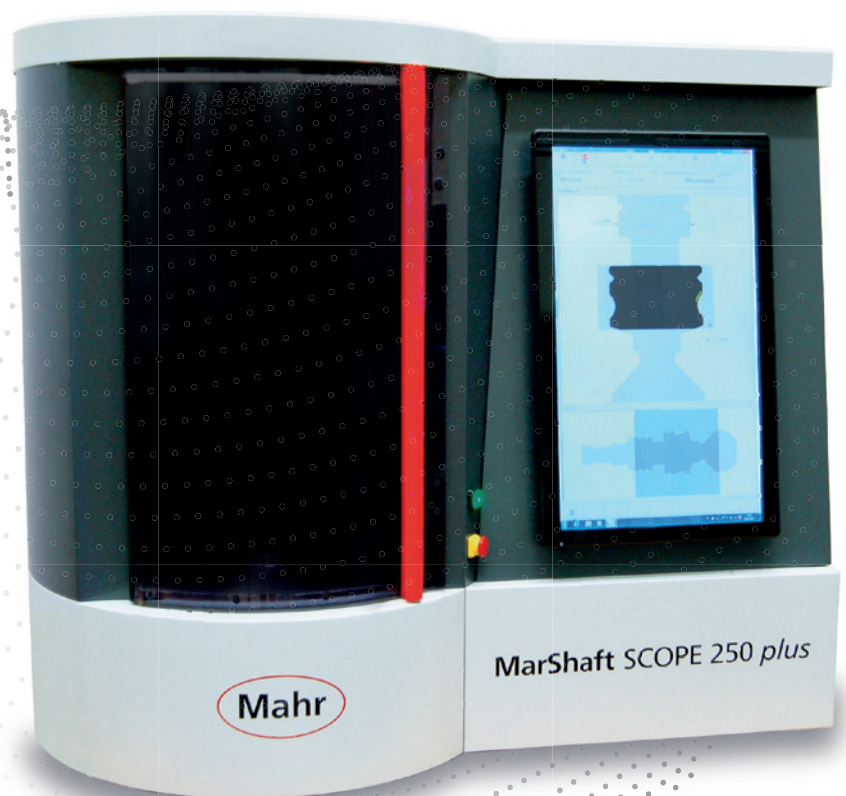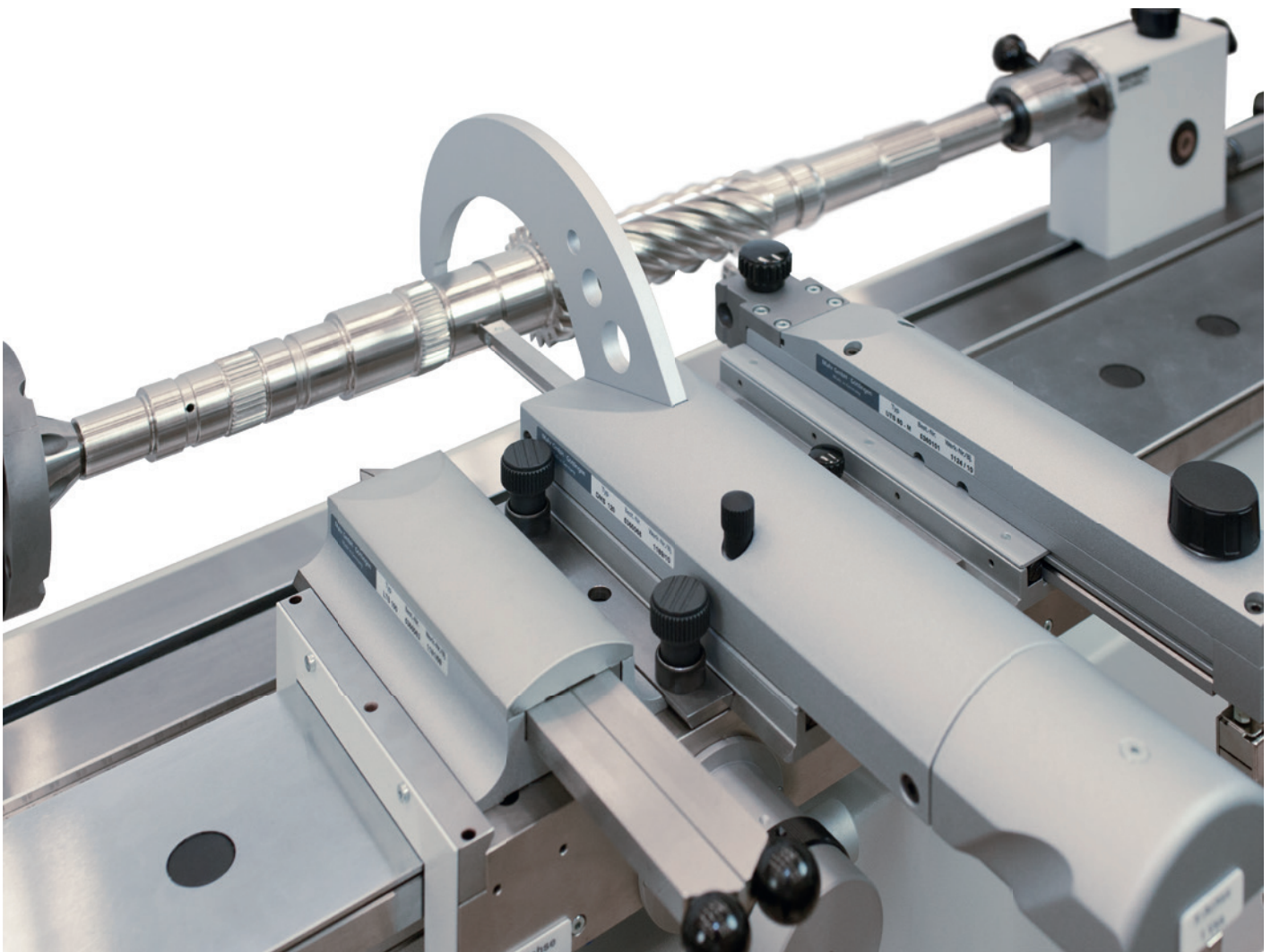## MarShaft | Shaft Measuring Instruments

