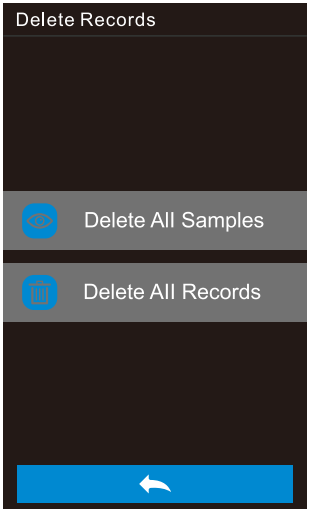


Figure 16 Delete Record Interface

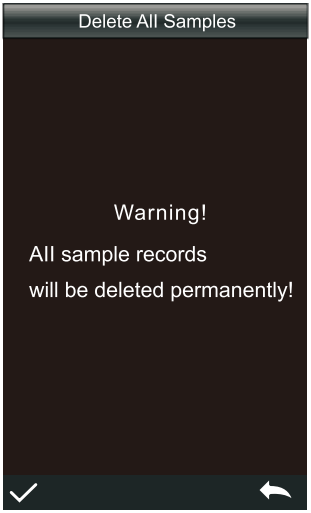


Figure 17 Delete Prompt Box

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, dustproof 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 18.

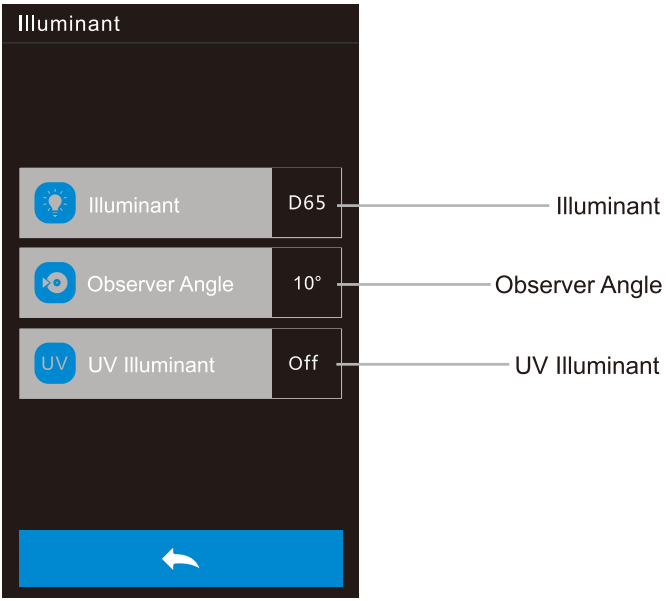


Figure 18 Illuminant

The user sets the corresponding light source according to the actual measurement condition. In the illuminant interface, you 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).

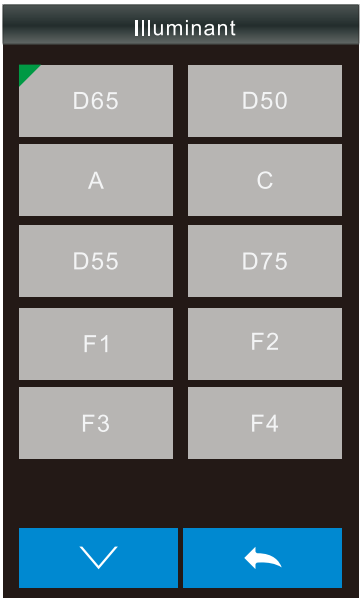


Figure 19 Illuminant Selection

Figure 20 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 20. 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 21. Let's take setting the "color difference formula" as ΔE*00 as an example for detailed explanation. Color index interface, color difference formula options are: ΔE * ab, ΔE * UV, ΔE * 94, ΔE * CMC (2: 1), ΔE * CMC (1: 1), ΔE * 00, ΔE (Hunter).

