DC/DC Railway Converter

TEP 100WIRCM Series, 100 Watt

- Chassis mount with screw terminal block
- Ultra wide 4:1 input voltage ranges 9–36, 18–75, 43–160 VDC
- EN 50155 approval for railway applications
- Very high efficiency up to 93%
- No minimum load
- Soft start
- Adjustable output voltage +10/-20%
- Sense line
- Remote On/Off input
- Under voltage lock-out circuit
- 3-year product warranty

The TEP 100WIR Series is a family of isolated high performance DC/DC converter modules with ultra-wide 4:1 input voltage ranges which come in a rugged, sealed industry standard half brick package. A very high efficiency allows full power operation without forced air cooling at 60°C This temperature can be increased to 70°C with optional mounted heatsink or up to 85°C when mounted on an iron base plate. The very wide input voltage range make these converters interesting solution for battery operated systems. Typical applications are in telecom/datacom, industry control and railway systems for on board power distribution.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>TEP-MK1</td>
<td>- Optional model with 3.3 VDC / 25'000 mA Output and 9 - 36 VDC Input</td>
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<tr>
<td></td>
<td>- Optional model with 5 VDC / 20'000 mA Output and 9 - 36 VDC Input</td>
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<tr>
<td></td>
<td>- Optional model with 12 VDC / 8'400 mA Output and 9 - 36 VDC Input</td>
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<tr>
<td></td>
<td>- Optional model with 15 VDC / 6'700 mA Output and 9 - 36 VDC Input</td>
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<td></td>
<td>- Optional model with 24 VDC / 4'200 mA Output and 9 - 36 VDC Input</td>
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<td>- Optional model with 28 VDC / 3'600 mA Output and 9 - 36 VDC Input</td>
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<td>- Optional model with 48 VDC / 2'100 mA Output and 9 - 36 VDC Input</td>
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<tr>
<td></td>
<td>- Optional model with 3.3 VDC / 25'000 mA Output and 18 - 75 VDC Input</td>
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<td></td>
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www.tracopower.com  December 11, 2023  Page 1 / 5
## Input Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>110 Vin models</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current</td>
<td>- At no load</td>
<td>10 mA typ.</td>
<td>20 mA typ.</td>
</tr>
<tr>
<td></td>
<td>25 mA typ.</td>
<td>(3.3 Vout model)</td>
<td>(5 Vout model)</td>
</tr>
<tr>
<td></td>
<td>25 mA typ.</td>
<td>(12 Vout model)</td>
<td>(15 Vout model)</td>
</tr>
<tr>
<td></td>
<td>25 mA typ.</td>
<td>(24 Vout model)</td>
<td>(28 Vout model)</td>
</tr>
<tr>
<td></td>
<td>25 mA typ.</td>
<td>(48 Vout model)</td>
<td>(75 Vout model)</td>
</tr>
</tbody>
</table>

| Surge Voltage              | 24 Vin models | 50 VDC max. | 100 VDC max. |
|                           | 48 Vin models | 185 VDC max. | 50 VDC max. |

| Under Voltage Lockout      | 24 Vin models | 15.5 VDC min. | 33 VDC min. |
|                           | 48 Vin models | 7.3 VDC typ. | 34.5 VDC typ. |

| Recommended Input Fuse     | 24 Vin models | 20'000 mA (fast acting) |
|                           | 48 Vin models | 12'000 mA (fast acting) |
|                           | 110 Vin models | 5'000 mA (slow blow) |

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

| Input Filter               | Internal Pi-Type |

## Output Specifications

### Output Voltage Adjustment

See application note: [www.tracopower.com/overview/tep100wirmc](http://www.tracopower.com/overview/tep100wirmc)

Output power must not exceed rated power!

### Voltage Set Accuracy

-20% to +10% (By external trim resistor)

### Regulation

- Input Variation (Vmin - Vmax)
  - 0.1% max.
- Load Variation (0% - 100%)
  - 0.1% max.

