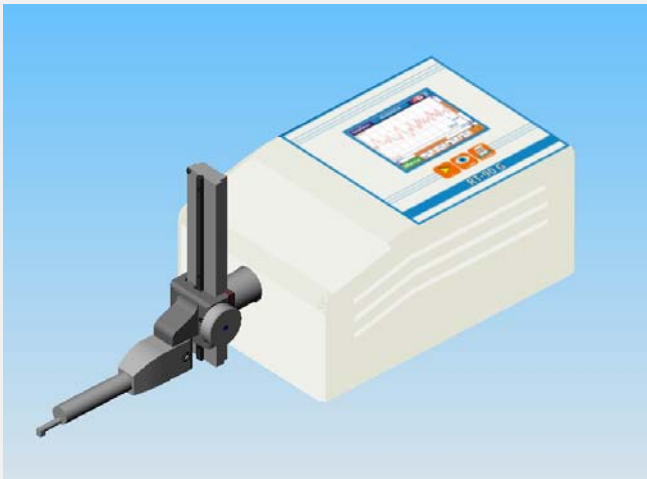# SM s.r.l.

RT-90G
roughness tester
quick reference

WARNINGS

To get the best results from this instrument and to use it satisfactorily, first read this manual. Observe the following precautions to obtain the best results from the instrument in the long term.

CAUTION! *this instrument uses a calibrated stylus on the end of the pick-up. Therefore always take great care when handling it and avoid shocks. Keep it permanently clean using a jet of dry air of pressure not more than two bar.*

IMPORTANT

➲ For the mains power supply, follow the indications on the power supply and in this manual. Do not use power supplies other than the one supplied.

➲ Do not disassemble the instrument, with the exception of the parts specified in this manual. Damage or malfunctions may result.

➲ The pick-up is a delicate, precision part. Do not subject to stresses or shocks.

➲ Do not use the instrument in dusty environments and with strong vibrations. Where possible, keep it away from generators of noise, such as large power supplies or transformers, high voltage switches and relays.

➲ Do not use/leave the instrument in places where there may be excessive and sudden temperature excursions, or in closed rooms with very high temperature or with direct sunlight.

➲ Store the instrument in places where the temperature can be kept at between -10°C and +50°C. Do not leave it exposed to direct sunlight.

➲ Before starting measurements, eliminate all oil residues and dirt from the surface to be measured.

➲ Do not subject the instrument to shocks or drops because its internal translator, in spite of being extremely robust, may become damaged and falsify the readings.

Table of contents

Chapter 1: *general description.*

The RT-90G roughness tester is a portable instrument but with characteristics typical of a laboratory one, with good manageability easy-to-use and great measure accuracy characteristics.

It enables you to measure surface roughness, valueing parameters according to the following standards: ISO 4287:1997, DIN, and ISO 12085:1998 (MOTIF o CNOMO).

It is controlled by one microprocessor; it uses a 6" LCD touch screen color graphical display that introduces a great improvement in the usability of the instrument; the rechargeable battery gives to you a very good operational autonomy. All the messages and the menu could be displayed in any of available language: Italian, English, French, Dutch, Spanish and Portuguese.

The instrument is composed by: electronic unit, translation unit (internal) and printer (optional). It enables you to measure the most important surface roughness parameters, with a thousandth resolution.

The measure is completely adjustable by the **Measure Setup** of the instrument. By this menu is possible to setup: **cut-off length** (0,08 - 0,25 - 0,8 - 2,5-8mm), **cut-off number** (1-19) (1-5 with cut-off length 8mm), **measure speed** (0,5 - 1mm/sec) and **measure standard**.

The traverse length is automatically setup selecting the cut-off length, but is changeable selecting the cut-off number in the range from 1 and 19.

The instrument has an efficient warnings and error management. It warn you and block any erroneus operation or anomalies, during setup and measuring phase.

The instrument has an internal Memory of 2000Kbyte, that permits you to store the measures.

It gives you one storing mode: Memo. With the Memo mode, you can store up to 999 measures, in order to display them and/or print them.

The main functions, like the results display the measure start and the print report, are selectable directly by the keyboard; the other functions are available by menu with the use of the touch screen. By menu you can also setup the tolerance limits, that used in combination with a measurable parameter, help you in serial controls.

When you turn-off the instrument, it keep in its memory all the setups and the last measure data. It switch itself off, if not used for 2 minutes in battery mode and for 4 minutes with Power supply Adapter.

With the PRINTER connector you can use the dedicated Printer; with the RS232C connector you can send data to a Personal Computer. For these types of connections use only original manufacturer cables.

The print in the various modes availables, is selectable directly by the Print key on the instrument keyboard, or by the key on the printer.

In the computer link mode you can control all the instrument functions by the Rugosoft PC software that allow you to display on the PC screen the measure profile and its parameters.

Chapter 2: *the front panel elements.*

The front panel is composed by the graphic display, and the keyboard. The display is the output device, and the user-interface. With the keyboard located on the RT-90G front panel, you can activate the three main functions of the instrument. All the functions of the instrument are controlled directly with the touch screen. Some keys execute directly their function, others help you across the menu and setup mode. The next figure shows the main function of the front panel elements:
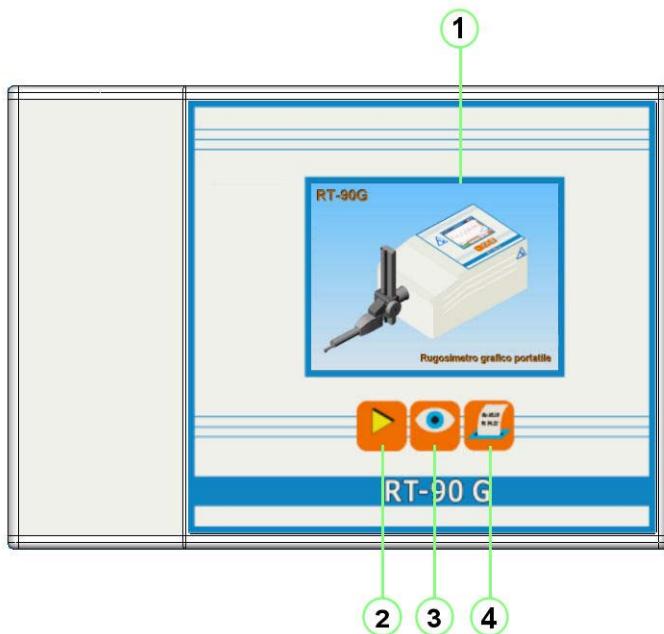
Figure 2-1.
Front panel elements.

① **Graphical Touch Screen Display.**

   Direct function keys:

②   Measure Start

③   Opens the Parameter Display Menu

④   Immediate Print Key

All the keyboard keys have the auto-repeat feature, so they have the capacity pf repeat continuously their function, until they are released.
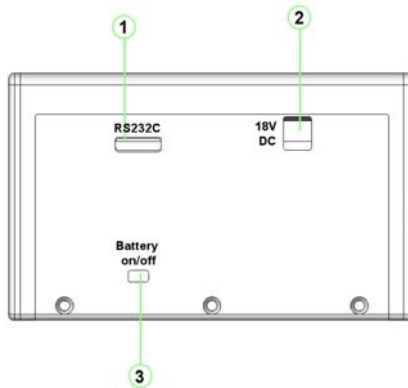
Chapter 3: *rear panel elements*.

