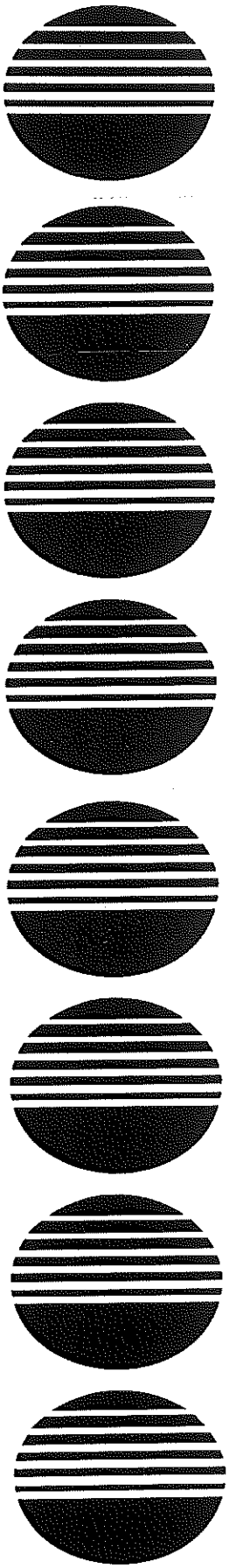
PRICE: $25.00



P SERIES

LOW PROFILE

SWITCHING POWER SUPPLIES

Manual No. P-1093-1

UNIPOWER CORPORATION
3900 Coral Ridge Drive ▪ Coral Springs, FL 33065 ▪ 305-346-2442 ▪ FAX 305-340-7901

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P SERIES OPERATING MANUAL

1.0 INTRODUCTION

1.1 This Operating Manual should be read through carefully before installing and operating the P Series switching power supplies.

1.2 This series of low-profile switching power supplies combines 100kHz MOSFET switching with high-density packaging employing hybrid surface-mount technology. See Fig. 1. Various standard models have output power from 250 watts to 800 watts with up to five outputs. The supplies are safety agency approved by UL, CSA and TUV. Case height is 2.75 inches (70mm) for 250 to 600 watt single and multiple output units and 3.8 inches (97mm) for 650 and 800 watt multiple output units.

The P Series incorporates a number of important features and options such as current sharing, N + 1 redundancy, remote sensing, input EMI filter, electronic inrush current limiting, thermal protection, input autoranging and battery backup. Control and supervisory signals include high and low margining, output inhibit, power good and DC OK. For a complete description and specifications see the P Series product data in the Appendix.

1.3 An optional Battery Backup Unit is available. It comes in a companion metal case which is 2.75 x 5.0 x 12.0 inches (70 x 127 x 305mm) and connects to the power supply by means of a cable. An external 24V or 48V battery is required.

2.0 SAFETY WARNINGS

2.1 This switching power supply has hazardous external and internal voltages. It should be handled, tested and installed only by qualified technical persons who are trained in the use of power supplies and are well aware of the hazards involved.

2.2 The AC input terminals are at hazardous voltage potentials. Do not touch this area when AC power is applied.

2.3 When operating this power supply, the AC input ground terminal must be connected to safety ground to minimize electrical shock hazard and to ensure low EMI (electromagnetic interference).

2.4 The internal voltages are at hazardous potentials. The power supply cover should not be removed. There are no user-serviceable components in this unit. Opening the power supply will void the warranty.

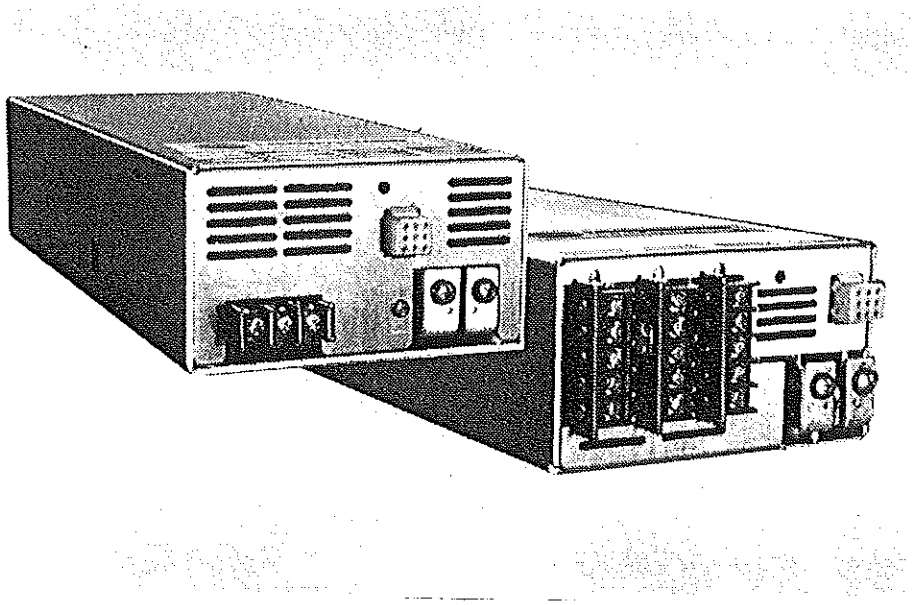


Figure 1. P Series Power Supplies

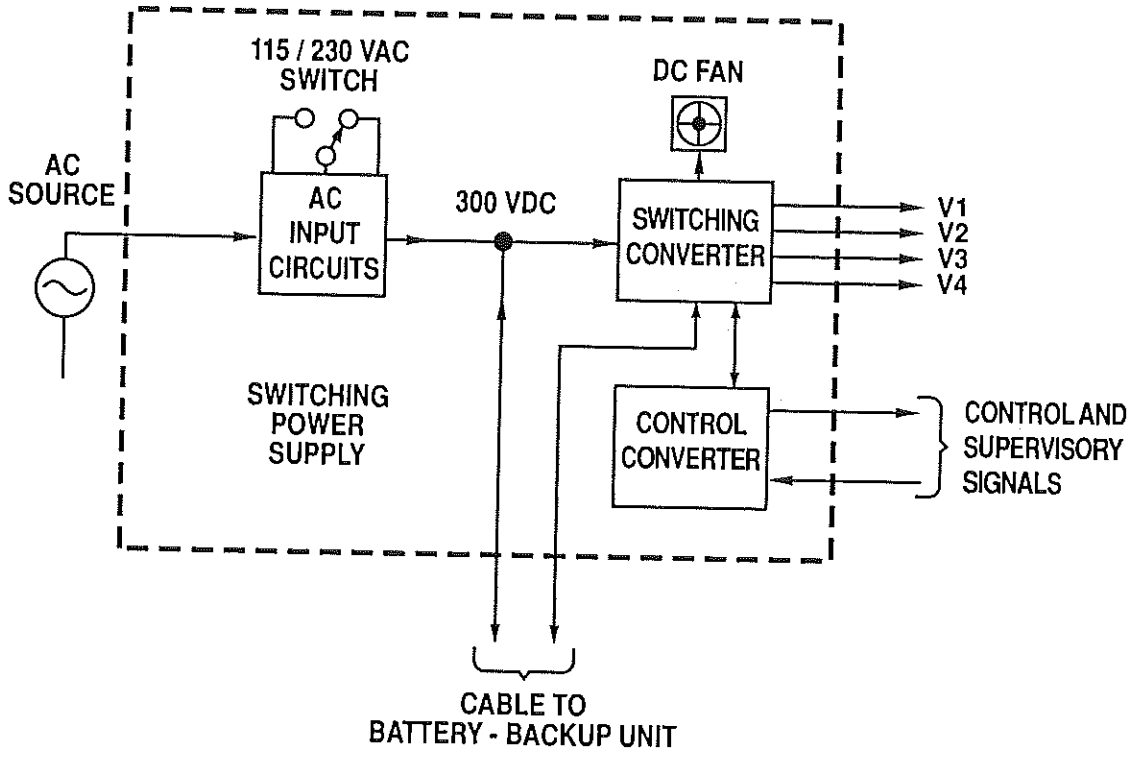


Figure 2. P Series Block Diagram

2.5 For units without the autorange option, make sure that the 115/230 VAC selector switch is in the proper position for the input voltage used. Operating the power supply with the switch in the wrong position will damage the supply, and this damage is not covered by the warranty.

3.0 WARRANTY POLICY

3.1 UNIPOWER Corporation warrants its power supplies for two (2) years from date of shipment against defects in materials and workmanship. UNIPOWER's liability under this warranty is limited to the satisfactory repair or replacement, at its option, of the defective product which has not been damaged through accident, misapplication, negligence, or unauthorized repair. UNIPOWER will in no case be liable for special or consequential damages of any nature. This warranty is extended directly by the manufacturer to the buyer and is the sole warranty applicable.

To exercise this warranty, the buyer must contact our factory (or one of our authorized service centers throughout the world) to obtain a Return Material Authorization (RMA) number and shipping instructions. Products returned under this warranty must be shipped freight prepaid and include the RMA number. Returned units will be shipped prepaid from UNIPOWER Corporation or its authorized service center.

4.0 UNPACKING AND INSPECTION

4.1 This P Series Power Supply was carefully tested, inspected and packaged for shipment from our factory. Upon receipt of the unit it should be carefully unpacked and inspected for any damage in shipment. The final acceptance test report is included with each power supply.

4.2 If there is evidence of damage, do not attempt to test the unit. The freight carrier should be notified immediately and a claim for the cost of the power system should be filed with the carrier for direct reimbursement. Be sure to include the model and serial number of the damaged unit in all correspondence with the freight carrier. Also save the shipping carton and packing materials as evidence of damage for the freight carrier's inspection.

4.3 UNIPOWER Corporation will cooperate fully in case of any shipping damage investigation.

4.4 Always save the packing materials for later use in shipping the unit. Never ship the power system without proper packing.

5.0 DESCRIPTION OF OPERATION

5.1 **Main Output.** The P Series are auxiliary output type modular switching power supplies. See Fig. 2. The main output has an isolated feedback circuit which is used to regulate the output voltage. This is done by means of pulse-width modulation using MOSFET switches operating at 100kHz.

5.2 **Auxiliary Outputs.** In the multi-output models, auxiliary outputs are derived from additional windings on a high-frequency power transformer. Each winding has an auxiliary output circuit which rectifies, filters, and regulates the 100kHz pulses to produce an isolated, regulated output. The auxiliary outputs employ magnetic amplifiers to achieve tight regulation. Up to three auxiliary output modules are available in the P Series.

