Contents

Product Description

Note: This user manual is for model NR60CP, NR110, NR10QC colorimeter, but all the following descriptions are according to model NR60CP. You will find NR110 and NR10QC technical parameters in appendix.

This instrument is researched and developed in accordance with CIE (International Commission on Illumination) and CNS (China National Standards). It is a high precise colorimeter with simple user interface and stable performance. It can be powered by both Li-ion battery and external DC power supply.

The instrument has following advantages:

● Can perform measurement at start-up. No need to calibrate each time which simplify the operation.

● Adopt illuminating locating and precise cross locating to aim at the tested object quickly.

● 4mm measuring aperture for more measurement occasions.

● Save data automatically.

● The precise and stable hand-head structure to make the measurement easier.

Cautions

● This colorimeter is a precise measuring instrument. Please avoid dramatic changes of external environment when measuring. These changes, including the flicker of surrounding light, the rapid change of temperature, will affect the measuring accuracy.

● Keep the instrument balanceable; make sure the measuring aperture cling to the test sample, and no shaking or shifting when measuring. Please prevent the colorimeter from fierce collision or crash.

● This instrument is not waterproof. Do not use it in high humidity environment or in water.

● Keep the colorimeter clean. Avoid dust, powder or solid particles entering the measuring aperture and the instrument.

- Replace the white calibration cover and put the colorimeter into instrument cabinet when not in use.

- Please take out the battery to prevent the colorimeter from damage if you don’t use it for a long time.

- Please keep the colorimeter in a cool dry place.

- Any unauthorized changes to the colorimeter are not permitted, or it will affect the measuring accuracy, even cause irreversible damage.

I. Button Description

The following is a brief introduction of the buttons. We will give more detailed information about its function separately in next chapters.

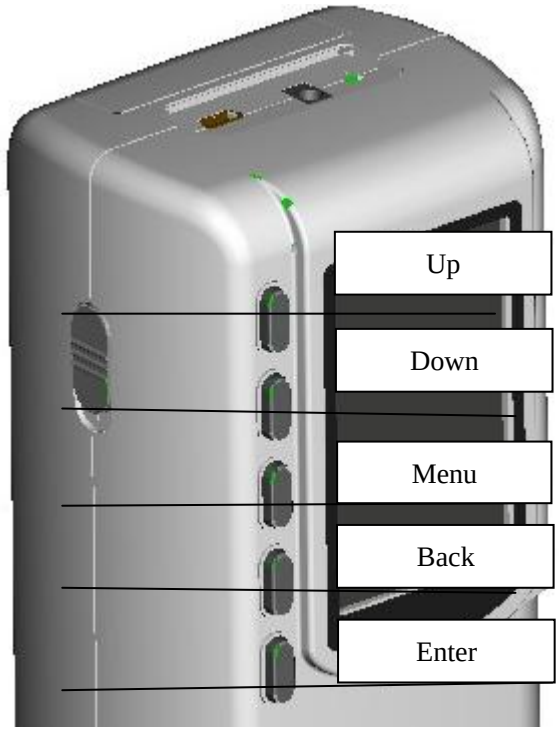


Figure 1 Button Function

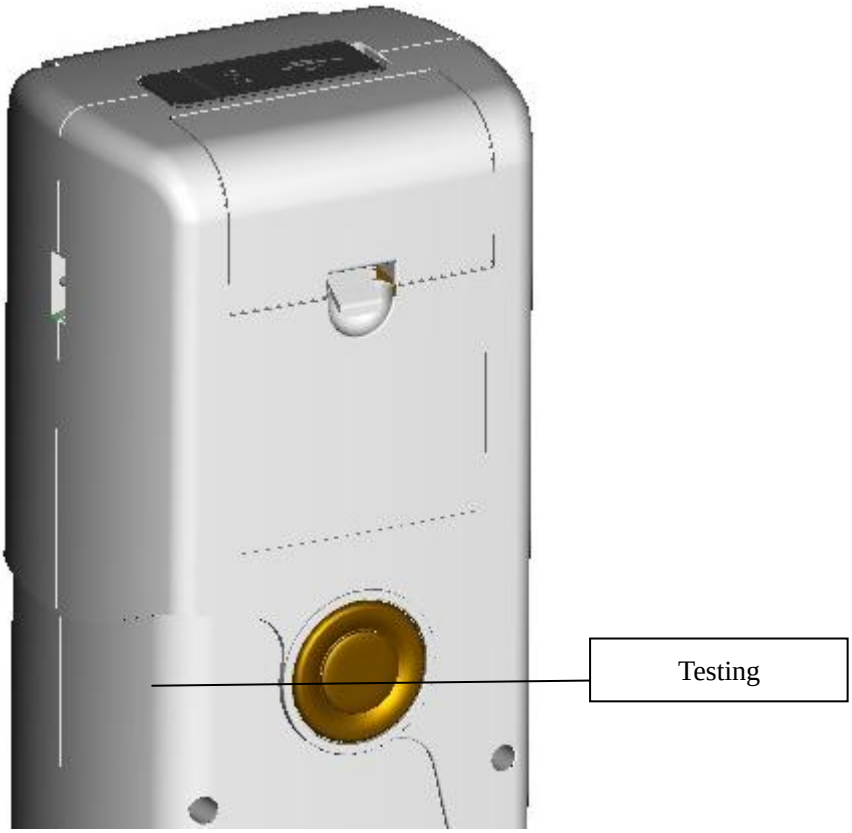


Figure 2 Testing Button Diagram

Button Function Introduction

1. ≡ Menu
2. ↑ Up
3. ↓ Down
4. ↵ Enter
5. ↖ Back
6. Testing

II. Interface Description

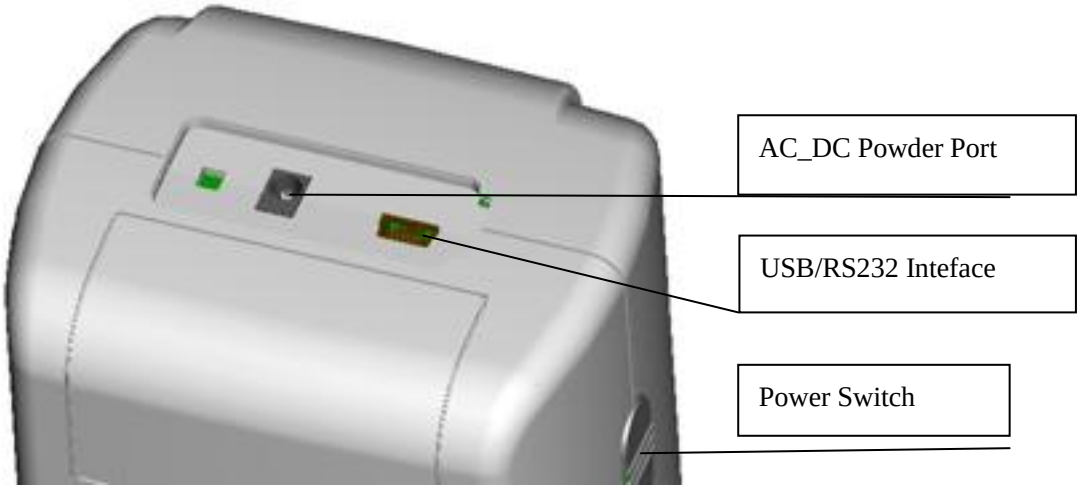


Figure 3 Interface Diagram

Interface Description

1. Power Switch: Push the switch to “1” to turn on the colorimeter. Push the switch to “0” to turn it off.

2. DC Interface: It is used to connect to external power source. The specification of external power source is 5V=2A.

3. USB Interface / RS-232 Interface: This interface is a common interface. The instrument judges the connection status automatically. USB interface is used to transfer data to PC. Its baud rate is 115200bps. RS-232 interface is used to connect to the printer.

Note: When connecting to external power source, please press the power switch to start the instrument.

III. Battery Description and Installation

Battery Description

1. The Battery is Li-ion 3.7V = 0.5A. Its capacity is 3200mAh.

2. Please use original Li-ion battery. Do not use other batteries, or it will cause irreversible damage.

3. Please take out the battery to prevent the colorimeter from the damage of battery leakage if you don't use it for a long time.

4. When charging the battery, the instrument must connect external power source or USB cable to connect the PC. Meanwhile, push the switch to "1", and then the battery will be charging. If not charge the battery, then take out the battery and connect external power source, the instrument still works normally.

