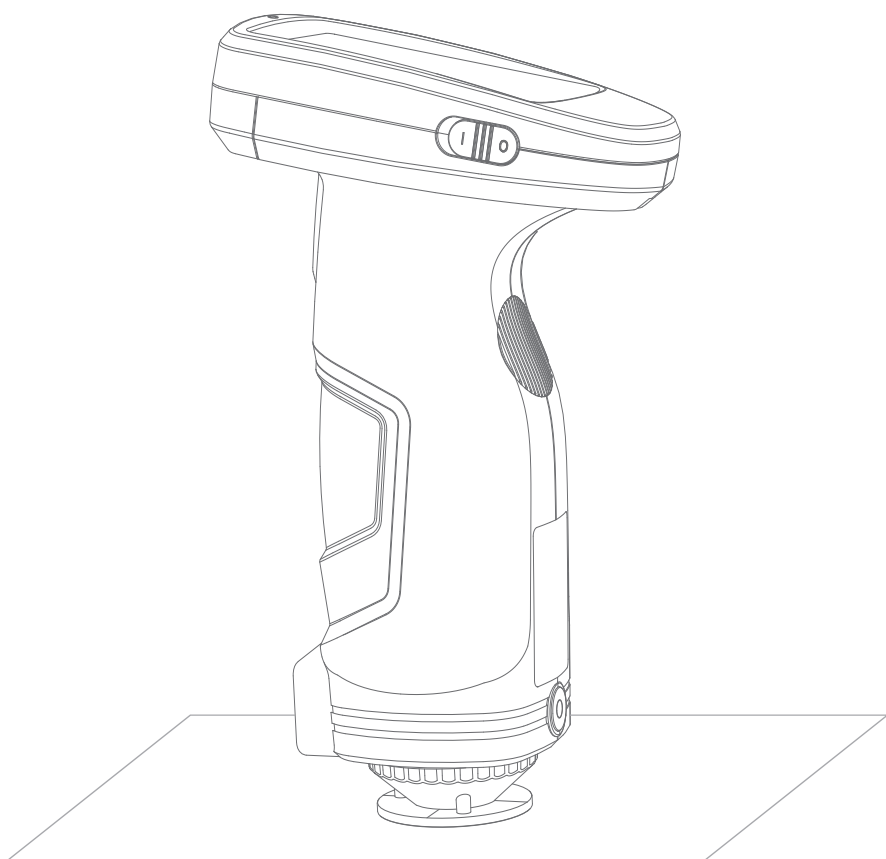# Spectrophotometer

Operation Manual

V4.0

Safety Instructions

Please read carefully and strictly abide by the following provisions to avoid accidental injury or harm. The company shall not be liable for any loss arising from the use of the instrument in violation of this manual.

Battery	1. This instrument uses built-in battery which can not be replaced with other batteries, in case of damage to the instrument or other malfunctions. 2. Do not dismantle, squeeze, strike and heat the battery, and do not put the battery in the fire or high temperature environment, otherwise the battery will explode and cause fire. 3. When the instrument is fully charged and not in use, cut off the external power supply to prevent electric shock and instrument damage. 4. If the instrument is not used for a long time, charge the instrument every two weeks, or the internal battery may be damaged and the instrument cannot be used again. 5. For the first three times of charging, it is better to get fully charged and then use it out before next charging.
External power	1. When external power supply is required, please use the standard power adapter of the instrument, or it may shorten the battery life or even cause electric shock to damage the instrument or cause fire. 2. If the instrument is not used for a long time, the external power should be cut off to prevent burning the instrument Grating Spectrophotometer and causing fire.
External power	1. Do not use the instrument in a place with flammable gas (gasoline, etc.), as this may cause a fire. 2. Do not dismantle the instrument privately, or it will be damaged. And if dust and metal foreign objects may enter the instrument, it may cause short circuit, generate electric shock, and damage to the instrument, even cause fire. 3. If the instrument emits peculiar smell like burning when using it, it should be stopped immediately and sent to the maintenance point for testing and maintenance.

Content

Content

Instruduction

This instrument is a high-precision spectrophotometer with independent intellectual property rights independently developed by the company. It is a leader in the field of portable spectrophotometers. It is suitable for precise color transfer and quality control of plastic electronics, chemical coatings, ink printing, textile printing and dyeing, automotive electronics, medical analysis, cosmetics and food analysis, etc. It is also widely used in scientific research institutions, laboratories and other fields.

Under the condition of D / 8 ° geometric optical illumination, the instrument has accurate and stable color measurement, large storage capacity, equipped with USB and Bluetooth dual communication modes, and its PC color management software has powerful extension functions, which can realized accurate measurement and presentation for different color difference formula and color indexes in a variety of color spaces.

Cautions

● The spectrophotometer is a precise measuring instrument. Please avoid drastic changes of external environment when measuring. These changes, including the flash of surrounding light and the rapid change of temperature, will affect measurement accuracy.

● Keep the instrument stable; make sure the measuring aperture touch the surface of the test sample placidly, and no shaking or shifting when measuring.

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

● Keep the instrument clean. Avoid dust, powder or solid particle entering the measuring aperture and the instrument. Please prevent the colorimeter from fierce collision or crash.

● White calibration cavity should be cleaned regularly with wiping cloth to ensure the surface clean, and kept it in a dark cool dry place.

● Please take out the battery to prevent the instrument from damage if you don't use it for a long time.

● Please keep the instrument in a cool dry place.

● Any unauthorized changes to the instrument are not permitted, or it will affect the measuring accuracy, even cause irreversible damage

1.Instruduction
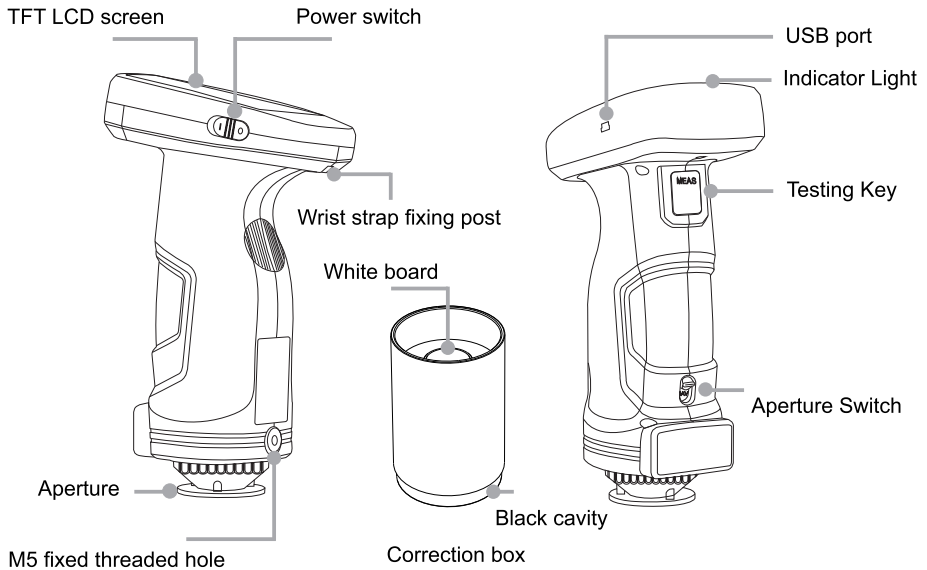
Figure 1 Interface Description

Port Description

1. Power Switch 1/0: Push the switch to "1" to turn on the instrument.
Push the switch to "0" to turn it off.

2. USB/RS-232/Charging port: common interface. The instrument automatically judges the connection. USB interface is used to connect to PC software. RS-232 port is used to connect to the printer. It can charge the instrument by connecting the USB interface to power charger or PC. The specification of the external power charger is 5V === 2A.

3. Switch / Testing button: Long press for 3 seconds to turn ON/OFF power, short press for measurement.

4. Aperture switch: used for changing the measuring aperture, setting this switch to "MAV", turn to Φ8mm aperture, while setting this switch to "SAV", turn to Φ4mm aperture.

5. Indicator light: LED has green and red colors, which are used to indicate the working status of the instrument.

* During turn-on charging, when the charging capacity is greater than 90%, the green light will be on, and the red light will be on when the charging capacity is lower than 90%.

* During the normal start-up process, the instrument is in normal state (no power adapter is connected, black and white calibration is in the validity period, the power is more than 10%, the instrument has no fault), the green indicator light is on for 10 seconds, the green light flashes during the measurement process, and it goes out after the measurement.

* When the instrument is in working mode and the power of the instrument is less than 10%, the red light will flash.

6. M5 fixed thread hole: fixed instrument thread interface. Thread type is standard metric common coarse thread, pitch 0.8mm, depth 5mm.

7. Wrist strap fixing post: used to fix the wrist strap. When the wrist strap is put on the wrist, it can prevent the instrument from slipping accidentally.

8.Calibration Board: including white board and black cavity. White board is used for white calibration and black cavity is used for black calibration. Please refer to the black and white correction section for details.

2. Operating Instruction

2.1 Power On& Off

As shown in Figure 1, press the power switch to "1", to start the instrument. Press the power switch to "0", the instrument is turned off.

If the instrument is without any operation for a long time, it will automatically enter into standby mode. At this time, press the Testing Keyor click the LCD screen to wake up the instrument.

2.2 Calibration

In the measurement interface, click   or   to enter main menu, as shown in Figure 2.

