

DESCRIPTION AND SERVICING INSTRUCTIONS  
FOR 321290 ONE-HALF AMPERE AND 321132  
ONE AND ONE-HALF AMPERE POWER SUPPLY  
CIRCUIT CARD ASSEMBLIES ASSOCIATED WITH  
ELECTRICAL SERVICE ASSEMBLIES EQUIPPED  
FOR LOW LEVEL RFI (POLAR-EMC) OPERATION

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1. DESCRIPTION

1.01 The 0.5 ampere and 1.5 ampere power supplies, when installed in a shielded electrical service assembly (ESA) containing the proper transformer and filter assembly, are intended as radio frequency interference (rfi) suppression power sources in systems requiring low level rfi (Polar-EMC) kits.

1.02 The required power supply should be plugged into the 15-pin 148458 connector in the ESA that has a 198650 polarizing key between pins M and N for the 0.5 ampere power supply and between pins K and L for the

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the 1.5 ampere power supply. Refer to Specification 50505S for information regarding the ESA to be used, all of its components, and to the applicable wiring diagrams. See Figures 1 through 6 for the 0.5 ampere power supply and Figures 7 through 11 for the 1.5 ampere power supply.

1.03 The transformer and filter circuits for both power supplies are located in part of their associated electrical service assemblies (Figures 6, 10, and 11). The power transistor and heat sink for the 1.5 ampere power supply is also part of the electrical service assembly (ESA). The power transistor and heat sink for the 0.5 ampere power supply are included as part of the 321290 circuit card assembly.

1.04 Refer to Specification 50505S for information regarding complete power supplies, all associated electrical service assemblies, and for the wiring diagrams applicable to the electrical service assembly used. If more detailed information is required, obtain latest applicable circuit card assembly drawings 321290 and 321130 for one-half ampere power supply and drawing 321132 for the one and one-half ampere power supply.

1.05 The amperage rating and quantity of power supply circuit cards to be used (one per electrical service assembly) will depend upon the modification kit in which the ESA is to be included. Each power supply circuit card assembly is a part of some electrical service assembly and each ESA is part of a modification kit for conversion to low level operation.

## 2. TECHNICAL DATA

2.01 In the following paragraphs, the technical data refers to the complete power supply, including transformer and filter components in the associated electrical service assembly (ESA).

### ONE-HALF AMPERE POWER SUPPLY (321290)

2.02 The following technical data applies to 0.5 ampere power supplies when installed in an electrical service assembly that accommodates one to three selector magnet drivers (SMD), or clutch magnet drivers (CMD).

(a) Input: 100 v ac to 130 v ac, 45 to 66 hertz

(b) Output

- (1) +47 v dc to +53 v dc at 0.5 ampere maximum
- (2) +6.6 v dc to +7.8 v dc at 0.018 ampere maximum
- (3) -6.6 v dc to -7.8 v dc at 0.018 ampere maximum

(c) Fusing:

- (1) ac: 0.8 ampere, slow-blowing (162360)
- (2) dc: 0.5 ampere, fast-blowing (131807)

(d) Operating Ambient Temperature: +40<sup>o</sup>F to +120<sup>o</sup>F with cooling fan in Automatic Send-Receive Set (ASR)

**ONE AND ONE-HALF AMPERE POWER SUPPLY (321132)**

2.03 The following technical data applies to the 1.5 ampere power supply installed in an electrical service assembly that accommodates one to six selector magnet drivers (SMD), or clutch magnet drivers (CMD).

(a) Input: 100 v ac to 130 v ac, 45 to 66 hertz (cps)

(b) Output: +47 v dc to +53 v dc at 1.5 amperes maximum

(c) Fusing:

- (1) ac: 2 ampere slow-blowing (120166)
- (2) dc: 1.5 ampere fast-blowing (143631)

(d) Operating Ambient Temperature: +40<sup>o</sup>F to +120<sup>o</sup>F with cooling fan in a multiple page printer monitor cabinet (LBAC)

**3. PRINCIPLES OF OPERATION**

3.01 The following paragraphs explain the general operation of each power supply circuit card assembly when it is installed in an electrical service assembly (ESA). The transformer, filter, and the 1.5 ampere power transistor with heat sink are included as part of the ESA. For more detailed information, refer to the wiring diagram of the specific ESA that is used.

3.02 Refer to Paragraph 1.04 and 1.05 for associated apparatus and related specifications.

3.03 All electrical service assemblies which accommodate keyers and selector magnet drivers consist of a "double box" chassis construction. An inner aluminum box functions as an electrostatic shield for components mounted within the box. The inner box is enclosed by, and electrically isolated from, a slightly larger outer steel box which functions as a magnetic shield. Service assemblies for clutch magnet drivers do not contain an inner aluminum box; a single "box" construction is used to function as electrostatic and magnetic shield.

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(a) The inner box contains:

- (1) A mounting plate with printed circuit card connectors to accommodate a power supply printed circuit card assembly and the required number of driver and keyer card assemblies.
- (2) A screw terminal strip for signal and battery connections.
- (3) The power supply rectifier filter capacitor.

(b) In addition to enclosing the inner box, the outer box contains a power supply transformer, power line filter, and a screw terminal block for ac supply connections. A power switch and fuse are located on one side of the box.

### ONE-HALF AMPERE POWER SUPPLY (321290)

- 3.04 Transformer T1 and capacitor C8 of the full-wave rectifier circuit and low-pass filter components L1, L2, C9, C10, C11, and C12 are all located in the electrical service assembly, not on the circuit card assembly. (Refer to Figures 3, 4, 5, and 6.)
- 3.05 Transformer T1, diodes CR1, CR3, and capacitor C8 form a full-wave rectifier to obtain a minimum 58 volts unregulated dc.
- 3.06 Transistors Q1 and Q2 form a two stage series voltage regulating element. Both transistors are always conducting with the base-emitter drop of each transistor at approximately 0.7 volts. The drop across R2 (used in conjunction with C5 for noise suppression) is negligible. In effect, the emitter of Q1 (dc output) is clamped to the same potential as the reference diode combination CR7-CR12 (nominally 47 v). The difference between the dc output and unregulated dc appears across the collector-emitter junction of Q1.
- 3.07 Resistor R1 limits the current that divides between the CR7-CR12 reference diodes and the base of Q2, which is a gain stage for Q1. The base current of Q1 (Q2 collector current) is the base current of Q2 multiplied by the dc current gain ( $H_{FE}$ ) of Q2.
- 3.08 Resistor R7 across the output acts as a bleeder and also assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R6, the output would rise to the same value as the unregulated dc with no load connected.
- 3.09 The +7 volt output is obtained by dropping the unregulated dc voltage through resistor R4 to supply the zener reference diode CR6, which appears across the output.

