

XM-60 multi-axis calibrator



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Process foundation

Component quality is dependent on machine performance. Without understanding a machine's error profile it is impossible to have confidence that your components will fall within specification during manufacture.

Periodic measurement of a machine's performance capability is the foundation of process control, providing a known, stable environment in which the process is to be performed. Quantifying process capability reduces costs and improves efficiency.

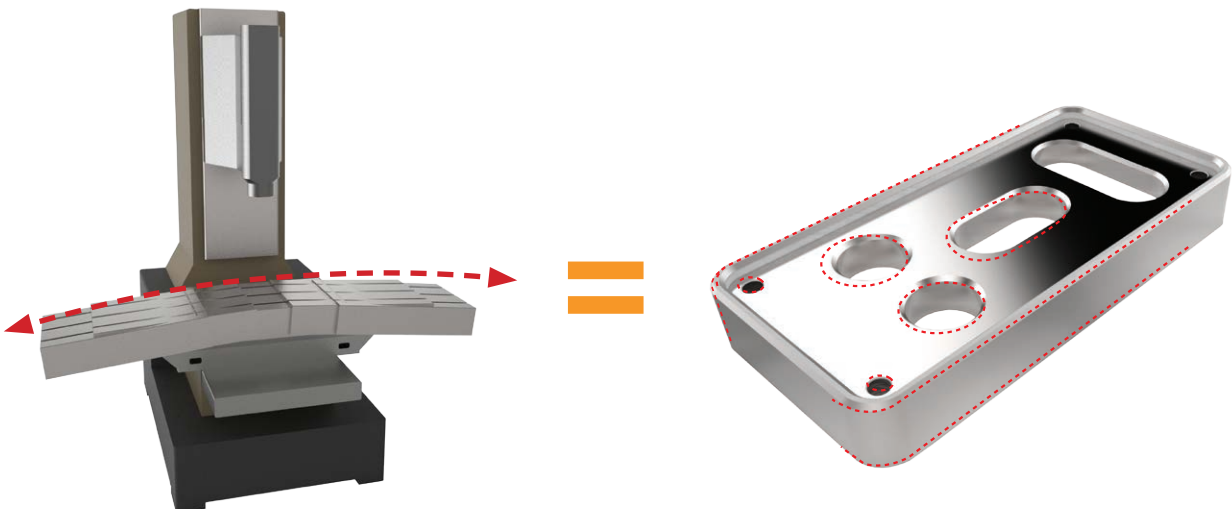
Why do you need an XM-60 multi-axis calibrator?

The machine tool industry is developing quickly. Initiatives to improve efficiency, and reduce scrap and production costs have created the need to understand manufacturing processes better than ever before. Knowing machine capability before metal cutting is the foundation of any machining process.

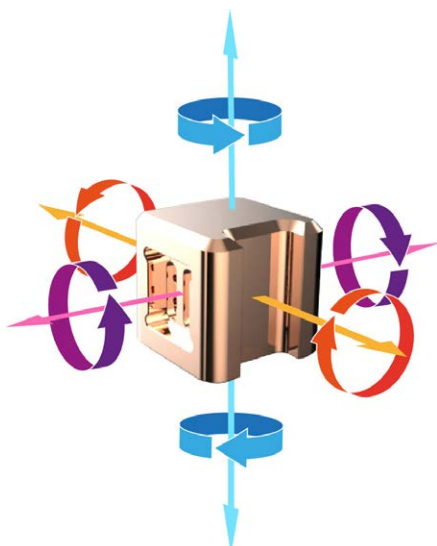
Laser interferometry, the globally recognised approach for machine calibration, offers the ultimate in accuracy. However, measuring one error per set-up is time consuming for users who wish to measure more than linear errors. With complex machine structures and more intricate components being manufactured, measuring linear performance alone is not enough. Frictional effects and other faults in the axis construction can cause the axis to rotate as it moves, creating a difference between the indicated and actual positions of machine elements. These 'angular' and 'straightness' effects can cause significant feature position errors, or profile and surface deviation, resulting in out-of-tolerance components.

