

- Fully encapsulated 1"x1.6" package
- 4000 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 +75°C without derating
- 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 20WIRH is a series of 20 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 20WIRH 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 to +75°C without derating (depending on the model), the TEN 20WIRH 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 20-11011WIRH	36 - 160 VDC (110 VDC nom.)	5.1 VDC	4'000 mA			91 %
TEN 20-11012WIRH		12 VDC	1'670 mA			89 %
TEN 20-11013WIRH		15 VDC	1'330 mA			90 %
TEN 20-11015WIRH		24 VDC	833 mA			89 %
TEN 20-11021WIRH		+5 VDC	2'000 mA	-5 VDC	2'000 mA	86 %
TEN 20-11022WIRH		+12 VDC	833 mA	-12 VDC	833 mA	89 %
TEN 20-11023WIRH		+15 VDC	667 mA	-15 VDC	667 mA	90 %

### Options

<b>on demand</b> (backorder with MOQ non stocking item)	- Optional models with inverse remote on/off function (passiv = off)
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### Input Specifications

Input Current	- At no load	10 mA typ.
Surge Voltage		200 VDC max. (1 s max.)
Input Inrush Current		50 A typ.
Start-up Voltage		36 VDC
Under Voltage Lockout		32 VDC min. / 34 VDC typ. / 35.8 VDC max.
Recommended Input Fuse		1'000 mA (slow blow) (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 single models) -10% to +20% (15, 24 Vout single models) (By external trim resistor) See application note: <a href="http://www.tracopower.com/overview/ten20wirh">www.tracopower.com/overview/ten20wirh</a> Output power must not exceed rated power!
Voltage Set Accuracy		±1% max.
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%) - Voltage Balance (symmetrical load) - Cross Regulation (25% / 100% asym. load)	single output models: 0.2% max. dual output models: 0.2% max. single output models: 0.5% max. dual output models: 1% max. (Output 1) 1% max. (Output 2) dual output models: 2% max. dual output models: 5% max.
Ripple and Noise (20 MHz Bandwidth)	- single output - dual output	5.1 Vout models: 75 mVp-p typ. (w/ 1 µF, 50 V, X7R) 12 Vout models: 100 mVp-p typ. (w/ 1 µF, 50 V, X7R) 15 Vout models: 100 mVp-p typ. (w/ 1 µF, 50 V, X7R) 24 Vout models: 150 mVp-p typ. (w/ 1 µF, 50 V, X7R) 5 / -5 Vout models: 75 / 75 mVp-p typ. (w/ 1 µF, 50 V, X7R) 12 / -12 Vout models: 100 / 100 mVp-p typ. (w/ 1 µF, 50 V, X7R) 15 / -15 Vout models: 100 / 100 mVp-p typ. (w/ 1 µF, 50 V, X7R)
Capacitive Load	- single output - dual output	5.1 Vout models: 5'000 µF max. 12 Vout models: 850 µF max. 15 Vout models: 700 µF max. 24 Vout models: 220 µF max. 5 / -5 Vout models: 2'500 / 2'500 µF max. 12 / -12 Vout models: 500 / 500 µF max. 15 / -15 Vout models: 350 / 350 µF max.
Minimum Load		Not required
Temperature Coefficient		±0.02 %/K max.
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. (depending on model) 6.2 VDC typ. (5.1 Vout model) 15 VDC typ. (12 Vout model) 20 VDC typ. (15 Vout model) 30 VDC typ. (24 Vout model) (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	320 mV typ. / 400 mV max. (75% to 100% Load Step)
	- Response Time	250 $\mu$ s typ. / 300 $\mu$ s max. (75% to 100% Load Step)

