

Surface Roughness Tester TR110

Instruction Manual



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1. General Introduction

TIME Pocket-Sized Surface Roughness Tester TR110 is a new generation of Surface Roughness Tester Series, introduced to market by TIME Group Inc. in 2003. It features high accuracy, wide application, simple operation, portability and stable performance. The tester is widely used in measuring the surface roughness of various metals and non-metals. Its integrated structure of sensor and main body and hand-held design make it suitable to be used in production sites.

Updated functions of TR110:

TR110's appearance, which tallies with current new design trend, makes it more amiable than previous product generation. More logical operation offers a comfortable use procedure to users.

With a long-life Li-ion rechargeable battery, the tester can be worked for a long time with a short rechargeable time, and is workable during battery recharge.

Circuit function is improved. Working voltage is debased. Accordingly, its work wastage and circuit noise are debased.

Its pickup's driver setup, material and processing technics have been ameliorated. With a more precise assembly, the tester has gotten a more stable performance.

Some necessary instruction information such as testing indication, low battery indication etc has been added to the new designed LCD interface.

A protective sheath for the sensor stylus offers an effective protect for the sensor stylus, so as to guarantee its precision.

Backlight is adopted to assure the tester to be used in dark place.

Smaller size and lighter weight.

2. Work Principle

When the pickup was driven by a driver is making a linear uniform motion along the testing surface, the stylus which touches with the work surface moves up and down along the work surface perpendicularly. Its motion is converted into electric signals, which are amplified, filtered and transformed into digital signals through A/D. The signals are then processed by CPU into Ra and Rz values before being displayed on the screen.

3. Standard Delivery



Standard sample plate 1



Main unit 1



Li-ion rechargeable Battery 1

4. Name of each part



- | | |
|--|---------------------|
| 1. Stylus mark | 7 . LCD |
| 2. Switch of sensor stylus protective sheath | 8 . Start Key |
| 3. Main body crust | 9 . Charging socket |
| 4. Left Key | 10 . Reset Key |
| 5. Middle Key | 11 . Hole lid |
| 6. Right Key | 12. Label |

5. Operation

5.1 Preparation before operation

The pickup stylus protective sheath should be closed, when the gauge is taken out of casing for the first time.

(Refer to Picture 1)



Picture1 Closed pickup stylus protective sheath

Pull the switch of pickup stylus protective sheath to the right , and open the pickup stylus protective sheath.

The pickup stylus will show for measuring (Refer to Picture 2) 。



Picture2 Open pickup stylus protective sheath



Show the location of stylus protective sheath (on or off) and the stylus status of being used or being protected. The key on the left means the pickup stylus protective sheath is closed and the stylus is protected. On the contrary the key on the right means the pickup stylus protective sheath is opened and the stylus can be used.

5.2 Switch on, Switch off and Backlight

Press the discretionary Key to switch on. The screen will display as picture 3.

After a “d...” sound, the tester enters the measuring status and is ready to work with the display of measuring parameters and sampling length, which set at previous time.(Refer to Picture 3)

When the tester has been switched on, keep pressing the Right Key for 1.5 seconds, the Backlight will be turned on; if keep pressing the Right Key for 3.5 seconds, the tester will be turned off, and enter the status of low work wastage.



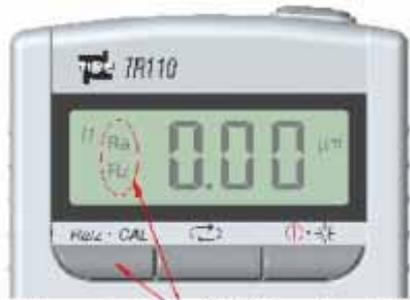
Picture 3

5.3 Set up parameters

Before measuring the user should set up these parameters such as Ra, Rz and suitable sampling length (2.5mm, 0.8mm or 0.25mm) (refer to chapter 9).

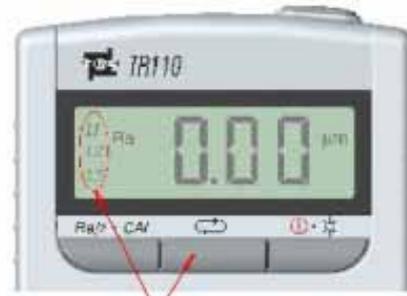
After switch on, press the Left Key gently and quickly to select the parameter Ra or Rz by turns. (Refer to Picture 4)

Press the Middle Key gently and quickly to select the sampling length (0.25mm、 0.8mm、 2.5mm) by turns.(Refer to Picture 5)



Ra/Rz conversion by press the Left Key gently and quickly

Picture 4

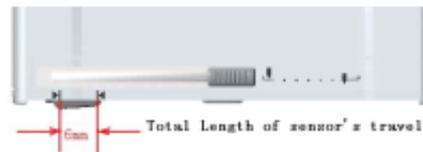


Select the cut-off sample length by pressing the Middle Key

Picture 5



Picture 6



Picture 7

5.4 Measuring

When the parameters are set up and the cut-off samples length is decided, it will come to measurement.

