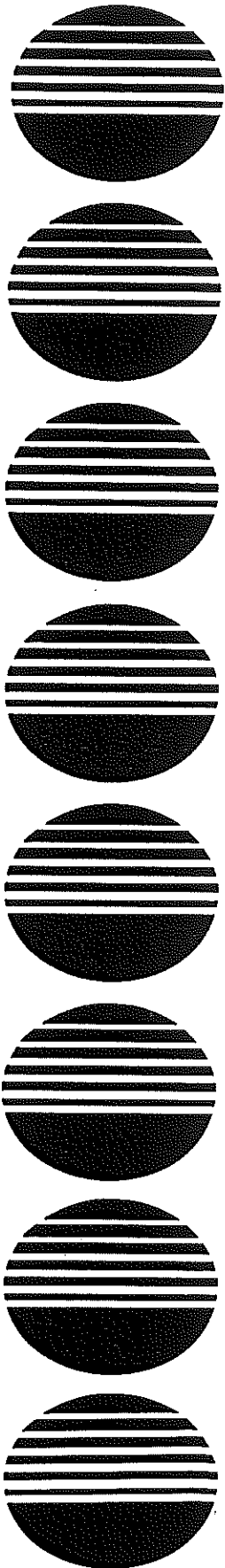


PRICE: \$25.00

**Z SERIES  
MODULAR, PF CORRECTED  
SWITCHING POWER SUPPLIES**



Manual No. Z-995-0

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**UNIPOWER**  
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## Z SERIES OPERATING MANUAL

### 1.0 INTRODUCTION

- 1.1 This Operating Manual should be read through carefully before installing and operating the Z Series switching power supplies.
- 1.2 This series of very compact switching power supplies combines 100 kHz MOSFET switching with power factor correction and high-density packaging. Power density is up to 3.8 watts per cubic inch. See Fig. 1. Various standard models have output power from 140 watts to 500 watts. Multi-output models have a 300 or 350 watt main output and up to three lower power auxiliary outputs which are wide-range adjustable up to a 3 to 1 voltage range. The supplies are safety agency approved by UL, CSA and TUV.

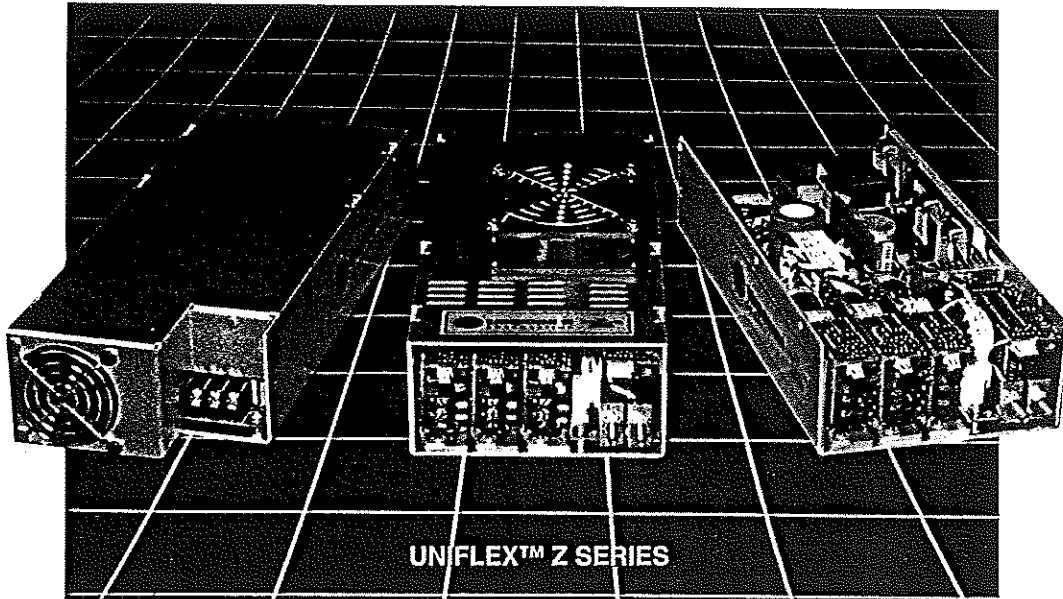
The Z Series incorporates a number of important features such as flexible/modular architecture, input EMI filter, power factor correction, internal thermal protection and remote sensing on all outputs. Current sharing and Class B EMI filter are optional features. Control and supervisory signals include AC power fail and logic inhibit.

There are three case configurations to choose from: a standard open frame version, a top-mounted fan version with cover, and an end-mounted fan version with five-sided case. For a complete description and specifications, see the data sheet in the Appendix.

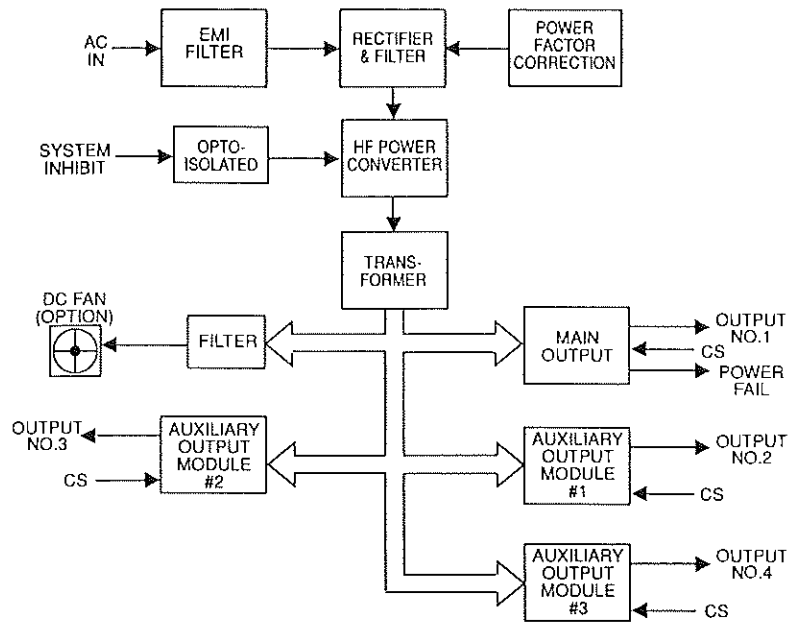
### 2.0 SAFETY WARNINGS

- 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).

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**Figure 1. Z Series Power Supplies**



**Figure 2. Z Series Block Diagram**

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

### 3.0 WARRANTY POLICY

ALL PRODUCTS of UNIPOWER Corporation are warranted for two (2) years from date of shipment against defects in material and workmanship. This warranty does not extend to products which have been opened, altered or repaired by persons other than persons authorized by the manufacturer or to products which become defective due to acts of God, negligence or the failure of customer to fully follow instructions with respect to installation, application or maintenance. This warranty is extended directly by the manufacturer to the buyer and is the sole warranty applicable. EXCEPT FOR THE FOREGOING EXPRESS WARRANTY, THE MANUFACTURER MAKES NO WARRANTY, EXPRESS OR IMPLIED INCLUDING, BUT NOT LIMITED TO, THE WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. As the sole and exclusive remedy under this warranty, the manufacturer, at its option, may repair or replace the non-conforming product or issue credit, provided the manufacturer's inspection establishes the existence of a defect. To exercise this remedy, the buyer must contact the manufacturer's Customer Service Department to obtain a Return Material Authorization number and shipping instructions. Products returned without prior authorization will be returned to buyer. Freight charges incurred in returning the defective products will be paid by UNIPOWER. Charges incurred in returning the material will be paid by the buyer. If the buyer fails to fully comply with the foregoing, the buyer shall not be entitled to any allowance or claim with respect to such product. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property or any other incidental or consequential losses) shall be available to the buyer.

### 4.0 UNPACKING AND INSPECTION

- 4.1 This Z 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

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the power system without proper packing.

### 5.0 DESCRIPTION OF OPERATION

- 5.1 **Main Output.** The Z Series are modular-design switching power supplies with power factor correction. 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 100 kHz.
- 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 100 kHz pulses to produce an isolated, regulated output. The auxiliary outputs employ high-efficiency magnetic amplifiers to achieve tight regulation. Up to three auxiliary output modules are available in the Z 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 is universal, accepting voltages from 90-264 VAC for worldwide operation. Inrush current limiting controls the initial AC input current on power up.

