AC/DC Medical Power Supply

TPP 40 Series, 40 Watt

- Enclosed power supply with screw terminal connection
- Certification according to IEC/EN/ES 60601-1 3rd edition for 2 x MOPP
- Low leakage current <75 µA rated for BF applications
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- EMC compliance to IEC 60601-1-2 ed. 4
- Protection class I and II prepared
- Operating up to 5000 m altitude
- Ready to meet ErP directive, <0.15 W no load power consumption
- 5-year product warranty

The TPP 40 Series of 40 Watt AC/DC power supplies feature a reinforced double I/O isolation system according to latest medical safety standards IEC/EN/ES 60601-1 3rd edition for 2 x MOPP up to 5000 m altitude. The leakage current is below 75 µA what makes the units suitable for BF (body floating) applications. The excellent efficiency of up to 92% allows a high power density for the standard 2.38” x 3.53” packaging format. The full load operating temperature range is −40°C to +70°C while it goes up to 85°C with 50% load derating. The EMC characteristic complies to IEC 60601-1-2 ed.4 and is dedicated for applications in industrial and domestic fields. 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>Order Code</th>
<th>Output Power</th>
<th>Output 1</th>
<th>Output 2</th>
<th>Output 3</th>
<th>Efficiency typ.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Vnom</td>
<td>Imax</td>
<td>Vnom</td>
<td>Imax</td>
</tr>
<tr>
<td>TPP 40-105</td>
<td>40 W</td>
<td>5 VDC</td>
<td>8'000 mA</td>
<td>+12 VDC</td>
<td>+16'700 mA</td>
</tr>
<tr>
<td>TPP 40-112</td>
<td></td>
<td>12 VDC</td>
<td>3'340 mA</td>
<td>+15 VDC</td>
<td>+2'670 mA</td>
</tr>
<tr>
<td>TPP 40-115</td>
<td></td>
<td>15 VDC</td>
<td>2'670 mA</td>
<td>+24 VDC</td>
<td>1'670 mA</td>
</tr>
<tr>
<td>TPP 40-124</td>
<td></td>
<td>24 VDC</td>
<td>1'670 mA</td>
<td>+24 VDC</td>
<td>500 mA</td>
</tr>
<tr>
<td>TPP 40-221</td>
<td>+12 VDC</td>
<td>3'340 mA</td>
<td>+5 VDC</td>
<td>6'000 mA</td>
<td>−12 VDC</td>
</tr>
<tr>
<td>TPP 40-231</td>
<td>+15 VDC</td>
<td>2'670 mA</td>
<td>+5 VDC</td>
<td>6'000 mA</td>
<td>−15 VDC</td>
</tr>
<tr>
<td>TPP 40-251</td>
<td>+24 VDC</td>
<td>1'670 mA</td>
<td>+5 VDC</td>
<td>6'000 mA</td>
<td>+12 VDC</td>
</tr>
<tr>
<td>TPP 40-321M2</td>
<td>+12 VDC</td>
<td>3'340 mA</td>
<td>+5 VDC</td>
<td>6'000 mA</td>
<td>−12 VDC</td>
</tr>
<tr>
<td>TPP 40-331M3</td>
<td>+15 VDC</td>
<td>2'670 mA</td>
<td>+5 VDC</td>
<td>6'000 mA</td>
<td>−15 VDC</td>
</tr>
<tr>
<td>TPP 40-3512</td>
<td>+24 VDC</td>
<td>1'670 mA</td>
<td>+5 VDC</td>
<td>6'000 mA</td>
<td>+12 VDC</td>
</tr>
</tbody>
</table>

Note: Total output power must not exceed 40 W.
- Other output models are available on request.
## Input Specifications

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

### Input Frequency
- 47 - 63 Hz

### Input Current
- Full Load & Vin = 230 VAC
  - single output models: 500 mA max.
  - dual output models: 550 mA max.
  - triple output models: 550 mA max.
- Full Load & Vin = 115 VAC
  - single output models: 1'000 mA max.
  - dual output models: 1'050 mA max.
  - triple output models: 1'050 mA max.