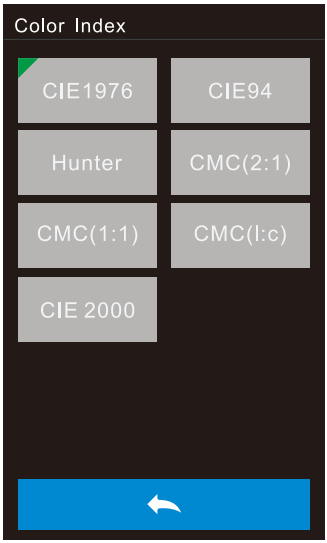


Figure 21 Color Index

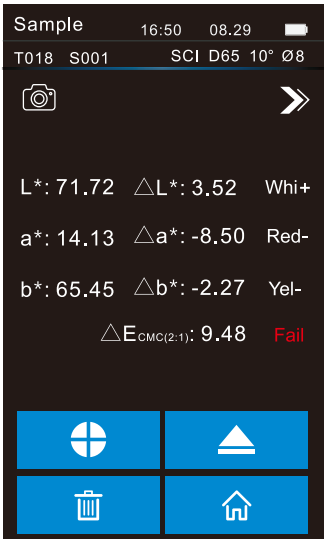


Figure. 22 Calculation of Color Difference Using ΔE CMC (2: 1)

The selected color difference formula will be used to calculate the color difference of the sample when it is measured, as shown in Figure 22.

The selected color index will be displayed in the color index display area of standard sample and sample measurement (depending on the index, it may only be displayed in the sample).

3.6 System Setting

Click "System Set" in the main menu to enter the interface of system setting, as shown in Figure 23. System setting include measurement setting and instrument setting. Click to check and select different setting options.

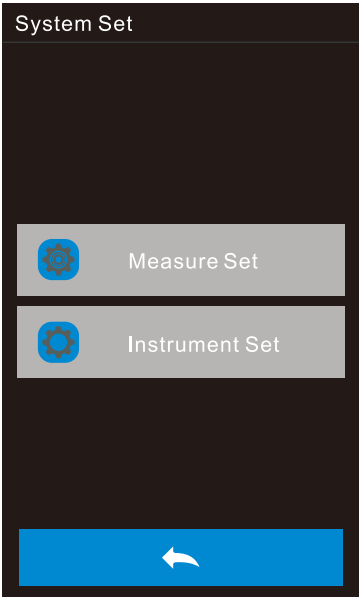


Figure 23 System setting

3.6.1 Measurement setting

Click "Measurement Set" in the system setting to enter the interface of measurement setting, as shown in Figure 24. setting include automatic measurement saving, aperture selection, Bluetooth, simple mode, measurement mode, display setting,

tolerance setting, average measurement, print setting, buzzer and other options. You can check and select different setting options.

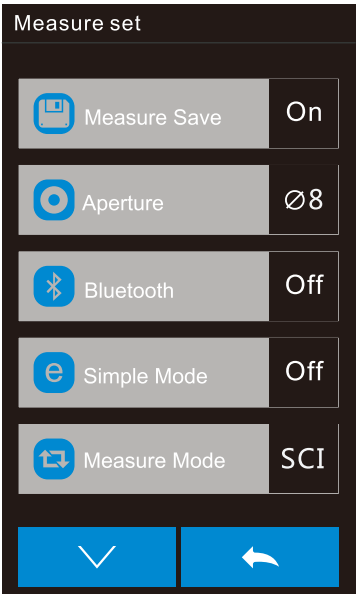


Figure 24 Measurement setting

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 25.

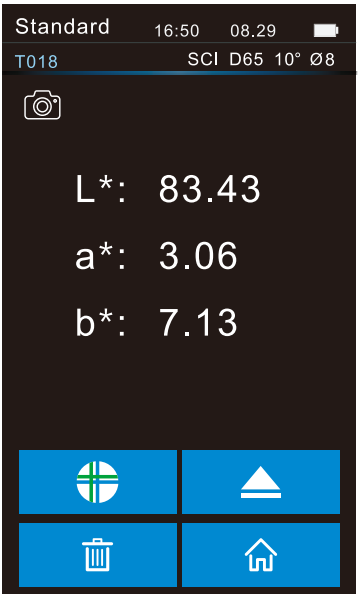


Figure 25 When automatic saving is turned off,
the measurement results need to be saved manually.

