

High-accuracy machine tool probes

On-machine probing solutions

Why probe?

Time spent manually setting workpiece positions and inspecting finished products impacts manufacturing performance and profitability. Using a probing system eliminates costly machine down-time and the scrapping of components associated with manual setting and inspection.

Increase throughput from your existing assets

If your machines are overloaded then you could face a sizeable capital investment to make up the shortfall, a large sub-contract bill, or even have to turn away profitable work. What if you could extract more throughput from your machines?

- Defer capital expenditure
- Reduce your sub-contract and overtime bills
- Pursue additional business

Increase automation, reduce human intervention

Are high labour costs from machine operation and shop support affecting your competitiveness? Could reducing these costs improve your manufacturing efficiency?

- Automate manual setting and measurement processes
- Reduce direct labour costs
- Redeploy staff into proactive engineering roles

Reduce rework, concessions and scrap

Scraping and reworking parts is non-productive. How would minimising waste from scrapped parts and reducing rework improve your delivery times and profitability?

- Improve conformance and consistency
- Lower unit costs
- Have consistently shorter lead times

Enhance your capability and take on more work

Are increasing customer demands and regulations challenging your current capabilities? Could you benefit from a cost-effective enhancement of your machining and inspection processes?

- Offer your customers state-of-the-art capabilities
- Take on more complex work
- Meet customer demands for traceability

Reduce your total cost of ownership

Are the costs of outdated, inflexible metrology equipment affecting your business? What impact would reducing the total cost of ownership have on your bottom line?

- Make your machines more productive
- Eliminate expensive, inflexible custom gauges
- Reduce calibration and maintenance costs

