

XR20-W Rotary axis calibrator

Accuracy and flexibility

±1 arc second verification of rotary axes in any orientation. Multiple mounting options

Simple operation

Wireless technology, self calibration and simple test setup and data capture

Rapid testing

Quick system and test setup and our fastest ever data capture

Why you should use XR20-W

Importance of rotary axis calibration

Rotary axes on machine tools used to mean just rotary tables. With the increasing introduction of trunnion, swivel head and mill-turn machine designs, the nature of the rotary axes has changed and so have the challenges associated with their measurement. Just like with linear axes on machines, rotary axes are subject to errors relative to the intended positioning. This can be due to machine installation issues, collisions or general wear in use. Errors in either the angular positioning accuracy or alignment of the axes can produce significant defects in finished parts.

> Rotary axis calibrator

Introducing XR20-W

Renishaw has responded to these challenges with the introduction of the XR20-W rotary axis calibrator and the Axiset[™] Check-Up*. The XR20-W works in conjunction with the Renishaw XL-80 laser measurement system.

b

The XR20-W consists of an integrated angular retroreflector mounted on a precision servo-controlled axis. The angular position of this axis, and the optics relative to the main body housing, is controlled by a very high accuracy encoder system with the scale directly machined onto the main bearing. The XR20-W is attached to the axis under test using a separate mounting ring (included in the kit). The combination of XR20-W and a separate laser interferometer allows the axis rotation to be measured to within ±1 arc second (equivalent to a movement of less than 5 microns at a distance of 1 m).

Compared to existing rotary axis calibration systems, the XR20-W is designed to allow traceable ±1 arc second axis measurement to be applied to more rotary axes, more simply and more quickly.

* For more details see Page 7



Testing an axis

A typical test (5° step size) is performed as follows:

- 1. The XR20-W is located on the axis under test and the laser system aligned (as shown in the diagram opposite).
- 2. The laser is datumed at the axis start position, data capture is started on the PC and the CNC program run.
- After overrun the axis reaches the initial target position (laser reading equals zero) and a laser reading is triggered.
- The axis under test then moves 5° to the 2nd target and the XR20-W rotates 5° in the opposite direction.
- The system records the positional error in the axis under test by combining the XL-80 and XR20-W readings.
- By driving the rotary axis to a series of points it is possible to build up a picture of the overall accuracy of the axis.



XR20-W features and benefits

Compact and light weight	 Handling and fixing on machine can be achieved single handed Easy, cost effective transportation Clearance issues on machine minimised 	
Flexible mounting system	 Can be configured to allow fitment to a wider variety of rotary tables, lathes and other rotary axes than existing rotary calibrators Simpler and quicker setup 	
Wireless operation	 Lithium batteries and Bluetooth[®] communications give truly wireless operation Provides for easier and quicker setup and avoids issues with trailing cables, eliminating the safety hazard these create 	
Integrated target optics	 Factory set alignment to base unit minimises alignment and resulting measurement errors 	
Built in alignment targets	 Simple optics-to-laser 'alignment aid' to help minimise measurement errors. Optics adjustments made via software provides quicker and safer working for the operator 	
Auto calibration and pre-test cycles	 Pre-measurement calibration cycle compensates for remaining angular alignment errors Test overrun sampling detects and sets axis direction sense and axis feedrate 	
Use of Renishaw laser system	 Provides a high integrity, non-contact reference measurement, remote from the axis under test 	
Traceability	All XR20-W systems are calibrated and delivered with traceable certification	
Servo controlled drive	 Rotary axis measurement speeds for larger angles (>5°) of up to 10 rpm Uses unique, integrated rotary encoder technology 	
New data collection software	Enables quicker and more consistent test setup to give faster test results with increased confidence	

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Test setup and data capture



The key to mounting the XR20-W to rotary axes is a range of modular mounts to suit different applications. All of these can be installed on the axis under test independently of the XR20-W itself.

Standard mounting

The standard mounting ring (a) can be bolted directly to the test surface or secured using toe clamps or similar. This arrangement allows you to more easily centre the system, whilst the XR20-W itself can remain secure in its case, off the machine.

Centration on the axis is typically very simple, using the graduated markings around the circumference and a

separate plastic centration aid (b) that fits temporarily inside the mounting ring. The ring can usually be centred on the axis by eye only i.e. there should be no need to 'clock-in' the mounting plate.



With the mounting ring centred, the XR20-W can be inserted and locked into position using the cam levers.



(d)





Flexible options

As well as the standard mounting arrangement above, an adapter plate (c) is also available to allow fitting to rotary tables with unsuitable centre recesses. The adaptor also provides the attachment point for a chuck (lathe) adapter (d) supplied with the XR20-W kit. The hardened steel shaft of the chuck adapter has been dimensioned to fit most popular chuck sizes. Finally, both of these accessories can be used for securing the XR20-W to users' own custom mounts.

With the XR20-W mounted and centred, alignment with the measurement laser can take place using a built-in alignment aid. This ensures that the laser will hit the target perpendicular to the mirror face and in the right location. This is important to minimise measurement errors. The remote alignment avoids having to access optics from inside the machine enclosure.

