

Industrial Grade AC/DC Power Supply With PFC

85-264 Vrms Input Voltage	12/24/36/48 V Semi-Regulated Output	500 W Output Continuous	700 W Output Transient	Up to 90% Full Load Efficiency
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ACuQor®

Product Features

- High efficiency (90% for 48 VOUT Model at 500 W)
- Universal input voltage range
- Semi-regulated output for bus stability
- Parallel operation supported
- Integral fan cooling with speed control
- Active PFC; EN61000-3-2 compliant
- Low noise; EN55011 / EN55022 Class B compliant
- Over-current, over-voltage, and over-temp protection
- DC Power Good / AC Power Good signals
- Remote enable input
- Fan status output / Fan enable input
- Small size: 3.59" x 5.25" x 1.63" (QorCool Encased)
- RoHS 6/6 compliant
- 5 V (250 mW) standby output



Technical Specification

AC Input: 85-264 Vrms
DC Output: 12/24/36/48 V Semi-reg.
Power: 500 W
Grade: Industrial

ACuQor 500W Series Electrical Characteristics

All specifications typical with $T_A = 25\text{ }^\circ\text{C}$, unless otherwise specified.

MAIN OUTPUT SPECIFICATIONS			GENERAL SPECIFICATIONS			
Output power (continuous) (5 s transient)	85-132/170-264 Vrms	500 W	Fundamental ripple freq.	Input	500 kHz	
	85-132/170-264 Vrms	700 W		Output	250 kHz	
	132-170 Vrms	See Figures 11, 12		Audible noise	Fan speed varies with temp.	39 dBA @ 1 m max.
Nominal DC output voltage (at 250W) (Semi-regulated)	12 Vout	12.4 V	Weight (EC)	540 g (19.1 oz)		
	24 Vout	25 V		MTBF	MIL-217	343.6 kWhours
	36 Vout	37.5 V		ISOLATION SPECIFICATIONS		
	48 Vout	50 V		Isolation voltage	Input to output	3000 Vrms
Efficiency (see figs. 1, 3, 5, 7)	12 Vout, 115 Vrms, 500 W	86% typ.		Input to ground	1768 Vrms	
	48 Vout, 115 Vrms, 500 W	89% typ.		Output to ground	500 Vrms	
	12 Vout, 230 Vrms, 500 W	88% typ.	Insulation resistance	Output to ground		10 MΩ min.
	48 Vout, 230 Vrms, 500 W	90% typ.		Leakage currents		See Note 2
Hold-up time (to -20%)	12 Vout	12 ms @ 500 W		ENVIRONMENTAL CHARACTERISTICS		
	24 / 36 / 48 Vout	16 ms @ 500 W		Thermal performance	Operating ambient (see Figure 9)	-40°C to +70 °C
Maximum load capacitance	12 Vout	16,000 μF		Non-operating ambient	-40 °C to +85 °C	
	24 Vout	8,000 μF	Relative humidity	Non-condensing	5-95% RH	
	36 Vout	4,000 μF	Altitude	Operating	10,000 ft max.	
	48 Vout	2,000 μF		Non-operating	30,000 ft max.	
Output ripple voltage	Switching frequency (20 MHz BW)	0.5% p-p	Random vibration	5-500 Hz	0.03 g2/Hz	
	Twice line frequency (at 300 W)	5.0% p-p	Shock	Half-sine, 10 ms, 3 axes	20 g peak	
Turn-on delay		2 s max.	EMC CHARACTERISTICS			
Transient response	Iout steps from 50-75%	3% typ / 6% max. dev.	Conducted emissions	EN55011 and EN55022, FCC part15	Level B	
	At 0.2 A/μs	100 ms recovery	Line frequency harmonics	EN61000-3-2	Class A	
Overvoltage protection	Cyclic restart	110-120%	Voltage fluctuations	EN61000-3-3	Clause 5b	
Short circuit protection	Cyclic operation	115% rated Iout	ESD air	EN61000-4-2	Level 3	
Total regulation	Over line, load and temperature	±6.0%	ESD contact	EN61000-4-2	Level 3	
Auxillary Output	Always on (See Note 1)	5 V @ 50 mA	Radiated immunity	EN61000-4-3	Level 3	
Thermal protection	Automatic recovery	+125 °C (PCB Temp)	Fast transients	EN61000-4-4	Level 3	
REMOTE_ENABLE	Input Low Voltage	0.45 V (max)	Line surge immunity	EN61000-4-5	Level 3	
	Input High Voltage	4.15 V (min)	Conducted immunity	EN61000-4-6	Level 3	
INPUT SPECIFICATIONS			Power freq. mag. field	EN61000-4-8	3 A/m	
AC input voltage	Universal range	85-264 Vrms	Voltage dip immunity	EN61000-4-11	Perf Criteria A, A, B <5% UT 10 ms, 70% UT 500 ms, 40% UT 100 ms	
Input frequency		47-63 Hz				
Input current	115 Vrms @ 500 W	5 Arms				
	230 Vrms @ 500 W	2.5 Arms				
Power factor		>0.98				
Input surge current	264 Vrms (cold start)	40 A max.				
Internal input fuses	Both AC lines	10.0 A				

