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INSTRUCTION MANUAL FOR ROUGHNESS TESTER (809-100)

1 Brief Introduction

The hand-held roughness tester is a new product developed by Time Group Inc. This tester applies to production site and can be used to measure surface roughness of various machinery-processed parts, calculate parameters according to selected measuring conditions and clearly display all measurement parameters and profile graphs on LCD.

Features:

- Multi-parameter measuring:Ra, Rz, Ry, Rq, Rp, Rm, Rt, R3y,R3z, Rmax, Rsk, Rku, S, Sm, tp, Rmr, Rpc, RzJIS;
- High accuracy inductance sensor;
- Four filtering methods of RC, PC-RC, GAUSS and D-P;
- Compatible with four standards of ISO, DIN, ANSI and JIS;
- 128×64 dot matrix LCD displays all parameters and graphs;

- ARM processor chip is used to control and process data with high speed and low power consumption;
- Built-in lithium ion chargeable battery and control circuit have high capacity, without memory effect. Consecutive work time is longer than 20 hours;
- Design of mechanical and electrical integration is adopted to achieve small bulk, lightweight and easy usage;
- Built-in Bluetooth module enables drive the printer wirelessly to print all parameters and graphs;
- Mini USB interface enables communication with PC;
- Automatic switch off, memory and various prompt instructions;
- Accessories of curved surface sensor, measurement stand, sheath of pickup, adjustable supporter and extending rod are available.

1.1 Measurement Principle

When measuring surface roughness of workpiece, the pickup is placed on the surface of the part and then tracing the surface at constant rate. The pickup acquires the surface roughness by the sharp stylus in pickup. The roughness causes displacement of pickup which results in change of inductive value of induction coils thus generate analogue signal which is in proportion to surface roughness at output end of phase-sensitive rectifier. This signal enters data collection system after amplification and level conversion. After that, those collected data are processed with digital filtering and parameter calculation by ARM processor and the measuring result can be read on LCD, printed through printer and communicated with PC.

1.2 Standard Configuration

Table 1-1Standard Configuration List

Item	Quantity
Main Unit	1
Standard Sensor	1
Standard Sample plate	1
Organic Glass Test Support	1
Power Adapter	1
Communication Cable	1
Sheath of Pickup	1
Height Adjustable Supporter	1

1.3 Names of Each Part of the Instrument

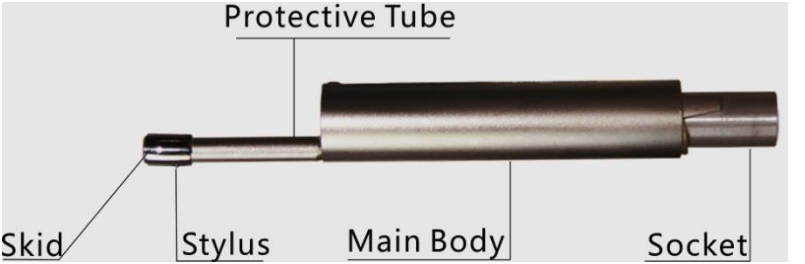


Figure 1-1-1 Pickup

Figure1-1-2 Front View

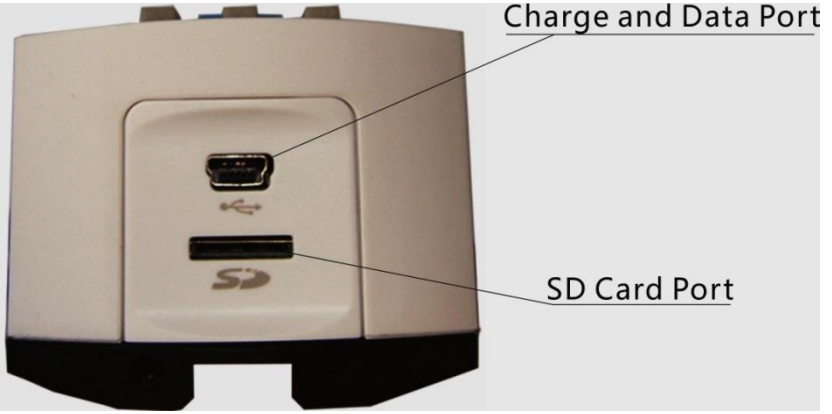


Figure 1-1-3 Side View

Figure 1-1Names of Each Part of Instruments

1.4 Basic Connection Method

1.4.1 Installation and Removing of Pickup

For installation, hold the main part of pickup with hand, push it into connection sheath at the bottom of the instrument as shown in Figure 1-2 and then slightly pushed it to the end of the sheath. To remove, hold the main part of pickup or the root of protective sheath with hand and slowly pull it out.

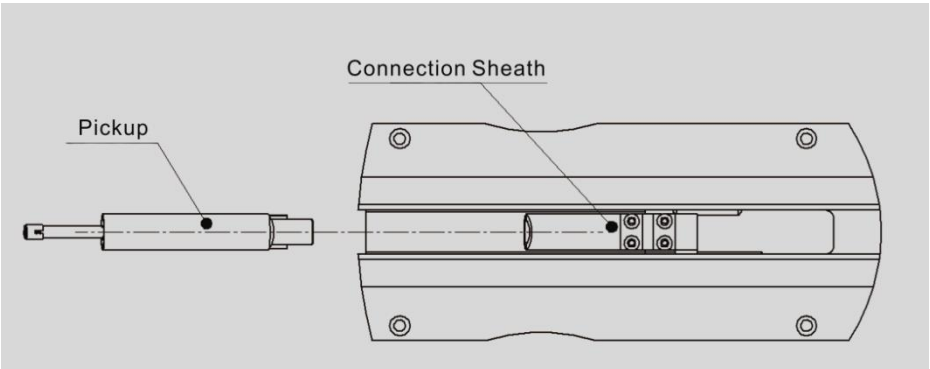


Figure 1-2 Installation of Pickup

Tip:

1.The stylus of pickup is key part of this tester and great attentionshould be paid to it.

2.During installation and unloading, the stylus should not be touched in order to avoid damage and affecting measurement.

3.Connection of pickup should be reliable during installation.