5.3 **AC Input.** The front end of the power supply incorporates an input EMI filter to suppress line noise and high frequency transients both from the AC power line and from the power supply to the line. The AC input voltage range can be either switch selected (standard) or automatically selected by an autoranging circuit (optional). Electronic inrush current limiting controls the initial AC input current on power up.

6.0 FRONT AND REAR PANEL DESCRIPTIONS

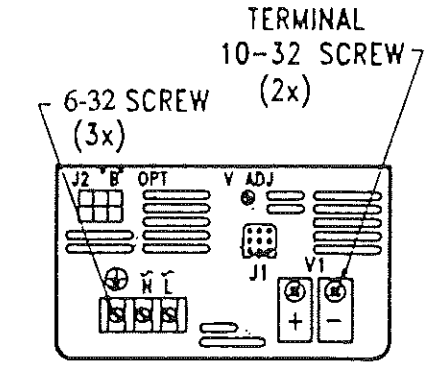
6.1 Front and rear views of the P Series cases are shown in Fig. 3. The case types are designated as follows:

Case 10	Single Output	250 to 600 Watts
Case 15	Multi Output	400 and 500 Watts
Case 25	Multi Output	650 and 800 Watts

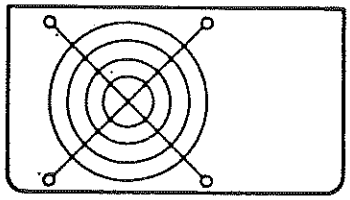
6.2 The main output (V1) on all cases is at two terminal lugs on the lower, right-hand section of the front panel. Connections are made by means of No. 10-32 screws. Above each of these terminals and to the left is the V1 adjustment potentiometer which adjusts the main output voltage $\pm 5\%$.

6.3 AC input connections are made to a barrier terminal strip with No. 6-32 screws. This terminal strip is located on the front panel of case 10 and on the rear panel of cases 15 and 25.

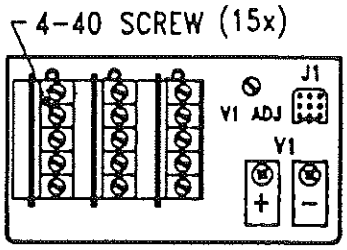
6.4 Auxiliary DC output connections are made to a barrier terminal strip on case 15 with No. 4-40 screws and to a pluggable connector on case 25 (optional on case 15). Voltage adjustment potentiometers are located above each connector or strip



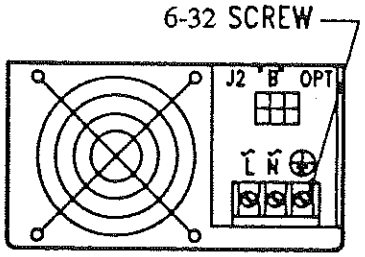
FRONT VIEW CASE #10



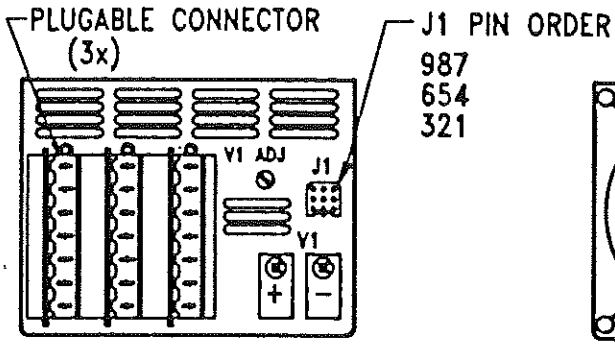
REAR VIEW CASE #10



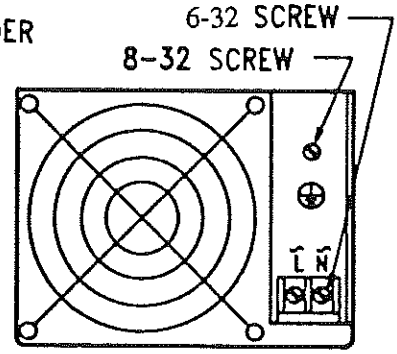
FRONT VIEW CASE #15



REAR VIEW CASE #15



FRONT VIEW CASE #25



REAR VIEW CASE #25

Figure 3. **Front and Rear Panel Views**

and below it for dual outputs.

6.5 On the front panels above the main output terminals is J1, a 9-pin Molex connector, for the control and supervisory signal inputs and outputs. If the battery backup version is ordered, there is a J2 connector on the upper left front of case 10 and on the upper right rear of case 15. This connector is for the cable which goes to the Battery Backup Unit and is a 6-pin Molex connector.

7.0 AVAILABLE AUXILIARY OUTPUTS

The following are the auxiliary outputs available on multi-output models. The table does not include the main output. The specification of these outputs is included in the model number.

VOLTAGE	CURRENT	OUTPUT POWER
2V 2V	10A[1] 20A[1,2]	20W 40W
5V 5V 5V	2A 10A[1] 20A[1,2]	10W 50W 100W
12V 12V 12V	2A 8A(12A)[1] 10A(15A)[1,2]	24W 96W 120W
15V	7A[1]	105W
24V 24V	4A(6A)[1] 5A(7A)[1,2]	96W 120W
12V/12V 15V/15V 5V/12V	2A 2A 2A	48W 60W 34W

Notes: ( ) is peak current for 30 seconds max.
1. Can be current shared (Option H).
2. Available only on 650W and 800W models (Case 25).

8.0 DESCRIPTION OF FEATURES AND OPTIONS

FEATURE/OPTION	DESCRIPTION
Switch-Selectable AC Input	A slide switch on the side of the case selects either of the two AC input ranges, 90 to 132VAC or 180 to 264VAC. This is standard for 250 to 600W models (cases 10 and 15). The 650W and 800W models (case 25) have autoranging as standard.
Isolated Outputs	All DC outputs are floating and isolated from all other outputs. They can be connected as + or - outputs and may be referenced up to ±100V from chassis ground.
Electronic Inrush Current Limiting and Soft Start	This circuit limits the input current to 40 amperes peak when the power supply is first turned on. The output voltage rises monotonically to its specified value within 500 msec. of turn-on.
Safety Agency Approvals	All P Series models are labelled with the appropriate safety agency logos or labels and are recognized or certified to UL 1950, CSA 22.2 and TUV approved to EN 60950.
EMI Input Filter	The input filter suppresses conducted noise on the AC line. The filter meets FCC level A and VDE 0871 level A requirements for conducted noise.
Thermal Protection	The power supply latches off when the internal temperature reaches an excessive value. The supply must be reset by cycling the AC input off and then on.
Output Current Limiting	Current limiting protects each output and the main converter from overload conditions. Current limiting is set at a minimum of 110% of the rated output load. Auxiliary outputs have their own independent current limiting circuits. Overload protection is continuous, without damage, and recovery is automatic when the overload is removed.

FEATURE/OPTION	DESCRIPTION
Overvoltage Protection	All outputs are protected from fault conditions in the power supply. OVP operates at 120% to 135% of nominal output voltage. The main converter is shut down. The outputs are reset by cycling the AC input off and then on.
Autorange (Option A)	With autoranging, the AC input circuit automatically switches to the proper input line range. This is an option on all models up to 600W output (cases 10 and 15). It is standard on 650W and 800W multi-output models.
Battery-Backup Connector (Option B)	This option is available on all models up to 600W output (cases 10 and 15). It permits cable connection to the separate Battery-Backup Unit for battery-backup operation.
DC "OK" Signal (Option D)	See description in Section 11.0.
No Load Operation, Main Output (Option E)	With this option the main output of multi-output units may be operated down to zero load current.
Current Share/Monitor, Main Output (Option F)	The main output will share current with other P Series power supply main outputs of identical voltage and current ratings when the current share pins are connected together. See description in Section 11.0.
Current Share, Aux. Outputs (Option H)	High current, single auxiliary outputs will share current with other identical auxiliary outputs when the current share terminals are connected together. See description in Section 11.0.
Pluggable Aux. Connector, Case 15 (Option P)	The pluggable connectors shown as standard on Case 25 in Fig. 3 are available as an option on Case 15. They are LMI type connectors.
DC Input (Option Q)	A 42 to 56VDC input option is available. The factory should be consulted for details on this option.
Reverse Air Flow (Option R)	Standard air flow is from fan to front panel of the power supply. This option reverses the air flow.

9.0 OPERATING INFORMATION

9.1 **Input Voltage.** The P Series switching power supplies operate on standard 120VAC (90 to 132VAC) or 220-240VAC (180 to 264VAC) input voltages. An autorange option (Option A) is available which automatically sets the power supply input for the voltage range used. On standard models a switch mounted on the side of the case (see Fig. 4) permits the user to set the AC input range to the desired one. **Note that this switch must be set to the proper position before plugging the unit into AC power. Do not change the position of the line select switch while power is applied.** Autorange is a standard feature on 650W and 800W models (case 25). There is also a DC input option (Option Q) permitting 42 to 56VDC input voltage. Further details on this should be obtained from the factory.

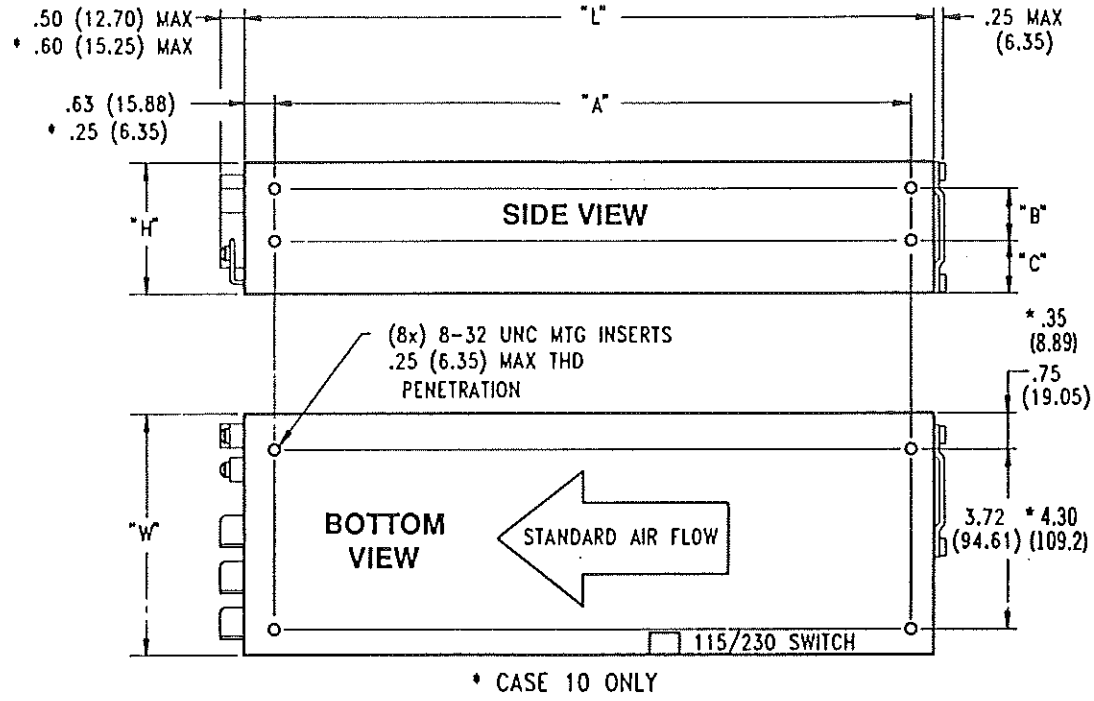
9.2 **Outputs.** The main output (V1) power connections are made to no. 10-32 screws on nickel-plated brass bus bars. See Fig. 3. The left bus bar is positive and the right one negative. See Section 12.4 for maximum torque on the screws.