- 3.10 R5 and CR5 provide -7 volts in a similar manner; however, a full-wave rectifier consisting of rectifier diodes CR2, CR4, and capacitor C4 is required to obtain the negative unregulated potential with respect to circuit common.
- 3.11 Capacitors C1, C2, and C3 are used to suppress noise transients which occur due to rectifier switching. Capacitors C6 and C7 and inductors L3, L4 suppress zener diode noise.
- 3.12 A low-pass filter consisting of L1, L2, C9, C10, C11, C12, and transformer shielding are used to obtain noise isolation between power line and power supply.

#### ONE AND ONE-HALF AMPERE POWER SUPPLY (321132)

- 3.13 Transformer T1 and capacitor C101 of the full-wave rectifier circuit and low-pass filter components L1, L2, C102, C103, C104, C105, transformer shielding, and the power transistor with heat sink Q2 (Q1 of ESA) are located in and are parts of the associated electrical service assembly. (Refer to Figures 8, 9, 10, and 11.)
- 3.14 Transformer T1, diodes CR1, CR2, and capacitor C101 form a full-wave rectifier to obtain a minimum 58 volts unregulated dc.
- 3.15 Transistors Q1 and Q2 (Q2 may be designated as Q1, or as some other designation on the ESA diagram) form a two-stage series voltage regulating element. Both transistors are always conducting with the base-emitter drop of each transistor at approximately 0.7 volts. The drop across R2 (used in conjunction with C4 for noise suppression) is negligible. In effect, the emitter of Q2 (dc output) is clamped to the same potential as the reference diode combination CR3-CR8 nominally 47 v). The difference between the dc output and unregulated dc appears across the collector-emitter junction of Q2.
- 3.16 Resistor R1 limits the current that divides between the CR3-CR8 reference diodes and the base of Q1, which is a gain stage for Q2. The base current of Q2 (Q1 collector-emitter current) is the base current of Q1 multiplied by the dc current gain ( $H_{FE}$ ) of Q1.
- 3.17 Resistor R4 across the output acts as a bleeder and also assures that Q1 and Q2 will conduct even when no load is connected across the output terminals. Without R4, the output would rise to the same value as the unregulated dc with no load connected.
- 3.18 Capacitors C1, C2, and C3 are used to suppress noise transients which occur due to rectifier switching.

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- 3.19 A low-pass filter (in ESA) consisting of L1, L2, C102, C103, C104, C105, and transformer shielding is used to obtain noise isolation between power line and power supply.
- 3.20 Fuse F102 limits current flowing in regulator and output to a total of 1.5 amperes.

### 4. SERVICING

Note: For installation instructions and other information not covered here, refer to the associated electrical service assembly (ESA) Specification 50505S, the referenced wiring diagrams, and modification kit specification for the applicable type of low level operation.

- 4.01 Servicing is required only to repair the power supply or correct wiring in case of fault. When a fault is not obvious, remove keyers and drivers from the service assembly; apply 100-130 volts ac power.
- 4.02 Colored test point jacks are located at the top of the power supply circuit card assembly; these jacks accept standard meter probes. All voltages are measured with respect to circuit common (black test jack labeled COM).
- 4.03 Whenever a power supply fault is apparent or suspected, immediately check all voltages at the test jacks; proper values are given in the following charts.

#### ONE-HALF AMPERE POWER SUPPLY (321290)

- 4.04 Test jack voltage measurements are shown on the following chart:

Required Measurements	Test Jack Labels			
	-7	+7	+UNREG	+50
Minimum — should be	-6.6	+6.6	+57	+47
Maximum — should be	-7.8	+7.8	+90	+53

4.05 If the +UNREG (unregulated rectifier) voltage is correct, use the following guide. (Refer to Figure 5.)

<u>Test Jack</u>	<u>Meter Reading</u>	<u>Difficulty</u>
+7	None (zero)	CR6 shorted or R4 open
+7	+57 to 90	CR6 open
-7	Zero	CR5 shorted or R5 open
-7	+57 to 90	CR5 open
+50	Zero	Q1 and/or Q2 open
+50	+57 to 90	Q1 and/or Q2 shorted

4.06 If the +UNREG voltage is not correct, check for the following:

<u>Test Jack</u>	<u>Meter Reading</u>	<u>Difficulty</u>
+UNREG	Zero	Loose or blown fuse
	Too low	CR1 and/or CR4 open or shorted defective filter capacitor defective transformer or primary filter

4.07 Fuse blowing - Continually blowing fuses indicate a shorted component or components. Disconnect power, remove the circuit card assembly and make continuity checks between circuit card connector terminals B and N, N and H, and B and H. A zero or near zero reading on the one ohm scale of a multimeter indicates a short; disregard any other reading. Also, check continuity between the power transistor case and its heat sink; the power transistor must be electrically isolated from the heat sink with mica insulators. If the board assembly checks satisfactorily, examine the power line filter, power transformer, and rectifier filter capacitor for a shorted condition. (These components are located within the service assembly.)

4.08 Failure to detect the fault using the methods described above normally indicates a loose or cold connection, broken or misplaced wire in the service assembly. Check all wiring according to appropriate wiring diagrams referenced in ESA specification.

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ONE AND ONE-HALF AMPERE POWER SUPPLY (321132)

4.09 Test jack voltage measurements are shown on the following chart:

Required Measurements	Test Jack Labels	
	+UNREG	+50
Minimum — should be	+57	+47
Maximum — should be	+90	+53

4.10 If the +UNREG (unregulated rectifier) voltage is correct, use the following guide:

<u>Test Jack</u>	<u>Meter Reading</u>	<u>Difficulty</u>
+50	Zero	Q1 and/or Q2 open
+50	+57 to 90	Q1 and/or Q2 shorted

