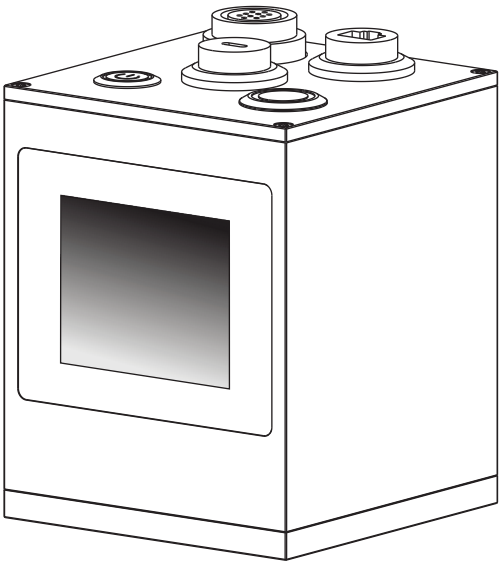
Non-Contact Spectrophotometer

Operation Manual



V1.0

Read this manual carefully before use the spectrophotometer.

Safety Instructions

Safety Symbol

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

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

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

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

Represents a prohibiting execution. This is absolutely not executable.

Represents an instruction.
The instruction must be strictly performed.

Represents a prohibiting execution.
Do not disassemble this instrument.

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

Safety Instructions

Cautions

- No copy or copy of all or part of this manual is strictly prohibited without authorization from the company.
- The contents of this manual are subject to change without prior notice.
- When preparing this manual, we have done our best to ensure the accuracy of its contents. If you have any questions or find any errors, please contact your retailer or our authorized maintenance agency.
- The company has no liability for all consequences arising from the improper operation of this instrument.

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

Safety Instructions

Safety Measures

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

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

1.Do not use this instrument in a place where there are combustible or flammable gases (gasoline, etc.), otherwise it may cause fire.

2.Do not allow liquid or metal objects to enter the instrument, otherwise it may cause fire or electric shock. If a liquid or metal object enters the instrument, turn off the power immediately, unplug the AC adapter plug, and contact the nearest authorized maintenance institution.

3.Do not force, twist or pull the power cord of the AC adapter. Do not scrape or modify the power cord, or place heavy objects on the power cord, otherwise it may damage the power cord, and cause fire or electric shock.

4.Do not use wet hand to plug AC adapter plug, otherwise it may cause electric shock.

5.If the instrument or AC adapter is damaged, or smokes, do not continue to use this instrument, otherwise it may cause fire. In this case, power should be switched off immediately, AC adapter plug removed from the AC socket, and contact the nearest authorized maintenance institution.

6.Do not measure the face directly on the sample measuring aperture, otherwise it may damage the eyes.

7.Do not place the instrument on an unstable or inclined surface, or it may cause the instrument to slide or overturn, causing injury to personnel.

1.Be sure to always use a standard AC adapter or an optional AC adapter and connect it to an AC socket with rated voltage and frequency. If you use a not specified AC adapter, it may damage the instrument or cause a fire or electric shock.

2.Be careful not to put your hand in the notch of the instrument, or you may get stuck in your finger and cause injury.

Safety Instructions

	1.Do not disassemble or refit the instrument or AC adapter, otherwise it will cause fire or electric shock.
	1.If the instrument is not used for a long time, please pull the AC adapter plug from the AC socket. Because the dust or water stains on the AC adaptor pins may cause a fire, they should be pulled out immediately. 2.When pulling the AC adapter plug out of the AC socket, be sure to always hold the plug itself to avoid pulling the power cord, which may damage the power cord and cause fire or electric shock.

Table of Contents

Overview

The Non-Contact Spectrophotometer is an independently developed instrument with proprietary intellectual property. Equipped with a 3.5-inch TFT capacitive touchscreen, it is designed for precise color measurement and quality control in automated production lines.

Key Features:

1）3.5-inch TFT true color display.

2）Dual optical path spectral analysis for fast, high-precision, and repeatable measurements.

3）More powerful extended functions at the PC software..

4）Support RS232, RS485, USB, network port, analog models and various communication modes;

5）Uses LED light source, with a longer service.

6）Supports internal calibration to ensure the high stability of the instrument.

