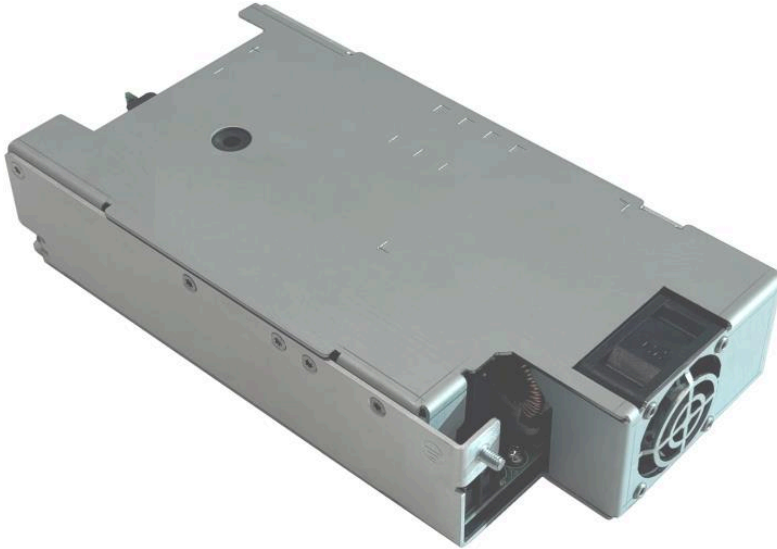


MEDICAL AND A/V ITE RATED 1200 W AC-DC COMPACT, EFFICIENT POWER SUPPLY

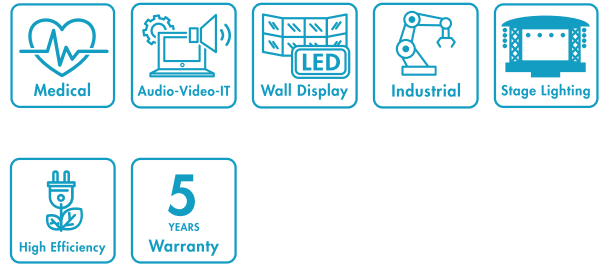
HDP1200 Series



Certifications



Applications



FEATURES

- » Universal input voltage range (90 – 305 V_{AC})
- » Input Inrush current limiting
- » 1200 W rated power
- » High efficiency, 95.5% typical
- » 24, and 48 V_{DC} standard output voltages
- » Active GaN based PFC, EN61000-3-2 (Class C at >150 W)
- » Low earth / touch leakage current
- » Fan speed control for quiet operation
- » Over temperature, OV, OC and SC protections.
- » Stand by +5 V, 1.5 A
- » Built-in current share signal for parallel operation
- » Remote On / Off signal
- » Power good and remote sense signals
- » U-chassis and enclosed packages fits 1U applications
- » Audio / Video IT safety approval to IEC/UL 62368-1
- » Medical safety approval to IEC 60601-1 3rd edition, 2x MoPP rated and BF appliances compatible.
- » Designed to be compliant with UL8750 LED lighting
- » IEC 60601-1-2 4th edition EMC compliant.
- » RoHS 3 compliant (Directive EU 2015/863)
- » Medical version compatible with 4000 m altitude operation

MARKET SEGMENTS AND APPLICATIONS

- » Stage Steady / Dynamic LED Lighting
- » Video Wall Display and SSL Lighting
- » Industrial Process Control and Automation
- » Telecommunications
- » Laboratory / Analysis Equipment
- » CT / MRI medical Equipment
- » Dental / Surgical Units
- » Medical applications

PRODUCT DESCRIPTION

The HDP1200 series of A/V&ITE and medical grade AC-DC power supplies provide the compact form factor and high efficiency that the marketplace demands.

The series provides a steady 1200 W of regulated DC power through the 180 to 305 V_{AC} input range, all in a 4.2 x 8.1 x 1.6" form factor. The HDP1200 comes in an enclosed chassis with a built-in front mounted fan to facilitate system integration.

By converting energy at typical 95% efficiency, the HDP1200 generates less heat, facilitating optimal thermal management in space constrained environments, resulting in very high reliability.

