TE Connectivity’s SENSOR TECHNOLOGIES for the Automotive Industry
TE Connectivity (TE) is one of the largest sensor companies in the world, with innovative sensor solutions that help customers transform concepts into smart, connected creations. To transport passengers safely and efficiently, vehicles need data. Today’s cars can sense and respond to changing conditions, inside and out.

TE sensors help provide the data for control, adaptation and response of vehicle functions that increase safety, comfort, and efficiency. Our technology is an integral part of many modern nervous systems in vehicles.

### ENGINE/E-MOTOR

Our engine and e-motor sensors are used in vehicle applications such as travel sensor for turbo charger actuator, pneumatic (EGR) Cylinder, CAM and Crank Shaft Speed sensors and resolvers for e-motor commutation.

### EXHAUST

TE provides a range of sensors for exhaust gas applications, such as urea quality, level and temperature, urea pump pressure and exhaust gas temperature (EGTS). These sensors help the OEM to comply with the latest emission regulations and significant performance improvement of modern aftertreatment systems.

### CHASSIS

We provide a range of chassis solutions for roof and convertible switches, actuator and cylinder position, seat position and weight classification. Our humidity and temperature technologies are used in Heating, Ventilation and Air Conditioning (HVAC) systems to prevent wind screen fogging and for energy management.
TE Connectivity is committed to making cars safer, greener and more connected. We support this commitment by integrating innovative sensors in demanding application areas such as automated transmissions, engines, clutch, brake and other mission critical areas.

Our sensors are designed and manufactured to exacting specifications, often on a custom basis. Together with our customers, we are working to solve today’s biggest application challenges in new and creative ways.

**BRAKE**

Our brake sensors are used in vehicle applications such as travel sensor for brake master cylinder position (optional redundancy), travel sensor for rear axle steering, rotary sensor for brake pedal position detection (optional redundancy); contactless brake light switch and wheel speed sensor. We also provide pressure sensors such as the vacuum brake booster sensor and brake line pressure for ABS/ESC modules.

**TRANSMISSION**

TE’s transmission sensors are used in vehicle applications such as all gear/neutral detection for manual transmission (MT) to support start and stop function, drive mode (travel or rotary) for automatic (AT), continuously variable (CVT), or dual clutch (DCT) transmissions. We also provide pressure and temperature solutions.

**CLUTCH**

The clutch sensors are used in vehicle applications such as Permanent-magnetic Linear Contactless Displacement (PLCD) sensors for concentric slave cylinder and clutch slave cylinder, rotary sensors for clutch pedal position detection; contactless switch for clutch master cylinder and travel sensor for clutch master cylinder and Dual Clutch Transmission (DCT).
Our Engine / E-Motor sensors are used in vehicle applications such as travel sensor for turbo charger actuator (truck), pneumatic EGR Cylinder (truck), and pneumatic turbo charger actuator; rotary sensor for EGR actuator, and resolver for e-motor commutation.

INTRODUCTION

**Position**
- Actuator Valve
- Resolver Commutation
- Oil Level *

**Pressure**
- Oil Pressure
- Air Intake
- GDI Pressure
- MAP / TMAP / TMAP and Humidity *

**Temperature**
- Engine Oil

**Humidity**
- Air Intake
- Combined Humidity / Pressure / Temperature

* in development
### Engine / E-Motor / Exhaust Sensors

#### Single Coil Resolver (SCR)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Hybrid powertrain / e-motor</td>
</tr>
<tr>
<td>Functions</td>
<td>Angular position sensor for electric motors for EV and HEV cars</td>
</tr>
<tr>
<td>Technology</td>
<td>Inductive Magnetic Field</td>
</tr>
</tbody>
</table>
| Features | • Temperature range -40° C to +170° C (works in oil if necessary)  
• Up to 20,000 rpm (rpm)  
• High accuracy  
• Pole pair numbers: 2-, 3-, 4-, 5-, 6-, 10-, 12-, and 18-speed  
• Customized cable assembly and connector interface  
• Fault-tolerant with eccentricity (static/dynamic) through patented winding scheme  
• Fault-tolerant against external fields |

#### Multi-Coil Resolver (MCR)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>E-motor for hybrid and electrical vehicles</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring rotor position of E-motor</td>
</tr>
<tr>
<td>Technology</td>
<td>MCR (Multi-Coil Resolver)</td>
</tr>
</tbody>
</table>
| Features | • Non-contact measurement of rotor position  
• Analog output  
• High accuracy  
• Temperature up to +150°C  
• Rotational speed up to 20,000 rpm  
• Adaptable to pole pairs of E-motor |

