

## MAIN FEATURES

- Universal input voltage range, 90 – 305 V<sub>AC</sub>, MoOP; 90 – 264 V<sub>AC</sub>, MoPP
- Input inrush current limiting
- 1200 W rated power
- High efficiency up to 94%
- Single 24 and 48 V<sub>DC</sub> output voltage available
- Active PFC, EN61000-3-2 compliant (Class C, >25% load)
- Low earth / touch leakage current
- Fan speed control function
- Over temperature, OV, OC and SC protections
- +12 V, 0.5 A; +5 V, 1 A Stand by outputs
- Built-in current sharing and OR-ing for parallel operation and N+1 redundancy
- Remote On / Off signal
- Power good and remote sense signals
- All packages fit 1U applications
- Medical safety approval to IEC 60601-1 3<sup>rd</sup> edition, 2x MoPP rated and BF appliances compatible
- IEC 60601-1-2 4<sup>th</sup> edition EMC compliant
- RoHS 3 compliant (Directive 2015/863/EU)
- Up to 4000 m altitude operation (MoPP)
- PMBus™ digital power-management protocol supported



BF APPLIANCES COMPATIBLE

## DESCRIPTION

The medical grade MDP1200 series of AC-DC power supplies offer increased embedded power in three (3) compact 1U compatible packages, high energy efficiency and wide versatility.

The series provides a steady 1200 W of regulated DC power through 180-305 V<sub>AC</sub> and 1000 W through 85-137 V<sub>AC</sub> input voltage ranges in a single output of 24 or 48 V<sub>DC</sub>.

The MDP1200 series is available in three (3) compact 1U height compatible packages; one, enclosed with a built-in front mounted pair of fans and two (available only 24V variant), U-shaped chassis with or without protective cover, to facilitate system integration.

By converting AC power at a 94% typical efficiency rate, the MDP1200 series generates very little heat allowing for optimal thermal management.

The series offers a 12 V<sub>DC</sub>, 0.5 A and a 5 V<sub>DC</sub>, 1 A stand-by outputs and the full set of protection features including 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 MDP1200 series supports digital power management over the PMBus™ communications protocol enabling interoperability with and easy integration into a system. In addition, analogue control signals include Power Good (P\_OK), Remote On / Off (+/-PS\_Inhibit) and Sense terminals (RS+, RS-).

Multiple MDP1200 units may be used in parallel mode for redundancy and / or higher power, made possible with the internal OR-ing and current sharing functions.

The dual front-mounted fan version provides the full output rated power up to 60 °C. Its fan rotation speed is digitally controlled to guarantee the minimum required airflow, minimizing audible noise for quiet operation, and enhancing the power supply service life time. Rated power is also achieved in the U-chassis variants, with or without perforated cover, when providing them with an 800 LFM airflow from top side up to 55 °C. All variants can be operated up to 70 °C de-rating the output power.

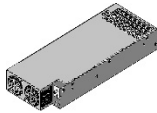
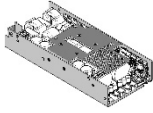
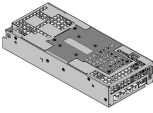
The MDP1200 series complies with the 3<sup>rd</sup> edition of the IEC60601-1 and ANSI/AAMI ES/EN 60601-1 safety standards for medical equipment requiring 2x MoPP protection grade. It is suitable for BF rated medical equipment under specific conditions.

The MDP1200 series meets the EN 60601-1-2 EMC limits of Class B for conducted and radiated emissions as well as the IEC/EN61000-3 for flicker and harmonics content. It also meets the IEC 60601-1-2 4<sup>th</sup> edition for EM immunity.

### MARKET SEGMENTS AND APPLICATIONS

- X-Ray / CT Scanner
- Dental Equipment
- Laboratory / Analysis Equipment
- Medical Devices / Applications

### MODEL CODING AND OUTPUT RATINGS

Model Grade, Output Power	Output Voltages	Packages and Cooling	
Medical Grade: <b>MDP1200-</b>	24 VDC: <b>-US24-</b>	 Front Mounted Fans: <b>-FF</b>	 U-Chassis External Forced Air Cooling: <b>-UCF</b> (only available for the 24V variant)
	48 VDC: <b>-US48-</b>		 Perforated Cover External Forced Air Cooling: <b>-PCF</b> (only available for the 24V variant)

Output Parameter	24V		48V	
	180-305V <sub>AC</sub> 163-300V <sub>DC</sub>	85-137V <sub>AC</sub> 120-163V <sub>DC</sub>	180-305V <sub>AC</sub> 163-300V <sub>DC</sub>	85-137V <sub>AC</sub> 120-163V <sub>DC</sub>
V1 Nom Voltage	24 V <sub>DC</sub>		48 V <sub>DC</sub>	
V1 Adjust Range	±5% V <sub>NOM</sub>			
V1 Rated Power	1200 W	1000 W	1200 W	1000 W
V1 Rated Current	50 A	41.7 A	25 A	20.8 A
V1 Line Regulation	±0.1%			
V1 Load Line Cross Regulation	±2%			
V1 Ripple & Noise	1% Peak-to-peak			
V1 Transient response	±5%V1 to 25% load change at 1 A/μs			
V1 Over Current Protection	<75 A		<37.5 A	
V1 Over Voltage protection	116% V <sub>NOM</sub> < V <sub>OUT</sub> < 145% V <sub>NOM</sub>			
V1 Max Out Capacitance	16000 μF		8000 μF	
12V <sub>SB</sub> Nominal Voltage	12 V <sub>DC</sub> (stand-by output voltage is referred to the same V1 output voltage return)			
12V <sub>SB</sub> Rated Current	0.5 A (maximum +12V <sub>SB</sub> and +5V <sub>SB</sub> combined output power is 6 W)			
12V <sub>SB</sub> Ripple & Noise	120 mV Peak-to-peak			
12V <sub>SB</sub> Line Cross Regulation	±5%			
5V <sub>SB</sub> Nominal Voltage	5 V <sub>DC</sub> (stand-by output voltage is referred to the same V1 output voltage return)			
5V <sub>SB</sub> Rated Current	1 A (maximum +12V <sub>SB</sub> and +5V <sub>SB</sub> combined output power is 6 W)			
5V <sub>SB</sub> Ripple & Noise	50 mV Peak-to-peak			
5V <sub>SB</sub> Load, line cross Regulation	±5%			

