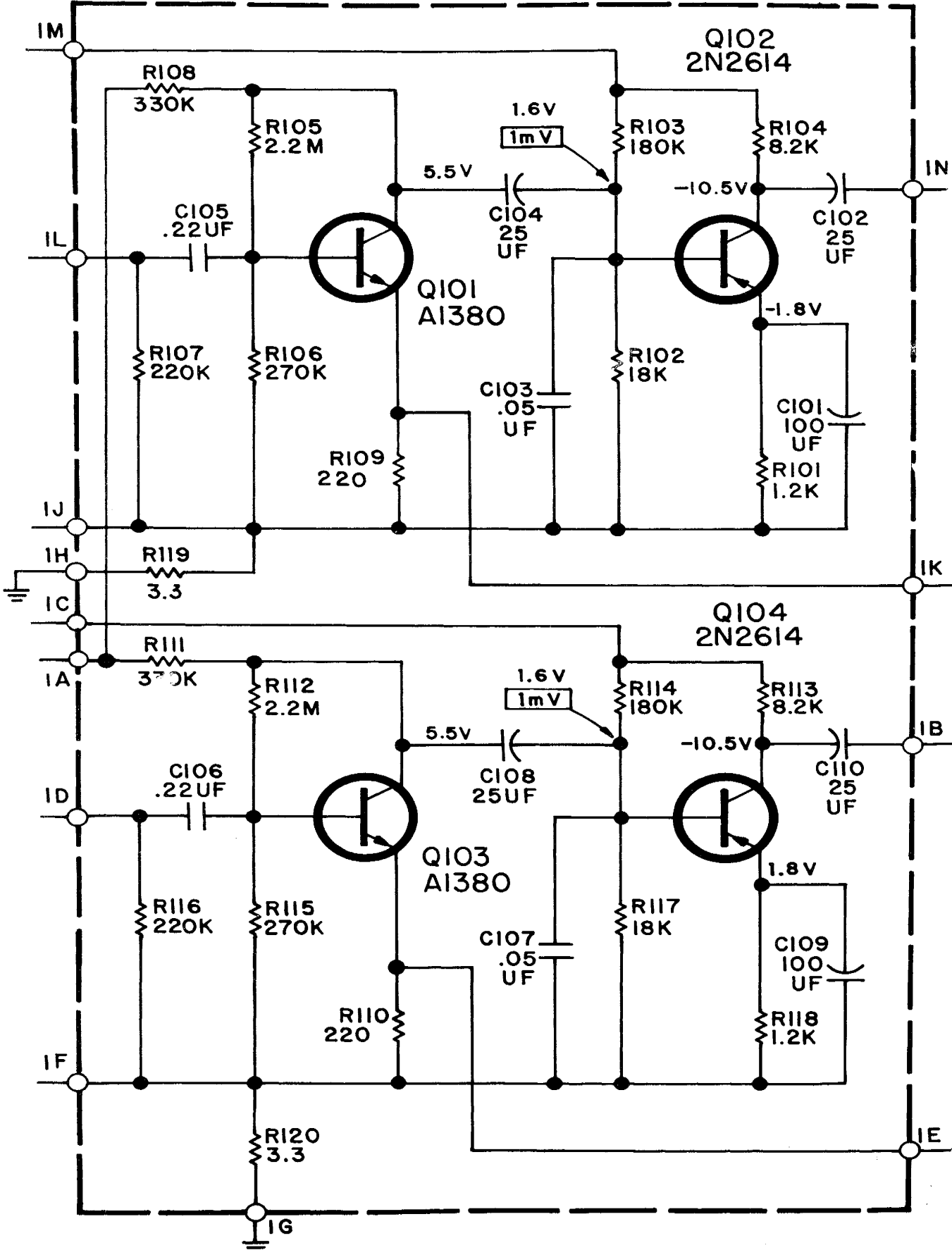


## PARTS DESCRIPTION LIST

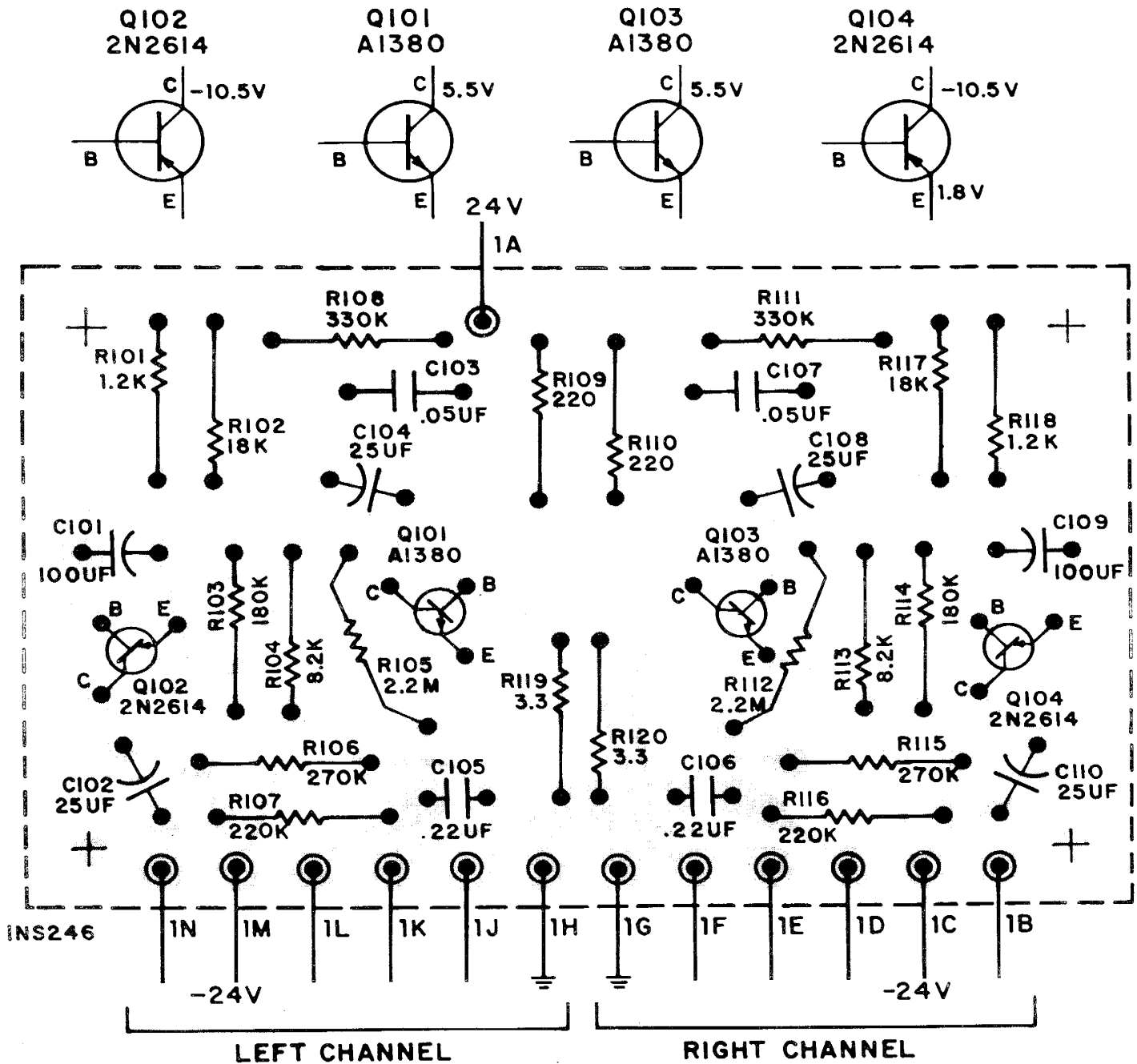
Symbol	Description	Part No.	Symbol	Description	Part No.
R101	Resistor, 220K	R12DC224J	C101	Capacitor, .22UF/160V	C50B575-3
R102	Resistor, 220K	R12DC224J	C102	Capacitor, .22UF/160V	C50B575-3
R103	Resistor, 2.7K	R12DC272J	C103	Capacitor, 100/±10%	C50B568-3
R104	Resistor, 2.7K	R12DC272J	C104	Capacitor, 100/±10%	C50B568-3
R105	Resistor, 3.3	R12DC3R3J	C105	Capacitor, 100/±10%	C50B568-3
R106	Resistor, 3.3	R12DC3R3J	C106	Capacitor, 100/±10%	C50B568-3
R107	Resistor, 180K	R12DC184J	C107	Capacitor, 4UF/35V	C50483-1
R108	Resistor, 180K	R12DC184J	C108	Capacitor, 4UF/35V	C50483-1
R109	Resistor, 180K	R12DC184J	C109	Capacitor, .22UF/160V	C50575-3
R110	Resistor, 180K	R12DC184J	C110	Capacitor, .22UF/160V	C50575-3
R111	Resistor, 220	R12DC221J	C111	Capacitor, 100UF/15V	C50483-5
R112	Resistor, 220	R12DC221J	C112	Capacitor, 100UF/15V	C50483-5
R113	Resistor, 1.2M	R33DC125J	Q101	Transistor	A1380
R114	Resistor, 1.2M	R33DC125J	Q102	Transistor	A1380
R115	Resistor, 8.2K	R12DC822J	Q103	Transistor	2N2924
R116	Resistor, 8.2K	R12DC822J	Q104	Transistor	2N2924
R117	Resistor, 3.3K	R12DC332J	—	Transistor Spacer	E50A624
R118	Resistor, 3.3K	R12DC332J	—	Printed Circuit Board	PB1240

# P1095 PREAMPLIFIER

## SCHEMATIC DIAGRAM



# P 1095 PRINTED-CIRCUIT LAYOUT



## PARTS DESCRIPTION LIST

Symbol	Description	Part No.	Symbol	Description	Part No.
R101	Resistor, 1.2K	R12DC122J	R119	Resistor, 3.3	R12DC3R3J
R102	Resistor, 18K	R12DC183J	R120	Resistor, 3.3	R12DC3R3J
