MAIN FEATURES

- Universal input voltage range (90 – 264 V_{AC})
- Class II IEC protection
- Input surge current limiting
- 400 W rated power (440 W peak up to 10 s)
- High efficiency up to 94%
- Low No-Load power consumption (1 W typ.)
- 24 V standard output voltage
- Active PFC, EN61000-3-2 compliant (Class C, >25 % load).
- Low leakage current (<250 µA)
- Over temperature protection
- OV, OC and SC protections
- Class B conducted/radiated emission as per EN 55032
- Sealed, potted package IP66/67 rated
- ITE safety approval to UL/IEC 60950-1 and 62368-1
- RoHS 3 compliant (Directive 2015/863/EU)
- 4000 m altitude operation

IP66/67

DESCRIPTION

The DDP400-US24-SC-2 is a sealed, full potted, compact, high efficiency, IEC class II, AC-DC power supplies.
It provides a steady 400 W of regulated DC power and can be operated over the full 90 to 264 V_{AC} input voltage range in a (4 x 9 x 2)" form factor.
By converting energy at a typical 94% efficiency, the DDP400-US24-SC-2 generates less heat facilitating thermal management in space constrained environments, resulting in very high reliability.
It comes in a 24 $V_{DC,}$ standard output voltage.

The sealed and full potted package allows an IP66/67 ingress protection index and can be installed in contact with thermo-conductive part of the system so to transfer heat by conduction, therefore, enhancing performances.
Input and output cables, in addition to meeting the specific isolation requirements of the IEC Class II, are UV resistant for outdoor installation.

When conduction cooled, or convection cooled with its optional heat sink assembled, the SC series can deliver full output power from -20 to 50 °C. It can operate up to 70 °C with derating and is capable to start up from – 30 °C and from – 40 °C with reduced start up load.

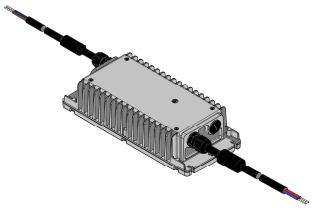
Protection features do include fuse on each AC lines, input under-voltage lockout (IUV), output over-current (OC), output short-circuit (SC), output over-voltage (OV) and over-temperature (OT).

The DDP400-US24-SC-2 complies with UL/IEC 60950-1 and 62368-1 standards, meets the EN55032 EMC limits of Class B for conducted and radiated emissions as well as the IEC/EN 61000-3 and IEC/EN 55024 EMC standards.

MARKET SEGMENTS AND APPLICATIONS

- Video Wall and VMS Display
- Industrial and Process Control
- Class II outdoor signage
- Test and Measurement Equipment

MODEL CODING AND OUTPUT RATINGS

Model Grade and Output Power	Output Nominal Voltage	Package	IEC Protection Class
DDP400-	*24 V_{DC}:* **US24-**	*Sealed Conduction/Convection Cooling:* **SC-** 	*Class II:* **2**

Model Number	V1 [V]	I1 [1] Convection No heatsink (A)	V1 [2] Ripple (mV)	Over Current Trip (A)	Over Voltage Trip (V)
DDP400-US24-SC-2	24	14.6	240	>18.3	>26.4

[1] The output power when convection cooled and $V_{IN} \geq 100\ V_{RMS}$, must not exceed 360 W up to 40 °C, and 260 W at 70 °C ambient temperature. See de-rating curves below. In any case, the chassis hot spot temperature T_C should never exceed 90 °C.

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

INPUT SPECIFICATIONS

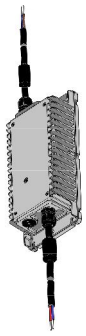
Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
AC Input Voltage	PS starts and operates at 90 V_{AC} at all load conditions	90	100-240	264	V_{AC}
Input Frequency		47	50/60	63	Hz
Input Current	RMS at 180 V_{AC}, maximum load RMS at 90 V_{AC}, maximum load	-	-	2.5 5	A
Inrush Current (peak)	265 V_{AC}, full load, cold start	-	-	20	A
Fusing	2X Time Lag 6.3 A, 250 V on L and N	-	-	6.3	A
Efficiency	230 V_{AC}, From 50 % to full load At 20 % full load At 115 V_{AC}, 20 % rated load At 100 % load	- - - -	94 90 90 92	- - - -	%
Input Power Consumption	Power on, 115-230 V_{RMS}, no load	-	1	1.5	W
Power Factor	At full rated load, 115 V_{AC} 60 Hz and 230 V_{AC} 50 Hz input voltages	0.95	-	-	-
Harmonic Current Fluctuations and Flicker	Complies with EN-61000-3-2 Class C at 230 V_{AC} 50 Hz, >50 W load. Complies with EN-61000-3-3 at nominal voltages and full load.				
Touch Leakage Current	Normal conditions, 264 V_{RMS}, 60 Hz.	-	-	250	µA