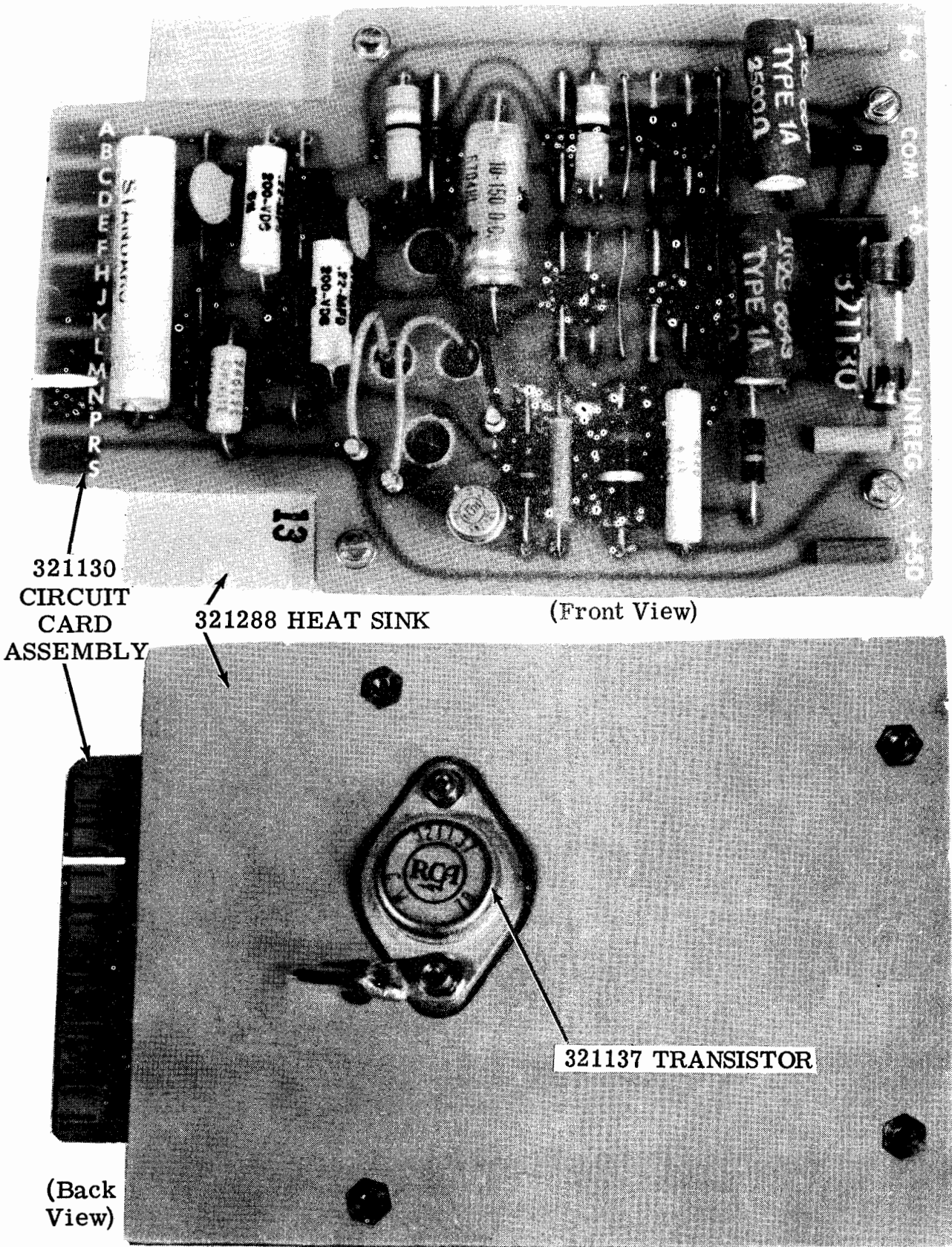
4.11 If the +UNREG voltage is not correct, check the following:

<u>Test Jack</u>	<u>Meter Reading</u>	<u>Difficulty</u>
+UNREG	Zero	Loose or blown fuse
	Too low	CR1 and/or CR2 open or shorted defective filter capacitor defective transformer or primary filter

4.12 Fuse blowing - Continually blowing fuses indicate a shorted component or components. Disconnect power, remove the circuit card assembly, and make continuity checks between circuit card connector terminals D and S, S and K and D and K. A zero or near zero reading on the one ohm scale of a multimeter indicates a short; disregard any other reading. Also, check continuity between the power transistor case and its heat sink; the power transistor must be electrically isolated from the heat sink with mica insulators. If the card assembly checks satisfactorily, examine the power line filter, power transformer, and rectifier filter capacitor for a shorted condition. (These components are located within the service assembly.)



**4.13 Failure to detect the fault using the methods described above normally indicates a loose or cold connection, broken or misplaced wire in the service assembly. Check all wiring according to appropriate wiring diagrams referenced in ESA Specification 50505S.**



