

# MarSurf M 400. Mobile Surface Measuring Instrument

## MarSurf M 400. The best of the mobile devices

Both in the measuring room and increasingly also in the production area, there is a need for surface evaluations requiring skidless tracing.

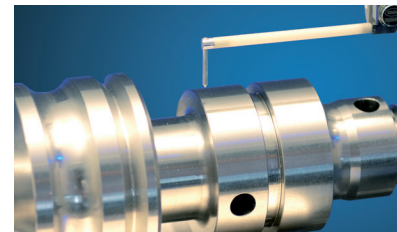
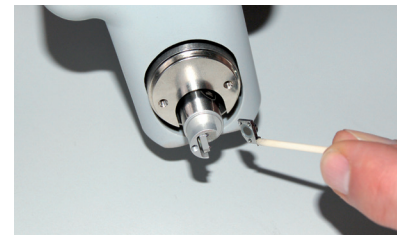
This generally requires more highly skilled operators, more time and more adjustment work.

Within the "mobile surface metrology" range, MarSurf M 400 provides the necessary range of functions, while at the same time being quick and easy to use.

- Mobile and stationary measuring instrument
- Roughness and waviness measurements
- Traversing lengths up to 26 mm
- Over 50 R, W and P surface parameters
- Automatic choice of cut-off and traversing length in accordance with international standards
- Dynamic calibration function
- Cable and Bluetooth connection between drive unit and evaluation instrument (4 m)
- Magnetic probe holder (breakaway probe) BFW 250
- Motorized probe zero setting (max. 7.5 mm)

### Supplied with:

- MarSurf M 400 evaluation instrument
- MarSurf SD 26 drive unit including BFW 250 probe system
- Standard probe arm (6852403)
- 1 roll of thermal paper
- Wide-range power supply unit with 3 adapters
- 2 x USB cables (for connecting to the PC and the M 400)
- Operating instructions
- Case



BFW probe system with magnetic probe arm holder

## Technical Data

<b>Measuring principle</b>	Stylus method
<b>Probe</b>	BFW skidless system
<b>Measuring range</b>	+/-250 µm (up to +/-750 µm with 3x probe arm length)
<b>Profile resolution</b>	Measuring range +/-250 µm: 8 nm Measuring range +/-25 µm: 0.8 nm
<b>Filter according to ISO/JIS</b>	Gaussian filter as per ISO 11562 Filter as per ISO 13565
<b>Cutoff <math>l_c</math> according to ISO/JIS</b>	0,25 mm, 0,8 mm, 2,5 mm, automatical, variable
<b>Number n of sampling length according to ISO/JIS</b>	1-5
<b>Contacting speeds</b>	0,2 mm/s; 1,0 mm/s
<b>Measuring force</b>	0,7 mN
<b>Surface parameters</b>	Over 50 surface parameters for R, P and W profiles according to current ISO/JIS or MOTIF standards (ISO 12085)

## Accessories

### Measuring stand

- ST-D, ST-F and ST-G
- Holder on measuring stand

### Other accessories

- CT 120 XY table, parallel vise, V-block
- Assorted probe arms for the BFW probe system

## Applications

### Machine building

Bearings, shafts, racks, valves

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head, cylinder block, turbocharger

### Steel industry

Measurement of sheet metal surfaces  
Measurement of roller surface

### Medicine

Surface roughness measurement for hip and knee endoprostheses

### Aerospace

Turbine components

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# MarSurf XR 1. Roughness Measuring Station

## MarSurf XR 1. The ideal instrument for a low-cost introduction to user-friendly surface metrology.

The PC-based instrument delivers all common surface parameters and profiles in accordance with international standards, both in the measuring room and in production. MarSurf XR 1 from Mahr stands for innovative roughness evaluation software.

- Over 80 surface parameters for R, P and W profiles according to current ISO/JIS or MOTIF standards (ISO 12085)
- Bandpass filter Ls in accordance with current standard; Ls can also be switched off or varied as required.
- Comprehensive measuring records
- Teach-in methods for the rapid creation of Quick & Easy measuring programs
- Automatic functions for choosing cut-off and traversing length in accordance with international standards (patented)
- Support for various calibration methods (static and dynamic) by specifying the Ra or Rz parameter
- Adjustable maintenance and calibration intervals
- Multiple measuring station configurations for custom applications
- Range of options provide system flexibility
- Various user levels protect the device against misuse and prevent unauthorized use

### Drive units and probe options:

- Skidded or skidless tracing
- MarSurf RD 18 or MarSurf SD 26 drive units

### Supplied with:

- MarSurf XR 1, XR 1 software, Mahr license key with standard license
- Drive unit adapter
- All-in-one PC optional
- MarSurf SD 26 and/or RD 18 drive unit set including probe system
- MFW 250 B probe system set
- MarSurf ST-G measuring stand
- CT 120 XY table



## Technical Data

<b>Measuring principle</b>	Stylus method
<b>Probe</b>	BFW skidless system with MarSurf SD 26 drive unit and/or PHT skidded system with MarSurf RD 18 drive unit
<b>Measuring range</b>	+/-250 µm (up to +/-750 µm with 3x probe arm length) applies to BFW system 350 µm applies to PHT probe system
<b>Filter according to ISO/JIS</b>	Gaussian filter as per ISO 11562 Filter as per ISO 16610-21 / ISO 16610-31
<b>Number n of sampling length according to ISO/JIS</b>	1 to 50 (default: 5)
<b>Traversing lengths</b>	MarSurf GD 26 / SD 26: Automatic; 0.56 mm*; 1.75 mm; 5.6 mm; 17.5 mm, 56 mm, Measurement up to stop, variable * Traversing length dependent on drive unit RD 18: Automatic; 1.75 mm; 5.6 mm; 17.5 mm
<b>Measuring force</b>	0.7 mN
<b>Surface parameters</b>	Over 80 surface parameters for R, P and W profiles according to current ISO/JIS or MOTIF standards (ISO 12085)

## Accessories

### General software options:

- Dominant waviness option (Wdc) for MarWin
- ISO 13565-3 surface parameters option
- QS-STAT / QS-STAT Plus option
- Profile processing option
- User defined parameters between operator and authorized personnel
- Contour 1 for MarSurf XR 1 / XR 20 option (in conjunction with MarSurf SD 26 drive unit)
- All options on one MLK

### Software options:

- Expanded evaluation option
- Multiple measurement option
- Expanded measuring record option
- Script program integration option
- Digital I/O set option

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## Applications

### Machine building

Bearings, shafts, racks, valves, various components from the engineering and precision engineering industry

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head, cylinder block, turbocharger

### Medicine

Surface roughness measurement for hip and knee endoprostheses

### Aerospace

Turbine components

### Optics

Various optical components

# MarSurf XR 20 with GD 25. Roughness Measuring Station



## MarSurf XR 20, the perfect introduction to top-class surface metrology

The PC-based instrument delivers all common surface parameters and profiles in accordance with international standards, both in the measuring room and in production. The powerful MarSurf XR 20 combines decades of experience in surface metrology with innovative technology, easy-to-read icons and user-friendly operator assistance.

