WORLD METROLOGY

3D Coordinate Measuring Machine

0.25um repeatability of three axes

World Metrology CO., LTD is famous brand for measurement technology industry and inherited German MAHR . Depending on our design, R&D group with craftsman's spirit, we provide good quality and reliable product to global customers.

WM's coordinate measuring machine are made of high-precise nature granite with stable expansion coefficient ($5.2*10^{-6}$), water absorptivity (<0.2 or less), high intensity and strong rigidity(HS 85 °) at the international level.

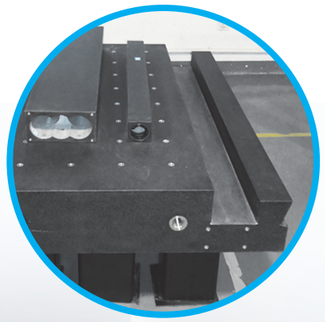
WM's products not only have passed international cross-certification but also cooperated with the major international measurement technology parts and components manufacturers to create more amazing measuring machine.

WM's professional group promises the efficient and quality customer service and we are still devoting to upgrading our technical support to view global challenges and competition in the rapidly changing world.

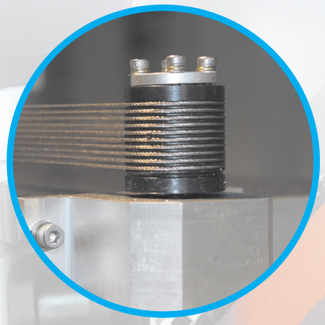
WM's focus on high accuracy machine and we are definitely a good helper for your measurement technology.

International Patent

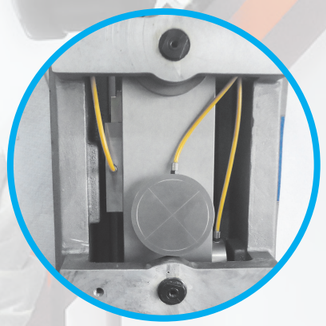
Reducing the weight of Z axis
All the machine adopt lightweight design and reducing the weight of Z axis to guarantee the stability and precision



Dovetail type guideways
Y-axis guideway adopts dovetail type, which has high precision and good stability



Steel wire transmission
Steel wire transmission, which keeps the small system following error and faster response speed during the motion time. And the dynamic performance of measurement of the machine is improved; The influence of the motion inertia on the measurement accuracy is reduced; low cost for maintenance and repair makes the machine use and rapid.



Patented air bearing
Patented air bearing is adopted Star and double circular curve designed to guarantees the small resistance, no abrasion and stable motion

Adopt special composite materials
The main and secondary columns structure adopt special composite materials that reduce the weight of the machine to achieve the world's fastest moving speed and the most stable measurement results

Granite: CMM material NO.1

Physical characteristics of materials in metrology

Material	Specific gravity(kg/dm3)/Hardness	Expansion coefficient (1/k)	Temperature Diffusion rate (W/mK)
Steel	7.25/HRC53	$10.4*10^{-6}$	42-63
Aluminum	2.7/HRC45	$23.8*10^{-6}$	210
Ceramic	3.85/HRC70	$8*10^{-6}$	28
Granite	2.8/HRC65	$5.2*10^{-6}$	3.5

Comparison Table

	Granite	Aluminum	Ceramic	Steel
High hardness	✓		✓	
High stability	✓			
Wear resistance	✓		✓	
Corrosion resistance	✓			
Low expansion coefficient	✓			
Low cost		✓		
Transmogrification		✓		✓

