

# Spectrophotometer

Code: 86178

User Manual V1.01

Please read this manual carefully before using and reserve it for reference.

# I Product Introduction

The small-aperture split-type multifunctional spectrophotometer, with a 1 mm measuring aperture, is ideal for measuring the color of small workpieces and irregularly shaped materials. The probe and main unit are designed separately, making it easy to align the probe with small objects. The probe can also be inverted, with the measuring aperture facing upward, allowing small objects to be placed on the aperture for measurement without affecting the reading. It has a 3.5-inchIPS color display and capacity touch panel, which has an excellent operating experience. The instrument integrates multiple color charts and can quickly match the measured color to the closest color code. It also has color difference comparison function, color difference threshold can be set and a variety of color difference formulas can be selected to achieve rapid QC testing. The instrument can also connect to APP for color measurement and sharing. It is also equipped with a powerful PC software to meet various needs of customers. The instrument meets the requirements about grade 1 colorimeter in the *Chinese JJG 595-2002 Colorimeters and Color Difference Meters* in all directions employing full-spectrum LED light source and advanced spectral sensor.

## Standards for the product

*JJG 595-2002 Colorimeters and Color Difference Meters*

*GB/T 3978-2008 Standard illuminants and geometric conditions*

*GBT 7921-2008 Uniform color space and color difference formula*

*GB/T 11186.1-1989 Methods for measuring the colour of paint films--Part 1: Principles*

*GB/T 11186.2-1989 Methods for measuring the colour of paint films--Part 2: Colour measurement*

*GB/T 11186.3-1989 Methods for measuring the colour of paint films--Part 3: Calculation of colour differences*

*GB/T 39822-2021 Plastics—Determination of yellowness index and change in yellowness index*

*GB/T 17749-2008 Methods of whiteness specification*

*ASTM E313-98 Standard Practice for Calculating Yellowness and Whiteness Indices from Instrumentally Measured Color Coordinates*

# II Parameters

Illumination geometry	D/8, specular component include (SCI)
Illumination light source	Full spectrum LED light source
Spectral range	400-700nm
Spectral interval	10nm
Measuring aperture	1mm

Measurement conditions	Light source D65, field of view 10°
Measuring time	About 1s
Color space	CIE Lab, Luv, LCh, Yxy, CMYK, RGB, WI-98, WI-Gauz, WI-Hunter, YI-98, WI-R457, HSL, HSV, Spectra
Color difference formula	$\Delta E^*ab$ , $\Delta E^*uv$ , $\Delta E^*94$ , $\Delta E^*cmc(2:1)$ , $\Delta E^*cmc(1:1)$ , $\Delta E^*cmc(1.4:1)$ , $\Delta E^*00$
Repeatability	Standard deviation $\Delta E^*ab$ is within 0.03 (Measurement condition: the average value of 30 measurements on the whiteboard at an interval of 3s after calibration)
Inter-instrument agreement	$\Delta E^*ab \leq 0.4$ , based on avg. of 12 BCRA series II tiles
Dimension	Host: 132*67*20mm Probe: 45*37*64mm
Weight	About 390g
Power supply	Rechargeable lithium battery 3.7V@4000mAh, can measure 10,000 times continuously under full charge
Display	480 * 320 dot matrix IPS color screen
Language	Simplified Chinese, English
Data transmission	USB, Bluetooth
Operating temperature range	0~45°C, 0~85%RH (no condensation)
Storage temperature range	-25~55°C, 0~85%RH (no condensation)
Supply voltage	DV 5V
Operating current	150mA
Operating power consumption	750mW

### III Features

1. The 1 mm measuring aperture is especially suitable for measuring small, smooth, and opaque objects.
2. The instrument is fashioned with a full-spectrum LED light source and spectral sensor, and it meets the requirements of the national metrology grade 1 machine.
3. Adopt a 3.5-inch capacity touch panel with human-machine interaction interface for convenient

operation.

4. Contains multiple electronic color charts, which can quickly match the closest color code with matching accuracy rate greater than 90%.
5. QC testing function: the color difference threshold can be set and a variety of color difference formulas are optional.
6. A variety of color spaces are available, suitable for various needs of color measurement.
7. It can store 1000 colors and 1000 color comparison records with large storage space.
8. It can connect to APP for color sharing.
9. Equip with PC software which has stronger color difference statistical analysis function, spectral reflectance measurement and curve data export EXCEL function.
10. The instrument has a built-in compensation optical path with stable values, allowing long-period calibration.
11. With built-in rechargeable lithium battery, the instrument can measure continuously for 10,000 times under full charge.