- Over 100 surface parameters available for R, P and W profiles in accordance with ISO / JIS, ASME or MOTIF (ISO 12085)
- Tolerance monitoring and statistics for all surface parameters
- Teach-in methods for the rapid creation of Quick & Easy measuring programs
- Comprehensive measuring records
- Automatic functions for choosing filter and traversing length in accordance with international standards
- Support for various calibration methods (static/dynamic) by specifying the Ra or Rz parameter
- Adjustable maintenance and calibration intervals
- Simulation mode for rapid familiarization with operating principle
- Multiple measuring station configurations for custom applications

### Supplied with:

- MarSurf XR 20 including PC, Mid-Range Standard, XR 20 software, Mahr license key
- TFT monitor
- MarSurf GD 25 drive unit
- MFW 250 B probe system set
- MarSurf ST-G measuring stand
- PGN 3 calibration standard
- MCP 23 manual control panel
- CT 120 XY table

## Technical Data

<b>Measuring principle</b>	Stylus method
<b>Probe</b>	R probe, MFW 250 B
<b>Measuring range</b>	MFW 250: $\pm 25 \mu\text{m}$ , $\pm 250 \mu\text{m}$ , (up to $\pm 750 \mu\text{m}$ ); $\pm 1000 \mu\text{in}$ , $\pm 10,000 \mu\text{in}$ (up to $\pm 30,000 \mu\text{in}$ )
<b>Filter according to ISO/JIS</b>	Gaussian filter as per ISO 11562, filter as per ISO 16610-21/ISO 16610-31
<b>Number n of sampling length according to ISO/JIS</b>	1 to 50 (default: 5)
<b>Traversing lengths</b>	Automatic; 0.56 mm; 1.75 mm; 5.6 mm; 17.5 mm, 56 mm*, Measurement up to stop, variable * Traversing length dependent on drive unit
<b>Surface parameters</b>	Over 100 surface parameters for R, P and W profiles according to current ISO/JIS or MOTIF standards (ISO 12085)

## Accessories

- Parallel vise
- V-block

### General software options:

- Dominant waviness option (WDc) for MarWin
- ISO 13565-3 surface parameters option
- QS-STAT / QS-STAT Plus option
- Profile processing option
- User defined parameters option
- Contour 1 for MarSurf XR 1 / XR 20 options
- All options on one MLK (Mahr license key)

## Applications

### Machine building

Bearings, threads, threaded rods, ball screws, shafts, racks, valves

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head, cylinder block, turbocharger

### Medicine

Surface roughness measurement for hip and knee endoprostheses

### Aerospace

Turbine components

### Optics

Various optical components

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# MarSurf XR 20 with GD 120. Roughness Measuring Station

## MarSurf XR 20, the introduction to surface metrology

- PC based instrument delivers all common surface parameters and profiles in accordance with international standards (both in measuring room and in production)
- Combines decades of experience in surface metrology with innovative technology
  - Easy to read icons
  - User friendly operator assistance
- A sampling length of up to 120 mm is possible in conjunction with the GD 120 drive unit
  - In addition to surface roughness evaluations, profile and waviness evaluations can also be performed in this way
- Over 100 surface parameters available for R, P and W profiles in accordance with ISO / JIS, ASME or MOTIF (ISO 12085)
- Tolerance monitoring and statistics for all surface parameters
- Teach-in methods for the rapid creation of Quick & Easy measuring programs
- Comprehensive measuring records
- Automatic functions for choosing filter and traversing length in accordance with international standards
- Support for various calibration methods (static/dynamic) by specifying the Ra or Rz parameter
- Adjustable maintenance and calibration intervals
- Simulation mode for rapid familiarization with operating principle
- Multiple measuring station configurations for custom applications

## Supplied with:

- MarSurf XR 20 including PC, Mid-Range Standard, XR 20 software, Mahr license key
- TFT monitor
- MarSurf GD 120 drive unit
- MFW 250 B probe system set
- MarSurf ST 500 measuring stand
- PGN-3 calibration standard
- MCP 23 manual control panel
- CT 300 XY table

## Technical Data

<b>Measuring principle</b>	Stylus method
<b>Probe</b>	R probe, MFW 250 B
<b>Measuring range</b>	MFW 250: $\pm 25 \mu\text{m}$ , $\pm 250 \mu\text{m}$ , (up to $\pm 750 \mu\text{m}$ ); $\pm 1000 \mu\text{in}$ , $\pm 10,000 \mu\text{in}$ (up to $\pm 30,000 \mu\text{in}$ )
<b>Filter according to ISO/JIS</b>	Gaussian filter as per ISO 11562, filter as per ISO 16610-21/ISO 16610-31
<b>Number n of sampling length according to ISO/JIS</b>	1 to 50 (default: 5)
<b>Traversing lengths</b>	Automatic; 0.56 mm; 1.75 mm; 5.6 mm; 17.5 mm, 56 mm*, Measurement up to stop, variable * Traversing length dependent on drive unit
<b>Surface parameters</b>	Over 100 surface parameters for R, P and W profiles according to current ISO/JIS or MOTIF standards (ISO 12085)

## Accessories

### Optional:

- MarSurf ST 750 measuring stand
  - Manual control panel with joystick and display
  - Parallel vise
  - V-block
  - Equipment table
  - Vibration dampening system
  - Measuring cabinet
- ### General software options:
- Dominant waviness option (Wdc) for MarWin
  - ISO 13565-3 surface parameters option
  - QS-STAT / QS-STAT Plus option
  - Profile processing option
  - User defined parameters option
  - Contour 1 for MarSurf XR 1 / XR 20 options
  - Topography option

## Applications

### Machine building

Bearings, threads, threaded rods, ball screws, shafts, racks, valves

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head, cylinder block, turbocharger

### Medicine

Surface roughness measurement for hip and knee endoprostheses

### Aerospace

Turbine components

### Optics

Various optical components

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# MarSurf XC 2 with CD 120. Contour Measuring Station



## Your entry into precision contour measurement

- The quick, simple and inexpensive 2D contour measuring system satisfies all demands in terms of accuracy and range of evaluation criteria
- Consistently delivers safe and reliable results
- Parameters that are dependent on datum elements are recalculated as soon as a datum element is changed
- Password protected user access prevents improper use
- Outstanding calibration processes, including geometry calibration, measuring force calibration, compensation, etc.
- Sturdy, rigid probes
- Reliable drive unit
- Automatic lowering and raising of the probe arm at individually adjustable speeds
- Patented probe arm attachment for collision protection

