SURFACE ROUGHNESS TESTER

DR230

Instruction Manual

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1. Summary

Surfaces roughness tester is suitable for fixed and mobile measurement with small handheld instrument. It's simple operation, overall function, fast measurement, high accuracy and stability, which 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

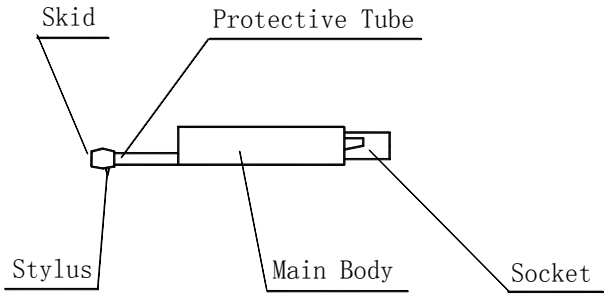
- Electro-mechanical integration design, small size, light weight, easy to operation;
- DSP chip control and data processing, high speed, low power consumption;
- 160μm Large measurement range;
- 20parameters:Ra,Rz,Rq,Rt,Rp,Rv,R3z,R3y,Rz(JIS),Rs,Rsk,Rsm,Rku,Rmr; Ry(JIS)=Rz; Rmax=Rt, RPc, Rk, Rpk, Rvk, Mr1, Mr2.
- 128 × 64 OLED dot matrix display, digital or graphic highlight display; no viewing angle;
- Display full information, intuitive and graphical displays all parameters;
- Compatible with ISO1997, DIN, ANSI, JIS2001 multiple national standards;
- 4 Profile Filter: Gauss, RC, PC-RC, DP
- Built-in lithium-ion rechargeable battery and control circuit, high capacity, no memory effect;
- There are remaining charge indicator, charging hint;
- Tester has charging instructions, the operator can readily understand the level of charge
- Can work more than 20 hours while the power is enough;
- Large capacity data storage, can store 100 item of raw data and waveforms;
- Real-time clock setting and display for easy data recording and storage;
- With automatic sleep, automatic shutdown power-saving features;

- Reliable circuit and software design of prevent the motor stuck;
- Instrument can display a variety of information tips and instructions. For example Measurement result display, the menu prompts and error messages;
- Metal case design, rugged, compact, portable, high reliability；
- Can connected to the computer and printer;
- All parameters can be printed or print any of the parameters which set by the user;
- Optional curved surface pickup sensor, holes sensors, measurement stand, Sheath of sensor, extension rod, printer and analysis software.

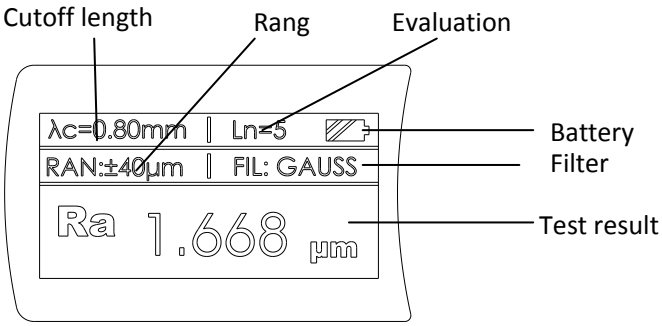
1.2 Principle

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.

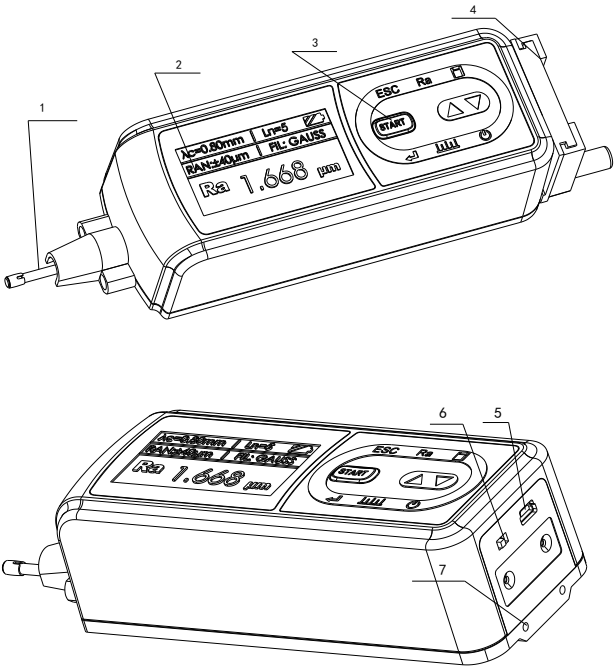
1.3 Name of each part



Pickup



Display Interface



1.Pickup 2. Display 3. Key area 4. Adjustable support
5. USB charge 6. Power switch 7. Fixing hole