#### Ni1000 SOT

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Engine Oil Temperature</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring temperature of engine oil</td>
</tr>
<tr>
<td>Technology</td>
<td>Nickel RTD</td>
</tr>
</tbody>
</table>
| Features | • Resistance: 1000 ohms at 0°C  
• Temperature range: -55°C to +160°C  
• Measurement current: 0-5 mA, typ. 0.2 mA  
• ESD class 1  
• Tolerance: ± (0.4+0.007 x |T|) in range from 0°C to +160°C |

#### GDI Sensor Element

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>GDI Engine</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring pressure of fuel pipe</td>
</tr>
<tr>
<td>Technology</td>
<td>Kristal Bond</td>
</tr>
</tbody>
</table>
| Features | • Pressure range up to 300 bar  
• Small Diameter < 6 mm |
### EGR Actuator Sensor

**Industry**  
Industrial & Commercial Transportation

**Application**  
Exhaust Gas Recirculation

**Functions**  
Measuring piston position of Pneumatic Cylinder for truck

**Technology**  
Active PLCD (moving magnet)

**Features**  
- Non-contact travel measurement through cylinder wall
- Robust design for truck application

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### HTD 2610

**Industry**  
Automotive

**Application**  
Humidity at air intake manifold

**Functions**  
Dew point measurement

**Technology**  
Capacitive

**Features**  
- Humidity range: 0% RH to 100% RH
- Humidity time constant (with 2 m/s flow rate): typical 5 s
- Temperature range: -40°C to +125°C
- Calibration: +/-1° DP at 25°C
- Operating Voltage: 12 V
- LIN output

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### Turbocharger Pneumatic Actuator Position Sensor (Truck)

**Industry**  
Industrial & Commercial Transportation

**Application**  
Turbo charger for truck

**Functions**  
Measuring piston position of Pneumatic Actuator (over pressure)

**Technology**  
Active PLCD (moving magnet)

**Features**  
- Non-contact travel measurement
- Highly insensitive against vibration and temperature (up to +160°C)

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### Turbocharger Pneumatic Actuator Position Sensor (Automotive)

**Industry**  
Automotive

**Application**  
Turbo charger

**Functions**  
Measuring piston position of pneumatic actuator (vacuum)

**Technology**  
3D Hall (moving magnet)

**Features**  
- Non-contact travel measurement inside the actuator
- Unguided magnet
- Wear and tear free
- High life time accuracy

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All specifications subject to change. Consult TE Connectivity for latest specifications.
### Urea Pressure Sensor U86B

| Industry          | Automotive
|-------------------|------------------|
| Application       | Industrial & Commercial Transportation
| Functions         | Selective Catalytic Reduction (SCR)
| Technology        | Piezoresistive
| Features          | • Analor or SENT output  
|                   | • Pressure range: 0-3, 7, 10, or 14 bar  
|                   | • Total Error Band: ± 2.0  
|                   | • Operating temperature: -7°C ... +105°C  
|                   | • Cable option

### Urea Temperature Sensor

| Industry          | Industrial & Commercial Transportation
|-------------------|------------------|
| Application       | Selective Catalytic Reduction (SCR)
| Functions         | Pressure measurement of urea liquid in SCR systems
| Technology        | NTC
| Features          | • Suitable for high pressure applications  
|                   | • NTC – Custom tolerances available: ± 2%, ± 3%, and ± 5%  
|                   | • Beta 25 / 85: 3976  
|                   | • Operating temperature: -40°C ... +125°C  
|                   | • 8mm sensor tip diameter  
|                   | • Freeze cycle proven design

### NTC Temperature Sensor

| Industry          | Automotive
|-------------------|------------------|
| Application       | 48 V Beltdriven Starter Generator (BSG) temperature monitoring
| Functions         | Monitor the temperature inside of the 48 V motor
| Technology        | NTC
| Features          | • Operating temperature: -40°C ... +200°C  
|                   | • Resistance @ 25°C: 30 KOhms  
|                   | • Beta value 25 / 85: 3960 K

### Pressure Sensor Transmission

| Industry          | Automotive
|-------------------|------------------|
| Application       | Transmission CVT, DCT, AT & others
| Functions         | Measuring transmission oil pressure
| Technology        | Semiconductor Strain Gage (SemSG)
| Features          | • Lightweight: < 18 grams  
|                   | • Operating pressure: 1 - 80 / 20 bar (gauge)  
|                   | • Proof pressure: > 2x or more to operating range  
|                   | • Burst pressure: > 500 bar or more to operating range  
|                   | • Operating temperature: -40°C to +140°C  
|                   | • Interface: Analog or SENT  
|                   | • Compliance with ASIL “B”, optional ASIL “C”
Our transmission sensors are used in vehicle applications such as neutral detection sensor for Manual Transmission (MT) to support the start and stop function; drive mode sensor (travel or rotary measurement) for Automatic Transmission (AT), Continuously Variable Transmission (CVT), and Dual Clutch Transmission (DCT).

