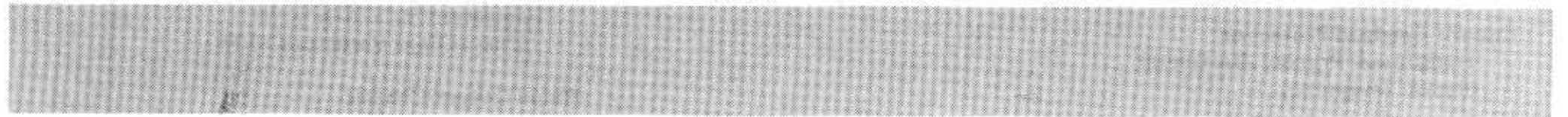


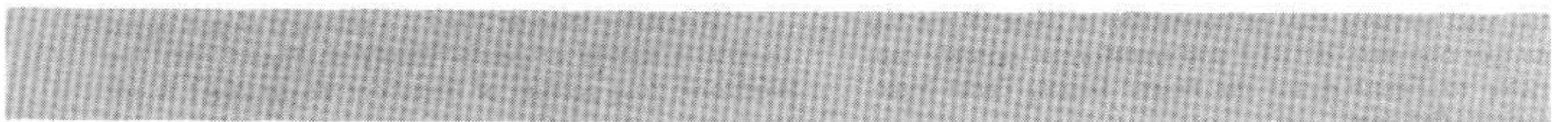
# **Mobile Communication Equipment**



## **Power Supply Panel MI-559472**

### **Description & Adjustment**

#### **Series 1000 Base Station**



## GENERAL INFORMATION

This Instruction Book provides coverage for the Series 1000 Base Station Power Supply Panel MI-559472, and includes technical data (Table 1), circuit description, adjustments, and replacement parts. Additionally, a table of emergency semiconductor substitutes, together with the latest equipment production variations, are provided at the end of this manual. Information is also included on emergency battery connections for the panel.

The Power Supply Panel is designed for standard 19-inch rack or cabinet mounting in a Series 1000 Base Station System. The Panel contains two separate supplies which provide regulated +13.8 VDC (low current) and unregulated (high current) +12.8 VDC outputs. The regulated +13.8 VDC is generally used as a supply source for the base station receiver, exciter and control circuits. The high current +12.8 VDC provides the power source for the final transmitter stages of the station.

**TABLE 1. TECHNICAL DATA**

NOTE: The following TECHNICAL DATA is based on an ambient Power Supply temperature of 25° Centigrade.	
<b>AC Input Voltage</b> Tap Selected 109 VAC (up to 115 VAC) 121 VAC (116 to 127 VAC) 133 VAC (128 and above)	<b>Regulated DC Output</b> Full Load Voltage: 13.8 ± 0.1 VDC No Load Voltage: 14.0 ± 0.2 VDC Full Load Ripple: 7.5mV Regulation for ± 10% Line Voltage Variation: ± 20%
<b>AC Input Current</b> No Load: 0.5 ± 0.1A Full Load: 8.9A (max.)	<b>Unregulated DC Output</b> Full Load Voltage: 13.9 ± 0.3 VDC No Load Voltage: 18.0 ± 0.5 VDC Full Load Ripple: 14mV Regulation for ± 10% Line Voltage Variations ±10%
<b>Input Frequency</b> 50/60 Hz	<b>Rated Output Current</b> Regulated: 5A @ +13.8 VDC Unregulated: 22A @ +12.8 VDC
<b>Current Overload Protection</b> Transformer Primary -9A Circuit Breaker (magnetic) Regulated +13.8 VDC Circuit-7A, 3AG Fuse	

## CIRCUIT DESCRIPTION

### GENERAL

Both supplies of the Panel provide fullwave rectification and operate from a common 60Hz power transformer. Panel operation over a wide range of available site voltages is selectable by primary taps (109, 121, and 133 VAC) on the transformer (Table 1). These taps are brought out to terminal board 20TB1-2, -3, and -4, respectively (refer to equipment interconnect diagram). The Panel is normally factory wired, however, for 121 VAC operation. For remote on-off control of the Panel, and external switch (properly rated for 6A full load current) may be connected in place of the tap jumper between 20TB1-1 and transformer primary tap. Refer to Figure 4 for the Power Supply Panel Interconnect Diagram.

### LOW CURRENT SUPPLY (+13.8 VDC)

The low current supply incorporates Voltage

Regulator Module 20A1 to produce a highly regulated +13.8 VDC source (see TECHNICAL DATA for regulation specifications). The regulated +13.8 VDC is available between 20TB2-1 (+) and 20TB2-4 (equipment ground) of the Power Supply Panel. Fusing for the regulated supply is provided by fuse 20F1. Additionally, protective output voltage clamping is provided by Zener diode 20CR5. Diode 20CR5 clamps the output voltage to a safe level (15 VDC) in the event the regulator transistor 20Q1 shorts, causing an abnormal increase in output voltage.

Regulator Module 20A1 is a standard circuit board used in a variety of power supply configurations. The electronic fuse portion of Regulator Board 20A1 is not used in this application and is, therefore, disabled during manufacturing by removal of 8R13. The circuit associated with this portion of the board is shown in the shaded areas of Figure 4.

The removal of 8R13 assures that 8Q1 will be

biased on at all times by electrically grounding the base of 8Q1 through 8R6 and switch 8Q5 (biased on). This, in effect, provides proper forward biasing on the series pass regulator (consisting of Darlington connected pair 20Q1 and 8Q2) and error amplifier 8Q4.

The circuit consisting of 8Q1, 8CR5 and 8R5 comprises a temperature compensated load impedance for error amplifier 8Q4. Diode 8CR5 (multi-junction) introduces thermal compensation for 8Q1 (controls forward bias) to prevent thermal "runaway" of the series pass transistor (20Q1). Voltage divider 8R9, 8R10 (supply output level adjustment) and 8R11 samples a portion of the regulator output which is applied to the base of error amplifier 8Q4. This sampled voltage is compared to a reference voltage across Zener diode 8CR6 (6.8 V). Any resulting error voltage (difference) is applied as a control voltage to the base of 8Q2 of the Darlington connected pass regulator.