1.4 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



Parameter selection Key: Used to view various parameters


Record storage key/ print key: For storing and print the record results


Up Arrow key: To select items for the switch


Down arrow keys: Select the item for switching


Menu / Enter key: To enter the menu settings



Cancel / Exit key: Used to exit the menu and unset

1.5 Battery Charge

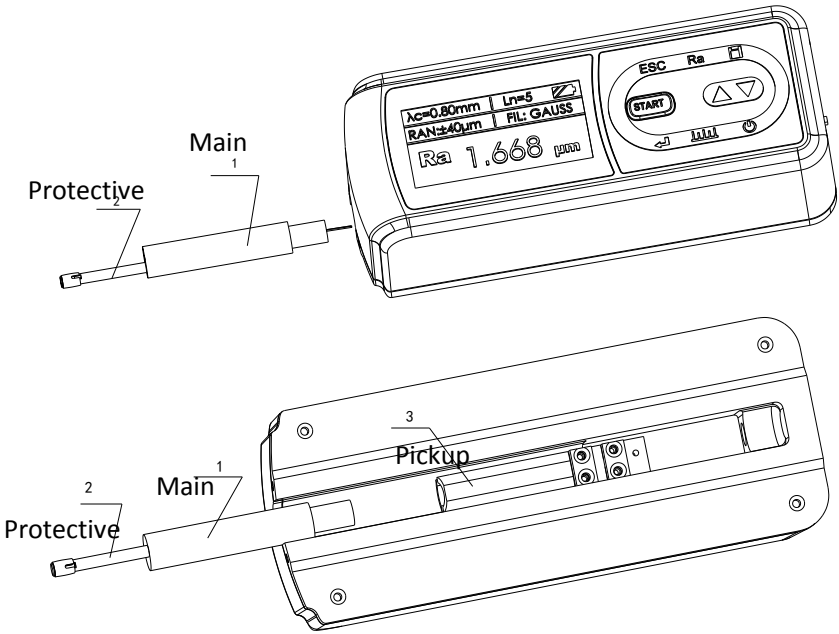
When battery voltage is too low (that is, battery voltage symbol display on screen to remind low voltage), the instrument should be charged as soon as possible. USB port of the instrument is used for charge. Users could charge the instrument with built-in power adapter or use computer's USB port for charge. Instrument displays charging animation when charging after full animation ends, the display is full of symbols. Charging time is about 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.

Notice:

When charging, ensure that the instrument power control is in the ON position

1.6 Connection 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 pushed 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.

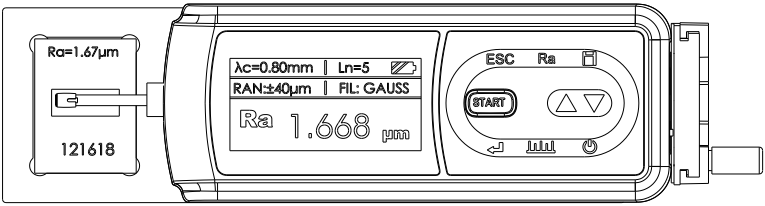
Notice:

1. Stylus of pickup is key part of this tester and great attention should be paid to it.
2. During installation and removal, 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 normal;
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 process line of the measured surface.

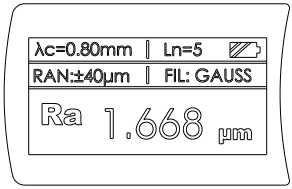


Notice:

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

2.2 Power On/Off

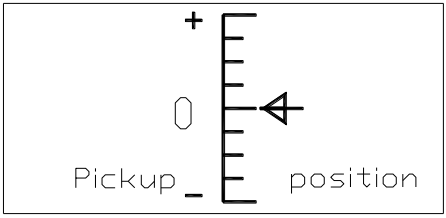
Press the key  to turn on the instrument and main interface is shown as below:



