AC/DC Medical Power Supply

TPP 450B-M Series, 450 Watt

- High power density 3" x 5.8" encased medical power supply
- Protection class II prepared
- 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 x MOPP
- EMC compliance to IEC/EN 60601-1-2 4th edition
- Risk management process according to ISO 14971 incl. risk management file
- 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 450B-M 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 x MOPP) and is suitable for class II applications. 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

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TPP 450-112B-M</td>
<td>450 W</td>
<td>12 VDC (11.0 - 13.0 VDC)</td>
<td>37'500 mA</td>
<td>91 %</td>
</tr>
<tr>
<td>TPP 450-115B-M</td>
<td></td>
<td>15 VDC (13.8 - 16.2 VDC)</td>
<td>30'000 mA</td>
<td>92 %</td>
</tr>
<tr>
<td>TPP 450-124B-M</td>
<td></td>
<td>24 VDC (22.1 - 25.9 VDC)</td>
<td>18'750 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TPP 450-128B-M</td>
<td></td>
<td>28 VDC (25.8 - 30.2 VDC)</td>
<td>16'100 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TPP 450-136B-M</td>
<td></td>
<td>36 VDC (33.1 - 38.9 VDC)</td>
<td>12'500 mA</td>
<td>93 %</td>
</tr>
<tr>
<td>TPP 450-148B-M</td>
<td></td>
<td>48 VDC (44.2 - 51.8 VDC)</td>
<td>9'400 mA</td>
<td>94 %</td>
</tr>
<tr>
<td>TPP 450-153B-M</td>
<td></td>
<td>53 VDC (49.8 - 57.2 VDC)</td>
<td>8'550 mA</td>
<td>94 %</td>
</tr>
</tbody>
</table>

### Options

- **on demand (backorder with MOQ non stocking item)**: Optional version with fan on top
### Input Specifications

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>AC Range</th>
<th>Operational Range: 85 - 264 VAC (Full Range)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DC Range</td>
<td>Rated Range: 100 - 240 VAC (Full Range)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operational Range: 120 - 370 VDC (Designed for, no certification)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Polarity: +DC: L / −DC: N</td>
</tr>
</tbody>
</table>

### Input Frequency

<table>
<thead>
<tr>
<th>Input Current</th>
<th>Certified: 50/60 Hz</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operational Range: 47 - 440 Hz</td>
</tr>
</tbody>
</table>

### Power Consumption

<table>
<thead>
<tr>
<th>Input Inrush Current</th>
<th>- Full Load &amp; Vin = 230 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Full Load &amp; Vin = 115 VAC</td>
</tr>
<tr>
<td></td>
<td>- No load &amp; Vin = 230 VAC</td>
</tr>
<tr>
<td></td>
<td>- No load &amp; Vin = 115 VAC</td>
</tr>
<tr>
<td></td>
<td>- At 230 VAC</td>
</tr>
<tr>
<td></td>
<td>- At 115 VAC</td>
</tr>
<tr>
<td></td>
<td>- At 115 VAC</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>100 A max.</td>
</tr>
<tr>
<td></td>
<td>55 A max.</td>
</tr>
</tbody>
</table>

### Power Factor

<table>
<thead>
<tr>
<th>Power Factor</th>
<th>- At 230 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.95 min. (Active Power Factor Correction)</td>
</tr>
<tr>
<td></td>
<td>0.95 min. (Active Power Factor Correction)</td>
</tr>
</tbody>
</table>

### Input Protection

<table>
<thead>
<tr>
<th>Recommended Input Fuse</th>
<th>T 6.3 A / 250 VAC (Internal Fuse in L &amp; N)</th>
</tr>
</thead>
</table>

(The need of an external fuse has to be assessed in the final application.)

### Output Specifications

<table>
<thead>
<tr>
<th>Output Voltage Adjustment</th>
<th>±8% (by trim potentiometer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Set Accuracy</td>
<td>±1% max.</td>
</tr>
<tr>
<td>Regulation</td>
<td>- Input Variation (Vmin - Vmax)</td>
</tr>
<tr>
<td></td>
<td>- Load Variation (0 - 100%)</td>
</tr>
</tbody>
</table>

#### Ripple and Noise (20 MHz Bandwidth)

<table>
<thead>
<tr>
<th>Ripple and Noise model</th>
<th>12 VDC model: 250 mVp-p typ. (w/ 1 µF X7R)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 VDC model: 300 mVp-p typ. (w/ 1 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>24 VDC model: 240 mVp-p typ. (w/ 1 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>28 VDC model: 280 mVp-p typ. (w/ 1 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>36 VDC model: 360 mVp-p typ. (w/ 1 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>48 VDC model: 480 mVp-p typ. (w/ 1 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>53 VDC model: 530 mVp-p typ. (w/ 0.1 µF X7R)</td>
</tr>
</tbody>
</table>