Data Manage	Calibration
Illuminant	Average
Color Space	Color Index
Display	Settings

Calibration

UV   D/8   SCI   23:32 02.09

Calibration Valid

Cal Valid Time
Left: 03h,   58m
Calibration required, Please
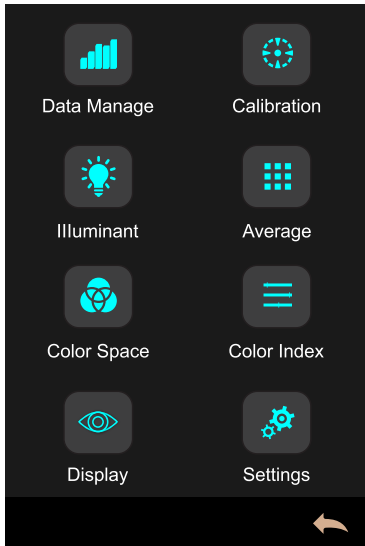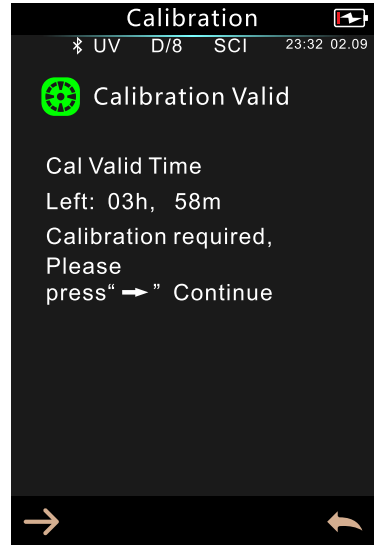press" ➡ " Continue

Figure 2 Main menu   Figure 3 White and Black Calibration

Select "Calibration" to enter white and black calibration interface as shown in Figure 3. It will show if the calibration is valid or not, and the remaining time if it is valid.

Click   to continue and enter "Black Calibration" as shown in Figure 4. Fit the measuring port to the black cavity according to the prompt, and then click the "Testing Key" for black calibration. You can click the back button   to cancel the calibration.
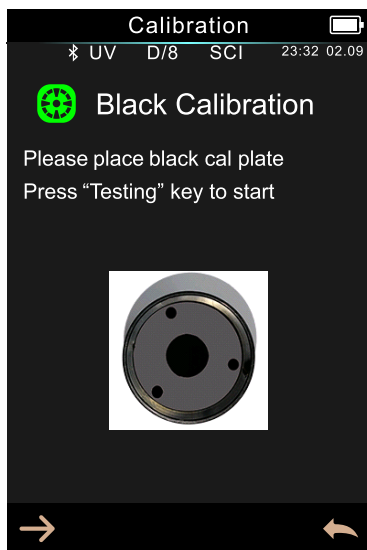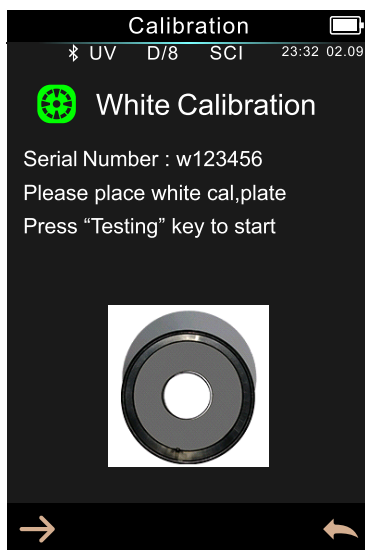
Figure 4 Black Calibration

Figure 5 White Calibration

After black calibration, it will prompt you to white calibration as shown in Figure 5. According to the prompt, confirm the serial number of white calibration plate correspond to the instrument and correct aperture setting, then put the measuring aperture on white board and press "Testing key" for white calibration, or click ↰ to cancel and quit the calibration.

2.3 Measurement Instruction

As shown in Figures 6, 7, and 8, it is working condition area at the top of measurement interface, displaying the status of measurement mode (SCI/SCE), Bluetooth and UV conditions. Under the measurement interface is a shortcut display area. You can click the corresponding shortcut key to quickly switch the test data. The middle part of the measurement interface is the data display area. The instrument displays the corresponding chromaticity data according to the current user settings. The bottom of the measurement interface is the key operation area. You can operate the current data by clicking the corresponding operation button. Figures 7 and 8 respectively show the spectral area and the color index area and quickly switch by clicking the down button ▼ .

Standard
D/8   SCI   23:32 02.09

T00888

L*: 296.15
a*: 201.20
b*: 221.60

SCI   Tolerance

— Working status area

— Data display area

— Quick display area

— Key operation area
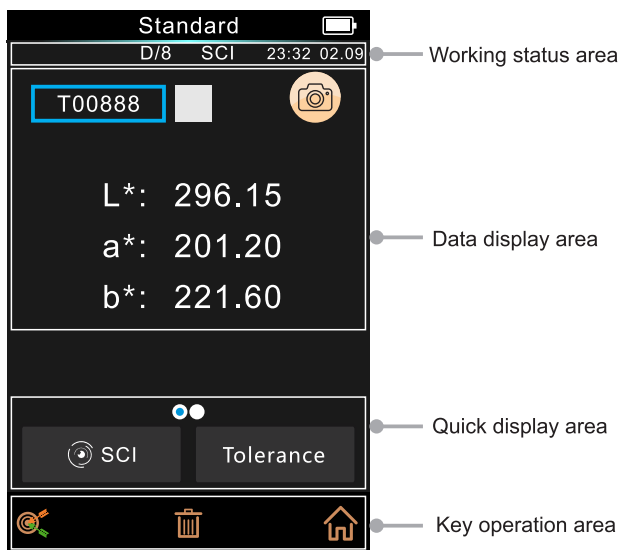
Figure 6 Standard Measurement Interface

Standard
D/8   SCI   23:32 02.09

T00888

Waveleng	Reflect
400	29.54

SCI   Tolerance

spectrum display area

Color index display area

Figure 7 Spectral Reflectance

Standard
UV   D/8   I+E   23:32 02.09

T00888

Yellowness

YI(ASTM D1925):3.91
YI(ASTM E313-00):3.70

Figure 8 Color Index Interface

2.4 Measurement

Measurement is divided into standard measurement and sample measurement.

The standard measurement is to measure the chromaticity data of standard sample, while sample measurement is to measure the color different or contrast chroma data between standard sample and target sample.
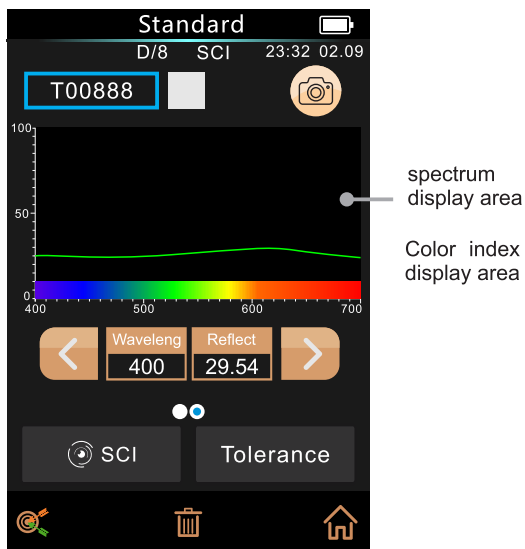
After turning on the the instrument and finishing the white and black calibration, it is ok to do the standard measurement and sample measurement (the users can set the corresponding color space and color index in the main menu interface as required (please refer to Chapter 3 for details), and the system default setting is CIE lab color space, ΔE * ab color formula, and the color index is empty). If it is not currently in the measurement interface, continuously click the return key ◄ several times in the interface or tap the "testing key" to return to the measurement interface.

2.4.1 Standard Measurement

In the "Standard Measurement" interface, Align the measuring aperture of the instrument to the tested sample and press the "Testing key" tightly. Then there is a "Beep" voice, and the LED indication light will go from flashing to off. After that, a "Beep" voice will come again, and it means measurement finished as shown in Figure 9 and in Figure 10.

Detail instructions of standard measurement interface are as following:

1) Interface Title: Indicating it is under interface of standard measurement.

2) Condition area: display system setting such as illumination,UV (on/off), Bluetooth (on/off), measurement mode and the current time, date and power etc. Only when turn on Bluetooth or UV function, they will be highlighted.

3) Camera Locating: Click to use the camera to position the measurement, then press "Testing" key to complete measurement.

4) Standard Name: Display the current measurement standard name, and click it to quickly modify, or the default is No name.

5) Display mode: Click "SCI/SCE" to refresh the current measurement data in real time.

Note: The switchable of SCI or SCE model is only to display the current data, and the sample measurement mode "SCI/SCE/I+E" is required to switch in the system setting (Refer to Chart 3.8.5). The default standard measurement model is I+E, while the default sample measurement is SCI.

6) Illuminant: Click it to quickly switch different light source among the D 6 5,A,C,F1 ~ F12 etc.

7) Color space: Click it to quickly switch different color spaces among CIE lab,CIE XYZ,Hunterlab etc.

8) Observer angle: Click it to quickly switch the observer angle 10 and 2 degree.

9) Switch to sample measurement: Click it to sample measurement.

10) Measurement aperture: Indicate the current measurement aperture on use.

11) Tolerance setting: Click it to set the tolerance of the current sample.

12) Delete/Save: If the auto-save function opens, click it to delete the current data. If the auto-save function closes, it will display save button, and click it to save the current data.

13) Page Turing: Click it to quickly switch the current data among data display area, spectrum display area and color index display area (as shown in Figure 8).