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

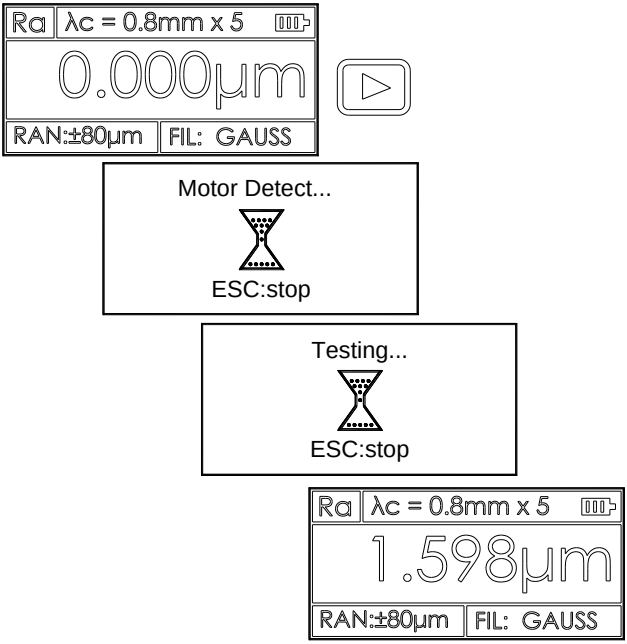


Users should determine the location of the sensor with reference of stylus position. The best measurement condition is in the middle.

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

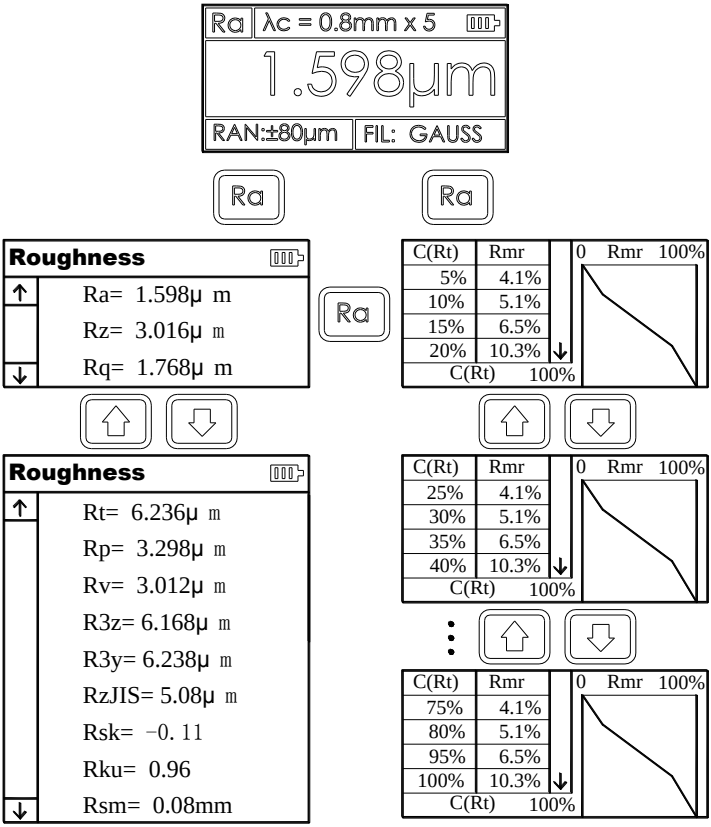
2.4 Measurement

Under main interface, press Start button to start measurement.



2.5 Test Result Display

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



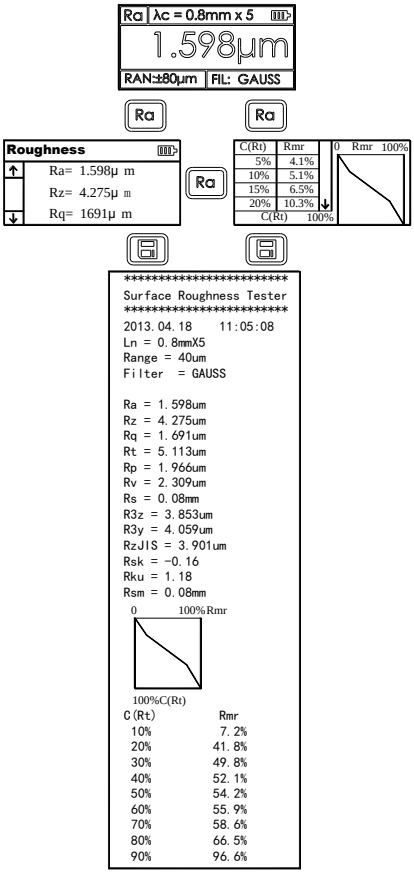
2.6 Print Test Results

Test results will be printed with optional printer.

After measurement, Press Ra key to display the results.

