The XL275 Short Course

Introduction

This document provides a short synopsis of the N2Power XL275 series of power supplies, their output voltage and current specifications, their installation and operation. The supplies are high-efficiency line-switching AC to DC power supplies with universal AC input power (100-240VAC 50-60Hz). They're all rated for 275 total DC watts output with full-load efficiencies of up to 90% (model dependent). All models have Power-Factor-Correcting (PFC) AC inputs to reduce input current and harmonic distortion on the AC line.

The XL275-3, -5, -6 and -7 can be used as standalone power supplies or in redundant or N+1 configurations with up to 4 units connected in parallel. All outputs may be connected in parallel, but only the main V1 output features active current sharing. When connected in parallel, the +5 $V_{standby}$ and +12 V_{aux} outputs provide redundancy, but their total output current is still limited to that of a single supply. S45 versions do not have current sharing abilities.

The XL275 is a UL recognized component and is certified to U.S., Canadian and European standards. It also bears the CE mark. For complete product details, please refer to the XL275 product specification (document 705123) at www.n2power.com. Follow the Support and Documents links.

Safety Warning

The XL275 is a component, not a stand-alone power supply. It must be mounted inside a protective enclosure to prevent accidental shock by contact with the supply. Lethal voltages are present while and after AC power is applied to the XL275. Allow 1-minute for storage capacitors to discharge after removing AC power before handling the XL275.

The safety ground connection is the chassis itself and it must be connected to Protective Earth.

Cooling

The XL275-3, -5, -6 and -7 power supplies can operate with convection cooling at temperatures below 50°C when total output power output is less than 150 watts and they are mounted open side up. 10-CFM of forced-air cooling at a maximum of 50°C is required when the output power exceeds 150-watts. The XL275 may be mounted in any attitude when forced-air cooled.

A 12-volt fan (rated at 10-CFM or more) should be connected to the auxiliary 12-volt output. The fan should be in close proximity to the supply with its airflow axis parallel to the plane of the XL275's printed circuit board and the airflow directed to the center of either open end of the supply. The fan may also be centrally mounted above the supply while blowing air into its center.

Mounting

The XL275 may be mounted at all four corners of its bottom surface (preferred) or by the two mounting holes on either side using 6-32 screws. The XL275's chassis provides the safety ground (Protect Earth) connection and it must be securely connected to Protective Earth. Since its black anodizing is not conductive, the mounting screws are the only means of grounding the XL275's chassis. An aluminum mounting plate will provide better conductive cooling than steel.

To mount on the bottom surface, remove the four 6-32 x 3/8" 100° flathead Phillips screws from the bottom of the XL275 and use them to mount the supply to your chassis (up to 2mm or .08" thick). Tighten them securely (5 in-lb or 0.6N-m) to assure safety ground (Protective Earth) continuity.

To mount on the side surfaces, use 6-32 screws that do not penetrate into the XL275 by more than ¼-inch (6.4mm). The bottom four screws must be securely installed when side-mounting is utilized.

