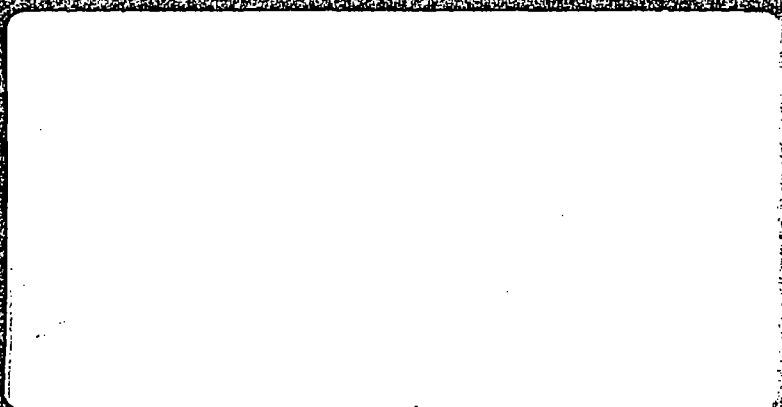


1/86

INSTRUCTION MANUAL

REGULATED POWER SUPPLIES



LAMBDA ELECTRONICS

MELVILLE, L. I., N. Y.

**INSTRUCTION MANUAL
FOR
REGULATED POWER SUPPLIES**

LDS-X-SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LDS-X models unless otherwise specified.

LAMBDA ELECTRONICS

MELVILLE, L.I., N.Y.

MAIN PLANT TELEPHONE: 516 MYrtle 4-4200

IM-LDS-X

TABLE OF CONTENTS

Section	Page
SPECIFICATIONS AND FEATURES	1
OPERATING INSTRUCTIONS	3
Basic Mode of Operation	3
Connections for Operation	3
Supply Load Connections	3
Mounting of L-12-OV Overvoltage Protector Accessory	5
Mounting of LH OV Overvoltage Protector Accessory	5
Operation After Protective Device Shutdown	5
MAINTENANCE	5
General	5
Trouble Analysis	6
Checking Transistors and Capacitors	6
Printed Circuit Board Maintenance Techniques	6
Performance Checks	7
Adjustment of Calibration Control R105	7
SERVICE	8
PARTS ORDERING	8

SPECIFICATIONS AND FEATURES

D.C. OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT AMPS)* AT AMBIENT TEMPERATURE			INPUT POWER (WATTS)**
		40°C	50°C	60°C	
LDS-X-5-OV	5 ± 5%	10.0 (8.5)	8.6 (7.3)	7.0 (6.0)	180
LDS-X-6	6 ± 5%	9.5 (8.1)	7.9 (6.7)	6.4 (5.4)	180
LDS-X-12	12 ± 5%	6.5 (5.5)	5.5 (4.7)	4.5 (3.8)	220
LDS-X-15	15 ± 5%	5.5 (4.7)	4.6 (3.9)	3.6 (3.1)	200
LDS-X-20	20 ± 5%	4.4 (3.7)	3.6 (3.1)	2.6 (2.2)	200
LDS-X-24	24 ± 5%	3.8 (3.2)	3.2 (2.7)	2.4 (2.0)	200
LDS-X-28	28 ± 5%	3.4 (2.9)	2.9 (2.5)	2.2 (1.9)	200
LDS-X-48	48 ± 5%	2.1 (1.9)	1.8 (1.6)	1.4 (1.2)	230
LDS-X-01	0 — 7	4.8 (4.1)	4.0 (3.4)	3.1 (2.6)	110
LDS-X-02	0 — 18	2.3 (1.95)	1.9 (1.6)	1.5 (1.3)	100
LDS-X-03	0 — 32	1.5 (1.25)	1.3 (1.1)	1.1 (0.95)	100

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

*Ratings apply for use with cover removed. Use ratings in parentheses when unit is used with cover.

Refer to figure 12 for cover removal.

**With output loaded to full current rating and input voltage 127 volts AC, 60 Hz.

REGULATED VOLTAGE OUTPUT

Regulation (Line)	0.005% +0.5 mV for input variations from 105-127, 127-105, 210-254, or 254-210 volts AC.
Regulation (Load)	0.005% +0.5 mV for load variations from no load to full load or full load to no load.
Ripple and Noise	150 μV rms, 1 mV peak-to-peak with either positive or negative terminal grounded.
Temperature Coefficient	Output change in voltage ±(0.005% +10 μV)/°C on 01, 02, 03 with external programming resistors. ±(0.01% +10 μV)/°C on 01, 02, 03 with internal programming resistors and on 5V thru 48V units.

Remote Programming

External Resistor Nominal 1000 ohms/volt output. Downward programming to voltages less than 1 volt must be accomplished in two steps; first, from original voltage value to 1 volt, and then from 1 volt to final desired value.

Programming Voltage One-to-one voltage change.

Remote Sensing Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

OVERSHOOT — No overshoot under conditons of power turn-on, turn-off, or power failure.

AC INPUT — 105-127 or 210-254 volts AC at 47-440 Hz. Standard LDS-X power supplies are factory wired for 105-127 volt input, but can be rewired for 210-254 volt input. See figure 8 and schematic diagram for rewiring of AC input. For input power see table I. Ratings apply for 57-63 Hz input. For 47-53 Hz or 63-440 Hz input consult factory.

OVERLOAD PROTECTION

Thermal Thermostat, resets automatically when over temperature condition is eliminated.

Electrical Automatic electronic current limiting circuit, limits output current to a safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — Model LDS-X-5-OV includes a fixed built-in overvoltage protection circuit which prevents damage to the load caused by excessive power supply output voltage. Overvoltage protection range varies between 6.3 and 6.9 volts D.C.

INPUT AND OUTPUT CONNECTIONS — Refer to figure 12 for location.

AC input Screw terminals on printed circuit board

Ground Terminal on transformer

DC output Screw terminals on a printed circuit board

Sensing Screw terminals on printed circuit board

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 60°C ambient with corresponding load current rating for all modes of operation.

STORAGE TEMPERATURE (non operating) — -55°C to +85°C

FUNGUS — All LDS-X power supplies are fungus inert.

DC OUTPUT CONTROL — Screwdriver voltage adjust control permits adjustment of DC output voltage. Refer to figure 12 for location of control. On wide range models, an adjustable range of 1% V_o max to V_o max is provided by the internal programming potentiometer; programming over the full 0 to V_o max range can be accomplished by remote programming.

PHYSICAL DATA

Size 7" x 4-7/8" x 2-7/8" with cover in place
7" x 4-7/8" x 2-3/4" with cover removed

Weight 7-3/4 lbs. net., 8-1/4 lbs. shipping

Finish Gray, FED. STD. 595 No. 26081

MOUNTING — Three surfaces, two with tapped mounting holes and one with clearance mounting holes, can be utilized for mounting this unit. Two mounting surfaces on LDS-X-01 thru 03 and LDS-X-48 when used with optional LH OV series overvoltage protectors. Air circulation is required when unit is mounted in confined areas. Refer to figure 12 for mounting details.

OVERVOLTAGE PROTECTOR — Internally mounted L-12-OV series overvoltage protector, standard on 5V unit. Internally mtd L-12-OV series overvoltage protectors optional on LDS-X-6 thru LDS-X-28. LH OV series externally mounted, adjustable overvoltage protector accessory for LDS-X-01 through LDS-X-03 and LDS-X-48 are available.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When load exceeds 105% of 40°C rating, both voltage and current decrease until voltage reaches zero and the current at short circuit equals approximately 40 percent or less of the rated current. (For wide range models, short circuit current equals the rated current.)

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminals provided. Apply input power to AC terminals; always connect the ungrounded (hot) lead to terminal indicated in figures 3 through 9.

The supply positive terminal is brought out to terminal +V. The supply negative terminal is brought out to terminal -V. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks as shown in figure 11. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. Local sensing is the connection suitable for application with relatively constant load or for applications with short power output leads.

Remote Sensing Connection, Figure 4. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf, elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at 1000 ohms/volt change and shorting-type switch as shown in Figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volts ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation. On wide range models, downward programming to voltages less than 1 volt must be accomplished in two steps; first, from original voltage value to 1 volt and then from 1 volt to final desired value.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 2 ma. minimum.

Alternatively, when supplies with less than 2 ma. reverse current capability are used, a resistor capable of drawing 2 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation, Figure 7.

The voltage capability of LDS-X power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of "Specifications and Features", for power supply current and voltage ratings.

Connections For Parallel Operation, Figure 9 (Applicable only to LDS-X-01 — LDS-X-03)

The current capability of LDS-X power supplies can be extended by parallel operation of LDS-X power supplies of equal* voltage capacities.

Units "M" and "S" are shown connected for parallel operation in figures 9A and 9B. One power supply, designated the "M" unit, controls its own output as well as the output of the second power supply, designated the "S" unit.

*For applications using supplies of unequal voltage ratings, consult factory for details of operation.

Unit S operates to regulate its current in a ratio to that of the M unit by comparing the current in its internal sampling resistor with that current sampled by the master internal sampling resistor.

CAUTION: Always set "S" unit voltage control to zero (fully CCW) during parallel operation, otherwise excessive current will flow through "M" unit voltage control.

MOUNTING OF L-12 OV OVERVOLTAGE PROTECTOR ACCESSORY

Mount OV protector to the power supply using two 6-32 x 1/2" screws, 4 #6 split lockwashers and two 6-32 nuts.

Two 3/8" holes are available on the chassis under preregulator IC1 bracket for mounting the OV protector.

After mounting, connect wires from overvoltage protector +V to +V terminal on printed circuit board and from -V to -V terminal on printed circuit board.

MOUNTING OF LH OV OVERVOLTAGE PROTECTOR ACCESSORY

Mount LH OV protector to the power supply by aligning the two 6-32 captive screws, located on the protector with the two existing tapped 6-32 holes located in the power supply chassis behind the output terminals.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat opens the input circuit only when the temperature of the internal heat sink exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Overvoltage Shutdown (LDS-X-5-OV only)

When the power supply output voltage increases above the overvoltage limit, IC2 will short circuit output of the supply. After eliminating the cause(s) for overvoltage, resume operation of the supply by momentarily interrupting the AC input circuit. (Refer to Troubleshooting Chart.)

MAINTENANCE

GENERAL

This section described trouble analysis routine, replacement procedures, calibration and test procedures that are useful for servicing the Lambda LDS-X power supply. A trouble chart is provided as an aid for the troubleshooter. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check primary power lines, external circuit elements, and external wiring for malfunction before troubleshooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumper and supply-load connections.

Use the electrical schematic diagram and block diagram, figure 10, as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuits components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an instrument that has a highly limited current capability. Observe proper polarity to avoid error in measurement. The forward transistor resistance is low but never zero; backward resistance is always higher than the forward resistance..

For good transistors, the forward resistance for any function is always greater than zero.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional defective components could damage the replaced component.

When soldering semi-conductor devices, wherever possible, hold the lead being soldered with a pair of pliers placed between the component and the solder joint to provide an effective heat sink.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder, it is a good contact. Do not attempt to cover with solder.
2. Voltage measurements can be made from either side of the board. Use a needle point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapter to the measuring instrument.
3. Wherever possible use a heat sink when soldering transistors.
4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.
5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:
 - a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.
 - b) Dip the wick in liquid rosin flux.

c) Place the wick onto the soldered connection and apply soldering iron onto the wick.

d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 11. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-127 or 127-105 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a TVM, John Fluke Model 931B or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output. Connect oscilloscope probe directly across the +V and -V terminals of the unit with probe positioned upward. Return lead of probe should be as short as possible and away from any wires.

ADJUSTMENT OF CALIBRATION CONTROL R105

Whenever R104, R105, R106, R1, R2, R122 or IC101 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R105 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and stabilized and not operating.

1. Remove AC input power to the supply.
2. Break seal on wiper of R105 from resistor housing.
3. Operate power supply for constant voltage with local sensing, connected as shown in figure 3, with no external load.
4. Turn voltage adjust control until minimum rated output voltage is obtained.
5. Apply load so that output current is 105% of 40°C rating for the unit. It may be necessary to turn R105 CW in order to achieve this value of current.
6. Using a DVM John Fluke 891A or equivalent, observe output voltage while adjusting R105 in CCW direction. Adjust R105 until output voltage begins to decrease.
7. Turn voltage adjust control until maximum rated output voltage is obtained.
8. Increase load. Maximum attainable load current shall not exceed 110% of 40°C rating for the unit.
9. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R105 to resistor housing.
10. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description, function, and location, of the part.

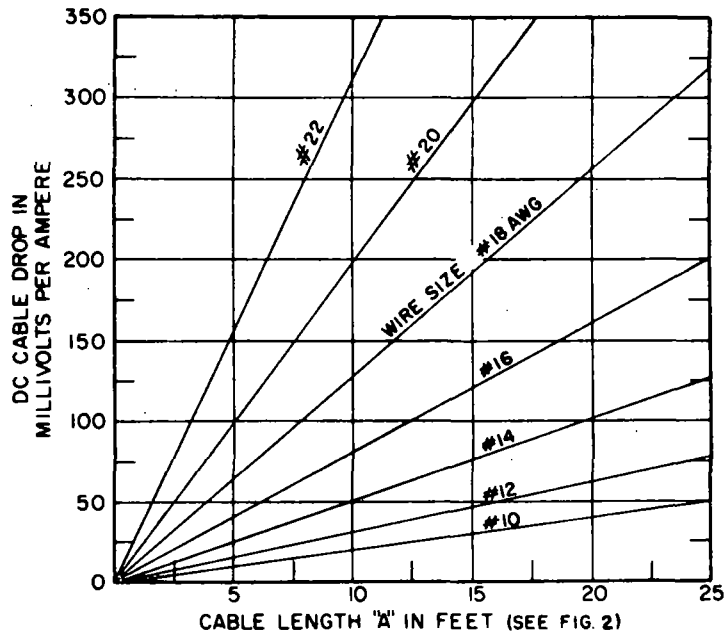


Figure 1. Cable Connection Chart

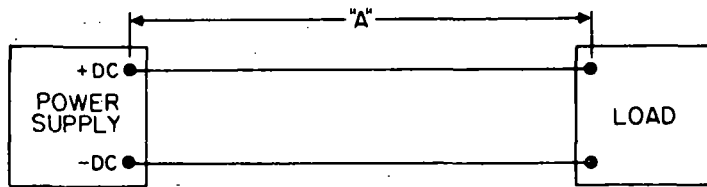
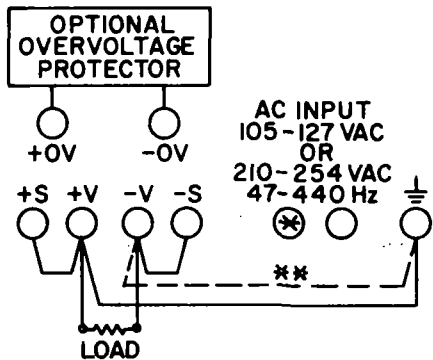
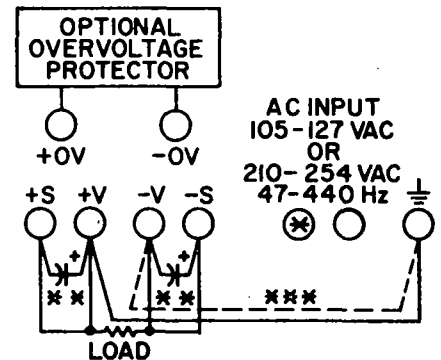


Figure 2. Cable Length "A" in Feet



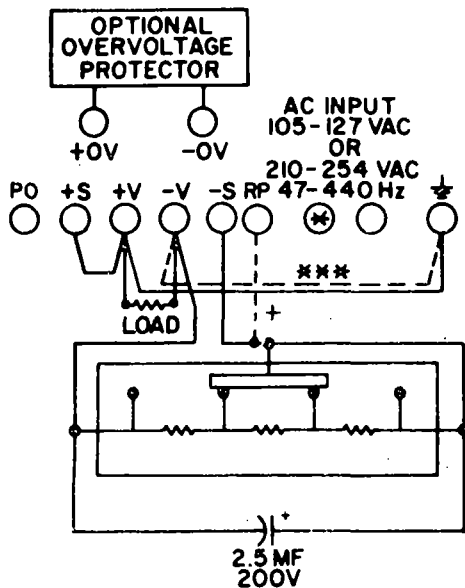
- * CONNECT UNGROUND (HOT) LEAD TO THIS TERMINAL
- ** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 3. Local Sensing Connection.

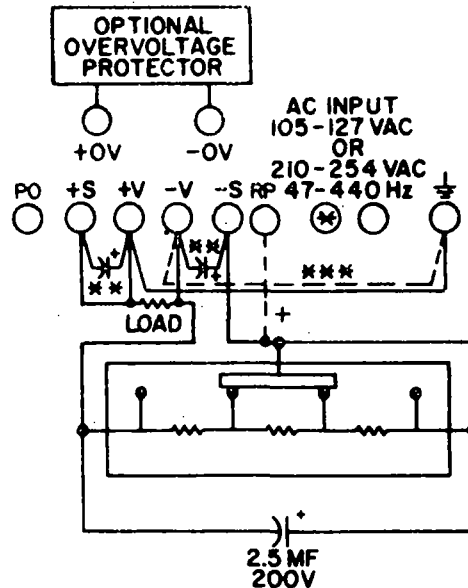


- * CONNECT UNGROUND (HOT) LEAD TO THIS TERMINAL
- * * A 2.5 MF, ELECT., CAP. MAY BE REQUIRED
- * * * FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 4. Remote Sensing Connection.



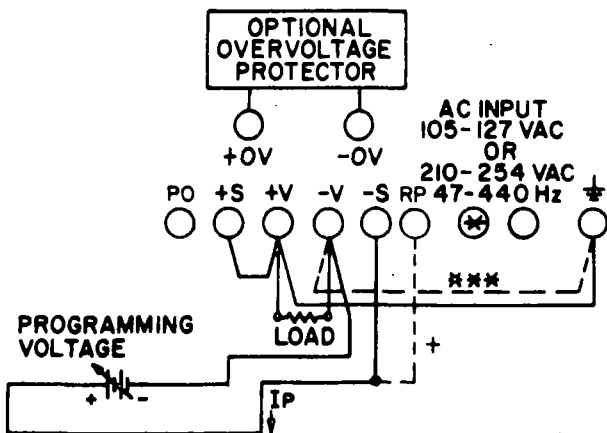
(A) LOCAL SENSING



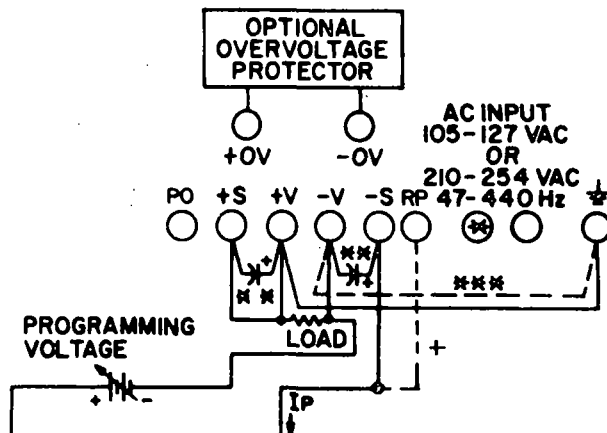
(B) REMOTE SENSING

- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \oplus AND RECONNECT TO TERMINALS -V & \oplus .
- + LDS-01,02,03 ONLY, USE RP TERMINAL INSTEAD OF -S; -S IS LEFT OPEN.

Figure 5. Programmed Voltage, With External Resistor.



