140-TYPE AMPLIFIER — DESCRIPTION

CONTENTS

1. GENERAL

1.01 This section describes the 140A amplifier. When mounted in a metal cabinet it is known as the 1140A. The electrical and mechanical features of this amplifier are discussed in detail; installation information is also included.

1.02 This amplifier was designed as a general purpose amplifier. Its principal application is in paging system service. It can also be used for general monitoring and in similar services to supply power to loudspeakers. The amplifier may be used on subscriber premises. The input transformer is so designed that it may be connected directly to telephone lines, eliminating the need for external repeating coils to provide isolation between the line and the amplifier.

1.03 The amplifier contains its own power supply which requires 105 to 125 volts ac 50 to 60 cycles or 105 to 125 volts dc. Conversion of the amplifier from one to the other is by means of a switch mounted on the chassis. The amplifier is protected by a 2 ampere Slow Blow fuse. The amplifier is operated ungrounded and is insulated electrically from the KS-13678 cabinet. The cabinet is grounded by means of a third conductor in the power cord.

1.04 The gain frequency characteristic of the amplifier is essentially flat ± 1 db over the range from 50 to 10,000 cycles and ± 2 db over the range from 50 to 15,000 cycles. The maximum gain between 600 ohm impedances is nominally 60 db. The amplifier is equipped with a volume control which is continuously variable from "off" to maximum output.

1.05 The amplifier will deliver into its optimum load impedance a power of 10 watts (+40 dbm) when operated on ac power and 6 watts (+37.8 dbm) when operated on dc.

1.06 The output noise should not exceed −15 dbm unweighted. The signal-to-noise ratio at full power output is 55 db.

1.07 The 140-type amplifier may be mounted in a KS-13678 cabinet or in a 19-inch relay rack. When rack mounted, a 205B mounting plate and a 405C panel must be supplied. The amplifier is 12-1/2 inches long, 7 inches deep and 6 inches high. The cabinet is 12-3/4 inches long, 8-1/2 inches deep and 9 inches high. The amplifier is shown in Fig. 1.

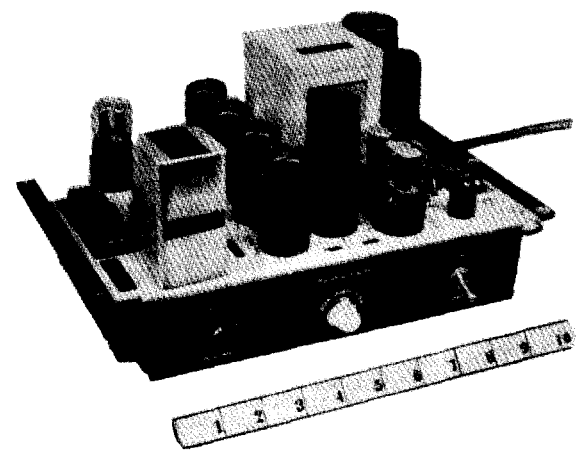


Fig. 1—140 Amplifier

On the front side of the chassis and extending through a cut-out in the cabinet panel are an "ON-OFF" power switch, a pilot light, and a volume control, which is continuously adjustable to "OFF." Knockouts are provided in the sides, back and bottom of the cabinet to accommodate the power cord and the input and output external wiring.

2. TRANSMISSION AND CIRCUIT FEATURES

2.01 The schematic diagram of the 140A amplifier is shown in Fig. 3.

Basic Amplifier Circuit

2.02 Eight commercial receiving type electron tubes are used in the amplifier: two 6SL7 tubes as voltage amplifiers, four 25L6 tubes as

power amplifiers, and two 25Z6 rectifier tubes, are used in a voltage doubling rectifier circuit when the amplifier is operated from alternating current. When operated from direct current the anodes and cathodes of the two rectifier tubes are effectively disconnected from the circuit, and the direct current line voltage is applied to the amplifier tubes. Filaments of the eight tubes are connected in series parallel in two groups, as shown in the schematic diagram. A winding on the output transformer provides a sample of the output voltage of the amplifier for insertion in the cathode connection of the second voltage amplifier stage for stabilized feedback. This feedback voltage aids in reducing noise and distortion and stabilizes the internal output impedance of the amplifier.

Input Circuit and First Stage

2.03 Input to the amplifier is by means of connection to the input transformer, T1. The impedance of the circuit to which the amplifier input may be connected ranges from 75 to 1200 ohms for the direct connection and from 0 to 10,000 ohms bridging. The actual internal input impedance of the amplifier is 1200 ohms direct and 7200 ohms bridging.

