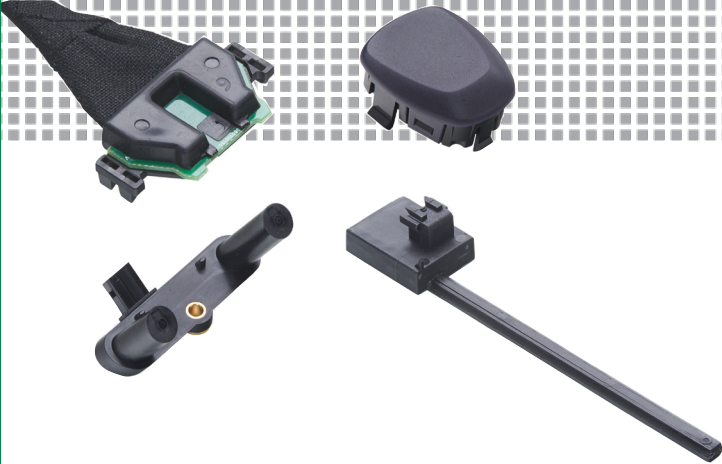




Expertise Applied | Answers Delivered



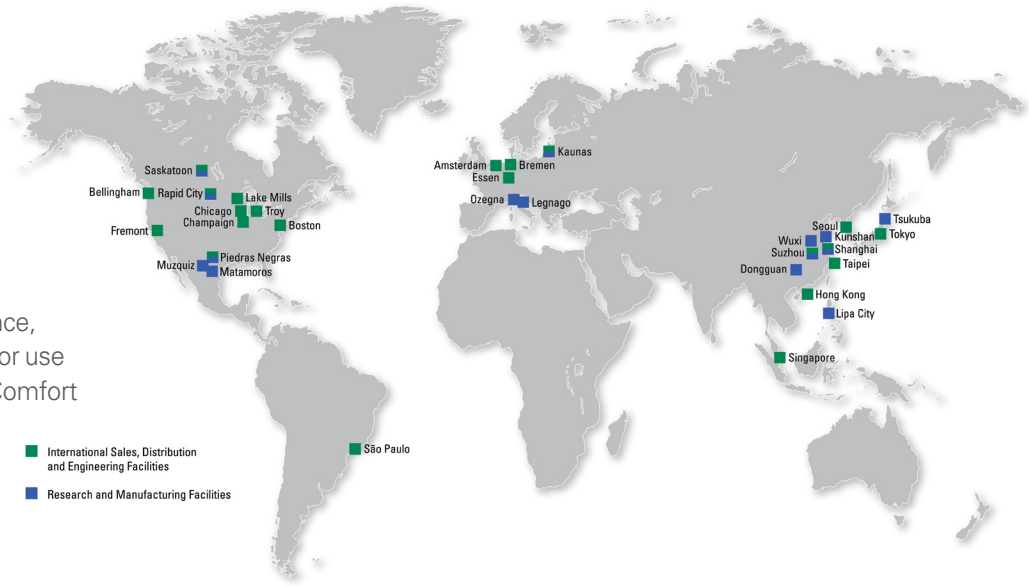
SENSING SOLUTIONS
FOR PASSENGER
COMFORT & SAFETY
& AUTOMOTIVE
POWERTRAIN



AUTOMOTIVE SENSOR PRODUCTS

Local Resources for a **GLOBAL** Market

Littelfuse products help to aid and protect operators and passengers while supporting the clean and effective operation of the vehicle's powertrain for OEM and aftermarket applications for the automotive industry as well as the heavy-duty truck, construction and agriculture industries. We offer a broad and reliable selection of presence, position, level, rotation and optical sensors for use in Powertrain, Chassis, Safety, Emissions, Comfort and Convenience applications.