321130 CIRCUIT CARD ASSEMBLY (Front View)  
321288 HEAT SINK

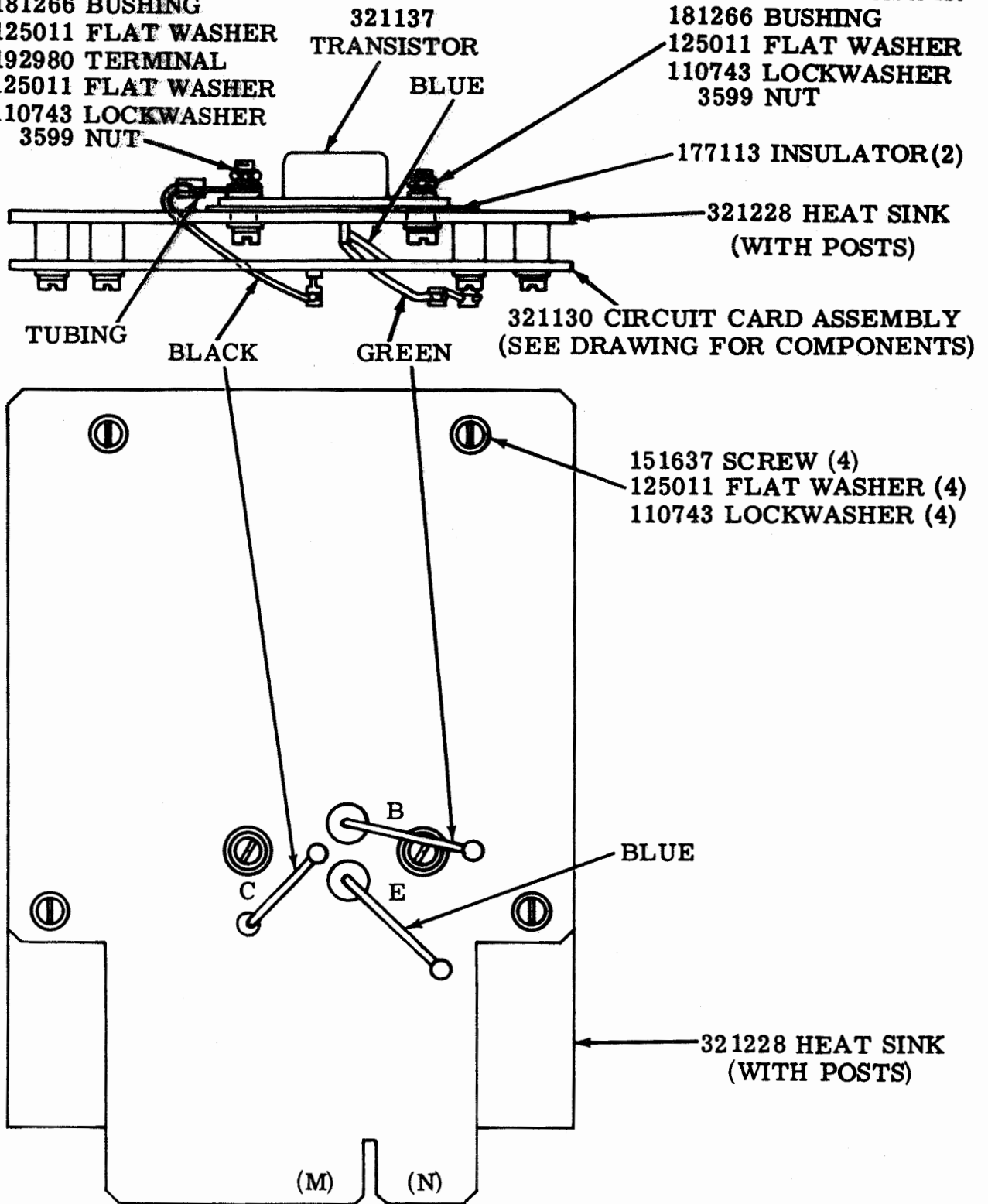
321137 TRANSISTOR

Figure 1 - One-Half Ampere Power Supply (321290)

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- 151687 SCREW
- 125011 FLAT WASHER
- 181266 BUSHING
- 125011 FLAT WASHER
- 192980 TERMINAL
- 125011 FLAT WASHER
- 110743 LOCKWASHER
- 3599 NUT

- 151687 SCREW
- 125011 FLAT WASHER
- 181266 BUSHING
- 125011 FLAT WASHER
- 110743 LOCKWASHER
- 3599 NUT



**Figure 2 - 321288 Heat Sink, Power Transistor and Hardware for 321290 One-Half Ampere Power Supply**

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REF. DESIGN.	PART NO.	TOTAL QTY	NAME AND DESCRIPTION	FUNCTION
C1	193053	1	CAPACITOR, 2 MFD 200V	RF FILTER
C2,3	171585	2	CAPACITOR, .22MFD 200V	RF FILTER
C4	171831	1	CAPACITOR, 10MFD 150V	RECTIFIER FILTER
C5	178860	1	CAPACITOR, .022MFD 100V	RF FILTER
C6,7	321134	2	CAPACITOR, .1MFD 10V	RF FILTER
R1	198937	1	RESISTOR, 2.7K 2W	
R2	182180	2	RESISTOR, 200 OHM 1/2W	
R3	171533	1	RESISTOR 4 OHM 5W	
R4,5	311664	2	RESISTOR, 2.5K 8W	DROPPING
R6			SAME AS R2	RF FILTER
R7	305298	1	RESISTOR, 3.3K 3W	BLEEDER
CR1-4	182520	4	DIODE (1N4383)	RECTIFIER
CR5,6	327794	2	DIODE, ZENER 7.2V	REFERENCE
CR7	321286	2	DIODE, ZENER (1N4749A)	REFERENCE
CR8-11	178844	4	VARISTOR (W.E. 100A)	REFERENCE
CR12			SAME AS CR7	REFERENCE
L3,4	321159	2	INDUCTOR 39 uH	RF FILTER
	144495	1	PAD TRANSISTOR	
Q2	321145	1	TRANSISTOR (2N2270)	GAIN
FC1,2	311068	2	FUSE CLIP	
F102	131807	1	FUSE .5 AMP.	
TP1	320042	1	JACK, TEST (SLATE)	
TP2	320041	1	JACK, TEST (GREEN)	
TP3	320039	1	JACK, TEST (BLACK)	
TP4	320040	1	JACK, TEST (ORANGE)	
TP5	320038	1	JACK, TEST (RED)	
P1-3	137471	3	TERMINAL POST	CONNECTOR
	321140	1	CIRCUIT CARD	
	39603RM	.33 FT.	24 GA. WIRE, BARE (4 STRAPS)	
1	151637	2	SCREW FIL.	
2	125011	2	WASHER, FLAT	
3	110743	2	WASHER, LOCK	
4	3599	2	NUT	

Figure 3 - 321130 Circuit Card Components for  
321290 One-Half Ampere Power Supply

