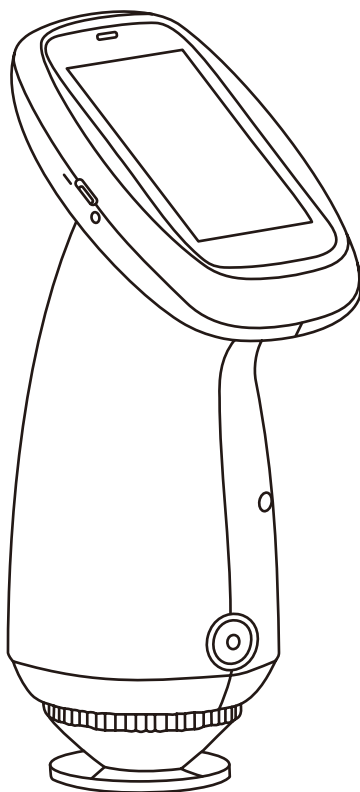


Spectrocolorimeter

User Manual



V2.0

Read this manual carefully before use the spectrophotometer.

Safety Instructions

This instrument is a very safe device, but in order to ensure that user can use it correctly and safely, please carefully read and strictly abide by the following clauses to avoid accidental injury or harm. The loss caused by not using the instrument according to the operation guide of this manual is not within the scope of our company.

Battery	1. This instrument is a built-in battery. Please use the original battery, and do not replace other batteries to prevent damage to the instrument or other failures. 2. Do not disassemble, squeeze, blow or heat the battery privately, or place the battery in a fire or a high-temperature environment, otherwise the battery will explode and cause a fire. 3. When the instrument is fully charged and not in use, the external power supply should be cut off to prevent electric shock and damage to the instrument. 4.If user don't use the instrument for a long time, user should charge it once every two weeks, otherwise the internal battery will be easily damaged, which will make it impossible to use the instrument again.
External Power	1. When external power supply is required, please use the standard power adapter of this instrument, and do not use other power adapters that do not meet the technical specifications, otherwise it may shorten the battery life or even cause electric shock, which may damage the instrument or cause fire. 2.If the instrument is not used for a long time, the external power supply should be cut off to prevent the instrument from burning and causing fire.
Instrument	1.Do not use this instrument in places where there are flammable or combustible gases (gasoline, etc.), or it may cause fire. 2.Do not disassemble the instrument privately, otherwise it will be destroyed, and dust and foreign metals may enter the instrument. The instrument may be short-circuited, resulting in electric shock, resulting in the destruction of the instrument and even fire. 3.In the process of using the instrument, if the instrument emits peculiar smell such as burning, it should be stopped immediately and sent to the maintenance point for inspection and maintenance.

Please keep this manual properly for reference at any time

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Instructions

Spectrocolorimeter is a domestic color measuring instrument independently developed by our company with independent intellectual property rights. It is a color measuring instrument developed according to CIE (International Commission on Lighting) standard and national standard. It is a simple spectral colorimeter with convenient use, stable performance, fast and accurate measurement. This instrument is powered by lithium battery or external DC power adapter.

This instrument has the following advantages (some models have different configurations):

- 1) It can be measured when it is turned on, without black-and-white calibration every time, which simplifies the operation steps; without black-and-white calibration every time, which simplifies the operation steps;
- 2) Camera locating, light spot positioning or cross positioning are adopted, which can quickly aim at the measuring part;
- 3) Equipped with 2.8-inch capacitive touch TFT display screen, large-capacity storage space and Bluetooth 5.0/USB interface;
- 4) SQCX quality management software, connecting PC to realize more function expansion;
- 5) It can be connected to the color management software of mobile APP, to meet users' various needs;
- 6) Original whiteboard calibration technology, reliable calibration, greatly increasing the service life of whiteboard;
- 7) $\Phi 8\text{mm}$, $\Phi 4\text{mm}$ and $\Phi 1 \times 3\text{mm}$ measuring apertures, which are suitable for more test samples;
- 8) It can test the reflection spectrum and various chromaticity indexes of the object, with accurate measurement and simple use.

Cautions

1) This instrument is a precision measuring instrument. During measurement, drastic changes in the external environment of the instrument should be avoided, for example, the flickering of the ambient light and the rapid change of temperature should be avoided.

2) During measurement, the instrument should be kept stable, the measuring port should be close to the measured object, and shaking and shifting should be avoided. This instrument is not waterproof and cannot be used in high humidity environment or water mist.

3) Keep the instrument clean and tidy. Prevent liquids, dust, powders or solid foreign substances from entering the measurement aperture and the interior of the instrument. Avoid impacts and collisions with the instrument.

4) After the instrument is used, put the instrument and related accessories into the instrument box and keep them properly;

5) The instrument should be stored in a dry and cool environment; Users are not allowed to make any unauthorized changes to this instrument. Any unauthorized changes may affect the accuracy of the instrument, or even irreversibly damage the instrument;

1. External Structure Description

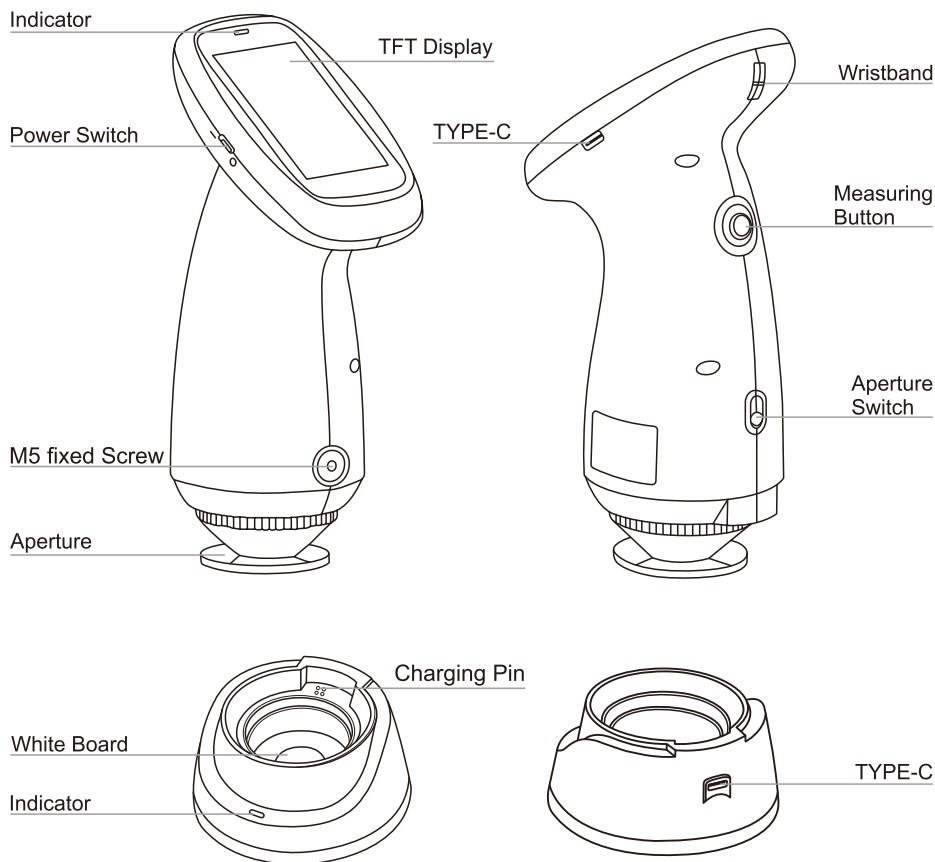


Figure1 Schematic diagram of instrument button interface

Power Switch I/O: when the switch is turned to "I", the instrument is powered on and started; When the switch is turned to "O", the instrument is powered off and turned off, and the hardware is turned on and off by turning the switch.

TYPE-C Interface: the TYPE-C interface on the instrument is a common interface, which can be used to connect and communicate with PC, and the instrument automatically judges the connection; It can also be used to connect printers.

The TYPE-C interface on the base is a power charger, which can charge the instrument (5V=2A).

Note: Two TYPE-C interfaces cannot be connected to the data cable for charging at the same time, so as to avoid unknown danger.

Measurement Button: Short press to wake up the instrument in sleep state, and short press to measure in normal state.

Aperture Switch: Aperture switch (some models) is used to switch the measurement aperture. When the switch is toggled, the logo shows "MAV", which means that the lens is switched to the $\Phi 8\text{mm}$ aperture position; When the switch is toggled, the logo shows "SAV", which means that the lens is switched to the $\Phi 4\text{mm}$ aperture position. Some models support $\Phi 1 \times 3\text{mm}$ measuring aperture. When $\Phi 1 \times 3\text{mm}$ aperture is used, dial the aperture switch to "SAV".

LED Indicator: The indicator on the instrument has three indicator states: green, yellow and red. When the power is turned on, the power below 20% is a red light; More than 20% is a green light. When the measurement indicator is yellow.

Note: The indicator light on the base has only two indication states: green on and off. When not connected to USB, it is off; The green light is always on when the USB cable is plugged in.

M5 fixed Screw Hole: The screw interface of the fixed instrument. The screw thread type is standard metric common coarse thread, with a pitch of 0.8mm and a depth of 5mm.