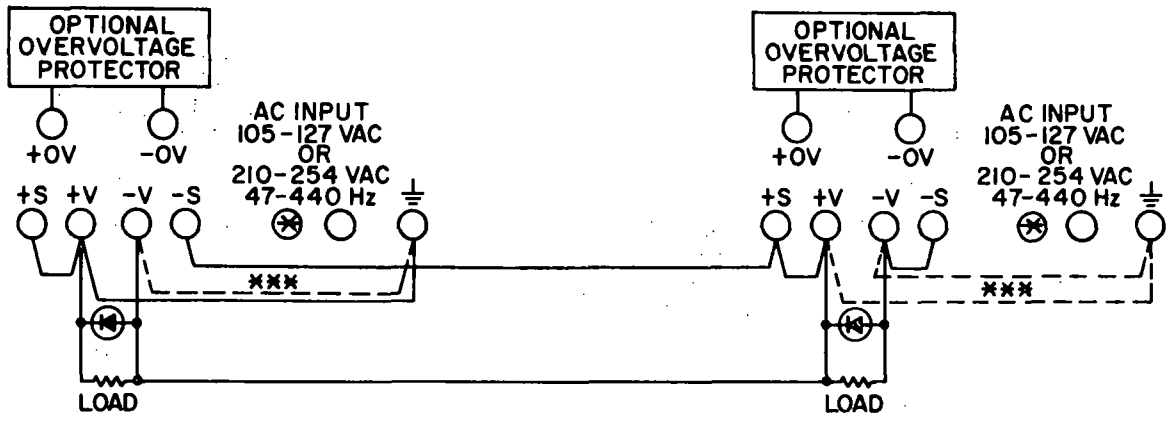
(A) LOCAL SENSING



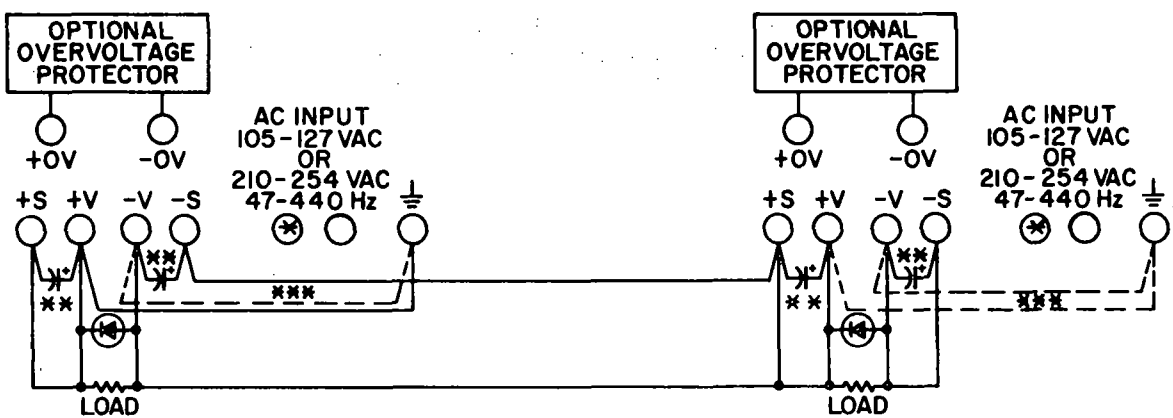
(B) REMOTE SENSING

- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \oplus AND RECONNECT TO TERMINALS -V & \oplus .
- + LDS-01,02,03 ONLY, USE RP TERMINAL INSTEAD OF -S; -S LEFT OPEN.

Figure 6. Programmed Voltage, With External Programming Voltage Source.



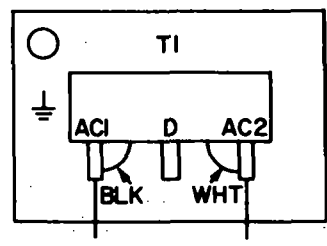
(A) LOCAL SENSING



(B) REMOTE SENSING

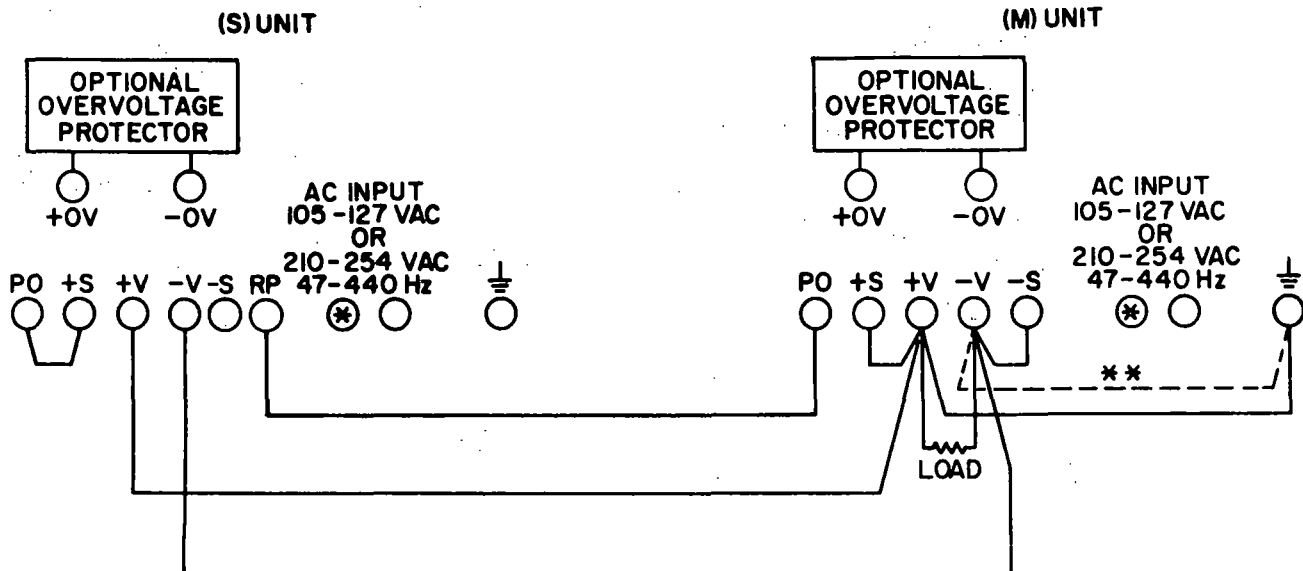
- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT. CAP. MAY BE REQUIRED.
- *** MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS +V & ⚡ ON LEFT UNIT AND CONNECT ANY ONE OF THE JUMPERS AS SHOWN IN DOTTED LINE.

Figure 7. Series Connection.



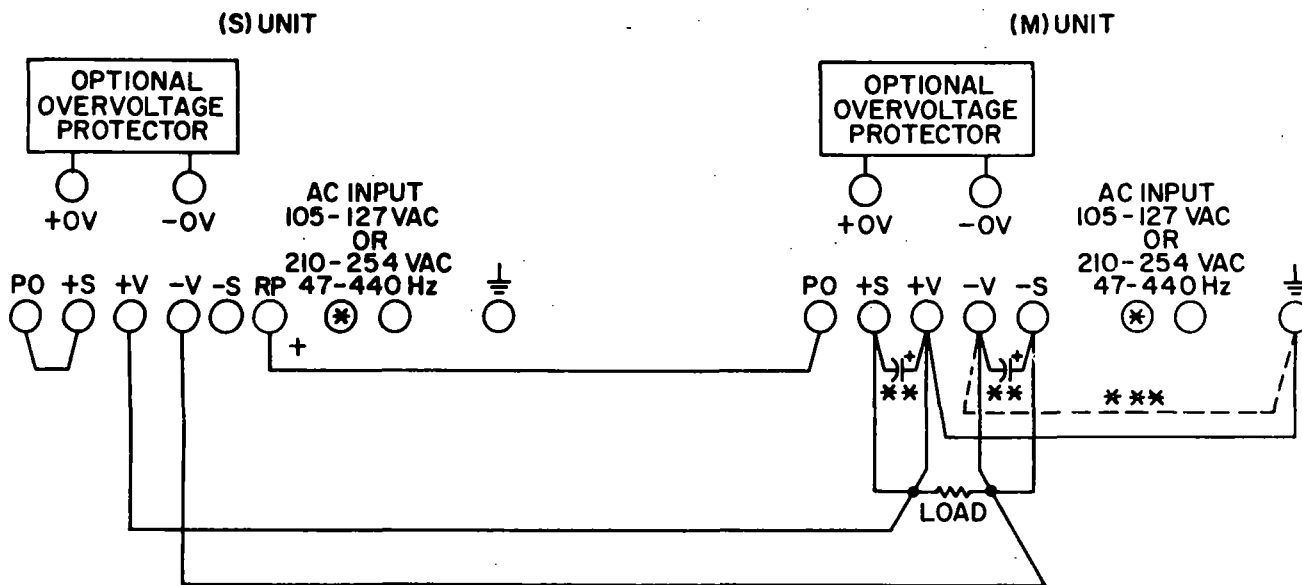
CONNECTION SHOWN IS FOR 105-127 VAC. FOR 210-254V INPUT, DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMS AC1 & AC2 AND RECONNECT BOTH LEADS TO TERM D.

Figure 8. Transformer Connections for AC Input Conversion.



* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
 ** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM
 TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

(A) LOCAL SENSING



* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
 ** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.
 *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM
 TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 9. Parallel Connection

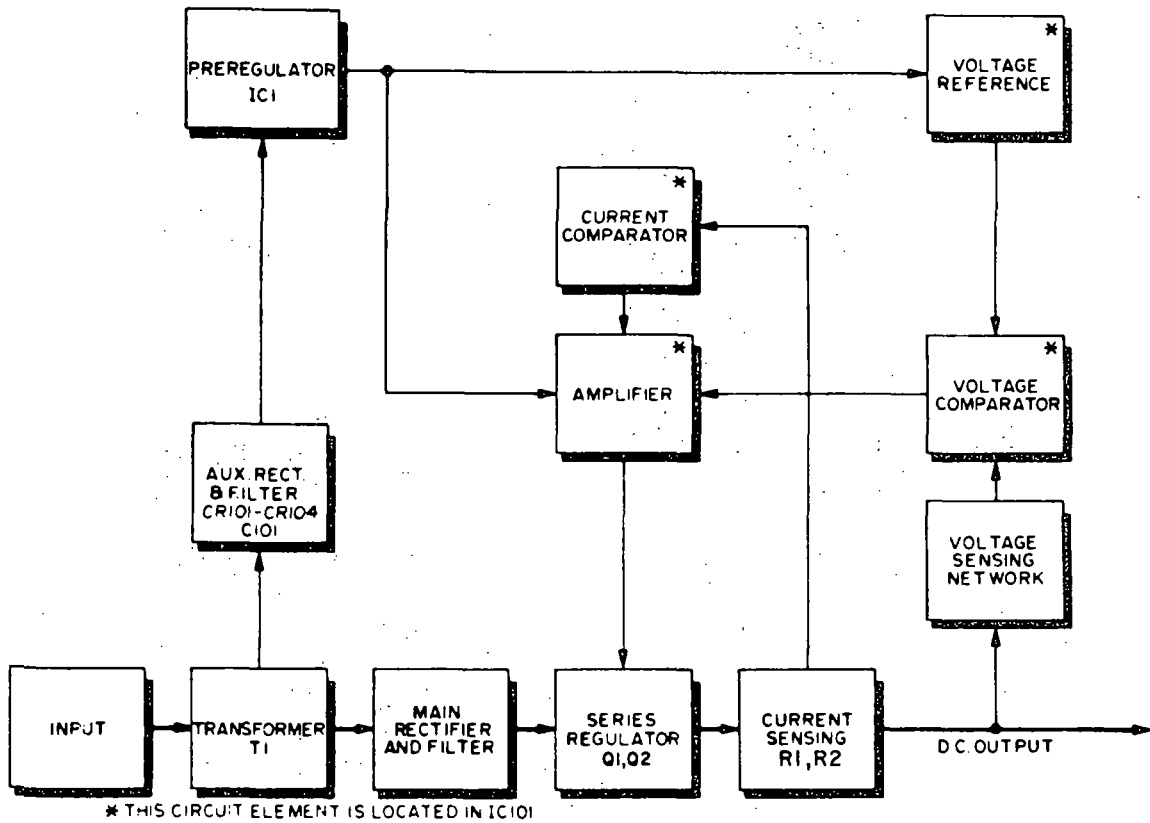
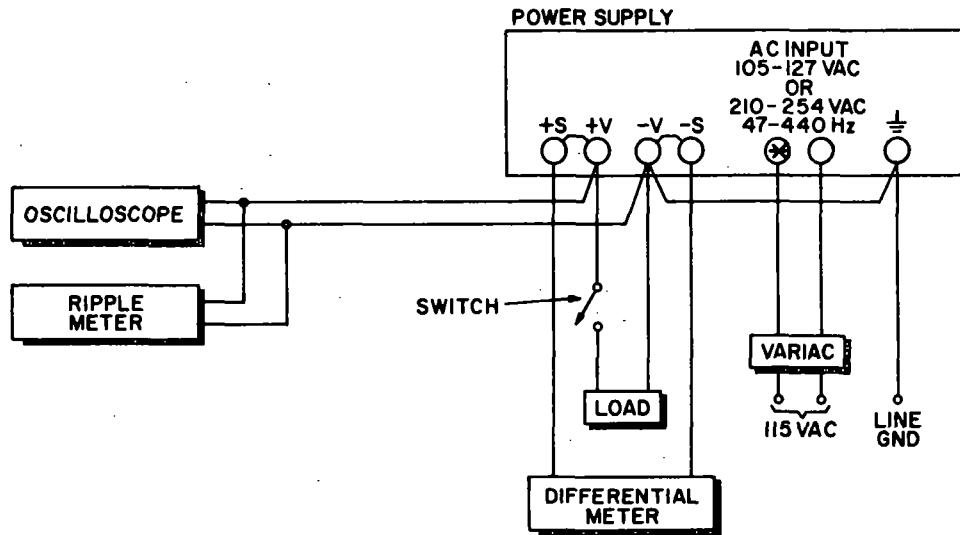


Figure 10. Typical Block Diagram

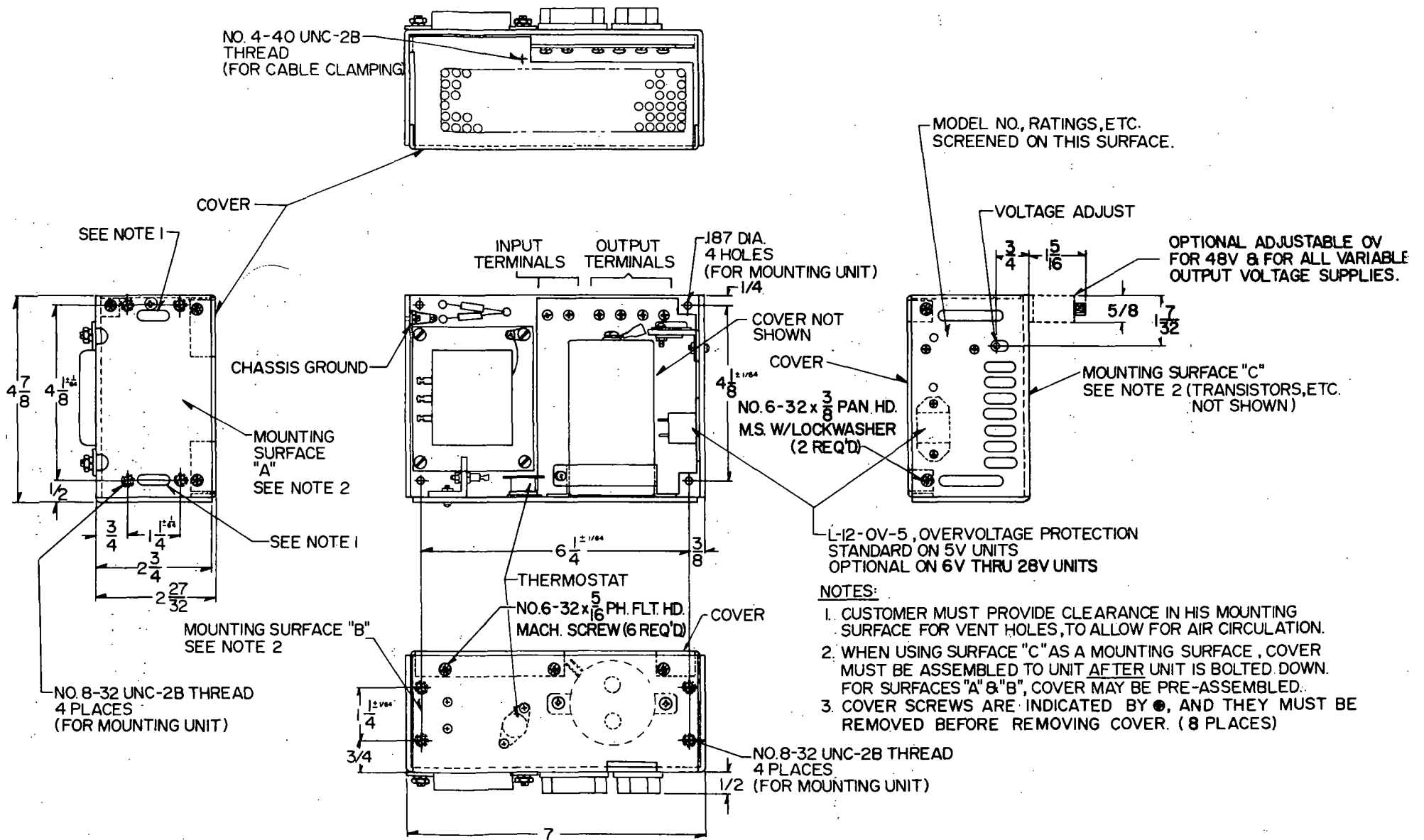


* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL

NOTES:

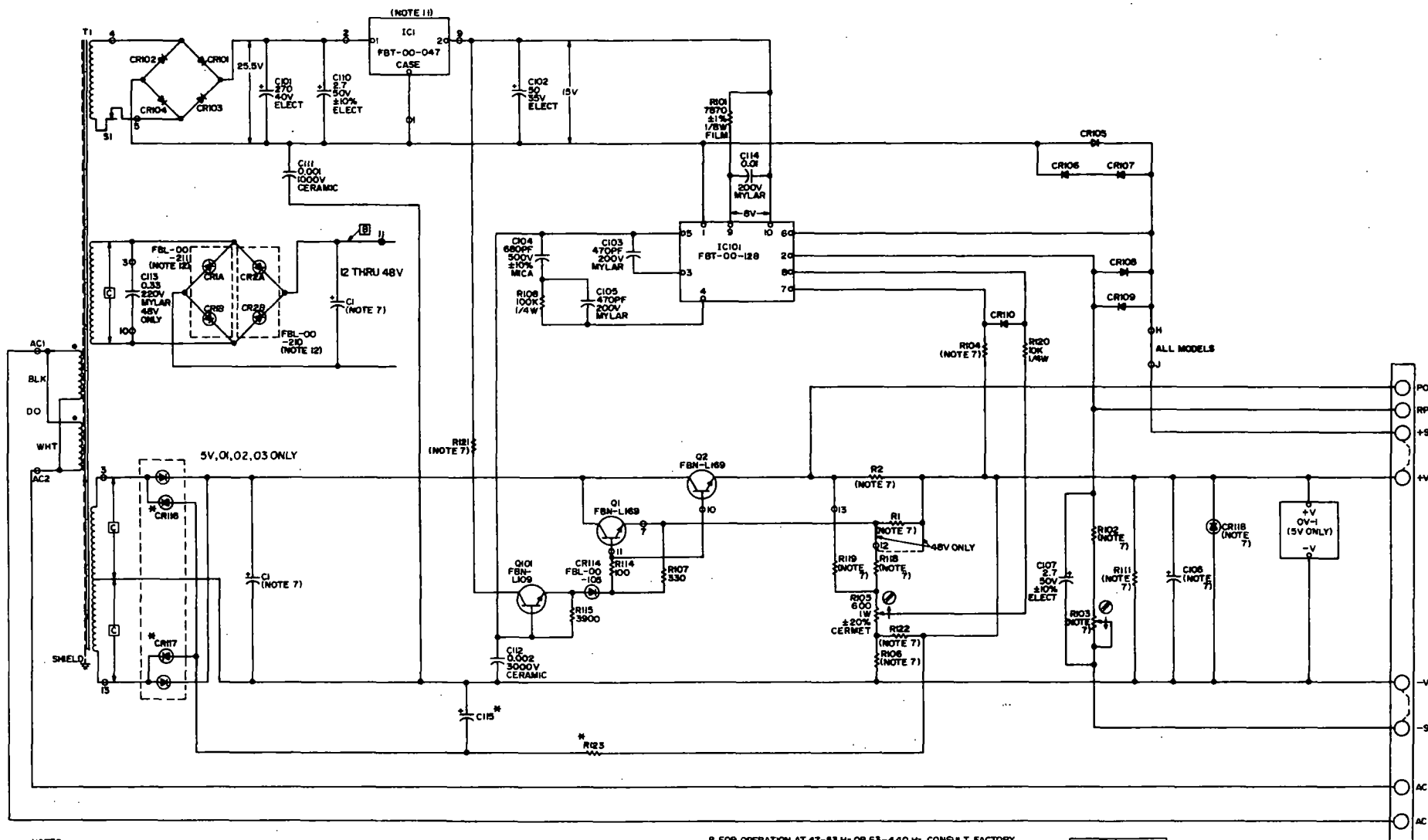
1. REGULATION AND RIPPLE CHECKMETERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.

Figure 11. Test Connections For Constant Voltage Performance Checks



- NOTES:**
1. CUSTOMER MUST PROVIDE CLEARANCE IN HIS MOUNTING SURFACE FOR VENT HOLES, TO ALLOW FOR AIR CIRCULATION.
 2. WHEN USING SURFACE "C" AS A MOUNTING SURFACE, COVER MUST BE ASSEMBLED TO UNIT AFTER UNIT IS BOLTED DOWN. FOR SURFACES "A" & "B", COVER MAY BE PRE-ASSEMBLED.
 3. COVER SCREWS ARE INDICATED BY ●, AND THEY MUST BE REMOVED BEFORE REMOVING COVER. (8 PLACES)

Figure 12. Outline Drawing.



NOTES

1. RESISTORS ARE 1/2W COMP WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
3. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%, CERAMIC $\pm 20\%$, MYLAR $\pm 10\%$ UNLESS OTHERWISE NOTED.
4. RESISTOR TOLERANCES: COMP. $\pm 10\%$, WIRE WOUND $\pm 5\%$, FILM $\pm 1\%$.
5. SYMBOLS
 INDICATES ACTUAL UNIT MARKING

- INDICATES CLOCKWISE ROTATION OF SHAFT.
- * SEE INSTRUCTION MANUAL
- INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
- INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
- LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
- 6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
- 7. SEE TABLE 1 FOR COMPONENT VALUES.