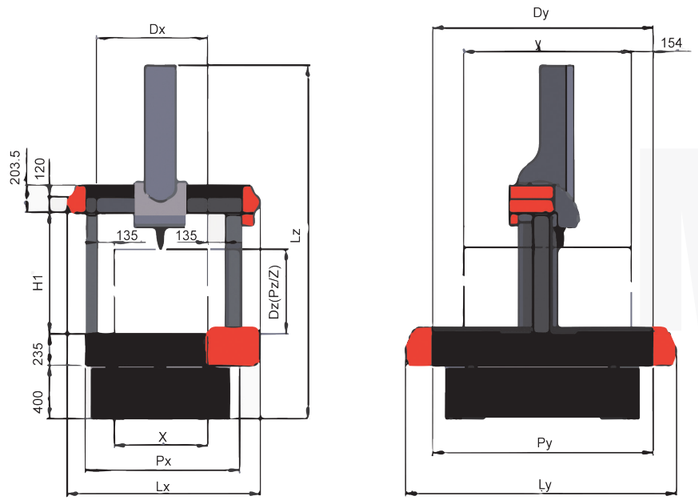
Coordinate Measuring Machine

Type 1: Micro Series Bridge Type CMM

Cost-effective, Highly Efficient

- Adoption of integrated granite-material guideways makes sure of stable thermal performance of themselves
- The totally enclosed surrounding guideway structure makes measuring more accurate
- 21 terms of compensation technique as to mechanical geometric errors improve the machine's precision greatly
- Three axis's adoption of quiescent air pressure air-bearing guideway, comprised of air bearings which are self-cleaning, pre-loading and high precision, guarantees the large span of bearings strong anti-sways, small resistance, no abrasion and stable motion
- Unenclosed structure leads to various measurement configuration solutions
  Therefore, measurement experience gets so flexible
- Adoption of advanced F.E.M (finite element method) makes it have a stable and reliable resistance to effective deformation

Micro Technical Parameter



Micro

0.25um repeatability of three axes

Type	Micro686	Micro8106
MPEe (μm)	1.2+L/400	1.5+L/400
MPEp (μm)	1.2μ	1.5μ
Measuring range (mm) (Dx*Dy*Dz)	600x800x600	800x1000x600
Dimension (mm) (Lx*Ly*Lz)	1392x1889x2626	1592x2089x2626
Platform (mm) (Px*Py*Pz)	762x1500x631	962x1700x631
Load capacity (Kg)	1000	1200

International Certification

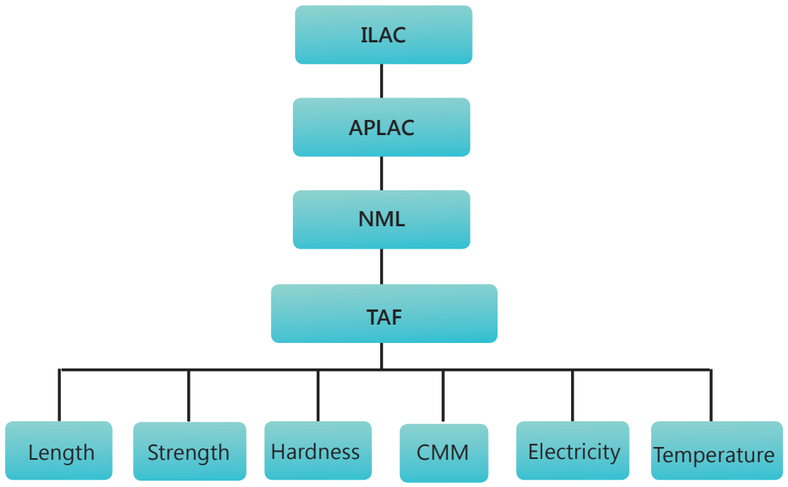
DAkkS Deutsche Akkreditierungsstelle D-ZM-14143-01-03

