

## DC/DC Railway Converter

## TEP 150WI Series, 150 Watt

- Shielded metal case with screw terminals
- 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 89%
- Constant current output characteristic for battery load applications
- Optional with input filter to meet EN 55032 class B
- Wide Operating temperature range: –40°C to +75°C
- Under voltage lock-out & overtemperature protection
- Easy chassis and wall mounting
- 3-year product warranty



The modules have originally been designed for harsh industrial environment. High EMC immunity against surge, burst, radiated and conducted disturbances and the shock/ vibration and thermal shock resistance make them very popular for stringent requirements. With the extended input voltage ranges that cover the nominal 24, 36, 72 and 110 VDC with  $\pm 40\%$  tolerance and the approval in accordance to EN 50155 standard they now also offer a reliable solution for mobile and stationary railway applications. At 100% load the current characteristics goes from constant voltage to constant current what makes the units also suitable for battery charger applications. With protection against over-temperature, overload, short-circuit, overvoltage and input under-voltage lock-out they are hard to destroy.

| Models         |                                |                                  |                     |                 |
|----------------|--------------------------------|----------------------------------|---------------------|-----------------|
| Order Code     | Input Voltage Range            | Output Voltage nom. (adjustable) | Output Current max. | Efficiency typ. |
| TEP 150-2412WI | 9 - 36 VDC<br>(24 VDC nom.)    | 12 VDC (12.0 - 14.4 VDC)         | 12'500 mA           | 86 %            |
| TEP 150-2413WI |                                | 15 VDC (15.0 - 18.0 VDC)         | 10'000 mA           | 86 %            |
| TEP 150-2415WI |                                | 24 VDC (24.0 - 28.8 VDC)         | 6'300 mA            | 87 %            |
| TEP 150-2416WI |                                | 28 VDC (28.0 - 33.6 VDC)         | 5'400 mA            | 87 %            |
| TEP 150-2418WI |                                | 48 VDC (48.0 - 57.6 VDC)         | 3'200 mA            | 86 %            |
| TEP 150-4812WI | 18 - 75 VDC<br>(48 VDC nom.)   | 12 VDC (12.0 - 14.4 VDC)         | 12'500 mA           | 88 %            |
| TEP 150-4813WI |                                | 15 VDC (15.0 - 18.0 VDC)         | 10'000 mA           | 89 %            |
| TEP 150-4815WI |                                | 24 VDC (24.0 - 28.8 VDC)         | 6'300 mA            | 89 %            |
| TEP 150-4816WI |                                | 28 VDC (28.0 - 33.6 VDC)         | 5'400 mA            | 89 %            |
| TEP 150-4818WI |                                | 48 VDC (48.0 - 57.6 VDC)         | 3'200 mA            | 88 %            |
| TEP 150-7212WI | 43 - 160 VDC<br>(110 VDC nom.) | 12 VDC (12.0 - 14.4 VDC)         | 12'500 mA           | 88 %            |
| TEP 150-7213WI |                                | 15 VDC (15.0 - 18.0 VDC)         | 10'000 mA           | 89 %            |
| TEP 150-7215WI |                                | 24 VDC (24.0 - 28.8 VDC)         | 6'300 mA            | 89 %            |
| TEP 150-7216WI |                                | 28 VDC (28.0 - 33.6 VDC)         | 5'400 mA            | 89 %            |
| TEP 150-7218WI |                                | 48 VDC (48.0 - 57.6 VDC)         | 3'200 mA            | 88 %            |

| Options                                                    |                                                                                                                                                                  |
|------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Suffix F</b>                                            | - Optional models with input filter to meet EN 55032 class B: <a href="http://www.tracopower.com/overview/tep150wi-f">www.tracopower.com/overview/tep150wi-f</a> |
| <b>on demand</b><br>(backorder with MOQ non stocking item) | - Optional models with inverse Remote On/Off function (passive = off)                                                                                            |