14) Wavelength switch button: As shown in Figure 10, click ◀ or ▶ ,the wave length and reflectance of the current sample will switch as range of 10nm interval.
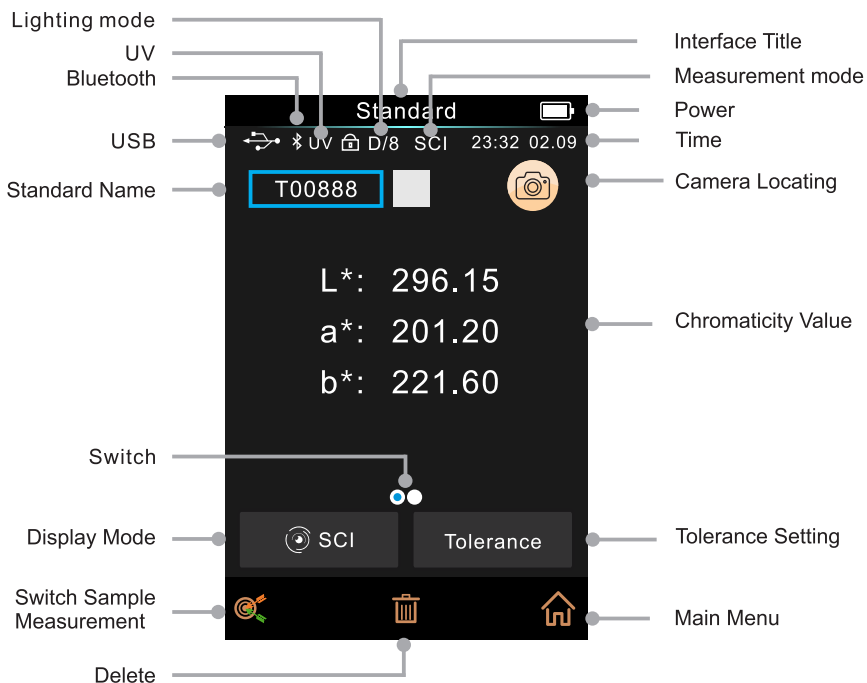
Figure 9 Standard measurement
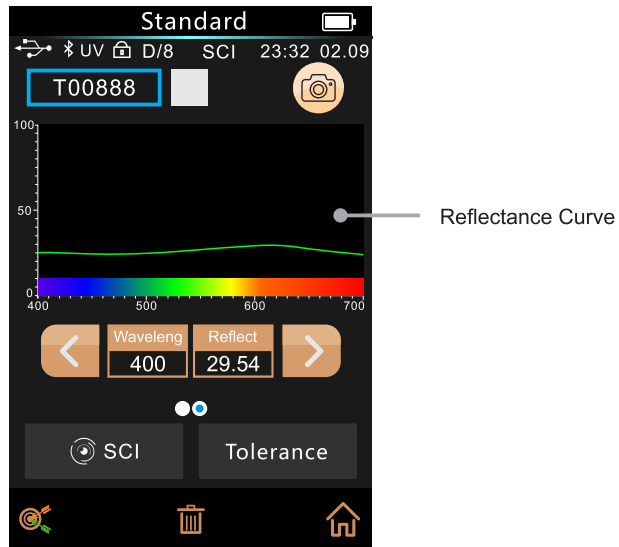
Reflectance Curve

Figure 10 Reflectance of standard measurement

2.4.2 Sample Measurement

After testing the standard, click "Sample measurement" to enter Sample Measurement interface. It is the same steps with standard measurement. After measurement, it will display as shown in Figure 11 and in Figure 12.

Sample measurement is similar with standard measurement but it will display the color difference between the current standard and measured sample.

Detail instructions of sample measurement are as following:

1) Interface Title: Indicating it is under interface of sample measurement.

2) Standard Name: Display the current measurement standard name, and all sample chromatic data is based on the current standard.

3) Sample Name: Display the current measurement sample name, and click it to quickly modify, or the default is No name.

4) Display mode: Click "SCI/SCE" to refresh the current measurement data in real time.

Note: The SCI and SCE of the display mode is the same as those of the standard measurement.

5) Sample Chromatic Data: Display the current chromatic data.

6) Delta E (Color Difference): The color difference between standard and sample.

7) Measurement Result: Display the test result under the color formula and tolerance. If the result is larger than the tolerance value, it will show red "Failure", or show green "Pass". This function only exists when you turn on the function of "Display Measurement Result" in the system setting.

8) Color Offset: Color deviation of the current sample compared with standard. It only displays color offset when you turn on the function in the system setting.
9) Wavelength switch button: As shown in Figure 12, click ◄ or ► , the wave length and reflectance of the current sample will switch as range of 10nm interval.

Sample Mame

Sample Chromatic Data

Color Offset

Delta E Color Differenc

Measurement Result

Switch Standard Measurement

Figure 11 Sample Measurement
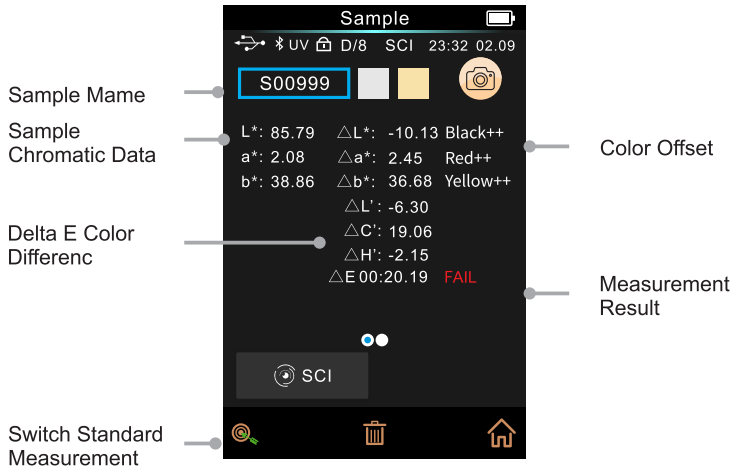
Reflectance of Sample
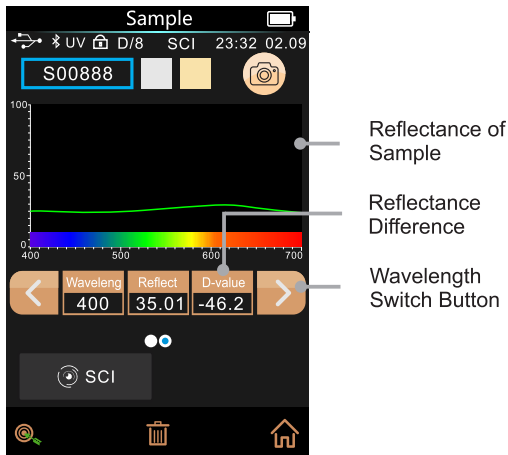
Reflectance Difference

Wavelength Switch Button

Figure 12 Reflectance of Sample Measurement

2.4.3 Average Measurement

When the measured sample is very large or relatively not very uniform, it needs to measure several points to get an average reflectance to show the sample true chromatic value. This instrument can realize 2-99 times average measurement.

In the main menu, click "Average Measurement" as shown in Figure 13, input average times and click   to confirm.

If input 1 time, it measures as usual; if more than 1, the output measurement results will be calculated on average after the set number of measurement.

Figure13 Average Measurement

2.5 Connecting to PC

The instrument has a PC software with powerful extended function, and it could realize more chromatic data analysis. It can connect to PC through USB cable or Bluetooth (Only for the model with Bluetooth function) .

2.5.1 USB Connection

First install the software on the computer, then use USB cable to connect PC and the instrument. The software will aromatically connect to the instrument. If it successes to connect, it will display the icon of USB icon or if not, it won't display USB icon. If the connection is successful, the instrument can be fully controlled by software, and relevant samples can be tested and analyzed.

2.5.2 Bluetooth Connection

For these models with Bluetooth function, it can connect to PC software through Bluetooth. 14

After installing the PC software, open Bluetooth function in the system setting, and set Bluetooth matching in the PC software setting. If Bluetooth matching successes, it could measure the sample and standard or analyze the data on the computer.If the connection is successful, the instrument can be fully controlled by software, and relevant samples can be tested and analyzed.

2.6 Print

Micro Printer is an optional accessory and is required to be purchased separately.

Users should measure the sample first, and save all records. Then connect to micro printer by USB cable. Find the printed data from the sample or standard records as shown in Figure 14, click "Operate" to pop up menu as shown in Figure 15, and select "Print Data" to print the current data.
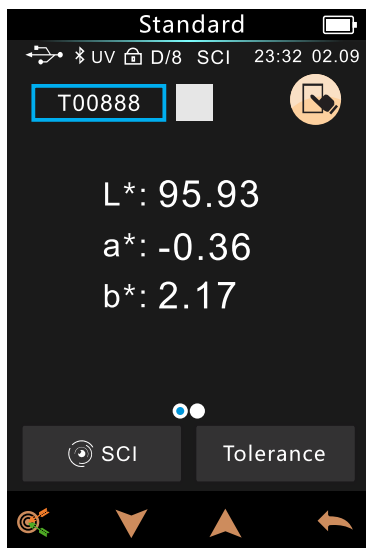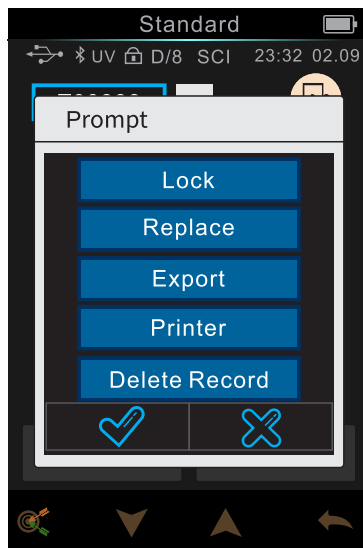
Figure14 Standard Records   Figure15 Print Data

3. Main Menu

Click [home icon] in the main menu interface or [back arrow icon] in other interfaces to enter the main menu and set all system functions from each submenu.

3.1 Data Management

Click "Data Manage" in main menu to enter data management interface as shown in Figure 16. Data management is mainly for checking, operating the measured records and inputting standard data manually.
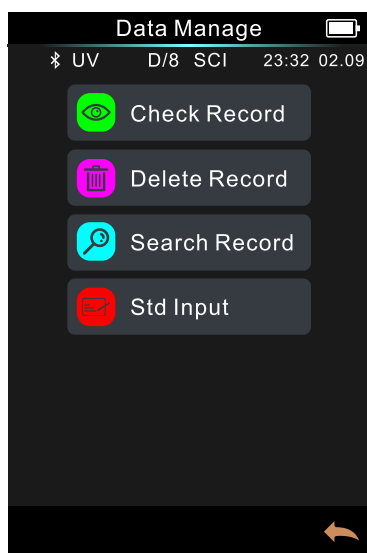
Figure 16 Data Management

3.1.1 Check Record

1)Check Standard Record

Select "Check Record" to enter "Standard Record" interface as shown in Figure 17. The measurement condition shows the standard light mode, UV status and the measurement mode, measurement time & date.
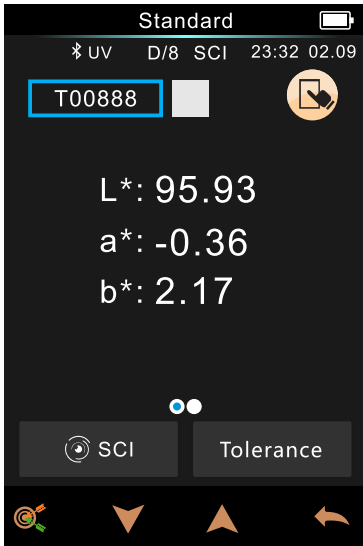
Figure 17 Standard Record

Figure 18 Reflectance of Standard Record

Click ▼ or ▲ to check previous or next record.