Over 60 Years of Automotive Sensor Expertise

Technology

Hamlin is one of first companies to manufacture Reed Switch Technology



1957

Technology

Hamlin components aboard first lunar mission



1968

Technology

Sigmar produces Diesel Fuel Heaters



1996

Technology

ACCEL launches Multi-Zone Solar Sensors



2000

Technology

ACCEL launches Dual Zone Solar Sensors, Hamlin adds Hall Effect technology to its profile



2003



2012

Technology

Littelfuse starts first project using its PWG™ technology for level/linear sensing



2014

1927



1965



Technology

Hamlin launches change-over Reed Switch

1983



Technology

Sigmar produces Water in Fuel Sensors

1999



Technology

ACCEL launches Single Zone Solar Sensors

2002



Technology

ACCEL begins production of Hall Effect based Seat Belt Buckle Presence Sensors

2007



Technology

ACCEL is granted two patents for Solar Sensor Technology

2013



2015



Our Market Focus **TRANSPORTATION** and Applications



Chassis

- Position Sensing
- Level Sensing



Comfort and Convenience

- Solar Sensing - Irradiance & Ambient Light
- Rain and Humidity/Temperature Sensing
- Power Assist Speed & Direction Sensing



Emissions

- DEF Heater
- DEF Level Sensing
- DEF Concentration Sensing



Passenger Safety

- Seat Belt Buckle Sensing
- Seat Occupancy
- Seat Belt Tension Sensing



Powertrain

- Speed Sensing
- Fluid Level Sensing
- Diesel Fuel Sensors
- Position Sensing
- Speed & Direction Sensing

Value Added Sensing System Features



Littelfuse offers an extensive portfolio of Automotive Sensors that includes a wide range of automotive and commercial vehicle products designed to monitor the passenger compartment occupants and environment as well as the vehicle's powertrain, emissions, speed and suspension.

Littelfuse.com/products/automotive-sensor-products



Improve Safety

Custom Design
Robust and Cost Effective
Global Engineering Support



Comfort and Convenience

Custom Design
Multiple Features Available
Global Supply Base & Production



Powertrain

Full Range of Powertrain Speed, Position and Diesel Application Sensors
Hall/TMR/PWG™ Sensing Technologies

Passionate About Our Products

Delivering results that exceed customer expectations

Why Choose Littelfuse?

Littelfuse products are vital components in virtually every market that uses electrical energy, from consumer electronics to automobiles, commercial vehicles and industrial equipment. Littelfuse is the preferred brand for leading manufacturers around the world, with more than 40 sales, manufacturing and engineering facilities and a global network of distribution channels.



Product Development and Testing Expertise

Our global team of engineers work to design innovative solutions, provide customer support and perform product testing to ensure the best solution that meets all requirements and regulations.

Global Support Team

Littelfuse has a world-wide team of specialists prepared to support any application needs from conceptual development to continuous quality assurance for the full program life.

Custom Solutions Provider

Our history of innovation, proven technical expertise and one of the industry's broadest and deepest portfolios of automotive sensors enables us to provide objective, comprehensive solutions for each customer's unique needs and deliver value added propositions.

Purpose

To improve the safety, reliability, and performance of our customers' products that use electrical energy.

Values

Customer Focus, Teamwork, Results Driven, Integrity

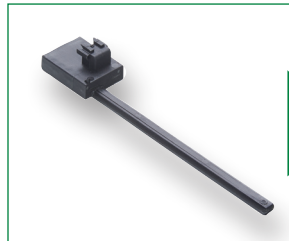


Developing **NEXT GENERATION** Products and Continuously Improving **TECHNOLOGIES**

Developing Industry Leading Technology to Better Serve your Needs

- Littelfuse Pulsed WaveGuide (PWG™) sensor provides a continuous and linear output allowing for accurate level measurement of fluids such as DEF even in unique tank configurations
- The continuous linear output can also be used in position sensing application such as seat position, active suspension and construction equipment
- Measurement frequency can be optimized to the application to minimize power consumption

Littelfuse.com/products/automotive-sensor-products/powertrain/level-sensing/fuel



Unique Technology to Enhance the Driver Experience

- Multidirection (3D) sensors detect solar irradiation intensity/angle and are used by the climate control system for better cabin temperature zone control, enhancing the driving experience.
- Patented hemispheric calibration technology tailors the sensor to the specific vehicle configuration to allow for full styling flexibility.
- Capable of integrating additional functions such as ambient light sensing, temperature sensing and visual indicators.

Littelfuse.com/products/automotive-sensor-products/comfort-and-convenience/solar-sensing/multizone



Innovating Use of Existing Solutions to Monitor the Vehicle's Drivetrain

- Robust construction allows the speed sensor to operate in harsh environments such as inside the automatic transmission.
- Sensors can be designed to measure speed only or speed and direction.
- Sensors are zero speed measurement capable.

