Guaranteeing tip-top taps

Sensor Technology has provided a TorqSense wireless torque sensor to Advanced Design Innovations (ADI) - a supplier of custom manufacturing and testing equipment - to assist in the development of a new durability test rig to help optimise product performance for Bristan, a manufacturer of bathroom taps and showers

Left: torque sensors are essential for providing real time performance data

In order to ensure that its products always meet high standards, Bristan regularly subjects samples to an exhaustive testing regime, an important part of which is durability testing for taps, thermostatic radiator valves (TRVs) and the rotary controls on its show units.

Traditionally, these tests were carried out by continuously operating the taps and controls using a pneumatically operated test rig with fixed stop positions for the rotary motion. However, this arrangement made little allowance for any increase in operating torque that occurred during testing and it could not accommodate the effects of wear in, for example, the rubber washers used in taps.

As a result Bristan approached ADI to help develop a better method of testing. With previous experience in developing specialist test equipment, and after carefully analysing the application requirements, ADI proposed a completely new test rig, which would be driven by servo motors rather than pneumatic cylinders, as this would allow much more accurate and consistent control to be achieved.

In addition, instead of using fixed stops for the rotary motion, the new test rig would be arranged to stop when the torque in the drive system reached a preset value. This arrangement was preferred as it would not only compensate automatically for wear in the component under test, but would also more accurately reflect the real life operation of the component, since users typically stop tightening a tap or rotating a control after reaching a certain level of 'stiffness'.

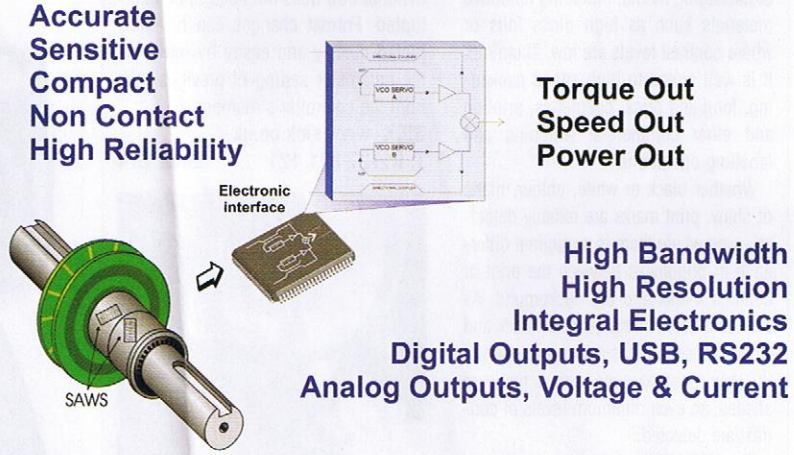
Rising to the challenge

The design of the new test rig was relatively straightforward, but what did present ADI with a challenge was how to measure the torque developed by the drive system accurately and in real time, so that the stopping points could be determined.

Preliminary investigations revealed that typical torque sensors were far too bulky to accommodate in a reasonably sized test rig, and also that they were incapable of delivering accurate results over the range required - from 1.5Nm to 3.0Nm. In addition, most of the torque sensors had non-optional speed monitoring functions built-in, which increased costs even though they were not required for this application.

After further research, however, ADI discovered the TorqSense range of sensors from Sensor Technology. "These versatile sensors were exactly what we needed," said Jeff Lowe of ADI. "They're tiny, so they were easy to accommodate on the test rig, they're dependable, and they provide very accurate results in real time, even at the very low torque levels we are interested in. Also, because they're not tied to unnecessary extras like speed monitoring, they were a very cost effective choice for this application."

Right: TorqSense provides a non-contact method for measuring power in a rotating shaft



A new type of sensor

The TorqSense units make use of surface acoustic wave transducers which comprise two thin metal electrodes, in the form of interlocking 'fingers', on a piezoelectric substrate such as quartz. When an RF signal of the correct frequency is applied to the transducer, surface acoustic waves are set-up, and the transducer behaves as a resonant circuit.

However, the essential feature is that if the substrate is deformed, the resonant frequency changes. When the transducer is attached to a drive shaft, the deformation of the substrate and hence the change in resonant frequency is related to the torque applied to the shaft. In other words, the transducer, in effect, becomes a frequency dependent strain gauge.

Since the transducers operate at radio frequencies, it is easy to couple signals to them wirelessly. Hence, TorqSense sensors that incorporate the SAW transducer technology can be used on rotating shafts, and can provide data continuously without the need for the inherently unreliable brushes and slip rings that are often found in traditional torque measurement systems.

"At Bristan we pride ourselves on our rigorous test procedures to ensure that our taps and showers are of the highest quality," said Adrian Lowe, test laboratory manager at Bristan. "Our previous test rig, while fit for purpose, didn't allow for such thorough and accurate testing. The new rig is an invaluable tool in ensuring that we continue to maintain the high quality for which our products are known, and also for helping us develop new and groundbreaking products in the future."

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