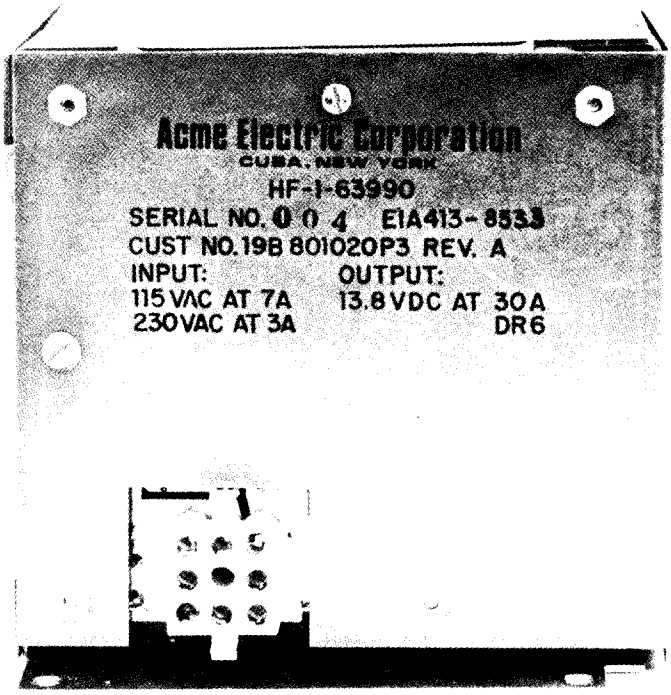
MOBILE RADIO

MAINTENANCE MANUAL

POWER SUPPLY
19B801020P3

NOTE: This power supply was used in early versions of 75/100W Delta and Rangr stations.



MANUFACTURED BY
ACME ELECTRIC CORPORATION
20 WATER STREET
CUBA, NY 14727

*These specifications are intended primarily for the use of the serviceman. Refer to the appropriate Specification Sheet for the complete specifications.

GENERAL ELECTRIC

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SPECIFICATIONS

POWER	
Input	115 or 230 VAC Nominal (Selectable)
Output	13.8 VDC ±5% at 30 Amps (Adjustable)
DUTY CYCLE	20%: one minute on, four minutes off or five minutes on, fifteen minutes off
SIZE	12 in. by 4-5/8 in. by 4-5/8 in.
WEIGHT	8-1/2 lbs.

WARNING

This unit contains dangerous voltage levels. In addition to line voltage, 300 Volts DC is present at high energy storage levels. It is strongly recommended that defective units be returned to the manufacturer for service.

If field repair is necessary, remove input power and WAIT five minutes before opening unit. This allows the high voltage capacitors to discharge. Wait at least five minutes after input power is removed before connecting or removing test probes.

The input and converter sections of this unit are NOT isolated from the AC input source; therefore, an isolation transformer should be used during any maintenance. Use extreme caution when connecting test equipment.

MAINTENANCE MANUAL
POWER SUPPLY
19B801020P3

INTRODUCTION

This unit is a pulse width modulated half bridge switching regulator. It converts 115/230 volts RMS to 13.8 volts DC, 30A maximum.

The AC input voltage is rectified and filtered to develop a nominal ±150 volts DC. This DC level is chopped at a 27.5 KHz rate to a ±150 volt variable duty factor square wave. An isolating step down transformer reduces the amplitude to approximately ±40 volts peak, which is rectified and filtered to produce the 13.8 VDC output.

The output voltage is controlled by a feedback loop which incorporates a pulse width modulator control circuit. The output voltage is sampled and compared to a reference voltage. The resulting error signal is compared with a ramp waveform (clock) to set the proper duty factor of the inverter. Current limit and over temperature shutdown functions are provided.

CIRCUIT DESCRIPTION

INPUT SECTION (PC1)

SS1 suppresses the voltage spikes on the AC input. C1-C6, L1, and L2 form a line filter to reduce conducted E.M.I. CB1 functions as an on/off switch and over current protector. J1 is the input voltage range selector. CRB1, C7A, C7B, C8A, and C8B rectify and filter the AC input to develop a ±150 volt DC bulk voltage. Transformer T1 develops an isolated low voltage AC.

CONVERTER/CONTROL SECTION (PC2)

The isolated low voltage AC from T1 is rectified by CR10, CR11, CR17, and CR18. This signal raises A2 pin 5 above 4 volts DC allowing initial start up of the converter. The rectified signal charges C19 through blocking diode CR7 to develop DC bias to operate the control circuit.

Switching transistors Q1 and Q2 are alternately switched on at a 27.5 KHz rate. This develops a ±150 volt variable duty factor square wave that is applied to the primary of T4. CR1, CR2, C10, C12, C13, and R3 reduce spikes across Q1 and Q2. T3, CR3, CR4, CR5, CR6, R9, and R41 supply proper forward base current to Q1 and Q2. C14 and C15 apply reverse voltage to the base emitter junction when Q1 and Q2 are off. R8, R10, C16, and C17 eliminate unwanted turn-on spikes.

T4 isolates and steps down the ±150 volt square wave, which is rectified by CR19 and CR20.

The output voltage is regulated by A1, a pulse width modulator control. A1 pin 1 samples the output voltage through the voltage divider R26 and R27. The sample is compared to the 2.5 volt reference voltage on A1 pin 2. The error voltage developed on pin 3 is compared internally to the 55 KHz ramp on A1 pin 5. On alternate cycles of the ramp, pin 8 or pin 11 will switch to a low state during the interval that the ramp voltage exceeds the error voltage on pin 3. When pin 3 is low, Q3 is off which turns on Q1. When pin 11 is low, Q4 is off which turns on Q2. When both Q3 and Q4 are on, Q1 and Q2 are both off.

T2 senses primary converter current which is proportional to the DC output current. The secondary current of T2 is rectified by CR13, CR14, CR15, and CR16. This develops a voltage across R37 which is approximately .05V for each amp of DC output current. A1 pin 16 senses this voltage and compares it to the 1.7V reference on pin 15. This limits the DC output current during overload/short circuit.

The 27.5 KHz operating frequency is controlled by R19, C22.

An over temperature condition will close TS1. This turns on Q5, raising A1 pin 4. This shuts off the converter. TS1 will automatically reset when cool, enabling the converter.

OUTPUT FILTER SECTION (PC3)

The rectified secondary voltage of T4 is applied to the network of L3 and C33 which filters the waveform to a smooth DC with low ripple voltage. L3, C34, C34A, C35, C36, C36A, C37 and C37A provide additional filtering to reduce voltage spikes on the output. The components in this section are critical for a low noise output. These components should be replaced only with the specified type.

MAINTENANCE

DISASSEMBLY PROCEDURE:

WARNING

This unit contains dangerous voltage levels. In addition to line voltage, 300 volts DC is present at high energy storage levels. It is strongly recommended that defective units be returned to the manufacturer for service.