Littelfuse.com/products/automotive-sensor-products/powertrain/speed-position-sensing





Product Development & Engineering

Resources to meet your project goals on time and on budget

Business Excellence from Concept to Completion

Leading vehicle OEMs look to Littelfuse Automotive Sensor Products for answers to their Powertrain, Emissions, Chassis, Comfort & Convenience and Passenger Safety needs. Our innovation, technical expertise and product offerings enable us to provide comprehensive solutions for customer's unique applications. That is the value you can expect from Littelfuse.



Plan & Define Program

- Product requirements agreed
- Milestones and deliverables agreed
- Manufacturing strategy agreed
- Concept design

Product Design & Development

- Concept samples built and validated
- Detailed design completed
- Design validation (DV) plan agreed
- Design freeze for prototypes

Process Design & Development

- Design Validation (DV) build; testing & report
- Process design completed
- Process Validation (PV) plan agreed
- Design freeze for production

Product & Process Validation

- Production line completed
- Mass production trials and run at rate
- Process Validation (PV) build; testing & reporting
- Production Part Approval Process (PPAP)

Post Launch Review

- Start of Production (SOP)
- Launch containment
- Quality performance/customer satisfaction monitoring
- Continuous improvement/VAVE

Global **MANUFACTURING** Footprint

Littelfuse offers global manufacturing centers to provide better and more cost effective products to our customers. Learn more at: [Littelfuse.com/about-us/world-wide-locations](https://www.littelfuse.com/about-us/world-wide-locations)

Europe



Kaunas, Lithuania & Ozegna, Italy

- ISO/TS 16949, ISO 9001, ISO 14000
- PCB Assembly
- Sensor Assembly
- Facility Size: 8,200 m² (Kaunas); 3,000 m² (Ozegna)
- Business Functions: Sensor Design Engineering, Manufacturing, Quality, Purchasing, Finance, Logistics
- Production Type: PCB-Assembly, Manual, Semi-automated, Automated
- Products Manufactured: Solar Sensors, Safety products, Speed & direction sensors, Level Sensors
- Employees: 730 (Kaunas); 48 (Ozegna)

The Americas



Matamoros, Mexico

- ISO/TS 16949, ISO 9001, ISO 14000
- Sensor Assembly
- Reed Switch Manufacturing
- Facility Size: 9,660 m²
- Business Functions: Sensor Design Engineering, Manufacturing, Quality, Finance, Logistics
- Production Type: PCB-Assembly, Wire processing, Plastic molding, Manual, Semi-automated, Automated
- Products Manufactured: Safety products, Speed & direction sensors, Reed Switches
- Employees: 740

Asia



Suzhou, China

- ISO/TS 16949, ISO 9001, ISO 14000
- PCB Assembly
- Sensor Assembly
- Facility Size: 3,500 m²
- Business Functions: Sensor Design Engineering, Manufacturing, Sales & Marketing, Quality, Purchasing, Finance, Logistics
- Production Type: PCB-Assembly, Manual, Semi-automated, Automated
- Products Manufactured: Safety products, Speed & direction sensors, Reed Switches
- Employees: 230

Automotive Product Applications

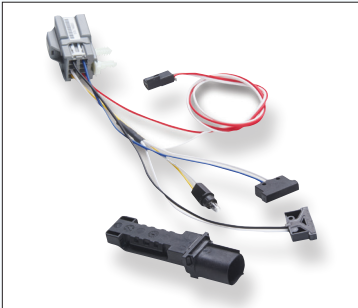
Passenger car, commercial vehicle and off-highway



Solar Sensor



Cam & Crank



Clutch

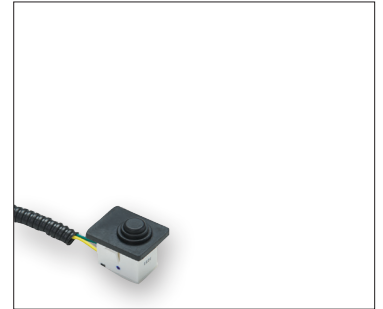


Transmission



Gear Selection





Seat Belt



Fluid Level



Powered Tailgate



Emissions Control

Powertrain

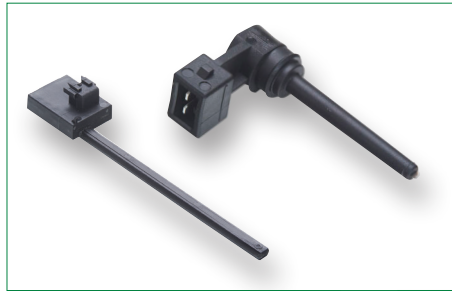
Littelfuse Powertrain sensors cover the entire range of vehicles needs providing position, level, rotation and speed data from such components as the engine Camshaft, Crankshaft, transmission and Fluid Levels utilizing P/WG™, Hall and Reed technology. In addition, Littelfuse offers Diesel fluid heaters that utilize PTC elements.

