

# McIntosh

## C 28

*PREAMPLIFIER*



## SERVICE INFORMATION

FROM SERIAL NO. 10X01 TO 91X49

McINTOSH LABORATORY INC. 2 CHAMBERS STREET BINGHAMTON, NEW YORK

C 28

## ELECTRICAL SPECIFICATIONS

## FREQUENCY RESPONSE

+0 to 0.5 dB from 20 Hz to 20,000 Hz.

## DISTORTION

Less than 0.1% at each output at rated output level, 20 Hz to 20,000 Hz.

## INPUT SENSITIVITY AND IMPEDANCE

Phono 1 and Phono 2  
2 millivolts at 47k ohms (1,000 Hz)

Aux, Tuner, Tape 1 and Tape 2  
0.25 volts at 250k ohms

Microphone  
2.5 millivolts at 500k ohms

Tape Head  
2 millivolts at 500k ohms (500 Hz)

## HUM AND NOISE

Aux, Tuner, Tape 1 and Tape 2  
90 dB below rated output

Phono 1, Phono 2 and Tape Head  
78 dB below 10 millivolt input, equivalent to less than 1.2 microvolts at the input terminals.

Microphone  
Less than 1.5 microvolts at the input terminals.

## OUTPUT LEVEL AND IMPEDANCE

Main Output  
2.5 volts with rated input, less than 100 ohms source impedance, to operate into 47k ohm or greater load.

Tape Output  
0.25 volts with rated input. Less than 150 ohm source impedance, to operate into 47k ohm or greater load.

Headphone/Line Output  
0.75 volts into 8 ohm load or 3.0 volts into 600 ohm line. Less than 0.2 ohms source impedance. Level controls provided.

Center Channel  
0.7 volts with rated input to both channels. Level control provided.

## BASS CONTROL

+  
±20 dB at 20 Hz.

## TREBLE CONTROL

±18 dB at 20,000 Hz.

## L.F. FILTER

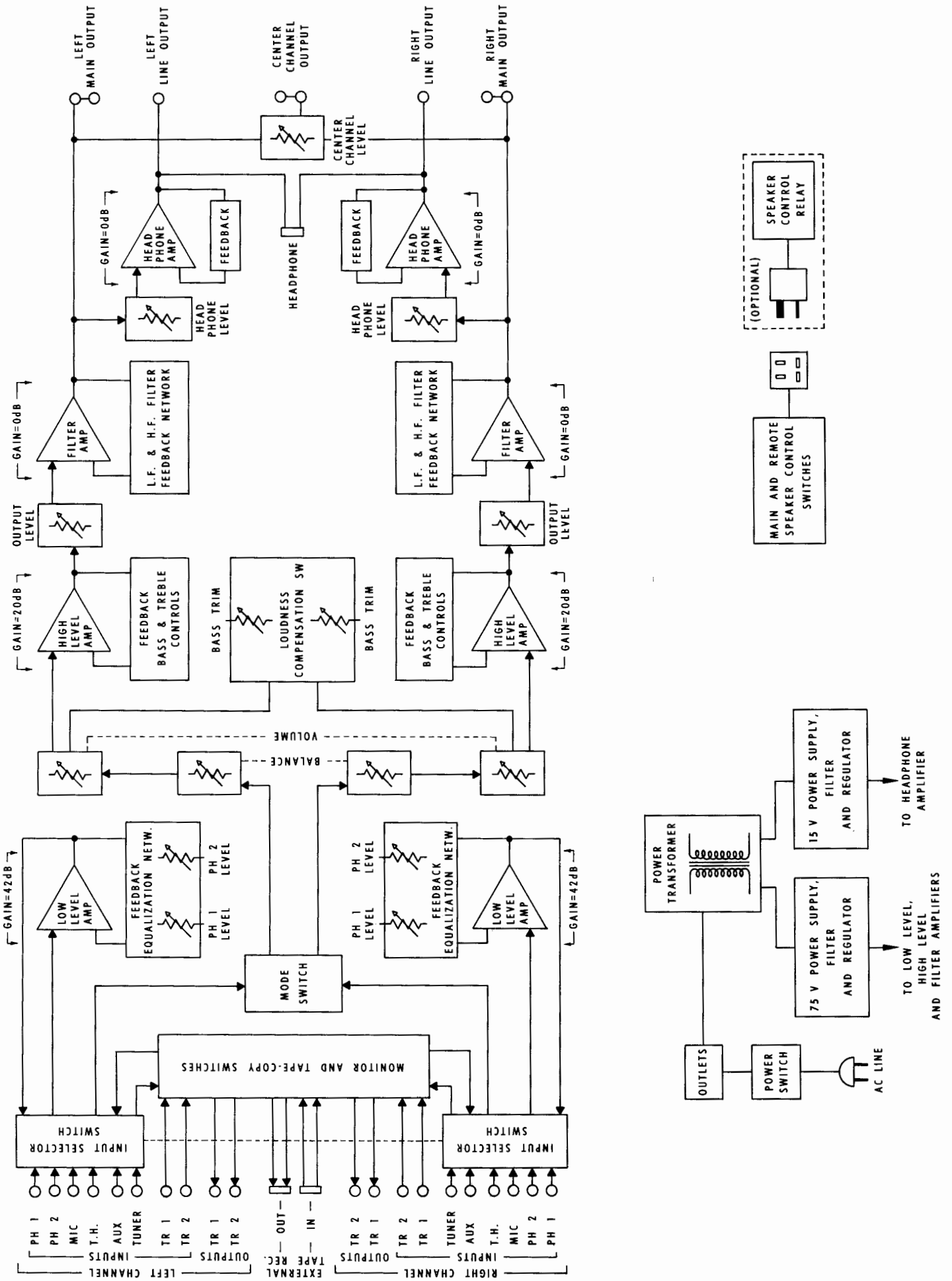
Flat or roll off below 50 Hz, active filter 12 dB/octave down 18 dB at 20 Hz.

## H.F. FILTER

Flat or roll off above 7,000 Hz, active filter 12 dB/octave down 20 dB at 20,000 Hz.

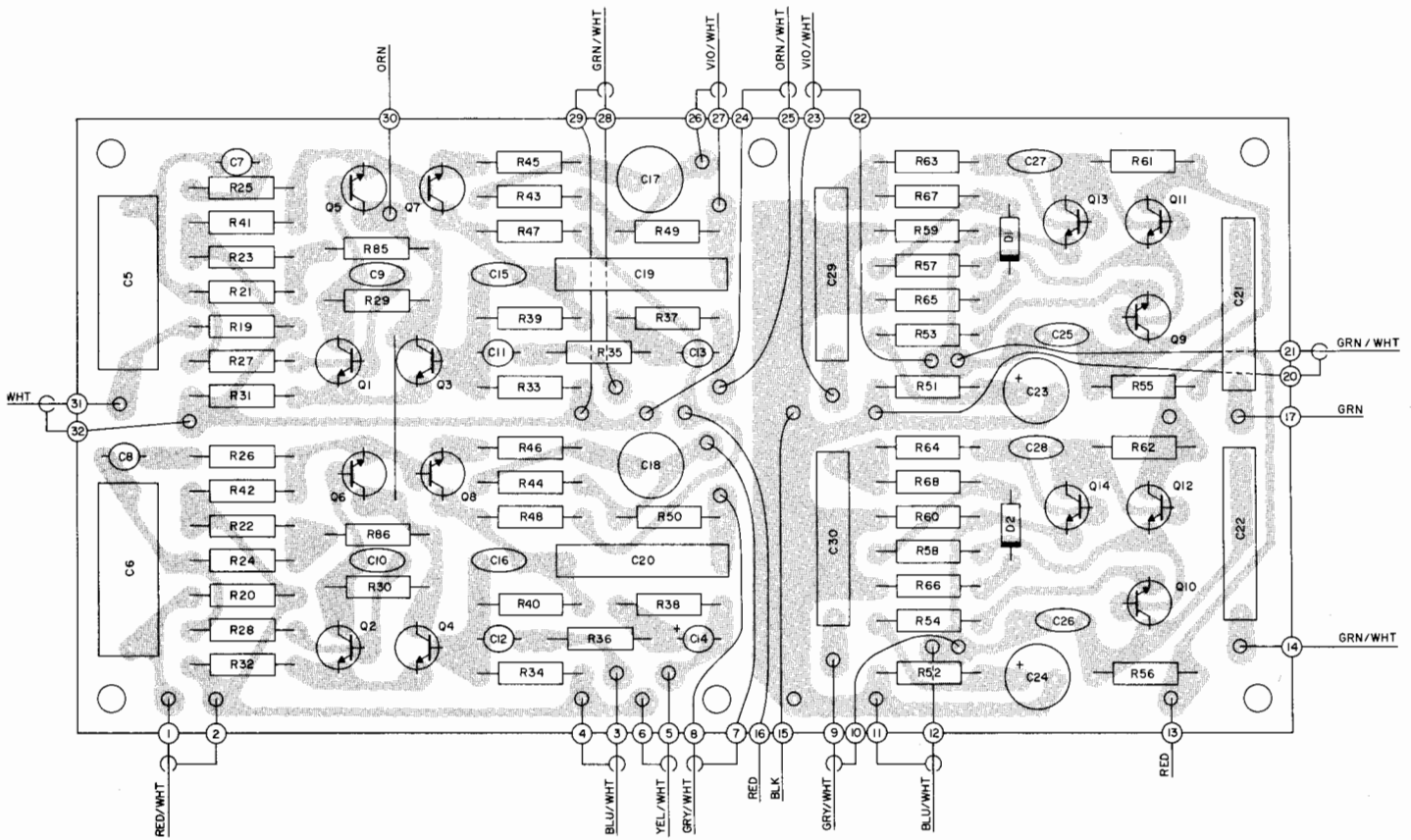
## POWER REQUIREMENT

117 volts, 50/60 Hz, 45 watts.