## Input Specifications

|                        |              |                                                                                                                                                                                                     |
|------------------------|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Current          | - At no load | 24 Vin models: 100 mA typ.<br>48 Vin models: 65 mA typ.<br>110 Vin models: 30 mA typ.                                                                                                               |
| Surge Voltage          |              | 24 Vin models: 50 VDC max. (1 s max.)<br>48 Vin models: 100 VDC max. (1 s max.)<br>110 Vin models: 185 VDC max. (1 s max.)                                                                          |
| Under Voltage Lockout  |              | 24 Vin models: 7.9 - 8.5 VDC max.<br>48 Vin models: 15.6 - 16.8 VDC max.<br>110 Vin models: 33 - 36 VDC max.                                                                                        |
| Recommended Input Fuse |              | 24 Vin models: 30'000 mA (slow blow)<br>48 Vin models: 15'000 mA (slow blow)<br>110 Vin models: 7'000 mA (slow blow)<br>(The need of an external fuse has to be assessed in the final application.) |
| Input Filter           |              | Internal Pi-Type                                                                                                                                                                                    |

## Output Specifications

|                                        |                                                                                             |                                                                                                                                                                                                             |
|----------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Voltage Adjustment              |                                                                                             | 0% to +20% (By external trim resistor)<br>See application note: <a href="http://www.tracopower.com/tep150wi-adj">www.tracopower.com/tep150wi-adj</a><br>Output power must not exceed rated power!           |
| Voltage Set Accuracy                   |                                                                                             | ±1% max.                                                                                                                                                                                                    |
| Regulation                             | - Input Variation (Vmin - Vmax)<br>- Load Variation (0 - 100%)                              | 0.2% max.<br>0.4% max.                                                                                                                                                                                      |
| Ripple and Noise<br>(20 MHz Bandwidth) | 12 Vout models:<br>15 Vout models:<br>24 Vout models:<br>28 Vout models:<br>48 Vout models: | 100 mVp-p max.<br>100 mVp-p max.<br>200 mVp-p max.<br>200 mVp-p max.<br>300 mVp-p max.                                                                                                                      |
| Capacitive Load                        | 12 Vout models:<br>15 Vout models:<br>24 Vout models:<br>28 Vout models:<br>48 Vout models: | 40'000 µF max.<br>26'000 µF max.<br>10'000 µF max.<br>7'600 µF max.<br>2'600 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:<br><a href="http://www.tracopower.com/info/holdup_en50155.pdf">www.tracopower.com/info/holdup_en50155.pdf</a> ) |
| Start-up Time                          |                                                                                             | 35 ms typ.                                                                                                                                                                                                  |
| Short Circuit Protection               |                                                                                             | Continuous, Automatic recovery                                                                                                                                                                              |
| Overload Protection                    |                                                                                             | Constant Current Mode                                                                                                                                                                                       |
| Output Current Limitation              |                                                                                             | 105 - 120% of Iout max.                                                                                                                                                                                     |
| Overvoltage Protection                 |                                                                                             | 125 - 140% of Vout nom.                                                                                                                                                                                     |
| Transient Response                     | - Response Time                                                                             | 200 µs typ. (25% Load Step)                                                                                                                                                                                 |

## Safety Specifications

|           |                             |                                                                                                                                                                                                        |
|-----------|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Standards | - IT / Multimedia Equipment | EN 60950-1<br>EN 62368-1<br>IEC 60950-1<br>IEC 62368-1<br>UL 60950-1<br>UL 62368-1<br>EN 50155<br><a href="http://www.tracopower.com/tep150wi-safety-cert">www.tracopower.com/tep150wi-safety-cert</a> |
|           | - Railway Applications      |                                                                                                                                                                                                        |
|           | - Certification Documents   |                                                                                                                                                                                                        |

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

|                       |                           |                             |
|-----------------------|---------------------------|-----------------------------|
| Energy Source         | - Output, acc. to 62368-1 | ES2 (48 Vout models)<br>ES1 |
| Power Source          | - Output, acc. to 62368-1 | PS3                         |
| Pollution Degree      |                           | PD 2                        |
| Over Voltage Category |                           | Not mains connected         |