1.4.2 Power Adapter and Charging of Battery

When battery voltage is too low (that is, battery voltage symbol  flashes on screen to prompt low voltage), the instrument should be charged as soon as possible. As shown in Figure 1-3, the plug of power adapter should be plugged into power socket of the instrument. Power adapter could be connected to power of 220V 50Hz .then charging will begin. Input voltage for power adapter is AC 220V with DC 6V of output, about 500mA of maximum charge current, charging time of 2.5 hours. This instrument adopts lithium ion chargeable battery without memory effect and charging can be fulfilled at any time without affecting normal operation of the instrument

Tip:

- Layout of connection lines shall not affect measuring part under charging state.
- Meanings of battery voltage prompts are:

   indicates normal voltage and measurement can be carried out; the black part inside prompt shows capacity of battery;

   indicates too-low voltage and battery should be charged as soon as possible;

   indicates that battery is full and charging power should be cut off as soon as possible;
- The instrument needs to monitor the process of charging so it is not necessary to turn it off. The instrument will turn on automatically even it's turned off.
- When the PRSR200 is delivered the battery switch is off, User should set the switch on firstly before use it.
- When the instrument does not work properly, restart PRSR200 after switching off the battery for 10 seconds

2 Measuring Operation

2.1 Preparation for Measurement

a.Switch-on to check if battery voltage is normal;

b. Clear the surface of part to be measured;

c. Refer to Figure 2-1 and Figure 2-2 to place the instrument correctly, stably and reliably on the surface to be measured;

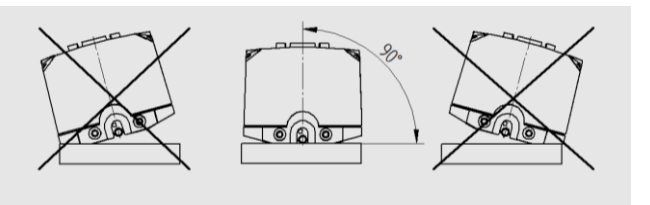


Figure 2-1 Front View

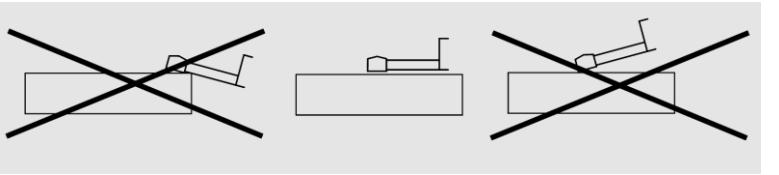


Figure 2-2 Side View

d. Refer to Figure 2-3，trace of the pickup must be vertical to the direction of process line of the measured surface.

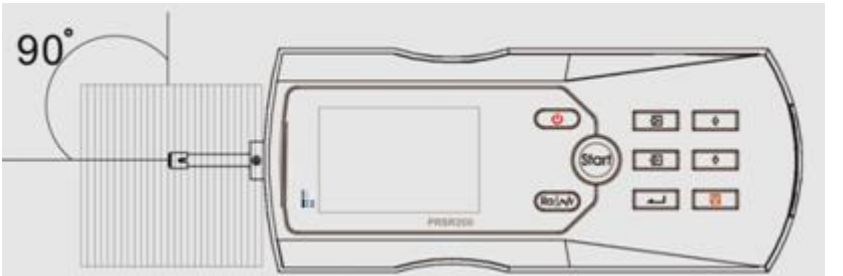


Figure 2-3 Measuring Direction

Instruction:*Correct and standard operation is the premise for accurate measurement result, please make sure to follow it.*

2.2 Basic Measurement Status

Press and release Power key ⏻ to switch on. The instrument automatically displays model, nameand information of manufacturer, and then enters basic measurement status, as shown in Figure 2-4.

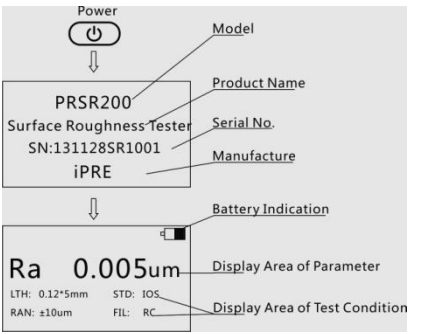


Figure 2-4Boot Process

Instruction:

1. *Contents of basic measurement status entered in the first switch-on are factory settings of this instrument. Settings and data of last switch-off will be displayed in the next switch-on. Basic measurement status will be entered automatically for each switch-on (as shown in Figure 2-4).*
2. *Please don't keep pressing* (⏻) *for a long time to switch on the instrument.*

In basic measurement status, the follows can be performed:

◆ **Measurement**

Press Start key (Start) to start measurement，as shown in Figure 2-5.

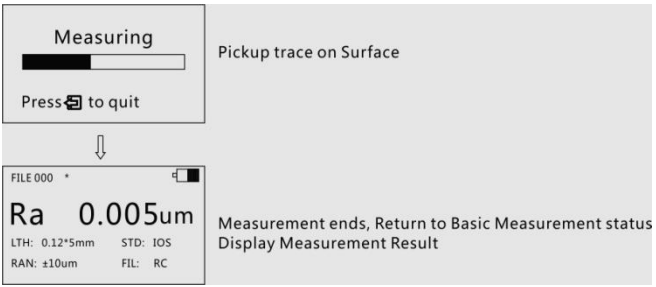


Figure 2-5 Measuring Process

- **Enter menu operation status**

Press Menu key [ ] to enter menu operation status. For detailed operation, see descriptions in corresponding chapters and sections later.

- **Display measurement parameters**

Press Parameter key (Ra) first to shows all parameter values of this

measurement. Press Scroll key [⇧] [⇩] to scroll pages; secondly, press Parameter key (Ra) to displays profile graphs of this measurement. Press Scroll key [⇧] [⇩] to roll profile graphs with other sampling lengths; thirdly, press Parameter key (Ra) to displays tp curve and tp value of this measurement; Press the keys again will repeat above descriptions. Press Esc key [↵] in each status to return basic measurement status (as shown in figure below).

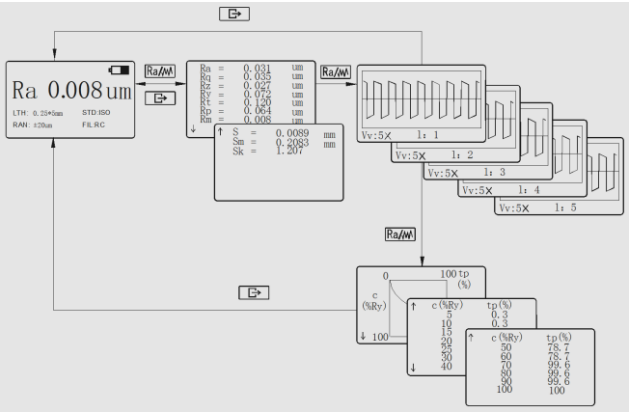


Figure 2-6 Display of Parameters

◆ **Display position of stylus**

Press Enter key [↵] to show the position of stylus in shortcut mode, which is easy to use in practical measurement.

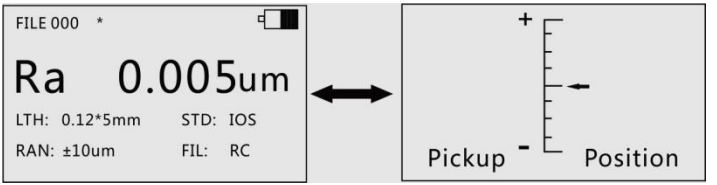


Figure 2-7 Postion of Stylus

Instruction:

1. Tester automatically stores results and conditions of last measurement beforeit is turned off, and will automatically enter this status while it is turned on again.