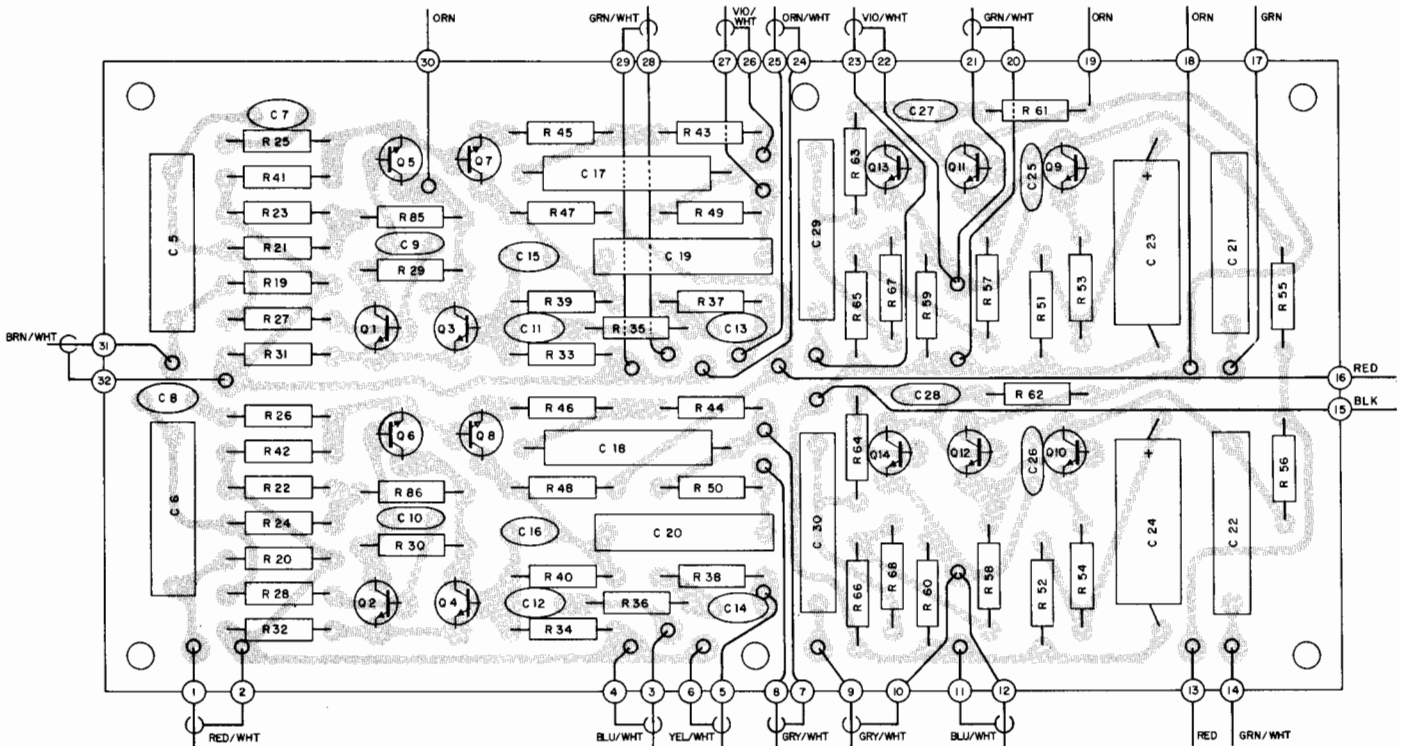


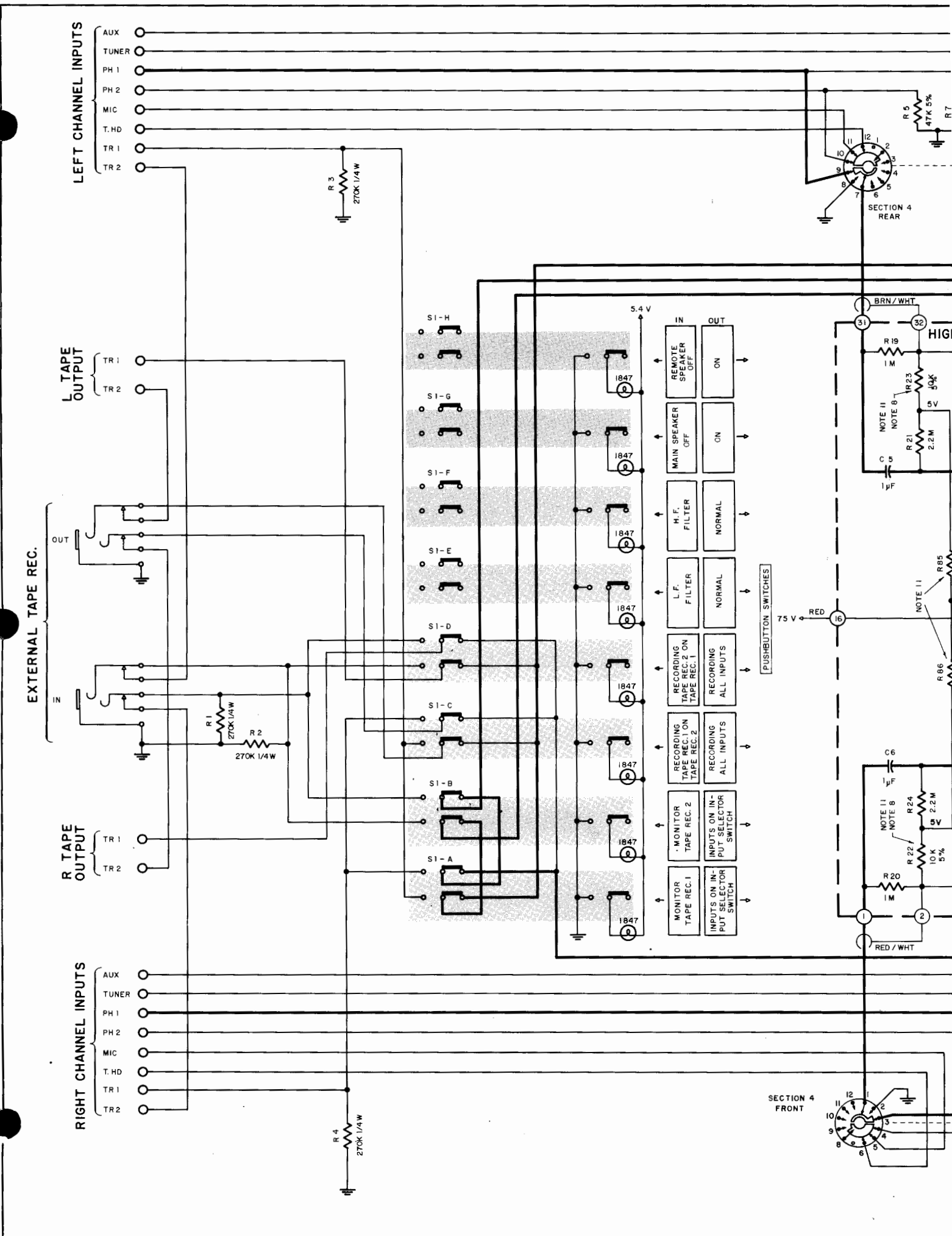
C 28 BLOCK DIAGRAM

HIGH 8. LOW LEVEL PC BOARD 044-309



HIGH & LOW LEVEL PRINTED CIRCUIT BOARD FOR UNITS WITH SERIAL NOS. BELOW 30X00





LEFT CHANNEL INPUTS

- AUX
- TUNER
- PH 1
- PH 2
- MIC
- T.H.D.
- TR 1
- TR 2

L TAPE OUTPUT

- TR 1
- TR 2

EXTERNAL TAPE REC.

