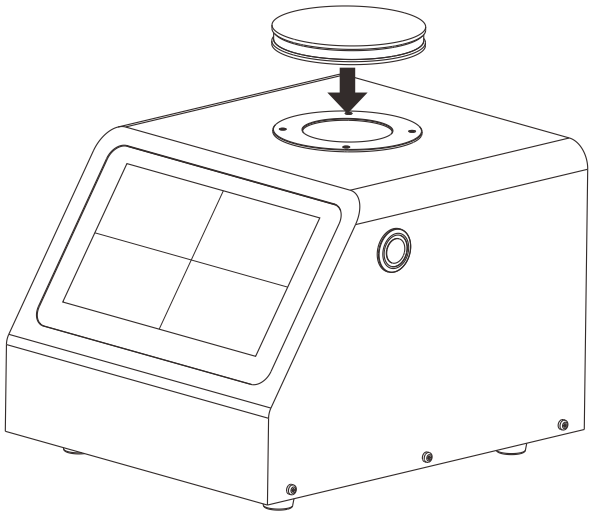
LARGE APERTURE Colorimeter

OPERATION MANUAL



V1.0

Read this manual carefully before use the Colorimeter

Safety Instructions

Safety Symbol

In order to avoid accidents caused by improper operation, the following symbols are used in this manual or on the instrument label.

This symbol instructs relative safety warnings or precautions.
Read these instructions carefully to use this instrument safely and correctly.

This symbol is a description of electrical hazards associated with electric shock.
Read these instructions carefully to use this instrument safely and correctly.

This symbol is a description of fire hazards。
Read these instructions carefully to use this instrument safely and correctly。

Represents a prohibiting execution. This is absolutely not executable.

Represents an instruction.
The instruction must be strictly performed.

Represents a prohibiting execution. Do not disassemble this instrument.

Represents an instruction.
Make sure that the AC adapter is pulled out from the AC socket.

Cautions

• No copy or copy of all or part of this manual is strictly prohibited without authorization from the company.

• The contents of this manual are subject to change without prior notice.

• When preparing this manual, we have done our best to ensure the accuracy of its contents. If you have any questions or find any errors, please contact your retailer or our authorized maintenance agency.

• The company has no liability for all consequences arising from the improper operation of this instrument。

Please keep this manual carefully for your reference at any time.

Safety Measures

To ensure proper use of this instrument, please read carefully and strictly observe the following points.

Warning: Failure to comply with the following points may pose a danger to personal safety.

	1.Do not use this instrument in a place where there are combustible or flammable gases (gasoline, etc.), otherwise it may cause fire. 2.Do not allow liquid or metal objects to enter the instrument, otherwise it may cause fire or electric shock. If a liquid or metal object enters the instrument, turn off the power immediately, unplug the AC adapter plug, and contact the nearest authorized maintenance institution.

	3.Do not force, twist or pull the power cord of the AC adapter. Do not scrape or modify the power cord, or place heavy objects on the power cord, otherwise it may damage the power cord, and cause fire or electric shock. 4.Do not use wet hand to plug AC adapter plug, otherwise it may cause electric shock. 5.If the instrument or AC adapter is damaged, or smokes, do not continue to use this instrument, otherwise it may cause fire. In this case, power should be switched off immediately, AC adapter plug removed from the AC socket, and contact the nearest authorized maintenance institution. 6.Do not measure the face directly on the sample measuring aperture, otherwise it may damage the eyes. Do not place the instrument on an unstable or inclined surface, or it may cause the instrument to slide or overturn, causing injury to personnel.
	1.Be sure to always use a standard AC adapter or an optional AC adapter and connect it to an AC socket with rated voltage and frequency. If you use a not specified AC adapter, it may damage the instrument or cause a fire or electric shock. 2.Be careful not to put your hand in the notch of the instrument, or you may get stuck in your finger and cause injury.
	Do not disassemble or refit the instrument or AC adapter, otherwise it will cause fire or electric shock.
	1.If the instrument is not used for a long time, please pull the AC adapter plug from the AC socket. Because the dust or water stains on the AC adaptor pins may cause a fire, they should be pulled out immediately. 2.When pulling the AC adapter plug out of the AC socket, be sure to always hold the plug itself to avoid pulling the power cord, which may damage the power cord and cause fire or electric shock.

Technical Specifications

Reflection measurement geometric optical structure

•Meet the D/8 (diffuse illumination 8-degree reception) geometric optical structure specified by CIE15
•Meet the geometric optical structure of CIE15 45/0 (45° ring uniform lighting 0° reception) Chromaticity standard

Note: Please distinguish different geometric optical structures according to the purchased instrument model.

Chromaticity standard:

•CIE1964 10 degree observer angle
•CIE1931 2 degree observer angle
•GB/T 3978, GB/T 18833,GB 2893
•ASTM D1003/1044, CIE No.15,ASTM E308,DIN5033 Teil7
•Reflective multi-light source
•D65,A,C,D50,D55,D75,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,F11,F12,CWF,DLF,TL83, TL84,TPL5,U30,B,U35,NBF,ID50, ID65, LED-B1, LED-B2, LED-B3, LED-B4, LED-B5, LED-BH1, LED-RB1, LED-V1, LED-V2, LED-C2, LED-C3, LED-C5 (a total of 41 light sources, all of which are implemented through the upper computer)

CATALOGUE

CATALOGUE

Instruction

This instrument is a domestic Colorimeter independently developed by our company with complete independent intellectual property rights. It adopts nano-integrated spectral devices and uses a silicon photodiode array (20 groups in double rows) for signal collection to accurately obtain the reflectance of reflective samples. Equipped with a 400~700nm full-spectrum long-life light source, the optical system has an optical resolution of 10nm. The instrument has built-in multiple color spaces and color difference formulas, enabling multi-dimensional chromaticity expression of samples. With good human-computer interaction, reliable and accurate measurement data, large storage capacity, USB and Bluetooth dual communication modes, and powerful expansion functions of PC-side color management software, this instrument is widely used in plastic electronics, paint and ink, textile printing and dyeing, printing, ceramics, food and other industries.

Cautions

(1) This instrument belongs to precision optical measuring instruments. During measurement, drastic changes in the external environment of the instrument should be avoided, such as flickering of ambient light and rapid temperature changes.
(2) When measuring, the instrument should be kept stable, the measured object should be tightly attached to the measuring port, and shaking and displacement should be avoided.
(3) This instrument is not waterproof and cannot be used in high humidity environments or water mist.
(4) Keep the instrument clean and prevent liquids, powders, or solid foreign objects such as water and dust from entering the integrating sphere and the interior of the instrument. Avoid impact or collision with the instrument.
(5) The standard board should be regularly cleaned with a wiping cloth to ensure that the working surface of the standard board is clean. The standard board should be stored in a dark, dry, and cool environment.

(6) After using the instrument, the power should be cut off and the instrument and standard board should be placed in the instrument box for storage in a dry and cool environment.
(7) Users are not allowed to make any unauthorized changes to this instrument. Any unauthorized changes may affect the accuracy of the instrument and even irreversibly damage it.

I . EXTERNAL STRUCTURE DESCRIPTION

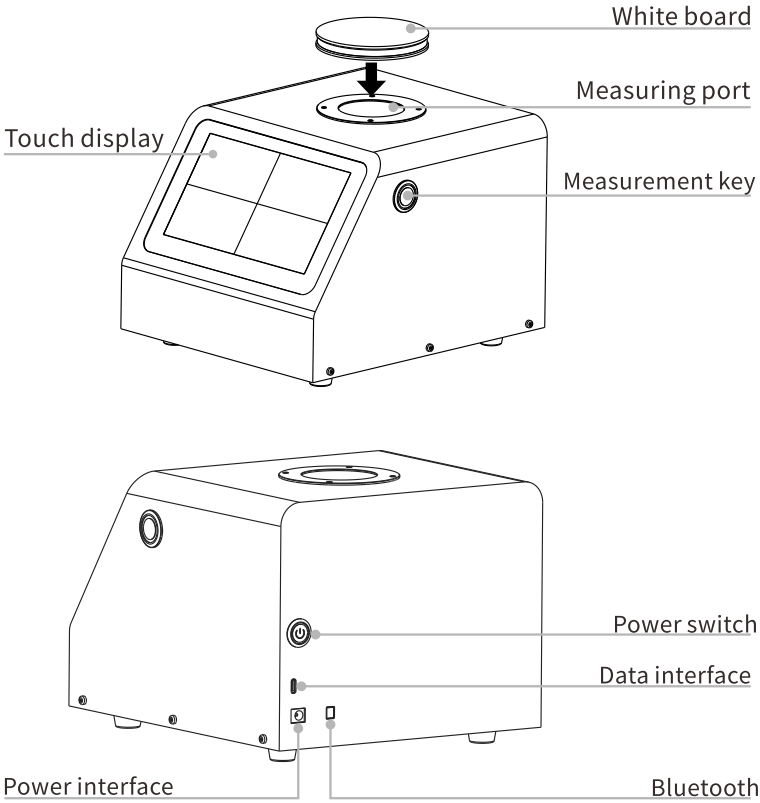


Figure 1 Colorimeter external structure diagram

Touch screen: TFT true color 7-inch, capacitive touch screen.
Wake up/measurement button: Short press the measurement button in standby mode to wake up the system, and short press to start measurement.
Measurement Port: Place the sample above the measurement port when measuring.
Data Interface: USB interface for connecting and communicating with PC, enabling more functional expansion through PC-side color management system software.
Power Interface: The power adapter is connected to AC power (AC110V-240V) to supply power to the instrument. The specification of the external power adapter is DC 24V/3A.
Power Switch: Enables hard power-on after the instrument is energized.
White Plate: Used for white calibration of the instrument.

II . Operating Instruction

2.1 Power On & Off

Press the power switch, power on the instrument, the power indicator light stays on, and the instrument starts up normally; Press the power switch, the instrument shuts down, and the power indicator light goes out.

If no operation is performed for a long time during the startup state, the instrument will automatically enter standby mode. At this time, press the measurement button to wake up the instrument and enter working mode. (Refer to section 3.8.8 Sleep Time)Please cuff off the power if not to use the instrument for a long time.

2.2 Calibration

Calibration is required under the following circumstances.

1. Before the first time of measuring after power is on.
2.When the environmental condition change relatively large (such as temperature changes exceeding 5 degrees Celsius).
3.Use the instrument for a continuous long time (over 8 hours)
4.When the user finds that the measuring data is inaccurate.

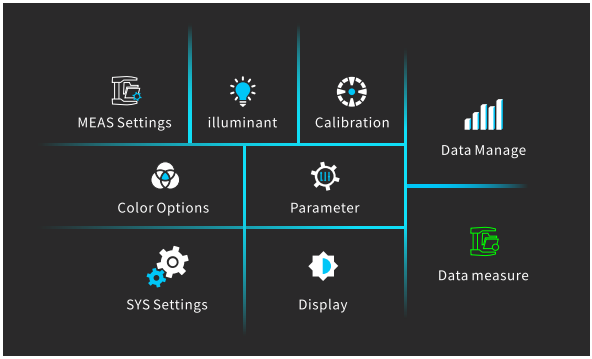


Figure 2 Main Menu

Calibration Steps:

1. Click on "Instrument Calibration" in the main menu interface to enter the calibration prompt interface (Figure 3). The interface will display whether the current calibration is effective and the remaining time for calibration to be effective.