How a probe works

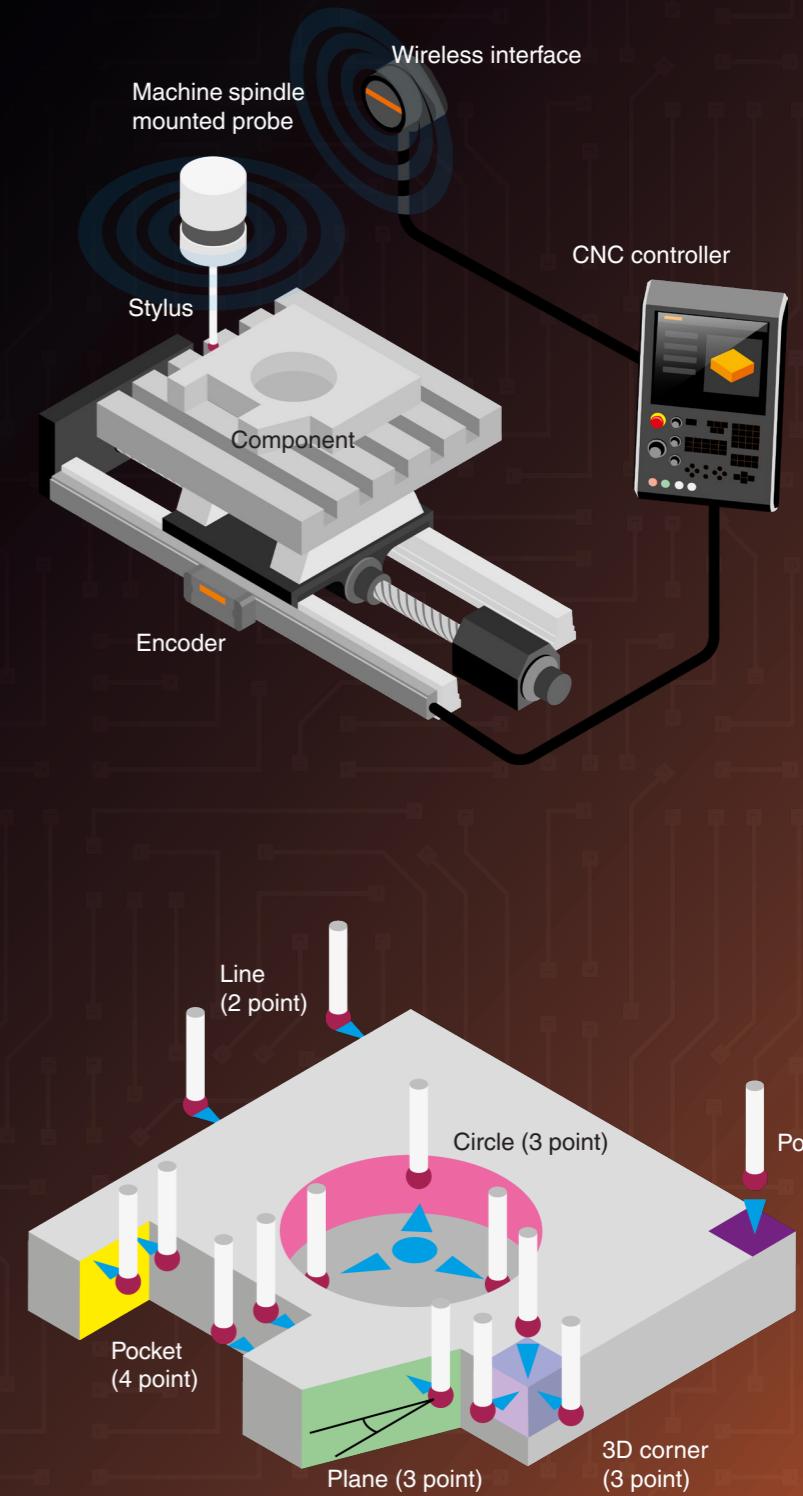
Touch-trigger probes

Machine mounted probes are often referred to as touch-trigger probes because they use switches that are triggered upon contact between the probe's stylus and the component being measured or set. Switching is highly repeatable.

When triggered, the probe signals the machine tool controller via an interface (almost simultaneously). The machine tool controller automatically captures the machine tool position via its encoders (feedback system).

With a co-ordinate point captured, the machine moves the probe on to trigger at a different location. When multiple points are found, shapes and features take form. The minimum number of points needed to measure each type of feature (shown right) is based on each feature's known degrees of freedom.

Measurement is taken by substituting a feature on the component with its theoretical equivalent, for example, a circle or 3D corner. The comparison between the actual and the expected dimension, measures deviation and enables accurate, detailed inspection.



Superior metrology for superior parts

High-accuracy probes with RENGAGE™ technology

With unbeatable 3D measurement capability and submicron repeatability, Renishaw's family of machine tool probes with RENGAGE™ technology combines precise silicon strain gauge sensors with ultra-compact electronics to deliver superior performance.

Excelling in the measurement of complex shapes and contours, probes with RENGAGE technology are ideally suited to applications of all sizes, where the use of 5-axis machines are common.

Suitable for small to large machining centres, the OMP400 and OMP600 use optical transmission – providing exceptional resistance to light interference.

For machines operating in high-density radio frequency environments, RMP400 and RMP600 probes use radio transmission with frequency-hopping spread spectrum technology, which provides excellent reliability.

The small and versatile MP250 probe is ideal for the harsh environments found in grinding machine applications. The probe is hard-wired for maximum resistance to interference.



High-accuracy probes with micro-kinematic technology

RMP24-micro is the world's smallest wireless machine tool probe, measuring just 24 mm in diameter and 31.4 mm in length.

A miniaturised version of our established kinematic design provides an ultra low trigger force comparable with our strain gauge probes. This allows RMP24-micro to deliver fast, accurate and reliable part set-up and inspection on high-value parts with delicate surfaces.

It is designed for micro precision applications typically found in medical, dental, electronics, jewellery and watchmaking industries. RMP24-micro is the ideal probing solution for machines with small working envelopes.