Figure 3-1.
Rear panel elements.

As you can see in the last figure, on the rear panel are allocated:
①   Serial Connector RS-232 for data and printer output.
②   External Power Supply Connector at 18V DC.
③   ON/OFF internal battery supply selection.

Chapter 4: *switching the instrument on/off.*

You can switch-on you RT-90G instrument pressing any key of the front panel.
The instruments will execute its internal tests, then for few seconds, the graphical Display
will show the Start Window:

Figure 4-1
Start Window

When the Main menu is displayed, it means that the RT-90G is ready to use.

Th instrument *switch-off* could happen in two modes:
- *automatically:* in the default configuretion, after 120 seconds from the last operation
  if the instrument is used with battery, after 4 minutes if used with power supply. If you

press a key within the 120 seconds period (or 4 minutes), the count of the period restarts and is reset to other 120 seconds (or 4 minutes).

- **manually:** from the main menu by selecting the Switch-off function:

All the function activable by keyboard, are ready to use only after the instrument switching-on.

It is also possible to switch-on the instrument by:
• external button or pedal (call the manufacturer for the adapter);
• Printer Keyboard
• Rugosoft application software.

Note: *if the RT-90G turn itself off while you try to press a key, it is advisable to wait ½ second before turn the instrument on again.*

Chapter 5:   Starting the measure

From inside any menu, by pressing the key you make the instruments perform the measure immediately.

According to the previous parameters defined for the measure (see paragraph **6.3.4** - **Measure setup menu)** the following popup window is displayed:

Figure 5-1
Measure popup window

here are visualized the actual measure parameters with a measure progression indicator in the bottom, when the acquisition is finished, the popup is closed and the results are displayed.

If the instrument has not been previously calibrated (see paragraph **6.3.5** - **Calibration menu**), a message box appears signalling it and you have the choice to proceed to the calibration menu or closing the popup window without making any further operation.

Chapter 6:   *The* RT-90G *menus. Use, notes and structure.*

The instrument programming, setup and output results are achievable by the operator with the menus displayed on the graphical display.

6.1 - The menus structure.

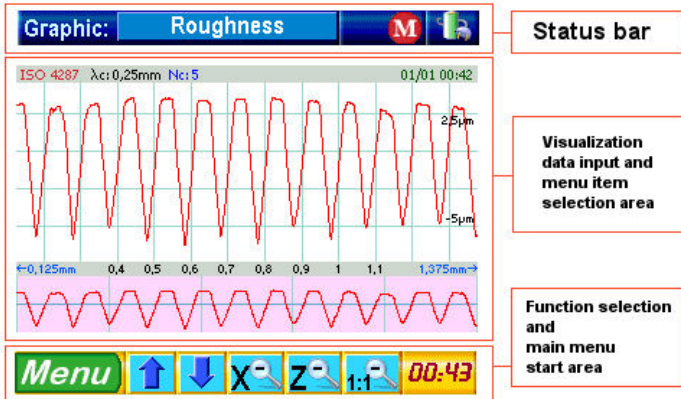All the RT-90G menus, are structured like the following one:

Figure 6-1-1.
Graphical Display Menu Structure.

6.1.1 - The Status Bar.

The Status Bar is positioned on the upper zone of the Display; it shows the instrument state, and the functions actually in use.

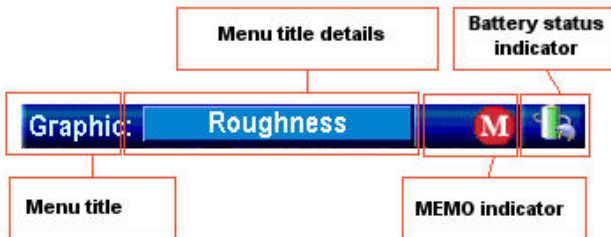In the next figure are shown all the informations displayed on the status bar:

Figure 6-1-1-1
The Status Bar.

Menu Title: it shows the selected menu title.

Menu Title details: it shows when required by the menu further details for the menu title. As show in figure we have the **Roughness** graph type for the **Graphic** menu

MEMO Indicator: it shows if the storing Memo mode is enabled. The flag M

(Memo) is followed by the number of the stored measures.

It also permits the Memo management menu activation by directly clicking on it.

Battery Status Indicator: It shows the battery charge status. When the instrument is connected to the external power supply in the charging phase, an animated icon will be shown.

It also permits the Diagnostic management menu activation by directly clicking on it.

6.1.2 - The Display Area

The Display Area, is located in the middle of the Graphical Display, and shows the menu items, the measures results, the graphs, the menu options, and all the user-interface windows.

In the last figure, for example, the Display Area showed the Roughness Graph.

In the next paragraphes we will analyse all the object viewable in this area.

6.1.3 - Function selection and main menu start Area

This area contains at his left the main menu visualization button and then in the larger zone, the function selection buttons. Each menu screen has is own list of function selection buttons that depends on what operations you can perform on this menu.
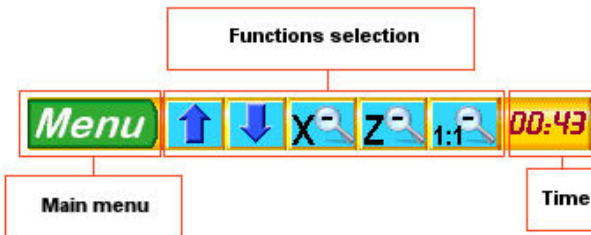

Figure 6-1-3-1.
The main menu and functions selection area.

Main Menu:	activates the main menu.
Functions selection:	it shows the buttons related to the functions of the current active menu on screen.
Hour Indicator:	it shows the current hour in the 24h format. It also permits the Time management menu activation by directly clicking on it.

6.1.4 - The fields.

In the RT-90G menus, are used many kinds of *field*, to select and insert parameters, text and values; this fields should be familiar for people using PCs.
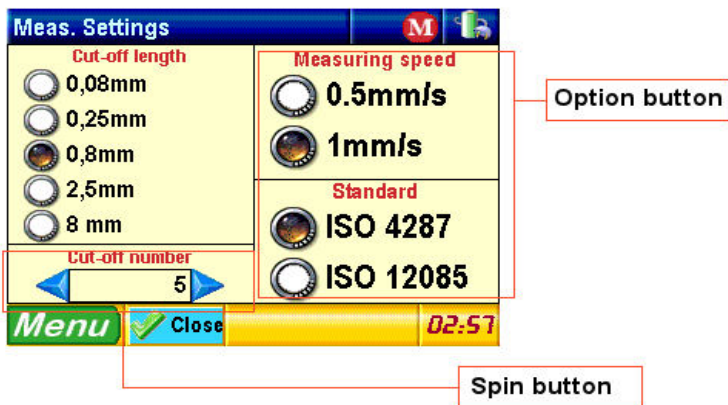
Figure 6-1-4.1
Data fields types.

1) **OptionButton fields:** Are used to select one option among many. In our example the possible options are two. The selected one is shown with the ⬤ symbol. To select the desired option, click directly on it. The modification is immediately applied.