**Position**
- All Gear Detection
- Drive Mode (P - R - N - D - L)
- DCT Gear / Shift
- Clutch

**Pressure**
- Transmission Control Unit (TCU) Hydraulic Oil
- Pneumatic Air
- Transfer Case 4WD

**Temperature**
- Oil Sump
- Wet Clutch
- Oil Pump

**Speed**
- Input Speed (TISS)
- Output Speed (TOSS)
- Gear Speed
Transmission Sensors

**Speed Sensor Platform**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Transmission, Engine, Clutch, Chassis, Brake</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring gear speed, travel and angle position</td>
</tr>
<tr>
<td>Technology</td>
<td>Hall (moving magnet)</td>
</tr>
</tbody>
</table>
| Features | • Triggered by ferromagnetic gear wheel  
• Current interface with direction detection  
• Sealed connector interface  
• Diagnostics ability due to two-wire interface  
• IP6K9  
• Temperature range: -40°C up to +150°C |

**Hall Sensor T40MC2**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Transmission, Engine, Clutch, Chassis, Brake</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring travel position</td>
</tr>
<tr>
<td>Technology</td>
<td>Hall (moving magnet)</td>
</tr>
</tbody>
</table>
| Features | • Non-contact measurement up to 40mm  
• Highly insensitive to vibration  
• Temperature up to +150°C  
• Analog or PWM interface  
• Small geometry  
• Optional redundancy  
• Supply 5 V (optional 12 V)  
• 4-way MCON connector interface  
• Optional protocol (e.g. SENT) |

**AMT Position Sensor**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Industrial &amp; Commercial Transportation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Automated Manual Transmission (AMT)</td>
</tr>
<tr>
<td>Functions</td>
<td>Measure position of shift rails / forks (linear)</td>
</tr>
<tr>
<td>Technology</td>
<td>3D Hall (moving magnet)</td>
</tr>
</tbody>
</table>
| Features | • Non-contact travel  
• Robust design for truck application  
• One fastener interface to reduce installation time  
• 3D Hall with temperature compensation factor  
• 4-way MCON sealed connector interface  
• Operating temperature: -40°C ... +150°C |

**Dual Clutch Position Sensor**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Dual Clutch Transmission</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring piston position of clutch actuator</td>
</tr>
<tr>
<td>Technology</td>
<td>Active PLCD (moving magnet) or Hall</td>
</tr>
</tbody>
</table>
| Features | • Two sensors in one housing  
• Small and robust design |
Transmission Sensors

### Drive Mode Sensor

- **Industry**: Automotive  
- **Application**: Automated Transmission (AT)  
- **Functions**: Measuring drive mode position (PRND) inside the gearbox  
- **Technology**: Active PLCD (moving magnet) or Hall  
- **Features**:  
  - Non-contact travel measurement  
  - Robust and oil sealed design  
  - High measurements accuracy  
  - No wear and tear

### All Gear Detection Sensor

- **Industry**: Automotive  
- **Application**: Manual Transmission (MT)  
- **Functions**: Measuring gear and shift position  
- **Technology**: 3D Hall  
- **Features**:  
  - Non-contact rotary and travel measurement integrated in one housing  
  - Robust design

### Gear Fork Position Sensor

- **Industry**: Automotive  
- **Application**: Dual Clutch Transmission  
- **Functions**: Measuring gear fork position  
- **Technology**: Active PLCD (moving magnet) or Hall  
- **Features**:  
  - Non-contact measurement through transmission wall  
  - High life time accuracy  
  - Small magnet design

### Neutral Position Sensor

- **Industry**: Automotive  
- **Application**: Start-/Stop application  
- **Functions**: Measuring gear lever position inside manual transmission  
- **Technology**: Active PLCD (moving magnet) or Hall  
- **Features**:  
  - Non-contact measurement through transmission wall  
  - High life time accuracy  
  - Small magnet design  
  - Diagnostics ability due to two-wire interface
### Speed Sensor SP1M

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Transmission</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring gear speed</td>
</tr>
<tr>
<td>Technology</td>
<td>Hall (with integrated magnet)</td>
</tr>
</tbody>
</table>
| Features   | • Triggered by ferromagnetic gear wheel  
              • Current interface with direction detection  
              • Sealed connector interface  
              • Diagnostics ability due to two-wire interface  
              • IP69K  
              • Temperature range: −40°C ... +150°C |