2. After entering basic measurement status, press Start key (Start) *to measure, if measuring conditions are not needed to be changed.*

3. If position of stylus is close to the limit of range or beyond it, adjust the position of

pickup slightly. Note to keep in line with instructions in 2.1 Preparation for Measurement (adjustment is not needed generally).

4.When press Ra *key to display profile, press* ↵ *can change magnifying times, which can be 1X → 2X → 5X → 10X → 20X → 50X and display circularly.*

2.3 Modifying Conditions of Measurement

Under basic measurement status, press Menu key [ ] to enter menu operation status. Press Scroll key [⇧] [⇩] to select setting function of measured conditions, and then press Enter key [↵] to enter Set Measurement Conditions status. In this status, all measurement conditions can be modified (as shown in Figure 2-8).

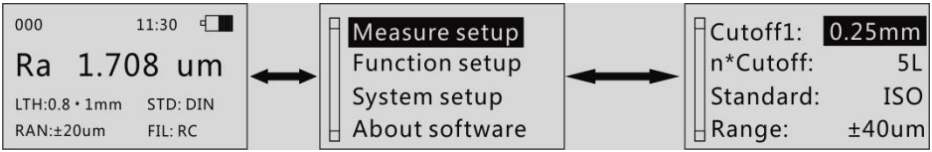


Figure 2-8

2.3.1 Sampling Length

After entered setting status, press Scroll key [⇧] [⇩] to select Set Sampling Length. Press Enter key [↵] to cycle with 0.8 mm →2.5mm →auto→0.25mm (as shown in Figure 2-8). Stop at the value you want and press Scroll key [⇧] [⇩] to modify others.

2.3.2 Evaluation Length

Press Menu key [ ] to enter menu operation status and press Scroll key to select Set Measurement Conditions. Press Enter key [ ] to enter Set Measurement , and press Scroll key [ ] [ ] to select Set n*cutoff. Press Enter key [ ] to cycle with 1L→2L→3L→4L→5L (as shown in Figure 2-9) Stop at the value you want and press Scroll key [ ] [ ] to modify others.

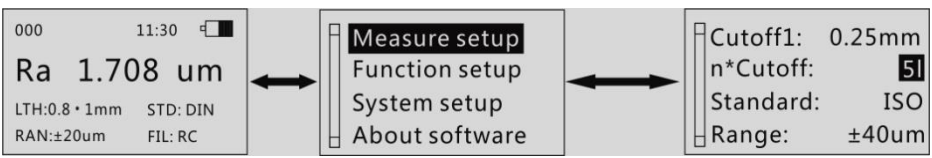


Figure 2-9

Instruction:

When sampling length is set to be automatic, evaluation length will automatically display value 5 to match. This value can not be modified.

2.3.3 Standard

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to select Set Measurement Condition. Press Enter key [↵] for measurement setting, and press Scroll key [⇧] [⇩] to select Set Standard. Press Enter key [↵] to cycle with ISO⇔DIN⇔ JIS⇔ ANSI.

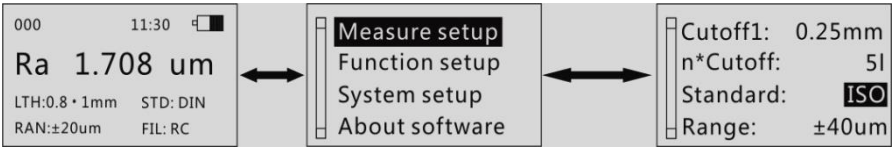


Figure 2-10

Table 2 Standard Code and Name

Code	Standard Name
ISO 4287	International Standard
DIN 4768	Germany Standard
JIS B601	Japan Industrial Standard
ASME B46.1	USA Standard

2.3.4 Range

Press Menu key [ ] to enter menu operation status and press Scroll key [⇧] [⇩] to select Set Measurement Conditions. Press Enter key [↵] for measurement setting, and press Scroll key [⇧] [⇩] to select Set Range. Press Enter key [↵] to cycle with ±20μm⇔±40μm ⇔±80μm⇔auto.

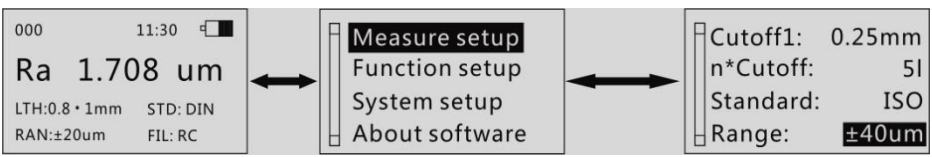


Figure 2-11

2.3.5 Filter

Press Menu key [ ] to enter menu operation status and press Scroll key [⇧]

[⇩] to select Set Measurement Conditions. Press Enter key [↵] for measurement setting, and press Scroll key [⇧] [⇩] to select Set Filter. Press Enter key [↵] to cycle with RC⇔PC-RC⇔Gauss⇔D-P.

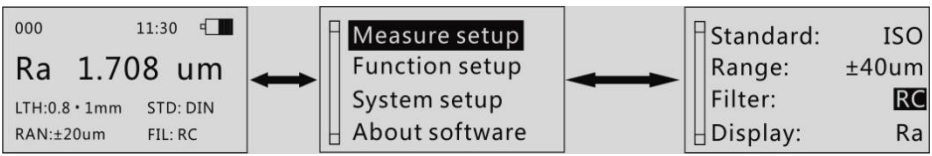


Figure 2-12

2.3.6 Parameter

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to select Set Measurement Conditions. Press Enter key [↵] for measurement setting , and press Scroll key [⇧] [⇩] to select Parameter. Press

Enter key [↵] to cycle with Ra⇔Rz⇔Ry⇔Rq (of which: five parameters of Ra⇔Rz⇔Ry⇔Rmax ⇔Rq are available for ANSI[American Standard] and DIN[German Standard]). After confirmation, parameters selected will be displayed in basic measurement status.

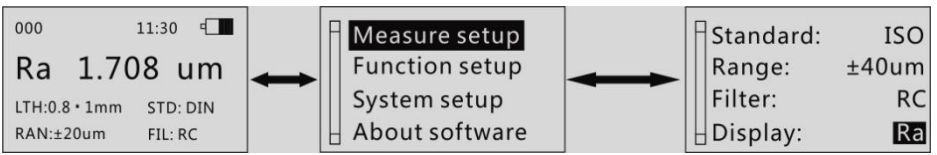


Figure 2-13

2.4 Function Setup

Press Menu key [⊟] to enter menu operation status and press Scroll key [⇧] [⇩] to select Function Setup. Press Enter key [↵] for function

setting.In function Setup (as shown in Figure 2-14), modify contents of system settings.