The role of metrology is changing, to keep pace with innovations in manufacturing processes. Given the ever more stringent accuracy requirements and falling cycle times, rapid measurement directly at the manufacturing machine is absolutely essential. Flexible MarShaft shaft measuring technology from Mahr is the right solution for quick and accurate measurement in production.

MarShaft SCOPE 250 *plus*

Mahr

602   **Mahr**   MarShaft | Shaft measuring instruments

MarShaft. Measurement of Shaft-Type Parts in Production.

MarShaft shaft measuring instruments are mostly used in production. However, with their high measuring accuracy they can also be used in measuring laboratories. The instruments are available in various sizes, and their modular design allows them to be optimized to individual measuring tasks. Inline measurement directly in the manufacturing process saves the time and expense of measurements in the measuring room and increases productivity.

Mahr   MarShaft | Shaft measuring instruments

MarShaft MAN

Manual tactile Shaft Measuring Machine

DESCRIPTION

- MarShaft MAN is a universal, modular shaft measuring instrument for the fast and flexible measurement of shaft-type testpieces.
- Precision workpieces can be produced cost-effectively and to a high level of quality across all manufacturing stages – from cutting to length through to hard finishing – if the individual process steps are kept consistently stable. That is exactly where production-floor characteristics testing with MarShaft MAN comes in. Short feedback times on reaching the tolerance limits and seamless documentation of all functional data relating to the component soon pay off.
- The MarShaft MAN shaft measuring center is the right solution for your quality control.
- The MarShaft MAN shaft measuring center is available in a number of different instrument sizes (workpiece lengths up to 400 mm / 800 mm / 1200 mm / 1600 mm / 2000 mm / 2400 mm, diameters from 120 mm to 220 mm) and its modular design allows it to be adapted to individual measuring tasks. The measuring modules (e.g. diameter, length, roundness module) can be arranged in any order or can easily be added at a later date.

- **Advantages at a glance:**
- No operator influence
- Highly accurate measuring results
- Excellent repeatability
- Measuring system for all typical measuring tasks, including length, diameter, radial run-out, axial run-out, recess width, cone angle, roundness, coaxiality, concentricity and much more
- Automatic measuring force application to avoid operator influence
- Good workshop compatibility for direct use in production
- User-friendly MarCheck evaluation computer (2 models)

