HUICOLOR

SPECTRAL LUMINANCE COLORIMETER series

COLOR ANALYZER series

User Manual

Please read carefully,
before using the instrument.

V 1.5

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 adapter is pulled out from the AC socket.

Represents the identification of DC

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.

Safety Measures

	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, and contact the nearest authorized maintenance institution. 3. Do not force, twist or pull the power cord of the 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. Please keep the hand dry to plug the adapter plug, otherwise it may cause electric shock. 5. If the instrument or the 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, the adapter plug removed from the socket, and contact the nearest authorized maintenance institution. 6. 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. 7. Please put the instrument in a place that children can 't touch. Otherwise, accidents may occur.
	1 .Be sure to always use a standard adapter and connect it to a socket with rated voltage and frequency. If you use a not specified adapter, it may damage the instrument or cause a fire or electric shock. 2. Be careful not to put your hand in the notch of the instrument, or you may get stuck in your finger and cause injury.
	Do not disassemble or refit the instrument or the adapter, otherwise it will cause fire or electric shock.
	1. When pulling the adapter plug out of the 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. 2. Because the dust or water stains on the adaptor pins may cause a fire, they should be pulled out immediately. 3. If the instrument is not used for a long time, please pull the adapter plug from the socket. When wiping the instrument, please pull the adapter plug out of the socket , otherwise it may cause electric shock.

1 Instrument Description

1.1 Overview

Note: Different models have different functional parameters. Please refer to the specific technical specifications.

This instrument is a portable luminance colorimeter with precise measurement. It measures an angle of 1 °, uses a telephoto lens, and has a minimum measurement area of Φ 22mm. It is widely used in engineering lighting, projectors, car lights, and LCD screen industries.

The instrument adopts high-precision concave grating or filter+CMOS detector as the optical signal detection element, which can collect the irradiance spectrum of the light source in the wavelength range of 350 ~ 800nm / 400 ~ 700nm, and output 1nm interval irradiance spectrum，with the highest measuring range of 200000 cd/ ㎡ . The instrument is equipped with 2.8-inch TFT capacitive touch screen, 4000mAh lithium-ion battery, Bluetooth /WIFI multifunctional chip, large-capacity memory, high-precision ADC, etc.

The instrument can not only measure technical parameters such as luminance spectrum, luminance, color temperature, color rendering index and white balance of camera, but also measure display color gamut, uniformity of luminous panel, CQS, TM-30, TLCI-2012, flicker frequency and other parameters. This instrument is equipped with multiple measurement modes, such as single measurement,

average measurement, continuous measurement, flash measurement, flicker frequency, etc. It is easy to operate, accurate and stable.

This instrument is widely used in the following aspects:

(1) Can be used for measuring and analyzing parameters such as luminance, chromaticity coordinates, color gamut, uniformity, color rendering index, and realism of various projectors, displays, televisions, and LCD.

(2) Accurate measurement and evaluation of radiation spectra, luminance, color temperature, chromaticity coordinates, color rendering index, and other parameters for LED lighting sources and various light-emitting modules.

(3) Can be used for measuring and evaluating the luminance and color coordinates of tunnel lighting, traffic signal lights, and safety exit indicator lights.

(4) Can be used for measuring and evaluating on-site lighting environments in places such as libraries, shopping malls, schools, factories, and street lighting projects

(5) Can be used for measuring and evaluating dashboard luminance and chromaticity coordinates.

(6) Can be used for testing and evaluating the uniformity, luminance, color rendering index, color temperature, and ideal luminance spectrum deviation of standard light source color light boxes.

1.2 Product Characteristic

(1) The high-end luminance colorimeter adopts high-precision concave grating as the spectral element, with a measurement range of 350-800nm wavelength and an

accuracy of 0.3nm wavelength. It outputs a 1nm interval radiance spectrum with accurate and stable measurement. The measurement angle is 1 °, the minimum measurement area is Φ 22mm, and there is no XYZ response adaptation error.

The economical luminance colorimeter adopts a filter method to collect the luminance, chromaticity coordinates, color temperature, dominant wavelength, and uniformity of visible light in the range of 400-700nm, with high cost-effectiveness.

(2) 2.8-inch TFT capacitive touch screen, 4000mAh lithium battery, large-capacity storage, Type C interface, Bluetooth 5.0 (reserved WIFI).Multiple luminance colorimeters can be synchronously measured using PC software, with a portable design.

(3)It can not only test luminance, color temperature, color rendering index, dominant wavelength, light-dark visual ratio S/P, camera white balance and other conventional luminance parameters, it can also test Flicker, display color gamut, uniformity of light-emitting panel, CQS index, TM30 index, etc.

(4) There are many test indicators, but the classification is clear, the icon information is clearly expressed, and the operation interface is concise, smooth and humanized.

(5) The built-in D65 / A / C / D75 / D50 standard radiance spectrum can easily compare the test spectrum with the built-in standard spectrum.

(6) PC software(HIQC) provides instruments with

more functional extensions.

1.3 Cautions

(1)This instrument is a precision optical measuring instrument. When measuring, it should be measured in a laboratory and other environments with good test conditions, so as to avoid the instrument from measuring in such environments as severe temperature change, dust, strong vibration, strong magnetic field, humid water mist and other environments.

(2) During weak light measurement, the instrument will turn off the indicator light and the backlight of the display screen (to avoid disturbing the test results), and the test time will also exceed 5 seconds.

(3) It is recommended that users send the instrument to the manufacturer for testing and calibration regularly (one year), and can also be sent to a laboratory with photometric calibration qualification for calibration.

2 Structure Components

2.1 Structure

Fig. 1 Structural components

Host: The main control part of the instrument, which contains CPU, detector, communication module, Bluetooth /WIFI module, lithium battery, etc.

Protective Cover: When the instrument is zero-calibrated, it is necessary to cover the head with a protective cover to block the ambient light from entering the head; when the instrument is idle and stored, it is necessary to cover the head with a protective cover to protect the head.

MEAS Button: This button is a multifunction button，the button operation is invalid during measurement.

When the display screen is in the testing or calibrated interface, short-press will start the measurement, and long press will lock/unlock the main interface of the screen (in the locked state, only the MEAS button can be pressed to test, and the touch screen can't be operated, long press again will unlock the main interface of the screen); When the screen is in the non-measurement or calibration interface, the short-click execution returns to the test interface.

When the instrument is in sleep mode (automatic shutdown), short-press can wake up the instrument.

Lens: used to capture the ray of the sample to be tested.

M5 Fixing Nut: This nut is a metric M5 coarse-tooth nut (M5× 5), which is used to fix the instrument in the scene.

Power switch: When the switch is turned to "1", the instrument is powered on; when the switch is turned to "0", the instrument will be powered off. By stirring the switch, it is on/off by cutting off the power supply.

Type C USB: This port is a multifunctional interface.

Charging interface: The power adapter with 5V output charges the instrument through this interface, and the specification of the external power adapter is 5V⎓ 2A.

Communication interface: Through this interface, USB communication can be carried out with PC computer; through this interface can also be connected with the 5V voltage serial port, performing 5V TTL serial communication (it can be connected with the serial printer or other equipment).

Hanging Shaft : Used for binding hanging rope.

Laser: When testing samples at a distance, the laser can be turned on to guide the testing area.

Indicator Light: When the instrument is turned on, the green indicator light is on. During the test, the green indicator light flashes. When testing weak light, the indicator light is turned off to avoid interfering with the results. When the instrument is charged, the green indicator light is on, the charging is completed, indicator light is off.

2.2 Lens installation

Open the packaging box, the host and lens are separate(Note:Some instrument models, such as CI820S, have the host and lens firmly bonded and cannot be disassembled when they leave the factory). Align the thread, rotate the lens clockwise, tighten it appropriately, and install the host and lens together; Otherwise, disassemble the lens.

When not using the instrument for a long time, it is recommended to disassemble the lens and store the host and lens separately in the packaging box for safe storage.

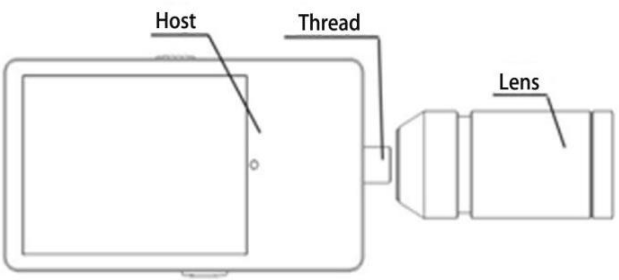


Fig. 2 Lens installation

3 Introduction Operation

3.1 Turn on/off the instrument and charging

3.1.1 Turn on/off the instrument

As shown in Fig. 1, when the switch is turned to “1”, the instrument is powered on and started. When the switch is turned to “0”, the instrument is powered off.

When the switch is turned to “1”, the instrument is powered on and enters the testing interface, as shown in Fig. 4; If the instrument doesn't start when it is turned on (the display screen doesn't show anything), you can check whether the lithium battery is charged. If there is no electricity, turn the switch to “0”, charge the instrument with the original 5V ⎓ 2A power adapter for more than half an hour, and then restart it.