Precautions

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

2) During measurement, the instrument should be kept stable, and the measured object should be aimed at the measuring port to avoid moving.

3) This instrument is not waterproof and cannot be used in high humidity environment or water mist.

4) Keep the instrument clean and tidy, and avoid liquid, powder or solid foreign matter such as water and dust from entering the integrating sphere and inside the instrument, and avoid the impact and collision on the instrument.

5) After using the instrument, cut off the power supply, and put the instrument and accessories into the instrument box, and store them in a dry and cool environment.

6) The user shall not make any unauthorized changes to this instrument. Any unauthorized changes may affect the accuracy of the instrument and even irreversibly damage this instrument.

1. Interface and Button Instructions

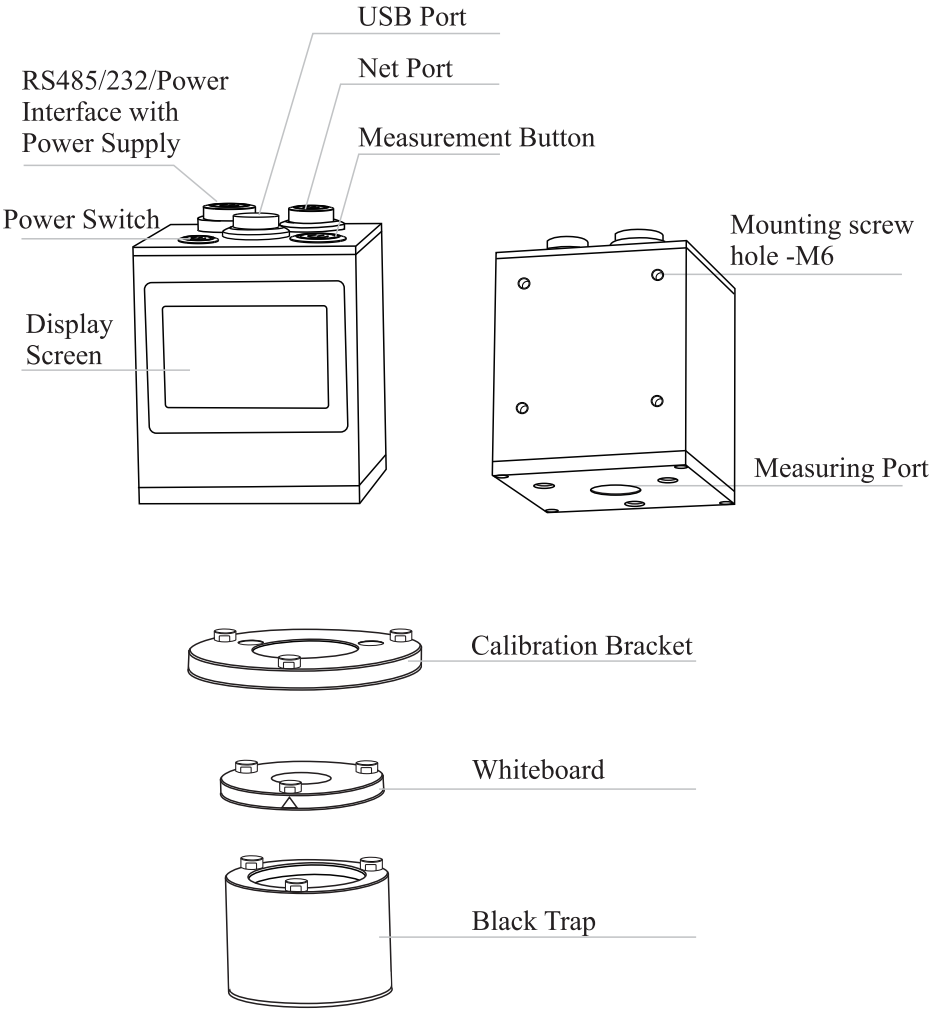


Figure 1 Button/Interface Diagram (Front/Back)

