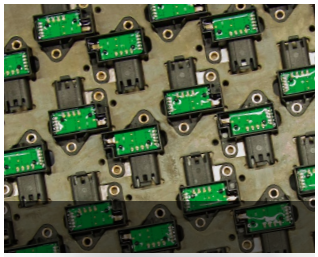


TE Connectivity's

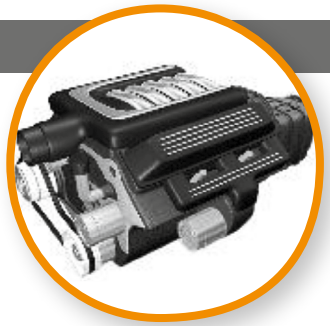
SENSOR TECHNOLOGIES

for the Automotive Industry

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

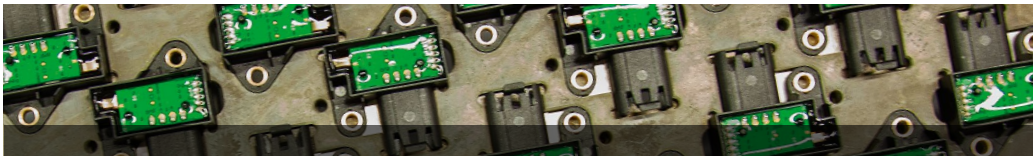
Our engine and e-motor sensors are used in vehicle applications such as travel sensor for turbo charger actuator, pneumatic (EGR) Cylinder, CAM and Crank Shaft Speed sensors and resolvers for e-motor commutation.

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).

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Sensor Technologies for the Automotive Industry

Brake Sensors

INTRODUCTION

Our brake sensors are used in vehicle applications such as brake master cylinder position detection, travel sensor for rear axle steering to support advanced ESP, rotary sensor for brake pedal position detection, hall brake light switch and wheel speed sensors.

Many of our sensors offer optional redundant output signals for increased safety.

Position

- Brake Light
- Regenerative Brake
- Pedal Simulator
- Angular/Linear Actuator

Pressure

- Vacuum Brake Booster
- Electronic Stability Control Brake Pressure

Speed

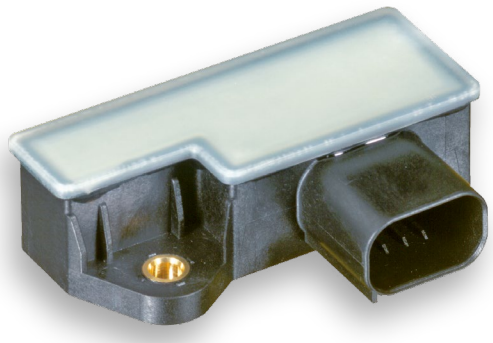
- Wheel Speed (ABS/ESC)
- Brake Pad*

* in development

Brake Vacuum Sensor

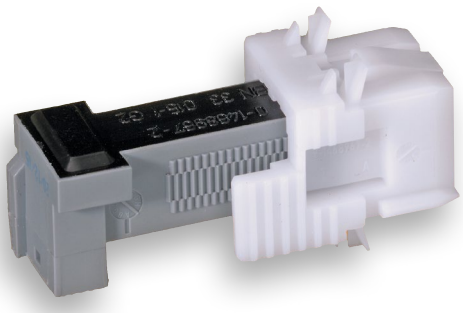
Industry	Automotive
Application	Start-Stop System
Functions	Measuring pressure of brake booster
Technology	MEMS
Features	• Operating Voltage: 5V (4.5 - 5.5 V) • Operating Temperature: -40 to +150° C • Operating Pressure Range: ±1.05 bar (programmable for each customer) • Analog or Digital (SENT) output • Burst Pressure: 5 Bar • Accuracy over lifetime: 1.5% • Compliance with ASIL “C”

Brake Cylinder Position Sensor



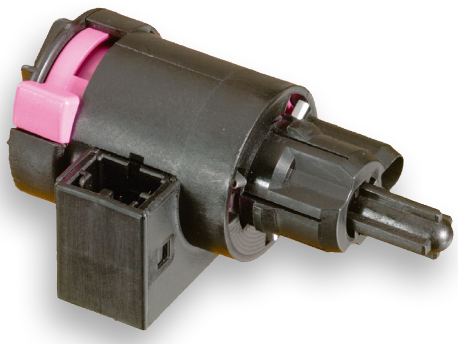
Industry	Automotive
Application	Regenerative Braking
Functions	Measuring piston position of Brake Master Cylinder
Technology	Active PLCD (moving magnet)
Features	• Non-contact travel measurement through cylinder wall • Optional redundancy

Brake Light Sensor



Industry	Automotive
Application	Pedal Box
Functions	Measuring Brake Pedal Position
Technology	Hall Switch (magnet integrated in sensor)
Features	• Easy adjustment to brake pedal • High switching point accuracy • No wear and tear • Non-contancting • Two- and three-wire interface available • Dual output for added safety

Brake Light Sensor (self-adjusting features)



Industry	Automotive
Application	Pedal Box
Functions	Measuring Brake Pedal Position
Technology	Hall Switch (magnet integrated in sensor)
Features	• Easy adjustment to brake pedal (self-adjusting features) • High switching point accuracy • Redundancy

Wheel Speed Sensor – Option 1

Industry	Automotive Industrial & Commercial Transportation
Application	Anti-lock brake system
Functions	Wheel speed detection
Technology	Hall (magnet integrated in sensor)
Features	• Long life time and high reliability • Compact size and comparative price • Flexible design depending on customer's requirements • Non-contact hall sensor • Rapid response time • Tone wheel detection

Wheel Speed Sensor – Option 2

Industry	Automotive Industrial & Commercial Transportation
Application	Anti-lock brake system
Functions	Wheel speed detection
Technology	Hall (magnet integrated in sensor)
Features	• Long life time and high reliability • Compact size and comparative price • Flexible design depending on customer's requirements • Non-contact hall sensor • Rapid response time • Tone wheel detection

Brake Pedal Sensor

Industry	Automotive
Application	Regenerative Braking
Functions	Measuring position of brake pedal
Technology	Active PLCD (moving magnet)
Features	• Non-contact travel measurement • Optional redundancy • 5 V supply (optional 12 V) • Analog or PWM output

Hall Sensor T40MC2

Industry	Automotive
Application	Brake, Engine, Transmission, Clutch, Chassis
Functions	Measuring travel position
Technology	Hall (moving magnet)
Features	• Non-contact measurement of magnet target – up to 360° angular measurement – up to 40mm linear measurement • Highly insensitive to vibration • Temperature range -40° C ... +150° C • Analog or PWM interface • Small geometry • Optional redundancy • Supply 5 V (optional 12 V) • 4-way MCON connector interface • Optional alternative output protocol (e.g. SENT

Clutch Sensors

INTRODUCTION

Our clutch sensors are used in vehicle applications such as Concentric Slave Cylinder (CSC) and clutch slave cylinder position, rotary clutch pedal and Clutch Master Cylinder (CMC) position, and Dual Clutch Transmission (DCT) travel.