## IV Operation

### 1. Power on/off

**Power on:** Short press the power button to turn on the instrument.

**Power off:** Long press the power button to turn off or press "Power off" in the menu bar. If automatic power off is set, the instrument will automatically power off as no operation time exceeds the set value, when the time of no operation is longer than the set automatic power off time. When the spectrophotometer is connected to the App via Bluetooth, it will automatically power off with no operation over 30 minutes.

### 2. Calibration

After entering "calibration" interface, you can perform calibration operation as the calibration animation, or skip the calibration. It is recommended to calibrate after a long time of no usage.



For failed calibration, the possible reasons are as below:

- ◆ The standard tile is not closed properly;
- ◆ The standard tile needs to clean;
- ◆ The attenuation of the light source leads to failure of normal use and it needs to be returned to the factory for inspection and repair.

### 3. Measurement

The default measurement parameter of the instrument is "Lab". Users can click the "Param" at the top of the screen to enter the setting interface to select the parameters to be measured (CIE Lab, CIE Luv, CIE LCh, Yxy, CMYK, RGB, WI-98, WI-Gauz, WI-Hunter, YI-98, WI-R457, HSL, HSV, Spectra).

Color Format Setting			
CIE_Lab	<input checked="" type="radio"/>	WI-Gauz	<input type="radio"/>
CIE_LCh	<input type="radio"/>	WI-Hunter	<input type="radio"/>
CIE_Luv	<input type="radio"/>	WI-R457	<input type="radio"/>
Yxy	<input type="radio"/>	HSL	<input type="radio"/>
CMYK	<input type="radio"/>	HSV	<input type="radio"/>
RGB	<input type="radio"/>	Spectra	<input type="radio"/>
YI-98	<input type="radio"/>		
WI-98	<input type="radio"/>		

To enter the main measurement interface, there are two modes: "Color Scan" and "Color Compare". You can press the button at the bottom of screen to switch and the selected mode will turn blue .

Param History Save			
L*	a*	b*	Scan
-----	-----	-----	
Color Matches			Color Chart
Color Scan		Color Compare	

Param History Save			
L*	a*	b*	
Standard -----	-----	-----	
Sample -----	-----	-----	
$\Delta$ -----	-----	-----	
$\Delta L$ Setup			
Save standard	Input Standard	Add Standard	
Scan Standard		Scan Sample	
Color Scan		Color Compare	

### 3.1 Color Compare

The screenshot shows a mobile application interface for color comparison. At the top, there are three tabs: 'Param', 'History', and 'Save'. Below the tabs, there is a table with three columns: L\*, a\*, and b\*. The table has two rows: 'Standard' and 'Sample'. The 'Standard' row has values 72.53, 20.24, and 74.53. The 'Sample' row has values 72.19, 20.43, and 71.50. Below the table, there is a row for the color difference  $\Delta$  with values -0.34, 0.19, and -3.03. Below this, there are three labels: 'slight black', 'Normal', and 'slight blue'. A green bar at the bottom of the table area displays  $\Delta E^*ab = 3.05$  and 'PASS'. Below the green bar, there are three buttons: 'Save standard', 'Input Standard', and 'Add Standard'. At the bottom, there are two large orange buttons: 'Scan Standard' and 'Scan Sample'. Below these buttons, there are two labels: 'Color Scan' and 'Color Compare'.

