N2Power™
A subsidiary of Qualstar Corporation

Product Specification

# Mid to High Power
# XL & PL Series
## 500W-3000W Power Supplies

**707251 Rev 7**

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# 1. Introduction

## 1.1 Introduction

This specification defines the XL and PL series of universal input, single output, power factor corrected 500W, 650W, 800W, 1500W and 3000W switch mode power supplies. The PL650 through PL3000 models are also programmable. It includes information regarding the mechanical details, cooling requirements, electrical and signal specifications and environmental ranges for storage and operation of the power supply. These supplies achieve very high packaging densities and air convection cooling. All of the XL and PL family models are listed in Table 3-1.

All models of the XL and PL Series can be used as standalone power supplies. Models PL650 through PL3000 may be connected for slope current sharing at parallel operation.

XL500

PL650

PL800

PL1500

PL3000

**Figure 1-1 XL and PL Series**

## 1.2 Agency Compliance

| Safety | Complies with Standard | Remarks |
|---|---|---|
| United States and Canada | UL 60950-1 listed | 2nd edition |
| European | EN 60950-1:2006+A11 | |
| **Dielectric Withstand Voltage** | I/P-O/P: 4242Vdc; I/P-GND: 2121Vdc<br>O/P-FG:0.5K VAC(707VDC=500VAC x 500VAC × √2),1minute<br>Output 56V-12V fan, 56V- 5Vsb and 56V to FG 1.6K VAC(2250VDC),1minute | This is for POE application that requires isolated 56V power supply (only for XL500-56 POE*) |
| **Isolation Resistance** | I/P-O/P, I/P-FG, O/P-FG: > 100MΩ/500Vdc | |
| **EMC** | **Complies with Standard** | **Remarks** |
| RFI Emission | EN 55022: 2006 Class B | Emission Standard (All models, except the XL500 series, which is Class A) |
| | EN 61204-3: 2000 | |
| | EN 61000-6-3: 2007 | |
| | EN 61000-3-2: 2006 Class A | Limits for harmonic current emission |
| | EN 61000-3-3: 1995+A1:2001+A2: 2005 | Limitation of voltage fluctuations and flicker in low-voltage supply system |
| Immunity: | EN 55024: 1998+A1:2001_A2:2003 | Immunity standard |
| | EN 61204-3: 2000 | |
| | EN 61000-6-1: 2007 | |
| | IEC 610000-4-2 | Electrostatic discharge immunity |
| | IEC 610000-4-3 | Radio frequency immunity |
| | IEC 610000-4-4 | Electrical fast transient burst immunity |
| | IEC 610000-4-5 | Power line surge immunity |
| | IEC 610000-4-6 | RF common mode immunity |
| | IEC 610000-4-8 | Power frequency magnetic field immunity |
| | IEC 610000-4-11 | Voltage dips and short interruptions immunity |

| Reduction of Hazardous Substances (RoHS) | Complies with Standard | Remarks |
|---|---|---|
| EU Council | 2011/65/EU | RoHS 2 Directive |

**Marks of Conformance**

**United States & Canada** — c UL us E211115 Underwriters Laboratories File E211115

**TUV**

**EU Council** CE

*The XL500-56 POE model will be released soon.

**Table 1-1 Agency Compliance**

# 2. AC Input

## 2.1 Input Line Requirements

The following table defines the voltage and frequency requirements for the AC line inputs to the XL and PL models which are capable of supplying full rated power in continuous operation throughout the specified ranges of voltages and frequencies. The power supply will automatically recover from AC power loss and is capable of starting under maximum load at the minimum AC input voltage described below.

| Parameter | Minimum | Nominal | Maximum |
|---|---|---|---|
| RMS Input Voltage | | | |
| XL500 & PL650 Series | 90VAC | 100–240VAC | 264VAC |
| PL800 thru PL3000 Series | 90VAC | 100–240VAC | 264VAC |
| RMS Input Current | | | |
| XL500 Series | | | 6.00A/115VAC<br>3.00A/230VAC |
| PL650 Series | | | 5.30A/115VAC<br>2.48A/230VAC |
| PL800 Series | | | 6.58A/100VAC<br>2.62A/240VAC |
| PL1500 Series | | | 12.73A/100VAC<br>6.36A/240VAC |
| PL3000 Series | | | 13.93A/100VAC<br>10.25A/240VAC |
| Input Frequency | 47Hz | 50/60Hz | 63Hz |

**Table 2-1 XL/PL Input Parameters**

## 2.2 Input Over Current Protection

The XL and PL series incorporates a primary AC line fuse for input over current protection to prevent damage to the power supply and meet product safety requirements as outlined in Section 1.2.

## 2.3 Inrush Current Limiting

The cold start inrush current varies by the XL and PL series power supply model. Repetitive ON/OFF cycling of the AC input voltage shall not damage the power supply or cause the input fuse to fail.

| Model | Inrush Current |
|---|---|
| XL500 Series | 35A/115VAC, 70A/230VAC |
| PL650 Series | 27A/115VAC, 54A/230VAC |
| PL800 Series | 30A/115VAC, 60A/230VAC |
| PL1500 Series | 30A/115VAC, 45A/230VAC |
| PL3000 Series | 33A/115VAC, 65A/230VAC |

**Table 2-2 Cold Start Inrush Current**

## 2.4 Low Input Voltage

The application of an input voltage below the minimums specified in Table 2-1 shall not cause damage to the power supply.

## 2.5 Leakage Current

The leakage current from AC line or AC Neutral inputs to Earth Ground is <1mA/240Vac for models PL650, PL800 and PL3000. For the XL500 models it is <.50mA/240Vac and for the PL1500 models it is <2.5mA/240Vac.

# 3. DC Outputs

## 3.1 Output Voltage Regulation

The DC output voltages shall remain within the Minimum and Maximum limits of Table 3-1 when measured at the power supply connector under all specified line, load and environmental conditions contained herein. The main output (V1) in the single output models (5V thru 60V).

| Model | Output | Rated Voltage | Regulation | Minimum (VDC) | Nominal (VDC) | Maximum (VDC) |
|---|---|---|---|---|---|---|
| XL500-12 | V1 | 12 | ±1.2% | 11.86 | 12.00 | 12.14 |
| | V2 | 5 | | 4.50 | 5.00 | 5.50 |
| | V3 | 12 | | 10.20 | 12.00 | 13.30 |
| XL500-24 | V1 | 24 | ±1% | 23.76 | 24.00 | 24.24 |
| | V2 | 5 | | 4.50 | 5.00 | 5.50 |
| | V3 | 12 | | 10.20 | 12.00 | 13.30 |
| XL500-48 | V1 | 48 | ±1% | 47.52 | 48.00 | 48.48 |
| | V2 | 5 | | 4.50 | 5.00 | 5.50 |
| | V3 | 12 | | 10.20 | 12.00 | 13.30 |
| XL500-56 POE* | V1 | 56 | ±1% | 55.44 | 56.00 | 56.56 |
| | V2 | 5 | | 4.50 | 5.00 | 5.50 |
| | V3 | 12 | | 10.20 | 12.00 | 13.30 |
| PL650-05 | V1 | 5 | ±1% | 4.95 | 5.00 | 5.05 |
| PL650-12 | V1 | 12 | ±1% | 11.88 | 12.00 | 12.12 |
| PL650-15 | V1 | 15 | ±1% | 14.85 | 15.00 | 15.15 |
| PL650-24 | V1 | 24 | ±1% | 23.76 | 24.00 | 24.24 |
| PL650-27 | V1 | 27 | ±1% | 26.73 | 27.00 | 27.27 |
| PL650-48 | V1 | 48 | ±1% | 47.52 | 48.00 | 48.48 |
| PL800-12 | V1 | 12 | ±2% | 11.76 | 12.00 | 12.24 |
| PL800-15 | V1 | 15 | ±2% | 14.70 | 15.00 | 15.30 |
| PL800-24 | V1 | 24 | ±2% | 23.52 | 24.00 | 24.48 |
| PL800-30 | V1 | 30 | ±2% | 29.40 | 30.00 | 30.60 |
| PL800-36 | V1 | 36 | ±2% | 35.28 | 36.00 | 36.72 |
| PL800-48 | V1 | 48 | ±2% | 47.04 | 48.00 | 48.96 |
| PL800-60 | V1 | 60 | ±2% | 58.80 | 60.00 | 61.20 |
| PL1500-12 | V1 | 12 | ±2% | 11.76 | 12.00 | 12.24 |
| PL1500-15 | V1 | 15 | ±2% | 14.70 | 15.00 | 15.30 |
| PL1500-24 | V1 | 24 | ±2% | 23.52 | 24.00 | 24.48 |
| PL1500-30 | V1 | 30 | ±2% | 29.40 | 30.00 | 30.60 |
| PL1500-36 | V1 | 36 | ±2% | 35.28 | 36.00 | 36.72 |
| PL1500-48 | V1 | 48 | ±2% | 47.04 | 48.00 | 48.96 |
| PL1500-60 | V1 | 60 | ±2% | 58.80 | 60.00 | 61.20 |
| PL3000-12 | V1 | 12 | ±2% | 11.76 | 12.00 | 12.24 |

| Model | Output | Rated Voltage | Regulation | Minimum (VDC) | Nominal (VDC) | Maximum (VDC) |
|---|---|---|---|---|---|---|
| PL3000-15 | V1 | 15 | ±2% | 14.70 | 15.00 | 15.30 |
| PL3000-24 | V1 | 24 | ±2% | 23.52 | 24.00 | 24.48 |
| PL3000-30 | V1 | 30 | ±2% | 29.40 | 30.00 | 30.60 |
| PL3000-36 | V1 | 36 | ±2% | 35.28 | 36.00 | 36.72 |
| PL3000-48 | V1 | 48 | ±2% | 47.04 | 48.00 | 48.96 |
| PL3000-60 | V1 | 60 | ±2% | 58.80 | 60.00 | 61.20 |

*The XL500-56 POE model will be released soon.

**Table 3-1 XL and PL Output Voltage Specifications**

## 3.2 No Load Operation

The power supply will operate under a no load condition and will not result in damage to the supply. The power supply will remain stable and operate normally after application of loads.

### 3.2.1 Output Loading for Single Output Models

The output currents listed in Table 3-2 are with the Forced Air internal fan included inside the power supply at no more than 50°C.

| Model | Rated V1 Output | Maximum Load |
|---|---|---|
| XL500-12 | 12V | 41.5A |
| XL500-24 | 24V | 20.8A |
| XL500-48 | 48V | 10.4A |
| XL500-56 POE | 56V | 8.9A |
| PL650-05 | 5V | 100.0A |
| PL650-12 | 12V | 50.0A |
| PL650-15 | 15V | 40.0A |
| PL650-24 | 24V | 27.0A |
| PL650-27 | 27V | 24.0A |
| PL650-48 | 48V | 13.6A |
| PL800-12 | 12V | 66.7A |
| PL800-15 | 15V | 53.4A |
| PL800-24 | 24V | 33.5A |
| PL800-30 | 30V | 26.7A |
| PL800-36 | 36V | 22.3A |
| PL800-48 | 48V | 16.7A |
| PL800-60 | 60V | 13.4A |
| PL1500-12 | 12V | 125.0A |
| PL1500-15 | 15V | 100.0A |
| PL1500-24 | 24V | 62.5A |

| Model | Rated V1 Output | Maximum Load |
|---|---|---|
| PL1500-30 | 30V | 50.0A |
| PL1500-36 | 36V | 41.7A |
| PL1500-48 | 48V | 31.3A |
| PL1500-60 | 60V | 25.0A |
| PL3000-12 | 12V | 200.0A |
| PL3000-15 | 15V | 160.0A |
| PL3000-24 | 24V | 125.0A |
| PL3000-30 | 30V | 100.0A |
| PL3000-36 | 36V | 83.5A |
| PL3000-48 | 48V | 62.5A |
| PL3000-60 | 60V | 50.0A |

**Table 3-2 Max Load Currents Single Output Models**

### 3.2.2 High Temperature Derating

The XL500 series can be operated at elevated temperatures by derating the total maximum output power (or current) by 2.5%/°C from 50°C to 70°C. The PL650 and PL1500 models will derate by 4.0%/°C from 50°C to 60°C and the PL3000 models will derate by 5.0%/°C from 50°C to 60°C.

