



## TE CONNECTIVITY SENSORS FOR E-MOBILITY IN COMMERCIAL AND INDUSTRIAL VEHICLES

TE Connectivity's (TE) sensor products enable reliability in the industrial and commercial transportation electrification movement by offering products supporting increased efficiency, safety and comfort transmitting data for increased control, adaptation, and response of the vehicle functions. TE's sensor products have advanced performance when exposed to harsh extreme conditions like high temperatures, humidity, dust, vibration and electrical noise.

Batteries, AC/DC inverters, DC/DC converters, and electric powertrains are becoming lighter weight and miniaturized, all contributing to robust designs and reduced energy consumption that extend vehicle range. With TE's engineering expertise several sensors are designed for performance in ultra-harsh environments, such as our resolver sensors that measure e-motor rotor position; our temperature sensors, which measure e-motor thermal management and charging inlet temperature; and our current sensors for battery pack power management and power electronics such as the inverter.

When considering driver comfort and automation, use of sensors is critical to optimize dynamic vehicle controls and create energy efficiency. For example, TE's wheel speed and pedal travel position sensors support driver assistance systems (ADAS) like automotive braking systems (ABS) and cruise control. For energy management, TE's cost-effective humidity sensing innovations help prevent overconsuming energy by automating HVAC controls and windshield defogging.

### TE CONNECTIVITY ADVANTAGES

- Portfolio Breadth
- ICT and EV Experience
- Manufacturing Scale / Global Footprint
- Customization Capability







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# ELECTRIC BATTERY MODULES

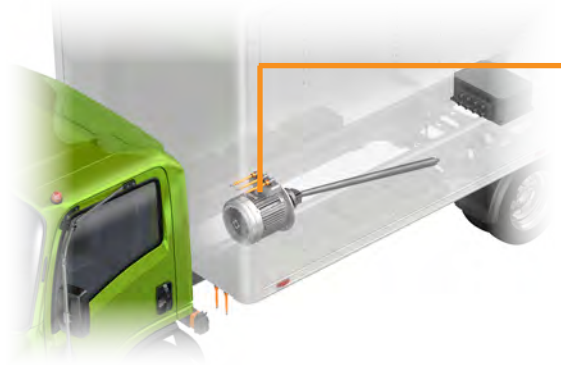


## BATTERY UNIT

- A** Battery Management Current Measurement - Current Sensor
- B** Battery Coolant Leak Detection - Humidity Sensor
- C** Battery Management for Thermal Runaway - Barometric Air Pressure Sensor
- D** Battery Temperature - Temperature Sensor




