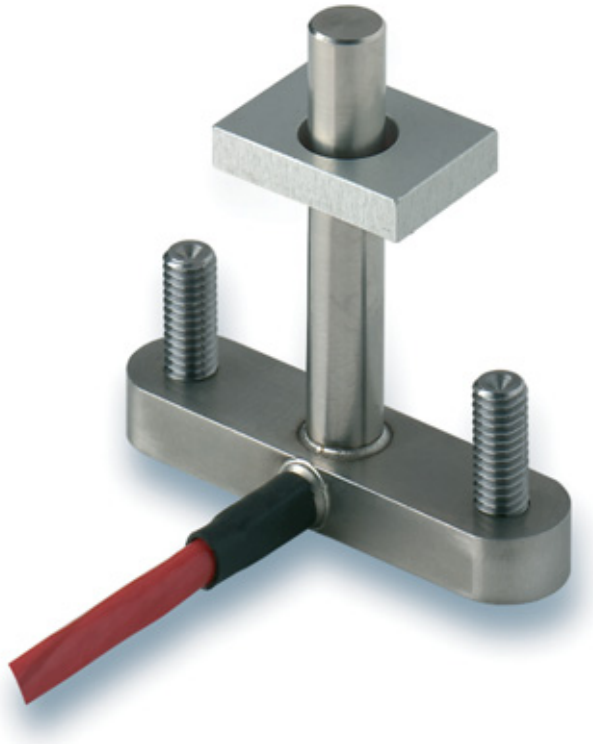
Clutch wear in racing cars

Racing cars are stressed to the limits of their capabilities. It is not without reason that pioneering technologies are often first tested in racing cars before they find their way into mass production. The 24-hour race at Le Mans produces particularly high stress levels for drivers and materials. And in this respect the clutch is a component that is subjected to the highest stresses. Audi Sport therefore decided to monitor the clutch wear during the race to be able to adopt a less arduous pace at the right time or to even carry out a replacement. A displacement sensor from MICRO-EPSILON is used for this application.

The sensor is located directly on the clutch release bearing and acquires both the normal stroke of the clutch as well as its wear. The stresses that prevail here are enormous: temperatures up to 150°C and the sensor must withstand shocks and vibrations without damage.



The decisive factor is therefore the ´non-contacting measurement principle: The sensor is based on the patented technique of the vipSENSOR (eddy-current loss principle) and is not subject to any wear at all. A further advantage is that the sensor, in contrast to conventional clutch sensors, does not need any magnets for the displacement measurement. Magnets change their properties significantly due to temperature and also collect metallic swarf, leading to a change in the characteristic. The most important decisive reason for choosing the sensor is however its excellent relationship of measurement range to installed length. This enabled the sensor to be used directly without modifying the release bearing. The sensor electronic system is located in a small control unit and requires just a few simple components without any complicated sine wave oscillators being needed. For series production applications, an ASIC has been developed which facilitates the large-scale production of economical sensors for integration into products. Consequently, the sensor is not only suitable for racing applications, but can be inexpensively manufactured in large quantities in mass production to replace contacting sensors which are subject to wear (potentiometers) or magnetic sensors.

Picture: Audi Sport GmbH

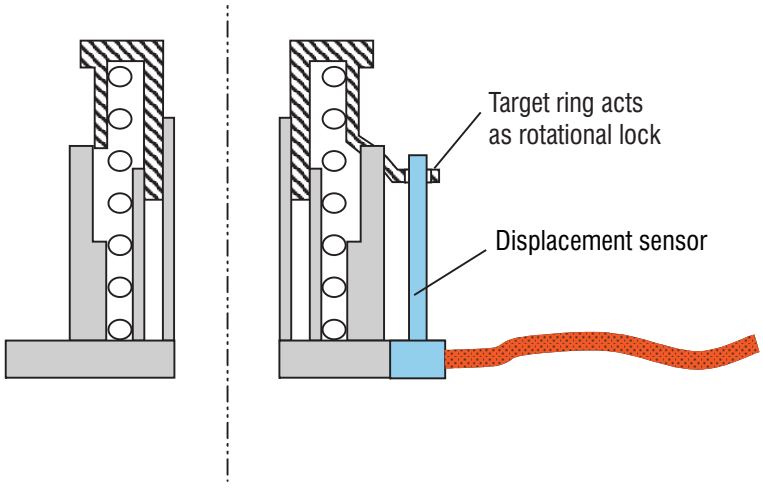
Application

Measurement system requirements:

- Measuring range	25 mm
- Linearit y	< ±0.5% FSO
- Electronics	control via microcontroller
- Resolution	0.1% FSO (10 bit A/D converter)
- Dynamic response	sampling rate 40 kHz
- Temperature range	-20...+150 °C
- Medium	air, oil
- Interference fields	typical automotive ambient EMC

Decisive advantages

- Short, compact construction, but at same time large measurement range
- No magnet
- Controlled by microcontroller (simple, economical electronics)
- High dynamic response
- Rugged, non-contacting and wear-free sensor



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