If field repair is necessary, remove input power and WAIT five minutes before opening unit. This allows the high voltage capacitors to discharge. Wait at least five minutes after input power is removed before connecting or removing test probes.

The input and converter sections of this unit are NOT isolated from the AC input source; therefore, an isolation transformer should be used during any maintenance. Use extreme caution when connecting test equipment.

1. Remove input power, wait five minutes, disconnect input and output wiring.

2. Remove the 4-40 x 1/4 pan head screw from top center of the front panel. Remove the 6-32 x 1/4 pan head screw from the left center of the front panel. Remove the 4-40 x 1/4 flat head screw from the top of the left side panel (see Figure 1). Remove the two 6-32 x 3/8 pan head screws and nylon washers holding left side panel to heat sink (see Figure 2). Note the insulator between the heat sink and left side panel.

3. Remove two 4-40 x 1/4 flat head screws from bottom edge of right side panel. Remove 4-40 x 1/4 flat head screw from top center of right side. Lift off top cover. (Figure 3).

4. Place unit so that it rests on the left side panel. Rotate the front and right side panel assembly 180 degrees counter-clockwise so that it rests on the right side panel (see Figures 5 and 6).

5. In this position, all electrical connections are maintained and the unit can be energized for troubleshooting.

WARNING

Dangerous voltages are exposed in this condition. Do not connect or remove test probes while unit is energized. Wait at least five minutes after input power is removed before connecting or removing test probes.

RE-ASSEMBLY PROCEDURE

WARNING

Observe the five minute discharge time before re-assembling unit.

1. Re-assemble in reverse order the procedures in the Disassembly Procedure paragraph insuring that all leads and connections are oriented correctly.

2. Insure that noise shield is positioned correctly as shown in Figure 7.

3. Insure that the insulator is installed between the left side panel and the heat sink. The small diameter end of the nylon shoulder washers must be inserted into the left side panel and properly seated before the two 6-32 x 1/4 pan head screws are tightened.

TROUBLESHOOTING

The checks in the following table should be followed when troubleshooting a suspected defective power supply. When a component or assembly has been isolated as being defective, replace defective component BUT check associated components before applying power to the unit in the event a series of components are defective.

When replacing Q1, Q2, CR19, CR20 and/or heat sink, insure that insulators and heat conducting grease are applied properly.

When either Q1 or Q2 is replaced, replace driver transistors Q3 and Q4 along with the replacement of Q1 and Q2 as a pair.

Recommended test equipment for maintenance of this power supply should include:

- Isolation Transformer
- Digital Voltmeter
- Frequency Counter
- Oscilloscope
- 50 Amp DC Meter
- Resistive Load

SYMPTON	AREA TO CHECK
Circuit breaker trips	1) Shorted capacitor(s) or bridge rectifier (PC1). 2) CR1, CR2, Q1, Q2 shorted (PC2). 3) Input voltage selector (observe through top cover) 230 volts AC applied with 115 volts AC range selected can cause many component failures in the converter and control.
No output	1) Proper input voltage for range selected. 2) Output properly connected. 3) Over temperature shutdown. 4) DC bulk voltage ±150 volts. 5) Bias voltage. 6) A1 pin 4 should be 0 volts. 7) 15 volt switching waveform on A1 pins 8, 11.
Output voltage low	1) Proper input voltage for range selected. 2) Output overloaded. 3) Output voltage not adjusted (R25). 4) Current limit set too low (R15). 5) 5 volt ±.25 volt on A1 pin 14. 6) 4 volt ±.4 volt on A2 pin 3.
Output voltage high	1) Output voltage not adjusted (R25). 2) E14 or E15 wires broken (PC3). 3) 2.5 volts ±.1 volt on A1 pin 2.

POWER SUPPLY VOLTAGE READINGS

LOCATION	READING (TYPICAL)	NOTES
A1-1	2.5 VDC	
A1-2	2.5 VDC	
A1-4	0 VDC	
A1-12	20 VDC	
A1-13	5 VDC	
A1-15	1.7 VDC	
A2-1	5 VDC	
A2-3	4 VDC	
A2-6	4 VDC	
A2-8	20 VDC	

SUPPLY ADJUSTMENTS

The power supply adjustments have been completed at the factory and no further adjustments are required. However, if A1, R15 or R25 are replaced, the following adjustments should be made.

1. The output voltage is adjusted by R25. Adjust the output to 13.8 volts DC ±0.5 VDC.

2. The output current limit is adjusted by R15. Load the output to 32.5 Amperes DC ±2A and adjust R15 counter-clockwise until the output voltage decreases 0.2 to 0.4 volts.

