

SECTION 7

LOW VOLTAGE POWER SUPPLY (A1)

7-1. GENERAL. The low voltage power supply (figure 7-1) converts an AC line voltage input or a DC voltage input to the required DC operating voltages. The power supply is composed of four modules, each module containing a printed wiring board. These modules are the relay, control, switcher, and output modules. Protection circuits protect the power supply against short circuits, high internal temperatures, and high and low DC bus voltages.

7-2. INPUT POWER CONTROL. When AC power is applied to the power supply, the output of the AC rectifier and filter circuit provides the DC bus voltage. An AC sense circuit provides a control voltage when AC power is present. This control voltage isolates the DC voltage input from the DC bus and drives the front panel AC indicator.

7-3. The off, standby, or on operating mode of the power supply is selected by the control circuit. When the analyzer is off, the frequency standard and chopper generator are off, and the battery charger is on. When the analyzer is in standby, the chopper generator is off and the frequency standard and battery charger are on. When the analyzer is on, the frequency standard and chopper generator are on and the battery charger is off. Thus, the battery is charged when the analyzer is in the off and standby modes of operation. The frequency standard operates in the standby and on modes of operation.

7-4. The battery charger requires a voltage higher than the nominal DC bus voltage. This increased voltage, 32V, is provided by the AC boost circuit.

7-5. To operate the power supply using a DC voltage input, the AC power input must be removed, disabling the AC sense voltage. When the AC power is removed and the analyzer turned off, no power is present on the DC bus. When the analyzer is switched to the standby mode, the DC relay closes, connecting the DC voltage input to the DC bus and the supply voltage to the frequency standard. When the analyzer is switched on, the chopper generator is enabled and normal operation occurs.

7-6. DC OUTPUT CONTROL. Regulation of the DC output voltages is accomplished by using the +5volt output as feedback. This feedback voltage is compared to a stable reference voltage (7.9V). The resultant control voltage determines the on time of the pulse width modulator, thus regulating the input voltage to the chopper circuits. The output transformer winding ratios determine the output voltages with respect to the +5-volt feedback.

7-7. The chopper generator provides a 7-volt reference voltage, a 20-kHz squarewave chopper drive signal, and a 20 kHz triangular waveform. The pulse width modulator has a 50 percent duty cycle. For control voltages that are above or below the mean DC voltage of the triangular waveform, the duty cycle is proportionately increased or decreased.

7-8. The filtered DC output from the pulse width modulator is chopped 50 percent through the primary windings of output transformer T2 at a 20 kHz rate. The DC output is alternately switched between each half of the primary winding of T2. Current through the primary winding center tap is passed through a current transformer whose output is used for overcurrent protection.

7-9. PROTECTION CIRCUIT. This power supply is protected from shorted outputs, high internal temperatures, and high or low DC bus voltage. In each case, the protection circuit pulls the control voltage line low, disabling the pulse width modulator and shutting down the power supply outputs.

7-10. Short circuit protection is provided by monitoring the current in the primary winding of the output transformer T2. When an output is shorted, the primary winding current will increase significantly. This causes the overcurrent detector to pull the control voltage line low, disabling the pulse width modulator and shutting down the output. With the output shut down, there is no primary winding current, causing the control voltage line to be released. When the control voltage line is released, the pulse width modulator is again enabled and the power supply outputs are available again. If the short circuit is still present, the shutdown sequence will be repeated. A delay is provided in the overcurrent detector causing the shutdown sequence to cycle at an approximately 0.5 second rate.

7-11. Over temperature protection is provided by a thermal switch. When the temperature of the power supply exceeds the setting of the thermal switch, the switch closes, pulling the control voltage line low, disabling the pulse width modulator and shutting down the power supply outputs. Normal power supply operation will resume when the temperature returns to a safe operating level.

7-12. Protection against high or low DC or AC line inputs is provided by monitoring the DC bus voltage. When the DC bus voltage exceeds 20 volts, or falls below 10 volts, the high/low shutdown circuit pulls the control voltage line low, disabling the pulse width modulator and shutting down the power supply outputs. When the DC bus voltage returns to normal, the power supply will automatically resume normal operation.

7-13. HIGH VOLTAGE CONTROL. The HV BIAS V line and the HV SOURCE V line provide the high voltage power supply A10 with bias voltage and primary power, respectively.

7-14. SWITCHER MODULE A1A1. The switcher module (figure 7-4) contains the pulse width modulator and chopper circuits. The input PWM DRIVE signal, from the control module, switches the chopping circuit on and off. This produces a rectangular wave output which is filtered and applied to transformer choppers A and B. In effect, this action regulates the voltage which is applied to transformer T201 on the output module. The PWM OUT signal is a secondary input to the voltage regulator comparator on the control module.

7-15. Transformer choppers A and B are driven by CHOPPER DR A and CHOPPER DR B signals from the control module. Output signals XFMR DR A and XFMR DR B are 180-degrees out-of-phase and XFMR DR A1 and XFMR DR B1 are 180-degrees out-of-phase. An output, HV SOURCE V, from the chopping circuit is the primary power source for the high voltage power supply.

7-16. OVP (Overvoltage Protection). The OVP zener is connected to the +5V output from the output module and limits the maximum +5 volt level to +6.3 volts.

7-17. OUTPUT MODULE A1A2. The output module (figure 7-8) provides the regulated output voltages and the current sense voltage for the overcurrent protection circuit. Input power is provided by signals XMFR DR A, A¹, B, and B¹. These signals are 20 kHz squarewaves and drive the primary windings of transformer T201. After full wave rectification and filtering, the nominal output voltages are available as shown in figure 7-8.

7-18. The primary current of transformer T201 is monitored by transformer T202. The voltage developed across T202 is full wave rectified and applied to the current limit circuit on the control module by the CURRENT LIMIT SENSE signal. An increase in the primary current of T201 produces a corresponding increase in the voltage developed across T202. This increase is applied to the current limit circuit and overcurrent protection is initiated.

7-19. Regulation of the output voltage is accomplished by the +5-volt feedback. When the +5-volt output is regulated, the remaining output voltages will be regulated because of the turns ratio of the windings between the outputs. When the +5-volt output is held to one percent regulation, the other outputs will be held to five percent regulation.

7-20. The OVP (Overvoltage Protection) output is applied to a 6.2-volt zener diode mounted on the chopper assembly. This provides overvoltage protection to the +5-volt output.

7-21. CONTROL MODULE A1A3. The control module (figure 7-11) provides pulse width modulation control and contains the protection circuits. Pulse width modulation control is accomplished by comparing a 7.9V reference voltage to the +5-volt feedback from the output module. The resultant integrated control voltage is applied to the pulse width control. This voltage is compared to the 20 kHz triangle voltage to determine the duty cycle of the pulse width modulator. The chopper drive outputs are squarewaves and are 180-degrees out-of-phase with each other.

7-22. When the DC BUS voltage is over 20 or under 10 volts DC, the over/under voltage protection circuit pulls the control voltage signal to the pulsedwidth control circuit low. This action shuts down the pulsedwidth modulator.

7-23. The soft start circuit slows the rise time of the control signal to the pulsedwidth control circuits. When the signal reaches the operating level the soft start circuit is switched out of the control loop.

7-24. The overcurrent detector compares a signal that is proportioned to the current in the current transformer, to a reference. When the current is too high, the control signal is pulled low, shutting down the output module. After a delay, the output module operates again, if the malfunction causing the overcurrent is still present, the module will shutdown again. This sequence will cycle at a 0.5 second rate until the malfunction is corrected.

7-25. When the internal temperature of the power supply rises above 85°C, the overtemp shutdown circuit causes the control signal to go low, shutting down the pulsedwidth control circuit. The control logic functions are shown in table 7-1.

Table 7-1. Control Logic Functions

Input Signals		Output Signals				
Pwr On	AC Sense	Batt Chr Enable	HV Bias Supply V	AC Led	DC Led Anode	Relay Enable*
Low	Low	High	On	Off	On	Low
Low	High	Low	On	On	Off	High
High	Low	Low	Off	Off	Off	Low
High	High	High	Off	On	Off	High

*Note that RELAY ENABLE low, does not imply that the relay is closed. The PWR OFF signal on the relay module must also be high to close the relay.

7-26. RELAY MODULE A1A4. The relay module (figure 7-14) is mounted on one end plate of the power supply. Primary power is applied to the module through a line transformer or the DC input. When an AC input is used, the RELAY ENABLE line is high, the relay is open, and the power supply operates from the AC input. The MAIN AC and MAIN AC lines receive a 13.5-volt AC rms input from the line transformer. After full wave rectification, the DC power is routed throughout the power supply on the DC bus. Filtering of the DC power is done on the switcher module.

7-27. When the DC input is used, the RELAY ENABLE line is low, the relay is closed, and the power supply operates from the DC input. The battery charge voltage is boosted to 32 volts using the AC bus voltage to bias an AC boost winding center tap.