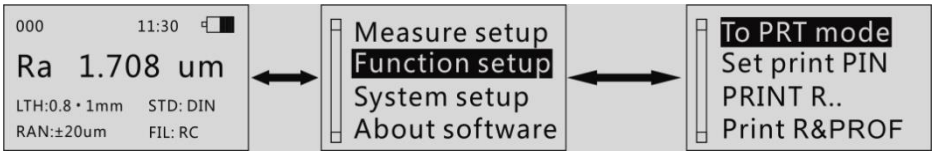


Figure 2-14

2.4.1. Switch to Print Mode/ to Data Mode

Via built-in blue-tooth module, PRSR200 can realize wireless printing and data transferring with PC, mobile etc. These two functions are realized in different modes by blue-tooth module, hence function switch off is needed. If the current mode is digital mode, the menu display “to PRT (PRINT) mode.If the current mode is printing mode, the menu display“to data mode”.Press enter key [↵] to switch the mode. As the

following figure shows:

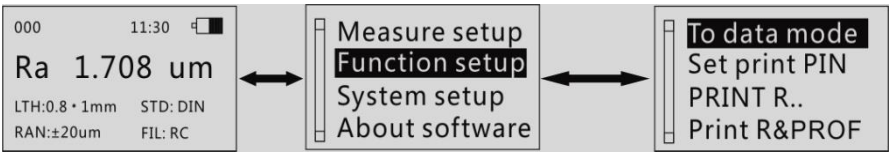


Figure 2-15

2.4.2. Setting the Pair (PIN) Code

Setting the pair code is to enhance the applicability of roughness tester for Bluetooth printer, and to avoid the limitation of Bluetooth printer manufacture.

Press the menu key [ ] to enter menu operation and press the scroll key [ ] [ ] to choose function setup. Press the enter key [ ] to enter function setup and press the scroll key [ ] [ ] to enter set print pin function. Press the enter key

[↵] to the interface of set print pin.Press the enter key [↵] to choose the different No. position and press the scroll key [⇧] [⇩] to select the choosed No.

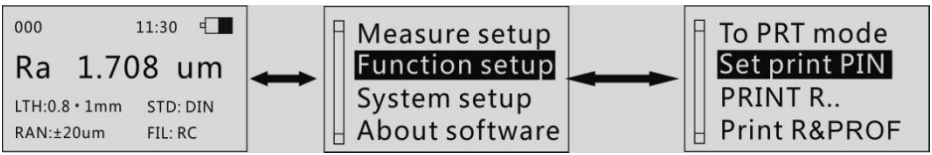


Figure 2-16

2.4.3. Print Parameters

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to choose Function Selection. Press Enter key [↵] to enter Function Selection status and press Scroll key [⇧] [⇩] to select Print Parameter. Press Enter key [↵] to print all measurement parameters (as shown in

Figure 2-19).

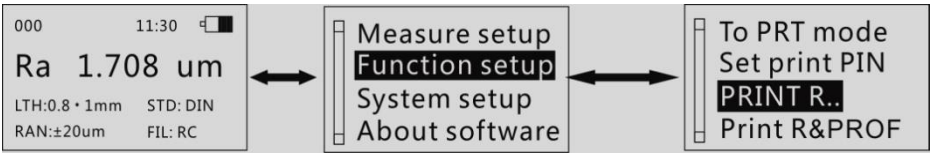


Figure 2-17

2.4.4. Print Parameter and Profile

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to choose Function Selection. Press Enter key [↵] to enter Function Selection status and press Scroll key [⇧] [⇩] to select Print Parameter and Profile. Press Enter key [↵] to start printing. The contents to print include all measurement parameters, profile figures after filtering and tp figure.

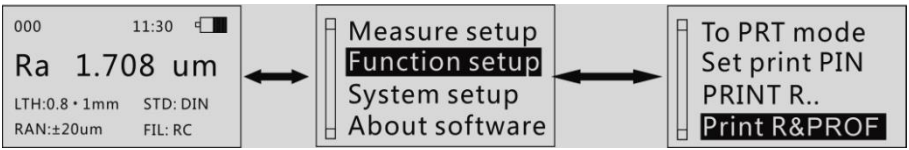


Figure 2-18

2.4.5. Print Primary File

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to choose Function Selection. Press Enter key [↵] to enter Function Selection status and press Scroll key [⇧] [⇩] to select Primary Profile. Press Enter key [↵] to display Primary Profile (i.e. Direct Profile or Original Profile) in this measurement on LCD.

2.4.6. Stylus Position

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to choose Function Selection. Press Enter key [↵] to enter Function Selection status and press Scroll key [⇧] [⇩] to select Stylus Position. Press Enter key [↵] to display the Stylus position.

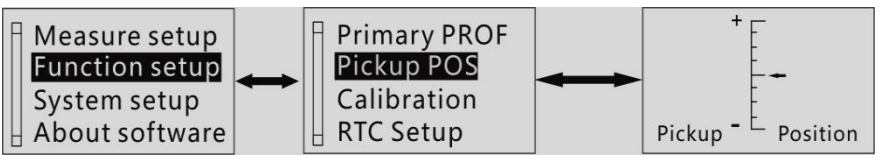


Figure 2-19

2.4.7. Calibration

Press Menu key [⏎] to enter menu operation status and press Scroll key

[⇧] [⇩] to choose Function Selection. Press Enter key [↵] to enter Function Selection status and press Scroll key [⇧] [⇩] to select Display Value Calibration function. Press Enter key [↵] to enter Calibration status and press Scroll key [⇧] [⇩] to change calibration coefficients. Press Enter key [↵] to move cursor.

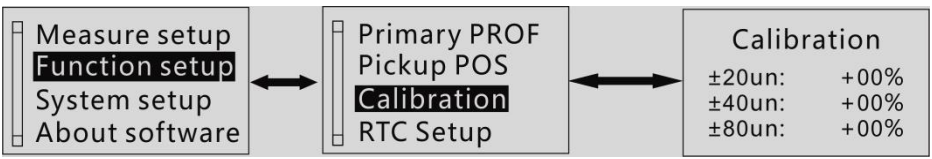


Figure 2-20

Instruction:

1. While using correct measuring method to test random sampling plate, if measured

value exceeds ±10% of the value of sampling plate, use Display Value Calibration function to calibrate according to the percentage of real deviation with calibration range within ±20%.

2. Generally, instrument has been strictly tested before delivery so as to ensure display value error to be much less than ±10%. In this case, user is suggested not to frequently use Display Value Calibration function.

2.4.8. Time Setting

Press enter key [ ] to enter into menu operation，and press the scroll key [ ] [ ] to choose key of Function Setup, then press the enter key [ ] to enter into function item， press the scroll key [ ] [ ] to choose RTC Setup，press the enter key [ ] to enter into TIME SETTING

Press the scroll key [ ] [ ] to change the number under the cursor，press

the enter key [↵] to Move cursor circularly.

2.4.9. Delete all data

This function can delete all the historical data without changing the measuring settings.

2.4.10. Restore Factory Settings

This function can delete all the historical data with changing all the settings to default.