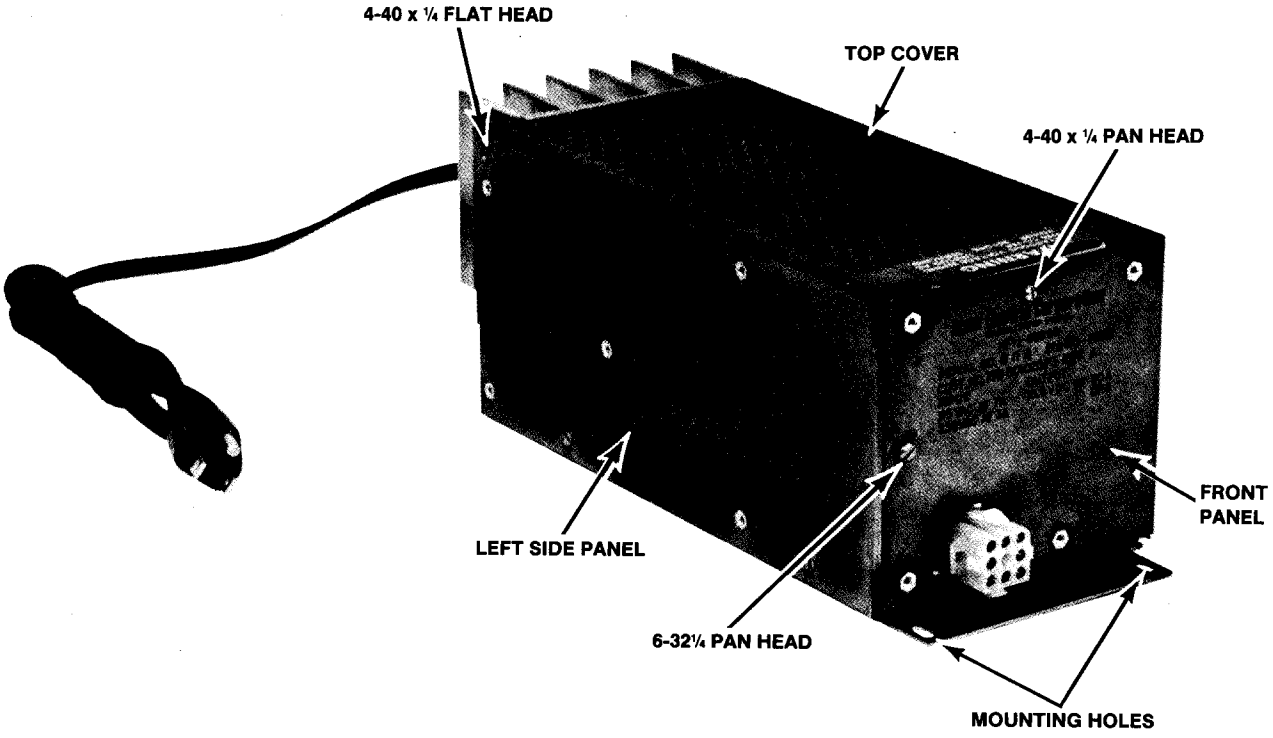
INSTALLATION

The power supply can be mounted by using the mounting holes on the chassis (Figures 1 and 4).

NOTE

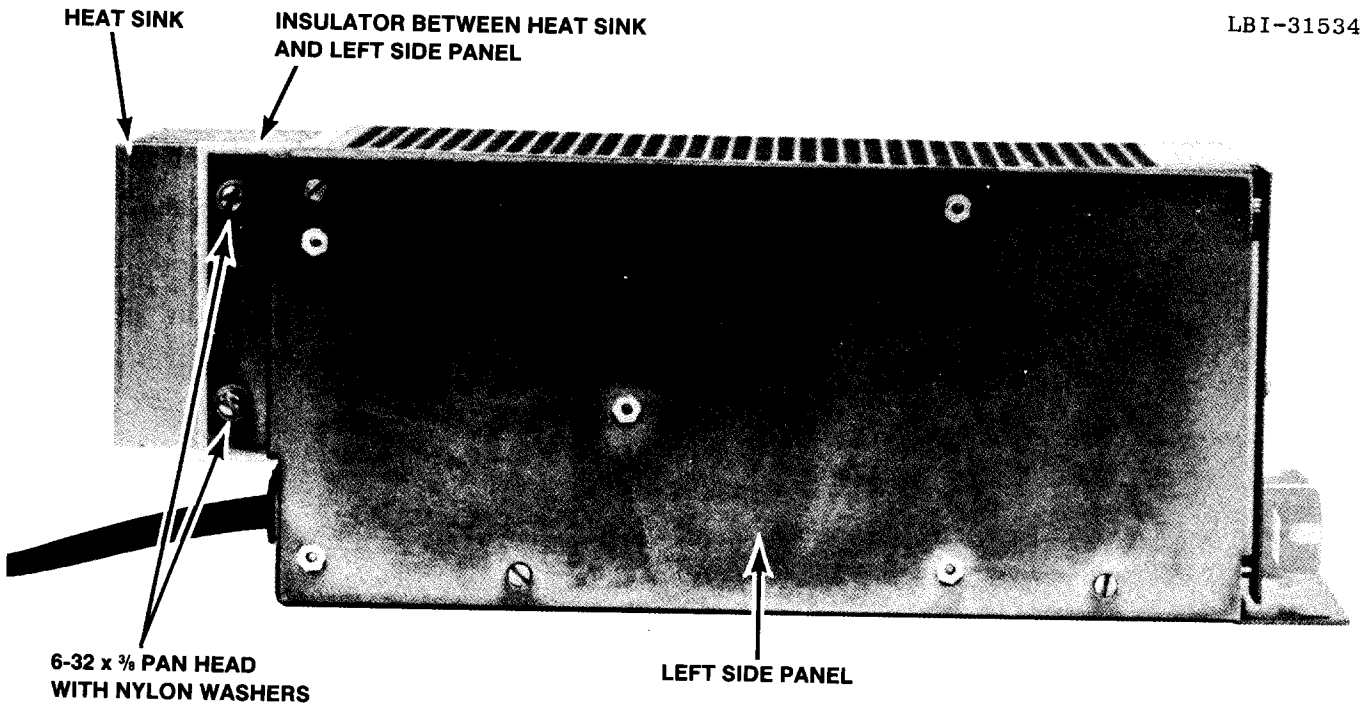
Insure that ventilation holes in the unit are not obstructed when unit is mounted or in operation.

Before the power supply is connected to a power source, the input voltage tap selector should be checked for the correct insertion for the power source. The input range selector position can be observed through the top cover. Removal of the top cover is required to change the input range selected.



