

SPRINT™: MTM Toolkit

Toolkit overview

The SPRINT™ MTM Toolkit offers exceptionally repeatable diameter measurement to machine tool builders who produce Y-axis multi-task machine tools for use in the machining of highly accurate diameters.

Integration of the MTM Toolkit delivers a number of game-changing capability enhancements – most notably a highly repeatable diameter measurement cycle. When used with the required artefact, this unique cycle (patents applied for) is not affected by thermal changes to the machine structure or the on-centre error of the component. It provides users with the potential for extremely accurate automatic ‘cut-measure-cut’ operations with tolerances of a few microns.

The MTM Toolkit consists of two elements:

- An on-machine executable element comprising a series of software cycles, including specialised calibration routines for nodding head machines, which are executed through the Productivity+™ CNC plug-in software.
- Engineering support – provided by Renishaw to the machine tool builder – allowing integration of the cycles and artefacts into machine designs.

The supplied cycles, which are programmable using G-code, control the OSP60 SPRINT probe during diameter measurements on a reference artefact and the workpiece. Workpiece measurements are automatically compensated using the reference artefact measurements, thereby minimising thermal effects on the CNC machine tool. Returned measurement results are stored to user variables on the CNC machine tool control, allowing them to be used for Go/No go checks or for updating tool parameters within the NC program.

The cycle takes advantage of the unique 3D scanning capability of the SPRINT system to collect measurement data from every part of the component surface whilst rotating the part and interpolating the machine axes simultaneously. This reduces measurement variation from component form and machine positioning.



Target industries and applications

Industries

The SPRINT MTM Toolkit provides game-changing capability to manufacturers in industries that require high accuracy turned components, such as aerospace, automotive, oil and gas, and power generation.

Applications

The MTM Toolkit, suitable for integration into multi-tasking machine tools where the machine can travel across the spindle axis, for example Y-axis lathes, is designed to provide precision diameter measurement and is particularly suitable for components of 150 mm and larger, where thermal effects have an influence on measurement results obtained.

Benefits

The principal benefits of the SPRINT MTM Toolkit are:

- A highly repeatable diameter measurement, independent of machine axis drift and off-centre errors caused by thermal effects.
- Enables manufacturing tolerances of a few microns, capable of $\pm 1 \mu\text{m}$ measurement repeatability.
- On-machine measurement of diameter, part run-out, machine centrelines and circularity, eliminating diameter errors caused by machine axis drift or off-centre errors.
- Results saved to CNC user variables allowing use as a Go/No go check, or for updating tool parameters within the NC program.
- Enables completely new 'cut-measure-cut' processes based on automatic closed loop process control capabilities, removing the need for tool length updates based on manual measurements of turned diameters.
- The use of standard machine tool G-code language allows programming to be performed on the CNC machine tool or from any CAM package.

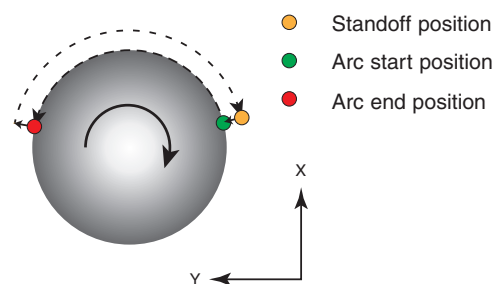
Technology overview

The single-sided diameter measurement cycle within the SPRINT MTM Toolkit provides unique measurement capability.

The measurement itself comprises an arc move in the XY plane, with simultaneous spindle rotation to produce a measurement over multiple revolutions of the component. Start and end positions of the arc move are automatically calculated to give the maximum angular sweep, given the nominal diameter, and the known X and Y stroke of the machine – defined as the stroke angle.

