Medidor de Rugosidad DR230, Dragon Electronics

bDE-DR230

SURFACE ROUGHNESS TESTER

DR230

Operating Manual

CONTENT

1. Summary

Surfaces roughness tester DR230 is suitable for fixed and mobile measurement with small handheld instrument. Its simple operation, overall function, fast measurement, high accuracy and stability, makes users more convenience in testing.

This tester is widely used in production site and measurement surface roughness of various machinery-processed parts. This tester is also capable of evaluating surface textures with a variety of parameters according to international standard and various national standards. The measurement results are displayed in digital/graphically on OLED display and output to the printer.

1.1 Features

- Electro-mechanical integration design, small size, light weight, easy to operate;
- DSP chip control and data processing, high speed, low power consumption;
- 128 × 64 OLED dot matrix display, digital or graphic highlight display;
- Display rich information and graphical displays all parameters;
- Compatible with ISO1997, DIN, ANSI, JIS2001 multiple national standards;
- 20 parameters: Ra, Rz, Rq, Rt, Rp, Rv, R3z, R3y, Rz(JIS), Rs, Rsk, Rsm, Rku, Rmr; Ry(JIS)=Rz; Rmax=Rt, RPc, Rk, Rpk, Rvk, Mr1, Mr2.
- 160μm large measurement range;
- 4 Profile Filter: Gauss, RC, PC-RC, DP
- Built-in lithium-ion rechargeable battery, more than 20 hours continuous work;
- Auto shutdown for power saving;
- Large capacity storage of 100 data and waveforms;
- Connected to PC for data transfer and print;
- Optional pickups and stand, such as curved surface, small holes, deep grooves, extension rod and measurement stand.

1.2 Principle

When measuring roughness of workpiece, pickup is placed on workpiece 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 DSP chip and the measuring result can be read on OLED or print through printer and communicated with PC.

1.3 Measuring range

Parameter	Measuring range
Ra,Rq	0.005μm ～ 16μm
Rz,,R3z,Ry,Rt,Rp,Rm	0.02μm ～ 160μm
Sk	0 ～ 100%
S,Sm	1mm
Tp	0～100%

1.4 Technical parameter

Description		Parameter
Measurement Range	The Z axis (vertical)	160μm
	TheX axis(horizontal)	17.5mm
Resolution	The Z axis (vertical)	0.01μm/±20μm
		0.02μm/±40μm
		0.04μm/±80μm
Measurement item	Parameter	Ra, Rz, Rq ,Rt, Rp, Rv, R3z ,R3y, Rz (JIS), Rsk, Rku, Rsm, Rs; Ry(JIS)=Rz; Rmax=Rt, Rpc, Rk, Rpk, Rvk, Mr1 and Mr2
	Standard	ISO, ANSI, DIN, JIS, TOTAL
	Graphic	Material ratio curve of the profile
Filter		RC,PC-RC,Gauss,D-P
The sampling length(*l*r)		0.25,0.8,2.5mm
Assessment length（*l*n）		$Ln= lr \times n$ n=1~5
Sensor	Principle	The displacement differential inductance
	Stylus	Natural Diamond, 90° cone angle, 5μm tip
	Force	<4mN
	Skid	Ruby, Longitudinal radius 40mm
	Traversing speed	*l*r=0.25, Vt=0.135mm/s
		*l*r=0.8, Vt=0. 5mm/s
		*l*r=2. 5, Vt=1mm/s
		Return Vt=1mm/s
Accuracy		No more than±10%
Repeatability		No more than 6%
Power supply		Built-in 3.7VLithium ion battery
Working Time		More than 20 hours
Outline dimension L×W×H		141×55×40mm
Weight		About 400g
working Environment		Temperature：- 20℃ ~ 40℃
Store and Transportation		Temperature：- 40℃ ~ 60℃

1.5 Name of each part

1. Main unit
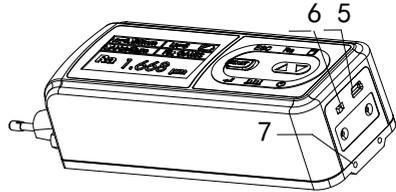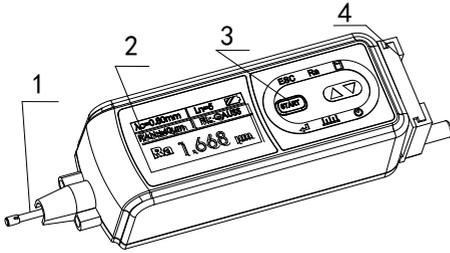
1.Pickup **2**. Display **3**. Keypad **4**. Adjustable support
5. USB charge **6**. Power switch **7**. Fixing hole

2. Pickup
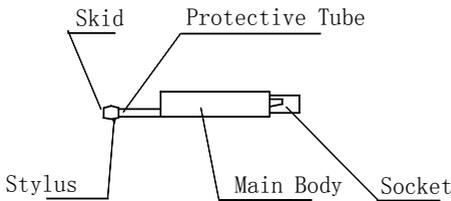
3. Display
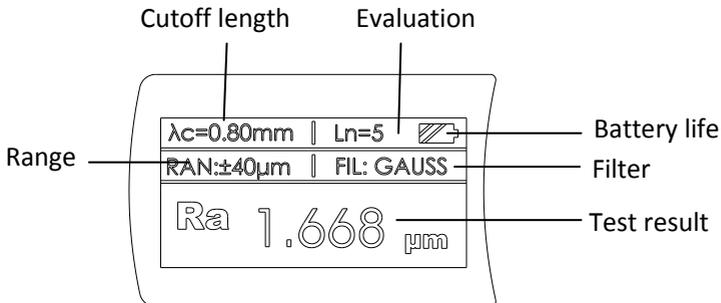
1.6 Keypad

[⏻]	Power key: Turn On/Off the instrument
[⨅]	Stylus position keys: For switching between stylus position display
[▷]	Start measurement key: Start the instrument to measuring mode
[Ra]	Parameter selection key / read graphic Used to view various parameters or graphic
[🗔]	Record storage key/ print key: For storing and print the record results
[⬆]	Up Arrow key: To select items
[⬇]	Down arrow keys: Select the item
[↵]	Menu / Enter key: To enter the menu settings
[ESC]	Cancel / Exit key: Used to exit the menu and unset

1.7 Battery charge

When battery voltage is too low (Battery voltage display on screen reminds users of low battery), the instrument should be charged as soon as possible. USB port is used for charge. Users could charge the main unit with power adapter or use computer's USB port.

Main unit displays charging animation. It takes users about 2.5 hours to charge the battery full and display reminds users on that.

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.

Notice:

When charging, ensure that the instrument power control is at "ON" position.

1.8 Connection between main unit and pickup
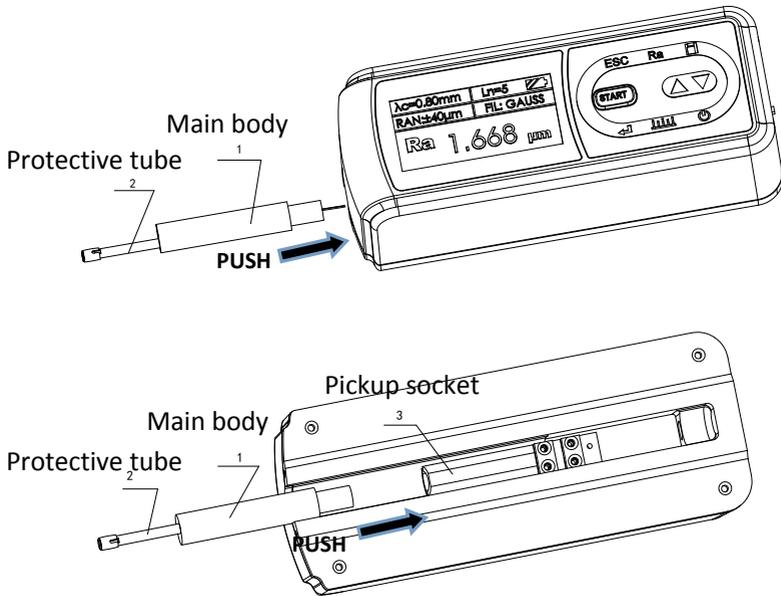
For installation or removal of pickup, users should hold the main body of pickup with one hand and pushes it into connection adapter at the bottom of the instrument as shown in Figure; and then slightly push it to the end of the sheath. To remove, hold the main body of pickup or the root of protective sheath with hand and slowly pull it out.