Physikalisch-Technische Bundesanstalt

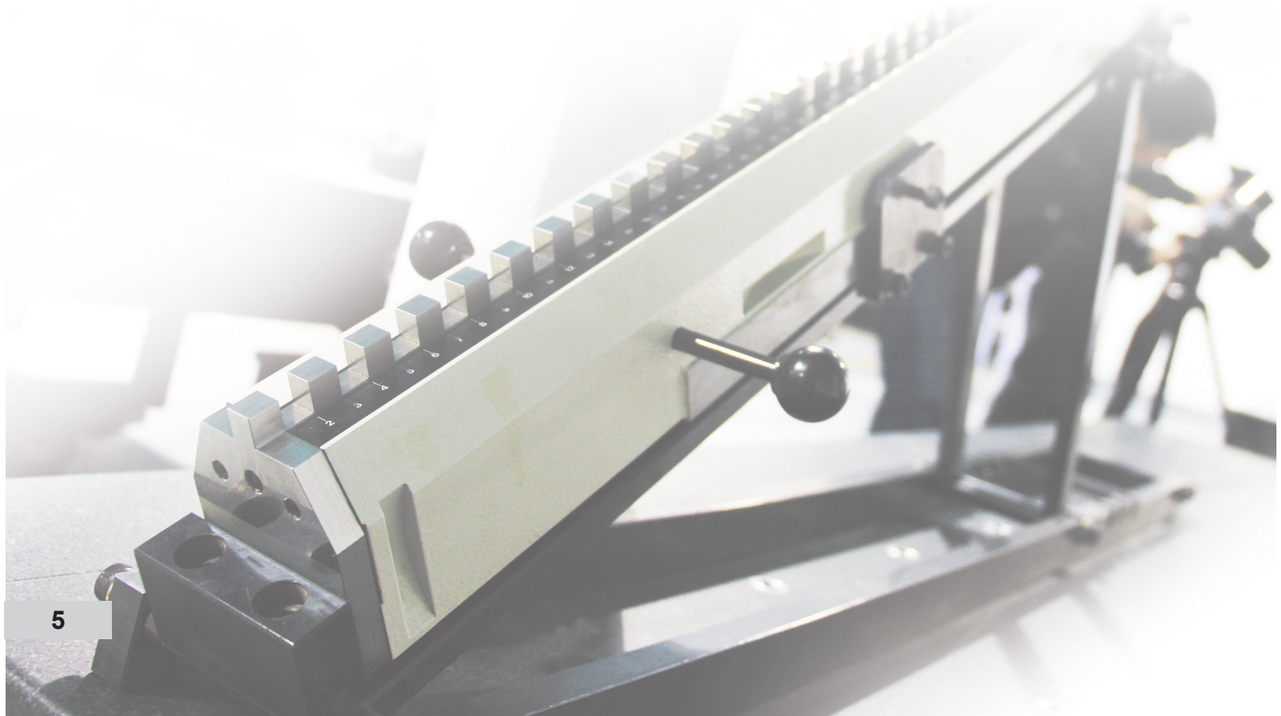
ISO 22093: 2003-(DMIS)

The software alogorithms have been authorized by PTB

World Metrology Traceability of Measurement



(measurement system, standard scale, gauge blocks, step gauge, height gage, oscilloscope, load cell)



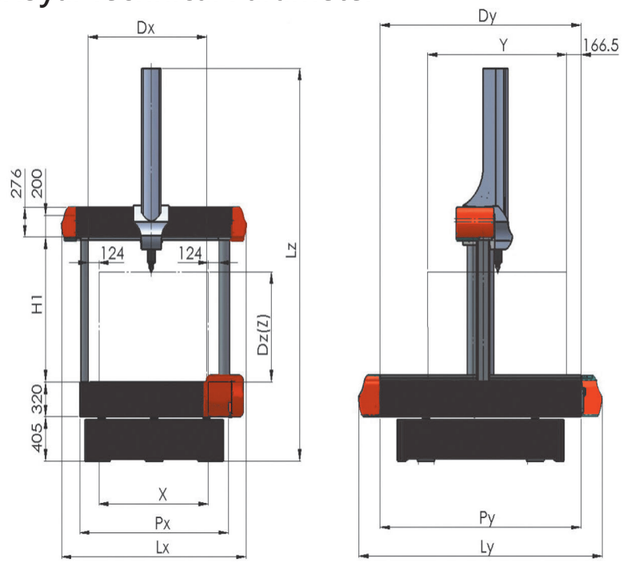
Royal

Type 2：Royal Series Bridge Type CMM

Stable, Multifunctional

- Adoption of integrated granite-material guideways makes sure of stable thermal performance of themselves
- The mechanical structure has the characteristics of strong rigidity and small geometric errors
- Adoption of collision-avoidance protection improves measurement 's safety
- 21 terms of compensation technique as to mechanical geometric errors improve the machine's precision greatly
- Y-axis guideway adopts dovetail type, which has high precision and good stability
- Z-axis adopts cylinder equilibrator system, which improves orientation precision and stability greatly for Z axis
- Adoption of advanced F.E.M.(finite element method) makes it have a stable and reliable resistance to effective deformation.

