

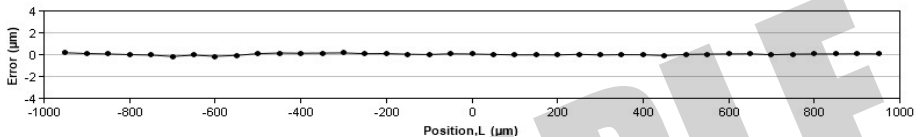
Product **QC20**
 Serial number **3XY232**
 Date of calibration **18 January 2022**



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 $\pm 1000 \mu\text{m}$:	$\pm 0.17 \mu\text{m}$
Uncertainty of measurement (95% confidence level, k=2):	$\pm 0.40 \mu\text{m}$

Environmental conditions (nominal)	Value
Air temperature:	20.2 °C
Pressure:	973 mbar
Relative humidity:	52.3 %RH

Reference standards	Ref. no.	Certificate no.	Calibration date
XL-80	0YHR91	0YHR91-211118-00	18 November 2021
XC-80	2LW533	2LW533-210804-00	04 August 2021
Renishaw XC Air Temperature Sensor	23F739	23F739-210804-00	04 August 2021
Test procedure	WI-10733		

Authorised signature	Signatory	Position	Issue date
	Chris Hunt	General Manager	03 February 2022

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Certificate number
3XY232-220118-00

L-8014-1606-03

Calibration notes

- 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.
- 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.
- 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.
- Rotary axis calibrators (XR20)** are calibrated using a HeNe laser angular interferometer.
- 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.
- 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.
- 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).
- Environment.** The equipment used for calibration is in a facility held between 15 °C and 25 °C.
- Uncertainty calculations.** The uncertainty calculations have been carried out according to the European Co-operation for Accreditation document EA-4/02.
- 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.
- 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.