Notice:

1. Stylus of pickup is key part of this instrument and great attention should be paid to it.

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

3. Connection of pickup should be reliable during installation.

2   Operation of the instrument

2.1 Preparation before measurement

1. Turn on the instrument to check if battery voltage is in normal condition;

2. Clear the surface of part to be measured;

3. Place the instrument correctly, stably and reliably on the surface
to be measured;

4. Trace of the pickup must be vertical to the direction of the measured
surface.
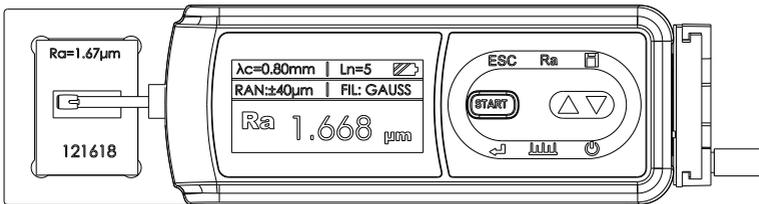
Notice:

Correct and standard operation is the premise for accurate measurement
result; please make sure to follow it.

2.2 Power on/off

Press the key 🔘 to turn on the instrument and main interface is shown as

below:
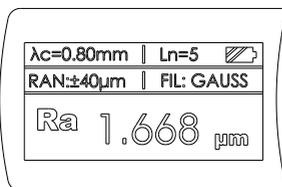
Notice:

1. Turn on the instrument and set data.

2. Main interface shows the setting at last time.

3. The instrument will be auto turned off if it is not used for long time.

4. Please adjust the stylus cursor position to the best position "0"

2.3 Stylus position
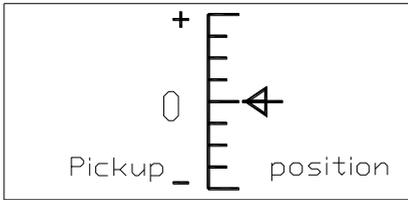
Users should determine the location of the sensor with reference of stylus position. The best measurement condition is in the middle.

Under main interface, press the stylus position key 〔〕 to change to stylus position display and press this key again to back to main display.

2.4 Parameters setting

Turn on the instrument, press 〔〕 key to enter main menu, press

〔↑〕〔↓〕 keys to set parameters, and then press 〔〕 key to enter into detailed parameter setting. Under parameter setting, users could modify all measurement parameters.

Menu	▥
▷ 1.Parameter	
2.Record	
↓ 3.Date	

Parameter		▥	Content
⏶ ▷ λc		0.8mm	0.25mm, 0.8mm, 2.5mm
ln	5		1–5
RANGE		± 40 μm	±20, ±40, ±80μm
FILTER	GAUSS		RC, PC-RC, GAUSS, D-P
STANDARD	ISO		ANSI,ISO,DIN,JIS,TOTAL
DISPLAY	Ra		Ra, Rz, Rt, Rq
UNIT	μ m		μ m, μ in
↓ LANGUAGE	ENG		ENG, CHN

Notice:

Standard: There are 5 standard options. They are ANSI, ISO, DIN, JIS and TOTAL.

If users set standard as ISO, for example, only parameters under this standard could be found. Operation in detail is like this:

1. After measurement, press $\boxed{\text{Ra}}$ key

2. Press $\boxed{\text{⇧}}\boxed{\text{⇩}}$ keys to check parameters. Under ISO standard, there are Ra, Rz, Rq, Rt, Rp, Rv, Rsk, Rs, Rsm, Ry and Rpc

3. Press $\boxed{\text{Ra}}$ key twice back to main interface

2.5 Measurement

Under main interface, press Start button to start measurement.
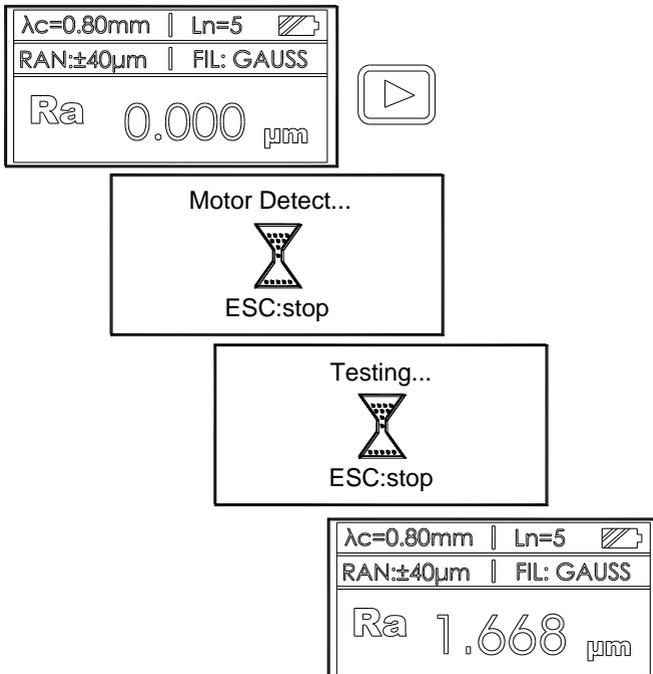
2.6 Test result and graph display

After measurement, test results and graph can be observed in Figure shows the results of all measurements.

λc=0.80mm	Ln=5	▨
RAN:±40μm	FIL: GAUSS	

Ra 1.598 μm

[Ra]

Roughness	▥
↑	Ra= 1.598μ m
	Rz= 3.016μ m
↓	Rq= 1.768μ m

[⬆] [⬇]

Roughness	▥
↑	Rt= 6.236μ m
	Rp= 3.298μ m
	Rv= 3.012μ m
	R3z= 6.168μ m
	R3y= 6.238μ m
	RzJIS= 5.08μ m
	Rsk= −0.11
	Rku= 0.96
↓	Rsm= 0.08mm

[Ra]

C(Rt)	Rmr	0 Rmr 100%
5%	4.1%	
10%	5.1%	
15%	6.5%	
20%	10.3% ↓	
C(Rt)	100%	

[⬆] [⬇]

C(Rt)	Rmr	0 Rmr 100%
25%	4.1%	
30%	5.1%	
35%	6.5%	
40%	10.3% ↓	
C(Rt)	100%	

⋮ [⬆] [⬇]

C(Rt)	Rmr	0 Rmr 100%
75%	4.1%	
80%	5.1%	
95%	6.5%	
100%	10.3% ↓	
C(Rt)	100%	

[Ra]

↕: ±20.0μm 【0.00~0.25mm】

[⬆] [⬇]

