TEN - TEC

OPERATOR'S MANUAL

MODEL 9420
POWER SUPPLY

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SPECIFICATIONS

PRIMARY POWER:	220-250 VAC @7 A, 50/60 Hz or 110-125 VAC, jumper selectable.
DC OUTPUT:	14 VDC @ 100, maximum (20 A maximum @ transceiver connector)
PROTECTION:	Primary line fuses, overvoltage lockout, and overcurrent lock out at transceiver connector. (Overcurrent lockout on main dc supply lines is provided by Model 420 amplifier rf deck.
CONNECTORS / CABLES:	Primary AC power cable with removable plug, main DC cable with 12 pin connector for Model 420 amplifier, 20 A mp. DC transceiver connector (4 pin) and cable.
SIZE:	HWD 12.5" x 12.5" x 9.25", (31.75 x 31.75 x 23.5 cm).
WEIGHT:	58 lbs, (26.3 Kg).

INTRODUCTION

The Model 9420 Power Supply is designed primarily to power the Ten-Tec Model 420 Linear Amplifier. An auxiliary output will also power most HF transceivers including the Ten-Tec Models 560/561, 562 and 585. The supply delivers a combined 100 Amperes at 13.8 Vdc. Built-in over voltage sensing turns off the supply if the output climbs above 16 Vdc and over current shut down, factory set to 25 Amperes, is included on the exciter output.

The supply is designed for "hands-off" operation and can be placed on the floor or in an otherwise out of the way location.

UNPACKING

Carefully remove the power supply from the packing carton and inspect it for signs of shipping damage. If the power supply has been damaged, notify the delivering carrier immediately, stating the full extent of the damage. Save all damaged cartons and packing material. Liability for any shipping damage rests with the carrier. Complete the warranty registration form and mail to TEN-TEC immediately.

Save the packing material for re-use in the event that moving, storage, or reshipment is necessary. Shipment of your TEN-TEC power supply in other than factory packing may result in damage which is not covered under warranty. The following hardware and accessories are packed with your Model 9420. Make sure you have not overlooked anything.

2 — #27043	Fuse, 30A, 250V AGC
1 — #27048	Fuse, 15A, 250V AGC
1 — #35110	12 Pin Connector Cap
12 — #41019	Male Terminal Pin
1 — #46026	Wire, #16 Red
1—#74020	Warranty Card
1—#74198	Owner' Manual
1—#86018	Transceiver Cable

If any of the above items are missing, contact the customer service department at Ten-Tec for replacements.

CHAPTER 1

INSTALLATION

1-1 INTRODUCTION When setting up the Model 9420 Power Supply, be sure to locate it where there is adequate ventilation. The supply normally should be set on its bottom with the carrying handle up. But for a lower profile, rubber feet are also mounted on the back panel so that the supply can be tipped back. Setting the supply upright with the heatsink fins running vertically maximizes the supply's heat dissipation. Regardless of orientation, the supply needs plenty of free air circulation and should not be placed on a thickly carpeted floor or be cramped under a desk. Maximum load, especially at high line voltage, will eventually raise the heat sink fin temperature to as much as 70° F above the ambient air.

1-2 ELECTRICAL CONNECTIONS The Model 9420 Power Supply is factory wired for 240 Vac operation and typically draws about 9 Amperes of primary current at full load (about 2 KW). Although 120 Vac operation is possible, it is not recommended because most residential 120 Vac wiring cannot deliver the necessary current safely.

If you wish to use 120 Vac line voltage, refer to section 2-3 for details on modifying the Model 9420 transformer primary circuits.

Power Cable Connection. The power cable plug provided is recommended for 240VAC, 20A service. If another type connector must be used, the green wire of the amplifier power cord is the chassis safety ground. It must always (and ONLY) be connected to the safety ground of the ac mains -- NEVER to one of the "hot" power wires. The black and white wires are interchangeable and connect to the two "hot" service conductors.

Output Connections. The high current 13.8 Vdc output, along with several control lines, are cabled to the 12 pin OUTPUT CONNECTOR.

A separate four pin output connector (TRANSCEIVER CONNECTOR) on the Model 9420 provides power for an HF exciter.

1-3 GROUND CONNECTIONS With such high currents being conducted between power supply and amplifier some voltage drop will occur along the output cable. The return current in particular can raise the amplifier chassis as much as +0.3 Vdc above the supply chassis. To help reduce this loss and in keeping with goof RF practice, a heavy braid or ground wire should be run between the ground posts of both the power supply and the amplifier. Solid ground connections between the amplifier, transceiver and a good earth ground are of course a must.

CHAPTER 2

OPERATING INSTRUCTIONS

2-1 INTRODUCTION The following instructions will enable the operator to quickly place the Model 9420 Power Supply into operation. Included are descriptions of the Front Panel connectors and their functions.

2-2 FRONT PANEL CONNECTOR FUNCTIONS The following sections describe the front panel connectors and their function.

2-2.1 OUTPUT CONNECTOR This connector provides the high current 13.8 Vdc outputs, along with several control lines. The pin numbers and functions are silkscreened on the power supply case and are also shown in FIGURE 2-1. This connector plugs directly into the Model 420 Linear Amplifier. The POWER switch on the Model 420 activates the relays in the 9420 which turn on the supply.

