

- 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



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): <a href="http://www.tracopower.com/overview/tpp450-aux1">www.tracopower.com/overview/tpp450-aux1</a>
on demand (backorder with MOQ non stocking item)	- Optional version with fan on top

### Input Specifications

Input Voltage	- AC Range	Operational Range: <b>85 - 264 VAC</b> (Full Range) Rated Range: <b>100 - 240 VAC</b> (Full Range)
	- DC Range	Operational Range: <b>120 - 370 VDC</b> (Designed for, no certification) Polarity: <b>+DC: L / -DC: N</b>
Input Frequency		Operational Range: <b>47 - 440 Hz</b> Certified: <b>50/60 Hz</b>
Power Consumption	- No load & Vin = 230 VAC	<b>1'050 mW max.</b>
	- No load & Vin = 115 VAC	<b>1'450 mW max.</b>
Input Current	- Full load & Vin = 230 VAC	<b>2'400 mA max.</b>
	- Full load & Vin = 115 VAC	<b>5'800 mA max.</b>
Input Inrush Current	- At 230 VAC	<b>100 A max.</b>
	- At 115 VAC	<b>55 A max.</b>
Power Factor	- At 230 VAC	<b>0.95 min.</b> (Active Power Factor Correction)
	- At 115 VAC	<b>0.95 min.</b> (Active Power Factor Correction)
Input Protection		<b>T 6.3 A / 250 VAC</b> (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		<b>±8%</b> (By trim potentiometer) Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	<b>0.2% max.</b>
	- Load Variation (0 - 100%)	<b>0.5% max.</b>
Ripple and Noise (20 MHz Bandwidth)	12 VDC model:	<b>250 mVp-p typ.</b> (w/ 1 µF X7R)
	15 VDC model:	<b>300 mVp-p typ.</b> (w/ 1 µF X7R)
	24 VDC model:	<b>240 mVp-p typ.</b> (w/ 1 µF X7R)
	28 VDC model:	<b>280 mVp-p typ.</b> (w/ 1 µF X7R)
	36 VDC model:	<b>360 mVp-p typ.</b> (w/ 1 µF X7R)
	48 VDC model:	<b>480 mVp-p typ.</b> (w/ 1 µF X7R)
Capacitive Load	53 VDC model:	<b>530 mVp-p typ.</b> (w/ 0.1 µF X7R)
	12 VDC model:	<b>31'250 µF max.</b>
	15 VDC model:	<b>20'000 µF max.</b>
	24 VDC model:	<b>7'820 µF max.</b>
	28 VDC model:	<b>5'750 µF max.</b>
Minimum Load	36 VDC model:	<b>3'500 µF max.</b>
	48 VDC model:	<b>1'960 µF max.</b>
	53 VDC model:	<b>1'600 µF max.</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Hold-up Time	- At 230 VAC	<b>12 ms min.</b>
	- At 115 VAC	<b>12 ms min.</b>
Start-up Time	- At 230 VAC	<b>2'000 ms max.</b>
	- At 115 VAC	<b>2'000 ms max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b> (Level 1, nom.) <b>Latch</b> (Level 2, instantaneous high current)
Output Current Limitation		<b>115 - 155% of Iout max.</b>
Overvoltage Protection		<b>110 - 135% of Vout nom.</b> (Latch off, Standby Power Source always present)
Transient Response	- Response Deviation	<b>3% max.</b> (50% to 75% Load Step)
	- Response Time	<b>600 µs typ.</b> (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	<a href="http://www.tracopower.com/overview/tpp450">www.tracopower.com/overview/tpp450</a>
Protection Class		Class I (Prepared): Connection to PE
Pollution Degree		PD 2
Over Voltage Category		OVC II

## EMC Specifications

EMI (Emissions)	- Conducted Emissions	EN 60601-1-2 edition 4 (Medical Devices) EN 55011 class B (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)	- Electrostatic Discharge	EN 60601-1-2 edition 4 (Medical Devices) EN 55024 (IT Equipment) EN 55035 (Multimedia) Air: EN 61000-4-2, $\pm 15$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 8$ kV, perf. criteria A EN 61000-4-3, 3 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A
	- RF Electromagnetic Field	L to L: EN 61000-4-5, $\pm 1$ kV, perf. criteria A L to PE: EN 61000-4-5, $\pm 2$ kV, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-6, 20 Vrms, perf. criteria A Continuous: EN 61000-4-8, 30 A/m, perf. criteria A
	- Conducted RF Disturbances	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
	- PF Magnetic Field	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
	- Voltage Dips & Interruptions	
EMC / Environmental	- Certification Documents	<a href="http://www.tracopower.com/overview/tpp450">www.tracopower.com/overview/tpp450</a>

## 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: <a href="http://www.tracopower.com/overview/tpp450">www.tracopower.com/overview/tpp450</a>

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

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

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](http://www.tracopower.com/info/reach-declaration.pdf)

- RoHS Declaration

REACH SVHC list compliant

REACH Annex XVII compliant

[www.tracopower.com/info/rohs-declaration.pdf](http://www.tracopower.com/info/rohs-declaration.pdf)

Exemptions: 7a, 7c-l

(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))