Auxiliary output connections are made to barrier terminal strips with no. 4-40 screws for 400W and 500W multiple output models (case 15). See section 12.4 for maximum torque on the screws. For the 650W and 800W multi-output models (and Option P for 400W and 500W multi-output models) an LMI type pluggable connector is used. Output wires are inserted into the mating LMI connector.

The connecting wires for all outputs should be sized to carry the rated output current plus 30%. Connecting wires or lugs must be clean and securely connected to the terminals to reduce contact resistance. All outputs should have a 0.1uF ceramic capacitor and 10uF electrolytic capacitor in parallel across each output at the backplane, connection point, or point of load to prevent noise pickup.

9.3 **Output Power.** The P Series multi-output models have maximum ratings of 400W, 500W, 650W, and 800W. However, the ratings of the individual outputs, when totalled, may exceed these values. See the "Standard Models" table in the Appendix. The continuous output power from all outputs **must not** exceed the output rating of the given power supply model.

The maximum continuous output power of the power supply may be drawn at up to 50°C ambient temperature. Above 50°C, the output must be derated at 2.4%/°C. See Fig. 5. The maximum operating temperature is 65°C.



CASE STYLE	DIMENSIONS INCHES (mm)					
	H	W	L	A	B	C
10	2.75 (69.8)	5.00 (127)	12.15 (308.6)	11.62 (295.15)	1.00 (25.4)	0.75 (19.05)
15	2.75 (69.8)	5.00 (127)	14.30 (363.2)	13.20 (335.28)	1.10 (27.94)	1.10 (27.94)
25	3.80 (96.52)	5.00 (127)	14.30 (363.2)	12.38 (314.45)	1.10 (27.94)	1.33 (33.78)

Figure 4. **P Series Mechanical Dimensions**

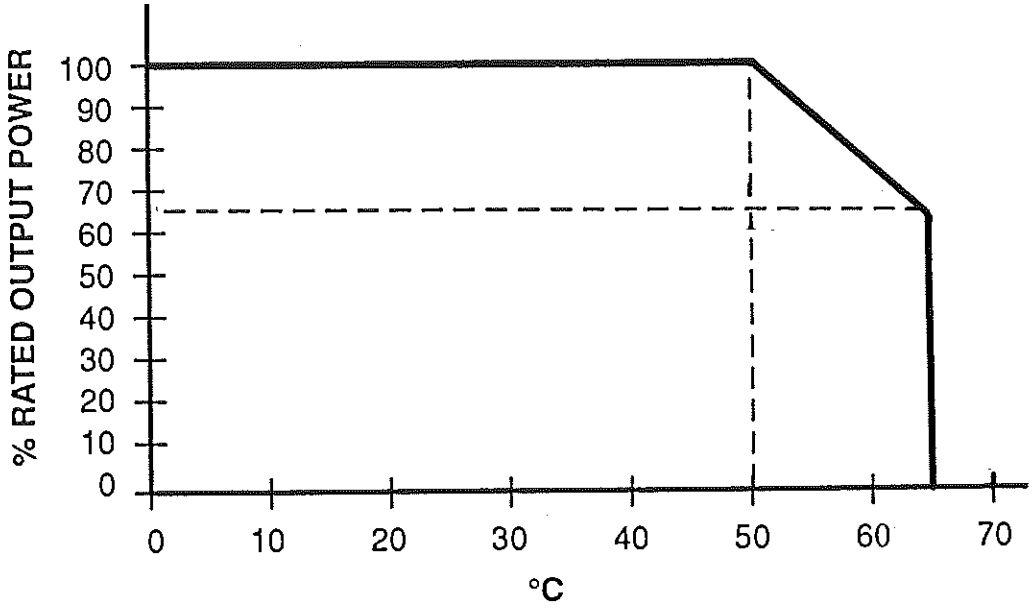


Figure 5. **Output Power vs. Ambient Temperature**

9.4 **Remote Sensing.** Remote sense connections for the main output are made to pins 1 and 4 of J1. For high current auxiliary outputs the connections are made on the barrier strips or pluggable connectors as shown in Fig. 7. The dual outputs and low power single outputs do not have remote sensing.

The remote sense feature is used to regulate the output voltage at the point of load. The + Sense is connected to the + output at the load, and the - Sense is connected to the - output at the load. The sense leads should be a twisted pair to minimize noise pickup. The outputs can compensate for a total voltage drop in the power leads up to 0.5 V, or 0.25 V on each lead. Sense leads can be #22 or 24 AWG wire, but should not exceed 10 feet (3 meters) in length. If remote sensing is not required, the sense leads should be connected to the proper output terminals at the DC output.

9.5 **Control and Supervisory Signals.** All control and supervisory signals, with the exception of auxiliary output current share, are accessible at the 9-pin J1 receptacle on the front panel of the power supply. The auxiliary output current share connection is on the output barrier terminal strip or pluggable connector. For the Battery-Backup Unit they are accessible at the 12-pin J3 receptacle. Some of the pins are for control inputs and others are for warning outputs. The inputs and outputs that are used must have external 0.1uF ceramic capacitors across them to prevent noise pickup. For a description of each function see the sections on "Description of Control and Supervisory Signals".

9.6 **Current Sharing (Paralleled Outputs).** Two or more outputs may be connected in parallel to current share if they are identical outputs in both voltage and current rating. The main output and high current, single auxiliary outputs may be current shared. See the auxiliary output table in section 7.0 for the outputs that can be current shared. The main output may be current shared with other identical P Series main outputs and the auxiliary single outputs may be current shared with other identical single auxiliary outputs.

The current share function is implemented by first adjusting the output voltages of all outputs which are to be current shared to within $\pm 2\%$ of each other. For best performance adjust to $\pm 1\%$. This is required so that the output with the lowest voltage will be within the capture range of the output with the highest output voltage. Then with the power off, the outputs are connected in parallel with all remote sense leads connected, and the current share terminals are connected together. After this the output voltages should not be adjusted since it will cause the variation between outputs to exceed the capture range and result in unstable operation. AC power may then be applied.

If the main output is not being current shared, its current share connection can be used as an output current monitor. The voltage with respect to the negative sense lead is directly proportional to the output current.

The current sharing accuracy of each output is within ±10% of its output rating.

9.7 **Output Voltage Adjustment.** The main output voltage and all auxiliary output voltages are independently adjustable by means of potentiometers on the front panel. See Fig. 3. No output should be continuously operated outside its nominal range of ±5%, and the total output power of all outputs must not exceed the maximum rating of the power supply.

9.8 **Timing Diagram.** The Power Good signal on pin 5 of J1 is a warning signal for the loss of AC power, main output loss, or thermal shutdown. It is a TTL output signal which is shown in the timing diagram of Fig. 6. As shown, the Power Good signal gives at least a 2 millisecond warning of either a thermal shutdown or loss of AC power.

9.9 **N + 1 Redundancy.** This feature is a type of parallel operation. Redundancy is achieved by having one more output in parallel operation than needed to supply the load power. If two identical outputs in parallel can provide the total load power, then three outputs are used, each providing approximately one third of the total current. If one output fails, the other two automatically take up the total load current, sharing it approximately 50/50.

10.0 AUXILIARY OUTPUT AND CONTROL & SUPERVISORY SIGNAL CONNECTIONS

The connections for the auxiliary outputs and the control and supervisory signals are shown in Fig. 7. Following are the pin designations for J1.