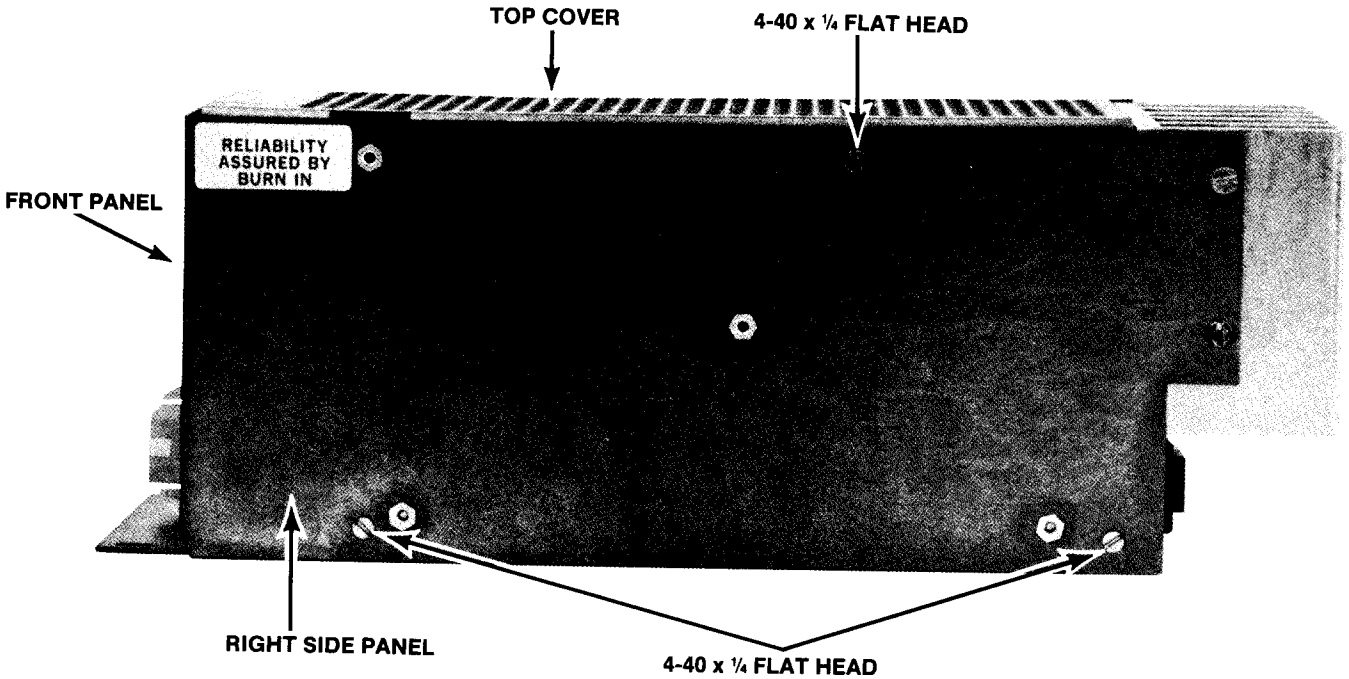
OVERALL EXTERNAL VIEW

Figure 1



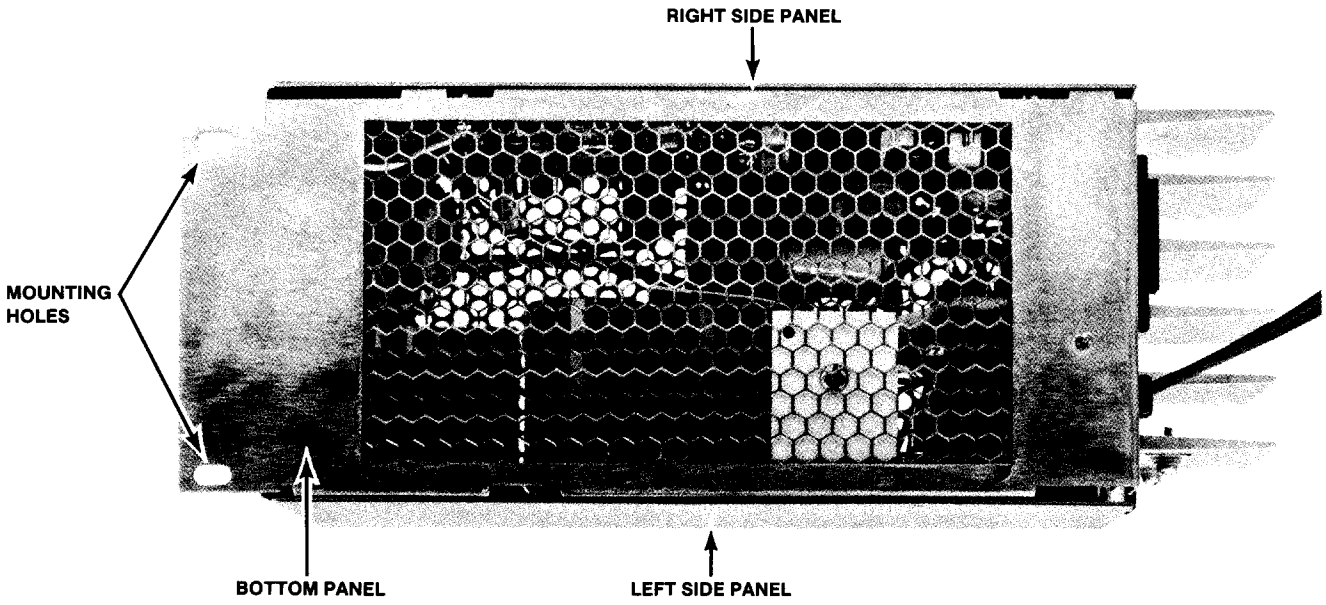
LEFT SIDE VIEW

Figure 2



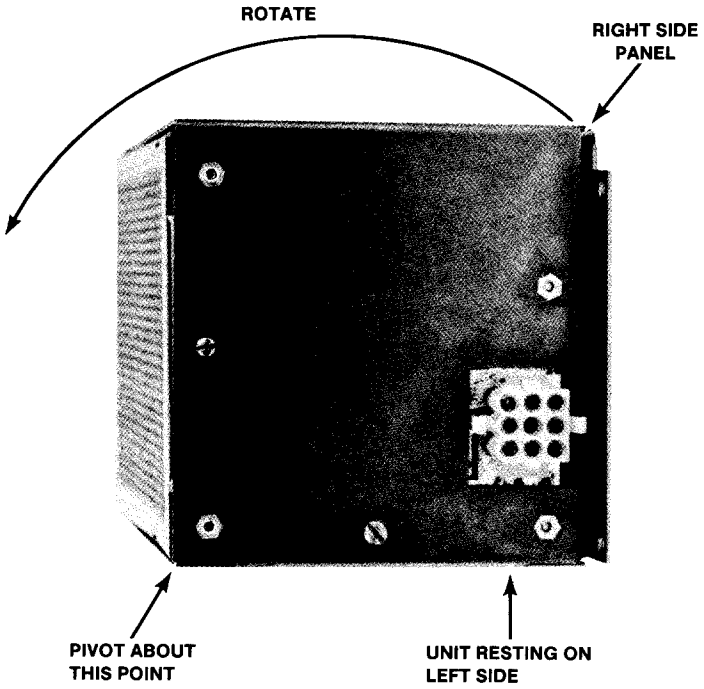
RIGHT SIDE VIEW

Figure 3



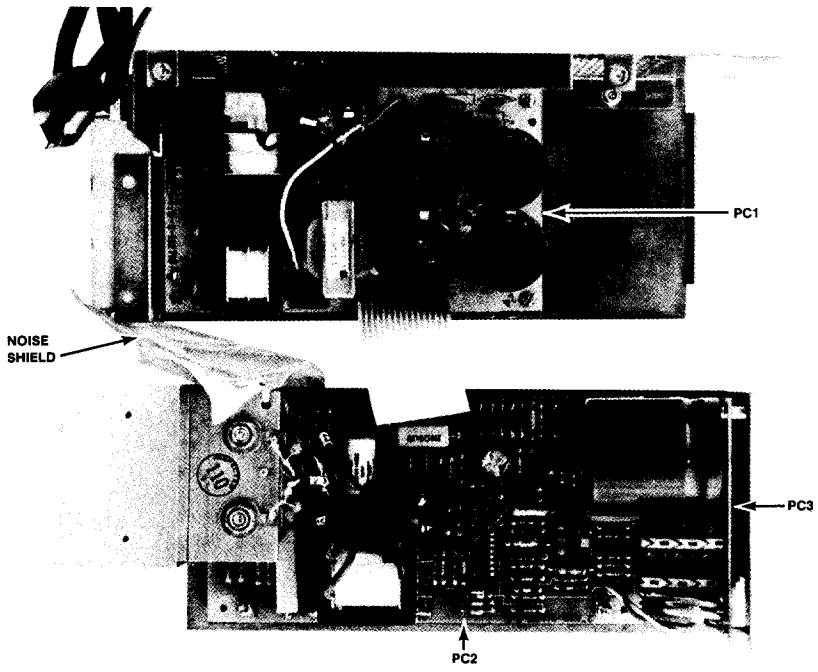
BOTTOM VIEW

