



The subminiature displacement sensor EU05/65 can be integrated even under the most arduous of conditions - here in the running engine compartment and it supplies highly accurate measurement results

Oil film thickness measurement in an internal combustion engine

Included in the objectives of current engine development are minimization of pollutants and the reduction of oil consumption. In order to be able to take measures in achieving these objectives, then along with a number of other factors, it is very important to obtain knowledge of the behavior and the thickness of the oil film between the cylinder wall and piston or piston rings. In this respect the upper third of the cylinder bore is of particular interest. To obtain reliable measurement results which can be of use in development for large-scale production, tests must be conducted on real engines and under realistic operation conditions.

The sensors are built into the cylinder wall behind a protective layer. The protective layer both thermally insulates the sensor and also replicates the contour of the cylinder wall. The spacing of the piston rings to the cylinder wall is measured. For the measurement it is assumed that the gap between the cylinder wall and the piston rings is completely filled with oil. A measurement system with a high temporal resolution (0.1° crankshaft rotation) and a very high spatial resolution ($\sim 1\mu\text{m}$) is required for the measurements. It must not be affected by oil and must be tolerant of contamination. The sensors are subjected to high temperatures (short-term up to 200°C) and, to prevent damage, are temperature-monitored. Due to their very small construction, the effect on the tribological system piston ring and cylinder wall is very slight.

Measuring system performance data

- Measurement range: 0.5mm
- Resolution: better than $1\mu\text{m}$
- Bandwidth: 100kHz

Ambient conditions

- Temperatures up to 200°C on the sensor
- Oil, fuel, air mixture
- Combustion gases
- Vibration, high pressures

System design

- 3 x DT3300 multifunction controller
- 3 x additional temperature output
- 3 x miniature sensor EU05/180(65)
- 3 x EA3200-EU05/180(65)M-EC3,25 adaptation board
- 3 x E3000 TCS/20°C/180°C/TA special temperature compensation
- 1 x PS300/12/5 power supply
- 3 x EC3/2 sensor cable
- 2 x PSC30 supply/synchronisation cable
- 3 x SCA3/5 signal cable

Reasons for choosing the system

- Non-contacting
- Wear-free
- Not affected by fuel, oil and exhaust fumes
- High temperature resistance
- Pressure-proof
- Very small sensor design
- Very accurate

With its rugged ceramic cap the subminiature displacement sensor EU05/65 is predestined for applications in the engine compartment.