2)Measuring Aperture

This series of instruments is equipped withΦ8mm measuring aperture andΦ4mm measuring aperture, and different Φ1*3 measuring aperture models are equipped with different measuring apertures. When the measured surface of the sample is large and uniform, it is recommended to use Φ8mm measuring aperture, and when the measured surface of the sample is small, it is recommended to use Φ4mm or Φ1*3 measuring aperture.

Measuring aperture (Φ8mm/Φ4mm/Φ1x3) 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 Φ8mm is used to measure the aperture, it is necessary to turn the aperture switch to the position of MAV; If it is φ4mm measuring aperture, dial the aperture switch to the SAV position; If the assembled aperture Φ1*3 is used to

it is necessary to turn the aperture switch to the SAV position.

Step 3: Switch the aperture setting in the instrument software, and manually set the corresponding Φ8mm/Φ4mm/Φ3 aperture.

Note: The measurement aperture size, optical lens position and software aperture setting must be matched to ensure the accurate test results. Φ1×3 aperture, the corresponding optical lens position is SAV, and the software shows that it is 1*3; Φ4mm diameter, the corresponding optical lens position is SAV, and the software shows Φ4mm; Φ8mm aperture, the corresponding optical lens position is MAV, and the software shows Φ8; 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, you 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

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 includes specular reflection measurement mode, SCE excludes specular reflection measurement mode. In this instrument, the SCI/SCE test mode is switched by the traditional way of setting mechanical optical traps. The SCI measurement mode is when the motor drives the paddles to block the mechanical optical traps, and the SCE measurement mode is when the paddles are opened. Standard measurement, the instrument automatically completes SCI and SCE measurement

and the test time is about 3 seconds.

When measuring the sample, the instrument measures according to the measurement mode set by the customer. Customers can set the measurement mode as SCI, SCE or I+E according to the needs of measurement products, and some models only have some options.

I+E is SCI+SCE mode. The measurement time of SCI/SCE alone is about 1.5 seconds, and the simultaneous measurement of SCI+SCE takes 3.2 seconds.

If the current measurement mode of the instrument is SCI (SCI is displayed in the working state area), the instrument will only test the SCI data of the sample; if the display mode is set to SCE, the corresponding chromaticity data will be displayed as "-",and the spectral data and color index will 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, you 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 27; 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 27.

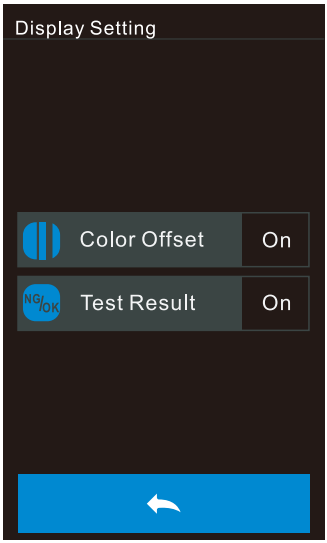


Figure 26 Display setting

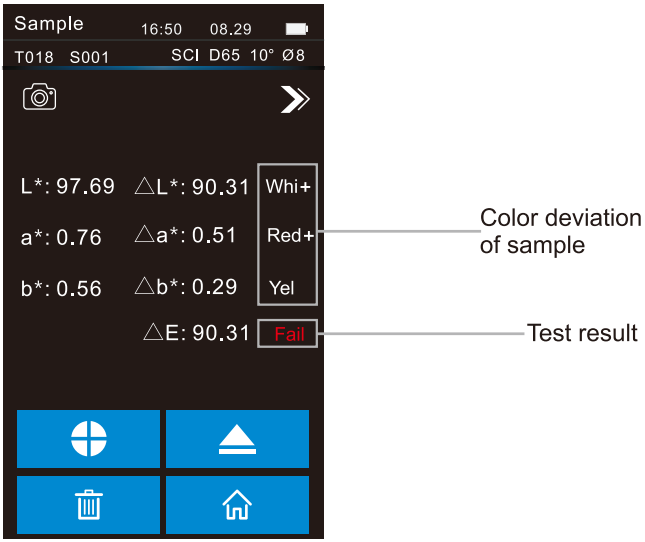


Figure 27 Open color deviation and measurement results

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 buttonpad will pop up. Press the " ✓ " button to move the cursor to the next digit. When the cursor is on the last digit, press the " ✓ button to save the setting and return to the measurement setting. If you don't want to set or modify the tolerance, 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 △E* is qualified according to the tolerance value set by the user during the sample measurement. If the total color difference △E* value is less than the tolerance value, it is qualified; if it is greater than the tolerance value, it is unqualified.