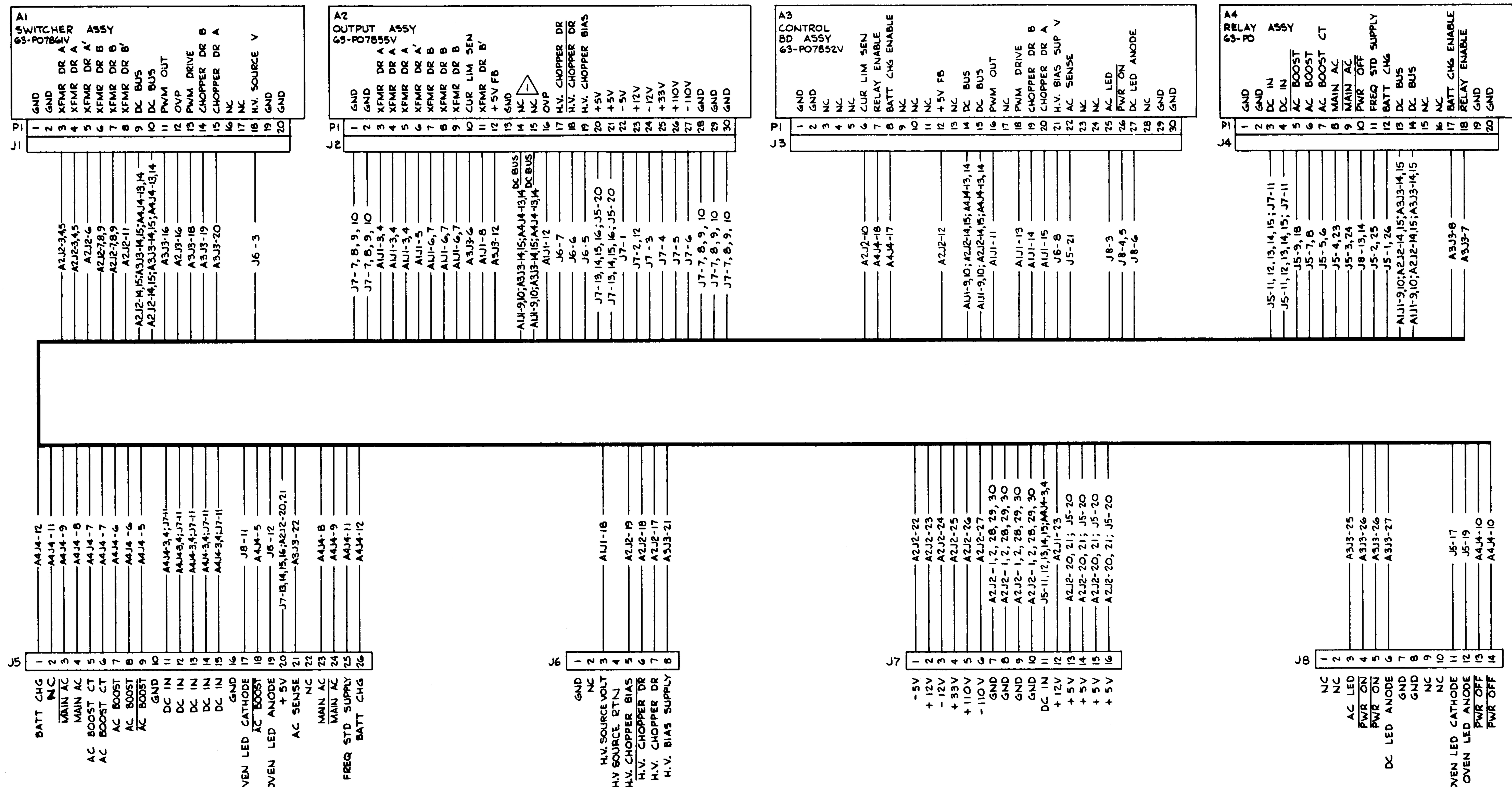


Figure 7-1. Low-Voltage Power Supply A1
Block Diagram



Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
005	1	27-P07858V001	CHASSIS,LVPS	
006	6	MS24693-S25	SCREW,FH	.138-32X.312
007	6	03-139581	SCREW,PH	4-40X.312
008	6	04-114583	WASHER,LOCK	.112
009	6	04-7607	WASHER,FLAT	.125
011	3	MS35206-227	SCREW	.1380-32X.312
012	3	MS35338-41	WASHER	.138
013	3	MS27183-6	WASHER	.156
014	AR	11-14167A01	INK	BLACK
A 001	1	RTP-4016A	SWITCHER ASSEMBLY	
A 002	1	RTP-4013A	OUTPUT PWB ASSEML	
A 003	1	RTP-4012A	CONTROL PWB ASSEMB	
A 004	1	01-80305A68	RELAY ASSEMBLY	
A 005	1	RTP-4014A	MOTHER BOARD ASSEM	