Power-on state (the switch is turned to “1”), if there is no operation for a long time, the instrument will automatically enter the sleep state. At this time, pressing and holding the “MEAS” key for about 3 seconds to wake up the instrument.

If the instrument is not used for a long time, it is recommended to turn off the power. (Note: When you see “1” on the switch button, it is power on; when you see “0” on the switch button, it is power off.)

3.1.2 Charging

The instrument has a built-in large-capacity lithium battery. When the instrument is not used for a long time, it is recommended to turn off the power(the switch is turned to

"0"), and regularly charge the lithium-ion battery once every three months.

The power output specification of the power adapter is 5V⎓ 2A. When charging, connect one end of the cable to the power adapter and the other end to the TypeC of the instrument. The indicator light is on and the instrument is charged. The normal charging time is 8 hours (the instrument can be charged in both power-on and power-off states, so it is recommended to charge the instrument in the power-off state (the switch is turned to"0").

3.2 Test flow

The instrument test process is shown in Figure 3.

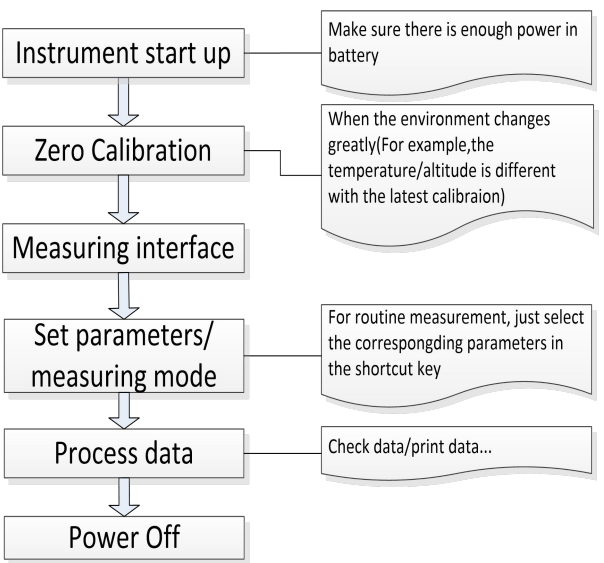


Fig. 3 Test process

The test process of the instrument is very simple. For more than 90% of the functional tests, you only need to click the shortcut key of color index in the test interface, select color index and press MEAS button to complete the testing.

The test data is displayed on the test interface, as shown in Fig. 4. Click the chart switch button to view the spectrum chart, CIE1931 chromaticity chart, CIE1976UCS chart, white balance chart, color tolerance Macadam ellipse chart, CRI histogram and CRI radar chart, as shown in Figs 5 ~ 11.

Fig. 4 color parameter shortcut key

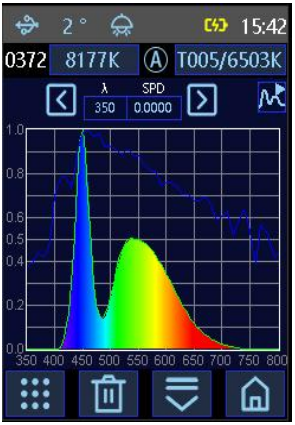


Fig. 5 Spectral chart

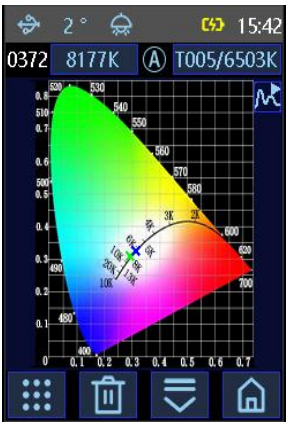


Fig.6 CIE31 chromaticity

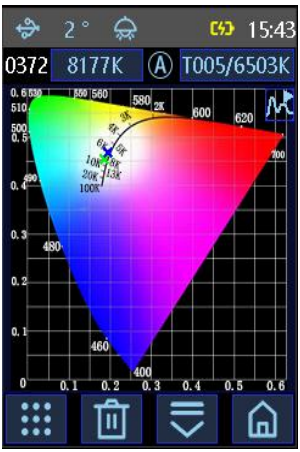


Fig. 7 CIE1976UCS

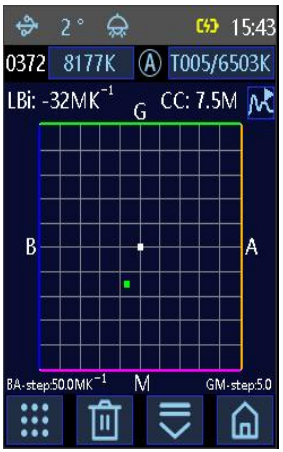


Fig. 8 White balance

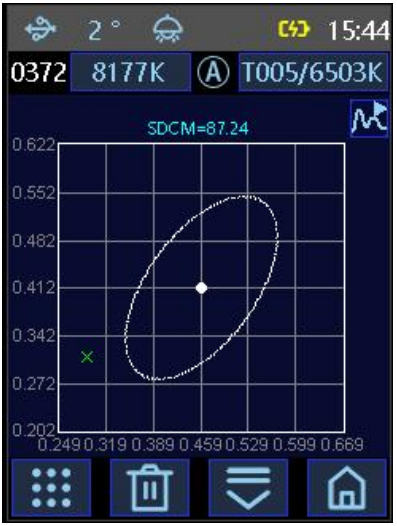


Fig. 9 Color Tolerance Macadam Ellipse Diagram

Fig. 10 Histogram of CRI and CQS CRI

Fig. 11 Radar chart of CRI and CQS

3.3 Calibration

3.3.1 Zero Calibration

The dark signal response of the detector will change with the temperature fluctuation (environment). When the temperature of the current environment changes more than 5 degrees Celsius(Comparison with zero calibration), it is recommended to do zero calibration. In addition, when testing weak optical signals, it is also recommended to do zero calibration.

Click “Calibration”->“Zero Calibration” in the main menu to enter the “Zero Calibration” interface, as shown in Fig. 12, according to the prompt, cover the protective cover, press MEAS button or to perform zero calibration, and click to return to the back interface.

Fig.12 Zero calibration

3.3.2 Luminance Calibration

When the instrument leaves the factory, the manufacturer has already done the calibration and stored it in a specific calibration channel (default channel). Customs can accurately measure various light source parameters by selecting the default channel. Luminance calibration usually requires technical personnel to be operated, and technical personnel need to input the password.

When the irradiance spectral power distribution of the light source is close to that of the calibration light source, the irradiance spectrum of the light source is more accurate. Tungsten filament lamp (halogen tungsten lamp) with color temperature of 2856 K is usually used as the standard lamp for luminance calibration. The energy of tungsten filament lamp (halogen tungsten lamp) is relatively weak in the

ultraviolet and blue light regions, and the calibration in the ultraviolet and blue light regions is not ideal. The radiation spectrum of LED light source is quite different from that of tungsten filament lamp (halogen tungsten lamp). If tungsten filament lamp (halogen tungsten lamp) is used as the standard lamp calibration to test the irradiance spectrum of LED light source, the effect will be worse in the ultraviolet and blue light regions.

Luminance calibration usually needs professional institutions, and calibration is carried out in the darkroom, as shown in Fig.13. Adjust the filament plane of the standard lamp and the working surface of the standard whiteboard to be perpendicular to the metering axis, with the center point located on the axis. Adjust the distance between the standard lamp and the diffuse reflection whiteboard to generate proper luminance values on the diffuse reflection standard board. The luminance meter is installed on the supporting device, and the metering axis of the luminance meter is in the same plane as the metering axis of the light track at a 45 ° angle.

The instrument is equipped with five calibration channels, which are the default channel and the CAL channel n (n = 1 ~ 4). The default channel is the special channel of the instrument manufacturer, and the custom channel n (n = 1 ~4) is used to store the custom -defined calibration data. Luminance and CCT data or tristimulus values XYZ can be directly inputted on the calibration interface, or can be inputted through the PC software.

Taking the CH1 as an example, the luminance calibration process is illustrated:

Firstly, the calibration channel is selected as “CAL Channel 1”(n = 1 ~ 4) in Calibration interface.

Then click the “Luminance Calibration” button in the calibration interface, enter the password (the default is “123456”). In the calibration interface, input Lv and CCT of the standard lamp(Target box).

(**Note:** For tungsten filament lamp, halogen tungsten lamp, standard lamp color temperature and luminance values need to be input, and the instrument calculates the irradiance spectral data of the standard lamp by itself ; For the full-spectrum xenon lamp or LED standard lamp, the radiance spectral power of the standard lamp is input by the PC soft.)

And then light up the standard lamp and preheat it to make the standard lamp emit light stably.

Once again, the instrument is installed on the supporting device, and the metering axis of the luminance meter is in the same plane as the metering axis of the light track at a 45 ° angle.

Finally, as shown in Fig.14, click the calibration button or MEAS button to start calibration, when the testing data is stable, click the button to save the calibration data, and then the calibration of the channel 1 is completed.

(Note: If the standard spectrum already exists, it is

only necessary to fine tune the Lv or CCT based on the standard spectrum, and the scaling factor K can be used to adjust it)

When measuring the sample, selecting the corresponding “CAL Channel 1”, and the above luminance calibration will take effect.