#### Capacitive Load

<table>
<thead>
<tr>
<th>Capacitive Load model</th>
<th>12 VDC model: 31.250 µF max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15 VDC model: 20'000 µF max</td>
</tr>
<tr>
<td></td>
<td>24 VDC model: 7'820 µF max</td>
</tr>
<tr>
<td></td>
<td>28 VDC model: 5'750 µF max</td>
</tr>
<tr>
<td></td>
<td>36 VDC model: 3'500 µF max</td>
</tr>
<tr>
<td></td>
<td>48 VDC model: 1'960 µF max</td>
</tr>
<tr>
<td></td>
<td>53 VDC model: 1'600 µF max</td>
</tr>
</tbody>
</table>

#### Minimum Load

<table>
<thead>
<tr>
<th>Minimum Load</th>
<th>Not required</th>
</tr>
</thead>
</table>

#### Temperature Coefficient

<table>
<thead>
<tr>
<th>Temperature Coefficient</th>
<th>±0.02% / K max.</th>
</tr>
</thead>
</table>

#### Hold-up Time

<table>
<thead>
<tr>
<th>Hold-up Time</th>
<th>- At 230 VAC</th>
<th>- At 115 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 ms min.</td>
<td>12 ms min.</td>
</tr>
</tbody>
</table>

#### Start-up Time

<table>
<thead>
<tr>
<th>Start-up Time</th>
<th>- At 230 VAC</th>
<th>- At 115 VAC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2'000 ms max.</td>
<td>2'000 ms max.</td>
</tr>
</tbody>
</table>

#### 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

<table>
<thead>
<tr>
<th>Transient Response</th>
<th>Response Deviation</th>
<th>Response Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3% max. (50% to 75% Load Step)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>600 µs typ. (50% to 75% Load Step)</td>
<td></td>
</tr>
</tbody>
</table>

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

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## 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
- Certification Documents: 2 x MOPP (Means Of Patient Protection)

### Protection Class
- Class I & II (Prepared): Reinforced Insulation

### Pollution Degree
- PD 2

### Over Voltage Category
- OVC II

## EMC Specifications

### EMI Emissions
- Conducted Emissions: EN 60601-1-2 edition 4 (Medical Devices)
- Radiated Emissions: EN 55011 class B (internal filter)
- Harmonic Current Emissions: EN 61000-3-2, class A
- Voltage Fluctuations & Flicker: EN 61000-3-3

### EMS Immunity
- Electrostatic Discharge: EN 61000-4-2, ±15 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
- Conducted RF Disturbances: EN 61000-4-6, 20 Vrms, perf. criteria A
- PF Magnetic Field: EN 61000-4-8, 30 A/m, perf. criteria A
- Voltage Dips & Interruptions: EN 61000-4-11

### General Specifications

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>95% max. (non condensing)</th>
</tr>
</thead>
</table>
| Temperature Ranges
  - Operating Temperature | -40°C to +80°C |
  - Storage Temperature | -40°C to +80°C |
| Power Derating
  - High Temperature | Depending on model 1.33 %/V below 100 VAC |
  - Low Input Voltage |

See application note: www.tracopower.com/overview/tpp450b-m

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Over Temperature Protection Switch Off
- **Protection Mode**: 110°C to 125°C (Latch off)
- **Measurement Point**: See application note: [www.tracopower.com/overview/tpp450b-m](http://www.tracopower.com/overview/tpp450b-m) (Standby Power Source always present)

### Cooling System
- **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**
- **Remote Pin Input Current**: On: 3.0 to 12 VDC or open circuit
- **Off**: 0 to 1.2 VDC or short circuit
- **Refers to ‘+Remote’ and ‘-Remote’ Pin**:
  - 0.5 to 1.0 mA
  (Standby power source is always present)

### Altitude During Operation
- **Altitude During Operation**: 5'000 m max.

### Switching Frequency
- **Switching Frequency**: 55 - 85 kHz (PFM)

### Insulation System
- **Insulation System**: Reinforced Insulation

### Working Voltage (rated)
- **Working Voltage**: 312 VAC

### Isolation Test Voltage
- **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
- **Isolation Resistance**
  - Input to Output, 500 VDC: 100 MΩ min.

### Leakage Current (at 264 VAC)
- **Leakage Current**
  - Touch Current: 100 µA max.

### Reliability
- **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

### Housing Material
- **Housing Material**: Stainless Steel (Cover)

### Housing Type
- **Housing Type**: Metal Case

### Mounting Type
- **Mounting Type**: Chassis Mount

### Connection Type
- **Connection Type**: Pin Connector

### Weight
- **Weight**: 552 g

### Power OK Signal
- **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: 23.0 - 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**
- **Power Off**: High resistance
  (Refers to ‘PG’ and ‘-Vout’ Pin)
- **Pin Specifications**
  - 50 VDC / 50 mA / 120 mW max.

### Sense Function
- **Sense Function**: 8% max. of Vout nom.
  (If sense function is not used, sense pins should be connected to output pins)

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All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
Environmental Compliance
- REACH Declaration
- RoHS Declaration
- SCIP Reference Number

Supporting Documents
Overview Link (for additional Documents)

Outline Dimensions

Max. screw penetration: 1.3 (0.05) units

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

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Optional version with fan on top

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

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