5. When charging the battery, dynamic battery icon will display on the top right corner of measurement interface.

Battery Installation

1. When installing battery, be sure the power is cut off. (The switch is pushed to "0"). Then remove the battery cover.

2. Insert the Li-ion battery into battery compartment and push it gently in right direction.

3. Put the battery cover on Li-ion battery, and then push it up.

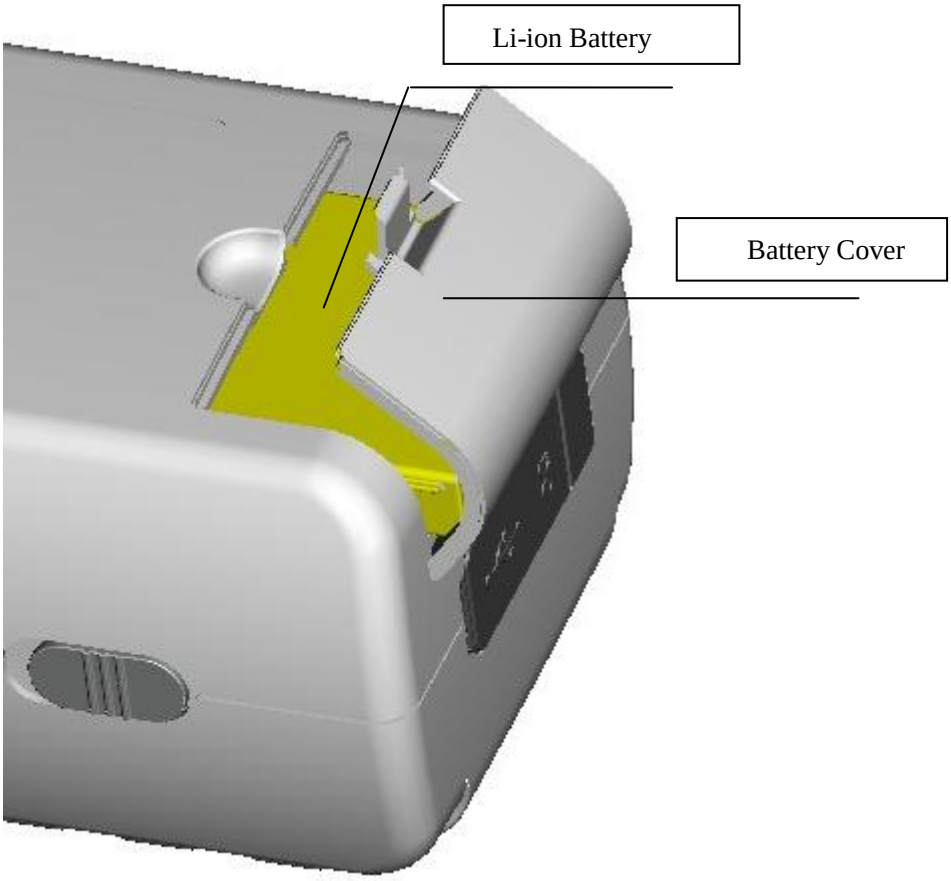


Figure 4 Battery Installation

IV. Changing Measuring Aperture

1. Measuring Aperture Installation

As shown in Figure 5, make the measuring aperture align at the installation position of integrating sphere. Then gently turn it counterclockwise. When hear slight “Da”, it means measuring aperture is buckled with integrating sphere. Then the installation is finished.

2. Measuring Aperture Dismantlement

As shown in Figure 5, gently turn measuring aperture clockwise. When hear slight “Da”, it means the measuring aperture is separated with the buckling parts of integrating sphere. Then the measuring aperture is dismantled.

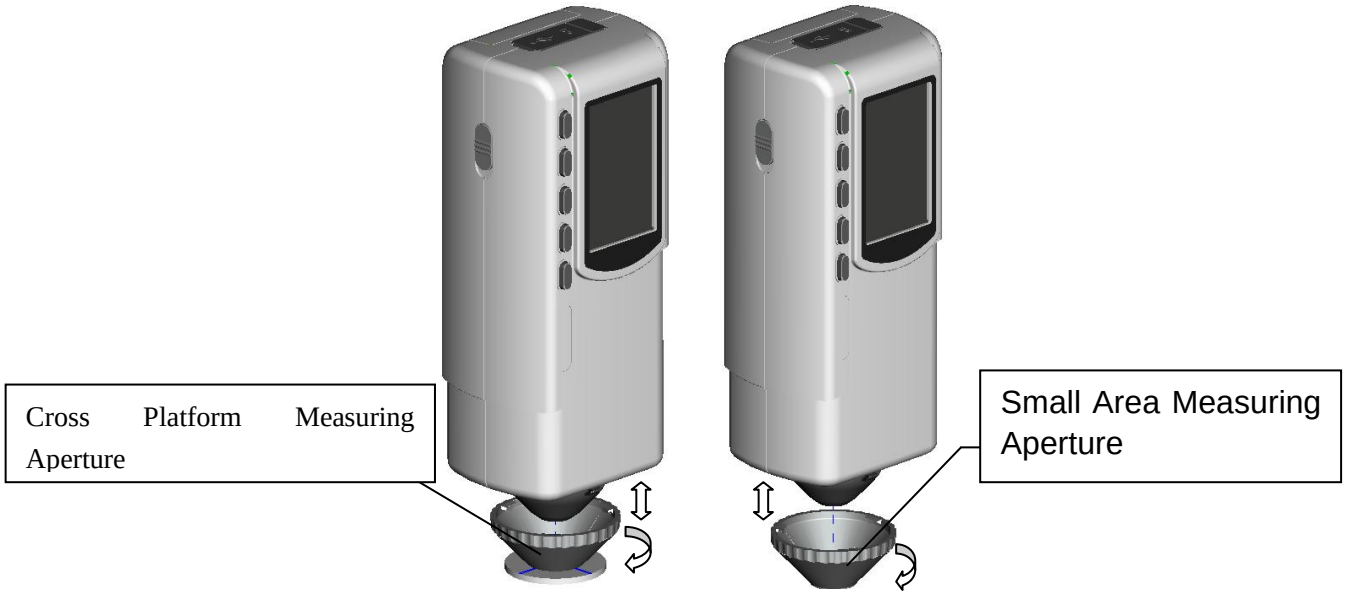


Figure 5 Installation and Dismantlement of Measuring Aperture

Note: some models are only equipped with cross platform measuring aperture.

V. Operating Instruction

（I） Turning On

1. Preparations Before Power On

Check whether there is battery powered or external power supply.

2. Turning On

Push the power switch to “1”, the LCD screen will display 3nh logo. After a few seconds, it will enter Standard Measurement interface automatically, and the default display is L*a*b*C*H.

（II） Measurement

1. Measurement Locating

The instrument can locate by measurement facula. Enter “Standard Measurement” or “Sample Measurement” interface, press the “Testing” key and hold it. The facula will appear at the moment. You can observe the matching status between the facula and the measured sample. At the same time, hold the measuring aperture close to the measured sample and adjust it. Then the alignment is achieved.
After the locating, release “Testing” button. The instrument will finish sample testing in approx. 1 sec and display color parameters of the measured sample.

2. Standard Measurement

Enter standard measurement to perform measurement, as shown in Figure 6, align the measuring aperture to the sample, press “Testing” button, the screen will display color data of this sample.

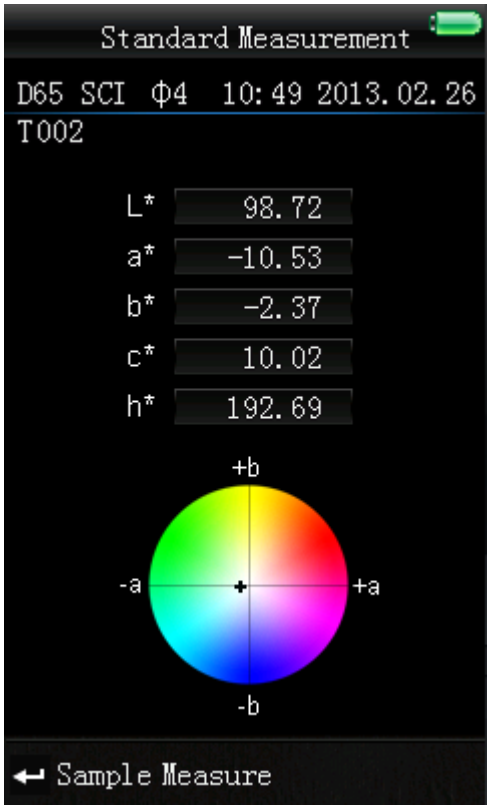


Figure 6 Standard Measurement Interface

3. Sample Measurement

After completing standard measurement, press “Enter” button, the instrument will enter “Sample Measurement” interface automatically, as shown in Figure 7. Align the measuring aperture to the test sample to perform sample measurement.

