



**TESA**  
TECHNOLOGY

Instruction Manual

# TESA-rugosurf 20

English

Compact Surface  
Roughness Gauge



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## 1 INTRODUCTION

You have purchased the compact TESA Rugosurf 20 and we thank you for your choice. To help you to get the best performances from your surface roughness gauge and to use it satisfactorily, we would advise to first read this manual carefully.

To achieve reliable measurement results over a long period of time, we would also recommend to take all the precautions stated hereafter.



*Your roughness gauge uses a calibrated stylus mounted at the probe end. It is, therefore, advisable to handle this unit with special care in order to avoid shocks.*

*To keep it perfectly clean, use compressed air under a pressure contained within 2 bars.*

## 2 SAFETY PRECAUTIONS

- Make sure the indicated voltage matches that of your mains supply.
- Do not attempt to dismantle the unit, except for the parts listed in this manual. If you fail to take this precaution, you might damage your roughness gauge or cause a failure to occur.
- Do not subject the probe to stresses or shocks. This sensitive component must be handled with care.
- Do not use your roughness gauge in a dusty environment, or have it exposed to vibrations. Keep it away from appliances emitting noise on the mains, such as air conditioners, transformers or high-voltage relays.
- Do not use the gauge unit in places where there may be excessive and sudden temperature variations. Do not leave it in a closed, overheated room or exposed to direct sunlight.
- Store your roughness gauge where temperature remains within  $-10^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ .
- Before you start measuring, remove any oil spots or dust particles on the surface to be inspected.
- Do not drop your roughness gauge. Avoid shocks. Although solidly built, the measuring system inside the unit may be damaged, thus leading to incorrect measurement results.

### 3 GENERAL DESCRIPTION

Your TESA-Rugosurf 20 is a compact surface roughness gauge that is very easy to handle and to use. This microprocessor-controlled gauge uses a graphical LC Display. It is powered by a rechargeable battery, which provides a remarkable operating independence. All menus and messages can be displayed in the most usual international languages.

This gauge consists of an electronic unit, a built-in drive unit and a printer unit available as optionally. It allows the main roughness parameters on the surface finish to be measured with a resolution to the nanometre. Whether held in the hand, or clamped to a stand, this versatile tool can face any conditions of use. In order to avoid vibrations that could alter the measurement results, you may switch it on and start the measurement either through the printer used as remote control, the remote control itself or TESA Rugosoft. These last two components are optional.

The measuring length will be automatically set when choosing either of the three cut-offs available. However, the length may be changed by selecting the number of cut-offs contained within 1 and 5.

Your roughness gauge prevents and displays any incorrect handling or irregularities. The memory lets you store more than 1000 roughness parameters or 20 measurements along with graphical representations, which can be recalled and further printed out at any time.

The most common functions, such as summoning up the measurement results or the cut-offs besides starting the measurement operations are directly accessible from the keyboard while any other function linked to measurable parameters is available as an auxiliary function. This makes your part series inspection easier.

All presettings and other data related to the last measurements you have taken will be stored in the memory as you turn off your Rugosurf 20. Used with battery power, it switches off automatically whenever it is left unused for 1 minute.

Each digital output enables a direct connection of the gauge unit to the optional printer or to a host computer using a Micro-USB standard cable available from the range of optional accessories.

With the gauge connected to a printer, you can output a user-defined 3-line header. Through the appropriate software installed on the computer, you will be able to download or modify all settings, let the measured values be transferred, display graphics or print detailed reports.

The various printing modes can only be enabled over the TESA-Rugosurf printer keyboard.

#### Printable parameters

- Any previously selected roughness parameter
- Rmr parameter (Abbott curve)
- Measured profile
- Parameters of saved measurements

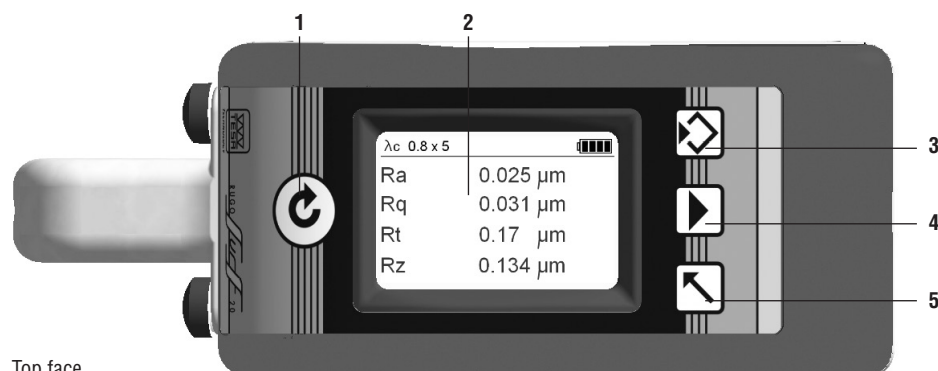
## 4 ELEMENTS ON THE TOP FACE

Your roughness gauge can be entirely controlled over the keys located on the right and the left of the display screen.