R103	Resistor, 180K	R12DC184J	C101	Capacitor*, 100UF/15V	C50483-5
R104	Resistor, 8.2K	R12DC822J	C102	Capacitor*, 25UF/70V	C50B572-1
R105	Resistor, 2.2M	R33DC225J	C103	Capacitor, .05UF/100V	C50483-12
R106	Resistor, 270K	R12DC274J	C104	Capacitor*, 25UF/35V	C50B573-3
R107	Resistor, 220K	R12DC224J	C105	Capacitor, .22UF/160V	C50B573-3
R108	Resistor, 330K	R12DC334J	C106	Capacitor, .22UF/160V	C50B572-1
R109	Resistor, 220	R12DC221J	C107	Capacitor, .05UF/100V	C50483-13
R110	Resistor, 220	R12DC221J	C108	Capacitor*, 25UF/70V	C50483-5
R111	Resistor, 330K	R12DC334J	C109	Capacitor*, 100UF/15V	C50483-12
R112	Resistor, 2.2M	R33DC225J	C110	Capacitor*, 25UF/35V	A1380
R113	Resistor, 8.2K	R12DC822J	Q101	Transistor	2N2614
R114	Resistor, 180K	R12DC184J	Q102	Transistor	A1380
R115	Resistor, 270K	R12DC274J	Q103	Transistor	2N2614
R116	Resistor, 220K	R12DC224J	Q104	Transistor	E50A624
R117	Resistor, 18K	R12DC183J	—	Transistor Spacer	PB1095B110
R118	Resistor, 1.2K	R12DC122J	—	Printed Circuit Board	

\*Electrolytic Capacitor

To add protection for the output transistors in cases of D.C. balance control failure, the 22 ohm resistor across each of these controls should be replaced with an 8.2 ohm, ½ watt, 10% value. In those chassis observed with this modification, the technician need only follow the procedure detailed below.

1. Set volume control to minimum.
2. Connect V. T. V. M. across each of the 1 ohm resistors in the emitters of the output transistors.
3. Adjust the corresponding bias control until a reading of 20 millivolts is observed.