The series comes in 24, 48 V_{DC} standard output voltages. It offers a +5 V_{DC} stand-by output capable of 1.5 A. Available control signals include Power Good (P_OK), Remote On / Off (PS_Inhibit) and Sense Terminals (RS+, RS-).

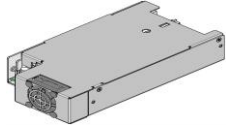
The HDP1200 features a built-in I-share circuit for parallel operation between power units to enhance total power.

The front-mounted fan rotation speed is digitally controlled to guarantee the minimum required airflow, minimizing audible noise for quiet operation, and enhancing the power supply service lifetime. Protection features include High Breaking capacity fuses on both AC lines, input under voltage lockout (IUV), output over-current (OC), output short-circuit (SC), output over-voltage (OV) and over-temperature (OT).

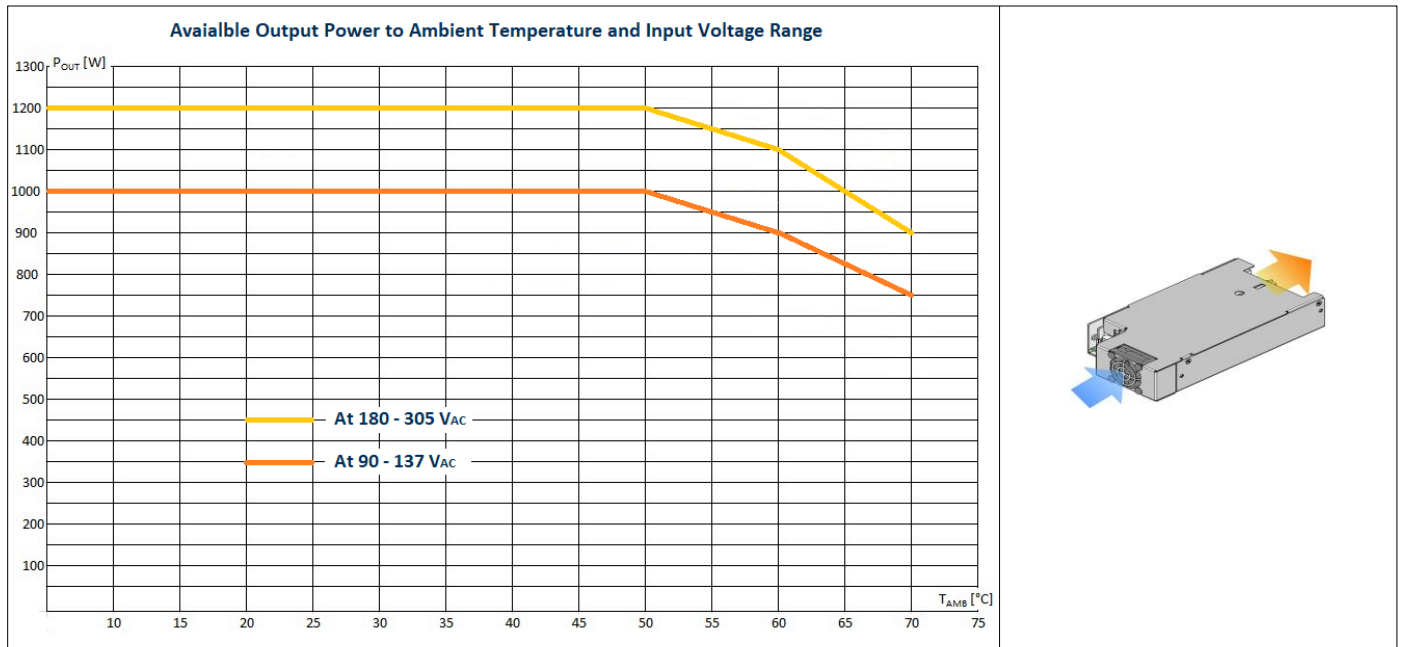
The series complies with IEC 60601-1 safety standard for medical equipment, offers 2x MoPP means of patient protection, and is suitable for BF rated medical equipment.

The series also complies with the latest edition of the IEC 62368-1 standards for Audio Video and IT equipment and UL8750 for LED lighting applications. The series meets the EN55032 EMC limits of Class B for conducted and radiated emissions as well as the IEC/EN 61000-3 for flicker and harmonics content. The series also comply with the immunity standards: IEC/EN 61000-6-2, IEC/EN 60601-1-2 4th edition, and EN 55035.