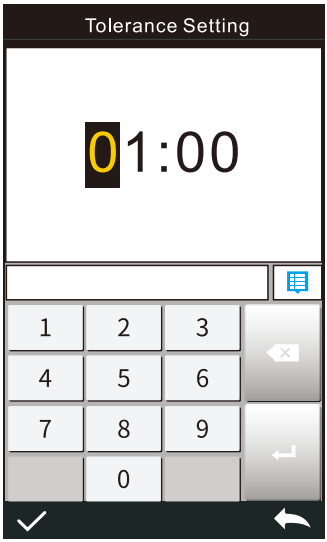


Figure 28 Tolerance Setting

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 then the calculate chromaticity data can more represent the true chromaticity value of the sample to be

measured, and the instrument can realize 2-99 average measurement.

Click Average Measurement in the main menu to enter the average measurement, where you can set the average measurement times, as shown in Figure 29. Then enter the average number of measurements, and click theto confirm. If the average number of input times is 1, measure it in the conventional way; If it is greater than 1, the measurement results will be generated after the specified number of measurements are averaged during the standard and sample measurement.

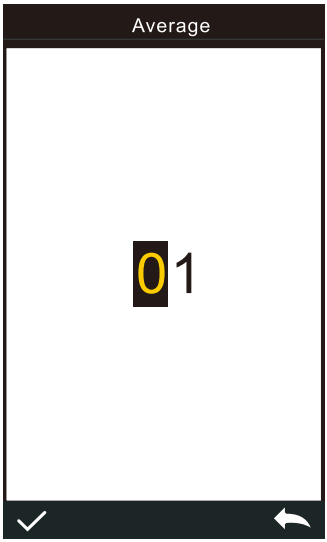


Figure 29 Average Measurement

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. When you need to print, you can choose to turn on the corresponding printer.

①Use USB printer

Users can connect the micro printer to the instrument through USB (as shown in Figure 30). 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.

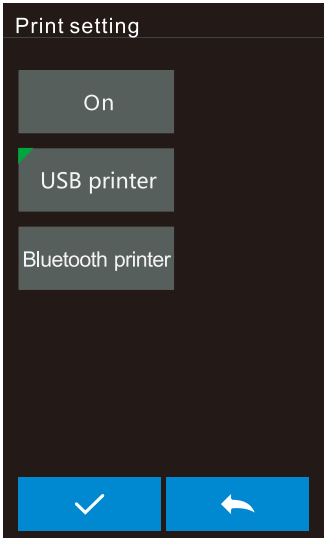


Figure 30 Print setting

②Use 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 you 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" ▶ ",
5. After the Bluetooth printer is connected, you 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 31. The instrument setting include language selection, time setting, screen backlight time, factory setting and instrument-related options. You can check and select different setting options.

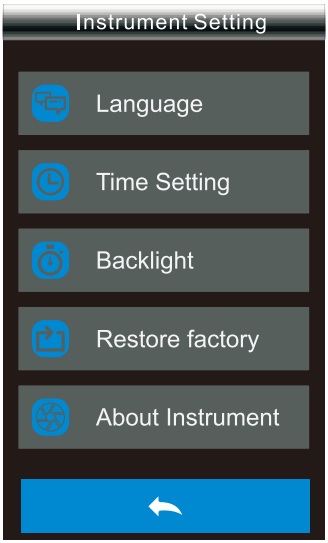


Figure 31 Instrument setting

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)Timeset

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 32.