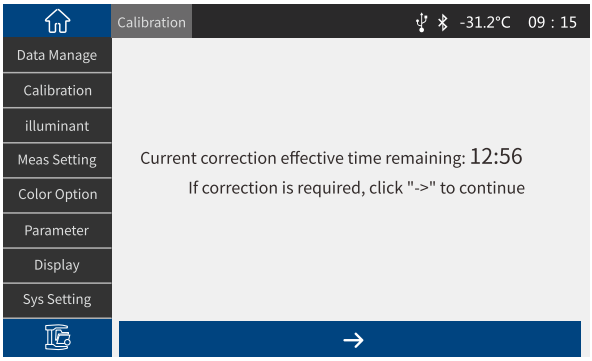


Figure 3 Calibration Interface

2. Within the calibration validity period, you need to click " → " to enter the calibration interface (Figure 4). After placing the whiteboard according to the prompts, press the measurement button to perform white calibration.

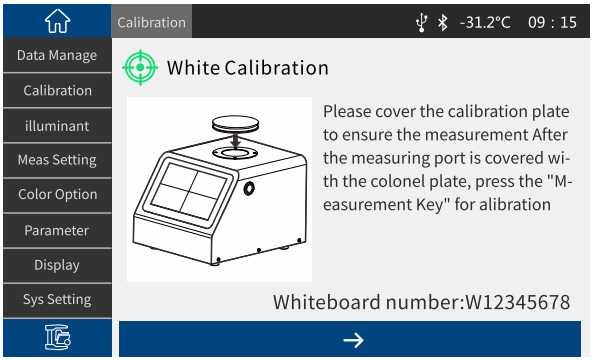


Figure 4 White Calibration

3. After completing the white calibration, it will return to the instrument calibration prompt interface, and the instrument will be re-timed according to the white calibration validity period set by the user.

2.3 Measurement

The measurement is divided into standard sample measurement and sample measurement. Standard sample measurement is generally used to measure the chromaticity data of the target sample, while sample measurement is used to measure the chromaticity or contrast chromaticity data of the sample and the target sample.

After the instrument is turned on and the correct instrument calibration is completed, the measurement can be carried out (the customer sets the corresponding light source, color space, color index, etc. in the main menu interface as needed).If you are not currently in the measurement interface, you can click the measurement interface icon ( ) to return to the measurement interface.

Note: The default color space of the system is CIE lab, and the color difference formula is ΔE*ab.

2.3.1 Standard Measurement

In the standard sample measurement interface, align the sample under test with the instrument to measure the caliber and stick it tightly, tap the measurement button, the buzzer will ”drop", and the LED indicator will blink from to off, the buzzer will “drop” again, indicating that the measurement is completed (the buzzer status in the system settings is on).After the test of the sample under test is completed, the interface is shown in Figure 5.

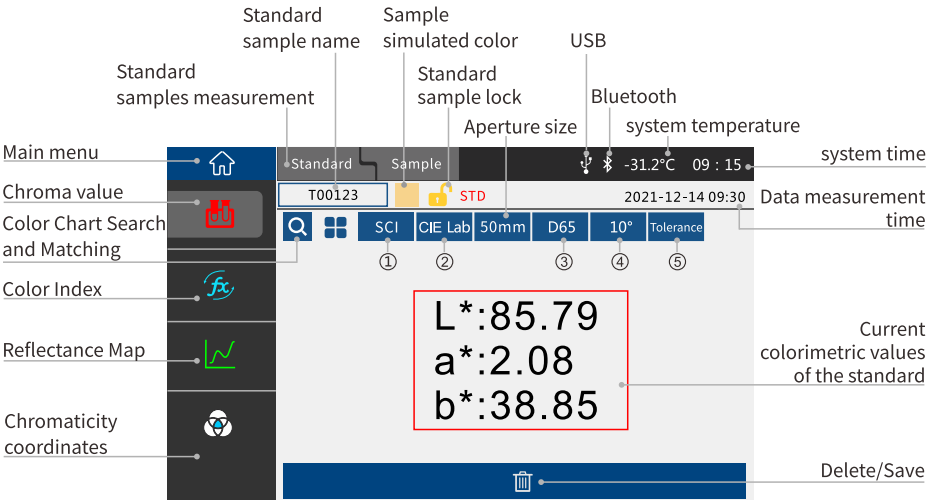


Figure 5 Standard sample measurement interface

Standard sample measurement interface description:

As shown in Figure 5, the upper part of the measurement interface is divided into a working status area, which is used to display the current setting working status and interface switching, including: main menu, standard/sample measurement interface switching, instrument connection status (USB, Bluetooth), system

temperature, system time, standard sample name, simulation color, standard sample lock, standard sample measurement time, etc., Some information needs to be displayed by clicking “ ”.

The left part of the measurement interface is the shortcut display area, you can click the corresponding shortcut keys to quickly switch the test data.

The middle part of the measurement interface is the data display area, and the instrument displays the corresponding chromaticity data according to the current user's settings.

At the bottom of the measurement interface is the operation button area, which realizes the operation of the current data by clicking the corresponding operation button.

Detailed description of the operation interface:

1.Click the words "Standard sample measurement” to enter the standard sample measurement interface, and the standard sample and data are displayed on the interface; click the words ”Sample measurement", the instrument enters the sample measurement interface, and the sample and data are displayed on the interface.
2.Click to find the color of the color card based on the latest measured data, and pair and display the data with similar color differences.
3.Click to return directly to the main interface.
4.Click to open the shortcut bar, click ① to quickly switch the measurement mode SCI/SCE data (different models, there are differences), click ② to quickly set the color space, click③ to quickly set the light source, click④ to quickly set the observer angle, click⑤ to quickly set the current standard sample tolerance.
5.Click to enter the color index data display interface to display the color index of the current measurement data. The color index can be replaced in the color index setting interface in the color options.

6.Click to enter the reflectance spectrum interface to display the reflectance curve of the current data within different 400-700nm.
7.Click to enter the chrominance coordinate interface to display the chrominance coordinates of the current data.
8.Click to delete the current measurement data. The default of the instrument is deleted at the factory. The automatic saving can be turned off in the "System Settings", and the save button is displayed .
9.Standard sample name: You can rename the current standard sample.
10.System temperature: Display the real-time temperature of the instrument.
11.Standard sample lock: The corresponding standard sample can be locked, and operations such as deletion, renaming, etc. cannot be performed. The standard sample needs to be locked in the viewing record in “Data Management”.

Note: Please set the above operating instructions according to the corresponding purchased model. There are certain differences in the functions of different models.

2.3.2 Sample measurement

Under the standard sample measurement interface, click "Sample measurement” to switch to the sample measurement interface.Align the sample under test with the instrument to measure the caliber and stick it tightly, tap the measurement button, and the buzzer will ”drop". At the same time, the buzzer will “drop” again as the LED indicator flashes from to off, indicating that the measurement is completed.After the sample measurement is completed, the interface is shown in Figure 6. The differences from the standard sample measurement are described in detail below.

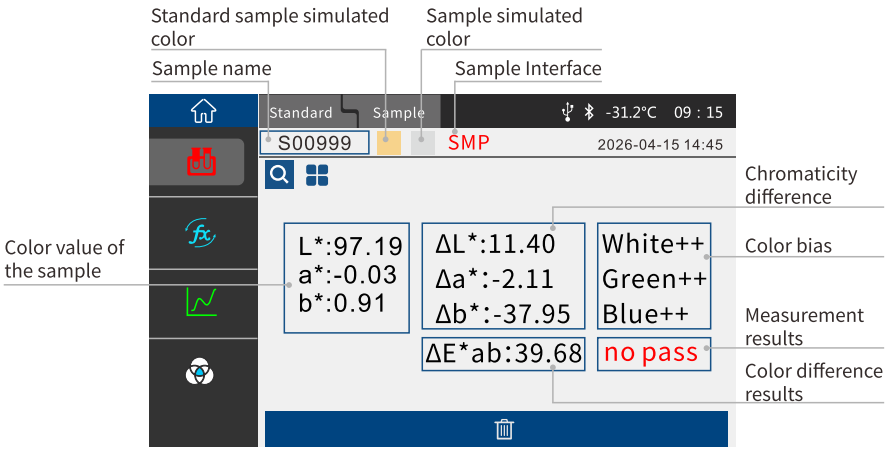


Figure 6 Sample measurement interface

1.Sample name: You can rename the current sample

2.Sample interface: Indicates that it is currently the sample measurement interface

3.Chromaticity difference: The difference between the chromaticity value of the sample minus the chromaticity value of the standard sample

4.Color bias: Displays the color bias of the current standard sample compared with the sample sample. You need to turn on the color bias in the ”Display Settings" to display it.

5.Measurement results: Display the test results of the current standard sample and the sample, determined by the tolerance set by the standard sample and the specified chromatic aberration formula. When the chromatic aberration value exceeds the tolerance, “unqualified” will be displayed in red, otherwise “qualified” will be displayed in green.It will only be displayed when ”Display Settings“ sets ”Test Results" to on.

6.Chromatic aberration value result: The specified chromatic aberration formula is calculated and displayed. You can select a different chromatic aberration formula for display in the chromatic aberration formula in ”Color Options".

2.3.3 Color Card Matching

The interface of color card matching function displays the current target color (i.e., the currently selected specimen/specimen data), according to the target color, it automatically matches the similar color card color (eight color cards can be selected), and displays two pieces of data on each page, as shown in Fig. 7, which can be flipped up and down through the buttons " Prev "," Next ". button to turn up and down the page, up to 6 data can be displayed, the color difference error range within 10, more than the range or can not find similar color card data is displayed as empty, as shown in Figure 8. If you need to select a different color card for matching filter, as shown in Figure 9.

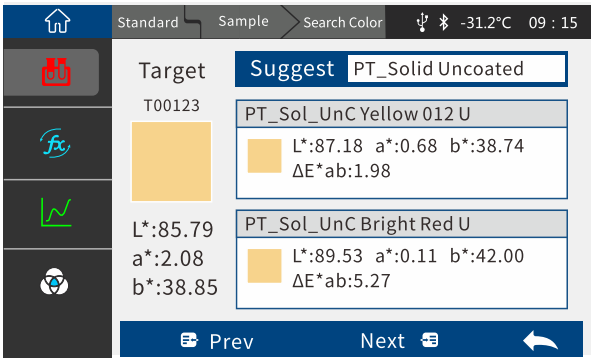


Figure 7 Color Search Function Interface-1

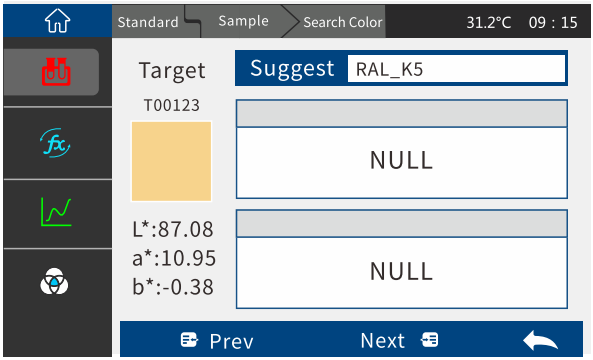


Figure 8 Color Search Function Interface-2

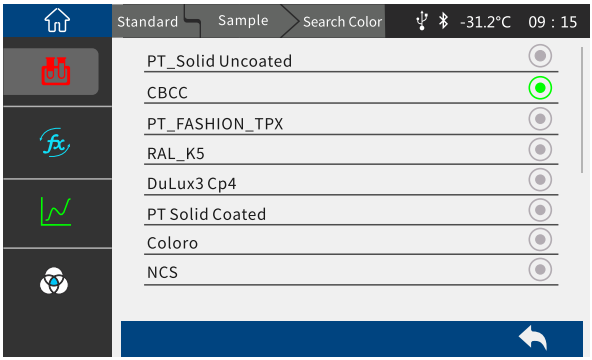


Figure 9 Select color card

Note: To enter the color search interface, you must select the measurement mode as SCI mode, the standard light source as D65, the observer angle as 10°, and the measurement data is not empty. The above conditions are indispensable.If one item is not satisfied, you cannot enter the color finding interface to use the color finding function.The prompt message is shown in Figure 10 below.

