

- Ultra wide 4:1 input range up to 160 VDC
- Certified for Railway applications (EN 50155)
- Operating temperature range -40°C to + 85°C
- Input under voltage lockout
- I/O isolation 1500 VDC
- Input filter to meet EN 55022 class A
- Remote On/Off



The TEN 8WI series is a family of high performance 8 Watt dc/dc converter modules featuring ultra wide 4:1 input voltage ranges in a DIP-24 package with industry- standard footprint. Input voltages up to 160 VDC, excellent EMC characteristics and EN 50155 approval make this product the best choice for many demanding applications in railroad and transportation systems. Further standard features include remote On/Off, over voltage protection, under voltage lockout and short circuit protection. Typical applications for these converters are also in wireless networks, telecom/datacom, industry control systems and measurement equipment.

### Models

Order Code	Input Voltage Range	Output 1		Output 2		Efficiency typ.
		Vnom	I <sub>max</sub>	Vnom	I <sub>max</sub>	
TEN 8-2410WI	9 - 36 VDC (24 VDC nom.)	3.3 VDC	2'400 mA			85 %
TEN 8-2411WI		5 VDC	1'600 mA			87 %
TEN 8-2412WI		12 VDC	666 mA			86 %
TEN 8-2413WI		15 VDC	533 mA			86 %
TEN 8-2421WI		+5 VDC	800 mA	-5 VDC	800 mA	84 %
TEN 8-2422WI		+12 VDC	333 mA	-12 VDC	333 mA	86 %
TEN 8-2423WI		+15 VDC	267 mA	-15 VDC	267 mA	86 %
TEN 8-4810WI	18 - 75 VDC (48 VDC nom.)	3.3 VDC	2'400 mA			85 %
TEN 8-4811WI		5 VDC	1'600 mA			87 %
TEN 8-4812WI		12 VDC	666 mA			87 %
TEN 8-4813WI		15 VDC	533 mA			88 %
TEN 8-4821WI		+5 VDC	800 mA	-5 VDC	800 mA	84 %
TEN 8-4822WI		+12 VDC	333 mA	-12 VDC	333 mA	87 %
TEN 8-4823WI		+15 VDC	267 mA	-15 VDC	267 mA	87 %
TEN 8-7210WI	43 - 160 VDC (110 VDC nom.)	3.3 VDC	2'400 mA			84 %
TEN 8-7211WI		5 VDC	1'600 mA			85 %
TEN 8-7212WI		12 VDC	666 mA			86 %
TEN 8-7213WI		15 VDC	533 mA			86 %
TEN 8-7221WI		+5 VDC	800 mA	-5 VDC	800 mA	82 %
TEN 8-7222WI		+12 VDC	333 mA	-12 VDC	333 mA	85 %
TEN 8-7223WI		+15 VDC	267 mA	-15 VDC	267 mA	85 %

## Input Specifications

Input Current	- At no load	24 Vin models: <b>30 mA typ.</b> 48 Vin models: <b>15 mA typ.</b> 110 Vin models: <b>6 mA typ.</b>
	- At full load	24 Vin models: <b>390 mA typ. / 1'400 mA max.</b> 48 Vin models: <b>190 mA typ. / 700 mA max.</b> 110 Vin models: <b>90 mA typ. / 300 mA max.</b>
Surge Voltage		24 Vin models: <b>50 VDC max.</b> (100 ms max.) 48 Vin models: <b>100 VDC max.</b> (100 ms max.) 110 Vin models: <b>170 VDC max.</b> (100 ms max.)
Under Voltage Lockout		24 Vin models: <b>7 VDC min. / 8 VDC typ. / 8.8 VDC max.</b> 48 Vin models: <b>15 VDC min. / 16 VDC typ. / 17.5 VDC max.</b> 110 Vin models: <b>37 VDC min. / 40 VDC typ. / 42 VDC max.</b>
Reflected Ripple Current		24 Vin models: <b>22 mA typ.</b> 48 Vin models: <b>13 mA typ.</b> 110 Vin models: <b>19 mA typ.</b>
Recommended Input Fuse		24 Vin models: <b>2'000 mA</b> (slow blow) 48 Vin models: <b>1'000 mA</b> (slow blow) 110 Vin models: <b>500 mA</b> (slow blow) (The need of an external fuse has to be assessed in the final application.)
Input Filter		<b>Internal Pi-Type</b>

## Output Specifications

Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax)	single output models: <b>0.2% max.</b>
	- Load Variation (10 - 90%)	single output models: <b>0.3% max.</b> dual output models: <b>0.8% max.</b> (Output 1) <b>0.8% max.</b> (Output 2)
	- Cross Regulation	dual output models: <b>5% max.</b>
	(25% / 100% asym. load)	
Ripple and Noise (20 MHz Bandwidth)		24 Vin models: <b>50 mVp-p typ.</b> 48 Vin models: <b>50 mVp-p typ.</b> 110 Vin models: <b>75 mVp-p typ.</b>
Capacitive Load	- single output	3.3 Vout models: <b>1'330 µF max.</b> 5 Vout models: <b>1'330 µF max.</b> 12 Vout models: <b>288 µF max.</b> 15 Vout models: <b>200 µF max.</b>
	- dual output	5 / -5 Vout models: <b>900 / 900 µF max.</b> 12 / -12 Vout models: <b>133 / 133 µF max.</b> 15 / -15 Vout models: <b>90 / 90 µF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Start-up Time		<b>450 ms typ.</b> (power on) <b>5 ms typ.</b> (remote on)
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Output Current Limitation		<b>150% typ. of Iout max.</b>
Transient Response	- Response Time	<b>250 µs typ.</b> (25% Load Step)