Some keys are able to execute a function directly, while some others are used for selecting the relevant menu or submenu that will let you configure the gauge according to your needs.

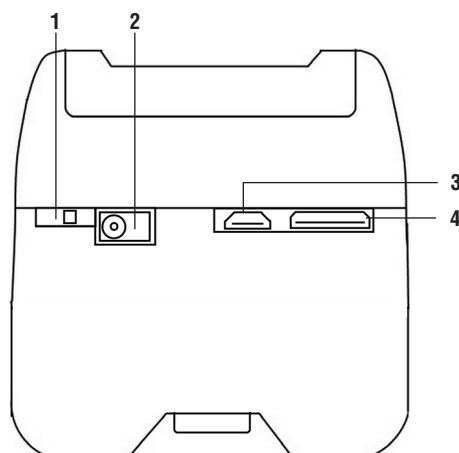
The function of some keys will vary, depending upon the conditions.

- 1 START/STOP key (starting/discontinuing a measurement).
- 2 Graphical LC Display, black&white, 2 in.
- 3 ENTER key (confirmation).
- 4 Scroll key.
- 5 Backward key.



Top face

## 5 ELEMENTS ON THE REAR FACE



Rear face

- 1 ON/OFF toggle switch used whenever the gauge will be stored for a long period of time (with ON directed to the right, if so).
- 2 Mains connector for power supply.
- 3 Micro-USB connector for data output.
- 4 Printer connector.

## 6 GETTING STARTED

Switching on your roughness gauge is done by toggling the mains switch to the right, and then pressing down the START/STOP key (1). The **Startup** screen disappears a few seconds later. The gauge unit is then ready to measure and the results of the measurement lastly carried out are displayed.

Display switches off automatically whenever the gauge is left unused for 60 seconds. Pressing any key within this short while causes this stand-by condition to increase for 60 additional seconds.

Any menu, submenu or function susceptible to be directly triggered from the keyboard will not be accessible unless the gauge is powered up.

Your Rugosurf 20 can also be turned on in either of the following ways:

- Using the optional remote control connected to the printer port.
- Pressing any key on the printer connected to the Rugosurf.
- As soon Rugosoft and the roughness gauge will be capable to communicate.

### Note

*Turning the toggle switch to OFF then back to ON will enable you to restart your gauge unit.*


*If your roughness gauge is left unused for a long time, we would highly recommend to use the toggle switch to have it totally powered down. This way of doing will contribute to preserve the battery.*

## 7 MAIN MENU AND SUBMENUS




### Structure

Every menu and submenu lets you control every operating function.

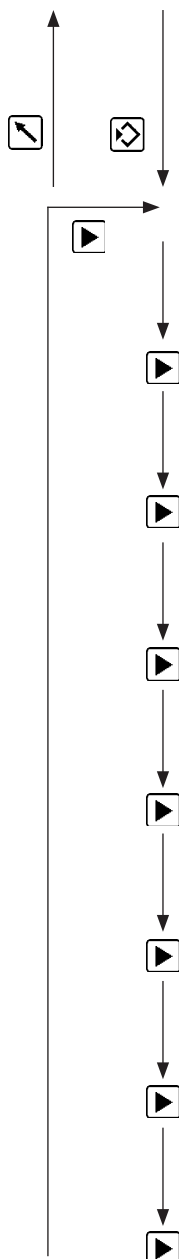
The main menu appears on the display screen in the following conditions:

- 1 Once the gauge has been turned on.
- 2 When the **ENTER**-key  is pressed down.

Available keys.

-  Confirming and accessing selected menu.
-  Moving the scroll key.
-  Getting back or quitting the menu.