**NOTE:** Replace any bias control that appears erratic when following the above procedure. If any doubt exists regarding the condition of the pots, replacement of all is recommended.

**CAUTION:** When measuring voltage across the emitter resistor, be careful not to cause an accidental short which will immediately damage the output transistors.

# PARTS DESCRIPTION LIST

## CAPACITORS

10% Tolerance for all fixed capacitors unless otherwise noted or marked GMV (Guaranteed minimum value). All capacitors not marked uF on the schematic are pF (uuf).

Symbol	Description	Part No.
C1, 2	100, N1500, 1000V	C50070-6
C3, 4	Electrolytic, 50 uF, 35V	C50483-4
C5	Electrolytic, 200 uF, 35V	C50483-7
C6	Electrolytic, 50 uF, 35V	C50483-4
C7	Electrolytic, 1.0 uF, 50V	C50483-18
C8, 9	Ceramic, 270, 1000V	C50072-16
C10, 11	Electrolytic, 3000 uF, 40V	C50180-60
C12	Electrolytic, 200 uF, 35V	C50483-7
C13	Electrolytic, 50 uF, 35V	C50483-4
C14	Electrolytic, 1000 uF, 45V	C50180-69
C15	Electrolytic, 100 uF, 25V	C50483-6
C16	Molded, .01, uF 20%, 600V	C2747
C17, 18	100, N1500, 1000V	C50070-6
C19, 20	680, 1000V	C50072-2
C21, 22	Mylar, 0.33 uF, 160V	C50575-4
C23, 24	Electrolytic, 200 uF, 15V	C50483-13
C25, 26	Electrolytic, 1000 uF, 25V	C50483-14
C27, 28	Electrolytic, 100 uF, 25V	C50483-6
C29, 30	Electrolytic, 100 uF, 25V	C50483-6
C31, 32	330, 1000V	C50072-1
C33, 34	300, 1000V	C50072-39
C35, 36	120, N1500, 1000V	C50070-9

## RESISTORS & POTENTIOMETERS

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

Symbol	Description	Part No.
R1, 2	100K	R12DC104J
R3, 4	100K	R12DC104J
R5, 6	1K, 1/3W	R33DC102J
R7	220, 1/3W	R33DC221J
R8	1K	R12DC102J
R9, 10	47K	R12DC473J
R11	120K, 1/3W	R33DC124J
R12	1K	R12DC102J
R13	22K, 1/3W	R33DC223J
R14	Wirewound, 470, 5% 2W	RW200W471J
R15	Wirewound, 220, 5%, 2W	RW200W221J
R16	1K	R12DC102J
R17, 18	Potentiometer, 100K, Dual, Level Set	R50150-8
R19	1K	R12DC102J
R20	Wirewound, 270, 5% 2W	RW200W271J
R21	15K, 1/3W	R33DC153J
R22, 23	22K	R12DC223J
R24	12K, 1/3W	R33DC123J
R25	120K, 1/3W	R33DC124J
R26, 27	2.2K, 1/3W	R33DC222J
R28	Wirewound, 1, 5%, 3W	RL300W010J
R29	Composition, 820K, 10%, 1/2W	RC20BF824K
R30, 31	1M	R12DC105J
R32, 33	100K	R12DC104J
R34, 35	560K	R12DC564J
R36, 37	39K	R12DC393J
R38, A, B	Potentiometer, 100K, Dual, Treble	R30160-145
R40 A, B	Potentiometer, 100K, Dual, Bass	R50160-145
R42 A, B	Potentiometer, 50K, Dual, Balance	R50160-158
R44, 45	1.8K	R12DC182J
R46 A, B	Potentiometer, 50K, Dual, Volume	R50160-146
R48, 49	Wirewound, 150, 10%, 3W	RPG3W151K
R50, 51	150	R12DC151J
R52, 53	Wirewound, 270, 5%, 2W	RW200W271J
R54, 55	Wirewound, 100, 5%, 2W	RW200W101J
R56, 57	Wirewound, 220, 5%, 2W	RW200W221J

R58, 59	Control, W. W. 10, 20%, 2W (DC Zero & IM Distortion)	R50160-142-1
R60, 61	Wirewound, 100, 5%, 2W	RW200W101J
R62, 63	Wirewound, 220, 5%, 2W	RW200W221J
R64, 65	Control, W. W. 10, 20%, 2W (DC Zero & IM Distortion)	R50160-142-1
R66, 67	Wirewound, 270, 5%, 2W	RW200W271J
R68, 69	Wirewound, 1, 5%, 3W	RL300W010J
R70, 71	Wirewound, 1, 5%, 3W	RL300W010J
R72 A, B	Wirewound, 1.5 + 1.5, 10%, 10W, Dual	R50500-3
R73, 74	Wirewound, 330, 5%, 2W	RW200W331J
R75, 76	3.9K	R12DC392J
R77, 78	Wirewound, 220, 5%, 2W	RW200W221J
R79, 80	8.2K	R12DC822J
R81, A, B	Wirewound, 4 & 5, 10%, 10W, Dual	R50500-4
R82, 83	Wirewound, 330, 5%, 2W	RW200W331J
R84, 85	Wirewound, 330, 5%, 2W	RW200W331J
R86, 87	Composition, 22, 10% 1/2W	RC20BF220K
R88, 89	Composition, 22, 10% 1/2W	RC20BF220K

## SWITCHES

Symbol	Description	Part No.
S1	Switch, Pushbutton, Input	S949-140
S2	Switch, Mode Selector	S949-137
S3	Switch, Low Level Selector	S949-138
S4	Switch, Speaker Selector	S949-139
S5	Switch, Power (on Volume Control)	Part of R46
-	Switch, Rocker (Tan)	S50200-10
-	Switch, Rocker (Maroon)	S50200-15-1
-	Switch, Slide (Impedance Select.)	S50200-2

## TRANSFORMERS AND TRANSISTORS

Symbol	Description	Part No.
T1	Transformer, Driver Left Channel	T949-116-1
T2	Transformer, Driver, Right Channel	T949-116-2
T3	Transformer, Power	T949-115
Q1, 3, 5, 7	Transistor 35144	TR35144
Q2, 4, 6, 8	Transistor 35524	TR35524
Q9, 10	Transistor 2N2148	TR2N2148
Q11, 13	Transistor 2N2614	TR2N2614
Q12	Transistor 40022	TR4022

