

Styli and Custom products and applications

A new Products Division was established in 2001 to provide further focus on the business opportunities for Renishaw for styli and accessories and where a standard Renishaw product is unable to address a customer's specialised requirements.

Renishaw supplies a comprehensive range of styli for component inspection on CMMs and machine tools, and for scanning applications. These are available in a variety of profiles, sizes and machine fittings to best suit the probe employed and the components' features and dimensions.

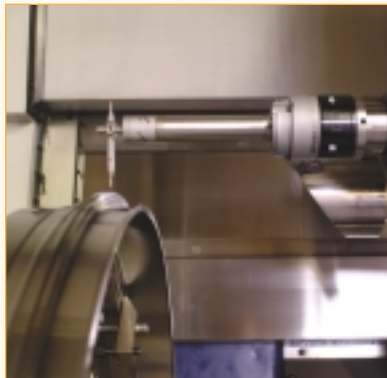
In liaison with a customer's supplier, Renishaw's custom design team encompasses design, engineering, production and marketing, to ensure a comprehensive and efficient "total product" service. Design and manufacturing solutions are based on Renishaw's knowledge and experience in manufacturing applications worldwide.

On CMMs, the newly introduced MH20 inspection probe and the new manual scanning probe MSP1 both started life as custom products. New market niches, where standard Renishaw products have been customised, include articulating measuring arms and touch-

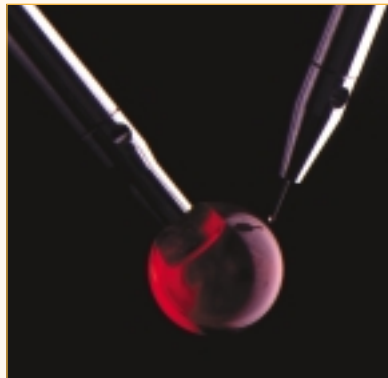
trigger probing with stylus/module changing on vision CMMs. Both have provided significant areas of growth for the CMM business.



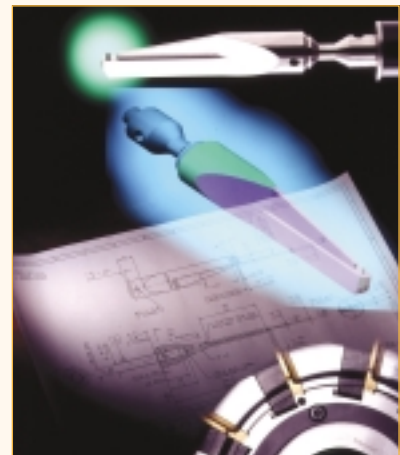
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1. Comprehensive stylus kit.

2. Customised LP2 probe at Castle Precision Engineering.

3. Comparison of smallest and largest stylus balls.

4. Custom stylus, for cutter profile scanning, courtesy of Holroyd Machine Tools.

5. Customised products for Mitutoyo Vision CMM.

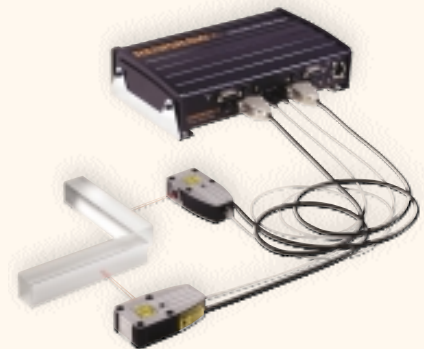
6. TS32 customised optical tool setting probe installed at Harkers Engineering Limited.

Laser scale products and applications

Renishaw's HS10 laser scale system has been incorporated into many precision motion systems providing direct position feedback at resolutions to 40nm. Applications range from machining aerospace components to laser writers (which produce photomasks for the electronics, flat panel display and semiconductor manufacturing industries), with the corresponding range of axis lengths being from sixty metres to less than one metre.

The HS10 system, used in conjunction with the HC10 real time thermal compensation system, enables one part per million (1 micrometre in a metre) positioning accuracy over a wide range of environmental conditions. The HC10 compensation system also includes a facility to compensate for thermal expansion of the machine structure or, more usually, the piece part.

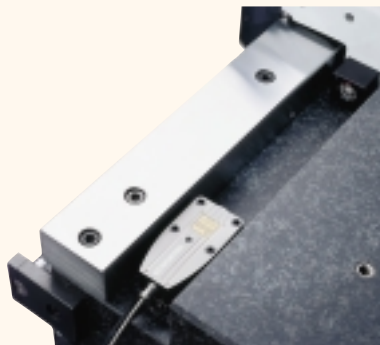
The RLE fibre optic laser encoder has been developed to complement the existing ranges of laser scale products and the RGH encoder product family. This system, having dual axis capability from one laser source, uses fibre optic links to transport the laser beam directly to the axis measuring position. This facility radically reduces the external optical path complexity associated with other laser scales. The RLE fibre optic laser encoder provides the high resolution positioning performance expected from interferometer systems, with levels of installation simplicity normally reserved for traditional encoders. Applications for this system include semiconductor wafer inspection, laser writers, lithography equipment, laser ablation machines, precision gauges, machine tools and CMMs.