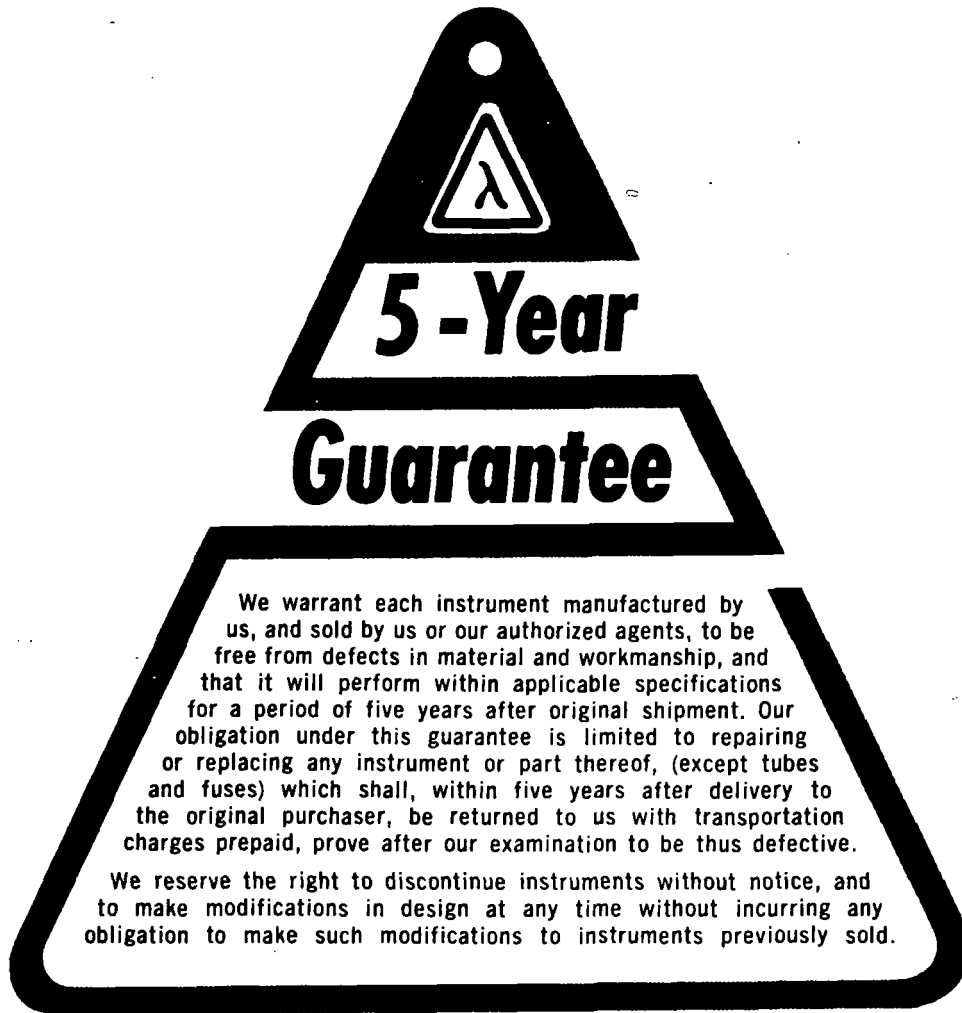
8. FOR OPERATION AT 47-53 Hz OR 63-440 Hz, CONSULT FACTORY.
9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 230-254 VAC INPUT, DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERM'S AC1 & AC2 AND RECONNECT BOTH LEADS TO TERM. D.
10. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS:
 INPUT: 115 VAC, 60 Hz, NOMINAL OUTPUT VOLTAGE, NO LOAD.
 +S AND +V SHORTED, -S AND -V SHORTED. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTME TER BETWEEN -S AND INDICATED POINTS UNLESS OTHERWISE NOTED.
11. IC1 WAS FBT-00-151 ON UNITS WITH SERIAL NO. PREFIX A.
12. CR1A,B WAS FBL-00-147 AND CR2A, 2B WAS FBL-00-146 ON UNITS WITH SERIAL NO. PREFIXES A & B.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES F-H

SCHEMATIC DIAGRAM REGULATED POWER SUPPLY LMS-X SERIES

LAMBDA
ELECTRONICS
MELVILLE, NEW YORK

DIVISION OF INSTRUMENTS INC.



LAMBDA ELECTRONICS

515 BROAD HOLLOW ROAD • MELVILLE, L.I., NEW YORK • 516-694-4200

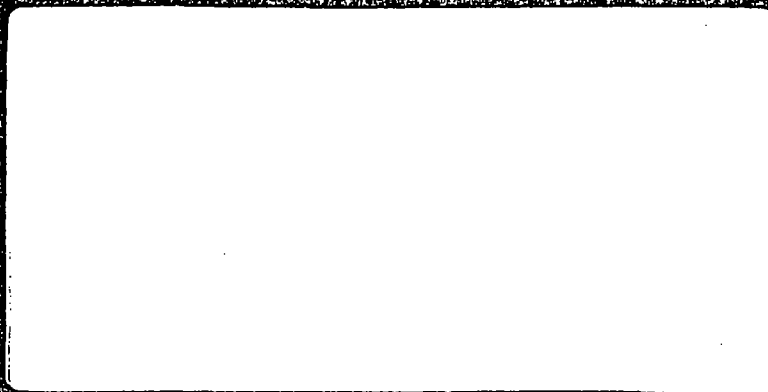
DIVISION of



INSTRUMENTS INC.

INSTRUCTION MANUAL

REGULATED POWER SUPPLIES



LAMBDA ELECTRONICS

MELVILLE, L. I., N. Y.

**INSTRUCTION MANUAL
FOR
REGULATED POWER SUPPLIES**

LDS-Y-SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LDS-Y models unless otherwise specified.

LAMBDA ELECTRONICS

MAIN PLANT TELEPHONE: 516-694-4200

MELVILLE, L.I., N.Y.

IM-LDS-Y

TABLE OF CONTENTS

Section	Page
SPECIFICATIONS AND FEATURES	1
OPERATING INSTRUCTIONS	4
Basic Mode of Operation	4
Connections for Operation	4
Supply Load Connections	4
Mounting of L-6-OV Overvoltage Protector Accessory	5
Mounting of LH OV Overvoltage Protector Accessory	6
Operation After Protective Device Shutdown	6
MAINTENANCE	6
General	6
Trouble Analysis	6
Checking Transistors and Capacitors	6
Printed Circuit Board Maintenance Techniques	7
Performance Checks	7
Adjustment of Calibration Control R105	8
SERVICE	8
PARTS ORDERING	8

SPECIFICATIONS AND FEATURES

D. C. OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS)* AT AMBIENT TEMPERATURE			INPUT POWER (WATTS)**
		40°C	50°C	60°C	
LDS-Y-5-OV	5 ± 5%	5.4 (5.0)	4.4 (4.0)	3.3 (3.0)	110
LDS-Y-12	12 ± 5%	3.7 (3.4)	2.9 (2.55)	2.0 (1.75)	120
LDS-Y-15	15 ± 5%	3.25 (3.00)	2.50 (2.25)	1.7 (1.55)	120
LDS-Y-20	20 ± 5%	2.5 (2.25)	2.0 (1.80)	1.5 (1.35)	125
LDS-Y-24	24 ± 5%	2.1 (1.9)	1.70 (1.55)	1.3 (1.15)	125
LDS-Y-28	28 ± 5%	1.9 (1.65)	1.5 (1.35)	1.10 (1.00)	130
LDS-Y-48	48 ± 5%	1.3 (1.2)	1.05 (0.95)	.75 (0.70)	155
LDS-Y-01	0 - 7	3.4 (3.4)	2.9 (2.85)	2.4 (1.80)	100
LDS-Y-02	0 - 18	1.8 (1.8)	1.60 (1.60)	1.4 (0.90)	110
LDS-Y-03	0 - 32	1.1 (1.1)	1.0 (0.95)	0.80 (0.60)	110
LDS-Y-100	100 ± 5%	0.55†	0.45†	0.35†	110
LDS-Y-120	120 ± 5%	0.45†	0.35†	0.25†	110
LDS-Y-150	150 ± 5%	0.35†	0.25†	0.15†	110

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

*Ratings apply for use with cover removed. Use ratings in parentheses when unit is used with cover. Refer to figure 12 for cover removal.

**With output loaded to full current rating and input voltage 127 volts AC, 60 Hz.

†With or without cover.

REGULATED VOLTAGE OUTPUT

Regulation (Line) 0.005% +0.5 mV for input variations from 105-127, 127-105, 210-254, or 254-210 volts AC.

Regulation (load) 0.005% +0.5 mV for load variations from no load to full load or full load to no load.

Ripple and Noise 150 μV rms, 1 mV peak to peak for LDS-Y-5-OV thru - LDS-Y-48 and LDS-Y-01, 02, 03; 250 μV rms, 1 mV peak to peak for LDS-Y-100, 120, 150 with either positive or negative terminal grounded.

Temperature Coefficient Output change in voltage ±(0.005% +10 μV)/°C on 01, 02, 03 with external programming resistors. ±(0.01% +10 μV)/°C on 01, 02, 03 with internal programming resistors and on 5V thru 150 V units.

Remote Programming

- External Resistor Nominal 1000 ohms/volt output. Downward programming to voltages less than 1.0 volt must be accomplished in two steps; first, from original voltage value to 1.0 volt, and then from 1.0 volt to final desired value.
- Programming Voltage One-to-one voltage change.
- Remote Sensing Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 105-127 or 210-254 volts AC at 47-440 Hz. Standard LDS-Y power supplies are factory wired for 105-127 volt input, but can be rewired for 210-254 volt input. See figure 8 and schematic diagram for rewiring of AC input. For input power see table I. Ratings apply for 57-63 Hz input. For 47-53 Hz or 63-440 Hz input consult factory. Where applicable, regulatory agency approval applies only for input voltages up to 250VAC.

OVERLOAD PROTECTION

- Thermal Thermostat, resets automatically when over temperature condition is eliminated.
- Electrical Automatic electronic current limiting circuit, limits output current to a safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — Model LDS-Y-5-OV includes a fixed built-in overvoltage protection circuit which prevents damage to the load caused by excessive power supply output voltage. Overvoltage protection range varies between 6.4 and 6.8 volts D.C.

INPUT AND OUTPUT CONNECTIONS — Refer to figure 12 for location.

- AC input Screw terminals on printed circuit board
- Ground 6-32 stud on printed circuit board
- DC output Screw terminals on printed circuit board
- Sensing. Screw terminals on printed circuit board

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 60°C ambient with corresponding load current rating for all modes of operation.

STORAGE TEMPERATURE (non operating) — -55°C to +85°C

TRANSFORMER — MIL-T-27C, Grade 6; electrostatic shield; 4,000 VAC input/output isolation.

FUNGUS — All LDS-Y power supplies are fungus inert.

SPECIFICATIONS AND FEATURES

D. C. OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS)* AT AMBIENT TEMPERATURE			INPUT POWER (WATTS)**
		40°C	50°C	60°C	
LDS-Y-5-OV	5 ± 5%	5.4 (5.0)	4.4 (4.0)	3.3 (3.0)	110
LDS-Y-12	12 ± 5%	3.7 (3.4)	2.9 (2.55)	2.0 (1.75)	120
LDS-Y-15	15 ± 5%	3.25 (3.00)	2.50 (2.25)	1.7 (1.55)	120
LDS-Y-20	20 ± 5%	2.5 (2.25)	2.0 (1.80)	1.5 (1.35)	125
LDS-Y-24	24 ± 5%	2.1 (1.9)	1.70 (1.55)	1.3 (1.15)	125
LDS-Y-28	28 ± 5%	1.9 (1.65)	1.5 (1.35)	1.10 (1.00)	130
LDS-Y-48	48 ± 5%	1.3 (1.2)	1.05 (0.95)	.75 (0.70)	155
LDS-Y-01	0 - 7	3.4 (3.4)	2.9 (2.85)	2.4 (1.80)	100
LDS-Y-02	0 - 18	1.8 (1.8)	1.60 (1.60)	1.4 (0.90)	110
LDS-Y-03	0 - 32	1.1 (1.1)	1.0 (0.95)	0.80 (0.60)	110
LDS-Y-100	100 ± 5%	0.55†	0.45†	0.35†	110
LDS-Y-120	120 ± 5%	0.45†	0.35†	0.25†	110
LDS-Y-150	150 ± 5%	0.35†	0.25†	0.15†	110

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

*Ratings apply for use with cover removed. Use ratings in parentheses when unit is used with cover. Refer to figure 12 for cover removal.

**With output loaded to full current rating and input voltage 127 volts AC, 60 Hz.

†With or without cover.

REGULATED VOLTAGE OUTPUT

Regulation (Line) 0.005% +0.5 mV for input variations from 105-127,127-105, 210-254, or 254-210 volts AC.

Regulation (load) 0.005% +0.5 mV for load variations from no load to full load or full load to no load.

Ripple and Noise 150 μV rms, 1 mV peak to peak for LDS-Y-5-OV thru - LDS-Y-48 and LDS-Y-01, 02, 03; 250 μV rms, 1 mV peak to peak for LDS-Y-100, 120, 150 with either positive or negative terminal grounded.

Temperature Coefficient Output change in voltage ±(0.005% +10 μV)/°C on 01, 02, 03 with external programming resistors. ±(0.01% +10 μV)/°C on 01, 02, 03 with internal programming resistors and on 5V thru 150 V units.

Remote Programming

- External Resistor Nominal 1000 ohms/volt output. Downward programming to voltages less than 1.0 volt must be accomplished in two steps; first, from original voltage value to 1.0 volt, and then from 1.0 volt to final desired value.
- Programming Voltage One-to-one voltage change.
- Remote Sensing Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 105-127 or 210-254 volts AC at 47-440 Hz. Standard LDS-Y power supplies are factory wired for 105-127 volt input, but can be rewired for 210-254 volt input. See figure 8 and schematic diagram for rewiring of AC input. For input power see table I. Ratings apply for 57-63 Hz input. For 47-53 Hz or 63-440 Hz input consult factory. Where applicable, regulatory agency approval applies only for input voltages up to 250VAC.

OVERLOAD PROTECTION

- Thermal Thermostat, resets automatically when over temperature condition is eliminated.
- Electrical Automatic electronic current limiting circuit, limits output current to a safe value. Automatic current limiting protects the load and power supply when external overloads and direct shorts occur.

OVERVOLTAGE PROTECTION — Model LDS-Y-5-OV includes a fixed built-in overvoltage protection circuit which prevents damage to the load caused by excessive power supply output voltage. Overvoltage protection range varies between 6.4 and 6.8 volts D.C.

INPUT AND OUTPUT CONNECTIONS — Refer to figure 12 for location.

- AC input Screw terminals on printed circuit board
- Ground 6-32 stud on printed circuit board
- DC output Screw terminals on printed circuit board
- Sensing Screw terminals on printed circuit board

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 60°C ambient with corresponding load current rating for all modes of operation.

STORAGE TEMPERATURE (non operating) — -55°C to +85°C

TRANSFORMER — MIL-T-27C, Grade 6; electrostatic shield; 4,000 VAC input/output isolation.

FUNGUS — All LDS-Y power supplies are fungus inert.

DC OUTPUT CONTROL — Screwdriver voltage adjust control permits adjustment of DC output voltage. Refer to figure 12 for location of control. On wide range models, an adjustable range of 1% V_o max to V_o max is provided by the internal programming potentiometer; programming over the full 0 to V_o max range can be accomplished by remote programming.

PHYSICAL DATA

Size 5-5/8" x 4-7/8" x 2-5/8" with cover in place
5-5/8" x 4-7/8" x 2-1/2" with cover removed

Weight 5-1/2 lbs. net; 6 lbs. shipping

Finish Gray, FED. STD. 595 No. 26081

MOUNTING — Three surfaces, two with tapped mounting holes and one with clearance mounting holes, can be utilized for mounting this unit. Two mounting surfaces on LDS-Y-01 thru 03 and LDS-Y-48 when used with optional LH OV series overvoltage protectors. Air circulation is required when unit is mounted in confined areas. Refer to figure 12 for mounting details.

ACCESSORIES

Overvoltage Protector Internally mounted L-6 OV series Overvoltage Protectors for LDS-Y-5 thru LDS-Y-28 and LH OV series adjustable overvoltage protectors for LDS-Y-01 through LDS-Y-03 and LDS-Y-48 are available.

Use a 3.0A, 250V Norm-Blo fuse (not supplied in unit) in AC input line for 110 VAC input.
Use a 1.5A, 250V Norm-Blo fuse in AC input line for 220 VAC input.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When load exceeds 105% of 40°C rating, both voltage and current decrease until voltage reaches zero and the current at short circuit equals approximately 40 percent or less of the rated current. (For wide range models 01, 02, and 03, short circuit current equals the rated current)

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminals provided. Apply input power to AC terminals; always connect the ungrounded (hot) lead to terminal indicated in figures 3 through 9.

The supply positive terminal is brought out to terminal +V. The supply negative terminal is brought out to terminal -V. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks as shown in figure 11. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. Local sensing is the connection suitable for application with relatively constant load or for applications with short power output leads.

Remote Sensing Connection, Figure 4. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf, elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at 1000 ohms/volt change and shorting-type switch as shown in Figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation. On wide range models, downward programming to voltages less than 1 volt must be accomplished in two steps; first, from original voltage value to 1.0 volt, and then from 1.0 volt to final desired value.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 2 ma. minimum.

Alternatively, when supplies with less than 2 ma. reverse current capability are used, a resistor capable of drawing 2 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation, Figure 7.

The voltage capability of LDS-Y power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of "Specifications and Features", for power supply current and voltage ratings.

Connections For Parallel Operation, Figure 9 (Applicable only to LDS-Y-01 — LDS-Y-03)

The current capability of LDS-Y power supplies can be extended by parallel operation of LDS-Y power supplies of equal* voltage capacities voltage capacities.

Units "M" and "S" are shown connected for parallel operation in figures 9A and 9B. One power supply, designated the "M" unit, controls its own output as well as the output of the second power supply, designated the "S" unit.

*For applications using supplies of unequal voltage ratings, consult factory for details of operation.

Unit S operates to regulate its current in a ratio to that of the M unit by comparing the current in its internal sampling resistor with that current sampled by the master internal sampling resistor.

CAUTION: Always set "S" unit voltage control to zero (fully CCW) during parallel operation, otherwise excessive current will flow through "M" unit voltage control.

MOUNTING OF L-6-OV OVERVOLTAGE PROTECTOR ACCESSORY

Mount overvoltage protector to the power supply using two 6-32 x 1/2" pan head screws, two #6 flat washers, one #6 split lockwasher, one #6 internal tooth solder lug, and two 6-32 hex nuts. Overvoltage protector case must be insulated from power supply chassis. Use TO-3 insulating wafer coated on both sides with Dow Corning no. 340 silicone grease and transistor mount (Accessories For Electronics Inc. part no. AEM-3HD-WOB or equivalent).

Use a TVM, John Fluke Model 931AB or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output.

ADJUSTMENT OF CALIBRATION CONTROL R105

Whenever R104, R105, R106, R122, R109, R110 or IC101 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R105 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating.

1. Remove AC input power to the supply.
2. Break seal on wiper of R105 from resistor housing.
3. Operate power supply for constant voltage with local sensing, connected as shown in figure 3, with no external load.
4. Turn voltage adjust control until minimum rated output voltage is obtained.
5. Apply load so that output current is 105% of 40°C rating for the unit. It may be necessary to turn R105 CW in order to achieve this value of current.
6. Using a DVM John Fluke 891A or equivalent, observe output voltage while adjusting R105 in CCW direction. Adjust R105 until output voltage begins to decrease.
7. Turn voltage adjust control until maximum rated output voltage is obtained.
8. Increase load. Maximum attainable load current shall not exceed 110% of 40°C rating for the unit.
9. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R105 (R104) to resistor housing.
10. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard Components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description, function, and location, of the part.

