Betriebsanleitung
Operating Instructions
Guide de l'utilisateur
Manuale di istruzioni
Manual de instrucciones

MarSurf PS1

Mahr

Deutsch

English

Français

Italiano

Español

Dear valued customer,

congratulations on your decision to use this product from Mahr GmbH. We kindly request that you follow the instructions below in order to ensure the continued precision operation of the instrument over the long-term.

We operate a policy of continuous improvement and are constantly developing our products, especially with regard to renaming of type designations. It is possible therefore that there may be slight differences between the text and illustrations in this document and the product in your possession. We reserve the right to make changes to the design and scope of supply, the right to undertake further technical developments, and all rights relating to translation of this documentation.

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Permitted Uses

The MarSurf PS1 roughness measuring instrument must only be used for measurement and evaluation of roughness.

The MarSurf PS1 roughness measuring instrument can be installed both close to production areas and in inspection rooms.

Do not modify the instrument. This may create additional hazards that cannot be sufficiently protected by the safety mechanisms.

The operating, maintenance and repair requirements specified in these operating instructions must be followed.

Disposal

Electronic devices, including accessories and used batteries (rechargeable and disposable), must not be disposed of as regular garbage, since they contain high-value materials that can be recycled and reused. European Directive 2002/96/EC (WEEE) requires that electrical and electronic devices must be collected separately to unsorted municipal waste so that they may be subsequently reprocessed. The crossed-out garbage can symbol indicates that separate collection is necessary.
Mahr GmbH carries out the redemption and disposal of its electrical and electronic products in accordance with legal requirements. Please contact your local service representative.

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

⚠ Safety Instructions

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

1. Before you connect up and use the equipment for the first time, read the accompanying documentation.
   Follow the safety precautions detailed in the operating instructions.
   Keep the documentation close to the equipment ready for quick reference.

2. The instrument is designed for roughness measurement only, as specified in the permitted uses.

3. This instrument is NOT designed for operation in explosive environments. The equipment can emit electrical sparks which could trigger an explosion.

4. Follow safety precautions, accident prevention regulations and internal company instructions. You should request further information from your company safety officer.

5. Only the power pack provided with the device should be used for charging the internal rechargable battery or supplying power to the device when used in stationary applications.

6. Ensure the appropriate mains adapter for the mains socket is connected to the power pack.

7. Before you connect up the equipment, check that the power supply voltage marked on the type plate of the power pack matches that of the local mains power supply system. DO NOT under any circumstances connect the power pack if the voltage is not the same!
   The power pack must only be connected to an earthed power socket which complies with the regulations of the local power supply company. This also applies to any extension cables used.

8. Only use the power pack in enclosed areas.

9. Never use the power pack to charge disposable batteries.

10. Never carry out measurements on machines while they are running or on moving items.

11. Maintenance tasks, for example replacing the battery, must only be carried out by trained technicians. Disconnect the power supply before replacing the battery.

12. Only Mahr-trained personnel are permitted to carry out work on this instrument and its components. Protective covers must only be removed by trained technicians and only when servicing is required. Any procedures carried out on this instrument that go beyond those tasks described in the operating instructions will void the equipment warranty. Mahr GmbH declines all liability for damage caused by unauthorized procedures.

13. Do not use fluids on or near the instrument and its components.

14. Do not use cleaning materials that contain harmful substances. Do not use solvents.

15. Inspect the connecting cables at regular intervals and check for damage. Change damaged cables immediately (Mahr service personnel).

Order No.	Last Modification	Version
3757410	March 10, 2008	Valid from Prog v1.01-08

Table of Contents

These Operating Instructions contain the following symbols:

General information.

Important information. Non-observance of this information can result in incorrect measurements or even damage to the instruments!

1   Functions

The MarSurf PS1 is a compact roughness measuring instrument for mobile use under shopfloor conditions.

The maximum measuring range is 350 µm *(0.014 in)* (-200 µm to +150 µm) *(-0.008 in to +0.006 in)*.

With the built-in drive unit, measurements can be performed in any measuring position without the need for setup times. The maximum traversing length is 17.5 mm *(0.700 in)*. The instrument is easy to use and complies with DIN EN ISO 3274.

The MarSurf PS1 and all Mahr pick-ups are balanced at the factory. For high-precision measurements using the stylus method and subsequent checks, an automatic dynamic calibration function is available. A standard is integrated in the MarSurf PS1 for this purpose. [1]

PHT pick-ups have an innovative open skid [1] that virtually eliminates deposits of dirt and oil.

The bow-type vertical adjusters [2] allow many different forms of support (stable three-point support, four-point support, e.g. for cylindrical testpieces, combination with the pick-up protection, etc.) and makes vertical adjustment very easy.

The rugged housing makes the MarSurf PS1 ideal for operation under severe conditions. The instrument combines an ergonomic design with clearly arranged operating elements and a specially designed easy-to-read LCD.

Its compact form and low weight (approx. 400 g / *0.88 lbs*) make the MarSurf PS1 ideal for mobile use. Thanks to the carrying case with shoulder strap and belt loop, it is easy to carry around. The built-in rechargeable battery offers enough capacity for several days' work [3].

The instrument's power pack comes with three exchangeable mains adapters, allowing the instrument to be connected directly to the mains all over the world.

All the functions supported by the instrument are set out in a logically structured catalog. The arrow keys are used to select and set the required functions from this catalog.
Instrument settings can be blocked and also protected against unauthorized modification by means of a code number.

The operator can switch between ISO (DIN), JIS, ANSI/ASME and MOTIF standards to select the traversing length and for evaluation purposes.

When measurements are performed in accordance with ISO (DIN), JIS or ANSI/ASME, the recorded profile is filtered with a phase-correct profile filter (Gaussian filter) complying with DIN EN ISO 11562. A shorter cutoff can also be selected for this purpose.
Even inexperienced users can perform correct, reproducible roughness measurements thanks to an automatic function. If this function is active, the instrument detects periodic and aperiodic profiles and automatically sets the standard cutoff and associated traversing length in accordance with DIN EN ISO 4288. [1]

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[1]   Patented

[2]   Patent pending

[3]   The capacity is sufficient for approx. 500 measurements (depending on the traversing length)

Most of the parameters stipulated in ISO (DIN), JIS, ANSI/ASME and MOTIF are available to evaluate the measured profile (see Section 4.4).

The evaluation conditions can be set, e.g. reference line and intersection line for material ratio Rmr, symmetrical or asymmetrical intersection lines for peak count RPc, operators A and B for the MOTIF evaluation, and intersection lines for zone widths CR, CF and CL.

In order to monitor tolerances, tolerance limits can be set for all selected parameters. If limits are exceeded, this is indicated on the display (and in the measuring record).

Results and settings can be displayed using either the metric or the Imperial system of units.

The internal memory can store up to 15 profiles or 20,000 results.

The MarConnect interface allows an external printer (e.g. the Mahr MSP2) to be connected. This printer can be used to print out both the entire measuring record and individual measuring results.

The MarSurf PS1's USB interface allows it to be connected directly to a PC. It is treated like a USB memory stick and detected without a driver.
This allows measuring results and profiles to be transferred to the PC for evaluation, e.g. with the MarSurf XR 20 evaluation software. Additional evaluation options allow flexible management and documentation of measuring results.

From MarSurf PS1 V1.01 onwards, the "MarSurf PS1 Explorer" software (see Section 10) enables records of the profiles and measuring results to be saved and printed.
The software also serves to copy profile and result files from the MarSurf PS1 to a computer in a straightforward way.

Thanks to its extensive range of accessories, the MarSurf PS1 has a wide variety of applications (see Section 10):
– For testpieces such as crankshafts or camshafts which are measured in the axial direction, an optional adapter for transverse tracing is available.
– The optional end face vee-block allows measurements on end faces of planar and cylindrical workpieces.

Operating conditions
Storing/transport temperature range:
    -10 °C to +40 °C *(14°F to 104°F)*
Working/operating temperature range:
    +5 °C to +40 °C *(41°F to 104°F)*
Relative humidity:
    max. 85 %, noncondensing
Protection class: IP40

1.1   Memory Capacity

Each file type is stored in its own folder in the internal memory:

"PROFILE"
contains
– Profile files with the file extension "*.pcd" (Perthometer Concept format).
  These files can be read and evaluated using the MarSurf XR 20 software.
– Profile files with the file extension "*.txt" (ASCII format).

"RESULT"
contains result files with the file extension "*.txt".

These files can be transferred to a PC via the USB interface (see Section 7.1).

If only files of a single type are stored in the memory, the following maximum number of files of a given type can be stored:

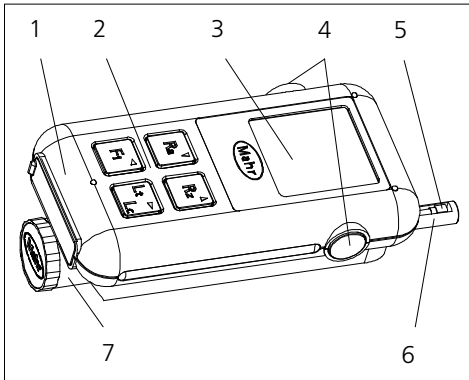| File type	Number of bytes per file		Max. number of files
Result file (*.txt)	1 KB	for 10 meas. with 4 parameters	approx. 750
	2 KB	for 20 meas. with 4 parameters	approx. 375
	3 KB	for 50 meas. with 4 parameters	approx. 250
	5 KB	for 100 meas. with 4 parameters	approx. 150
Profile file (*.pcd)	45 KB	with $n = 5$	approx. 15
Profile file (*.txt)	66 KB to 88 KB	with $n = 5$	approx. 8 to 11

2 Operating Elements

Fig. 1
MarSurf PS1 roughness measuring instrument

1 Housing
Top:	Three-point support for upside-down measurements
Bottom:	Vee-block for cylindrical test-pieces, 4 internal threads for attaching accessories
Inside:	Standard

2 Keypad

Ra, Rz	Keys to display the parameters Ra and Rz (with JIS: RzJ)
F1	Key to display a freely programmable parameter
Lt/Lc	Key for setting [4] the cutoff and traversing length or the automatic selection of cutoff and traversing length in accordance with ISO, JIS or ANSI, or the traversing length in accordance with MOTIF
▼▲◄►	Arrow keys to change settings [4] in the catalog

3 Display
4 Green **Start** keys (left and right)

Start	Switches the instrument on. [5]
Start	Confirms the pick-up.
Start	Starts a measurement.
Start	Aborts a measurement in progress.

For the following key combinations, hold down one of the **Start** keys and then press the key indicated:

Start + Lt/Lc	Opens the catalog of settings.
Start + Ra	Displays the selected parameters in turn.
Start + Rz	Switches off the instrument. The instrument settings used for the last error-free measurement are retained.

5 Pick-up
6 Pick-up protection
   can be used in conjunction with a vertical adjuster or a measuring stand as a second support point
7 Drive unit
   can be rotated and moved longitudinally, with various lock-in positions

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[4] Instrument settings can only be modified if they are not blocked, i.e. if "Blocking off" (see Section 3.3.1) and "Save off" or "Save interrupt" (see Section 4.6) is set.

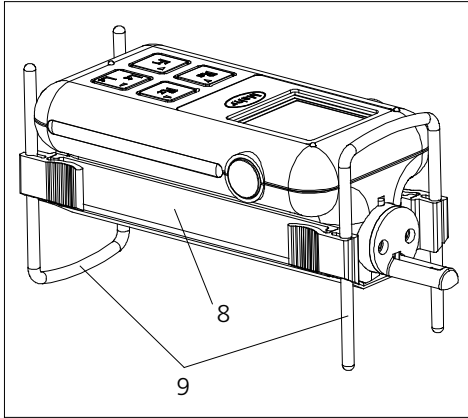[5] Only possible if the reset switch (17) is in the "I" position.

