N2Power™
A subsidiary of Qualstar Corporation

Product Specification

Industrial & Medical

XLM 500 Series

500W AC-DC

Power Supplies

Document No. 703593 Rev 03-10-20

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1. Introduction

1.1 Introduction

This specification defines the XLM 500 series of universal input, single output, power factor corrected 500W switch mode power supplies. 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 power supplies achieve very high packaging densities. All of the XLM 500 family models are listed in Table 3-1.

All models of the XLM 500 series can be used as standalone power supplies and have different chassis options – XLM**O**500 for **O**pen frame, XLM**U**500 for **U** Chassis, and XLM**E**500 for **E**nclosure.

XLMO500 **XLMU500** **XLME500**

Figure 1-1 XLM 500 Series

1.2 Agency Compliance

All of the XLMO500, XLMU500 and XLME500 models comply with the following international agency standards:

Safety	Complies with Standard	Remarks
United States	UL 60950-1 2nd Ed + A1:2009 + A2:2013 (Information Technology equipment) UL 60601-1 3.1 Ed + C1:09 + A2:10 (Medical)	I/P-O/P: 4000VAC; I/P-GND: 2000VAC 2MOPP
Canada	CSA 22.2 60950-1 CSA 22.2 60601-1	
International	IEC/EN 60950-1 Second Edition IEC/EN 60601-1 3.1 Edition	
EU Council	2014/35/EU	Low Voltage Directive
EMC	**Complies with Standard**	**Remarks**
International	EN60601-1-2 : 2015 (4TH Edition)	Medical electrical equipment
	EN61204-3 : 2000 (refer to the following)	Low voltage power supplies – DC output
	EN55011: 2009+A1 Class B Group 1	Conducted Emission Standard
	EN55024: 1998 + A1: 2001_ A2:2003	Immunity Standard
	EN61000-3-2:Class D	Harmonic Current Emissions (PFC)
	EN61000-3-3	Voltage Fluctuations & Flicker
	EN61000-4-3 Ed 3.2	Radio frequency immunity
	EN61000-4-4 Ed 3.0	Electrical fast transient burst immunity
	EN61000-4-5 Ed 3.0	Power line surge immunity
	EN61000-4-6 Ed 4.0	RF Common mode immunity
	EN61000-4-11 Ed 2.0	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 — Underwriters Laboratories File E468416(Medical), E211115 (Industrial)

EU Council

RoHS

Table 1-1 Agency Compliance

2. AC/DC Input

2.1 Input Line Requirements

The following table defines the voltage and frequency requirements for the AC line inputs to the XLM 500 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	90VAC	100–240VAC	264VAC
RMS Input Current	-	-	6.0A/115VAC 3.0A/230VAC
Input Frequency	47Hz	50/60Hz	63Hz

Table 2-1 XLM 500 Series Input Parameters

Note: The XLM 500 series can also operate with a DC input between 127 VDC and 370 VDC

2.2 Input Over Current Protection

The XLM 500 series incorporate 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 (25° C) inrush current at 90° input phase angle (i.e. AC switch is closed at the peak of the AC sine wave input) is limited to less than 80 Amps peak for 230 VAC and 40 Amps peak for 115VAC.

Repetitive ON-OFF cycling of the AC input voltage should not damage the power supply or cause the input fuse to open.

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 <0.1mA/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.

Model	Output	Rated Voltage	Regulation	Minimum (VDC)	Nominal (VDC)	Maximum (VDC)
XLM#500-12	VOUT	12	±3.5%	11.58	12	12.42
XLM#500-15	VOUT	15	±3.5%	14.48	15	15.53
XLM#500-24	VOUT	24	±3.5%	23.16	24	24.84
XLM#500-48	VOUT	48	±3.5%	46.32	48	49.68
All	5VSB	5		4.2	5	5.5
	12VAUX	12		10.2	12	13.3

Table 3-1 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 though a minimum load of 3% is required to meet line and load regulation. The power supply will remain stable and operate normally after application of loads.

3.3 Output Current/Power

The maximum available output power is always a function of the input voltage, cooling airflow and temperature. 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 Output	Minimum Load	Maximum Load
XLM#500-12	12V	1.25 A	41.5 A
XLM#500-15	15V	1.00 A	33.3 A
XLM#500-24	24V	0.63 A	20.8 A
XLM#500-48	48V	0.32 A	10.4 A
All : 5VSB	5V	0 A	1 A 0.4 A (without fan)
All : 12VAUX	12V	0 A	0.3 A (for fan supply usage only)

Table 3-2 Max Load Currents

3.3.1 Input Voltage Derating

The XLM 500 series can be operated at the minimum input voltage of 90VAC with the maximum load of 60% of the total maximum output power. From 90VAC to 115VAC, the output load can be increased by 1.6%/VAC.