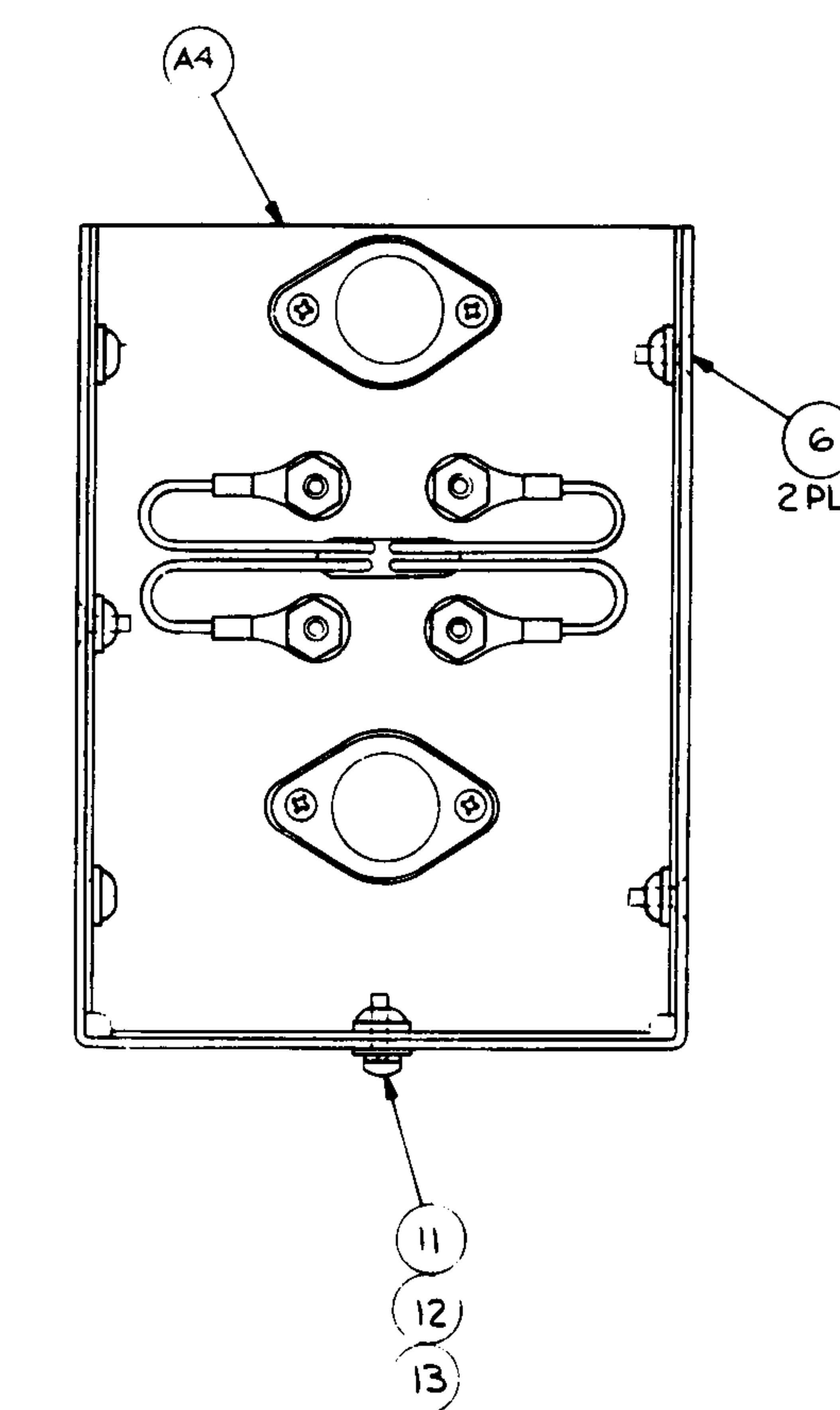
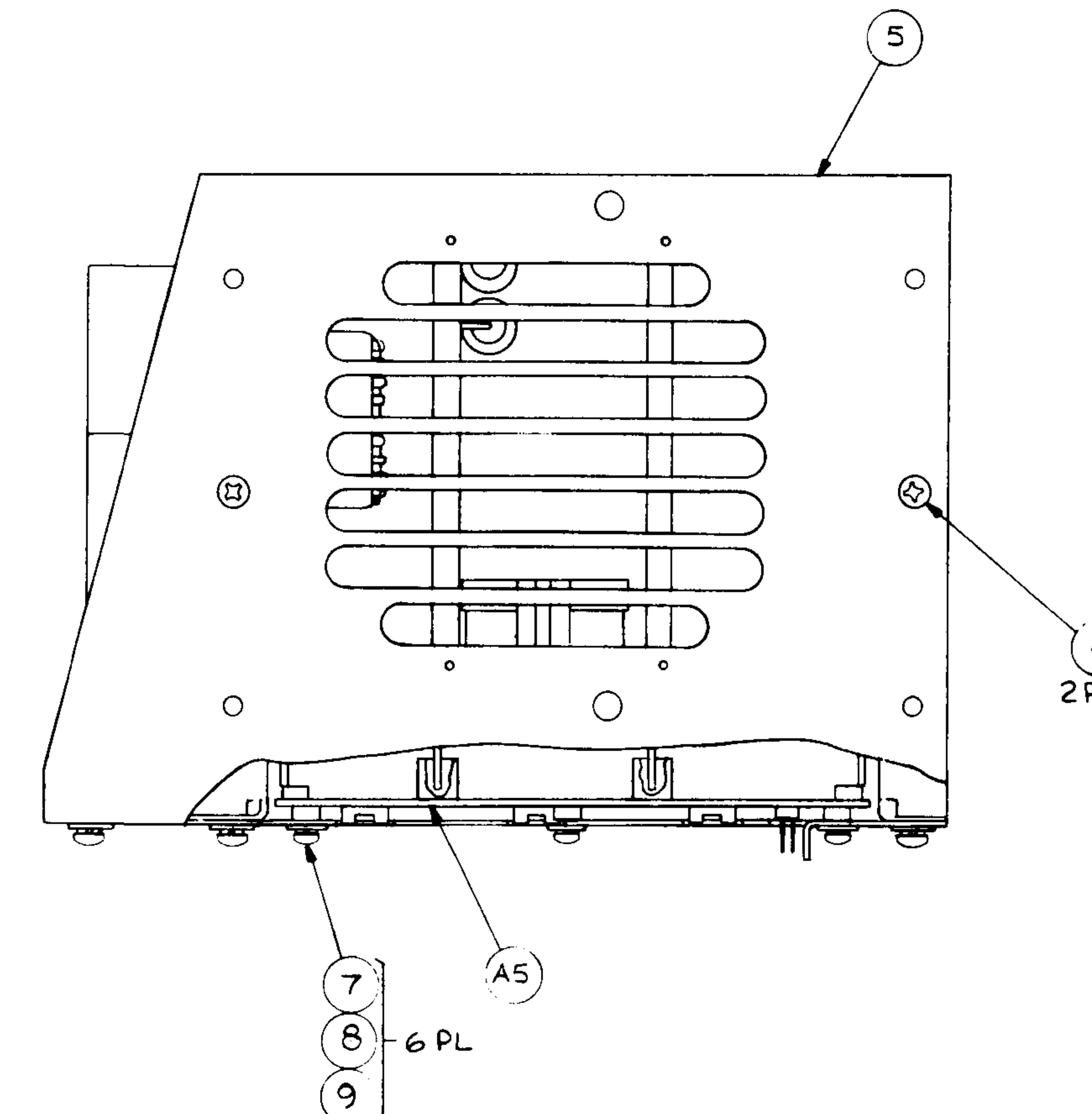
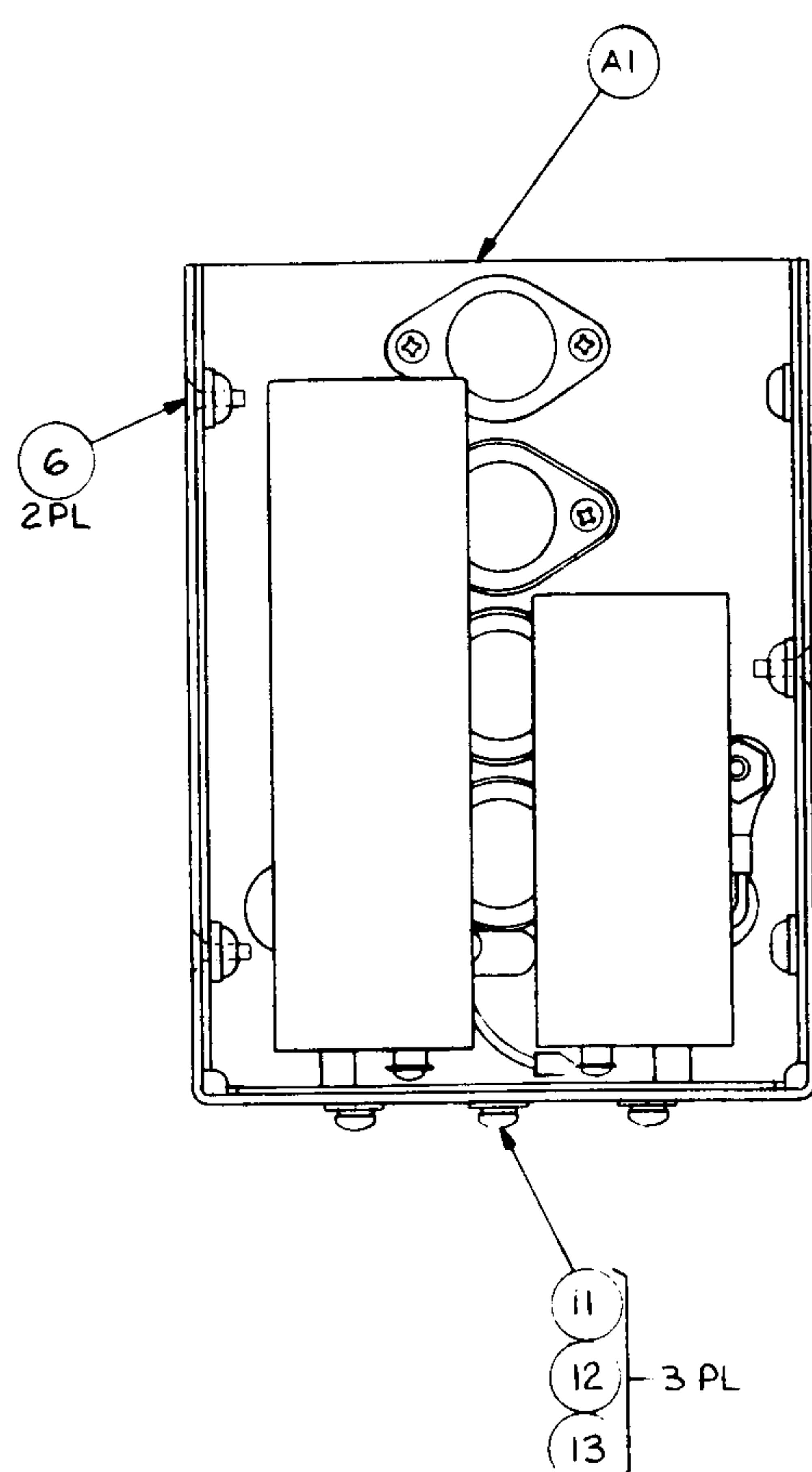
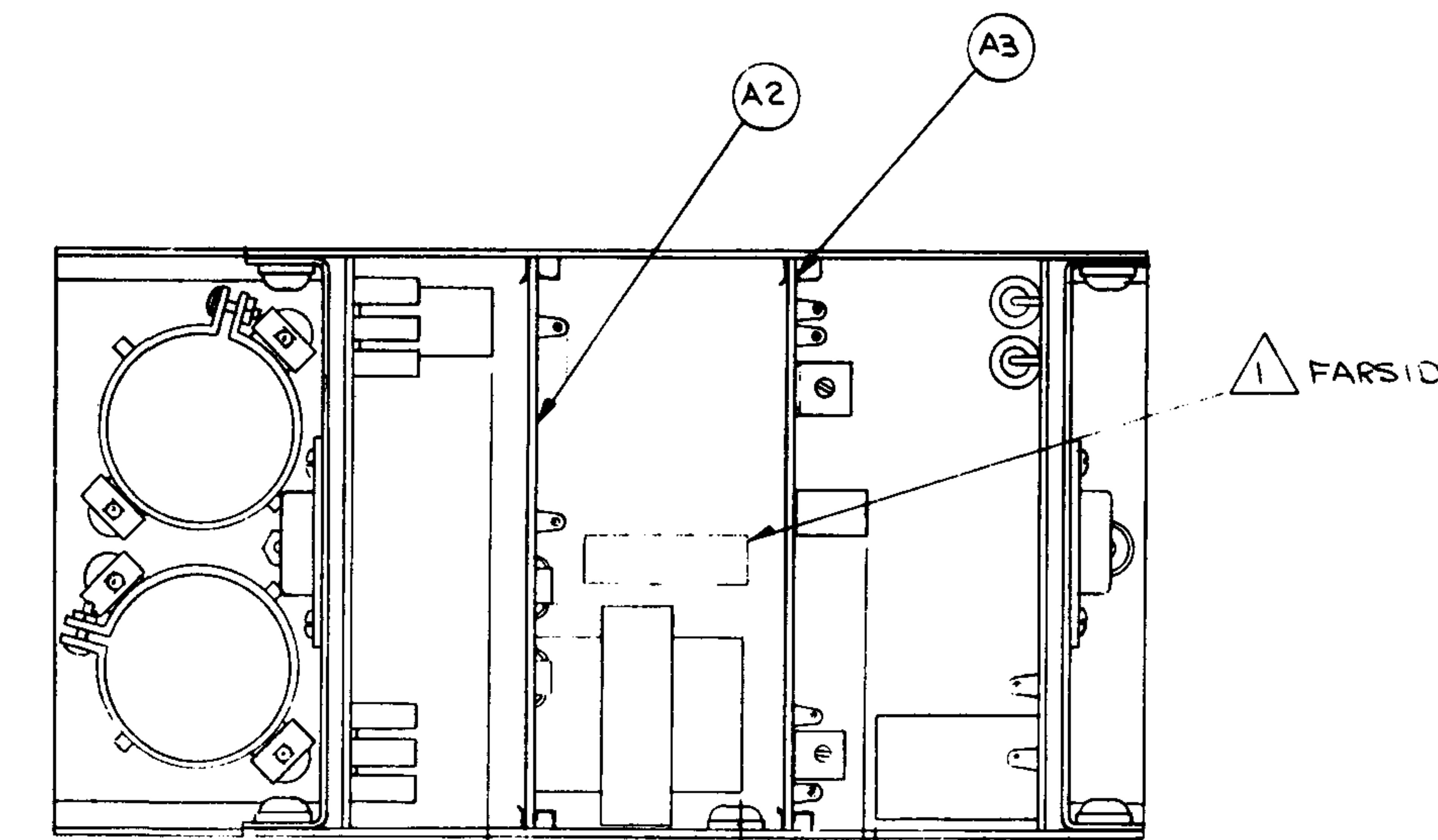
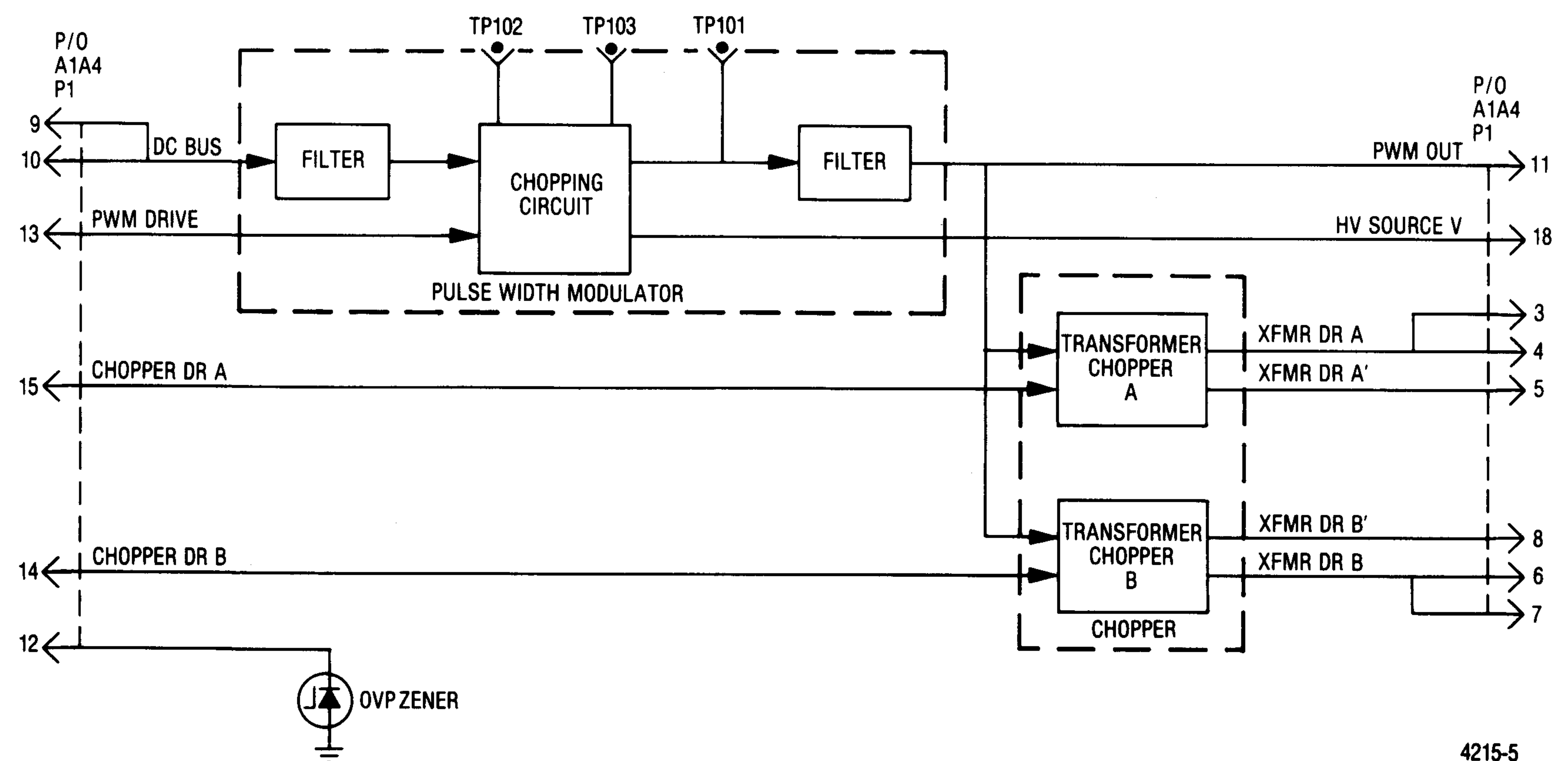


Figure 7-3. Low Voltage Power Supply
A1(RTP-1005A) Parts Location
Diagram



4215-5

Figure 7-4. Low Voltage Power Supply Switcher
Module A1A1 Block Diagram

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH A1.
2. FOR REFERENCE DRAWINGS REFER TO:
OI-PO7891V SWITCHER ASSY
OI-PO7862V SWITCHER PWB ASSY
3. UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE IN OHMS,
 ± 5 PCT, 1/4 WATT.
ALL CAPACITORS ARE IN UF.
ALL INDUCTORS ARE IN UH.
ALL VOLTAGES ARE DC.
4. * - COMPONENTS MOUNTED TO PLATE SWITCH MOUNTING.