### DCT Transmission Sensor Module

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Dual Clutch Transmission</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring drive mode position and gear speed inside transmission</td>
</tr>
<tr>
<td>Technology</td>
<td>Active PLCD or Hall</td>
</tr>
</tbody>
</table>
| Features   | • Sensor module with integrated position and speed sensors  
              • Oil sealed pass through connector system  
              • Highly robust design |

### DCT Transmission Sensor Module

<table>
<thead>
<tr>
<th>Industry</th>
<th>Automotive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Dual Clutch Transmission</td>
</tr>
<tr>
<td>Functions</td>
<td>Measuring shift fork position, gear speed and temperature inside transmission</td>
</tr>
<tr>
<td>Technology</td>
<td>Hall and NTC</td>
</tr>
</tbody>
</table>
| Features   | • Sensor module with integrated speed (2x), position (4x) and temperature sensors  
              • Oil sealed 12 pin pass through connector system  
              • Highly insensitive against vibration, temperature and pollution inside the transmission |

### DCT Transmission Sensor Module

<table>
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</tr>
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<tbody>
<tr>
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</tr>
<tr>
<td>Functions</td>
<td>Measuring shift fork position, gear speed and temperature inside transmission</td>
</tr>
<tr>
<td>Technology</td>
<td>Active PLCD, Hall and NTC</td>
</tr>
</tbody>
</table>
| Features   | • Sensor module with integrated speed (2x), position (4x) and temperature sensors  
              • Oil sealed connector system  
              • Highly insensitive to vibration, temperature and pollution inside the transmission |
Gear-Shift-Split Detection Sensor

Industry
Industrial & Commercial Transportation

Application
Automated Manual Transmission (AMT)

Functions
Measuring gear-shift and split position

Technology
Active PLCD (moving magnet)

Features
• Non-contact measurement
• High life time accuracy
• Small magnet design

Neutral Position Sensor

Industry
Automotive

Application
Start-/Stop application

Functions
Measuring gear lever position inside manual transmission

Technology
Hall (moving magnet)

Features
• Non-contact measurement
• Oil tight connector interface
• High life time accuracy
• Small magnet design
• Diagnostics ability due to three-wire interface

Water in Fuel Detection Sensor

Industry
Automotive

Application
Fuel Filter

Functions
Water detection

Technology
Resistance measurement

Features
• Flexible electrical interface (AC or DC, 12 V or 24 V)
• Different measurement levels
• Bayonet or thread interface
• Optional header or pigtail interface

Gear Detection Sensor

Industry
Industrial & Commercial Transportation

Application
Automated Manual Transmission

Functions
Measuring gear position

Technology
Active PLCD (moving magnet)

Features
• Non-contact measurement
• High life time accuracy
• Small magnet design
• Highly insensitive to vibration, temperature and pollution inside the transmission
Transmission Sensors

**Redundant Neutral Position Sensor**

- **Industry**: Automotive
- **Application**: Start-/Stop application
- **Functions**: Measuring gear lever position inside manual transmission
- **Technology**: Active PLCD (moving magnet) or Hall
- **Features**:
  - Non-contact measurement through transmission wall
  - High lifetime accuracy
  - Small magnet design
  - Diagnostics ability due to two-wire interface

**Shift Detection Sensor**

- **Industry**: Industrial & Commercial Transportation
- **Application**: Automated Manual Transmission
- **Functions**: Measuring shift position
- **Technology**: Active PLCD (moving magnet)
- **Features**:
  - Non-contact measurement
  - High lifetime accuracy
  - Small magnet design
  - Highly insensitive to vibration, temperature and pollution inside the transmission

**Drive Mode / Transmission Rotary Sensor (TRS)**

- **Industry**: Automotive
- **Application**: Transmission
- **Functions**: Drive mode and shift drum detection
- **Technology**: Hall 3D with integrated magnet
- **Features**:
  - Operating voltage: 5 ±0.5 V
  - Operating temperature: -40°C to +140°C
  - Operating travel range: 360°
  - Analog and digital (SENT) output
  - Accuracy over lifetime 1%
  - Compliance with ASIL “C”

**Pressure Sensor Transmission**

- **Industry**: Automotive
- **Application**: Transmission CVT, DCT, AT & others
- **Functions**: Measuring transmission oil pressure
- **Technology**: Semiconductor Strain Gage (SemSG)
- **Features**:
  - Lightweight: <18 grams
  - Operating pressure: 1 - 80 / 20 bar (gauge)
  - Proof pressure: >2x or more to operating range
  - Burst pressure: >500 bar or more to operating range
  - Operating temperature: -40°C to +140°C
  - Interface: Analog or SENT
  - Compliance with ASIL “B”, optional ASIL “C”