Industrial Grade AC/DC Power Supply With PFC

85-264Vrms	12/15/24/28/48V	800W	1000W	93%
Input Voltage	Semi-Regulated Output	Output Continuous	Output Transient	Full Load Efficiency

ACuQor®

Product Features

- High efficiency (93% for 48 VOUT Model at 800W)
- Universal input voltage range
- Semi-regulated output for bus stability
- Integral fan cooling with speed control
- Active PFC; EN61000-3-2 compliant
- Low noise; EN55011 / EN55022 Class B compliant
- Over-current, over-voltage, & over-temp protection
- DC Power Good / AC Power Good signals
- Fan status output / Remote enable input
- Small size: 4.75" x 7" x 1.625" (encased)
- RoHS 6/6 compliant
- 5 V (500 mW) standby output
- Parallel option (24 V, 28 V, 48 V only)

ACuQor 800W Series Electrical Characteristics

All specifications typical with TA = 25 °C, unless otherwise specified. Specifications subject to change without notice.

MAIN OUTPUT SPECIFICATIONS		
Output power (continuous)	85-132/170-264 Vrms	800W
(5 s transient)	85-132/170-264 Vrms	1000W
	132-170 Vrms	See Figure 12
Nominal DC output voltage (at 800W) (Semi-regulated)	12 Vout	12.4 V
	15 Vout	15.6 V
	24 Vout	25 V
	28 Vout	29 V
	48 Vout	50 V
Efficiency (see figs. 1 - 10)	12 Vout, 115 Vrms, 800W	90% typ.
	24 Vout, 115 Vrms, 800W	91% typ.
	48 Vout, 115 Vrms, 800W	92% typ.
	12 Vout, 230 Vrms, 800W	91% typ.
	24 Vout, 230 Vrms, 800W	92% typ.
	48 Vout, 230 Vrms, 800W	93% typ.
Hold-up time (to -20%)	12 / 15 Vout	20 ms @ 800W
	24 / 28 / 48 Vout	24 ms @ 800W
Maximum load capacitance	12 Vout	48,000 µF
	15 Vout	40,500 µF
	24 Vout	24,000 µF
	28 Vout	19,200 µF
	48 Vout	6,000 µF
Output ripple voltage	Switching frequency (20 MHz BW)	0.5% p-p
	Twice line frequency (at 800W)	5.0% p-p
Turn-on delay		2.5 s max.
Transient response	Iout steps from 50-75%	3% typ / 6% max. dev.
	At 0.2 A/µs	100 ms recovery
Overvoltage protection	Cyclic restart	110-120%
Short circuit protection	Cyclic operation	115% rated Iout
Total regulation	Over line, load and temperature	±6.0%
Auxiliary Output	Always on (See Note 1)	5 V @ 100 mA
Thermal protection	Automatic recovery	+125 ºC (PCB Temp)
REMOTE_ENABLE	Input Low Voltage	0.45 V (max)
	Input High Voltage	4.15 V (min)

INPUT SPECIFICATIONS		
AC input voltage	Universal range	85-264 Vrms
Input frequency		47-63 Hz
Input current	115 Vrms @ 800W	8 Arms
	230 Vrms @ 800W	4 Arms
Power factor		>0.98
Input surge current	264 Vrms (cold start)	50 A max.
Internal input fuses	Both AC lines	20 A

GENERAL SPECIFICATIONS		
Fundamental ripple freq.	Input	500 kHz
	Output	250 kHz
Audible noise	Fan speed varies with temp.	45 dBA @ 1 m max.
Weight	(AQ0800xxxxGC)	998 g (35.2 oz)
	(AQ1100xxxxGC)	1179 g (41.6 oz)
	(AQ1400xxxxGC)	1179 g (41.6 oz)
MTBF	MIL-217	533 kHours

ISOLATION SPECIFICATIONS		
Isolation voltage	Input to output	3000 Vrms
	Input to ground	1768 Vrms
	Output to ground	500 Vrms
Insulation resistance	Output to ground	10 MΩ min.
Leakage currents		See Note 2

ENVIRONMENTAL CHARACTERISTICS		
Thermal performance	Operating ambient (see Figure 11)	-40 ºC to +70 ºC
	Non-operating ambient	-40 ºC to +85 ºC
Relative humidity	Non-condensing	5-95% RH
Altitude	Operating	10,000 ft max.
	Non-operating	30,000 ft max.
Random vibration	5-500 Hz	0.03 g2/Hz
Shock	Half-sine, 10 ms, 3 axes	20 g peak

EMC CHARACTERISTICS		
Conducted emissions	EN55011 and EN55022, FCC part15	Level B
Line frequency harmonics	EN61000-3-2	Class A
Voltage fluctuations	EN61000-3-3	Clause 5b
ESD air	EN61000-4-2	Level 3
ESD contact	EN61000-4-2	Level 3
Radiated immunity	EN61000-4-3	Level 3
Fast transients	EN61000-4-4	Level 3
Line surge immunity	EN61000-4-5	Level 3
Conducted immunity	EN61000-4-6	Level 3
Power freq. mag. field	EN61000-4-8	3 A/m
Voltage dip immunity	EN61000-4-11	Perf Criteria A, A, B <5% UT 10 ms, 70% UT 500 ms, 40% UT 100 ms

NOTES:

1. Derate 2 mA per °C above 50 °C ambient temperature.
2. See Leakage Currents Table.

EFFICIENCY, DERATING, AND V_{OUT} DROOP CURVES

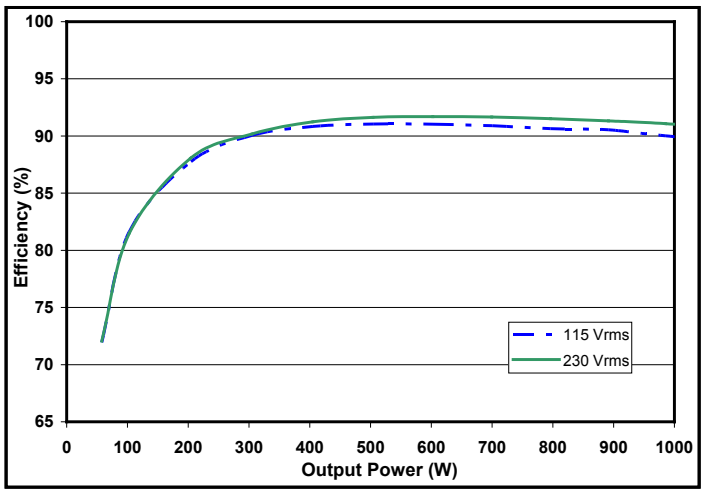


Figure 1: 12 VOUT efficiency curves.

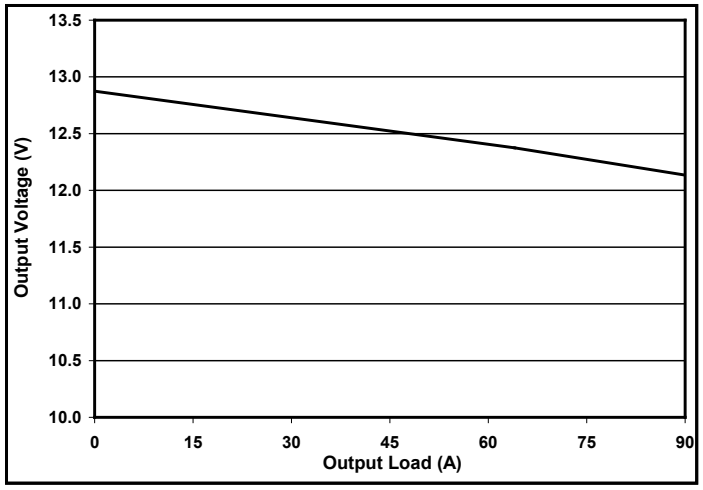


Figure 2: 12 VOUT droop characteristic.

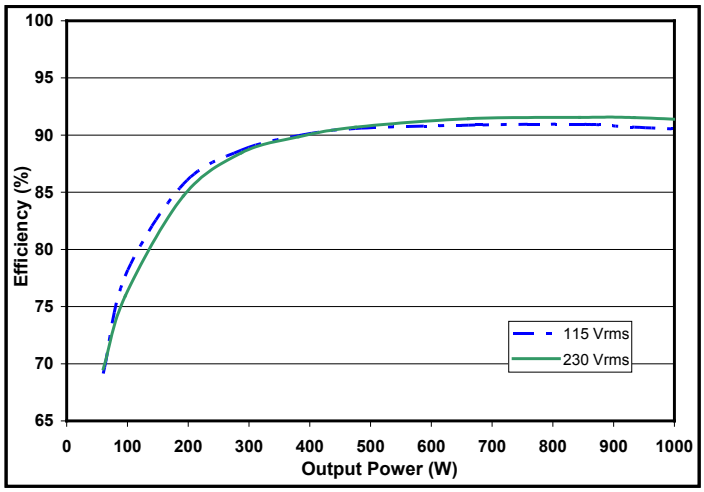


Figure 3: 15 VOUT efficiency curves.

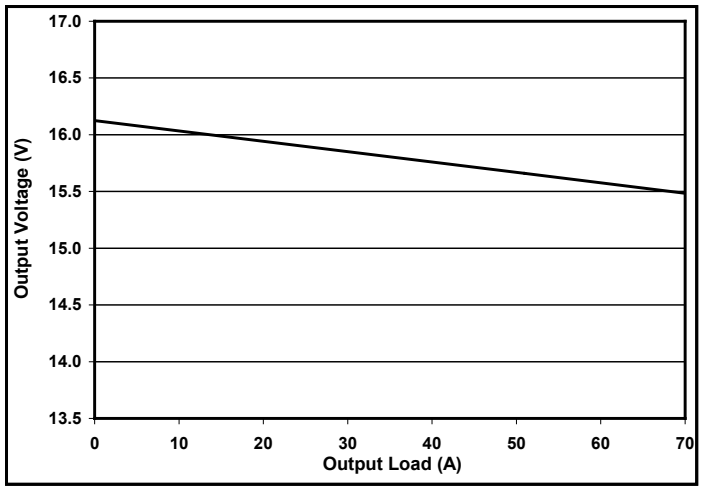


Figure 4: 15 VOUT droop characteristic.