“ Accuracy is the main reason we use Renishaw technology. I don't think we could do half of what we do without their probes. ”

Tridan Engineering (UK)



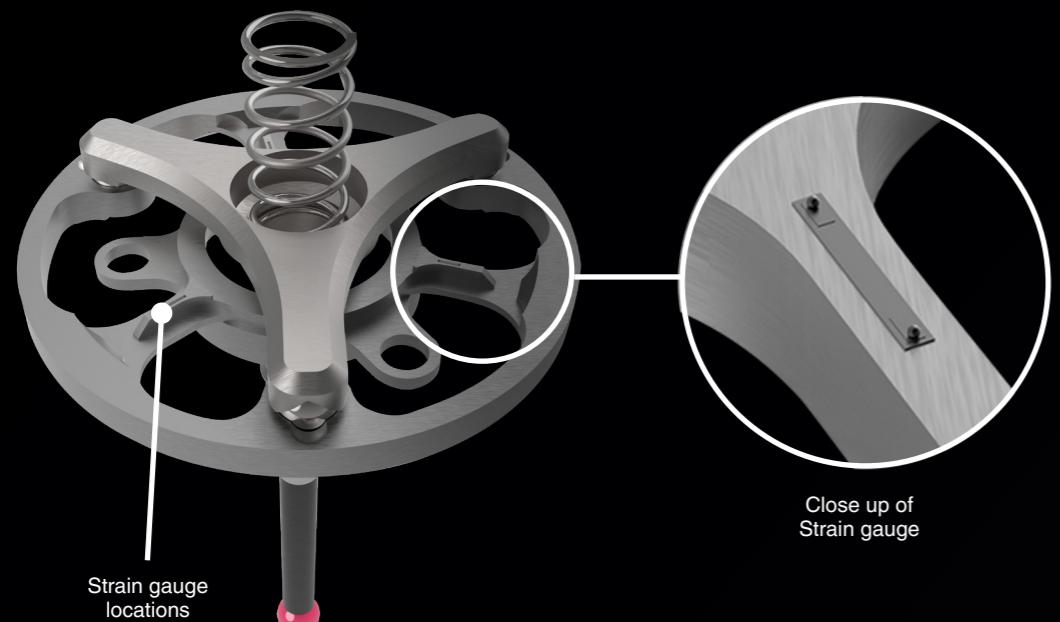
Technologies explained

RENGAGE™ technology

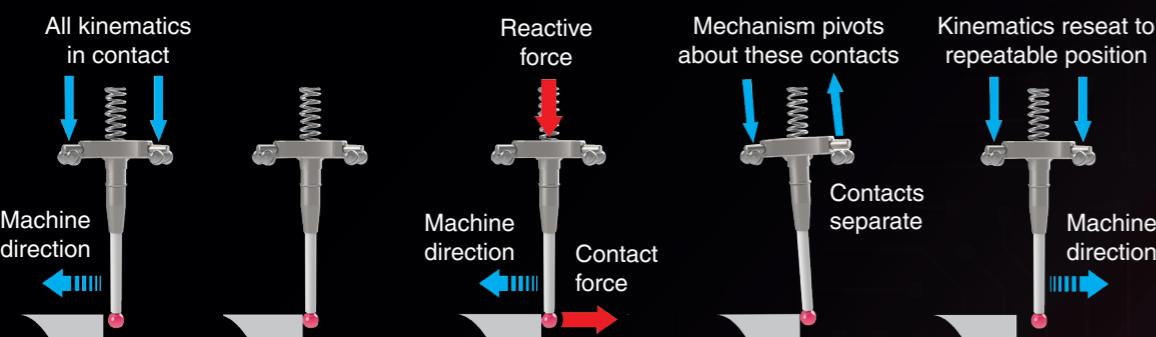
RENGAGE technology combines proven silicon strain gauge technology with ultra-compact electronics - allowing on-machine probing systems to achieve outstanding 3D measurement capability and sub-micron repeatability.