Wristband Fixing Post: It is used to fix the wrist band, which can prevent the instrument from slipping off accidentally when the wrist band is put on the wrist.

Charging stand: used for white calibration and charging. Please refer to the chapter on black and white calibration for details.

2. Operating Instruction

2.1 Power On & Off

As shown in Figure 1, when the I/O switch of the power supply is turned to "I", the instrument will be powered on and started, and the instrument will automatically enter the startup screen and start. When the I/O switch of the power supply is turned to "O", the instrument will be powered off and shut down. If user don't do anything for a long time in the startup state, the instrument will automatically enter the sleep state. At this time, press the "Measure button" to wake up the instrument.

2.2 Black and White Calibration

Click the main menu button “” on the measurement interface or other interfaces to enter the main menu interface, as shown in Figure 2.

Click Black and White calibration in the main menu to enter the Black and White calibration interface, as shown in Figure 3. The whiteboard number and the aperture used will be displayed in the interface.

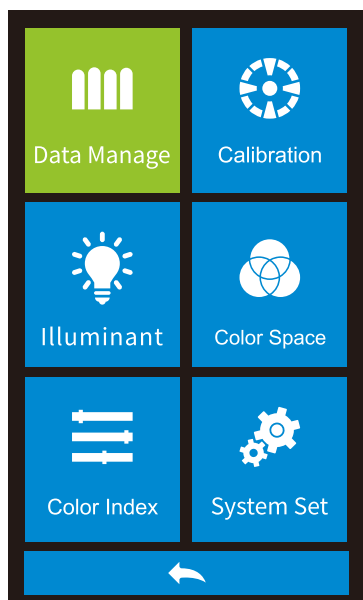


Figure 2 Main menu

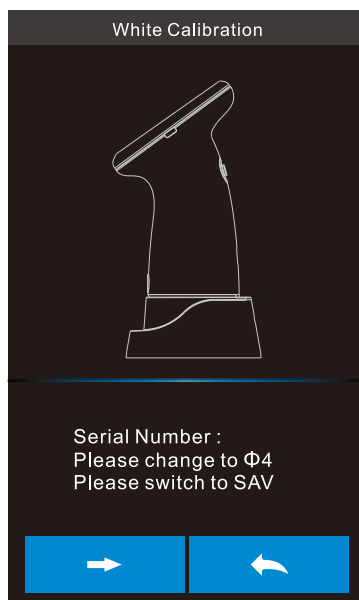


Figure 3 Black and white calibration

Click “” to return to the main menu interface.

White calibration interface, according to the prompt requirements, make white calibration. Please align the measuring aperture with the whiteboard and stick it tightly. After the whiteboard number and measuring aperture are set correctly, press the “” button or the “Measure” button to start white calibration. The words “On calibrating, please waiting” will appear in the interface, and the indicator will turn yellow. If the correct white calibration is completed, it will automatically jump to the black calibration interface in Figure 5. If there is any misunderstanding in the white calibration, the corresponding reminder box will pop up.

In the black calibration interface, click the " → " button or press the "Measure" button to perform black calibration on the instrument, and the words "On calibrating, please waiting" will appear in the interface, and the indicator will turn yellow. Correct black calibration will automatically jump to the main menu interface (as shown in Figure 2). If there is any misunderstanding in the black calibration, the corresponding reminder box will pop up.

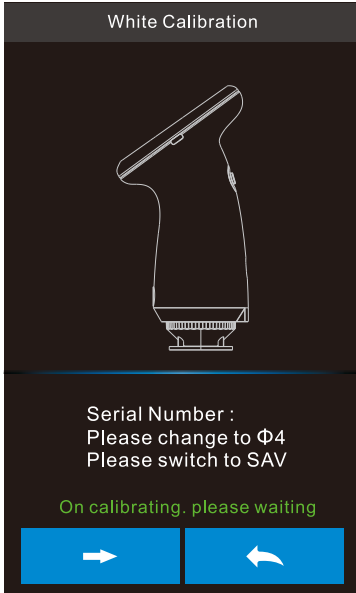


Figure 4 White calibration

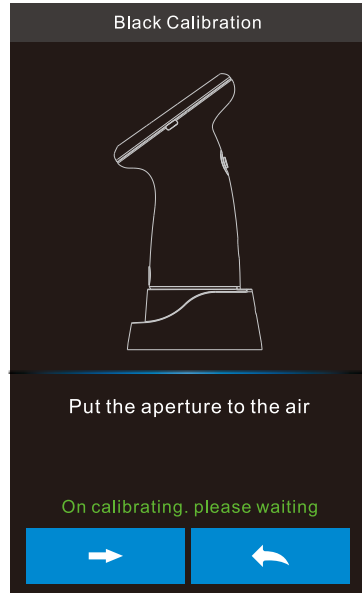


Figure 5 Black calibration

After the black calibration is finished, user will jump back to the main menu in Figure 2, and perform corresponding operations as required. Click the " ← " button to return to the standard sample measurement interface.

2.3 Description of Measurement Interface

As shown in Figure 6, the upper part of the measurement interface is the working status area, where the measurement mode and Bluetooth status set by the instrument are displayed in real time. The middle part of the test interface is the data display area, and the instrument displays the corresponding chromaticity data according to the current user's setting. Below the data display area are the shortcut display area and the

operation button area, and the operation of the current data can be realized by clicking the corresponding operation button.

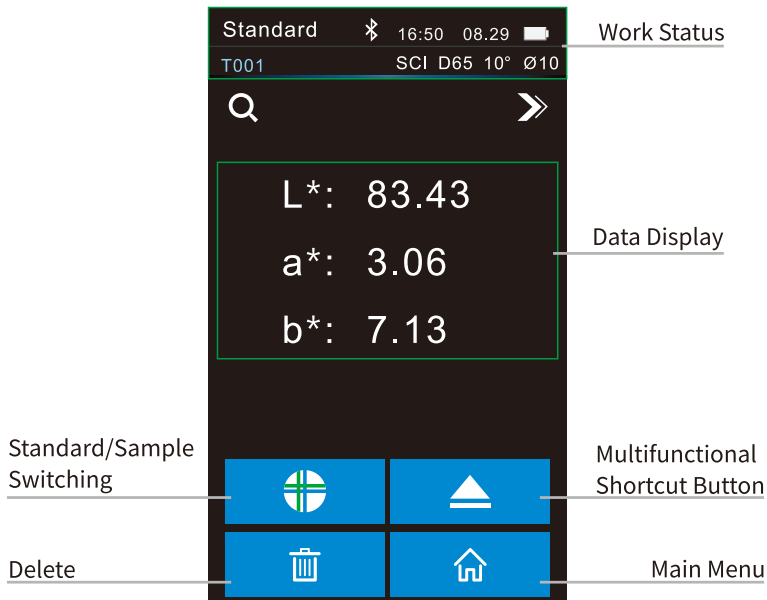


Figure 6 Measurement Interface

2.4 Measurement

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

After the instrument is turned on and the correct black-and-white calibration is completed, the measurement can be carried out (customers can set the corresponding light source, color space and color index in the main menu interface as required). If user are not currently in the measurement interface, user can click the "  " button on the interface to return to the measurement interface.

Note: The default color space of the system is CIE lab, the color difference formula is ΔE^*ab , and the color index is CIE1976.

2.4.1 Standard Measurement

On the standard measurement interface, aim the measured sample at the measuring aperture of the instrument and stick it tightly. Press the measuring button lightly, and the buzzer will "drip" and the LED indicator will turn from yellow to green, which means the measurement is completed. The interface of the tested sample after the test is completed is shown in Figure 7.

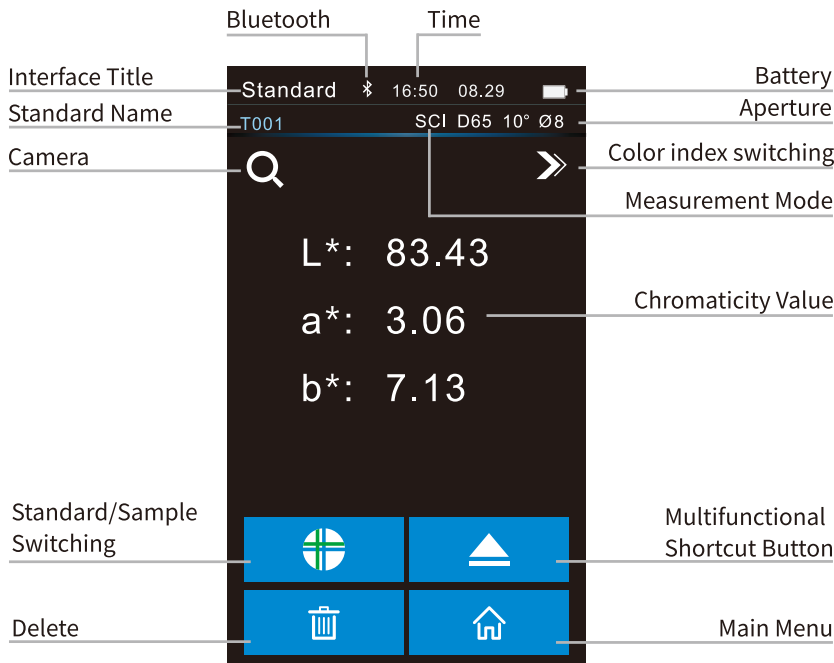


Figure 7 Standard Measurement

- 1) Interface Title:** Indicates that it is currently under the standard measurement interface.
- 2) Status Bar:** Displays system setting information, such as lighting mode, Bluetooth logo, measurement mode, and current time, date, light source, observation angle, aperture and power quantity, etc. If Bluetooth is turned on, its logo will be displayed in the status bar, otherwise it will not be displayed.