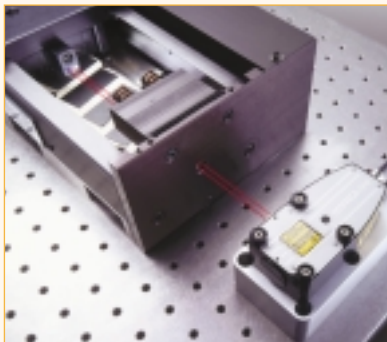
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1. RLE fibre optic laser encoder system.

2. Close-up of detector head.

3. Application of the RLE system on a CMM.

4. RLE fibre optic laser encoder system fitted to a linear stage.

5. HS10 laser scale system fitted to an Asquith gantry machine. photograph courtesy of British Aerospace.

Calibration products and applications

The laser interferometer is used to determine the accuracy of CMMs, machine tools, and other industrial and scientific applications requiring accurate measurement and calibration. The principle of laser measurement is based on the International Standard for the metre – the speed of light*. Its novel design features offer the ultimate in flexibility of operation, portability and software/hardware interfacing.

The original Renishaw laser calibration system (ML10 laser and EC10 compensation unit) was introduced 12 years ago. Having quickly established a reputation as the market leader in terms of system accuracy and customer support, there are now thousands of ML10 systems in use worldwide.

Renishaw's ML10 "Gold Standard" system introduces sub-1ppm accuracy for ultra-precise machine calibration. The system has an axis range of 40m as standard and works in temperatures from 0-40°C, with an environmental compensation unit that "normalises" all temperature, pressure and humidity factors. The new system has doubled the laser frequency accuracy to $\pm 0.05\text{ppm}$ and handles axis speeds to 1000mm/sec.

The system configurations and options available for both systems allow many operating parameters to be checked and calibrated quickly and easily. The latest Windows® based measurement and analysis software, together with an innovative laser beam steering optic, makes the set-up of the laser system even easier.

The National Physics Laboratory (NPL) has given formal traceability to the iodine stabilised helium-neon reference system utilised by Renishaw. All Renishaw laser interferometers are calibrated to this reference source, which in turn gives each unit traceability to the NPL.

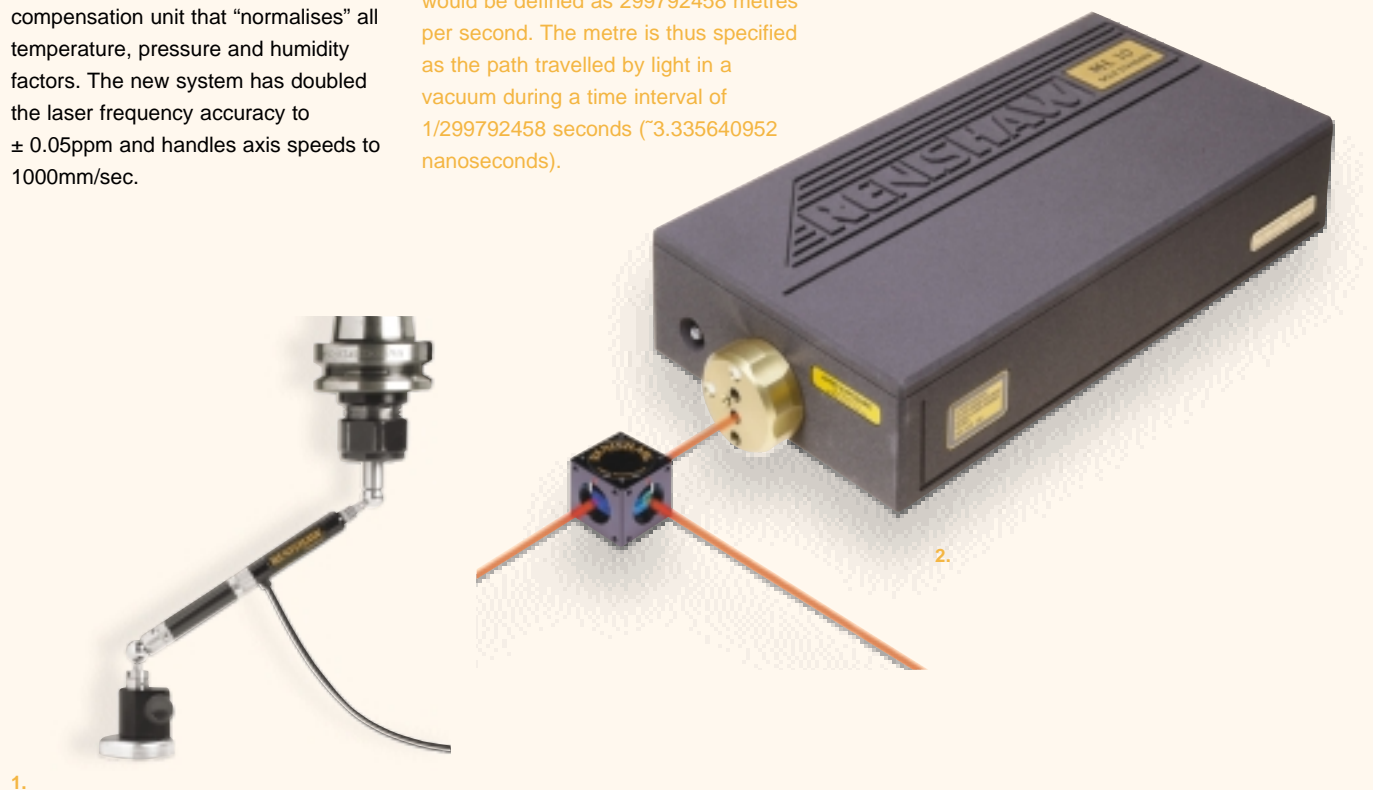
In conjunction with Renishaw's laser interferometer, the RX10 rotary axis calibration system enables fully automatic calibration at any angular increment, in accordance with the latest International Standard.