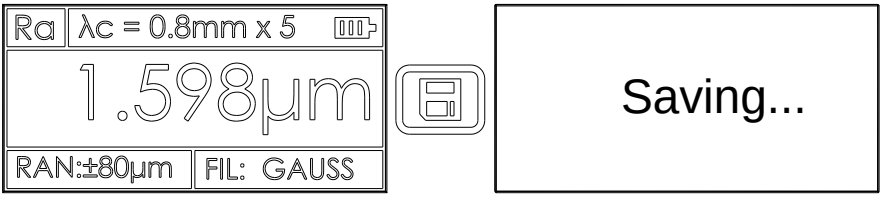
Press key to print the measured data to a serial printer. At this point, key is a print key to use.

The instrument can be tested according to the actual requirements of arbitrary parameters choose to print or print all the parameters. How to set parameters, please refer to "Print Settings."



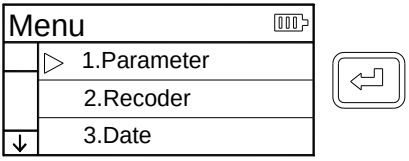
2.7 Store Test Results

Under main interface, press the 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.



2.8 Parameters Setting

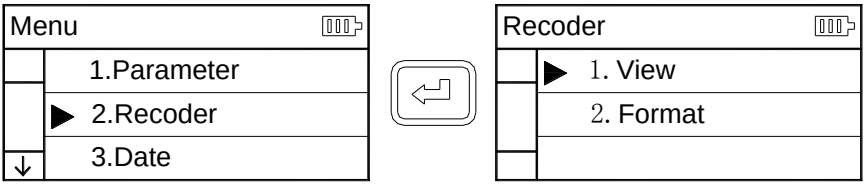
Under main interface, press key to enter main menu, press the keys to select "Preferences" function, and then press the key to enter the parameter setting mode. Under parameter setting, users could modify all measurement conditions.



Parameter		Content
▷	λ c 0.8mm	0.25mm; 0.8mm; 2.5mm
	Nxλ c 5	1-5
	RANGE ±40μ m	±20; ±40; ±80μ m
	FILTER GAUSS	RC; PC-RC; GAUSS; D-P
	DISPLAY Ra	Ra Rz Rt Rq
	UNIT μ m	μ m μ in
	LANGUAGE ENG	ENG CHS

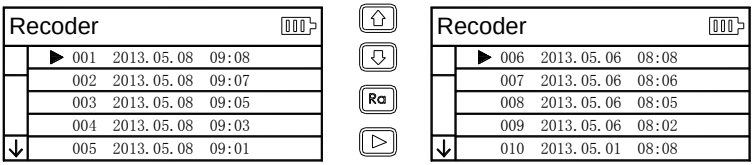
2.9 Storage Management

Under main interface, press the key to enter main menu. Press the keys to select "Recorder" function, Press the key to enter management projects.



There are 2 sub-menus: 1 view and 2 format.
Selected item and press the Enter key to enter.

2.9.1 Check Record

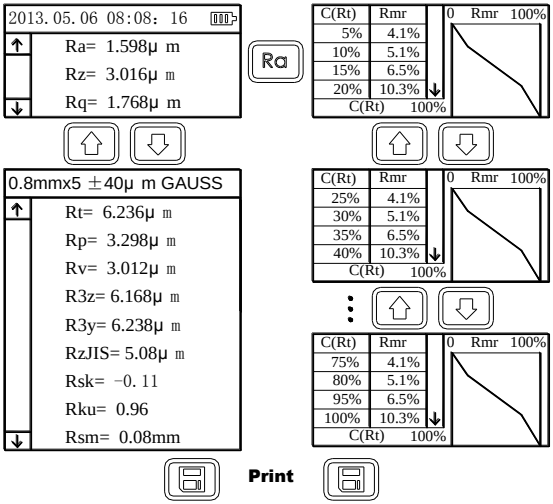


Item Up Page Up

Item Down Page Down

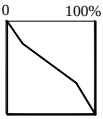
Choose specific records and press View content.

In checking data storage, press the key and data can be printed according to specified printer. Please check below.