J1	
PIN	**FUNCTION**
1	+ Sense
2	HI Margin
3	LO Margin
4	- Sense
5	Power Good

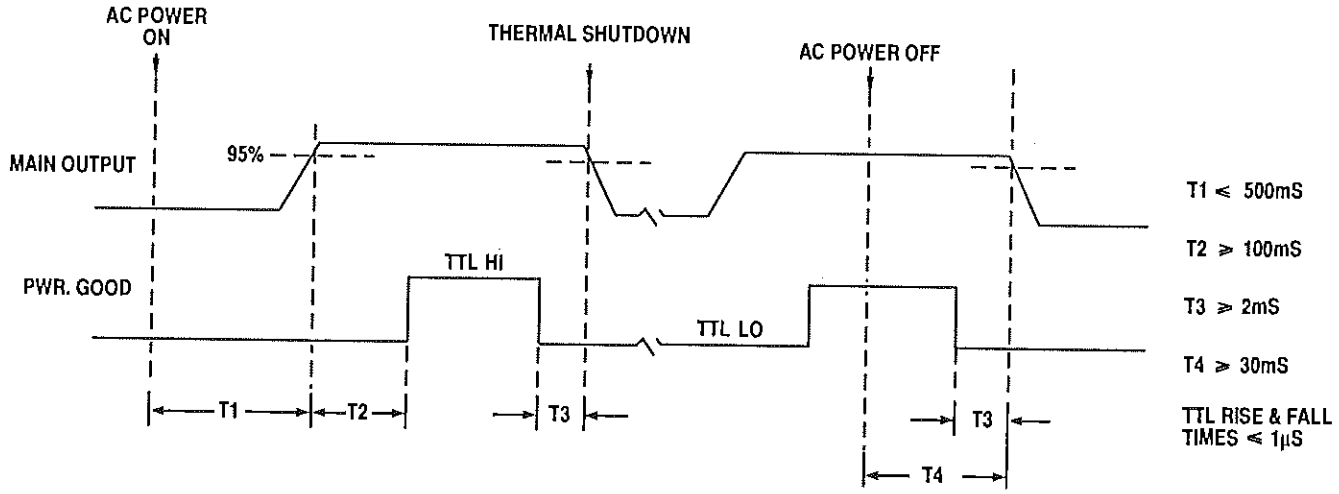


Figure 6. **Timing Diagram**

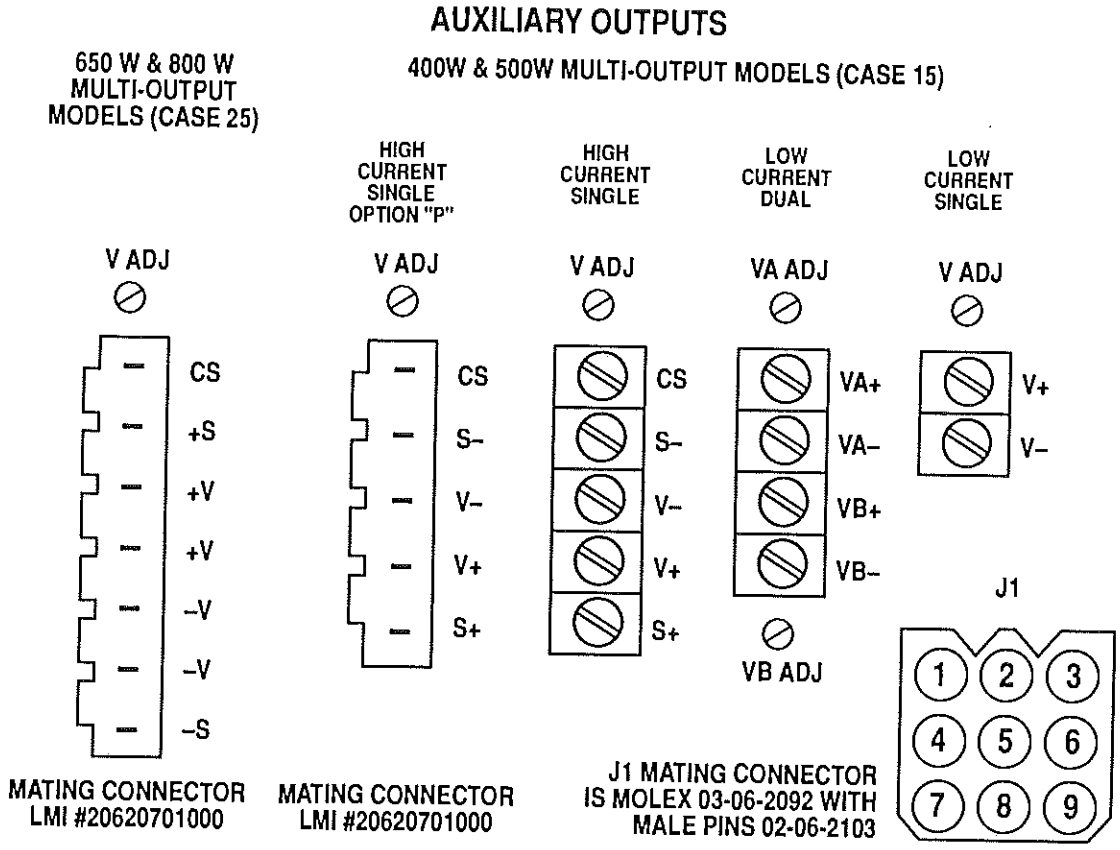


Figure 7. **Auxiliary Output and Control & Supervisory Signal Connections**

J1	
PIN	FUNCTION
6	Inhibit
7	Current Share/Current Monitor
8	DC OK
9	Common

J1 Mating Connector:
Molex #03-06-2092
Male Pins
Molex #02-06-2103

11.0 DESCRIPTION OF CONTROL AND SUPERVISORY SIGNALS (J1)

SIGNAL	PIN	DESCRIPTION
+ Sense	1	This remote sense lead should be connected to the + output at the load point by means of a twisted pair with the - Sense lead. See Section 9.4 for a full description of remote sensing.
HI Margin (Input)	2	The main output voltage can be remotely controlled by a switch closure. Closing a switch between this pin and - Sense (pin 4) or common (pin 9) will put the main output into the HI Margin state in which the output voltage is 5% to 7% higher than its nominal value.
LO Margin (Input)	3	LO Margin operates the same as HI Margin above except that switch closure puts the main output into the LO Margin state in which the output voltage is 5% to 7% lower than its nominal value.

SIGNAL	PIN	DESCRIPTION
- Sense	4	This remote sense lead should be connected to the - output at the load point by means of a twisted pair with the + Sense lead. See Section 9.4 for a full description of remote sensing.
Power Good (Output)	5	The Power Good signal is a warning signal for the loss of AC power, main output power loss or thermal shutdown. A TTL LO (sinks 30mA) occurs at least 2msec. before the main output voltage drops by 5%. See Fig. 6. A TTL HI (sources 10mA) is normal. The signal is referenced to the main output - Sense (pin 4) or common (pin 9).
Inhibit (Input)	6	The power supply can be remotely turned on and off by means of the inhibit input. A TTL HI (sourcing 0mA) or open circuit turns the power supply on and a TTL LO (sinking 0.25mA) turns it off. The signal is referenced to the main output - Sense (pin 4) or common (pin 9).
Current Share/ Current Monitor	7	This connection, made between other P Series power supplies with identical main outputs, permits current sharing with ±10% accuracy. See Section 9.6 for a full description of current sharing. If current sharing is not used, this output may be used as a current monitor. The output voltage is proportional to the main output current. This signal is referenced to the - Sense (pin 4) or common (pin 9).
DC OK (Output)	8	This optional output signal (Option D) indicates that the main output voltage is outside a tolerance limit of ±4% to ±7% of nominal value. A TTL LO (sinks 0.1mA) indicates the output is within tolerance and a TTL HI (sources 0.5mA) indicates it is out of tolerance. This signal is referenced to the main output - Sense (pin 4) or common (pin 9).
Common	9	This is connected internally to the main output - Sense and is the reference for all control and supervisory signals.

12.0 INSTALLATION

12.1 **Mounting.** See Fig. 4. The P Series has two mounting surfaces, one on the bottom and one on the side, each with four threaded mounting inserts. The inserts accept no. 8-32 screws with maximum penetration of 0.25 inch (6.4mm). Maximum torque on these screws is 19 in.-lbs.

12.2 **Cooling.** The P Series is cooled by means of an internal DC, ball-bearing fan. To insure proper cooling, the power supply requires a minimum clearance of 1 inch (25mm) between all air intakes and outlets, and other surfaces. Both standard and optional reverse air cooling (Option R) are available.

12.3 **Input Connections.** AC input connections are made to a three-terminal barrier strip. The barrier strip has no. 6-32 screws. A three-wire AC line and plug must be used for the AC power connection with proper connection made to line, neutral and safety ground terminals. See front and rear panel diagrams in Fig. 3. The proper line cord wire size must be used: No. 14 AWG is recommended. Maximum torque on the screws is 9 in.-lbs.

12.4 **Output Connections.** Connections to the main output (V1) are made to nickel-plated, brass bus bars by means of no. 10-32 screws. The connections must be secure, and the wires or lugs must be clean to reduce contact resistance. Maximum torque on the 10-32 screws is 30 in.-lbs. The wires must be of correct size to carry the rated output current plus 30%.

Connections to the auxiliary outputs are to barrier terminal blocks with no. 4-40 screws for 400W and 500W multi-output models (case 15). The maximum torque on the screws is 5 in.-lbs. For the 650W and 800W multi-output models and Option P for 400W and 500W multi-output models an LMI pluggable connector is used. Mating connectors are LMI no. 20620701000 (for 650W and 800W models) and LMI no. 20620501000 (for 400W and 500W models). The connections should be clean and secure to reduce contact resistance, and the wire size must be able to carry the rated output current plus 50%.

12.5 **Control and Supervisory Signal Connections.** These connections are made to J1, a 9-pin Molex connector. The mating plug is Molex 03-06-2092 with male pins 02-06-2103.

13.0 MAINTENANCE

No routine maintenance is required on the P Series power supplies except for periodic cleaning of dust and dirt around the fan intake. A small vacuum nozzle should be used for this. The power supply cover should not be removed; there are no user-serviceable components in the unit.

14.0 POWER SUPPLY SETUP AND TESTING

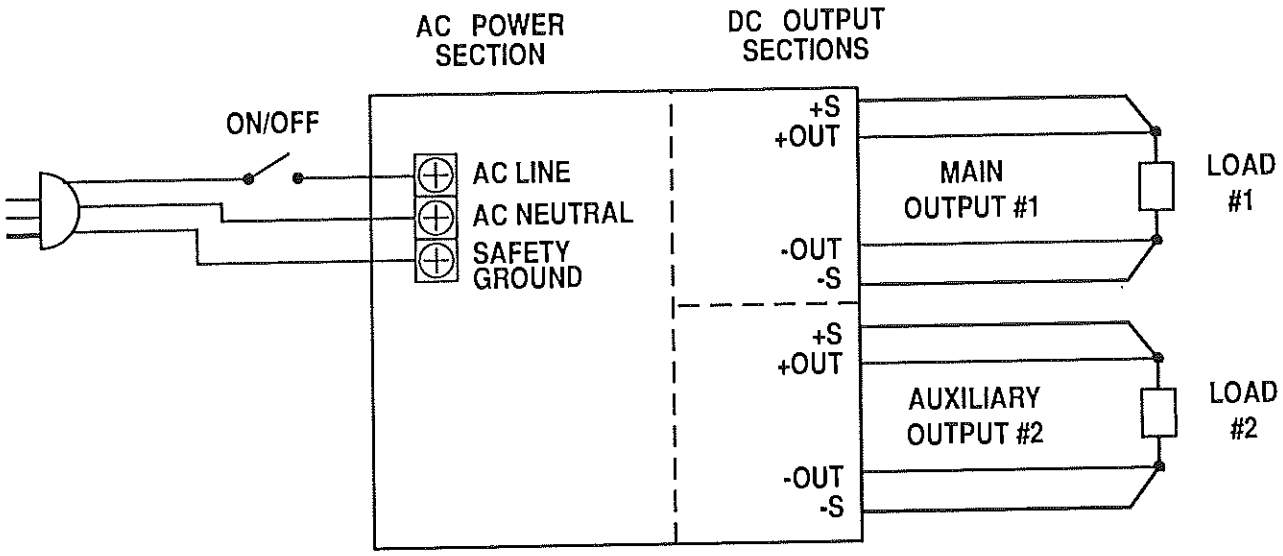
14.1 Connect the AC power cord to the AC input barrier terminal strip. See Fig. 3. Be sure to use a three-wire connection to the proper terminals including the safety connection. Do not plug in the AC power cord yet. See Fig. 8.