Fig. 2
MarSurf PS1 with vertical adjustment

8 Mount for attaching accessories
(vertical adjusters,
optional end face vee-block)
9 Pair of bow-type vertical adjusters,
arranged as three-point support
(can also be used individually)
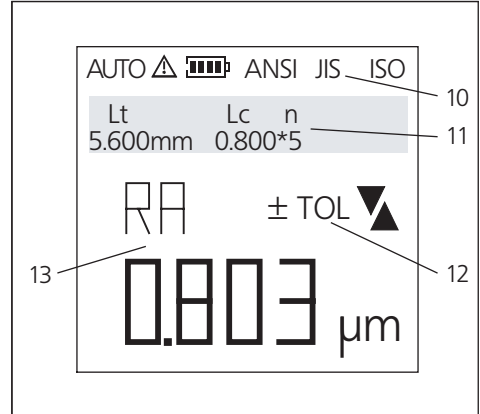
Fig. 3
MarSurf PS1 display
(Diagram: Not all display elements can appear at the same time in measuring mode.)

10 Symbols
AUTO   Automatic setting of cutoff and traversing length

⚠   Non-standard measuring conditions

🔋   Battery status
(▭: battery almost empty)

ANSI,
JIS, ISO   Standard

11 Text field to display the traversing length Lt
(cutoff Lc × number n of sampling lengths),
catalog, operating instructions and error
messages

12 Symbols
+TOL   Upper tolerance exceeded for the displayed parameter

-TOL   Lower tolerance exceeded for the displayed parameter

▲   Upper limit of measuring range exceeded

▼   Lower limit of measuring range exceeded

13 Parameter with measuring result
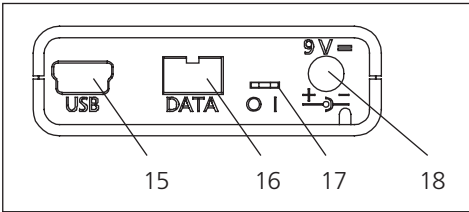
Fig. 4
MarSurf PS1 connections

15 USB   *USB interface*
              for connection to a PC [6]
16 DATA *MarConnect interface (RS232)*
              for connection of a printer
17 0 / I *Reset switch*
              "0": As supplied (power supply
              disconnected), instrument settings
              reset
              "I": Operating status
18 9 V = *Connection for charger / mains*
              adapter

> **i** Activating the reset switch resets all the MarSurf PS1's settings to the factory settings and deletes all the profiles and results stored in the memory.
> If necessary, connect the MarSurf PS1 to a PC and save the data first.

Carrying case

The **brief guide** describing the main operating steps can be found in the front pocket of the carrying case.
The case's shoulder strap and belt loop allow the MarSurf PS1 to be carried around easily.

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[6] With the Windows 2000 or Windows XP operating system.

3   Commissioning

The MarSurf PS1 is delivered with the power supply isolated to ensure that the built-in battery does not lose its charge if stored for a lengthy period.

1. Move the reset switch (17) to the right into the "I" position to make the instrument ready for operation.

3.1   Charging the Battery

The MarSurf PS1 is powered by a built-in battery. The power pack supplied can be used for stationary operation.

The battery should be charged

–   if the instrument is being commissioned for the first time,

–   if around 3 months have passed since the battery was last charged,

–   if the ⊏⊐ symbol is flashing (i.e. the battery is down to around 15 % of its capacity),

–   if no measurement is possible even though the ⊏⊐ symbol is not flashing. [7]

For charging, only use the power pack supplied!
If other power packs are used, the MarSurf PS1 may be damaged and any warranty will be rendered null and void.

To prepare the power pack:

1. Select the appropriate mains adapter and insert it into the power pack.

To charge the battery:

1. Connect the power pack to the "9 V =" socket (18) on the MarSurf PS1 and plug it into the mains socket.

    During the charging process, the four bars in the ⊏⊐ symbol appear and disappear in sequence.

Once the power pack has been connected, measurements can be carried out immediately.

The battery capacity reached in % can be displayed at any time (see Section 3.3.1).

The battery will be fully charged after approx. 1 hour, and the instrument automatically switches from rapid charge to trickle charge.

The MarSurf PS1 is also charged if it is connected to a PC via its USB interface (15), but the battery takes longer to charge using this method.

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[7]   This can happen after long periods of storage, for example.

3.2   Setting up the Measuring Station

3.2.1   Mobile Measuring Station

To set up the drive unit:

1. Carefully introduce the pick-up (5) into the pick-up holder on the end face of the drive unit (7), bearing in mind the plug assignment.

2. Screw the pick-up protection (6) firmly onto the end face of the drive unit.

   The pick-up protection should be used at all times if possible as it protects the pick-up from damage.
   Exception: When measuring in small-diameter bores or at points that are difficult to access.

   After a pick-up has been replaced, the new pick-up should be calibrated or its correction value set (if this is already known) (see Section 5).

3. Fit any additional accessories, e.g. for vertical adjustment – i.e. the mount (8) and one or both vertical adjusters (9).

4. Place the drive unit in the correct measuring position by moving it longitudinally and rotating it. Guide pins on the drive unit help to find the ideal operating position.

Practical examples:

– MarSurf PS1 standing on its vee-block bottom or on the vertical adjusters, measurement on level surface or in bore, stylus tip pointing downwards.
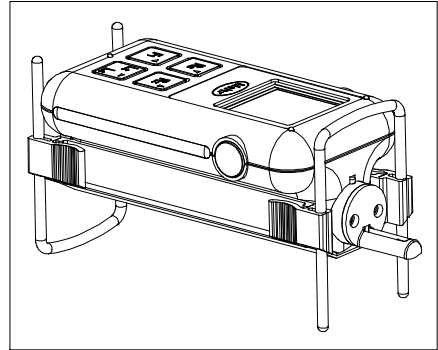
– MarSurf PS1 lying upside-down on its top surface (three-point support), vee-block serving as mount, measurement on cylindrical testpieces of up to 1 kg *(2.205 lbs)*, stylus tip pointing upwards.
  Depending on the length of the testpiece, the drive unit can be moved longitudinally into the front or rear lock-in position.
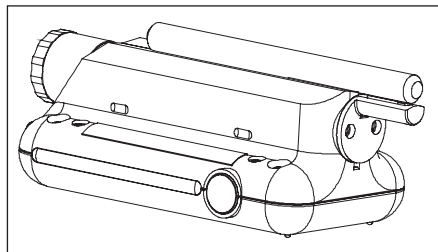
– MarSurf PS1 is held vertically; optional end
  face vee-block lies on the circumference of a
  cylindrical testpiece, the stylus tip contacting
  the end face of the testpiece.
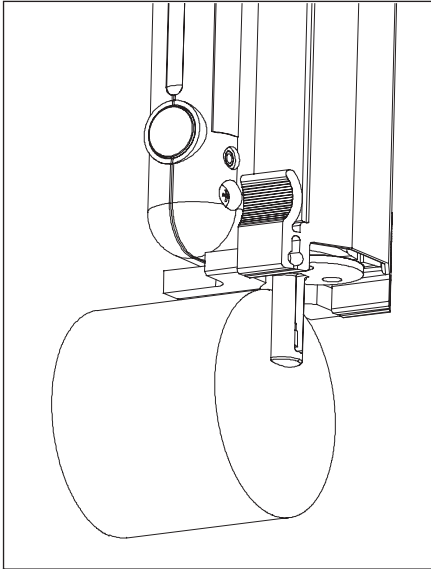
3.2.2 Stationary Measuring Station

During stationary operation, the MarSurf PS1 can be attached to the measuring stand (see Fig. 5). Measuring stands of types ST-D, ST-F and ST-G can be used.
A mount (6910201) is required for this which is available as an optional accessory.

To fit the MarSurf PS1 on the measuring stand:

1. Set up the drive unit (see Section 3.2.1).
   The pick-up protection is not absolutely essential for operation on a measuring stand.

2. Lay the MarSurf PS1 on its top surface and put the mount (22) on top of it so that the mount's two screws fit into the threaded inserts on the bottom of the MarSurf PS1.

3. Tighten the two screws on the mount.

4. Introduce the mount's bolt into the orifice on the cage of the column and clamp it in place using the two set screws (on the reverse of the cage).

5. Align the testpiece and the drive unit using the adjusting screw (21) so that they are parallel.
   The MarSurf PS1 can be inclined by ± 15°.

6. Rotate the handwheel for height adjustment (20) to lower the pick-up to the level of the testpiece.

7. To change the testpiece, the MarSurf PS1 can be tilted upwards in the mount and locked in place.

   It is essential that the two screws on the mount and the two set screws are properly tightened as otherwise the MarSurf PS1 could come off and be damaged!

Fig. 5
Stationary measuring station
with measuring stand

20 Handwheel for height adjustment
21 Adjusting screw to correct inclination
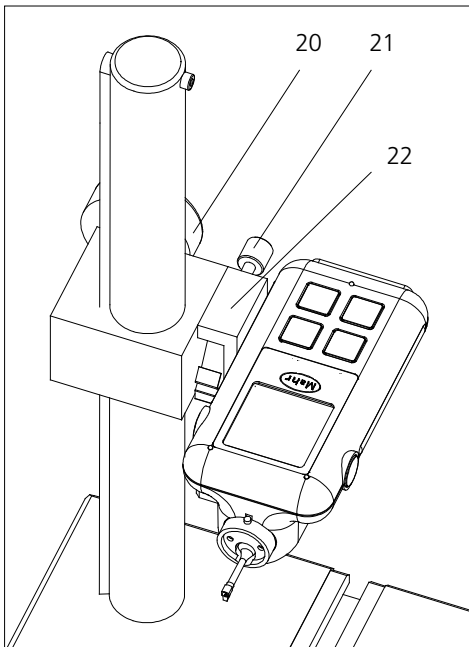*22 Mount for MarSurf PS1 (6910201)*

3.3 Making Instrument Settings

The basic setting

– standard

and the measuring conditions

– traversing length
– number of sampling lengths
  (as per ISO, JIS, ANSI/ASME)
– Ls filter (as per ISO, JIS, ANSI/ASME)

must be changed before a measurement.
All further settings can be changed before or after the measurement.

> **i** Instrument settings can only be modified if they are not blocked, i.e. if
> – `"Blocking    off"` is set in the `"Basic settings"` subcatalog (see Section 3.3.1)
> – and `"Save    off"` or `"Save interrupt"` (see Section 4.6) is set in the `"Results"` subcatalog.

To modify instrument settings:

1. Hold down one of the green **Start** keys and press the **Lt/Lc** key.
   The catalog of instrument settings opens and the first subcatalog `"Measuring conditions"` appears.

2. Select the required subcatalog (e.g. `"Basic settings"`) using ▼ or ▲.

3. Open the subcatalog with ►.
   The first line (e.g. `"Language"`) is displayed.

4. Select the required line (e.g. `"Timeout"`) with ▼ or ▲.

5. To change the value, press ► and select the required value (e.g. `"on"`) with ▼ or ▲.

6. Confirm the change with ◄. [8]
   Press ◄ again to close the subcatalog; press ◄ again to close the catalog.

> **i** To retain modified instrument settings after the MarSurf PS1 is switched off, an error-free measurement must be carried out with these settings.

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[8] Pressing ► cancels the selection and the change is not made.

The following table shows the catalog of instrument settings with its subcatalogs and the lines they contain (for further details, see Sections 3.3.1 to 3.3.4).
The top line always gives the value on delivery of the MarSurf PS1 or after a reset.

