DC/DC Railway Converter

- 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 91%
- No minimum load
- Soft start
- Adjustable output voltage +10 / -20%
- Sense line
- Remote On/Off input
- Under voltage lock-out circuit

The TEP 160WIRCM Series is a family of isolated high performance DC/DC converter modules with ultra-wide 4:1 input voltage ranges. They come in chassis mount version with screw terminal block. A very high efficiency allows full power operation without forced air cooling at 25°C. The very wide input voltage range and reverse input voltage protection 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.

### Options

|---------|----------------------------------------------------------------------------------|
| on demand (backorder with MOQ non stocking item) | - Optional model with 3.3 VDC / 40'000 mA Output and 9 - 36 VDC Input  
- Optional model with 5 VDC / 28'000 mA Output and 9 - 36 VDC Input  
- Optional model with 12 VDC / 12'000 mA Output and 9 - 36 VDC Input  
- Optional model with 15 VDC / 9'500 mA Output and 9 - 36 VDC Input  
- Optional model with 24 VDC / 6'000 mA Output and 9 - 36 VDC Input  
- Optional model with 28 VDC / 5'000 mA Output and 9 - 36 VDC Input  
- Optional model with 48 VDC / 3'000 mA Output and 9 - 36 VDC Input  
- Optional model with 3.3 VDC / 40'000 mA Output and 18 - 75 VDC Input  
- Optional model with 5 VDC / 30'000 mA Output and 18 - 75 VDC Input  
- Optional model with 12 VDC / 13'000 mA Output and 18 - 75 VDC Input  
- Optional model with 15 VDC / 10'000 mA Output and 18 - 75 VDC Input  
- Optional model with 24 VDC / 6'500 mA Output and 18 - 75 VDC Input  
- Optional model with 28 VDC / 5'500 mA Output and 18 - 75 VDC Input  
- Optional model with 48 VDC / 3'200 mA Output and 18 - 75 VDC Input  
- Optional model with 3.3 VDC / 43'000 mA Output and 43 - 160 VDC Input  
- Optional model with 5 VDC / 32'000 mA Output and 43 - 160 VDC Input  
- Optional model with 12 VDC / 15'000 mA Output and 43 - 160 VDC Input  
- Optional model with 15 VDC / 12'000 mA Output and 43 - 160 VDC Input  
- Optional model with 24 VDC / 7'500 mA Output and 43 - 160 VDC Input  
- Optional model with 28 VDC / 6'500 mA Output and 43 - 160 VDC Input  
- Optional model with 48 VDC / 3'800 mA Output and 43 - 160 VDC Input  
- Negative (passive = Off) Remote On/Off function |
### Input Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
<th>110 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Current - At no load</td>
<td>20 mA typ.</td>
<td>15 mA typ.</td>
<td>10 mA typ.</td>
</tr>
<tr>
<td>Surge Voltage</td>
<td>50 VDC max. (1 s max)</td>
<td>100 VDC max. (1 s max)</td>
<td>185 VDC max. (1 s max)</td>
</tr>
<tr>
<td>Under Voltage Lockout</td>
<td>7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max.</td>
<td>15.5 VDC min. / 16 VDC typ. / 16.3 VDC max.</td>
<td>33 VDC min. / 34.5 VDC typ. / 36 VDC max.</td>
</tr>
<tr>
<td>Recommended Input Fuse</td>
<td>29'000 mA (fast acting)</td>
<td>15'000 mA (fast acting)</td>
<td>8'000 mA (fast acting)</td>
</tr>
<tr>
<td>Input Filter</td>
<td>Internal Pi-Type</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Output Specifications

#### Output Voltage Adjustment

<table>
<thead>
<tr>
<th>Specification</th>
<th>24 Vin models</th>
<th>48 Vin models</th>
<th>110 Vin models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage Set Accuracy</td>
<td>±1% max.</td>
<td>±1% max.</td>
<td>0.1% max.</td>
</tr>
<tr>
<td>Regulation</td>
<td>- Input Variation (Vmin - Vmax)</td>
<td>3.3 Vout models: 75 mVp-p max. (w/ 1 µF X7R // 25 µF poscap)</td>
<td>5 Vout models: 75 mVp-p max. (w/ 1 µF X7R // 25 µF poscap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 Vout models: 100 mVp-p max. (w/ 1 µF X7R // 25 µF poscap)</td>
<td>15 Vout models: 100 mVp-p max. (w/ 1 µF X7R // 25 µF poscap)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 Vout models: 200 mVp-p max. (w/ 4.7 µF X7R)</td>
<td>28 Vout models: 200 mVp-p max. (w/ 4.7 µF X7R)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 Vout models: 300 mVp-p max. (w/ 2.2 µF X7R)</td>
<td>48 Vout models: 300 mVp-p max. (w/ 2.2 µF X7R)</td>
</tr>
<tr>
<td></td>
<td>- Load Variation (0 - 100%)</td>
<td>3.3 Vout models: 121’000 µF max.</td>
<td>5 Vout models: 56’000 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 Vout models: 10’000 µF max.</td>
<td>15 Vout models: 6’300 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 Vout models: 2’500 µF max.</td>
<td>28 Vout models: 1’700 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 Vout models: 620 µF max.</td>
<td>48 Vout models: 620 µF max.</td>
</tr>
<tr>
<td></td>
<td>- 48 Vin input</td>
<td>3.3 Vout models: 121’000 µF max.</td>
<td>5 Vout models: 60’000 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 Vout models: 10’800 µF max.</td>
<td>15 Vout models: 6’600 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 Vout models: 2’700 µF max.</td>
<td>28 Vout models: 1’900 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 Vout models: 660 µF max.</td>
<td>48 Vout models: 660 µF max.</td>
</tr>
<tr>
<td></td>
<td>- 110 Vin input</td>
<td>3.3 Vout models: 130’000 µF max.</td>
<td>5 Vout models: 64’000 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12 Vout models: 12’500 µF max.</td>
<td>15 Vout models: 8’000 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 Vout models: 3’100 µF max.</td>
<td>28 Vout models: 2’300 µF max.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>48 Vout models: 790 µF max.</td>
<td>48 Vout models: 790 µF max.</td>
</tr>
</tbody>
</table>