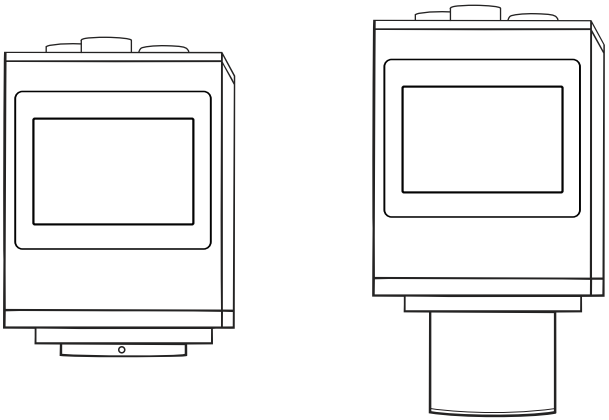


Figure 2 Black/White Calibration Diagram

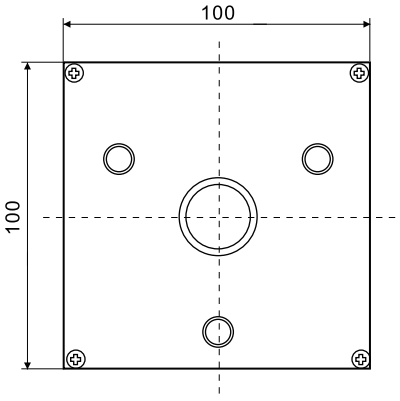
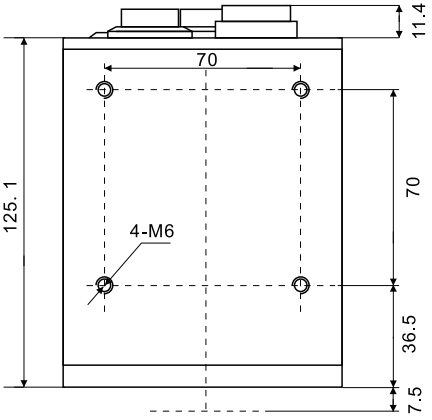


Figure 3-1 Bottom of
Installation Dimension Drawing



Measurement surface

Note: the length of the mounting screw screwed into the shell is > 5<10.

Figure 3-2 Back of
Installation Dimension Drawing

Display Screen: TFT true color 3.5inch display screen, which is used to display measurement data and instrument information.

Measurement Button: short press the measurement button to start measurement in measurement mode, and short press the measurement button to wake up the system in standby mode.

Power Switch: turn on/off by pressing the power switch button. When the instrument is powered on (power adapter is powered on, press the power switch), the red light will be on after the instrument is powered on.

Interface: the interface can support RS232,RS485,USB, network port, analog signal and other communication modes for connection. The USB interface is used to communicate with PC or supply power to the instrument through the power adapter. The input of the power adapter is 24V/3A DC.

Calibration bracket: during calibration, this position is the placement area of whiteboard and black light trap.

Whiteboard: During white calibration, aim the whiteboard at the measuring port.

Black Trap: When correcting black light, aim the black trap at the measuring port.

Dust-proof Cover: cover the dust-proof cover on the measuring port when it is turned off or on standby, so as to prevent dust from contaminating the instrument and protect the integrating sphere.

2. Operating Instruction

2.1 Power On & Off

Press the power switch, the indicator light will light up and the LOGO interface will be displayed. After a few seconds, the instrument will automatically enter the measurement interface, as shown in Figure 4.

In the power-on state, if no operation is performed for a long time, the instrument will automatically enter the sleep state. At this time, press the "measurement button" or touch the screen to wake up the instrument to enter the working state. After starting the machine, press the "power switch" key to turn it off.

Note: Please turn off the power supply when the instrument is not used for a long time.

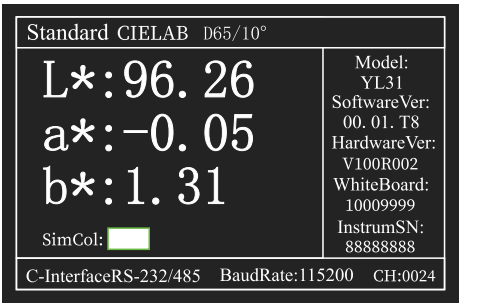


Figure 4 Measurement Interface (Standard Sample Measurement)

2.2 Calibration

Press and hold the measurement button to enter the calibration interface, as shown in Figure 5. Display the black calibration interface, put the black trap face up according to the prompt, align the calibration bracket with the black trap, and press the measurement button to perform black calibration.