OUT

R TAPE OUTPUT

- TR 1
- TR 2

RIGHT CHANNEL INPUTS

- AUX
- TUNER
- PH 1
- PH 2
- MIC
- T.H.D.
- TR 1
- TR 2

SECTION 4 REAR

SECTION 4 FRONT

HIGH

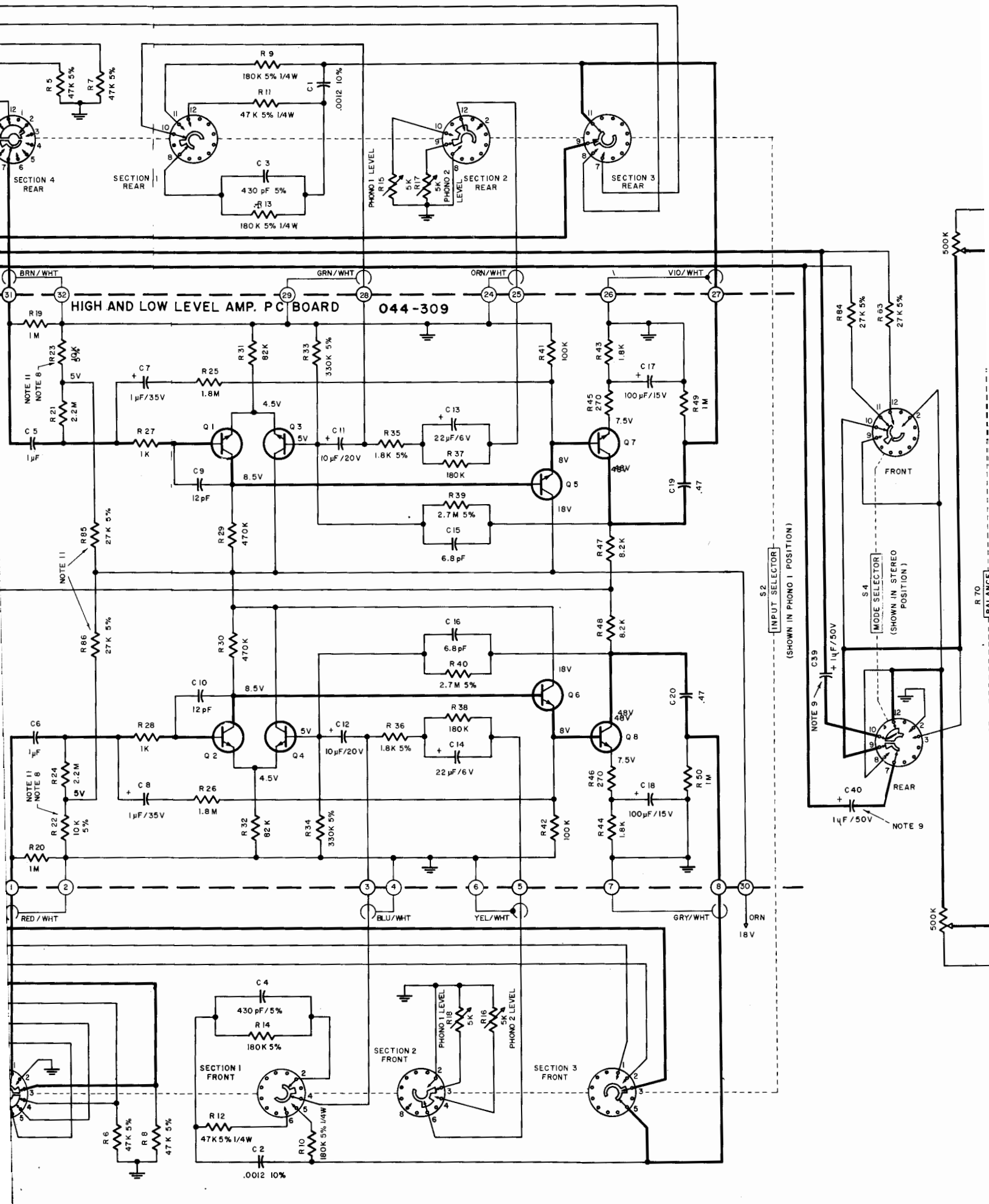
PUSHBUTTON SWITCHES

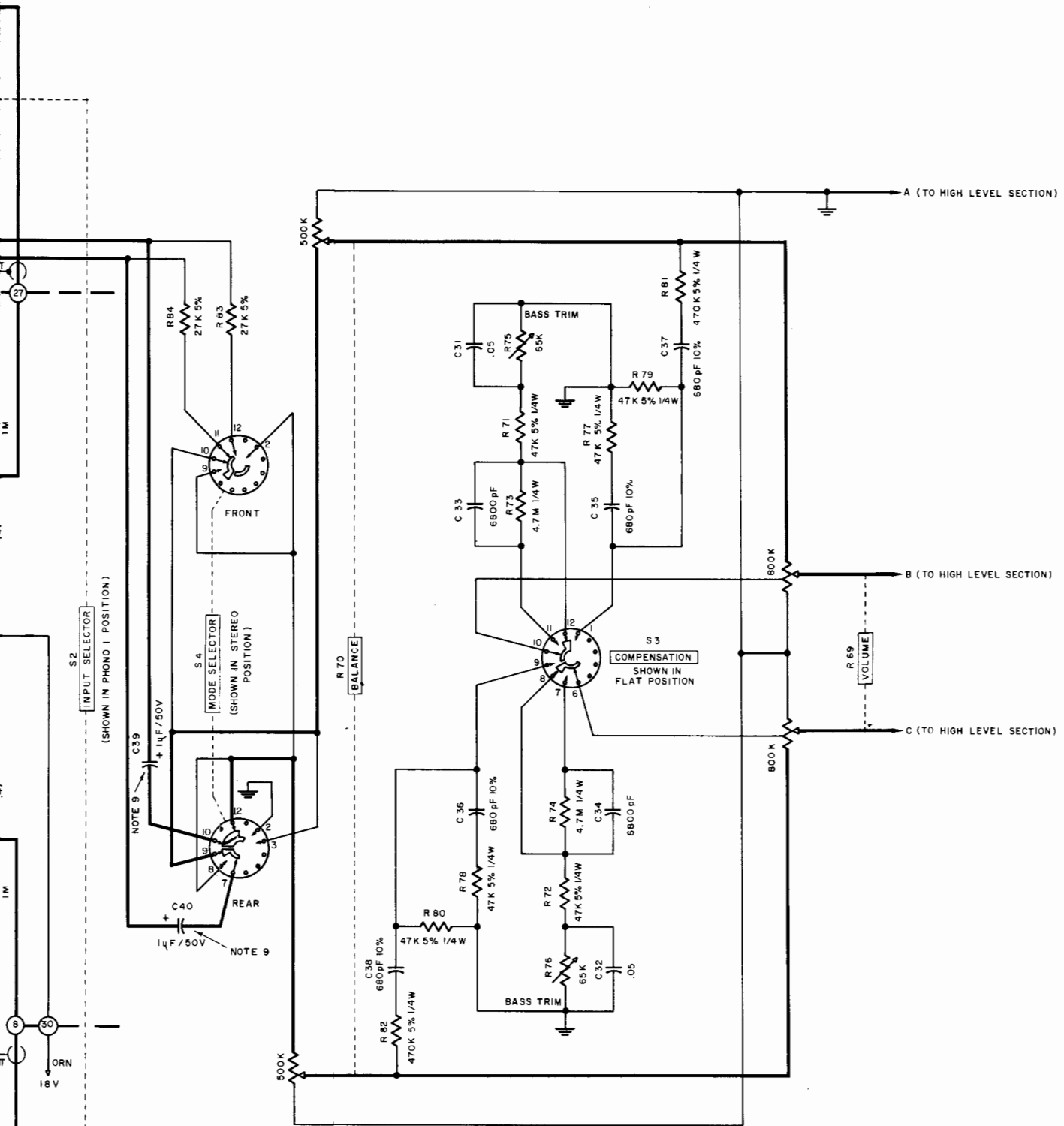
NOTE I I

NOTE I I

NOTE B

NOTE B





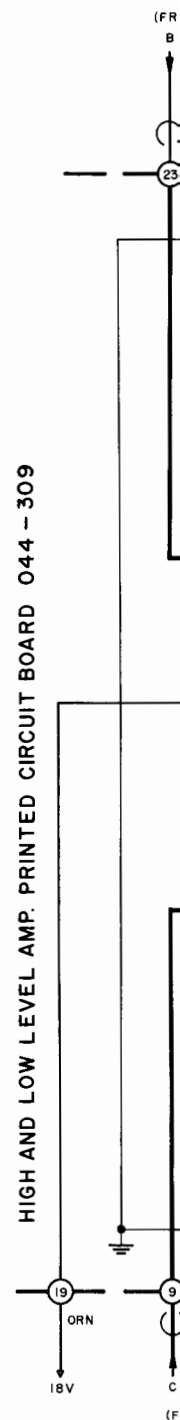
LOW LEVEL SECTION

## SCHEMATIC NOTES

1. Unless otherwise specified: Resistance values are in ohms, 1/2 watt, and 10% tolerance; capacitance values smaller than 1 are in microfarads ( $\mu\text{F}$ ); capacitance values greater than 1 are in picofarads (pF); inductors are in microhenries ( $\mu\text{H}$ ).
2. Printed circuit board components are outlined on the schematics by dotted lines. The circled numbers around the dotted lines correspond to the numbers on the PC Board layouts.
3. The heavy lines on the schematics denote the primary signal path.
4. The terminal numbering of rotary switches is for reference only.
5. All voltages indicated on the schematics are measured under the following conditions:
  - a. Use of an 11 megohm input impedance VTVM.
  - b. All voltages  $\pm 10\%$  with respect to chassis ground.
  - c. No signal at input terminals.
  - d. AC input at 117 volts, 50/60 Hz.
  - e. Front panel controls at:
 

|                |                                     |
|----------------|-------------------------------------|
| Volume         | Fully CCW, but with power switch on |
| Mode           | Stereo                              |
| Input selector | Phono 1                             |
| Loudness       | Flat                                |

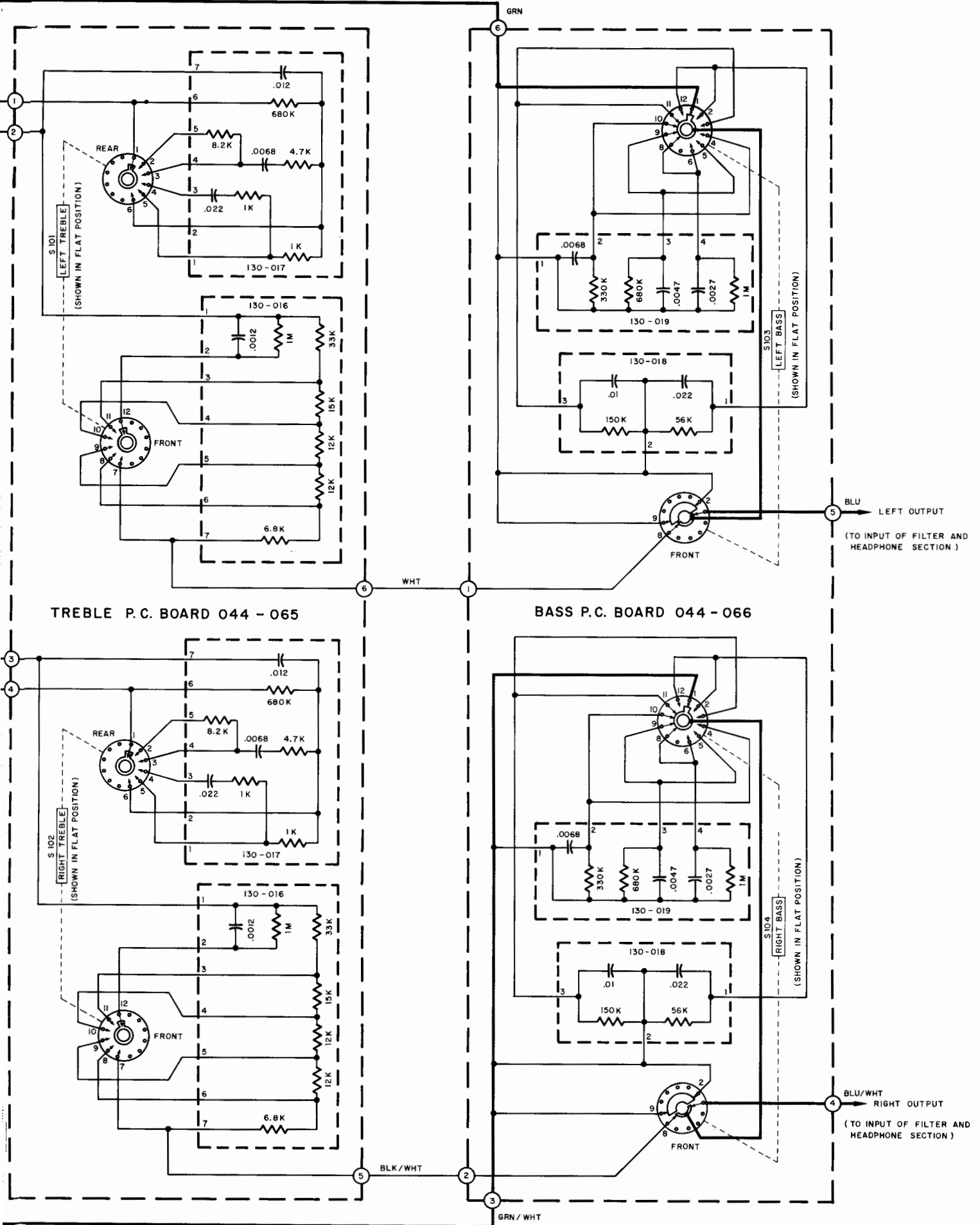
 All other controls at normal positions.
6. In units with Serial No.'s below 23X01, S302 is SPST switch (McIntosh Part No. 148-017); R303 is 10% tolerance and R304 is 8.2k.
7. In units with Serial No.'s below 17X01: R65 & R66 are 4.7k, and D1 & D2 are not used.
8. In units with Serial No.'s below 19X44: R22 & R23 are 12 $\Omega$ .
9. In units with Serial No.'s below 32X44: C39 & C40 are not used.
10. In units with Serial No.'s below 33X73: C27 & C28 are 12pF; R219 & R220 are 56k; and R63 & R64 are 3.3k.
11. In units with Serial No.'s below 36X82: R22, R23, R85, and R86 are 10% resistors.
12. In units with Serial No.'s below 50X33: R243 and R244 are 4.7k; R235 and R236 are used.
13. In units with Serial No.'s below 56X57: R243 and R244 are 4.7k.