	L*	a*	b*
Standard	72.53	20.24	74.53
Sample	72.19	20.43	71.50
$\Delta$	-0.34	0.19	-3.03

slight black   Normal   slight blue

$\Delta E^*ab = 3.05$    PASS    $\Delta E$  Setup

Save standard   Input Standard   Add Standard

Scan Standard   Scan Sample

Color Scan   Color Compare

In the measurement interface, press the "Scan Standard" button to set current value as standard. Press the "Scan Sample" button to use current value as sample. If short press the power button side, another measurement will also be taken and the current value will replace the previous one. When measuring or adding a standard and measuring a sample, the color difference between the two measured values will be calculated with the following results:

- ◆ **The difference value**

The difference  $\Delta$  is the sample data minus the standard data;

- ◆ **Color Bias**

When the measurement parameter is selected as Lab, the color bias will be judged by  $\Delta L$ ,  $\Delta a$ , and  $\Delta b$ ;

- ◆  **$\Delta E$  value**

When the measurement parameter is selected as Lab, LCh, Luv, Yxy, CMYK, RGB, HSL or HSV,  $\Delta E$  is calculated using the  $\Delta E^*ab$  color difference formula;

- ◆ **QC test**

Suitable for color difference inspection in production process. If  $\Delta E$  is higher than the set threshold, it will read "NG" and shown in red; if  $\Delta E$  is less than or equal to the set threshold, it will read "Pass" and display in green.



Pass



NG

The following steps can be performed after completing compare measurement:

- **Save**

To save the comparison result, press "Save" on the upper right corner. You can choose default or name the record manually.

- **History**

If users need to view the saved results, click "History" to view the records, and records can be paged, deleted, renamed and searched.

- **Save standard**

After the user has finished measuring the standard value, if need to save it for later calling, click the "Save standard" to save it, and the saved value can be queried in the add standard interface.

- **Add standard**

After clicking "Add standard", the interface will jump to "Add standard", click the value you want to add, and the selected value will be used as the standard, and will automatically return to the measurement interface to compare with the current sample or the upcoming sample.

- **Input standard**

The user can manually input the Lab, Luv, LCh, Yxy, CMYK, RGB, WI-98, WI-Gauz, WI-Hunter, YI-98, WI-R457, HSL, HSV value as standard.

- **$\Delta E$  Setup**

Setting the  $\Delta E$  formula and threshold for QC inspection.



## 3.2 Color Scan

In the measurement interface, click on "Scan" or short press the button on the right side of the instrument to measure.



**Matching colors:** According to the selected color chart by the user, the closest three color chart numbers are matched for display.

The following steps can be performed after completing measurement:

- **Save**

To save the comparison result, press "Save" on the upper right corner. You can choose default or name the record manually.


- **History**

If users need to view the saved results, click "History" to view the records, and records can be paged, deleted, renamed and searched.

- **Color chart**

Select one set of color charts for matching, then samples will be only compared within this chart. Three closest color codes will be matched.

## 4. Menu bar

In the measurement interface, click the  icon on the upper left corner to pop up the menu bar, with the following options: Language, Calibration, Param Settings, Device Info, Auto Off Setting, Reset to defaults and Power Off.

## 4.1 Language

Support Simplified Chinese and English.

## 4.2 Calibration

Can enter the calibration interface to perform calibration operation of the instrument.

## 4.3 Device Info

"Device Info" displays the basic information of the instrument, including: Serial Number, Firmware Version, and Device Status.

## 4.4 Auto Off Setting

The automatic shutdown time of the instrument can be set.

## 4.5 Reset to defaults

To restore parameters to the factory settings and clear the data in the measurement interface.

## 4.6 Power Off

Press "Power off" to power off the instrument.

## 5. Aviation plug connection

When plugging out the probe, make sure not to violently rotate and pull the connector, but plug out the plug by the way as shown in the following diagram.



## V Bluetooth Connection

### 1. App Installation

The spectrophotometer APP supports Android operating system 7.0 and above as well as iOS system 7.0 and above. Choose one of the following methods to install:

- 1) Scan the QR code on the cover with a mobile browser or WeChat, follow the prompts to download and install Lscolor.
- 2) Search for "Lscolor" from the iOS App Store or Google Play App market and follow the prompts to

download and install LScolor.



App icon

### **Precautions:**

Open the App during the installation process or after the first installation, the mobile phone will prompt the permission of setting, the customer needs to allow all of them, otherwise the App cannot search for the device, and App cannot be used.

## **2. Device connection**

Turn on the spectrophotometer, open the App, after display of LOGO. Enter the "Connect Device" interface and automatically start searching for Bluetooth devices. The searched devices will be displayed at the bottom of the interface. Click the device that matches the SN of the spectrophotometer and wait for the device to connect. Once connected, it will jump to "Calibration interface.