2.5 System Setup

Press Menu key [⎋] to enter menu operation status and press Scroll key [⇧] [⇩] to select System Setup. Press Enter key [↵] for system setting.In System Setup (as shown in Figure 2-21), modify contents of system settings.

2.5.1 Language

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to select System Setup. Press Enter key [↵] for system setting, and press Scroll key [⇧] [⇩] to select Language. Press Enter key [↵] for language selection and press [⇧] [⇩] to select the language you want. Press Enter key [↵] to confirm.

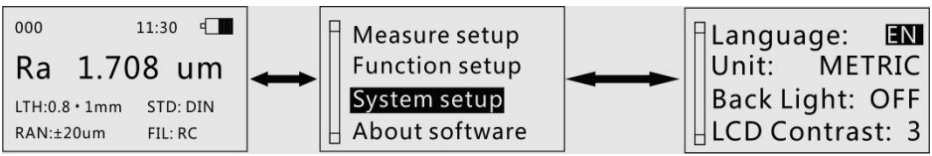


Figure 2-21

2.5.2 Unit

Press Menu key [⏎] to enter menu operation status and press Scroll key

[⇧] [⇩] to select System Setup. Press Enter key [↵] for system setting, andpress Scroll key [⇧] [⇩] to choose Unit. Press Enter key [↵] to switch between metric system and British system.

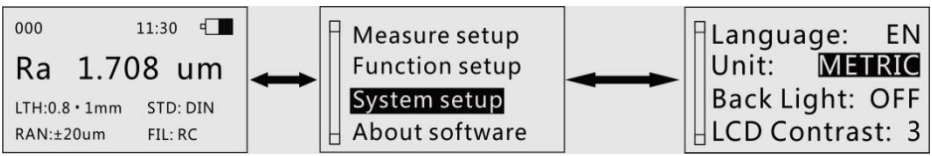


Figure 2-22

2.5.3 LCD Back-light

Press Menu key [⏎] to enter menu operation status and press Scroll key [⇧] [⇩] to select System Setup. Press Enter key [↵] for system setting and press Scroll key [⇧] [⇩] select LCD Back-light On/Off. Press Enter key [↵] to switch between On and Off.

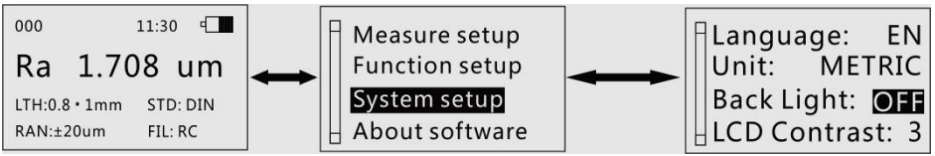


Figure 2-23

Tip：Press ⏻ *to switch the back-light for shortcut.*

2.5.4 LCD Contrast

Press Menu key [⎋] to enter menu operation status and press Scroll key [⇧] [⇩] to select System Setup. Press Enter key [↵] for system setting，and press Scroll key [⇧] [⇩] for LCD Brightness Adjustment. Press Enter key [↵] to enter LCD Brightness Adjustment and press Scroll key [⇧] [⇩] to adjust the brightness to satisfactory degree.

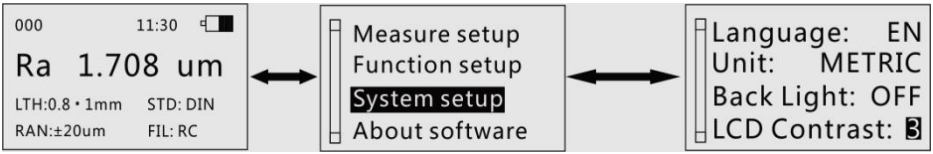


Figure 2-24

2.5.5 Bluetooth Power

Press menu key [⏎] to enter menu operation，then press [⇧] [⇩] to choose System Setup， press [↵] to enter，press [⇧] [⇩] to choose Bluetooth，press [↵] to display ON and OFF circularly.

This menu is mainly on occasion to some does not require the use of Bluetooth module , which can reduce the power consumption.

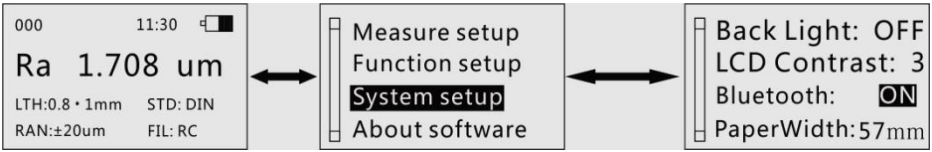


Figure 2-25

2.5.6 Printing Paper Width

The Bluetooth module of the roughness tester can drive a Bluetooth printer to print testing report, in order to enhance the adaptability of the instrument. Two kinds of printing paper can be choosed : 57mm and 80m. These 2 types of printers can be worked with PRSR200 perfectly!

Press menu key [ ] to enter menu operation status and press scroll key [ ] [ ] to choose System Setup . Press enter key [ ] to enter System Setting and press scroll key [ ] [ ] to choose Paper Width. Press enter key [ ] to

show 57mm、80mm circularly.

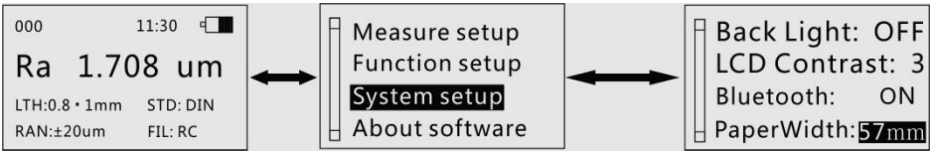


Figure 2-26

2.6 Connection with PC

Before communicating with PC, connect the instrument to serial interface of PC with communication cable attached to the instrument as shown in Figure, and enter private operation software Data View on PC.

3 Options and Usage

3.1 Adjustable Supporter and Sheath of Pickup

When measured surface of part is smaller than the bottom surface of the instrument, sheath of pickup and adjustable supporter of PRSR200 options can be used for auxiliary support to complete the measurement (as shown in Figure 3-1).

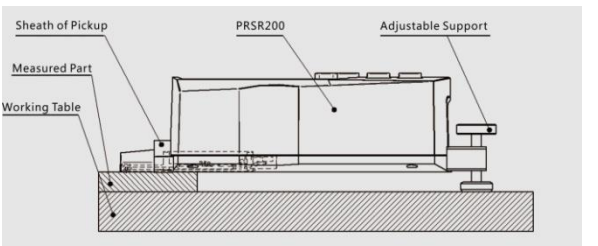


Figure 3-1Usage of Adjustable supporter and Sheath of Pickup

Tip:

1.L above shall not be shorter than driving stroke of this measurement to prevent pickupfrom dropping out of part during measurement.

