

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



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 an 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

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 - Optional models with Sync pin to synchronize switching frequency of up to 3 units (EMC reason) - Chassis mount models w/o filter: www.tracopower.com/products/tep160wircm.pdf - Chassis mount models w/ filter to meet EN 55032 class A: www.tracopower.com/products/tep160wircmf.pdf - Optional models with inverse Remote On/Off function (passive = off)

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) - Load Variation (0 - 100%)	0.1% max. 0.1% max.
Ripple and Noise (20 MHz Bandwidth)		3.3 Vout models: 75 mVp-p max. (w/ 1 μ F X7R 25 μ F poscap) 5 Vout models: 75 mVp-p max. (w/ 1 μ F X7R 25 μ F poscap) 12 Vout models: 100 mVp-p max. (w/ 1 μ F X7R 25 μ F poscap) 15 Vout models: 100 mVp-p max. (w/ 1 μ F X7R 25 μ F poscap) 24 Vout models: 200 mVp-p max. (w/ 4.7 μ F X7R) 28 Vout models: 200 mVp-p max. (w/ 4.7 μ F X7R) 48 Vout models: 300 mVp-p max. (w/ 2.2 μ F 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.
		24 Vout models:	2'500 µF max.
		28 Vout models:	1'700 µF max.
		48 Vout models:	620 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.	
	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: www.tracopower.com/info/holdup_en50155.pdf)	
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

Standards	- IT / Multimedia Equipment	EN 60950-1
		EN 62368-1
		IEC 60950-1
		IEC 62368-1
		UL 60950-1
		UL 62368-1
	- Railway Applications - Certification Documents	EN 50155
		www.tracopower.com/overview/tep160wir
		PD 2
		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)
		EN 55032 class B (with external filter)
	- Radiated Emissions	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: www.tracopower.com/overview/tep160wir

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EMS Immunity	- Electrostatic Discharge	Air: EN 50121-3-2 (EMC for Rolling Stock)
	- RF Electromagnetic Field	Contact: EN 61000-4-2, ± 8 kV, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-2, ± 6 kV, perf. criteria A
		EN 61000-4-3, 20 V/m, perf. criteria A
		EN 61000-4-4, ± 2 kV, perf. criteria A
		EN 61000-4-5, ± 2 kV, perf. criteria A
	- Conducted RF Disturbances	Ext. input component: 24 & 48 Vin models: 2x KY 220 μ F
	- PF Magnetic Field	110 Vin models: 2x KXJ 150 μ 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

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +75°C
	- Case Temperature	+115°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	Depending on model
	See application note:	www.tracopower.com/overview/tep160wir
Over Temperature	- Protection Mode	120°C typ. (Automatic recovery at 105°C typ.)
Protection Switch Off	- 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 (Optional models with inverse Remote On/Off function (passive = off))
Altitude During Operation		2'000 m max. (for reinforced insulation)
		5'000 m max. (for functional insulation)
Switching Frequency		225 - 275 kHz (PWM)
		250 kHz typ. (PWM)
Insulation System		Reinforced Insulation
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
	- Input to Case, 60 s	1'500 VAC
	- Output to Case, 60 s	1'500 VAC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M Ω 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)
Washing Process		According to Cleaning Guideline www.tracopower.com/info/cleaning.pdf
Environment	- Vibration	MIL-STD-810F
		EN 61373
	- Mechanical Shock	MIL-STD-810F
		EN 61373
	- Thermal Shock	MIL-STD-810F
	- Flammability	EN 45545-2 www.tracopower.com/info/en45545-declaration.pdf

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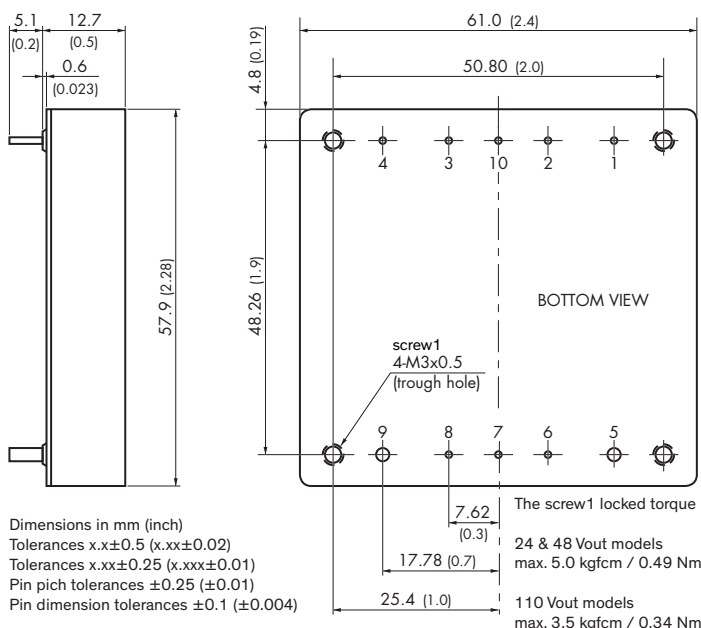
Housing Material	Alu base-plate w. metal case (24 and 48 Vin models) Alu base-plate w. plastic case (110 Vin models)
Base Material	Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material	Silicone (UL 94 V-0 rated)
Pin Material	Copper
Pin Foundation Plating	Nickel (2 - 3 µm)
Pin Surface Plating	Tin (3 - 5 µm), 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 www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant - RoHS Declaration www.tracopower.com/info/rohs-declaration.pdf 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 2f0f12ea-8c1e-4f75-863d-c66836c1954b

Supporting Documents

Overview Link (for additional Documents)

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)