Assembly - 243 Dual Voltage Regulated Power Supply

Construction

(D) Clean the copper side of the printed circuit board with a piece of Scotch-brite® if it appears dull or oxidized.

(S) Mount all of the parts on the printed circuit board excluding integrated circuit IC-1, using the parts list and the printing on the top side of the circuit board. Be sure to orient all diodes and electrolytic capacitors properly. Mount the components flush with the top of the board. Bend the leads on the foil side of the board and trim so that 1/16" to 1/8" of wire remains. The two power transistor sockets should be inserted in the PC board holes indicated for Q1 and Q2. These sockets should be inserted from the component side.

(O) Attach integrated circuit, IC1, to the board. Be sure to orient the IC properly and note there is no hole for pin 4 of the IC. Bend the pin up away from the board and either cut it off or move it such that it is electrically isolated.

( ) Solder all of the board connections with a 30 to 50 watt soldering iron. Use only the solder supplied or an equivalent 60/40 alloy resin core solder. Do not use acid core solder or any type of paste flux. We will not guarantee or repair any kit on which such a product has been used.

(D) Set the board aside and begin on the chassis assembly using the chassis wiring diagram as a reference. Attach the angle brackets and rubber feet to the chassis in the holes near the edge of the chassis. Use #6 - 32 X 1/4" screws, Lockwashers, and nuts to secure the angle brackets.

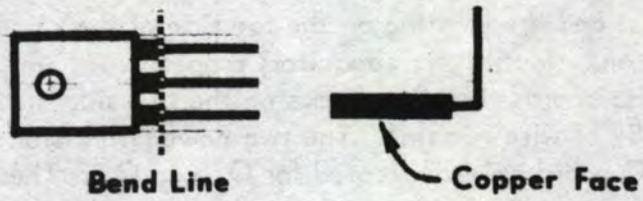
( ) Attach the following to the chassis ammeter - M1, voltmeter - M2, switch - S1, jacks - J1, J2, J3, potentiometers - R8 and R9. The finished front panel is sandwiched between the chassis hardware and the chassis itself. The meters are installed by removing the two nuts on the back of the meters, removing the metal shells, slipping the meters through the holes, replacing the shells and securing the nuts. Switch S1 is held by #6 - 32 X 1/4" phillips head screws, lockwashers and nuts. Potentiometers R1 and R2 are fastened by placing a 3/8" lockwasher between the potentiometers and the inside of the chassis and securing the controls with a 3/8" nut.

(D) Attach the fuse holder F1.

(A) Attach the two capacitor clamps to the chassis using #6 - 32 X 3/16" screws, lockwashers, and nuts.

(N) Coat both sides of the mica insulators with a small amount of the heat sink compound supplied with the kit. Place each insulator over each of the two power transistor mounting holes on the inside rear panel of the chassis orientated so the length of the insulator is toward the right side of the chassis. The heatsink compound should temporarily hold the insulator in place.

( ) Bend all three leads on both Q1 and Q2 at right angles to the body of the transistor and away from the copper face side of the transistor. The case of the transistor is made of plastic and can be cracked so be careful. One way of bending the leads is to grasp all three leads of the transistor with a pair of needlenose pliers along the bend line shown in the figure below and carefully push the transistor body to the side forming a 90 bend. Remember, the leads must be bent away from the copper face side of the transistor.



( ) The transistors can now be secured to the chassis. Place the heatsink against the rear panel on the outside of the chassis. Run the two #6 - 32 X 1/2" screws through the heatsink, rear panel, insulating washer, and appropriate power transistor and secure with an expandable cup washer and nut. Mount the power transistors so their leads are nearer the right side of the chassis. Remember transistors Q1 and Q2 are different so be sure not to interchange the two.

( ) Attach the power transformer, T1 and lug strip, LS-1, to the chassis. The transformer should be turned as shown in the wiring diagram and should be secured using #6 - 32 X 1/4" screws, lockwashers, and nuts. The lug strip is attached under one of the transformer mounting screws as shown in the wiring diagram.

( ) Attach the line cord to the chassis. Crimp the strain relief over the line cord 6" from the end and while compressing the strain relief with a pair of pliers, insert the cord into the hole provided in the rear panel of the chassis, release.

( ) Snap the two electrolytic capacitors, C5 and C6, into the clamps. Note that both capacitors are polarized.

( ) Refer to the wiring table and complete steps 1 thru 10. Cut each of the wires as near as possible to the indicated length and strip approximately 1/4" of insulation from each end. Solder only those connections indicated. Be sure to use the wire gauge specified in the table. Most of the longer wires should be routed from point to point by running the wires along the bend at the front of the chassis. This will give a neat wiring appearance and the lengths of wire specified will fit properly.