↕: ±20.0μm 【0.25~0.75mm】
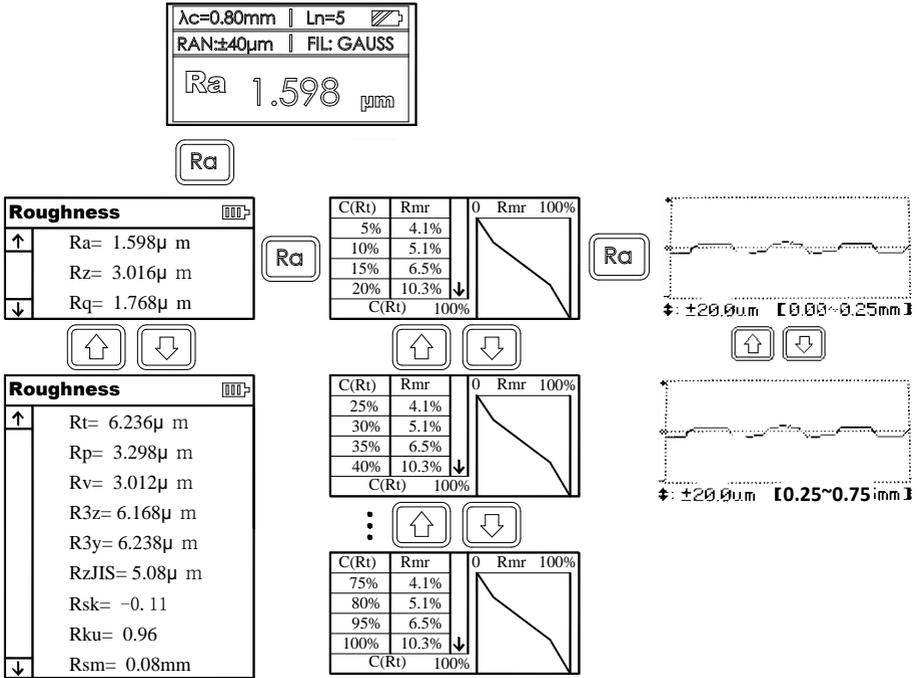
2.7 Print

DR230 can print any parameter selection or print all.

1. Select Parameters
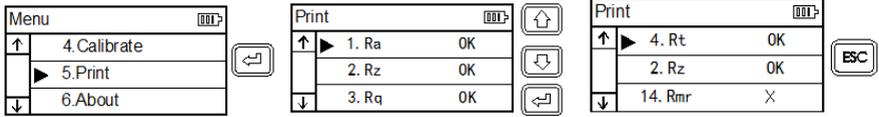
2. Press [Ra] key to display the results.

3. Press [🖶] key to print the measured data. At this time, [🖶] key

is used as function of print.

If user needs to print all parameters, please follow step 2 and step3 directly.
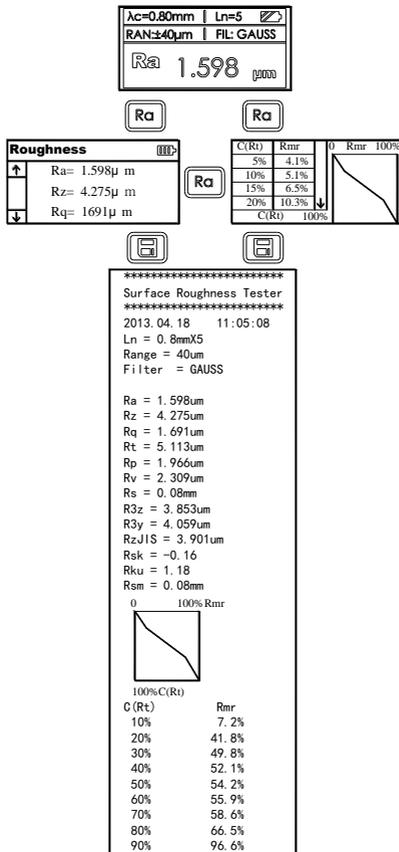
2.8 Store test results

Under main interface, press ⬚ key to save measurement results stored in instrument. Its built-in large capacity memory could store 100 groups of data and waveform including date and time.
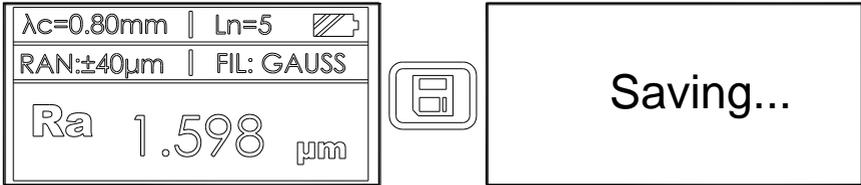
2.9 Storage management

Under main interface, press ⬚ key to enter main menu. Press ⬆ ⬇ keys to select "Record" menu, press ⬚ key to enter data management.
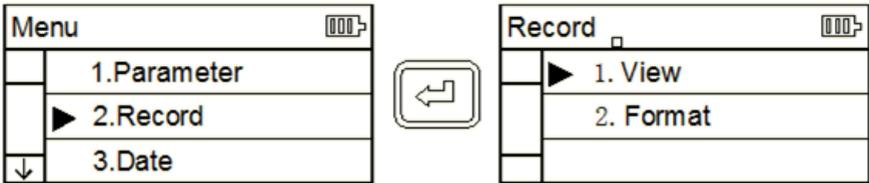
Selected item and press the Enter key to enter.

2.9.1 View record

Press ⬚ to enter data list; press ⬆ ⬇ key to select the target record; press ⬚ again to check in detail. Under this condition, press ⬚ key to print all data of record selected directly.
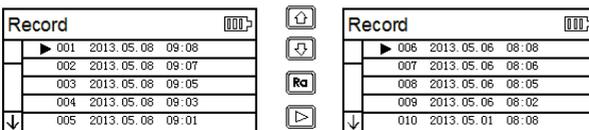
2013.05.06 08:08: 16 ▯▮▯▷	
↑ Ra= 1.598μ m	
Rz= 3.016μ m	
↓ Rq= 1.768μ m	

Ra

C(Rt)	Rmr
5%	4.1%
10%	5.1%
15%	6.5%
20%	10.3% ↓
C(Rt)	100%

↑ ↓ ↑ ↓

0.8mmx5 ±40μ m GAUSS
↑   Rt= 6.236μ m
Rp= 3.298μ m
Rv= 3.012μ m
R3z= 6.168μ m
R3y= 6.238μ m
RzJIS= 5.08μ m
Rsk= −0. 11
Rku= 0.96
↓   Rsm= 0.08mm

C(Rt)	Rmr
25%	4.1%
30%	5.1%
35%	6.5%
40%	10.3% ↓
C(Rt)	100%

⋮ ↑ ↓

C(Rt)	Rmr
75%	4.1%
80%	5.1%
95%	6.5%
100%	10.3% ↓
C(Rt)	100%

Print

```
**************************
Surface Roughness Tester
**************************
2013.04.18    11:05:08
Ln = 0.8mmX5
Range = 40um
Filter  = GAUSS

Ra = 1.598um
Rz = 4.275um
Rq = 1.691um
Rt = 5.113um
Rp = 1.966um
Rv = 2.309um
Rs = 0.08mm
R3z = 3.853um
R3y = 4.059um
RzJIS = 3.901um
Rsk = −0.16
Rku = 1.18
Rsm = 0.08mm
```

0   100% Rmr

100%C(Rt)

C(Rt)	Rmr
10%	7.2%
20%	41.8%
30%	49.8%
40%	52.1%
50%	54.2%
60%	55.9%
70%	58.6%
80%	66.5%
90%	96.6%

2.9.2 Format

Data format is deletion of all data. Once users confirm deletion, all data is deleted and could not be found back.
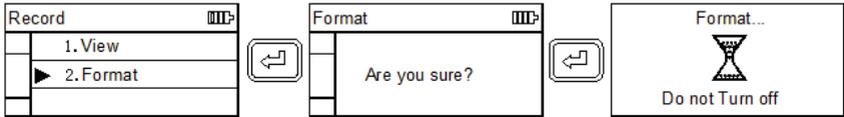
2.10 Date Setting