## Safety Specifications

Safety Standards	- IT / Multimedia Equipment	<b>EN 62368-1</b> <b>IEC 62368-1</b> <b>UL 62368-1</b>
	- Railway Applications	<b>EN 50155</b>
	- Certification Documents	<a href="http://www.tracopower.com/overview/ten8wi">www.tracopower.com/overview/ten8wi</a>
Pollution Degree		<b>PD 2</b>

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

## EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55011 class A (with external filter) EN 55011 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter)
	- Radiated Emissions	EN 55011 class A (with external filter) EN 55011 class B (with external filter) EN 55032 class A (with external filter) EN 55032 class B (with external filter)
External filter proposal: <a href="http://www.tracopower.com/overview/ten8wi">www.tracopower.com/overview/ten8wi</a>		
EMS Immunity	- Electrostatic Discharge	Air: EN 50155 (Railway Applications) EN 61000-4-2, $\pm 8$ kV, perf. criteria A
	- RF Electromagnetic Field	Contact: EN 61000-4-2, $\pm 6$ kV, perf. criteria A EN 61000-4-3, 20 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, $\pm 2$ kV, perf. criteria A EN 61000-4-5, $\pm 2$ kV, perf. criteria A
		Ext. input component: 24 & 48 Vin models: KY 220 $\mu$ F, 100 V 110 Vin models: KX J 150 $\mu$ F, 200 V
		External filter proposal: <a href="http://www.tracopower.com/overview/ten8wi">www.tracopower.com/overview/ten8wi</a>
	- Conducted RF Disturbances - PF Magnetic Field	Continuous: EN 61000-4-6, 10 Vrms, perf. criteria A 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	- Operating Temperature	-40°C to +85°C
	- Case Temperature	+105°C max.
	- Storage Temperature	-55°C to +125°C
Power Derating	- High Temperature	3 %/K above 70°C
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
	- Off Idle Input Current	2.5 mA typ.
	- Remote Pin Input Current	-0.5 to 0.5 mA
Altitude During Operation		4'000 m max.
Switching Frequency		270 - 330 kHz (PWM)
		300 kHz typ. (PWM)
Insulation System		Functional Insulation
Isolation Test Voltage	- Input to Output, 60 s	1'600 VDC
Isolation Resistance	- Input to Output, 500 VDC	1'000 M $\Omega$ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'500 pF max.
Reliability	- Calculated MTBF	2'800'000 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 EN 50155
Housing Material		Nickel coated Copper
Base Material		Non-conductive Plastic
Potting Material		Epoxy (UL 94 V-0 rated)
Pin Material		Copper
Soldering Profile		Wave Soldering
		265°C / 10 s max.
Connection Type		THD (Through-Hole Device)

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

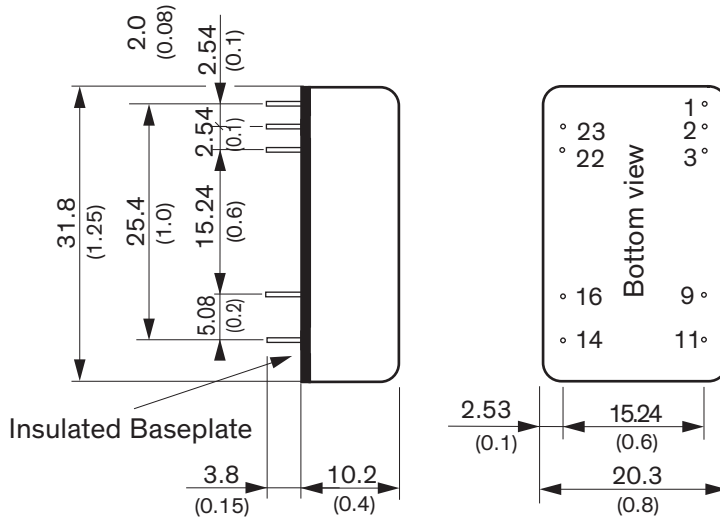
Weight	18 g
Thermal Impedance	20 K/W
Environmental Compliance	<ul style="list-style-type: none"> <li>- Reach <a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a></li> <li>- RoHS <a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a></li> <li>- Flammability (EN 45545-2) <a href="http://www.tracopower.com/info/en45545-declaration.pdf">www.tracopower.com/info/en45545-declaration.pdf</a></li> </ul>

### Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/ten8wi](http://www.tracopower.com/overview/ten8wi)

### Outline Dimensions



Pinout		
Pin	Single	Dual
1	Remote On/Off	Remote On/Off
2	-Vin	-Vin
3	-Vin	-Vin
9	ntc	Common
11	ntc	-Vout
14	+Vout	+Vout
16	-Vout	Common
22	+Vin	+Vin
23	+Vin	+Vin

ntc = not to connect

Dimensions in mm (inch)  
 Pin diameter  $\varnothing 0.5 \pm 0.05$  ( $0.02 \pm 0.002$ )  
 Tolerances  $\pm 0.5$  ( $\pm 0.02$ )  
 Pin pitch tolerances  $\pm 0.25$  ( $\pm 0.001$ )