

Ignition Technology

Diesel Cold-Start Technology

Electronics

Sensor Technology

Sensors

BERU sensor technology





BERU sensors – high precision and extreme reliability

Sensors for environment and safety

Tighter emissions limits and ever-growing demands in the areas of safety, accident protection and ride comfort require an increase in the use of sensors and the corresponding electronic control units. State-of-the-art cars are equipped with up to 100 of these high-precision electronic "sensory organs".

Measurement, Control and Regulation

Sensors measure, control and regulate temperatures, speeds, angles or positions. In order to be able to meet these different tasks with max. precision, BERU sensors are equipped with different technological systems—such as, for example, inductive technology, Hall effect or thermistor technology.

- BERU develops sensors in cooperation with the automotive industry which is based on partnership.
- BERU sensors are tailor-made exactly for the specific application in the car.
- BERU disposes of an extensive program of standard sensors – and works out innovative customer-specific sensor technology solutions.
- BERU always gives priority to the functional reliability of their sensors– even under extreme operating conditions.
- BERU offers extensive services on a one-stop basis: development by means of Catia V5, material selection and material pairing and electronics, inspection of the electromagnetic compatibility (EMC), failure modes and effects analysis (FMEA), efficient sample constructions (A, B, and C samples) and testing at 100 % on own test benches, and EMC specification.
- BERU exclusively cooperates with top suppliers.
- BERU sensors are installed by nearly all renowned vehicle manufacturers.



The safety of a globally active partner

BERU, the expert in ignition technology, diesel cold-start technology, electronics and sensor technology is a competent partner of the automotive industry. For nearly 100 years we have consequently been pursuing the objective to have a global top position in our business fields and to maintain a lasting top position thanks to innovative new developments.

Customer-specific solutions

In the field of sensor technology, BERU offer standard sensors, but also tailor-made sensor technology solutions:

- Sensor technology
- Connection, line, plug sets
- Single and multi-pole version
- Fastening possibility and housing

Globally certified quality

BERU AG is represented on three continents with 23 sites, the head office is in Ludwigsburg/Germany. All factories are certified according to DIN ISO 9001 which attests highest quality standards regarding shape, function and performance and a permanent optimization of product and service. All German BERU factories have additional certificates, namely QS 9000, VDA 6.1 and ISO TS 16949 and the environmental certificate ISO 14001. Moreover, a tight sales network guarantees an excellent delivery service – so that our products will always be in the right place at the right time.

Speed sensors



Function:

- Measurement of speeds by sensor rotors (gear wheels).
- Position detection by sensor rotors (gear wheels) to measure the angle of a shaft (e.g. camshaft or crankshaft).
- Applications: ABS systems, engine control, transmission.

Inductive sensor measuring principle:

The coil detects the change in magnetic flux caused by the tooth/space geometry. The rotary movement of the gear wheel induces a quasi-sinusoidal voltage in the coil. The sensor rotor speed determines the amplitude and frequency of the induced alternating voltage.

Hall sensor measuring principle:

Non-contact measurement of the rotary movement of a gear wheel. The sensing element of the speed sensor is a dynamic Hall IC, which receives its initial load from a permanent magnet. The IC evaluates the difference between the magnetic flux density in Hall plates S1 and S2 and assigns them the switching stages "high" and "low". If we consider the interplay with a gear wheel moving past the sensor, magnetic field changes are indicated by the change between space and tooth: in high and low states. These map the image of the gear wheel. The signal amplitudes to a large extent depend on speed and distance to the gear wheel and this is an advantage compared to inductive systems.

Variants:

- Inductive sensor with and without permanent magnet
- Hall sensor with detection of the sense of rotation
- Hall sensor with 2-wire interface



Temperature sensors

TEMPERATURE SENSOR

RANGE FROM -40°C TO $+200^{\circ}\text{C}$

Function:

Measuring the temperature of water, oil, fuel and air in the car engine.