Sub-catalog	Line	Value	Explanation
Meas-uring condi-tions	n	5	Select number n of sampling lengths (in accordance with ISO, JIS, ANSI/ASME).
	Lc	standard short	Select standard or short cutoff Lc (in accordance with ISO, JIS, ANSI/ASME).
	Ls	on off	Switch Ls profile filter on/off.
	C1	0.50 µm	Set upper intersection line for peak count RPc.
	C2	-0.50 µm	Set lower intersection line for peak count RPc.
	CREF	5.0 %	Set reference line for material ratio Rmr.
	C	-1.00 µm	Set intersection line for material ratio Rmr (1st individual value).
	C	-2.00 µm	Set intersection line for material ratio Rmr (2nd individual value).
	C	-3.00 µm	Set intersection line for material ratio Rmr (3rd individual value).
	A	0.5 mm	Set operator A for MOTIF evaluation.
	B	2.5 mm	Set operator B for MOTIF evaluation.
	Scr1	5.0 %	Set upper intersection line for zone width CR of profile peak zone.
	Scr2	15.0 %	Set lower intersection line for zone width CR of profile peak zone.
	Scf1	20.0 %	Set upper intersection line for zone width CF of profile core zone.
	Scf2	80.0 %	Set lower intersection line for zone width CF of profile core zone.
	Scl1	85.0 %	Set upper intersection line for zone width CL of profile valley zone.
	Scl2	98.0 %	Set lower intersection line for zone width CL of profile valley zone.

Sub-catalog	Line	Value	Explanation
Record contents	`Autoprinting`	`off` `on`	Switch automatic record printing on/off.
	`Ra`	`on` `off`	Switch arithmetic mean roughness *Ra* for record on/off.
	`...`		Switch further parameters on/off.
Tolerance limits	`Ra      Max   0.00 μm`		Set upper tolerance limit for *Ra*.
	`Ra      Min   0.00 μm`		Set lower tolerance limit for *Ra*.
	`...`		Set tolerance limits for further selected parameters.
Basic settings	`Language      English`		Select language for settings, operating instructions and error messages.
	`Unit`	`mm` `inch`	Select system of units for results and settings.

	`Standard`	`ISO`
		`JIS`
		`MOTIF`
		`ANSI/ASME`
			Select standard for selection of traversing length and assignment of **Rz** and **F1**.

	`Timeout`	`off` `on`	Switch automatic instrument shutdown on/off.
	`Blocking`	`off` `on`	Switch blocking for instrument settings on/off.
	`Code number    ****`		Change code number for blocking.
	`Batt 4.081V  78.3 %`		Display battery capacity.
	`F1 =          Rmax`		Select parameter for **F1** key.
	`Pick-up type    350`		Select pick-up type.
	`Calibrate`		Start pick-up calibration (see Section 5.2).
	`Corr. value     0 %`		Set correction value of pick-up (see Section 5.1).
	`Traverse         on` `off`		Switch pick-up traverse on/off.
	`Date    09/15/2005`		Set date.
	`Time          14:35`		Set time.

Sub-catalog	Line	Value	Explanation
Pro-files (see Section 4.5)	Save profile		Save current profile in internal memory.
	Load profile		Load saved profile.
	Delete profile		Delete profile file from memory. To delete all profile files, select "P000*.PCD" or "P000*.TXT".
	Format	*.pcd *.txt	Select profile format.
	Delete measurement		Delete last automatically saved profile file from memory.
	Save	off on	Switch automatic saving of profiles on/off.
	Profiles	10	Display number of profile files already saved.
Re-sults (see Section 4.6)	Save result		Save current results as file in internal memory.
	Delete result		Delete result file from memory. To delete all result files, select "R000*.TXT".
	Results	6	Display number of result files already saved.
	Save	off on interrupt continue	Switch on, switch off, interrupt or continue saving of results in internal memory.
	Delete memory		Delete result memory.
	Delete measurement		Delete last measurement from series.
	No. of meas.	26/497	Display number of measurements already saved.

3.3.1 Basic Settings

Selecting the standard

It is possible to switch between the ISO, JIS, ANSI/ASME and MOTIF standards to select the traversing length and assign the **Rz** and **F1** keys.

The selected standard is shown in the top right-hand corner (10) of the display. [9]
When switching the standard, non-standard measuring conditions are automatically reset. The traversing length and the parameter for **F1** may need to be reselected.

> **i** If the **ISO, JIS or ANSI/ASME standard** is selected, the R-profile will be evaluated.

The assignment of the **Rz** parameter key depends on the selected standard:
- With ISO, ANSI/ASME and MOTIF, pressing **Rz** displays the result for Rz (ISO).
- With JIS, pressing **Rz** displays the result for RzJ (JIS).

If the **ANSI/ASME** standard is selected, the parameters Rp (ASME) and Rpm (ASME) are available. With the ISO, JIS and MOTIF standards, the parameter Rp (ISO) is available.

If the **MOTIF standard** is selected, the P-profile will be evaluated. MOTIF parameters are evaluated in accordance with ISO 12085.
The number of sampling lengths and the cutoff (in accordance with ISO/JIS) cannot be changed.

Switching the timeout on/off

To save battery power, the switch-on time can be limited using a timeout function.
If the timeout is active, the MarSurf PS1 switches off automatically after around one minute if no key has been pressed during this time. The instrument settings used to perform the last error-free measurement are retained. The results of the last measurement are also retained.

The timeout can be deactivated for continuous operation in mobile applications.

> **i** The timeout function does not work if the MarSurf PS1 is connected
> - to the power supply via the power pack or
> - to a computer via the USB interface.

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[9] The MOTIF standard is displayed in the text field after the traversing length.

Switching blocking for instrument settings on/off (code number protection)

The instrument settings can be blocked. They can also be protected against unauthorized changes by means of a code number. This code number is also requested when opening the "Profiles" and "Results" subcatalogs.

The code number "0000" is set at the factory. This setting allows any user to change the instrument settings, including switching blocking on/off (provided that saving of the results has been disabled or set to "interrupt"). It is therefore advisable to enter a code number when commissioning the MarSurf PS1.

 Instrument settings can only be modified if they are not blocked, i.e. if
– "Blocking off" is set in the "Basic settings" subcatalog
– and "Save off" or "Save interrupt" (see Section 4.6) is set in the "Results" subcatalog.

To enter or change the code number:

1. If necessary, switch off blocking for instrument settings (see below).

2. In the "Basic settings" subcatalog, select the "Code number" line using either ▼ or ▲ .

3. To enter or change the code number, press ►.
   The current code number will be displayed with the first digit underlined.

4. Press ► and ▲ or ▼ to enter any 4-digit code number between "0001" and "9999".

5. Press ◄ to confirm the change.

6. If necessary, switch blocking for instrument settings back on again (see below).

 With blocking switched off, the code number can be changed by any user.

To switch blocking on/off:

1. In the "Basic settings" subcatalog, select the "Blocking" line using either ▼ or ▲ .

2. To change the setting, press ►. "Code number 0000" is displayed with the first digit underlined.

3. Enter the current code number using ► and ▲ or ▼.

4. Press ◄ to confirm the code number.

   If an incorrect code number has been entered, the "Blocking" line will be displayed again with the previous setting:

   • Press ►, enter the correct code number and press ◄ to confirm.

5. Switch blocking on/off using either ▼ or ▲ .

6. Press ◄ to confirm the change.

ⓘ To ensure that the new instrument settings (including the setting for blocking) are retained after the MarSurf PS1 is switched off, an error-free measurement must be performed with these settings.

Selecting the parameter for the F1 key

The **F1** key can be programmed as one of the basic settings but the setting can also be accessed at any time by holding down the **F1** key for around 2 s.

The standard selected determines the parameters available:
– If the ANSI/ASME standard is selected, the parameters *Rp* (ASME) and *Rpm* (ASME) are available.
– With the ISO, JIS and MOTIF standards, the parameter *Rp* (ISO) is available.

ⓘ The parameter you assign to the **F1** key will automatically be activated in the "Record contents" subcatalog, and you can set tolerance limits for this parameter in the "Tolerance limits" subcatalog.
When performing a new programming of the **F1** key, the previous parameter will be deactivated in the "Record contents" and "Tolerance limits" subcatalogs.

Selecting the pick-up type

The pick-up type selected determines the pick-up measuring range (100 μm, 150 μm or 350 μm). This ensures that the entire pick-up measuring range can be used and that measuring errors (air measurements) are avoided.

i After a pick-up has been changed, the new pick-up should be calibrated or its correction value set (if this is already known).
Section 5 describes how to calibrate and set the pick-up correction value.

Switching the traverse on/off

If the testpiece is moved by a third-party drive system such as the PURV rotation device, the pick-up's traverse must be switched off.
The third-party drive system must be set to a drive speed of 0.5 mm/s.

Setting the date

The date is saved for each measurement.
The format depends on the language selected. If "Language   English" is selected, the format will be "Month / Day / Year".
The date is output if the measuring record is printed.

Setting the time

The time (Hour : Minute) is saved for each measurement.
The time is output if the measuring record is printed.

3.3.2   Measuring and Evaluation Conditions

Selecting the traversing length in accordance with ISO, JIS or ANSI/ASME

The text field in the display (11) shows the traversing length *Lt*, the length of the cutoff *Lc* and the number *n* of sampling lengths, e.g.

```
"  Lt          Lc    n
   5.600mm   0.800*5"
```
or
```
"  Lt          Lc    n
   0.224in   0.032*5".
```

1. Press the **Lt/Lc** key repeatedly until the required cutoff and the resulting standard traversing length are displayed.

    If "*****" is displayed instead of a value for *Lt* and *Lc* with the "AUTO" symbol (10) displayed above, automatic setting of cutoff and traversing length has been selected.

The traversing length in accordance with ISO, JIS or ANSI/ASME is calculated from the cutoff to be selected with reference to Table 3.

The MarSurf PS1 provides three cutoffs. The cutoff defines which elements of the measured profile will be attributed to roughness.

Lt	*Lc* *n*	*ln*
1.750 mm	(0.250 * 5)	1.250 mm
5.600 mm	(0.800 * 5)	4.000 mm
17.50 mm	(2.500 * 5)	12.50 mm
0.070 in	(0.010 * 5)	0.050 in
0.224 in	(0.032 * 5)	0.160 in
0.700 in	(0.100 * 5)	0.500 in

Table 1
Available traversing lengths (and cutoffs)
in accordance with ISO, JIS or ANSI/ASME

The traversing length normally consists of a pre-travel, five sampling lengths *lr* (= evaluation length *ln*) and a post-travel. The sampling lengths and the pre-travel and post-travel are exactly the same length as the standard cutoff (see Table 3).

If "AUTO" (automatic setting of cutoff and traversing length) has been activated, the instrument first checks during the measurement whether the profile is a periodic one:

–   With a periodic profile, the instrument automatically sets the standard cutoff and associated traversing length according to the *RSm* value (see Table 3).
–   With an aperiodic profile, the cutoff and traversing length are set automatically according to the *Rz* value (see Table 3).

The settings established are displayed after the measurement.

Selecting the number of sampling lengths (in accordance with ISO, JIS or ANSI/ASME)

If the testpiece does not allow the traversing lengths derived from the standard, the number n of sampling lengths can be reduced in accordance with the standard. [10]

If n is less than 5, the symbol ⚠ (10) appears in the display.

> **i** By selecting a standard traversing length with **Lt/Lc**, the number n of sampling lengths is reset to 5.

Selecting the traversing length in accordance with MOTIF

The text field in the display (11) shows the traversing length Lt, e.g. `"16.00 mm MOTIF"`.

1. Press the **Lt/Lc** key repeatedly until the required traversing length is displayed.

Lt		
1.000 mm	or	0.040 in
2.000 mm	or	0.080 in
4.000 mm	or	0.160 in
8.000 mm	or	0.320 in
12.00 mm	or	0.480 in
16.00 mm	or	0.640 in

Table 2
Available traversing lengths
in accordance with MOTIF

Switching the Ls profile filter on/off

If the Ls profile filter is switched on, the profile is filtered after the measurement with a cut-off wavelength of 2.5 μm or 8 μm *(100 μin or 320 μin)*, depending on the traversing length.

---

[10] If "AUTO" (automatic setting of cutoff and traversing length) has been activated, the number n of sampling lengths (and the cutoff) cannot be changed.