3) Checking and Positioning: Click on the checking and positioning camera (some models), and user can use the checking and positioning camera to position the measurement position. After the positioning is completed, lightly press the measurement button to complete the measurement.

4) Standard Name: Displays the name of the currently measured standard sample, which starts with "T" by default, followed by the serial number from T001 to T500.

5) Standard Chromaticity Value: The value measured by standard. Some models of instruments display one decimal place, while others display two decimal places.

6) Multifunctional Shortcut Button: Click the shortcut switch menu button to switch SCI, observation angle and light source.

Note: SCI and SCE switching of display mode only switches the current display data, and the measurement modes of standard sample and sample are set in measurement mode of system setting.

If the current test data does not support the mode selected by the customer, the corresponding display may be "---" (for example, if the measurement mode is SCI, but the user switches SCE, SCE, Lab will be displayed as "---").

7) Standard/Sample Switching: Click to switch to the sample measurement interface

8) Delete/Save: When automatic saving of measurement is turned on, click delete the current measurement data. When the automatic saving of measurement is closed, it will be displayed as the save button "", and click to save the current measurement data

9) Wavelength Switch Button: As shown in Figure 8, click the " " button, and the reflectivity of the currently measured sample and the wavelength of light will be switched at intervals of 10nm.

10) Color index switching: Clicking on " " allows user to switch back and forth between the chromaticity value interface, the spectral graph interface, and the color index display interface. The data displayed in the color index display interface is determined by the options in the color index settings. For example: If the color index interface selects whiteness, then the color index display interface will show the whiteness value (Figure 9). Different instrument models have different color indices, which should be referred to the instrument specification sheet.

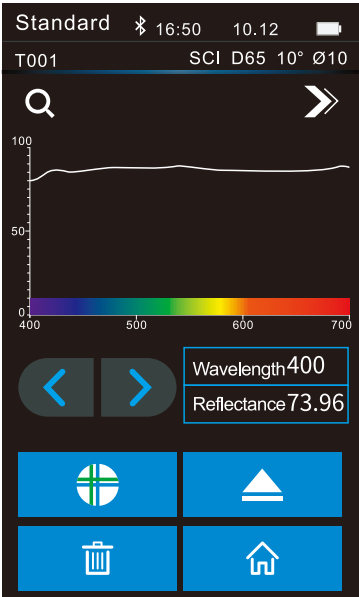


Figure 8 Standard Measurement Reflectance Graph

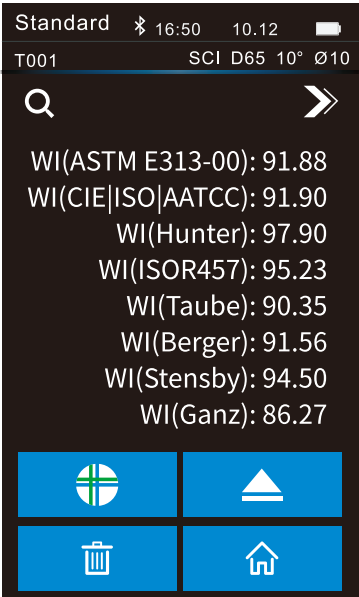


Figure 9 Standard Measurement WI

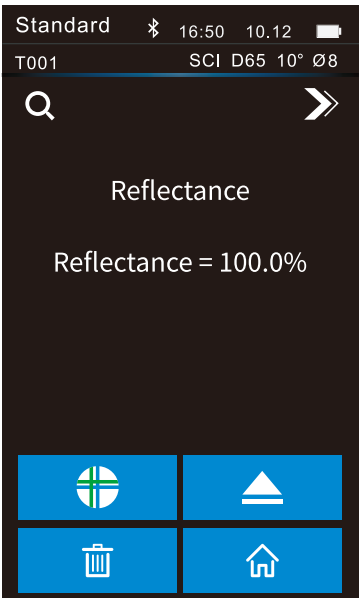


Figure 10 Standard Measurement Reflectance

2.4.2 Sample Measurement

Under the standard measurement interface, click "Sample Measurement" to switch to the sample measurement interface. Point the measured sample at the measuring aperture of the instrument and stick it tightly. Press the measuring button lightly, and the buzzer will "drip" and the LED indicator will turn from yellow to green, which means that this measurement is completed. The interface of the sample after measurement is shown in Figure 11, and the differences from the standard sample measurement are described in detail below.

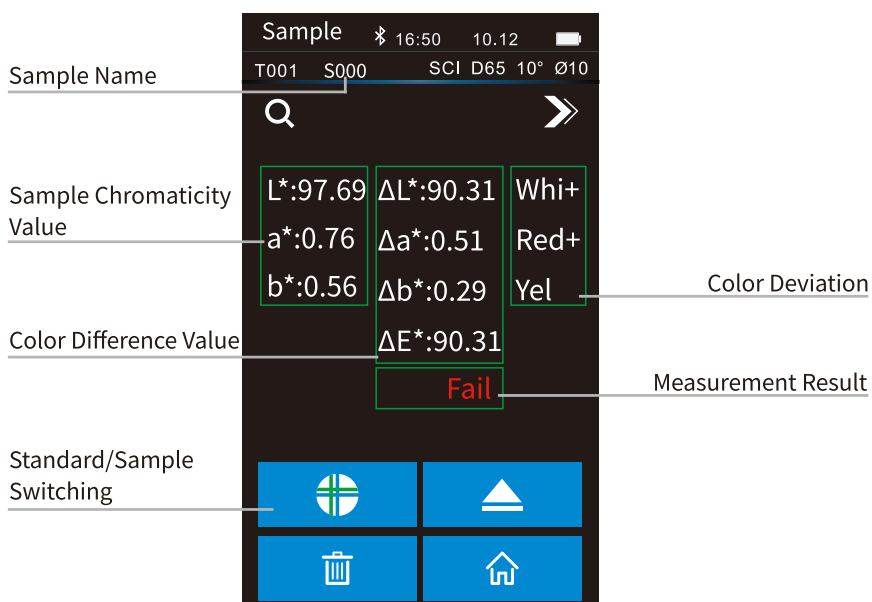


Figure 11 Sample Measurement

1) Sample Name: Displays the name of the currently tested sample, which starts with "S" by default, followed by the serial number.

2) Sample Chromaticity Value: The value measured by the sample in the current display mode is displayed. Some models of instruments display one decimal place, while others display two decimal places.

3) Color Difference Value: displays the difference between the chromaticity value of the sample minus the chromaticity value of the standard sample in the current display mode.

4) Color Deviation: The color deviation of the current sample compared with the standard. It will only be displayed if "Color Deviation" is turned on in the display setting.

5) Measurement Result: The test result of the current sample is displayed, which is judged by the tolerance of the standard sample and the specified color difference formula. If the color difference exceeds the tolerance, it will show "Fail", otherwise it will show "Pass". It will only be displayed when "Test Result Prompt" is turned on in the display setting.

6) Reflectance Difference: The difference between the measurement sample and the standard under the current reflectivity. As shown in Figure 12, click the button "**< >**", and the difference between the light wavelength of the currently measured sample, the reflectivity of the sample and the reflectivity of the sample standard will be switched at intervals of 10nm.

