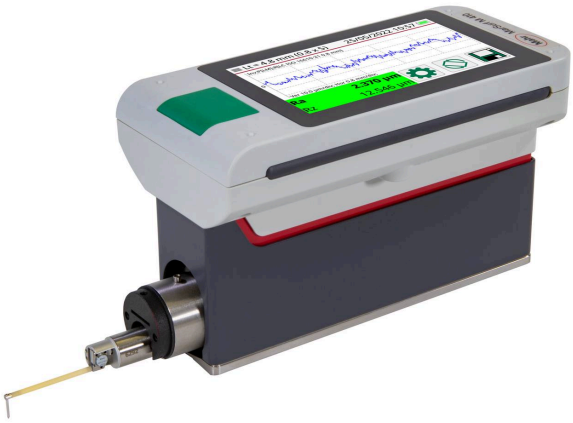
Ürün bilgileri

Mobil yüzey ölçüm aleti MarSurf M 410

Ürün özellikleri

Simple, innovative, flexible – modern surface metrology for handheld use

- Handy roughness tester for mobile use
- Simple and intuitive operation: As easy as operating a smartphone
- Large, backlit 4.3" TFT touch display
- Rotatable display
- Magnetic probe holder: Fast probe arm change without tools
- Thanks to skidless probe: measurements of roughness as well as waviness – no extra measuring station required, determination of R, W and P parameters
- Simple alignment of the probe system: The inclination can be easily corrected using the menu-guided graphic instructions./li>
- Process and material safety thanks to automatic zeroing
- Micro USB interface for remote control via ASCII commands, e.g. via software for statistical process control
- USB-A interface for connecting e.g. a USB wireless adapter or the USB wireless printer
- Wireless transmission of measurement results via wireless stick to the free MarCom software
- Remote start of measurement via cable or wireless
- Connection of a scanner for automatic start of the measuring programs or reading of protocol texts via barcode or QR code
- Specification of the profile section lebel C in µm or in % of Rz for the characteristic values Rmr and tp/li>
- Data backup as TXT, X3P, CSV and PDF file
- Transmission of measurement protocols and data optionally via cable or wireless
- IATF 16949 compliant - secure traceability with MarConnect.
- Print directly to the mobile printer (as an option or directly in the set with printer)
- Creation of finished PDF protocols directly in the measuring device



Malzeme no.: **6910290**

Teknik veriler

Hareket uzunluğu (Lt)	till 26 mm
Measuring principle	tactile stylus method, tactile skidless probe
Unit of measurement	metric/inch
Ölçüm kuvveti (N)	0.00075
Probe tip radius	2 µm
ISO/JIS'e göre filtre	Gaussian filter according to DIN EN ISO 16610-21, robust Gaussian filter according to DIN EN ISO 16610-31, special filter according to DIN EN ISO 13565-1, ls filter according to DIN EN ISO 3274 (can be switched off)
ISO/JIS'e göre Kesme lc	0,08 mm, 0,25 mm, 0,8 mm, 2,5 mm, otomatik filtre algılama, değişken
ISO/JIS'ye uygun kısa strok	selectable
ISO/JIS'e göre örnekleme uzunluğu sayısı n	selectable: 1 to 16
Ölçüm hızı	0.1 mm/s - 1 mm/s
Konumlandırma hızı (mm/sn), X ekseni	till 3 mm/s
Yüzey parametreleri	Over 55 characteristic values for R-, P-, W-profile in accordance with current ISO/JIS/ASME/Motif standardization
Enerji kaynağı	Integrated rechargeable battery (min. 1200 measurements) or via charging unit
Veri arabirimi	USB A, MarConnect (RS-232), SD / SDHC kartlar için Micro SD yuvası, 32 GB
Diller	Almanca, İngilizce, Fransızca, İtalyanca, İspanyolca, Portekizce, Felemenkçe, İsveççe, Rusça, Lehçe, Çekçe, Japonca, Çince, Korece, Macarca, Türkçe, Rumence
Depolama kapasitesi	min. 3900 profiles, min. 500,000 results, min. 1500 PDF logs, expandable with microSD card up to 32 GB (increases storage capacity by a factor of 320)
Prob	inductive skidless probe system
IP koruması kategorisi	IP 40
Bağıl nem	30 % to 85 %, non-condensing!
Çalışma sıcaklığı	10 °C - 45 °C
Lagertemperatur	-10 °C - 60 °C
Ağırlık ölçüm aleti	300 g
Ağırlık tahrik ünitesi	1120 g
Mm cinsinden boyutlar	198 mm x 77 mm x 97 mm
Ölçüm aleti için mm cinsinden boyutlar (U x G x Y).	162 mm x 77 mm x 35 mm
Tahrik ünitesi için boyutlar (U x G x Y), mm cinsinden.	194 mm x 38 mm x 72 mm
Diğer	Lock/code word protection, date/time

Ürün bilgileri

Mobil yüzey ölçüm aleti MarSurf M 410

- Customer-specific comments for the PDF log are entered directly on the MarSurf M 410
- MRK and ADK curve display and printing
- Measuring programs are saved (Quick & Easy)
- Mains-independent operation: over 1200 measurements without having to recharge the device
- Everything in the palm of your hand. Small size and low weight (approx. 500 g)
- Flexible device: Removable drive unit
- More than 50 parameters: Offer a performance range like a laboratory instrument.
- Quick access to your desired functions through favorites storage in the display
- Automatic cutoff selection: ensures correct measurement results even for the non-measuring technician

- Free software "MarWin Easy Roughness Viewer" for further documentation (statistics, multiple profiles and results on one page etc.) available for download on the Mahr website.

Uygulama

Mechanical engineering
Bearings, shafts, racks, valves, various components from the engineering and precision mechanics industries

Automotive
Steering, brake systems, transmissions, crankshafts, camshafts, cylinder heads, cylinder blocks, turbochargers

Medical
Roughness measurement on hip and knee endoprostheses

Aerospace
Turbine components

Optics
Diverse optical components

Teknik veriler

Tarama ucu	2 µm; 5 µm
Parametreler	Ra, Rq, Rz, Rz (JIS), Rz (Ry (JIS) Rz eşdeğeridir), Rmax, Rp, Rp (ASME), Rpm (ASME), Rv, R3z, Rk, Rpk, Rvk, Mr1, Mr2, A1, A2, Vo, Rt, RPc, Rmr (tp (JIS, ASME) Rmr eşdeğeridir), RSm, RS, Rdq, RSk, Rku, Rdc, RHtp, Pdc, Pa, Pt, PMr, Wa, Wq, WSm, WSk, Wt, CR, CF, CL, R, Ar, Rx, W, AW (MOTIF), Wx (MOTIF), Wte (MOTIF), NW (MOTIF), NR (MOTIF), NCRX (MOTIF), CPM (MOTIF)
Koruma sistemi	IP 40
Şarj edilebilir piller	Li-Ion battery, 3.7 V, nominal capacity 11.6 Wh, min. 500 measurements
Geniş aralıklı güç kaynağı	100 to 264 V
Ölçüm aralığı	500 µm (±250 µm) for probe arm length 45 mm to 1500 µm (±750 µm) for probe arm length 135 mm

Boyutlar

Mm cinsinden boyutlar	198 mm x 77 mm x 97 mm

Aksesuarlar

Sipariş no.	Adı	Ürün tipi
4102603	Veri kablosu USB çift yönlü	DK-U1
6710803	Dökme demir tabanlı 300 mm ölçüm standı	ST-D
6710806	Granit plakalı 300 mm ölçüm standı	ST-F
6710807	Granit plakalı ve T yuvalı 300 mm ölçüm standı	ST-G
6710401	V blok	PP
6710604	Paralel mengene	PPS
6710529	XY Tablası	CT 120
4246819	Minyatür hassas mengene takımı	109 PS
6820420	Mahr kalibrasyon sertifikası ile pürüzlülük standardı, profil derinliği 10 µm	PRN 10

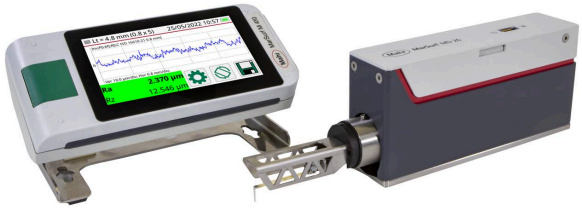
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Malzeme no.: **6910291**

Teknik veriler

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Measuring principle	tactile stylus method, tactile skidless probe
Unit of measurement	metric/inch
Ölçüm kuvveti (N)	0.00075
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ISO/JIS'e göre filtre	Gaussian filter according to DIN EN ISO 16610-21, robust Gaussian filter according to DIN EN ISO 16610-31, special filter according to DIN EN ISO 13565-1, ls filter according to DIN EN ISO 3274 (can be switched off)
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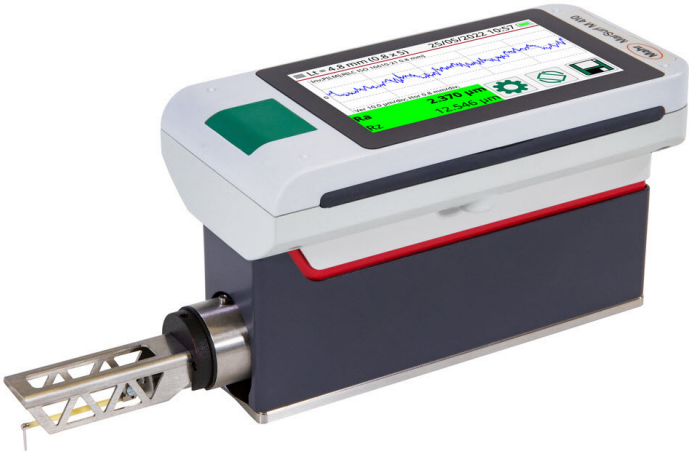
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6820420	Mahr kalibrasyon sertifikası ile pürüzlülük standardı, profil derinliği 10 µm	PRN 10

Mahr



MarSurf M 410

Originalbetriebsanleitung
Translation of the Original Operating Instructions
Traduction du guide de l'utilisateur original
Traduzione del manuale di istruzioni originale
Traducción del manual de instrucciones original
Tradução do manual de instruções original
Překlad originálního návodu k obsluze
Tłumaczenie oryginalnych instrukcji obsługi

3755783_DE-EN-FR-IT-ES-PT-CS-PL

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Order No.	Last Modification	Version
3755783	10/17/2024	Valid from software version 3.50-05

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The following symbols are used in these operating instructions:



General information.



Important note. Failure to follow instructions marked with this symbol may cause inaccurate results and damage equipment.



Warning. Risk of injury or death. Must be observed!

Reasonably foreseeable misuse



Any incidental maintenance work may only be carried out by skilled, trained staff as directed by the operating company.



Any incidental maintenance work must be carried out with the necessary personal protective equipment.



Work on any parts carrying live voltage must only be carried out once the power supply to the device has been disconnected and any potential residual voltage has been safely discharged.



Safety mechanisms on the instrument must not be disassembled or bypassed.



Only original probe arm units and other accessories produced by the manufacturer may be used.



Only the original power supply unit and the original battery produced by the manufacturer may be used.



The battery must be replaced carefully and exactly as described in these operating instructions (see Section 8.4).

Permitted uses

The MarSurf M 410 surface measuring instrument may only be used for roughness measurement and evaluation.
The MarSurf M 410 surface measuring instrument can be used both close to production areas and in inspection rooms.



The operating, maintenance and repair requirements specified in these operating instructions and in the operating instructions for the measuring station components must be observed.



Any use not in accordance with the "Permitted Uses" or any other use will be considered inappropriate and will result in a voided warranty and the manufacturer's exclusion from liability.

Information about Open Source Software

Some of the components contained in the software used in this product by Mahr GmbH are licensed as open source software (OSS).
Mahr GmbH accepts no liability for the parts of the open source software not used in this product. The copyright for such parts is held by one or more authors.
To read the versions and licenses of the OSS packages contained in the software: Tap **Licenses** in the menu of the MarSurf M 410.
You can request the source code of the open source software contained in this product from Mahr GmbH. Please send an email to *opensource@mahr.com* stating the product name and version. We will send you the source code subject to a fee which covers the costs of the data carrier, processing and postage.

Safety instructions

This instrument complies with the relevant safety regulations. It was dispatched from our production facility in a good condition and perfect working order. Failure to follow the instructions given below can cause personal injury or death.

General information

1. Read the safety instructions and the associated operating instructions carefully before starting to use the device!
2. Only use the instrument in accordance with the operating instructions.

The operating instructions must be stored within reach of where the instrument is used.

3. Internal regulations and local accident prevention regulations (as defined by the Employer's Liability Insurance Association for example) must be strictly observed. For further information, contact the responsible safety officer at your company.
4. This instrument is not designed for operation in explosive environments. The equipment can emit electrical sparks which could trigger an explosion.

Power supply and network connection

5. Before connecting the device to the mains, make sure that the voltage specified on the rating plate matches the local mains voltage. Under no circumstances connect the device to the mains if the voltage is not the same!
6. The device may only be connected to socket outlets equipped with protective conductors. Extension cables must meet the stipulations of the VDE (German Association for Electrical, Electronic & Information Technologies) or an equivalent in your country.

Faults

7. The instrument should only be used if it is in perfect technical condition.

Any malfunctions that could impair safety must be rectified immediately.

Tampering with the measuring station components

8. Any modification or manipulation of the instrument requires the express written approval of Mahr GmbH and must be carried out by qualified personnel.

Covers on the machine may only be opened or removed by authorized personnel for maintenance or repair work.

Before opening the instrument, switch it off completely (e.g. by pulling the plug out of the mains socket). Any unauthorized work on the machine renders the warranty null and void and releases the manufacturer from any liability.

Information on measuring accuracy

The MarSurf MD 26 drive unit, together with the MarSurf M 410 operating unit, forms a high-precision measuring station. The MarSurf MD 26 has a built-in datum plane and a skidless probe system. Datum plane probe systems are used in arbitration cases because, unlike skidded probe systems, they cause no distortion of the surface profile.

However, datum plane probe systems are sensitive to environmental conditions – especially vibration – which influence the measuring results. The user should always check whether and to what extent vibration is present.

For applications in which problems occur, please contact Mahr Service.

1 Functions

Mechanical properties

The MarSurf M 410 is a compact surface measuring instrument for mobile or stationary use under shop floor conditions. It consists of the MarSurf M 410 operating unit and the MarSurf MD 26 drive unit.

The measuring range is ±250 µm *(±0.010 in)* (with the default probe arm provided in the set with the probe arm length × 1.00). Using other probe arm units can extend the measuring range up to a maximum of ±750 µm *(±0.030 in)* (probe arm length × 3.00).

The MarSurf MD 26 drive unit has a built-in datum plane and is, therefore, suitable for measuring the P-profile and for roughness and waviness measurements.
A wizard on the MarSurf M 410 facilitates the manual tilt adjustment of the datum plane on the drive unit (see Section 4.3).

With the MarSurf MD 26 drive unit, measurements can be performed in any measuring position without the need for setup times. The maximum traversing length is 26 mm *(1.02 in)*. The instrument is easy to use and complies with DIN EN ISO 3274.

The MarSurf MD 26 drive unit has a built-in motorized height adjustment mechanism [1] of the probe arm unit over a range of 7.5 mm *(0.30 in)*. For measurements conducted with a skidless probe system, this allows automatic contacting, even in all spatial positions when using the default probe arm.

The complete unit (drive unit including the operating unit) can be placed directly on a flat surface or a flat measuring object surface (three-point support).
For measurements in the longitudinal direction of cylindrical measuring objects with a diameter of 80 mm *(3.15 in)* or more, the MarSurf MD 26 can be placed directly on the measuring object (vee-block base or four-point support, see Section 4.5).

The MarSurf M 410 operating unit and the MarSurf MD 26 drive unit can be separated from one another and connected using the USB cable provided. [2]
With the cable connection, the docking station can be used to set up the operating unit at the workstation or to mount it on the wall. The docking station can be tilted and thus adjusted to a comfortable reading angle (see Section 4.1).

The drive unit or the complete unit (drive unit including the operating unit) can be mounted on a measuring stand (see Section 4.6) to allow measurements in all spatial positions without setup times.
For measurements in cylindrical bores with a diameter of 80 mm *(3.15 in)* or more, the entire drive unit can be inserted into the bore because of its compact size. For smaller diameters, only the probe arm unit is inserted.