NOTES:

- Derate 1 mA per °C above 50 °C ambient temperature.
- Leakage currents see page 5.

EFFICIENCY, DERATING, AND VOUT DROOP CURVES

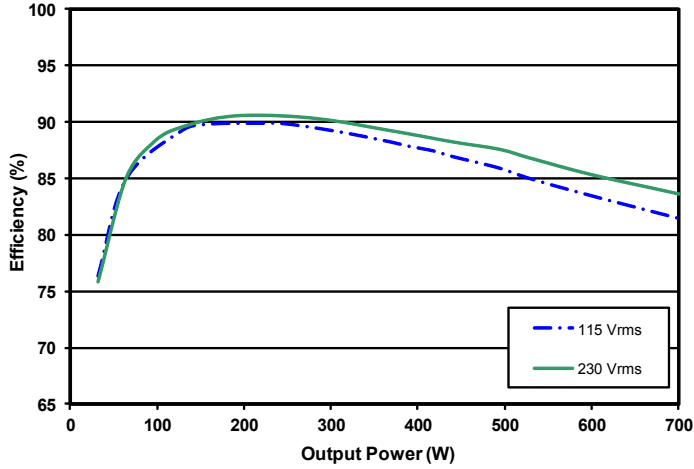


Figure 1: 12 V_{OUT} efficiency curves.

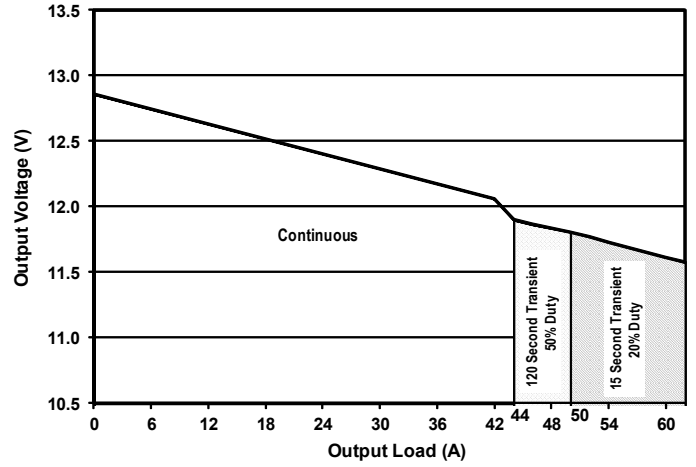


Figure 2: 12 V_{OUT} droop characteristic.

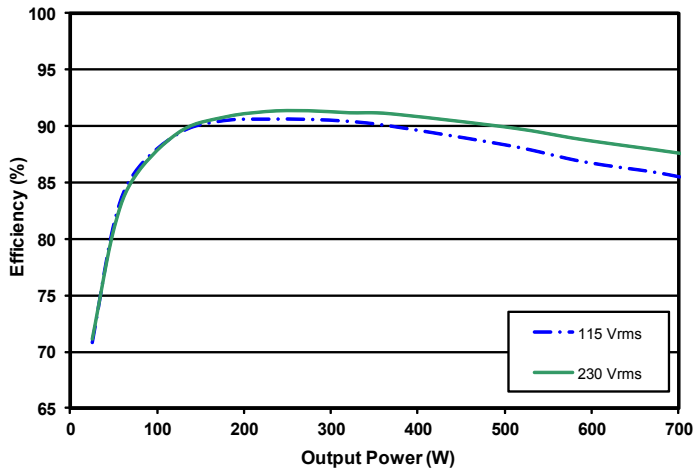


Figure 3: 24 V_{OUT} efficiency curves.