Built-in real time clock calendar is used to record date and time for users convenience.
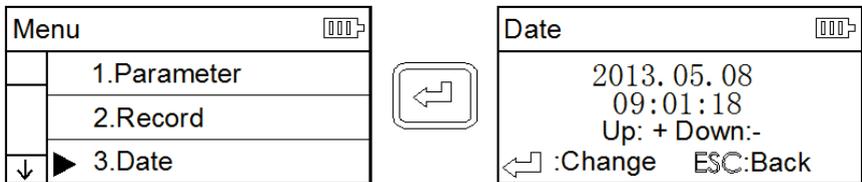
2.11 Information

All instrument information could be found here including serial number, version and so on.
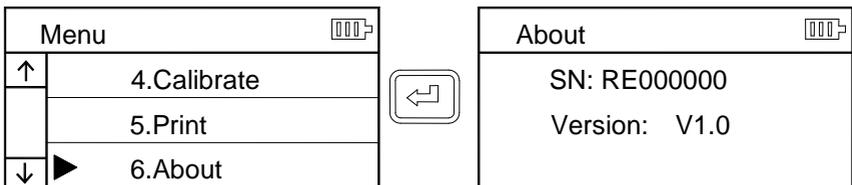
2.12 Calibrate

Before measuring, the instrument is usually required to do calibration on the standard test block in the standard delivery. Under normal circumstances, when the measured value is within tolerance, it can be used directly.

If it is out of tolerance or users require high accuracy, it is necessary to make calibration and improve accuracy. Calibration procedure is as shown below:

```
┌─────────────────────────┐
│ Menu                ▥▷ │
├─┬───────────────────────┤
│↑│ ▶ 4.Calibrate         │
│ ├───────────────────────┤        ┌───┐
│ │   5.Print             │        │ ⏎ │
│ ├───────────────────────┤        └───┘
│↓│   6.About             │
└─┴───────────────────────┘
┌─────────────────────────┐
│ Calibrate           ▥▷ │
├─────────────────────────┤        ┌───┐
│                         │        │ ⇧ │
│     Ra= 1. 51 μ m       │        └───┘
│                         │        ┌───┐
│                         │        │ ⇩ │
└─────────────────────────┘        └───┘
┌─────────────────────────┐
│ Calibrate           ▥▷ │
├─────────────────────────┤
│                         │        ┌───┐
│     Ra= 1. 63 μ m       │        │ ▷ │
│                         │        └───┘
│                         │
└─────────────────────────┘
┌─────────────────────────┐
│       Calibrate...      │
│                         │
│          ⏳             │
│                         │
│       ESC: Stop         │
└─────────────────────────┘
┌─────────────────────────┐
│ Calibrate           ▥▷ │
├─────────────────────────┤
│                         │        ┌───┐
│     Ra= 1. 63 μ m       │        │ ⏎ │
│                         │        └───┘
│                         │
└─────────────────────────┘
┌─────────────────────────┐
│ Menu                ▥▷ │
├─┬───────────────────────┤
│↑│ ▶ 4.Calibrate         │
│ ├───────────────────────┤
│ │   5.Print             │
│ ├───────────────────────┤
│↓│   6.About             │
└─┴───────────────────────┘
```
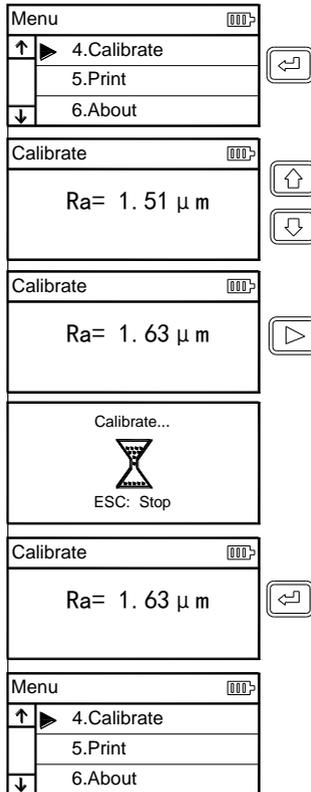
Notice:

1. Under normal circumstances, instruments in the factory are been rigorously tested and error is less than ± 10%. Under this condition, it is not required users to do calibration frequently.

2. After setting the calibration value, users must press ▷ key

   for a measurement; press ⏎ key calibration process is complete.

3. New parameters after calibration must be set again once a complete

   measurement and press ⏎ key is to confirm.

4. Press "ESC" key to return to main menu without saving calibration results.

2.13 Software

2.13.1 Instruction for installing software

1.　　Run SetupDV_EN_ROUGHNESS_V1.31
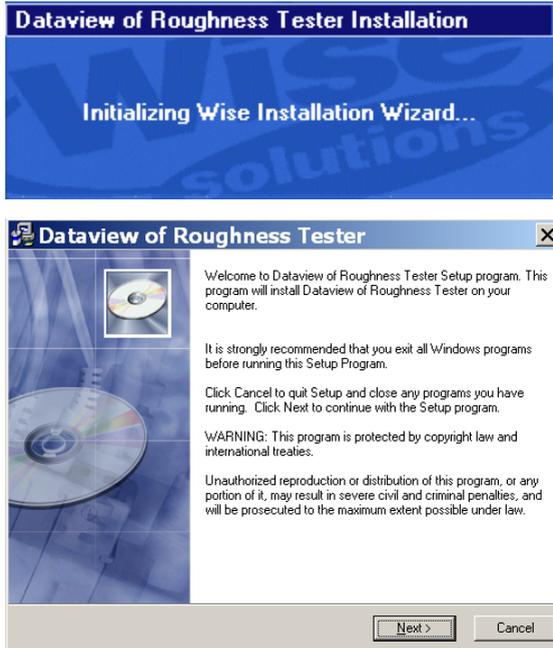
2.　　Choose location of installing
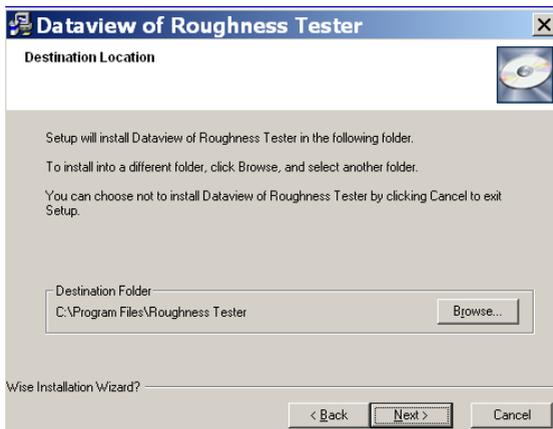
3.   Installing document
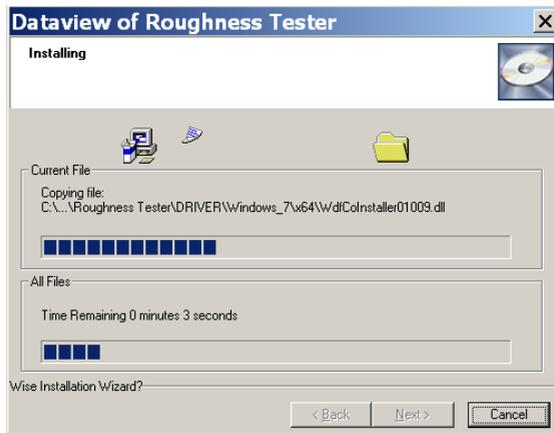
4.   Finish in installing document
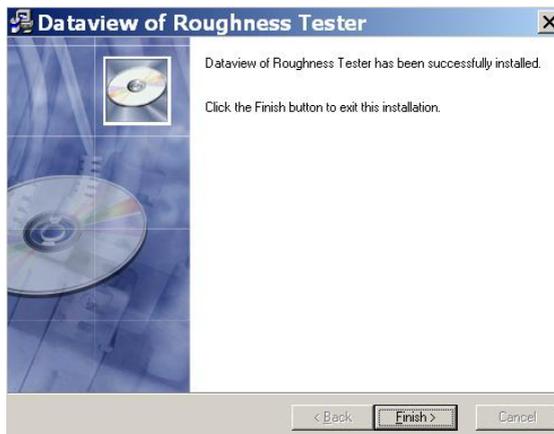
5.   After successful installation, please find it in procedure list like below:
Under Windows 7 System

6.   Driver procedure should be installed after installation of software,

then connect to the main unit of roughness tester.

