TRACO POWER

AC/DC Medical Power Supply

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 edition 3.2 for 2 x MOPP**
- **EMC compliance to IEC/EN 60601-1-2 4th edition**
- **Risk management process according to ISO 14971 incl. risk management file**
- **Acceptance criteria for electronic assemblies acc. to IPC-A-610 class 3**
- **Isolation (4000 VAC) and leakage current (<100 µA) rated for BF applications**
- **Standard features: 5 V standby output 12 V fan output, Remote On/Off, Power Good Signal, variable fan speed**
- **Operating up to 5000 m altitude**
- **5-year product warranty**



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

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 edition 3.2, 2 x 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 nom. (adjustable)	Output Current max.	Efficiency typ.
TPP 450-112-M	450 W	12 VDC (11.0 - 13.0 VDC)	37'500 mA	91 %
TPP 450-115-M		15 VDC (13.8 - 16.2 VDC)	30'000 mA	92 %
TPP 450-124-M		24 VDC (22.1 - 25.9 VDC)	18'750 mA	93 %
TPP 450-128-M		28 VDC (25.8 - 30.2 VDC)	16'100 mA	93 %
TPP 450-136-M		36 VDC (33.1 - 38.9 VDC)	12'500 mA	93 %
TPP 450-148-M		48 VDC (44.2 - 51.8 VDC)	9'400 mA	94 %
TPP 450-153-M		53 VDC (48.8 - 57.2 VDC)	8'550 mA	94 %

Options

TPP 450-AUX1	- Optional Cable for auxiliary connection (2 x 4 pin): www.tracopower.com/overview/tpp450-aux1
on demand (backorder with MOQ non stocking item)	- Optional version with fan on top

Input Specifications

Input Voltage	- AC Range	Operational Range:	**85 - 264 VAC** (Full Range)
		Rated Range:	**100 - 240 VAC** (Full Range)
	- DC Range	Operational Range:	**120 - 370 VDC** (Designed for, no certification)
		Polarity:	**+DC: L / –DC: N**
Input Frequency		Operational Range:	**47 - 440 Hz**
		Certified:	**50/60 Hz**
Power Consumption	- No load & Vin = 230 VAC		**1'050 mW max.**
	- No load & Vin = 115 VAC		**1'450 mW max.**
Input Current	- Full load & Vin = 230 VAC		**2'400 mA max.**
	- Full load & Vin = 115 VAC		**5'800 mA max.**
Input Inrush Current	- At 230 VAC		**100 A max.**
	- At 115 VAC		**55 A max.**
Power Factor	- At 230 VAC		**0.95 min.** (Active Power Factor Correction)
	- At 115 VAC		**0.95 min.** (Active Power Factor Correction)
Input Protection			**T 6.3 A / 250 VAC** (Internal Fuse in L & N)
Recommended Input Fuse			(The need of an external fuse has to be assessed in the final application.)

Output Specifications

Output Voltage Adjustment			**±8%** (By trim potentiometer) Output power must not exceed rated power!
Voltage Set Accuracy			**±1% max.**
Regulation	- Input Variation (Vmin - Vmax)		**0.2% max.**
	- Load Variation (0 - 100%)		**0.5% max.**
Ripple and Noise (20 MHz Bandwidth)		12 VDC model:	**250 mVp-p typ.** (w/ 1 µF X7R)
		15 VDC model:	**300 mVp-p typ.** (w/ 1 µF X7R)
		24 VDC model:	**240 mVp-p typ.** (w/ 1 µF X7R)
		28 VDC model:	**280 mVp-p typ.** (w/ 1 µF X7R)
		36 VDC model:	**360 mVp-p typ.** (w/ 1 µF X7R)
		48 VDC model:	**480 mVp-p typ.** (w/ 1 µF X7R)
		53 VDC model:	**530 mVp-p typ.** (w/ 0.1 µF X7R)
Capacitive Load		12 VDC model:	**31'250 µF max.**
		15 VDC model:	**20'000 µF max.**
		24 VDC model:	**7'820 µF max.**
		28 VDC model:	**5'750 µF max.**
		36 VDC model:	**3'500 µF max.**
		48 VDC model:	**1'960 µF max.**
		53 VDC model:	**1'600 µF max.**
Minimum Load			**Not required**
Temperature Coefficient			**±0.02 %/K max.**
Hold-up Time	- At 230 VAC		**12 ms min.**
	- At 115 VAC		**12 ms min.**
Start-up Time	- At 230 VAC		**2'000 ms max.**
	- At 115 VAC		**2'000 ms max.**
Short Circuit Protection			**Continuous, Automatic recovery** (Level 1, nom.) **Latch** (Level 2, instantaneous high current)
Output Current Limitation			**115 - 155% of Iout max.**
Overvoltage Protection			**110 - 135% of Vout nom.** (Latch off, Standby Power Source always present)
Transient Response	- Response Deviation		**3% max.** (50% to 75% Load Step)
	- Response Time		**600 µs typ.** (50% to 75% Load Step)