2-2.2 TRANSCEIVER CONNECTOR This connector is used to provide 13.8 Vdc power to an HF exciter. The pin out of this connector is silkscreened on the power supply case and is shown in FIGURE 2-2. Included in the packing kit is a 4 conductor cable which can be used to connect any of the Ten-Tec Models 560/561, 562 or 585 transceivers to the Model 9420 Power Supply. A special load sensing circuit turns on the power supply when only the transceiver is being used.

2-2.3 LINE FUSES These fuses are in line with the incoming a.c. line voltage. Each side of the 240 Vac line is fused with a 15 ampere fast blow fuse. If these fuses ever need to be replaced be sure to use an AGC 15 or equivalent type designed for use at 250 Vac.

2-3 OPERATION ON 120 VAC The Model 9420 Power Supply features dual primaries on all four power transformers allowing for either 240 or 120 Vac operation. The supply is shipped wired for 240 Vac operation and is outfitted with a 240 volt style power plug. If the supply must be operated on 120 Vac several modifications are required. **Be warned that at full load the supply consumes over 2000 watts, which is well over the recommended load for standard 120 Vac house wiring.** To convert the 9420 to 120 Vac operation proceed as follows:

Step 1. Change the power plug:

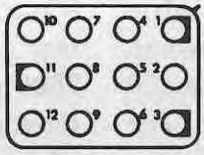
Substitute a heavy duty 120 Vac power plug for the existing one and wire it according to the diagram in FIGURE 2-3.

Step 2. Change the line fuses.

Locate the AGC 30 rated fuses in the packing kit and install them in the front panel fuse holders. The fuse types have been specially selected to handle both the turn-on inrush current and steady state primary current. Don't try using anything but the recommended fuses.

Step 3. Modify the control board.

There are four eyelets on the 81419 Control Board that are used to jumper the transformer windings for either 240 or 120 Vac. **Before you do anything else unplug the power supply!** To get access to the circuit board remove the top cover of the power supply. Locate the four eyelets and jumper them as shown in FIGURE 2-4, Part B. A large soldering iron or gun may be needed to solder these connections easily. A spare length of jumper wire is included in the packing kit for this purpose. This jumper carries a considerable amount of current and should be a heavy gauge wire like the one provided (at least #16 gauge). Do NOT use light weight hookup wire for this jumper!



(FRONT VIEW)

PIN	CONNECTION	PIN	CONNECTION
1	GND A	7	GND C
2	DC A	8	DC C
3	PWR ON	9	+14v/3A
4	GND B	10	GND D
5	DC B	11	DC D
6	+ REG	12	NC

FIGURE 2-1. OUTPUT CONNECTOR PINOUT

PIN	CONNECTION
1	GND
2	PWR ON
3	+ 13.5v/LO I
4	+ 13.5v/20 A

FIGURE 2-2. TRANSCEIVER CONNECTOR PINOUT

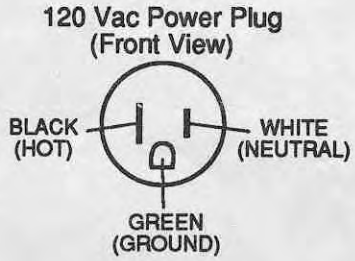
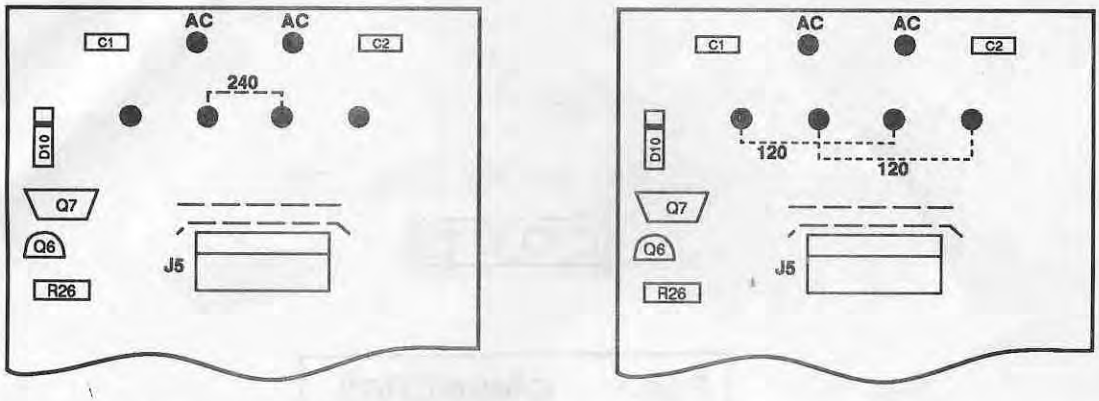


FIGURE 2-3. 120 VAC POWER PLUG WIRING DIAGRAM



Part A — 240 Vac Jumpering
(As wired from factory)