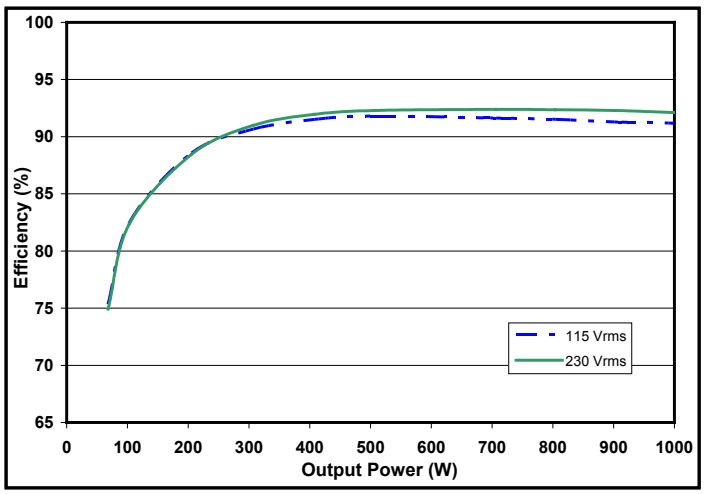


Figure 5: 24 VOUT efficiency curves.

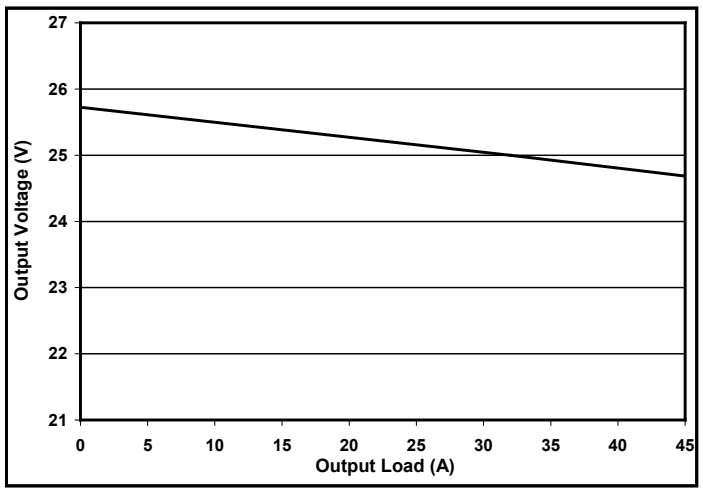


Figure 6: 24 VOUT droop characteristic.

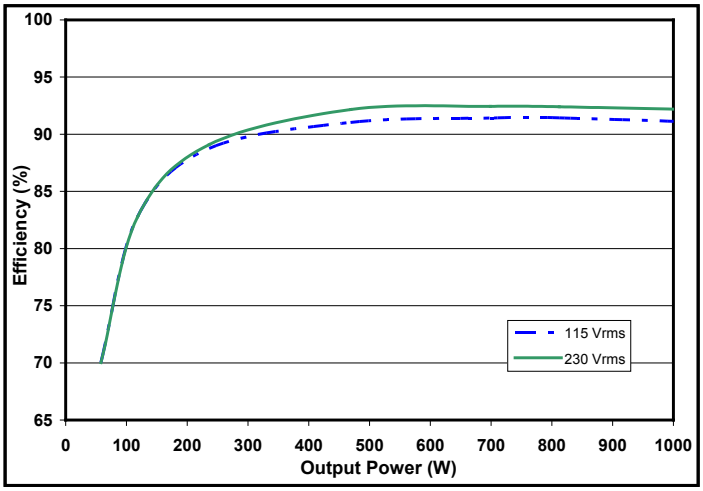


Figure 7: 28 VOUT efficiency curves.

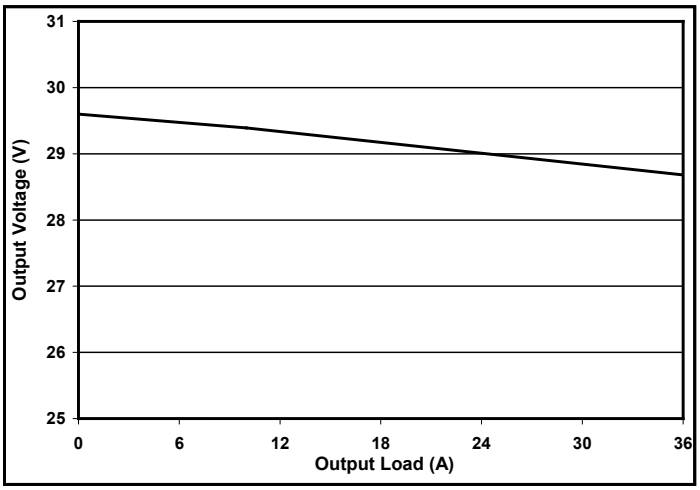


Figure 8: 28 VOUT droop characteristics.

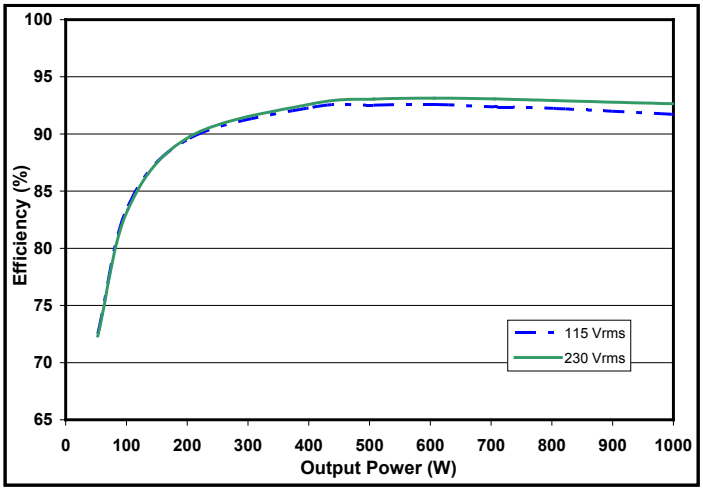


Figure 9: 48 VOUT efficiency curves.