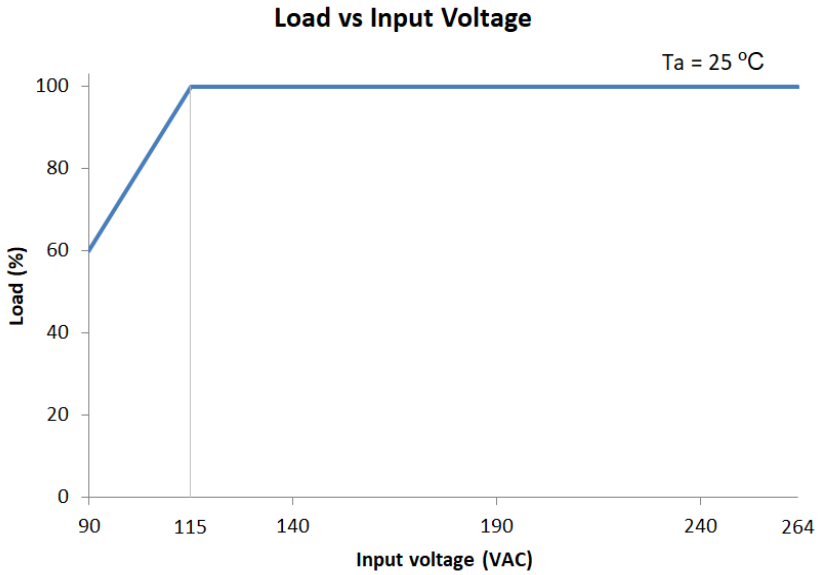

Figure 3-1 Load vs. Input Voltage

3.4 Cooling

Required cooling is always dependent on output power needed and available space for cooling air flow with recommended internal testing for temperature rating after the power supply is mounted in the OEM product. Typically, the XLM 500 can operate in a convection cooling mode at 50°C with the maximum output power of 230 watts. If more than 230 watts load is required at convection cooling mode with ambient temperature less than 50°C, the OEM will have to do internal testing to make sure what the maximum power is available. For optimum cooling, it is recommended that the power supply is mounted open side up with 30-CFM of forced-air cooling impinging downward in the center of the open topside. With proper cooling, the XLM 500 can deliver 500 watts of power at a maximum internal temperature rating of 50°C.

3.4.1 High Temperature Derating

The XLM 500 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. When the power supply is operated at convection cooling and the input voltage is 115VAC, the total maximum output power (or current) must be derated by 0.7%/°C from 40°C to 70°C.

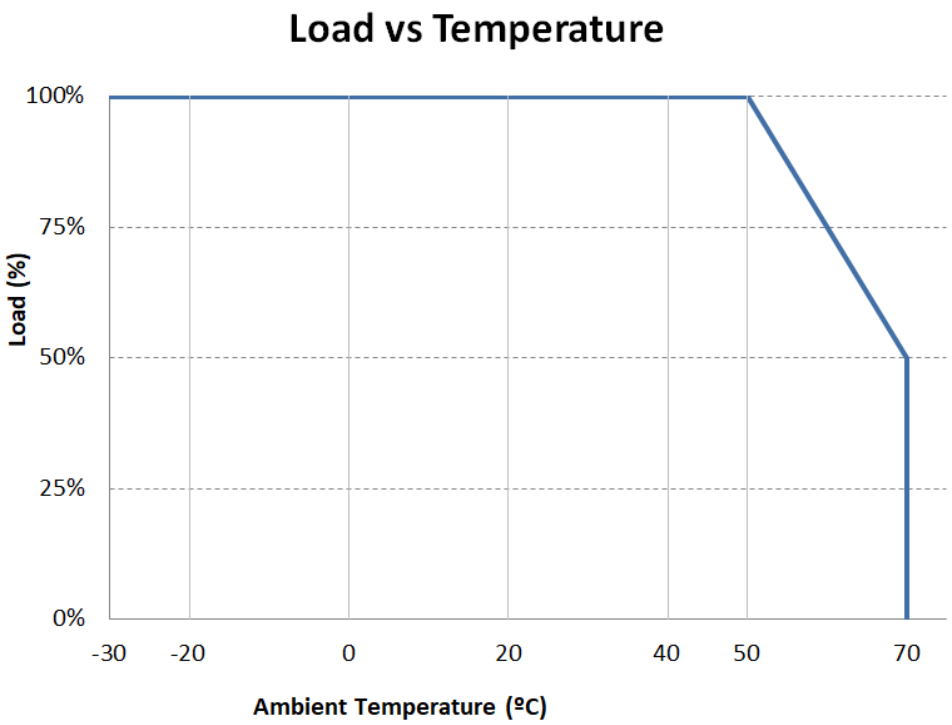

Figure 3-2 Temperature Derating Curve

(For convection usage, "100% available power" is 230 watts @ 50˚C.
With 30CFM Airflow, "100% available power" is 500 watts @ 50˚C.)

3.5 Output Ripple/Noise

Output ripple voltage and noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with 0.1 µF & 47 µF in parallel. The ripple noise is measured from the output pin connectors (VOUT and RTN).

3.5.1 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 3.3.