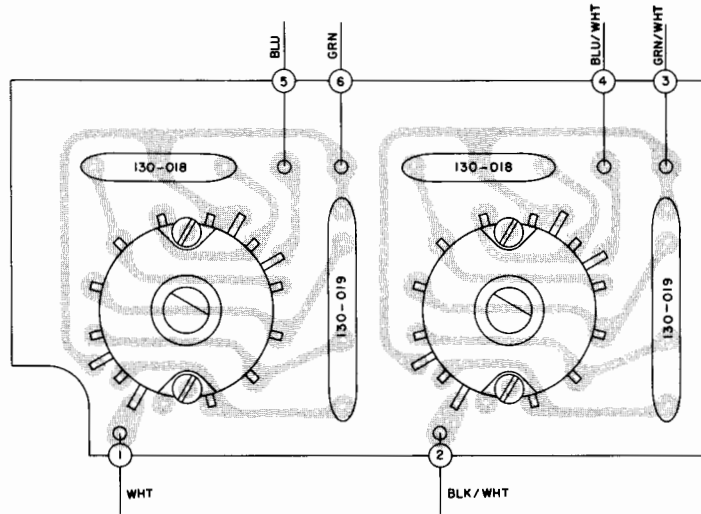
HIGH LEVEL S



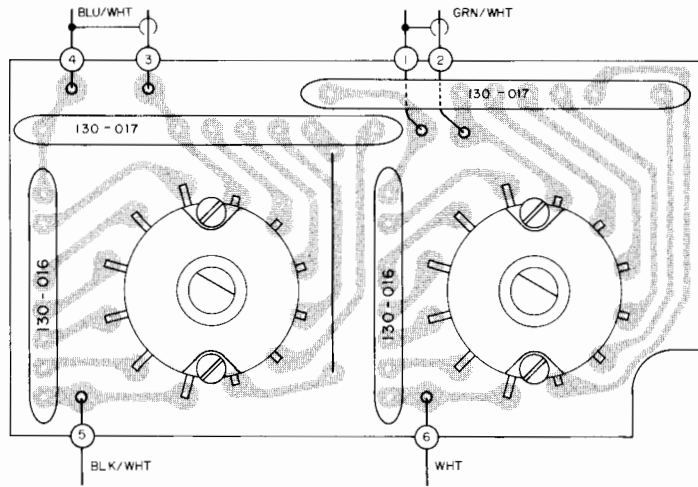




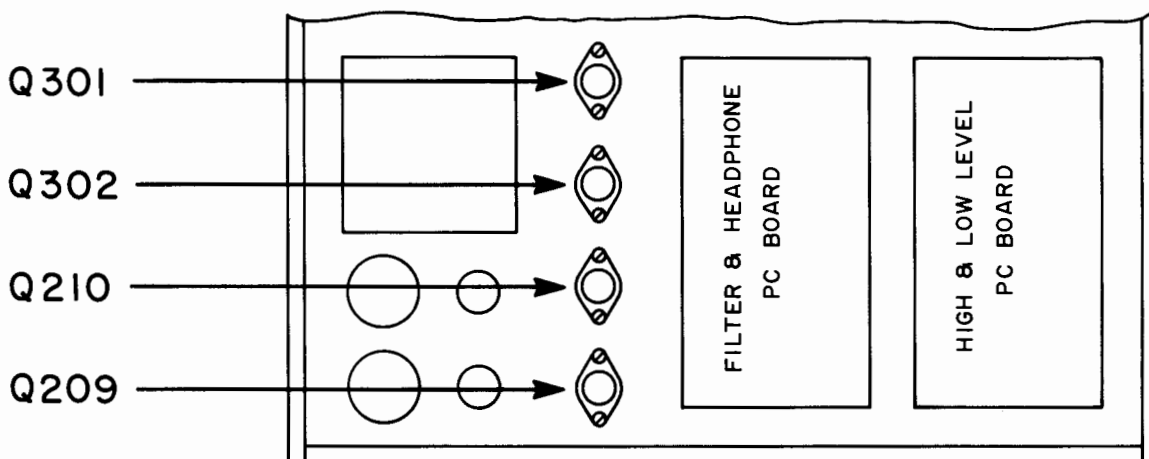
BASS PRINTED CIRCUIT BOARD 044-066



TREBLE PRINTED CIRCUIT BOARD 044-065



TOP VIEW



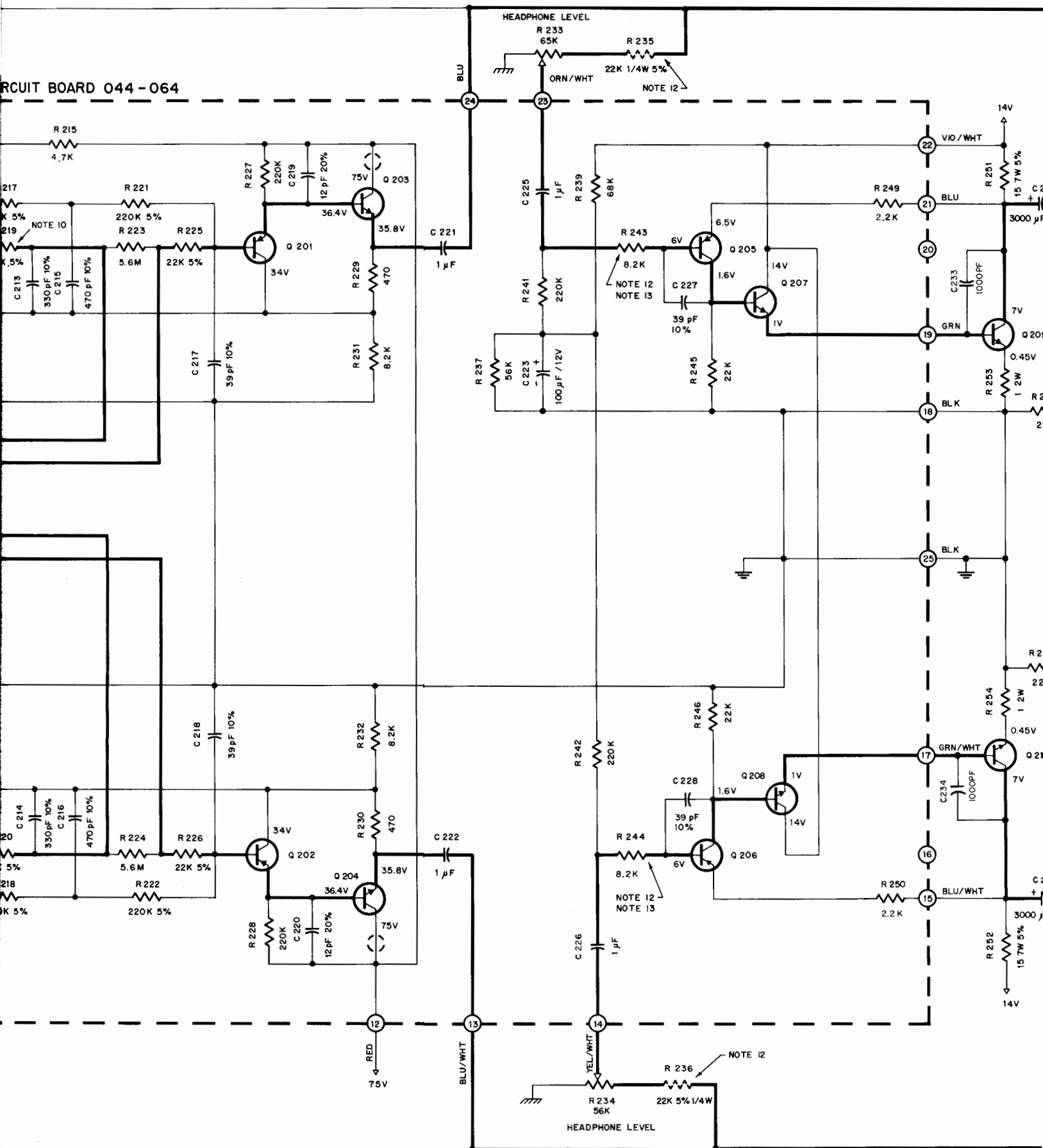
REAR OF UNIT

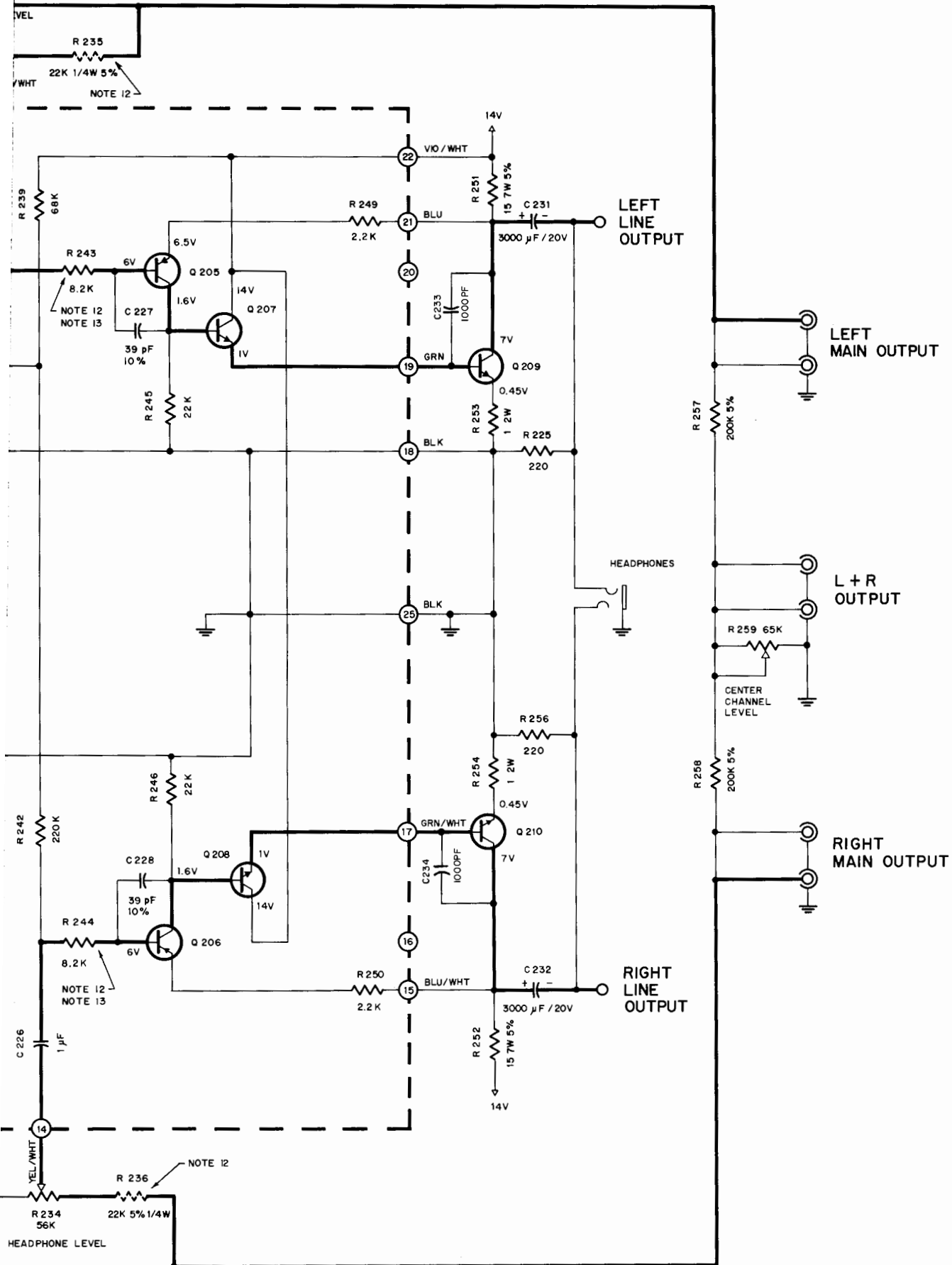
LOCATION OF TRANSISTORS NOT ON PRINTED CIRCUIT BOARDS