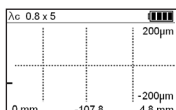
## Main menu and submenus



Ac 0.8 x 5	
Ra	0.025 µm
Rq	0.031 µm
Rt	0.17 µm
Rz	0.134 µm



Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time



Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5	
✓ Ra	✓ Rq
✓ Rz	✓ Rc
✓ RSm	✓ Rmax
✓ RPa	✓ Rmr%

Ac 0.8 x 5	
Ra	✓ Show
✓ Tol	1 0 0 0 0 ↑
µm	0 2 0 0 0 ↓

Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5 M.O	
✓ Enable	Delete
Show	Reset
✓ Save Profile	43%

Ac 0.8 x 5	
Do you want to remove all measures?	
No	Yes

Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5	
Ra of the specimen	
0 0 2 9 7 µm	
Start measure	

Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5	
Delay measure start	
✓ Without delay	1s
4	6
8	10

Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5	
✓ ISO 4287	
✓ mm	inches
ISO 12085	

Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5	
✓ English	Français
Deutsch	Italiano
Español	Português
中文	→

Ac 0.8 x 5	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

Ac 0.8 x 5	
Watch	
Year	20 1 1
Month	0 7
Day	0 6
Hour	1 0 3 7
Save	

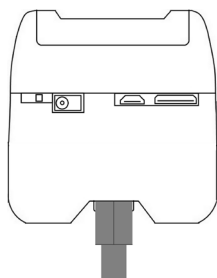


## 8 PROBE

Your Rugosurf 20 incorporates a translation mechanism with the probe attached by means of the height articulated probe-holder. In order to swap the probe, simply pull it in its axis opposite to its displacement. For attachment, the probe is just plugged in.

The measurements can be taken by lying down the gauge unit on the surface to be checked. But, you may also mount it on a support or use its protection to rest it on the relevant surface.

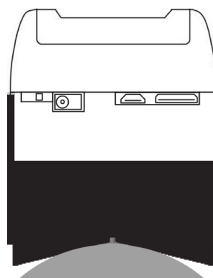
Special parts or hard-to-reach locations can be measured with the Rugosurf 20 clamped to the standard support using the 8 mm diameter fixing rod provided with the gauge. The latter will be screwed into the convenient thread located on the lower face of the gauge.



Other supports can additionally be made available, rendering all measurement operations easier.

When inspecting cylinders, use the auxiliary supports that came with the roughness gauge.

The two extra V-shaped supports allow for any cylinder up to 80 mm in diameter to be measured. They will need to be attached on both front and rear gauge faces.




### Note


*The probe comes with a built-in inductive measuring system. Should this feature be swapped, or important changes in the ambient conditions occur, a calibration as described in chapter 10.4 will then be required.*

*For checking purposes, it is advisable to regularly carry out a measurement on the standard contained in the delivery scope.*

## 9 ROUGHNESS MEASUREMENT

For a correct way of proceeding when measuring the roughness of a surface finish, the following items must be taken into account.

- 1 Whenever possible, install your roughness gauge on a rigid support, free from vibrations. Carefully clean the surface to be measured. As the measurement is being taken, don't keep the gauge in your hand, so as to prevent any movement. If necessary, take several measurements for comparison purposes. If one of the measured values is significantly different from all others, this means that the gauge has been disturbed during the measurement operation. The accessories supplied with the gauge, i.e. the probe itself, probe cover and raising items, make positioning easier.
- 2 Press the key  on the left side of the display screen to power up your roughness gauge.
- 3 Select the value together with the number of cut-offs you want to use for the measurement (see in the table below).
- 4 Position the probe in a such way that its axis lies parallel to the surface to be measured, as far as possible. Enabling the function **Position** will let you check the probe position, especially in hard-to-reach locations.

- 5 Press the key  to start the measurement cycle. You may also use the command available from Rugosoft (06930034). The drive unit moves the probe along the surface to be measured. The graph displayed during the measurement shows the probe advance, so that any noticed irregularity can be checked in the course of the probing operation. On completion of data acquisition, display shows the measured value for each parameter and the drive unit moves the probe back to its start position.

Pressing the key  allows you to discontinue the measurement at once.