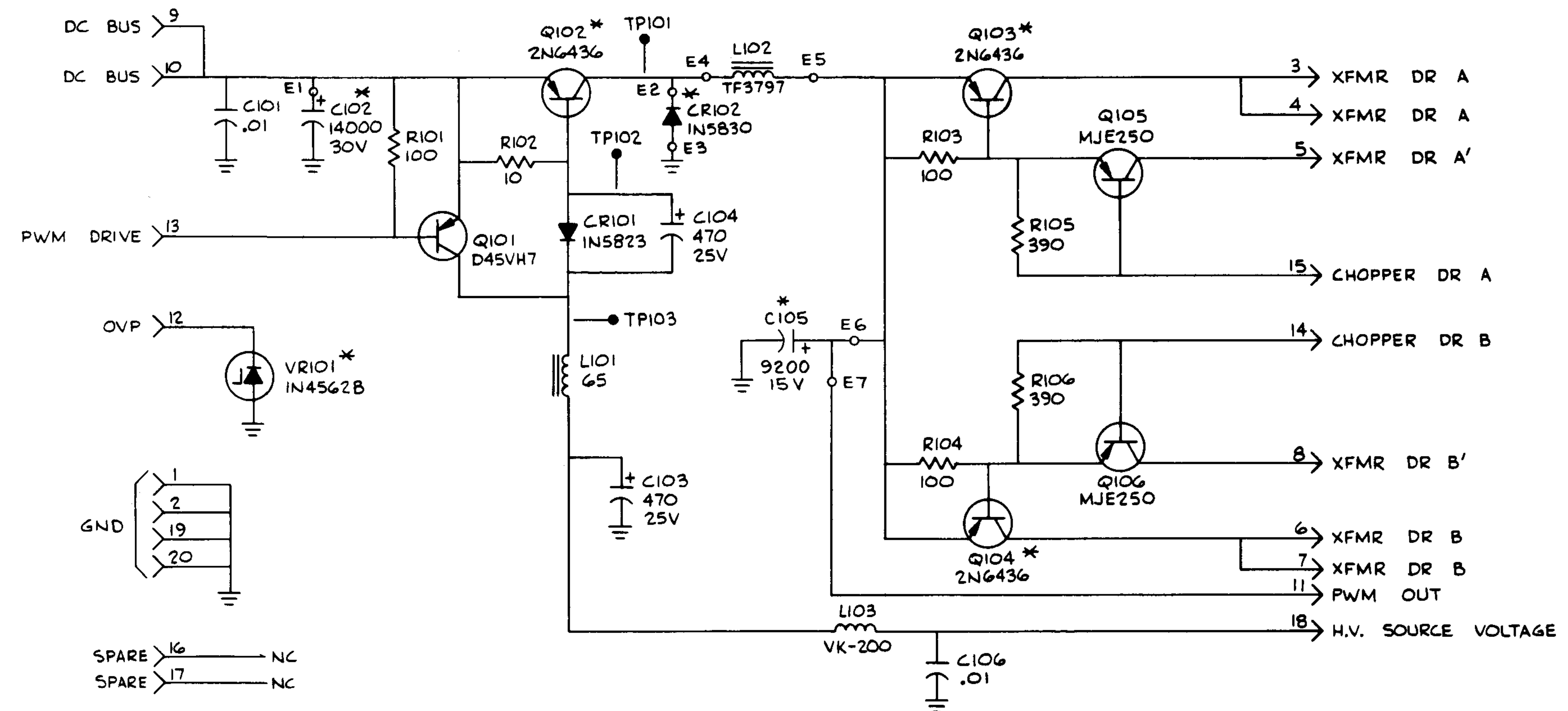


Figure 7-5. Low Voltage Power Supply Switcher
Module A1A1 Schematic Diagram

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	01-80305A66	SWITCHER PWB ASSEM	
002	1	64-P07867V001	PLATE,MOUNTING SWI	
003	1	B51566F020	WASHER,LOCK	NO.10
004	1	B51568F015	NUT,HEX	10-32
005	1	M38527/8-76P	INSULATOR,PLATE,FI	STUD MT
006	1	B-225-10X	TERMIAL,CRIMP INSU	NO.10
007	1	5607-99	WASHER,SHOULDER	
008	3	M38527/8-03P	INSULATOR,PLATE,FI	TO-3
009	6	5607-171	WASHER,SHOULDER	
010	2	42-P08107V001	CLAMP,CAPACITOR	M/F 4586-97A
011	6	C9029-4Z-1	CLIP,FASTENER	
012	4	MSS1861-14	SCREW	.112-24X.375
014	2	MS35207-263	SCREW	.1900-32X.500
015	2	MS27183-8	WASHER,FL	.219
016	4	MS35333-39	WASHER,LK,INTERNAL	.190
017	2	MS35207-260	SCREW	.1900-32X.312
018	2	MS20659-104	TERMINAL,LUG-CRIMP	
019	12	MS35206-215	SCREW,PH	.1120-40X.375
020	4	04-7607	WASHER,FLAT	.125
021	4	04-114583	WASHER,LOCK	.112
022	AR		WIRE,ELEC	#14 WHT
023	AR	SN63WRP3	SOLDER	
025	AR	11-14167A01	INK	BLACK
026	2	1186-10-B-5	SPACER	
027	AR	RTI-125#1BLK	INSULATION SLEEVIN	.220 BLK
028	8	MS35335-29	WASHER,LK,EXTERNAL	.112
029	AR		WIRE,TEF INS	#22 WHT
030	AR		WIRE,SOLID BUS	#22
031	2	MS51861-15	SCREW	.112-24X.500
C 102	1	23-80369A69	CAPACITOR	14000UF-30V
C 105	1	23-80369A70	CAPACITOR	9200UF-15V
CR102	1	48-80368A99	DIODE	
Q 102	1	48-80345A61	TRANSISTOR	
Q 103	1	48-80345A61	TRANSISTOR	
Q 104	1	48-80345A61	TRANSISTOR	
VR101	1	48-80345A79	DIODE	




Figure 7-6. Low Voltage Power Supply Switcher Module A1A1 (RTP-4016A) Parts Location Diagram

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	84-P07863V001	PRINTED WIRING BOA	
002	1	2-87988-0	CONNECTOR	
003	7	1S6-17-B-20	TERMINAL	
004	6	B1534-B-1/8-5	SPACER,SWAGE	.125LG
005	6	B1534-B-3/32-5	SPACER,SWAGE	.093LG
006	3	6107B-14	HEAT SINK	
007	8	640206-1	JACK,PC	
008	AR	SN63WRP3	SOLDER	
009	AR	11-14167A01	INK	BLACK
010	1	5607-84	BUSHING,NYLON	
011	1	MS35206-234	SCREW	.1380-32X1
012	1	MS27183-5	WASHER,FLAT	.156
013	1	MS35338-41	WASHER,LOCK	.138
014	1	MS35649-262	NUT,HEX	.1380-32
015	2	02-7019	NUT	.1120-40
016	2	04-114583	WASHER,LOCK	.112
018	2	MS35206-216	SCREW,P.H.	.1120-40X.438
019	2	B52200F006	WASHER,COMP	
020	1	14-80370A48	INSULATOR,INDUCTOR	
021	AR	SN96WRMAP3	SOLDER	
022	AR	M23053/5-206-C	INSULATION SLEEVIN	.250 CLR
023	1	5607-4	WASHER,SHOULDER	NO.2
024	1	03-15013G12	SCREW,P.H.	2-56X.375
025	1	MS35338-39	WASHER,LK	.086
026	1	MS27183-2	WASHER,FL	.094
027	1	MS35649-222	NUT,HEX	.0860-56
028	2	14-80370A46	INSULATOR	
029	1	B08853A001	INSULATOR,MICA	
C 101	1	21-80396A52	CAPACITOR	.01UF-20+80-200
C 103	1	23-80369A77	CAPACITOR	470UF-25V
C 104	1	23-80369A77	CAPACITOR	470UF-25V
C 106	1	21-80396A52	CAPACITOR	.01UF-20+80-200
CR101	1	48-80346A67	DIODE	20V-5A
L 101	1	25C84148F01	INDUCTOR	65UH
L 102	1	24-80369A54	INDUCTOR	57MH
L 103	1	24-80369A46	COIL	
Q 101	1	48-80368A86	TRANSISTOR	
Q 105	1	48-80368A88	TRANSISTOR	
Q 106	1	48-80368A88	TRANSISTOR	
R 101	1	6S124A25	RESISTOR	100-5-1/4
R 102	1	6S124A01	RESISTOR	10-5-1/4
R 103	1	6S124A25	RESISTOR	100-5-1/4
R 104	1	6S124A25	RESISTOR	100-5-1/4
R 105	1	6S124A39	RESISTOR	390-5-1/4
R 106	1	6S124A39	RESISTOR	390-5-1/4
TP101	1	09-80331A88	JACK,TIP	WHT
TP102	1	09-80331A88	JACK,TIP	WHT
TP103	1	09-80331A88	JACK,TIP	WHT




Figure 7-7. Low Voltage Power Supply Switcher Module A1A1 PWB Parts Location Diagram