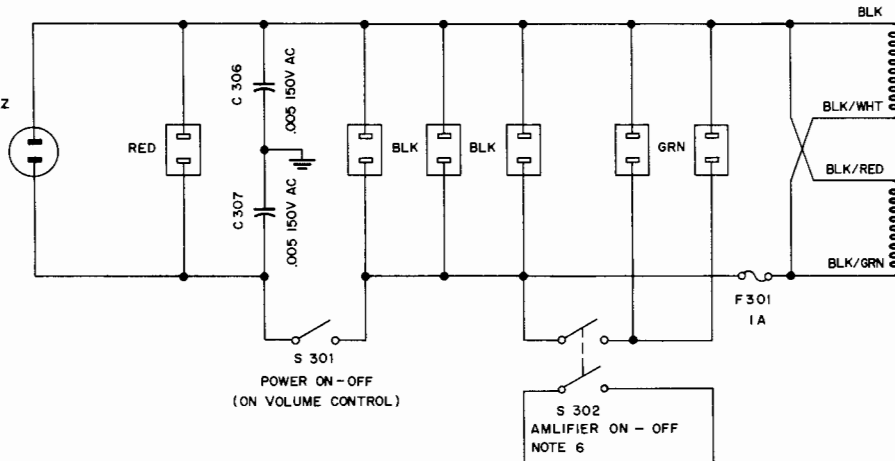


CIRCUIT BOARD 044-064

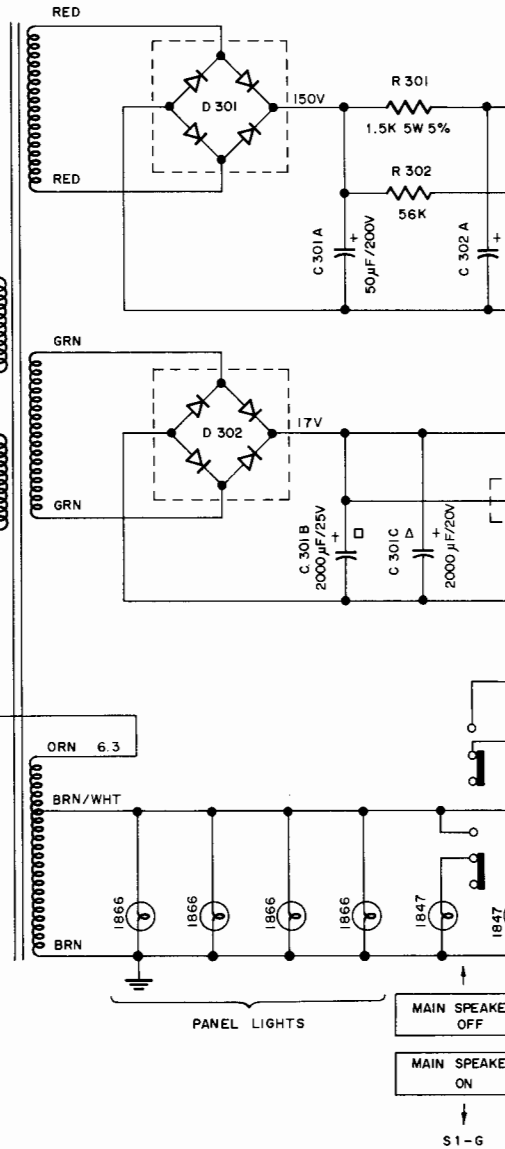




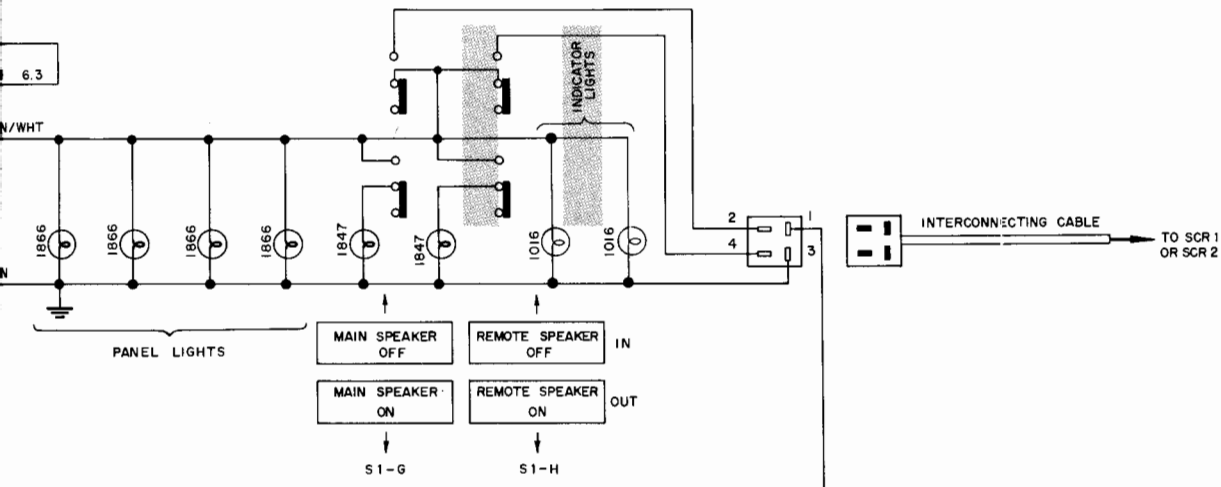
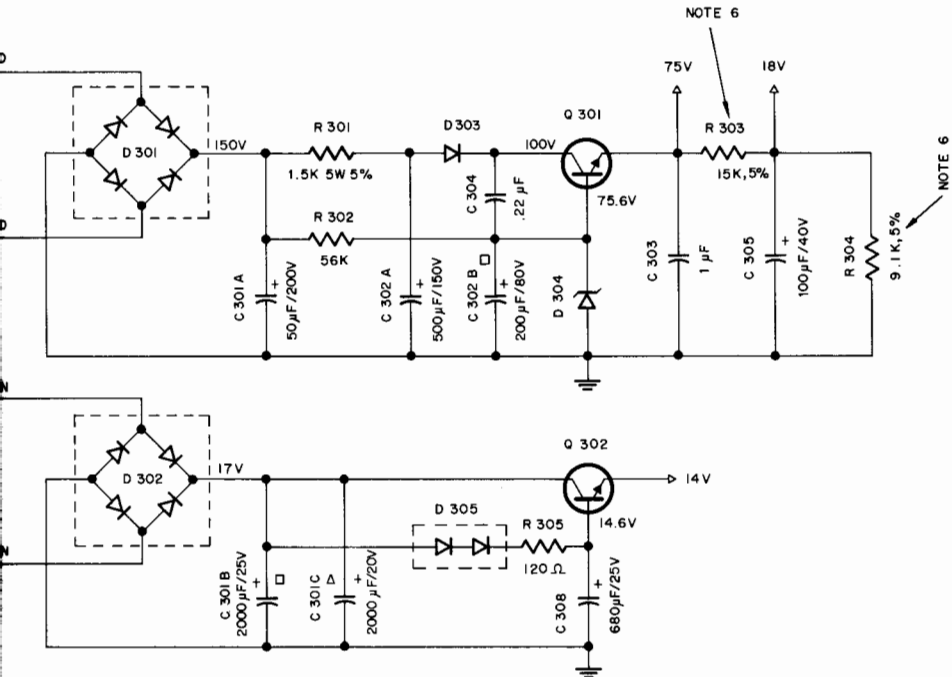
117V  
50-60 HZ



T 301

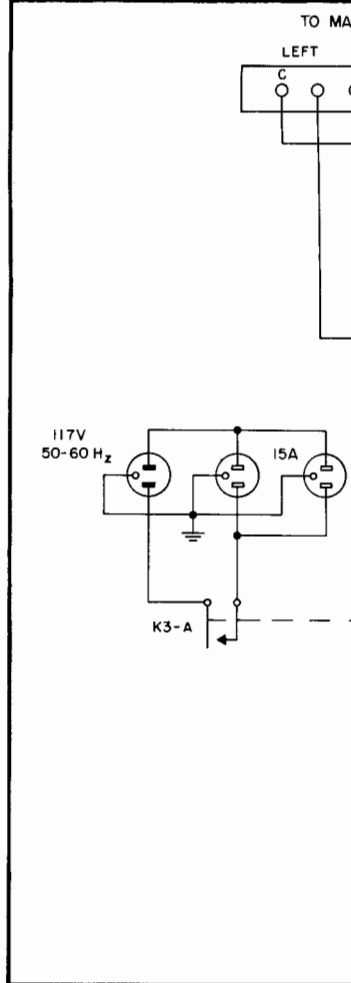
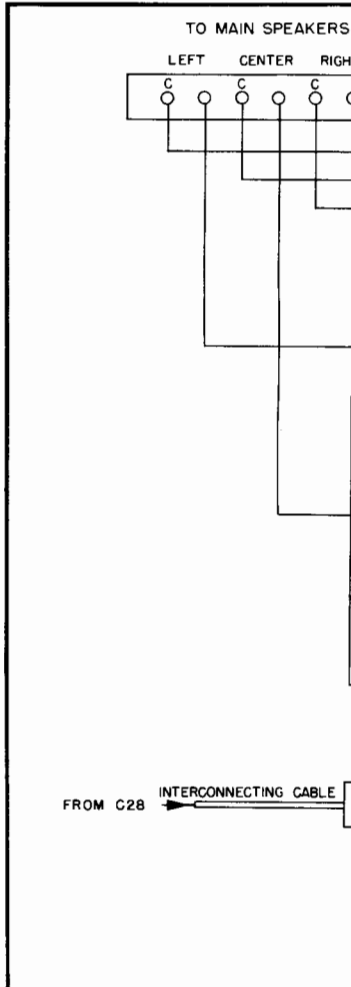


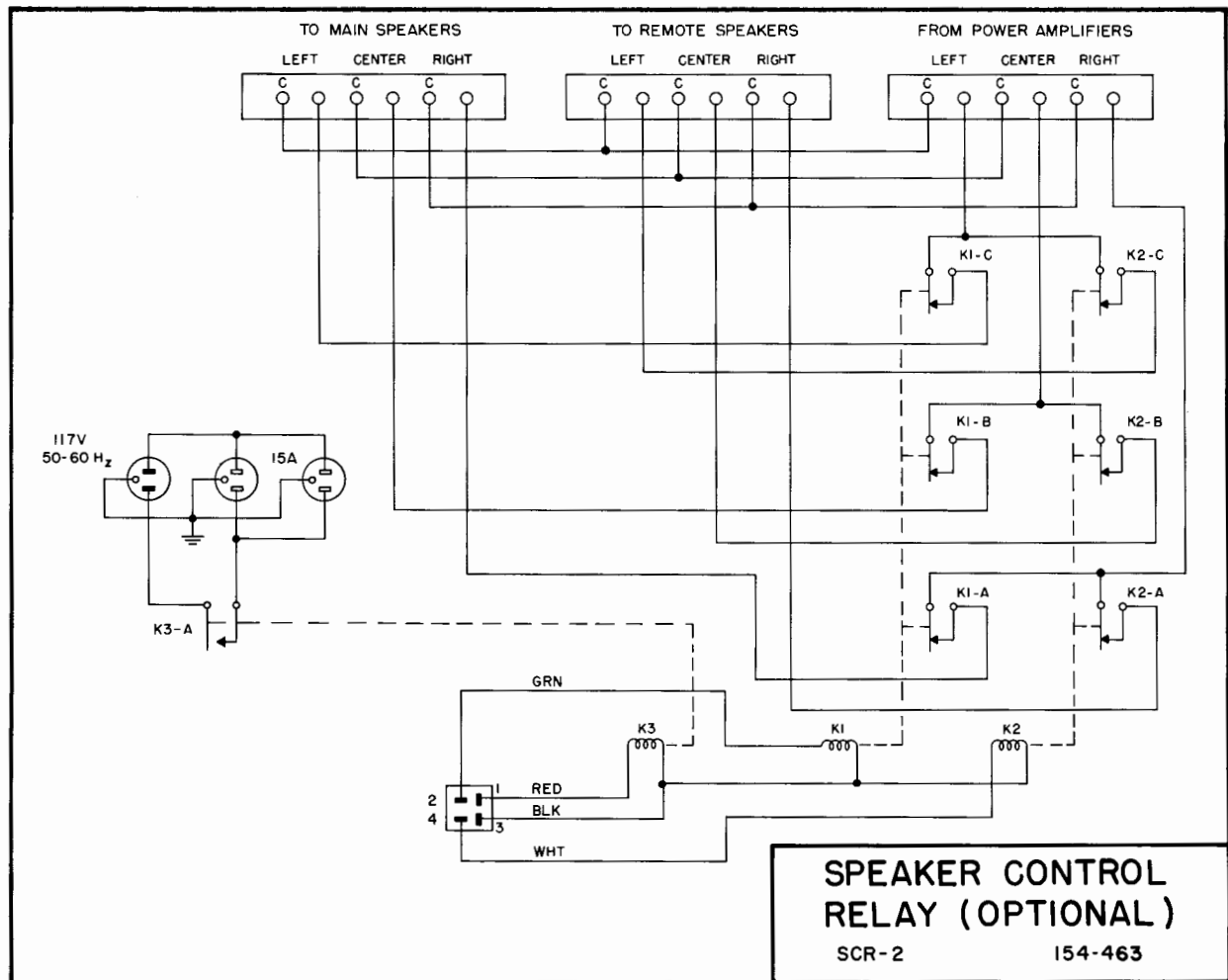
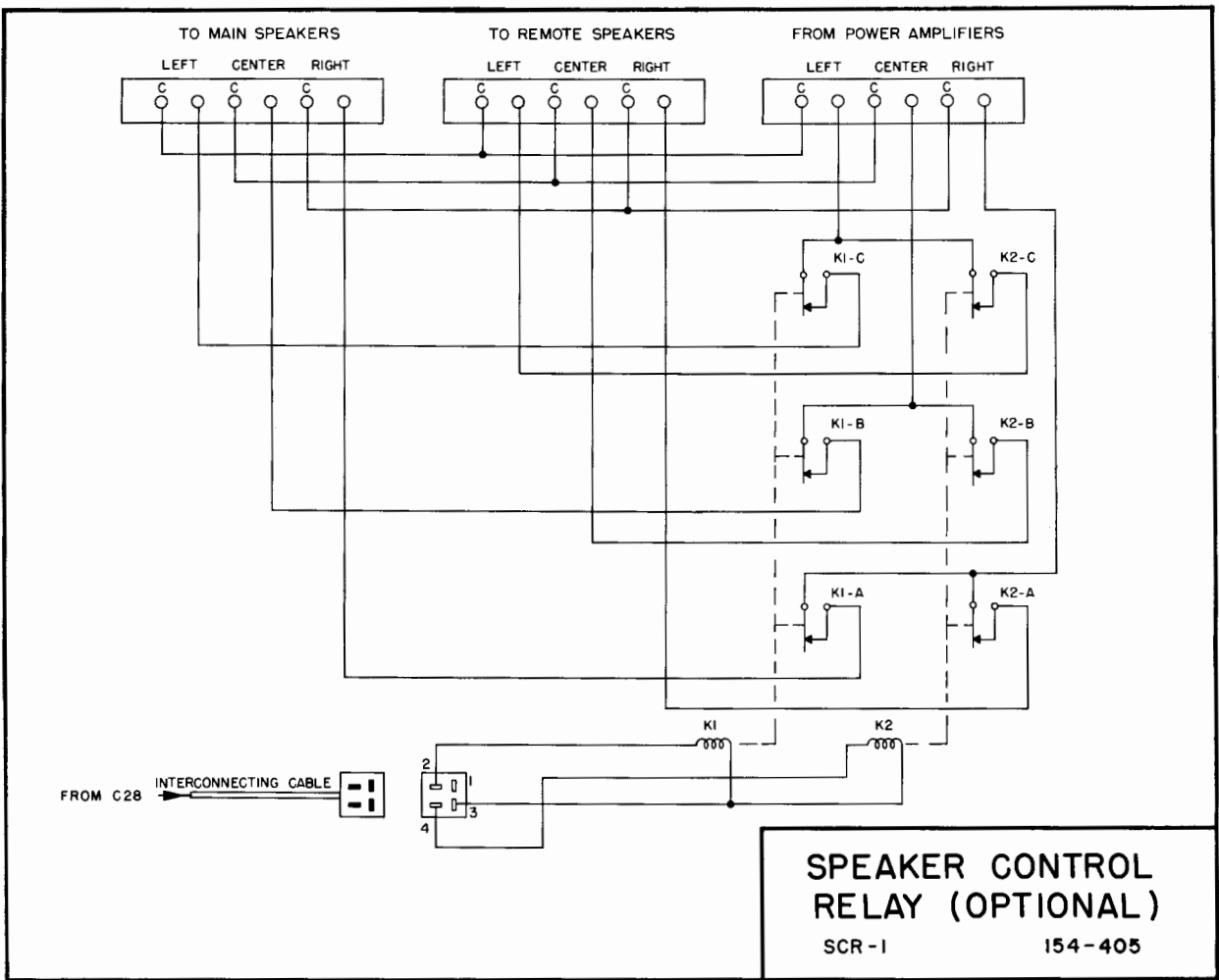