Part B — 120 Vac Jumpering

FIGURE 2-4. SELECTING LINE VOLTAGE ON 81419 CONTROL BOARD

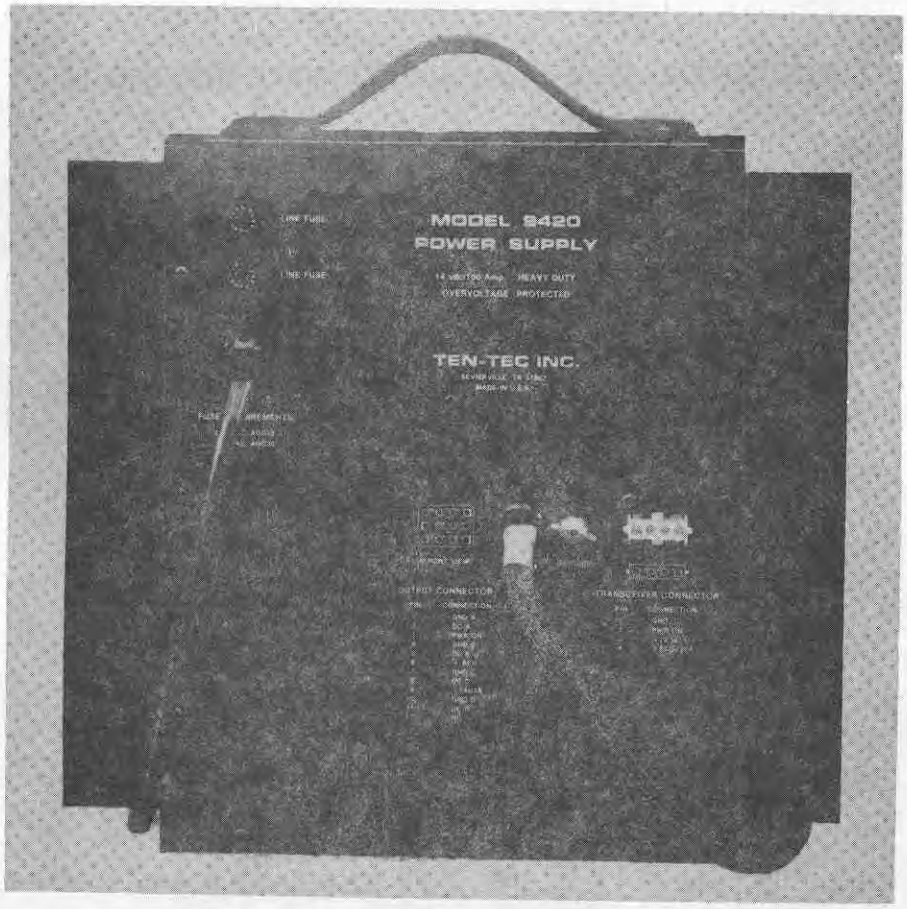


FIGURE 2-5. MODEL 9420 FRONT PANEL

CHAPTER 3

ILLUSTRATIONS AND CIRCUIT SCHEMATICS

3-1 INTRODUCTION The following sections contain circuit trace drawings and detailed component layout diagrams for all of the printed circuit board subassemblies used in the Model 9420 Solid State Power Supply. These drawings are followed by detailed circuit descriptions and a fold-out schematic diagram which contains the power supply and each circuit board subassembly.