Click ▼ to switch among chromatic data, reflectance, color index as shown in Figure 17 and in Figure 18.

Click "Operate" to delete record, edit name, standard entering or print data as shown in Figure 19.

Figure19 Standard Record Interface

Click the standard name in standard record interface to edit as shown in Figure 20, and input new name (not over 8 characters), click ✓ to confirm or ← to cancel.

Delete record: Click "Delete Record" to delete data as shown in Figure 19, and click to confirm or to cancel delete back to operate menu.

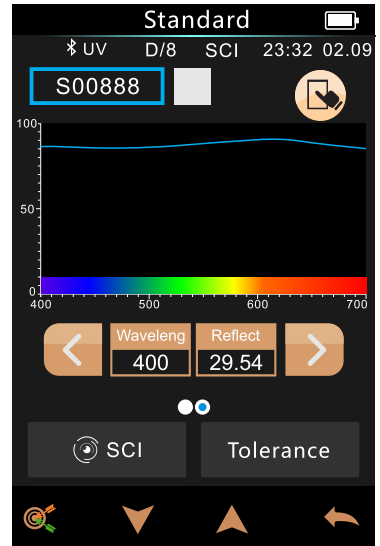Print Data: Click "Print data" to print the current record data through micro printer.

Standard entering: Click "Standard entering" to set the standard record to the current standard as shown in Figure 21, and click "Sample" to make sample measurement.

Standard Replace: Click "Standard Replace", the user can replace the current standard with a new standard and the samples under the current standard are not affected.

Standard Lock: Click "Standard Lock", the user can lock the current standard to prevent misoperation of the standard result. This standard cannot be deleted and renamed in locked mode. If you want to operate the locked standard, you need to unlock the current standard first.
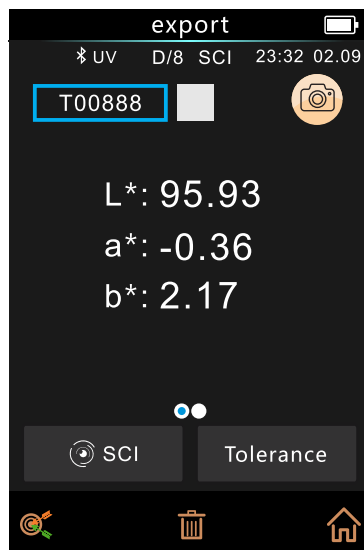
Figure 20 Edit Name   Figure 21 Standard Entering

2)Check Sample Record

Click in standard record interface to check the sample record as shown in Figure 22.
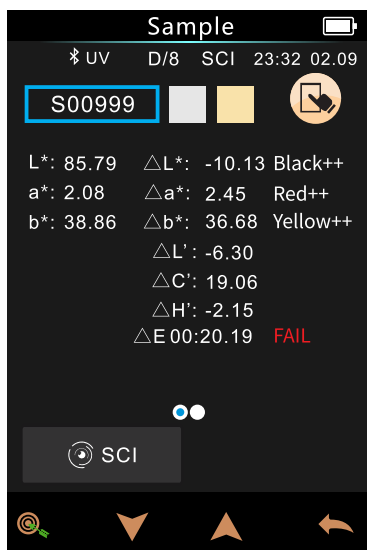
Figure 22 Sample Record
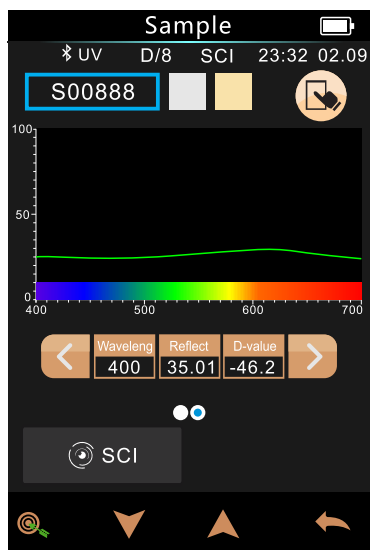
Figure 23 Reflectance of Sample Record

Click ▼ or ▲ to check previous or next record.

Click ▼ to switch among chromatic data, reflectance, color index as shown in Figure 22 and in Figure 23.

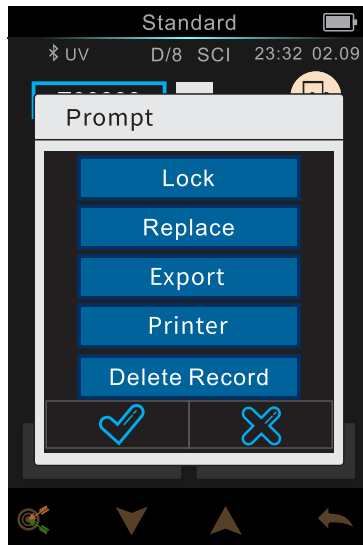Click to delete record, edit name, standard entering or print data. It is the same with standard record operation.

Delete record, print data option is the same as standard record operation.

Standard Input: Click "Standard Input" to set the viewed sample record as the new current standard, and then click "Sample Measurement" to perform sample measurement under this setting standard.

3.1.2 Delete Record

In the data management interface, click "Delete Record" to enter the delete record interface, as shown in Figure 24. Delete records include "Delete All Samples" and "Delete All Records".

Click the corresponding option, it will pop up a warning interface, click "ok" will delete all corresponding records; click "No" will cancel the operation, as shown in Figure 25.
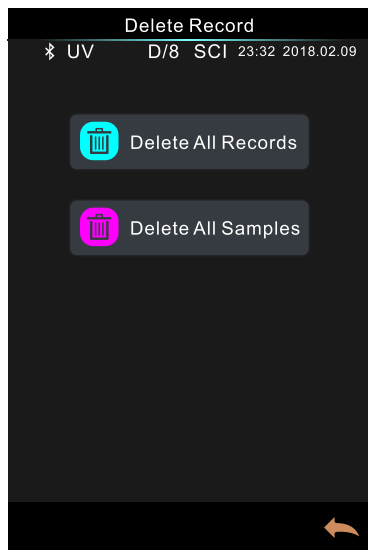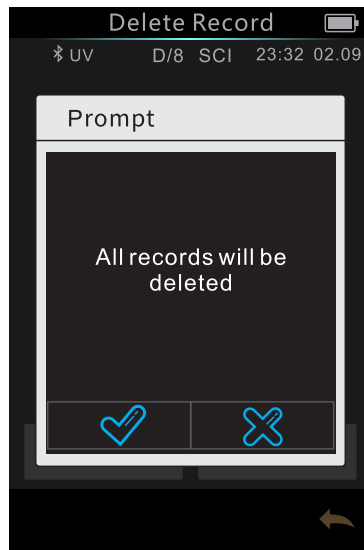
Figure 24 Delete Record   Figure 25 Delete All Samples

3.1.3 Search Record

In the data management interface, click "Search Record" to enter the search menu, as shown in Figure 26. It could choose "Search Standard Name", "Search Standard Index" and "Search Sample Name".
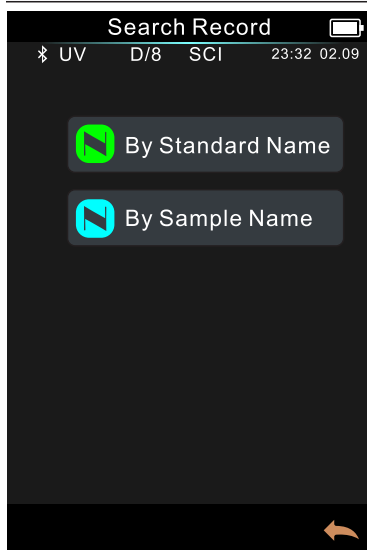
Figure 26 Search Record

Figure 27 Input Search Name

Search Standard Name

Click "Search Standard Name" to pop up to input search name interface as shown in Figure 27. Input searched name or contained character, then click ✓ to confirm, the instrument will search all standard records automatically and list all matching records, as shown in Figure 28. If there is no matching record,it will prompt "This record is empty" and return to the search record menu, as shown in Figure 29.
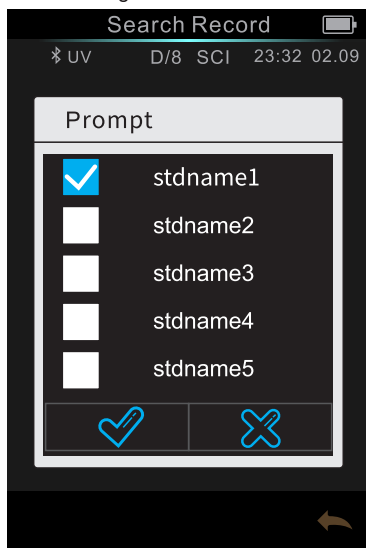
Figure 28 Search Record

Figure 29 Tips for no records

3.1.4 Standard Input

In the data management interface, click "Standard Input" to enter the standard input interface, as shown in Figure 30.
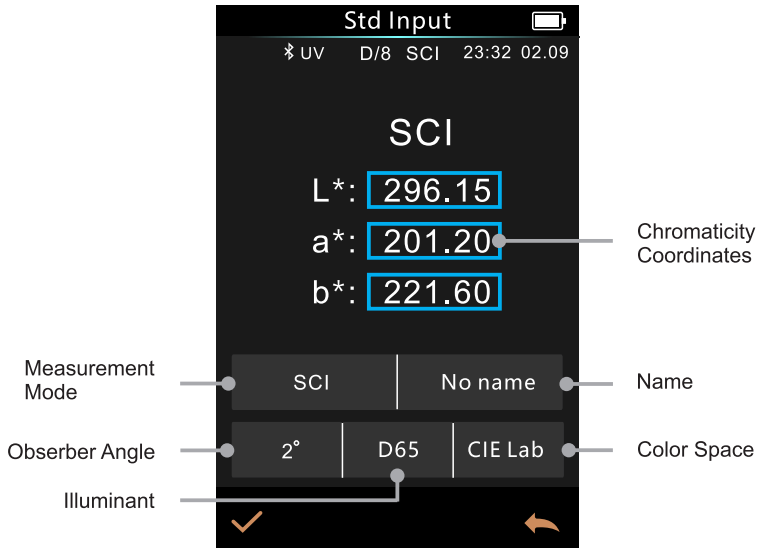
Figure 30 Standard Input

Click "Name" to input the standard name. The default is "No Name".