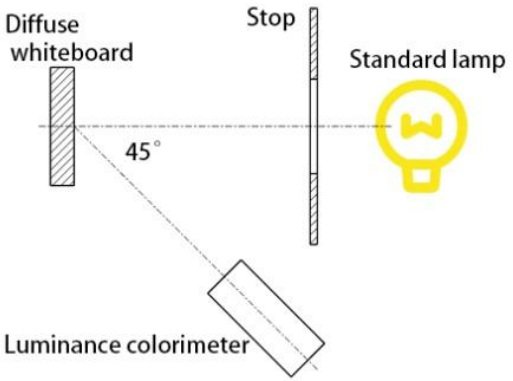
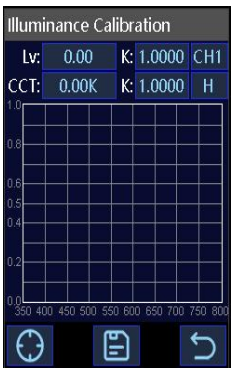


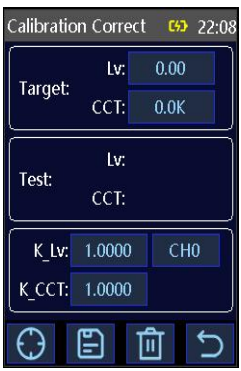
Fig.13 Calibration

For colorimeters based on the CIE XYZ filter principle (such as CI510), the manufacturer uses full spectrum LED calibration in the CH0 channel, and 2856K tungsten filament lamp calibration in the CH1 channel. When testing LED light sources, users need to select the CH0 channel, and when measuring tungsten filament light sources, users need to select the CH1 channel. Users can also directly input the three stimulus values XYZ of the calibration light source for luminance calibration.

3.3.3 Calibration Correct

Luminance calibration correct, mainly aimed at the situation that the luminance value needs to be fine-tuned. For example, if the instrument has been used continuously for 5 years without accurate calibration, the test luminance data will deviate due to the aging of components. At this time, the calibration correction can be used to correct the deviation.





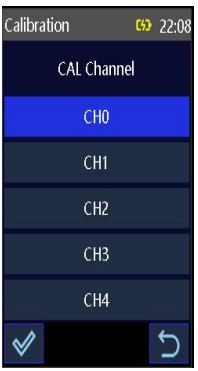


Fig. 14 Calibration Fig. 15 Cal. Correction Fig. 16 CAL.Channel

Firstly, in calibration correct interface, select “CAL Channel n” (n = 0 ~ 4) as the calibration channel, and then perform luminance calibration correct.

As shown in Fig.15, input the standard luminance data Lv and CCT in the target box. .

And then light up the standard lamp , preheat it and make the standard lamp emit light stably.

Finally, click the button or MEAS button, the instrument starts to test, and finally automatically generates

the proportional coefficient K (It can also directly inputs the proportional coefficient K). When the testing data is stable, click the button  , and then click  to complete the calibration correction; and click  to return to the back interface.

When measuring the sample , selecting the corresponding “CAL Channel n” and the above calibration correction will take effect.

3.3.4 Calibration Channel

The instrument has five calibration channels, as shown in Fig.16, CH0~CH4. The default channel (CH0) is the dedicated channel of the instrument manufacturer, so it is impossible to calibrate. CH1~CH4 are user calibration channels that can be used to store various calibration data.

If customs have an accurate standard calibration light source traceability system, they can establish their own calibration system in custom channel n(n=1~4). When measuring, select the corresponding calibration channel, then the test results can be traced back to the custom-defined calibration light source traceability system.

For colorimeters based on the CIE XYZ filter principle (such as CI510), the manufacturer uses full spectrum LED calibration in the CH0 channel, and 2856K tungsten filament lamp calibration in the CH1 channel. When testing LED light sources, users need to select the CH0 channel, and when measuring tungsten filament light sources, users

need to select the CH1 channel. Users can also directly input the three stimulus values XYZ of the calibration light source for luminance calibration.

3.4 Measurement

The instrument measurement shows two modes, one is the comparison mode, as shown in Figs17 and 19, the current test data can be compared with the reference record or other existing test records; the other is the non-contrast mode, as shown in Fig.20, which only shows the current test data.

The setting method is: “Main Menu->Display ->Contrast Mode”, and the check is to enable the contrast mode.

Taking the testing of LCD luminance, color temperature, and chromaticity coordinates as an example, illustrate the testing process

When the instrument is turned on, the power switch is turned to “1”, and the instrument is powered on to enter the test interface.

As shown in Fig. 4, click  (color parameter) to select “Lv xy CCT” and click OK.

As shown in Figure 17, you can click on  to turn on laser positioning, then press the MEAS button. The laser will automatically turn off, the buzzer will sound, and the indicator light will flash, starting the testing. The indicator

light will stop flashing, and the test will end. The results will be displayed on the screen; Click  to enter the interface for viewing spectra and color rendering index.

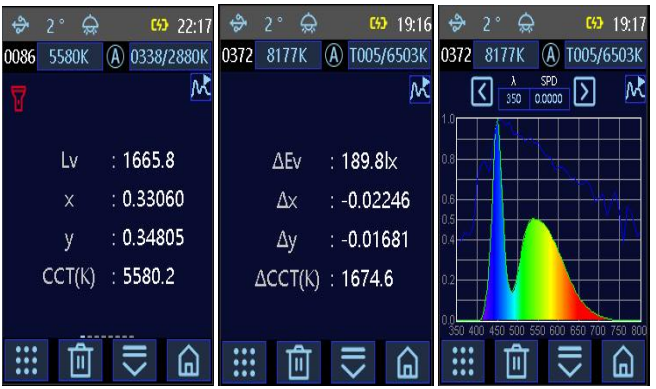


Fig. 17 Contrast Mode Test Interface

3.5 Luminance Unit

The default luminance unit : cd/㎡(nit), and customs can choose footlambert (fl), Please refer to “main menu-> system” for details. (1 fl = 3.426 cd/㎡)

The default irradiance unit : miliwatt /sr/㎡/nanometer (mW/sr/㎡/nm).

The default SUM irradiance unit: milliwatts / sr/cm² (mW/sr/ cm²), integral irradiance (also including weighted integral irradiance) refers to the sum of irradiance within a certain wavelength range, such as radiation luminance Le ,visible light irradiance Lvis, etc.

Wavelength unit: nanometer (nm),1nm=10^{-9} meters.

3.6 LCD panel and testing distance

When measuring LCD luminance and color coordinates with instruments, it is recommended that the axis of the luminance meter lens be perpendicular to the surface of the LCD, and the measuring port be aligned with the LCD for measurement or leave a 1mm gap.

For colorimeters based on the CIE XYZ filter principle (such as CI510), it is recommended to enable the user calibration mode (check the box in "Main Menu ->System Settings ->User Calibration Mode", √). When using high luminance lens accessories, the high luminance mode needs to be turned on (high luminance mode checked, √).

4 Basic Operation

4.1 Hanging Rope Installation

As shown in Fig.18, one end of the hanging rope passes through the hanging shaft and the other end passes through and is knotted. The hanging rope is sleeved on the wrist when instrument testing, which can effectively prevent the instrument from falling.

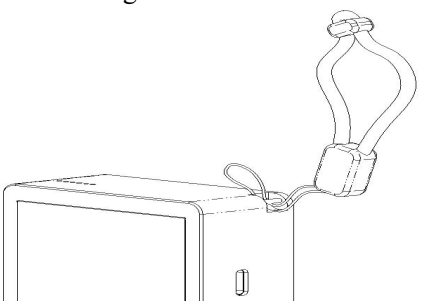


Fig. 18 Hanging rope operation

4.2 Main interface of Instrument

As shown in Figs.19 and 20, the upper area is the status bar, where the Bluetooth, observer angle, MEAS mode, screen lock, battery, sample name, exposure speed and other states set are displayed in real time. The middle area is the data area, the current test data is in the middle part of the data area, and the chart switching button is set in the upper right part of the data area. Click the chart switching button to display the radiation luminance spectrum chart, color rendering index chart, white balance chart, etc. The bottom area is the shortcut key area. Click the corresponding shortcut key to switch the test function quickly.

Fig. 19 Testing interface of contrast mode

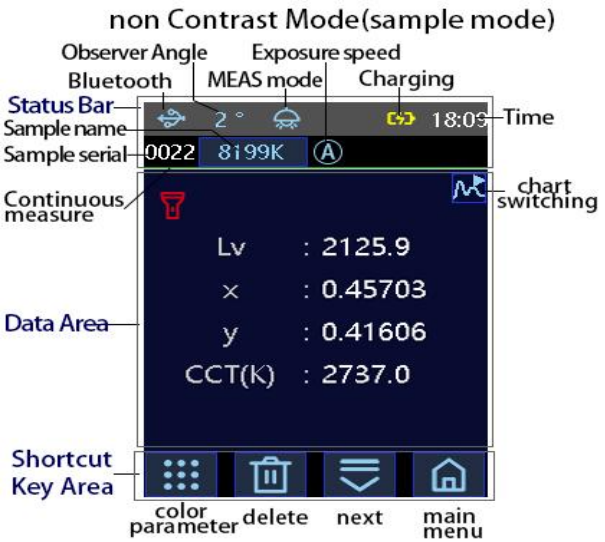


Fig. 20 Testing interface of non-contrast mode

Color parameter shortcut key: Click as shown in Fig.21, this key can make the test data quickly switch between various color spaces and color indexes.