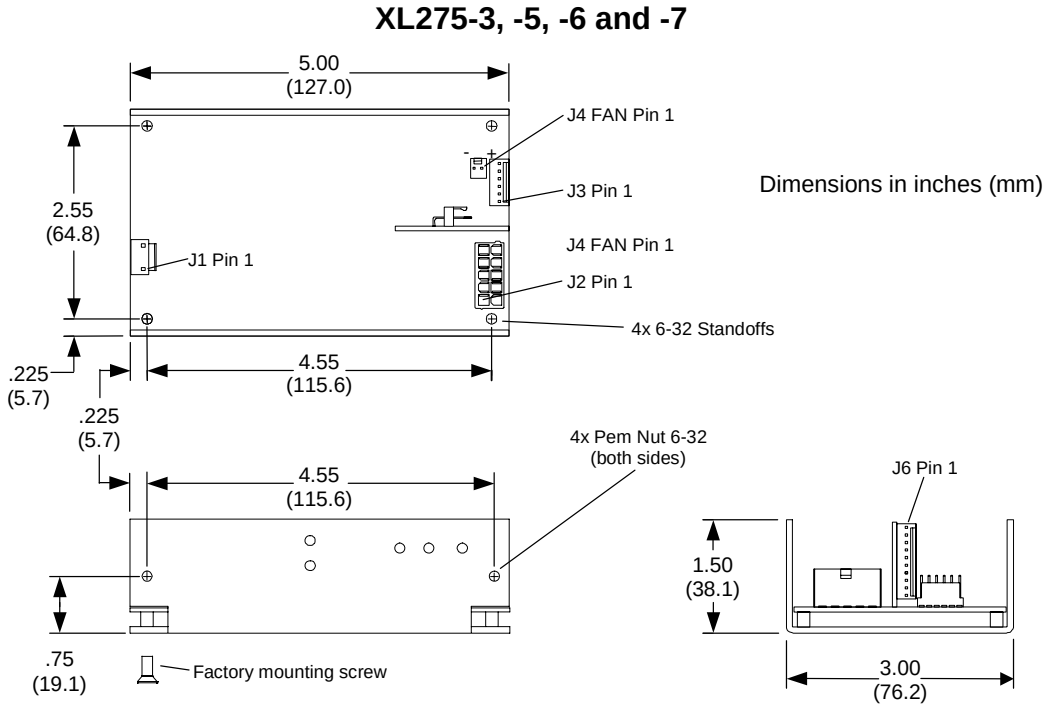

Figure 1 XL275 Dimensions and Mounting Holes

XL275 Models and Specifications

Model	Output	Rated Voltage (VDC)	Maximum Output Current	Current Sense Output	Remote Sense Available
XL275-3	V1	+12 V	22.9 A	11.34 A/V	V1/RTN
	V2	+12 V_{aux}	1.0 A		None
	V3	+5 $V_{standby}$	1.0 A		None
XL275-5	V1	+24 V	11.5 A	5.69 A/V	V1/RTN
	V2	+12 V_{aux}	1.0 A		None
	V3	+5 $V_{standby}$	1.0 A		None
XL275-6	V1	+48 V	5.7 A	2.82 A/V	V1/RTN
	V2	+12 V_{aux}	1.0 A		None
	V3	+5 $V_{standby}$	1.0 A		None
XL275-7	V1	+56 V	4.9 A	2.43 A/V	V1/RTN
	V2	+12 V_{aux}	1.0 A		None
	V3	+5 $V_{standby}$	1.0 A		None

Table 1 XL275 Specification Synopsis

The approximate V1 output current can be determined from the DC voltage on the V1 Current Share pin (J3-4) (with respect to DC Return (J3-5)). This positive DC output voltage indicates the approximate output current of a single supply or of each supply when current sharing parallel units. Do not load this output with any capacitance and use a DC voltmeter for measurement. See Table 1 above for output scaling. Too much measurement capacitance is present if the V1 output voltage increases when making the above measurement. To improve measurement accuracy of the output current, first measure the J3-4 offset voltage with no load current (J2 unplugged). Subtract this offset voltage from your meter readings before applying the scaling factors in Table 1.

Mating Connectors

WARNING

The pin-1 location differs amongst connector manufacturers. Sometimes the pin-1 location differs between the header (on the power supply) and the mating housing from the same manufacturer. Please disregard the manufacturer's pin-1 location and follow only the pin-1 locations in Figure 1.

AC Input Mating Connector (J1)

The AC input connector to the XL275 is a 3-pin Molex style header with 0.156" centers. The center pin is omitted to provide adequate insulation spacing. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers. AWG 18 wire is recommended.

Protective Earth should be connected to the metal chassis of the XL275.

J1	Molex P/N
Connector Circuits (pins)	3
XL275 Header	26-62-4030
Mating Housing	09-50-8031
Crimp Terminal	08-52-0113
Rated Wire Size	AWG 18 or 20

Table 2 J1 Mating Connector

DC Output Connector (J2)

The DC output connector is a Molex Mini-Fit, Jr.® header with 0.156" centers. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers. AWG 16 wire with the 39-00-0078 contact is recommended.

J2	XL275-3, -5, -6, -7	Rated AWG
Connector Circuits (pins)	10	
XL275 Header	39-28-1103	
Mating Housing	39-01-2100	
Rated Contact Current	9.0 A	16
Recommended Crimp Terminal	39-00-0078	16
Alternate Crimp Terminal	39-00-0039	18-24

Table 3 J2 Mating Connector

Auxiliary Connector (J3)

The auxiliary connector on the XL275 is a Molex KK header with 0.100" centers. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers.