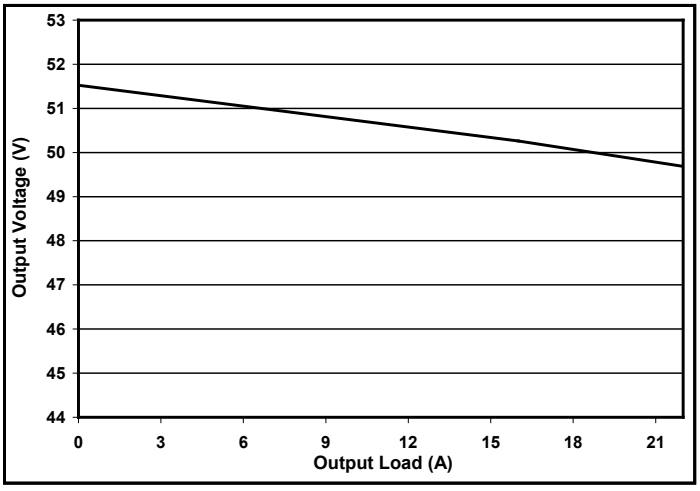


Figure 10: 48 VOUT droop characteristics.

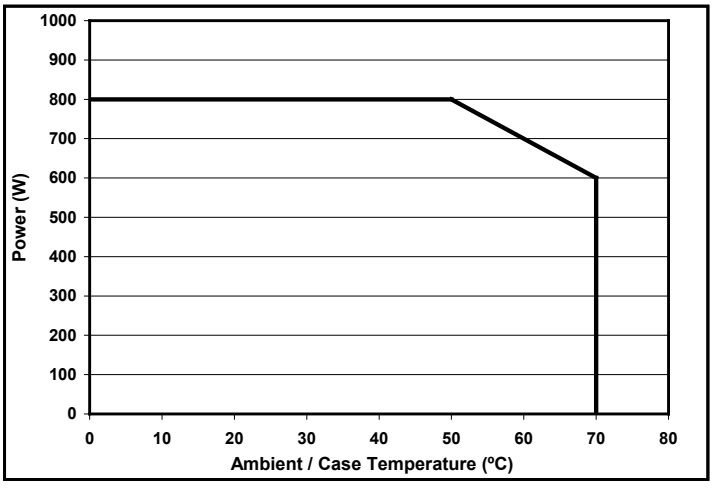


Figure 11: Continuous power derating curve in natural convection.

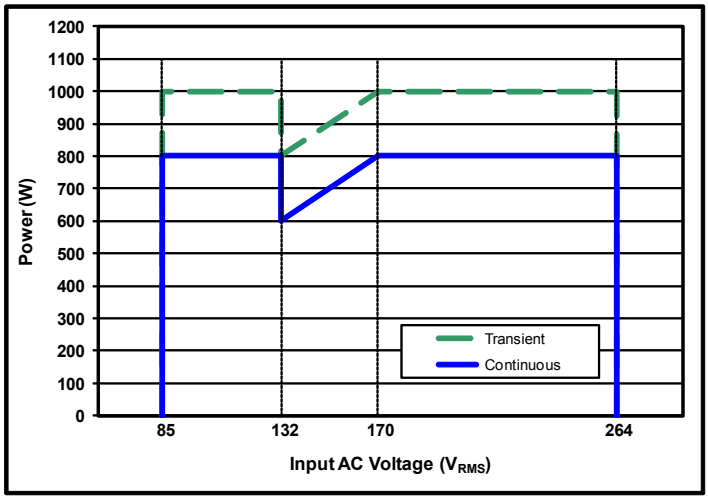
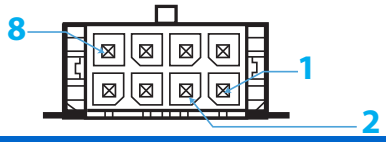
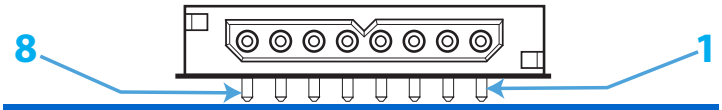


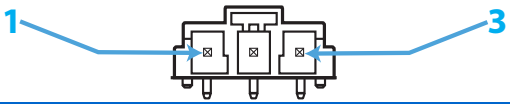
Figure 12: Rated output power vs Input AC Voltage.



OUTPUT DATA CONNECTOR PINOUT		
Pin 1	Reserved	Reserved for future use.
Pin 2	Reserved	Reserved for future use.
Pin 3	VOUT(–)	Negative Output Voltage
Pin 4	REMOTE_ENABLE	Logic input. See Figure B. Pull high to enable main output.
Pin 5	FAN_GOOD	Open collector with internal 5 V pullup. See Figure A. Pulsed low on fan failure, 100 ms, 50% duty.
Pin 6	AC_POWER_GOOD	Open collector with internal 5 V pullup. See Figure A. Pulled low on AC power dropout.
Pin 7	DC_POWER_GOOD	Open collector with internal 5 V pullup. See Figure A. Pulled low during startup ramp and within 5ºC of temperature shutdown threshold.
Pin 8	5V_STANDBY	5 V @ 100 mA available whenever AC power is applied.