As the strain gauges are independent from the kinematic mechanism, probes with RENGAGE technology have an ultra-low trigger force, providing exceptional measurement accuracy as well as eliminating the possibility of surface and form damage on the parts inspected – ideal for inspecting delicate workpieces.

Strain gauge probe design



Based on the kinematic principle, the stages in trigger generation are shown below. Repeatable reseating of the mechanism is critical to this process and fundamental to reliable metrology.



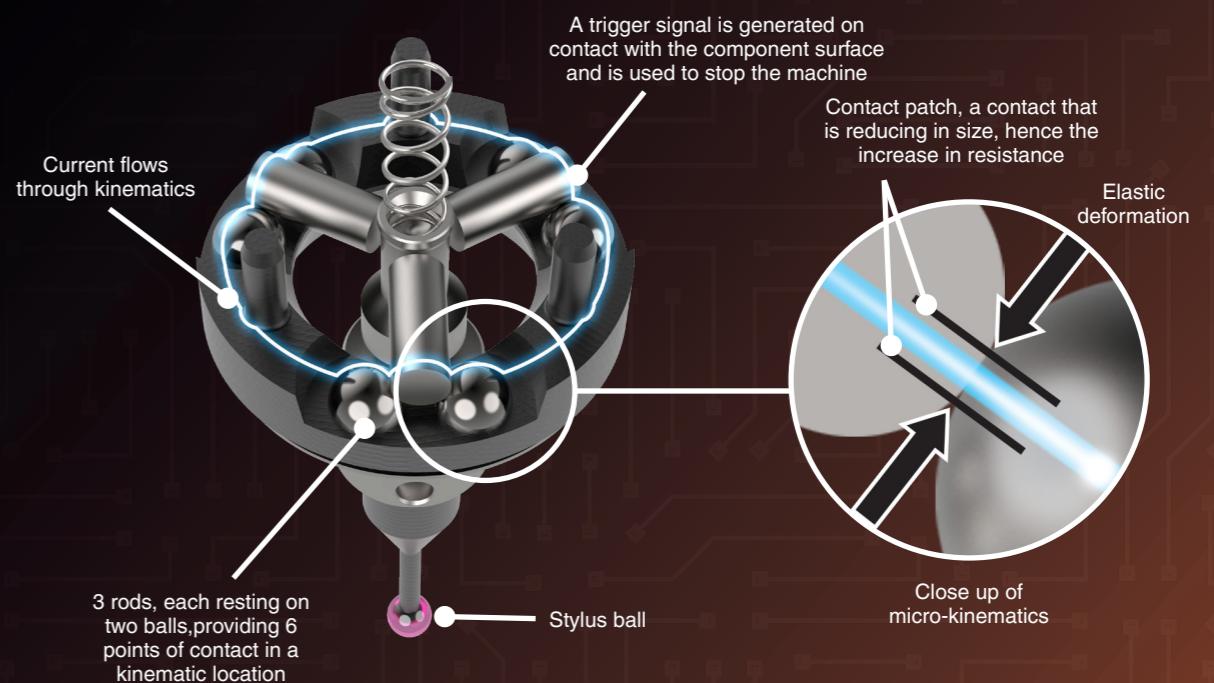
Micro kinematics

RMP24-micro uses Renishaw's popular kinematic resistive probe design in micro form to achieve market-leading metrology performance for a wireless machine tool probe in this size category.

The probe mechanism consists of three rods supported by six balls made of tungsten carbide. These balls form six kinematic contacts and an electrical circuit. The mechanism is also spring loaded, which enables the probe to move when it touches the part and to return to its original position within less than 1 µm when it is not in contact (when using a 10 mm stylus).

When the probe touches the workpiece, the force on the contact patch is measured as a change in electrical resistance. The probe output is triggered when the resistance reaches a certain level.

Micro kinematics probe design



Transmission technology to suit your needs

Probes and CNC controllers communicate bidirectionally. This communication is handled by a transmission system, the choice of which depends on the probe, the machine type and application.