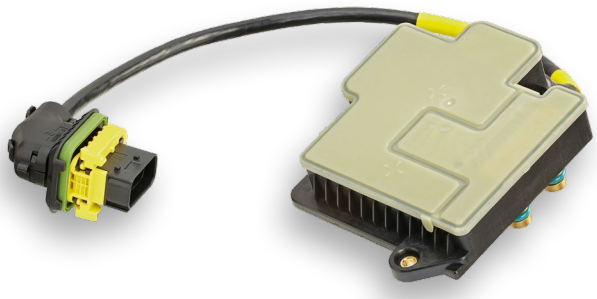
Position

- Clutch Pedal
- Master Cylinder CMC
- Slave Cylinder CSC
- Clutch Actuator

Pressure

- Clutch Fluid

Clutch Position and Pressure Sensor



Industry Industrial & Commercial Transportation

Application Dual Clutch Transmission for Delivery Trucks

Functions Measuring piston position of concentric slave cylinder

Technology 2 PLCD Sensors
2 Pressure Sensors

Features
- Non-contact measurment
- Operating Temperature -40° C ... 140° C
- Integrated module with two position and two pressure sensors
- Travel range: 0 - 42 mm
- Pressure range: 0 - 10 bar (20 bar burst pressure)
- HDSCS sealed connector for harsh environment

Differential Axle Clutch Position Sensor

Industry Automotive
Industrial & Commercial Transportation

Application Position of differential locking clutch

Functions Determine the position of clutch for electronic locking

Technology Hall (moving magnet)

Features
- Non-contact measurement
- Small package and robust design
- Up to 3 output channels (witch or sensor)
- Integrated magnetic shield to minimize external magnetic influences
- 3pos MCON sealed connector interface
- Operating temperature: -40° C ... 150° C

Dual Clutch Position Sensors

Industry Industrial & Commercial Transportation

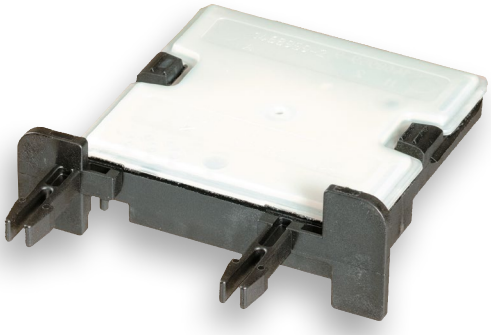
Application Dual Clutch Transmission

Functions Measure position of shift rails/forks (linear) and shift lever selector (angular)

Technology 3D Hall (moving magnet)

Features
- Non-contact linear travel and rotary measurement
- Robust design for truck application
- Pigtail solutions with routing protection and pre-capture fasteners
- Operating temperature: -40° C ... +150° C

Dual Clutch Position Sensor



Industry Automotive

Application Dual Clutch Transmission

Functions Measuring piston position of clutch actuator

Technology Active PLCD (moving magnet)

Features
- Two sensors in one housing
- Small and robust design
- Oil sealed design
- Easy assembly

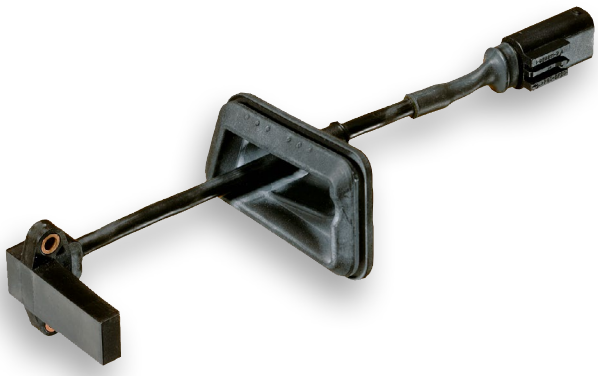
Clutch Position Sensor – Option 1

Industry	Automotive
Application	Cruise control, Engine management, Interlock, Electrical park brake
Functions	Measuring piston position of Clutch Master Cylinder
Technology	Hall (moving magnet)
Features	• Non-contact measurement through cylinder wall • Up to three switching points or travel measurement up to 40mm

Clutch Position Sensor – Option 2

Industry	Automotive
Application	Cruise control, Engine management, Interlock
Functions	Measuring piston position of Clutch Master Cylinder
Technology	Hall (moving magnet)
Features	• Non-contact measurement through cylinder wall • Up to three switching points • Small and flat design

Clutch Position Sensor – Option 3

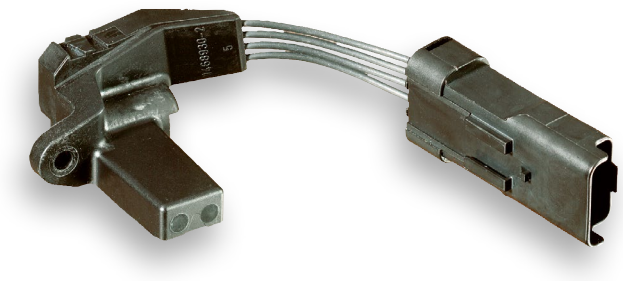


Industry	Automotive
Application	Automated Manual Transmission (AMT)
Functions	Measuring piston position of Concentric Slave Cylinder inside the gearbox
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement • Robust design (temperatures up to +160° C) • Signal processing in transmission controller

Clutch Position Sensor – Option 4

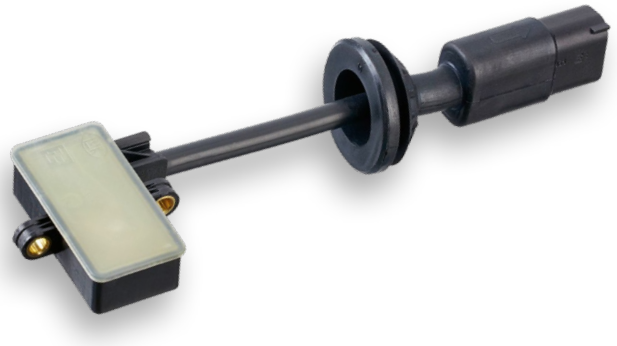
Industry	Automotive
Application	Automated Manual Transmission (AMT)
Functions	Measuring piston position of Concentric Slave Cylinder
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement • Short term peak temperature up to +150° C

Clutch Position Sensor – Option 5



Industry	Automotive
Application	Automated Manual Transmission (AMT)
Functions	Measuring piston position of Concentric Slave Cylinder inside the gearbox
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement • Robust design (temperatures up to +160° C) • Signal processing in transmission controller

Clutch Position Sensor – Option 5

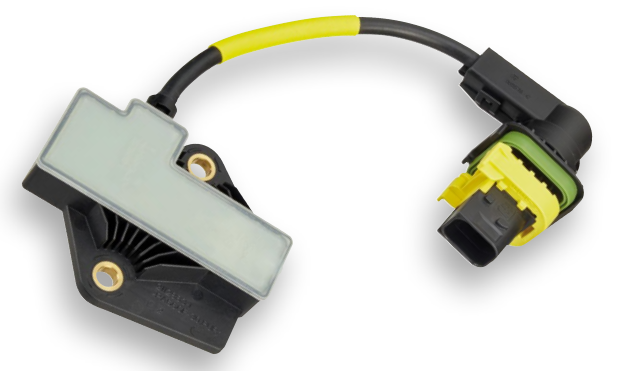


Industry	Automotive
Application	Automated Manual Transmission (AMT)
Functions	Measuring piston position of Concentric Slave Cylinder
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement • Short term peak temperature up to +150° C

