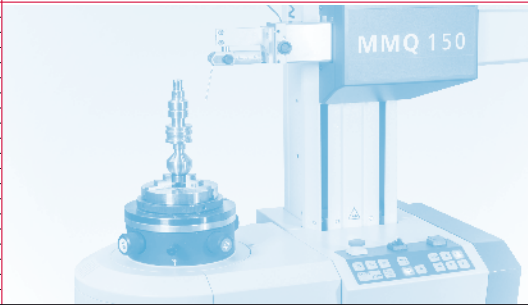


MARFORM | FORMTESTER MMQ 150



- 0 +



E X A C T L Y

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. | ◀

► I MarForm. Formtester MMQ 150

MarForm. Entry into the Field of Cylindricity Testing	4
MarForm MMQ 150	5
MarForm MMQ 150. Technical data	10
MarForm MMQ 150. Software	11
MarWin Software Wizards	12
MarWin Measuring Strategies	14
MarWin Software Package. Velocity analysis	17
MarWin Software Option. QE QS-STAT data export	18
MarWin Software Package. Commutator analysis	20
MarForm. Measuring probe T20W	21
MarForm. Clamping devices	23
MarForm. Testing and calibration standards	24
MarForm. Equipment tables, other accessories	26

MarForm. Formtester MMQ 150. 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 150

The new MarForm MMQ 150



The new **MarForm MMQ 150** offers you entry into the field of automatic form and location testing. The interplay of mechanically exactly manufactured components enables the MarForm MMQ 150 to attain excellent measuring results. To verify your production quality, the formtester MarForm MMQ 150 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 150 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
- 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

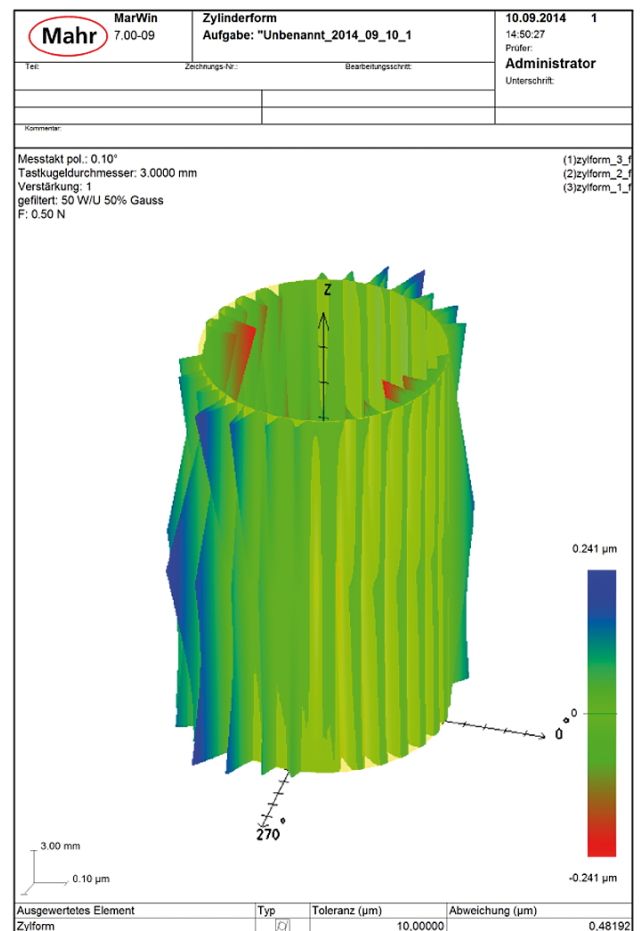
The easy way to measure form. Intuitive operation enables immediate measurements without programming. Thanks to the touch-screen technology, EasyForm can also be quickly and easily operated without mouse or keyboard. The required settings are limited to a minimum, thus extremely shortening the time until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



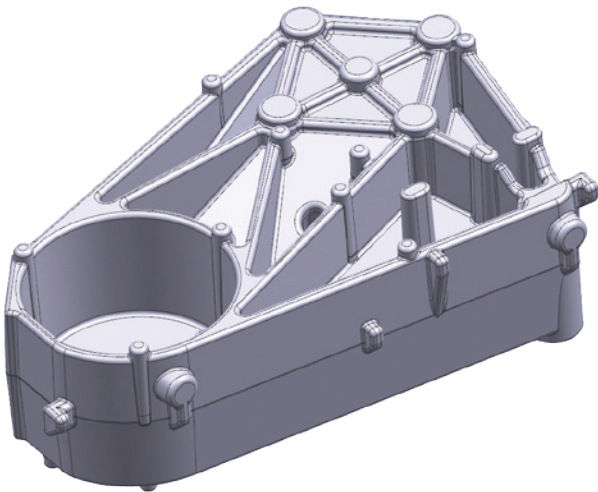
MarForm MMQ 150. Software

Absolutely solid and highly precise

The entire construction of the **MMQ 150** 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 150** is ensured by a highly stable steel body with an internal reinforcing structure in which the mechanical rotational axis is embedded.



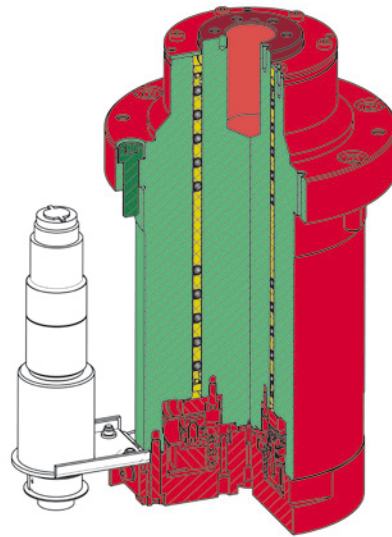
Vertical measuring axis

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 150** is ideal when conditions are less than optimal. The use of homogenous materials ensures that the **MMQ 150'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 150

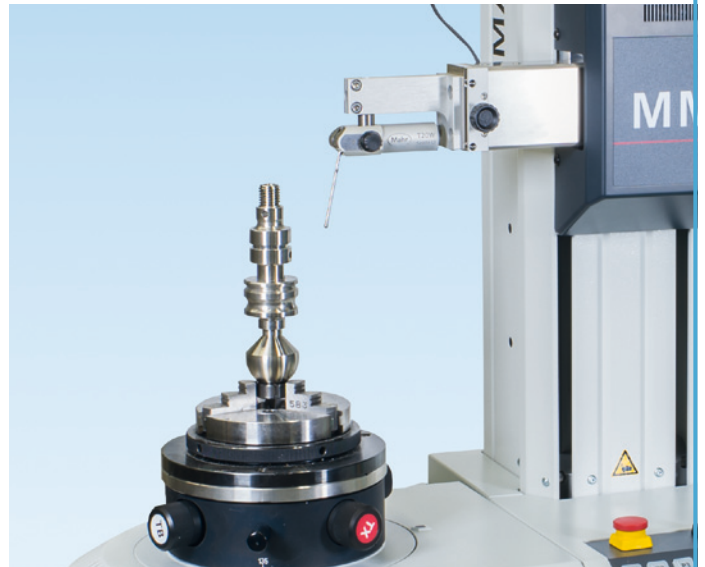
Flexibility

A variety of available probe arm units and clamping devices enables the universal use of the MarForm MMQ 150. 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 150**.

You always attain your measurement result flexibly but quickly.