#### HIGH CURRENT SUPPLY (+12.8 VDC)

The rectified, full-wave output of the high current supply is filtered by a multi-section choke input filter

(Figure 4) consisting of 20L1, 20L2, 20C1-20C3, and 20R1. Bleeder resistor 20R1 maintains a minimum load current through the filter to improve no load-to-full load regulation. The supply output (+12.8 VDC at 22A) is available between 20TB2-2 (+) and 20TB2-4 (equipment ground) of the Power Supply Panel. Fusing for the high current supply is provided by the main circuit breaker 20CB1 (9A).

#### EMERGENCY POWER CONNECTIONS

The emergency power source is connected to 20TB2-3 (+) and -4 (-). The source should provide +13.8 VDC and have a current capacity of 30 amperes. If the source is connected with the polarity reversed, diodes 20CR6 and 20CR7 will block current flow and prevent damage to the source and the base station.

Note that an external on-off switch and fusing must be placed, by the user, between the panel and emergency power source. At least a #12 AWG wire size should be used for connecting the source to terminal board 20TB2. A #8 spade type lug may be used on 20TB2. Fusing for the battery source should be adequate for a full load current of 30A.

## ADJUSTMENTS

#### GENERAL

The Power Supply Panel has been tested and adjusted for proper output voltages with 121 VAC input before shipment. Since the power supply provides for line voltages other than 121 VAC, check that the jumper is installed between 20TB1-1 and -3 upon receipt of equipment. Refer to Table 2 below for other AC line voltage jumper connections.

#### WARNING

This equipment contains dangerous voltages which are accessible when the cover over 20TB1 is removed.

TABLE 2. AC LINE INPUT TAP CONNECTIONS

AC Line Voltage	20TB1 Jumper Connections
Up to 115 VAC	1 to 4
116 to 127 VAC	1 to 3
128 VAC and Above	1 to 2

#### ADJUSTMENT PROCEDURE

Adjustment of the Power Supply Panel is limited to the setting of the regulated +13.8 VDC output level under load conditions. This adjustment has been set, prior to shipment, for +13.8 VDC between 20TB2-1 (+) and -4 (gnd) at 5A. Should readjustment be necessary during initial installation or after repairs to the unit, adjust 8R10 on Voltage Regulation Module 20A1 for  $13.8 \pm 0.1$  VDC between 20TB2-1 (+) and -4 (gnd). This adjustment must be made under full load conditions (i.e., base station transmitter keyed).

NOTE: If the supply is bench adjusted, full load conditions may be simulated with a 2.72-ohm, 100 watt resistor. Connect the resistor across 20TB2-1 and -4.

## EMERGENCY SUBSTITUTION LIST – SOLID STATE DEVICES

In the event of a semiconductor failure, the exact replacement found in the replacement parts list should be used. In an emergency, to minimize equipment downtime, the following common semiconductor types

of Table 3 may be temporarily used. However, use of these substitutes may result in degraded system performance.

**TABLE 3. EMERGENCY SUBSTITUTES**

Component Location	Component Designation	Emergency Substitute
Power Supply Assembly	20CR1 20CR2 20CR3 20CR4 20CR5 20CR6 20CR7 20CR8 20Q1	1N3659, 30A, 50V PIV 1N3659R, 30A, 50V PIV 1N3659, 30A, 50V PIV 1N3659R, 30A, 50V PIV MDA 980-1 1N3659R, 30A, 50V PIV 1N3650R, 30A, 50V PIV 1N5352B, 15V, 5W Zener 2N3055
Voltage Regulator Board	8Q1 8Q2 8Q4 8Q5 8Q6 8Q7 8CR5 8CR6 8CR7	2N4126 40250V1 2N3053 2N4124 2N4124* 2N4126* No common substitute 1N4736, 6.8V, 1W Zener 1N914*
*Not operative in this application.		

## PRODUCTION VARIATIONS

The production level of any assembly is identified by a code-level stamping (example: CODE B) on the assembly. CODE A production level is the initial

production level of an assembly. The differences in production levels for this equipment are tabulated in Table 4.

**TABLE 4. PRODUCTION VARIATIONS**

Code Level Difference	Description of Change	Code Level Difference	Description of Change
POWER SUPPLY PANEL – CURRENT VERSION P/L 3720788 CODE B		VOLTAGE REGULATOR MODULE – CURRENT VERSION P/L 3457998-503 CODE B	
A-B	Zener diode 20CR8 added between 20TB2-1 and -4.  Fuse 20F1 was located between 20CR5 and 20C4.	A-B*	8R13 was 22K Dwg. 99206-066 Stock 108866. now 22K Dwg 99206-078 Stock 285421
*Note: Code Level B is the initial production level used in the Power Supply Panel.			