2) **CheckBox fields:** Are used to select many options simultaneously. In our example you can select the components to be used in the Print Report composition. The selected options are shown with the ✅ symbols.

To enable (or disable) selections, click directly on it. The modification is immediately applied.

3) **SpinButton fields:** Are used to select one value, among a circular list of predefined ones. In the previous example if you want to modifiy the cut-off number, press on ▶ to increase the value, otherwise press on ◀ to decrease it.

5) **TextBox fields:** Are used to input a numerical value. An example of TextBox field is shown in the Calibration Menu:
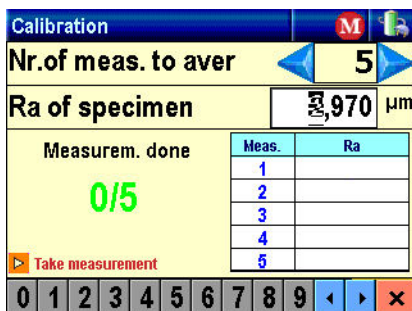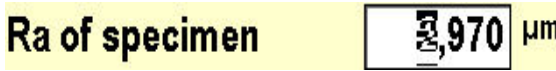

Figure 6-1-4-2.
TextBox field example with numeric keypad acivated

In this example, to insert the Ra sample value, clic on the filed on the digit that you want to modify:

A blinking cursor is visualized on the selected digit:

Ra of specimen   3,970 µm

to show that text insertion mode has been activated, and contemporarily the status bar is substituted with the numeric values insertion management buttons:

0 1 2 3 4 5 6 7 8 9 ◄ ► ✕

To modify the selected value, simply click on one of the numerical buttons 0 1 2 3 4 5 6 7 8 9 , the selection button will automatically move on the next digit.

To manually change the selection cursor position between the digits to be modified use the directional buttons: ◄ ► .

When you have finished the modification procedures press the button ✕ , to exit from the text insertion mode, the numeric values insertion management buttons panel is closed and the status bar is restored.

6.2 - Moving inside the menus.

In many RT-90G menus, inside the Display Area, a parameter input is requested to the user. In other ones is possible to move graphical cursors.

6.2.1 - Moving across the menu fields

As described before, we have many types of field inside the instrument menus. Each field is selected and activated by pressing directly on it. For the inserting and editing operations refer to the specific field commands (See par. **6.1.4**).

6.3 - The Main Menu.

The Main Menu, available all the time by pressing the following button:

Menu

allow you to access to the main RT-90G Setup and Calibration functions.

Figure 6-3-1.
The Main Menu

Supervisor Main Menu:

- *Postioning*   *Activates the positioning/measure menu*

- **System settings:**   *Activates the system settings submenu*

- **Archive:**   *Activates the Archive tool.*

- **Measure settings:**   *Activates the measure settings submenu.*

- **Calibrations:**   *Activates the Calibration menu of the instrument.*

- **Close session:**   *Manually Turn off the instrument..*

Now we can analyse the single menu functions in detail:

6.3.1 - The Positioning/measure Menu.

The positioning menu, that you can recall from the main menu by pressingthe key:

activates the positioning menu.

Here you can control the gauge position and if it is necessary execute its centering procedure.
The window shown will be like the following:

Figure 6-3-1-1
the positioning submenu.

By this submenu you can control in the range you want to explore, the gauge position referring to the surface.

This is very useful in two cases:

1) To avoid that when the gauge body is inside holes or grooves, with its surface contact, being outside the measure range, causes a sensor overflow, and the stylus loses its contact causing the instrument stopping the exploration.

2) To position correctly the gauge on critical surfaces like concave ore convex surfaces, etc.

To obtain a correct measure, this arrow should be positioned in the middle of the range identified by the ruled bar in the left side of the display, as near as possible from the dotted line shown on the graphical area.

If you press the **AUTO** (**functions selection zone**) the arrow indicating the stylus position is automatically moved to the center of the measuring range.

On the upper right corner of the graphical area, you have in real time the value of the stylus deviation respect to the centre, dimensioned referring to the selected measure range.

By pressing the keys (**functions selection zone**) you can **Enlarge** and

Reduce the range magnification, or execute a **Test Measure with** **Test Measure**
(**functions selection zone**).

By choosing Test Measure you can see as the arrow image corresponding to the stylus position will follow the relieved profile peaks while the instruments performs a surface scan and contemporarily shows gradually the points as relieved, with a screen like this:
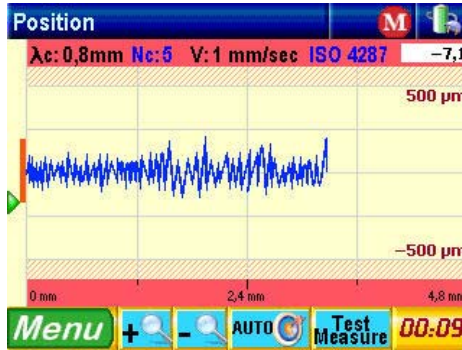
Figure 6-3-1-2
The positioning submenu during test-measure

In this way you can control the gauge excursions near the centering zero.

Analyzing again the submenu Positioning, a click on the button , will start the measure, that is will proceed as in test-measure, with the difference that at the end of the scan the acquired data will be processed and the resulting parameters will be visualized.

6.3.2 - The system settings menu.

The system settings menu, that you can recall from main menu by pressing

permits to access to a further submenu throught wich modify various instrument configuration settings:

Figure 6-3-2-1
The system settings submenu.

Let's now analyze in detail the items composing the submenu:

6.3.2.1 - The parameters menu

that you can recall from system settings menu by pressing

Permits to select the parameters to show inside the parameters menu and their associated tolerances limits.

The following menu is visualized:

Figure 6-3-2-1-1
Parameters settings mode selection menu

here you can select which operation to perform between the two availables: modify the list of on-screen visibles parameters or modify the tolerances to them associated.

6.3.2.1.1 - the Enable parameters menu

If in figure 6.3.2.1.1 the option **Enable parameters** is selected, the following menu will be displayed:

Figure 6-3-2-1-1-1
Enable parameters menu

Fields are of the **checkbox** type (see paragraph **6.1.3.1** item **2**) therefore to enable or disable a parameter simply clic repeatedly on it. The menu is able to show only a paraneter group at once, then to show the other groups use the buttons located in the upper zone just below the status bar.

When you have finished to make selections click on **(functions selection zone)** to return to **System settings** menu**.**

6.3.2.1.2 - the Enable tolerances menu

If in figure 6.3.2.1.1 the option **Set tolerances** is selected, the following menu will be displayed:

Figure 6-3-2-1-2-1
Set tolerances menu

For each parameter you have to set the two upper and lower tolerance limits. Fields are of **TextBox** type(see paragraph **5.1.3.1** item **5**) therefore to modify a value click on the field to activate the numerical keypad, and also with the keypad modify the value as like and confirm the modifications.

Also in this case the menu is able to display only a parameter's group at once, then to display the other groups use the buttons located in the upper zone just below the status bar.