Delete the shortcut key: If auto saving is turned on in "Main Menu-> System", the shortcut key will appear at the bottom area. When the instrument tests a sample, the result will be saved. If you are not satisfied with the result, you can click the Delete button to delete the current test data.

Downturn shortcut key: In the case of requiring multiple pages to display test data, click the Downturn key to switch the test data circularly.

Main menu shortcut key: Click the main menu key in any interface, which will quickly switch to the main menu interface, as shown in Fig.22. Press MEAS button to return to the test interface.

Save the shortcut key: If auto saving is turned off in "Main Menu-> System", the shortcut key will be appeared at the bottom of the test interface. The instrument tests a sample, and the result is not saved. If you are satisfied with the data, you need to manually click the Save button.

Shortcut key for chart switching: Click the chart

switching key to switch the page quickly between test data page, spectrum chart, CIE1931 chromaticity chart, CIE1976UCS chart, white balance chart, color tolerance Macadam ellipse chart, color rendering index histogram and color rendering index radar chart.

Measure mode: "Main Menu-> Meas.-> Measure Mode" is selected for the radiation spectrum stability of the current test light source,  indicates ambient light measurement (such as outdoor sunlight, office lighting, display and other stable light emitting modules);  indicates flash measurement (usually, the lighting time is within 5ms, such as pulse hernia lamp);  represents a conventional flash measurement (usually lighting for more than 5s, such as the LED flash of a camera),and ambient light measurement is selected by default  .

Exposure speed: "Main Menu-> Meas.-> Exposure Speed" is selected for the current test speed,  indicates strong light environment and fast exposure speed;  indicates a weak light environment and slow exposure speed;  represents automatic mode, and the instrument switches the exposure speed according to the current test

environment, and are selected by default Ⓐ.

Lock screen: In the testing interface, press and hold the MEAS button for 3 seconds to lock/unlock the test interface. 🔒 represents that the measure interface is locked, and the touch screen does not respond to the custom's operation, so you can only press the MEAS button to measure, or press the MEAS button for 3 seconds to unlock the testing interface.

9999/100000K： The sample serial number and name. Click “100000K” in the box to rename the sample.

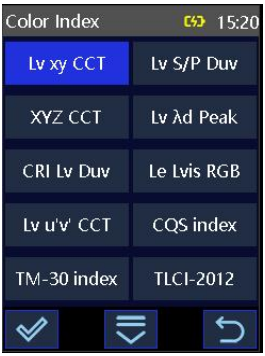
T001/5000K: The current comparison sample in the contrast mode, and click to select the reference color temperature record or the stored record or the prLvious test record. Non-contrast mode, there is no such content.

1/9 ： Average testing progress status displays, molecule 1 indicates the current test serial number in this average process, denominator 9 means that this average measurement will be measured 9 times in total, If the average measurement is not enabled by default, there is no progress display

-----: It means that continuous measurement is currently being carried out, and long press MEAS button to pause continuous measurement.

“Main Menu->Meas.” is used to set average /continuous measurement. Average and continuous measurement can’t be enabled at the same time. If average /continuous measurement are not enabled by default, the

progress status will not be displayed in the main testing interface.



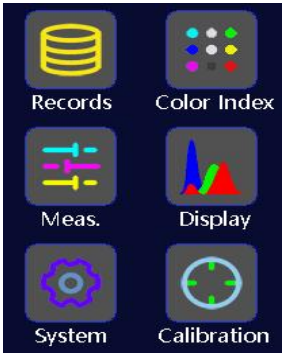


Fig. 21 Color parameter Fig. 22 The main menu

4.3 Sample and Users Data Input

For each record, the sample serial number and sample name will be generated, where the sample serial number is the unique index in the storage system and can't be changed; the sample name is defaulted to the color temperature of the current sample and can be renamed.

Fig. 23 The sample rename interface

As shown in Fig.23, click on the sample name box at position “1” to enter the sample name editing interface, and the sample name can support up to 8 characters; in editing interface, “2”is the number / capital Latin alphabet / lowercase Latin alphabet switch key; “3”is to click the keyboard to enter the characters to be selected; “4”is the delete key (click to delete the character before the active cursor in the text box “5”.). Click to save the input sample name, and click to cancel the operation.

4.4 Testing of Luminance, CCT and CRI

As shown in Fig.24, the instrument is powered on to enter the test interface, click (color index) to select “CRI Lv Duv”, and click OK.

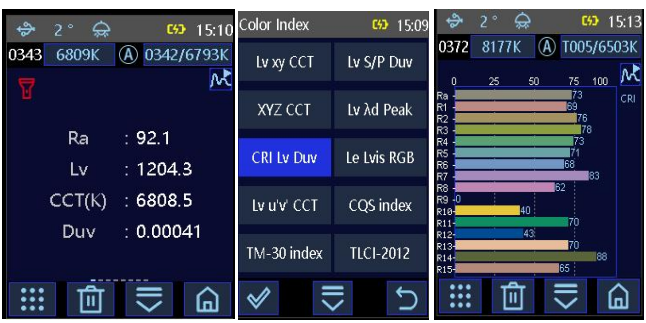


Fig. 24 Testing interface of CRI Lv Duv

You can click on to turn on laser positioning, then press the MEAS button. The laser will automatically turn off, the buzzer will sound, and the indicator light will flash,

starting the testing. The indicator light will stop flashing, and the test will end. The results will be displayed on the screen; Click  to enter the interface for viewing spectra and color rendering index.

4.5 Testing of Main Wavelength, Pe and Peak

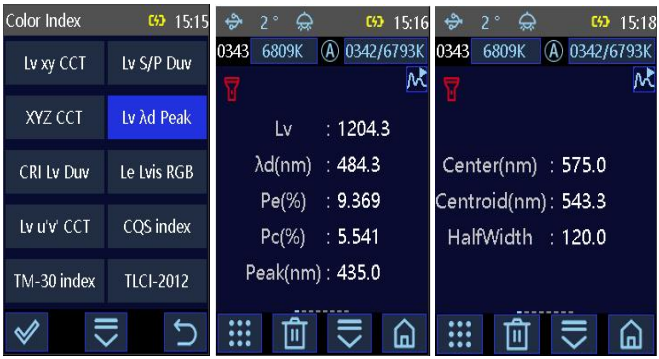


Fig. 25 Main wavelength, excitation purity, peak wavelength

As shown in Fig.25, the instrument is powered on to enter the testing interface, click  (color parameter) to select “Lv λ d Peak “, and click  OK.

You can click on  to turn on laser positioning, then press the MEAS button. The laser will automatically turn off, the buzzer will sound, and the indicator light will flash, starting the testing. The indicator light will stop flashing, and the test will end. The results will be displayed on the screen; Click to switch the next page test data, and

click  to enter the interface for viewing spectra and color rendering index.

4.6 The Uniformity Testing of LCD/Luminous Panel

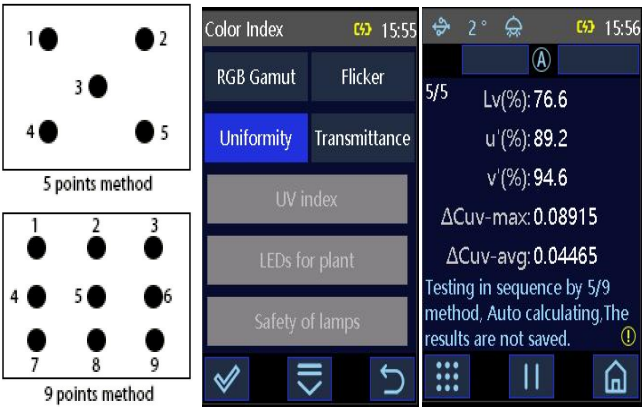


Fig.26 Testing of uniformity of LCD/luminous panel

As shown in Fig.26, the instrument is powered on to enter the test interface, click  (color parameter) to select “Uniformity”, and click  OK.

According to the uniformity method in the system setting (5-point method in Fig. 26), press the MEAS button to test, the buzzer sound, the indicator light flashes. The indicator light will stop flashing, and the test will end, and the indicator light is always on. The second, third, fourth and fifth points are measured in turn. The test results are presented on the display screen, and the test results are not

saved.