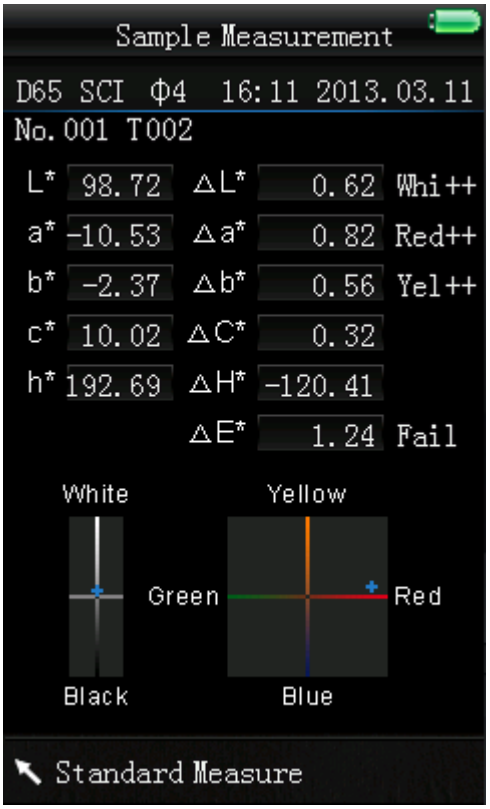


Figure 7 Sample Measurement Interface

Note: During the measurement (Approx. 1 sec), all buttons are ineffective.

（III）Connect Colorimeter to PC (only for models equipped with software)

Press “MENU ☰” button to enter the main menu, as shown in Figure 8.

Then, select “Comm” to enter an interface shown in Figure 9. Follow the tips in the interface, connect colorimeter to the PC with USB cable. Press “Enter” button, the instrument will enter “Communicating…” interface, as shown in Figure 10.

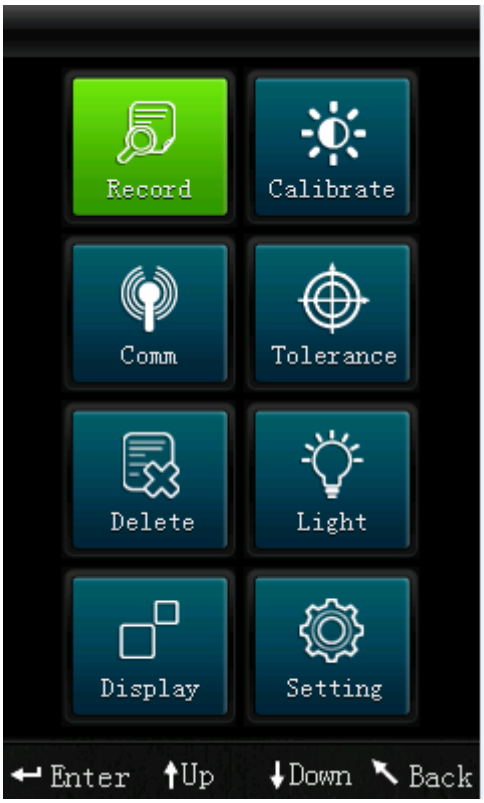


Figure 8 Main Menu

Figure 9 USB Communication

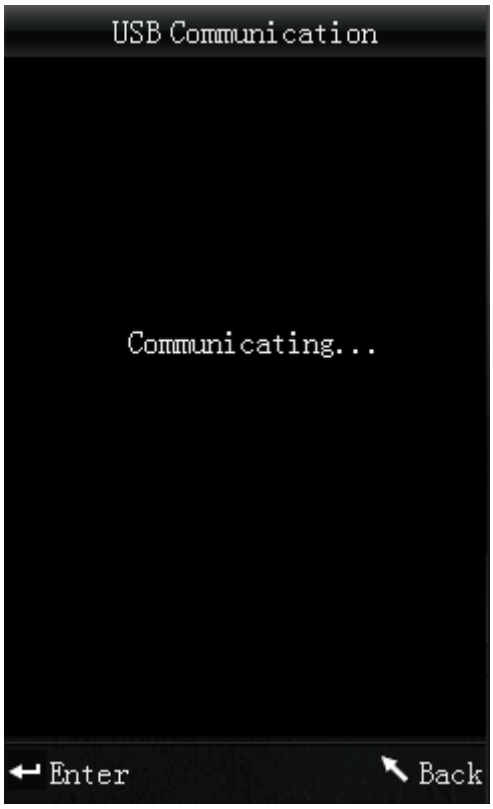


Figure 10 “Communicating” Interface

（IV）print

Connect colorimeter to the printer. When the colorimeter is in “Standard Measurement” or “Sample Measurement” interface, you can print measurement data automatically.

VI. System Function Description

Abut operating the functions of this colorimeter, please through main menu as shown in Figure 8.

1. Record and Standard Entering

a) Record

Select “Record” in main menu to enter “Standard Record”, as shown in Figure 11. The figure shows the standard sample data. You can check different standard data through “Up” and “Down”. “T002” is a standard number. After selecting a standard, you can press “Enter” to check test sample data and color difference, as shown in Figure 12. You can check different data through “Up” and “Down”. No.001 is the serial number of sample measurement.

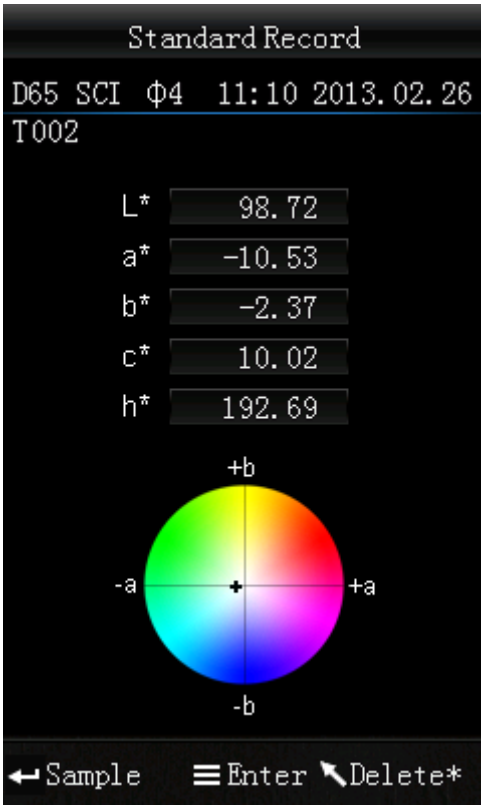


Figure 11 Standard Record

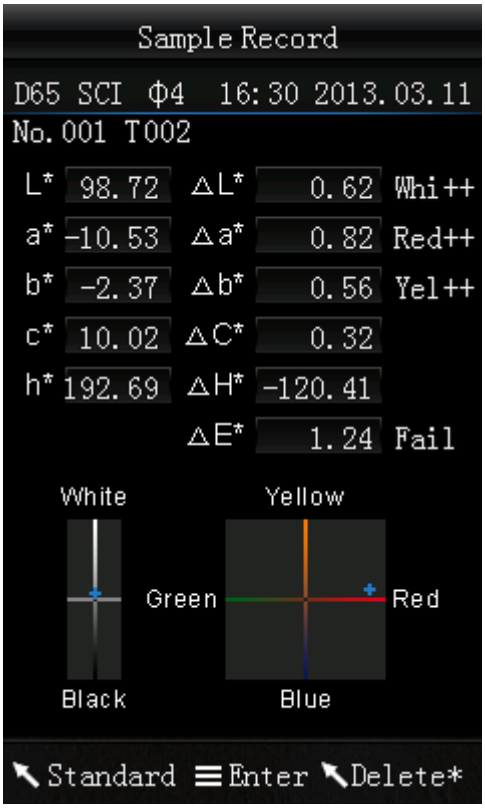


Figure 12 Sample Record

b) Standard Entering

In some cases, it's needed to measure color difference under a saved standard. Then, you can select "Record" in main menu to enter standard sample records interface. You can search the needed standard data through "Up" and "Down". After finding it, press "Menu ☰" button, and then the standard record is entered to the measurement interface, press "Enter", you can perform sample measurement under this standard.

c) Sample Record Entered to a Standard

In some cases, it's needed to use a stored sample as a standard. Then, you can select "Record" to enter sample records interface, as shown in Figure 12. You can search the needed sample data through "Up" and "Down". After finding it, press "Menu ☰" button, and then the sample record is entered to the measurement interface as a standard, press "Enter", you can perform the color measurement under this standard.

2. White and Black Calibration

Press “MENU ☰” to enter the main menu. Select “Calibrate” to enter manual white calibration and black calibration interface, as shown in Figure 13.

Select “White Calibration” and press “Enter” button; the interface will prompt you to put away the white calibration cover. Turn the colorimeter upside down and make the measuring aperture upwards, then put the white calibration board in the center of the colorimeter and make sure it is closed to measuring aperture. Re-press “Testing” key to perform white calibration.

Next step is black calibration: remove white calibration board. Select “Black Calibration” and press “Enter” button, the instrument will prompt to direct the measuring aperture to the air (please refer to the “Notes” under Figure 13). Re-press “Enter” again or press “Testing” key to perform black calibration.

Then, white calibration and black calibration are completed.

Figure 13 White and Black Calibration

Notes:

1. *When performing black calibration, direct the measuring port to the air. Be sure the black calibration is starting in a dark, no bright light source environment. Keep the measuring port more than 1m away from any reflective items (hands, desks, walls etc.).*

2. *No need to enforce black and white calibration. Once turning it on, you can start the measurement. It is suggested to perform calibration in following occasions: first use, great change of the environment, long-term unused or inaccurate data.*

3. Tolerance Setting

Select “Tolerance” in main menu to enter tolerance setting interface, as shown in Figure 14. You can add or subtract the number in which the cursor is positioned through “Up” and “Down” button. After setting the number to the needed one, press “Enter” button, the cursor will jump to the last number. When the cursor is in the last number, press “Enter” button to save the settings and return to the main menu.