( ) Cut, strip and attach the wires in steps 11 thru 16 to the printed circuit board only. Do not connect the other ends of the wires yet. This will be done in a later step. All of these wires should be attached from the copper side of circuit board.

( ) Now slide the PC board onto power transistors Q1 and Q2. The component side of the board should be adjacent to the right side of the chassis and the foil side should be adjacent to the left side of the chassis.

( ) Now attach the wires from the PC board to their appropriate terminals as given in steps 11 thru 16 of the wiring table. Run the wires down from the board, along the chassis toward the ammeter, then along the bend line to the appropriate terminal.

( ) Cut, strip and attach the wires in steps 17 thru 25. Note that the wires from capacitors C5 and C6 are attached from the component side of the board.

( ) Check over all connections to be sure they have been soldered.

( ) Insert the fuse into the fuse holder.

( ) Attach the knobs to the potentiometers R1 and R2.

Checkout

Check over all wiring carefully. The circuit is short proof for external loads, but a wiring error can destroy many of the components if it occurs in the wrong place.

With both the voltage and current controls fully counterclockwise and nothing connected to the output jacks, apply power to the unit. Varying the voltage control should cause voltmeter to vary from 0 to 20 volts DC. If not unplug the unit and check for errors.

If the voltage did vary as it was supposed to, set the voltage control for maximum voltage output and temporarily connect a piece of non-insulated heavy gauge wire between the (+) and GND jacks. Advancing the current control should cause the current to rise to a maximum of about 1 amp DC. Remove the shorting wire.

The (-) supply can best be checked by monitoring the voltage on the (-) supply with a volt-ohmmeter while watching the voltmeter on the power supply. The two voltages should track as the voltage control is varied.

Attach the cover to the unit using #6 - 32 X 1/4" screws.

In Case of Problems

If you at any time through the checkout procedure find the power supply is not working properly, unplug the unit and check all wiring, soldering, and component installation. It is not that this is the only problem that ever arises but it does occur the most often and is the easiest to locate and correct. If you are not able to spot the problem a few voltage checks may be helpful if you are familiar with the circuit's operation. Should any unsolvable problem occur, consult the company staff before returning the kit for repair.

Operation

The #243 DC regulated power supply is a plus-minus, 0-20 volt, 0-1 amp current limited device. The voltage of both supplies is simultaneously adjusted by the voltage control while the current control limits only the (+) supply from an adjustable 20 ma to 1 amp. The (-) supply is limited to 1 amp regardless of the setting of the current control.

Should the (-) supply go into a current limit mode during operation the voltage of the (+) supply will remain the same as that of the (-) supply. If on the other hand the (+) goes into a current limit mode during operation the voltage or current of the (-) supply will be unaffected. This non-symmetrical operation is a characteristic of the integrated circuit, IC1.

Maximum heat build-up within the power supply occurs in low voltage-high current modes of operation. Although the unit can tolerate this type of operation, it is not good to subject the unit to this punishment for any length of time. The integrated circuit IC1 is provided with an internal thermal shutdown feature which will cause it to temporarily stop operating should it become overheated.

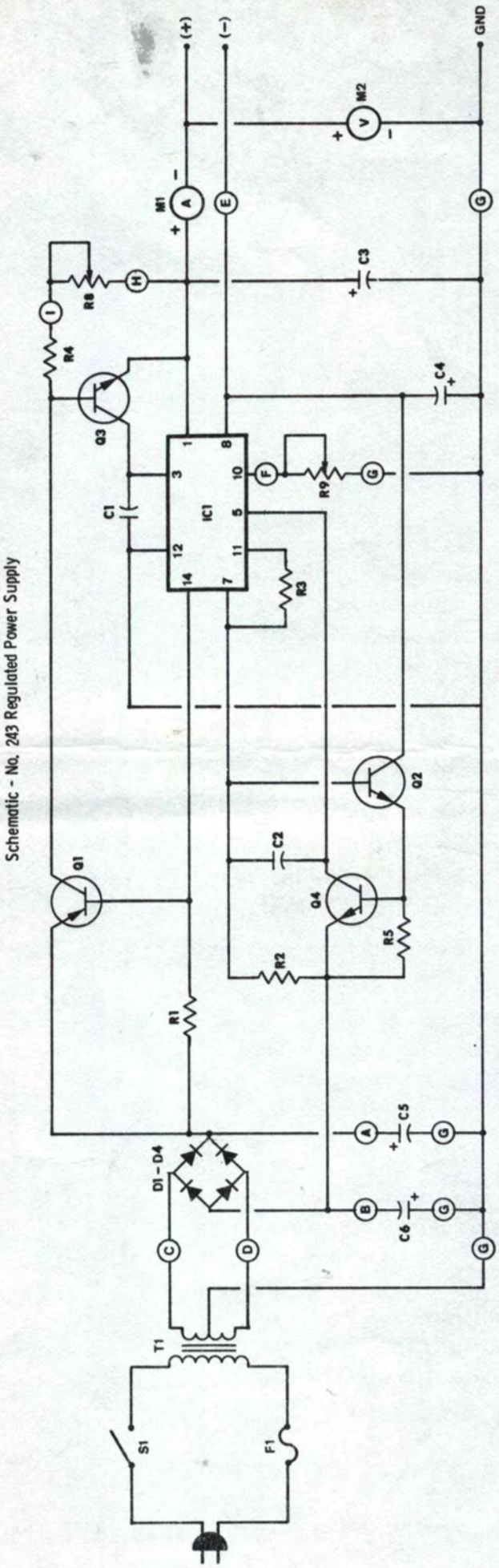
It should be noted that the maximum current on the (+) supply may vary from about 0.75 amps to 1.25 due to variation of the end resistance of potentiometer R8. If desired the value of resistor R5 can be changed slightly to give a 1 amp maximum current.

