

- Compact half-brick housing
- Ultra-wide 12:1 input: 14–160 VDC
- –40°C to +105°C operating temperature
- Fully encapsulated
- Dedicated holdup capacitor connection
- EN 50155, EN 45545-2 and EN 61373 certified
- Reinforced 3000VAC I/O isolation
- Remote on/off and trim function
- Protection against short-circuit (SCP), overvoltage (OVP), overtemperature (OTP)
- 3-year product warranty



The TEP 200UIR is a series of railway-certified DC/DC converters designed for highest reliability in demanding applications. Its ultra-wide 12:1 input voltage range allows the application engineer to target an array of nominal system voltages with a single power supply design. Thanks to its dedicated holdup capacitor connection, the TEP 200UIR meets extended holdup-time requirements without the need for bulky input capacitors. The TEP 200UIR series is EN 50155 certified for applications on rolling stock. Additional certifications include EN 61373 for mechanical shock and vibration, EN 45545-2 for fire behavior and IEC/EN/UL 62368-1 for IT and general-purpose industrial applications.

### Models

Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 200-7211UIR	14 - 160 VDC (72 VDC nom.)	5 VDC (4.0 - 5.5 VDC)	40'000 mA	91 %
TEP 200-7212UIR		12 VDC (9.6 - 13.2 VDC)	16'800 mA	93 %
TEP 200-7213UIR		15 VDC (12.0 - 16.5 VDC)	13'400 mA	92 %
TEP 200-7215UIR		24 VDC (19.2 - 26.4 VDC)	8'400 mA	89 %
TEP 200-7218UIR		48 VDC (38.4 - 52.8 VDC)	4'200 mA	93 %

### Options

<b>TEP-HS6</b>	- Optional Heat Sink: <a href="http://www.tracopower.com/products/tep-hs6.pdf">www.tracopower.com/products/tep-hs6.pdf</a>
<b>TEP-HS7</b>	- Optional Heat Sink: <a href="http://www.tracopower.com/products/tep-hs7.pdf">www.tracopower.com/products/tep-hs7.pdf</a>
<b>on demand</b> (backorder with MOQ non stocking item)	- Optional model with 28 VDC / 7'200 mA Output and 14 - 160 VDC Input - Optional model with 53 VDC / 3'900 mA Output and 14 - 160 VDC Input - Optional models with inverse Remote On/Off function (passive = off)

Note - A capacitor 150 µF / 200 V must be connected between BUS pin and -Vin

### Input Specifications

Input Current	- At no load - At full load	30 mA typ. 3'000 mA typ.
Surge Voltage		185 VDC max. (1 s max.)
Under Voltage Lockout		10 VDC min. / 11 VDC typ. / 12 VDC max. (Adjustable w/ external resistor; see application note)
Recommended Input Fuse		20 A (fast acting) (The need of an external fuse has to be assessed in the final application.)
Input Filter		Internal Capacitor

### Output Specifications

Output Voltage Adjustment		-20% to +10% (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/tep200uir">www.tracopower.com/overview/tep200uir</a> Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	0.2% max. 0.1% max.
Ripple and Noise (20 MHz Bandwidth)	5 Vout models: 12 Vout models: 15 Vout models: 24 Vout models: 28 Vout models: 48 Vout models: 53 Vout models:	75 mVp-p typ. (w/ 22 µF/25 V X7R MLCC    22 µF/25 V POSCAP) 150 mVp-p typ. (w/ 22 µF/25 V X7R MLCC    22 µF/25 V POSCAP) 150 mVp-p typ. (w/ 22 µF/25 V X7R MLCC    22 µF/25 V POSCAP) 200 mVp-p typ. (w/ 2.2 µF/50 V X7R MLCC) 200 mVp-p typ. (w/ 2.2 µF/50 V X7R MLCC) 300 mVp-p typ. (w/ 1 µF/100 V X7R MLCC) 300 mVp-p typ. (w/ 1 µF/100 V X7R MLCC)
Capacitive Load	5 Vout models: 12 Vout models: 15 Vout models: 24 Vout models: 28 Vout models: 48 Vout models: 53 Vout models:	60'000 µF max. 10'300 µF max. 6'600 µF max. 2'600 µF max. 1'800 µF max. 620 µF max. 470 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 BUS connection: <a href="http://www.tracopower.com/overview/tep200uir">www.tracopower.com/overview/tep200uir</a> )
Start-up Time		350 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	250 µs typ. (25% Load Step)

