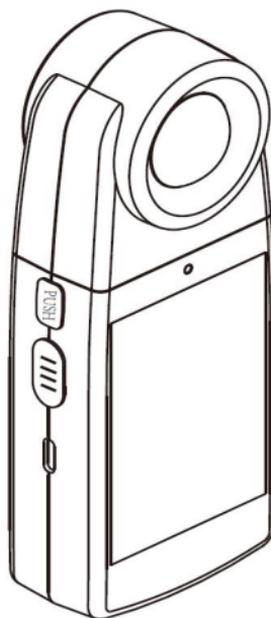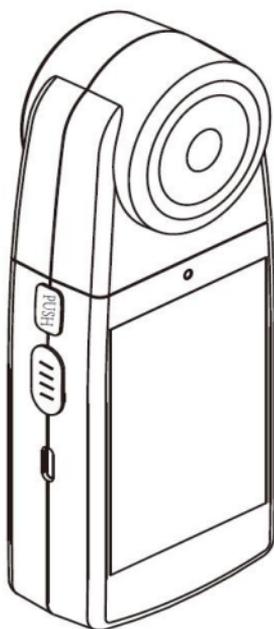# HUICOLOR

800 series SPECTRAL COLORIMETER

500 series COLORIMETER

⚠️ # User Manual

Please read carefully,
before using the instrument.

V 1.0

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.

CONTENTS

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 spectrometer with accurate measurement. It adopts a portable design that the test head and the test host can be separated, and the test head can rotate 180 degrees in the opposite direction.

The instrument adopts high-precision concave grating/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/CIEXYZ, and output 1nm interval irradiance spectrum，with the highest measuring range of 200000 lx. 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 irradiance spectrum, illumination, color temperature, color rendering index and white balance of camera, but also measure plant growth lamp parameters, UVI index, blue light hazard, 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 measuremut, flash measurement, flicker frequency, etc. It is easy to operate, accurate and stable.

This instrument is widely used in the following aspects:

(1)The radiation spectrum, illumination, color temperature, chromaticity coordinates, color rendering index and other parameters of LED lighting source and various light emitting modules can be accurately measured and evaluated.

(2)It can be used for the measurement and evaluation of on-site lighting environment in libraries, shopping malls, schools, factories, street lighting projects and other occasions.

(3) It can be used to evaluate the photosynthetic performance of various light sources in intelligent agriculture, especially the LED light performance evaluation for plant growth.

(4) It can be used to analyze chromaticity coordinates, color gamut, uniformity, color rendering index and radiation spectrum performance of various TV sets, displays and projectors.

(5) It can be used to detect the light source performance and white balance parameters of camera products;

(6) Various biological safety parameters such as ultraviolet level and blue light hazard can be measured, and the performance of eye protection lamp and outdoor

environment can be evaluated.

(7) It can be used to test and evaluate the uniformity, illumination, color rendering index, color temperature, and spectrum deviation of ideal illuminator of the standard light source box.

(8) It can be used to detect and evaluate CRI color rendering index, CQS, TM30, TLCI-2012 fidelity, color gamut and other parameters in multimedia industry.

1.2 Product Characteristic

(1) The high-grade version uses a high-precision concave grating as the splitting element, the measuring range of optical wavelength is $350 \sim 800$ nm, the wavelength accuracy is 0.2nm, the irradiance spectrum with 1nm interval is output, the measurement is accurate and stable, and it has good data compatibility with highly recognized spectral radiometer.

(2) 2.8-inch TFT capacitive touch screen, 4000mAh lithium battery, large-capacity storage, Type C USB, Bluetooth 5.0 (reserved WIFI), detachable test head with 180-degree reverse installation, portable design.

(3)It can not only test illumination, color temperature, color rendering index, dominant wavelength, light-dark visual ratio S/P, camera white balance and other conventional illumination parameters, it can also test Flicker, UV index, blue light hazard, plant growth lamp parameters, 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 illuminator radiation spectrum can easily compare the test spectrum with the built-in standard illuminator 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 the 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 calibration regularly (one year), and can also be sent to a laboratory with photometric calibration qualification for calibration.