J3	XL275-3, -5, -6, -7
Connector Circuits (pins)	6
J3: Remote/PG	22-11-2062
Mating Housing	10-11-2063
Crimp terminal (selective gold)	08-65-0816
Rated Contact Current	2.5 A
Rated Wire Size	AWG 22 thru 30

Table 4 J3 Mating Connector

FAN Connector (J4)

The FAN connector on the XL275 is a Molex KK header with 0.100" centers. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers.

J4	XL275-3, -5, -6, -7
Connector Circuits (pins)	2
PCB Header (Tinned)	22-11-2022
Mating Housing	10-11-2023
Crimp terminal (selective gold)	08-65-0816
Rated Contact Current	2.5 A
Rated Wire Size	AWG 22 thru 30

Table 5 J4 Mating Connector

J5 Mating Connector

J5 is used internally, thus no mating connector is required.

Control Connector (J6)

The control connector found on models XL275-3 through XL275-7 is a Molex KK header with 0.100" centers. The Molex part numbers for the mating housing and crimp-style snap-in terminals are listed below. There may be equivalent connectors available from other manufacturers.

J6	XL275-3, -5, -6, -7
Connector Circuits (pins)	10
PCB Header (Gold)	22-12-2104
Mating Housing	10-11-2103
Crimp terminal (selective gold)	08-65-0816
Rated Contact Current	2.5 A
Rated Wire Size	AWG 22 thru 30

Table 6 J6 Mating Connectors

Signal Descriptions and Remarks

Signal	Description/Remarks
AC Line	Highest in potential compared to earth ground. Should be connected to the AC power switch.
AC Neutral	Closest in potential to earth ground. Should not be connected to a single-pole power switch.
DC Return	XL275 ground for all outputs and status/control signals. It is recommended that all four pins on J2 be wired in parallel.
V1	The main output (+) capable of 275W. It is recommended that all four output pins be wired in parallel.
V1 Sense (+)	Remote sense for V1 at load (compensates for wiring losses)
V1 Sense (-)	Remote sense for DC Return at load (affects V1, see above)
V1 Trim Input	Connect a resistor between this pin and DC Return to increase the V1 output voltage. Connect a resistor between this pin and V1 to decrease the output voltage. See page 8.
V1 Current Share	This analog signal is both an input and output and is used to evenly distribute the total load current amongst two or more XL275 power supplies wired in parallel. The signal also indicates the approximate load current of any single power supply. See page 9.
V2 (+12Vaux)	Provides 1A of 12V power for fans. Uses common ground DC Return. Turns off with V1
V3 (+5 $V_{standby}$)	Provides 1A of 5V power whenever AC power is presents. Uses common ground DC Return
PS_ON	A low-logic level enables the V1 and V2 outputs. Pulled-up by 5K resistor to +4.5V. Factory default is shorted to DC Return with removable jumper. See page 9.
Power Good	A high-logic level (4.5V) indicates the output power is in regulation for at least the next 2mS. See page 9.
Power Good LED	Connect to the anode of an LED whose cathode is connected to DC Return. Will illuminate the LED when Power Good is high. See page 9.
Standby LED	Connect to the anode of an LED whose cathode is connected to DC Return. Will illuminate the LED when PS_ON is open or high. See page 9.
Fan 2: Tachometer Input	The tachometer output of a single fan may be connected to this input. The loss of the tachometer signal is detected and can be reported over the optional serial data interface.
Fan 2: Controlled Output	This output can drive a 12V fan and turns on only when the ambient temperature approaches the normal operating limits.
I^2C Serial Data	Optional: Provides PMBus™ control/status interface
I^2C Serial Clock	Optional: Provides PMBus™ control/status interface