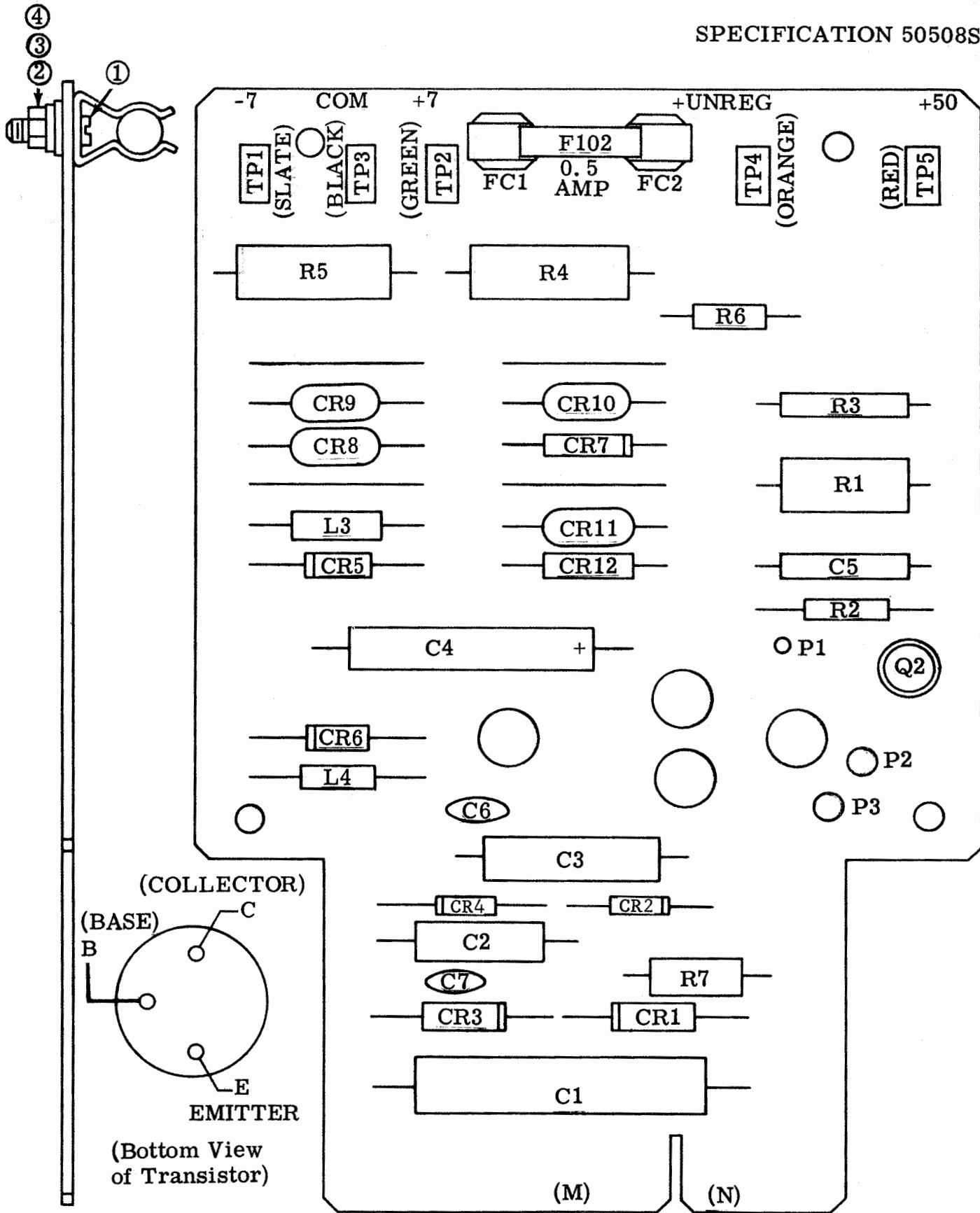
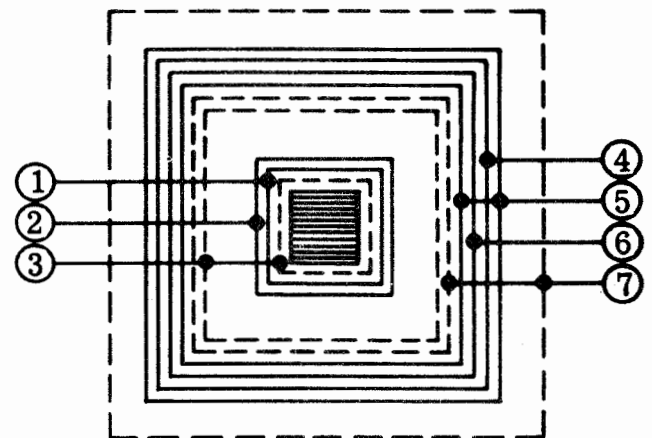
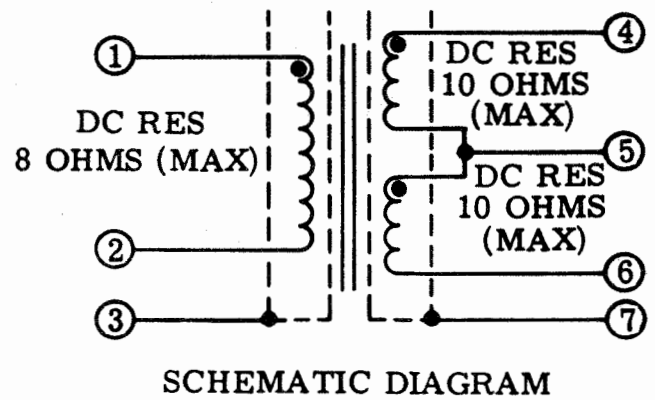
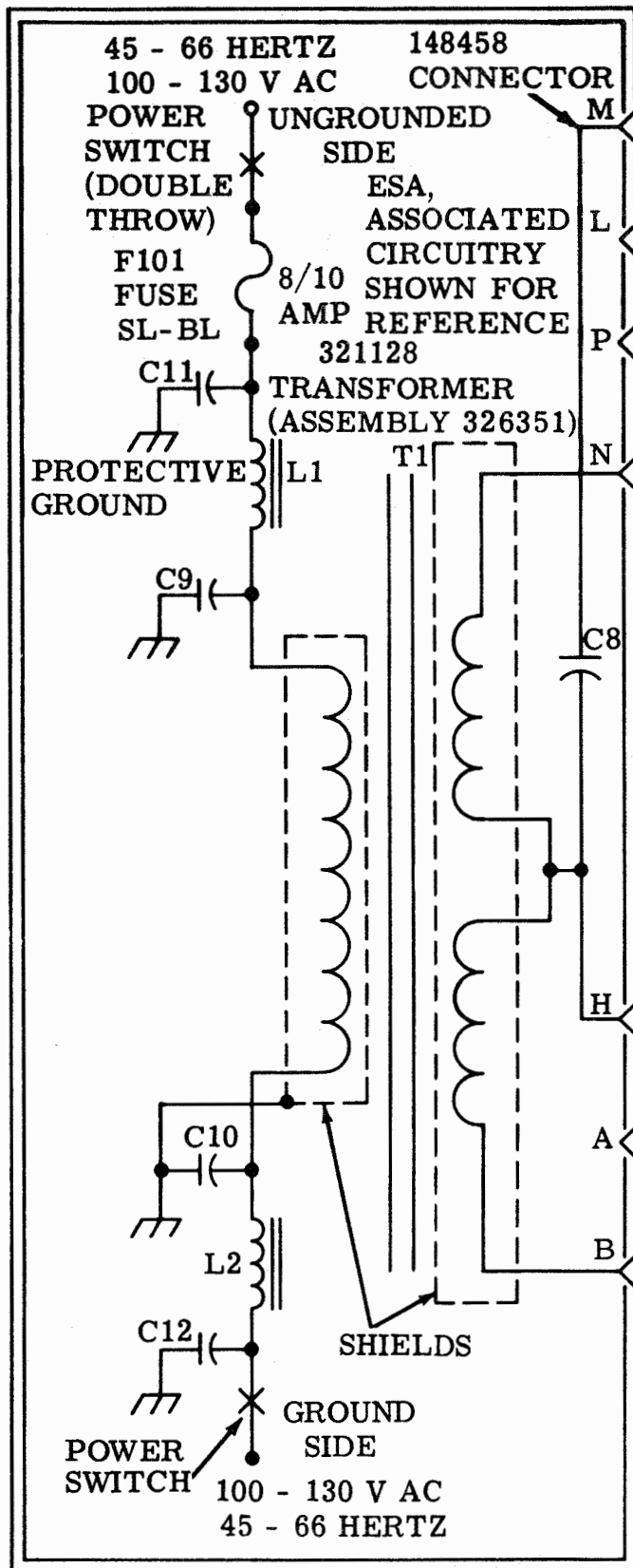


Figure 4 - One-Half Ampere Circuit Card Assembly 321130 for 321290 Power Supply



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321128 TRANSFORMER

Note: For reference only, see schematic wiring diagram of associated electrical service assembly (ESA) to be used.