## INPUT SPECIFICATIONS

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
<b>AC Input Voltage</b>	PS starts at 85 V <sub>AC</sub> at all load conditions Operating input voltage range MDP1200 is designed to operate with a square or trapezoidal input voltage wave form (i.e. from UPS)	85	100-277	305	V <sub>RMS</sub>
<b>DC Input Voltage</b>	Built in fuses has been safety certified up to 250V <sub>DC</sub> . Operating the MDP1200 above that limit up to 300 V <sub>DC</sub> , does require an external fuse protection. (*)	120	-	300	V <sub>DC</sub>
<b>Input Frequency</b>		47	50/60	63	Hz
<b>Input Current</b>	At 180 V <sub>AC</sub> , maximum load, 50 / 60 Hz At 85 V <sub>AC</sub> , 1000 W load, 50 / 60 Hz 163 V <sub>DC</sub> , maximum load 120 V <sub>DC</sub> , 1000 W	-	-	8.0 14.5 9.0 10.0	A <sub>RMS</sub> A
<b>Inrush Current</b>	At power-on asserted Cold start, 25 °C ambient, full load Any point of the AC input sine				
	230 V <sub>AC</sub>	-	-	30	A
	277 V <sub>AC</sub>	-	-	50	A
<b>Fusing</b>	High breaking, 16 / 20 A, 277 V <sub>AC</sub> (250 V <sub>DC</sub> ) on each AC lines.	-	-	16 / 20	A
<b>Efficiency</b>	<b>24, 48V variants:</b> At 120 V <sub>AC</sub> , 20% rated load 50% rated load 100% rated load At 230 V <sub>AC</sub> , 20% rated load 50% rated load 100% rated load	88 92 92 90 93 94	- - - - - -	- - - - - -	%
<b>Input Power Consumption</b>	At power on, no load, 100-277 V <sub>AC</sub> range, FF At power on, no load, 100-277 V <sub>AC</sub> range UCF/PCF Stand by, no load, nominal 100-277 V <sub>AC</sub> range	- - -	7.0 6.0 4.0	- - -	W
<b>Power Factor</b>	Any nominal input line voltage, 50/60 Hz, from 50 to 100% maximum load	0.95	-	-	-
<b>THDi</b>	From 50 to 100% rated load, 100-277 V <sub>AC</sub> , 50/60 Hz.	-	-	20	%
<b>Harmonic Current Fluctuations and Flicker</b>	Complies with EN 61000-3-2 at 230 V <sub>AC</sub> , 50/60 Hz, Class A, D. Complies with EN 61000-3-2 Class C at 230 V <sub>AC</sub> , 50/60 Hz, >300 W load. Complies with EN 61000-3-3 at nominal voltages and full load.				
<b>Earth Leakage Current</b>	Normal conditions 115 V <sub>RMS</sub> , 60 Hz 230 V <sub>RMS</sub> , 50 Hz 264 V <sub>RMS</sub> , 60 Hz (worst case)	- - -	130 240 -	- - 400	μA
<b>Touch Leakage Current</b>	264 V <sub>RMS</sub> , 60 Hz Normal Condition (NC) Single Fault Condition (SFC)	- - -	- - -	100 500	μA
<b>Patient Leakage Current</b>	264 V <sub>RMS</sub> , 60 Hz Normal Condition (NC) Single Fault Condition (SFC)	- - -	- - -	100 500	μA

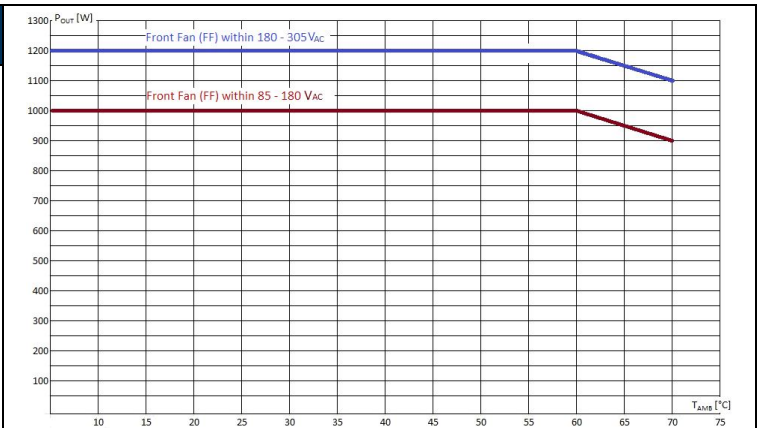
(\*) Suggested fuse SIBA 5012434.16 and fuse holder SIBA 5105805.1

