

The fundamentals of probing



How to automate your machine tool

Why probe with Renishaw?

Despite advancements in CNC machine performance, the set-up of tools and workpieces often remains a manual process. This impacts throughput, quality, and ultimately profitability. Renishaw technologies can fully automate these steps and enable in-process control.

Increase automation, reduce human intervention

On-machine tool setting and probing systems allow tool and workpiece set-up, in-process feedback and are key to enabling full lights-out automation.

Reduce rework, concessions and scrap

Automated tool setting and workpiece set-up significantly reduces the risk of error, combined with the ability to monitor ongoing processes.

By implementing process control through the use of spindle probes and tool setters in our own manufacturing processes, we have been able to achieve a consistent scrap rate of less than 0.5%.

Increase throughput from your existing assets

CNC machines are often underutilised, awaiting manual operations. Renishaw probing systems boost your machine capacity, minimising the need for additional equipment.

Enhance your capability and take on more work

Using traditional and manual tool and workpiece setting can undermine the performance of high-quality CNC machines. Standardising these processes with Renishaw probing gives you the confidence to take on customers' higher accuracy demands.

Accuracy is in everything we do

Renishaw probing technology is accurate and repeatable, ensuring each part is manufactured within the specified tolerances.

Unmatched customer support

Dedicated teams of engineers and regional offices are available globally, ensuring support for all our products is always within reach.

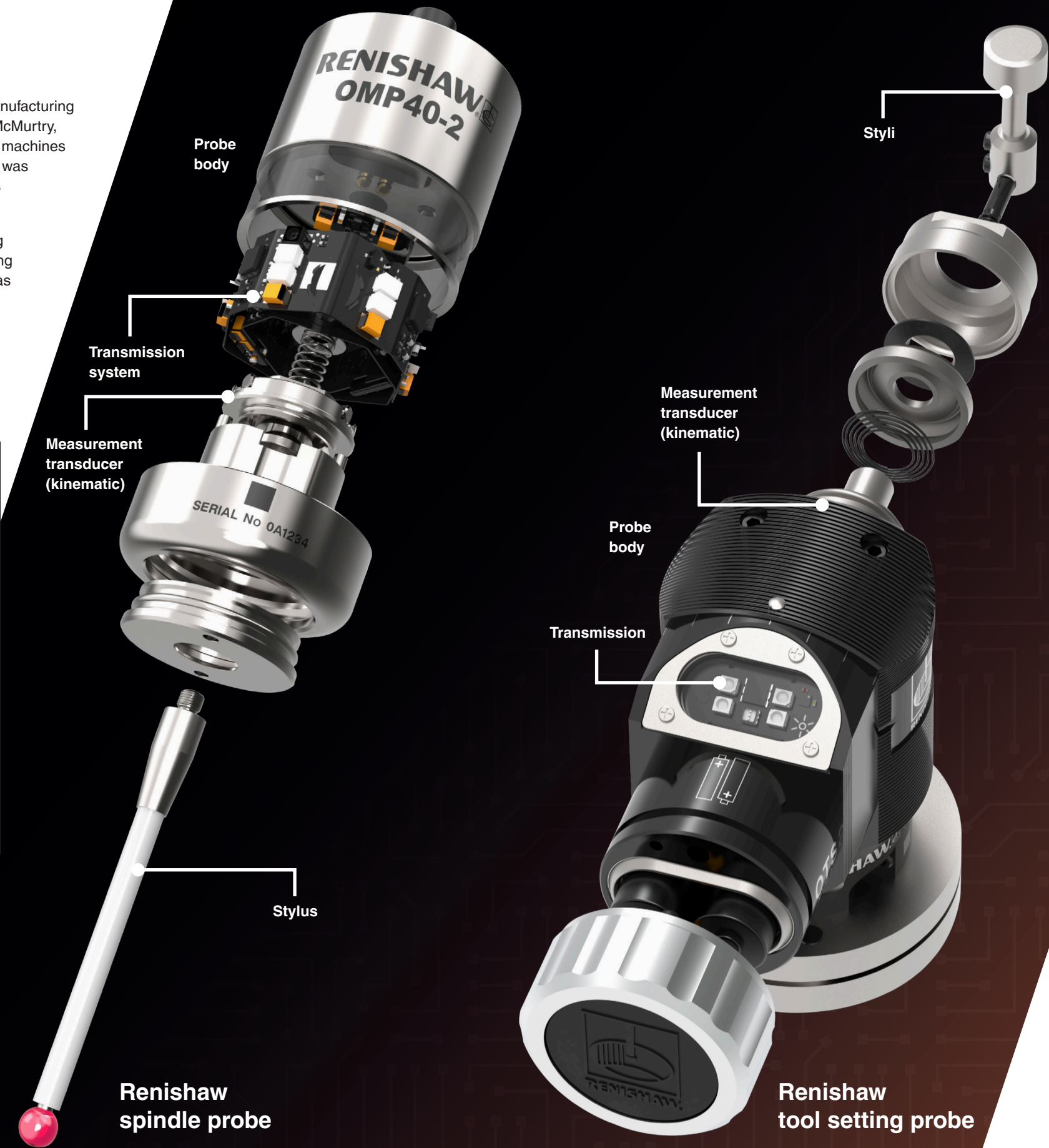
The anatomy of a Renishaw machine tool probe