### Power Consumption
- At no load: 150 mW max. (Ready to meet ErP directive)
- At 230 VAC: 60 A max.

### Input Inrush Current
- T 3.15 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
- ±10% (only Output 1)
  (By trim potentiometer)
- ±1% max. (Output 1)
- ±2% max. (Output 2 and 3)

### Voltage Set Accuracy
- ±1% max. (Output 1)
- ±2% max. (Output 2 and 3)

### Regulation
- Input Variation (Vmin - Vmax)
  - single output models: 0.2% max.
  - dual output models: 0.2% max.
  - triple output models: 0.2% max.
- Load Variation (0 - 100%)
  - single output models: 0.7% max. (5 VDC model)
  - dual output models: 0.5% max. (Output 1)
  - triple output models: 1.5% max. (Output 2)
- Cross Regulation (25% / 100% asym. load)
  - single output models: 1.5% max.
  - dual output models: 1.5% max.
  - triple output models: 1.5% max.

### Ripple and Noise (20 MHz Bandwidth)
- 5 VDC model: 75 mVp-p typ. (w/ 10 µF X7R)
- 12 VDC model: 75 mVp-p typ. (w/ 10 µF X7R)
- 15 VDC model: 75 mVp-p typ. (w/ 10 µF X7R)
- 24 VDC model: 75 mVp-p typ. (w/ 1 µF X7R)
- 12 / 5 VDC model: 120 / 100 mVp-p typ. (w/ 10 µF X7R)
- 15 / 5 VDC model: 150 / 100 mVp-p typ. (w/ 10 µF X7R)
- 24 / 5 VDC model: 240 / 100 mVp-p typ. (w/ 10 µF X7R)
- 12 / 5 / -12 VDC model: 120 / 100 / 120 mVp-p typ. (w/ 10 µF X7R)
- 15 / 5 / -15 VDC model: 150 / 100 / 150 mVp-p typ. (w/ 10 µF X7R)
- 24 / 5 / -12 VDC model: 240 / 100 / 120 mVp-p typ. (w/ 10 µF X7R)

### Capacitive Load
- single output
  - 5 VDC model: 16’000 µF max.
  - 12 VDC model: 2’785 µF max.
  - 15 VDC model: 1’780 µF max.
  - 24 VDC model: 700 µF max.
- dual output
  - 12 / 5 VDC model: 1’750 / 2’000 µF max.
  - 15 / 5 VDC model: 1’870 / 2’000 µF max.
  - 24 / 5 VDC model: 440 / 2’000 µF max.
- triple output
  - 12 / 5 / -12 VDC model: 1’750 / 2’000 / 420 µF max.
  - 15 / 5 / -15 VDC model: 1’870 / 2’000 / 420 µF max.
  - 24 / 5 / -12 VDC model: 440 / 2’000 / 420 µF max.

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
### Minimum Load
Not required
(0.5 W for Vout1 and Vout2 if Vout3 = Full Load)

### Temperature Coefficient
±0.02 %/K max.

### Hold-up Time
- At 115 VAC
  25 ms min.

### Start-up Time
- At 230 VAC
  1'000 ms max.

### Short Circuit Protection
Continuous, Automatic recovery

### Output Current Limitation
115 - 180% of Iout max.
145% typ. of Iout max.
(Pout1 + Pout2)

### Overvoltage Protection
125 - 140% of Vout nom.
(only Output 1)

### Transient Response
- Response Deviation
  3% max. (50% to 75% Load Step)
- Response Time
  600 µs typ. (50% to 75% Load Step)
(only Output 1)

### Safety Specifications

#### Safety 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
  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 60610-1-2 edition 4 (Medical Devices)
  EN 55011 class B (internal filter)
  EN 55032 class B (internal filter)
  FCC Part 18 class B (internal filter)
- Radiated Emissions
  EN 55011 class B (internal filter)
  EN 55032 class B (internal filter)
  FCC Part 18 class B (internal filter)
- Harmonic Current Emissions
  EN 61000-3-2, class A
- Voltage Fluctuations & Flicker
  EN 61000-3-3