Point the Stylus mark  to the measured area stably and then press the Start Key on the top to start measurement.

The stylus will move along the measured surface, and the screen will display as Picture 6.

 shows the stylus' travel dynamically. The traverse length is 6mm. Pickup Stylus travels as Picture 7.

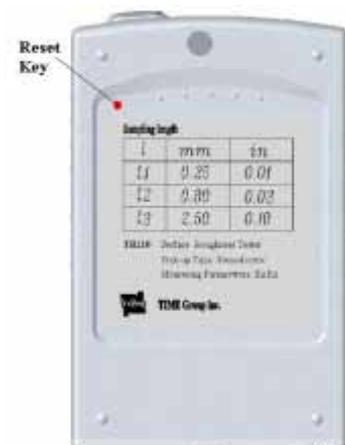
When the icon  lighting, it means the pickup is coming to the start position and at this time it will be invalid to press the Star Key. After the icon  disappeared with two “d, d.”  d, the measurement has being finished, and the screen will show as the picture8.

Note:

- ◆ During the pickup's travel, do your best to make sure the tester is on



Picture 8



Picture 9

the measured surface stably so as to avoid its influence to the precision.

- ◆ Before the pickup return to its previous position, the tester will not make any response to further operation. New measurement is prohibited until the entire measurement is finished.
- ◆ When  appears on the screen, that means a mistake.
- ◆ If the tester has been dying, you must press the Reset Key, and then you can use it again. (Refer to the picture9)

5.5 Calibration

Before use, Calibration should be done with the standard sample plate .For example, there is a standard sample plate pointed to 3.27: Firstly, locate the tester onto the reticle area of the standard sample plate, and make the pickup's travel direction is vertical to the veins direction of the reticle (refer to picture 10). After that, press the start



Picture 10

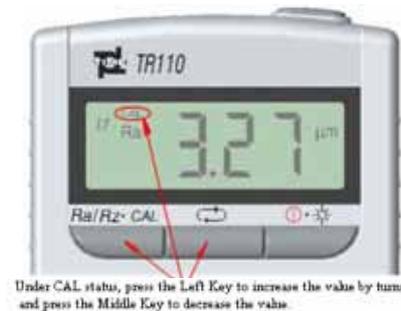
key to make measurement. The measuring value will be shown on the screen that is 3.21. And then it comes to the next step of calibration.

When the tester is under non-measuring status, keep pressing the Left Key more than 2 seconds, the tester will enter the status of Calibration. (Refer to picture 11)

Press the Left Key and Middle Key to adjust the displaying value to the value 3.27 (Refer to picture 12).



Picture 11



Picture 12

Press the Start Key to exit the status of Calibration. After calibration, the calibrated measuring value Ra will show on the screen.

(At the meantime, the new standard sample plate value Ra will be stored to the memory instead of the old one).

After the sensor returns to its original place, the tester can be used to make normal measurement.

If the user has multi-reticle sample plate, he can choose suitable sample plate to calibrate the tester against his measuring range in common use. By this way, the tester's precision can be improved greatly.

5.6 M/in Conversion

Keep pressing the Middle Key more than 2 seconds, the tester will enter the status of M/IN conversion. (Refer to Picture 13)

5.7 Switch off automatically

The tester will switch off automatically if there is no operation in 90 seconds.

5.8 Indication of low battery



Switch the m/in by keep pressing the Middle Key.

Picture 13

When the battery symbol  displays on the upper right of the screen, that means low battery. Recharging is needed.

When  are shown on the screen together with “d.d.” sound, that means utmost low battery and prompt recharging should be done. (Refer to Picture14).

5.9 Battery recharge

Plug the charger into the tester's recharge socket and have the tester  recharged together with the battery symbol lighting (if no lighting, plug it again). 3 hours recharging-time is enough.

The tester is workable during recharging. Recharge socket is on the right of tester.



The symbol will appear when low battery, and it will twinkle during recharging

Picture 14

6. Maintenance

- ◆ Protect the tester from collision, violent shock, heavy dust, dampness, oil stain and strong magnetic field etc.

- ◆ Please switch off in time after each measurement to save the energy, and have the battery recharged promptly when necessary.
- ◆ The usual suitable recharging-time for the tester is 3 hours. Please pay attention to prevent the battery from being damaged by over-time recharge.
- ◆ The sensor is the precision part of the tester and particular care should be taken of it. After each use, put on the protective sheath gently so as to avoid violent shock to the sensor.
- ◆ Standard sample plate provided with the tester should be given special protection to avoid scratch that may make the calibration inaccurate.