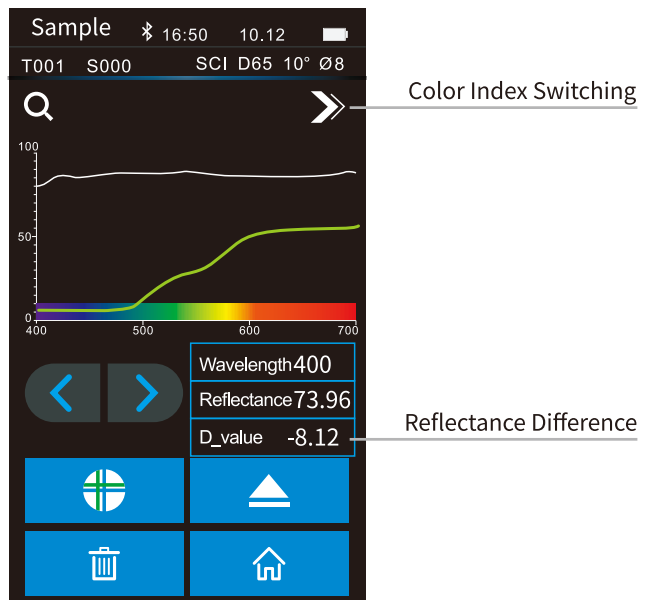


Figure 12 Sample measurement spectrum graph

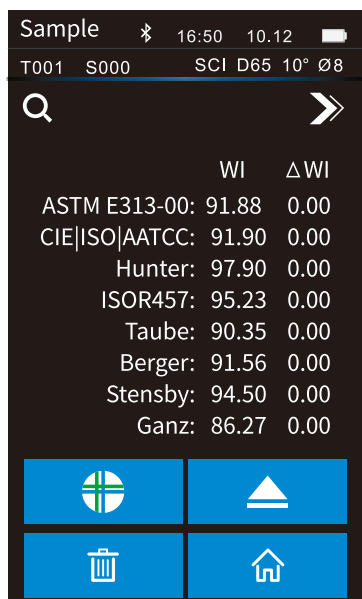


Figure 13 Sample Measurement WI

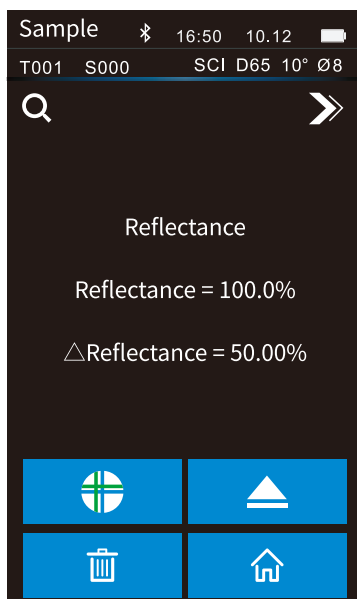


Figure 14 Sample Measurement Reflectance

2.5 Communication with PC through Bluetooth

The PC-side software has powerful function expansion, which can realize more chroma data analysis. This series of instruments can communicate with PC software models (some models) through USB data cable and Bluetooth module (only for products equipped with Bluetooth module).

2.5.1 Communication with PC through USB

When the client program is installed on the PC, connecting the instrument with the PC by USB data cable will automatically recognize the connection. If the connection is successful, the terminal instrument can be fully controlled by software, and the samples can be measured.

2.5.2 Communication with PC and Mobile APP through Bluetooth

For some instruments equipped with Bluetooth module, user can communicate with PC through Bluetooth.

When the client program is installed on the PC, turn on the Bluetooth option in the system setting of the instrument, and match the computer with Bluetooth. After the matching is successful, the software is connected in Bluetooth connection mode, and the Bluetooth icon appears in the lower right corner of the software, which indicates that the connection is successful through Bluetooth. Then, the comprehensive control of the terminal equipment can be realized by software, and the relevant samples can be tested and analyzed.

When the APP is installed on the mobile phone, turn on the "Bluetooth" option in the "system setting" of the instrument, and match the APP with the instrument. After the matching is successful, the APP uses Bluetooth connection mode to connect, and the Bluetooth connection is successful. The software realizes the overall control of the terminal instrument, and tests and analyzes samples.

3. Description of System Function

Click the main menu "  " in the measurement interface to enter the main menu interface (as shown in Figure 2). In other interfaces, user can click the back button "  " to enter the main menu. From the main menu, user can enter each sub-menu to realize all system function setting.

3.1 Data Manage

Click data management in the main menu to enter the data manage, as shown in Figure 15. Data manage is mainly used to check and operate the measured records.

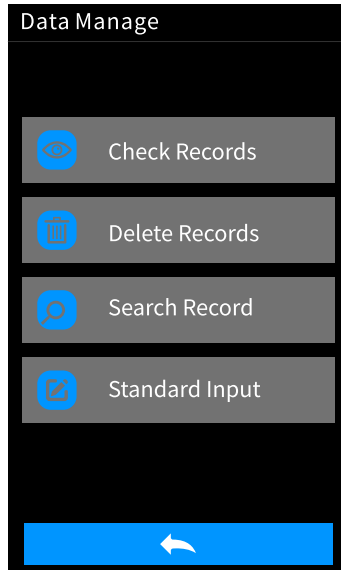


Figure 15 Data Manage

3.1.1 Check Records

1) Check Standard Record

Click check record in the data manage to enter the standard record, as shown in Figure 16. Note: The instrument displays two decimal places when checking the chromaticity value of the standard record. Click "▼" to check the next record, and click "▲" to check the previous record. Click "📄" to perform operations: SCI, 10, delete records, and import standard samples, as shown in Figure 17.

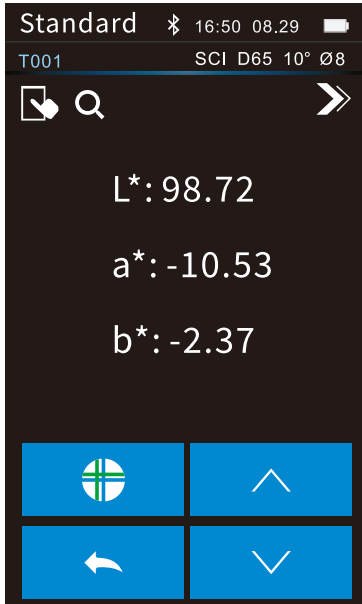


Figure 16 Standard Record

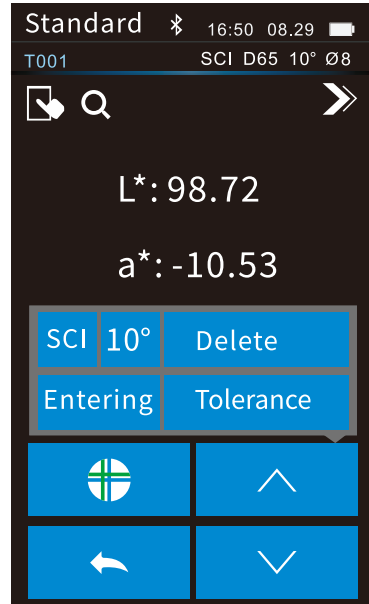


Figure 17 Standard Record Operation Menu

SCI: Click "SCI" to switch the measurement mode to SCE mode.

10: Click "10" to switch the observation angle to 2.

Delete Record: click "delete" to enter the interface of deleting record, and click "OK" to finish deleting; Or click cancel to delete and return to the operation menu.

Entering: Click "Entering" to set the standard being checked as the current standard, and then click "sample measurement" to measure the sample under this standard.

2) Check Sample Records

Click "Sample" under the standard record to check the sample record under this standard, as shown in Figure 18.

Click "▼" to check the next record, and click "▲" to check the previous record.

Click "👉" to perform operations: standard transfer in, record deletion, SCI and 10, as shown in Figure 19.

Entering: Click "Entering" to set the sample record being checked as the new current standard sample, and then click "Sample Measurement" to measure the sample under this standard sample.

SCI: Click "SCI" to switch the measurement mode to SCE mode.

10: Click "10" to switch the observation angle to 2.

Delete: click "delete" to enter the interface of deleting record, and click "OK" to finish deleting; Or click Cancel to delete and return to the operation menu.

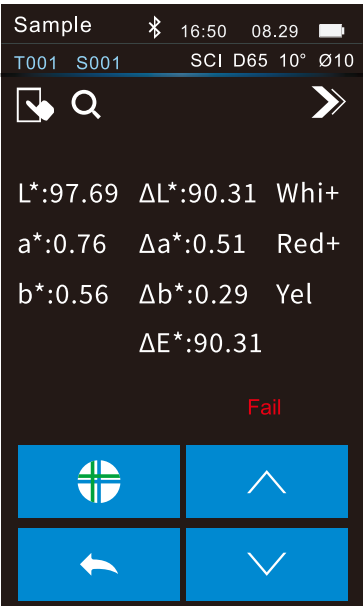


Figure 18 Sample Record

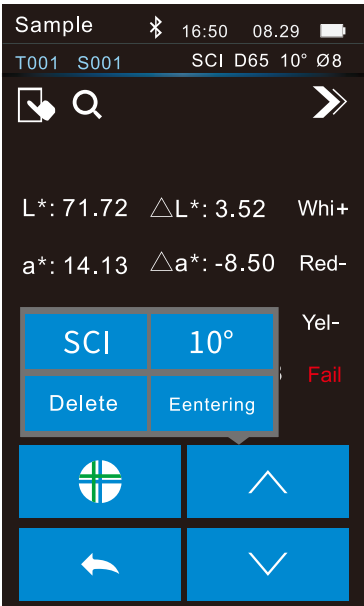


Figure 19 Sample Record Operation Menu

3.1.2 Delete Records

Click Delete Record in the data management interface to enter the Delete Record menu interface, as shown in Figure 20. Delete records are divided into "all records delete" and "all samples delete".

Click the corresponding option, enter the delete warning prompt interface, and click the "✓" to delete all the corresponding records; To cancel, click the "↩", as shown in Figure 21.

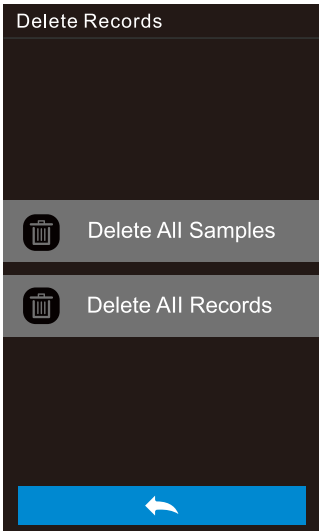


Figure 20 Delete Record

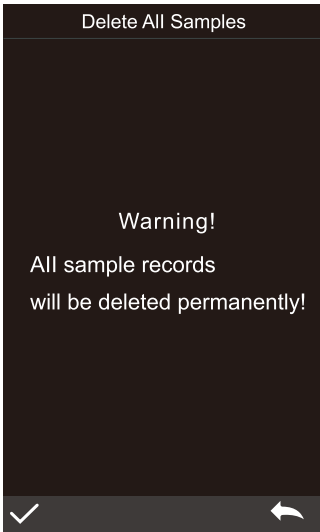


Figure 21 Delete Prompt

3.1.3 Search Records

In the data management interface, click "Search Records" to enter the search menu, as shown in Figure 22. User can select "Search Standard Name", and "Search Sample Name".