Clutch Position Sensor – Option 1

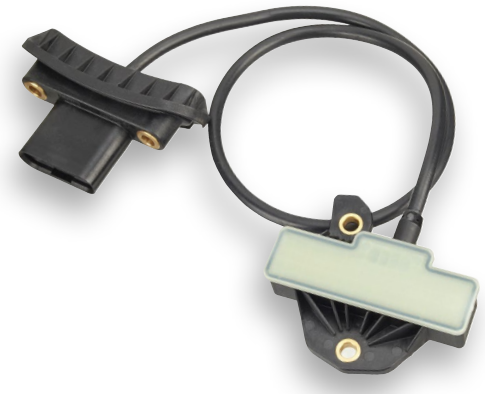
Industry	Industrial & Commercial Transportation
Application	Automated Manual Transmission (AMT) for truck
Functions	Measuring piston position of Clutch Slave Cylinder
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement through cylinder wall • Robust design for truck application

Clutch Position Sensor – Option 2



Industry	Industrial & Commercial Transportation
Application	Automated Manual Transmission (AMT)
Functions	Measuring piston position of Concentric Slave Cylinder
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement • Highly insensitive against vibration and temperature (up to +150° C) • Pigtail interface with truck compatible connector

Clutch Position Sensor – Option 3



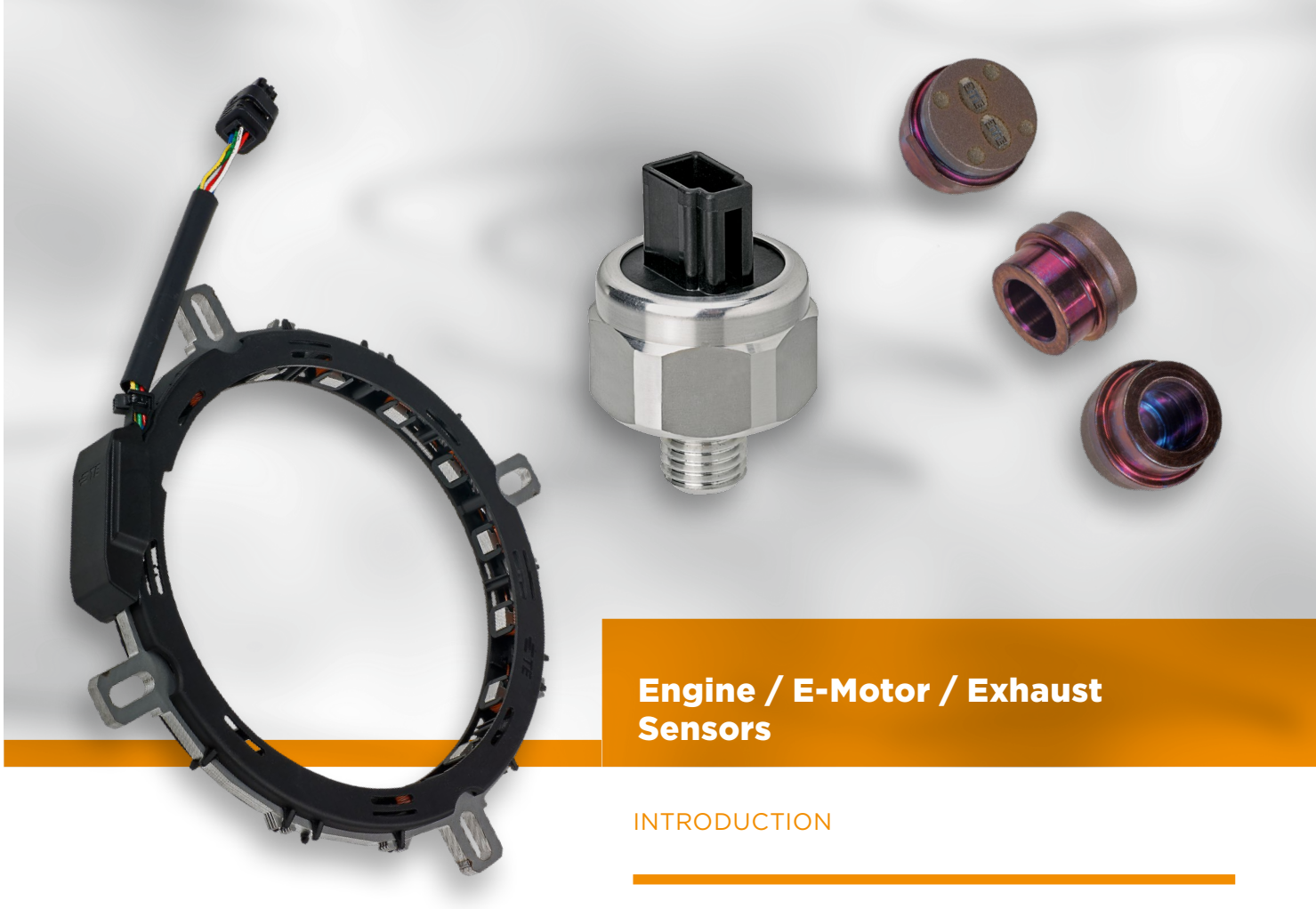
Industry	Industrial & Commercial Transportation
Application	Automated Manual Transmission (AMT)
Functions	Measuring piston position of Concentric Slave Cylinder
Technology	Passive PLCD (moving magnet)
Features	• Non-contact travel measurement • Highly insensitive against vibration and temperature (up to +150° C) • Pigtail interface with truck compatible connector

Hall Sensor T40MC2

Industry	Industrial & Commercial Transportation
Application	Clutch, Engine, Transmission, Chassis, Brake
Functions	Measuring travel position
Technology	Hall (moving magnet)
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

Platform Sensor Clutch Master Cylinder (CMC)

Industry	Automotive
Application	Start-/Stop System
Functions	Travel sensor for Clutch Master Cylinder (CMC)
Technology	Hall Array
Features	• Operating voltage: 12 V (6-16 V) • Operating temperature: -40° C ... +80° C • Operating travel range: 33.5mm • Analog and digital (SENT) output: Analog output (2 switch signals and 1 PWM output) • Accuracy over lifetime: Accuracy of switch signal: ±3mm; accuracy of PWM output: ±5 % • Compliance with ASIL “C”



Engine / E-Motor / Exhaust Sensors

INTRODUCTION

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.