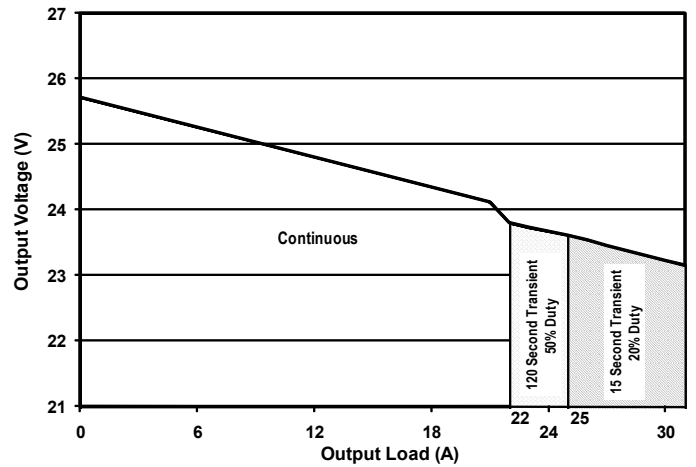


Figure 4: 24 V_{OUT} droop characteristic.

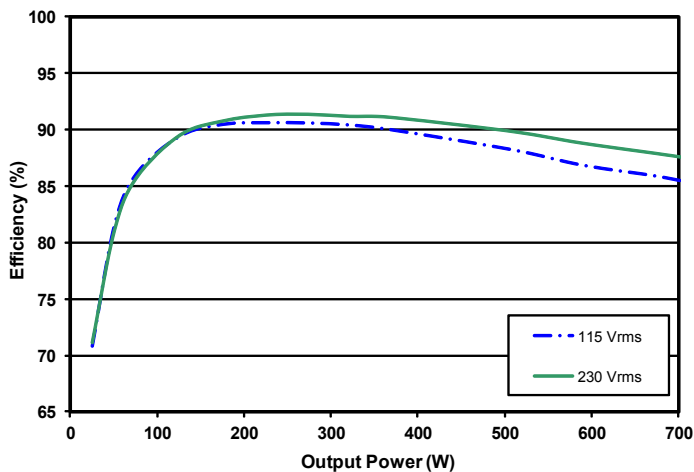


Figure 5: 36 V_{OUT} efficiency curves.

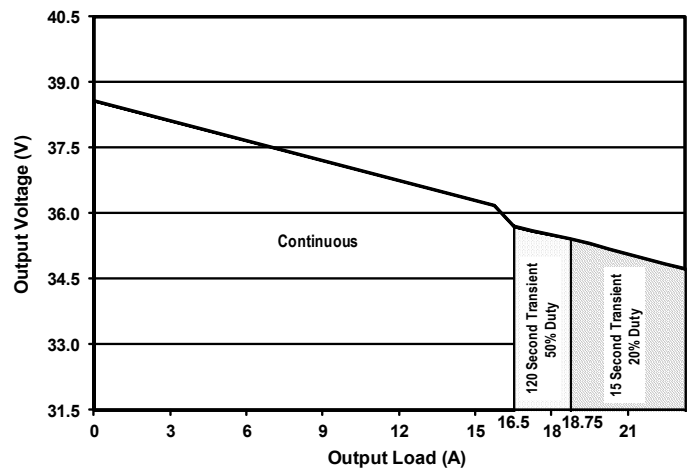


Figure 6: 36 V_{OUT} droop characteristic.

EFFICIENCY, DERATING, AND VOUT DROOP CURVES

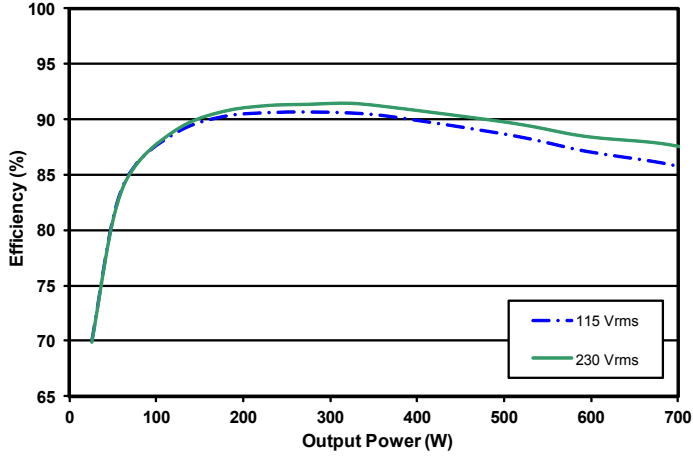


Figure 7: 48 V_{OUT} efficiency curves.