2.13.2 Installation of Driver procedure

Notice:

Please disconnect between Main unit and PC before installation of
Driver procedure.

Under Windows 7 System

Run Setup_Driver_w7

Show like this:
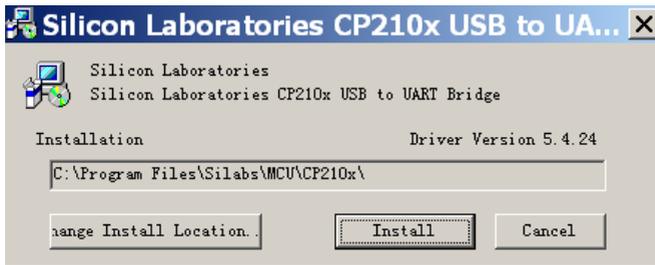
Click button of Install, then auto installation is carried out.

Please connect Main unit with PC with USB cable. The Driver accordingly will
be installed automatically.

2.13.3 Operation of software

1. Connect

①Connect DR230 and PC with communication cable

②Power on DR230 and enter main interface

③Run software DATAVIEW_ROUGHNESS_TESTER   installed.

④Enter into main interface
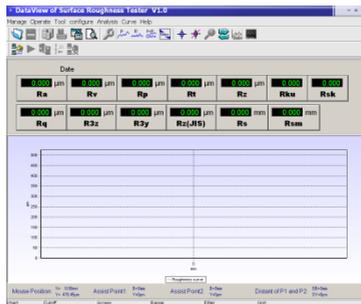
⑤ Click the buttonCONNECT. The screen prompts for a successful

   connection
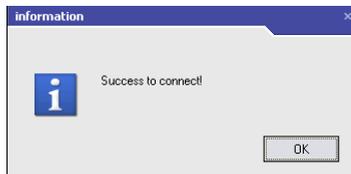
2. Disconnect

If you want to disconnect the communication between main unit and PC,
please click the button DISCONNECT as showing below.
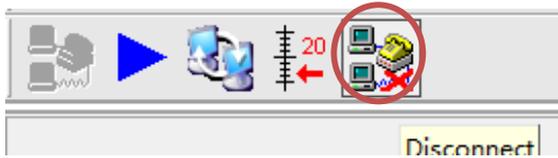
3. Measuring

When connection between main unit and PC is successful, please press the button below to start measuring.

Measuring

It is under measuring right now like below.

Ptompt

Measuring, please wait...
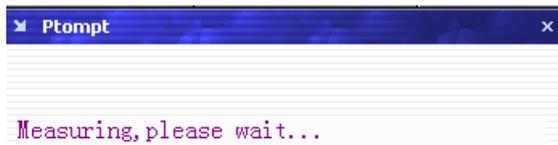
If measuring is completed, it shows like this:
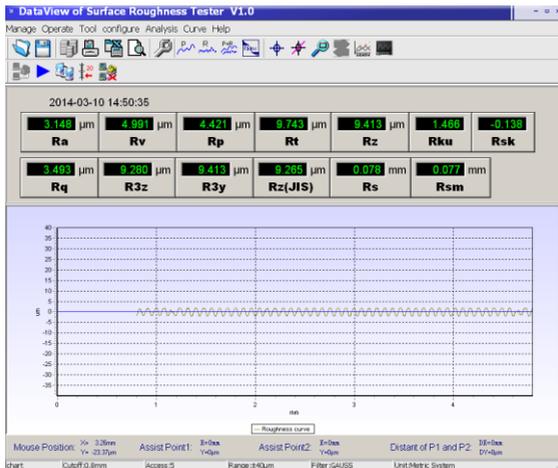
4. Load data

Click the button below, the
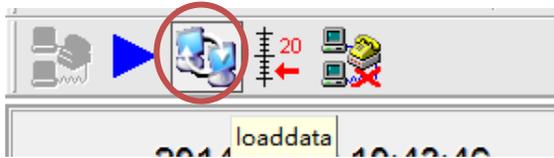
5. Stylus position collection

Click "stylus position collection"

It shows like this:
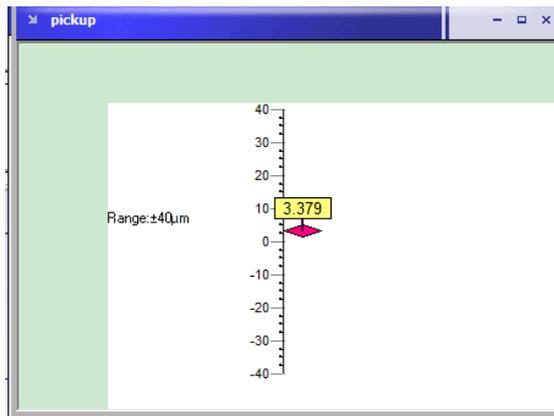
Stylus position collection appears as well as DR230 enter into the mode of stylus position selection. The image above will be displayed, and different measuring range is shown according to different measuring range setting.

6. Preview before printing

Click the button below and check the data before printer.
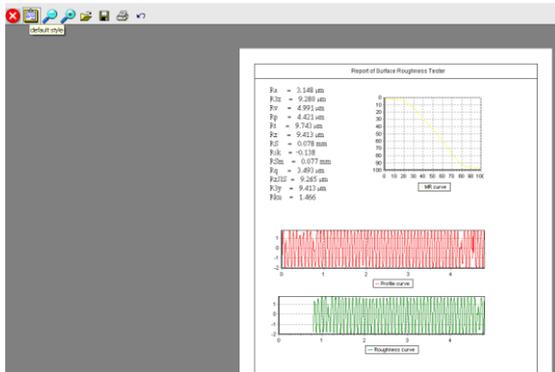
7. Configure setting

Click the button below to enter into configure setting
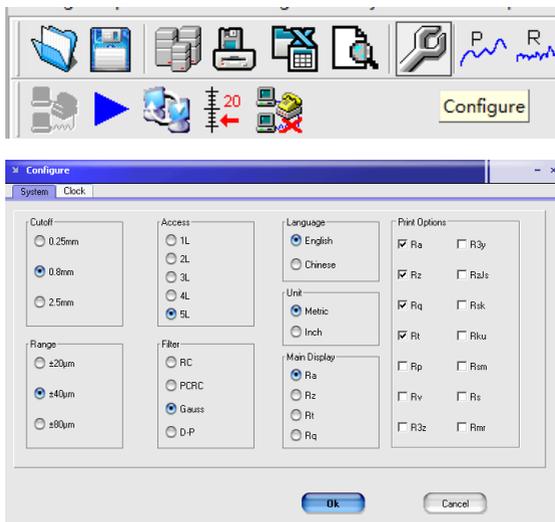
Here users are allowed to do the configuration as one's individual needs. The configuration information will be loaded to DR230 main unit automatically when click "OK", in "parameter selection", if Rk parameter is not necessary, please don't select it, thus the sampling will be much faster.