At Renishaw, we have over 50 years' experience designing, manufacturing and using probing technology. In 1972, our founder, Sir David McMurtry, invented the first touch-trigger probe for co-ordinate measuring machines to solve a dimensional measurement problem that Rolls-Royce was experiencing during the manufacture of its Olympus jet engines – used to power the supersonic Concorde aircraft.

In 1977, we introduced the first dedicated probe for CNC milling machines enabling automated setting and inspection, and paving the way for machine tool process control. Our probes design was revolutionary, and much of it remains in use today, across the globe.

Key elements

- **Probe body:** The probe's robust external housing keeps the internal components safe and functional when exposed to the harsh environment found within a machine tool.
- **Transmission system:** How the probe communicates with the machine tool controller. Renishaw machine tool probes are available with either an optical, radio (battery powered) or hard-wired transmission system.
- **Measurement transducer:** The primary moving element that enables the probe to capture co-ordinate points within the working area of the machine tool. Types of transducers include kinematic, strain gauge or capacitive transducer.
- **Stylus:** The machine uses a stylus to collect data points from the surface of the workpiece or tool, initiating the measurement process.



A probe is an electro-mechanical switch, designed to trigger on contact with a component surface, providing accurate, repeatable geometric data.

Types of Renishaw probes

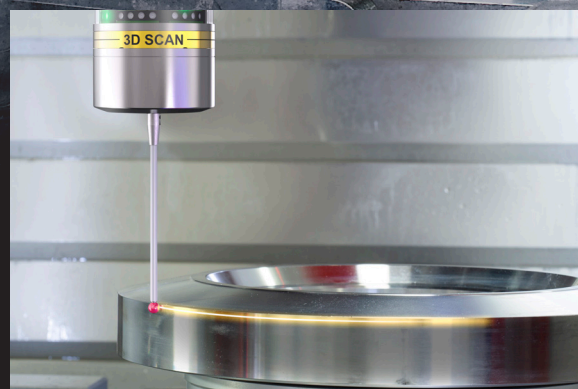
The type of Renishaw probe you need depends on your application. Renishaw produces a wide range of probing systems to greatly enhance any machining process.

Touch-trigger probes

Renishaw produces two types of touch-trigger spindle probes, standard and high-accuracy, which can be used in a broad range of applications.

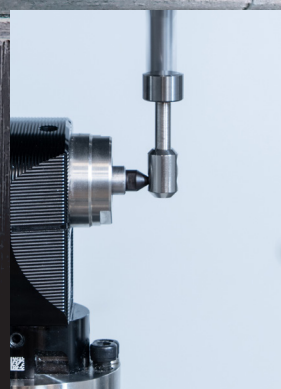
Standard-accuracy probes use a kinematic switch which detects contact between the probe's stylus and a component. When contact is detected, a signal is sent to the machine tool controller via a probe interface.

High-accuracy probes use highly sensitive strain gauges (RENGAGE™ technology), increasing the performance over a standard-accuracy probe. This means you can measure more complex components without compromising on accuracy, and in 3D.



Scanning probes

Scanning probes can be used in the same way as touch-trigger probes, or can have the capability to scan over the component surface with the stylus in constant contact. This allows the probe to capture 1,000 data points per second from the component being measured.



Tool setting probes

Probes used for tool setting are typically attached to the machine table or frame and are commonly referred to as tool setters. Our range includes 'contact' systems, which measure basic lengths and radii and detect broken tools, or 'non-contact' laser-based systems which offer greater precision, functionality, and speed.