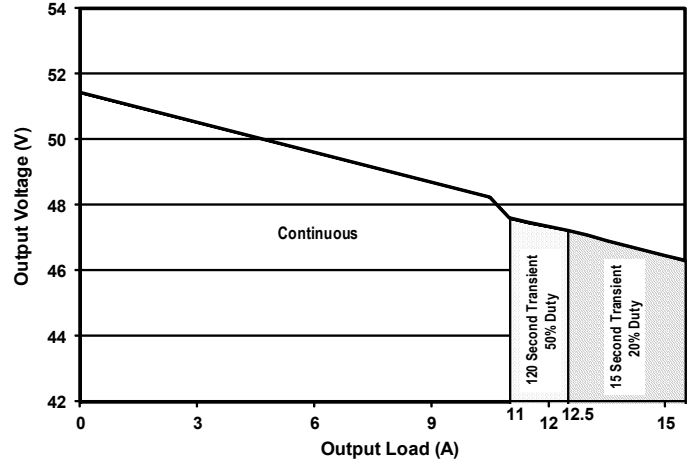


Figure 8: 48 V_{OUT} droop characteristic.

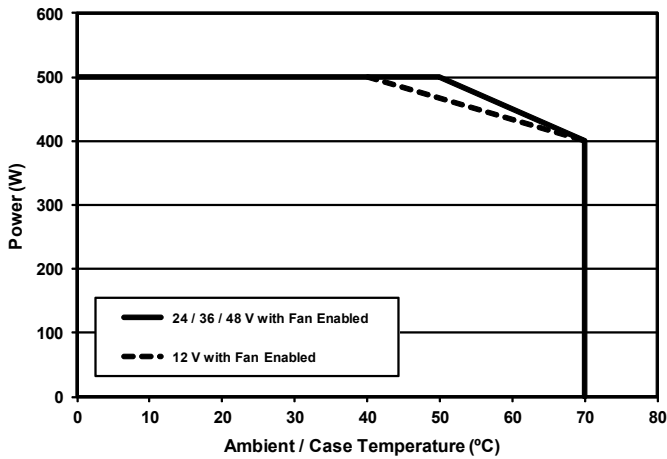


Figure 9: Continuous power derating curve in natural convection.
 For Fan Disabled, see Figure 10

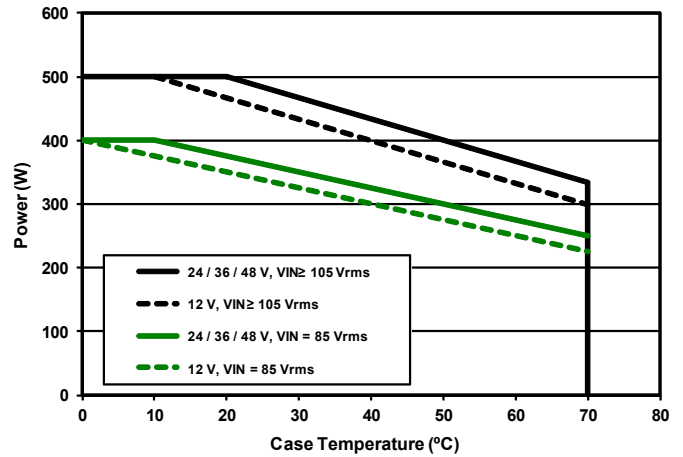


Figure 10: Fan Disabled continuous power derating curve in natural convection

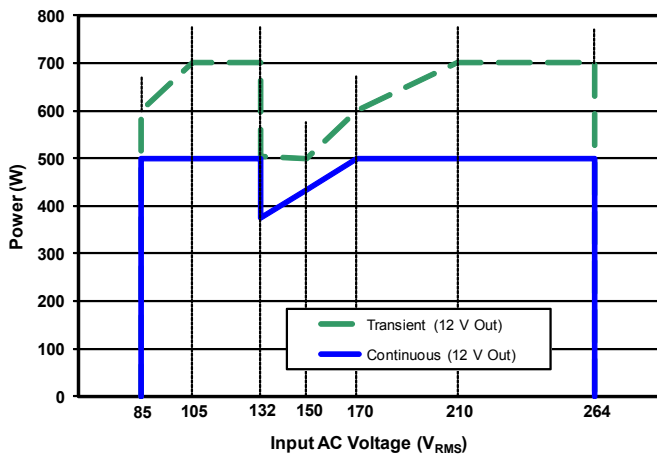


Figure 11: Rated output power vs Input AC Voltage.