Renishaw probes use three main types of transmission systems: optical and radio (both of which are wireless), and hard-wired (connected directly to the machine tool controller via a cable).

Optical transmission

Probes designed for small to large machine tools where there is line-of-sight between the probe and receiver. Transmitting at a distance up to six metres, optical transmission is a secure, robust, and well-proven transmission method.

The OMP400 and OMP600 are effective high-accuracy touch probes with optical transmission for your manufacturing operations.

Safe, reliable and efficient transmission

Renishaw's optical transmission systems use infrared technology to transmit information between the probe and the interface (or receiver). Optimised technology operates amidst other light sources and rejects external light interference, ensuring reliable communication.



Hard-wired

Probes designed for abrasive particle-laden environments which can withstand high vibration usually associated with grinding and lathe operations.

The robust MP250 probe has a hardwired connection providing more resistance to interference and allows the probe to operate battery-free.

The benefits of hardwired

The probe sustains superior performance even when subjected to the high vibration. If machine vibration is a problem, the probe can be switched to a more vibration resistant configuration. If you require a quicker probe response time, lower-latency configurations are also available.



Radio transmission

Probes designed for large machines or installations where the spindle probe is not necessarily within line-of-sight of the receiver. Operating at a range of up to fifteen metres.

The RMP400, RMP600 and RMP24-micro probes are Renishaw's range of high-accuracy radio transmission probes, offering exceptional reliability and is trusted choice for many customers.

Resistance to radio interference

With increased use of automation and wireless communication, radio interference can be a problem in modern factories.

Renishaw's radio transmission probes continue to work even when other devices using Wi-Fi, Bluetooth® and microwaves enter the same environment. Industry-proven frequency-hopping spread spectrum (FHSS) technology enables devices to jump from channel to channel while maintaining synchronisation. Operating within the recognised 2.4 GHz frequency band, these radio systems are compliant with radio regulations in all major markets.

Transmission comparison chart

	Transmission type			
		Optical	Radio	Hard-wired
OMP400	●			OMI-2, OMI-2T, OMI-2H, OMI-2C or OMM-2 / OMM-2C with OSI
OMP600	●			
RMP400		●		RMI-QE
RMP600		●		
RMP24-micro		●		HSI and HSI-C
MP250			●	
				Operating range
				Up to 5 m (16.4 ft)
				Up to 6 m (19.7 ft)
				Up to 15 m (16.4 ft)
				Up to 5 m (16.4 ft)
				N/A

Unmatched performance

3D performance

All touch trigger probes have lobing errors due to stylus flexing and probe mechanism movement. While these errors can be calibrated out in 2D applications. In 3D applications – such as the inspection of free-form parts – a probe with RENGAGE technology is beneficial due to its low pre-travel variation.

The strain gauge sensors in RENGAGE probes produce a trigger signal well before the kinematic mechanism moves. This eliminates 90% of lobing errors and provides a superior 3D performance when compared to other probing technology.

Ultra-low trigger force

Probes with RENGAGE technology have an unmatched ultra-low trigger force, eliminating the chance of damaging delicate workpieces during inspection.

The ultra-low trigger force in the RMP24-micro – helps eliminate surface and form damage when inspecting high-value parts with delicate surfaces or soft metal components.

Robust design

Constructed from high grade materials, all Renishaw probes are robust and reliable in the harshest environments withstanding shock, vibration, and extreme temperatures.

Inspect difficult parts

RENGAGE technology allows Renishaw's high-accuracy probes to be used with long styli and custom heavy styli. They can measure difficult-to-reach features with ease and are recommended for use with high modulus carbon fibre styli up to 200 mm long.

