

- 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
- Adjustable output voltage +10 / -20%
- Sense line
- Remote On/Off input
- Under voltage lock-out circuit



The TEP 160WIR Series is a family of isolated high performance DC/DC converter modules with ultra-wide 4:1 input voltage ranges which come in a rugged, sealed industry standard half brick package. A very high efficiency allows full power operation without forced air cooling at 25°C This temperature can be increased to 40°C with optional mounted heatsink or up to 60°C when mounted on an iron base plate. 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. These series is available in many optional designs on demand --> see options.

Models				
Order Code	Input Voltage Range	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TEP 160-2412WIR	9 - 36 VDC (24 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	12'000 mA	90 %
TEP 160-2413WIR		15 VDC (12.0 - 16.5 VDC)	9'500 mA	91 %
TEP 160-2415WIR		24 VDC (19.2 - 26.4 VDC)	6'000 mA	90 %
TEP 160-2416WIR		28 VDC (22.4 - 30.8 VDC)	5'000 mA	90 %
TEP 160-2418WIR		48 VDC (38.4 - 52.8 VDC)	3'000 mA	90 %
TEP 160-4812WIR	18 - 75 VDC (48 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	13'000 mA	91 %
TEP 160-4813WIR		15 VDC (12.0 - 16.5 VDC)	10'000 mA	91 %
TEP 160-4815WIR		24 VDC (19.2 - 26.4 VDC)	6'500 mA	91 %
TEP 160-4816WIR		28 VDC (22.4 - 30.8 VDC)	5'500 mA	91 %
TEP 160-4818WIR		48 VDC (38.4 - 52.8 VDC)	3'200 mA	91 %
TEP 160-7212WIR	43 - 160 VDC (110 VDC nom.)	12 VDC (9.6 - 13.2 VDC)	15'000 mA	90 %
TEP 160-7213WIR		15 VDC (12.0 - 16.5 VDC)	12'000 mA	90 %
TEP 160-7215WIR		24 VDC (19.2 - 26.4 VDC)	7'500 mA	90 %
TEP 160-7216WIR		28 VDC (22.4 - 30.8 VDC)	6'500 mA	90 %
TEP 160-7218WIR		48 VDC (38.4 - 52.8 VDC)	3'800 mA	90 %

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 / 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 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 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 models with Sync pin to synchronize switching frequency of up to 3 units (EMC reason)</li> <li>- Chassis mount models w/o filter: <a href="http://www.tracopower.com/products/tep160wircm.pdf">www.tracopower.com/products/tep160wircm.pdf</a></li> <li>- Chassis mount models w/ filter to meet EN 55032 class A: <a href="http://www.tracopower.com/products/tep160wircmf.pdf">www.tracopower.com/products/tep160wircmf.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>25 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>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/tep160wir">www.tracopower.com/overview/tep160wir</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.	
		- 48 Vin input	15 Vout models: 6'300 µF max.
			24 Vout models: 2'500 µF max.
			28 Vout models: 1'700 µF max.
		- 110 Vin input	48 Vout models: 620 µF max.
			3.3 Vout models: 121'000 µF max.
			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.	
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
	- Railway Applications - Certification Documents	IEC 62368-1
		UL 60950-1
		UL 62368-1
		EN 50155
		<a href="http://www.tracopower.com/overview/tep160wir">www.tracopower.com/overview/tep160wir</a>
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55011 class A (with external filter)
		EN 55011 class B (with external filter)
		EN 55032 class A (with external filter)
	- Radiated Emissions	EN 55032 class B (with external filter)
		EN 55011 class A (with external filter)
		EN 55011 class B (with external filter)
		EN 55032 class A (with external filter)
		EN 55032 class B (with external filter)
		External filter proposal: <a href="http://www.tracopower.com/overview/tep160wir">www.tracopower.com/overview/tep160wir</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		

## General Specifications

<b>Relative Humidity</b>		<b>95% max. (non condensing)</b>
<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/tep160wir">www.tracopower.com/overview/tep160wir</a>
<b>Over Temperature Protection Switch Off</b>	- Protection Mode	<b>120°C typ.</b> (Automatic recovery at 105°C typ.)
	- 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.</b> (for reinforced insulation) <b>5'000 m max.</b> (for functional insulation)
<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</b> (3.3 and 5 Vout models) <b>185 VAC</b> (4.8 Vout models) <b>172 VAC</b> (other output models)
<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</b> (MIL-HDBK-217F, ground benign)
<b>Washing Process</b>		<b>According to Cleaning Guideline</b> <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
<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>

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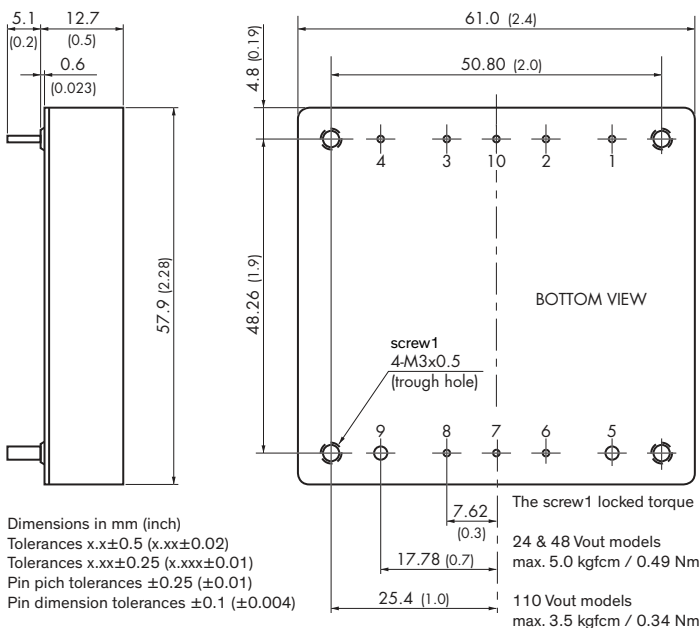
Housing Material	Alu base-plate w. metal case (24 and 48 Vin models) Alu base-plate w. plastic case (110 Vin models)
Base Material	Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material	Silicone (UL 94 V-0 rated)
Pin Material	Copper
Pin Foundation Plating	Nickel (2 - 3 $\mu\text{m}$ )
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 <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.) 2f0f12ea-8c1e-4f75-863d-c66836c1954b <a href="http://www.tracopower.com/info/en45545-declaration.pdf">www.tracopower.com/info/en45545-declaration.pdf</a> - SCIP Reference Number - Flammability (EN 45545-2)

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tep160wir](http://www.tracopower.com/overview/tep160wir)

### 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)