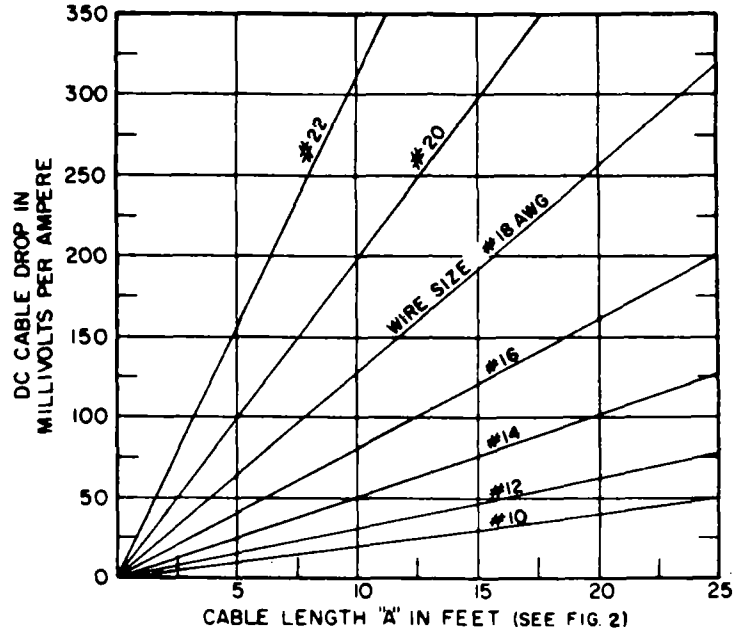


Figure 1. Cable Connection Chart

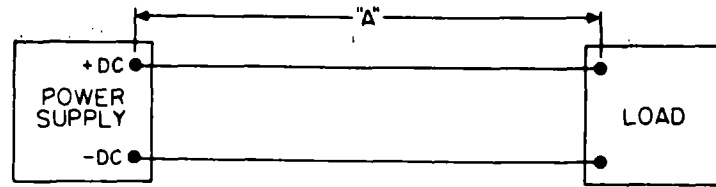
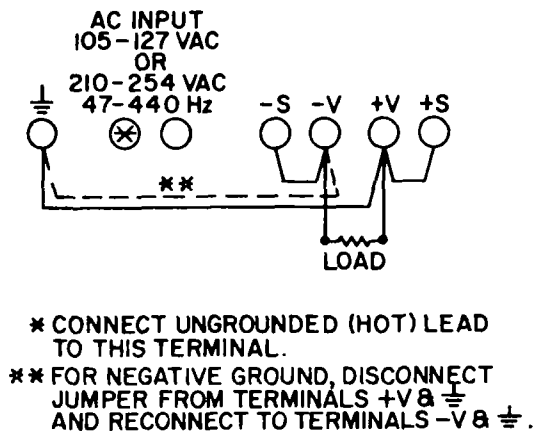
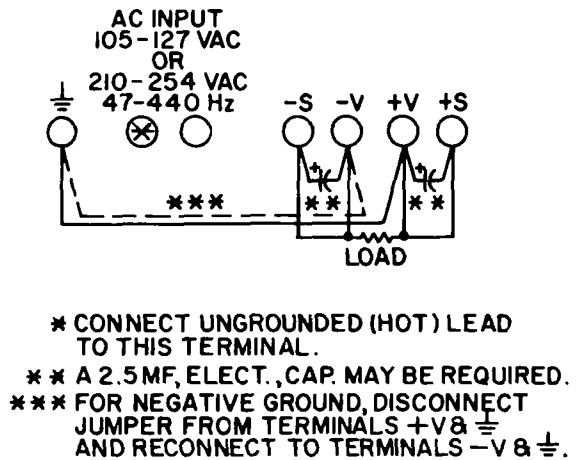


Figure 2. Cable Length "A" in Feet



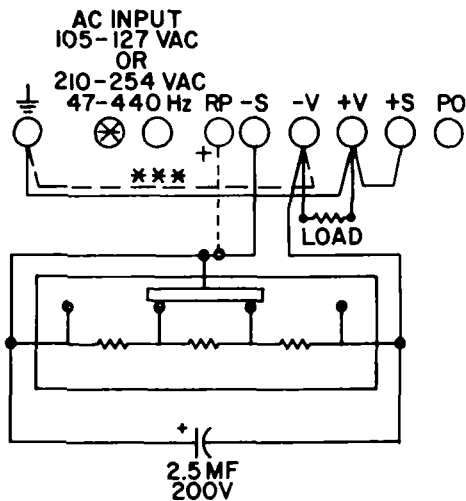
- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 3. Local Sensing Connection.

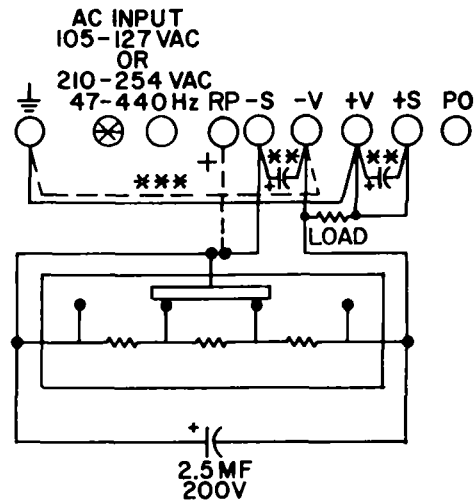


- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 4. Remote Sensing Connection.



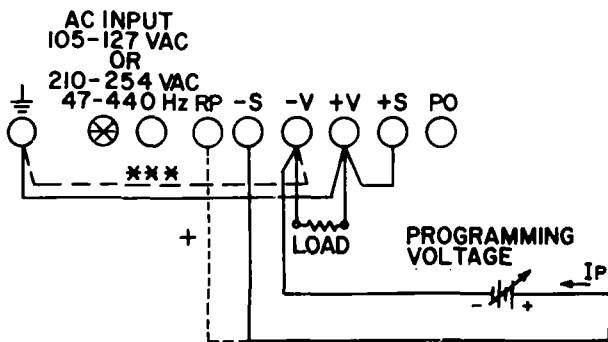
(A) LOCAL SENSING



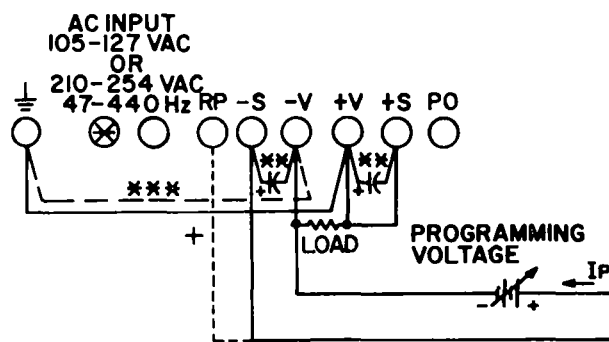
(B) REMOTE SENSING

- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .
- + ON LDS-Y-01,02,03 ONLY, USE TERMINAL RP INSTEAD OF -S; -S IS LEFT OPEN ON THESE MODELS.

Figure 5. Programmed Voltage, With External Resistor.



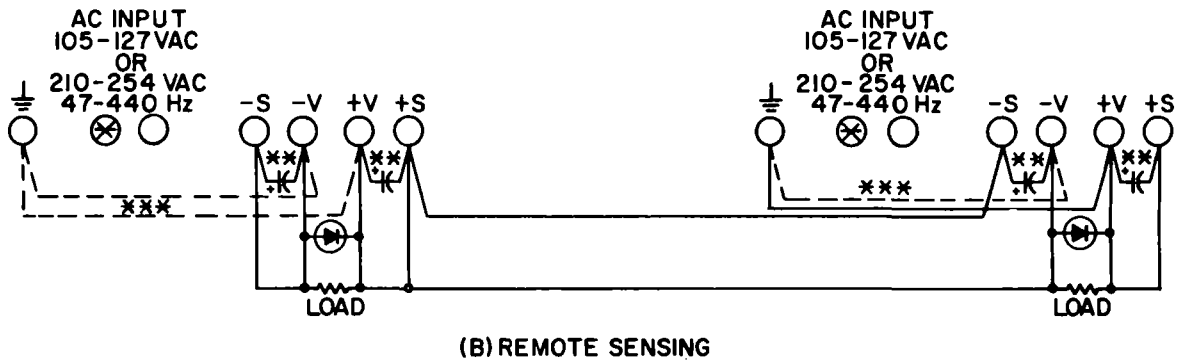
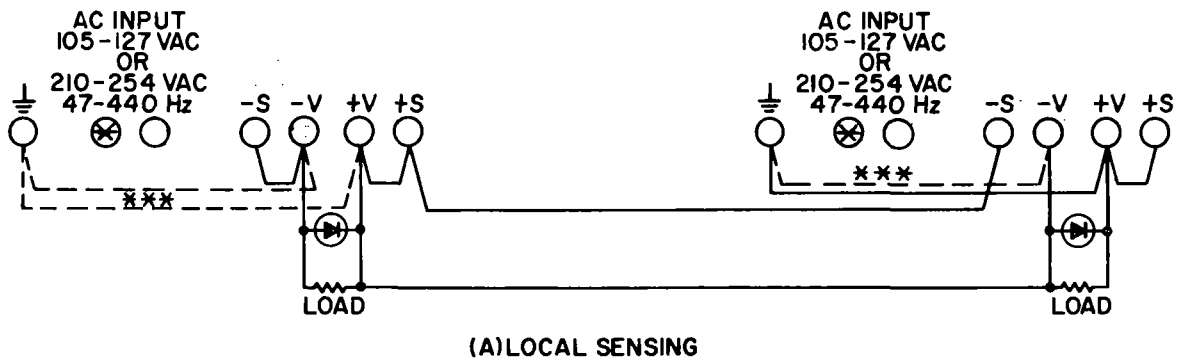
(A) LOCAL SENSING



(B) REMOTE SENSING

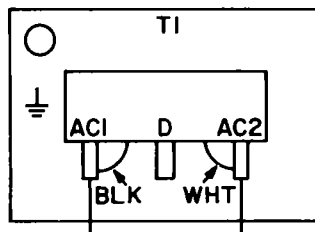
- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .
- + ON LDS-Y-01,02,03 ONLY, USE TERMINAL RP INSTEAD OF -S; -S IS LEFT OPEN ON THESE MODELS.

Figure 6. Programmed Voltage, With External Programming Voltage Source.



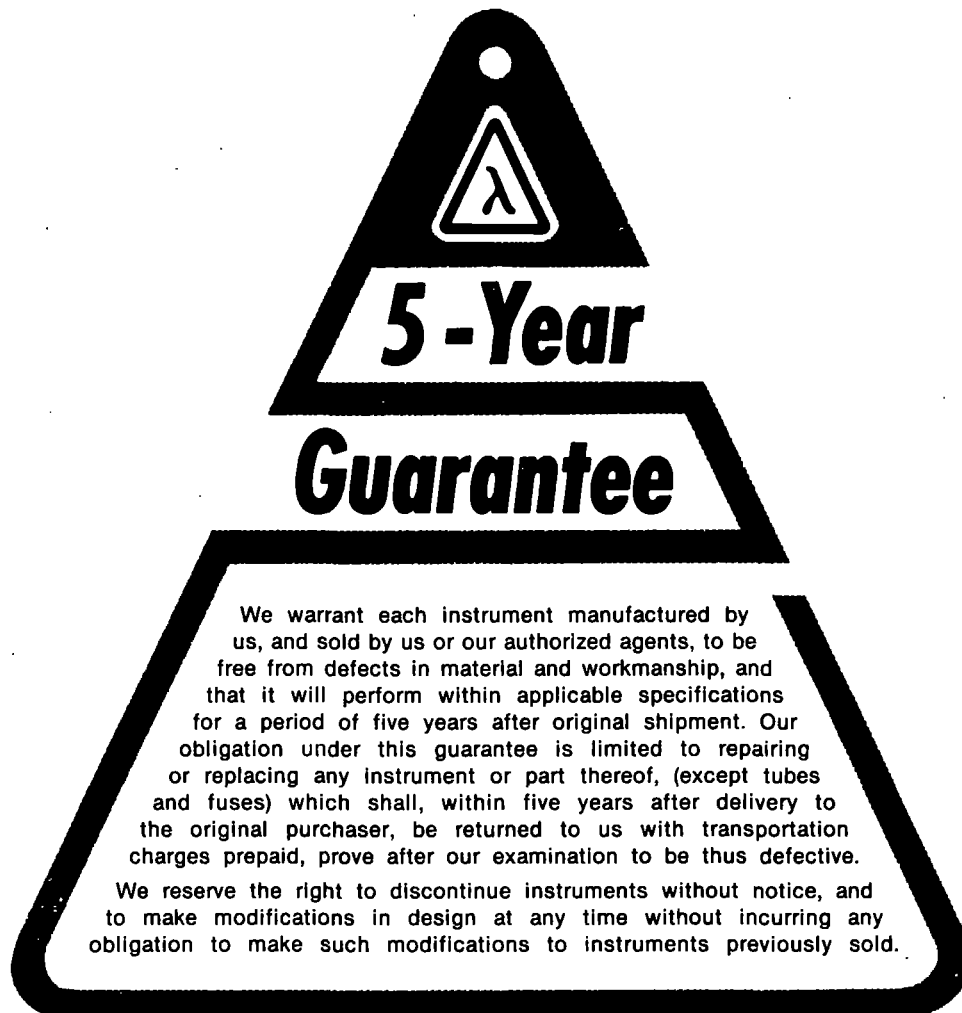
- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.
- *** MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM +V & ⏚ ON RIGHT UNIT AND CONNECT ANY ONE OF THE OTHER JUMPERS AS SHOWN IN DOTTED LINE.

Figure 7. Series Connection.



CONNECTION SHOWN IS FOR 105-127 VAC. FOR 210-254 V INPUT, DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMS AC1 & AC2 AND RECONNECT BOTH LEADS TO TERM D.

Figure 8. Transformer Connections for AC Input Conversion.



L A M B D A ELECTRONICS
515 BROAD HOLLOW ROAD • MELVILLE, L.I., NEW YORK • 516-694-4200

DIVISION of  INSTRUMENTS INC.

INSTRUCTION MANUAL

REGULATED POWER SUPPLIES



LAMBDA ELECTRONICS

MELVILLE, L. I., N. Y.

**INSTRUCTION MANUAL
FOR
REGULATED POWER SUPPLIES**

LDS-P-SERIES

This manual provides instructions intended for the operation of Lambda power supplies, and is not to be reproduced without the written consent of Lambda Electronics. All information contained herein applies to all LDS-P models unless otherwise specified.

LAMBDA ELECTRONICS

MELVILLE, L.I., N.Y.

MAIN PLANT TELEPHONE: (516) 694-4200

IM-LDS-P

TABLE OF CONTENTS

Section	Page
SPECIFICATIONS AND FEATURES	1
OPERATING INSTRUCTIONS	4
Basic Mode of Operation	4
Connections for Operation	4
Supply Load Connections	4
Mounting of Optional Overvoltage Protector Accessories	6
Operation After Protective Device Shutdown	6
MAINTENANCE	6
General	6
Trouble Analysis	6
Checking Transistors and Capacitors	7
Printed Circuit Board Maintenance Techniques	7
Performance Checks	8
Adjustment of Calibration Control R105	8
SERVICE	9
PARTS ORDERING	9

SPECIFICATIONS AND FEATURES

D.C. OUTPUT — Voltage regulated for line and load. See table I for voltage and current ratings.

TABLE I

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS)* AT AMBIENT TEMPERATURE			INPUT POWER (WATTS)**
		40°C	50°	60°C	
LDS-P-5-OV	5 ± 5%	22.0 (20.9)	18.8 (18.0)	15.6 (14.8)	345
LDS-P-12	12 ± 5%	14.0 (13.3)	12.4 (11.8)	10.0 (9.5)	380
LDS-P-15	15 ± 5%	12.0 (11.4)	10.6 (10.0)	8.5 (8.1)	395
LDS-P-20	20 ± 5%	10.0 (9.5)	8.9 (8.5)	7.0 (6.6)	405
LDS-P-24	24 ± 5%	9.0 (8.5)	8.0 (7.6)	6.0 (5.7)	410
LDS-P-28	28 ± 5%	8.0 (7.6)	7.1 (6.7)	5.2 (4.9)	425
LDS-P-48	48 ± 5%	4.5 (4.28)	4.0 (3.8)	3.4 (3.2)	420
LDS-P-01	0 - 7	9.5 (9.0)	8.5 (8.0)	7.5 (7.1)	175
LDS-P-02	0 - 18	4.5 (4.3)	4.0 (3.8)	3.3 (3.1)	170
LDS-P-03	0 - 32	2.7 (2.5)	2.5 (2.4)	2.3 (2.2)	160
LDS-P-100	100 ± 5%	1.6†	1.4†	1.2†	270
LDS-P-120	120 ± 5%	1.4†	1.2†	1.0†	270
LDS-P-150	150 ± 5%	1.1†	0.9†	0.8†	270

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

*Ratings apply for use with cover removed. Use ratings in parentheses when unit is used with cover.

Refer to figure 12 for cover removal.

**With output loaded to full current rating and input voltage 127 volts AC, 60 Hz.

†With or without cover.

REGULATED VOLTAGE OUTPUT

Regulation (Line) 0.005% +0.5 mV for input variations from 105-127, 127-105, 210-254, or 254-210 volts AC.

Regulation (Load) 0.005% +0.5 mV for load variations from no load to full load or full load to no load.

Ripple and Noise 150 μ V rms, 1 mV peak to peak for LDS-P-5-OV thru -48-OV and LDS-P-01, 02, 03; 250 μ V rms, 1 mV peak-to-peak for LDS-P-100, 120, 150 with either positive or negative terminal grounded.

Temperature Coefficient Output change in voltage ±(0.005% +10 μ V)/°C on 01, 02, 03 with external programming resistors; ±(0.01% +10 μ V)/°C on 01, 02, 03 with internal programming resistors and on 5V thru 150V units.

Remote Programming

- External Resistor Nominal 1000 ohms/volt output. Downward programming to voltages less than 1.0 volt must be accomplished in two steps; first, from original voltage value to 1.0 volt, and then from 1.0 volt to final desired value less than 1.0 volt.
- Programming Voltage One-to-one voltage change.
- Remote Sensing Provision is made for remote sensing to eliminate effect of power output lead resistance on DC regulation.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 105-127 or 210-254 volts AC at 47-440 Hz. Standard LDS-P power supplies are factory wired for 105-127 volt input, but can be rewired for 210-254 volt input. See figure 8 and schematic diagram for rewiring of AC input. For input power see table I. Ratings apply for 57-63 Hz input. For 47-53 Hz input, derate 40°C rating by 10%. For 63-440 Hz input consult factory. Use an 8A, 250V, Norm-Blo fuse in AC line (not supplied in unit) for 110 VAC input. Use a 4A, 250V Norm-Blo fuse in AC input line for 220VAC input. Where applicable, regulatory agency approval applies only for input voltages up to 250VAC.

OVERLOAD PROTECTION

- Thermal Thermostat, resets automatically when over temperature condition is eliminated.
- Electrical Automatic electronic current limiting circuit, limits output current to a safe value. Automatic current limiting protects the load and power supply when direct shorts occur.

OVERVOLTAGE PROTECTION — Model LDS-P-5-OV includes a fixed built-in overvoltage protection circuit which prevents damage to the load caused by excessive power supply output voltage. Overvoltage protection range varies between 6.3 and 6.9 volts DC.

ISOLATION RATING — 10 megohm isolation minimum from DC to ground at 1000 VDC.

INPUT AND OUTPUT CONNECTIONS — Refer to figure 12 for location.

- AC input Screw terminals on printed circuit board
- Ground Terminal on transformer
- DC output Screw terminals on printed circuit board; solder turret provided for remote programming operation.
- Sensing Screw terminals on printed circuit board

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to 60°C ambient with corresponding load current rating for all modes of operation.

STORAGE TEMPERATURE (non-operating) — -55°C to +85°C

TRANSFORMER — MIL-T-27C, Grade 6; electrostatic shield; 4,000 VAC input/output isolation.

FUNGUS — All LDS-P power supplies are fungus inert.

DC OUTPUT CONTROL — Screwdriver voltage adjust control permits adjustment of DC output voltage. Refer to figure 12 for location of control. On wide range models, an adjustment range of 1% V_o max to V_o max is provided by the internal programming potentiometer; programming over the full 0 to V_o max range can be accomplished by remote programming.

PHYSICAL DATA

- Size 11" x 4-7/8" x 4-13/32" with or without cover in place
- Weight 14 lbs. net., 15-1/2 lbs. shipping
- Finish Gray, FED. STD. 595 No. 26081

MOUNTING — One surface, with tapped mounting holes, can be utilized for mounting this unit. The supply must be mounted with top side facing up, in horizontal plane.

ACCESSORIES

- Overvoltage Protector Internally mounted L-35-OV-5 series overvoltage protector, standard on 5V unit. Internally mounted L-20-OV series overvoltage protectors optional on LDS-P-12 thru LDS-P-28; overvoltage protector L-35-OV-6 optional on LDS-P-6 and overvoltage protector LMOV-3 optional on model LDS-P-48. LHOV series adjustable overvoltage protector accessory optional for models LDS-P-01 through LDS-P-03.

OPERATING INSTRUCTIONS

BASIC MODE OF OPERATION

This power supply operates as a constant voltage source provided the load current does not exceed the rated value at 40°C. For continuous operation, load current must not exceed the rating for each ambient temperature. When load exceeds 105% of 40°C rating, both voltage and current decrease until voltage reaches zero and the current at short circuit equals approximately 20 percent or less of the rated current. (For wide range models, 01, 02 and 03 short circuit current equals the rated current).

CONNECTIONS FOR OPERATION

NOTE: Make all connections to the unit before applying AC input power.

Ground Connections. The Lambda power supply can be operated either with negative or positive output terminal grounded. Both positive and negative ground connections are shown for all suggested output connections illustrated in this manual.

Connection Terminals. Make all connections to the supply at the terminals provided. Apply input power to AC terminals; always connect the ungrounded (hot) lead to terminal indicated in figures 3 through 9.