2.04 Input connections for various source impedances are shown in Table 1.

Table 1—Input Connections

Nominal Source Impedance	Impedance Range	Input Connections
150 ohms	75 to 300 ohms	2 and 3
600 ohms	300 to 1200 ohms	2 and 4
600 ohm bridging	0 to 10,000 ohms	1 and 5

2.05 The first stage uses both sections of the 6SL7 twin triode, V1, in parallel operation. The grids are connected to the arm of the gain control, P1. The plates are connected to the interstage circuit consisting of R4, C4 and R5.

2.06 The volume control used in the 140A amplifier is a potentiometer of 50,000 ohms for adjusting the input signal voltage to the grid of V1. The control is continuously adjustable to "OFF."

Phase Inverter and Interstage Circuit

2.07 The second 6SL7, V2, is a voltage amplifier which converts the single input to push-pull output to drive the push-pull power output tubes, V3, V4, V5 and V6. The circuit of V2 in which a single input is converted to push-pull output is shown schematically in Fig. 2. The two sets of elements of V2 are labeled for convenience #1 and #2. Section 1 acts as a conventional single ended amplifier and accepts the signal voltage from the plate load resistor of V1, amplifies it and supplies the driving voltage for the grids of V3 and V5. Signal voltage from the plate load resistor of section 1 of V2 is also applied through capacitor C5 to the grid of section 2 of V2. The requirements under which section 2 must operate are that the output voltage across its load resistor must be of the same amplitude as is the signal voltage across the plate load resistor of section 1, and the phase of the output signal voltage from section 2 must be shifted 180 degrees from that of section 1.

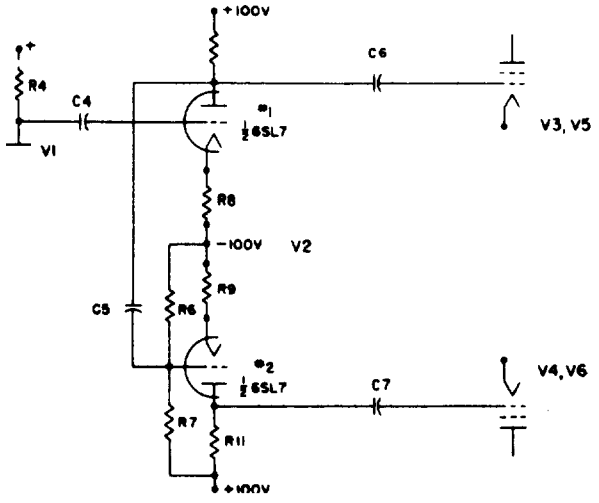


Fig. 2—Phase Inverter Schematic

2.08 For dc operation the grid of section 2 is maintained at approximately 18.5 volts dc above the negative terminal of the 100 volts plate supply, by means of the voltage divider R6 and R7. This positive bias causes the tube to stabilize itself at a plate current of approximately 0.6 milliampere, due to the voltage drop across the cathode resistor R9. This voltage drop is approximately 20 volts, or one and one-half volts greater than the voltage across R6, resulting in an effective grid bias of −1.5 volts. Due to the relatively low value of the plate load resistor, and to the large amount of signal voltage (degenerative voltage) appearing across the cathode resistor R9, the useful gain of the tube is unity. This, with the phase reversal, which is a normal function of the tube, causes section 2 to meet the requirements set up for that tube.

Output Stage

2.09 The output stage consists of four 25L6 electron tubes, V3, V4, V5 and V6 connected in push-pull parallel.

2.10 The following output power and distortion characteristics are typical for the 140A amplifier when operated from alternating current mains, and into optimum nominal load impedance:

Output Power	% Distortion	Freq. Range in Cycles
4 watts	less than 1%	50—3000
8 watts	less than 2%	50—4000
10 watts	less than 5%	50—6000

2.11 The following output power and distortion characteristics are typical for dc operation, into optimum nominal load impedance:

Output Power	% Distortion	Freq. Range in Cycles
4 watts	less than 1%	50 — 5000
5 watts	less than 2%	50 — 6000
6 watts	less than 5%	50 — 7500

