

KINETIC SYSTEMS CORPORATION

Model 1500

Powered CAMAC Crate

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Model 1500
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June 1983

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FEATURES

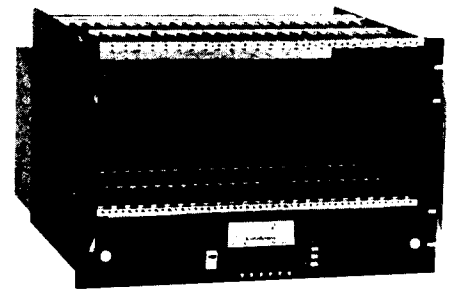
- MANDATORY VOLTAGES (+24, +6, -6, -24) AVAILABLE, ALL TYPES
- MODEL 1500 ALSO PROVIDES +12V, -12V
- 120V/220V STRAP-SELECTABLE, ALL TYPES
- 100V STRAP-SELECTABLE ON MODEL 1500
- UNITS AVAILABLE WITH 9, 12 AND 25 SLOTS
- METERING FOR VOLTAGE AND CURRENTS (1500)
- BUILT-IN DISK DRIVE OPTION, MODEL 1510

APPLICATIONS

- GENERAL PURPOSE CAMAC SYSTEMS
- IN-CRATE MICROCOMPUTER SYSTEM
- REMOTE STATION IN DISTRIBUTED SYSTEM

GENERAL DESCRIPTION

This series of powered CAMAC crates fully complies with CAMAC specification IEEE 583. They include the CAMAC Dataway with an 86-contact P.C. edge connector at each station. All units include one or more self-contained blowers as well as a power supply which converts the ac source to the mandatory dc CAMAC Dataway voltages (+24V, +6V, -6V, -24). The Model 1500 also provides the optional +12V and -12V.



Model 1500 25-Slot Crate

TYPE SUMMARY

Model	Description
1500	Full-featured 25-station crate
1505	9-slot crate that uses minimum rack space
1510	Economical 12-station crate; disk drive option available
1570	Similar to 1500, but with separate power supply

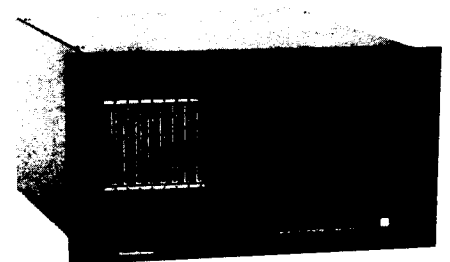


Model 1505 9-Slot Crate

All crates in this series are arranged for 19" relay rack mounting.

The Model 1500 is a full-featured 25-station CAMAC crate. It includes a rear-mounted power supply unit and a front-removable fan tray. The front panel includes over-temperature warning, a switch-selected meter for monitoring all voltages and currents, and removable air-intake grills. Adapter strips can be purchased for mounting 36-contact rear I/O connectors.

(Continued on following page)



Model 1510 12-Slot Crate

1500 - 1570 (Continued)

The Model 1505 is a 9-station CAMAC crate. Its small size makes this unit ideal where a minimum of modules are used and valuable rack space can be used. Switching regulators are used to minimize size, weight and heat. Since the modules are mounted in a horizontal plane, units with mercury-wetted contact relays (such as the 3530) cannot be used.

The Model 1510 is an economical 12-station crate for modest size systems or remote units. In the "standard" version of this crate, the panel space on the right side is available for customer use. The 1510 is also available with built-in dual 5¼" floppy disk drives and controller for an 8030 System.

The Model 1570 is similar to the 1500 crate except that the power supply is mounted separately.

POWER SUPPLY INFORMATION

Model	+24V	-24V	Shared To	+12V	-12V	Shared To	+6V	-6V	Shared To	Notes
1500/70	6A	6A	6A	3A	3A	6A	42A	25A	42A	1, 2, 3
1505	2A	2A	2A	—	—	—	10A	4A	12A	1, 3
1510	1A	1A	2A	—	—	—	12A	4A	16A	1, 3

Notes: 1. The 1500 and 1570 can be strap selected for 100V, 120V or 220V, 50/60 Hz; the other units can be strap selected for 120V or 220V.
 2. On the 1500 and 1510, the +12V and -12V are derived from the +24V and -24V sources; therefore, the +12V load must be considered part of the +24V load and the -12V load considered part of the -24V load.
 3. All types provide current foldback limiting and overvoltage crowbar protection for all output voltages.

ORDERING INFORMATION

Model	Description	Size (H x W x D)	Weight
1500-P1K	25-slot crate, self-contained PS	31.1 cm (12¼") X 48.3 cm (19") X 55.9 cm (22")	34 kg. (75 lb.)
1505-P1A	9-slot powered crate	17.8 cm (7") X 48.3 cm (19") X 36.8 cm (14½")	14.6 kg. (32 lb.)
1510-P1C	12-slot powered crate	25.4 cm (10") X 48.3 cm (19") X 55.9 cm (22")	25 kg. (55 lb.)
1510-P2J	12-slot powered crate w/disk drives	25.4 cm (10") X 48.3 cm (19") X 55.9 cm (22")	30 kg. (65 lb.)
1570-P1B	25-slot crate, separate PS	31.1 cm (12¼") X 48.3 cm (19") X 38.1 cm (15")	34 kg. (75 lb.)

Notes: 1. The 1570-P1B includes a separately mounted power supply, 22.2 cm (8¾")H x 48.3 cm (19")W x 17.8 cm (7")D.
 2. When ordering state ac voltage desired. The unit will be strapped and fused for that voltage.

- Accessories** — Model 5962-Z1A Adapter Kit for 36-Contact Rear I/O Connectors
 Model 1180 Extender for Power Supply Maintenance, Model 1500 Crate
 Model 1920-Z1A Chassis Slides for 1510 Crates (pair)

Model 1500

UNPACKING AND INSPECTION

The 1500 powered CAMAC crate includes the following units.

1. 1500-100 ventilation unit (shipped in crate assembly).
2. 1500-200 power supply with detached power cord.
3. 1500-300 crate assembly.

Remove the ventilation unit from the crate assembly. This is done by first loosening the two large captive screws on the front panel (one on each side of the ventilation unit). Then slide the ventilation unit forward.

While unpacking, check the following for possible shipping damage:

Ventilation Unit:

1. Damage to rear connector.
2. Damage to switches or meter on the front panel.

Note: Do not re-install ventilation unit in crate assembly at this time.

Power Supply:

1. Check external connectors and cable.
2. Check for any external damage.

Crate Assembly:

1. Check Dataway connector.
2. Check for bent connector pins on Dataway.
3. Check for damaged module connectors.

AC INPUT VOLTAGE SELECTION

The 1500-200 power supply operates from 100V, 120V, 200V, or 220V 50/60HZ (strap selectable) AC input voltage. Prior to operating the power supply for the first time, the input strapping should be checked. This is accomplished as follows (see Figure 1):

1. Check tag attached to power supply mounting block to assure that local supply voltage agrees with that set at the factory.
2. Remove supply cover by turning five quarter-turn fasteners on the rear of the cover.
3. Check for any internal damage.
4. Check straps on TB1 terminal strip per the following chart (see Figure 2).

<u>Nominal AC Voltage</u>	<u>Strap TB1 Terminals</u>
100V	3&4, 4&5, 7&8
120V	1&2, 2&3, 7&8
200V	3&4, 9&10
220V	2&3, 6&7

5. Replace rear cover. Tighten five quarter-turn fasteners.
6. Check that F1 and F2 agree with fuse data on supply cover.

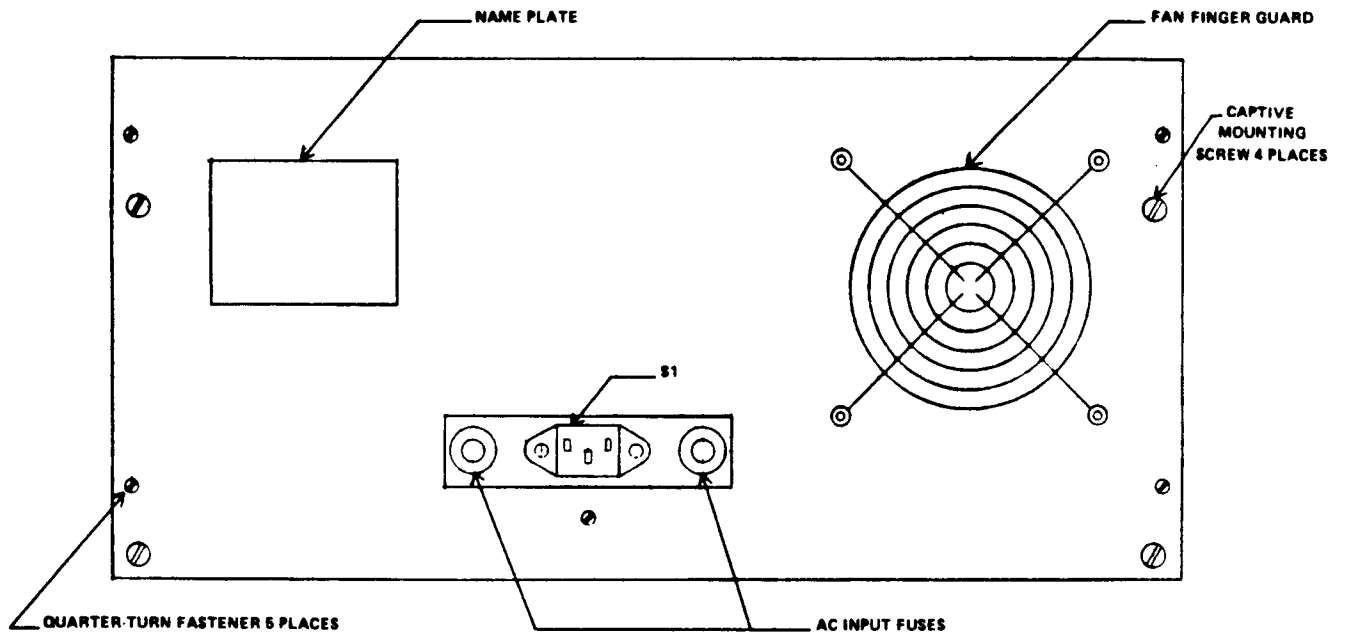


Figure 1 - Power Supply, Rear View

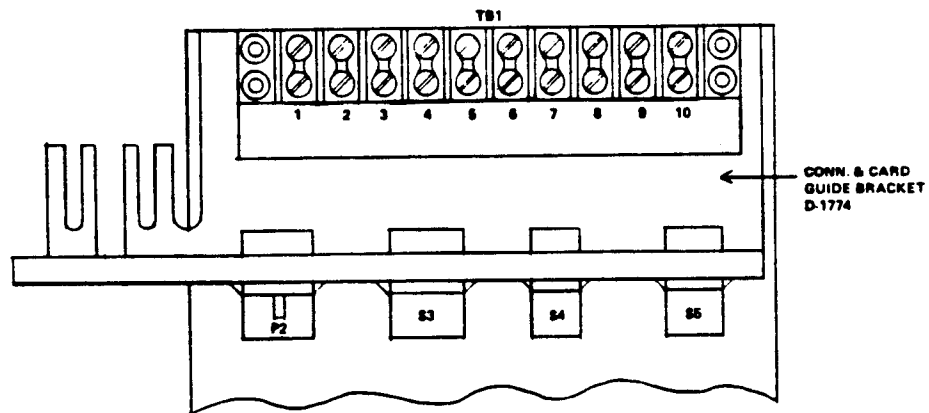


Figure 2 - Strap Selection on Terminal Strip

INSTALLATION

The Model 1500 powered crate mounts in any standard 19" equipment cabinet with a minimum depth of 61cm (24 inches). The crate assembly has a front-panel height of 31.1 cm (12.25 inches).

Model 1500

MOUNTING THE CRATE

For ease of mounting, we recommend that the crate assembly be mounted with the power supply and ventilation unit removed.

ADDING THE POWER SUPPLY

The power supply should be mounted as follows (see figure 3):

1. Extend the pinned slides of the crate.
2. Place the supply onto pins on the slides.
3. Connect the Dataway socket PG. 27. (Caution: Do not bend the Dataway backplane pins).
4. Push the supply against the crate and start the four captive screws.
5. Tighten the captive screws.

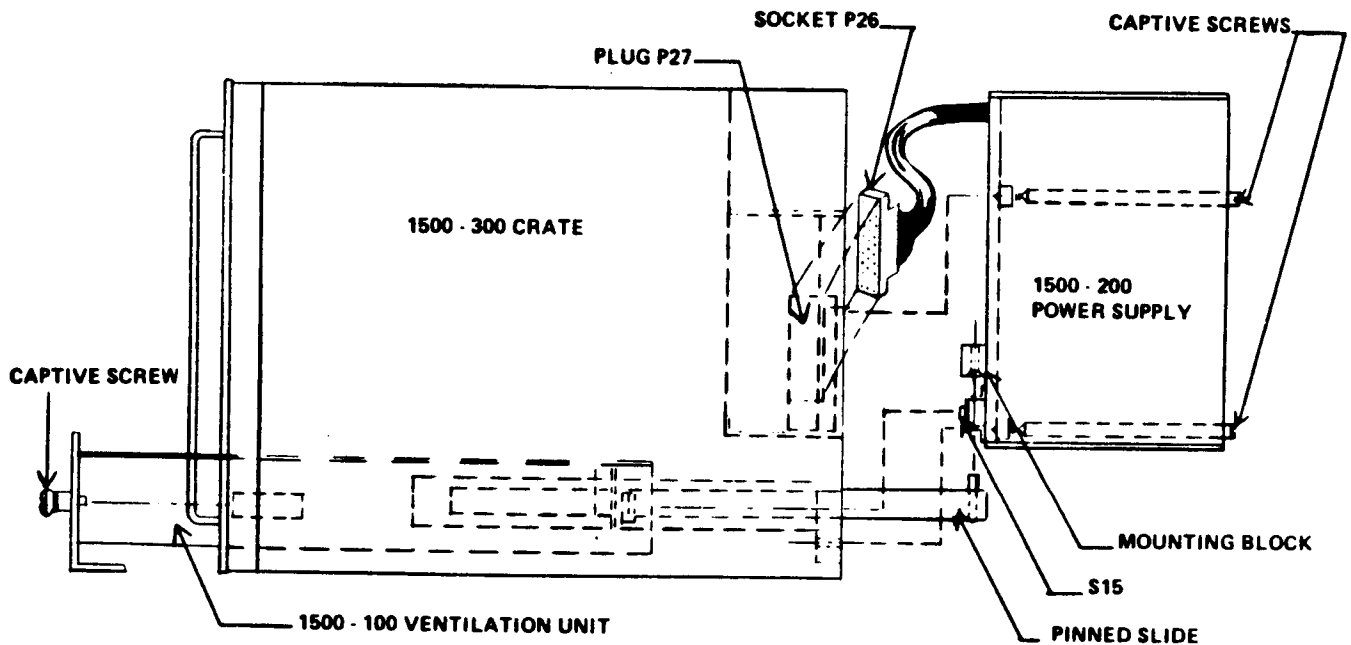


Figure 3 - Model 1500 Powered Crate Installation

MOUNTING THE VENTILATION UNIT

The ventilation unit should be mounted as follows:

1. Insert the ventilation unit into the blower section of the crate.
2. Slide the unit into the crate until the rear connector mates with the connector on the power supply.
3. Tighten the two captive screws on the front panel of this unit.

**CAUTION: AC POWER IS PRESENT AT S15 WHEN
POWER CORD IS CONNECTED TO S1**

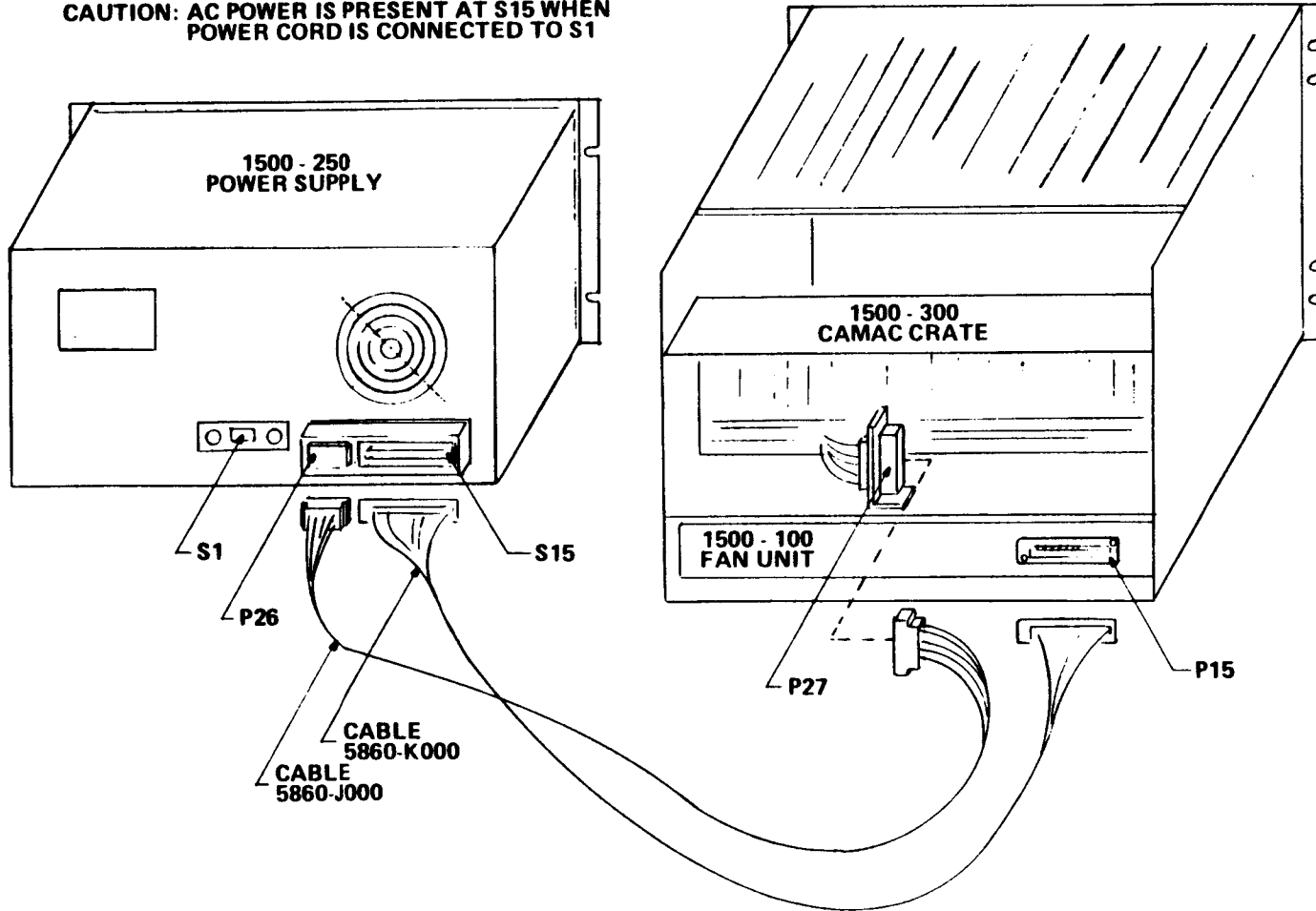


Figure 3A - Model 1570 Powered Crate Installation

APPLYING POWER TO THE CRATE ASSEMBLY

The crate is now ready for power to be applied as follows:

1. Connect the power cord to the power supply and an appropriate power source.
2. Turn the power switch to ON position (see figure 4). The ON indicator lamp on the switch should glow. The three fans on the ventilation unit and the rear power supply fan should be rotating.