### Safety Specifications

Safety Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 62368-1
	- Railway Applications - Certification Documents	EN 50155 <a href="http://www.tracopower.com/overview/ten20wirh">www.tracopower.com/overview/ten20wirh</a>
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 50121-3-2 (EMC for Rolling Stock) EN 55032 class A (internal filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55032 class A (internal filter) EN 55032 class B (with external filter) External filter proposal: <a href="http://www.tracopower.com/overview/ten20wirh">www.tracopower.com/overview/ten20wirh</a>
EMS Immunity	- Electrostatic Discharge	EN 50155 (Railway Applications) EN 50121-3-2 (EMC for Rolling Stock) EN 55024 (IT Equipment) Air: EN 61000-4-2, $\pm 8$ kV, perf. criteria A Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A
	- RF Electromagnetic Field - EFT (Burst) / Surge	EN 61000-4-3, 20 V/m, perf. criteria A EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 2$ kV, perf. criteria A
	- Conducted RF Disturbances - PF Magnetic Field	Ext. input component: 2x 220 $\mu$ F, 200 V, KXJ // SMDJ170A Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A 1 s: EN 61000-4-8, 100 A/m, perf. criteria A 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 +85°C
	- Case Temperature	+105°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	See application note: <a href="http://www.tracopower.com/overview/ten20wirh">www.tracopower.com/overview/ten20wirh</a>
Over Temperature Protection Switch Off	- Protection Mode - Measurement Point	115°C typ. (Automatic recovery) Case
Cooling System		Natural convection (20 LFM)
Remote Control	- Voltage Controlled Remote	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. / 3.5 mA max. (Optional models with inverse logic (passiv = off) available)
	- 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)		182 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	1'558'000 h (MIL-HDBK-217F, ground benign)
Washing Process	See Cleaning Guideline:	Allowed (hermetical product)
		Baking after washing: 100°C for 45 min <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration	MIL-STD-810F EN 61373
	- Mechanical Shock	MIL-STD-810F EN 61373
	- Thermal Shock	MIL-STD-810F EN 50155
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
Soldering Profile		Wave Soldering 260°C / 6 s max.
Connection Type		THD (Through-Hole Device)
Weight		24 g
Thermal Impedance		11.5 K/W
Environmental Compliance	- REACH Declaration	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule). The SCIP number is provided on request.)
	- Flammability (EN 45545-2)	<a href="http://www.tracopower.com/info/en45545-declaration.pdf">www.tracopower.com/info/en45545-declaration.pdf</a>

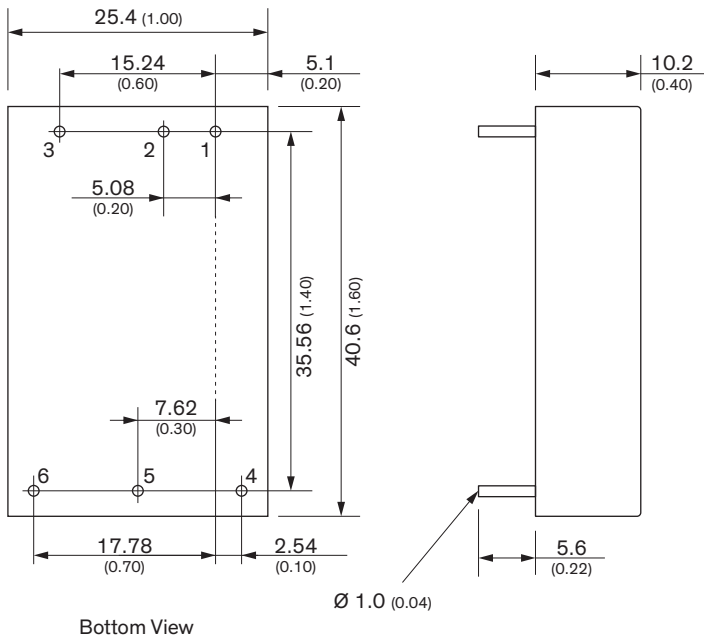
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten20wirh](http://www.tracopower.com/overview/ten20wirh)

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**Outline Dimensions**



Pinout		
Pin	Single	Dual
1	+ Vin	+ Vin
2	- Vin	- Vin
3	Ctrl	Ctrl
4	+ Vout	+ Vout
5	- Vout	Common
6	Trim	- Vout

NC = not connected

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)