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

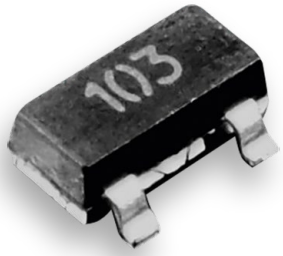
Single Coil Resolver (SCR)

Industry	Automotive
Application	Hybrid powertrain / e-motor
Functions	Angular position sensor for electric motors for EV and HEV cars
Technology	Inductive Magnetic Field
Features	• Temperature range -40° C to +170° C (works in oil if neccessary) • Up to 20,000 / min (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 excentricity (static / dynamic) through patented winding scheme • Fault-tolerant against external fields

Multi-Coil Resolver (MCR)

Industry	Automotive
Application	E-motor for hybrid and electrical vehicles
Functions	Measuring rotor position of E-motor
Technology	MCR (Multi-Coil Resolver)
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

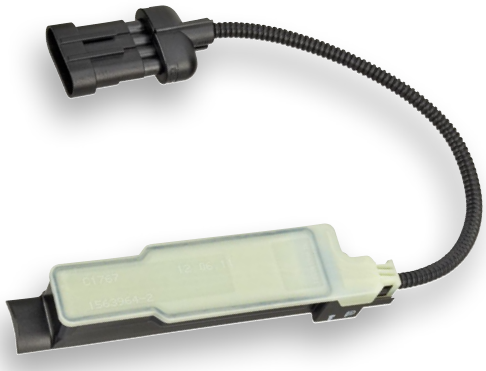


Industry	Automotive
Application	Engine Oil Temperature
Functions	Measuring temperature of engine oil
Technology	Nickel RTD
Features	• Resistance: 1000 ohms at 0° C • Temperature range: -55° C to +160° C • Measurement current: 0-5 mA, typ. 0.2 mA • ESD class 1 • Tolerance: ± (0.4+0.007 x |T|) in range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

GDI Sensor Element

Industry	Automotive
Application	GDI Engine
Functions	Measuring pressure of fuel pipe
Technology	Kristal Bond
Features	• Pressure range up to 300 bar • Small Diameter < 6mm

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

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

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)

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

Urea Pressure Sensor U86B

Industry	Automotive Industrial & Commercial Transportation
Application	Selective Catalytic Reduction (SCR)
Functions	Pressure measurement of urea liquid in SCR systems
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”

Transmission Sensors

INTRODUCTION

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

Speed Sensor Platform

Industry	Automotive
Application	Transmission, Engine, Clutch, Chassis, Brake
Functions	Measuring gear speed, travel and angle position
Technology	Hall (moving magnet)
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

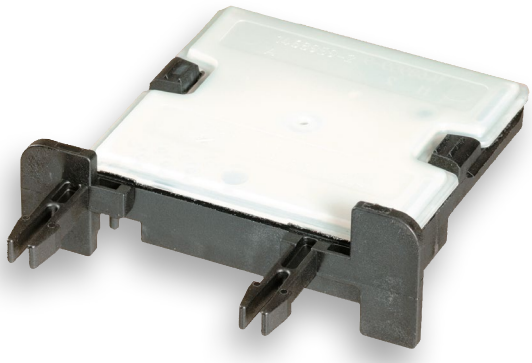
Hall Sensor T40MC2

Industry	Automotive
Application	Transmission, Engine, Clutch, Chassis, Brake
Functions	Measuring travel position
Technology	Hall (moving magnet)
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

Industry	Industrial & Commercial Transportation
Application	Automated Manual Transmission (AMT)
Functions	Measure position of shift rails / forks (linear)
Technology	3D Hall (moving magnet)
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



Industry	Automotive
Application	Dual Clutch Transmission
Functions	Measuring piston position of clutch actuator
Technology	Active PLCD (moving magnet) or Hall
Features	• Two sensors in one housing • Small and robust design

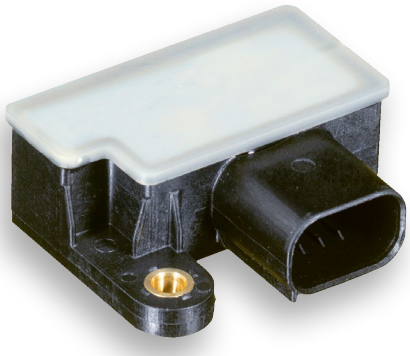
Drive Mode Sensor

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

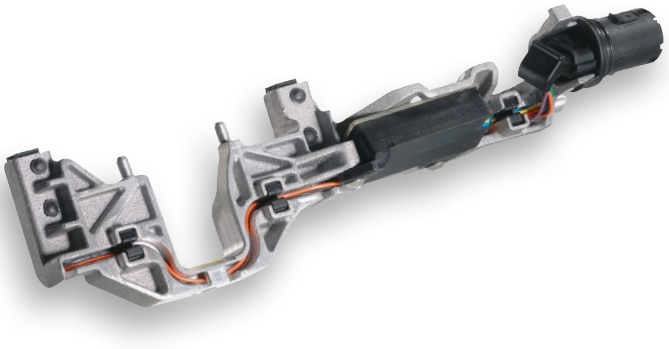
Neutral Position Sensor

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

Industry	Automotive
Application	Transmission
Functions	Measuring gear speed
Technology	Hall (with integrated magnet)
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

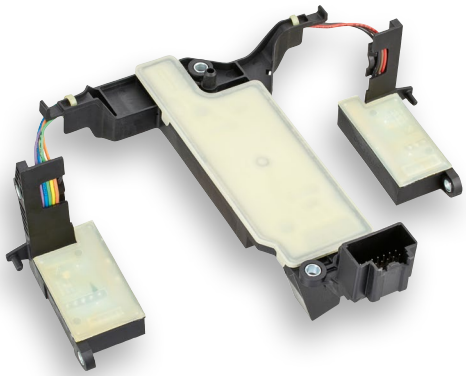


Industry	Automotive
Application	Dual Clutch Transmission
Functions	Measuring drive mode position and gear speed inside transmission
Technology	Active PLCD or Hall
Features	• Sensor module with integrated position and speed sensors • Oil sealed pass through connector system • Highly robust design

DCT Transmission Sensor Module

Industry	Automotive
Application	Dual Clutch Transmission
Functions	Measuring shift fork position, gear speed and temperature inside transmission
Technology	Hall and NTC
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



Industry	Automotive
Application	Dual Clutch Transmission
Functions	Measuring shift fork position, gear speed and temperature inside transmission
Technology	Active PLCD, Hall and NTC
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