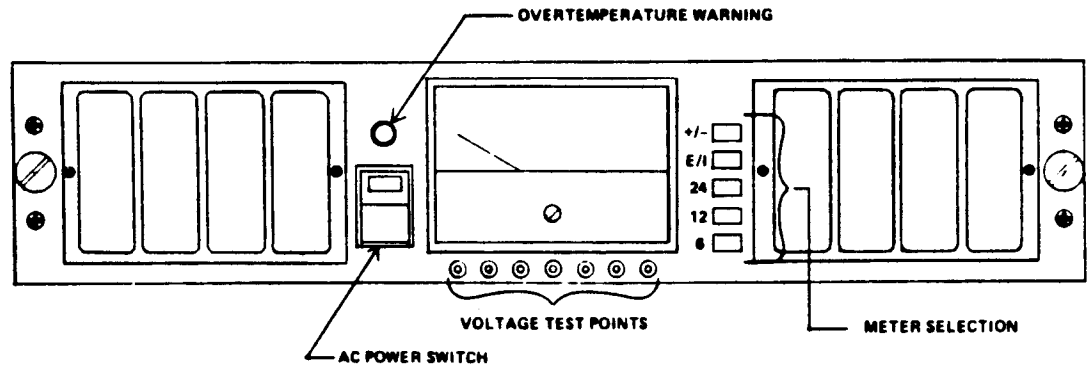


Figure 4 - Ventilation Unit Front Panel

METERING OF VOLTAGE AND CURRENT

Check the supply voltages with the front panel meter as indicated below.

Note: All voltages should be within the nominal voltage mark on the scale.

1. Press the +/- switch to its IN position.
2. Press the E/I switch to its IN position.
3. Press the 24, 12, and 6 switch IN, one at a time. Read the positive voltages on their respective ranges (see figure 5).
4. Release the +/- switch to its OUT position.
5. Press the 24, 12, and 6 switches IN, one at a time. Read the negative voltages on their respective ranges (see figure 5).

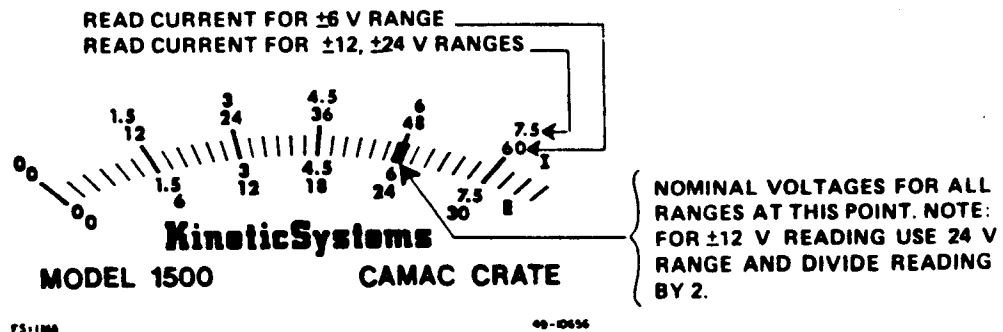


Figure 5 - Front Panel Meter Face

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The current drain for all six voltages can also be monitored. Switch selection is the same as for voltage monitoring, except that the E/I switch is released to its OUT position. With no modules inserted, all current ranges should read "zero". If any current is indicated (and the associated voltage is very low), the protective "high voltage crowbar" may have been activated. This is described later under "SCR CROWBAR".

Note: If the maximum current (as indicated under specifications) for any voltage range is exceeded, the power supply will go into "foldback limiting". This will result in a reduced output voltage.

TEST POINTS

Test points for monitoring the six supply voltages are provided on the front panel of the ventilation unit. (See figure 4). Each test point is connected to a series resistor. These resistors allow grounding of any test point without affecting operation of the power supply. Any meter with 20,000 ohms/volt or higher sensitivity can be used without affecting the accuracy of the reading.

COOLING

To decrease failure rate and prolong the life of the power supply, an uninterrupted flow of air over the critical components must be assured.

For power supply cooling, air is drawn into the front filters, through the ventilation unit, around the power transformer, across the power rectifiers, and exhausted through the pass transistor assembly. The fan in the pass transistor assembly provides this air flow.

The air in the ventilation unit is exhausted into the crate by the three fans in this unit. These fans provide the module cooling that is needed. It is important that there are no obstructions to the filters or the rear exhaust area of the power supply.

It is very important to clean the filter foam by immersing in warm, soapy water on a routine basis. Also, check periodically for free rotation of all fans.

OPERATION

After the modules are installed, the crate is now ready for operation.

Caution: Turn the crate power OFF when inserting or removing CAMAC modules to avoid possible damage caused by momentary misalignment of contacts.

SCR CROWBAR

Note that the +12 volt supply is derived from the +24 volt supply; also, if the +12 volt supply produces excessive voltage, it triggers the +24 volt crowbar. The same is true of the -12 volt and -24 volt supplies.

POWER SUPPLY TROUBLE ISOLATION AND REPAIR - INTRODUCTION

To prevent damage to the CAMAC modules it is suggested they be removed from the crate during power supply trouble diagnosis and repair. The following table is provided to assist in isolating a troubled area.

<u>Trouble Indication</u>	<u>Probable Cause</u>
Complete loss of power	F1 or F2 open, thermal cutout open, blocked air flow, clogged filters, supply overload, defective pass transistor fan.
High temperature indicator ON	Defective pass transistor fan, clogged filters, supply overload, defective thermal sensor
One voltage low	SCR protective "crowbar" triggered, defective regulator card, supply in current limiting
One voltage at zero volts	Defective power rectifier, "blown" pass transistor fuse(s), defective regulator card
All positive voltages at zero	Defective 30 volt boost supply on positive regulator card
All negative voltages at zero	Defective 30 volt boost supply on negative regulator card
Pass transistor fuse open	Pass transistor short

A low voltage condition on an output may be caused by its crowbar SCR being turned on. An SCR in the ON state will cause the regulator associated with that voltage to current limit, thereby lowering its output voltages; if an SCR were triggered by a transient condition, turning the AC power OFF for a short period of time will reset the SCR. If the condition persists, the regulator card should be suspected and checks internal to the supply are necessary.

POWER SUPPLY SUBASSEMBLIES

The 1500-200 power supply is constructed of pluggable subassemblies; this greatly enhances repair. With the exception of the high current wires to the main filter capacitors, each subassembly is totally pluggable. Removal of a defective subassembly from the main chassis consists of unplugging cables and removal of the hold-down screws on the subassembly.

A list of the subassemblies include:

1. Transformer assembly. (Figure 6)
2. Regulator assembly mother board, B438. (Figure 7)
3. Crate interface assembly, B430. (Figure 8)
4. Cable assembly to ventilation unit. (Figure 9)
5. Pass transistor assembly (Figure 10)
6. Negative and positive and regulator cards, R500 and R501 (Figures 24 and 28, respectively).

In addition to the subassemblies listed above, details of the pass transistor assembly are also shown. These are:

1. Pass transistor fuse blocks (Figure 11).
2. Heatsink for +6 volt pass transistors. (Figure 12)
3. Heatsink for -6 volt pass transistors. (Figure 13)
4. Heatsink for the +24, -24, +12 and -12 transistors. (Figure 14)

