MarForm MMQ 200
COMPACT FORM MEASURING MACHINE

- MarForm MMQ 200 is suitable for universal use for extensive workpiece evaluation according to DIN ISO 1101
- High precision measuring axes in C and Z make diverse form measuring tasks possible

- 0 +

Mahr

EXACTLY

This is what we mean by EXACTLY.

IN OUR VIEW, FORM DEVIATION IS NOT A QUESTION OF PERCEPTION.

THAT IS WHY WE HAVE MARFORM

To ensure problem-free functionality and durability of a workpiece, the key factors are its dimensions and, above all, its form. Requirements in terms of roundness, flatness, straightness, coaxiality or run-out - particularly when it comes to axis-symmetrical workpieces - are becoming increasingly strict. These requirements can only be reliably tested by using high-precision formtesters optimized for this purpose. Whether you are dealing with fuel injection technology, microelectronics, precision mechanics or medical technology, the key functional components are becoming ever smaller and ever more precise. To enable the production department to take advantage of the specified tolerances, measuring uncertainty must be kept as low as possible. MarForm helps you to reduce process costs without increasing testing costs, thanks to innovative instruments with the highest possible level of automation, flexibility, and precision. MarForm offers the ideal combination for all requirements.

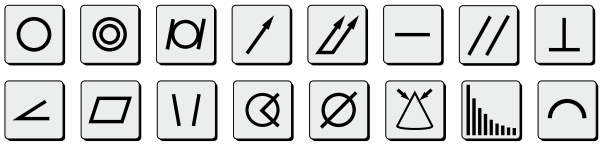
MarForm. FORMTESTER MMQ 200

MarForm MMQ 200

Entry into the Field of Cylindricity Testing. Easy, fast and cost-efficient

There are many aspects of our daily lives where we rely on technical components functioning correctly. Take, for example, the ABS braking system, fuel injection system and the gearbox of a car, the drive of a PC, the compressor in an air conditioning system, the blade of an electric razor, or the landing flaps of an aircraft. For moving components, it is vital they work together smoothly if they are to function efficiently over long periods of time. To ensure this is the case, axis-symmetrical workpieces with tight tolerances are required. Compliance with these tight tolerances can only be verified by using a precision formtester that has been specifically optimized for these applications. MarForm helps you to reduce process costs without increasing testing costs, thanks to innovative instruments exhibiting the highest possible precision and reliability. MarForm offers the ideal combination for all requirements.

MarForm MMQ 200 SERIES



The new **MarForm MMQ 200** offers you entry into the field of automatic form and location testing. The interplay of mechanically exactly manufactured components enables the MarForm MMQ 200 to attain excellent measuring results. To verify your production quality, the formtester MarForm MMQ 200 fully automatically determines the form and location deviation as per DIN/ ISO 1101, such as roundness, straightness, flatness (single trace), parallelism, conicity, coaxiality, cylindricity.

Features

The Formtester MarForm MMQ 200 is distinguished by the following features:

- High-precision roundness measuring axis (C)
- Motorized vertical measuring axis (Z)
- Motorized horizontal positioning axis (X)
- High measuring accuracy, optimized for cylindricity tolerances
- Manual centering and tilting table
- Manual length measuring probe T20W or motorized probe T7W
- Ergonomic control panel, also enables the start of selected measuring programs (P1, P2, P3)
- All-in-one PC with touchscreen function for easy and fast operation

Your advantages

- Immediate recognition of production errors
- Minimization of post-processing and rejected parts
- Documentation of product quality
- Immediate use due to easy operation
- For production and measuring room

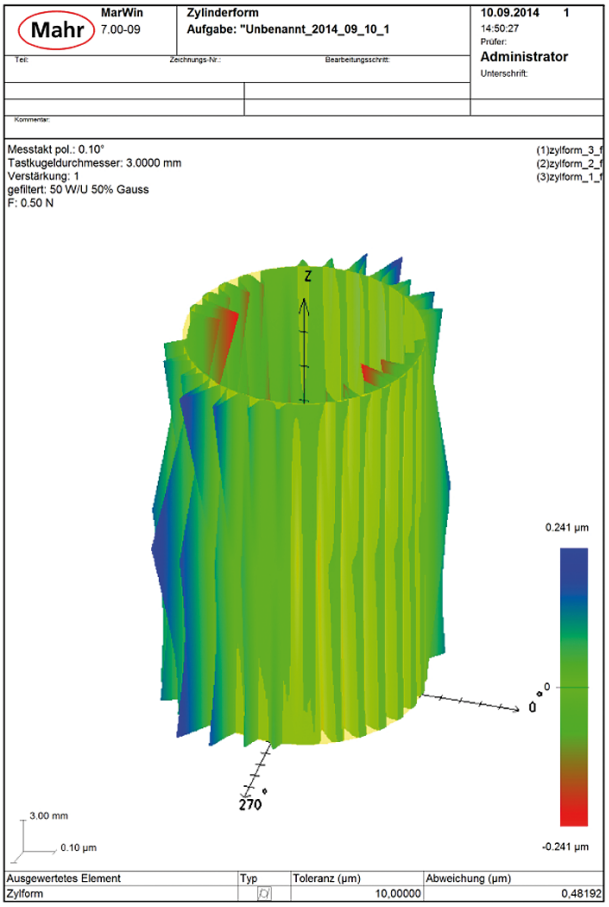
MarWin EasyForm Software for MMQ

The easy way to measure form. Intuitive operation enables immediate measurements without programming. Thanks to the touch-screen technology, EasyForm can also be quickly and easily operated without mouse or keyboard. The required settings are limited to a minimum, thus extremely shortening the time until a finished measuring record is in your hands.

The complete solution

Mahr delivers the complete solution for your measuring task:

- Competent advising and pre-testing on your workpiece before purchase
- After-sales services: Measuring program creation and advising, maintenance contract, software maintenances contract, DKD calibration service program
- Metrology and application training
- Competence from one source: production and development at one site - and that for over 100 years



The quick way to a complete measuring record

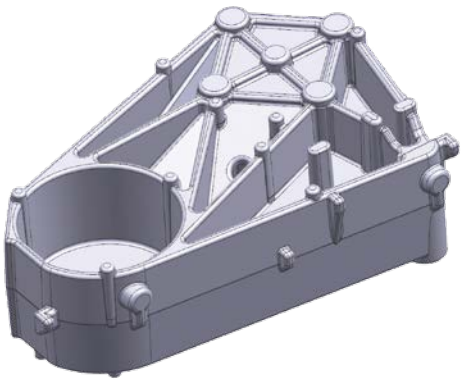
MarForm MMQ 200

Absolutely solid and highly precise

The entire construction of the **MMQ 200** has been designed with robustness, stability and resistance to external influences in mind.

Base unit

The base unit serves as the 'foundation' of each measuring instrument. The high mechanical stability of the MMQ 200 is ensured by a highly stable steel body with an internal reinforcing structure in which the mechanical rotational axis is embedded.

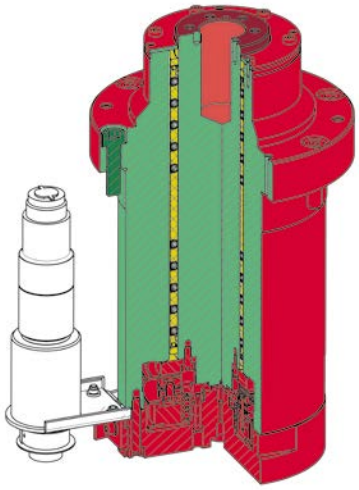


Vertical measuring axis

The vertical axis has been developed completely from scratch. It is also enclosed in a steel body and is aligned precisely to the rotational axis using special control elements. Particular attention has been paid to the long-term stability of this critical alignment to ensure that it is resilient to environmental influences. Like all mechanical components, the column has been optimized in CAD using the Finite Element Method.

Thermal encapsulation

Temperature changes are the arch enemy of precision measurement. However, conditions in the measuring room cannot always be perfect. The MMQ 200 is ideal when conditions are less than optimal. The use of homogenous materials ensures that the MMQ 200's geometry remains accurate and consequently, thermal expansion uniform, even if temperatures fluctuate. Both the base unit and the vertical axis are also thermally encapsulated. Brief changes in the ambient temperature therefore have only a minor effect on measurement results. Internal heat sources (motors and electronics) are also thermally insulated and arranged so that the heat that they radiate cannot influence the measuring axes.



Mechanical bearings: Up to 70x more rigid than air bearings

Mahr is the leading manufacturer of ultra-precise bearings for rotating and lifting movements and supplies customers world-wide. Our customers are from the fields of mechanical engineering, precision engineering, optics, medical technology and production of electronic parts. Mahr produces well over 100,000 rotary stroke bearings each year. Mahr has also been producing high-precision air bearings for more than 60 years. Through its unique technology, Mahr has been able to combine the benefits of air bearings with the robustness of mechanical bearings.

With air bearings, the interplay of the components is distributed by means of an air gap over a very large area. The high integration this yields supports exceptional radial run-out properties - but only if external influences are kept within limits. External influences such as forces arising from the drive or an irregular load distribution or from vibrations in the environment introduce forces into the bearing. The impact this has on accuracy depends on the rigidity of the bearing. This is very low in the case of air bearings due to their very nature.

With mechanical bearings, the balls between the rotor and stator establish a direct mechanical connection. This increases rigidity 70-fold which ensures external influences are minimal. The limited number of contact points reduces the level of integration, therefore mechanical bearings are less precise.

However, Mahr's decades of experience has been combined with the use of special production techniques and materials to produce mechanical bearings of the same quality as an exceptionally good air bearing. This quality is maintained even under difficult environmental conditions!

MarForm MMQ 200

Ergonomic workplace

Usually, the MMQ 200 is operated on a work table with a basic area of 1,150 x 750 mm (45.3 x 29.5"), i.e. a table of the size of a Euro pallet. This work table provides sufficient space for a monitor, keyboard and accessories and offers adequate leg room over the entire width and depth so the user can work comfortably, even when seated. Roller-type cabinets that can be positioned next to or beneath the work table are also available. If you need to view drawings or draw up measuring plans and measuring programs on a regular basis, the preparation table with separate monitor and keyboard provides an efficient working option.

The machine can also be operated easily when standing. The ergonomic manual control panel and sensitive joystick round off the overall impression of a very user-friendly unit.

Speed and cost-effectiveness

Speed is not an issue. But combining speed and accuracy has proved to be far trickier when it comes to axes control. Through put time when measuring a workpiece is now more important than ever. The Z-axis of the MMQ 200 permits movements at up to 100 mm/s - more than three times faster than any other form measuring instrument. The adjustable speeds and accelerations, fewer alignment operations thanks to sophisticated algorithms, and simultaneous movement of up to three axes all combine to save valuable time. This reduces the costs per measurement significantly.

Safety reserves built in

If you travel fast, you need to be able to stop fast, too. When designing the new MMQ 200 a concentrated effort was made to protect both the operator and the machine. A whole array of safety features has been included to ensure trouble free operation. These range from passive safety measures to prevent possible crush points, and extend to the probe protection contact (when the permissible measuring range is exceeded), thermal overload protection and collision protection switch, right through to the emergency off switch with triple relay technology, counter-current braking and defined "crush zones".

Serviceability

If a service issue does arise, all service-relevant assemblies can be accessed easily from the outside. This means short repair times and low repair costs even after many years of operation. But to ensure that repairs are not necessary in the first place, we can offer you maintenance services, maintenance agreements or extended warranties.

An MMQ 200 after all, is almost an investment for life....

MarForm MMQ 200

Flexibility

A variety of available probe arm units and clamping devices enables the universal use of the **MarForm MMQ 200**. The field of application of the formtester is also diverse. It ranges from the measuring room to production for the accompanying form and location verification in the production process. Stored measurement programs can be started done via the touchscreen or the desktop as well as via the function keys on the manual control panel. This speaks in favor of the **MMQ 200.**

You always attain your measurement result flexibly but quickly.

Compact design

Despite the extremely generous measuring volume, the **MMQ 200** has a much smaller footprint than other, comparable units. The electronics are integrated in the unit and the fact that no compressed air is required means that the **MMQ 200** does not require an additional power source. Consequently, there is sufficient space available to ensure that the working environment is as ergonomic as possible.

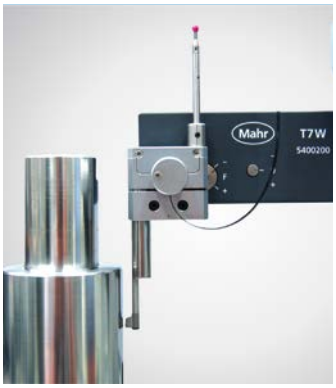
Variable

The **MMQ 200** is available in two versions:

- with manual probe T20W
- with motorized probe T7W

Furthermore, there are various software extensions and options available, e.g .

- MarWin AdvancedForm - the user-friendly learning programming
- Marwin ProfessionalForm - the powerful script programming for maximum flexibility and sophisticated measurements



MarForm MMQ 200

Versions

Measuring Station	Order No.	Centering and tilting table manual Ø 160 mm	C- axis motorized measuring axis	X-axis motorized positioning axis	Z-axis motorized measuring axis	Scale systems in C, Z and X	MarWin EasyForm Evaluation	MarWin AdvancedForm Evaluation	MarWin ProfessionalForm Evaluation	Probe T20W	Probe T7W motorized	Roughness measurement	Twist measurement
MarForm MMQ 200 with Z = 250 mm and X = 150 mm													
MMQ 200 with T20W	5440750	x	x	x	x	x	x	o	o	x	-	-	-
MMQ 200 with T7W	5440751	x	x	x	x	x	x	o	o	-	x	o	o

x = standard
o = option
- = not intendet

MarForm MMQ 200

Technichal Data

Formtester	MMQ 200 Z = 250 mm, X = 150 mm
Roundness measuring device, C-axis	
Roundness deviation	0.03 + 0.0006 (µm+µm/mm meas. height)**
Roundness deviation	0.015 + 0.0003 (µm+µm/mm meas. height)*
Axial run-out deviation	0.04 + 0.0006 (µm+µm/mm meas. radius)**
Axial run-out deviation	0.02 + 0.0003 (µm+µm/mm meas. radius)*
Centering and tilting table	
Coarse and fine adjustment	manual
Table diameter	160 mm
Table load capacity, centric	200 N
Rotational speed (50 Hz / 60 Hz)	1 – 15 (1/min)
Vertical unit, Z-axis	
Motor-drivie measuring path length	250 mm
Straightness deviation/100mm **	0.15 µm
Straightness deviation/total meas. path **	0.3 µm
Parallelism deviation Z/C axis	0.5 µm
Measuring speed	0.5 - 20 mm/s
Positioning speed	0.5 - 100 mm/s
Horizontal unit, X-axis	
Positioning path, motor-driven	150 mm
Positioning speed	0.5 – 30 mm/s
Measuring volume	
Test diameter up to	210 mm
Measuring height up to	380 mm
Distance C/Z-axis	218 mm
Dimensions, weight	
Length	803 mm
Width	388 mm
Height	883 mm
Weight	ca. 120 kg
Connection data	
Voltage supply	100 V to 240 V (50 Hz up to 60 Hz)
Power consumption	180 VA
Data conneciton to PC	USB 2.0
Installation requirements	
Ambient temperature	20°C ± 1K
Humidity	40% - 70% RL

* Values as maximum deviation from reference circle LSC, at 20 °C ±1 °C in oscillation-neutral environment, filter 15 upr, 5 rpm and standard probe arm with ball dia. 3 mm (0.12").