OUTPUT POWER CONNECTOR PINOUT		
Pin 1	VOUT(+)	Positive Output Voltage
Pin 2	VOUT(–)	Negative Output Voltage
Pin 3	VOUT(+)	Positive Output Voltage
Pin 4	VOUT(–)	Negative Output Voltage
Pin 5	VOUT(+)	Positive Output Voltage
Pin 6	VOUT(–)	Negative Output Voltage
Pin 7	VOUT(+)	Positive Output Voltage
Pin 8	VOUT(–)	Negative Output Voltage



INPUT CONNECTOR PINOUT	
Pin 1	Ground
Pin 2	AC Neutral
Pin 3	AC Line

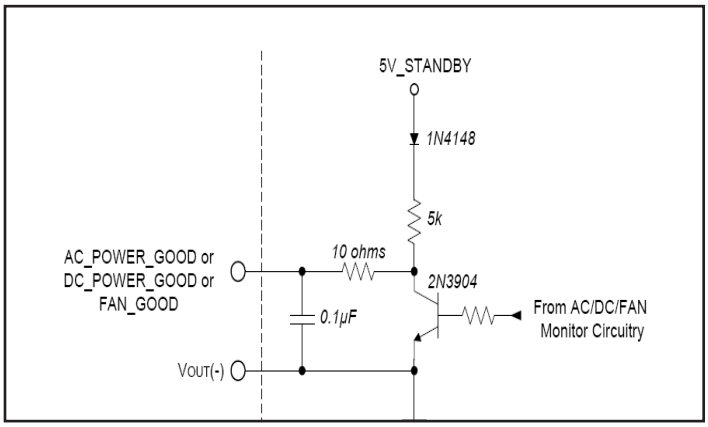


Figure A: Power good and fan good interface circuitry.

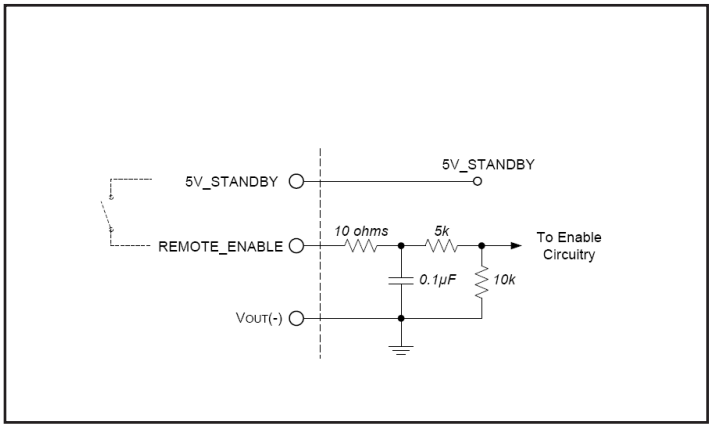


Figure B: Remote enable interface circuitry.

MATING CONNECTORS		
Connector	**Type**	**Contact**
OUTPUT (Power)	Positronic PLA08M7	Positronic MS112N
OUTPUT (Data)	Molex 43025-0800	Molex 43030-0008
INPUT	Hirose DF22B-3S-7.92C	Hirose DF22A-1012SCA

AC Leakage Current from Input to Earth	AC Line Connection	Normal Condition	Open Neutral Fault
ACuQor Typical at 110% nominal input voltage 60 Hz	240 V L-N, 1 phase	400 µA	800 µA
	208 V L-L, 120 V L-N, 1 of 3 phases	200 µA	400 µA
	240 V L-N-L, 120 V L-N, split phase	200 µA	400 µA

Table 1: *Leakage Currents*

Standard Testing Certifications

SAFETY AGENCY CERTIFICATIONS
CAN/CSA-C22.2 No. 62368-1
UL 62368-1
EN 62368-1
CE Marked

PARALLEL OPERATION

General

Up to 3 units may be parallel connected for higher power if the parallel option is specified (see Part Numbering System on last page). All units must be of the same output voltage and power rating. Only 24 V, 28 V , and 48 V output models are supported. With the parallel option, the Vout droop shown in Figures 6, 8, and 10 is precisely controlled and slightly modified (~1%) beyond rated power. As a result, full rated power and current is guaranteed from a bank of multiple units wired in parallel. Parallel option units may still be used stand-alone.

Specifications of Parallel Units

As a rule, units connected in parallel behave the same as single units. Any specification will remain unchanged that is expressed in units of voltage, time, frequency, or efficiency. Specifications expressed in terms of power, current, or capacitance, should be scaled by the number of units wired in parallel.