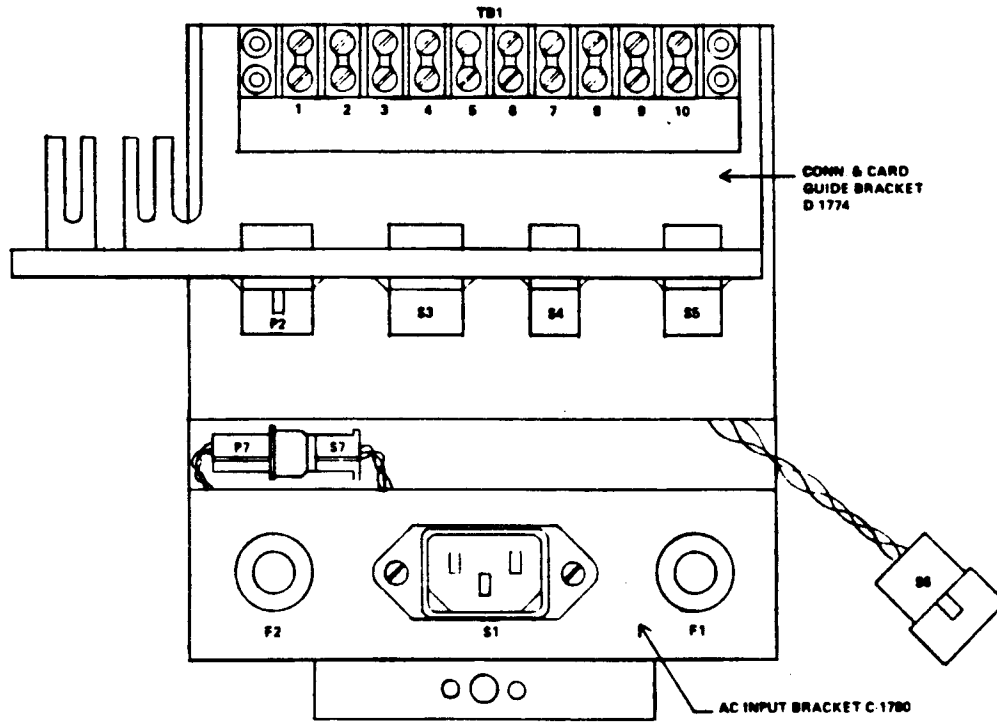


Figure 6 - Transformer Assembly

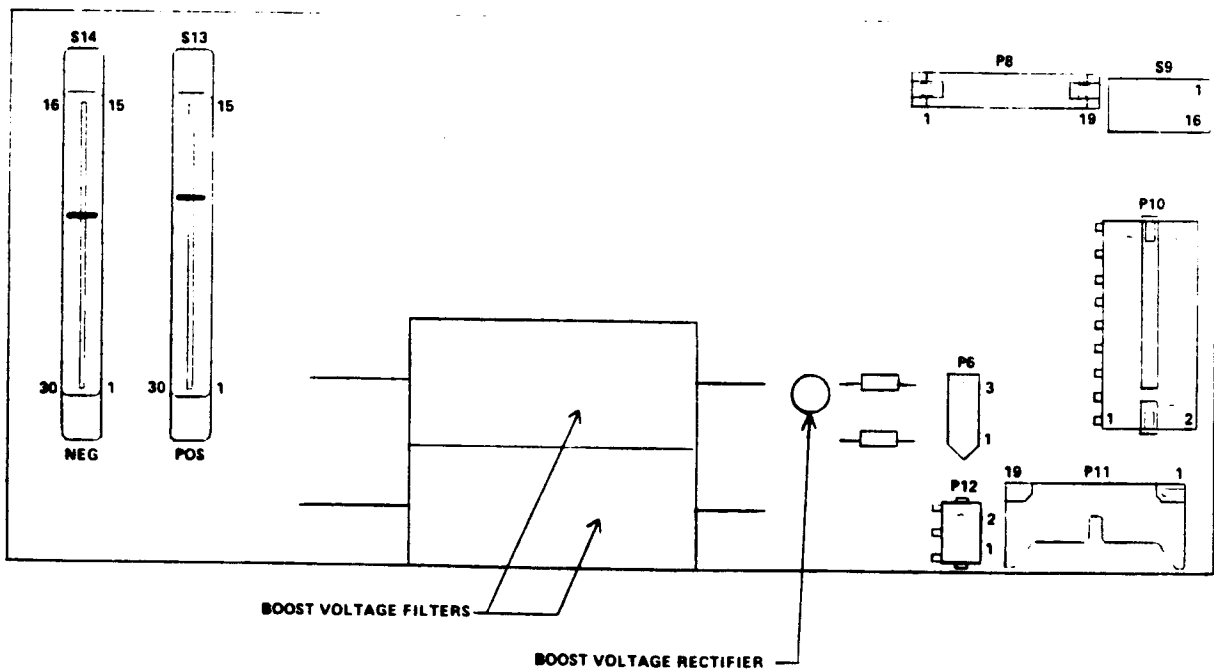


Figure 7 - Regulator Assembly Mother Board

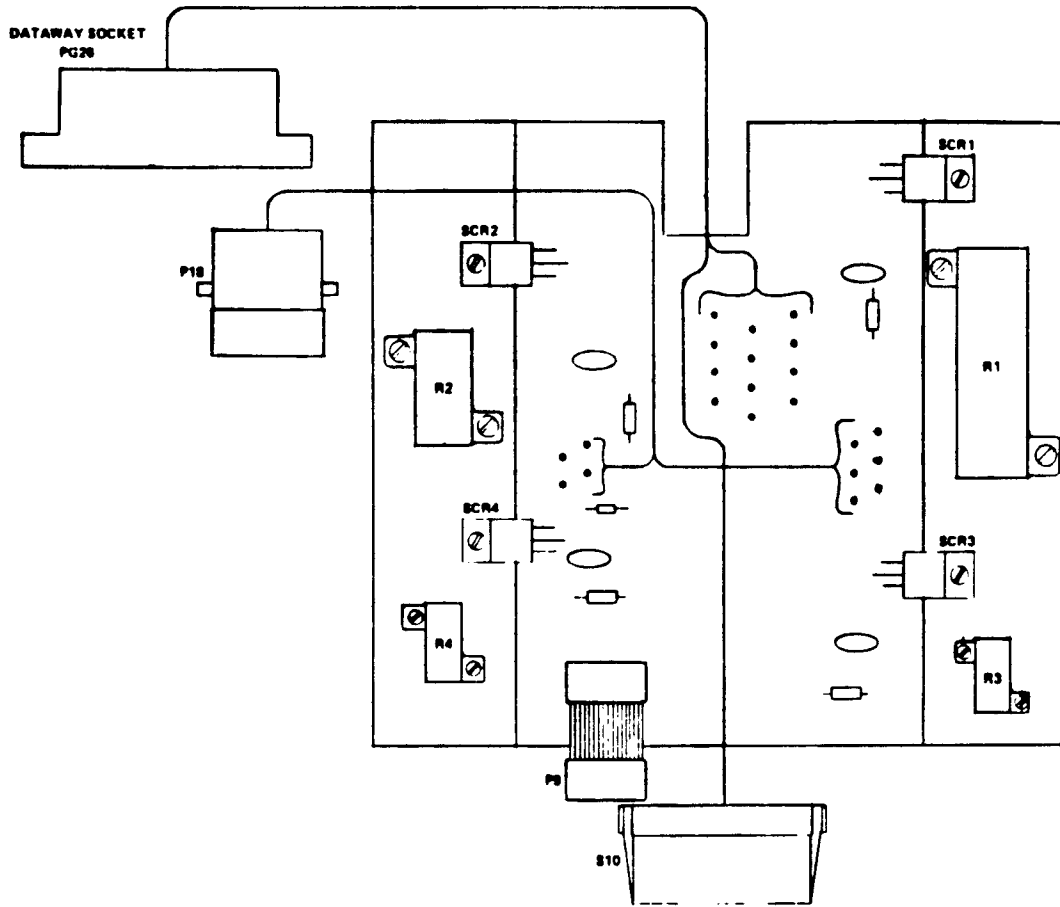


Figure 8 - Crate Interface Assembly, B430

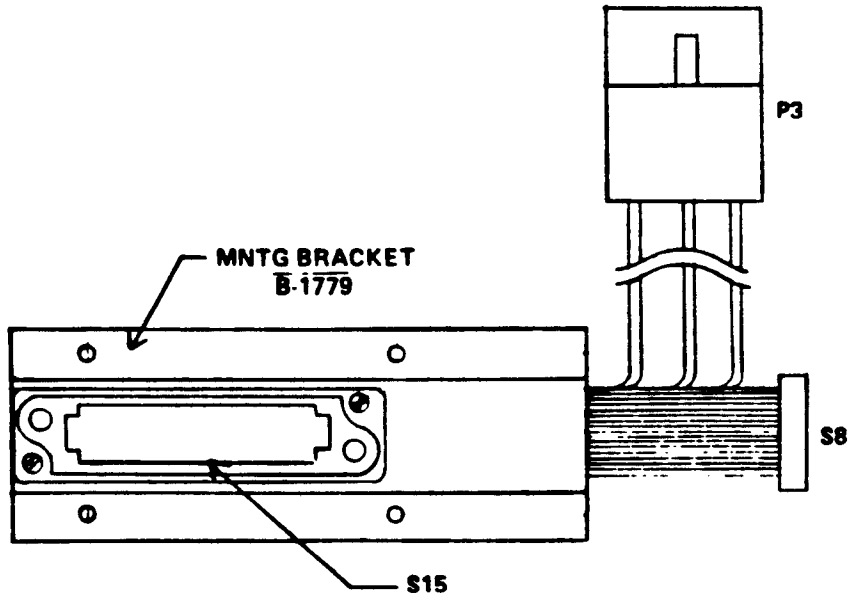


Figure 9 - Cable Assembly to Ventilation Unit

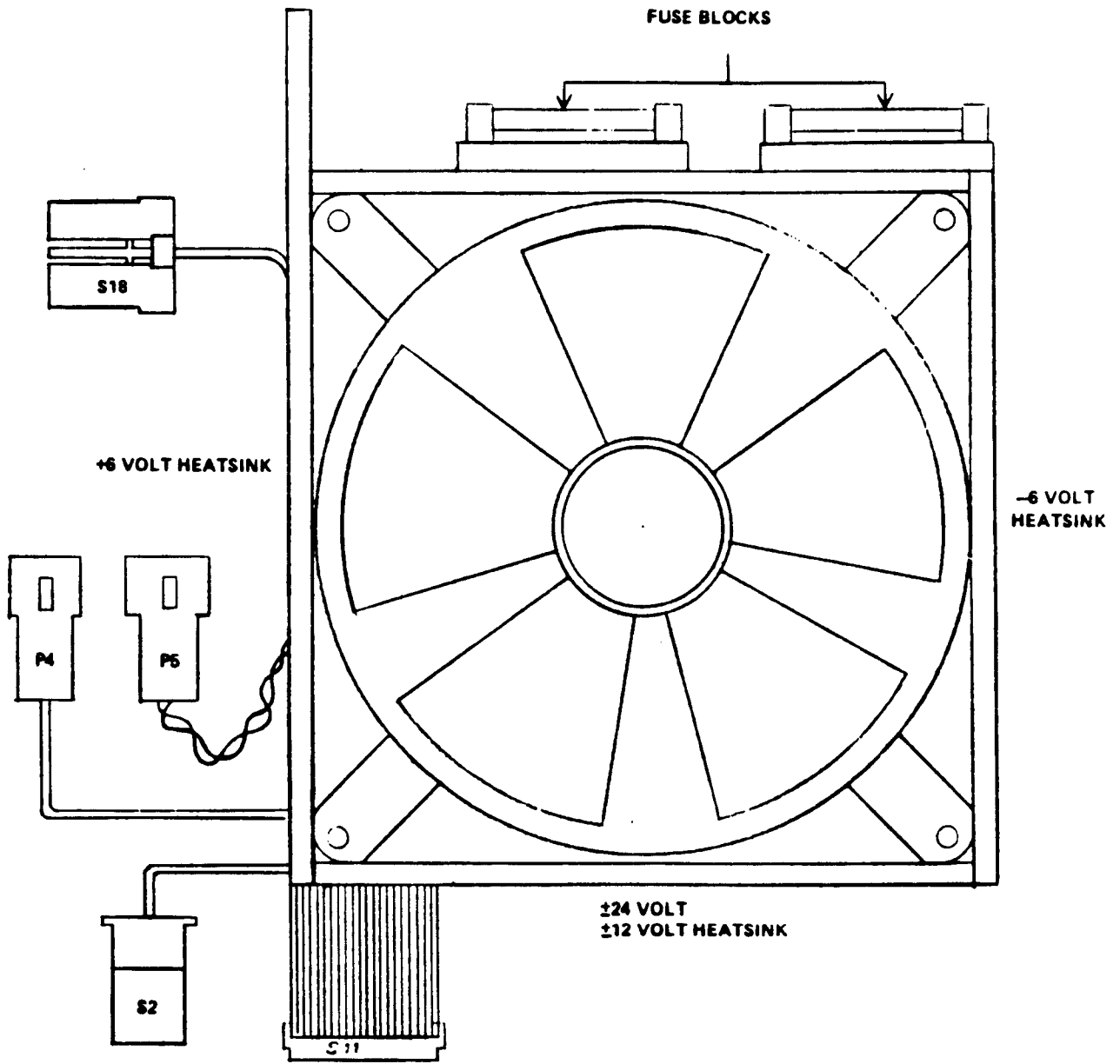


Figure 10 - Pass Transistor Assembly

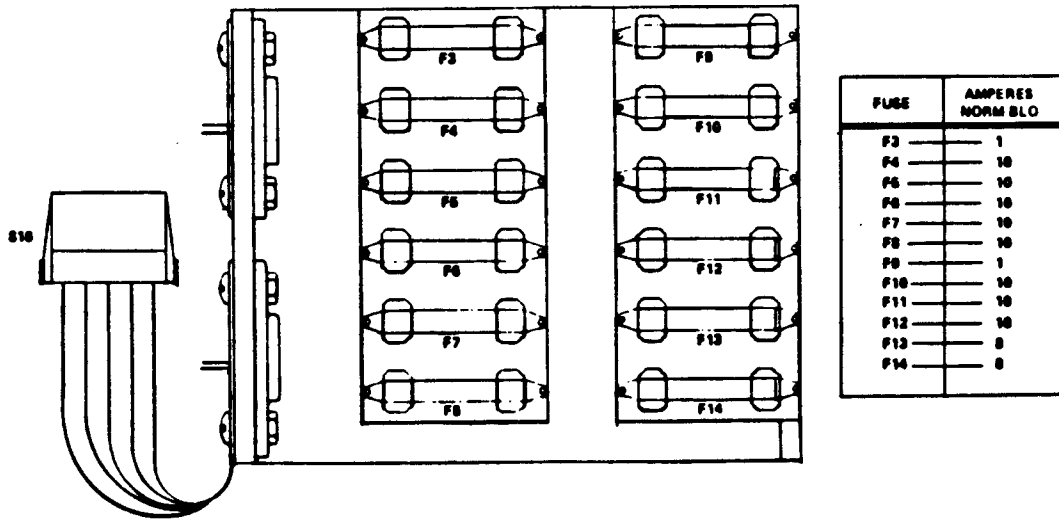


Figure 11 - Pass Transistor Fuse Blocks

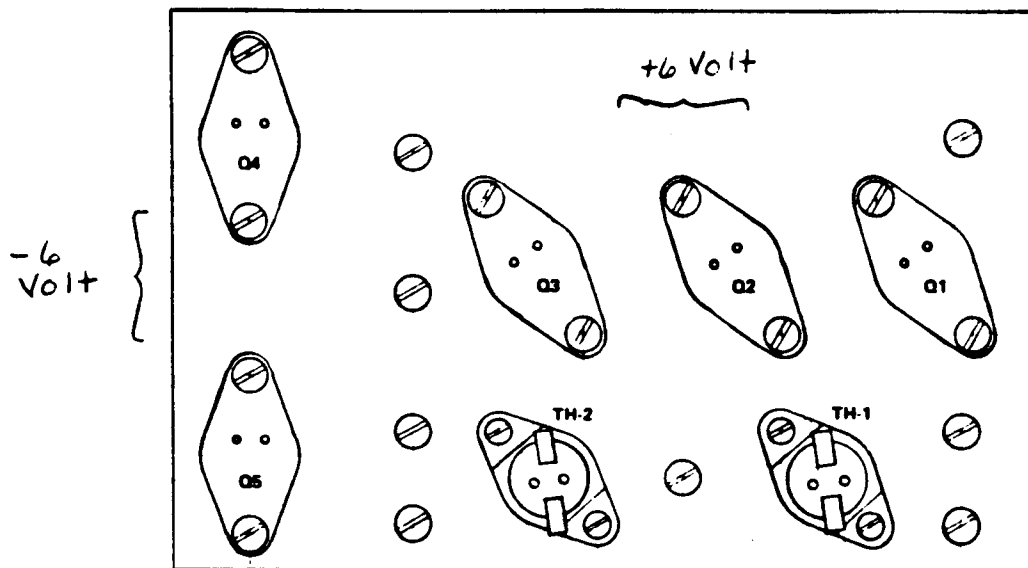


Figure 12 - Heatsink for ± 6 volt Pass Transistors

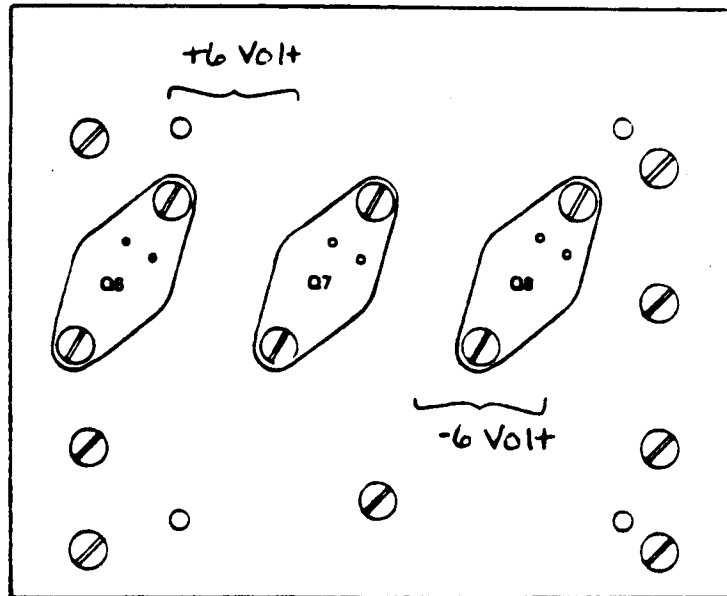


Figure 13 - Heatsink for +6 volt Pass Transistors

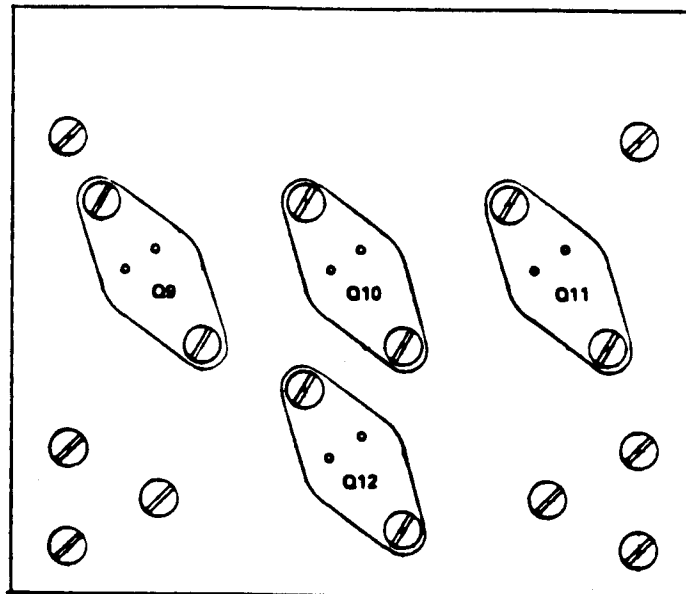


Figure 14 - Heatsinks for +24, -24, +12, -12 volt Pass Transistors

INITIAL INTERNAL CHECKS

1. Remove the AC cord.
2. Remove power supply cover.
3. Locate pass transistor fuse blocks (see Figure 11).
4. If a fuse is open, see PASS TRANSISTOR ASSEMBLY REPAIR.
5. Replace AC cord, turn power ON.
6. Measure voltage across the main filter capacitors, C1 and C2; the no load voltage should be approximately 17V (unregulated voltage for + or -6 supplies).
7. Measure voltage across the filter capacitors, C3 and C4; the no load voltage should be approximately 45V (unregulated voltage for + or - 24 supplies).
8. If steps 6 or 7 resulted in a voltage reading of zero or substantially less than stated, see TRANSFORMER ASSEMBLY REPAIR.
9. Turn power OFF, read sections on regulator operation.

PASS TRANSISTOR ASSEMBLY REPAIR

If after inspecting the pass transistor fuse blocks (see Figure 11), the 1 amp fuses, F3 or F9, were found open, a faulty component in the +6 regulator (fuse 3 open) or a faulty component in the -6 regulator (fuse 9 open) should be suspected. If any other fuse is open, its associated pass transistor is probably shorted and must be checked before the fuse is replaced and power restored. To check the pass transistors, the assembly must be removed from the main chassis.

PASS TRANSISTOR ASSEMBLY REMOVAL

Caution: REMOVE AC CORD AND BLEED CURRENT FROM MAIN FILTER CAPACITORS C1, C2, C3 AND C4 BEFORE ATTEMPTING TO REMOVE ANY SUBASSEMBLY.

1. Detach power supply from crate and place on workbench.
2. Unplug S11 and S12 from regulator assembly mother board (Figure 7).
3. Disconnect P18-S18 to crate interface board (Figure 8).
4. Remove four 8-32 mounting screws from side of main chassis.
5. Lift out pass transistor assembly.

Note: IT IS NOT NECESSARY TO DISCONNECT HIGH CURRENT WIRES FROM MAIN FILTER CAPACITORS.

With the pass transistor assembly removed an ohmmeter can be used to locate the faulty transistor. Removal of the cooling fan (four 6-32 screws) is necessary for replacement of a bad transistor. Reverse the removal process to replace the pass transistor assembly.

TRANSFORMER ASSEMBLY REPAIR

A low or zero voltage reading in steps 6 or 7 under INITIAL INTERNAL CHECKS generally indicates a faulty power rectifier diode. The power rectifiers are mounted on the AC input bracket directly beneath the transformer. The +6V diodes (MR5005) and the -6V diodes (1N3660R) are

pressed into $\frac{1}{4}$ " black anodized aluminium blocks and bused together to form a bridge. The +24V and -24V use a commercially available bridge. In either case, replacement of a rectifier requires removal of the transformer assembly from the main chassis.

TRANSFORMER ASSEMBLY REMOVAL AND DIODE REPLACEMENT

Caution: REMOVE AC CORD AND BLEED CURRENT FROM MAIN FILTER CAPACITORS C1, C2, C3 AND C4 BEFORE ATTEMPTING TO REMOVE ANY SUBASSEMBLY.

1. Detach power supply from crate and place on workbench.
2. Remove regulator cards (loosen screw on side of each card before removal).
3. Unplug P3, P4 and P5 from connector bracket.
4. Unplug S6 from regulator assembly.
5. Unscrew 12 gauge blue wire from C1 (positive terminal).
6. Unscrew 12 gauge yellow wire from C2 (negative terminal).
7. Unscrew 12 gauge black wire from ground terminals of C1 and C2.
8. Unscrew 16 gauge violet wire from C3 (positive terminal).
9. Unscrew 16 gauge orange wire from C4 (negative terminal).
10. Unscrew 12 gauge black wire from ground terminals of C3 and C4.
11. Remove four $\frac{1}{4}$ -20 Allen-head transformer mounting screws.
12. Lift transformer assembly out of main chassis.

With the assembly removed, the transformer may be separated from the AC input bracket by unplugging P7-S7, unplugging S2, and removing two 10-32 screws on the transformer. An ohmmeter may now be used to locate the faulty rectifier diode.

Removal and replacement of swage-fit diodes:

1. Unsolder diode bus bars.
2. Remove four 6-32 diode block mounting screws (retain two TO-3 mica washers for remounting).
3. With diode block removed, use punch to drive bad diode from diode block.
4. Replace new diode by applying pressure on top outside edge. (A hollow shaft with a $\frac{1}{4}$ " I.D. and a drill press is suggested).
5. Replace diode block on AC input bracket. (Make sure mica insulating washers and screw shoulder washers are in place).
6. Use an ohmmeter to check that the black anodized diode block and AC input bracket are not shorted.
7. Resolder diode bus bars.
8. Reconnect transformer and AC input bracket and replace assembly in the main chassis.

Note: BLACK ANODIZED BLOCKS WITH SWAGED IN DIODES MAY BE ORDERED AS SPARE PARTS.

REGULATOR OPERATION

The R500 regulator card provides regulation for the -6, -12, and -24 volt sources. The R501 card regulates the +6, +12, and +24 volt sources. A brief discussion on the operation of each regulator follows.

R500 NEGATIVE REGULATOR CARD OPERATION

The three negative regulators on the R500 card each utilize an LM304 as the basic regulation element. The unregulated input voltage to all three LM304's is supplied by the rectified boost voltage. Zener diode D5 regulates the boost voltage at -32V and emitter follower Q3 drives the LM304's.

Since all three negative regulators are basically the same, the following discussion will refer only to the -6V regulator and the reader may appropriately translate the information to the -24V and -12V regulators.

The output voltage of regulator U4 is linearly dependent on the value of R6 (voltage adjustment potentiometer) and R60 giving approximately 2V for each 1K of resistance. This scale factor is set by R61. The output current capability of the LM304 is increased by emitter follower Q18 which drives transistor Q4. The collector of Q4 drives the three negative 6V pass transistors (on the pass transistor assembly) through isolation resistors R68, R69, and R70. Remote voltage sensing at the crate is employed to eliminate the effect of wire resistance in the power cable. This is accomplished by returning crate ground through card pin 4, to the LM304 ground (pin 9) and connecting pin 8 of the regulator through edge connector pin 27 to the negative 6 volt bus bar on the crate. Resistor R47 provides a low ohmic sense line connection from the regulator to negative 6V on the crate interface card when the crate is disconnected.

A considerable amount of power, under full load conditions, is dissipated in the series pass transistors. If the output is shorted, this dissipation could damage the pass transistors. Foldback current limiting is used to eliminate this situation. With current limiting, the available output current decreases as the maximum load is exceeded and the output voltage is reduced.

Normally Q17 is held in a non-conducting state by voltage divider R53, R52, and R58 (current limit adjustment potentiometer). However, when the voltage across the -6 current limit resistor R2 (located on the crate interface board) increases to where the emitter of Q17 becomes more positive than the base, Q17 turns ON and begins to shunt base drive from Q18. This causes an increase in the output current of the LM304, and it will go into current limiting at a current determined by R62.

Potentiometer R58 is factory adjusted for current foldback limit; THIS SHOULD NOT BE TURNED unless test equipment is available to properly re-adjust the maximum current fold-back point. The same is true for R15 and R11 on the -24 and -12V regulators, respectively.

Component failure in the regulator circuits could cause the voltage on the Dataway to become excessive thereby causing possible damage. A voltage crowbar is used to prevent this problem. Zener diode D2 provides a -6.2V reference on the base of Q15. Transistors Q15 and Q14 form a voltage comparator. The base and, therefore, the emitter of Q14 is controlled by voltage divider R50 and R56. As the output voltage (card pin 6) becomes more negative, the emitter of Q14 also becomes more negative. At approximately -7.5V, the emitter of Q14 is sufficiently negative to turn Q15 ON, this turns Q16 ON, driving "-6CB" (connector pin 21) to ground. Pin 21 is routed to the gate of SCR2 on the crate interface card.

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With a ground potential on its gate, the SCR conducts, causing a sufficient amount of current to flow through the current limit resistor to cause the regulator to go into current limiting.

R501 POSITIVE REGULATOR CARD OPERATION

The three positive regulators on the R501 card each utilize an LM305 as the basic regulation element. The unregulated input voltage to all three LM305's is supplied by the rectified positive boost voltage. Zener diode D6 regulates the boost voltage at +32V, and emitter follower Q2 drives the LM305's. Since all three positive regulators are basically the same, the following discussion will refer only to the positive 6 volt regulator and the reader may appropriately translate the information to the positive 24 volt and positive 12 volt regulators.

The output voltage of U4 is determined by R46, R3 (voltage adjustment potentiometer) and R47. The resistor values are selected based on a feedback voltage of 1.8V to pin 6 of the LM305. Capacitors C15 and C16 are required to suppress oscillations in the feedback loop. Capacitor C21 compensates the internal regulator circuitry to make stability independent for all loading conditions. The output current capability of the LM305 is increased by emitter follower Q16 which drives Q4. The collector voltage for emitter follower Q4 is provided directly from the positive 6 volt rectifier which is routed through F3 on the pass transistor assembly. The emitter of Q4 (through 1.3 ohm isolation resistors) drives the five +6 pass transistors on the pass transistor assembly.

Remote voltage sensing at the crate is employed to eliminate the effect of wire resistance in the power cable. This is accomplished by returning crate ground, through card pin 24, to the LM305 ground (pin 4) and connecting the positive 6V crate bus bar (through edge connector pin 24), to the feedback resistor divider on pin 6. Resistor R60 provides a low ohmic sense line connection from the regulator to the positive 6V on the crate interface board and provides feedback when the crate is disconnected.

Foldback current limiting is used to protect the positive 6 volt regulator circuitry from overloads. Voltage divider R62, R56 (current limit adjustment potentiometer), and R65 provide a voltage bias on the base of Q17. When the voltage across the +6 current limit resistor R1 (located on the crate interface board) increases to where the emitter of Q17 becomes more negative, then the base, Q17 turns ON, shunting the output of U4. This increase in current demand causes U4 to current limit and decrease its output voltage. This condition remains until the overload is removed.

Potentiometer R56 is factory adjusted and SHOULD NOT BE TURNED unless test equipment is available to properly readjust the maximum current foldback point. The same is true for R39 and R34 on the +24V and +12V regulators.

A crowbar is used to prevent excessive voltage on the crate Dataway. The positive 6 volt crowbar functions in the following manner. Diode D4 provides a reference voltage for the voltage comparator comprised of Q14 and Q15. As the output voltage increases, the voltage at the center of divider R49 and R50 increases, causing the emitter of Q14 to rise

proportionately. As the emitter of Q15 rises above the reference voltage, Q15 turns ON causing the emitter of emitter follower Q12 to rise. This positive voltage, routed through edge connector pin 22, causes SCR1 to conduct, which causes regulator U4 to current limit and thereby lower its output voltage.

On each regulator card (R500 and R501), the 12 volt pass transistor's source voltage is from the regulated 24 volt output, therefore a current sharing arrangement exists between the two voltages. Further, when the 24-volt regulator decreases its voltage because of an over-current or over-voltage condition, it reflects into the 12 volt regulator, giving the appearance the 12 volt regulator is also faulty. This shut-down ability is utilized in the 12 volt crowbar circuit. The 12V output (through a 8.2V zener) is applied to the 24V SCR voltage comparator. At approximately 15V, the SCR is turned ON, causing the 24V regulator to current limit, lowering both the 24- and 12-volt outputs.

CONNECTOR DESIGNATIONS

The following table, in conjunction with Figure 15, is provided to clarify the interconnection of subassembly units.

