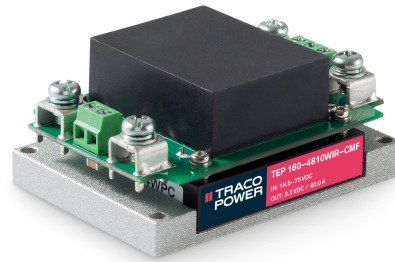


- Including EMI filter to meet EN 55032, class A
- Ultra wide 4:1 input voltage ranges 9–36, 18–75, 43–160 VDC
- EN 50155 approval for railway applications
- Very high efficiency up to 91%
- No minimum load
- Soft start
- Adjustable output voltage +10 / -20%
- Sense line
- Remote On/Off input
- Under voltage lock-out circuit



The TEP 160WIRCMF 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

TEP-MK1	- Optional DIN-Rail Mounting Kit: <a href="http://www.tracopower.com/products/tep-mk1.pdf">www.tracopower.com/products/tep-mk1.pdf</a>
<p><b>on demand</b> (backorder with MOQ non stocking item)</p>	<ul style="list-style-type: none"> <li>- Optional model with 3.3 VDC / 40'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 5 VDC / 28'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 12 VDC / 12'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 15 VDC / 9'500 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 24 VDC / 6'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 28 VDC / 5'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 48 VDC / 3'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 3.3 VDC / 40'000 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 5 VDC / 30'000 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 12 VDC / 13'000 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 15 VDC / 10'000 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 24 VDC / 6'500 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 28 VDC / 5'500 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 48 VDC / 3'200 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 3.3 VDC / 43'000 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 5 VDC / 32'000 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 12 VDC / 15'000 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 15 VDC / 12'000 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 24 VDC / 7'500 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 28 VDC / 6'500 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 48 VDC / 3'800 mA Output and 43 - 160 VDC Input</li> <li>- Negative (passive = Off) Remote On/Off function</li> </ul>

### Input Specifications

Input Current	- At no load	24 Vin models: <b>20 mA typ.</b> 48 Vin models: <b>15 mA typ.</b> 110 Vin models: <b>10 mA typ.</b>
Surge Voltage		24 Vin models: <b>50 VDC max.</b> (1 s max.) 48 Vin models: <b>100 VDC max.</b> (1 s max.) 110 Vin models: <b>185 VDC max.</b> (1 s max.)
Under Voltage Lockout		24 Vin models: <b>7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max.</b> 48 Vin models: <b>15.5 VDC min. / 16 VDC typ. / 16.3 VDC max.</b> 110 Vin models: <b>33 VDC min. / 34.5 VDC typ. / 36 VDC max.</b>
Recommended Input Fuse		24 Vin models: <b>25'000 mA</b> (fast acting) 48 Vin models: <b>15'000 mA</b> (fast acting) 110 Vin models: <b>8'000 mA</b> (fast acting) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Pi-Type</b>

### Output Specifications

Output Voltage Adjustment		-20% to +10% (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/tep160wircmf">www.tracopower.com/overview/tep160wircmf</a> Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	<b>0.1% max.</b> <b>0.1% max.</b>
Ripple and Noise (20 MHz Bandwidth)		3.3 Vout models: <b>75 mVp-p max.</b> (w/ 1 µF X7R // 25 µF poscap) 5 Vout models: <b>75 mVp-p max.</b> (w/ 1 µF X7R // 25 µF poscap) 12 Vout models: <b>100 mVp-p max.</b> (w/ 1 µF X7R // 25 µF poscap) 15 Vout models: <b>100 mVp-p max.</b> (w/ 1 µF X7R // 25 µF poscap) 24 Vout models: <b>200 mVp-p max.</b> (w/ 4.7 µF X7R) 28 Vout models: <b>200 mVp-p max.</b> (w/ 4.7 µF X7R) 48 Vout models: <b>300 mVp-p max.</b> (w/ 2.2 µF X7R)
Capacitive Load	- 24 Vin input	3.3 Vout models: <b>121'000 µF max.</b> 5 Vout models: <b>56'000 µF max.</b> 12 Vout models: <b>10'000 µF max.</b> 15 Vout models: <b>6'300 µF max.</b> 24 Vout models: <b>2'500 µF max.</b> 28 Vout models: <b>1'700 µF max.</b> 48 Vout models: <b>620 µF max.</b>
	- 48 Vin input	3.3 Vout models: <b>121'000 µF max.</b> 5 Vout models: <b>60'000 µF max.</b> 12 Vout models: <b>10'800 µF max.</b> 15 Vout models: <b>6'600 µF max.</b> 24 Vout models: <b>2'700 µF max.</b> 28 Vout models: <b>1'900 µF max.</b> 48 Vout models: <b>660 µF max.</b>
	- 110 Vin input	3.3 Vout models: <b>130'000 µF max.</b> 5 Vout models: <b>64'000 µF max.</b> 12 Vout models: <b>12'500 µF max.</b> 15 Vout models: <b>8'000 µF max.</b> 24 Vout models: <b>3'100 µF max.</b> 28 Vout models: <b>2'300 µF max.</b> 48 Vout models: <b>790 µF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>75 ms typ.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>