## MISCELLANEOUS

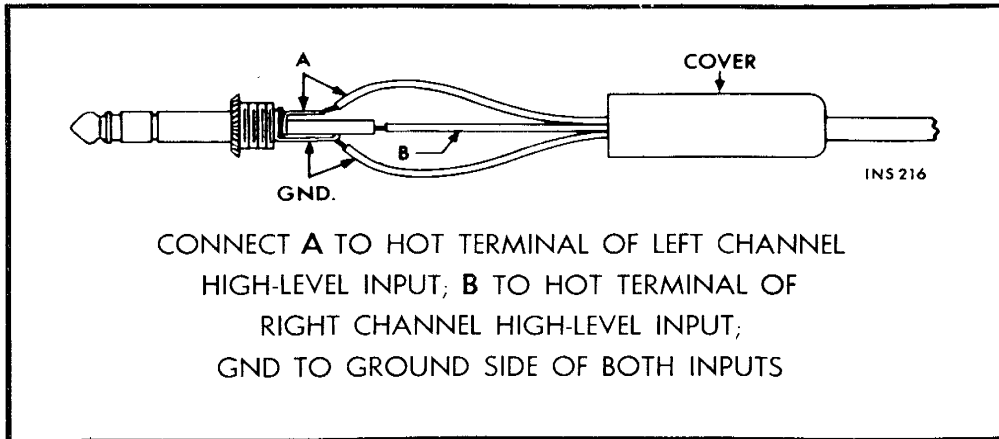
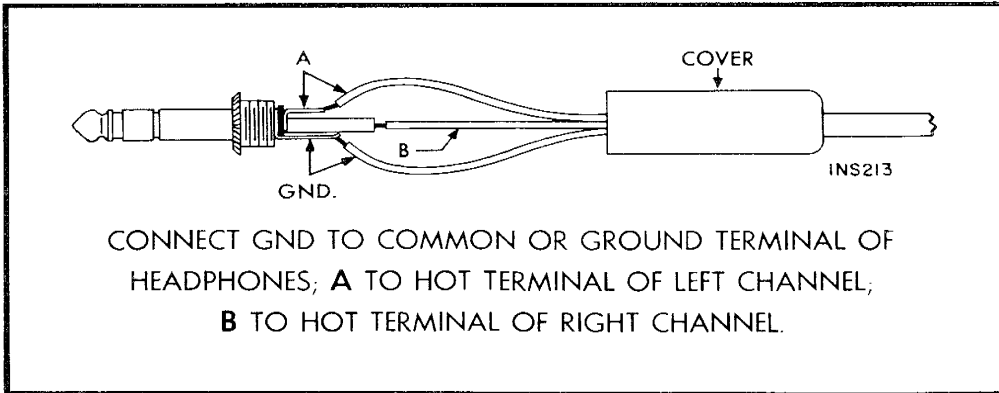
Symbol	Description	Part No.
CR1, 2, 3, 4	Silicon Rectifier	SR50517
CR5	Selenium Rectifier	SR50597-1
F1	Fuse, 2.5 Amp Slo-Blo	F1077-118
F2, 3, 4, 5	Fuse, 2 Amp	F755-145
I1, 2, 3, 4	Input Indicator Lamp	I50594
I5	Power Indicator Lamp	I50009-6
P1, 2	Printed Circuit, Equalization	PC50187-14
PC3, 4	Printed Circuit, Tone	PC50489
	Printed Circuit Board, Pre-Amp	P1240
	Printed Circuit Board, Audio	P1096
	Insert, Dress Panel, Screened (Lower) (For Tan Rocker Switches)	AS949-121
	Insert, Dress Panel, Screened (Lower) (For Maroon Rocker Switches)	AS949-121-EX
	Knob, Made, Low Level, Speakers, Balance	E50562-1
	Knob, Dual, Top, Tone Control	E50563
	Knob, Dual, Bottom, Tone Control	E50564
	Knob, Volume	E50566-1
	Barrier Strip, Speakers	E50596
	Screws, For Cage & Bottom Cover	H50598-7
	Insulator, Transistor Socket	E50510
	Jack, Phone, Tape	J50545
	Transistor, Socket	X50509