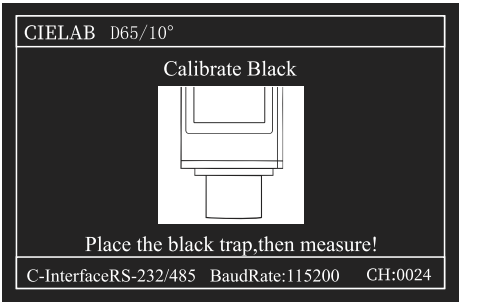


Figure 5 Black Calibration

After the black calibration is passed, enter the white calibration interface, as shown in Figure 6. Align the calibration bracket with the whiteboard according to the prompt, and press the measurement button to perform white calibration.

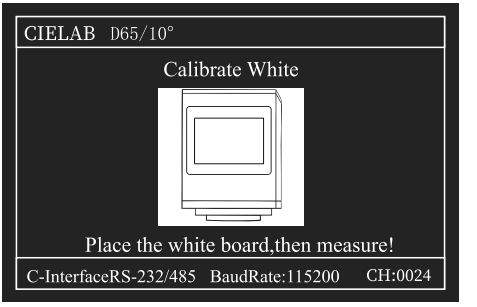


Figure 6 White Calibration

After the calibration is completed, a white calibration interface as shown in Figure 7 will be displayed. Press and hold the measurement button to enter the standard sample measurement interface, as shown in Figure 8. **Note: the whiteboard number corresponds to the instrument one by one, and the "whiteboard number" is displayed in the measurement interface.**

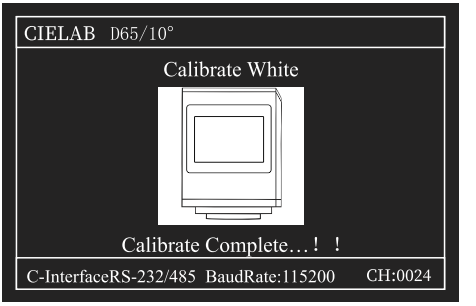


Figure 7 White Calibration Interface

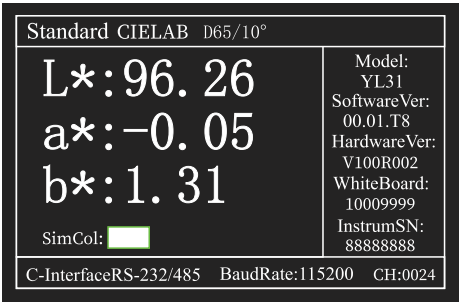


Figure 8 Standard Sample Measurement Interface

After the standard sample measurement is completed, press and hold the measurement button to enter the sample measurement interface, as shown in Figure 9.

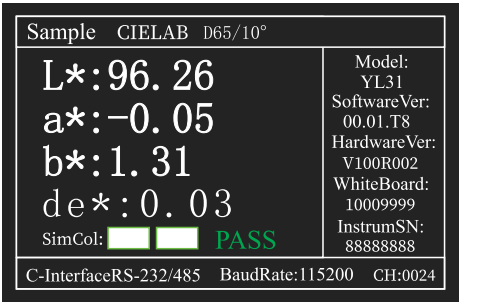


Figure 9 Sample Measurement Interface

2.3 Measurement Interface

2.3.1 Standard Sample Measurement Interface

The upper part of the standard sample measurement interface includes: interface name, color space, standard light source and observer angle, current time; The middle part is the data display area, including sample simulation color, measurement results, instrument model, version information, whiteboard number and instrument number; The bottom shows the current interface status and baud rate, as shown in Figure 10.

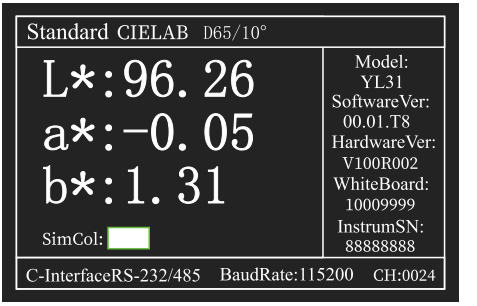


Figure 10 Standard Sample Measurement Interface

Interface Name: displays the name of the current measurement interface;

Color Space: displays the current color space;

Measuring Angle: displays the current measuring angle;

Light Source: displays the current standard light source;

Data Display Area: display the chromaticity value data of the current color space and the simulated color of the sample.