4.7 Color Gamut Testing of Display Screen

As shown in Fig.27, the instrument is powered on to enter the test interface, click (color parameter) to select “RGB Gamut”, and click OK

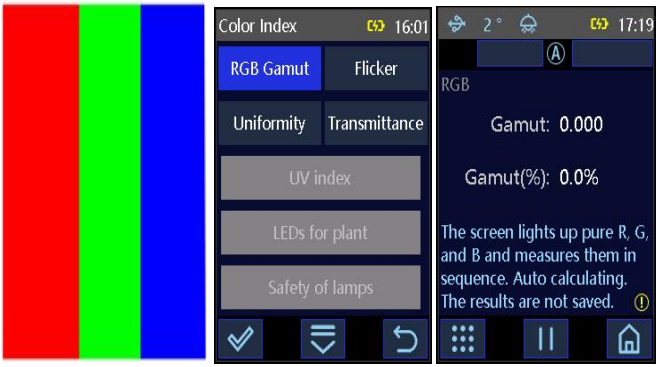


Fig.27 Display screen color gamut measurement

Controlling the display to light pure R, the instrument collects pure R photometric data, press the MEAS button, the buzzer will sound to start testing, and the indicator light will flash. The indicator light will stop flashing, and the test will end, and pure R test results will be presented on the display screen. According to the above operation, the pure G and B photometric data are tested in turn. Finally, the instrument calculates the color Gamut area GAMUT and the color gamut coverage GamutP, the calculation formula is described in section 5.5.7，and the results are not saved.

4.8 Testing of Flicker

As shown in Fig.28, the instrument is powered on to enter the test interface, click (color parameter) to select “Flicker”, and click OK.

Press the MEAS button, the buzzer will sound to start testing, and the indicator light will flash. The indicator light will stop flashing, and the test will end. The results will be displayed on the screen.

Note: The limited sampling frequency of the 800 series instrument can only capture flicker frequencies below 60Hz. The 500 series instrument has a sampling frequency of up to 10KHz and can capture flicker frequencies below 5KHz. The instrument needs to test many times of the light source and perform FFT analysis. The testing time is slightly longer and the results are not saved. Colorimeters based on the CIE XYZ filter principle (such as CI510) does not support flicker measurement.

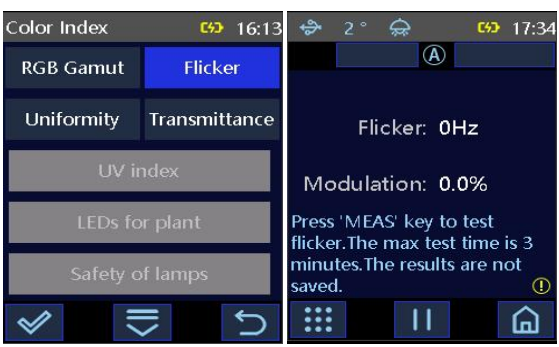


Fig28. Testing of flicker

4.9 Testing of CQS Index

As shown in Fig.29, the instrument is powered on to enter the test interface, click (color parameter) to select “CQS index”, and click OK

Fig.29 CQS index

Press the MEAS button, the buzzer will sound, and the indicator light will flash, starting the testing. The indicator light will stop flashing, and the test will end. The results will be displayed on the screen. Click to enter the interface of viewing spectrum and CQS color rendering index.

4.10 Testing of TM-30 Index

As shown in Fig.30, the instrument is powered on to enter the test interface, click (color parameter) to select “TM-30 index”, and click OK.

Press the MEAS button, the buzzer will sound, and the indicator light will flash, starting the testing. The indicator light will stop flashing, and the test will end. The results will be displayed on the screen; Click  to enter the interface for viewing spectra and color rendering index.

Fig.30 TM-30 index

5 Main Menu

Clicking the main menu shortcut key  on any interface will quickly switch to the main menu interface. As shown in Fig. 22, pressing the MEAS button will return to the testing interface. The following is a detailed description of the main menu.

5.1 Records

Clicking “Records” in the main menu interface to enter the records interface, as shown in Fig.31.

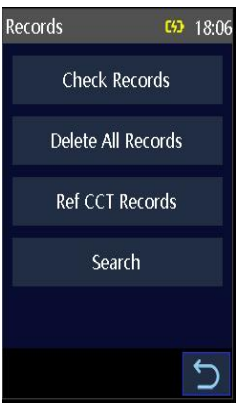


Fig.31 Records

Fig.32 Records and edit

5.1.1 Check Record

Click the “Check Records” submenu to enter the check records interface (Fig.32); Click to delete records, print records, to Current STD and rename records.

5.1.2 Reference Color Temperature Recording

Click the “Ref CCT Records” submenu to enter the records interface (Fig.33); view the D65 / A / C spectrum,

and click to set the record as a comparison sample

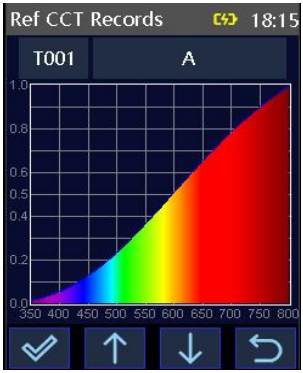


Fig.33 Reference record.

Fig.34 Search Records

5.1.3 Delete All Records

As shown in Fig.31, click “Delete All Records” in the records interface, click to delete all records, and click to return to the upper interface.

5.1.4 Delete a Single Record

Click the “Check Records” submenu in the check records interface to enter the record lists (Figs .32 and 33); Click to delete a single record.

5.1.5 Print

Click the “Check Records” submenu in the check records interface to enter the sample lists (Figs .32 and 33); Click and click Print Record button, and the instrument will send the sample record to the printer, and the printer will print the record. (Note: The printer needs to be purchased additionally.)

5.1.6 Set as Contrast Sample

In the records interface, click “Check Records / Ref

CCT Records" sub-menu to enter the record lists (Figs.32and 33) ; click , click and set as the comparison sample. If the instrument enables the contrast mode (Display - >Contrast Mode), then the sample data will be displayed as a comparison mode.

5.1.7 Search Records

In the records interface, click "Search" to enter the search menu.

As shown in Figure 34, enter the keyword of the sample name, and then click to confirm. The instrument will list the eligible records, and click to flip down to view all the records searched that meets the screening condition. If there is no matching record, it will prompt that " This record does not exist " and return to the search record menu.

5.2 Color Index and Charts

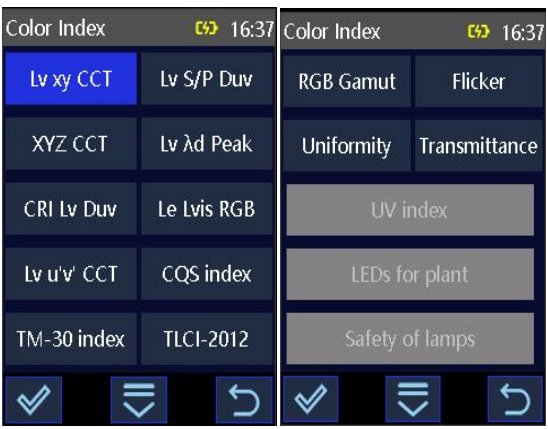


Fig. 35 Color index

In “Main Menu-> Color Index”, open the color index interface, as shown in Fig.35,click to switch between different color index pages, select the required color index, click to confirm, click to flip down, and click to return to the back interface.

5.2.1 Lv xy CCT

This color index can be used to test the luminance Lv, CIE1931 chromaticity coordinates xy and color temperature CCT, as shown in Fig. 36.

Fig.36 Lv xy CCT

Fig.37 Lv S/P Duv

Fig. 38 XYZ CCT

5.2.2 Lv S/P Duv

This color index can be used to test luminance Lv, color temperature CCT, light-dark visual ratio S / P, black deviation Duv and color tolerance SDCM, as shown in Fig.37.

5.2.3 XYZ CCT

This color index can be used to test the CIE1931, Tristimulus value XYZ and color temperature CCT of the

sample to be tested, where Y = luminance Lv, as shown in Fig. 41.

5.2.4 Lv λ d Peak

The color index can be used to test the luminance Lv, the dominant wavelength λd, the excitation purity PE, the chromaticity purity PC, the peak wavelength, the center wavelength, the centroid wavelength, and the half-wave width, as shown in Fig.25.

5.2.5 CRI Lv Duv

This color index can be used to test the color rendering index Ra, luminance Lv, color temperature CCT, and blackbody deviation Duv, as shown in Fig 24.

5.2.6 Le Lvis RGB

Fig. 39 Le Lvis RGB test interface

This color index can be used to test the luminance Lv, the irradiance Le, the visible light irradiance Lvis, the ultraviolet irradiance Luv ; far red irradiance Lfr, infrared

irradiance Lir, blue irradiance Lb, green irradiance Lg, red irradiance Lr ; The ratios of blue light, green light and red light irradiance to visible light irradiance Lb(%), Lg(%) and Lr(%) ,as shown in Fig 39.

The irradiance Lvis is the irradiance integral sum in the wavelength range of 380 ~ 780 nm. Blue light irradiance Lb is the irradiance integral sum in the wavelength range of 380 ~ 500 nm. Green light irradiance Lg is the irradiance integral sum in the wavelength range of 500 ~ 600 nm. Red light irradiance Lr is the irradiance integral sum in the wavelength range of 600 ~ 780 nm. Far-red irradiance Lfr is the irradiance sum integral in the wavelength range of 700 ~ 780 nm. Infrared irradiance Lir is the irradiance integral sum in the wavelength range of 780 ~ 2500 nm.

5.2.7 RGB Gamut

This color index can be used to test the color Gamut area and color gamut coverage GamutP of the display. As shown in Fig 27, the display is controlled to light up pure R/G/B in turn, and the instrument collects photometric data in turn, and then calculates the color Gamut area GAMUT and the color gamut coverage GamutP.