## Supplied with:

- MarSurf XC 2 including PC, Mid-Range Standard, MarSurf XC 2 software, Mahr license key
- TFT monitor
- MarSurf CD 120 drive unit
- MarSurf ST 500 measuring stand (including holder)
- Calibration set
- MCP 23 manual control panel
- CT 120 XY table including rotary adjustment

## Technical Data

Measuring range	(in Z) 50 mm
Traversing lengths	0.2 mm to 120 mm
Measuring force	1 mN to 120 mN
Sampling angle	on smooth surfaces, depending on deflection: trailing edges up to 88°, leading edges up to 77°
Contacting speed (in Z)	0.1 to 1 mm/s
Resolution	In Z, relative to stylus tip: 0.38 µm (350 mm probe arm) / 0.19 µm (175 mm probe arm) In Z, relative to measuring system: 0.04 µm
Guide deviation	< 1 µm (over 120 mm)
Measuring speed	0.2 mm/s to 4 mm/s
Positioning speed	In X and return speed: 0.2 to 8 mm/s In Z: 0.2 to 10 mm/s
Probe arm length	175 mm, 350 mm
Tip radius	25 µm

## Accessories

### Optional:

- MarSurf ST 750 measuring stand
- Manual control panel with joystick and display MCP 21
- Parallel vise, V-block
- Equipment table

### Software options:

- DXF import option
- Tangential elements option
- Thread evaluation option
- Chamfer option
- QS-STAT / QS-STAT Plus option
- Topography option

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## Applications

### Machine building

Bearings, threads, threaded rods, ball screws, shafts, racks

Measurement close to the production area  
Contour measurement in semi-automated operation

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head

### Medicine

Contour measurement for hip and knee endoprostheses  
Contour measurement for medical screws  
Contour measurement for dental implants

# MarSurf XC 20 with PCV 200. Contour Measuring Station

## The international benchmark for contour measurement

The MarSurf XC 20 is recognized as the ultimate in contour evaluation. What started some 30 years ago with the Konturograph - consisting of a drive unit and X-/Y-recorders — has developed into a top-quality contour measuring system using cutting-edge technology. The finely tuned device configuration offers superb performance standards. The drive unit and the measuring stand are controlled and positioned via the reliable measuring and evaluation software.

- User prompts can be displayed
- Interactive control elements support evaluations and automatic routines
- Measurement of upper and lower contours with a twin-stylus probe; a relative evaluation of the two contours is also possible
- Profile section images with evaluation of different parameters for each section
- Segmented measurement is possible across obstacles such as bores or steep sides
- Import and export of DXF files supported for setpoint/actual value comparison
- PCV 200 drive unit with patented probe arm magnetic attachment for reproducible probe arm change
- Patented probe system for measuring station flexibility
- Manually variable tracing forces also support flexibility
- Synthetic creation of nominal profiles from straight lines and circle arcs
- Easy comparison of nominal and actual profiles
  - Different tolerances can be selected by within a profile

### Supplied with:

- MarSurf XC 20 including PC, Mid-Range Standard including XC 20 software, Mahr license key
- TFT monitor
- MarSurf PCV 200 drive unit
- MarSurf ST 500 measuring stand (including holder)
- Calibration set
- MCP 23 manual control panel
- CT 300 XY table

## Technical Data

<b>Measuring range</b>	(in Z) 50 mm
<b>Traversing lengths</b>	0.2 mm to 200 mm
<b>Measuring force</b>	1 mN to 120 mN, below and above (can be set in MarSurf XC 20)
<b>Sampling angle</b>	on smooth surfaces, depending on deflection: trailing edges up to 88°, leading edges up to 77°
<b>Contacting speed (in Z)</b>	0.1 to 1 mm/s
<b>Resolution</b>	In Z, relative to stylus tip: 0.38 µm (350 mm probe arm) / 0.19 µm (175 mm probe arm) In Z, relative to measuring system: 0.04 µm
<b>Guide deviation</b>	< 1 µm (over 200 mm)
<b>Measuring speed</b>	0.2 mm/s to 4 mm/s
<b>Positioning speed</b>	In X and return speed: 0.2 to 8 mm/s In Z: 0.2 to 10 mm/s
<b>Probe arm length</b>	175 mm, 350 mm
<b>Tip radius</b>	25 µm

## Accessories

### Optional:

- MarSurf ST 750 measuring stand
- Manual control panel with joystick and display MCP 21
- Parallel vise, V-block
- Equipment table

### Software options:

- Thread evaluation option
- Chamfer option
- QS-STAT / QS-STAT Plus option
- Topography option

## Applications

### Machine building

Bearings, threads, threaded rods, ball screws, shafts, racks

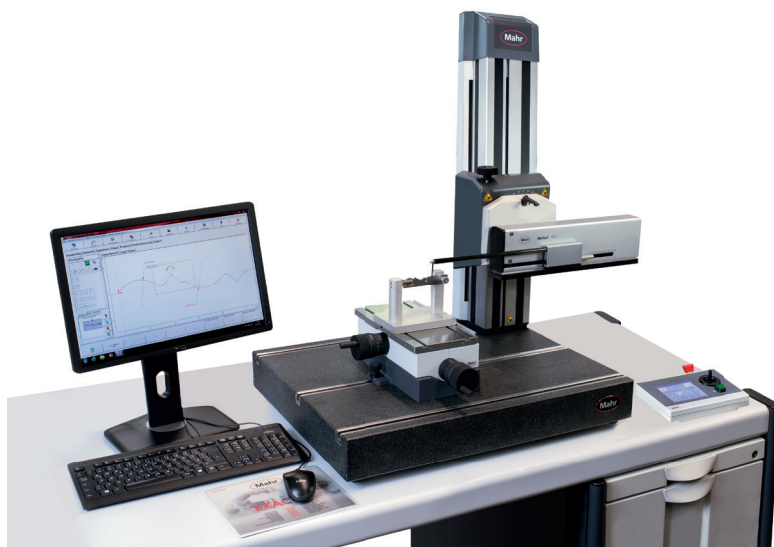
Measurement close to the production area  
Contour measurement in semi-automated operation

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head

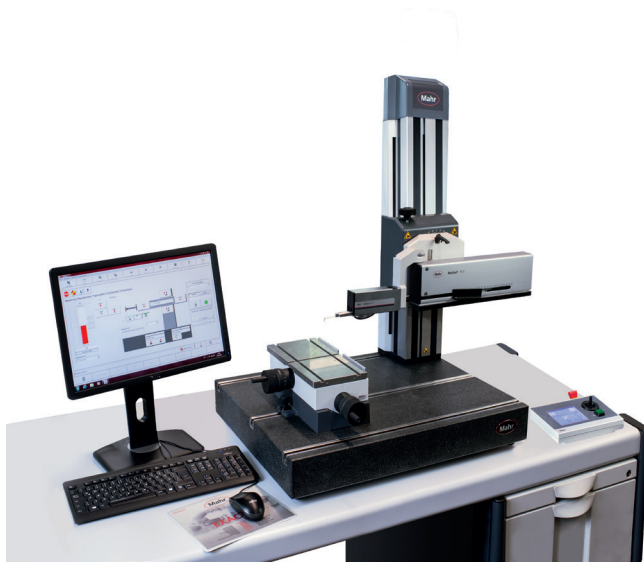
### Medicine

Contour measurement for hip and knee endoprostheses  
Contour measurement for medical screws  
Contour measurement for dental implants



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# MarSurf XCR 20. Roughness and Contour Measuring Station



## Roughness and contour measurement at a measuring station with MarSurf XCR 20

This combined measuring station allows both surface roughness and contour measurements to be performed at a single measuring station.