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

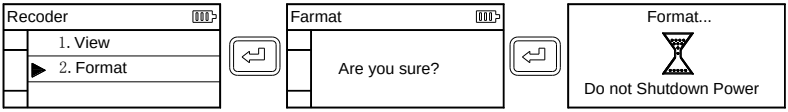
Ra = 1.598um
Rz = 4.275um
Rq = 1.691um
Rt = 5.113um
Rp = 1.966um
Rv = 2.309um
Rs = 0.08mm
R3z = 3.853um
R3y = 4.059um
RzJIS = 3.901um
Rsk = -0.16
Rku = 1.18
Rsm = 0.08mm
```



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%

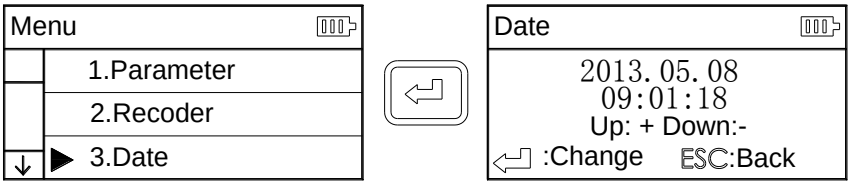
2.9.2 Format

Data format is the deletion of data records, once users confirm deletion, all data clears and could not be back.



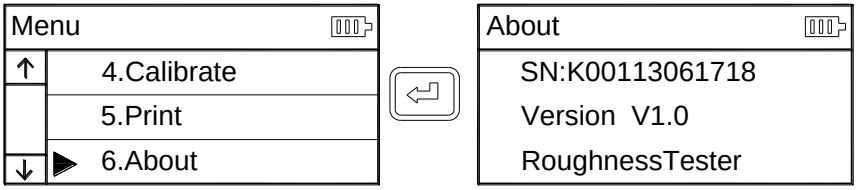
2.10 Date Setting

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



2.11 Information

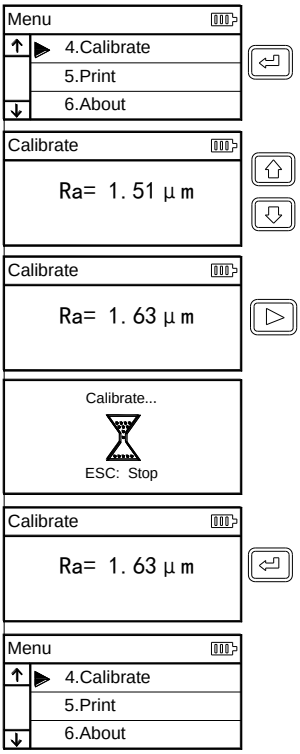
All instrument information could be found here including serial number, version and so on.



2.12 Calibration

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 correct the indication calibration function and improve measurement accuracy. Calibration procedure is as shown below.

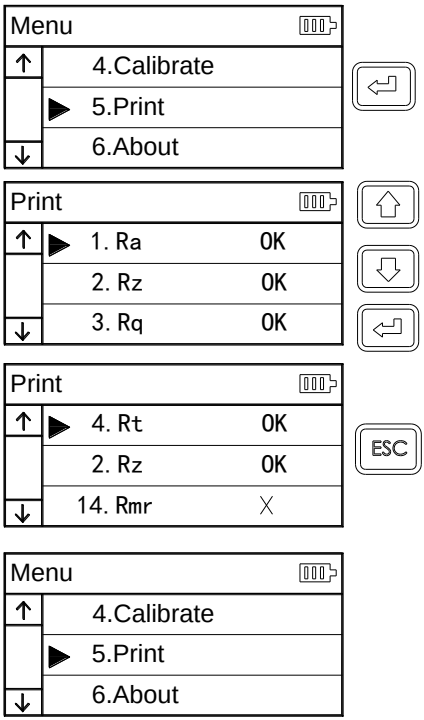


Notice:

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 the key for a measurement, calibration process is complete.
3. New parameters after calibration must be set again once a complete measurement and press the key is to confirm.
4. Press "ESC" key to return to main menu without saving calibration results.

2.13 Print

The instrument can be tested according to the actual requirements and print any parameter selection or Print all. Steps are shown below.



