

Quickly diagnose the performance of your machine tools



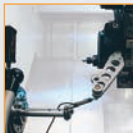
Reduces down-time & costs

Reduces both machine down-time and maintenance costs



Compliance

Full compliance with ISO, ASME and JIS machine performance standards



Predictive maintenance

Forms the basis of predictive maintenance programs



Quickly diagnose the performance
of your machine tools

Get a Renishaw QC10 ballbar, get control!

The problems

- Inspection failures
- Scrapped components
- Wasted time
- Reduced productivity
- Quality crisis

Before you blame . . .

- The tooling
- The drawing
- The inspection
- The part program
- The machine operator

. . . maybe your machines are at fault!

The quality of every component produced on a CNC machine is highly dependent on the machine's performance. Problems with a machine inevitably result in inspection failures, scrapped components and unexpected down-time.

All too frequently, quality and inspection procedures only identify problems after components have been produced. However, this is often too late to avoid any of the incurred scrap and down-time costs.

For this reason, it is ESSENTIAL that your machine performance is checked before component manufacture.



QC10 ballbar kit with Zerodur® calibrator

The solution

Renishaw's QC10 ballbar offers you the perfect solution. A quick 10 minute test* is all that is required to assess the positioning performance of your machine.

The Ballbar 5 software guides you through the dynamic circular test, analysing your machine's performance in accordance with ISO, JIS and ASME standards, as well as Renishaw's own reports. In addition, advanced mathematical techniques are used to identify the specific error sources on your machines.

Take the guesswork out of your machine's performance. The QC10 ballbar system provides you with a quick and effective solution to evaluate machine performance, and actually helps you to improve it through targeted maintenance.

- Verify machine performance
- Achieve manufacturing tolerances
- Grade and compare machines
- Test and monitor machine condition
- Predict maintenance requirements
- Check new machines at commissioning

QC10 ballbar kit

The quickest, easiest and most effective way to monitor machine tool condition. The ballbar kit provides a complete, powerful and portable solution – just add a PC and go!

*Based on typical feedrates and test radius.

Accurate

When used with the Zerodur® calibrator, the QC10 ballbar measures the absolute radius of the tested tool path. The ballbar can be used to diagnose pitch errors, thermal distortion, scaling errors and radial deviation (ISO 230-4 and B5.57). In addition the software will automatically calculate the positional tolerance of the machine.



Who can benefit?

- End users
- Distributors
- OEMs
- Service and maintenance contractors

Where can you benefit?

- Production
- Maintenance
- Engineering
- Management
- Quality
- Sales and Marketing

With a QC10 Ballbar system it only takes 10 minutes to diagnose the fault

1. Set-up



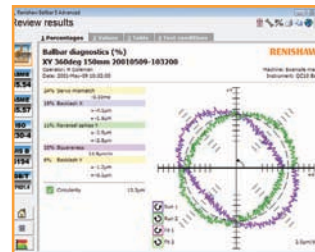
- Set-up is quick and easy.
- The QC10 ballbar is mounted between two repeatable magnetic joints.
- A simple G02 and G03 command program is used for the test.

2. Capture



- The machine performs two consecutive circular arcs. One test is in the clockwise direction, the other in the counter-clockwise direction.
- The QC10 ballbar accurately measures any variations in radius during the test.

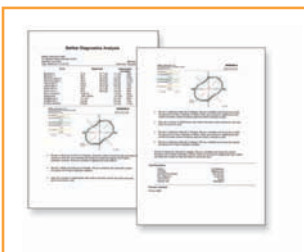
3. Analyse



- QC10 ballbar data is sent directly to a PC via a standard RS232 cable*.
- Renishaw's Ballbar 5 HPS software analyses the data in accordance with ISO 230-4, ANSI B5.54, B5.57, or JIS B 6190-4 standards.



6. Report



- Professional reports can be generated for easy future reference.
- Implement predictive maintenance programs by regularly tracking a machine's performance.

5. Fix



- Pinpointing specific machine faults enables efficient, targeted machine maintenance, minimising downtime.
- The on-line manual explains the possible causes of machine error and offers advice on how best to fix them.

4. Diagnose

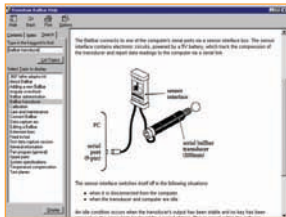


- Powerful software analysis enables diagnosis of specific machine errors.
- Each error is ranked according to its significance to overall machine accuracy.
- Overall machine performance is graded with a value of circularity.

* Optional USB adaptor available.

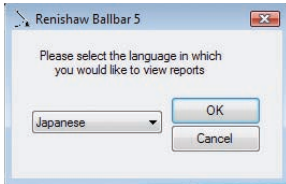
Quickly diagnose the performance
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Measurement and diagnosis software



Integrated manual

Integrated manual, with hotlinks and search.