The BFW 250 probe system is permanently integrated in the MarSurf MD 26 drive unit. The BFW probe arm units are located in a magnetic probe arm holder and are therefore easy to swap. The magnetic probe arm holder also provides overload protection. If tracing forces or transverse forces are too great, the probe arm unit is moved out of the magnetic retaining range and drops down.
Fitting the optional skid [3] converts the probe system to a skidded probe system.

The BFW probe arm units are factory calibrated. For high-precision measurements using the stylus method and for subsequent checks, a number of different calibration functions are available in the MarSurf M 410 operating unit.

1 patented

2 Alternatively, the MarSurf MD 26 drive unit can be connected to a computer with the "MarWin EasyRoughness mobile" software (see Section 10) via a cable connection.

3 The skid height is adjustable.
The skid can only be used with the default probe arm.

The built-in rechargeable battery offers enough capacity for several days' battery-powered measuring [4].
Stationary operation is possible with the AC adapter plugged in. The instrument's AC adapter comes with four interchangeable mains adapters, allowing it to be connected directly to the mains all over the world.

Instrument settings

All the functions supported by the instrument are set out in a logical menu structure which can be opened via the touchscreen (see Section 5).
Instrument settings can be blocked and also protected against unauthorized modification by means of a code number.

The instrument settings can be saved as Quick&Easys so that even inexperienced users can operate the instrument without any difficulty.

The traversing length can be selected or entered manually. The number of sampling lengths can be adjusted. The traversing length can also include a pre-travel and post-travel measuring half the length of the cutoff.

The recorded profile can be filtered with an Ls filter according to DIN EN ISO 3274 (can be disabled). For measurements according to ISO (DIN), JIS and ANSI/ASME, a phase-correct profile filter (Gaussian filter) is used according to DIN EN ISO 16610-21. A shorter cutoff can be selected for this, or you can enter a cutoff manually.
Operators A and B can be set for the MOTIF evaluation.

For the display and evaluation of replica measurements, the inversion can be enabled to provide the measured profile points with the opposite sign.

Arc elimination can be used to filter out the arc from circular arc measurements taken on convex or concave measuring objects.

The total traversing length or the measuring length (N x Lc) can be selected as the reference for the P-profile.

The traverse of the MarSurf MD 26 drive unit can be disabled, e.g. if the measuring object is moved by a third-party drive.

With automatic contacting, the probe arm unit can be lowered onto the measuring object so that Z = 0 or a definable target value is reached.

"Measuring station" view

The "Measuring station" view offers the following setup functions:
- Probe arm management for creating, changing and deleting probe arm units (see Section 4.2).
- Display of the stylus element position (bar graph and numeric).
- Positioning the probe arm unit in X and Z.
- Automatic contacting.
- Positioning in the parking position.
- Measuring range (for resolution and probe stroke).
- Wizard for correcting the inclination of the drive unit datum plane.

Evaluation

Most of the parameters stipulated in ISO (DIN), JIS, ANSI/ASME and MOTIF are available to evaluate the measured profile.

4 The capacity is sufficient for approx. 1,200 measurements (depending on the traversing length).

The evaluation conditions can be set:
- Reference line and section level for the material ratios Rmr and Pmr (tp and Ptp according to ASME and JIS).
- Reference line and section level for zone widths Rdc and Pdc.
- Symmetrical or asymmetrical section levels for the peak count RPc.
- Section level for the peak count R Hsc.
- Intersection lines for the zone widths CR, CF, CL.

In order to monitor tolerances, tolerance limits can be set for all selected parameters. Any exceeded limits are indicated on the screen and in the PDF measuring record.

Results and settings can be displayed in either metric or imperial units.

For every Quick&Easy, statistics can be produced for up to 200 measurements. The raw data is retained, even if the instrument is switched off.

Up to 3,900 profiles, 500,000 results or 1,500 measuring records can be saved in the internal memory. [5]

The profile, the profile with results, the results and/or the measuring record of a measurement can be saved manually or automatically. The file name for profiles, profiles with results and measuring records can be comprised of four different texts (profile information) as well as date_time.
The header of the measuring record can contain a customer-specific logo, a 3-line record header and 5 lines of profile information.

Interfaces

The MarSurf M 410 has an **SD slot** for a microSD or MicroSDHC card (up to 32 GB), to which the profiles, profiles with results, results and/or measuring records can be saved. [6]
Software can be updated if necessary using a microSD card.

The MarSurf M 410 can be used with the professional data transfer software "MarCom Professional" via the **MarConnect duplex interface**.

USB-A port
- If the MarSurf MD 26 drive unit has been separated from the MarSurf M 410 operating unit, it is connected to the USB-A port via the USB cable provided.
- A USB Wireless adapter, for example, can be plugged into the USB-A port.
- The wireless printer [7] can be connected to the MarSurf M 410 by USB cable or wirelessly.
- A scanner [8] can be connected to the MarSurf M 410 by USB cable or wirelessly.
- A keyboard can be connected to the USB-A port for conveniently entering the record texts.

Micro USB port
- To charge the battery, the AC adapter is connected to the micro USB port using the USB cable provided.
- The MarSurf M 410 can be connected directly to a computer via its micro USB port. It is treated like a USB memory stick.

5 These figures apply if files of one particular type are saved. The figures also depend on the traversing length, the selected parameters and associated profiles and the file format etc.

6 A 32 GB microSD card offers 320 times the memory capacity.

7 The wireless printer is included in the 6910291 set or available as an accessory (see Section 10).

8 A USB scanner and a wireless digital scanner are available as accessories (see Section 10).

Various applications are possible when connected via the micro USB port:

- The "MarWin Roughness Viewer" software allows you to print out the measuring record of a measurement on a connected printer or save it as a PDF file.
- The MarWin software (e.g. "MarWin EasyRoughness") can perform and evaluate measurements with the drive unit of the MarSurf M 410.
- Software can be updated if necessary using the micro USB port.
- In addition, the MarSurf M 410 can be controlled remotely using ASCII commands, e.g. via statistical process control software.

Docking port

- The docking port is used to connect the operating unit to the drive unit when the two instruments are assembled together to form a complete unit (see Section 3.1, "Clamp connection").
- When using the docking station (see Section 4.1), the docking port connects the operating unit to the docking station.

Accessories

The extensive range of accessories for the MarSurf M 410 makes it extremely versatile:

- Fitting the optional skid converts the probe system to a skidded probe system (see Section 10).
- Optional probe arm units allow measurements on a wide variety of measuring objects (see Section 10).
- The wireless printer (6910271) can be used to print out entire measuring records with profile diagram (including with ADC or MRC) and results (see Section 6.2).
- Connecting a scanner to the MarSurf M 410 can simplify and speed up processes (e.g. in receiving inspection) (see Section 6.7).

2 Operating elements

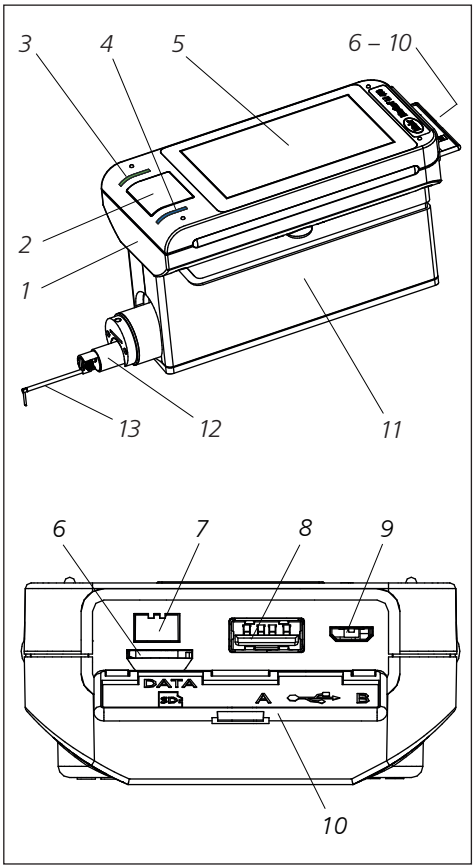


Fig. 1
MarSurf M 410 surface measuring instrument

1 MarSurf M 410 operating unit

2 Green **Start** *key*
- *Switches the instrument on.*
- *Exits the menu (except in the "MarWin operation" dialog) and displays the basic view.*
- *Starts a measurement.*
- *Aborts a measurement in progress.*
- *Switches the instrument off if it is held down for more than 2 s.*

3 Green light strip (charge status)
- *All LEDs off:*
  No AC adapter connected, no USB connection.
- *All LEDs on:*
  Instrument is switched on; battery is fully charged; trickle charge via AC adapter or USB connection.
- *Last LED flashing:*
  Instrument is switched on; battery charging by trickle charge or USB connection.
- *Front LED flashing:*
  Instrument is switched off; battery charging by AC adapter or USB connection.
- *Front LED flashes twice:*
  Instrument is in sleep mode.

4 Blue/red light strip (status display)
- *All LEDs off:*
  No action.
- *LEDs flashing alternately blue:*
  Measuring record printing.
- *All LEDs flashing red:*
  Error occurred, error message displayed.

5 Display with touchscreen
(see Fig. 4)

6 SD *SD slot for microSD card*

7 DATA *MarConnect duplex interface (RS232) for remote control*

8 A *USB-A port e.g. for connecting a USB Wireless adapter*

9 B *Micro USB port for connecting to a computer*

10 Protective cap for ports, removable

11 MarSurf MD 26 drive unit
(see Fig. 2)

12 BFW 250 probe system

13 BFW probe arm unit

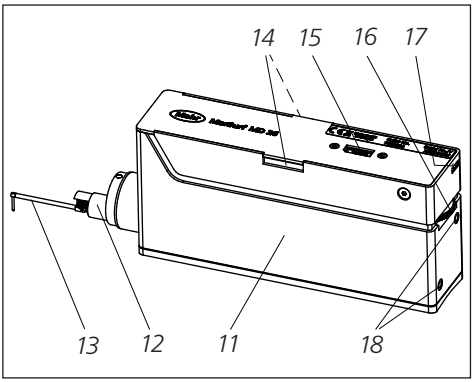


Fig. 2
MarSurf MD 26 drive unit

11 MarSurf MD 26 drive unit

Prismatic base for cylindrical measuring objects, with 5 inner threads for support feet or screws (see Section 4.5)

12 BFW 250 probe system, fixed in the drive unit, with magnetic probe arm holder

13 BFW probe arm unit with magnetic bracket

14 Clamping recesses for clamping the drive unit in the MarSurf M 410 operating unit

15 Docking port, active when drive unit is clamped in the MarSurf M 410 operating unit

16 Rotary knob for inclination correction [9]

17 Micro USB port for connection to the operating unit or the docking station

18 Threaded bores for attaching the measuring stand holder

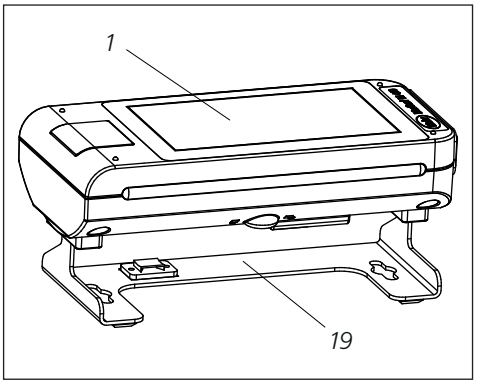


Fig. 3
MarSurf M 410 operating unit on the docking station

1 MarSurf M 410 operating unit
19 Docking station (see Section 4.1)

9 For details on inclination correction: see Section 4.3.

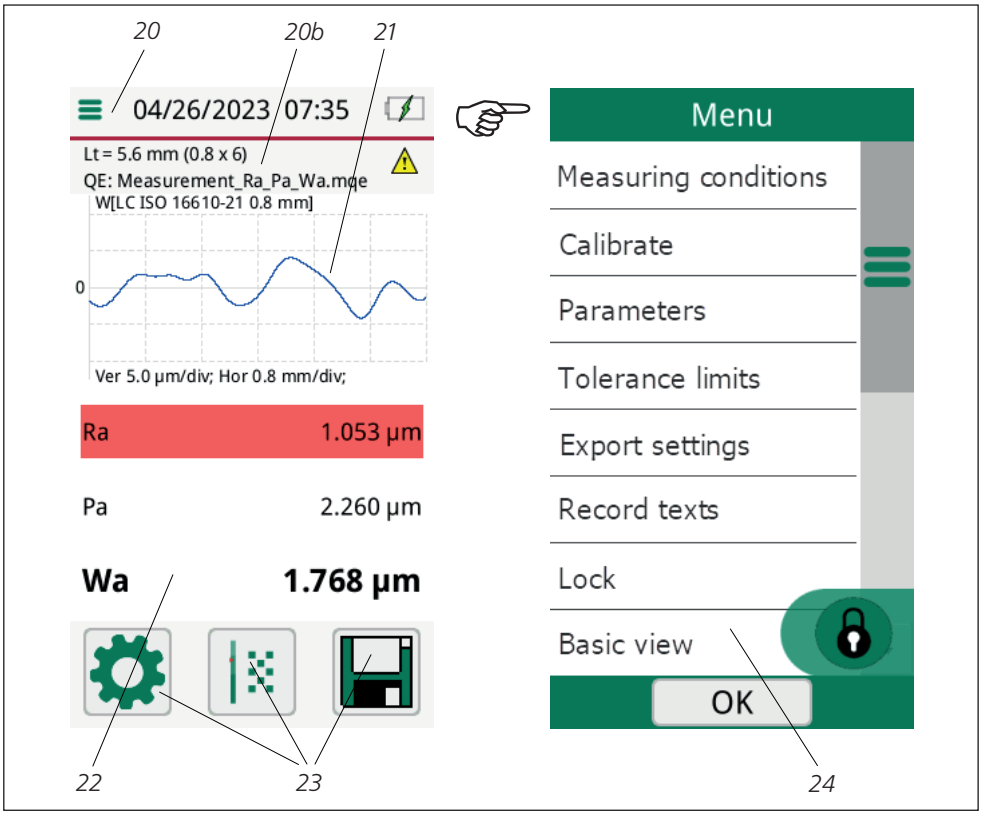


Fig. 4 MarSurf M 410 screen with vertical basic view and menu

20 Title bar with date, time, battery status (☞: tap title bar to display menu)

20b Text box with measuring conditions [10]

Lt *Traversing length (cutoff Lc × number n of sampling lengths)*

QE *Name of the current Quick&Easy Measuring conditions do not meet standards*

21 Profile field: Profile type depending on the selected parameter [11]

*22 Surface parameters with measuring result: **Selected parameter** determines the profile type for the profile field* [11]

Above upper tolerance limit
Result within tolerance
Below lower tolerance limit

23 Function keys

F1, **F2**, **F3** *User-programmable keys for displaying a parameter or performing a function*

24 Menu for settings

Screen is locked; tap symbol to unlock screen.

Basic settings (en) *Menu item for setting language, date, time, unit of measurement*

Settings are locked

10 In the horizontal basic view, the text box *(20b)* is part of the title bar *(20)*.

11 Example: Parameter key **Wa** displays W-profile.

3 Getting started

You can start measuring as soon as you have completed the following steps:
- Connect drive unit to operating unit.
- Put on probe arm unit.
- Switch on the MarSurf M 410 operating unit.
- Define the basic settings.
- Set the measuring conditions.

The measuring station can then be set up in different ways (see Section 4).

Be sure to keep the transport protection (2 pieces of red PE foam)!
If the instrument is to be shipped, the transport protection must be put back in (see Section 8.3).

3.1 Connecting the drive unit to the operating unit

The MarSurf MD 26 drive unit can be connected to the MarSurf M 410 operating unit in two ways:

- Clamp connection (= complete unit):
  The drive unit can be clamped in the operating unit. This complete unit can be placed directly on flat or cylindrical surfaces.
- Cable connection (= individual devices):
  The operating unit and the drive unit can be separated from one another and connected via the USB cable provided.

With the cable connection, the docking station can be used to set up the operating unit at the workstation or to mount it on the wall (see Section 4.1).

Clamp connection

1. Turn the MarSurf M 410 operating unit *(1)* upside down.
2. Using the flat-tip screwdriver (0.8 mm / 0.03 in), turn the two clamping elements *(25)* half a turn counterclockwise (= to the stop), so that the arrow points to the 🔓 symbol (*see Fig. 5)*. Do not use force to turn the clamping elements!

