

- 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	
TEP-HS1	- Optional Heat Sink: www.tracopower.com/products/tep-hs1.pdf
on demand (backorder with MOQ non stocking item)	<ul style="list-style-type: none"> - 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 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.
	- 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.
	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	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 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)
	- 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

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

EMS Immunity	<ul style="list-style-type: none"> - Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field 	EN 50121-3-2 (EMC for Rolling Stock) Air: EN 61000-4-2, ± 8 kV, perf. criteria A Contact: 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 Ext. input component: 24 & 48 Vin models: 2x KY 220 μ F 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	<ul style="list-style-type: none"> - Operating Temperature - Case Temperature - Storage Temperature 	-40°C to +75°C +115°C max. -55°C to +125°C
Power Derating	<ul style="list-style-type: none"> - High Temperature 	Depending on model See application note: www.tracopower.com/overview/tep160wir
Over Temperature Protection Switch Off	<ul style="list-style-type: none"> - Protection Mode - Measurement Point 	120°C typ. (Automatic recovery at 105°C typ.) 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	<ul style="list-style-type: none"> - Voltage Controlled Remote - Off Idle Input Current - Remote Pin Input Current 	On: 3.0 to 12 VDC or open circuit Off: 0 to 1.2 VDC or short circuit Refers to 'Remote' and '-Vin' Pin 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)
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	<ul style="list-style-type: none"> - Input to Output, 60 s - Input to Case, 60 s - Output to Case, 60 s 	3'000 VAC 1'500 VAC 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	<ul style="list-style-type: none"> - Vibration - Mechanical Shock - Thermal Shock - Flammability 	MIL-STD-810F EN 61373 MIL-STD-810F EN 61373 MIL-STD-810F EN 45545-2 www.tracopower.com/info/en45545-declaration.pdf

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

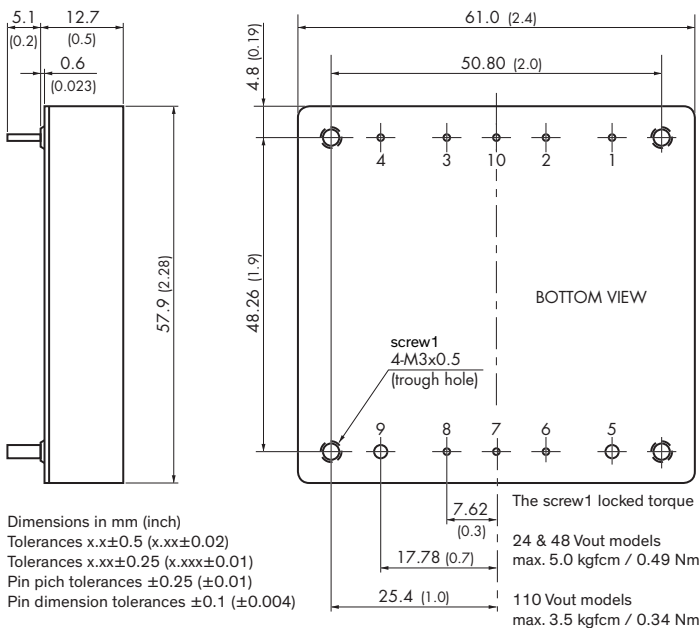
Housing Material		Alu base-plate w. metal case (24 and 48 Vin models) Alu base-plate w. plastic case (110 Vin models)
Base Material		Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Copper
Pin Foundation Plating		Nickel (2 - 3 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)