

**Product** XC material temperature sensor  
**Serial number** 077F74  
**Date of calibration** 25 September 24  
**Customer name**  
**Customer address**  
**Customer reference**



# Calibration certificate

**Specification**                      **Material temperature sensor accuracy**                       $\pm 0.10\text{ }^{\circ}\text{C}$

**Measured values and uncertainties of calibration**

Time (mins)	Material temperature ( $^{\circ}\text{C}$ )		
	Reference	Measured	Error
0	23.53	23.48	-0.05
10	23.52	23.48	-0.04
20	23.52	23.48	-0.04
30	23.53	23.49	-0.04
40	23.52	23.48	-0.04
50	23.53	23.48	-0.05
60	23.54	23.48	-0.05
Mean error			-0.04
Uncertainty (k=2)			0.07

Reference standards	Ref. no.	Certificate no.	Date
XC material temperature sensor	22T157	22T157-240108-00	08 January 24
Test Procedure	PT-50304-01		30 January 09

**Laser measurement system accuracy:** When a Renishaw XL-80 laser is used with a Renishaw XC-80 compensator and a Renishaw air temperature sensor (*all within specification*) the laser measurement system accuracy in linear measurement mode will be within:  $\pm 0.5\text{ ppm}$  (k=2) - see the system manual for details.

Authorized signature	Signatory	Position	Date
	Dave Wall	Director & General Manager	25 September 2024

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**Certificate number**  
**077G74-240925-00**

L-9908-1128-02

# 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.