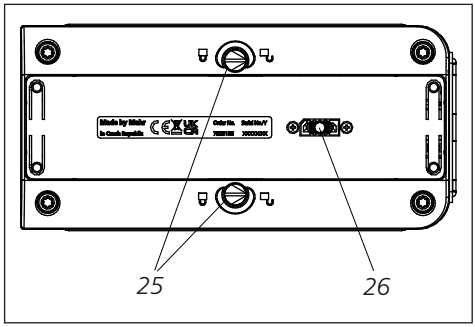


Fig. 5
Components for clamp connection to the MarSurf MD 26 drive unit or docking station

25 Clamping elements with arrow, engage in the clamping recesses (14/34)
- 🔓 *Clamp open*
- 🔒 *Clamp closed*

26 Docking port, clicks into the docking port of the drive unit or docking station

3. Insert the MarSurf MD 26 drive unit *(11)* upside down into the notch of the operating unit *(1) (see Fig. 6)*.
   The docking port *(26)* of the operating unit clicks into the docking port *(15)* of the drive unit.

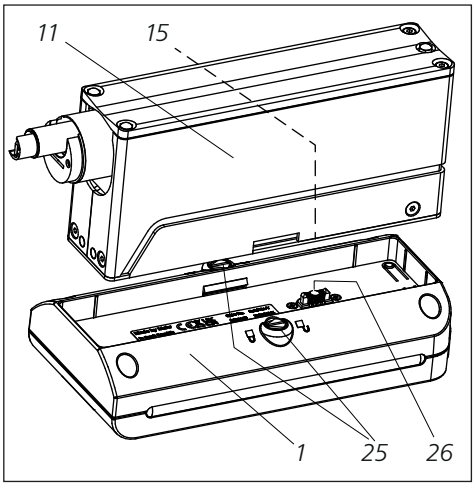


Fig. 6
Clamping the drive unit in the operating unit (= complete unit)

1 MarSurf M 410 operating unit
11 MarSurf MD 26 drive unit
26 Docking port of drive unit
25 Clamping elements
26 Docking port of operating unit

4. Turn the two clamping elements *(25)* half a turn clockwise (= to the stop), so that the arrow points to the 🔒 symbol. Do not use force to turn the clamping elements!

5. Check whether the drive unit is firmly positioned in the oper ating unit.

Cable connection

1. Connect the USB cable provided by its USB-A plug to port A *(8)* of the MarSurf M 410.

2. Connect the micro USB plug of the USB cable to the micro USB port *(17)* of the MarSurf MD 26 drive unit.

3. Insert the dust plug Mahr into the docking port *(15)* on the top of the drive unit.

3.2 Putting on the probe arm unit

The probe arm units that can be used for the integrated BFW 250 probe system are listed in Section 10.

1. Place the probe arm unit *(13)* on the magnetic probe arm holder of the BFW 250 probe system *(12)*. Make sure that the positioning cones on the probe arm holder engage in the corresponding recesses on the magnetic bracket of the probe arm unit.

2. Check if the correct probe arm unit is loaded in the probe arm management (see Section 4.2).

   If the default probe arm (6852403) provided in the set is used directly after delivery, measurements can be taken immediately.

3. If necessary, attach the probe arm protection:
   - Slide the probe arm protection *(27)* into the slot on the front of the drive unit (*see Fig. 7*).
   - Use the Allen wrench (1.3 mm */ 0.05 in*) to screw in the set screw to secure the probe arm protection.

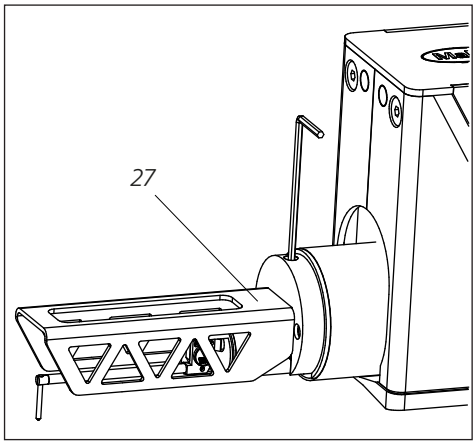


Fig. 7 Attaching the probe arm protection

27 Probe arm protection

The probe arm protection is optimized for the default probe arm 6852403. When using other probe arm units, please check whether the probe arm protection offers sufficient protection in the respective application.

The probe arm protection should always be used, if possible, to protect the probe arm unit from damage. [12]

3.3 Switching on MarSurf M 410

1. Press the green **Start** key *(1)* on the MarSurf M 410 operating unit *(2)*.
2. If the operating unit and the drive unit are not connected:
   - The "Please connect the drive unit to the operating unit" message appears.
   - Connect the drive unit to the operating unit (see Section 3.1).
   - Tap **Next** in the message.

3.4 Defining the basic settings

1. In the "Congratulations" dialog:
   - Tap the **>** key to set the language, followed by the date and time.
   - Select the unit of measurement "mm" or "inch".
   - Tap **OK**.
     The menu appears. Tap **OK** again to display the basic view.

3.5 Setting the measuring conditions

1. In the basic view, tap  (or the **Measuring conditions** option in the menu).
2. Tap  again and set the relevant measuring conditions.
   For details about the measuring conditions, please see Section 5, "Measuring conditions".
3. Tap **OK**. Tap **OK** again.

3.6 Performing further settings

For details about the settings, please see Section 5.



To set the required language:
In the menu, tap **Basic settings (en)**, tap the top **>** key and select e.g. "English (en)".

3.7 Starting a measurement

1. Press the green **Start** key *(1)* on the MarSurf M 410 operating unit *(2)*.

   The machine initializes when starting the first measurement after switching it on. The X-axis of the probe system moves to X = 0 and the Z-axis to the upper stop.

   Then the measurement is performed and evaluated according to the current settings.

3.8 Switching off the MarSurf M 410

1. Press and hold the green **Start** key *(1)* on the operating unit for longer than 2 s.

   Or with cable connection:
   Pull the USB cable out of the micro USB port *(17)* of the drive unit.

12 Exception: when measuring on measuring stands, in small-diameter bores or at points that are difficult to access.

3.9 Charging the battery

The MarSurf M 410 is powered by a built-in rechargeable battery.

When operated in stationary mode, the instrument can be charged by connecting the AC adapter provided to the MarSurf M 410 using the USB cable provided (see below).

The battery requires charging
- if the instrument is being commissioned for the first time,
- if around three months have passed since the battery was last charged,
- if the battery symbol appears in the title bar and only one LED in the green light strip *(3)* is illuminated (i.e. the battery has less than 20% capacity).

Only ever use the AC adapter and the USB cable provided for charging!
If another AC adapter is used, the MarSurf M 410 may be damaged and any warranty will be invalidated.
Using a different USB cable may slow down or not fully charge the MarSurf M 410.

Preparing the AC adapter

1. Select the appropriate mains adapter and plug it into the AC adapter provided.
2. Plug the USB-A plug of the USB cable provided into the AC adapter.

Charging the battery

1. Connect the micro USB plug of the USB cable to micro USB port B *(9)* of the MarSurf M 410 and plug the AC adapter into the mains socket.

   The battery symbol appears in the title bar during the charging process and one of the LEDs in the green light strip *(3)* flashes.

   Measurements can be carried out as soon as the AC adapter has been connected.

   The battery will be fully charged after approx. 3 hours and the instrument automatically switches from rapid charge to trickle charge.
2. To display the battery capacity reached in %: Disconnect the MarSurf M 410 from the AC adapter and tap **Info** in the menu.

The MarSurf M 410 can also be charged by connecting it to a computer via its micro USB port B *(9)*.
If the computer has a special USB charging port, the charging time is also approx. 3 hours.
If, however, the computer has a regular USB port, charging will take approx. 6 to 7 hours.

The maximum capacity of the built-in battery gradually decreases over a long period of use and the built-in battery, therefore, may need to be replaced.
To change the battery: see Section 8.4.

4 Setting up the measuring station

The measuring station can be set up in different ways:

- The MarSurf MD 26 drive unit can be clamped in the MarSurf M 410 operating unit *(see Section 3.1, "Clamp connection")*. This complete unit can be placed directly on flat surfaces *(see Section 4.5, "Three-point support")* or lengthwise on cylinders *(see Section 4.5, "Four-point support")*.
- The MarSurf M 410 operating unit and the MarSurf MD 26 drive unit can be separated from one another and connected using the USB cable provided.
  (See Section 3.1, "Cable connection")
- With the cable connection, the docking station can be used to set up the operating unit at the workstation or to mount it on the wall.
  (see Section 4.1)
- The complete unit (drive unit including the operating unit) can be attached to a MarSurf ST-D, ST-F or ST-G measuring stand.
  An optional holder (6910294) is required for this.
  (see Section 4.6)

4.1 Mounting the operating unit on the docking station

1. Turn the MarSurf M 410 operating unit *(1)* upside down.
2. Using the flat-tip screwdriver (0.8 mm / 0.03 in), turn the two clamping elements *(25)* half a turn counterclockwise (= to the stop), so that the arrow points to the 🔓 symbol (*see Fig. 5)*. Do not use force to turn the clamping elements!
3. Insert the docking station *(19)* upside down into the notch of the operating unit *(1) (see Fig. 8)*.
   The docking port *(26)* of the operating unit clicks into the docking port *(28)* of the docking station.

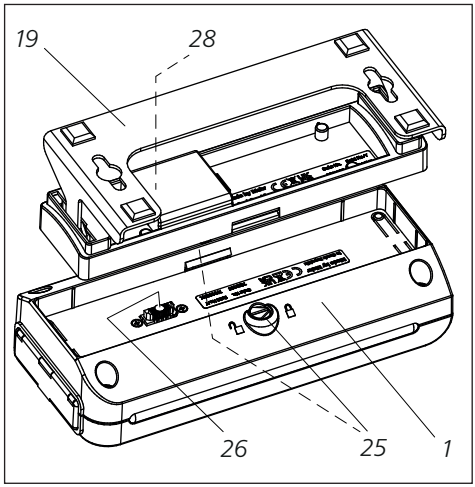


Fig. 8
Clamping the docking station into the operating unit

1 MarSurf M 410 operating unit
19 Docking station
25 Clamping elements
26 Docking port of operating unit
28 Docking port of the docking station

4. Turn the two clamping elements *(25)* half a turn clockwise (= to the stop), so that the arrow points to the 🔒 symbol. Do not use force to turn the clamping elements!
5. Check that the docking station is firmly positioned in the operating unit.

6. Connect the drive unit:
   - Connect the USB cable provided by its USB-A plug to the USB-A port *(33)* of the docking port *(see Fig. 9)*.
   - Connect the micro USB plug of the USB cable to the micro USB port *(17)* of the MarSurf MD 26 drive unit.
   - Insert the dust plug Mahr into the docking port *(15)* on the top of the drive unit.
7. Connect the AC adapter:
   - Connect the second USB cable provided by its micro USB-A plug to the micro USB port *(32)* of the docking station *(see Fig. 9)*.
   - Connect the USB-A plug of the USB cable to the USB-A port of the AC adapter and plug the AC adapter into the mains socket.
8. To establish a wireless connection between the wireless printer or an optional wireless scanner and the MarSurf M 410:
   - Plug the USB Wireless adapter into the USB-A port *(35)* of the docking station *(see Fig. 9)*.
9. Place the docking station at the workstation.

   Or:
   Mount the docking station on the wall. [13]
10. Tilt the base *(30)* of the docking station so that the display can be read comfortably.

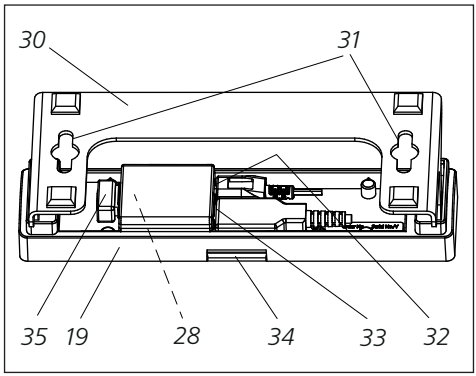


Fig. 9
Docking station components

19 Docking station

28 Docking port

30 Base for tilting the operating unit

31 Slotted holes for wall mounting the docking station

32 Micro USB port for connecting the AC adapter

33 USB-A port for connecting the MarSurf MD 26 drive unit

34 Clamping recesses for clamping the docking station in the MarSurf M 410 operating unit

35 USB-A port e.g. for connecting a USB Wireless adapter

13 with 2 holes (horizontal distance 121 mm / *4.76 in*) and 2 screws (head diameter 10 mm / *0.39 in*).

4.2 Creating a new probe arm unit

The MarSurf M 410 comes with the default probe arm BFW A 10-45-2/90° (6852403) included in the set already created so that measurements can be taken immediately.

To create, load or delete another probe arm unit in the probe arm management:

1. In the basic view, tap (or **Measuring station** in the menu). [14]
   The "Measuring station" view is displayed (see Section 5, "Measuring station").
2. When the view is opened for the first time after switching on, a message is displayed that the machine must be initialized.
   - Tap **OK**.
     The X-axis of the probe system moves to X = 0 and the Z-axis to the upper stop.
3. Tap **BFW A 10-45-2**.

   The probe arm management appears.

   The "Current probe arm" field displays the probe arm unit mounted on the drive unit and loaded in the settings *(see Fig. 10)*.

   The "Created probe arms" field displays the probe arm units created so far. [15]

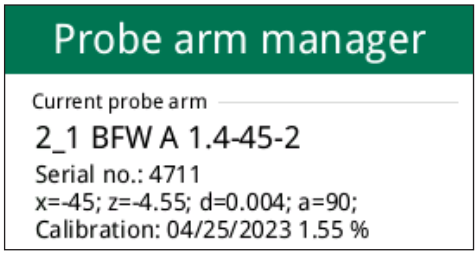


Fig. 10
Probe arm management, "Current probe arm" field

2_1	*Probe arm "2" with stylus element "1"* *The probe arms are numbered consecutively when created (up to max. 20).* *With BFW probe arm units, the stylus element is always "1"*
BFW A	*BFW probe arm unit with basic design A*
hh	*Height of the probe arm above the stylus element (in mm)*
-ll	*Functional length of the probe arm (in mm):* *45 mm = ×1,* *67.5 mm = × 1.5,* *90 mm = × 2,* *112.5 mm = × 2.5,* *135 mm = × 3*
-rr	*Radius of the stylus element (in µm)*
Serial number	*The serial number is entered at the time of creation*
x; z; d; a	*The geometric values of the stylus element are taken from the probe arm template at the time of creation*
Calibration	*Date and correction value of the last calibration*

14 (or tap **Measuring conditions** in the menu, tap the key and slide the scroll bar to "Probe type").

15 On delivery, the field only contains the default probe arm BFW A 10-45-2.

4. To create a new probe arm unit:
   - Tap the key.
     The "Create probe arm" dialog appears. The "Select probe arm template" section lists all the available probe arm templates (name of probe arm, ID no., geometry data).
   - Select the probe arm template of the desired probe arm unit.
   - If the displayed name of the probe arm unit is to be changed in the "Edit name and serial number" section:
     Tap , edit the name and tap **OK**.
   - Tap the key after "<Serial number>", enter the serial number of the probe arm unit and tap **OK**.
   - Tap the **Create** key.
5. To load another probe arm unit:
   - Tap the key.
     The data of the probe arm unit is loaded; the probe arm unit is displayed as the current probe arm unit.
   - Remove the previous probe arm unit from the magnetic probe arm holder of the BFW 250 probe system and put on the probe arm unit that has just been loaded (see Section 3.2).
6. To delete a probe arm unit:
   - In the "Created probe arms" field, select the entry of the probe arm unit to be deleted. [16]
   - Tap the key.
7. Tap the **Close** key.
   The "Measuring station" view is displayed again.

4.3 Correcting the inclination of the datum plane

The rotary knob for inclination correction *(16)* can be used to align the datum plane of the MarSurf MD 26 drive unit ±1.0° to the surface of the measuring object.
A wizard on the MarSurf M 410 facilitates manual inclination setting of the datum plane on the drive unit.

To determine and correct the inclination:

1. Perform a measurement (if not already done).
2. In the basic view, tap (or **Measuring station** in the menu).
   The "Measuring station" view is displayed (see Section 5, "Measuring station").

   The **Inclination** key displays the inclination correction value (in µm/mm).
3. Tap the **Inclination** key.