If you don’t want to set or modify the tolerance, you can press “Back” button to return to the main menu.

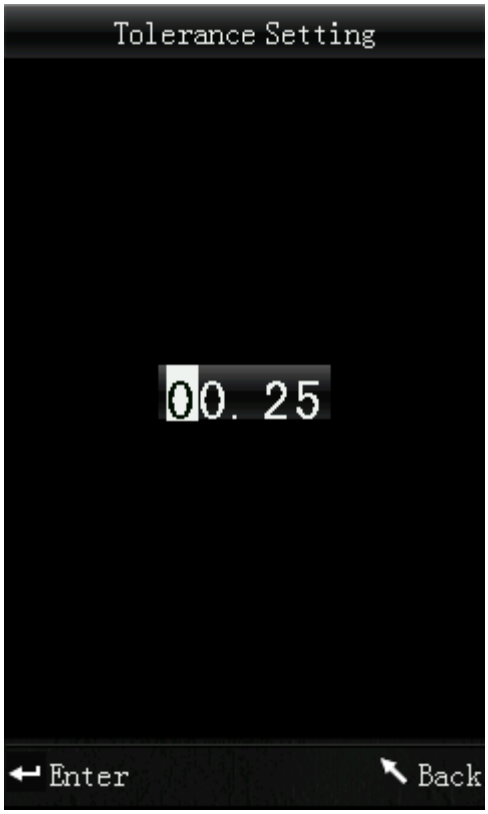


Figure 14 Tolerance Setting

The tolerance value is artificial. It is a standard value to judge whether the total color difference ΔE is qualified or not according to the demand of color management. If ΔE is smaller than tolerance value, then it is qualified. If ΔE is bigger than tolerance value, then it is unqualified. As shown in Figure 14-1, the ΔE in sample measurement interface is unqualified.

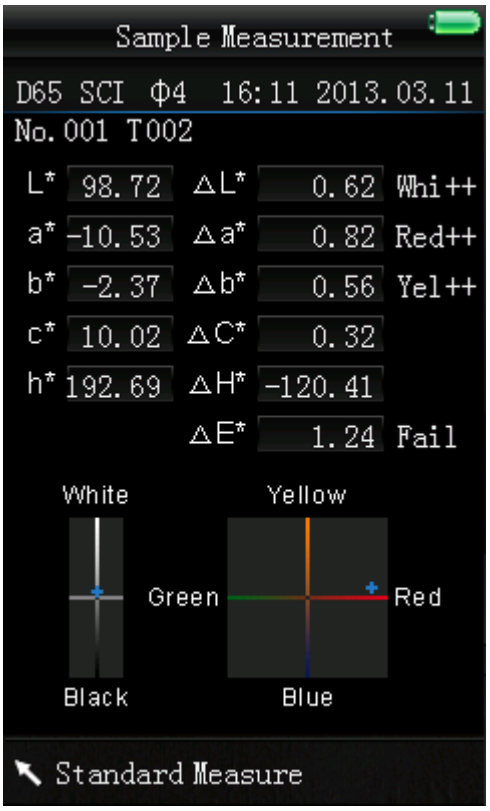


Figure 15 Sample Measurement Interface

4. Delete Records

Select “Delete” in main menu to enter the interface shown in Figure 15. There are two options: “Delete All Samples” and “Delete All Records”.

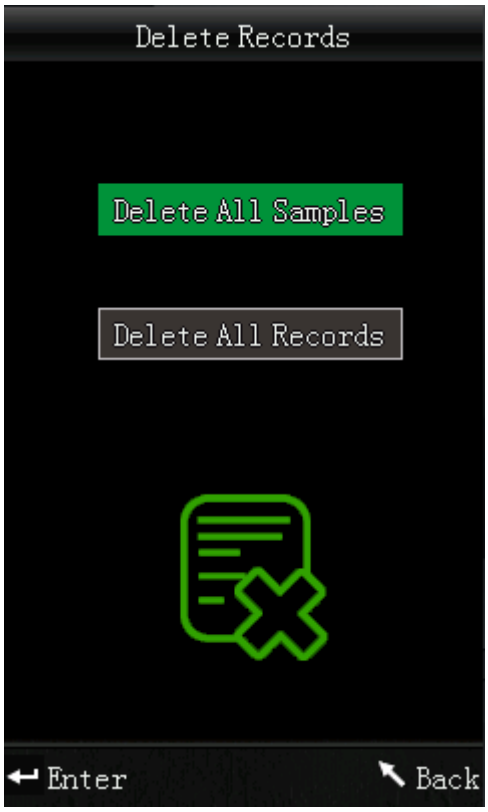


Figure 16 Delete Records

a) Delete All Samples

When select “Delete All Samples”, it will delete all test samples in the instrument and save the standard records. Then, the instrument will display a warning interface, as shown in Figure 16. Press “Enter”, all sample data will be deleted, but the standard records are still retained.

Figure 17 “Delete All Samples” Warning Interface

b) Delete All Records

When select “All Records Delete”, all records in the instrument will be deleted, including all standard records and all sample records. Then, the instrument will pop up a warning interface, as shown in Figure 17. Press “Enter” button, all records in the instrument will be deleted.

Note: Please operate this interface carefully, in case of accidental deletion of the needed historical records.

Figure 18 “Delete All Records” Warning Interface

5. Light Source Selection

Click “Light” in main menu. Customer can choose the light source

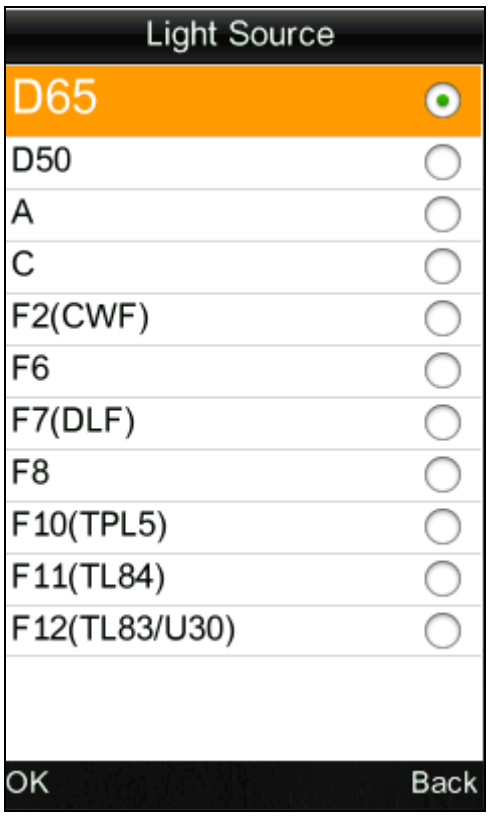


Figure 19 Light Source Selection

6. Display Mode

Select “Display” in the main menu to enter an interface, as shown in Figure 19. You can select different color spaces according to your need. This selection will affect the display in “Standard Measurement” and “Sample Measurement” interfaces. You can make settings by pressing “Up” and “Down” button. Then press “Enter” to save the settings and return to main menu.

