

- Fully encapsulated 2"x1" package
- 3000 VAC I/O isolation (reinforced)
- 4:1 input voltage range: 36 – 160 VDC
- EN 50155 and EN 61373 certified
- Internal class A EMI filter
- -40°C up to +70°C operating temperature
- EN 45545-2 fire behavior
- Remote on/off function
- Undervoltage lockout (UVLO), short-circuit protection (SCP), overtemperature protection (OTP), and overvoltage protection (OVP)
- 3-year product warranty



The TEN 40WIRH is a series of 40 watt railway-certified DC/DC converters with reinforced I/O isolation for highest reliability in harsh environments. The proven and certified design guarantees highest resistance against thermal shocks, moisture, mechanical shocks, and vibration. The TEN 40WIRH comes with additional EN 62368-1 safety approvals for IT equipment and EN 45545-2 certification for fire behavior. Thanks to its favorable operating temperature range of -40°C up to +70°C (depending on the model), the TEN 40WIRH presents a first choice for demanding applications.

| Models           |                                |          |                  |          |                  |                 |
|------------------|--------------------------------|----------|------------------|----------|------------------|-----------------|
| Order Code       | Input Voltage Range            | Output 1 |                  | Output 2 |                  | Efficiency typ. |
|                  |                                | Vnom     | I <sub>max</sub> | Vnom     | I <sub>max</sub> |                 |
| TEN 40-11011WIRH | 36 - 160 VDC<br>(110 VDC nom.) | 5.1 VDC  | 8'000 mA         |          |                  | 88 %            |
| TEN 40-11012WIRH |                                | 12 VDC   | 3'330 mA         |          |                  | 89 %            |
| TEN 40-11013WIRH |                                | 15 VDC   | 2'666 mA         |          |                  | 90 %            |
| TEN 40-11015WIRH |                                | 24 VDC   | 1'666 mA         |          |                  | 89 %            |
| TEN 40-11022WIRH |                                | +12 VDC  | 1.666 mA         | -12 VDC  | 1.666 mA         | 88 %            |
| TEN 40-11023WIRH |                                | +15 VDC  | 1.333 mA         | -15 VDC  | 1.333 mA         | 89 %            |

| Options   |   |
|---|---|
| on demand<br>(backorder with MOQ non stocking item) | - Optional models with inverse Remote On/Off function (passive = off) |

### Input Specifications

|                        |              |   |
|------------------------|--------------|---|
| Input Current          | - At no load | 10 mA typ.  |
| Surge Voltage          |              | 200 VDC max. (1 s max.)   |
| Input Inrush Current   |              | 55 A typ.   |
| Under Voltage Lockout  |              | 32 VDC min. / 34 VDC typ. / 35.8 VDC max.   |
| Recommended Input Fuse |              | 3'150 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           |  | ±10% (5.1, 12 Vout models)<br>-10% to +20% (15, 24 Vout models)<br>(single output models only)<br>(By external trim resistor)<br>See application note: <a href="http://www.tracopower.com/overview/ten40wirh">www.tracopower.com/overview/ten40wirh</a><br>Output power must not exceed rated power!   |
| Voltage Set Accuracy                |  | ±1% max.   |
| Regulation                          | - Input Variation (Vmin - Vmax)<br>- Load Variation (0 - 100%)<br>- Voltage Balance (symmetrical load)<br>- Cross Regulation (25% / 100% asym. load) | single output models: 0.2% max.<br>dual output models: 0.5% max.<br>single output models: 0.5% max.<br>dual output models: 1% max. (Output 1)<br>1% max. (Output 2)<br>dual output models: 2% max.<br>dual output models: 5% max.  |
| Ripple and Noise (20 MHz Bandwidth) | - single output<br>- dual output   | 5.1 Vout models: 75 mVp-p typ. (w/ 1 µF, 50 V, X7R)<br>12 Vout models: 100 mVp-p typ. (w/ 1 µF, 50 V, X7R)<br>15 Vout models: 100 mVp-p typ. (w/ 1 µF, 50 V, X7R)<br>24 Vout models: 150 mVp-p typ. (w/ 1 µF, 50 V, X7R)<br>12 / -12 Vout models: 100 / 100 mVp-p typ. (w/ 1 µF, 50 V, X7R)<br>15 / -15 Vout models: 100 / 100 mVp-p typ. (w/ 1 µF, 50 V, X7R) |
| Capacitive Load                     | - single output<br>- dual output   | 5.1 Vout models: 9'600 µF max.<br>12 Vout models: 1'667 µF max.<br>15 Vout models: 1'066 µF max.<br>24 Vout models: 417 µF max.<br>12 / -12 Vout models: 833 / 833 µF max.<br>15 / -15 Vout models: 533 / 533 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: <a href="http://www.tracopower.com/info/holdup_en50155.pdf">www.tracopower.com/info/holdup_en50155.pdf</a> )   |
| Start-up Time                       |  | 30 ms typ. / 60 ms max.  |
| Short Circuit Protection            |  | Continuous, Automatic recovery   |
| Output Current Limitation           |  | 150% typ. of Iout max.   |
| Overvoltage Protection              |  | 126% typ. of Vout nom.<br>(depending on model)<br>6.2 VDC typ. (5.1 Vout model)<br>15 VDC typ. (12 Vout model)<br>20 VDC typ. (15 Vout model)<br>30 VDC typ. (24 Vout model)<br>(by Zener diode)   |