Click "Measurement Mode" to set the standard measurement mode, including SCI, SCE, SCI+SCE(I+E).

Click "Illuminant" to set the standard light source.

Click "Color Space" to select color space. At present, it only supports CIE LAB, and CIE XYZ.

Click "Observer Angle" to set the standard observer angle (2 or 10 degree). Click "Chromatic Coordinates" to enter the corresponding chromatic value, click "L" to input L value as shown in

Figure 31. Enter the corresponding L value and confirm. After all the information of the standard are finished and click OK, the standard will be stored in the standard record list, and its serial number will be accumulated in turn.

Note: The manual input of the standard on the instrument only supports CIE Lab / XYZ chromaticity coordinate. If you want to input the standard reflectance, you need to input it through the PC software and download it to the instrument. The input standard data matches a specific observer angle, light source, and observer angle. To view the input standard data, you need to set the corresponding conditions to view it. When viewing the standard record interface, if the observer's angle, test mode, and light source change, the corresponding chromaticity data will be displayed as "--".

Figure 31 Input L Value

3.2 Calibration

White and black calibration as a standard for chromatic data, is required to be done correctly, otherwise it will affect the validity of the data.

When the calibration environment is very different from the test environment of the current sample (for example temperature fluctuate violently), the instrument is required to be re-calibrated timely. It is also recommended to re-calibrate if the calibration time is more than 24 hours from last successful calibration.

Black and white board is required to be cleaned regularly,and kept in dark, dustproof, and dry conditions.

For black and white calibration operation, please refer to Section 2.2.

3.3 Illuminant

User should set corresponding Illuminant according to the actual test conditions. In the "Illuminant" interface, it can set the standard observer angle, light source and UV light source (different model has different configuration). In the main menu interface, click "Illuminant" to enter the light source setting interface, as shown in Figure 32.
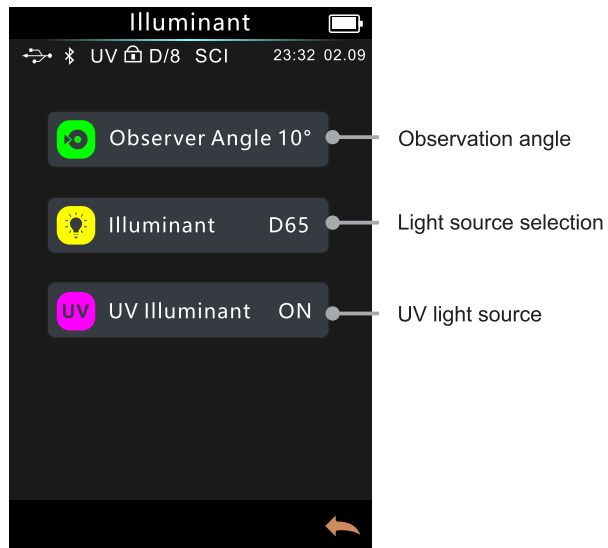
Figure 32 Light Source

Click "Observer Angle" to switch 10 degree or 2 degree. 10 degree is CIE1964 standard, while 2 degree is CIE1931 standard.

Click "Illuminant",as shown in Figure 33, users could select D65, A, C, D50, D55, D75, F1, F2(CWF), F3, F4, F5, F6, F7(DLF), F8, F9, F10(TPL5), F11(TL84), F12(TL83/U30).

Click "UV illuminant" to select the UV light source switch. It is recommended to turn on the UV light source when measuring fluorescent sample, and turn off when measuring general sample.
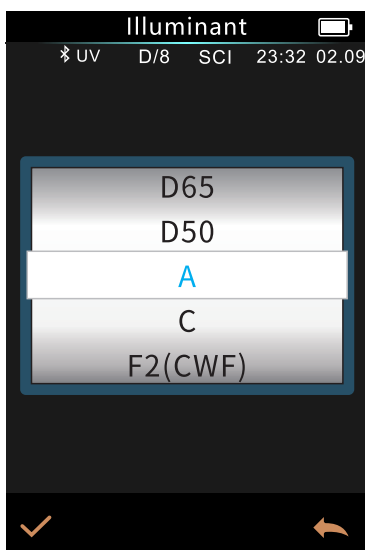
Figure 33 Illuminant

3.4 Average

When the measured sample is very large or relatively not very uniform, users need to measure several points to get an average reflectance to show the sample true chromatic value. This instrument can achieve 2-99 times average measurement.

In the main menu, click "Average", input average times and click ✓ to confirm.

If input 1 time, it measures as usual; if more than 1, it will generate measurement results after average times under standard and sample measurement.

3.5 Color Space

In the main menu, click "Color Space" to open the color space interface as shown in Figure 34. Select the corresponding color space and click to complete the setting.

Color Space	Color Index

Figure 34 Color Space   Figure 35 Color Index
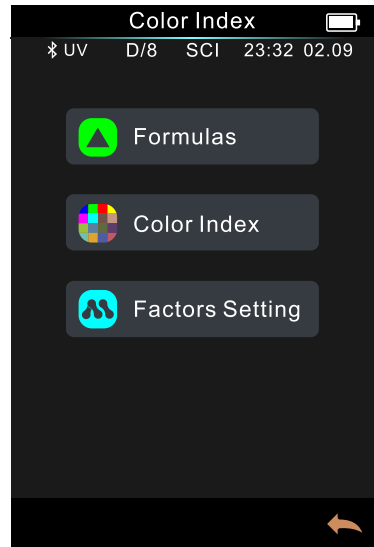
3.6 Set Color Index

Color Index interface could select the current color formula and color index, as well as set the parameter of color formula and metameric index, as shown in Figure 35.

3.6.1 Set Color Index

In the main menu, click "Color Index" as shown in Figure 35.

Click any color formula or color index to choose the corresponding color formula or color index and click ✓ to confirm as shown in Figure 36. The selected color formula will be used to calculate the color difference during sample measurement as shown in Figure 37.

Formulas 🔋
✳ UV   D/8   SCI   23:32 02.09
ΔE94
ΔE00
ΔEcmc(2:1)
ΔEcmc(1:1)
ΔEuv
✓   ↩

Figure 36 Color Formula

Sample
✳ UV   D/8   SCI   23:32 02.09
S00999   📷
L*: 85.79   △L*: -10.13 Black++
a*: 2.08   △a*: 2.45   Red++
b*: 38.86   △b*: 36.68   Yellow++
            △L' : -6.30
            △C': 19.06
            △H': -2.15
            △E 00:20.19 FAIL
            ⊙ SCI
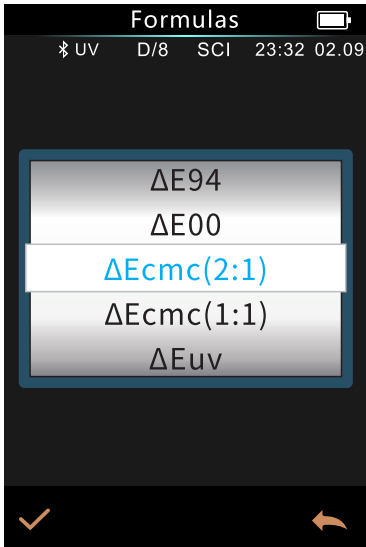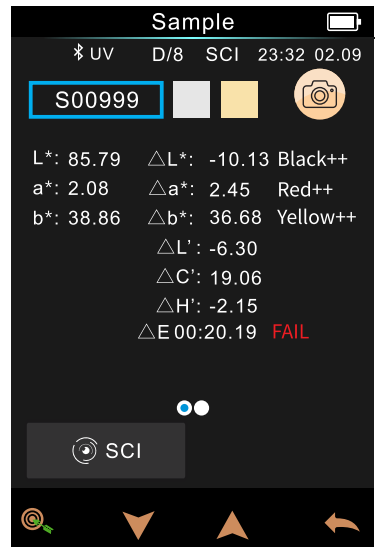
Figure 37 Color Formula ΔE00

The selected color index will display the color index on standard measurement or sample measurement (some only display on measurement according to different color index). In the measurement interface or record interface, click ▼ to the color index interface. and Yellowness index as shown in Figure 38.
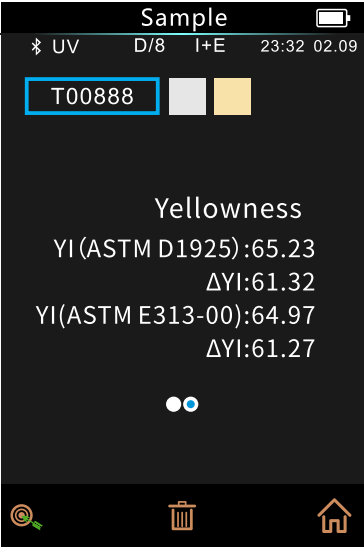
Figure 38 Yellowness Index

Figure 39 Parameter Factors Setting

3.6.2 Parameter Factors Settings and Metameric Index

In the color index interface, click "Parameter factors settings" as shown in Figure 39.