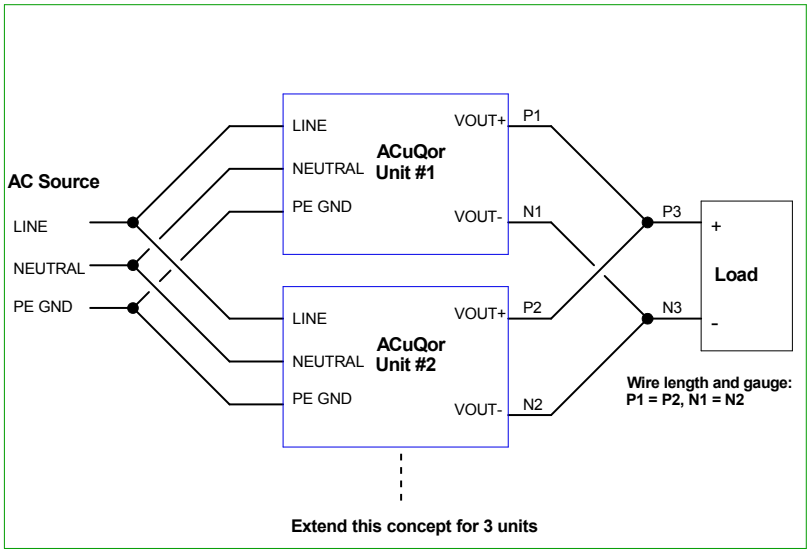


Figure P1: *Parallel Power Connections*

Interconnection of Parallel Units

The AC inputs and DC outputs must be parallel connected as shown in Figure P1. The length and gauge of the wires for each ACuQor output should be matched to within 10% to match electrical resistance and thereby achieve optimum sharing.

Signal connections will vary by application. The simplest case is shown in Figure P2 where the ACuQors are wired to self-enable on power-up and other signals are not in use. Beyond this simple case, there are isolated and non-isolated connection schemes.

Figure P3 shows an example of a non-isolated signal connection strategy. Because the Vout- is used as both the power and signal return, consideration must be given to preventing large load currents from flowing through the signal return. A current magnitude of greater than 5 A can damage the signal connector or cable. This can happen if the Vout- power connection of one unit becomes disconnected while loaded.

Figure P4 shows an example of an isolated signal connection strategy. The opto-isolation prevents load currents from flowing through the signal cable under any condition.