Multilingual support

Ballbar 5 allows multi-language report generation as well as a choice of operating language.**

Ballbar 5 HPS* software

Ballbar 5 HPS is a Microsoft® Windows® operating system and Windows Vista™ compatible software package for machine tool performance analysis. Just like the QC10 ballbar, Ballbar 5 HPS software is powerful and easy to use. The simple interface and step-by-step instruction means you can be using the system in minutes.

Key features are:

- Easy to use Windows XP operating system or Windows Vista™ interface
- Live data capture
- Analysis and display of test data in accordance with the latest ISO 230-4, JIS B 6190-4 and B5.57, B5.54 standards as well as extensive Renishaw analysis
- Automatic feedrate calculation
- Positional tolerance value analysis
- Comprehensive, hyperlinked manual with hotlinks and search
- Multilingual support

Despite such powerful features you only have to use those you need, with three different user modes.

Quick check - Use for one-off testing of machines with differing set-ups.

Operator - Use for regular comparative testing of a machine's condition. Pre-defined test templates speed up the machine check and ensure consistency of set-up.

Advanced - Full access to set-up, edit and organise machine data.

Key functions of Ballbar 5 HPS software are:

- Machine history - Review machine performance over time in graphical format
- Part program generator - Quickly and automatically generate ballbar test part programs
- Ballbar plot simulator - Predict effect of maintenance and tuning on machine performance

Machine history



The machine history function allows you to build and review a test history for any specific machine. Just choose a test template and then select some or all of the tests in the machine folder.

The machine history function then allows the variations in the performance of your machine over time to be displayed graphically, using any of the standard report values.

You can clearly see how your machine's performance has varied and can even "interrogate" individual plot points back to the original test report and polar graph.

New for 2008 is a combined history plot which shows the independent circularity values for all parameters over time. This is a very useful "first stop" in reviewing the performance history of a machine and the relative importance of the errors that are present.

* HPS (History Programmes Simulator)

** Available in English, German, French, Italian, Spanish, Japanese, Czech, Korean and Russian.

Windows® is a registered trademark of Microsoft Corporation in the United States and other countries.

Measurement and diagnosis software

Machine history allows you to:

- See how machine performance is degrading with use
- Predict maintenance requirements in advance to reduce unscheduled downtime
- Compare performance before and after a crash to pinpoint corrective maintenance requirements
- Review the effects of maintenance and service adjustments as they are carried out
- Assess machine history to spot recurring problems, and the effectiveness of previous fixes

In short, compile a complete “medical record” for your machine!

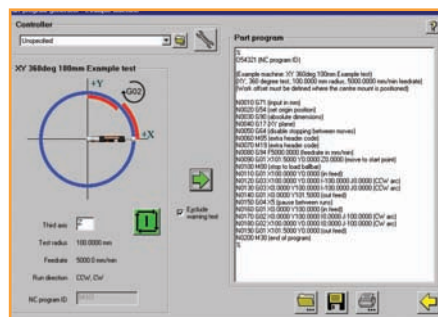


The software also allows you to:

- Set individual warning and failure performance tolerances for each machine characteristic
- Get instant notification, during the ballbar test, if a machine's performance exceeds these tolerances

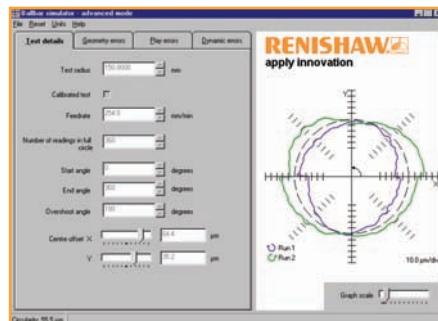
Part program generator

This facility allows the automatic generation of a part program for the specific ballbar test. To create a part program, all the user has to do is define a ballbar test, or select an existing test template, select a pre-defined CNC controller definition and then click the “generate” button.



The part program generated can be reviewed on-screen prior to printing or exporting to a removable storage device, for transfer to the machine tool.

Ballbar plot simulator



This is a powerful tool to aid decisions on corrective action or maintenance prediction. The simulator allows the user to see his test results on screen and then to change various machine geometry, play and dynamic parameters to see “what if” results on the ballbar plot and circularity and positional tolerance values. The original test results are maintained separately and cannot be corrupted, no matter what scenarios are played out in the simulator.

Ballbar 5 HPS availability and compatibility



Ballbar 5 HPS software comes as standard with all new QC10 ballbar kits and is just the answer for users with Windows® operating systems.