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

- **Electrostatic Discharge**
  - Air: EN 60601-1-2 Edition 4 (Medical Devices)  
  - Contact: EN 61000-4-2, ±15 kV, perf. criteria A
- **RF Electromagnetic Field**
  - EN 61000-4-3, 20 V/m, perf. criteria A
  - EN 61000-4-4, ±2 kV, perf. criteria A
  - EN 61000-4-5, ±1 kV, perf. criteria A
  - EN 61000-4-6, 20 Vrms, perf. criteria A
- **EFT (Burst) / Surge**
  - L to L: EN 61000-4-2, ±15 kV, perf. criteria A
  - L to PE: EN 61000-4-2, ±15 kV, perf. criteria A
  - Continuous: EN 61000-4-8, 30 A/m, perf. criteria A
- **Conducted RF Disturbances**
  - EN 61000-4-11  
  - EN 61000-4-11  
  - EN 61000-4-11
- **PF Magnetic Field**
  - EN 61000-4-8, 30 A/m, perf. criteria A
- **Voltage Dips & Interruptions**
  - Continuous: 230 VAC / 60 Hz  
  - EN 60601-1-2 Edition 4 (Medical Devices)  
  - >95%, 25 periods, perf. criteria A
  - >95%, 250 periods, perf. criteria B
  - >95%, 25 periods, perf. criteria A
  - >95%, 250 periods, perf. criteria B
  - >95%, 25 periods, perf. criteria A
  - >95%, 250 periods, perf. criteria B
  - >95%, 25 periods, perf. criteria A
  - >95%, 250 periods, perf. criteria B
  - >95%, 25 periods, perf. criteria A
  - >95%, 250 periods, perf. criteria B

### General Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative Humidity</td>
<td>95% max. (non-condensing)</td>
</tr>
<tr>
<td>Temperature Ranges</td>
<td></td>
</tr>
<tr>
<td>- Operating Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>- Storage Temperature</td>
<td>-40°C to +85°C</td>
</tr>
<tr>
<td>Power Derating</td>
<td>See application note: <a href="http://www.tracopower.com/overview/tpp40">www.tracopower.com/overview/tpp40</a></td>
</tr>
<tr>
<td>- High Temperature</td>
<td></td>
</tr>
<tr>
<td>- Low Input Voltage</td>
<td><a href="http://www.tracopower.com/overview/tpp40">www.tracopower.com/overview/tpp40</a></td>
</tr>
<tr>
<td>Cooling System</td>
<td>Natural convection (20 LFM)</td>
</tr>
<tr>
<td>Altitude During Operation</td>
<td>5'000 m max.</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>50 - 140 kHz (PWM) (Output 1)</td>
</tr>
<tr>
<td></td>
<td>750 kHz typ. (PWM) (Output 2)</td>
</tr>
<tr>
<td></td>
<td>510 kHz typ. (PWM) (Output 3)</td>
</tr>
<tr>
<td>Insulation System</td>
<td>Reinforced Insulation</td>
</tr>
<tr>
<td>Working Voltage (rated)</td>
<td>256 VAC</td>
</tr>
<tr>
<td>Isolation Test Voltage</td>
<td></td>
</tr>
<tr>
<td>- Input to Output, 60 s</td>
<td>4'000 VAC</td>
</tr>
<tr>
<td>- Input to Case or PE, 60 s</td>
<td>2'500 VAC</td>
</tr>
<tr>
<td>- Output to Case or PE, 60 s</td>
<td>2'500 VAC</td>
</tr>
<tr>
<td>Creepage</td>
<td>8 mm min.</td>
</tr>
<tr>
<td>Clearance</td>
<td>8 mm min.</td>
</tr>
<tr>
<td>Isolation Resistance</td>
<td>100 MΩ min.</td>
</tr>
<tr>
<td>Leakage Current (at 264 VAC)</td>
<td>75 μA max.</td>
</tr>
<tr>
<td>Reliability</td>
<td></td>
</tr>
<tr>
<td>- Calculated MTBF</td>
<td>3'000'000 h (for single output models)</td>
</tr>
<tr>
<td></td>
<td>1'700'000 h (for multi output models)</td>
</tr>
<tr>
<td></td>
<td>(MIL-HDBK-217F, ground benign)</td>
</tr>
<tr>
<td>Environment</td>
<td>IEC 60068-2-6</td>
</tr>
<tr>
<td>- Vibration</td>
<td>5 g, 3 axis, sine sweep, 5-500 Hz, 1 oct/min</td>
</tr>
<tr>
<td></td>
<td>IEC 60068-2-27</td>
</tr>
<tr>
<td></td>
<td>50 g, 3 axis, half sine, 11 ms</td>
</tr>
<tr>
<td>Housing Material</td>
<td>Aluminium</td>
</tr>
<tr>
<td>Housing Type</td>
<td>Metal Case</td>
</tr>
<tr>
<td>Mounting Type</td>
<td>Chassis Mount</td>
</tr>
<tr>
<td>Connection Type</td>
<td>Screw Terminal</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
</tr>
<tr>
<td>- single output</td>
<td>169 g</td>
</tr>
<tr>
<td>- dual output</td>
<td>216 g</td>
</tr>
<tr>
<td>- triple output</td>
<td>216 g</td>
</tr>
</tbody>
</table>