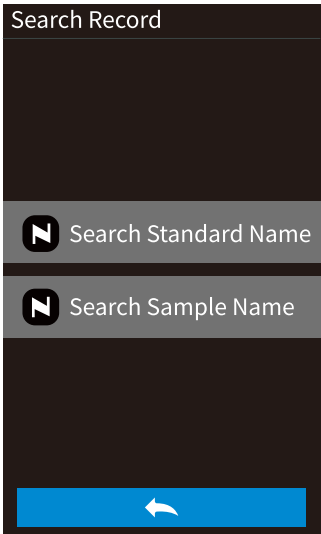


Figure 22 Search Record Interface

1) Search by Standard name

Click "Search Standard name", which will display an input interface for the search name, as shown in Figure 23. Enter the name to be searched or the characters included in the name summary, then click "✓". The instrument will automatically perform the search in all sample record entries and list the matching sample records, as shown in Figure 24.

Clicking on "▼" and "▲" allows user to view all the matching records found. If there are no matching records, a message "This record does not exist" will be displayed and user will be returned to the search record menu.

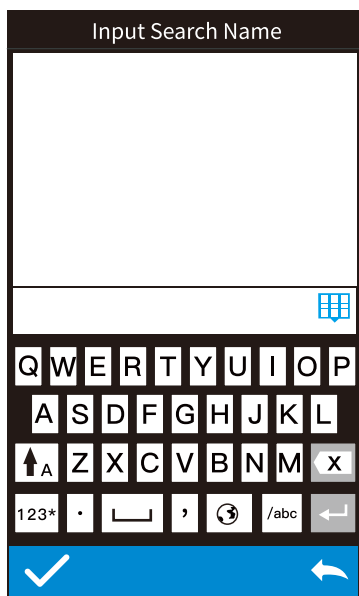


Figure 23 Input Search Name

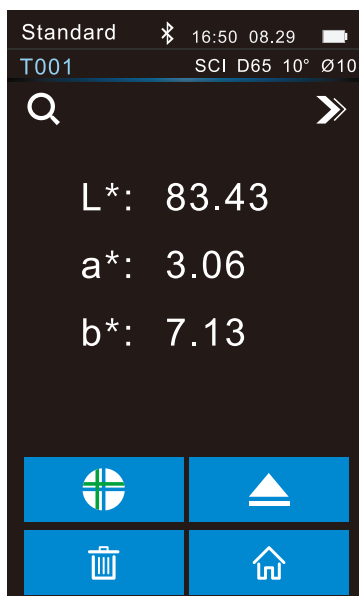


Figure 24 Search Result

2) Search by Sample Name

Click "Search by Sample Name". In the input name window, enter the name of the sample or the characters contained in the name, then click "✓", and the instrument will automatically perform the search in all sample records and list the matching sample records.

3.1.4 Standard Input

Standard input consists of the “L” value, “a” value, “b” value input interface, and the name editing interface. After completing the editing, the data will be automatically saved and the input interface will be exited.

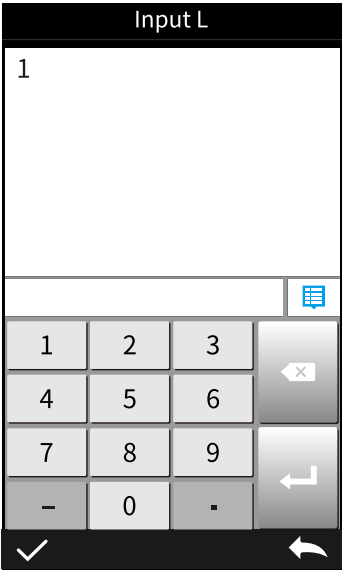


Figure 25 Standard Input

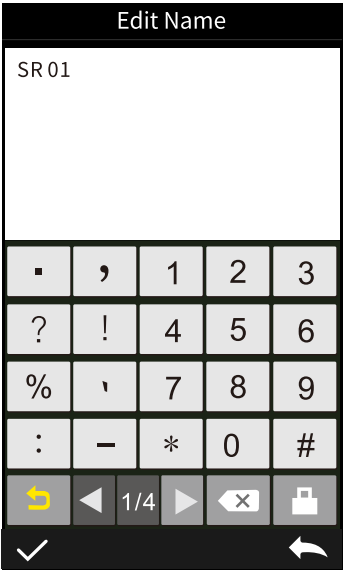


Figure 26 Edit Name

3.2 Black and White Calibration

As the benchmark of chromaticity data measurement, black-and-white calibration must be carried out accurately, otherwise it will affect the accuracy of test data. When the black-and-white calibration environment is quite different from the current sample testing environment (such as drastic fluctuations in temperature and humidity), or the data is obviously abnormal, it is necessary to calibrate the black-and-white board in time. When the instrument is used continuously for 8 hours or the instrument is switched on and off again, it is also recommended to do a black-and-white board calibration again.

The whiteboard should be cleaned regularly, and the charging seat should be properly kept in a dark, Dust-proof and dry condition.

Please refer to Section 2.2 for black-and-white calibration method.

3.3 Illuminant

Click "Illuminant" in the main menu to enter the light setting interface, as shown in Figure 27. The configurations of different models of instruments vary. When a certain model does not support this function, the function will be disabled and displayed in gray.

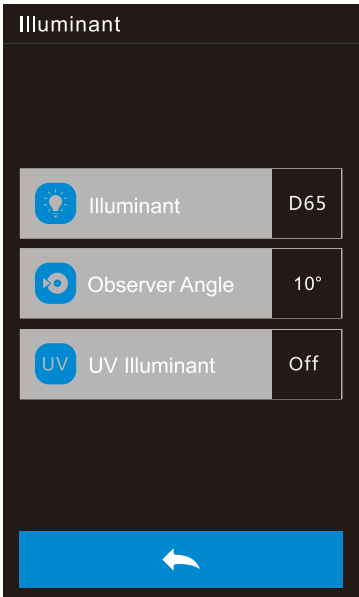


Figure 27-1 Illuminant Setting

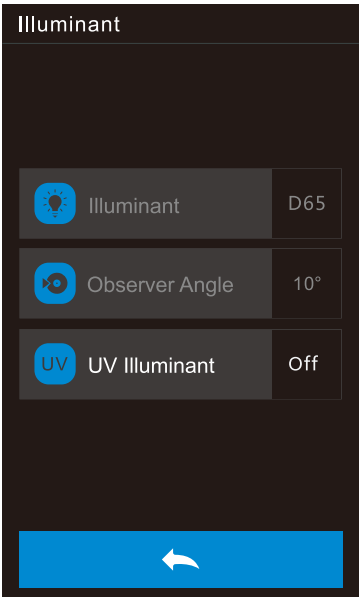


Figure 27-2 Illuminant Setting in Gray

The user sets the corresponding light source according to the actual measurement condition. In the illuminant interface, user can set the standard observer angle, standard light source type and UV light source (different types of instruments have different configurations) of the system.

Click the observer angle to switch between 10 and 2. Where 10 is CIE1964 standard; 2 is CIE1931 standard.

Click the light source, and there are options in the light source selection interface: D65, D50, A, C, D55, D75, F1, F2(CWF), F3, F4, F5, F6, F7(DLF), F8, F9, F10(TPL5), F11 (TL84), F12 (TL83).

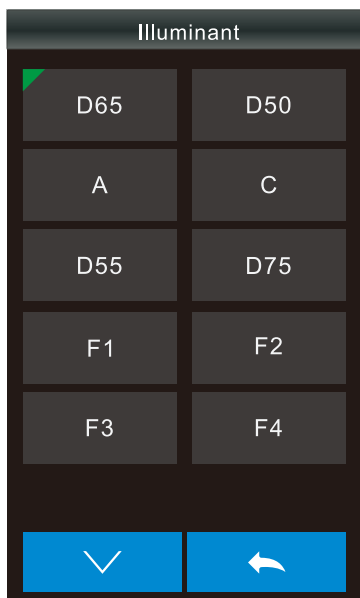


Figure 28 Illuminant Setting

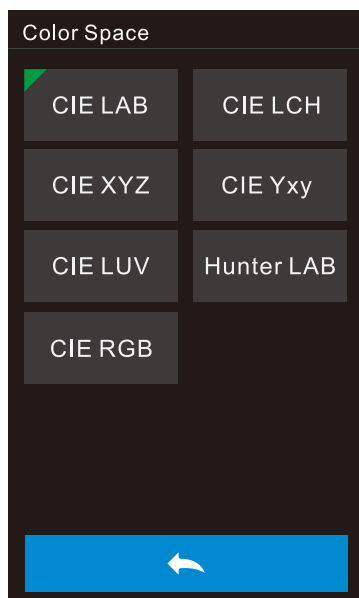


Figure 29 Color Space

Click on the UV light source to switch the UV light source switch. It is recommended to turn on the UV light source when testing fluorescent samples and turn off the UV light source when testing common samples.