Once aligned the target can be rotated 180° (via the software) and data capture can begin.



Software

With RotaryXL software, the emphasis is firmly on simplifying the test setup. The software guides you through the connection of the XR20-W *Bluetooth* device and displays the serial number of the unit and connection status throughout the test. The main screen also displays similar data for the measurement laser and (if connected) a Renishaw XC-80 environmental monitoring system.

'Open test' allows you to use a previous test set-up as the basis for a new test. You can, of course, edit the parameters if you wish.



Prior to testing, an autocalibration cycle eliminates errors due to manufacturing variances in the retroreflector and misalignment to the laser. Sampling during the initial overrun calculates the axis direction sense and the axis rotational speed (feedrate). This enables the speed of the XR20-W to match the axis feedrate (ensuring that the laser beam always returns to the laser, allowing higher rotation speeds at larger target intervals). Data capture starts automatically as the system detects the axis moving to its first target position. As data is captured it is displayed directly on screen with the option to select and display individual test runs (for greater clarity when there are multiple targets/runs).

Completed data can be saved for later analysis, including standard reports for a number of International standards.

Even if you do need to set up a completely new test, the process is streamlined. The 'New Test' option gives you three further options:

- A 'quick complete' option for ISO 230 or ASME B5.54 testing. You just input the minimum of data and this routine will set up test targets and parameters to suit.
- A 'custom' option that will define targets based on start and end positions and size of target steps
- A 'manual' option where you can edit the 'custom' file to enter any random targets.



Off axis rotary measurement



The optional addition of off axis rotary software allows the XR20-W to be used to measure the rotary axis positioniong accuracy of an axis, even when the XR20-W is not mounted on the centre of rotation (pivot point) of that axis.

This overcomes a previous restriction and extends the capability of XR20-W to many five axis machine tools.

Specifications and supporting information

XR20-W specifications

Weight and dimensions				
Height		130mm		
Diamet	er 100 mm (150	100 mm (150 mm on mounting plate)		
Weight	(XR20-	(XR20-W) 1.2 kg (Kit) 6.25 kg		
Performance				
Measurement accuracy (zero at 0°) ±1 arc sec				
Angular	target range	up to 25 revolutions		
Max axi	is rotation speed (<5° axis rotation)	Unlimited		
Max axis rotation speed (>5° axis rotation) 10 rpm				
Bluetooth range		Typically 5 - 10 metres		
Compatibility				
PC:	Windows XP SP3 or Windows 7 operating system. Bluetooth enabled or with USB Bluetooth adaptor (Microsoft stack only) Please ask for full PC requirements			
Laser:	Currently XL-80 laser only (ML10 compatibility planned)			



Power and connectivity



Each XR20-W is supplied with three high-power, rechargeable lithium batteries and a battery recharger unit. Typical battery life is three hours, more than enough for most test programmes. A low power warning is given via the LED's on the XR20-W and via the RotaryXL software.

In cases where no charged battery is available, the unit can be powered via the USB cable and mains adapter supplied with the kit.

Communications between XR20-W and RotaryXL software are via *Bluetooth* (see Specifications).

Test and certification

Product calibration of all XR20-W systems is carried out by Renishaw and is traceable to the NPL (National Physical Laboratory) in the UK.

A comprehensive calibration certificate is issued with all XR20-W systems giving the full test data in graphical format, as well as details of specification, calculated results, calibration standards used and traceability to international standards.

Certificate format and content meets the requirements of ISO 17025.





XR20-W kit



The XR20-W is supplied as a complete kit with power adaptors for use in UK, Europe and USA.

- XR20-W
- Mounting ring
- Adaptor plate
- · Centration aid
- · Chuck adapter
- · Battery charger
- Batteries x 3
- · USB cable and mains adapter
- Rotary software kit. Including RotaryXL data capture software, XCal-View data analysis software and system manuals*
- Peli[™] system case
- * RotaryXL and XCal-View supports use in English and supported languages (see www.renishaw.com/lasercalsupport for details).

Related products

Renishaw's AxiSet[™] Check-Up system provides machine users with a fast and accurate health check of rotary axis pivot points and alignment. It comprises a single calibration sphere conveniently mounted on a magnetic base which is used with a machine tool probe and probing macro software.



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About Renishaw

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Products include:

- · Additive manufacturing, vacuum casting, and injection moulding technologies for design, prototyping, and production applications
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- · Dental CAD/CAM scanning and milling systems and supply of dental structures
- Encoder systems for high accuracy linear, angle and rotary position feedback
- · Fixturing for CMMs (co-ordinate measuring machines) and gauging systems
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- · High speed laser measurement and surveying systems for use in extreme environments
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- Medical devices for neurosurgical applications
- · Probe systems and software for job set-up, tool setting and inspection on CNC machine tools
- · Raman spectroscopy systems for non-destructive material analysis
- · Sensor systems and software for measurement on CMMs
- Styli for CMM and machine tool probe applications

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