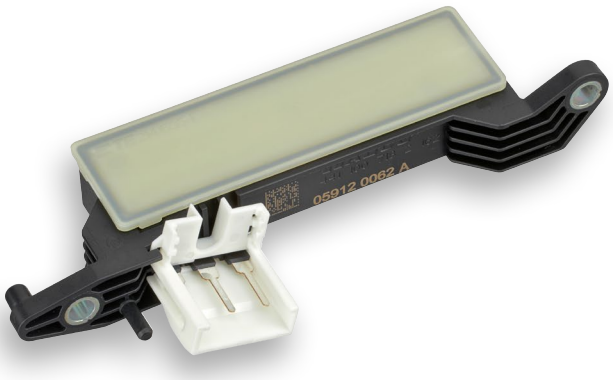
Neutral Position Sensor

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

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

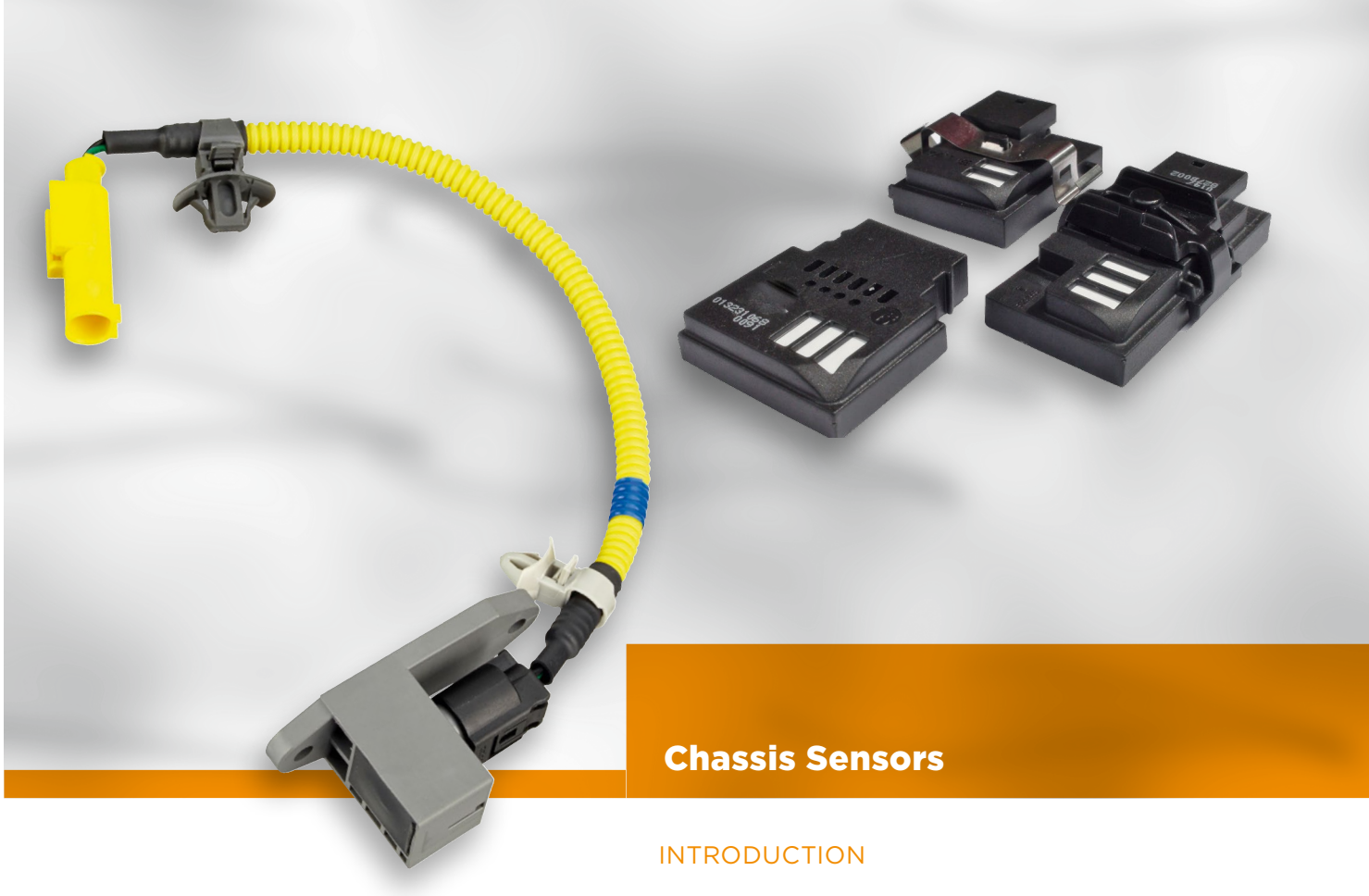
Industry	Industrial & Commercial Transportation
Application	Automated Manual Transmission
Functions	Measuring shift position
Technology	Active PLCD (moving magnet)
Features	• Non-contact measurement • High lifetime accuracy • Small magnet design • Highly insensitive to vibration, temperature and pollution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



Chassis Sensors

INTRODUCTION

Our chassis sensors are used in vehicle applications such as travel sensors for rear axle steering, wheel speed sensors for advanced Electronic Stability Program (ESP), steering angle position sensors, seat track position sensors and hall switches for position detection.

Position

- Rear Axle Steering
- Seat Position
- Chassis Switch
- Convertible Roof
- Fluid Level

Pressure

- Fuel Pump (Low Pressure)
- Power Steering
- Weight Classification
- Impact
- HVAC Fluid *

Temperature

- Fuel Temperature
- Passenger Cabin
- Ambient Air / HVAC
- Seat Heater
- Battery Management

Humidity

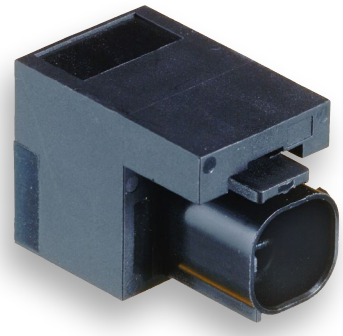
- Ambient
- Cabin
- Fog / Moisture
- HVAC
- EV Battery Management

* in development

Seat Track Position Custom Sensor

Industry	Automotive
Application	Measure position of seat track
Functions	Input for dual stage airbags
Technology	Hall Switch (magnet integrated in sensor)
Features	• Non-contact switch triggered by seat track or ferrous target • No moving magnets • Custom package size and sensor mounting • Optional bushing • Operating temperature: -40° C to +85° C

Seat Track Position Platform Sensor



Industry	Automotive
Application	Measure position of seat track
Functions	Input for dual stage airbags
Technology	Hall Switch (magnet integrated in sensor)
Features	• Non-contact switch triggered by seat track or ferrous target • No moving magnets • Small package size • Operating temperature: -40° C to +85° C

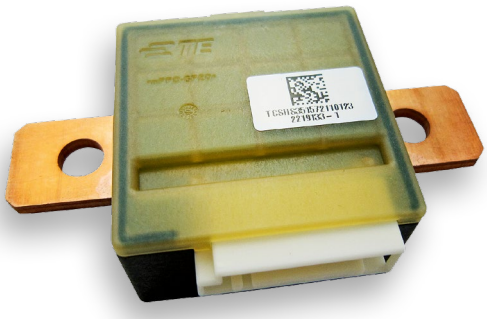
H2TG/D Defogging Sensor

Industry	Automotive
Application	Cabin energy management and defogging (HVAC)
Functions	Measuring dew point and windshield temperature measurement
Technology	Capacitive and NTC
Features	• Humidity range: 0 % RH to 100 % RH • Temperature range: -40° C ... +125° C • Calibration: ± 1.5° DP at 10° C, ± 0.8° C at 25° C • Operating voltage: 12 V • Analog or digital (LIN) output

Coreless Current Sensor

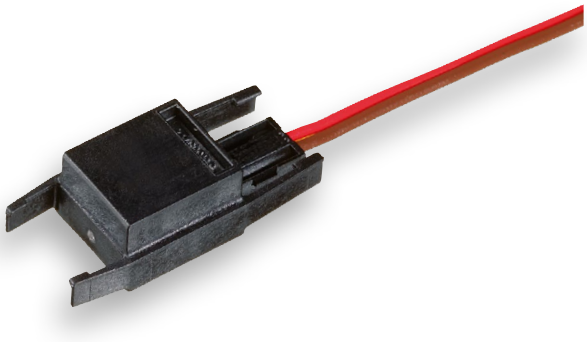
Industry	Automotive
Application	Battery Pack (BDU: Battery Disconnect Unit) Battery Management for xEV application
Functions	Measuring current of battery
Technology	Hall
Features	• Operating voltage: 5 V (4.5 to 5.5 V) • Operating temperature: -40° C to +85° C • Operating current range: -350 A ~ +350 A • Analog output • Accuracy @ 25° C: 1% (Hall)