## REPLACEMENT PARTS

Symbol	Stock No.	Drawing No.	Description
			POWER SUPPLY PANEL MI-559472 (SEE FIGURES 1 & 2) P/L 3720788-501 REV 5 CODE B
20C1 TO			
20C4	247822	3457794-002	ELECTROLYTIC, 14,000 MF 30 V
20C5	418322	3464636-102	ELECTROLYTIC, 1000 MF 16 V
20CB1	246922	3731230-002	CIRCUIT BREAKER - MAGNETIC 9A
	421886	3731349-002	INSULATION POD-CIRCUIT BREAKER TERMINALS
20CR1	418324	3731357-001	DIODE-RECTIFIER, SILICON 30A 50V PIV
20CR2	418325	3731357-002	DIODE-RECTIFIER, SILICON 30A 50V PIV
20CR3	418324	3731357-001	DIODE-RECTIFIER, SILICON 30A 50V PIV
20CR4	418325	3731357-002	DIODE-RECTIFIER, SILICON 30A 50V PIV
20CR5	418323	3731358-001	BRIDGE RECTIFIER ASSEMBLY - 12A 50V PIV
20CR6	418325	3731357-002	DIODE-RECTIFIER, SILICON 30A 50V PIV
20CR7	418325	3731357-002	DIODE-RECTIFIER, SILICON 30A 50V PIV
20CR8	428020	3723764-502	DIODE, SILICON, ZENER, 15V