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

Output Current Limitation	120 - 150% of I <sub>out</sub> max.
Overvoltage Protection	115 - 130% of V <sub>out</sub> nom.
Transient Response - Response Time	200 µs typ. / 250 µs max. (25% Load Step)

### Safety Specifications

Safety Standards	- IT / Multimedia Equipment - Railway Applications - Certification Documents	EN 60950-1 IEC 60950-1 UL 60950-1 EN 50155 <a href="http://www.tracopower.com/overview/tep160wircmf">www.tracopower.com/overview/tep160wircmf</a>
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55011 class B (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55011 class B (with external filter) EN 55032 class B (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/tep160wircmf">www.tracopower.com/overview/tep160wircmf</a>
EMS Immunity	- Electrostatic Discharge	EN 50155 (Railway Applications) EN 50121-3-2 (EMC for Rolling Stock) 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
	- EFT (Burst) / Surge	EN 61000-4-4, ±2 kV, perf. criteria A
	- Conducted RF Disturbances	EN 61000-4-5, ±2 kV, perf. criteria A
	- PF Magnetic Field	EN 61000-4-6, 10 V <sub>rms</sub> , perf. criteria A 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 - Case Temperature - Storage Temperature	-40°C to +75°C +105°C max. -40°C to +105°C
Power Derating	- High Temperature	See application note: <a href="http://www.tracopower.com/overview/tep160wircmf">www.tracopower.com/overview/tep160wircmf</a>
Over Temperature Protection Switch Off	- Protection Mode - Measurement Point	115°C typ. (Automatic recovery at 105°C typ.) Base-Plate
Cooling System		Natural convection (20 LFM)
Sense Function		10% max. of V <sub>out</sub> 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  - Off Idle Input Current - Remote Pin Input Current	On: 3.0 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 3 mA typ. -0.5 to 1.0 mA
Altitude During Operation		2'000 m max.
Switching Frequency		225 - 275 kHz (PWM) 250 kHz typ. (PWM)
Insulation System		Reinforced Insulation (110 V <sub>in</sub> models) Basic Insulation (other models)
Working Voltage (rated)		145 VAC (3.3 and 5 V <sub>out</sub> models) 185 VAC (4.8 V <sub>out</sub> models) 172 VAC (other output models)

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

<b>Isolation Test Voltage</b>	- Input to Output, 60 s	3'000 VAC (110 Vin models) 2'250 VDC (other models)
	- Input to Case, 60 s	1'500 VAC (110 Vin models) 1'600 VDC (other models)
	- Output to Case, 60 s	1'500 VAC
<b>Isolation Resistance</b>	- Input to Output, 500 VDC	1'000 MΩ min.
<b>Isolation Capacitance</b>	- Input to Output, 100 kHz, 1 V	2'500 pF max.
<b>Reliability</b>	- Calculated MTBF	350'000 h (MIL-HDBK-217F, ground benign)
<b>Environment</b>	- Vibration	MIL-STD-810F EN 61373
	- Mechanical Shock	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F EN 50155
<b>Housing Material</b>		Alu base-plate w. plastic case (110 Vin models) Alu base-plate w. metal case (other models)
<b>Base Material</b>		Non-conductive FR4 (UL94 V-0 rated) (24 Vin & 48 Vin models only)
<b>Potting Material</b>		Silicone (UL 94 V-0 rated)
<b>Connection Type</b>		Screw Terminal
<b>Weight</b>		287 g (models with filter)
		280 g (models without filter)
<b>Thermal Impedance</b>		6.1 K/W
<b>Environmental Compliance</b>	- Reach	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a>
	- RoHS	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>
	- Flammability (EN 45545-2)	<a href="http://www.tracopower.com/info/en45545-declaration.pdf">www.tracopower.com/info/en45545-declaration.pdf</a>