Model Coding and Output Ratings

Model Grade and Output Power	Output Voltages	Packages ITE/ME: DDP600-	
A/V ITE and ME Equipment: HDP1200-	24 VDC: US24- 48 VDC: US48-	Front Fan Box: FF	

Output Parameter	24 V		48 V	
	180-305 V _{AC}	90-137 V _{AC}	180-305 V _{AC}	90-137 V _{AC}
V _{OUT} Nom Voltage	24 V _{DC}		48 V _{DC}	
V _{OUT} Rated Power	1200 W	1000 W	1200 W	1000 W
V _{OUT} Rated Current	50 A	41.7 A	25 A	20.8 A
V _{OUT} Line Regulation	±0.1%			
V _{OUT} Load Line Cross Regulation	±2%			
V _{OUT} Ripple & Noise	1% Peak-to-peak			
V _{OUT} Transient response	±5%V _{OUT} to 25% load change at 1 A/μs			
V _{OUT} Over Current Protection	<61A		<30.5 A	
V _{OUT} Over Voltage protection	120% V _{NOM} < V _{OUT} < 145% V _{NOM}			
V _{OUT} Max Out Capacitance	16000 μF		8000 μF	
5 V _{SB} Nominal Voltage	5 V _{DC} (stand-by output voltage is referred to the same V _{OUT} output voltage return)			
5 V _{SB} Rated Current	1.5 A			
5 V _{SB} Ripple & Noise	50 mV Peak-to-peak			
5 V _{SB} Load, line cross Regulation	±5%			



Input Specifications

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
AC Input Voltage	PS starts and operates at 90 V _{AC} ; 0-100% load	90	100-277	305	V _{RMS}
Input Frequency		47	50/60	63	Hz
Input Current	RMS at 180 V _{AC} , 1200 W load RMS at 90 V _{AC} , 1000 W load	- -	-	7.3 12.5	A
Inrush Current (peak)	Cold start, 25 °C ambient, full load				
	115 V _{AC}	-	-	20	A
	230 V _{AC}	-	-	30	A
	277 V _{AC}	-	-	36	A
Fusing	16 A, 300 V on each AC lines High Breaking, fast acting	-	-	16	A
Efficiency	At 115 V _{AC} 200 W load 500 W load 1000 W load At 230 / 277 V _{AC} 240 W load 600 W load 1200 W load	- - - - - - -	91.5 94.5 93.7 93.0 95.7 95.3	- - - - - -	%
Input Power Consumption	Power on, 115 V _{AC} , no load Power on, 230 / 277 V _{AC} , no load Standby at 115 Standby at 230 Standby at 277	- - - - -	4.5 5.0 0.6 0.9 1.2	- - - - -	W
Power Factor	From 50 to 100% of rated load, 277, 230, 115 V _{AC} , 50 / 60 Hz	1.12	-	-	-
THDi	From 50 to 100% rated load, 115, 230, 277 V _{AC} 50 / 60 Hz.	-	-	20	%
Harmonic Current Fluctuations and Flicker	Complies with EN 61000-3-2 at 230 V _{AC} , 50/60 Hz, Class A, D. Complies with EN 61000-3-2 Class C at 230 V _{AC} , 50/60 Hz, >150 W load. Complies with EN 61000-3-3 at nominal voltages and full load.				
Earth Leakage Current	Normal conditions 115 V _{RMS} , 60 Hz 230 V _{RMS} , 50 Hz 277 V _{RMS} , 60 Hz 305 V _{RMS} , 60 Hz	- - - -	130 240 350 -	- - - 500	μA
Touch Leakage Current	264 V _{RMS} , 60 Hz Normal Condition (NC) Single Fault Condition (SFC)	- - -	- - -	100 500	μA
Patient Leakage Current	264 V _{RMS} , 60 Hz Normal Condition (NC) Single Fault Condition (SFC)	- - -	- - -	100 500	μA