### **Precautions:**

- 1) If there is a Bluetooth connection error or failure, you can restart the App and the spectrophotometer, or turn off/start Bluetooth in the setting interface and reconnect.
- 2) Click the "Browse" button, App is not connected to the spectrophotometer, you can enter the App to view historical data.

## **3. APP operation**

The APP has the same function of color scan and color compare as the instrument with the same operation. The only difference is that the APP has color sharing function, and can import and export colors.

### **3.1 Color sharing**

There are two ways to share colors:

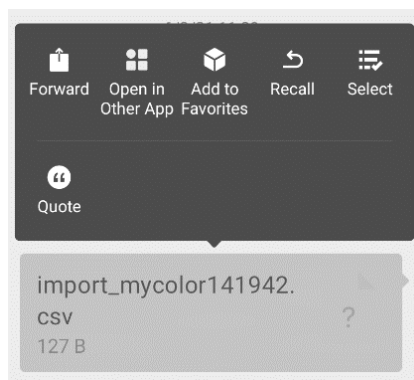
- a) Scan a color in the "Color Scan" interface, press the "Share" icon to share the scanned color in image format or data format (the sharing methods are: WhatsApp, Facebook, email, etc.).
- b) In the "My Colors" folder, select the colors to share and click "Share" icon to share the colors in data format.

### **3.2 Color import**

Users can import colors shared by others into their own App, but the colors must be scanned by the same model of spectrophotometer. Both single color and batch of colors can be imported as follows:

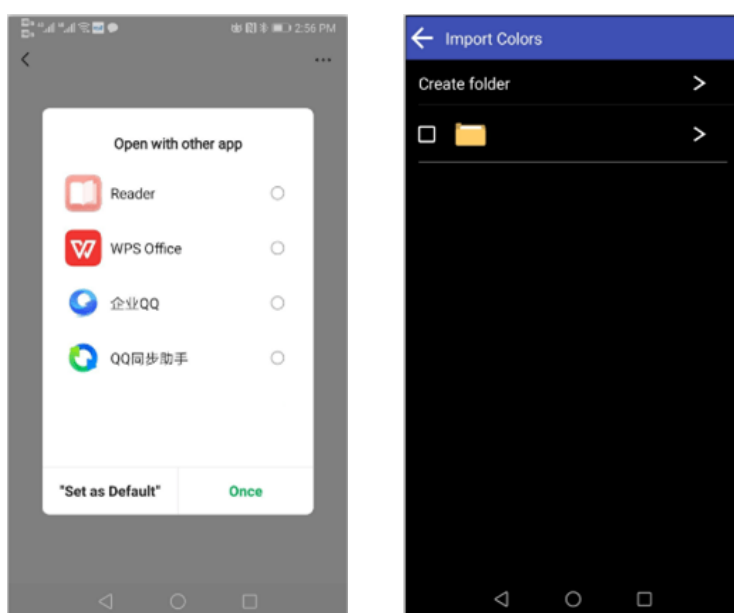
Take WeChat sharing and import on Android as an example, find the file to import with a name of

"import\_mycolor" and long press the file to be imported.



If use the iOS system, click the file and download it first, and then select "Open with other app" to realize data sharing.

- a) If the above interface appears, click "Open with other app" and select the App "LScolor", after confirmation, jump to the import interface and select the file to complete the import.