When you have finished to make selections click on **(functions selection zone)** to return to **System settings** menu**.**

6.3.2.2 - The display settings menu

that you can recall from system settings menu by pressing

Permits to set some specific options of the instrument:

a) **At measure end shows:**
selection of the result type to show at the end of measure.

b) **Audio:**
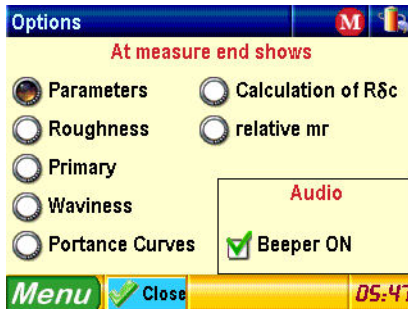Enabling/disabling internal beeper.

Figure 6-3-2-2-1
the options menu

The parameter type to show at end of measure is an option button type field(see paragraph **6.1.3.1** list item **1**) to select the desired option simply directly clik on it.

Enabling/disabling the internal beeper is managed by a checkbox type field(see paragraph **6.1.3.1** list item **2**). To select/deselect the item click more times on it.

To close the menu and return to the **system settings** menu click on **(functions selection zone).**

6.3.2.3 - The print menu

that you can recall from system settings menu by pressing

permits to establish what to send to printing when a certain key is pressed on the printer. .It is first displayed a small window over the main window (popup window):

Figure 6-3-2-3-1
Selection of printer printing key

where you select the key to which associate the results tipologies to print. To perform the selection click on the desired item and the appropriated settings menu is displayed.

To return to the **System settings** menu without performing any selection click on

Close (functions selection zone).

The available options are two and precisely:

6.3.2.3.1 - The print graph key
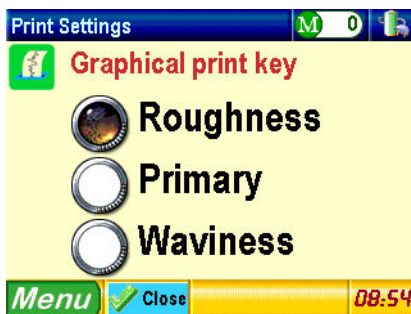
Figure 6-3-2-3-1-1
Print graph key settings

Select the graph type to print by clicking on the desired item, fields are of the OptionButton type (see paragraph **6.1.3.1** item **1**), therefore it is possible to select only one value between those availables.

When you have finished to make selections click on **Chiudi (functions selection zone)** to return to **Print** menu.

6.3.2.3.2 - The print report key
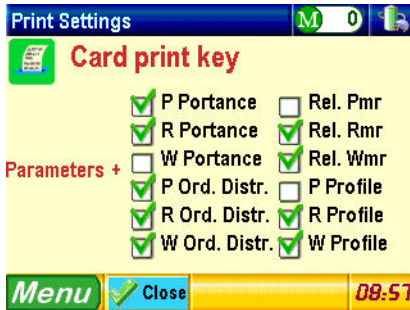
Figure 6-3-2-3-2-1
Print card key settings

Select which graph types to print in addiction to the parameters one by clicking on the desired items, fields are of the Checkbox type (see paragraph **6.1.3.1** item **3**), therefore the values are selectables one by one.

When you have finished to make selections click on **Chiudi** **(functions selection zone)** to return to **Print** menu**.**

6.3.2.4 - The measure unit menu

that you can recall from system settings menu by pressing

permits to set the measure unit that is used to calculate the results an represent them and it is visualized as:
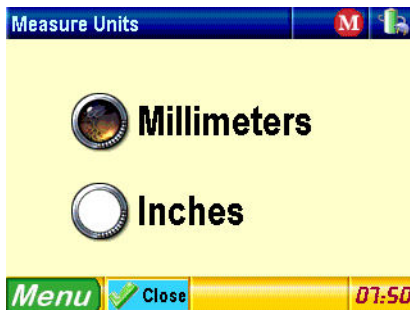
Figure 6-3-2-4-1
The measure unit menu

To activate the desired option simply click on it.

To return to system settings **menu** without making any selection clic on [✓ Close] **(functions selection zone)**.

6.3.2.5 - The Language menu

that you can recall from system settings menu by pressing

permits to set the language with wich all the text inside the menus and the messages are displayed and presents the following screen:

Figure 6-3-2-5-1
The language setting menu

To activate the desired option click on it, the selection is istantly applied and the menu is automatically closed. To return to system settings **menu** without making any selection clic on [✓ Close] **(functions selection zone)**.

6.3.3 - The Archive menu.

Function not already implemented.

6.3.4 - The Measure Setup menu.
The Setup Menu, activable at any time froma the main using the key, permits you to view or modify the instrument configuration (Setup).

6.3.4.1 - ISO 4287 Measure Setup.

If previously the standard ISO 4287 has been selected, or the instrument has been switched on for the first time, or the measure parameters have been resetted, the menu shows the following screen:
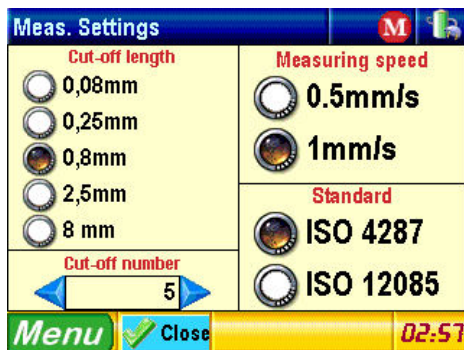
Figure 6-3-4-1-1
The ISO 4287 Measure Setup Menu.

The modifiable fields are accessible directly by using the touch screen:

- **Cut-off length**: OptionButton type field with the five cut-off length availables: 0.08, 0.25, 0.8, 2.5, 8

To select the desired value, as indicated in Par.**6.1.2.1**, simply directly click on the corresponding item.

- **Cut-off number**: SpinBox type field, therefore it is possible to increase or decrease

the cut-off number by using and keys.

- **Measure speed**: OptionButton type field with the two availables measure speeds: 0,5 mm/sec or 1 mm/sec:

- **Standard**: OptionButton type field with the two available options: ISO 4287, ISO 12085. The modification of this value invokes the automatic regeneration of the menu to show the measure options related to the selection just performed.

To return to **system settings** menu at any time click on **(functions selection zone)**.

6.3.4.2 - ISO 12085 Measure setup

If previously the standard ISO 12085 has been selected the menu shows the following screen:
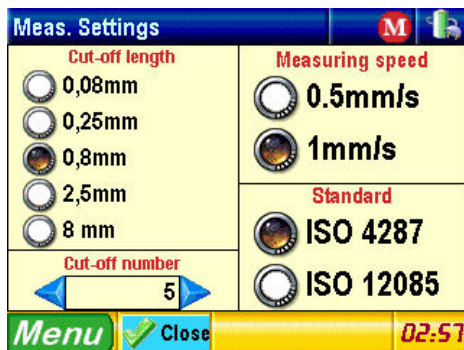
Figure 6-3-4-1-2
The ISO 12085 Measure Setup Menu.

In questo caso i campi elencati sono i seguenti:

- **Course length**: SpinBox type field, therefore it is possible to increase or decrease the course length value by using and keys.

- **A and B coefficients**: OptionButton type field, with the four available coefficients value couples.