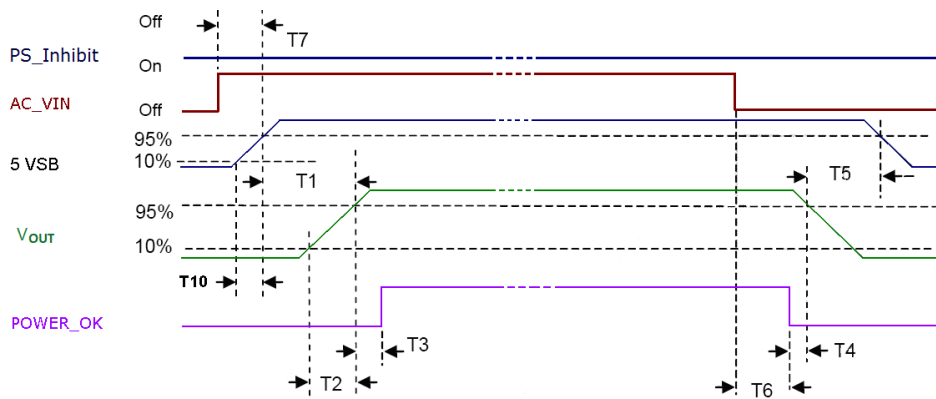
Output Specifications

Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
V_{OUT} Nominal Voltages	±0.5% set point accuracy RS+ closed on +V _{OUT} , RS- closed on V _{OUT} RTN, at 10% load.	-	24	-	V
		-	48	-	
V_{OUT} Output Power Rating	Steady at 180 – 305 V _{AC} Steady at 90 – 137 V _{AC}	-	-	1200	W
		-	-	1000	
5 V_{SB} Output Voltage	±3% set point accuracy, 20% load.	-	5	-	V
5 V_{SB} Output Current		-	-	1.5	A
V_{OUT} Voltage Adjustment Range	Manually by potentiometer	-	-	±5	%V _{NOM}
V_{OUT} Load-Line-Cross Regulation	V _{AC} : 90 – 305 V _{RMS} ; I _{OUT} : 0 – 100%	-	-	±2	%V _{NOM}
5 V_{SB} Load-Line-Cross regulation	V _{AC} : 90 – 305 V _{RMS} ; I _{5SB} : 0 – 100%	-	-	±5	%5 V _{SB}
V_{OUT} Line Regulation	V _{AC} : 90 – 305 V _{RMS}	-	-	±0.1	%V _{NOM}
Transient Response: V_{OUT}, 5 V_{SB} Voltage Deviation	25% load changes at 1 A/μs 24 V at 1000 μF load / I _{OUT} > 2.5 A 48 V at 560 μF load / I _{OUT} > 1.25 A 5 V _{SB} at 560 μF load / I _{OUT} > 0.1 A	-	-	±5	%V _{NOM} %5 V _{SB}
V_{OUT} Ripple and Noise	Rated load, Peak-to-peak, 20 MHz BW. (100 nF ceramic, 10 μF tantalum at load)	-	-	1	%V _{NOM}
V_{OUT} Start-up Rise Time	90 < V _{IN} < 305, any load conditions.	1	-	80	ms
Start-up Delay	V _{OUT} in regulation after de-asserting PS_Inhibit V _{OUT} in regulation after AC is applied, cold start V _{OUT} in regulation after AC is applied, cycling (worst case: 90 V _{AC}) 5 V _{SB} in regulation after AC is applied, cold start 5 V _{SB} in regulation after AC is applied, cycling (worst case: 90 V _{AC})	-	-	450	ms
		-	-	1000	
		-	-	2800	
		-	-	500	
		-	-	2400	
Turn-on Overshoot		-	-	13	%V _{OUT}
		-	-	10	%V _{SB}
V_{OUT} Hold-up Time	At nominal V _{IN} , 1000 W load At nominal V _{IN} , 1200 W load SEMI F47-0706 compliant at ≥208 V _{AC} 50% sag (104 V) 30% sag (145 V) 20% sag (166 V)	16	-	-	ms
		12	-	-	
		200	-	-	
		500	-	-	
		1000	-	-	
Minimum Load	V _{OUT} and 5 V _{SB}	0	-	-	A
Maximum Load Capacitance	24 V _{DC} 48 V _{DC}	-	-	16000	μF
		-	-	8000	
V_{OUT} Current Sharing Accuracy	Two units in parallel at I _{OUT} rated load. VS-Logic and I-Share signals daisy-chained connected among power units. RS+, RS- signals connected and to the load. Max load at start up 1200 W, operating 2200 W max, 180 + 305 V _{AC} . Max load at start up 1000 W, operating 1850 W max, 90 + 137 V _{AC} .	45.5	-	54.5	%I _{OUT}
V_{OUT} Remote Sense	RS+ and RS- power path voltage loss compensation	-	-	0.12	V

