

- 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

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>
<b>on demand</b> (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 - Optional models with inverse Remote On/Off function (passive = off)

## Input Specifications

Input Current	- At no load	110 Vin models: <b>10 mA typ.</b> 24 Vin models: <b>20 mA typ.</b> (3.3 Vout model) <b>25 mA typ.</b> (5 Vout model) <b>25 mA typ.</b> (12 Vout model) <b>25 mA typ.</b> (15 Vout model) <b>25 mA typ.</b> (24 Vout model) <b>25 mA typ.</b> (28 Vout model) <b>35 mA typ.</b> (48 Vout model) 48 Vin models: <b>15 mA typ.</b> (3.3 Vout model) <b>15 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>25 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>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		<b>-20% to +10%</b> (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/tep160wircm">www.tracopower.com/overview/tep160wircm</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: 121'000 µF max.
		5 Vout models: 56'000 µF max.
		12 Vout models: 10'000 µF max.
		15 Vout models: 6'300 µF max.
	- 48 Vin input	24 Vout models: 2'500 µF max.
		28 Vout models: 1'700 µF max.
		48 Vout models: 620 µF max.
		3.3 Vout models: 121'000 µF max.
	- 110 Vin input	5 Vout models: 60'000 µF max.
		12 Vout models: 10'800 µF max.
		15 Vout models: 6'600 µF max.
		24 Vout models: 2'700 µF max.
	28 Vout models: 1'900 µF max.	
	48 Vout models: 660 µF max.	
	3.3 Vout models: 130'000 µF max.	
	5 Vout models: 64'000 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: 790 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	EN 50155
	- Certification Documents	<a href="http://www.tracopower.com/overview/tep160wircm">www.tracopower.com/overview/tep160wircm</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/tep160wircm">www.tracopower.com/overview/tep160wircm</a>

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

<b>General Specifications</b>		
<b>Relative Humidity</b>		<b>95% max. (non condensing)</b>
<b>Temperature Ranges</b>	- Operating Temperature	<b>-40°C to +75°C</b>
	- Case Temperature	<b>+115°C max.</b>
	- Storage Temperature	<b>-40°C to +105°C</b>
<b>Power Derating</b>	- High Temperature	<b>Depending on model</b>
		See application note: <a href="http://www.tracopower.com/overview/tep160wircm">www.tracopower.com/overview/tep160wircm</a>
<b>Over Temperature Protection Switch Off</b>	- Protection Mode	<b>120°C typ. (Automatic recovery at 105°C typ.)</b>
	- Measurement Point	<b>Base-Plate</b>
<b>Cooling System</b>		<b>Natural convection (20 LFM)</b>
<b>Sense Function</b>		<b>10% max. of Vout nom.</b> (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	<b>On: 3.0 to 12 VDC or open circuit</b> <b>Off: 0 to 1.2 VDC or short circuit</b> <b>Refers to 'Remote' and '-Vin' Pin</b> <b>3 mA typ.</b> <b>-0.5 to 1.0 mA</b> (Optional models with inverse Remote On/Off function (passive = off))
	- Off Idle Input Current	
	- Remote Pin Input Current	
<b>Altitude During Operation</b>		<b>2'000 m max. (for reinforced insulation)</b> <b>5'000 m max. (for functional insulation)</b>
<b>Switching Frequency</b>		<b>225 - 275 kHz (PWM)</b> <b>250 kHz typ. (PWM)</b>
<b>Insulation System</b>		<b>Reinforced Insulation</b>
<b>Working Voltage (rated)</b>		<b>145 VAC (3.3 and 5 Vout models)</b> <b>185 VAC (4.8 Vout models)</b> <b>172 VAC (other output models)</b>
<b>Isolation Test Voltage</b>	- Input to Output, 60 s	<b>3'000 VAC</b>
	- Input to Case, 60 s	<b>1'500 VAC</b>
	- Output to Case, 60 s	<b>1'500 VAC</b>
<b>Isolation Resistance</b>	- Input to Output, 500 VDC	<b>1'000 M<math>\Omega</math> min.</b>
<b>Isolation Capacitance</b>	- Input to Output, 100 kHz, 1 V	<b>2'500 pF max.</b>
<b>Reliability</b>	- Calculated MTBF	<b>350'000 h (MIL-HDBK-217F, ground benign)</b>
<b>Environment</b>	- Vibration	<b>MIL-STD-810F</b> <b>EN 61373</b>
	- Mechanical Shock	<b>MIL-STD-810F</b> <b>EN 61373</b>
	- Thermal Shock	<b>MIL-STD-810F</b> <b>EN 50155</b>
<b>Housing Material</b>		<b>Alu base-plate w. metal case (24 and 48 Vin models)</b> <b>Alu base-plate w. plastic case (110 Vin models)</b>

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

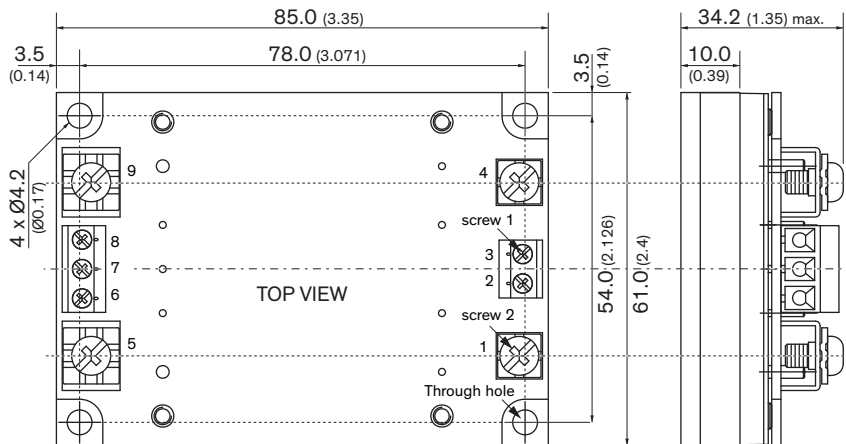
Base Material	Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material	Silicone (UL 94 V-0 rated)
Housing Type	Metal Case (24 and 48 Vin models) Plastic Case (110 Vin models)
Mounting Type	Chassis Mount
Connection Type	Screw Terminal
Weight	235 g
Thermal Impedance - Case to Ambient	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	c550d5a2-b5a2-4f2f-b9ea-01f7202e60dd
- 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/tep160wircm](http://www.tracopower.com/overview/tep160wircm)

### Outline Dimensions



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

NC: Not connected

Dimensions in mm (inch)  
Tolerances  $x.x \pm 0.5$  ( $x.xx \pm 0.02$ )  
 $x.xx \pm 0.25$  ( $x.xxx \pm 0.01$ )  
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. 16.8 kgfcm / 1.65 Nm