2 Structure Components
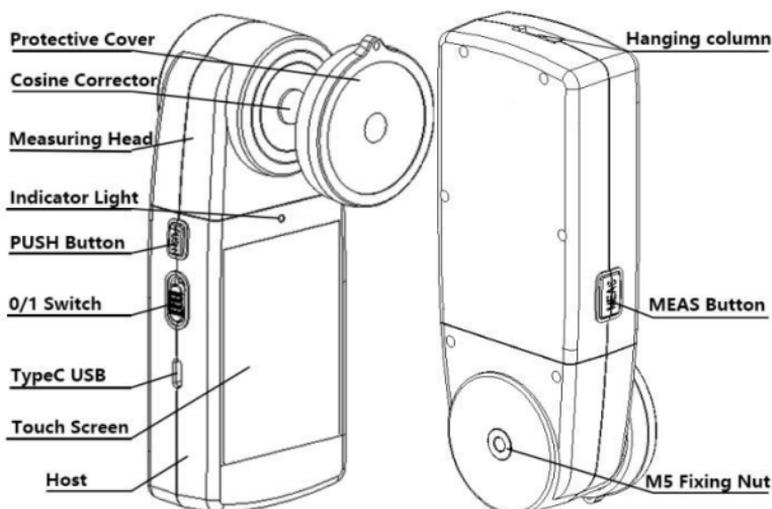
Fig. 1 Structural components
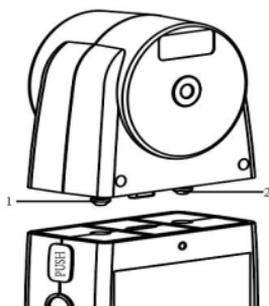
Fig. 2   Measuring head 180 reverse installation

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

Measuring Head: The optical signal acquisition parts of the instrument, including the detector, cosine corrector, etc. By pressing the "PUSH" button, the head can be detached from the host, which can be installed in front (Fig.1) or back (Fig. 2).

Protective Cover: When the instrument is zero-calibrated, it is necessary to cover the head with a protective cover to block the ambient light; 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); 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 to wake up the instrument .

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 $5V \overline{}\ 2A$.

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).

0/1 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. It is on/off by cutting off the power supply.

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 test results. When the instrument is charged, the green indicator light is on, the charging is completed, the indicator light is off.

PUSH Button: This button controls the connection switch between the host and the measuring head. Pressing the PUSH button can open the guide shafts slot(1 and 2 is guide shafts in Fig. 2). The measuring head can be removed from the host, and then the PUSH button can be released to restore the slot.

Note: Do not disassemble the measuring head during the testing process.

Disassemble the measuring head: Press and hold the PUSH button, then gently pull out the measuring head to separate it from the host along the guide axis.

Assembly test head: Press the PUSH button to align the guide shaft with the host hole, press down on the measuring head, and release the PUSH button when it is in place.

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

Hanging Column : Used for binding hanging rope.

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 $\overline{}$ 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 $\overline{\cdots}$ 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

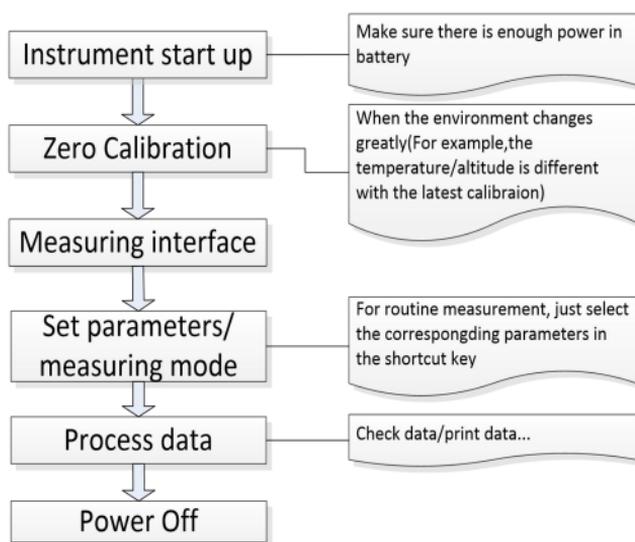The instrument test process is shown in Figure 3.

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

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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.