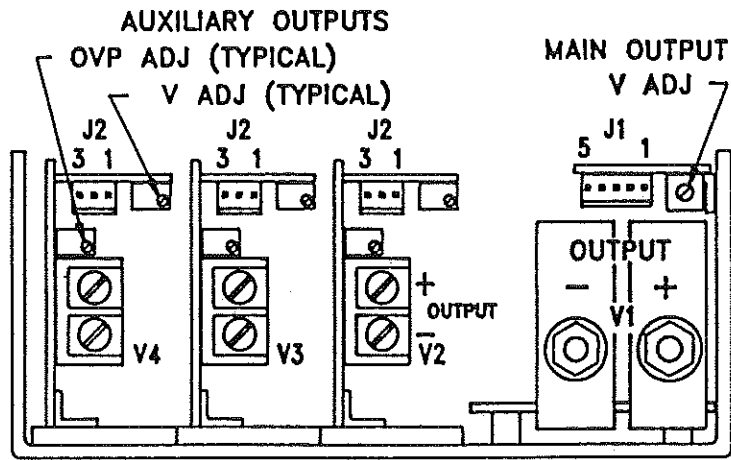
### 6.0 FRONT AND REAR PANEL DESCRIPTIONS

- 6.1 The front panel view of the Z Series is shown in Fig. 3. The case types are designated as follows (see Fig. 4a,b,c):

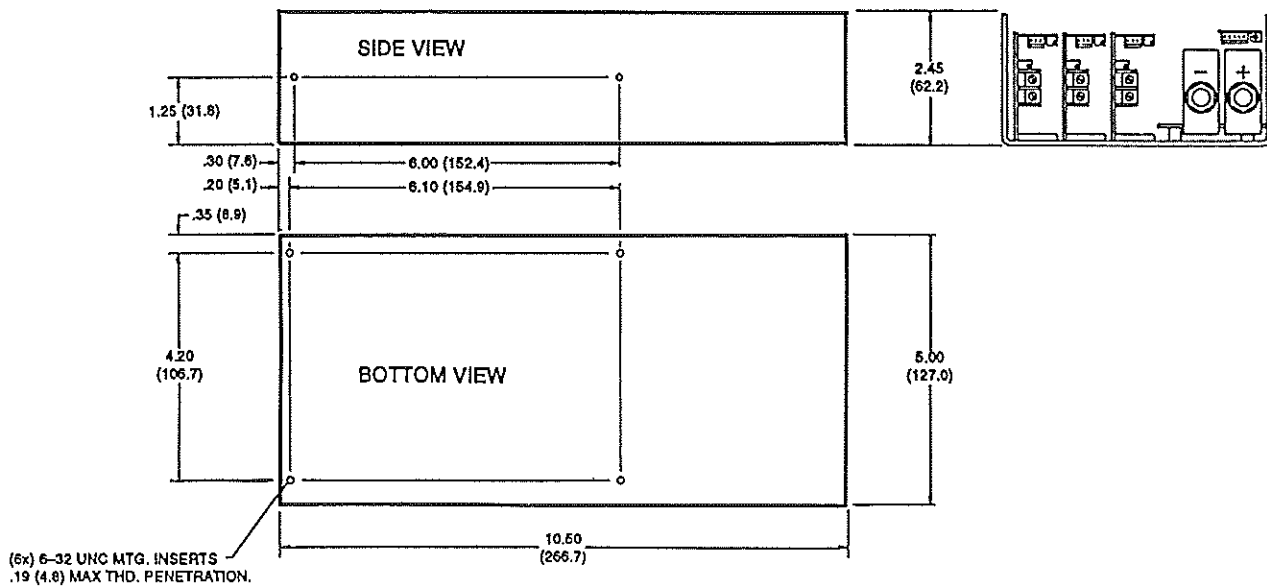
Standard	Open Frame	Class A EMI Filter
Option M	Top-Mounted Fan with Cover	Class A EMI Filter
Option N	End-Mounted Fan with Case	Class A EMI Filter
Option CN	End-Mounted Fan with Case	Class B EMI Filter

- 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 studs. Above these terminals and to the right is the V1 adjustment potentiometer which adjusts the main output voltage  $\pm 5\%$ . The initial factory setting is within  $\pm 1\%$  of the nominal specified voltage.

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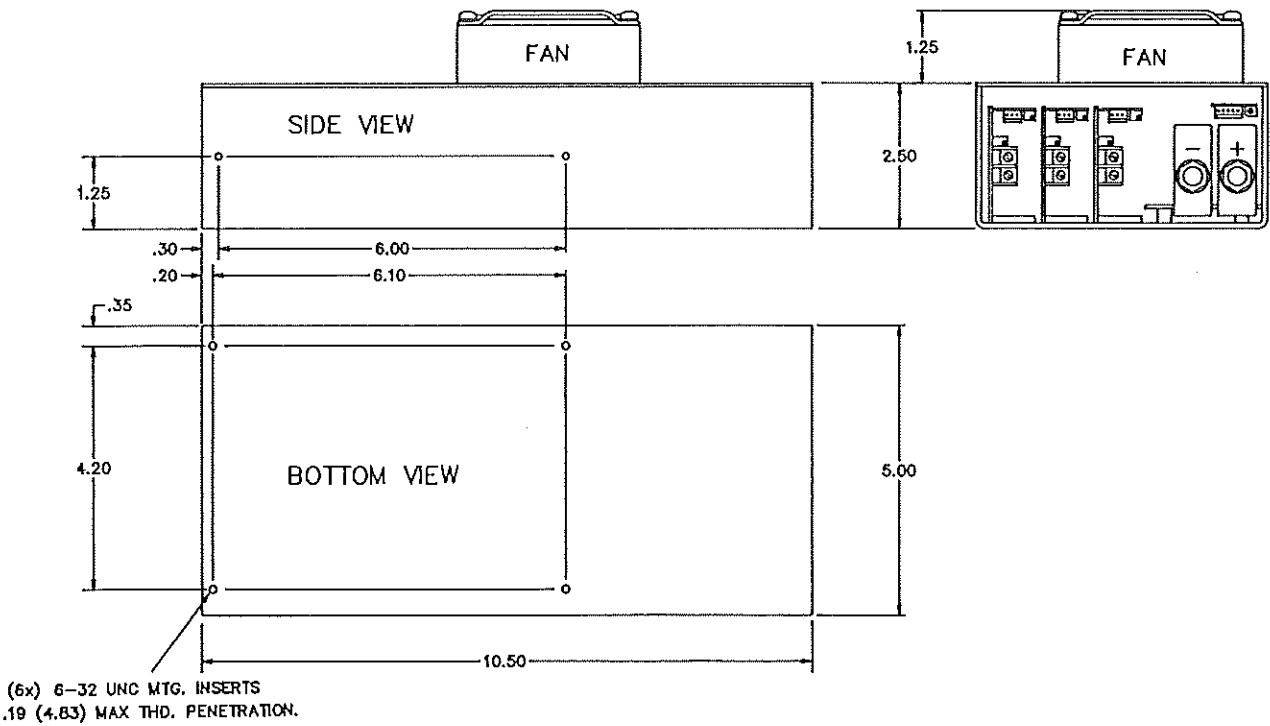
**Figure 3. Z Series Front Panel**



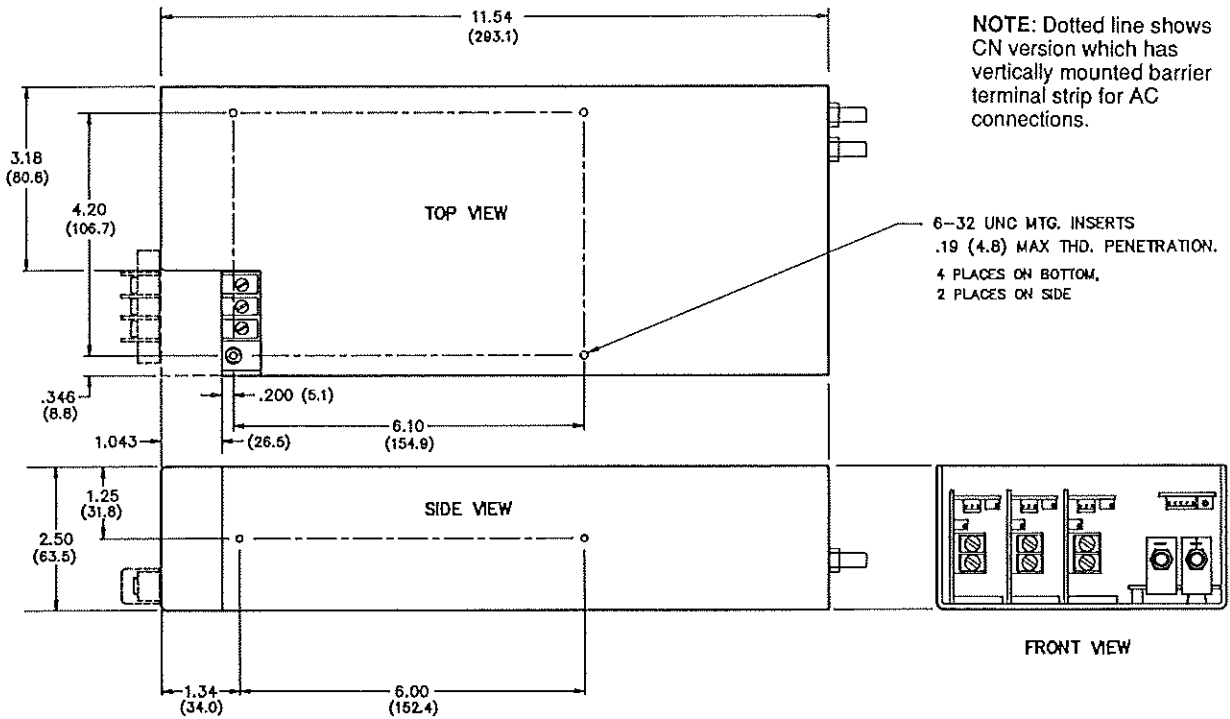
**Figure 4a. Case Drawing: Standard Version, Open Frame**