For more information about the types of probes Renishaw produce and how a machine tool probe can enhance your process, visit www.renishaw.com/mtp

Types of Renishaw probing software

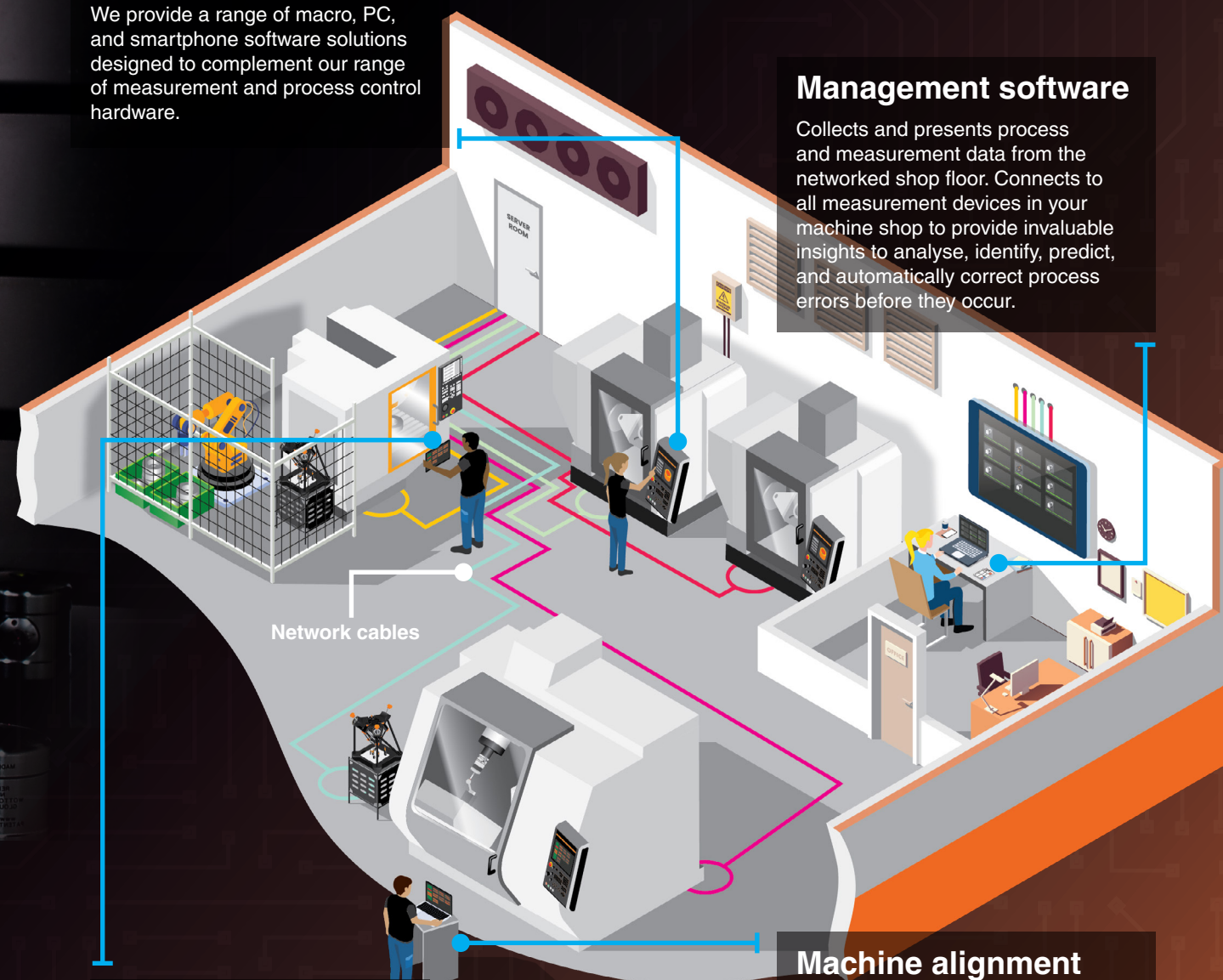
Probing software is required to make the most of your probing hardware. Renishaw offers a comprehensive range of software applications which can be categorised into four main types:

Probing software

We provide a range of macro, PC, and smartphone software solutions designed to complement our range of measurement and process control hardware.

Management software

Collects and presents process and measurement data from the networked shop floor. Connects to all measurement devices in your machine shop to provide invaluable insights to analyse, identify, predict, and automatically correct process errors before they occur.



Reporting software

Designed to display measurement data and production trends either on machine or an external device like a tablet.

Machine alignment check software

Identify poor machine alignments and geometry that can cause extended process setting times and non-conforming parts.