Featured Product		Key Product Features	Benefits
<b>A</b>	<a href="#">Coreless Current Sensor</a> 	<ul style="list-style-type: none"> <li>• Operating voltage 5V and current range 350A</li> <li>• 1% Accuracy at 25° C (hall technology)</li> <li>• Analog output</li> </ul>	<ul style="list-style-type: none"> <li>• Innovative no magnetic core reduces measurement drift during temperature changes</li> <li>• Price to performance ratio</li> </ul>
<b>A</b>	<a href="#">Integrated Current Sensor</a> 	<ul style="list-style-type: none"> <li>• Operating voltage 5V and current range 350A</li> <li>• 1% Accuracy at 25° C (hall technology)</li> <li>• Integrated NTC temperature sensor</li> </ul>	<ul style="list-style-type: none"> <li>• &lt;0.1% linearity failure rate creates increased safety for critical power management in battery</li> <li>• Integrated hall and shunt solution provides low drift and high performance in critical modules</li> </ul>
<b>A</b>	<a href="#">Passive Shunt Current Sensor</a> 	<ul style="list-style-type: none"> <li>• Operating voltage 0-12V and current range 0-300A</li> <li>• 1% Accuracy at 25° C (hall technology)</li> <li>• Analog and digital (SENT) output to calculate “start of charge” of the battery</li> </ul>	<ul style="list-style-type: none"> <li>• Optimized shunt resistance to minimize power consumption during operation</li> <li>• Faster NTC temperature signal without PCB offers increased performance and robust design</li> </ul>
<b>B</b>	<a href="#">Humidity Sensor HTU31X</a> 	<ul style="list-style-type: none"> <li>• Humidity range from 0% RH to 100% RH</li> <li>• Typical accuracy ±2%</li> <li>• Digital or analog output available</li> </ul>	<ul style="list-style-type: none"> <li>• Combines humidity, temperature and pressure measurement</li> <li>• Design in eased by compact dimensions (2.5 x 2.5 x 0.9mm)</li> <li>• High resistance to chemicals</li> </ul>
<b>C</b>	Barometric Air Pressure Sensor SM1131 	<ul style="list-style-type: none"> <li>• Absolute pressure measurement with temperature output</li> <li>• Full thermal compensation to accuracy ±1.0 kPa</li> <li>• I2C interface provides diagnostic, ID-data and controls with 16 bit resolution</li> </ul>	<ul style="list-style-type: none"> <li>• Increased accuracy through correction for pressure non-linearity and an on-chip temperature sensor can be read via I<sup>2</sup>C</li> <li>• Sleep mode option for low power consumption</li> </ul>
<b>D</b>	<a href="#">RTD Temperature Sensor</a> 	<ul style="list-style-type: none"> <li>• Temperature measurement on round or uneven surfaces</li> <li>• Optional adhesive backing</li> </ul>	<ul style="list-style-type: none"> <li>• Available with hazardous location approvals including intrinsically safe and explosion proof areas</li> <li>• Design flexibility for accuracy and tolerance bands with availability of platinum, nickel, and copper materials</li> </ul>

# ELECTRIC POWERTRAIN



## ELECTRIC MOTOR

- E** Rotor Position - Single Coil Resolver Sensor
- F** Travel Position - Position Sensor
- G** Thermal Monitoring - Temperature Sensor

Featured Product		Key Product Features	Benefits
<b>E</b>	<a href="#">Single Coil Resolver Sensor</a> 	<ul style="list-style-type: none"> <li>• Angular position sensor</li> <li>• High accuracy with up to 20,000/min (rpm)</li> <li>• Wide temperature range from -40°C up to +170°C</li> <li>• Compatible with difficult media e.g. oil</li> <li>• Adaptable to pole pairs of E-motor</li> </ul>	<ul style="list-style-type: none"> <li>• Fault-tolerant with excentricity (static/dynamic) and external fields through patented winding scheme</li> <li>• Reliable performance in high temperature and various fluid consistencies, withstanding rotation speeds above 20,000 RPM</li> </ul>
<b>F</b>	<a href="#">Position Sensor T40MC2</a> 	<ul style="list-style-type: none"> <li>• Non-contact measurement of magnet target with up to 360° angular measurement and up to 40mm linear measurement</li> <li>• Highly insensitive to vibration</li> <li>• Analog or PWM interface</li> </ul>	<ul style="list-style-type: none"> <li>• Saves space with non-contact measurement up to 40mm</li> <li>• Exceptional accuracy in high vibration environments, including optional redundancy for critical applications</li> </ul>
<b>G</b>	<a href="#">NTC Stator Temperature Sensor MEAS 400 Series</a> 	<ul style="list-style-type: none"> <li>• Rectangular, flat, laminated sensor</li> <li>• Various configurations available:                             <ul style="list-style-type: none"> <li>• Thermocouple types J, K, T, and E</li> <li>• Custom body thickness: .060" to .375"</li> <li>• Custom body widths: .250" to 2.50"</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Rectangular or round probe head shape for better temperature transfer from flat surfaces</li> <li>• Robust construction for durability in harsh environments, protected with PFA heat shrink insulated fluoroelastomer</li> </ul>

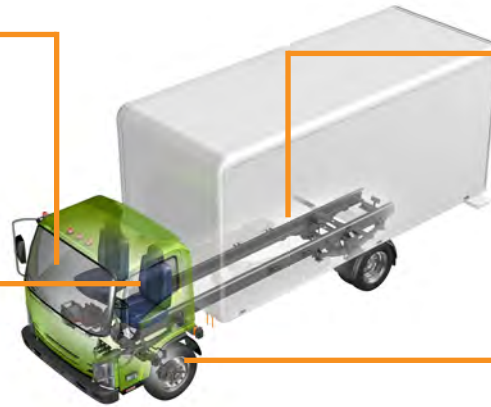
# ENERGY EFFICIENCY & DRIVER AUTOMATION CONTROL