   If a measurement has not yet been performed, a message is displayed.
   - Tap the **Cancel** key.
   - Tap **OK**. Tap **OK** again to start a measurement.
   - Repeat steps 2 and 3.
4. The measuring object is automatically contacted. The "Inclination correction" dialog displays the wizard *(see Fig. 11)*.

16 The default probe arm BFW A 10-45-2 and the current probe arm unit cannot be deleted (key is gray).

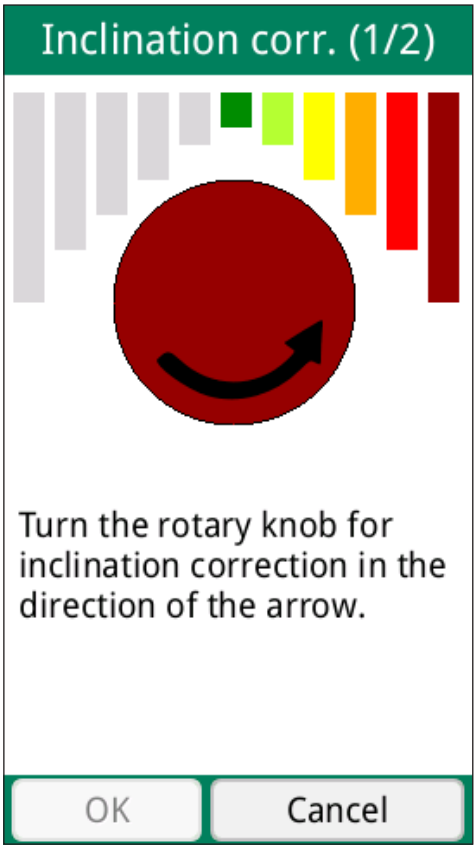


Fig. 11 "Inclination correction" dialog

(1/2) *The wizard must be run several times for the inclination correction*

Inclination deviates considerably from 0°

Inclination is sufficiently corrected

Symbolic rotary knob: Arrow indicates the direction of the inclination correction

Turn rotary knob (16) *to the left*

Turn rotary knob (16) *to the right*

5. If the inclination of the datum plane deviates significantly from 0°, the wizard may need to be run 3 times *(see* (1/2) *in the title bar)* to correct the inclination fully.

   The magnitude of the inclination to be corrected is represented by bars of different length and color *(here:* = *significant inclination)*.

   The symbolic rotary knob is the same color as the greatest inclination.
   The arrow on the symbolic rotary knob indicates the direction in which the rotary knob needs to be turned on the drive unit for the inclination correction *(16)*.

6. Turn the inclination correction knob *(16)* in the direction of the arrow displayed until only the shortest, dark green bar is displayed.
   The arrow on the symbolic rotary knob disappears. A message indicates that the inclination has finished being corrected.

7. Tap **OK**.
   The "Measuring station" view is displayed again.

4.4 Attaching the skid

The skid (6852402) is available as an optional accessory for the BFW 250 probe system.

Probe arms longer than 45 mm cannot be used with the skid.

To perform a skid measurement:

1. Correct the inclination of the datum plane of the drive unit (see Section 4.3).
2. Screw the skid to the front of the BFW 250 probe system using the Allen wrench (1.3 mm / 0.05 in).

3. Adjust the height of the skid if necessary:
   - Approaching it from above, use an Allen wrench (0.9 mm */ 0.035 in*) to turn the screw on the front end of the skid.
     The height adjustment of the skid is approximately 0.35 mm *(0.014 in)* per turn.

   Do not unscrew the skid too far. There is nothing to prevent it from falling off.

4. Activate the skid measurement in the settings:
   - In the basic view, tap (or the **Measuring conditions** option in the menu).
   - Tap the key again and move the scroll bar to "Probe type".
   - Enable the "Skidded tracing" option.

   When the "Skidded tracing" option is selected, the "Contact" and "Lift" functions are automatically disabled.

5. Adjust the height of the drive unit (e.g. using the measuring stand) and/or lower the stylus element so that the skid and the stylus element rest on the measuring object.

4.5 Adjusting the bottom of the device to the measuring object

Any unused support feet and/or fastening screws must be kept in a safe place.

Three-point support

To place the drive unit on flat surfaces:

1. Insert three support feet ◉ *(36)* in the two front and the rear center threaded bores on the bottom of the device and tighten using the special wrench *(see Fig. 12)*.
2. Insert two screws ◎ *(37)* into the two rear threaded bores and tighten them with the Allen wrench (2.0 mm */ 0.08 in*).

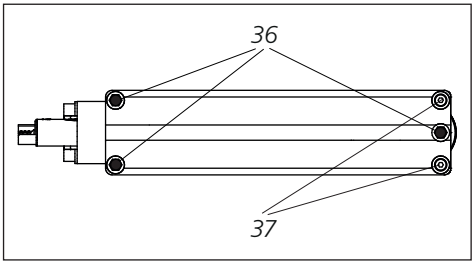


Fig. 12
Three-point support for measurement on flat surfaces

36 Three support feet ◉
37 Two screws ◎

Four-point support

To place the drive unit lengthwise on cylindrical measuring objects (Ø > 500 mm */ 19.69 in*):

1. Insert four support feet ◉ *(36)* into the two front and the two rear threaded bores on the bottom of the device and tighten them with the special wrench *(see Fig. 13)*.
2. Insert a screw ◎ *(37)* into the rear center threaded bore and tighten it with the Allen wrench (2.0 mm */ 0.08 in*).

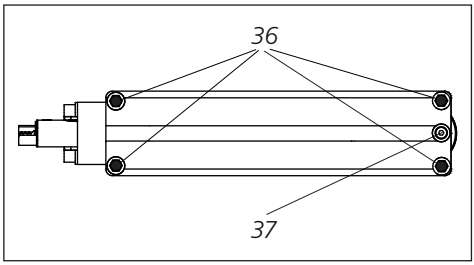


Fig. 13
Four-point support for lengthwise measurement on cylindrical measuring objects

36 Four support feet
37 One screw

If the drive unit is positioned entirely on the measuring object, the rear center support foot must always be removed.

Support on vee-block base

To insert the drive unit into cylindrical holes (Ø > 80 mm */ 3.15 in*) or to place it lengthwise on cylindrical measuring objects (Ø > 80 mm */ 3.15 in*):

1. Insert five screws *(37)* to fix the vee-block base of the instrument and tighten them with the Allen wrench (2.0 mm */ 0.08 in*) *(see Fig. 14)*.

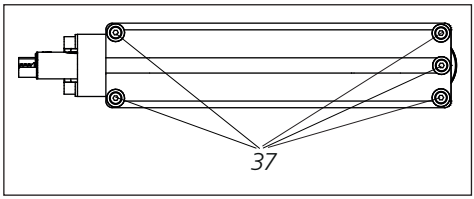


Fig. 14
Support on vee-block base

37 Five screws

Depending on the diameter of the bore, it may be necessary to fit a different probe arm unit to ensure that contact is made between the stylus element and the measuring surface in the bore.

4.6 Mounting the drive unit on the measuring stand

The MarSurf MD 26 drive unit or the complete unit (drive unit including the operating unit) can be attached to a MarSurf ST-D, ST-F or ST-G measuring stand.

An optional holder (6910294) is required for this.

1. Insert the spindle of the holder *(40)* into the opening on the slide *(41)* of the measuring stand and clamp it using the two set screws *(41b) (see Fig. 15)*.

   Be sure to tighten the two set screws *(41b)*, otherwise the drive unit could fall off and get damaged.

2. If the complete unit is to be attached to the measuring stand:
   - Clamp the drive unit *(11)* in the operating unit *(1) (see Section 3.1, "Clamp connection")*.

3. Insert the drive unit *(11)* with its rear short side into the holder *(40)* so that the two knurled screws *(43)* on the holder engage in the threaded bores *(18)* of the drive unit, and tighten the two knurled screws.

4. If only the drive unit is attached to the measuring stand:
   - Connect the operating unit and the drive unit using the USB cable provided *(see Section 3.1, "Cable connection")*.
   - If necessary, mount the operating unit in the docking station (see Section 4.1).
   - Insert the connecting cable through the designated notch in the holder.

5. Use the adjusting screw *(42)* on the holder to align the drive unit parallel to the measuring object.
   The drive unit can be tilted by ±15°.

   For details on the inclination correction: see Section 4.3.

6. Clamp the holder in place with the clamping screw *(44)* to stabilize the measuring system.

   If the inclination is to be roughly corrected again with the adjusting screw *(42)*, the clamping screw *(44)* must be loosened first.

7. Turn the height adjustment handwheel *(41a)* on the measuring stand to bring the probe arm unit closer to the measuring object.

8. To change the measuring object, the drive unit can be tipped up and locked in place while still in the holder.

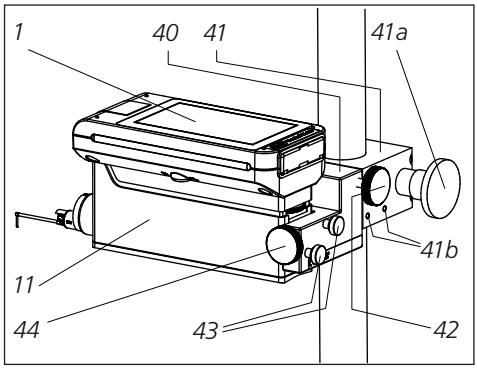


Fig. 15
Drive unit on the measuring stand

1 MarSurf M 410 operating unit

11 MarSurf MD 26 drive unit

40 Holder (6910294)
for MarSurf MD 26 drive unit or complete unit

41 Measuring stand slide

41a Handwheel for height adjustment

41b Set screws
for attaching the holder to the slide

42 Adjusting screw
for correcting the inclination of the holder

43 Knurled screws
for attaching the drive unit to the holder

44 Clamping screw

5 Adjusting the settings

To check and, if necessary, change the instrument settings:

1. Tap the title bar to open the menu *(see Figure 4)*.

   If the screen is locked, tap the symbol.

   Pressing the green **Start** key will close the menu at any time and display the basic view.

   Use the scroll bar on the right of the display to show further menu options.

2. Tap the relevant menu item.
3. Adjust the required settings:
   - ○ Option is not selected.
   - ◉ Option is selected.
   - ☐ Function is not enabled.
   - ☑ Function is enabled.
   - ▢ Input box.
   - Tap this key to edit.
4. Tap **OK**.

Measuring conditions	Quick&Easy:	The name of the loaded Quick&Easy (e.g. "settings_1.mqe") is displayed. There is no Quick&Easy loaded with "temp". To change the measuring conditions, tap the key. Tap **OK** to save the changes. An asterisk (*) will then appear after the name of the Quick&Easy. Tap **Save Quick&Easy** in the menu to save as Quick&Easy (measuring conditions, evaluation conditions, surface parameters, tolerance limits, profile options, export settings).
Traversing length	Lt = 0.48 mm Lt = 1.5 mm Lt = 4.8 mm Lt = 15.0 mm	Fixed traversing length with half pre-travel/post-travel (without pre-travel/post-travel: 1.25 mm, 4.0 mm, 12.5 mm). The cutoff for "Filter Lc = Standard" (see below) is: Lt = 0.48 mm with Lc = 0.08 mm Lt = 1.5 mm with Lc = 0.25 mm Lt = 4.8 mm with Lc = 0.8 mm Lt = 15.0 mm with Lc = 2.5 mm
	Lt = N x Lc	Traversing length = number N of sampling lengths x length of cutoff.
	Lt ▢ mm	Traversing length can be user-defined (e.g. Lt = 16 mm for MOTIF).
	Automatic	The traversing length is set automatically during the measurement depending on the magnitude of the value for RSm or Rz (as per DIN EN ISO 4288 and ASME B46.1). One-off display in title bar "Lt = Automatic".

Number N of sampling lengths	N 5	Number N of sampling lengths (as per ISO, JIS, ANSI/ASME).
	N ☐	Input of N = 1 to 16 (only for "Lt = N x Lc").
Pre-travel/post-travel	Half	Traversing length includes a pre-travel and a post-travel measuring half the length of the cutoff.
	None	Traversing length without pre-travel/post-travel.
Ls filter	Automatic	Profile is automatically filtered after the measurement with a cutoff wavelength of 2.5 µm or 8.0 µm depending on the traversing length.
	2.5 µm 8.0 µm	Ls filter with a fixed value.
	Off	Ls filter is disabled.
Lc filter	Standard	Standard cutoff (as per ISO, JIS, ANSI/ASME).
	Short	Next shortest cutoff.
	0.8 mm	Fixed cutoff.
	Lc ☐ mm	Cutoff freely defined.
Filter MOTIF	A ☐ mm B ☐ mm	Operators A and B for maximum length of roughness motifs / waviness motifs.
Inversion	On	Measured profile points are given an inverted sign for display and evaluation (e.g. in the case of a replica measurement). The measured values of the following parameters are influenced by the inversion: Rp, Rp (ASME), Rpm, Rv, Rpk, Rk, Rvk, Mr1, Mr2, A1, A2, Vo, RPc, Rmr, tp, RSm, Rsk, RS, R HSC, Rku, Rdc, Pmr, Ptp, Pdc, WSm, Wsk, CR, CF, CL, R, AR, Rx, Wx, Wte, AW, W, NR, NCRX, NW, CPM.
	Off	Profile inversion is disabled.
Arc elimination	On	The arc is filtered out from circular arc profiles recorded on convex or concave measuring objects.
	Off	Arc elimination is disabled.
Reference for P-profile	Traversing length	Total traversing length is reference for the evaluation of the P-profile.
	Evaluation length	Evaluation length (N x Lc) is reference for evaluating the P-profile.

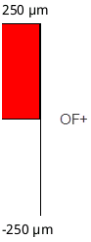
Drive	On	The MarSurf MD 26 drive unit is enabled.
	Off	The MarSurf MD 26 drive unit is disabled (e.g. if the measuring object is moved by a third-party drive). The third-party drive must be set to the selected measuring speed (see below).
Measuring speed	1.0 mm/s 0.5 mm/s 0.1 mm/s	Measuring speed at which the drive unit moves the probe arm unit over the measuring object.
Contact	Automatic	Before each measurement, the measuring object is automatically contacted so that Z = 0 is reached.
	Off	Automatic contacting is disabled. *With "Skidded tracing", the "Contact" function is automatically "Off".*
	☐ µm	Target value for contacting can be user-defined, e.g. to better utilize the measuring range with convex or concave measuring objects.
Lift	Off	Automatic lifting is disabled. *With "Skidded tracing", the "Lift" function is automatically "Off".*
	☐ mm	The target value (above the profile maximum) to which the probe arm unit is to be lifted after the measurement can be user-defined.
	Maximum	Probe arm unit is lifted to the maximum value after the measurement.
Probe type	**BFW A 10-45-2**	Display of current probe arm unit. Tap **BFW A 10-45-2** to create, load or delete another probe arm unit in the probe arm management (see Section 4.2).
	Skidless tracing	Perform measurements with skidless probe system.
	Skidded tracing	Perform measurements with the skid mounted. *With "Skidded tracing", the "Contact" and "Lift" functions are automatically "Off";* *probe arms longer than 45 mm cannot be used.*
Measuring range	±25.0 µm ±250.0 µm	Measuring range: Small measuring range: higher profile resolution Large measuring range: larger probe stroke possible
Calibration		Calibrate the probe arm unit (see Section 8.1).

Parameters	☑ Ra ☐ Rq … ☑ RPc (0.5; -0.5) …	Activated parameters (☑) will be evaluated. Tapping this key opens the **Parameter app** with explanations of the surface parameters.
		To edit the evaluation conditions, tap the key next to the parameter. The dialog with the evaluation conditions for the parameter is displayed.
	C1 ☐ µm C2 ☐ µm	RPc: Upper section level C1, lower section level C2.
	Constant Percentage of Rz	Rmr or tp: Constant values (µm) or percentages of Rz (%) for section levels C and H.
	C / H ☐ µm / %	Rmr or tp (3 possible values) : Section level C or H (unit: see above).
	CREF ☐ %	Rmr or tp: Reference line.
	HSC C ☐ µm	R Hsc: Section level HSC C.
	C1 ☐ % C2 ☐ %	Rdc (3 possible values) or Htp (1 value): Upper section level C1, lower section level C2.
	C / H ☐ µm / %	Pmr or Ptp (3 possible values): Section level C or H (unit: see above).
	CREF ☐ %	Pmr or Ptp: Reference line.
	C1 ☐ % C2 ☐ %	Pdc (3 possible values): Upper section level C1, lower section level C2.
	SCR1 ☐ % SCR2 ☐ %	CR (zone width of the profile peak zone): Upper intersection line SCR1, lower intersection line SCR2.
	SCF1 ☐ % SCF2 ☐ %	CF (zone width of the profile core zone): Upper intersection line SCF1, lower intersection line SCF2.
	SCL1 ☐ % SCL2 ☐ %	CL (zone width of the profile valley zone): Upper intersection line SCL1, lower intersection line SCL2.
Tolerance limits	Ra 0.000 0.000 …	Lower and upper tolerance limit for each parameter.