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**Figure 4b. Case Drawing: Option M, Top-Mounted Fan with Cover**



**Figure 4c. Case Drawing: Options N and CN, End-Mounted Fan with Cover**

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- 6.3 AC line, neutral and ground input connections are made to a 3-terminal barrier strip with No. 6-32 screws. This terminal strip is located at the rear of the power supply. See Fig. 7. For Option CN (cased version with end-mounted fan and Class B EMI filter) the terminal strip is mounted vertically and also has No. 6-32 screws.
- 6.4 Auxiliary DC output connections are made to the auxiliary output modules to the left of the main output by means of No. 6-32 screws. The positive output is on top and the negative output on bottom. Above and to the right of these terminals is the voltage adjustment potentiometer. Directly above the terminals is an overvoltage protection (OVP) adjustment potentiometer. See Fig. 3.
- 6.5 On the front panel, above each set of output terminals, is a connector for control and supervisory signals. These connectors have standard 25 mil (0.6mm) square pins on 0.1 inch (2.5mm) centers. See section 10.0.

### 7.0 AVAILABLE OUTPUTS

- 7.1 The main output is 5 VDC and is adjustable over  $\pm 5\%$ . Note that the main output on multi-output units must have a minimum 10% load. 12 and 24 VDC main outputs are also available on special order; consult the factory on this. The auxiliary outputs are adjustable over a wide voltage range as shown in the table below. Fig. 5 is a V-I diagram showing current limitations for the auxiliary outputs.

VOLTAGE RANGE, ADJ	MAXIMUM CURRENT	MAX. WATTS
2V TO 6V	15A	90W
5V TO 15V	12A	150W
15V TO 36V	7A	150W

- 7.2 The following table gives the output voltages and auxiliary module adjustment ranges for each standard model. All outputs are set at the factory to  $\pm 1\%$  of specified value.

# Z SERIES

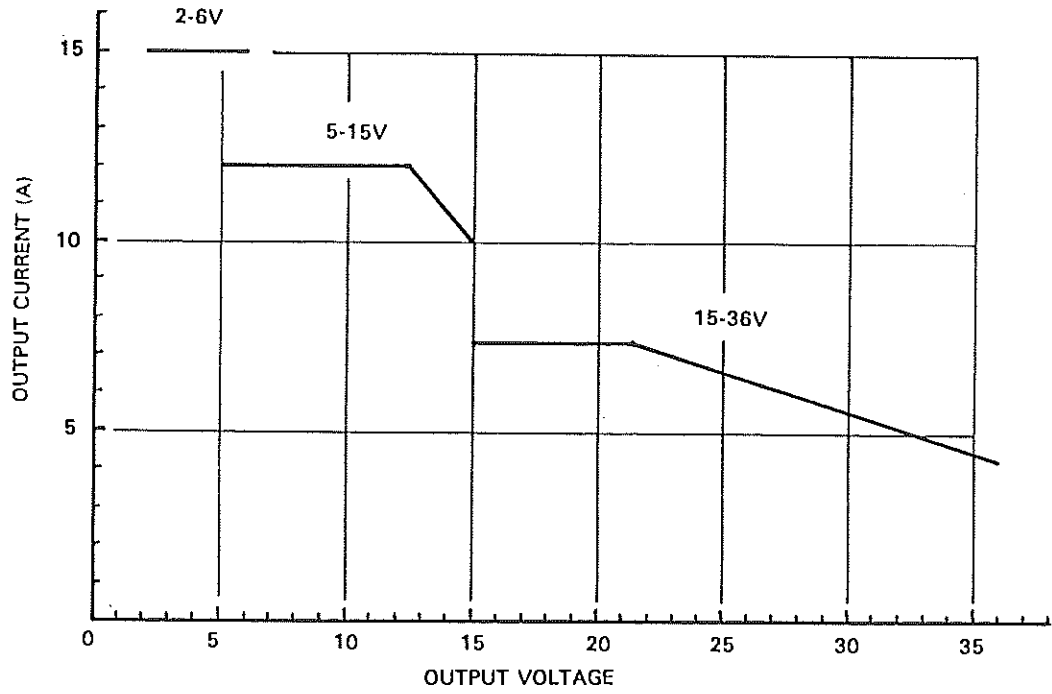


Figure 5. V-I Curves for Auxiliary Outputs

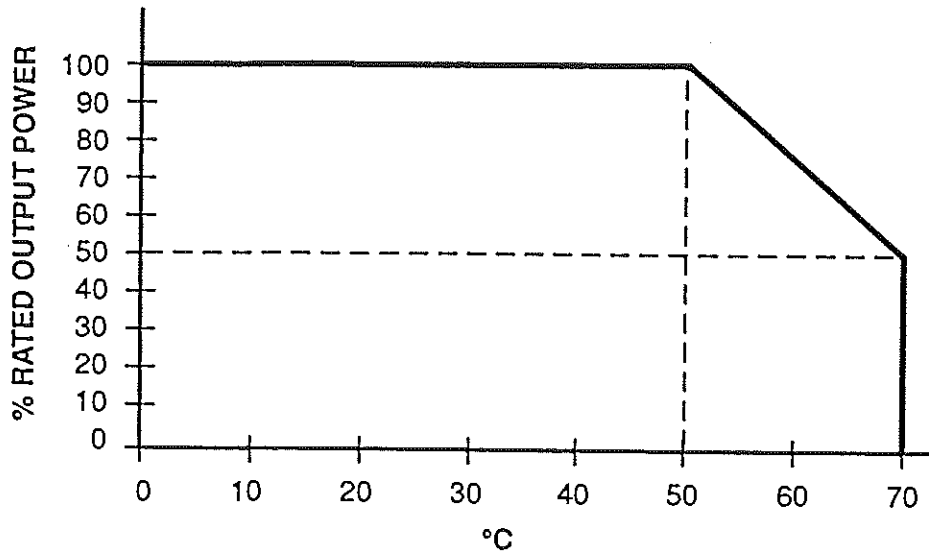


Figure 6. Output Power vs. Ambient Temperature

## Z SERIES

MAX. WATTS <sup>1</sup>	MODEL NUMBER	MAIN OUTPUT V1 <sup>2</sup>	AUX. <sup>3</sup> OUTPUT V2	AUX. <sup>3</sup> OUTPUT 3	AUX. <sup>3</sup> OUTPUT V4
140 230 350	ZB1000 ZE9000 ZE2000	2V70A 3.3V70A 5V70A			
400	ZF3000 ZF4000 ZF5000 ZF7000	12V34A 15V27A 24V17A 48V8.5A			
400	ZF2330 ZF2440	5V60A 5V60A	12V12A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 15V10A (5-15V)	
500	ZG2330 ZG2440	5V70A 5V70A	12V12A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 15V10A (5-15V)	
400	ZF2332 ZF2333 ZF2335 ZF2442 ZF2444 ZF2445	5V60A 5V60A 5V60A 5V60A 5V60A 5V60A	12V12A (5-15V) 12V12A (5-15V) 12V12A (5-15V) 15V10A (5-15V) 15V10A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 12V12A (5-15V) 12V12A (5-15V) 15V10A (5-15V) 15V10A (5-15V) 15V10A (5-15V)	5V15A (2-6V) 12V12A (5-15V) 24V6A (15-26.5V) 5V15A (2-6V) 15V10A (5-15V) 24V6A (15-26.5V)
500	ZG2332 ZG2333 ZG2335 ZG2442 ZG2444 ZG2445	5V70A 5V70A 5V70A 5V70A 5V70A 5V70A	12V12A (5-15V) 12V12A (5-15V) 12V12A (5-15V) 15V10A (5-15V) 15V10A (5-15V) 15V10A (5-15V)	12V12A (5-15V) 12V12A (5-15V) 12V12A (5-15V) 15V10A (5-15V) 15V10A (5-15V) 15V10A (5-15V)	5V15A (2-6V) 12V12A (5-15V) 24V6A (15-26.5V) 5V15A (2-6V) 15V10A (5-15V) 24V6A (15-26.5V)

### NOTES:

1. Maximum continuous total output power must not exceed the maximum power rating.
2. 12 or 24V main available on multi-output models (consult factory).
3. Outputs can be adjusted over the ranges shown. Maximum continuous auxiliary output power and current must not exceed the maximum rating shown in paragraph 7.1 for each auxiliary output module. See Fig. 5.