TECHNICAL DATA

MarShaft MAN, length and diameter measurement, MarCheck II measuring computer	
Measuring range length (Z) (mm)	400 / 800 / 1200 / 1600 / 2000 / 2400
Measuring range diameter (X) (mm)	120 or 220
Workpiece weight (max.) in kg	20 / 60
Length/diameter resolution (mm)	0.0001
Angle resolution (°)	0.001
Length error limit (Z) (µm)	(3 + L/100) µm, L (length) in mm (at 20°C ± 1°C on reference standard)
Diameter error limit (X) (µm)	(0.8 + L/100) µm, L (length) in mm (at 20°C ± 1°C on reference standard)
Drives	manual
Lens	Optical measuring system (OMS) with matrix camera and software

APPLICATIONS
- **Typical workpieces:**
- Crankshaft, camshaft, gear shaft, rack, axle journal, hollow shaft, drive shaft, turning parts

- **Typical measuring tasks:**
- Length, diameter, radial run-out/axial run-out

- **Other measuring tasks:**
- Distance, recess width, depth, increment, recess diameter, roundness, taper, radius, position of cross-holes, and much more

For more information, please visit our website: www.mahr.com

MarShaft | Shaft measuring instruments   **Mahr**   **605**

MarShaft MAN

Measured Value Display MarCheck for MAN Shaft Measuring Instruments

DESCRIPTION

- **MarCheck** is a compact measuring and evaluation unit for manual MarShaft MAN shaft measuring machines, featuring intuitive controls and an excellent range of functions.

- The minimal training input that is required means that the instrument can be used straight away, saving time and money. The large, easy-to-read monochrome LCD display (240 x 160 dots) can display up to three measuring channels at the same time. The individual measuring channels are activated automatically on the display when measuring with the corresponding measuring axis. The measuring direction is displayed.

- MarCheck comes as standard with three measuring channels, for two linear measuring axes (Z and X) and one rotational measuring axis (C), which if necessary can be reconfigured to a linear measuring axis (R). The precision measuring spindle (C-axis) is controlled by MarCheck and switched on and off automatically for radial run-out and roundness measurements.

Performance features
- Large, easy-to-read monochrome LCD display (240 x 160 dots) with backlight
- 3 measuring channels (Z-axis, X-axis, and C-/R-axis)
- Numeral size approx. 13 mm
- 1 USB interface for max. 3 GB USB stick
- 1 USB interface for PC (optionally RS232 interface, data analysis in Excel or MarCom software) or software installation (updates)
- Can be connected to an inkjet printer
- Roundness and radial run-out measured with the DMS 120, no additional R-axis required
- Automatic adoption of measuring values on reaching the non-user specific measuring force
- Automatic adoption of calibration values from the individual measuring modules

TECHNICAL DATA

MarShaft MAN with MarCheck, measured value display for MAN shaft measuring instruments	
Measuring range length (Z) (mm)	400 / 800 / 1200 / 1600 / 2000 / 2400
Measuring range diameter (X) (mm)	120 or 220
Workpiece weight (max.) in kg	20 / 60
Length/diameter resolution (mm)	0.0001
Angle resolution (°)	0.001
Length error limit (Z) (µm)	(3 + L/100) µm, L (length) in mm
Diameter error limit (X) (µm)	(0.8 + L/100) µm, L (length) in mm
Lens	Optical measuring system (OMS) with matrix camera and software

Measuring and programming functions
- Evaluation of diameters, length dimensions, distances, taper, symmetry, center-to-center distance, roundness, axial run-out, radial run-out, concentricity, workpiece axis datum calculation, maximum/minimum function, preset function for datum points outside the workpiece.
- Teach-in programming, storage in MarCheck or on external PC or USB stick, printing to an external printer, internal storage of up to 40 measuring programs.

MarShaft MAN

## OMS 120 optical Measuring System

DESCRIPTION

- In conjunction with the evaluation software, the optical measuring system OMS 120 can be used to measure geometry elements which cannot be contacted or evaluated with the available contacting measuring probes of MarShaft MAN. The operating concept is optimized for use directly on the production line and can be used without any knowledge of metrology whatsoever. The testpiece contour is mapped on the camera chip using the shadow image method and displayed on the monitor. High-quality, telecentric optical components are used for precision mapping. To this end the corresponding testpiece contour is positioned only roughly in the camera's image field. There is no need for precision adjustment in the Z or X direction. The software has quick measuring functions which automatically evaluate the relevant feature results for the current measuring task.

Quick measuring functions
- Recess
- Chamfer
- Radius
- Straight line
- Intersection point line-line A quick measuring function analyses multiple feature results at the same time. The relevant results can be selected for recording or for data transfer. Most shaft measuring tasks can be performed in a quick and user-friendly manner using these functions.