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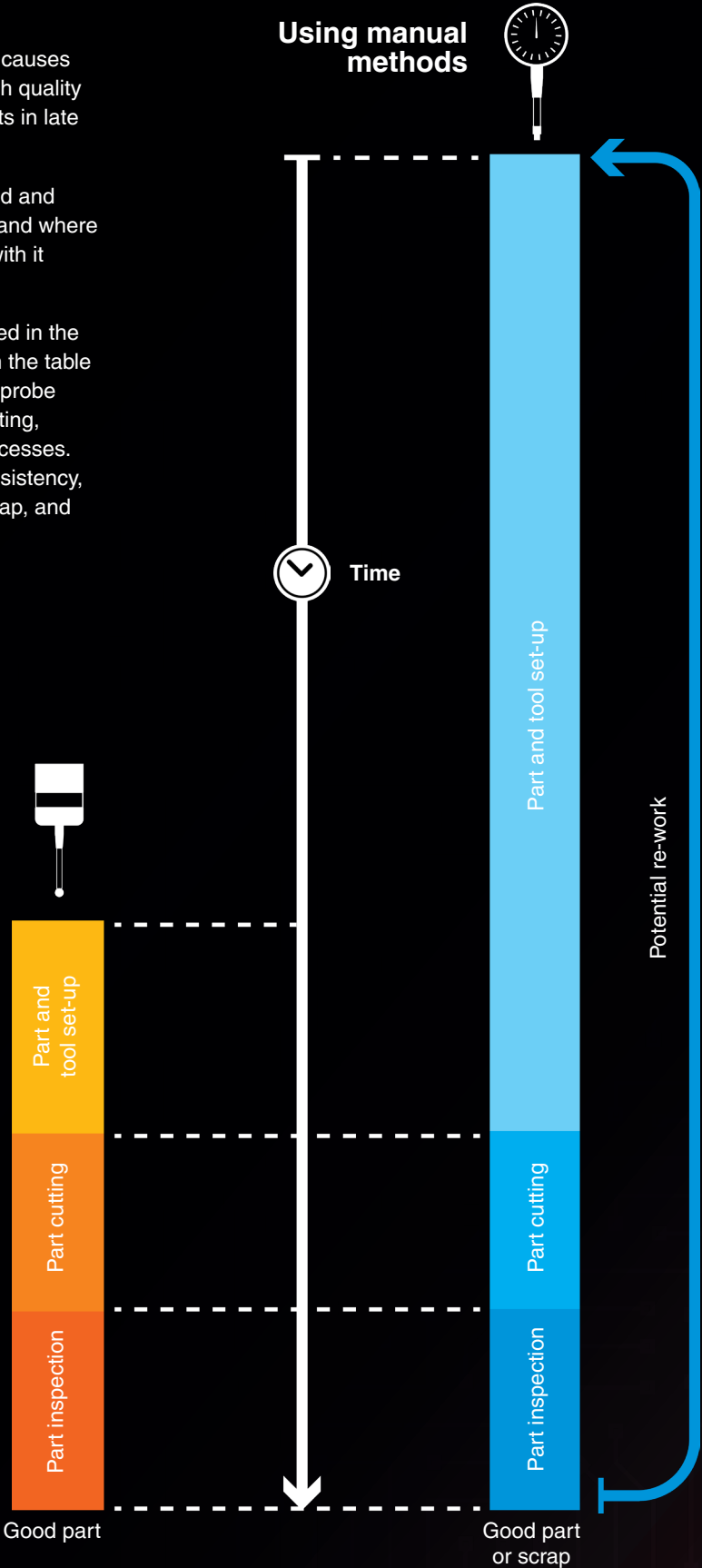
Automate with Renishaw and increase productivity

Process variation is the enemy of competitiveness and profitability. It causes waste and inefficiency, leads to high quality costs and staffing levels, and results in late deliveries and poor traceability.

The secret to consistent, automated and productive machining is to understand where variation comes from and to deal with it at source.