3.4 Color Space

Click "Color Space" under the main menu to open the color space interface, as shown in Figure 29. Select the corresponding color space in the color space interface to complete the color space setting. Color options include CIE LAB, XYZ, Yxy, LCh, CIE LUV, s-RGB, HunterLab, etc. Some models only have some options.

3.5 Color Index

Click "Color Index" under the main menu to enter the color index window, as shown in Figure 30. The configurations of different models of instruments vary. When a certain model does not support this function, the function will be disabled or not displayed.

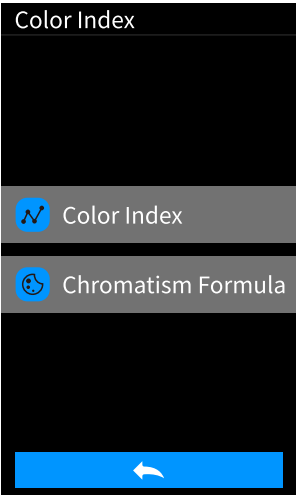


Figure 30 Color Index

1) Color Index

The selected color index will be displayed in the color index display area of standard sample and sample measurement (Some indices are only displayed from a specific observer's perspective and under a certain illuminant).

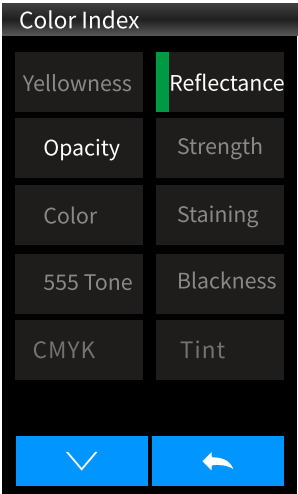


Figure 31 Color Index-1

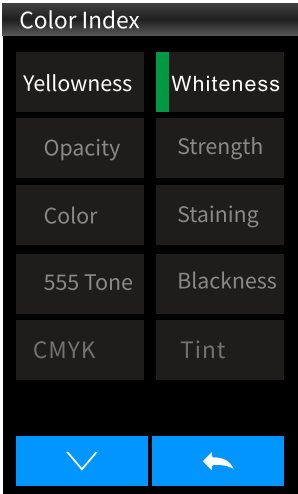


Figure 32 Color Index-2

2) Color Difference Formula

Color difference formula options are: LIE * ab, LIE * UV, LIE * 94, LIE * CMC (2: 1), LIE * CMC (1: 1), LIE * 00, LIE (Hunter). Setting the "color difference formula" as AE*00 as an example for detailed explanation.

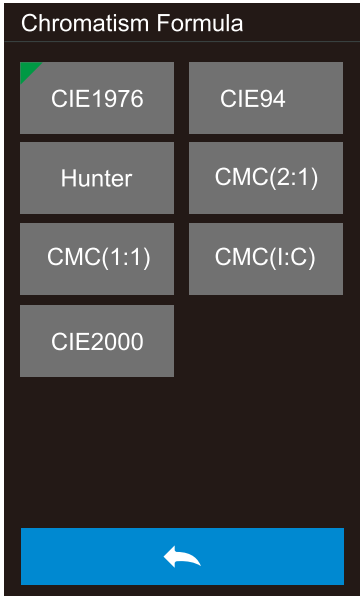


Figure 33 Color Difference Formula



Figure 34 Calculation of Color Difference Using ΔE CMC (2: 1)

The selected color difference formula is calculated in the sample measurement.

3.6 System Setting

Click "System Set" in the main menu to enter the interface of system setting, as shown in Figure 35. System setting include measurement setting and instrument setting. Click to check and select different setting options.

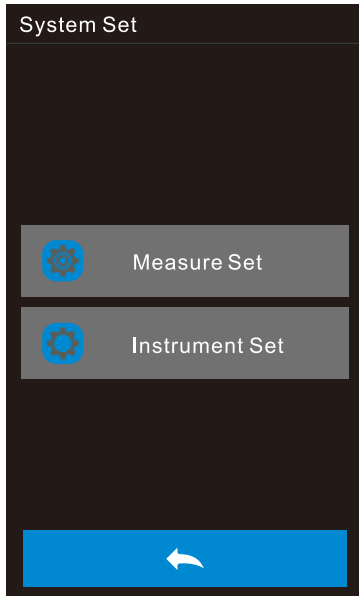


Figure 35 System setting

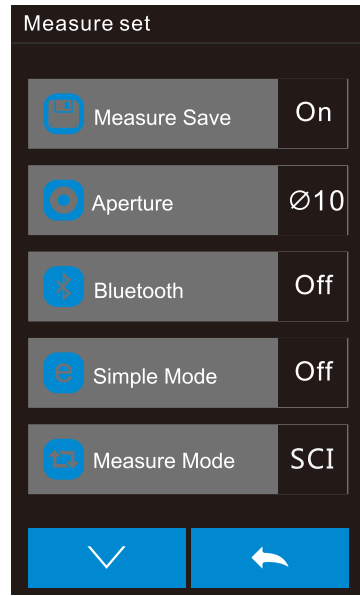


Figure 36 Measurement Setting

3.6.1 Measurement Setting

Click "Measurement Set" in the system setting to enter the interface of measurement setting, as shown in Figure 36. setting include automatic measurement saving, aperture selection, Bluetooth, simple mode, measurement mode, display setting, tolerance setting, average measurement, print setting, buzzer and other options. User can check and select different setting options. When a certain model does not support this function, the function will be disabled and displayed in gray.

1) Automatic Saving of Measurement

When automatic measurement saving is turned on, each test sample will be automatically stored in the instrument; otherwise, the record will not be automatically saved after the test of the sample is finished, and it will be saved only after manually clicking the save icon "  ", as shown in Figure 37.

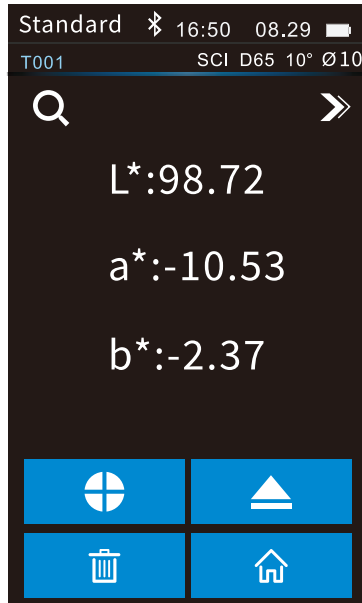


Figure 37 When automatic saving is turned off, the measurement results need to be saved manually

2) Measuring Aperture

This series of instruments is equipped with $\Phi 8\text{mm}$ measuring aperture, $\Phi 4\text{mm}$ measuring aperture, and $\Phi 1 \times 3$ measuring aperture models. Different models equipped with different measuring apertures. When the measured surface of the sample is large and uniform, it is recommended to use $\Phi 8\text{mm}$ measuring aperture, and when the measured surface of the sample is small, it is recommended to use $\Phi 4\text{mm}$ or $\Phi 1 \times 3$ measuring aperture.

Measuring aperture ($\Phi 8\text{mm}/\Phi 4\text{mm}/\Phi 1 \times 3\text{mm}$) switching needs to complete the following two steps:

Step 1: Install the aperture, rotate the measuring aperture counterclockwise, and remove the original aperture. Align the measuring aperture to be installed with the installation hole of the integrating sphere, and rotate clockwise. When there is a "click", it means that the measuring aperture is well matched with the buckle position of the integrating sphere, that is, the measuring aperture to be installed is installed.

Step 2: Switch the position of the optical lens. If the assembled aperture $\Phi 8\text{mm}$ is used to measure the aperture, it is necessary to turn the aperture switch to the position of MAV; If it is $\Phi 4\text{mm}$ or $\Phi 1 \times 3\text{mm}$ measuring aperture, dial the aperture switch to the SAV position.

Step 3: Switch the aperture setting in the instrument software, and manually set the corresponding $\Phi 8\text{mm}/\Phi 4\text{mm}/\Phi 1 \times 3$ aperture.

Note: The measurement aperture size, optical lens position and software aperture setting must be matched to ensure the accurate test results. $\Phi 1 \times 3$ aperture, the corresponding optical lens position is SAV, and the software shows that it is $\Phi 1 \times 3$; $\Phi 4\text{mm}$ diameter, the corresponding optical lens position is SAV, and the software shows $\Phi 4\text{mm}$; $\Phi 8\text{mm}$ aperture, the corresponding optical lens position is MAV, and the software shows $\Phi 8$; There is a corresponding display in the status bar of the test interface.

Note: After the measurement aperture is switched, the black-and-white calibration must be carried out again before a new data test can be carried out.

3) Bluetooth

For products equipped with Bluetooth, user can choose to communicate with PC software through Bluetooth.