- A whole range of manual analysis functions are available for measuring tasks which are not covered by the quick measuring functions.

Technical data
- Traverse path in X-direction: 120 mm
- Measurement resolution: 0.001 mm

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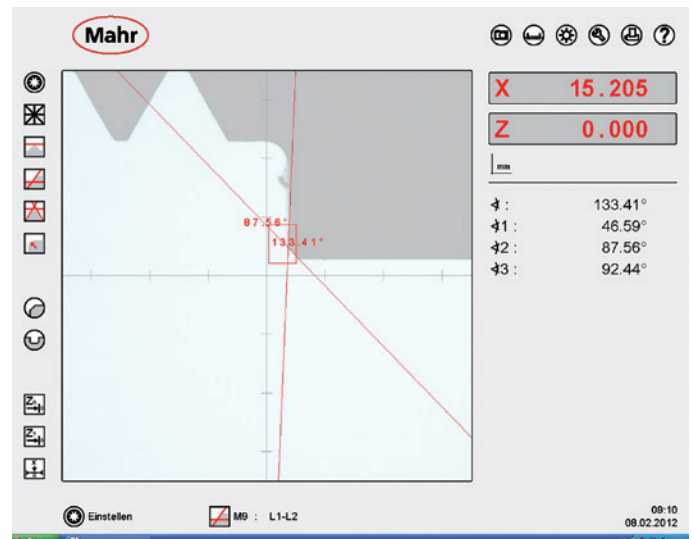
MarShaft MAN

## Manual tactile Shaft Measuring Machine with Software MarWin EasyShaft

DESCRIPTION

- The MarCheck *plus* control electronic is designed exclusively for the operation of MarShaft MAN units (sizes 400 mm to 2400 mm) with the MarWin EasyShaft MAN measurement and evaluation software. The control electronic is available in the basic version (4 channels) or premium version (9 channels). The Premium version has two additional connections fortemperature sensors required for the optional temperature compensation.
- With the new evaluation software MarWin EasyShaft MAN, Mahr again sets new standards in manual shaft measurement technology on the market.
- The software operation concept was largely taken over by the very successful evaluation software of the optical Mahr shaft measuring devices of the MarShaft SCOPE *plus* product line.
- The very simple, intuitive operation minimizes the training requirements. The evaluation software MarWin EasyShaft MAN can be mastered in a very short time. No programming knowledge is required; the creation of measuring programs is done in Teach-In mode. The individual characteristics are simply measured one after the other and subsequently this measurement sequence is stored as a measurement program.
- A robust panel PC with 15.6" touchscreen monitor (including stand) is suitable for use in production.

Features

- Robust panel PC suitable for production with 15.6" touchscreen monitor (including stand)
- Protection class IP54 (dustproof and splash-proof)
- TFT 15.6" touchscreen
- i5 CPU 3337U, 1.8GHz, DDR3 SO-DIMM max. 8GB, SSD SATA 2.5" 256GB, RAM4GB
- Operating system Windows 10
- 4 measuring channels (MarCheck basic) and 9 measuring channels (MarShaft premium)
- Designed for the manual shaft measuring machines MarShaft MAN 400 to MAN 2400
- Can be retrofitted to all MarShaft MAN shaft machines

Measurement and programming functions

- Absolutely simple operation
- Fast measurement without measuring program
- Teach-In programming
- Barcode connection
- Data export to statistics programs extends the scope of services,
- QS-Stat and QS-Stat plus interface
- The well-known Windows® user interface ensures short processing times
- Uniform Mahr software across all products (e.g. MarWin EasyShaft Scope or MarWin EasyForm)
- Overview of structure through window technology
- Easy handling thanks to 100% touchscreen functionality
- Many functions can be directly selected via symbols (icons)
- Comfortable and state-of-the-art measurement program management
- Precise test reports - black or white or colored - on all Windows® printers
- Future-proof investment, runs under Windows 10
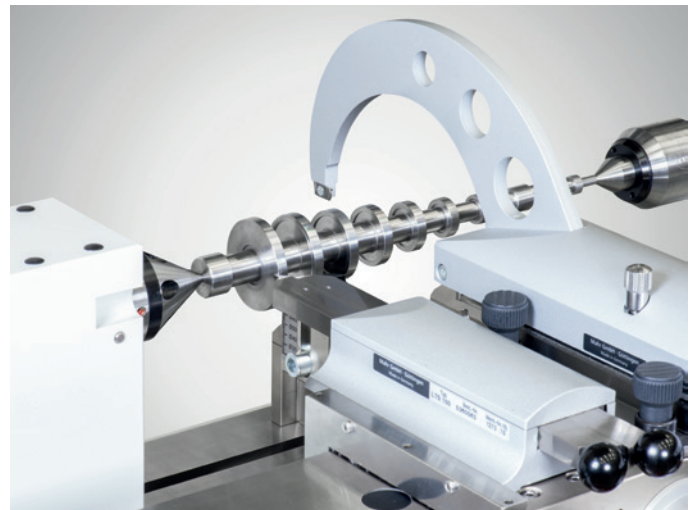
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MarShaft SCOPE *plus*