**In October 1983, it was agreed internationally that the speed of light would be defined as 299792458 metres per second. The metre is thus specified as the path travelled by light in a vacuum during a time interval of $1/299792458$ seconds (~ 3.335640952 nanoseconds).*

The QC10 ballbar was developed to check CNC machine tools quickly and cost effectively by the machine operator, enabling more frequent and rigorous quality assurance. The specially developed software can be used to diagnose a variety of machine errors to most recognised international standards. A notebook computer can be used for portability. The QC10 was granted a Queen's Award for Technological Achievement, 1995.

Ballbar 5 software offers many new features and enhancements.

Renishaw's Machine Checking Gauge (MCG) enables rapid volumetric measuring of a CMM. The MCG complies with British Standard BS EN ISO 10360-2.

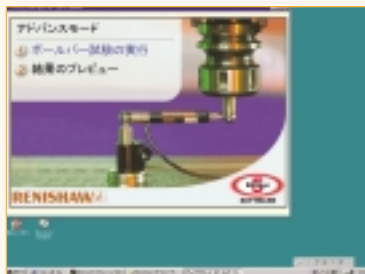


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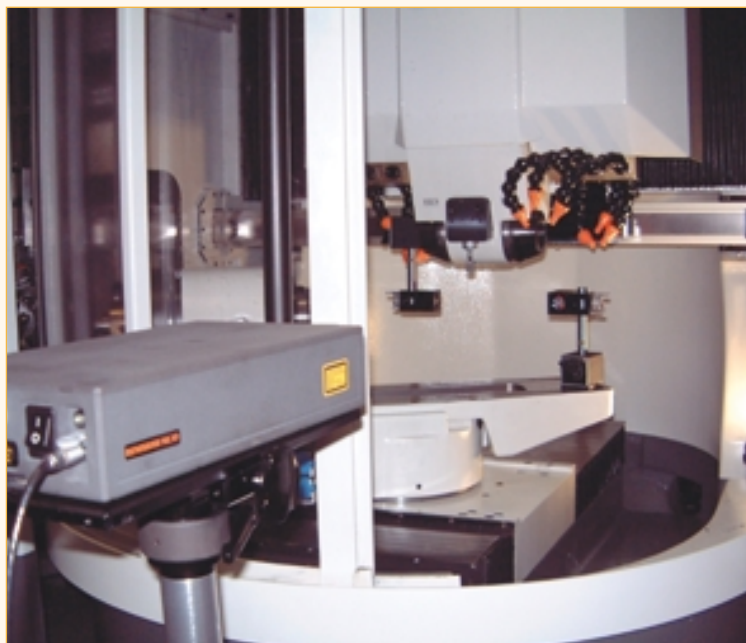
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1. QC10 ballbar.
2. ML10 'Gold Standard' system.
- 3-4. Examples of computer screens showing QC10 ballbar test set-up and new Japanese language screen options.
5. QC10 ballbar system, photograph courtesy of Thomson Machine & Tool.
6. MCG machine checking gauge.
7. Laser calibration of a 5-axis Helitronic Power Production unit, a high-performance machine with a powerful 18 kW grinding spindle motor.
8. Compact carrying case for QC10 ballbar system.