### Note

*The ambient temperature, but also that of the roughness gauge and the part to be measured should be as identical as possible and within the given operating temperature limit. The best from your gauge is obtained at 20°C.*

### Possible settings for roughness measurement according to ISO 3274 on non-periodic surfaces

Ra (µm)		Cut-off (mm)	L <sub>t</sub> (mm)
from	up to and including		
0,02	0,1	0,25	0,75 to 1,75
0,1	2	0,8	1,30 to 4,50
2	10	2,5	3,00 to 13,0


Relationship between the roughness and cut-off, in millimetre

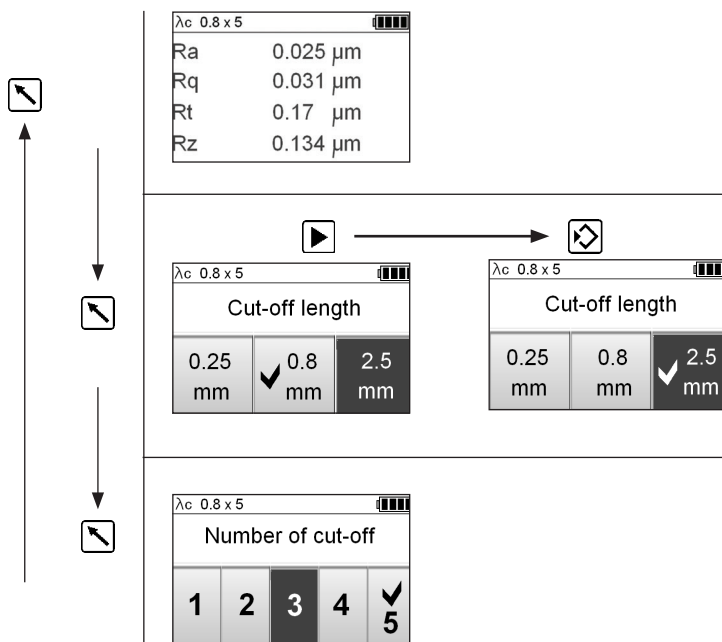
Ra (µin)		Cut-off (mm)	L <sub>t</sub> (mm)
from	up to and including		
0,5	2,5	0,01	0,03 to 0,07
2,5	50	0,03	0,05 to 0,18
50	250	0,10	0,12 to 0,51

Relationship between the roughness and cut-off, in inches

## 9.1 Selecting the length and the number of cut-offs according to ISO 4287

To access this option, press the key  from the results window, select the value over the key  and confirm via **ENTER** .

To confirm your selection and let you set the number of cut-offs, press the key .



The total length is dependent on the selected cut-off.




$$L_t = (\text{number of cut-offs} + 1) \times L_c$$

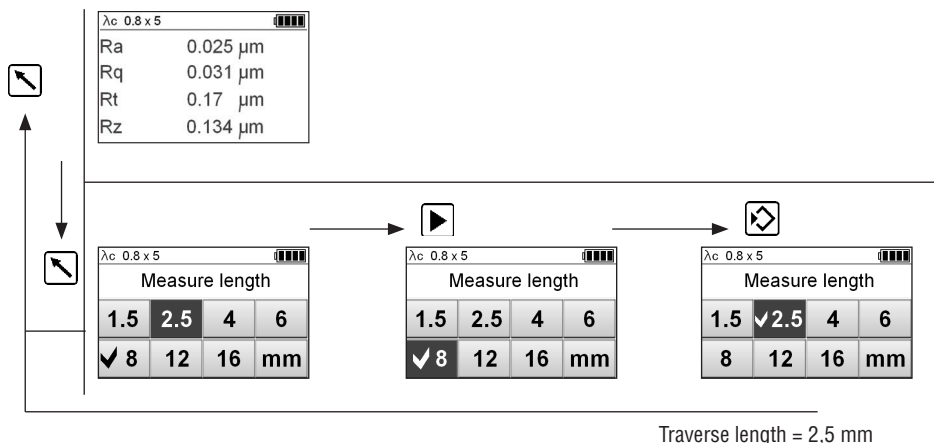
If this length is too important, you can change it by reducing the number of cut-offs to be used for the measurement.

Usually, 5 matches the selected number of cut-offs. You may, however, choose another number contained within 1 and 5.

## 9.2 Selecting the cut-offs according to ISO 12085 (CNOMO)


Once the standard ISO 12085 has been chosen, the length of the measuring range, which does no longer depend on the cut-off value, will be directly selected.

To access this menu option, press the key  from the results window, select desired value over the key  and confirm via **ENTER** .



## 10 MENU AND STATUS BAR

To access this menu, press the **ENTER**-key .

$\lambda_c 0.8 \times 5$ 	
Position	Parameters
Files	Calibration
Delay	Standard
Language	Time

The status bar appearing on top of the display screen summarizes all selected measuring conditions in addition to the battery level and the number of measurements saved in the memory, if enabled.

