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**LinACE™ absolute InAxis™ linear shaft encoders measure exactly at the point of load**

LinACE is a heavy-duty absolute linear encoder that is designed for integration into hydraulic, pneumatic and electromechanical actuators as a feedback element for position or velocity. The system has an accuracy of ±5 µm and users can achieve full closed-loop control, significantly improving safety and performance. LinACE is a completely novel approach to linear position feedback which is designed and manufactured by Renishaw’s associate company [RLS](http://www.rls.si).

The LinACE encoder comprises a solid steel shaft with fully-integrated scale and a sliding readhead module that has no internal moving parts, making the entire system highly resistant to shock and vibration. Reliability over a wide temperature range is assured, with an operating temperature range from -40 °C to +85 °C.

As with most actuators, the shaft is made from steel, to exploit its ‘soft’ magnetic characteristics. The absolute code under the shaft surface is composed of small circumferential grooves, which are filled with non-magnetic material such as hard chrome or copper, depending on the application. Finally, the surface is plated with hard chrome and polished to a fine finish.

Since the scale is passive, external magnetic fields have negligible effect and LinACE is completely immune to dirt contamination. Because the scale extends all round the shaft, it can even be rotated as it moves in and out without losing position. Furthermore, the scale manufacturing technique retains a hard, smooth outside surface on the shaft, so operation of the actuator is not affected by its presence. Shaft diameters range from 4 mm to 30 mm and measuring lengths are up to 750 mm.

The scale is read by a module that incorporates a custom-made ASIC with an array of Hall-effect sensors, providing a reliable, compact, solid-state detection method. Signals from the ASIC are processed to provide a range of industry-standard output configurations, allowing replacement of traditional analogue voltage or current transducers, classical potentiometers and LVDTs. Furthermore, absolute positions can be communicated in a range of protocols including CAN, SSI, SPI, I2C, RS422, RS485 asynchronous serial and PWM, with a range of resolutions from 100 µm to 0.5 µm.

The module includes two bronze bearings that are integrated in the stainless steel housing to allow smooth movement, whilst at the same time maintaining precise alignment of the sensor over the shaft, even under hostile conditions.

Placing the scale directly on the actuator shaft provides several metrology benefits. Firstly, the system has an impressive accuracy of ±5 µm, thanks to internal compensation inside the readhead. Secondly, because the scale is marked directly onto the actuator shaft, it gives direct measurement of the actual position of the shaft, eliminating hysteresis and backlash while improving repeatability and stability.

LinACE can be fitted directly onto the front of the actuator, thus minimising overall system size, reducing complexity and eliminating potential failure modes by removing the need for parallel measuring systems. This technology enables OEMs to consider new possibilities for the use of actuators in space-limited and demanding closed-loop applications.

The system is available in kit form at RLS. Renishaw sales teams together with RLS engineering team are able to work with customers to provide a fully-embedded OEM solution for a wide range of applications including motion control, medical, automation and any other industry where pneumatic, hydraulic or electric actuators are used.

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