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

|                    |                  |   |
|--------------------|------------------|---|
| Transient Response | - Peak Variation | 450 mV typ. / 650 mV max. (75% to 100% Load Step) |
|                    | - Response Time  | 250 µs typ. / 300 µs max. (75% to 100% Load Step) |

### Safety Specifications

|                       |   |  |
|-----------------------|---|--|
| Standards             | - IT / Multimedia Equipment                         | EN 62368-1<br>IEC 62368-1<br>UL 62368-1  |
|                       | - Railway Applications<br>- Certification Documents | EN 50155<br><a href="http://www.tracopower.com/overview/ten40wirh">www.tracopower.com/overview/ten40wirh</a> |
| Pollution Degree      |   | PD 2   |
| Over Voltage Category |   | OVC II   |

### EMC Specifications

|               |                             |  |
|---------------|-----------------------------|--|
| EMI Emissions | - Conducted Emissions       | EN 50121-3-2 (EMC for Rolling Stock)<br>EN 55032 class A (internal filter)<br>EN 55032 class B (with external filter)  |
|               | - Radiated Emissions        | EN 55032 class A (internal filter)<br>EN 55032 class B (with external filter)  |
|               | External filter proposal:   | <a href="http://www.tracopower.com/overview/ten40wirh">www.tracopower.com/overview/ten40wirh</a>   |
| EMS Immunity  | - Electrostatic Discharge   | EN 50121-3-2 (EMC for Rolling Stock)<br>EN 55024 (IT Equipment)<br>EN 55035 (Multimedia)   |
|               | - RF Electromagnetic Field  | Air: EN 61000-4-2, ±8 kV, perf. criteria A   |
|               | - EFT (Burst) / Surge       | Contact: EN 61000-4-2, ±6 kV, perf. criteria A<br>EN 61000-4-3, 20 V/m, perf. criteria A<br>EN 61000-4-4, ±2 kV, perf. criteria A<br>EN 61000-4-5, ±2 kV, perf. criteria A |
|               | - Conducted RF Disturbances | Ext. input component: 2x 220 µF, 200 V, KXJ    SMDJ170A<br>EN 61000-4-6, 10 Vrms, perf. criteria A   |
|               | - PF Magnetic Field         | Continuous: EN 61000-4-8, 100 A/m, perf. criteria A<br>1 s: EN 61000-4-8, 1000 A/m, perf. criteria A   |

### General Specifications

|  |                             |  |
|--|-----------------------------|--|
| Relative Humidity                      |                             | 95% max. (non condensing)  |
| Temperature Ranges                     | - Operating Temperature     | -40°C to +70°C   |
|  | - Case Temperature          | +105°C max.  |
|  | - Storage Temperature       | -55°C to +125°C  |
| Power Derating                         | - High Temperature          | Depending on model   |
|  |                             | See application note: <a href="http://www.tracopower.com/overview/ten40wirh">www.tracopower.com/overview/ten40wirh</a>   |
| Over Temperature Protection Switch Off | - Protection Mode           | 115°C min. (Automatic recovery)  |
|  | - Measurement Point         | Case   |
| Cooling System                         |                             | Natural convection (20 LFM)  |
| Remote Control                         | - Voltage Controlled Remote | 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 mA typ. / 3.5 mA max.<br>(Optional models with inverse Remote On/Off function (passive = off)) |
|  | - Off Idle Input Current    |  |
| Altitude During Operation              |                             | 5'000 m max.   |
| Switching Frequency                    |                             | 250 - 310 kHz (PWM)  |
|  |                             | 275 kHz typ. (PWM)   |
| Insulation System                      |                             | Reinforced Insulation  |
| Working Voltage (rated)                |                             | 161 VAC  |