Depending on the measuring task, either the GD 25 drive unit for surface roughness measurements or the PCV drive unit for contour measurements can be activated. The two measuring systems are fixed to the measuring stand by means of a combi holder.

- Space-saving design: the two drive units can be adapted by means of the corresponding combi holder to MarSurf ST 500 or ST 750 measuring stands
- Roughness and contour evaluation from a single measurement
- High precision contour and roughness evaluation for components requiring a long stroke and very high resolution with the MarSurf LD 130 / LD 260 measuring system
- Quick changeover between roughness and contour measurement by switching within the software platform and swapping mechanical components such as the drive unit and probe

### Options:

- MarSurf PCV 200 contour drive unit
- MarSurf GD 25 roughness drive unit

### Supplied with:

- MarSurf XCR 20 including PC, MidRange Standard, MarSurf XCR 20 software, Mahr license key
- TFT monitor
- MarSurf PCV 200 / MarSurf GD 25 drive unit
- MarSurf ST 500 measuring stand (including combi holder)
- Calibration set, PGN-3
- MCP 21 manual control panel
- CT 300 XY table

## Technical Data

Roughness	XR 20 with GD 25
Measuring principle	Stylus method
Probe	R probe, MFW 250 B
Measuring range	MFW 250: $\pm 25 \mu\text{m}$ , $\pm 250 \mu\text{m}$ , (up to $\pm 750 \mu\text{m}$ ); $\pm 1000 \mu\text{in}$ , $\pm 10,000 \mu\text{in}$ (up to $\pm 30,000 \mu\text{in}$ )
Filter according to ISO/JIS	Gaussian filter as per ISO 11562, filter as per ISO 16610-21/OSO 16610-31
Number n of sampling length according to ISO/JIS	1 to 50 (default: 5)
Traversing lengths	Automatic; 0.56 mm; 1.75 mm; 5.6 mm; 17.5 mm, 56 mm*, Measurement up to stop, variable * Traversing length dependent on drive unit
Surface parameters	Over 100 surface parameters for R, P and W profiles according to current ISO/JIS or MOTIF standards (ISO 12085)

Contour	XC 20 with PCV 200
Measuring range	(in Z) 50 mm
Traversing lengths	0.2 mm to 200 mm
Measuring force	1 mN to 120 mN, below and above (can be set in MarSurf XC 20)
Sampling angle	on smooth surfaces, depending on deflection: trailing edges up to 88°, leading edges up to 77°
Contacting speed (in Z)	0.1 to 1 mm/s
Resolution	In Z, relative to stylus tip: $0.38 \mu\text{m}$ (350 mm probe arm) / $0.19 \mu\text{m}$ (175 mm probe arm) In Z, relative to measuring system: $0.04 \mu\text{m}$
Guide deviation	$< 1 \mu\text{m}$ (over 200 mm)
Measuring speed	0.2 mm/s to 4 mm/s
Positioning speed	In X and return speed: 0.2 to 8 mm/s In Z: 0.2 to 10 mm/s
Probe arm length	175 mm, 350 mm
Tip radius	$25 \mu\text{m}$

## Accessories

### Optional:

- MarSurf ST 750 measuring stand
- Parallel vise
- Equipment table

### Software options:

- Profile processing option

- Dominant waviness option
- User defined parameters
- Topography option
- QS-STAT / QS-STAT Plus option
- Thread evaluation option

## Applications

### Machine building

Bearings, threads, threaded rods, ball screws, shafts, racks, valves

### Automotive industry

Steering, brake system, gearbox, crankshaft, camshaft, cylinder head, cylinder block, turbocharger

### Medicine

Contour and surface roughness measurement for hip and knee endoprostheses, contour measurement for medical screws, contour and surface roughness measurement for dental implants

### Aerospace

Turbine components

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# MarSurf LD 130 / LD 260. Combined Contour and Surface Measuring Station

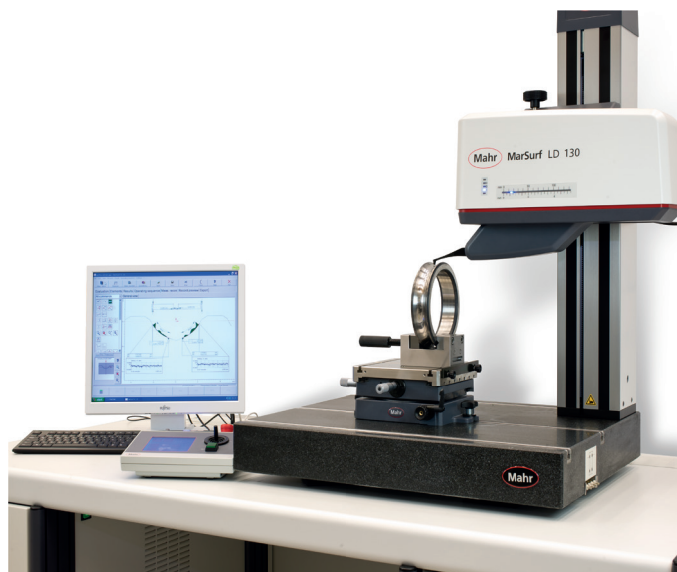
## MarSurf LD 130 / LD 260. A step into a new dimension

Combined contour and roughness measurements in just one step come courtesy of proven cutting-edge technology from Mahr metrology. The MarSurf LD 130 and MarSurf LD 260 measuring stations have been systematically developed to draw on the experience from the first generation of equipment.