## CABIN ENERGY MANAGEMENT

- H** Automatic Windshield Defogging System and HVAC Controlling - Defogging Sensor

## DRIVER SAFETY

- J** Seat Belt Buckle, Seat and Pedal Position, Door Position (Open/Close) - Position Sensor
- K** Pedal Position - Tilt Sensor








## SAFETY AND AUTONOMOUS CONTROL

- K** Chassis Position - Tilt Sensor
- L** Chassis Suspension, Hydraulic and Pneumatic Pressure - Pressure Transducer

## SAFETY

- M** Brake Control System - Wheel Speed Sensor

Featured Product		Key Product Features	Benefits
<b>H</b>	<a href="#">H2TG/D Defogging Sensor</a> 	<ul style="list-style-type: none"> <li>Dew point and windshield temperature sensor</li> <li>Humidity range 0% RH to 100% RH</li> <li>Calibrated <math>\pm 1.5^\circ</math> DP at <math>10^\circ\text{C}</math>, <math>\pm 0.8^\circ\text{C}</math> at <math>25^\circ\text{C}</math></li> <li>12V Operating voltage</li> </ul>	<ul style="list-style-type: none"> <li>Enables smart auto windshield defogging</li> <li>Proper defogging management saves energy and increases autonomy by up to 40km</li> <li>High resistance to chemicals</li> </ul>
<b>J</b>	<a href="#">Reed Switch Sensor</a> 	<ul style="list-style-type: none"> <li>Non-contact switch triggered by ferrous target and various switch forms (A, B, C)</li> <li>1A maximum current rating available</li> <li>Cable exits available from axial, central, left, and right positions</li> </ul>	<ul style="list-style-type: none"> <li>Increased driver safety with high accuracy of magnetic targets</li> <li>System design flexibility with various switch forms and cable exits</li> </ul>
<b>K</b>	<a href="#">AXISENSE-2 Tilt Sensor</a> 	<ul style="list-style-type: none"> <li>Load and tilt monitoring sensor</li> <li>Measurement ranges <math>\pm 90^\circ</math> and accuracy typically <math>0.5^\circ</math> (at <math>-40^\circ\text{C}</math> to <math>+85^\circ\text{C}</math>), <math>0.15^\circ</math> (at <math>+25^\circ\text{C}</math>)</li> <li>Digital signal processing includes filter (e.g. vibration damping) and temperature compensation</li> <li>12-bit resolution and 100 Hz refresh rate</li> </ul>	<ul style="list-style-type: none"> <li>Enables automatic tipover protection</li> <li>Provides cabin/chassis leveling for autonomous navigation applications</li> <li>Allows depth control and bucket/tool control for autonomous excavation</li> </ul>
<b>L</b>	<a href="#">Pressure Transducer M7100</a> 	<ul style="list-style-type: none"> <li>Liquid or gas pressure measurement</li> <li>Long-term stability and <math>\pm 0.25\%</math> accuracy</li> <li>Stainless steel wetted surfaces</li> <li>Difficult media compatibility</li> </ul>	<ul style="list-style-type: none"> <li>High reliability and durability</li> <li>Superior accuracy especially in high vibration environments</li> <li>Suited even for difficult media such as contaminated water, steam and corrosive fluids through leak proof machined components</li> </ul>
<b>M</b>	<a href="#">Wheel Speed Sensor Option 1</a> 	<ul style="list-style-type: none"> <li>Non-contact hall sensors capable of tone wheel detection</li> <li>Compact size with flexible design depending on customer's requirements</li> </ul>	<ul style="list-style-type: none"> <li>Non-contact technology increases accuracy, response time, and durability</li> <li>Compact size allows for design flexibility in wide range of vehicle sizes and tone wheel configurations</li> </ul>