Compact design

Despite the extremely generous measuring volume, the **MMQ 150** 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 150** does not require an additional power source. Consequently, there is sufficient space available to ensure that the working environment is as ergonomic as possible.



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 offer you maintenance services, maintenance agreements or extended warranties.

An **MMQ 150**, after all, is almost an investment for life.

MarForm MMQ 150

Technical Data

Roundness measuring device, C-axis

Roundness deviation ($\mu\text{m} + \mu\text{m}/\text{mm}$ meas. height)**	0.03 + 0.0006
Roundness deviation ($\mu\text{m} + \mu\text{m}/\text{mm}$ meas. height)*	0.015 + 0.0003
Axial run-out deviation ($\mu\text{m} + \mu\text{m}/\text{mm}$ meas. radius)**	0.04 + 0.0006
Axial run-out deviation ($\mu\text{m} + \mu\text{m}/\text{mm}$ meas. radius)*	0.02 + 0.0003

Centering and tilting table

Coarse and fine adjustment	manual
Table diameter	160 mm
Table load capacity, centric	200 N
Rotational speed	1 – 6 (1/min)

Vertical unit, Z-axis

Motor-drive measuring path length	250 mm
Straightness deviation/100mm **	0.4 μm
Straightness deviation/total meas. path **	1 μm
Parallelism deviation Z/C axis	1 μm
Measuring speed	0.5 - 20 mm/s
Positioning speed	0.5 - 50 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 (50 Hz up to 60 Hz)	100 V to 240 V
Power consumption	180 VA
Data connection 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.

MarForm MMQ 150. Software

Software MarWin EasyForm

The software platform MarWin has been synonymous with innovative solutions in metrology for many years. MarWin is more than just a software. Behind MarWin is the philosophy that for each desired task and mode there is a perfectly matched solution. The measurement and operating software EasyForm is very simple and requires no programming knowledge. EasyForm is thus perfectly suited for the MarForm MMQ 150 as the entry model in the testing of cylindricity. Your staff and your operating costs benefit from the number of steps needed until you have your measuring record being reduced to a minimum. You can perform a roundness measurement in two simple steps. And the software guides you through any settings you want to perform. At the end you are only a few clicks away from a complete measuring record.

The EasyForm software records each step of your measurements. Whether you want to repeat the last measurements or if you decide to combine different measurements and evaluations of a workpiece to a feature sequence:

The EasyForm learning mode will learn the steps that you want to perform

After the measurement, just click on the button "Add to feature sequence" and create your own measurement program. You can save your measurement programs in any of the 32 programmable function keys.

EasyForm – A component of the proven MarWin software platform from Mahr

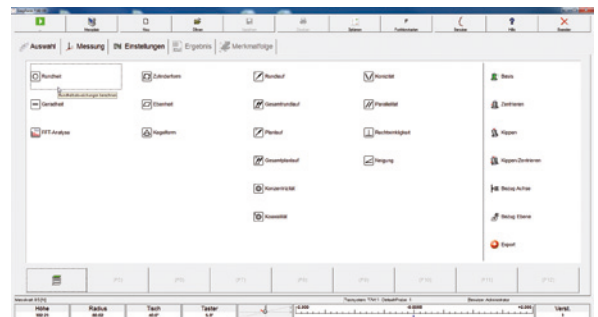
EasyForm is based on highly optimized MarWin measurement and evaluation routines and can be combined with other MarWin modules. It runs under the Windows® operating system and includes user management capabilities, network support, for the electronic storage of measuring records and is expandable for future options.

The easiest way to operate a formtester.

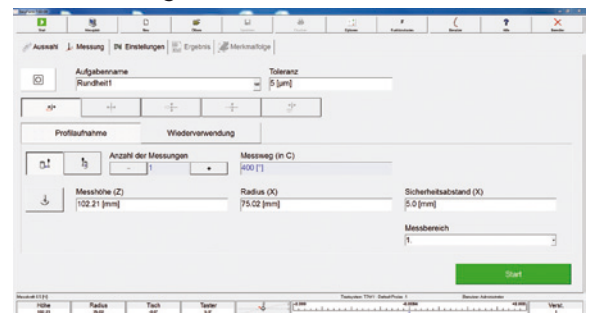
- Pre-positioning and parametrization
- Random features in random order
- In addition to circular and line profiles, helix and spiral profiles are now possible
- Freely designable complete measuring record made from result tables and graphics
- 3D depictions
- Result data can be saved, e.g. as a PDF
- Data processing functions e.g. FFT and interactive hide function
- Data export, such as QS-STAT (option) or text file
- Measuring functions can be called up using function keys

Monitor

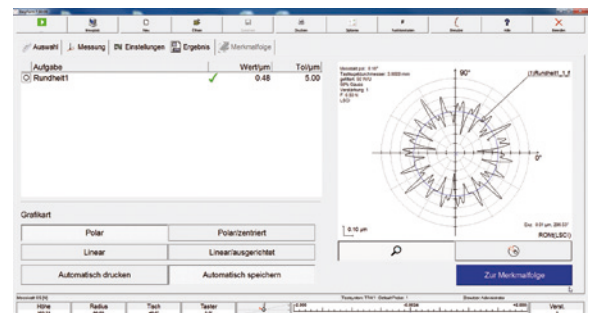
The touchscreen monitor makes work easier. EasyForm offers the possibility of both a normal TFT monitor and a touchscreen monitor, thus without keyboard or mouse. This is a useful alternative, especially for use in production.