Angular deviation of a machine axis

The effect of angular errors on a component

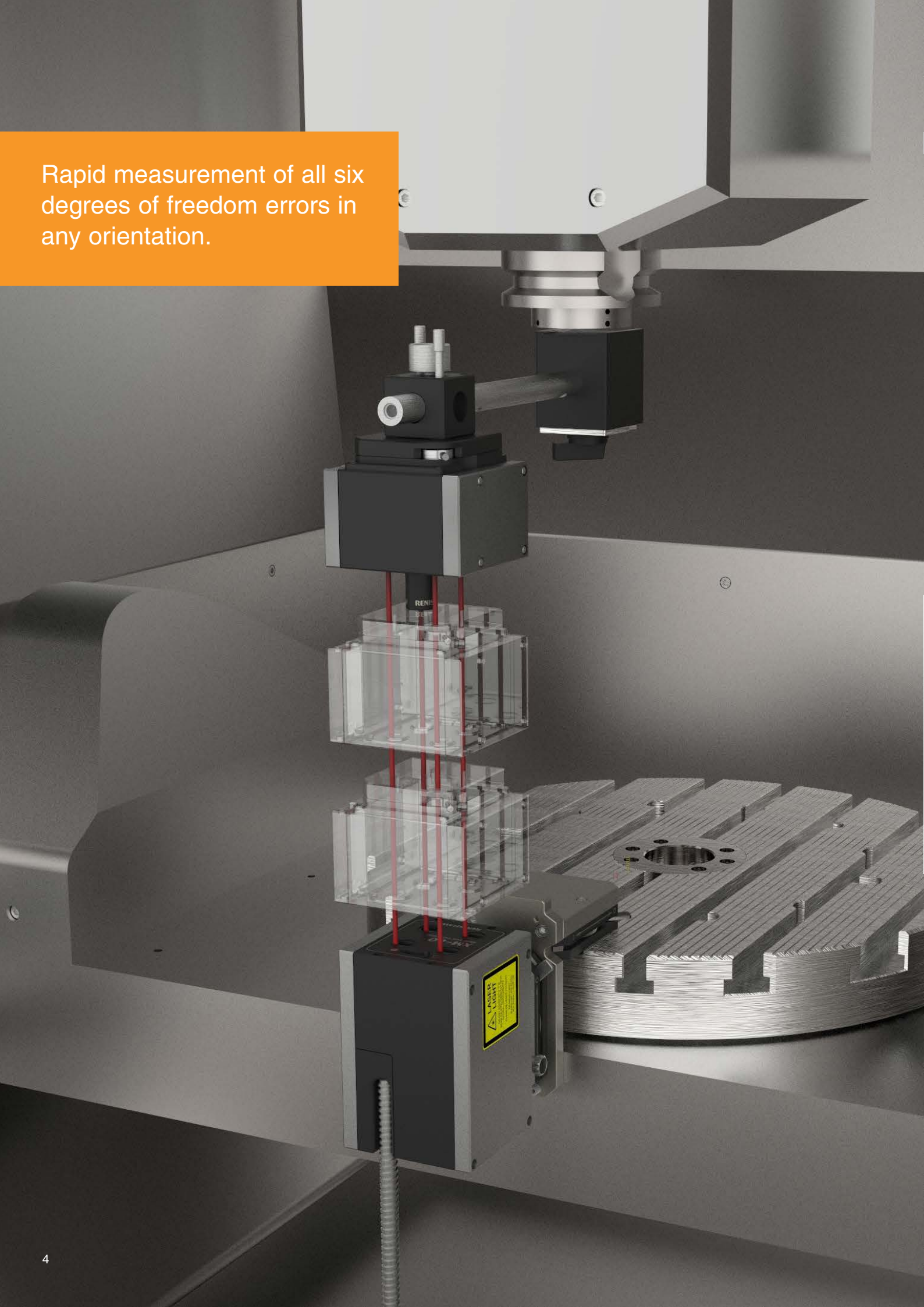


The position of any object in space is defined by six degrees of freedom, similar to the relationship between a cutting tool and a workpiece inside a machine tool. Errors within each machine axis cause deviations in the parts produced. Only by measuring all the errors can an assessment of the process capability be made. Directly measuring all the errors simultaneously not only saves time but allows the true picture of a machine's performance to be assessed.



XM-60 measures all **Six degrees** of freedom from a **single** set-up. This **highlights** problems before they affect **productivity**.

Rapid measurement of all six degrees of freedom errors in any orientation.