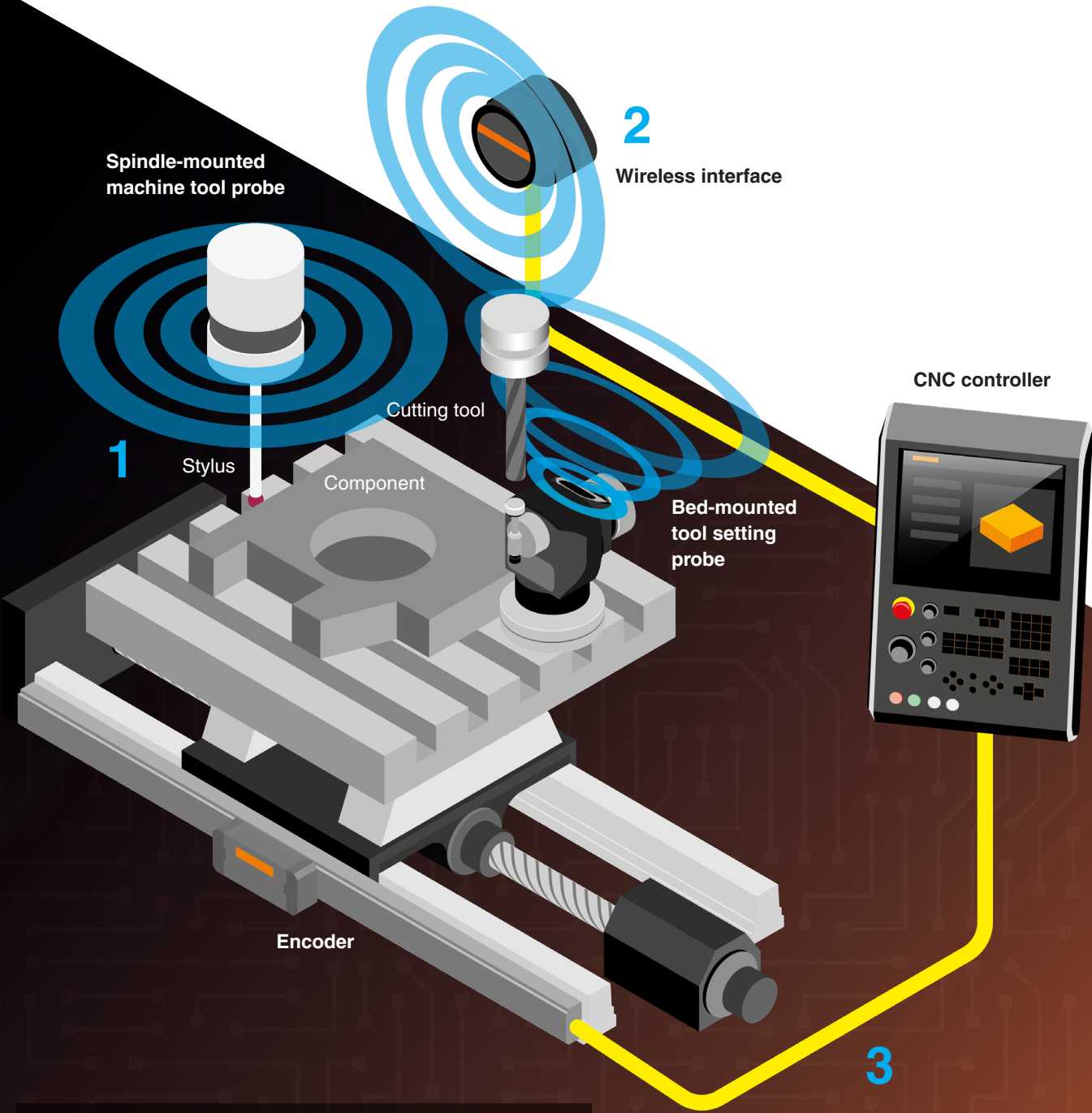
Machine tool probes can be installed in the CNC machine's tool carousel or on the table as a tool setter. Using a Renishaw probe allows automated part and tool setting, eliminating errors from manual processes. This automation improves part consistency, speeds up production, reduces scrap, and saves money.

Using Renishaw products (automated)



How a probe system works

The probes used in this system provide automated workpiece set-up, in-process control, and part verification.



1. The spindle probe or the tool-setting probe is triggered.
2. The probe signals the machine tool controller via an interface (almost simultaneously).
3. The machine tool controller automatically captures the machine tool position via its encoders (feedback system).

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. Renishaw probes facilitate 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.

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.
- Broken tool detection, thermal growth and tool wear.
- 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.
- Automated tool-setting.
- 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.

