SPRINT™: Machine Health Check

Application overview

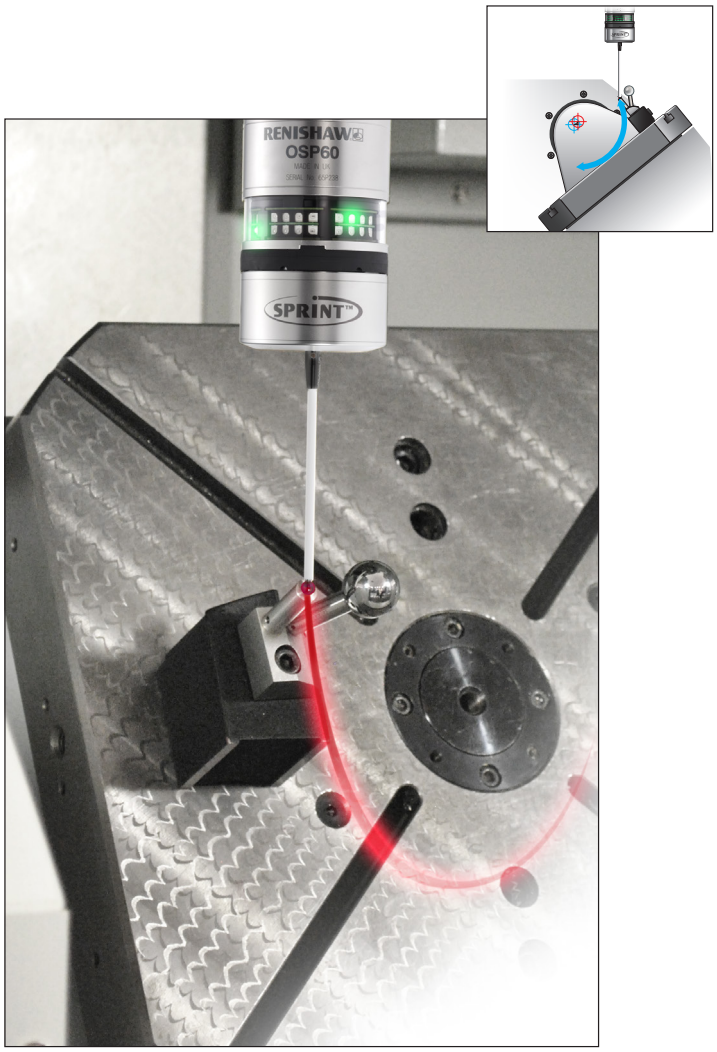
The SPRINT™ Machine Health Check application provides a unique solution for end-users and machine tool builders who are looking to design sustainable machining processes on 3-axis and 5-axis table/table milling centres.

This application allows machine tool performance verification in less than one minute using a simple test based on the exceptionally accurate measurement capability of the SPRINT system.

Fast enough to be used automatically prior to machining – in order to detect warm-up issues or any other previously unidentified problems – the application can also be used as part of a regular maintenance regime, to provide long-term sustainability and monitoring of manufacturing processes.

The Machine Health Check application comprises tests for 3-axis and 5-axis machine tools.

- The linear test – for 3-axis machines – performs a simultaneous X, Y, Z sphere measurement and stores a calculated form error to a CNC variable. This test can be considered comparable to a ballbar test performed over a small volume of the machine.
- The kinematic test – for 5-axis machines – uses a unique ball in cone concept where the probe locates into a cone feature. This test checks the relationship between the CNC kinematic model and the real machine condition, storing new kinematic centres to CNC variables. The test also reports the deviation from ideal kinematic, allowing traceability of linear axes and use as a Go/No go check.



The SPRINT™ Machine Health Check application is one of a range of industry focused applications developed by Renishaw for use with the SPRINT system. For more information on these applications, see www.renishaw.com/sprint

Target industries and applications

Industries

The SPRINT Machine Health Check application provides game-changing capability for companies in all high-value manufacturing sectors, such as medical, aerospace, mould and die, and power generation.

Applications

The SPRINT Machine Health Check application is designed for end users with 3-axis and 5-axis table/table milling machines.

The technology provided by the application is particularly suitable for the collection of data to determine machine capability and to assist in planned maintenance activities.

This data can assist end users working with expensive materials to ensure that a machine is in a suitable condition to manufacture the required component, and machine tool builders who are looking to provide long term machine condition monitoring, sustainable processes and self monitoring.

Benefits

The principal benefits of the SPRINT Machine Health Check application are:

- A health check routine requiring minimal operator intervention and with the potential for full automation.
- A test which is fast enough to be run before machining commences to detect warm up and other unidentified problems.
- Results which provide an immediate Go/No go decision, and are written to user variables for future reference or integration into reporting processes and process control tests.
- Machine verification for sustainable processes, for both machine tool builders and end users.

Technology overview

The SPRINT system provides unique capability in comparison with other machine health checking devices. As the SPRINT probe is already in the CNC machine tool changer, the Machine Health Check application is always available, ready to be run. It can be integrated into a CNC machining cycle, ensuring the test is performed exactly when it is needed – just before machining. It complements perfectly the extended diagnostic capabilities of Renishaw's QC20-W ballbar.