Direct measurement of errors

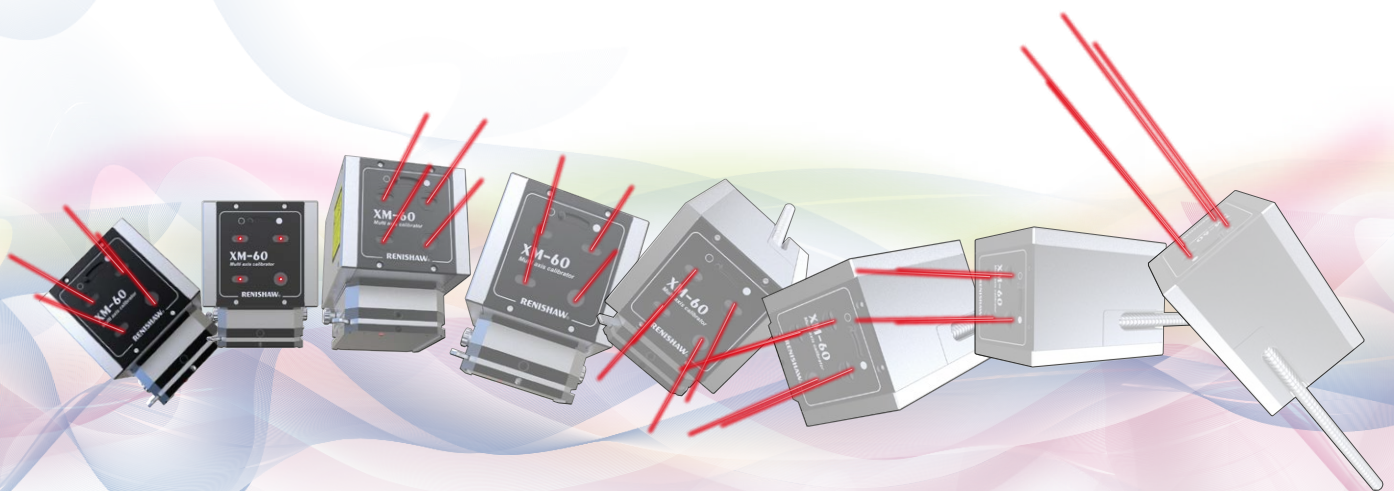


XM-60 provides users with powerful machine diagnostic capability through the measurement of all degrees of freedom from a 'single shot'. By capturing six degrees of freedom, users can discover the source of their errors, rather than the effect which is often seen when performing linear measurement alone.

Reducing measurement uncertainties is important for any user. The XM-60 has been designed to measure machine errors directly, by aligning the laser beams with a machine axis. This reduces the inaccuracies which can result from complex mathematics used in alternative measurement techniques. Direct measurement makes comparison before and after machine adjustments a quick and simple task.

Operation in any orientation

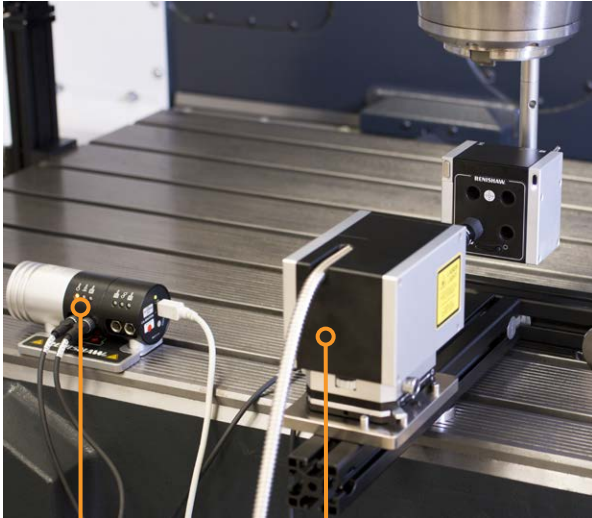
The pure optical system in the XM-60 allows operation in any orientation. The launch unit can be mounted on its side, upside down and on its back, useful for vertical axis testing, slant-bed lathes and more complex machine structures.



System overview

Key features and benefits:

- **Quick** – linear, pitch, yaw, roll, horizontal and vertical straightness measurement in the same time as a single measurement with conventional laser techniques.
- **Simple** – easy set-up, familiar to users of other interferometric systems. Automatic sign detection and graphical alignment minimise human errors.
- **Reassuring** – measuring all errors directly allows the user to see results as the test is in progress.
- **Capable** – unique optical roll measurement system provides roll measurement in any orientation.



1. XM-60 launch unit

2. XM-60 receiver

4. XC-80 environmental compensator



Renishaw produces innovative products designed with a deep understanding of customer needs, providing an uncompromised solution.

1. Laser / launch unit

- **Flexible** – a separate laser unit enables the use of a remote compact fibre optic launch unit. This gives more flexible mounting options and minimises the impact on measurement volume.
- **Thermal stability** – the laser heat source is located outside the machine environment. The use of an external laser source reduces thermal effects on the measurement optics and on the machine under test.

2. Receiver

- **Wireless communication** – the roll and straightness data is communicated wirelessly back to the laser unit via an integrated wireless connection.
- **No cables** – powered by rechargeable batteries avoiding trailing cables during machine moves.
- **Lightweight** – designed to minimise the load on the machine spindle.

3. CARTO software suite

- **Intuitive** – guides the user through the workflow of the measurement process. The Capture and Explore applications provide data capture and analysis for XM-60.

4. XC-80 environmental compensator

- **Reliable** – XC-80 environmental compensator minimises the effect of the operating environment.
- **Accurate** – maintains full measurement accuracy from 0 °C – 40 °C.

5. System case

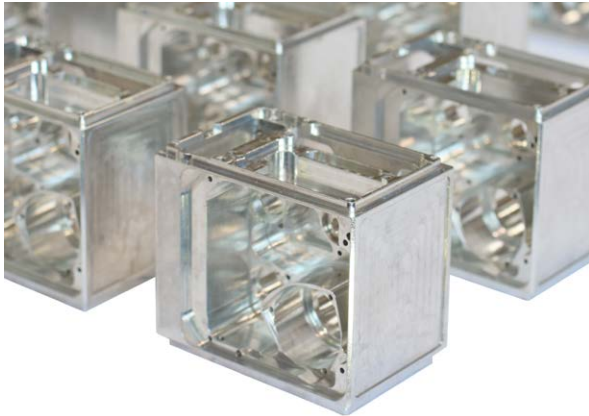
- **Portable** – robust Peli™ storm system case designed to provide safe storage and transportation of the laser system, with space for accessories and XC-80 compensator kit.