1) Setting Factors

For C I E D E 2000 (ΔE00), C I E D E 1994 (Δ E 94), C M C (Δ E C M C (l: C)), users can set L, C, H value (CMC only sets L and C). Take Δ E 94 for example as shown in Figure 40.
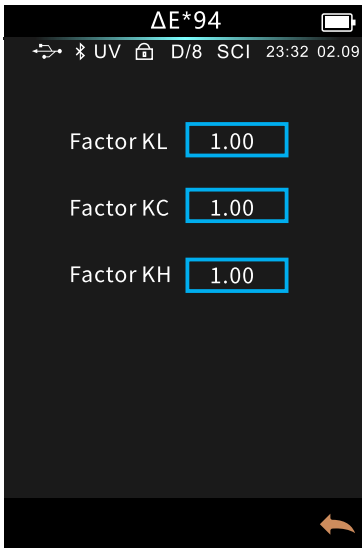
Figure 40 Δ E 94 Factors

Figure 41 Factor KL

Click KL, KC, KH to enter edit interface as shown in Figure 41, input a value to click ✓ to confirm or ← to cancel.

2)Metameric Index

In the Parameter factors settings interface, click "Metameric Index" as shown in Figure 42, separately set light 1 and light 2, and click ✓ to confirm or ← to cancel.
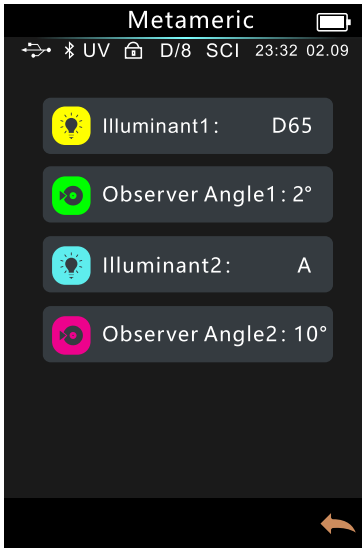
Figure 42 Metameric Settings
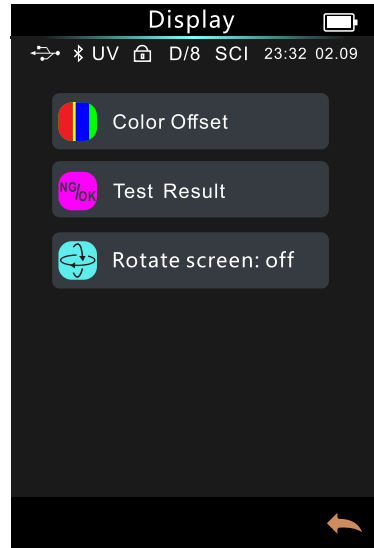
Figure 43 Display

3.7 Display Setting

In the main menu, click "Display" as shown in Figure 43. It could set color offset, test result, and operate habit.

If turn on the function of color offset, it will display the color offset on the sample measurement as shown in Figure 44; if turn off, it won't display color offset.

If turn on the function of test result, when the measurement result is larger than the tolerance value, it will display red fail, if smaller, it will display green pass, as shown in Figure 44.
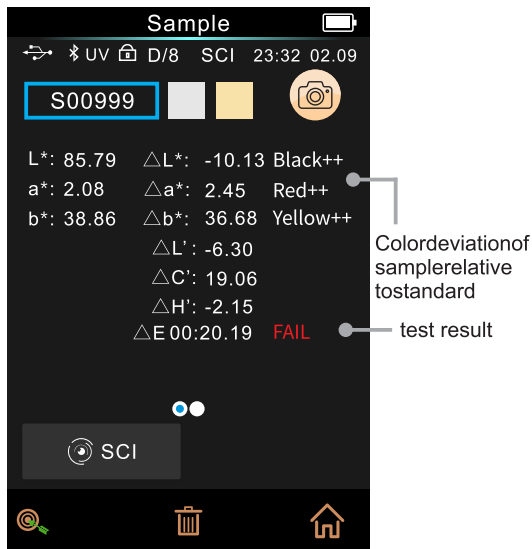
Figure 44 Sample Measurement with color offset

3.8 System Setting

In the main menu, click "System Setting" as shown in Figure 45, Figure 46 and Figure 47.

System Settings include automatic measurement save, measurement aperture, Bluetooth, buzzer, measurement mode, calibration valid, measurement control mode, language, time, screen backlight time, screen backlight brightness, etc., as well as factory Settings recovery, view software and hardware version number, SN code and other functions.

Settings

UV D/8 SCI   23:32 02.09

Quick measurement mode:ON

One click mode: OFF

Auto Save

Aperture Size

Communication interface: Ble

Buzzer
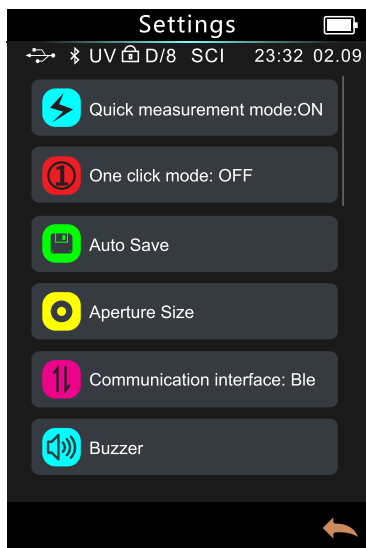
Figure 45 System Settings

Settings

UV D/8 SCI   23:32 02.09

Control Mode

Cal. Validity

Control Mode

Language

Time Setting

Backlight Time
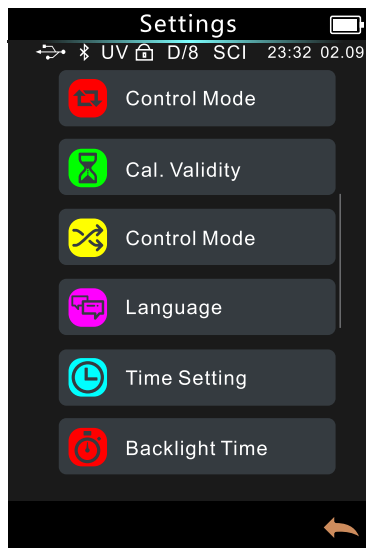
Figure 46 System Settings

3.8.1 Auto Save

When turn on the function of auto-save, it will automatically save data when measured, or it is required to manual click 💾 to save as shown in Figure 48.

Settings

UV D/8 SCI   23:32 02.09

Backlight Time

Backlight brightness

Restore factory

Instrument

System Tolerance

Print Settings

Figure 47 System Settings

Standard

UV D/8 SCI   23:32 02.09

T00888

L*: 95.93

a*: -0.36

b*: 2.17
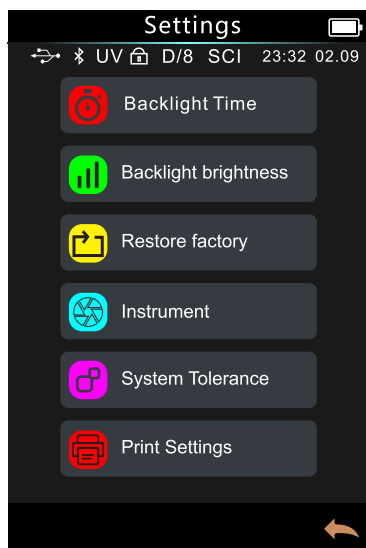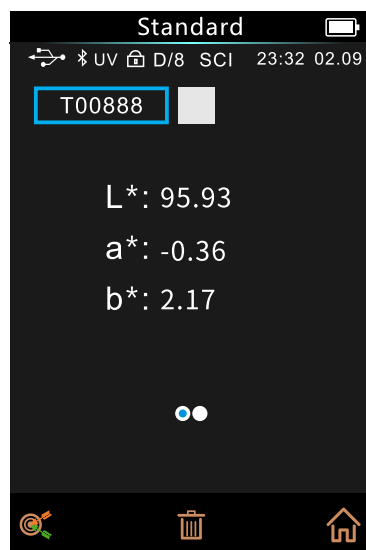
Figure 48 Manually Save Data

29

3.8.2 Measurement Aperture

The series spectrophotometer features with 8mm or 4mm aperture.

Different model has different aperture. When the area of measured sample is large and uniformity, it is recommended to use 8mm aperture, while it is small, recommenced 4mm aperture.

Measuring Aperture Switching Steps:

Step 1: As shown in Figure 49, counterclockwise rotates the measurement aperture, and take off it, then install the new aperture clockwise.When there is a voice, it means that the measuring aperture and the integrating

sphere button position are well matched, that is, the measuring aperture is installed

Step 2: As shown in Figure 49, if it is Φ4mm aperture, it is required to switch to SAV; if it is Φ8mm aperture, switch to MAV.

Step 3: Set the aperture switch in the instrument software. If the measurement aperture in the system is set to automatic mode, the instrument will automatically recognize the aperture and do the corresponding software processing when re-calibrating the black and white board, or you need to manually set the corresponding aperture.

Note: Please confirm the system measurement aperture should be the same with the actual aperture. If it is Φ4mm aperture, switch to SAV; if Φ8mm aperture, switch to MAV, or it could cause wrong test result. After switching the measurement aperture, you have to re-calibrate the instrument
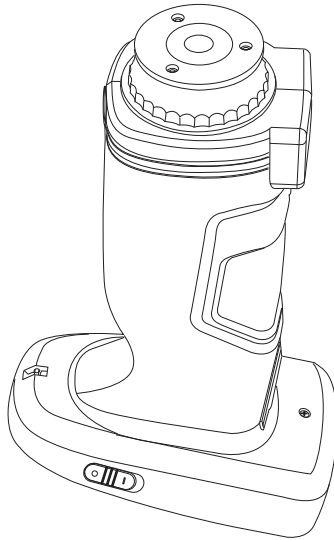
Figure 49 Measurement Aperture

3.8.3 Bluetooth

The Bluetooth® that some models have is New Mode, which can connect PC with software.