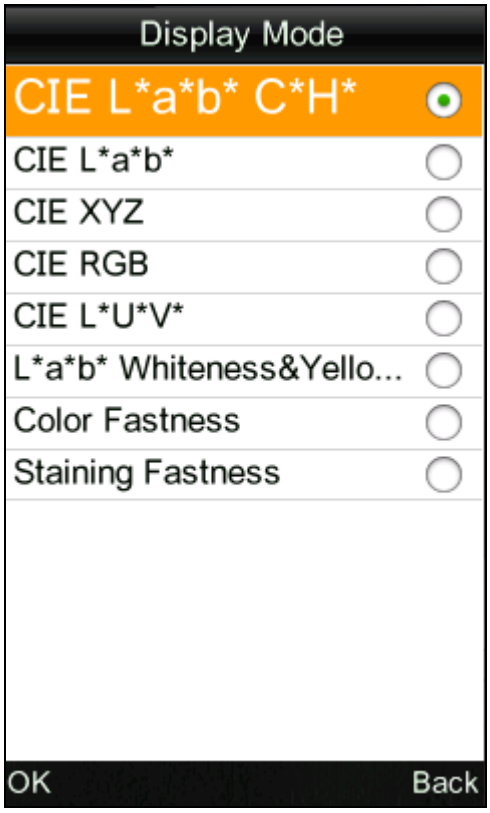


Figure 20 Display Mode Interface

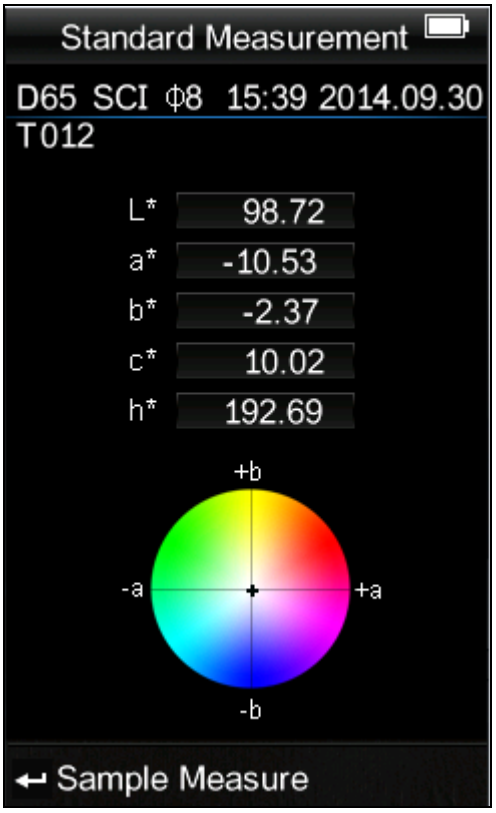


Figure 21 CIE L*a*b*C*H*

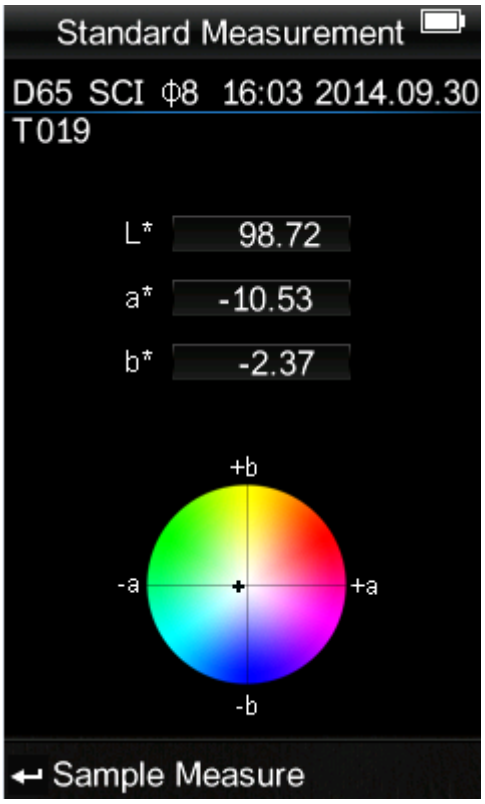


Figure 22 CIE L*a*b*

Figure 23 CIE XYZ

The display mode will default to “CIE L*a*b*C*H*”. This instrument has 8 display modes: “CIE L*a*b*C*H*”, “CIE L*a*b*”, “CIE XYZ”, “CIE RGB”, “CIE L*U*V”, “L*a*b* Whiteness & Yellowness”, “Color Fastness” and “Staining Fastness” (Figure 21~Figure 29). In addition, “CIE XYZ”, “CIE RGB”, “CIE L*U*V” only have standard measurement. Other modes have both standard measurement and sample measurement.