Learn more at: Littelfuse.com/products/automotive-sensor-products/powertrain



Fuel Heater

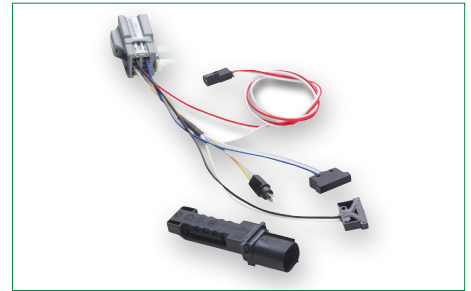
- Stand-alone function eliminates the need for temperature probes or power switches
- PTC design with no mechanical contact ensures high reliability and a long life



Fluid Level Sensor

- TMR*, P/WG™*, Reed* technologies available
- Low power and solid state switching
- Discrete voltage linear and step level sensing options

*Float not pictured



Clutch Position Sensor

- TMR or Hall technology available
- Low power consumption; No standby power required
- Magnetically operated position sensor



Fuel Heater Module

- Fuel heater, temperature sensor, water in fuel detection, diagnostic function, pressure sensor
- High reliability



Water in Fuel Sensor

- Measures resistance to determine the level of water in the tank
- Integrated self-test feature



Transmission and Engine Speed Sensor

- Ferrous target speed sensing (Hall)
- Robust construction makes this sensor well suited to harsh environments



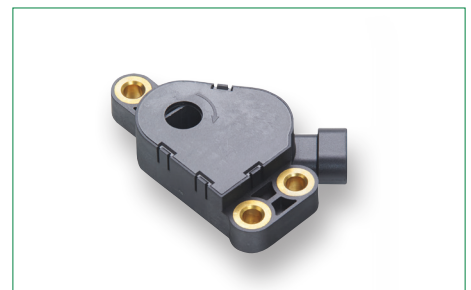
Pedal Position (Rotary) Sensor

- Hall-based absolute rotary position sensor
- Programmable angular range



Transmission Fork Position Sensor

- Non-contact Hall technology
- Large air gap operation



PRNDS Position (Rotary) Sensor

- Analog or PWM output
- Clockwise or counterclockwise option

Passenger Safety

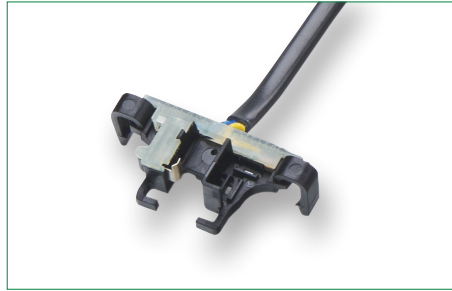
Littelfuse Seat Belt Safety sensors are a key component in the driver/passenger active and passive restraint systems as well as occupant presence sensing systems using Reed, Hall Effect and Mechanical sensing.

To learn more, visit: Littelfuse.com/products/automotive-sensor-products/passenger-safety



Seat Belt Buckle Sensor

- Non-contact, Hall Effect and TMR presence sensing technology
- Low power consumption
- Customizable logic output states
- Design allows for diagnostic capabilities



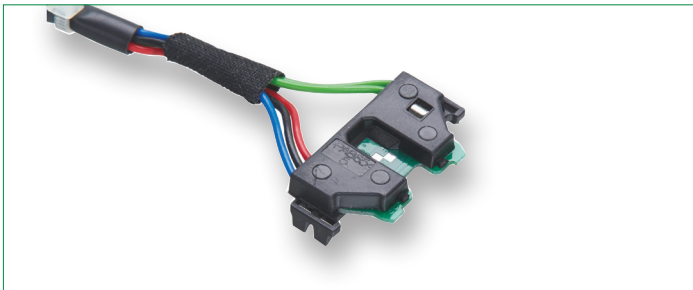
Seat Belt Buckle Sensor - Mechanical

- No standby power required
- Excellent life and reliability
- Clean and cost effective design