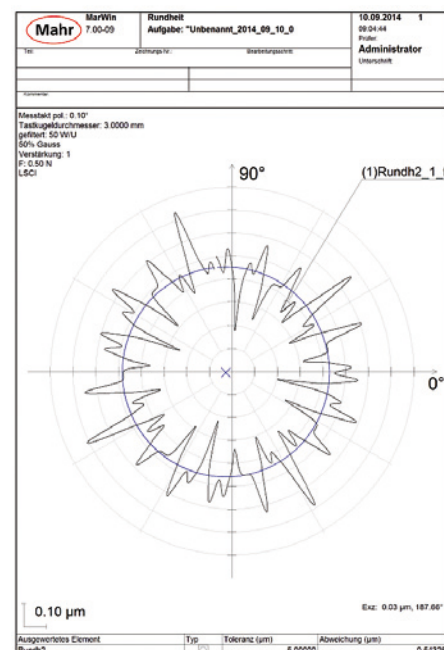
Select measuring task



Specify measuring parameters

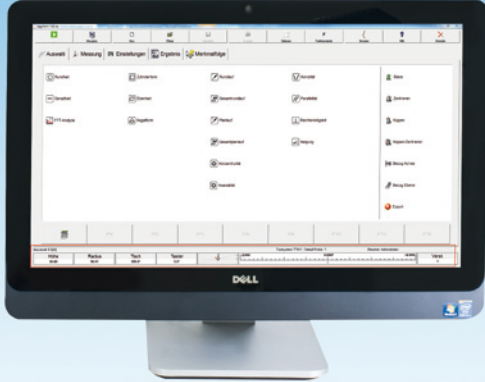


Select depiction type and area

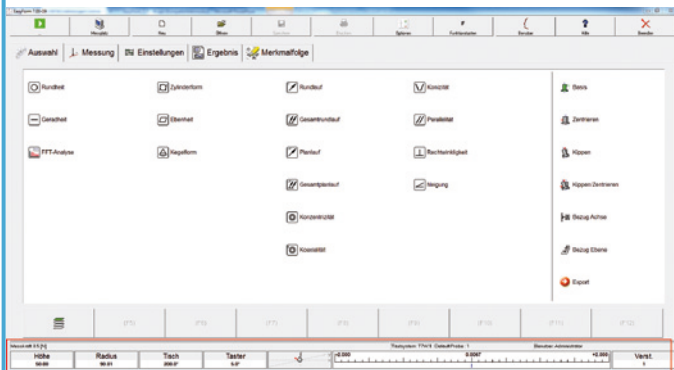


Complete measuring record

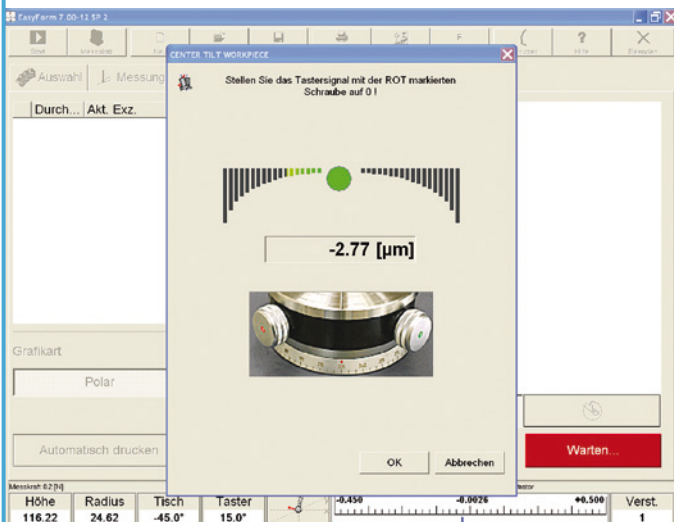
MarWin. Software Wizards



EasyForm: touch-screen capable



View for starting measuring programs

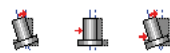


View for centering and tilting

Software wizards:

• Start screen with extended mini-monitor

The start screen depicts all available EasyForm wizards using clear and icons, enabling a quick start of the desired measuring task. The mini-monitor is always displays a button for the measuring direction change, the numerical probe signal, probe type, probe arm and user.



• Measuring station

To position axes and probe arm

• Run-out alignment

Wizard for tilting and levelling; based on an axial run-out measurement

• Preset

The command "Preset" is used for positioning (strict separation of positioning and evaluation) for loading/defining probe, probe arm, tactile element to define multiple graphics (1-, 2-, 3-, 4-, 5-, 6-fold representation) and for storing parameters with choice between standard and enhanced results table.

• Centering / Tilting / Centering and Tilting

For machines with manual centering and tilting table, the software facilitates manual alignment. The respective setting screws are automatically rotated in the direction of the operator. The red / green signal and a numerical value shows the operator whether he is in the desired range. Colored markers of the setting screws accurately show, with which screw the adjustment must be made.



• Reference axis

Wizard for generating a datum axis; based on at least two circumferential measurements performed at different heights or one axial run-out measurement and one circumferential measurement

• Reference plane

Wizard for generating a datum plane; calculation of datum plane; based on at least two polar or linear measurements.

MarWin. Software Wizards



• 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

• Cylindricity

Wizard for measuring, evaluating and recording the cylindricity; based on measurements of full and partial circles or straightness measurements

• Coaxiality

Wizard for measuring, evaluating and recording the coaxiality with respect to a datum axis; based on measurements of full and partial circles

• 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



• 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

• 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



• 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

• 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

• Conicity

Wizard for measuring, evaluating and recording the conicity relative to a datum axis or opposite profile; based on linear measurements

• 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

• 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



• 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

• 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

• Flatness

Wizard for measuring, evaluating and recording the flatness; based on measurements of full and partial circles or linear measurements

• 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



• Fourier analysis

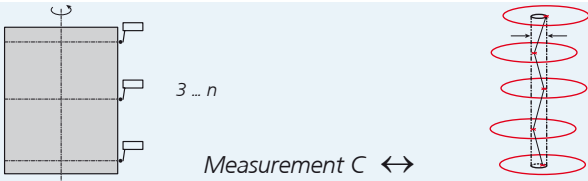
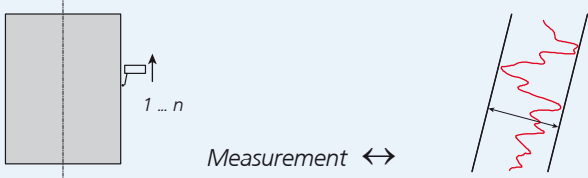
Wizard for performing a Fast Fourier Transformation on a polar/linear profile; result presentation in a histogram or table. Including a tolerance band monitoring function for the amplitude height in the histogram (nominal value read from an ASCII file); RTA analysis based on the FAG standard with calculation 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

• QS-STAT (Option)

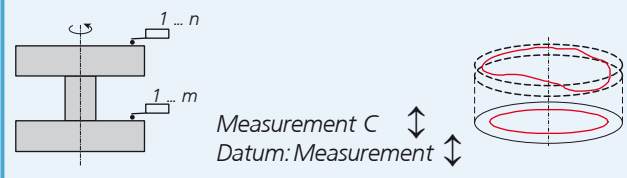
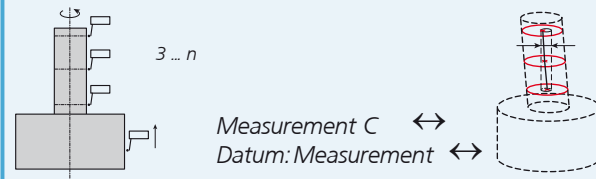
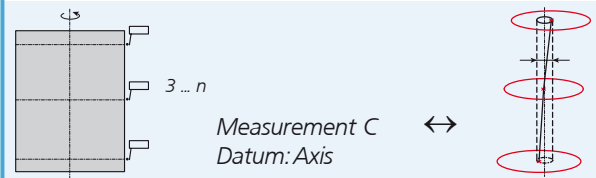
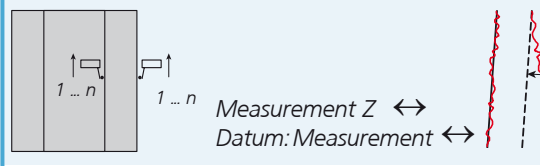
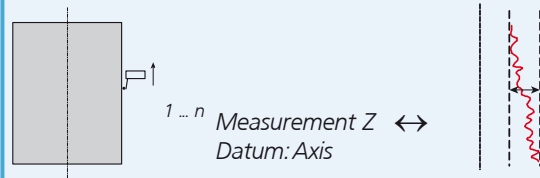
Wizard for easy export of result values to the statistics software QS-STAT (separate description upon request)

