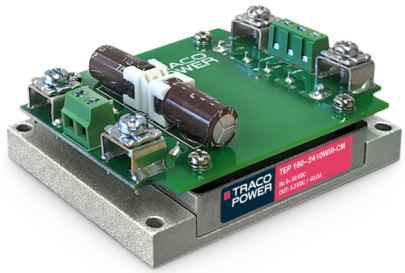
DC/DC Railway Converter

TEP 160WIRCM Series, 160 Watt

- **Chassis mount with screw terminal block**
- **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**



UL 62368-1 IEC 62368-1

The TEP 160WIRCM Series is a family of isolated high performance DC/DC converter modules with ultra-wide 4:1 input voltage ranges. They come in chassis mount version with screw terminal block. A very high efficiency allows full power operation without forced air cooling at 25°C. The very wide input voltage range makes these converters interesting solution for battery operated systems. Typical applications are in telecom/datacom, industry control and railway systems for on board power distribution.

Options

TEP-MK1	- Optional DIN-Rail Mounting Kit: www.tracopower.com/overview/tep-mk1
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 12 VDC and 12'000 mA Output, and 9 - 36 VDC Input - Optional model with 15 VDC and 9'500 mA Output, and 9 - 36 VDC Input - Optional model with 24 VDC and 6'000 mA Output, and 9 - 36 VDC Input - Optional model with 28 VDC and 5'000 mA Output, and 9 - 36 VDC Input - Optional model with 48 VDC and 3'000 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 12 VDC and 13'000 mA Output, and 18 - 75 VDC Input - Optional model with 15 VDC and 10'000 mA Output, and 18 - 75 VDC Input - Optional model with 24 VDC and 6'500 mA Output, and 18 - 75 VDC Input - Optional model with 28 VDC and 5'500 mA Output, and 18 - 75 VDC Input - Optional model with 48 VDC and 3'200 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 model with 12 VDC and 15'000 mA Output, and 43 - 160 VDC Input - Optional model with 15 VDC and 12'000 mA Output, and 43 - 160 VDC Input - Optional model with 24 VDC and 7'500 mA Output, and 43 - 160 VDC Input - Optional model with 28 VDC and 6'500 mA Output, and 43 - 160 VDC Input - Optional model with 48 VDC and 3'800 mA Output, and 43 - 160 VDC Input - Optional models with inverse Remote On/Off function (passive = off)

Input Specifications

Input Current	- At no load	110 Vin models:	**10 mA typ.**
		24 Vin models:	**20 mA typ.** (3.3 Vout model)
			25 mA typ. (5 Vout model)
			25 mA typ. (12 Vout model)
			25 mA typ. (15 Vout model)
			25 mA typ. (24 Vout model)
			25 mA typ. (28 Vout model)
			35 mA typ. (48 Vout model)
		48 Vin models:	**15 mA typ.** (3.3 Vout model)
			15 mA typ. (5 Vout model)
			20 mA typ. (12 Vout model)
			20 mA typ. (15 Vout model)
			20 mA typ. (24 Vout model)
			20 mA typ. (28 Vout model)
			25 mA typ. (48 Vout model)
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/tep160wircm
			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, 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/tep160wircm
Pollution Degree		PD 2
Over Voltage Category		OVC II

EMC Specifications

EMI (Emissions)		EN 50121-3-2 (EMC for Rolling Stock)
	- 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/tep160wircm

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EMS (Immunity)			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
EMC / Environmental	- Certification Documents		www.tracopower.com/overview/tep160wircm

General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	–40°C to +75°C
	- Case Temperature	+115°C max.
	- Storage Temperature	–40°C to +105°C
Power Derating	- High Temperature	Depending on model
	See application note:	www.tracopower.com/overview/tep160wircm
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 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)
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 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
	- Flammability	EN 45545-2 www.tracopower.com/info/en45545-declaration.pdf

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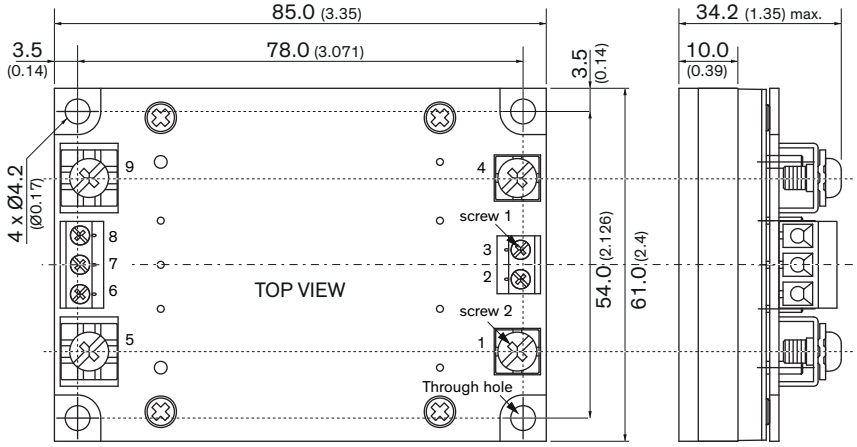
Housing Material		Alu base-plate w. metal case (24 and 48 Vin models) Alu base-plate w. plastic case (110 Vin models)
Base Material		Non-conductive FR4 (UL 94 V-0 rated) (24 and 48 Vin models only)
Potting Material		Silicone (UL 94 V-0 rated)
Housing Type		Metal Case (24 and 48 Vin models) Plastic Case (110 Vin models)
Mounting Type		Chassis Mount
Connection Type		Screw Terminal
Weight		235 g
Thermal Impedance	- Case to Ambient	6.1 K/W typ.
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	c550d5a2-b5a2-4f2f-b9ea-01f7202e60dd

Supporting Documents

Overview Link (for additional Documents)	www.tracopower.com/overview/tep160wircm

Outline Dimensions



Dimensions in mm (inch)
Tolerances x.x ±0.5 (x.xx ±0.02)
x.xx ±0.25 (x.xxx ±0.01)
Mounting hole pitch tolerances ±0.25 (±0.01)

Screw 2:
Type M5
Head diameter 8.9 (0.350)
Rated current: 65 A

The screw 1 locked torque: max. 5.2 kgfcm / 0.51 Nm
The screw 2 locked torque: max. 16.8 kgfcm / 1.65 Nm

Mounting screw locked torque: max. 11.2 kgfcm / 1.10 Nm

Pinout

Pin	Single
1	–Vin (GND)
2	NC
3	Remote On/Off
4	+Vin (Vcc)
5	–Vout
6	–Sense
7	Trim
8	+Sense
9	+Vout

NC: Not connected

Wire gauge range:
AWG 14 - 26