When Bluetooth is turned on, the Bluetooth icon will be displayed on the status bar of the measurement interface. When the client program is installed on the PC, turn on Bluetooth in the instrument "System setting" and match the computer with Bluetooth. After the matching is successful, the software uses Bluetooth connection mode to connect, and a prompt appears in the lower right corner of the software, indicating that the connection is successful through Bluetooth. Then, the comprehensive control of the terminal equipment can be fully controlled through software, and the measurement can also be conducted.

4) Simple Mode

After the simple mode is turned on, go back to the measurement page for standard measurement. After the standard measurement, it will automatically switch to the sample measurement mode.

5) Measurement Mode

SCI: Specular Component Include

SCE: Specular Component Exclude

In this instrument, the SCI/SCE 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 (Some models have only partial options). I+E is SCI & SCE modes. SCI or SCE mode measurement time is about 1.5 seconds, and both SCI+SCE measurement time is about 3.2 seconds.

If the current instrument measurement mode is SCI (the working status area is displayed as SCI), the instrument only measures the sample SCI data. If the display mode is set to SCE, since there is no test SCE data, the corresponding chromaticity data is displayed as "--", spectral data and color index will also not be displayed.

6) Display setting

Click "Display setting" in the main menu to enter the display setting, as shown in Figure 26. In this interface, user can set whether to turn on color bias and test result prompt.

When the color deviation is turned on, the color deviation of the sample compared with the standard will be prompted when the sample is measured, as shown in Figure 38; when it is turned off, there is no prompt.

If the test result prompt is turned on, during sample measurement, if the test result exceeds the tolerance range set by the standard sample, it will prompt unqualified; if the error of the sample is within the tolerance range of the standard sample, it will show qualified, as shown in Figure 39.

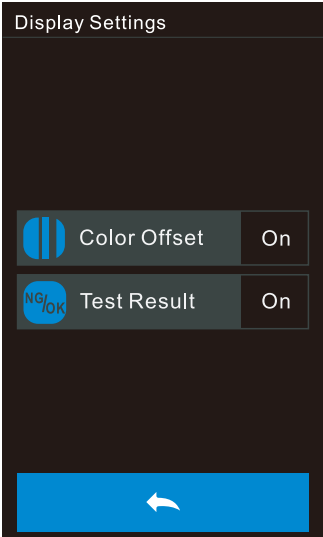


Figure 38 Display Setting

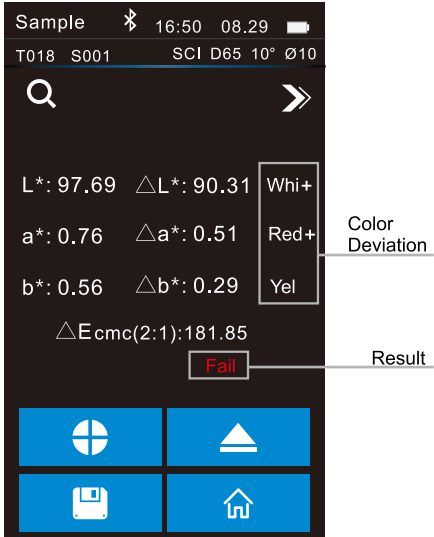


Figure 39 Open Color Deviation and Measurement Results

7) Tolerance Setting

Select "Tolerance Setting" in the measurement setting to enter the tolerance prompt setting. Users can set the tolerance values in the tolerance setting according to the requirements of color management. After selecting the number to be modified, the numeric button pad will pop up. Press the "✓" button to save the setting. Press the "←" button to return to the main menu.

When the tolerance setting is completed, the instrument will automatically judge whether the total color difference ΔE^* is qualified according to the tolerance value set by the user during the sample measurement. If the total color difference ΔE^* value is less than the tolerance value, it is Pass; if it is greater than the tolerance value, it is Fail.

System Tolerance	
ΔE^*	1.00
ΔL^*	- 1.00 + 1.00
Δa^*	- 1.00 + 1.00
Δb^*	- 1.00 + 1.00

←

Figure 40 Tolerance Setting

8) Average Measurement

When that sample to be measure is relatively large or not very uniform, the average reflectivity of multiple points can be obtain by measuring a plurality of representative test points, and the result can more represent the true chromaticity value of the sample. The instrument can realize 2-99 average measurement.

Click Average Measurement in the main menu to enter the average measurement, as shown in Figure 41. Then input the average number of measurements, and click “✓” to confirm. If the average number of input times is 1, measure 1 time of standard and sample measurement; If it is greater than 1, calculate the average value in the standard and sample measurement.

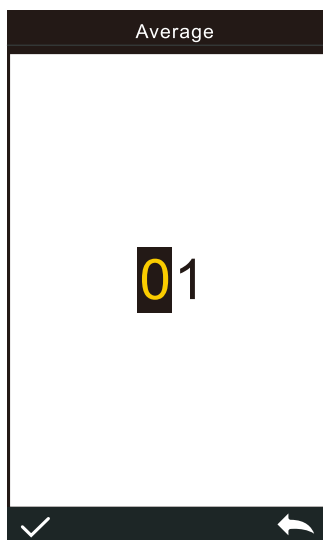


Figure 41 Average measurement

9) Print Setting

The micro printer is a non-standard accessory and needs to be purchased separately.

Use USB printer or Bluetooth printer to print out the current measurement record (some models). "Print setting" is off by default in the "System setting" of the main menu. User can choose to turn on the corresponding printer.

① Use USB printer

The User can connect the micro printer to the instrument through USB (as shown in Figure 42). After the micro printer connects to the instrument through USB, it can perform the operation of measuring and printing in the measurement interface. The instrument will send the current measurement record data to the printer, and the printer will finish printing.

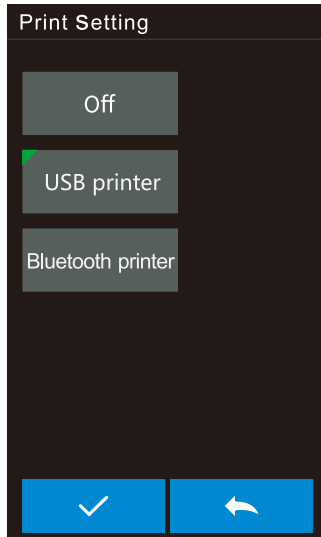


Figure 42 Print Setting

② Use Bluetooth printer

Similar to the USB printer, users can connect the instrument to the micro printer first, and print while measuring in the measurement interface. The instrument will send the current measurement record data to the printer, and the printer will finish printing.

Steps to use Bluetooth printer:

1. Press the power of Bluetooth printer for a long time, and let go when user see the indicator light flashing.
2. Enter into System setting → Print Setting → Bluetooth Printer.
3. Enter the mac address on the back of the Bluetooth printer in BLE mac, with a fixed length of 12 characters (for example, "4CE173C3F00E"), and the MAC address will be automatically stored.
4. Click Connect Printer"  ".

After the Bluetooth printer is connected, user can print while measuring in the measurement interface.

3.6.2 Instrument Setting

Click "Instrument Set" in system setting to enter the instrument setting, as shown in Figure 43. The instrument setting include language selection, time setting, screen backlight time, Restore factory and about instrument options.

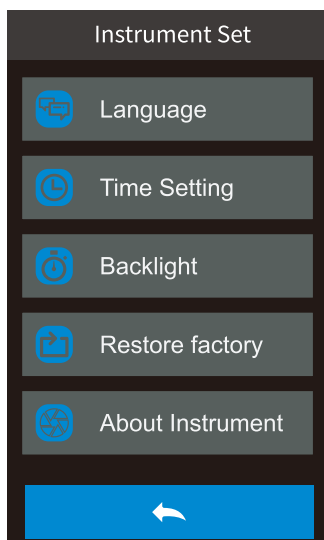


Figure 43 Instrument Setting

1) Language Setting

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

2) Time setting

When the instrument leaves the factory, the local time of the manufacturer is usually synchronized, and the customer can also set the time of the instrument according to the actual situation. Click "Time Setting" in the system setting interface to enter the interface shown in Figure 44.

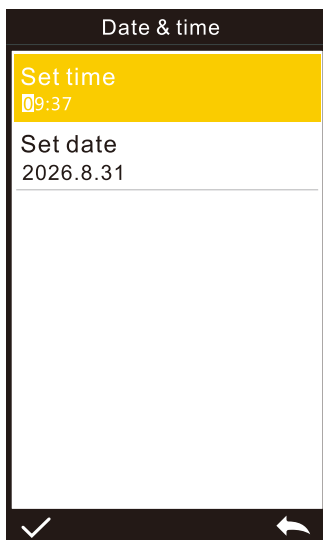


Figure 44 Time Setting

3) Screen Backlight Time

Click "Screen Backlight Time" in the system setting to enter the screen backlight time selection interface.

The backlight time is divided into: normally on, 5 minutes, 60 seconds, 30 seconds and 15 seconds. If normally open is selected, the screen will not be automatically turned off when there is no operation. If it is set to "60 seconds", the instrument will time from the last customer operation, and after 60 seconds, the screen will be turned off, making it in power-saving mode. "5 minutes", "30 seconds" and "15 seconds" have the same meaning as above. User can press the "Measuring button" to wake up the instrument when the screen is off.

4) Restore Factory Setting

Click "Restore Factory Setting" in the system setting to enter the interface shown in Figure 45. Click "✓" to clear all measurement records and customer setting, and restore to the factory status; Click "↩" to cancel this operation.