Note : Test results are not stored ; for 8-bit color display, pure R / G / B corresponding RGB are (255,0,0), (0,255,0), (0,0,255) respectively.

5.2.8 CQS Index

CQS (Color Quality Scale) is an index proposed by the North American Institute of Lighting Engineering (IES) to evaluate the color quality of light sources. It

comprehensively considers the factors such as reproducibility, saturation and luminance of various colors, and more comprehensively evaluates the ability of the light source to restore the color of the object, making up for the deficiency of the color rendering index CRI color reproducibility index.

This color parameter can be used to test the color rendering index Qa-CQS, fidelity Qf-CQS, color gamut index Qg-CQS, color index Qp-CQS, as shown in Fig32. Under the CQS system, the color rendering index histogram and color rendering index radar map of each color block are shown in Figs 10 and 11.

5.2.9 TM-30 Index

TM-30 is a new method proposed by the North American Institute of Lighting Engineering (IES) to evaluate the color rendering of lighting sources. There are 99 evaluation reference templates, and it is currently recognized as a more accurate and more objective light color evaluation index, including fidelity Rf, color gamut index Rg.

This color index can be used to test the fidelity Rf, color gamut index Rg, luminance Lv, color temperature CCT, as shown in Fig 30.

5.2.10 TLCI-2012

The Television Light Source Consistency Index (TLCI-2012) was initiated by the British Broadcasting Corporation (BBC) to solve the color rendering measurement index of TV and video cameras.

This color index can be used to test TLCI index, luminance Lv and color temperature CCT, as shown in Fig 40.

Fig. 40 TLCI-2012

Fig. 41 Lv u'v' CCT

5.2.11 Lv u'v' CCT

This color index can be used to test the luminance Lv, CIE1976 chromaticity coordinates u 'v ', and color temperature CCT, as shown in Fig 41.

5.2.12 Uniformity

This color index can be used to test the luminance uniformity Lv (%) and CIE1976 chromaticity coordinate uniformity u 'v ' (%) of the luminous panel, and measure the color tolerance ΔCuv with the central area at the same time. The calculation method is based on the content of 5.5.7chapter.

As shown in Figs.26 and 42, according to the setting of the uniformity measurement method, multiple point data on the luminous panel are measured in turn, and the uniformity

and color tolerance of the panel are calculated by the instrument itself. (Note: Test results are not saved)

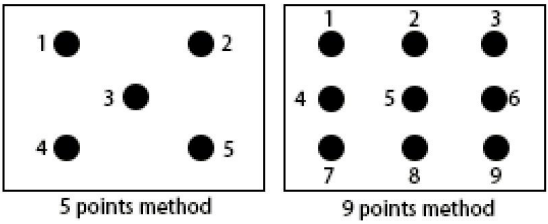


Fig. 42 Uniformity measurement method

5.2.13 Flicker

This color index can be used to test flicker frequency (Hz) and fluctuation depth (%), as shown in Fig 31. The limited sampling frequency of the 800 series instrument can only capture flicker frequencies below 60Hz. The 500 series instrument has a sampling frequency of up to 10KHz and can capture flicker frequencies below 5KHz. The instrument needs to test many times of the light source and perform FFT analysis. The testing time is slightly longer and the results are not saved. Colorimeters based on the CIE XYZ filter principle (such as CI510) does not support flicker measurement.

5.2.14 Transmittance

Transmittance is a very important optical characteristic, such as the transmittance of sunlight through glass curtain walls in office buildings. The transmittance of office building glass curtain walls to sunlight is usually a mandatory inspection item for engineering acceptance, and traditional transmittance meters are difficult to test. The

luminance colorimeter can accurately measure the transmittance of glass curtain walls to sunlight. First, test the spectrum of sunlight that has not passed through the glass curtain wall, and then test the spectrum of sunlight that has passed through the glass curtain wall. Then, the transmittance of visible /ultraviolet /infrared light that passes through the glass curtain wall will be calculated, as shown in Figure 43.

Note: When collecting the solar spectrum before and after passing through the glass curtain wall, make sure that the measurement angle of the instrument's measuring port axis is as consistent as possible, and the collection time interval should be small.

Fig. 43 Transmittance

5.2.15 Spectrogram, CRI Histogram, White Balance

In the spectrogram chart, the spectrum display is normalized, by default, light wavelength position is the peak wavelength position, and different light wavelengths can be switched by the direction arrow.

In the CRI histogram chart, each histogram color block represents an evaluation sample, and its numerical value is the color rendering index of the evaluation sample, and the simulated color of the histogram color block represents the simulated color of the evaluation sample.

In the white balance chart, the abscissa represents the color temperature difference between the current test sample and the target contrast sample, and LBi is expressed in units of MMK-1 (1000000/color temperature); the ordinate represents the number value of the compensation filter, the suffix G represents the green filter, and the suffix M represents the magenta filter. By default, the instrument supports Kodak's G/M series compensation filters. If you need other brands or series filters, you can ask our company for personalized customization.

5.3 Measurement settings

In “Main Menu->Meas.” inteface, as shown in Fig 44, measure mode, exposure speed, average times, continue times, continue interval, Modbus Slave Address can be set, click to confirm, and click to cancel.

5.3.1 Measure Mode

According to the stability of the irradiance of the light source, the measure modes are divided into ambient light ,flash (<5ms)and long time flash(>5ms) .The stable lighting modules such as outdoor sunlight, office lighting, and displays are measured by ambient light , flash lamps with lighting time within 5ms are used ,

such as pulsed xenon lamps; flash lights with lighting time of more than 5ms are used, such as the camera 's LED flash ; ambient light is selected by default.

5.3.2 Exposure Speed

According to the irradiance spectrum intensity of the light source, the exposure speed is selected. represents a strong light environment, and the exposure speed is fast; indicates a weak light environment with slow exposure speed; represents automatic mode, and the instrument switches the exposure speed by itself according to the current test environment, which is selected by default.

5.3.3 Average Times

When the irradiance spectrum of the sample to be tested is not very stable, the average irradiance spectrum is obtained by measuring the spectrum of multiple representative time points, and then the calculated photometric data can better represent the true photometric value of the sample. The instrument can achieve an average Testing of 2 ~ 10.

Click “Average Times”, input the average times, click to confirm, click to return to the upper interface. If the average number of inputs is 1, it is measured in a conventional way; if it is greater than 1, the average measurement will be performed.

5.3.4 Continue Tines/ Continue Interval

In the application of pipeline operation, timed measurements are required, and continue Times can be started.

Click “Continue Times”, input the number of continuous measurement, click ✓ to confirm. Click “Continue Interval” to set the continue interval (1~300 seconds), click ✓ to confirm. If the number of consecutive inputs is 1, it will be measured in the conventional way; if it is greater than 1, continuous measurement will be carried out according to the continuous measurement interval.

If continuous measurement is started, during the test, there will be a green progress bar above the main testing interface, indicating that the current measurement is continuous measurement, and long press the MEAS button to pause the continuous measurement.

Fig. 44 Meas. Settings

Fig.45 Display settings.

5.4 Display settings

“Main Menu->Display” enters the display interface, as

shown in Fig. 45, The irradiance spectrum display wavelength range can be selected, for the contrast mode, xy diagram, u'v' diagram, CRI histogram, CRI radar chart, SDCM diagram, and white balance, whether to open for setting (✓ enabled, ✗ not enabled).

5.4.1 Wave Length Range

Click "Display ->Wave Length Range", and you can choose from 350 ~ 800 nm, 360 ~ 780 nm and 400 ~ 700 nm.

(Note: Different types of instruments have different parameters. Please refer to the specifications.)

5.4.2 Contrast Mode

There are two modes in the measurement , one is the contrast mode, the current test data can be compared with the reference color temperature record or other existing test records. The other is non-contrast mode, only the current test data is displayed.

In some cases, it is necessary to compare the radiance spectrum of the sample to be tested / other photometric index with the known comparison sample (Eg. the D65 spectrum is adjusted in LED light distribution). At this time, the contrast mode can be turned on, and the D65 in the reference color temperature record is set as the comparison sample. At the testing interface, each testing data will be compared with D65. As shown in Fig 17.

The setting method is: "Main Menu->Display ->Contrast Mode", and the sample mode is enabled (✓ enabled, ✗ not enabled).

5.4.3 Chart Switch Options

Click “xy diagram”, “u’v’ diagram ”, “CRI histogram”, “CRI radar chart”, “SDCM diagram ”, “ White Balance”, whether to open for setting (enable, not enable).

If enabled, in the testing interface, click to display the corresponding chart, which is turned on by default.

5.5 System Setup

Fig. 46 System Settings 1

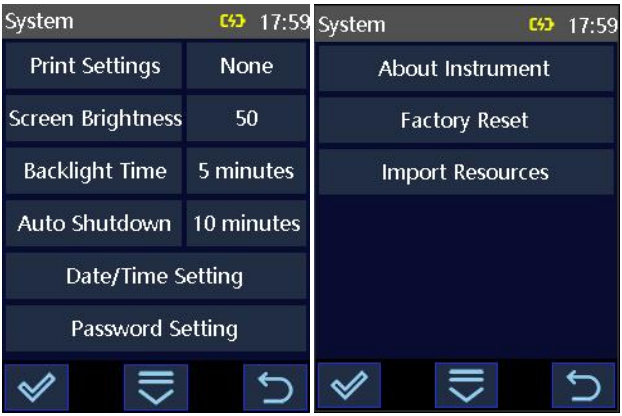


Fig. 47 System Settings 2

Click “Main Menu->System” to enter the system interface, as shown in Figs.46 and 47.