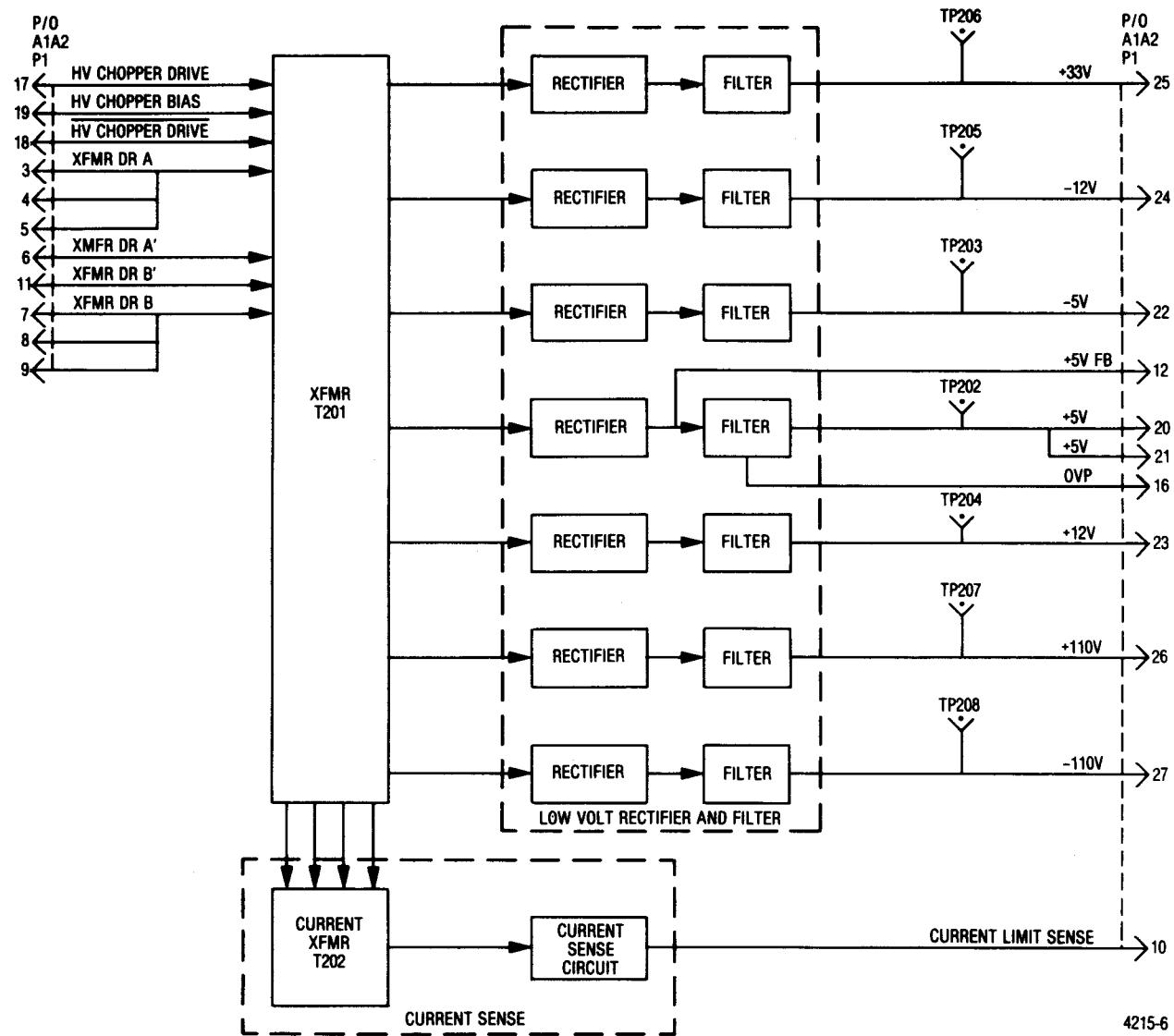


Figure 7-8. Low Voltage Power Supply Output Module A1A2 Block Diagram

NOTES:
 1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH A2.
 2. FOR REFERENCE DRAWINGS REFER TO: OI-P07856V OUTPUT PWB ASSY

3. UNLESS OTHERWISE SPECIFIED:
 ALL RESISTORS ARE IN OHMS,
 $\pm 5\text{ PCT}$, $1/4\text{ WATT}$.
 ALL CAPACITORS ARE IN UF.
 ALL INDUCTORS ARE IN UH.
 ALL VOLTAGES ARE DC.

- 4 MOTOROLA P/N 24-P08041V001
- 5 MOTOROLA P/N 24-P07903V001
- 6 MOTOROLA P/N 24-P08042V001

REF DESIGNATIONS	
HIGHEST USED	NOT USED
C224	
CR218	
L210	
R208	
T202	
TP208	

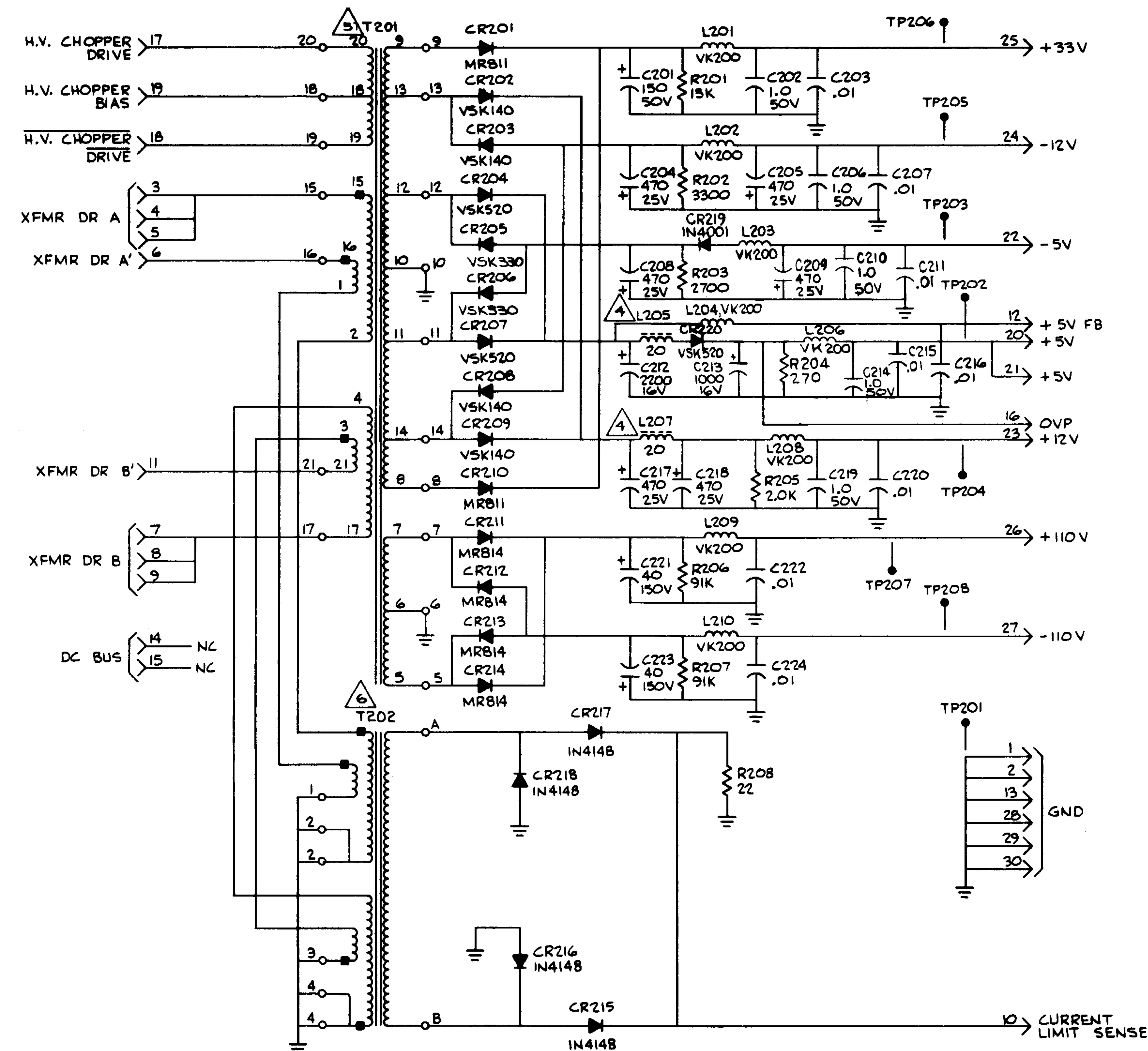


Figure 7-9. Low Voltage Power Supply Output
Module A1A2 Schematic Diagram


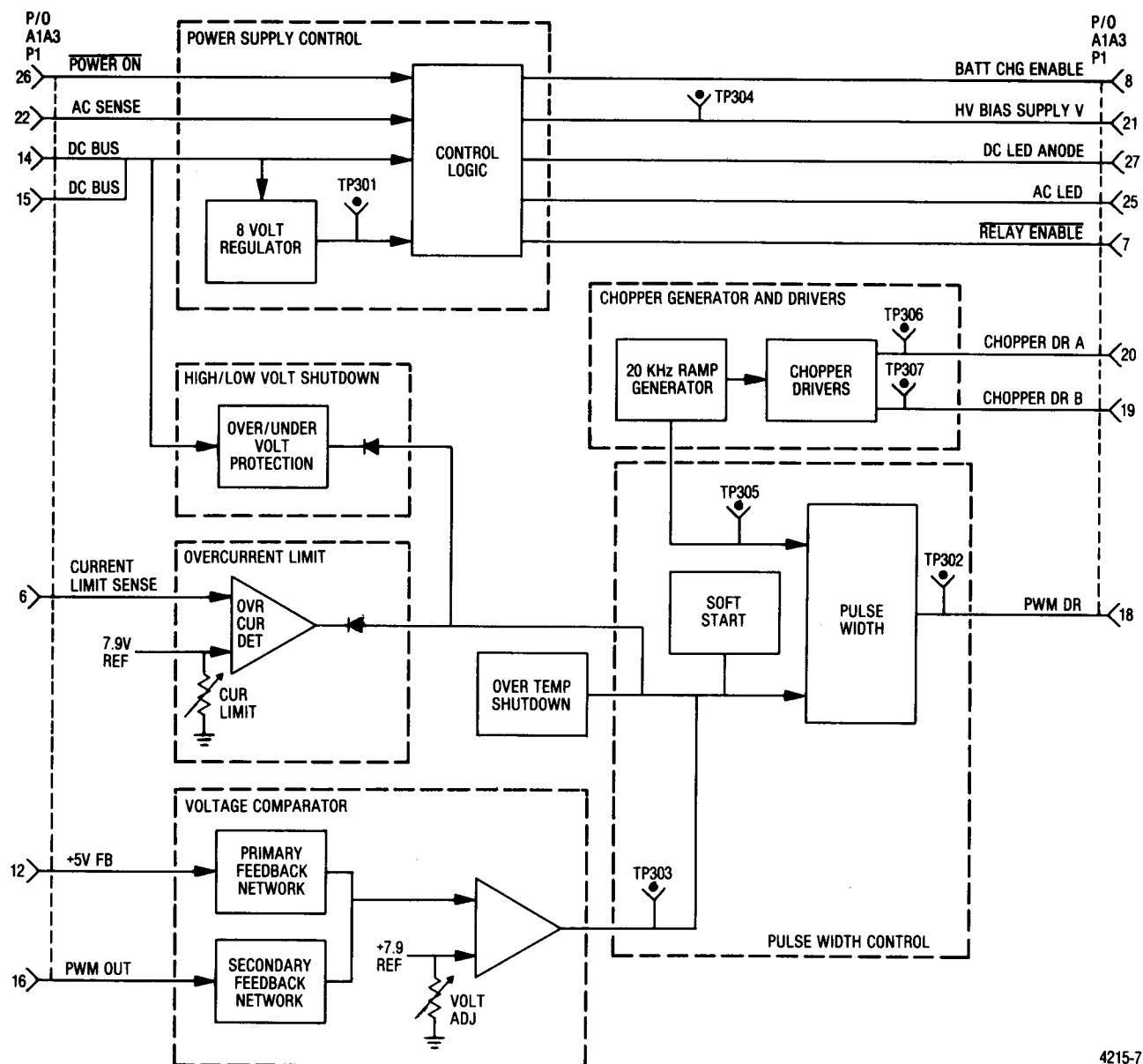


Figure 7-10. Low Voltage Power Supply Output Module A1A2 (RTP-4013A) Parts Location Diagram (Sheet 1 of 2)