The coefficient values must be applied following this table:

Lunghezza max misura (mm)	A	B
0,64	0,02	0,1
3,2	0,1	0,5
16	0,5	2,5
80	2,5	12,5

- **Measure speed**: OptionButton type field with the two availables measure speeds: 0,5 mm/sec or 1 mm/sec:

- **Standard**: OptionButton type field with the two available options: ISO 4287, ISO 12085. The modification of this value invokes the automatic regeneration of the menu to show the measure options related to the selection just performed.

To return to **system settings** menu at any time click on **(functions selection zone)**.

6.3.5 - The Calibration Menu.

The calibration menu activated with the button , permits to perform the calibration of the instrument.

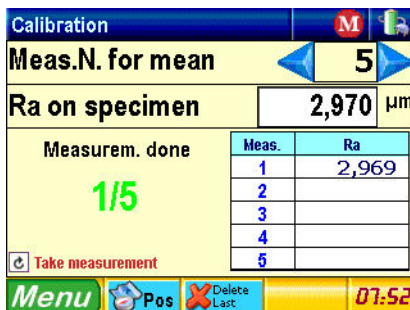The display will show a screen like this:

Figure 6-3-5-1
The calibration submenu.

In this menu it is possibile to modify:
1) the **number of measure to average.** You use the keys

 and to select the desired measure number.

2) the **sample Ra value** to measure: is a textbox ytpe field, follow the procedure indicated at paragraph **6.1.3.1** at point **5** to modify its value.

The measure is performed by pressing the key: .

The measure status is visualized in the measure popup window while the measured values are displayed on the table.

The key **(functions selection zone)** permits to delete the last reference measure and it is visualized only if it at least one measure has been performed.

The key **(functions selection zone)** permits to go directly in the **positioning menu** and is always visualized.

At the end of the measure cycle, the button appears **(functions selection zone)**. clicking on it the calibrating operations are confirmed.

6.3.6 - The Switch-off Button.

As described in Chapter 4, it is possible to turn-off the instrument using the

from the Main Menu.

6.4 - the display menu

The display menu, selectable in any moment by pressing the key activates the results output mode.
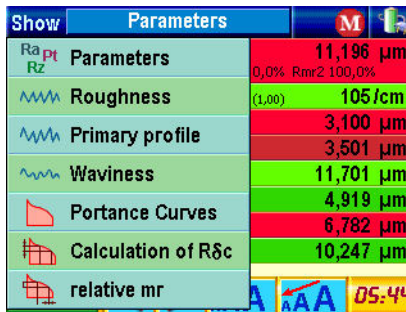
The result tipologies are the following:

      1 - Parameters display
      2 - Profile graphs
      3 - Portance graphs

Depending on what tipology has been selected inside the display settings preferences menu , pressing the above mentioned button will show the result tipology previously selected.

To access a different result tipology, from inside any results screen click the central zone of the status bar, ie in the parameter's display screen:

To make the result tipology selection drop-down menu appear:

Figure 6-4-1
drop-down menu for the result tipology selection.

Click on the desired item to activate the corresponding display menu.
It is also possible to activate sequentially the various visualization menu by pressing

more times the key.

6.4.1 The parameters display menu

Activable by selecting from the drop down menu the item [Ra Pt Rz **Parameters**].

The screen shown will vary depending on the Parameters Setup settings made by the user, but should be similar to the next figure:
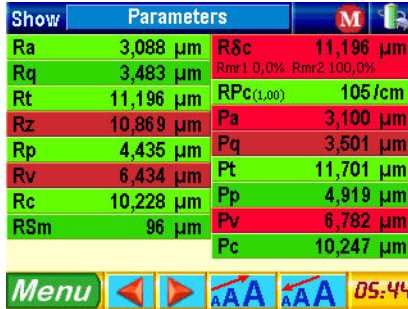

Figure 6-4-1-1
The parameter's display menu.

In case all the parameters are not displayed in the screen simply use the directional keys ◀ ▶ **(functions selection zone)** to move respectively to the previous page or to the next page.

the keys ▴A**A** and ▴A**A** **(functions selection zone)** permits to respectively increase or decrease the size of characters displayed on the screen.

In particular in the parameters display in base to the characters size you have the following max numer of parameters displayed for each page:

- Small: 36 parameters
- Medium: 16 parameters
- Big: 6 parameters

6.4.2 - The Primary Profile, Roughness and Waviness Graphs.

By selecting from the drop down menu the item [∿∿ **Primary profile**] the following graph is visualized:
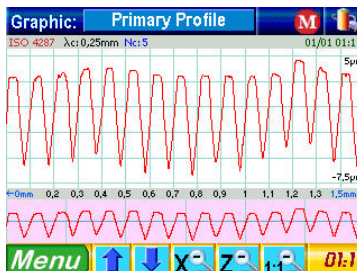

Figure 6.4.2.1
The Primary Profile Graph

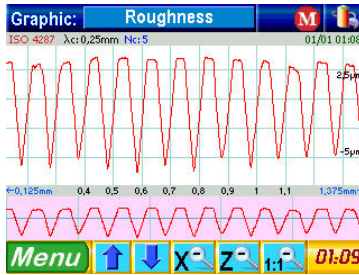By selecting from the drop down menu the item **∿∿∿ Roughness** the following graph is visualized:

Figure 6.4.2.2
The Roughness Graph

By selecting from the drop down menu the item **∿∿∿ Waviness** the following graph is visualized:
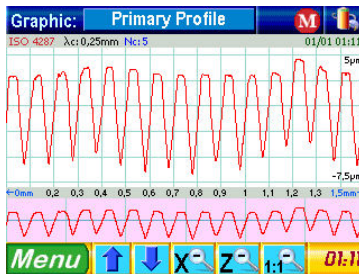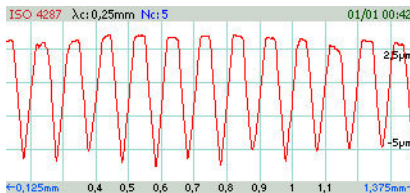

Figure 6.4.2.3
The Waviness Graph

the graphs displayed from the instrument are all visualized with the central area divided in two sections clearly distincted, if for example we examine the roughness graph:

a)   **magnification detail area**:

is the section in wich the profile portion corresponding to the area actually selected for the magnification is displayed. If no area has been selected for the magnification, as in figure, that area shows the whole profile graph.

b) **global profile visualization area**

is the section in which the global view of the profile is displayed , with inside the rectangle area selected for the magnification.

To perform a magnification on a profile, first click in a point of the **a area,** then maintaining pressed, drag until you define the opposite corner of the area to magnify, then release. the **a area** will display the graph of the magnified section while the **b area** will display the magification area rectangle inside the global graph.

To scroll the magnified graph orizzontally you use directly the **b area** by clicking on the rectangle that represents the magnification selection area and drag it maintaining pressed towards left or towards right.

To scroll the magnified graph orizontally use the keys **(functions selection zone).**

It is also possible to perform further magnifications inside the area already magnified. In this case to return to the previous magnification level horizontal or vertical you use the and keys **(functions selection zone).**

To cancel all of the magnification operations on the graph use the key **(functions selection zone).**

6.4.3 - The Portance Graphs.

the portance curve graphs are represented with one or two cursors (depending on the type of representation) inside them trought which it is possible to interact to display the calculated values in base on their position on the curve.
The interaction with the portance graphs can be performed in two different ways:

1 - **direct**: you click directly on one point of the curve and the cursors are automatically positioned.