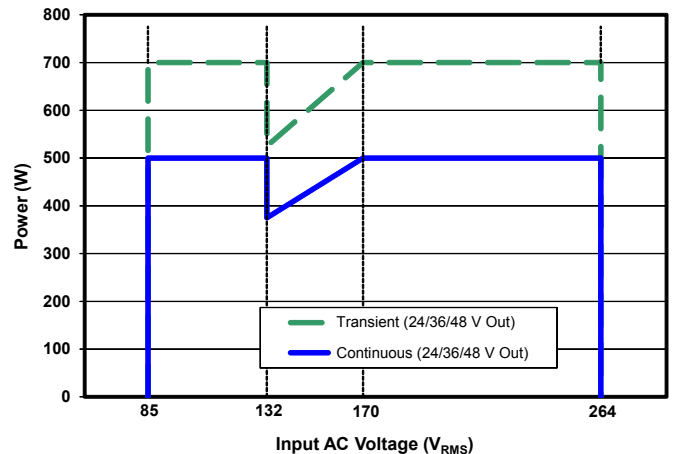


Figure 12: Rated output power vs Input AC Voltage.



Technical Specification

AC Input: 85-264 Vrms
DC Output: 12/24/36/48 V Semi-reg.
Power: 500 W
Grade: Industrial

Leakage Currents

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 μ A	800 μ A
	208 V L-L, 120 V L-N, 1 of 3 phases	200 μ A	400 μ A
	240 V L-N-L, 120 V L-N, split phase	200 μ A	400 μ A

Standard Testing Certifications

SAFETY AGENCY CERTIFICATIONS

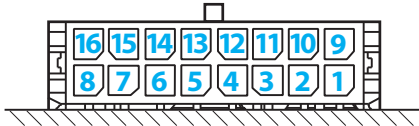
CAN/CSA-C22.2 No. 62368-1

UL 62368-1

EN 62368-1

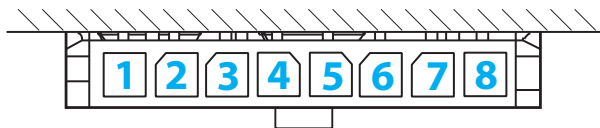
CE Marked

CONNECTOR DETAILS



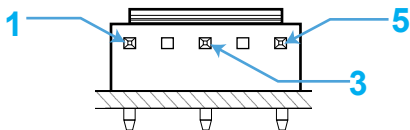
OUTPUT CONNECTOR PINOUT (top side)

Pin 1	FAN_GOOD	Open collector with internal 5V pullup. See Figure A. Pulsed low on fan failure, 100ms, 50% duty. Short to VOUT(-) to disable fan.
Pin 2	AC_POWER_GOOD	Open collector with internal 5V pullup. See Figure B. Pulled low on AC power dropout.
Pin 3	DC_POWER_GOOD	Open collector with internal 5V pullup. See Figure B. Pulled low during startup ramp and within 5 °C of temperature shutdown threshold.
Pin 4	5V_STANDBY	5 V @ 50 mA available whenever AC power is applied.
Pin 5	VOUT(+)	Positive Output Voltage.
Pin 6	VOUT(+)	Positive Output Voltage.
Pin 7	VOUT(+)	Positive Output Voltage.
Pin 8	VOUT(+)	Positive Output Voltage.
Pin 9	Reserved	Reserved for future use.
Pin 10	Reserved	Reserved for future use.
Pin 11	REMOTE_ENABLE	Logic input. See Figure C. Pull high to enable main output.
Pin 12	VOUT(-)	Negative Output Voltage.
Pin 13	VOUT(-)	Negative Output Voltage.
Pin 14	VOUT(-)	Negative Output Voltage.
Pin 15	VOUT(-)	Negative Output Voltage.
Pin 16	VOUT(-)	Negative Output Voltage.



