MarShaft



FLEXIBLE SHAFT MEASURING MACHINE FOR MEASURING SMALL, ROTATIONALLY SYMMETRICAL WORKPIECES

- Highest measuring accuracy in the rough production environment
- Extremely short measuring times due to high measuring speeds of up to 200 mm/s



That is what **EXACTLY** means to us.

MarShaft SCOPE 250 *plus* Mahr offers measuring systems for factories of the future



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. So, measurement at the point of origin of the product, with rapid feedback to the manufacturing process to avoid waste is the problem you need to get solved. 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. The jewel in the crown is the state-of-the-art, high resolution CMOS matrix camera (providing the live image) with an image field of 40 x 24 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 are difficult, and in some cases even impossible, to test with conventional measuring methods.

MarShaft | Optical Shaft Measuring Machine

MarShaft SCOPE 250 plus

The main measurable features

- Length
- Diameter
- Form and position tolerances
- Offsets

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- Recess width
- Bevel width
- Intersection points
- Position of intersection points
- Radii
- Position of radii
- Taper lengths
- Hole contours
- Angles
- Pitches
- Widths across flats
- Outer threads





MarShaft SCOPE 250 *plus* Versions



MarShaft SCOPE 250 *plus* with C-axis and tailstock Order no. 5361802

Model with C-axis and tailstock for the static and dynamic measuring of workpieces clamped between centers.

2 centering tips with a cone of 60° for centering bore diameters of 2 mm to 15 mm (order no. 5361112) are included in package

MarShaft SCOPE 250 *plus* with high-precision C-axis and tailstock Order no. 5361803

Model with high-precision C-axis and tailstock for the static and dynamic measuring of workpieces clamped between centers.

2 centering tips with a cone of 60° for centering bore diameters of 2 mm to 15 mm (order no. 5361112) are included in package.

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Performance Features a Glance:

- New, high-resolution CMOS matrix camera with a large 40 x 24 mm live image field allows fast scanning with over 120 images per second
- High precision when measuring diameters and lengths
- Extremely fast measuring times thanks to high measuring speeds of up to 200 mm/s
- By using Mahr's MarWin software platform, you can benefit from our decades of experience in length, shape, position and contour measurement
- Excellent entry level price into the small optical shaft measuring machine segment

MarShaft | Optical Shaft Measuring Machine

MarShaft SCOPE 250 *plus* Components and Accessories

Precision measuring spindle (C-axis) with table plate

High-precision measuring spindle (C-axis) for dynamic measurements such as roundness, radial runout, coaxiality, cylindricity or diameter. The C-axis features the Mahr standard table plate and holds centering tips and other clamps that can be used for many types of workpiece.

Tailstock

The tailstock serves as the top workpiece holder bearing. The tailstock is equipped with an eccentric clamping mechanism for clamping at any Z-height. This mechanism is tightened and loosened by a clamping lever. The spindle is spring-loaded and automatically exercises the clamping force. Operating the tailstock with one hand allows you to change testpieces safely and easily. For dynamic (i. e. rotational) measurements, the spindle is situated in a high-precision ball bearing.

Centering tip with 60° cone for bore Ø 2 mm to 15 mm Order no. 5361112

Interchangeable standard tip for clamping various workpieces between centers.

2 centering tips with a cone of 60° for centering bore diameter of 2 mm to 15 mm are included in the MarShaft SCOPE 250 *plus* package.

Rim chuck with three jaws and Ø 70 mm Order no. 5361080

with adaptor for the MarShaft SCOPE 250 *plus* Outer clamping range 1 mm to 70 mm









MarShaft | Optical Shaft Measuring Machine

MarShaft SCOPE 250 *plus* Software MarWin EasyShaft



MarShaft | Optical Shaft Measuring Machine

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MarShaft SCOPE 250 plus

Software MarWin EasyShaft

MarWin EasyShaft software is the measuring, control and evaluation program for the MarShaft SCOPE *plus* series. It enables the precision measurement of diameters, lengths, contour features and form and position tolerances in accordance with standards, and offers 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 EasyShaft user interface is in line with the standard user interface across all Mahr products (cf. EasyForm or Contour 1)
- Clear, windows-based layout
- User-friendly, 100% touchscreen functionality
- Predefined macros for easy programming (e.g. diameter measurement at the touch of a single button)
- Many functions can be selected directly via obvious icons
- Touchscreen-controllable machine axes
- The live image from the matrix camera is continuously displayed during measurement, i.e. direct visual assessment of the workpiece surface (e.g. soiling) even during measurement
- For individual and series measurements: the ideal operating strategy for every task
- User-friendly, state-of-the-art measuring program management
- Time-optimized measuring program sequence, thus minimal measuring times
- Clear measuring records in black-and-white or color output to all Windows® printers
- Future-proof investment, runs under Windows® 7 Ultimate
- Optional data export to statistics programs extends the range of functions of the EasyShaft software

EasyShaft Program Window

The EasyShaft software gives you full control of the MarShaft SCOPE 250 plus. The touchscreen gives you direct access to positioning, programming, measurement and documentation. The clear, simple user interface helps you keep track of everything you need to know. Many functions, e.g. loading measuring results or adding feature measurements, can be activated simply by clicking on obvious icons.