## Z SERIES

### 8.0 DESCRIPTION OF FEATURES AND OPTIONS

FEATURE/OPTION	DESCRIPTION
Safety Agency Approvals	UL1950; CSA22.2 No. 234; and EN60950. All outputs are approved to SELV.
Turn-On Time	Less than one second from AC turn-on. For AC turn-on or release of inhibit control the output voltage rise is monotonic with 2.5% maximum overshoot.
EMI Input Filter	Standard input line filter meets FCC and EN level A requirements. An optional model, Option CN, is available which is cased with an end-mounted fan and meets FCC and EN level B requirements.
AC Undervoltage Protection	Power supply is protected for all conditions below low line voltage.
Thermal Protection	Power supply shuts down when the internal temperature reaches an excessive value. It automatically recovers when the AC input is cycled off and then on, or the inhibit input is activated.
Isolated Outputs	All DC outputs are isolated from each other and from ground. They may be connected as either + or - outputs and may be referenced up to $\pm 400V$ with respect to ground or another output.
Remote Sense	Remote sense is provided on the main output and all auxiliary outputs. Connecting the remote sense leads provides regulation at the point of load. Total external voltage drop from the DC output to the sense points can be 500 mV maximum. The outputs are open-sense protected.
Output Current Limiting	Main Output: Current-protected on the input circuit with automatic recovery. Auxiliary Outputs: Current limiting takes place at approximately 125% of nominal output rating. Outputs are individually current limited.
Short Circuit Current	Main Output: Short circuit shuts down all outputs. To restart, remove load or cycle the AC input off then on. Auxiliary Outputs: Short circuit current is approx. 120% of rated current and affects only the shorted module.

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FEATURE/OPTION	DESCRIPTION
Overvoltage Protection	<p>Main Output: OVP operates at 125% of the nominal output voltage. The power supply shuts down and must be reset by cycling the AC input off and then on, or activating the inhibit input.</p> <p>Auxiliary Outputs: OVP operation on each auxiliary module is set by a multi-turn potentiometer which is factory set to 115% of nominal voltage. When activated, individual module outputs shut down and must be reset by cycling AC input off and then on.</p>
Reverse Voltage Protection	To 100% of rated output current, maximum.
Main Output Power Fail	A TTL LO provides an advance warning of 3 msec. before the main output drops by 5% after an input power failure. A TTL LO also occurs whenever the output is 10% below nominal voltage.
Logic Inhibit	A short provided at this input inhibits (turns off) all power supply outputs. An open turns the outputs on. This input is referenced to the main output -Sense pin.
Class B EMI Filter (Option CN)	With this option the power supply is enclosed in a case except for the front end. The fan is mounted at the rear of the case and the input EMI filter meets FCC and EN level B requirements.
Current Sharing (Option F)	All outputs can current share with identical outputs of another Z Series power supply. Current sharing accuracy is $\pm 10\%$ of rated load current for each output.
Top-Mounted Fan with Cover (Option M)	Cooling fan and cover are mounted on top of power supply. See case drawing. This option adds approx. 1.3" to height of unit.
Rear-Mounted Fan with Case (Option N)	With this option the power supply is enclosed in a case except for the front end. The fan is mounted at the rear of the case.

### 9.0 OPERATING INFORMATION

- 9.1 **Input Voltage.** The Z Series switching power supplies operate on standard 115VAC or 220-240VAC input voltages. The universal input voltage range (90-264 VAC) accepts worldwide AC inputs.

## Z SERIES

- 9.2 **Outputs.** The main output (V1) power connections are made to no. 10-32 studs on tin-plated copper bus bars. See Fig. 3. The left bus bar is negative and the right one positive. Auxiliary output connections are made to terminal blocks with no. 6-32 screws. See section 12.4 for maximum torque on the stud nuts and screws.

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 0.1 $\mu$ F ceramic capacitor and 10 $\mu$ F 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 Z Series single output models have maximum output power ratings from 140W to 400W. The multi-output models have maximum ratings of 400W or 500W. However, the ratings of the individual outputs, when totalled, may exceed these values. See the table of standard models in Section 7.2. **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 2.5%/°C. See Fig. 6. The maximum operating temperature is 70°C. For the standard open frame version up to 400W output, an air flow of 400 LFM min. across the length of the power supply must be maintained for cooling. For the 500W version, 500 LFM min. must be maintained. The air should flow from front to rear of the power supply.

- 9.4 **Remote Sensing.** Remote sense connections for the main output are made to pins 1 and 2 of the main output connector (J1). For the auxiliary outputs the connections are made to pins 1 and 2 of the auxiliary output connectors (J2).

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 maximum voltage drop in the power leads of 500 mV, or 250mV on each lead. Sense leads can be No. 22 or 24AWG wire, but should not exceed 10 feet (3 meters) in length. If remote sensing is not required, the sense leads should be connected directly to the proper DC output terminals for local sensing.

- 9.5 **Control and Supervisory Signals.** The control and supervisory signals are accessible at the 3- or 5-pin connectors (J1 or J2) above each set of output terminals. The terminals are for Power Fail (AC), Current Share, Logic Inhibit and Remote Sense. The inputs and outputs that are used must have external 0.1 $\mu$ F ceramic capacitors across them to prevent noise pickup. For a description of each function see Section 11, "Description of Control and Supervisory Signals."

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- 9.6 **Current Sharing (Paralleled Outputs).** Two or more Z Series units may have any or all of their outputs connected in parallel to current share if the outputs are identical in both voltage and current rating. Current sharing accuracy is within  $\pm 10\%$  of the rated current for each output.

The current share function is implemented by first adjusting the output voltages of all outputs which are to be current shared to within  $\pm 1\%$  of each other. 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, all outputs are connected in parallel with all remote sense leads connected, and the current share terminals are connected together. Connections should be made as shown in Fig. 9 with wires twisted 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.

- 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. The main output is adjustable over  $\pm 5\%$  and the auxiliary outputs are adjustable up to 3 to 1. See Fig. 3. No output should be continuously operated beyond its current rating or power rating, and the total output power of all outputs must not exceed the maximum rating of the power supply. See the tables in Sections 7.1 and 7.2

- 9.8 **Power Fail Signal.** This signal on pin 3 of the main output control and supervisory signal connector is a warning signal for the loss of AC power, main output loss, or thermal shutdown. It is a TTL output signal which gives at least a 3 millisecond warning before the main output voltage drops by 5% due to loss of AC input power. The TTL output also indicates if the output is 10% below nominal voltage.

- 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. Isolation diodes are required in series with each output for this application.

## 10.0 CONTROL & SUPERVISORY SIGNAL CONNECTIONS

The connections for the control and supervisory signals are shown in Fig. 3. Following are the pin designations:



## Z SERIES

MAIN OUTPUT CONNECTOR, J1	
PIN	FUNCTION
1	+ Sense
2	- Sense
3	Power Fail
4	Current Share (CS)
5	Logic Inhibit

AUXILIARY OUTPUT CONNECTORS, J2	
PIN	FUNCTION
1	+ Sense
2	- Sense
3	Current Share (CS)

**NOTE:**

All Control and Supervisory Signal connectors have standard 25 mil. (0.6mm) square, 0.1 inch (2.5mm) center pins.

	CONNECTOR	MATE
J1	AMP 640457-5	AMP 643814-5
J2	AMP 640457-3	AMP 640441-3

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### 11.0 DESCRIPTION OF CONTROL AND SUPERVISORY SIGNALS

#### MAIN OUTPUT CONNECTOR, J1

SIGNAL	PIN	DESCRIPTION
+ Sense - Sense	1 2	These remote sense leads are connected to the + output and - output respectively at the load point by means of a twisted pair. See Section 9.4 for a full description of remote sensing.
Power Fail (Output)	3	This is a warning signal for the loss of AC power. A TTL LO (sinks 10mA) occurs 3 msec. before the main output drops 5% below specification. A TTL LO also occurs whenever the output is 10% below nominal voltage. This signal is referenced to the main output - Sense connection (pin 2).
Current Share (CS)	4	This connection, made between other identical Z Series power supplies, permits optional current sharing of outputs within $\pm 10\%$ accuracy. See Section 9.6 for a full description of current sharing.
Logic Inhibit (Input)	5	The power supply can be remotely turned on and off by means of this input. A short turns off all outputs, and an open turns on all outputs. This input is referenced to the main output - Sense connection (pin 2).

#### AUXILIARY OUTPUT CONNECTORS, J2

SIGNAL	PIN	DESCRIPTION
+ Sense - Sense	1 2	See description for pins 1 and 2 of J1 above.
Current Share (CS)	3	This connection is made between the outputs of identical auxiliary output modules. See description for pin 4 of J1 above.