# P 1096 PARTS DESCRIPTION LIST

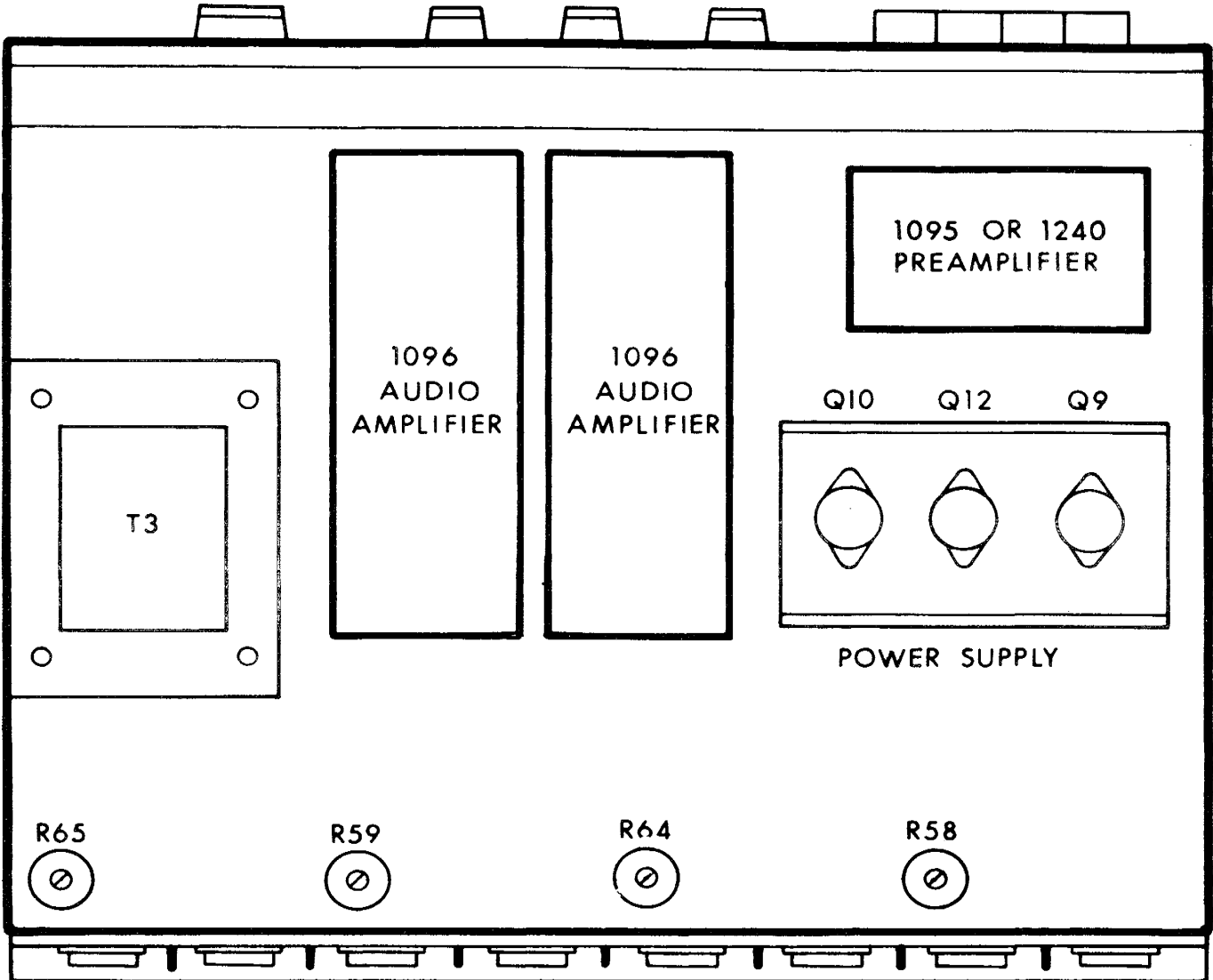
Symbol	Description	Part No.	Symbol	Description	Part No.
R201	Resistor, 270K	R12DC274J	R227	Resistor, 6.8K, 1/2 W	RC20BF682K
R202	Resistor, 6.8K	R12DC682J	C201	Capacitor, .22UF	C50B575-2
R203	Resistor, 330K	R12DC334J	C202	Capacitor, 2	C50B568-1
R204	Resistor, 180K	R12DC184J	C203	Capacitor, .5UF/70V	C50483-11
R205	Resistor, 10K	R12DC103J	C204	Capacitor*, 4UF/25V	C50483-1
R206	Resistor, 560K	R12DC564J	C205	Capacitor*, 4UF/25V	C50483-1
R207	Resistor, 180	R12DC181J	C206	Capacitor, .039UF	C50B575-4
R208	Resistor, 47K	R12DC473J	C207	Capacitor*, 50UF/10V	C50483-15
R209	Resistor, 33K	R12DC333J	C208	Capacitor*, 4UF/25V	C50483-1
R210	Resistor, 3.9K	R12DC392J	C209	Capacitor*, 4UF/25V	C50483-1
R211	Resistor, 47K	R12DC473J	C210	Capacitor*, 4UF/25V	C50483-1
R212	Resistor, 2.7K	R12DC272J	C211	Capacitor, 82	C50B568-2
R213	Resistor, 100K	R12DC104J	C212	Capacitor*, 4UF/25V	C50483-1
R214	Resistor, 3.9K	R12DC392J	C213	Capacitor, 500UF/10V	C50483-9
R215	Resistor, 27K	R12DC273J	C214	Capacitor, .5UF/70V	C50483-11
R216	Resistor, 2.2K	R12DC222J	C215	Capacitor*, 4UF/35V	C50483-1
R217	Resistor, 68K	R12DC683J	Q201	Transistor	2N2613
R218	Resistor, 22K	R12DC223J	Q202	Transistor	2N2614
R219	Resistor, 5.6K	R12DC562J	Q203	Transistor	2N2613
R220	Resistor, 1.5K	R12DC152J	Q204	Transistor	2N2614
R221	Resistor, 100K	R12DC154J	Q205	Transistor	2N2614
R222	Resistor, 220K	R12DC224J	Q206	Transistor	2N2614
R223	Resistor, 1K	R12DC102J	Q207	Transistor	2N2614
R224	Resistor, 15K	R12DC153J	—	Printed Circuit Board	PB1096-110
R225	Resistor, 8.2K, 1/2 W	RC20BF822J	—	Transistor Spacer	E50A624
R226	Resistor, 100	R12DC101J			

