

## DC/DC Railway Converter

## TEP 200WIRCMF Series, 200 Watt

- Chassis mount with screw terminal block
- 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
- Under voltage lock-out circuit
- Adjustable output voltage +10 / -20%
- Sense line



The TEP 200WIRCMF 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 and with integrated EMI input filter to meet EN 55032 class A. 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 200-2412WIRCMF	9 - 36 VDC (24 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	15'000 mA	89 %
TEP 200-2413WIRCMF		15 VDC (12.0 - 16.5 VDC)	12'000 mA	90 %
TEP 200-2415WIRCMF		24 VDC (19.2 - 26.4 VDC)	7'500 mA	90 %
TEP 200-2416WIRCMF		28 VDC (22.4 - 30.8 VDC)	6'500 mA	90 %
TEP 200-2418WIRCMF		48 VDC (38.4 - 52.8 VDC)	3'700 mA	89 %
TEP 200-4812WIRCMF	18 - 75 VDC (48 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	18'000 mA	90 %
TEP 200-4813WIRCMF		15 VDC (12.0 - 16.5 VDC)	14'000 mA	91 %
TEP 200-4815WIRCMF		24 VDC (19.2 - 26.4 VDC)	9'000 mA	90 %
TEP 200-4816WIRCMF		28 VDC (22.4 - 30.8 VDC)	7'500 mA	91 %
TEP 200-4818WIRCMF		48 VDC (38.4 - 52.8 VDC)	4'500 mA	90 %
TEP 200-7212WIRCMF	43 - 160 VDC (110 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	20'000 mA	89 %
TEP 200-7213WIRCMF		15 VDC (12.0 - 16.5 VDC)	16'000 mA	90 %
TEP 200-7215WIRCMF		24 VDC (19.2 - 26.4 VDC)	10'000 mA	89 %
TEP 200-7216WIRCMF		28 VDC (22.4 - 30.8 VDC)	8'500 mA	90 %
TEP 200-7218WIRCMF		48 VDC (38.4 - 52.8 VDC)	5'000 mA	89 %

Options	
<b>TEP-MK1</b>	- Optional DIN-Rail Mounting Kit: <a href="http://www.tracopower.com/products/tep-mk1.pdf">www.tracopower.com/products/tep-mk1.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>- Chassis mount models w/o filter: <a href="http://www.tracopower.com/products/tep200wircmf.pdf">www.tracopower.com/products/tep200wircmf.pdf</a></li> <li>- Optional models with inverse Remote On/Off function (passive = off)</li> </ul>

Input Specifications	
Input Current	- At no load 24 Vin models: <b>35 mA typ.</b> 48 Vin models: <b>20 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>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	-20% to +10% (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/tep200wircmf">www.tracopower.com/overview/tep200wircmf</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.	
		- 48 Vin input	15 Vout models: 8'000 µF max.
			24 Vout models: 3'100 µF max.
			28 Vout models: 2'300 µF max.
		- 110 Vin input	48 Vout models: 770 µF max.
			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.	
Minimum Load		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.	
Temperature Coefficient		Not required	
Hold-up Time		±0.02 %/K max.	
Start-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> )	
Short Circuit Protection		75 ms typ.	
Output Current Limitation		Continuous, Automatic recovery	
Overvoltage Protection		120 - 150% of Iout max.	
Transient Response	- Response Time	115 - 130% of Vout nom.	
		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	EN 50155
	- Certification Documents	<a href="http://www.tracopower.com/overview/tep200wircmf">www.tracopower.com/overview/tep200wircmf</a>
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55011 class A (internal filter)
		EN 55032 class A (internal filter)
	- Radiated Emissions	EN 55011 class A (internal filter)
		EN 55032 class A (internal filter)