Signals / Controls and Timing

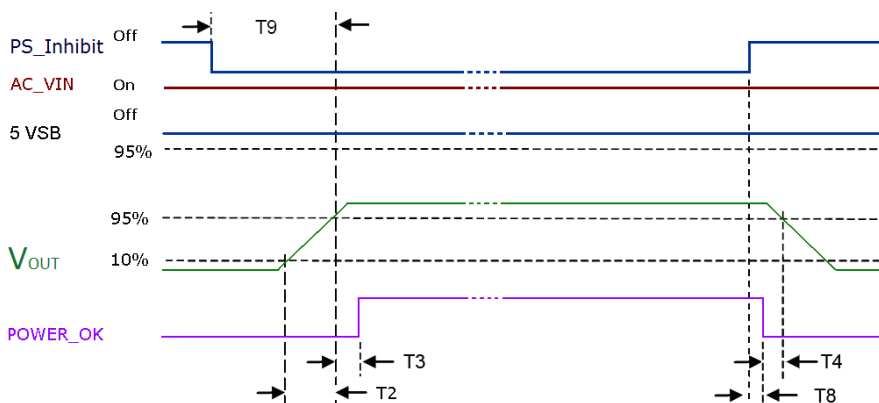
Signal	Notes	Min	Typ.	Max	Unit
+PS_Inhibit	Active high. Input low voltage	0	-	1.5	V
	Input high voltage (IIN= 300 μ A)	3.5	-	5.5	V
	V_{OUT} disabled when PS_Inhibit is pulled high				
	$5V_{SB}$ not affected by PS_Inhibit				
	V_{OUT} enabled when PS_Inhibit is open or low				
-PS_Inhibit	Active low (reverse control, same voltage levels)				
P_OK*	Logic level low (<10 mA sinking)	-	-	0.7	V
	Logic level high (100 μ A sourcing)	2.4	-	5.5	V
	Low to high time after V_{OUT} in regulation	200	-	350	ms
	Power down warning time	1	-	-	ms
$5V_{SB}$ Output	$5V_{SB}$ in regulation after AC is applied, cold start	-	-	500	ms
	$5V_{SB}$ in regulation after AC is applied, cycling	-	-	2400	ms
	At worst case $90 V_{AC}$				
	$5V_{SB}$ not affected by PS_Inhibit				

(*) When V_{OUT} is On, a P_OK low may indicates V_{OUT} under voltage condition. When two HDP1200 operate in parallel, P_OK low in one unit indicates that it is not sharing the expected amount of current (current sharing fault). A 10 k Ω internal pull-up to $5V_{SB}$ is used; do not add any other external pull-up.



Above waveforms are expected with AC Input ON/OFF:

$5 V_{SB}$ On to V_{OUT} On	$150 \text{ ms} \leq T1 \leq 500 \text{ ms}$
V_{OUT} rise time	$1 \text{ ms} \leq T2 \leq 80 \text{ ms}$
$5 V_{SB}$ rise time	$3 \text{ ms} \leq T10 \leq 40 \text{ ms}$
V_{OUT} On – POWER_OK delay	$200 \text{ ms} \leq T3 \leq 350 \text{ ms}$
Power down warning	$T4 \geq 1 \text{ ms}$
V_{OUT} Off $5 V_{SB}$ Off	$T6 \geq 15 \text{ ms}$ (1000 W load); $T6 \geq 11 \text{ ms}$ (1200 W load)
AC Off to POWER_OK low	$T6 \geq 15 \text{ ms}$
AC On $5 V_{SB}$ turn on time	$T7 \leq 0.5 \text{ s}$ (cold start)



Above waveforms are expected with PS_Inhibit Signal On/Off state change:

V_{OUT} rise time	$1 \text{ ms} \leq T2 \leq 80 \text{ ms}$
V_{OUT} On – POWER_OK delay	$200 \text{ ms} \leq T3 \leq 350 \text{ ms}$
Turn-Off warning	$T4 \geq 1 \text{ ms}$
PS_Inhibit – POWER_OK low timing	$T8 \leq 2 \text{ ms}$
PS_Inhibit – V_{OUT} On delay	$T9 \leq 450 \text{ ms}$

Protection Features

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
Input Under Voltage	Auto-recovering, hiccup mode.	70	-	85	V _{AC}
Input Fuse	16A, 300V on each AC lines High Breaking, fast acting	-	-	16	A
Over Current	At nominal input voltages				
	24V: Hiccup mode, auto-recovering (OC1 > 10 s)	53	-	61	A
	24V: Hiccup mode, auto-recovering (OC2 > 80 ms)	59.5	-	67.5	A
	48V: Hiccup mode, auto-recovering (OC1 > 10 s)	26.5	-	30.5	A
	48V: Hiccup mode, auto-recovering (OC2 > 80 ms)	29.75	-	33.75	A
5 V _{SB} : Hiccup mode, auto-recovering	2	-	3.3		
Short Circuit	At nominal input voltages				
	V _{OUT} : Hiccup mode, auto-recovering.	-	-	-	
	5V _{SB} : Hiccup mode, auto-recovering.				
Over Voltage	V _{OUT} : Power shut down, latch off.	120	-	145	%V _{NOM}
	5V _{SB} : Hiccup mode, auto-recovering.	-	-	150	
Over Temperature (on primary stage)	Shut down, latch off.	-	-	-	°C
Over Temperature (on secondary side)	Hiccup mode, auto-recovering.	-	-	-	°C
Isolation: Primary-to-secondary	Reinforced (2x MoPP).	4977	-	-	V _{AC}
Isolation: Input-to-Earth	Basic (1x MoPP)	1768	-	-	V _{AC}
	Production tested at 2642 V _{DC}				
Isolation: Output-to-Earth	Basic (1x MoPP)	1554	-	-	V _{AC}
Means Of Protection: Primary-to-secondary	2x MoPP (IEC 60601-1 3rd edition) at 100 – 277 V _{AC} , 50/60 Hz up to 4000 m				
Means Of Protection: Primary-to-Protection Earth	1x MoPP (IEC 60601-1 3rd edition) at 100 – 277 V _{AC} , 50/60 Hz up to 4000 m				
Means Of Protection: Secondary-to-Protection Earth	1x MoPP (IEC 60601-1 3rd edition) at 100 – 277 V _{AC} , 50/60 Hz up to 4000 m				
Equipment Protection Class	Class I, compatible with BF (Body Floating) ME				

Environmental Specifications

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
Operating Temperature Range	No de-rating up to 50°C HDP1200 starts at -40 °C upon warm up delay	-20	-	50	°C
Operating Temperature Range with De-rating	See de-rating curves	-20	-	70	°C
Storage Temperature	As per IEC/EN 60721-3-1 Class 1K4	-40	-	85	°C
Transportation Temperature	As per IEC/EN 60721-3-2 Class 2K4				
Humidity	RH, Non-condensing Operating.	-	-	90	%
	Non-operating			95	%
Operating Altitude	MoPP (100 – 277 V _{AC} , 50/60 Hz)	-	-	4000	m
	MoOP, ITE grade	-	-	5000	
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 gRMS, 3 axes, 30 min. Non-Operating: 5 – 500 Hz, 2.46 gRMS (0.0122 g ² /Hz), 3 axes, 30 min.				
MTBF	Full Load, 40 °C ambient 80% Duty cycle, Telcordia SR-332 Issue 2	TBD	-	-	Hours
Useful Life	Worst nominal V _{IN} , 80% load, 40 °C ambient.	TBD	-	-	Years

Electromagnetic Compatibility (EMC) – Emissions

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
Conducted	115, 230, 277 V _{RMS} . Maximum load.	EN 55032 (ITE) EN 55011 (ISM) EN 60601-1-2 (Medical) FCC Part 15	B
Radiated		EN 55032 (ITE) EN 55011 (ISM) EN 60601-1-2 (Medical) FCC Part 15	B(*)
Line Voltage Fluctuation and Flicker	At 20%, 50% and 100% maximum load. Nominal input voltages	EN 61000-3-3	
Harmonic Current Emission	230 V _{AC} input voltage, 50 / 60 Hz 230 V _{AC} 50 / 60 Hz, >150 W load	EN 61000-3-2 EN 61000-3-2	A, D C

(*) Class B radiated emission should be assessed at system level. An appropriate HF chokes on L1 and L2 input might be required.