3. CARTO software suite





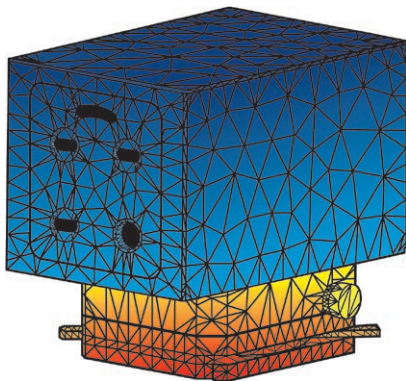
Precision engineered



Engineered by Renishaw

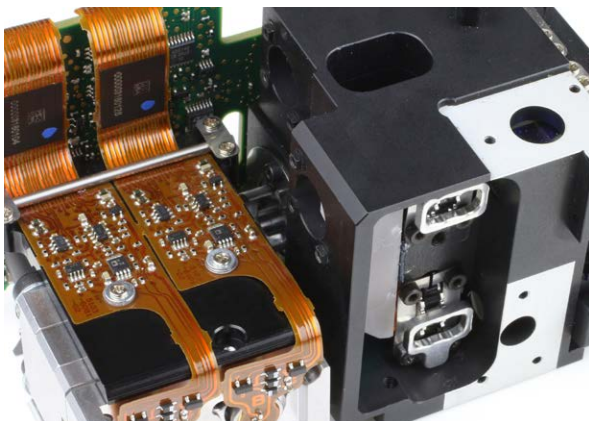
Renishaw laser measurement systems are manufactured to provide high performance and long operational lives.

The aluminium substructure provides lightweight yet strong construction, designed to give the smallest package to fit onto machine tools. The combined weight of the launch and receiver is only 2.5 kg.



Thermal design

The XM-60 employs thermal breaks between the magnetic mount and the product housing. This ensures changes in machine thermals do not affect the device and temperature variation in the XM-60 does not affect machine performance.



Roll detection

The XM-60 provides a highly accurate laser system that incorporates unique technology with a patented optical roll measurement and fibre optic launch system. The compact launch unit is remote from the laser unit, reducing heat effects at the point of measurement. It can be mounted directly to the machine on its side, upside down and even on its back, which is particularly beneficial in areas with difficult machine access.

Precision engineered



Four-beam system

Easy, flexible set-up using any of the four beams during visual alignment. The only four-beam system on the market matching interferometric accuracy of angular and linear measurement with the simplicity of Position Sensitive Device (PSD) straightness measurement. Allows a greatly reduced package size.



