TRACO POWER

AC/DC Medical Power Supplies

TPP 450 Series, 450 Watt

- **High power density 3" x 5.8" encased medical power supply**
- **450 Watt up to 65°C without derating 320 Watt fanless operation without derating up to 50°C**
- **Medical certification to IEC/EN/ES 60601-1 3rd edition for 2×MOPP**
- **EMC compliance to IEC/EN/ES 60601-1-2 4th edition**
- **Risk management process according to ISO 14971 including risk management file**
- **Acceptance criteria for electronic assemblies according to IPC-A-610 Level 3**
- **Isolation (4000 VAC) and leakage current (< 100 µA) rated for BF applications**
- **Standard features: 5 V standby output 12 V aux output, Remote On/Off, Power Good Signal, variable fan speed**
- **Operating up to 5000 m altitude**
- **5 year product warranty**

IEC 60601-1 ES 60601-1 UL 62368-1

Open-frame version see TPP 450A Series

www.tracopower.com/overview/tpp450a

The TPP 450 Series of 450 Watt AC/DC power supplies feature a reinforced double I/O isolation system according to latest medical safety standards (60601-1 3rd edition, 2 × MOPP). The earth leakage current is below 100 µA what makes the units suitable for BF (body floating) applications. The excellent efficiency of up to 94% allows a high power density for the standard 3" x 5" packaging format.

Fanless operation power is 320W up to +50°C and 450W at +65°C with fan. Thus you can power your medical device in a quiet and hygienic way as you don't need to run a fan to cool down the power supply. High reliability is provided by use of industrial quality grade components and an excellent thermal management. It makes the products an ideal solution for medical devices and for demanding safety and space critical applications.

Models

Order Code	Output Power (max.)	Output Voltage (adj. ±8%)	Output Current (max.) *1	Efficiency (typ.)
TPP 450-112-M	450 Watt	12 VDC	37.5 A	91 %
TPP 450-115-M		15 VDC	30.0 A	92 %
TPP 450-124-M		24 VDC	18.75 A	93 %
TPP 450-136-M		36 VDC	12.5 A	93 %
TPP 450-148-M		48 VDC	9.4 A	94 %

Options

on demand (backorder with MOQ, non stocking items)	– for version with fan on top suffix **-M** has to be replaced by **-MB1** – model with 28 VDC / 16.1 A available – model with 53 V / 8.55 A available

*1 While fan is running

Input Specifications

Input voltage range	– AC range (universal input) – DC range – Power derating at low input voltage		85 – 264 VAC (47 – 63 Hz) 120 – 370 VDC 1.33 %/V below 100 VAC
Input current at full load	– at 100 VAC – at 240 VAC		5.8 A max. 2.4 A max.
Input protection	– Internal fuse in line and neutral		T 6.3 A / 250 VAC
Zero load power consumption (acc. ErP directive)		12 VDC models: other output models:	0.4 W typ. 0.8 W typ.
Leakage current	– at 264 VAC		100 µA max.
Power factor			0.95 min. (active power correction)

Output Specifications

Voltage set accuracy	– at 230 VAC		± 1%
Output voltage adjustment			± 8% (by trim potentiometer)
Regulation	– Input variation (85 - 264 VAC) – Load variation (0 - 100%)		0.2% max. 0.5% max.
Minimum load			not required
Temperature coefficient			0.02 %/K max.
Hold-up time	– at 115 VAC		14 ms typ.
Start-up time			2 s max.
Rise time			30 ms typ.
Ripple and noise (20 MHz Bandwidth)		12 VDC model: 15 VDC model: 24 VDC model: 28 VDC model: 36 VDC model: 48 VDC model: 53 VDC model:	250 mVp-p typ. (w. cap. 1µF/25V 1206 X7R MLCC) 300 mVp-p typ. (w. cap. 1µF/25V 1206 X7R MLCC) 240 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC) 280 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC) 360 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC) 480 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC) 530 mVp-p typ. (w. cap. 0.1µF/100V 1206 X7R MLCC)
Transiente response	– Peak deviation (50 - 75% load change) – Recovery time		3% Vout typ. 600 µs typ.
Overvoltage protection (Featured by main power output)			110 – 135% of Vout (latch mode)
Overload protection (Featured by main power output and standby power output)			115 – 150% of Iout max. (current limitation)
Short circuit protection (Featured by all outputs)	– Protection level 1 (nominal) – Protection level 2 (instantaneous high current)		continuous, automatic recovery (hiccup mode) latch
Auxiliary outputs	– Power source for fan (variable fan speed control) – Standby power source		12 VDC / 500 mA max. Refers to pin +Fan and –Fan 5 VDC / 2000 mA max. Refers to pin +Standby and –Standby
Capacitive load		12 VDC model: 15 VDC model: 24 VDC model: 28 VDC model: 36 VDC model: 48 VDC model: 53 VDC model:	31‘250 µF max. 20‘000 µF max. 7'820 µF max. 5'750 µF max. 3'500 µF max. 1'960 µF max. 1'600 µF max.