Export settings		
Export	Measuring results Profile Profile with results Record (PDF)	Select the content to be saved. Saving can be done automatically or by pressing the  key (see "Function keys"). The files are saved in the internal memory or on a microSD card (if a microSD card is in the SD slot) in the following folders: — "Export" for measuring results in CSV format, — "Profiles" for profiles in TXT or X3P format, — "Records" for measuring records in PDF format (see also Section 6.1), — "Results" for profiles with results in MQEP format. These can be read using the "MarWin Roughness Viewer" software.
	Automatic	The activated contents are saved automatically after every measurement.
Export file for measuring results	Replace	The results of a measurement are exported to a CSV file; the results of the previous measurement are overwritten.
	Append	The results of a measurement are exported to a CSV file and written below the existing results of previous measurements.
	Export profile information	Profile information is exported to the CSV file (in columns "Text_1" to "Text_4").
	Generate file name from profile information	Instead of "Results.csv", the file name for measuring result export files is made up of the profile information "Text 1" to "Text 4" enabled under "File name" (see below).
Export file for profile	TXT X3P	Format of profile file: Text file (*.txt) or file according to DIN EN ISO 5436-2 (*.x3p).
File name	Text 1 … Text 4 Date_time	The file name for profiles, profiles with results and measuring records can be made up of the profile information "Text 1" to "Text 4" as well as "Date_time" (Enter this text via **Record texts** in the menu).

Record texts		
Record header	Title, line 1 …	You can enter up to 3 lines of text (each max. 30 characters) for the record header of the measuring record. Tap  to edit.
Query profile information	Text 1 … Text 4 Comment	You can enter up to 5 lines of text ("Text 1" to "Text 4" each max. 30 characters; "comment" max. 60 characters) for the profile information of the measuring record. Tap  to edit. The enabled texts (☑) are automatically retrieved after each measurement and can then be adapted to the measured part.
Lock		Users can enter a code number of their choice between 0 and 9999 to lock the settings of the MarSurf M 410. The code number must be entered again to unlock the settings.
Basic view		Basic view for the evaluation (horizontal to the left, horizontal to the right, vertical, results only).
Power options		
Dim the screen after	10 s 30 s Never	Idle period after which the screen is dimmed and locked. Tapping the  symbol unlocks the screen and switches the normal lighting back on.
Enable sleep mode after	30 s 5 min Never	Idle period after which the MarSurf M 410 switches to sleep mode (unless the AC adapter is connected or there is a cable connection to the computer or the "Wireless pairing" dialog is open). When you press the green **Start** key, the instrument will return to operating mode.
Switch off after	15 min 30 min Never	Idle period after which the MarSurf M 410 switches off (unless the AC adapter is connected or there is a cable connection to the computer or the "Wireless pairing" dialog is open).
Function keys		Assigns a function or parameter to the freely programmable **F1**, **F2**, **F3** keys in the basic view.
Statistics settings		Settings for the statistics (see Section 6.3).
Statistics		"Statistics" view (see Section 6.3).

Basic settings (en)	Language	Select the language for the text displayed.
	Date	Enter the date (format depends on the language).
	Time	Enter the time (format depends on the language).
	mm inch	Select the unit of measurement "mm" or "inch".
Profile options	Profile only Profile with ADC Profile with MRC	Select the profile diagram for the basic horizontal view, the printed measuring record and the PDF measuring record.
Print options		If the settings are correct, you can print by pressing the  key (see "Function keys") (see Section 6.2).
	No printer USB printer Wireless printer	Select the printer type. With "Wireless printer", the printer found is displayed underneath, e.g. "STAR L200-xxxxx" ("xxxxx" = serial number of the printer).
	Print record texts	The enabled profile information (see "Record texts / Query profile information") is printed at the start of the measuring record.
	Print profile	The profile is printed at the end of the measuring record.
	Print automatically	The measuring record is printed automatically after every valid measurement if there is a connection to a printer (see Section 6.2).
Save Quick&Easy	xxx.mqe …	Saves the current settings (measuring conditions, evaluation conditions, parameters, tolerance limits, profile options, export settings, statistics settings) as Quick&Easy (e.g. "settings_1.mqe") in the "QuickAndEasy" folder. If necessary change the file name.
Load Quick&Easy	xxx.mqe …	Tapping an MQE file (e.g. "settings_1.mqe") loads the saved Quick&Easy (measuring conditions, evaluation conditions, parameters, tolerance limits, profile options, export settings, statistics settings).
Load profile	xxx.x3p …	Tapping an X3P file loads the saved profile (D-profile) for a new evaluation.
Load result	xxx.mqep …	Tapping an MQEP file loads the saved profile with results (filtered profiles with the results, measuring conditions, evaluation conditions) for a new evaluation.

Measuring station		"Measuring station" view for setting up the measuring station.
	BFW A 10-45-2	Display of current probe arm unit. Tap **BFW A 10-45-2** to create, load or delete another probe arm unit in the probe arm management (see Section 4.2).
		Positioning the probe arm unit in the "+Z" / "-Z" direction.
		Positioning the probe arm unit in the "-X" / "+X" direction.
		Automatic positioning of the probe arm unit in "-Z" direction until the stylus element is contacted at the measuring object (Z = 0). *Automatic contacting is not possible with "Skidded tracing"* (see "Measuring conditions / Contact").
		Automatic positioning in the parking position (probe system is moved all the way up and into the housing).
		Display of the current stylus element position (bar graph and numeric) for precise positioning. OF+ = Measuring range exceeded upwards OF– = Measuring range exceeded downwards ±xx.x µm = Stylus element has workpiece contact
	±250.0 µm	Tap the **±250.0 µm** key to toggle the measuring range (see "Measuring conditions / Measuring range").
	Inclination	Display of the inclination correction value (in µm/mm). Press the **Inclination** key to open the wizard for correcting the inclination of the datum plane of the drive unit (see Section 4.3).
Remote control		Settings for remote control of the MarSurf M 410 (see Section 6.8).
Remote control		Select the protocol for the remote control.
	Off	No remote control.
	MarCom	Remote control via "MarCom Professional" software.
	S2	Remote control by ASCII commands.
	Suppress dialogs	The dialogs (except TEXT) are suppressed. This means that some touchscreen functions cannot be used.

Interface		Select the port used on the MarSurf M 410.
	Duplex	Cable 4102603 connected to "DATA" *(7)*.
	USB to serial adapter	Adapter cable RS232/USB (e.g. 4102331) connected to "⇐ A" *(8)*.
	Micro USB	Cable 3028323 connected to "⇐ B" *(9)*.
	Wireless	USB Wireless adapter connected to "⇐ A" *(8)*.
Status	**Reset**	Enables a restart of the serial connection when the status is "disabled".
Wireless pairing		Wireless pairing of the MarSurf M 410 with the computer is required for MarWin operation (see below). This usually only needs to be carried out once.
	☑ Device is visible	Displays whether the Wireless functionality of the MarSurf M 410 is active (USB Wireless adapter is plugged into the USB-A port) or not.
	☐ Connected to PC	Indicates whether the MarSurf M 410 is connected wirelessly to the computer or not.
Wireless scanner		Dialog for connecting a wireless scanner to the MarSurf M 410 (see Section 6.7). The connection usually only needs to be established once.
	☑ Device is visible	Displays whether the Wireless functionality of the MarSurf M 410 is active (USB Wireless adapter is plugged into the USB-A port) or not.
MarWin operation		Dialog for operating the MarSurf M 410 with the MarWin software (see Section 6.6).
	No connection	The MarSurf M 410 is not connected to the computer by USB cable or wirelessly.
	Connection established	The MarSurf M 410 is connected to the computer by USB cable or wirelessly.
Assign code		Dialog for assigning codes to a Quick&Easy (see Section 6.7). The symbol indicates that at least one code is already assigned to the respective Quick&Easy. Tap **Edit** to edit the assignments.
Activate barcode scanner mode		Activates barcode scanner mode to start measurements of workpieces in serial operation with the scanner (see Section 6.7).

Info	**Save**	Saves the information as "machineinfo.pdf". Compressed file "marlog.tar.gz" is also created, which should be sent to Mahr Service if a fault occurs.
	Battery	Shows the battery capacity in %.
	Probe position	Shows the current probe position ("-.-- µm" when screen is dimmed).
	Measurements	Shows the number of measurements performed.
	Charge cycles	Shows the number of charging cycles performed.
Operating hours	Standard mode	Shows the normal operating time (in hours).
	Economy mode	Shows the operating time in sleep mode (in hours).
Calibration operations		Shows the last three calibration procedures (date, calculated correction value).
Software		Shows the current software version of the MarSurf M 410.
Parameter app		Shows the explanations of the surface parameters.
Licenses		Shows the Mahr license agreement and the list of OSS packages and licenses used in the MarSurf M 410.
Reset to default settings		Instrument is reset to default settings. The data in the internal memory is retained. Tap **OK** to restore the default settings.
Service		Service menu (only accessible for Mahr service technicians).

6 Evaluation and remote control

6.1 Displaying a customer-specific logo in the measuring record

The header of the measuring record can contain a customer-specific logo, a 3-line record header and 5 lines of profile information.

To display your own company logo in the measuring record:

1. Create an image file of your company logo.
   — File format:
   *.svg, *.png, *.jpg, *.bmp or *.gif
   — Optimal size (W x H):
   135 x 80 pixels [17]

   When printing the measuring record on the wireless printer (see Section 6.2), the company logo must be available as a black and white file (2 colors).

2. Connect the MarSurf M 410 to a computer via its micro USB port ⇨ B *(9)*.
   The MarSurf M 410 is recognized as a new drive "MarSurfM410".

3. Open the "usersettings" folder.

4. Save the image file with the company logo in the "usersettings" folder.

5. Open the "usersettings.ini" file with a text editor (e.g. Wordpad). Microsoft Editor is not suitable!

   The INI file contains the `[ProtocolHeader]` section with the following keys:

```
[ProtocolHeader]
LOGO_NAME=
TITLE_1=
TITLE_2=
TITLE_3=
TEXT_1=
TEXT_2=
TEXT_3=
TEXT_4=
COMMENT_0=
```

6. Enter the name of the image file containing the company logo after the equal sign of the "`LOGO_NAME`" key.
   Example: `LOGO_NAME`=MyLogo.bmp

7. Save the "usersettings.ini" file. You must not change the file format (text file only)!

   The text for the keys "`TITLE_1`" to "`COMMENT_0`" can also be set under **Record texts** in the menu (see Section 5, "Record texts").
   Lines "`TITLE_1`" to "`TEXT_4`" can each contain max. 30 characters, the "`COMMENT_0`" line max. 60 characters. You can use any UTF-8 character set for the text.

17 If the image is a different size, it will automatically be scaled to 135 x 80 pixels.

6.2 Printing the measuring record on a wireless printer

A wireless connection or a cable connection can be established between the MarSurf M 410 and the wireless printer [18]. The printing options must also be selected.

Charge the wireless printer before first use.
To charge, place the printer in its charging cradle. Connect the printer's USB cable to the "Micro-B" port on the back of the charging cradle and to a mains socket with a USB port.

1. Switch on the wireless printer.
2. Establish a wireless connection:

   The wireless connection will remain once the MarSurf M 410 is switched off. When you switch the MarSurf M 410 and the wireless printer back on again, you will be able to print immediately.

   - Plug the USB Wireless adapter into port ⇔ A *(8)* of the MarSurf M 410 or into the USB-A port *(35)* of the docking station.
   - In the MarSurf M 410 menu, tap **Print options** in the menu and select "Wireless printer".
   - Tap the **Search** key.
     The printer found is displayed, e.g. "STAR L200-xxxxx" ("xxxxx" = serial number of the printer).
   - Tap **OK**.
     The printer found appears under "Wireless printer".

   Or establish a cable connection:

   If connecting by cable, the wireless printer should first be charged.

   - Connect the USB cable of the printer to port ⇔ A *(8)* of the MarSurf M 410 or to the USB-A port *(35)* of the docking station using its USB-A plug.
   - Connect the USB-B plug of the USB cable to the micro USB port (see ⇔) on the left side of the wireless printer.
   - In the MarSurf M 410 menu, tap **Print options** and select "USB printer".

3. Select settings for printing:

   If "Print record texts" is enabled, the enabled profile information (see Section 5, "Record texts / Query profile information") will be printed at the start of the measuring record.

   If "Print profile" is enabled, the profile will be printed at the end of the measuring record.

   If "Print automatically" is enabled, the measuring record will be printed automatically after every valid measurement.

   Tap **OK**.
   The menu appears. Tap **OK** again to display the basic view.

   A customer-specific logo can be displayed to the right of the Mahr logo (see Section 6.1).

4. Print measuring record of a valid measurement:

   Tap the function key  assigned with the "Print" function (see Section 5, "Function keys").

5. Switch off the wireless printer.

18 The wireless printer is included in the 6910291 set or available as an accessory (see Section 10).

6.3 Statistics

In the MarSurf M 410, the parameters of the measuring results selected in the Quick&Easy from up to 200 measurements can be saved separately for each Quick&Easy.
The raw data (i.e. the individual values of all measure ments) is retained even after the instrument is switched off.

The number of measurements included in the statistical analysis is determined by the defined sample size (1 to 200). If a sample size > 1 is set in the statistics settings, statistics are enabled. If the sample size has not yet been reached, the statistical analysis is conducted over the available measurements.

When a Quick&Easy is loaded, the associated statistics settings are active and the raw data is stored in the associated statistics file (e.g. "settings_1.json" in the "Stat" folder). [19]
When changing the Quick&Easy, the current status of the statistics are retained. When the Quick&Easy is reloaded, the associated statistical analysis will continue.
If a Quick&Easy is exited (e.g. by changing the measuring conditions, the parameter selection or the tolerance limits), the system switches to the temporary statistics "temp.json". You can work with these temporary statistics as long as no settings are changed. Changing settings will delete the temporary statistics.

Defining settings for statistics

1. Tap **Statistics settings** in the menu.
   The "Statistics settings" dialog appears *(see Fig. 16)*.

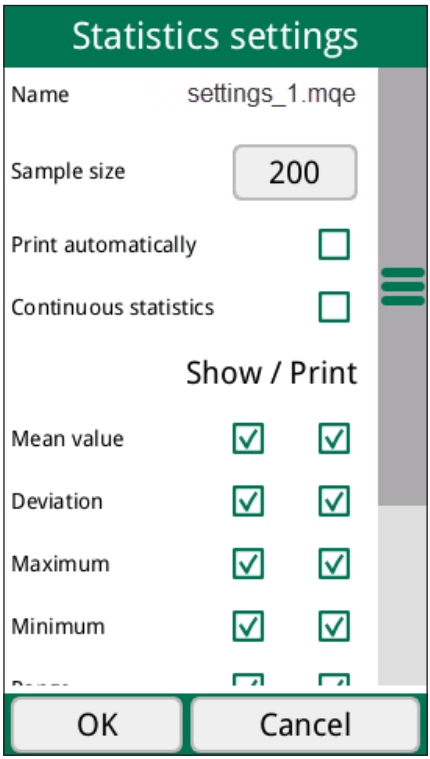


Fig. 16 "Statistics settings" dialog

   The name of the loaded Quick&Easy (e.g. "settings_1.mqe") is displayed.
   If there is an asterisk (*) after the name, the Quick&Easy has been changed and not yet saved, i.e. the temporary statistics are active.

2. Enter the sample size (1 to 200) in the "Sample size" field.
   No statistics are calculated for "0" and "1".

19 In the JSON file, the statistical values and the raw data is stored in millimeters or without dimension (even if the oper ating unit is set to "inch").

3. To display the statistics automatically:

   • Disable the "Print automatically" function.
   When the sample size is reached, the statistics are displayed automatically.

   To print the statistics automatically:

   • Enable the "Print automatically" function.
   When the sample size is reached, the statistics for all the selected parameters are printed automatically.