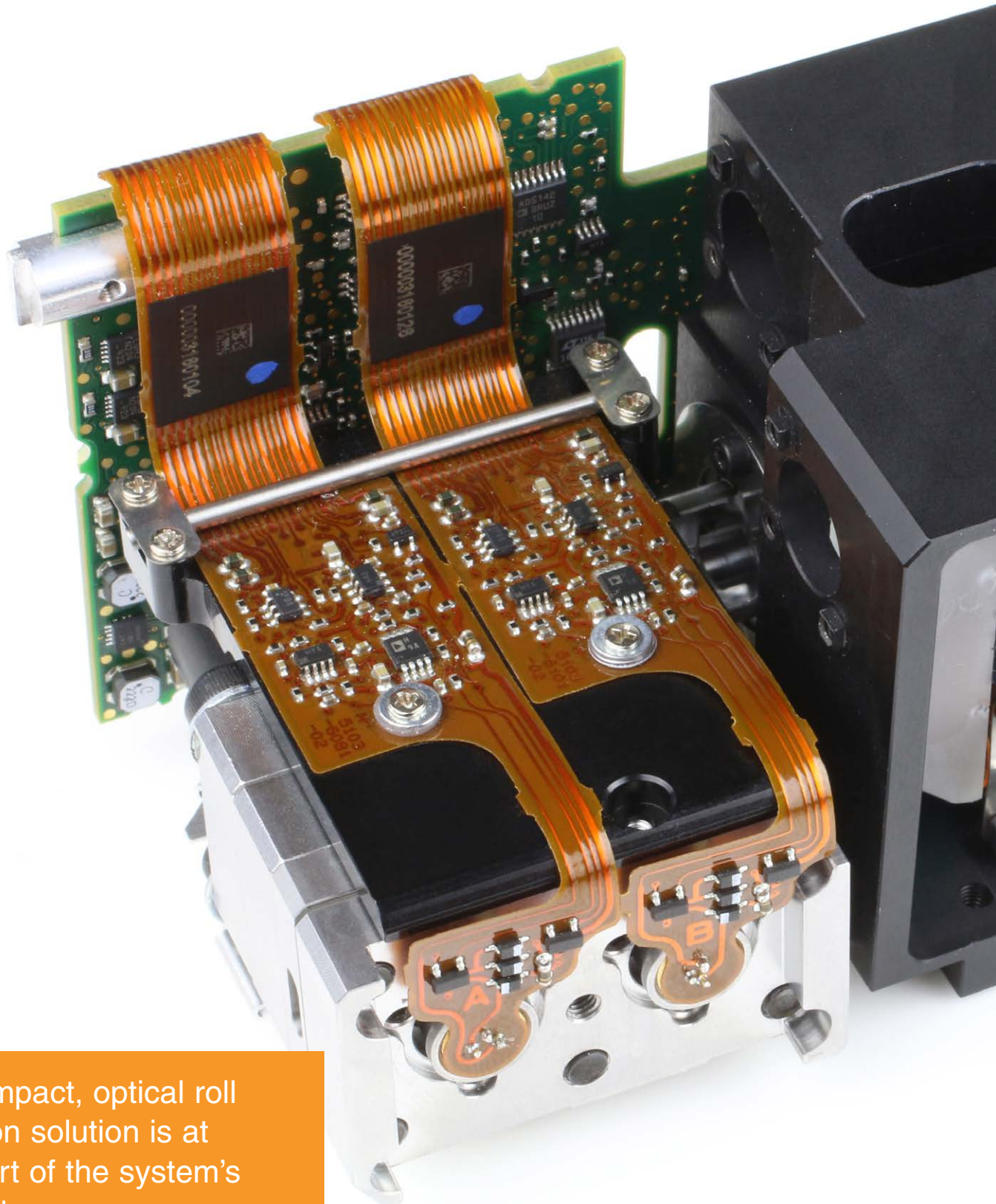
Proven performance

The laser tube in the XM-60 is developed from technology used in Renishaw's RLE20 laser encoder system, produced for over 10 years, and found in the most demanding applications in the semiconductor industry.



Attention to detail

The standard XM-60 kit is supplied with a set of magnetic conduit clamps to tidy and control the conduit during a test. A comprehensive user guide is available in multiple languages for local support. The whole system can be transported in a portable 'wheelie-case' with an attachable fixturing kit.



Our compact, optical roll detection solution is at the heart of the system's capability.



CARTO software



The CARTO software suite guides the users through the workflow of the XM-60 measurement process, from setting up a test to analysing the data. Building upon customer feedback and years of calibration experience, the intuitive user interface and the flow of the software matches the easy set-up of the XM-60 multi-axis calibrator.

The CARTO suite is made up of two applications;

- Capture to collect laser measurement data.
- Explore to provide powerful analysis to international standards.

CARTO features a database system which automatically stores and organises data for the user. This simplifies operation and allows users to quickly and easily compare data across multiple machines over time.

The CARTO user interface can easily be configured to suit user preferences, with the ability to change themes and customise displays. It is tablet-friendly and has expandable menu sections for ease of use on compact screens.

Test methods are automatically saved, so users conducting repeat tests can simply recall an earlier test.



Capture

Guides the user step-by-step through the data capture process



Software that thinks for the user

When a new test method is created, CARTO can provide defaults from previous set-ups. Fields such as dwell time are automatically populated based on the averaging that the user has chosen, saving the user test and set-up time.

Automatic triggering for all channels

Always having a linear position channel with XM-60 enables automatic triggering for all tests, even if the user is only interested in the angular measurement. There is never the need to manually trigger the laser.

Elegant, simple alignment

The straightness measurement from XM-60 is also used to align the system. CARTO graphically displays the alignment of the system making set-up simple and easy to understand.