- Roughness and contour in just one step
- High measuring and positioning speed reduces measuring times
- Innovative probe system removal
- Quick and reliable probe arm exchange with simultaneous probe arm detection by magnetic bracket
- Long measuring length up to 260 mm (MarSurf LD 260) with a measuring stroke of 13 mm (100 mm probe arm length) or 26 mm (200 mm probe arm length)
- Modular construction for ease of maintenance

### Supplied with:

- MarSurf XCR 20 including MidRange LD, MarSurf XCR 20 software, Mahr license key
- TFT monitor
- MCP 21 manual control panel
- MarSurf LD 130 or LD 260 drive unit including LP D 14–10–2/60, LP D 14–10–500 probe system and probe arms
- Calibration standard for contour 1, accuracy class 1
- MarSurf ST 500 CNC measuring stand with 700 mm x 550 mm HG granite plate, including control module
- Dampening element set
- CT 300 XY table



## Technical Data

<b>Measuring range</b>	13 mm (100 mm probe arm length) 26 mm (200 mm probe arm length)
<b>Traversing lengths</b>	0.1 mm – 130 mm or 260 mm
<b>Measuring force</b>	0.5 mN to 30 mN, software-adjustable
<b>Resolution</b>	0.8 nm
<b>Measuring speed</b>	0.02 mm/s to 10 mm/s; for roughness measurements 0.1 mm/s to 0.5 mm/s is recommended
<b>Positioning speed</b>	0.02 mm/s to 200 mm/s

## Accessories

- ST 750 measuring stand
- Parallel vise
- V-block, equipment table
- Measuring cabinet
- Extensive range of probe arms

### Software options:

- Profile processing option
- Dominant waviness option (Wdc) for MarWin
- ISO 13565–3 surface parameters option
- User defined parameters option (also requires the parameter or work by the application engineering team)
- Topography option (MarWin MarSurf XT only)
- MarSurf XT option with MfM / MfM plus
- Thread evaluation option
- Double stylus option for MarSurf LD 120 / MarWin
- Chamfer evaluation option (in accordance with Bosch standard)
- QS-STAT / QS-STAT Plus option
- Digital I/O set option

## Applications

### Machine building

Roller bearings, threads, threaded rods, ball screws, shafts, racks, ball heads, valves

### Measurement close to the production area

Contour and surface roughness measurement in semi-automatic and fully automatic operation

### Automotive industry

Engine parts including cylinder block, cylinder head, crankshaft, camshaft, valves, steering, gearbox, injection systems, turbocharger

### Medicine

Contour and surface roughness measurement for hip and knee endoprostheses  
Contour measurement for medical screws  
Contour and surface roughness measurement for dental implants

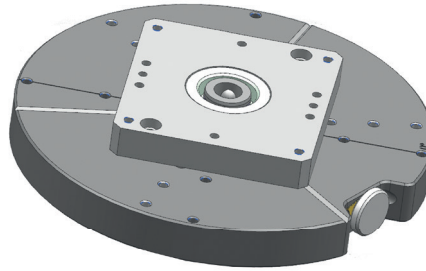
### Optics

Contour and surface roughness measurement of aspherical lenses

For more information, please visit our website: [www.mahr.com](http://www.mahr.com)



## MarSurf CNC modular



**MarSurf CNC modular.** CNC measuring stations based on standard components

A standard surface measuring station can be expanded into a user-friendly, semi-automatic CNC measuring station by adding auxiliary table axes and a measuring cabinet (optional)

- Plug-and-play configuration of the control unit
- Easy to operate MarSurf software measuring wizard
- Clever universal concept for work-piece holder and clamp
- Minimal training required

### Supplied with:

- MarSurf XR 20 measuring station with GD 120
- alternatively: MarSurf XC 20 measuring station with PCV
- alternatively: MarSurf LD 130 / LD 260 measuring station
- Including MidRange CNC controller
- MarSurf ST 500 / 750 CNC measuring stand
- MCP 21 manual control panel

### Optional table axes

- T1S-L linear axis 200 mm
- T1S-R rotation axis
- T3S-LLR 3 table axes comprising 2 linear and one rotation axis

### Optional measuring cabinet

## Technical Data

	<p><b>T1S-L</b> Linear axis Complete with control module for MidRange CNC Displacement path 200 mm Dimensions 510 mm x 200 mm x 200 mm Bearing strength 50 kg</p>
	<p><b>T1S-R</b> Rotation axis Complete with standard support plate and control module for MidRange CNC For use as a TA or TC axis Dimensions 270 mm x 200 mm x 210 mm Bearing strength 30 kg</p>
	<p><b>T3S-LLR</b> 3 axis combination Complete with standard support plate and control module for MidRange CNC Multiaxis, monolithic structure comprising axes TX-TY-TC Bearing strength 30 kg</p>

## Accessories

- Table plate with clamping sphere adapter and universal clamping plate
- Standard measuring station upgraded to MarSurf CNC modular

## Applications

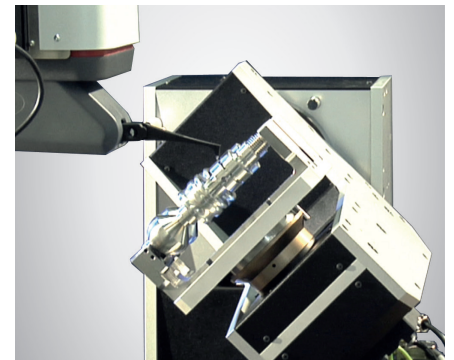
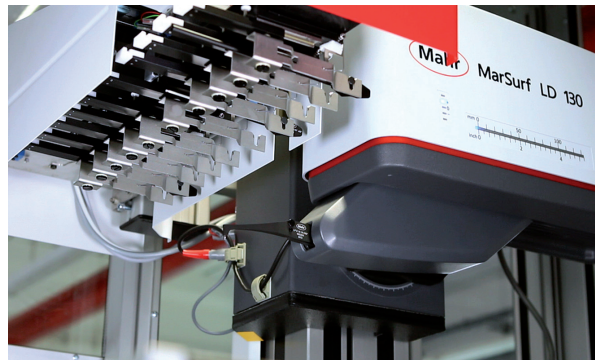
### Measurement close to the production area

- Pallet measurement
- Topography measurement
- Multiple measuring points on one part without reclamping
- Automatic X-axis alignment
- Universal measuring station for a wide variety of measuring tasks
- Automatic zenith search

For more information, please visit our website: [www.mahr.com](http://www.mahr.com)

## MarSurf CNC premium

- **MarSurf CNC premium**
- The MarSurf CNC concept is a high-quality solution for surface roughness and contour measurement in fully automatic manufacturing processes. Mahr has set standards worldwide with this measuring station concept.
- Complex measuring tasks can be performed fully automatically, without operator influence, reliably and with complete control.
- In conjunction with the probe arm changer, fully automatic procedures can be performed without operator influence with manual probe arm replacement, even in complex, multifaceted measuring tasks.
- A coordinated range of components, comprising motorized table and auxiliary axes along with tried-and-tested drive units and probe systems, forms the ideal basis for a perfect solution.
- The MarWin software platform from Mahr is a sophisticated, modular, cross-product control and evaluation system offering the necessary flexibility and process reliability for CNC operation in particular.
- **Probe arm changer TWE:**
- Up to 10 different probe arms from the LD system can be changed fully automatically.