14.2 Connect the remote sense leads, with proper polarity, directly to each output on the front panel of the power supply. See Section 9.4. Make sure that the Inhibit input (pin 6 of J1) is open or at a TTL HI. Make sure that the HI and LO Margin inputs (pins 2 and 3 of J1) are both open. For multi-output models without the No Load Operation option (Option E), make sure there is a minimum 10% load on the main output.

14.3 Plug the AC power cord into the wall socket and measure each output voltage with a digital voltmeter to see that it is the correct value. Each voltage should be within $\pm 1\%$ of nominal value as set at the factory. If a more precise value is required, adjust the proper voltage-adjustment potentiometer for the output. A clockwise adjustment increases the output voltage. See Section 9.7. Unplug the AC power cord.

14.4 If any outputs are to be current shared (connected in parallel) or connected for N + 1 redundancy, follow the instructions in Sections 9.6 and 9.9.

14.5 With the AC input unplugged, connect the desired load to each output and connect the remote sense leads to the load points as described in Section 9.4. Plug the AC power cord into the wall socket and re-check the output voltages at the sense points with a digital voltmeter. These readings should be nearly the same as before, within the regulation specification for the outputs.



NOTE: Remote sense leads (+S & -S) should be twisted to minimize noise pickup.

Figure 8. **Input and Output Connections**

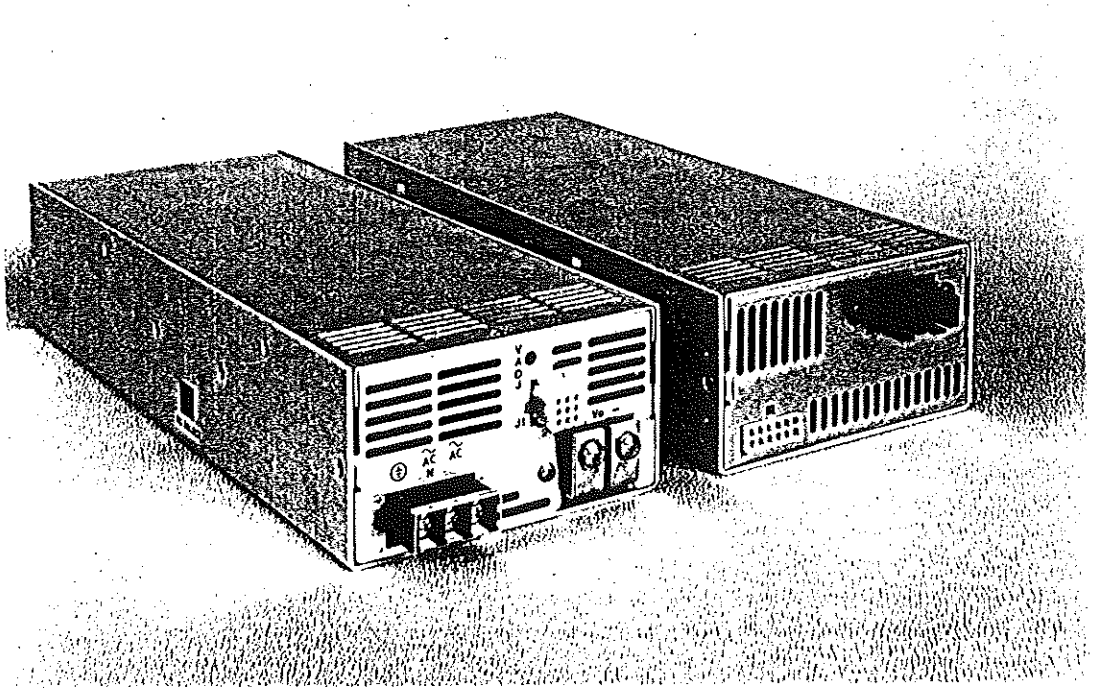


Figure 9. **P Series Power Supply with Battery-Backup Unit**

15.0 TROUBLE SHOOTING GUIDE

15.1 If you encounter difficulty and do not get the proper output voltages, go through the following trouble shooting guide.

SYMPTOM	POSSIBLE CAUSE	ACTION TO TAKE
No output (all outputs).	No AC input.	Check connection to AC power.
No output (one output).	Shorted output.	Remove short.
No output (all outputs).	Line select switch is on 230VAC. The AC source is 115VAC.	Unplug AC power. Move line select switch to 115VAC. Plug in AC power.
No output (all outputs).	Line select switch is on 115VAC. The AC source is 230VAC.	Unplug AC power. Move line select switch to 230VAC. Plug in AC power. If there is still no output, the power supply has been damaged and must be returned to the factory for repair.
No output (all outputs).	Overvoltage protection (OVP) is engaged.	Check Power Good output (pin 5) for a logic LO. Cycle AC input off and then on.
No output (all outputs).	Overtemperature protection is activated.	Check Power Good output (pin 5) for a logic LO. Check to see that fan is operating. Cycle AC input off and then on.
No output (all outputs).	Output is turned off by Inhibit control.	Check to see if pin 6 is a logic LO. It should be logic HI, or open.
No output (all outputs).	In current sharing operation, one or more sense leads are not connected to the outputs. This causes the power supply to shut down.	Connect all sense leads to outputs.

SYMPTOM	POSSIBLE CAUSE	ACTION TO TAKE
Output higher than nominal value (any output).	Remote sense leads not connected.	Connect sense leads as instructed in Section 9.4.
Main output higher or lower than nominal value.	HI or LO Margin is activated.	Check pins 2 and 3 to make sure they are logic HI or open.
Low output voltage on auxiliary outputs.	Insufficient load on main output (V1).	A 10% minimum load on main output is required unless it has no load option (Option E).
Fan does not operate.	Power supply is not loaded and does not have no load option (Option E).	Connect sufficient load. The fan will not operate if the power supply is not loaded.
Noisy output voltages.	External pickup in sense leads.	Twist or shield sense leads and re-route away from noise source. Connect capacitors as instructed in Section 9.2.

15.2 If none of these actions solves the problem, call the UNIPOWER factory for help and try to resolve the problem over the telephone. If this is not successful, request an RMA (Return Material Authorization) number and return the power supply to UNIPOWER. Be sure to pack the unit carefully in the original packing material, if possible. UNIPOWER will fax a form to be filled out and returned with the unit.

16.0 BATTERY-BACKUP UNIT (See Fig. 9)

16.1 **Battery-Backup Operation.** A separate Battery-Backup Unit permits continuous operation of the power supply when the AC input voltage is interrupted or sags below the specified input range. See Fig. 10. This unit is connected by means of a cable to the P Series power supply and may be remotely located. An external, user-supplied 24V or 48V lead-acid battery provides standby power to the unit. During normal operation from the AC line, the battery charger charges the battery and maintains it in a charged state. When AC failure is sensed, the DC/DC boost converter is turned on, drawing current from the battery and boosting the voltage from 24V or 48VDC to a higher DC level. This action keeps the MOSFET switcher driving the high-frequency power transformer with

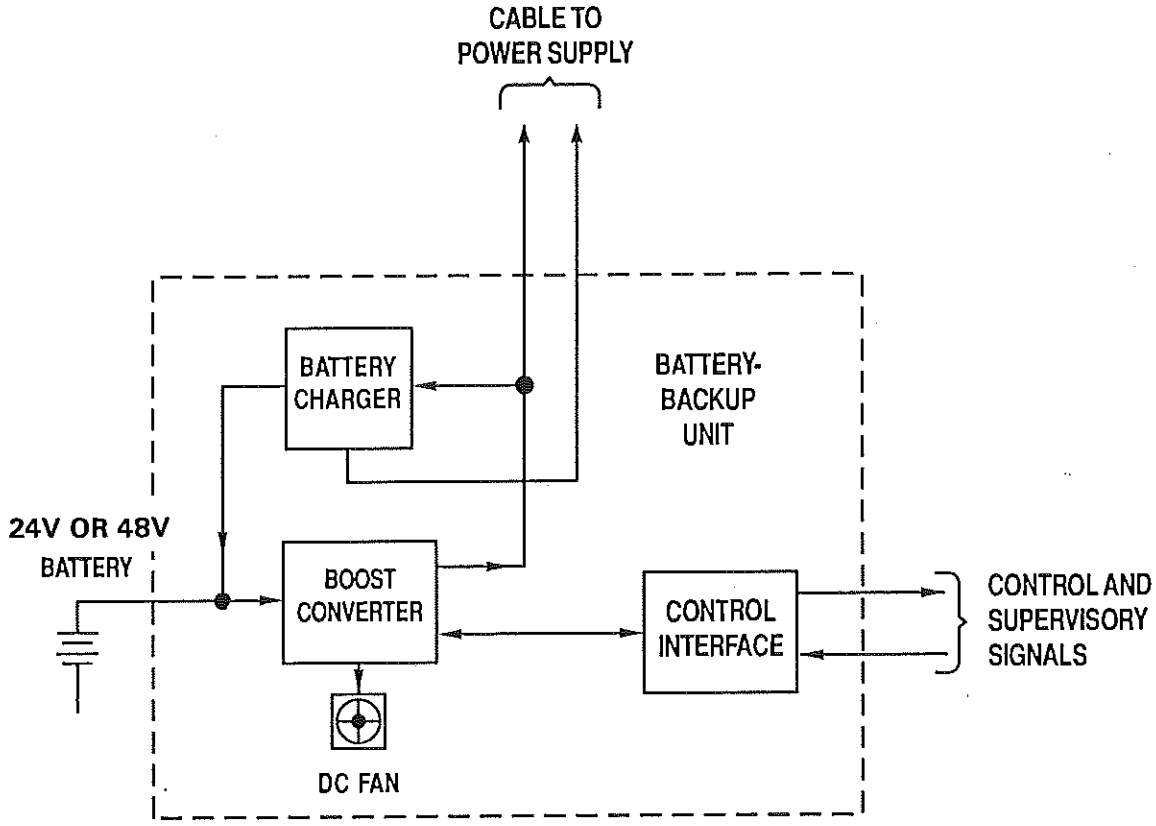


Figure 10. Battery-Backup Unit Block Diagram

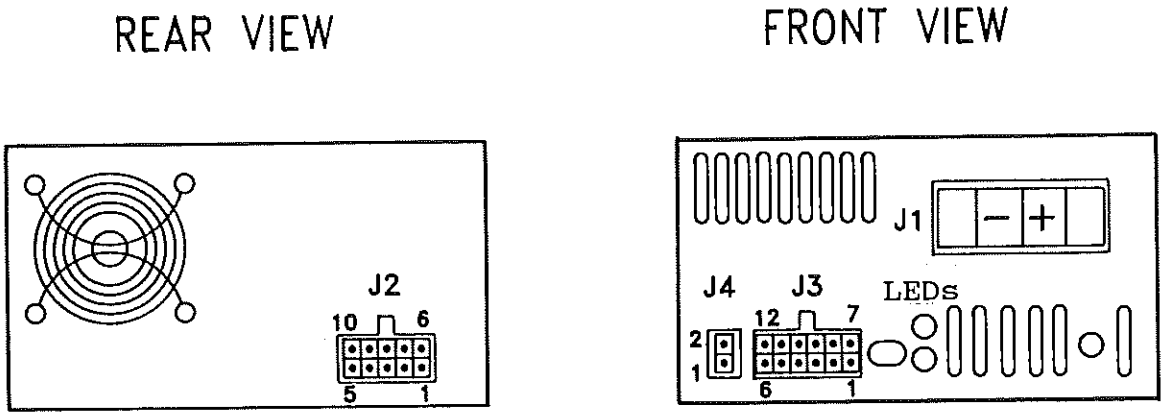


Figure 11. Battery-Backup Unit Front and Rear Panel Views

the main output and all auxiliary outputs continuing to operate. The switchover from AC to battery operation is automatic and free from transients. When AC power is restored, the power supply automatically switches back to AC operation and the battery is charged.