	421883	3720792-001	INSULATION-DIODE MOUNTING PLATES 20CR1, 2, 3 & 4.
	421881	3468018-004	HEAT SINK 20CR1, 2, 3 & 4.
	421878	3457204-406	SPACER-HEAT SINK MOUNTING #10 x 1/2"
20L1	421885	3731347-001	CHOKE - FILTER
20L2	421884	3731347-002	CHOKE - FILTER
20F1	126327	990157-018	FUSE - 7A, 3AG
20Q1	232359	3464510-002	TRANSISTOR - SILICON PNP, POWER
	421882	3468018-003	HEAT SINK FOR 20Q1
20R1	300115	3465422-035	WIREWOUND, 25 OHMS 20 W
20T1	418326	3720686-001	TRANSFORMER - POWER
20TB1	421880	3463461-007	TERMINAL - STRIP, 7 POS.
20TB2	242571	428813-002	TERMINAL - STRIP, 4 POS.
20XF1	205604	8875711-003	FUSE - HOLDER
20XQ1	240143	3464424-001	SOCKET - POWER TRANSISTOR
	421879	3457204-210	SPACER - REGULATOR BOARD MOUNTING #6 x 3/4"
	211332	426766-003	INSULATOR - STEATITE .5 DIA .6 LONG

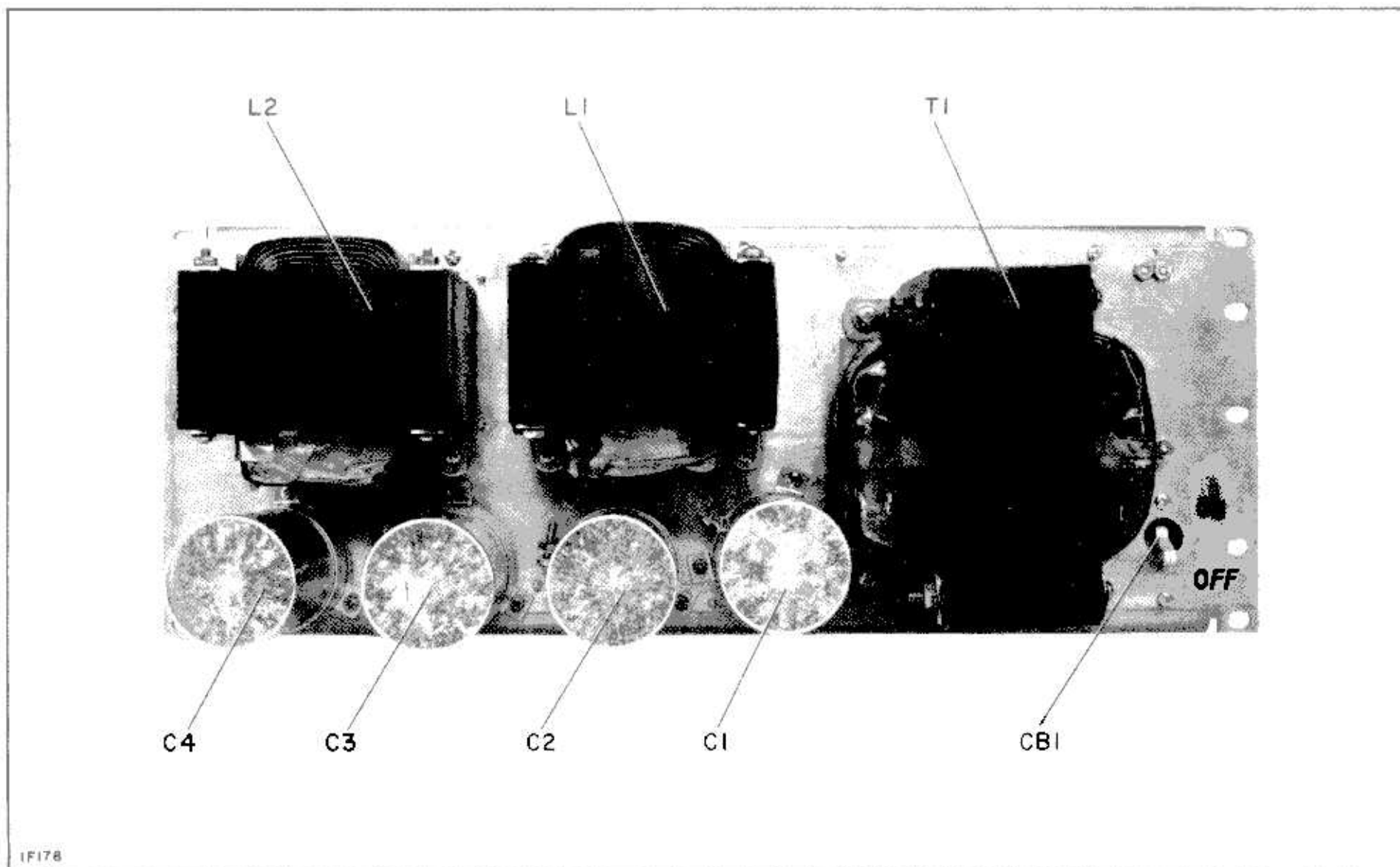
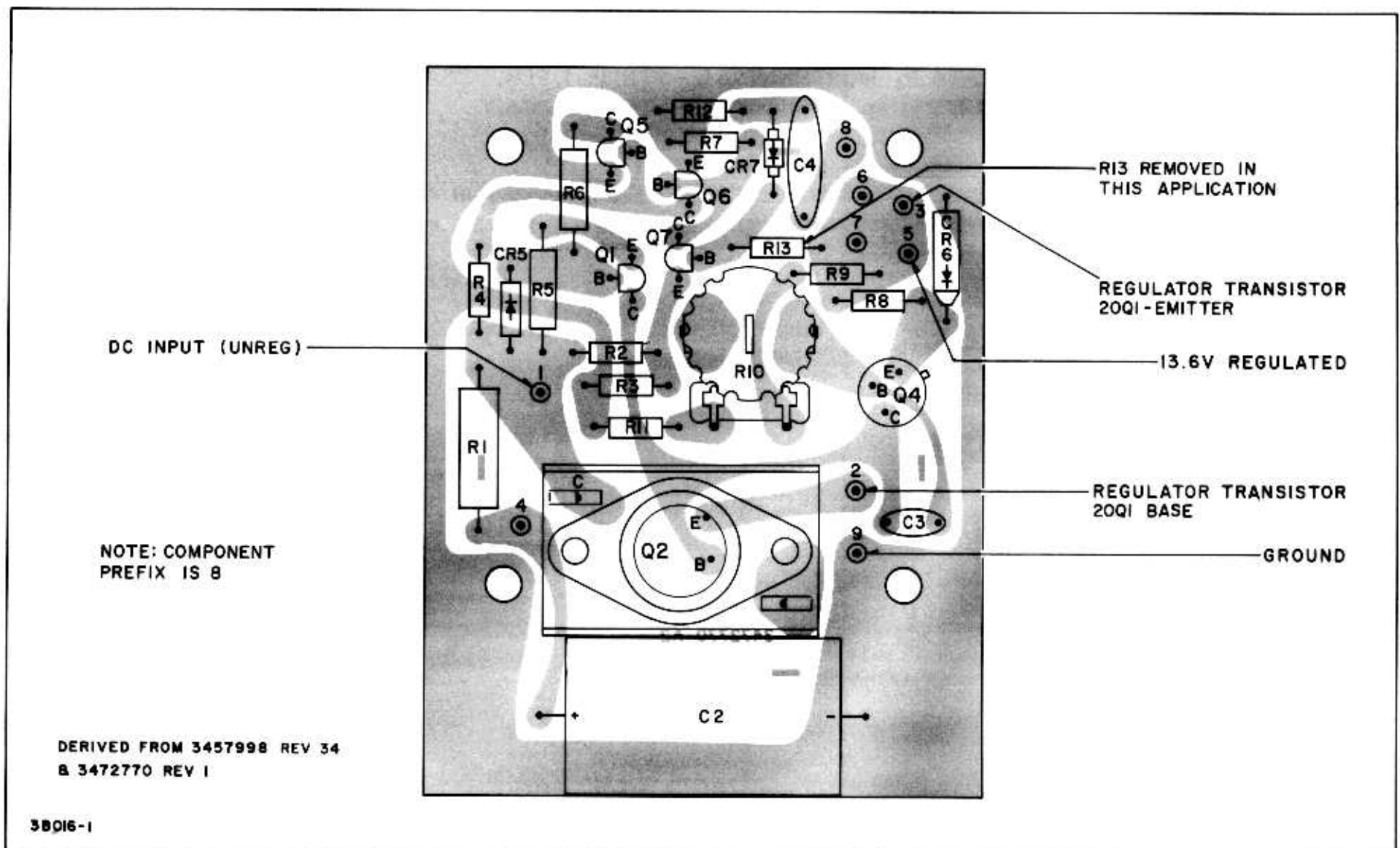