Minimum computer requirements:

- Microsoft® Windows® XP (SP2) or Windows Vista™ compatible
- Minimum screen resolution 800 x 600 pixels
- CD-ROM drive
- One RS232 port or USB to RS232 adaptor required for USB only PCs

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Test a wide range of machines

Flexible and easily adaptable

The QC10 ballbar is an extremely versatile tool designed to be used on a large variety of machines. The standard system can be used to test 3-axis CNC machines such as horizontal and vertical machining centres. With the addition of other accessories detailed below, the QC10 ballbar can also be used to test a much wider range of machines.

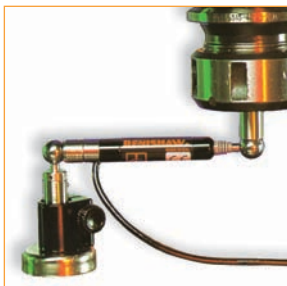
For 2-axis CNC applications, a special retractable centre mount, the VTL adaptor, is used. This enables typical 2-axis machines such as pick and place machines, laser cutting machines and vertical turning lathes etc, to benefit from QC10 ballbar diagnosis.

The 360° lathe adaptor enables the QC10 ballbar to be used on a wide range of CNC lathes. As with machining centres, it also allows a full diagnosis of lathe capabilities to be performed.

To address smaller machines, the small circle accessory kit allows testing of CNC machines with shorter axis travel. Additionally, it can help to give an enhanced analysis of servo control systems on most types of machines.

System specification

Resolution	0.1 μm (4 μin)
Ballbar sensor accuracy	$\pm 0.5 \mu\text{m}$ (at 20 °C) $\pm 20 \mu\text{in}$ (at 68 °F)
Maximum sample rate	250 values per second
Extension bars	50 mm, 150 mm, 300 mm
Operating range	0 °C - 40 °C (32 °F - 104 °F)
Calibrator accuracies (at 20 °C)	$\pm 1 \mu\text{m}$ (50 mm) $\pm 1 \mu\text{m}$ (100 mm) $\pm 1 \mu\text{m}$ (150 mm) $\pm 1.5 \mu\text{m}$ (300 mm)



QC10 ballbar



VTL adaptor



360° lathe adaptor



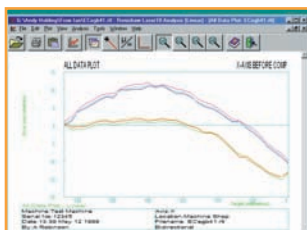
Small circle accessory kit

Understanding machine performance - integrating performance testing and calibration using QC10 and XL-80

Machine calibrations

Typically, laser machine calibrations are performed on an annual basis. Using the new XL-80 laser measurement system, or superseded ML10 laser measurement system, to gather a comprehensive view of all the geometric and dynamic characteristics of a machine, means that information obtained can be used to decide required machine maintenance. However, machine performance can vary significantly throughout a year, particularly if the machine has crashed or has been moved. Therefore, annual calibrations should ideally be supplemented by regular interim machine performance checks. The QC10 ballbar provides the ideal quick and simple check.

1. Perform full laser calibration



Perform a full laser calibration test, measuring all geometric, positioning and motion characteristics for each axis. Compensate or repair as appropriate.

2. Benchmark with a ballbar



Immediately benchmark the calibration with the QC10 ballbar test on machine tools. The quick tests are now linked to the comprehensive laser calibration.

3. Regularly re-check machine

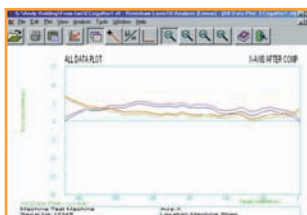


Re-check the machine with the QC10 ballbar at regular weekly or monthly intervals, following machine relocation or machine crash, or when parts begin to drift from tolerance.

Regular pre-planned checks enable a machine's performance to be charted over time and future accuracy problems to be intelligently predicted through trend analysis.

Using Ballbar 5 HPS software users can review a series of tests via the machine history function.

5. Repair, and re-calibrate with a laser



After maintenance work, the machine can be re-calibrated using the XL-80 laser measurement system. At this point it is possible to refer back to stage 2 to repeat the cycle.

4. Pinpoint problem areas



If overall machine accuracy falls below an acceptable level, use the QC10 diagnostic software to analyse and pinpoint problem areas.

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Renishaw applies innovation to provide solutions to your problems

Renishaw is an established world leader in metrology, providing high performance, cost-effective solutions for measurement and increased productivity. A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Renishaw designs, develops and manufactures products which conform to ISO 9001 standards.

Renishaw provides innovative solutions using the following products:

- Probe systems for inspection on CMMs (co-ordinate measuring machines).
- Systems for job set-up, tool setting and inspection on machine tools.
- Scanning, digitising and dental systems.
- Laser and automated ballbar systems for performance measurement and calibration of machines.
- Encoder systems for high accuracy position feedback.
- Spectroscopy systems for non-destructive material analysis in laboratory and process environments.
- Styli for inspection and tool setting probes.
- Customised solutions for your applications.

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