Part program generation

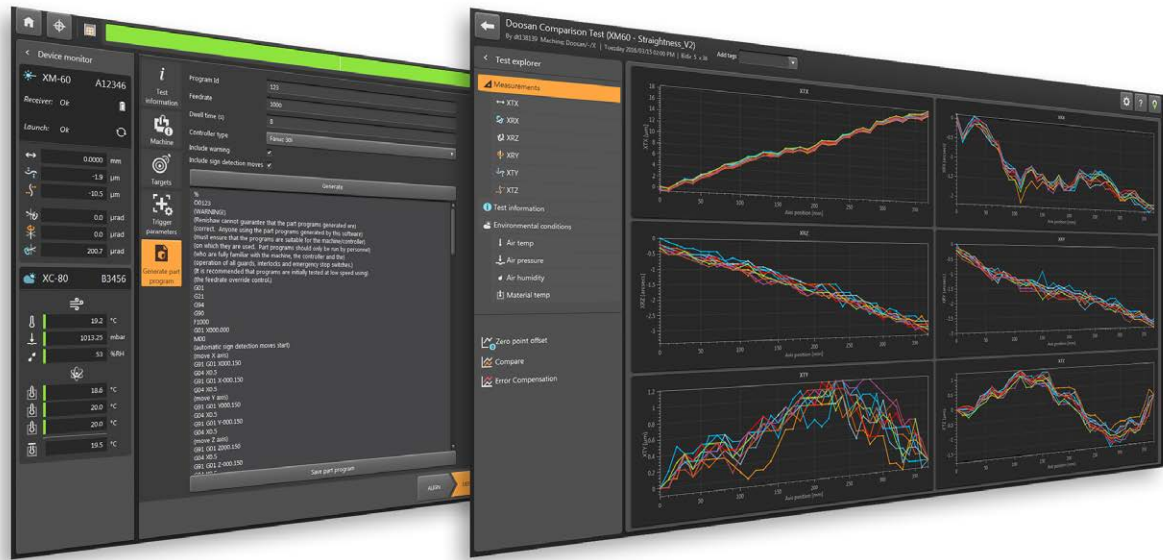
Capture features a part program generator, supporting Fanuc 30, Heidenhain 530, Mazak Matrix and Siemens 840D controllers, with more to follow.

'Free-run mode'

Allows users to capture data immediately, without having to define the positions, or even the number of targets. The software displays straightness (horizontal and vertical), pitch, yaw and roll errors against linear position. Triggering can be manual (with a keypress), automatic (based on stability of position) or continuous (captured during motion at a user-defined interval).

Explore

Rapid analysis and reporting of results



Analysis standards

Different companies need to comply with different standards, therefore each measurement (linear, pitch, yaw, roll and straightness) can be displayed with all supported analysis standards. To make it easier for the user, these can also be sorted, enabled or hidden from view.

PDF printing

In order to generate reports quickly, individual measurement data, test information, environmental conditions and error compensation can all be saved directly to pdf.

Tagging

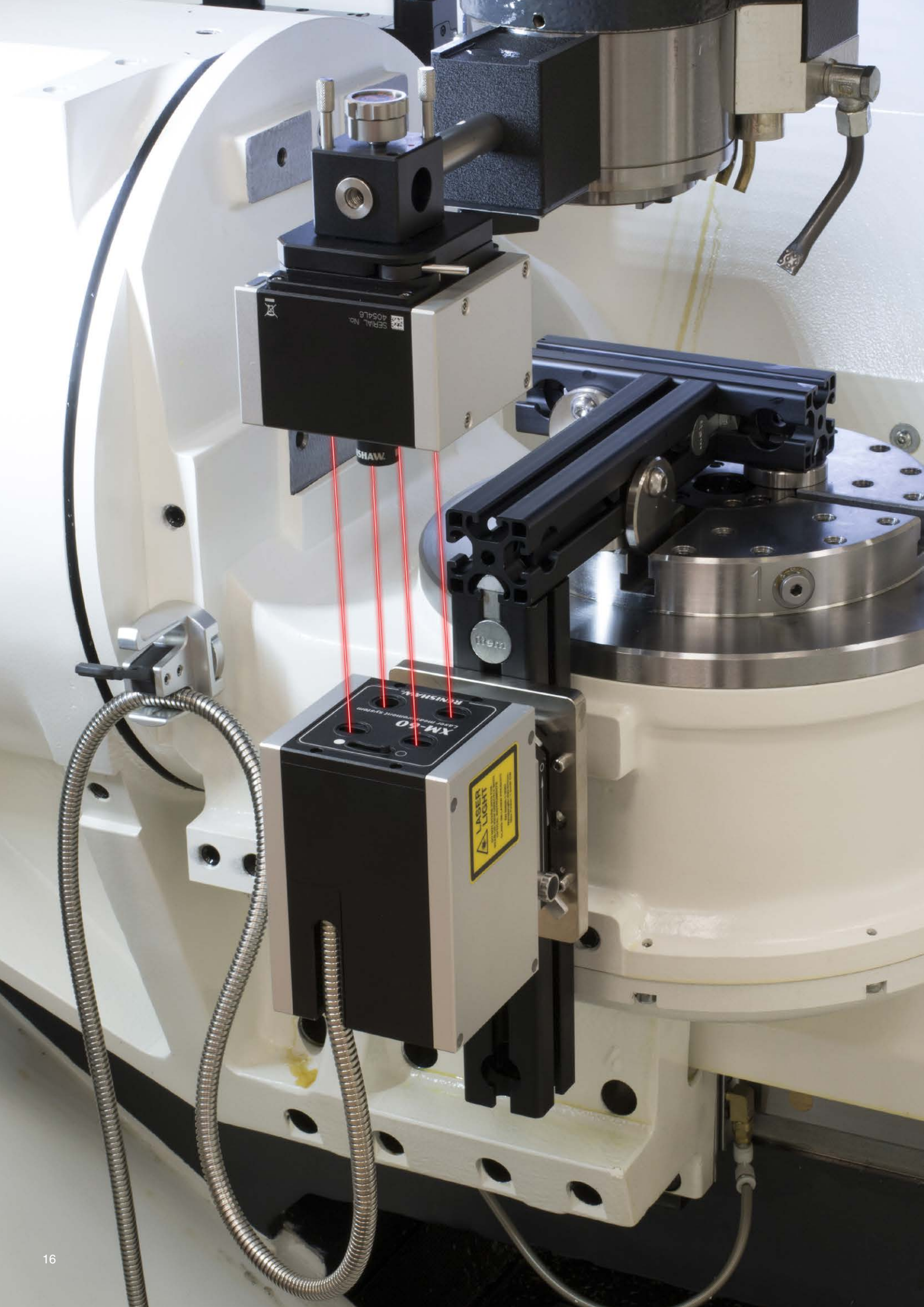
As the analysis browser fills up with a large quantity of tests, finding the data you need can take time. Explore has made this simple by allowing the user to assign a tag to any test saved in the database. All the data can then be filtered by a tag or multiple tags.