** All values to DIN ISO 1101 at 20 °C ± 1°C in oscillation-neutral environment; filter 15 upr LSC, 5 rpm and standard probe arm with ball dia. 3 mm (0.12"). Tested on a standard using compensation algorithms

MarWin

Software MarWin EasyForm

For years, the software platform MarWin has stood for innovate solutions in metrology. MarWin is more than just a software. Behind MarWin is the philosophy that for every desired task and moder of operation there is an optimally suited solutions. The measuring and operating software EasyForm is very easy and does not require any previous programming knowledge. EasyForm is therefore perfectly suited with the MarForm MMQ 200 as the entry model into cylinder form testing. You personnel - and in the end your operating costs - profit from the low number of steps it takes to reach the measuring record. You can perform roughness measurements in two easy steps.And the sfotware guides you through every setting that you would like to use. At the end, you have attained a complete measuring record in only a few clicks.

EasyForm Software remembers every step of your measurement

It doesn't matter if you need to repeat the most recent measurement or if you decide to combine several measurements and evaluations on workpiece to a comprehensive program:

The EasyForm Teach-In feature will learn what you want!
After the measurement, simply click on "Add to feature sequence" to create your own measuring program. You can save your measuring programs under one of the 32 programmable operation keys.

EasyForm – Part of the proven MarWin software platform from Mahr

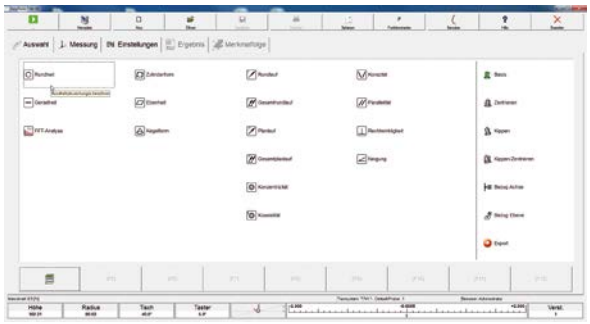
EasyForm is based on highly optimized MarWin measurement and evaluation routines and can also be combined with other MarWin modules. It runs on Windows® operating systems and includes functions for user administration, network support, electronic storage of results and is extendable for future options.

The easiest way to operate a Formtester.

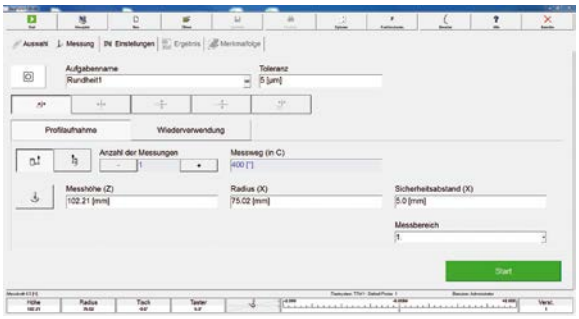
- Prepositioning and parameterzation
- Any features in any order
- In addition to circle and line profiles, helical and spiral profiles are now also possible
- Complete measuring record can be freely designs from result charts and graphics
- 3D depiction
- Results can be saved e.g. as a PDF file
- Functions for data processing such as FFT and interactive hiding
- Data export QS-STAT (option) or text file, among others
- Measuring programs can be easily called up using function keys

Monitor

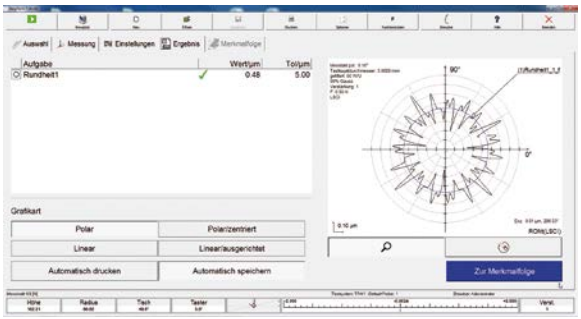
The touch screen monitor alleviates works. EasyForm offers the possibility to us a regular TFT monitor as well as a touch screen monitor, i.e. without keyboard or mouse. This is particularly useful for use in production.



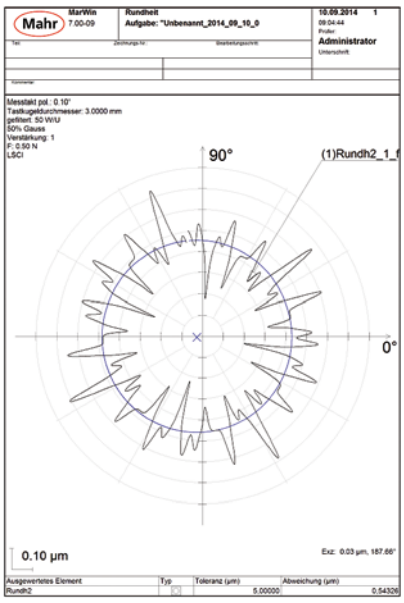
Select measuring task



Specify measuring parameters



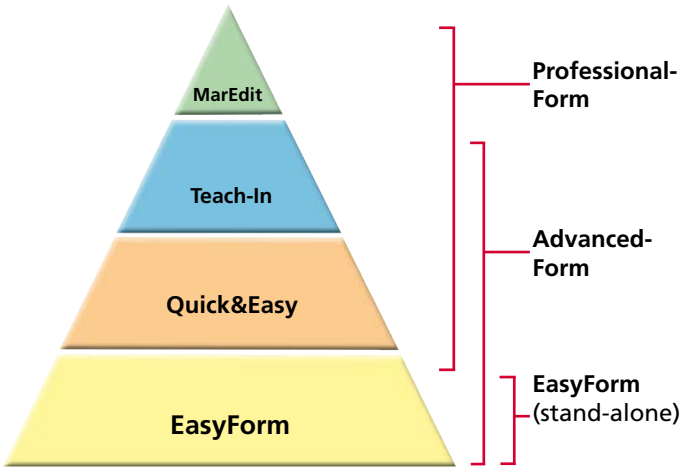
Select depiction mode and hide area



Complete measuring record

MarWin

Software MarWin AdvancedForm



AdvancedForm gives you total control over your form measuring station. You can perform positioning, alignment, measurement or documentation tasks with a click of the mouse - and the graphical user interface gives you a constant overview.

As with other Windows® applications, functions can be selected from menu bars with pull-down menus using the mouse.

Many functions, e.g. printing results, loading measuring programs or changing a program step, can be activated simply by clicking the appropriate icons.

With AdvancedForm you always have complete control over the form measuring station. For example, you can track the profile during measurement and intervene if necessary. Operation can be adapted to suit individual requirements, regardless of whether you want to perform a quick single measurement, conduct a program run on a series part or convert a complex measuring task into a measuring program. **AdvancedForm** provides the ideal operating strategy whatever the task.
Given that tasks can vary a great deal, no operating strategy is exactly right for every application. Consequently, **AdvancedForm** provides several different operating strategies:

- **Measuring run - Preferences**
  for measurements with an existing measuring program
- **Quick&Easy**
  for rapid measurements, obtaining a measuring result quickly with the minimum of effort
- **Teach-in programming**
  for creating, modifying and running a measuring program with a large number of options
- **MarEdit** (optional)
  the operating level for application engineers and trained specialists, for solving the most challenging and complex of tasks

AdvancedForm provides a clear overview of all the required measuring and evaluation parameters. Many of these parameters have default settings which simply have to be confirmed for the majority of measuring tasks. It is, of course, also possible to adapt individual parameters to the relevant task.

AdvancedForm has a powerful **teach-in programming** function to create measuring programs for workpieces that are to be measured repeatedly. It can also be used for measuring runs with special positionings, measurements, evaluations and forms of presentation.

With teach-in programming, as soon as you click an icon - e.g. for a run-out measurement and evaluation - a window opens where you can describe the feature in more detail if necessary (e.g. radial or axial run-out, datum, brief designation, tolerance etc.). The number of measurements and their type (original measurement or new evaluation of profiles already measured) are also specified in this window. Separate windows can be opened to change measuring, evaluation and display parameters, but in many cases this is not necessary because logical defaults that apply to a large number of measuring tasks have already been entered. If different settings are required for specific measuring tasks, the clear way the window is designed helps you to quickly find the correct location and optimize the settings in no time at all.

The layout of a measuring record, for example, can be modified right down to the finest detail.
The color of the profile, reference and borders can be selected individually, and the scaling (in µm/µin per scale division), type of graph (polar or linear, centered or uncentered) and additional display parameters can be set in any combination you choose.

Measuring programs for a series of parts that are to be run repeat-edly can be saved and called up at any time (see above).

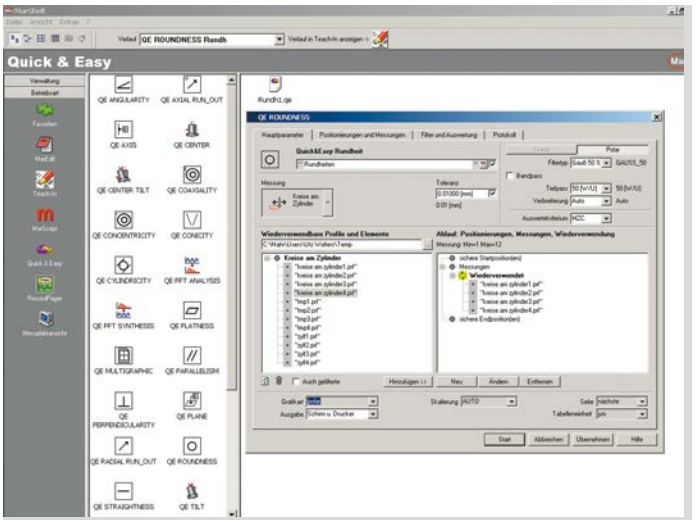
Informative profile graphs - if required with several profiles in a single graph, displayed in different colors and in different ways - are then immediately available on the large color screen. If you are looking for exact numerical values, you can opt to display the results in a table.

With the new **AdvancedForm**, standard-compliant measurements and evaluations are displayed in a way which is both clear and representative. There is even an interactive layout customization feature with a 3D preview in real time.

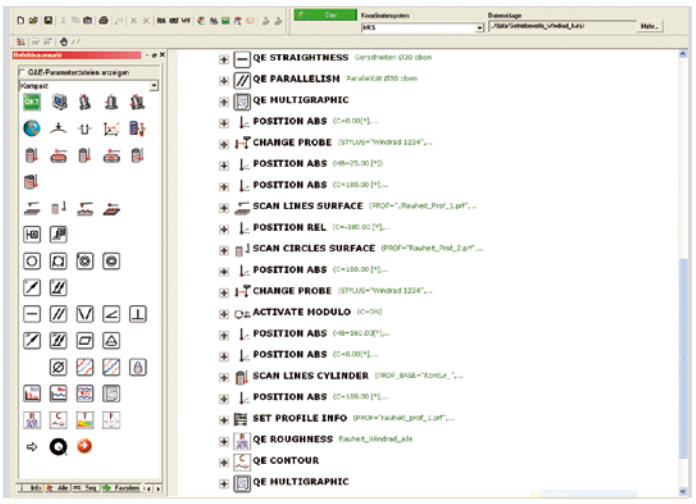
MarWin

Software Wizards for MarForm

MarWin EasyForm - touch-screen capable



***Quick&Easy** Roundness*



Teach-In Listing

MarWin software modules in detail

If you need to carry out form measurements, rather than creating long measuring programs you may prefer to gain direct access to a comprehensive and informative measuring record. In order to be able to do so, it is particularly important for the software to be transparent. Immediately after logging in at the **MarWin** user administration, you are directed to the **MarShell**, a clearly arranged user interface comparable with the Windows Desktop. It is from this MarShell that you start the finished measuring programs in the preferences view. These preferences can be easily identified by means of saved images or graphics. One click is all that is needed to start the measuring program.

The **MarShell** is also used to start the measuring wizard module, **Quick&Easy (QE)**.

The **Quick&Easy** wizards provide support for "quick interim mea-surements" and, with little effort, guide the user quickly to his objective, namely a highly informative measuring record.

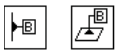
A further click results in all **Quick&Easy** wizards that have so far been run being adopted as a chronological sequence into the **MarWin** teach-in program. This sequence merely has to be saved and the measuring program is then ready.