<u>Connector</u>	<u>Contacts</u>	<u>Purpose</u>
P1/S1	3	AC power source
P2/S2	2	Power input for transformer
P3/S3	9	AC power control
P4/S4	4	High temperature warning and thermal cutout
P5/S5	2	AC to pass transistor fan
P6/S6	2	Boost voltage to regulators
P7/S7	2	AC voltage to + and -24V bridge
P8/S8	20	Input to metering
P9/S9	16	Current sense and SCR drive
P10/S10	16	Dataway sense to regulator assembly
P11/S11	20	Pass transistor drive
P12/S12	2	+ and -12V to regulator assembly
P13/S13	30	Positive regulator card connector
P14/S14	30	Negative regulator card connector
P15/S15	32	Power supply ventilation unit interconnect
P16/S16	20	Meter card connection
P17/S17	10	Test point and meter connection
P18/S18	10	Regulated voltage to crate interface
PG 26 & 27	50	Crate Dataway connection

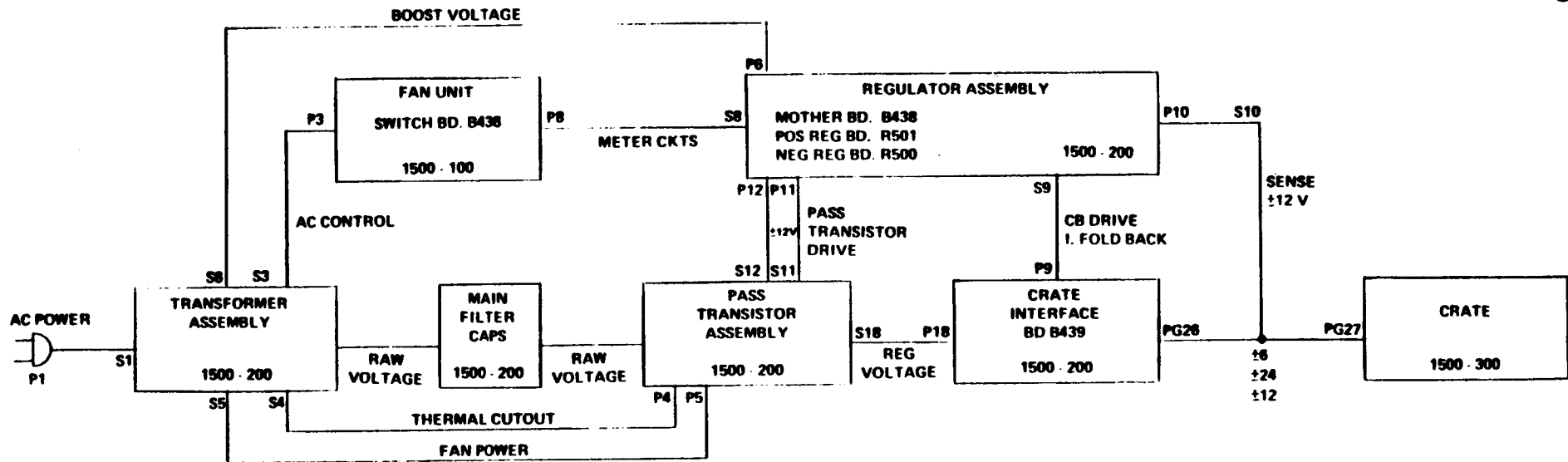


Figure 15 - Power Supply Block Diagram

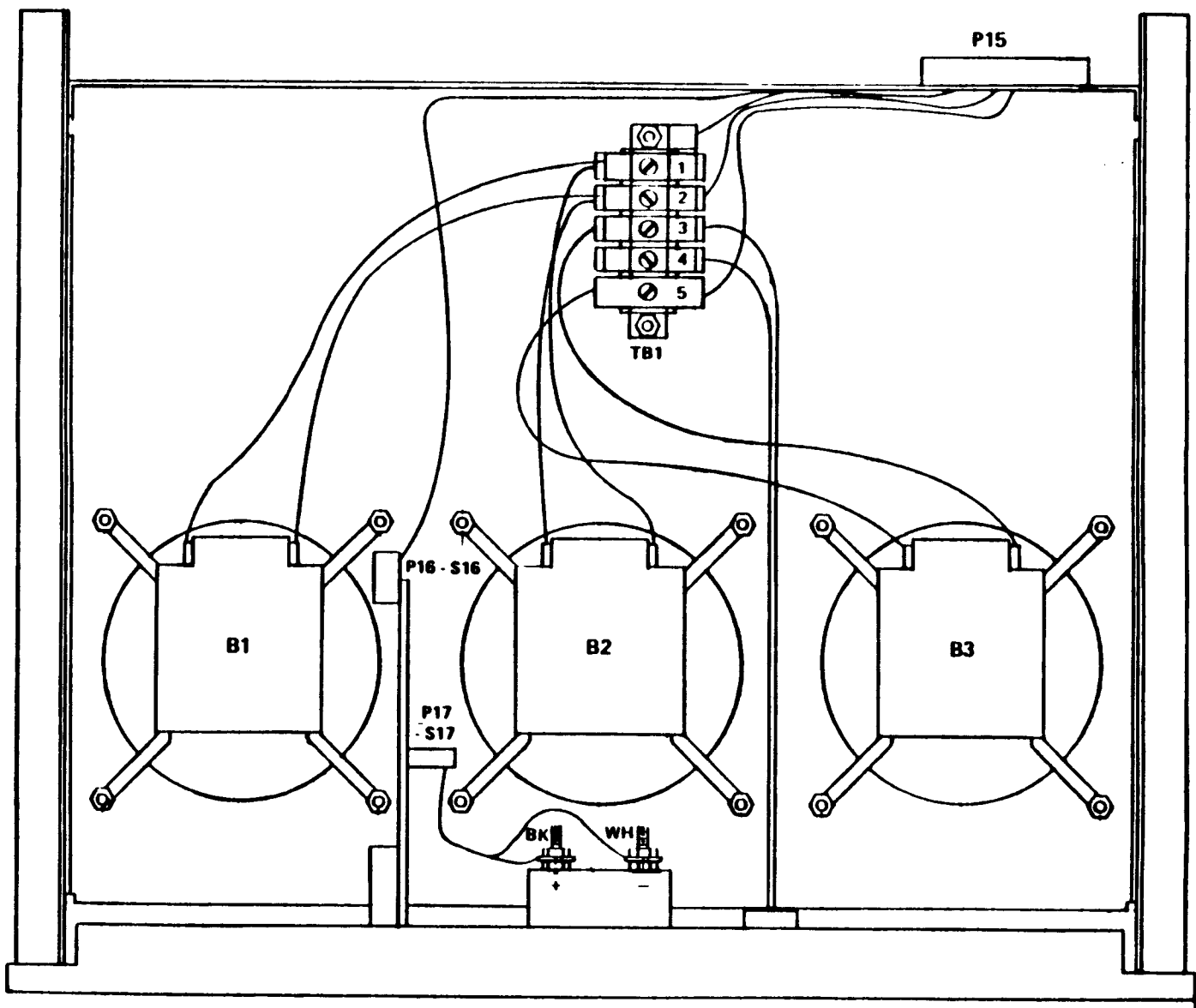


Figure 16 - Ventilation Unit, Bottom View

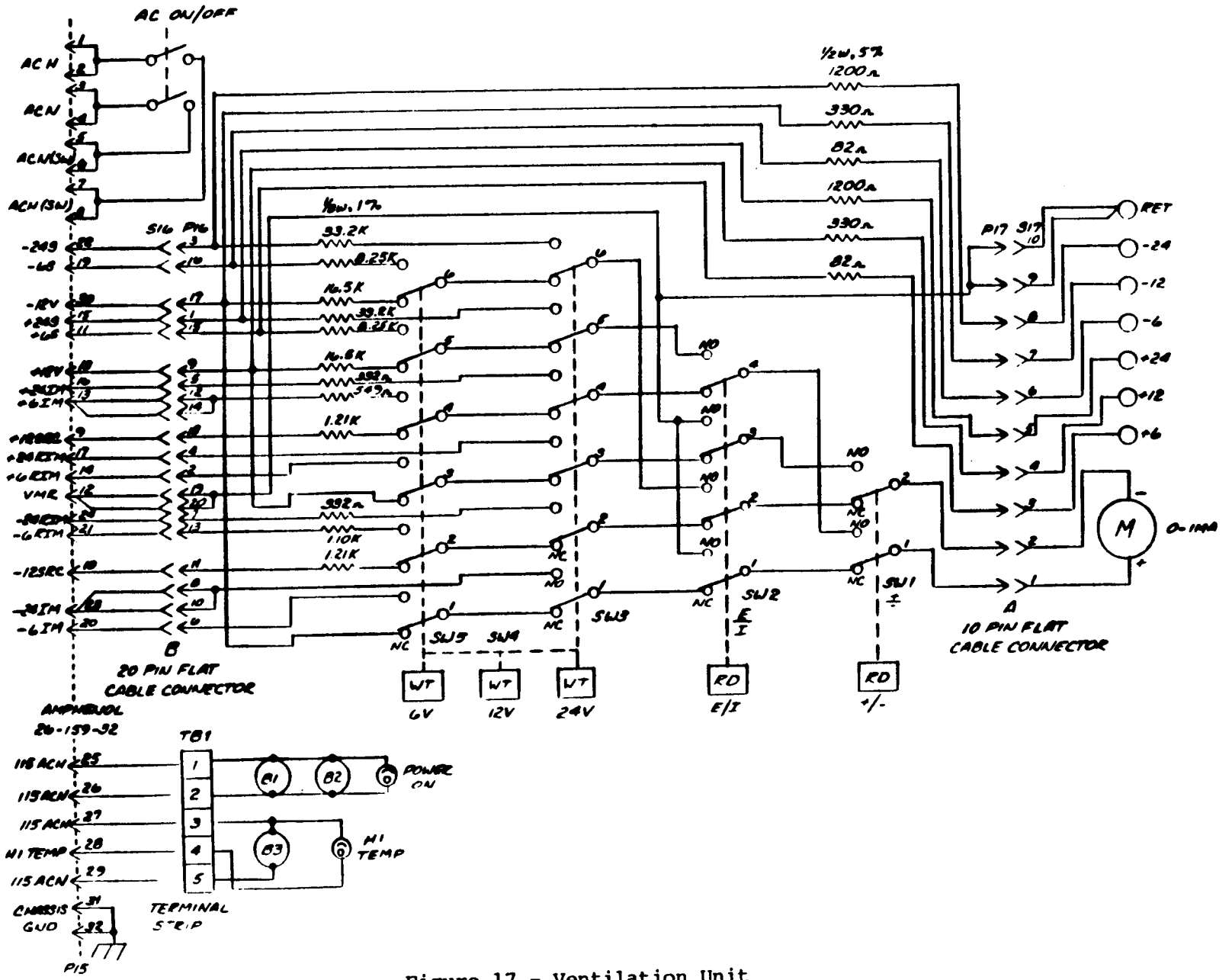
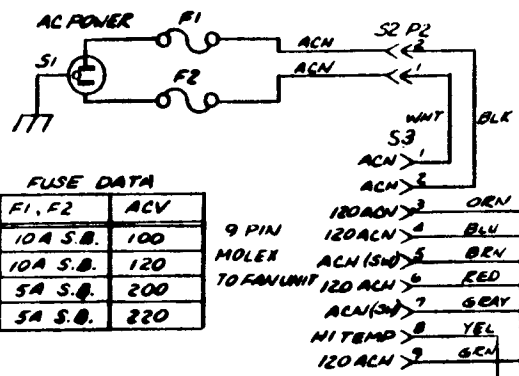


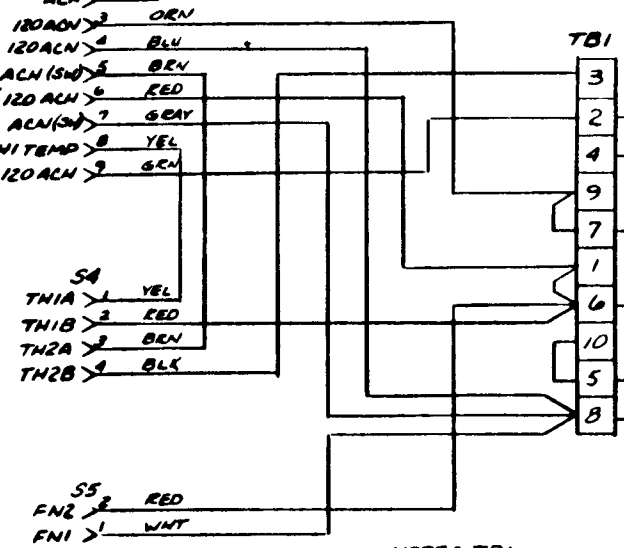
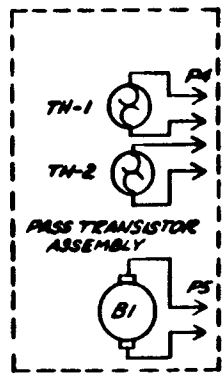
Figure 17 - Ventilation Unit



FUSE DATA

F1, F2	ACV
10A S.B.	100
10A S.B.	120
5A S.B.	200
5A S.B.	220

9 PIN
MOLEX
TO FAN/WNT



NOTE: TBI
SHOWN WITHOUT
VOLTAGE SELECTION
JUMPERS

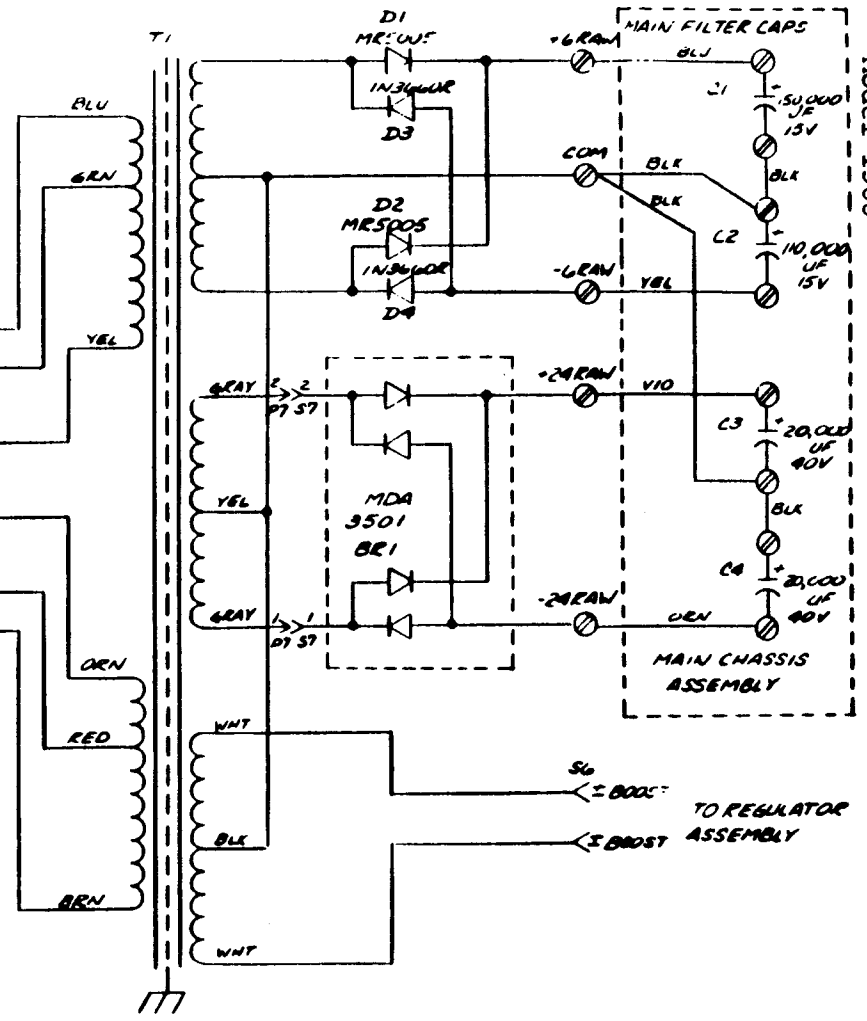
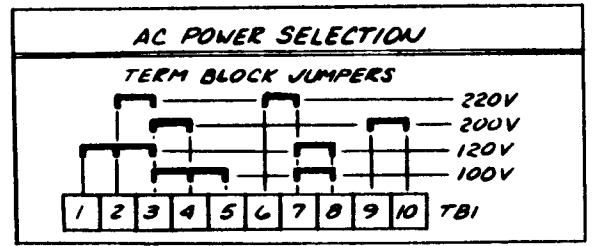