Figure 1. Power Supply Panel – Front View



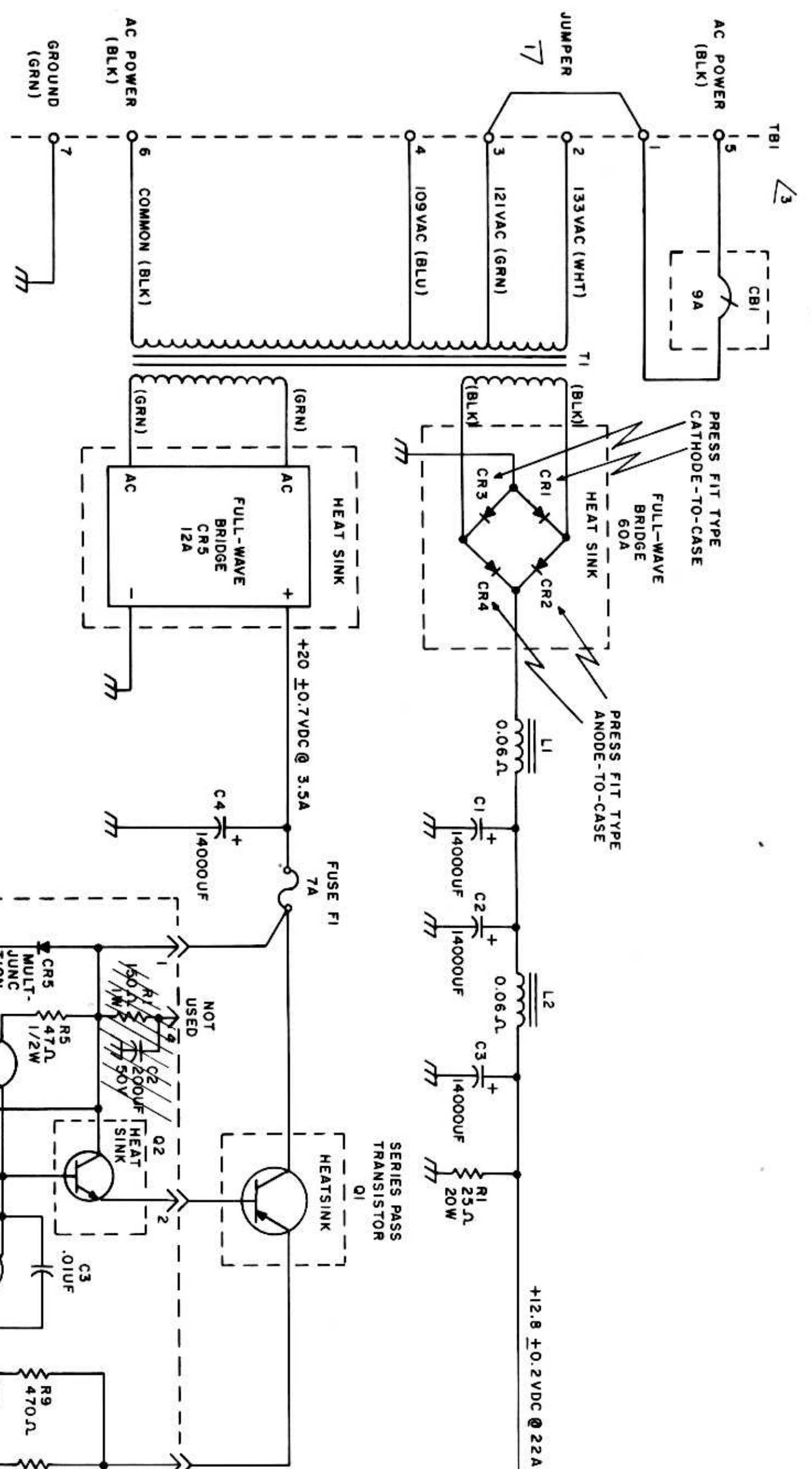
## REPLACEMENT PARTS

Symbol	Stock No.	Drawing No.	Description
<b>VOLTAGE REGULATOR MODULE (SEE FIGURE 3)</b>			
20A1	421606	3457998-503	PRINTED CIRCUIT BOARD - REGULATOR
8C2	247823	3731187-004	ELECTROLYTIC, 200 MF
8C3	224570	8982805-002	CERAMIC, .01 MF
8C4	223142	8982805-006	CERAMIC, 0.1 MF
8CR5	242721	3731160-001	DIODE - SILICON, MULTI-JUNCTION
8CR6	245479	3731199-012	DIODE - SILICON, ZENER 6.8 V
8CR7	242522	3464611-001	DIODE - SILICON
8Q1	241884	3468183-002	TRANSISTOR - SILICON, PNP
8Q2	246365	3463100-002	TRANSISTOR - SILICON, NPN POWER
8Q4	230254	3463099-001	TRANSISTOR - SILICON, NPN POWER
8Q5	242759	3468182-002	TRANSISTOR - SILICON, NPN
8Q6	242759	3468182-002	TRANSISTOR - SILICON, NPN
8Q7	241884	3468183-002	TRANSISTOR - SILICON, PNP
	228124	3450797-003	CONTACT PIN .093 DIA.
8R1	512115	90496-053	150 OHMS, 10% 1 W
8R2	108866	99206-066	2200 OHMS 10% 1/4W
8R3	219459	99206-064	1500 OHMS 10% 1/4W
8R4	285404	99206-080	33,000 OHMS 10% 1/4W
8R5	502047	82283-046	47 OHMS 10% 1/2W
8R6	502222	82283-066	2200 OHMS 10% 1/2W
8R7	218499	99206-074	10,000 OHMS 10% 1/4W
8R8	108864	99206-058	470 OHMS 10% 1/4W
8R9	108864	99206-058	470 OHMS 10% 1/4W
8R10	236640	3463187-008	VARIABLE, 1000 OHMS
8R11	108864	99206-058	470 OHMS 10% 1/4W
8R12	218499	99206-074	10,000 OHMS 10% 1/4W
8R13	426112	99206-078	22K OHMS 10% 1/4 W (REMOVED IN THIS APPLICATION)
	248228	8985442-001	WASHER - INSULATING (FOR Q4 TRANSISTOR)