In **AdvancedForm**, additional functions can be added to the measuring program. The following **Quick&Easy** wizards assist in this process:

- **QE Determine starting position**
  Wizard for organizing and preparing the measurements with selection of the probe elements, messages and display of workpiece / clamping images
- **Measuring station**
  For manually controlling the machine's axes and probe arm
- **QE Axial run-out alignment**
  Wizard for tilting and leveling the workpiece; based on an axial run-out measurement
- **QE Centering**
  Wizard for centering the workpiece; based on a circumferential measurement
- **QE Centering and tilting**
  Wizard for centering and leveling the workpiece; based on two circumferential measurements at two different heights

- **QE Set parameters**
  Wizard for defining the global and local parameters conveniently
- **QE Zenith**
  Wizard for determining the maximum X- or Z-position of a profile

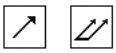
- **QE Edge search**
  Wizard for determining an edge position which can then be used to generate a workpiece coordinate system
- **QE Switch coordinate system**
  Wizard for defining and naming coordinate systems
- **QE Move to calculated position**
  Wizard for moving the probe to a calculated position



- **QE Axis**
  Wizard for generating a datum axis; based on at least two circum-ferential measurements performed at different heights or one axial run-out measurement and one circum-ferential measurement
- **QE Plane**
  Wizard for generating a datum plane; based on at least two circum-ferential measurements performed at different heights or one axial run-out measurement and one circum-ferential measurement

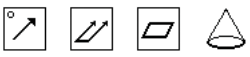
- **QE Circles on cylinder**
  Wizard for polar measurements on the internal or external circumference with the C-axis
- **QE Circles on the flat face/plane**
  Wizard for polar measurements with contacting from above or below with the C-axis
- **QE Lines on cylinder**
  Wizard for vertical measurements on the internal or external generating line with the Z-axis
- **QE Lines on the flat face/plane**
  Wizard for horizontal measurements on the flat face from above or below with the X-axis

- **QE Roundness**
  Wizard for measuring, evaluating and recording the roundness; also as local deviation within a sliding window; based on measurements of full and partial circles
- **QE Cylindricity**
  Wizard for measuring, evaluating and recording the cylindricity; based on measurements of full and partial circles or straightness measurements along the generating line
- **QE Coaxiality**
  Wizard for measuring, evaluating and recording the coaxiality with respect to a datum axis; based on measurements of full and partial circles
- **QE Concentricity**
  Wizard for measuring, evaluating and recording the concentricity with respect to a datum profile at the same Z measuring height; based on measurements of full and partial circles



- **QE Radial run-out**
  Wizard for measuring, evaluating and recording the radial run-out with respect to a datum axis; based on measurements of full and partial circles
- **QE Total radial run-out**
  Wizard for measuring, evaluating and recording the total radial run-out with respect to a datum axis; based on measurements of full and partial circles or linear measurements along the generating line

- **QE Straightness**
  Wizard for measuring, evaluating and recording the straightness; also as local deviation within a sliding window; based on linear measurements or a theoretical axis from circular measurements on the generating line
- **QE Parallelism**
  Wizard for measuring, evaluating and recording the parallelism relative to a datum axis, datum plane or opposite profile; based on linear and polar measurements or a theoretical axis
- **QE Conicity**
  Wizard for measuring, evaluating and recording the conicity relative to a datum axis or opposite profile; based on linear measurements
- **QE Angularity**
  Wizard for measuring, evaluating and recording the angularity relative to a datum axis or datum plane; based on linear and polar measurements or a theoretical axis
- **QE Perpendicularity**
  Wizard for measuring, evaluating and recording the perpendicularity relative to a datum axis or datum plane; based on linear and polar measurements or a theoretical axis

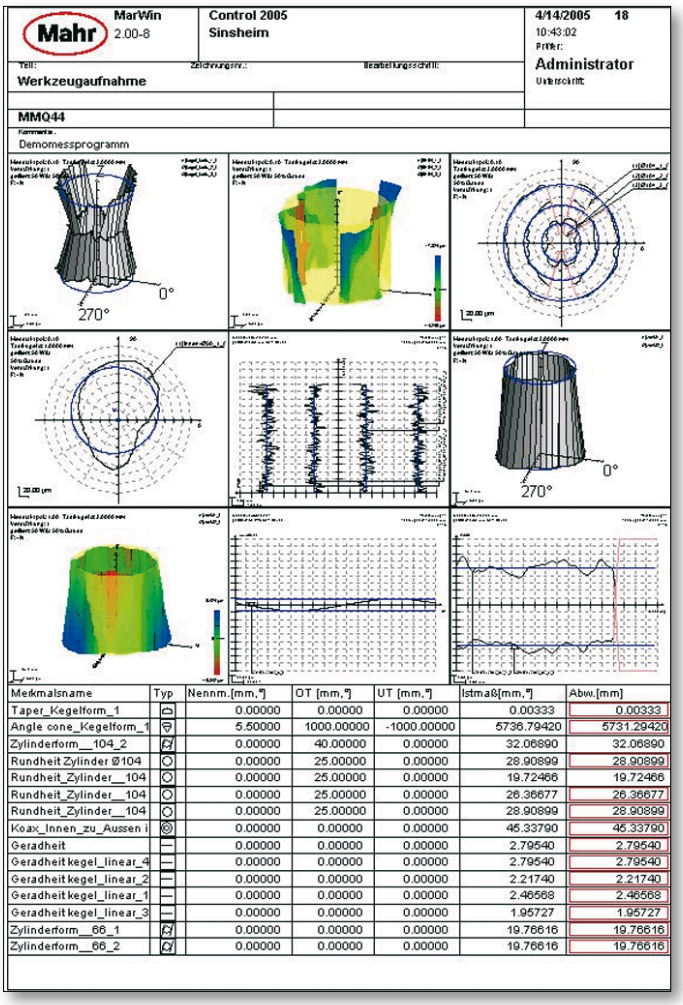


- **QE Axial run-out**
  Wizard for measuring, evaluating and recording the axial run-out relative to a datum axis; based on measurements of full and partial circles
- **QE Total axial run-out**
  Wizard for measuring, evaluating and recording the total axial run-out relative to a datum axis based on measurements of full and partial circles or linear measurements on an end face
- **QE Flatness**
  Wizard for measuring, evaluating and recording the flatness; based on measurements of full and partial circles or linear measurements
- **QE Cone form**
  Wizard for measuring, evaluating and recording the cone; based on measurements of full and partial circles or linear measurements. The cone angle can also be computed and output

MarWin

Software Wizards for MarForm

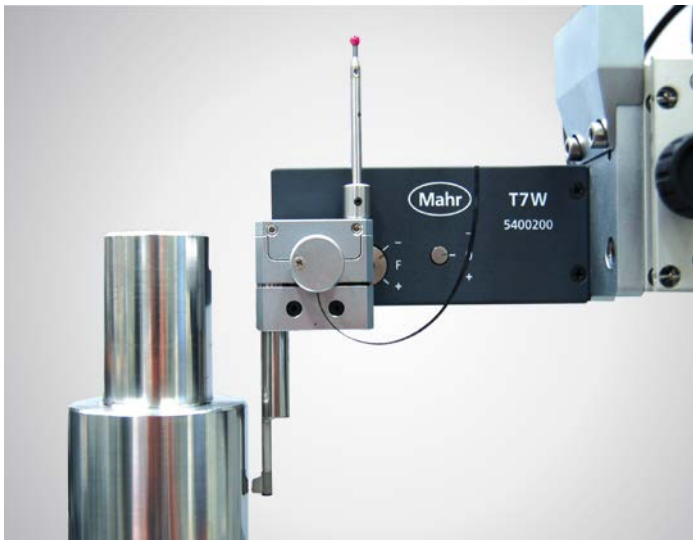
- **QE Fourier analysis**
  Wizard for performing a Fast Fourier Transformation on a polar/ linear profile; result presentation in a histogram or table. Including a tolerance band monitoring function for the amplitude height in the histogram (nominal value read from an ASCII file); RTA analysis based on the FAG standard with calculation and representation of a tolerance band in the Fourier histogram as described in the FAG in-house standard in the form of an RTA analysis
- **QE Fourier synthesis** (optional)
  Wizard for generating new profiles from profiles from which some wavelengths have been removed. Instrument for removing any wavelength from a profile. Reversal of a Fast Fourier Transformation and selection of specific wavelengths for generating a new, "synthetic" profile that can then be subject to further evaluation
- **QE Profile arithmetic**
  Wizard for calculating profiles and generating new profile informa-tion which can then be put to further use. Required in order to determine e.g. the relative thickness profile of two opposite profiles
- **QE Multigraphic**
  Wizard for generating multigraphics on a record sheet
- **QE Result export** (optional)
  Wizard for exporting measuring results to the Mahr DataTransferTools (optional) and, consequently, to statistical software packages such as qs-STAT, Excel, etc.
- **QE Roughness measurement** (optional)
  Wizard for the measurement and evaluation of roughness parameters
- **QE Contour measurement** (optional)
  Wizard for the measurement and evaluation of contour features
- **QE Diameter measurement** (optional)
  Wizard for the measurement and evaluation of diameter deviation from polar profiles and with LSC evaluation
- **QE QS-STAT** (Option)
  Wizard for easy export of result values to the statistics software QS-STAT (separate description upon request)
- **QE Tolerance band evaluation** (optional)
  Wizard for defining, measuring and evaluating free forms. The measurement takes place as a comparison to the target profile with the path control or in the "Tracking Mode" for unfamiliar free forms
- **QE Cam evaluation** (optional)
  Wizard for defining, importing, measuring and evaluating cam shape and cam-specific features (pg. 22 ff.). The measurement takes place as a comparison to the target profile with the path control or in the "Tracking Mode" for unfamiliar cam geometries.
- **QE Dominant roundess waviness** (optional)
  Wizard for the measurement and evaluation of dominant roundness waviness according to MBN 10455. Evaluated are RONWDt, RONWDmax, RONWDc and RONWDn. (separate description upon request)

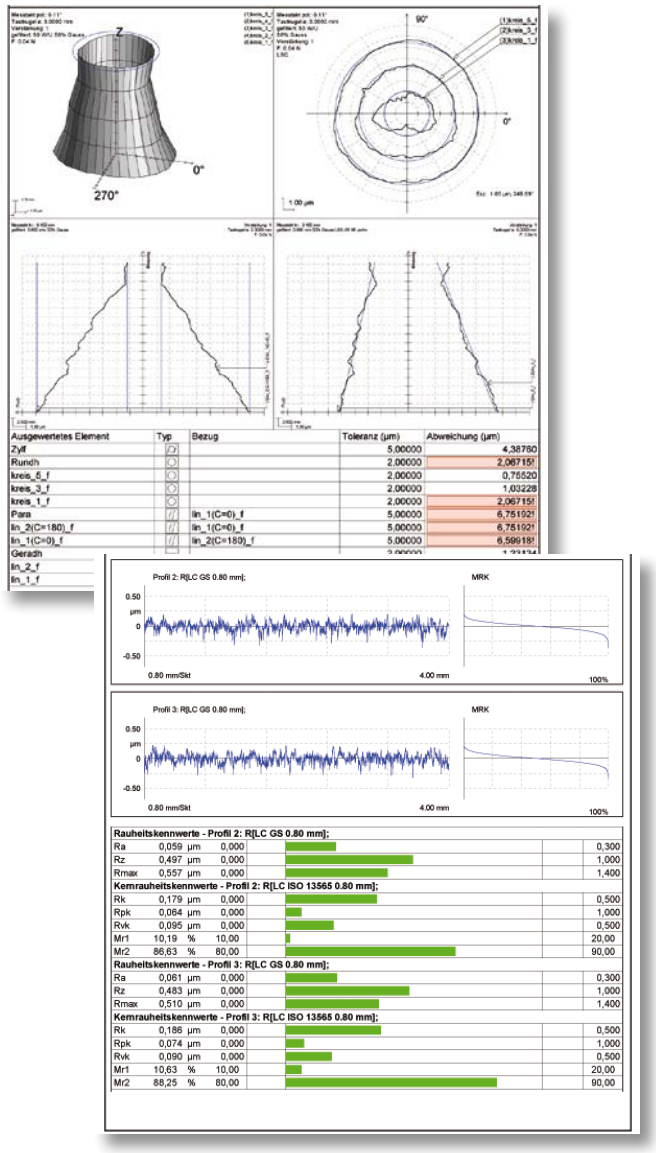


Merkmalsname	Typ	Nennm.[mm,°]	OT [mm,°]	UT [mm,°]	Istmaß[mm,°]	Abw.[mm]
Taper_Kegelform_1		0.00000	0.00000	0.00000	0.00333	0.00333
Angle cone_Kegelform_1		5.50000	1000.00000	-1000.00000	5736.79420	5731.29420
Zylinderform__104_2		0.00000	40.00000	0.00000	32.06890	32.06890
Rundheit Zylinder Ø104		0.00000	25.00000	0.00000	28.90899	28.90899
Rundheit_Zylinder__104		0.00000	25.00000	0.00000	19.72466	19.72466
Rundheit_Zylinder__104		0.00000	25.00000	0.00000	26.36677	26.36677
Rundheit_Zylinder__104		0.00000	25.00000	0.00000	28.90899	28.90899
Koax_Innen_zu_Aussen i		0.00000	0.00000	0.00000	45.33790	45.33790
Geradheit		0.00000	0.00000	0.00000	2.79540	2.79540
Geradheit kegel_linear_4		0.00000	0.00000	0.00000	2.79540	2.79540
Geradheit kegel_linear_2		0.00000	0.00000	0.00000	2.21740	2.21740
Geradheit kegel_linear_1		0.00000	0.00000	0.00000	2.46568	2.46568
Geradheit kegel_linear_3		0.00000	0.00000	0.00000	1.95727	1.95727
Zylinderform__66_1		0.00000	0.00000	0.00000	19.76616	19.76616
Zylinderform__66_2		0.00000	0.00000	0.00000	19.76616	19.76616

An informative measuring record is available at the end of the measurement.

Software Option Roughness Measurement





What is more obvious than assessing and documenting the surface roughness parameters of your workpiece while checking it for form and position tolerances?
Why not assess e.g. the Ra and Rz values with a MarForm form measuring instrument?
If you do so, you can be sure of uncompromisingly high quality for the pick-up or probe required for the relevant measuring task is always in optimum measuring position.