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

Safety Specifications

Standards	- IT / Multimedia Equipment		EN 62368-1 IEC 62368-1 UL 62368-1
	- Medical Equipment		EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 2 x MOPP (Means Of Patient Protection)
	- Certification Documents		www.tracopower.com/tpp450-safety-cert
Protection Class			Class I (Prepared): Connection to PE
		See application note:	www.tracopower.com/info/protection-class.pdf (Any one of the four mounting holes can be considered as PE connection for class I application)
Energy Source	- Output, acc. to 62368-1		ES1
Power Source	- Output, acc. to 62368-1		PS3
Pollution Degree			PD 2
Over Voltage Category			OVC II

EMC Specifications

EMI (Emissions)			EN 60601-1-2 edition 4 (Medical Devices)
	- Conducted Emissions		EN 55011 class A (internal filter) EN 55011 class B (internal filter) EN 55032 class A (internal filter) EN 55032 class B (internal filter)
	- Radiated Emissions		EN 55011 class A (internal filter) EN 55032 class A (internal filter)
	- Harmonic Current Emissions		EN 61000-3-2, class A EN 61000-3-2, class D
	- Voltage Fluctuations & Flicker		EN 61000-3-3 (For optimal EMI performance the power supply should be mounted to a grounded aluminium plate (480 x 248 x 12 mm) with electrical contact to the four PCB mounting holes. To comply with safety standards, this plate must be grounded.)
EMS (Immunity)			EN 60601-1-2 edition 4 (Medical Devices) EN 55024 (IT Equipment) EN 55035 (Multimedia)
	- Electrostatic Discharge	Air:	EN 61000-4-2, ±15 kV, perf. criteria A
		Contact:	EN 61000-4-2, ±8 kV, perf. criteria A
	- RF Electromagnetic Field		EN 61000-4-3, 3 V/m, perf. criteria A
	- EFT (Burst) / Surge		EN 61000-4-4, ±2 kV, perf. criteria A
		L to L:	EN 61000-4-5, ±1 kV, perf. criteria A
		L to PE:	EN 61000-4-5, ±2 kV, perf. criteria A
	- Conducted RF Disturbances		EN 61000-4-6, 20 Vrms, perf. criteria A
	- PF Magnetic Field	Continuous:	EN 61000-4-8, 30 A/m, perf. criteria A
	- Voltage Dips & Interruptions	230 VAC / 50 Hz:	EN 61000-4-11 30%, 25 periods, perf. criteria A >95%, 0.5 periods, perf. criteria A >95%, 1 period, perf. criteria A >95%, 250 periods, perf. criteria B
		115 VAC / 60 Hz:	EN 61000-4-11 30%, 25 periods, perf. criteria A >95%, 0.5 periods, perf. criteria A >95%, 1 period, perf. criteria A >95%, 250 periods, perf. criteria B
EMC / Environmental	- Certification Documents		www.tracopower.com/tpp450-emc-cert

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +80°C
	- Storage Temperature		–40°C to +80°C
Power Derating	- High Temperature		Depending on model
	- Low Input Voltage		1.33 %/V below 100 VAC
		See application note:	www.tracopower.com/tpp450-cc
Over Temperature Protection Switch Off	- Protection Mode		110°C to 125°C (Latch off)
	- Measurement Point	See application note:	www.tracopower.com/tpp450-thermal
			(Standby Power Source always present)
Cooling System			Forced air cooling (with internal fan)
Fan Power Source	- Characteristic		Variable fan speed (temperature regulated)
	- Output Voltage		12 VDC
	- Output Current		500 mA max.
Standby Power Source	- Output Voltage		5 VDC
	- Output Current		2000 mA max.
Remote Control	- Voltage Controlled Remote (passive = on)		On: 3.0 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to '+Remote' and '-Remote' Pin
	- Remote Pin Input Current		-0.5 to 1.0 mA
			(Standby power source is always present)
Altitude During Operation			5'000 m max.
Regulator Topology			LLC Converter
Switching Frequency			55 - 85 kHz (PFM)
Insulation System			Reinforced Insulation
Working Voltage (rated)			312 VAC
Isolation Test Voltage	- Input to Output, 60 s		4'000 VAC
	- Input to Case or PE, 60 s		2'500 VAC
	- Output to Case or PE, 60 s		2'500 VAC
Isolation Resistance	- Input to Output, 500 VDC		100 MΩ min.
Leakage Current (at 264 VAC)	- Touch Current		100 µA max.
Reliability	- Calculated MTBF		410'000 h (MIL-HDBK-217F, ground benign)
Environment	- Vibration		IEC 60068-2-6
	- Mechanical Shock		IEC 60068-2-27
	- Flammability		EN 45545-2
			www.tracopower.com/info/en45545-declaration.pdf
Housing Material			Stainless Steel (Cover)
Housing Type			Metal Case
Mounting Type			Chassis Mount
Connection Type			Pin Connector
Weight			552 g
Power OK Signal			Open collector output
	- Trigger Threshold	12 VDC model:	9.8 - 11 VDC
		15 VDC model:	12.3 - 13.8 VDC
		24 VDC model:	19.7 - 22.1 VDC
		28 VDC model:	23 - 25.8 VDC
		36 VDC model:	29.5 - 33.1 VDC
		48 VDC model:	39.4 - 44.2 VDC
		53 VDC model:	43.5 - 48.8 VDC
	- Power OK		Low level
	- Power Off		High resistance
			(Refers to 'PG' and '-Vout' Pin)
	- Pin Specifications		50 VDC / 50 mA / 120 mW max.
Sense Function			8% max. of Vout nom.
		See application note:	www.tracopower.com/tpp450-sense