## OUTPUT SPECIFICATIONS

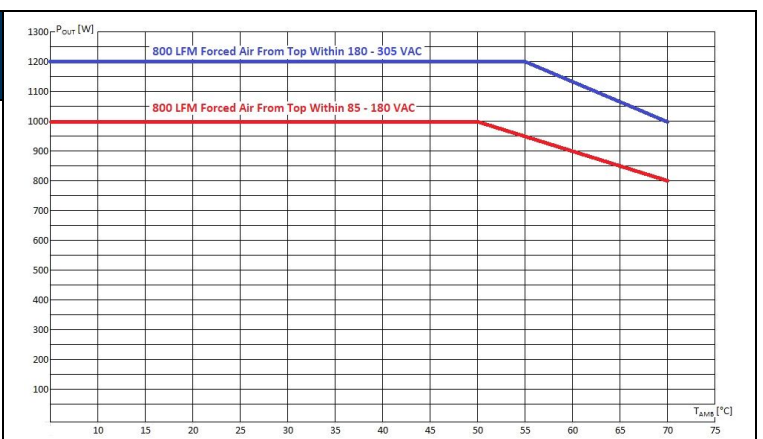
Specification	Test Conditions / Notes	Min.	Nom.	Max.	Units
<b>V1 Output Voltages</b>	±0.5% set point accuracy RS+ closed on +V1, RS- closed on V1 RTN, at 6% load.	-	24 48	-	V
<b>V1 Output Power Rating</b>	FF variant at 180 – 305 V <sub>AC</sub> UCF, PCF variants at 180-305 V <sub>AC</sub> , 800 LFM FF variant at 85 – 137 V <sub>AC</sub> UCF, PCF variants at 85 – 137 V <sub>AC</sub> , 800 LFM			1200 1200 1000 1000	W
<b>12V<sub>SB</sub> Output Voltage</b>		-	12	-	V
<b>12V<sub>SB</sub> Output Current</b>	FF, UCF and PCF packages up to 70 °C	-	-	0.5	A
<b>5V<sub>SB</sub> Output Voltage</b>		-	5	-	V
<b>5V<sub>SB</sub> Output Current</b>	FF, UCF and PCF packages up to 70 °C	-	-	1	A
<b>V1 Voltage Adjustment Range</b>	Manually by push up and down buttons	-	-	±5	%V1
<b>V1 Load-Line-Cross Regulation</b>	V <sub>AC</sub> : 85 – 305 V <sub>RMS</sub> ; I <sub>1</sub> : 0 – 100%	-	-	±2	%V1
<b>5V<sub>SB</sub>, 12V<sub>SB</sub> Load-Line-Cross regulation</b>	V <sub>AC</sub> : 85 – 305 V <sub>RMS</sub> ; I <sub>SB</sub> : 0 – 100%	-	-	±5	%V <sub>SB</sub>
<b>V1 Line Regulation</b>	V <sub>AC</sub> : 85 – 305 V <sub>RMS</sub>	-	-	±0.1	%V1
<b>Transient Response:</b>	25% load changes at 1 A/μs				
<b>V1, 12V<sub>SB</sub>, 5V<sub>SB</sub> Voltage Deviation</b>	24V at 1000 μF load / I <sub>OUT</sub> > 2.5 A 48V at 560 μF load / I <sub>OUT</sub> > 1.25 A 12V <sub>SB</sub> , 5V <sub>SB</sub> at 0-2200 μF load	-	-	±5	%V1 %V <sub>SB</sub>
<b>V1 Ripple and Noise</b>	Rated load, Peak-to-peak, 20 MHz BW. (100 nF ceramic, 10 μF tantalum at load)	-	-	1	%V1
<b>V1 Start-up Rise Time</b>	85 < V <sub>IN</sub> < 305, any load conditions.	10	-	150	ms
<b>Start-up Delay</b>	V1 in regulation after de-asserting PS_Inhibit V1 in regulation after AC is applied (worst case: 85 V <sub>AC</sub> ) 5V <sub>SB</sub> in regulation after AC is applied (worst case: 85 V <sub>AC</sub> )	-	-	1700 2200 500	ms
<b>Turn-on Overshoot</b>		-	-	10 10	%V1 %V <sub>SB</sub>
<b>V1 Hold-up Time</b>	At nominal V <sub>IN</sub> , full load SEMI F47-0706 compliant at ≥208 V <sub>AC</sub> 50% sag (104 V) 30% sag (145 V) 20% sag (166 V)	10 200 500 1000	- - - -	- - - -	ms
<b>Minimum Load</b>	V1, 12V <sub>SB</sub> , 5V <sub>SB</sub>	0	-	-	A
<b>Maximum Load Capacitance</b>	V1: 24 V <sub>DC</sub> V1: 48 V <sub>DC</sub>	- -	- -	16000 8000	μF
<b>V1 Current Sharing Accuracy</b>	Parallel operation up to four units. Two units in parallel at I <sub>1</sub> rated load. I-Share signals connected together. RS+, RS- signals connected together and to the load. Max load at start up 1200 W, operating 2000 W, 180 ÷ 305 V <sub>AC</sub> . Max load at start up 1000 W, operating 1667 W, 85 ÷ 137 V <sub>AC</sub> . (referred to -FF, -PCF and -UCF)	40	-	60	%I <sub>1</sub>
<b>V1 Remote Sense</b>	RS+ and RS- power path voltage loss compensation	-	-	0.36	V

**OUTPUT POWER DE-RATING CURVES**

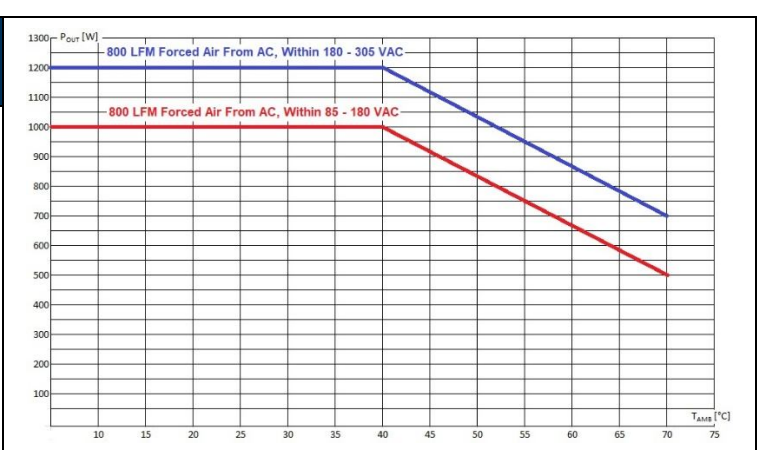
**Front Fan (FF); 24, 48 V**  
Any orientation, V1 nominal



**U-Chassis and Perforated Cover**  
**Forced Air Cooling (UCF, PCF); 24 V**  
Air flow from top, V1 nominal



**U-Chassis and Perforated Cover**  
**Forced Air Cooling (UCF, PCF); 24 V**  
Air flow from AC side, V1 nominal



## PMBus

The MDP1200 does support communication according the PMBus 1.2 protocol via SDA, SCL and #SMBALERT signals as defined in the SMBus Specification version 2.0.

The power supply shall not load the SMBus if it has no input power (SCL & SDA lines should go to High-Z).

The pull-up resistors (2.2 k $\Omega$ ) for these signals shall be external to the power supply and referenced to an external +3.3V bus voltage.

The DSP circuits inside the power supply are powered by the standby output.

The PMBus is active whatever input power is applied to the power supply or a parallel redundant power supply in the system, provided that their 12V<sub>SB</sub> are connected in parallel.

Maximum speed of SMBus is 100 kHz.

The ADDR0 and ADDR1 signals, are inputs to the power supply that control the PMBus address assigned to the power supply.

On the system side, the ADDR0 and ADDR1 signals will either be connected to return through a 1 k $\Omega$  pull-down resistor or connected to +3.3V external bus voltage through a 1 k $\Omega$  pull-up resistor.

The address shall be derived from the logic of this pin as indicated on Outline Drawing and Connections section.

The power supply is a slave only on SMBus device.

For a comprehensive description of MDP1200 PMBus management, do refer to the application note, "AN\_MDP-DDP1200 PMBus Mgt\_Rev00". Examples of MDP1200 parameters available through communication bus are:

- Input voltage status
- Output voltages +V1 measured value
- Output current on +V1 measured value
- Current sharing status
- Thermal health measured value
- Fan health status
- Power-On / Working hours
- Product information
- Status information

Failures shall be reported by PMBus for all failure types:

- Fan fault
- Protections failure (OV, OC, OT)
- Voltages out of specification.