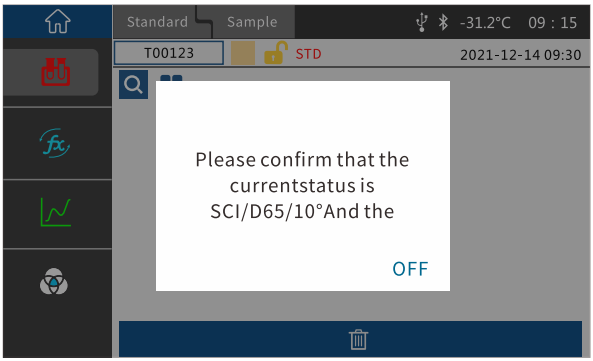


Figure 10 Color Finding Condition Tips Interface

2.3.4 Average measurement

When the item under test is relatively large, or the chromaticity is relatively uneven, the average reflectance of multiple points is obtained by measuring multiple representative test points, and then the calculated chromaticity data can better represent the true chromaticity data of the sample under test. Data. This instrument can achieve an average measurement of 1~99 times, and the average number of measurements can be set for both samples and standard samples.

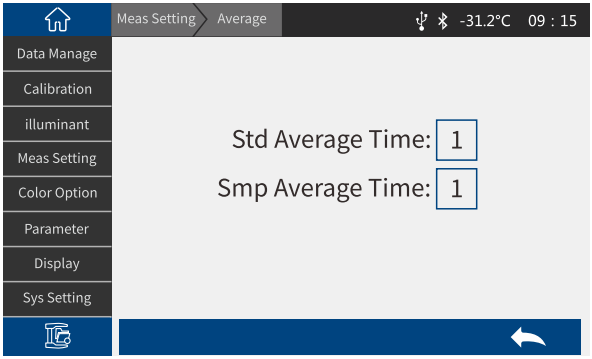


Figure 11 Average measurement setting interface

The main menu → Measurement settings → average measurement, you can enter the average measurement setting interface and set the average number of measurements of the standard sample or the average number of measurements of the sample, as shown in Figure 11 above.

2.3.5 Continuous measurement

When the measurement conditions are fixed and the sample needs to be continuously measured (such as the automated operation process of the assembly line), the continuous measurement mode can be used to reduce the operation links and save measurement time.Both standard sample measurement and sample measurement can set the number of consecutive

measurements (up to 9999 times) and the time between each measurement (999 seconds), and save the results of each measurement.During the continuous measurement process, you can press the measurement button to abort the continuous measurement.

Main menu → Measurement mode→continuous measurement, you can enter the continuous measurement setting interface and set the number of consecutive times or intervals of standard samples/samples, as shown in Figure 12. :

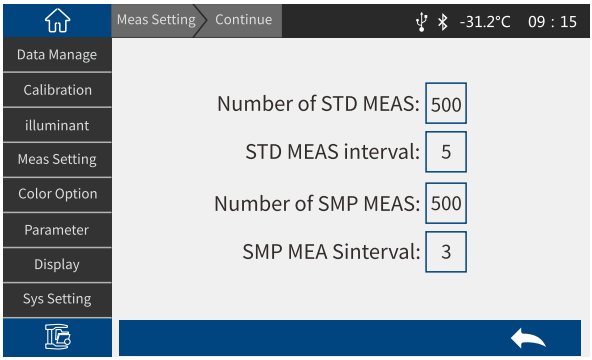


Figure 12 Continuous measurement setting interface

2.4 Connect to PC

The PC color management software has functional scalability and can achieve richer chromaticity data analysis. This series of instruments can communicate with the installed PC color management software through USB or Bluetooth module (limited to product models equipped with Bluetooth module).

2.4.1 USB Connection

After installing the color management software on the PC, connect the instrument to the PC by using a USB data cable, and the software will automatically connect to the instrument. If the connection is successful, the

status bar of the instrument will display the USB connection icon , allowing for comprehensive control of the terminal instrument and conducting relevant sample testing and analysis through the PC color management software.

2.4.2 Bluetooth Connection

For instruments equipped with Bluetooth function, first turn on the Bluetooth function in the system setting interface , and turn on Bluetooth on the PC with Bluetooth function, search for devices, and the search box will display the model and SN code of the current instrument. After turning it on, the status bar of the instrument will display the Bluetooth connection icon " ". After the connection is successful, the PC color management software can be used to fully control the terminal instrument and perform relevant sample testing and analysis.

2.5 Tolerance Setting

Tolerance is for Standards. The tolerance of Standards will affect the instrument's judgment of the sample results. System tolerance is the tolerance assigned to the Standard by the instrument by default. If the Standard tolerance is not set, the system tolerance will be used by default. Therefore, the accuracy of the system tolerance is crucial to the accuracy of the test data.

2.5.1 System Tolerance Setting

Main Menu → System Settings , slide the interface, find the tolerance threshold (Figure 13), click "Tolerance Threshold " to enter the system tolerance editing interface, as shown in Figure 14 :

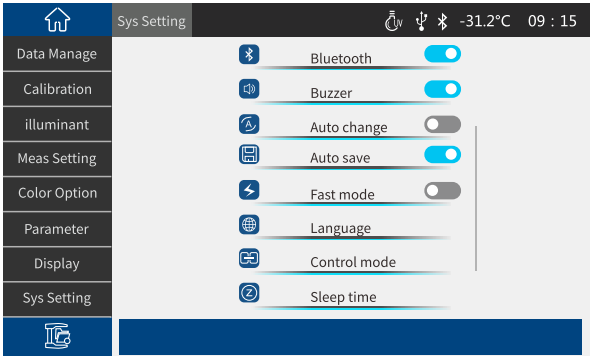


Figure 13 System Settings Interface - Tolerance Threshold

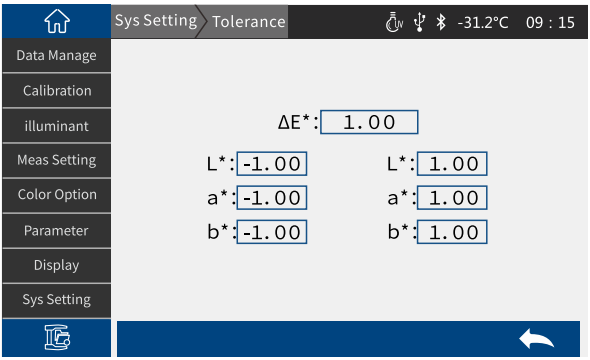


Figure 14 System tolerance setting interface

In Figure 14, ΔE* is the total tolerance of the Standard (CIE1976); L* on the left is the lower limit of the Standard tolerance, and L* on the right is the upper limit of the Standard tolerance. The upper limit on the right must be greater than the lower limit; the setting method of a* and b* is the same as L*. After all settings are completed, click " " to exit.

When the Standard uses the default system tolerance, the sample data is compared with the Standard data. Only when ΔE*, L*, a*, and b* are all within the tolerance range, the sample will be prompted as qualified, otherwise it will be prompted as unqualified (the test result prompt function is turned on).

2.5.2 Standard tolerance setting

In the Standard measurement interface (Figure 5) , click “Tolerance” to enter the Standard tolerance editing interface, as shown in Figure 15.

The standard tolerance setting is the same as the system tolerance setting, except that the setting path is different. When the user has special tolerance requirements for the standard, the tolerance is set for the standard. If the standard tolerance of the current standard is not set, the system tolerance is used by default.

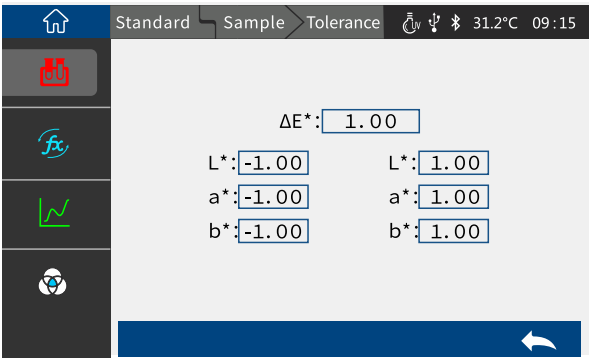


Figure 15 Standard tolerance setting interface

2.6 Printing

There are three ways for users to print the sample chromaticity data tested by this instrument. One way is to connect the instrument to the PC color management software and print it through the printer connected to the PC (refer to the color management software manual for usage); The second way is to print it through the micro printer connected to this instrument. The third way involves using an instrument to connect to a Bluetooth printer via Bluetooth for printing. The following will provide detailed explanations for the latter two methods.

Note: USB mini printers and Bluetooth printers are non-standard accessories and need to be purchased separately.

2.6.1 Use USB printer

USB Printing steps:

1,The user first measures the sample data and saves the sample records to be printed;
2,Enter "System Settings" in the main menu, click " Printer Settings " to open this function Figure 16 ;
3, Connect the micro printer to the instrument via USB;
4, Enter "Data Management" from the main menu and find the sample record to be printed (Standard record or test sample record);
5, Click " " , select "Print" in the pop-up menu and click "Confirm" to start printing the sample chromaticity data, as shown in Figure 17 :

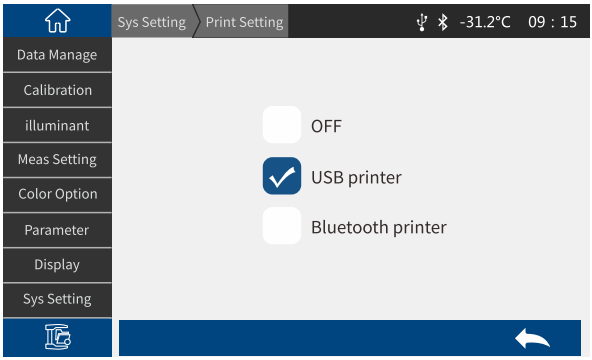


Figure 16 Printer settings

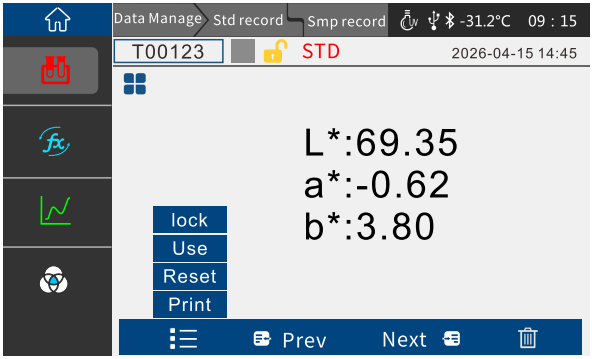


Figure 17 Sample Recording Interface

2.6.2 Use Bluetooth printer

Similar to using a USB printer, users can first measure the chromaticity data of the sample, save the sample record that needs to be printed, and then perform the printing operation.Similarly, the Bluetooth printer also supports the function of printing while measuring.

