COMPACT, EFFICIENT 400 W AC-DC POWER SUPPLY 277/347/480VAC INPUT DDP400HV SERIES

DESCRIPTION

DDP400HV is a series of high efficiency, small form factor AC-DC power supplies operating at 277/347/480VAC inputs.

The series provides a steady 400 W of regulated DC power through the full input range of 249V_{AC} to 528 V_{AC}. Available in 24V, 36V and 48V models. Each model includes auxiliary 12Vdc and 5Vdc stand-by outputs. Control signals include AC_OK and remote on/off.

The DDP400HV series comes in an IP67 sealed enclosure with flying leads for both input and output. An optional heat sink is available or the DDP400HV may be installed directly to the end equipment with heat transferred by conduction.

By converting energy at 93% typical efficiency, the DDP400HV series generates less heat facilitating better thermal management in space constrained systems and offering higher reliability.

The product provides full output power rating from -35 to 50 °C, with operation up to 70 °C with de-rating and is capable of start up from –40 °C.

KEY FEATURES

- Wide input voltage range (249-528VAC)
- 400 W rated power (420 W peak)
- Extremely high efficiency (93% typical)
- Low stand-by consumption (<2.8 W at 480Vac)
- 36V and 48V standard output voltage variants
- Active PFC, EN61000-3-2 compliant (Class C, >100 W load)
- Low earth leakage current
- Over temperature protection
- OV, OC, and short circuit protections
- Stand-by +5V Output
- Auxiliary fan +12V output
- Remote On/Off and power good signals
- RoHS-6 compliant (EU directive 2002/95/EC)
- 4000 m altitude operation.

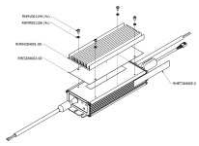
MARKET SEGMENT AND APPLICATIONS

- Large Format Display Power
- Large Venues and Stadium Lighting
- High Powered Street Lighting
- Large Area Parking
- High Bay Industrial Space
- Architectural Lighting
- Outdoor Lighting
- Horticultural Lighting

MODEL CODING AND OUTPUT RATINGS

Model Grade and Output Power	Output Nominal Voltage	Package/Fan Options
DDP400HV-	*24 V_{DC}:* **US24-**	*Sealed Conduction/Convection Cooling:* **SC**

DP400HV	**-**	**US 24**	**-**	**SC**	Heat sink can be ordered as an accessory using the code: **RHPS384PH-3** Mounting kit includes 4X screws M4x8, 4X split washer and a thermally conductive graphite sheet



Model Number	V1 (V)	I1[1] W/O HS (A)	I1[2] W/HS (A)	V1[3] Ripple (mV)	V2 (V)	I2[1] W/O HS (A)	I2[2] W/HS (A)	V2[3] Ripple (mV)	$5V_{SB}$ (V)	$I5V_{SB}$[1] W/O HS (A)	$I5V_{SB}$[2] W/HS (A)	$5V_{SB}$[3] Ripple (mV)
DDP400HV-US24-SC	24	13.33	16.7	240	12	1	1	240	5	2	2	50

[1] The combined output power of V1, V2 and $5V_{SB}$ without the heat sink, must not exceed 400W at 25°C, 320W at 50 °C, and 215W at 70 °C ambient temperature (480 V_{AC}). See de-rating curves below.

[2] The combined output power of V1, V2 and $5V_{SB}$ with the optional heat sink must not exceed 400W up to 50°C and 275W at 70°C ambient temperature (480 V_{AC}). See de-rating curves below.

[3] Peak-to-Peak measured at 20 MHz Bandwidth.

[4] In any case, the chassis hot spot temperature T_c should never exceed 90 °C.

All above data refer to 480 V_{AC} and 50°C ambient temperature.

INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
AC Input Voltage	PS starts and operates at 249 V_{AC} at all load conditions	249	277/347/480	528	V_{AC}
DC Input Voltage		300	365	400	V_{DC}
Input Frequency		47	50/60	63	Hz
Input Current	RMS at 249 V_{AC}, maximum load	-	-	1.8	A
Inrush Current	Peak at 480 V_{AC}, cold start, no damage	-	-	60	A
Fusing	2X Time Lag, 500 Vac/400Vdc on ACL1 and ACL2	-	-	5.0	A
Efficiency	480 V_{AC} at 20% load 480 V_{AC} at 50% load 480 V_{AC} at 100% load 277 V_{AC} at 20% load 277 V_{AC} at 50% load 277 V_{AC} at 100% load	- - - - - -	89.0 92.6 93.5 89.6 92.5 92.6	- - - - - -	%
Input Power Consumption	Power on, 480 V_{AC}, no load Stand by, 480 V_{AC}, no load	- -	3.9 2.8	4.5 3.3	W
Power Factor	From 50% to 100% rated load, 277/347/480 V_{AC}, 50 Hz and 60 Hz	0.90	-	-	-
THD	From 50% to 100% rated load, 277/347/480 V_{AC}, 50 Hz and 60 Hz	-	-	20	%
Harmonic Current Fluctuations and Flicker	Complies with EN-61000-3-2 Class C 277/347/480 V_{AC}, 50 Hz and 60 Hz, load >100 W Complies with EN-61000-3-3 at 277/347/480 V_{AC}, 50 Hz and 60 Hz, full load				
Leakage Current	Normal operation, 480 V_{AC}, 60 Hz Neutral connected to Earth	-	-	750	µA

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OUTPUT SPECIFICATIONS

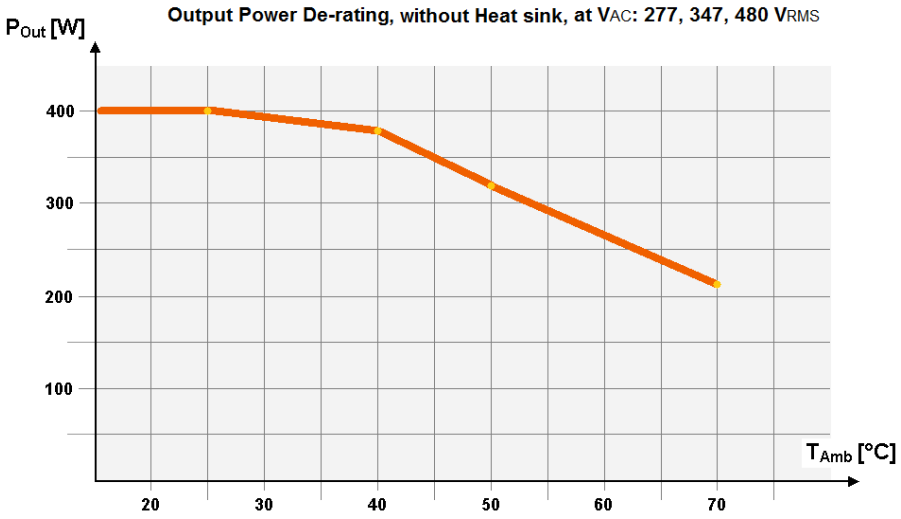
Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
V1 Output Voltage	24V (0.5% set point accuracy)	-	24	-	V
V1 Output Power Rating	All models	-	-	400	W
V2 Output Voltage	All versions. Load on V2: from 5 to 1000 mA Load on V1: from 0.1 to I1 rated	11.25	12.5	13.75	V
V2 Output Current	All models	-	-	1	A
$5V_{SB}$ Output Voltage	All models (3% set point accuracy)	-	5	-	V
$5V_{SB}$ Output Current	All models	-	-	2	A
V1 Load-Line-Cross Regulation	V_{AC}: 249 – 528 V_{AC} V1 Load: 0 – 16.7 A (24V) V2 Load: 0 – 1 A $5V_{SB}$ Load: 0 – 2 A	-	-	±2	%V1
$5V_{SB}$ Load-Line-Cross regulation	V_{AC}: 249 – 528 V_{AC} V1 Load: 0 – 16.7 A (24V) V2 Load: 0 – 1 A $5V_{SB}$ Load: 0 – 2 A	-	-	±5	%$5V_{SB}$
V1 Line Regulation	V_{AC}: 249 – 528 V_{AC}	-	-	±0.1	%V1
Transient Response (Voltage Deviation) V1, $5V_{SB}$	25% load changes at 1 A/µs 24 V at 1000 µF Load / I_{OUT}> 0.5 A $5V_{SB}$ at 560 µF Load / I_{OUT}> 0.1 A	-	-	±5	%V1 %$5V_{SB}$
V1 Ripple & Noise	All models, Peak-to-peak, 20 MHz BW 100 nF ceramic and 10 µF tantalum caps at the load	-	-	1	%V1
Start-up Rise Time	249< V_{AC} <528, any load conditions for V1, V2, $5V_{SB}$	2	-	40	ms
Start-up Delay	V1 in regulation after PS_ON is asserted V1 in regulation after AC is applied $5V_{SB}$ in regulation after AC is applied	-	-	0.2 1.7 1.5	s
Turn-on Overshoot	At 500 mA output current, V1 in regulation within 50 ms	-	10 10 10	-	%V1 %V2 %V_{SB}
Hold-up Time	277/347/480 V_{AC}, full load 277/347/480 V_{AC}, 365 W load 277/347/480 V_{AC}, 200 W load	- - -	16 20 35	- - -	ms
Minimum Load *	All models; V1, V2 and $5V_{SB}$	0	-	-	A
Maximum Load Capacitance	277/347/480 V_{AC}, 25 °C ambient 24 V	-	-	16000	µF
Temperature Drift		-1.2	-	+1.2	mV/°C