Integrated Current Sensor



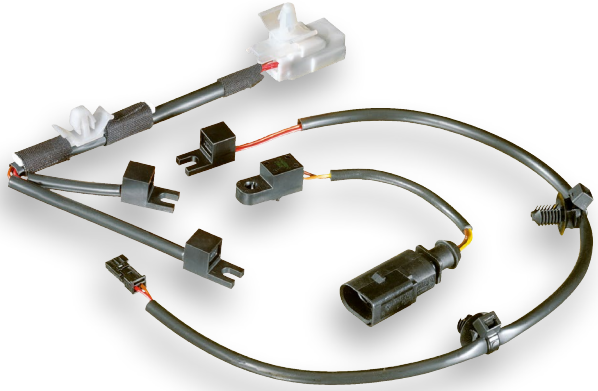
Industry	Automotive
Application	Battery Pack (BDU: Battery Disconnect Unit) Battery Management for xEV application
Functions	Measuring current of battery
Technology	Hall or Shunt
Features	• Operating voltage: 5 V (4.5 to 5.5 V) • Operating temperature: -40° C ... +85° C • Operating current range: -350 A ~ +350 A • Analog output • Accuracy @ 25° C: 1% (Hall) • Tolerance: 100 µΩ ± 5 % • Temperature sensor: NTC

Cylinder Hall Switch



Industry	Automotive
Application	Hydraulic cylinder for convertible roofs
Functions	Measuring piston position of hydraulic cylinder
Technology	Hall Switch (magnet integrated in sensor)
Features	• No moving magnet inside cylinder • Small and robust design • Pigtail with flexible connector interface

Hall Switch Cable Assemblies

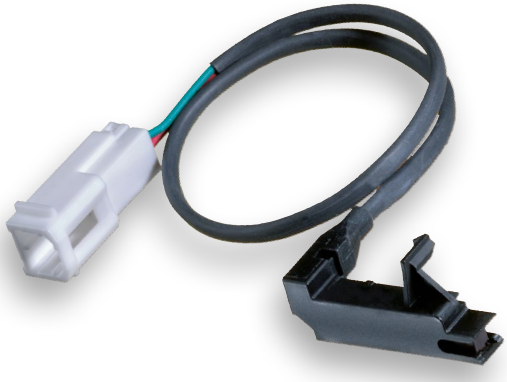


Industry	Automotive
Application	Convertible roof systems
Functions	Digital position detection
Technology	Hall Switch (magnet integrated in sensor)
Features	• Variety of cable assembly with integrated Hall switches

Roof Sensor

Industry	Automotive
Application	Roof railing detection
Functions	Adaptive ESP support
Technology	Hall (moving magnet)
Features	• Current interface • Small geometry • Diagnostics ability due to two-wire interface

Seat Buckle Switch

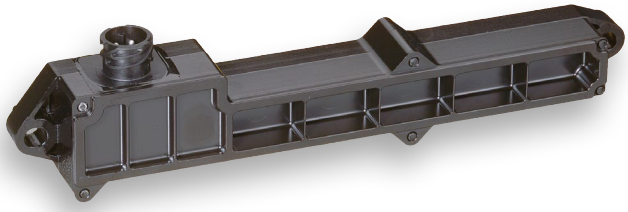


Industry	Automotive
Application	Airbag
Functions	Detecting buckle up status
Technology	Hall Switch (magnet integrated in sensor)
Features	• Non-contact measurement • Small design

Steering Position Sensor

Industry	Automotive
Application	Steering / Attention Assistant
Functions	Measuring steering angle
Technology	Hall (moving magnet)
Features	• Non-contact measurement • High resolution of steering angle (single turn) • Adapted to actuator motor

Truck Rear Axle Steering Sensor



Industry	Industrial & Commercial Transportation
Application	Truck Rear Axle Steering
Functions	Measuring piston position of Hydraulic Steering Cylinder
Technology	Active PLCD (moving magnet)
Features	• Non-contact measurement through cylinder wall • Robust design • Truck specific connector interface

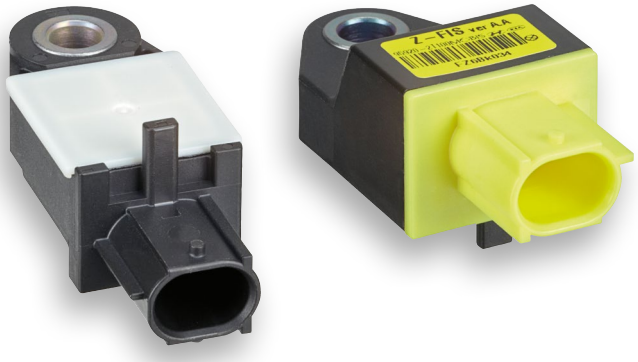
Weight Sensor

Industry	Automotive
Application	Passenger detection
Functions	Measuring seat weight to classify passenger for airbag deployment
Technology	Strain gage technology
Features	• High resolution of weight • Very small package (integration to seat track) • Sensor array with ECU for in system calibration • Mechanical overload protection • Very robust design

P-SIS Side Impact Sensor

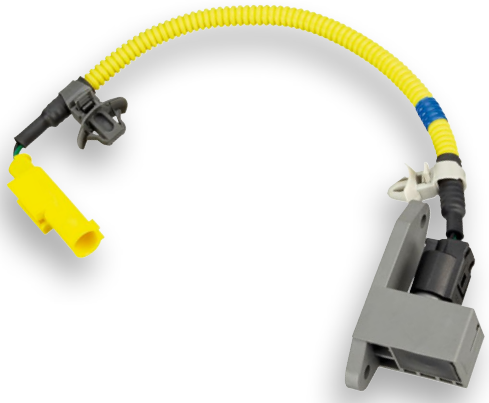
Industry	Automotive
Application	Side impact detection
Functions	Measuring the quick increase of pressure within the cavities of passenger car door to determine the airbag deployment
Technology	MEMS
Features	• Small package and robust design • PAS4 data transmission mode

FIS / Z-Fis Front Impact Sensor



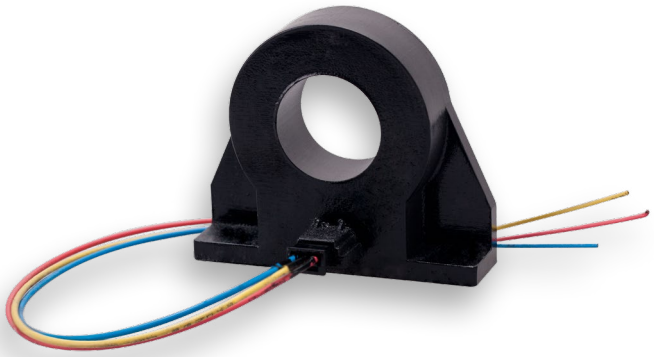
Industry	Automotive
Application	Front impact detection
Functions	Measuring acceleration data for front impact detection
Technology	MEMS
Features	• Small package and robust design • PSI5-A data transmission mode

