AC/DC Medical Power Supply

TPP 450A Series, 450 Watt

- High power density 3" x 5" open frame medical power supply
- 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 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 450A 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. 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.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TPP 450-112A-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 450-115A-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 450-124A-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 450-128A-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 450-136A-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 450-148A-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 450-153A-M</td>
<td>53 VDC (48.8 - 57.2 VDC)</td>
<td>8’550 mA</td>
<td>6’050 mA</td>
<td>94 %</td>
<td></td>
</tr>
</tbody>
</table>

Options

<table>
<thead>
<tr>
<th>Order Code</th>
<th>Description</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>TPP 450-AUX1</td>
<td>- Optional Cable for auxiliary connection (2 x 4 pin)</td>
<td><a href="http://www.tracopower.com/products/tpp450-aux1.pdf">www.tracopower.com/products/tpp450-aux1.pdf</a></td>
</tr>
<tr>
<td>TPP 450-AUX2</td>
<td>- Optional Cable for auxiliary connection (2 x 5 pin)</td>
<td><a href="http://www.tracopower.com/products/tpp450-aux2.pdf">www.tracopower.com/products/tpp450-aux2.pdf</a></td>
</tr>
</tbody>
</table>
## Input Specifications

| Input Voltage     | Operational Range: 85 - 264 VAC (Full Range)  
|                  | Rated Range: 100 - 240 VAC (Full Range)  
|                  | - DC Range Operational Range: 120 - 370 VDC (Designed for, no certification)  
|                  | Polarity: +DC: L / −DC: N  

| Input Frequency   | Operational Range: 47 - 440 Hz  
|                  | Certified: 50/60 Hz  

| Input Current     | Certified: 2'400 mA max.  
|                  | 5'800 mA max.  
| - Full Load & Vin = 230 VAC  
| - Full Load & Vin = 115 VAC  

| Power Consumption | 650 mW max.  
|                  | 900 mW max.  
| - No load & Vin = 230 VAC  
| - No load & Vin = 115 VAC  

| Input Inrush Current | 100 A max.  
|                     | 55 A max.  
| - At 230 VAC  
| - At 115 VAC  

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

| Input Protection   | T6 3 A / 250 VAC (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 | ±8% (By trim potentiometer)  
|                          | Output power must not exceed rated power!  

| Voltage Set Accuracy     | ±1% max.  
|                         | 0.2% max.  
|                         | 0.5% max.  

| Regulation              | 0.2% max.  
|                         | 0.5% max.  
| - Input Variation (Vmin - Vmax)  
| - Load Variation (0 - 100%)  

| 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: 31'250 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: 1'800 µF max.  

| Minimum Load            | Not required  
|                       | ±0.02 %/K max.  

| Temperature Coefficient | 0.02 %/K max.  
|                       | 12 ms min.  
|                       | 12 ms min.  
| - At 230 VAC  
| - At 115 VAC  

| Hold-up Time            | 2'000 ms max.  
|                        | 2'000 ms max.  
| - At 230 VAC  
| - At 115 VAC  

| Start-up Time           | Continuous, Automatic recovery [Level 1, nom.]  
|                        | Latch [Level 2, instantaneous high current]  
|                        | 115 - 155% of Iout max.  

| Short Circuit Protection | 110 - 135% of Vout nom.  
|                         | (Latch off, Standby Power Source always present)  

| Overvoltage Protection  | 3% max. ([50% to 75% Load Step]  
|                         | 600 µs typ. ([50% to 75% Load Step]  

| Transient Response      | 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.
**Safety Specifications**

<table>
<thead>
<tr>
<th>Protection Class</th>
<th>Safety Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 (Prepared)</td>
<td>- IT / Multimedia Equipment: EN 55011-1 2 edition 4 (Medical Devices)</td>
</tr>
<tr>
<td></td>
<td>- Railway Fire Protection: EN 45545-2</td>
</tr>
<tr>
<td></td>
<td>- Medical Equipment: EN 60601-1</td>
</tr>
<tr>
<td></td>
<td>- Certification Documents: ANSI/AAMI ES 60601-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pollution Degree</th>
<th>Over Voltage Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD 2</td>
<td>OVC II</td>
</tr>
</tbody>
</table>