### Safety Specifications

Standards	- IT / Multimedia Equipment  - Railway Applications - Certification Documents	EN 62368-1 IEC 62368-1 UL 62368-1 EN 50155 <a href="http://www.tracopower.com/overview/tep200uir">www.tracopower.com/overview/tep200uir</a>
Pollution Degree		PD 2
Over Voltage Category		Not mains connected

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

## EMC Specifications

<b>EMI Emissions</b>		EN 50121-3-2 (EMC for Rolling Stock)
- Conducted Emissions		EN 55032 class A (with external filter)
		EN 55032 class B (with external filter)
- Radiated Emissions		EN 55032 class A (with external filter)
		EN 55032 class B (with external filter)
	External filter proposal:	<a href="http://www.tracopower.com/overview/tep200uir">www.tracopower.com/overview/tep200uir</a>
<b>EMS Immunity</b>		EN 50121-3-2 (EMC for Rolling Stock)
		EN 55024 (IT Equipment)
		EN 55035 (Multimedia)
- 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
	External filter proposal:	<a href="http://www.tracopower.com/overview/tep200uir">www.tracopower.com/overview/tep200uir</a>
- Conducted RF Disturbances		EN 61000-4-6, 10 Vrms, perf. criteria A
- 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

<b>Relative Humidity</b>		95% max. (non condensing)
<b>Temperature Ranges</b>		-40°C to +105°C
- Operating Temperature		+105°C max.
- Case Temperature		-55°C to +125°C
- Storage Temperature		
<b>Power Derating</b>		Depending on model
- High Temperature	See application note:	<a href="http://www.tracopower.com/overview/tep200uir">www.tracopower.com/overview/tep200uir</a>
<b>Over Temperature Protection Switch Off</b>	- Protection Mode	115°C typ. (Automatic recovery at 100°C typ.)
	- Measurement Point	Base-Plate
<b>Cooling System</b>		Natural convection (20 LFM)
<b>Sense Function</b>		10% max. of Vout nom.
		(If sense function is not used, sense pins must be connected to corresponding polarity output pins.)
<b>Remote Control</b>		On: 3.0 to 12 VDC or open circuit
- Voltage Controlled Remote (passive = on)		Off: 0 to 1.2 VDC or short circuit
		Refers to 'Remote' and '-Vin' Pin
- Off Idle Input Current		15 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>		5'000 m max.
<b>Regulator Topology</b>		Soft switch half bridge Converter
<b>Switching Frequency</b>		189 - 231 kHz (PWM)
		210 kHz typ. (PWM)
<b>Insulation System</b>		Reinforced Insulation
<b>Working Voltage (rated)</b>		166 VAC
<b>Isolation Test Voltage</b>		3'000 VAC
- Input to Output, 60 s		1'500 VAC (where case is the baseplate)
- Input to Case, 60 s		1'500 VAC (where case is the baseplate)
- Output to Case, 60 s		
<b>Isolation Resistance</b>		1'000 M $\Omega$ min.
- Input to Output, 500 VDC		
<b>Isolation Capacitance</b>		1'000 pF typ.
- Input to Output, 100 kHz, 1 V		
<b>Distance Through Isolation</b>		0.4 mm
<b>Reliability</b>		230'500 h (MIL-HDBK-217F, ground benign)
- Calculated MTBF		
<b>Washing Process</b>		According to Cleaning Guideline
		<a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>