7. Technical Parameters and Functions

7.1 Main Technical Parameters

- ◆ Parameters (μm): Ra, Rz
- ◆ Traverse Length (mm): 6
- ◆ Sampling Length (mm): 0.25, 0.80 and 2.5
- ◆ Evaluation Length (mm): 1.25, 4.0 and 5.0

- ◆ Measuring Range (μm): Ra: 0.05--10.0
Rz: 0.1--50
- ◆ Display error: $\pm 15\%$
- ◆ Repeatability of Displayed Value: $< 12\%$
- ◆ Stylus: Diamond tip Radius: $10\mu\text{m} \pm 1\mu\text{m}$
Diamond tip Angle: $90^{\circ} \begin{matrix} +5^{\circ} \\ -10^{\circ} \end{matrix}$
- ◆ Stationary measuring force and its variations of the stylus:
Stationary measuring force: $\leq 0.016\text{N}$
Variation of the measuring force: $\leq 800\text{N/m}$
- ◆ Pressure of the skid-dependent of the sensor: $\leq 0.5\text{N}$
- ◆ Power supply: 3.6V Li-ion battery
- ◆ Charger: DC 6V, with 3-hour recharging time.
- ◆ Overall Dimensions: 110 mm \times 70 mm \times 24 mm
- ◆ Weight: 160g

7.2 Main Functions

- ◆ Selectable measurement parameters: Ra, Rz
- ◆ Optional sampling length
- ◆ Calibration function
- ◆ Automatic testing of battery voltage and sound of alarm
- ◆ Battery recharging function, workable while recharging

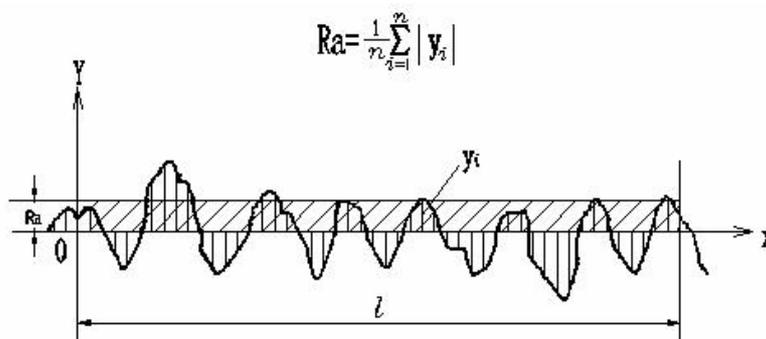
7.3 Operating Environment

- ◆ Operating conditions
 - Temperature: 0~40
 - Relative humidity: < 80%
 - No vibration; no corrosive media
- ◆ Conditions for storing
 - Temperature: - 25 ~ 60
 - Relative humidity: < 90%

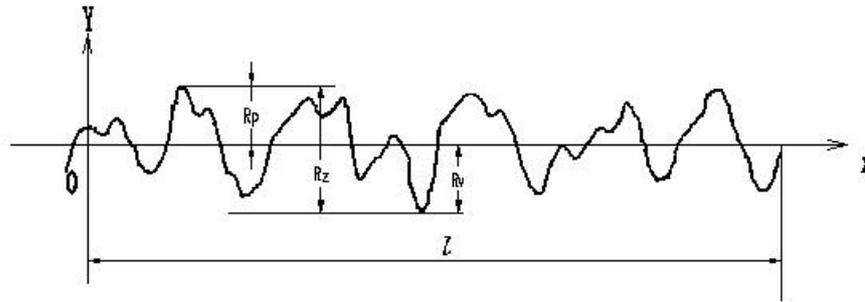
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8. Terminology and Parameters for Surface Roughness

- ◆ Surface Roughness is the microcosmic geometric form on the work-piece surface composed by peak and valley with small interspaces.
- ◆ Sampling Length is the benchmark's length used to be distinguished its surface roughness.
- ◆ Evaluation Length is the necessary length for evaluating the roughness profile. It may include one or more sampling lengths.
- ◆ Ra: Arithmetical Mean Deviation of the Profile is arithmetic mean value of the deviation of the profile within sampling length.



- ◆ Rz: The maximum Height of Irregularities is the distance between maximum depth of the profile peaks and maximum depth of the profile valley within the sampling length.



9. Recommended Sampling Length Table

Ra (μm)	Rz (μm)	Sampling Length (mm)
> 40 ~ 80	> 160 ~ 320	8
> 20 ~ 40	> 80 ~ 160	
> 10 ~ 20	> 40 ~ 80	
> 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 > 0.05 ~ 0.063 > 0.04 ~ 0.05	> 0.32 ~ 0.4 > 0.25 ~ 0.32 > 0.2 ~ 0.25	
> 0.032 ~ 0.04 > 0.025 ~ 0.032 > 0.02 ~ 0.025	> 0.16 ~ 0.2 > 0.125 ~ 0.16 > 0.1 ~ 0.125	
> 0.016 ~ 0.02 > 0.0125 ~ 0.016 > 0.01 ~ 0.0125	> 0.08 ~ 0.1 > 0.063 ~ 0.08 > 0.05 ~ 0.062	0.08
> 0.008 ~ 0.01 > 0.0063 ~ 0.008 ≤0.063	> 0.04 ~ 0.05 > 0.032 ~ 0.004 ≤0.032	

10. Non-warranty Parts

Sheath of TR100, Pickup, Battery, Charger, Communication cable