   With the start of the next measurement, the previous statistics are deleted and a new sample begins.

   When "Print automatically" is enabled, the "Continuous statistics" function is automatically disabled.

4. To always include the last measurements in the statistics:

   • Enable the "Continuous statistics" function.

   The sample size includes the last measurements. After exceeding the sample size, the oldest measurement is lost at the start of the next measurement.

   When "Continuous statistics" is enabled, the "Print automatically" function is automatically disabled.

   The statistics will not be displayed or printed automatically.

5. Select which statistical values to display when the sample size is reached:

   • Enable the "Show" function for the statistical values to be evaluated.

6. Select which statistical values are to be included when printing:

   • Enable the "Print" function for the statistical values to be evaluated.

   If the "Print" function is enabled for the raw data, the individual values of all measurements of the sample size are printed for the selected parameters.

7. Tap **OK**.

Evaluating statistics

1. To delete the most recent measurement from the list of raw data:

   • In the basic view, tap the function key **CE** assigned with the "Delete last measurement" function (see Section 5, "Function keys"). [20]

2. When the sample size is reached, the "Statistics" view *(see Fig. 17)* is automatically displayed, provided the "Print automatically" function is disabled in the statistics settings (see above, step 3).

   To display statistics when continuous statistics are running (see above, step 4):

   • Press the **STAT** function key assigned with the "Statistics" function (see Section 5, "Function keys"). [21]
   Or tap **Statistics** in the menu.

   The "Statistics" view is displayed *(see Fig. 17)*.

20 The **CE** function key is gray if no statistics are active or if the last measurement has already been deleted. It is not, therefore, possible to delete several measurements one after another.

21 The **STAT** function key is gray when no statistics are active.

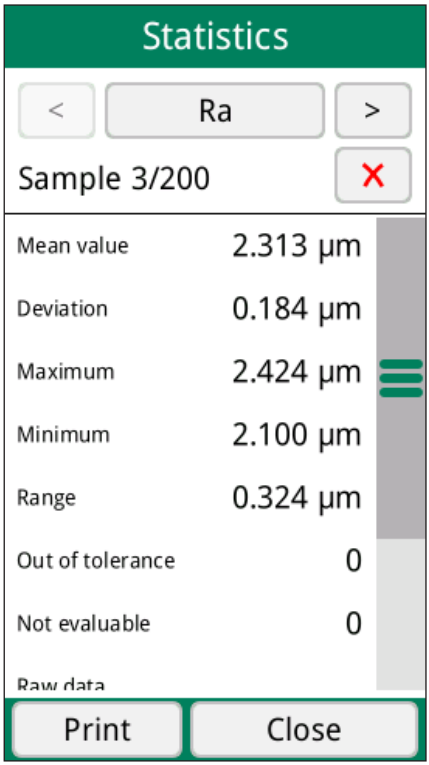


Fig. 17 "Statistics" view

If several parameters are selected, the statistical values of the first parameter are displayed.

3. To display the statistical values of another selected parameter:
   - Tap the key with the current parameter (e.g. **Ra**), select the desired parameter in the "Parameter" dialog box and tap **OK**. Or scroll through the selected parameters using the **<** and **>** keys.
4. The "Sample" line shows how many measurements of the set sample size are already stored in the statistics (here 3 of 200).
5. To delete all the statistics:
   - Tap the [X] key and confirm the warning with **OK**.
6. To print the statistics for the current parameter:
   - Tap the **Print** key.
     The statistics of the parameter are printed line by line *(see Fig. 18)*.

Mahr

MarSurf M 410 (xxxxx)

Printing date 07/07/2023

Statistics Rz

Sample	5/5
Out of tolerance	1
Cannot be evaluated	0
Mean value	1.598 µm
Deviation	2.142 µm
Maximum	5.431 µm
Minimum	0.616 µm
Range	4.815 µm
1:	0.640 µm
2:	0.652 µm
3:	0.654 µm
4:	0.616 µm
5:	5.431 µm

Fig. 18 Statistics of a parameter (all statistical values enabled)

xxxxx	*Serial number of the operating unit*
Out of tolerance	*Number of measurements below or above tolerance*
Cannot be evaluated	*Number of measurements which cannot be evaluated for the parameter*
1 – 5	*Raw data*

7. Tap **Close**.

6.4 Recording results with "MarWin Roughness Viewer" software

The "MarWin Roughness Viewer" software (from version 1.00-14) allows you to print out the measuring record of a measurement on a connected printer or save it as a PDF file.

The USB port of the computer must be configured in BIOS in such a way that it is not possible to boot via USB.

1. Connect the MarSurf M 410 to the computer via its micro USB port ⇔ B *(9)*.
   The MarSurf M 410 is recognized as a new drive "MarSurfM410".
2. Open the "MarWin Roughness Viewer" software.
3. The "Profile Explorer" view allows you to copy/move the results files contained in the connected MarSurf M 410 to the computer.

   The "Create record" view allows you to assign the results file(s) to the measuring record and create the measuring record.

For details: See online help of "MarWin Roughness Viewer" software.

6.5 Transferring measuring results using "MarCom Professional" software

The measuring results from the MarSurf M 410 can be sent directly to Microsoft Excel, a text file or via keyboard code to any application using the "MarCom Professional" software (from version 5.4-1).

1. Connect data cable DK-U1 (4102603) to the MarConnect duplex port "DATA" *(7)* on the MarSurf M 410 and to the USB port of a computer.
2. Switch on the MarSurf M 410.
3. Tap **Remote control** in the menu of the MarSurf M 410.
   Select "MarCom" in the "Remote control" field.
   In the "Interface" field, select "Duplex".
   Tap **OK**.
4. Open the "MarCom Professional" software (from version 5.4-1).
   The "MarSurf M 410" instrument with "DK-U1" connecting cable is automatically recognized and displayed.
5. Adjust the settings as required in the "MarCom Professional" software:
   - Select **Measuring instruments/Edit** from the menu in the software.
   - If necessary, enter a description for the instrument.
   - For "Data request via", select the trigger to be used to initiate measurements on the MarSurf M 410.
   - On the "Device parameters" tab you can easily enter the tolerance limits for all parameters and send them to the MarSurf M 410.
   - Select the relevant destination application on the "Transfer to" tab.
   - Confirm the changes with **OK.**

For details: see operating instructions for the "MarCom Professional" software.

6. Measurements on the MarSurf M 410 can be started in different ways:
   - Either press the green **Start** key on the MarSurf M 410.
   - Or activate the trigger selected in the "MarCom Professional" software (e.g. F2 key).

7. After each measurement, the numerical values of all the activated parameters on the MarSurf M 410 are transferred to the selected destination in the following format:
   — Unit as shown on the MarSurf M 410 screen (even though the unit is not sent),
   — Decimal places as shown on the MarSurf M 410 screen.

Results that cannot be evaluated are exported as "-.--".

6.6 MarWin operation with MarWin software

The MarSurf M 410 can be connected to a computer by cable or wirelessly.
The MarWin software [22] (e.g. "MarWin EasyRoughness") can then perform and evaluate measurements with the drive unit of the MarSurf M 410.

The separate operating instructions (3764809) explain how MarWin works. Download from *metrology.mahr.com* (search for "6910290") or via QR code:

22 MarWin from version 14.00-07.

6.7 Starting measurements by scanning

The "QR code/barcode scanner" option allows a USB scanner or wireless scanner (both operating in HID mode) to be connected to the MarSurf M 410 surface measuring instrument.

A USB scanner and a wireless digital scanner are available as accessories (see Section 10). [23]

Connecting a scanner to the surface measuring instrument can simplify and speed up processes (e.g. in the receiving inspection).

Commissioning and operation of these scanners are described in the separate operating instructions (3764814). Download from *metrology.mahr.com* (search for "6910290") or via QR code:

6.8 Remote control by ASCII commands

The MarSurf M 410 can be controlled remotely using ASCII commands, e.g. via statistical process control software.

1. Switch on the MarSurf M 410.
2. Connect the MarSurf M 410 to the relevant port on the computer.
3. Tap **Remote control** in the menu of the MarSurf M 410.
   Select "S2" in the "Remote control" field.
   Select the relevant entry from the "Interface" field (see Section 5, "Remote control / Interface").
   Tap **OK**.

The list of available ASCII commands is available from Mahr on request.

23 These scanners can also be used on MarWin measuring stations. For commissioning of another scanner: see also the corresponding operating instructions.

7 Troubleshooting

Error / `Message`	**Cause**	**Remedy**
➔ Parameters		
`-.--` (instead of measuring value)	Condition for calculating the result is not satisfied.	
	For RzJ: There are not 5 peaks and 5 valleys present in each sampling length.	If necessary, select a longer traversing length.
	For R3z: There are not 3 peaks and 3 valleys present in each sampling length.	If necessary, select a longer traversing length.
	For Rmr or Pmr (tp or Ptp for ASME): The total height *Rt* or Pt of the R-profile or P-profile is ≤ 0.8% of the measuring range.	If necessary, select a smaller measuring range.
	For RSm or WSm: The arithmetic mean deviation Ra or Wa of the R-profile or W-profile is ≤ 0.4% of the measuring range.	If necessary, select a smaller measuring range.
	For Rsk or Wsk: The total height *Rt* or Wt of the R-profile or W-profile is ≤ 1.6% of the measuring range.	If necessary, select a smaller measuring range.
	For R, AR, W, AW, Rx, Wx, Wte, NR, NCRX, NW, CPM: Evaluation of the motifs produces no roughness/waviness.	Check the setting of operators A and B for the "Filter MOTIF".
	For Rpk, Rk, Rvk, Mr1, Mr2, A1, A2:	
	— The total height Rt of the R-profile is ≤ 0.8% of the measuring range.	If necessary, select a smaller measuring range.
"(number!)" in the name of the parameter, e.g. `Rk (9!) 0.115 µm`	— Fewer than 10 classes of the material ratio distribution are within the range of the core profile.	Check the machining of the measuring object.
"(S!)" in the name of the parameter, e.g. `Rk (S!) 6.395 µm`	— The material ratio curve is not S-shaped as stipulated by ISO 13565-2.	Check the machining of the measuring object.

Error / `Message`	**Cause**	**Remedy**
➔ Battery		
The battery symbol is displayed (i.e. the battery has less than 20% of its capacity).	The M 410 battery is almost exhausted.	Charge the battery (see Section 3.9). It takes approx. 7 hours to fully charge the battery. Charging takes longer if the instrument is switched on.
`Attention: Connect the AC adapter!`	The M 410 battery is exhausted.	Charge the battery (see Section 3.9). It takes approx. 7 hours to fully charge the battery. Charging takes longer if the instrument is switched on.
The battery of the MarSurf M 410 is not charged via the USB connection to the computer.	The computer has put the MarSurf M 410 into energy-saving mode.	Right-click the icon (Start) in the taskbar of the computer, select **Device Manager** and open the "Universal Serial Bus controllers" menu. Double-click the USB mass storage device entry for the MarSurf M 410. Click the **Change settings** button. In the "USB Mass Storage Device Properties" dialog box, switch to the "Power management" tab. Uncheck the "Allow the computer to turn off this device to save power" check box and confirm with **OK**. If necessary, repeat this procedure for the USB root hub or the hub to which the M 410 is connected.
Instrument not working after a battery change.	Battery has not been inserted correctly.	Open the instrument, take out the battery and replace it as described (see Section 8.4).

Error / `Message`	**Cause**	**Remedy**
➔ Switching on		
`Initialization failed. Please make sure that the drive unit is not blocked.`	The probe arm unit may be blocked by an object.	Make sure that no object is blocking the probe arm unit.
	The probe arm unit cannot be moved to the start position (right to the front, right to the top), e.g. because it is deflected upward beyond the measuring range.	Tap **Measuring station** in the menu (see Section 5, "Measuring station"). When "OF+" is shown next to the bar display of the stylus element position, tap the  key (+Z) until the bar turns blue. The drive unit is initialized when the next measurement starts. As long as the drive unit is not initialized, all positioning keys of the "Measuring station" view are inactive (except ).
➔ Measure		
`No contact with the workpiece.`	Automatic contacting is enabled. However, contact cannot be made with the measuring object during contacting because the probe arm unit cannot be moved further down in Z-direction.	Reposition the measuring object or the drive unit.
	Automatic contacting is disabled. When starting the measurement, the stylus element was not in contact with the measuring object.	Tap **Measuring station** in the menu (see Section 5, "Measuring station"). Observe the bar display of the stylus element position. Position the probe arm unit with  (-Z) and  (+Z) until the stylus element makes contact with the measuring object.
	The BFW probe arm unit is deflected upwards – beyond the measuring range and the probe protection contact – to the mechanical stop (e.g. after a collision or a probe arm change).	Gently tap the top of the probe arm unit to return it to its working position.

Error / Message	**Cause**	**Remedy**
OF-. Please make sure that the transport lock has been removed, and that the probe is in contact with the testpiece.	The lower limit of the measuring range has been exceeded; measurement has been aborted; no evaluation possible.	Reposition the measuring object or the drive unit.
OF+, measurement canceled	The upper limit of the measuring range has been exceeded; measurement has been aborted; no evaluation possible.	Reposition the measuring object or the drive unit.
	The BFW probe arm unit is deflected upwards – beyond the measuring range and the probe protection contact – to the mechanical stop (e.g. after a collision or a probe arm change).	Gently tap the top of the probe arm unit to return it to its working position.
➔ Calibration		
Measurement not plausible: Please check the nominal value and start the calibration.	The measuring value for Ra or Rz deviates significantly from the nominal value entered.	• Check the measuring setup. • Correct the inclination of the datum plane of the drive unit (see Section 4.3) so that the stylus tip is perpendicular to the measuring object. • Check the probe arm unit. • Check the nominal Rz or Ra value. • Repeat the calibration. • If necessary, send in the probe arm unit for inspection.
Correction value is outside the ±15% range: Please check the nominal value and start the calibration.	The calculated probe correction value lies outside the tolerance of ±15%.	• Check the measuring setup. • Correct the inclination of the datum plane of the drive unit (see Section 4.3) so that the stylus tip is perpendicular to the measuring object. • Check the probe arm unit. • Check the nominal Rz or Ra value. • Repeat the calibration. • If necessary, send in the probe arm unit for inspection.

Error / Message	**Cause**	**Remedy**
➔ Settings, data		
Settings are locked.	The instrument settings cannot be modified because they are locked.	To change the settings, disable the lock in the menu (see Section 5, "Lock").
Changed texts were found on the mass storage. Please select the variant to be used. TITLE_1=Abc ... LOGO_NAME= TITLE_1=Abc Deg ... LOGO_NAME=logo.bmp	The "usersettings.ini" file with the customer-specific logo, record header and profile information has been changed on the computer and does not correspond to the record header saved in the loaded Quick&Easy.	Tap the button with the record header version to be used for the current measuring object. Save the Quick&Easy if necessary.
The mass storage is full. Please move the data to a PC, then restart the device.	The mass storage is full and cannot hold further results files.	Copy the files stored in the instrument (results, profiles, measuring records, statistics) to a computer via the USB port and delete the files in the mass storage. Switch the MarSurf M 410 off and on again.
The SD card is full. Please archive the data on another storage device.	The SD card is full and cannot hold further results files.	Transfer the files stored on the SD card (results, profiles, measuring records, statistics) to a computer and delete the files on the SD card.
The "usersettings.ini" file was corrupted and has been deleted.	The INI file with the customer-specific logo, record header and profile information has been deleted (e.g. because it was incorrectly edited on the computer).	Tap **Record texts** in the menu. This will create a new, empty INI file. If necessary, redefine the customer-specific logo, the record header and the profile information (see Section 5 or Section 6.1).
The "usersettings.ini" file is corrupted and could not be deleted.	The INI file with the customer-specific logo, record header and profile information cannot be deleted (e.g. because it was incorrectly edited on the computer and write-protected).	Connect the MarSurf M 410 to a computer. Open the "usersettings" folder on the "MarSurfM410" drive and delete the "usersettings.ini" file. If necessary, redefine the customer-specific logo, the record header and the profile information (see Section 5 or Section 6.1).