MarWin. Measuring Strategies

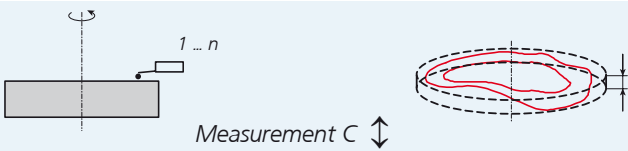
— Straightness, including by section



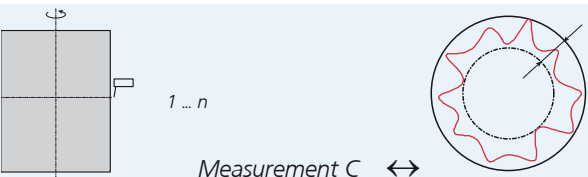
// Parallelism



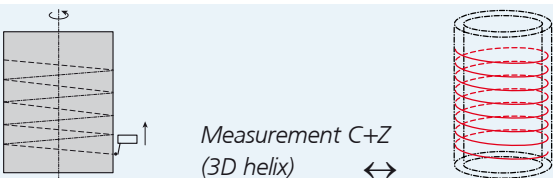
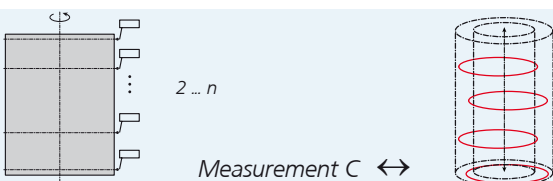
▱ Flatness



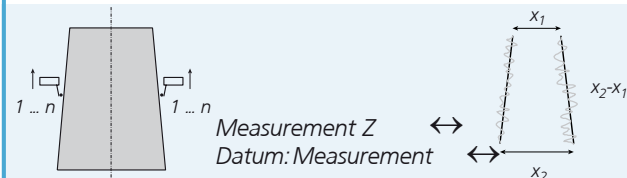
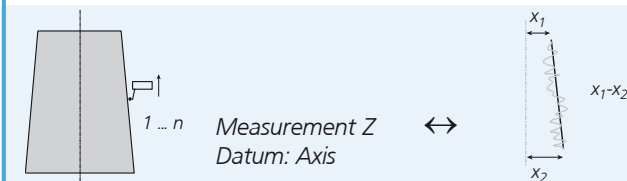
○ Roundness