The supply positive terminal is brought out to terminal +V. The supply negative terminal is brought out to terminal -V. Recommended wiring of the power supply to the load and selection of wiring is shown in figures 1 through 9. Selection of proper wiring is made on the basis of load requirements. Make all performance checks as shown in figure 11. Connect measuring devices directly to terminals or use the shortest leads possible.

SUPPLY LOAD CONNECTIONS

Connections for Operation as a Constant Voltage Source

The output impedance and regulation of the power supply at the load may change when using the supply as a constant voltage source and connecting leads of practical length are used. To minimize the effect of the output leads on these characteristics, remote sensing is used. Recommended types of supply-load connections with local or remote sensing are described in the following paragraphs.

Refer to figure 1 to determine voltage drop for particular cable length, wire size and current conditions. Lead lengths must be measured from supply terminals to load terminals as shown in figure 2.

Local Sensing Connection, Figure 3. Local sensing is the connection suitable for application with relatively constant load or for applications with short power output leads.

Remote Sensing Connection, Figure 4. Remote sensing provides complete compensation for the DC voltage drops in the connecting cables. Sensing leads should be a twisted pair to minimize AC pick-up. A 2.5 mf, elect., capacitor may be required between output terminals and sense terminals to reduce noise pick-up.

Programmed Voltage Connections, Using External Resistor, Figure 5. Discrete voltage steps can be programmed with a resistance voltage divider valued at 1000 ohms/volt change and shorting-type switch as shown in figure 5. When continuous voltage variations are required, use a variable resistor with the same 1000 ohms/volt ratio in place of the resistive voltage divider and shorting-type switch. Use a low temperature coefficient resistor to assure most stable operation. On wide range models, downward

programming to voltages less than 1.0 volt must be accomplished in two steps: first from original voltage value to 1.0 volt and then from 1.0 volt to final desired value less than 1.0 volt.

Before programming, adjust programming resistor for zero resistance and set voltage adjust control to the minimum rated output voltage. Output voltage of programmed supply will be minimum output voltage plus 1 volt per 1000 ohms.

As shown in figure 5, voltages can be programmed utilizing either local or remote sensing connections, as desired.

Programmed Voltage Connections Using Programming Voltage, Figure 6. The power supply voltage output can be programmed with an externally connected programming power supply. The output voltage change of the programmed supply will maintain a one-to-one ratio with the voltage of the programming supply. If the output voltage control of the programmed supply is set to minimum output voltage, output voltage of programmed supply will be minimum output voltage plus voltage of programming supply.

The programming supply must have a reverse current capability of 2 ma. minimum.

Alternatively, when supplies with less than 2 ma. reverse current capability are used, a resistor capable of drawing 2 ma. at the minimum programming voltage must be connected across the output terminals of the supply. This programming supply must be rated to handle all excess resistor current at the maximum programming voltage.

Connections For Series Operation, Figure 7.

The voltage capability of LDS-P power supplies can be extended by series operation. Figure 7 shows the connections for either local or remote sensing in a series connection where the voltage control of each unit functions independently to control the output.

A diode, having a current carrying capability equal to or greater than the maximum current rating of the supply, must be used and connected as shown in figure 7. The diode blocking voltage should be at least twice the maximum rated output voltage of the supply. See table I, of "Specifications and Features", for power supply current and voltage ratings.

Connections For Parallel Operation, Figure 9 (Applicable only to LDS-P-01 -- LDS-P-03)

The current capability of LDS-P power supplies can be extended by parallel operation of LDS-P power supplies of equal* voltage capacities.

Units "M" and "S" are shown connected for parallel operation in figures 9A and 9B. One power supply, designated the "M" unit, controls its own output as well as the output of the second power supply, designated the "S" unit.

*For applications using supplies of unequal voltage ratings, consult factory for details of operation.

Unit S operates to regulate its current in a ratio to that of the M unit by comparing the current in its internal sampling resistor with that current sampled by the master internal sampling resistor.

CAUTION: Always set "S" unit voltage control to zero (fully CCW) during parallel operation, otherwise excessive current will flow through "M" unit voltage control.

MOUNTING OF OPTIONAL OVERVOLTAGE PROTECTOR ACCESSORIES

Mount L-20-OV and L-35-OV protectors to the power supply using two 6-32 x 3/8" pan-head screws and 2 #6 split lockwashers. Overvoltage protectors LMOV-3 and LHOV series have 6-32 captive screws for mounting the protector to the chassis.

Two 6-32 threaded holes are available on the chassis adjacent to the transformer for mounting the OV protector.

After mounting, connect wires from overvoltage protector +V terminal to +V terminal on printed circuit board and from -V to -V terminal on printed circuit board. For models LDS-P-01 thru LDS-P-03 and LDS-P-48, which use LHOV and LMOV protectors respectively, two tie points, adjacent to the transformer, and provided for use as intermediate connection points between the protector and the unit output voltage terminals. Protector red lead connects to one tie point and unit +V output terminal and protector black lead connects to other tie point and unit -V output terminal.

OPERATION AFTER PROTECTIVE DEVICE SHUTDOWN

Thermostat Shutdown

The thermostat opens the input circuit only when the temperature of the internal heat sink exceeds a maximum safe value. The thermostat will automatically reset when the temperature of the heat sink decreases to a safe operating value. After eliminating the cause(s) for overheating and allowing time for the power supply to cool to a proper temperature, resume operation of the supply.

Overvoltage Shutdown (LDS-P-5-OV only)

When the power supply output voltage increases above the overvoltage limit, the protector will short circuit output of the supply. After eliminating the cause(s) for overvoltage, resume operation of the supply by momentarily interrupting the AC input circuit.

MAINTENANCE

GENERAL

This section describes trouble analysis routine, replacement procedures, calibration and test procedures that are useful for servicing the Lambda LDS-P power supply. Refer to the section on specifications and features for the minimum performance standards.

TROUBLE ANALYSIS

Whenever trouble occurs, systematically check fuse, primary power lines, external circuit elements, and external wiring for malfunction before trouble shooting the equipment. Failures and malfunctions often can be traced to simple causes such as improper jumper and supply-load connections or fuse failure due to metal fatigue.

Use the electrical schematic diagram and block diagram, figure 11 as an aid to locating trouble causes. The schematic diagram contains various circuit voltages that are averages for normal operation. Measure these voltages using the conditions for measurement specified on the schematic diagram. Use measuring probes carefully to avoid causing short circuits and damaging circuits components.

CHECKING TRANSISTORS AND CAPACITORS

Check transistors with an instrument that has a highly limited current capability. Observe proper polarity to avoid error in measurement. The forward transistor resistance is low but never zero; backward resistance is always higher than the forward resistance.

For good transistors, the forward resistance for any function is always greater than zero.

Do not assume trouble is eliminated when only one part is replaced. This is especially true when one transistor fails, causing other transistors to fail. Replacing only one transistor and turning power on, before checking for additional defective components could damage the replaced component.

When soldering semi-conductor devices, wherever possible, hold the lead being soldered with a pair of pliers placed between the component and the solder joint to provide an effective heat sink.

NOTE: The leakage resistance obtained from a simple resistance check of a capacitor is not always an indication of a faulty capacitor. In all cases the capacitors are shunted with resistances, some of which have low values. Only a dead short is a true indication of a shorted capacitor.

PRINTED CIRCUIT BOARD MAINTENANCE TECHNIQUES

1. If foil is intact but not covered with solder, it is a good contact. Do not attempt to cover with solder.
2. Voltage measurements can be made from either side of the board. Use a needle point probe to penetrate to the wiring whenever a protective coating is used on the wiring. A brass probe can be soldered to an alligator clip adapted to the measuring instrument.
3. Wherever possible use a heat sink when soldering transistors.
4. Broken or damaged printed wiring is usually the result of an imperfection, strain or careless soldering. To repair small breaks, tin a short piece of hook-up wire to bridge the break, and holding the wire in place, flow solder along the length of wire so that it becomes part of the circuitry.
5. When unsoldering components from the board never pry or force loose the part; unsolder the component by using the wicking process described below:
 - a) Select a 3/16 inch tinned copper braid for use as a wick; if braid is not available, select AWG No. 14 or No. 16 stranded wire with 1/2 inch insulation removed.
 - b) Dip the wick in liquid rosin flux.
 - c) Place the wick onto the soldered connection and apply soldering iron onto the wick.
 - d) When sufficient amount of solder flows onto the wick, freeing the component, simultaneously remove iron and wick.

PERFORMANCE CHECKS

Check the ripple and regulation of the power supply using the test connection diagram shown in figure 11. Use suggested test equipment or equivalent to obtain accurate results. Refer to SPECIFICATIONS AND FEATURES for minimum performance standards.

Set the differential meter, DC DVM (John Fluke Model 891A or equivalent) to the selected power supply operating voltage. Check the power supply load regulation accuracy while switching from the load to no-load condition. Long load leads should be a twisted pair to minimize AC pick-up.

Use a Variac to vary the line voltage from 105-127 or 127-105 volts AC and check the power supply line regulation accuracy on the DVM differential meter.

Use a TVM, John Fluke Model 893AB or equivalent, to measure rms ripple voltage of the power supply DC output. Use oscilloscope to measure peak-to-peak ripple voltage of the power supply DC output. Connect oscilloscope probes directly across the +V and -V output terminals. Position probes upward and take care to use short probe leads placed away from any other wires.

ADJUSTMENT OF CALIBRATION CONTROL R105

Whenever R104, R105, R106, R124, R1A, R1B, R2B, R3, R4 or IC101 are replaced, and voltage and current indications do not reflect maximum ratings, adjust R105 as follows. The adjustment procedure requires that the power supply is removed from associated equipment, is at an ambient temperature of 25-30°C, and is stabilized and not operating.

1. Remove AC input power to the supply.
2. Break seal on wiper of R105 from resistor housing.
3. Operate power supply for constant voltage with local sensing, connected as shown in figure 3 with no external load.
4. Turn voltage adjust control until minimum rated output voltage is obtained.
5. Apply load so that output current is 105% of 40°C rating for the unit. It may be necessary to turn R105 CW in order to achieve this value of current.
6. Using a DVM John Fluke 891A or equivalent, observe output voltage while adjusting R105 in CCW direction. Adjust R105 until output voltage begins to decrease.
7. Turn voltage adjust control until maximum rated output voltage is obtained.
8. Increase load. Maximum attainable load current shall not exceed 110% of 40°C rating for the unit.
9. After adjustment is completed, remove AC power input to the supply and use glyptol sealant to seal wiper of R105 to resistor housing.
10. After sealing, check setting and repeat adjustment procedure if required.

SERVICE

When additional instructions are required or repair service is desired, contact the nearest Lambda office where trained personnel and complete facilities are ready to assist you.

Please include the power supply model and serial number together with complete details of the problem. On receipt of this information Lambda will supply service data or advise shipping for factory repair service.

All repairs not covered by the warranty will be billed at cost and an estimate forwarded for approval before work is started.

PARTS ORDERING

Standard components and special components used in the Lambda power supply can be obtained from the factory. In case of emergency, critical spare parts are available through any Lambda office.

The following information must be included when ordering parts:

1. Model number and serial number of power supply and purchase date.
2. Lambda part number.
3. Description of part together with circuit designation.
4. If part is not an electronic part, or is not listed, provide a description, function, and location, of the part.

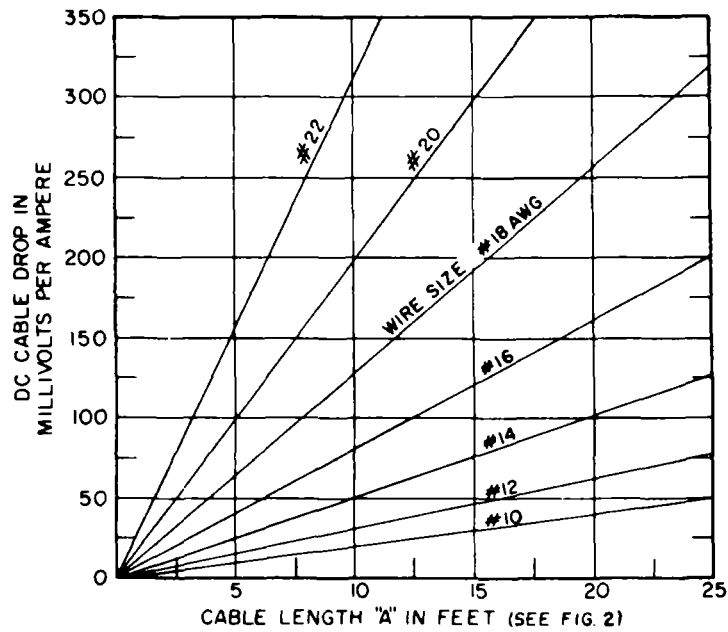


Figure 1. Cable Connection Chart

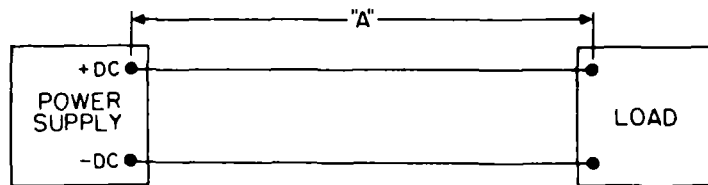
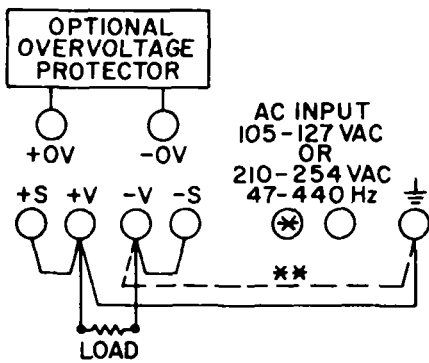
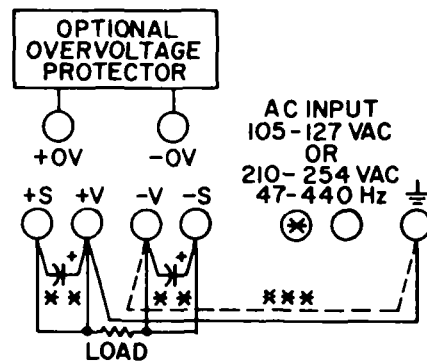


Figure 2. Cable Length "A" in Feet



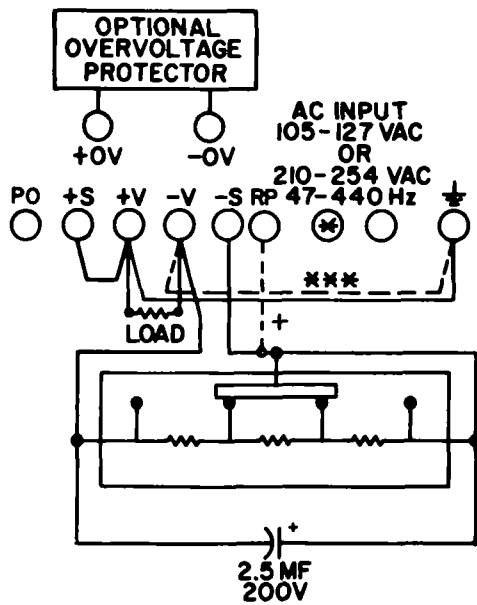
- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL
- ** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 3. Local Sensing Connection.

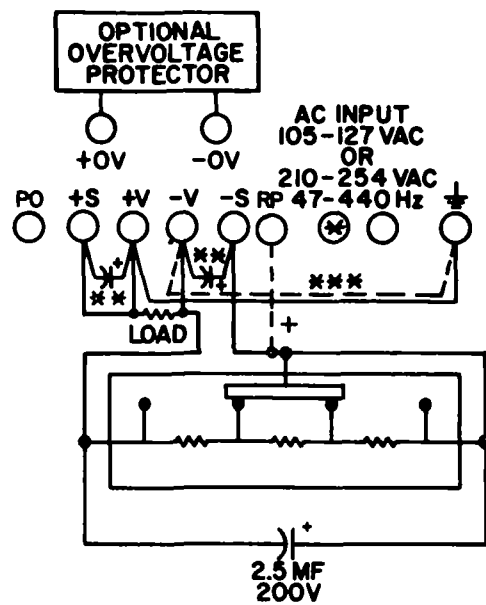


- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

Figure 4. Remote Sensing Connection.



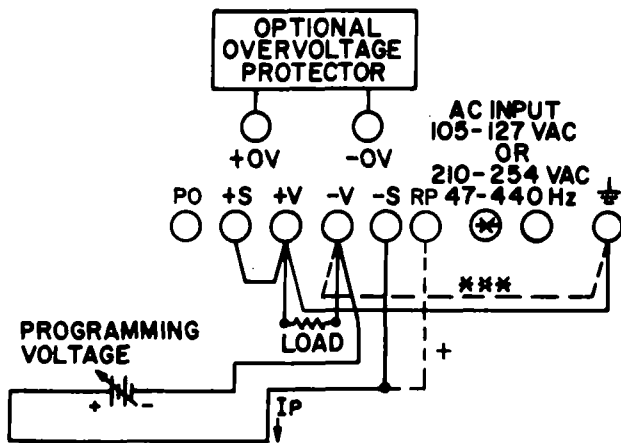
(A) LOCAL SENSING



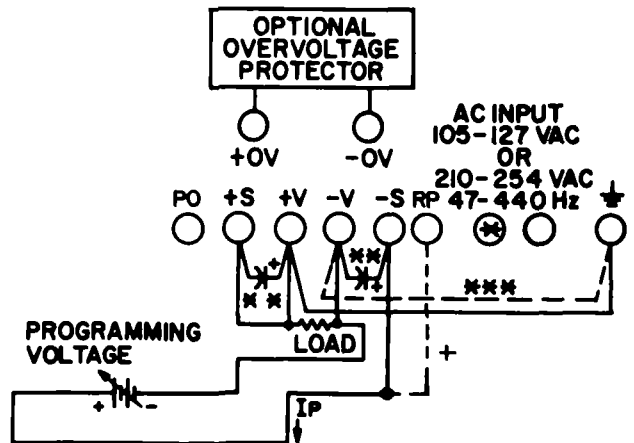
(B) REMOTE SENSING

- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT. CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & ⏏ AND RECONNECT TO TERMINALS -V & ⏏ .
- + LDS-01,02,03 ONLY, USE RP TERMINAL INSTEAD OF -S; -S IS LEFT OPEN.

Figure 5. Programmed Voltage, With External Resistor.



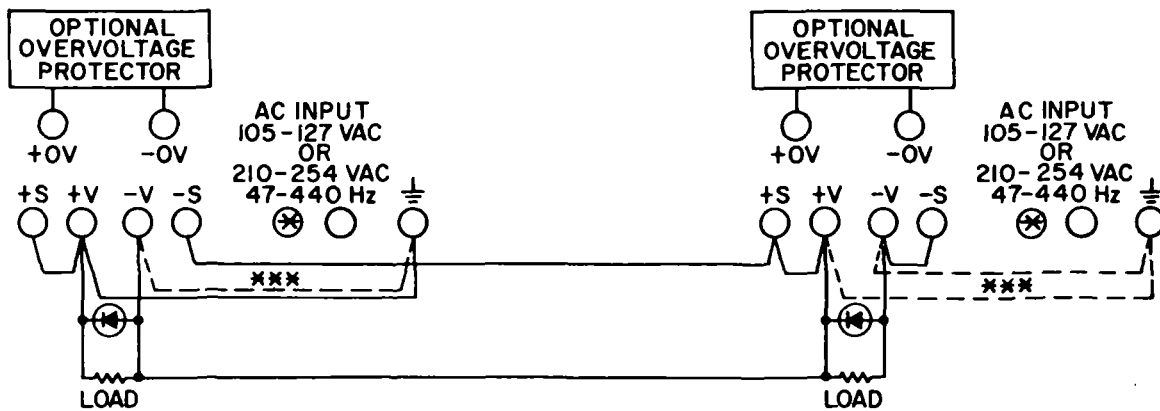
(A) LOCAL SENSING



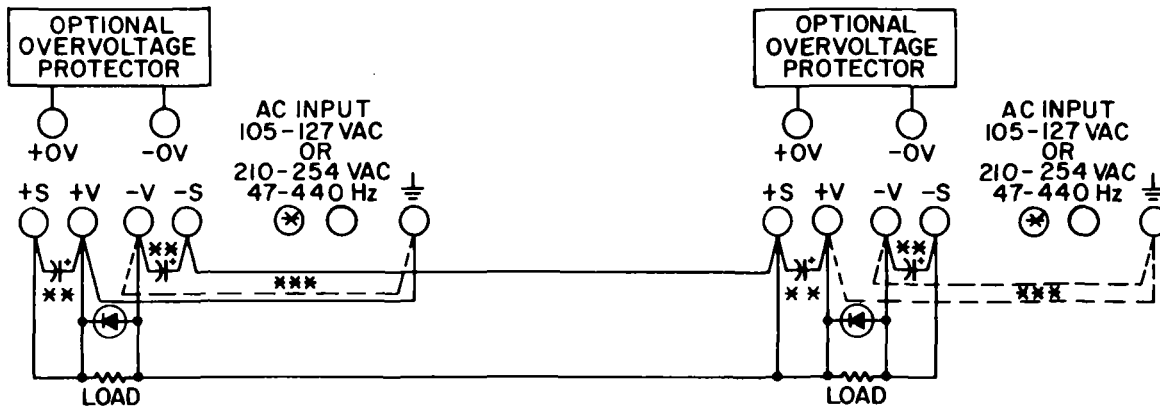
(B) REMOTE SENSING

- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL
- ** A 2.5 MF, ELECT. CAP. MAY BE REQUIRED.
- *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & ⏏ AND RECONNECT TO TERMINALS -V & ⏏ .
- + LDS-01,02,03 ONLY, USE RP TERMINAL INSTEAD OF -S; -S LEFT OPEN.