Royal Technical Parameter



0.32um repeatability of three axes

Type	Royal10158	Royal122210
MPEe (μm)	2.2+L/400	2.2+L/400
MPEp (μm)	2.2μ	2.2μ
Measuring range (mm) (Dx*Dy*Dz)	1000x1500x800	1200x2200x1000
Dimension (mm) (Lx*Ly*Lz)	2000x2600x3100	2500x4000x3700
Platform (mm) (Px*Py*Pz)	1146x2300x824	1493x3260x1031
Load capacity (Kg)	1800	1900

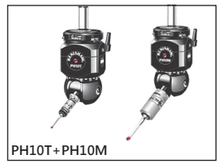
Measurement system

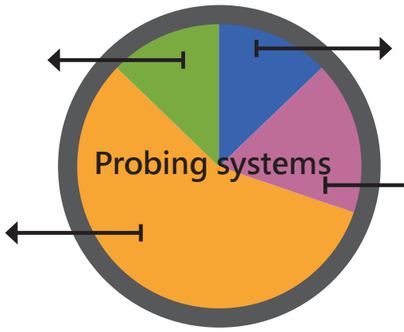
Precise Measurement System

One set of CMM which is accurate, reliable and flexible can meet various needs of the customer. CMM becomes a comprehensive multipurpose measuring and testing equipment, depending on the diverse probe configuration and highly efficient scanning. CMM can complete such tasks as the measurement and test of the workpiece, form measurement. They are also used in reverse engineering, quality control and some other applications.
After touch-trigger , scanning or non-contact probes get upgraded, characteristic dimensions of the box type workpiece as well as complex geometries can be measured by them, full scan also can be realized. In this way, they can't only meet customer's current measurement needs, but also meet their future needs. CMM'S value of economy, high efficiency and multifunction will be realized in truth.

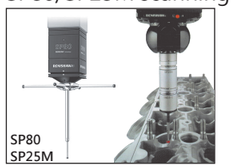
MH20I manual probe head

PH10T/PH10M/PH20
Motorised probe head





SP80/SP25M scanning probe



Laser scanning module

Renishaw types of styli (the most in common use)

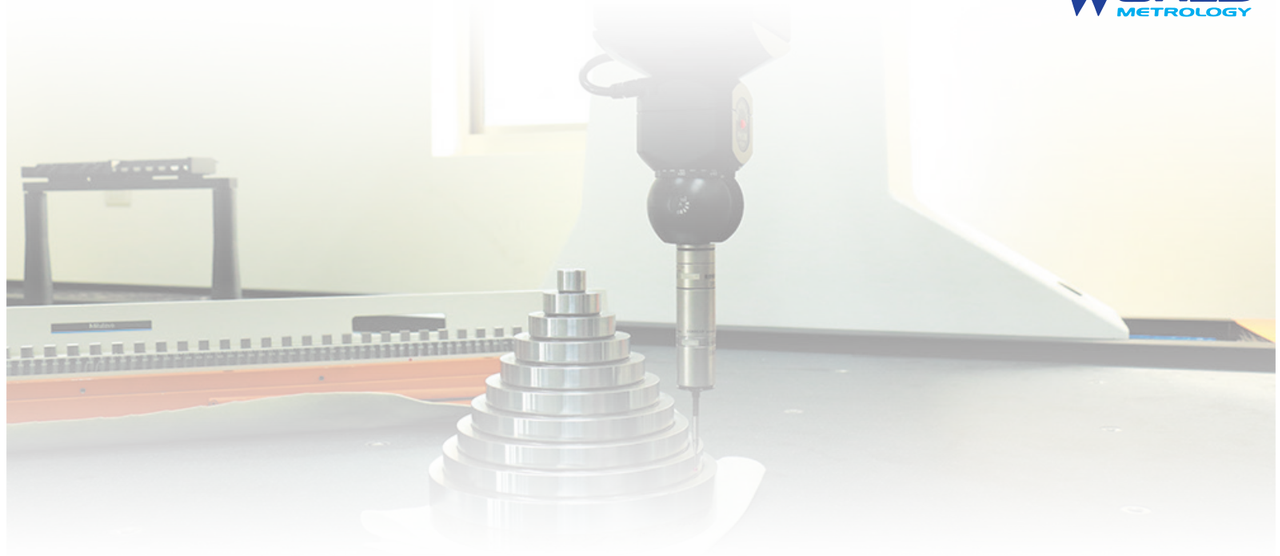
- **Straight styli**
  The simplest and most frequently used type of stylus, these are suitable for the majority of probing applications.
  Styli can have balls made from ruby, silicon nitride, zirconia, ceramic or tungsten carbide

- **Star styli**
  These are multi-tip stylus configurations with fixed mounted styli. These can be used to inspect a variety of different features, including surfaces and holes with which direct contact can be made. This configuration gives flexibility, enabling the tip to make contact with features without changing the stylus. You can configure your own star styli using stylus centres to mount up to 5 styli components.