Figure 18 - Transformer Assembly

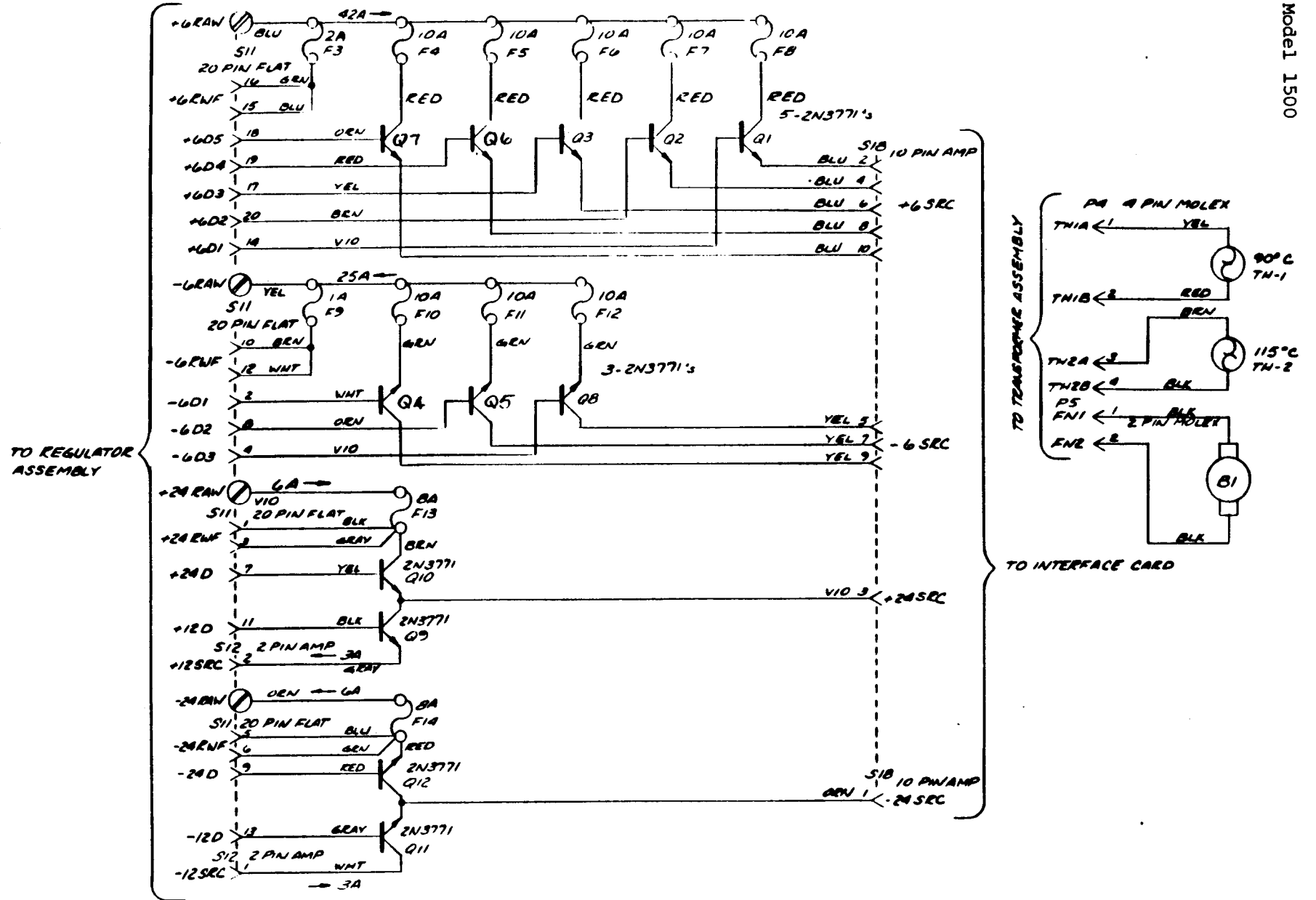


Figure 19 - Pass Transistor Assembly

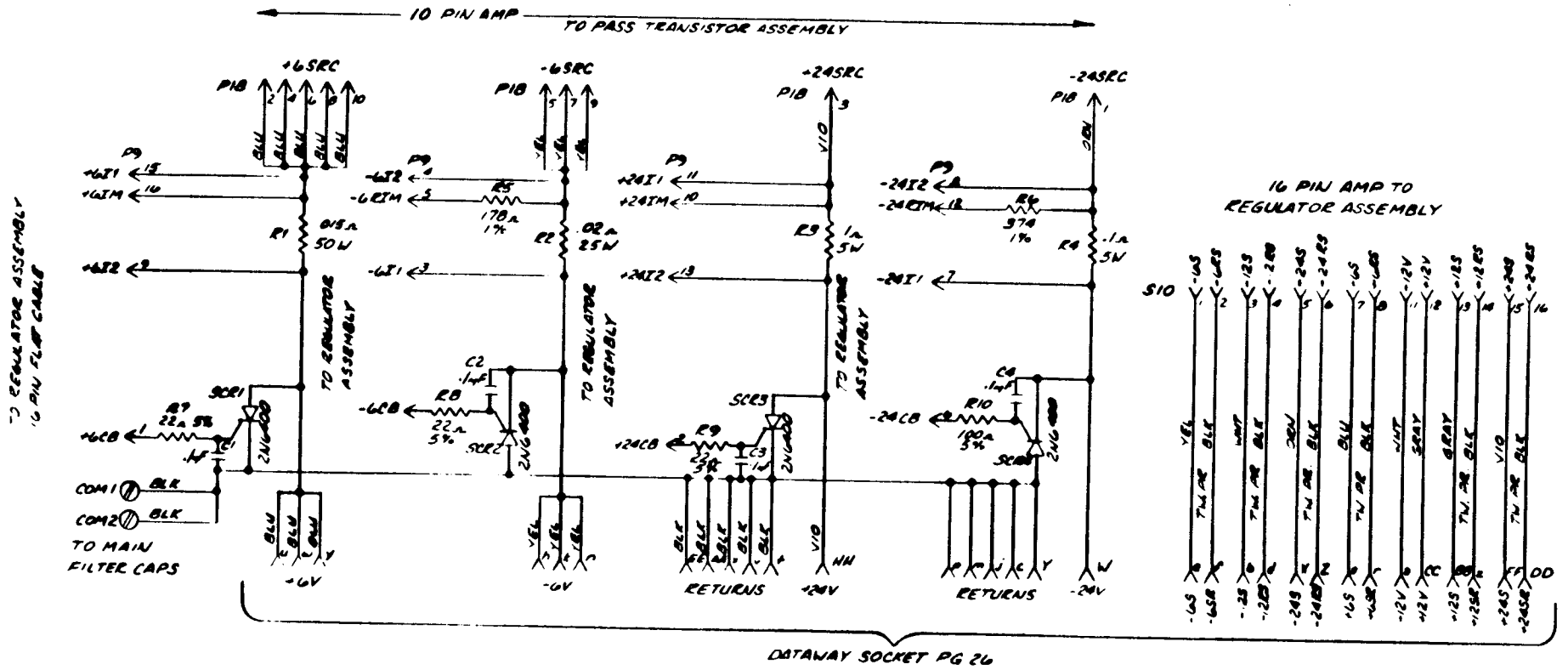


Figure 20 - Crate Interface Assembly - B439

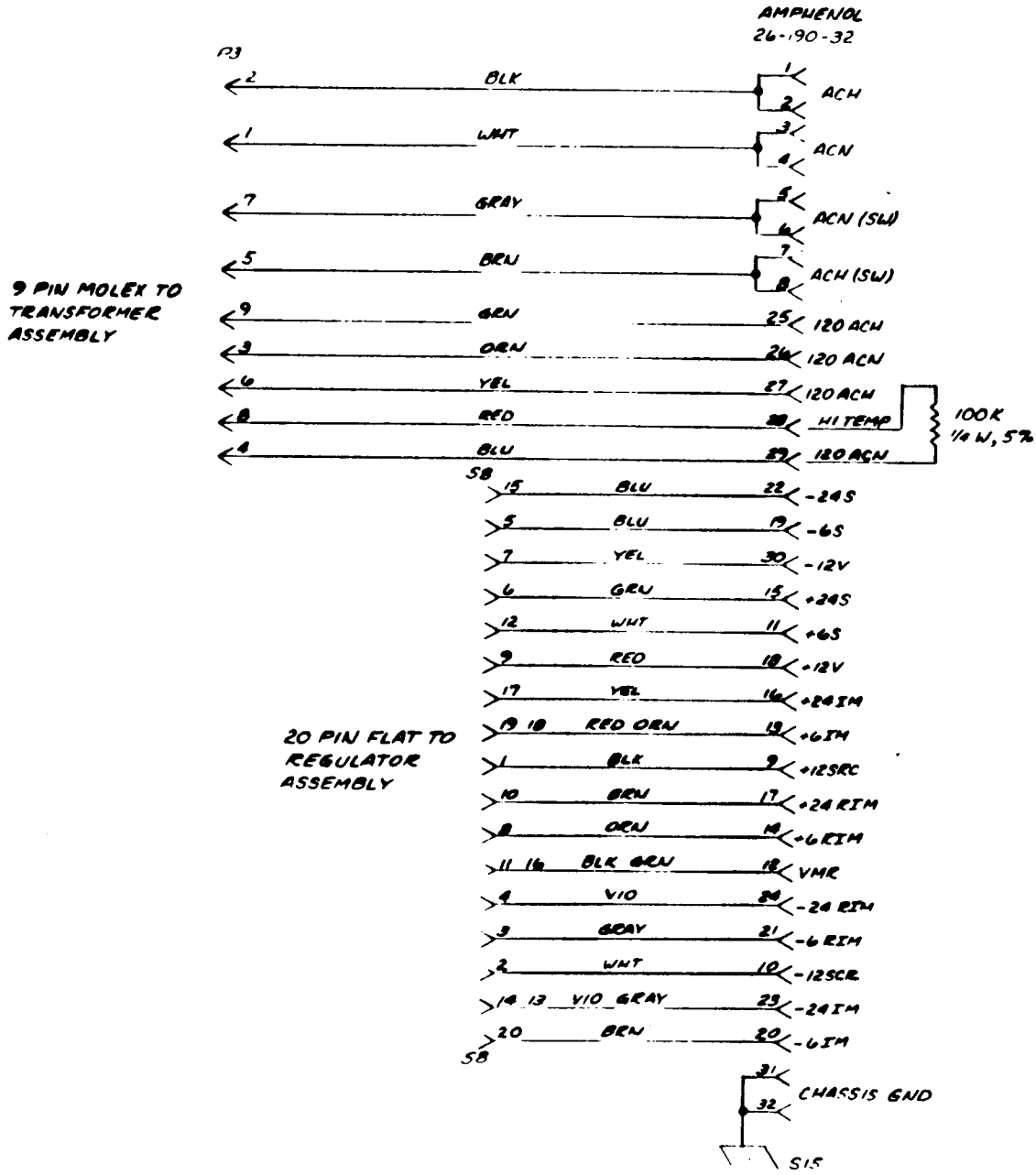


Figure 21 - Cable Assembly to Ventilation Unit

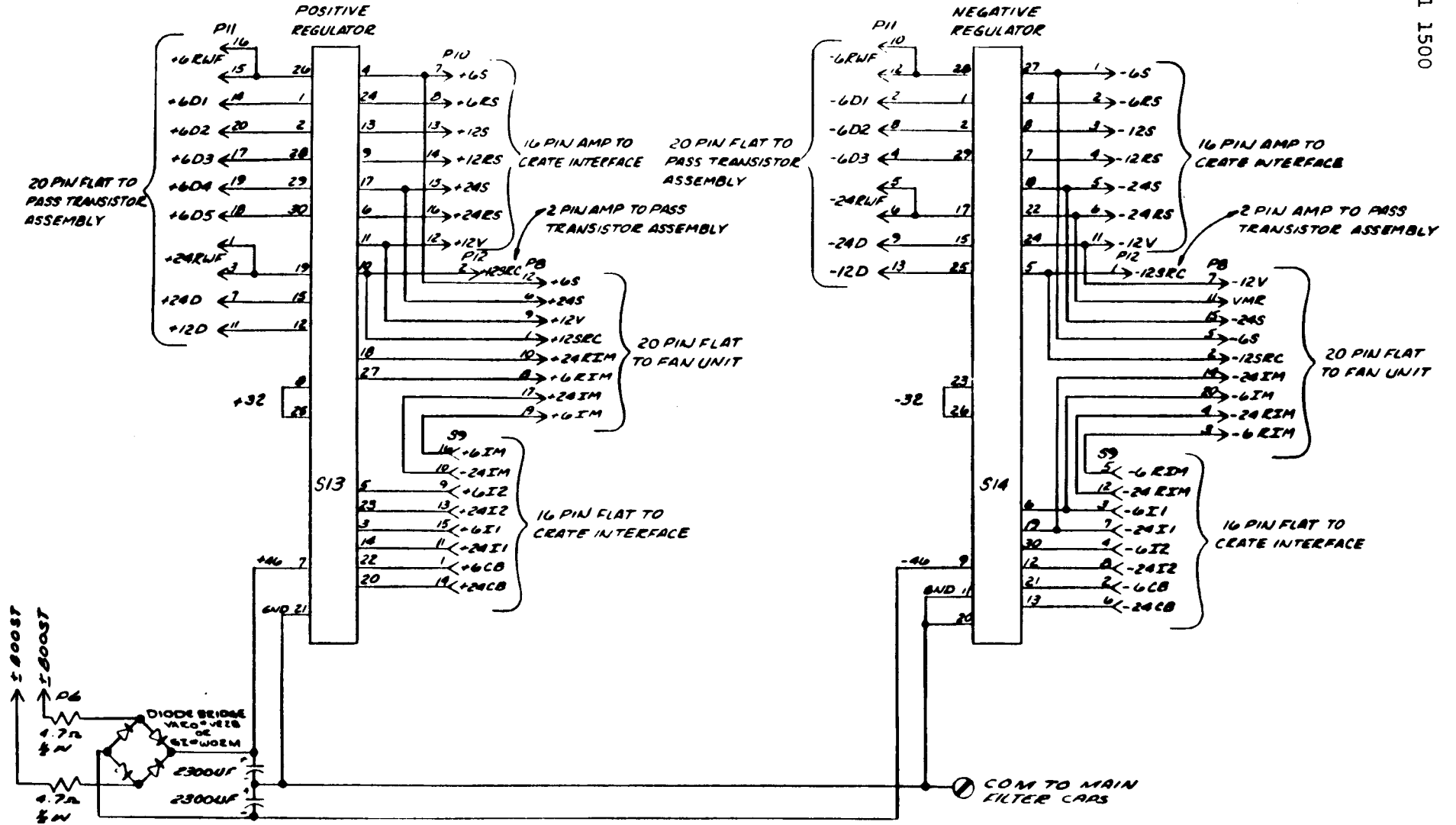


Figure 22 - Regulator Assembly Mother Board B438

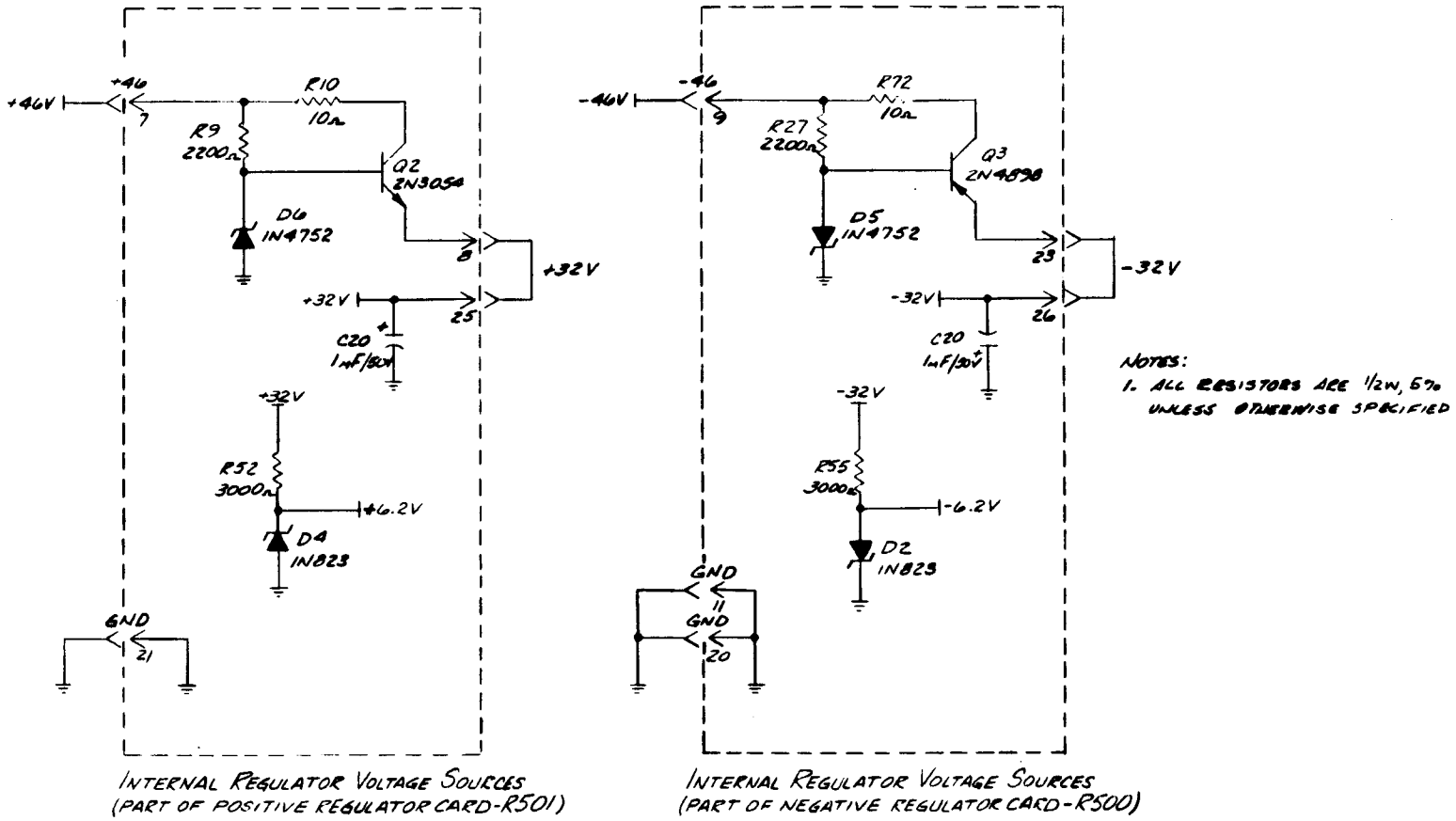


Figure 23 - Internal Regulator Voltage Sources

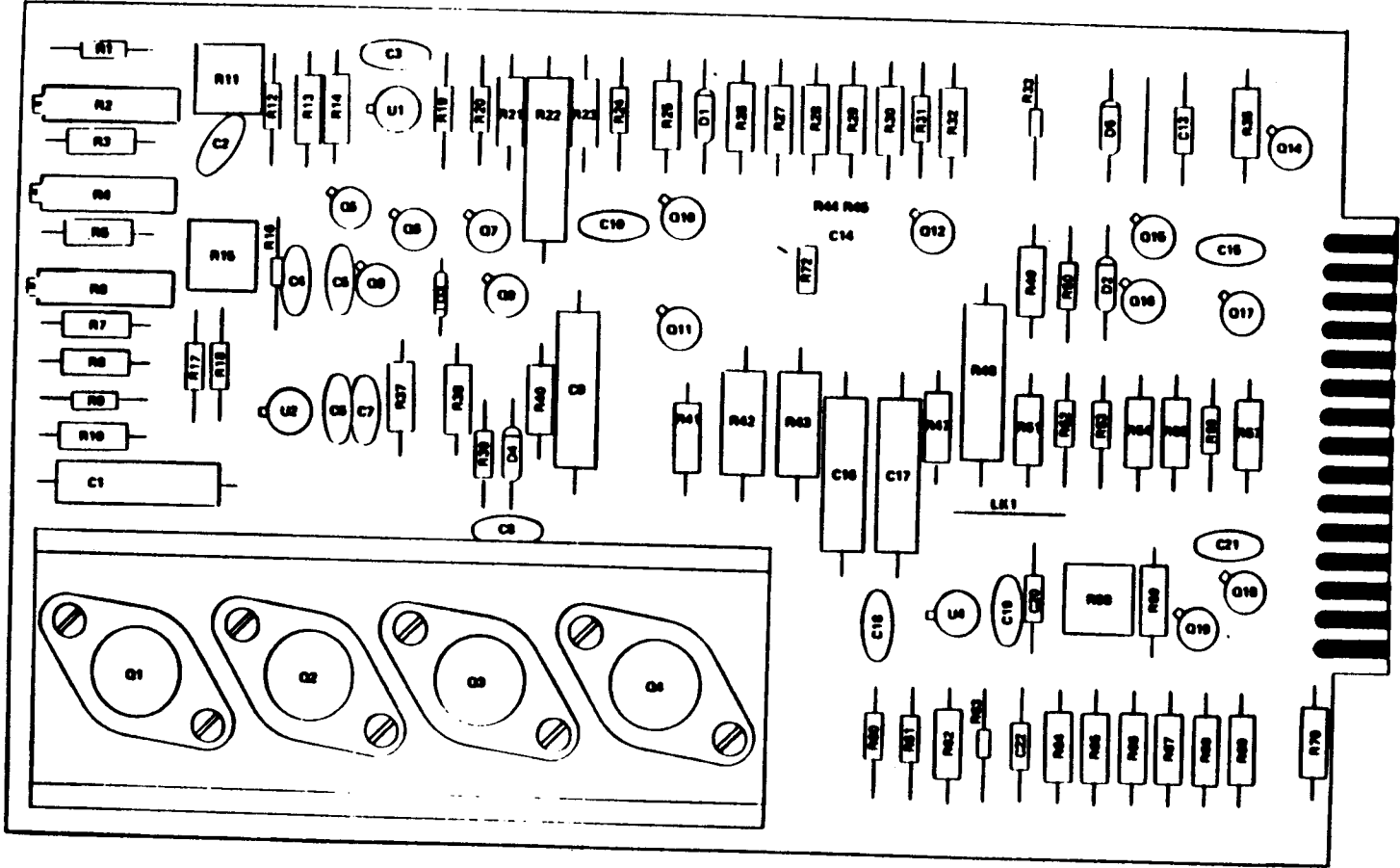


Figure 24 - Negative Regulator Board, R500

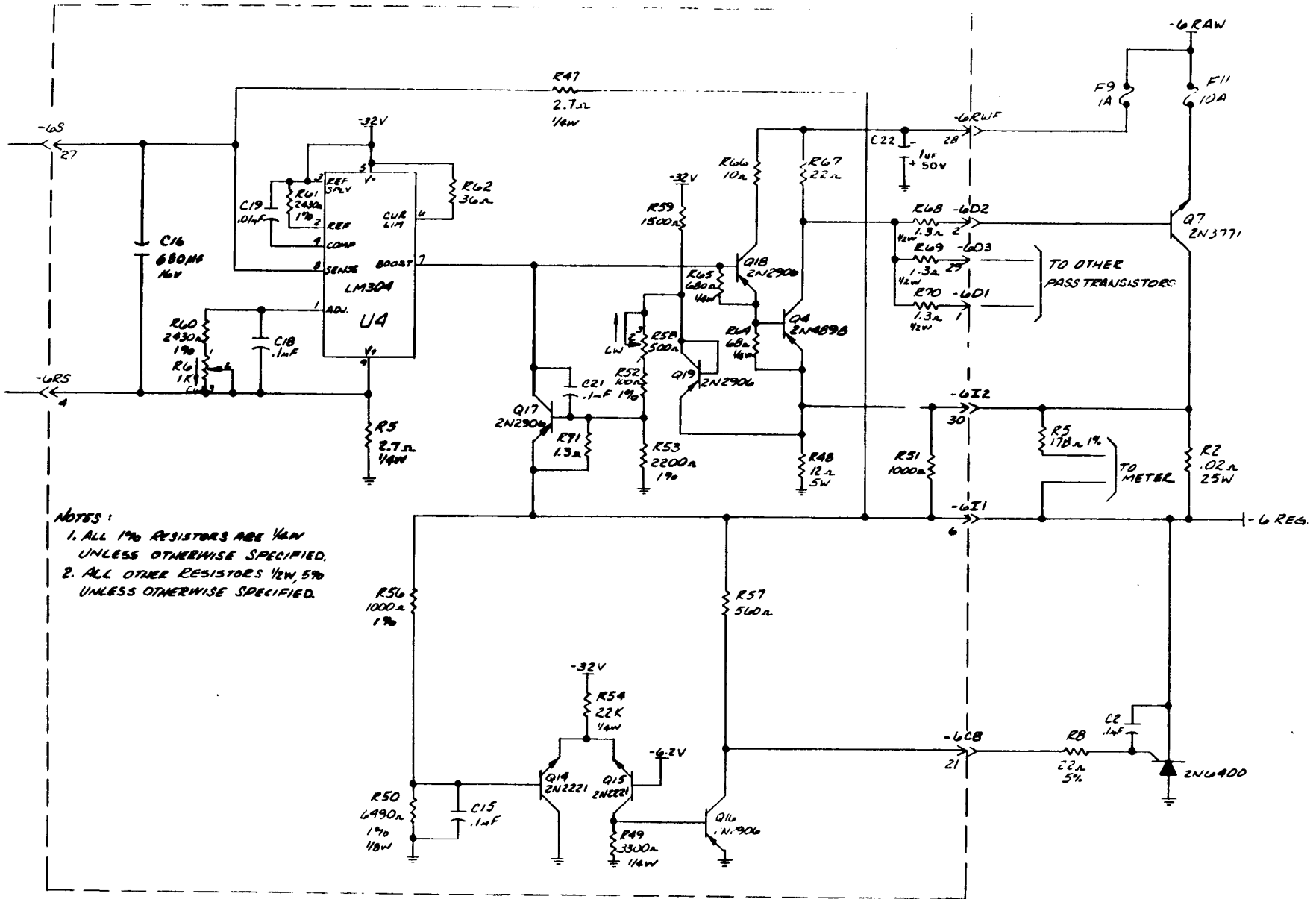


Figure 25 - Negative 6-volt Regulator (Part of Negative Regulator Card R500)