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	84-P07857V001	PRINTED WIRING BOA		CR219	1	48-86850C47	DIODE	
003	AR	SN63WRP3	SOLDER		CR220	1	48-80346A67	DIODE	20V-5A
004	AR	11-14167A01	INK	BLACK	L 201	1	24-80369A46	COIL	
006	2	5607-84	WASHER,SHOULDER		L 202	1	24-80369A46	COIL	
007	2	MS35206-232	SCREW,PH	.1380-32X.750	L 203	1	24-80369A46	COIL	
008	2	MS35338-41	WASHER,LOCK	.138	L 204	1	24-80369A46	COIL	
009	2	MS27183-5	WASHER,FLAT	.156	L 205	1	24-80369A55	CHOKE	20UH
010	2	MS35649-262	NUT,HEX	.1380-32	L 206	1	24-80369A46	COIL	
011	2	14-15140A04	INSULATOR,INDUCTOR		L 207	1	24-80369A55	CHOKE	20UH
012	AR	M23053/5-206-C	INSULATION SLEEVIN	.250 CLR	L 208	1	24-80369A46	COIL	
013	1	5612-91-31	WASHER,TEFLON		L 209	1	24-80369A46	COIL	
C 201	1	23-80369A75	CAPACITOR	150UF-50V	L 210	1	24-80369A46	COIL	
C 202	1	2C30Z5U105Z050B	CAPACITOR	1UF-20+80-50	R 201	1	6S124A76	RESISTOR	13K-5-1/4
C 203	1	21-80396A52	CAPACITOR	.01UF-20+80-200	R 202	1	6S124A61	RESISTOR	3.3K-5-1/4
C 204	1	23-80396A44	CAPACITOR	470UF-25V	R 203	1	6S124A59	RESISTOR	2.7K-5-1/4
C 205	1	23-80396A44	CAPACITOR	470UF-25V	R 204	1	6S124A35	RESISTOR	270-5-1/4
C 206	1	2C30Z5U105Z050B	CAPACITOR	1UF-20+80-50	R 205	1	6S124A56	RESISTOR	2.0K-5-1/4
C 207	1	21-80396A52	CAPACITOR	.01UF-20+80-200	R 206	1	6S125A96	RESISTOR	91K-5-1/2
C 208	1	23-80396A44	CAPACITOR	470UF-25V	R 207	1	6S125A96	RESISTOR	91K-5-1/2
C 209	1	23-80396A44	CAPACITOR	470UF-25V	R 208	1	6S124A09	RESISTOR	22-5-1/4
C 210	1	2C30Z5U105Z050B	CAPACITOR	1UF-20+80-50	T 201	1	25-80369A12	TRANSFORMER	
C 211	1	21-80396A52	CAPACITOR	.01UF-20+80-200	T 202	1	24-80369A56	TRANSFORMER	
C 212	1	23-80369A76	CAPACITOR	2200UF-16V	TP201	1	09-80331A88	JACK,TIP	WHT
C 213	1	23-80369A74	CAPACITOR	1000UF-16V	TP202	1	09-80331A88	JACK,TIP	WHT
C 214	1	2C30Z5U105Z050B	CAPACITOR	1UF-20+80-50	TP203	1	09-80331A88	JACK,TIP	WHT
C 215	1	21-80396A52	CAPACITOR	.01UF-20+80-200	TP204	1	09-80331A88	JACK,TIP	WHT
C 216	1	21-80396A52	CAPACITOR	.01UF-20+80-200	TP205	1	09-80331A88	JACK,TIP	WHT
C 217	1	23-80396A44	CAPACITOR	470UF-25V	TP206	1	09-80331A88	JACK,TIP	WHT
C 218	1	23-80396A44	CAPACITOR	470UF-25V	TP207	1	09-80331A88	JACK,TIP	WHT
C 219	1	2C30Z5U105Z050B	CAPACITOR	1UF-20+80-50	TP208	1	09-80331A88	JACK,TIP	WHT
C 220	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 221	1	23-80369A67	CAPACITOR	40UF-150V					
C 222	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 223	1	23-80369A67	CAPACITOR	40UF-150V					
C 224	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
CR201	1	48-80345A69	DIODE	100V-1A					
CR202	1	48-80346A66	DIODE	40V-1A					
CR203	1	48-80346A66	DIODE	40V-1A					
CR204	1	48-80346A67	DIODE	20V-5A					
CR205	1	48-80368A94	DIODE	30V-3A					
CR206	1	48-80368A94	DIODE	30V-3A					
CR207	1	48-80346A67	DIODE	20V-5A					
CR208	1	48-80346A66	DIODE	40V-1A					
CR209	1	48-80346A66	DIODE	40V-1A					
CR210	1	48-80345A69	DIODE	100V-1A					
CR211	1	48-80345A70	DIODE	400V-1A					
CR212	1	48-80345A70	DIODE	400V-1A					
CR213	1	48-80345A70	DIODE	400V-1A					
CR214	1	48-80345A70	DIODE	400V-1A					
CR215	1	48-84463K02	DIODE						
CR216	1	48-84463K02	DIODE						
CR217	1	48-84463K02	DIODE						
CR218	1	48-84463K02	DIODE						

Figure 7-10. Low Voltage Power Supply Output Module A1A2 (RTP-4013A) Parts Location Diagram (Sheet 2 of 2)



4215-7

Figure 7-11. Low-Voltage Power Supply Control Module A1A3 Block Diagram




Figure 7-12. Low Voltage Power Supply Control Module A1A3 Schematic Diagram




Figure 7-13. Low Voltage Power Supply Control Module A1A3 (RTP-4012A) Parts Location Diagram (Sheet 1 of 2)

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	84-P07854V001	PRINTED WIRING BOA		L 310	1	24C83961B01	CHOKE,RF		R 342	1	6S124A73	RESISTOR	10K-5-1/4
003	AR	SN63WRP3	SOLDER		L 311	1	24C83961B01	CHOKE,RF		R 343	1	6S124A31	RESISTOR	180-5-1/4
004	AR	11-14167A01	INK	BLACK	Q 301	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED	R 344	1	6S124A73	RESISTOR	10K-5-1/4
006	2	MS35206-217	SCREW,PH	.1120-40X.500	Q 302	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED	S 301	1	40-80369A06	SWITCH,THERMAL	85 DEG C
008	2	04-114583	WASHER,LOCK	.112	Q 303	1	48-80368A87	TRANSISTOR		TP301	1	09-80331A88	JACK,TIP	WHT
009	2	02-7019	NUT	.1120-40	Q 304	1	48-80368A88	TRANSISTOR		TP302	1	09-80331A88	JACK,TIP	WHT
010	2	14-80370A46	INSULATOR		Q 305	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED	TP303	1	09-80331A88	JACK,TIP	WHT
011	2	B52200F006	WASHER,COMP		Q 306	1	48-80368A92	TRANSISTOR	MPS6519 SCREENED	TP304	1	09-80331A88	JACK,TIP	WHT
014	AR		WIRE,SOLID	#24 WHT,TEFLON	Q 307	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED	TP305	1	09-80331A88	JACK,TIP	WHT
C 301	1	23-80396A40	CAPACITOR	.10UF-25V	Q 308	1	48-80345A41	TRANSISTOR		TP306	1	09-80331A88	JACK,TIP	WHT
C 302	1	21-80370A31	CAPACITOR	.1UF-20-50	Q 309	1	48-80368A87	TRANSISTOR		TP307	1	09-80331A88	JACK,TIP	WHT
C 303	1	21-80370A31	CAPACITOR	.1UF-20-50	Q 310	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED	U 301	1	51-80345A08	INTEGRATED CIRCUIT	LM341P-8.0 SCREENED
C 304	1	21-80370A31	CAPACITOR	.1UF-20-50	R 301	1	6S124A49	RESISTOR	1K-5-1/4	U 302	1	51-80345A02	INTEGRATED CIRCUIT	CA3160E SCREENED
C 305	1	21-80370A31	CAPACITOR	.1UF-20-50	R 302	1	6S124A49	RESISTOR	1K-5-1/4	U 303	1	51-80368A68	INTEGRATED CIRCUIT	LM311P SCREENED
C 306	1	21-80370A31	CAPACITOR	.1UF-20-50	R 303	1	6S124A73	RESISTOR	10K-5-1/4	U 304	1	51-80345A02	INTEGRATED CIRCUIT	CA3160E SCREENED
C 307	1	23-80369A75	CAPACITOR	.150UF-50V	R 304	1	6S124A45	RESISTOR	680-5-1/4	U 305	1	51-80368A32	INTEGRATED CIRCUIT	MC14011BCP SCREENED
C 308	1	21-80370A31	CAPACITOR	.1UF-20-50	R 305	1	6S124A65	RESISTOR	4.7K-5-1/4	U 306	1	51-80345A24	INTEGRATED CIRCUIT	MC3420P SCREENED
C 309	1	21-80370A31	CAPACITOR	.1UF-20-50	R 306	1	6S124A73	RESISTOR	10K-5-1/4	VR301	1	48-86850C95	DIODE,ZENER	20V-5-.5
C 310	1	21-80396A52	CAPACITOR	.01UF-20+80-200	R 307	1	6S124A79	RESISTOR	18K-5-1/4	VR302	1	48-82256C38	DIODE,ZENER	9.1V
C 311	1	23D83441B15	CAPACITOR	.1UF-20-35	R 308	1	6S124A33	RESISTOR	220-5-1/4	VR303	1	48-818459	DIODE,ZENER	6.8V
C 312	1	21-80396A52	CAPACITOR	.01UF-20+80-200	R 309	1	6S124A89	RESISTOR	47K-5-1/4	VR304	1	48-818459	DIODE,ZENER	6.8V
C 313	1	21-80396A52	CAPACITOR	.01UF-20+80-200	R 310	1	6S124A73	RESISTOR	10K-5-1/4	VR305	1	48-82256C25	DIODE,ZENER	12V-5-1/2
C 314	1	21-80370A31	CAPACITOR	.1UF-20-50	R 311	1	6S124A49	RESISTOR	1K-5-1/4					
C 315	1	21-80396A52	CAPACITOR	.01UF-20+80-200	R 312	1	6S124A59	RESISTOR	2.7K-5-1/4					
C 316	1	21-80370A06	CAPACITOR	.22UF-10-50	R 313	1	6S124A73	RESISTOR	10K-5-1/4					
C 317	1	21-80370A31	CAPACITOR	.1UF-20-50	R 314	1	6S124A90	RESISTOR	51K-5-1/4					
C 318	1	21D82428B36	CAPACITOR	.002UF-10-200	R 315	1	18D83452F11	RESISTOR, VARIABLE	5K					
C 319	1	2C37Z5U105Z050B	CAPACITOR	.1UF-20+80-50	R 316	1	6S124A59	RESISTOR	2.7K-5-1/4					
C 320	1	21-80370A31	CAPACITOR	.1UF-20-50	R 317	1	6S124A89	RESISTOR	47K-5-1/4					
C 321	1	21-80370A31	CAPACITOR	.1UF-20-50	R 318	1	6S124B11	RESISTOR	360K-5-1/4					
C 322	1	21-80396A51	CAPACITOR	.100PF-10-100	R 319	1	6S124B11	RESISTOR	360K-5-1/4					
C 323	1	23-80369A72	CAPACITOR	.10UF-50V	R 320	1	18D83452F11	RESISTOR, VARIABLE	5K					
C 324	1	21-80370A31	CAPACITOR	.1UF-20-50	R 321	1	6S124A73	RESISTOR	10K-5-1/4					
C 325	1	21-80370A31	CAPACITOR	.1UF-20-50	R 322	1	6S124A89	RESISTOR	47K-5-1/4					
C 326	1	21-80370A31	CAPACITOR	.1UF-20-50	R 323	1	6S124A65	RESISTOR	4.7K-5-1/4					
C 327	1	21-80370A31	CAPACITOR	.1UF-20-50	R 324	1	6S124A49	RESISTOR	1K-5-1/4					
C 328	1	21D82428B10	CAPACITOR	.3300PF-10-100	R 325	1	6S124A73	RESISTOR	10K-5-1/4					
C 329	1	23D83441B18	CAPACITOR	.47UF-20-20	R 326	1	6S124A44	RESISTOR	620-5-1/4					
C 330	1	23D84762H14	CAPACITOR	.47UF-20-50	R 327	1	6S124A89	RESISTOR	47K-5-1/4					
CR301	1	48-80345A68	DIODE	.50V-1A	R 328	1	18D83452F11	RESISTOR, VARIABLE	5K					
CR302	1	48-84463K02	DIODE		R 329	1	6S124A92	RESISTOR	62K-5-1/4					
CR303	1	48-84463K02	DIODE		R 330	1	06D83175C12	RESISTOR	13K-1-1/4					
CR304	1	48-80345A68	DIODE	.50V-1A	R 331	1	6S124A01	RESISTOR	10-5-1/4					
CR305	1	48-80345A68	DIODE	.50V-1A	R 332	1	6S124A73	RESISTOR	10K-5-1/4					
L 301	1	24C83961B01	CHOKE,RF		R 333	1	6S124A35	RESISTOR	270-5-1/4					
L 302	1	24-84309A90	INDUCTOR	.100UH	R 334	1	6S124B30	RESISTOR	2.2M-5-1/4					
L 303	1	24C83961B01	CHOKE,RF		R 335	1	6S125A33	RESISTOR	220-5-1/2					
L 304	1	24C83961B01	CHOKE,RF		R 336	1	6S125A33	RESISTOR	220-5-1/2					
L 305	1	24C83961B01	CHOKE,RF		R 337	1	6S124A03	RESISTOR	12-5-1/4					
L 306	1	24C83961B01	CHOKE,RF		R 338	1	6S124A56	RESISTOR	2000-5-1/4					
L 307	1	24C83961B01	CHOKE,RF		R 339	1	6S124A73	RESISTOR	10K-5-1/4					
L 308	1	24C83961B01	CHOKE,RF		R 340	1	6S124A63	RESISTOR	3900-5-1/4					
L 309	1	24C83961B01	CHOKE,RF		R 341	1	6S124A95	RESISTOR	82K-5-1/4					