OUTPUT SPECIFICATIONS

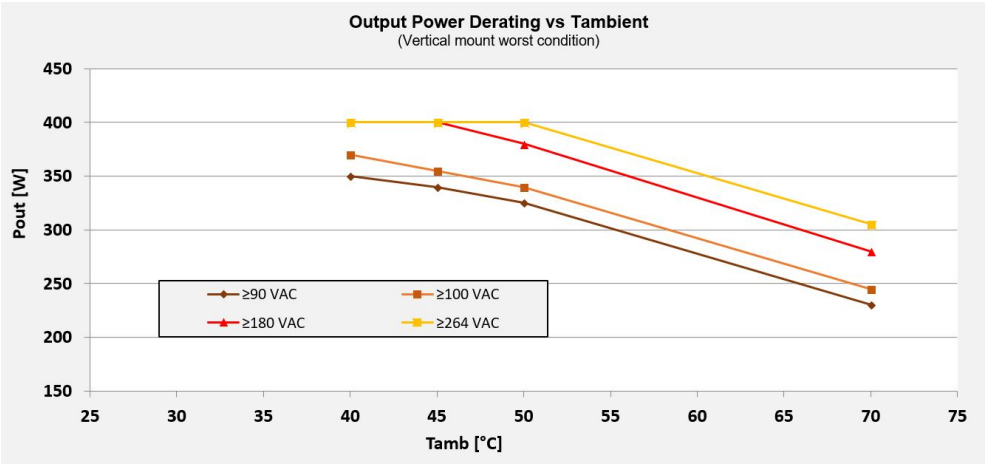
Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
V1 Output Voltage	±0.5% set point accuracy on all outputs	-	24	-	V
V1 Output Power Rating	Natural convection cooling	-	-	360	W
	Conduction cooling / heat sink	-	-	400	
	Peak power (≤ 10 s)	-	-	440	
V1 Voltage Adjustment Range		±5	-	-	%V1
V1 Load-Line-Cross Regulation	V_{AC}: 90 – 264 V_{RMS} V1 Load: 0 – 16.7 A	-	-	±2	%V1
V1 Line Regulation	V_{AC}: 90 – 264 V_{RMS}	-	-	±0.1	%V1
Transient Response (V1 Deviation)	25% load changes at 1 A/µs at 1000 µF Load / I_{OUT}> 0.5 A	-	-	±5	%V1
V1 Ripple & Noise	Peak-to-peak, 20 MHz BW. 100nF ceramic and 10µF tantalum to the load.	-	-	1	%V1
Start-up Rise Time	90<V_{IN}<264, any load conditions.	5	-	85	ms
Start-up Delay	V1 in regulation after AC is applied	-	-	750	ms
Turn-on Overshoot	At 500 mA output current, V1 in regulation within 50 ms	-	10	-	%V1
Hold-up Time	At nominal V_{IN}, 400 W, for all outputs	-	16	-	ms
	At nominal V_{IN}, 365 W, for all outputs	-	20	-	
	At nominal V_{IN}, 200 W, for all outputs	-	35	-	
Minimum Load		0	-	-	A
Maximum Load Capacitance	At nominal V_{IN}, 25 °C ambient	-	-	16000	µF
Temperature Drift		-1.2	-	+1.2	mV/°C

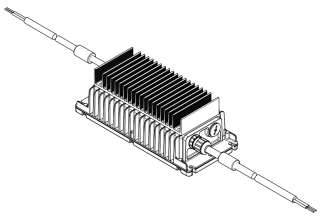
Output Power Derating Curves

Vertical Mounting Orientation
No Heat Sink

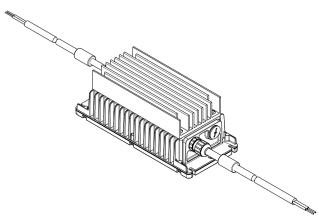


This installation mode represents the worst case as a reference for thermal management.
Any other orientation will provide better result which can be furtherly enhanced using the optional heatsink[3].





Transversal Heat Sink (**DDP-HS Kit**)[3]



Longitudinal Heat Sink (**DDP-HSL Kit**)[3]

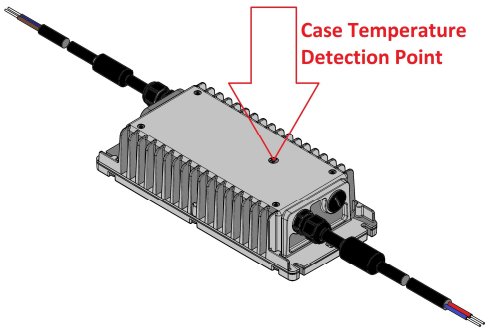
[3] The optional heatsinks (DDP-HS or DDP-HSL) they must be requested separately and applied by the installer. Each kit includes heatsink, graphite sheet and fixing systems (screws and washers). Tight the screws to 0.8-1.0 Nm.