All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

General Specifications

Operating temperature			–40°C to +80°C see thermal considerations for power derating
Storage temperature			–40°C to +80°C
Over temperature protection			Applies at 110 – 125°C (latch out) Standby power source is allways present
Humidity (non condensing)			5 – 95 % rel. H
Altitude during operation			5000 m max.
Switching frequency	– at 230 VAC	15 VDC models: other output models:	75 kHz typ. (pulse frequency modulation) 65 kHz typ. (pulse frequency modulation)
Isolation voltage (2 × MOPP insulation)	– Input to output (60 s) – Input/output to field ground (60 s)		4000 VAC 2500 VAC
Isolation resistance	– at 500 VDC		100 MOhm min.
Reliability	– calculated MTBF at +25°C acc. to MIL-HDBK-217F		400'000 h
Protection class *			class I
EMC emissions *	– conducted input emission – radiated emission – Medical devices emission limits – Harmonic current emissions – Voltage flicker		EN 55032, class B EN 55032, class A IEC 60601-1-2 ed.4 IEC / EN 61000-3-2, class A and D IEC / EN 61000-3-3
EMC immunity			EN 60601-1-2 ed.4, EN 55024, IEC 61000-6-2
	– Electrostatic discharge (ESD)		EN 61000-4-2, ±15 kV air, ±8 kV contact perf. criteria A
	– RF field immunity		EN 61000-4-3, 3 V/m perf. criteria A
	– Electrical fast transients/burst immunity		EN 61000-4-4, ±2 kV perf. criteria A
	– Surge		EN 61000-4-5, ±1 kV line to line, ±2kV line to ground, perf. criteria A
	– Conducted RF		EN 61000-4-6, 20 Vrms perf. criteria A
	– Magnetic field (only for single output models)		EN 61000-4-8, 30 A/m perf. criteria A
	– Voltage dips and interruptions		EN 61000-4-11
Voltage dip and interruptions according EN 60601-1-2			
	– at 100 VAC / 50 Hz		100%, 20 ms perf. criteria A 30%, 500 ms perf. criteria B 100%, 5000 ms perf. criteria B
	– at 230 VAC / 50 Hz		100%, 10 ms perf. criteria A 100%, 20 ms perf. criteria B 30%, 500 ms perf. criteria A 100%, 5000 ms perf. criteria B
Safety standards	– Medical equipment		IEC/EN 60601-1 3rd edition, ANSI/AAMI ES 60601-1:2005(R)2012
	– IT and multimedia equipment		UL 62368-1
	– Certification documents		www.tracopower.com/overview/tpp450

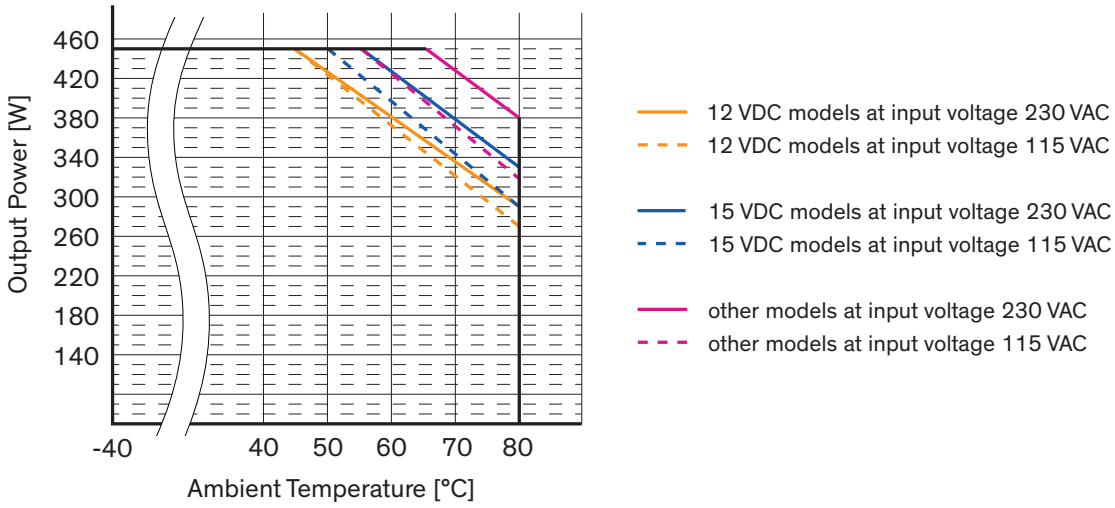
* For optimal EMI performance the power supply should be mounted to a grounded aluminium plate (480×248×12 mm) with electrical contact to the four PCB mounting holes. To comply with safety standards, this plate must be grounded to PE.

