RENISHAW
apply innovation™

Accuracy and flexibility

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

Simple operation

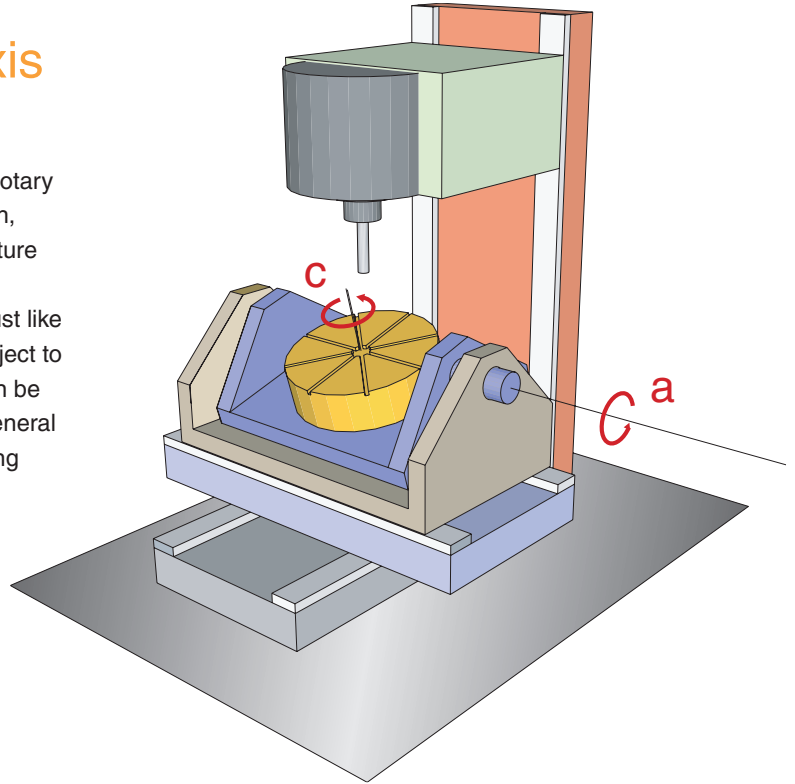Wireless technology, self calibration and simple test setup and data capture

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.

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.

The XR20-W consists of an integrated angular retroreflector mounted on a precision rotary indexer. The angular position of the optics relative to the main body housing is servo-controlled using a very high accuracy encoder system directly machined onto the main bearing. The main body can be locked into a separate mounting ring which is attached to the axis being measured. If the XR20-W rotates then the associated laser system measures that rotation very accurately, giving an overall measurement to within ±1 arc second (equivalent to a movement of less than 5 microns at a distance of 1m).
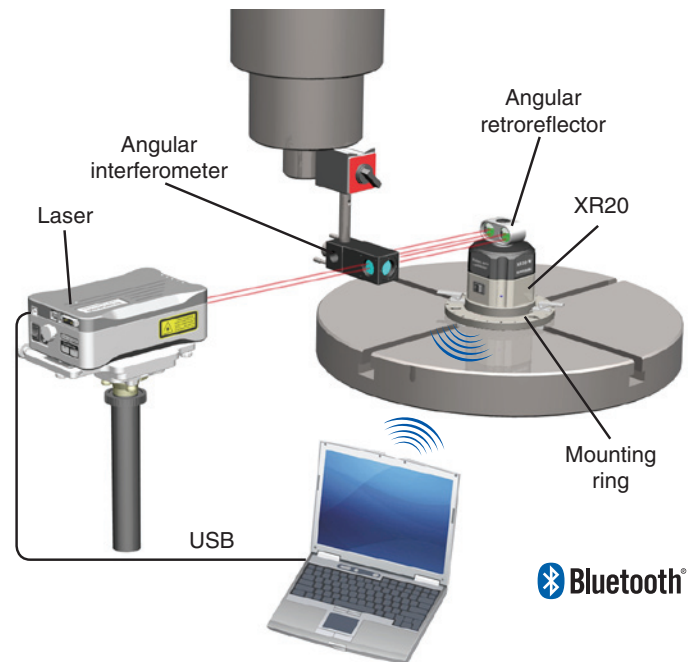
Compared to existing rotary indexers the XR20-W is designed to allow traceable ±1 arc second axis measurement to be applied to more rotary axes, more simply and more quickly. It also has significant advantages compared to other methods such as auto collimators and the use of optical polygons.