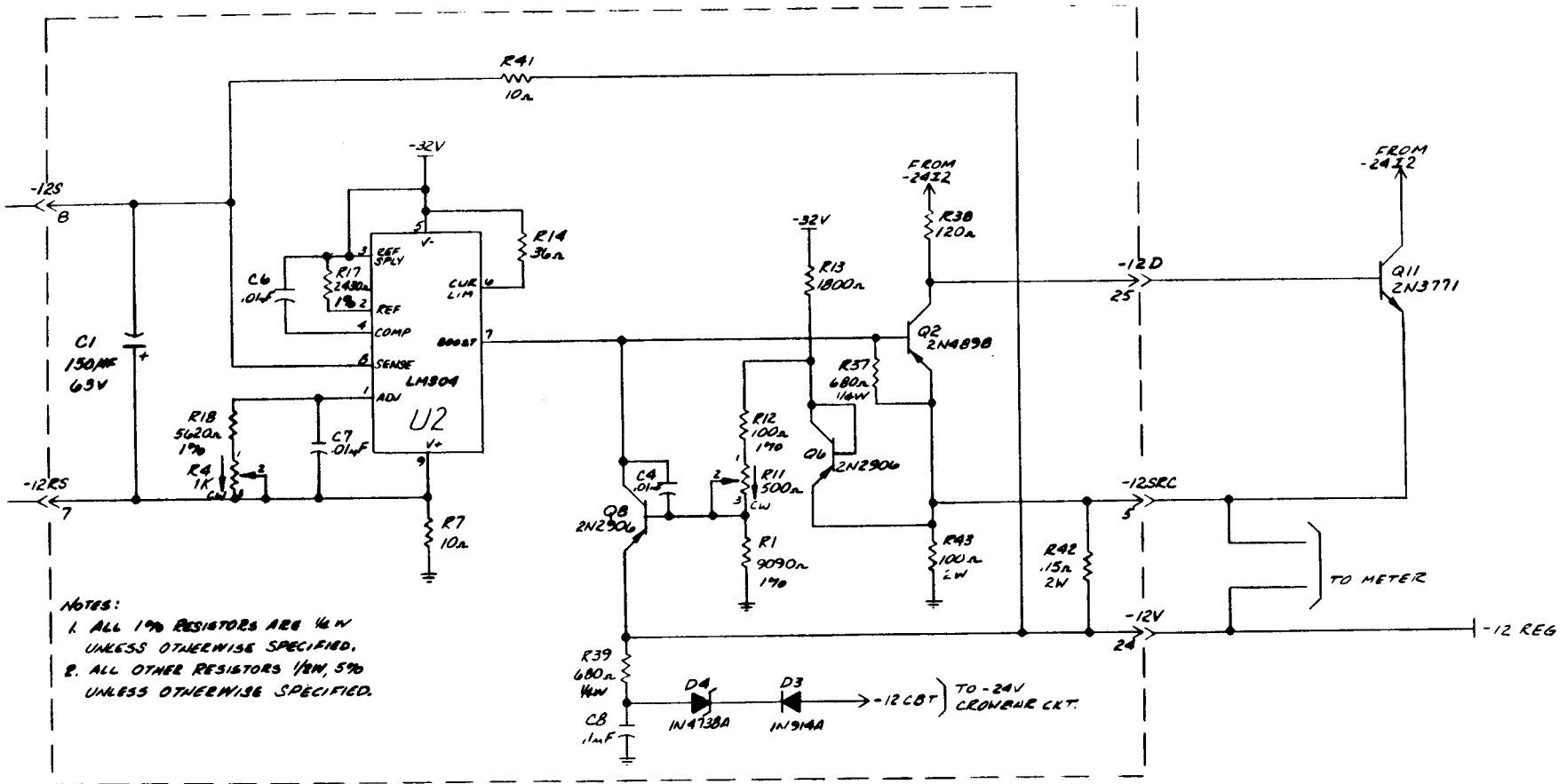


Figure 26 - Negative 12-volt Regulator (Part of Negative Regulator Card R500)

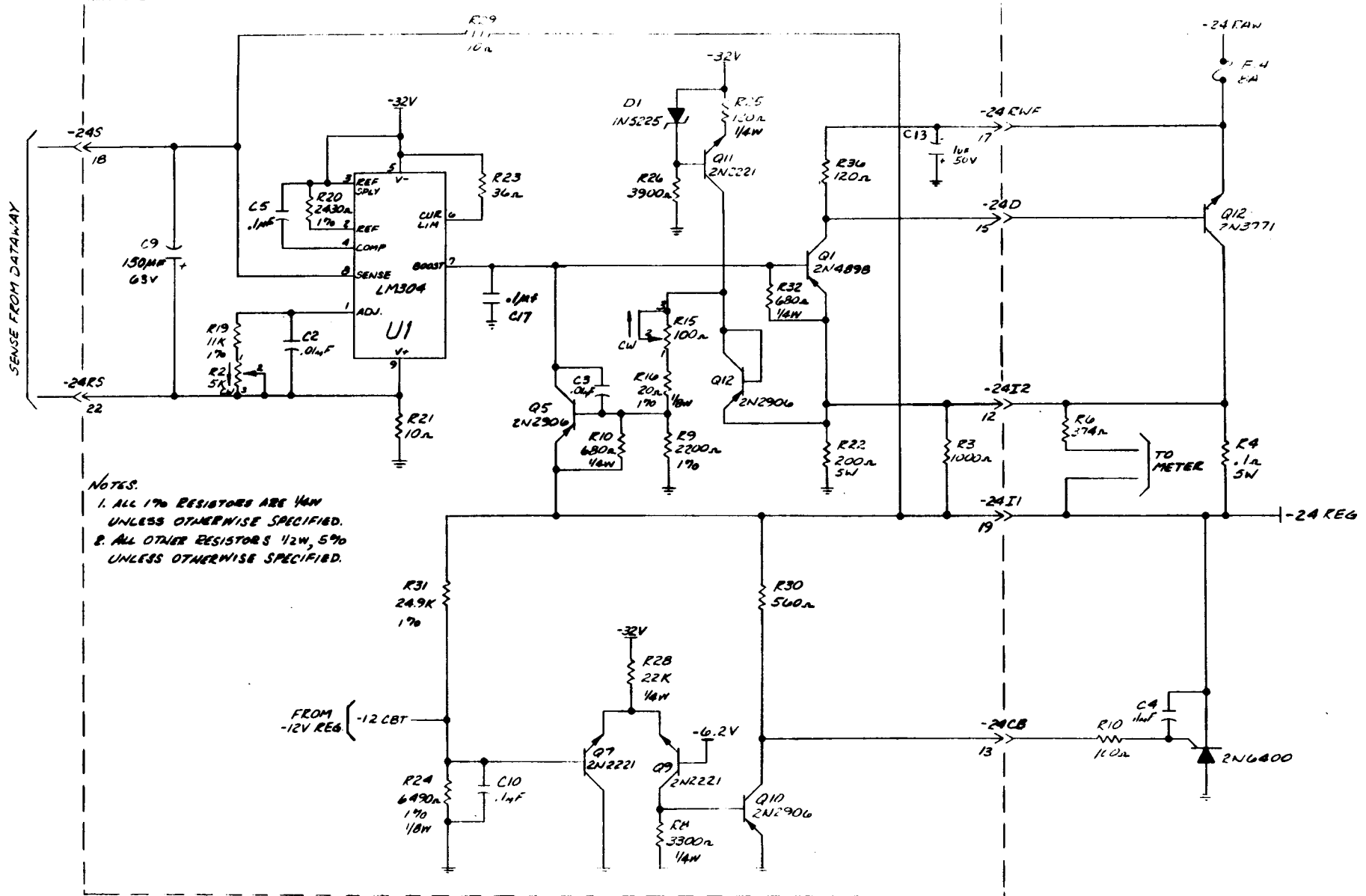


Figure 27 - Negative 24-volt Regulator (Part of Negative Regulator R500)

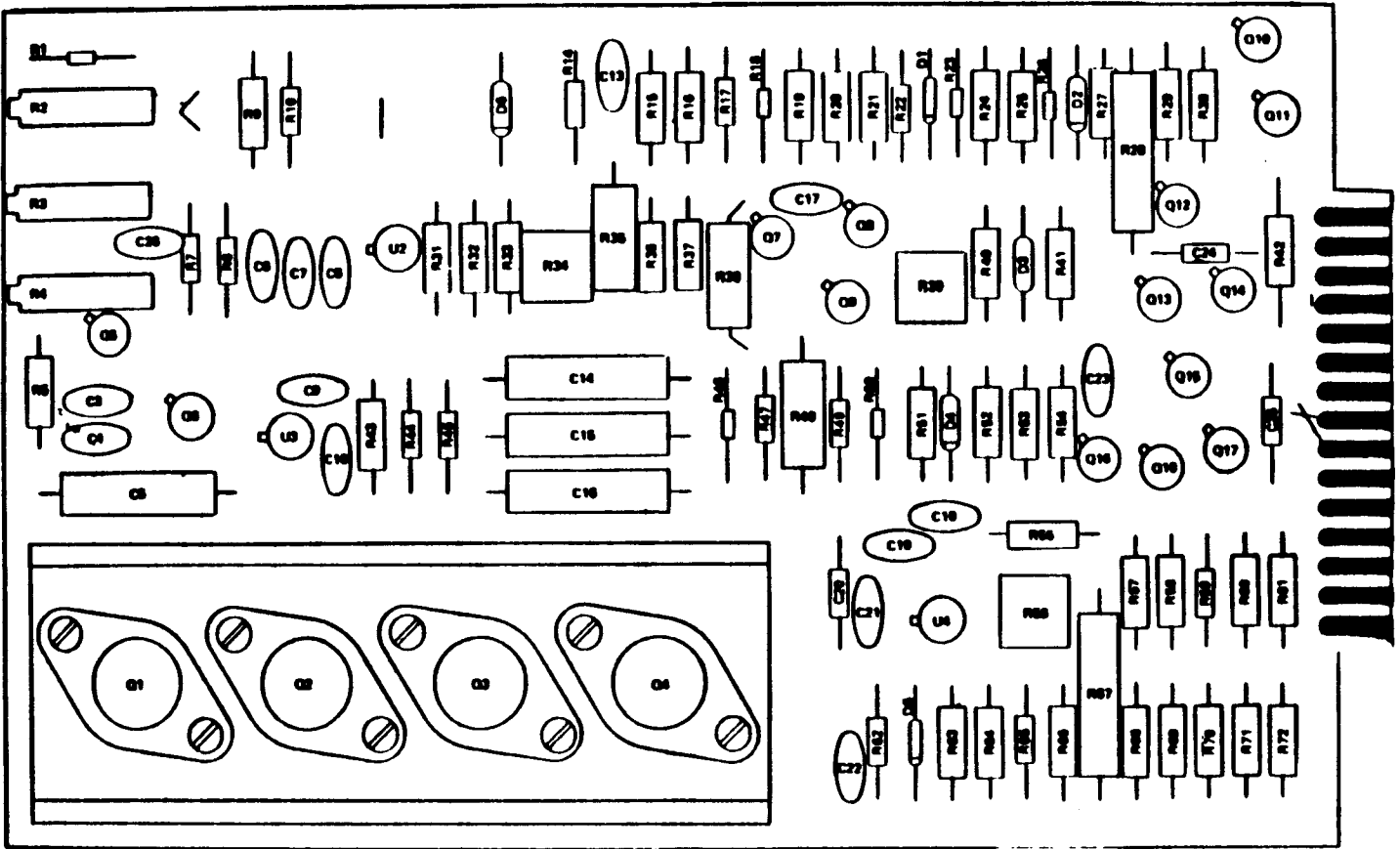


Figure 28 - Positive Regulator Board R501

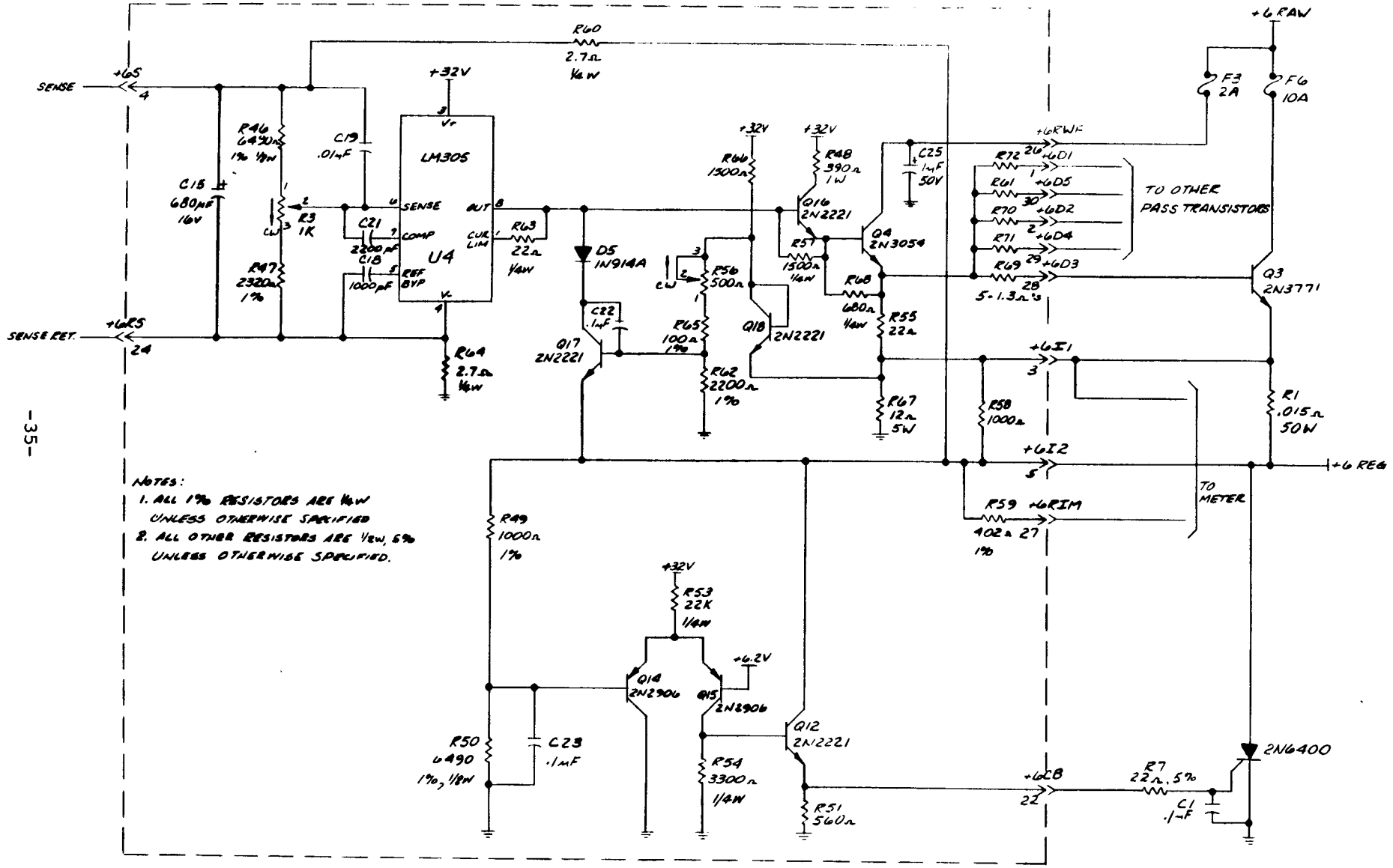


Figure 29 - Positive 6-volt Regulator (Part of Positive Regulator Card R501)

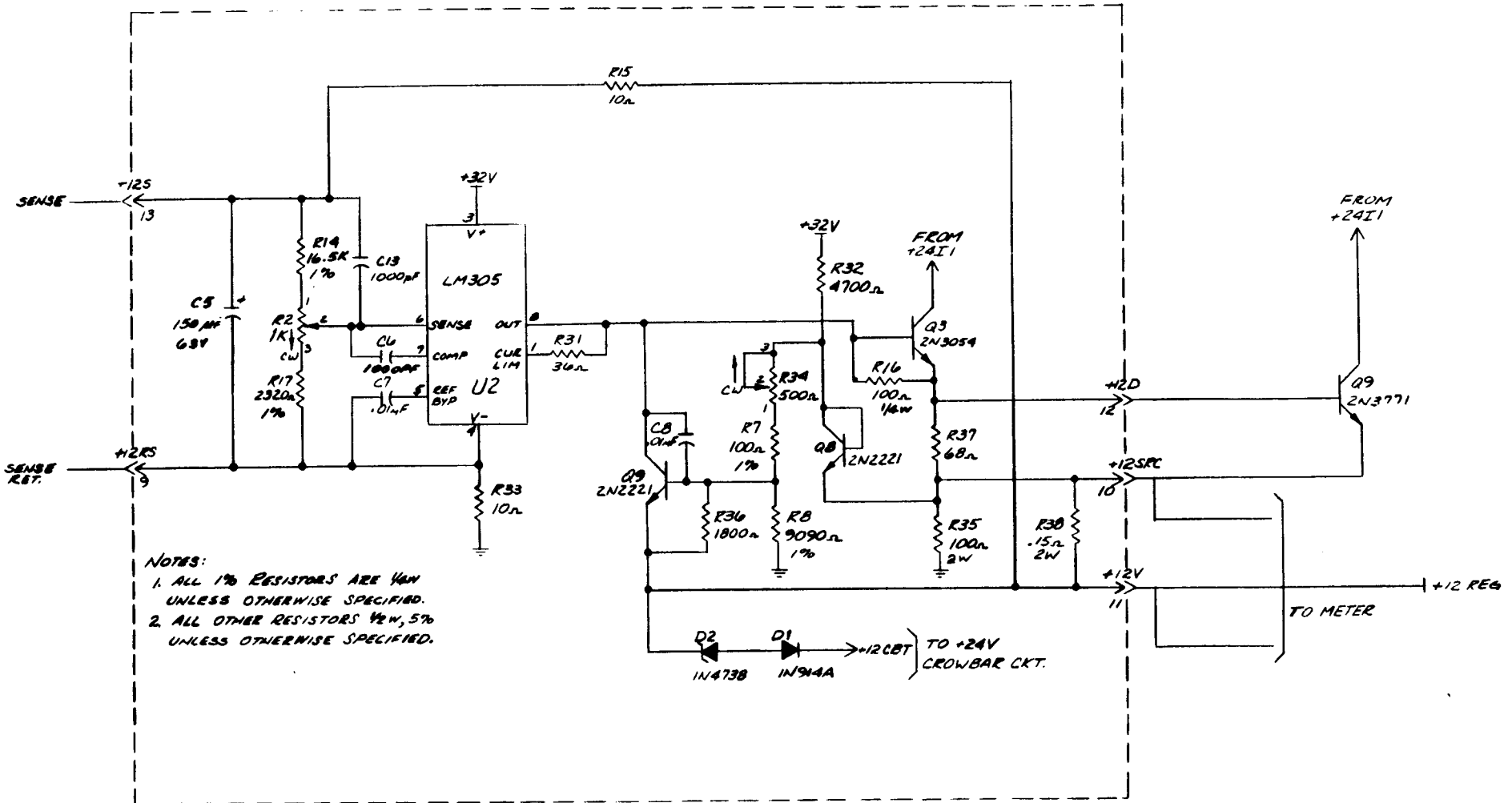


Figure 30 - Positive 12-volt Regulator (Part of Positive Regulator Card R501)