Selecting the cutoff
(in accordance with ISO, JIS or ANSI/ASME)

When evaluating in accordance with ISO, JIS or ANSI/ASME, the roughness profile is generated from the measured profile using digital filtering.

The phase-correct profile filter (Gaussian filter) is used. When evaluating the parameters in accordance with DIN EN ISO 13565-2, the special filtering method with groove suppression as per DIN EN ISO 13565-1 is used. The filter is characterized by the cutoff.

The cutoff is the wavelength *Lc* of a sinusoidal profile, the amplitude of which will be transmitted by the phase-correct filter to a level of 50 %. The cutoff defines which elements of the measured profile will be attributed to the roughness.

The cutoff and traversing length are selected together before the measurement by pressing **Lt/Lc**.

DIN EN ISO 4288 states that the cutoff for standard measurements should be selected as follows:
– for periodic profiles, according to the mean width *RSm* of the profile elements,
– and for aperiodic profiles, depending on *Ra* or *Rz*
(see Table 3).

In special cases, the next shortest cutoff may be used instead of the standard one required by ISO 4288. This cutoff can also be set after the measurement. [11]

After the cutoff has been set, its value is displayed in the text field (11).
If the short cutoff is selected, the ⚠ symbol (10) appears in the display.

> **i** If a standard traversing length is selected by pressing **Lt/Lc**, the short cutoff is deactivated again.

---

[11] If "AUTO" (automatic setting of cutoff and traversing length) has been activated, the cutoff cannot be changed.

Periodic profiles	Aperiodic profiles		Cutoff	Sampling length Evaluation length
RSm in mm	Rz in μm	Ra in μm	Lc in mm	lr in mm ln in mm (with $n = 5$)
$RSm \leq 0.13$	$Rz \leq 0.5$	$Ra \leq 0.1$	0.25	0.25 1.25
$0.13 < RSm \leq 0.4$	$0.5 < Rz \leq 10$	$0.1 < Ra \leq 2$	0.8	0.8 4
$0.4 < RSm$	$10 < Rz$	$2 < Ra$	2.5	2.5 12.5

Table 3
Determining the cutoff
in accordance with DIN EN ISO 4288

Intersection lines for peak count

In order to calculate the peak count *RPc*, an upper intersection line C1 (30) and a lower intersection line C2 (32) are placed into the roughness profile. The two intersection lines run parallel to the diagram mean line (31).

The distance (in μm or μin) from the intersection lines to the diagram mean line can be set to symmetrical or asymmetrical values. [12]
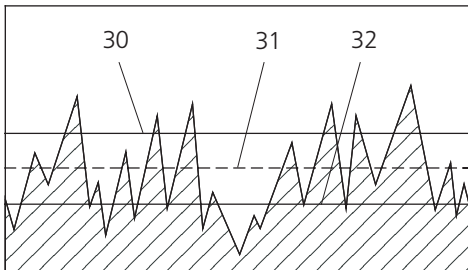

Fig. 6
Intersection lines for peak count

30 Upper intersection line C1
31 Diagram mean line
32 Lower intersection line C2

When setting the upper intersection line C1, the value for the lower intersection line C2 is automatically set to -C1.

To set an asymmetrical distance from intersection lines C1 and C2 to the diagram mean line:

1. First set the value in line "C1".
    The value for the lower intersection line C2 is automatically set at -C1.

2. Display the line "C2" by pressing ▼ and set the required distance C2 for the lower intersection line.
    If the value is negative, the intersection line lies below the diagram mean line.

ℹ️ Every time the value for C1 is changed, C2 will be reset to -C1. If C2 ≠ -C1 is required, C2 must then be reset.

---

[12] The values for C1 and C2 should be entered in steps of 0.1 μm. The profile resolution of up to 8 nm means that there is no point having smaller steps.

Reference line and intersection line for material ratio

In order to calculate the material ratio *Rmr*, an intersection line C (36) is placed into the profile. The position of this intersection line is derived from its distance (in μm or μin) from the reference line CREF (35).

The reference line runs parallel to the diagram mean line; its position is determined by a material ratio value (e.g. "CREF   5 %").
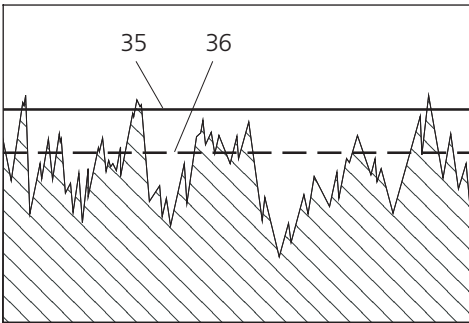
Fig. 7
Reference and intersection lines
for material ratio

35 Reference line CREF
36 Intersection line C for material ratio

Three different intersection lines C can be set, enabling three individual *Rmr* values to be output. If the value is negative, the intersection line lies below the reference line.

Operators for MOTIF evaluation

When calculating the measuring results for the MOTIF parameters, operators are used which define the maximum length (in mm or in) of the roughness motifs (operator A) or the waviness motifs (operator B).

ISO 12085 states that operators A and B are selected according to the expected length of the motifs.

Opera-tor A	Opera-tor B	Traversing length	Evalua-tion length
in mm	in mm	in mm	in mm
0.02	0.1	0.64	0.64
0.1	0.5	3.2	3.2
0.5	2.5	16	16

Table 4
Determining operators A and B
in accordance with ISO 12085

Unless otherwise specified, the default values are A = 0.5 mm and B = 2.5 mm.

Intersection lines for zone widths

With the three-zone measurement, zone widths *CR*, *CF* and *CL* are calculated. Two intersection lines (in %) are specified for each of these parameters. These determine the position of the relevant zone in the material ratio curve (40).
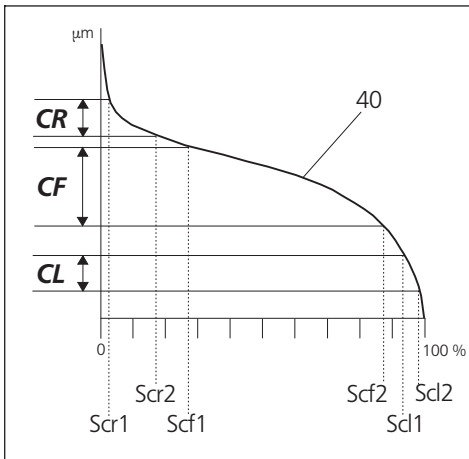
Fig. 8
Intersection lines for three-zone measurement

40	*Material ratio curve*
Scr1, Scr2:	*Upper and lower intersection lines for CR*
Scr1, Scr2:	*Upper and lower intersection lines for CF*
Scr1, Scr2:	*Upper and lower intersection lines for CL*

3.3.3 Record Contents

The parameters selected in the "`Record con-tents`" subcatalog (e.g. "`Rmr    on`") can be displayed subsequently in the "`Parameters`" mode by holding down one of the green **Start** keys and pressing the **Ra** key.

Tolerance limits can be set and monitored for the parameters selected (see Section 3.3.4).

If a printer (e.g. MSP2) is connected to the MarSurf PS1, the record includes the parameters activated in the "`Record contents`" subcatalog.

If "`Autoprinting    on`" is set, the record is automatically printed after each error-free measurement, provided a printer is connected.

3.3.4   Tolerance Limits

An upper and lower tolerance limit can be entered for each selected parameter (see Section 3.3.3) in order to monitor results. [13]

If the value "`0.00`" appears after "`Max`" or "`Min`", this tolerance limit has not been defined. If the value "`0.00`" has been set for "`Max`" **and** "`Min`", there is no tolerance monitoring for this parameter.

When evaluating the selected parameters, the tolerance limits are checked:

– If the tolerance for one of the selected parameters is exceeded, this parameter is displayed first after a measurement and the "+TOL" or "-TOL" symbol (12) appears.
"+TOL" indicates that the upper tolerance limit has been exceeded while "-TOL" indicates that the lower tolerance limit has been exceeded.

Example: If "`Ra   Max 1.50 µm`" has been set for the upper tolerance limit and the measuring result for *Ra* is 1.75 µm, "+TOL" is displayed.

– If the upper tolerance limit is exceeded for any of the parameters, a plus sign appears between the measured value and the unit in the printed record. If the lower tolerance limit is exceeded, a minus sign appears here.

– No tolerance violations are indicated in the result file, which can be transferred to a PC after saving the results.

> **i** If one of the parameters selected for the measuring record is deactivated, the corresponding tolerance limits are deleted.

---

[13]   To set a tolerance limit with decimal digits, e.g. for *Rmr* or *RPc*:
First enter "`0001`" and confirm with ◀, then set the value and confirm.
To adjust a tolerance limit with decimal digits to a higher value without decimal digits:
In the first entry position, enter "`9`" and confirm with ◀, then open with ▶. Repeat the process until the decimal point disappears. The maximum value is 2,500 µm.

4   Measurement and Evaluation

4.1   Switch-on

1. Press one of the green **Start** keys (4) to switch on the MarSurf PS1. [14]

   All instrument settings are the same as for the last error-free measurement before the instrument was switched off. The results of the last measurement are displayed.

2. Move the drive unit from the parking position to the measuring position (see Section 3.2.1).

After switch-on, the message `"Pick-up? START?"` appears in the display when **Start** is pressed:

3. Check whether the pick-up type used in the drive unit (see inscription on pick-up) has been set on the MarSurf PS1 (see Section 3.3.1).

   If a pick-up is changed, the pick-up correction value should also be checked.

   Pressing **Start** again starts a measurement.

> **i** If the timeout (see Section 3.3.1) is active during mobile applications and no key is pressed for one minute, the instrument automatically switches off.
> The instrument settings and the results of the last measurement are retained.

---

[14]   Only possible if the reset switch (17) is in the "I" position.

4.2 Measurement

The MarSurf PS1 is ready to carry out measurements immediately after switch-on if the standard (see Section 3.3.1) and the measuring conditions (see Section 3.3.2) have been set correctly.

Measurement is normally at right angles to the direction of the testpiece's machining tracks. If no machining tracks are visible, carry out either two measurements 90° apart or three measurements 60° apart.

The surface to be measured should be cleaned before performing the measurement.

1. Move the pick-up to the measuring position. The tracing arm must be parallel to the surface to be traced.

2. Start the measurement by pressing one of the green **Start** keys (4).

   During the measuring run, the display will show "Measurement". The number after this word indicates the traversing length section currently being traversed by the pick-up. [15]

   If automatic setting of cutoff and traversing length has been activated or a measurement is being carried out in accordance with MOTIF, "Measurement --A--" will be displayed.

   The measuring range is automatically switched internally so that the best possible profile resolution is always used for measurement.

   After the measurement, "End of measurement" is displayed until the pick-up is back in its initial position.
   As soon as the traversing length is displayed again, a new measurement can be started by pressing one of the green **Start** keys.

Measurement can be aborted at any time by pressing **Start**. This stops the drive immediately and the pick-up is returned to its initial position. A new measurement can then be started by pressing **Start**.

Pick-up deflection is monitored during the measurement. If the measuring range is exceeded, the pick-up is stopped immediately and returned to its initial position. The display will show the ▲ or ▼ symbol (12) and an error message.

Ensure that the upper measuring range limit is not exceeded during return travel as this can damage the pick-up!

---

[15] With ISO, JIS and ANSI/ASME, the traversing length section corresponds to a multiple of the standard cutoff length.

4.3   Evaluation

Evaluation can be performed immediately after a measurement provided that the evaluation conditions (see Section 3.3.2) and a number of the basic settings (see Section 3.3.1) have been set correctly.

The first parameter selected for the measuring record is displayed following an error-free measurement.
If the tolerance for one of the selected parameters is exceeded, this parameter is displayed first and the "+TOL" or "-TOL" symbol (12) appears.

To display the other measuring results:

• The parameter keys **Ra** and **Rz** are used to display the parameter values for *Ra* and *Rz* (with ISO, ANSI/ASME and MOTIF) or *RzJ* (with JIS).