**POWER SUPPLY SECTION**

C28 154-540





CABLE TO SCR 1 OR SCR 2

APPLY ON

154-540

## REPLACEMENT PARTS

All parts not listed are common items obtainable from radio parts jobbers.

Replacement parts may be obtained when ordered by PART NUMBER from:

McIntosh Laboratory, Inc.  
Customer Service Department  
2 Chambers Street  
Binghamton, New York 13903  
(telephone 607-723-3512)

## CAPACITORS

| Symbol Number | Description                               | Part Number |
|---------------|---|-------------|
| C5,6          | Mylar 1 $\mu$ F 250V                      | 064-088     |
| C7,8          | Elect. 1 $\mu$ F 35V                      | 066-147     |
| C11,12        | Elect. 10 $\mu$ F 20V                     | 066-149     |
| C13,14        | Elect. 22 $\mu$ F 6V                      | 066-151     |
| C17,18        | Elect. 100 $\mu$ F 16V                    | 066-177     |
| C19,20        | Mylar .47 $\mu$ F 250V                    | 064-069     |
| C21,22        | Mylar .47 $\mu$ F 250V                    | 064-069     |
| C23,24        | Elect. 100 $\mu$ F 16V                    | 066-177     |
| C29,30        | Mylar .47 $\mu$ F 250V                    | 064-069     |
| C201,202      | Elect. 1 $\mu$ F 35V                      | 066-147     |
| C203,204      | Mylar .047 $\mu$ F 250V                   | 064-085     |
| C205,206      | Mylar .01 $\mu$ F 250V                    | 064-040     |
| C207,208      | Mylar .01 $\mu$ F 250V                    | 064-040     |
| C209,210      | Mylar .01 $\mu$ F 250V                    | 064-040     |
| C211,212      | Mylar .22 $\mu$ F 250V                    | 064-068     |
| C221,222      | Mylar 1 $\mu$ F 250V                      | 064-088     |
| C223          | Elect. 100 $\mu$ F 15V                    | 066-127     |
| C225,226      | Mylar 1 $\mu$ F 250V                      | 064-088     |
| C231,232      | Elect. 3000 $\mu$ F 20V                   | 066-130     |
| C301          | Elect. 50/2000/2000 $\mu$ F<br>200/25/20V | 066-132     |
| C302          | Elect. 500/200/50 $\mu$ F<br>150/80/80V   | 066-131     |
| C303          | Mylar 1 $\mu$ F 250V                      | 064-104     |
| C304          | Mylar .22 $\mu$ F 250V                    | 064-043     |
| C305          | Elect. 100 $\mu$ F 40V                    | 066-176     |
| C308          | Elect. 640 $\mu$ F 25V                    | 066-135     |

## DIODES

|      |                       |         |
|------|-----------------------|---------|
| D1,2 | Si. Signal Diode      | 070-047 |
| D301 | Full Wave Bridge 400V | 070-044 |
| D302 | Full Wave Bridge 50V  | 070-045 |
| D303 | Si. Rectifier         | 070-031 |
| D304 | Zener Diode 75V       | 070-025 |
| D305 | Bias Diode            | 070-046 |

|      |                |         |
|------|----------------|---------|
| F301 | Fuse, 1 ampere | 089-002 |
|------|----------------|---------|

## TRANSISTORS

|          |                    |         |
|----------|--------------------|---------|
| Q1,2     | Si. NPN transistor | 132-105 |
| Q3,4     | Si. NPN transistor | 132-093 |
| Q5,6     | Si. NPN transistor | 132-093 |
| Q7,8     | Si. NPN transistor | 132-095 |
| Q9,10    | Si. NPN transistor | 132-095 |
| Q11,12   | NPN transistor     | 132-092 |
| Q13,14   | Si. NPN transistor | 132-105 |
| Q201,202 | Si. PNP transistor | 132-096 |
| Q203,204 | Si. NPN transistor | 132-095 |
| Q205,206 | Si. PNP transistor | 132-096 |
| Q207,208 | Si. NPN transistor | 132-092 |
| Q209,210 | Si. NPN transistor | 132-065 |
| Q301     | Si. NPN transistor | 132-028 |
| Q302     | Si. NPN transistor | 132-065 |

## POTENTIOMETERS

|          |                         |         |
|----------|-------------------------|---------|
| R15,16   | Phono level control     | 134-219 |
| R17,18   | Phono level control     | 134-219 |
| R69      | Volume control          | 134-210 |
| R70      | Balance control         | 134-209 |
| R75,76   | Bass trim control       | 134-186 |
| R201,202 | Output level control    | 134-186 |
| R233,234 | Headphone level control | 134-186 |
| R259     | Center channel level    | 134-186 |

## RESISTORS

|          |                             |         |
|----------|-----------------------------|---------|
| R251,252 | Wirewound 15 $\Omega$ 5% 7W | 139-073 |
| R253,254 | Wirewound 1 $\Omega$ 10% 2W | 139-075 |
| R301     | Wirewound 1.5k 5% 5W        | 139-074 |

## SWITCHES

|          |                       |         |
|----------|-----------------------|---------|
| S1       | Pushbutton switch     | 150-005 |
| S2       | Input selector switch | 146-131 |
| S4       | Mode selector switch  | 146-134 |
| S101,102 | Treble control switch | 146-133 |
| S103,104 | Bass control switch   | 146-132 |
| S302     | Power amp. switch     | 148-028 |

## TRANSFORMERS

|      |                   |         |
|------|-------------------|---------|
| T301 | Power transformer | 044-062 |
|------|-------------------|---------|

## MODULES

|  |                       |         |
|--|-----------------------|---------|
|  | Tone control (treble) | 130-016 |
|--|-----------------------|---------|

ELIMINATION OF TURN-ON AND TURN-OFF NOISE

MODEL: C 28 Preamplifier

PURPOSE OF MODIFICATION: To eliminate the "shhhh" type of noise when initially turned-on, or a second or two after being turned off.

WHAT UNITS ARE AFFECTED: Serial No. 10X01 to 17X01 only.

WHEN MODIFICATION SHOULD BE MADE: When the customer specifically complains of the noise.

McINTOSH MODIFICATION KIT NUMBER: No kit available.

## PARTS REQUIRED:

| QUANTITY | PART NUMBER | DESCRIPTION            |
|----------|-------------|------------------------|
| 2        | 070-022     | Diode                  |
| 2        | 136-121     | 1.8k 1/2W 10% resistor |

PROCEDURE: (Refer to diagram on reverse side)

- Step 1: Remove top cover.
- Step 2: Remove R65 and R66 (4.7k resistors).
- Step 3: Install the new diode and resistor as shown.

(over)



ASSURE GROUND CONNECTION TO LOW LEVEL INPUTS

MODEL: C 28 Preamplifier

PURPOSE OF MODIFICATION: To assure that the high and low level amp. PC board 044-309 will always have a positive ground return.

WHAT UNITS ARE AFFECTED: All units with Serial No's. below AS 1660

WHEN MODIFICATION SHOULD BE MADE: When intermittent or complete loss of a channel is experienced in any of the low-input-level modes- or when units are being serviced for any other reason.

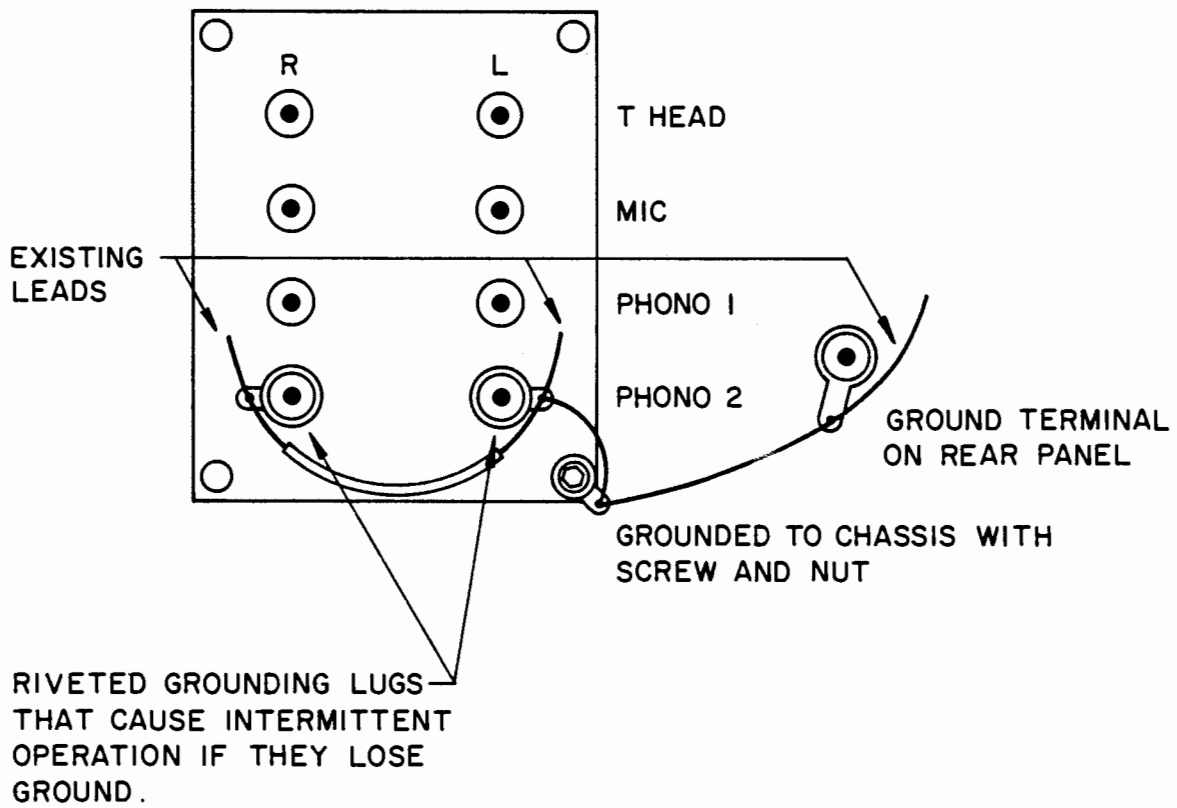
PARTS REQUIRED:

| QUANTITY | PART NUMBER | DESCRIPTION                 |
|----------|-------------|-----------------------------|
| 2-1/2"   | -           | #22 Bare hookup wire        |
| 1        | -           | Solder lug, lockwasher type |
| 1"       | -           | Sleeving                    |