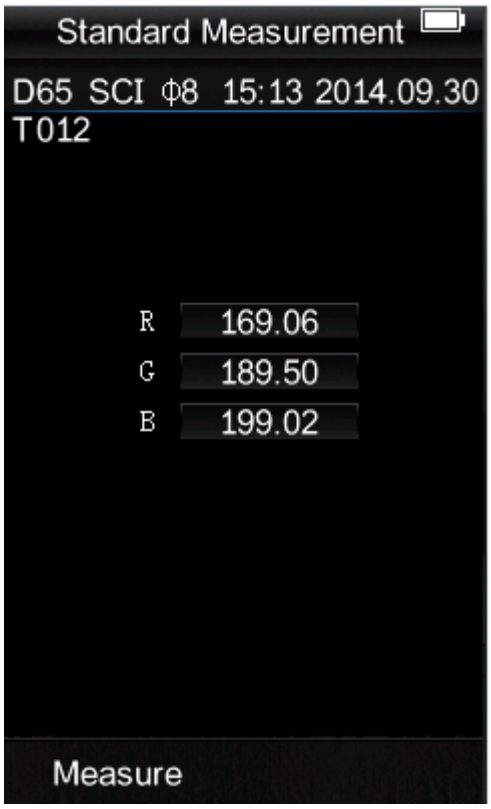


Figure 24 CIE RGB

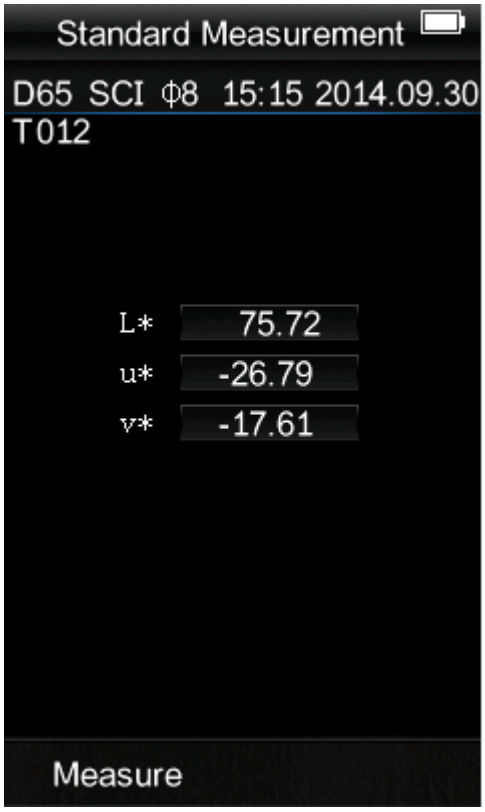


Figure CIE L*U*V*

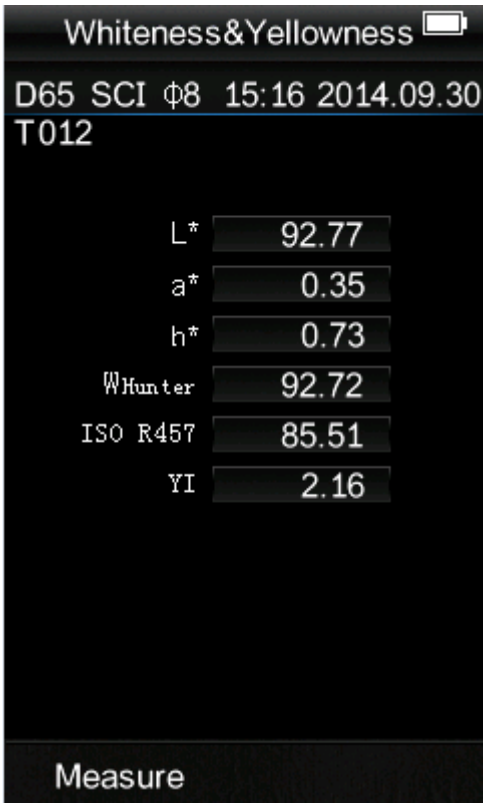


Figure 26 Whiteness&Yellowness Standard Measurement

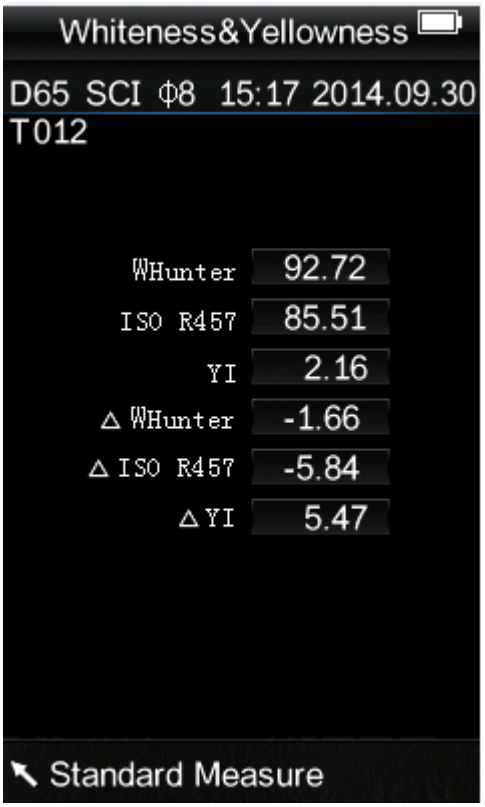


Figure 27 Whiteness&Yellowness Sample Measurement

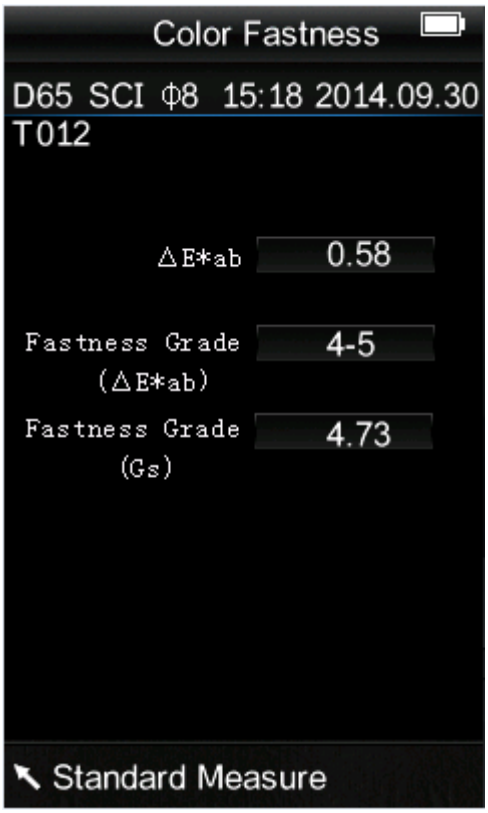


Figure 28 Color Fastness

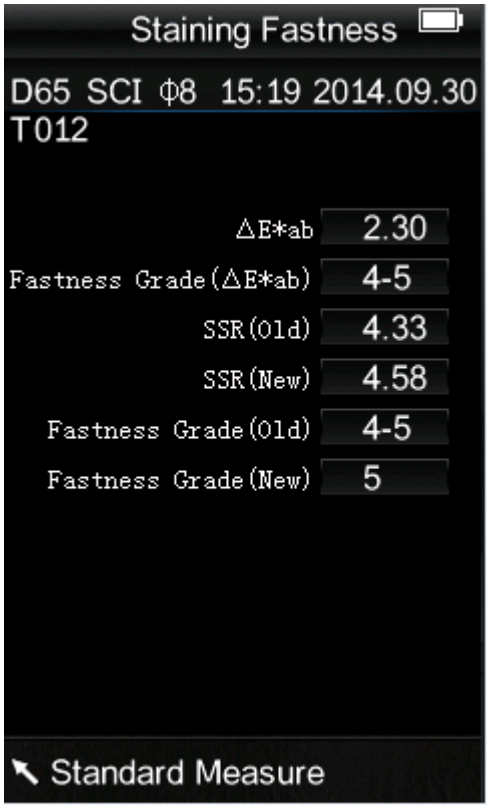


Figure 29 Staining Fastness

7. Function Setting

Select “Settings” in main menu to enter an interface shown in Figure 23. You can select the object according to your need by pressing “Up” and “Down” buttons. Press “Enter” to enter the corresponding setting interface. After completing these settings, press “Enter” button to save the settings and return to the previous menu.

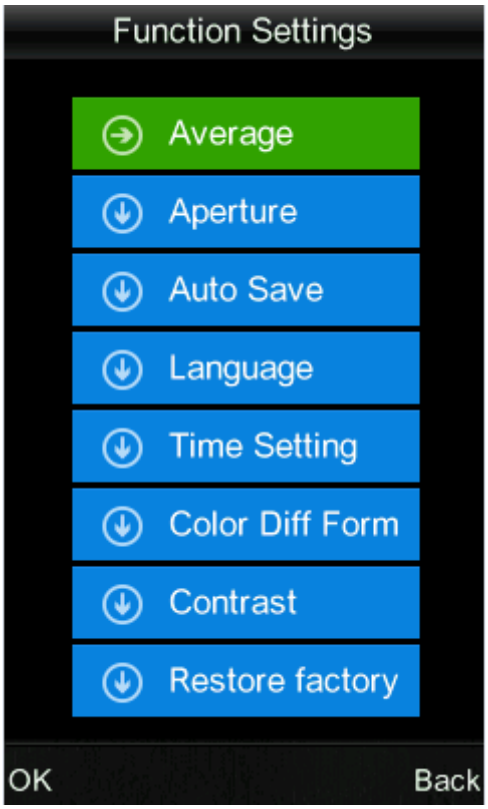


Figure 30 Function Setting

a) Average Measurement

Select “Average” in the main menu to enter an interface shown in Figure 31. You can set the times of average measurements according to your need. You can add or subtract the times by pressing “Up” and “Down” buttons. Press “Enter” to save the settings and return to the main menu. When the number is set to “00”, “01”, the instrument will only make single measurement, and will not perform average measurement. The instrument is defaulted to one time measurement.

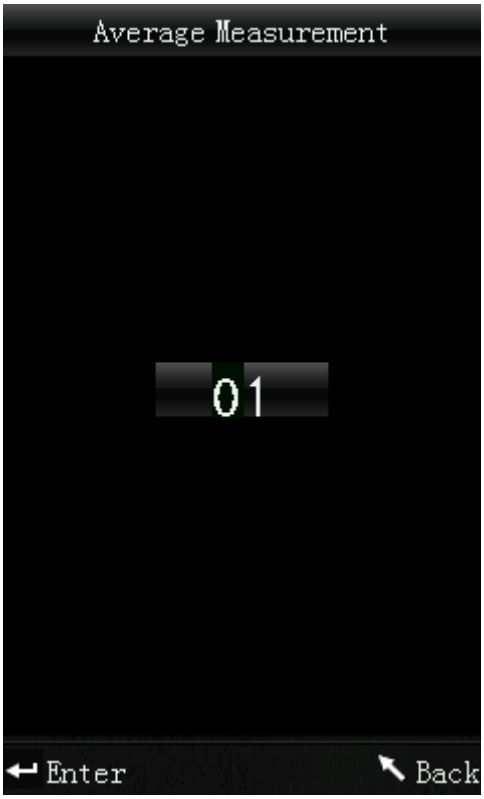


Figure 31 Average Measurement

b) Measuring Aperture Selection

The instrument has two apertures 4mm and 8mm.
Select “Settings” - “Aperture Setting” to enter an interface shown in Figure 32.

After changing the aperture, be sure to select the corresponding aperture in “Aperture Setting”, or it will cause the inaccuracy of the measured data. After changing the aperture, you need to re-perform white and black calibration, or it will also cause the inaccuracy of the measured data.

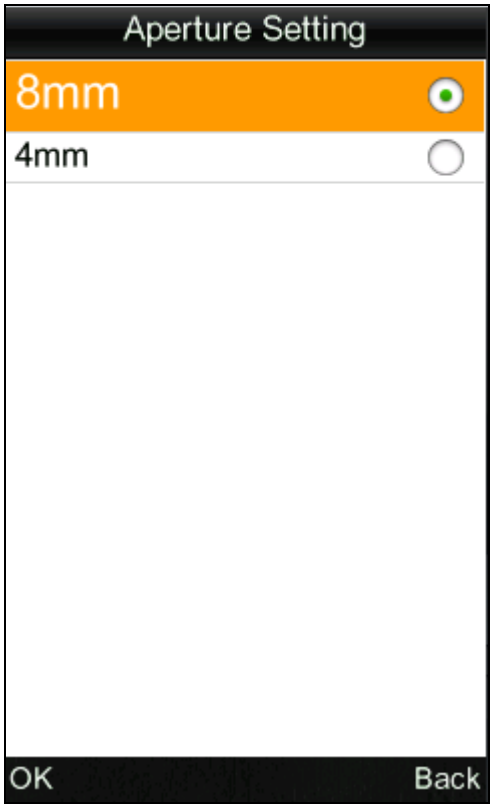


Figure 32 Average Measurement

c) Auto Save

Click “Auto Save” in “Setting”. You can set the save method.

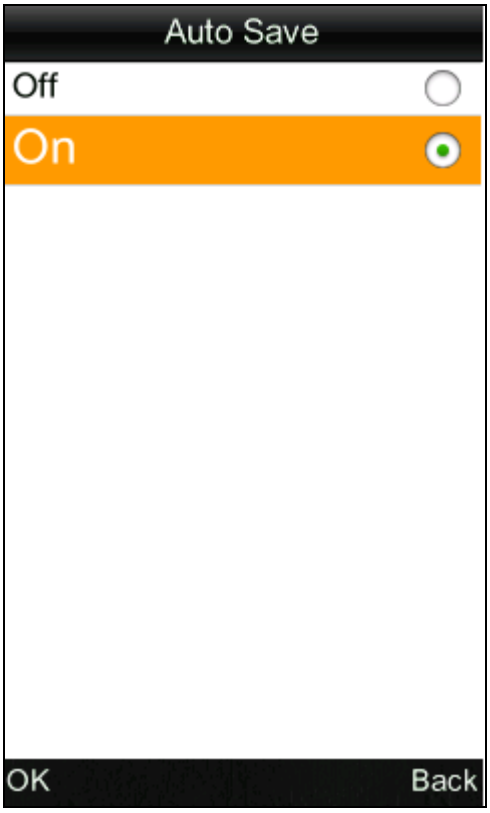


Figure 33 Auto Save

d) Language Selection

Click “Language” in “Setting”. You can select the language English/Chinese.

Figure 34 Language Selection

e) Select “Time & Date” to enter an interface shown in Figure 35. You can make settings by pressing the button “Up” and “Down. In Figure 36 and Figure 37, you can add or subtract time and date by pressing the button “Up” and “Down. In Figure 38 and Figure 39, you can set display format of time and date by pressing “Up” and “Down”. Press “Enter” to save the settings and return to the previous menu.