* When the load on the main output is less than 100 mA, V2 output voltage might regulate below its minimum value. Contact ROAL Electronics for details.

Package	Model Number	Output Power De-rating Curves

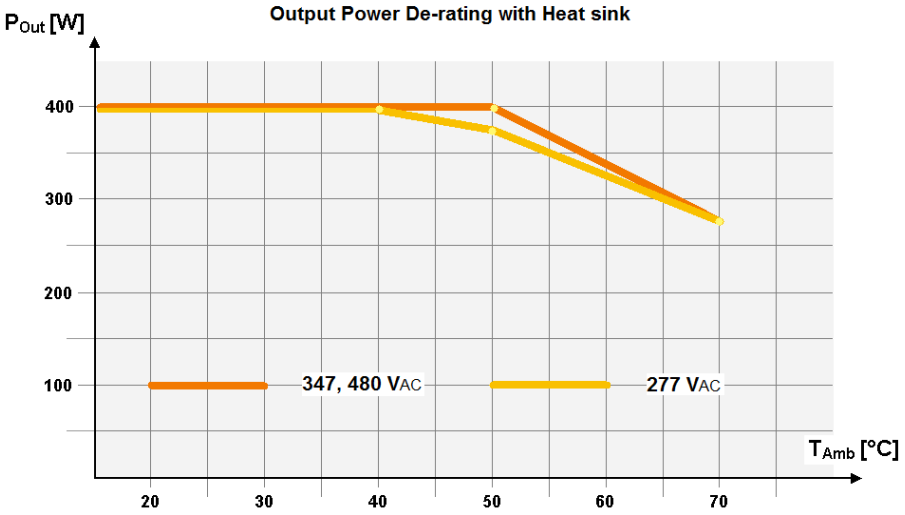
Sealed Box
without Heat Sink

DDP400HV-US24–SC



Sealed Box
with Heat Sink

DDP400HV-US24-SC



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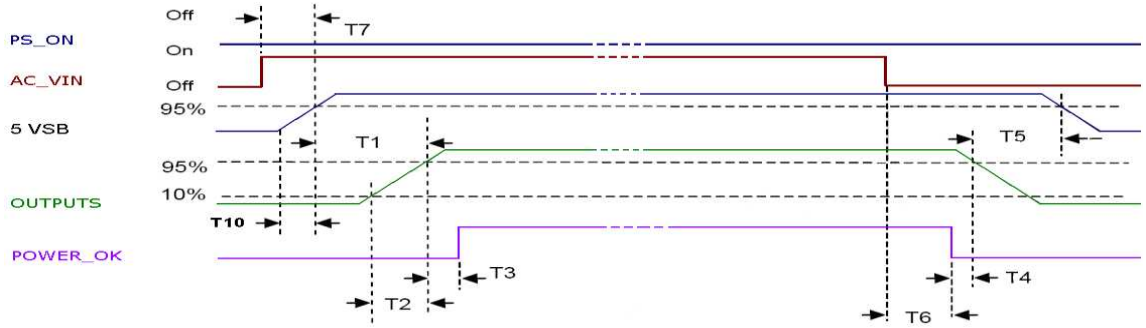
SIGNALS/CONTROLS