Model	Output	Voltage	Maximum Ripple+Noise (peak-to-peak)
XLM#500-12	VOUT	12V	160mV
XLM#500-15	VOUT	15V	160mV
XLM#500-24	VOUT	24V	240mV
XLM#500-48	VOUT	48V	480mV

Table 3-3 Ripple Voltage

3.5.2 Ripple/Noise Test Setup

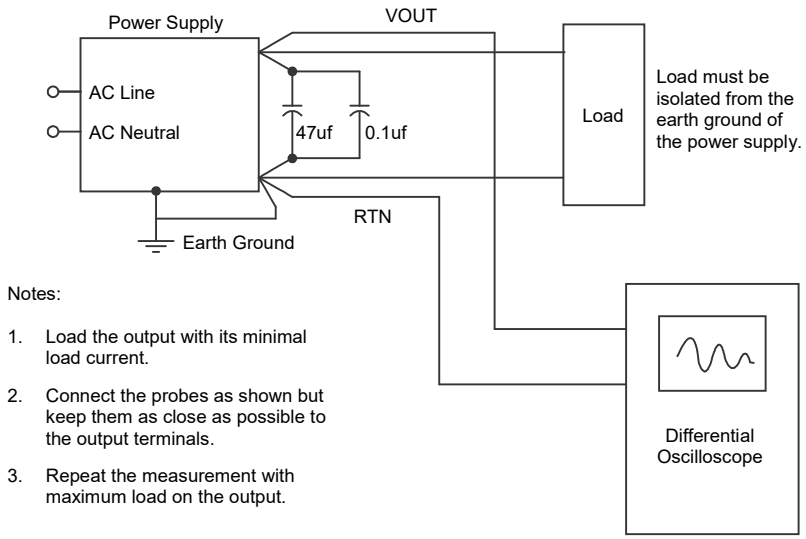

Figure 3-3 Ripple Noise Measurement Setup

3.6 Local and Remote Sensing

Remote sensing is provided to compensate for voltage drops in the VOUT (+Main Output) and RTN (Main Output Return) connections to the load. For every model, the Negative Remote Sense (-RS) input must always be connected to either the RTN terminal at the load or one of the RTN pins of the power supply. Connecting it to the return side of the load will reduce the voltage drop in the external return wiring.

If the Positive Remote Sense (+RS) input is left open, the VOUT output will still meet its load regulation specification at the output terminals. Connecting the +RS pin to the VOUT output at the load will reduce the voltage drop in the external VOUT wiring.

3.6.1 Remote Sensing Connection

Up to 0.5V in the RTN and the VOUT connections may be compensated. Refer to Figure 3-4 which shows the required remote sensing connections for the XLM 500 series.

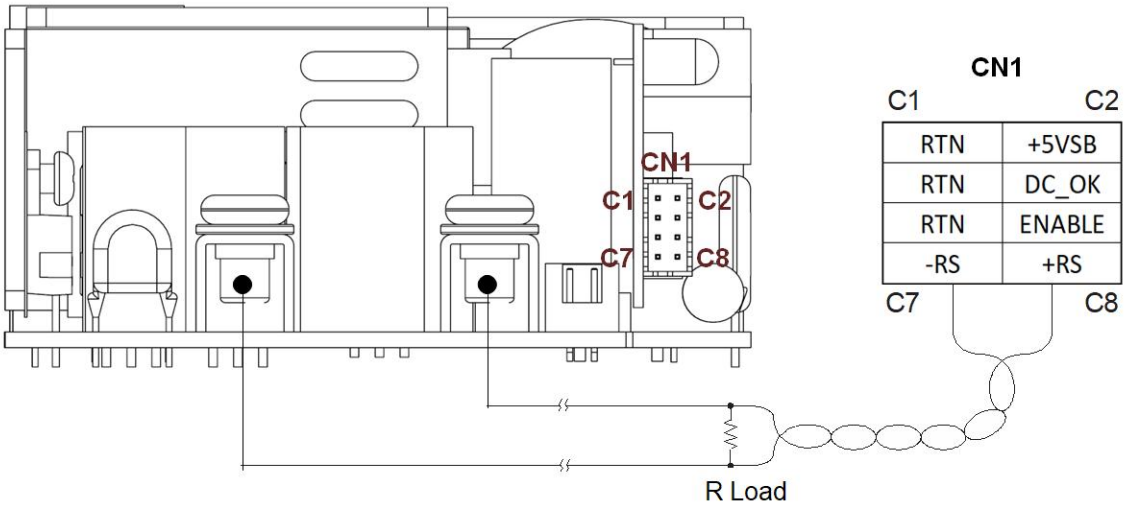

Figure 3-4 Remote Sensing Wiring

3.7 Output Protection

There are three different output protection schemes designed to protect the load and the XLM 500 Series from component failures and extraordinary circumstances.

3.7.1 Over Temperature Protection (OTP)

If the XLM 500 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.

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 recover automatically after the fault causing over voltage condition is removed.