2.12 The output will accommodate load impedances from 1 to 600 ohms and from 2 to 1500 ohms (depending on whether the line voltage supply is ac or dc) as well as the standard 70 volt loudspeaker distribution line. Satisfactory operation will be obtained when operating the 140A amplifier into the various load impedances as shown in Table 2 below:

Power Supply

2.13 A three wire power cord is provided to which is attached a three prong Hubbell Cap. The WHITE (negative) and the BLACK (positive) wires carry the power to the amplifier, while the GREEN wire connects to the ground terminal of the outlet. This wire grounds the cabinet but not the chassis, which is insulated from the cabinet by insulating strips on the channels which support the chassis. Care must be taken to assure that the color code is carried through on the power co d, since it is possible, in some combinations, to place the cabinet at a potential other than ground potential by improperly connecting the wires. The amplifier is protected by a 2 ampere Slow Blow 3AG Littlefuse.

2.14 When operated from alternating current the ac-dc switch on the chassis must be in the ac position. This connects the two rectifier tubes, V7 and V8, in the voltage doubling rectifier circuit. The load on the rectifier is such that approximately 220 volts maximum is available for the plates of the amplifier tubes. Plate voltage for V1 and V2 is supplied through resistor R18, and is filtered by capacitor C2.2.

2.15 The ac-dc switch must be in the dc position when the amplifier is operated from direct current mains. In this position the two rectifier tubes, V7 and V8 are switched from the circuit (with the exception of the filament circuit). Capacitor C1 is also switched from the circuit. The full line voltage is applied to the plates and screens of the 25L6 vacuum tubes, and a reduced voltage is applied to the plates of V1 and V2 through resistor R18, and noise voltages are filtered by means of C2.2. Since the voltage available for the amplifier circuits is lower when the amplifier is operated from direct current mains than it is when operated from alternating current mains, the maximum power output is somewhat less.

3. INSTALLATION

Cabinet Mounting

3.01 The 140A amplifier is intended for mounting in the KS-13678 cabinet, after which it becomes the 1140A amplifier. The 1140A amplifier is designed for either shelf or wall mounting. Holes in the back of the cabinet are provided for wall mounting. Knockouts for the entrance of the power cord and external wiring are provided on the back, sides and bottom of the cabinet. To mount on the wall it will

Table 2—Load Impedances

AC Supply

Nominal Load	Load Range	Strap	Output Terminals
4 ohms	2 to 6 ohms		1 and 2
8 ohms	4 to 12 ohms		2 and 3
24 ohms	12 to 36 ohms		1 and 3
250 ohms	125 to 375 ohms	4-6, 5-7	4 and 7
1000 ohms	500 to 1500 ohms	5-6	4 and 7
70 volts		3-4-6, 5-7	1 and 7

DC Supply

Nominal Load	Load Range	Strap	Output Terminals
1.5 ohms	1 to 2.5 ohms		1 and 2
3 ohms	2 to 4.5 ohms		2 and 3
8 ohms	6 to 14 ohms		1 and 3
100 ohms	60 to 150 ohms	4-6, 5-7	4 and 7
400 ohms	250 to 600 ohms	5-6	4 and 7
70 volts		3-4, 5-6	1 and 7

be necessary to remove the amplifier from the cabinet. This may be done by removing two screws which hold the chassis on the mounting brackets inside the chassis. The green wire from the power cord is connected under one of the screws, and care should be exercised to reconnect this wire to ground the cabinet after the amplifier is reassembled.

Relay Rack Mounting

3.02 For relay rack mounting a 405C panel and a 205B mounting plate must be ordered separately. This includes a 205A mounting plate with mounting screws, mounting accessories and a detailed assembly drawing. The mat occupies 8-3/4 inches of vertical rack space. The order of assembly is as follows:

(1) Relocate the front control panel of the 140A amplifier by removing the mounting screws and remounting the plate in a position 90 degrees from the original position on the chassis brackets by using the same screws and washers. Tapped holes are provided for the new position in the brackets.

(2) Referring to the instruction sheet, which is packed with the 205B mounting plate assemble the brackets to the 205A mounting plate.

(3) Mount the 140A amplifier on the brackets, fastening the GREEN wire from the power cord under the top right-hand mounting screw as shown, in order to ground the mounting plate.

(4) Mount the assembled unit on the relay rack.

(5) Assemble the 405C panel to the rack. A three pole receptacle is required to accommodate the cap on the power cord.