2.14 Software

Waveform or data could be recorded by instruments and transfer to PC for further analysis and print through printer.

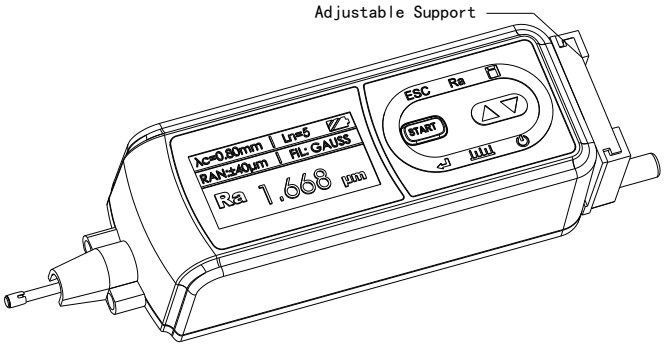
2.15 Rpc Setting

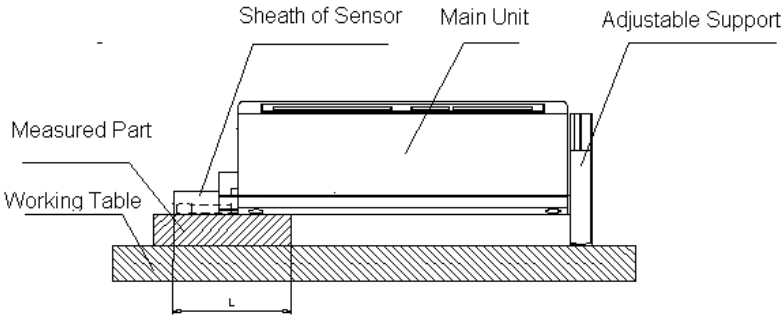
According to user's requirement, Rpc-parameter's calculation can be selected from "μm" and "%". Under main menu "Parameter Set", select item in "Rpc BW set" and input relevant value in "Rpc BW Set".

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.



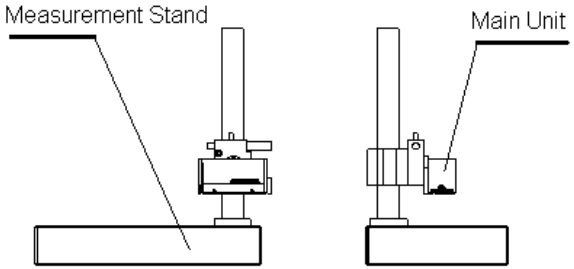


Notice:

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.

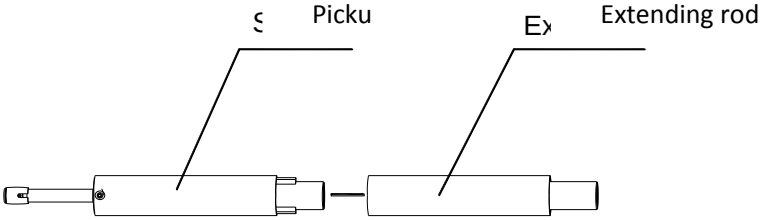
3.2 Measurement Stand

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.



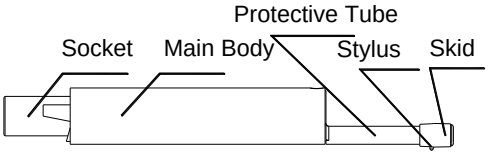
3.3 Extending Rod

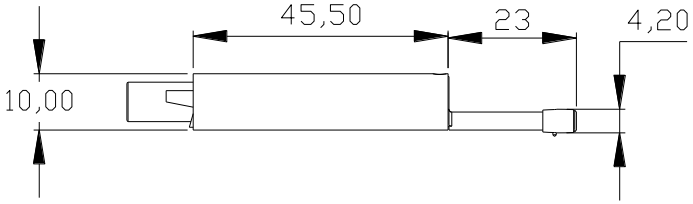
Extending rod increases the depth of pickup to enter into pipe or tube. Length of extending rod is 50mm.



3.4 Standard Pickup

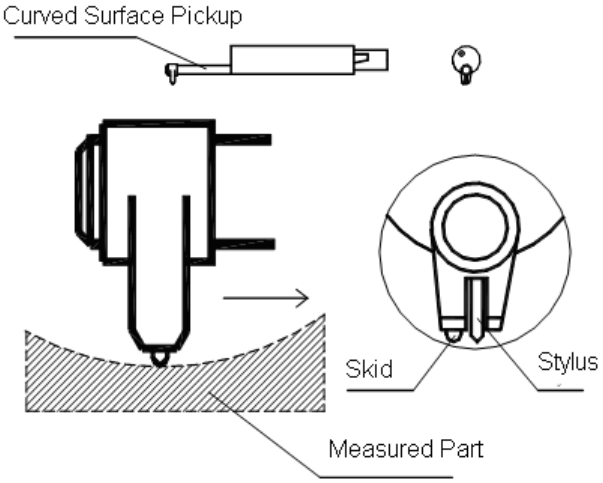
Standard pickup could be used in most conditions. In addition to the standard pickup, other special ones are needed to measure cone surface, inner hole, groove and other surface roughness.





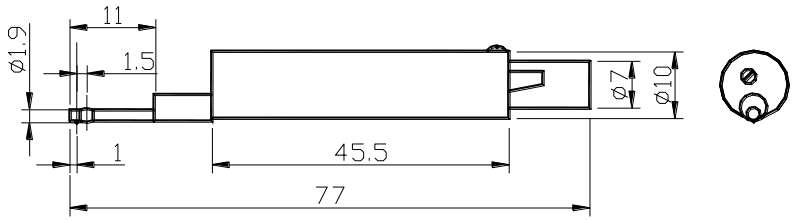
3.5 Curved Surface Pickup

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.



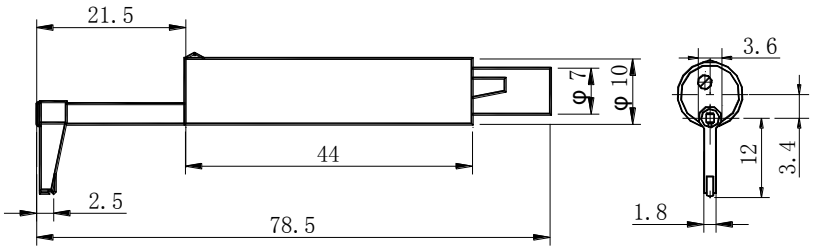