Table 7 Signal Descriptions and Remarks

Pin	Signal
J1-1	AC Line
J1-2	No Pin
J1-3	AC Neutral
Pin	**Signal**
J2-1	V1 (+ Output)
J2-2	V1 (+ Output)
J2-3	V1 (+ Output)
J2-4	V1 (+ Output)
J2-5	V1 Sense (+)
J2-6	DC Return
J2-7	DC Return
J2-8	DC Return
J2-9	DC Return
J2-10	V1 Sense (–)
J3-1	V1 Trim Input
J3-2	V3 (+5V Standby)
J3-3	DC Return
J3-4	V1 Current Share
J3-5	DC Return
J3-6	V2 (+12Vaux)
J4-1	V2 (+12Vaux (Fan 1))
J4-2	DC Return
J6-1	Fan 2: Tachometer Input
J6-2	I^2C Serial Data
J6-3	I^2C Serial Clock
J6-4	Power Good (output, high-true)
J6-5	Power Good LED (+output)
J6-6	Standby LED (+output)
J6-7	DC Return
J6-8	PS_ON (input, low-true)
J6-9	DC Return
J6-10	Fan 2: Controlled Output (derived from +12Vaux)

Table 8 Pin Assignments in Pin Order

Signal	Pin
DC Return	J2-6
DC Return	J2-7
DC Return	J2-8
DC Return	J2-9
DC Return	J3-3
DC Return	J3-5
DC Return	J4-2
DC Return	J6-7
DC Return	J6-9
V1 (+ Output)	J2-1
V1 (+ Output)	J2-2
V1 (+ Output)	J2-3
V1 (+ Output)	J2-4
V1 Sense (–)	J2-10
V1 Sense (+)	J2-5
V1 Trim Input	J3-1
V1 Current Share	J3-4
V2 (+12Vaux)	J3-6
V2 (+12Vaux (Fan 1))	J4-1
V2 (+12Vaux (Fan 2)) V-Speed	J6-10
Fan 2 Tachometer Input	J6-1
V3 (+5V Standby)	J3-2
PS_ON (input, low-true)	J6-8
Power Good (output, high-true)	J6-4
Power Good LED (+output)	J6-5
Standby LED (+output)	J6-6
I^2C Serial Data	J6-2
I^2C Serial Clock	J6-3

Table 9 Pin Assignments in Signal Order

All outputs and inputs are referenced to DC Return

Identical signal names (excluding information within parenthesis) are connected together on all connectors

Protective Earth should be connected to the XL275's metal chassis via 2 or 4 6-32 mounting screws

Refer to Figure 1 for the pin-1 location of the XL275's headers (disregard connector manufacturer's recommendations)

Remote Sense

Remote sensing is provided to compensate for voltage drops in the V1+Output and the DC RETURN wiring to the V1 load. The voltage at the remote sense inputs must never be allowed to differ by more than 0.5-volts from their respective output and return pins. If the Remote Sense inputs are left open, the output voltage at the J2 terminals will still meet the load regulation specification. Wire remote sense lines as shown in Figure 2.

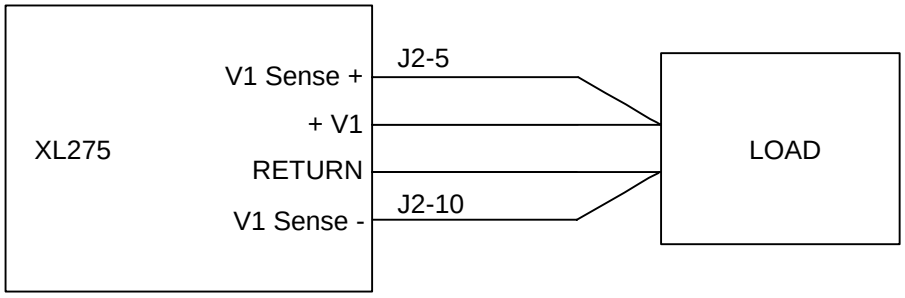

Figure 2 Remote Sense Wiring

Voltage Trim

A voltage trim input pin is provided to allow the user to adjust the V1 output up or down by up to 5%. Connecting a resistor between this pin and DC Return will increase the output voltage while connecting a resistor between this pin and the V1 output will decrease the output voltage. The ability of the V1 output to maintain its specified regulation accuracy under severe load or line conditions could be diminished by trimming the output to a higher than nominal voltage. The trim range is limited to +/- 5% as determined by the resistor values listed in Table 10. Only resistance values greater than or equal to those listed in Table 10 should be used.