### Ripple and Noise

(20 MHz Bandwidth)

<table>
<thead>
<tr>
<th>Vout models</th>
<th>3.3V max.</th>
<th>5V max.</th>
<th>12V max.</th>
<th>15V max.</th>
<th>24V max.</th>
<th>28V max.</th>
<th>48V max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>mVp-p max.</td>
<td>75</td>
<td>75</td>
<td>100</td>
<td>100</td>
<td>200</td>
<td>200</td>
<td>300</td>
</tr>
<tr>
<td>(w/ 1 µF X7R)</td>
<td>22 µF poscap</td>
<td>22 µF poscap</td>
<td>22 µF poscap</td>
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</tr>
</tbody>
</table>

### Capacitive Load

<table>
<thead>
<tr>
<th>µF max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3V out</td>
</tr>
<tr>
<td>5V out</td>
</tr>
<tr>
<td>12V out</td>
</tr>
<tr>
<td>15V out</td>
</tr>
<tr>
<td>24V out</td>
</tr>
<tr>
<td>28V out</td>
</tr>
<tr>
<td>48V out</td>
</tr>
</tbody>
</table>

### Minimum Load

Not required

### Temperature Coefficient

±0.02 %/K max.

### Hold-up Time

10 ms min. (acc. to EN 50155 Class S2, see application note for ext. capacitor calculation: [www.tracopower.com/info/holdup_en50155.pdf](http://www.tracopower.com/info/holdup_en50155.pdf))

### Start-up Time

75 ms typ.

All specifications valid at nominal voltage, resistive full load and +25°C after warm-up time, unless otherwise stated.
<table>
<thead>
<tr>
<th>Short Circuit Protection</th>
<th>Continuous, Automatic recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Current Limitation</td>
<td>150% typ. of Iout max. (110 Vin models)</td>
</tr>
<tr>
<td></td>
<td>120 - 150% (other models)</td>
</tr>
<tr>
<td>Overvoltage Protection</td>
<td>115 - 130% of Vout nom.</td>
</tr>
<tr>
<td>Transient Response</td>
<td>- Response Time</td>
</tr>
<tr>
<td></td>
<td>200 µs typ. / 250 µs max. (25% Load Step)</td>
</tr>
</tbody>
</table>

### Safety Specifications

**Standards**
- IT / Multimedia Equipment
  - EN 60950-1
  - EN 62368-1
  - IEC 60950-1
  - IEC 62368-1
  - UL 60950-1
  - UL 62368-1
- Railway Applications
  - EN 50155
- Certification Documents
  - www.tracopower.com/overview/tep100wircm

### EMC Specifications

**EMI Emissions**
- Conducted Emissions
  - EN 50121-3-2 (EMC for Rolling Stock)
  - EN 55011 class B (with external filter)
  - EN 55032 class B (with external filter)
- Radiated Emissions
  - EN 50121-3-2 (EMC for Rolling Stock)
  - EN 55011 class B (with external filter)
  - EN 55032 class B (with external filter)

**EMS Immunity**
- Electrostatic Discharge
  - Air: EN 61000-4-2, ±8 kV, perf. criteria A
  - Contact: EN 61000-4-2, ±6 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, ±2 kV, perf. criteria A

**Conducted RF Disturbances**
- Continuous: EN 61000-4-6, 24 Vin models, 10 Vrms, perf. criteria A
- 1 s: EN 61000-4-8, 100 A/m, perf. criteria A
- Ext. input component: 24 Vin models: 2 x KY 220 µF
  - 48 Vin models: 2 x KY 220 µF
  - 110 Vin models: 2 x KXJ 150 µF

**PF Magnetic Field**
- Continuous: EN 61000-4-8, 100 A/m, perf. criteria A
- 1 s: EN 61000-4-8, 1000 A/m, perf. criteria A

### General Specifications

**Relative Humidity**
- 95% max. (non condensing)

**Temperature Ranges**
- Operating Temperature
  - -40°C to +75°C
- Case Temperature
  - +105°C max.
- Storage Temperature
  - -40°C to +105°C

**Power Derating**
- High Temperature
  - See application note: www.tracopower.com/overview/tep100wircm

**Over Temperature Protection Switch Off**
- Protection Mode
  - 115°C typ. (Automatic recovery at 105°C typ.)
- Measurement Point
  - Base-Plate