In about instrument, you can check the instrument number, instrument SN code, hardware version, software version, probe SN code and other functions.

5.5.1 Measurement Unit

The default luminance unit : cd/㎡(nit), and customs can choose footlambert (fl), Please refer to “main menu-> system” for details. (1 fl = 3.426 cd/㎡)

The default irradiance unit : miliwatt /sr/㎡/nanometer (mW/sr/㎡/nm).

The default SUM irradiance unit: milliwatts / sr/cm² (mW/sr/ cm²), integral irradiance (also including weighted integral irradiance) refers to the sum of irradiance within a certain wavelength range, such as radiation luminance Le ,visible light irradiance Lvis, etc.

Wavelength unit: nanometer (nm): 1nm=10^{-9} meters.

5.5.2 Measuring Control mode

Key: This mode is selected, when the instrument communicates with the PC software, the instrument measurement can only be triggered by the MEAS button.

PC: This mode is selected, when the instrument communicates with PC software, the instrument measurement can only be triggered by PC software test command.

Key |PC: This mode is selected, customs can use the MEAS button or PC software test command to trigger.

Note: The measurement control mode only takes effect when the instrument is connected to the PC software. When it is not connected, only MEAS can be used.

5.5.3 Auto-Save

When the auto saved is turned on, each testing result will be automatically saved, otherwise the testing result will not be automatically saved, and it will be saved when you need to manually click the save button  .

5.5.4 Language

Click “Language”, and then select the language .(The instrument has Chinese, English, and other languages need additional customization).

5.5.5 Bluetooth

“Main Menu -> System-> Bluetooth” enable the bluetooth (✓ enabled, ✗ not enabled). When Bluetooth is enabled, the Bluetooth icon will be presented on the status bar area of the measurement. Other electronic devices, with Bluetooth enabled, can pair and communicate with

each other.

The name of the instrument Bluetooth is "model – SN", such as "CL800-12800068", and the pairing password is "123456". The connection method is refer to the HIQC manual.

The WIFI module interface is reserved in the instrument, and customs with WIFI requirements can customize it.

It is usually recommended to turn off the Bluetooth / WIFI module to reduce power consumption.

5.5.6 Buzzer

The buzzer switch controls whether a prompt sound is sounded during testing. When the buzzer is turned on, the prompt sound will be sounded for each testing, otherwise, there will be no prompt sound during the test.

5.5.7 Uniformity

For light-emitting panels such as displays, lightbox, and LED displays, it is usually necessary to evaluate the luminous uniformity of the light-emitting panels. In the industry, luminance colorimeters are usually used to test the representative multi-point photometric values on the light-emitting panels, and then their uniformity and chromaticity differences are calculated. The test diagram refers to Chapter 5.2.13, and the formula is as follows.

$$(1-\frac{Emax-Emin}{Eavg})\times 100\% \quad \text{----------5-1}$$

$$\Delta Cuv=((u'-u'_{center})^2+(v'-v'_{center})^2)^{0.5} \quad \text{------5-2}$$

In GB/15609 standard for chromaticity Testing of color displays, it is required to calculate the color tolerance ΔCuv between each test point and the central area. The uniformity measurement method defaults to the 5-point method.

5.5.8 Printer Setting

Micro printers need to be purchased separately. If you want to configure a Bluetooth printer, the printing is set to the bluetooth; if you want to configure a USB serial printer, the printing setting is set to USB, and the default is none.

5.5.9 Password Setting

Luminance calibration and calibration correction are related to the accuracy of the test data and need to be carefully operated. Luminance calibration usually needs professional technicians to operate, and professional technicians can enter the password to enter the calibration interface.

The factory **default password is: 123456,** in“ Main Menu- >System - >Password Setting ”, the password can be modified.

5.5.10 Screen Brightness

Click “Screen Brightness” in the system interface to enter the " Screen Brightness" interface. According to the actual work situation, adjust by 25% and 50%, 75 %, 100 % to adjust, click  to confirm, click  to return to the upper interface.

5.5.11 Backlight Time

Backlight Time is divided into: “1 minute”, “5 minutes”, “10 minutes”, “30 minutes”, “always on”. If you

choose to keep bright, it will not automatically close when there is no operation, or will not automatically shut down. If it is set to “5 minutes”, the instrument will be timed from the last custom operation, and the screen will be closed after 5 minutes, and the indicator light will remain on.

During the screen rest time, the instrument can light up the display screen by pressing the MEAS button or clicking the touch screen.

5.5.12 Auto Shutdown

The auto shutdown time can be divided into “10 minutes”, “30 minutes”, “60 minutes” and “never”. After the instrument screen is closed, the instrument will be soft-shut down according to the set auto shutdown time.

During the soft shutdown time, the instrument can be awakened by pressing the MEAS button.

5.5.13 Date and Time Setting

Click “Date and Time Setting” in the system interface, and set the date and time as needed.

5.5.14 About Instrument

Click “About Instrument” in the system interface to enter the “About Instrument” interface, the instrument model, the SN code, hardware version, and software version information can be viewed.

5.5.15 Factory Reset

Click “Factory Reset” in the system interface, click to clear all measurement records and custom settings, and click to cancel this operation.

Note: The operating instrument will be cleared all data

and custom settings, and return to the set state， all the data is unrecoverable, please operate carefully.

5.6 Calibration

5.6.1 Zero calibration

Click “Calibration”-> “Zero Calibration” in the main menu to enter the “Zero Calibration” interface, as shown in Fig. 12. Following the prompts, cover the protective cover, press MEAS button or to perform zero calibration, and click to return to the back interface.

5.6.2 Calibration Correct

Calibration correct should be carefully operated, and the specific calibration operation principle is referred to chapter 3.3.3.

5.6.3 Luminance Calibration

Calibration should be carefully operated, and the specific calibration operation principle is referred to chapter 3.3.2.

5.6.4 CAL Channel

Please refer to Chapter 3.34 for the operating principle and steps.

6. Technical Parameters

Model	CI820S	CI510S
Product	SPECTRAL LUMINANCE COLORIMETER	COLOR ANALYZER
Wavelength Range	350～800nm	/
Wavelength Interval	1nm	/
Spectrophoto-metric Mode	Concave Grating	CIE XYZ Filter
Lv Range	0.1～200000cd/㎡	
Unit	cd/m²,fL	
Accuracy (Light A)	Lv:±3%±1 display value xy:±0.004(>5cd/㎡)	Lv:±4%±1 display value xy:±0.005(>5cd/㎡)
Repeatability (Light A)	Lv:0.15%±1 display value xy:0.001(>10cd/㎡) xy:0.002(5~10cd/㎡)	Lv:0.25%±1 display value xy:0.0015(>10cd/㎡) xy:0.0025(5~10cd/㎡)
Measure Angle	1°	
Aperture	Φ2mm (Note:Customizable for other aperture)	
Measurement Area	Distance=0~1mm,min area Φ2mm;	
Aim	650nm laser positioning	
Measurement Mode	Auto mode,Continuous mode,Average mode,Flash mode(**except CI510S**)	
Measuring Time	Auto mode:0.2~5 s	Auto mode:0.1~5 s
Observer Angle	2°(CIE1931)	
Color Space	CIE XYZ, Lv xy, Lv u'v' ,Spectrum(**except CI510S**)	
Colorimetric Index	1.Lv,CCT(K);CIE31x,y;CIE76u',v';CIE31X,Y,Z;Duv,SDCM;λd,Pe,Pc; Le,Lvis,Luv,Lb,Lg,Lr,Lfr,Lir,Lrb,R(%),G(%),B(%)**(except CI510S)**; CRI,S/P,Peak,Center,Centroid (**except CI510S**); 2.Flicker(Hz),Modulation(%);(**except CI810,CI510S**) 3.Display screen Gamut,Gamut Area(%),ΔCuv;5 Points/9 Points Uniformity; 4.CQS CRI,Color Fidelity Qf,Gamut Index Qg and Qp;(**except CI510S**); TM-30 Color Fidelity Rf and Gamut Index Rg;TLCI-2012(**except CI510S**); 5.CIE31 xy diagram,CIE76 u'v' diagram,MacAdam ellipse diagram, CRI/CQS histogram,CRI/CQS radar chart(**except CI510S**); 6.UVA,UVI,Ls-uv,Ls-B,RG(BLH),PermitTime(S);(**except CI510S**)	
Data Storage	10000 Pcs	2000 Pcs
Dimension	Body:L*W*H=116X60X28mm, Lens:Φ20X32mm	
Weight	about 280g	
Battery	Li-ion battery,3.7V,4000mAh(8000 measurements within 24 hours)	
Display	2.8-inch TFT color LCD, Capacitive Touch Screen	
Interface	Type C USB，Bluetooth 5.0(Customizable WIFI)	
Language	English, Chinese	
Operating Environment	-10~40℃(0~85%RH/no condensing)	
Storage Environment	-20~50℃(0~85%RH/no condensing)	
Standard Accessory	Power adapter,USB cable,manual(Electronic Version),Wrist strap,Wiping Cloth, PC Software(Download from office website)	