Note：

1. If the loaded data was not saved, the information will show.

2. Under condition of disconnect, "configuration" doesn't work.

8. Data management

Open file   **save file**   **open database**   **save data**   **output to excel**
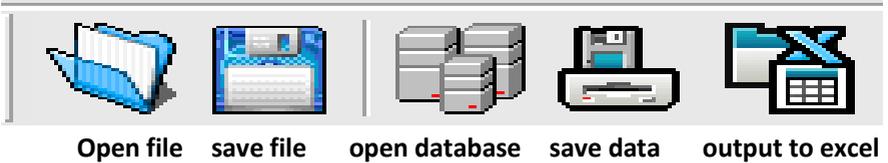
8.1 Open file

Click "Open file", following column appears. The stored data can be checked.
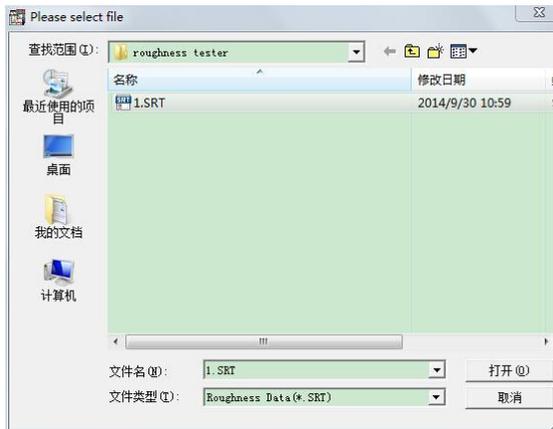
8.2 Save file

Click "Save file", the current data will be saved in format of SRT with memory location.

8.3 Open database

Open and check the data stored before.
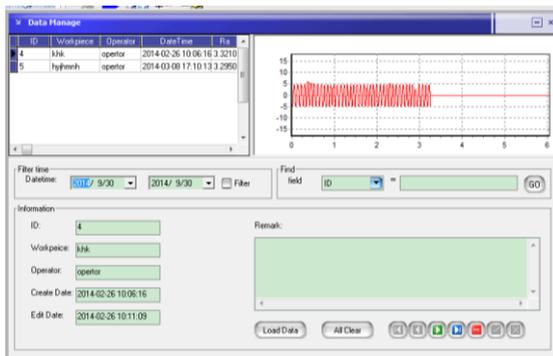
8.4 Save data

Click "save data"，the following graph will appear, users are required to input the essential information for saving data.
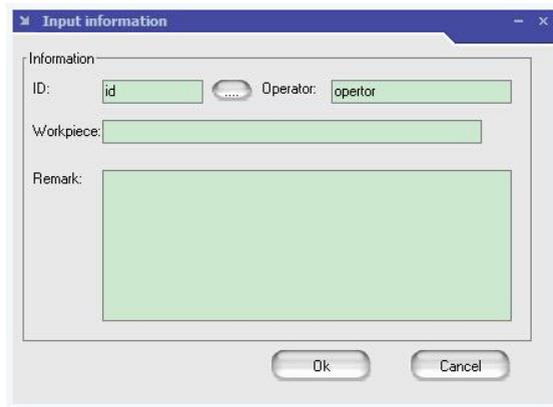
8.5 Output to excel

Enter the first ID and the end ID, and then click Output to excel form.
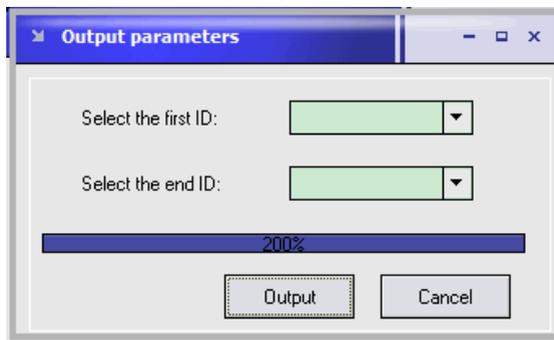
9. Curve analysis

Profile curve   Roughness curve   Profile and roughness   cruve Rk curve

9.1 Profile curve

Click "profile curve", following graph will be shown.
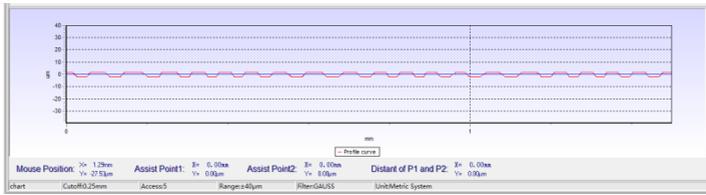
9.2 Roughness curve

Click "Roughness curve", following graph will be shown.
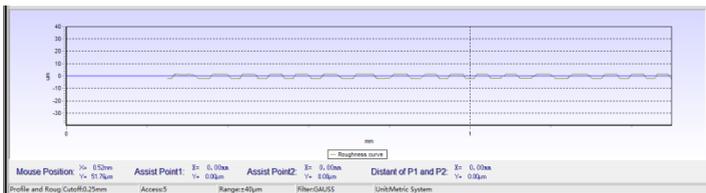
9.3 Profile & Roughness curve

Click "Profile & Roughness curve", following curve will be shown.

9.4 Rk curve

Click "Rk curve", following graph will be shown.

10. Assistant service

Show assist | Hide assist | Zoom | Cancel zoom | default view| Screen

10.1 Show assistant line

Click "Show assist line", following graph (red and green line) will be shown.
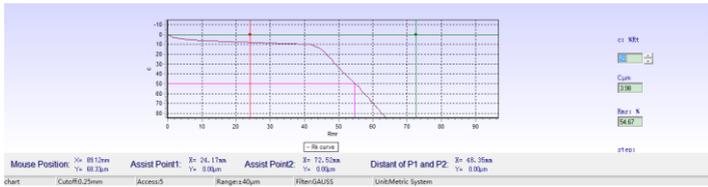
10.2 Hide assistant line

Click "Hide assist line", following graph (without red and green line) will be shown.

11. Zoom

Click "Zoom" button, user could zoom in select part.

12. Cancel zoom

Click "Cancel zoom" button, user could cancel this function.

13. Default view

Click "Default view", the curves will be back to the primary status.

14. Screen

Click "Screen", the curves will fill the whole image zone.

15. Help

Click "Help" button, users could get brief description of any item of the interface.

2.14 Rpc setting

According to user's requirement, Rpc-parameter's calculation can be selected from "μm" and "%". Under main menu "Parameter Set", select item in "Rpc BW set" and input relevant value in "Rpc BW Set".