Version Information: display the model parameters, software version information, hardware version information, corresponding number of the current instrument and whiteboard number;

Interface Status: display the interface currently used by the instrument;

Baud Rate: displays the baud rate of the instrument currently connected;

2.3.2 Sample Measurement Interface

The sample measurement interface is basically the same as the standard sample measurement interface. The difference is that the sample measurement interface displays the measurement data of the current sample and the difference between it and the standard sample. When the sample measurement is completed, the measurement result prompt will be displayed, as shown in Figure 11.

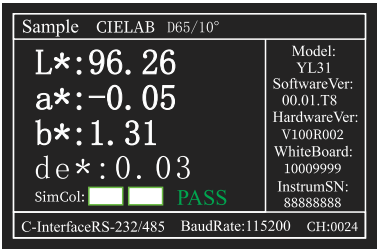


Figure 11 Sample Measurement Interface 1

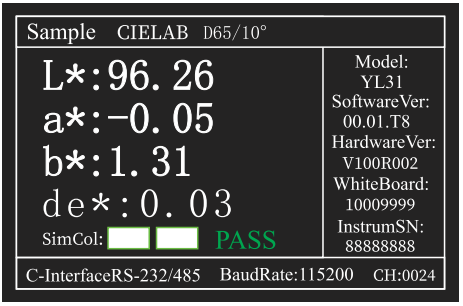


Figure 11 Sample Measurement Interface 2

The measurement results suggest that if the color difference between the sample and the standard sample is within the tolerance range, the green font will be "PASS", and if it exceeds the tolerance range, the red font will be "FAIL".

2.4 Instrument Version Information

As shown in Figures 10 and 11, the instrument version information is located on the right side of the measurement interface, which is displayed as instrument model, software version, hardware version, whiteboard number and instrument number respectively.

3. Daily Repair and Maintenance of the Instrument

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 20~25 degrees Celsius, 1 standard atmospheric pressure, humidity 30~70%RH).

2) In order to ensure the validity of the measurement data of the instrument, it is recommended to go to the manufacturer or a qualified measurement research institute for measurement inspection one year from the date of purchase.

4) This instrument supplies power to the external power adapter. Please use the original power adapter and standardize the use of power supply to avoid frequent plugging and unplugging, protect the performance of power supply and prolong the service life of power supply.

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.

4. Technical Parameters

Project	Technical Parameter
Optical Geometry	45/0(45° Circular Illumination, 0° Viewing); Conformto the Standards CIE No.15, GB/T 3978, GB 2893, GB/T 18833, ISO 7724-1, ASTM E 1164, DIN 5033 TEIL 7, GB 2893, GB/T 18833.
Features	The non-contact test between the test probe and the tested sample realizes the non-contact precise color measurement of liquid, paste, powder and fragile surface. It is mainly used in accurate color measurement and quality control of automatic production line; The measurement time can be as fast as 0.05 seconds. It can communicate with other systems through 485 or USB, and is equipped with upper computer software.
Light Source	Full spectrum LED light source
Spectroscopic Mode	Concave grating beam splitting
Sensor	256 pixel double array CMOS image sensor
Wavelength Range	400~700nm, 10nm output
Display Accuracy	0.01
Reflectance Resolution	0.01%

Reflectance Range	0~200%
Measuring Aperture	Φ8mm
Non-contact Distance	7.5mm(±0.15mm)
Sample Height	Unlimited thickness, only use test probes
Measurement and Observation Mode	Visual
Measurement Interval	1S
Measurement Mode	Instrument trigger or online control trigger
Color Space	CIE LAB,XYZ,Yxy,LCh,CIE LUV,Musell, s-RGB,HunterLab, β xy,DIN Lab99
Color Difference Formula	ΔE*ab,ΔE*94,ΔE*cmc(2:1),ΔE*cmc(1:1),ΔE*00，ΔE（Hunter）,DINΔE99
Other Colorimetric Index	Spectral reflectance, WI(ASTM E313, CIE/ISO, AATCC, Hunter, ISO 2470/R457, Taube, Berger, Stensby),Tint(ASTM E313-00), YI(ASTM D1925，ASTM 313), Metamerism index MI,