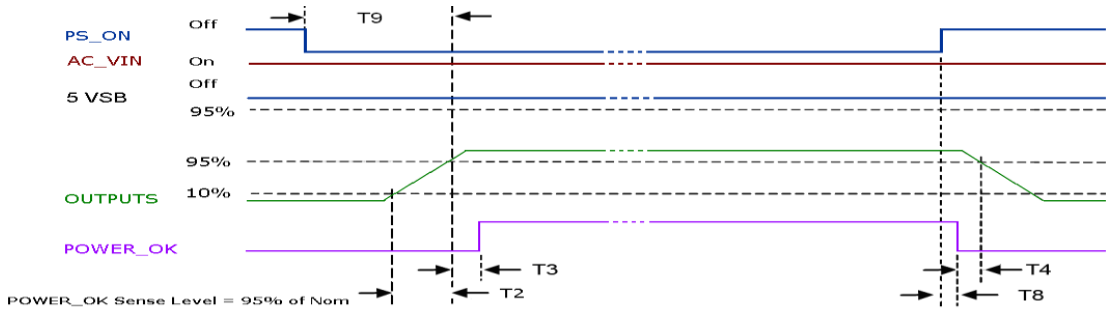
Signal	Notes	Min	Typ	Max	Unit
PS_ON	Active low, +5 V TTL signal compatible. Input low voltage	0	-	2.0	V
	Input high voltage (I_{IN}= 200 µA)	3.0	-	-	V
	V1 and V2 disabled when PS_ON is open				
	$5V_{SB}$ not affected by PS_ON				
	V1 and V2 enabled with PS_ON connected to RTN				
P_OK	+5 V TTL compatible				
	Logic level low (<10 mA sinking)	-	-	0.7	V
	Logic level high (100µA sourcing)	2.4	-	5	V
	P-OK Delay Time after V1 in regulation (T3 of the below graph)	0.05	-	0.1	s
	Power down warning time	1	-	-	ms
$5V_{SB}$ output	Active and in regulation after a 249<V_{AC}<528 is applied	-	-	1.5	s
	$5V_{SB}$ not affected by PS_ON				

SIGNAL TIMINGS



Above waveforms are expected with AC Input ON/OFF:

Standby on - Main outputs ON	40 ms ≤ T1 ≤ 200 ms
Main output Rise Time	2 ms ≤ T2 ≤ 40 ms
5 VSB Rise Time	4 ms ≤ T10 ≤ 40 ms
Main outputs On – P_OK delay	50 ms ≤ T3 ≤ 100 ms
Power down warning[1]	T4 ≥ 1 ms
Main Output off – Standby off[2]	T5 ≥ 500 ms
Hold-up time (AC off – P_OK low)	T6 ≥ 15 ms (277/347/480 Vac)
AC_ON - Standby turn on time	T7 ≤ 1.5 s (249 to 528Vac)



Above waveforms are expected with PS_ON Signal ON/OFF state change:

Main Output Rise Time	2 ms ≤ T2 ≤ 40 ms
Main Outputs ON – P_OK delay	50 ms ≤ T3 ≤ 100 ms
Power down warning[1]	15 ms ≤ T4 ≤ 30 ms
PS_ON - Power down warning	T8 ≤ 2 ms
PS_ON - Main Output (on) Timing	T9 ≤ 200 ms

[1] T4 parameter measurement setup will assume 100% of the maximum load on each output (400W max total power).
[2] T5 parameter measurement setup will assume at least 50% of the maximum load on main output.

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PROTECTION FEATURES

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
Input Under Voltage Lockout	Auto Recovery, Hiccup Mode	175	195	-	V_{AC}
Input Fuse	2X Time Lag, 500 Vac/400Vdc on ACL1 and ACL2	-	-	5.0	A
Over Current 277/347/480Vac	V1: Hiccup mode, auto-recovery	106	-	118	%
	V2: PTC limiting, auto-recovery	106	-	210	%
	5VSB: Hiccup mode, auto-recovery	125	-	230	%
Short Circuit 277/347/480Vac	V1: Hiccup mode, auto-recovery V2: PTC limiting, auto-recovery 5 VSB: Hiccup mode, auto-recovery	-	-	-	
Over Voltage	24V: Hiccup mode, auto-recovery	125	-	140	$\%V_{NOM}$
	5VSB: Hiccup mode, auto-recovery	120	-	160	$\%V_{NOM}$
Over Temperature (on primary stage)	Shut down, latch off	-	-	-	
Over Temperature (on secondary side)	Hiccup mode with auto-recovery	-	-	-	
Isolation Input-Output	Reinforced Not tested in production	4242	-	-	V_{DC}
Isolation Input to Earth	Basic	2780			V_{DC}