3. Options and usage

3.1 Adjustable support

When measured surface is smaller than the bottom surface of the instrument, sheath of pickup and adjustable support could be used to complete this measurement.
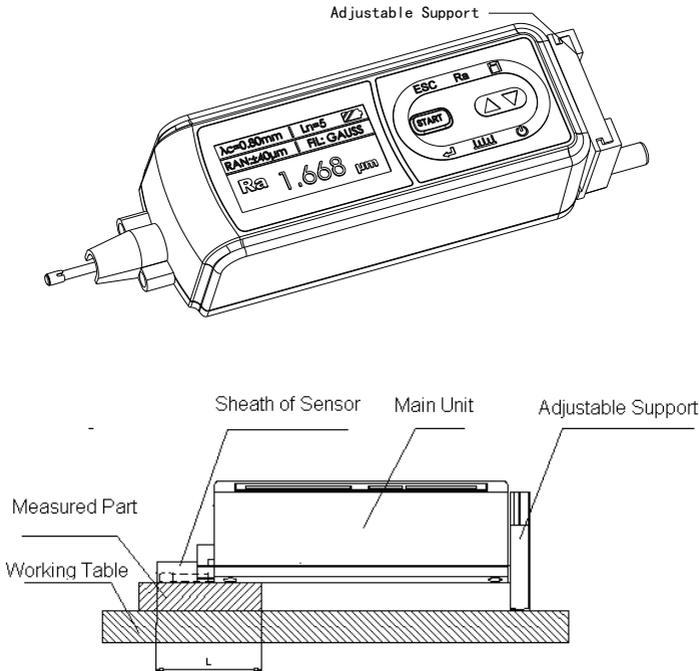
Notice:

1. The value L above should be larger than total length to prevent pickup from dropping out of part during measurement.

2. Locking of adjustable supporter shall be reliable.

3.2 Measurement stand

Measurement Stand could adjust positions between instrument and workpiece with flexible, stable support and wide application. Roughness of

complex shapes can also be measured. Measurement stand enables adjustment of stylus position more precise and measurement more stable. If Ra value of measured surface is relatively low, measurement stand is recommended.

Measurement Stand   Main Unit
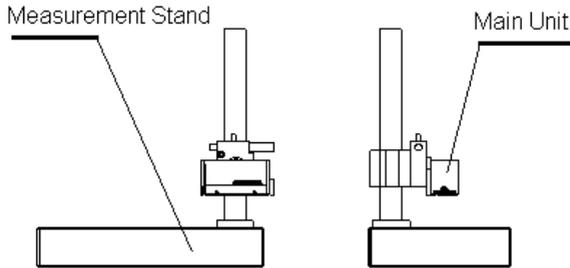
3.3 Extending rod

Extending rod increases the depth of pickup to enter into pipe or tube. Length of extending rod is 50mm.

Pickup   Extending rod
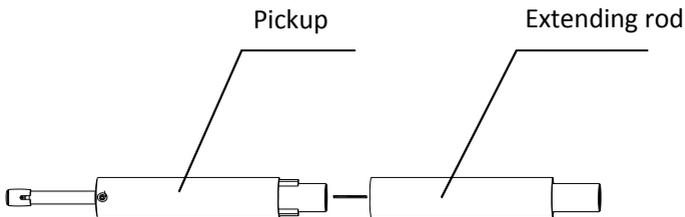
3.4 Standard pickup

Standard pickup could be used in most conditions. In addition to the standard pickup, other special ones are needed to measure cone surface, inner hole, groove and other surface roughness.

Socket Main Body Protective Tube Stylus Skid

45,50   23   4,20

10,00
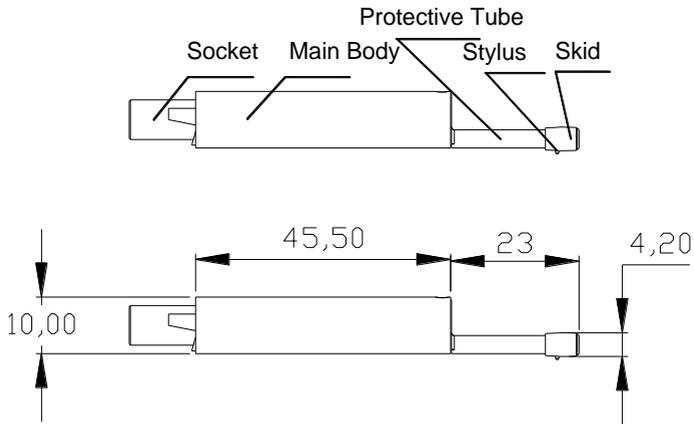
3.5 Curved Surface Pickup

Curved surface pickup is mainly used for measuring radius is larger than 3mm.
It is also used for larger radius smooth spherical surface with good effect. The
smoother of surface; the better effect in measurement.

Curved Surface Pickup

Skid   Stylus

Measured Part
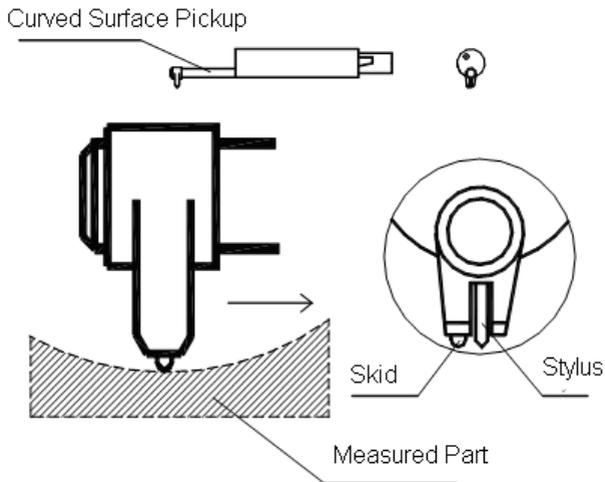
3.6 Pin hole pickup

Pin hole pickup is used in inner surface of holes with radius more than 2mm.
Please check below for detail dimension.
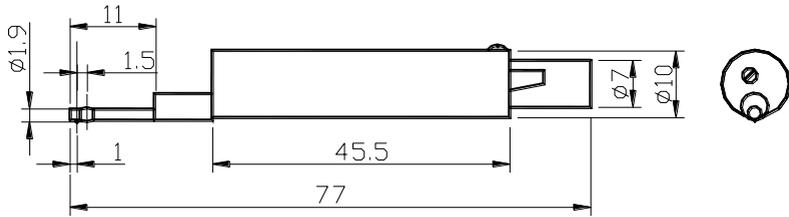
3.7 Deep groove pickup

Deep groove pickup is used in measuring groove with width more than 3mm and depth more than 10mm, or the surface roughness of step with height less than 10mm; also can used to measure the planar, cylindrical used with platform. Please check below for detail dimension.
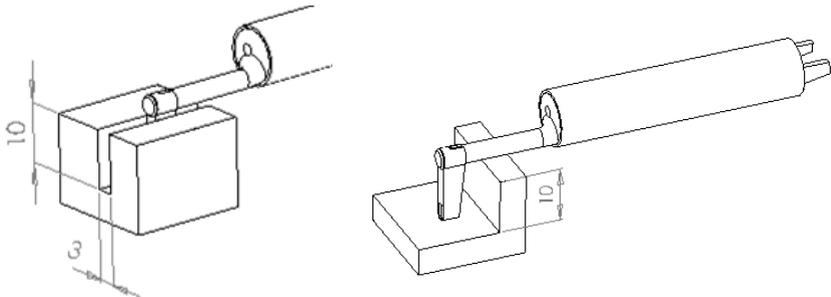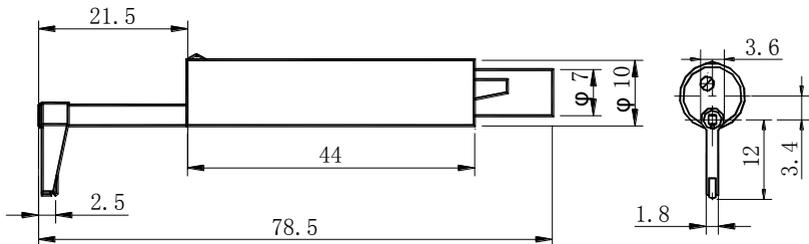
4. Maintenance

4.1 Pickup

1. Any time pickups are especially taken care. Owing to fragile of guide head and stylus, please locate in the package if it is not used.

2. Pickup is precision components, any knock, touch, fall off may cause

damage. Such condition should be avoided.