* 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.

3. After overrun the axis reaches the initial target position (laser reading equals zero) and a laser reading is triggered.

4. The axis under test then moves 5° to the 2nd target and the XR20-W rotates 5° in the opposite direction.

5. The system records the positional error in the axis under test by combining the XL-80 and XR20-W readings.

6. 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 set up
Wireless operation	• Lithium batteries and Bluetooth® communications give truly wireless operation • Provides for easier and quicker set up and avoids issues with trailing cables and 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-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' remote from the machine under test • Renishaw laser interferometers give industry leading levels of accuracy and repeatability • 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 set up 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.
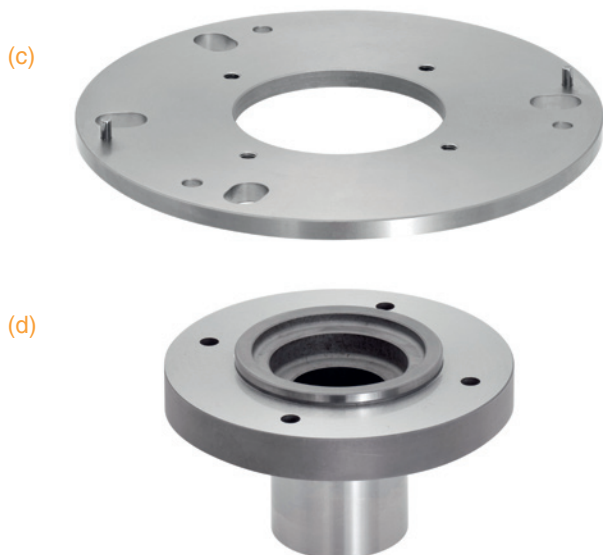
Standard mounting

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.

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 assessories 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 set up. 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.

Specifications and supporting information

XR20-W specifications

Weight and dimensions	
Height	130mm
Diameter	100 mm (150 mm on mounting plate)
Weight	(XR20-W) 1.2 kg (Kit) 6.25 kg

Performance	
Measurement accuracy	±1 arc sec
Resolution	0.1 arc sec
Angular measurement range	25 revolutions
Max axis rotation speed (<5° axis rotation)	Unlimited
Max axis rotation speed (>5° axis rotation)	10 rpm
Bluetooth range	Typically 5 - 10 metres

Compatibility	
PC:	WindowsXP 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.

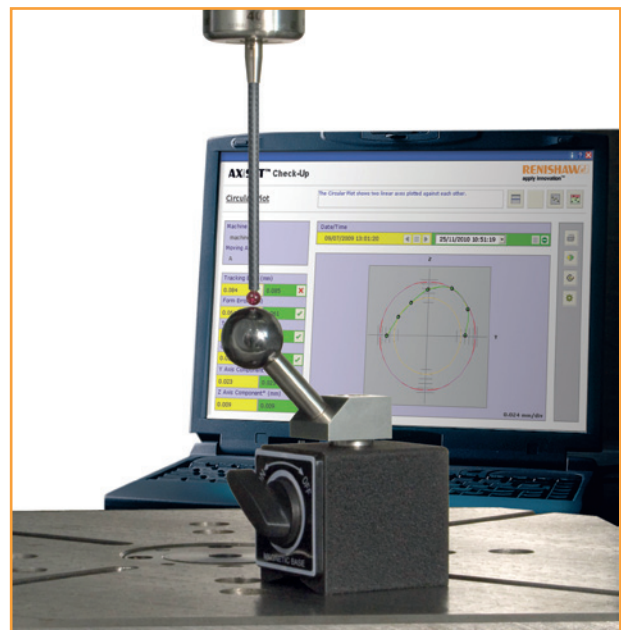Certificate format and content meets the requirements of ISO 17025.