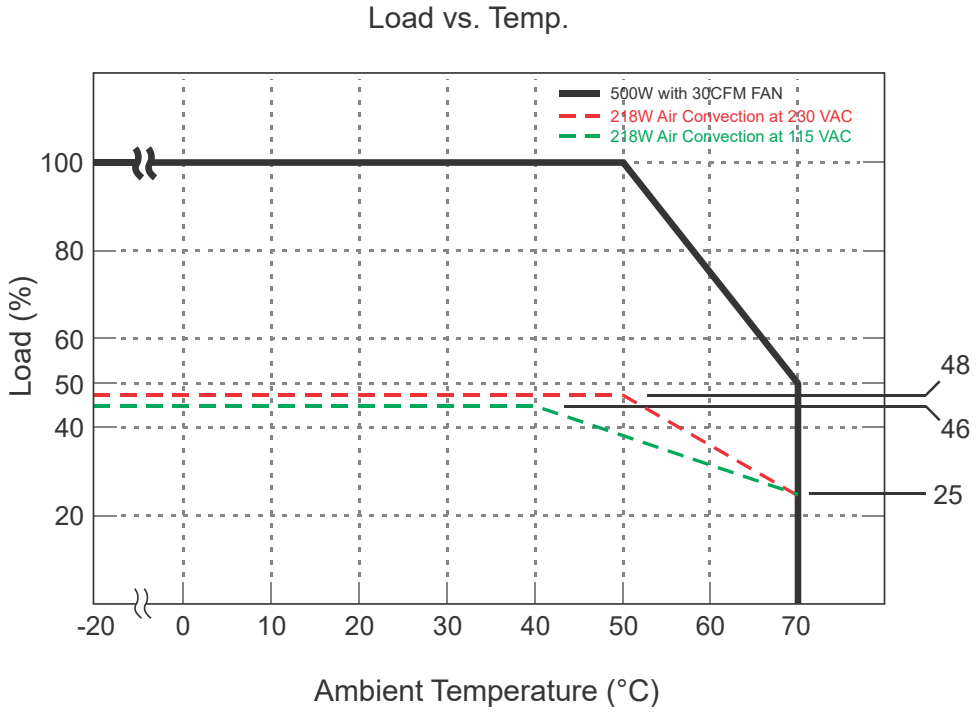



**Figure 3-1 Derating Curve: Models XL500-12, 24 and 48**

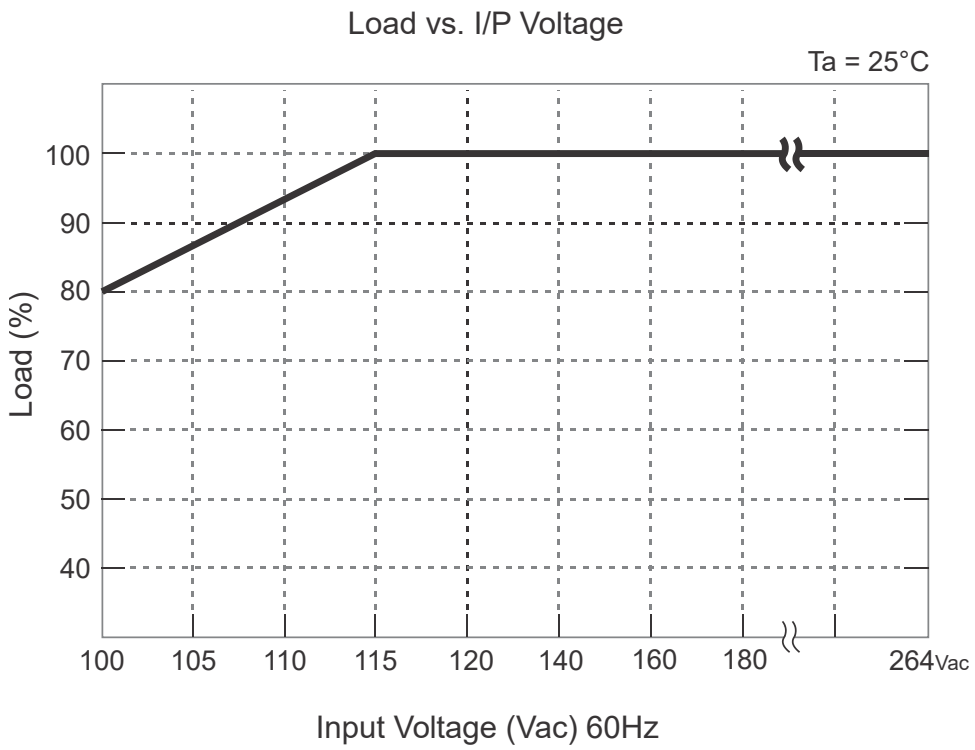



**Figure 3-2 Load vs. Input Voltage: Models XL500-12, 24 and 48**

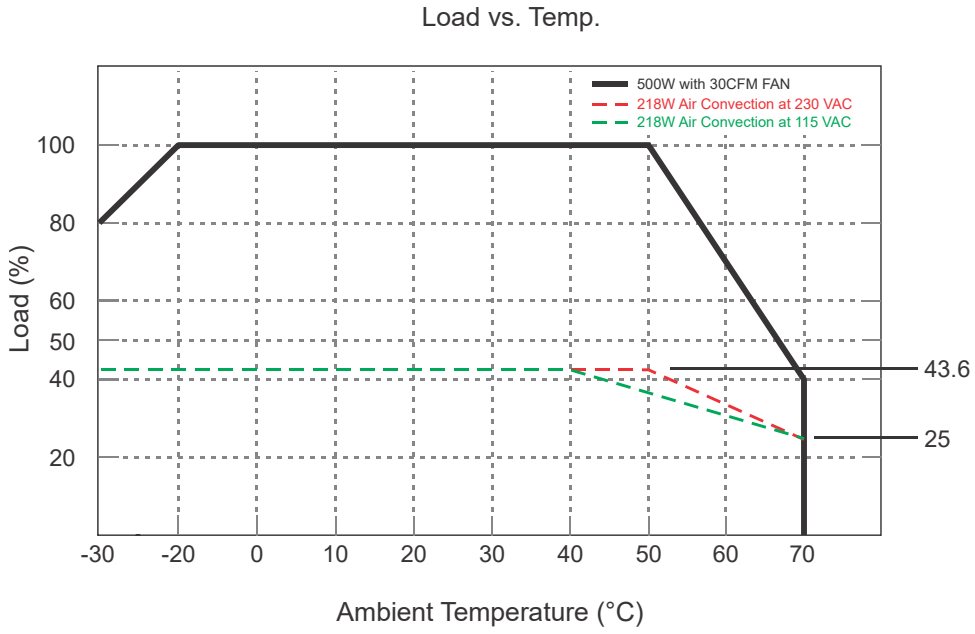



**Figure 3-3 Derating Curve: Model XL500-56 POE**

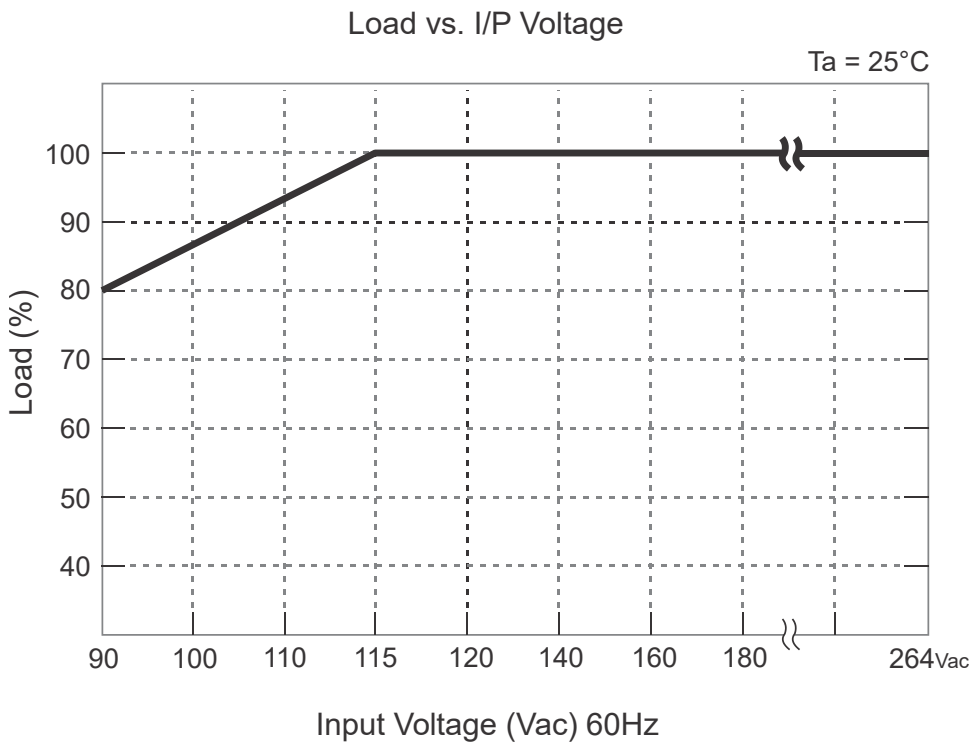



**Figure 3-4 Load vs. Input Voltage: Model XL500-56 POE**

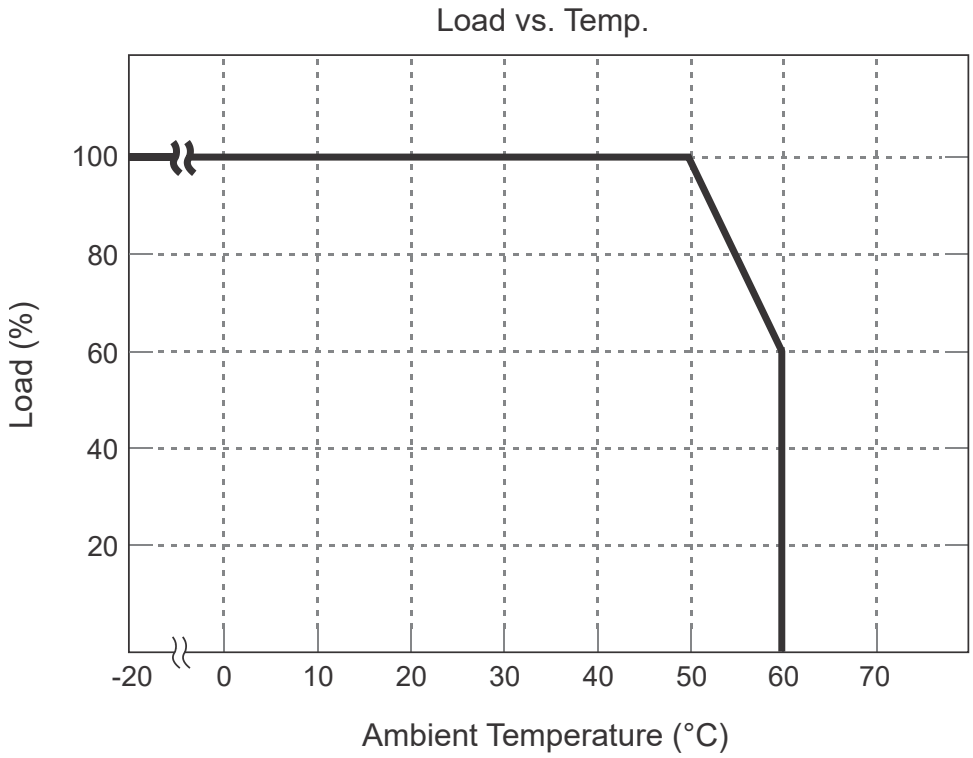



**Figure 3-5 Derating Curve: Models PL650, PL800, PL1500 and PL3000**

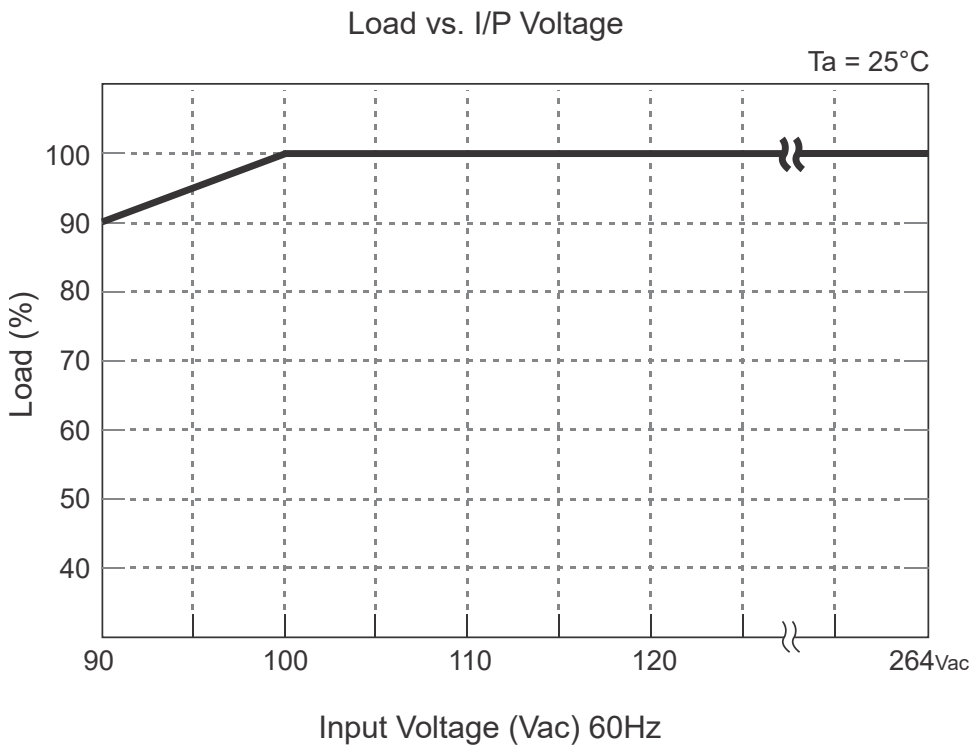



**Figure 3-6 Load vs. Input Voltage: Models PL650, PL800, PL1500 and PL3000**

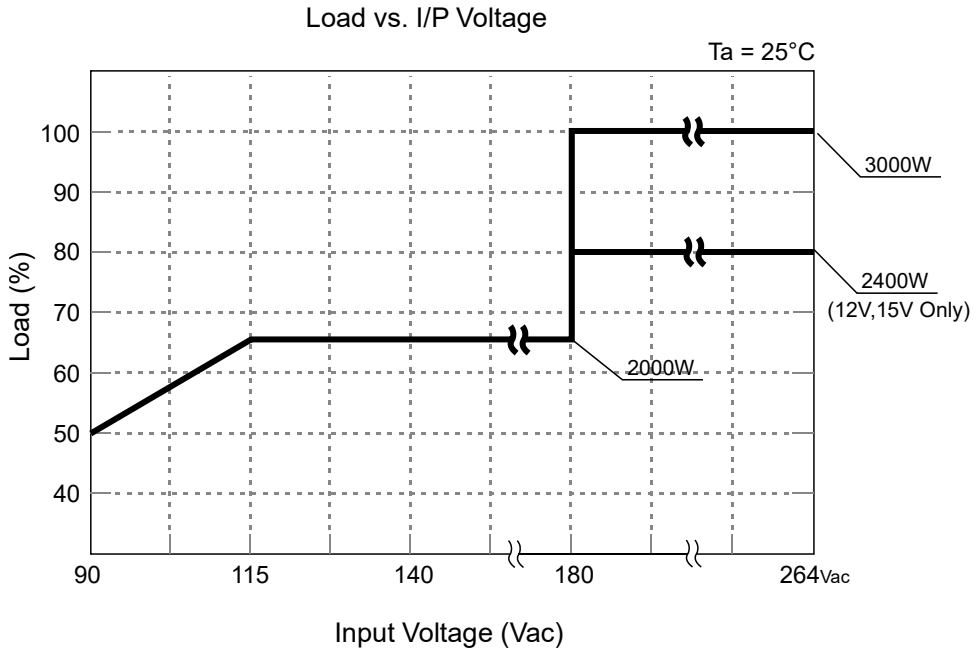



**Figure 3-7 Load vs. Input Voltage: PL3000 Series, 12V-60V Models**

## 3.3 Output Current/Power

The maximum available output power is always a function of the cooling airflow and temperature.