	Color fastness, color fastness, strength, coverage, blackness (My,dM), color density CMYK (partly realized by PC software).
Observer Angle	2°/10°
Illuminants	A,B,C,D50,D55,D65,D75,F1,F2,F3,F4,F5,F6,F7, F8, F9,F10,F11,F12,CWF,U30,U35,DLF,NBF, TL83,TL84, ID50,ID65,LED-B1,LED-B2, LED-B3,LED-B4,LED-B5, LED-BH1,LED-RGB1, LED-V1, LED-V2
Displayed Data	Data, sample chromaticity value, color difference value/graph, color simulation, qualified/unqualified results, display tolerance can be set.
Measuring Time	0.05 seconds at the earliest (about 0.1 seconds in general)
Calibration	Intelligent automatic calibration
Waterproof grade	IP66
Repeatability	In the optimal test mode (when the single measurement time is 1.0 seconds): Chromaticity value: Δ E*ab within 0.02 (after preheating, measure the average value of the whiteboard for 30 times at intervals of 5s).
Inter-station difference	ΔE*ab within0.2 (average value of BCRA series Ⅱ 12 color tiles)

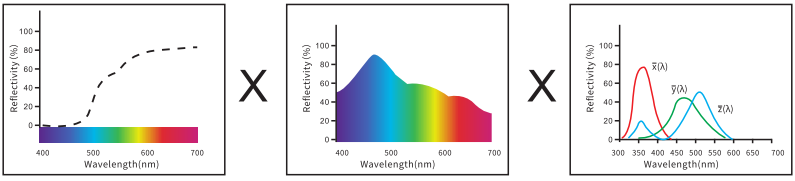
Accuracy Assurance	Ensure that the first-level measurement is qualified
Measurement Mode	Single measurement, average measurement (2~99 times)
Dimension	100*100*140mm
Weight	About 1400g
Power Supply	DC 24V,3A Power Adapter
Illuminant Life Span	5 years, more than 3 million times measurements
Display	TFT true color 3.5inch
Interface	USB, RS485, RS232, Ethernet, External Trigger, Analog Signal Output.
Language	Simplified Chinese, traditional Chinese, English
Operating Environment	0~40℃, 0~85%RH (no condensing), Altitude < 2000m
Storage Environment	-20~50℃, 0~85%RH (no condensation)
Standard Accessory	Power adapter, User manual, USB cable, RJ45 Ethernet cable, RS485 multi-device communication cable, RS232 communication cable, standard calibration board and black calibration trap .
Note:	Note: This model is specially suitable for assembly line, and deep function customization will generate additional customization costs.

Appendix

1.Object color

There are three elements to observing color: lighting source, object, and observer. Changes inany of these three will affect the color perception of the observer. When the lighting source andthe 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 havedifferent reflection spectra (transmission spectrum). (Spectrum) modulation to obtain differentresults, because the observer does not change, so it presents different colors, the principle isshown in the figure below.



Reflectance spectra X Light source X Standard observer

=

L=70.95
a=69.72
b=40.35

ΔL+ represent whitish, ΔL- represent blackish
Δa+ represent reddish, Δa- represent greenish
ΔL+ represent yellowish, ΔL- represent bluish

2.Color Difference Formula

CIE 1976 ΔE*ab

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

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

CIE 2000 ΔE*ab

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

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

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

CIE 1994 ΔE*ab

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

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

3. Normal color difference allowable range

The allowable range of normal color difference varies depending on different industries and application scenarios. The following are the allowable ranges of color difference for some major industries

Overview:

1. Electronic device industry

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

2. Plastic coating industry

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

3. Textile industry

General standard: △ E below 2.0 is considered an acceptable range, especially in textile color management.Specific standards: In some standards, it is required that the color difference of specific parts should not be less than level 4, which is equivalent to a color difference value between 0 and 2.0

4. Printing industry

Range: A color cast range between 1.5 and 3.0 is usually considered normal, but specific values may vary depending on product grade and customer requirementsSeeking to be different.

Standard: Some standards stipulate that the color difference value for both fine and general products should not exceed 6.

5. Railway signal flag

Standard: The color difference is less than or equal to 3.0 to ensure the clarity and recognition of the signal flag.

Color difference and perception

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