### Applications

- Automotive industry
- Injection system components
- Engine parts
- Cylinder head
- Cylinder block
- Crankshaft
- Camshaft
- Connecting rod
- Automatic gearbox
- Rack/steering nut
- Brake system components

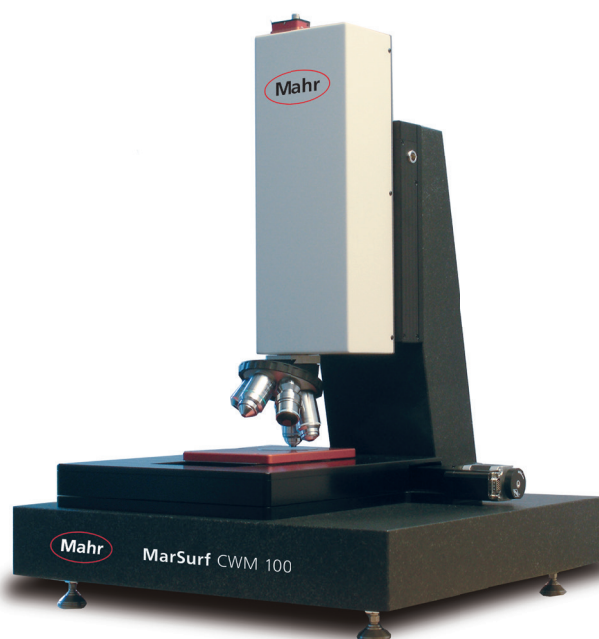
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# MarSurf CWM 100

- **MarSurf CWM 100**, a precision, computer-controlled optical measuring instrument with sub-nanometer resolution. This combined 3D measuring system comprises a confocal microscope and white light interferometer.
- Highest precision with sub-nanometer resolution
- Universal suitability for technical, optical and reflective surfaces. Also for surfaces of printed circuit boards and semiconductor products as well as biological tissues
- 2D surface analysis and measuring evaluations
- Topographic 3D surface analysis and measuring evaluations
- Intelligent measuring strategies - fast measurements – short measuring times
- Microscope image field sizes, easily expandable by fully automatic stitching
- Automatic table or object positioning: 100 mm x 100 mm, longer distances on request
- A wide range of lenses allows for an ideal adaptation to the measurement object
- Solid construction with granite base plate and granite column for the best possible vibration damping
- Professional evaluation software based on MountainsMap ©

#### Supplied with:

- Sensor system, comprising:
  - Confocal microscope KFM with 6x nosepiece
  - Camera, 780 x 580 pixels, up to 48 images/s (standard version)
  - 100 mm CNC-controlled Z-axis with integrated Heidenhain glass scale
  - One operating software with WLI and confocal software modules
- Granite base frame and column with sensor system and CNC-controlled object table
- CNC-controlled motorized Z-axis and XY table for probe positioning and image field merging
- Lenses (optional):
  - 4x to 150x (confocal microscope)
  - 2.5x to 100x (white light interferometer)



## Technical Data

<b>Measuring principle</b>	By interferometer, by white light interferometer and confocal Light source (KFM and WLI): LED, 505 nm
<b>Measuring range</b>	Sensor unit can be moved 100 mm in Z, CNC controlled Object table can be moved 100 mm in X and Y, CNC controlled  Interferometer, white light interferometer: Measuring range (WLI): More as 4 mm (Standard mode), more as 20 mm in extended mode  Confocal microscope: Measuring range (KFM): Up to 10 mm (depending on resolution in Z and lens)

## Accessories

### CT 120 two axis tilting table

**Setting table angle** +/-30°

### Standards set

**Confocal microscope:**  
**KFM objective lenses** 10x0.5; 20x0.75; 50x0.6 with 11 mm gap between object table and workpiece; 50x0.8; 100x0.9

**White light interferometer:**  
**WLI objective lenses** 2.5x0.075; 5x0.13; 10x0.3; 20x0.4; 50x0.55; 100x0.7

## Applications

### Machine building

All types of metal surfaces (ground, rolled, etc.), also laser structured surfaces, ceramic and plastic surfaces, mold surfaces

### Medicine

Metal, ceramic and plastic surfaces of implants, prostheses and instruments

### Electronics

Surface analysis of coatings, measurement and analysis of electronic and semi-conductor components

### Optics

Form and roughness analysis of various optical components (all materials)

For more information, please visit our website: [www.mahr.com](http://www.mahr.com)

# MarSurf WM 100



## Technical Data

WM 100	
<b>Measuring principle</b>	By interferometer, by white light interferometer Light source (WLI): LED, 505 nm
<b>Measuring range</b>	Sensor unit can be moved manually over 200 mm in Z Object table can be moved manually in X and Y  Interferometer, white light interferometer: Measuring range (WLI): Up to 100 µm (vertical). More on request.

- MarSurf WM 100, a 3D white light interferometer measuring system. This precision optical measuring instrument has sub-nanometer resolution and measuring accuracy.
  - Maximum precision with sub-nanometer resolution and measuring accuracy
  - Suitable for all optical and reflective surfaces, fine technical surfaces and surfaces of circuit boards, semiconductor products and biological tissue
  - 2D surface analysis and measurement evaluations
  - Topographical 3D surface analysis and measurement evaluations
  - Fast measurements #96 short measuring times
  - Manual table and object positioning in up to 4 axes
  - Wide choice of lenses for perfect adjustment to the measuring object
  - Sturdy design with granite base plate
  - Professional evaluation software based on MountainsMap®
- Supplied with:**
- Sensor system, comprising:
    - WLI sensor head
    - Camera, 768 x 582 pixels, up to 48 f/s
    - 100 µm piezo drive z-measuring head
    - WLI software module, operating software
  - Granite base and column with manual positioning of sensor system
  - Manual XY object table for probe positioning
  - 20x0.4 DI lens (white light interferometer)

## Applications

### Machine building

All types of fine metal surfaces (ground, rolled, etc.), also laser structured surfaces, fine ceramic and plastic surfaces, mold surfaces

### Medicine

Metal, ceramic and plastic surfaces of implants, prostheses and instruments

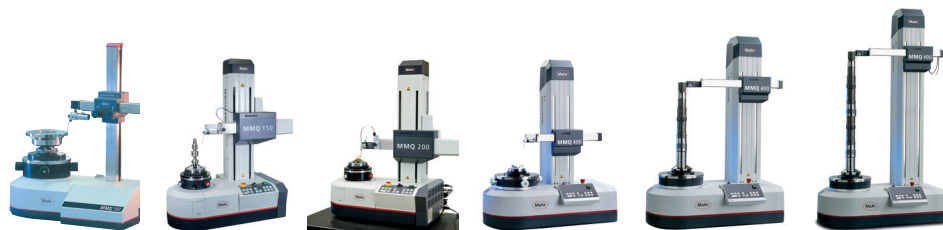
### Electronics

Surface analysis of coatings, measurement and analysis of electronic and semi-conductor components

### Optics

Roughness analysis of various optical components (all materials)