## EMC Specifications

|                     |                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EMI (Emissions)     | - Conducted Emissions<br><br>- Radiated Emissions                                                                                              | EN 50121-3-2 (EMC for Rolling Stock)<br>EN 55032 class A (internal filter)<br>FCC 47 Part 15 class A (internal filter)<br>EN 55032 class A (internal filter)<br>FCC 47 Part 15 class A (internal filter)                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| EMS (Immunity)      | - Electrostatic Discharge<br><br>- RF Electromagnetic Field<br>- EFT (Burst) / Surge<br><br>- Conducted RF Disturbances<br>- PF Magnetic Field | EN 50121-3-2 (EMC for Rolling Stock)<br>EN 55024 (IT Equipment)<br>EN 55035 (Multimedia)<br>Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A<br>Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A<br>EN 61000-4-3, 20 V/m, perf. criteria A<br>EN 61000-4-4, $\pm 2$ kV, perf. criteria A<br>EN 61000-4-5, $\pm 1$ kV, perf. criteria A<br>Ext. input component: 24 Vin models: KY 470 $\mu$ F, ESR 45 mOhm<br>48 Vin models: KY 220 $\mu$ F, ESR 48 mOhm<br>110 Vin models: KXJ 150 $\mu$ F<br>Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A<br>1 s: EN 61000-4-8, 100 A/m, perf. criteria A<br>EN 61000-4-8, 1000 A/m, perf. criteria A |
| EMC / Environmental | - Certification Documents                                                                                                                      | <a href="http://www.tracopower.com/tep150wi-emc-cert">www.tracopower.com/tep150wi-emc-cert</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## General Specifications

|                                        |                                                                            |                                                                                                                                                                                                      |
|----------------------------------------|----------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relative Humidity                      |                                                                            | 95% max. (non condensing)                                                                                                                                                                            |
| Temperature Ranges                     | - Operating Temperature<br>- Case Temperature<br>- Storage Temperature     | -40°C to +75°C<br>+100°C max.<br>-55°C to +125°C<br>(Mount on conducting surface to optimize thermal coupling)                                                                                       |
| Power Derating                         | - High Temperature                                                         | Depending on model<br>See application note: <a href="http://www.tracopower.com/tep150wi-cc">www.tracopower.com/tep150wi-cc</a>                                                                       |
| Over Temperature Protection Switch Off | - Protection Mode                                                          | 110°C typ. (Automatic recovery)                                                                                                                                                                      |
| Cooling System                         |                                                                            | Natural convection (20 LFM)                                                                                                                                                                          |
| Remote Control                         | - Voltage Controlled Remote (passive = on)<br><br>- Off Idle Input Current | On: 3.0 to 12 VDC or open circuit<br>Off: 0 to 1.2 VDC or short circuit<br>Refers to 'Remote' and '-Vin' Pin<br>3.5 mA typ.<br>(Optional models with inverse Remote On/Off function (passive = off)) |
| Altitude During Operation              |                                                                            | 5'000 m max.                                                                                                                                                                                         |
| Switching Frequency                    |                                                                            | 203 - 330 kHz (PWM)                                                                                                                                                                                  |
| Insulation System                      |                                                                            | Functional Insulation                                                                                                                                                                                |
| Isolation Test Voltage                 | - Input to Output, 60 s<br>- Input to Case, 60 s<br>- Output to Case, 60 s | 2'250 VDC<br>1'600 VDC<br>1'600 VDC                                                                                                                                                                  |
| Isolation Resistance                   | - Input to Output, 500 VDC                                                 | 1'000 M $\Omega$ min.                                                                                                                                                                                |
| Isolation Capacitance                  | - Input to Output, 100 kHz, 1 V                                            | 3'500 pF max.                                                                                                                                                                                        |
| Reliability                            | - Calculated MTBF                                                          | 495'000 h (MIL-HDBK-217F, ground benign)                                                                                                                                                             |