Model	Minimum	Nominal	Maximum
XLM#500-12	12.6 V	14.4 V	16.2 V
XLM#500-15	15.8 V	18.0 V	20.3 V
XLM#500-24	25.2 V	28.8 V	32.4 V
XLM#500-48	50.4 V	57.6 V	64.8 V

Table 3-4 Over Voltage Protection Limits

3.7.3 Over Current Protection (OCP)

An excessive load on the VOUT output will induce constant-current limiting which will cause the output voltage to droop. The constant-current limiter has a threshold of with the range of 105~165% of the rated output current. 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.

3.7.4 Short Circuit Protection

A short circuit is defined as an impedance of less than 0.1 ohms placed between RTN and any output. A short circuit will cause no damage to the power supply, but will cause it to shut down. 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 within 60ms. The output voltages waveform must be a monotonic ramp from 10% to 90% of final set point 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.

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% above the nominal voltage. No opposite polarity voltage will be present on any output during turn on or turn off.

4. General Specifications

4.1 Environmental

The XLM 500 Series meets or exceeds the following environmental specifications:

Parameter	Conditions	Specification	Remarks
	Operating	-30°C to 70°C*	
	Non-Operating	-30°C to 85°C	
Relative Humidity	Operating	20-90% Maximum	Non-Condensing
	Non-Operating	95% Maximum	Non-Condensing
Altitude	Operating	16404 feet MSL Max.	5,000 meters
Vibration	No damage	2.0 G RMS Maximum 2.0 G RMS Maximum	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

Note on (*): Refer to **Figure 3-2** for derating at different temperatures.

4.2 Mean Time Between Failures

The calculated MTBF of all models is equal to or greater than 160,000 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 in accordance with (MIL-HDBK-217F). Actual failure rates vary from unit to unit.

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. A typical label is pictured below.

Figure 4-1 Sample XLM 500 series label

4.4 Net Weight

Model	Pound	Ounces	Kilograms
XLMO500	1.06	16.93	0.48
XLMU500	1.28	20.46	0.58
XLME500	1.52	24.34	0.69

Table 4-2 Net Weights

4.5 Mounting and Physical Dimensions

The XLM 500 power supplies may be mounted with the following screws.

Model	Bottom Mounting	Side Mounting
XLMO500	(open frame)	(open frame)
XLMU500	M3, length 2.5	M3, length 2.5
XLME500	M3, length 2.5	M3, length 2.5

Table 4-3 Mounting Screw Sizes

The power supplies may be mounted on their bottom surface or their sides. See mechanical drawings for mounting hole locations and the dimensions of the power supplies. All the units are in "mm[in]" format.