Figure 4



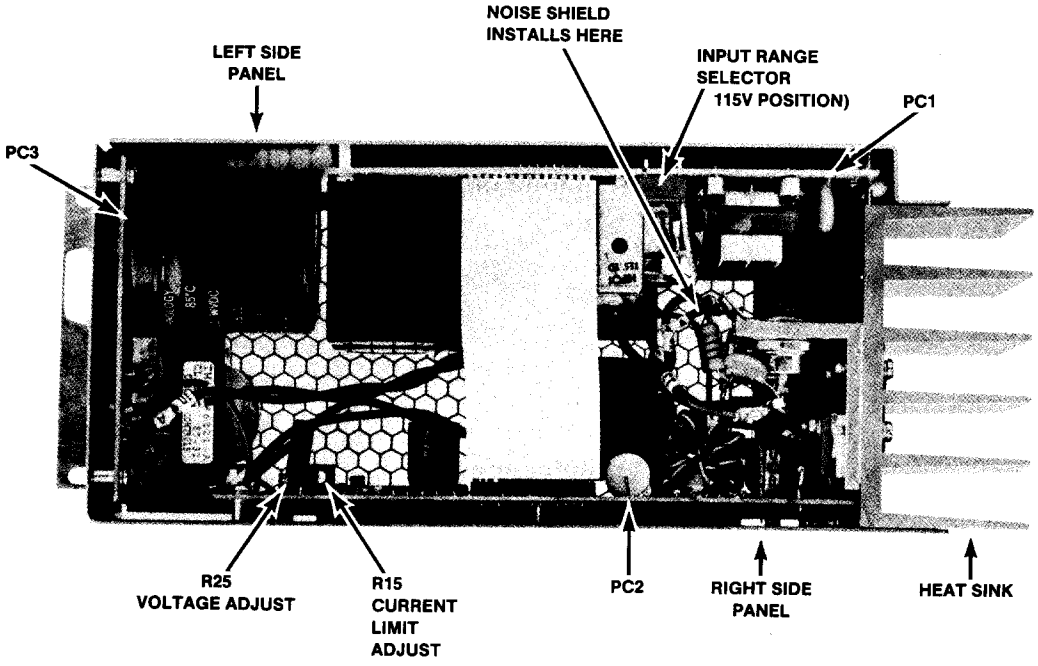
DISASSEMBLY, BEFORE

Figure 5



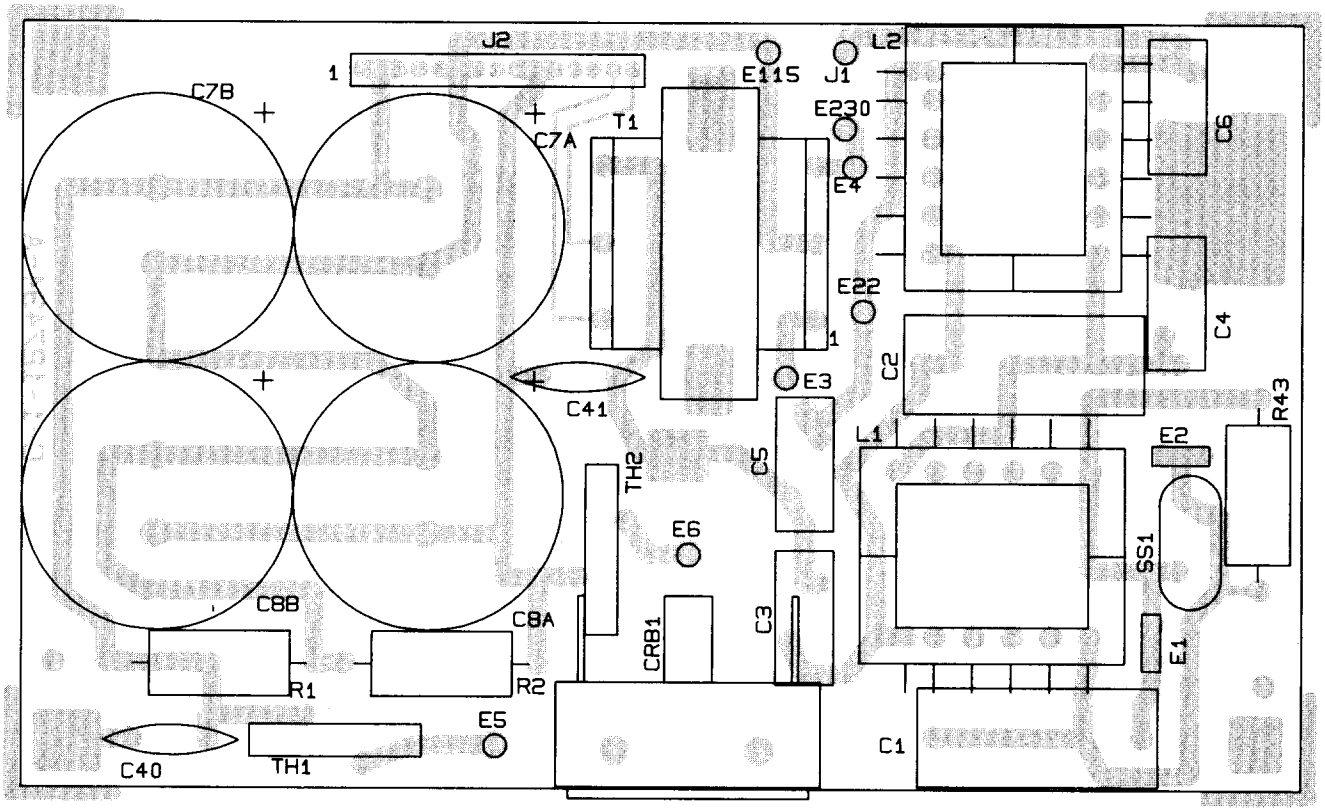
DISASSEMBLY, AFTER

Figure 6



TOP VIEW, COVER REMOVED

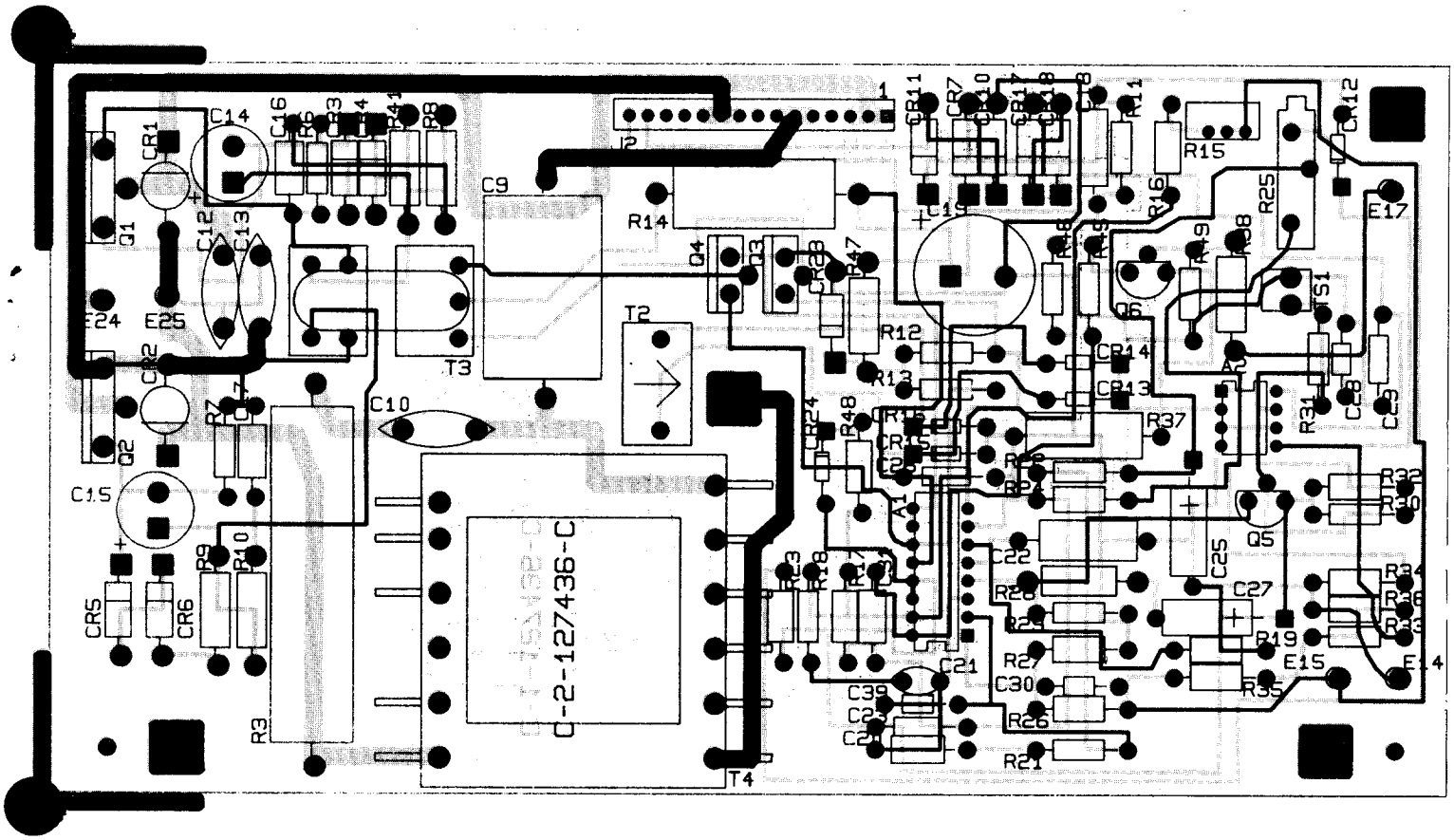
Figure 7



(C-127435)
(C-1-127434-A)