Electromagnetic Compatibility (EMC) – Immunity

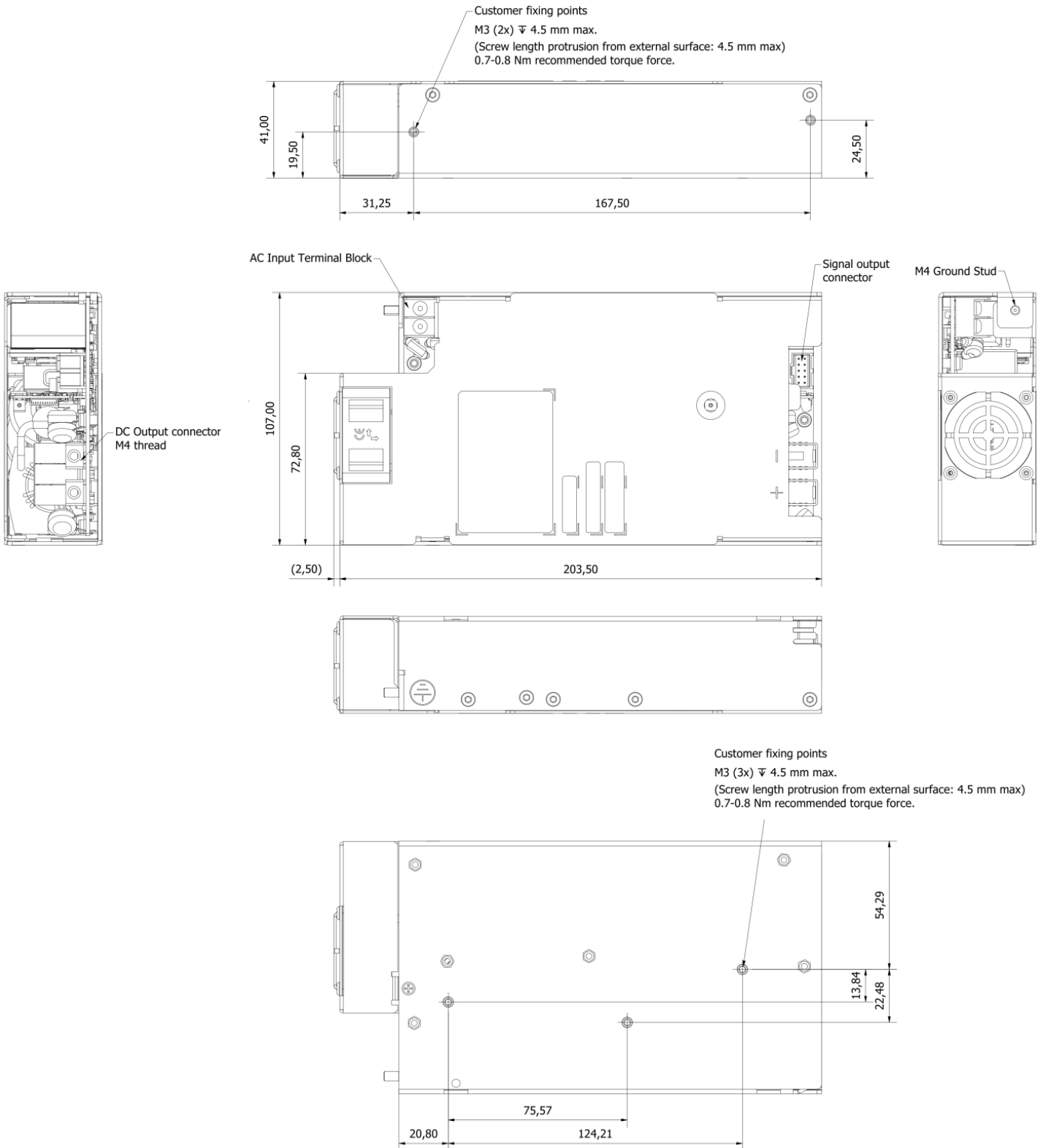
Phenomenon	Conditions / Notes	Standard	Test Level	Criteria
	Reference standard for the medical version Reference standards for ITE Reference standard for Industrial/ISM equipment	EN 60601-1-2, 4th edition EN 55035 EN 61000-6-2		
ESD	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
Radiated Field	10 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	EN 61000-4-4	3	A
Surge	±1 kV line to line; ± 2 kV line to earth on AC power port	EN 61000-4-5	3	A
Conducted RF Immunity	10 V _{RMS} , 0,15-80 MHz, 1 kHz/2 Hz 80% AM	EN 61000-4-6	3	A
Dips and Interruptions	200 – 277 V_{AC}: Drop-out to 0% for 10 ms Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 0% for 5 s 100 – 127 V_{AC}: Drop-out to 0% for 10 ms Dip to 40% for 5 cycles (100 ms) Dip to 70% for 25 cycles (500 ms) Drop-out to 0% for 5 s	EN61000-4-11 EN61000-4-11 EN61000-4-11 EN61000-4-11 EN 61000-4-11 EN 61000-4-11 EN 61000-4-11 EN 61000-4-11		A A (derate to 1000 W) A B A A (de-rate to 150 W) A (de-rate to 20 W) B