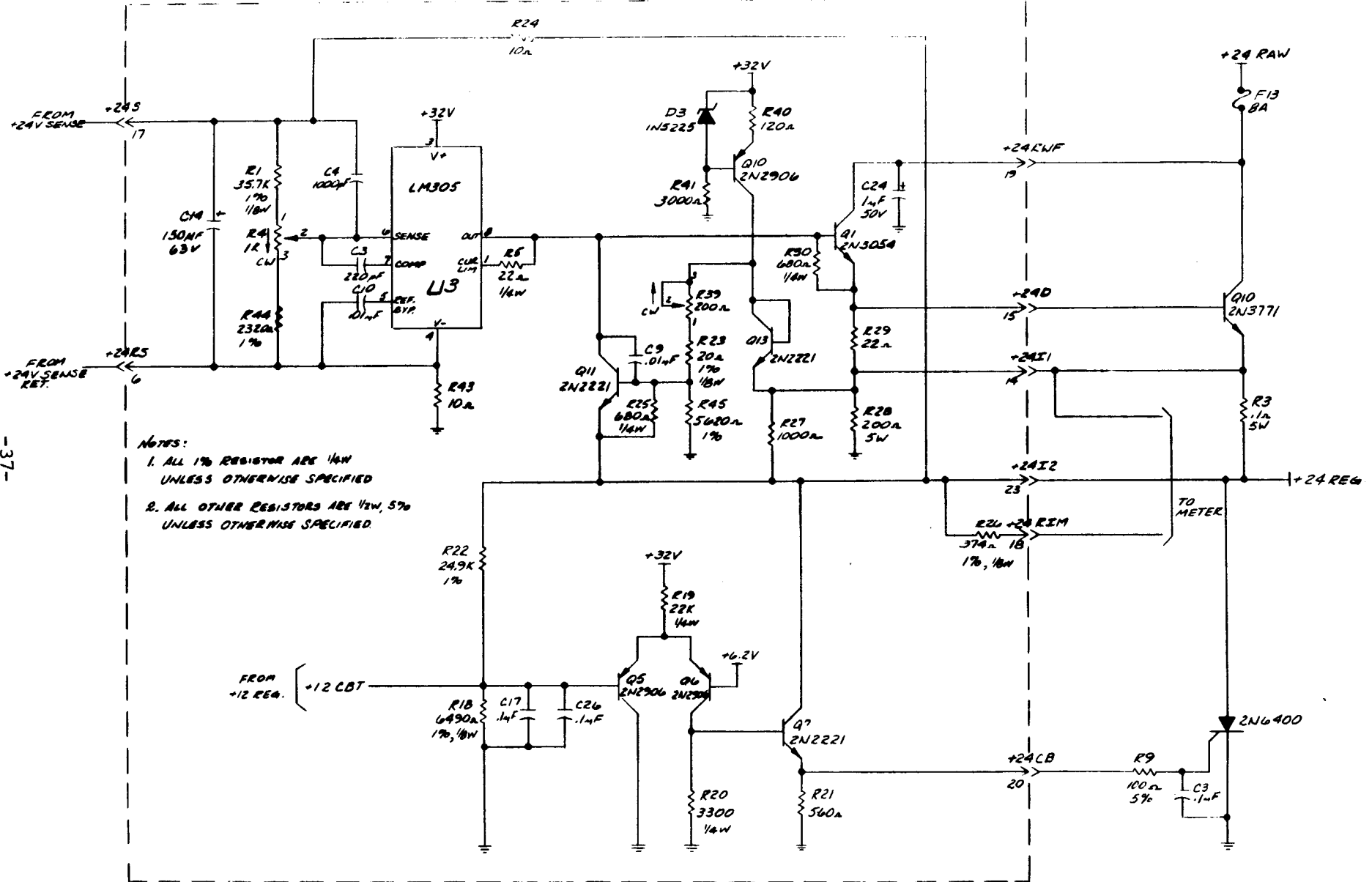


Figure 31 - Positive 24-volt Regulator (Part of Positive Regulator Card R501)

Model 1500

CAMAC SPECIFICATIONS - TYPICAL POWERED CRATE

This powered CAMAC crate meets or exceeds the specifications for a typical crate, power supply and ventilation unit, found in Appendix D of IEEE Standard 583-1975. The Model 1500 includes the following features not found on this specification:

1. The +6 volt output is rated at 42 amperes with the +6 volt -6 volt current shared to 42 amperes. The -6 volt is still rated at 25 amperes maximum.
2. The power supply and ventilation unit are separate to provide for easy installation and maintenance.

Typical Crate Mounted Power Supply and Ventilation Unit With Crate/Power Supply Interface Housing

D1. General

The power supply described herein is suitable for use with the Standard Modular Instrumentation and Digital Interface System (CAMAC).

This description is written in the form of a specification for the convenience of those who wish to use it for that purpose.

Due to the high operational reliability required, only the highest quality components should be employed. All semiconductor components shall be silicon and shall be encapsulated in metal or ceramic, hermetically sealed, cases. Components shall not be used beyond their design ratings. The supply shall be designed with a life expectancy of at least 5 yr. See Fig D1 for block diagram. Wiring to the right of PG-26 is not considered part of the power supply.

D2. Input

For 120 V nominal voltage, the input voltage range shall be 103 to 129 volts. For other nominal voltages the input voltage range shall be the nominal + 10 percent to - 12 percent.

Line frequency range shall be the nominal (60 Hz in the U.S.) ± 3 Hz.

D3. Output

The supply is to provide four dc outputs with at least the following current ratings:

<u>Voltage Volts</u>	<u>Current Amperes</u>
+ 6.00	0-25
- 6.00	0-25
+24.00	0-6
-24.00	0-6

The four outputs shall be simultaneously available, but the currents may be limited to a minimum total output power of 294 W. The ± 6.0 V supplies shall operate on a current sharing basis, such that the total combined current outputs may be limited to 25 A. Likewise, the ± 24 V supplies shall be current shared and may be limited to a total combined current output of 6 A. Rated output current shall also be available to loads connected between the positive outputs and the negative outputs.

If the output power demanded should exceed a safe operating value, the supply shall protect itself.

Remote sensing shall be utilized on all outputs of this power supply. Remote sense points can be expected to be within 305 mm of the crate connector, PG-27. All wiring shall be in accordance with Fig D1.

D4. Regulation and Stability

(1) During a 24 h period the ± 6.0 V outputs shall vary by not more than ± 0.5 percent due to changes of input voltage and output current within the specified ranges.

(2) During a 24 h period the ± 24 V outputs shall vary by not more than ± 0.2 percent due to changes of input voltage and output current within the specified ranges.

(3) The long-term stability shall be such that, after a 24 h warmup, over a six month period for constant load, line, and ambient temperature conditions, the ± 6.0 V output shall drift not more than ± 0.5 percent; the ± 24 V outputs shall drift not more than ± 0.3 percent. (See Figs D3 and D4)

D5. Noise and Ripple

Noise and ripple, as measured on an oscilloscope of dc to 50 MHz bandwidth, shall not exceed 15 mV peak-to-peak.

D6. Temperature and Temperature Coefficient

The ambient temperature range is from 0°C to 50°C without derating. Ambient temperature as used throughout this specification shall be taken at a location that is not affected by the temperature of the power supply.

The output voltage coefficients for changes in ambient temperatures between 0°C and 50°C shall not exceed 0.02 percent per °C.

D7. Voltage Adjustment

The output voltage shall be adjustable over a nominal range of at least ± 2 percent by means of screwdriver adjustments accessible through the rear or top of the supply. The maximum error in resetting each output voltage shall be ± 0.5 percent.

D8. Recovery Time and Turn-on— Turn-off Transients

The outputs shall recover to within ± 0.2 percent of their steady state values within 1 ms for any change within the specified input voltage and for a 50 percent rated load current change. The peak output excursions during 1 ms shall not exceed ± 5 percent of rated voltage for such line or load changes and shall be proportionately less for smaller changes.

Response to input voltage changes or to ± 5 percent bus line voltage changes shall be non-oscillatory.

From turn-on the power supply output shall stabilize to within ± 1 percent of its final value within 1 min for constant line, load, and ambient temperature. The turn-on and turn-off transients shall not exceed 20 percent of the nominal voltage.

D9. Magnetic Field Effects

A magnetic field of 50 G in any direction shall not cause performance characteristic variations of more than ± 0.5 percent.

D10. Power Transformers

The power transformers shall be constructed with an electrostatic shield which is connected to the core.

D11. Terminals

All wiring shall be as shown in Fig D1.

(1) When designed for use with 117 V ac mains, a three-wire power cord of approximately 1.5 m in length shall be included. It shall have a NEMA Cap, 5-15P. The power cord may be permanently attached to the power supply, or alternatively, may terminate in a NEMA Connector Body 5-15R, mating with a NEMA Inlet 5-15P on the power supply.

(2) The dc output power shall be supplied via a connector (PG-26) as designated in Fig D1, or mating equivalent. Wire size, socket types, and pin assignments are specified in Fig D1.

D12. Protection

(1) The input of the supply shall be protected with a fuse of adequate rating in each side of the line. The fuses shall be readily accessible.

(2) The output of the supply shall be short-circuit protected by means of an electronic circuit. The current limiting threshold shall be set at least 0.2 A above the specified maximum output currents. The output voltage shall be resumed after the short has been removed. A continuous short circuit shall not damage the supply or blow a fuse.

(3) The output shall be protected by limiting circuits so that under no conditions will the ± 24 V outputs exceed 34 V or the ± 6.0 V outputs exceed 7.5 V. Operation of the overvoltage protection shall not damage the power supply.

(4) In no case shall a failure of any supply cause an increase in voltage of any other supply by more than 20 percent.

(5) The power supply shall not damage itself, and the conditions of D12(3) shall apply if the power supply is turned on with any or all pins of PG-26 disconnected.

(6) Thermal protection circuits shall be provided to disable the supply when the temperature exceeds a safe operating value.

The maximum safe operating temperature, as measured at the thermal switch, shall be specified on the schematic circuit diagram.

D13. Crate Ventilation

This power supply shall include fans and mechanical assembly to provide forced air ventilation of a CAMAC crate. Air flow of at least 12 ft³/min shall be directed into each of four equal crate sections extending from front to back. The air flow impedance of densely packed CAMAC modules in all twenty-five stations shall be considered in determining the minimum air flow rate.

Air shall be drawn from directly in front of the rack in which the assembly is mounted. Air filters, allowing a visual inspection from the front, shall be included. The air shall be channeled in such a way that it does not experience an appreciable temperature rise due to the heat of the power supply. The unit shall include a POWER ON-OFF switch. The switching shall be such that the fans must operate whenever the power supply is operating.

D14. Mounting

The supply shall be constructed for rack mounting immediately below a CAMAC crate in such a fashion that the ventilation requirements of this specification are achieved.

(1) Fig D2 specifies several outline dimensions and component locations to which the unit must adhere.

(2) Interface housing units (see Fig D5) mechanically adapt CAMAC crates from various sources to this power supply. They also house and protect PG-27, power busing, and the dataway connectors.

An interface housing unit is not a part of this specification. The power supply shall, however, be provided with four #10-32 captive screws in the positions shown in Fig D2 as a means of securing to an interface housing unit.

(3) The panel height of the supply is not specified. Panel height is at a premium in rack space. Trade offs between panel height and power supply costs should be optimized.

D15. Monitoring

(1) Front panel metering shall be provided to monitor the four dc voltages and their current loads. The metering shall be accurate to ± 2.5 percent full scale.

The meter scales shall be calibrated with full scales of 120-135 per cent of nominal voltage and rated current values and shall have labeled markers at nominal voltage values and at rated current values.

(2) A front panel neon lamp (or suitable solid state indicator) wired as shown in Fig D1 shall be provided to indicate the ac power on condition.

(3) A front panel thermal warning light, wired as shown in Fig D1, shall be provided. It shall light whenever the temperature within the supply exceeds a value 20°C below the maximum safe operating temperature.

D16. Mechanical Construction

(1) Insulating materials such as printed wiring boards shall be flame retardant.

(2) All components shall be accessible for testing and replacement.

(3) All integrated circuits shall be mounted in high-quality integrated circuit sockets.

(4) Markings: Major components such as solid state devices, transformers (including leads), large capacitors, controls, and terminals shall be marked in the most readable position in the unit with respect to their identification on the schematic diagram.

D17. Circuit Diagram

Two copies of the schematic circuit diagram, which include component values, shall be provided with each supply. All semiconductor components shall be designated by Electronic Industries Association numbers or in nomenclature commonly used by semiconductor manufacturers or shall be directly replaceable by the same. Where special types are used, the schematic diagram or instruction book shall recommend a semiconductor manufacturer's equivalent that will provide satisfactory performance.

D18. Finish

All front panel metal surfaces shall be finished with a baked-on enamel or with an equally hard, chip-resistant, material. All surfaces not seen from the front may be finished similarly, or may be finished with nickel plate, iridite or other material that will assure good electrical contact and that, where necessary, is passivated against atmospheric corrosion or against electrolysis when in contact with copper or with other common finishes.

Numerals 1-25, representing station numbers in a CAMAC crate, and to identify modules inserted into a crate which may be mounted immediately above the supply, shall be printed on the front panel near the top edge. They shall be in consecutive order from left to right as viewed from the front with the numeral 13 at the front panel centerline, and shall be positioned at 17.2 mm intervals. The numerals shall be at least 4 mm in height.

D19. Test Conditions

Crate wiring between PG-27 and the Dataway power bus shall be simulated by 305 mm of lead. Sense leads and test-load leads shall be attached at this distance from PG-27, and measurements to determine adherence to these specifications shall be made at this point. Users are alerted to the fact that, in practice, performance will depend upon the actual positions of sense points and the reactive nature of loads.

D20. Optional Feature—Status Bit

A Status Bit to indicate whether the power unit is functioning normally may be provided. This optional feature, when provided, shall be standardized as follows:

(1) The Status Bit source shall be a relay which provides contact closure when in the alarm condition; shorting the Status Bit line to the power-unit chassis. Under normal operating conditions, the Status Bit line shall be an open circuit in the power unit.

Contact rating shall be minimally 50 V, 500 mA.

(2) The Status Bit alarm condition shall indicate that any one of the following conditions exist:

- (a) Any one of the voltages supplied by the unit is outside of specified voltage range.
- (b) Any one or combination of supplies is being loaded beyond specified current range.
- (c) The thermal warning switch is in the alarm condition.

The Status Bit may indicate additional alarm conditions at the option of the manufacturer, but (a), (b), and (c) must minimally be included.

(3) In the power unit, the Status Bit shall be wired to contact K of PG-26 and to a front panel 50CM coaxial connector.

D21. Figures

Fig D1 interconnection block diagram.

Fig D2 outline dimensions and illustrated unit.

Fig D3 Time and voltage characteristics ± 6 V.

Fig D4 Time and voltage characteristics, ± 24 V

Fig D5 Interface housing unit

Fig D6 Typical Power buses and power return bus, feed and sense wiring (see note below).

NOTE: The information on Figs D5 and D6 indicate preferred practice for fabrication and assembly of CAMAC crate wiring and the interface housing unit. It is presented here because of the intimate relationship between these and the power supply and ventilation unit.

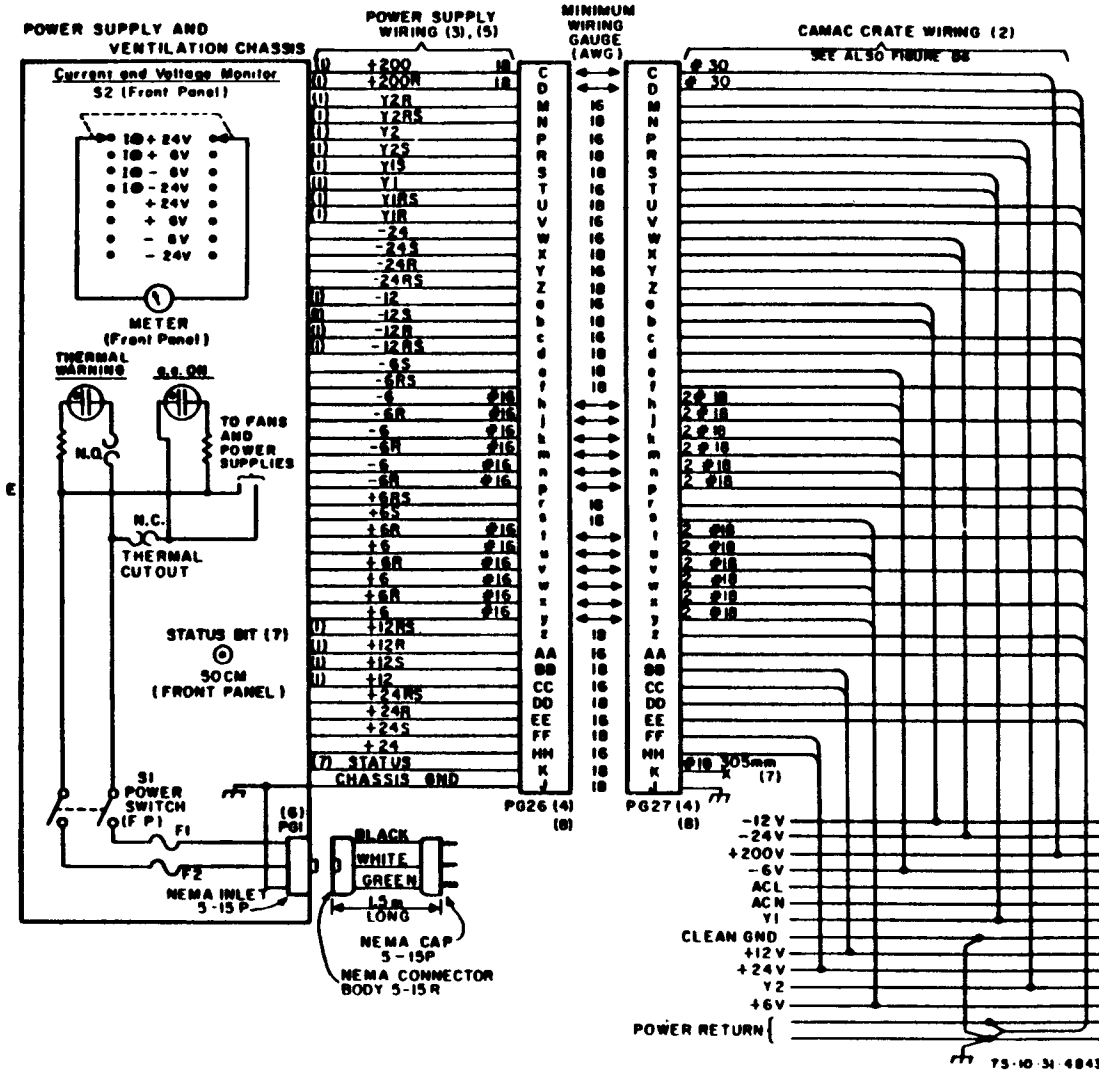


Fig D1
Interconnection Block Diagram

- NOTES:**
- (1) Optional voltages. Pins reserved for optional voltages not supplied by this unit. If wired, minimum wire gauges shown pertain.
 - (2) All pins wired as shown. PG27 and CAMAC crate wiring are not provided with this power supply.
 - (3) Sufficient length, positioning, and flexibility to mate with crate connector mounted as shown in Fig D2 (minimum length, 305 mm)
 - (4) PG-26—Fixed Member (crate connector) with socket contacts in accordance with Appendix C of IEEE Std 583.
 - PG-27—Free Member (power supply connector) with pin contacts in accordance with Appendix C of IEEE Std 583.
 - Other connectors fully mateable with these and with at least 13 A per contact rating may be used.
 - (5) 24 indicates 24 V line
24 R indicates 24 V return line
24 S indicates 24 V sense line
24 RS indicates 24 V return sense line and so forth for other voltages
 - (6) PG-1 optional
 - (7) Optional feature, Section T.
 - (8) Polarization of connectors PG-26 and PG-27 is to be provided by the use of two guide pins in the corner holes of one end and two guide sockets in the corner holes of the other end of each connector block, in accordance with Appendix C of IEEE Std 583.