EasyShaft Commands

The command bar contains a summary overview of all of 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 etc.)
- 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 etc.).

Display palette (touchscreen control of machine axes)

- Used to show or hide the display palette
- Used to select the zoom range
- May be joystick for the C-axis depending on device version
- May be joystick for the Z-axis depending on device version
- Zoom in or out incrementally
- Zoom in or out continuously



MarShaft SCOPE 250 *plus* Software MarWin EasyShaft. Sample Result Record

MarWin			Vor	Vorführung MarShaft SCOPE 250 plu					27.04.2015 1		
(Mahr) 8.00-05			Aufgabe: "Scope"						10:28:36		
Control 20						Prüfer:					
	Teil: Zeichnungs-Nr.: Bearbeitungsschritt: Mahr Erfolgswelle Unterschrift:										
Kom	mentar:										
_											
Nr. 1	Merkmal thread_2 (Außendurchmesser)	Nennmaß 15.8220	UT -0.1400	0.1400	Istmaß 15.9632	Abweichung TG	Abw	0.1412	Abweichung 0.1412	0.0012	
1	mm thread_2 (Kerndurchmesser)	13.3895	-0.1185	0.1185	13.3661			-0.0234	-0.0234		
1	mm thread_2 (Flankendurchmesser)	14.5830	-0.0800	0.0800	14.6138			0.0308	0.0308		
1	mm thread_2 (Teilflankenwinkel 2)	30.0000	-0.1667	0.1667	29.6267			-0.3733	-0.3733	-0.2066	
1	o thread_2 (Teilflankenwinkel 1)	30.0000	-0.1667	0.1667	30.0409			0.0409	0.0409		
1	o thread_2 (Steigung)	2.0000	-0.0050	0.0050	1.9967			-0.0033	-0.0033		
2	mm distance_4	15.0000	-0.1000	0.1000	14.9962			-0.0038	-0.0038		
4	mm diameter_2	20.0000	-0.1000	0.1000	19.9894			-0.0106	-0.0106		
6	mm	15.0000	-0.1000	0.1000	14.9939			-0.0106	-0.0061		
	distance_6 mm										
9	diameter_4 mm	26.0000	-0.1000	0.1000	26.0321			0.0321	0.0321		
13	diameter_5 mm	20.0000	-0.1000	0.1000	19.9894			-0.0106	-0.0106		
14	radius_2 mm	2.0000	-0.1000	0.1000	2.0690			0.0690	0.0690		
17	angle_1	45.55	-0.10	0.10	45.15			-0.39	-0.39	-0.29	
18	angle_2	90.000000	-0.100000	0.100000	90.184730			0.184730	0.184730	0.084730	
19	distance_13 mm	5.0000	-0.1000	0.1000	5.0502			0.0502	0.0502		
20	radius_3 mm	6.0000	-0.1000	0.1000	6.0416			0.0416	0.0416		
24	distance_18 mm	23.90976	-0.10000	0.10000	23.97411			0.06435	0.06435		
25	diameter_7 mm	20.0000	-0.2000	0.0000	19.8782			-0.0218	-0.1218		
26	angle_5	70.000000	-0.100000	0.100000	70.002439			0.002439	0.002439		
27	diameter_8	15.0000	-0.2000	0.0000	14.8863			-0.0137	-0.1137		
28	mm distance_22	6.6500	-0.1000	0.1000	6.6251			-0.0249	-0.0249		
30	mm angle_6	45.000000	-0.100000	0.100000	45.046121			0.046121	0.046121		
31	° radius_4	0.5000	-0.1000	0.1000	0.4959			-0.0041	-0.0041		
33	mm radius_6	0.5000	-0.1000	0.1000	0.4432			-0.0568	-0.0568		
34	mm radius_7	0.5000	-0.1000	0.1000	0.5633			0.0633	0.0633		
35	mm radius_9	1.0000	-0.1000	0.1000	0.9892			-0.0108	-0.0108		
36	mm diameter_10	38.0000	-0.1000	0.1000	37.9313			-0.0687	-0.0687		
37	mm diameter_11	39.0000	-0.1000	0.1000	38.9420			-0.0580	-0.0580		
39	mm radius_10	0.5000	-0.1000	0.1000	1.4096			0.9096	0.9096	0.8096	
40	mm radius_11	0.73221	-0.10000	0.10000	0.44620			-0.28601	-0.28601	-0.18601	
40	mm axial_runout_1	0.00000	0.10000	0.01000	0.00760			0.00260	0.00760	0,10001	
41	mm roundness_1	0.00000		0.01000	0.00336			0.00260	0.00336		
	mm										
43	runout_1 mm	0.00000		0.01000	0.00512			0.00012	0.00512		
45	distance_24 mm	20.0000	-0.1000	0.1000	19.9894			-0.0106	-0.0106		
46	diameter_13 mm	4.00000	-0.10000	0.10000	19.99072			15.99072	15.99072	15.89072	
47	diameter_14 mm	20.0000	-0.1000	0.1000	19.9717			-0.0283	-0.0283		
48	diameter_15 mm	30.0000	-0.1000	0.1000	29.9909			-0.0091	-0.0091		
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MarShaft SCOPE 250 *plus* Software MarWin EasyShaft. Sample Result Record



