

Product  
Serial number  
Date of calibration

Ballbar Calibrator  
39W378  
22 February 2021

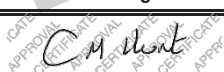
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## Calibration certificate

Results	100mm	150mm	300mm
Quoted Length (mm):	100.0044	150.0065	300.0196
Measured Length (mm):	100.0044	150.0065	300.0196
Uncertainty of measurement (95% confidence level, k=2):	0.00085mm		

Environmental conditions (nominal)	Value
Air temperature:	20.8 °C
Pressure:	1007 mbar
Relative humidity:	43 %RH

Reference standards	Ref. no.	Certificate no.	Calibration date
Master Ballbar Calibrator	19U001	2014090259/8/19U001	17 September 2014
Master Ballbar	0879U8	0879U8-210122-00	22 January 2021
XC-80 Compensator	43K582	43K582-200713-00	13 July 2020
XC80 Air Temperature Sensor	22N452	22N452-200506-00	06 May 2020
Test procedure	RD0133		

Authorised signature	Signatory	Position	Issue date
	Chris Hunt	General Manager	21 April 2021

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Renishaw plc  
Laser & Calibration Products Division  
Bath Road, Woodchester  
Stroud  
Gloucestershire  
GL5 5EY  
United Kingdom  
Tel +44 (0) 1453 524524

Certificate number  
39W378-210222-00

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-W 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.