Figure 6 - Typical Electrical Service Assembly (ESA) Circuit Associated with 321290 Power Supply

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CIRCUIT CARD ASSEMBLY, POWER SUPPLY (47-53 V DC 1.5 AMP MAX)				
REF. DESIGN.	PART NO.	TOTAL QTY.	NAME AND DESCRIPTION	LOCATING FUNCTION
C1	193053	1	CAPACITOR 2.0 MFD 200V	RF FILTER
C2	171585	2	CAP. .22 MFD 200V	RF FILTER
C3			SAME AS C2	RF FILTER
C4	178860	1	CAP. .022 MFD 100V	RF FILTER
CR1,2	321136	2	DIODE (1N4722)	RECTIFIER
CR3,8	321286	2	DIODE, ZENER (1N4749A)	OUTPUT REFERENCE
CR4,5	178844	4	VARIATOR (W. E. 100A)	VOLTAGE
CR6,7			SAME AS CR4,5	ADJUSTMENT
R1	198937	1	RESISTOR 2700 OHM, 2W	
R2,3	182180	2	RESISTOR 200 OHM 1/2W	
R4	305298	1	RESISTOR 3.3K 3W	BLEEDER
R5	171533	1	RESISTOR 4 OHM 5W	
Q1	321145	1	TRANSISTOR (2N2270)	
SI-4	39603RM	.28FT.	.24 GA. WIRE, BARE (4 STRAPS)	
FI02	143631	1	FUSE, 1.5 AMP.	
TP1	320039	1	JACK, TEST (BLACK)	TEST POINT
TP2	320040	1	JACK, TEST (ORANGE)	TEST POINT
TP3	320038	1	JACK, TEST (RED)	TEST POINT
FC1,2	311068	2	CLIP, FUSE	
1	151637	2	SCREW, FIL.	
2	125011	2	WASHER, FLAT	
3	110743	2	WASHER, LOCK	
4	3599	2	NUT	
	321291	1	BOARD, ETCHED CIRCUIT	