If you don’t want to set or modify time and date, you can press “Back” button to return to the main menu.

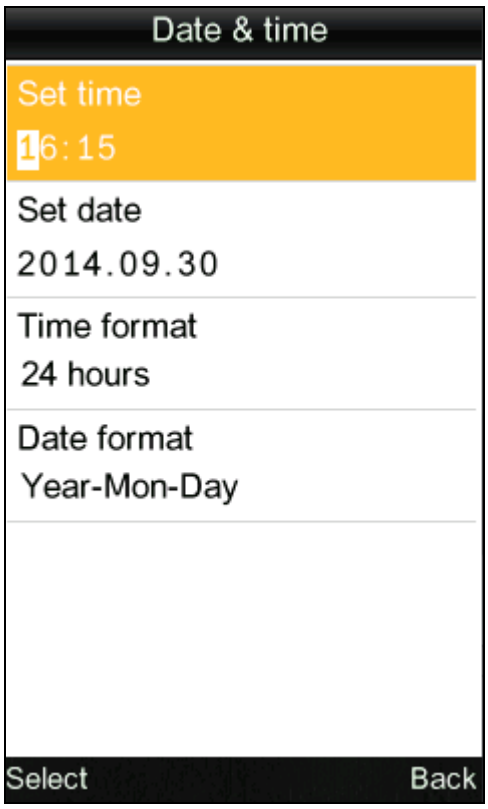


Figure 35 Time & Date

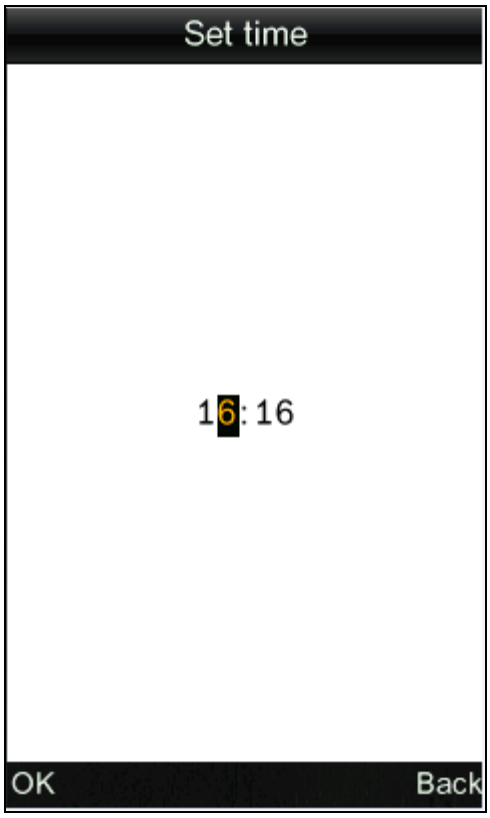


Figure 36 Time Setting

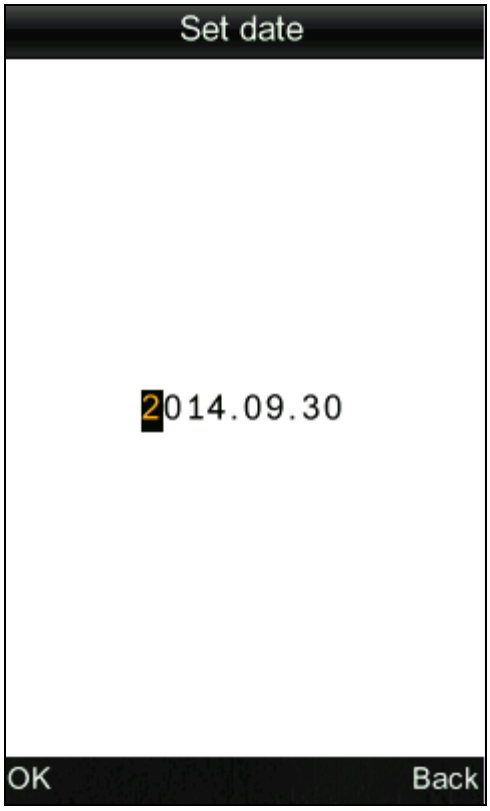


Figure37 Date Setting

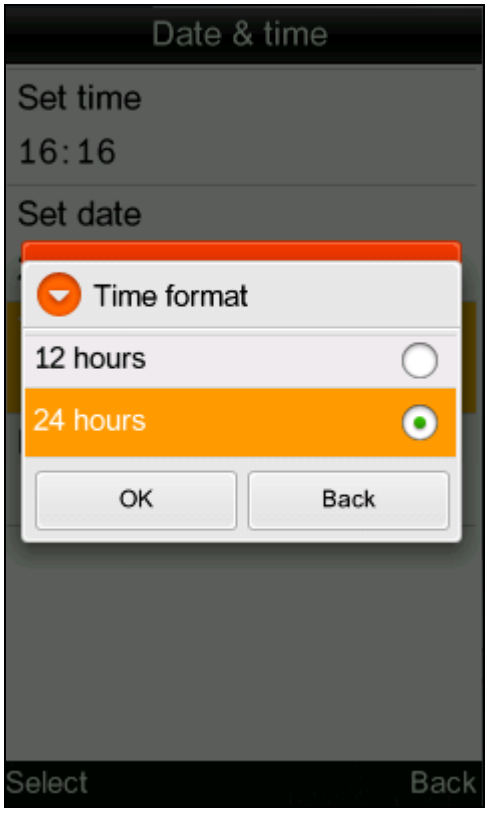


Figure 38 Time Format

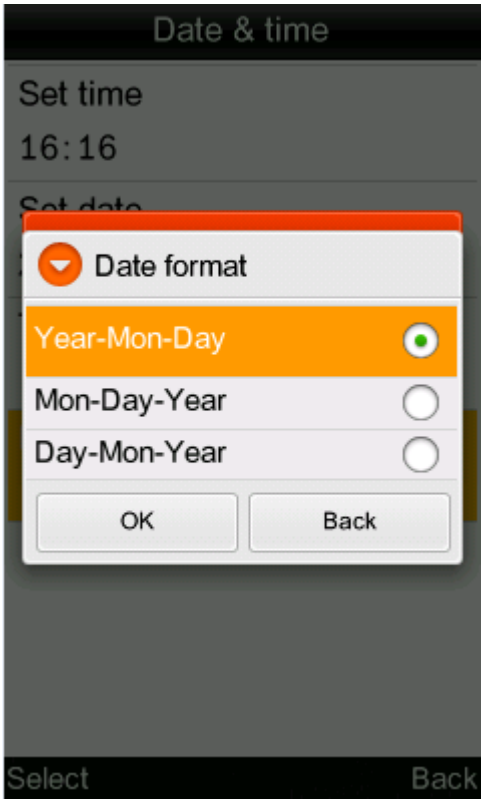


Figure 39 Date Format

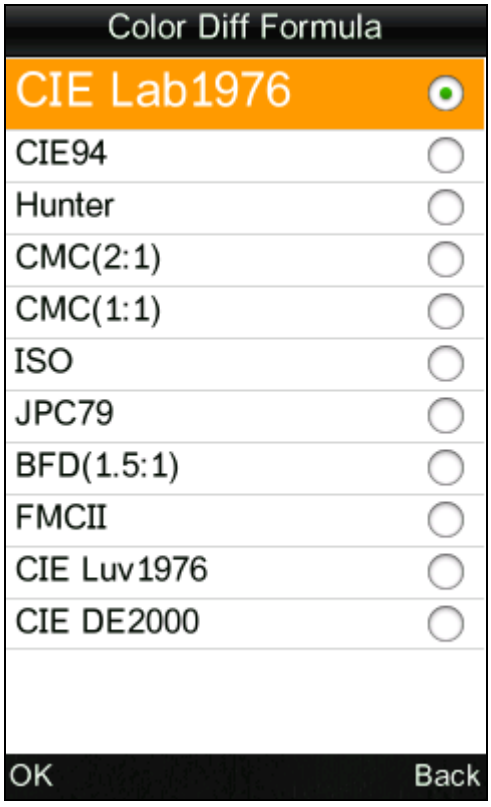


Figure 40 Color Difference Formula

f) Select "'Color Diff Formula" in main menu, as shown in Figure 40. Customer can choose the required color difference formula.

g) Select "Settings" - "Contrast" to set the backlight brightness.

h) Select "Settings" - "Restore Factory Set", as shown in Figure 41. Press "Enter" button. The instrument will restore to factory default setting and clear all records.

Note: When you choose this setting, it will pop up a warning. Please operate it carefully. If you don't want to carry out "Restore Factory Settings", please press "Back" button.

