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 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
- 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 3rd edition, 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.

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</thead>
<tbody>
<tr>
<td>TPP 450-112-M</td>
<td>12 VDC (11.0 - 13.0 VDC)</td>
<td>37’500 mA</td>
<td>91 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPP 450-115-M</td>
<td>15 VDC (13.8 - 16.2 VDC)</td>
<td>30’000 mA</td>
<td>92 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPP 450-124-M</td>
<td>24 VDC (22.1 - 25.9 VDC)</td>
<td>18’750 mA</td>
<td>93 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPP 450-128-M</td>
<td>28 VDC (25.8 - 30.2 VDC)</td>
<td>16’100 mA</td>
<td>93 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPP 450-136-M</td>
<td>36 VDC (33.1 - 38.9 VDC)</td>
<td>12’500 mA</td>
<td>93 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPP 450-148-M</td>
<td>48 VDC (44.2 - 51.8 VDC)</td>
<td>9’400 mA</td>
<td>94 %</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TPP 450-153-M</td>
<td>53 VDC (48.8 - 57.2 VDC)</td>
<td>8’550 mA</td>
<td>94 %</td>
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<thead>
<tr>
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<tbody>
<tr>
<td>on demand (backorder with MOQ non stocking item)</td>
<td>- Optional version with fan on top</td>
<td></td>
</tr>
</tbody>
</table>

www.tracopower.com March 1, 2021
### Input Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>AC Range</th>
<th>DC Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>85 - 264 VAC (Full Range)</td>
<td>120 - 370 VDC (Designed for, no certification)</td>
</tr>
<tr>
<td>Frequency</td>
<td>47 - 63 Hz</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>2'400 mA max.</td>
<td>5'800 mA max.</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>800 mW max.</td>
<td></td>
</tr>
<tr>
<td>Inrush Current</td>
<td>100 A max.</td>
<td></td>
</tr>
<tr>
<td>Power Factor</td>
<td>0.95 min. (Active Power Factor Correction)</td>
<td>0.95 min. (Active Power Factor Correction)</td>
</tr>
<tr>
<td>Protection T</td>
<td>6.3 A / 250 VAC (Internal Fuse in L &amp; N)</td>
<td></td>
</tr>
</tbody>
</table>

**Recommended Input Fuse**

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

### Output Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>±8% (By trim potentiometer)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Set Accuracy</td>
<td>±1% max.</td>
</tr>
<tr>
<td>Ripple and Noise</td>
<td>250 mVp-p typ. (w/ 1 µF X7R)</td>
</tr>
<tr>
<td>Capacitive Load</td>
<td>3'250 µF max.</td>
</tr>
<tr>
<td>Temperature Coefficient</td>
<td>±0.02 %/K max.</td>
</tr>
<tr>
<td>Hold-up Time</td>
<td>12 ms min.</td>
</tr>
<tr>
<td>Start-up Time</td>
<td>2'000 ms max.</td>
</tr>
<tr>
<td>Short Circuit Protection</td>
<td>Continuous, Automatic recovery (Level 1, nom.)</td>
</tr>
<tr>
<td>Output Current Limitation</td>
<td>115 - 155% of Iout max.</td>
</tr>
<tr>
<td>Overvoltage Protection</td>
<td>110 - 135% of Vout nom.</td>
</tr>
<tr>
<td>Transient Response</td>
<td>3% max. (50% to 75% Load Step)</td>
</tr>
<tr>
<td></td>
<td>600 µs typ. (50% to 75% Load Step)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Safety Standards</th>
<th>EN 62368-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>- IT / Multimedia Equipment</td>
<td>IEC 62368-1</td>
</tr>
<tr>
<td>- Railway Fire Protection</td>
<td>UL 62368-1</td>
</tr>
<tr>
<td>- Medical Equipment</td>
<td>EN 45545-2</td>
</tr>
<tr>
<td>- Certification Documents</td>
<td>IEC 60601-1</td>
</tr>
<tr>
<td></td>
<td>ANSI/AAMI ES 60601-1</td>
</tr>
<tr>
<td></td>
<td>2 x MOPP (Means Of Patient Protection)</td>
</tr>
</tbody>
</table>

#### Protection Class
- Class 1 (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)
- Radiated Emissions: EN 60601-1-2 edition 4 (Medical Devices)
- Harmonic Current Emissions: EN 61000-3-2, class A
- Voltage Fluctuations & Flicker: EN 61000-3-3

#### EMS Immunity
- 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
  - 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
- Voltage Dips & Interruptions: EN 61000-4-11
  - 230 VAC / 50 Hz: 30%, 25 periods, perf. criteria A
  - 115 VAC / 60 Hz: 30%, 25 periods, perf. criteria A

### General Specifications

<table>
<thead>
<tr>
<th>Relative Humidity</th>
<th>95% max. (non-condensing)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Ranges</td>
<td>-40°C to +80°C</td>
</tr>
<tr>
<td>- Operating Temperature</td>
<td>-40°C to +80°C</td>
</tr>
<tr>
<td>- Storage Temperature</td>
<td>-40°C to +80°C</td>
</tr>
</tbody>
</table>

#### Power Derating
- High Temperature: See application note: www.tracopower.com/overview/tpp450
- Low Input Voltage: 1.33 %/V below 100 VAC

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

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### Over Temperature Protection Switch Off
- **Protection Mode**: 110°C to 125°C (Latch off)
- **Measurement Point**: See application note: [www.tracopower.com/overview/tpp450](http://www.tracopower.com/overview/tpp450)

(Standby Power Source always present)

### Cooling System
- **Fan Power Source**: Forced air cooling (with internal fan)
- **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**
  - **On**: 3.0 to 12 VDC or open circuit
  - **Off**: 0 to 1.2 VDC or short circuit
- **Remote Pin Input Current**
  - **-0.5 to 1.0 mA**
  (Standby power source is always present)

### Altitude During Operation
- 5’000 m max.

### 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

### Housing Material
- Stainless Steel (Cover)

### Connection Type
- JST

### 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.

### Environmental Compliance
- **REACH Declaration**
  [www.tracopower.com/info/reach-declaration.pdf](http://www.tracopower.com/info/reach-declaration.pdf)
- **REACH SVHC list compliant**
- **REACH Annex XVII compliant**
- **RoHS Declaration**
- **Exemptions: 7a, 7c-4**

### Supporting Documents

**Overview Link** (for additional Documents)
[www.tracopower.com/overview/tpp450](http://www.tracopower.com/overview/tpp450)

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

**Internally connected with –Vout

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

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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

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