

- 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 2xMOPP
- 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

Open-frame version see TPP 450A Series



[www.tracopower.com/overview/tpp450a](http://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.) * | 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 %              |

\* While fan is running

### Input Specifications

|                                                  |                                                                                     |                                                                      |
|--------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| Input voltage range                              | – AC range (universal input)<br>– DC range<br>– Power derating at low input voltage | 85 – 264 VAC (47 – 63 Hz)<br>120 – 370 VDC<br>1.33 %/V below 100 VAC |
| Input current at full load                       | – at 100 VAC<br>– at 240 VAC                                                        | 5.8 A max.<br>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 Vout models:<br>other output models:                                             | 0.4 W typ.<br>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%                                                                                                                                                                                                                                                   |
| Regulation                                                                      | – Input variation (85 - 264 VAC)<br>– Load variation (0 - 100%)                     | 0.2% max.<br>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<br>(20 MHz Bandwidth)                                          | 12 VDC model:<br>15 VDC model:<br>24 VDC model:<br>36 VDC model:<br>48 VDC model:   | 250 mVp-p typ. (w. cap. 1µF/25V 1206 X7R MLCC)<br>300 mVp-p typ. (w. cap. 1µF/25V 1206 X7R MLCC)<br>240 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC)<br>360 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC)<br>480 mVp-p typ. (w. cap. 1µF/50V 1206 X7R MLCC) |
| Transiente response                                                             | – Peak deviation (50 - 75% load change)<br>– Recovery time                          | 3% Vout typ.<br>600 µs typ.                                                                                                                                                                                                                            |
| Overvoltage protection<br>(Featured by main power output)                       |                                                                                     | 110 – 135% of Vout (latch mode)                                                                                                                                                                                                                        |
| Overload protection<br>(Featured by main power output and standby power output) |                                                                                     | 115 – 150% of Iout max. (current limitation)                                                                                                                                                                                                           |
| Short circuit protection<br>(Featured by all outputs)                           | – Protection level 1 (nominal)<br>– Protection level 2 (instantaneous high current) | continuous, automatic recovery (hiccup mode)<br>latch                                                                                                                                                                                                  |
| Auxiliary outputs                                                               | – Power source for fan (variable fan speed control)<br><br>– Standby power source   | 12 VDC / 500 mA max.<br>Refers to pin +Fan and –Fan<br>5 VDC / 2000 mA max.<br>Refers to pin +Standby and –Standby                                                                                                                                     |