Bluetooth printer usage steps：

1. Press and hold the Bluetooth printer power supply, and see the indicator light flashing and let go.,
2. Enter the instrument system settings, print settings, and check the Bluetooth printer.,
3. Enter the mac address on the back of the BLUETOOTH printer on the BLE MAC, the length is fixed at 12 characters (for example, “4CE173C3F00 E”), and the mac address is automatically stored.,
4. Click to connect to the printer ,
5. After the Bluetooth printer is connected, find the sample record to be printed in the standard sample record or sample record, and click the “Operation” icon.,
6. Select “Print” in the pop-up submenu, and the printer will complete the printing work.

III.System Function Description

Click " " to enter the main menu. From the main menu, you can enter various submenus to implement all system function settings.

3.1 Data Management

Main Menu → Data Management , enter the data management interface. (Figure 18) Data management can realize functions such as viewing records, deleting records, searching records, and inputting Standards.

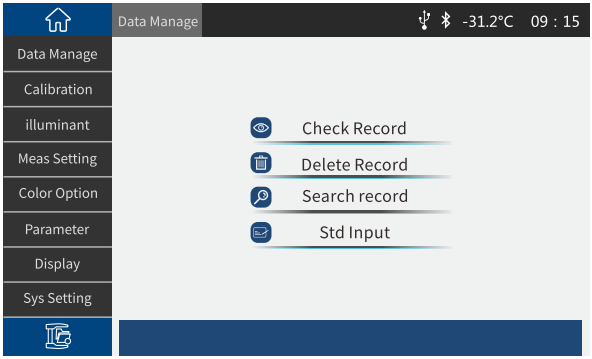


Figure 18 Data management interface

3.1.1 View Records

(1) View the Standard records

In the data management interface, click “View Records” to enter the “Standard Records” interface. The Standard will be displayed after the current data name in the Standard record interface, as shown in Figure 19.

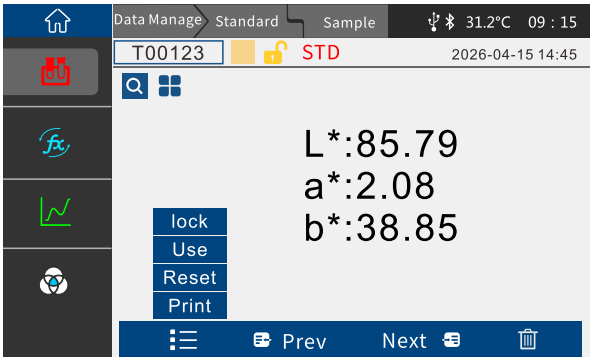


Figure 19 Standard Recording Interface

Switch records by clicking " Prev " or " Next ".
Click " ☰ " to lock data , load Standards , reset data, and print.
Click the data number position to modify the data number, and click the sample record to view the samples under the Standard.
Delete the sample record being viewed: Click " 🗑 ", select Delete, and enter the record deletion reminder interface, as shown in Figure 20. Click “Confirm” to delete; click “ Cancel ” to cancel the deletion and return to the operation interface.

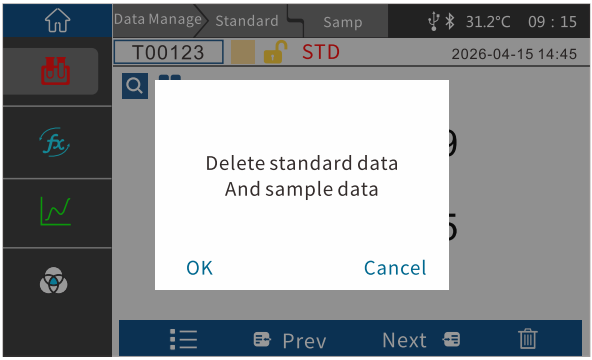


Figure 20 Deletion record reminder interface

Edit record name: Click the name to enter the name editing interface, enter a new name, press " OK " to confirm and save, and click " Cancel " to cancel the name editing operation, as shown in Figure 21 :

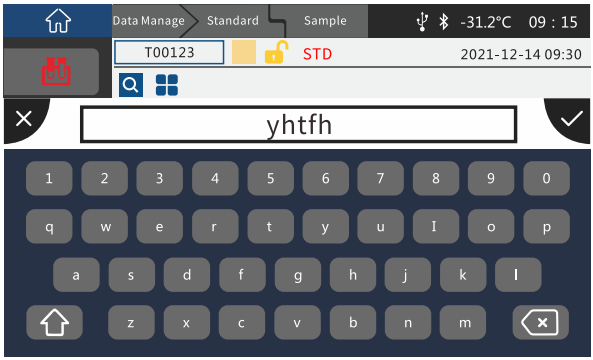


Figure 21 Edit name interface

Lock the sample record being viewed: This function can only lock the sample data. Click " " and then click Lock to set the sample record being viewed to a locked state. After setting it to a locked state, the lock icon on the sample record will turn into a locked state. (Figure 22)

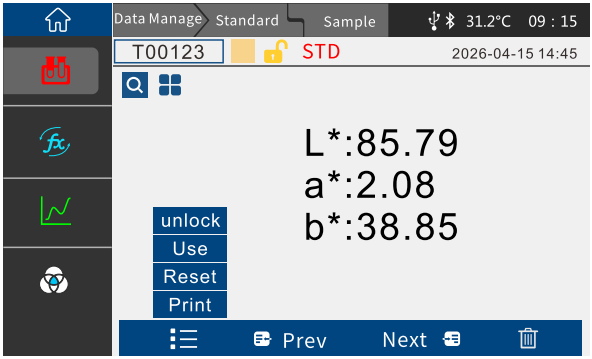


Figure 22 Standard lock

Set the Standard record being viewed as the current Standard: Click " ", then click Load to set the Standard record being viewed as the current Standard, and then click " Sample Measurement " to perform sample measurement operations under this Standard.

Reset the sample record data being viewed: Click " " and then click Reset (place the sample to be measured before clicking).

(2) View sample records

In the Standard viewing interface, click " Sample Record " to switch to the sample record interface and view the sample record corresponding to the Standard. In the sample record interface, click " Sample Record " to return to the Standard record interface. The sample will be displayed after the current data name in the sample interface, as shown in Figure 23 .

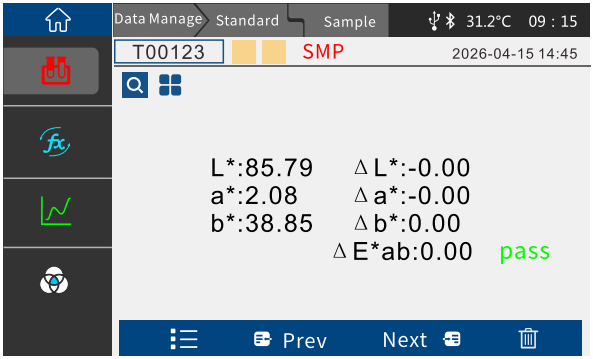


Figure 23 Sample record viewing interface

3.1.2 Deleting Records

In the data management interface, Select to enter the "Delete Records" interface (Figure 24). the deletion options are: " Delete all records " and " Delete all samples ".

Click the corresponding option to enter the deletion prompt interface. The prompt will tell you whether to delete the Standard or the sample according to your operation. Click " Confirm " in the deletion prompt interface to delete all corresponding records; click " Cancel " to cancel the deletion operation. (Figure 25)

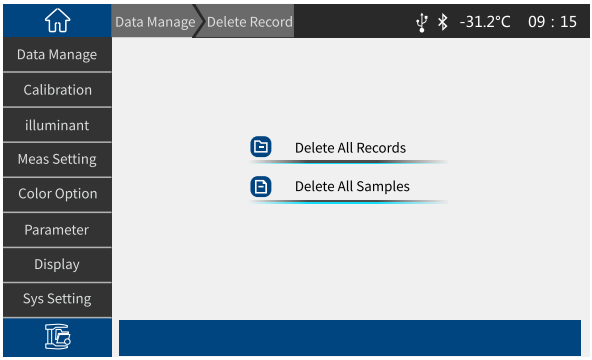


Figure 24 Delete record interface

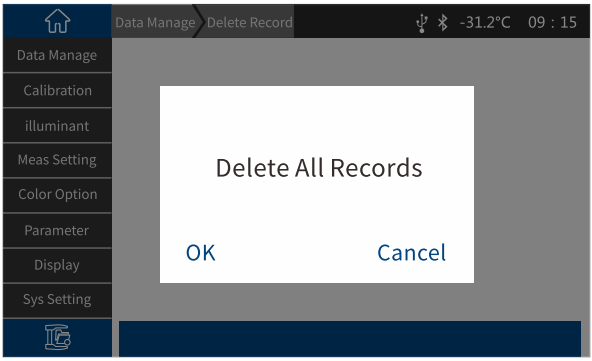


Figure 25 Delete prompt interface

3.1.3 Search History

In the data management interface (Figure 26), you can select " Search by standard name " and " Search by sample name ". If the entered name does not exist, a message "No search records found" will be displayed; otherwise, the searched records will be shown.

Note: 1. Case sensitive 2. Maximum 8 search records are displayed.

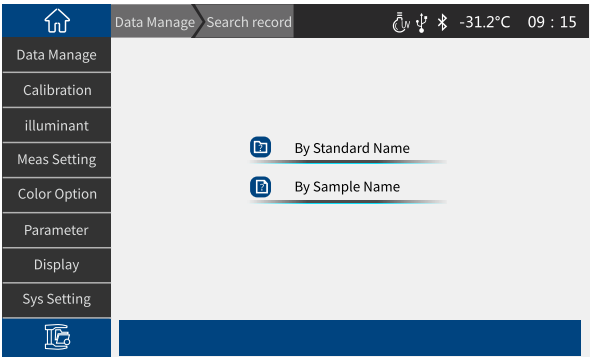


Figure 26 Search records

3.1.4 Standard input

In the data management interface, click “Standard Input” to enter the Standard input interface (Figure 27)

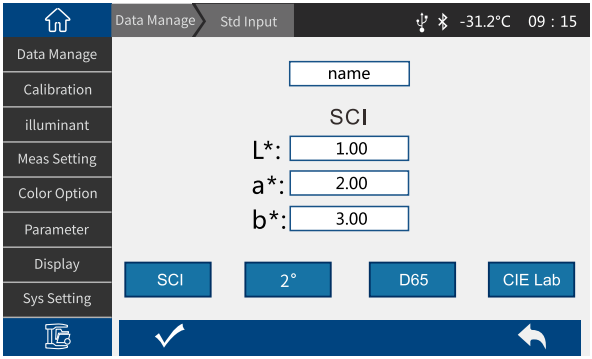


Figure 27 Standard input interface

Enter the Standard input interface. Click the 10° position to set the observer angle, and click the CIELab position to set the color space. After entering all, click " " to save the input data, and click " " to exit the Standard input interface. The saved data can be viewed and called out in the Standard record interface.

Note: Color space switching currently only supports CIE Lab and CIE XYZ input.

3.2 Instrument Calibration

This Colorimeter white calibration is the basis for measuring data. Please refer to Chapter 2.2 for specific operations.

3.3 Illuminant settings

The user sets the corresponding light source according to the actual measurement situation. In the illuminant setting interface, the system's standard observer angle and standard light source type can be set.

Main menu → illuminant settings , enter the settings interface (Figure 28) , click on the observer angle, you can switch between 10° and 2°. 10° is the CIE1964 standard, and 2° is the CIE1931 standard.

