TRACO POWER

DC/DC Railway Converter

TEP 160WIR Series, 160 Watt

- **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**

UL 60950-1 IEC 60950-1

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.	Output Current max.	Efficiency typ.
TEP 160-2412WIR	9 - 36 VDC (24 VDC nom.)	12 VDC	12'000 mA	90 %
TEP 160-2413WIR		15 VDC	9'500 mA	91 %
TEP 160-2415WIR		24 VDC	6'000 mA	90 %
TEP 160-2416WIR		28 VDC	5'000 mA	90 %
TEP 160-2418WIR		48 VDC	3'000 mA	90 %
TEP 160-4812WIR	18 - 75 VDC (48 VDC nom.)	12 VDC	13'000 mA	91 %
TEP 160-4813WIR		15 VDC	10'000 mA	91 %
TEP 160-4815WIR		24 VDC	6'500 mA	91 %
TEP 160-4816WIR		28 VDC	5'500 mA	91 %
TEP 160-4818WIR		48 VDC	3'200 mA	91 %
TEP 160-7212WIR	43 - 160 VDC (110 VDC nom.)	12 VDC	15'000 mA	90 %
TEP 160-7213WIR		15 VDC	12'000 mA	90 %
TEP 160-7215WIR		24 VDC	7'500 mA	90 %
TEP 160-7216WIR		28 VDC	6'500 mA	90 %
TEP 160-7218WIR		48 VDC	3'800 mA	90 %

Options

TEP-HS1	- Optional Heat Sink: www.tracopower.com/products/tep-hs1.pdf
on demand (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 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 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 - Sync pin to synchronize switching frequency of up to 3 units (EMC reason) - Chassis mount models without filter: www.tracopower.com/products/tep160wircm.pdf - Chassis mount models with EN 55032 class A filter: www.tracopower.com/products/tep160wircmf.pdf - Negative (passive = Off) Remote On/Off function

Input Specifications

Input Current	- At no load	24 Vin models:	**25 mA typ.**
		48 Vin models:	**20 mA typ.**
		110 Vin models:	**10 mA typ.**
Surge Voltage		24 Vin models:	**50 VDC max.** (1 s max.)
		48 Vin models:	**100 VDC max.** (1 s max.)
		110 Vin models:	**185 VDC max.** (1 s max.)
Under Voltage Lockout		24 Vin models:	**7.3 VDC min. / 7.7 VDC typ. / 8.1 VDC max.**
		48 Vin models:	**15.5 VDC min. / 16 VDC typ. / 16.3 VDC max.**
		110 Vin models:	**33 VDC min. / 34.5 VDC typ. / 36 VDC max.**
Recommended Input Fuse		24 Vin models:	**25'000 mA** (fast acting)
		48 Vin models:	**15'000 mA** (fast acting)
		110 Vin models:	**8'000 mA** (fast acting)
			(The need of an external fuse has to be assessed in the final application.)
Input Filter			Internal Pi-Type

Output Specifications

Output Voltage Adjustment			**−20% to +10%** (By external trim resistor)
		See application note:	www.tracopower.com/overview/tep160wir
			Output power must not exceed rated power!
Voltage Set Accuracy			**±1% max.**
Regulation	- Input Variation (Vmin - Vmax)		**0.1% max.**
	- Load Variation (0 - 100%)		**0.1% max.**
Ripple and Noise (20 MHz Bandwidth)		3.3 Vout models:	**75 mVp-p max.** (w/ 1 µF X7R // 25 µF poscap)
		5 Vout models:	**75 mVp-p max.** (w/ 1 µF X7R // 25 µF poscap)
		12 Vout models:	**100 mVp-p max.** (w/ 1 µF X7R // 25 µF poscap)
		15 Vout models:	**100 mVp-p max.** (w/ 1 µF X7R // 25 µF poscap)
		24 Vout models:	**200 mVp-p max.** (w/ 4.7 µF X7R)
		28 Vout models:	**200 mVp-p max.** (w/ 4.7 µF X7R)
		48 Vout models:	**300 mVp-p max.** (w/ 2.2 µF X7R)

All specifications valid at nominal voltage, 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.
		24 Vout models:	2'500 µF max.
		28 Vout models:	1'700 µF max.
		48 Vout models:	620 µF max.
	- 48 Vin input	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.
	- 110 Vin input	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.
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
			IEC 60950-1
			UL 60950-1
	- Railway Applications		EN 50155
	- Certification Documents		www.tracopower.com/overview/tep160wir
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:	www.tracopower.com/overview/tep160wir
EMS Immunity			EN 50155 (Railway Applications)
			EN 50121-3-2 (EMC for Rolling Stock)
	- Electrostatic Discharge	Air:	EN 61000-4-2, ±8 kV, perf. criteria A
		Contact:	EN 61000-4-2, ±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, ±2 kV, perf. criteria A
			EN 61000-4-5, ±2 kV, perf. criteria A
		Ext. input component:	24 & 48 Vin models: 2x KY 220 µF
			110 Vin models: 2x KXJ 150 µF
	- 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