Figure 7-13. Low Voltage Power Supply Control
Module A1A3 (RTP-4012A) Parts
Location Diagram (Sheet 2 of 2)

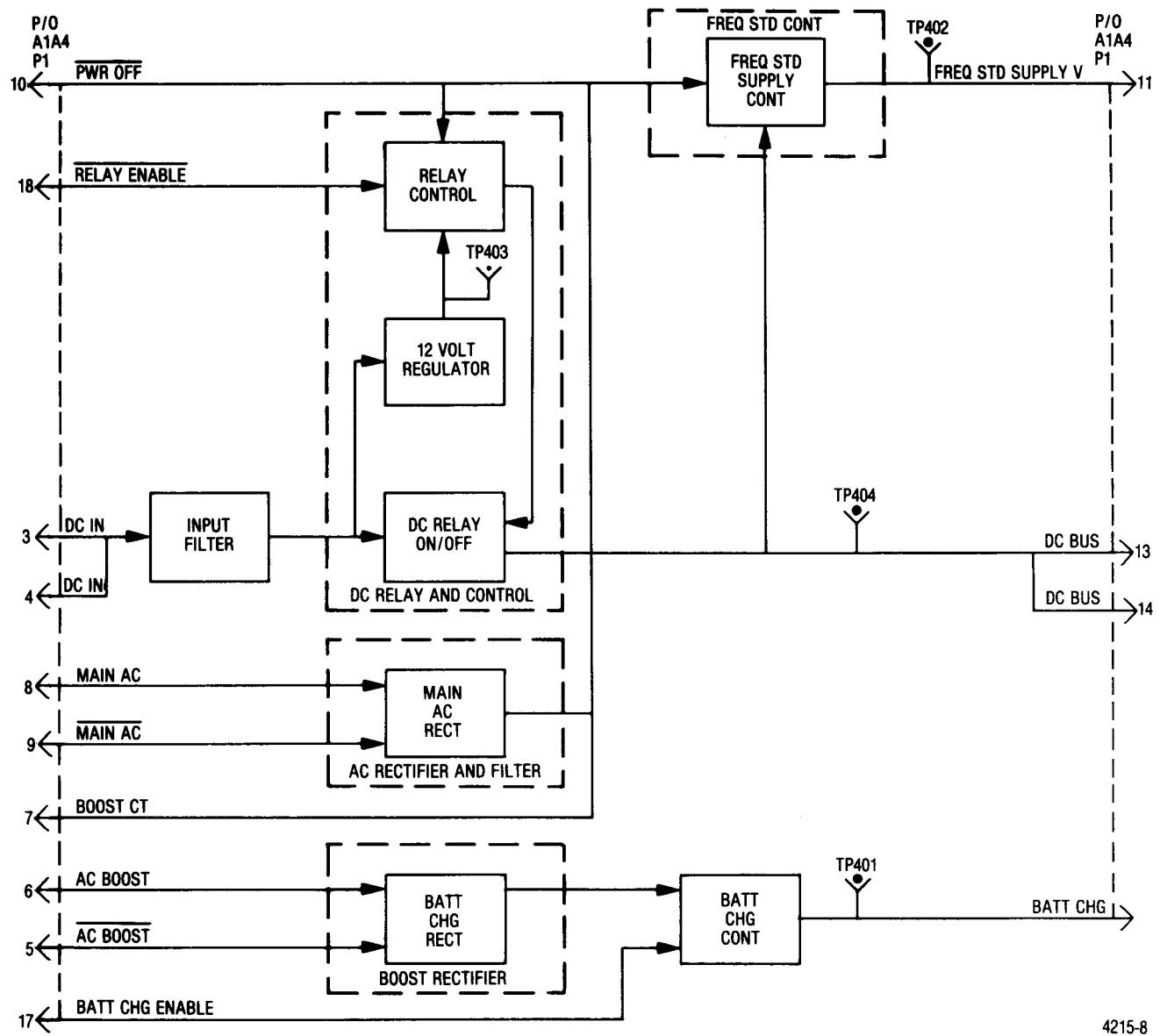


Figure 7-14. Low Voltage Power Supply Relay Module A1A4 Block Diagram

NOTES:

- PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH A1A4.

2. FOR REFERENCE DRAWINGS REFER TO:

3. UNLESS OTHERWISE SPECIFIED:
ALL RESISTORS ARE IN OHMS,
 $\pm 5\text{ PCT}$, $1/4$ WATT.
ALL CAPACITORS ARE IN UF.
ALL INDUCTORS ARE IN UH.
ALL VOLTAGES ARE DC.