### 12.0 INSTALLATION

- 12.1 **Mounting.** See Fig. 4. The Z Series has four threaded mounting inserts on the bottom and two on the side of the chassis. The inserts accept no. 6-32 screws with maximum penetration of 0.19 inch (4.8mm). Maximum torque on these screws is 9 in.-lbs.

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12.2 **Cooling.** The Z Series open frame models up to 400W must be cooled by means of a 400 LFM minimum air flow across the length of the power supply from front to rear. The open frame 500W models must have 500 LFM minimum air flow. The M, N and CN options have DC ball-bearing fans for cooling. To ensure proper cooling, the power supply requires a minimum clearance of 1 inch (25mm) between all air intakes and outlets, and other surfaces.

12.3 **Input Connections.** See Fig. 7. AC input connections are made to barrier terminal strips with no. 6-32 screws. On the standard model and Options M and N there is a horizontally mounted three-terminal strip. On Option CN the strip is mounted vertically. AC connections are made at the rear of the power supply.

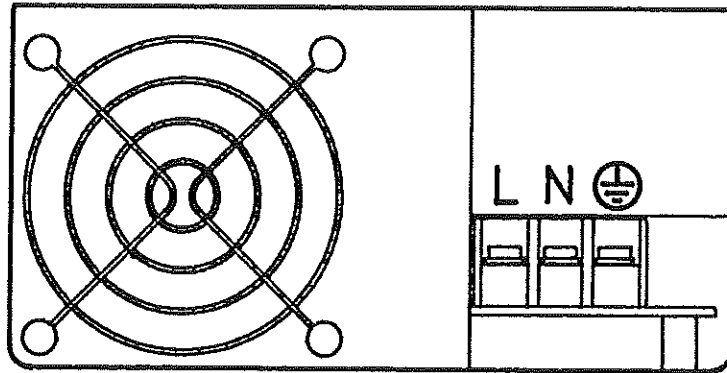
A three-wire AC line and plug must be used for the AC power connection with proper connection made to line, neutral and safety ground terminals. The proper line cord wire size must be used: no. 14 AWG is recommended. Maximum torque on the screws is 9 in.-lbs.

12.4 **Output Connections.** Connections to the main output (V1) are made to tin-plated, copper bus bars by means of no. 10-32 studs. The connections must be secure, and the wires or lugs must be clean to reduce contact resistance. Maximum torque on the 10-32 stud nuts is 22 in.-lbs. The wires must be of correct size to carry the rated output current plus 30%. The main output of multi-output models must have a 10% minimum load connected to it.

Connections to the auxiliary outputs are to terminal blocks with no. 6-32 screws. The maximum torque on the screws is 9 in.-lbs. 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 30%.

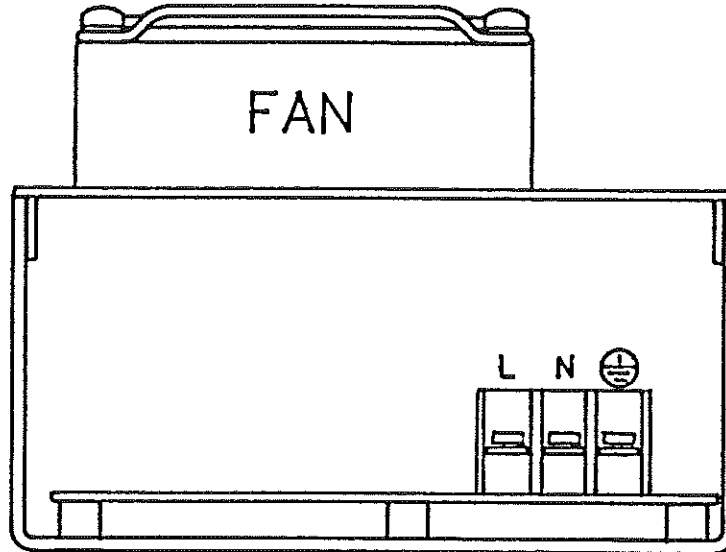
12.5 **Control and Supervisory Signal Connections.** These connections are made to J1 and J2 by means of standard connectors with 25 mil square receptacles on 0.1 inch centers. See Fig. 3 and Section 10.0.

## Z SERIES



Note: For Option CN, the terminal strip is mounted vertically.

### Options N and CN



### Standard Model and Option M

Figure 7. AC Input Connections

## Z SERIES

### 13.0 MAINTENANCE

No routine maintenance is required on the Z Series power supplies except for periodic cleaning of dust and dirt around the fan intake or the chassis on the standard model. A small vacuum nozzle should be used for this. The power supply cover should not be removed, and AC power should be disconnected when cleaning.

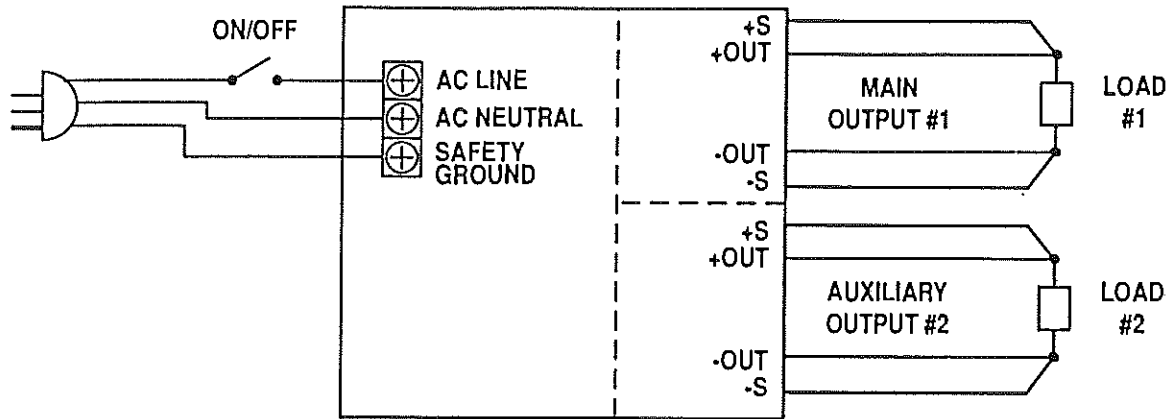
### 14.0 POWER SUPPLY SETUP AND TESTING

- 14.1 **AC Power Connection.** Connect the AC power cord to the AC input barrier terminal strip. See Fig. 7. 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 **Remote Sense Local Connection.** Connect the remote sense leads, with proper polarity, directly to each output terminal on the front panel of the power supply. See Section 9.4. Make sure that the Logic Inhibit input (pin 5 of J1) is left open. Connect a minimum 10% load to the main output.
- 14.3 **Output Voltage Check.** 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 each output. A clockwise adjustment increases the output voltage. See Section 9.7. Unplug the AC power cord.
- 14.4 **Changing the Output Voltage.** The auxiliary output voltages are adjustable over the following ranges:
- 2V to 6V
  - 5V to 15V
  - 15V to 26.5V

If it is desired to change any of the auxiliary outputs from their factory adjusted values by more than a few percent, the following procedure must be used to set both the voltage and the overvoltage protection (OVP) circuit.

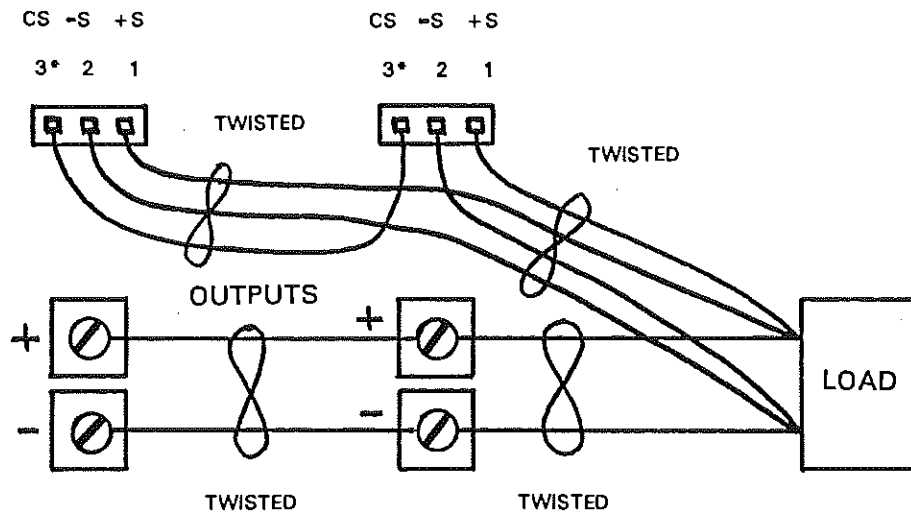
- 14.5 **Adjustment Procedure.** See the front panel diagram in Fig. 3. Do the following with no loads on the auxiliary outputs and a 10% minimum load on the main output:
- 14.51 Unplug the AC power. Turn the OVP adjustment potentiometer clockwise to its limit. This potentiometer is located immediately above the output terminals.