- **Disc styli**
  These styli are 'sections' of highly spherical balls used to probe undercuts and grooves within bores, which may be inaccessible to star styli.

- **Cylinder styli**
  These are used for probing holes in sheet metal, pressed components and thin work pieces with which proper contact cannot be guaranteed with ball styli. In addition, various threaded features can be probed and the centres of tapped holes located

- **Stylus extensions**
  These are available in different lengths and materials – steel, titanium, aluminum, ceramic and carbon fibre. With long extensions consideration must be given to the thermal characteristics of the material.



Advanced Control System

- The original control system is imported from a famous international brand;
- The core of the system, a 64-bit digital signal processor, has the ability to support many kinds of probes;
- As for the control system, since we take I++IDE as its standard, the real multi-sensor integration is realized;
- The continuous track motion is controlled by the system. Then the fast accurate measurement is realized in Fly mode;
- The imported high-performance DC servo motor is adopted for the drive system, so the steady high-efficient driving gets realized.
- The terminal control unit is in the form of a portable operating case. The multifunction keyboard has many functions as a microcomputer, such as the ability to set the motion speed of the axis and the ability to reset the machine to certain satate.
- Multiple security protection modes as well as the function of on-line fault diagnosis result in the machine's characteristics of safety and reliability.

SPA2

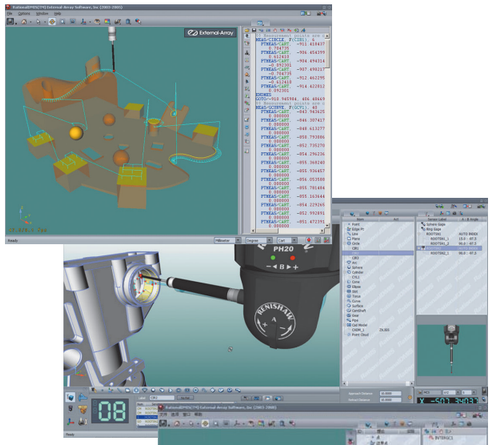
UCC2

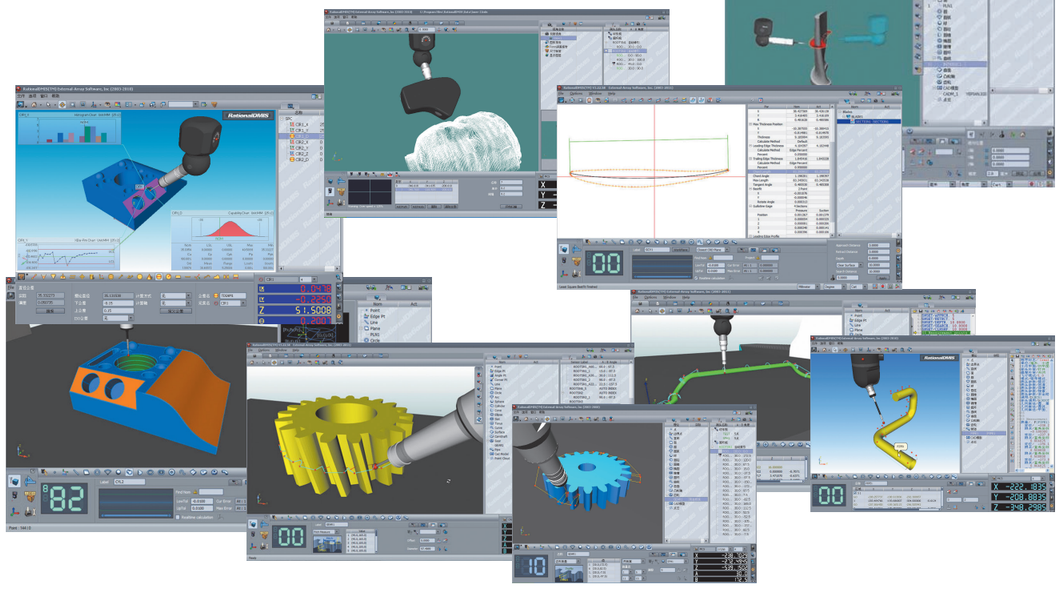
PI2000

The software system

The CMM software has a full graphical display, so it is visualized, convenient and intelligent. Even without too much experience, you can easily learn to use the software after a few days of training.