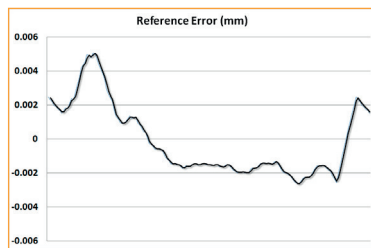
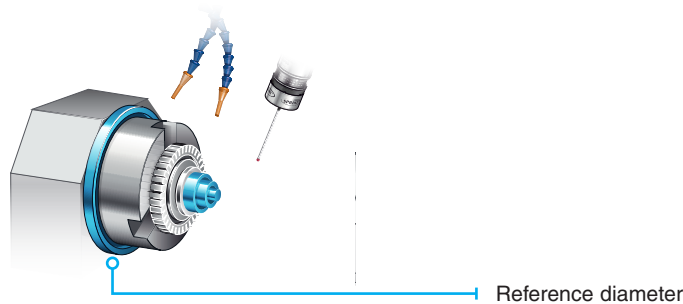
Using this move, measurements are taken over the entire surface of the rotating part profile, giving full feature information. Every point along the rotating profile is measured multiple times, allowing averaging of the measured points to reduce measurement noise.

By measuring the diameter over the stroke angle of the machine, measurement is exercised across a volume of the machine, which in turn effectively eliminates volumetric errors.

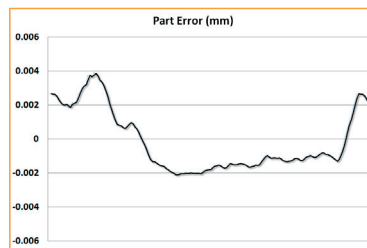


Highly repeatable measurements are made possible through the use of a reference artefact, which reduces thermal effects over time, giving results that are repeatable enough to be used in closed loop 'cut-measure-cut' operations.

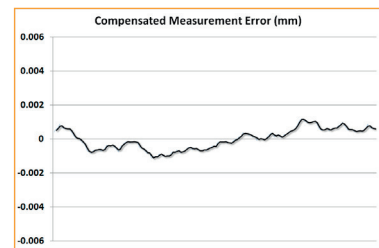
The use of coolant during all measurement is recommended to provide better thermal stability of the measured parts, and to reduce stylus pick up and wear.



Reference measurement error



Part measurement error



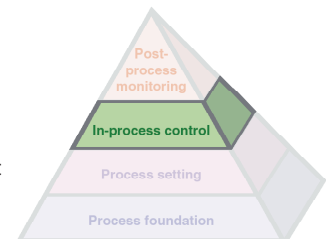
Compensated measurement

Productive Process Pyramid™

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

Renishaw's Productive Process Pyramid™ provides a framework within which to identify and control variation in your factory, backed by innovative technology, proven methods and expert support.

The Productive Process Pyramid shows how layers of control can build upon one another to systematically remove variation from the machining process, increasing throughput, maximising conformance and eliminating human error.



The SPRINT MTM Toolkit addresses issues relating to the in-process control layer of the Productive Process Pyramid.

- Within the **active layer** the MTM Toolkit can be used to determine highly accurate diameter measurements.

Requirements and compatibility

Requirements

To use the SPRINT MTM Toolkit you need:

- SPRINT system installation on the CNC machine tool.
- SPRINT MTM Toolkit on-machine installation.

Compatibility

The SPRINT MTM Toolkit is compatible with multi-tasking machine tools, including nodding head machine configurations which are fitted with a compatible controller.

Certain controller options are also required in order to use this Toolkit.

For more information on these options, refer to the range of SPRINT™ system controller requirements documents available from Renishaw.

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A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Products include:

- Additive manufacturing, vacuum casting, and injection moulding technologies for design, prototyping, and production applications
- Advanced material technologies with a variety of applications in multiple fields
- Dental CAD/CAM scanning and milling systems and supply of dental structures
- Encoder systems for high accuracy linear, angle and rotary position feedback
- Fixturing for CMMs (co-ordinate measuring machines) and gauging systems
- Gauging systems for comparative measurement of machined parts
- High speed laser measurement and surveying systems for use in extreme environments
- Laser and ballbar systems for performance measurement and calibration of machines
- Medical devices for neurosurgical applications
- Probe systems and software for job set-up, tool setting and inspection on CNC machine tools
- Raman spectroscopy systems for non-destructive material analysis
- Sensor systems and software for measurement on CMMs
- Styli for CMM and machine tool probe applications

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