## 3.4 Output Ripple/Noise

Output ripple voltage and noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 0.47uf parallel. The ripple noise is measured from the output pin connectors (V+ and V-).

### 3.4.1 Ripple/Noise Limits

The ripple voltage of the outputs is measured at the pins of the mating connector. Ripple and noise shall not exceed the limits specified in Table 3-3 under any condition of line voltage and frequency specified in Section 2.1 and DC loading specified in Section 3.2.1.

| Model | Output | Voltage | Maximum Ripple+Noise (peak-to-peak) |
|---|---|---|---|
| XL500-12 | V1 | 12V | 150mV |
| XL500-24 | V1 | 24V | 240mV |
| XL500-48 | V1 | 48V | 480mV |
| XL500-56 POE | V1 | 56V | 480mV |
| PL650-05 | V1 | 5V | 150mV |
| PL650-12 | V1 | 12V | 150mV |
| PL650-15 | V1 | 15V | 150mV |
| PL650-24 | V1 | 24V | 150mV |
| PL650-27 | V1 | 27V | 150mV |
| PL650-48 | V1 | 48V | 150mV |
| PL800-12 | V1 | 12V | 120mV |
| PL800-15 | V1 | 15V | 150mV |
| PL800-24 | V1 | 24V | 240mV |
| PL800-30 | V1 | 30V | 300mV |
| PL800-36 | V1 | 36V | 360mV |
| PL800-48 | V1 | 48V | 480mV |
| PL1500-12 | V1 | 12V | 150mV |
| PL1500-15 | V1 | 15V | 150mV |
| PL1500-24 | V1 | 24V | 240mV |
| PL1500-30 | V1 | 30V | 300mV |
| PL1500-36 | V1 | 36V | 360mV |
| PL1500-48 | V1 | 48V | 480mV |
| PL1500-60 | V1 | 60V | 600mV |
| PL3000-12 | V1 | 12V | 150Mv |
| PL3000-15 | V1 | 15V | 150mV |
| PL3000-24 | V1 | 24V | 240mV |
| PL3000-30 | V1 | 30V | 300mV |
| PL3000-36 | V1 | 36V | 360mV |
| PL3000-48 | V1 | 48V | 480mV |
| PL3000-60 | V1 | 60V | 600mV |

**Table 3-3 Ripple Voltage: XL500 through PL3000**

### 3.4.2 Ripple/Noise Test Setup

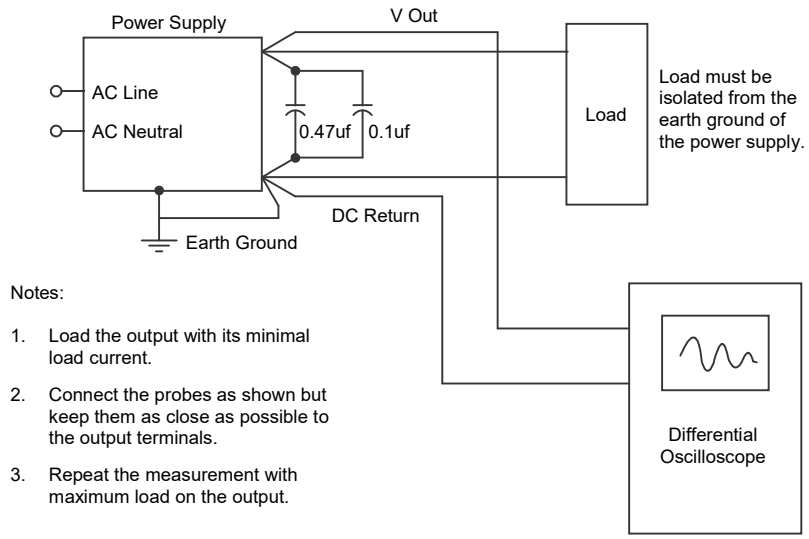



**Figure 3-8 Ripple Noise Measurement Setup**

## 3.5 Local and Remote Sensing

Remote sensing is provided to compensate for voltage drops in the V1 (+ Output) and DC RETURN connections to the load. For every model, the 0V Sense input must always be connected to either the DC Return terminal at the load or one of the DC Return pins on the XL500 (except XL500-56 POE), PL650, PL800, PL1500 and PL3000 models. Connecting it to the return side of the load will reduce the voltage drop in the external return wiring.

If the V1 Sense input is left open, the V1 output may not meet its load regulation specification. The V1 output will meet its load regulation specification when the V1 Sense pin is connected to one of the V1 output pins. Connecting the V1 Sense pin to the V1 output at the load will reduce the voltage drop in the external V1 wiring.

### 3.5.1 Local and Remote Sensing: XL500 and PL650 thru PL3000 Models

Up to 0.5V in the return and the V1 connections may be compensated. Note that CN1 has 8 pins for the XL500 models. CN2 has 24 pins for the PL800, PL1500 and PL3000 models while CN9 has 16 pins for the PL650. Refer to Figure 3-9 through Figure 3-13 which show the required and optional remote sensing connections for the XL500 and PL650 thru PL3000 models. Refer to Table 4-5 for the pin definition of the XL500 and PL650 thru PL3000 connectors.