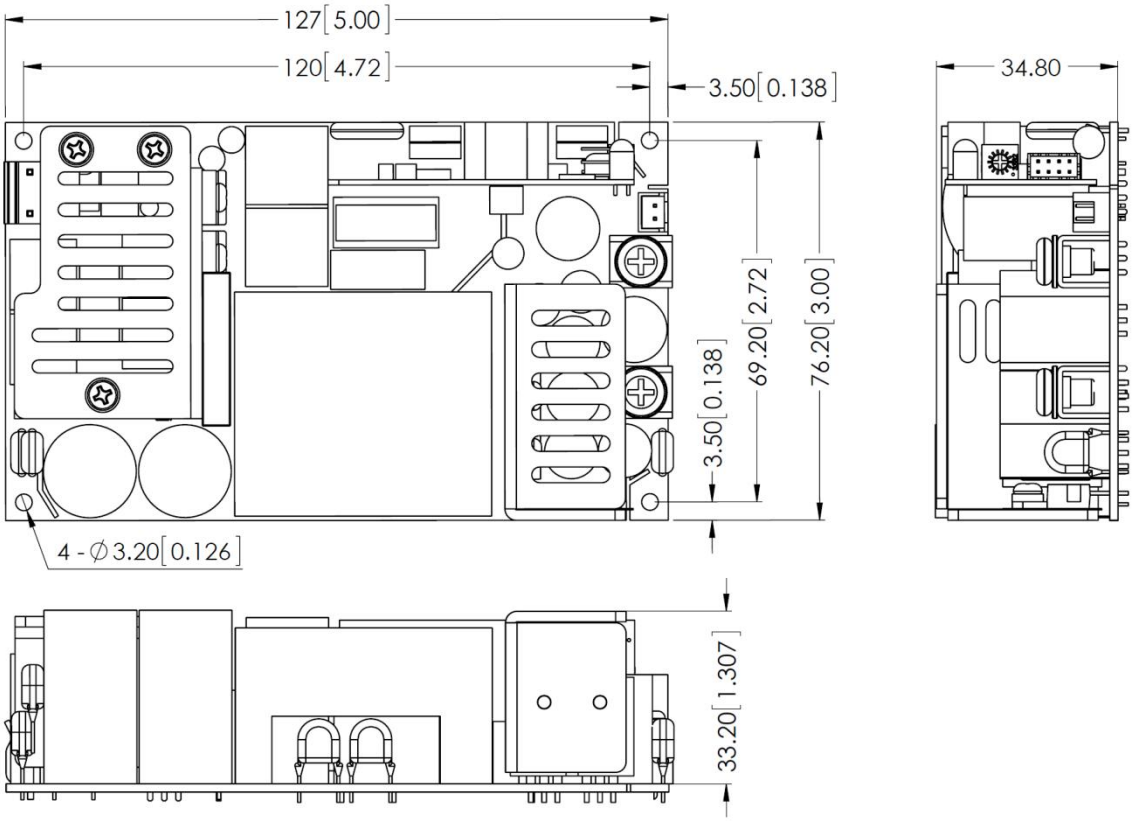

Figure 4-2 XLMO500 Mounting Hole Locations and Dimensions

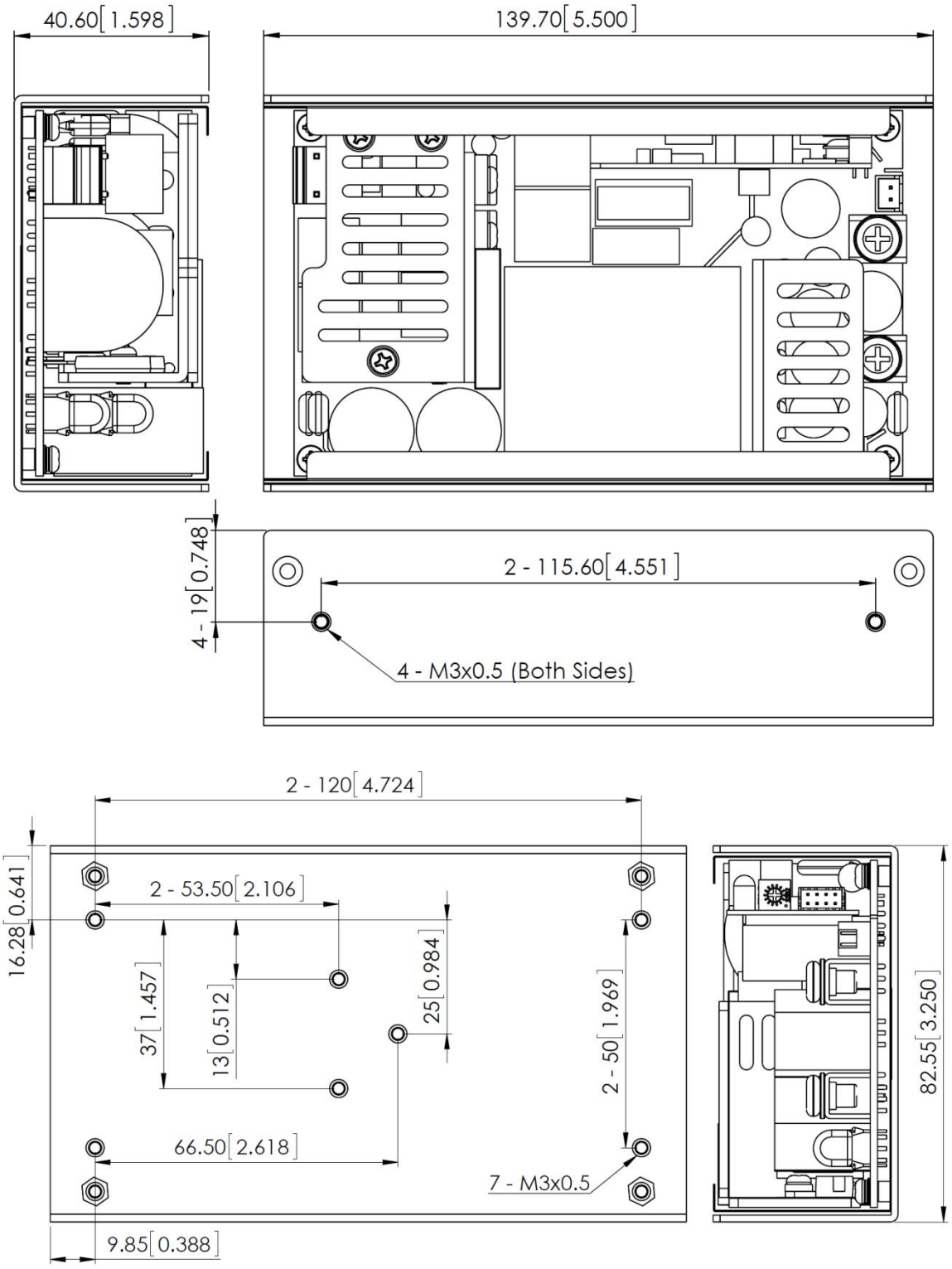

Figure 4-3 XLMU500 Mounting Hole Locations and Dimensions

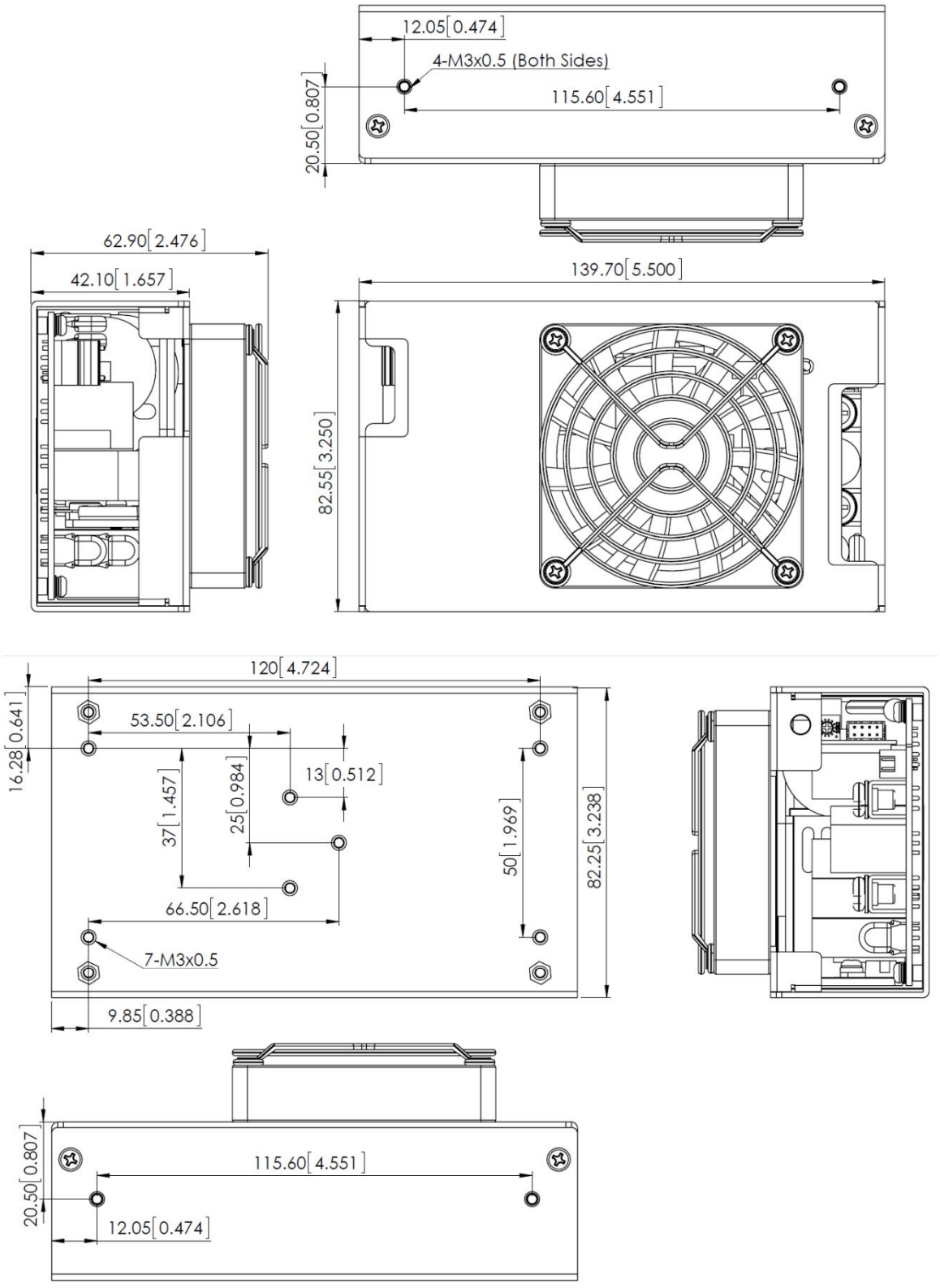

Figure 4-4 XLME500 Mounting Hole Locations and Dimensions

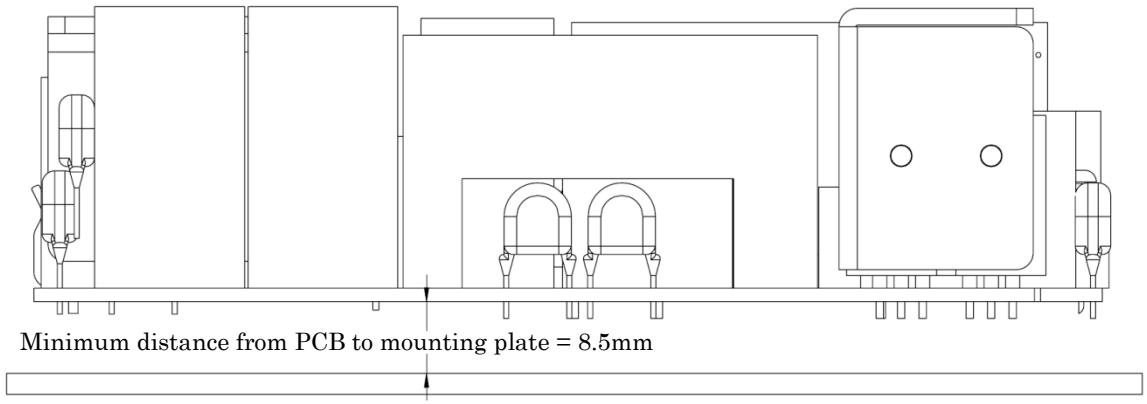

Figure 4-5 XMLO500 minimum distance requirement from mounting plate

The distance from the mounting plate (FG Plane) to the PCB must be at least 8.5mm. A standoff less than 8.5mm high is acceptable when a thin insulator, 0.4mm thick (polyester, fish paper or equivalent UL rated 94V-2 minimum) is placed between the power supply and the mounting chassis (refer to applicable UL standard for clearance requirements).