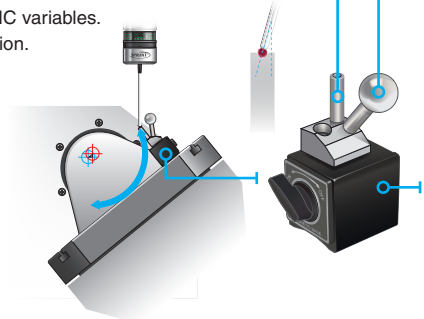
The machine pivot point check uses a special inverted cone artefact. The stylus ball of the OSP60 SPRINT probe is positioned into the cone and it automatically centres itself within the cone. As the machine moves, the deviation between actual and calculated positions is recorded in 3D by the SPRINT system and the centre errors are reported in machine variables. The entire test is complete in less than one minute and can be performed automatically to ensure machine capability prior to cutting metal.

For machines with three axes only, or for a specific test of machine linear axis capability, a linear check is performed using a special toolpath on a calibrated sphere. This test also takes less than one minute.

The results of both tests are written to CNC variables, allowing an instant Go/No go decision and undisturbed machine operation, giving the operator confidence in the machine's ability to meet the required tolerance for the workpiece.

Kinematic test (5-axis machines)

- Uses 'ball in cone' concept.
- Checks relationship between CNC kinematic model and real machine condition.
- New kinematic centres stored to CNC variables.
- Tests linear axis for Go/No go decision.



Linear test (3-axis machines)

- Performs checks in X, Y and Z on a sphere.
- 'Form error' stored to CNC variable.

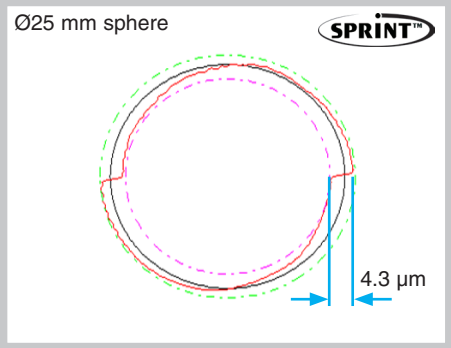
Artefact

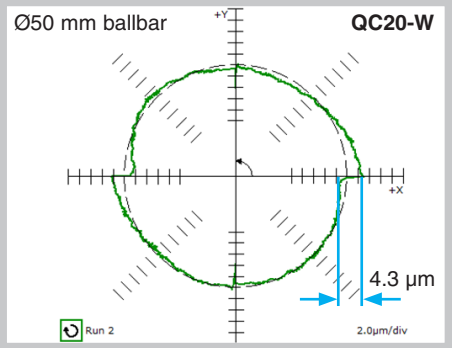
- Mounted on a magnetic base for ease of placement.
- Contains a calibrated sphere and dedicated cone artefact.
- Cone depends on stylus ball size, and is replaceable.

Machine Health Check capability

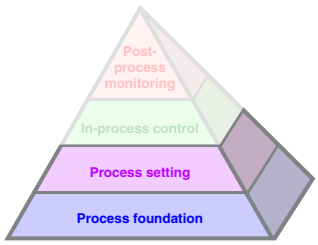
Representative data captured during SPRINT system testing shows that Machine Health Check results are comparable to ballbar results data.

Using a 25 mm diameter sphere, test results from the SPRINT Machine Health Check cycle (linear test) are indicative of performance capability over this machine volume. In addition to allowing an instant Go/No go decision, the results obtained could prompt further investigation using a Renishaw QC20-W ballbar system.





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 Machine Health Check application addresses issues relating to the bottom two layers of the Productive Process Pyramid.

- Within the **predictive layer** the application can be used to perform a test immediately before machining to determine machine capability, ensuring that the machine is fit for purpose.
- Within the **preventative layer** the application can be used as part of a regular machine monitoring programme to quickly indicate problems with the CNC machine tool.

Requirements and compatibility

Requirements

To use the SPRINT Machine Health Check application you need:

- SPRINT system installation on the CNC machine tool.
- SPRINT Machine Health Check: on-machine installation. Includes reference artefact: a calibrated sphere, and a cone artefact which is paired to the stylus ball size.[1]

Compatibility

The SPRINT Machine Health Check application is compatible with 3-axis and 5-axis table/table configuration machines fitted with a compatible controller.

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

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

[1] Provided as part of the Machine Health Check application, as standard, these artefacts are mounted on magnetic bases for easy replacement. It is possible for them to be permanently mounted, or for unique artefacts to be created for a specific installation, for example, machining drill points (cones) into an existing fixture on the machine.

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About Renishaw

Renishaw is an established world leader in engineering technologies, with a strong history of innovation in product development and manufacturing. Since its formation in 1973, the company has supplied leading-edge products that increase process productivity, improve product quality and deliver cost-effective automation solutions.

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

Products include:

- Additive manufacturing and vacuum casting technologies for design, prototyping, and production applications
- Dental CAD/CAM scanning 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

For worldwide contact details, visit www.renishaw.com/contact

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