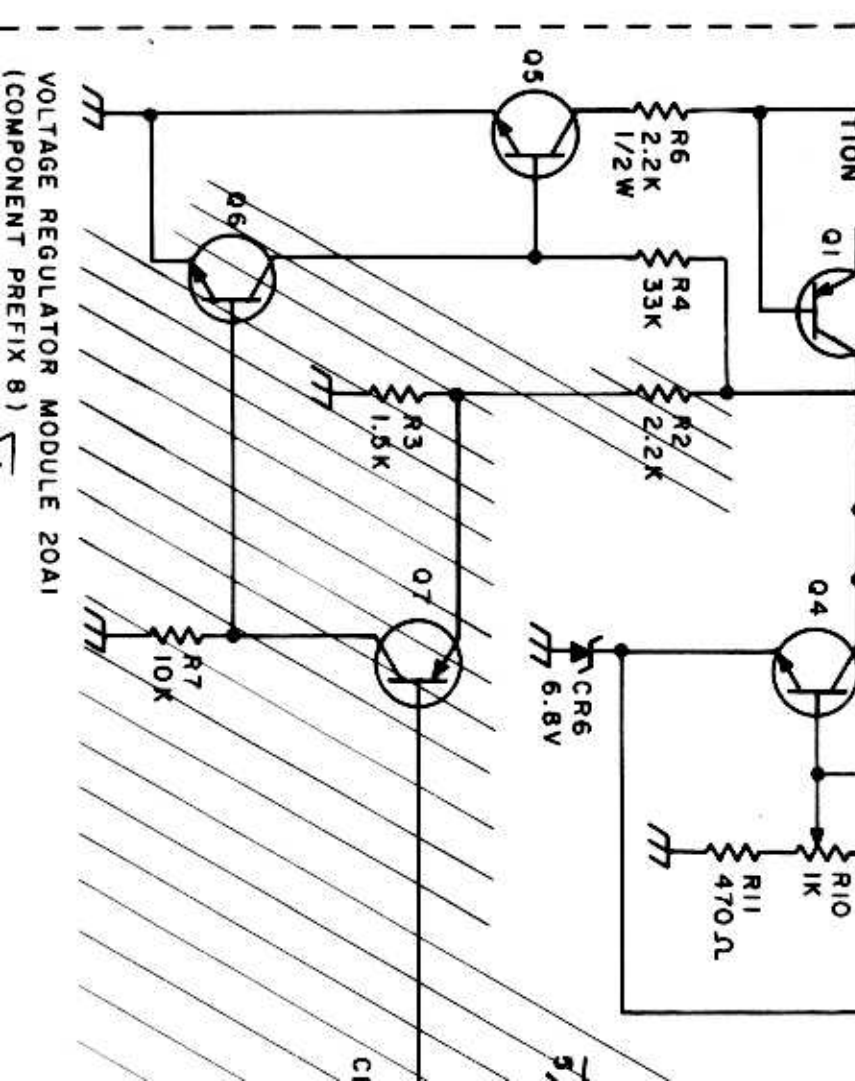


3457998-503 CODE B

Figure 3. Voltage Regulator Module 20A1 Component View

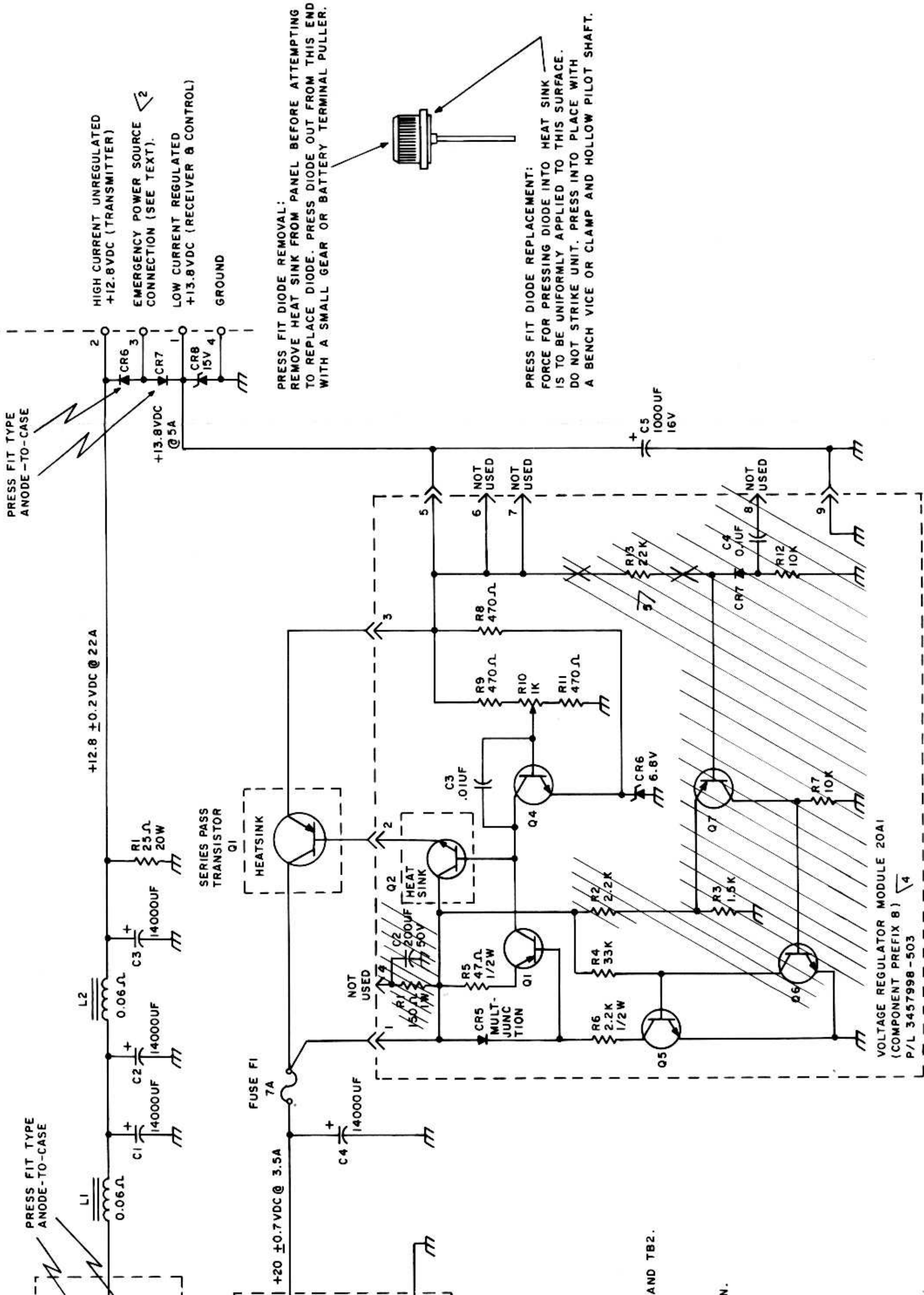


- NOTES:
1. CONNECT JUMPER FOR AVAILABLE SITE POWER.
  2. CONNECT EMERGENCY POWER SOURCE BETWEEN TB2-3 (POSITIVE) AND TB2-4 (NEGATIVE).
  3. REFER TO THE SYSTEM INSTRUCTIONS FOR EXTERNAL CONNECTIONS TBI AND TB2.
  4. COMPONENT PREFIXES FOR MODULE 20A1 ARE 8.
  5. RESISTOR BR13 REMOVED DURING MANUFACTURING FOR THIS APPLICATION.
  6. NOT OPERATIVE IN THIS APPLICATION.
  7. ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.