Safety Agencies Approvals

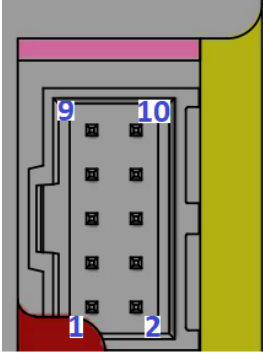
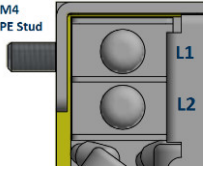
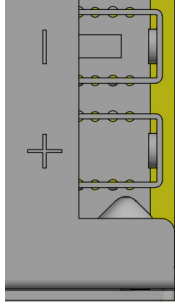
Certification Body	Safety Standards and file numbers	Category
CSA/UL	CSA C22.2 No. 62368-1, and UL 62368-1	Audio Video and Information Technology Equipment
	CSA C22.2 No.60601-1, ANSI/AAMI ES60601-1 3rd edition Including Risk Management Assessment	Medical
	IEC/EN 62368-1	Audio Video and Information Technology Equipment
IEC IEC60601-1 CB Certification	IEC/EN 60601-1 3rd edition Including Risk Management Assessment	Medical
	Directive 2014/35/EU: Electrical Safety: Low Voltage electrical equipment (LVD)	Audio Video and Information Technology Equipment
CE	Directive 93/42/CEE: Safety Requirement of the Medical Device	Medical
	Directive 2014/30/EU: Electromagnetic Compatibility (EMC)	
	Directive EU 2015/863: RoHS 3	
	Designed to meet IEC/EN/UL/CSA 61010-1, UL8750, CSA C22.2 No 250.13	

Outline Drawing and Connections

OVERALL DIMENSIONS: 107.0 x 206.0 x 41.0 mm (4.21 x 8.11 x 1.61 in)
WEIGHT: < 750 g (< 1.65 lb)



I / O Signal Connections

Signals Connector – P301			AC Input Connector – P1		
<p>Molex 90130-1110 Mates with Molex 90142-0010 (housing) Molex 90119-0109 (terminal) Use 22-24 AWG wires</p> 	Pin Ref.	Function		Pin ref.	Function
	1	RS-		1	L1
	2	RS+	2	L2	
	3	+5V _{SB}			
	4	RTN			
	5	+PS_Inhibit			
	6	I-Share			
	7	P_OK			
	8	VS_Logic			
	9	-PS_Inhibit			
10					
			DC Output Connector – P2		
			<p>BRASS M4 THREADED TERMINAL (tight to 0.8-1Nm, max deep screws 7 mm)</p> <p>Optional: Tab 6.35 mm x 0.81 mm On PCB</p>		

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