- SCIP Reference Number

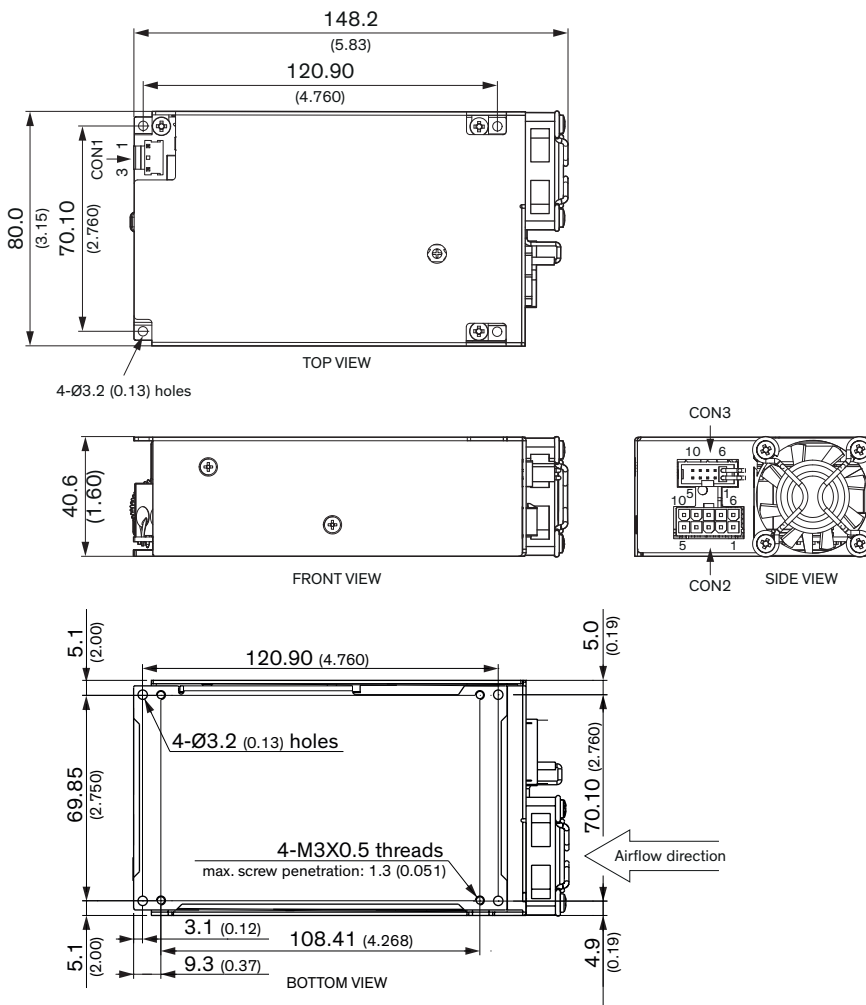
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### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tpp450](http://www.tracopower.com/overview/tpp450)

### Outline Dimensions



Max. screw penetration: 1.3 (0.05)

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. 5.2 kgfcm / 0.51 Nm

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

Output	
CON2	
Pin <sup>*3</sup>	Function
1-5	-Vout
6-10	+Vout

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

<sup>\*3</sup> 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:

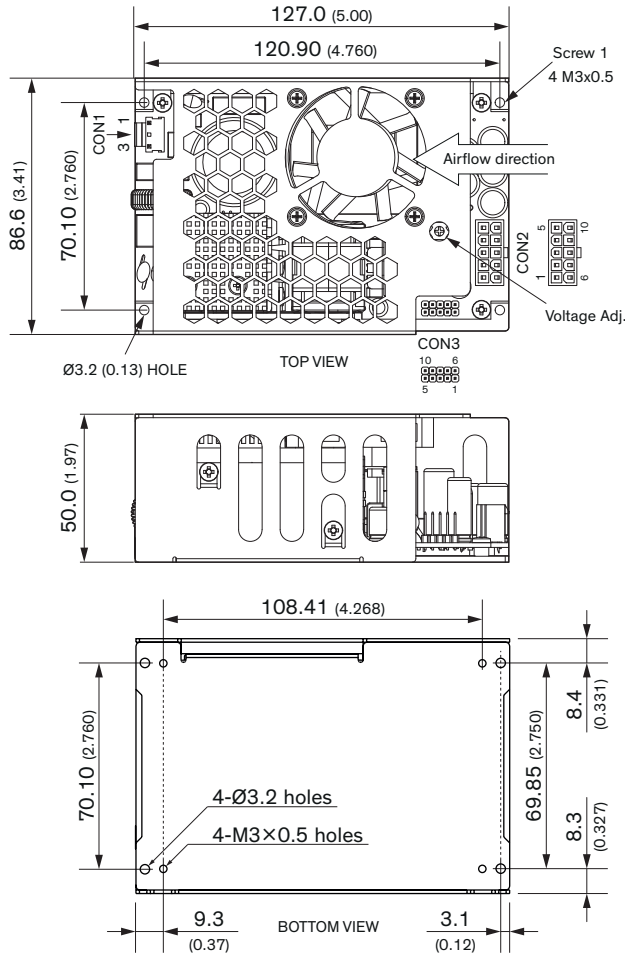
90143-0010  
Molex crimp terminals:  
90119

<sup>\*1</sup> Occupied by internal fan (unplugging is possible)

<sup>\*2</sup> Internally connected with -Vout

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



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. 5.2 kgfcm / 0.51 Nm  
 Max. screw penetration: 1.3 (0.05)

FAN dimension: 40x40x10mm Air flow: 9.5 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 <sup>*3</sup>	Function
1-5	+Vout
6-10	-Vout

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

<sup>\*3</sup> 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

<sup>\*1</sup> Occupied by internal fan (unplugging is possible)  
<sup>\*2</sup> Internally connected with -Vout