Error / `Message`	**Cause**	**Remedy**
➔ Ports		
In case of a wireless connection, the transmission range is less than 4 meters *(13.1 ft)*	An obstacle in the direct line of sight between the M 410 and the computer or the printer can reduce the transmission range of a wireless connection down to 2 meters *(6.6 ft)* (especially if this obstacle is close to one of the instruments).	Remove the obstacle if possible. Take care not to stand between the instruments when using the MarSurf M 410.
	There is a relatively strong WLAN transmitter or another strong transmitter in the 2.4 GHz frequency band in the immediate vicinity of the M 410, the computer or the printer.	Remove the transmitter if possible.
When saving, the mass storage device of the MarSurf M 410 does not log back onto the computer.	The computer has put the MarSurf M 410 into energy-saving mode.	Right-click the ⊞ icon (Start) in the taskbar of the computer, select **Device Manager** and open the "Universal Serial Bus controllers" menu. Double-click the USB mass storage device entry for the MarSurf M 410. Click the **Change settings** button. In the "USB Mass Storage Device Properties" dialog box, switch to the "Power management" tab. Uncheck the "Allow the computer to turn off this device to save power" check box and confirm with **OK**. If necessary, repeat this procedure for the USB root hub or the hub to which the M 410 is connected.
Windows message: MarSurfM410(D:) There is a problem with this drive. Check the drive now and fix the problems.	Windows has detected an error while writing to the "MarSurfM410" drive.	Click **OK** in the dialog. After that, everything should work normally again.

Error / `Message`	**Cause**	**Remedy**
➔ Printer		
`Printer "STAR L200-xxxxx" could not process the print job. Is it switched on and connected?`	The printer is not switched on.	Switch on the printer.
	There is no wireless connection between the MarSurf M 410 and the printer (e.g. because the USB Wireless adapter is not plugged in).	Make sure that the USB Wireless adapter is plugged into port ⇐ A *(8)* of the MarSurf M 410 or the USB-A port *(35)* of the docking station (see Section 6.2).
`No wireless printer could be detected.`	The printer is not switched on and therefore cannot be found when searching for wireless printers.	Switch on the printer. Tap **Print options** in the menu, select "Wireless printer" and tap **Search** (see Section 6.2).
`The USB Wireless adapter was not found.`	Cannot search for wireless printers because the USB Wireless adapter is not plugged in.	Plug the USB Wireless adapter into port ⇐ A *(8)* of the MarSurf M 410 or into the USB-A port *(35)* of the docking station (see Section 6.2).
`No USB printer could be detected.`	The printer is not switched on.	Switch on the printer.
	There is no cable connection between the MarSurf M 410 and the printer.	In the menu, tap **Print options** and select "USB printer" (see Section 6.2).

8 Maintenance, cleaning and transport

The MarSurf M 410 and the probe arm unit are calibrated at the factory and do not need to be adjusted.
We nevertheless recommend having the measuring accuracy checked at regular intervals or if there is any suspicion that the measured values are incorrect. This is done by calibrating with a separate geometry standard (see Section 8.1).

The instrument and all other components of the MarSurf M 410 set must be protected from prolonged exposure to sunlight, high humidity and dust.

High temperatures can shorten the service life of electronic devices, damage batteries and deform or melt certain plastics or synthetic materials.

The instrument must not be stored in cold environments. When it returns to its normal temperature, moisture can form internally and damage the electronic circuits.

Do not touch the stylus element. Protect it from impacts.
Do not allow grease, oil or other liquids to get into the probe system or probe arm unit.

If necessary, apply one of the optional protective films (6910240) to the screen *(5)* of the MarSurf M 410.

8.1 Calibrating the probe arm unit

A separate geometry standard (e.g. MGS 3) is required for calibration.

For "MGS" type standards, we recommend using the optional standard holder (7026421), in which the MarSurf MD 26 drive unit is automatically positioned correctly to the standard. [24]

1. In the basic view, tap (or **Measuring station** in the menu). Use the key to position the probe arm unit up at the upper stop.
2. Place the drive unit on its vee-block base, e.g. into the 4 edges on the standard holder *(51) (see Fig. 19)*.
3. Position the standard *(50)* in such a way that the entire traversing length is within the field with the defined roughness *(see Fig. 19)*. When using the standard holder: Push the standard to the right against the wavy line . [25]

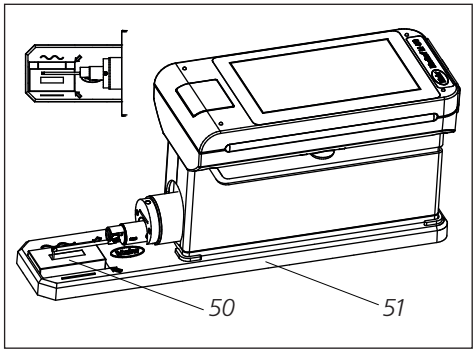


Fig. 19
Calibration with standard holder 7026421

50 "MGS" type standard
51 Standard holder

24 For "PGN" type standards, the standard holder is not required.

25 If you move the standard to the left against the straight line , the optical flat is measured.

4. Place the drive unit at the required height. When using the standard holder, the drive unit is automatically at the correct height.

5. If necessary, correct the inclination of the datum plane of the drive unit (see Section 4.3).

6. In the basic view, tap the  function key that is assigned with the "Calibrate" function (see Section 5, "Function keys").
Or tap **Calibrate** in the menu.

7. Select the calibration method.

8. Read off the nominal Ra or Rz value from the calibration certificate of the standard.

9. Enter the nominal value for the standard in the "Nominal value" input box.

10. Select the relevant traversing length in the "Measuring conditions" field:

    - For "Standard" the traversing length will be automatically calculated in accordance with DIN EN ISO 4288 / ASME B46.1 depending on the nominal value. Half a pre-travel and post-travel is added to this.
    - For "Lt = 15.0 mm Lc = 2.5 mm" and "Lt= 4.8 mm Lc = 0.8 mm", measurement is performed with a fixed traversing length (incl. half pre-travel/ post-travel).

    Tap **OK**.

11. Tap the **Start calibration** button.
Three measurements will be performed automatically.

12. After the third measurement, a correction value will be calculated from the three measured values (Rz or Ra).

    — If the "Correction value (new)" is in a range of ±15%, it can be applied to the instrument settings by tapping **OK**.
    — You can return to the "Calibrate" dialog by tapping **Cancel** to repeat the calibration process.
    — If the correction value exceeds the above range, an error message appears.
    Remedy: Tap **OK**, check the measuring setup, the probe arm unit, the nominal value entered and that the stylus element is vertical, and repeat the calibration.

13. If repeated calibration attempts do not produce a viable result, the probe arm unit is probably faulty. It should be sent in to be tested.

14. Store the standard together with the calibration certificate safely, e.g. in the dedicated compartment in the transport case of the MarSurf M 410 *(see Fig. 20)*.

8.2 Cleaning

- If necessary, clean the MarSurf M 410 operating unit and the MarSurf MD 26 drive unit with a soft, lint-free cloth slightly moistened with water or a conventional cleaning agent for plastics.
- Clean the magnetic probe arm holder of the BFW 250 probe system *(12)* and the magnetic holder of the probe arm unit *(13)* as needed with compressed air to remove magnetic or other shavings and dirt, for example.
  This can be done using a universal air gun with a 1.5 mm *(0.06 in)* standard nozzle and a 6 bar *(87.02 psi)* compressed air connection.

  Do not use a safety or silencing nozzle to clean the probe system and probe arm unit as the pressure will be too low.

When cleaning, do not allow any liquids to enter the instrument!
Do not use cleaners containing plastic-dissolving chemicals (in particular acetone) or alkaline cleaners (lyes).

8.3 Storage, transport and shipping

Caution:
The drive unit and probe arm unit can be damaged during transport or shipping. The following instructions must be observed when transporting internally or shipping the instrument. Otherwise, all warranty claims will be void.

Do not allow the USB cable to become kinked or overextended.

Protect the thermal paper from intense light radiation and heat (approx. 80°C / 176 °F).
For archiving purposes, do not use clear plastic sleeves or adhesives that contain solvents.

When the MarSurf M 410 and accessories are not in use, we recommend storing them in their transport case. For this purpose, the same steps as for internal transport must be followed (see below).

For internal transport and shipping:

1. Remove the probe arm unit and place it in its storage box.
2. Remove the probe arm protection (if it is mounted on the drive unit).
3. Move the drive unit and the probe system to the safe parking position (see Section 5, "Measuring station / ").
4. Switch off the MarSurf M 410.

5. Internal transport:
It is possible to store either the complete unit (drive unit together with the operating unit) or the individual devices (drive unit and operating unit separated from one another) in the case.

Complete unit:

- Remove the loose foam insert from the compartment for the drive unit *(see Fig. 20)* and place it in the compartment for the operating unit.
- Store the complete unit (drive unit together with the operating unit) in the compartment for the drive unit.

Individual devices:

- Separate the MarSurf MD 26 drive unit from the MarSurf M 410 operating unit (see Section 3.1).
- Insert the loose foam insert from the drive unit compartment into the compartment so that the side with the recessed grip is facing up.
- Store the drive unit and the operating unit in their compartments.

6. Shipping:
The individual devices (drive unit and operating unit separated from one another) must be stored in the case:

- Separate the MarSurf MD 26 drive unit from the MarSurf M 410 operating unit (see Section 3.1).
- Remove the loose foam insert from the compartment for the drive unit *(see Fig. 20)*.
- Store the drive unit and the operating unit in their compartments.
- Place the loose foam insert on the right side of the drive unit so that the side with the recessed grip is facing down.
- Stick the transport protection (2 pieces of red PE foam) between the cylindrical part of the MarSurf MD 26 drive unit and the foam in the transport case.

7. Store the remaining accessories in the transport case *(see Fig. 20)*.

8. Shipping:
Pack the transport case in the shipping box (3700019) using the two foam inserts (3003965).

To order the original shipping packaging necessary for shipping (3700019 + 3003965), contact us on:
Phone: +49 551 7073-0
Email: info@mahr.com

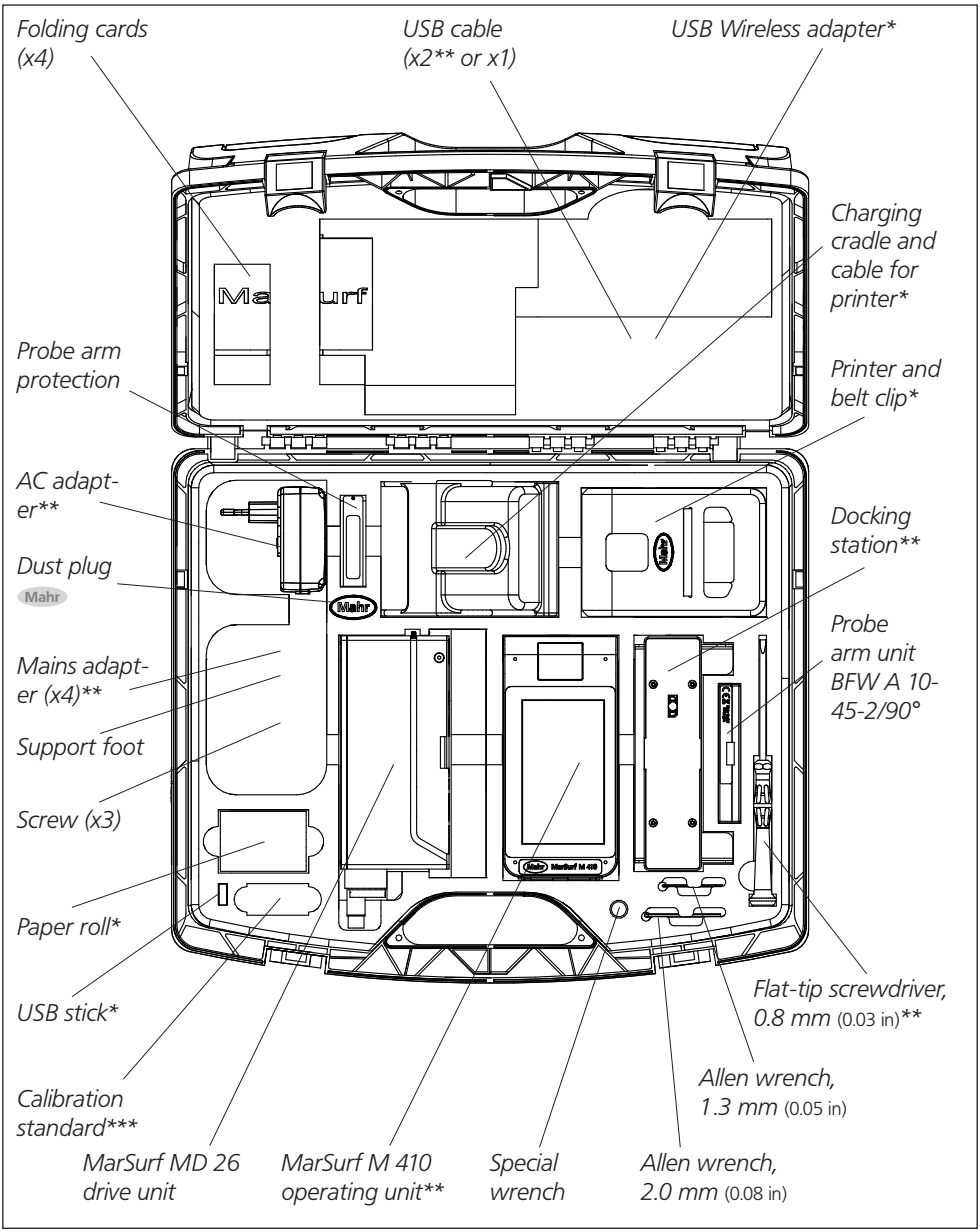


Fig. 20 Equipment of the case with set 6910291 ("MarSurf M 410 (with printer)")

* *Component not included in sets 6910290* ("MarSurf M 410 (without printer)"), *6910296* ("MarSurf M 410 PC"), *6910292* ("MarSurf MD 26"), *6910297* ("MarSurf MD 26 PC")

** *Component not included in sets 6910292* ("MarSurf MD 26"), *6910297* ("MarSurf MD 26 PC")

*** *Optional component*

Product documentation: in the shipping box

8.4 Replacing the battery

The maximum capacity of the built-in battery gradually decreases over a long period of use and the built-in battery, therefore, may need to be replaced.

The battery should only be replaced by trained specialist staff.

Only the lithium-ion battery of 3.7 V / 3150 mAh (6200001) may be used, otherwise the instrument might be destroyed.

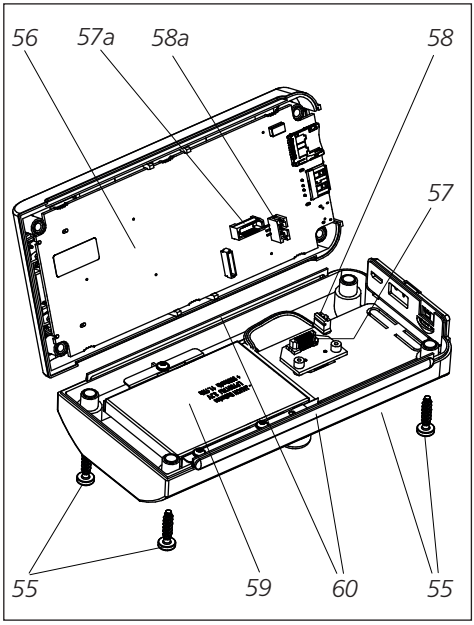


Fig. 21
Battery change

55 Four housing screws
56 Top of the operating unit
57 Plug on board of docking port
57a Plug socket of the motherboard
58 Battery plug
58a Battery connection on the motherboard
59 Battery with glued on fastening
60 Two handle strips

1. Switch off the MarSurf M 410.
2. Separate the operating unit from the drive unit (see Section 3.1) or remove it from the docking station (see Section 4.1).
3. Using a TORX® screwdriver (T20), loosen and remove the four screws *(55)* on the bottom of the MarSurf M 410 operating unit.
4. Place the operating unit on its bottom.
5. Carefully tilt the top *(56)* of the operating unit 90° to the left (like the cover of a book) *(see Fig. 21)*.
6. Carefully disconnect the plug *(58)* from the connector *(58a)* on the motherboard.
7. Use a TORX-PLUS® screwdriver (8IP) to loosen the three screws on the battery mount *(59)*.
8. Remove the battery with the glued on mount.
9. Insert the new battery incl. mount (6200001).
10. Tighten the three self-tapping screws on the battery mount *(59)* with the TORX-PLUS® screwdriver (8IP) to a torque of 0.4 Nm *(0.3 ft lb)*.
11. Carefully connect the plug *(58)* of the battery to the connector *(58a)* on the motherboard. Make sure that the cables are positioned next to the board *(57)* of the docking port *(see Fig. 21)*.
12. Carefully replace the top of the operating unit.
    The plug *(57)* clicks into the plug socket *(57a)*.
13. Make sure that the two handle strips *(60)* are in the correct position.