Figure 6. Programmed Voltage, With External Programming Voltage Source.



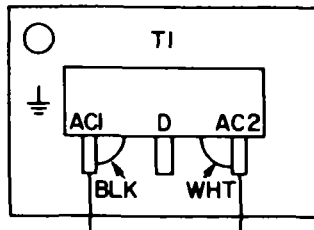
(A) LOCAL SENSING



(B) REMOTE SENSING

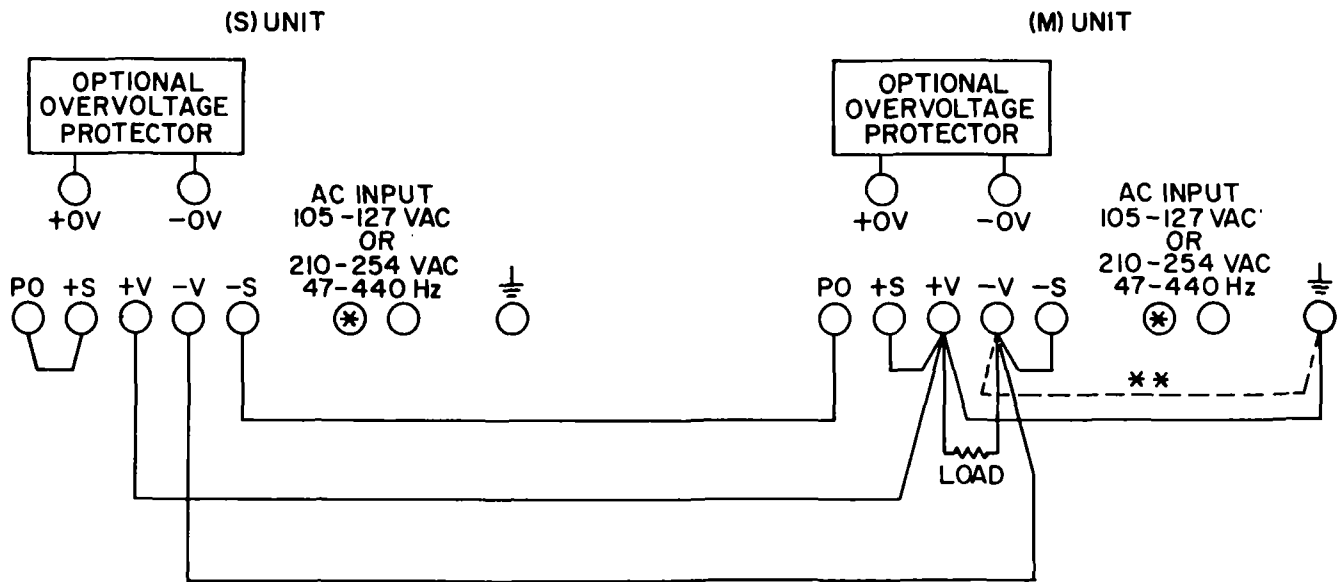
- * CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
- ** A 2.5 MF, ELECT., CAP. MAY BE REQUIRED.
- *** MAKE ONLY ONE GROUND CONNECTION FOR SERIES COMBINATION. TO CHANGE GROUND AS SHOWN, REMOVE JUMPER FROM TERMINALS +V & \perp ON LEFT UNIT AND CONNECT ANY ONE OF THE JUMPERS AS SHOWN IN DOTTED LINE.

Figure 7. Series Connection.



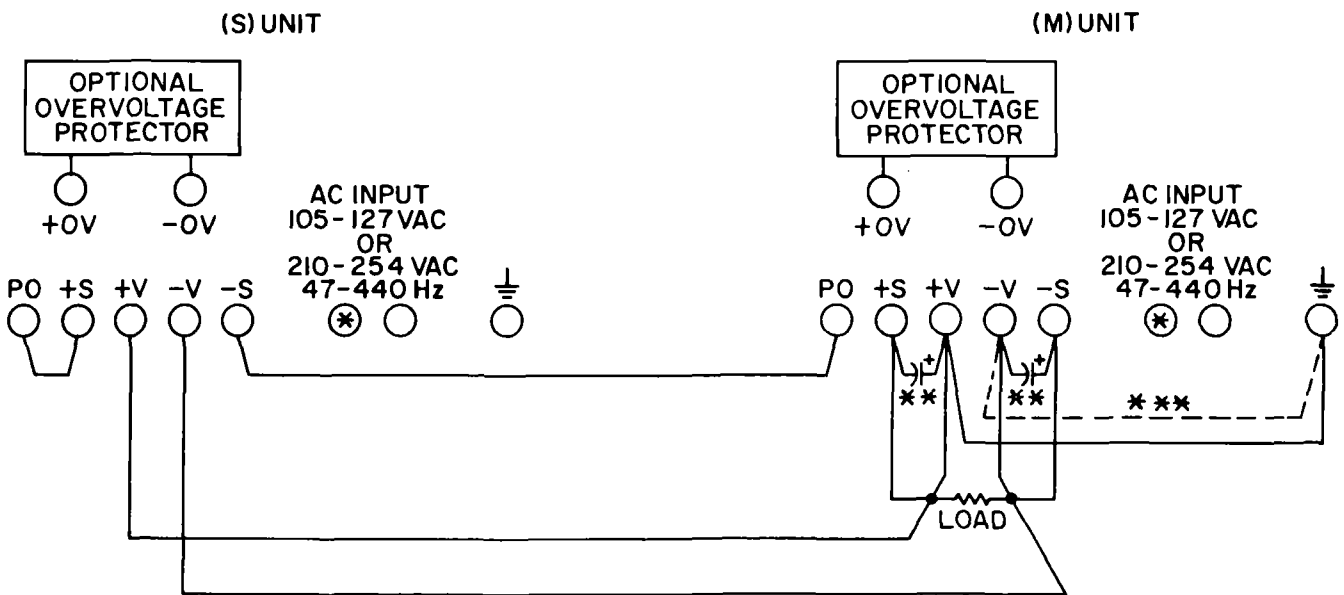
CONNECTION SHOWN IS FOR 105-127 VAC. FOR 210-254V INPUT, DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMS AC1 & AC2 AND RECONNECT BOTH LEADS TO TERM D.

Figure 8. Transformer Connections for AC Input Conversion.



* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
 ** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

(A) LOCAL SENSING



* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL.
 ** A 2.5MF, ELECT., CAP. MAY BE REQUIRED.
 *** FOR NEGATIVE GROUND, DISCONNECT JUMPER FROM TERMINALS +V & \perp AND RECONNECT TO TERMINALS -V & \perp .

(B) REMOTE SENSING

Figure 9. Parallel Connection

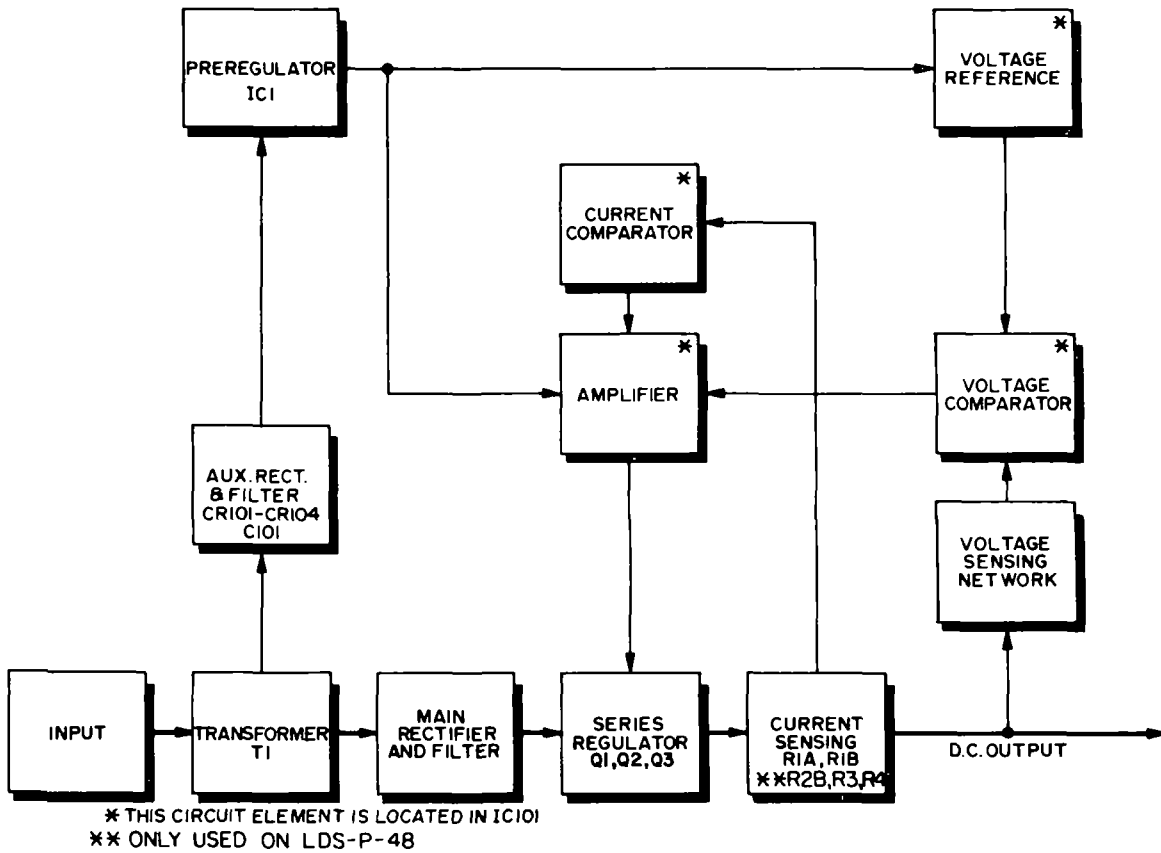
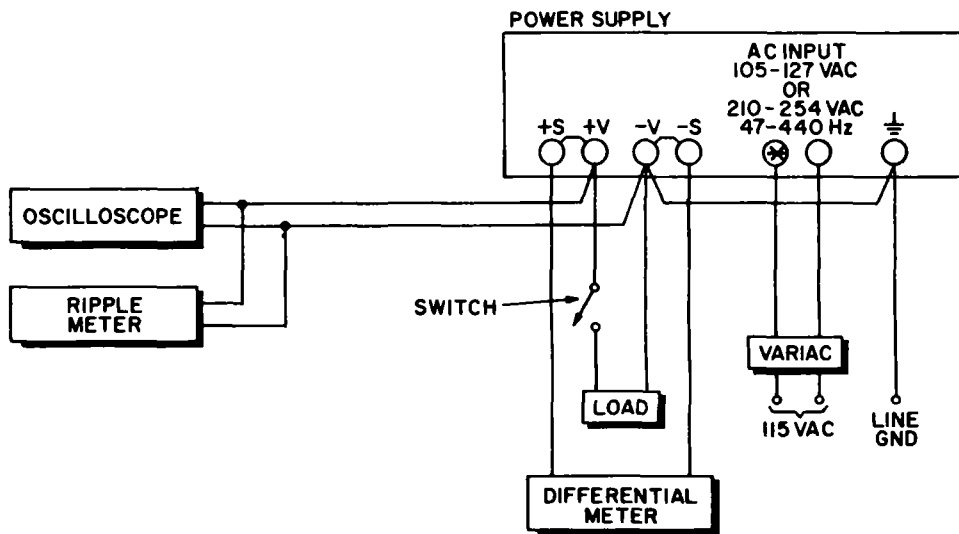


Figure 10. Typical Block Diagram



* CONNECT UNGROUNDED (HOT) LEAD TO THIS TERMINAL

NOTES:

1. REGULATION AND RIPPLE CHECKMETERS MUST NOT BE GROUNDED THROUGH THREE-WIRE LINE CORD TO GROUND.
2. PERFORM CHECKS WITH LOCAL SENSING CONNECTIONS ONLY.
3. FOR RIPPLE MEASUREMENTS DRESS LOAD WIRES CLOSE TO EACH OTHER AND AWAY FROM THE AC-LINE CORD TO PREVENT PICK-UP.

Figure 11. Test Connections for Constant Voltage Performance Checks.

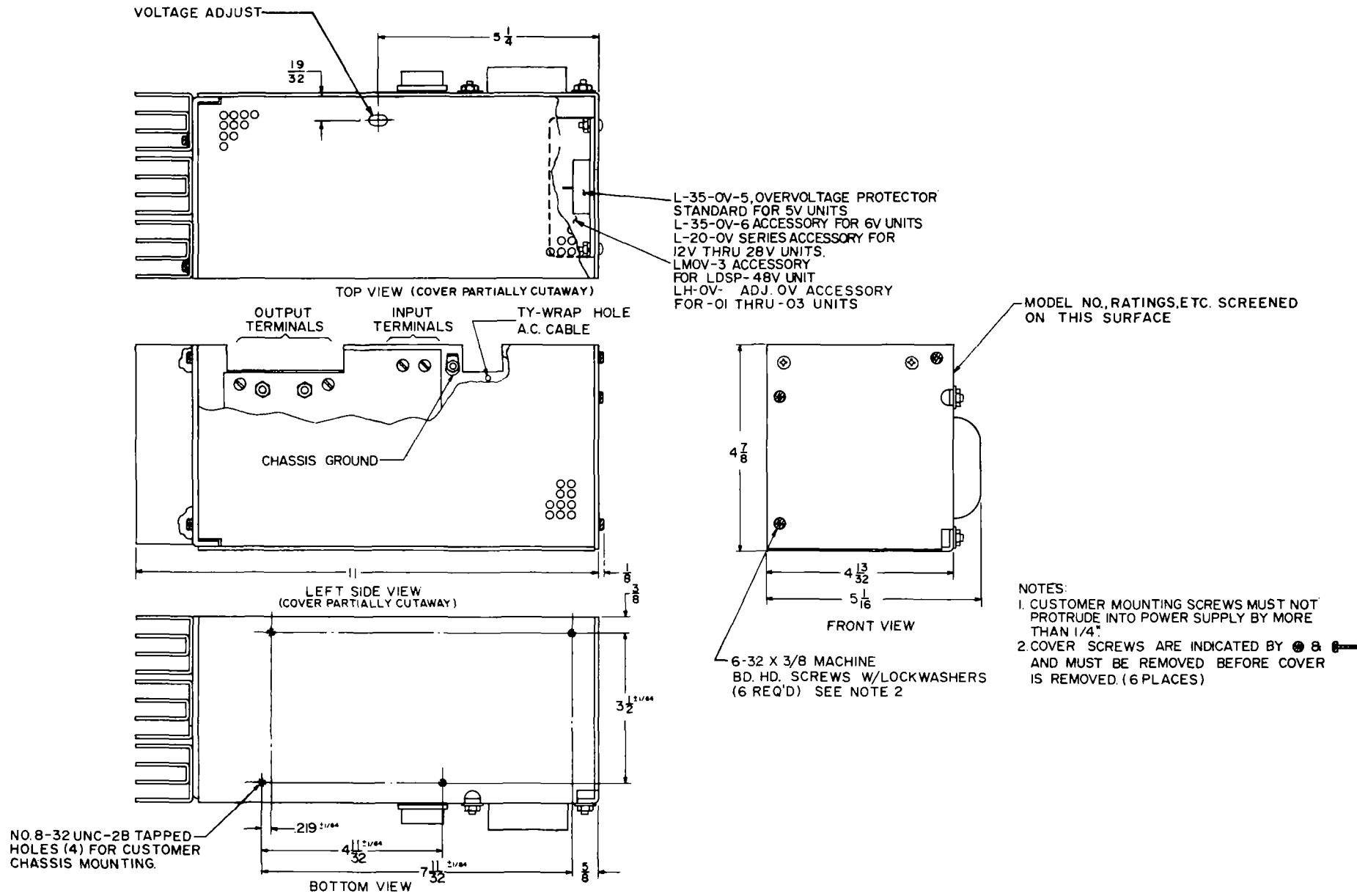
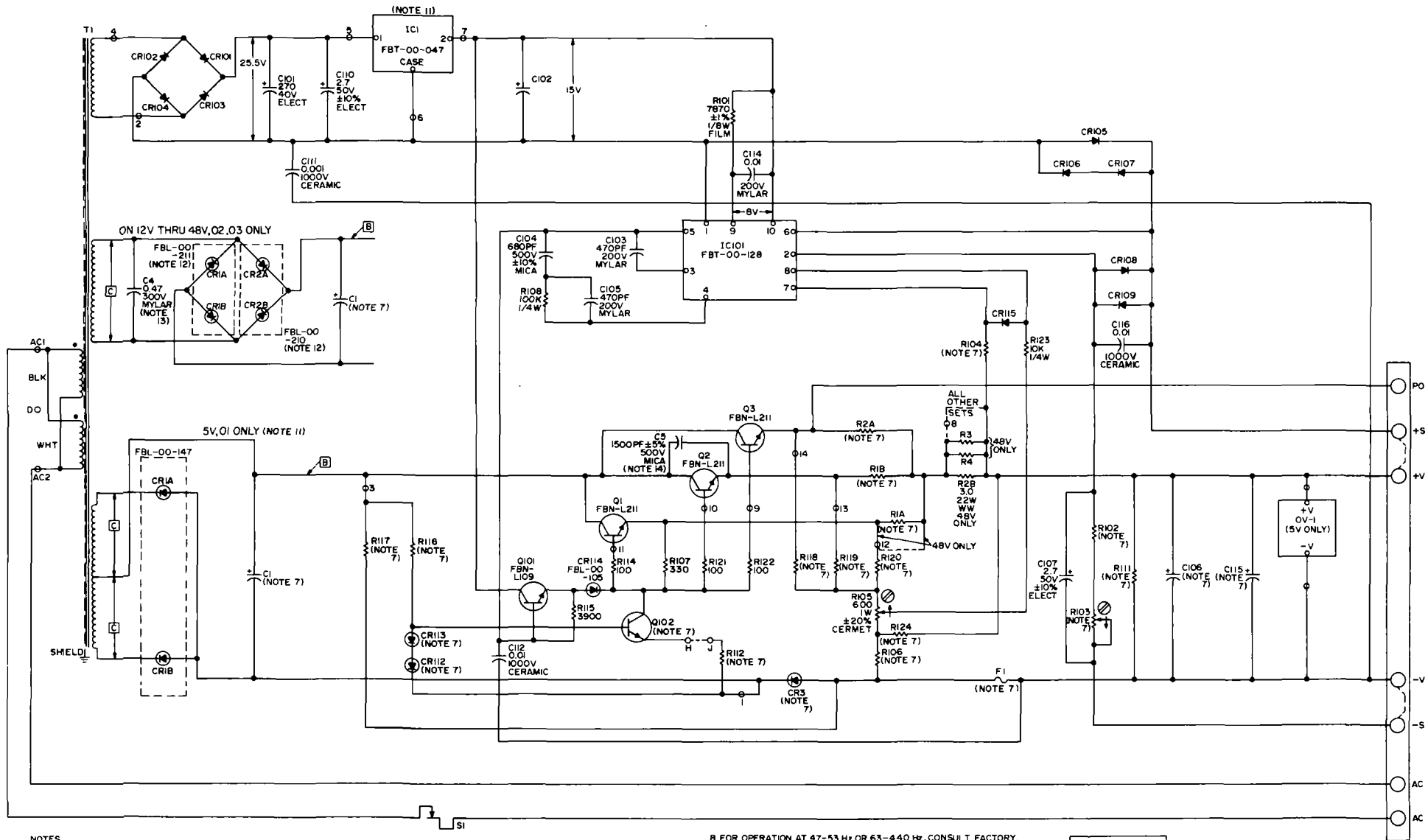


Figure 12. Outline Drawing.