3 TB2



PRESS FIT TYPE ANODE-TO-CASE

+12.8 ±0.2VDC @ 22A

HIGH CURRENT UNREGULATED +12.8VDC (TRANSMITTER)

EMERGENCY POWER SOURCE CONNECTION (SEE TEXT) < 2

LOW CURRENT REGULATED +13.8VDC (RECEIVER & CONTROL)

GROUND

SERIES PASS TRANSISTOR Q1

FUSE F1 7A

+20 ±0.7VDC @ 3.5A

HEATSINK

C4 14000UF

NOT USED

CR5 MULT-JUNCTION

R1 25Ω 20W

C2 200UF 50V

R5 47Ω 1/2W

Q1

R2 2.2K

R3 1.5K

R4 33K

R6 2.2K 1/2W

R7 10K

R8 470Ω

R9 470Ω

R10 1K

R11 470Ω

R12 10K

R13 22K

C3 .01UF

Q2 HEAT SINK

Q3

Q4

Q5

Q6

Q7

CR6 6.8V

CR7 0.7V

CR8 15V

C4 0.7UF

C5 1000UF 16V

NOT USED

NOT USED

NOT USED

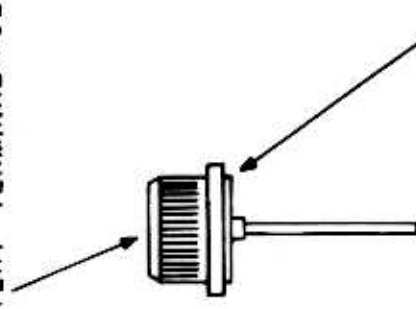
NOT USED

NOT USED

NOT USED

NOT USED

PRESS FIT DIODE REMOVAL: REMOVE HEAT SINK FROM PANEL BEFORE ATTEMPTING TO REPLACE DIODE. PRESS DIODE OUT FROM THIS END WITH A SMALL GEAR OR BATTERY TERMINAL PULLER.



PRESS FIT DIODE REPLACEMENT: FORCE FOR PRESSING DIODE INTO HEAT SINK IS TO BE UNIFORMLY APPLIED TO THIS SURFACE. DO NOT STRIKE UNIT. PRESS INTO PLACE WITH A BENCH VICE OR CLAMP AND HOLLOW PILOT SHAFT.

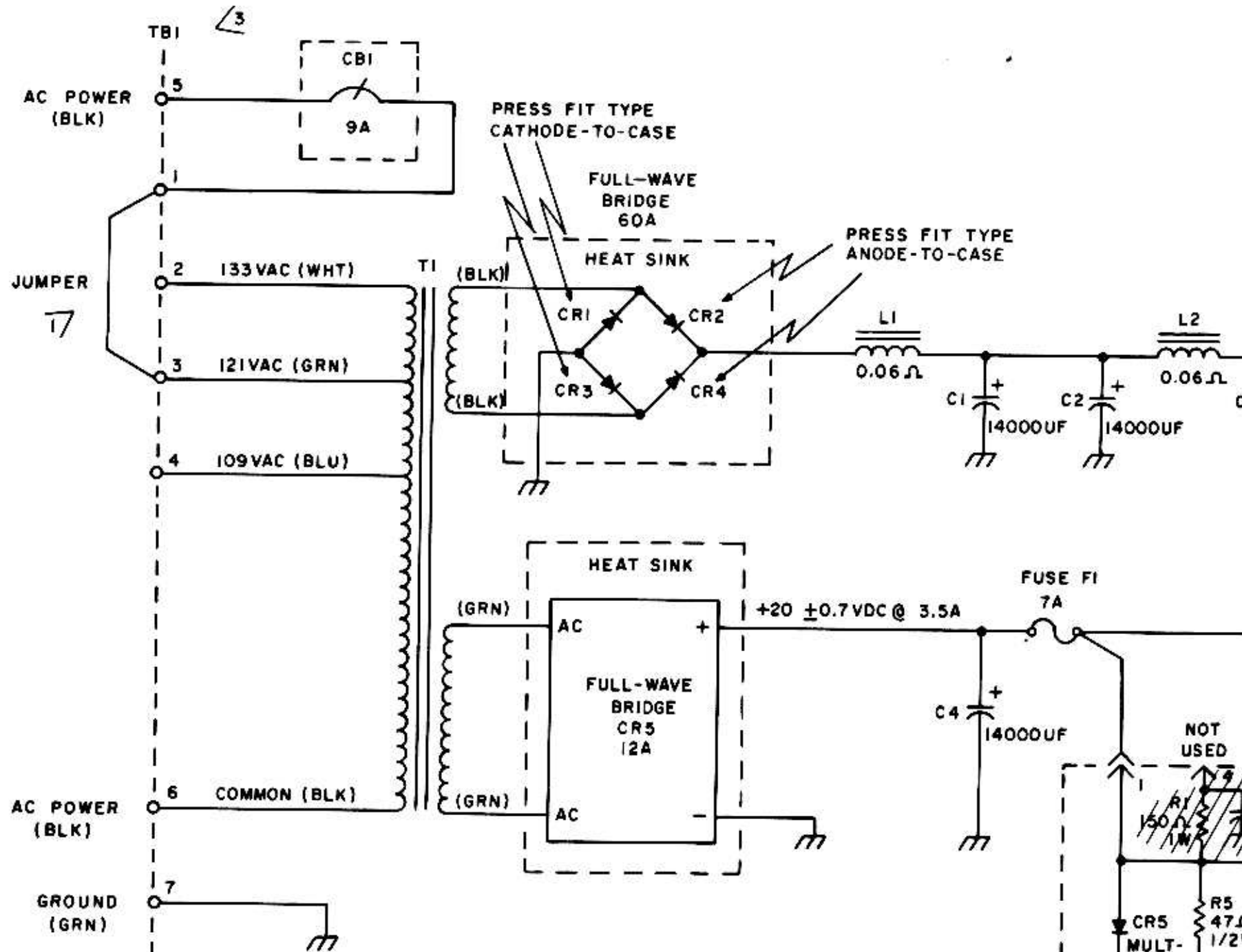
VOLTAGE REGULATOR MODULE 20A1 (COMPONENT PREFIX 8) P/L 3457998-503

AND TB2.