Profit from:

- Reduced testing times and costs due to complete workpiece assessment in a single set up and in just one run
- Higher accuracies due to the automatic selection and position ning of the probe or pick-up for each measuring task
- Simple operation due to a software which is equally well suited for surface roughness as well as form and position measurements
- Detailed and telling measuring records
- Well-proven surface roughness metrology combined with equally well-proven form metrology

Delivery scope of:
Option Roughness Measurement for MMQ 200
Order no. 5400240, 5400241

Hardware package

- Roughness probe PHT 6-350 with 90° probe tip, rounding radius 2 µm
- Double probe arm holder unit to support the PHT 6-350 as well as the probe arm for form measurement
- Adapter to connect the PHT 6 to Formtester MMQ 200

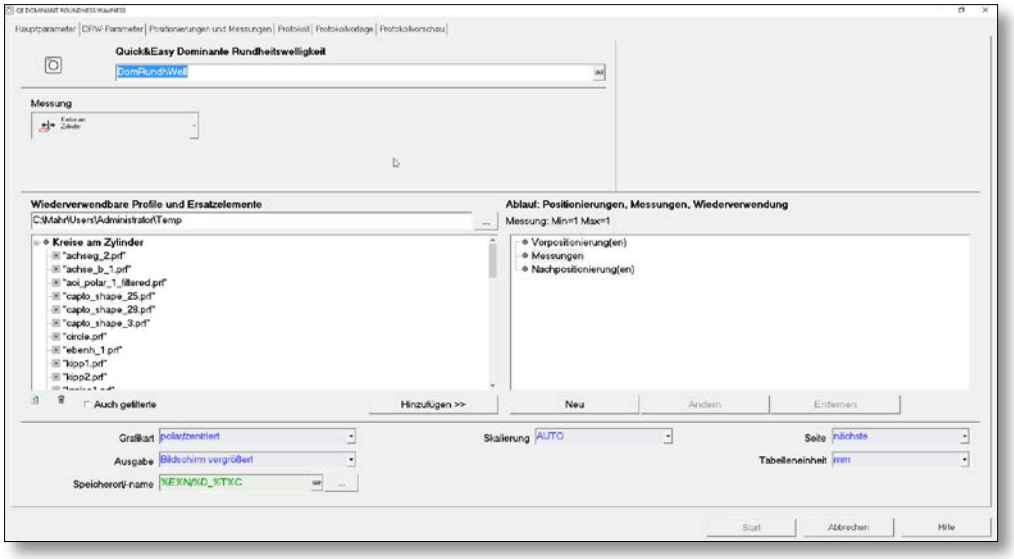
Software package

- Software license for roughness evaluation, for use in AdvancedForm
- Software option AdvancedForm for use with MMQ 200

RPHT 6-350 Pick-up	Order no. 6111520
System	Skidded probe
Skid radius	In tracing direction 25 mm, laterally 2.9 mm
Contact point	0.8 mm in front of the probe tip
Measuring range	350 µm
Specification	For level surfaces, For bores from 6 mm Ø to 17 mm depth Grooves from 3 mm width, min. workpiece length = tracing length + 1 mm
Probe tip geometry	2 µm/90° diamond

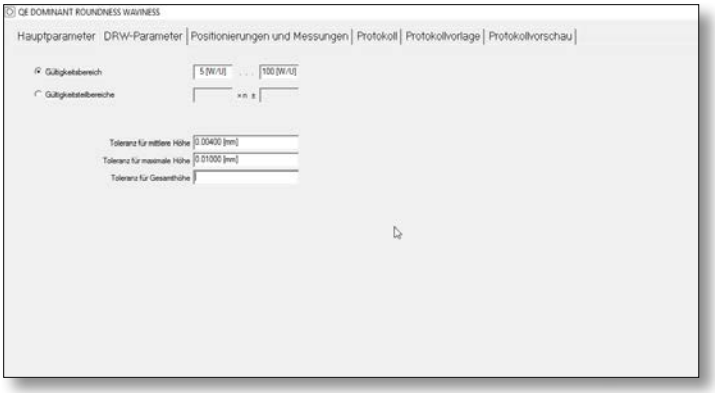
MarWin

Software Option Dominant Roundness Waviness



QE Dominant Roundness Waviness

The software option "Dominant Roundness Waviness " is based on the DAIMLER company standard MBN 10 455. It deals with periodically occurring waves in roundness profiles. Based on the dominant waviness analysis of profile profiles (VDA 2007), an evaluation method is described which recognizes the periodic dominant characteristics existing at the circumference, evaluates them via a roundness profile and derives parameters from them.
Furthermore, tolerance specifications are defined for this evaluation, which are easy to vary depending on the functional case.



Setting Range of Validity and Tolerances

Measured value acquisition and processing

The Dominant Roundness Waviness is a software-based evaluation method that is applied to the raw data set (detected polar circumference) after a standard roundness measurement. The shorter and longer-wave components that do not belong to the dominant characteristic are eliminated by the method of the zero bandpass..

Measurement conditions:

- Number of measuring points on the circumference = 3600 points (corresponds to 0.1 ° measuring cycle)
- Selection of the probe ball diameter according to VDI 2631-3 , example:
  - Expected max. Wave depth: 5µm
  - N = 500W / U
  - workpiece diameter = 40mm
  - Outside probing

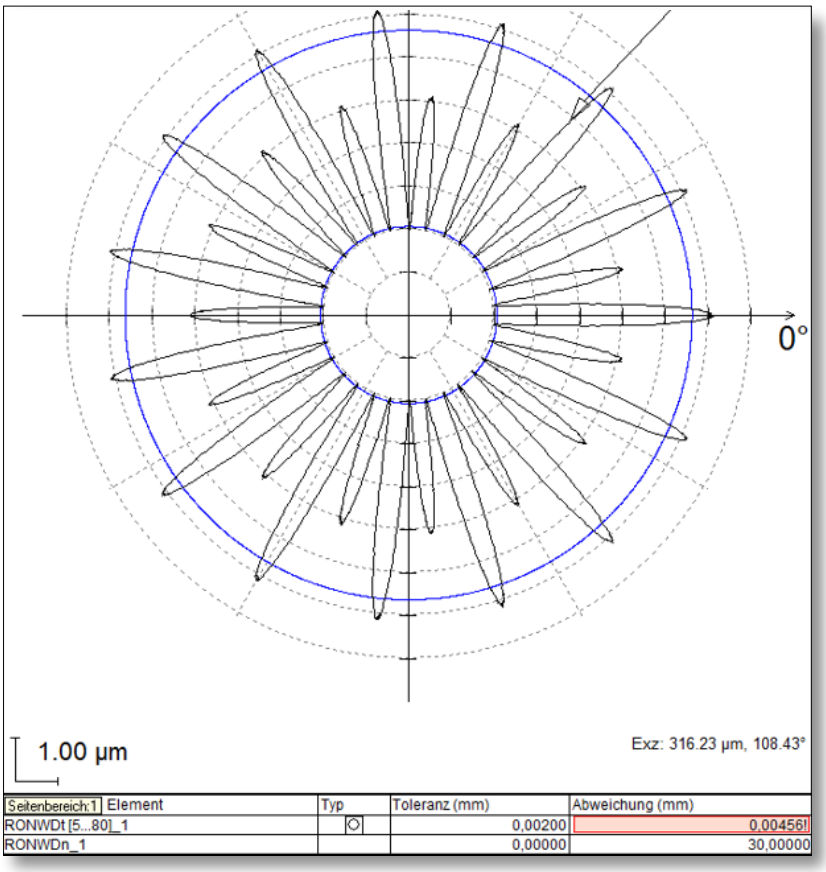
  ➔ max. possible probe ball diameter = 1.3mm

  → chosen: 1mm probe ball diameter

Application

The evaluation method of the Dominant Roundness Waviness is used for cylindrical components or component sections in which periodic structures in the circumferential direction lead to functional impairments. This applies above all to sealing surfaces and seating surfaces of bearings on undulating components.

Structures extending circumferentially periodically either in subregions or repeat over the entire circumference (chatter marks) are detrimental to a variety of applications. Depending on the functional case and functional partner, the effects, such as Noise or increased wear, depend on the number of structures on the circumference or a multiple thereof and on the amplitude of the structures.



Evaluation and reporting

The basis of the recognition is the amplitude spectrum of the unfiltered roundness profile, in which each order (wave number at the circumference) is assigned a corresponding amplitude. In the amplitude spectrum, the test is for dominance of a periodic expression. This is the case if firmly defined horizontal and vertical limit criteria are met.

The characteristics of Dominant Roundness Waviness are always evaluated depending on the given validity range. The parameters are:

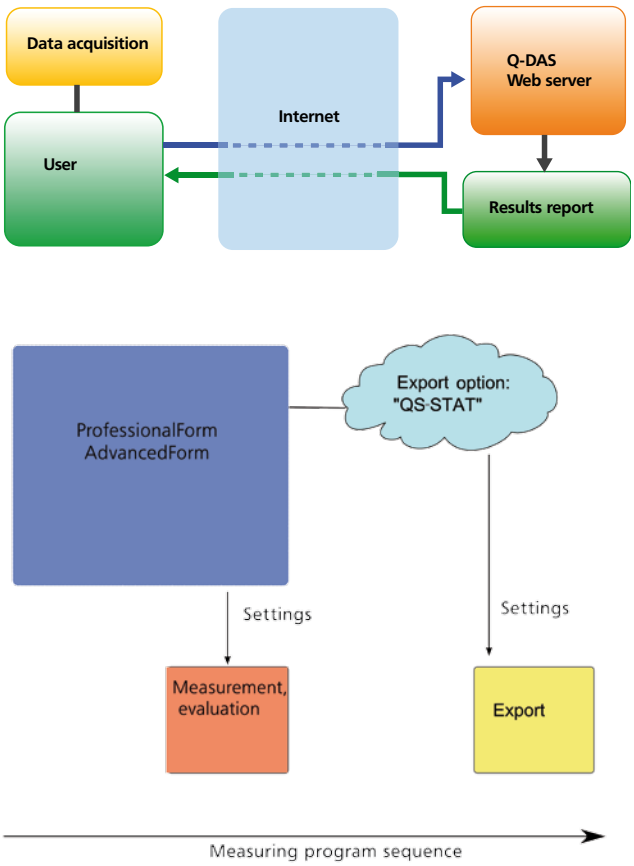
- RONWDc = mean height of Dominant Roundness Waviness
- RONWDt = total height of Dominant Roundness Waviness
- RONWDmax = Maximum height of the Dominant Roundness Waviness ripple
- RONWDn = number of waves of Dominant Roundness Waviness

The representation of the parameters c, RONWDt, RONWDmax in measuring reports always takes place in connection with the scope of validity. If dominance is outside the scope, it will not be used for tolerance considerations. In this case, 0D ist written in the result table.

RONWDn is always output with the integer value in the existing expression without scope.

MarWin

Software Option QE QS-STAT Data Export



The following 31 AutoKeys are currently supported with the option QE QS-STAT:

K0001	Values
K0002	Attribute
K0004	Time / Date
K0009	Text / Comment
K0053	Order
K0100	Total no. of features in the file
K1001	Part numbers
K1002	Part description
K1053	Order
K1086	Work cycle / Operation
K1103	Department / Cost Center
K1201	Testing device number as text / number
K1202	Testing device description
K1221	Tester name
K1900	Text / Comment

K2001	Feature no.
K2002	Feature descr.
K2009	Parameter, key data for the type of feature
K2022	No. of decimals after comma
K2101	Nominal dimension
K2110	Lower limit
K2111	Upper limit
K2112	Lower allowance
K2113	Upper allowance
K2120	Type of limit below
K2121	Type of limit above
K2142	Unit description
K2402	Testing unit description
K2415	Testing device serial number
K2900	Text / Comment

For users of the statistics software from Q-DAS, and in conjunction with surface and form measuring unit programs, Mahr offers easy and comfortable data export, tuned to all your individual needs with the options QE QS-STAT and QE QS-STAT Plus.

QE QS-STAT

With this option, **all features** can be exported according to **Q-DAS** handbook rules.
Fo many applications, this option enables the easy and fast export of data.

QE QS-STAT can create valid export data from measured characteristics and record header data without having to make any adaptations. There are a series of K-fields ("keys") for this purpose, which can automatically be filled with the corresponding data from the features and 'environmental data' (e.g. information from the record header, number of features, ...).

Measuring stations from the surface and form product groups with the following software applications can be extended with this solution:

The evaluation of **QE QS-STAT** essentially pertains to standard keys that are always the same.

Changes such as switching off the key or use of further keys are possible in measuring programs with the following applications:
for form metrology:

- AdvancedForm and
- ProfessionalForm

If you would like deviations from the Q-DAS standard, our application technology department can make necessary changes in the software structure for you.

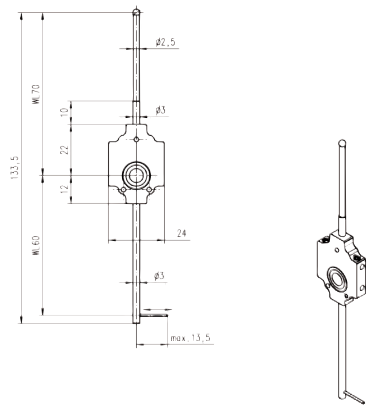
QE QS-STAT Plus:

With this option, all features can be exported according to Q-DAS handbook rules.

Additional solutions are also possible.

With **QE QS-STAT Plus** so-called field lists ("factory standard") are supported, which are created according to customer requirements. K-fields are defined in the field list that can be used for export (type, length, description etc. can be freely selected). A field list of this type is typically used in many measuring programmes.

Software Package Lead Testing and Analysis



Measured value acquisition

The surface structure of the seal face of a shaft influences the flow behavior of the fluid that is to be sealed and therefore greatly influences the sealing function.

A lead structure on the seal face can interfere with the interplay of shaft surface, fluid and sealing lip support creating leakage due to a conveying effect.

Lead is a surface feature appearing over the entire scope on rotation symmetrical surfaces. The evaluation of the macro lead is conducted with the option lead testing as per the Mercedes Benz Standard 31007-7.