## 10.1 Probe position

This menu option allows you to check the correct probe position against the surface to be inspected. Its use is helpful in the two following cases:

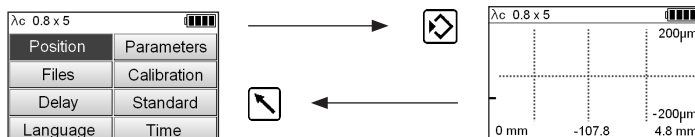
### 1 When measuring grooves or bores.

As display shows the probe displacement, its position can be set according to the measuring range. If necessary, this menu option assures you that the probe keeps on contacting the surface being checked, otherwise the measurement will be interrupted.

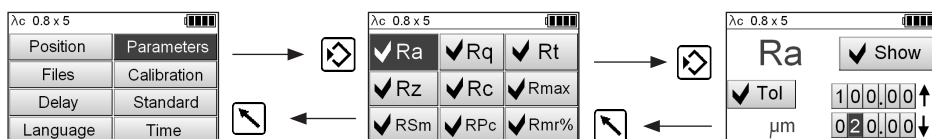
### 2 When measuring critical surfaces.


In a such case, this option serves to the correct positioning of the probe on concave or convex surfaces.

To access this menu option, select **Position**, and then confirm via **ENTER** .



## 10.2 Setting roughness parameters and tolerances




Press the key  to select desired roughness parameter in the list.


Confirm via **ENTER** .

Each parameter can be enabled or disabled, depending on whether you want to have them displayed or not.

A tolerance value may also be assigned to each measured value.

Press the key  to choose the value you want to modify, and then **ENTER**  to set the correct value.

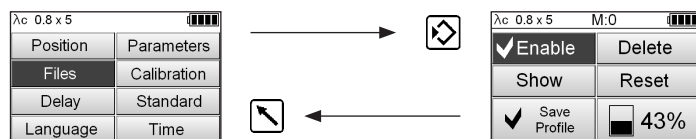
Keep on pressing the key  until setting of the chosen value is completed.



Press the key  to get back to upper menu. All modifications will be automatically stored in the memory.

Proceed in the same way to select each roughness parameter you want to view and to set the appropriate tolerance values.

## 10.3 Storing the measured values in the memory

Your Rugosurf 20 allows you to store more than 1000 measured roughness parameters or 20 measured values with graphical representation.



A navigation through the submenu **Files** allows you to activate the memory. Once this is done, confirm the menu option **Enable** via **ENTER**  to enable/disable the **Memory** function. Finally, press the key  to get back to the main menu.

The status bar tells you the number of measured values stored in the memory, e.g. M:0.

Any stored value can either be cancelled by selecting **Delete** or viewed over **Show**, or the memory cleared by choosing **Reset**.

The option **Save Profile** let you define whether the roughness parameters alone or together with graphs must be stored in the memory.

The available space appears in percentage in the submenu **Files**. If the memory is full, an error message tells you that no other values can be stored unless you clear the memory.

To have the measured values be printed out, just press the appropriate key on the printer. The output can be restarted as long as all values remain in the memory. The measured values may also be checked one after the other.

## 10.4 Calibration

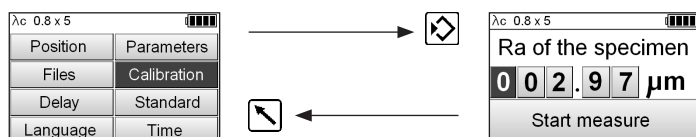
It is advisable to check and calibrate your roughness gauge regularly. The measured parameter value **Ra** (or **R** using a specimen complying with ISO 12085) must be close to the specified one.

The calibration process is based on the roughness parameter **Ra** (or **R** value for ISO 12085). The reference value (specimen) will be set prior to carrying out the measurement.




The measuring conditions along with the cut-off and the number of cut-offs will be previously set

according to the indicated value on the specimen. So, for example, defined cut-off length will match 0,8 mm and 5 for their number with a parameter value **Ra** of 2,97  $\mu\text{m}$ .

To access this menu option and calibrate your roughness gauge, select **Calibration** and confirm via **ENTER** .



## Roughness parameter Ra on the specimen

Firstly, press the key  to select the digit you want to change, then the **ENTER**-key  to increase desired value. Once the value on the specimen (e.g. 2,97  $\mu\text{m}$ ) is properly set, position the probe stylus conveniently prior to running the calibration cycle. To have this cycle be started up, move the scroll key  to the option **Start measure**, and then confirm via **ENTER**. The graph appearing on the display screen shows the probe progression throughout the calibration cycle.