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Formtester	MMQ 100	MMQ 150	MMQ 200	MMQ 400-2 Z = 350 mm X = 180 mm	MMQ 400-2 Z = 500 mm X = 280 mm	MMQ 400-2 Z = 900 mm X = 280 mm
<b>Roundness measuring unit, C-axis</b>						
Roundness deviation ( $\mu\text{m}+\mu\text{m}/\text{mm}$ measuring height) **	0,05 + 0,0006	0,03 + 0,0006	0,03 + 0,0006	0,02 + 0,0005	0,02 + 0,0005	0,02 + 0,0005
Roundness deviation ( $\mu\text{m}+\mu\text{m}/\text{mm}$ measuring height) *	0,025 + 0,0003	0,015 + 0,0003	0,015 + 0,0003	0,01 + 0,00025	0,01 + 0,00025	0,01 + 0,00025
Axial run-out deviation ( $\mu\text{m}+\mu\text{m}/\text{mm}$ measuring radius) **	0,04 + 0,0006	0,4 + 0,0006	0,04 + 0,0006	0,04 + 0,0002	0,04 + 0,0002	0,04 + 0,0002
Axial run-out deviation ( $\mu\text{m}+\mu\text{m}/\text{mm}$ measuring radius) *	0,02 + 0,0003	0,02 + 0,0001	0,02 + 0,0001	0,02 + 0,0001	0,02 + 0,0001	0,02 + 0,0001
<b>Centering and tilting table</b>						
Centering and tilting table	manual	manual	manual	manual / automatic	manual / automatic	automatic
Table diameter	160	160	160	285	285	285
Table load capacity, centered (N)	200	200	200	600	600	400
Speed (rpm) 50 Hz / 60 Hz	5 / 6	1–15	1–15	0,2–15	0,2–15	0,2–15
<b>Vertical straightness measuring unit, Z-axis</b>						
Positioning path (mm), Z-axis	300, manual	-	-	-	-	-
Z-axis positioning	manual	-	-	-	-	-
Measuring path, motorized (mm), Z-axis	-	250	250	350	500	900
Straightness deviation / 100 mm measuring path ( $\mu\text{m}$ )**, Z-axis	-	0,4	0,15	0,15	0,15	0,15
Straightness deviation / total measuring path ( $\mu\text{m}$ )**, Z-axis	-	1	0,3	0,3	0,4	0,9
Parallelism deviation Z-/C-axis in tracing direction ( $\mu\text{m}$ )	-	1	0,5	0,5	0,8	2
Measuring speed (mm/s), Z-axis	-	0,5–30	0,5–30	0,1–30	0,1–30	0,1–30
Positioning speed (mm/s), Z-axis	-	0,5–50	0,5–100	0,5–100	0,5–100	0,5–100
<b>Horizontal straightness measuring unit, X-axis</b>						
Positioning path (mm), X-axis	180, manual	150, motorized	150, motorized	-	-	-
Measuring path, motorized (mm), X-axis	-	-	-	180	280	280
Straightness deviation / 100 mm measuring path ( $\mu\text{m}$ )**, X-axis	-	-	-	0,4	0,8	0,8
Straightness deviation / total measuring path ( $\mu\text{m}$ )**, X-axis	-	-	-	0,8	1,5	1,5
Perpendicularity X-/C-axis ( $\mu\text{m}$ )	-	-	-	1	2	2
Positioning speed (mm/s), X-axis	-	0,5–30	0,5–30	0,5–30	0,5–30	0,5–30
Measuring speed (mm/s), X-axis	-	-	-	0,5–10	0,5–10	0,5–10

\* Values as maximum deviation from LSC reference circle, filter 15 undulations/revolution.

\*\* All values in accordance with DIN ISO 1101 at 20°C ±1°C in a vibration-neutral environment, filter 15 undulations/revolution LSC or 2.5 mm LSS, 5 rpm or 5 mm/s and standard probe arm with ball diameter 3 mm. Proof at the standard using error separation techniques. Given the number of different options available, only a few machines are described here by way of example. Technical data for "your" MMQ is available from Mahr on request.

For more information, please visit our website: [www.mahr.com](http://www.mahr.com)

# MarForm MFU 100. Reference Form Measuring Station



Reference form measuring station in a new dimension.

The journey from high precision measuring axes to competent measurements is often a long one that the MFU 100 has mastered completely. Only the MFU 100 has integrated reference elements for the real-time spatial compensation of geometric deviations, recording all profiles as high-precision 3D coordinates. For decades

MarForm measuring machines have been recognized for their accuracy and stability. The new MarForm MFU 100 was developed with the claim of testing the shape and position features of product parts in a one liter measuring volume close to the production area and at a reasonable cost. In so doing, it has taken our long experience into a new dimension.

MarForm MFU 100 is a precision reference form measuring center which with its exceptionally low measurement uncertainty increases the tolerance margin for your production processes, thereby lowering production costs.

- Circular roundness measuring axis (C)
- Motorized centering and tilting table (X, Y, A, B)
- Vertical straightness measuring axis (Z)
- Horizontal straightness measuring axis (X)
- Tangential multifunction axis (Y)
- Motorized length measuring probe T7W
- MarWin evaluation software for form and position features

All axes are coordinated to ensure maximum measuring reliability. The horizontal X-axis extends beyond the center of the workpiece, allowing „true parallelism“ to be checked free from other measuring influences. The tangential Y-axis is an innovative new feature. This additional motorized axis, which is new to conventional form testers helps to locate the zenith of miniature workpiece geometries without operator influence. The actual precision measurement can then be started in exactly the right place. This significantly increases process accuracy.

The Y-axis is used together with the vertical Z-axis and the horizontal X-axis to determine the workpiece diameter. This allows tolerances to be checked in the sub-nanometer range by the maximum material principle, in accordance with standards, for the very first time and at a very reasonable price.

High-resolution digital scales in conjunction with the machine electronics provide a level of positioning accuracy which allows even miniature part geometries to be tested. MarForm MFU 100 is also suitable for error-free scanning of surfaces.

The MarWin software package offers the full range of functions of a modern measuring and evaluating application including user friendly records and electronic documentation in the company network.

The rigorous separation of control and evaluation functions ensures that MarForm MFU 100 is future-proof and expandable. New language versions, special evaluations and new standards are easy to incorporate. The MFU 100 is also ready for the addition of future sensor systems.

In short: MarForm MFU 100 brings form measuring machines for inspection rooms and production areas into a new dimension.

MarForm MFU 110 with optional optical sensor which is interchangeable with T7W (motorized)

## Applications

- Checking product parts for form and position features
- Roundness, Concentricity / Coaxiality, Cylindricity, Radial run-out, Axial run-out, Total run-out, Straightness, Parallelism, Perpendicularity, Angularity, Flatness, Conicity, Diameter, Taper, Fourier analysis (waviness analysis), Line profile, Surface profile, Cam profile
- Recording of all profiles as high precision 3D coordinates with real-time spatial compensation of geometric deviations
- Perfect scanning of surfaces, roughness evaluation
- Scanning and evaluation of contours and shapes

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## MarForm MFK 500. Reference Form Measuring Station

Reference form measuring center for laboratory and measuring room, with a large measuring volume for heavy workpieces  
The benchmark form measuring centers for laboratories and measuring rooms.