2. Locking of adjustable supporter shall be reliable.

3.2 Measurement Stand

PT series measurement Stand can adjust the positions between tester and measured part conveniently with flexible and stable operation and wider application range. Roughness of complex shapes can also be measured. PT series measurement stand enable the adjustment of the position of stylus to be more precise and measurement to be more stable. If Ra value of measured surface is relatively low, Using measurement platform is recommended.

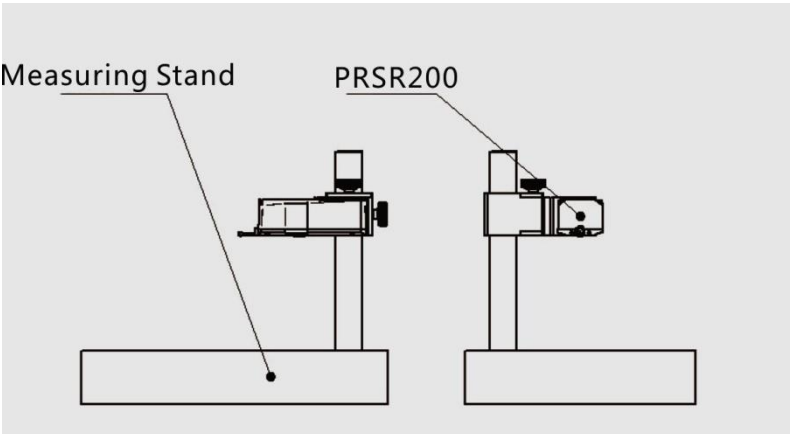


Figure 3-2Measurement stand

3.3 Extending Rod

Extending rod increases the depth for pickup to enter the workpiece. Length of extending rod is 50mm.

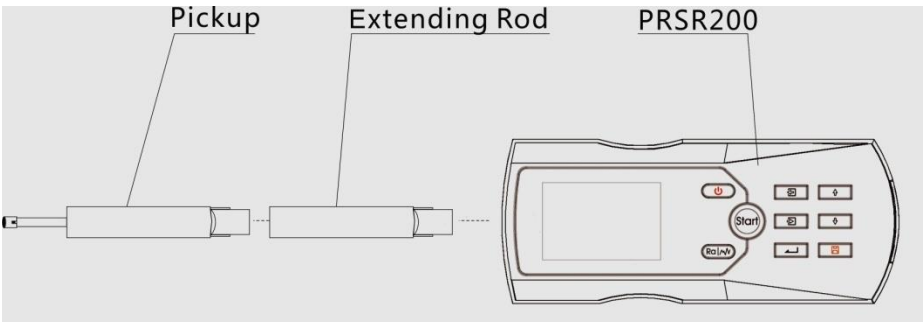


Figure 3-3Extending Rod

3.4 Connection Rod of Magnetic Gauge Base

Connection rod connects the tester with magnetic gauge base so as to measure various surfaces of parts flexibly and easily as shown in figure 3-5. It's particularly suitable for production sites.

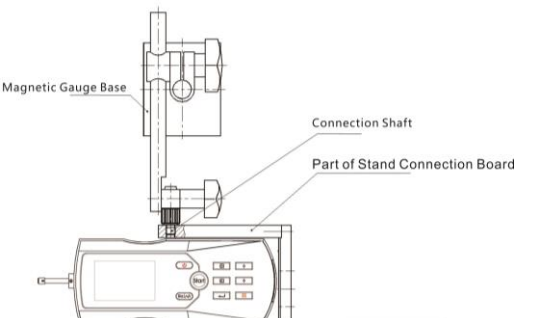


Figure 3-4 Test Stand connect with Magnetic Base

3.5 Curved Surface Pick Up

Curved surface pickup can measure convex or concave surfaces of parts, as shown in the figure below.

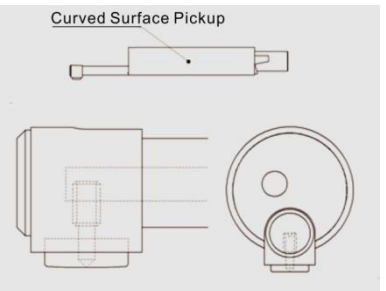


Figure 3-5Curved Surface Pick up

4 Technical Parameter and Features

4.1. Pickup

Test Principle:Inductance type

MeasurementRange:160μm

Stylus tip Radius:5μm

Stylus tip Material:Diamond

Measuring force :4mN(0.4gf)

Stylus tip Angle:90°

Radius of Skid curvature:45mm

4.2. Driving Parameter

Maximum drive range: 17.5mm/0.7inch

Traversing speed:

Vt=0.135mm/s, whilesampling length = 0.25mm

Vt=0.5mm/s, while sampling length = 0.8mm

Vt=1mm/s, while sampling length = 2.5mm

V=1mm/s, whilereturning;

4.3. Display Accuracy：

Less than or equal to ±10%

4.4. Display Repeatability：

Less than or equal to 6%

4.5. Display Content

Menu: modify measurement conditions, calibration display value and select communication with PC or printing.

Parameter: parameters of roughness compatible with four standards of ISO, DIN, ANSI and JIS.

Graph: Primary profile, filtered profile and tp curve.

Prompt information: measurement, menu prompt, errors, battery capacity and switch-off prompt information.

4.6. Profile and Filter

Table 3

Profile	Filter
Filtered Profile	RC
	PC-RC
	Gauss
Non-Filtered Profile	D-P

4.7. Sampling Length and Cut-off length L

Automatic，0.25mm，0.8mm，2.5mmare selectable

4.8. Evaluation Length ln

（1~ 5）*Sampling Length is selectable

4.9. Roughness Parameter and Display Range

Table 4

Parameter	Display Range
Ra Rq	0.005μm ~ 16μm
Rz Ry Rt Rp Rm	0.02μm ~ 160μm
S,Sm	1mm
tp	5%~10%

4.10. Measuring Range and Resolution

Table 5

Measuring Range	Resolution
Automatic	0.01μm ~0.04μm
±20μm	0.01μm
±40μm	0.02μm
±80μm	0.04μm

4.11. Power Supply

Built-in battery(Lithium ion battery): 3.7V rechargeable

Charging time: 2.5 hours

Charging voltage: 5V DC (can be from USB interface)

Consecutive work time per charge: more than 20 hours

Auto-sleep function: display turns off if not operated for 5 minutes

4.12. Temperature/Humidity Range

Working environment:

Temperature:0 ~ 40℃

Humidity:< 90% RH

Store and transportation:

Temperature:-40℃~ 60℃

Humidity: < 90% RH

4.13. Dimension and Weight

L×W×H: 140×52×48mm,

Mass: approximately 440g

4.14. Connect with PC

MINI USB cable

4.15. Connect with Printer

Connecting with PT210-BT Bluetooth series printerscan print parameters as well as profile figures.

4.16. Battery Switch

The battery switch is at the bottom of the instrument as shown in Figure 6-1.