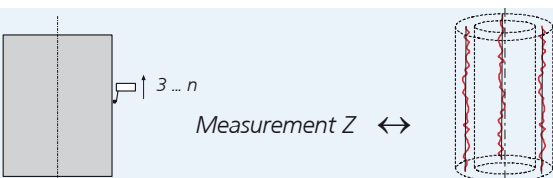
⌢ Cylindricity



\\ Concitiy

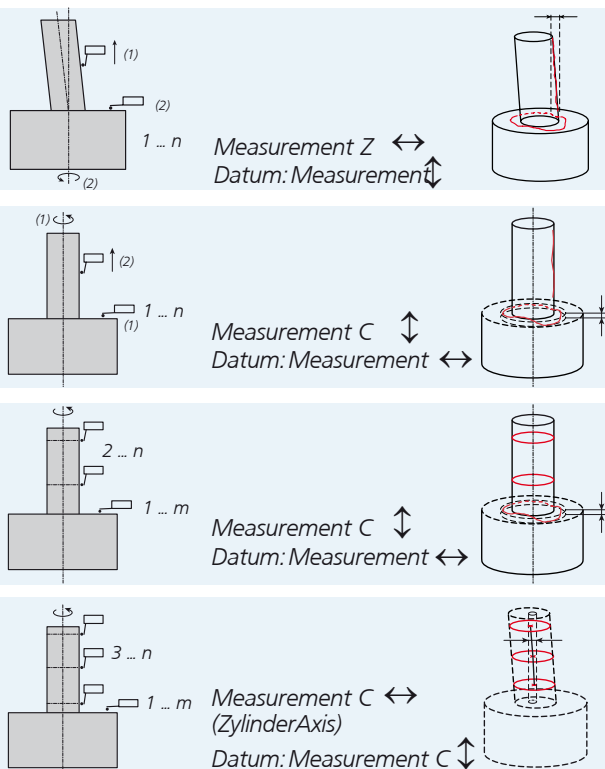


⌢ Cylindricity

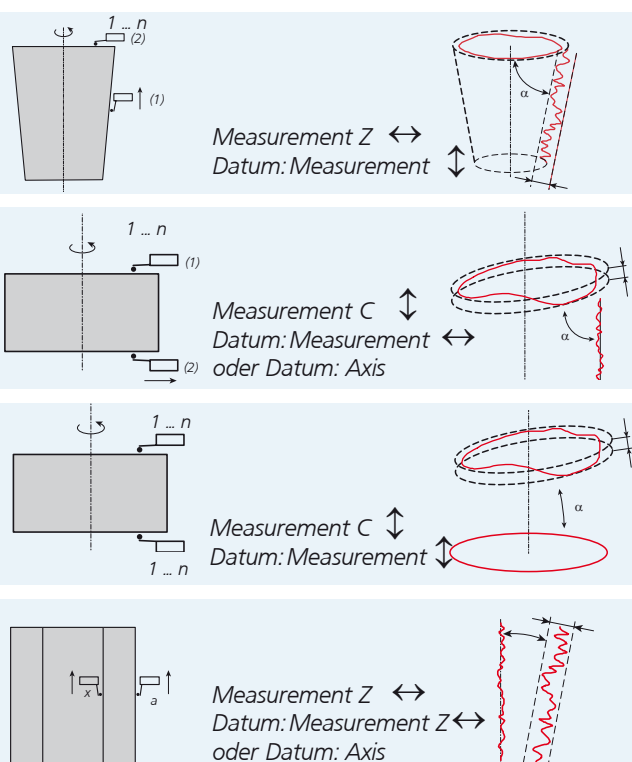


MarWin. Measuring Strategies

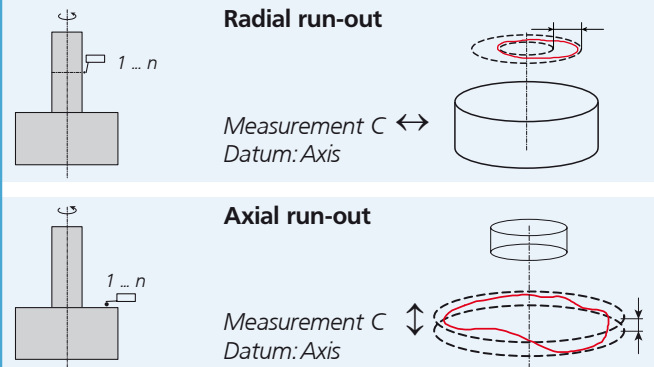
⊥ Perpendicularity



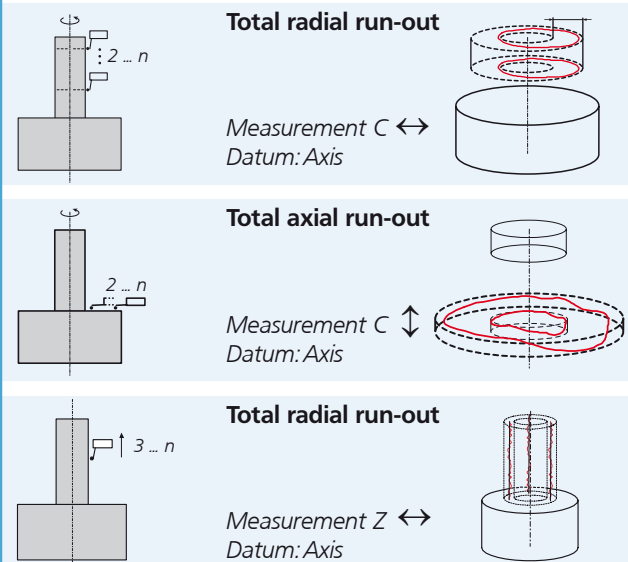
∠ Angularity



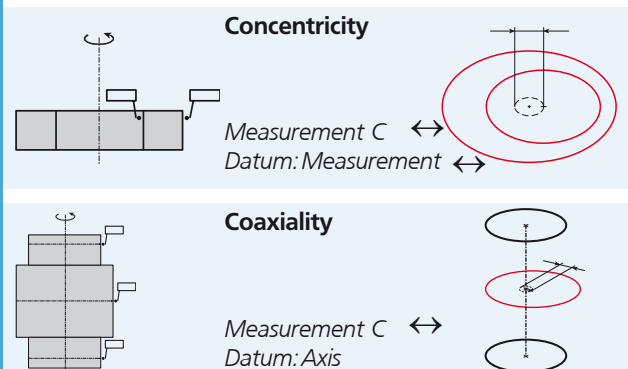
↗ Run-out



↗ Total run-out



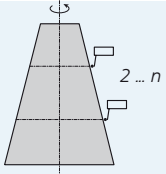
🎯 Concentricity and Coaxiality



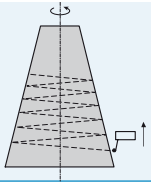
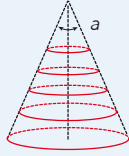
MarWin. Measuring Strategies



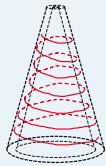
Conicity



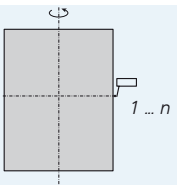
Measurement C ↔



Measurement C+Z
(3D helix) ↔

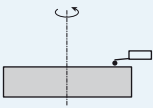
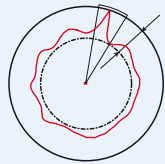


Angle sector



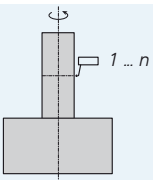
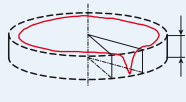
Roundness

Measurement ↔



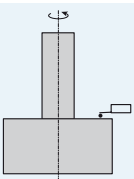
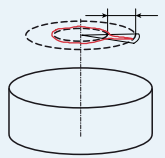
Flatness

Measurement ↔



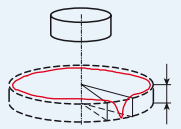
Radial run-out

Measurement C ↔
Datum: Axis



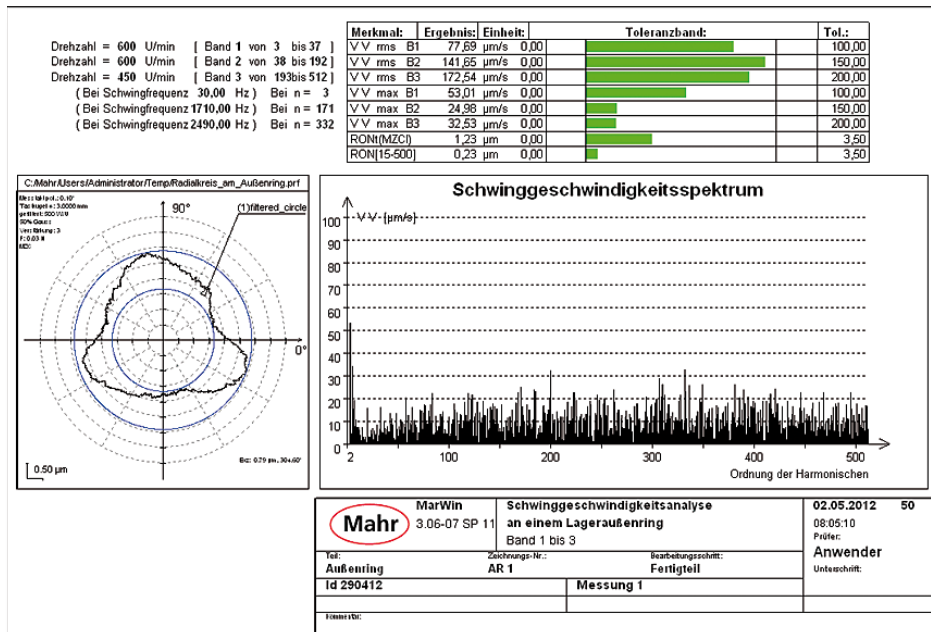
Axial run-out

Measurement C ↔
Datum: Axis



Note: Measurements with 3D helix optional.

MarWin Software Package. Velocity Analysis for Roller Bearing Components



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 relating 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
EasyForm
AdvancedForm and
ProfessionalForm.

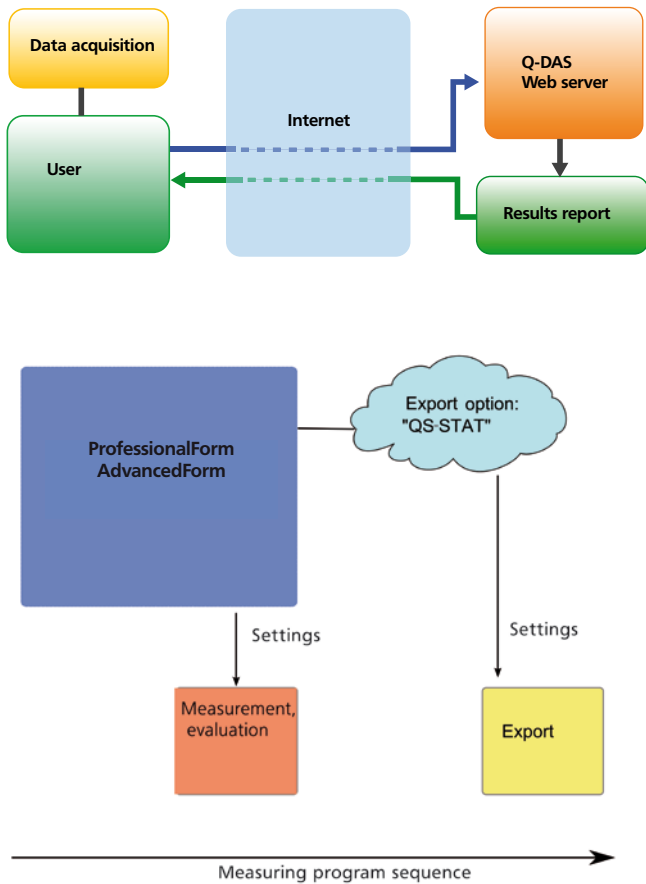
The velocity analysis software option is an independent analysis software that can be used with raw profiles that have been captured at an earlier time using MarForm measuring machines (fully-closed radial (axial) profiles at raceways normal to the circumferential surfaces (perpendicular to the end-faces)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

MarWin Software Option. QE QS-STAT Data Export



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.