**BASE SIGNALS / CONTROLS (ACCESSIBLE FROM SIGNAL CONNECTOR P204)**

Signal	Notes	Min	Typ.	Max	Unit
<b>+PS_Inhibit (Active High)</b>	Input low voltage ( $I_{IN}= 0 \mu A$ )	0	-	0.8	V
	Input high voltage ( $I_{IN}= 500 \mu A$ at 5.5 V)	2.5	-	5.5	
<b>-PS_Inhibit (Active Low)</b>	V1 disabled when PS_Inhibit is pulled high				
	V1 enabled when PS_Inhibit is floating or low				
<b>5V<sub>SB</sub> and 12V<sub>SB</sub></b>	5V <sub>SB</sub> and 12V <sub>SB</sub> not affected by PS_Inhibit				
	Input low voltage ( $I_{IN}= -800 \mu A$ at 0 V)	0	-	0.8	V
Input high voltage ( $I_{IN}= -200 \mu A$ at 2.5 V)	2.5	-	5.5		
<b>(I<sub>IN</sub>= 700 μA at 5.5 V)</b>	V1 disabled when -PS_Inhibit is pulled low				
	V1 enabled when -PS_Inhibit is floating or high				
<b>Power_OK (*) (PS_OK)</b>	5V <sub>SB</sub> and 12V <sub>SB</sub> not affected by -PS_Inhibit				
	Logic level low (<10 mA sinking)	-	-	0.7	V
Logic level high (200 μA sourcing)	2.4	-	3.45		
<b>Low to high time after V1 in regulation</b>	Low to high time after V1 in regulation	150	-	350	ms
	Power down warning time	2	-	-	
<b>I_Share</b>	The I_SHARE signals shall be daisy chained among power supplies operating in parallel. On a single power supply operating it provides current measurement on V1 output. On multiple power supplies operating in parallel, it provides current measurement on master V1 output.				
<b>SDA, SCL, #SMBALERT, ADDR0, ADDR1</b>	These are signals which support PMBus communication protocol as specified in the application note AN_MDP-DDP1200 PMBus Mgt_Rev00.				
<b>RSVD RX, RSVD TX</b>	Mainly intended for internal Enedo use, these RX and TX signals - available at the output signal connector P204 - may be used to access some DSP functions (monitoring, threshold settings, debug functions). These signals work as an UART Rx/Tx port and can also work as a RS-232 Rx/Tx port by building in the "RS-232 LINE DRIVERS/RECEIVERS" IC				
<b>5V<sub>SB</sub> Output (**)</b>	Active and in regulation after an $85 < V_{AC} < 305$ is applied Not affected by PS_Inhibit. Available on P204, pin#4	-	-	500	ms
<b>12V<sub>SB</sub> Output (***)</b>	Active and in regulation after an $85 < V_{AC} < 305$ is applied Not affected by PS_Inhibit. Available on P204, pin#16	-	-	500	ms

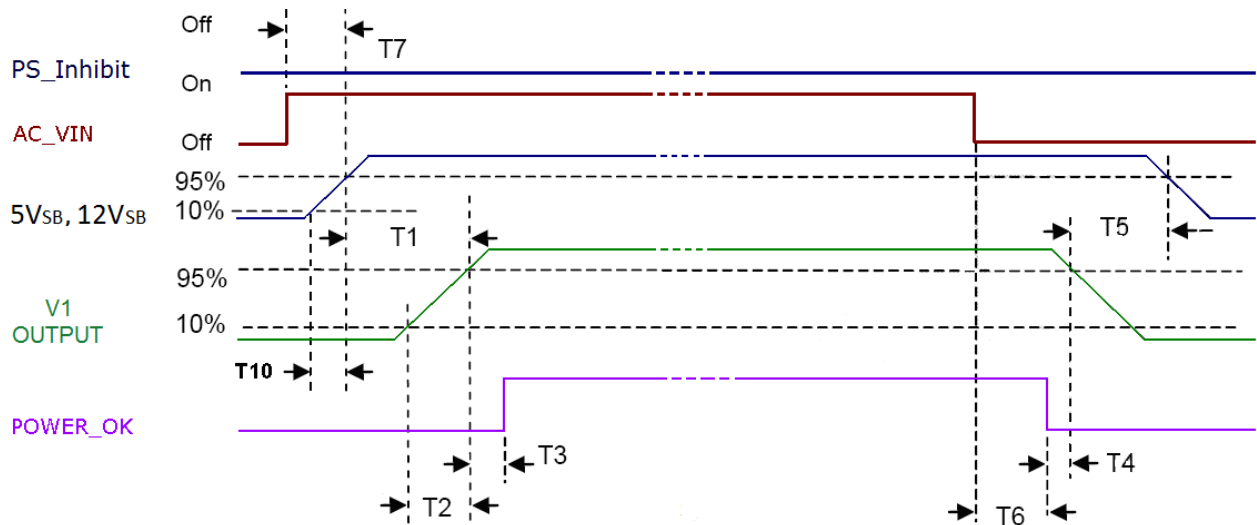
(\*) When V1 is On, a P\_OK low may indicates V1 under voltage condition. When two MDP1200 operate in parallel, P\_OK low in one unit indicates that it is not sharing the expected amount of current (current sharing fault). A 3.3 kΩ internal pull up to a 3.3 V internal reference voltage is used; do not add any other external pull up.

(\*\*) The 5V<sub>SB</sub> outputs of two or more MDP1200s operating in parallel, cannot be connected in parallel in turn, since doing so results in power supplies damage.

(\*\*\*) The 12V<sub>SB</sub> outputs of two or more MDP1200s operating in parallel can be connected in parallel in turn, taking into account that the maximum available power will not be higher of a single operating power supply one.