- NOTES
1. RESISTORS ARE 1/2W COMP WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
 2. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
 3. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%, CERAMIC $\pm 20\%$, MYLAR $\pm 10\%$ UNLESS OTHERWISE NOTED.
 4. RESISTOR TOLERANCES: COMP. $\pm 10\%$, WIREWOUND $\pm 5\%$, FILM $\pm 1\%$.
 5. SYMBOLS
 INDICATES ACTUAL UNIT MARKING

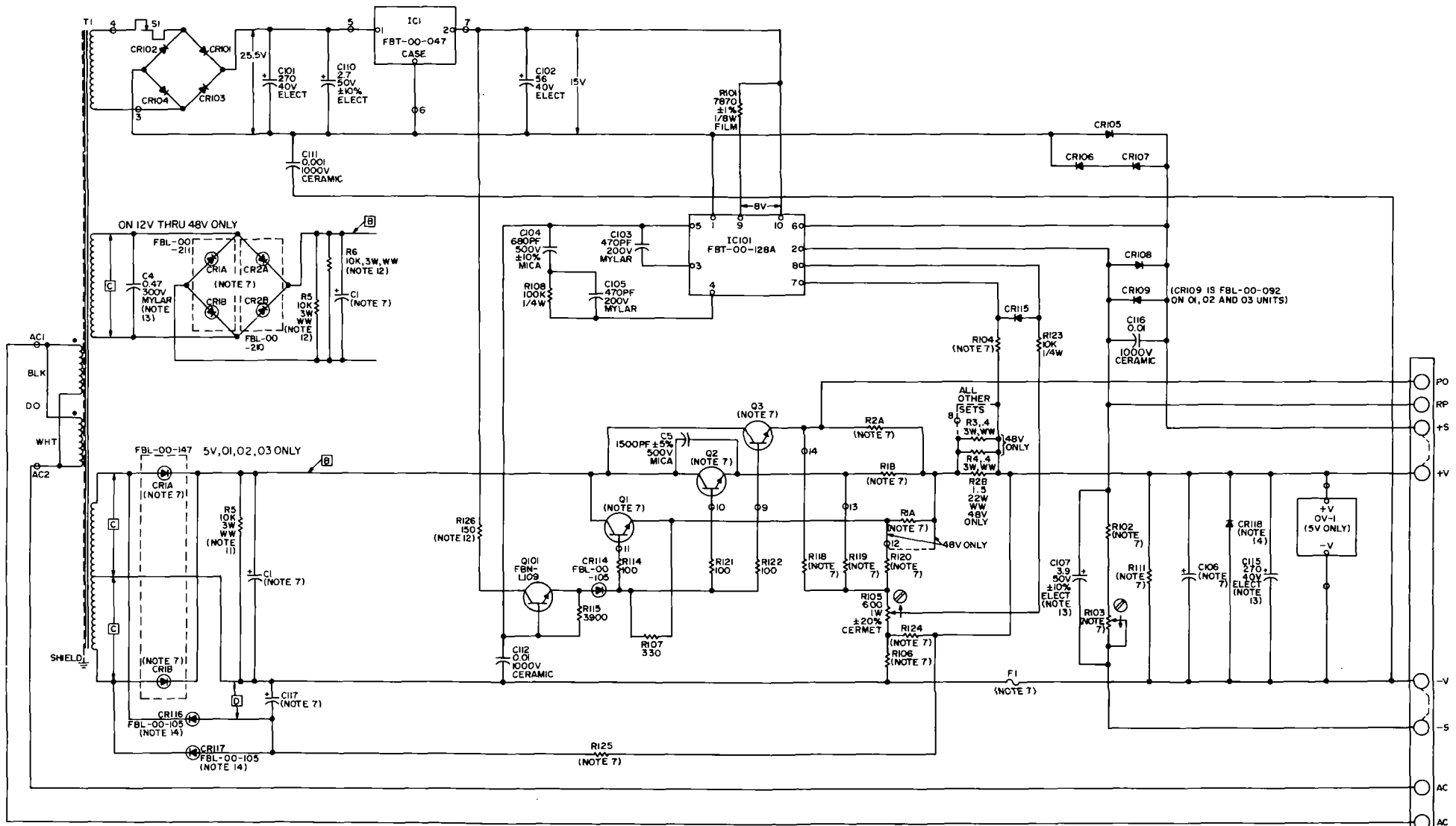
- INDICATES CLOCKWISE ROTATION OF SHAFT.
- SEE INSTRUCTION MANUAL
- INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
- INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
- LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
- 6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
- 7. SEE TABLE 1 FOR COMPONENT VALUES.

8. FOR OPERATION AT 47-53 Hz OR 63-440 Hz, CONSULT FACTORY.
9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 210-254 VAC INPUT, DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERM.S AC1 & AC2 AND RECONNECT BOTH LEADS TO TERM.D.
10. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS:
 INPUT: 115 VAC, 60 Hz, NOMINAL OUTPUT VOLTAGE, NO LOAD.
 +S AND +V SHORTED, -S AND -V SHORTED. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTME TER BETWEEN -S AND INDICATED POINT'S UNLESS OTHERWISE NOTED.
11. IC1 WAS FBT-00-131 ON UNITS WITH SERIAL NO. PREFIX A.
12. CR1A, 1B WAS FBL-00-147 AND CR2A, 2B WAS FBL-00-146 ON UNITS WITH SERIAL NO. PREFIXES A-B.
13. C4 ONLY USED ON UNITS WITH SERIAL NO. PREFIXES A-C.
14. C5 NOT USED ON UNITS WITH SERIAL NO. PREFIXES A-D.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES A-E

SCHEMATIC DIAGRAM
 REGULATED POWER SUPPLY
 LDS-P SERIES

 LAMBDA
 ELECTRONICS
 MELVILLE, NEW YORK
 DIVISION OF INSTRUMENTS INC.



NOTES

1. RESISTORS ARE 1/2W COMP WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
2. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
3. CAPACITOR TOLERANCES: ELECTROLYTIC -10+100%, CERAMIC ±20%, MYLAR ±10% UNLESS OTHERWISE NOTED.
4. RESISTOR TOLERANCES: COMP ±10%, WIRE WOUND ±5%, FILM ±1%.
5. SYMBOLS
 INDICATES ACTUAL UNIT MARKING

- ↓ INDICATES CLOCKWISE ROTATION OF SHAFT.
- * SEE INSTRUCTION MANUAL
- INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
- ⊗ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
- ⊕ LAMBDA PART NO. FBL-00-030; USE IN4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
- 6. DESIGNATIONS ARE LAMBDA PART NUMBERS.
- 7. SEE TABLE 1 FOR COMPONENT VALUES.

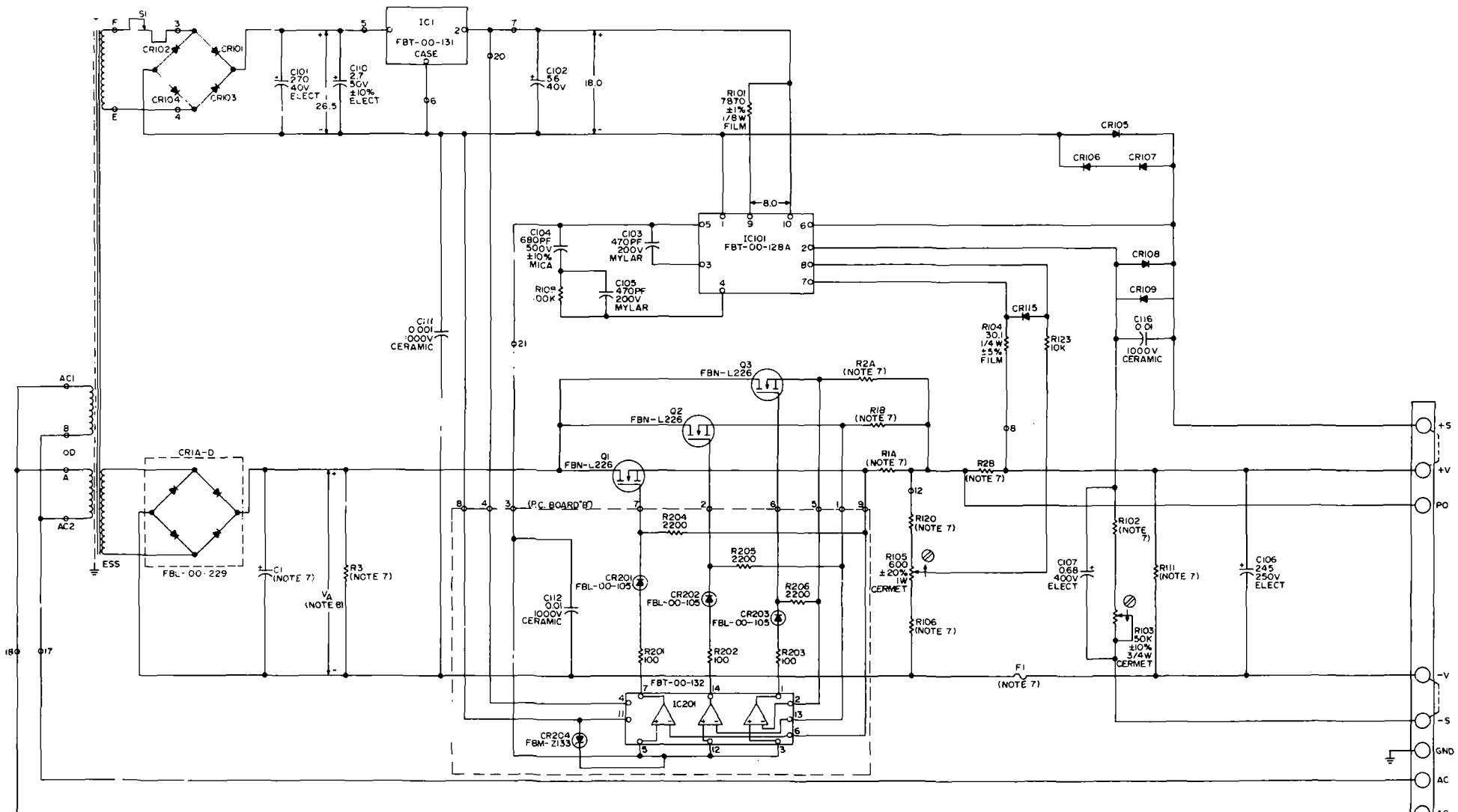
8. FOR OPERATION AT 47-53 Hz OR 63-440 Hz, CONSULT FACTORY.
9. T1 PRIMARY CONNECTION SHOWN IS FOR 105-127 VAC INPUT. FOR 210-254 VAC INPUT: DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERM'S. AC1 & AC2 AND RECONNECT BOTH LEADS TO TERM.D.
10. CONDITIONS FOR CIRCUIT POINT MEASUREMENTS:
 INPUT: 115 VAC, 60Hz. NOMINAL OUTPUT VOLTAGE, NO LOAD, +S AND +V SHORTED, -S AND -V SHORTED. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLTMETER BETWEEN -S AND INDICATED POINTS UNLESS OTHERWISE NOTED.
11. RS ONLY USED ON O3 MODELS; NOT USED ON O3 MODELS WITH SERIAL NO. PREFIXES A-H.
12. RS AND RS ONLY USED ON 48V MODELS; NOT USED ON 48V MODELS WITH SERIAL NO. PREFIXES A-H; R126 NOT USED ON UNITS WITH SERIAL NO. PREFIXES A-H.
13. ON 48V UNIT: C107 IS 2.5 MF -15 +75% 100 VDC; C115 IS 100 MF 85 VDC; C4 IS ONLY USED ON 48V UNIT
14. CR116, CR117, CR118 ONLY USED ON 01, 02 AND 03 UNITS.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO. PREFIXES F-K.

SCHEMATIC DIAGRAM
 REGULATED POWER SUPPLY
 LOS-P SERIES

LAMBDA
 ELECTRONICS
 MELVILLE, NEW YORK

DIVISION OF INSTRUMENTS INC.



- NOTES
1. RESISTORS ARE 1/4W COMP WITH VALUES IN OHMS UNLESS OTHERWISE NOTED.
 2. CAPACITOR VALUES ARE IN MICROFARADS UNLESS OTHERWISE NOTED.
 3. CAPACITOR TOLERANCES: ELECTROLYTIC - $\pm 100\%$, CERAMIC $\pm 20\%$, MYLAR $\pm 10\%$ UNLESS OTHERWISE NOTED.
 4. RESISTOR TOLERANCES: COMP. $\pm 10\%$, W/REWOUND $\pm 5\%$, FILM $\pm 1\%$ UNLESS OTHERWISE NOTED.
 5. SYMBOLS
 - ⊥ INDICATES ACTUAL UNIT MARKING

- ⊥ INDICATES CONNECTION TO CHASSIS
- ↻ INDICATES CLOCKWISE ROTATION OF SHAFT.
- * SEE INSTRUCTION MANUAL
- ⊙ INDICATES TERMINAL ON PRINTED WIRING BOARD OR TERMINAL BOARD.
- ⊕ INDICATES ADJUSTMENT OR CALIBRATION CONTROL.
- ⊖ LAMBDA PART NO. FBL-00-030; USE IN 4002 DIODE REPLACEMENT UNLESS OTHERWISE NOTED
- 6. DESIGNATIONS ARE LAMBDA PART NUMBERS
- 7. SEE TABLE II FOR COMPONENT VALUES.

8. SEE TABLE II FOR VOLTAGES

TABLE II	
MODEL	V _A
LDS-P-100	144.5 VDC
LDS-P-120	174.25 VDC
LDS-P-150	216.00 VDC

CONDITIONS FOR CIRCUIT POINT MEASUREMENTS
 INPUT: 115 VAC, 60 HZ
 INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE DC UNLESS OTHERWISE NOTED. DC MEASUREMENTS TAKEN WITH 20,000 OHMS/VOLT VOLTMETER BETWEEN +S AND INDICATED POINTS UNLESS NOTED OTHERWISE.

THIS SCHEMATIC APPLIES TO UNITS BEARING SERIAL NO PREFIXES A-K

SCHEMATIC DIAGRAM
 REGULATED POWER SUPPLY
 LDS-P-100,120,150
LAMBDA
 ELECTRONICS
 MELVILLE, NEW YORK
 DIVISION OF VACO INSTRUMENTS INC.

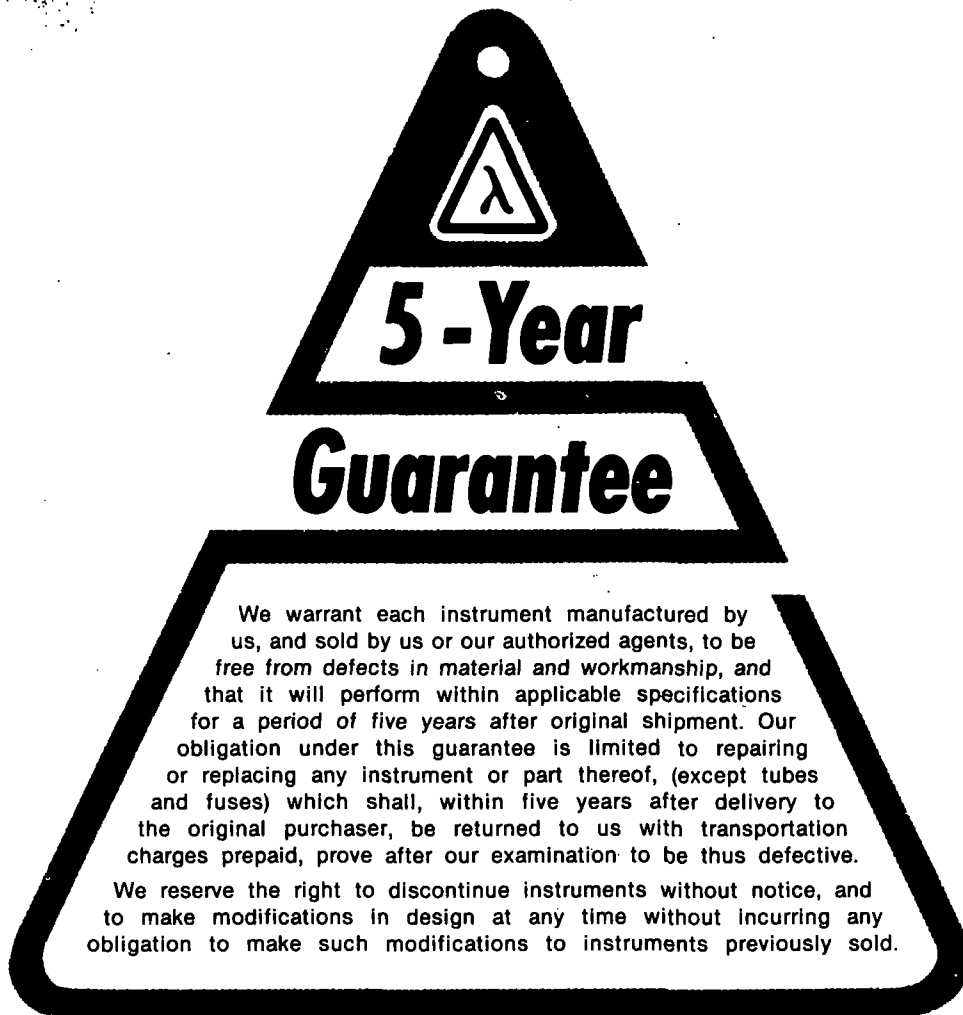
TABLE II
SCHEMATIC DATA REFERENCES
MODELS LDS-P-5-0V — LDS-P-48; LDS-P-01 — LDS-P-03; LPS-P-100 — LDS-P-150

MODEL	Schematic Voltage Measurements			Schematic Components																
	A (VDC)	B (VDC)	C (VRMS)	C1 -10 +100% ELECT	C106 -10+100% ELECT	C117 -10 +100% ELECT	CR1A,B *FBL- 00-	CR2A,B *FBL- 00-	F1 250V	Q1, Q2 Q3 *FBN-	R1A,R1B R2A **R2B ±5%, 22W CTR-TAP	R102 ±1% 1/4W FILM	R102+ ±1% 1/4W FILM	R103 ±1% 3/4W CERMET	R104 ±1% 1/4W FILM	R106 ±1% 1/4W FILM	R111 ±10% 2W COMP	R118, R119, R120 ±10% 1/2W COMP	R124 ±5% WW	
LDS-P-5-0V	14.6	14.6	10.5 ±.1	65,000 MF -10 +50% 15V	3,500 MF 15V	NOT USED	147		30A 125V	L164	0.20	3,880	4,320	1,000	27.0 ±5%	1,820	180 1/2W	47	NOT USED	
LDS-P-12	24.9	24.9	18.0 ±.2	32,000 MF -10 +50% 30V	1,700 MF 30V	NOT USED	211	210	30A 125V	L164	0.36	9,090	10,000	5,000	82.5	4,700 ±2%	470	47	NOT USED	
LDS-P-15	29.1	29.1	21.0 ±.2	32,000 MF -10 +50% 30V	1,700 MF 32V	NOT USED	211	210	30A 125V	L164	0.36	11,800	12,900	5,000	64.9	6,800 ±2%	560 1W	47	NOT USED	
LDS-P-20	37.6	37.6	27.1 ±.3	23,000 MF 50V	1,200 MF 45V	NOT USED	211	210	20A	L167	0.60	15,400	15,400	10,000	105.0	6,340	680	47	NOT USED	
LDS-P-24	42.7	42.7	30.8 ±.3	23,000 MF 50V	1,200 MF 45V	NOT USED	211	210	20A	L167	0.60	18,200	20,000	10,000	82.5	6,860	820	47	NOT USED	
LDS-P-28	48.9	48.9	35.3 ±.4	23,000 MF 50V	1,200 MF 45V	NOT USED	211	210	20A	L167	0.60	22,100	23,700	10,000	105.0	11,800	1,000	47	NOT USED	
LDS-P-48	79.1	79.1	57.1 ±.6	9,000 MF 85V	500 MF 75V	NOT USED	142	143	10A	L211	3.0	33,200	40,200	25,000	30.1	13,000	2,200	R118, R119, NOT USED R120 IS JUMP- ERED	NOT USED	
LDS-P-01	15.9	15.9	11.5 ±.1	32,000 MF -10 +50% 30V	1,700 MF 30V	135MF 50V	146	NOT USED	20A	L164	0.60	51 1/2W	51 1/2W	10,000	562.0	NOT USED	NOT USED	15	600 ±3% 3W	
LDS-P-02	31.2	31.2	22.5 ±.2	23,000 MF 50V	1,200 MF 45V	82 MF 60V	210	NOT USED	10A	L167	0.94 16W	150 1/2W	150 1/2W	25,000	374.0	NOT USED	NOT USED	15	1,200 5W	
LDS-P-03	50.0	50.0	36.1 ±.4	9,000 MF 85V	500 MF 75V	50 MF 75V	210	NOT USED	10A	L211	1.50 16W	280 1/2W	280 1/2W	50,000	374.0	NOT USED	NOT USED	15	1,800 7W	
LDS-P-100	—	—	—	1,500 MF 200V	245MF 250V	NOT USED	—	—	5A	—	0.6	73,200	73,200	50,000	30.1	82,000 ±2%	10,000 ±5% 3W, WW	NOT USED	NOT USED	
LDS-P-120	—	—	—	1,500 MF 200V	245 MF 250V	NOT USED	—	—	3A	—	0.6	91,000 ±2%	100,000	50,000	30.1	118,000	10,000 ±5% 3W, WW	NOT USED	NOT USED	
LDS-P-150	—	—	—	1,200 MF 250V	245 MF 250V	NOT USED	—	—	3A	—	0.94 16W	121,000	121,000	50,000	30.1	118,000	16,000 ±5% 5W, WW	NOT USED	NOT USED	

*LAMBDA PART NO.