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MarShaft SCOPE 250 *plus* Software MarWin EasyShaft



Software MarWin EasyShaft

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Country package with Windows[®] 7 Ultimate operating system, with optional language versions

- German
- English/International
- French
- Other languages on request



Offline Programming Option for MarWin EasyShaft

Creating measuring programs in offline mode. The testpiece contours can either be created by a fully automatic form scan with a MarShaft SCOPE 250 *plus* or loaded from a STEP file (from a CAD system).



ProfessionalShaft Software Option

Free programming with MarWin MarScript for implementing customer-specific applications such as measuring symmetry in keyways.

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MarShaft SCOPE 250 *plus* Technical Data

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MarShaft SCOPE 250 <i>plus</i>							
Dimensions (basic unit) W/H/D	1054 mm x 952 mm x 592 mm						
Equipment table height for optimal operation	800 mm - 900 mm						
Weight	approx. 120 kg						
Measuring range (Z)	250 mm						
Workpiece weight	max. 5kg						
Workpiece dimensions							
Max. length in centers	250 mm						
Max. length in chuck	150 mm						
Max. measurable diameter	40 mm						
Max. swivel diameter in centers	100 mm						
Max. swivel diameter in chuck	50 mm						
Measurement resolution	Adjustable						
Lengths/diameters	0.01 mm0.0001 mm 0.001 inch0.0001 inch						
Angle	0.010.0001 degrees (decimal) or degrees, minutes, seconds						
Repeatability 4 σ for 50 measurements							
Length	2.0 μm						
Diameter	(0.4 + D/80) μm; D in mm for clean, ground workpiece surfaces						
Error limit MPE _{E1}							
Length	≤ (1.5 + I/40) µm; I in mm						
Diameter	\leq (3.0 + l/125) µm; l in mm Valid in temperature range 20°C ± 2 K						
Drives							
Travel speed Z	max. 200 mm/s						
Rotational speed C	max. 1.0 1/s						
Optics							
	Telecentric precision lens; lighting with high light output in flash mode						
Camera							
CMOS matrix camera with USB 3.0 interface	40 x 24 mm						
Full frame mode	120 images/s						
Subframe mode (16 rows)	approx. 1000 images/s						

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MarShaft SCOPE 250 *plus* Technical Data

Measuring computer	SFF-PC; WIN 7 x 64; Intel CPU; DVD-RW
Ambient conditions	
Operating temperature	+10 °C +35 °C
Recommended working temperature	+15 °C +35 °C
Storing/transport temperature	-10 °C +50 °C
Permitted humidity	max. 90%; non-condensing!
Temporal temperature gradient	< 2 K/h
Spatial temperature gradient	< 1 K/m ceiling height
Air pressure	1000 hPa ± 200 hPa
Perm. ambient sound pressure	< 75 dB(A)
Electrical connection	
Supply voltage U~	100 V 240 V +10 %/-15 %
Mains frequency	50/60 Hz
Power consumption	max. 500 VA
Protection class	I
Protection rating	IP32
Sound level	
Emitted sound level	< 70 dB(A)
Perm. ground vibrations	
Range 0.5 Hz 20 Hz	2 mm/s to 50 mm/s linear gradient
Range >20 Hz	50 mm/s

Subject to change without notice.

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EXACTLY

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