The (+) current control will be sensitive near the maximum current end of the control. This is normal and makes adjustment of low current levels where the current limit feature is really important, less critical.

Theory of Operation

The circuit in its physical form is really simple since most of the complex circuitry is within integrated circuit IC1.

The 117 VAC power line voltage is stepped down to about 32 VAC by transformer T1 and rectified and filtered by diodes D1-D4 and capacitors C5 and C6 into independent +20 and -20 volt sources. Power transistor Q1 is the series pass transistor for the (+) Supply and Q2 for the (-) supply. Pins 14 and 7 of IC1 regulates the base current supplied to these transistors and thus determine the voltage at the output terminals of the supply. The output current of both the (+) and (-) supplies must pass through resistors R4 + R9 and R5. When the voltage drop across these resistor combinations reaches 0.6 volts transistor Q3 for the (+) supply and transistor Q4 for the (-) supply begin to conduct. This initiates the current limit mode of operation. The transistor current of Q3 and Q4 to pins 3 and 5 of IC1 in turn cause IC1 to limit the base current to transistors Q1 and Q2 yielding a current limit mode of operation.



Schematic - No. 243 Regulated Power Supply

Parts List - #243 Regulated Power Supply

Resistors

R1, R2	47 ohm 1/4 watt resistor
R3	75K ohm 1/4 watt resistor
R4	0.47 ohm 2 watt resistor
R5	0.39 ohm 2 watt resistor
R6	Omit in this kit
R7	Omit in this kit
R8	50 ohm wire wound potentiometer
R9	50K ohm potentiometer