- PROCEDURE:
1. Remove top and bottom covers.
  2. Unscrew screw and nut and place solder lug between plate and rear panel. Tighten screw.
  3. Solder bare wire between ground terminal lug on rear panel to newly mounted lug, then another piece of bare wire to riveted solder lug at Phono 2 left.
  4. Then solder sleeved bare wire between phono 2 left solder lug and phono 2 Right solder lug.
  5. Replace top and bottom covers.

(over)

BACKSIDE OF LOW LEVEL INPUT PLATE



ELIMINATION OF RADIO FREQUENCY INTERFERENCE

Model: C 28

Purpose of Modification: To eliminate radio interference caused by Citizens Band Transceivers and other transmitters.

When Modification Should Be Made: When customer complains of this type of interference.

Parts Required:

| <u>Quantity</u> | <u>Part No.</u> | <u>Description</u>                |
|-----------------|-----------------|-----------------------------------|
| 12              | 136296          | Resistor: 1K $\Omega$ , 1/4W, 10% |
| 6               | 061128          | Capacitor, disc: 470pF            |
| 2               | 061023          | Capacitor, disc: 100pF            |

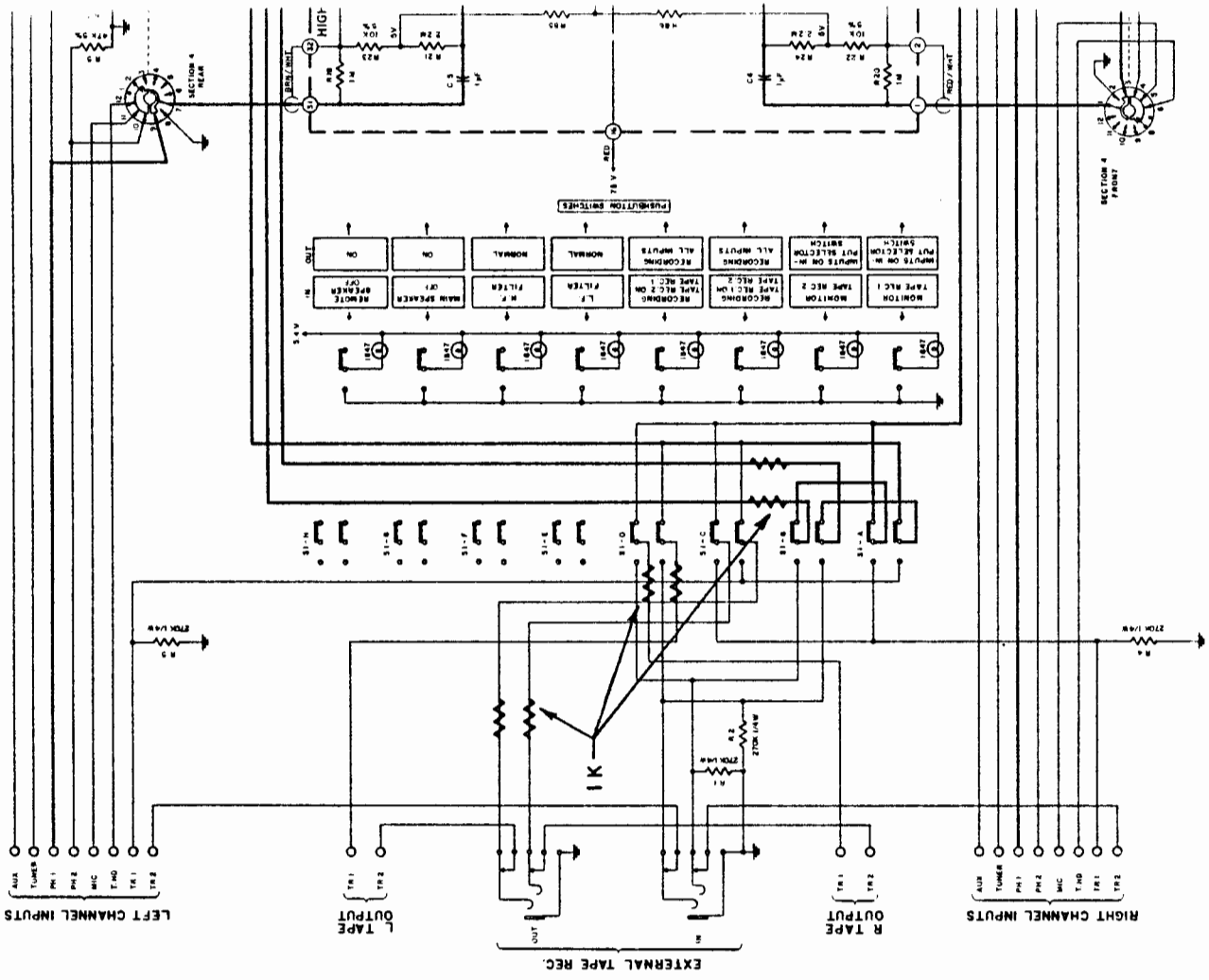
Procedure:

1. Remove top and bottom covers.
2. Remove the screws holding the level set panel in place.
3. Referring to diagram 1 and with the C 28 upside down, locate the four coaxial cables that connect to push button switches, S1-B and S1-D. Insert the 1K $\Omega$  resistors in series with each coaxial cable right at the switch terminal.
4. Referring to diagram 1 and with the C 28 upside down, replace each of the two wires (Blue and Blue/white) that connect the front panel "Tape-Output" jack with push button switch S1-B, with 1K $\Omega$  resistor. Provide sleeving on both resistor leads.
5. Referring to diagram 2 and with the C 28 right side up, locate Section 3 - wafer (front and rear) of the input selector switch. Locate the coaxial cables connected to lugs 9-rear and 3-front. Insert a 1K $\Omega$  resistor in series with each cable right at the switch lugs.
6. Referring to diagram 3 and with the C 28 right side up, locate the volume control underneath the level set panel. Locate the coaxial cables connected to the center lugs of the volume control. Insert a 1K $\Omega$  resistor in series with each cable right at the control lugs. Use sleeving to prevent shorting to panel.
7. Referring to diagram 4 and 5 and with the C 28 upside down locate the 044309 high and low level PC board. Connect a 100pF and a 470pF capacitor for each channel as indicated on the PC board diagram 4 and schematic diagram 5. Capacitor leads should not exceed 1/4 inch.

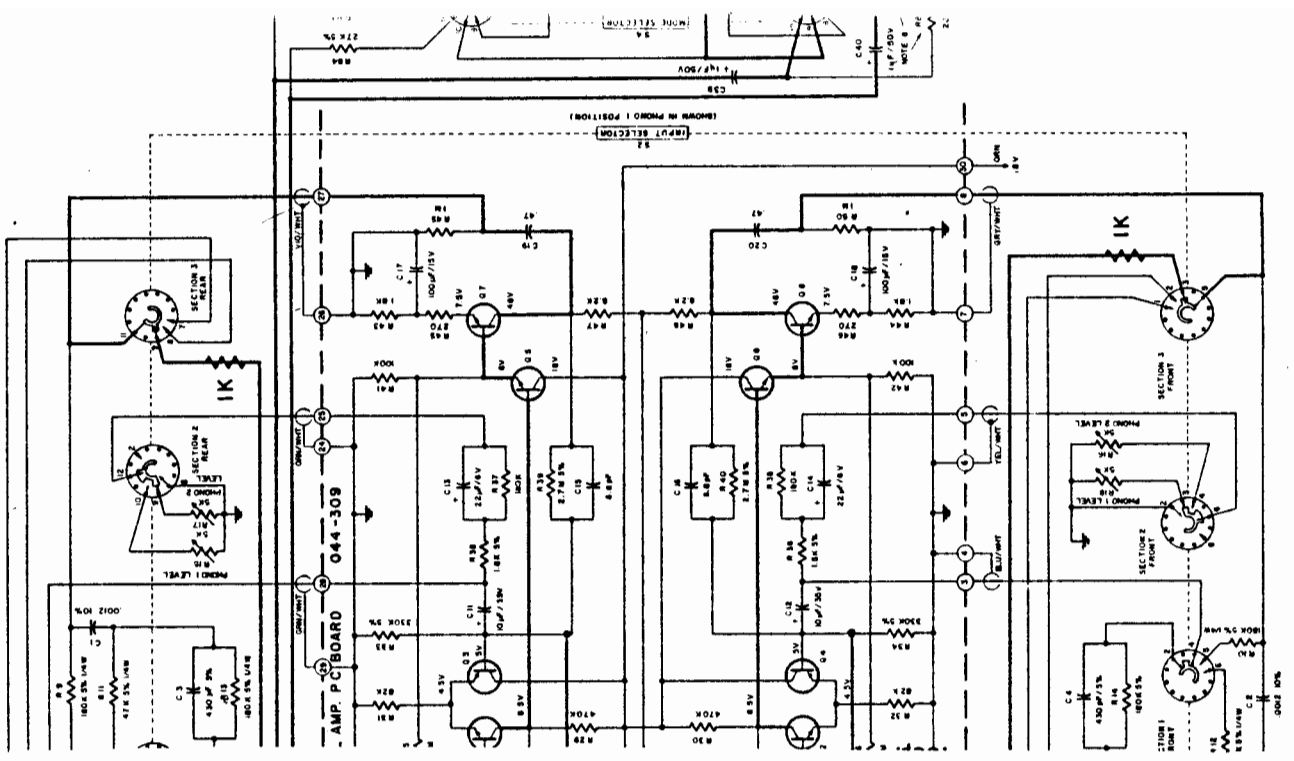
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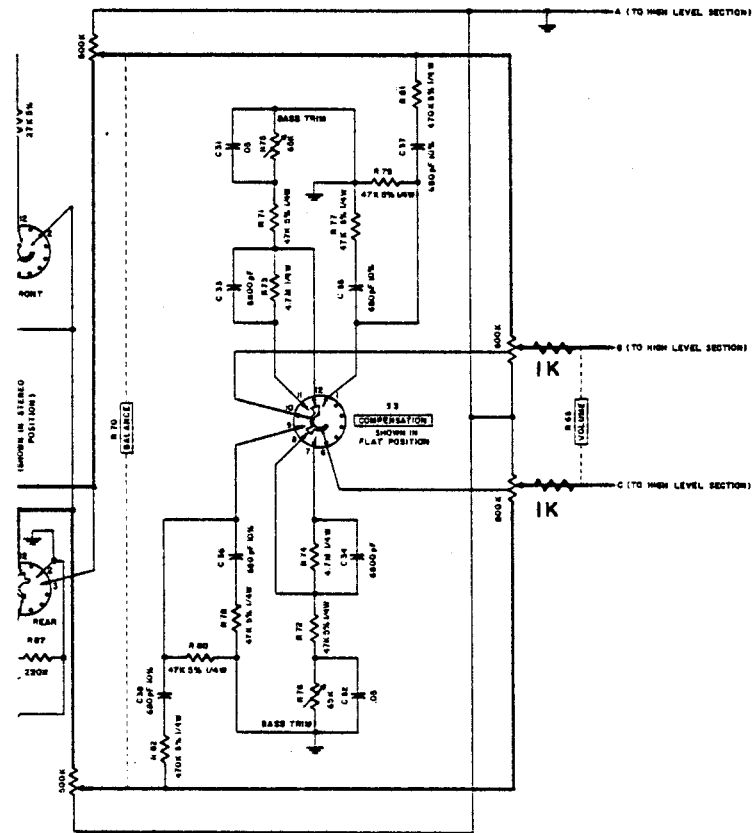
8. Referring to diagram 6 and with the C 28 upside down, locate the filter and headphone PC board- 044509. Insert a  $1K\Omega$  resistor in series with the blue wire connected to pin 24 and the blue/white wire connected to pin 13. Both resistors to be inserted right at the pins.
9. Referring to diagram 6 and with the C 28 upside down, locate the filter and headphone PC board- 044509. Connect 2 each  $470pF$  for each channel as indicated on the diagrams. Capacitor leads should not exceed  $1/4$  inch.
10. Referring to diagram 7 and with the C 28 right side up, locate the blue/white and green/white coaxial cables that connects to the right and left output level controls on the level set panel. Disconnect the blue shield - wire of the blue/white coaxial cable from the terminal strip and reconnect it to an adjacent lug of the same terminal strip. This lug is already occupied by a yellow wire. Disconnect the green shield - wire of the green/white coaxial cable from the terminal strip and reconnect it to an adjacent lug of the same terminal strip, already occupied by a yellow wire. The net effect of this would be as shown on diagram 7.
11. Replace level set panel and top and bottom covers. Test for proper function of all inputs and outputs. Check specifications.