REF DESIGNATIONS	
HIGHEST USED	NOT USED
C414	
CR420	
K401	
L401	
Q408	
R414	
TP404	
V401	
VR401	




Figure 7-15. Low Voltage Power Supply Relay
Module A1A4 Schematic Diagram

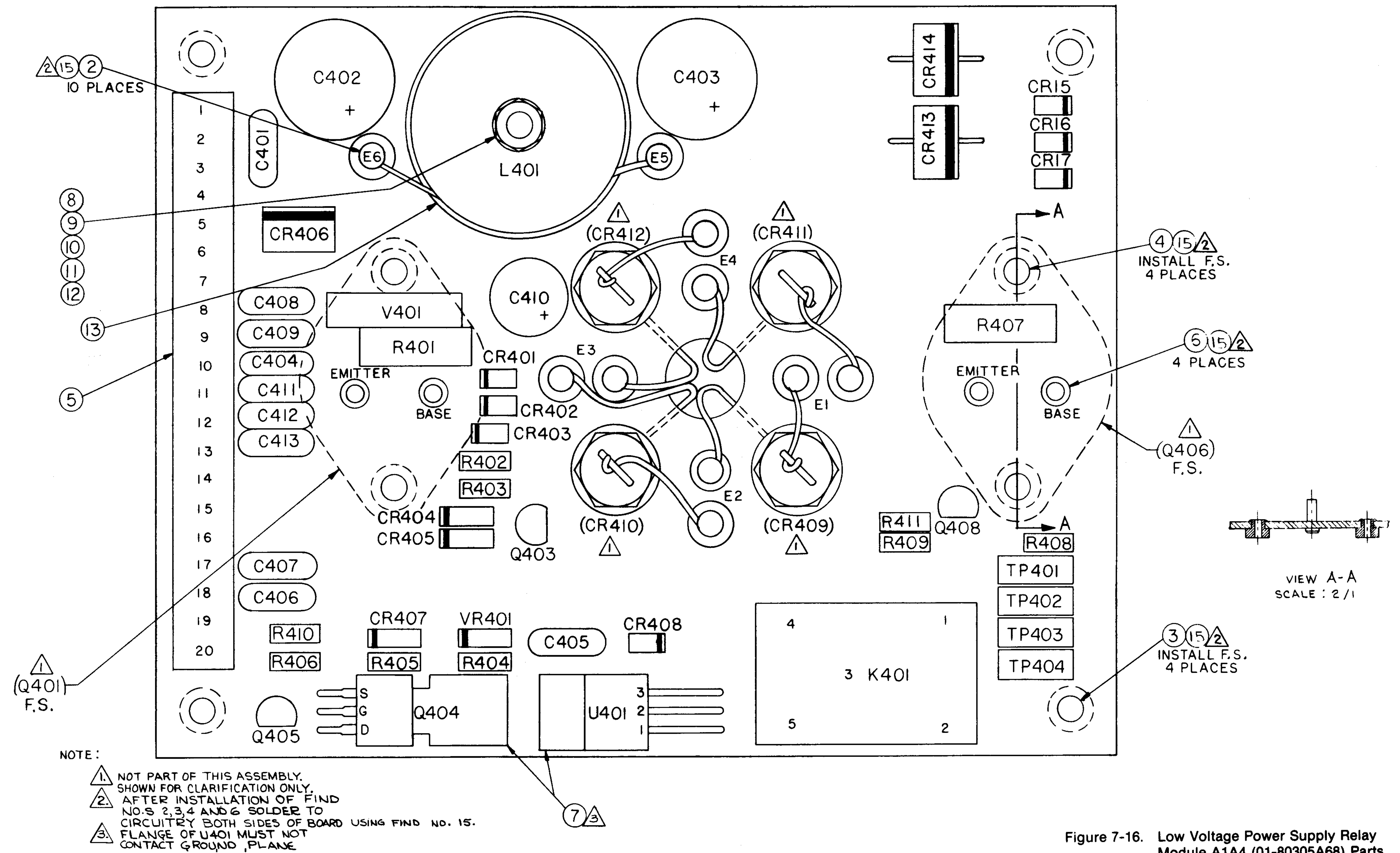
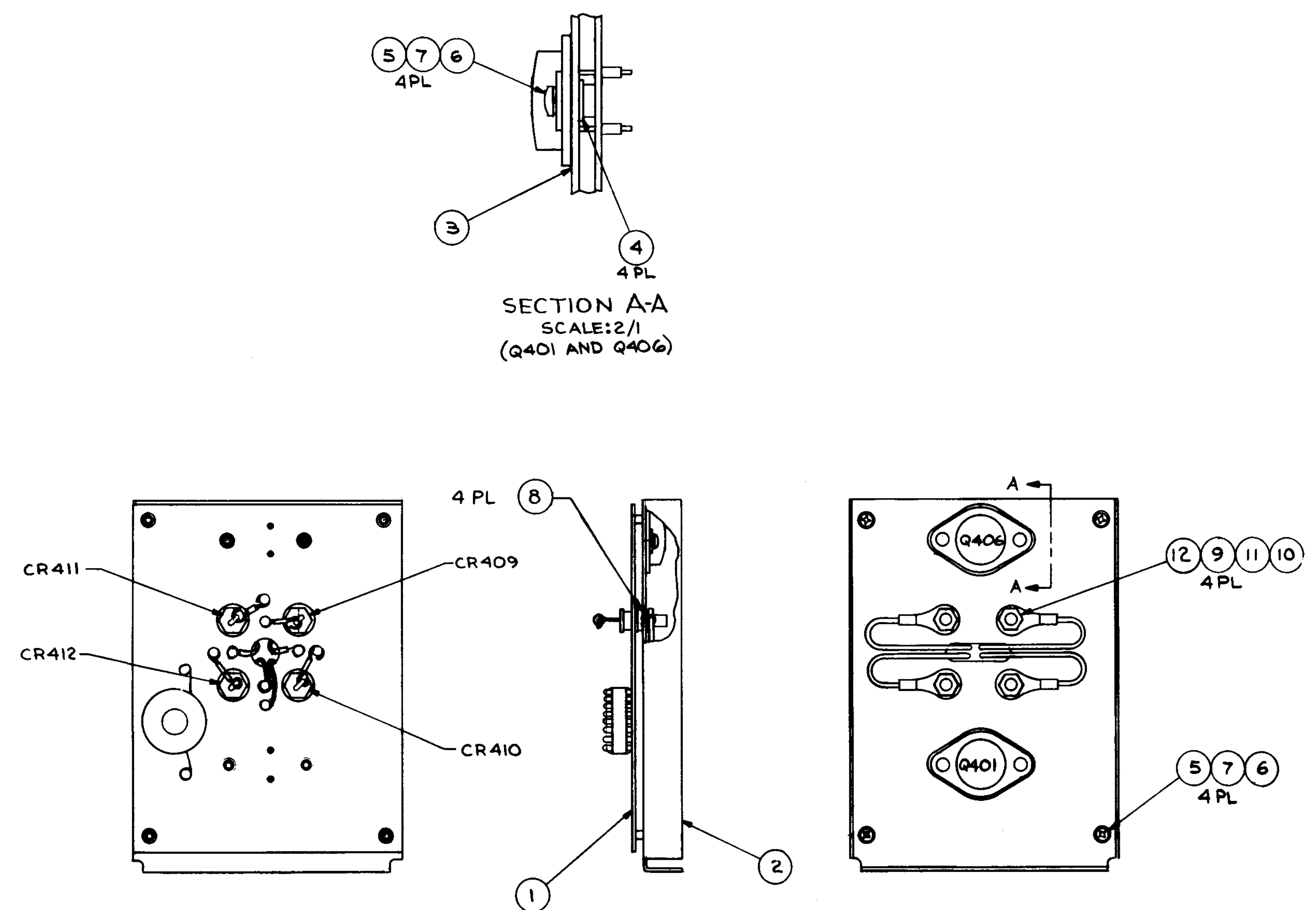


Figure 7-16. Low Voltage Power Supply Relay Module A1A4 (01-80305A68) Parts Location Diagram (Sheet 1 of 3)

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	84-P07866V001	PRINTED WIRING BOA		Q 408	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED
002	10	1S6-17-B-20	TERMINAL		R 401	1	06-80370A44	RESISTOR	.499-1-3
003	4	B1534-B-1/8-5	STANDOFF,THREADED		R 402	1	6S124A73	RESISTOR	10K-5-1/4
004	4	B1534-B-3/32-5	STANDOFF,THREADED		R 403	1	6S124A55	RESISTOR	1.8K-5-1/4
005	1	2-87988-0	CONNECTOR		R 404	1	6S124B30	RESISTOR	2.2M-5-1/4
006	4	640206-1	JACK,PRINTED CIRCU		R 405	1	6S124B22	RESISTOR	1M-5-1/4
008	1	5607-65	WASHER,SHOULDER		R 406	1	6S124A73	RESISTOR	10K-5-1/4
009	1	MS35206-232	SCREW,PH	.1380-32X.750	R 407	1	06-80370A44	RESISTOR	.499-1-3
010	1	MS35338-41	WASHER,LOCK	.138	R 408	1	6S124A63	RESISTOR	3.9K-5-1/4
011	1	MS27183-5	WASHER,FLAT	.156	R 409	1	6S124A73	RESISTOR	10K-5-1/4
012	1	MS35649-262	NUT,HEX	.1380-32	R 410	1	6S124A71	RESISTOR	8.2K-5-1/4
013	1	14-80370A48	INSULATOR,INDUCTOR		R 411	1	6S124A59	RESISTOR	2.7K-5-1/4
014	AR	SN63WRP3	SOLDER		R 412	1	6S124A57	RESISTOR	2.2K-5-1/4
015	AR	SN96WRMAP3	SOLDER		R 413	1	6S125B59	RESISTOR	3.9-5-1/2
016	AR	M81822/6-A20-9	WIRE,SOLID	#20 WHT,TEF	R 414	1	6S124A46	RESISTOR	750-5-1/4
017	1	5610-22-31	WASHER,PLAIN NYLON	NO.10	TP401	1	09-80331A88	JACK,TIP	WHT
C 401	1	21-80396A52	CAPACITOR	.01UF-20+80-200	TP402	1	09-80331A88	JACK,TIP	WHT
C 402	1	23-80369A78	CAPACITOR	470UF-35V	TP403	1	09-80331A88	JACK,TIP	WHT
C 403	1	23-80369A78	CAPACITOR	470UF-35V	TP404	1	09-80331A88	JACK,TIP	WHT
C 404	1	21-80396A52	CAPACITOR	.01UF-20+80-200	U 401	1	51-80368A67	INTEGRATED CIRCUIT	MC7812CT SCREENED
C 405	1	21-80396A52	CAPACITOR	.01UF-20+80-200	V 401	1	06-80346A21	VARISTOR	
C 406	1	21-80396A52	CAPACITOR	.01UF-20+80-200	VR401	1	48-82256C25	DIODE,ZENER	12V-5-1/2
C 407	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 408	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 409	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 410	1	23-80369A73	CAPACITOR	100UF-35V					
C 411	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 412	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 413	1	21-80396A52	CAPACITOR	.01UF-20+80-200					
C 414	1	23D83441B18	CAPACITOR	4.7UF-20-20					
CR401	1	48-86850C47	DIODE						
CR402	1	48-86850C47	DIODE						
CR403	1	48-86850C47	DIODE						
CR404	1	48-84463K02	DIODE						
CR405	1	48-84463K02	DIODE						
CR406	1	48-80345A67	DIODE	100V					
CR407	1	48-83192A09	DIODE						
CR408	1	48-80345A68	DIODE	50V-1A					
CR413	1	48-80345A67	DIODE	100V					
CR414	1	48-80345A67	DIODE	100V					
CR415	1	48-86850C47	DIODE						
CR416	1	48-86850C47	DIODE						
CR417	1	48-86850C47	DIODE						
CR418	1	48-86850C47	DIODE						
CR419	1	48-83192A09	DIODE						
CR420	1	48-83192A09	DIODE						
K 401	1	80-80370A56	RELAY						
L 401	1	24-80369A57	CHOKE						
Q 402	1	48-80396A24	TRANSISTOR						
Q 403	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED					
Q 404	1	48-80345A58	TRANSISTOR	VN88AF SCREENED					
Q 405	1	48-80368A91	TRANSISTOR	MPS6520 SCREENED					
Q 407	1	48-80345A58	TRANSISTOR	VN88AF SCREENED					

Figure 7-16. Low Voltage Power Supply Relay Module A1A4 (01-80305A68) Parts Location Diagram (Sheet 2 of 3)

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
001	1	01-80305A67	RELAY PWB ASSEMBLY	
002	1	64-P07868V001	PLATE,MOUNTING REL	
003	2	M38527/8-03P	INSULATOR,PLATE,FI	TO-3
004	4	5607-171	WASHER,SHOULDER	
005	8	MS35206-215	SCREW,PH	.1120-40X.375
006	8	04-7607	WASHER,FLAT	.125
007	8	04-114583	WASHER,LOCK	.112
008	2	M38527/8-76P	INSULATOR,PLATE,FI	STUD MT
009	4	B-225-10X	TERMAL,CRIMP INSU	#10
010	4	B51568F015	NUT,HEX	10-32
011	4	B51566F020	WASHER,LOCK	NO.10
012	4	5607-99	WASHER,SHOULDER	
013	AR		WIRE,ELEC	#16 WHT
014	AR	SN63WRP3	SOLDER	
015	AR	11-14167A01	INK	BLACK
CR409	1	48-80345A66	DIODE	
CR410	1	48-80345A66	DIODE	
CR411	1	48-80345A66	DIODE	
CR412	1	48-80345A66	DIODE	
Q 401	1	48-80368A89	TRANSISTOR	
Q 406	1	48-80368A89	TRANSISTOR	



Low Voltage Power Supply Relay
End Plate Assembly

Figure 7-16. Low Voltage Power Supply Relay
Module A1A4 (01-80305A68) Parts
Location Diagram (Sheet 3 of 3)

Find No.	Qty.	Part No.	Nomenclature	Part Value
001	1	84-P07871V001	MOTHER BOARD	
002	6	B1534-B-1/8-5	SPACER,SWAGE	
003	AR	SN63WRP3	SOLDER	
004	AR	11-14167A01	INK	BLACK
005	2	KFS2-256	NUT,PRESS,MIN	
006	AR	M81822/6-A22-9	WIRE,SOLID	#22 WHT,TEF
J 001	1	2-87633-0	CONNECTOR	
J 002	1	09-80331A89	CONNECTOR,EDGE CAR	
J 003	1	09-80331A89	CONNECTOR,EDGE CAR	
J 004	1	2-87633-0	CONNECTOR	
J 005	1	1-87227-3	CONNECTOR	
J 006	1	09-80331A95	SOCKET,SOLDER DIP	
J 007	1	09-80331A97	SOCKET,SOLDER DIP	
J 008	1	09-80331A96	SOCKET,SOLDER DIP	14 PIN




Figure 7-17. Low Voltage Power Supply A1
Motherboard Parts Location

RTP-4014 A