Model	CI820	CI810	CI510
Product	SPECTRAL LUMINANCE COLORIMETER	SPECTRAL COLOR ANALYZER	COLOR ANALYZER
Wavelength Range	350～800nm	360～780nm	/
Wavelength Interval	1nm		/
Spectrophoto-metric Mode	Concave Grating		CIE XYZ Filter
Lv Range	0.1～200000cd/㎡		
Unit	cd/m²,fL		
Accuracy (Light A)	Lv:±2%±1 display value xy:±0.004(>5cd/㎡)		Lv:±3%±1 display value xy:±0.005(>5cd/㎡)
Repeatability (Light A)	Lv:0.1%±1 display value xy:0.001(>10cd/㎡) xy:0.002(5~10cd/㎡)		Lv:0.2%±1 display value xy:0.0015(>10cd/㎡) xy:0.0025(5~10cd/㎡)
Measure Angle	1°		
Aperture	Φ22mm		
Measurement Area	minimum area Φ22mm; Distance=30mm,minimum area Φ24mm; Distance=100mm,minimum area Φ26mm; Distance=500mm,minimum area Φ42mm; Distance=1000mm,minimum area Φ65mm;		
Aim	650nm laser positioning		
Measurement Mode	Auto mode,Continuous mode,Average mode,Flash mode(**except CI510**)		
Measuring Time	Auto mode:0.2~5 s		Auto mode:0.1~5 s
Observer Angle	2°(CIE1931)		
Color Space	CIE XYZ, Lv xy, Lv u'v' ,Spectrum(**except CI510**)		
Colorimetric Index	1.Lv,CCT(K);CIE31x,y;CIE76u',v';CIE31X,Y,Z;Duv,SDCM;λd,Pe,Pc; Le,Lvis,Luv,Lb,Lg,Lr,Lfr,Lir,Lrb,R(%),G(%),B(%)**(except CI510)**; CRI,S/P,Peak,Center,Centroid (**except CI510**); 2.Flicker(Hz),Modulation(%);(**except CI810,CI510**) 3.Display screen Gamut,Gamut Area(%),ΔCuv;5 Points/9 Points Uniformity; 4.CQS CRI,Color Fidelity Qf,Gamut Index Qg and Qp;(**except CI510**); TM-30 Color Fidelity Rf and Gamut Index Rg;TLCI-2012(**except CI810,CI510**); 5.CIE31 xy diagram,CIE76 u'v' diagram,MacAdam ellipse diagram, CRI/CQS histogram,CRI/CQS radar chart(**except CI510**); 6.UVA,UVI,Ls-uv,Ls-B,RG(BLH),PermitTime(S);(**except CI810,CI510**) **(Note:CI510 does not have partial functions)**		
Data Storage	10000 Pcs	8000 Pcs	2000 Pcs
Dimension	Body:L*W*H=116X60X28mm, Lens:Φ30X62mm		
Weight	about 320g		
Battery	Li-ion battery,3.7V,4000mAh(8000 measurements within 24 hours)		
Display	2.8-inch TFT color LCD, Capacitive Touch Screen		
Interface	Type C USB，Bluetooth 5.0(Customizable WIFI)		
Language	English, Chinese		
Operating Environment	-10~40℃(0~85%RH/no condensing)		
Storage Environment	-20~50℃(0~85%RH/no condensing)		
Standard Accessory	Power adapter,USB cable,manual(Electronic Version),Wrist strap,Wiping Cloth, PC Software(Download from office website)		

Appendix

Num	Abb.	Description	Num	Abb.	Description
1	Lv	luminance(cd/m², 1nit=1cd/m²)	28	Luv	uv radiance(100~400nm)
2	x	chromaticity(CIE1931) x	29	Lb	blue radiance(380~500nm)
3	y	chromaticity(CIE1931) y	30	Lg	green radiance(500~600nm)
4	CCT(K)	correlated color temperature	31	Lr	red radiance(600~780nm)
5	u'	chromaticity(1976UCS) u'	32	Lfr	far red radiance(700~780nm)
6	v'	chromaticity(1976UCS) v'	33	Lir	infrared radiance(780~2500nm)
7	u	chromaticity(1960UCS) u	34	UVA	UVA radiance
8	v	chromaticity(1960UCS) v	35	Lrb	ratio of red and blue radiance
9	X	psychophysical color specification X	36	R(%)	ratio of red and visible radiance
10	Y	psychophysical color specification Y	37	G(%)	ratio of green and visible radiance
11	Z	psychophysical color specification Z	38	B(%)	ratio of blue and visible radiance
12	Duv	the closest distance from the Planckian locus on 1960UCS	39	Gamut	color gamut
13	SDCM	Chromaticity Tolerances	40	Gamut(%)	Gamut Area(%)
14	S/P	ratio of Scotopic and photopic	41	ΔCuv	ΔCuv
15	Peak(nm)	peak wavelength	42	Uniformity	Uniformity
16	Center(nm)	Center wavelength	43	Qa-CQS	Qa-CQS
17	Centroid(nm)	Centroid wavelength	44	Qf-CQS	Color Fidelity
18	λd(nm)	dominant wavelength/ complementary wavelength	45	Qg-CQS	Gamut Index
19	PE(%)	excitation purity	46	Qp-CQS	color Preference Scale
20	PC(%)	colorimetric purity	47	Rf-TM-30	Color Fidelity
21	Half Width	half width(of spectral line)	48	Rg-TM-30	Gamut Index
22	Ra	CRI-Ra(color rendering index)	49	TLCI-2012	TV Lighting Consistency Index
23	R1~R15	CRI-Ri(color rendering index)	50	UVI	index of UV
24	Flicker(Hz)	Flicker frequency	51	Ls-uv	Weighted radiance of photochemical ultraviolet hazards
25	Modulation	modulation depth	52	Ls-B	Weighted radiance of blue light hazard
26	Le	radiance(mW/sr/cm²)	53	RG(BLH)	blue light hazard (BLH)risk group
27	Lvis	visible radiance(380~780nm)	54	PermitTime(S)	The permissible time for exposure to ultraviolet or blue radiation

Fig. 48 Terminology Description

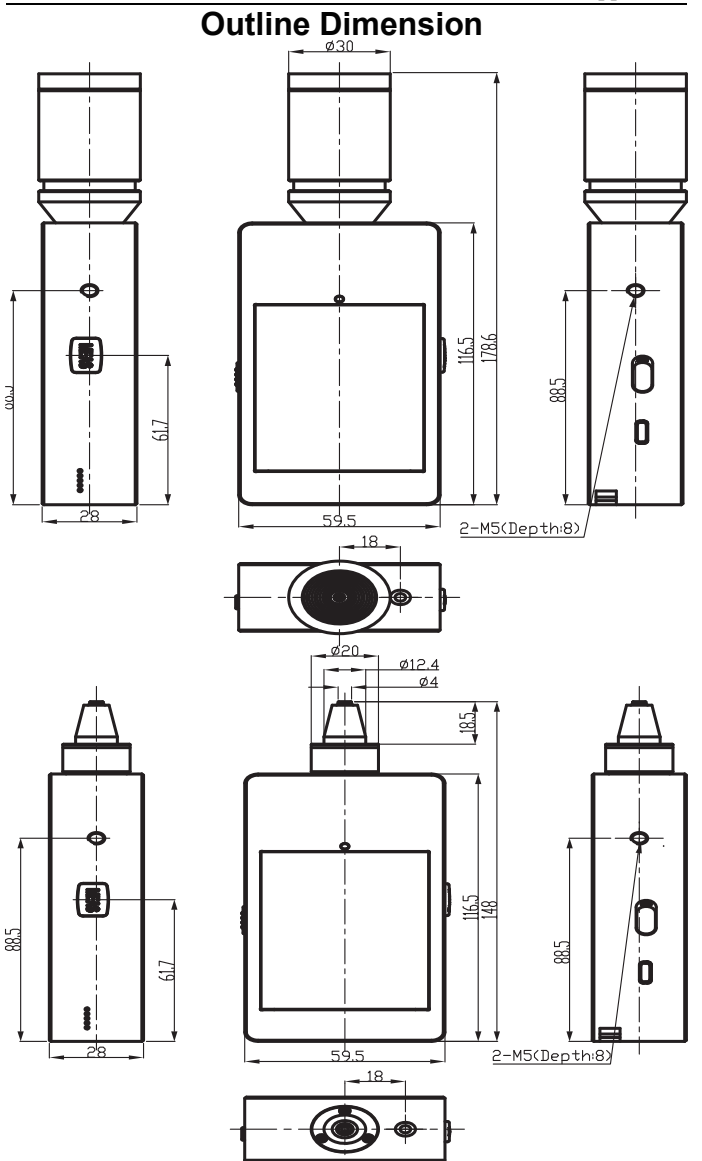


Fig. 49 Dimensions of the instrument

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Please keep the manual properly for reference.