When Bluetooth® is on, the icon will be displayed on the screen. After installing PC software in the computer, turn on the Bluetooth ® in the instrument system setting, and start to pair the Bluetooth with the PC software. If Bluetooth matching successes, it could measure the sample and standard or analyze the data on the computer.

3.8.4 Buzzer

Click "Buzzer" in "Settings". When click "On", there is a voice when measuring or there is no voice when measuring.

3.8.5 Measurement Mode

SCI: Specular Component Include

SCE: Specular Component Exclude

In this instrument, the SCI / SCE test mode is switched through the traditional way of setting mechanical optical well. The SCI measurement mode is when the motor drives the paddle to block the mechanical optical well, and the SCE measurement mode is when the paddle is opened.

In the standard measurement, the instrument default completes SCI and SCE measuring mode and test time is about 3.2 second.

In the sample measurement, the instrument is measured according to users' setting. It could be set for: SCI, SCE, or I+E. I+E is SCI & SCE modes. Single SCI or SCE mode test time is about 1.5 seconds, and both SCI+SCE test time is about 3.2 seconds.

3.8.6 Calibration Validity

White and black calibration as the benchmark for chromatic data, is required to be done correctly,otherwise it will affect the validity of the data.

When the calibration environment is very different from the test environment of the current sample (for example temperature fluctuate violently) or when the data is obviously abnormal, the instrument is required to be re-calibrated timely.

If the instrument is used continuously for 8 hours or the instrument is turned on and off again, it is also recommended to make a black-and-white board calibration again.

In the system menu, click "Calibration Validity" to select as shown in Figure 50.
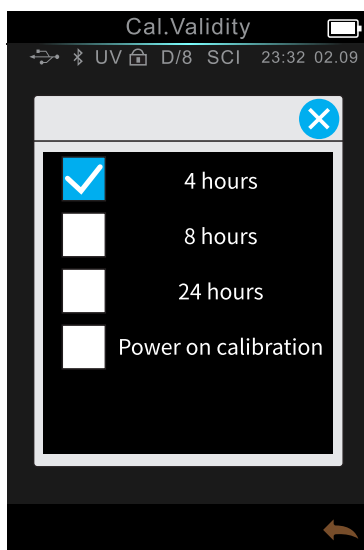
Figure 50 Calibration Validity

If power on calibration is selected, it could do white and black calibration every time when you turn on the instrument. If not, it would be only able to check records and not complete the test.

If 4 Hours validity is selected, the validity of Calibration will expire in 4 hours. If Expired, it would be only able to check records and not complete the test. Until re-calibrate it, the calibration is valid.

If 8 Hours validity is selected, the validity of Calibration will expire in 8 hours. If Expired, it would be only able to check records and not complete the test. Until re-calibrate it, the calibration is valid.

If 24 Hours validity is selected, the validity of Calibration will expire in 24 hours. If Expired,it would be only able to check records and not complete the test. Until re-calibrate it, the calibration is valid.

3.8.7 Control Mode

When the instrument communicates with the PC software, the user can set the specific measurement control mode.

In the system settings interface, click "Control Mode" to choose as shown in Figure 51.

Key: if selecting this mode, when the instrument is connected with PC software, it only could use keys to complete the test and upload data to PC software.

PC software: if selecting this mode, when the instrument is connected with PC software, the instrument only could use software to complete the test and if necessary, it is able to upload data to the instrument.

Key | PC software: if selecting this mode, the instrument could use software or keys to complete the test and upload data to PC software. This mode is the default setting for the instrument.

Note: The control mode is only valid when connecting to the PC software. If unconnected, it is only measured by keys.
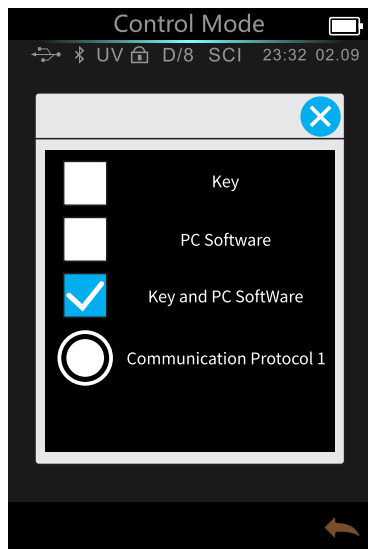
Figure 51 Control Mode
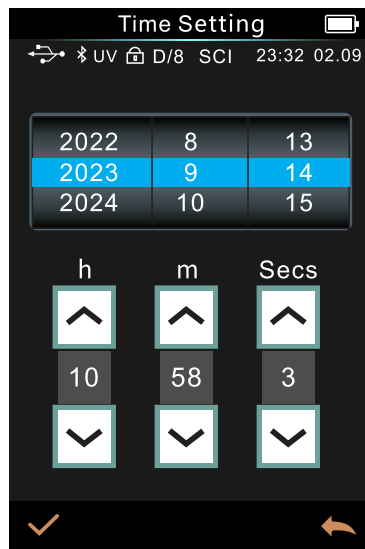
Figure 52 Time Setting

3.8.8 Language Setting

Click "Language Setting" in "Settings" interface to choose the corresponding language.

3.8.9 Time Setting

General the instrument is default set with the local time. In the setting menu to click "Time setting" as shown in Figure 52.

3.8.10 Backlight Time

Click "Backlight Time" in the system settings interface to enter the "Backlight Time" selection interface.

It includes: "Normally Open", "1 minutes", "5 minutes", "10 minutes", "30 minutes". If selecting normally open, It will not automatically stop the screen or shut down when there is no operation except no power.

If it is set to "1 minute", the instrument will be timed from the last operation, the screen will disappear after 60 seconds, and the instrument will automatically soft shut down after 3 minutes, and enter the power saving mode. "5 minutes", "10 minutes", "30 minutes" is the same setting as above.

When the screen is disappear, it is able to short press the key to light up the screen, , and if the instrument is soft shut, it is able to long press the key to wake it up. Please refer to Section 2.1 for detail. The default backlight time is "1 minute", which makes it in power saving mode.

3.8.11 Screen Brightness

Click "Screen Brightness" in the system settings interface to enter the "Screen Brightness" interface as shown in Figure 53.

Drag the slider to adjust the screen brightness. It can be adjusted according to the actual working conditions. After the adjustment is completed, click the confirmation button ✓ on the lower side to save the set time, and click the return button ← to cancel the save.
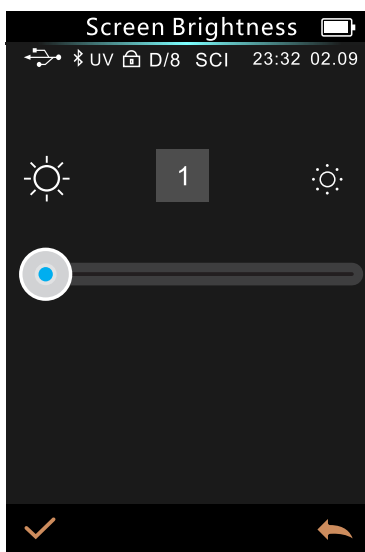
Figure 53 Screen Brightness

3.8.12 Restore Factory Settings

Click "Restore Factory Setting" in "Settings" as shown in Figure 54. Click ✓ ,the instrument will restore factory settings and all records will be cleared, while click ← to cancel this operation.

Note: Restore factory setting will delete all test data and settings. All are irrecoverable so please operate it carefully.
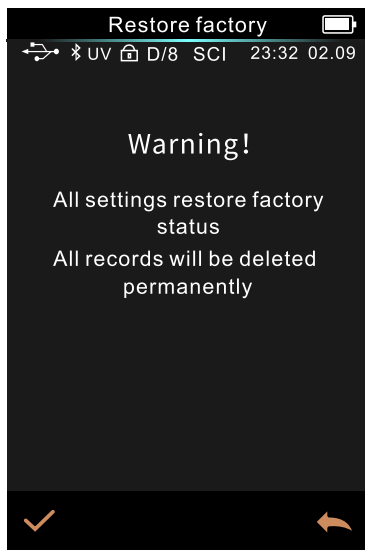
Figure 54 Restore Factory Setting

4. Daily Maintenance

1) The instrument is a precision optical instrument. This instrument is a precision optical instrument. Please keep and use the instrument properly. Avoid using and storing the instrument under humid, strong electromagnetic interference, strong light and dusty environment. It is recommended to use and store the instrument in a standard laboratory environment (temperature 20 degrees Celsius, 1 standard atmospheric pressure, humidity 50 ~ 70% RH).

2) The white board is a precision optical component. It should be stored and used properly. Avoid rubbing the working surface with sharp objects, avoid soiling the working surface with dirt, and avoid exposing the White board under strong light. Regularly clean the whiteboard working surface with a cloth and alcohol. When calibrating, clean the dust on the working surface of the whiteboard in time.

3) In order to ensure the validity of the test data, the instrument and white board are recommended to be calibrated by the manufacturer or a qualified metrology institute every one year from the date of purchase.

4) The instrument has built-in lithium battery. If not using the instrument for a long time, please charge it every 2 weeks to protect the performance of lithium battery and extend the lifespan.

5) Please do not disassemble the instrument. If there is any question, please contact the relevantafter-sales staff. Do not tear the labels, or it will affect its after-sales maintenance service.