DIAG. 1

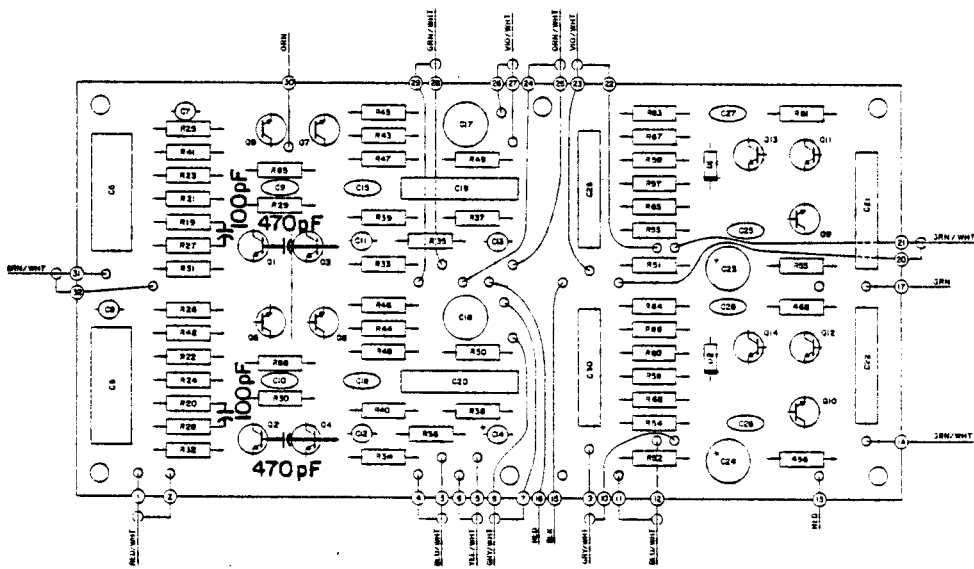


DIAG. 2

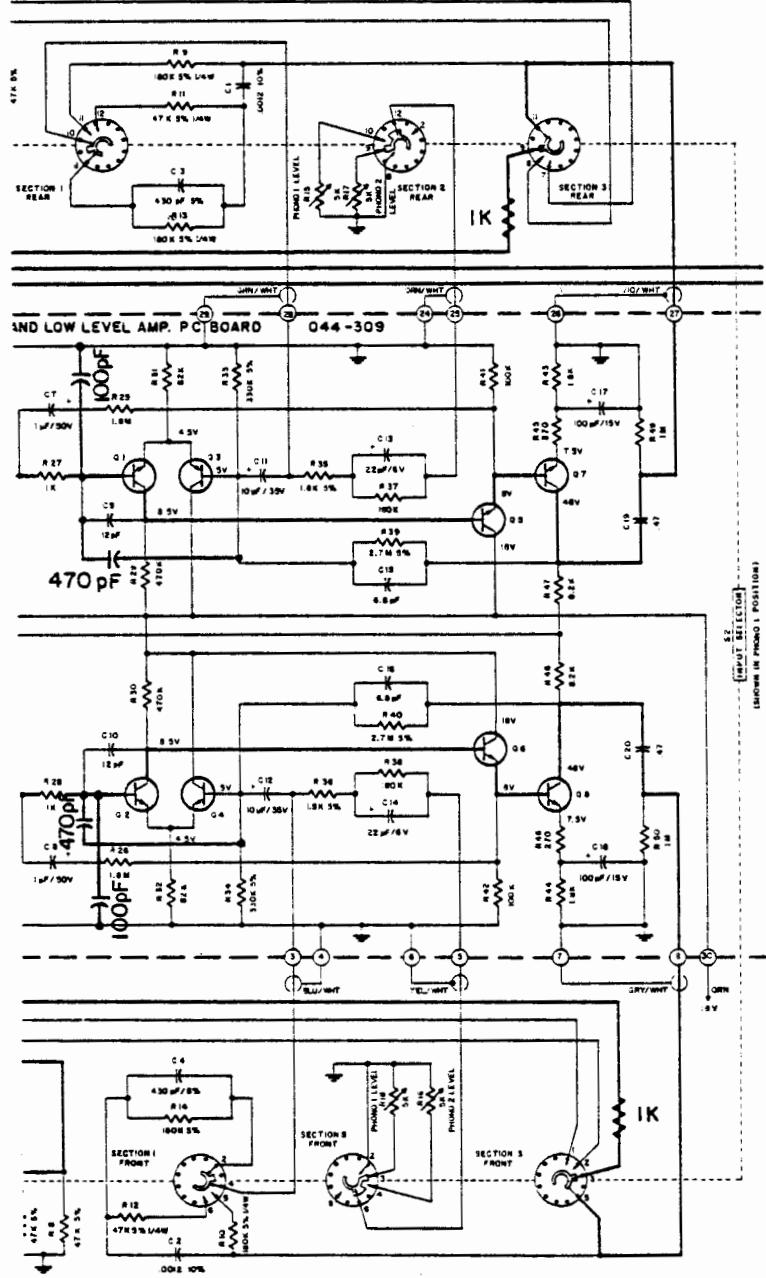


DIAG. 3

HIGH & LOW LEVEL PC BOARD 044-309

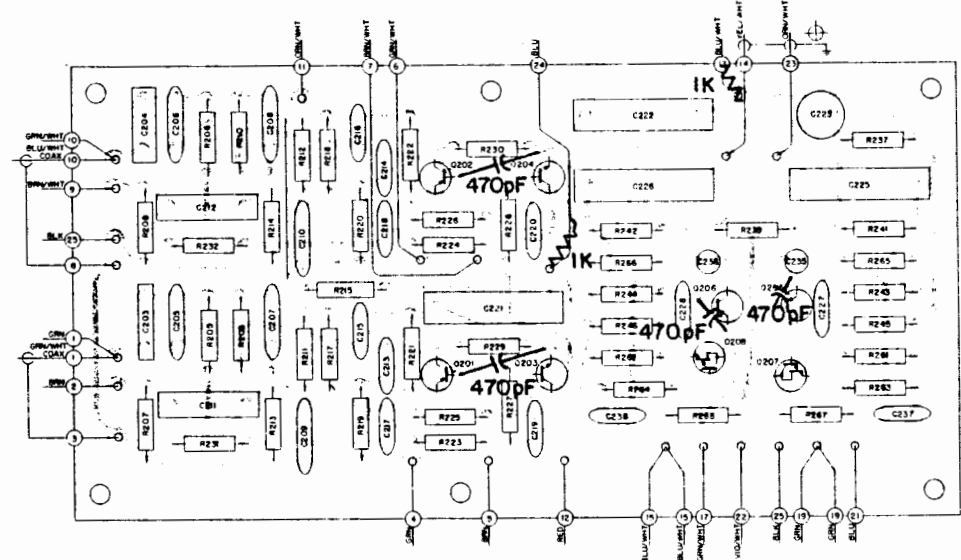


DIAG. 4



DIAG. 5

FILTER & HEADPHONE PRINTED CIRCUIT BOARD 044-509



DIAG. 6



|                       |         |
|-----------------------|---------|
| Tone control (treble) | 130-017 |
| Tone control (bass)   | 130-018 |
| Tone control (bass)   | 130-019 |

## LAMPS

|                          |         |
|--------------------------|---------|
| #1866 (Front Panel)      | 058-014 |
| #1847 (Pushbutton Lamps) | 058-008 |
| Indicator Lamp           | 058-041 |

## FRONT PANEL &amp; TRIM

|                      |         |
|----------------------|---------|
| Front panel          | 044-067 |
| Front panel end caps | 018-120 |
| Volume control knob  | 044-372 |
| Mode selector knob   | 044-372 |
| Input selector knob  | 044-372 |
| left bass knob       | 044-371 |
| Right bass knob      | 044-371 |
| Left treble knob     | 044-371 |
| Right treble knob    | 044-371 |
| Balance knob         | 090-100 |
| Comp. knob           | 044-375 |
| Pushbutton           | 017-128 |
| Bass trim knob       | 090-010 |
| Phono level knob     | 090-010 |
| Headphone level knob | 090-010 |
| Output level knob    | 090-010 |
| Center channel knob  | 090-010 |

## MOUNTING SYSTEM

|                        |         |
|------------------------|---------|
| Shelf Bracket (right)  | 043-622 |
| Shelf Bracket (left)   | 043-623 |
| Mounting Template #100 | 038-179 |
| Hardware Package       | 043-792 |

## MISCELLANEOUS ITEMS

|                  |         |
|------------------|---------|
| Line Cord        | 170-021 |
| Fuseholder       | 178-001 |
| Shipping carton  | 044-082 |
| Plastic feet     | 017-041 |
| Shorting plug    | 127-001 |
| Audio cable (6') | 170-015 |
| Owners manual    | 038-628 |

REPLACEMENT PARTS  
FOR SCR 1

|      |                       |         |
|------|-----------------------|---------|
| K1,2 | Relay 3PST            | 087-011 |
|      | Terminal Block        | 074-003 |
|      | Interconnecting Cable | 170-062 |

REPLACEMENT PARTS  
FOR SCR 2

|      |                       |         |
|------|-----------------------|---------|
| K1,2 | Relay 3PST            | 087-011 |
| K3   | Relay SPST            | 087-009 |
|      | Terminal Block        | 074-003 |
|      | AC Power Cord         | 170-068 |
|      | Interconnecting Cable | 170-067 |