• The **F1** key shows the measuring result for the parameter previously assigned to it (see Section 3.3.1).

• To display the parameters selected for the measuring record one after the other, hold down one of the green **Start** keys and press the **Ra** key.
The ▼ or ▲ key can be used to display the selected parameters one after the other. The ◄ key serves for quitting the "Parameters" mode.

If "----" is displayed instead of a measured value, the result cannot be calculated
– because no valid measurement is available (e.g. as a result of the last measurement being aborted or the measuring conditions being changed)
– or because the conditions for calculating the result for this parameter have not been satisfied (see Section 6).

If the measuring conditions change, the results of the last measurement will no longer be available.

Additional parameters selected following a measurement are evaluated the next time the "Parameters" mode is opened, without having to repeat the measurement.

If no parameter is selected for the measuring record, *Ra* is displayed automatically.

[i] If MOTIF parameters are calculated using the evaluation in accordance with ISO, JIS or ANSI/ASME, it is important to note that the traversing length evaluated will generally not match the traversing length recommended in ISO 12085!

If parameters in accordance with ISO, JIS or ANSI/ASME are calculated using the evaluation in accordance with MOTIF, it is important to note that the traversing length evaluated will generally not match the traversing length based on ISO 4288!

[i] Section 4.4 gives details on the available parameters.

4.4   Available Parameters

The following parameters are available for MarSurf PS1:

Param-eter	Out-put	Meaning	Standards
Ra	RA	Arithmetic mean roughness *Ra*	DIN EN ISO 4287 : 1998 ISO 4287 : 1997 JIS B 0601 : 1994
Rq	RQ	Root mean square roughness *Rq*	DIN EN ISO 4287 : 1998 ISO 4287 : 1997 JIS B 0601 : 2001
Rz *Ry* (JIS) equiv. to *Rz*	RZ	Mean peak-to-valley height *Rz* (as per ISO) or *Ry* (as per JIS)	DIN EN ISO 4287 : 1998 ISO 4287 : 1997 JIS B 0601 : 2001
Rz (JIS)	RZJ	Mean height *Rz* of profile elements	JIS B 0601 : 2001 (formerly: ISO 4287/1 : 1984)
Rmax	RMAX	Maximum roughness depth *Rmax*	DIN 4768 : 1990
Rp	RP	Mean profile peak height *Rp*	DIN EN ISO 4287 : 1998 ISO 4287 : 1997
Rp (ASME)	RP	Maximum profile peak height *Rp*	ASME B46
Rpm (ASME)	RPM	Mean profile peak height *Rp*	ASME B46
Rpk	RPK	Reduced peak height *Rpk*	DIN EN ISO 13565-2 : 1998
Rk	RK	Core roughness depth *Rk*	DIN EN ISO 13565-2 : 1998
Rvk	RVK	Reduced valley depth *Rvk*	DIN EN ISO 13565-2 : 1998
Mr1	MR1	Smallest material ratio *Mr1* of the roughness core profile: Material ratio (in %) of the intersection line which separates the protruding peaks from the roughness core profile.	DIN EN ISO 13565-2 : 1998
Mr2	MR2	Largest material ratio *Mr2* of the roughness core profile: Material ratio (in %) of the intersection line which separates the deep valleys from the roughness core profile.	DIN EN ISO 13565-2 : 1998
A1	A1	Material-filled profile peak range *A1* (in $\mu m^2/mm$)	DIN EN ISO 13565-2 : 1998
A2	A2	Lubricant-filled profile valley range *A2* (in $\mu m^2/mm$)	DIN EN ISO 13565-2 : 1998

Param-eter	Out-put	Meaning	Standards
Vo	VO	Oil-retaining volume *Vo* (in mm³/cm²)	
Rt	RT	Total height *Rt* of R-profile	DIN EN ISO 4287 : 1998
R3z	R3Z	Arithmetic mean third peak-to-valley height *R3z*	DB N 31007 : 1983
RPc	RPC	Peak count *RPc* (depending on intersection lines C1 and C2): Number of profile elements (see *RSm*) per cm (or per inch) which exceed first the set upper intersection line C1 and then fall short of the lower C2.	EN 10049 : 2005 ASME B46
Rmr *tp* (JIS, ASME) equiv. to *Rmr*	RMR	Material ratio *Rmr* (depending on reference line CREF and intersection line C; 3 individual values may be selected)	DIN EN ISO 4287 : 1998 ISO 4287 : 1997 JIS B 0601 : 2001
RSm	RSM	Mean width *RSm* of profile elements (formerly: groove spacing)	DIN EN ISO 4287 : 1998 ISO 4287 : 1997 JIS B 0601 : 2001
Rsk	RSK	Skewness *Rsk* of the profile	DIN EN ISO 4287 : 1998 ISO 4287 : 1997 ASME B46
S	S	Mean spacing *S* of local profile peaks	JIS B 0601 : 2001
CR	CR	Zone width *CR* [16] of profile peak zone (French "critère de rodage") (dep. on intersection lines Scr1 and Scr2)	ISO 4287 : 1997
CF	CF	Zone width *CF* [16] of profile core zone (French "critère de fonctionnement") (dep. on inters. lines Scf1 and Scf2)	ISO 4287 : 1997
CL	CL	Zone width *CL* [16] of profile valley zone (French "critère de lubrification") (dep. on intersection lines Scl1 and Scl2)	ISO 4287 : 1997
R	R	Mean depth *R* of roughness motifs (depending on operators A and B)	ISO 12085 : 1996
Ar	AR	Mean width *Ar* of roughness motifs (depending on operators A and B)	ISO 12085 : 1996
Rx	RX	Maximum depth *Rx* of profile irregularity (depending on operators A and B)	ISO 12085 : 1996

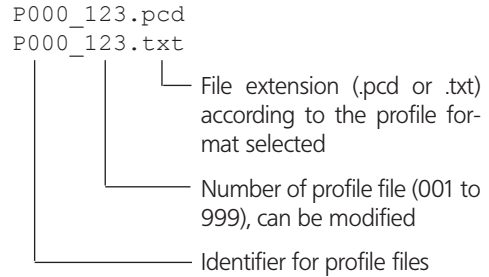[16] Corresponds to the definition of *Rdc*.

4.5   Saving Profiles

The MarSurf PS1 features an integrated memory for up to 15 profile files (D-profiles). [17]

The functions of the "Profiles" subcatalog can only be accessed after entering the code number: [18]

1. Hold down one of the green **Start** keys and press the **Lt/Lc** key.

2. Select the "Profiles" subcatalog using ▼ or ▲ and press ►.
   "Code   number   0000" is displayed with the first digit underlined.

3. Enter the current code number using ► and ▲ or ▼.

4. Press ◄ to confirm the code number.

   If an incorrect code number is entered, the "Profiles" subcatalog does not open:
   • Press ►, enter the correct code number and confirm with ◄ .

5. Select the required line (e.g. "Save") using ▼ or ▲ .

6. To change the value, press ► and select the required value (e.g. "on") using ▼ or ▲ .

7. Confirm the change with ◄ . [19]
   Press ◄ again to close the subcatalog; press ◄ again to close the catalog.

Profile files are saved in the "PROFILE" folder with the following structure:

```
P000_123.pcd
P000_123.txt
```

    └── File extension (.pcd or .txt) according to the profile format selected

    └── Number of profile file (001 to 999), can be modified

    └── Identifier for profile files

Selecting the profile format (.pcd or .txt)

Profile data can be saved in two different profile formats:

– Profile files with the file extension ".pcd" (Perthometer Concept format) can be read and evaluated directly using the MarSurf XR 20 software.

   From MarSurf PS1 V10.1 onwards, the "MarSurf PS1 Explorer" software (see Section 10) enables records of these profile files to be saved and printed.

– Profile files with the file extension "*.txt" (ASCII format) are ASCII files in which the individual profile points are displayed as normalized profile values. The dimensioned profile value in μm is obtained by multiplying the normalized profile value with the vertical profile resolution.
   This ensures that profiles in the ASCII format can be read by both a normal text editor and a spreadsheet program (e.g. Microsoft Excel).

---

[17] The possible number of profiles depends on the number *n* of sampling lengths and the number of result files stored.

[18] If the code number "0000" set at the factory is used, the "Profiles" subcatalog is freely accessible.

[19] Pressing ► cancels the selection and the change is not made.

Switching automatic saving of profiles on/off

If automatic profile saving is activated, each valid measurement is automatically saved in the internal memory. The file name is generated from the lowest free profile number and the file extension.

1. Select the "`Save`" line in the "`Profiles`" subcatalog.

2. Press ►, select "`on`" or "`off`" and confirm with ◄ .

Saving a profile

To save the current profile manually in the selected profile format:

1. Select the "`Save profile`" line in the "`Profiles`" subcatalog.

2. Press ►.
   The file name with the lowest free profile file number appears in the text field.

3. If necessary, change the file number.

4. Confirm with ◄ .

   If a file with the same name already exists, "`Confirm with F1`" appears. If you want to overwrite the profile file, press **F1**. Pressing a key other than **F1** cancels the saving procedure.

   The full file name is displayed for the duration of the saving procedure, e.g. "`P000_001.pcd`".

Deleting the last automatically saved profile file

This function provides a simple means of deleting the profile file last saved when automatic profile saving is activated. It is not possible to delete several files step by step.

1. Select the "`Delete measurement`" line in the "`Profiles`" subcatalog.

2. Press ► and confirm with **F1**.

   The last automatically saved profile file will be deleted from the memory.
   Pressing a key other than **F1** cancels the deletion procedure.

Loading a profile

To load a profile (of the selected profile format) from the memory for a new evaluation:

1. Select the "`Load profile`" line in the "`Profiles`" subcatalog.

2. Press ►.
   The first file name in the list appears in the text field, e.g. "`File name   P000_001`".

3. Select the profile file to be loaded.

4. Confirm with ◄ .
   Press ◄ again to close the subcatalog; press ◄ again to close the catalog.

5. The loaded profile can now be evaluated as usual (see Section 4.3).

Deleting one or more profile files

To delete a profile file (or all profile files) of the selected profile format:

1. Select the "Delete profile" line in the "Profiles" subcatalog.

2. Press ▶.
   The first file name in the list appears in the text field, e.g. "File name   P000_001".

3. Select the profile file to be deleted.

   If all profile files are to be deleted, select the last entry of the list, i.e. "P000*.PCD" or "P000*.TXT" depending on the profile format selected, by pressing ▼.

4. Press ◀ and confirm with **F1**.

   Pressing a key other than **F1** cancels the deletion procedure.

Displaying the number of profile files stored

1. Select the "Profiles" line in the "Profiles" subcatalog.

   The display shows e.g. "Profiles   5", i.e. five profile files are available in the memory.

4.6   Saving Measuring Results

The MarSurf PS1 has an integrated mem-
ory which is able to store the results of up to
400 series of measurements, each containing up
to 500 results, as result files. [20]

Before starting a series of measurements, the re-
quired settings must be made (see Section 3.3).

If saving of results is activated, the MarSurf PS1
automatically blocks all instrument settings in or-
der to ensure the comparability of results.

The number of measurements in the current series
of measurements for which results have been
stored is displayed after each measurement.

If the last measurement is to be ignored (e.g. be-
cause it has been affected by external factors), it
can be deleted from the series of measurements
straight away.

The series of measurements can be inter-
rupted (`"Save    interrupt"`) in order to
perform measurements with other settings.
If saving of results is continued afterwards
(`"Save    continue"`), the correct settings
are automatically restored.

If the result memory is full or the series of meas-
urements is to be terminated, the measuring re-
sults collected up to that point can be saved as
a file and transferred to a connected PC using
the USB interface (see Section 7.1).
In order to save new results, the result memory
has to be cleared.

If saving of results is switched off, the blocking
of instrument settings is deactivated again, al-
lowing the settings to be changed.