Color Index Shortcutkey

Fig. 4 Color parameter shortcut keys
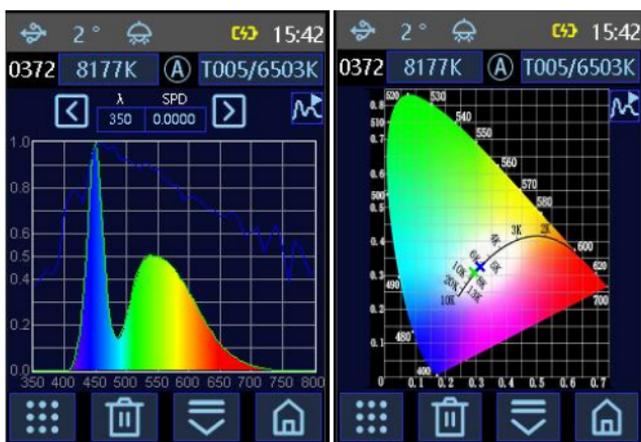

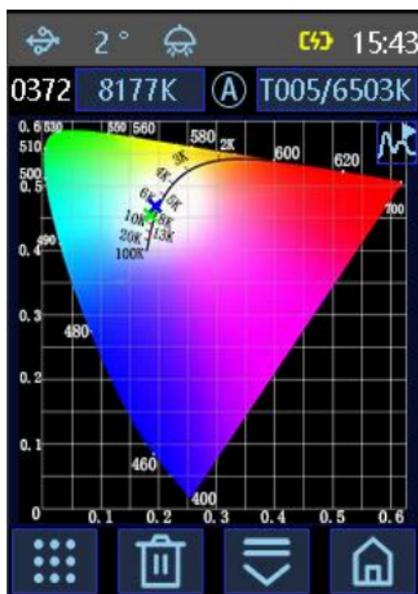Fig. 5 Spectral chart   Fig.6 CIE31 chromaticity
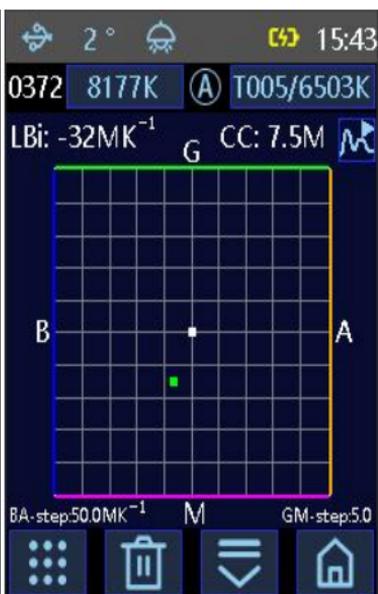
Fig. 7 CIE1976UCS   Fig. 8 White balance
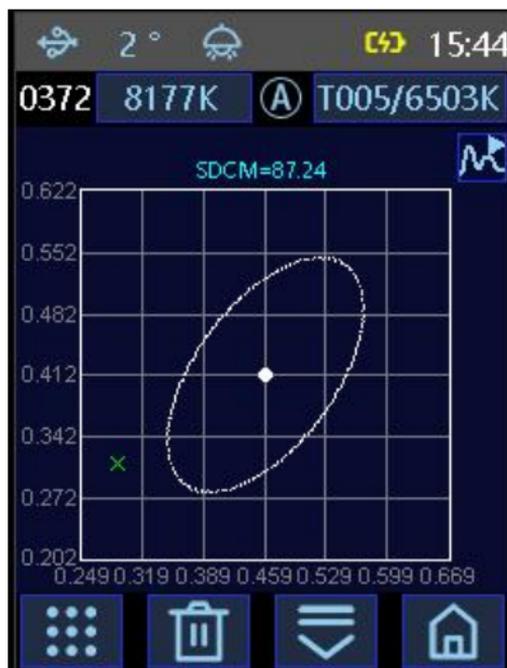
Fig. 9 Color Tolerance Macadam Ellipse Diagram

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 Illuminace Calibration

When the instrument leaves the factory, the

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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. Illumination 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 illumination 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.

Illumination calibration usually needs professional institutions, and calibration is carried out on the optical rail platform in the darkroom, as shown in Fig.13. The illumination value is high when the distance from the standard lamp is close, and the illumination value is low when the distance is far. The illumination and light intensity satisfy the following formula: $Ev = I/d^2$ (I : standard light

intensity ; d : The distance from the light surface of the standard lamp to the measuring surface).The length of the light track is usually more than 10 meters. Adjusting the distance between the measuring head and the standard lamp on the light track can produce various standard illumination values. The spectrometer needs to calibrate multiple illumination data within the measurement range, and the test accuracy of the corresponding Spectrometer will be higher. The coordinate points of the optical rail platform with standard illumination of 100K/20K/5K/1K/500/200/50/10/1 lx were recorded respectively, and the instruments were calibrated under these standard illuminations in turn.

The instrument is equipped with five calibration channels, which are the default channel (CH0) 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. Each calibration channel can store up to four gradients of standard illumination data, which are H/M/L/LL, and customs can also calibrate only one of the gradients (such as M).