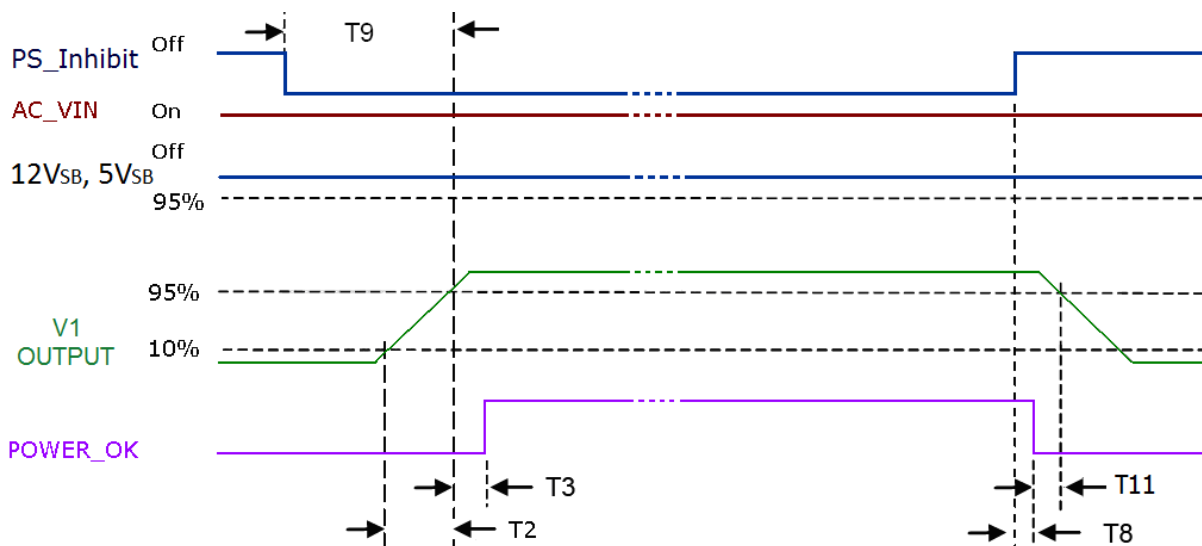
**BASE SIGNALS / CONTROLS TIMING**

**AC/DC input Off-to-On and On-to-Off timings:**



12V <sub>SB</sub> /5V <sub>SB</sub> On to V1 On	250 ms ≤ T1 ≤ 1700 ms
V1 rise time	10 ms ≤ T2 ≤ 150 ms
12V <sub>SB</sub> /5V <sub>SB</sub> rise time	3 ms ≤ T10 ≤ 150 ms
V1 On – POWER_OK delay	150 ms ≤ T3 ≤ 350 ms
Power down warning	T4 ≥ 2 ms
V1 Off to 12V <sub>SB</sub> /5V <sub>SB</sub> Off	T5 ≥ 0.5 s (V1 load > 25 W)
AC Off to POWER_OK low	T6 ≥ 8 ms
AC_On to 12V <sub>SB</sub> /5V <sub>SB</sub> On	T7 ≤ 500 ms

**PS\_Inhibit Off-to-On and On-to-Off timings:**



V1 rise time	10 ms ≤ T2 ≤ 150 ms
V1 On – POWER_OK delay	150 ms ≤ T3 ≤ 350 ms
Turn-Off warning	T11 ≥ 1 ms
PS_Inhibit – POWER_OK low delay	T8 ≤ 3 ms
PS_Inhibit – V1 On delay	T9 ≤ 1700 ms



## PROTECTION FEATURES

Specification	Test Conditions / Notes	Min.	Nominal	Max.	Units
<b>Input Under Voltage</b>	Auto-recovering, hiccup mode.	58	75	82	V <sub>AC</sub>
<b>Input Fuse</b>	High breaking, 16 / 20 A, 277 V <sub>AC</sub> (250 V <sub>DC</sub> ) on each AC lines.	-	-	16/20	A
<b>Over Current</b>	At nominal input voltages V1: Hiccup mode, auto-recovering 5V <sub>SB</sub> : Auto-recovering 12V <sub>SB</sub> : Hiccup mode, auto-recovering	-	-	150	%I <sub>Rated</sub> A A
<b>Short Circuit</b>	At nominal input voltages V1: Hiccup mode or latch 5V <sub>SB</sub> : Auto-recovery 12V <sub>SB</sub> : Hiccup mode, auto-recovering.	-	-	-	
<b>Over Voltage</b>	V1, Power shut down, latch off. 12V <sub>SB</sub> , Hiccup mode, auto-recovering.	116	-	145	%V <sub>NOM</sub>
<b>Over Temperature (ambient)</b>	Hiccup mode, auto-recovering.	70	-	-	°C
<b>Over Temperature (on secondary side)</b>	Hiccup mode, auto-recovering.	-	-	-	°C
<b>Fan Fault Protection</b>	Relevant to the "-FF" variant. The DSP monitors the signals (frequency generator) provided by both fans. If one fan fails, the DSP asserts maximum speed the other fan and provides an alarm indication through PMBus. If both fans fail, the DSP provides an alarm indication through LED and PMBus and after 20 s, does shut down V1. PS INHIBIT or AC/DC input have to be cycled to resume operations, after removed the fault.				
<b>Isolation: Primary-to-Secondary</b>	Reinforced	5660	-	-	V <sub>DC</sub>
		4000	-	-	V <sub>AC</sub>
<b>Isolation: Input-to-Earth</b>	Basic Production tested at 2642 V <sub>DC</sub>	2642	-	-	V <sub>DC</sub>
		1865	-	-	V <sub>AC</sub>
<b>Isolation: Output-to-Earth</b>	Basic	1500	-	-	V <sub>AC</sub>
<b>Means Of Protection: Primary to secondary</b>	2x MoPP (IEC 60601-1 3 <sup>rd</sup> edition) at 90 – 264 V <sub>AC</sub> , 50/60 Hz (120-300 V <sub>DC</sub> ) up to 4000 m				
<b>Means Of Protection: Input to Protection Earth</b>	2x MoOP (IEC 60601-1 3 <sup>rd</sup> edition) at 90 – 305 V <sub>AC</sub> , 50/60 Hz (120-300 V <sub>DC</sub> ) up to 4000 m				
<b>Means Of Protection: Output to Protection Earth</b>	1x MoPP (IEC 60601-1 3 <sup>rd</sup> edition) at 90 – 264 V <sub>AC</sub> , 50/60 Hz (120-300 V <sub>DC</sub> ) up to 4000 m				
<b>Means Of Protection: Equipment Protection Class</b>	1x MoOP (IEC 60601-1 3 <sup>rd</sup> edition) at 90 – 305 V <sub>AC</sub> , 50/60 Hz (120-300 V <sub>DC</sub> ) up to 4000 m				
<b>Equipment Protection Class</b>	Class I, compatible with BF (Body Floating) ME (Medical Equipment)				

## ENVIRONMENTAL SPECIFICATIONS

Specification	Test Conditions / Notes	Min	Nominal	Max	Units
<b>Operating Temperature Range</b>	No de-rating up to 60 °C (FF) and up to 55 °C (UCF/PCF) See de-rating curves above MDP1200 starts at -40 °C upon warm up delay	-20	-	60	°C
<b>Operating Temperature Range with De-rating</b>	See de-rating curves and conditions in the Output Specifications section	-	-	70	°C
<b>Storage Temperature</b>	As per IEC/EN 60721-3-1 Class 1K4	-40	-	85	°C
<b>Transportation Temperature</b>	As per IEC/EN 60721-3-2 Class 2K4				
<b>Humidity</b>	RH, Non-condensing Operating. Non-operating	-	-	90 95	% %
<b>Operating Altitude</b>	MoPP (90 – 264 V <sub>AC</sub> , 50/60 Hz, 120 – 300 V <sub>DC</sub> ) MoOP (90 – 305 V <sub>AC</sub> , 50/60 Hz) Power de-rating above 1800 m	-	-	4000 4000	m
<b>Shock</b>	<b>EN 60068-2-27</b> 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).				
<b>Vibration</b>	<b>EN 60068-2-64</b> Operating: Sine, 10 – 500 Hz, 1 g, 3 axes, 1 oct/min., 60 min. Random, 5 – 500 Hz, 0.02 g <sup>2</sup> /Hz, 1 g <sub>RMS</sub> , 3 axes, 30 min. Non-Operating: 5 – 500 Hz, 2.46 g <sub>RMS</sub> (0.0122 g <sup>2</sup> /Hz), 3 axes, 30 min.				
<b>MTBF</b>	Full load, 25 °C ambient, 100% duty cycle, Full load, 40 °C ambient, 75% duty cycle Telcordia SR-332 Issue 2	700.000 600.000	- -	- -	Hours
<b>Useful Life</b>	Nominal V <sub>IN</sub> , 80% load, 40 °C ambient (IPC9592)	-	7	-	Years