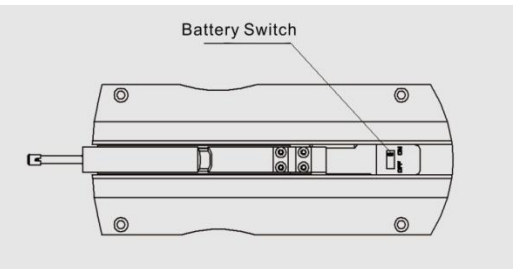


Figure 4-1 Power ON and OFF

1. When charging, the battery switch must be in the ON position, or can not be charged.

2. When not in use for long time, if switch off the battery, which can prolong the battery life, while the calibration data will be lost. Suggesting make a backup before switching

off the battery.

3. When the instrument is delivered from manufacture, the switch off is in the OFF position, press the POWER key to turn on if PRSR200 does not work after switching on.

4. If the instrument does not work properly, restart PRSR200 after switching off the battery for 10 seconds

5 General Maintenance

- Avoid crash, intensive vibration, heavy dust, humidity, grease stain and strong magnetic field;
- Pickup is a precise part and should be protected carefully. Put it back in the package box after operation of each time;
- Protect standard sample plate provided with tester carefully so as to avoid calibration fault caused by scratching.

5.1 Trouble Shooting

When the tester breaks down, handle the troubles according to measures described in next section Fault Information. If troubles still exist, please return the instrument to factory for repair. Users should not dismantle and repair the device by themselves. Returned instrument should be accompanied with warranty card and

sample plate attached. Phenomenon of problem should be explained.

5.2 Fault Information

Table 6

Display Content	Cause	Solutions
Out of Range	Maximum value of measured signal exceeds measuring range;	1. Press Esc key to return; 2. Enter menu setting status, increase measuring range, press Esc key to return; 3. Measure again.
Motor failure	Mechanical fault;	Scheme 1: Switch off and switch on again; Scheme 2: Press Reset key; Scheme 3: Return to factory to repair.
Pickup failure	Pickup is in automatic returning process	1. Press Esc key to return and wait till pickup returns to the start position; 2. Measure again.
Working abnormally		1. Turnoff and then restart 2. switch the battery off, then switch the battery on 10 seconds later.

WARNING:

1. *Any operation to open the shell of the roughness tester is forbidden without permission.*

2. *The user is permitted to do general maintenanceonly following the instructions above.*

6 Reference

6.1 Profile and Filter

6.1.1 Profile

Primary profile: non-filtered profile signal obtained by pickup

Filtered profile: profile signal after primary profile is filtered to remove waviness

6.1.2 Filter

RC filter:analogue 2RC filter with phase difference;

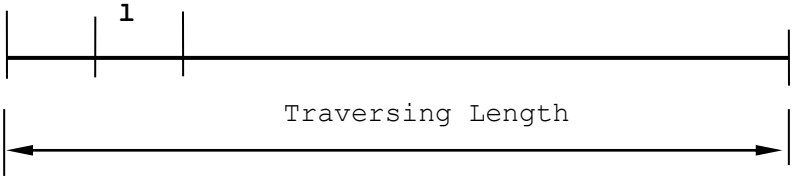
PC-RC filter: RC filter with phase-correction;

Gauss filter:DIN4777

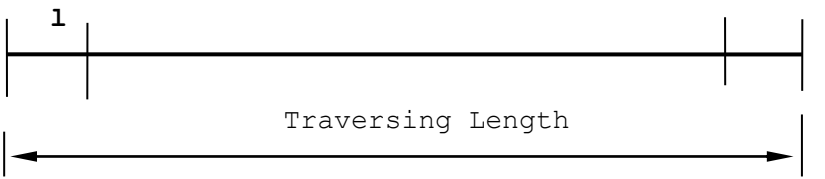
D-P (direct-profile): adopt central line of Least Square Algorithm.

6.2 Traveling Length

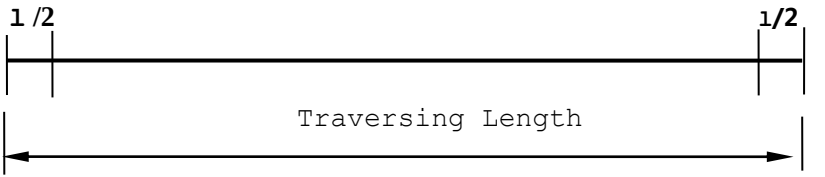
6.3.1 RC filter



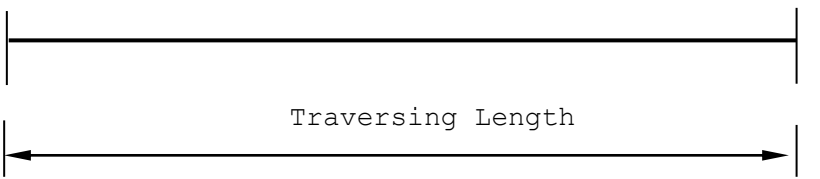
6.3.2 PC-RC filter



6.3.3 Gauss Filter



6.3.4 D-P Direct Profile



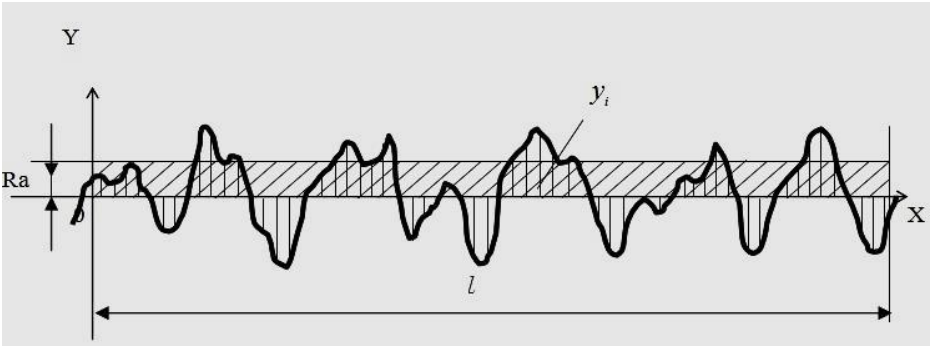
6.3 Definitions of PRSR200 Roughness Parameters

This section gives definitions of PRSR200 measurement parameters.