MarShaft SCOPE 350 / 750 / 1000 *plus* optical Shaft Measuring Systems

DESCRIPTION

- The **MarShaft SCOPE *plus*** is a universal, fully automatic optical shaft measuring system for testing rotationally symmetrical workpieces.

- The **MarShaft SCOPE *plus*** has a highly accurate roundness measuring axis (C), a vertical measuring axis (Z) and a horizontal measuring axis (X).

- A tactile measuring system with an inductive measuring probe is available as an option, for measuring radial and axial run-out, for example. The measuring device is calibrated to the optical measuring system, so it can perform tactile and optical measuring tasks in combination.

- The new MarWin EasyShaft software provides a high level of flexibility and exceptionally user-friendly operation.

- The measuring sequences are carried out fully automatically, free from operator influences.

- The MarShaft SCOPE *plus* is suitable for use in both the harsh workshop environment and in the inspection room. Zoom functions allow the smallest details to be measured, which with conventional measuring methods are difficult if not impossible to test.

- Automatic measuring procedure
- Matrix camera, 1280 x 1024 pixels
- User-friendly touchscreen operation
- One measuring instrument for multiple measuring tasks
- Good workshop compatibility
- MarWin EasyShaft software provides a high level of flexibility and user-friendly operation

Options:
- Tactile measuring unit for measuring radial run-out and axial run-out
- Temperature compensation
- Thread measurement
- Turbocharger shaft measurement
- Manual control panel
- Signal lamp
- Barcode scanner
- MarWin Professional Shaft software
- QS-Stat interface

TECHNICAL DATA

Optical, fully automated CNC-controlled shaft measuring machines	
Measuring range length (Z) (mm)	350 / 750 / 1000
Measuring range diameter (X) (mm)	80 or 120
Workpiece weight (max.) in kg	15 (optional 30)
Length/diameter resolution (mm)	0.01 to 0.0001
Angle resolution (°)	0.01 to 0.0001
Length error limit (Z) (µm)	(2 + L/125) L in mm (at 20°C ± 1°C on reference standard)
Diameter error limit (X) (µm)	(1.0 + L/125) L in mm (at 20°C ± 1°C on reference standard)
Drives	Servo motors
Lens	Telecentric precision lens High-resolution CCD array

APPLICATIONS

Typical workpieces

- Turned parts
- Tripods
- Transmission shaft
- Rack
- Axle journal
- Hollow shaft
- Drive shaft
- Camshaft
- Turbocharger shafts
- Bone screws
- Worm gears
- Balance shafts
- Hydraulic parts
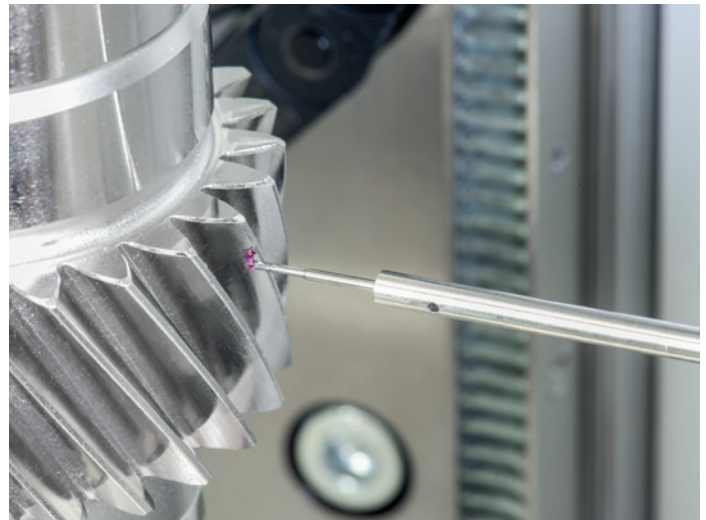- Valves (diesel engine)
- and much more