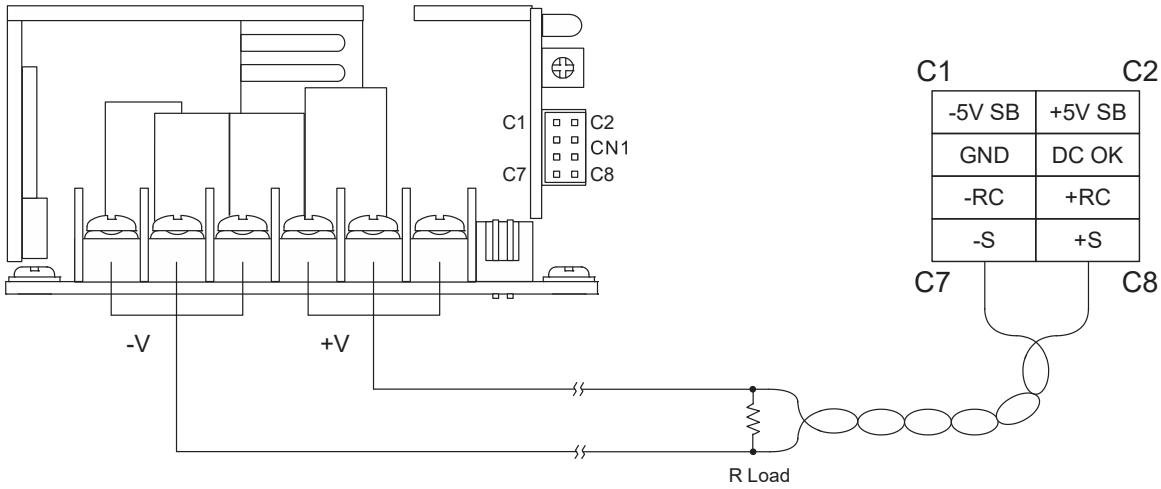



**Figure 3-9 Remote Sensing Wiring: XL500-12, -24 and -48**

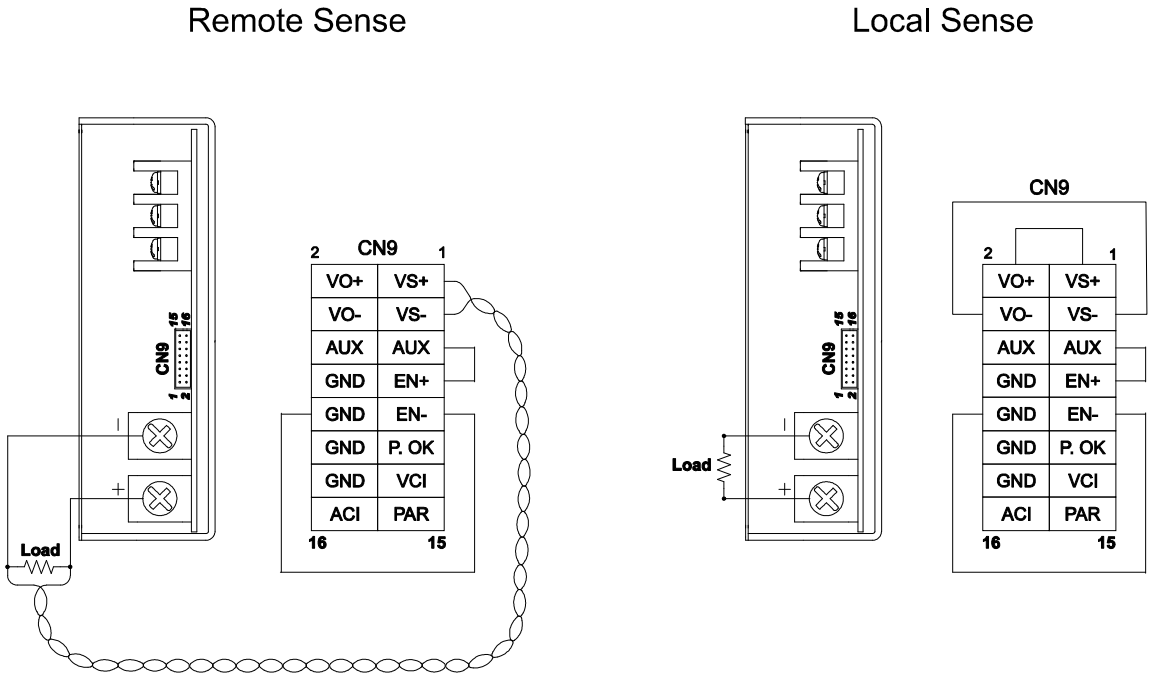



**Figure 3-10 Local and Remote Sensing Wiring: PL650**

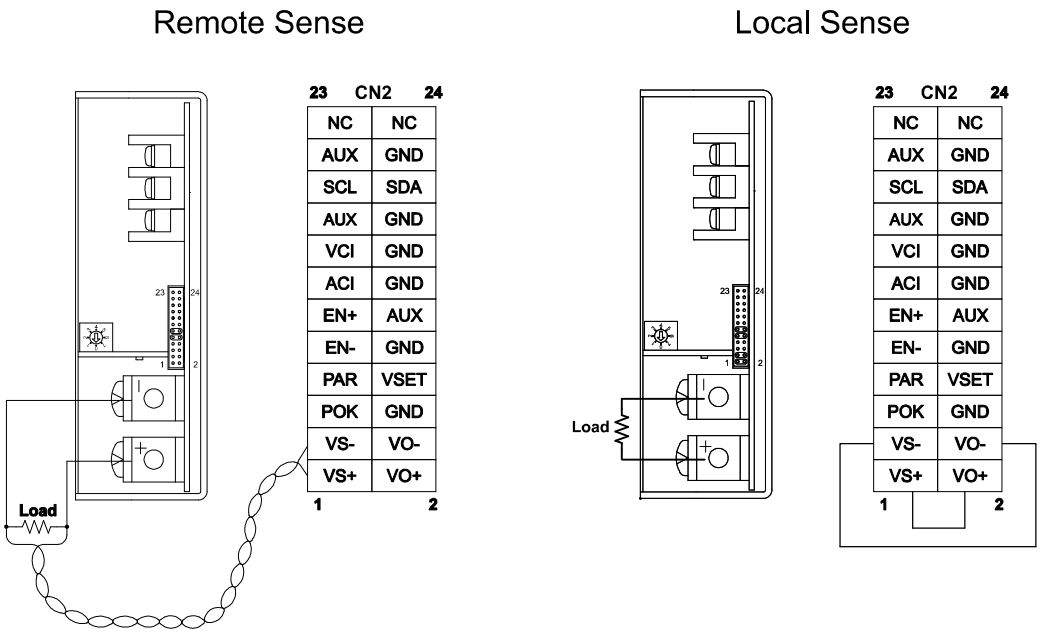



**Figure 3-11 Local and Remote Sensing Wiring: PL800**

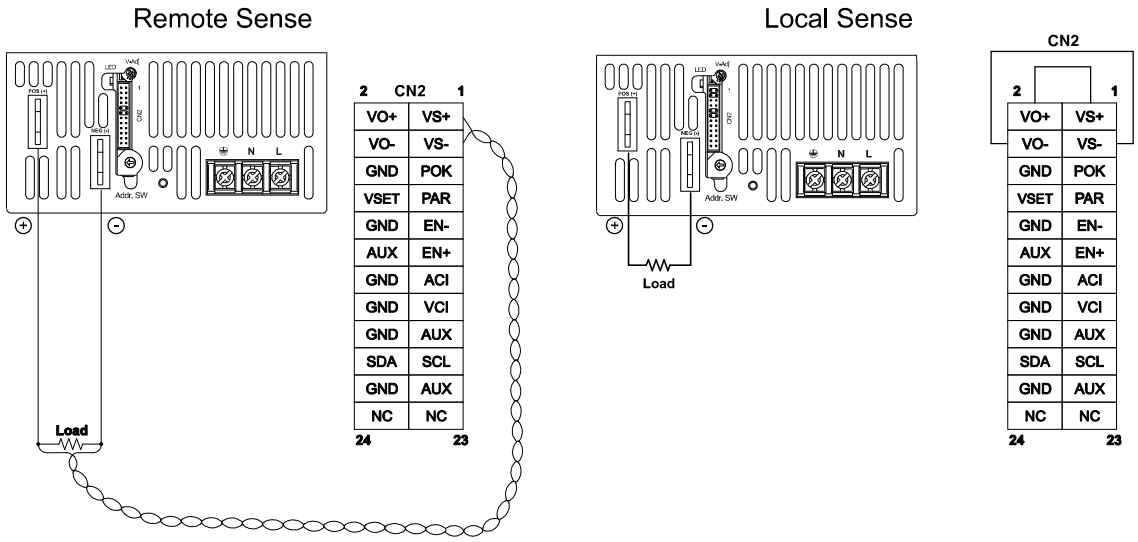



**Figure 3-12 Local and Remote Sensing Wiring: PL1500**

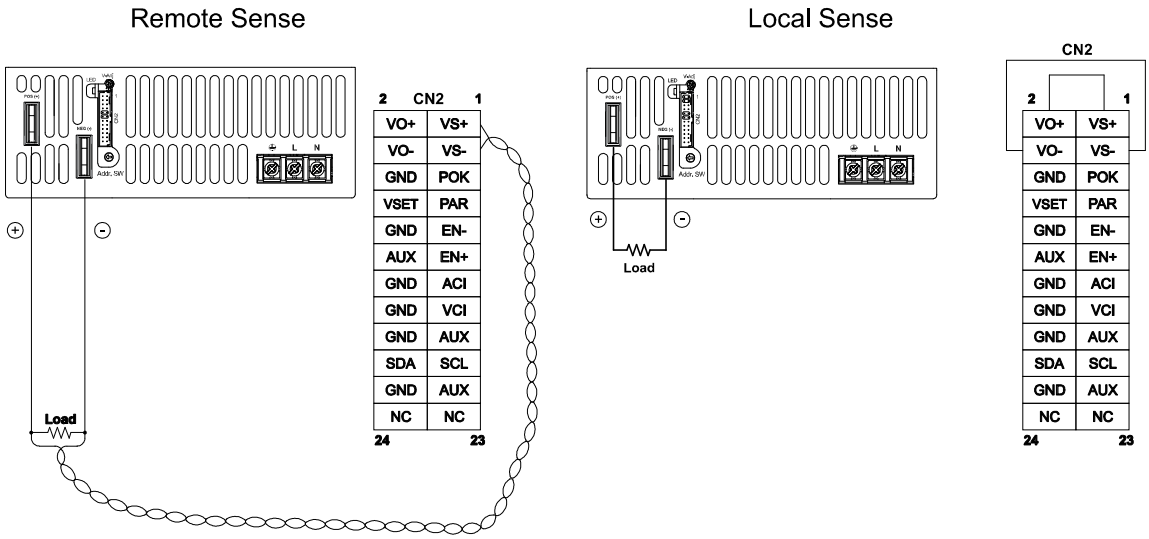



**Figure 3-13 Local and Remote Sensing Wiring: PL3000-12 thru -60**

## 3.6 Parallel Operation: PL650 thru PL3000 Models

The PL650, PL800, PL1500 and PL3000 models are available for slope current share. Up to 10 power supplies may be connected in parallel to provide higher output power and for N+1 configurations.

### 3.6.1 Current Share Connections

The Par (Parallel or CS) and Gnd (Ground) signal (see Table 4-5) of each supply operating in parallel must be connected together. Power sharing does not require the 0V Sense signals connected together. Operating in parallel must be connected together.

## 3.7 Output Protection

There are three different output protection schemes designed to protect the load and the XL and PL Series from component failures and extraordinary circumstances.

### 3.7.1 Over Temperature Protection (OTP)

If the PL650 models are operated without adequate cooling they will sense an over-temperature condition by detecting primary and secondary heat and shut themselves down. The power supplies will recover automatically after the temperature goes down to below its maximum operating temperature. The XL500 models will shut down between 110-130°C when they sense an over-temperature condition and will recover automatically after the temperature goes down to below its maximum operating temperature. The PL800, PL1500 and PL3000 models will shut down at 85° +/-5°C if an over temperature is detected on the secondary side of the controller board. They will recover automatically after the temperature goes down to below its maximum operating temperature.

### 3.7.2 Over Voltage Protection (OVP)

No single fault is able to cause a sustained over voltage condition on any output. When an over-voltage condition occurs, the power supply will shut down and will not restart until AC power is turned off and back on.

| Model | Minimum | Nominal | Maximum |
|---|---|---|---|
| XL500-12 | 14.40V | 15.00V | 16.80V |
| XL500-24 | 28.80V | 30.00 V | 31.20V |
| XL500-48 | 54.20V | 56.00V | 64.40V |
| XL500-56 POE | 65.20V | 68.00V | 73.40V |
| PL650-05 | 5.75V | 6.25V | 6.75V |
| PL650-12 | 13.80V | 15.00V | 16.20V |
| PL650-15 | 17.25V | 18.75V | 20.25V |
| PL650-24 | 27.60V | 30.00V | 32.40V |
| PL650-27 | 31.05V | 33.75V | 36.45V |
| PL650-48 | 55.20V | 60.00V | 64.40V |
| PL800-12 | 13.56V | 14.40V | 15.24V |
| PL800-15 | 16.95V | 18.00V | 19.05V |
| PL800-24 | 27.12V | 28.80V | 30.48V |
| PL800-30 | 33.90V | 36.00V | 38.10V |
| PL800-36 | 40.68V | 43.20V | 45.72V |
| PL800-48 | 54.24V | 57.60V | 60.96V |
| PL800-60 | 67.80V | 72.00V | 76.20V |
| PL1500-12 | 13.56 V | 14.40V | 15.24V |
| PL1500-15 | 16.95V | 18.00V | 19.05V |
| PL1500-24 | 27.12V | 28.80V | 30.48V |
| PL1500-30 | 33.90V | 36.00V | 38.10V |
| PL1500-36 | 40.68V | 43.20V | 45.72V |
| PL1500-48 | 54.24V | 57.60V | 60.96V |
| PL1500-60 | 67.80V | 72.00V | 76.20V |
| PL3000-12 | 13.56V | 14.40V | 15.24V |
| PL3000-15 | 16.95V | 18.00V | 19.05V |
| PL3000-24 | 27.12V | 28.80V | 30.48V |
| PL3000-30 | 33.90V | 36.00V | 38.10V |
| PL3000-36 | 40.68V | 43.20V | 45.72V |
| PL3000-48 | 54.24V | 57.60V | 60.96V |
| PL3000-60 | 67.80V | 72.00V | 76.20V |

**Table 3-4 Over Voltage Protection Limits**

### 3.7.3 Over Current Protection (OCP)

For model XL500: 110~160% rated power or short circuit is constant current limiting. Overload current applied to the output will cause the output to shut down. The power supply will periodically attempt to restart until the over-current condition is removed.

For model PL650: 105~125% rated power or short circuit is constant current limiting. Protection type is Latch style (Recovery after reset AC power on or inhibit).

For models PL800, PL1500 and PL3000: Overload currents applied to the output will cause the output to shut down. The power supply will periodically attempt to restart until the over-current condition is removed. This feature is tested with an ever-increasing load at a rate of 10A/second starting at maximum load. Constant Current limit:> 105% rated power.

### 3.7.4 Short Circuit Protection

A short circuit is defined as an impedance of less than 0.1 ohms placed between DC RETURN and any output. A short circuit will cause no damage to the power supply, but will cause it to shutdown. The power supply will periodically attempt a restart until the short circuit condition is removed. After successfully restarting, the power supply will operate normally.

## 3.8 Output Rise Time

All output voltages shall rise from 10% to 90% of nominal output voltage (as specified in Table 3-1) within the specified time for each model. The output voltages waveform must be a monotonic ramp from 10% to 90% of final setpoint within the regulation band under any loading conditions specified in the respective load current tables in Table 3-2.

For the purposes of this specification, a monotonic ramp is defined as always having a positive slope from zero to 10*Vout volts/millisecond. During any 5-millisecond portion of the ramp, its slope must be greater than 5% of its rated voltage per millisecond.

| Model | Inrush Current |
|---|---|
| XL650 Series | 60ms at full load |
| XL500 | 86ms at full load |
| PL800 & PL1500 Series | 100ms at full load |
| PL3000 Series | 50ms at full load |

**Table 3-5 Output Rise Time**

## 3.9 Overshoot at Turn On/Turn Off

The output voltage overshoot upon the application or removal of the input mains voltage is less than <5% for all XL and PL models above the nominal voltage. No opposite polarity voltage is present on any output during turn on or turn off.

# 4. General Specifications

## 4.1 Environmental

The XL and PL Series meet or exceed the following environmental specifications:

| Parameter | Conditions | Specification | Remarks |
|---|---|---|---|
| Temperature | Operating | -30°C to 70°C | XL500 |
| | | -25°C to 60°C | PL650, PL800, PL1500 and PL3000 |
| | Non-Operating | -30°C to 85°C | XL500 |
| | | -40°C to 85°C | PL650, PL800, PL1500 and PL3000 |
| Relative Humidity | Operating | 20-90% Maximum | Non-Condensing |
| | Non-Operating | 95% Maximum | Non-Condensing |
| Altitude | Operating | 6,561 feet MSL Max. | 2,000 meters |
| Vibration | No damage | 2.0 G RMS Maximum | XL500, PL650, PL800 and PL1500 |
| | | 5.0 G RMS Maximum | PL3000 |
| | | | 10-500Hz, 10-min/1cycle, 60 min each along x, y, z axis. Mounting: Compliance to IEC60068-2-6 and IEC60068-2-64 |

**Table 4-1 Environmental Specifications**

## 4.2 Mean Time Between Failures

The calculated MTBF of all models is equal to or greater than the specified hours of continuous operation at maximum output loading and worst-case input line voltage with convection cooling at 25°C. N2Power does not warrant the MTBF to be representative of any particular unit. The MTBF of the power supply is calculated with an 80% confidence level in accordance with (MIL-HDBK-217F). Actual failure rates vary from unit to unit.

| Model | MTBF |
|---|---|
| XL500 | 160.0K HRS |
| PL650 | 166.2K HRS |
| PL800 | 112.0K HRS |
| PL1500 | 111.0K HRS |
| PL3000-12 thru -60 | 60.26K HRS |

**Table 4-2 MTBF by Model**

## 4.3 Labeling/Marking

The power supply is marked and labeled with the N2Power logo and part number, model number, input and output specifications, production code, appropriate safety agency logos and CE mark. Typical labels are pictured below.

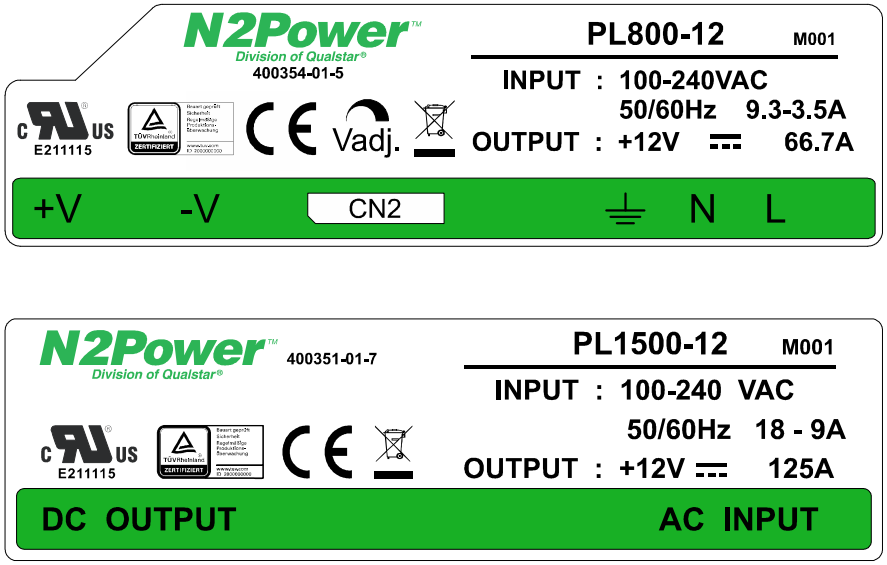



**Figure 4-1 Sample XL and PL Labels**

## 4.4 Net Weight

| Model: | XL500 | PL650 | PL800 | PL1500 | PL3000 |
|---|---|---|---|---|---|
| Pounds | 1.01 | 4.82 | 4.55 | 6.96 | 10.18 |
| Ounces | 16.23 | 57.87 | 54.66 | 83.59 | 122.20 |
| Kilograms | 0.46 | 1.80 | 1.70 | 2.60 | 3.80 |

**Table 4-3 XL and PL Net Weights**

## 4.5 Mounting

The XL and PL power supplies may be mounted with the following screws. Sizes will vary between models.

| Model | Bottom Mounting | Side Mounting |
|---|---|---|
| XL500 | (open frame) | (open frame) |
| PL650 | M4, length 3 | M4, length 6 |
| PL800 | M4, length 3 | M4, length 6 |
| PL1500 | M4, length 5 | M4, length 5 |
| PL3000 | M4, length 4 | M4, length 4 |

**Table 4-4 Mounting Screw Sizes**

The power supplies may be mounted on their bottom surface or their sides. See mechanical drawings for mounting hole locations.