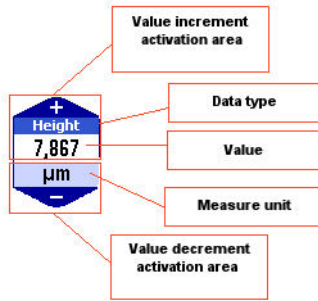2 - **indirect:** for the cursors positioning you use the appropriate fields for the regulation of the values:

Figure 6.4.3.1
Scheme of the regulation field structure of the position of the cursors in the curve of portance.

As you can see in figure the cursor position value is incremented by clicking on the upper zone of the field, while it si decremented by clicking on the lower zone.

All the graphs have inside two fields for the regulations of the values, independently from the fact that the selected calculation type require using one or two cursors, the first upper field performs always the regulation of the values towards the vertical axis while the second lower field performs always the regulation of the values towards horizontal axis (in the Rdc, Pdc, Wdc graphs visualization menu the two fields are located respectively on the left and on the right side of the graph).

6.4.3.1 - The Rmr, Pmr and Wmr Graphs.

By selecting from the drop down menu the item **Portance Curves** or from the functions bar the **Rmr** button the following graph is visualized:
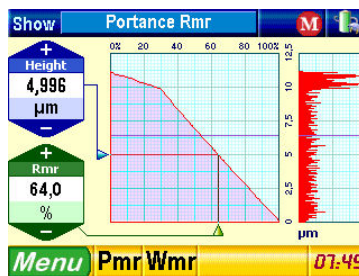

Figure 6-4-3-1-1
The Rmr Portance Curve Graph

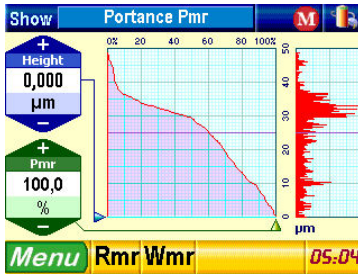By selecting from the functions bar the **Pmr** button the following graph is visualized:

Figure 6-4-3-1-2
The Pmr Portance Curve Graph

By selecting from the functions bar the **Wmr** button the following graph is visualized:
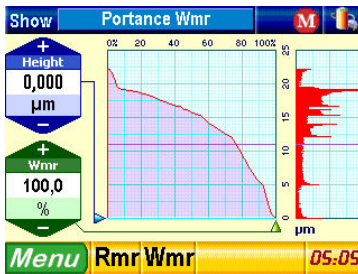

Figure 6-4-3-1-3
The Wmr Portance Curve Graph

6.4.3.2 - the relative Rmr, relative Pmr and relative Wmr graphs

By selecting from the drop down menu the item **relative mr** or from the functions bar the **Rmr rel.** button the following graph is visualized:
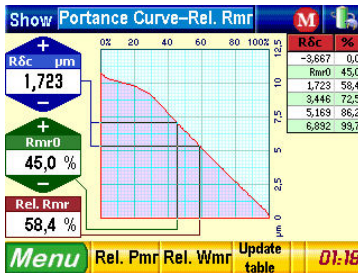

Figure 6-4-3-2-1
The Relative Rmr Portance Curve Graph

By selecting from the functions bar the **Pmr rel.** button the following graph is visualized:
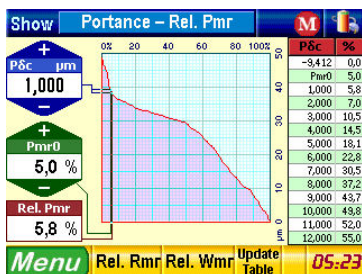
Figure 6-4-3-2-2
The Relative Pmr Portance Curve Graph

By selecting from the functions bar the **Wmr rel.** button the following graph is visualized:
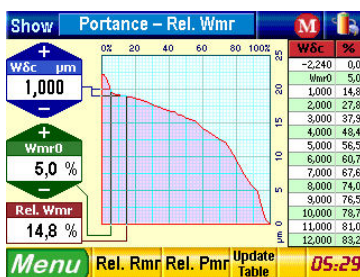

Figure 6-4-3-2-3
The Relative Wmr Portance Curve Graph

Inside those menus, each time that the values are modified by acting on the regulation fields or clicking directly on the curve, the respective table values aren't automatically updated. To do so click directly on the table or click on the **Update table** button.

6.4.3.3 - The Rdc, Pdc, Wdc Graphs.

By selecting from the drop down menu the item **Calculation of Rδc** or from the functions bar the **Rδc** button the following graph is visualized:
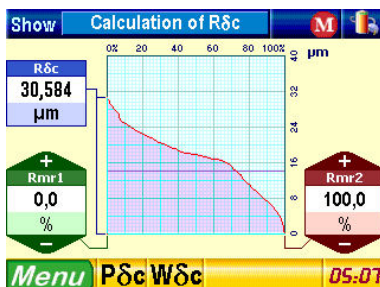

Figure 6-4-3-3-1
The Calculation of Rdc Graph

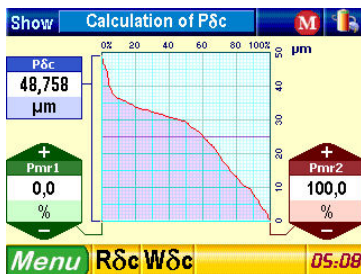By selecting from the functions bar the $\mathbf{P\delta c}$ button the following graph is visualized:

Figure 6-4-3-3-2
The Pdc Calculation Graph

By selecting from the functions bar the $\mathbf{W\delta c}$ button the following graph is visualized:
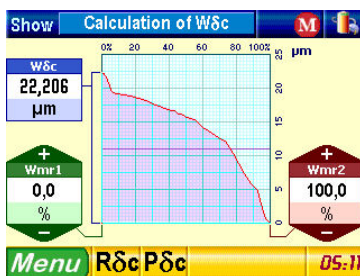

Figure 6-4-3-3-3
The Wdc Calculation Graph

6.5 - Display diagnostics.

Accessible in any moment from the status bar by clicking on the icon
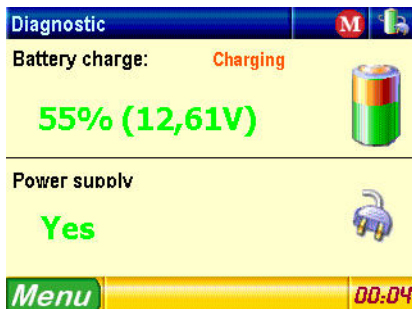
The following menu appears:

Figure 6-5-1
Diagnostic menu

where it is possible to examine the actual power supply status of the instrument.