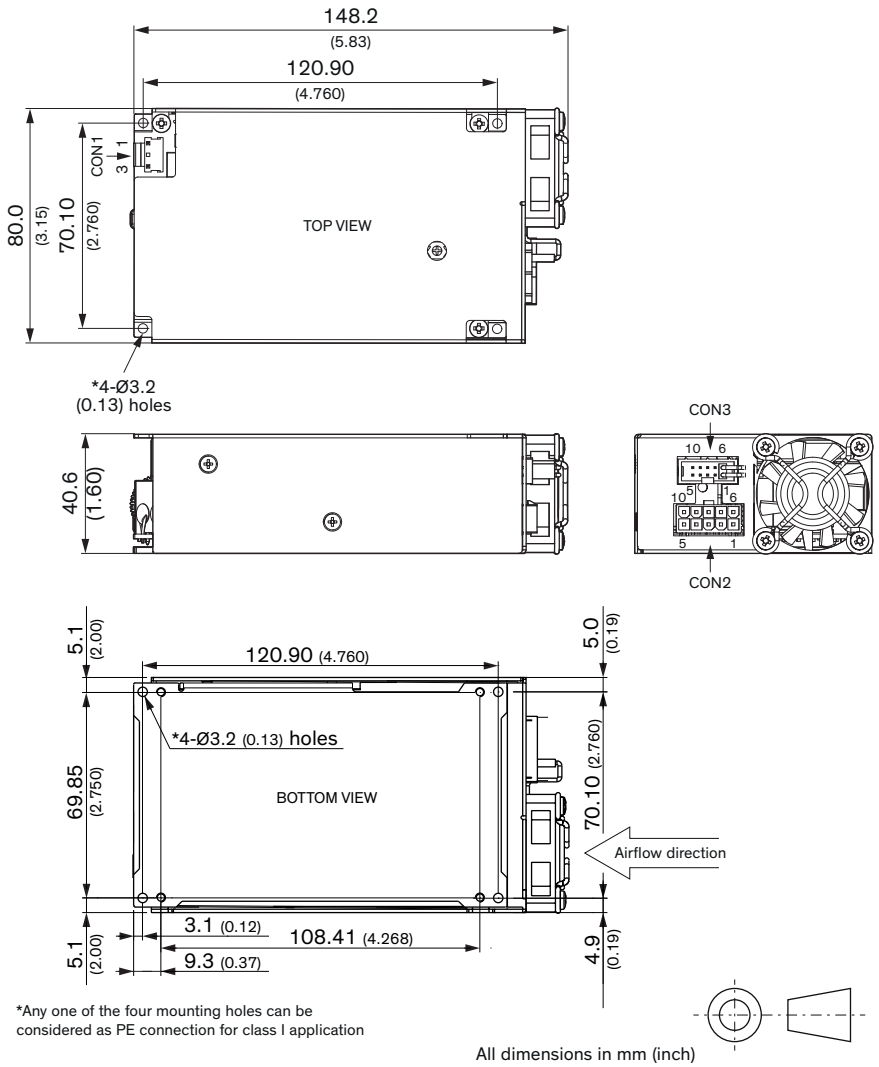
All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

Environmental Compliance	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf
		REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf
		Exemptions: 7(a), 7(c)-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)
	- SCIP Reference Number	48f4e8fa-a51e-453d-a4d3-54d733464d7b

Additional Information

Supporting Documents	www.tracopower.com/overview/tpp450
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

Outline Dimensions



*Any one of the four mounting holes can be considered as PE connection for class I application

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.