**Figure 7 - 321132 Circuit Card Components for One and One-Half Ampere Power Supply**



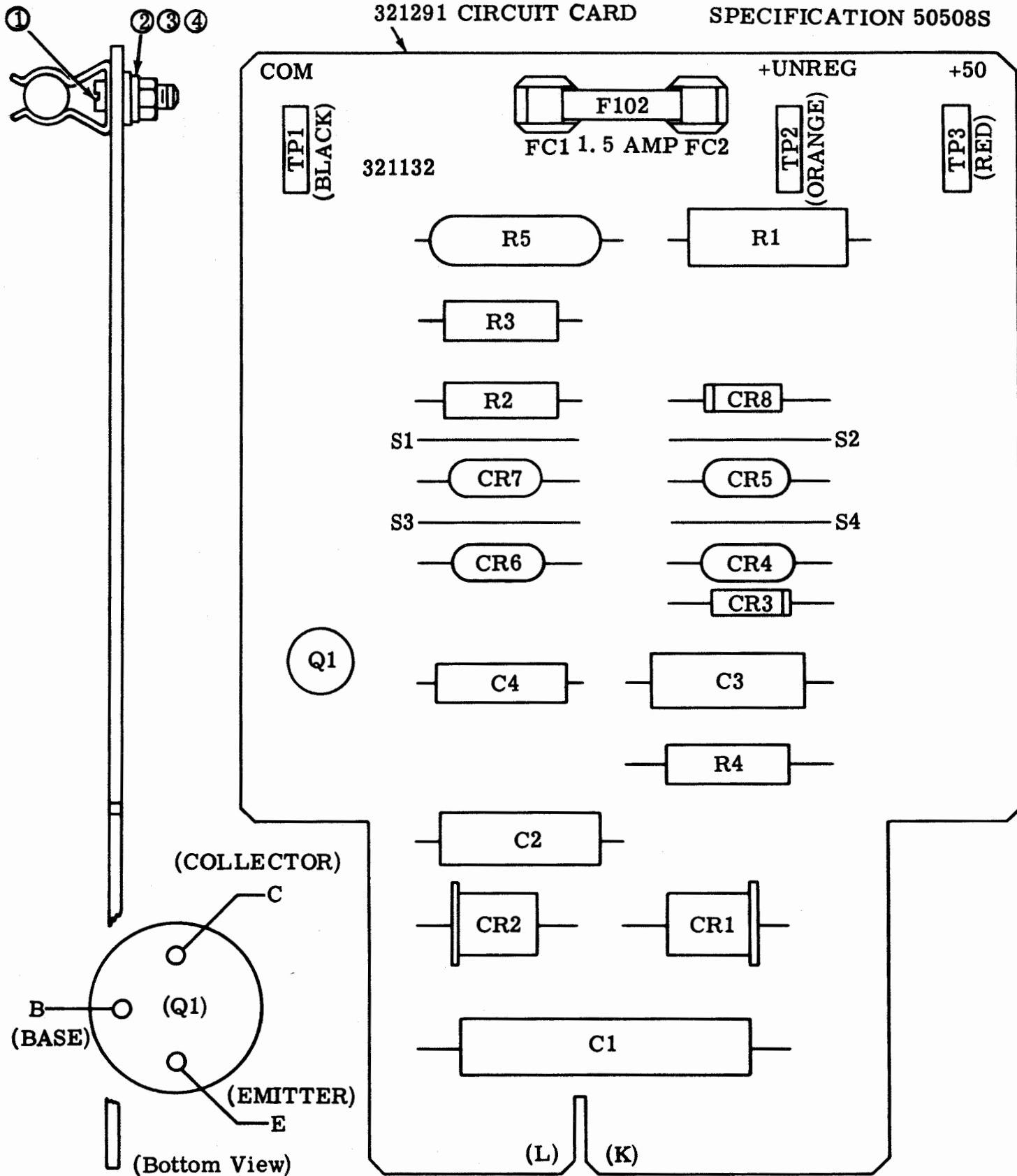
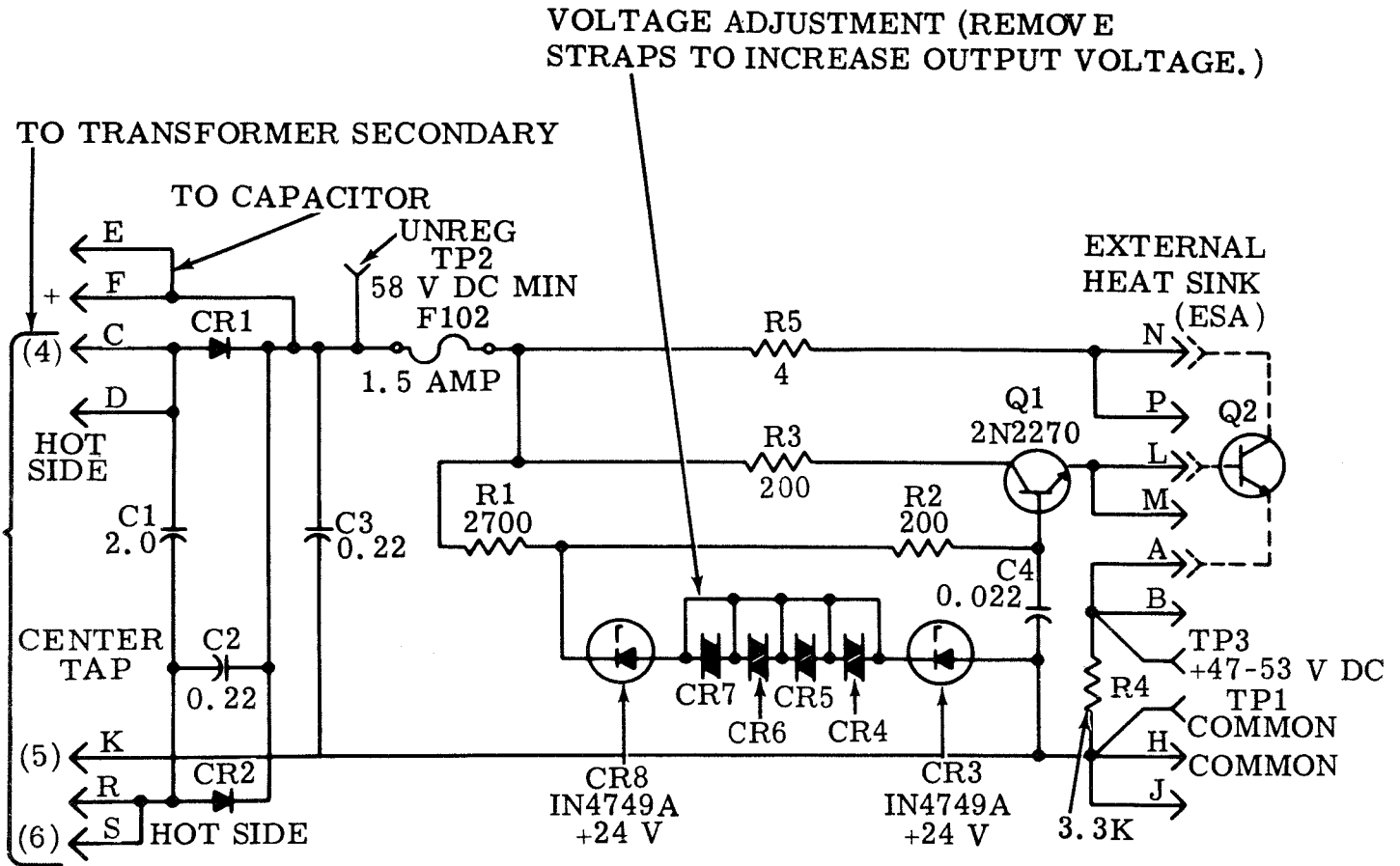


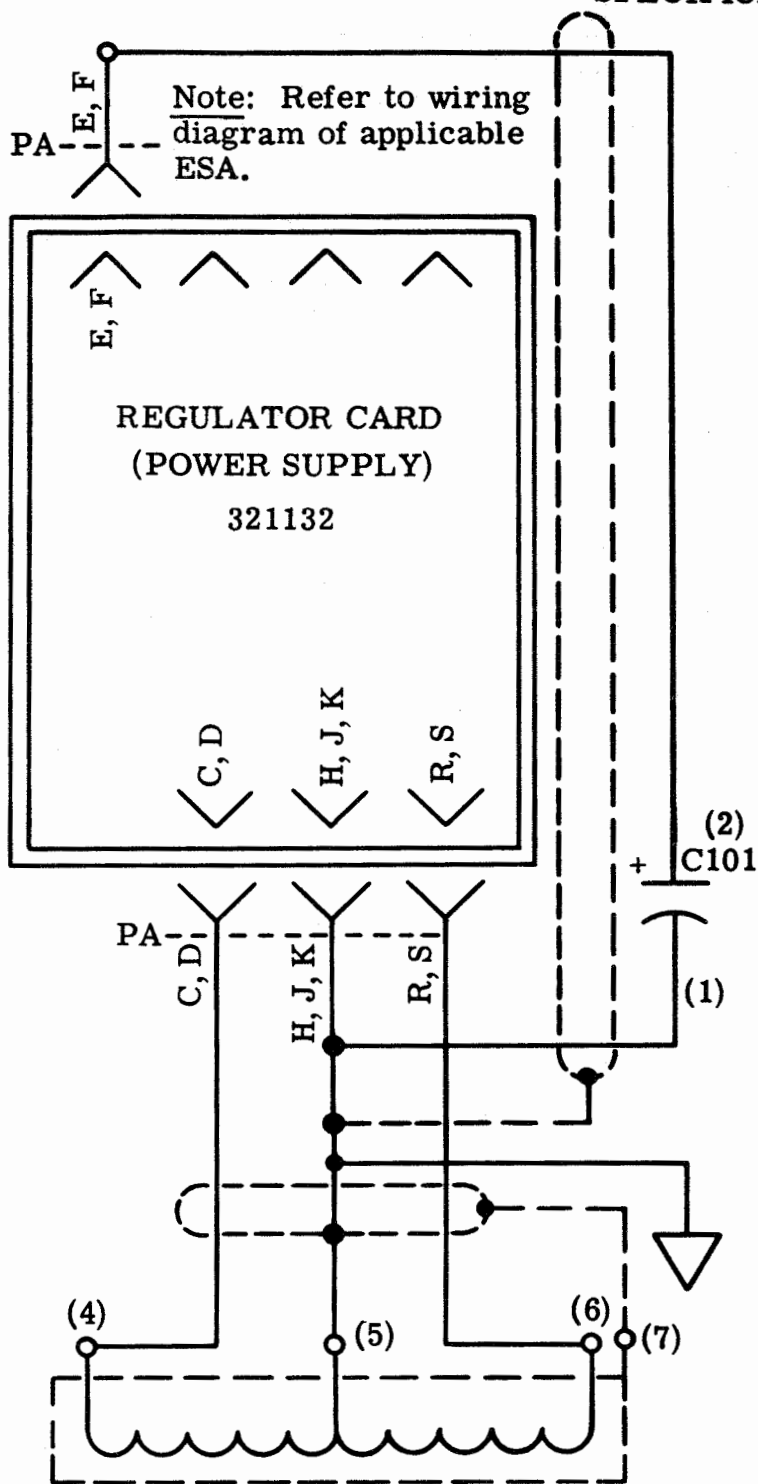
Figure 8 - One and One-Half Ampere 321132 Circuit Card Assembly on 321291 Printed Circuit Card