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

|                          |                                 |   |
|--------------------------|---------------------------------|---|
| Isolation Test Voltage   | - Input to Output, 60 s         | 3'000 VAC   |
|                          | - Input to Case, 60 s           | 3'000 VAC   |
|                          | - Output to Case, 60 s          | 2'000 VAC   |
| Creepage                 | - Input to Output               | 4.5 mm min.   |
| Clearance                | - Input to Output               | 4.5 mm min.   |
| Isolation Resistance     | - Input to Output, 500 VDC      | 1'000 MΩ min.   |
| Isolation Capacitance    | - Input to Output, 100 kHz, 1 V | 650 pF typ.   |
|                          |                                 | 1'000 pF max.   |
| Reliability              | - Calculated MTBF               | 1'253'000 h (MIL-HDBK-217F, ground benign)  |
| Washing Process          |                                 | According to Cleaning Guideline<br><a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>   |
| Environment              | - Vibration                     | MIL-STD-810F<br>EN 61373  |
|                          | - Mechanical Shock              | MIL-STD-810F<br>EN 61373  |
|                          | - 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>  |
| Housing Material         |                                 | Non-conductive Plastic (UL 94 V-0 rated)  |
| Base Material            |                                 | Non-conductive Plastic (UL 94 V-0 rated)  |
| Potting Material         |                                 | Silicone (UL 94 V-0 rated)  |
| Pin Material             |                                 | Tinned Copper   |
| Pin Foundation Plating   |                                 | Nickel (2 - 3 μm)   |
| Pin Surface Plating      |                                 | Tin (3 - 5 μm), matte   |
| Housing Type             |                                 | Plastic Case  |
| Mounting Type            |                                 | PCB Mount   |
| Connection Type          |                                 | THD (Through-Hole Device)   |
| Footprint Type           |                                 | 2" x 1"   |
| Soldering Profile        |                                 | Lead-Free Wave Soldering  |
|                          |                                 | 260°C / 6 s max.  |
| Weight                   |                                 | 32 g  |
| Thermal Impedance        | - Case to Ambient               | 11.3 K/W typ.   |
| 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: 7a, 7c-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule)) |
|                          | - SCIP Reference Number         | d93cc74d-a0b0-4a72-a0be-6ca840ea9503  |

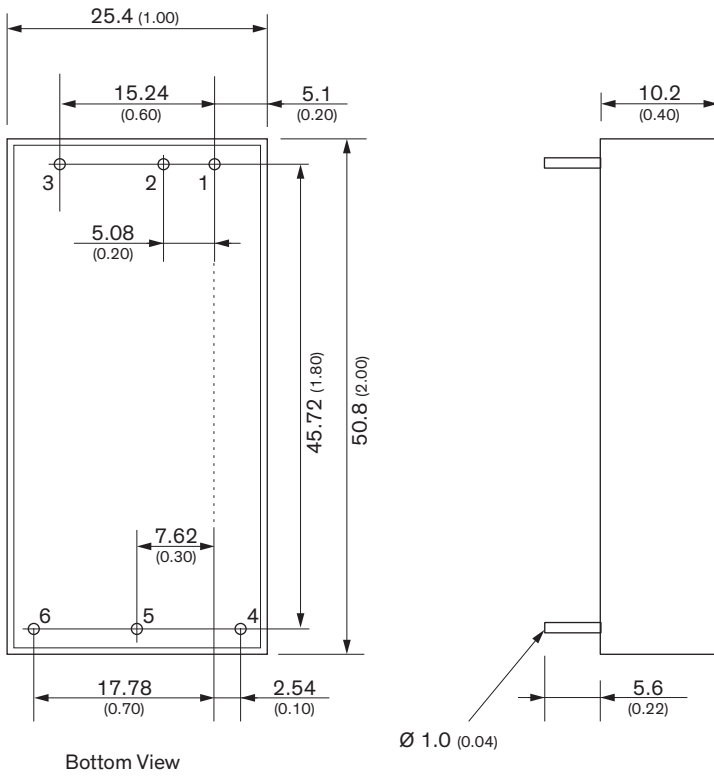
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten40wirh](http://www.tracopower.com/overview/ten40wirh)

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

**Outline Dimensions**



| Pinout |               |        |
|--------|---------------|--------|
| Pin    | Single        | Dual   |
| 1      | +Vin          |        |
| 2      | -Vin          |        |
| 3      | Remote On/Off |        |
| 4      | +Vout         |        |
| 5      | -Vout         | Common |
| 6      | Trim          | -Vout  |

All dimension in mm (inch)  
 Tolerance: X.X ±0.5 (X.XX ±0.02)  
           X.XX ±0.25 (X.XXX ±0.010)  
 Pin dimension tolerance ±0.10 (±0.004)