6.6 - Display clock settings

Accessible in any moment from the functions bar by clicking on the area

The following menu appears:
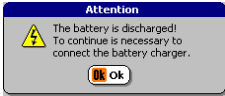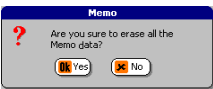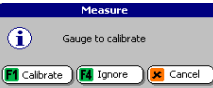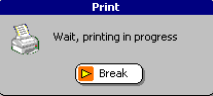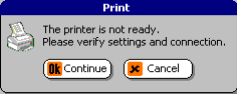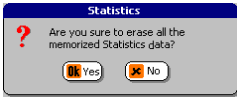
Figure 6-6-1
Clock menu
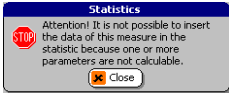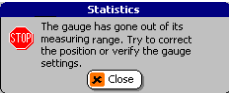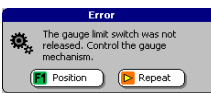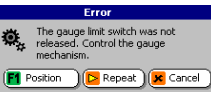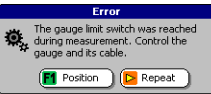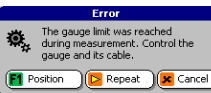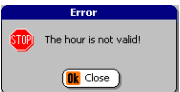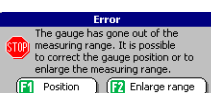
Inside this menu you can modify the actual values of year, month, day, hours and minutes.
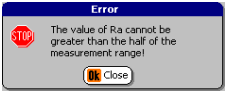
Each of those values is associated to a **SpinButton type field**(see paragraph **6.1.3.1**

- The fields), so to modify its value simply click on the related and buttons.

Chapter 7:   *warnings and error messages*

Description	Type	Level	Message	Notes
Battery discharged at the startup	Attention message	Attention	**Attention** — The battery is discharged! To continue is necessary to connect the battery charger. [Ok]	*The battery is discharged! To continue is necessary to connect the battery charger.*
Function not available	Attention message	Attention	**Attention** — Function not available [Ok]	*This Function is not available in this firmware version.*
Measure not available	Attention message	Attention	**Attention** — No data available. Make a new measure. [Ok]	*Almost one measure should be executed. No data available.*
Memo Erase	Attention message	Memo	**Memo** — Are you sure to erase all the Memo data? [Yes] [No]	*Memo erase confirmation request*
Measure interrupted	Attention message	Measure	**Error** — The measure has been interrupted. [Position] [Repeat]	*The Measure was interrupted by the user. You can execute Positioning or retry the measure.*
Measure interrupted (in calibration)	Attention message	Measure	**Error** — The measure has been interrupted. [Position] [Repeat] [Cancel]	*The Measure was interrupted by the user in Calibration Mode.*
Gauge to calibrate	Attention message	Measure	**Measure** — Gauge to calibrate [Calibrate] [Ignore] [Cancel]	*The gauge results to be calibrated.Calibrate it or try to measure ignoring the calibration*
Gauge not connected	Attention message	Measure	**Error** — Warning! The gauge was not connected or some communication errors occurred. [Retry] [Ignore] [Cancel]	*The gauge results to be not connected to the instrument. Control the cable.*
Printing in progress	Attention message	Print	**Print** — Wait, printing in progress [Break]	*Printing progress message. You can stop the print in any moment,*
Printer not ready	Attention message	Print	**Print** — The printer is not ready. Please verify settings and connection. [Continue] [Cancel]	*Printer Timeout Error. Control the cable connection and the printer.*
Statistics Erase	Attention message	Statistics	**Statistics** — Are you sure to erase all the memorized Statistics data? [Yes] [No]	*Statistics Data Erase confirmation message.*

Description	Type	Level	Message	Notes
Measure not ready to statistics	Attention message	Statistica	**Statistics** — Attention! It is not possible to insert the data of this measure in the statistic because one or more parameters are not calculable. — Close	*The instrument cannot pass the Memo data to Statistics, because one ore more parameters are not valuable.*
Statistics Full	Messaggio di attenzione	Statistica	**Statistics** — The gauge has gone out of its measuring range. Try to correct the position or verify the gauge settings. — Close	*The instrument cannot pass the Memo data to Statistics, because the memory is full or has errors.*
Calibration done	Messaggio di attenzione	Taratura	**Calibration** — Calibration done — Ok	*Message of correct Calibration executed.*
Date not valid	Error Message	Error	**Error** — The date is not valid! — Close	*The inserted date is not correct. Control that the day is in 1 to 31 range, and the month in 1 to 12 range.*
Gauge Limit not released	Error Message	Error	**Error** — The gauge limit switch was not released. Control the gauge mechanism. — Position — Repeat	*Gauge positioning Error. Verify that the Stylus was correctely positioned.*
Gauge Limit not released (in calibration)	Error Message	Error	**Error** — The gauge limit switch was not released. Control the gauge mechanism. — Position — Repeat — Cancel	*Gauge positioning Error. Verify that the Stylus was correctely positioned.Error occurred in calibration mode*
Gauge Limit reached	Error Message	Error	**Error** — The gauge limit switch was reached during measurement. Control the gauge and its cable. — Position — Repeat	*Gauge limit reached during measure.Control the gauge and its cable.*
Gauge Limit reached (in calibration)	Error Message	Error	**Error** — The gauge limit was reached during measurement. Control the gauge and its cable. — Position — Repeat — Cancel	*Gauge limit reached during measure.Control the gauge and its cable.Error occurred in calibration mode.*
Time not valid	Error Message	Error	**Error** — The hour is not valid! — Close	*The inserted clock time is not correct. Control that the hour value is in 0 and 23 range, and seconds between 0 and 59.*
Motor block protection	Error Message	Error	**Error** — The protection of the motor of the translator has happened. Verify its movement — Close	*Errore di attivazione protezione motore. Controllare il movimento e avvertire l'assistenza tecnica.*
Measure range overflow (larger range are avilable)	Error Message	Error	**Error** — The gauge has gone out of the measuring range. It is possible to correct the gauge position or to enlarge the measuring range. — Position — Enlarge range	*Measure range overflow. Control the Positioning or enlarge the measure range.*

Description	Type	Level	Message	Notes
Maximum Measure range overflow	Error Message	Error	**Error** — The gauge has gone out of its measuring range. Try to correct the position or verify the gauge settings. [F1 Position] [Repat] [Cancel]	*Measure range overflow. Control the Positioning. The measure range is just at this maximum value.*
Gauge movement problem	Error Message	Error	**Error** — The gauge could not move properly. [Ok Close]	*Gauge movement problem.Verify its connection, and its positioning.*
Value not valid	Error Message	Error	**Error** — The date is not valid! [Ok Close]	*The value is not in its valid range: from XXX to YYY. Modify the value.*
Ra Value larger than Measure Range	Error Message	Error	**Error** — The value of Ra cannot be greater than the half of the measurement range! [Ok Close]	*The Model Ra value is larger than half Measure Range.Verify the gauge type or the measure Range.*

Chapter 8: *Internal traverse unit*.

The traverse unit is the member supporting and moving the pick-up.

The instrument incorporates a traverse unit that enables precise measurements to be made on even difficult pieces, thanks to the possibility of being able to fit all the types of pick-up.

Figure 8-1
Detail of the pivoting support.

The pick-up is affixed to a pivoting support by means of which it can be raised using a micrometer screw provided with knob. The support can easily be height adjusted and can be rotated through 90° for measurements in throats or points that are difficult to access.

Figure 8-2
Measure witht pickup at 90°.

The traverse unit can be mounted on the ST250 tripod to facilitate the checking of pieces with special.