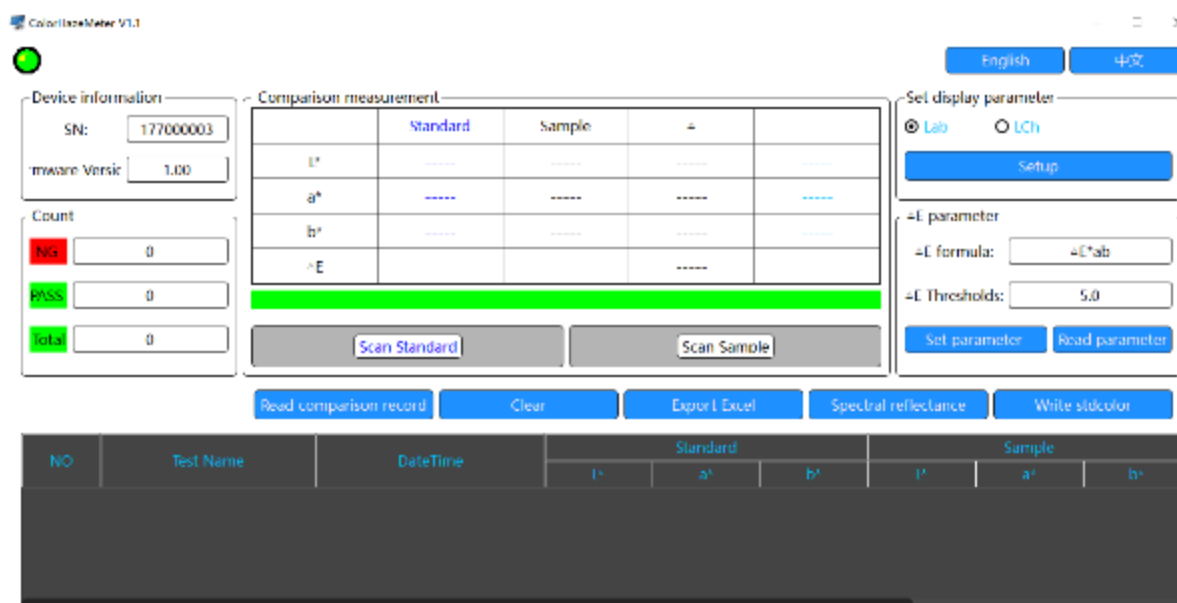


- b) If the import has completed, it will prompt "Import successful". After pressing "Confirm", the imported color will be displayed. After the import is completed, the import can be checked as the first record under the folder.
- c) If the product model does not match, it will prompt "Unmatched device model ". Please connect to the correct model before importing.

## VI PC Software

You can use the PC software to connect the computer via USB. The software has functions of color compare measurement, reading compare record, export compare data to Excel, spectral reflectance measurement, qualified number, unqualified number, total number statistics, report generation and

printing, etc. For specific operation, please refer to the "Color Haze Meter Software Operation Manual".

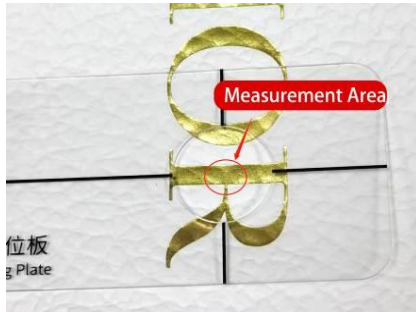


## VII Precaution

1. The surface of the measured object should be smooth, flat, clean and opaque within the aperture range; otherwise, measurement accuracy may be affected.
2. When the spectrophotometer has not been used for a long time, it is recommended to perform calibration before using.
3. Please ensure that the sample is evenly colored with a flat and clean surface, otherwise it will affect the measurement accuracy.
4. The calibration cover should be adsorbed to the iron shell of the probe after removal, to avoid fouling of the standard plate.
5. Do not insert any object inside the spectrophotometer to clean it, as this will damage the instrument and affect the measurement accuracy and operational safety.
6. When the instrument is not in use, put on the calibration cover to prevent dust from entering or prolonged humidity, which may affect the measurement accuracy.
7. When the instrument's battery is low, it should be charged promptly.
8. If the instrument is not used for more than six months, regular charging is recommended to prevent battery over-discharge and damage."
9. It's recommended to calibrate the instrument once each year. And we offer calibration service.
10. Due to color difference in the LCD display, the color displayed on the instrument screen is for reference only.

## VIII Locating Plate

In order to meet the requirements for precise alignment of some measurement areas, the spectrophotometer is equipped with a locating plate.



Measurement area



Insert the probe into the hole



Measurement result

## IX Packing List

No.	Description	Quantity	Unit
1	Spectrophotometer	1	Set
2	USB cable	1	pcs
3	Cleaning cloth	1	pcs
4	Locating Plate	1	pcs
5	User manual	1	pcs
6	Calibration Report	1	pcs

## X Service

1. The spectrophotometer has one-year warranty. If the meter works abnormally, please send the whole instrument to our company for maintenance.
2. Provide users with spare parts and lifelong maintenance services.
3. Provide the users with the gauge calibration service.
4. Free technical support for long term.