Circuit Description: This card assembly used with associated transformer (321214) and capacitor (321279) provides 47 - 53 volts dc regulated output at 1.5 ampere maximum. Q2 is the series regulating element with the emitter biased to the reference voltage set by reference diodes CR3-CR8. The base collector of Q2 absorbs the voltage difference between the unregulated rectifier voltage at terminals E, F, and the fixed output appearing at A, B. Q1 is a gain stage for Q2.

Note: Key slot is located between pins K and L.

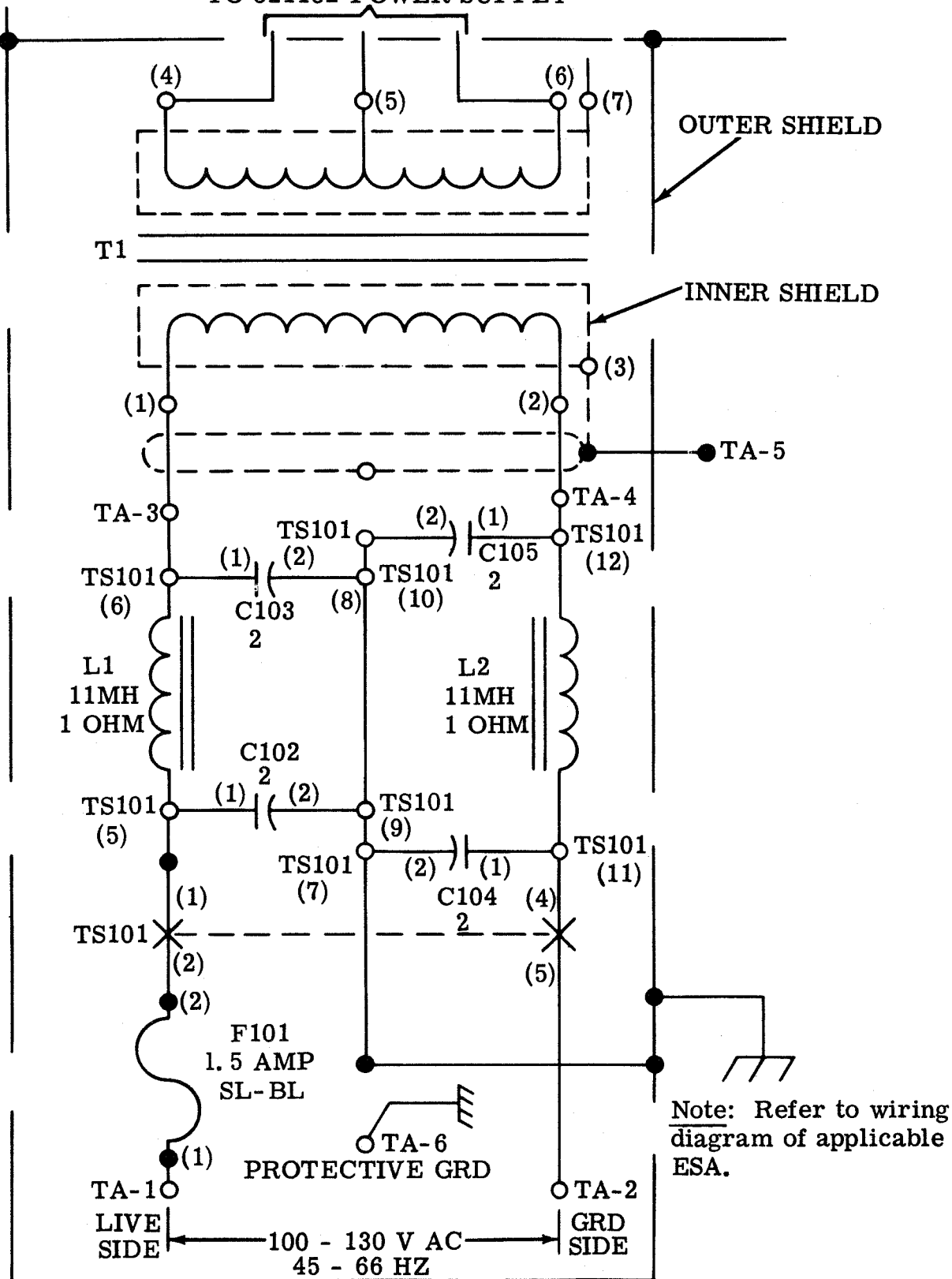
Figure 9 - Schematic Wiring Diagram of 321132 One and One-Half Ampere Power Supply Circuit Card Assembly



Note: Refer to appropriate ESA wiring diagram for primary circuit elements.

Figure 10 - Electrical Service Assembly (ESA) Transformer Secondary Winding Circuit Connections to 321132 One and One-Half Ampere Power Supply

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TO 321132 POWER SUPPLY**



**Figure 11 - Typical ESA Transformer and Low-Pass Filter Circuit for 1.5 Ampere Power Supply 321132**