16.2 **Front and Rear Panel Descriptions.** The Battery-Backup Unit has three connectors on the front panel (See Fig. 11). J1 is an AMP connector for the battery input. To the right of J3 are two LEDs, an amber one on top which indicates the unit is on battery operation and a green one underneath which indicates the unit is on AC operation. J3 is a 12-pin Molex connector for the Battery-Backup control and supervisory signals. J4 is a two-pin Molex connector for an optional 5V external isolated alarm circuit.

On the rear panel is the cooling fan and J2, a 10-pin Molex connector for the cable going to the power supply.

17.0 BATTERY-BACKUP UNIT SPECIFICATIONS

17.1 24 Volt Battery-Backup Unit

Typical at 24VDC, full load and 25°C unless otherwise noted.

Battery Input Specifications

Nominal Input Voltage 24VDC
Type of Battery ..... Sealed Lead-Acid, 12 cells
Input Voltage Range
500W Continuous Output..... 21 to 30VDC
250W Continuous Output..... 20 to 30VDC
Input Current, max.
500W load with 21VDC in 44A
250W load with 20VDC in 24A
Battery Drain, max. with batt. oper. inhibited 1mA
Battery Drain, AC input in specified range..... 0 A
Output Voltage Transient, max.
(during transfer to battery) ..... ±2% change
AC Voltage for Transfer to Battery..... 75 to 90 VAC
.....150 to 180 VAC
Battery Voltage for Output
Latch Off.....18-21V, adjustable

Battery Charger Specifications

Charger Output Current
- Battery Voltage 21 to 29 V ..... 0.55 A
- Battery Voltage 20 to 23 V ..... Folds back to 0.5 A min. @ 21V
- Battery Voltage 0 to 20 V ..... Self-protected to short

Charger Current Regulation, max.
- Above 23V and 0.55A ..... ±0.1 A

Charger Output Voltage, rated load ..... 28 VDC
Charger Voltage Adj. Range, rated load ..... 28 to 29 VDC
Charger Minimum Load Current 2mA
Charger Output Voltage, min.
- Zero Charge Current ..... 30 VDC

17.2 48 Volt Battery-Backup Unit

Typical at 48 VDC, full load and 25°C unless otherwise noted.

Battery Input Specifications

Nominal Input Voltage 48VDC
Type of Battery ..... Sealed Lead-Acid, 24 cells
Input Voltage Range
- 500W Continuous Output..... 42 to 60VDC
- 250W Continuous Output..... 40 to 60VDC

Input Current, max.
- 500W load with 42VDC in 22A
- 250W load with 40VDC in 12A

Battery Drain, max. with batt. oper. inhibited 1mA
Battery Drain, AC input in specified range ..... 0 A
Output Voltage Transient, max.
- (during transfer to battery) ..... ±2% change

AC Voltage for Transfer to Battery..... 75 to 90 VAC
..... 150 to 180 VAC

Battery Voltage for Output Latch Off..... 38-42V, adjustable

Battery Charger Specifications

Charger Output Current
- Battery Voltage 46 to 57V ..... 0.55 A

Battery Voltage 40 to 46V ..... Folds back to 0.5 A min. @ 40V
Battery Voltage 0 to 40V ..... Self-protected to short
Charger Current Regulation, max.
Above 46V and 0.55A ..... ±0.1 A
Charger Output Voltage, rated load 56VDC
Charger Voltage Adj. Range, rated load ..... 56 to 58VDC
Charger Minimum Load Current 2mA
Charger Output Voltage, min.
Zero Charge Current 60VDC

18.0 DESCRIPTION OF BATTERY-BACKUP UNIT FEATURES

FEATURE	DESCRIPTION
Battery-Backup Output Latch-Off	The battery-backup converter latches off when the battery voltage drops below a preset level of 18-21V for a 24V battery or 38-42V for a 48V battery. This voltage is adjustable by means of a potentiometer. The converter remains off until the AC voltage is reapplied within its specified limits.
Battery Input Isolation	The battery is isolated from both the AC input circuit and all DC outputs of the power supply.
Battery Charger Isolation	A series-connected diode isolates the battery charger output from the battery.
Battery Charger Paralleling	The battery charger produces a 0.55A charging current but may be connected in parallel with other multiple chargers to provide more charging current. The Battery-Backup Unit will still provide all fault detection capabilities as specified.
5V Isolated Alarm (Option)	This option permits all alarm circuits on the Battery-Backup Unit to operate from an external 5V source that is isolated from the battery and all power supply circuits.

19.0 CONTROL AND SUPERVISORY SIGNAL CONNECTIONS

BATTERY-BACKUP UNIT RECEPTACLE (J3)

PIN	FUNCTION
1	Low Battery Voltage Alarm
2	Battery Charge Fault Alarm
3	Battery Operation Inhibit
4	Charge Rate Alarm
5	5V Alarm Supply Return
6	Charge Current Monitor
7	NC
8	+ Battery Voltage
9	NC
10	Battery Voltage Return (- Battery Voltage)
11	NC
12	NC

OPTIONAL 5V ALARM SUPPLY RECEPTACLE (J4)

PIN	FUNCTION
1	+5V Alarm Supply Input
2	5V Alarm Supply Return

NOTES:

1. NC = No Connection.
2. J3 signal receptacle is Molex Mini-Fit Jr. 39-30-0120. Mating plug is Molex 39-01-2125with female pins 39-00-0039.
3. J4 signal receptacle is Molex Mini-Fit Jr. 39-30-0020. Mating plug is Molex 39-01-2025 with female pins 39-00-0039.

20.0 DESCRIPTION OF CONTROL AND SUPERVISORY SIGNALS: BATTERY-BACKUP UNIT (J3 and J4)

J3

SIGNAL	PIN	DESCRIPTION
Low Battery Voltage Alarm (Output)	1	A TTL LO (sinks 10 mA) occurs when the battery voltage drops below a value 1.5 to 3V above the voltage at which the battery backup converter latches off. A TTL HI (sources 1.8 mA) is normal. This signal is referenced to the 5V Alarm Supply Return (J4 Pin 2 or J3 Pin 5).
Battery Charge Fault Alarm (Output)	2	A TTL LO (sinks 10 mA) occurs when: 1) the battery circuit is opened, or 2) there is an overvoltage on the battery, or 3) there is a short circuit on the battery (voltage is below 18 V for a 24 V battery or 36 V for a 48 V battery). A TTL HI (sources 1.8 mA) is normal. This signal is referenced to the 5V Alarm Supply Return (J4 Pin 2 or J3 Pin 5).
Battery Operation Inhibit (Input)	3	A TTL HI (sourcing 0 mA) provided at this input inhibits (turns off) all DC outputs only when the system is operating from batteries. The outputs remain latched off until the AC voltage is reapplied. A TTL LO (sinking 4.4 mA) is normal. This signal is referenced to the 5V Alarm Supply Return (J4 Pin 2 or J3 Pin 5).
Charge Rate Alarm (Output)	4	A TTL LO (sinks 10 mA) occurs when the charger is providing a charge current higher than 0.2A to 0.3A. A TTL HI (sources 1.8 mA) is normal. This signal is referenced to the 5V Alarm Supply Return (J4 Pin 2 or J3 Pin 5).

SIGNAL	PIN	DESCRIPTION
Charge Current Monitor (Output)	6	This analog output voltage is proportional to the battery charging current. At 0.55A battery charging current, the voltage is +4.5V ±0.5V. At 0A charging current, the voltage is +0.5V ±0.5V. The output can drive a 2.5K load. The signal is referenced to the negative battery terminal (Pin 10).
+ Battery Voltage (Output)	8	This pin is connected to the positive battery terminal for monitoring the battery voltage. This output is referenced to the negative battery terminal (Pin 10).
Battery Voltage Return (- Battery)	10	This pin is connected to the negative battery terminal.

J4

SIGNAL	PIN	DESCRIPTION
5V Alarm Supply (Input)	1	This input is for +5V DC ±5% at 200mA, providing isolated power for the three Battery-Backup Unit alarm output signals on pins 1, 2, and 4 of J3.
5V Alarm Supply Return (Input)	2	This input is the return (negative) input of the 5VDC, 200mA isolated alarm supply. The three Battery-Backup Unit alarm output signals are referenced to this return.

21.0 BATTERY-BACKUP UNIT INSTALLATION AND MAINTENANCE

21.1 **Mounting.** See mechanical dimensions diagram, Fig. 12. The Battery-Backup Unit has two mounting surfaces, one on the top and the other on the side. There are four threaded inserts on the top and four on the side. The inserts accept no. 8-32 screws with maximum penetration of 0.25 inch (6.4mm). Maximum torque on these screws is 19 in.-lbs.

21.2 **Cooling.** The Battery-Backup Unit is cooled by means of an internal DC ball bearing fan. To insure proper cooling, the unit requires a minimum clearance of 1 inch (25mm) between all air intakes and outlets, and other surfaces.