ENVIRONMENTAL SPECIFICATIONS

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating Temperature Range		-35	-	50	°C
De-rated Operating Temperature Range	Without Heatsink (277/347/480 V_{AC}) 400W at 25 °C 375W at 40°C Linear derating from 40°C to 70°C 320W at 50°C 215W at 70°C With Heatsink (480 V_{AC}) 400W up to 50°C Linear derating from 50°C to 70°C 275W at 70 °C				
Storage Temperature Range		-40	-	85	°C
Humidity	RH, Non-condensing Operating	-	-	90	%
	Non-operating			95	%
Operating Altitude		-	-	4000	m
Shock	**EN 60068-2-64** Operating: 5-500 Hz, 1 GRMS (0.002 g2/Hz), 3 axes, 30 min. Non-Operating: 5-500 Hz, 2.46 GRMS (0.0122 g2/Hz), 3 axes, 30 min.				
Vibration	**EN 60068-2-27** Operating: 30 G /18 ms HALF SINE, 3 axes, 6x axes (3 positive and 3 negative). Non-Operating: 50 G /11ms HALF SINE, 3 axes, 6x axes (3 positive and 3 negative).				
MTBF	277/347/480V_{AC}, Full load, 40°C ambient 80% Duty cycle, Telcordia SR-332 Issue 2	-	400000	-	Hours
Useful Life	277/347/480 V_{AC}				
	300 W, 40°C ambient, natural convection	-	52000	-	Hours
	300 W, 25°C ambient, natural convection	-	145000	-	Hours
Cooling	Convection with or without heat sink and conduction providing an adequate thermal path between the unit and the external environment. Case hot spot temperature Tc should not exceed 90 °C in any working condition.				

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ELECTROMAGNETIC COMPATIBILITY (EMC) - EMISSIONS

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
Conducted	277/347/480 $V_{AC,}$ full load	FCC Part 15 EN55022 EN55015	B
Radiated	At 10 m distance	FCC Part 15 EN5502 EN55015	B
Line Voltage Fluctuation and Flicker	277/347/480 V_{AC} At 20%, 50% and 100% rated load	EN 61000-3-3	
Harmonic Current Emission	277/347/480 V_{AC} All load conditions > 100 W	EN 61000-3-2	C

ELECTROMAGNETIC COMPATIBILITY (EMC) - IMMUNITY

Phenomenon	Conditions / Notes	Standard	Test Level	Performance criteria
ESD	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
Radiated Field	3 V/m, 80-1000 MHz, 1 KHz/2 Hz 80% AM Dwell time is 3 sec for 2 Hz modulation Dwell time is 1 sec for 1KHz modulation	EN 61000-4-3	3	A
Electric Fast Transient	±2 kV on AC power port for 1 minute; ±1 kV on signal/control lines	EN 61000-4-4	3	A
Surge	± 4kV line to line; ± 6 KV line to earth on AC power port; ±0.5 kV for outdoor cables	EN 61000-4-5	3	B
Conducted RF Immunity	3 V_{RMS}, 0,15-80 MHz, 1 KHz/2 Hz 80% AM	EN 61000-4-6	3	A
Dips and Interruptions	Dip to 30% for 0.5 cycle (10 ms) Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 5% for 10 ms Interrupts > 95% for 5 s	EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11		A B B B B

SAFETY AGENCIES APPROVAL

Certification Body	Safety Standards and file numbers
CSA/UL	c UL us - UL Recognized *(E330583.FKSZ2,8)* according to UL 8750 and CSA C22.2 No 250, suitable for dry and damp locations, rated HL, meaning Class I, Division 2 hazardous (Classified) location luminaires. Auxiliary output, I/O signals and stand by output are rated Class 2.
CE	CE Mark for EU according to IEC/EN 61347-1, IEC/EN 61347-2-13 standards electronic control gear for LED Modules.