6.3.1 Arithmetical Mean Deviation of Profile(Ra)

Ra is arithmetic mean of the absolute values of profile deviation (*yi*) from mean within sampling length.

$$Ra = \frac{1}{n}\sum_{i=1}^{n}\left|y_i\right|$$



6.3.2 Root-mean-square Deviation of Profile (Rq)

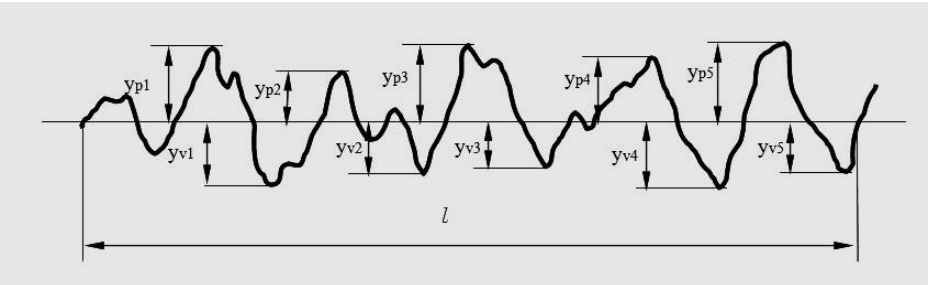
*Rq*is the square root of the arithmetic mean of the squares of profile deviation (Yi) from mean within sampling length.

$$Rq = \left(\frac{1}{n} \sum_{i=1}^{n} y_i^{\,2} \right)^{\frac{1}{2}}$$

6.3.3 Ten Point Height of Irregularities(Rz)

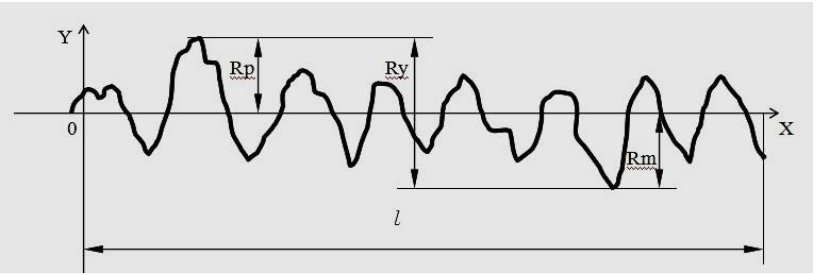
The sum of the mean height of the five highest profile peaks and the mean depth of the five deepest profile valley from mean within the sampling length.

$$Rz = \frac{\sum_{i=1}^{5} y_{pi} - \sum_{i=1}^{5} y_{vi}}{5}$$



6.3.4 Ry（ISO）Maximum Height of Profile

Ry is The sum of height Rp of the highest profile peak from the mean line and depth Rv of the deepest profile valley from the mean line within sampling length.



6.3.5 Maximum Height of Profile (Ry (DIN))

To get Ry (DIN) value: firstly calculate Ryi in each sampling length, the maximum of which is the Ry (DIN) for the evaluation length.

6.3.6 Total Peak-to-valley Height (Rt)

Rt is the sum of the height of the highest peak and the depth of the deepest valley

over the evaluation length.

6.3.7 Maximum Depth of Profile Peak (Rp)

Rp is the height from the highest profile peak line to mean line within sampling length.

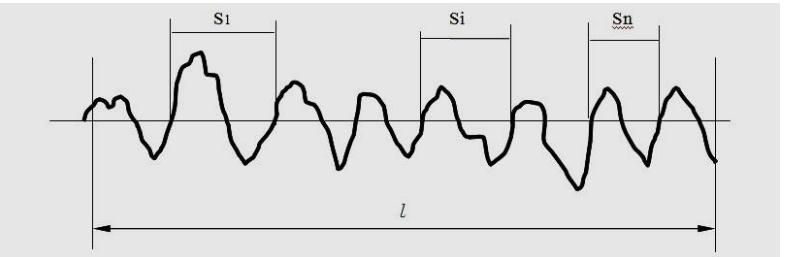
6.3.8 Maximum Depth of Profile Valley(Rm)

Rm is the depth from the deepest profile valley line to mean line within sampling length.

6.3.9 Mean Spacing of Profile elements (Sm)

Sm is the mean spacing between profile peaks at the mean line within sampling length.

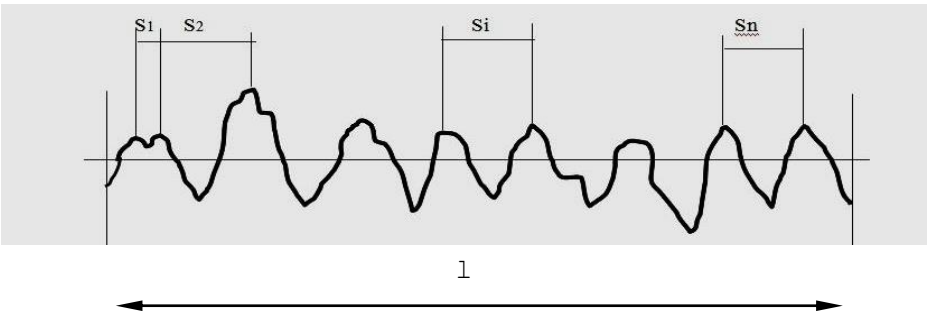
$$Sm = \frac{1}{n}\sum_{i=1}^{i=n} Si$$



6.3.10 Mean Spacing of Local Peaks of Profile(S)

S is the mean spacing of adjacent local peaks of the profile within sampling length.

$$S = \frac{1}{n}\sum_{i=1}^{i=n} S_i$$



6.3.11 Profile Bearing Length Ratio (tp)

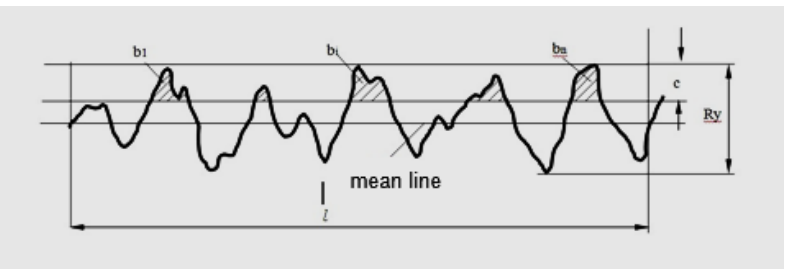
The bearing ratio tp is the length of bearing profile, at a depth c below the highest

peak.

Tp(%) is the ratio at the depth c.

$$tp = \frac{\eta_p}{l}$$

$$\eta_p = b_1 + \cdots\cdots + b_i + \cdots\cdots + b_n$$



6.3.12 Skewness of the profile (Rsk)

Rsk is the quotient of the mean cube value of the profile deviation (Yi) and the cube of Rq within sampling length.

$$R_{sk} = \frac{1}{R_q^3} \times \frac{1}{n} \sum_{i=1}^{n} \left(y_i\right)^3$$

6.3.13 Third Maximum Peak-to-valley Height (R3z)

R3z is the mean of the sum of the third profile peak height and the third profile valley depth of each sampling length over evaluation length.

AttachedTable:DISPLAY MAGNIFYING TIMES

Following is the table of comparison between Display magnificationtimes and Screen display full range.

Magnification times / RangeDisplaying /range	×1	×2	×5	10×	20×	50×
±20μm	±20μm	±10μm	±4μm	±2μm	±1μm	±0.4μm
±40μm	±40μm	±20μm	±8μm	±4μm	±2μm	±0.8μm
±80μm	±80μm	±40μm	±16μm	±8μm	±4μm	±1.6μm