

DC/DC Railway Converter

TEP 160WIR Series, 160 Watt

- Compact half-brick 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
- 3-year product warranty



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 makes 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. This 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 TEP 160-2413WIR TEP 160-2415WIR TEP 160-2416WIR TEP 160-2418WIR	9 - 36 VDC (24 VDC nom.)	12 VDC (9.6 - 13.2 VDC) 15 VDC (12.0 - 16.5 VDC) 24 VDC (19.2 - 26.4 VDC) 28 VDC (22.4 - 30.8 VDC) 48 VDC (38.4 - 52.8 VDC)	12'000 mA 9'500 mA 6'000 mA 5'000 mA 3'000 mA	90 % 91 % 90 % 90 % 90 %
TEP 160-4812WIR TEP 160-4813WIR TEP 160-4815WIR TEP 160-4816WIR TEP 160-4818WIR	18 - 75 VDC (48 VDC nom.)	12 VDC (9.6 - 13.2 VDC) 15 VDC (12.0 - 16.5 VDC) 24 VDC (19.2 - 26.4 VDC) 28 VDC (22.4 - 30.8 VDC) 48 VDC (38.4 - 52.8 VDC)	13'000 mA 10'000 mA 6'500 mA 5'500 mA 3'200 mA	91 % 91 % 91 % 91 % 91 %
TEP 160-7212WIR TEP 160-7213WIR TEP 160-7215WIR TEP 160-7216WIR TEP 160-7218WIR	43 - 160 VDC (110 VDC nom.)	12 VDC (9.6 - 13.2 VDC) 15 VDC (12.0 - 16.5 VDC) 24 VDC (19.2 - 26.4 VDC) 28 VDC (22.4 - 30.8 VDC) 48 VDC (38.4 - 52.8 VDC)	15'000 mA 12'000 mA 7'500 mA 6'500 mA 3'800 mA	90 % 90 % 90 % 90 % 90 %

Options

TEP-HS1	- Optional Heat Sink: www.tracopower.com/overview/tep-hs1
on demand (backorder with MOQ non stocking item)	- Optional model with 3.3 VDC and 40'000 mA Output, and 9 - 36 VDC Input - Optional model with 5 VDC and 28'000 mA Output, and 9 - 36 VDC Input - Optional model with 3.3 VDC and 40'000 mA Output, and 18 - 75 VDC Input - Optional model with 5 VDC and 30'000 mA Output, and 18 - 75 VDC Input - Optional model with 3.3 VDC and 43'000 mA Output, and 43 - 160 VDC Input - Optional model with 5 VDC and 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/overview/tep160wircm - Chassis mount models w/ filter to meet EN 55032 class A: www.tracopower.com/overview/tep160wircmf - 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 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, 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 50121-3-2 (EMC for Rolling Stock)
		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)
		EN 55011 class A (with external filter)
	- Radiated Emissions	EN 55011 class B (with external filter)
		EN 55032 class A (with external filter)
		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: 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
	- Conducted RF Disturbances	EN 61000-4-3, 20 V/m, perf. criteria A
	- PF Magnetic Field	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: 2 x KY 220 μ F 100 V
		110 Vin models: 2 x KXJ 150 μ F 200 V
EMC / Environmental	- Certification Documents	Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A
		1 s: EN 61000-4-8, 100 A/m, perf. criteria A
		www.tracopower.com/overview/tep160wir

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 Switch Off	- Protection Mode	120°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. (If sense function is not used, sense pins must be connected to corresponding polarity output pins.)
Remote Control	- Voltage Controlled Remote (passive = on)	On: 3.0 to 12 VDC or open circuit
		Off: 0 to 1.2 VDC or short circuit
	- Off Idle Input Current	Refers to 'Remote' and '-Vin' Pin
	- Remote Pin Input Current	3 mA typ. -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)
Regulator Topology		Forward Converter
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

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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
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 260°C / 6 s max.
Weight		105 g
Thermal Impedance	- Case to Ambient	6.1 K/W typ. 4.6 K/W typ. (with Heat Sink)
	- REACH Declaration	www.tracopower.com/info/reach-declaration.pdf REACH SVHC list compliant REACH Annex XVII compliant
Environmental Compliance	- RoHS Declaration	www.tracopower.com/info/rohs-declaration.pdf Exemptions: 7(a), 7(c)-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

Additional Information

Supporting Documents	www.tracopower.com/overview/tep160wir
Frequently Asked Questions	www.tracopower.com/glossary-faq
Glossary	www.tracopower.com/info/glossary.pdf

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5.1 (0.2) 12.7 (0.5) 0.6 (0.023) 57.9 (2.28)

61.0 (2.4) 50.80 (2.0) 4.8 (0.19) 48.26 (1.9) 7.62 (0.3) 17.78 (0.7) 25.4 (1.0)

4 3 10 2 1 9 8 7 6 5

screw1
4-M3x0.5

BOTTOM VIEW

The screw1 locked torque

24 & 48 Vout modules
max. 5.0 kgfcm / 0.49 Nm

110 Vout modules
max. 3.5 kgfcm / 0.34 Nm

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

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)