

- Compact metal package
- 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
- Under voltage lock-out circuit
- Adjustable output voltage +10 / -20%
- Sense line



The TEP 200WIR Series is a family of isolated high performance DC/DC converter modules with ultra-wide 4:1 input voltage ranges. They come in rugged, sealed industry standard half brick package. A very high efficiency allows full power operation at 25°C with only 100 LFM air flow cooling and operation at 60°C with only 40% power derating. 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 onboard power distribution.

Models				
Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 200-2412WIR	9 - 36 VDC (24 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	15'000 mA	89 %
TEP 200-2413WIR		15 VDC (12.0 - 16.5 VDC)	12'000 mA	90 %
TEP 200-2415WIR		24 VDC (19.2 - 26.4 VDC)	7'500 mA	90 %
TEP 200-2416WIR		28 VDC (22.4 - 30.8 VDC)	6'500 mA	90 %
TEP 200-2418WIR		48 VDC (38.4 - 52.8 VDC)	3'700 mA	89 %
TEP 200-4812WIR	18 - 75 VDC (48 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	18'000 mA	90 %
TEP 200-4813WIR		15 VDC (12.0 - 16.5 VDC)	14'000 mA	91 %
TEP 200-4815WIR		24 VDC (19.2 - 26.4 VDC)	9'000 mA	90 %
TEP 200-4816WIR		28 VDC (22.4 - 30.8 VDC)	7'500 mA	91 %
TEP 200-4818WIR		48 VDC (38.4 - 52.8 VDC)	4'500 mA	90 %
TEP 200-7212WIR	43 - 160 VDC (110 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	20'000 mA	89 %
TEP 200-7213WIR		15 VDC (12.0 - 16.5 VDC)	16'000 mA	90 %
TEP 200-7215WIR		24 VDC (19.2 - 26.4 VDC)	10'000 mA	89 %
TEP 200-7216WIR		28 VDC (22.4 - 30.8 VDC)	8'500 mA	90 %
TEP 200-7218WIR		48 VDC (38.4 - 52.8 VDC)	5'000 mA	89 %

Options	
<b>TEP-HS1</b>	- Optional Heat Sink: <a href="http://www.tracopower.com/products/tep-hs1.pdf">www.tracopower.com/products/tep-hs1.pdf</a>
<b>on demand</b> (backorder with MOQ non stocking item)	<ul style="list-style-type: none"> <li>- Optional model with 3.3 VDC / 50'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 5 VDC / 36'000 mA Output and 9 - 36 VDC Input</li> <li>- Optional model with 3.3 VDC / 50'000 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 5 VDC / 40'000 mA Output and 18 - 75 VDC Input</li> <li>- Optional model with 53 VDC / 3'800 mA Output and 33 - 75 VDC Input</li> <li>- Optional model with 3.3 VDC / 57'000 mA Output and 43 - 160 VDC Input</li> <li>- Optional model with 5 VDC / 44'000 mA Output and 43 - 160 VDC Input</li> <li>- Optional models with 2:1 Input</li> <li>- Optional models with inverse Remote On/Off function (passive = off)</li> <li>- Optional models with Sync pin to synchronize switching frequency of up to 3 units (EMC reason)</li> </ul>

### Input Specifications

Input Current	- At no load	24 Vin models: <b>35 mA typ.</b> 110 Vin models: <b>10 mA typ.</b> 48 Vin models: <b>20 mA typ.</b> (3.3 Vout model) <b>20 mA typ.</b> (5 Vout model) <b>20 mA typ.</b> (12 Vout model) <b>20 mA typ.</b> (15 Vout model) <b>20 mA typ.</b> (24 Vout model) <b>20 mA typ.</b> (28 Vout model) <b>20 mA typ.</b> (48 Vout model)
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>32'000 mA</b> (fast acting) 48 Vin models: <b>20'000 mA</b> (fast acting) 110 Vin models: <b>10'000 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		<b>-20% to +10%</b> (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/tep200wir">www.tracopower.com/overview/tep200wir</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)