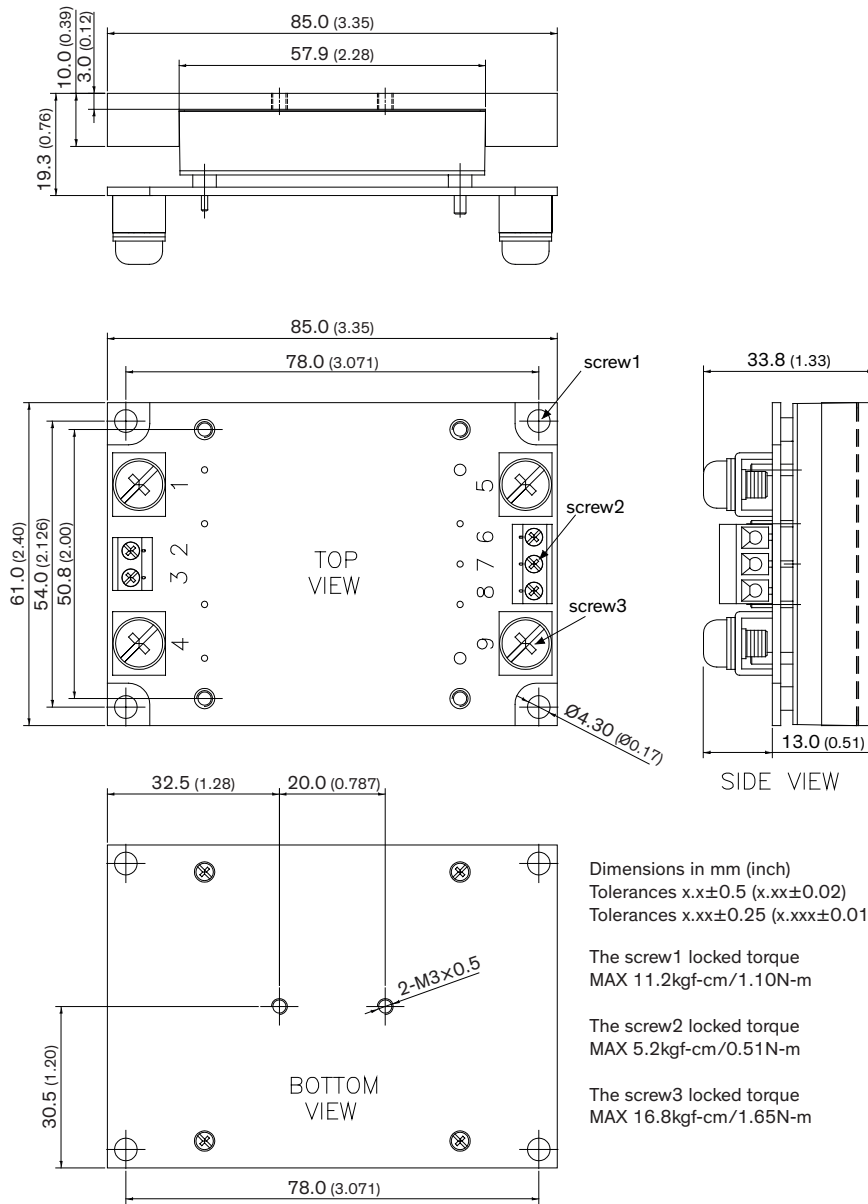
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tep160wircmf](http://www.tracopower.com/overview/tep160wircmf)

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

### Outline Dimensions



Pinout	
Pin	Function
1	-Vin (GND)
2	NC
3	Remote
4	+Vin (Vcc)
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

NC: No Connection