Ventilation

3.03 In addition to the heat dissipated by the electron tubes, resistors R22.1, R22.2 and R22.3 dissipate a total of approximately 25 watts of heat. Openings in the cabinet are provided for adequate circulation of air to carry away this heat. The cabinet, however, must not be mounted in an enclosed space where free access to circulating air is not available. Operating the 1140A amplifier in an enclosure such as a closet requires ventilation of the enclosure to prevent excessive temperature rise over extended periods of operation. When the 140A amplifier is mounted in an enclosed relay rack, approximately 30 square inches of opening should be provided at the top and bottom of the rack for each 140A amplifier or equivalent heat generating equipment.

Wiring

3.04 A wiring diagram of the amplifier is shown in Fig. 4. The usual methods should be followed in connecting the input, output and power circuits to the amplifier.

4. PARTS LIST

4.01 The various component parts of the 140A and 1140A amplifier are listed in Table 3.

Table 3—Parts List

Desig. No.	Catalog Description Apparatus
Sprague Electric Company Capacitors or Equivalent	
C1	DFP 110 MFD. 150 VDC
C2	DFP 110 MFD. 150 VDC, 80 MFD. 300 VDC
C3	SPX 24A20 0.1 MFD.
C4	SPP 24B17 .05 MFD.
C5	SPP 24B17 .05 MFD.
C6	PPX 24B17 .05 MFD.
C7	PPX 24B17 .05 MFD.
Cornell Dubilier Capacitors or Equivalent	
C8	1W .001 MFD.
C9	5W .0001 MFD.
Allen Bradley Company Resistors or Equivalent Except as Noted	
R1	Type EB 3000 ohms ± 5%
R2	Type EB 3000 ohms ± 5%
R3	Type EB 2000 ohms ± 5%
R4	Type EB 33,000 ohms ± 10%
R5	Type EB 0.22 megohm ± 20%
R6	Type EB 0.51 megohm ± 5%
R7	Type EB 2.0 megohm ± 5%
R8	Type EB 3000 ohms ± 5%
R9	Type EB 39,000 ohms ± 5%
R10	Type EB 0.1 megohm ± 20%
R11	Type EB 51,000 ohms ± 5%
R12	Type EB 0.22 megohm ± 20%
R13	Type EB 0.22 megohm ± 20%
R14	Type HB 33 ohms ± 10%
R15	Type EB 10,000 ohms ± 20%
R16	Type EB 10,000 ohms ± 20%
R17	Type EB 10,000 ohms ± 20%
R18	Type EB 24,000 ohms ± 5%
R19	Type HB 24 ohms ± 10%
R22	Type SBT-CM3207 Ballast per BA-170591. Obtain from Clarostat Mfg. Co., Dover, New Hampshire.
R23	Type BW 1/2 5.1 ohms ± 20% International Resistance Co.

Desig. No.	Catalog Description Apparatus
R24	Type BW 1/2 5.1 ohms ± 20% International Resistance Co.
D1	DPST H. & H. Switch per ESA-676800-13
D2	BO 147058 Switch
F1	Cat. #313002 Fuse (2A), Cat. #342001 Fuse MTG. Littlefuse Inc., Chicago, Ill.
LP1	91408-937 Dial Light with NE-51 lamp. Dial Light Co. of America
P1	Allen Bradley Co. potentiometer type JA 5031 with type FS 3048 shaft and equipped with nut and lockwasher.
T1	285S Input Transformer W. E. Co.
T2	171D Output Transformer W. E. Co.