Click on the light source, you can choose D65, A, C, D50, D55, F1~F12 and other light sources Figure 29.

Note: Please select according to the purchased instrument model. The light source type and observer angle vary with different models.

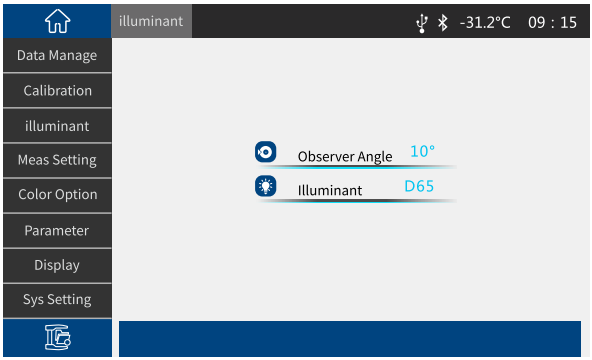


Figure 28 Illuminant setting interface

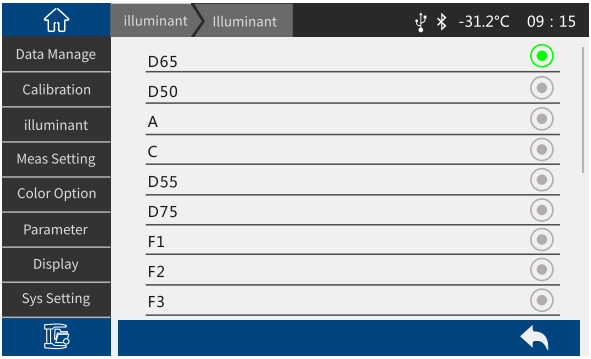


Figure 29 Illuminant optional interface

3.4 Measurement setup

Main Menu → Measurement Settings , enter the measurement settings interface (Figure 30) . Contains: average measurement, continuous measurement, select different options to perform the corresponding operation, please refer to 2.3.4 Average measurement and 2.3.5 Continuous measurement for details; You can select one measurement mode from SCI, SCE, or I+E.

Note: Please set according to the optical structure of the purchased instrument. Some models do not have the measurement mode selection function.

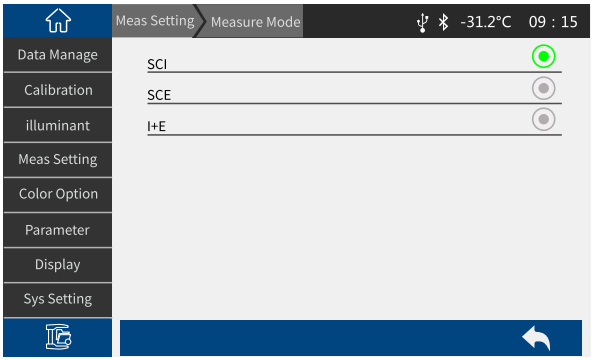


Figure 30 Measurement setting

3.5 Color Options

Options " in the main menu to enter the color options interface, which includes color space, color difference formula, and color index. (Figure 31)

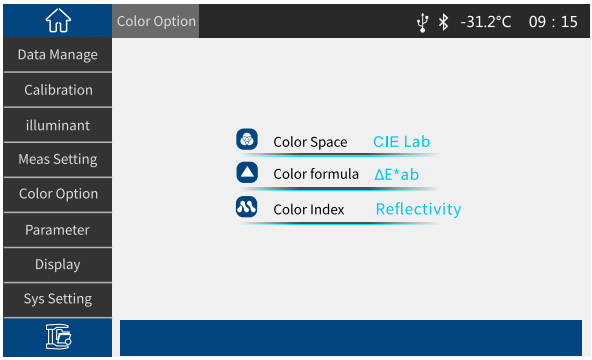


Figure 31 Color option interface

3.5.1 Color Space

Click "Color Space " under the color option to enter the color space interface (Figure 32) , and select the corresponding color space in the color space selection interface .

Note: Please select according to the purchased instrument model. The color space varies with different models.

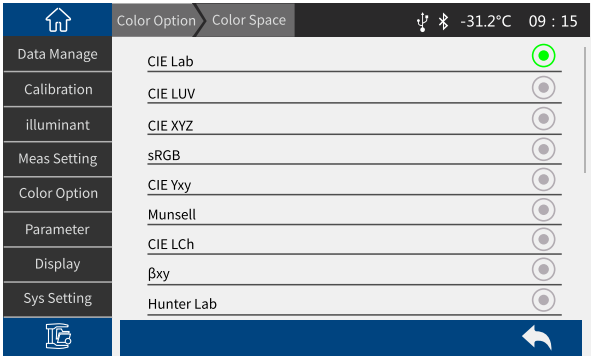


Figure 32 Color Space Interface

3.5.2 Color difference formula

To set the color difference formula, users can choose ΔE* ab , ΔEcmc(2:1), ΔE94, etc. (Figure 33)

Note: Please choose according to the model of the instrument you purchased. The color difference formula is different for different models.

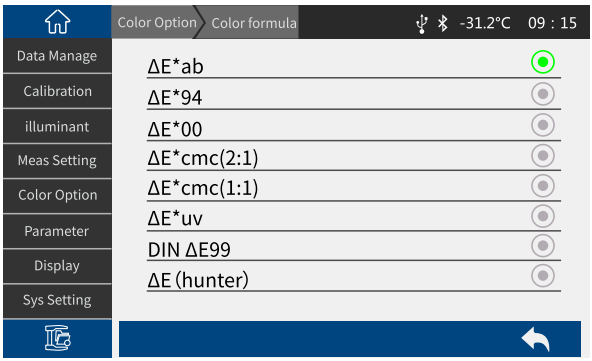


Figure 33 Color formula selection interface

3.5.3 Color Index

Color index setting (Figure 34), the selected color index will be displayed in the color index area of the standard and sample measurement interface (depending on the index, some indexes are only displayed under specific observer angles and light sources). Click " " in the measurement interface to switch to the color index display area, as shown in Figure 35 , which is the display interface of the yellowness.

Note: Please select according to the purchased instrument model. The color index varies with different models.

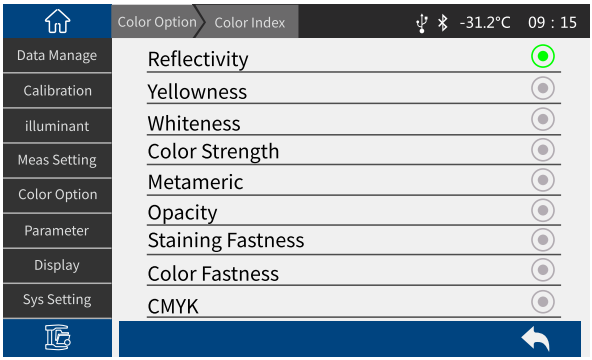


Figure 34 Color Index Interface

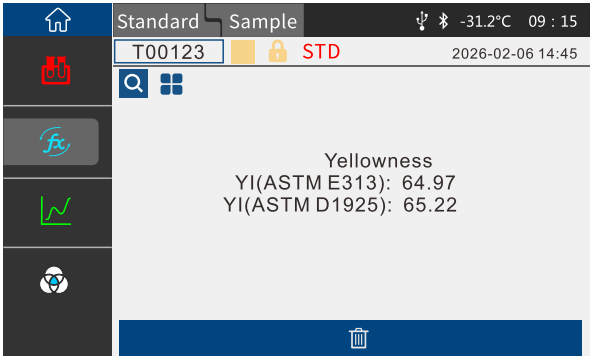


Figure 35 Yellowness display interface under Standard measurement

3.6 Parameter settings

Parameter Setting " in the main menu to enter the parameter setting interface. In the parameter setting interface, you can choose to set the color difference formula parameter factor, metamerism index, yellowness and whiteness , and strength. (Figure 36)

Note: The parameter settings vary with different models and optical structures. Please set the parameters according to your own instrument model and optical structure.

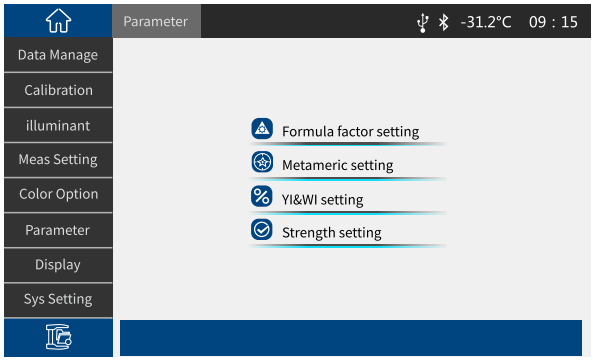


Figure 36 Parameter setting interface

Click "Color Difference Formula Parameter Factor Settings " to enter the setting interface, where you can set the parameter factors of the color formulas ΔE*94 、ΔE*2000. (Figure 37)

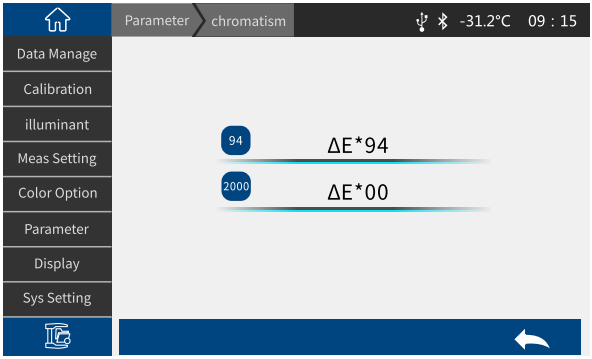


Figure 37 Color difference formula parameter factor setting interface

Click “Metamerism Index Settings” to enter the settings page (Figure 38), where you can set the standard light source and observer angle for metamerism reference 1 and reference 2.

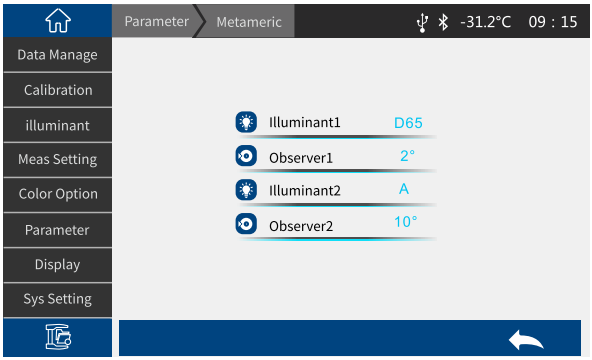


Figure 38 Metamerism index setting interface

Click "Yellowness, Whiteness Settings" to enter the settings interface, where you can select the yellowness or whiteness index standard to be displayed. (Figure 39)

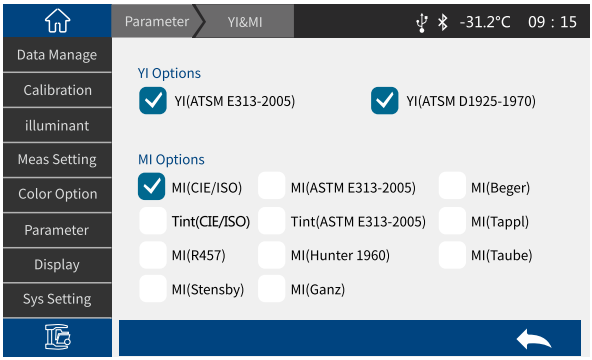


Figure 39 Yellowness and whiteness setting interface

Click "Strength Setting" to enter the setting interface, where you can select the strength type to be displayed and specify the strength wavelength position. (Figure 40)

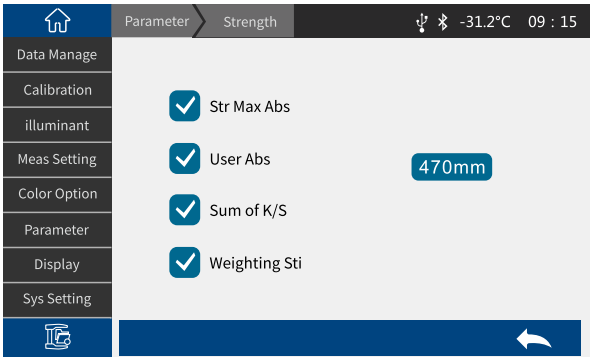


Figure 40 Color Strength setting interface

3.7 Display Settings

Click "Display Settings" on the main menu interface to enter the display settings interface (Figure 41) . In this interface, you can set whether to open the color bias, test result prompt, spectrum curve or spectrum difference display , etc.