\* Electrolytic type



# CHASSIS LAYOUT

FRONT



Q1      Q2      Q3      Q4      Q5      Q6      Q7      Q8

REAR

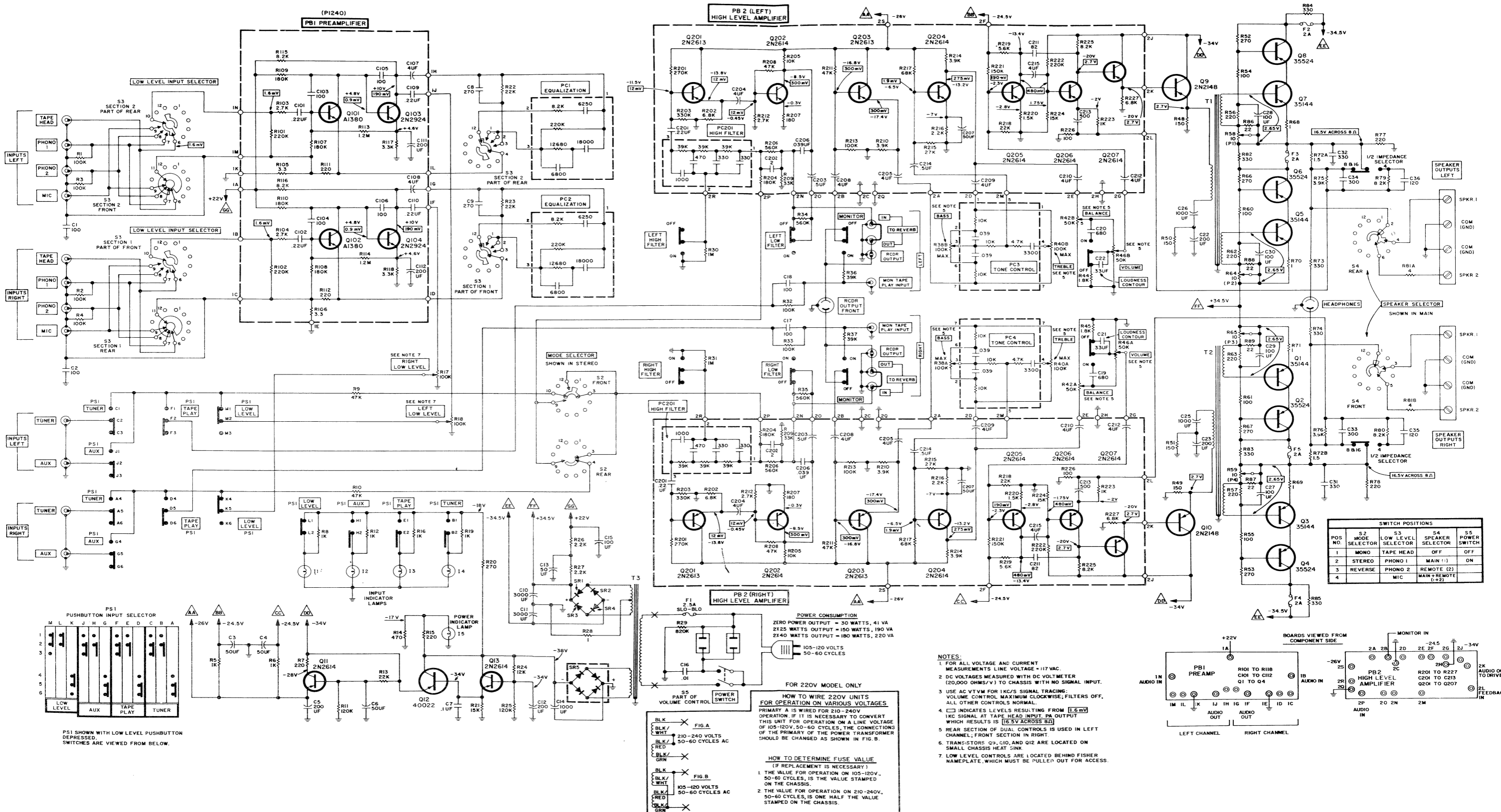
INS 287

**FISHER RADIO CORPORATION • NEW YORK**



# The Fisher TX-300 Transistor Stereo Control-Amplifier

# SCHEMATIC DIAGRAM



POS NO.	S2 MODE SELECTOR	S3 LOW LEVEL SELECTOR	S4 SPEAKER SELECTOR	S5 POWER SWITCH
1	MONO	TAPE HEAD	OFF	OFF
2	STEREO	PHONO 1	MAIN (1)	ON
3	REVERSE	PHONO 2	REMOTE (2)	
4		MIC	MAIN+REMOTE (1+2)	

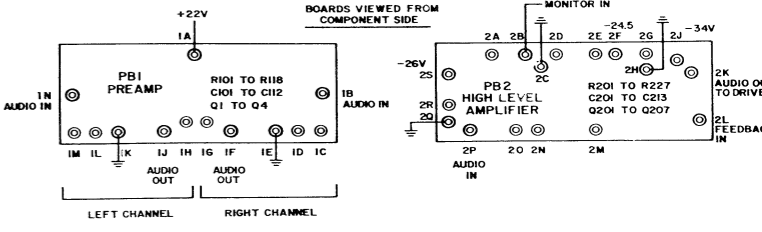
**POWER CONSUMPTION**  
 ZERO POWER OUTPUT = 30 WATTS, 41 VA  
 2X25 WATTS OUTPUT = 150 WATTS, 190 VA  
 2X40 WATTS OUTPUT = 180 WATTS, 220 VA

**FOR 220V MODEL ONLY**

**HOW TO WIRE 220V UNITS FOR OPERATION ON VARIOUS VOLTAGES**  
 PRIMARY A IS WIRED FOR 210-240V OPERATION. IF IT IS NECESSARY TO CONVERT THIS UNIT FOR OPERATION ON A LINE VOLTAGE OF 105-120V, 50-60 CYCLES, THE CONNECTIONS OF THE PRIMARY OF THE POWER TRANSFORMER SHOULD BE CHANGED AS SHOWN IN FIG. B.

**HOW TO DETERMINE FUSE VALUE (IF REPLACEMENT IS NECESSARY)**  
 1. THE VALUE FOR OPERATION ON 105-120V, 50-60 CYCLES, IS THE VALUE STAMPED ON THE CHASSIS.  
 2. THE VALUE FOR OPERATION ON 210-240V, 50-60 CYCLES, IS ONE HALF THE VALUE STAMPED ON THE CHASSIS.

- NOTES:**
- FOR ALL VOLTAGE AND CURRENT MEASUREMENTS LINE VOLTAGE = 117 VAC.
  - DC VOLTAGES MEASURED WITH DC VOLTMETER (20,000 OHMS/V) TO CHASSIS WITH NO SIGNAL INPUT.
  - USE AC VTVM FOR 1KC/S SIGNAL TRACING: VOLUME CONTROL MAXIMUM CLOCKWISE; FILTERS OFF, ALL OTHER CONTROLS NORMAL.
  - INDICATES LEVELS RESULTING FROM 1.6mV 1KC SIGNAL AT TAPE HEAD INPUT. PA OUTPUT WHICH RESULTS IS 15.5V ACROSS 8Ω.
  - REAR SECTION OF DUAL CONTROLS IS USED IN LEFT CHANNEL, FRONT SECTION IN RIGHT.
  - TRANSISTORS Q9, Q10, AND Q12 ARE LOCATED ON SMALL CHASSIS HEAT SINK.
  - LOW LEVEL CONTROLS ARE LOCATED BEHIND FISHER NAMEPLATE, WHICH MUST BE PULLED OUT FOR ACCESS.