Miscellaneous Hardware

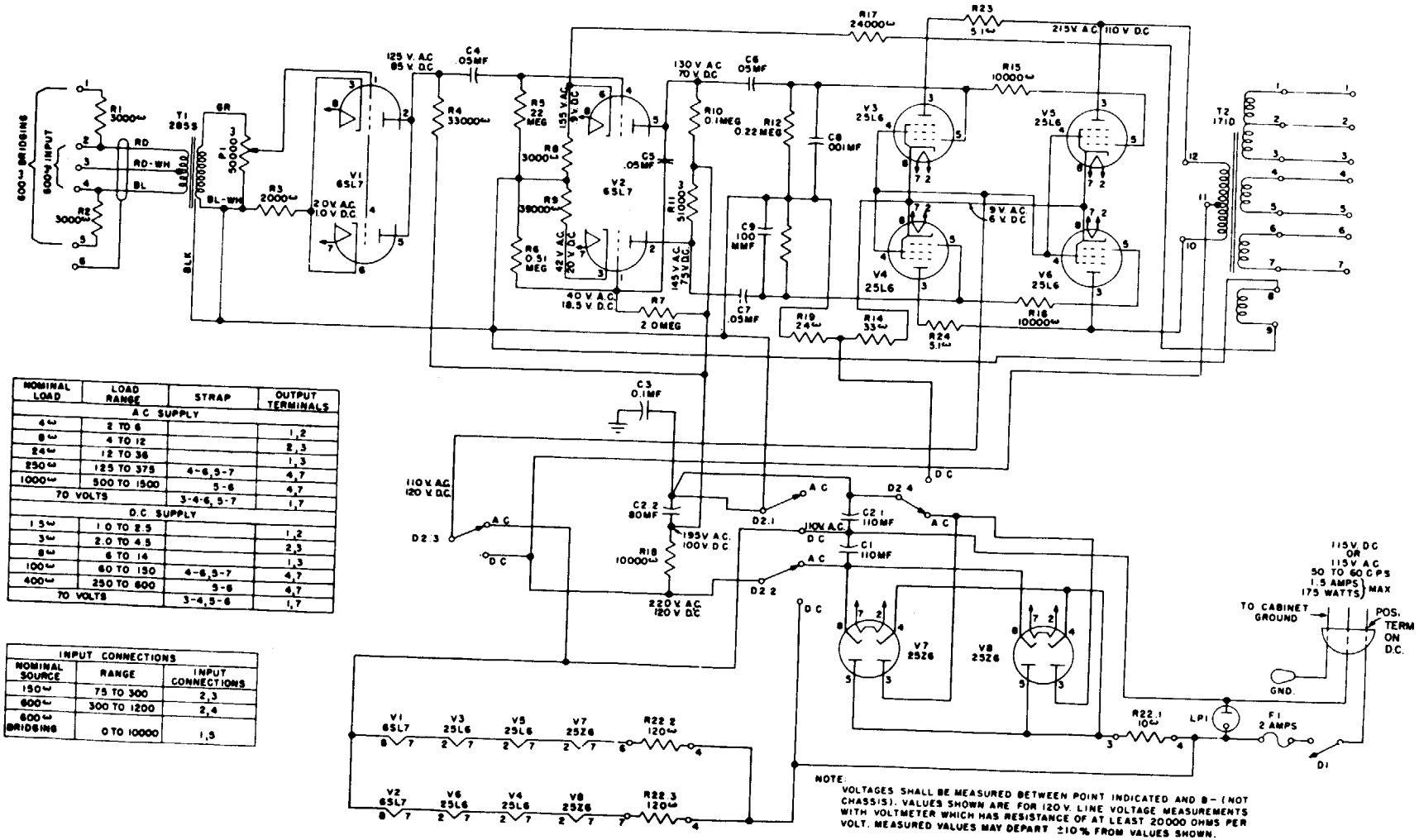
Number Required	Description
1	Harvey Hubbell Plug Cap #5264
2	Howard B Jones Terminal Strips Type 7-140 Y-MS
9	KS-13364, List 3, Vacuum Tube Sockets
1	S-292-3L Kurz Kasch Knob

Electron Tubes

Number Required	Type
2	6SL7
4	25L6
2	25Z6

Cabinet

(For 1140A amplifier only)
1 per KS-13678



NOMINAL LOAD	LOAD RANGE	STRAP	OUTPUT TERMINALS
A C SUPPLY			
4Ω	2 TO 6		1,2
8Ω	4 TO 12		2,3
24Ω	12 TO 36		1,3
250Ω	125 TO 375	4-6,5-7	4,7
1000Ω	500 TO 1500	5-6	4,7
70 VOLTS		3-4-6,5-7	1,7
D.C SUPPLY			
1.5Ω	1.0 TO 2.5		1,2
3Ω	2.0 TO 4.5		2,3
8Ω	6 TO 14		1,3
100Ω	60 TO 150	4-6,5-7	4,7
400Ω	250 TO 600	5-6	4,7
70 VOLTS		3-4,5-6	1,7

INPUT CONNECTIONS		
NOMINAL SOURCE	RANGE	INPUT CONNECTIONS
150Ω	75 TO 300	2,3
600Ω	300 TO 1200	2,4
600Ω BRIDGING	0 TO 10000	1,5

NOTE.
VOLTAGES SHALL BE MEASURED BETWEEN POINT INDICATED AND B- (NOT CHASSIS). VALUES SHOWN ARE FOR 120 V. LINE VOLTAGE MEASUREMENTS WITH VOLTMETER WHICH HAS RESISTANCE OF AT LEAST 20000 OHMS PER VOLT. MEASURED VALUES MAY DEPART ±10% FROM VALUES SHOWN.