Compare

Even after a report has been printed, we don't stop there. Explore features a handy comparison tool, allowing users to look through the history of their test records and see the effect that numerous factors have on six channels of error.

Error compensation

Create linear error compensation files to improve machine performance. Error plots from before and after compensation can be added to a comparison graph to verify the improved machine performance.



Versatile fixturing

Magnetic mounting

The integral switchable magnetic base on the XM-60 launch unit allows quick attachment to the machine. An internal protection device ensures the magnet is only activated when correctly installed on the machine, preventing damage.

90 degree bracket

The 90 degree bracket enables users to switch the orientation of the XM-60 with ease. Guide pins assist the location of the XM-60 until the magnetic base is activated, making accurate positioning simple. The 90 degree bracket can also be used to mount the unit off the edge of the machine bed.

Standard clamp block mount

The XM-60 receiver uses a clamp block and pillar method for simple attachment to the machine. The standard kit contains four pillars and two clamp blocks which gives even more flexibility in mounting options.

Custom fixture interface

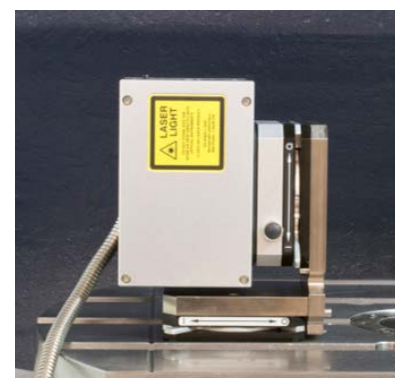
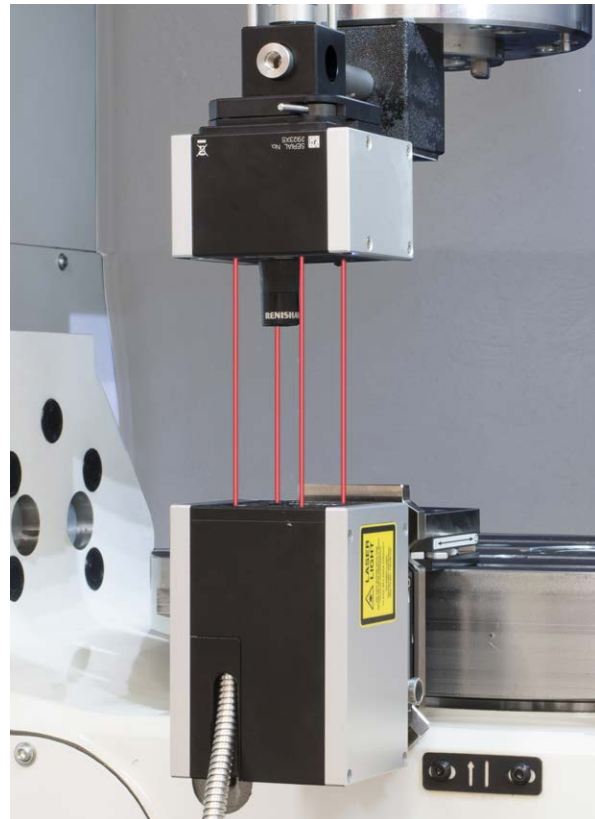
For specialist fixture applications the clamp block can be easily removed for the user to attach custom fixturing to the back of the receiver, using the tapped holes directly.

Fixturing kit

The fixturing kit simplifies and extends the options for mounting the XM-60 into the working volume of a machine tool. Applications that previously were too complex to measure can now easily be catered for. The kit contains a series of extrusions that can be easily assembled.