21.3 **Battery Connections.** The battery connections are made to J1, an AMP connector, by means of two mating AMP Innergy Series housings, 556137-4 (Red) for + input and

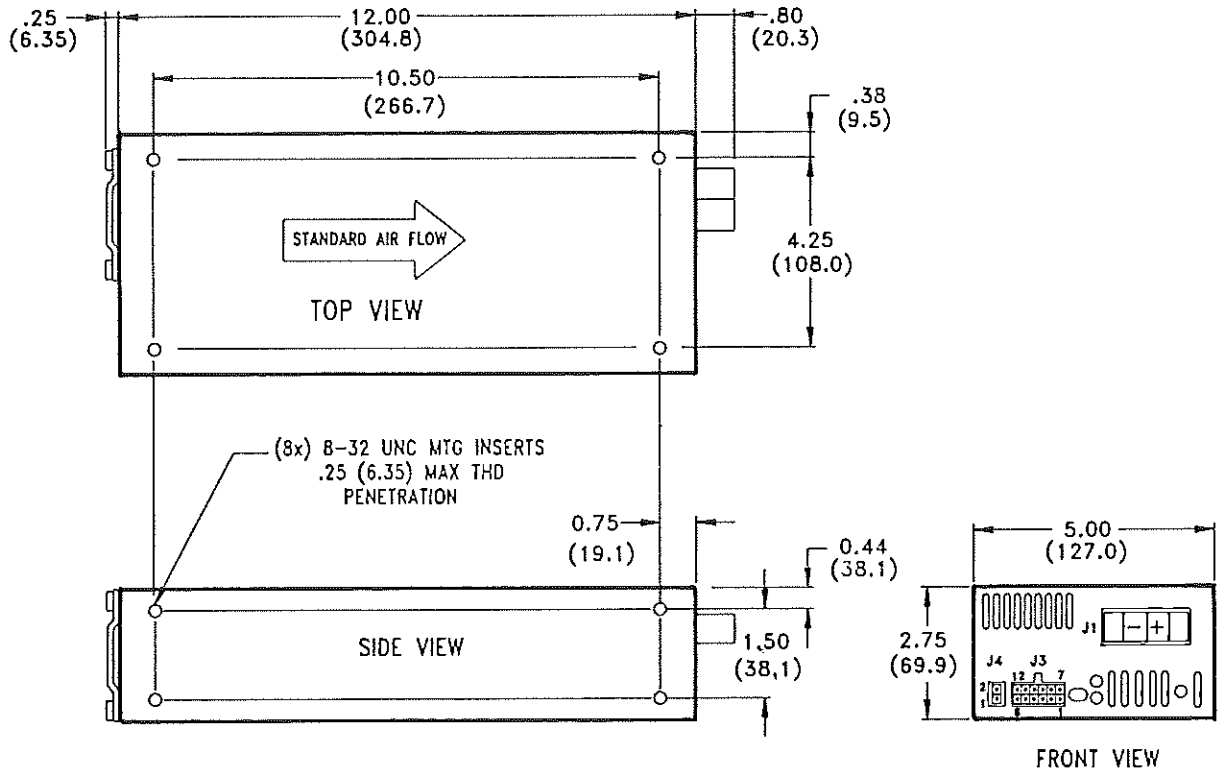


Figure 12. **Battery-Backup Unit Mechanical Dimensions**

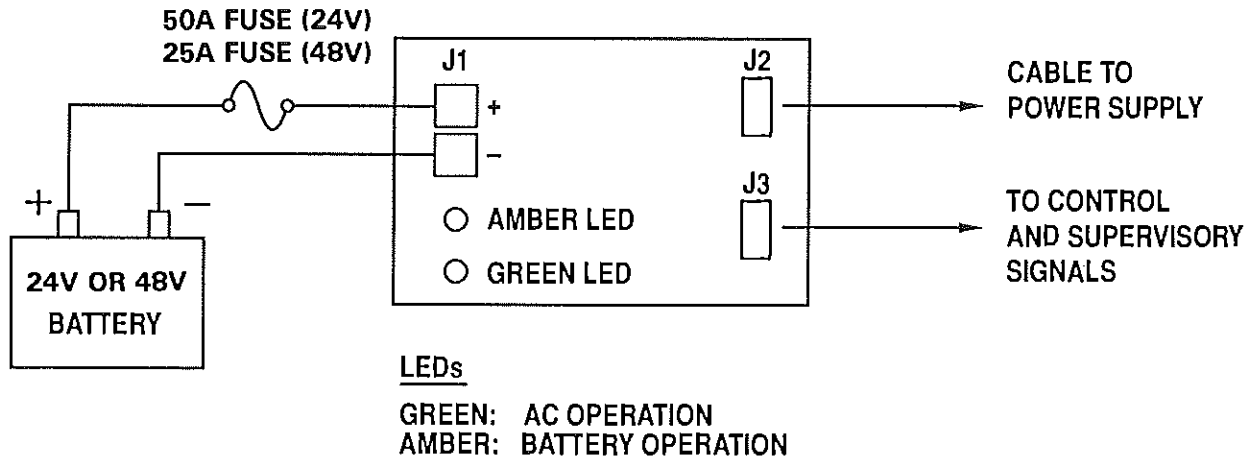


Figure 13. **Battery-Backup Unit Connections**

556137-2 (Black) for - input, with 556136-2 contacts. The positive input is on the right. No. 12AWG wire size or lower should be used for connection to the battery. The positive battery terminal must be connected in series with a 50 ampere fuse for a 24V battery or a 25 ampere fuse for a 48V battery to meet safety agency requirements. **Be sure to connect only a 24V battery to a 24V Battery-Backup Unit and only a 48V battery to a 48V Battery-Backup Unit. Otherwise damage could result to the Battery Backup Unit.**

21.4 **Output Connections.** The output connections to the P Series power supply are made by means of the cable supplied with the Battery-Backup Unit. This cable plugs into J2 on the Battery-Backup Unit and also into J2 on the P Series power supply. J2 at the power supply is a 6-pin Molex connector and J2 at the Battery-Backup Unit is a 10-pin Molex connector.

21.5 **Control and Supervisory Signal Connections.** These connections are made to J3, a 12-pin Molex connector and J4, a 2-pin Molex connector. The J3 mating plug is Molex 39-01-2125 plug with female pins 39-00-0039, and the J4 mating plug is Molex 39-01-2025 with female pins 39-00-0039.

21.6 **Maintenance.** No routine maintenance is required on the Battery Backup Unit except for periodic cleaning of dust and dirt around the fan intake. A small vacuum nozzle should be used for this. The cover should not be removed; there are no user-serviceable components in the unit.

22.0 BATTERY-BACKUP SETUP AND TESTING

22.1 Unplug the AC power cord to the P Series power supply and wait 5 minutes so that the internal filter capacitors are fully discharged.

22.2 See Fig. 13. Connect a 24V or 48V, sealed lead-acid battery, in fully charged condition, to the battery terminals of the unit. The positive terminal **must be connected in series with a 50 ampere fuse for a 24V battery or a 25 ampere fuse for a 48V battery** to meet safety agency requirements. Connect the cable from J2 of the Battery-Backup Unit to J2 of the power supply.

22.3 Make sure that the Battery Operation Inhibit input (Pin 3) is at a logic LO or connected to the 5V Alarm Supply Return (J4 Pin 2 or J3 Pin 5).

22.4 The power supply outputs and sense leads should be connected to their loads, and the setup and testing as described in section 14.0 should be completed.

22.5 Plug in the AC power cord. The power system is now in the AC mode of operation and all output voltages should be normal. The green LED should be on.

22.6 Unplug the AC power cord. The power supply is now on battery operation. All output voltages should remain within specification. The amber LED should be on.

NOTE: The Battery-Backup Unit will not initially start up and operate on the battery. It must start up on AC operation first. Then it can be switched to battery operation.

22.7 If the Battery Operation Inhibit control is to be used, it should be checked out as follows. Apply a logic HI, or open, to this input (Pin 3). Since the system is on battery operation, this will cause all the DC outputs to turn off. Return the input on pin 3 to a logic LO, or connection to the Battery Voltage Return (Pin 10). The outputs remain latched off. Plug in the AC power cord, and the DC outputs should come back on again.

22.8 After sufficient testing in the battery-backup mode, after the AC power cord is plugged in again, the battery will be recharged by the charging circuit. This charging is indicated by a positive output voltage on pin 6 of J3. See description for Charge Current Monitor (Pin 6) in Section 20.0.

23.0 BATTERY-BACKUP UNIT TROUBLE SHOOTING GUIDE

23.1 If you encounter difficulty with battery-backup operation, go through the following trouble shooting guide.

SYMPTOM	POSSIBLE CAUSE	ACTION TO TAKE
No outputs.	Battery voltage is low and the battery-backup converter is latched off.	Check battery voltage to see that it is above 22 volts for a 24V battery or 42 volts for a 48V battery. If not, replace with a fully-charged battery or allow the battery sufficient time to recharge when the system is operating from AC. NOTE: The battery voltage may drop below the latch-off point under heavy load but then rise above 22V or 42V when the load is removed. This can cause the output to latch off. AC must be reapplied to reset the unit.

SYMPTOM	POSSIBLE CAUSE	ACTION TO TAKE
No outputs.	A logic HI, or open, is on J3 Pin 3, which inhibits all outputs.	Apply a logic LO to J3 Pin 3 or connect it to Pin 5. Cycle the AC input on and then off again. The outputs should then be normal.
No outputs.	Faulty battery connection.	Check battery terminals, clean them if necessary and make a tight connection. Cycle the AC input on and then off again.

23.2 If none of these actions solves the problem, call the UNIPOWER factory for help and try to resolve the problem over the telephone. If this is not successful, request an RMA (Return Material Authorization) number and return the Battery-Backup Unit to UNIPOWER. Be sure to pack the unit carefully in the original packing material if possible. UNIPOWER will fax a form to be filled out and returned with the unit.

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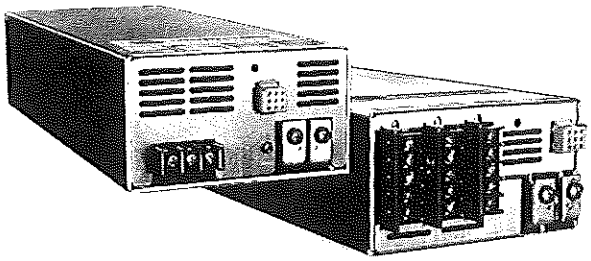

KEY FEATURES
- Low Profile Cases (From 2.75")
- Power Density To 3.6W/Cubic Inch
- Switch Selectable 115/230VAC
- Redundant N + 1 Capability
- 12V Main On Multi For Disc Drives
- No Load Oper. (Single & Aux. Outputs)

OPTIONS
- Worldwide Autorange 115/230VAC
- DC "OK" Signal
- No Load Operation (Main On Multi)
- Current Share/Monitor (Main Output)
- Current Share (Auxiliary Outputs)
- Reverse Air Flow

OTHER FEATURES
- Outputs From 2VDC To 48VDC
- Full Output Power To 50°C
- Fully Isolated Outputs
- Special Output Configurations
- 100Khz MOSFET Switching
- Efficiency To 85%
- Surface Mount Technology
- Hi-Rel Hybrid Control Circuits
- Current Share On All Outputs
- Modular Auxilliary Outputs
- Mag Amp Regulation
- Rear Mounted DC Ball Bearing Fan
- Soft Start
- Electronic Inrush Current Limiting
- Tight Regulation, Low Noise
- Overload And Overvoltage Protection
- Thermal Warning And Protection
- EMI Input Filter
- Remote Sense, Inhibit, Margin
- AC Power Fail Signal
- 24 Hour Power-Cycle Burn-In At 50°C
- Full Test Data With Each Unit
- Safety Agency Approvals
- Manufactured In U.S.A.
- Two Year Warranty

SPECIFICATIONS
Typical at Nominal Line, Full Load and 25°C Unless Otherwise Noted.