Taking the M gradient as an example, the illumination calibration process is illustrated:

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

Then click the "Illuminance Calibration" button in the calibration interface, enter the password (the default is "123456"). In the calibration interface, input Ev and CCT

of the standard lamp(Target box),and select M in the gradient Grade 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 placed on the trolley platform, so that the center of the sampling hole of the instrument to be calibrated, the center of the diaphragm and the luminous center of the standard lamp are on the same horizontal line, and the trolley platform is moved to make it stop at the position point of the input radiation illumination data, and the trolley platform is fixed.

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 M gradient calibration of the channel 1 is completed.

When measuring the sample, selecting the corresponding "CAL Channel CH1", and the above illumination calibration will take effect.
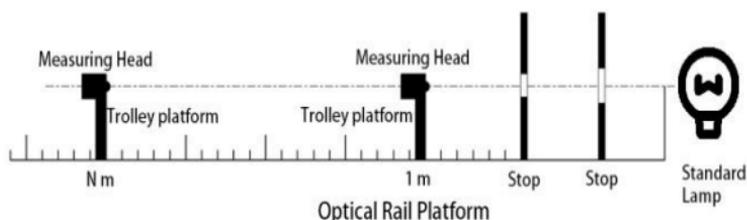
Fig.13 Illumination calibration diagram

3.3.3 Calibration Correct

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

As shown in Fig.15, input the standard illumination data Ev and CCT in the target box.   .

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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.
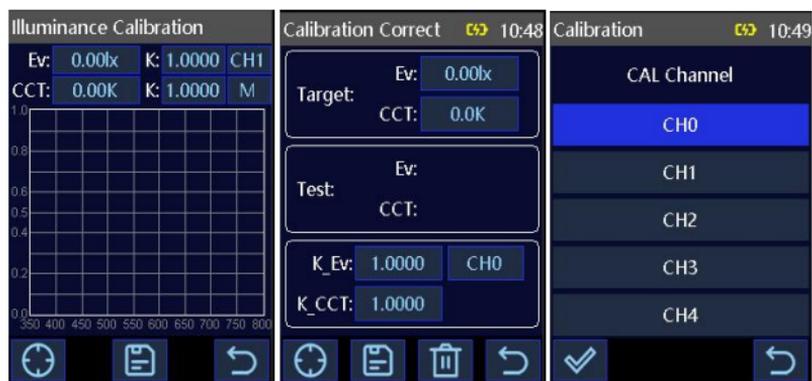
3.3.4 Calibration Channel

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.

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 LED module illumination, CCT, 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.
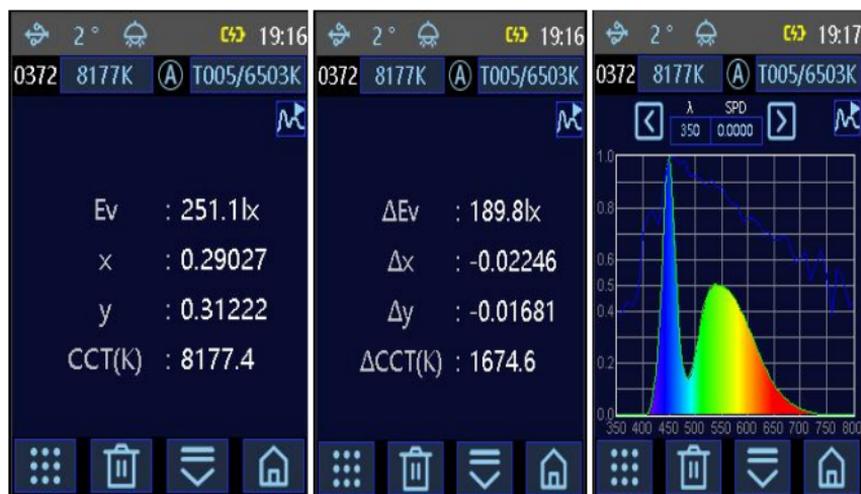

Fig. 17 Contrast Mode Test Interface

As shown in Fig. 4, click ⊞ (color parameter) to

select "Ev xy CCT" and click ✓OK.

Pressing 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 as shown in Fig.17.

3.5 Illuminance Unit

The default illuminance unit : lx (lux), and customs can choose candlelight (FC). Please refer to "main menu-> system" for details

The default irradiance unit : milliwatt / square meter / nanometer (mW / m² /nm).

The default SUM irradiance unit: milliwatts / cm² (mW / cm²), integral irradiance (also including weighted integral irradiance) refers to the sum of irradiance within a certain wavelength range, such as radiation illuminance Ee ,visible light irradiance Evis, ultraviolet UVA, photosynthetically active radiation PAR and chlorophyll A weighted irradiance E-ch A/ E-ch B, etc.

