

Product
Serial number
Date of calibration

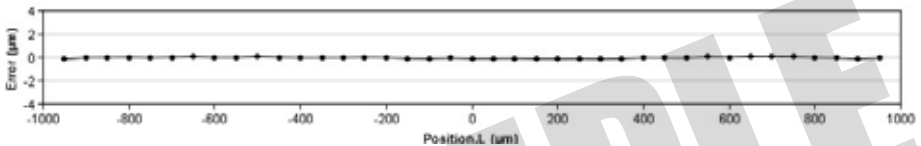
QC20
6KFY77
23 September 2024



Calibration certificate

Specified accuracy of Ballbar measuring radial variation of the machine tool $\pm[0.7 + 0.3\%*L] \mu\text{m}$
 Where *L* is the absolute value of Ballbar sensor measured range

Measured values and uncertainties of calibration



Results	Value
Maximum error over full range $\pm 1000 \mu\text{m}$:	$\pm 0.13 \mu\text{m}$
Uncertainty of measurement (95% confidence level, $k=2$):	$\pm 0.40 \mu\text{m}$

Environmental conditions (nominal)	Value
Air temperature:	20.4 °C
Pressure:	998 mbar
Relative humidity:	47.7 %RH

Reference standards	Ref. no.	Certificate no.	Calibration date
XL-80	10R887	10R887-240130-00	30 January 2024
XC-80	43K582	43K582-240708-00	08 July 2024
Renishaw XC Air Temperature Sensor	23P560	23P560-240406-00	06 April 2024
Test procedure	WI-100198		

Authorised signature	Signatory	Position	Issue date
	Dave Wall	Director & General Manager	26 September 2024

This certificate may not be reproduced other than in full, except with the prior written approval of:

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**Certificate number
6KFY77-240923-00**

L-8014-1606-03

Calibration notes

- 1. Lasers (XM, XL, ML, HS and RLU)** are calibrated by comparison to a reference HeNe laser using an optical beat frequency technique. Reference lasers are routinely calibrated against an iodine-stabilised HeNe laser supplied by the National Physical Laboratory (NPL), or by a national standards laboratory. All frequency measurements are taken over a 1 hour period.
- 2. Air pressure and relative humidity (RH) sensors are installed in a compensator (XC and RCU).**
The air pressure sensors are calibrated over 650 mbar to 1150 mbar range in a temperature controlled oven by direct comparison with a reference pressure meter. The RH sensors (where fitted) are certified by the manufacturer to be within specification. They are calibrated by comparison of the readings with those from a reference RH meter at a single applied humidity.
- 3. Air and material temperature sensors (XC and RCU)** are calibrated by direct comparison with transfer platinum resistance thermometers (PRTs) in a temperature controlled water bath over 0 °C to 40 °C (50 °C for material sensor). The transfer PRTs are routinely calibrated against reference PRTs.
- 4. Rotary axis calibrators (XR20)** are calibrated using a HeNe laser angular interferometer.
- 5. Ballbar transducers (QC20 and QC10)** are calibrated using a HeNe laser interferometer. The scale factor (QC10 only) is calculated and must be entered into the Renishaw application software prior to use.
- 6. Ballbar calibrators** are calibrated by direct comparison with a reference ballbar calibrator (calibrated by a national standards laboratory) using a reference ballbar as a transfer standard. The measured values for the ballbar calibrator must be entered into the Renishaw application software prior to use.
- 7. Traceability.** All the reference standards (listed overleaf) used in these calibrations are traceable either directly to major international metrology institutes who have signed the CIPM Mutual Recognition Agreement (e.g. NPL: UK; LNE: France; NIST: USA; PTB: Germany; NMIJ: Japan) or to a national accreditation body (e.g. UKAS: UK; A2LA: USA).
- 8. Environment.** The equipment used for calibration is in a facility held between 15 °C and 25 °C.
- 9. Uncertainty calculations.** The uncertainty calculations have been carried out according to the European Co-operation for Accreditation document EA-4/02.
- 10. Quality accreditation.** All calibrations above are covered by Renishaw's ISO 9001 quality assurance system. The system is audited and certified by an accredited agency.
- 11. Re-calibration.** Customers may wish to confirm that systems are performing within published specifications over time. If so, it is recommended that they should be periodically re-calibrated. Please note that compensators and temperature sensors are re-calibrated only at a single applied temperature, air pressure and humidity. Please refer to the appropriate system manual for further details.