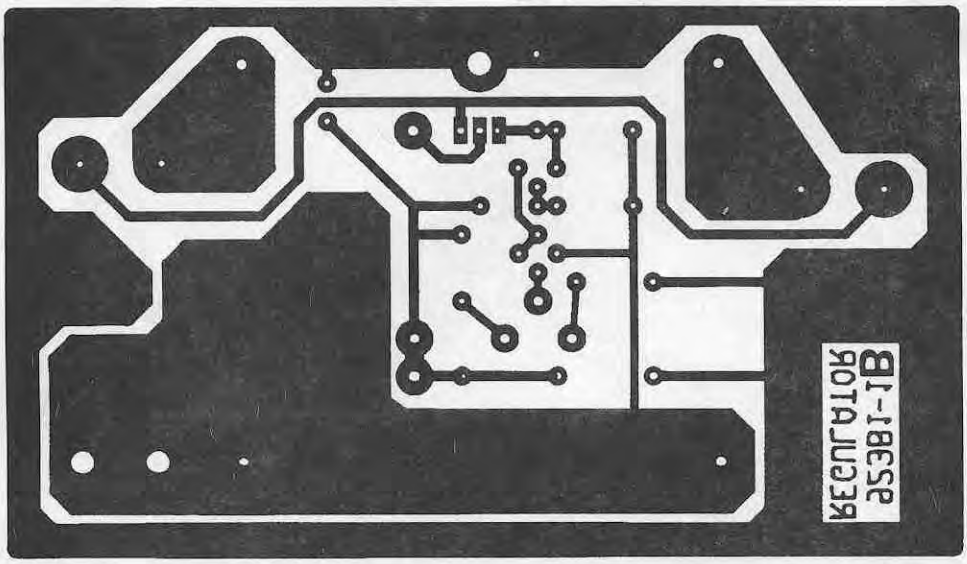


FIGURE 3-1. 81417 REGULATOR BOARD CIRCUIT TRACE

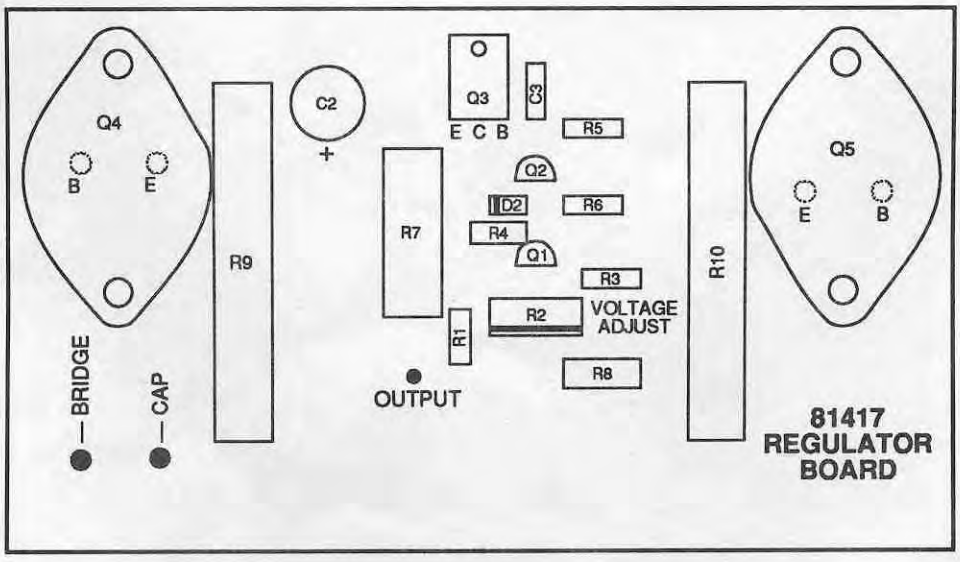


FIGURE 3-2. 81417 REGULATOR BOARD COMPONENT LAYOUT

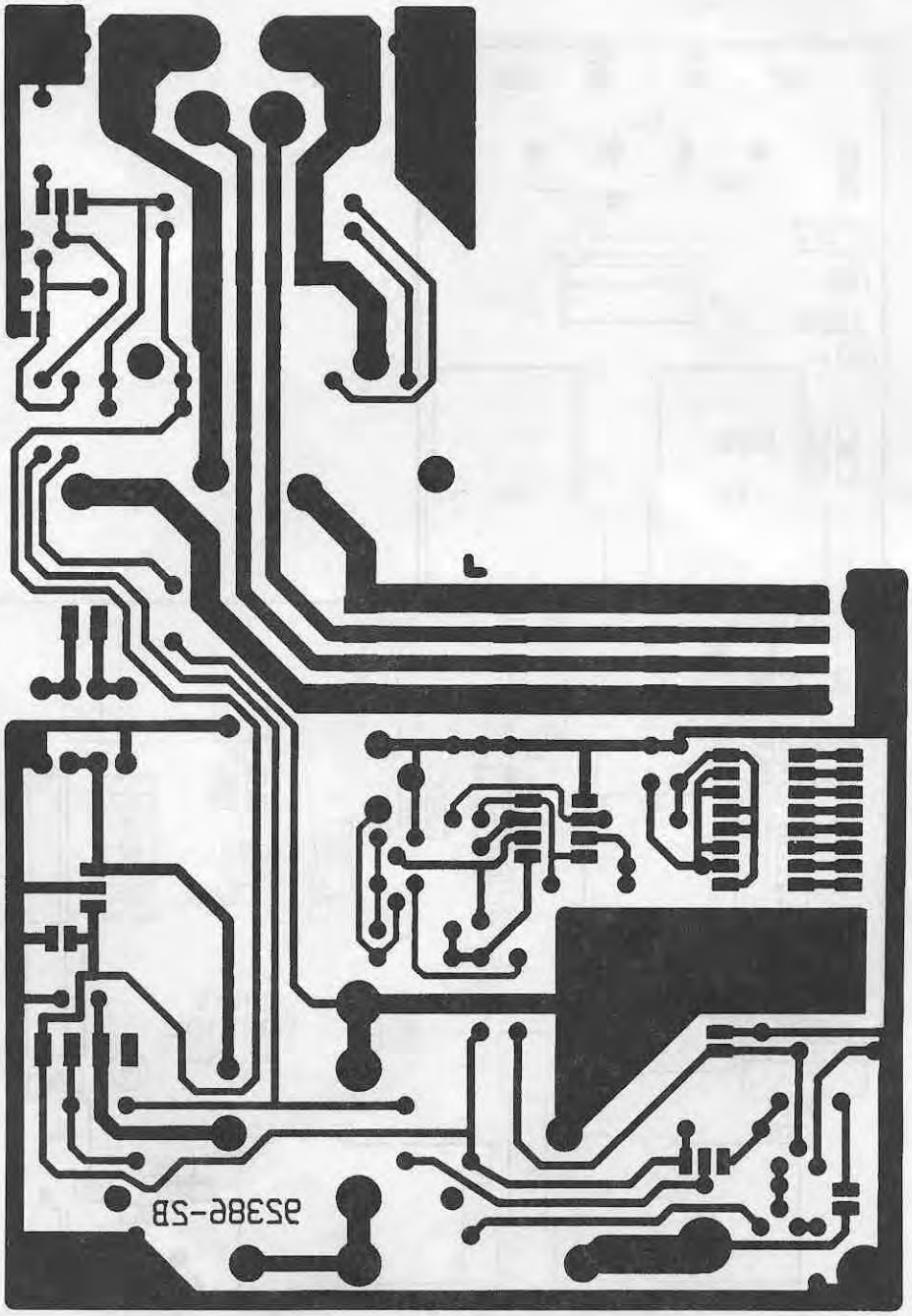


FIGURE 3-3. 81419 P.S. CONTROL BOARD CIRCUIT TRACE

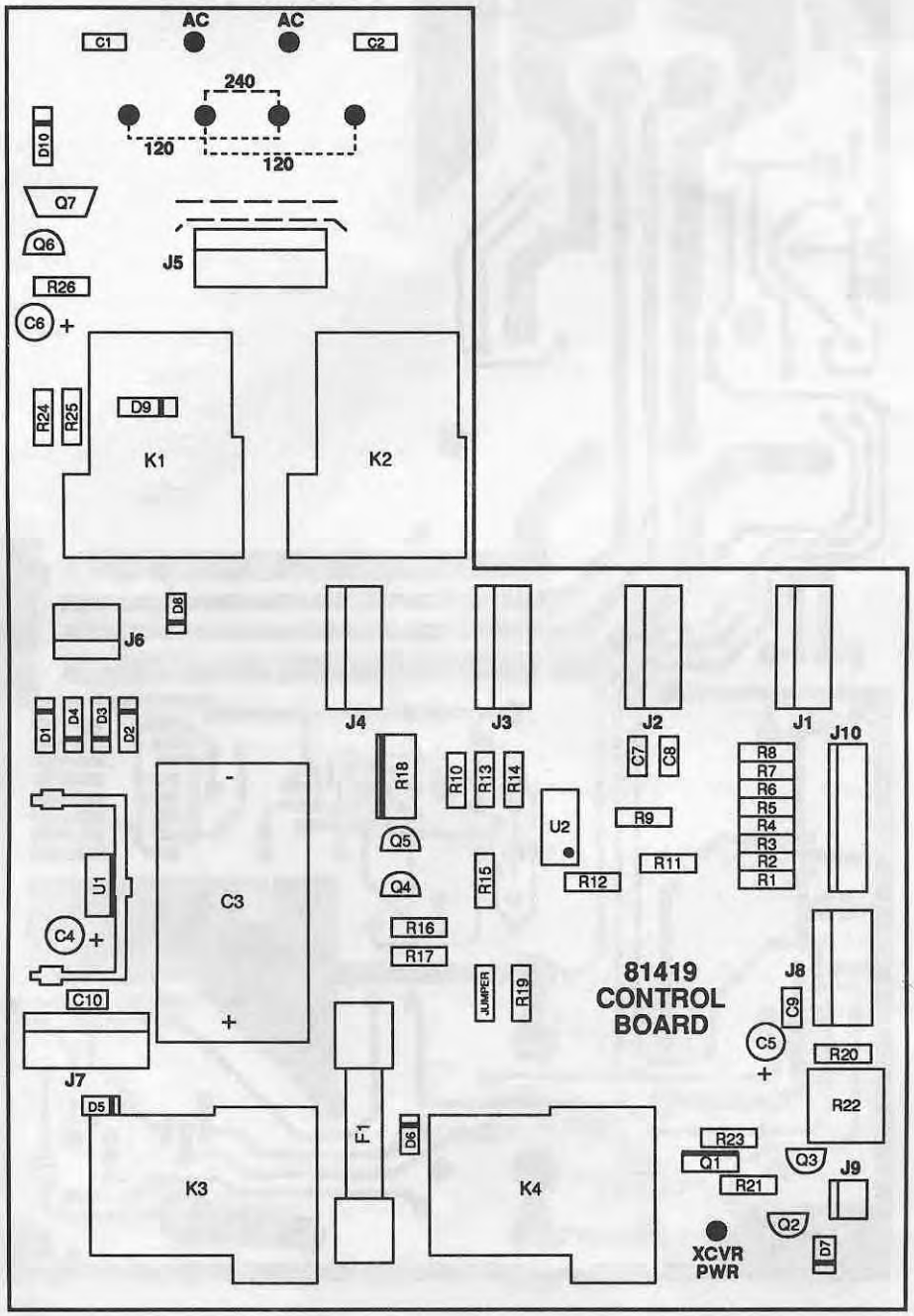


FIGURE 3-4. 81419 P.S. CONTROL BOARD COMPONENT LAYOUT

3-4 POWER SUPPLY CIRCUIT DESCRIPTIONS To best deliver the huge currents required and because of the nature of the Model 420 Linear Amplifier load, the Model 9420 Power Supply consists of four separate regulators. The output of each regulator is kept independent and powers one of the four amplifier stages in the 420. A controller board handles the power supply on-off switching, current sensing for the transceiver, and over voltage protection.