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

The default unit of photosynthetic photon flux density PPFD/ effective photon flux density YPFD of plant growth lamp/： micromole/square meter/second (μmol/ m² /s).

The default unit of photosynthetic photon flux density conversion ratio Kppfv of plant growth lamp :μmol/s/klm.

4 Basic Operation

4.1 Hanging Rope Installation

As shown in Fig.18, 1 is the hanging shaft and 2 is the hanging rope. 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.
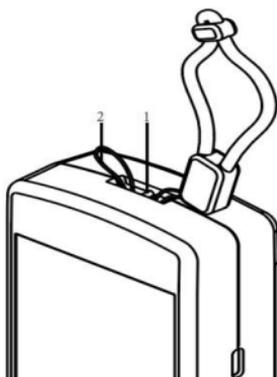
Fig. 18 Hanging rope operation

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
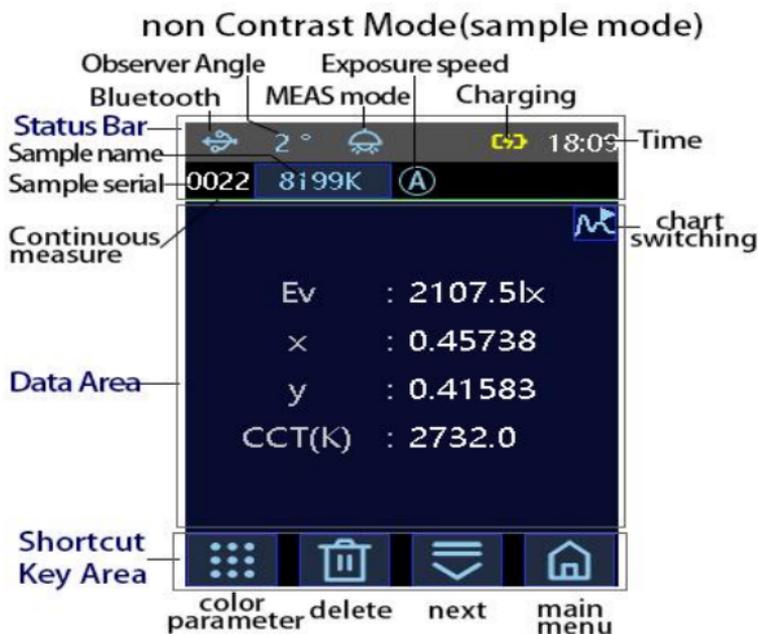
Fig. 20 Testing interface of non-contrast mode

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 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 previous 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.
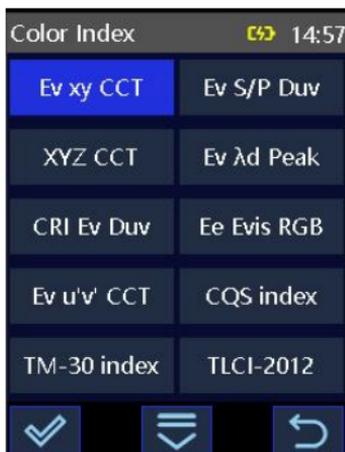
Fig. 21 Color parameter   Fig.22 The main menu

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 Illumination, CCT and CRI

As shown in Fig.24, the instrument is powered on to enter the test interface, click ⠿ (color index) to select "CRI Ev Duv", and click ✅ OK.

Fig. 24 Testing interface of CRI Ev Duv

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 switch the next page test data, and click ⚡ to enter the interface for viewing spectra and color rendering index.

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4.5 Testing of Main Wave, Pe and Peak Wave

Fig. 25 Main wavelength, excitation purity, peak wavelength

As shown in Fig.25, the instrument is powered on to enter the test interface, click ⚙ (color index) to select "Ev λ d Peak ", 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 switch the next page test data, and click 📈 to enter the interface for viewing spectra and color rendering index.

4.6 Testing of LEDs for Lamp

As shown in Figs 26,27, the instrument is powered on to enter the test interface, click ⚙ (color parameter) to select " LEDs for plant ", 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 switch the next page test data, and click 📈 to enter the interface for viewing spectra and color rendering index.