Capacitors

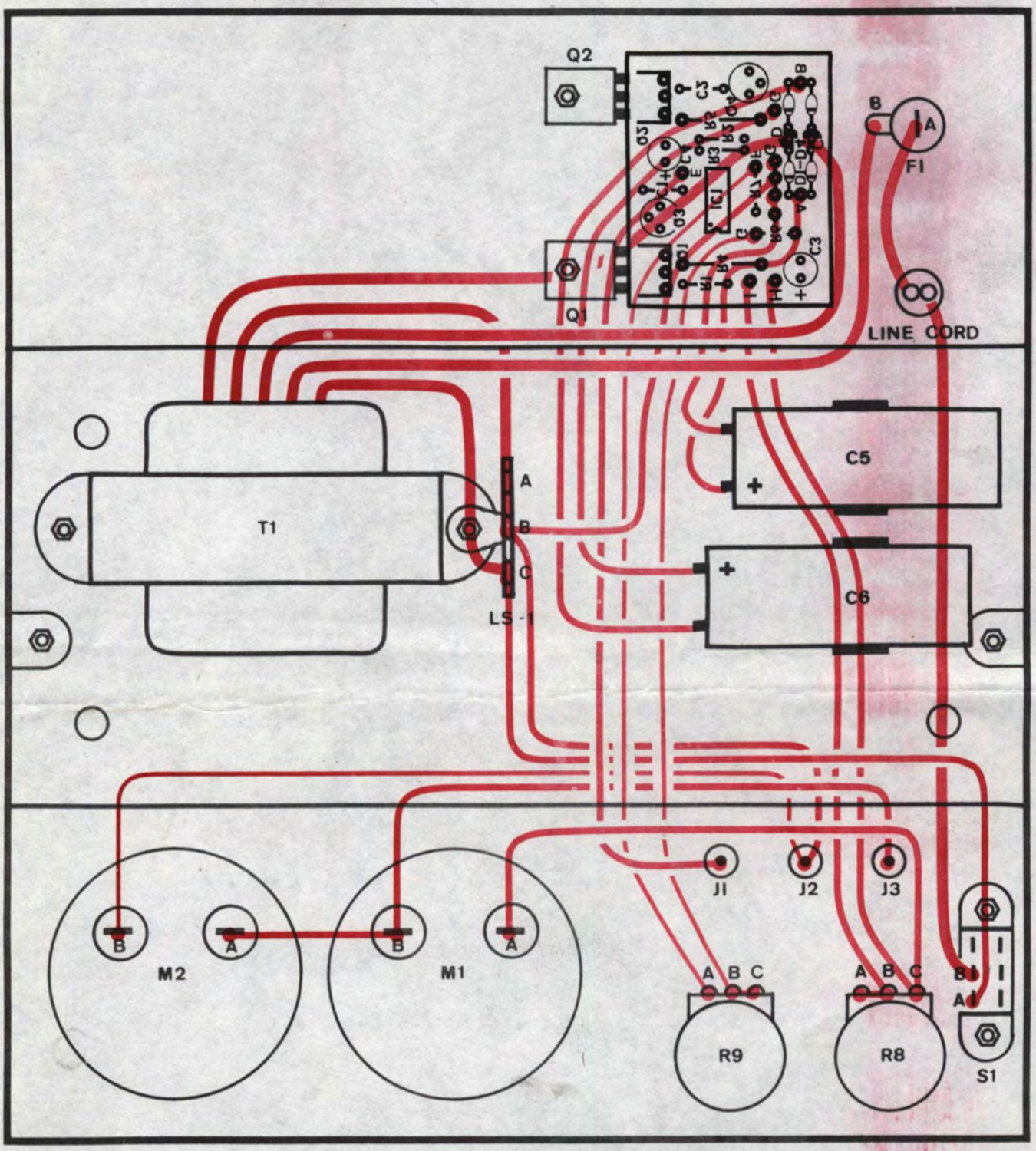
C1, C2	0.1 mfd capacitor
C3, C4	10 mfd @ 63V electrolytic capacitor
C5, C6	2000 mfd @ 35V electrolytic capacitor

Semiconductors

Q1	MJE2955 transistor
Q2	MJE3055 transistor
Q3, Q4	SS1123 transistor
IC 1	RC4194D integrated circuit
D1 - D4	IN5060 diode

Misc.

T1	117 VAC primary - 32 VAC 1.5 amp secondary power transformer
F1	1 amp standard fuse
M1	0-2 amp DC ampmeter
M2	0-35 volt DC voltmeter
S1	SPST slide switch
J1	Yellow binding post
J2	Black binding post
J3	Red binding Post



Wiring Diagram - No. 243 Power Supply

Wiring Table - #243 Power Supply

WIRE			FROM			TO		
STEP	LENGTH	GAUGE	PART	TERMINAL	SOLDER	PART	TERMINAL	SOLDER
1	2"	Heavy	M1	B	No	M2	A	Yes
2	7"	Heavy	M1	B	Yes	J3	-	Yes
3	8 1/2"	Light	M2	B	Yes	J2	-	No
4	8 1/2"	Heavy	LS-1	C	No	S1	A	Yes
5	6"	Heavy	LS-1	B	No	J2	-	Yes
6	7"	Heavy	M1	A	Yes	R8	C	No
7	6"	-	line cord	-	-	S1	B	Yes
8	3"	-	line cord	-	-	F1	A	Yes
9	Full	-	T1	Black	-	F1	B	Yes
10	3"	-	T1	Black	-	LS-1	C	Yes
11	7"	Heavy	PC Board	E	Yes	J1	-	Yes
12	7 1/2"	Heavy	PC Board	H	Yes	R8	C	Yes
13	7 1/2"	Heavy	PC Board	I	Yes	R8	B	No
14	5"	Heavy	PC Board	G	Yes	LS-1	B	No
15	7 1/2"	Light	PC Board	F	Yes	R9	A	Yes
16	7"	Light	PC Board	G	Yes	R9	B	No
17	1/2"	Light	R9	C	Yes	R9	B	Yes
18	1/2"	Heavy	R8	A	Yes	R8	B	Yes
19	4"	-	C5	(-)	-	PC Board	G	Yes
20	4"	-	C5	(+)	-	PC Board	A	Yes
21	4"	-	C6	(-)	-	PC Board	B	Yes
22	4"	-	C6	(+)	-	PC Board	G	Yes
23	6"	-	T1	Gn-Yel	-	LS-1	B	Yes
24	6"	-	T1	Green	-	PC Board	C	Yes
25	6"	-	T1	Green	-	PC Board	D	Yes