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

Capacitive Load	- 24 Vin input	3.3 Vout models: 151'000 µF max. 5 Vout models: 72'000 µF max. 12 Vout models: 12'500 µF max. 15 Vout models: 8'000 µF max. 24 Vout models: 3'100 µF max. 28 Vout models: 2'300 µF max. 48 Vout models: 770 µF max.
	- 48 Vin input	3.3 Vout models: 151'000 µF max. 5 Vout models: 80'000 µF max. 12 Vout models: 15'000 µF max. 15 Vout models: 9'300 µF max. 24 Vout models: 3'700 µF max. 28 Vout models: 2'600 µF max. 48 Vout models: 930 µF max.
	- 110 Vin input	3.3 Vout models: 172'000 µF max. 5 Vout models: 88'000 µF max. 12 Vout models: 16'600 µF max. 15 Vout models: 10'600 µF max. 24 Vout models: 4'100 µF max. 28 Vout models: 3'000 µF max. 48 Vout models: 1'000 µF max.
	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: <a href="http://www.tracopower.com/info/holdup_en50155.pdf">www.tracopower.com/info/holdup_en50155.pdf</a> )
	Start-up Time	75 ms typ.
	Short Circuit Protection	Continuous, Automatic recovery
	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 EN 62368-1 IEC 60950-1 IEC 62368-1 UL 60950-1 UL 62368-1
	- Railway Applications - Certification Documents	EN 50155 <a href="http://www.tracopower.com/overview/tep200wir">www.tracopower.com/overview/tep200wir</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/tep200wir">www.tracopower.com/overview/tep200wir</a>

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<b>EMS Immunity</b>		<p>EN 50155 (Railway Applications)</p> <p>EN 50121-3-2 (EMC for Rolling Stock)</p> <p>Air: EN 61000-4-2, <math>\pm 8</math> kV, perf. criteria A</p> <p>Contact: EN 61000-4-2, <math>\pm 6</math> kV, perf. criteria A</p> <p>EN 61000-4-3, 20 V/m, perf. criteria A</p> <p>EN 61000-4-4, <math>\pm 2</math> kV, perf. criteria A</p> <p>EN 61000-4-5, <math>\pm 2</math> kV, perf. criteria A</p> <p>Ext. input component: 24 &amp; 48 Vin models: 2 x KY 20 <math>\mu</math>F</p> <p>110 Vin models: 2 x KXJ 150 <math>\mu</math>F</p> <p>EN 61000-4-6, 10 Vrms, perf. criteria A</p> <p>Continuous: EN 61000-4-8, 100 A/m, perf. criteria A</p> <p>1 s: EN 61000-4-8, 1000 A/m, perf. criteria A</p>
- Electrostatic Discharge		
- RF Electromagnetic Field		
- EFT (Burst) / Surge		
- Conducted RF Disturbances		
- PF Magnetic Field		

### General Specifications

<b>Relative Humidity</b>		95% max. (non condensing)
<b>Temperature Ranges</b>	- Operating Temperature	-40°C to +75°C
	- Case Temperature	+115°C max.
	- Storage Temperature	-55°C to +125°C
<b>Power Derating</b>	- High Temperature	Depending on model
		See application note: <a href="http://www.tracopower.com/overview/tep200wir">www.tracopower.com/overview/tep200wir</a>
<b>Over Temperature Protection Switch Off</b>	- Protection Mode	120°C typ. (Automatic recovery at 105°C typ.)
	- Measurement Point	Base-Plate
<b>Cooling System</b>		Natural convection (20 LFM)
<b>Sense Function</b>		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.)
<b>Remote Control</b>	- 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 '-Vin' Pin
	- Off Idle Input Current	3 mA typ.
	- Remote Pin Input Current	-0.5 to 1.0 mA
		(Optional models with inverse Remote On/Off function (passive = off))
<b>Altitude During Operation</b>		2'000 m max. (for reinforced insulation)
		5'000 m max. (for functional insulation))
<b>Switching Frequency</b>		225 - 275 kHz (PWM)
		250 kHz typ. (PWM)
<b>Insulation System</b>		Reinforced Insulation
<b>Working Voltage (rated)</b>		145 VAC (3.3 and 5 Vout models)
		185 VAC (4.8 and 5.3 Vout models)
		172 VAC (other output models)
<b>Isolation Test Voltage</b>	- Input to Output, 60 s	3'000 VAC
	- Input to Case, 60 s	1'500 VAC
	- Output to Case, 60 s	1'500 VAC
<b>Isolation Resistance</b>	- Input to Output, 500 VDC	1'000 M $\Omega$ min.
<b>Isolation Capacitance</b>	- Input to Output, 100 kHz, 1 V	2'500 pF max.
<b>Reliability</b>	- Calculated MTBF	300'000 h (MIL-HDBK-217F, ground benign)
<b>Washing Process</b>		According to Cleaning Guideline
		<a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
<b>Environment</b>	- Vibration	MIL-STD-810F
		EN 61373
	- Mechanical Shock	MIL-STD-810F
		EN 61373
	- Thermal Shock	MIL-STD-810F
		EN 50155