Measurement of n generating lines (72 as per MB Standard, MBN 31007-7)

A probe arm for T7W, equipped wtih two styli, is used to record measured values:

- Stylus # 1 with HM ball dia. 3 mm for mechanical centering and tilting of the workpiece on the MMQ 400 Formtester
- Stylus # 2 with diamond stylus tip for measuring lead and form parameters

Scope of application

External measurement on workpiece diameters
dia. = 2 - 200 mm

Form and lead evaluation

- Form/positional evaluation/parallelism parallel to lead evaluation
- Form/positional/lead evaluation of several wavelengths

Evaluation and recording

After the measurements have been performed, measurement records with the following content are generated:

Lead parameters (MBN 31007-7):

The following are measured as parameters for lead evaluation:

- Number of threads DG (upr)
- Period length DP (mm)
- Lead angle D_λ (degree)
- Lead direction
- Lead depth Dt (µm)
- Theoretical supply cross-section DF (µm²)
- Theoretical supply cross-section per turn DFu (µm²)
- Contact length

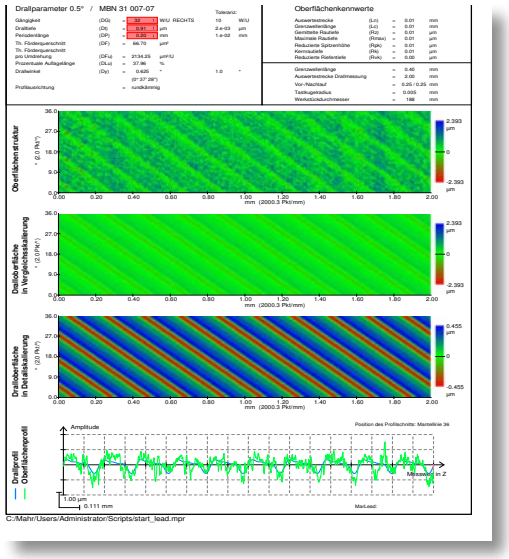
Graphic output

The measured profiles are output in the record as a graphic. Various graphic output types are available:

- 3D-cylinder in color, traditional and unwound
- Display of individual generating lines as a straightness profile for individual assessment of form and position parameters
- Amplitude spectra of the linear profiles in a bar graph

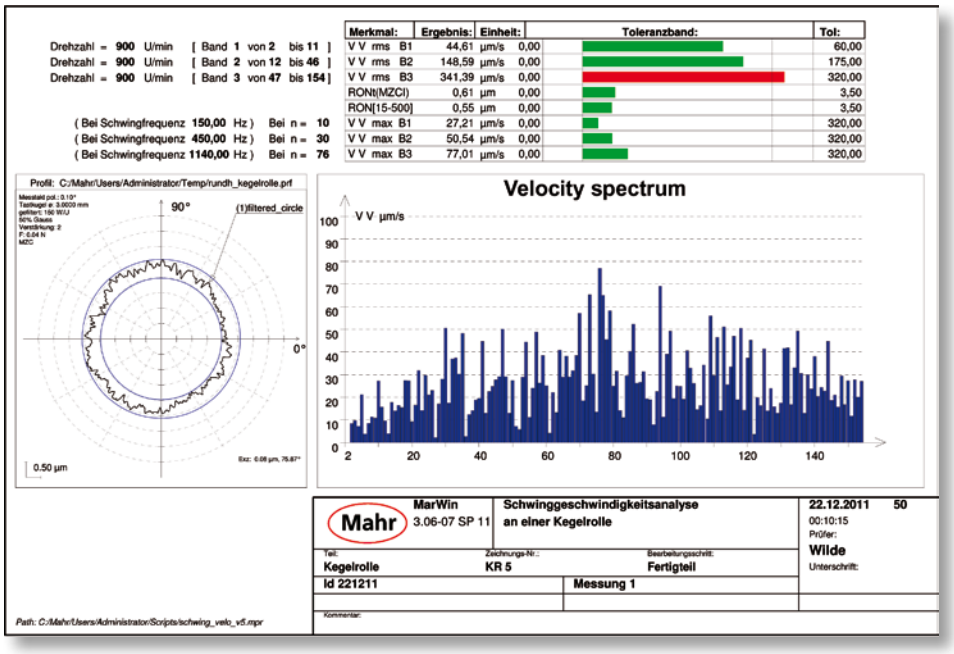
or as per MBN 31007-7: 3D cylinder unwinding, color,

- Surface structure
- Lead surface
- Display of surface profile and lead profile.



MarWin

Software Package Velocity Analysis for Roller Bearing Components



Manufactured parts for roller bearings come out of machining processes with roundness and waviness deviations from their ideal geometry. In components for high speed bearings (such as those found in computer hard disks, for example), form deviations of raceways from the ideal, smooth circle can lead to uneven running, development of noise, and reduced service life due to increased wear.

It is therefore important for the manufacturers of such bearings to have the ability to test for conformance to specified tolerances relat- ing to the roundness deviations and waviness amplitude sizes of the individual components, preferably before the bearing is assembled. Velocity analysis is a very powerful tool in this respect, as the method permits speed-dependent, quantitative prediction and assessment of the influence and effects that any form deviations of the individual components will have on the subsequent behavior of the fully-assembled, rotating bearing.

The software can be operated with

- **E**asyForm
- AdvancedForm and
- ProfessionalForm

The velocity analysis software option is an independent analysis software that can be used with raw profiles that have been captured at an earlier time using MarForm measuring machines (fully-closed radial (axial) profiles at raceways normal to the circumferential surfaces (perpendicular to the end-faces) of the corresponding bearing components).

Before a velocity analysis can be carried out on a bearing component, it is necessary to first measure a fully-closed polar profile (full circle over 360° with no gaps) in the area of the raceway (normal to circumferential surface/perpendicular to end-face) using a MarForm measuring machine. The axis of the bearing component must first be aligned mechanically with the rotational axis of the measuring machine.

The velocity analysis software initially calculates the **Fourier amplitude spectrum** (FFT analysis) from either the complete frequency range of the unfiltered raw profile or just a user-defined frequency band of the raw profile.

Each term in this spectrum is weighted (multiplied) by the ordinal number of the term (= the number of vibration periods associated with a complete rotation of the component), by the notional rotational frequency for the term specified by the user, and by an additional fixed factor. This allows the software to calculate the **velocity spectrum** corresponding to the specification provided.

In each measuring record sheet, parameter values are calculated for three bands of the spectrum which are then output in the result table of the measuring record. The limits of each band are freely selectable and set by specifying the ordinals of the thresh- old spectrum terms. These parameters are the value and ordinal number with the maximum vibration speed in each band and the RMS (root mean square) 'sum' of all vibration speeds in each band. The RMS parameters serve as a measure of the vibration energy produced in the respective spectral bands during the subsequent rotational motion of the bearing components. The energy is due to the reciprocating movements induced by any radial and/or axial form deviations of the raceway.

Evaluations with up to 15 bands are easily possible in this manner.

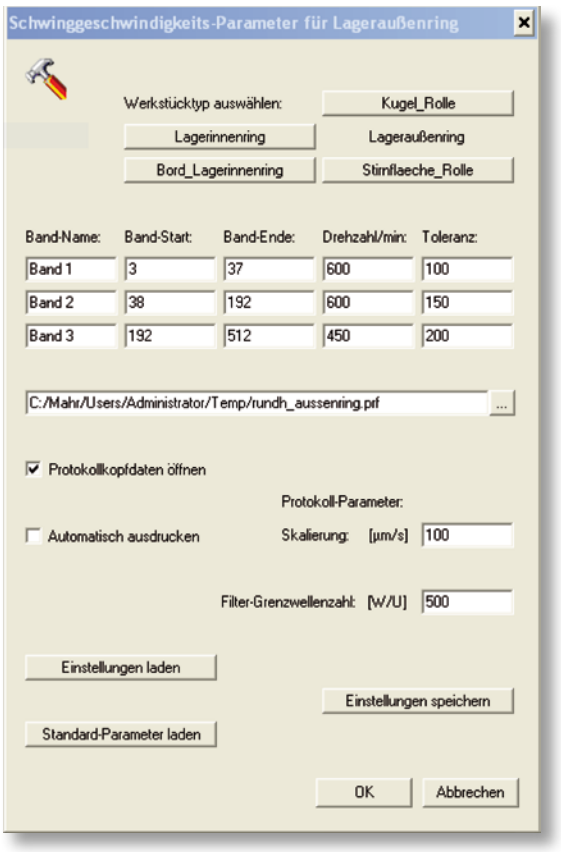
Users can pre-configure (and freely modify at any time) complete parameter sets for five types of raceways: raceways at the gener- ated surface of the rolling element (for balls, cylinder rollers, and cone rollers), at end face of the rolling element, at the rim of the inner bearing ring and at the circumferential surfaces of the outer and inner bearing rings.

These **parameter** sets each comprise:

- Description and band thresholds for three spectral analysis bands in the vibration speed spectrum
- Definition of a notional rotational speed for each band
- Definition of the tolerance for the sum of vibration speeds
- in each of the three bands

These memory spaces can also alternatively be used for the five most common bands.

In addition, a **cut-off wave number** can be specified, which can be used to exclude higher wave numbers of the measured raw profile prior to calculating the velocity spectrum.

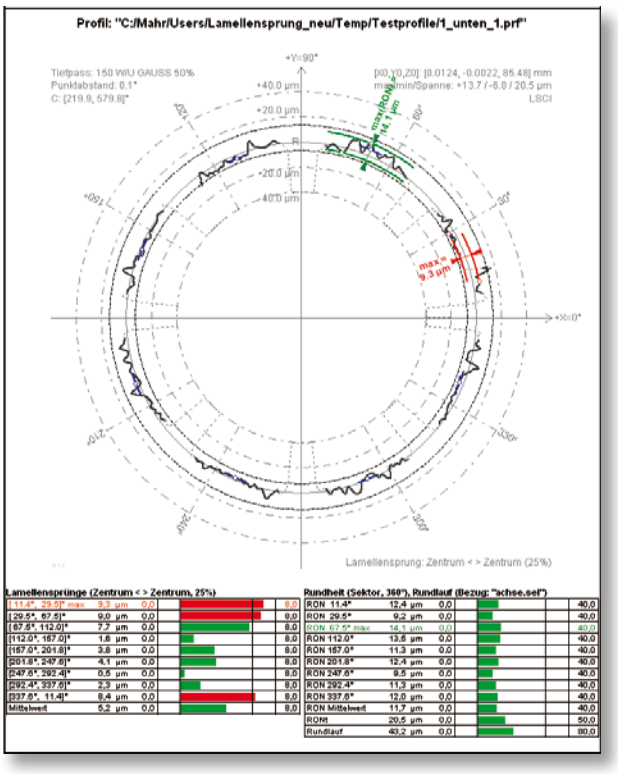


The user can also select the maximum value on the speed scale to be used when displaying the spectrum in a diagram on the measuring record.
Each of the five parameter sets configured by the user can be stored and reloaded at a later date for use in other analyses. It is possible to switch between the parameter sets for the five types of raceways at any time using the **input dialog** box displayed when the velocity analysis program is started.

A unique default dataset can also be set up by Mahr according to customer specifications for each raceway type (when the software option is first commissioned), which the user can then use to reset modified parameters back to the specified default values as necessary.

MarWin

Software Package Commutator Analysis



Software package for analysis of segment gap on commutators

Segment gap refers to the difference in height between the various segments on a commutator. This segment gap is a contributory factor in the wear of carbon brushes and brush fires in electric motors.

Using this software package it is possible to use MarWin analysis software with roundness measurements obtained from MarForm measuring machines in order to investigate and assess segment gaps.

Four calculation methods are provided for the evaluation of two neighboring segments (maximum segment gap):

1. Segment gap: center of segment
   Difference in the radii measured at the respective centers of two neighboring segments.
   The centers can optionally be expanded to ranges by entering their size as a percentage of the segment width; all radii are then averaged over this range.

2. Segment gap: max./min. radius
   Difference between the respective maximum and minimum radii of two neighboring segments

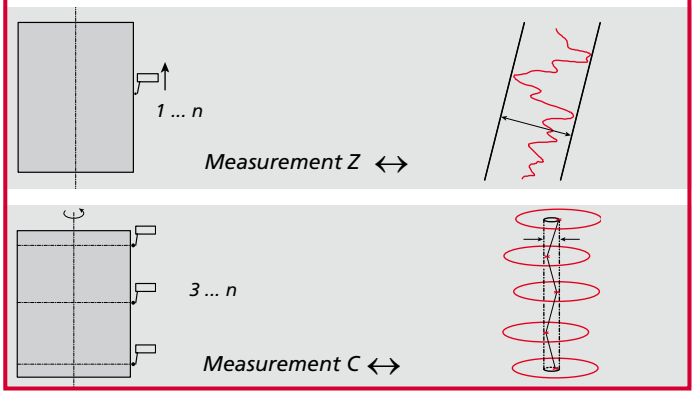
3. Segment gap: difference between. max. radii
   Difference between the respective maximum radii of two neighboring segments

4. Segment gap: end of segment–start of segment
   Difference between radii of two neighboring segments, measured at the end of one segment and the start of the next. The end and start points can optionally be expanded to ranges by entering their size as a percentage of the segment width; all radii are then averaged over this range.

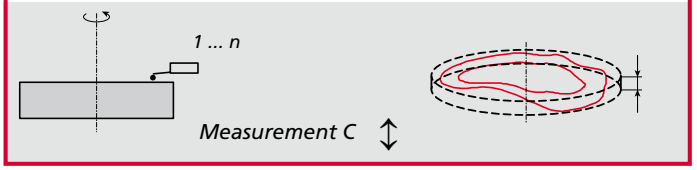
The results evaluated are the values of the individual segment gaps and their mean values. The form deviations of the commutator are also recorded (individual roundnesses, corresponding mean value, overall roundness), as is the radial run-out.