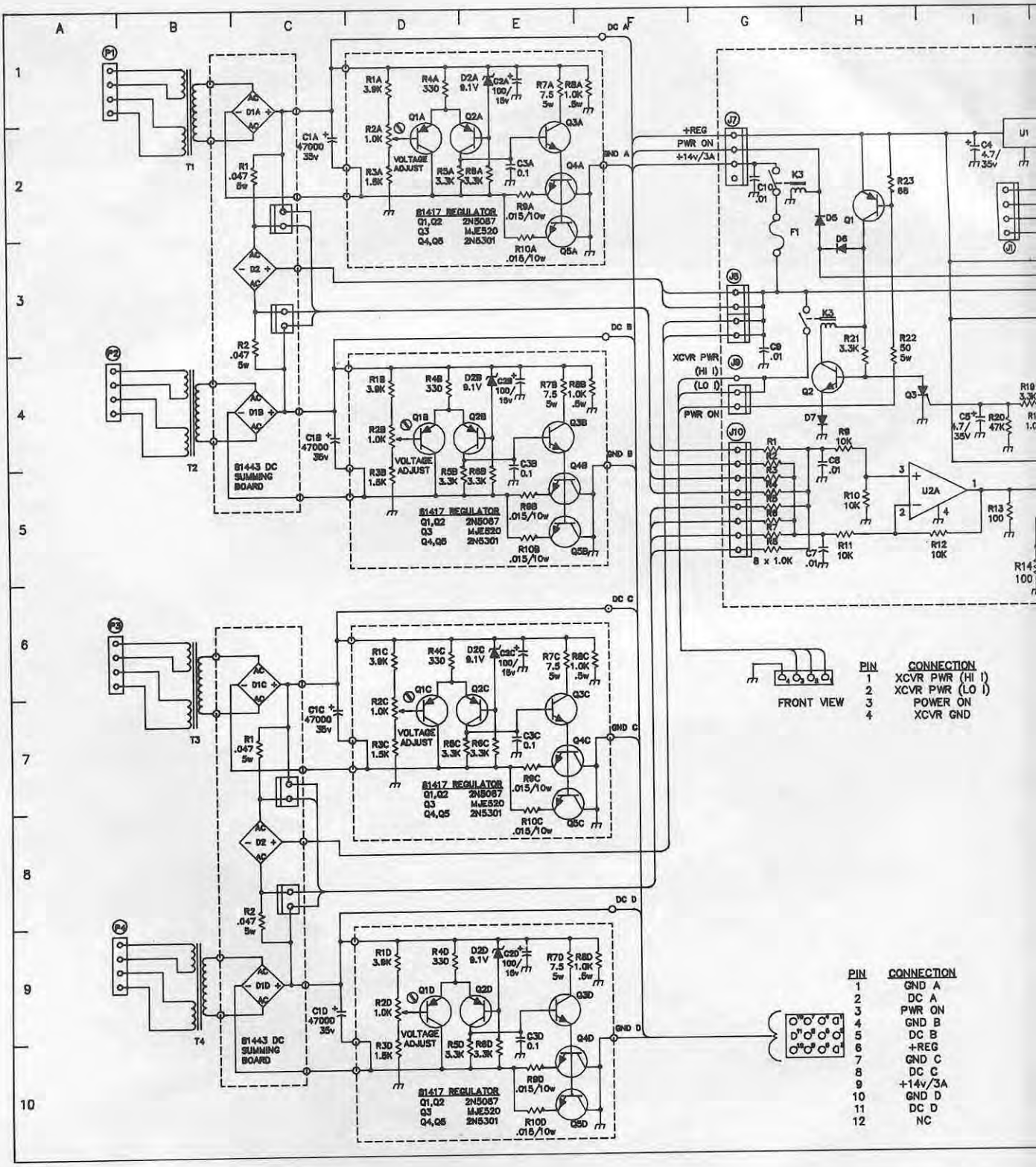
The controller uses transformer T5, diodes D1-D4, and regulator U1 to develop a regulated +15 Vdc "keep alive" voltage. This voltage is used to pull in the main power-on relays, K1 and K2, by one of two methods. When the Model 420 amplifier is switched on +15 Vdc is routed back down the amplifier power cable to J7 and on to Q7, the relay switching transistor. Q7 pulls in the power-on relays and powers up the four high current regulators. Alternatively, the amplifier can be off and if a load is connected to the POWER ON pin of the TRANSCEIVER CONNECTOR (pin 3), Q1 will be biased on and will provide the power-on signal to Q7. In this way the supply can detect when a transceiver has been turned on and will automatically power itself up.