Upon completion of the procedure, the calibration is confirmed for a few seconds on the display screen before getting you back to the measurement results.



### Note

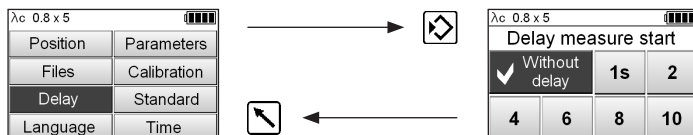
*The calibration procedure requires the unit system previously selected in the **Standard** menu. The measuring conditions must be set based on the information provided on the setting standard. This is essential.*

We recommend not to use the specimen longer than necessary, so as to prevent its surface from being scratched with the probe stylus, thus leading to erroneous roughness values.

## 10.5 Delayed measurement

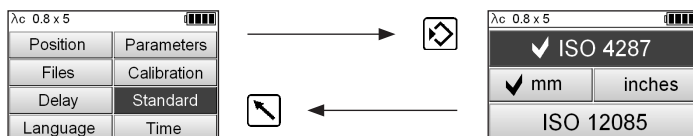
Selecting this option allows you to set a wait between the request for measurement and the measurement itself. Particularly useful when measuring hard-to-reach locations, this option replaces the remote control.




Move the key  to choose desired value in seconds and confirm via **ENTER** .



## 10.6 Selecting the unit system and the standard

To access this menu option, select **Standard** and confirm via **ENTER** .







Move the key  to chosen standard and confirm via **ENTER** . The unit system can only be selected under ISO 4287. To get back to the main menu, press the key .

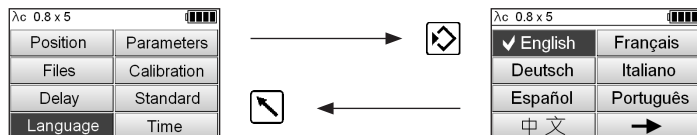
### Note

*Selecting ISO 12085 causes the metric unit system to be automatically enabled because this standard does not allow any measurement in imperial units.*

## 10.7 Selecting the language

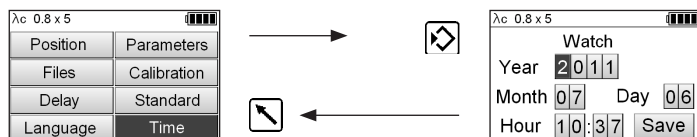
To access this menu option, select **Language** and confirm via **ENTER** . Move the key  to desired language and press the **ENTER**-key  to confirm your choice.



Finally, press the key  to access back this submenu.



## 10.8 Setting the clock

To access this submenu, select the option **Time** and confirm via **ENTER** .



Press the key  to select **Year**, **Month**, **Day** or **Hour** you want to change. Press then the **ENTER**-key  to increase the selected value until desired one is displayed.


Confirm all changes via **ENTER**  while the cursor is positioned on the **Save** option.


To get back to the main menu, press the key .



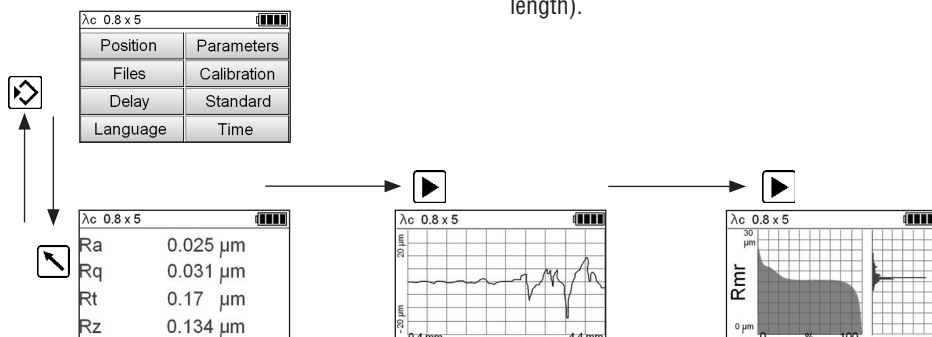
## 11 MEASUREMENT RESULTS

### 11.1 Displaying the measurement results

The results are automatically displayed on completion of the measurement. While navigating through the menu and submenus, press the key  to get back to the measurement results.

Pressing the key  lets you scroll through the pages showing the results by parameter or by graphs.