This supports users in:

- measuring the full axis of travel for:
 - linear extension from the bed of the machine
 - vertically mounting beside the machine bed
- mounting the XM-60 onto a chuck for lathe or machining centre applications
- mounting the receiver extended from the spindle



90 degree bracket



Fixturing kit mounting plate

Service and quality

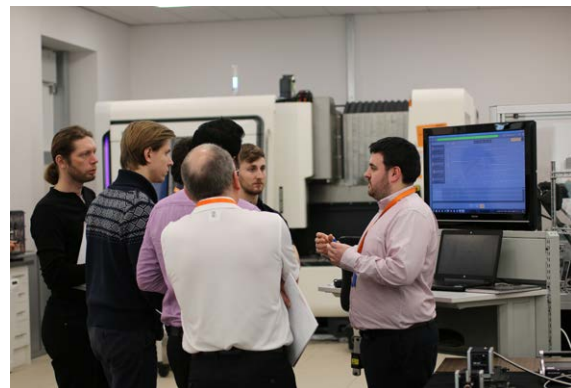


Our ongoing commitment to service and quality provides our customers with the complete solution

Training

Renishaw offers an established range of comprehensive operator training courses either on-site or at a Renishaw training centre. Our experience in metrology allows us to teach not just about our products, but also underlying scientific principles and methods of best practice.

This enables our customers to get the most out of their manufacturing processes.



Certification

Renishaw plc is certified and audited regularly to the latest ISO 9001 quality assurance standard. This ensures all aspects of design, manufacture, sales, after sales support, and recalibration remain at the highest standards.

The certificate is issued by BSI Management Systems, an internationally recognised certification body, accredited by UKAS.



Support

Our products enhance quality and productivity, and we strive for total customer satisfaction through superior customer service and expert knowledge of potential product applications. When you purchase a laser or ballbar system from Renishaw, you are buying into a worldwide support network that understands machine metrology and the service of production equipment.

Renishaw calibrations in the UK are traceable to the National Physical Laboratory, a signatory of the CIPM MRA. Calibration facilities worldwide can provide local laser calibration traceability.

Design and build

Not only does Renishaw have comprehensive in-house design capability, its extensive manufacturing capacity allows it to produce nearly all components and assemblies in-house. This gives us the ability to fully understand and control our design and build process.

The performance of Renishaw lasers has been independently verified by the National Physical Laboratory (UK) and the Physikalisch-Technische Bundesanstalt (Germany).



Renishaw's innovation has transformed industrial metrology

Renishaw offers a range of calibration solutions for machine tools, CMMs and other applications:

XL-80 laser measurement system

- The ultimate in traceable, versatile motion system analysis
- ± 0.5 ppm certified linear measurement accuracy



XR20-W rotary axis calibrator

- Measurement accuracy of ± 1 arc second
- Totally wireless operation for quick and easy set up

QC20-W ballbar

- The most widely used system for machine tool performance verification
- Reduces machine down-time, scrap and inspection costs

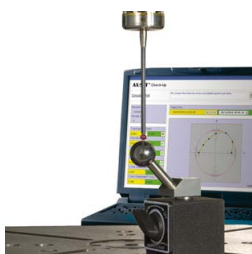


Renishaw laser encoder with RSU10

- Linear axis measurement for fixed installations in a compact package
- Compatible with Renishaw calibration software packages

Machine checking gauge

- Volumetric measurement performance for CMMs
- Verification of volumetric accuracy to BS ISO 10360-2



AxiSet™ Check-Up


- Rapid on-machine measurement of rotary axis performance
- Accurate detection and reporting of errors in rotary axis pivot points



LASER LIGHT
DO NOT STARE INTO THE BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS
CLASS 2B LASER PRODUCT
EN 60820-1:2007
Wavelength: 635-670nm
Max Power: 1.0mW CW

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XM-60 system information

XM-60 multi-axis calibrator	
Dimensions (weight)	<p>Laser (L) 320 mm x (H) 122 mm x (W) 193 mm (weight 3.7 kg)</p> <p>Launch 125.5 mm x 124.1 mm x 86 mm (weight 1.9 kg)</p> <p>Receiver 161.2 mm x 82 mm x 82 mm (weight 0.6 kg)</p> <p>Complete XM-60 system in the case excluding optional XC-80 compensator is 23 kg</p>
Power supply	24 V DC 2.5 A 60 W
System measurement capability	Linear, straightness, angular (pitch/yaw), roll
Laser output	
Interface	Integral USB comms, no separate interface

XC-80 environmental compensator	
Dimensions (weight)	135 mm x 58 mm x 52 mm (490 g)
Power supply	Powered via USB from PC
Internal sensors	Air pressure Relative humidity
Remote sensors	1 air temperature, 1 – 3 material temperature
Interface	Integral USB comms, no separate interface
Environmental sensors	Material temperature: 0 °C – 55 °C Air temperature: 0 °C – 40 °C

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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:

- Additive manufacturing and vacuum casting technologies for design, prototyping, and production applications
- Dental CAD/CAM scanning 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
- Gauging systems for comparative measurement of machined parts
- High-speed laser measurement and surveying systems for use in extreme environments
- 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
- Styli for CMM and machine tool probe applications

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