All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

General Specifications

Environment	– Vibration	acc. IEC 60068-2-6
	– Shock	acc. IEC 60068-2-27
	– Thermal shock	acc. MIL-STD-810F
Environmental compliance	– Reach	www.tracopower.com/info/reach-declaration.pdf
	– RoHS	RoHS directive 2011/65/EU
Connection		Pin terminal
Remote control	– On	Open or 3 to 12 VDC
	– Off (Standby power source is allways present)	Short or 0 to 1.2 VDC Applied between +Remote and –Remote pin
	– Input current of Remote-pins	–0.5 to 1.0 mA max.
PG - Power good signal		Open collector type
	– Power good	Low level (indicated by PG-pin)
	– Power off	High resistance (indicated by PG-pin)
	– PG-pin maximum ratings	50 VDC max. / 50 mA max. / 120 mW max.

Thermal Considerations

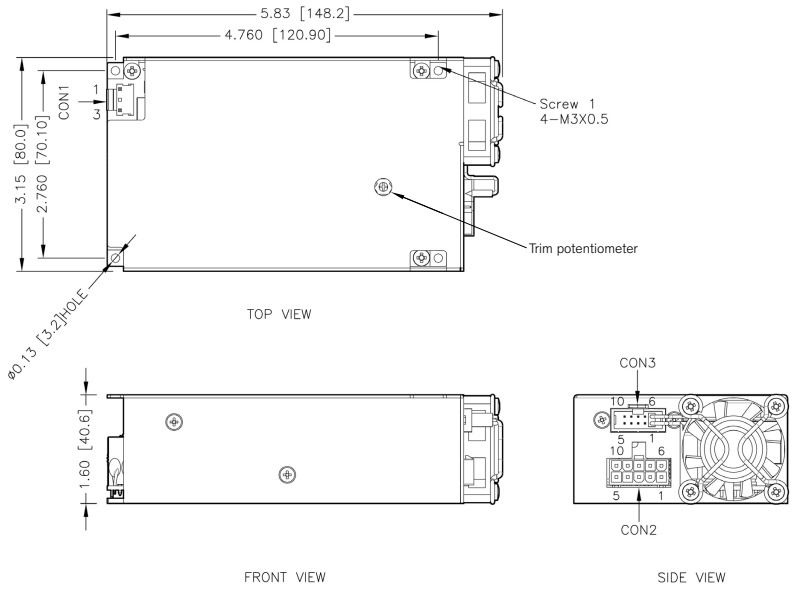


For this performance, fan needs to run.

The thermal considerations refer to the test setup (horizontal mounting) for certification.
Temperature reference positions for to determine the effective temperature limits in the application will be advised.

All specifications valid at nominal input voltage, full load and +25°C after warm-up time unless otherwise stated.

Dimension



Each one of the 4 srew holes can be used as a PE connection for class I applications

Input	
CON 1	
Pin	Function
1	AC (L)
3	AC (N)

Output	
CON 2	
Pin	Function
1-5	–VDC
6-10	+VDC

Auxiliary	
CON 3	
Pin	Function
1	+Fan
2	+Sense
3	+Remote
4	PG
5	+Standby
6	–Fan
7	–Sense
8	–Remote
9	No Pin
10	–Standby

CON 1:
Molex housing:
09-50-8031
Molex crimp terminals:
2478,6838,45570

CON 2:
Molex housing:
39-01-2105
Molex crimp terminals:
5556,45750

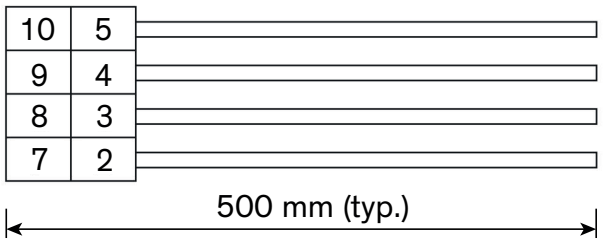
CON 3:
Molex housing:
90143-0010
Molex crimp terminals:
90119

FAN dimension: 40×40×10mm Air flow: 9.5 CFM
The fan's durability is lower compared to the power supply and has only 2 years warranty.

Weight: 552 g (19.47 oz)

Dimensions in inch, [ ] = mm
Outside dimension tolerance: ±0.02 Inch [±0.5 mm]
Hole spacing tolerance: ±0.01 Inch [±0.25 mm]

Optional cable for auxilary output connection



Order code	Connection
TPP 450-AUX1	2 × 4 pin

Auxilary cable 1			
Pin	Function	Color	AWG
2	+Sense	gray	26
3	+Remote	orange	26
4	PG	blue	26
5	+Standby	red	22
7	–Sense	green	26
8	–Remote	brown	26
9	No Wire	---	---
10	–Standby	black	22