XR20-W kit

The XR20-W is supplied as a complete kit with suitable electrical adaptors for use in any territory.

- XR20-W
- Mounting ring
- Adaptor plate
- Centration aid
- Chuck adapter
- Battery charger
- Batteries x 3
- USB cable and mains adapter
- RotaryXL software including system manual*
- Peli™ system case

* RotaryXL supports use in English, German, French, Italian, Spanish, Chinese, Japanese, Korean or Russian depending upon the Windows 'regional setting'.

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.

Renishaw plc

New Mills, Wotton-under-Edge,
Gloucestershire GL12 8JR
United Kingdom

T +44 (0) 1453 524524
F +44 (0) 1453 524901
E uk@renishaw.com

www.renishaw.com

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About Renishaw

Renishaw is an established world leader in engineering technologies, with a strong history of innovation in product development and manufacturing. Since its formation in 1973, the company has supplied leading-edge products that increase process productivity, improve product quality and deliver cost-effective automation solutions.

A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Products include:

- Dental CAD/CAM scanning and milling systems.

- Encoder systems for high accuracy linear, angle and rotary position feedback.

- Laser and ballbar systems for performance measurement and calibration of machines.

- 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 (co-ordinate measuring machines).

- Styli for CMM and machine tool probe applications.

Renishaw worldwide

Australia
T +61 3 9521 0922
E australia@renishaw.com

Austria
T +43 2236 379790
E austria@renishaw.com

Brazil
T +55 11 4195 2866
E brazil@renishaw.com

Canada
T +1 905 828 0104
E canada@renishaw.com

The People's Republic of China
T +86 21 6180 6416
E china@renishaw.com

Czech Republic
T +420 548 216 553
E czech@renishaw.com

France
T +33 1 64 61 84 84
E france@renishaw.com

Germany
T +49 7127 9810
E germany@renishaw.com

Hong Kong
T +852 2753 0638
E hongkong@renishaw.com

Hungary
T +36 23 502 183
E hungary@renishaw.com

India
T +91 80 6623 6000
E india@renishaw.com

Indonesia
T +62 21 2550 2467
E indonesia@renishaw.com

Israel
T +972 4 953 6595
E israel@renishaw.com

Italy
T +39 011 966 10 52
E italy@renishaw.com

Japan
T +81 3 5366 5316
E japan@renishaw.com

Malaysia
T +60 3 5631 4420
E malaysia@renishaw.com

The Netherlands
T +31 76 543 11 00
E benelux@renishaw.com

Poland
T +48 22 577 11 80
E poland@renishaw.com

Russia
T +7 495 231 16 77
E russia@renishaw.com

Singapore
T +65 6897 5466
E singapore@renishaw.com

Slovenia
T +386 1 527 2100
E mail@rls.si

South Korea
T +82 2 2108 2830
E southkorea@renishaw.com

Spain
T +34 93 663 34 20
E spain@renishaw.com

Sweden
T +46 8 584 90 880
E sweden@renishaw.com

Switzerland
T +41 55 415 50 60
E switzerland@renishaw.com

Taiwan
T +886 4 2473 3177
E taiwan@renishaw.com

Thailand
T +66 2 746 9811
E thailand@renishaw.com

Turkey
T +90 216 380 92 40
E turkiye@renishaw.com

UK (Head Office)
T +44 1453 524524
E uk@renishaw.com

USA
T +1 847 286 9953
E usa@renishaw.com

For all other countries
T +44 1453 524524
E international@renishaw.com

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