**EMC Specifications**

<table>
<thead>
<tr>
<th>EMI Emissions</th>
<th>EMC Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Conducted Emissions</td>
<td>EN 60601-1-2 edition 4 (Medical Devices)</td>
</tr>
<tr>
<td>- Radiated Emissions</td>
<td>EN 55011 class B (internal filter)</td>
</tr>
<tr>
<td>- Harmonic Current Emissions</td>
<td>EN 61000-3-2, class A</td>
</tr>
<tr>
<td>- Voltage Fluctuations &amp; Flicker</td>
<td>EN 61000-3-3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EMS Immunity</th>
<th>EMC Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Electrostatic Discharge</td>
<td>EN 61000-4-2, ±15 kV, perf. criteria A</td>
</tr>
<tr>
<td>- RF Electromagnetic Field</td>
<td>EN 61000-4-2, ±8 kV, perf. criteria A</td>
</tr>
<tr>
<td>- EFT (Burst) / Surge</td>
<td>EN 61000-4-3, 3 V/m, perf. criteria A</td>
</tr>
<tr>
<td>- Conducted RF Disturbances</td>
<td>EN 61000-4-4, ±2 kV, perf. criteria A</td>
</tr>
<tr>
<td>- PF Magnetic Field</td>
<td>EN 61000-4-5, ±1 kV, perf. criteria A</td>
</tr>
<tr>
<td>- Voltage Dips &amp; Interruptions</td>
<td>EN 61000-4-6, 20 Vrms, perf. criteria A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General Specifications</th>
<th>EMC Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Humidity</td>
<td>95% max. (non-condensing)</td>
</tr>
<tr>
<td>Temperature Ranges</td>
<td>- Operating Temperature: -40°C to +85°C</td>
</tr>
<tr>
<td></td>
<td>- Storage Temperature: -40°C to +85°C</td>
</tr>
</tbody>
</table>

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Power Derating
- High Temperature
- Low Input Voltage

See application note: [www.tracopower.com/overview/tpp450a](http://www.tracopower.com/overview/tpp450a)

1.33 %/V below 100 VAC

### Over Temperature Protection Switch Off
- Protection Mode
- Measurement Point

See application note: [www.tracopower.com/overview/tpp450a](http://www.tracopower.com/overview/tpp450a)

(Standby Power Source always present)

110°C to 125°C (Latch off)

### Cooling System
- Option 1
  - Forced air cooling (with external fan, 21 CFM)
- Option 2
  - Natural convection (20 LFM)

### Fan Power Source
- Characteristic
- Output Voltage
- Output Current

Variable fan speed (temperature regulated)

12 V DC

500 mA max.

### Standby Power Source
- Output Voltage
- Output Current

5 V DC

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)

### 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
- Input to Case or PE, 60 s
- Output to Case or PE, 60 s

4'000 VAC

2'500 VAC

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
  - Mechanical Shock

IEC 60068-2-6

IEC 60068-2-27

### 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: 39.4 - 44.2 VDC
53 VDC model: 43.5 - 48.8 VDC

- Power OK
- Power Off

Low level

High resistance

(Refers to ‘PG’ and ‘-Vout’ Pin)

- Pin Specifications

50 VDC / 50 mA / 120 mW max.

### 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
- RoHS Declaration
- Flammability (EN 45545-2)

**Supporting Documents**
Summary Link (for additional Documents) www.tracopower.com/overview/tpp450a

**Outline Dimensions**

![Diagram of TPP 450A Series, 450 Watt](image_url)

**Input**
- **CON1**
  - Pin 1: AC (L)
  - Pin 2: AC (N)
  - Pin 3: Voltage Adj.

**Output**
- **CON2**
  - Pin 1-5: +Vout
  - Pin 6-10: –Vout

**Auxiliary**
- **CON3**
  - Pin 1: +Fan
  - Pin 2: +Sense
  - Pin 3: +Remote
  - Pin 4: PG
  - Pin 5: +Standby
  - Pin 6: –Fan**
  - Pin 7: –Sense
  - Pin 8: –Remote**
  - Pin 9: No Pin
  - Pin 10: –Standby**

*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

**Specifications:**
- 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 kgfcm / 0.51 Nm

© Copyright 2022 Traco Electronic AG
Specifications can be changed without notice.

Rev. September 20, 2022
Page 5 / 5