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

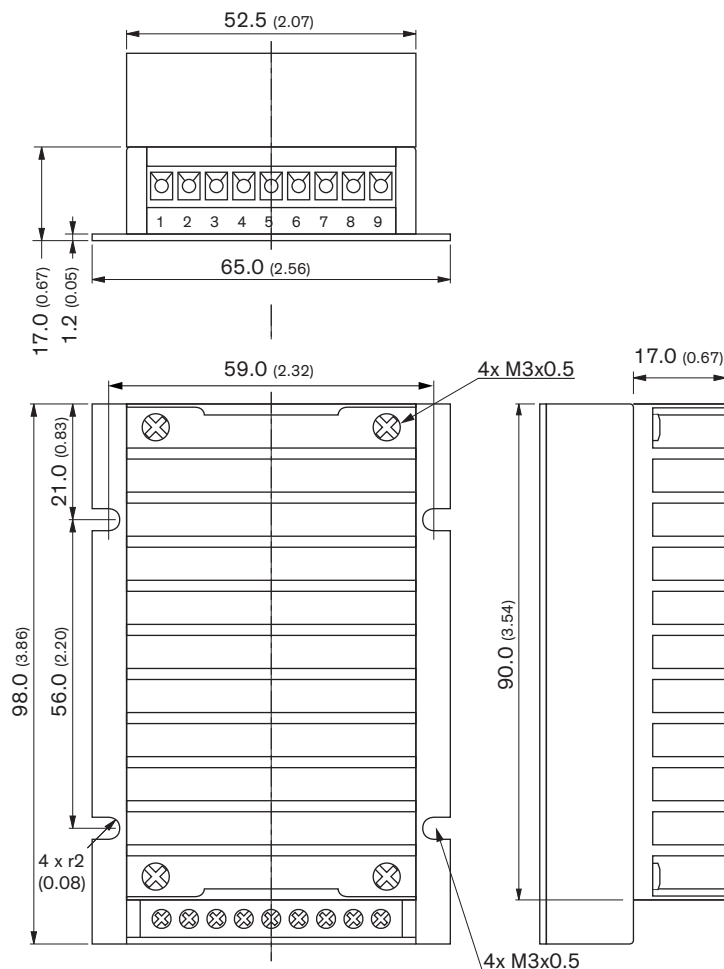
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|--------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environment              | - Vibration             | MIL-STD-810F<br>EN 61373<br>7.7 g, 3 axis, random waveform, 60 min                                                                                                                                                                                                     |
|                          | - Mechanical Shock      | MIL-STD-810F<br>EN 61373<br>50 g, 3 axis, 11 ms                                                                                                                                                                                                                        |
|                          | - Thermal Shock         | MIL-STD-810F                                                                                                                                                                                                                                                           |
|                          | - Flammability          | EN 45545-2<br><a href="http://www.tracopower.com/info/en45545-declaration.pdf">www.tracopower.com/info/en45545-declaration.pdf</a>                                                                                                                                     |
| Case Ingress Protection  |                         | IP 55 (acc. IEC 60529)                                                                                                                                                                                                                                                 |
| Housing Material         |                         | Aluminum                                                                                                                                                                                                                                                               |
| Potting Material         |                         | Silicone (UL 94 V-0 rated)                                                                                                                                                                                                                                             |
| Housing Type             |                         | Metal Case                                                                                                                                                                                                                                                             |
| Mounting Type            |                         | Chassis Mount                                                                                                                                                                                                                                                          |
| Connection Type          |                         | Screw Terminal                                                                                                                                                                                                                                                         |
| Weight                   |                         | 300 g                                                                                                                                                                                                                                                                  |
| Environmental Compliance | - REACH Declaration     | <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant                                                                                            |
|                          | - RoHS Declaration      | <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7(a), 7(c)-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).) |
|                          | - SCIP Reference Number | 68d4622a-aca5-4900-9ad3-cda990716870                                                                                                                                                                                                                                   |
|                          |                         |                                                                                                                                                                                                                                                                        |

## Additional Information

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| Supporting Documents       | <a href="http://www.tracopower.com/overview/tep150wi">www.tracopower.com/overview/tep150wi</a> |
| Frequently Asked Questions | <a href="http://www.tracopower.com/glossary-faq">www.tracopower.com/glossary-faq</a>           |
| Glossary                   | <a href="http://www.tracopower.com/info/glossary.pdf">www.tracopower.com/info/glossary.pdf</a> |
| Service Portal             | <a href="http://www.tracoserviceportal.com">www.tracoserviceportal.com</a>                     |

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

## Outline Dimensions



Dimensions in mm (inch)

Mounting slot tolerance  $\pm 0.25$  ( $\pm 0.001$ )

Case tolerance  $\pm 0.5$  ( $\pm 0.02$ )

Screw locked torque: 0.49 Nm (5.0 kgfcm)

Terminal screw locked torque: 0.25 Nm (2.5 kgfcm)

### Pinout

| Pin | Function | Wire dimension * |
|-----|----------|------------------|
| 1   | + Vin    | 14 – 16 AWG      |
| 2   | + Vin    |                  |
| 3   | - Vin    |                  |
| 4   | - Vin    |                  |
| 5   | Remote   | 14 – 24 AWG      |
| 6   | + Vout   | 14 – 16 AWG      |
| 7   | - Vout   |                  |
| 8   | Trim 1   | 14 – 24 AWG      |
| 9   | Trim 2   |                  |

\* The size of the wires has to be assessed in the final application.