All dimensions in mm (inch)
Tolerance: X.X ±0.5 (X.XX ±0.02)
X.XX ±0.25 (X.XXX ±0.01)
Screw locked torque: max. 4.2 kgfcm / 0.41 Nm

Input

CON1	
Pin	**Function**
1	AC (L)
3	AC (N)

Auxiliary

CON3	
Pin	**Function**
1	+Fan*1
2	+Sense
3	+Remote
4	PG
5	+Standby
6	–Fan*1 / *2
7	–Sense
8	–Remote*2
9	No pin
10	–Standby*2

*1 Occupied by internal fan (unplugging is possible)
*2 Internally connected with –Vout

Output

CON2	
Pin*3	**Function**
1-5	–Vout
6-10	+Vout

*3 Terminal rated for 13 A max. (at higher current connection has to be split)

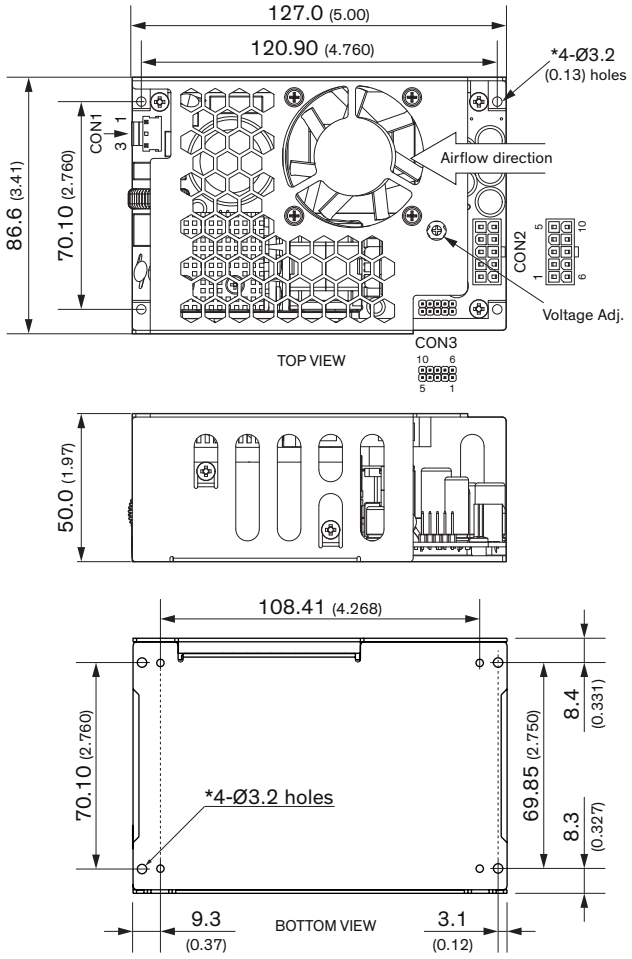
CON1:
Molex housing:
09-50-8031
Molex crimp terminals:
08500106 (2478),
08520112 (6838),
45570

CON2:
Molex housing:
39-01-2105
Molex crimp terminals:
5556,45750

CON3:
Molex housing:
90143-0010
Molex crimp terminals:
90119

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

Optional version with fan on top



*Any one of the four mounting holes can be considered as PE connection for class I application

All dimensions in mm (inch)
Tolerance: x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.010)
Screw locked torque: max. 4.2 kgfcm / 0.41 Nm

FAN dimension: 50×50×10mm Air flow: 11.4 CFM
The fan's durability is lower compared to the power supply and has only 2 years warranty.

Input	
CON1	
Pin	Function
1	AC (L)
3	AC (N)

Output	
CON2	
Pin*3	Function
1-5	+Vout
6-10	–Vout

*3 Terminal rated for 13 A max. (at higher current connection has to be split)

Auxiliary	
CON3	
Pin	Function
1	+Fan*1
2	+Sense
3	+Remote
4	PG
5	+Standby
6	–Fan*1 / *2
7	–Sense
8	–Remote*2
9	No pin
10	–Standby*2

*1 Occupied by internal fan (unplugging is possible)
*2 Internally connected with –Vout

CON1:
Molex housing:
09-50-8031
Molex crimp terminals:
08500106 (2478),
08520112 (6838),
45570

CON2:
Molex housing:
39-01-2105
Molex crimp terminals:
5556,45750

CON3:
Molex housing:
90143-0010
Molex crimp terminals:
90119

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