MFK form measuring center for comprehensive workpiece assessment.  
MFK form tester - ideal for testing engine blocks, cylinder heads, gear cases, hydraulic elements, crankshafts and camshafts. Generously sized, optimized design for high measuring accuracy throughout the machine. Long measuring and travel paths for easy, safe workpiece changing.

MarForm MFK 600 or MFK 500, built from individual coordinated components, offer flexibility and adaptability for a range of measuring tasks.

The form tester is based on a non-warping granite base, which is set up so that it is isolated from vibrations. Its high precision horizontal surface forms the datum plane for the measuring setup. The workpiece holder table supports and guides heavy workpieces by means of air bearings on the granite surface.

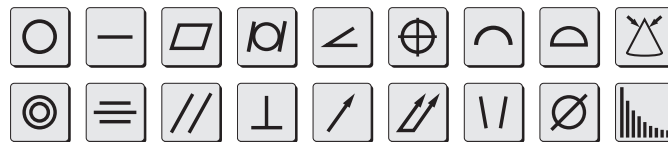
- Universal form measuring station with a large measuring volume for heavy workpieces
- MFK 600 with 5 measuring and set-up axes for measuring form elements and determining positions
- MFK 500 with 3 measuring and 4 set-up axes for measuring form elements
- Rotating measuring probes and automatic workpiece positioning make it easy to use and quick to set up
- Air bearings for low maintenance and continuous loading
- Collision-protected probe systems for diverse measuring tasks
- Large workpiece holder surface for large individual workpieces or workpiece pallets
- Roundness measuring device with automatic adjustment to the workpiece diameter, even with eccentric positioning
- Straightness measurements in 3 main coordinate directions
- Workpiece assessment as per ISO 1101
- Testing in machine and workpiece coordinates in accordance with production specifications
- Full evaluation of form and position features as well as diameter and position values
- Extensive accessories and choice of measuring probes for optimized performance of all measuring tasks
- Ready for use and easily expandable with additional movement axes for turning workpieces during a program sequence. In this way the most complex measuring tasks on V-engine blocks for example can be carried out without operator intervention

### Roundness measuring device

In addition to the measuring spindle (C-axis), the roundness measuring device also includes an axis for automatically adjusting the measuring probe to the workpiece diameter (X-axis). In roundness measurements the X-axis adjusts the measuring probe to the workpiece shape, even with eccentric deviations which are bigger than the measuring probe range.

### Straightness measuring device

The vertical straightness measuring device (Z-axis) guides the roundness measuring device on a granite surface. On the MFK 600 the accuracies of the horizontal straightness measuring device (Tx- and Ty-axis) are independent of the size, form and weight of the workpiece because the guides are separated from the air bearings. The MFK 500 offers the Tx-/Ty-axes of the motorized centering and tilting table as motorized positioning axes. Set-up axes (Ta and Tb) are integrated into the workpiece holder table and can automatically align workpieces mechanically in the machine volume.



### Measurement performance

Automatic set-up functions integrated into measuring sequences allow for continuous operation. Measuring value processing in parallel with measuring value recording shortens the measuring time. A full range of accessories is available for the form measuring station to extend the possible applications.

### Options:

- Additional movement axes for turning workpieces during a program sequence

## Applications

### Checking of form and position features:

- Roundness, Straightness, Flatness, Cylindricity, Angularity, Position, Line profile, Surface profile, Taper, Concentricity / Coaxiality, Symmetry, Parallelism, Perpendicularity, Radial run-out, Axial run-out, Total run-out, Conicity, Diameter, Fourier analysis (waviness analysis)

### Testing of:

- Engine blocks
- Cylinder heads
- Gear cases
- Hydraulic elements
- Crankshafts and camshafts

For more information, please visit our website: [www.mahr.com](http://www.mahr.com)

# MarForm MFU 200 Aspheric 3D. Precision 3D Measuring Station



Mahr developed the MarForm MFU 200 Aspheric 3D to enable optical components to be tested in 2D / 3D quickly and close to the production area. MarForm measuring machines have been recognized for decades for their accuracy and stability. With the MarForm MFU 200 Aspheric 3D this experience has now been made available to the optical industry.

## Accuracy

The MarForm MFU 200 Aspheric 3D is a precision measuring instrument which with its very low measurement uncertainty is ideally suited to your process optimization requirements.

## Measuring principle

The MarForm MFU 200 Aspheric 3D measures the topography of optical components. Of course, a quick 2D measurement can also be recorded with a profile across the zenith of the lens. For 3D measurements two linear profiles offset by 90° are first measured across the zenith of the lens in a single sequence. Then multiple concentric polar profiles are recorded by rotating the C-axis. These measuring points are used to generate a topography. Interrupted surfaces can be measured with the fully positionable probe arm.

Using the measuring station in a vibration-cushioned cabinet keeps external interference such as vibration and dirt away from the measuring objects.

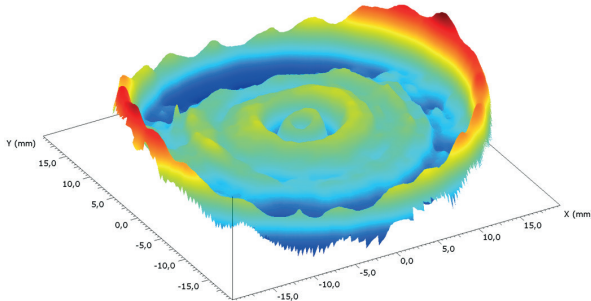
## Measuring procedure

Before starting the measurement, choose the nominal form type and set the parameters for the expected reference lens. In the next step the measuring data is recorded and compared with the nominal data for the lens. The RMS value, PV value and slope error are shown as parameters.

In the software the individual parameters for the aspheres, such as the radius of curvature  $R_0$ , conical constant  $k$  and the aspheric coefficients  $A_i$ , can be adjusted to the measuring results when adjusting the nominal asphere to the fit asphere.

The differential topography between the measured values and the nominal lens is displayed as a color-coded line chart. The 2D profiles and the differential topography can then be exported in known formats for correction for the machine tool.

In addition to measuring spheres and aspheres as described above, other rotationally symmetrical objects can also be measured and evaluated using the nominal form as a conical profile or Sagitta of a 3D scatter plot.



$$z(h) = \frac{\frac{h^2}{R_0}}{1 + \sqrt{1 - (1+k) \left(\frac{h}{R_0}\right)^2}} + \sum_{n=2}^5 A_{2n} \cdot h^{2n}$$

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