- Easy for operation
- Powerful Functions
- Intelligent Measurement and Test
- The rich diversity of output reports
- Hardware Supports
- Laser Scanning Module
- Pipe Inspection Module
- Gear/Cam Measurement Module
- Blade Analyses Module
- Statistic Function





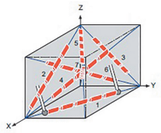
Comments on the accuracies

MPE=Maximum Permissible Error

As per DIN EN ISO 10360, every specification for accuracy is noted as Maximum Permissible Error (MPE). MPE defines a maximum value that a measuring deviation must not exceed for a certain measuring task. Measuring tasks are marked by an index. MPE_E describes the length measuring error and MPE_P the probing error.

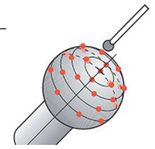
Maximum permissible length measuring error MPE_E

Calibrated gage blocks or stepper gage blocks are measured to determine length measuring error. 5 different lengths in 7 positions in the measuring range of the machine must be determined. Each length is measured three times. The determined values are compared with the calibrated values. The error must not exceed the specification. The specification depends on the length in most cases and is written $MPE_E=A+L/K$. L refers to the measuring length. The formula is occasionally written $MPE_E=A+F \cdot L/K$. In such cases, it must be converted in order to compare it to the first variation. For example, these values are identical: $MPE_E=2.5+1.5 \cdot L/333$ and $MPE_E=2.5+L/220$.



Maximum permissible probing error MPE_P

A sphere (10-50 mm diameter) with minimal form error is measured at 25 positions recommended by ISO 10360-2 in order to determine probing error. A Gaussian least squares sphere is calculated from the measured values. The range of radial distances from the sphere must exceed the specification.



Maximum permissible linear measuring error for camera sensors(VDI/VDE 2617 sheet 6.1) $MPE_{E\text{-}2D(OT)}$

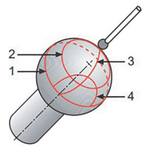
A linear measurement standard in the form of a glass scale is used to determine the length measuring error. The distances between the single marks are calibrated so that it is possible to determine the length measuring error from the comparison between the measured and calibrated values. The given value for the permissible length measuring error $MPE_{E\text{-}2D(OT)}$ must not be exceeded. As with contact sensors, the index "E" (for error) describes the length measuring error. Additionally, the index "2D" indicates that it deals with a two-dimensional measurement usually performed with cameras.
OT (Optical Error Translatory) indicates that the CMM moves the camera between the single measurements of the glass scale marks so that the deviations from the measuring machine and probe are taken into consideration.

Maximum permissible probing error for camera sensors(VDI/VDE 2617 sheet 6.1) $MPE_{PF\text{-}2D(OS)}$

When determining the probing error, a circle with minimal form error mounted to a glass plate is measured and the form error of the circle determined in the process. This deviation must not exceed the given value for the permissible probing error $MPE_{PF\text{-}2D(OS)}$.
The first index, PF, stands for probing form. 2D identifies the two-dimensional measurement. The index"OS" (Optical Error Static) identifies the static probe.

Maximum permissible probing error MPE_{THP} and MPT_{τ}

A sphere (25mm diameter) with minimal form error is measured on 4 paths specified in by ISO 10360-4 in order to determine scanning error. A comparison of the measured values with the specification MPE_{THP} must fulfill two requirements: the range of radial distances from the reference sphere determined by the single points must not exceed the specification (equivalent to : MPE_P). The deviation between the radial distances and the calibrated sphere diameter must not be larger than the specification. Furthermore, the required time τ must be given for the test as the speed of the measurement significantly influences the result. With the designation of speed and accuracy, the specification of scanning error is an important indicator of the productivity of a coordinate measuring machine.



Maximum permissible form measuring error $MPE_{RONt(MZCI)}$

The use of coordinate machines for form measurements is described in VDI 2617 sheet 2.2. Parameters on roundness measurements are defined in DIN EN ISO12181. A 50 mm ring gage with minimal form error is measured with high point density for the measurement. A Chebyshev circle (MZCI=Minimum Zone Circle) is calculated from the measured values. The form error is the range of radial distances from this circle. It is not allowed to exceed the specification.