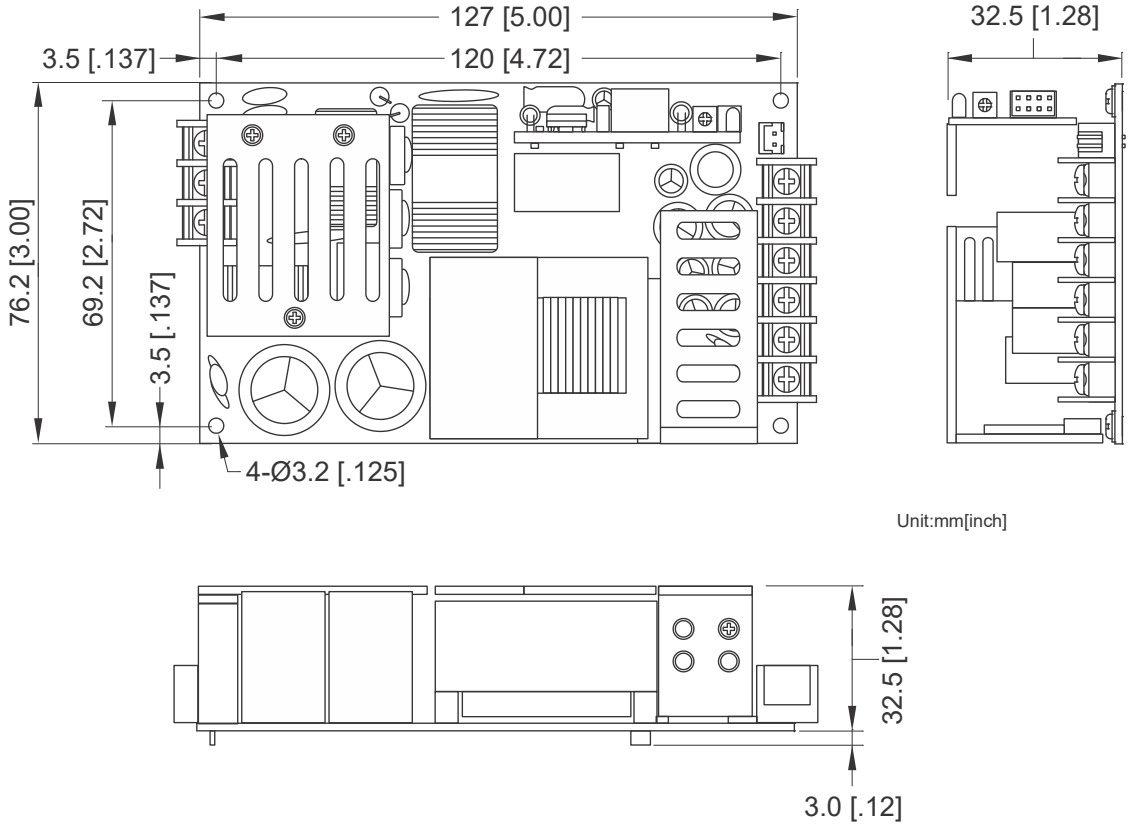
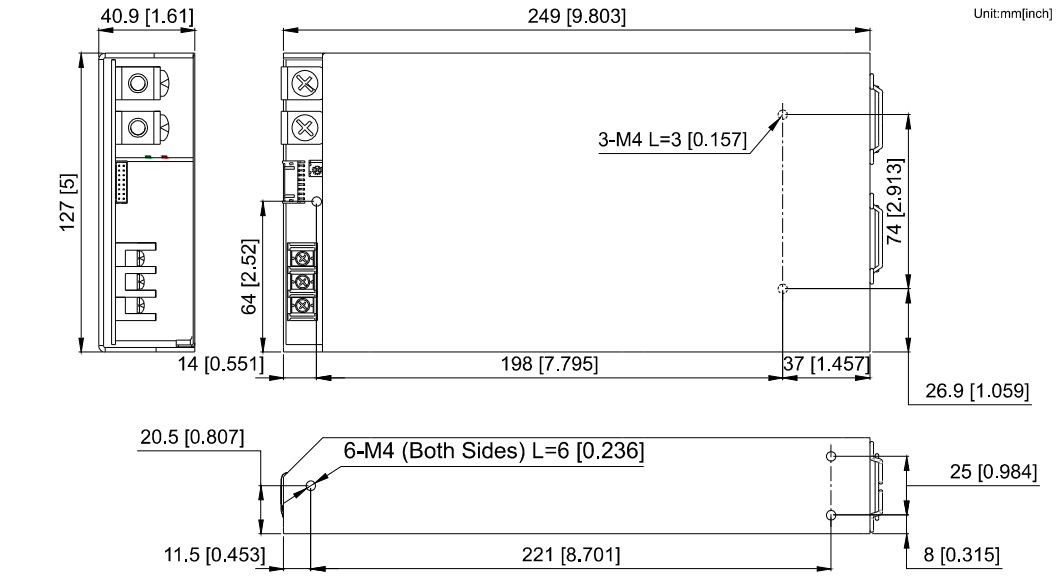
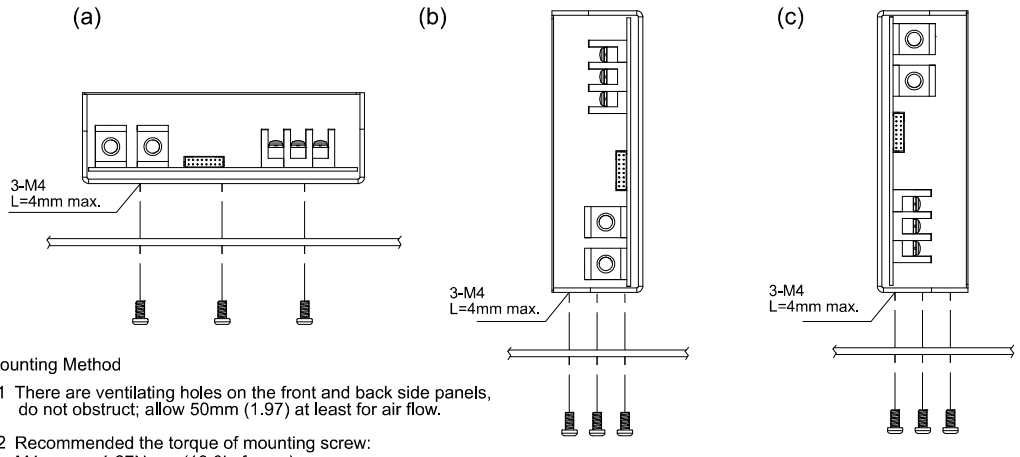



**Figure 4-2 XL500 Mounting Hole Locations**




1. Mounting Directions

1-1 Recommended standard mounting methods:




2. Mounting Method

2-1 There are ventilating holes on the front and back side panels, do not obstruct; allow 50mm (1.97) at least for air flow.

2-2 Recommended the torque of mounting screw:
M4 screw: 1.27N • m (13.0kgf • cm)

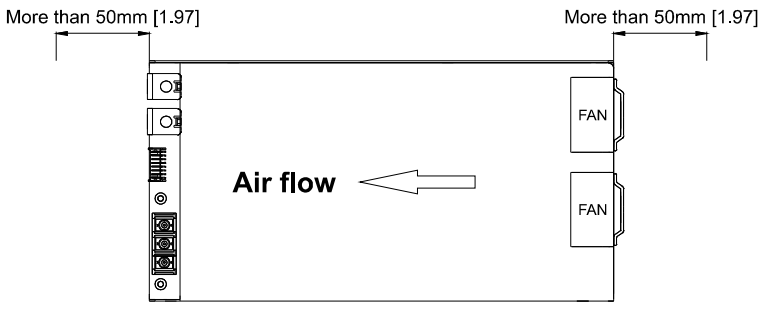
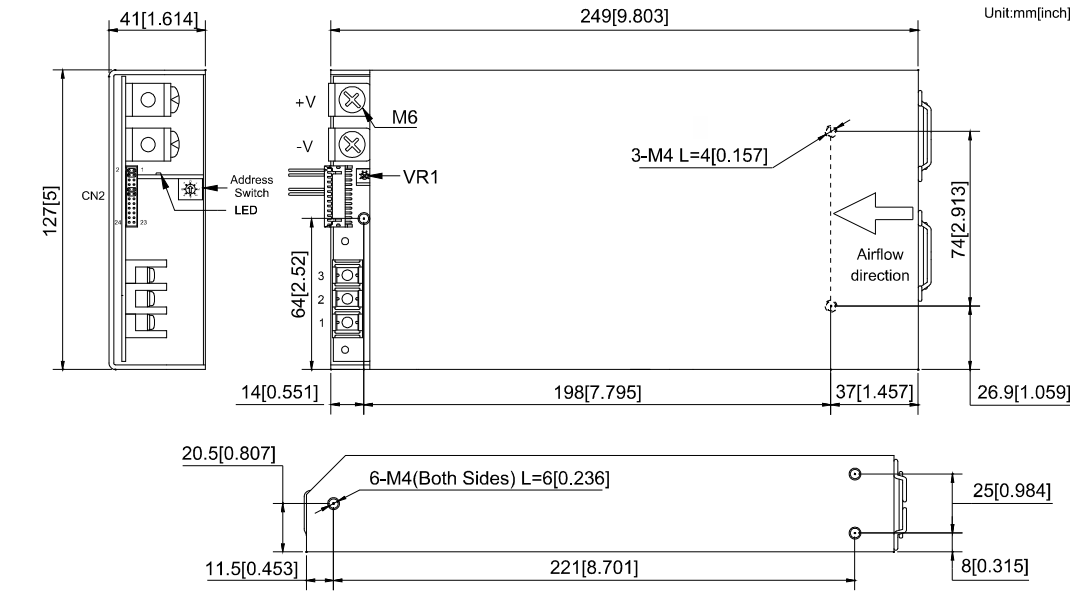
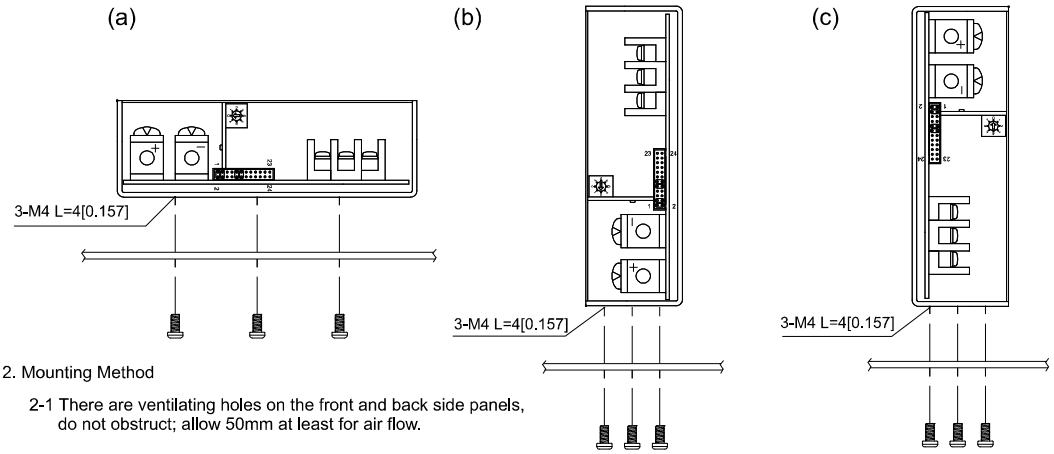



**Figure 4-3 PL650 Mounting Hole Locations**




1. Mounting Directions

1-1 Recommended standard mounting methods:




2. Mounting Method

2-1 There are ventilating holes on the front and back side panels, do not obstruct; allow 50mm at least for air flow.