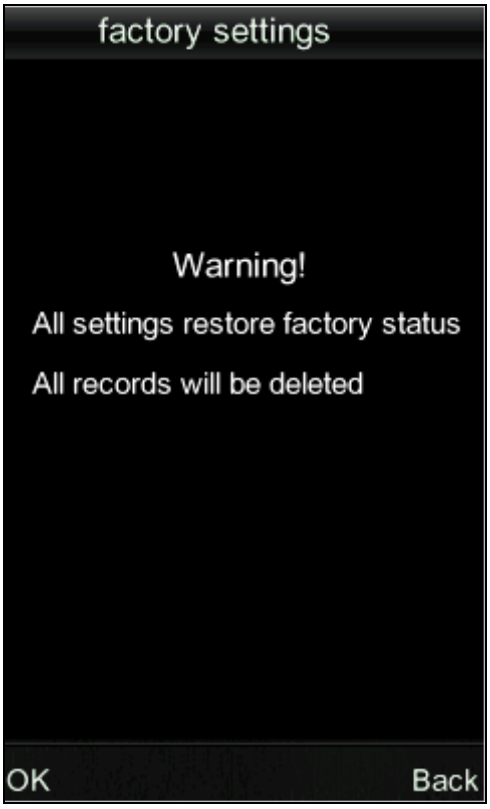


Figure 41 Restore Factory Set

VII. Product Parameters

1. Product Features

● The instrument fully considered the user experience, adopting humanized design concept – make the measurement easier.

● Adopting creative facula locating and cross locating – make the measurement conveniently, quickly and accurately.

● Small measuring aperture – easy to measure concave-convex object.

● No need to calibrate each time which simplify the operation.

● New integrating sphere optical path design – improve measurement stability and precision.

● This colorimeter has various color spaces. The users can select it according to their needs. And the instrument can display Whiteness, Yellowness and Color Fastness which is used widely.

● The precise and stable hand-head structure to make the measurement easier.

2. Product Specifications

Model	NR60CP
Illuminating/viewing geometry	8/d (8°illumination angle/diffuse viewing)
Measuring aperture	Φ8mm, Φ4mm
Locating	Illumination Locating/Cross Locating
Measuring End Face	Large stable end face and small concave-convex end face
Detector	Silicon photoelectric diode
Color Space	CIE L*a*b; CIE XYZ; CIE RGB;CIEL*u*v; CIE*C*H; Whiteness &Yellowness; Color Fastness
Color Difference Formula	ΔE*ab; ΔL*ab; ΔE*C*H; ΔECIE94; ΔEHunter
Light Source	D65, D50, A, C, F2, F6, F7, F8, F10, F11, F12
Measuring light source	LED blue light excitation
Errors between each equipment	≤0.50ΔE*ab
Storage	100 pcs standard samples; 10000 pcs test samples
Repeatability	Standard deviation within ΔE*ab 0.05 Measurement conditions: Average of 30 measurements of standard white plate
Weight	500g
Size	205 x 67 x 80 mm

Power source	Rechargeable lithium-ion battery 3.7VDC@3200mAh
Battery life	5 years, more than 1.6 million times
Measuring times before recharge	More than 5000 times after charging
Display	TFT True Color 2.8inch@ (16:9)
Operating temperature	-10~40℃ (14℉~104℉)
Humidity range	relative humidity 0~85% with no condensation
PC Software	CQCS3 Color Quality Management Software
Data interface	USB RS232
Portable packing bag	Original
Standard accessories	Powder adapter, Li-ion battery, operating instruction, white calibration board, wristband, 4mm and 8mm measuring aperture, software CD, USB cable,
Optional accessories	Miniature thermal printer, Powder Test Box

Model	NR110
Illuminating/viewing geometry	8/d (8°illumination angle/diffuse viewing)
Measuring aperture	Φ4mm
Locating	Illumination Locating/Cross Locating
Measuring End Face	Large stable end face and small concave-convex end face
Detector	Silicon photoelectric diode
Color Space	CIE L*a*b*C*H: CIE L*a*b; CIE XYZ;
Color Difference Formula	ΔE*ab; ΔL*ab; ΔE*C*H;
Light Source	D65
Measuring light source	LED blue light excitation
Errors between each equipment	≤0.50ΔE*ab
Storage	100 pcs standard samples; 20000 pcs test samples
Repeatability	Standard deviation within ΔE*ab 0.08 Measurement conditions: Average of 30 measurements of standard white plate
Weight	450g
Size	205 x 67 x 80 mm

Power source	Rechargeable lithium-ion battery 3.7VDC@3200mAh
Battery life	3 years, more than 1.6 million times
Measuring times before recharge	More than 3000 times after charging
Display	TFT True Color 2.8inch@ (16:9)
Operating temperature	-10~40℃ (14℉~104℉)
Humidity range	relative humidity 0~85% with no condensation
PC Software	CQCS3 Color Quality Management Software
Data interface	USB RS232
Portable packing bag	Original
Standard accessories	Horizontal charger, Li-ion battery, operating instruction, white calibration board, wristband, cross platform, 4mm measuring aperture, software CD, USB cable, 4mm aperture for small concave-convex surface
Optional accessories	Miniature thermal printer, Powder Test Box, AC adapter

Model	NR10QC
Illuminating/viewing geometry	8/d (8°illumination angle/diffuse viewing)
Measuring aperture	Φ4mm
Locating	Illumination Locating/Cross Locating
Detector	Silicon photoelectric diode
Color Space	CIE L*a*b;
Color Difference Formula	ΔE*ab;
Light Source	D65
Measuring light source	LED blue light excitation
Errors between each equipment	≤0.20ΔE*ab
Storage	100 pcs standard samples; 10000 pcs test samples
Repeatability	Standard deviation within ΔE*ab 0.03 Measurement conditions: Average of 30 measurements of standard white plate
Weight	500g
Size	205 x 67 x 80 mm
Power source	Rechargeable lithium-ion battery 3.7VDC@3200mAh

Battery life	5 years, more than 1.6 million times
Measuring times before recharge	More than 3000 times after charging
Display	TFT True Color 2.8inch@ (16:9)
Operating temperature	-10~40℃ (14℉~104℉)
Humidity range	relative humidity 0~85% with no condensation
Standard accessories	Horizontal charger, Li-ion battery, operating instruction, 4mm measuring aperture,
Optional accessories	Miniature thermal printer,

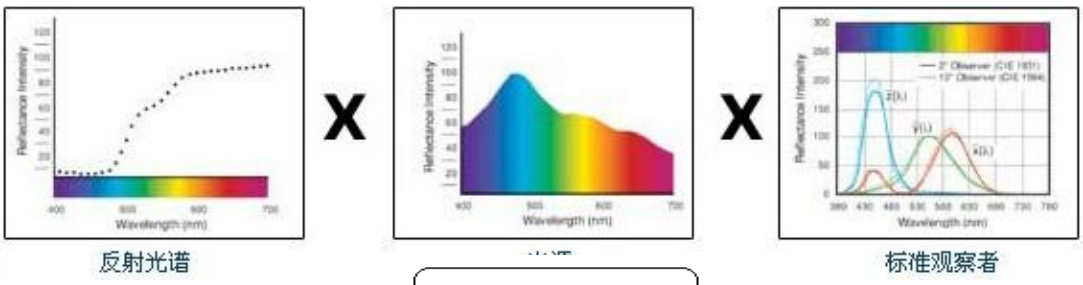
Note: The specifications are subject to change without notice.

Appendix

1. The Color of Objects

There are three major elements to perceive color: light, object and observer. Any change of these three elements will influence the observer's color perception. When the light source and the observer don't change, then the object will determine the observer's color perception.

Objects can affect the final color perception because the reflectance spectra (transmittance spectra) of the object have modulated the light source spectrum. Different objects have different reflectance spectra (transmittance spectra). The light source spectrum modulates the reflectance spectra (transmittance spectra) of different objects to obtain different results. The observer is the same, so it shows different colors. The theory is shown in the figure below.



2. Human Eyes to Distinguish Colors

The color difference unit, NBS, is derived from the unit of color difference formula which is established by Judd-Hunter. In 1939, the American Bureau of Standards adopts this color difference formula and calculates the color difference according to it. When the absolute value is 1, it is called “The NBS Color Difference Unit”.

Since then, people would consciously adjust the later color difference formulas to be similar with the NBS units. The formulas such as Hunter Lab, CIE LAB and CIE LUV are generally similar to NBS (not exactly the same),therefore, do not mistake the color difference units calculated by other color difference formulas are all NBS.

In national standards GB7705-87 (lithograph), GB7706-87 (letterpress), GB7707-87 (gravure) which promulgated by the National Bureau of Standards, the color printings rating in the same batch and same color according to color difference are defined as follows: General Product $\Delta E^*ab \leq 5.00 \sim 6.00$, Fine Product $\Delta E^*ab \leq 4.00 \sim 5.00$. Meanwhile, this quality standard is considered as a qualification for state enterprises promotion.

Table: The Perception Degree between NBS Unit and Color Difference

NBS Unit Color Difference	Perception Degree of Color Difference
0．0～0.50	The Tiny Color Difference: Travel
0.5～1.51	The Smaller Color Difference: slight
1.5～3	The Small Color Difference: Noticeable
3～6	The Big Color Difference: appreciable
Above 6	The Bigger Color Difference: much