PROTECTION FEATURES

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
Input Under Voltage	Auto-recovering, hiccup mode.	60	75	-	V_{AC}
Input Fuse	2X Time Lag 6.3 A, 250 V on L and N	-	-	6.3	A
V1 Over Current	At nominal input voltages. Hiccup mode. auto-recovering	110	-	155	$\%I1_{MAX}$
V1 Short Circuit	At nominal input voltages. Hiccup mode. auto-recovering	-	-	-	
V1 Over Voltage	Shut down, latch-off.	110	-	136	$\%V_{NOM}$
Over Temperature (on primary stage)	Shut down, latch off.	-	-	-	
Over Temperature (on secondary side)	Hiccup mode, auto-recovering.	-	-	-	
Isolation Input-to-Output	Reinforced	3000	-	-	V_{AC}
Isolation Input to Chassis	Reinforced	3000			V_{AC}
Isolation Output to Chassis	Basic	1500	-	-	V_{DC}

ENVIRONMENTAL SPECIFICATIONS

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating Temperature Range	PS starts up at -30 °C and from – 40 °C with reduced start up load. See graphs above for output power de-rating against T_{Amb} and V_{In}.	-20	-	70	°C
Storage Temperature Range		-40	-	85	°C
Humidity	RH, Non-condensing Operating Non-operating	-	-	90 95	% %
Operating Altitude		-	-	4000	m
Shock	**EN 60068-2-27** Operating: Half sine, 30 g, 18 ms, 3 axes, 6x each (3 positive and 3 negative). Non-Operating: Half sine, 50 g, 11 ms, 3 axes, 6x each (3 positive and 3 negative).				
Vibration	**EN 60068-2-64** Operating: Sine,10 – 500 Hz, 1 g, 3 axes, 1 oct/min., 60 min. Random, 5 – 500 Hz, 0.02 g^2/Hz, 1 g_{RMS}, 3 axes, 30 min. Non-Operating: 5 – 500 Hz, 2.46 g_{RMS} (0.0122 g^2/Hz), 3 axes, 30 min.				
MTBF	Full Load, 100-240 V_{AC}, 40 °C ambient 80% Duty cycle, Telcordia Issue 2	1.000.000	-	-	Hours
Useful Life	100-240 V_{AC}, 307W Output power, 40 °C ambient temperature, horizontal orientation, natural convection.	5.5	-	-	Years
Cooling	The power supply can operate under several environmental conditions: natural convection, ventilated, with or w/o additional heat sink, thermally isolated or installed onto metallic frame, allowing heat dispel by conduction. In any case, during normal operation, the power supply shall not exceed 90 °C at the case temperature detection point, Tc, marked on the top of the chassis, at any ambient temperature less or equal to 60 °C. For the ambient temperature within the 60 to 70 °C range, the Tc point shall not exceed 95 °C. In order to meet the above limits, the total output power must be conveniently de-rated and the thermal test must be performed in the end application.				



ELECTROMAGNETIC COMPATIBILITY (EMC) – EMISSIONS

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
Conducted	115 V_{RMS}, 230 V_{RMS} Maximum load.	EN 55032 (ITE)	B
Radiated		EN 55032 (ITE)	B
Line Voltage Fluctuation and Flicker	At 20%, 50% and 100% maximum load. Nominal input voltages.	EN 61000-3-3	
Harmonic Current Emission	Nominal input voltages. Output load > 100 W.	EN 61000-3-2	C

ELECTROMAGNETIC COMPATIBILITY (EMC) – IMMUNITY

Phenomenon	Conditions / Notes	Standard	Test Level	Performance criteria
	Reference standard for the ITE	**EN 55024**		
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, 80% AM.	EN 61000-4-3	3	A
Electric Fast Transient	±2 kV on AC power port	EN 61000-4-4	3	A
Surge	± 1kV line to line ± 1 KV line to chassis on AC power port	EN 61000-4-5	3	A A
Conducted RF Immunity	3 V_{RMS}, 0,15-80 MHz, 1 KHz, 80% AM	EN 61000-4-6	3	A
Dips and Interruptions	100 - 240V_{AC} Drop-out to 5% for 10 ms Dip to 70% for 25 cycles (500 ms) Interrupts > 95% for 5 s	 EN61000-4-11 EN61000-4-11 EN61000-4-11		 A B B

SAFETY AGENCIES APPROVALS

Certification Body	Safety Standards and file numbers	Category
c UL us	CSA C22.2 No. 60950-1, UL 60950-1, UL 62368-1	Audio/Video, Information and Communication technology
IEC IECEE CB Certification	IEC/EN 60950-1, 62368-1	Audio/Video, Information and Communication technology
CE	Directive 2014/35/EU: Electrical Safety: Low Voltage electrical equipment (LVD) Directive 2014/30/EU: Electromagnetic Compatibility (EMC) Directive 2015/863/EU: RoHS 3	Audio/Video, Information and Communication technology

OUTLINE DRAWING AND CONNECTIONS

Packaging:	Die cast Aluminium alloy EN AC-43400/AlSi10Mg/ZL 104 or EN AC-44300/AlSi12/ZL 10
Finishing:	Tumbling
I/O Connections:	Flying leads
Input Connections:	2x AWG18, L (Blue), L1 (Brown)
Output connections:	2x AWG14, + (Red), - (Blue)
Ingress Protection:	IP66/IP67
Dimensions:	100.0 x 228.0 x 51.5 mm (3.94 x 8.98 x 2.03 in)
Weight:	2.0 Kg (4.41 lb)