4.6 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
ALL	AC INPUT	B3P-VH	VHR-3N	SVH-21T-P1.1
XLM#500	+/-VOUT(DC Output)	M5 Pan Head Screw		Ring-lug
	FAN (DC Output)	B2B-XH-A	XHP-2	SXH-001T-P0.6, SXH-002T-P0.6
	CN1	CP-HD20R-2x4P	PHDR-08VS	SPHD-001T-P0.5, SPHD-002T-P0.5

Table 4-4 Mounting Screw Sizes

4.7 Output Grounding

The RTN signal may be connected to the power supply chassis ground (safety earth) screw terminals on the power supplies as shown in Figure 4-6

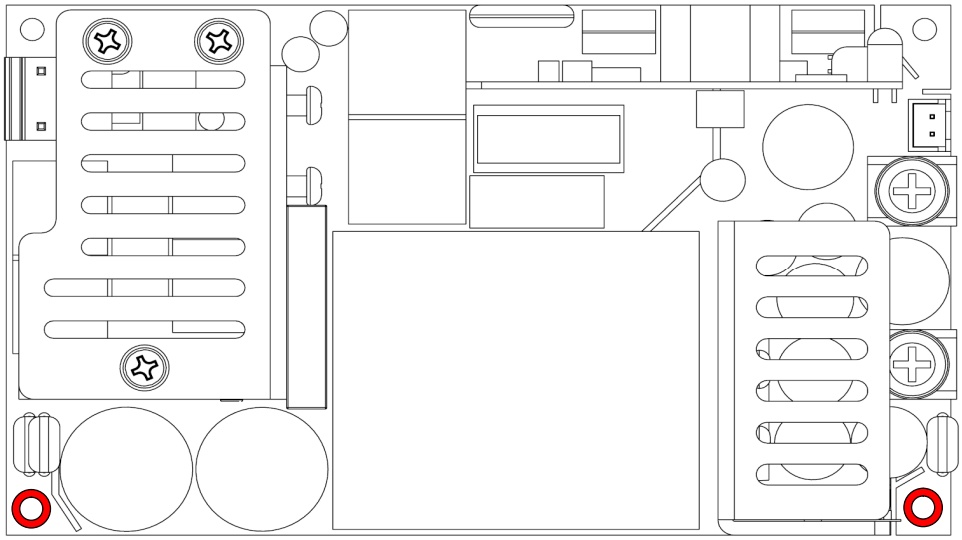

Figure 4-6 XLM 500 Grounding Location

4.8 Pin Definitions

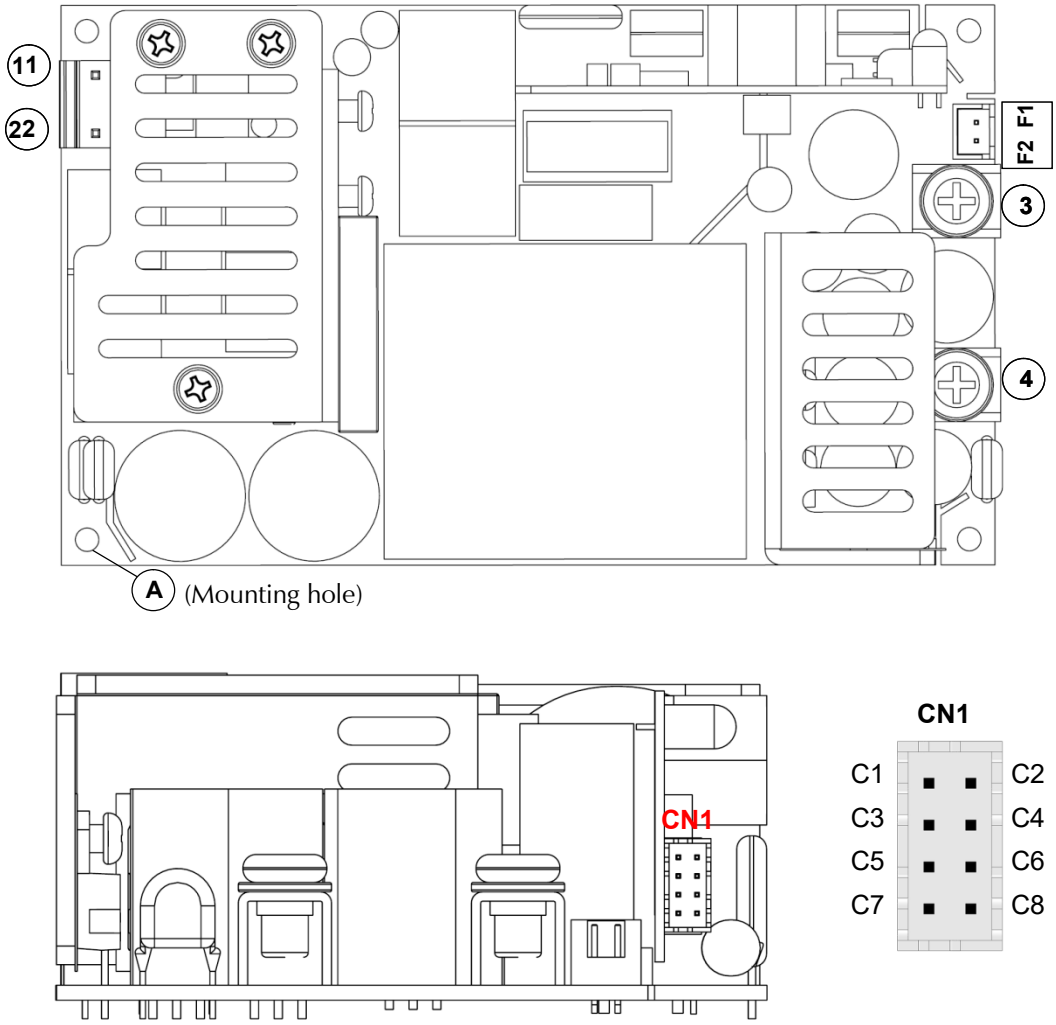

Figure 4-7 Pin Definitions

Model	Connector	Pin No.	Assignment
XLM#500	AC Input Terminal	A	FG
		1	AC NEUTRAL
		2	AC LINE
	Main Output	3	VOUT (+Output)
		4	RTN (Main Output Return)
	Connector (FAN)	F1	+12V (+12V fan supply)
		F2	RTN (Return)
	CN1	C1	RTN (Return)
		C2	+5VSB (+$5V_{standby}$)
		C3	RTN (Return)
		C4	DC_OK (Logic output, high-true)
		C5	RTN (Return)
		C6	ENABLE (Remote Enable)
		C7	-RS (Negative Remote Sense)
		C8	+RS (Positive Remote Sense)

Table 4-5 Pin Definitions

5. Efficiency

The efficiencies for the XLM 500 power supplies are listed below. They were measured at full load, 25 ˚C, at 230AC.

Model:	Output	Load	AC	Efficiency
XLM#500-12	12V	41.5A	230VAC	90.5%
XLM#500-15	15V	33.3A	230VAC	90.0%
XLM#500-24	24V	20.8A	230VAC	92.0%
XLM#500-48	48V	10.41A	230VAC	93.0%

Table 5-1 Output Currents at Rated Efficiency

6. Timing and Control

6.1 Power Supply Timing

The maximum duration for the output to rise up to regulated output voltage (99% of nominal voltage) from the start of AC input voltage is 1 second.

6.2 DC_OK