12 V OUTPUT CONNECTOR PINOUT (bottom side)

Pin 1	VOUT(+)	Positive Output Voltage.
Pin 2	VOUT(+)	Positive Output Voltage.
Pin 3	VOUT(+)	Positive Output Voltage.
Pin 4	VOUT(+)	Positive Output Voltage.
Pin 5	VOUT(-)	Negative Output Voltage.
Pin 6	VOUT(-)	Negative Output Voltage.
Pin 7	VOUT(-)	Negative Output Voltage.
Pin 8	VOUT(-)	Negative Output Voltage.



INDIVIDUAL INPUT CONNECTOR PINOUT

Pin 1	Ground
Pin 3	AC Neutral
Pin 5	AC Line

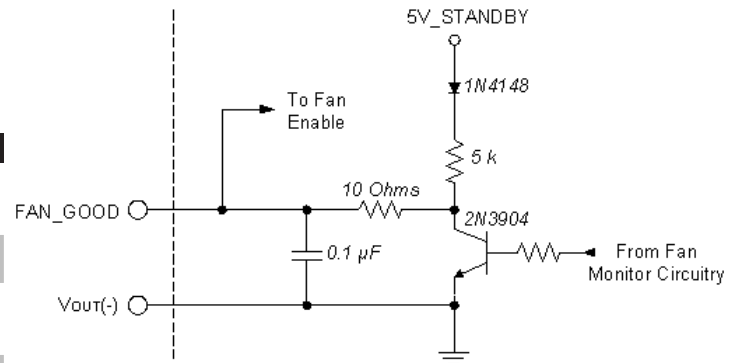


Figure A: Fan status output / Fan enable input interface circuitry.

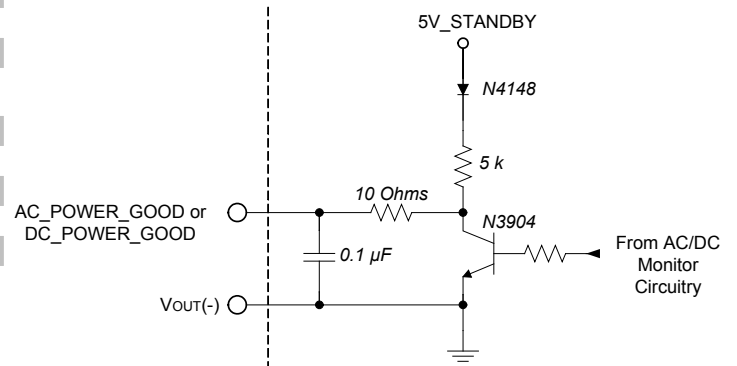


Figure B: Power good interface circuitry.

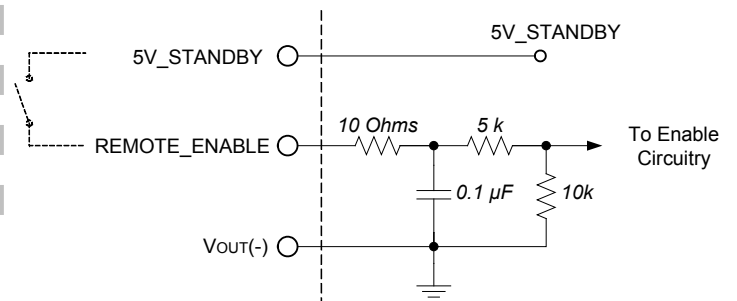


Figure C: Remote enable interface circuitry.

MATING CONNECTORS

Connector	Type	Contact
OUTPUT (16 pins)	Molex 430251600	Molex 430300008*
12V_OUTPUT (8 pins)	Molex 436450800	Molex 430300008*
INPUT	JST VHR-5N	JST SVH-41T-P1.1

* Each contact rated for a maximum of 5.5 A.

MECHANICAL DRAWINGS

(1 Module Encased Version - E Package Type)