4.2 Main unit

1. Please locate Main Unit in clean and dry place.

2. The instrument is a precision measuring instrument. Users should always be handled with care and avoid shock.

4.3 Battery

1. Please charge when it is in low battery.

2. The charging time is about 2.5 hours.

4.4 Standard sample plate

1. Surface of standard sample plate must be kept clean.

2. Avoid scratches on surface of sample area.

4.5 Trouble shooting

When tester breaks down, please solve problems according to following Information. If problems still exist, please send the instrument to factory for repair. Users should not dismantle and repair the device by themselves.

Error	Cause	Solutions method
Motor error	Motor stuck	Reboot
Out of Range	1. The measured surface signal exceeding the measurement range 2. Placed away from the center of the stylus position	Increase Measuring range Adjust the Stylus position
No test data	After the boot does not measure.	The actual measurement: one time
Measurement Accuracy Out of Range	Set the parameter error Calibration data error	Set the parameter measurement Calibrate the tester

5. Reference

5.1 Definitions

The instrument calculate parameters through filter profile and direct profile, all calculated in line with "Geometrical Product Specification (GPS) —— Surface texture: Profile method——Term, definitions and surface texture parameters."

5.1.1 Terms

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

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

RC filter: analogue 2RC filter with phase difference.

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

Gauss filter: ISO11562.

5.1.2 Traversing Length

● RC Filter

● **GAUSS Filter**

Principle
Travel   Pre-travel   Evaluation length   Post-travel
0.5mm   Ir/2   Ir ×n   Ir/2

Traversing length

Origin   End

● **PC-RC Filter**

Principle
Travel   Pre-travel   Evaluation length   Post-travel
0.5mm   Ir   Ir ×n   Ir

Traversing length

Origin   End
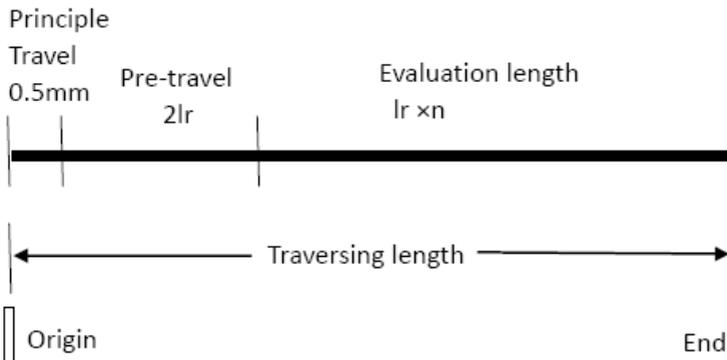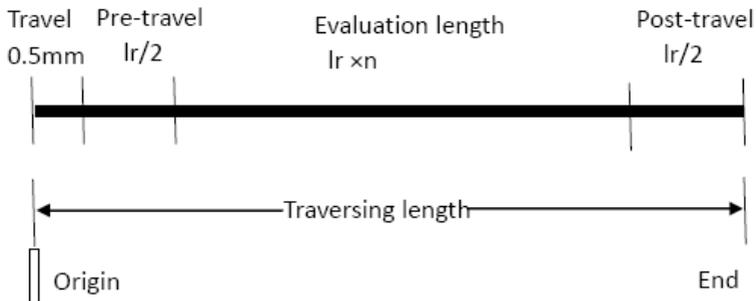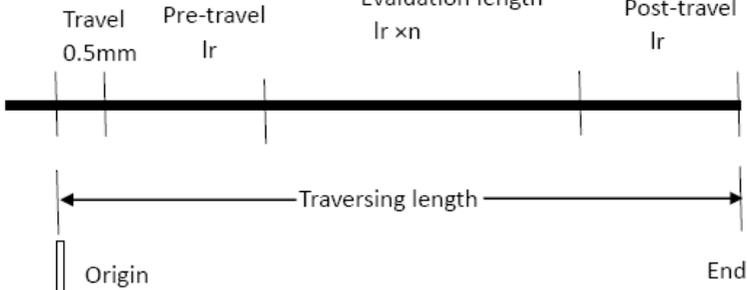
●**D-P direct profile**

Principle   Evaluation length
Distance   I ×n
0.5mm

Tracing Distance

Origin   End
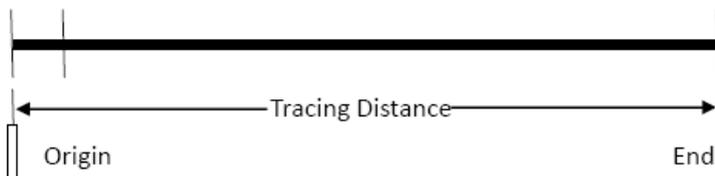
5.2 Parameters Definitions

5.2.1 Arithmetical Mean Deviation of Profile Ra

Ra is arithmetic mean of the absolute values of profile deviation $Z(x)$ from mean within sample length.

$$Ra = \frac{1}{l}\int_{0}^{l}|Z(x)|dx$$
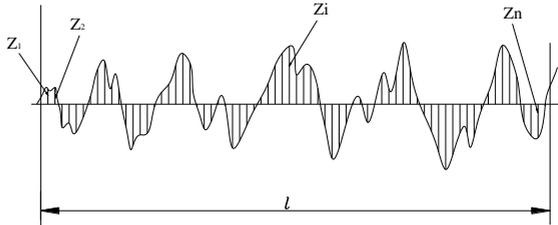
5.2.2 Root-mean-square Deviation of Profile Rq

Rq is the square root of the arithmetic mean of the squares of profile deviation Z(x) from mean within sample length.

$$Rq = \sqrt{\frac{1}{l}\int_{0}^{l}Z^{2}(x)dx}$$

5.2.3 Maximum Height of Profile Rz

Rz is The sum of height Zp of the highest profile peak from the mean line and depth Zv of the deepest profile valley from the mean line within sampling length。
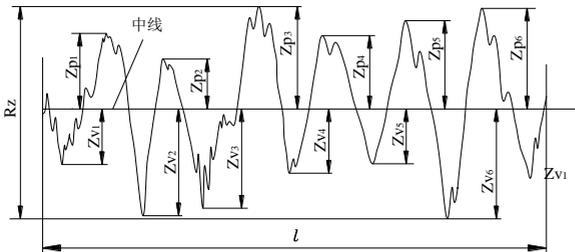
5.2.4 Total Peak-to-valley Height Rt

Rt is the sum of the height of the highest peak Zp and the depth of the deepest valley Zv over the evaluation length.

5.3 Recommended table of sample length

Ra (μm)	Rz (μm)	Sample length
＞5～10	＞20～40	2.5
＞2.5～5	＞10～20	
＞1.25～2.5	＞6.3～10	0.8
＞0.63～1.25	＞3.2～6.3	
＞0.32～0.63	＞1.6～3.2	
＞0.25～0.32	＞1.25～1.6	0.25
＞0.20～0.25	＞1.0～1.25	
＞0.16～0.20	＞0.8～1.0	
＞0.125～0.16	＞0.63～0.8	
＞0.1～0.125	＞0.5～0.63	
＞0.08～0.1	＞0.4～0.5	
＞0.063～0.08	＞0.32～0.4	
＞0.05～0.063	＞0.25～0.32	
＞0.04～0.05	＞0.2～0.25	
＞0.032～0.04	＞0.16～0.2	
＞0.025～0.032	＞0.125～0.16	
＞0.02～0.025	＞0.1～0.125	

Packing list

Number	Name	Quantity	Remarks
1	Main Unit	1	
2	Pickup	1	Precision parts
3	Calibration block	1	
4	Charger	1	
5	USB charging cable	1	
6	Software	1	
7	Adjustable Support	1	
8	Manual	1	
9	Certificate	1	

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