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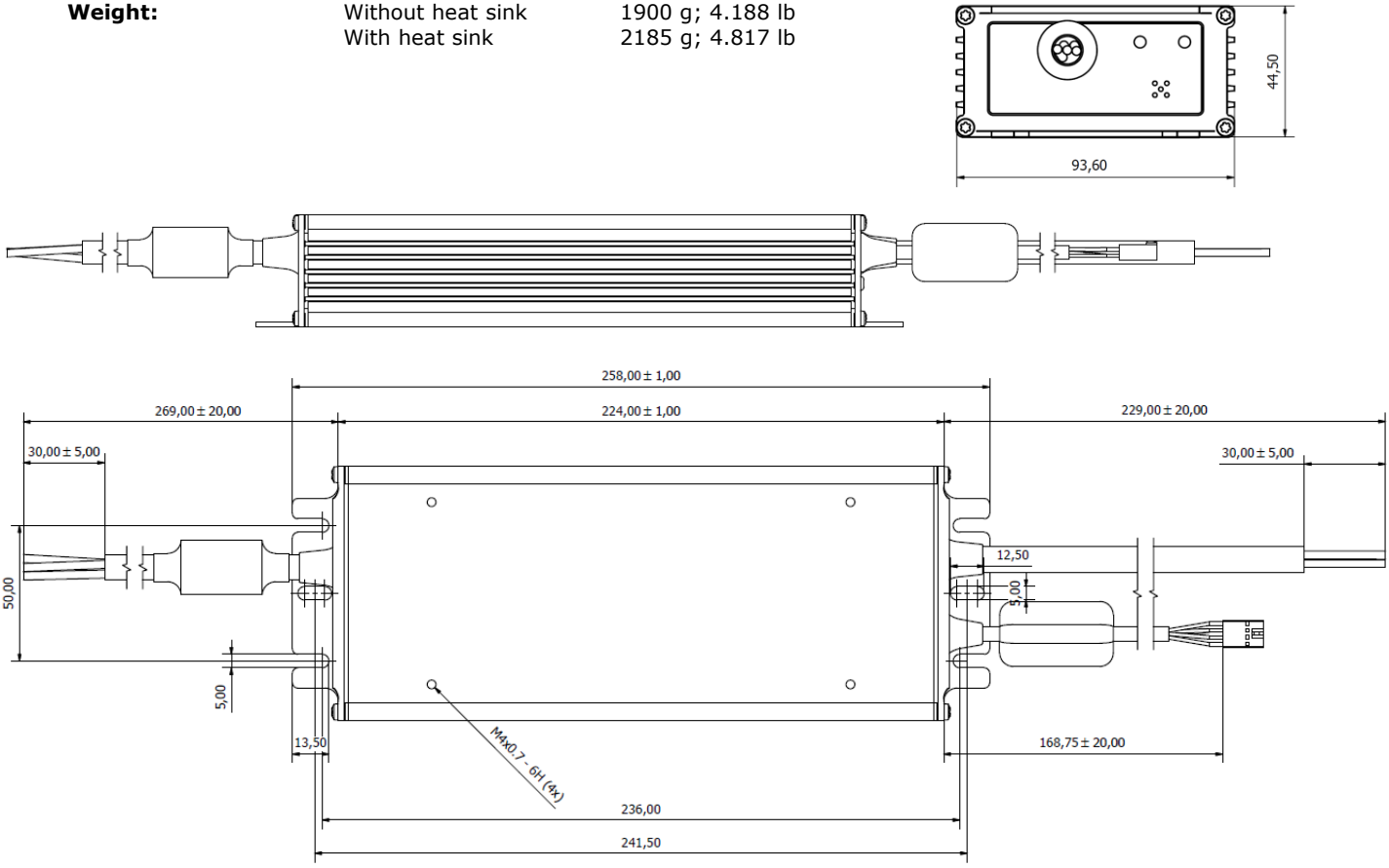
OUTLINE DRAWING AND CONNECTIONS _ SEALED BOX

Overall dimensions:	Without heat sink	(93.6 X 258.0 X 44.5) mm; (3.69 X 10.16 X 1.75) in
	With heat sink	(93.6 X 258.0 X 59.2) mm; (3.69 X 10.16 X 2.33) in
Weight:	Without heat sink	1900 g; 4.188 lb
	With heat sink	2185 g; 4.817 lb



Connections	Wires Gauge and Length	Assignment	Colour/Pin
AC Input	STW 3X18 AWG 105°C/600V, water resistant 60°C, stranded wires, 269.0±20 mm	ACL1	Black
		ACL2	White
		Protective Earth (PE)	Green
DC Output	SJTW 2X14 AWG 105°C/300V, water resistant 60°C, stranded wires, 229.0±20 mm	+V1 Output (+V1)	Red
		V1 Return (RTN)	Blue
Auxiliary Voltages Control Signals	SJTW 8X22 105°C/300V, water resistant 60°C, stranded wires 169±20 mm Mates with Molex 901301106 or equivalent	+5 V Stand-by Output (+$5V_{SB}$)	Red / 1
		Output Power Good (P_OK)	Green / 2
		- Fan Voltage (-V2)	Brown / 3
		Remote On/Off (PS_ON)	Grey or purple / 4
		+ Terminal Remote Sense (+RS)	Yellow / 5
		Stand-by/Signals Return (RTN)	Blue / 6
		+ Fan Voltage (+V2)	White / 7
		Stand-by/Signals Return (RTN)	Black / 8

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