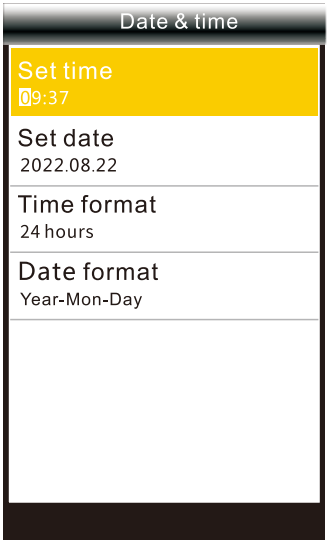


Figure 32 Time and Date Setting

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. You 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 33. Click" ✓ "Instruments 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.

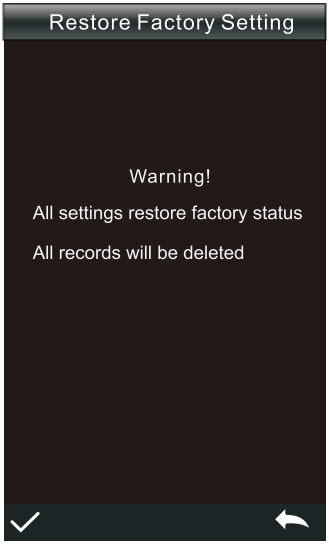


Figure 33 Restore Factory Setting

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 you 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 Technical Specifications

Product Model	**Spectrocolorimeter**
Optical Geometry	D/8 (diffuse illumination, receiving in 8 direction), SCI/SCE (including specular reflection light/removing specular reflection light), conforming to standards CIE No.15, GB/T3978, GB 2893, GB/T18833, ISO 724-1, ASTM E164, DIN 5033 TEIL 7.
Trait	CMOS dual-channel spectral sensor is used for color difference quality control in plastic electronics, paint ink, textile and garment printing and dyeing, printing, ceramics and other industries; UV can be used for fluorescence sample measurement.
Optical Geometry	Combined full-spectrum LED light source, UV light source
Integrating Sphere Size	Φ40mm

Sensor	CMOS dual-channel spectroscopic sensor
Measuring wavelength Range	400-700nm
Measuring Aperture	MAV:Φ8mm/Φ10mm； SAV:Φ4mm/Φ5mm； LAV:1x3mm (different models vary)
Light Containing Mode	Testing SCI/SCE simultaneously
Color Space	CIE LAB,XYZ,Yxy,LCh,CIE LUV,s-RGB,HunterLab,βxy,DIN Lab99
Color Difference Formula	ΔE*ab,ΔE*uv,ΔE*94,ΔE*cmc(2:1),ΔE*cmc(1:1),ΔE*00, DINΔE99,ΔE(Hunter)
Other Chromaticity Indexes	Spectral reflectance, WI(ASTM E313, CIE/ISO,AATCC,Hunter), YI(ASTM D1925, ASTM 313), metamerism index Mt, color fastness to staining, color fastness, strength, coverage, 555-tone classification, Munsell(C/2) (only implemented in mobile APP)
Observer Angle	2°/10°
Observation Light Source	D65,A,C,D50,D55,D75,F1,F2(CWF),F3,F4,F5,F6,F7(DLF),F8,F9,F10(TPL5),F11(TL84),F12(TL83/U30),U35,NBF,ID50,ID65
Displayed Data	Spectra/data, sample chromaticity value, color difference value/graph, qualified/unqualified results, color simulation, color bias.
Measuring Time	About 1s
Repeatability	Chroma value: MAV/SCI, standard deviation ΔE*ab 0.02 or less (after preheating and calibration, measure the average value of whiteboard for 30 times at intervals of 5s) Spectral reflectance: MAV/SCI, standard deviation within 0.08% (400 ~ 700 nm: within 0.18%)
Inter-instrument Error	MAV/SCI,ΔE*ab 0.2 or less (measured average value of 12 color plates in BCRA series Ⅱ)
Display Accuracy	0.01
Reflectivity Measurement Range	0-200%
Reflectivity Resolution	0.01%
Measurement Method	Single measurement, average measurement (2~99 times)
Location Mode	Stabilizing film positioning+camera framing positioning
Whiteboard Verification Mode	Non-contact automatic whiteboard calibration