---

[20] The possible number of measurements depends on the
number of parameters selected and the number of profile
files stored.

The functions of the "Results" subcatalog can only be accessed after entering the code number: [21]

1. Hold down one of the green **Start** keys and press the **Lt/Lc** key.

2. Select the "Results" subcatalog using ▼ or ▲ and press ►.
   "Code number 0000" is displayed with the first digit underlined.

3. Enter the current code number using ► and ▲ or ▼.

4. Press ◄ to confirm the code number.

   If an incorrect code number is entered, the "Results" subcatalog does not open:
   • Press ►, enter the correct code number and press ◄ to confirm.

5. Select the required line (e.g. "Save") with ▼ or ▲.

6. To change the value, press ► and select the required value (e.g. "on") with ▼ or ▲.

7. Confirm the change with ◄. [22]
   Press ◄ again to close the subcatalog; press ◄ again to close the catalog.

Switching on automatic saving of results

ℹ️ Before starting a series of measurements, the required settings must be made (see Section 3.3).

To save the future results of the selected parameters in the internal memory:

1. Select the "Save" line in the "Results" subcatalog.

2. Press ►, select "on" and confirm with ◄.

   The instrument settings are blocked to prevent changes and subsequent measurements are adopted into the series of measurements.

   The number of measurements in the current series of measurements for which results have been stored is displayed after each measurement (see below).

   With each measurement, the MarSurf PS1 saves the measuring results for the selected parameters as well as the date and time of the measurement.

---

[21]   If the code number "0000" set at the factory is used, the "Results" subcatalog is freely accessible.

[22]   Pressing ► cancels the selection and the change is not made.

Displaying the number of measurements stored

1. Select the "`No. of meas.`" line in the "`Results`" subcatalog.

   The display shows e.g. "`5/138`".
   The first number indicates the number of measurements for which results have been stored, while the second figure indicates the maximum number of measurements. [23]

Deleting the last measurement [24]

1. Select the "`Delete measurement`" line in the "`Results`" subcatalog.

2. Press ► and confirm with **F1**.

   The last measurement complete with all results is deleted from the series of measurements.

Interrupting automatic saving

1. Select the "`Save`" line in the "`Results`" subcatalog.

2. Press ►, select "`interrupt`" and confirm with ◄.

   The series of measurements is interrupted and the instrument settings are enabled for changes.

   ℹ️ If a further measurement is started despite the maximum number of measurements being reached, the one-off message "`Result memory full`" is displayed. Saving is automatically interrupted ("`Save interrupt`") but the instrument settings continue to be blocked.

   • To measure without saving the results: deactivate blocking (see Section 3.3.1) if you want to change the measuring conditions.
   • To allow new results to be saved: save the stored results as a result file and transfer them using the USB interface, select "`Save continue`" and delete the result memory.

---

[23] If "`No. of meas.    0/  0`" is displayed, saving of results is switched off.

[24] This function is only possible if "`on`" is displayed in the "`Save`" line.

Continuing automatic saving

1. Select the "`Save`" line in the "`Results`" subcatalog.

2. Press ►, select "`continue`" and confirm with ◄.
"`Save    on`" is displayed.

   The settings used for the results saved earlier are automatically restored.

   The instrument settings are blocked again and subsequent measurements are adopted into the series of measurements.

Deleting all results [25]

1. Select the "`Delete memory`" line in the "`Results`" subcatalog.

2. Press ► and confirm with **F1**.

   The entire series of measurements together with all saved results is deleted.
   Saving of results remains active.

Switching off automatic saving of results [25]

Saving of results can only be switched off if the result memory has been deleted.

1. Select the "`Save`" line in the "`Results`" subcatalog.

2. Press ►, select "`off`" and confirm with ◄.

   If the memory is empty, saving of results is switched off and the instrument settings are enabled for changes.

   The instrument settings used for the last measurement apply.

Saving results in a result file

If the series of measurements is to be terminated or the result memory is full, the measuring results collected up to that point can be saved as a result file and transferred to a connected PC using the USB interface.

Result files are saved in the "RESULT" folder with the following structure:

`R000_123.txt`

File extension (.txt)

Number of result file (001 to 999), can be modified

Identifier for result files

---

[25] This function is only possible if "`on`" is displayed in the "`Save`" line.

1. Select the "`Save result`" line in the "`Results`" subcatalog.

2. Press ►.
   The file name with the lowest free result file number appears in the text field.

3. If necessary, change the file number.

4. Confirm with ◄ .

   If a file with the same name already exists, "`Confirm with F1`" appears. If you want to overwrite the result file, press **F1**. Pressing a key other than **F1** cancels the saving procedure.

   The full file name appears briefly, e.g. "`R000_001.txt`".

| i | When saving results manually, the internal memory is not deleted automatically. If the current results have been saved as a file, the memory should be deleted (see above) so that these results are not recorded twice. |

A result file (text file) can be read by normal text editors and spreadsheet programs (e.g. Microsoft Excel). The individual details are separated by a semicolon and a point is used as the decimal separator.

The first line of the result file contains the [PS1 R] identifier.
The second line the gives the measuring conditions.
The third line contains the column headings "Date", "Time" and the names of the selected parameters with their corresponding units.

Each of the subsequent lines states the date [26] and time of a measurement and the measuring results [27] obtained.
If "`Lt AUTO`" was used for the measurement, the traversing length *Lt* and cutoff *Lc* are specified for each measurement.
The end of the file is indicated by the character "@".

From MarSurf PS1 V1.01 onwards, the "MarSurf PS1 Explorer" software (see Section 10) enables records of these result files to be printed in tabular form and as statistics.

```
[PS1 R ]
Lt 5.60 mm;Lc 0.80 mm;n 5;A 0.50 mm;B 2.50 mm
Date;Time;Ra          ***** µm;RPc(0.5,-0.5)**** /c
22.08.2005;14:44;0.464; 25
22.08.2005;14:44;0.443; 25
@
```

Fig. 9
Example of a result file

---

[26] The date is given in the format "Day . Month . Year" and the time in the format "Hour : Minute".

[27] If it was not possible to calculate the result for a parameter, "----" will be output instead.

Deleting one or more result files

1. Select the "`Delete result`" line in the "`Results`" subcatalog.

2. Press ►.
   The first file name in the list appears in the text field, e.g. "`File name   R000_001`".

3. Select the result file to be deleted.

   If all result files are to be deleted, select "`R000*.TXT`" by pressing ▼.

4. Press ◄ and confirm with **F1**.

   Pressing a key other than **F1** cancels the deletion procedure.

Displaying the number of result files stored

1. Select the "`Results`" line in the "`Results`" subcatalog.

   The display shows e.g. "`Results   15`", i.e. 15 result files are available in the memory.

4.7   Switching off

To switch off the MarSurf PS1 if it does not turn off automatically (i.e. if the timeout is not activated, the instrument is connected to the power supply via the power pack or to a computer via the USB interface):

1. Hold down one of the green **Start** keys and press **Rz** at the same time.

2. To move the drive unit and pick-up to the safe parking position for transport:
   Push the drive unit forward out of the housing, turn it 180° to the right (stylus tip points upwards) and pull it back into the housing (guide pin engages with guide groove) until the rear lock-in position is reached (see Fig. 10).
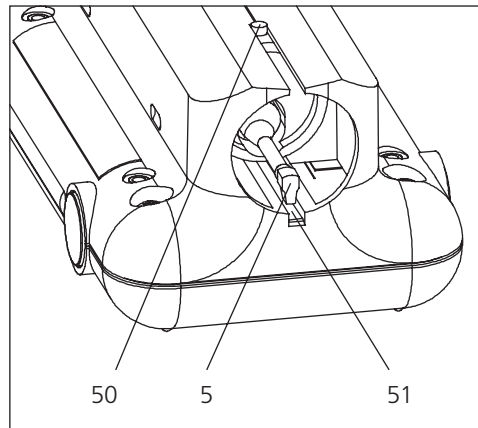

Fig. 10 (shown in reverse)
Pick-up in the parking / calibrating position

50 Guide pin in the rear lock-in position
5   Pick-up
51 Integrated standard

5   Calibrating and Setting the Pick-up Correction Value

The sensitivity of Mahr pick-ups is adjusted at the factory so they can be used for measurements straight away.

Sensitivity-matched pick-ups are set to their nominal sensitivity. If the "`Corr. value`" line in the "`Basic settings`" subcatalog contains the value 0 %, the pick-up used is operated with nominal sensitivity.

If necessary, pick-ups can be calibrated [28] to increase the measuring accuracy still further. Dynamic calibration involves determining the deviation of a pick-up from its nominal sensitivity. The instrument calculates a correction value which will then be taken into account in the evaluation.
This allows deviations lying within the tolerance for the entire measuring station (± 15 %) to be compensated.

For calibration
– a separate roughness standard (e.g. PRN 10) or a separate geometric standard (e.g. PGN 3)
– or the integrated standard
   (for the standard PHT 6-350 pick-up only)
can be used.

When using the integrated standard for calibration, it should be checked at regular intervals using a calibrated skid-less pick-up in order to ensure the validity of the *Rz* nominal value stated (see Section 8.1).

5.1   Setting the Pick-up Correction Value

The pick-up correction value can be entered [28] without calibrating the pick-up first. This option is used, for example, when exchanging pick-ups if the correction value of the pick-up is already known.

1. In the "`Basic settings`" subcatalog, select the "`Corr. value`" line using either ▼ or ▲.

2. To change the correction value, press the ► key and set the value using either ▲ or ▼ (value range -15 % to +15 %).

3. Press ◄ to confirm the change.

---

[28] Instrument settings can only be modified if they are not blocked, i.e. if "`Blocking off`" (see Section 3.3.1) and "`Save off`" or "`Save interrupt`" (see Section 4.6) is set.

5.2 Calibration

1. Set the MarSurf PS1 on its vee-block bottom.

2. If using a separate standard:
   Position the drive unit so that the pick-up sits correctly on the roughness standard, i.e.
   – the stylus tip is perpendicular and
   – the entire traversing length is within the field of defined roughness.

   If using the integrated standard (see Fig. 10 in Section 4.7):
   Push the drive unit forward out of the housing, turn it 180° to the right (stylus tip points upwards) and pull it back into the housing (guide pin engages with guide groove) until the rear lock-in position is reached.

3. If standard ISO has been set:
   • If using a separate standard:
     Press **Lt/Lc** to select the traversing length in accordance with the specified cutoff Lc on the standard.
     Example: Using the PRN 10 with $Lc = 0.8$ mm, a cutoff $Lc = 0.800$ mm is to be set on the MarSurf PS1. This gives a traversing length of $Lt = 5.600$ mm.
   • If using the integrated standard:
     Press **Lt/Lc** and select a traversing length of 5.600 mm.

4. In the "Basic settings" subcatalog, select the "Calibrate" line using either ▼ or ▲ and press ►.
   "Rz (nomin.)   09.50 µm" is displayed.
   If standard JIS, ANSI/ASME or MOTIF has been set, this is now automatically switched to ISO and a cutoff $Lc = 0.800$ mm with traversing length $Lt = 5.600$ mm is set.

5. Read the Rz nominal value from the bottom of the instrument [29] and enter the value using ► and ▲ or ▼. [30]

6. After confirming the value with ◄, three measurements are performed automatically. [31]
   "Measurement" is displayed during the measurements.

7. After each measurement, the calculated Rz value is displayed briefly (e.g. "Rz   9.45 µm")
   After the 3rd measurement, the average of the three measured Rz values is determined. This average is used to calculate a correction value.

   – If the correction value lies within a range of ± 15 %, it is adopted in the instrument setting (display e.g. "Corr. value   -4 %").
   – If the correction value exceeds the above-mentioned range, "Corr. value > ±15" is displayed.
     Remedy: Check the measuring setup, the pick-up, the perpendicular alignment of the stylus tip and the Rz nominal value entered, and repeat the calibration procedure.