Fig.26 Plant growth lamp test interface 1
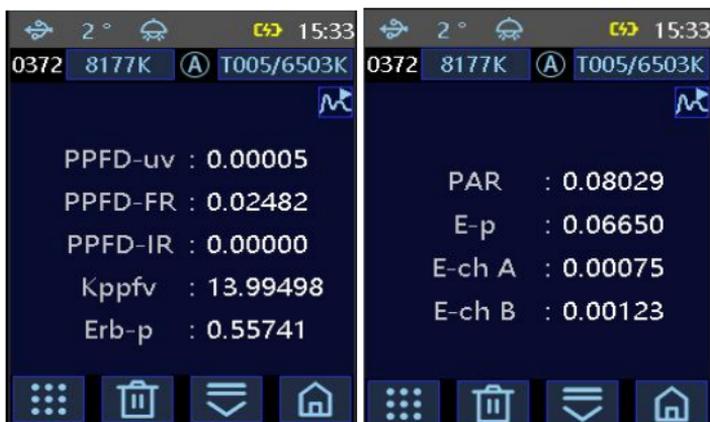
Fig.27Plant growth lamp test interface 2

4.7 Testing of Safety of Lamp

As shown in Fig.28, the instrument is powered on to enter the test interface, click ⬚⬚⬚ (color parameter) to select "Safety of Lamps", 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.

Fig28 Test interface of UV index and blue light hazard

4.8 The Uniformity Testing of LCD/Panel

As shown in Fig.29, 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. 29), 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.
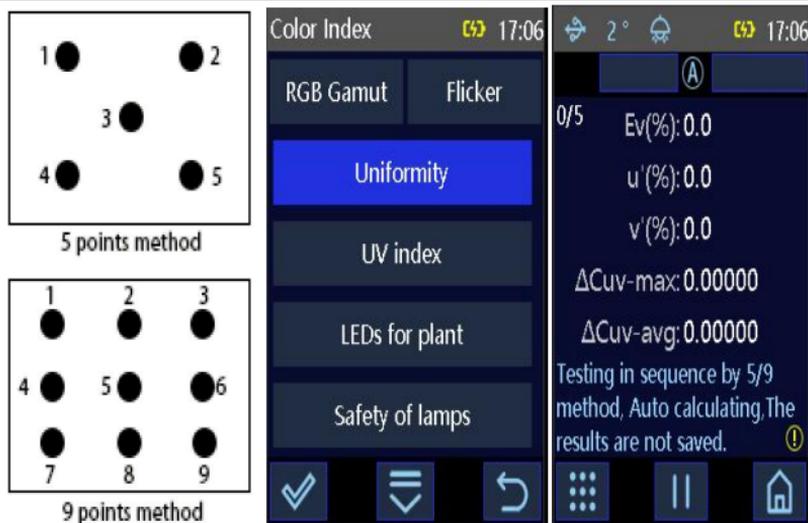
Fig.29 Testing of uniformity of display screen/luminous panel

4.9 Color Gamut Testing of Display Screen

As shown in Fig.30, the instrument is powered on to enter the test interface, click ⠿ (color parameter) to select "RGB Gamut", and click ✔ OK.

Fig.30 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.

4.10 Testing of Flicker

As shown in Fig.31, the instrument is powered on to enter the test interface, click 🔡 (color parameter) to select "Flicker", and click ✔ OK.
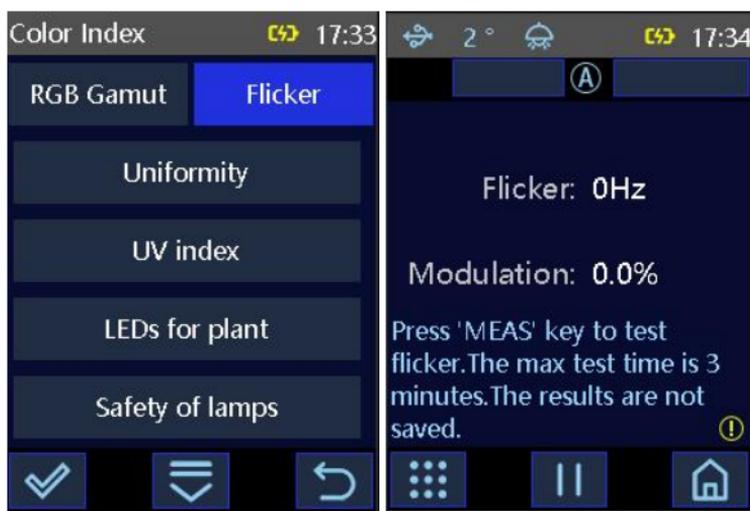
Fig31. Testing of flicker

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.

4.11 Testing of CQS Index

As shown in Fig.32, the instrument is powered on to enter the test interface, click 📇 (color parameter) to select "CQS index", and click ✅ OK

Fig.32 CQS index measurement

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.