**Cooling System**
- Natural convection (20 LFM)

**Sense Function**
- 10% max. of Vout nom.
  - (If sense function is not used, sense pins must be connected to corresponding polarity output pins.)
Remote Control - Voltage Controlled Remote
  (passive = on)
On: 3.0 to 12 VDC or open circuit
Off: 0 to 1.2 VDC or short circuit
Refer to 'Remote' and '-Vin' Pin
  3 mA typ.
- Off Idle Input Current
- Remote Pin Input Current
  -0.5 to 1.0 mA
(Optional models with inverse Remote On/Off function (passive = off))

Altitude During Operation
  2'000 m max. (for reinforced insulation)
  5'000 m max. (for functional insulation)

Switching Frequency
  300 kHz typ. (PWM (±10%, 110 V Vin models)
  250 kHz typ. (PWM (±10%, other models)

Insulation System
  Reinforced Insulation

Working Voltage (rated)
  177 VAC (110 V Vin models)
  145 VAC (24 and 48 V Vin, 3.3 and 5 Vout models)
  185 VAC (24 and 48 V Vin, 48 Vout models)
  172 VAC (24 and 48 V Vin, other output models)

Isolation Test Voltage
  - Input to Output, 60 s
    3'000 VAC
  - Input to Case, 60 s
    1'500 VAC
  - Output to Case, 60 s
    1'500 VAC

Isolation Resistance
  - Input to Output, 500 VDC
    1'000 MΩ min.

Isolation Capacitance
  - Input to Output, 100 kHz, 1 V
    2'500 pF max.

Reliability
  - Calculated MTBF
    409'000 h (MIL-HDBK-217F, ground benign)

Environment
  - Vibration
    MIL-STD-810F
    EN 61373
  - Mechanical Shock
    MIL-STD-810F
    EN 61373
  - Thermal Shock
    MIL-STD-810F
    EN 45545-2

Housing Material
  Alu base-plate w. metal case (24 and 48 V Vin models)
  Alu base-plate w. plastic case (110 V Vin models)

Base Material
  Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 V Vin models only)

Potting Material
  Silicone (UL 94 V-0 rated)

Housing Type
  Metal Case (24 and 48 V Vin models)
  Plastic Case (110 V Vin models)

Mounting Type
  Chassis Mount

Connection Type
  Screw Terminal

Weight
  235 g

Thermal Impedance
  - Case to Ambient
    6.7 K/W typ.

Environmental Compliance
  - REACH Declaration
    www.tracopower.com/info/reach-declaration.pdf
  - 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
  e467ae10-310c-4737-9941-0ad3db466a7d

Supporting Documents
Overview Link (for additional Documents)
www.tracopower.com/overview/tep100wircm

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

Dimensions in mm (inch)

- Tolerances x.x ± 0.5 (x.xx ± 0.02)
- Mounting hole pitch tolerances ± 0.25 (± 0.01)

Screw 1:
- Type M4
- Head diameter: 6.88 (0.271)
- Rated current: 15 A

Screw 2:
- Type M4
- Head diameter: 6.88 (0.271)

The screw 1 locked torque: max. 5.2 kgfcm / 0.51 Nm
The screw 2 locked torque: max. 12.0 kgfcm / 1.18 Nm
Mounting screw locked torque: max. 11.2 kgfcm / 1.10 Nm

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Single</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>–Vin (GND)</td>
</tr>
<tr>
<td>2</td>
<td>NC</td>
</tr>
<tr>
<td>3</td>
<td>Remote On/Off</td>
</tr>
<tr>
<td>4</td>
<td>+Vin (Vcc)</td>
</tr>
<tr>
<td>5</td>
<td>–Vout</td>
</tr>
<tr>
<td>6</td>
<td>–Sense</td>
</tr>
<tr>
<td>7</td>
<td>Trim</td>
</tr>
<tr>
<td>8</td>
<td>+Sense</td>
</tr>
<tr>
<td>9</td>
<td>+Vout</td>
</tr>
</tbody>
</table>

NC: Not connected

Wire gauge range:
AWG 14 - 26