The DC_OK signal provides a high logic level to indicate the DC outputs are within their regulation limits and that sufficient mains energy is stored by the power supply to ensure continuous power operation within specification for the duration of the hold-up time. The electrical specifications for the DC_OK outputs are described in Table 6-1 Status and Control Signal Specifications

Power On Delay	< 1.2s
Rise Time	< 50ms
DC_OK Output	ON, 3.7V~6V OFF, 0~1V

Table 6-1 Status and Control Signal Specifications

6.3 Remote Enable (ENABLE)

Remote enable feature is built into XLM 500. This input is normally floating to enable VOUT. It must be connected to RTN to disable VOUT. External voltage may be applied to this input to control VOUT. The input voltage must be less than 1V in order to disable VOUT and greater than 3.3V (up to 5V) to enable it.

6.4 Voltage Hold-Up Time

The power supply will maintain output regulation per Table 3-1 despite a loss of input power at 100VAC/50Hz and 230VAC/50Hz at maximum rated continuous output for a minimum of 8ms.

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	VOUT	N2Power Part Number
XLMO500-12	12V	400525-05-2
XLMO500-15	15V	400525-14-3
XLMO500-24	24V	400525-06-0
XLMO500-48	48V	400525-07-8
XLMU500-12	12V	400525-08-6
XLMU500-15	15V	400525-15-1
XLMU500-24	24V	400525-09-4
XLMU500-48	48V	400525-10-2
XLME500-12	12V	400525-11-0
XLME500-15	15V	400525-16-9
XLME500-24	24V	400525-12-8
XLME500-48	48V	400525-13-6

Table 7-1 XLM 500 Part Numbers

All XLM 500 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):		805-978-5212
Sales:	sales@n2power.com	805-583-7744 x122
Technical Support:	techsupport@n2power.com	805-583-7744 x119
Address:	1267 Flynn Road Camarillo, CA 93012	