8. In order to repeat calibration, proceed as follows:
   • Press ► twice.
   • Re-enter the Rz nominal value.
   • Press ◄.

9. If calibration is repeated several times without producing a useable result, the pick-up is probably faulty and should be sent in for inspection.

---

[29] If using a separate standard, read the Rz nominal value from the calibration standard or the associated calibration certificate.

[30] The maximum Rz nominal value is 20.00 µm.

[31] If no measurement has been carried out since switching on the instrument, the display will show "Pick-up? START?". Start the first calibration measurement by pressing one of the green **Start** keys.

6   Troubleshooting

The following remedies are recommended in the
case of errors:

Error / Message	Source	Remedy
"−−−−" (instead of measured value)	– Result cannot be calculated as no valid measurement is available.	Start a measurement.
	– Condition for calculating the result is not satisfied.	
	With *Rmr*: Total height *Rt* of R-profile is ≤ 0.8 % of measuring range.	No remedy.
	With *R3z*: Minimum of 3 peaks and 3 valleys per sampling length not available.	If necessary, select a longer traversing length.
	With *RzJ*: Minimum of 5 peaks and 5 valleys per sampling length not available.	If necessary, select a longer traversing length.
	With *RSm*: Mean roughness *Ra* of the roughness profile is ≤ 0.4 % of measuring range.	No remedy.
	With *R*, *Ar*, *Rx*: Evaluation of the motifs produces no roughness.	Check the setting of operators A and B.
	With *Rpk*, *Rk*, *Rvk*, *Mr1*, *Mr2*, *A1*, *A2*:	
	– Total height *Rt* of R-profile is ≤ 0.8 % of measuring range.	No remedy.
	– Less than 10 classes of the material ratio distribution are within the range of the core profile.	No remedy.
	– Material ratio curve is not S-shaped as stipulated by ISO 13565-2.	No remedy.

Error / Message	Source	Remedy
Battery symbol 🔋 flashes	Battery is nearly empty.	Recharge the battery (the battery's full capacity will be reached after approx. 1 hour).
Instrument not working after a battery change	Battery has not been inserted correctly.	Open the instrument, take out the battery and re-insert it as indicated in the battery compartment (see Section 8.2).
`Corr. value > ±15`	Calculated pick-up correction value lies outside the tolerance of ± 15 %.	– Check the measuring setup. – Check the pick-up. – Check that stylus tip is perpendicular. – Check the *Rz* nominal value. – Repeat calibration. – If necessary, send in the pick-up for inspection.
`Data loss`	When switching on the instrument, the instrument settings were found to have been lost.	Select new instrument settings.
`Lower limit exceeded` and ▼ symbol	Lower limit of the measuring range has been exceeded; measurement has been aborted; no evaluation possible.	Realign the testpiece or drive unit as appropriate.
`Memory error` or `System error`	Internal malfunction.	– Switch the instrument off and back on again. – Move the reset switch (17) to the left to the "0" position and back to the right, switch the instrument back on and reselect the instrument settings. – If the system error re-occurs: Send in the instrument for repair, enclosing a description of the preceding operating steps.

Error / Message	Source	Remedy
`Pick-up?` `START?`	After switch-on, the pick-up must be confirmed.	– Check whether the pick-up type used in the drive unit is set on the MarSurf PS1. – After exchanging a pick-up, also check that the pick-up correction value is correct. – Press one of the green **Start** keys again to start the measurement.
`Result memory` `empty`	Result memory is empty because automatic saving of results has not yet stored any results.	Switch on saving of results and perform measurement(s).
`Result memory` `full`	Result memory is full and cannot accept any further results. Saving is automatically interrupted ("`Save interrupt`") but the instrument settings continue to be blocked.	– To measure without saving the results: deactivate blocking if you want to change the measuring conditions. – To allow new results to be saved: save the stored results as a result file and transfer them using the USB interface, select "`Save    continue`" and delete the result memory.
`Settings` `blocked`	Instrument settings cannot be changed because – blocking is activated or – saving of results is switched on.	– To change the settings, deactivate blocking in the "`Basic settings`" subcatalog. – If necessary, switch off saving of results in the "`Results`" subcatalog.
`Start measure-` `ment!`	The required function (e.g. save profile) cannot be performed as there is no valid measurement (for example because the measuring conditions were changed after the last measurement).	Start measurement.

Error / Message	Source	Remedy
`Upper limit exceeded` and ▲ symbol	Upper limit of the measuring range has been exceeded; measurement has been aborted; no evaluation possible.	Realign the testpiece or drive unit as appropriate.

7   Interfaces

7.1   Connecting the MarSurf PS1 to a PC (USB Interface)

The MarSurf PS1's USB interface allows it to be connected to a PC. It is automatically recognized as a USB memory stick by Windows 2000 and above.

This allows measuring results and profiles to be transferred to the PC for evaluation, e.g. with the MarSurf XR 20 evaluation software. Additional evaluation options allow flexible management and documentation of measuring results.

From MarSurf PS1 V1.01 onwards, the "MarSurf PS1 Explorer" software (see Section 10) enables records of the profiles and measuring results to be saved and printed.
The software also serves to copy profile and result files from the MarSurf PS1 to a computer in a straightforward way.

To connect the MarSurf PS1 to a PC:

1. Switch on the MarSurf PS1 using one of the green **Start** keys.

2. Connect the USB cable (3018921), inserting the mini-USB plug in the "USB" interface (15) on the MarSurf PS1 and the standard USB plug in the PC.

Steps 3 and 4 do not have to be performed when using the "MarSurf PS1 Explorer" software.

3. In Windows Explorer, switch to the new "Mar-Surf_PS1" drive.

4. Copy or cut the required profiles from the "PROFILE" folder and the required result files from the "RESULT" folder.

> To avoid possible data loss, the Mar-Surf PS1 must be disconnected from the PC using the "Safe to remove" function.

5. Click the "Safe to remove" symbol in the bottom right-hand corner of the Windows taskbar's information area.

6. Select e.g. "Remove USB mass storage device – Drive (E:)".

7. Wait until the "It is now safe to remove the hardware" message appears and disconnect the instrument from the USB interface.

7.2 Connecting an MSP2 Printer to the MarSurf PS1 (MarConnect Interface)

The MarSurf PS1 has a MarConnect interface (RS232). This interface can be used to connect, for example, Mahr's MSP2 statistics printer to print out the record for the current measurement.

The transfer parameters specified for the Mar-Connect interface are as follows:
4800 baud transfer rate, even parity, 1 start bit, 7 data bits, 1 stop bit.

ℹ These transfer parameters must also be selected on the linked device (e.g. the MSP2 printer).

To connect the MSP2 printer and set the transmission parameters:

1. Connect the Opto-RS232 data connection cable (4102410), inserting the small plug in the "DATA" interface (16) on the MarSurf PS1 and the 9-pin D-SUB plug in the "INPUT" interface on the MSP2 printer.

2. Switch on the MarSurf PS1 using one of the green **Start** keys.

3. If necessary, connect the MSP2 printer to the power supply.

4. Switch on the printer with the **ON/OFF** key.

5. On the MSP2 printer, proceed as follows:

   - Press the **ENTER** key.
     The "Interface" main menu is displayed.
   - Select the "Interface Opto" setting using the ▲ or ▼ key.
   - Select the "ASCII printer" main menu using the ◄ or ► key.
   - Press the **STAT** key.
   - Select the "DTR 4" setting using ▲ or ▼ and confirm with **ENTER**.
   - Select the following settings one after the other using ► and ▲ or ▼:
     "Baud Dat Par Stp
      4800 7 E 1".
   - Press **ENTER**.
     Select the "Save? yes" setting using ▲ or ▼ and confirm with **ENTER**.

To print the measuring record or individual measuring results:

1. Switch on the printer with the **ON/OFF** key.

2. Press the **ENTER** key on the printer. The "Interface" main menu is displayed.

   • Select the "ASCII printer" main menu using the ◄ or ► key.
   • Press the **DATA** key.

3. If "Autoprinting on" has been set in the "Record contents" subcatalog on the MarSurf PS1, the measuring record is now printed automatically after each error-free measurement.

4. To print the individual parameter currently displayed on the MarSurf PS1: press the small red button on the data connection cable.

Record contents

In the first two lines, the record indicates date and time of the measurement.
The traversing length evaluated is specified in the following line.
For measurements in accordance with ISO, JIS or ANSI/ASME:
– Line "Lc" specifies the length of the cutoff.
– If "(AUTO)" appears additionally in the Lt and Lc line, the MarSurf PS1 has automatically set the cutoff and traversing length.
– If the measurement was carried out with a reduced number of sampling lengths, the line "n" is also output.

Below this, the measuring results for the parameters selected in the "Record contents" subcatalog (see Section 3.3.3) are output.

For the peak count *RPc*, the values for the upper intersection line C1 and the lower intersection line C2 (in µm or µin) are indicated in brackets.
For the material ratio *Rmr*, the values for the intersection line C (in µm or µin) and the reference line CREF (in %) are indicated in brackets.
For the zone widths *CR*, *CF*, *CL*, the values for the corresponding intersection lines (in %) are indicated in brackets.

When evaluating the selected parameters, the tolerance limits are checked:
If the upper tolerance limit is exceeded, a plus sign appears between the measured value and the unit. If the lower tolerance limit is exceeded, a minus sign appears here.

8   Maintenance, Cleaning and Transport

The MarSurf PS1 requires the following mainte-
nance work:

- Checking the integrated standard
    - at regular intervals,
      by the user (see Section 8.1),
    - after approx. 350 calibrations,
      by the Mahr after-sales service.

  Since the integrated standard is subject to
  natural wear during calibration, is should be
  checked at regular intervals by the user using
  a separate skidless pick-up.

  It has to be checked and replaced, if neces-
  sary, by the Mahr after-sales service after
  around 350 calibrations. When calibrating
  daily, this corresponds to a service life of one
  year.

- Replacing the battery
    - after around two to three years,
      by the user (see Section 8.2).

The MarSurf PS1 and the pick-up are balanced
at the factory and therefore require no further
adjustment.
We nevertheless recommend having the meas-
uring accuracy checked at regular intervals or if
there is any suspicion that the measured values
are incorrect. This calibration work is performed
using the integrated standard or a separate rough-
ness or geometric standard (see Section 5).

Like all other components in the MarSurf PS1 set,
the instrument must be protected from direct
sunlight, high humidity, and dust.

Do not touch the stylus tip. Protect it
from knocks.
Do not allow grease, oil or other liquids
to get into the pick-up.

As far as possible, avoid bringing the
MarSurf PS1 into contact with oil, grease
and cooling agents as these substances
can affect the operation of the keypad
and the **Start** keys.

Cleaning

- Clean the MarSurf PS1 as required with a soft
  lint-free cloth moistened with a small amount
  of water or a standard plastics cleaner.

- Clean the pick-up with a soft fine-hair brush
  if necessary.

Do not allow any liquid to get into the
instrument during cleaning.

Do not use cleaners containing plastic-
dissolving chemicals (in particular ac-
etone) or alkaline cleaners (lyes).

Storage

We recommend that you store the MarSurf PS1
and its accessories in the polypropylene transport
box provided when they are not in use.

The power pack's power cable must not be bent
or placed under strain!

Transport / shipment

The MarSurf PS1 and its accessories
should only be shipped in the proper
polypropylene transport box and using
appropriate packaging.
Ensure that the pick-up is packaged in
the proper protective sleeve.
Failure to do so will render the warranty
null and void.

8.1 Checking the Integrated Standard

To determine the Rz value of the integrated standard:

1. Position an appropriate roughness measuring instrument (e.g. Perthometer S2, drive unit PZK, skidless pick-up MFW) such that the pick-up is seated on the integrated standard and a traversing length of 5.6 mm *(0.224 in)* can be measured (see Fig. 11).