# P1096 AUDIO AMPLIFIER

## Control Positions for Tests

1—Unplug unit from AC-power line.

2—Set Balance, Bass and Treble controls to their center positions.

With the MONITOR "on" set Speaker selector to MAIN or position 1. Hi-Filter and Low-Filter switches out. Selector switch to AUX. Mono switch in the out position. The impedance selector (on the rear apron of chassis) is to be set to the 8-16 ohms position.

## Output Stage Balancing and IM Distortion Measurements

1—Connect an 8-ohm, 50-watt resistor across the left output terminals. In parallel to the load resistor connect the input leads of an IM (Inter-Modulation) distortion analyzer and the leads of a DC VTVM capable of reading 0.1 volt with accuracy.

2—Connect IM-analyzer generator output to the left Monitor input.

3—Apply AC power and rotate Volume control to its maximum clockwise position—full volume.

4—Increase signal input to amplifier for 20 watts output. (12.5 VAC across 8-ohm load resistor). After one full minute of warm-up time proceed to next step. *The warm-up time is very important (to get proper balance) — the characteristics of the transistors change slightly as their internal temperature rises. A longer warm-up time will not damage the transistors. Once they are warm the tests and adjustments should be completed without delay — before they can cool off.*

5—Reduce IM-analyzer generator output for 5 watts output from amplifier (5.16 VAC across load).

6—Adjust P1 and P2 (P3 and P4 for right channel) for minimum IM distortion and zero DC voltage across the load. (IM distortion should be less than 0.8% and DC voltage lower than ±0.1 volts across the 8-ohm load. Use two screwdrivers to adjust the controls—it's faster than shifting from one control to the other.)

7—Increase signal input for 40 watts output from amplifier. IM reading should be less than 1% — DC across load should be less than ±0.3 volt.

REPEAT steps 1 through 7 (above) for right-channel tests.

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-watts rating is built into the IM analyzer, a separate load resistor is not required for the channel under test—one should be wired across the other channel as a precaution. 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—this gives greater accuracy.

## Harmonic Distortion Test

1—Set amplifier controls to positions indicated above (control positions) but with MONITOR "off."

2—Connect an audio (sine-wave) generator to the left AUX input. Connect the harmonic-distortion analyzer to the left speaker #1 terminals across an 8-ohm, 50-watt resistive load.

3—Apply AC power — rotate Volume control to its maximum clockwise position.

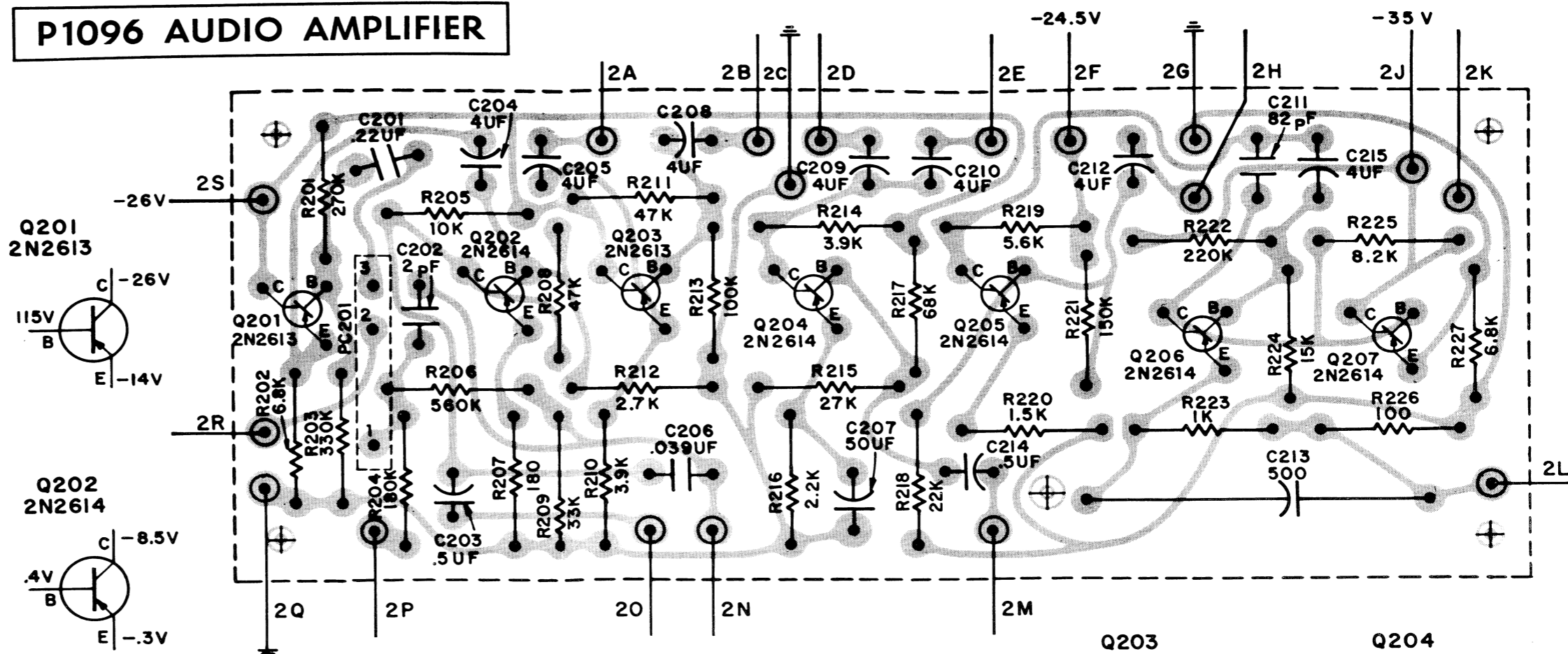
4—Set the frequency control of the audio generator to 20 cycles. Adjust the output level for 40 watts (17.9 VAC) across the 8-ohm load. Harmonic distortion should be less than 1%.