2-2 Recommended the torque of mounting screw:
M4 screw: 1.27N • m (13.0kgf • cm)

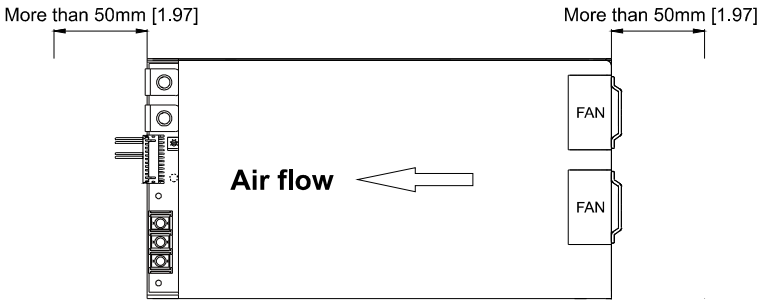



**Figure 4-4 PL800 Mounting Hole Locations**

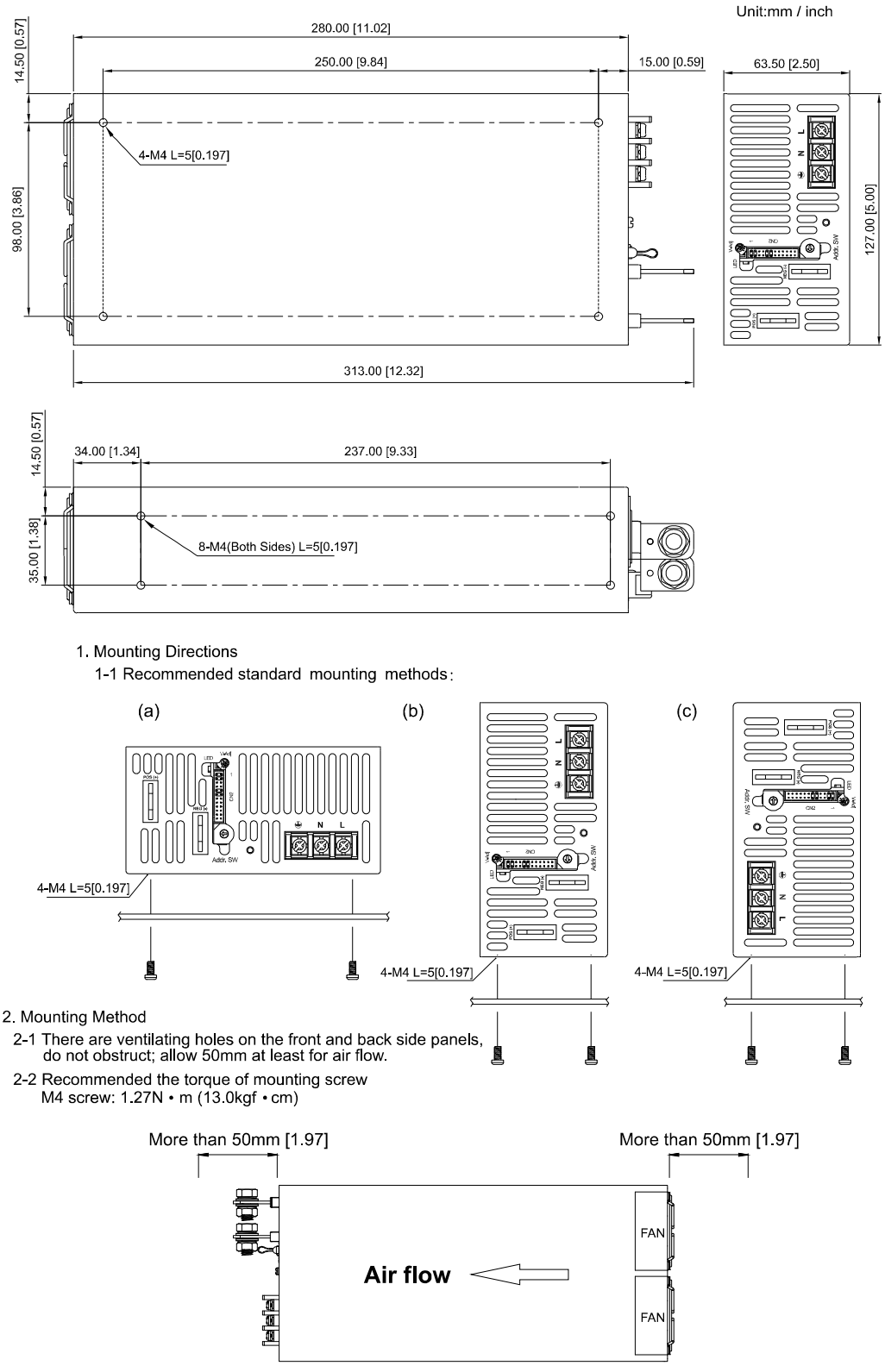
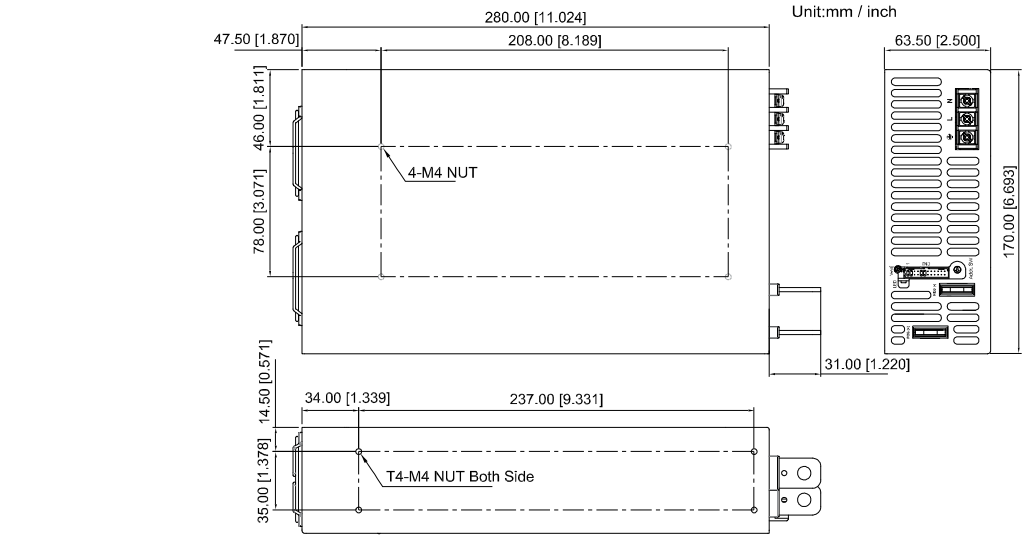
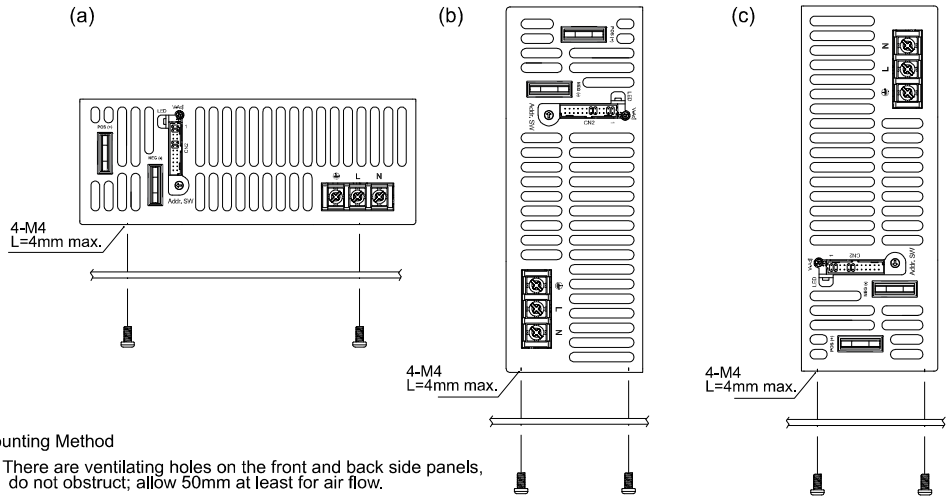



**Figure 4-5 PL1500 Mounting Hole Locations**




1. Mounting Directions

1-1 Recommended standard mounting methods:




2. Mounting Method

2-1 There are ventilating holes on the front and back side panels, do not obstruct; allow 50mm at least for air flow.

2-2 The Maximum allowable penetration of screw is 4mm. Incomplete threading should not be penetrated.

2-3 Recommended the torque of mounting screw
M4 screw: 1.27N • m (13.0kgf • cm)