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General Specifications

Relative Humidity			95% max. (non condensing)
Temperature Ranges	- Operating Temperature		–40°C to +75°C
	- Case Temperature		+105°C max.
	- Storage Temperature		–55°C to +125°C
Power Derating	- High Temperature	See application note:	www.tracopower.com/overview/tep160wir
Over Temperature Protection Switch Off	- Protection Mode		115°C typ. (Automatic recovery at 105°C typ.)
	- Measurement Point		Base-Plate
Cooling System			Natural convection (20 LFM)
Sense Function			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.)
Remote Control	- 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
Altitude During Operation			2'000 m max.
Switching Frequency			225 - 275 kHz (PWM) 250 kHz typ. (PWM)
Insulation System			Reinforced Insulation (110 Vin models) Basic Insulation (other models)
Working Voltage (rated)			145 VAC (3.3 and 5 Vout models) 185 VAC (48 Vout models) 172 VAC (other output models)
Isolation Test Voltage	- Input to Output, 60 s		3'000 VAC (110 Vin models) 2'250 VDC (other models)
	- Input to Case, 60 s		1'500 VAC (110 Vin models) 1'600 VDC (other models)
	- Output to Case, 60 s		1'500 VAC
Isolation Resistance	- Input to Output, 500 VDC		1'000 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V		2'500 pF max.
Reliability	- Calculated MTBF		350'000 h (MIL-HDBK-217F, ground benign)
Environment	- Vibration		MIL-STD-810F EN 61373
	- Mechanical Shock		MIL-STD-810F EN 61373
	- Thermal Shock		MIL-STD-810F EN 50155
Housing Material			Alu base-plate w. plastic case (110 Vin models) Alu base-plate w. metal case (other models)
Base Material			Non-conductive FR4 (UL94 V-0 rated) (24 Vin & 48 Vin models only)
Potting Material			Silicone (UL 94 V-0 rated)
Pin Material			Copper
Pin Foundation Plating			Nickel (2 - 3 µm)
Pin Surface Plating			Tin (3 - 5 µm), matte
Connection Type			THD (Through-Hole Device)
Weight			105 g
Thermal Impedance			6.1 K/W 4.6 K/W (with Heat Sink)
Environmental Compliance	- Reach		www.tracopower.com/info/reach-declaration.pdf
	- RoHS		www.tracopower.com/info/rohs-declaration.pdf
	- Flammability (EN 45545-2)		www.tracopower.com/info/en45545-declaration.pdf

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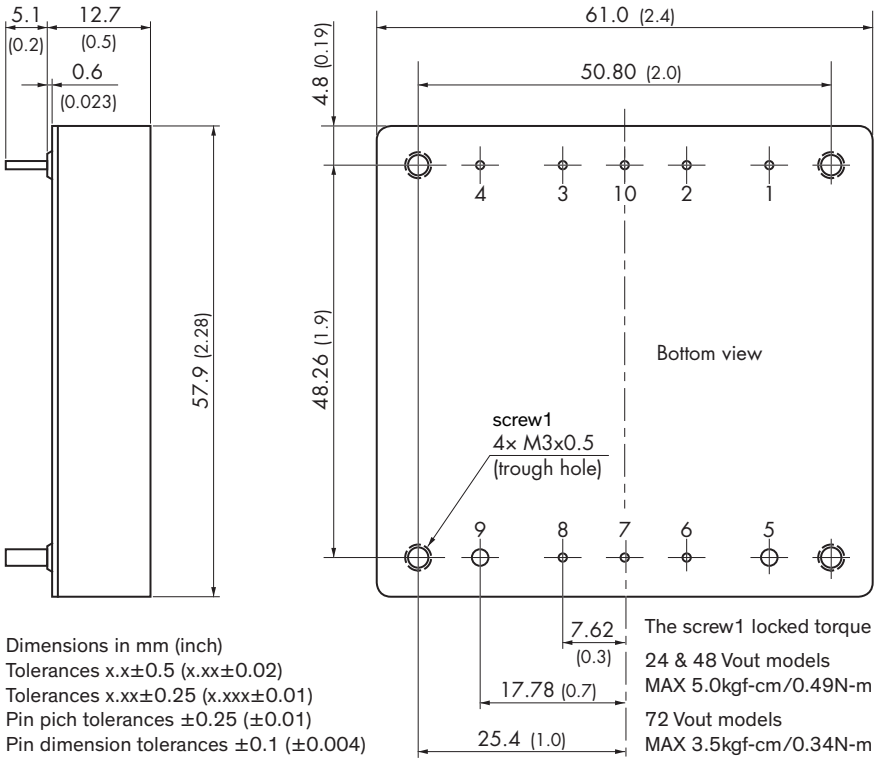
Supporting Documents

Overview Link (for additional Documents) www.tracopower.com/overview/tep160wir

Outline Dimensions



Dimensions in mm (inch)
Tolerances x.x±0.5 (x.xx±0.02)
Tolerances x.xx±0.25 (x.xxx±0.01)
Pin pich tolerances ±0.25 (±0.01)
Pin dimension tolerances ±0.1 (±0.004)

Pin diameter pins 5 & 9: 2.0 (0.08)
Pin diameter other pins: 1.0 (0.04)

Pinout		
Pin	**Function**	**Pin Diameter**
1	–Vin (GND)	1 mm
2	Case	1 mm
3	Remote	1 mm
4	+Vin (Vcc)	1 mm
5	–Vout	2 mm
6	–Sense	1 mm
7	Trim	1 mm
8	+Sense	1 mm
9	+Vout	2 mm
10	Sync (on demand)	1 mm