**R2B ONLY USED ON 48V UNIT

+R102 VALUES FOR MODELS WITH SERIAL NO. PREFIXES A-J



LAMBDA ELECTRONICS INC. 
Lambda Group of Unitech plc

515 BROAD HOLLOW ROAD • MELVILLE, L.I., NEW YORK • 516-694-4200

INSTRUCTION MANUAL

REGULATED POWER SUPPLIES

LOT-W-5152-A, LOT-X-5152-A

SPECIFICATIONS AND FEATURES

DC OUTPUT — Voltage regulated for line and load. For voltage and current ratings see table I below.

TABLE I

MODEL	VOLTAGE RANGE	MAXIMUM CURRENT (AMPS) AT AMBIENT TEMPERATURE		
		40°C	50°C	60°C
LOT-W-5152-A	5±5%	6.0	4.5	3.0
	±12 to ±15	1.0	0.750	0.400
LOT-X-5152-A	5 ±5%	3.0	2.2	1.4
	±12 to ±15	0.500	0.375	0.200

Current range must be chosen to suit the appropriate maximum ambient temperature. Current ratings apply for entire voltage range.

REGULATED VOLTAGE OUTPUT (each output)

Regulation (line)	0.15% for input variations from 105-125, 125-105, 210-250, or 250-210 volts AC.
Regulation (load)	0.15% for load variations from no load to full load or full load to no load.
Ripple and Noise	1.5mV rms, 5mV peak to peak.
Temperature Coefficient	0.03%/°C
Remote Programming (5V output only)	
External Resistor	Nominal 200 ohms/volt output. Use a low temperature coefficient resistor to assure most stable operation.
Programming Voltage	One-to-one voltage change. The programming supply must have a reverse current capability of 6 ma. min.
Remote Sensing	Provision is made for remote sensing to minimize the effect of power output lead resistance on DC regulation. Sensing leads should be a twisted pair to minimize AC pickup. A 2.5 mf, elect., capacitor may be required between output terminals and sense terminals to reduce noise pickup.

OVERSHOOT — No overshoot under conditions of power turn-on, turn-off, or power failure.

AC INPUT — 105-125 or 210-250 volts AC at 47-440 Hz. Standard LOT-W and LOT-X power supplies are factory wired for 105-125 volt input, but are available factory wired for 210-250 volt input. See Figure 1 and schematic diagram for rewiring of AC input. Input power*: 175 Watts (LOT-W) 90 watts (LOT-X). Power factor*: 0.8. Ratings apply for 57-63 Hz input. For 47-53 Hz input derate current 10% for each ambient temperature given in table I. For 63-440 Hz input consult factory.
*With output loaded to full current rating and input voltage 125 volts AC, 60 Hz.

TRACKING (±12 to ±15V output only) — Absolute difference between negative and positive outputs within 2%; 0.2% change for all conditions of line, load, and temperature.

OVERLOAD PROTECTION — Automatic electronic current limiting circuit, limits output current to a safe value, protecting load and power supply when overloads and direct shorts occur.

INPUT AND OUTPUT CONNECTIONS — See outline drawing for location.

AC input	Terminals on transformer
Ground	Terminal on transformer
DC output	Turret terminal on printed circuit board
Sensing	Turret terminal on printed circuit board
Overvoltage Protector	Quick disconnect terminal on printed circuit board with mating connector attached.

OPERATING AMBIENT TEMPERATURE RANGE AND DUTY CYCLE — Continuous duty from 0°C to +60°C ambient with corresponding load current ratings for all modes of operation.

STORAGE TEMPERATURE — -20°C to +85°C

DC OUTPUT CONTROL — Screwdriver voltage adjust controls permit adjustment of DC output voltages. One control simultaneously adjusts the dual (±12 to ±15V) outputs. A separate control is provided for the single, 5V output. See outline drawing for location of controls.

GUARANTEE — 60 day guarantee from date of shipment . . . materials and labor.

PHYSICAL DATA

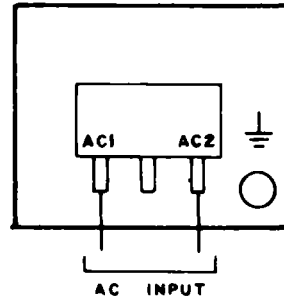
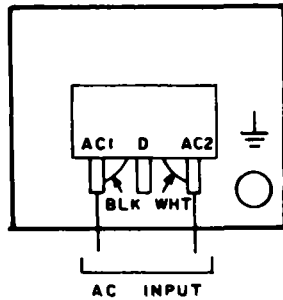
Size	LOT-W: 9" x 4-7/8" x 2-3/4"; LOT-X: 7" x 4-7/8" x 2-3/4"
Weight	LOT-W: 7-3/4 lbs. net, 8-1/4 lbs. shipping; LOT-X: 5-1/2 lbs. net, 6 lbs. shipping.
Finish	Gray, FED. STD. 595 No. 26081

MOUNTING — Three surfaces, each with clearance mounting holes, can be utilized for mounting this unit. Air circulation is required when unit is mounted in confined areas. Refer to Outline Drawing for mounting details.

"J" OPTION — Standard LOT-W and LOT-X power supplies can be obtained for 90-110 VAC, 47-440 Hz input. For 47-53 Hz input derate current 10% for each ambient temperature given in table I. For 63-440 Hz input consult factory.

ACCESSORIES

Overvoltage protector L-12-OV series Overvoltage Protectors are available.



* AC INPUT CONNECTION SHOWN IS FOR 105-125VAC
FOR 210-250V INPUT, DISCONNECT BLK & WHT TRANSFORMER
LEADS FROM TERMS AC1 & AC2 AND RECONNECT BOTH LEADS
TO TERM D

Figure 1. AC Input Connection.

Figure 2. AC Input Connection, "J" Option.

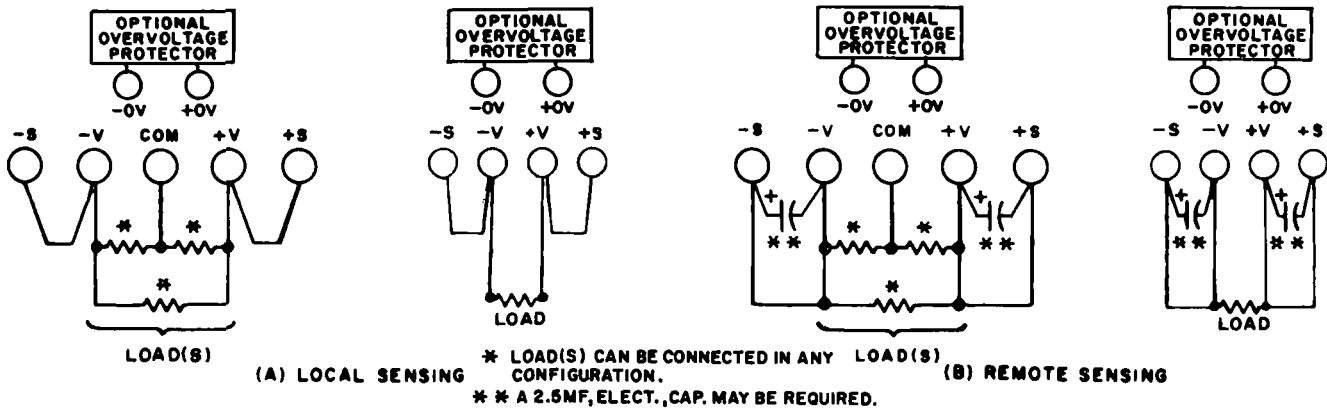


Figure 3. DC Output Connection.

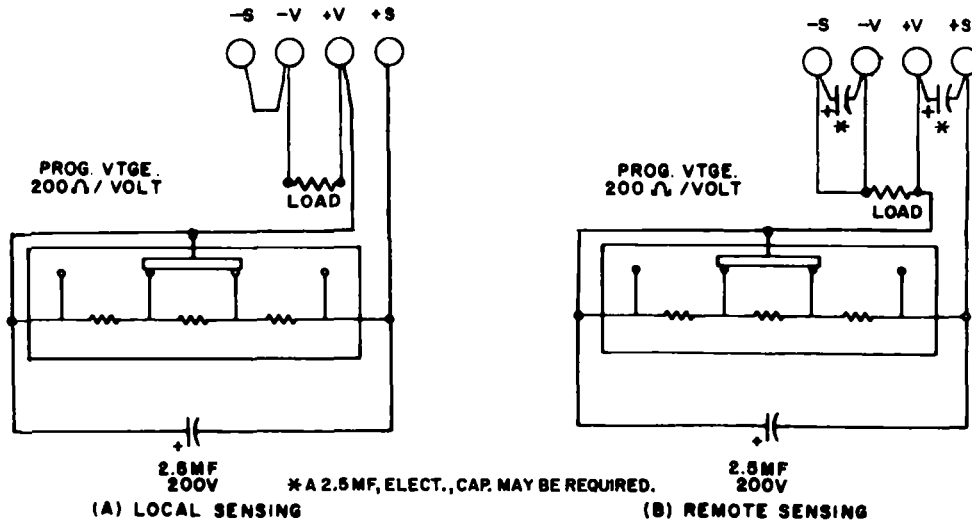
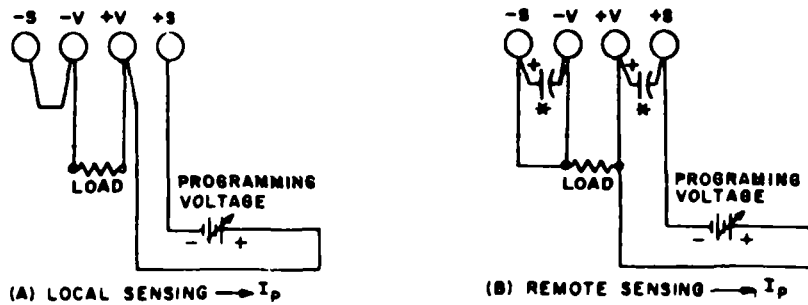
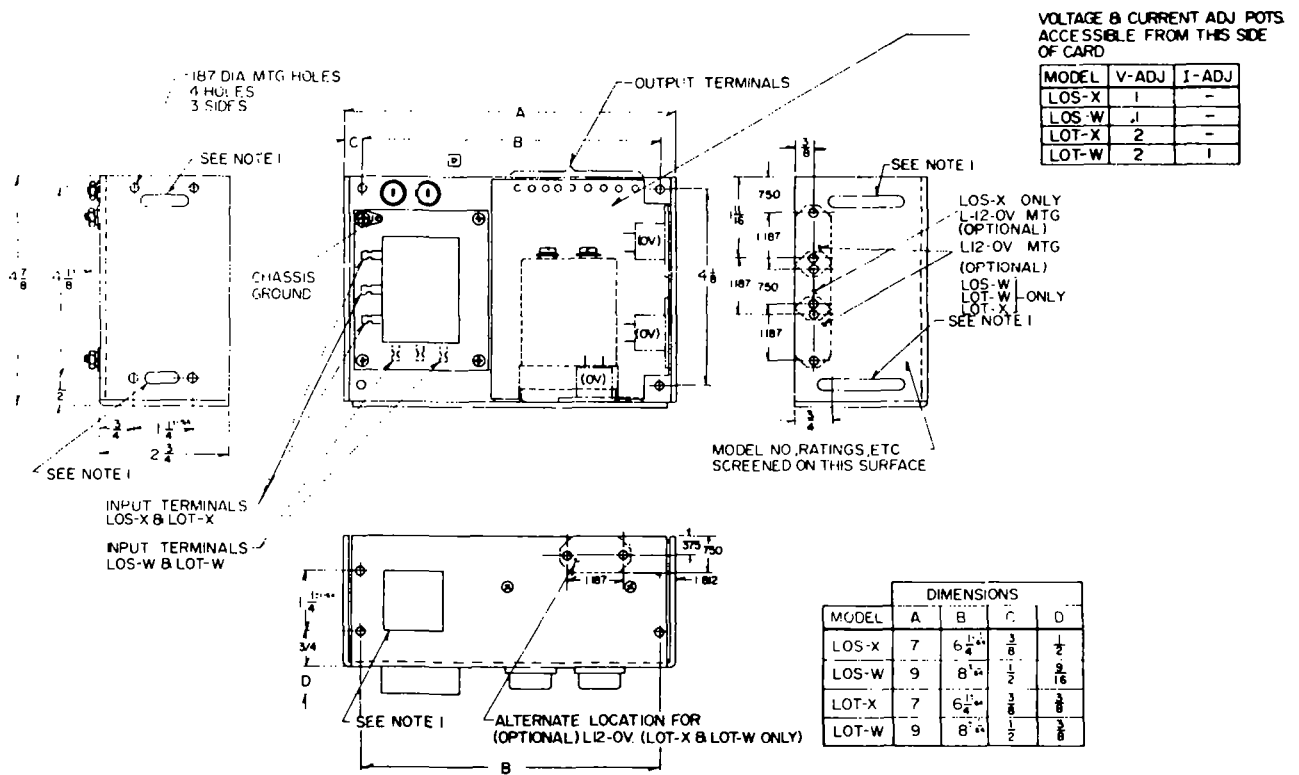


Figure 4. Programmed Voltage, With External Resistor (5V Output Only).



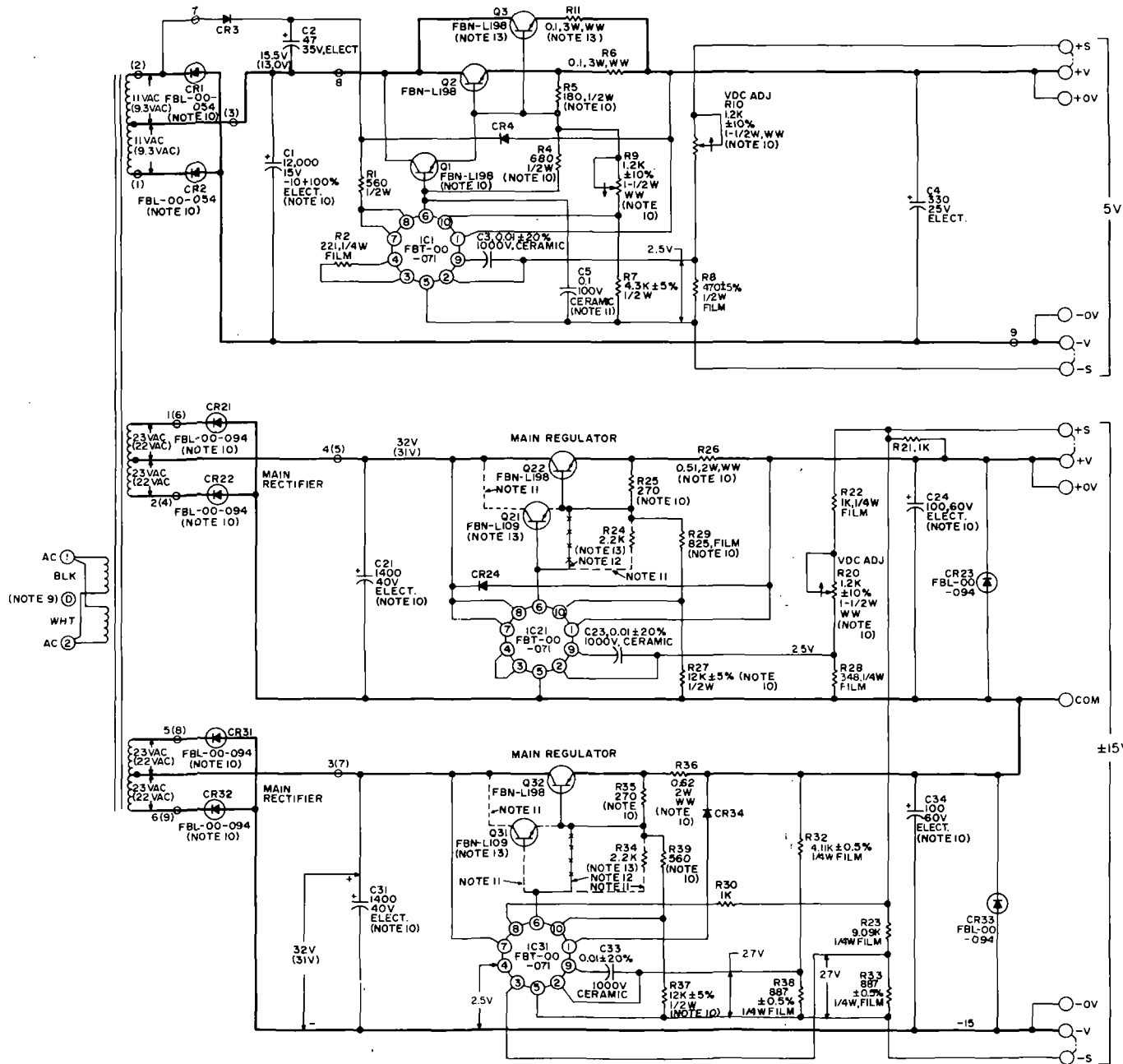
* A 2.5MF, ELECT., CAP. MAY BE REQUIRED.

Figure 5. Programmed Voltage, With External Programming Voltage Source (5V Output Only).



NOTES
1. CUSTOMER MUST PROVIDE CLEARANCE IN HIS MOUNTING SURFACE FOR VENT HOLES TO ALLOW FOR AIR CIRCULATION.

Outline Drawing.



- NOTES:
- RESISTORS ARE CARB.FILM 1/4W WITH VALUES IN OHMS, UNLESS OTHERWISE NOTED.
 - RESISTOR TOLERANCES: CARB.FILM ±5%, FILM ±1%, WIREWOUND 5%, UNLESS OTHERWISE NOTED.
 - CAPACITOR VALUES ARE IN MICROFARADS.
 - CAPACITOR TOLERANCES: ELECTROLYTIC -10 +75%.
 - DESIGNATIONS ARE LAMBDA PART NOS.
 - SYMBOLS:
 - ↑ INDICATES CLOCKWISE ROTATION OF SHAFT.
 - ⊥ INDICATES CONNECTION TO CHASSIS.
 - ✱ LAMBDA PART NO. FBL-00-030: USE IN 4002 DIODE FOR REPLACEMENT UNLESS OTHERWISE NOTED.
 - ⊙ INDICATES TERMINAL ON PRINTED CIRCUIT BOARD. TERM NOS. IN PARENTHESIS APPLY ONLY TO LOT-X-5152-A. TERM NOS. NOT IN PARENTHESIS APPLY ONLY TO LOT-W-5152-A.
 - INDICATES ACTUAL UNIT MARKING.
 - CONDITIONS FOR CIRCUIT POINT MEASUREMENTS: INPUT: 115 VAC, 60 HZ RATED VOLTAGE NO LOAD. INDICATED VOLTAGES ARE TYPICAL VALUES AND ARE D.C. UNLESS OTHERWISE NOTED. D.C. MEASUREMENTS TAKEN WITH 20,000 OHMS/V VOLT METER BETWEEN COM AND INDICATED POINTS FOR ±15V OUTPUT; BETWEEN -V AND INDICATED POINTS FOR 5V OUTPUT UNLESS OTHERWISE NOTED. VOLTAGES IN PARENTHESIS APPLY ONLY TO LOT-X-5152-A. A SINGLE READING APPLIES TO BOTH MODELS.
 - DERATE CURRENT 10% FOR 47-53 HZ INPUT, FOR 63-440 HZ CONSULT FACTORY.
 - T1 PRIMARY CONNECTION SHOWN IS FOR 105-125 VAC INPUT FOR 210-250 VAC INPUT: DISCONNECT BLK & WHT TRANSFORMER LEADS FROM TERMINAL AC1 & AC2 RECONNECT BOTH LEADS TO TERM D.
 - COMPONENT VALUES LISTED IN THE FOLLOWING TABLE REFER TO MODEL LOT-X-5152-A.

COMP DESIG	VALUE	COMP DESIG	VALUE
C1	6900 MF 1000MF	R5	390, 1/2W
C21, C31	1000MF	R9	750 ± 5%, 1/2W, COMP. FIXED
C24, C34	47MF, 35V	R10	12K ± 20%, 1W CERMET
CR1, CR2	FBL-00-116	R20	1K ± 10%, 1W, CERMET
CR21, CR22	FBL-00-030	R25, R35	1.2K
CR23, CR31	FBL-00-030	R26, R36	0.91, 2W, WW
CR32, CR33	FBL-00-030	R27, R37	12K ± 5%, 1/4W, FILM
Q1	FBL-L113	R29	680 ± 2%, FILM
R1	820, 1/2W COMP	R38	330
R4	4.7K, 1/2W	R39	

- ONLY USED ON LOT-W-5152-A.
- ONLY USED ON LOT-X-5152-A.
- R11, R24, R34, Q21, Q31 AND Q3 ONLY USED ON LOT-W-5152-A.

FOR WIRING OF POWER SUPPLY TO LOAD REFER TO SUPPLY-TO-LOAD WIRING DIAGRAMS.
 DOTTED CONNECTIONS SHOWN ON OUTPUT TERMS INDICATE JUMPERS IN PLACE FOR LOCAL SENSING CONNECTION

SCHEMATIC DIAGRAM
 REGULATED POWER SUPPLY
 MODELS
 LOT-W-5152-A
 LOT-X-5152-A



DIVISION OF **Veeco** INSTRUMENTS INC.