Seat Track Position Sensor – Option 3



Industry	Automotive
Application	Dual staged airbag
Functions	Measuring seat track position
Technology	Hall Switch (magnet integrated in sensor)
Features	• Triggered by seat track (no moving magnet) • Current interface • Small geometry • Diagnostics ability due to two-wire interface

Current Sensor for BMS



Industry	Automotive
Application	Current sensing for Battery Management System (BMS)
Functions	Indicates the real-time current flowing through the battery, which would be used to calculate the “start of charge” of the battery
Technology	Fluxgate
Features	• Operating voltage: ±12 V or 0-12 V • Operating temperature: -40° C to +85° C • Operating current range: 0 - 300 A • Analog and digital (SENT) output: current output or analog output • Accuracy @ room temperature: 1%

Platform Sensors

INTRODUCTION

In the automotive industry, development time is a key factor for successful market positioning. TE Connectivity's answer is a platform strategy for non-contact travel, angle and speed sensors.

Standardized designs and production processes offer short-term availability of fully functional sensors for system testing and low-volume production. Depending on the field of application, different technologies will be used.

The first platform is the PLCD travel sensor for measurement ranges up to 55mm. Thanks to the system's robustness, the possibility of large-scale integration and the high linear performance of PLCD in high-vibration and high-temperature applications, this technology is preferred for harsh environment systems (e.g. transmission, clutch).

The second platform TE Connectivity can offer is the hall technology based travel and angular sensor for measurement ranges up to 40mm or angle up to 360°. Travel and angle measurement can be realized within one sensor package. The hall technology used is a 2D/3D measurement principle that results in a significant measurement performance increase compared to existing hall sensors.

This sensor exhibits high performance related to linearity error and temperature drift. It also enables the opportunity to incorporate 12V board net supply, safety level B according ISO 26262 and up to three outputs, which can operate as programmable linear or switch outputs.

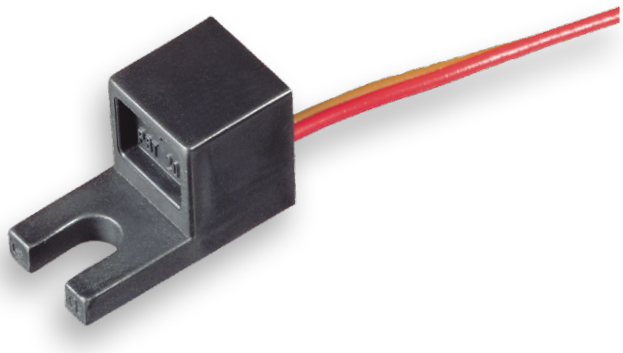
Compared to inductive systems, TE Connectivity's hall sensor platform needs a minimum of space and makes more cost-effective production possible. Our platform sensors are all suitable for IP class applications of 69K, which makes them suitable for harsh automotive environments. At the same time, the hall platform sensors can be programmed to suit customer specifications regarding measurement range and electrical interface (PWM or analog).

Our third platform is the speed sensor for gear speed measurement. This back-biased hall sensor is triggered by ferromagnetic gear or tone wheel. Thanks to its compact and robust packaging with integrated sealed connector interface (IP69K), it can be used for all kinds of application (e.g. transmission). The sensor also provides diagnostic functionality, thanks to two-wire technology, and is validated for a temperature range from -40° C to +150° C.

Hall Flap Switch SW01M

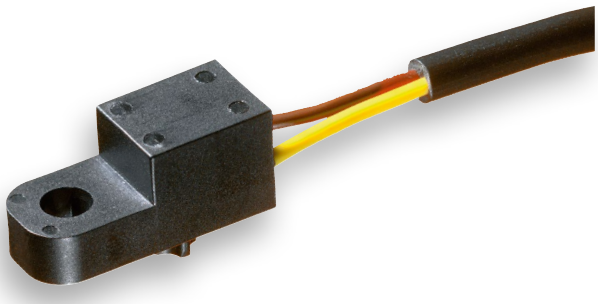
Industry	Automotive
Application	Powertrain, Chassis, Brake
Functions	Digital position detection
Technology	Hall Switch (magnet integrated in sensor)
Features	• Triggered by ferromagnetic part (no moving magnet) • Current interface • Sealed connector interface • Diagnostics ability due to two-wire interface • IP69K • Temperature range –40° C ... 105° C

Hall Switch SW01P



Industry	Automotive
Application	Body and Chassis
Functions	Digital position detection
Technology	Hall Switch (magnet integrated in sensor)
Features	• Triggered by ferromagnetic part (no moving magnet) • Current interface • Diagnostics ability due to two-wire interface • Temperature range –40° C ... 105° C

Hall Switch SW02P

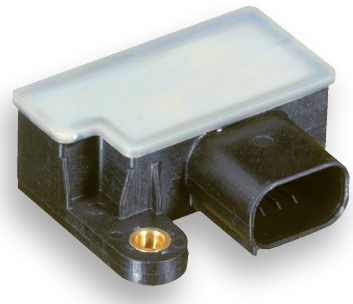


Industry	Automotive
Application	Body and Chassis
Functions	Digital position detection
Technology	Hall Switch (magnet integrated in sensor)
Features	• Triggered by ferromagnetic part (no moving magnet) • Current interface • Diagnostics ability due to two-wire interface • Temperature range –40° C up to 105° C

Hall Sensor T40MC2

Industry	Automotive Industrial & Commercial Transportation
Application	Engine, Transmission, Clutch, Chassis, Brake
Functions	Measuring travel position
Technology	Hall (moving magnet)
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

PLCD-15M

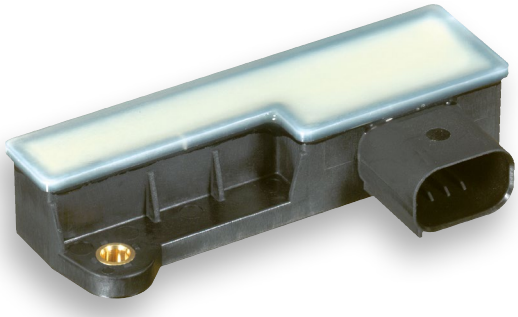


Industry	Automotive
Application	Transmission, Chassis, Engine
Functions	Measuring travel or angle position
Technology	Active PLCD (moving magnet)
Features	• Measurement range 5–18mm • Highly insensitive to vibration • Temperature up to 150° C • Redundancy possible • Analog or PWM interface • Supply 5V (optional 12V) • 4-way MQS sealed contact • Wide range of magnet design

PLCD-25M

Industry	Automotive
Application	Transmission, Brake, Clutch, Steering, Engine
Functions	Measuring travel or angle position
Technology	Active PLCD (moving magnet)
Features	• Measurement range 15–28mm • Highly insensitive to vibration • Temperature up to 150° C • Redundancy possible • Analog or PWM interface • Supply 5V (optional 12V) • 4-way MQS sealed contact • Wide range of magnet design