Model	V1 Up 3%	V1 Up 5%	V1 Down 3%	V1 Down 5%
Connect Trim pin to	to DC Return	to DC Return	V1 Output	V1 Output
XL275-3 (12V)	17.8K	4.32K	124K	68.1K
XL275-5 (24V)	17.8K	4.32K	294K	169K
XL275-6 (48V)	17.8K	4.32K	649K	383K
XL275-7 (56V)	17.8K	4.32K	768K	453K

Table 10 Minimum Trim Resistors for Maximum Output Voltage Change

When two or more XL275's are operating in parallel, each unit should be trimmed with the same resistor value connected to the same terminal.

Current Sharing with Multiple Power Supplies Wired in Parallel

Only the main output (V1) of two, three or four XL275-3, -5, -6 or -7 power supplies (must all be the same model) may be connected in parallel to provide higher output power. A current share signal must be wired between all sharing supplies. They can also be used in a N+1 configuration to provide higher output power and greater reliability. The +12 V_{aux} and +5 $V_{standby}$ outputs have a Schottky rectifier just before their output pins so that they can be connected directly to the like outputs of other units. However, the total output power on these two outputs is always limited to that of a single supply. For a complete description of current sharing, see product specification 705123.

PS_ON Input

This input must be grounded to enable the main and +12Vaux outputs. It has no effect on the +5Vstandby output. It is pulled up to 4.5V through a 5.0K resistor. The input voltage must be less than 0.4V when the output is to be activated and higher than 3.0V when the output is to be disabled. A jumper from J6-8 to J6-7 or J6-9 will enable the main and +12Vaux outputs (factory default: removable jumper installed J6-8 to J6-9).

Power Good: Outputs and LED

The Power Good 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. When the AC mains power is removed for a period longer than 20ms, the Power Good signal transitions to a low logic level. The Power Good signal is CMOS sourced and capable of sinking 20mA or sourcing 10mA. The green onboard Power Good LED (located behind J6) illuminates whenever the Power Good output is high.

The Power Good LED output follows the logical Power Good output but is intended to drive an external LED through a 470-ohm ballast resistor from a 4.4V source. The cathode of the external LED should be connected to DC Return.

Standby LED Output

The Standby LED output is designed to directly drive an LED from an internal 4.4V source through a 470-ohm internal ballast resistor. This output will go high when the PS_ON input is open or false, meaning the main output is disabled. The cathode of the external LED should be connected to DC Return.

AC LED

The amber AC LED illuminates whenever AC power is applied. The AC LED is located near the FAN header J4.

Power Supply Protection

There are several different protection circuits designed to protect the V1 load and the XL275 from component failures and extraordinary circumstances. These include:

- Over Temperature Protection
- Over-Voltage Protection
- Under-Voltage Protection
- Short-Circuit and Over-Current Protection
- Over-Power Protection

See the 705123 product specification for complete details on these protection functions.

Fault Code Summary

The XL275 utilizes a microcontroller to supervise its operation. It is powered by V3 (5V Standby) and is not affected by V1 and V2 output faults. It will enable and disable the V1 and V2 output voltages in response to requests on the PS_ON/ input and also provides the Power Good, Power Good LED and Standby LED outputs.

The microcontroller also measures the V1 output voltage and output current in addition to the ambient and main output transformer temperatures. It will shut the V1 (main) and V2 (12V Aux) outputs off whenever an abnormal condition occurs that could potentially damage the load or the power supply.

When the microcontroller disables the V1 and V2 output voltages, it blinks an alarm code on the green Power Good LED (located behind J6) and on an optional external Standby LED. A Long blink illuminates the Standby LED while it darkens the Power Good LED for 1000mS while a short blink lasts only 300mS. There is a 100mS pause between blinks and a 2000mS pause before repeating a fault code.

Fault Condition	Ends when…	Blink* Code
Under-voltage	AC power is recycled or PS_ON/ is recycled	5-Short
Over-voltage	AC power is recycled or PS_ON/ is recycled	4-Short
Short-circuit	Attempts to restart every half-second for up to 5-minutes	3-Short
Over-current	Attempts to restart every half-second for up to 5-minutes	2-Short
Transformer Over-temperature	XL275 cools down	Long-Short
Ambient Over-temperature	XL275 cools down	Short-Long

*Power Good LED located behind J6 blinks off (dark)
*Optional external Standby LED blinks on (light)

Table 11 Fault Code Summary

Utilizing an external Standby LED allows a user to see any fault codes on the front panel of the equipment.