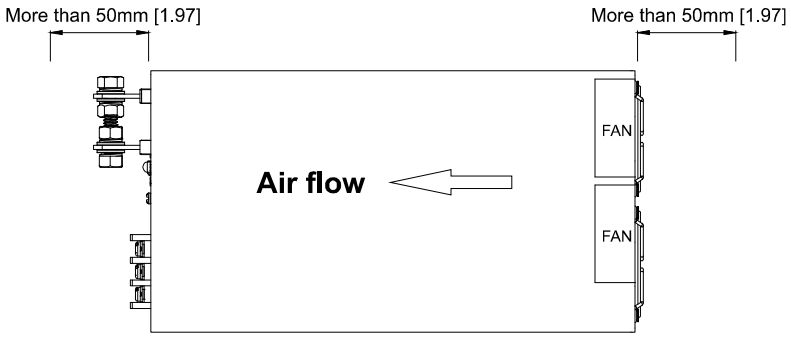



**Figure 4-6 PL3000-12 thru -60 Mounting Hole Locations**

## 4.6 Physical Dimensions

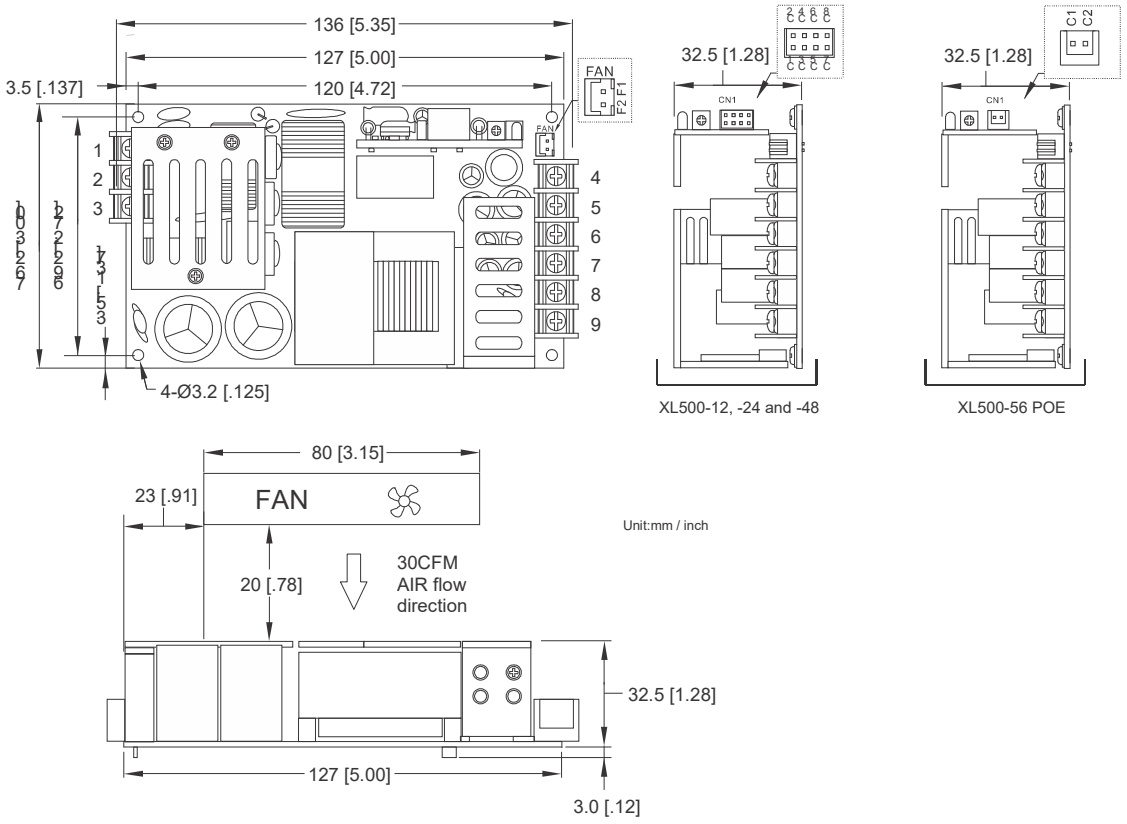



**Figure 4-7 XL500 Dimensions**

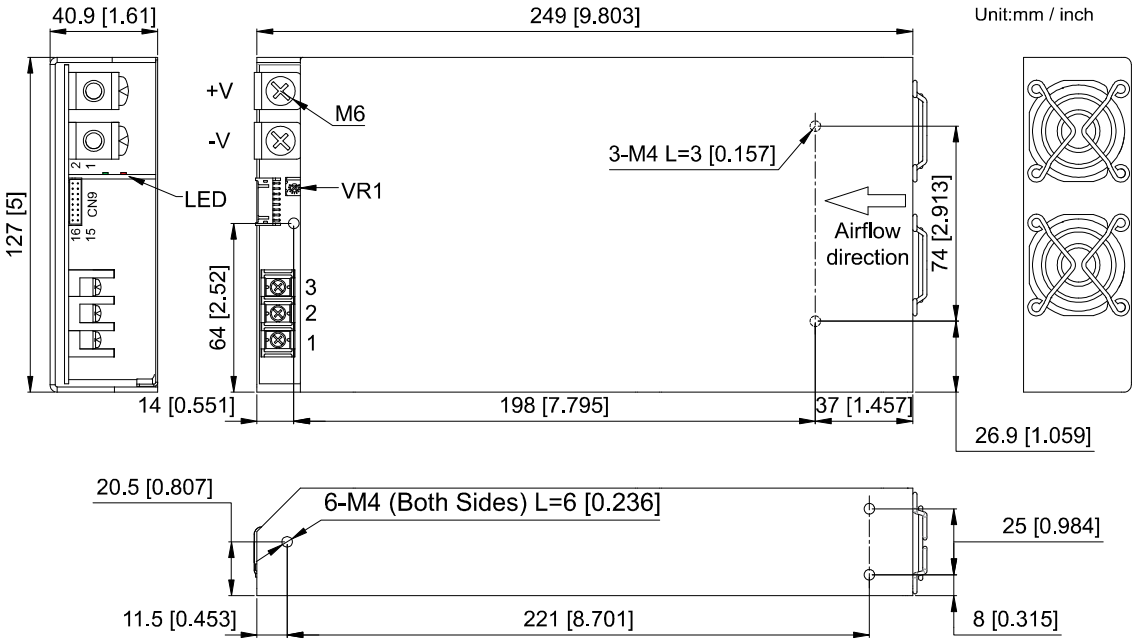



**Figure 4-8 PL650 Dimensions**

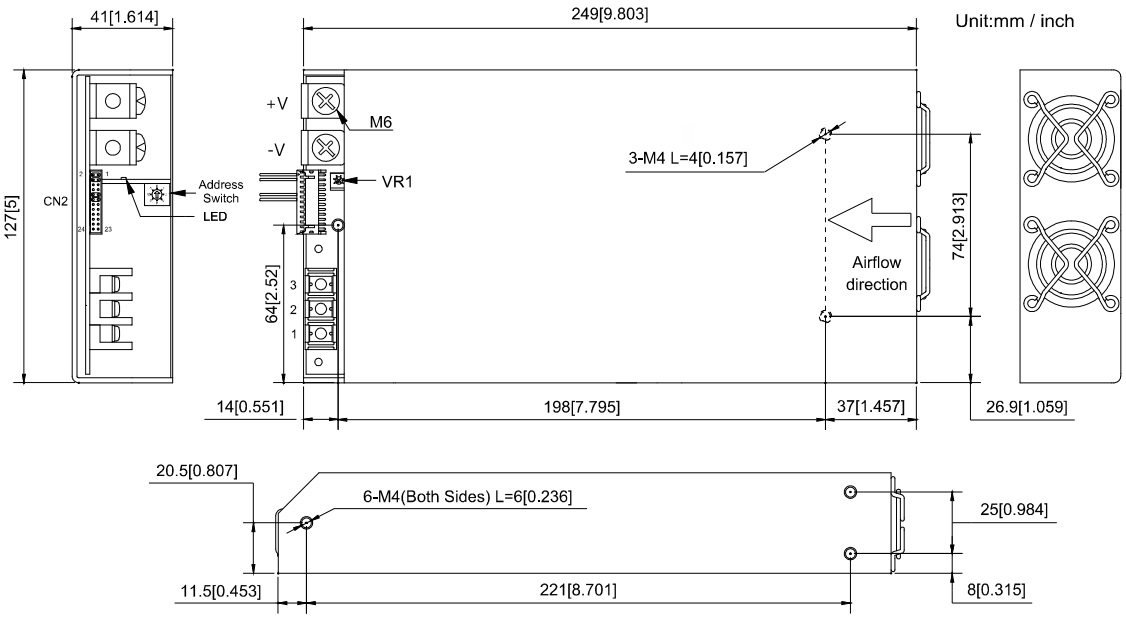



**Figure 4-9 PL800 Dimensions**

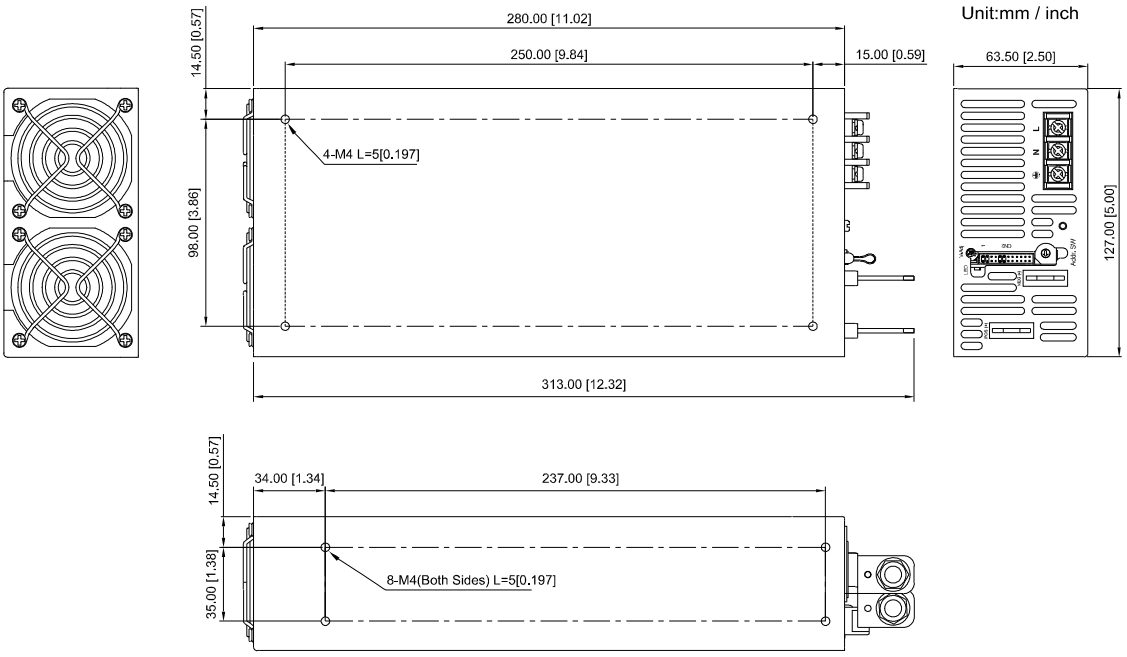



**Figure 4-10 PL1500 Dimensions**

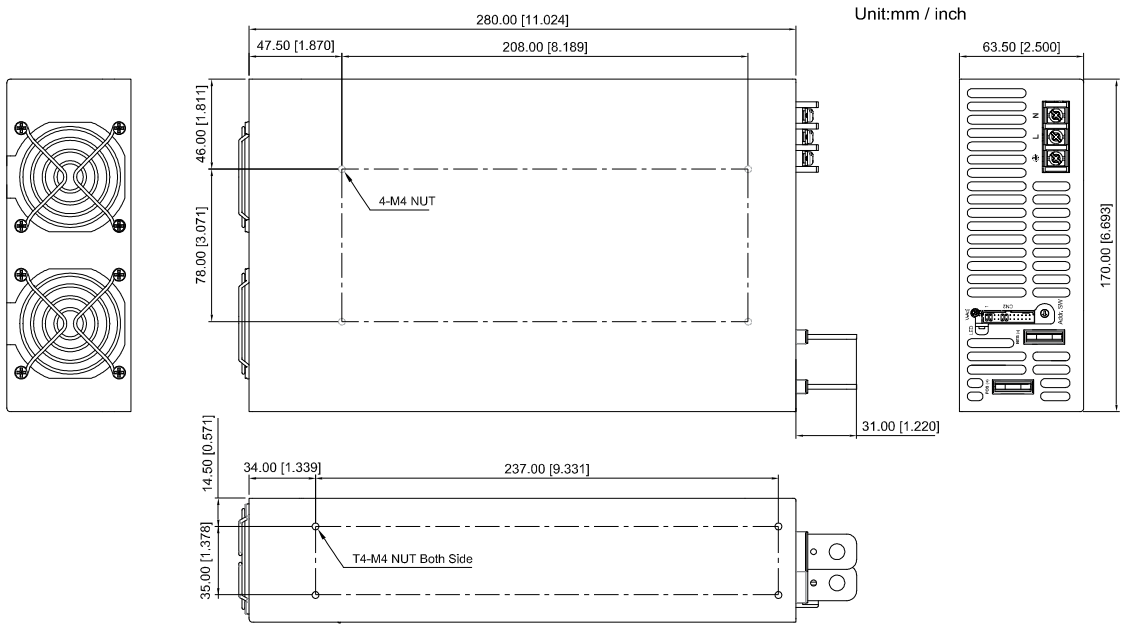



**Figure 4-11 PL3000-12 thru -60 Dimensions**

## 4.7 Mating Connectors

The user must furnish all mating connectors. The mating connectors must meet the requirements of all applicable safety agencies (UL and/or TUV).

| Model | Designator | Connector | Mating Housing | Terminal |
|---|---|---|---|---|
| XL500 | CN4 (DC Output) | JST S8B-PHDSS- or equivalent | PHDR-08VS | SPHD-002T-P05 |
| XL500 56V POE | FAN2 (DC Output) | JST Z2B-ZRDSS- or equivalent | ZHR-2 | SZH-002T-P05 |
| PL650 | CN9 (DC Output) | JST S16B-PHDSS- or equivalent | PHDR-16VS | SPHD-002T-P05 |
| PL800 | CN2 (DC Output) | JST S24B-PHDSS- or equivalent | JST PHDR-24VS or equivalent | JST SPHD-002T-P0.5 or equivalent |
| PL1500 | CN2 (DC Output) | JST S24B-PHDSS- or equivalent | JST PHDR-24VS or equivalent | JST SPHD-002T-P0.5 or equivalent |
| PL3000-12 thru PL3000-60 | CN2 (DC Output) | JST S24B-PHDSS- or equivalent | JST PHDR-24VS or equivalent | JST SPHD-002T-P0.5 or equivalent |

## 4.8 Output Grounding

The DC RETURN signal may be connected to the power supply chassis ground (safety earth) screw terminal on the front of the power supplies as shown in Figure 4-12 through Figure 4-16.

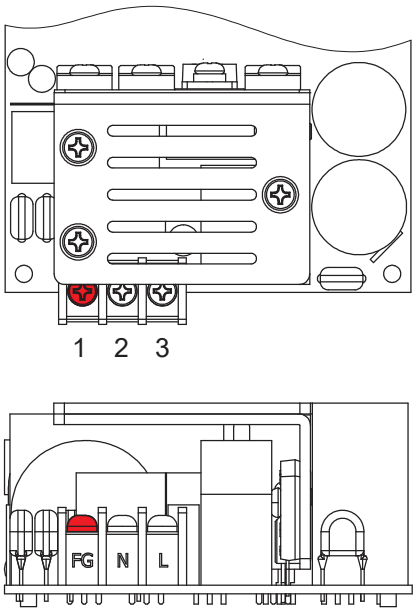



**Figure 4-12 XL500 Grounding Location**

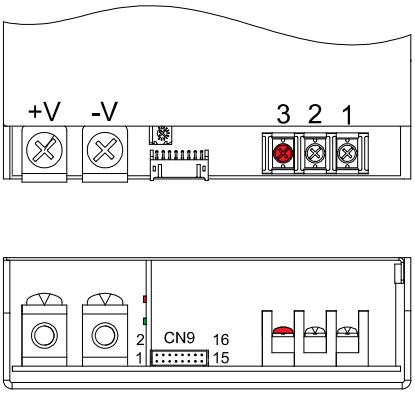



**Figure 4-13 PL650 Grounding Location**

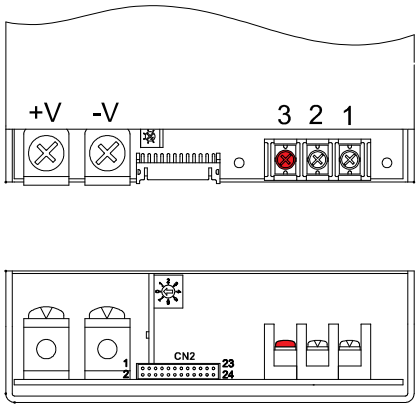



**Figure 4-14 PL800 Grounding Location**

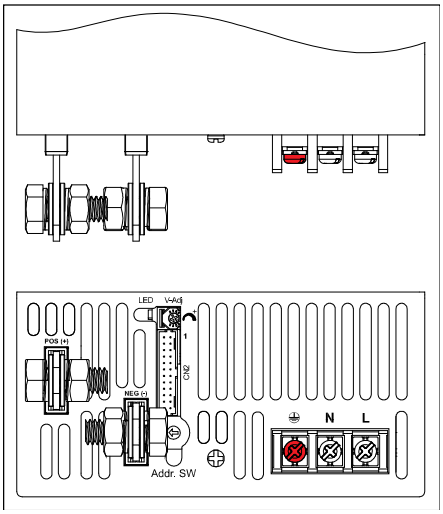



**Figure 4-15 PL1500 Grounding Location**

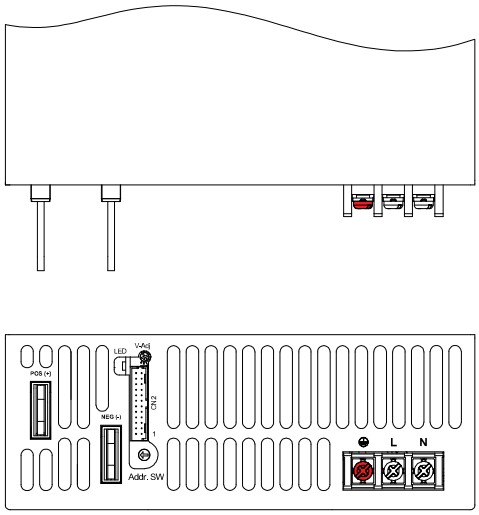



**Figure 4-16 PL3000-12 thru -60 Grounding Location**

## 4.9 Signal Pin Definitions

| Model | Connector | Pin No. | Assignment |
|---|---|---|---|
| XL500 | AC Input Terminal | 1 | FG |
| | | 2 | AC/N |
| | | 3 | AC/L |
| | | 4,5,6 | +DC out |
| | | 7,8,9 | -DC out |
| | Connector (FAN) | F1 | +12V |
| | | F2 | -12V |
| | CN1 | C1 | -5VSB |
| | | C2 | +5VSB |
| | | C3 | GND |
| | | C4 | DC OK |
| | | C5 | -RC |
| | | C6 | +RC |
| | | C7 | -S |
| | | C8 | +S |
| XL500-56 POE | AC Input Terminal | 1 | FG |
| | | 2 | AC/N |
| | | 3 | AC/L |
| | | 4,5,6 | +DC out |
| | | 7,8,9 | -DC out |
| | Connector (FAN) | F1 | +12V |
| | | F2 | 12V_return |
| | CN1 | C1 | +5VSB |
| | | C2 | -5VSB |