For 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:

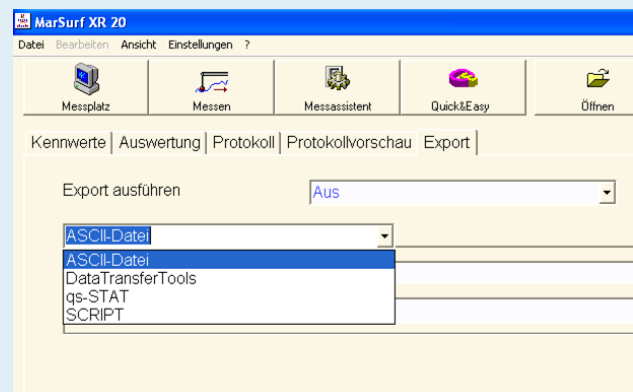
- for form metrology:

Advanced Form and Professional Form

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

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

K0001	Values	K2001	Feature no.
K0002	Attribute	K2002	Feature descr.
K0004	Time / Date	K2009	Parameter, key data for the type of feature
K0009	Text / Comment	K2022	No. of decimals after comma
K0053	Order	K2101	Nominal dimension
K0100	Total no. of features in the file	K2110	Lower limit
K1001	Part numbers	K2111	Upper limit
K1002	Part description	K2112	Lower allowance
K1053	Order	K2113	Upper allowance
K1086	Work cycle / Operation	K2120	Type of limit below
K1103	Department / Cost Center	K2121	Type of limit above
K1201	Testing device number as text / number	K2142	Unit description
K1202	Testing device description	K2402	Testing unit description
K1221	Tester name	K2415	Testing device serial number
		K2900	Text / Comment



MarWin Software Option. QE QS-STAT Data Export

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.

In the field list, optional default settings (predefined contents from the measuring sequence, fixed contents, catalogs) and restrictions (source in the configurator cannot be modified, key cannot be deactivated) can be specified for every K-field. For example, the key K0001 is typically specified with the data source "character value" by default, defined as the obligatory key and protected from changes. The user can view these settings in the configurator, but not change them.

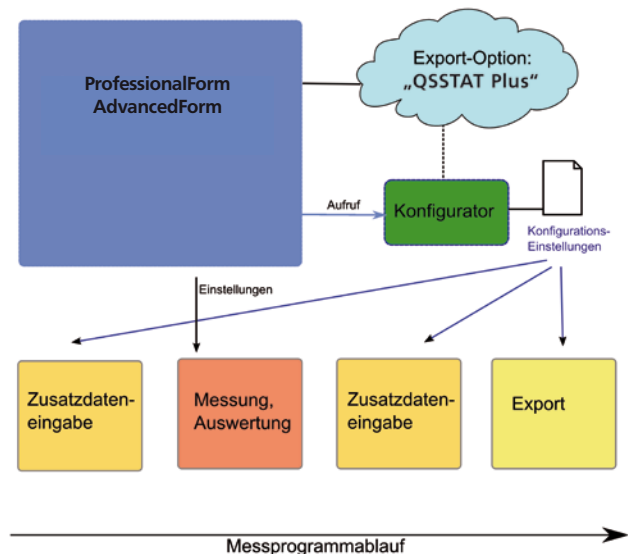
In the configurator, the field list is selected as the basis for export or measurement. The keys it includes can then be filled/adjusted via the dialog box.

With the right settings, a field list will minimize configuration work. A lot of information from the measuring program is available in the configurator to fill the K-fields via data sources (e.g. record header data, character information, user,...), so that in the ideal case only a small amount of information not available in the measuring program must be entered into the key.

An import function from .dfd/.dfq files alleviates the work of filling out the K-fields with fixed content.

In close cooperation with the software provider Q-DAS and the automotive industry as well as manufacturers of measuring devices, a standard for the exchange of data was specified (AQDEF = Advanced Quality Data Exchange Format). Data export products from Mahr are certified according to AQDEF and assure you easy operation. AQDEF certification from Mahr gives you additional reliability.

Mahr is currently the only manufacturer of measuring units with certification for Version 3.01 Category B.



qs-STAT-Exportkonfiguration:

Diese Konfiguration bearbeiten

Einstellungen kopieren von... Konfiguration leeren

Allgemeine Konfiguration:

Feldliste:

Untersuchungszweck:

Benutzerkatalog:

Einstellungen zur Exportdatei:

Name der Exportdatei:

Exportpfad:

Dateimodus:

Modus 'Anhängen':

Konfiguration der Schlüssel:

Daten aus Exportdatei übernehmen...

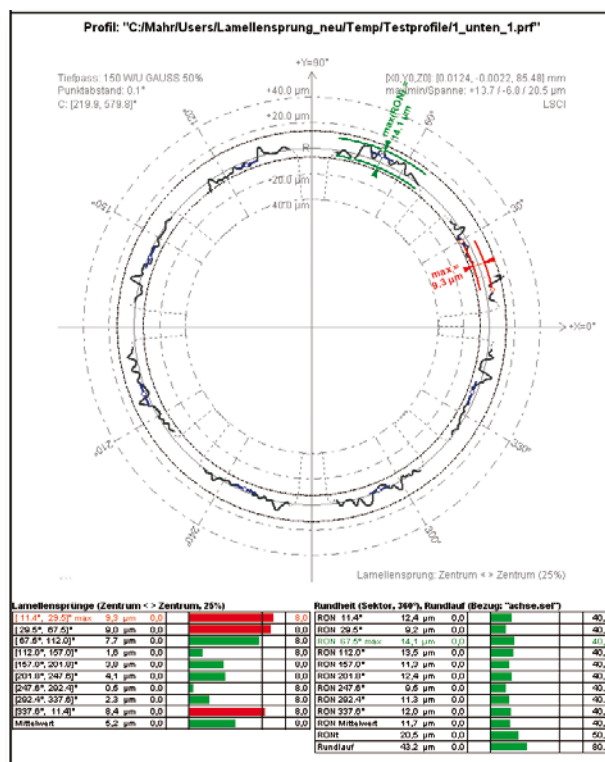
Teilebezogene Schlüssel:

Merkmalsbezogene Schlüssel:

Merkmalsbezogene Schlüssel

Konfigurations-Merkmal	Merkmalsbezogene Schlüssel	Quelle	Default	Eingabeart	Vorgabe
K0001	Werte	Automatisch gemäß Feldliste	Merkmals-Wert		
K0002	Attribut	Automatisch gemäß Feldliste			
K0004	Ziel-Datum	Automatisch gemäß Feldliste	Merkmals-Datum		
K0005	Ergebnisse	Benutzerkatalog vor Messung			
K0006	Chargennummer	Benutzerkatalog vor Messung			
K0007	Notizen	Benutzerkatalog vor Messung			
K0008	Prüfer	Benutzerkatalog vor Messung			
K0009	Adapter	Benutzerkatalog vor Messung			
K0012	Prüfmittel	Automatisch gemäß Feldliste			
K0014	Seitennummer (Teilname...)	Automatisch gemäß Feldliste			
K0015	Messungszähler	Benutzerkatalog			
K0016	Gesamtzahl Merkmale in d...	Automatisch gemäß Feldliste	Export: Anzahl der Mer...		
K0017	Merkmals-Numer	Benutzerkatalog	0000		
K0018	Merkmals-Beschreibung	Benutzerkatalog	Materialabgleich freigegeben		
K0019	Merkmalsbezug	Benutzerkatalog	Ka		
K0020	Dokumentationsart (Datei...)	Benutzerkatalog	1		
K0021	Neuigkeit (Prüfung / Ver...)	Automatisch gemäß Feldliste			
K0022	100% Messung	Automatisch gemäß Feldliste			
K0023	Ergebnisstatus	Benutzerkatalog	0		
K0024	Materialnummer der Baute...	Benutzerkatalog	NULL		
K0025	Index (über Bauteil)	Benutzerkatalog	NULL		
K0026	Submerkmal / Teilmerkmal	Benutzerkatalog	0		
K0027	Renormierung	Automatisch gemäß Feldliste			
K0028	Untere Grenzzeit	Automatisch gemäß Feldliste			
K0029	Obere Grenzzeit	Automatisch gemäß Feldliste			

MarWin Software Package. Commutator Analysis with MarForm EasyForm



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.