REPEAT steps above for right-channel harmonic-distortion measurements.

## Stability Test

1—Connect audio (sine-wave) generator to the left AUX input. Across the left-speaker terminals connect an 8-ohm, 50-watt load resistor and the vertical-input leads of an oscilloscope.

2—Set amplifier controls to positions listed above (control positions).



3—Apply AC power—rotate Volume control to its maximum clockwise positions—full volume.

4—Set the frequency control of the audio generator to 20 cycles. Increase the output level of the audio generator until the sine waves, as viewed on the scope, start to distort—the peaks are clipped from overdriving the amplifier. Check waveforms on scope for instability—changes in wave shape or oscillation (thicker line at a portion of the waveform).

5—Repeat the above steps using a 0.1-uf capacitor as a load. Remove the 8-ohm resistor.

REPEAT steps 1 through 5, above, for the right stereo channel.

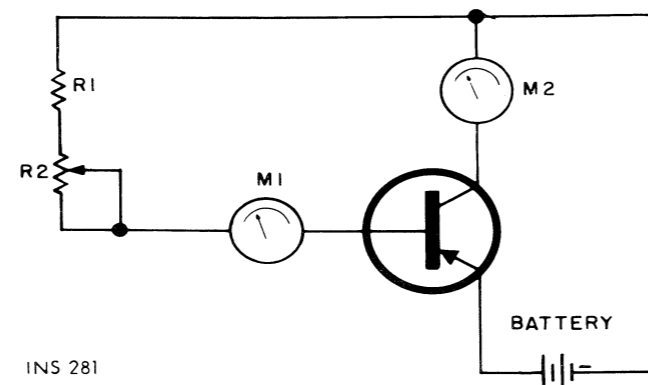
## Transistor Testing

If a power-transistor tester is not available the circuit given below can be used to determine the DC beta of the transistors. This is not a complete test of the transistor.

OPERATION: Connect the transistor to the test circuit. Adjust R2 for a 0.5-ampere reading on M2 in the collector circuit. The DC beta is then calculated

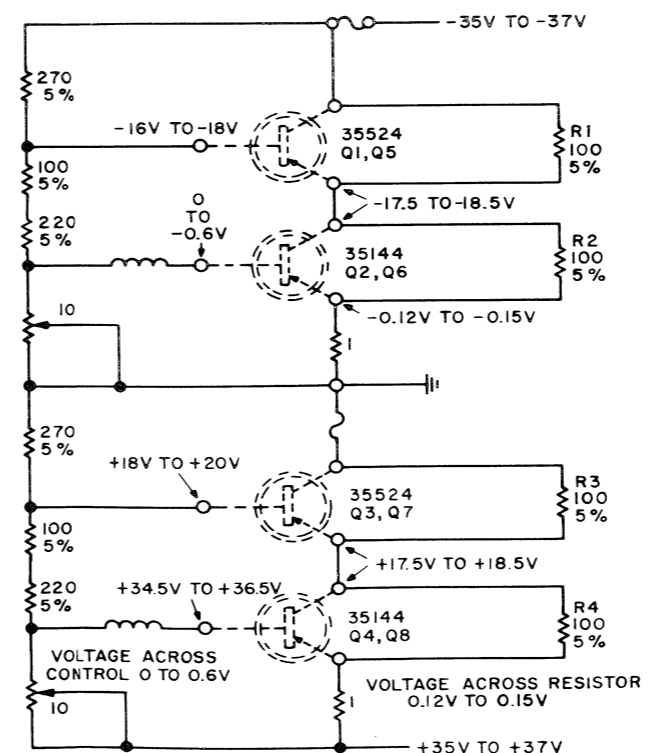
$$\text{by: DC beta} = \frac{\text{reading of M2}}{\text{reading of M1}}$$

The DC beta should be between 50 and 250.



INS 281

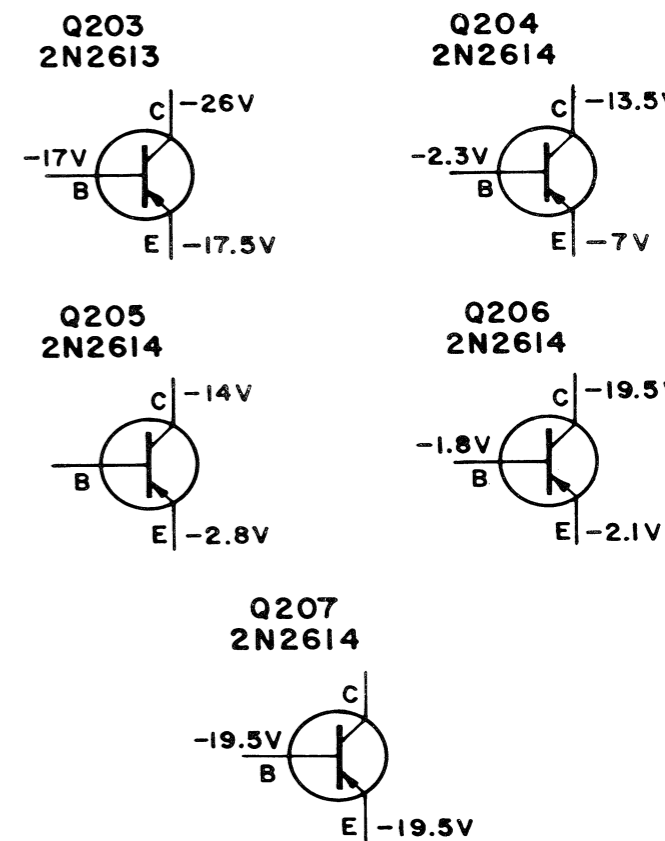
Voltage tests can be made with safety — without ruining transistors — by substituting resistors for the emitter-collector circuit of the power transistors. Voltages and resistor values are given



## NOTES:

1. VALUES MEASURED WITH DCVTVM TO GROUND, UNLESS OTHERWISE SPECIFIED.

INS 284



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.