# POWER SUPPLY PANEL

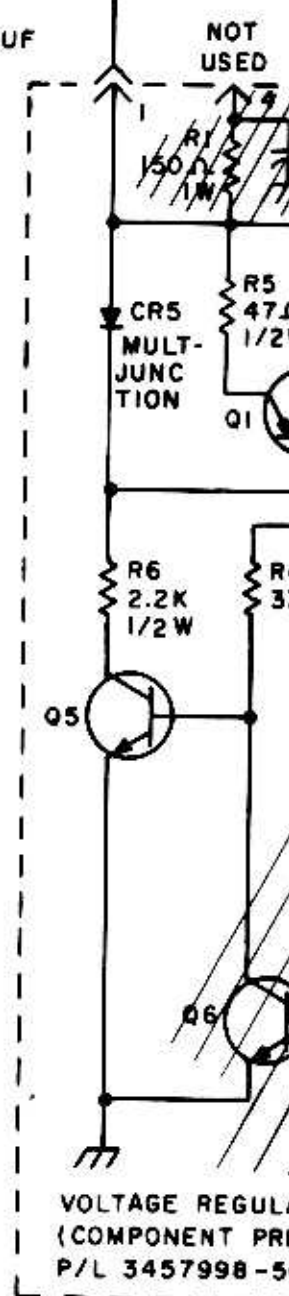
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## NOTES:

- 1 CONNECT JUMPER FOR AVAILABLE SITE POWER.
- 2 CONNECT EMERGENCY POWER SOURCE BETWEEN TB2-3 (POSITIVE) AND TB2-4 (NEGATIVE).
- 3 REFER TO THE SYSTEM INSTRUCTIONS FOR EXTERNAL CONNECTIONS TB1 AND TB2.
- 4 COMPONENT PREFIXES FOR MODULE 20A1 ARE B.
- 5 RESISTOR BR13 REMOVED DURING MANUFACTURING FOR THIS APPLICATION.
- 6 NOT OPERATIVE IN THIS APPLICATION.
- 7 ALL RESISTORS ARE 1/4 WATT UNLESS OTHERWISE SPECIFIED.



VOLTAGE REGULATOR  
(COMPONENT PREFIXES)  
P/L 3457998-501

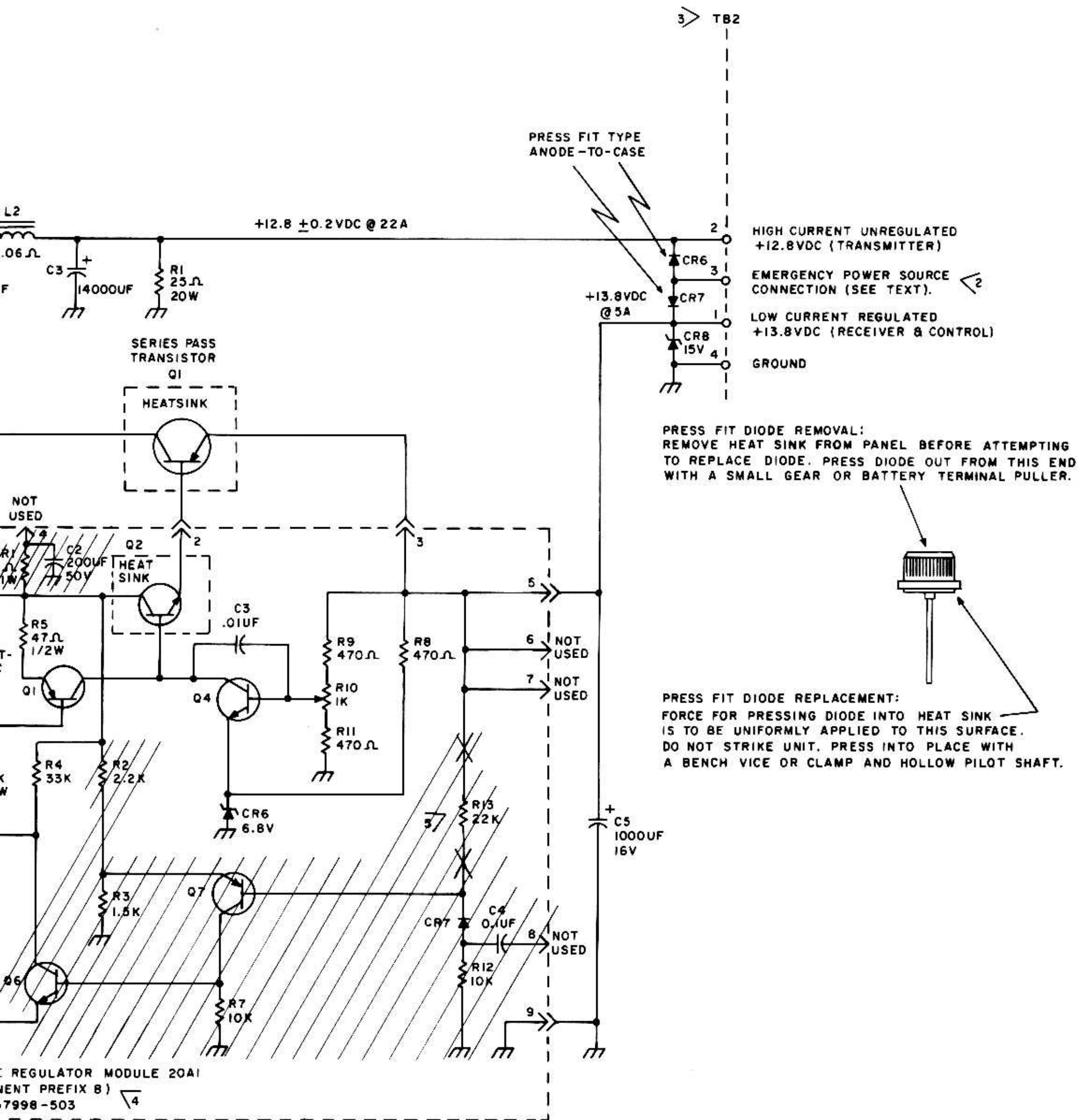


Figure 4. Power Supply Panel Interconnect Diagram