When the color deviation is turned on, the color deviation of the sample compared with the Standard will be prompted during sample measurement. When it is turned off, there will be no corresponding prompt.

If the test result prompt is turned on, when measuring the sample, if the test result exceeds the tolerance range set by the Standard, a red font " fail " will be displayed. If the error of the sample is within the tolerance range allowed by the Standard, a green font "pass" will be displayed.

If the spectrum curve display is turned on, click " " in the measurement interface to display the spectrum curve. If the spectrum difference is turned on, the difference between the sample and the standard (sample spectrum minus standard spectrum) will be displayed.

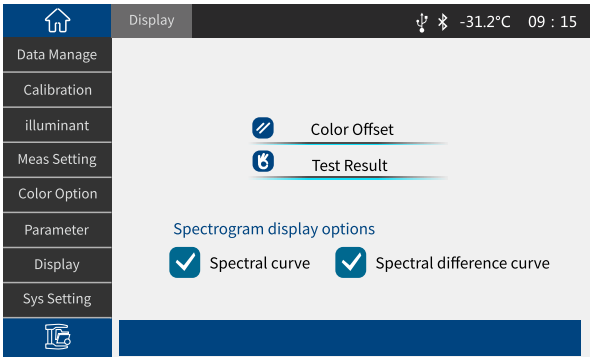


Figure 41 Display setting interface

3.8 System Settings

Click "System Settings" in the main menu to enter the system settings interface. (Figure 42,43)

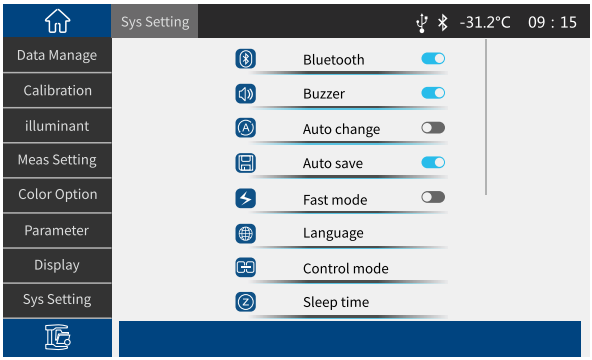


Figure 42 System settings interface 1

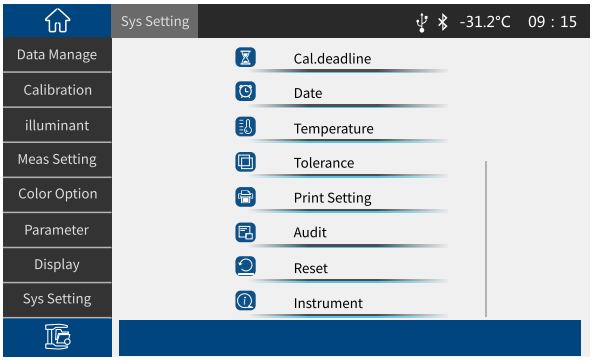


Figure 43 System settings interface 2

System settings include: Bluetooth, buzzer, auto switch, auto save, fast mode, language setting, control mode, sleep time, calibration validity period, system time, temperature threshold, tolerance threshold, print settings, reset instrument, about instrument.

3.8.1 Bluetooth

For instruments equipped with Bluetooth , click the menu item to toggle Bluetooth on or off.

3.8.2 Buzzer

Switch the buzzer on or off. When the buzzer is on, there will be a beep when the measurement key is pressed.

3.8.3 Automatic switching

When automatic switching is turned on and data is measured, the interface will automatically switch to the sample measurement interface after the Standard measurement is completed.

3.8.4 Automatic saving

Automatic save function is turned on, each sample tested will be automatically stored in the instrument. Otherwise, after the sample test is completed, the measurement record will not be automatically saved and you need to manually click " " to save it. (Figure 44)

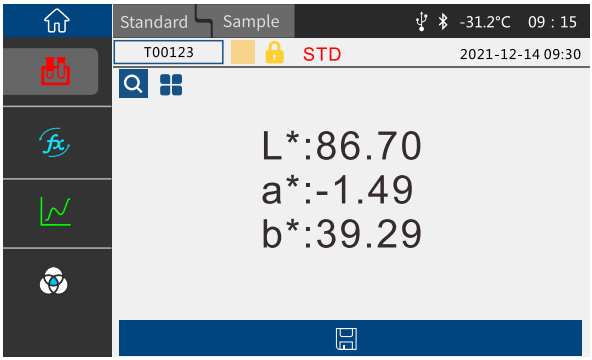


Figure 44 The auto-save interface is not turned on

3.8.5 Fast Mode

When the fast mode is turned on, the instrument measurement time will be shortened.

3.8.6 Language Settings

Language setting is used to set the language of the instrument interface. In the system setting interface, click "Language Setting" and then select the corresponding language to confirm.

3.8.7 Control Mode

When the instrument communicates with the PC color management software, the customer can set a specific measurement control method as needed. Click

"Measurement Control Method" in the system settings interface to open the measurement control method selection interface. There are three options: button, PC software, button | PC software. Select the corresponding method and confirm. (Figure 45)

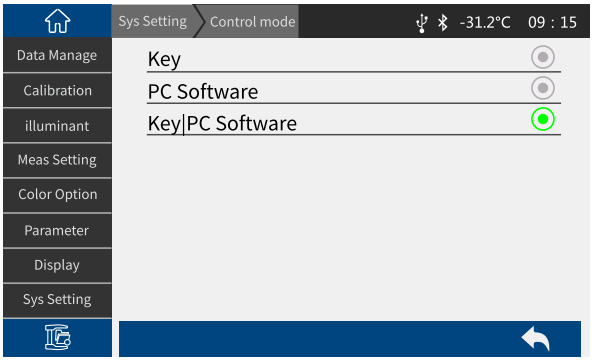


Figure 45 Measurement control mode configuration interface

Button: When this mode is selected, the user can only measure through the instrument measurement button when the instrument communicates with the PC software. After the measurement is completed, the test results will be automatically sent to the PC .

PC software: When this mode is selected, the instrument communicates with the PC software. The instrument can only be measured by issuing instructions through the PC color management software to control the instrument, complete data testing, and upload data to the PC software.

Button | PC software: Select this mode, the user can complete the sample test through the instrument test button or PC software instructions, and upload the data. This mode is the default selection mode of the instrument.

3.8.8 Sleep time

Sleep Time " in the system settings interface to enter the sleep time settings interface. (Figure 46)

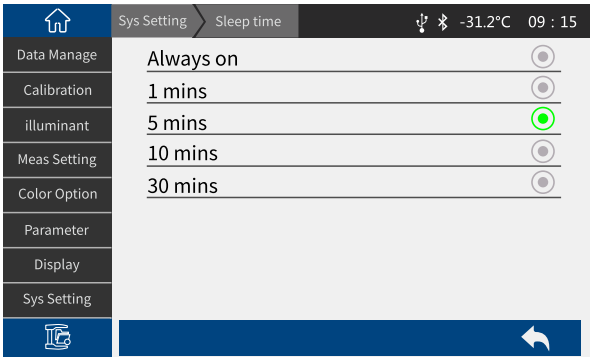


Figure 46 Sleep time setting interface

Sleep time are: always on , 30 minutes, 10 minutes, 5 minutes, 1 minute. If always on is selected , the screen will not automatically turn off when there is no operation; if set to other modes, the instrument will start counting down from the last operation, and enter the power saving screen state if there is still no operation after the countdown ends.

When the instrument enters the power-saving screen-off state, you can wake up the instrument by short pressing the test key.

3.8.9 Calibration validity period

validity period " in the system setting interface to enter the calibration validity period interface (Figure 47). Set the calibration validity period. When the validity period exceeds the validity period, the instrument will prompt you to calibrate again. The optional calibration validity period is 4 hours, 8 hours, 24 hours , and power-on calibration.

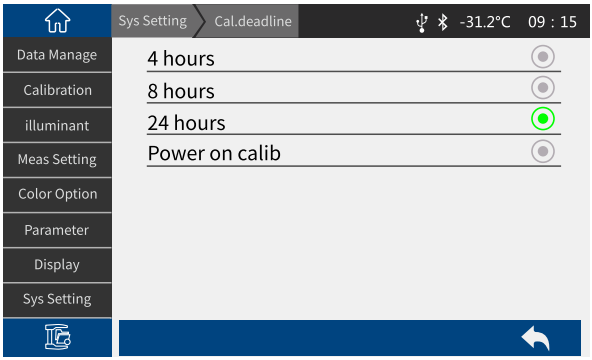


Figure 47 Calibration validity settings interface

3.8.10 System time

When the instrument leaves the factory, it is usually synchronized with the local time of the manufacturer. Users can set the instrument time according to actual conditions. In the system setting interface 2 (Figure 43), click "Date and Time Settings" to enter Figure 48 for setting.

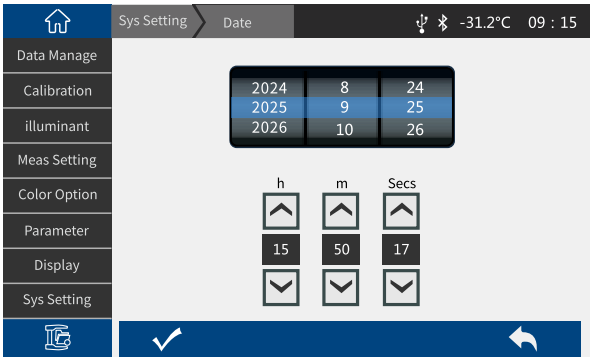


Figure 48 Time and date setting interface

After setting the date and time , click " ✓ " to save the settings, or click " ↩ " to cancel the save.

3.8.11 Temperature Threshold

Click "Temperature Threshold" in the system setting interface to enter the "Temperature Threshold" interface. When the alarm switch is turned on, set the alarm threshold . When the temperature change and the temperature difference during calibration exceed the threshold, the instrument buzzer will sound continuously, and the instrument needs to be recalibrated during measurement. (Figure 49)

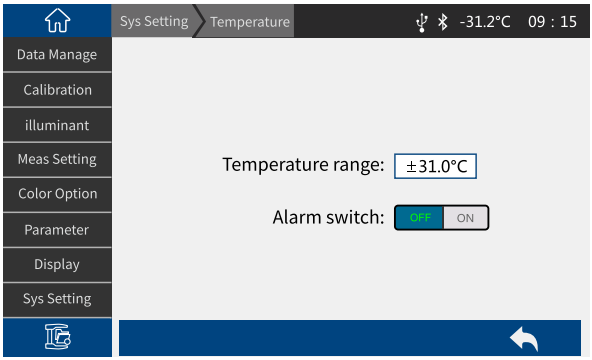


Figure 49 Temperature threshold setting interface

3.8.12 Tolerance threshold

Tolerance Threshold " in the system settings interface to enter the default system tolerance interface. For system tolerance settings, please refer to Section 2.5.1.