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MarShaft SCOPE *plus*

MarShaft 600 *plus* 3D optical Shaft Measuring System

DESCRIPTION

- Mahr, the application specialist, provides a completely new measurement method for the camshaft and now (optionally) also for straight and helical cylindrical gears using the new MarShaft SCOPE 600 *plus* 3D: The combination of optical and tactile sensors allow for the first time ever the functionally complete 3D inspection of the workpiece in one clamping. Due to this market need, Mahr further developed the highly anticipated and well-received MarShaft SCOPE 750 *plus* system. The advanced system now utilizes a new 2D probe system, a motorized tailstock and a calibration for the linear axes. A matrix camera optically measures characteristics such as diameters, lengths, radii, geometries, location characteristics, cam angle or cam lift in seconds. The additional 2D probe system detects features that are not optically measurable: concave cam profile, all common gear parameters on cylindrical gears, axial run out, reference elements in the axial direction such as blind holes. For this system, the tactile and optical systems are calibrated in one measuring coordinate system. The measuring station operates in conjunction with the MarWin software platform, thus providing full 3D functionality.

Features:
- Complete measuring of camshafts, including cam angle and all cam profiles
- Measurement of cylindrical gears
- Measurement of conturs
- No use of radial drivers
- Direct measurement of reference (2 flat, blind borehole or keyway)
- Measurement of keyway grooves
- Measurement of blind boreholes
- 100% 3D function with the new 2D probesystem 1320–2
- Additional Y- measuring axis
- Special calibration of the linear axis (Z-X-Y)
- MarShaft Professional Software
- Manual panel

Options:
- Barcode scanner
- Signal light (red, yellow, green)
- Coated tip (no driver required)
- Vibration isolation system
- Temperature compensation
- Thread measurement
- Turbocharger shaft measurement

TECHNICAL DATA

MarShaft SCOPE 600 *plus* 3D	
Measuring range length (Z) (mm)	600
Measuring range diameter (X) (mm)	120
Workpiece weight (max.) in kg	15
Length/diameter resolution (mm)	0.01 to 0.0001
Angle resolution (°)	0.01 to 0.0001
Length error limit (Z) (µm)	(2 + L/125) L in mm (at 20°C ± 1°C on reference standard)
Diameter error limit (X) (µm)	(1.0 + L/125) L in mm (at 20°C ± 1°C on reference standard)
Drives	Servo motors
Lens	Telecentric precision lens High-resolution CCD array

APPLICATIONS

- Complete measurement of camshafts
- Complete measurement of gear shafts

Typical workpieces
- Camshaft
- Gear shafts
- Eccentric shafts
- Shafts with keyways or blind boreholes

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MarShaft SCOPE *plus*

Universal, fully automatic optical Shaft Measuring System MarShaft SCOPE 250 *plus*

DESCRIPTION

- The role of dimensional metrology is expanding at a dramatic rate, in parallel with innovations in manufacturing processes. Given the ever more stringent accuracy requirements and falling cycle times in production (turning, milling, grinding, etc.), rapid measurement directly at the manufacturing machine is absolutely essential. Measurement at the point of origin of the product, with rapid feedback to the manufacturing process to avoid waste. Mahr's flexible MarShaft SCOPE 250 *plus* shaft measuring machine offers the right measuring solution for the fast, precise and fully automatic measurement of rotationally symmetrical workpieces in production.

- The MarShaft SCOPE 250 *plus* has a high precision roundness measuring axis (C) and a vertical measuring axis (Z) with a measuring range of 250 mm. At its heart is the state-of-the-art, high-resolution CMOS matrix camera (live image) with an image field of 1088 x 2048 mm. The extremely high image acquisition rate of over 120 images per second keeps measuring times to a minimum. Zoom functions allow the smallest details to be measured, which with conventional measuring methods are difficult if not impossible to test.