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Environment	- Vibration	MIL-STD-810F EN 61373 7.6 g, 3 axis, 60 min, 20-2000 Hz 7.7 g, 3 axis, random waveform, 60 min
	- Mechanical Shock	MIL-STD-810F EN 61373 50 g, 3 axis, terminal peak sawtooth, 11 ms
	- Thermal Shock	MIL-STD-810F -55°C to +125°C, 72 cycles, 30 min each
	- Flammability	EN 45545-2 <a href="http://www.tracopower.com/info/en45545-declaration.pdf">www.tracopower.com/info/en45545-declaration.pdf</a>
Housing Material		Alu base-plate w. plastic case
Isolation Frame Material		Non-conductive Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Tinned Copper
Pin Foundation Plating		Nickel (3 - 5 µm)
Pin Surface Plating		Tin (5 - 7 µm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Footprint Type		Half-Brick
Soldering Profile		Lead-Free Wave Soldering 260°C / 4 s max.
Weight		113 g
Thermal Impedance	- Case to Ambient	6.1 K/W typ. (without heatsink)
		4.6 K/W (with heatsink TEP-HS6)
		3.7 K/W (with heatsink TEP-HS7)
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	593e408b-5a6d-4a90-8906-9ca2ff3fac8c

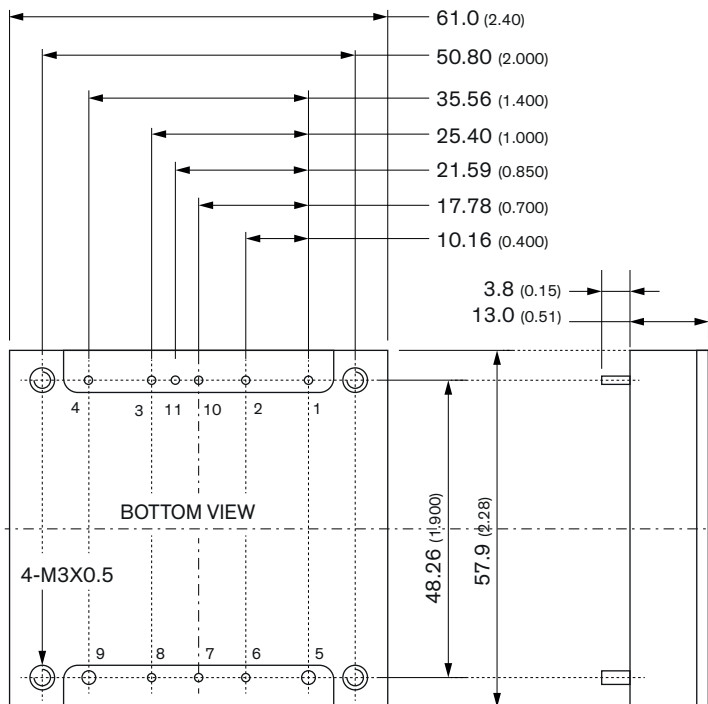
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tep200uir](http://www.tracopower.com/overview/tep200uir)

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

### Outline Dimensions



Pinout		
Pin	Function	Pin Diameter
1	-Vin (GND)	1.0 (0.04)
2	Bus	1.0 (0.04)
3	Remote On/Off (Ctrl)	1.0 (0.04)
4	+Vin (Vcc)	1.0 (0.04)
5	-Vout	2.0 (0.08)
6	-Sense	1.0 (0.04)
7	Trim	1.0 (0.04)
8	+Sense	1.0 (0.04)
9	+Vout	2.0 (0.08)
10	UVLO	1.0 (0.04)
11	Pulse Out	1.0 (0.04)

Important: A capacitor 150  $\mu$ F / 200 V must be connected between BUS pin and -Vin.

For more details regarding BUS Pin, Under Voltage Lockout (UVLO) and Pulse Out see application notes on [www.tracopower.com](http://www.tracopower.com).

Dimensions in mm (inch)

Tolerances: x.x  $\pm$ 0.50 (x.xx  $\pm$ 0.02)

x.xx  $\pm$ 0.25 (x.xxx  $\pm$ 0.010)

Pin dimension tolerance:  $\pm$ 0.10 ( $\pm$ 0.004)

Screw lock torque: Max. 0.34 Nm (3.5 kgfcm)