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

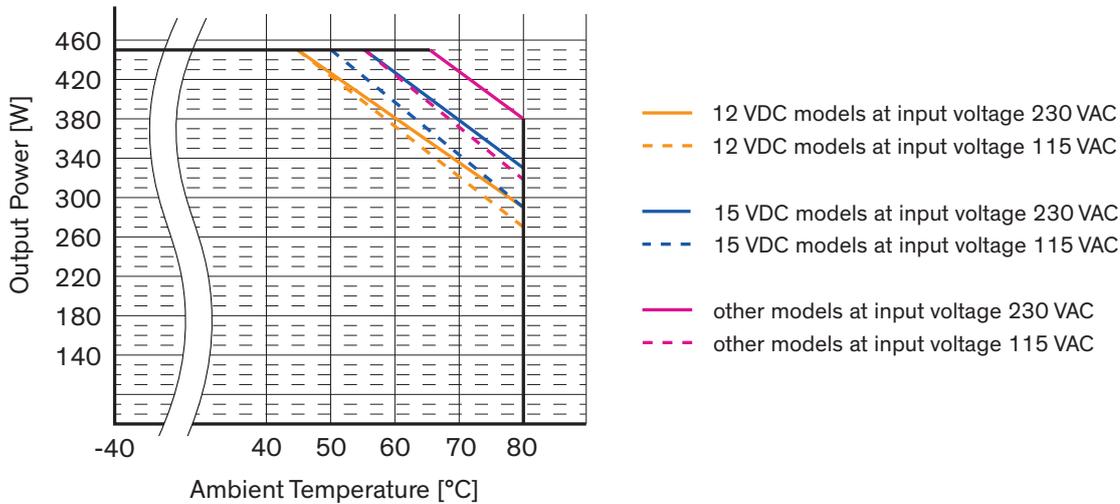
## General Specifications

|                                    |                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating temperature              |                                                                                                                                                                                                                                    | -40°C to +80°C<br>see thermal considerations for power derating                                                                                                                                                                                                                                                                                                                                                       |
| Storage temperature                |                                                                                                                                                                                                                                    | -40°C to +80°C                                                                                                                                                                                                                                                                                                                                                                                                        |
| Over temperature protection        |                                                                                                                                                                                                                                    | Applies at 110 – 125°C (latch out)<br>Standby power source is always present                                                                                                                                                                                                                                                                                                                                          |
| Humidity (non condensing)          |                                                                                                                                                                                                                                    | 5 – 95 % rel. H                                                                                                                                                                                                                                                                                                                                                                                                       |
| Altitude during operation          |                                                                                                                                                                                                                                    | 5000 m max.                                                                                                                                                                                                                                                                                                                                                                                                           |
| Switching frequency                | – at 230 VAC                                                                                                                                                                                                                       | 15 Vout models: 75 kHz typ. (pulse frequency modulation)<br>other output models: 65 kHz typ. (pulse frequency modulation)                                                                                                                                                                                                                                                                                             |
| Isolation voltage                  | – Input to output (60 s)<br>(2 × MOPP insulation) – Input/output to field ground (60 s)                                                                                                                                            | 4000 VAC<br>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<br>– radiated emission<br>– Medical devices emission limits<br>– Harmonic current emissions<br>– Voltage flicker                                                                                        | EN 55032, class B<br>EN 55032, class A<br>IEC 60601-1-2 ed.4<br>IEC / EN 61000-3-2, class A and D<br>IEC / EN 61000-3-3                                                                                                                                                                                                                                                                                               |
| EMC immunity                       | – Electrostatic discharge (ESD)<br><br>– RF field immunity<br>– Electrical fast transients/burst immunity<br>– Surge<br><br>– Conducted RF<br>– Magnetic field (only for single output models)<br>– Voltage dips and interruptions | EN 60601-1-2 ed.4, EN 55024, IEC 61000-6-2<br>EN 61000-4-2, ±15 kV air, ±8 kV contact<br>perf. criteria A<br>EN 61000-4-3, 3 V/m perf. criteria A<br>EN 61000-4-4, ±2 kV perf. criteria A<br>EN 61000-4-5, ±1 kV line to line,<br>±2kV line to ground, perf. criteria A<br>EN 61000-4-6, 20 Vrms perf. criteria A<br>EN 61000-4-8, 30 A/m perf. criteria A<br>EN 61000-4-11<br>EN 60601-1-2 (perf. criterias pending) |
| Safety standards and certification |                                                                                                                                                                                                                                    | IEC/EN 60601-1 3rd edition,<br>ANSI/AAMI ES 60601-1:2005(R)2012, 62368-1                                                                                                                                                                                                                                                                                                                                              |
| Environment                        | – Vibration<br>– Shock<br>– Thermal shock                                                                                                                                                                                          | acc. IEC 60068-2-6<br>acc. IEC 60068-2-27<br>acc. MIL-STD-810F                                                                                                                                                                                                                                                                                                                                                        |
| Environmental compliance           | – Reach<br>– RoHS                                                                                                                                                                                                                  | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>RoHS directive 2011/65/EU                                                                                                                                                                                                                                                                         |
| Connection                         |                                                                                                                                                                                                                                    | Pin terminal                                                                                                                                                                                                                                                                                                                                                                                                          |
| Remote control                     | – On<br>– Off (Standby power source is always present)<br><br>– Input current of Remote-pins                                                                                                                                       | Open or 3 to 12 VDC<br>Short or 0 to 1.2 VDC<br>Applied between +Remote and –Remote pin<br>–0.5 to 1.0 mA max.                                                                                                                                                                                                                                                                                                        |
| PG - Power good signal             | – Power good<br>– Power off<br>– PG-pin maximum ratings                                                                                                                                                                            | Open collector type<br>Low level (indicated by PG-pin)<br>High resistance (indicated by PG-pin)<br>50 VDC max. / 50 mA max. / 120 mW max.                                                                                                                                                                                                                                                                             |

\* 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.

### Thermal Considerations

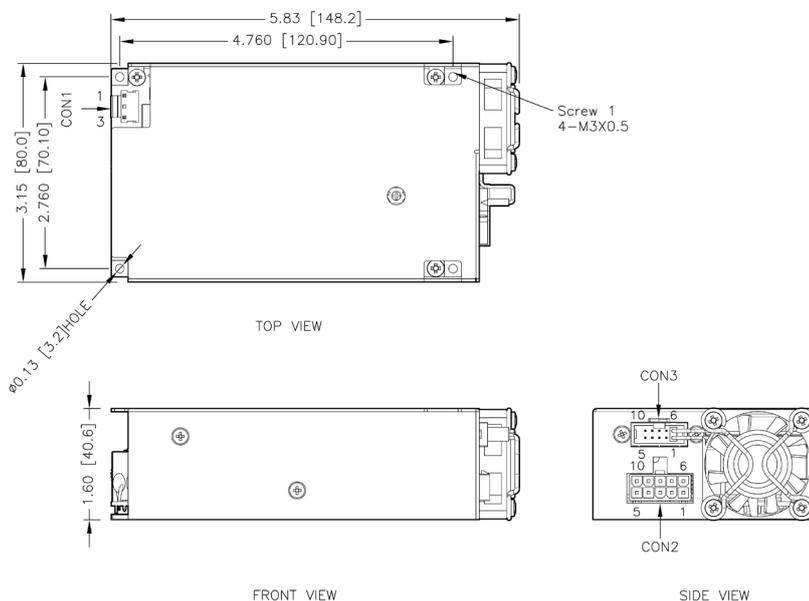


For this performance, fan needs to run.

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.

### Dimension



| Input<br>CON 1 |          |
|----------------|----------|
| Pin            | Function |
| 1              | AC (L)   |
| 3              | AC (N)   |

| Output<br>CON 2 |          |
|-----------------|----------|
| Pin             | Function |
| 1-5             | -Vout    |
| 6-10            | +Vout    |

| Auxiliary<br>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

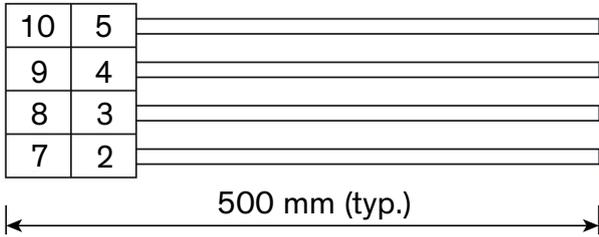
FAN dimension: 40×40×10mm Air flow: 9.5 CFM  
 The fan's durability is lower compared to the power supply and has only 2 years warranty.

**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]

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

**Optional cable for auxiliary output connection**



| Order code   | Connection |
|--------------|------------|
| TPP 450-AUX1 | 2 × 4 pin  |

| Auxiliary 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  |