PLCD-50M



Industry	Automotive
Application	Transmission, Brake, Clutch, Steering, Engine
Functions	Measuring travel or angle position
Technology	Active PLCD (moving magnet)
Features	• Measurement range 25–53mm • Highly insensitive to vibration • Temperature up to 150° C • Redundancy possible • Analog or PWM interface • Supply 5V (optional 12V) • 4-way MQS sealed contact • Wide range of magnet design

Hall Sensor R360MC2

Industry	Automotive Industrial & Commercial Transportation
Application	Transmission, Chassis, Engine, Steering, Clutch, Brake
Functions	Measuring angle position
Technology	Hall (moving magnet)
Features	• Non-contact measurement up to 360° • Highly insensitive to vibration • Temperature up to +150° C • Analog or PWM interface • Small geometry • Redundancy possible • Supply 5 V (optional 12 V) • 4-way MCON connector interface

Multi-Coil Resolver (MCR)

Industry	Automotive
Application	E-Motor for hybrid and electrical vehicles
Functions	Measuring rotor position of E-Motor
Technology	MCR (Multi-Coil Resolver)
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

Single Coil Resolver (SCR)

Industry	Automotive
Application	E-Motor for hybrid and electrical vehicles
Functions	Measuring rotor position of E-Motor
Technology	SCR (Single Coil Resolver)
Features	• Non-contact measurement of rotor position • Analog output • High accuracy for high temperature applications • Slim design for IMG applications in combination with oil • Rotational speed up to 20.000 rpm • Adaptable to pole pairs of E-Motor

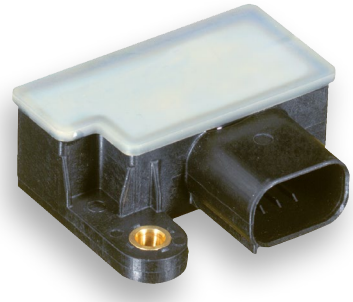
Speed Sensor

Industry	Automotive
Application	Transmission
Functions	Measuring gear speed
Technology	Hall (with integrated magnet)
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

H2TG/D Defogging Sensor

Industry	Automotive
Application	Cabin energy management and defogging (HVAC)
Functions	Measuring dew point and windshield temperature measurement
Technology	Capacitive
Features	• Humidity range: 0 % RH to 100 % RH • Temperature range: -40° C to +125° C • Calibration: ± 1.5° DP at 10° C, ± 0.8° C at 25° C • Operating voltage: 12 V • Analog and digital (LIN) output

PLCD-15M

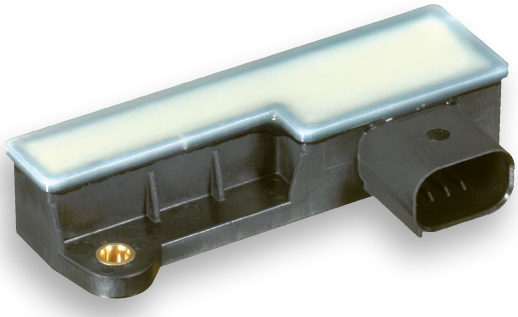


Industry	Automotive
Application	Transmission, Chassis, Engine
Functions	Measuring travel or angle position
Technology	Active PLCD (moving magnet)
Features	• Measurement range 5–18mm • Highly insensitive to vibration • Temperature up to 150° C • Redundancy possible • Analog or PWM interface • Supply 5V (optional 12V) • 4-way MQS sealed contact • Wide range of magnet design

PLCD-25M

Industry	Automotive
Application	Transmission, Brake, Clutch, Steering, Engine
Functions	Measuring travel or angle position
Technology	Active PLCD (moving magnet)
Features	• Measurement range 15–28mm • Highly insensitive to vibration • Temperature up to 150° C • Redundancy possible • Analog or PWM interface • Supply 5V (optional 12V) • 4-way MQS sealed contact • Wide range of magnet design

PLCD-50M



Industry	Automotive
Application	Transmission, Brake, Clutch, Steering, Engine
Functions	Measuring travel or angle position
Technology	Active PLCD (moving magnet)
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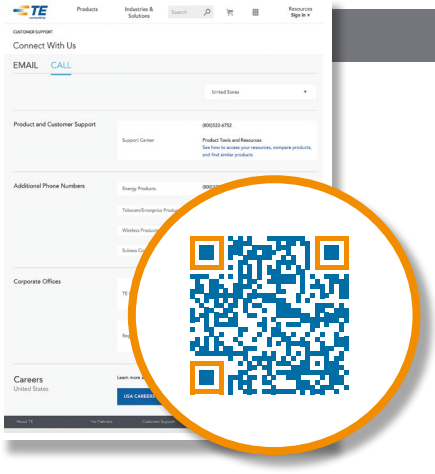

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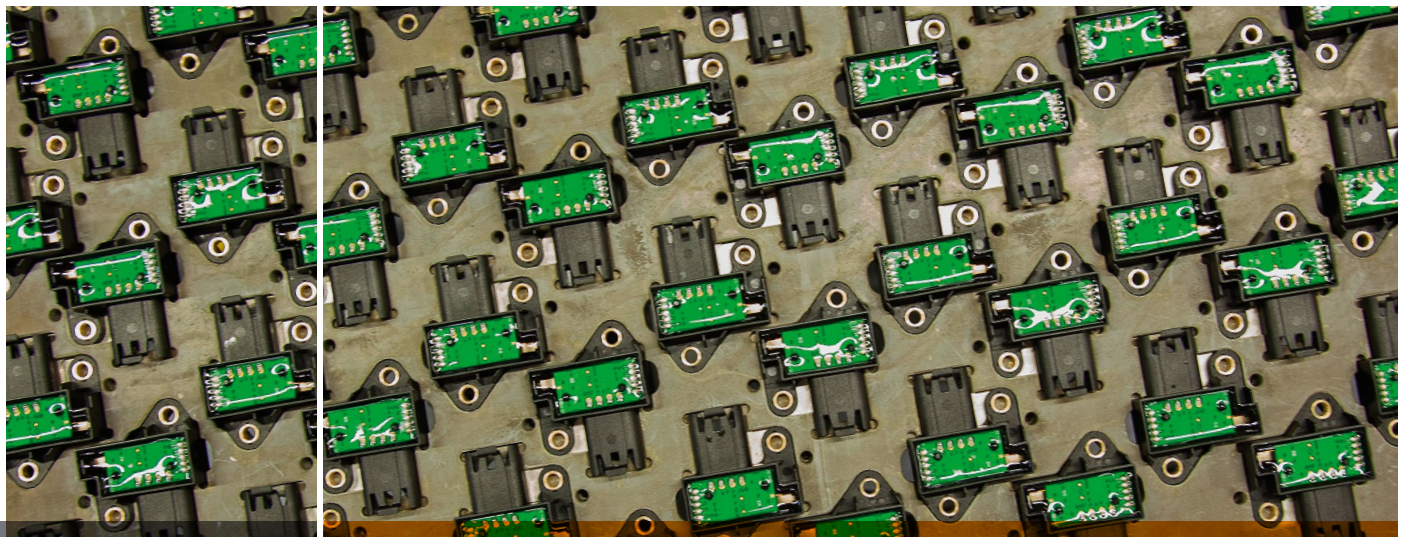

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