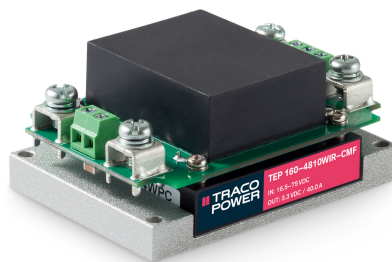


DC/DC Railway Converter

TEP 160WIRCMF Series, 160 Watt

- Including EMI filter to meet EN 55032, class A
- 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 160WIRCMF 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 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.

Options

| TEP-MK1 | - Optional DIN-Rail Mounting Kit: www.tracopower.com/products/tep-mk1.pdf |
|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>on demand (backorder with MOQ non stocking item)</p> | <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 12 VDC / 12'000 mA Output and 9 - 36 VDC Input - Optional model with 15 VDC / 9'500 mA Output and 9 - 36 VDC Input - Optional model with 24 VDC / 6'000 mA Output and 9 - 36 VDC Input - Optional model with 28 VDC / 5'000 mA Output and 9 - 36 VDC Input - Optional model with 48 VDC / 3'000 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 12 VDC / 13'000 mA Output and 18 - 75 VDC Input - Optional model with 15 VDC / 10'000 mA Output and 18 - 75 VDC Input - Optional model with 24 VDC / 6'500 mA Output and 18 - 75 VDC Input - Optional model with 28 VDC / 5'500 mA Output and 18 - 75 VDC Input - Optional model with 48 VDC / 3'200 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 model with 12 VDC / 15'000 mA Output and 43 - 160 VDC Input - Optional model with 15 VDC / 12'000 mA Output and 43 - 160 VDC Input - Optional model with 24 VDC / 7'500 mA Output and 43 - 160 VDC Input - Optional model with 28 VDC / 6'500 mA Output and 43 - 160 VDC Input - Optional model with 48 VDC / 3'800 mA Output and 43 - 160 VDC Input - Optional models with inverse Remote On/Off function (passive = off) |

Input Specifications

| | | |
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| 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

| | | |
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| Output Voltage Adjustment | | -20% to +10% (By external trim resistor) See application note: www.tracopower.com/overview/tep160wircmf 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.

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| 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. |
| | - 48 Vin input | 24 Vout models: 2'500 µF max. |
| | | 28 Vout models: 1'700 µF max. |
| | | 48 Vout models: 620 µF max. |
| | | 3.3 Vout models: 121'000 µF max. |
| | - 110 Vin input | 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. | |
| | 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

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|-----------------------|-----------------------------|--------------------------------------------------------------------------------------------------------|
| Safety 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/tep160wircmf |
| 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 (internal filter) |
| | | EN 55032 class A (internal filter) |
| | | EN 55011 class A (internal filter) |
| | - Radiated Emissions | EN 55011 class A (internal filter) |
| | | EN 55032 class A (internal filter) |

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

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| EMS Immunity | <ul style="list-style-type: none"> - Electrostatic Discharge - RF Electromagnetic Field - EFT (Burst) / Surge - Conducted RF Disturbances - PF Magnetic Field | EN 50155 (Railway Applications) 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 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. -40°C to +105°C |
| Power Derating | <ul style="list-style-type: none"> - High Temperature | Depending on model See application note: www.tracopower.com/overview/tep160wircmf |
| 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) |
| Environment | <ul style="list-style-type: none"> - Vibration - Mechanical Shock - Thermal Shock | MIL-STD-810F EN 61373 MIL-STD-810F EN 61373 MIL-STD-810F EN 50155 |
| 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) |

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

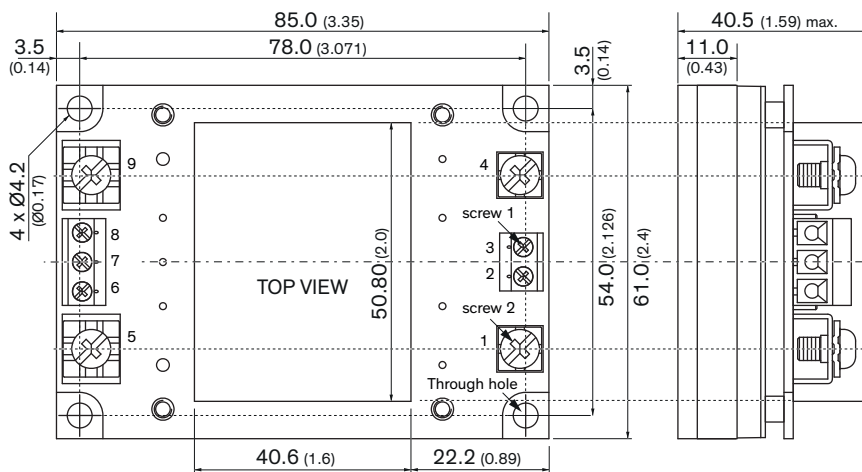
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|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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 | 287 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 50acc1a9-e38b-4509-8921-bfa0568ea954 - Flammability (EN 45545-2) www.tracopower.com/info/en45545-declaration.pdf |

Supporting Documents

Overview Link (for additional Documents)

www.tracopower.com/overview/tep160wircmf

Outline Dimensions



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

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. 16.5 kgfcm / 1.65 Nm

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