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

REACH SVHC list compliant
REACH Annex XVII compliant

- RoHS Declaration

www.tracopower.com/info/reach-declaration.pdf
www.tracopower.com/info/rohs-declaration.pdf

Supporting Documents
Overview Link (for additional Documents)

www.tracopower.com/overview/tpp40

Outline Dimensions

Single Output Models

Max. corner screw penetration: 2.3 (0.09)
Max. center screw penetration: 2.0 (0.08)
All dimensions in mm (inch)
Tolerance: \( X \pm 0.005 \) (\( X \pm 0.02 \))
\( X \pm 0.025 \) (\( X \pm 0.010 \))
The screw locked torque:
max. 5.0 kgfcm / 0.49 Nm
Terminal screw locked torque:
max. 4.0 kgfcm / 0.39 Nm

Screw Terminal

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</th>
<th>Pin*</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Line</td>
<td>1,2</td>
<td>–Vout</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
<td>3,4</td>
<td>+Vout</td>
</tr>
</tbody>
</table>

*Terminal rated for 10 A max.
(at higher current connection has to be split)

CON1: Terminal Block
mates with Screw locked torque MAX 2Kgf.cm/0.2N.m
Wire dimension range: 26 - 16 AWG

CON2: Terminal Block
mates with Screw locked torque MAX 2Kgf.cm/0.2N.m
Wire dimension range: 26 - 16 AWG

Multi Output Models

Max. corner screw penetration: 2.3 (0.09)
Max. center screw penetration: 2.0 (0.08)
All dimensions in mm (inch)
Tolerance: \( X \pm 0.005 \) (\( X \pm 0.02 \))
\( X \pm 0.025 \) (\( X \pm 0.010 \))
The screw locked torque:
max. 5.0 kgfcm / 0.49 Nm
Terminal screw locked torque:
max. 4.0 kgfcm / 0.39 Nm

Screw Terminal

<table>
<thead>
<tr>
<th>Input (CON1)</th>
<th>Output (CON2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pin</td>
<td>Function</td>
</tr>
<tr>
<td>-----</td>
<td>----------</td>
</tr>
<tr>
<td>1</td>
<td>Line</td>
</tr>
<tr>
<td>3</td>
<td>Neutral</td>
</tr>
<tr>
<td>4,5</td>
<td>Vout 2</td>
</tr>
<tr>
<td>6</td>
<td>Vout 1</td>
</tr>
</tbody>
</table>

*Terminal rated for 10 A max.
(at higher current connection has to be split)

CON1: Terminal Block
mates with Screw locked torque MAX 2Kgf.cm/0.2N.m
Wire dimension range: 26 - 16 AWG

CON2: Terminal Block
mates with Screw locked torque MAX 2Kgf.cm/0.2N.m
Wire dimension range: 26 - 16 AWG

Specifications can be changed without notice.

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Rev. January 13, 2022
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