### ELECTROMAGNETIC COMPATIBILITY (EMC) – EMISSIONS

Phenomenon	Conditions / Notes	Standard	Equipment/Performance Class
<b>Conducted</b>	115, 230 V <sub>RMS</sub> , Maximum load.	EN 60601-1-2 (Medical)	B
<b>Radiated</b>		EN 60601-1-2 (Medical)	B (*)
<b>Line Voltage Fluctuation and Flicker</b>	At 20%, 50% and 100% maximum load. Nominal input voltages	EN 61000-3-3	
<b>Harmonic Current</b>	230 V <sub>AC</sub> input voltage, 50 / 60 Hz	EN 61000-3-2	A, D
<b>Emission</b>	230 V <sub>AC</sub> , 50 / 60 Hz, >300 W load	EN 61000-3-2	C

(\*) Performance referred to the enclosed package with additional HF chokes on input, output power and signal cables.  
Radiated emission relevant to the UCF and PCF package variants, should be assessed at system level.

### ELECTROMAGNETIC COMPATIBILITY (EMC) – IMMUNITY

Phenomenon	Conditions / Notes	Standard	Test Level	Criteria
	<b>Reference standard for the medical version</b>	<b>EN 60601-1-2, 4<sup>th</sup> Edition</b>		
<b>ESD</b>	15 kV air discharge, 8 kV contact, at any point of the system.	EN 61000-4-2	4	A
<b>Radiated Field</b>	10 V/m, 20-2700 MHz, 1 kHz, 80% AM.	EN 61000-4-3	3	A
<b>Electric Fast Transient Surge</b>	±2 kV on AC power port for 1 minute ±2 kV line to line; ± 4 kV line to earth on AC power port	EN 61000-4-4 EN 61000-4-5	3 4	A A
<b>Conducted RF Immunity</b>	10 V <sub>RMS</sub> , 0, 15-80 MHz, 1 kHz, 80% AM	EN 61000-4-6	3	A
<b>Dips and Interruptions</b>	<b>200 – 264 V<sub>AC</sub>:</b> 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		A (*) A (de-rate to 900 W) A B
	<b>100 – 127 V<sub>AC</sub>:</b> 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	EN 61000-4-11 EN 61000-4-11 EN 61000-4-11 EN 61000-4-11		A (*) A (de-rate to 400 W) A (de-rate to 700 W) B

(\*\*) Performance referred to 5VSB, 12VSB and V1 (PS\_OK goes to low level after 8 ms as per timing described at page 8)

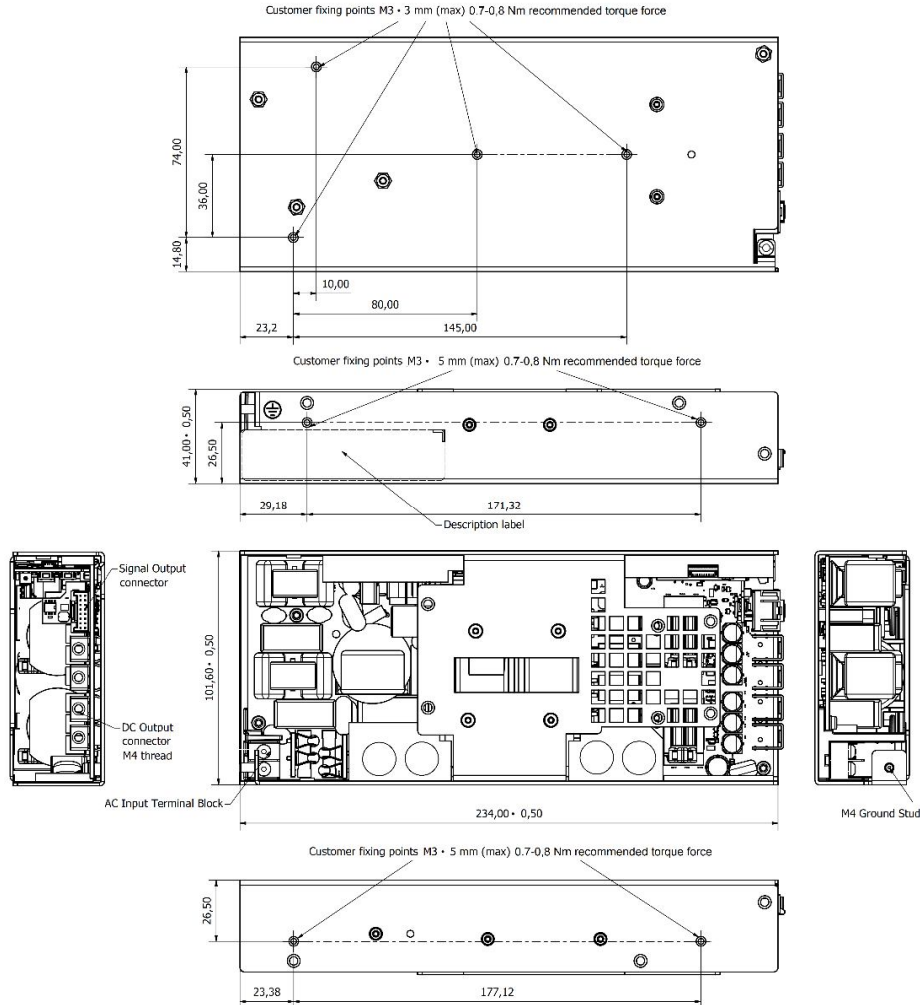
### SAFETY AGENCIES APPROVALS

Certification Body	Safety Standards and file numbers	Category
<b>CSA / UL</b>	CSA C22.2 No.60601-1, ANSI/AAMI ES60601-1 3 <sup>rd</sup> Edition + A1	Medical
	IEC/EN 60601-1 3 <sup>rd</sup> edition+A1	Medical
	Directive 93/42/CEE: Safety Requirement of the Medical Device	Medical
<b>CE</b>	Directive 2014/30/EU: Electromagnetic Compatibility (EMC)	
	Directive 2015/863/EU: RoHS 3	
	Meets all essential requirements of the standard IEC/EN/UL/CSA 61010-1 2 <sup>nd</sup> edition	