“ We had good success with the Renishaw tool setters and have since installed them on all our machines. They have been very reliable. ”

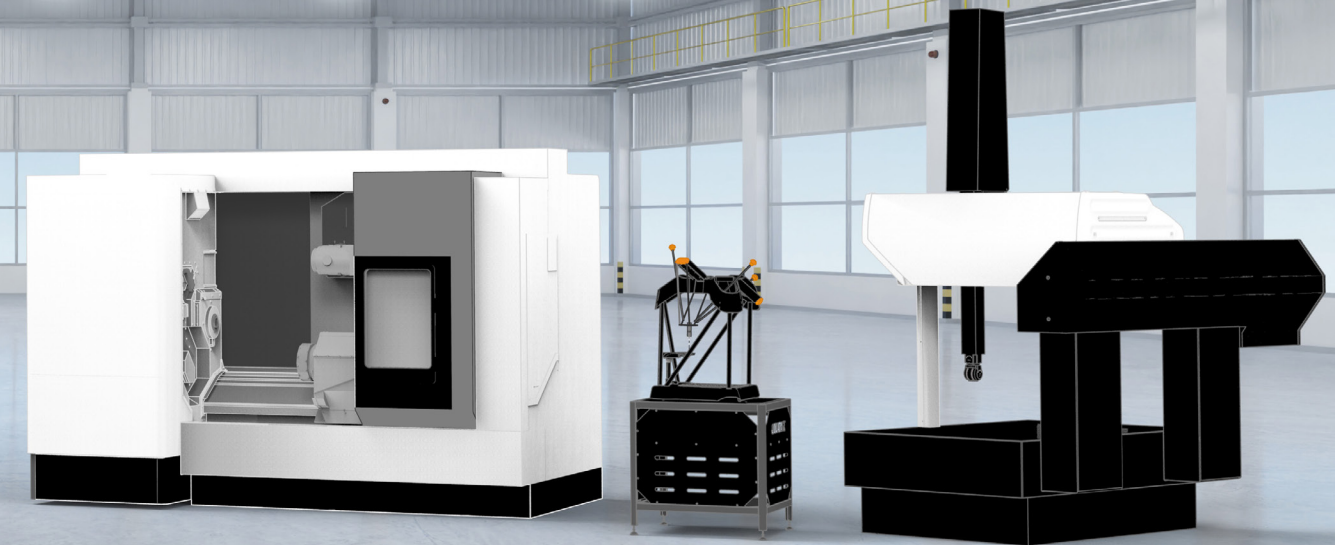
Standard Tool and Mold Inc (Canada)

Renishaw's manufacturing 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 set-up 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 used during the manufacturing and commissioning of 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

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



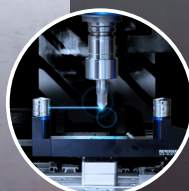
3D touch-trigger tool setters and broken tool detection

For more information, visit
www.renishaw.com/tool-setting



High-accuracy laser tool setting systems

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



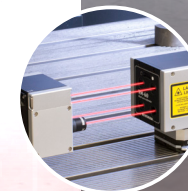
Tool setting arms for lathes and grinding machines

For more information, visit
www.renishaw.com/tool-setters-arms



Machine calibration and optimisation

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



Encoders for position and motion control

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



CMM inspection machines

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



Multi-sensor 5-axis measurement system

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



Shop floor gauging

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



The Renishaw advantage

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



Glossary of terms

Accuracy

The degree to which the result of a measurement conforms to the correct value.

Repeatability

The ability for a probe to consistently reproduce the same measurement under the same conditions, crucial for precision measurements.

Transducer

A device that converts energy from one form to another. In a probe a transducer converts physical quantities into electrical output.

Kinematic

A mechanism that consists of three contact points and an electrical circuit, which together, can detect stylus deflection with high levels of repeatability.

Strain gauge

Converts mechanical strain into an electrical signal by detecting changes in its electrical resistance. This detects stylus deflections at very low trigger forces which is excellent 3D performance and repeatability.

Capacitive transducer

Capacitance difference detected between circuits on two concentric rings are used to measure probe stylus tip deflections.

For a more information about how you can start your automation journey with Renishaw, visit www.renishaw.com/machinetool

Applying innovation since 1973

Renishaw is one of the world's leading engineering and scientific technology companies, with expertise in precision measurement and healthcare.

Our worldwide network of subsidiary companies and distributors provides dedicated global customer support, wherever you are.

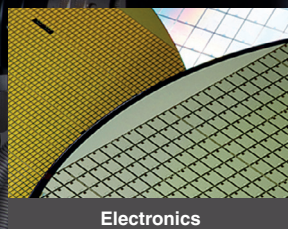
Our principal markets include:



Aerospace



Automotive



Electronics



Energy



Heavy industry



Medical and healthcare



Precision manufacturing



Scientific

www.renishaw.com/machinetool



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