Measuring Strategies

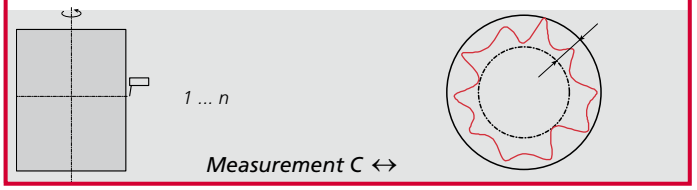
Straightness, including by section



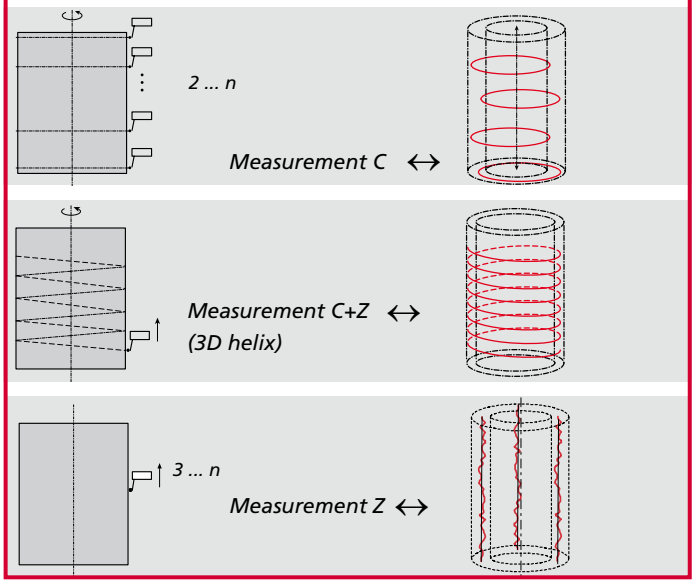
Flatness



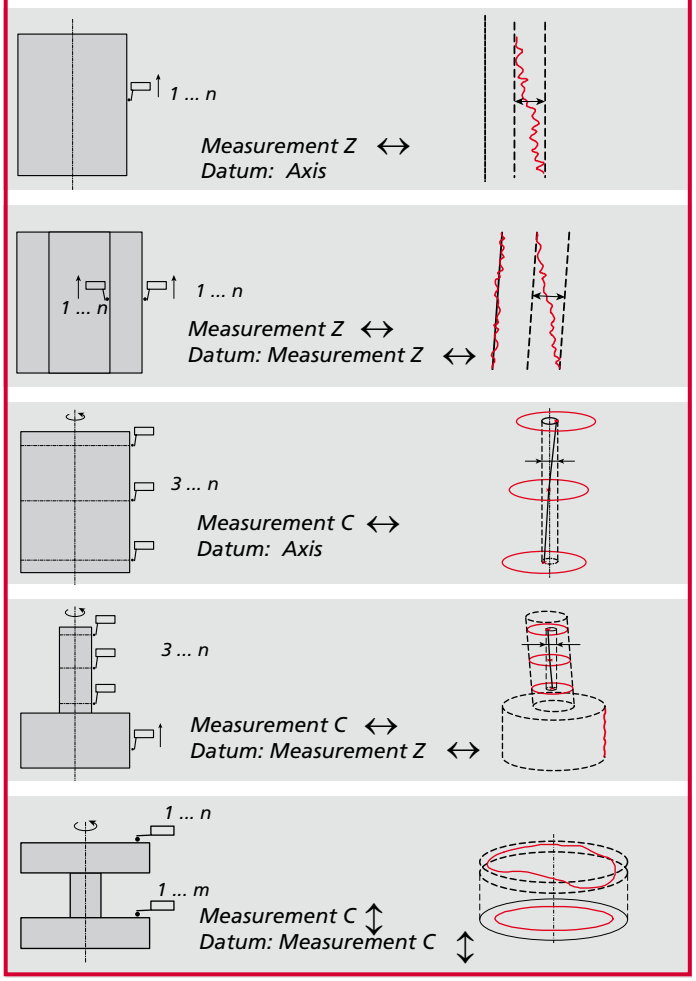
Roundness



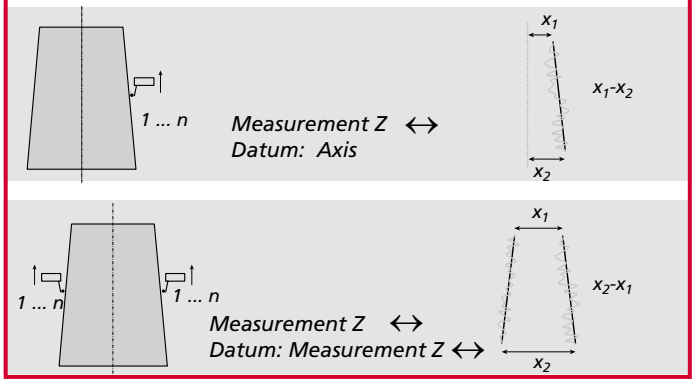
Cylindricity



Parallelism



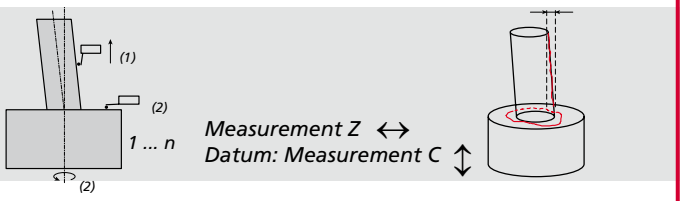
Conicity



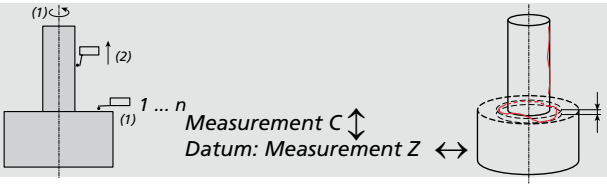
MarWin

Measuring Strategies

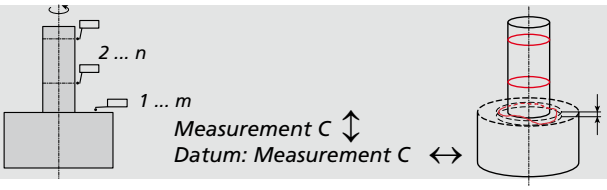
Parallelism



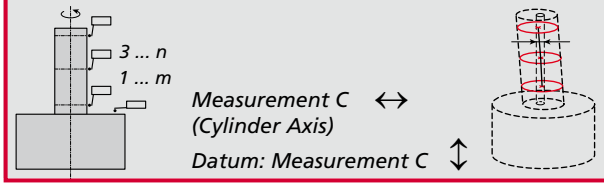
Measurement Z ↔
Datum: Measurement C ↕



Measurement C ↕
Datum: Measurement Z ↔

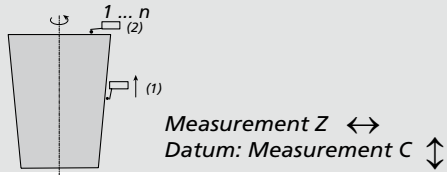


Measurement C ↕
Datum: Measurement C ↔

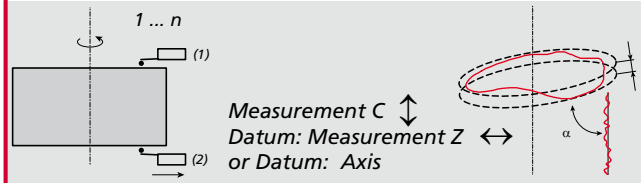


Measurement C ↔
(Cylinder Axis)
Datum: Measurement C ↕

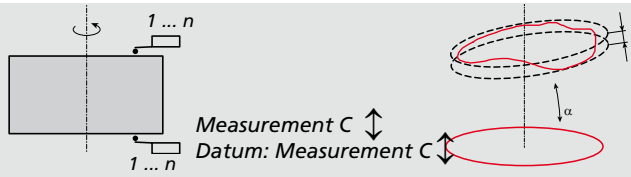
Angularity



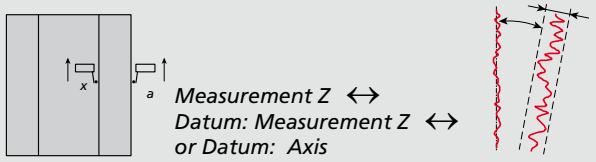
Measurement Z ↔
Datum: Measurement C ↕



Measurement C ↕
Datum: Measurement Z ↔
or Datum: Axis

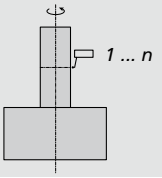


Measurement C ↕
Datum: Measurement C ↕



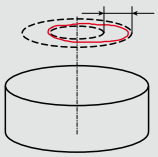
Measurement Z ↔
Datum: Measurement Z ↔
or Datum: Axis

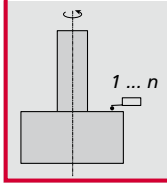
Run-out



Radial run-out

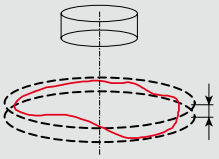
Measurement C ↔
Datum: Axis



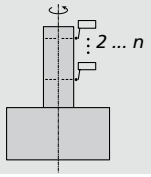


Axial run-out

Measurement C ↕
Datum: Axis

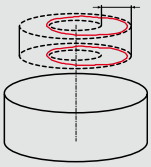


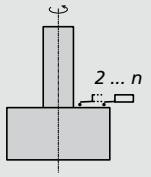
Total run-out



Total radial run-out

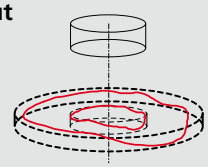
Measurement C ↔
Datum: Axis

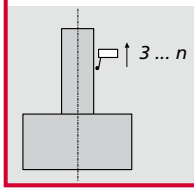




Total axial run-out

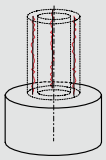
Measurement C ↕
Datum: Axis



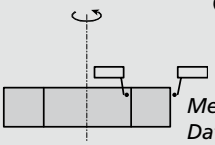


Total radial run-out

Measurement Z ↔
Datum: Axis

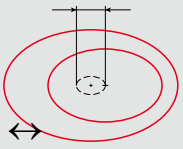


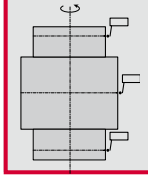
Concentricity and Coaxiality



Concentricity

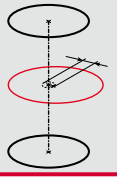
Measurement C ↔
Datum: Measurement C ↔



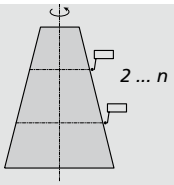


Coaxiality

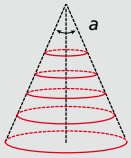
Measurement C ↔
Datum: Axis

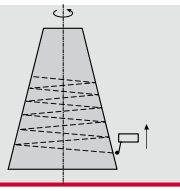


Cone form



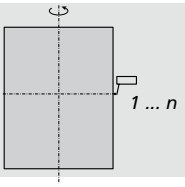
Measurement C ↔





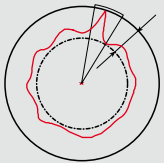
Measurement C+Z ↔
(3D helix)

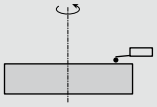
Angle sector



Concentricity

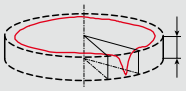
Measurement C ↔

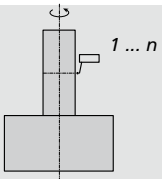




Roundness

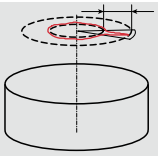
Measurement C ↕

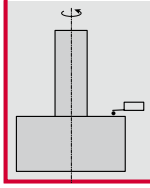




Radial run-out

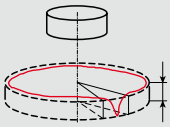
Measurement C ↔
Datum: Axis





Axial run-out

Measurement C ↕
Datum: Axis

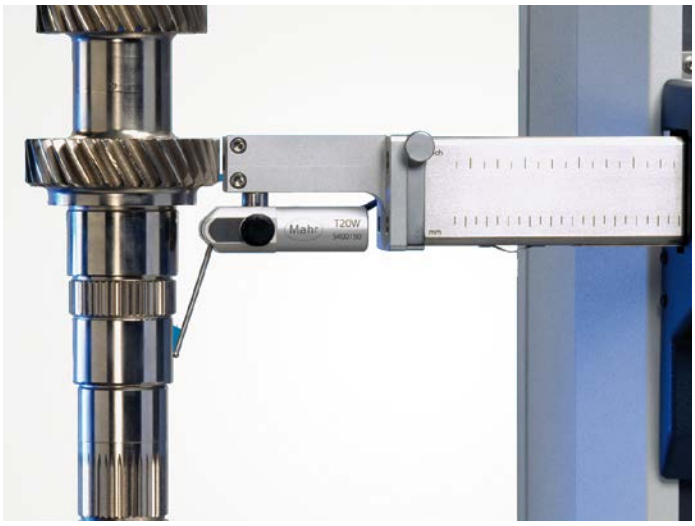


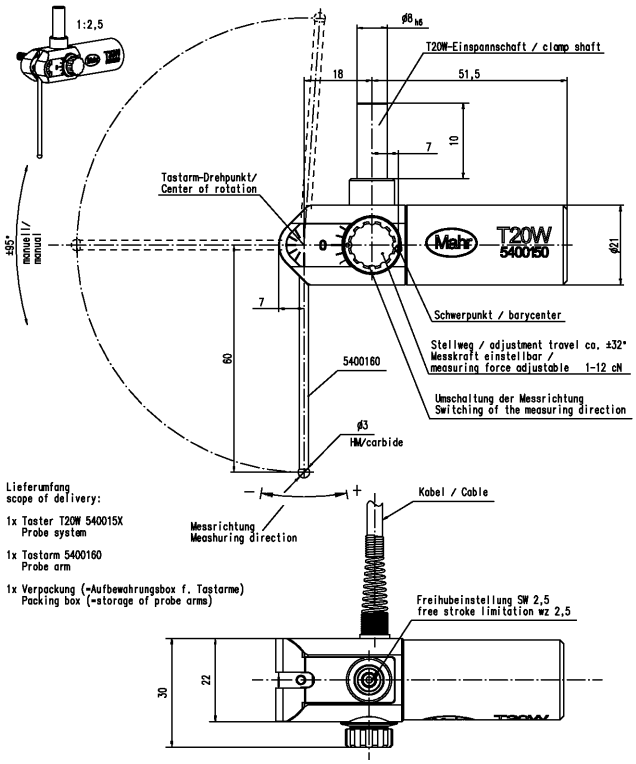
Note: Measurements with 3D helix optional.

MarForm

Accessories Probe

The optimal solution using accessories





T20W Probe

The inductive **T20W** probe is a universal device. The fact that the probe arm can be moved in a range of 190° and that there are a variety of clamping options for the probe means that measurements can also be performed in areas that are difficult to access. Easily exchangeable probe arms can be combined with a variety of styli in order to adapt the probe to the relevant measuring tasks or workpieces.