**OUTLINE DRAWING AND CONNECTIONS – U-CHASSIS FORCED AIR COOLING (-UCF)**

Overall dimensions: 101.6 x 234.0 x 41.0 mm (4.00 x 9.21 x 1.61 in)

Weight: 1150 g (2.53 lb)

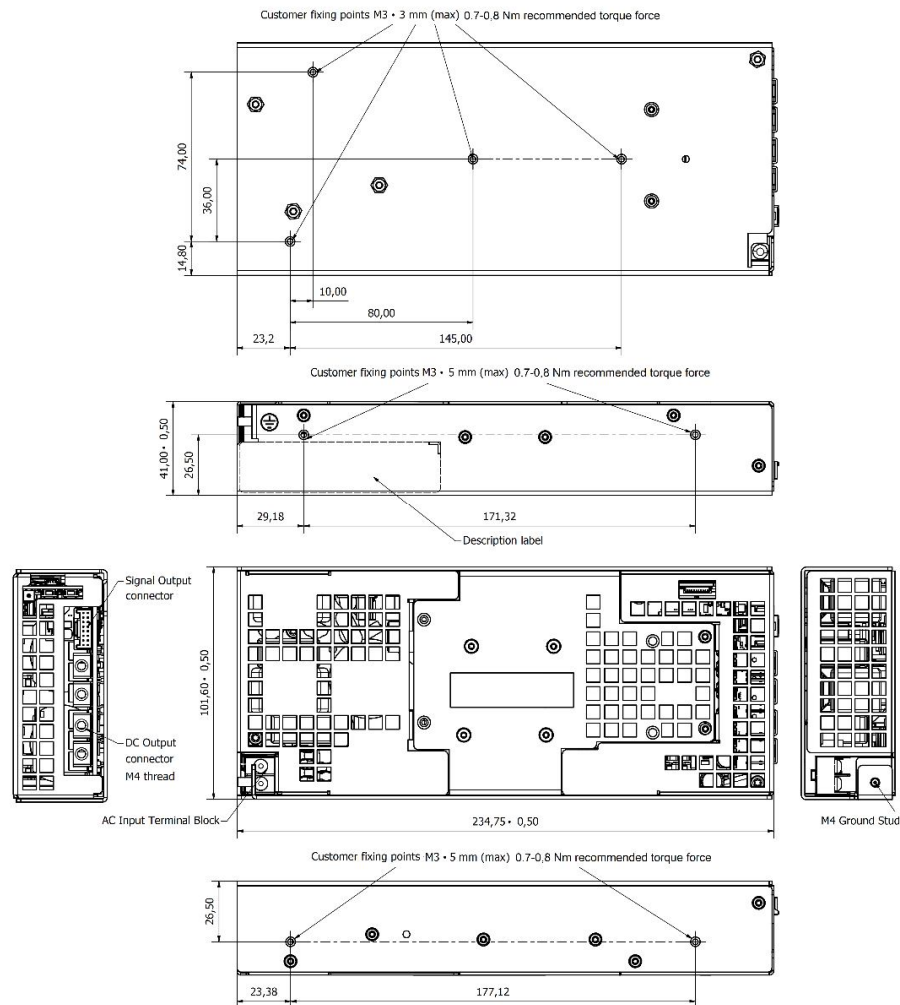


AC INPUT CONNECTIONS		DC OUTPUT CONNECTIONS		SIGNAL CONNECTOR		ADDITIONAL CONTROL FUNCTIONS	
P1: AMTEK TB25C-B02P-13-00A-L M4 GROUND STUD		P200, P201, P202, P203: BRASS M4 THREADED TERMINAL (tight to 0.8-1Nm, max deep screws 7 mm)		P204: MOLEX 501876-1640		SW600, SW601, DL600:	
Ref.	Function	Ref.	Function	Ref.	Function	Ref.	Function
1	Line 1		24V Optional	1	RMT (-)	SW600	V1_ADJ (UP)
2	Line 2		24 / 48V	2	RMT (+)		
3	Protection Earth	P200	+V1	3	I-SHARE	SW601	V1_ADJ (DOWN)
		P201	+V1	4	+5V <sub>SB</sub>	DL600	Bi-colour LED
		P202	V1 RTN	5	PS_INHIBIT		Off
		P203	V1 RTN	6	PS_OK		No AC/DC input power provided
				7	SCL		
				8	SDA		
				9	#SMBALERT	Blinking Green	Input power good, standby active, V1 inhibited
				10	ADDR0		
				11	-PS_INHIBIT	Steady Green	V1 Active
				12	ADDR1		
				13	RSVD_RX (OUT)	Steady or Blinking red	Power Supply Fault
				14	RSVD_TX (OUT)		
				15	RTN		
				16	+12V <sub>SB</sub>		

**OUTLINE DRAWING AND CONNECTIONS – PERFORATED COVER FORCED AIR COOLED (-PCF)**

Overall dimensions: 101.6 x 234.7 x 41.0 mm (4.00 x 9.24 x 1.61 in)

Weight: 1250 g (2.75 lb)