The maximum stroke is 50mm.

Chapter 9: *effects of the pick-up on measurement results.*

The pick-up essentially consists of two parts: the stylus and the skid or forerunner (figure 9-6). The stylus is the most important and delicate part as it detects the profile in contact with the workpiece. It consists of a fulcrum-mounted support, supporting the diamond point, the weight of which is calibrated according to the standards.

The skid, shape of which may depend on the type of measurement to be made, has the

purpose of guiding the stylus on the workpiece so that it follows the roughnesses and, accordingly, part of the wave is eliminated.
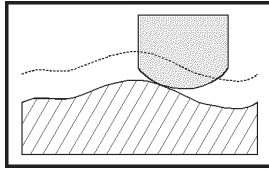

Figure 9-1.
Skid drive effect.

As it would be impossible for these two members to be perfect and suitable for all situations, they include a small percentage of error on the measurement results.

These errors cannot be eliminated and are present in all roughness testers so that, when comparing the results, they must be taken into account when trying to understand why certain deviations have occurred.

In particular, the diamond fitted on the stylus is normally cone-shaped with an angle of 60° or 90° and the point is generally radiated by less than $10\mu m$ (typically $2\mu m$).
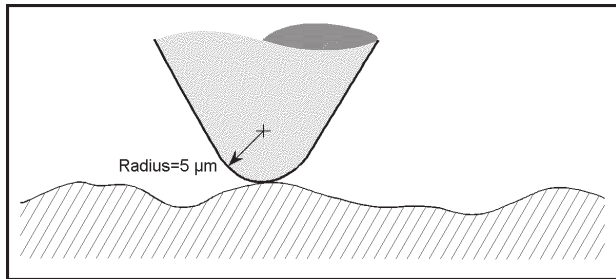

Figure 9-2
Comparison of the widths of
the diamond and the surface.

The finite width of the diamond determines in three ways the precision with which the profile may be detected:

a)   **Penetration into valleys**. The angle and the radius, depending on their values, imply a greater or lesser degree of penetration into the valleys of the profile. Diamonds with a large angle and radius have a low penetration and give poorer results than those where there is a lesser angle and radius.
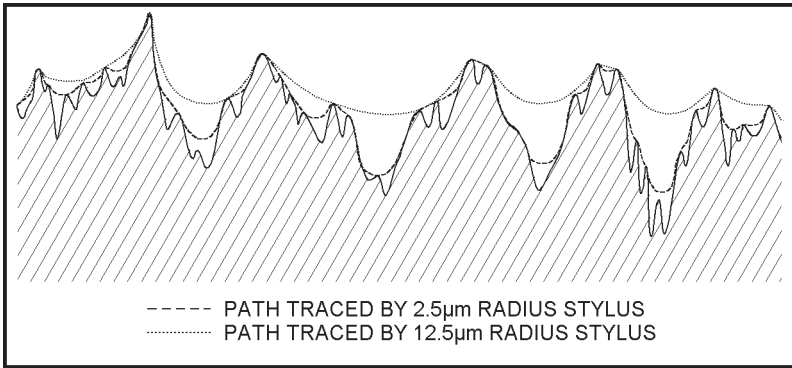
PATH TRACED BY 2.5μm RADIUS STYLUS
PATH TRACED BY 12.5μm RADIUS STYLUS

Figure 9-3.
Demonstration of the lesser penetration and width

detected in relation to radius of the diamond.

b) **Distortion of the shape of the peaks**. When a radiated diamond passes over a sharp peak, the point of contact straddles the radiancy generating a profile detected with a peak that is more rounded than the real one. This results in an alteration of the R_a value and must be taken into account where the roughness measurement is very low.
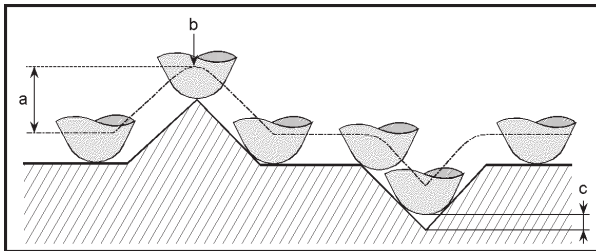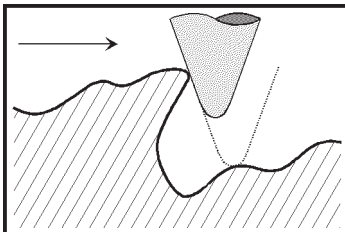

Figure 9-4.
Effect of the radius on the peaks and on the valleys.
The curvature tends to reduce depth of the valleys (c)
and round the peaks (b). Height of the peaks remains unaltered (a).

c) **Recesses cannot be detected**. When the stylus comes to a recess, it loses contact with the profile and alters shape of what it has already detected. Surfaces with recesses are to be found, for example, in sintered materials and porous materials.
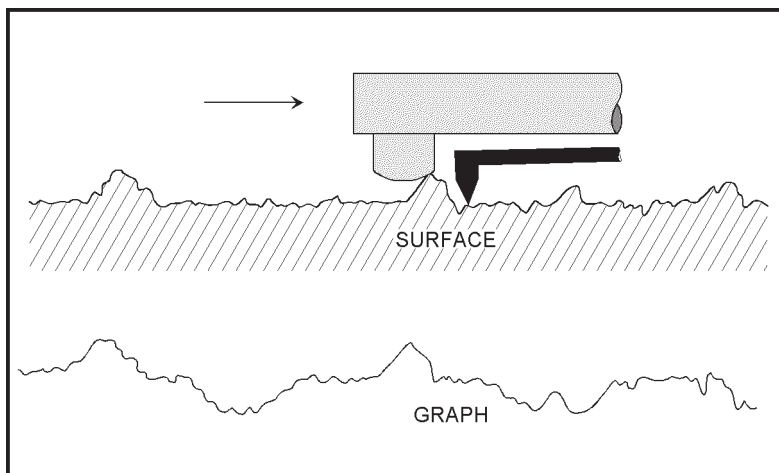
Figure 9-5.
Recess of a non-measurable surface.

The skid, on account of its shape and on certain surfaces, may cause a detection error as it implies an alteration of the profile due to passage over the roughnesses not in phase with the stylus (figure 9.7).
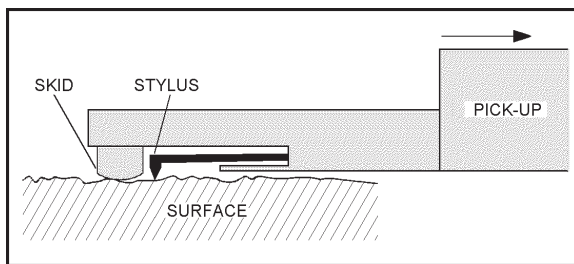
Figure 9-6.
Schematic view of the gauge with skid. The arrow indicates direction
of movement during exploration.

Figure 9-7.
Effect of the skid on phase of the profile detected.

Note: the stylus is a very delicate part that must be handled with care, must not be subjected
to mechanical stresses and must be kept clean (a jet of clean, low-pressure air may be
used) because the dirt that accumulates with time prevents penetration into the valleys
of the profile with a resultant deterioration of the values indicated.