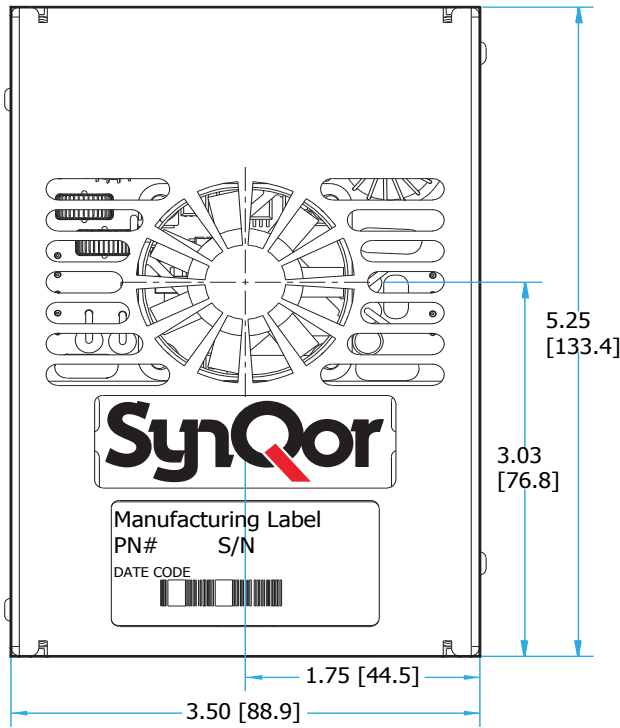
NOTES

(applies to all mechanicals)

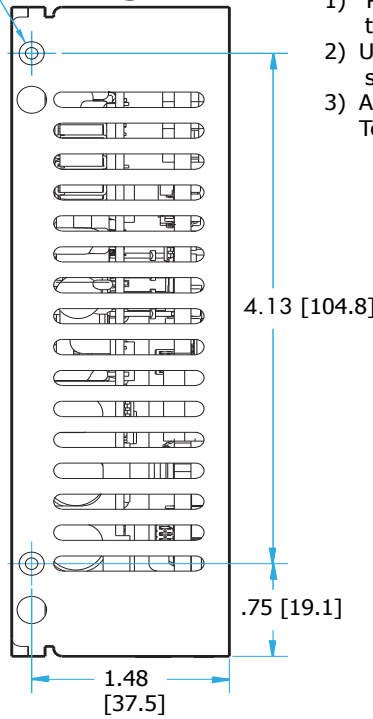
- 1) Recommended screw tightening torque of 6 in lbs
- 2) Undimensioned components are shown for visual reference only
- 3) All dimensions in inches (mm)
Tolerances: x.xx in ± 0.02
 x.xxx in ± 0.010

TOP

Ø.19 [4.8] PLASTIC RIVET OD.

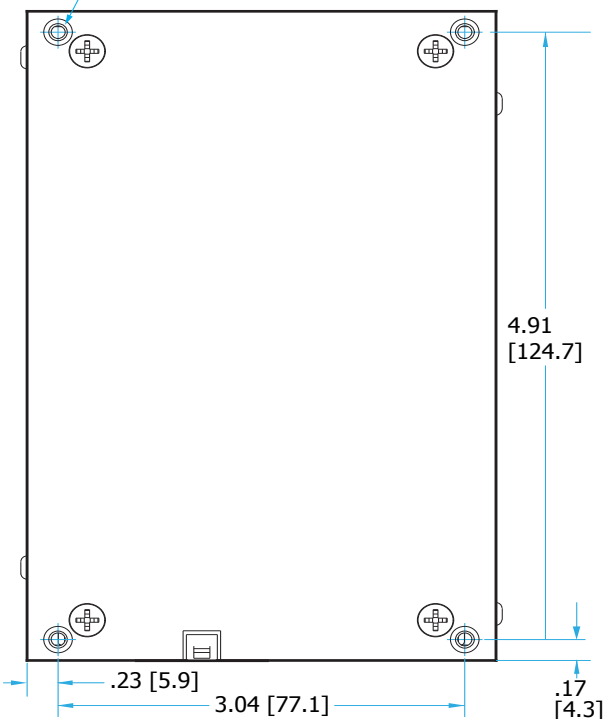


Right

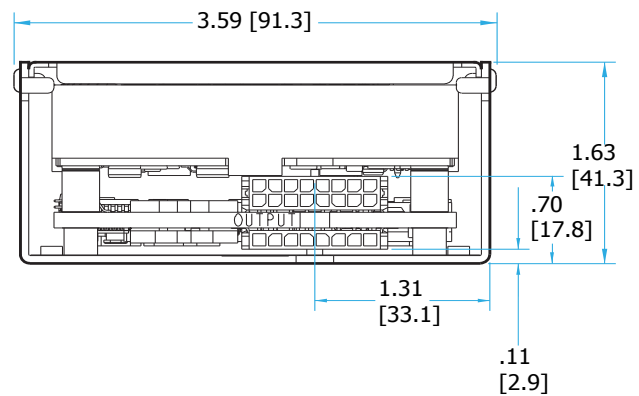


Bottom

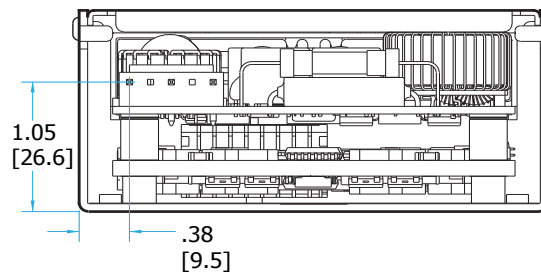
6 - 32 Self - Clinching Insert
 Mounting Screw shall not Protude
 3/8" into the chassis (4 pieces)