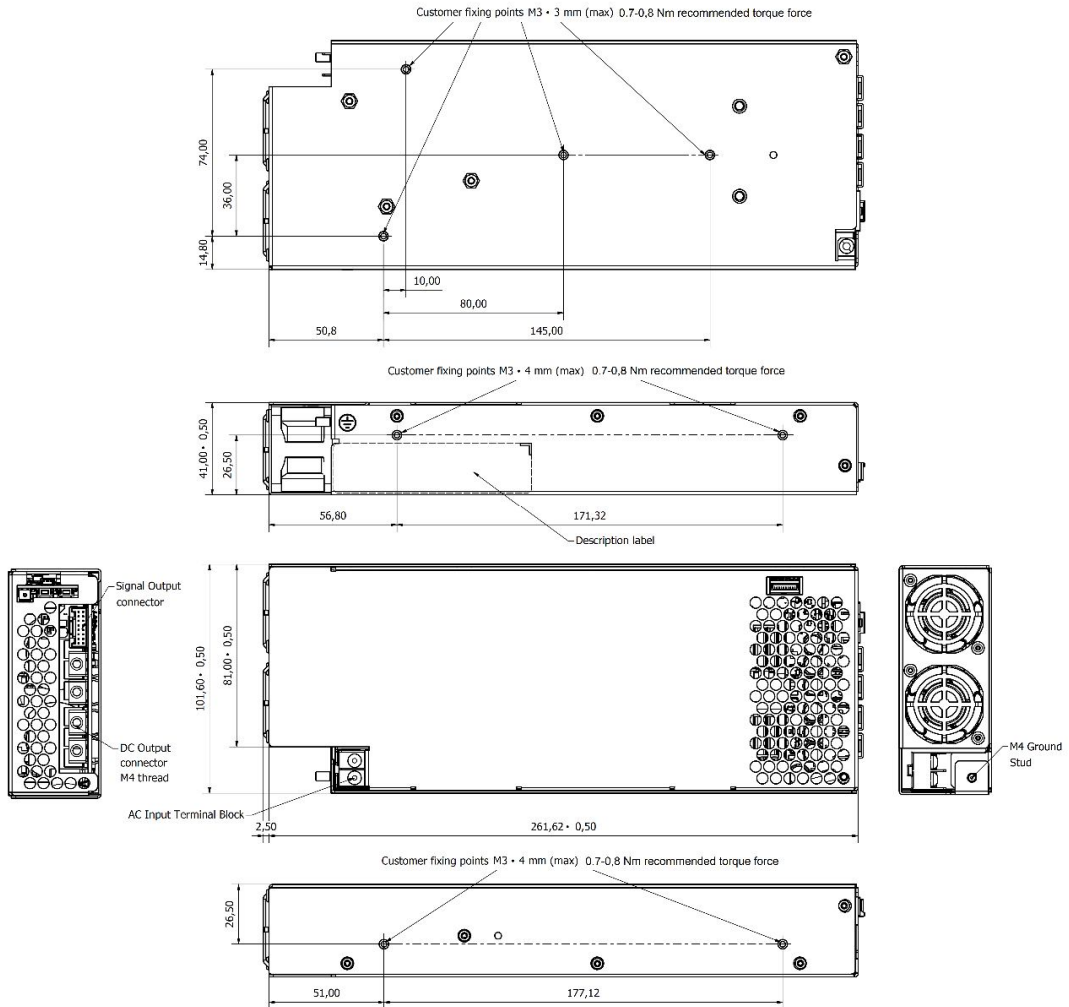


AC INPUT CONNECTIONS			DC OUTPUT CONNECTIONS			SIGNAL CONNECTOR		ADDITIONAL CONTROL FUNCTIONS	
P1: AMTEK TB25C-B02P-13-00A-L M4 GROUND STUD			P200, P201, P202, P203: BRASS M4 THREADED TERMINAL (tight to 0.8-1Nm, max deep screws 7 mm)			P204: MOLEX 501876-1640		SW600, SW601, DL600:	
<p>M4 GROUND STUD</p> <p>P1</p>			<p>DL600</p> <p>SW600</p> <p>SW601</p> <p>P200 P201 P202 P203 P204</p>						
Ref.	Function		Ref.	Function		Ref.	Function	Ref.	Function
1	Line 1			24V Optional	24 / 48V	1	RMT (-)	SW600	V1_ADJ (UP)
2	Line 2					2	RMT (+)		
3	Protection Earth					3	I-SHARE		
			P200	+V1	+V1	4	+5V <sub>SB</sub>	SW601	V1_ADJ (DOWN)
			P201	+V1	-	5	PS_INHIBIT		
			P202	V1 RTN	V1 RTN	6	PS_OK	DL600	Bi-colour LED
			P203	V1 RTN	-	7	SCL		
						8	SDA	Off	No AC/DC input power provided
						9	#SMBALERT		
						10	ADDR0	Blinking Green	Input power good, standby active, V1 inhibited
						11	-PS_INHIBIT		
						12	ADDR1	Steady Green	V1 Active
						13	RSVD_RX (OUT)		
						14	RSVD_TX (OUT)	Steady or Blinking red	Power Supply Fault
						15	RTN		
						16	+12V <sub>SB</sub>		

**OUTLINE DRAWING AND CONNECTIONS – FRONT MOUNTED FAN (-FF)**

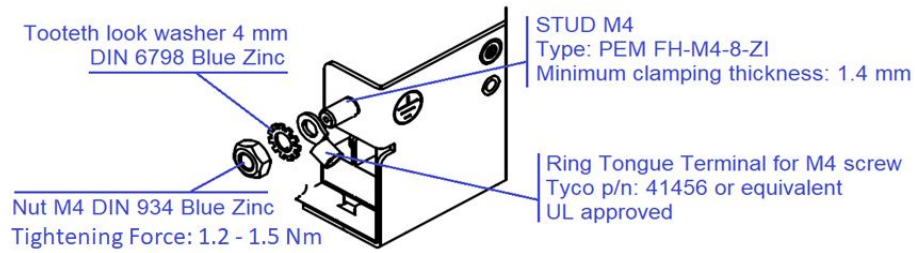
Overall dimensions: 101.6 x 264.12 x 41.0 mm (4.00 x 10.40 x 1.61 in)

Weight: 1550 g (3.42 lb)



AC INPUT CONNECTIONS			DC OUTPUT CONNECTIONS			SIGNAL CONNECTOR		ADDITIONAL CONTROL FUNCTIONS	
P1: AMTEK TB25C-B02P-13-00A-L M4 GROUND STUD			P200, P201, P202, P203: BRASS M4 THREADED TERMINAL (tight to 0.8-1Nm, max deep screws 7 mm)			P204: MOLEX 501876-1640		SW600, SW601, DL600:	
<p>M4 GROUND STUD</p>									
Ref.	Function		Ref.	Function		Ref.	Function	Ref.	Function
1	Line 1			24V Optional	24 / 48V	1	RMT (-)	SW600	V1_ADJ (UP)
2	Line 2			+V1	+V1	2	RMT (+)	SW601	V1_ADJ (DOWN)
3	Protection Earth		P200	+V1	-	3	I-SHARE	DL600	Bi-colour LED
			P201	+V1	-	4	+5V <sub>SB</sub>		
			P202	V1 RTN	V1 RTN	5	PS_INHIBIT		
			P203	V1 RTN	-	6	PS_OK		
						7	SCL	Off	No AC/DC input power provided
						8	SDA		
						9	#SMBALERT	Blinking Green	Input power good, standby active, V1 inhibited
						10	ADDR0	Steady Green	V1 Active
						11	-PS_INHIBIT	Steady or Blinking red	Power Supply Fault
						12	ADDR1		
						13	RSVD_RX (OUT)		
						14	RSVD_TX (OUT)		
						15	RTN		
						16	+12V <sub>SB</sub>		

## PROTECTION EARTH CONNECTION INSTRUCTIONS



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