Measurement principle:

Temperature detection by NTC resistor: A temperature-dependent NTC resistor or NTC thermistor (NTC = negative temperature coefficient) is mounted in the sensor tip. The resistance falls as the temperature rises. The resistance can be converted to temperature using the specific characteristic.

HIGH-TEMPERATURE SENSOR (HTS)

RANGE FROM -40°C TO $+600^{\circ}\text{C}$

Function:

Exhaust gas temperature measurement.

Measurement principle:

Temperature detection by platinum shunt resistor: There is a thin-layer platinum shunt resistor (Pt 1,000) mounted in the tip of the sensor. The resistance increases with increasing temperature.

The resistance can be converted to temperature using the standardized resistance characteristic (DIN IEC 751).

Variants:

- Temperature sensor
- High-temperature sensor (HTS)
- Sensor for cooling systems
- Miniaturized sensors



Media sensors

Function:

- Detection and distinction of different media.
- Applications: Water detection in fuel filters, fuel distinction in case of bio-diesel.
- Water sensors monitor the water level in fuel filters and protect them from corrosion.
- Bio-diesel sensors record the mixing ratio of bio-diesel and mineral diesel and together with the engine control unit they make it possible that the prescribed emission limit values are maintained.

Measurement principle:

The water sensor records the conductivity of the medium between two electrodes. If the water level reaches the electrodes, a switching signal will be sent (open collector). The bio-diesel sensor uses the different dielectric constants of diesel and bio-diesel, it measures them as capacity change in the measurement condenser and converts them into an analog voltage signal.

Variants:

- Water sensor
- Bio-diesel sensor





Position and distance sensors

Function:

- Precise measurement of distances, positions and angles in modern vehicles.
- Applications: Clutch systems, braking systems, gear boxes and actors.

Measurement principle:

The position and distance sensor of BERU is based on a magneto-static principle: By means of an analog "Hall effect" it measures sensor distances up to 50 mm and converts the movement of a magnet into an electrical signal. The BERU position and distance sensor can be programmed for the corresponding measuring tasks to perform this task with high precision.

Variants:

- Sensors with PWM interface
- Sensors with analog output
- Sensors with linearization (supporting points)
- Sensors with redundant signal

Piezo-resistive pressure sensor

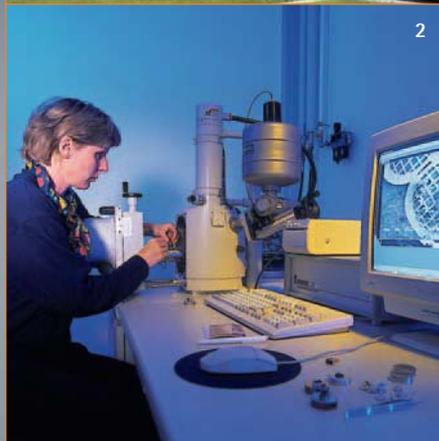
Function:

- Robust and exact pressure measurement in the diesel combustion chamber.
- Precise transmission of the stable pressure signals to the engine control electronic.
- Applications: Pressure sensor glow plug/PSG.

Measurement principle:

The pressure sensor glow plug PSG consists of an extremely robust heating rod from the BERU diesel Instant Start System, combined with a piezo-resistive sensor that cyclically records the quickly changing pressure levels in the combustion chamber and passes this information on to the engine's control electronic. Different from the self-regulating glow plug, the heating rod of the PSG is not pressed with the glow plug body, but it is on an elastic bearing. It transmits the combustion chamber pressure to a diaphragm in the rear area of the glow plug. Thanks to this constructive measure, the sensor could be positioned in a range with considerably more favorable environmental conditions.

- 1 | Research and development center in Ludwigsburg with state-of-the-art test laboratories and test equipments.
- 2 | Micro-world structures: The scanning electron microscope makes them visible- in this case the surface structure of a spark plug electrode after a permanent motor run.
- 3 | The EMC hall: Testing of the electromagnetic compatibility in the vehicle.



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