# Z SERIES



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

**Figure 8. Connections for Setup and Testing**



\* Pin 3 for aux. outputs; Pin 4 for main output.  
Label shows correct current share pin.

**Figure 9. Connections for Current Sharing**

## Z SERIES

- 14.52 Plug in the AC power. Connect a digital voltmeter to the output terminals of the module being adjusted. Adjust the output voltage to the value desired for the OVP trip setting. The voltage adjustment potentiometer is located just to the right of J2. This is generally set in the range of 20% to 35% higher than the output voltage. Thus for a 5V output voltage, the OVP would be set between 6.00 and 6.75V.
- 14.53 Next, lower the OVP voltage setting from the maximum by turning the OVP potentiometer counterclockwise until the OVP circuit trips and causes the output to latch up and the output voltage to go to zero. The OVP has now been set.
- 14.54 Unplug the AC power to reset the power supply. Lower the output voltage setting by turning the potentiometer one turn counterclockwise.
- 14.55 Plug in the AC power and adjust the output voltage to its desired value.
- 14.56 Repeat this procedure for each auxiliary output to be adjusted.
- 14.6 **Current Sharing.** If the 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 and see Fig. 9.
- 14.7 **Final Test with Remote Sense and Loads.** 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. There must be a 10% minimum load on the main output. 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.

## 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.

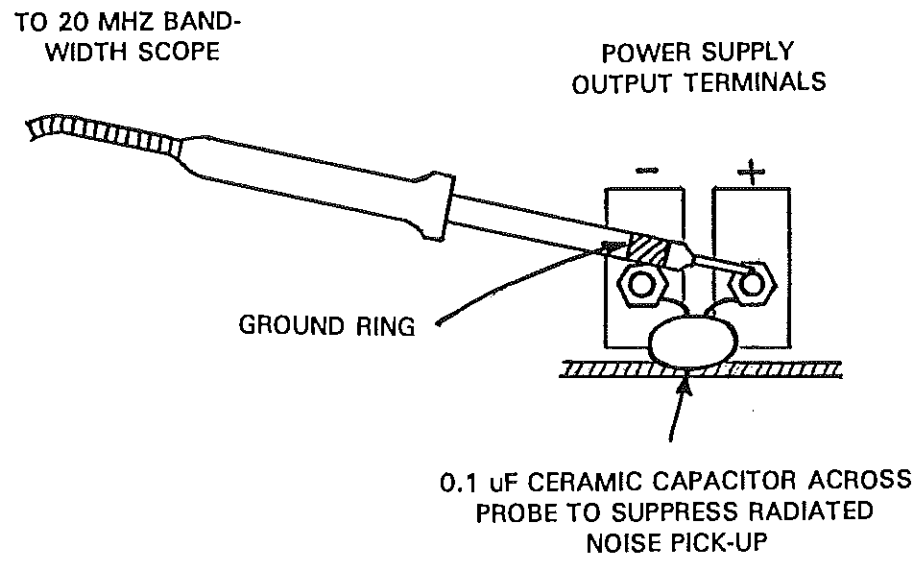
## Z SERIES

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. (one or all outputs).	Overvoltage protection (OVP) is engaged.	Remove overvoltage condition on output. Cycle AC input off and then on.
No output (all outputs).	Overtemperature protection is activated.	Check Power Fail output (pin 3, J1) for a logic LO. Check to see that power supply is being properly cooled.
No output (all outputs).	Output is turned off by Logic Inhibit control.	Check to see if pin 5 of J1 is shorted. It should be open.
Output higher than nominal value (any output)	Remote sense leads not connected.	Connect sense leads as instructed in Section 9.4.
Noisy output voltages or poor regulation.	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. The unit may be shipped freight collect to UNIPOWER.
- 15.3 If output ripple and noise measurements are made, they should be done as shown in Fig. 10. An oscilloscope with 20 MHz bandwidth should be used. Remove the ground lead from the scope probe. Connect a 0.1 $\mu$ F ceramic capacitor across the output terminals as close as possible to the terminals. Then measure the output noise with the tip of the probe on the + output terminal and the probe ground ring on the - output terminal as shown in the figure. The ceramic capacitor across the output suppresses radiated noise pickup.



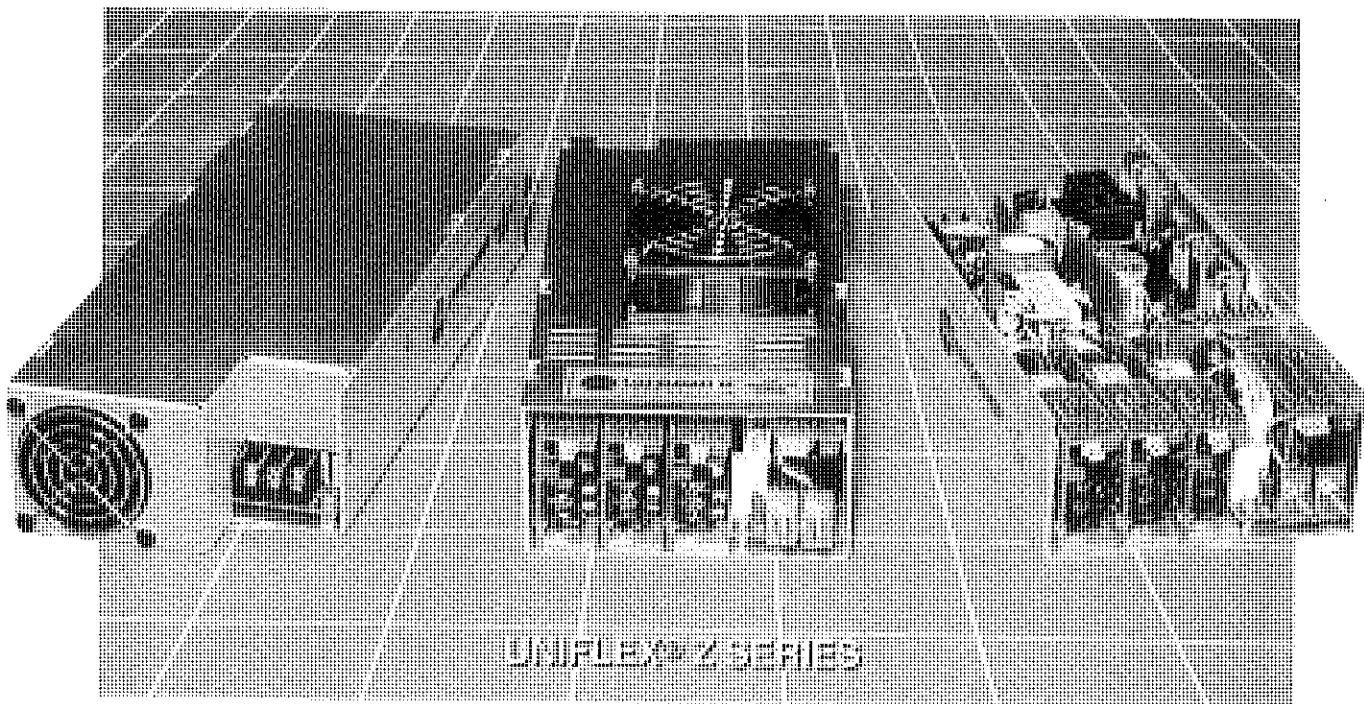
## Z SERIES



**Figure 10. Output Ripple and Noise Measurement**

# POWER FACTOR CORRECTED 400 & 500 WATT SWITCHERS

- ▲ Wide-Range Auxiliary Outputs
- ▲ Ultra-Compact Package
- ▲ One to Five Outputs

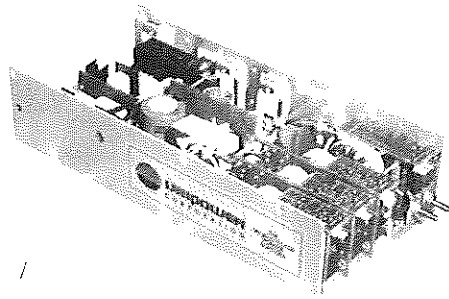


## FEATURES

- ▶ Modular Design
- ▶ 0.99 Power Factor
- ▶ 2 to 48 VDC Outputs
- ▶ Competitive Price
- ▶ Universal Input (90-264 VAC)
- ▶ Class A or B EMI Input Filter
- ▶ Top or Rear Fan Options
- ▶ PowerSpeed 5-Day Delivery

 **UNIPOWER**  
CORPORATION  
*"Leader In Medium To High Power Switchers"*

# UNIFLEX® Z SERIES



## GENERAL DESCRIPTION

The UNIFLEX® Z Series is a new series of high power-density, open frame switching power supplies employing a flexible, modular design with power factor correction. With total output power up to 500 watts, this series permits quick configuration at the factory of a single or multiple-output switcher from standard, in-stock output modules.