| Model | Connector | Pin No. | Assignment |
|---|---|---|---|
| PL650 | AC Input Terminal | 1 | AC/L |
| | | 2 | AC/N |
| | | 3 | FG |
| | CN9 | 1 | Remote Voltage Sense (-) |
| | | 2 | Local output voltage sense |
| | | 3 | Remote voltage sense (+) |
| | | 4 | Local output voltage sense (-) |
| | | 5,6 | +5V/0.5A Aux Power |
| | | 7 | Remote ON/OFF (+) |
| | | 8,10,12,14 | Ground |
| | | 9 | Remote ON/OFF (-) |
| | | 11 | Power OK |
| | | 13 | V Program |
| | | 15 | I Program |
| PL800 | AC Input Terminal | 1 | AC / L |
| | | 2 | AC / N |
| | | 3 | FG |
| | CN2 | 1 | Positive Output Voltage |
| | | 2 | Remote Sense (+) |
| | | 3 | Remote Sense (-) |
| | | 4 | Negative Output Voltage |
| | | 5 | Power OK |
| | | 6 | Ground |
| | | 7 | Parallel operation current share |
| | | 8 | Aux output setting |
| | | 9 | Inhibit ON/OFF (-) |
| | | 10 | Ground |
| | | 11 | Inhibit ON/OFF (+) |
| | | 12 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 13 | I Program |
| | | 14 | Ground |
| | | 15 | V Program |
| | | 16 | Ground |
| | | 17 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 18 | Ground |
| | | 19 | Serial Clock used in the I2C interface |
| | | 20 | Serial Data used in the I2C interface |
| | | 21 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 22 | Ground |
| | | 23 | For RS232 Transmission function |
| | | 24 | For RS232 Receiver function |
| PL1500 | AC Input Terminal | 1 | AC/L |
| | | 2 | AC/N |

| Model | Connector | Pin No. | Assignment |
|---|---|---|---|
| | | 3 | FG |
| | | 1 | Positive Output Voltage |
| | | 2 | Remote Sense (+) |
| | | 3 | Remote Sense (-) |
| | | 4 | Negative Output Voltage |
| | | 5 | Power OK |
| | | 6 | Ground |
| | | 7 | Parallel operation current share |
| | | 8 | Aux output setting |
| | | 9 | Inhibit ON/OFF (-) |
| | | 10 | Ground |
| | | 11 | Inhibit ON/OFF (+) |
| | | 12 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 13 | I Program |
| | | 14 | Ground |
| | | 15 | V Program |
| | | 16 | Ground |
| | | 17 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 18 | Ground |
| | | 19 | Serial Clock used in the I2C interface |
| | | 20 | Serial Data used in the I2C interface |
| | | 21 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 22 | Ground |
| | | 23 | For RS232 Transmission function |
| | | 24 | For RS232 Receiver function |
| | | 3 | FG |
| PL3000 | AC Input Terminal | 1 | AC/L |
| | | 2 | ACN |
| | | 3 | FG |
| | CN2 | 1 | Positive Output Voltage |
| | | 2 | Remote Sense (+) |
| | | 3 | Remote Sense (-) |
| | | 4 | Negative Output Voltage |
| | | 5 | Power OK |
| | | 6 | Ground |
| | | 7 | Parallel operation current share |
| | | 8 | Aux output setting |
| | | 9 | Inhibit ON/OFF (-) |
| | | 10 | Ground |
| | | 11 | Inhibit ON/OFF (+) |
| | | 12 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 13 | I Program |
| | | 14 | Ground |

| Model | Connector | Pin No. | Assignment |
|---|---|---|---|
| | | 15 | V Program |
| | | 17 | Ground |
| | | 18 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 19 | Serial Clock used in the I2C interface |
| | | 20 | Serial Data used in the I2C interface |
| | | 21 | +5V/0.5A or 9V/0.3A Aux Power |
| | | 22 | Ground |
| | | 23 | For RS232 Transmission function |
| | | 24 | For RS232 Receiver function |

**Table 4-5 XL/PL Signal Pin Definitions**

# 5. Efficiency

The efficiencies for the XL and PL power supplies are listed below. They were measured at full load, 25C, at 230AC.

| Model: | Output | Load | AC | Efficiency |
|---|---|---|---|---|
| XL500 | 12V | 20.0A | 230VAC | 88% |
| XL500 | 24V | 10.0A | 230VAC | 90% |
| XL500 | 48V | 5.0A | 230VAC | 92% |
| XL500 | 56V | 8.9A | 230VAC | 92% |
| PL650 | 5V | 100.0A | 230VAC | 83% |
| PL650 | 12V | 50.0A | 230VAC | 88% |
| PL650 | 15V | 40.0A | 230VAC | 88% |
| PL650 | 24V | 27.0A | 230VAC | 90% |
| PL650 | 27V | 24.0A | 230VAC | 90% |
| PL650 | 48V | 13.6A | 230VAC | 91% |
| PL800 | 12V | 66.7A | 230VAC | 89% |
| PL800 | 15V | 53.4A | 230VAC | 90% |
| PL800 | 24V | 33.5A | 230VAC | 92% |
| PL800 | 30V | 26.7A | 230VAC | 92% |
| PL800 | 36V | 22.3A | 230VAC | 92% |
| PL800 | 48V | 16.7A | 230VAC | 92% |
| PL800 | 60V | 13.4A | 230VAC | 93% |
| PL1500 | 12V | 125.0A | 230VAC | 89% |
| PL1500 | 15V | 100.0A | 230VAC | 90% |
| PL1500 | 24V | 62.5A | 230VAC | 92% |
| PL1500 | 30V | 50.0A | 230VAC | 92% |
| PL1500 | 36V | 41.7A | 230VAC | 92% |
| PL1500 | 48V | 31.3A | 230VAC | 92% |
| PL1500 | 60V | 25.0A | 230VAC | 93% |
| PL3000 | 12V | 200.0A | 230VAC | 88% |
| PL3000 | 15V | 160.0A | 230VAC | 89% |
| PL3000 | 24V | 125.0A | 230VAC | 91% |
| PL3000 | 30V | 100.0A | 230VAC | 91% |
| PL3000 | 36V | 83.5A | 230VAC | 92% |
| PL3000 | 48V | 62.5A | 230VAC | 92% |
| PL3000 | 60V | 50.0A | 230VAC | 93% |

**Table 5-1 XL and PL Output Currents at Rated Efficiency**

# 6. Signals

## 6.1 DC_OK

The DC_OK signal is the signal that is driven by an open-collector transistor. The electrical specifications for the DC_OK outputs are described in Table 6-1.

| Signal Type | |
|---|---|
| Power On Delay | Model XL500-12 to 48 <186ms<br>Model XL500-56 <208ms<br>Models PL800, PL1500 & PL3000 <800ms |
| Rise Time | Model XL500-12 to 48 <86ms/230VAC at full load<br>Model XL500-56 <66ms/230VAC at full load<br>Model PL650 <60ms/230VAC at full load<br>Models PL800 & PL1500 <100ms/230Vac at full load<br>Model PL3000 <50ms/230VAC at full load |
| PS DC _OK Output | Models PL650, PL800, PL1500 & PL3000 open drain signal low when PSU turns on. Maximum sink current: 20Ma. Maximum drain voltage: 40V.<br>Models XL500-12 to 48 DC_OK Output Voltage: 4.95V~5.49V TTL: output low voltage 0~0.4V; high voltage 2.4V~5V; 4.95V~5.49V >2.4V, above V oH, Logic is 1 |

**Table 6-1 XL and PL Status and Control Signal Specifications**

## 6.2 DC OK LED

A green LED on models PL650 through PL3000 illuminates when DC-OK signal is true (high).

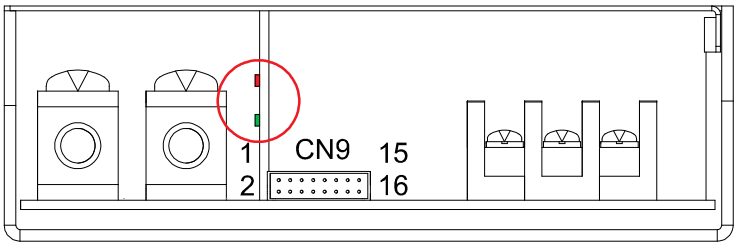



**Figure 6-1 PL650 LED Location**

| Green LED | Signal | Status |
|---|---|---|
| Solid | | Power OK |
| Slow Blink | | Power Standby |
| **Red LED** | **Signal** | **Status** |
| Fast Blink | | Over Voltage Protection (OVP) |
| | | Over Load Protection (OLP) |
| Solid | | Output Short Circuit Protection (SCP) |
| | | Under Voltage Protection (OVP) |
| Slow Blink | | Over Temperature Protection (OTP) |
| Intermittent Blink | | Fan Failure |
| Interlace Blink | | Power Failure |

**Table 6-2 PL650 LED Status Modes**

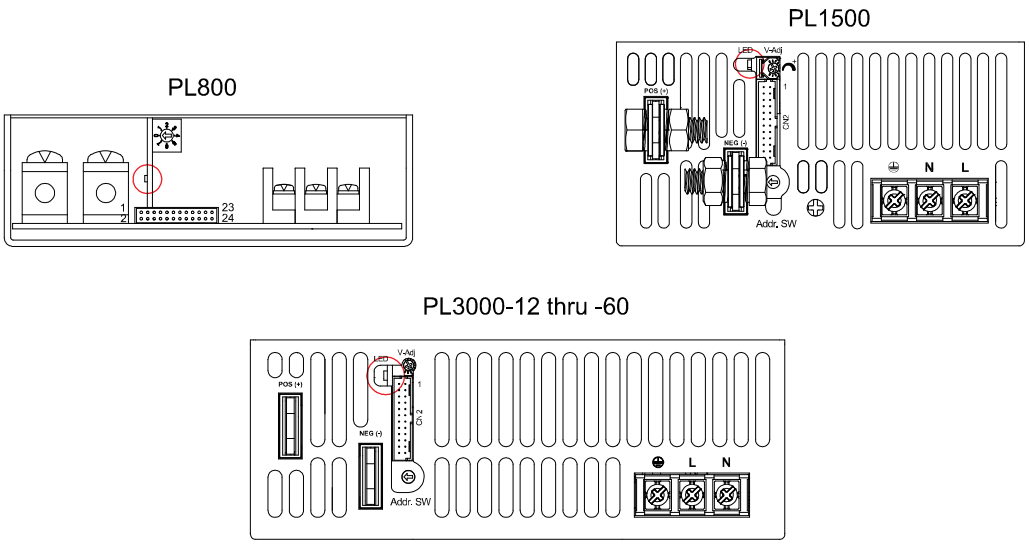



**Figure 6-2 PL800, PL1500 and PL3000-12 thru -60 LED Locations**

| LED | Signal | Status |
|---|---|---|
| Solid (Green) | | Power OK (Local mode) |
| Solid (Orange) | | Power OK (Remote mode) |
| Slow Blink (Green) | | Power Standby |
| Fast Blink (Red) | | Over Voltage Protection (OVP) |
| Solid (Red) | | Over Load Protection (OLP) |
| Slow Blink (Red) | | Over Temperature Protection (OTP) |
| Intermittent Blink (Red) | | Fan Failure |
| Interlace Blink (Red) | | Power Failure |

**Table 6-3 PL800, PL1500 and PL3000-12 thru -60 LED Status Modes**

## 6.3 Voltage Hold-Up Time

The power supply will maintain output regulation per Table 3-1 despite a loss of input power. The Hold-Up Time is as follows:

| Models | Hold-Up Time |
|---|---|
| XL500 | 8ms/230VAC at full load |
| PL650 | 16ms/230VAC at full load |
| PL800, PL1500 & PL3000 | 14ms/230VAC at full load |

**Table 6-4 Hold-Up Time by Model**

# 7. Ordering Information

The following table provides the N2Power part numbers that should appear on your purchase order and will appear on any N2Power correspondence:

| Model Number | V1 | N2Power Part Number |
|---|---|---|
| XL500-12 | 12V | 400525-01-0 |
| XL500-24 | 24V | 400525-02-8 |
| XL500-48 | 48V | 400525-03-6 |
| XL500-56 POE | 56V | 400525-04-4 |
| PL650-05 | 5V | 400353-01-7 |
| PL650-12 | 12V | 400353-02-5 |
| PL650-15 | 15V | 400353-03-3 |
| PL650-24 | 24V | 400353-04-1 |
| PL650-27 | 27V | 400353-05-8 |
| PL650-48 | 48V | 400353-06-6 |
| PL800-12 | 12V | 400354-01-5 |
| PL800-15 | 15V | 400354-02-3 |
| PL800-24 | 24V | 400354-03-1 |
| PL800-30 | 30V | 400354-04-9 |
| PL800-36 | 36V | 400354-05-6 |
| PL800-48 | 48V | 400354-06-4 |
| PL800-60 | 60V | 400354-07-2 |
| PL1500-12 | 12V | 400351-01-7 |
| PL1500-15 | 15V | 400351-02-5 |
| PL1500-24 | 24V | 400351-03-3 |
| PL1500-30 | 30V | 400351-04-1 |
| PL1500-36 | 36V | 400351-05-8 |
| PL1500-48 | 48V | 400351-06-6 |
| PL1500-60 | 60V | 400351-07-4 |
| PL3000-12 | 12V | 400350-01-3 |
| PL3000-15 | 15V | 400350-02-1 |
| PL3000-24 | 24V | 400350-03-9 |
| PL3000-30 | 30V | 400350-04-7 |
| PL3000-36 | 36V | 400350-05-4 |
| PL3000-48 | 48V | 400350-06-2 |
| PL3000-60 | 60V | 400350-07-0 |

**Table 7-1 XL and PL Part Numbers**

All XL and PL power supplies are RoHS compliant For warranty information refer to www.n2power.com. Direct all questions, orders or requests for quotation as follows:

| | | |
|---|---|---|
| N2Power Order Desk: | orders@n2power.com | 805-583-7744 x112 |
| Fax (Attention N2Power): | | 805-583-7749 |
| Sales: | sales@n2power.com | 805-583-7744 x122 |
| Technical Support: | techsupport@n2power.com | 805-583-7744 x119 |
| Address: | 130 W. Cochran St., Suite C | Simi Valley, CA 93065 |