3.8.13 Print Settings

Turn on the print data switch and connect the printer to print data output. For specific operations, see Section 2.6.

3.8.14 Audit function

Click "Audit Function" on the system settings interface to enter the audit login page. You can log in with the administrator account. The audit function can

control the basic operation of the instrument. Only those with login permission can modify or view it. The specific functions of the audit function are as follows:
1) Audit opening and closing interface
The account is hard-coded as root by default. If you need to turn on the audit function, enter the password and click the audit function switch button. After verifying that the password is correct, the audit function is turned on successfully (after turning on the audit function, the instrument will automatically turn on and off again). If you need to turn off the audit function, just repeat the above operation Closing the auditing function will not result in a reboot), as shown in Figure 50.

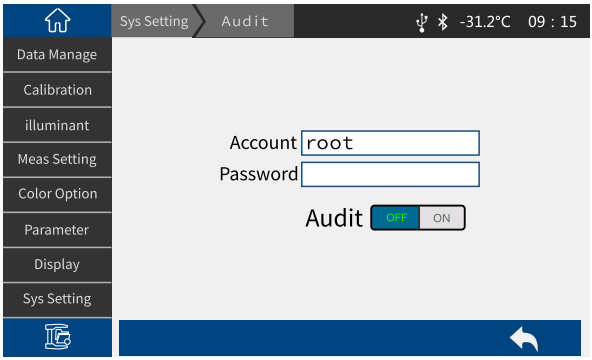


Figure 50 Audit function interface

2) Login interface display
After turning on the audit function, you enter the login interface, as shown in Figure 51. Enter the existing account name and correct password to log in. After successful login, you will enter the main menu interface, as shown in Figure 52.

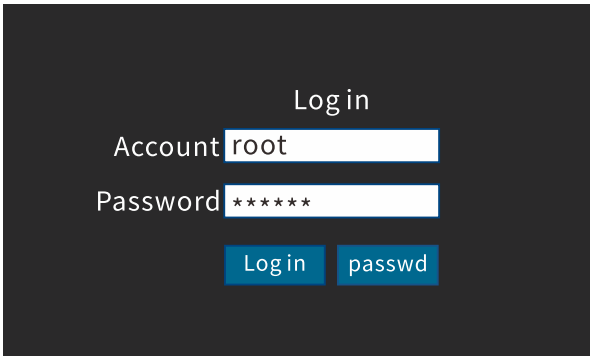


Figure 51 Log in interface

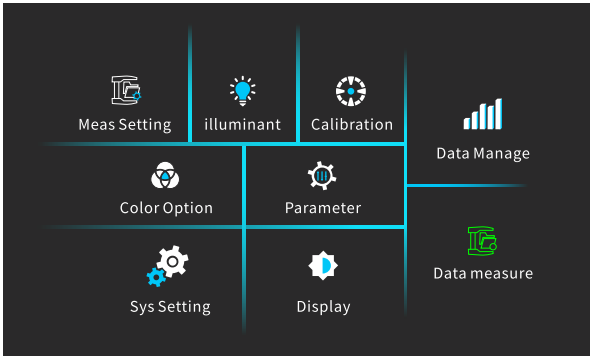


Figure 52 Main menu interface

3) The password modification interface is displayed

When the instrument is turned on, it will enter the login interface. You need to enter the existing account name and password. Click the Change Password button. After verifying that the password is correct, you will enter the password change interface, as shown in Figure 53. Enter the new password and confirm the password. After verifying that the two passwords are consistent, jump to the login interface, as shown in Figure 51.

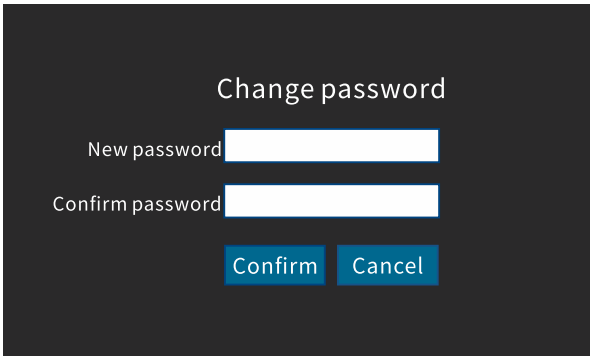


Figure 53 Password modification interface

4) Log information interface display

The log information is located in the data management interface, as shown in Figure 54.

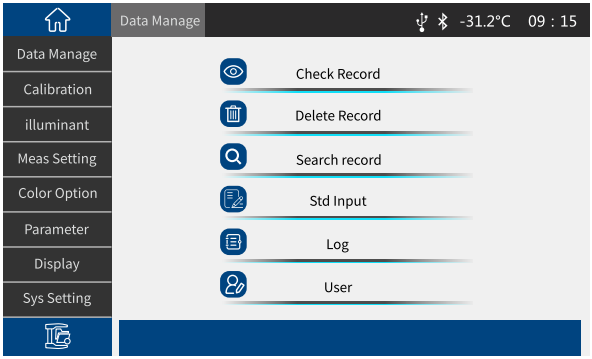


Figure 54 Data management interface

The log information records the instrument's power-on self-test information, login account, white calibration, and factory reset. As shown in Figure 55, every time the user makes an operation, a message will be generated for recording, and each page will record 10 log messages. (The upper limit of logs is 10,000)

Note: Only the root account can delete log information!

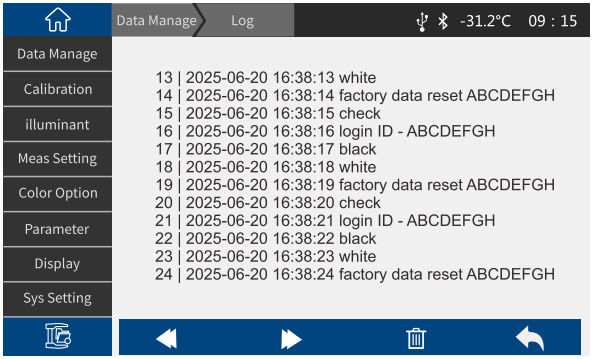


Figure 55 Log information interface

5) The user management interface is displayed (only root users can enter this interface)

User management is located in the data management interface, as shown in Figure 56.

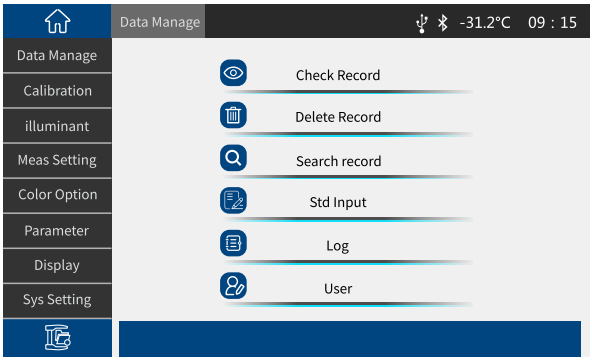


Figure 56 Data management interface

The user management interface allows you to edit user passwords, delete users, and add new users, as shown in Figure 57.

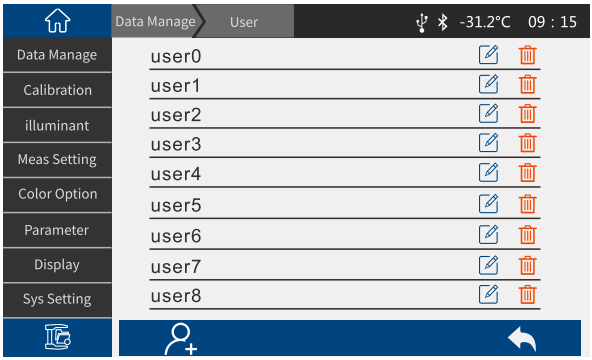


Figure 57 User management interface

After clicking the edit button, you will enter the password modification interface, as shown in Figure 58. Enter the new password and confirm the password, click OK, and verify that the passwords entered twice are consistent, then the password modification is successful.

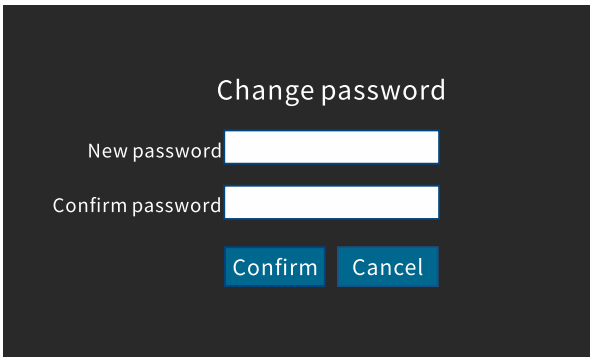


Figure 58 Edit and modify password interface

After clicking the delete button, a pop-up window prompts to delete the selected user, as shown in Figure 59. After clicking the OK button, the selected user is successfully deleted.

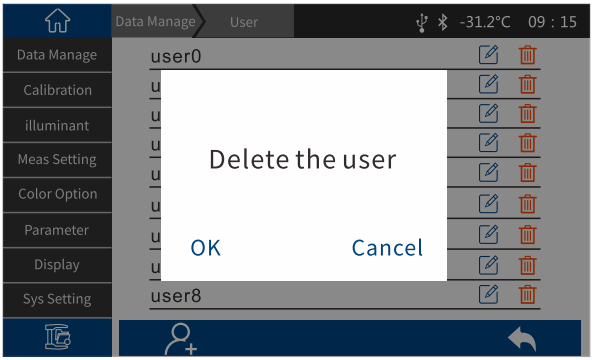


Figure 59 Delete user interface

6) Add user interface display

Click the Add user button to switch to the Add user interface. As shown in Figure 60, enter the account name and password. After clicking OK, the new user is successfully added. Users who have successfully added can view and edit operations in the user management interface.

Note: The same account cannot be added. The administrator root account cannot be added. The maximum number of new users is 20!

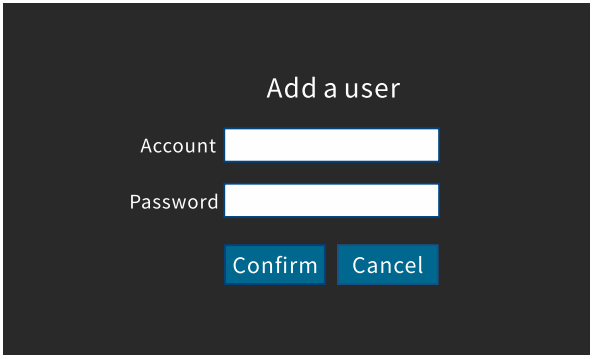


Figure 60 Add user interface

3.8.15 Reset the instrument

Reset Instrument " in the system settings interface to enter the "Restore Factory Settings" interface, Figure 61. Click " ✓ " to clear all measurement records and parameter settings of the instrument and restore them to the factory state; click " ↩ " to cancel this operation.