Performance features at a glance:

- New, high-resolution CMOS matrix camera with a 40 mm live image field allows fast scanning with over 120 images per second
- High accuracy for diameter and length measurement
- Measuring speeds of up to 200 mm/s result in extremely fast measuring times
- By using Mahr's MarWin software platform, you can benefit from our decades of experience in length, form, position and contour measurement
- Excellent entry level price into the small optical shaft measuring machine segment

TECHNICAL DATA

MarShaft SCOPE 250 *plus*	
Measuring range length (Z) (mm)	250
Measuring range diameter (X) (mm)	40
Length/diameter resolution (mm)	0.01...0.0001
Angle resolution (°)	0.01...0.0001
Length error limit (Z) (µm)	≤ (3.0+l/125) L in mm
Diameter error limit (X) (µm)	≤ (1.5+l/40) L in mm
Lens	Telecentric precision optics High-resolution CMOS camera

APPLICATIONS

The main measurable features

- Length
- Diameter
- Form and position tolerances
- Offsets
- Recess width
- Bevel width
- Intersection points
- Position of intersection points
- Angles of rotation
- Radii
- Position of radii
- Taper lengths
- Angles
- Pitches
- Widths across flats
- Outer threads

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MarShaft **|** Shaft measuring instruments   **Mahr**   **611**

MarShaft Software EasyShaft

DESCRIPTION

- **MarWin EasyShaft software** is the measuring, control and evaluation system for the MarShaft SCOPE *plus*. It offers precision measurement of diameters, lengths, contour features and form and position tolerances in accordance with standards, along with many new evaluation and documentation options, all with a well-laid-out, intuitive user interface.

- The software runs entirely under the familiar Windows® operating system. The user interface is compatible with other Windows® applications, reducing the familiarization time substantially. All Windows®-compatible printers can be used for record output.

Performance features at a glance:
- The familiar Windows® user interface makes for a short learning curve
- The user interface is used as standard across all Mahr products (e.g. EasyForm or Contour 1)
- Clear, windows-based layout
- User-friendly, 100% touchscreen functionality
- Predefined macros for easy programming (e.g. diameter measurement at a mouse click)
- Many functions can be selected directly via obvious icons
- Touchscreen-controllable machine axes
- The live image from the matrix camera is permanently displayed during measurement, i.e. direct visual assessment of the workpiece condition (e.g. soiling) even during measurement
- For individual and serial measurements: the ideal operating strategy for every task
- User-friendly, state-of-the-art measuring program management
- Time-optimized measuring program sequence (shortest measuring times)
- Meaningful measuring records – in black-and-white or color – output to all Windows® printers
- Future-proof investment, runs under Windows 10
- Optional data export to statistics programs extends the range of functions of the EasyShaft software
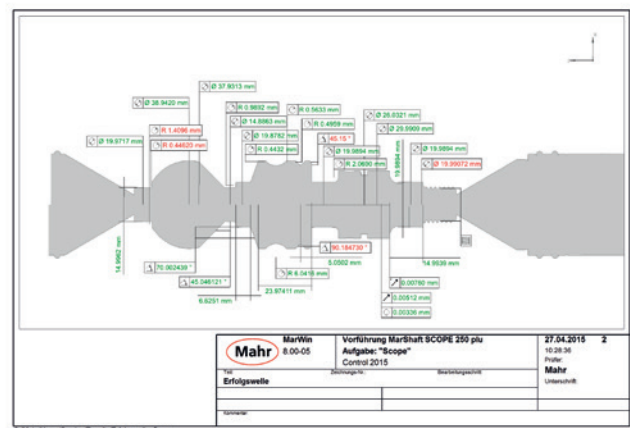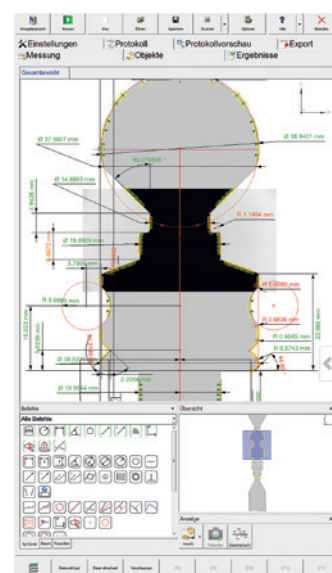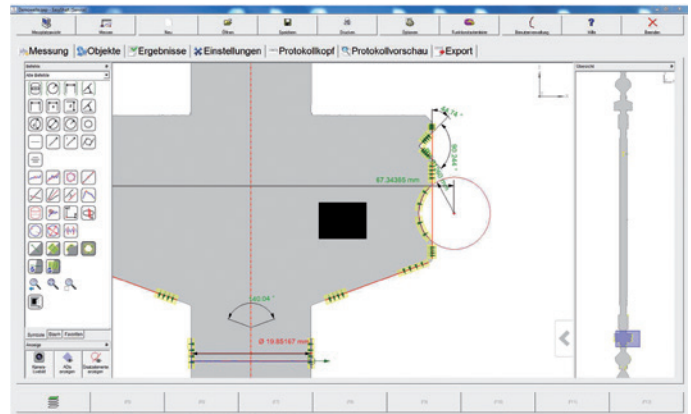
Options:
EasyShaft program window
- The EasyShaft software gives you full control over the MarShaft SCOPE. The touchscreen gives you direct access to positioning, programming, measurement and documentation. The excellent, simple user interface helps you keep track of everything you need to know.
- Many functions, such as loading measuring results or adding feature measurements, can be selected simply by clicking an icon.