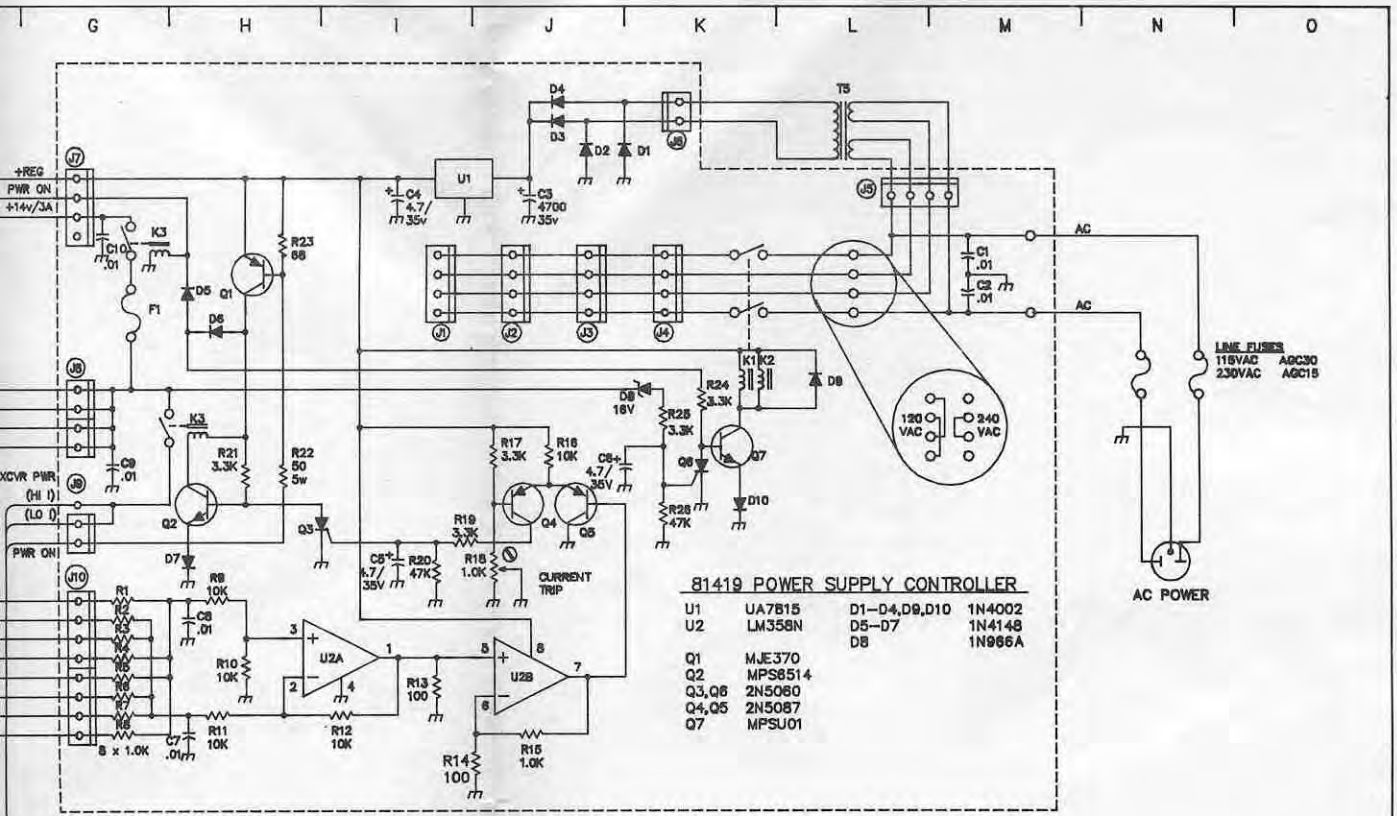
Assuming that the four output voltages are identical, the transceiver borrows current from the four regulators equally. Diodes in bridge D2, on the 81443 DC Summing Board, combine the four outputs through current shunt resistors which help equalize the current sharing. The voltage drop created by current through each shunt resistor is monitored by op-amps U2A and U2B. If the current delivered to the transceiver output becomes too large, comparator Q4 - Q5 fires the over-current SCR Q3. The SCR causes relay K4 to open and disconnects power from the transceiver connector. To reset the over current condition all load must be removed from the transceiver output.

Over voltage checking is done with zener diode D8 and SCR Q6. If any of the regulated outputs try to go higher than 16 volts the zener begins to conduct and fires Q6. This latches the power supply off until it is unplugged from the a.c. power line.

Each high current output consists of a transformer, full wave bridge rectifier, and filter capacitor which together provide unregulated d.c. for each regulator. The regulator itself consists of a reference diode D2, error amplifier Q1 and Q2, current gain stage Q3, and pass elements Q4 and Q5. The circuit is unconventional in that regulation occurs in the negative return path to the bridge rectifier. This arrangement allows the use of cost effective NPN power transistors as pass elements and lets the collectors operate at chassis ground potential. No mica insulators are needed between the transistors and the heatsink.

The differential amplifier of Q1 and Q2 compares a sample of the output voltage from R2 to a reference voltage from zener diode D2. The differential stage works to keep the voltage at both bases equal and generates an error signal at the collector of Q2. This signal is the feedback that drives the current gain stage Q3 and regulator transistors Q4 and Q5.


A
B
C
D
E
F
G
H
I
1
2
3
4
5
6
7
8
9
10
P1
P2
P3
P4
T1
T2
T3
T4
D1A
D2
D1B
D1C
D1D
C1A 47000 35v
C1B 47000 35v
C1C 47000 35v
C1D 47000 35v
R1 .047 5w
R2 .047 5w
81443 DC SUMMING BOARD
DC A
DC B
DC C
DC D
GND A
GND B
GND C
GND D
R1A 3.9K
R4A 330
D2A 9.1V
C2A 100/ 15v
R7A 7.5 5w
R8A 1.0K .5w
Q1A
Q2A
Q3A
Q4A
Q5A
R2A 1.0K
R3A 1.5K
VOLTAGE ADJUST
R5A 3.3K
R6A 3.3K
C3A 0.1
R9A .015/10w
R10A .015/10w
81417 REGULATOR
Q1,Q2 2N5087
Q3 MJE520
Q4,Q5 2N5301
R1B 3.9K
R4B 330
D2B 9.1V
C2B 100/ 15v
R7B 7.5 5w
R8B 1.0K .5w
Q1B
Q2B
Q3B
Q4B
Q5B
R2B 1.0K
R3B 1.5K
R5B 3.3K
R6B 3.3K
C3B 0.1
R9B .015/10w
R10B .015/10w
R1C 3.9K
R4C 330
D2C 9.1V
C2C 100/ 15v
R7C 7.5 5w
R8C 1.0K .5w
Q1C
Q2C
Q3C
Q4C
Q5C
R2C 1.0K
R3C 1.5K
R5C 3.3K
R6C 3.3K
C3C 0.1
R9C .015/10w
R10C .015/10w
R1D 3.9K
R4D 330
D2D 9.1V
C2D 100/ 15v
R7D 7.5 5w
R8D 1.0K .5w
Q1D
Q2D
Q3D
Q4D
Q5D
R2D 1.0K
R3D 1.5K
R5D 3.3K
R6D 3.3K
C3D 0.1
R9D .015/10w
R10D .015/10w
+REG
PWR ON
+14v/3A
J7
K3
C10 .01
F1
D5
D6
Q1
R23 68
U1
C4 4.7/ 35v
J1
J8
XCVR PWR (HI I)
(LO I)
PWR ON
C9 .01
R21 3.3K
R22 50 5w
Q2
Q3
D7
J10
R1 10K
R2
R3
R4
R5
R6
R7
R8
8 x 1.0K
C8 .01
C7 .01
R9 10K
R10 10K
R11 10K
R12 10K
U2A
R13 100
C5 4.7/ 35v
R20 47K
R19 3.3K
FRONT VIEW
PIN CONNECTION
1 XCVR PWR (HI I)
2 XCVR PWR (LO I)
3 POWER ON
4 XCVR GND
PIN CONNECTION
1 GND A
2 DC A
3 PWR ON
4 GND B
5 DC B
6 +REG
7 GND C
8 DC C
9 +14v/3A
10 GND D
11 DC D
12 NC