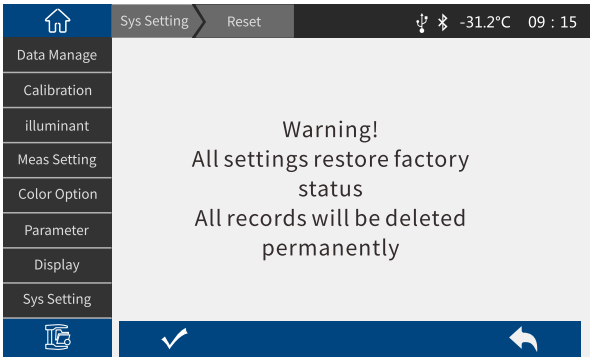


Figure 61 Restore factory settings interface

3.8.16 About Instruments

Click "About Instrument" in the system settings interface to enter the "About Instrument" interface. You can view the instrument's product model, SN code, software version, hardware version, whiteboard number and other information. (Figure 62)

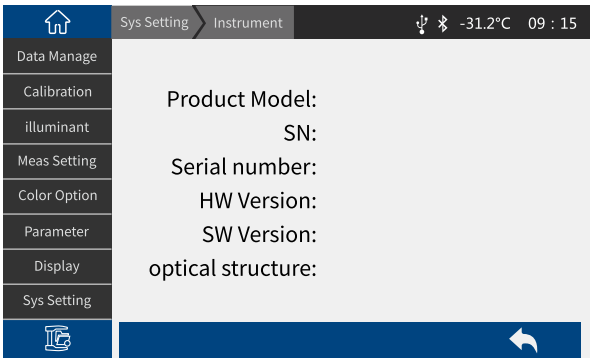


Figure 62 About the instrument

IV.Daily maintenance

1) This instrument is a precision optical instrument. Please keep and use it properly. Avoid using and storing the instrument in a humid environment, strong electromagnetic interference, strong light, or dusty environment. It is recommended to use and store the instrument in a standard laboratory environment.
2) The whiteboard is a precision optical component and should be properly stored and used. Avoid hitting the working surface with sharp objects, avoid dirtying the working surface with dirt, and avoid exposing the whiteboard to strong light. Clean the working surface of the whiteboard regularly with a cloth dipped in alcohol. Clean the dust on the working surface of the whiteboard in time when calibrating.
3) To ensure the validity of the test data, it is recommended that the instrument and whiteboard be inspected by the manufacturer or a qualified metrology institute every one year from the date of purchase.
4) This instrument is powered by an external power adapter. The power supply should be used in a standardized manner to avoid frequent plugging and unplugging of the power supply to protect the power supply performance and extend the power supply life.
5) Please do not disassemble the instrument without permission. If you have any questions, please contact the relevant after-sales staff. Tearing off the easy-to-tear label will affect the after-sales maintenance service of the instrument.

V .Technical Parameters

5.1 Product Features

1. High hardware configuration: 7-inch TFT pure color capacitive touch screen, Bluetooth, flat grating ;
2. Silicon photodiode array (20 groups in double rows), long-life full-spectrum LED lamp ;
3. Measure sample transmission spectrum and Lab data accurately ;
4. Reflection aperture: Φ 50 mm ;

5. Temperature monitoring and compensation, built-in temperature sensor, monitor and compensate the test environment to ensure more accurate measurement results ;
6. Test wavelength range : 400 ~ 700nm ;
7. Independent light source detector, constantly monitors light source changes to ensure light source reliability ;
8. Various accessories, suitable for more working conditions;
9. Large storage space, can store 1000 Standards and 30000 test data of samples ;
10. PC color management software has powerful extension functions.

5.2 Technical specifications (The parameters of different models are different)

Model	Type A
Name	Large Aperture Colorimeter
Illumination	D/8 (diffuse illumination, 8° Viewing); Comply with standards CIE No.15, GB/T 3978, GB 2893, GB/T 18833, ISO7724-1, ASTM E1164, DIN5033 Teil7
Characteristic	Large-aperture Colorimeter adopts D/8 optical structure and is equipped with a Φ50 large measuring aperture. It features a wide measurement area and highly representative data, making it suitable for color measurement of complex samples and fluorescent samples. It is used for accurate color measurement and quality control in industries including plastics and electronics, paints and inks, textiles and garment dyeing, printing, ceramics, and food, as well as for precise color analysis and communication in laboratories.
Light source	Combined LED light source

Integrating sphere size	Φ120 mm
Containing light method	SCI&SCE
Spectral method	Nano-integrated spectral devices
Sensor	Silicon photodiode array (dual row 20 groups)
Wavelength range	400-700 nm
Wavelength interval	10nm
Half bandwidth	10nm
Transmittance range	0~200%
Measuring aperture	Φ50 mm
Color Space Illuminant	D65,A,C,D50,D55,D75,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,F11, F12,CWF,DLF,TL83,TL84,TPL5,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
Observer Angle	2°/10°
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 color indexes	Spectral reflectance, WI (ASTM E313, CIE/ISO, AATCC, Hunter, Taube, Berger, Stensby), YI (ASTM D1925, ASTM 313), Tint (CIE/ISO,ASTM E313-20), MI (Metamerism Index), Staining Fastness, Color Fastness, Color Strength, Opacity, Color density CMYK

Repeatability	Spectral reflectance: standard deviation within 0.07% (400 ~ 700nm : within 0.2%); Chromaticity value: within ΔE*ab 0.03 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration);
Inter-instrument Error	Δ E*ab within 0.35 (Average for 12 BCRA Series II color tiles)
Displayed Data	Spectrum/values, sample chromaticity value, color difference value/graph, pass/fail results, color bias
Measuring time	about 1s
Measuring method	Single measurement, average measurement (2~99 times)
Size	210x245x188 mm
Weight	About 3.1kg
Power supply mode	Powered by DC 24V/3A power adapter
Illuminant Life Span	More than 2 million measurements in 5 years
Display	TFT true color 7-inch, capacitive touch screen
Interface	USB, Bluetooth
Data Storage	1000 Standards, 30000 test samples
Language	Simplified Chinese, Traditional Chinese, English, Russian
Operating Environment	0~40°C, 0~85%RH (no condensation), altitude: less than 2000m
Storage Environment	-20~50°C , 0~85%RH (no condensation)

Model	Type B
Name	Particle Colorimeter
Illumination	45/0(45 ring-shaped illumination, vertical viewing); Comply with CIE No.15, GB/T 3978,GB 2893,GB/T 18833, ISO7724-1,ASTM E1164,DIN5033 Teil7,GB 2893
Characteristic	Particle Colorimeter adopts 45/0 optical structure and is equipped with a Φ50 large measuring aperture. Comply with ASTM D6290-19 particle color and other test methods. It features a wide measurement area and highly representative data, making it suitable for color measurement of particle samples and fluorescent samples. It is used for accurate color measurement and quality control in industries including plastics and electronics, paints and inks, textiles and garment dyeing, printing, ceramics, and food, as well as for precise color analysis.
Light source	Combined LED light source
Integrating sphere size	Φ 120 mm
Spectral method	Nano-integrated spectral devices
Sensor	Silicon photodiode array (dual row 20 groups)
Wavelength range	400-700 nm
Wavelength interval	10nm
Half bandwidth	10nm
Transmittance range	0~200%
Measuring aperture	Φ 50 mm

Color Space Illuminant	D65,A,C,D50,D55,D75,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10, F11,F12,CWF,DLF,TL83,TL84,TPL5,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
Observer Angle	2°/10°
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 color indexes	Spectral reflectance, WI (ASTM E313, CIE/ISO, AATCC, Hunter, Taube, Berger, Stensby), YI (ASTM D1925, ASTM 313), Tint (CIE/ISO,ASTM E313-20), MI (Metamerism Index), Staining Fastness, Color Fastness, Color Strength, Opacity,Color density CMYK
Repeatability	Spectral reflectance: standard deviation within 0.07% (400 ~ 700nm : within 0.2%); Chromaticity value: within ΔE*ab 0.03 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration);
Inter-instrument Error	Δ E*ab within 0.35 (Average for 12 BCRA Series II color tiles)
Displayed Data	Spectrum/values, sample chromaticity value, color difference value/graph, pass/fail results, color bias
Measuring time	about 1s

Measuring method	Single measurement, average measurement (2~99 times)
Size	210x245x188 mm
Weight	About 3.1kg
Power supply mode	Powered by DC 24V/3A power adapter
Illuminant Life Span	More than 2 million measurements in 5 years
Display	TFT true color 7-inch, capacitive touch screen
Interface	USB, Bluetooth
Data Storage	1000 Standards, 30000 test samples
Language	Simplified Chinese, Traditional Chinese, English, Russian
Operating Environment	0~40°C, 0~85%RH (no condensation), altitude: less than 2000m
Storage Environment	-20~50°C , 0~85%RH (no condensation)
Standard accessories	Power adapter, manual, quality management software (download from official website), Whiteboard, petri dish
Optional accessories	Micro printer
Note:	The technical parameters are for reference only, please refer to the actual products sold

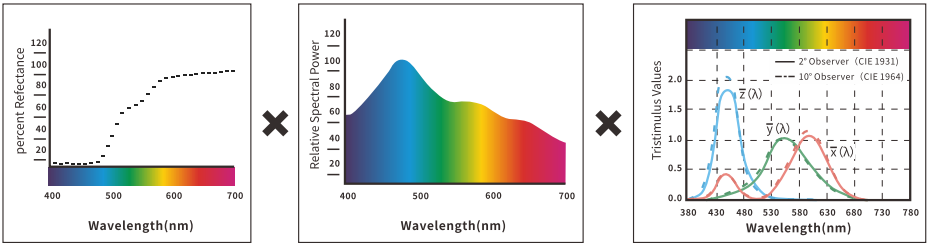
Appendix 1

1. Object color

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.



Reflectance spectra　　Light source　　Standard observer

=

L=70.95
a=69.72
b=40.35

ΔL+ represents whitish, ΔL-represents blackish;
Δa+ represents reddish, Δa-represents greenish;
Δb+ represents yellow, Δb- represent small bluish.

2. Color difference formula

The CIE 1976 color difference formula ΔE*ab is as follows:

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

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

The CIE 2000 color difference formula ΔE00 is as follows:

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

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

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

The CIE 1994 color difference formula ΔE*94 is as follows:

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

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

3. Normal color difference allowable range

The allowable range of normal skin color differences varies in different industries and application scenarios. The following are the allowable ranges of skin color differences in some major industries.

Scope description:

1. Electronic Equipment Industry

- Standard: ΔE < 0.5 is generally required to ensure color accuracy for screen display and product appearance.

2. Plastic & Coating Industry

- Standard: ΔE < 1.0 for color control of plastic products and coatings.

3. Textile Industry
- General standard: ΔE ⩽ 2.0 is considered acceptable, especially in textile color management.
- Specific standard: Color difference not lower than Grade 4, corresponding to ΔE 0–2.0.

4. Printing Industry
- Normal color deviation: ΔE 1.5–3.0 is generally regarded as normal, depending on product grade and customer requirements.
- General upper limit: ΔE ⩽ 6.0 for both high-precision and general products.

5. Railway Signal Flags
- Standard: ΔE ⩽ 3.0 to ensure clarity and recognition of signal flags.

Color difference and visual perception：

Color difference ΔE*ab	Meaning
0-0.25ΔE	Very small or no colordifference, ideal match
0.25-0.5ΔE	A normal invisible difference
0.5-1.0ΔE	Very small difference, only obvious to a trained eye
1.0-2.0ΔE	Medium difference, also obvious to an untrained eye
2.0-4.0ΔE	An obvious difference
Above 4.0ΔE	A very obvious difference