MarForm. Probe T20W

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 $\pm 1,000 \mu\text{m}$
- 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")

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

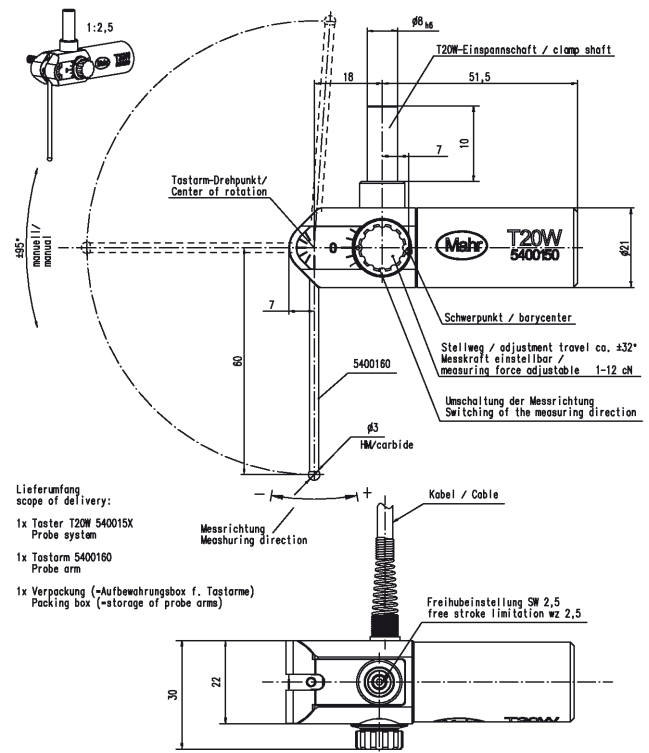
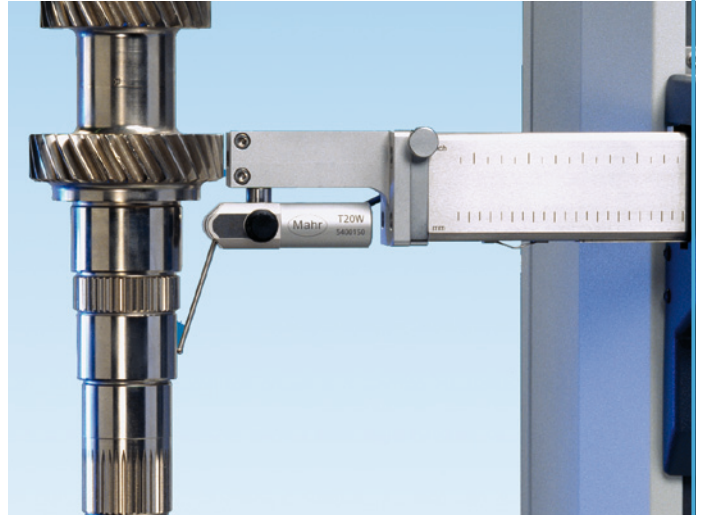
5400168

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

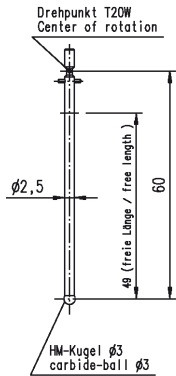
The optimal solution using accessories



Marform. Probe Arms for T20W Probes

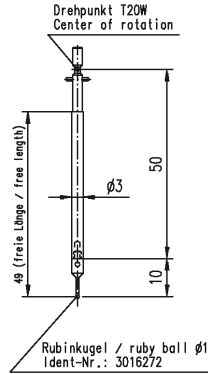
Ident-Nr.: 5400160

FT0002-0100.000



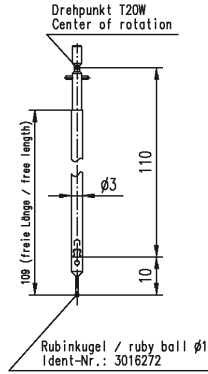
Ident-Nr.: 5400161

FT0002-0300.000



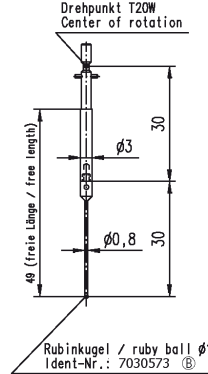
Ident-Nr.: 5400162

FT0002-0350.000



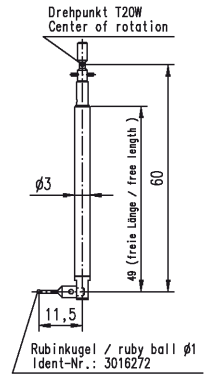
Ident-Nr.: 5400170

FT0002-0380.000



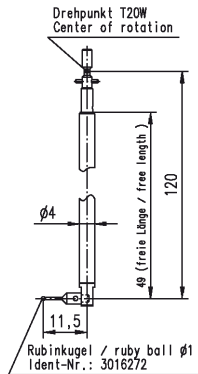
Ident-Nr.: 5400163

FT0002-0200.000



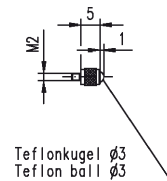
Ident-Nr.: 5400164

FT0002-0250.000



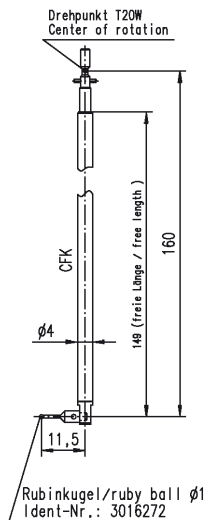
Ident-Nr.: 5400169

FT0002-0700.000



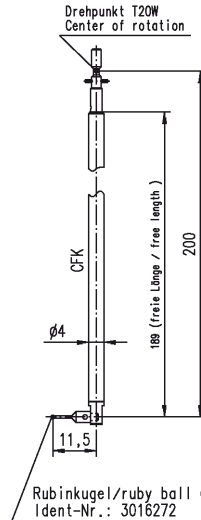
Ident-Nr.: 5400165

FT0002-0400.000



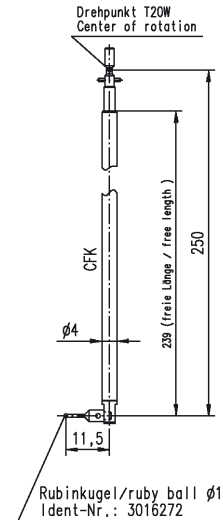
Ident-Nr.: 5400166

FT0002-0500.000



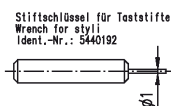
Ident-Nr.: 5400167

FT0002-0600.000

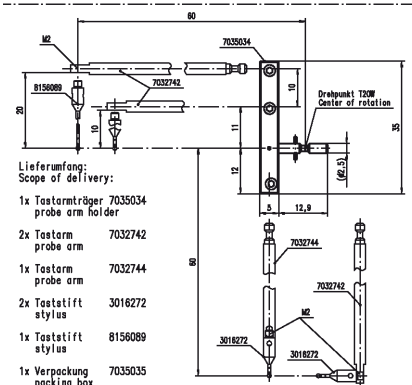


Taststifte / Stylus M2

Ident-Nr.	Kugel- ϕ [mm] ball- ϕ [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



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 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 1 to 152 mm, internal 24 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. 6710617

Three-jaw chuck, dia. 110 mm with mounting flange of dia. 164 mm; clamping range: external 3 to 100 mm, internal 27 to 100 mm. Total height with flange 73 mm (2.87"). Adjustment by means of rotating ring.