5.Technical Parameters

5.1 Technical Features (Advance)

1. Perfect combination of beautiful appearance and the human body mechanics structural design;

2. D / 8 geometric optical structure, conforming to CIE No.15, GB / T 3978, GB 2893, GB / T 18833, iso7724 / 1, ASTM e1164, din5033 teil7;

3. Adopt combined LED light source with high life and low power consumption, including UV / excluding UV;

4. Switch 8mm & 4mm aperture (the flat/ tip measuring aperture can be switched easily, which is suitable for more tested sample)

5. Dual optical path system, the optical resolution in the visible range is less than 10nm, which can measure the SCI and SCE spectrum of the sample at the same time;

6. Accurate spectrum and lab data, used for color matching and accurate color transmission;

7. High hardware configuration: 3.5-inch TFT true color screen, capacitive touch screen, 1000 line blazed grating, silicon photocell array detector with large photosensitive area, etc;

8. USB / Bluetooth dual communication mode, wider adaptability;

9. Super dirt resistant and stable standard white calibration board;

10. Large capacity storage space, which can store more than 30000 pieces of test data

11. 2/10 standard observer's angle, multiple light source modes, multiple surface color systems, meet various standards of chromaticity indicators, and the needs of various customers for color measurement;

12. Camera locating position and Stabilizer cross measurement position;

13. PC software has powerful function expansion;

5.2 Technique Specification

**The following are high configuration parameters,
with some parameters varying for different models.**

Optical Geometry	Reflect: di:8°, de:8°(diffused illumination, 8-degree viewing angle)
	SCI (specular component included)/SCE (specular component excluded)；Include UV / excluded UV light source
	Conforms to CIE No.15,GB/T 3978,GB 2893,GB/T 18833,ISO7724-1,ASTM E1164, DIN5033 Teil7
Characteristic	double apertures for accurate color analysis and transmission in laboratory
	It is used for precise color measurement and quality control in plastic electronics, paint and ink, textile and garment printing and dyeing, printing, ceramics and other industries, and for fluorescent sample measurement.
Integrating Sphere Size	Φ40mm
Light Source	Combined full spectrum LED light source, UV light source
Spectrophotometric Mode	Flat Grating
Senso	Silicon photodiode array (double row 40 groups)
Wavelength Range	400~700nm
Wavelength Interval	10nm
Semiband Width	10nm
Measured Reflectance Range	0-200%
Measuring Aperture	MAV:Φ8mm/Φ10mm；SAV:Φ4mm/Φ5mm
Specular Component	SCI&SCE
Color Space	CIE LAB,XYZ,Yxy,LCh,CIE LUV,s-RGB,HunterLab,βxy,DIN Lab99 Munsell(C/2)
Color Difference Formula	ΔE*ab,ΔE*uv,ΔE*94,ΔE*cmc(2:1),ΔE*cmc(1:1),ΔE*00, DINΔE99,ΔE(Hunter)

Other Colorimetric Index	Spectral reflectance, whiteness (ASTM E313-00, ASTM E313-73, CIE/ISO,AATCC,Hunter,TaubeBergerStensby), Yellowth (ASTM D1925, ASTM E313-00, ASTM E313-73), Isochromatic Index Mt, Stain Fastness, Color Fastness, Strength (dye strength, coloring power), Coverage, 8-degree Glossiness, 555 tone classification, Blackness (My, dM), Color Density CMYK, Tint(ASTM E313-00), Color density, Munsell (some functions are implemented through the upper computer)
Observer Angle	2°/10°
Illuminant	D65,A,C,D50,D55,D75,F1,F2(CWF),F3,F4,F5,F6,F7(DLF),F8,F9,F10(TPL5),F11(TL84),F12(TL83/U30),B,U35,NBF,ID50,ID65,LED-B1,LED-B2,LED-B3,LED-B4,LED-B5,LED-BH1,LED-RGB1,LED-V1,LED-V2,LED-C2,LED-C3,LED-C5, Customizable light sources (a total of 41 types of light sources, some of which are implemented through upper computer/APP)
Displayed Data	Spectrogram/Values, Samples Chromaticity Values, Color Difference Values/Graph, PASS/FAIL Result, Color Offset
Measuring Time	About 1.5s (Measure SCI & SCE about 3.2s)
Repeatability	Spectral reflectance: MAV/SCI, Standard deviation within 0.08% (400 nm to 700 nm: within 0.18%) — Spectral reflectance: MAV/SCI, Standard deviation within 0.1% (400 nm to 700 nm: within 0.2%) ; Chromaticity value: MAV/SCI, within ΔE^*ab 0.02 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration) — Chromaticity value: MAV/SCI, within ΔE^*ab 0.04 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration)
Inter-instrument Error	MAV/SCI, Within ΔE^*ab 0.15 (Average for 12 BCRA Series II color tiles) — MAV/SCI, Within ΔE^*ab 0.2 (Average for 12 BCRA Series II color tiles)
Measurement Mode	Single Measurement, Average Measurement(2-99times)
Locating Method	Camera Locating,stabilizer cross position
Dimension	L*W*H=129X76X217mm
Weight	Approx 600g
Battery	Li-ion battery, 6000 measurements within 8 hours
Illuminant Life Span	5 years, more than 3 million times measurements
Displayed Data	3.5-inch TFT color LCD, Capacitive Touch Screen
Data Port	USB, Bluetooth
Data Storage	Standard 1000 Pcs, Sample 30000 Pcs
Software support	Andriod,IOS,Windows, WeChat Mini Program, HarmonyOS

Language	Simplified Chinese, English,Traditional Chinese, Russian
Operating Environment	0~40°C, 0~85%RH (no condensing), Altitude < 2000m
Storage Environment	-20~50°C, 0~85%RH (no condensing)
Standard Accessory	Power Adapter, User Guide, PC Software(Download from office website), USB cable, White and Black Calibration Cavity, Protective Cover, Wrist strap, 8mm flat aperture, 8mm tip aperture, 4mm flat aperture, 4mm tip aperture
Optional Accessory	Micro Printer, Powder Test Box
Notes	The specifications are subject to change without notice.

Appendix

1.Object Color

There are three elements to observing color: lighting source, object, and observer. Changes in any of these three will affect the color perception of the observer. When the lighting source and the observer do not change, then the object will determine the color perception formed by the observer.

The reason why an object can affect the final color perception is that the reflection spectrum (transmission spectrum) of the object modifies the light source spectrum. Different objects have different reflection spectra (transmission spectrum). (Spectrum) modulation to obtain different results, because the observer does not change, so it presents different colors, the principle is shown in the figure below.

Reflectance spectra $\times$ Light source $\times$ Standard observer

$$=\quad \begin{array}{l} L=70.95 \\ a=69.72 \\ b=40.35 \end{array}$$
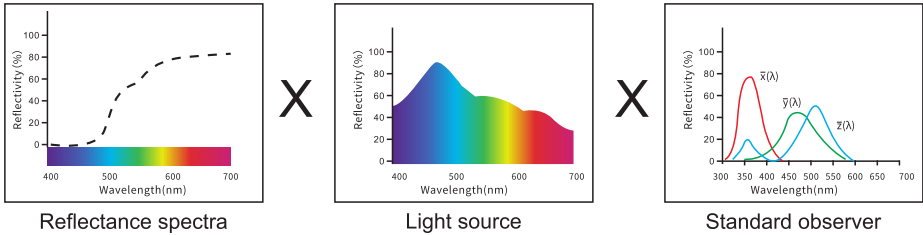
ΔL+ represent whitish, ΔL- represent blackish

Δa+ represent reddish, Δa- represent greenish

ΔL+ represent yellowish, ΔL- represent bluish

2.Color Difference Formula

CIE 1976 ΔE*ab

$$\Delta E^*_{ab}=[(\Delta L^*)^2+(\Delta a^*)^2+(\Delta b^*)^2]^{1/2}$$

$$\Delta L^* = L^*_1 - L^*_0$$
$$\Delta a^* = a^*_1 - a^*_0$$
$$\Delta b^* = b^*_1 - b^*_0$$

CIE 2000 ∆E*ab

$$\Delta E_{00} = \left[\left(\frac{\Delta L'}{K_L S_L} \right)^2 + \left(\frac{\Delta C'}{K_C S_C} \right)^2 + \left(\frac{\Delta H'}{K_H S_H} \right)^2 + R_T \left(\frac{\Delta C'}{K_C S_C} \right) \left(\frac{\Delta H'}{K_H S_H} \right) \right]^{1/2}$$

$$L' = L*$$
$$a' = a*(1+G)$$
$$b' = b*$$

$$G = 0.5 \left(1 - \sqrt{\frac{\overline{C}*^7_{ab}}{\overline{C}*^7_{ab} + 25^7}} \right)$$

CIE 1994 ∆E*ab

$$\Delta E*_{94} = \left[\left(\frac{\Delta L*}{K_L S_L} \right)^2 + \left(\frac{\Delta C*_{ab}}{K_C S_C} \right)^2 + \left(\frac{\Delta H*_{ab}}{K_H S_H} \right)^2 \right]^{1/2}$$

$$S_L = 1$$
$$S_C = 1 + 0.045\, C*_{ab}$$
$$S_H = 1 + 0.015\, C*_{ab}$$

3. Normal color difference allowable range

The allowable range of normal color difference varies depending on different industries and application scenarios. The following are the allowable ranges of color difference for some major industries
Overview:
1. Electronic device industry

Standard: △ E (color difference unit) is usually required to be less than 0.5 to ensure color accuracy in screen display, product appearance, and other aspects.

2. Plastic coating industry

Standard: Require △ E to be less than 1.0, applicable to color
control of plastic products and coating products.
3. Textile industry

General standard: △ E below 2.0 is considered an acceptable
range, especially in textile color management.Specific
standards: In some standards, it is required that the color
difference of specific parts should not be less than level 4,
which is equivalent to a color difference value between 0 and
2.0
4. Printing industry
Range: A color cast range between 1.5 and 3.0 is usually
considered normal, but specific values may vary depending on
product grade and customer requirementsSeeking to be
different.
Standard: Some standards stipulate that the color difference
value for both fine and general products should not exceed 6.
5. Railway signal flag
Standard: The color difference is less than or equal to 3.0 to
ensure the clarity and recognition of the signal flag.

Color difference and perception

ΔE	Perception
0-0.25	Very small or no color difference, ideal match
0.25-0.5	Minor color difference, usually acceptable
0.5-1.0	Minor to moderate color difference, certain applications Acceptable
1.0-2.0	Moderate color difference, perceptible to the human eye, Acceptable in specific applications
2.0-4.0	Obvious color difference, acceptable under specific conditions
> 4.0	The color difference is very large, most applicationsunacceptable