14. Replace the four self-tapping screws *(55)* and turn them counterclockwise with the TORX®screwdriver (T20) until they click into the thread.
    Then tighten the screws to a torque of 1 Nm *(0.74 ft lb)*.
15. Switch on the MarSurf M 410 to make sure it is working properly.
16. Check the settings on the MarSurf M 410.
17. Fully charge the MarSurf M 410 battery.

Dispose of the old battery properly (see Section 13).

8.5 Installing a software update

All settings and all profiles, results and measuring records saved in the memory are retained during software updates.

Software must only be updated when the battery is at least 50% charged or the MarSurf M 410 is plugged into the mains using the AC adapter!

The MarSurf MD 26 drive unit must be connected to the MarSurf M 410 operating unit for the software update!

To install a new software version:

1. Connect the MarSurf MD 26 drive unit to the MarSurf M 410 operating unit.
2. Switch on the MarSurf M 410.
3. Download the software update "ps10_PS10_x.yy-zz_armhf.deb.gpg" [26] from *metrology.mahr.com* (search for "6910290") or via QR code:
4. Copy the DEB.GPG file with the software update to the master directory (top level) of a FAT or FAT-32-formatted microSD card. Insert the microSD card in the SD slot *(6)*.

   Or:

   Connect the MarSurf M 410 to a computer via its micro USB port ⇔ B *(9)*.
   Copy the DEB.GPG file with the software update to the master directory (top level) of the internal memory.
5. Switch the MarSurf M 410 off and on again. The new software version will be installed automatically. This can take approx. 3 mins. The MarSurf M 410 may restart several times. At the end of the installation, confirm the "Update concluded" message with **OK**.

26 x.yy-zzz = version number

9 Scope of delivery

6910290 MarSurf M 410 set (without printer)"

7019764 MarSurf M 410 operating unit (17 language toggle)

7020593 MarSurf MD 26 drive unit with integrated BFW 250 probe system

6852403 Default probe arm BFW A 10-45-2/90° for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, for measurements on flat surfaces, in bores of Ø 11 mm *(0.43 in)* or more up to 33 mm *(1.30 in)* deep, and for groove widths of 1.2 mm *(0.047 in)* or more

7023332 Probe arm protection for BFW probe arm unit on MarSurf MD 26 drive unit

7021607 Docking station for MarSurf M 410 operating unit

3028331 AC adapter (100 VAC to 264 V AC, 5 V ⎓)

3028332 Mains adapter (x4) for AC adapter 3028331 (for use in Europe, UK, USA, Australia)

3028323 USB cable (USB-A, micro USB), length 2.0 m *(6.6 ft)* (x2); for connecting the AC adapter to the M 410; for connecting the M 410 and the MD 26; for connecting the M 410 or MD 26 to the USB port of a computer

7053541 Support foot (for four-point support on cylindrical measuring objects)

7020260 Special wrench for support feet

3026185 Screw (x3); for securing the vee-block base of the MD 26

3650434 Flat-tip screwdriver, 0.8 mm x 4.0 mm x 80 mm *(0.03 in x .0.16 in x 3.15 in)*

3650487 Allen wrench, 1.3 mm *(0.05 in)*

3005811 Allen wrench, 2.0 mm *(0.08 in)*

7024107 Dust plug Mahr for MarSurf MD 26

7025306 Transport protection for MarSurf MD 26 (2 pieces of red PE foam)

3756212 Product documentation (operating instructions, data sheet, EU and UK Declarations of Conformity)

3762815
3762817
3766111
3766114 "MarSurf. Surface Parameters" fold-out cards (German, English)

7023251 Transport case

3700019 Shipping box

3003965 Foam insert (x2) for shipping box

6910291 "MarSurf M 410 (with printer)" set
Same as set 6910290, plus:

6910270 Wireless printer (receipt printer, 58 mm */ 6.22 in*) with charging cradle, USB connecting cable, USB Wireless adapter 3003856, graph paper (1 roll) and belt clip

6910296 "MarSurf M 410 PC" set
Same as set 6910290, plus:

6299436 "MarWin EasyRoughness mobile" evaluation software (16 language toggle) incl. Mahr license key

10 Accessories, spare and wear parts

Spare and wear parts

6200001 Li-ion battery with glued-on mount, 3.7 V / 3150 mAh

7012495 Protective cap for MarSurf M 410 connectors, removable

Accessories: Measuring station components

6910292 "MarSurf MD 26" set with MarSurf MD 26 drive unit

6910297 Set "MarSurf MD 26 PC" with MarSurf MD 26 drive unit and "MarWin EasyRoughness mobile" evaluation software

6910240 Protective film (x3) for the screen of the MarSurf M 410

6710803 MarSurf ST-D measuring stand

6710806 MarSurf ST-F measuring stand

6710807 MarSurf ST-G measuring stand

6910294 Holder for attaching the MarSurf MD 26 drive unit or the complete unit (drive unit together with the MarSurf M 410 operating unit) to the ST-D, ST-F or ST-G measuring stand

6710529 MarSurf CT 120 XY table

6710601 PP vee-block, with 4 different vee-blocks for holding turned parts (Ø 1 mm to 160 mm */ 0.039 in to 6.3 in*)

6710604 PPS parallel vise, for clamping measuring objects

4246819 109 PS precision bench vise set with mini precision bench vises, V-blocks, carrier plates, tripods and mini indexing heads, jaw widths 15 mm, 25 mm, 35 mm *(0.59 in, 0.98 in, 1.38 in)*

Accessories: Calibration

7026421 Standard holder for positioning the MarSurf MD 26 drive unit and an "MGS" type standard (see below) during calibration

6800000DKS MGS 1 geometry standard, for dynamic calibration via Ra, Rz; sinusoidal groove profile, profile depth approx. 1.5 µm *(0.591 µin)*, groove spacing approx. 0.10 mm *(0.004 in)*; incl. DAkkS/DKD calibration certificate

6800001DKS MGS 3 geometry standard, for dynamic calibration over Ra, Rz; sinusoidal groove profile, profile depth approx. 3 µm *(118 µin)*, groove spacing approx. 0.12 mm *(0.005 in)*; incl. DAkkS/DKD calibration certificate

6800002DKS MGS 10 geometry standard, for dynamic calibration over Ra, Rz; sinusoidal groove profile, profile depth approx. 10 µm *(393 µin)*, groove spacing approx. 0.20 mm *(0.008 in)*; incl. DAkkS/DKD calibration certificate

Accessories: Evaluation

6910280 "MarWin Roughness Viewer" measuring record software [27] (17 language toggle)

6299436 "MarWin EasyRoughness mobile" evaluation software (16 language toggle), incl. Mahr license key

4102212 "MarCom Professional" software [28] for exporting measurement values from MarSurf M 410 directly to various file formats (e.g. Microsoft Excel)

4102603 Data cable DK-U1, bidirectional USB cable, length 2 m *(6.6 ft)*, for connecting to "MarCom Professional" software

27 from version 1.00-14; download from *metrology.mahr.com*; search for "6910290".

28 from version 5.4-1; download from *www.mahr.com/marcom*.

6910271 Wireless printer (receipt printer, 58 mm */ 6.22 in*) with charging cradle, USB connecting cable, USB Wireless adapter 3003856, graph paper (1 roll) and belt clip

5450105 Graph paper, 12 rolls, thermal paper, external coating, Ø 40.0 mm -1.0 mm *(1.57 in -0.04 in)*, width 57.5 mm -0.5 mm *(2.26 in -0.02 in)*

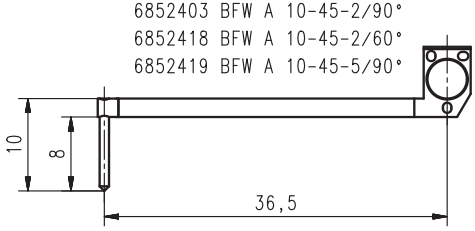
3028620 "Xenon™ 1900" USB scanner by Honeywell

3028820 "Zebra DS2278" wireless digital scanner

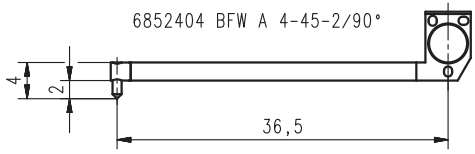
Accessories: Probe arm units

6852402 Skid for default probe arm of BFW 250 probe system, height of skid adjustable

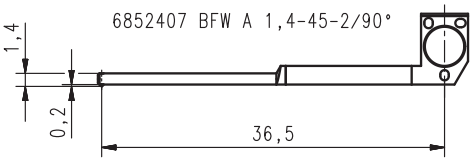
6852403 Default probe arm for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, for measurements on flat surfaces, in bores of Ø 11 mm *(0.43 in)* or more up to 33 mm *(1.30 in)* deep, and for groove widths of 1.2 mm *(0.047 in)* or more



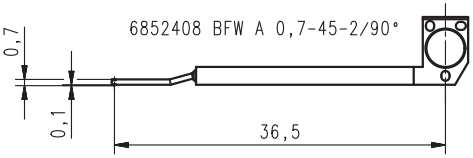
6852404 Probe arm unit for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, for measurements in bores of Ø 4.5 mm *(0.18 in)* or more up to 33 mm *(1.30 in)* deep



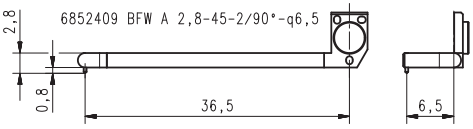
6852407 Probe arm unit for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, for measurements in bores of Ø 1.5 mm *(0.059 in)* or more up to 17 mm *(0.67 in)* deep



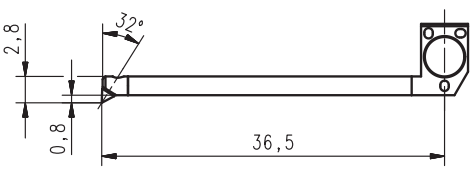
6852408 Probe arm unit for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, for measurements in small bores of Ø 0.8 mm *(0.031 in)* or more up to 6 mm *(0.24 in)* deep, or Ø 2.5 mm *(0.098 in)* or more up to 33 mm *(1.30 in)* deep



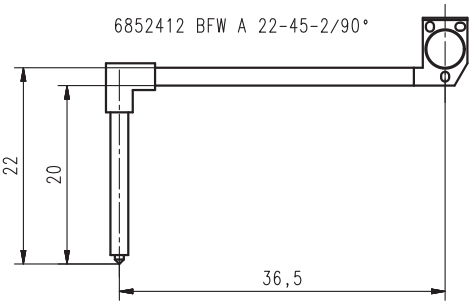
6852409 Probe arm unit for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, with side offset of 6.5 mm *(0.26 in)*, for measurements on undercuts or circumferential to bores



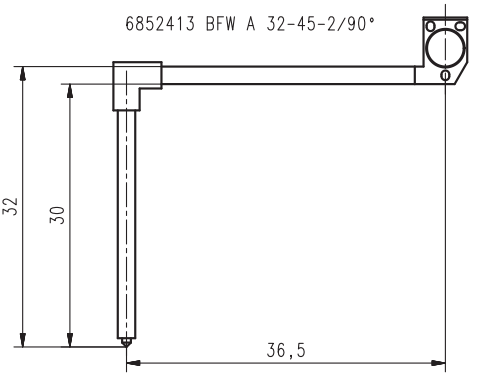
6852410 Probe arm unit for BFW 250 probe system, skidless probe, meas. range ±250 µm *(±0.010 in)*, with 30° inclined stylus element, for measurements on slopes and from the base of blind holes of Ø 3 mm *(0.118 in)* or more up to 33 mm *(1.30 in)* deep



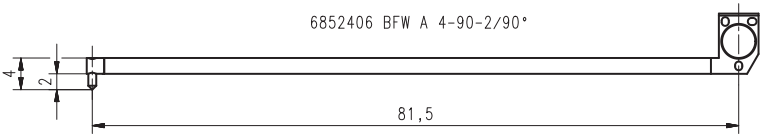
6852412 Probe arm unit for BFW 250 probe system, skidless probe, angled, meas. range ±250 µm *(±0.010 in)*, for measurements in deep measuring points, e.g. in grooves starting at 2.2 mm *(0.087 in)* wide to 20 mm *(0.79 in)* deep



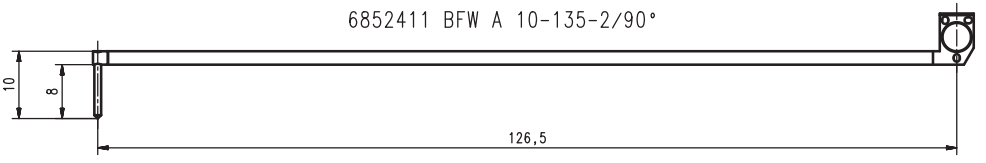
6852413 Probe arm unit for BFW 250 probe system, skidless probe, angled, meas. range ±250 µm *(±0.010 in)*, for measurements in deep measuring points, e.g. in grooves starting at 2.2 mm *(0.087 in)* wide to 30 mm *(1.18 in)* deep



6852406 Probe arm unit for BFW 250 probe system, skidless probe, probe arm length × 2.00, meas. range ±500 µm *(±0.020 in)*, for measurements in deep bores of Ø 4.5 mm *(0.177 in)* or more up to 78 mm *(3.07 in)* deep



6852411 Probe arm unit for BFW 250 probe system, skidless probe, probe arm length × 3.00, meas. range ±750 µm *(±0.030 in)*, for measurements in deep bores of Ø 11 mm *(0.43 in)* or more up to 123 mm *(4.84 in)* deep



11 Warranty

The instrument we have supplied has been designed and manufactured with utmost care. A further thorough check has been performed before shipment.

We therefore guarantee compliance with the applicable safety regulations, professional workmanship and perfect functioning.

The duration, terms and conditions of the warranty are set out in Mahr GmbH's General Terms and Conditions of Delivery or the applicable purchase agreement.

Provided no other agreements have been made, the following terms and conditions apply:
The warranty does not cover natural wear and tear or defects caused by incorrect handling, use for purposes other than those intended or non-observance of the operating instructions. In particular, the manufacturer shall only be held responsible for the instrument's function and safety provided that any intervention in the instrument outside the scope of the work described in the operating instructions is carried out exclusively by the manufacturer or by persons appointed by him.

Since the probe arm unit is subject to natural wear, which in turn is governed by the conditions of use and environment, any failure due to wear is excluded from the warranty.

Since the battery is subject to natural wear, its warranty is limited to six months.

This instrument's high level of accuracy can only be guaranteed if genuine Mahr probe arm units and other Mahr accessories are used.

12 Declarations of Conformity

This measuring instrument complies with the applicable EU and UK directives.
The current Declarations of Conformity are supplied with the product documentation. They can also be requested at the following address:

Mahr GmbH
Carl-Mahr-Straße 1
D-37073 Göttingen

13 Disposal



Electronic devices, including accessories and used batteries (rechargeable and disposable), must not be disposed of as regular garbage in line with European Directive 2002/96/EC (WEEE). On the one hand, they are made of high-value materials (iron, zinc or nickel) and on the other, depending on the type of rechargeable/disposable battery, they contain concentrations of harmful substances such as lead (Pb), cadmium (Cd) and mercury (Hg), which usually far exceed acceptable levels for these materials. These materials can be recycled and re-used to protect the environment and resources.

The crossed-out garbage can symbol indicates that separate collection is necessary.

Used rechargeable and disposable batteries, removal of which is described in the user manual, can be disposed of at any time and free of charge in the containers provided in stores or at municipal recycling centers. The poles on lithium-based rechargeable/disposable batteries should be masked beforehand as there is an increased fire risk in the event of a short circuit.

Mahr GmbH carries out the redemption and disposal of its own electrical and electronic products in accordance with legal requirements. Please contact your local service representative or

Mahr GmbH	Phone:	+49-551-70730
Carl-Mahr-Straße 1	Fax:	+49-551-71021
D-37073 Göttingen	Email:	info@mahr.com
Germany	Internet:	www.mahr.com

Mahr GmbH is registered in Germany with the Elektro-Altgeräte-Register (EAR, 'national register for used electrical appliances') under WEEE Reg. No. DE 56624193.

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