A wide variety of output configurations is achieved from a choice of main outputs, three basic auxiliary output modules with wide-range adjustable outputs, and a series of single or dual, low-power modules. Up to five total outputs can be realized. Single-output versions are also available with outputs of 2V to 48V at 400 or 500 watts. All but low-power outputs have remote sensing. On multiple-output versions the main output is 5V to 48V with total output power of 400W or 500W.

The UNIFLEX Z Series circuitry employs a high-frequency power converter which operates off the rectified, filtered, and power-factor-corrected AC line voltage. Switching at 100 kHz, the converter drives a power transformer which provides inputs to the main output regulator and auxiliary output regulators. The wide-range auxiliaries employ high-efficiency magamp regulators.

The basic version of this series is an ultra-compact, open frame unit only 2.45 x 5 x 10.5 inches, providing 3.9 watts per cubic-inch power density for 500 watts output. While the open frame unit requires external cooling, fan cooling is offered on two optional versions: one with a top fan and cover and the other with an end-mounted fan and case. Other options are current sharing on all but low-power outputs and an FCC and EN 55022 Class B EMI filter version with end-mounted fan and case.

The Z Series features also include output overload protection, adjustable overvoltage protection, internal thermal protection, independent isolated outputs, and reverse voltage protection. Control and monitoring functions are a main output power fail signal and an inhibit control. Selected Z Series models are available for PowerSpeed 5-day delivery. The Series carries a two-year warranty.



## SPECIFICATIONS

Typical at nominal line, full load and 25°C unless otherwise noted.

### OUTPUT SPECIFICATIONS

Total Output Power <sup>1</sup> , max. ....	140W to 500W
Main Output Voltage .....	2VDC to 48VDC (see table)
Voltage Adj. Range, min. ....	±5%
Factory Set Tolerance, max. ....	±1%
Minimum Load, aux. at rated load <sup>2</sup> .....	10%
Wide Range Auxiliary Outputs .....	See Table
Minimum Load .....	0.5A
Load Regulation .....	0.4% or 20 mV
Line Regulation .....	0.4% or 20 mV
Output Voltage Temp. Coeff. ....	±0.02%/°C
Ripple and Noise <sup>3</sup> , pk-pk .....	1% or 100 mV
Transient Response, 25% load step .....	2.5% peak
Transient Recovery to 1% .....	
Main Output, max. ....	500µsec.
Wide Range Auxiliary Outputs, max. ....	2.5 msec.
Low Power Auxiliary Outputs .....	See Table
Holdup Time .....	16 msec.

### AC INPUT SPECIFICATIONS

Universal Input Range .....	90-264 VAC
Power Factor .....	0.99
Input Harmonic Currents .....	Meet EN 60555-2
Input Frequency .....	47-63 Hz
Input Current .....	
400W Load, 230 VAC .....	2.5 A RMS
400W Load, 120 VAC .....	4.8 A RMS
500W Load, 230 VAC .....	3.1 A RMS
500W Load, 120 VAC .....	6.0 A RMS
Inrush Current, cold start .....	70 A Peak
Input Protection, internal .....	15 A Fuse

### GENERAL SPECIFICATIONS

Efficiency, 5V-48V outputs, min. ....	70%
2V & 3.3V outputs, min. ....	60%
Switching Frequency .....	100 kHz
Isolation, output to gnd. & other outputs .....	±400 VDC
Leakage Current, to ground, max. ....	1.4mA

### ENVIRONMENTAL SPECIFICATIONS

Operating Temp. Range, rated load .....	0°C to 50°C
Derating, 50°C to 70°C .....	2.5%/°C
Storage Temperature Range .....	-40°C to +85°C
Cooling Required <sup>4</sup> , min., 400W .....	400 LFM
500W .....	500 LFM

### EMI, Conducted<sup>5</sup>

220-240 VAC In. ....	EN 55022, Class A or B
120/220-240 VAC In .....	FCC 20780, Class A or B
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

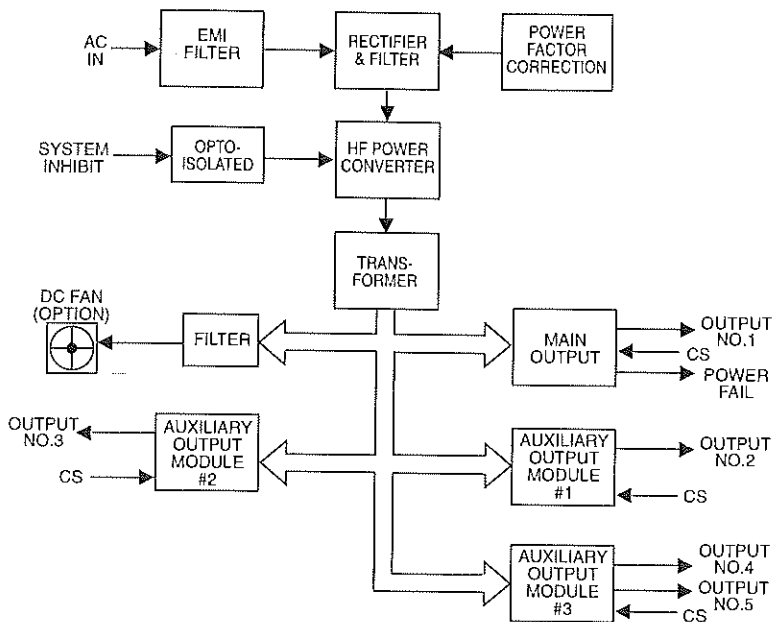
Case Material .....	Aluminum
Dimensions, open frame .....	2.45" H x 5" W x 10.5" D
(62 x 127 x 267 mm)	
Dimensions, covered, top fan .....	3.75" H x 5" W x 10.5" D
(95 x 127 x 267 mm)	
Dimensions, enclosed, end fan .....	2.5" H x 5" W x 11.6" D
(64 x 127 x 295 mm)	
Weight, open frame .....	4.25 lbs. (1.93 kg)
Weight, top fan cooled .....	4.75 lbs. (2.16 kg)
Weight, end fan with case .....	4.75 lbs. (2.16 kg)

### NOTES:

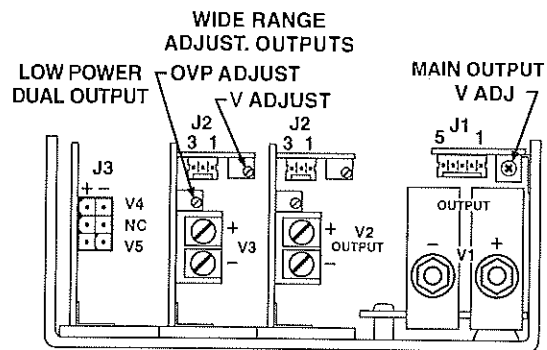
1. Output power depends on model no. See "Ordering Guide".
2. No minimum load on single-output models.
3. Whichever is greater; 20MHz bandwidth. 50mV P-P for 5V output.
4. Two options with fan are available. See "Option" list.
5. Class B filter is an option, available only on option CN with case and end-mounted fan.

## TWO-YEAR WARRANTY

## Z SERIES BLOCK DIAGRAM



## FRONT PANEL CONFIGURATION



V1 terminals are 10-32 studs.

V2, V3 & V4 terminals are #6-32 screws.

NOTE: J1 and J2 connectors have 25 mil. square pins on 0.1 inch centers.