4.12 Testing of TM-30 Index

As shown in Fig.33, the instrument is powered on to enter the test interface, click [⠿] (color parameter) to select "TM-30 index", and click ✓ OK.
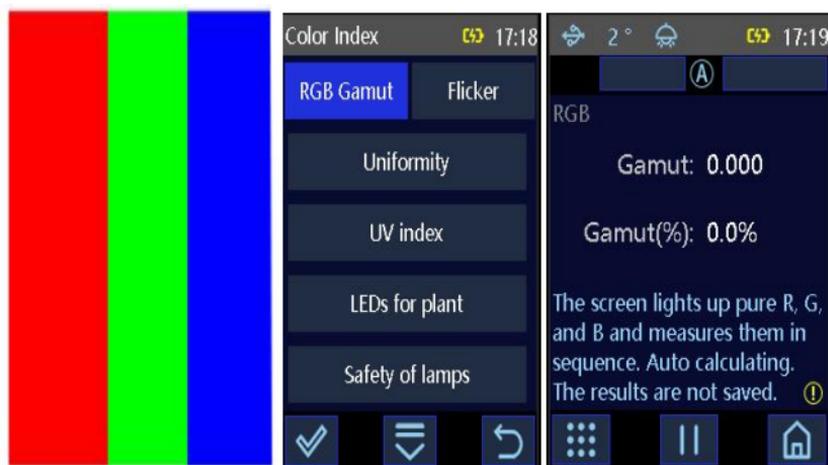

Fig.33 TM-30 index measurement

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.

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.34.

Records		Check Records		Check Records
Check Records		0001 8619K ⦂		Delete Record
Delete All Records		0002 8357K ⦂		Print Record
Ref CCT Records		0003 8501K ⦂		To Current STD
Search		0004 8451K ⦂		Rename
		0005 8415K ⦂		
		0006 8199K ⦂		

Fig.34 Records management   Fig.35 Records and edit

5.1.1 Check Record

Click the "Check Records" submenu to enter the check records interface (Fig.35); 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.36); view the D65 / A / C spectrum, and click ✅ to set the record as a comparison sample.
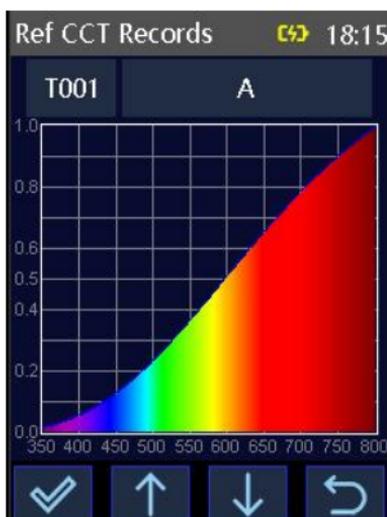
Fig.36 Reference record.   Fig.37 Search Records

5.1.3 Delete All Records

As shown in Fig.34, 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 .35 and 36); 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 .35 and 36); 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.35and 36) ; 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 37, enter the keyword of the sample name to be searched, 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. 38 Interface of color index

In "Main Menu-> Color Index", open the color index interface, as shown in Fig.38,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 upper interface

5.2.1 Ev xy CCT

This color index can be used to test the illumination Ev, CIE1931 chromaticity coordinates xy and color temperature CCT, as shown in Fig. 39.

Fig.39 Ev xy CCTFig.   40 Ev S/P Duv   Fig. 41 XYZ CCT

5.2.2 Ev S/P Duv

This color index can be used to test illumination Ev, color temperature CCT, light-dark visual ratio S / P, black deviation Duv and color tolerance SDCM, as shown in Fig.40.

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 = illumination Ev, as shown in Fig. 41.

5.2.4 Ev λ d Peak

The color index can be used to test the illumination Ev, 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 Ev Duv

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

5.2.6 Ee Evis RGB

Fig. 42 Ee Evis RGB test interface

This color index can be used to test the illumination Ev, the irradiance Ee, the visible light irradiance Evis, the ultraviolet irradiance Euv ; far red irradiance Efr, infrared

irradiance Eir, blue irradiance Eb, green irradiance Eg, red irradiance Er ; The ratios of blue light, green light and red light irradiance to visible light irradiance Eb(%), Eg(%) and Er(%) ,as shown in Fig 42.

The irradiance Evis is the irradiance integral sum in the wavelength range of 380 ~ 780 nm. Blue light irradiance Eb is the irradiance integral sum in the wavelength range of 380 ~ 500 nm. Green light irradiance Eg is the irradiance integral sum in the wavelength range of 500 ~ 600 nm. Red light irradiance Er is the irradiance integral sum in the wavelength range of 600 ~ 780 nm. Far-red irradiance Efr is the irradiance sum integral in the wavelength range of 700 ~ 780 nm. Infrared irradiance Eir 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 30, 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 brightness 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, illumination Ev, color temperature CCT, as shown in Fig 33.