PIN	CONNECTION
1	XCVR PWR (HI I)
2	XCVR PWR (LO I)
3	POWER ON
4	XCVR GND

FRONT VIEW

PIN	CONNECTION
1	GND A
2	DC A
3	PWR ON
4	GND B
5	DC B
6	+REG
7	GND C
8	DC C
9	+14v/3A
10	GND D
11	DC D
12	NC

FIGURE 4–5 | POWER SUPPLY | 9420

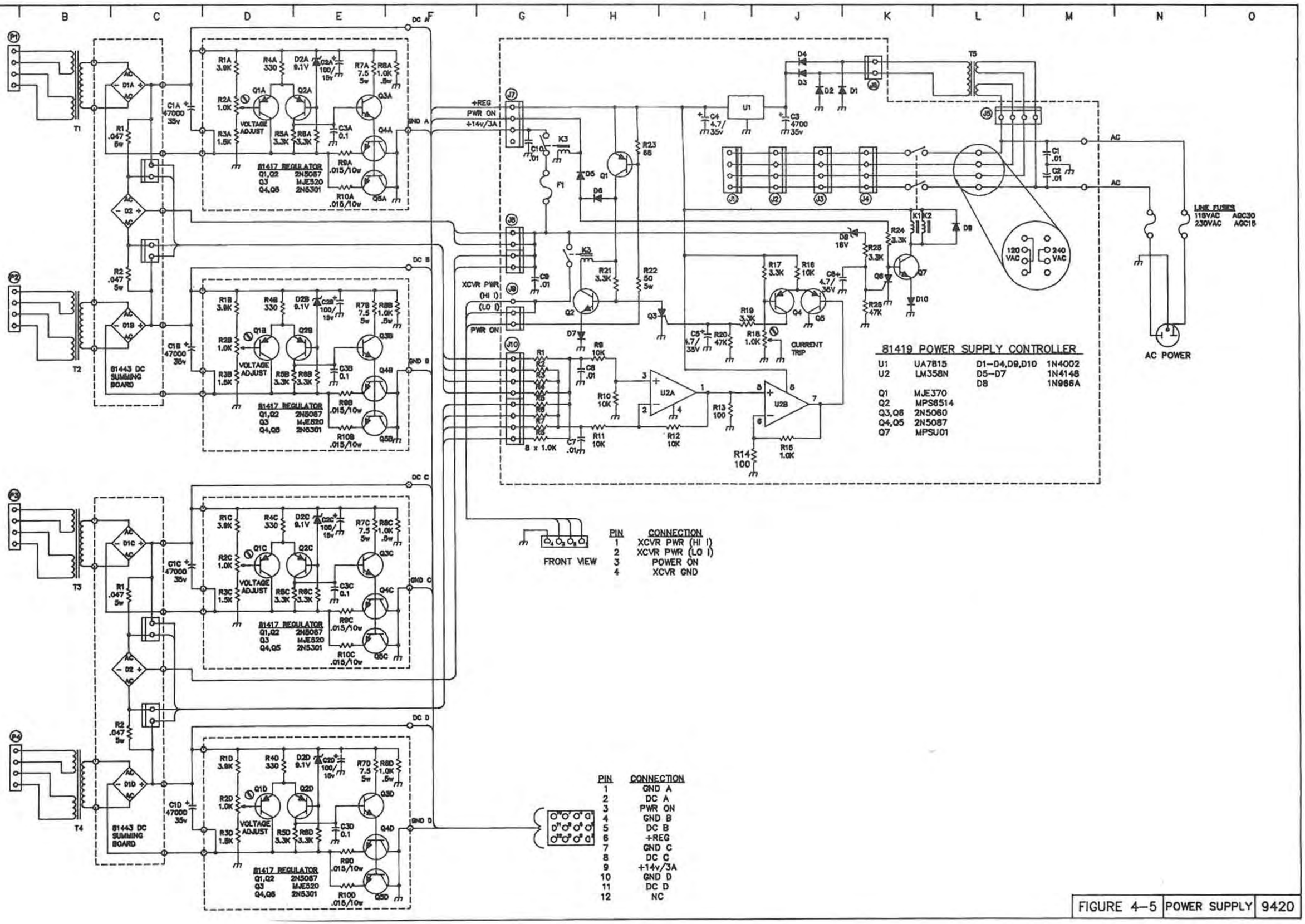


FIGURE 4–5 | POWER SUPPLY | 9420