Fig. 3—140A Amplifier Schematic

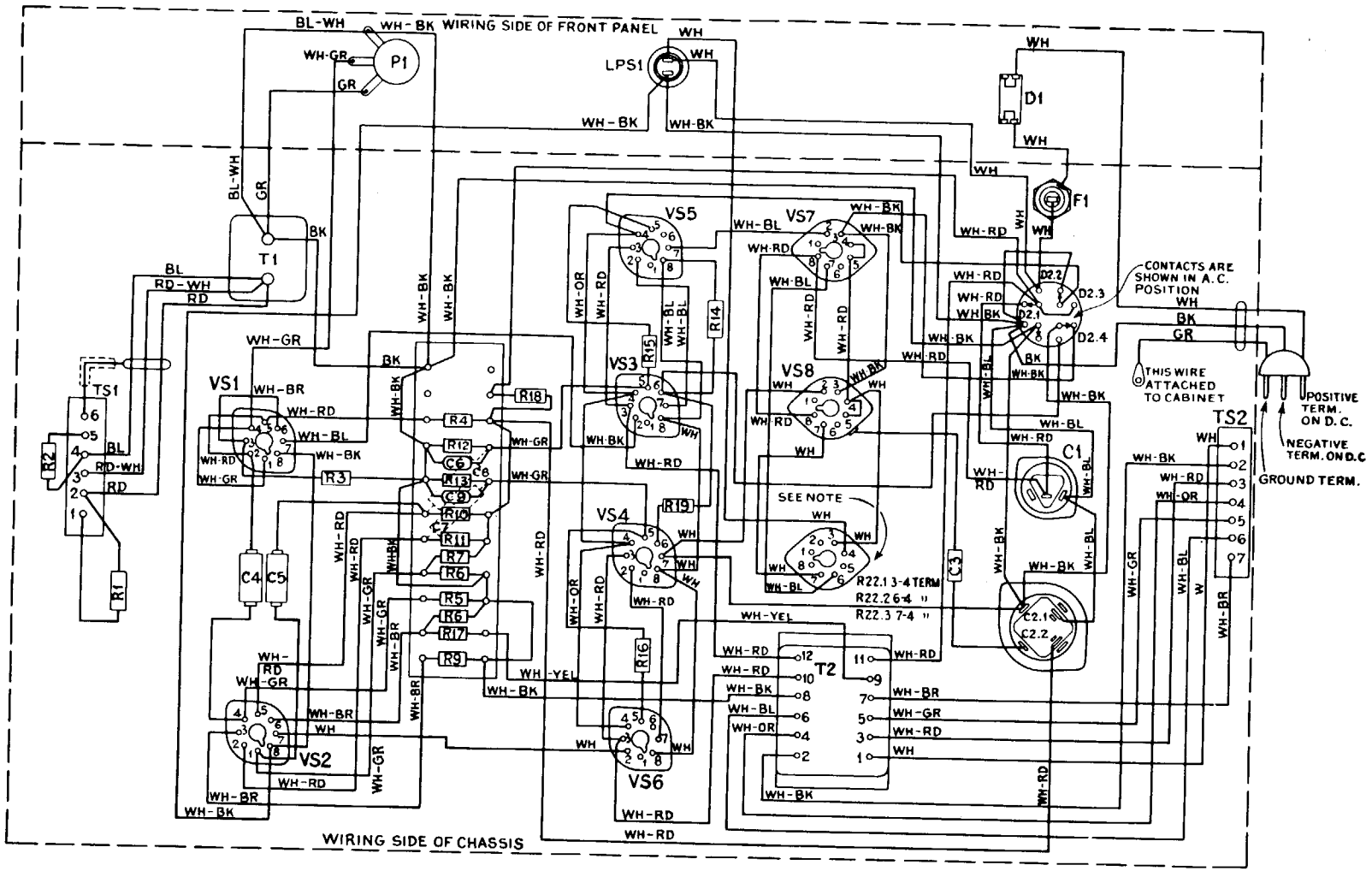


Fig. 4—Wiring Diagram