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

<b>EMS Immunity</b>		EN 50155 (Railway Applications) EN 50121-3-2 (EMC for Rolling Stock)
- Electrostatic Discharge	Air:	EN 61000-4-2, $\pm 8$ kV, perf. criteria A
	Contact:	EN 61000-4-2, $\pm 6$ kV, perf. criteria A
- RF Electromagnetic Field		EN 61000-4-3, 20 V/m, perf. criteria A
- EFT (Burst) / Surge		EN 61000-4-4, $\pm 2$ kV, perf. criteria A
		EN 61000-4-5, $\pm 2$ kV, perf. criteria A
	Ext. input component:	24 & 48 Vin models: 2 x KY 220 $\mu$ F 110 Vin models: 2 x KXJ 150 $\mu$ F
- Conducted RF Disturbances	Continuous:	EN 61000-4-6, 10 Vrms, perf. criteria A
- PF Magnetic Field	1 s:	EN 61000-4-8, 100 A/m, perf. criteria A EN 61000-4-8, 1000 A/m, perf. criteria A

## 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	-40°C to +105°C
<b>Power Derating</b>	- High Temperature	Depending on model
		See application note: <a href="http://www.tracopower.com/overview/tep200wircmf">www.tracopower.com/overview/tep200wircmf</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>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. metal case (24 and 48 Vin models) Alu base-plate w. plastic case (110 Vin models)

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

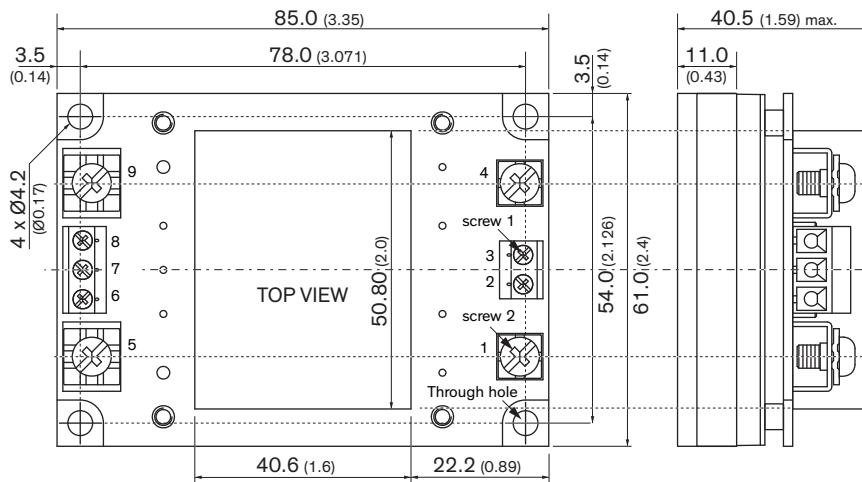
Base Material	Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material	Silicone (UL 94 V-0 rated)
Housing Type	Metal Case (24 and 48 Vin models) Plastic Case (110 Vin models)
Mounting Type	Chassis Mount
Connection Type	Screw Terminal
Weight	287 g
Thermal Impedance - Case to Ambient	6.1 K/W typ.
Environmental Compliance - REACH Declaration	<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
- RoHS Declaration	<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))
- SCIP Reference Number	814f10c5-0fbd-4350-bd50-90d0539e5374
- 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/tep200wircmf](http://www.tracopower.com/overview/tep200wircmf)

### Outline Dimensions



Pinout	
Pin	Single
1	-Vin (GND)
2	Case
3	Remote On/Off
4	+Vin (Vcc)
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

Dimensions in mm (inch)

Tolerances  $x.xx \pm 0.5$  ( $x.xx \pm 0.02$ )

$x.xx \pm 0.25$  ( $x.xxx \pm 0.01$ )

Mounting hole pitch tolerances  $\pm 0.25$  ( $\pm 0.01$ )

Screw 2:

Type M5

Head diameter 8.9 (0.350)

Rated current: 65 A

The screw 1 locked torque: max. 5.2 kgfcm / 0.51 Nm

The screw 2 locked torque: max. 16.5 kgfcm / 1.65 Nm