SERVICE OUTLINE

INPUT SECTION (PC1)

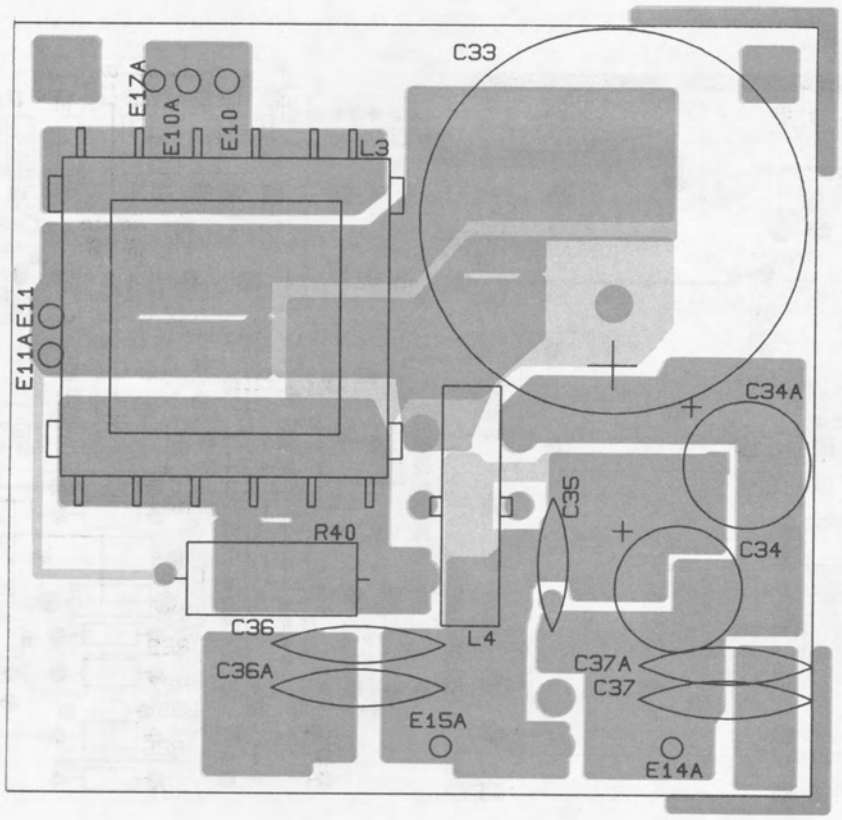


(C-127437)
(C-2-127436-C)
(C-1-127436-c)

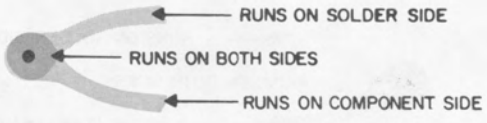
RUNS ON SOLDER SIDE
RUNS ON BOTH SIDES
RUNS ON COMPONENT SIDE

SERVICE OUTLINE

CONVERTER/CONTROL SECTION (PC2)