Minimum Load Not required

Temperature Coefficient ±0.02 %/K max.

Start-up Time 75 ms typ.

Short Circuit Protection Continuous, Automatic recovery

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.
Output Current Limitation      120 - 150% of Iout max.
Overvoltage Protection        115 - 130% of Vout nom.
Transient Response            - Response Time 200 µs typ. / 250 µs max. (25% Load Step)

Safety Specifications
Safety Standards:
- IT / Multimedia Equipment EN 60950-1
- Railway Applications IEC 60950-1
- Certification Documents UL 60950-1
- EN 50155
www.tracopower.com/overview/tep160wircm

Pollution Degree  PD 2
Over Voltage Category: OVC II

EMC Specifications
EMI Emissions:
- Conducted Emissions EN 55011 class B (with external filter)
- Radiated Emissions EN 55032 class B (with external filter)
- External filter proposal: www.tracopower.com/overview/tep160wircm

EMS Immunity:
- Electrostatic Discharge Air: EN 61000-4-2, ±8 kV, perf. criteria A
  Contact: EN 61000-4-2, ±1 kV, perf. criteria A
- RF Electromagnetic Field
  - 20 V/m, perf. criteria A
  - 48 Vin models: 2x KY 220 µF
  - 2x 100 Vin models: 2x 100 µF by external filter
  - Continuous: EN 61000-4-6, 10 V rms, perf. criteria A
- Conducted RF Disturbances
  - 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/tep160wircm
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.
(Sense line to be connected to the output either at the module or at the load under regard of polarity)
Remote Control
- Voltage Controlled Remote On: 3.0 to 12 VDC or open circuit
  Off: 0 to 1.2 VDC or short circuit
- Off Idle Input Current Refers to 'Remote' and '-Vin' Pin
  3 mA typ.
- Remote Pin Input Current -0.5 to 1.0 mA
Altitude During Operation 2'000 m max.
Switching Frequency 225 kHz to 275 kHz (PWM)
- 250 kHz typ. (PWM)
Insulation System Reinforced Insulation (110 Vin models)
Basic Insulation (other models)

All specifications valid at nominal voltage, full load and +25°C after warm-up time unless otherwise stated.
| **Isolation Test Voltage** | - Input to Output, 60 s | 3'000 VAC (110 Vin models)  
- Input to Case, 60 s | 2'250 VDC (other models)  
- Output to Case, 60 s | 1'500 VAC (110 Vin models)  
| - 60 s | 1'600 VDC (other models)  
| - 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 | 350'000 h (MIL-HDBK-217F, ground benign) |
| **Environment** | - Vibration | MIL-STD-810F  
- Mechanical Shock | EN 61373  
- Thermal Shock | MIL-STD-810F  
| **Housing Material** | Alu base-plate w. plastic case (110 Vin models)  
| | Alu base-plate w. metal case (other models) |
| **Base Material** | Non-conductive FR4 (UL94 V-0 rated) (24 Vin & 48 Vin models only) |
| **Potting Material** | Silicone (UL 94 V-0 rated) |
| **Connection Type** | Screw Terminal |
| **Weight** | 235 g |
| **Thermal Impedance** | 6.1 K/W |
| **Environmental Compliance** | - Reach | www.tracopower.com/info/reach-declaration.pdf  
| | - RoHS | www.tracopower.com/info/rohs-declaration.pdf  

**Supporting Documents**

| Overview Link | www.tracopower.com/overview/tep160wircm |

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

Pinout

<table>
<thead>
<tr>
<th>Pin</th>
<th>Function</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</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: No Connection

Dimensions in mm (inch)

Tolerances x.x±0.5 (x.xx±0.02)
Tolerances x.xx±0.25 (x.xxx±0.01)

The screw1 locked torque
MAX 11.2kgf-cm/1.10N-m

The screw2 locked torque
MAX 5.2kgf-cm/0.51N-m

The screw3 locked torque
MAX 16.8kgf-cm/1.65N-m