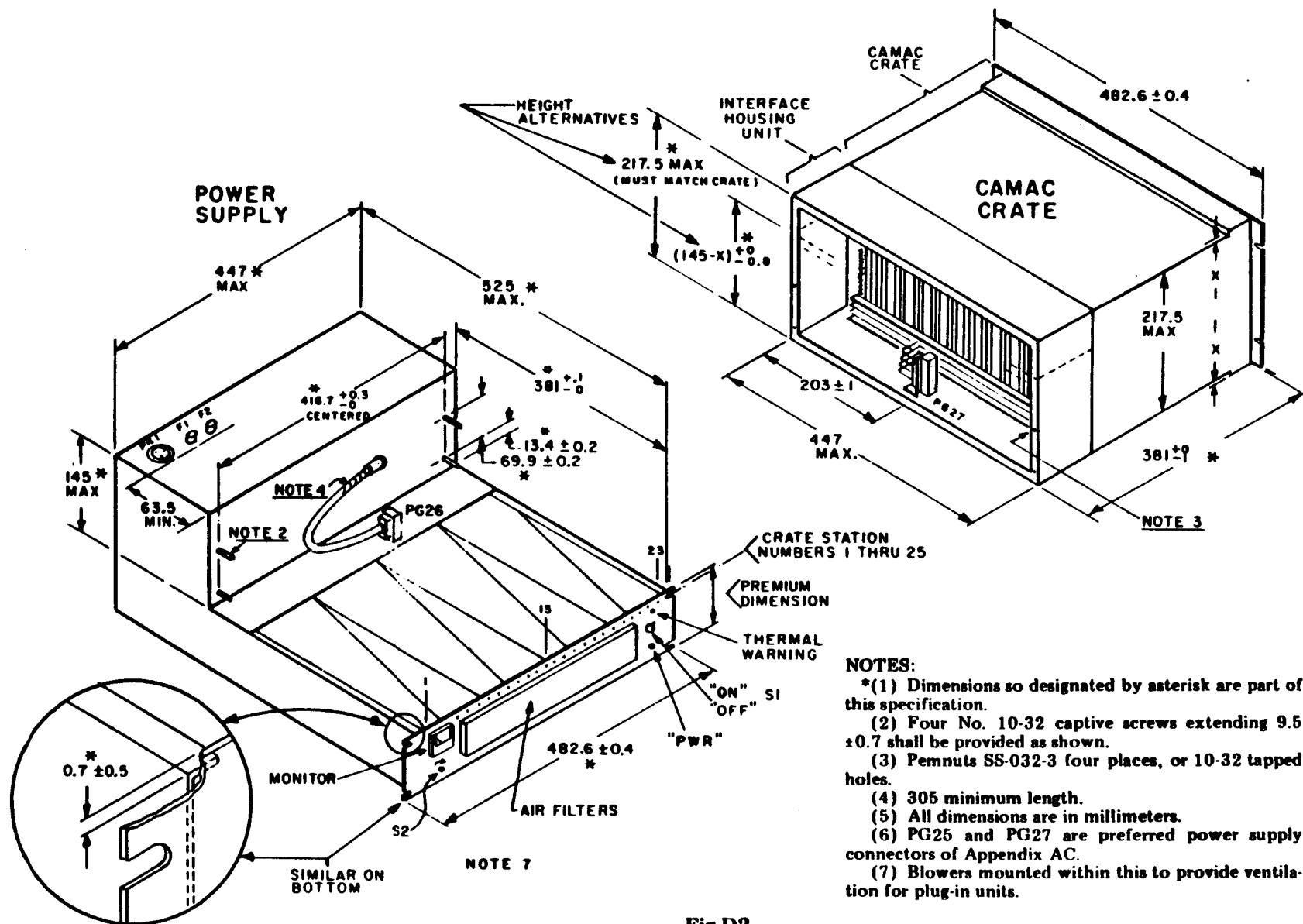


Fig D2
Outline Dimension and
Illustrative Unit

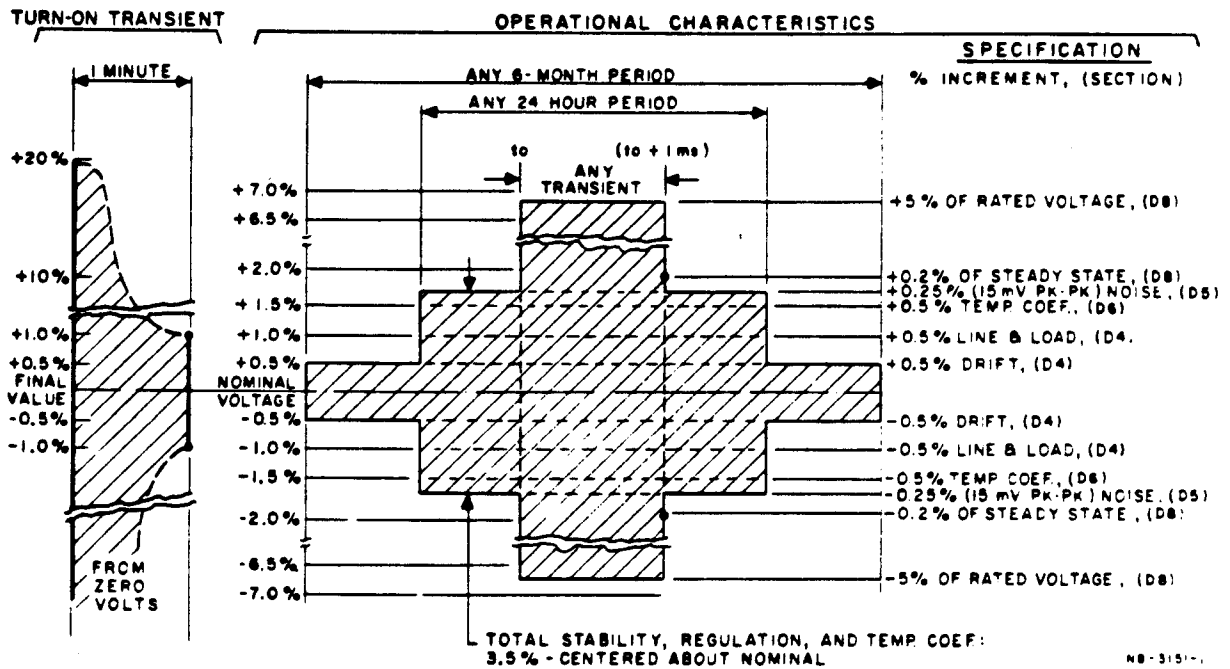


Fig D3
Time and Voltage Characteristics, ±6 V

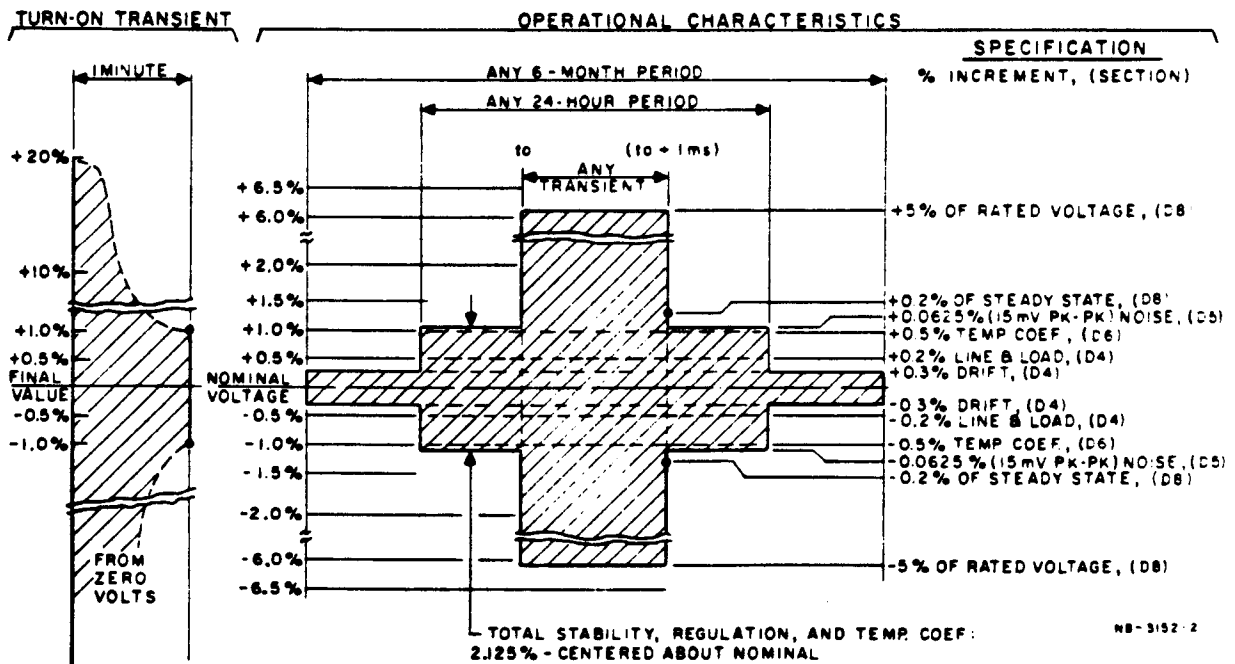
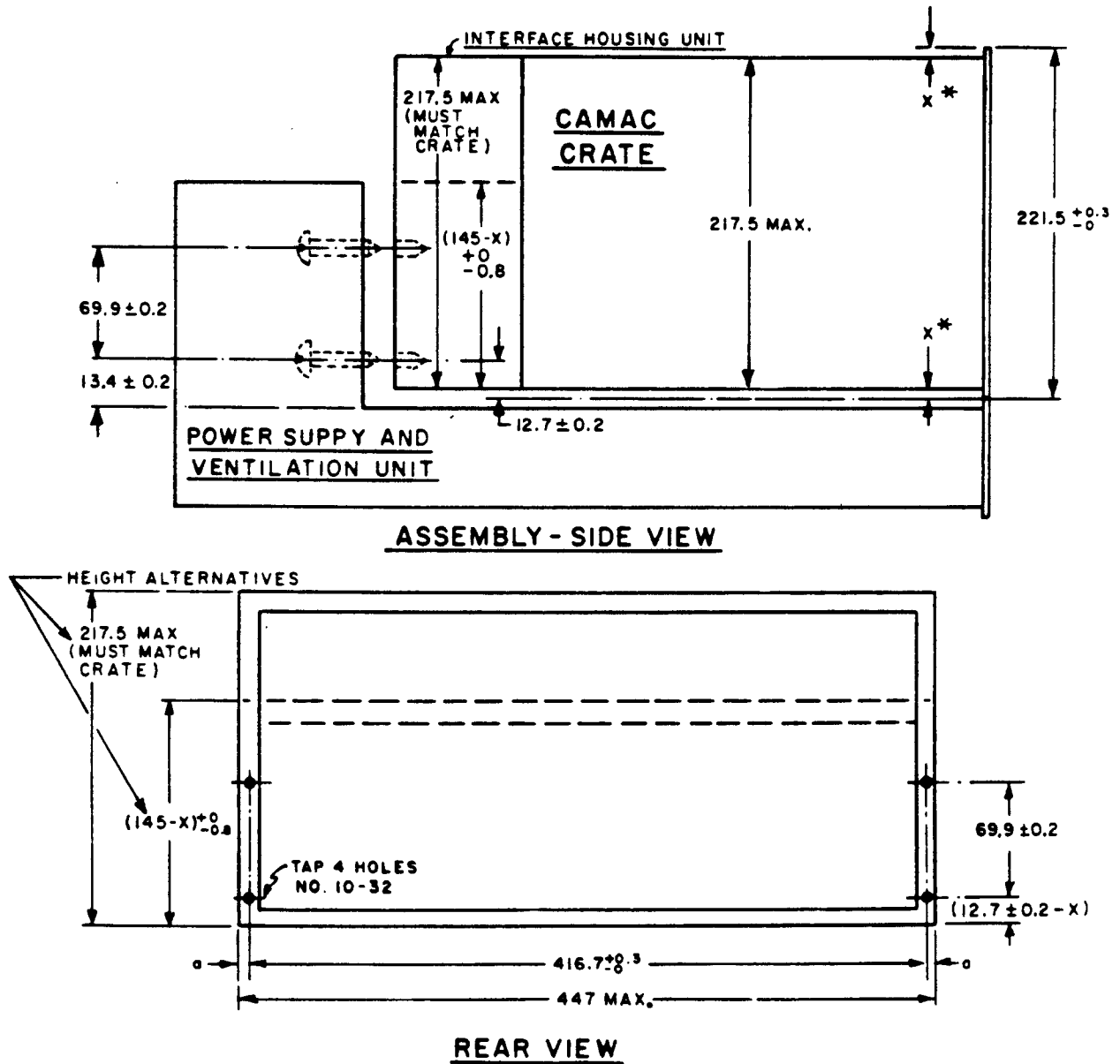


Fig D4
Time and Voltage Characteristics, ±24 V

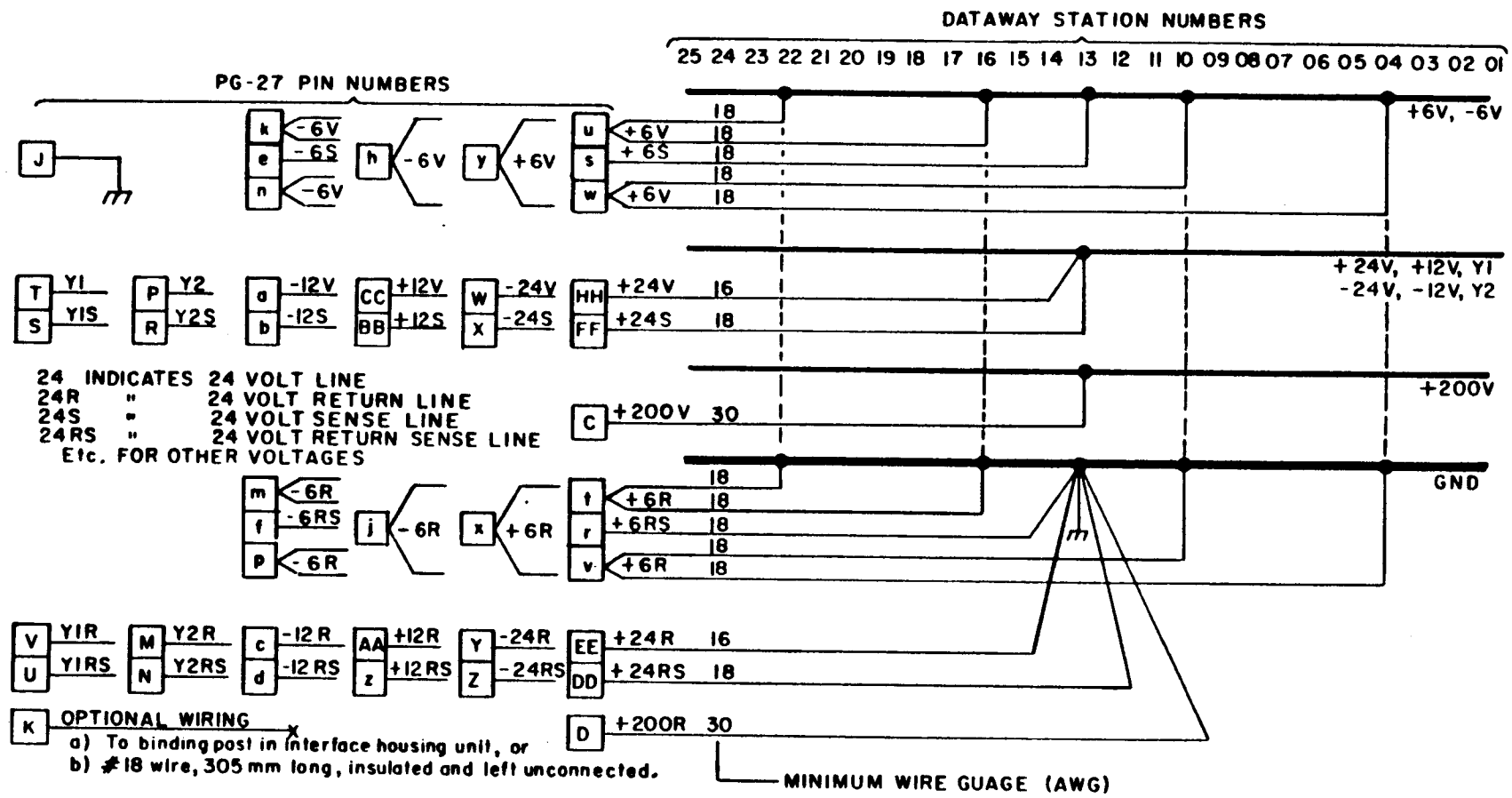


NB-3154-1

NOTES:

- (1) Power section and ventilation section may be separable.
 - (2) Power section need not extend upward at rear of crate as shown; if not, brackets for attaching to rear of interface housing unit must be provided.
- *Dimension varies with crates from different manufacturers.

Fig D5
 Interface Housing Unit



NOTES:
 (1) Suitable Connectors are Described in Appendix C of IEEE Std 583.
 (2) See note at the bottom of Section D21.

Fig D6
 Typical Power Buses and Power Return Bus,
 Feed, and Sense Wiring.

NB-3157-3

WARRANTY

All KineticSystems Corporation equipment is warranted against defects in workmanship and material under normal use and service for a period of two years from the date of shipment. KSC will repair or replace, at KSC's option, any equipment found to be defective in workmanship or material within two years of shipment. Repair charges will be applicable from two years after delivery with repair charges varying, depending on the complexity of the equipment. This warranty covers all such items delivered after March 1, 1978.

Equipment purchased by KineticSystems Corporation for resale will carry the original equipment manufacturers' warranty.

The equipment warranty outside the continental U.S.A. or Switzerland is limited to repair of the equipment and excludes shipping, custom's clearance, or any other charges.

Equipment for repair must be returned prepaid to KSC. Transportation charges for shipping the equipment to KSC shall be paid by the customer, while transportation charges for the return of the repaired equipment shall be paid by KSC except as indicated in the previous paragraph and will be made on a UPS basis, where available, or parcel post insured. Premium methods of shipment are available at customer's expense and will be used only when requested. If KSC selects the carrier, KSC will not thereby assume any liability in connection with the shipment nor shall the carrier be in any way construed to be the agent of KSC.

No equipment will be accepted for credit or exchange without the prior approval of KSC. Contact the Repair Service Center in your area for a return authorization number.

All customers (except European) please ship units to:

KineticSystems Corporation
Repair Service
11 Maryknoll Drive
Lockport, Illinois 60441
Telephone (815) 838-0005
TWX 910 638-2831

In Europe ship all units to:

Kinetic Systems International S.A.
Repair Service
6 Chemin de Tavernay
1218 Geneva, Switzerland
Telephone (022) 98 44 45
Telex 289 622 KSI CH

The following steps should be taken when returning a unit:

1. Contact KineticSystems and discuss the problem with an engineer.
2. Obtain a return authorization (RA) number.
3. Initiate a purchase order for the estimated repair charge if the equipment is out of warranty.
4. Ship the equipment to KineticSystems with the RA number, a description of the problem, and the name of the technical contact person.