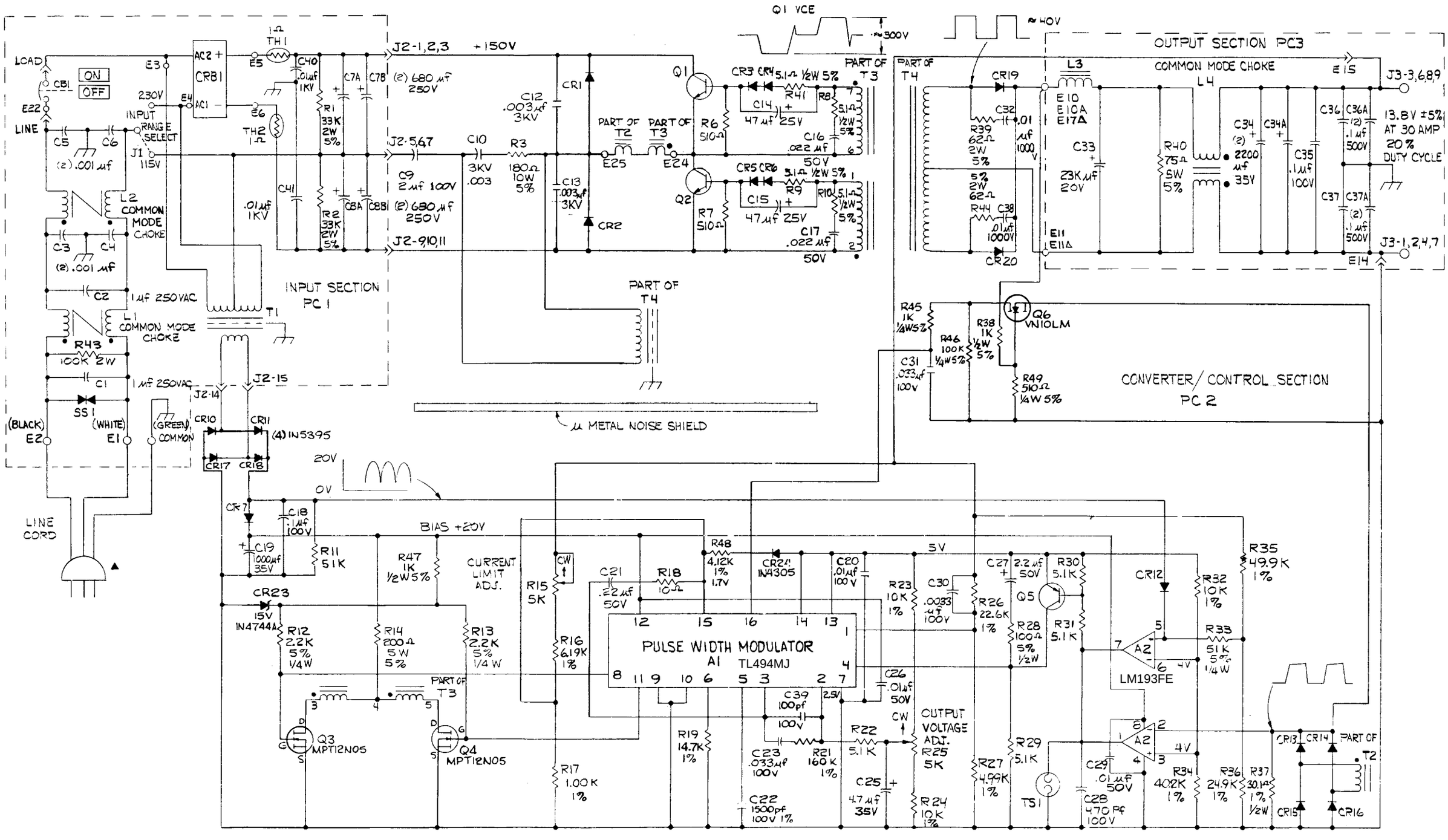


(PC3)



SERVICE OUTLINE

OUTPUT SECTION (PC3)



NOTES:

▲ PLUG REMOVED FOR 230V APPLICATIONS

SCHEMATIC DIAGRAM

30 A POWER SUPPLY

SYMBOL	DESCRIPTION	VENDOR/PART NUMBER
A1	TL494MJ PWM CONTROL	MOTOROLA SC77577P
A2	LM193 DUAL COMPARATOR	SIGNETICS LM193FE
C1	1.0U 250V CAP.	F-DYNE MPP 5X
C2	1.0U 250V CAP.	F-DYNE MPP 5X
C3	.001U 250V CAP.	RIFA PME277MB410
C4	.001U 250V CAP.	RIFA PME277MB410
C5	.001U 250V CAP.	RIFA PME277MB410
C6	.001U 250V CAP.	RIFA PME277MB410
C7A	680U 250V CAP.	NICHICON LPH2E681MHSC
C7B	680U 250V CAP.	NICHICON LPH2E681MHSC
C8A	680U 250V CAP.	NICHICON LPH2E681MHSC
C8B	680U 250V CAP.	NICHICON LPH2E681MHSC
C9	2U 100V CAP.	SPRAGUE 735P205X9100PLL
C10	.003U 3000V CAP.	CENTRALAB DD30-302
C12	.003U 3000V CAP.	CENTRALAB DD30-302
C13	.003U 3000V CAP.	CENTRALAB DD30-302
C14	47U 25V CAP.	PANASONIC ECE-A1EF470R
C15	47U 25V CAP.	PANASONIC ECE-A1EF470R
C16	.022U 50V CAP.	AVX SR305C223KAA
C17	.022U 50V CAP.	AVX SR305C223KAA
C18	.10U 100V CAP.	AVX SA401C104KAA
C19	1000U 35V CAP.	ILLINOIS CAP 108MRM035M
C20	.01U 100V CAP.	AVX SA201C103KAA
C21	.22U 50V CAP.	AVX 305C224KAA
C22	.0015U 100V CAP.	PAKTRON 152F01PP481
C23	.033U 100V CAP.	AVX SR301C333KAA
C25	4.7U 35V CAP.	ILLINOIS CAP. 475TLA035M
C26	.01U 50V CAP.	AVX SA201C103KAA
C27	2.2U 50V CAP.	PANASONIC ECE-B50Z2R2
C28	470P 100V CAP.	AVX SA101C471KAA
C29	.01U 50V CAP.	AVX SA201C103KAA
C30	.0033U 100V CAP.	AVX SA101C332KAA
C31	.033 100V CAP.	AVX SA301C333KAA
C32	.01U 1000V CAP.	SPRAGUE 5GAS10
C33	23000U, 20V CAP.	MEPCO/ELECTRA 319EA233M020BP
C34	2200U 25V CAP.	RUBY CON 25TMHA2200M
C34A	2200U 25V CAP.	RUBY CON 25TMHA2200M
C35	.1U 100V CAP.	SPRAGUE TG-P10
C36	.1U 500V CAP.	SPRAGUE 5HK-P10
C36A	.1U 500V CAP.	SPRAGUE 5HK-P10
C37	.1U 500V CAP.	SPRAGUE 5HK-P10
C37A	.1U 500V CAP.	SPRAGUE 5HK-P10
C38	.01U 1000V CAP.	SPRAGUE 5GAS10
C39	100 PF 100V CAP.	AVX SA101C101KAA
C40	.01U 1000V CAP.	SPRAGUE 5GA-S10
C41	.01U 1000V CAP.	SPRAGUE 5GA-S10
CB1	CIRCUIT BREAKER 10A	AIRPAX 203-11-20908-2
CR1	A115D DIODE	GENERAL ELECTRIC A115D
CR2	A115D DIODE	GENERAL ELECTRIC A115D
CR3	1N5395 DIODE	ITT 1N5395
CR4	1N5395 DIODE	ITT 1N5395
CR5	1N5395 DIODE	ITT 1N5395
CR6	1N5395 DIODE	ITT 1N5395
CR7	1N5395 DIODE	ITT 1N5395
CR10	1N5395 DIODE	ITT 1N5395
CR11	1N5395 DIODE	ITT 1N5395
CR12	1N4305 DIODE	ITT 1N5395
CR13	1N4305 DIODE	ITT 1N5395
CR14	1N4305 DIODE	ITT 1N5395
CR15	1N4305 DIODE	ITT 1N5395
CR16	1N4305 DIODE	ITT 1N5395
CR17	1N5395 DIODE	ITT 1N5395
CR18	1N5395 DIODE	ITT 1N5395
CR19	UES803 DIODE	UNITRODE UES-803
CR20	UES803 DIODE	UNITRODE UES-803
CR23	15V ZENER DIODE	ITT 1N4744A
CR24	1N4305 DIODE	GENERAL ELECTRIC 1N4305
CRB1	600V 25A BRIDGE	RECTRON BR256P
L1	EMI-C MODE	ACME THF-86223
L2	EMI-C MODE	ACME THF-86223
L3	FILTER CHOKE	ACME THF-1-86221
L4	C MODE CHOKE	ACME THF-86240
Q1	2SC2625 TRANSISTOR	FUJI (COLLMER) 2SC2625
Q2	2SC2625 TRANSISTOR	FUJI (COLLMER) 2SC2625
Q3	F.E.T.	MOTOROLA MTP 12N05
Q4	F.E.T.	MOTOROLA MTP 12N05
Q5	2N3906 TRANSISTOR	MOTOROLA 2N3906
Q6	F.E.T.	SILICONIX VN10LM
R1	33K OHMS 2.00W 5% RES.	STACKPOLE RS-2
R2	33K OHMS 2.00W 5% RES.	STACKPOLE RS-2
R3	180 OHMS 10.00W 5% RES.	TRW PW-10
R6	510 OHMS .25W 5% RES.	KOA CF-1/2
R7	510 OHMS .25W 5% RES.	KOA CF-1/2
R8	5.1 OHMS .50W 5% RES.	KOA CF-1/2
R9	5.1 OHMS .50W 5% RES.	KOA CF-1/2
R10	5.1 OHMS .50W 5% RES.	KOA CF-1/2
R11	51K OHMS .25W 5% RES.	KOA CF-1/4
R12	2.2K OHMS .25W 5% RES.	KOA CF-1/4
R13	2.2K OHMS .25W 5% RES.	KOA CF-1/4
R14	200 OHMS 5.00W 5% RES.	PACE TYPE 5QP
R15	5K OHMS .50W 10% ADJ. RES.	BOURNS 3386W-1-502
R16	6.19K OHMS .13W 1% RES.	KOA MF-55
R17	1.00K OHMS .13W 1% RES.	KOA MF-55
R18	10 OHMS .25W 5% RES.	KOA CF-1/4
R19	14.7K OHMS .13W 1% RES.	KOA MF-55
R21	160K OHMS .25W 5% RES.	KOA CF-1/4
R22	5.1K OHMS .25W 5% RES.	KOA CF-1/4
R23	10K OHMS .13W 1% RES.	KOA MF-55
R24	10K OHMS .13W 1% RES.	KOA MF-55
R25	5K OHMS .40W 10% ADJ. RES.	WESTON 830P5K
R26	22.6K OHMS .13W 1% RES.	KOA MF-55
R27	4.99K OHMS .13W 1% RES.	KOA MF-55
R28	100 OHMS .50W 5% RES.	KOA CF-1/2
R29	5.1K OHMS .25W 5% RES.	KOA CF-1/4
R30	5.1K OHMS .25W 5% RES.	KOA CF-1/4
R31	5.1K OHMS .25W 5% RES.	KOA CF-1/4
R32	10K OHMS .13W 1% RES.	KOA MF-55
R33	51K OHMS .25W 5% RES.	KOA CF-1/4
R34	40.2K OHMS .13W 1% RES.	KOA MF-55
R35	49.9K OHMS .13W 1% RES.	KOA MF-55
R36	24.9K OHMS .13W 1% RES.	KOA MF-55
R37	30.1 OHMS .50W 1% RES.	CORNING NA65
R38	1K OHMS .50W 5% RES.	KOA CF-1/2
R39	62 OHMS 2W MO 5% RES.	STACKPOLE RS-2
R40	75 OHMS 5.00W 5% RES.	PACE TYPE SQP
R41	5.1 OHMS .50W 5% RES.	KOA CF-1/2
R43	100K OHMS 2.00W 5% RES.	STACKPOLE RS-2
R44	62 OHMS 2W MO 5% RES.	STACKPOLE RS-2
R45	1K OHMS .25W 5%	KOA CF-1/4
R46	100K OHMS .25W 5%	KOA CF-1/4
R47	1K OHMS .50W 5%	KOA CF-1/2
R48	4.12K OHMS .13W 1%	KOA MF-55
R49	510 OHMS .25W 5%	KOA CF-1/4
SS1	V275LA20A SURGE SUPPRESSOR	GENERAL ELECTRIC V275LA20A
T1	BIAS TRANSFORMER	ACME T-78697
T2	I SENSE TRANSFORMER	ACME A-1300201
T3	BASE DRIVE TRANSFORMER	ACME THF-86080
T4	POWER TRANSFORMER	ACME THF-86502

SYMBOL	DESCRIPTION	VENDOR/PART NUMBER
TH1	1 OHMS 10%	CAL-R 113751
TH2	1 OHMS 10%	CAL-R 113751
TS1	THERMAL SWITCH	PORTAGE ELECTRIC CR11
	HEAT SINK	ACME B-132583
J1	INPUT RANGE SELECTOR	CAMBION 461-3771-01-03-12
J2	CONNECTOR	AMP 643115-1
J3	CONNECTOR	AMP 1-480672-0
	CONTACTS	AMP 350388-1
	SHIELD	ACME A-131180
	INPUT CORD	ACME A-132457
	STRAIN RELIEF	HEYCO SR-302-1
	RIBBON CABLE	AMP 1-86954-4

END OF DOCUMENT