EasyShaft commands
- The clearly laid-out command bar contains all the commands required for measuring and evaluating features.
- Macros (composed sequences of evaluation actions, e.g. diameter, radius, distance or angle)
- Features which can be calculated (e.g. direct distance, distance in X and Z, angle, angle sector, radius, roundness, straightness, radial run-out, axial run-out, cylindricity, symmetry)
- Substitute elements which can be calculated (e.g. point, line, circle, point on straight line, intersection point, symmetry straight line, parallel straight line, extreme point, C-reference)
- **Display palette (touchscreen control of machine axes)**
- Used to show or hide the display palette
- Used to select the zoom range
- Joystick for the C-axis
- Joystick for the X- and Z-axis
- Zoom in incrementally
- Zoom in or out continuously
- Zoom out incrementally

For more information, please visit our website: www.mahr.com

MarShaft

Engineered Solutions

DESCRIPTION

Shaft measuring system for the intelligent and cross-linked production of the future.

The advancing digitalization and automation also demands from measurement technology to adapt to new requirements – in terms of speed and reliability, for example.

That is why Mahr has been developing measuring systems for the intelligent factory: measuring instruments that can be loaded by robots and that measure automatically.

For the MarShaft Scope product family, Engineered Solutions offers concepts that can deliver fully automated quality assurance, without operator intervention, round the clock. In this way you can increase production efficiency, optimize process costs and boost product safety. The cameras used at Mahr optically detect features such as diameters, lengths, radii, form or position features contactlessly and with maximum precision, in just a few seconds.

Intelligent measuring machine with robot loading

As a Mahr customer you benefit from a comprehensive approach to integrating the measuring process into the existing production environment, through fully automatic robot loading and the proven performance features of the MarShaft Scope 600 *plus* 3D or MarShaft Scope 750.

If you need an additional measuring machine to solve the measuring tasks, the robot can transfer the workpiece to different stations for further measurements.
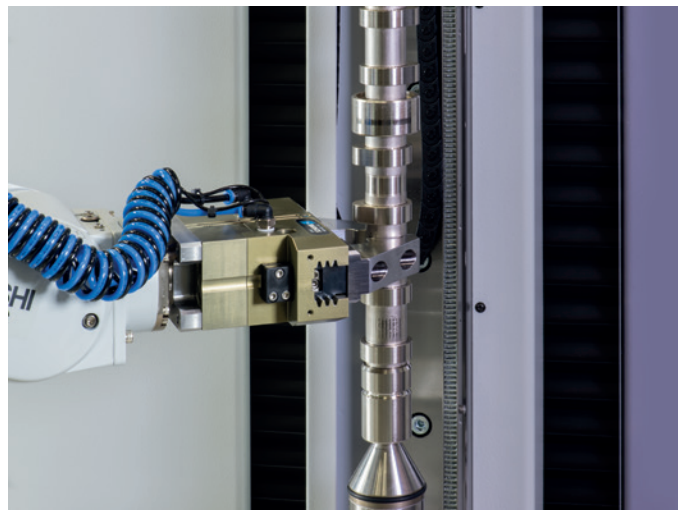
Using the Fieldbus interface in the MarWin platform software, measuring stations from all product groups can easily be integrated into the production process to design the measuring room of the future.

Fixtures for each measuring task

Mahr has a wealth of knowledge regarding the design of highly accurate fixtures for shaft measurement. For the measuring room of the future, fixtures will also need to be designed so that they clamp the workpiece in a secure and reproducible manner, even when loaded by a robots.

Even when no fully automatic and robot-loaded measuring machine is used, Engineered Solutions with its broad portfolio of various clamping device concepts can deliver a solution for the measuring task: from different tip shapes (hollow tips, centering tips), angles or diameters through to collet chucks or patented mandrels.

Together with you, we can find the right fixture for your measuring task.

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MarShaft | Shaft measuring instruments   **Mahr**   **613**