3.6 Pin Hole Pickup

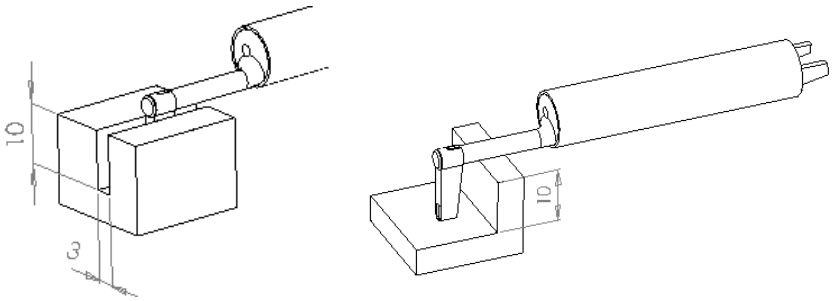
Pin hole pickup is used in inner surface of holes with radius more than 2mm. Please check below for detail dimension.



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. Technical Parameter and Features

4.1 Technical Parameter

Name		Content
Measurement	The Z axis (vertical)	160μm
Range	TheX axis(horizontal)	17.5mm
Resolution ratio	The Z axis (vertical)	0.01μm/±20μm
		0.02μm/±40μm
		0.04μm/±80μm
Measurement item	Parameter	Ra, Rz==Ry(JIS), Rq ,Rt==Rmax, Rp, Rv, R3z
	Standard	ISO,ANSI,DIN,JIS
	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）		*L*n= *l*r×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，Charger:
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℃

4.2 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%

5. Maintenance

5.1 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.

5.2 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.

5.3 Battery

1. Please charge when it is in low battery.
2. The charging time is about 2.5 hours.

5.4 Standard Sample Plate

1. Surface of standard sample plate must be kept clean.
2. Avoid scratches on surface of sample area.

5.5 Trouble shooting

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

Error message	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

6. Reference

6.1 Definitions

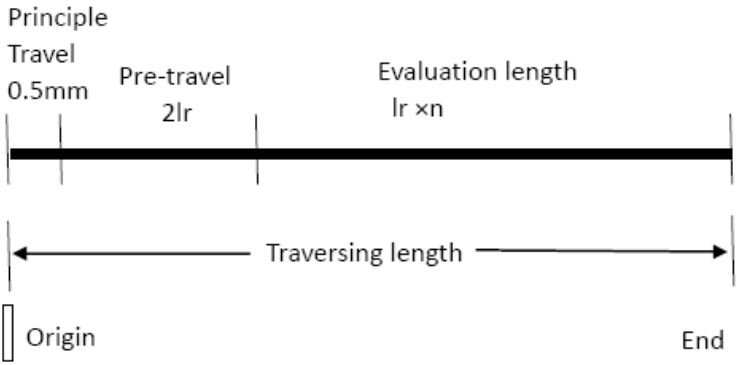