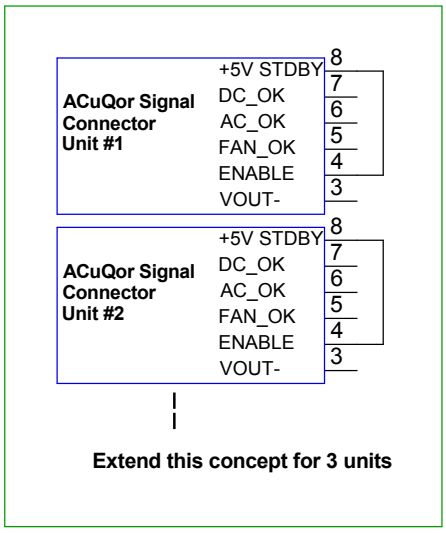


Figure P2: *Simplest Signal Connections*

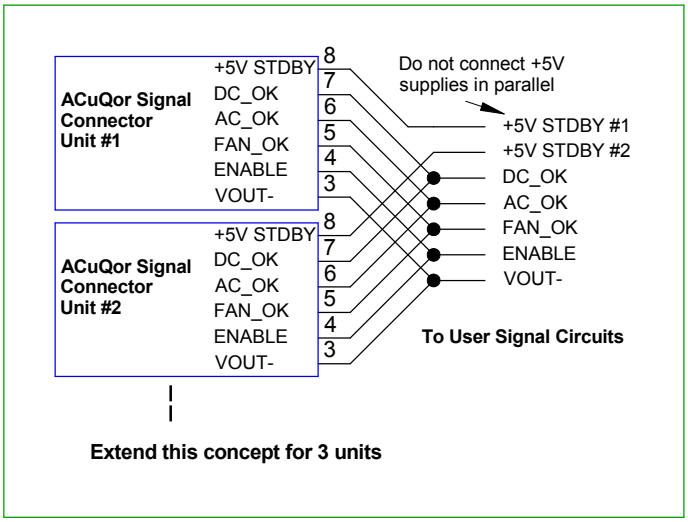


Figure P3: *Non-Isolated Signal Connections*

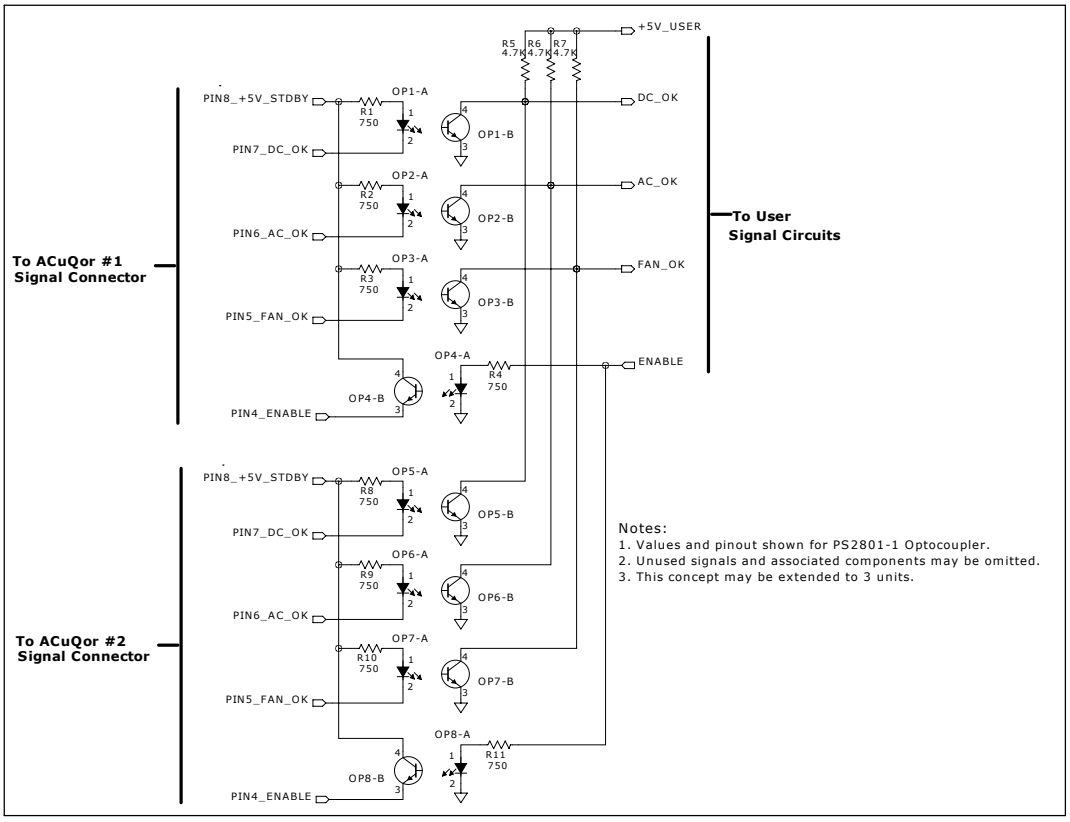
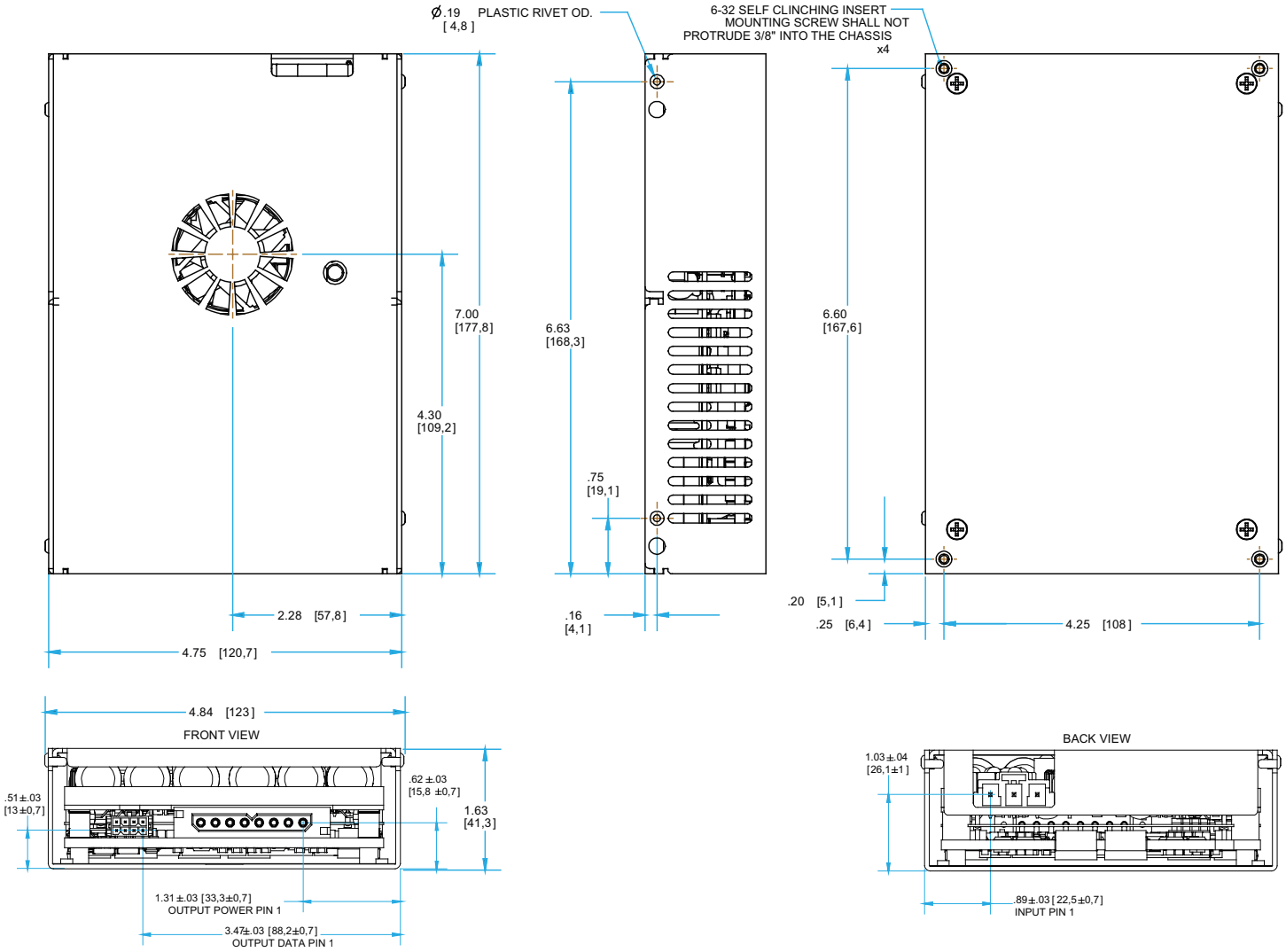