T20W probe with probe arm range of 190°

- Measuring range ± 1,000 µm
- Measuring force adjustable up to 0.15 N
- Measuring direction switchable
- Exchangeable probe arm
- Free travel limitation can be adjusted in contacting direction
- Clamping shaft dia. 8 mm (0.315")

Order No. 5400151 for MMQ 400

Probe arms for T20W probes

Probe arm 60 mm, ball dia. 1.0; M2 longitudinal	5400161
Probe arm 60 mm, ball dia. 3.0	5400160
Probe arm 60 mm, ball dia. 1.0; M2 transverse	5400163
Probe arm 60 mm, ball dia. 1.0; M2 longitudinal; shaft dia. 0.8 L=30 mm	5400170
Probe arm 120 mm, ball dia. 1.0; M2 longitudinal	5400162
Probe arm 120 mm, ball dia. 1.0; M2 transverse	5400164
Probe arm 160 mm, ball dia. 1.0; M2 transverse CFK	5400165
Probe arm 200 mm, ball dia. 1.0; M2 transverse CFK	5400166
Probe arm 250 mm, ball dia. 1.0; M2 transverse CFK	5400167

Multi-point probe arm kit for T20W

Basis for multiple probe arms; with one probe arm holder, two vertical probe arms and one horizontal probe arm, as well as two styli: 1 ruby stylus of L=10 mm and dia. 1.0 mm and 1 ruby stylus of L=20 mm and dia. 1.0 mm	5400168

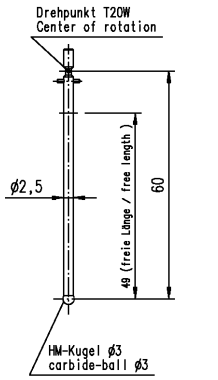
Styli M2

Stylus Teflon dia. 3 mm, M2	5400169
Stylus L=10 mm, ball dia. 0.3 mm ruby	4662093
Stylus L=10 mm, ball dia. 0.5 mm ruby	4662090
Stylus L=10 mm, ball dia. 1.0 mm ruby	3016272
Stylus L=10 mm, ball dia. 1.5 mm ruby	8154125
Stylus L=10 mm, ball dia. 3.0 mm ruby	8154398
Stylus L=20 mm, ball dia. 5.0 mm ruby	8159402
Stylus L=10 mm, ball dia. 1.0 mm carbide	8162168
Stylus L=10 mm, ball dia. 1.5 mm carbide	8049415
Stylus L=10 mm, ball dia. 2.0 mm carbide	8162164
Stylus L=10 mm, ball dia. 3.0 mm carbide	8159618
Stylus L=20 mm, ball dia. 5.0 mm carbide	8049416
Wrench for stylus arms/styli	5440192

Probe Arms for T20W Probe

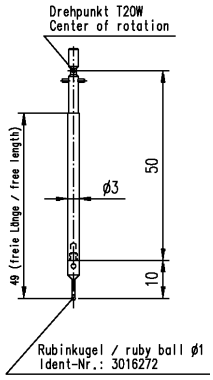
Ident-Nr.: 5400160

FT0002-0100.000



Ident-Nr.: 5400161

FT0002-0300.000



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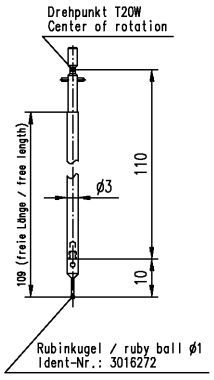
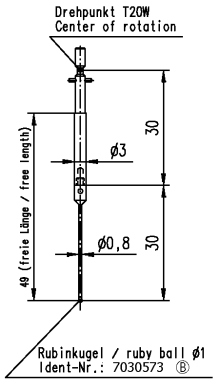


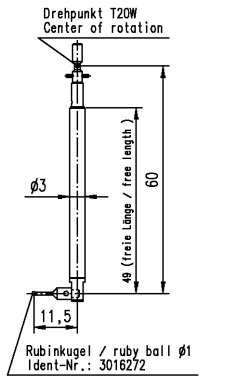
Ident-Nr.: 5400170

FT0002-0380.000



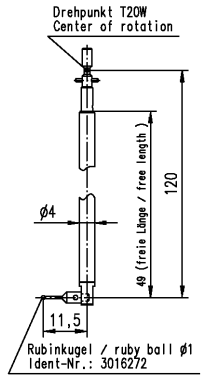
Ident-Nr.: 5400163

FT0002-0200.000



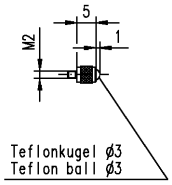
Ident-Nr.: 5400164

FT0002-0250.000



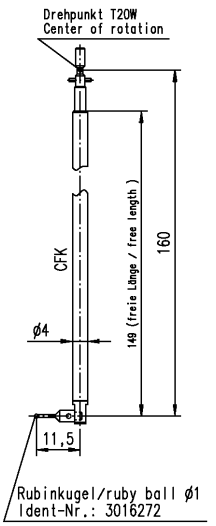
Ident-Nr.: 5400169

FT0002-0700.000



Ident-Nr.: 5400165

FT0002-0400.000



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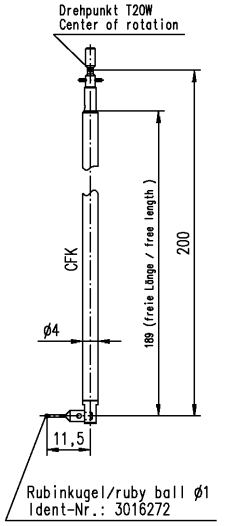

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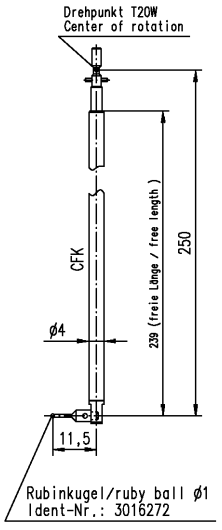
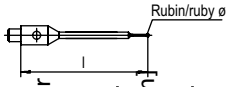
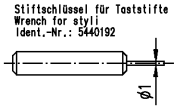
FT0002-0600.000



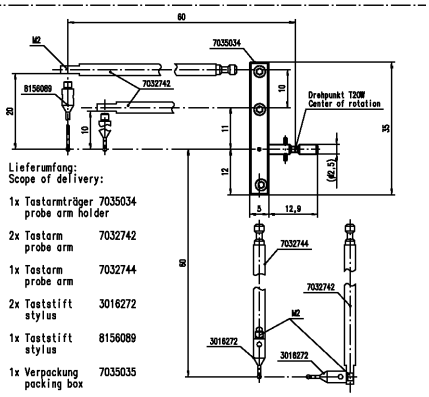
Stylus arms/styli M2



Ident-Nr.i Item number	Kugel-ø [mm] ball-ø [mm]	Material	Wirklänge [mm] operation length [mm]
4662093	0,3	Rubin/ruby	10
4662090	0,5	Rubin/ruby	10
3016272	1,0	Rubin/ruby	10
8156089	1,0	Rubin/ruby	20
8154125	1,5	Rubin/ruby	10
8154398	3,0	Rubin/ruby	10
8159402	5,0	Rubin/ruby	20
8162168	1,0	HM/carbide	10
8049415	1,5	HM/carbide	10
8162164	2,0	HM/carbide	10
8159618	3,0	HM/carbide	20
8049416	5,0	HM/carbide	20



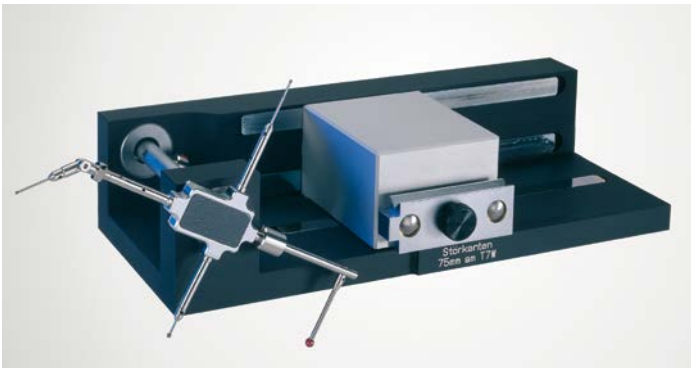
Ident-Nr.: 5400168



MarForm

Accessories for Probe

The optimal solution using accessories



Device for balancing probe arms

Motor-driven T7W Probe

The T7W probe is fitted with a motor-driven rotational axis. This makes it possible to move the probe arm gradually to the required contacting position. As a result, measurements can be performed on cylindrical surfaces and end faces. As a zero position probe, the T7W can also switch automatically between internal and external measurements or between end face measurements from above and below without operator intervention. Fully automatic measurement processes on complex workpieces can be carried out without operator intervention too. The probe arms of the T7W are exchangeable. Its motor-driven rotational axis enables the construction of "multi-point probe arms" - i.e. probe arms with a variety of contacting elements - making it possible to switch between different stylus ball geometries within a single measurement run.

Motor-driven T7W probe ith probe arm range of 360° for MMQ 400 and MMQ 400 CNC **Order No. 5400200**

- Total meas. range of 2,000 µm (0.079")
- Zero probe with a working range of ± 500 µm (± 0.0197")
- Measuring force adjustable from 0.01 to 0.2 N
- Two-way measuring direction
- Contacting angle freely selectable in 1° steps
- 360° adjustable (motor-driven)
- Probe arms easily exchangeable (magnetic mount)
  Flexible multi-point probe possible
- Mechanical and electrical overload protection

Accessories for Motor-driven T7W Probe

Probe arm module for T7W **Order No. 5400221**

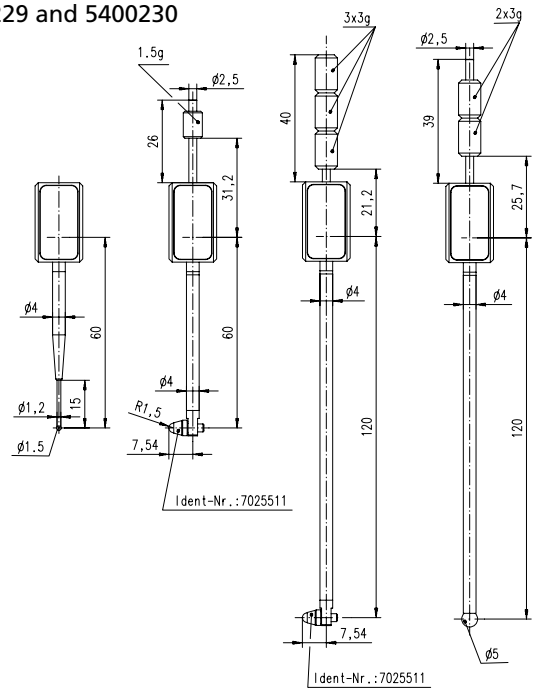
In storage case, consisting of

- Stylus arm dia. 0.5 mm, L=20 mm, M2a
- Stylus arm dia. 1.0 mm, L=20 mm, M2a
- Stylus arm dia. 1.0 mm, L=15 mm, M2a
- Stylus arm dia. 1.5 mm, L=10 mm, M2a
- Stylus arm dia. 3.0 mm, L=10 mm, M2a
- Stylus arm dia. 3.0 mm, L=25 mm , M2a
- Weight 1.5 g
- Weight 1.0 g
- Weight 2.0 g
- Weight 3.0 g
- Weight 0.5 g
- Weight 10.0 g
- Weight 5.0 g
- Probe arm L=15 mm 2x M2
- Stylus arm extension 10 mm, M2
- Stylus arm extension 20 mm, M2
- Stylus arm extension 30 mm, M2
- Stylus arm extension 40 mm, M2
- Rotary swivel joint M2
- Hex head screwdriver A/F 1.5
- Hex head screwdriver A/F 0.9
- Rotary part M2, concentric
- Wrench 1.0
- Stylus arm holder M2i transverse
- Stylus arm holder M2i axial
- Stylus M2i transverse
- Mount 2x M2i transverse
- Guide
- Adjuster

Probe Arm for T7W Probe

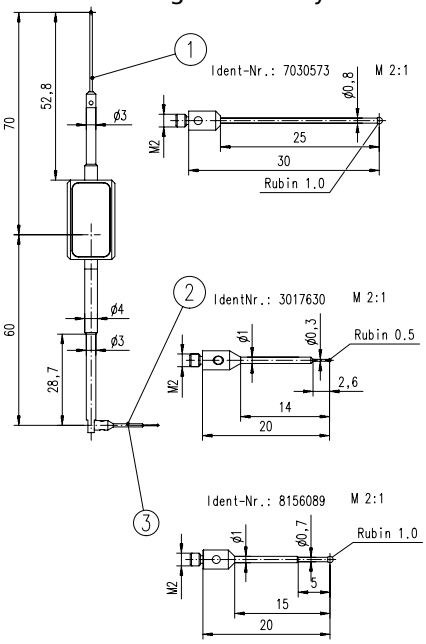
Probe arm set for T7W **Order No. 5400211**

Consisting of one each of probe arms 5400225, 5400226, 5400229 and 5400230



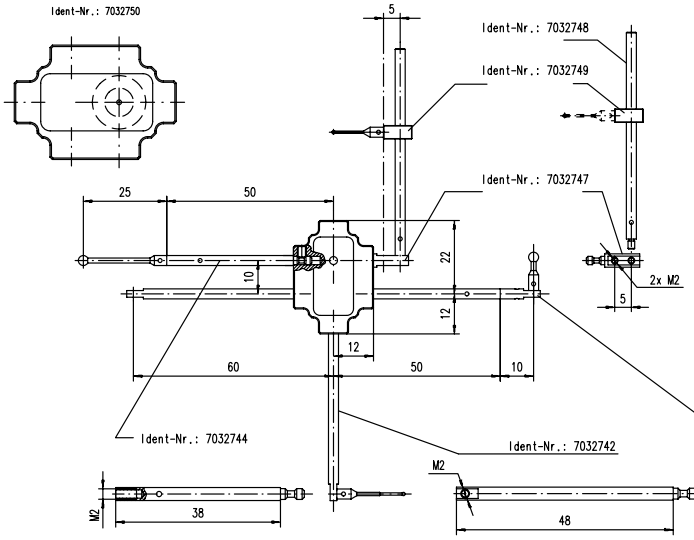
Probe arm set # 2 for T7W **Order No. 5400220**

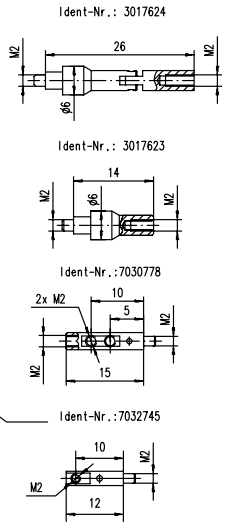
for measuring small workpieces, consisting of a probe arm holder and three exchangeable M2 styli

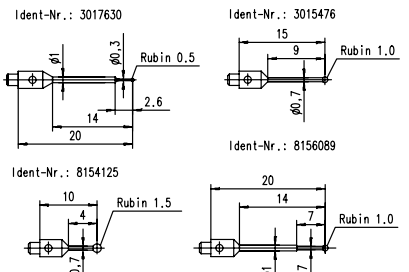


Probe arm module for T7W **Order No. 5400221**

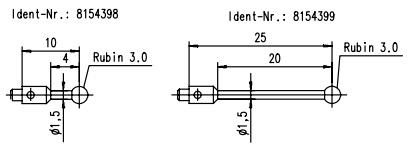
for universal measurement of various workpieces.



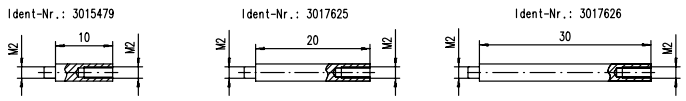




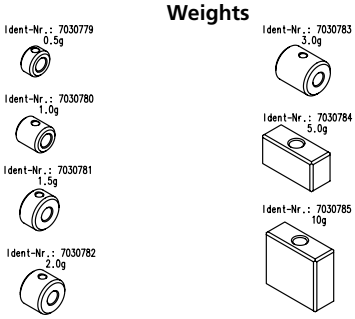
Stylus arms M2



Extensions M2



Weights



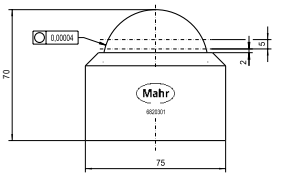
MarForm

Testing and Calibration Standards

Roundness Standard

High-precision glass hemisphere
Testing of the measuring spindle's radial run-out accuracy.
Calibrating the sensitivity of the signal transmission chain.
For testing the radial deviation of the rotational guide (C-axis).