2. Set traversing length $Lt = 5.6$ mm *(0.224 in)* on the measuring instrument.

3. Perform one or several measurements and read off the measured Rz value in each case.

4. Average over the measured Rz values.

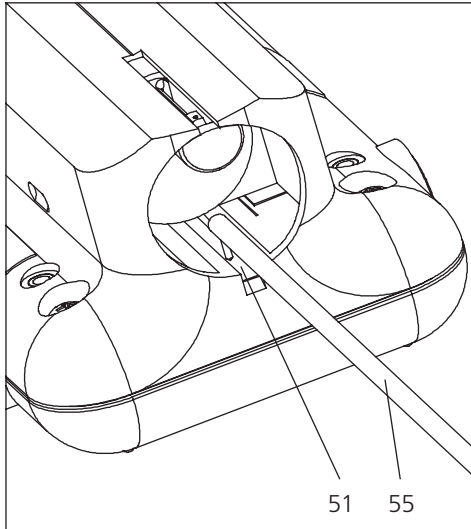5. When calibrating next time with the MarSurf PS1, enter the Rz value determined as Rz nominal value.

Fig. 11
Checking the integrated standard

51 Integrated standard
55 Separate skidless pick-up

8.2 Replacing the Battery

The maximum capacity of the built-in battery gradually decreases over a long period of use. Consequently, it is a good idea to replace the battery after around two to three years.

The battery should only be replaced by trained specialist staff.

Only a 3.6 V / 700 mAh Li-ion battery (3018466) should be used. Otherwise there is a risk of the instrument being damaged beyond repair.

The reset switch returns all MarSurf PS1 settings to the factory settings and deletes all profiles and results stored in the memory.
If necessary, connect the MarSurf PS1 to a PC and save the data first.
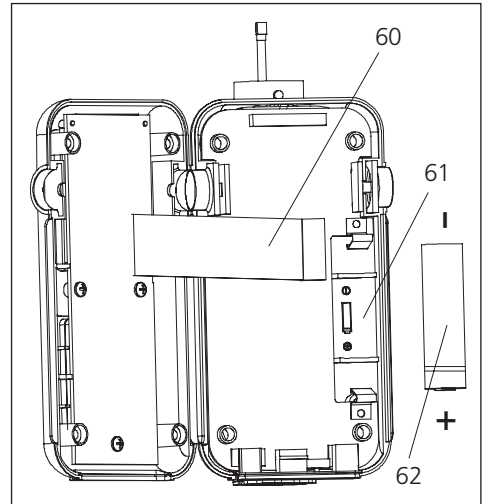

Fig. 12
Battery change

60 Ribbon cable
61 Battery compartment
*   indicating battery polarity*
62 Battery
*   (notch around the circumference indicates*
*   the positive pole)*

To replace the battery:

1. Move the reset switch (17) to the left into the "0" position to cut off the power supply to the MarSurf PS1.

2. Loosen and remove the four screws on the bottom of the MarSurf PS1 using a crosstip screwdriver.

3. Set the MarSurf PS1 on its vee-block bottom.

   Important: Do not allow the internal ribbon cable (60) to work loose or become twisted or bent!

4. Carefully move the top of the MarSurf PS1 90° to the left (as if opening the cover of a book).

5. Carefully lever the battery out of the battery compartment (61) using a small screwdriver or similar tool.

6. Insert the new battery (62) (3018466) between the spring contacts, making sure the polarity is correct. The notch around the battery's circumference indicates its positive pole.

7. Carefully place the top section of the MarSurf PS1 back in position.
   Ensure that
   – the internal ribbon cable (60) has not come loose and is in the correct position (i.e. not twisted or bent),
   – the green caps of the **Start** keys are in the correct position.

   The four screws are self-tapping screws and can badly damage the housing if screwed in too tightly!

8. Re-insert the four screws and tighten with a **torque of no more than 1 Nm**.

9. Move the reset switch (17) back to the right into the "I" position.

10. Connect the power pack to the "9 V =" socket (18) on the back of the MarSurf PS1 and plug it into the mains socket.

11. Switch on the MarSurf PS1 using one of the green **Start** keys and charge for around 1 hour.

12. Carry out the required settings again on the MarSurf PS1 (see Section 3).

9 Scope of Delivery

6910210   MarSurf PS1 set

6910200   MarSurf PS1 roughness measuring
instrument (14 languages, selectable),
with integrated drive unit and
standard

6111520   PHT 6-350 pick-up,
single-skid pick-up,
meas. range 350 μm *(0.014 in)*,
for measurements on level surfaces,
in bores of dia. ≥ 6 mm *(0.236 in)*
up to 17 mm *(0.669 in)* deep and
for groove widths ≥ 3 mm *(0.118 in)*

7028532   Pick-up protection
for bores of dia. ≥ 10 mm *(0.394 in)*

6910202   Vertical adjustment accessory
up to a max. of 50 mm *(1.969 in)*
(incl. mount and 1 pair of bow-type
vertical adjusters)

3018838   Long-range power supply
(100 V AC to 264 V AC, 9 V DC)
with three mains adapters

3903456   Hex head screwdriver, 2.0 A/F

3018921   USB cable, length 1.5 m *(4.92 ft)*,
for connection to the USB interface
of a PC

3757410   Operating instructions
3757413   (14 languages)
3757414

3757409   Brief guide (14 languages)

7035693   Carrying case with shoulder strap
and belt loop

7032977   Polypropylene transport box

The transport box has space for the following
additional accessories:
– two further PHT pick-ups,
– pick-up extension,
– adapter for transverse tracing,
– end face vee-block,
– measuring stand mount.

10 Accessories, Spare Parts and Wear Parts

Certain accessories are available as sets but the relevant parts can also be ordered individually.

6910213 PHT pick-up set for MarSurf PS1

6111521   PHT 3-350 pick-up,
single-skid pick-up,
meas. range 350 μm *(0.014 in)*,
for measurements in bores of dia. ≥
3 mm *(0.118 in)* and up to 17 mm
(0.669 in) deep

6111524   PHT 11-100 pick-up,
single-skid pick-up, cranked,
meas. range 100 μm *(0.004 in)*,
for measurements at recessed
measuring points, e.g. in grooves
≥ 2.5 mm *(0.10 in)* wide and up to
7.5 mm *(0.30 in)* deep

6910212 MarSurf PS1 accessory set

6850540   Pick-up extension,
length 80 mm *(3.15 in)*,
for measurements in bores of dia. ≥
9 mm *(0.354 in)*
(with PHT 3-350 pick-up)

6850541   Adapter for transverse tracing

6910203   End face vee-block
for measurements on flat faces of
planar and cylindrical components

6910201   Mount
for attaching the MarSurf PS1 to an
ST-D, ST-F or ST-G measuring stand

6910211 Printer set for MarSurf PS1

4102040   MSP2 statistics printer
(languages selectable: German,
English, French),
incl. power pack (100 V AC to
240 V AC, 7.5 V DC),
1 roll of thermal paper
(width 58 mm / *2.28 in*,
dia. 46 mm / *1.81 in*)

4102410   Opto-RS232 data connection cable,
length 2 m *(6.56 ft)*

Further accessories available individually:

6111520   PHT 6-350 pick-up,
single-skid pick-up,
meas. range 350 μm *(0.014 in)*,
for measurements on level surfaces,
in bores of dia. ≥ 6 mm *(0.236 in)*
up to 17 mm *(0.669 in)* deep and
for groove widths ≥ 3 mm *(0.118 in)*

6111526   PHT 6-350 pick-up,
single-skid pick-up,
stylus tip radius 5 μm *(0.0002 in)*,
meas. range 350 μm *(0.014 in)*,
for measurements on level surfaces,
in bores of dia. ≥ 6 mm *(0.236 in)*
up to 17 mm *(0.669 in)* deep and
for groove widths ≥ 3 mm *(0.118 in)*

6111522   PHTF 0.5-100 pick-up,
single-skid pick-up,
meas. range 100 μm *(0.004 in)*,
for measurements on tooth flanks

6111525   PHTR 100 pick-up,
single-skid pick-up with side skid,
meas. range 100 μm *(0.004 in)*,
for measurements on concave and
convex surfaces

6111523   PT 150 pick-up
dual-skid pick-up,
meas. range 150 μm *(0.006 in)*,
for measurements on metal sheets
and roller surfaces as per DIN EN
10049 (SEP)

3018466   Li-ion battery for MarSurf PS1,
3.6 V / 700 mAh

6710803	MarSurf ST-D measuring stand
6710806	MarSurf ST-F measuring stand
6710807	MarSurf ST-G measuring stand
6710529	MarSurf CT 120 XY table

6820420	PRN 10 roughness standard, surface standard for dynamic calibration; turned profile, profile depth approx. 10 μm *(393 μin)*; incl. Mahr calibration certificate
6820601	PGN 3 geometric standard, surface standard for dynamic calibration; sinusoidal groove profile, profile depth approx. 3 μm *(118 μin)*, groove spacing approx. 0.12 mm *(0.005 in)*

6299009	"MarSurf XR 20" evaluation software incl. dongle (USB) with associated license diskette and "MarSurf XR 20" software (9 languages, selectable)
6910205	"MarSurf PS1 Explorer" record software (14 languages, selectable)

11   Warranty

The unit supplied by us has been designed and manufactured with care. It has undergone thorough testing before being delivered.

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

The duration and conditions of warranty are set out in the general delivery terms of Mahr GmbH and/or in the sales contract.

The following provisions apply insofar as the general delivery terms and/or sales contract do not stipulate otherwise:
The warranty does not cover either natural wear and tear or faults resulting from improper handling, use for purposes other than those intended or non-observance of the operating instructions. In particular, the manufacturer may only be held liable for functional or safety features if all work on the unit, other than that described in the operating instructions, has been carried out exclusively by the manufacturer or by parties having the manufacturer's express authorization.

Since the pick-up 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.

The high accuracy of this instrument can only be guaranteed if genuine Mahr pick-ups and other Mahr accessories are used.

Mahr

Konformitätserklärung

Declaration of Conformity / Déclaration de conformité / Atestado de conformidad / Dichiarazione di conformità

Wir	**Mahr GmbH**	erklären in alleiniger Verantwortung, daß das Produkt
We	**Brauweg 38**	declare under our sole responsibility that the product
Nous	**D- 37073 Göttingen**	déclarons sous notre seule responsabilité que le produit
Nosotros		declaramos con responsabilidad exclusiva que el producto
Noi	**Germany**	dichiariamo con la responsabilità esclusiva che il prodotto

Bezeichnung:
name: / nom: / nombre: / nome:

Rauheitsmessgerät / surface analyzer

Typ:
type: / type: / tipo: / tipo:

MarSurf PS1

ab Lieferdatum oder Serien-Nr.:
from delivery date or serial number:
à partir de date de livraison ou n° de série:
a partir de fecha de entrega o núm. de serie:
da data di consegna o numero di serie:

1101/05

mit folgenden Normen übereinstimmt:
is in conformity with the following standards:
est conforme aux normes:
está conforme con las normas siguientes:
è conforme alle norme seguenti:

DIN EN 61010-1: 2002-08+B1/B2
DIN EN 55011: 2003-08; group 1, class B
DIN EN 61000-6-2: 2006-03, level C

gemäß der Richtlinie(n):
following the Directive(s):
conformément à la Directive:
con arreglo a la Directiva:
secondo alla Direttiva:

Niederspannungsrichtlinie 73/23/EWG, i.d.F. 93/68/EWG

Richtlinie Elektromagnetische Verträglichkeit 89/336/EWG, i.d.F. 93/68/EWG

Ort u. Datum: Göttingen 11.7.07 Unterschrift: *i. A. Kochta*   Prüfbeauftragter
Place and date: Signature: Inspector
Lieu et date: Signature: Gerhard Kochta   Contrôleur en chef
Lugar y fecha: Firma: Ingegnere collaudatore
Luogo e data: Firma: Verificador jefe

Dokument-Id.-Nr.:
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