Performance comparison chart

Probe	Stylus trigger force (typical minimum)		Repeatability (2σ)	3D lobing *	Battery type	Recommended styli
	XY plane	+Z direction				
OMP400	0.06 N 6.0 gf (0.22 ozf)	2.55 N 260 gf (9.17 ozf)	0.25 µm	±1.00 µm	½ AA	High modulus carbon fibre, lengths 50 mm (1.97 in) to 200 mm (7.88 in)
OMP600	0.15 N 15.0 gf (0.22 ozf)	1.75 N 178 gf (6.03 ozf)	0.25 µm	±1.00 µm	AA	
RMP400	0.09 N 9.0 gf (0.22 ozf)	3.34 N 341 gf (12.01 ozf)	0.25 µm	±1.00 µm	½ AA	
RMP600	0.20 N 20.0 gf (0.22 ozf)	1.90 N 194 gf (6.83 ozf)	0.25 µm	±1.00 µm	AA	
RMP24-micro	0.08 N 8.2 gf (0.22 ozf)	0.75 N 76.5 gf (2.70 ozf)	0.35 µm	N/A	CR1632	Steel, lengths 10 mm (0.39 in) to 30 mm (1.18 in)
MP250	0.08 N 8.0 gf (0.22 ozf)	2.25 N 229 gf (8.09 ozf)	0.25 µm	±1.00 µm	N/A	High modulus carbon fibre, lengths 50 mm (1.97 in) to 100 mm (3.94 in)

*For further information, please visit www.renishaw.com/high-accuracy



Probe specifications

OMP400	OMP600
Principal application	Workpiece inspection and job set-up on small to large machining centres and multi-tasking machines
Transmission type	360° infrared optical transmission
Compatible interfaces	OMI-2, OMI-2T, OMI-2H, OMI-2C or OMM-2 / OMM-2C with OSI
Operating range	Up to 5 m (16.4 ft)
Battery life	Standby life
	One year maximum
	800 days maximum
	Continuous use
	105 hours maximum
	380 hours maximum

RMP400	RMP600
Principal application	Workpiece inspection and job set-up on multi-tasking machines, machining centres and gantry machining centres.
Transmission type	Frequency hopping spread spectrum (FHSS) radio
Compatible interfaces	RMI-QE
Operating range	Up to 15 m (49.2 ft)
Battery life	Standby life
	37 months maximum
	116 months maximum
	Continuous use
	230 hours maximum
	540 hours maximum

RMP24-micro	
Principal application	Workpiece inspection and job set-up on micro to small machining centres and multi-tasking machines
Transmission type	Frequency-hopping spread spectrum (FHSS) radio
Compatible interfaces	RMI-QE
Operating range	Up to 5 m (16.4 ft)
Battery life	Standby life
	5 months
	Continuous use
	228 hours

MP250	
Principal application	Workpiece inspection and job set-up on CNC grinders.
Transmission type	Hard-wired transmission
Compatible interfaces	HSI and HSI-C

Powerful probing software

A comprehensive range of software applications offers diverse programming, analysis, and reporting options.

From traditional macro-based solutions to graphical CAD/CAM-style applications, the choice of programming, analysis, and reporting options makes on-machine scanning an accessible solution irrespective of your experience level.

Inspection Plus

Inspection Plus is the industry standard macro package for machine tools, offering solutions for part setting, inspection and in-process measurement.

Compatible with all major machine tool controller platforms, this machine-resident package is simple to program.



GoProbe app

The GoProbe smartphone app creates a probing or tool setting routine with just a few quick taps. Simply select the required cycle and populate the data entry fields. The result is a single-line command that is entered into the CNC controller.



Set and Inspect

Set and Inspect is a simple, intuitive, on-machine probing app for machine tool users who require an easy-to-use probing solution. Use the app to easily create probing and tool setting routines. These routines can be manually run as single cycles or executed as fully automated probing routines. Set and Inspect can upload probing routines to the CNC controller automatically.



AxiSet™ Check-Up

A cost-effective solution for checking the alignment and positioning performance of rotary axes. In just a few minutes, users of multi-axis machining centres and multi-tasking mill-turn machines can identify poor machine alignments and geometry that can cause extended process setting times and non-conforming parts.