CONNECTOR	MATE
J1 AMP 640457-5	AMP 643814-5
J2 AMP 640457-3	AMP 640441-3
J3 MOLEX 355-1542-000	MOLEX 39-01-2065

## Z SERIES FEATURE & OPTION DESCRIPTIONS

FEATURE/OPTION	DESCRIPTION	FEATURE/OPTION	DESCRIPTION
Safety Agency Approvals	UL1950; CSA22.2 No. 234; EN60950.	Short Circuit Current (Continued)	Wide Range Aux. Outputs: Short circuit current is approx. 120% of rated current and affects only the shorted module.
Turn-On Time	Less than one second from AC turn-on. For AC turn-on or release of inhibit control the output voltage rise is monotonic with 2.5% maximum overshoot.	Overvoltage Protection	Main Output: OVP operates at 110-135% of the nominal output voltage. The power supply shuts down and must be reset by cycling the AC input off and then on or activating the inhibit input. Wide-Range Aux. Outputs: OVP operation on each output is set by a multi-turn potentiometer which is factory set to 115-135% of nominal voltage. When activated, individual module outputs shut down and must be reset by cycling the AC input off and then on.
EMI Input Filter	Standard input line filter meets FCC and EN level A requirements. Optional filter (Option CN), is available on a cased version with end fan and meets FCC and EN level B requirements.	Reverse Voltage Protection	To 100% of rated output current, maximum.
AC Undervoltage Protection	Power supply is protected for all conditions below low line voltage.	Main Output Power Fail	The TTL LO provides an advance warning of 3 msec. before the main output drops by 5% after an input power failure. A TTL LO also occurs whenever the output is 10% below nominal voltage. This is on all 5V main outputs.
Thermal Protection	Power supply shuts down when the internal temperature reaches an excessive value. It automatically recovers when the AC input is cycled off and then on or the inhibit input is activated.	Logic Inhibit	A short provided at this input inhibits (turns off) all power supply outputs. An open turns the outputs on. This input is referenced to the main output -Sense pin.
Isolated Outputs	All DC outputs are isolated from each other and from ground. They may be connected as either + or - outputs and may be referenced up to $\pm 400V$ with respect to ground or another output.	Class B EMI Filter (Option CN)	This option is a cased Z Series with end-mounted fan and Class B EMI input filter.
Remote Sense	Remote sense is provided on the main output and all wide range auxiliary outputs. Connecting the remote sense leads provides regulation at the point of load. Total external voltage drop from the DC output to the sense points can be 500mV max. The outputs are open-sense protected.	Current Sharing (Option F)	All main and wide range auxiliary outputs can current share with identical outputs of another Z Series power supply. Current sharing accuracy is $\pm 10\%$ of rated load current.
Output Current Limiting	Main Output: Current-protected on the input circuit with automatic recovery. Wide Range Aux. Outputs: Current limiting takes place at approx. 125% of nominal output rating. Outputs are individually current limited.	Top-Mounted Fan with Cover (Option M)	Cooling fan and cover are mounted on top of power supply. See case drawing. This option adds approx. 1.3" to height of unit.
Short Circuit Current	Main Output: Short circuit shuts down all outputs. To restart, remove load or cycle the AC input off and then on.	Rear-Mounted Fan with Case (Option N)	With this option the power supply is enclosed in a case except for the front end. The fan is mounted at the rear of the case.

### SINGLE-OUTPUT MODELS

MAX. WATTS	OUTPUT VOLTS/AMPS	MODEL NO.
140	2V 70A	ZB1000
230	3.3V 70A	ZB9000
350	5V 70A	■ZE2000
400	12V 34A	■ZF3000
	15V 27A	ZF4000
	24V 17A	■ZF5000
	28V 14A	ZF6000
	36V 11A	ZF8000
	48V 8.5A	■ZF7000
500	12V 42A	■ZG3000
	15V 33A	ZG4000
	24V 21A	■ZG5000
	28V 18A	ZG6000
	36V 14A	ZG8000
	48V 10A	■ZG7000

### MULTI-OUTPUT MODELS MAIN OUTPUT

VOLTAGE	CURRENT	WATTS	CODE
5V	70A	350	■2
12V	34A	400	■3
15V	27A	400	4
24V	17A	400	■5
28V	14A	400	6
36V	11A	400	8
48V	8.5V	400	■7

### WIDE-RANGE ADJUSTABLE OUTPUT MODULES

VOLTAGE RANGE	MAX. CURRENT	MAX. WATTS	NORMAL FACT. SET	CODE
2V-6V	15A	90W	5V	■2
5V-15V	12A	150W	12V	■3
5V-15V	12A	150W	15V	■4
15V-26.5V	7A	150W	24V	■5

## ORDERING GUIDE

For a single-output Z Series, choose a model from the table above. For a multi-output model, first choose a main output from the upper-right table; then choose up to three wide-range adjustable output modules or two of these and one low-power, fixed-output module from the tables at the right. The low-power modules are either single- or dual-output; using the dual-output module, a total of five outputs can be realized. Fill in the power designator and the main and auxiliary module codes below. Choose the desired option codes and use a dash to separate them from the rest of the model number.

The 5V-15V module is normally factory set to either 12V or 15V by the code number. However, all the modules can be set to other voltages within their range by the user or by the factory. If the desired voltages are specified, they will be set at the factory and a unique suffix number will be assigned to the power supply.

### LOW-POWER, FIXED-OUTPUT MODULES

PIN	OUTPUT	CODE
Single	5V 2A	■2A
	12V 2A	3A
	15V 2A	4A
	24V 1.25A	■5A
Dual	5V 2A, 5V 2A	2B
	5V 2A, 12V 2A	2C
	5V 2A, 24V 1.25A	2D
	12V 2A, 12V 2A	■3B
	12V 2A, 24V 1.25A	3C
	15V 2A, 15V 2A	■4B

## CONTROL AND SUPERVISORY SIGNAL CONNECTIONS

### MAIN OUTPUT CONNECTOR<sup>1</sup>, J1

PIN	FUNCTION
1	+ Sense
2	- Sense
3	Power Fail <sup>2</sup>
4	Current Share (CS)
5	Logic Inhibit

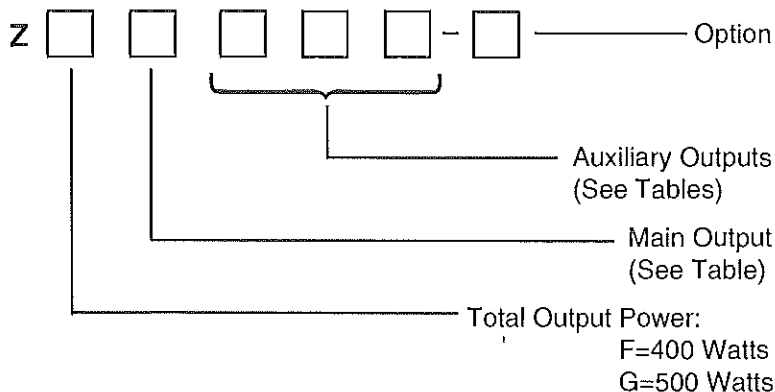
### AUXILIARY OUTPUT CONNECTOR<sup>1</sup>, J2

PIN	FUNCTION
1	+ Sense
2	- Sense
3	Current Share (CS)

#### NOTES:

- All connectors have standard 25 mil. (0.6mm) square, 0.1 inch (2.5mm) center pins.
- Power fail signal is on all units with a 5V main output.

### Z SERIES MULTI-OUTPUT MODELS



#### NOTES:

- Continuous total output power drawn must not exceed the maximum power rating.
- Outputs of the Wide Range Adjustable Output Modules can be adjusted over the ranges shown in the table above. Maximum continuous output current and power must not exceed the maximum ratings shown in the table.

CODE	OPTIONS
■CN	Class B Filter, Cased with End Fan
■F	Current Sharing*
■M	Top-Mounted Fan with Cover
■N	End-Mounted Fan with Case

\*On all main and wide range auxiliary outputs

## LOW-POWER MODULE SPECIFICATIONS (Typical, Single or Dual Output)

Output Voltage	5V	12V	15V	24V
Rated Output Current	2A	2A	2A	1.25A
Current Limit	3.5A	3.5A	3.5A	3.0A
Line Regulation	0.5% or 25mV	0.5% or 60mV	0.5% or 75mV	1%
Load Regulation	2% or 100mV	2% or 240mV	2% or 300mV	3%
Ripple, P-P	2% or 100mV	2% or 240mV	2% or 300mV	3%
Voltage Tolerance	±2%	±2%	±2%	+5%, -15%

NOTE: Minimum load on each output is 0.1A. The 5V output, only, has OVP.

## CONTROL AND SUPERVISORY SIGNAL DESCRIPTIONS

### MAIN OUTPUT CONNECTOR, J1

SIGNAL	PIN	DESCRIPTION
+ Sense - Sense	1 2	Leads from these pins should be connected to the + output and - output, respectively, at the point of load. Total external voltage drop from the DC output to the sense points can be up to 500mV. The outputs are open-sense protected.
Power Fail (Main Output)	3	On all 5V main outputs a TTL LO provides an advance warning of 3 msec. before main output drops by 5% after an input power failure. A TTL LO also occurs whenever the output is 10% below nominal voltage.
Current Share (CS)	4	Main outputs that are current shared must be identical and connected together by means of CS pins. Output voltages should be adjusted within 1% of each other, and then the output terminals connected in parallel.
Logic Inhibit	5	The power supply outputs are remotely controlled by means of this input. A short between pins 2 and 5 turns all outputs off and an open turns them on.

### AUXILIARY OUTPUT CONNECTORS, J2

SIGNAL	PIN	DESCRIPTION
+ Sense - Sense	1 2	Leads from these pins should be connected to the + output and - output, respectively, at the point of load. Low-power module outputs do not have remote sensing. See full description for pins 1 and 2 of Main Output Connector.
Current Share (CS)	3	Auxiliary outputs that are current shared must be identical and connected together by means of CS pins. Output voltages should be adjusted within 1% of each other, and then the output terminals connected in parallel. Low-power module outputs cannot be current shared.

## CASE DRAWINGS