Seat Belt Buckle Sensor - Reed

- No standby power required
- Non-contact, Reed Switch technology
- Can be connected directly to audio and/or LED alerts



Dual Seat Belt Buckle and Tension Sensor

- Non-contact, Reed and Hall Effect technology
- Customizable sensor output
- Design allows for diagnostic capabilities



Seat Occupancy Sensor

- TMR, Hall, or Reed technology available
- Integral neoprene boot provides protection from severe environments
- No stand-by power required (Reed)
- Two logic states (Hall and TMR)

Emissions

As the world moves toward more effective SCR systems, Littelfuse offers both level sensing (PWG™, Hall and Reed technology) for use with DEF/UREA Fluid as well as PTC heaters for Blow-by Gas heating.

Learn more at: Littelfuse.com/products/automotive-sensor-products/emissions



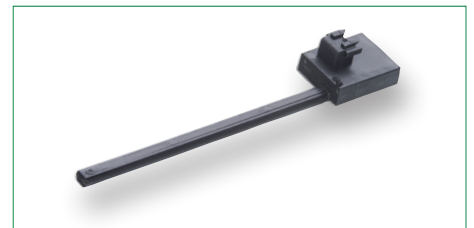
Blow-By Heater

- PTC self regulates the power absorption in function of flow and temperature of the blow-by gases
- No external thermostat needed
- Well suited to harsh environments



DEF Heater

- Self regulated PTC heating elements
- Stainless steel body
- All materials used are compatible with DEF solution to avoid contaminating the catalyst



DEF Level Sensor

- Sensor technology optimized for linear position sensing
- Contactless design
- Level sensing with or without a float

Comfort and Convenience

Littelfuse provides a full line of Comfort and Convenience products, including Ambient and Solar sensors plus Position, Speed and Direction Sensors, supporting the passenger assist features of Heating, Cooling and power assisted tailgate and side door open/close systems.

Learn more at: Littelfuse.com/products/automotive-sensor-products/comfort-and-convenience



Solar and Ambient Light Sensors

- Capable of integrating additional functions such as ambient light sensing, temperature sensing and visual indicators
- Customized styling, analog or LIN outputs available
- Patented diffuser technology provides horizon to horizon response and consistent characteristics



Tailgate Speed and Direction Sensors

- Hermetically sealed, magnetically operated non-contact sensing gives excellent life and reliability
- EMC / ESD protection available
- Sealed or unsealed construction options makes this sensor well suited to various environments



Rain-Light-Humidity-Temperature Sensor

- Mounted to windshield in front of mirror
- Manual sensitivity adjustment
- Full flexibility for functional integration
- Customized output and electrical interface

Chassis

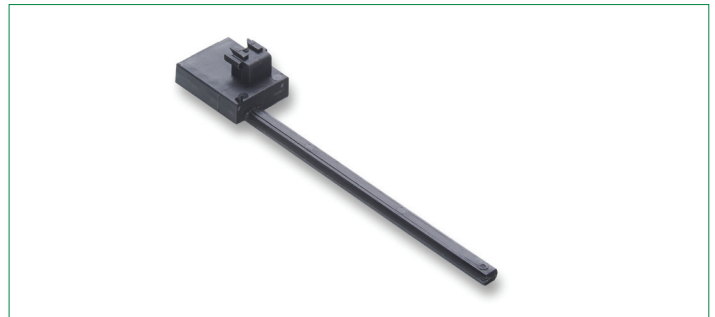
Littelfuse offers a full line of position, rotation and speed sensors that can be utilized in the vehicle's chassis systems including active suspension and braking using Hall Effect sensing technology.

Learn more at: Littelfuse.com/products/automotive-sensor-products/chassis



Rotary Position Sensor - Hall

- Magnetically operated position sensor
- High immunity to outside magnetic interference
- Analog or PWM outputs available



Linear Sensor

- Magnetically operated
- Contactless position sensing
- Robust, simple, cost effective design

WE ARE the #1 Circuit Protection Brand in the World



As the world's #1 brand in circuit protection Littelfuse offers the broadest and deepest portfolio of circuit protection products and a global network of technical support, backed by more than 90 years of application design expertise.

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Italy
Japan
Lithuania
Mexico
Philippines
Singapore
South Korea
Sweden
USA



Littelfuse World Headquarters

Chicago, Illinois
USA

www.littelfuse.com/products/automotive-sensor-products