Probe Setup app

The Probe Setup app is used to review and configure probe settings or to partner a radio probe with an RMI-Q or RMI-QE interface. Simple menus and animations guide the user through the Opti-Logic™ process.



Reporter

Reporter is an on-machine app designed to display measurement data and production trends in a quick and easy way. View live and historical measurement results as well as non-contact tool setting macro routines. The app is installed onto a Windows®-based CNC controller or a Windows tablet connected to the controller via Ethernet.



Renishaw Central

Renishaw Central is a smart manufacturing data platform that collects and presents process and metrology data from the shop floor. It connects to measurement devices across the manufacturing process and provides invaluable insights. Manufacturers can use these insights to analyse, identify, predict, and correct process errors before they occur.



The Productive Process Pyramid™

Tackle process variation at source, and reap the rewards

The higher the degree of human involvement in the manufacturing process, the higher the risk of error. Automated in-process measurement using Renishaw probes can help eliminate the risk. RENGAGE™ technology facilitates the following controls for enhanced management of production processes, leading to an increase in profits.

For further details regarding the benefits of all levels of process control within the Productive Process Pyramid™, visit www.renishaw.com/processcontrol.

“ With this probe, we can process wise, be in line with the adjustments we need for the process. So the initial RMP24-micro is one of the key elements for our micro five machine. This is a decisive device for measuring in the process as a result of the machining, and then we can react with some machining adjustment to the process and adjusted. ”

Chiron (DE)

Post-process monitoring

Analyse and report on measurement data obtained.

- Determine surface condition characteristics
- Rapid, traceable reporting of part conformance to specification
- Reduce off-machine inspection time and costs

In-process control

Automated, on-machine component verification.

- Compensate for environmental and machine conditions.
- Implement adaptive machining processes.
- Reduce non-productive time and scrap.

Process setting

Automated on-machine part setting eliminates costly fixtures and manual setting operations.

- Automatically update machine offsets for accurate positioning and alignment.
- Introduce new processes quickly and respond to new customer needs.
- Faster set-up, improved quality, and reduced scrap.

Process foundation

Determine machine capability before manufacturing.

- Benchmark machine performance
- Schedule in-cycle checks as part of the production process
- Reduce machine downtime



Our industrial metrology solutions

Renishaw produces metrology and manufacturing equipment used in machine shops around the world.

We develop systems for manufacturers and users of CNC machine tools, that are designed to maximise machine performance. Automating the setup and process control activities ensures high quality, highly productive manufacturing, across all industrial sectors.

Our experience, flexibility, knowledge and close working relationships with machine tool builders ensures that our latest - and even custom-designed - technologies are easily integrated into new machine designs. These technologies can also be utilised during manufacturing and commissioning new machine tools to make machines the best they can be.



Metal 3D printing

For more information, visit
www.renishaw.com/am

Machine tool probes for component setting and inspection

Used to identify and set-up parts, measure features in-cycle for adaptive machining, monitor workpiece surface condition and verify finished component dimensions.

For more information, visit
www.renishaw.com/machinetoolprobes

High-accuracy laser tool setting systems

For more information, visit
www.renishaw.com/nc4



3D touch-trigger tool setters and broken tool detection

For more information, visit
www.renishaw.com/toolsetters



Shop floor gauging

For more information, visit
www.renishaw.com/equator

Tool setting arms for lathes and grinding machines

For more information, visit
www.renishaw.com/toolsetters

Machine calibration and optimisation

For more information, visit
www.renishaw.com/machinecalibrationandoptimisation

The Renishaw advantage

At Renishaw, we enjoy an excellent reputation for offering strong support to our customers through a global network of service and support offices.



“ We are very happy with the accuracy of RMP600 and, in particular, the consequent reduction in scrap parts further down the production line. These are large, expensive components and we can use the probe to identify and avoid errors. **”**

Tods Composite Solutions Ltd (UK)