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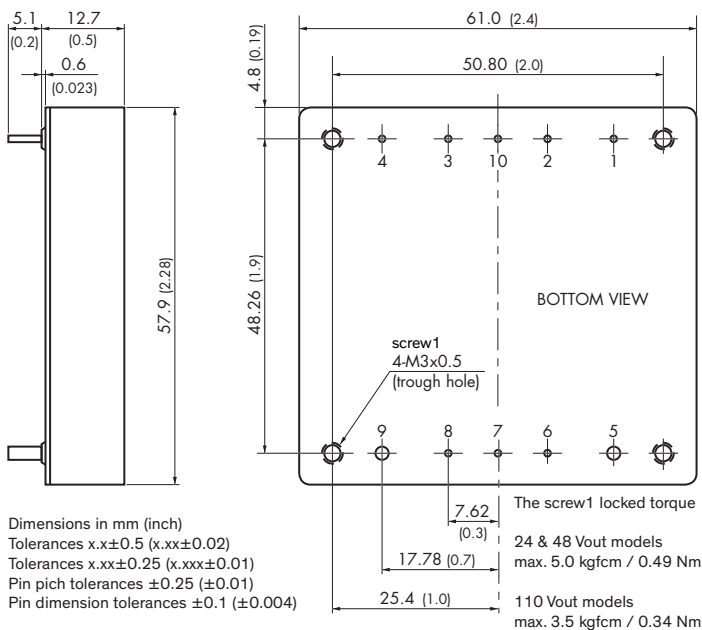
Housing Material		Alu base-plate w. metal case (24 and 48 Vin models) Alu base-plate w. plastic case (110 Vin models)
Base Material		Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (2 - 3 $\mu\text{m}$ )
Pin Surface Plating		Tin (3 - 5 $\mu\text{m}$ ), matte
Housing Type		Metal Case (24 and 48 Vin models) Plastic Case (110 Vin models)
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		Half-Brick
Soldering Profile		Lead-Free Wave Soldering
Weight		105 g
Thermal Impedance	- Case to Ambient	6.1 K/W typ. 4.6 K/W typ. (with Heat Sink)
Environmental Compliance	- REACH Declaration  - RoHS Declaration  - SCIP Reference Number - Flammability (EN 45545-2)	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a>  REACH SVHC list compliant REACH Annex XVII compliant <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a>  Exemptions: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule.)) <b>f71133ffe-527a-42e2-9bc2-f7351f90f2e9</b> <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/tep200wir](http://www.tracopower.com/overview/tep200wir)

### Outline Dimensions



### Pinout

Pin	Single	Pin Diameter
1	-Vin (GND)	1.0 mm (0.04 inch)
2	Case	1.0 mm (0.04 inch)
3	Remote On/Off	1.0 mm (0.04 inch)
4	+Vin (Vcc)	1.0 mm (0.04 inch)
5	-Vout	2.0 mm (0.08 inch)
6	-Sense	1.0 mm (0.04 inch)
7	Trim	1.0 mm (0.04 inch)
8	+Sense	1.0 mm (0.04 inch)
9	+Vout	2.0 mm (0.08 inch)
10	Sync (on demand)	1.0 mm (0.04 inch)