- 1 Displayed parameters (according to relevant standard and selected parameters).
- 2 Displayed graph (roughness curve).
- 3 Displayed Abbott curves (along with bearing length).



### 11.2 Specific result request using direct command

It is possible to send a command to request a specific parameter result in Hyperterminal or equivalent software. The driver of Rugosurf 20 instrument should be installed (available upon request to TESA)

List of commands:

- ?on? switch instrument permanently on
- ?off? switch off the instrument
- ?!? test to see if the instrument is on and if communication is established properly.

ISO 4287

- ?ra?
- ?rq?
- ?rt?
- ?rz?
- ?rc?
- ?rmax?
- ?rsm?
- ?rpc?

ISO 12085

- ?pt?
- ?r?
- ?ar?
- ?rx?
- ?ppc?

## 12 CHARGING AND REPLACING THE BATTERY PACK

The level of the battery charge is viewable in the top right corner of the display screen with the battery symbol changing gradually from full to empty. Should the battery be discharged, connect your roughness gauge as soon as possible to the charger supplied with the gauge.

Full recharging the battery pack takes at least 8 hours. The main switch must be in ON position during the battery charging. There is no recharging if the switch is in the OFF position. Since the power supply unit incorporates a system ensuring automatic regulation of the battery charge, this unit can remain connected during the measurement operations. Your roughness gauge will continue to operate whilst the battery is recharging.

### Note

*Do not leave the gauge unit unused for a long period of time with discharged battery as it could deteriorate. Check the charge level at least every 30 days. Should the battery charge fall below a given level, you won't be able to switch back the gauge. Do not replace the battery by zinc-carbon or alkaline batteries as they might blow up when attempting to recharge them, but in any case be damaging to the battery if their charge is low.*

Whenever your gauge will be left unused and stored over a long time, toggle the main switch to OFF to disconnect the battery pack from the electronics.

This procedure being similar to dismantling and turning off the gauge, all preference settings previously saved will be deleted.

The rechargeable battery can support a given number of charge/discharge cycles before its replacement by a new one from type NiMH, 7,2 V, 300 mAh, format PP3 (06960045) will be necessary.

Procedure to access the battery pack:

- Remove the probe.
- Undo both socket head screws on the bottom face of the gauge.
- Dismantle the upper case while paying a special attention to the cables.
- Remove the battery pack from its location and replace it by the new one.



***Make sure both positive and negative poles are not inverted.***

Provided the replacement is made within a few seconds, no data or setting value will be lost. Otherwise each calibration value, header and other significant data will be cancelled upon automatic resetting of the gauge.

## 13 TECHNICAL DATA

Measured roughness parameters	Ra - Rq - Rt - Rz - Rc - RSm - Pt - Rmr - Pmr according to <b>ISO 4287:1997</b> RPc – PPc according to <b>EN 10049</b> Rmax according to <b>DIN 4768</b> R - Rx - AR according to <b>ISO12085</b> .
Measuring range (Z)	Ra 0 to 100 µm, Rt 0,05 to 400 µm <i>Ra 0 to 3937 µinch, Rt 0 to 15748 µinch</i>
Total length (X)	(Number of cut-offs + 1) × Lc
Traverse length (X)	Number of cut-offs × Lc
Resolution	0,001 µm / <i>0,01 µinch</i>
Cut-off length	0,25 - 0,8 - 2,5 mm / <i>0.01 - 0.03 - 0.1 inch</i>
Electronic filter	GAUSS filter to ISO 11562
Number of cut-offs	1 up to 5
Keyboard	Four-key tactile keyboard protected against dust particles and oil splashes IP67
Selectable languages	English, French, German, Italian, Spanish, Portuguese, Dutch, Chinese, Slovak.
Display	2-inch LC Display, black and white, 160 x 160 pixels
Power supply	Battery pack 7,2 V, 300 mAh or 100-240 V, 50/60 Hz for the charger connected to the mains
Probing system	Inductive
Diamond-like stylus	R = 5 µm, 90°
Measuring force	0,75 mN according to ISO 3274
Precision	ISO 3274, class 1
Displacement speed	0,5 – 1 mm/s (measuring and positioning)
Operating temperature range	+10 to +40°C
Storage temperature range	-10 to +50°C
Full battery recharging	8 hours
Inside memory	>1000 roughness parameters or 20 measurements with graphical representations
Battery life	about 1000 measurements
Connectors	Micro USB (PC) and Special (printer)
Mass	122 x 60 x 62 mm (roughness gauge alone)
Weight	650 g
Packaging	Suited plastic case
Origin	UE