Verification Mode	
Dimension	L*W*H =114X70X208mm (excluding the calibration base)
Weight	70g (excluding the calibration base)
Battery Capacity	Lithium battery, 3.7V, 5000 mAh, 8000 times in 8 hours
Lighting Source Life	More than 1.2 million measurements in 10 years
Display	TFT true color 2.8inch, capacitive touch screen
Data Port	USB, Bluetooth 5.0 (different models vary)
Storage Data	There are 500 standard samples and 10,000 samples (one piece of data can include SCI/SCE at the same time), and app/PC stores them in large quantities.
Software Support	Andriod,IOS,Windows, WeChat applet, HarmonyOS (different models are different)
language	Simplified Chinese, English, Traditional Chinese
Operating Temperature Range	0~40°C,0~85%RH (without condensation), altitude: below 2000m
Storage Temperature Range	-20~50°C,0~85%RH (without condensation)
Standard Attachment	Power adapter, data cable, instruction manual, quality management software (downloaded from official website), black-and-white calibration box, protective cover, wrist strap, measuring aperture.
Optional Accessories	Miniature printer, powder test box
Note:	1. Technical parameters are for reference only, subject to the actual products sold. 2. It is subject to change without prior notice.

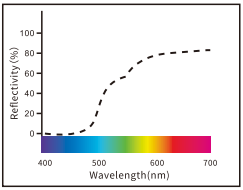
Appendix I

1. Color

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

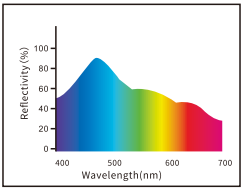
The reason why an object can affect the final color perception is that the reflection spectrum

(transmission spectrum) of the object modifies the light source spectrum. Different objects have different reflection spectra (transmission spectrum). (Spectrum) modulation to obtain different results, because the observer does not change, so it presents different colors, the principle is shown in the figure below.



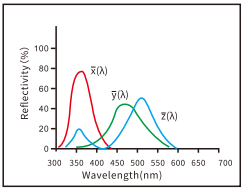
Reflectance spectra

X



Light source

X



Standard observer

=

L=70.95
a=69.72
b=40.35

2.Color Difference Formula

CIE 1976 ΔE*ab

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

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

CIE 2000 ΔE00

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

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

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

CIE 2000 ΔE00

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

$$S_L = 1$$

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

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

3. Color Offset Judgment

AL+ represent whitish, AL- represent blackish

Aa+ represent reddish, Aa- represent greenish

AL+ represent yellowish, AL- 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.

Annexed Table

NBS unit and color difference perception degree

NBS unit and color difference	Perceptual color difference
0.00~0.50	(micro chromatic aberration) sensation minimal
0.50~1.50	(small chromatic aberration) sensation slight (slight)
1.5~3	(small chromatic aberration) feeling noticeable (obvious)
3~6	(larger chromatic aberration) feeling very noticeable (appreciable)
6 or more	(large color aberration) feels strong (much).

Warning:Changes or modifications to this unit not expressly approved bythe party responsible forcompliance could void the user ’ sauthority to operate the equipment.

NOTE:This device complies with part 15 of the FCC Rules. Operation issubject to the followingtwo conditions: (1) This device may notcause harmful interference, and (2) this device mustaccept anyinterference received, including interference that may causeundesired operation.

FCC Statement:
This equipment has been tested and found to comply with the limitsfor a Class B digital device, pursuant to part 15 of the FCCRules.These limits are designed to provide reasonable protectionagainst harmful interference in a residential installation. Thisequipment generates, uses and can radiate radio frequency energyand, if not installedand used in accordance with theinstructions, may cause harmfulinterference to radio communications. However, there isnoguarantee that interference will not occur in a particularinstallation. If this equipment does cause harmful interference toradio or television reception, which can be determined byturningthe equipment off and on, the user is encouraged to try tocorrect the interference by oneor more of the following
measures :
---Reorient or relocate the receiving antenna.
---Increase the separation between the equipment and receiver.
---Connect the equipment into an outlet on a circuit different fromthat to which the receiver isconnected.
---Consult the dealer or an experienced radio/Ty technician forhelp.

The product is a portable device and meets the exposureassessment requirements for portable
devices.