DIGITAL CALIPER NOT JUST FAIR-WEATHER FRIEND

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Digital calipers are widely accepted because of accurate and better readable displays, compatibility with computers and/or data collection systems, and because the price is right.

Performance is good, but only as long as the unit stays dry. This limitation exists because all digital calipers have capacitance position sensors - conductors arrayed on the scale and on the slider form a row of capacitors bridging the gap between slider and scale. The measured capacities yield the displacement.

If correctly designed, capacitive sensors are immune to external electrical and magnetic fields, and are easy to protect against dust and metal chips - a set of wipers will usually do. But if a drop of water, oil or coolant seeps in and bridges the gap between the scale and the slider, it will distort the sensor's output by locally magnifying capacitance - up to 80 times its value in the case of water or water-based coolants.

Because of this, a digital caliper should be used carefully in a machine shop environment: a splash of coolant or even sweaty palms may intermittently alter or interrupt its function.

Another type of sensor was needed to make calipers compatible with wet environments - an inductive sensor. It consists of flat windings on the slider and an array of copper areas on the scale. Very short pulses (20 nanoseconds) applied to any one of the windings induce eddy currents in the copper areas facing them,

which in turn inducts voltages in the other windings. Sampling these voltages and repeating the process generates a waveform ultimately yielding the position. Even though the pulse current rises to about 200 milliamps, the caliper's average current consumption is kept below 50 microamps by the low pulse repetition rate.

Coupling is now done by magnetic fields - liquids do not distort magnetic fields, their presence between scale and slider goes unnoticed. Because of their low impedance, inductive sensors are not sensitive to electrical fields. And they do not react to magnetic fields either, but only to their sudden changes. 'Sudden' means less than a tenth of a microsecond, so there is no need to worry if the caliper gets accidentally clamped on a magnetic chuck.

The inductive sensor not only matches its capacitive predecessor in dry environments, but also keeps working in wet ones.

The whole digital caliper was designed to be water-resistant to IP54 as defined in the IEC529 standard. The IP54 code's first digit '5' means dust-protected. The second digit '4' means that the caliper is protected against splashing water - it has to withstand a shower from every direction for 10 minutes. This is more than what's likely to happen to the caliper in a machine shop.

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