AC/DC Medical Power Supply

TPP 450BA-M Series, 450 Watt

- High power density 3" x 5" open frame medical power supply
- Protection class II prepared
- 450 Watt with forced air cooling, up to 320 Watt convection cooled without derating up to 50°C
- Medical certification to IEC/EN/ES 60601-1 3rd edition for 2 x M OPP
- 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 450BA-M Series of 450 Watt AC/DC power supplies features a reinforced double I/O isolation system according to latest medical safety standards (60601-1 3rd edition, 2 x M OPP) 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. Natural convection cooled power up to 320 W at +50°C and 150W at +85°C. 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>
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</thead>
<tbody>
<tr>
<td>TPP 450-112BA-M</td>
<td>12 VDC (11.0 - 13.0 VDC)</td>
<td>37.500 mA</td>
<td>20.800 mA</td>
<td>91 %</td>
<td></td>
</tr>
<tr>
<td>TPP 450-115BA-M</td>
<td>15 VDC (13.8 - 16.2 VDC)</td>
<td>30.000 mA</td>
<td>16.600 mA</td>
<td>92 %</td>
<td></td>
</tr>
<tr>
<td>TPP 450-124BA-M</td>
<td>24 VDC (22.1 - 25.9 VDC)</td>
<td>18.750 mA</td>
<td>13.300 mA</td>
<td>93 %</td>
<td></td>
</tr>
<tr>
<td>TPP 450-128BA-M</td>
<td>28 VDC (25.8 - 30.2 VDC)</td>
<td>16.100 mA</td>
<td>11.400 mA</td>
<td>93 %</td>
<td></td>
</tr>
<tr>
<td>TPP 450-136BA-M</td>
<td>36 VDC (33.1 - 38.9 VDC)</td>
<td>12.500 mA</td>
<td>8.900 mA</td>
<td>93 %</td>
<td></td>
</tr>
<tr>
<td>TPP 450-148BA-M</td>
<td>48 VDC (44.2 - 51.8 VDC)</td>
<td>9.400 mA</td>
<td>6.650 mA</td>
<td>94 %</td>
<td></td>
</tr>
<tr>
<td>TPP 450-153BA-M</td>
<td>53 VDC (48.8 - 57.2 VDC)</td>
<td>8.550 mA</td>
<td>6.050 mA</td>
<td>94 %</td>
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### Options

## Input Specifications

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

### Input Frequency

| Operational Range: 47 - 440 Hz |

### Input Current

| Certified: 50/60 Hz |

### Power Consumption

<table>
<thead>
<tr>
<th>Full Load &amp; Vin = 230 VAC</th>
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<tbody>
<tr>
<td>2'400 mA max.</td>
</tr>
<tr>
<td>5'800 mA max.</td>
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<tr>
<td>No load &amp; Vin = 230 VAC</td>
</tr>
<tr>
<td>650 mW max.</td>
</tr>
<tr>
<td>900 mW max.</td>
</tr>
<tr>
<td>No load &amp; Vin = 115 VAC</td>
</tr>
<tr>
<td>100 A max.</td>
</tr>
<tr>
<td>55 A max.</td>
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</tbody>
</table>

### Input Inrush Current

| At 230 VAC |
| At 115 VAC |
| 0.95 min. (Active Power Factor Correction) |
| 0.95 min. (Active Power Factor Correction) |

### Power Factor

| At 230 VAC |
| At 115 VAC |

### Input Protection

- T 6.3 A / 250 VAC (Internal Fuse in L & N)
- (The need of an external fuse has to be assessed in the final application)

### 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) |

### Voltage Set Accuracy

| ±1% max. |

### Regulation

| Input Variation (Vmin - Vmax) |
| Load Variation (0 - 100%) |
| 0.2% max. |
| 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: 31250 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 |
| At 115 VAC |
| 12 ms min. |
| 12 ms min. |

### Start-up Time

| At 230 VAC |
| At 115 VAC |
| 2'000 ms max. |
| 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 |
| Response Time |
| 3% max. (50% to 75% Load Step) |
| 600 µs typ. (50% to 75% Load Step) |

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

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www.tracopower.com September 27, 2023
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)
  - www.tracopower.com/overview/tp450ba-m

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)
  - EN 55011 class B (internal filter)
  - EN 55032 class B (internal filter)
  - FCC Part 15 class B (internal filter)
  - FCC Part 18 class B (internal filter)
- Radiated Emissions
  - EN 55011 class A (internal filter)
  - EN 55032 class A (internal filter)
  - FCC Part 15 class A (internal filter)
  - FCC Part 18 class A (internal filter)
- Harmonic Current Emissions
  - EN 61000-3-2, class A
  - EN 61000-3-2, class D
  - EN 61000-3-3
- Voltage Fluctuations & Flicker
  - (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
  - 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
- Conducted RF Disturbances
- PF Magnetic Field
- Voltage Dips & Interruptions
  - Continuous: EN 61000-4-11
  - 230 VAC / 50 Hz: 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
  - EN 61000-4-6, 20 Vrms, perf. criteria A
  - EN 61000-4-8, 30 A/m, perf. criteria A

General Specifications

Relative Humidity
- 95% max. (non condensing)

Temperature Ranges
- Operating Temperature
  - -40°C to +85°C
- Storage Temperature
  - -40°C to +85°C

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

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<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
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</table>
| **Power Derating** | - High Temperature Depending on model  
- Low Input Voltage 1.33 %/V below 100 VAC  
See application note: [www.tracopower.com/overview/tpp450ba-m](http://www.tracopower.com/overview/tpp450ba-m) |
| **Over Temperature Protection Switch Off** | - Protection Mode 110°C to 125°C (Latch off)  
- Measurement Point (Standby Power Source always present)  
See application note: [www.tracopower.com/overview/tpp450ba-m](http://www.tracopower.com/overview/tpp450ba-m) |
| **Cooling System** | - Option 1  
Forced air cooling (with external fan, 21 CFM)  
- Option 2  
Natural convection (20 LFM) |
| **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  
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  
Refers to ‘+Remote’ and ‘-Remote’ Pin -0.5 to 1.0 mA  
(Standby power source is always present)  
- Remote Pin Input Current |
| **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  
- Flammability EN 45545-2  
| **Housing Type** | Open Frame |
| **Mounting Type** | Chassis Mount |
| **Connection Type** | Pin Connector |
| **Weight** | 462 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 - 25.8 VDC  
36 VDC model: 29.5 - 33.1 VDC  
48 VDC model: 38.4 - 44.2 VDC  
53 VDC model: 43.5 - 48.8 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: 38.4 - 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.  
See application note: [www.tracopower.com/overview/tpp450ba-m](http://www.tracopower.com/overview/tpp450ba-m) |
| **Sense Function** | 8% max. of Vout nom.  
(If sense function is not used, sense pins should be connected to output pins.) |

All specifications valid at nominal voltage, 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: 7a, 7c-I
(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))

- SCIP Reference Number
3ad60260-ecbf-4262-a022-cb0a645f33b4

Supporting Documents
Overview Link (for additional Documents)
www.tracopower.com/overview/tpp450ba-m

Outline Dimensions

Max. screw penetration: 1.3 (0.05)
All dimensions in mm (inch)
Tolerance: X.X ±0.5 (X.XX ±0.02)
X.X ±0.25 (X.XXX ±0.01)
Screw locked torque: max. 5.2 kgf cm / 0.51 Nm

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TPP 450BA-M Series, 450 Watt

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