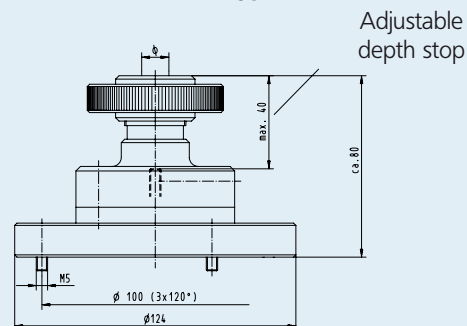
Order No. 6710629

Three-jaw chuck, dia. 80 mm with mounting flange of dia. 124 mm; clamping range: external 2 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



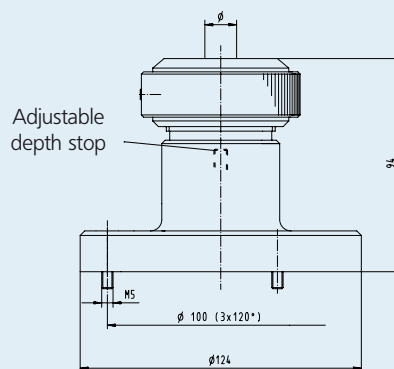
Quick-clamping device (collet chuck)

Dia. 1 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 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

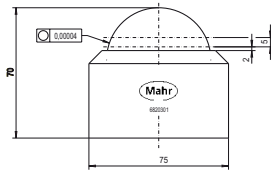
Clamping jaws 2x

With M5 fastening thread. Clamping height 40 mm.

Order No. 6710628

Further workpiece-specific clamps are available on request.

MarForm. Testing and Calibration Standards



Roundness standard

DKD* calibration certificate incl.
Mahr calibration certificate incl.
PTB** calibration certificate incl.



Order No. 6820302

Order No. 6820301

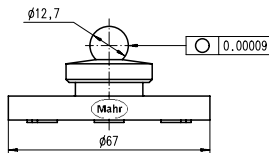
Order No. 9014439

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)



Metal roundness standard

without calibration certificate
DKD* calibration certificate incl.
Mahr calibration certificate incl.



Order No. 5400145

Order No. 9964115

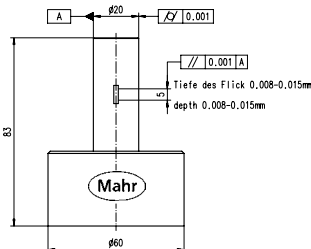
Order No. 9964307

Metal 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. 0.09 μm (3.54 μin)
Weight	approx. 0.3 kg (.661 lbs)



Magnification standard

without calibration certificate
DKD* calibration certificate incl.
Mahr calibration certificate incl.



Order No. 5400147

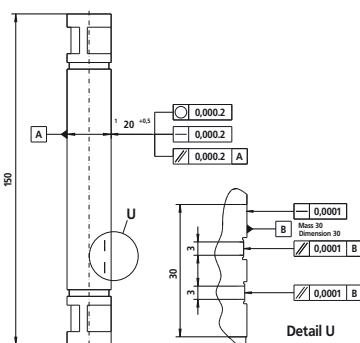
Order No. 9964148

Order No. 9964311

Magnification Standard for desktop Formtesters

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)



Universal cylinder square

DKD calibration certificate incl.
Mahr calibration certificate incl.
PTB calibration certificate incl.



Order No. 5400143

Order No. 5400140

Order No. 9021605

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)

Marform. Testing and Calibration Standards

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 (787 μin)
Weight	approx. 2 kg (4.409 lbs)



Optical flat

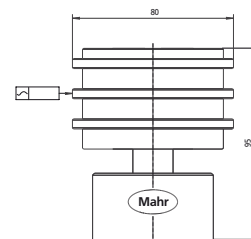
Mahr calibration certificate incl.
PTB** calibration certificate incl.

Order No. 6820205
Order No. 9964113

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
DKD* calibration certificate incl.
Mahr calibration certificate incl.

Order No. 5400142
Order No. 9964149
Order No. 9964312

Straightness Standards - Cylinder Squares

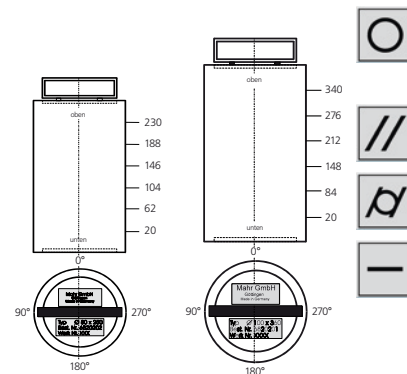
Testing and adjusting the vertical guide relative to the measuring spindle axis. For testing the straightness of the linear guides.
For testing the parallelism.

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

DKD* calibration certificate incl.
Mahr calibration certificate incl.

Order No. 6820204
Order No. 6820202

Type 2: 100 mm

DKD* calibration certificate incl.
Mahr calibration certificate incl.

Order No. 6820206
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

DKD* calibration certificate incl.
Mahr calibration certificate incl.

Order No. 9964313
Order No. 9964314

MarForm. Tables and Other Accessories



Equipment Tables for MarForm MMQ 150

Equipment table for MMQ 150

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

Container with rollers and 4 drawers

Size: 450 mm × 600 mm × 570 mm (L × W × H)

Order No. 5440705

Work table for MMQ 150

Size: 1,200 mm × 800 mm × 720 mm (L × W × H)
with mount for PC unit.

For use in addition to equipment table 5440701

Order No. 5440708

Equipment Tables for MarForm MMQ 150

Equipment table for MMQ 150

Size: 1,710 mm × 870 mm × 750 mm (L × W × H)

Order No. 6830139

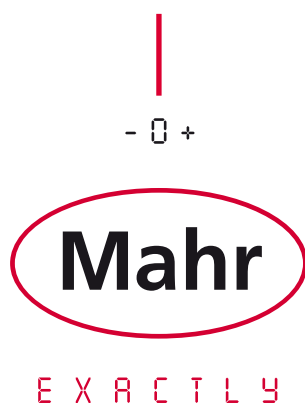




Notes

Blank area for notes.

WWW.MAHR.COM



Mahr GmbH Göttingen

Carl-Mahr-Str. 1, 37073 Göttingen, Germany
Phone: +49 (0)551-7073-800, Fax: +49 (0)551 7073-888
info@mahr.com, www.mahr.com

© by Mahr GmbH, Göttingen

We reserve the right to modify our products, particularly with a view to technical improvement and further development. All illustrations and numbers etc. are therefore subject to change.