## 14 DELIVERY PROGRAMME

### TESA Rugosurf 20 roughness gauge

(No. 06930013) supplied together with:

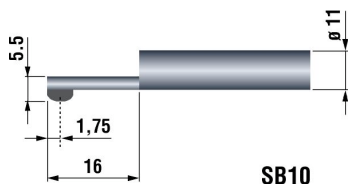
– SB 10 probe	06960036
– Mounted battery pack, 7,2 V	06960045
– Mains charger	06960046
– Setting standard, $R_a=2.97\mu\text{m}$	06960041
– Adapter for 8 mm dia. support	056633
– Positioning support	057655
– Probe protection	057653
– Knurled screws (4 items)	056632

## 15 OPTIONAL ACCESSORIES

For a detailed list of the full range of available accessories, report to the TESA general catalogue or to the Product Info on the Rugosurf 20.

- USB cable to the PC : 04760099
- Rugosoft software : 06960034
- Rugosurf20 battery : 06960045

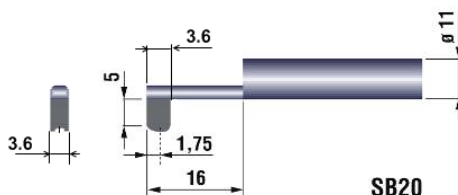
### 06960036



**SB10**

*For surface, bore and shaft  $\varnothing > 10\text{ mm}$*

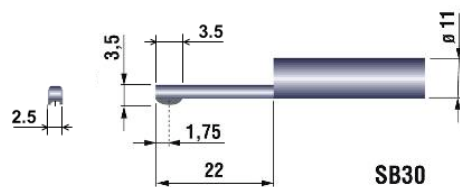
### 06960037



**SB20**

*For groove  $< 5\text{ mm}$  depth*

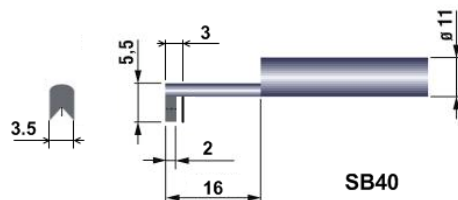
### 06960038



**SB30**

*For small bore  $\varnothing > 4\text{ mm}$*

### 06960039

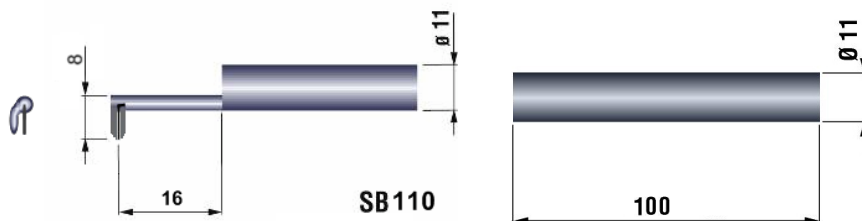


**SB40**

*Vee-shaped skid for  $\varnothing > 1\text{ mm}$  cylinder*

06960057

06960056 (Extension)



For concave or convex surface,  $R > 5$  mm rading

## 16 RECYCLING



This product must be treated separately. It is, therefore, important to comply with the rules in force in your country as regards recycling.

## 17 GUARANTEE

We guarantee the product against any fault of design, manufacture or material for a period of 12 months from the date of purchase. Any repair work carried out under the guarantee conditions is free of charge. Our responsibility is limited to the repair of the product or, if we consider it necessary, to its free replacement.

The following are not covered by our guarantee: probe, rechargeable battery and damage due to incorrect handling, failure to observe the instruction manual, or attempts by any non-qualified party to repair the product; any consequences whatever which may be connected either directly or indirectly with the product supplied or its use.

*Extract from our General Terms of Delivery, December 1st, 1981*

## 18 DECLARATION OF CONFORMITY WITH CONFIRMATION OF THE TRACEABILITY OF ALL INDICATED VALUES

Thank you very much for your confidence in purchasing our product, which was checked in our works.

We declare under our sole responsibility that it is in conformity with the standards and technical data as specified in our sales documentation (instruction manuals, leaflets, general catalogue).

In addition, we certify that the measuring equipment used to check this product refers to national master standards. The traceability of the measured values is guaranteed by our Quality Assurance.

**Quality Assurance**