OUTPUT SPECIFICATIONS
Output Voltage Adjustment Range, All Outputs ..... ±5%
Line Regulation[1] ..... 0.2% or 10 mV, max.
Load Regulation[2], NL-50% FL, 50%FL-FL ..... 0.2% or 10 mV, max.
Cross Regulation[2], Multi-Output ..... 0.2% or 10 mV, max.
Ripple and Noise[3]
- Main Output ..... 1.0% or 50 mV, max.
- Auxiliary Outputs ..... 1.5% or 75 mV, max.

Hold-Up Time ..... 20 msec., min.
Dynamic Response[4] ..... 500 usec., max.
Temperature Coefficient ..... 0.02%/°C, max.
Overvoltage Protection, All Outputs ..... Power Shutdown
Remote Sense[5] ..... All Outputs Except 2A Auxiliaries

INPUT SPECIFICATIONS
Voltage Range, User Selectable (Switch) ..... 90 to 132 VAC
180 to 264 VAC
Input Frequency ..... 47 to 63 Hz
Electronic Inrush Current Limiting ..... 40A Peak
Input EMI Filter, Conducted ..... FCC & VDE Class A
Input Protection ..... Internal Fuse

GENERAL SPECIFICATIONS
Efficiency ..... 70 to 85%
Switching Frequency ..... 100 kHz
Input To Output Isolation ..... 3000 VAC

ENVIRONMENTAL SPECIFICATIONS
Operating Temperature ..... 0°C to 65°C
Derating 50°C to 65°C ..... 2.4%/°C
Storage Temperature Range ..... −40°C to +85°C
Cooling ..... Internal DC Ball Bearing Fan
Vibration ..... Per MIL-STD 810D, Method 514-3, Cat-I, Proc I
Shock ..... Per MIL-STD 810D, Method 516-3, Proc II, IV, VI

PHYSICAL SPECIFICATIONS
Case Material ..... Aluminum
Dimensions ..... See Case Drawings
Weight:
- 250W, 400W, 500W, 600W Single ..... 4.0 lbs. (1.8 kg.)
- 400W, 500W Multi ..... 6.0 lbs. (2.7 kg.)
- 650W, 800W Multi ..... 8.5 lbs. (3.9 kg.)

NOTES:
1. Whichever figure is greater. Measured over AC input range.
2. Whichever figure is greater. Remote sense must be connected.
3. Whichever figure is greater. 20 MHz bandwidth.
4. 4% maximum deviation with recovery to within 1% for 25% step change at 75% rated load.
5. 0.25V maximum load cable voltage drop on all outputs.

UL 1950 | CSA 22.2, No. 220 or No. 234 | TUV EN 60 950

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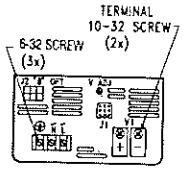
STANDARD MODELS (The following models are standard configurations of main and auxiliary modules. For special configurations of available auxiliary modules consult factory).

MAX WATTS[1]	MODEL NUMBER[2]	OUTPUT V1	OUTPUT V2[3]	OUTPUT V3[3]	OUTPUT V4[3]	OUTPUT V5[3]	CASE
250	PD 1000 PD 2000 PD 3000 PD 4000 PD 5000 PD 7000	2V65A 5V50A 12V21A 15V17A 24V11A 48V5A					10
400	PF 1000 PF 9000 PF 2000 PF 3000 PF 4000 PF 5000 PF 7000	2V100A 3.3V100A 5V80A 12V34A 15V27A 24V17A 48V8.5A					
500	PG 2000 PG 5000 PG 7000	5V100A 24V21A 48V10.5A					
600	PH 5000 PH 7000	24V25A 48V12.5A					
400	PF 2330 PF 2440 PF 3250	5V60A 5V60A 12V25A	12V8A(12) 15V7A 5V10A	12V8A(12) 15V7A 24V4A(6)			15
500	PG 2330 PG 2440	5V75A 5V75A	12V8A(12) 15V7A	12V8A(12) 15V7A			
650	PJ 2330 PJ 2440	5V85A 5V85A	12V10A(15) 15V7A	12V10A(15) 15V7A			25
800	PM 2330 PM 2440	5V100A 5V100A	12V10A(15) 15V7A	12V10A(15) 15V7A			
400	PF 2233 PF 2244 PF 2335 PF 2445	5V60A 5V60A 5V60A 5V60A	5V10A 5V10A 12V8A(12) 15V7A	12V8A(12) 15V7A 12V8A(12) 15V7A	12V8A(12) 15V7A 24V4A(6) 24V4A(6)		15
500	PG 2233 PG 2244 PG 2335 PG 2445	5V75A 5V75A 5V75A 5V75A	5V10A 5V10A 12V8A(12) 15V7A	12V8A(12) 15V7A 12V8A(12) 15V7A	12V8A(12) 15V7A 24V4A(6) 24V4A(6)		
650	PJ 2233 PJ 2244 PJ 2335 PJ 2445	5V85A 5V85A 5V85A 5V85A	5V20A 5V20A 12V10A(15) 15V7A	12V10A(15) 15V7A 12V10A(15) 15V7A	12V10A(15) 15V7A 24V5A(7) 24V5A(7)		25
800	PM 2233 PM 2244 PM 2335 PM 2445	5V100A 5V100A 5V100A 5V100A	5V20A 5V20A 12V10A(15) 15V7A	12V10A(15) 15V7A 12V10A(15) 15V7A	12V10A(15) 15V7A 24V5A(7) 24V5A(7)		
400	PF 21233 PF 22333 PF 22335	5V60A 5V60A 5V60A	2V10A 5V10A 5V2A	5V10A 12V2A 12V2A	12V2A 12V2A 12V8A(12)	12V2A 12V8A(12) 24V4A(6)	15
500	PG 21233 PG 22333 PG 22335	5V75A 5V75A 5V75A	2V10A 5V10A 5V2A	5V10A 12V2A 12V2A	12V2A 12V2A 12V8A(12)	12V2A 12V8A(12) 24V4A(6)	

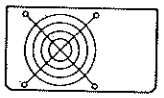
AVAILABLE AUXILIARY MODULES		
2V10A	12V2A	24V5A(7)[4]
2V20A[4]	12V8A(12)	12/12V2A
5V2A	12V10A(15)[4]	15/15V2A
5V10A	15V7A	5/12V2A
5V20A[4]	24V4A(6)	

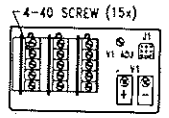
OPTIONS[2]	
A	Auto Range 115/230VAC[5]
D	DC "OK" Signal
E	No Load Operation (Main of Multi)
F	Current Share/Monitor (Main)
H	Current Share (Aux. Outputs)
P	Pluggable Aux. Conn. (Case 15)
R	Reverse Air Flow (Consult Factory)

NOTES:
1. Maximum continuous total output power must not exceed the maximum power rating.
2. Add suffix letters to model number for options.
3. Auxiliary output number does not represent output location.
4. 650 and 800 Watt only.
5. Standard on 650 and 800 Watt
( ) Peak Current for 30 seconds Max.

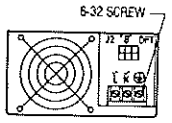


FRONT VIEW CASE #10

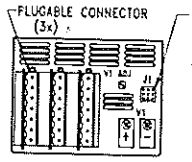

REAR VIEW CASE #10



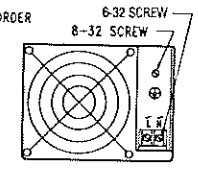
FRONT VIEW CASE #15



REAR VIEW CASE #15



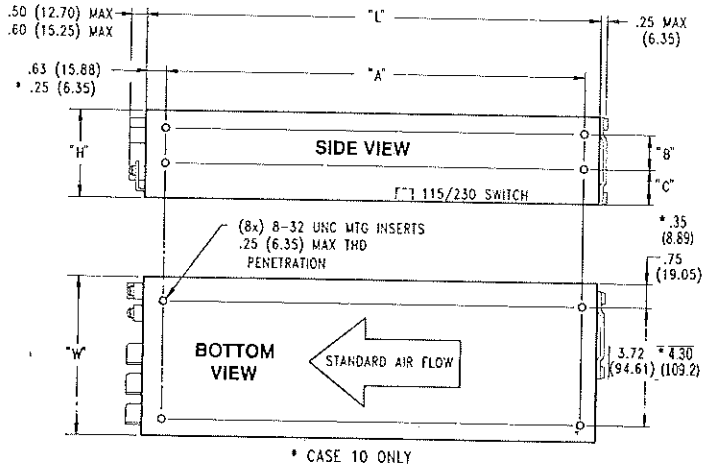
FRONT VIEW CASE #25



REAR VIEW CASE #25

CASE STYLE	DIMENSIONS INCHES (mm) H	W	L	A	B	C
10	2.75 (69.8)	5.00 (127)	12.15 (308.6)	11.62 (295.15)	1.00 (25.4)	0.75 (19.05)
15	2.75 (69.8)	5.00 (127)	14.30 (363.2)	13.20 (335.28)	1.10 (27.94)	1.10 (27.94)
25	3.80 (96.52)	5.00 (127)	14.30 (363.2)	12.38 (314.45)	1.10 (27.94)	1.33 (33.78)

MATING PLUGS AND PINS	
J1 mating plug: Molex 03-06-2092	Male pins are 02-06-2103
J2 mating plug: Molex 15-31-1063	Male pins are 02-06-2103
Case 25 auxilary output mating plugs are LMI 20620701000	
Case 15 auxilary output mating plugs are LMI 20620501000	



* CASE 10 ONLY

ALL DIMENSIONS IN INCHES (mm). All specifications subject to change without notice.

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