

A high performance sensor solution

Offering high resolution and speed, **Micro-Epsilon's** capacitive displacement sensors offer a number of benefits for applications within production plants

The number of applications for the use of sensors are expanding continuously across a wide range of industries, but in parallel to this both designers and end users are expecting more. Sensors need to be developed with design features that meet a number of requirements to suit the increasing need for higher performance, improved accuracy and resolution, precision and stability. In addition, they need to be reliable.

Meeting these demands are Micro-Epsilon's range of non-contact wear-free capacitive displacement measurement sensors which are suitable for use in production plants for demanding industrial measurement applications such as in-process quality assurance.

The capaNCDT (capacitive Non Contact Displacement Transducer) system uses a 'guard ring' principle that, explains the company, provides three specific technical advantages:

- Firstly, it enables earthing through the sensor rather than the target, meaning the target does not have to be electrically grounded. As a result, it is easier to install, especially on rotating or fast moving components. Furthermore, the customer only needs one sensor; and it can be used to measure plastic sheets or film, although the plastic must have a stable and consistent electrical resistivity.

- Secondly, it means the measurement output has a very high linearity so the user does not have to calibrate the sensor against the target on delivery.

- Thirdly, if the customer has to replace a damaged sensor or plug in another sensor with a different measurement range, this can be carried out without having to re-calibrate or make any adjustments to the sensor electronics.

The capaNCDT sensors can be used to measure a variety of features and characteristics including vibration, amplitude, clearance, run-out, displacement, distance or position, elongation, deflection, deformation, waviness, and tilt angle. In addition, they can be used for dimensional inspection, parts recognition, tolerance checking and sorting.

Applications

Capacitive displacement sensors are currently being used by a number of companies, one of which is a brake disc manufacturer. In this application, the

capaNCDT sensor is positioned 2mm from the brake surface during measurement, yet is suitable despite the temperature of the brake reaching 800°C.

Other applications include their use in the semiconductor and silicon wafer manufacturing industry where, for example, they have been used for ultra-precise lens alignment during processing. The sensors have also been used for measuring the wear of bore holes in extruder machines and the positioning of metal plate detectors used in large CAT scanner machines – where each of the hundreds of plates used need to be positioned precisely, typically to within nanometre accuracy.

Micro-Epsilon is also working with manufacturers of air bearings to provide ultra-precise measurement of running out of the bearing in hard disk drives. For this, the company has developed a special version of the sensor which measures down to 0.1nm resolution.

So why are these sensors suitable for such applications?

Chris Jones, managing director at Micro-Epsilon UK, explains: "The capacitive measurement principle is by far the most accurate and thermally stable method of non-contact measurement.

"The sensor measures over a defined surface area, which minimises errors due to surface roughness and the

thermal drift is 100 to 200 times smaller than optical devices."

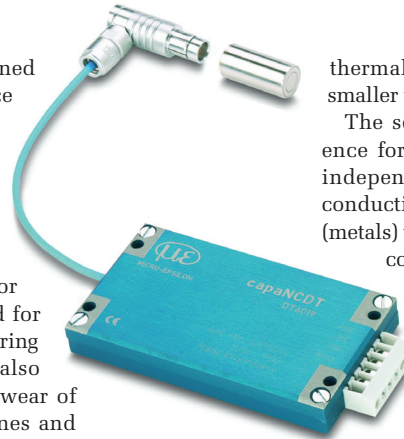
The sensors also exert no interference force on the target and operate independent of variations in the conductivity of electrically conductive (metals) target materials. Changes in the conductivity of the target material do not affect sensitivity or linearity. They therefore offer high zero point stability and accuracy and operate virtually independent of temperature.

In addition, the CapaNCDT system electronics and sensor are protected to IP54 and the sensor can operate in ambient temperatures of between -50°C and +200°C. Static (up to 2KHz) resolution is 0.1µm for the CS10 sensor, down to 0.0005µm for the S601 sensor. Measuring range for metals is from 10mm down to 0.05mm and from 20mm down to 0.4mm for insulating materials.

The high-speed version of the sensor is the capaNCDT 6350, which offers advanced performance via an integrated DSP (digital signal processor). The DSP achieves up to 50kHz (-3dB) bandwidth on analogue output. Fast moving production and inspection environments involving difficult materials can be measured using the calibrated DSP.

Micro-Epsilon
T: 0151 260 9800
www.micro-epsilon.co.uk

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The capaNCDT system is both accurate and thermally stable

Torque about testing steering columns

At ZF Steering Systems Nacam's steering column manufacturing facility in Gwent, it is critically important that components do not fail in service. To help meet the requirements, Paul Richards, manufacturing engineering manager at the company, designed a test rig with technical assistance from Eddie Jackson at Kistler to ensure the screw threads in the universal joints for the new Jaguar XF are within specification.

The test rig uses two Kistler Type 4502 miniature torque sensors to check that both threads have been formed correctly and are neither too loose or too tight. This latter parameter is important as, during installation on the car, the clamping screws are inserted after the steering column is in situ and space is tight. If the threads are not within spec, the whole column has to be removed – an expensive operation for which Nacam has to pay. In addition, if only one U/J fails inspection, the whole batch will be rejected.

The operation of the test rig, built by AC Solutions of Neath, is fully automatic once a U/J has been manually placed in the holder, which accurately locates the joint and checks the correct position of the clamps. Two test screws are driven into the threaded clamping bolt holes via Kistler Type 4502 torque sensors that measure the torque needed to rotate the test screws. A linear position sensor measures the distance the test screws travel to confirm that the spot faces have been correctly machined. The outputs from the torque and position sensors are sent to two Kistler CoMo View control monitoring systems that evaluate the signals and send a final pass/fail indication to the operator and the machine PLC. If a U/J fails in any one of the three parameters, the PLC locks out the test rig until the faulty unit is detected passing through the reject chute.

A joint that is in specification generates a pass signal that initiates the automatic engraving of a date code on the joint to provide end-to-end traceability.

Kistler Instruments

T: 01256 741550

www.kistler.com

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