Figure P4: *Isolated Signal Connections*

MECHANICAL DRAWINGS



NOTES

1. Recommended screw tightening torque of 6in.. lbs.
2. Undimensioned components are shown for visual reference only
3. All dimensions in inches [mm]
   Tolerances: x.xx in ± 0.02
   x.xxx in ± 0.010

INSTALLATION INSTRUCTIONS

GENERAL INFORMATION: ACuQor AC/DC power supplies are intended for use as components in medical and industrial equipment. ACuQor units must be properly installed within end use equipment before they can be safely applied as described in this document. The suitability of the ACuQor/equipment combination must be verified through end product investigation.

MOUNTING: Refer to the Mechanical Drawings section. ACuQor units are provided with threaded stainless-steel stand-offs or inserts for mounting. This mounting hardware is internally connected to the input connector protective-earth terminal for functional-earth EMC control. Any orientation (vertical, horizontal, etc.) may be used. Adequate air space should be provided over the fan intake (top) and exhaust (sides) to allow for exchange of cooling air. ACuQor is designed for a pollution degree 2 environment. A minimum of 5 mm electrical clearance should be allowed from the connector ends of encased models.

INPUT: Refer to the Connector Details section for input connector wiring. ACuQor products require a single phase AC power source of 100-240V 50/60Hz nominal. Refer to nameplate label for input current ratings. A protective-earth connection is also required. Minimum wire size of 14 AWG (2.5mm^2) is recommended. Both sides of the AC line are internally fused (see table for specifications). These fuses are not user replaceable.

OUTPUT: Refer to the Connector Details section for the output connector wiring and signal I/O functionality. Refer to nameplate label for output current ratings. Main DC output (Vout+, Vout-) pins should use 12 AWG (4.0mm^2) wire size. Individual main output pins should not be loaded to more than 30 A. For currents greater than 30 A, multiple main output pins/wires must be used in parallel. All signal I/O pins are referenced to Vout-.

EMC: ACuQor products have been tested to the EMC specifications listed in the section of this datasheet titled Electrical Characteristics, on page two. However, end use equipment must be tested to verify EMC compliance.

HIPOT TESTING: ACuQor products are rated for Hipot testing levels of 1768 Vac input to protective-earth, 500 Vac output to protective-earth, and 3000 Vac input to output. When performing the 3000 Vac input to output test, the test voltage must be balanced evenly 1500 Vac input and output to protective-earth. Two oppositely phased test voltage sources or a single test voltage source with external balancing impedances (capacitors) may be used to prevent overstressing input or output to protective-earth insulation per IEC/EN 62368-1.

MODEL	Input Fuses (in Both AC Lines)	Fuses Total
AQ0800	Safety agency recognized 20A 250V fast blow	2
AQ1100	Safety agency recognized 20A 250V fast blow	2
AQ1400	Safety agency recognized 20A 250V fast blow	2

Table 2: *AC line fuses for specific ACuQor Medical Models*

PART NUMBERING SYSTEM

The part numbering system for SynQor's ACuQor AC/DC power supplies follows the format shown in the table below. Not all combinations make valid part numbers, please contact SynQor for availability.

Family	Output Power	Grade	Range	Output Voltage	Package Type	Thermal Design	Options
AQ: ACuQor series of AC-DC semi-regulated output power supplies	**0800:** 800W **1100:** 1100W **1400:** 1400W	**I:** (Industrial)	**U:** Universal (85-264 VRMS)	**12:** 12V **15:** 15V **24:** 24V **28:** 28V **48:** 48V	**G:** 1 unit (5"x7")	**C:** Encased	**IND:** Industrial Grade **INP:** Parallel *

* Parallel output capable with up to 3 units. 12 V and 15 V outputs excluded.

Example: AQ0800IU24GCIND

ACCESSORIES

SynQor offers a series of assemblies that can be ordered according to the table below. Mechanical drawings for these accessories are available for download in pdf format from the SynQor website.

Part Number	Description
AQ-CBL-INPUT1CG	Input mating cable with pre-stripped wire ends (36" long)
AQ-CBL-OUT1CDG	Output mating cables (Signal and Power) with pre-stripped wire ends (18" long)

APPLICATION NOTES

A variety of application notes and technical white papers can be downloaded in pdf format from the SynQor website.
Online Application Notes
Online Library of Technical White Papers
SynQor website.

Contact SynQor for further information and to order:
Phone: 978-849-0600 **Fax:** 978-849-0602
E-mail: power@synqor.com **Web:** www.synqor.com
Address: 155 Swanson Road, Boxborough, MA 01719 USA

Warranty
SynQor offers a two (2) year limited warranty. Complete warranty information is listed on our website or is available upon request from SynQor.

PATENTS

SynQor holds numerous U.S. patents, one or more of which apply to most of its power conversion products. Any that apply to the product(s) listed in this document are identified by markings on the product(s) or on internal components of the product(s) in accordance with U.S. patent laws. SynQor's patents include the following:

7,765,687 7,787,261
8,149,597 8,644,027