Note: The operating instrument will clear all data and user setting, and be restored to the factory state. All data cannot be restored. Please operate with caution.

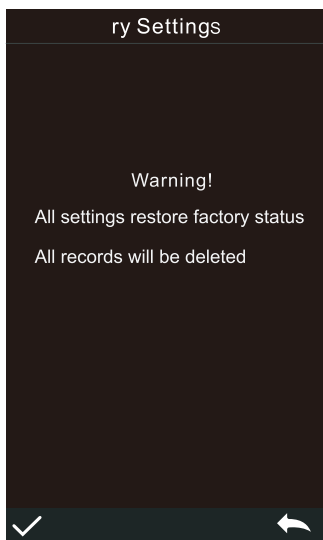


Figure 45 Restore Factory Setting

5) About Instruments

Display information such as instrument model and current software version.

4. Daily Maintenance

1) This instrument is a precision optical instrument, so please keep and use it properly, and avoid using and storing it in damp, 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 calibration box is a precision optical element, so it should be properly kept and used. Avoid bumping the working face with sharp objects, soiling the working face with dirt and exposure to strong light. Clean the working face of the calibration box with regular wiping cloth dipped in alcohol, and get rid of the dust on the working face in time during calibration.

3) In order to ensure the validity of the test data, it is recommended that the whole colorimeter and calibration box should be inspected by the manufacturer or a qualified metrology institute one year from the date of purchase.

4) This instrument is powered by a built-in lithium battery. If the instrument is not used for a long time, please charge it every 2 weeks to protect the performance of the lithium battery and prolong its life.

5) Please don't disassemble the instrument without permission. If user have any questions, please contact the relevant after-sales staff. Tearing up the easy-to-tear label will affect the after-sales maintenance service of the instrument

5. Technical Parameters

5.1 Product Features

1)This instrument fully considers the user's experience, and adopts the theme concept of humanized design-making the measurement easier.

2)It is convenient, fast and accurate to use the original light spot positioning or cross platform positioning.

3)This instrument can directly enter the measurement without black-and-white calibration, which improves the convenience of the colorimeter.

4)This instrument adopts a new photoelectric integrating sphere design, which greatly improves the repeatability accuracy and stability of measurement.

5)This instrument has a variety of technical specifications, which users can choose according to their needs.

5.2 Specifications

Model	Whiteness Meter
Optical Geometry	Reflect: D/8 (diffused illumination, 8-degree viewing angle) SCI/SCE measurement Conforms to CIE No.15, GB/T 3978
Integrating Sphere Size	Φ40mm
Light Source	Combined full spectrum LED light source, UV
Spectral Method	Nano Integrated Spectral Device
Sensor	Silicon photodiode array (double row 16 groups)
Wavelength Range	400~700nm
Measuring Range	0-200

Spectrocolorimeter

Measuring Aperture	Φ10mm
Specular Component	Measure SCI/SCE at the same time
Color Index	WI(ASTM E313, CIE/ISO,R457,AATCC, Hunter,Taube,Berger, Stensby,Ganz), YI(ASTM D1925, ASTM E313)
Observer Angle	10°
Illuminant	D65
Display Accuracy	0.01
Measuring Time	About 1s
Repeatability	Chromaticity value:MAV/SCI within AE*ab 0.1 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration)
Measurement Mode	Single Measurement,Average Measurement(2-99times)
Zero Drift	≤0.1/10 min
Indication Drift	≤0.1/3 min
Locating Method	stabilizer cross position
Dimension	L × W × H = 94 × 68 × 188 mm (excluding calibration base)
Weight	About 410g
Battery	Lithium Battery, 3.7 V, 3200 mAh, up to 8,000 measurements within 8 hours
Illuminant Life Span	10 years, more than 1.2 million times measurements
Display	2.8-inch TFT color LCD, Capacitive Touch Screen
Communication Port	USB, Bluetooth
Data Storage	Standard 1000 Pcs,Sample 30000 Pcs (One data can include SCI/SCE at the same time), APP Storage
Language	Simplified Chinese, English, Traditional Chinese
Software	Android, iOS, Windows, WeChat Mini Program, HarmonyOS
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 Manual, PC Software(Download from website),USB cable,White and Calibration Cavity,Protective Cover, Wrist strap, Measuring Aperture

Spectrocolorimeter

Optional Accessory	Powder Test Box, Powder Forming Tool
Notes	Technical parameters are for reference only,subject to actual sales

Model	Reflectance Meter
Illumination Geometry	D/8, SCI/SCE; Complies with CIE No.15, GB/T 3978, GB/T 13452.3, GB/T 23981, ISO 6504-1, and ISO 7724-2
Illuminant	Combined Full-Spectrum LED Light Source
Integrating Sphere Size	Φ40 mm
Spectral Method	Nano Integrated Spectral Device
Sensor	Silicon Photodiode Array (16 Dual-Column Sensor Groups)
Measurement Wavelength Range	400–700 nm
Measuring Aperture	Φ10 mm Platform Measuring Aperture
Measurement Mode	SCI/SCE
Observer Angle	10°
Illuminants	D65, C
Colorimetric Indices	Reflectance, Opacity
Measurement Range	0-100%
Resolution	0.1
Indication Error	±1.0
Repeatability	0.2%; after instrument warm-up and calibration, based on the average of 30 measurements of the white standard at 5-second intervals
Display	Spectral Graph/Data, Reflectance Difference, Pass/Fail Results
Measurement Time	1s
Positioning Method	Positioning Plate
White Standard Calibration	Contact White Standard Calibration

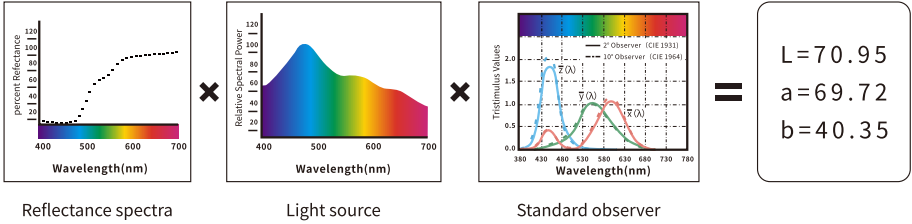
Spectrocolorimeter

Dimensions	94 × 68 × 188 mm (excluding calibration base)
Weight	410 g (excluding calibration base)
Battery	Lithium Battery, 3.7 V, 3200 mAh, up to 8,000 measurements within 8 hours
Illuminant Lifetime	More than 1.2 million measurements over 10 years
Display	2.8-inch TFT Color Touchscreen
Interfaces	USB, Bluetooth
Data Storage	200 Standard Samples, 10,000 Test Samples
Software Support	Windows, Android, iOS, WeChat Mini Program, HarmonyOS
Languages	Simplified Chinese, English, Traditional Chinese
Operating Temperature	0–40°C, 0–85% RH (non-condensing), Altitude: below 2,000 m
Storage Temperature	–20–50°C, 0–85% RH (non-condensing)
Standard Accessories	Power Adapter, USB Cable, User Manual, White Calibration Box, Protective Cap, Wrist Strap, Measuring Aperture
Optional Accessories	Mini Printer, Powder Test Box

Appendix 1

1.Object color

There are three elements to observe color: illumination source, object, observer. Any change in any of these three will affect the viewer's color perception. When the illumination source and observer do not change, then the object will determine the color perception formed by the observer. The reason why objects can affect the final color perception is because the reflection spectrum (transmission spectrum) of the object modulates the spectrum of the source. Different objects have different reflection spectra (transmission spectra), and the spectrum of the source is reflected by different objects (transmission spectrum). Spectral modulation yields different results, because the observer does not change, so it presents different colors, the principle of which is shown below.



2.Color Difference Formula

CIE 1976 color difference formula ΔE^*_{ab} is as follows:

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

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

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

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

CIE 2000 color difference formula ΔE_{00} is as follows:

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

$$L' = L^*$$

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

$$b' = b^*$$

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.Color Offset Judgment

$\Delta L+$ represent whitish, $\Delta L-$ represent blackish

$\Delta a+$ represent reddish, $\Delta a-$ represent greenish

$\Delta L+$ represent yellowish, $\Delta L-$ represent bluish

4.Human Eye Distinguishes Colors

The color difference unit of NBS is derived from the unit of the color difference calculation formula established by Judd-Hunter. The color difference of a color is called "NBS color difference unit" when the absolute value is 1. The new color difference formulas developed later often consciously adjusted the units to be close to the NBS units. For example, the units of the color difference formulas such as Hunter Lab and

CIE LAB,CIE LUV are almost the same as the NBS units (not equal). Therefore,do not misunderstand that the color difference units calculated by other color difference formulas are all NBS.

Color Difference Magnitude and Visual Perception:

ΔE^*	Visual Perception Level	ΔE^*	Visual Perception Level
0-0.25	Very small to no difference; ideal match	1.0-2.0	Medium difference; noticeable to the human eye, acceptable in specific applications
0.25-0.5	Minor difference; generally acceptable	2.0-4.0	Obvious difference; acceptable under specific conditions
0.5-1.0	Minor to medium difference; acceptable in some applications	4.0 and Above	Extremely large difference; unacceptable for most applications



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