Front



Back



PARALLEL OPERATION - MULTIPLE UNITS

The following table summarizes the recommended wiring to operate multiple units in parallel.

As a rule, units wired 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.

ACuQor units are individually calibrated at the factory, so that the output voltage vs. output current characteristic is always consistent (see Vout droop characteristic figures). As such, multiple units will share output current accurately. Full current is guaranteed from a bank of multiple units wired in parallel.

Output Connector Signal	Suggested Connection	Behavior with Multiple Units
REMOTE_ENABLE	Wire in parallel	Inputs activated simultaneously
FAN_GOOD	"	Wired-OR outputs – can be pulled low by any unit during an abnormal condition.
AC_POWER_GOOD	"	"
DC_POWER_GOOD	"	"
VOUT(+), VOUT(-)	"	Built-in droop characteristic ensures graceful current sharing.
12V_STANDBY*	"	"
5V_STANDBY	Do not wire in parallel	Fully regulated characteristic does not support current sharing. If placed in parallel, only the output with the highest set-point will drive current.

*Note: Triple output models only.

INSTALLATION INSTRUCTIONS

General: ACuQor AC/DC power supplies are intended for use as components in 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. The suitability of the enclosed ACuQor mechanical assemblies must be verified through end product investigation.

Encased models: 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 18 AWG (0.8mm²) is recommended. Both sides of the AC line are internally fused (see table for specific models). 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 20 AWG (0.5mm²) wire size. Individual main output pins should not be loaded to more than 5.5 A. For currents greater than 5.5 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 Electrical Characteristics section. 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.

Conductive Cooling: This product requires supplemental conductive cooling through its case to maintain the rated output power. The case should be mounted to a system chassis or heat sink with a thermally conductive interface material and kept at 50°C maximum to maintain full power rating of the product. For detailed applications assistance, consult Applications Engineering through the sales channel.

MODEL	Input Fuses (in Both AC Lines)
AQ0300	Littelfuse 6.3A 250V 21606.3XEP
AQ0400	Littelfuse 6.3A 250V 21606.3XEP
AQ0500	Littelfuse 10.0A 250V 216010XEP



Ordering Information

AC Input: 85-264 Vrms
DC Output: 12/24/36/48 V Semi-reg.
Power: 500 W
Grade: Industrial

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	0300: 300 W 0400: 400 W 0500: 500 W	I: (Industrial)	U: Universal (85-264 VRMS)	12: 12 V 1T: 12 V / 5 & 12 V STBY 24: 24 V 2T: 24 V / 5 & 12 V STBY 36: 36 V 3T: 36 V / 5 & 12 V STBY 48: 48 V 4T: 48 V / 5 & 12 V STBY	E: 1 unit (3"x5")	A: Open frame C: Encased	Industrial Grade: IND: Industrial

Example: AQ1000IU12RCIND

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-INPUT1C	Input mating cable with pre-stripped wire ends (36" long).
AQ-CBL-OUT1C	Output mating cables with pre-stripped wire ends (18" long).
AQ-CBL-OUT1CD	Same as AQ-CBL -OUT1C with an additional 8-pins connector.
AQ-CBL-OUT2C	Output mating cable with connectors on both ends (18" long).
AQ-CBL-OUT2CD	Same as the AQ-CBL-OUT2C with an additional 8-pins connector.
AQ-INSUL1M	Single module bottom-side Mylar insulator for open frame mounting
AQ-EVAL-PRL3	Evaluation board for up to three paralleled modules.

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 Toll Free: 888-567-9596 Fax: 978-849-0602

E-mail: power@synqor.com Web: www.synqor.com

Address: 155 Swanson Road, Boxborough, MA 01719 USA

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:

7,050,309 7,765,687 7,787,261
 8,149,597 8,644,027

WARRANTY

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