Diameter	approx. 55 mm (2.165 in)
Roundness deviation	max. 0.04 µm (1.57 µin)
Weight	approx. 1.8 kg (3.968 lbs)



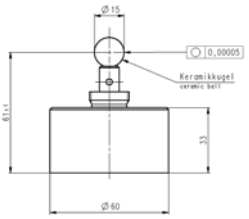
Roundness standard
without calibration certificate
DAkkS/DKD calibration certificate incl.
Mahr calibration certificate incl.

Order no. 6820300
Order no. 9964115
Order no. 9964307

Ceramic Roundness Standard

High-precision calibration ball
Testing of the measuring spindle's radial run-out accuracy.
Calibrating the sensitivity of the signal transmission chain.
For testing the radial deviation of the rotational guide (C-axis).

Diameter	approx. 13 mm (2.165 in)
Roundness deviation	max. 0.05 µm (1.97 µin)



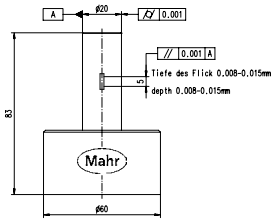
Roundness standard
without calibration certificate
DAkkS/DKD calibration certificate incl.
Mahr calibration certificate

Order no. 5400013
Order no. 9964115
Order no. 9964307

Magnification Standard

Cylinder with one slightly flattened section (Flick)
For checking the signal amplification.

Diameter	20 mm (.787 in)
Length	50 mm (1.969 in)
Flattening	approx. 10 µm (393.7 µin)
Cylindricity deviation	max. 1 µm (39.37 µin)
Weight	approx. 0.4 kg (.882 lbs)



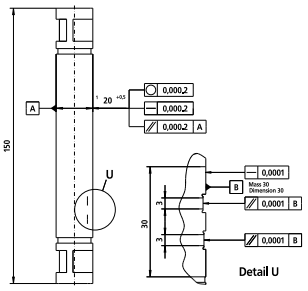
Magnification Standard
whitout calibration certificate
DAkkS/DKD calibration certificate incl.
Mahr calibration certificate incl.

Order no. 5400147
Order no. 9964148
Order no. 9964311

Universal Cylinder Square

High-precision cylinder square
With two flattened sections (Flicks).
For checking the vertical guide.
Two surfaces for calibrating the signal transmission chain and testing the measuring constancy.
Calibrating the sensitivity of the signal transmission chain.
For testing the straightness and parallelism of the axes.

Diameter	20 mm (.787 in)
Length	150 mm (5.906 in)
Flattening	approx. 4/12 µm (157.48/472.44 µin)
Roundness deviation (cyl.)	max. 0.2 µm (7.87 µin)
Straightness deviation (cyl.)	max. 0.2 µm (7.87 µin)
Parallelism deviation (cyl.)	max. 0.2 µm (7.87 µin)
Weight	approx. 0.4 kg (.882 bs)



High-precision cylinder square
DAkkS/DKD calibration certificate incl.
Mahr Calibration certificate incl.

Order no. 5400143
Order no. 5400140

Flatness Standard - optical flat

Testing and adjusting the horizontal measuring device.
Testing the axial deviation of the rotational guide.
Testing the straightness of the linear guide.

Diameter	150 mm (5.906 in)
Flatness deviation	0.2 µm (7.87 µin)
Weight	approx. 2 kg (4.409 lbs)

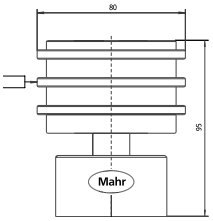
Optical flat

without calibration certificate	**Order no. 6820210**
DAkkS/DKD calibration certificate incl.	**Order no. 9964321**
Mahr calibration certificate incl.	**Order no. 9964310**

Multi-Wave Standard

Dynamic testing of the signal amplification.
Calibrating the sensitivity of the signal transmission chain.
Calibrating the vertical and horizontal profile components.
Testing of filters / Fourier analysis.

Diameter	80 mm (3.150 in)
Sinusoidal waves on the outside diameter	15, 50, 150, 500 upr
Weight approx.	2.3 kg (5.071 lb)



Multi-Wave Standard

without calibration certificate	**Order no. 5400142**
DAkkS/DKD calibration certificate incl.	**Order no. 9964149**
Mahr Calibration certificate **incl.**	**Order no. 9964312**

Straightness Standards - Cylinder Squares

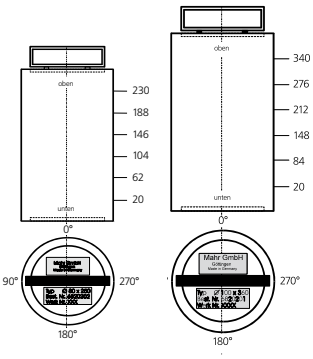
Testing and adjusting the vertical guide relative to the measuring spindle axis. For testing the straightness of the linear guides.
For testing the parallelism.

Type 1: 80 mm cylinder square

Diameter	80 mm (3.150 in)
Length	250 mm (9.843 in)
Cylindricity deviation	max. 1 µm (39.37 µin)
Roundness deviation	< 0.7 µm (27.56 µin)
Weight	approx. 11.5 kg (25.353 lbs)

Type 2: 100 mm cylinder square

Diameter	100 mm (3.937 in)
Length	360 mm (14.173 in)
Cylindricity deviation	max. 1 µm (39.37 µin)
Roundness deviation	< 0.7 µm (27.56 µin)
Weight	approx. 13 kg (28.660 lbs



Cylinder square

Type 1: 80 mm

DAkkS/DKD Calibration certificate incl.	**Order no. 6820204**
Mahr-Calibration certificate incl.	**Order no. 6820202**

Type 2: 100 mm

DAkkS/DKD-Calibration certificate incl.	**Order no. 6820206**
inkl. Mahr-Calibration certificate incl.	**Order no. 6820201**

Customer Master

For testing, adjusting and calibrating the measuring device without conversion work. You can use your own test items/ workpieces as the master/standard, provided these have been issued with a calibration certificate by the Mahr calibration laboratory.

Customer Master

DAkkS/DKD Calibration certificate incl.	**Order no. 9964313**
Mahr-Calibration certificate incl.	**Order no. 9964314**

* German Calibration Service

MarForm

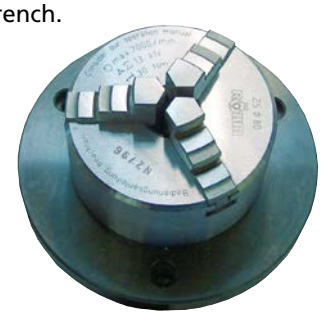
Accessories Clamping and Chucking Devices

Three-jaw chuck, dia. 100 mm with mounting flange of dia. 160 mm, reversible jaws for external and internal clamping.
Clamping range: external 1 mm to 100 mm,
internal 36 to 90 mm. Total height with flange 47 mm.
Adjustment by means of rotating ring.
Order No. 6710620

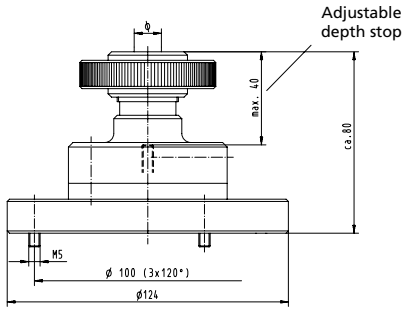
Rim chuck with 8 jaws, dia. 150 mm with mounting flange of dia. 198 mm; separate jaws for internal and external clamping.
Clamping range: external 1mm to 152 mm,
internal 24 mm to 155 mm.
Total height with flange 52 mm.
Cannot be used for Formtester MMQ 10/ MMQ 100.
Adjustment by means of rotating ring.
Order No. 6710518

Three-jaw chuck, dia. 110 mm with mounting flange of dia. 164 mm; clamping range: external 3 mm to 100 mm,
internal 27 mm to 100 mm.
Total height with flange 73 mm (2.87").
Adjustment by means of rotating ring.
Order No. 6710629

Three-jaw chuck, dia. 80 mm with mounting flange of dia. 124 mm; clamping range: external 2 mm to 78 mm,
internal 26 to 80 mm. Total height with flange 65.5 mm.
Adjustment by means of T-wrench.
Order No. 9032206

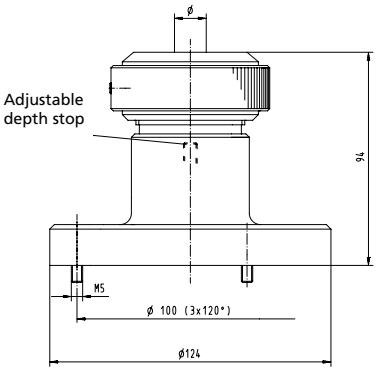


For collet chucks: Type 407 E



Quick-clamping device (collet chuck)
Dia. 1 mm to 12 mm with mounting flange of dia. 124 mm, for external clamping.
Supplied with collet chucks of dia. 1 mm to 8 mm in 0.5 mm steps. Total height 80 mm.
Further collet chuck devices are available on request.

For collet chucks: Type 444 E



Quick-clamping device (collet chuck)
Dia. 2 mm to 25 mm with mounting flange of dia. 124 mm, for external clamping.
Supplied with stand but no collet chucks.
Total height 94 mm.
Further collet chuck devices are available on request.

Clamping disks
Clamping disk set. Adjustable workpiece stop for pre-centering and clamping in series measurements.
For clamping diameters of 36 mm to 232 mm depending on machine type. Comprises two stop disks with slot and an eccentric clamping disk.
Order No. 6850808

Clamping jaws 2x
With M5 fastening thread. Clamping height 40 mm.
Order No. 6710628

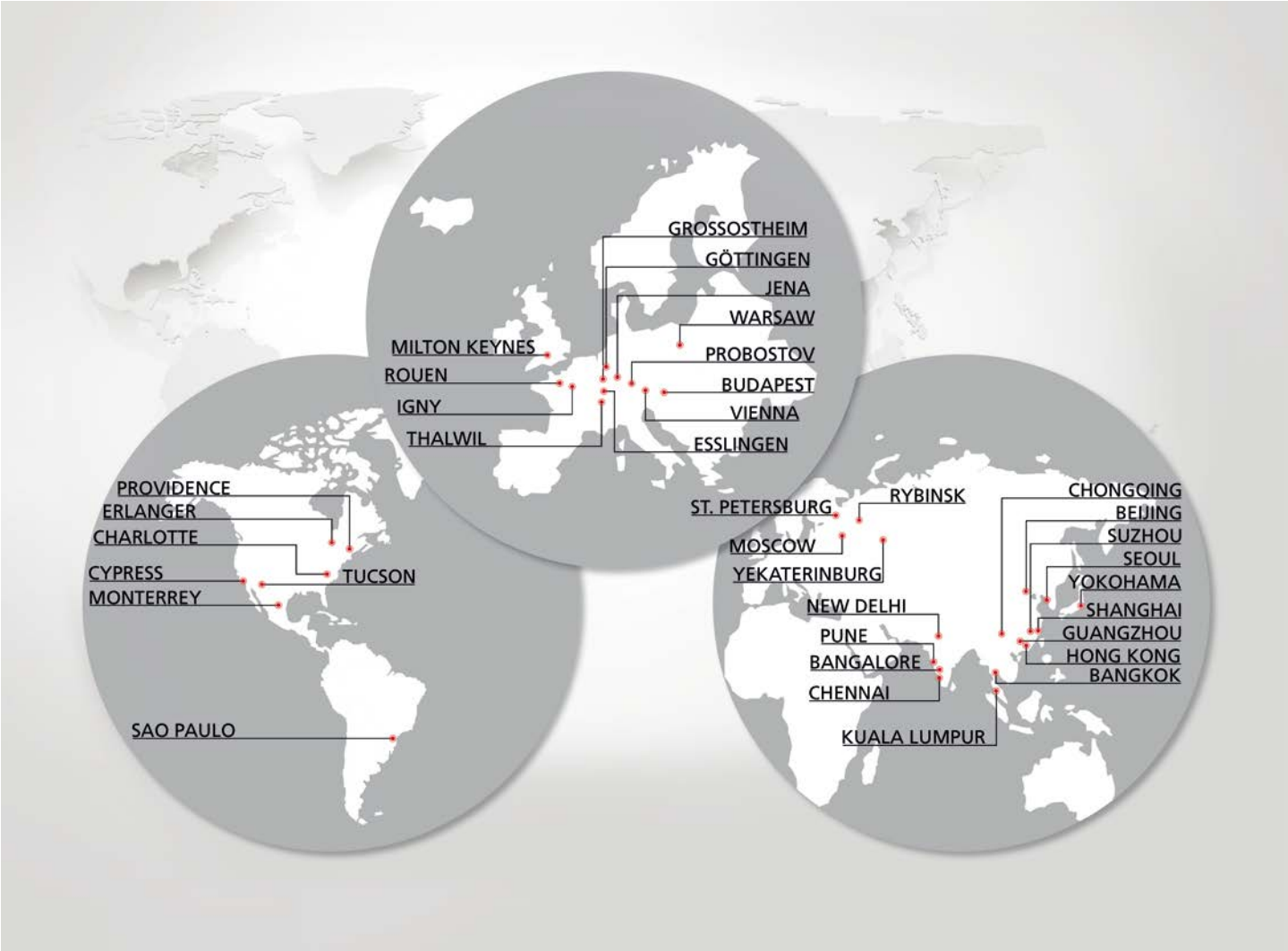
Further workpiece-specific clamps are available on request.

Accessories Equipment Tables and Other Accessories

Equipment Table for MarForm MMQ 200
Size: 1,150 mm × 750 mm × 720 mm (L × W × H)
We recommend using work table 5440708 in addition to this equipment table.
Order No. 5440701

Enclosure for MarForm MMQ 400
Size: 1,710 mm x 870 mm x 750 mm (L x W x H)
Order No. 6830159

Work table for MMQ 200
Size: 1,200 mm x 800 mm x 720 mm (L x W x H)
with mount for PC unit. For use in addition to equipment table 5440701 or 5440707 (shown in photo on the bottom right)
Order no. 5440708



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Close to our customers.

- 0 +

Mahr

EXACTLY

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