The instrument calculate parameters through filter profile and direct profile, all calculated in line with "Geometrical Product Specification (GPS) —— Surface texture: Profile method——Term, definitions and surface texture parameters."

6.1.1 Terms

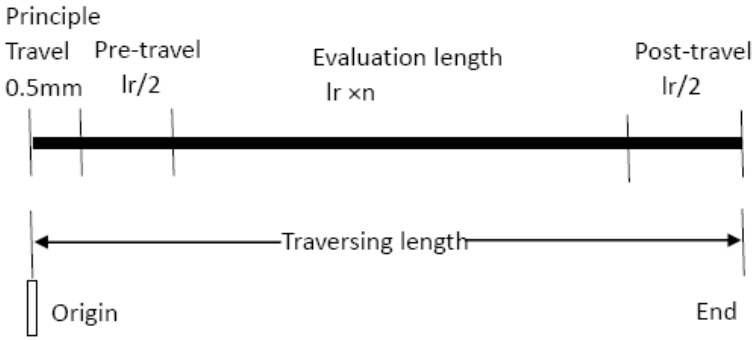
Filtered profile: profile signal after primary profile is filtered to remove waviness.
D-P (direct-profile): adopt central line of Least Square Algorithm.
RC filter: analogue 2RC filter with phase difference.
PC-RC filter: RC filter with phase-correction.
Gauss filter: ISO11562.

6.1.2 Traversing Length

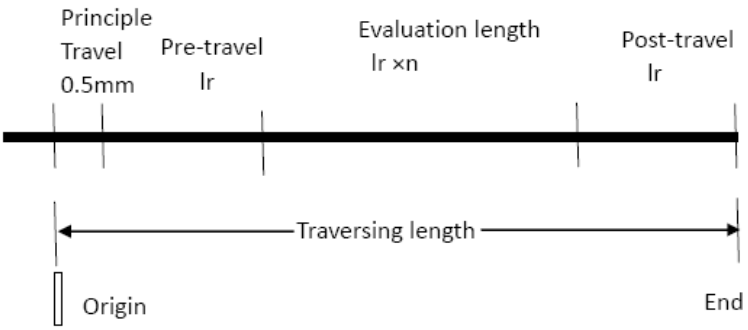
- **RC Filter**



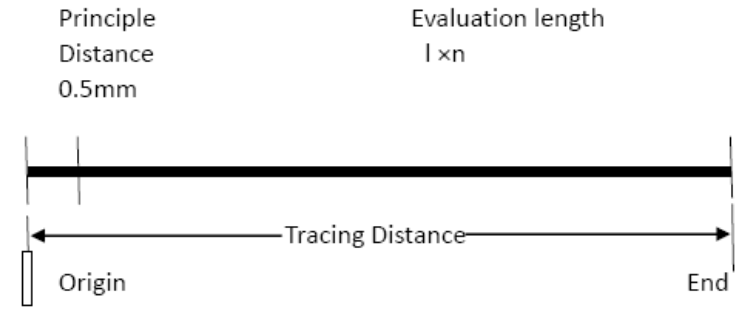
- **GAUSS Filter**



- **PCRC Filter**



●D-P direct profile

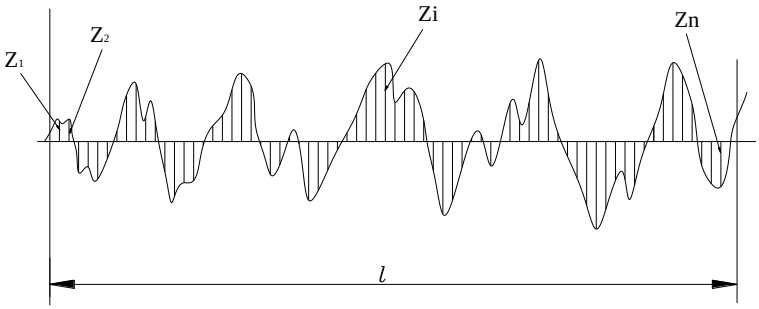


6.2 Parameters Definitions

6.2.1 Arithmetical Mean Deviation of Profile Ra

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

$$Ra = \frac{1}{l}\int_0^l |Z(x)|dx$$



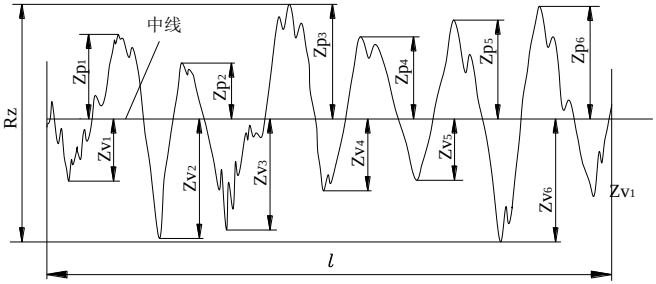
6.2.2 Root-mean-square Deviation of Profile Rq

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

$$Rq = \sqrt{\frac{1}{l}\int_0^l Z^2(x)dx}$$

6.2.3 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。



6.2.4 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.

6.3 Recommended table of the 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
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	