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, illumination Ev and color temperature CCT, as shown in Fig 43.
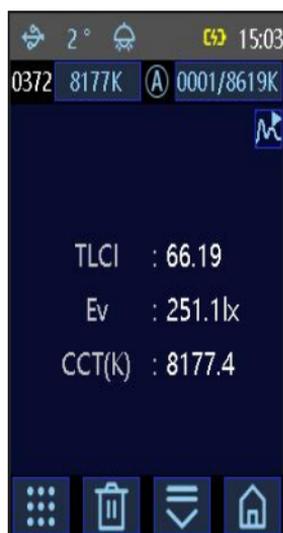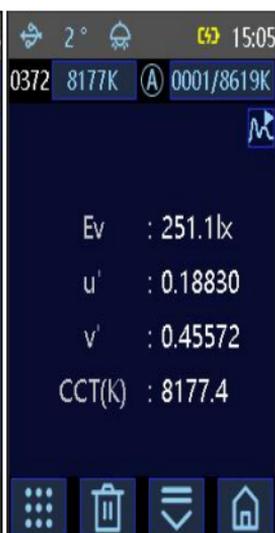
Fig. 43 TLCI-2012   Fig. 44 Ev u'v' CCT   Fig. 45 UV index
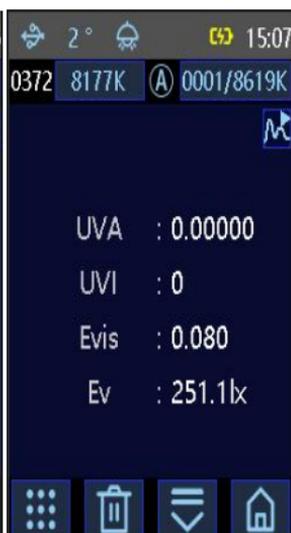
5.2.11 Ev u'v' CCT

This color index can be used to test the illumination Ev, CIE1976 chromaticity coordinates u 'v ', and color temperature CCT, as shown in Fig 44.

5.2.12 UV Index

This color index can be used to test ultraviolet radiation illumination UVA, ultraviolet index UVI, visible light irradiance Evis and illumination Ev, as shown in Fig 45.

Note: the wavelength range of UVA is $315 \sim 400$ nm, and the wavelength range of UVI is $280 \sim 400$nm. When the instrument supports a narrow wavelength range (for example $360 \sim 780$ nm), the measured values of UVA and UVI will be lower than the real ones.

5.2.13 Uniformity

This color index can be used to test the illumination uniformity Ev (%) 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 chapter 5.5.7.

As shown in Figs.29 and 46, 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.)
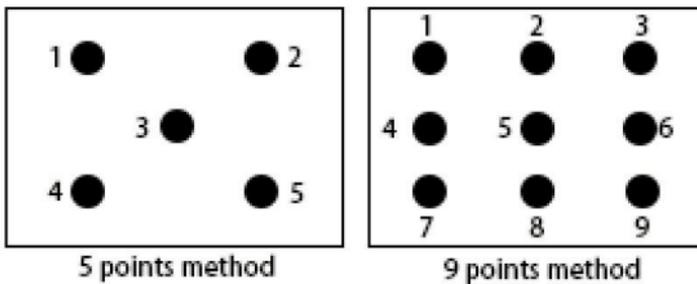
Fig. 46 uniformity measurement method

5.2.14 LEDs for Plant

LED lighting index for plant growth are mainly used in the field of plant lighting of intelligent agricultural LED light source.

This color index can test photosynthetically active radiation PAR, photosynthetic irradiance E-p, chlorophyll A weighted irradiance E-ch A, chlorophyll B weighted irradiance E-ch B ;photosynthetic photon flux density PPFD, effective photon flux density YPFD, UV / red / green / blue /

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far red / infrared photosynthetic photon flux density PPFD-uv / PPFD-R / PPFD-G / PPFD-B / PPFD-FR / PPFD-IR ; photosynthetic photon flux density conversion ratio Kppfv, photosynthetic red - blue irradiance ratio Erb-p, as shown in Figs 26 and 27.

In the plant growth lamp, the photosynthetic photon flux density of red light PPFD-R is the integral sum of photosynthetic photon flux density in the wavelength range of 600 ~ 700 nm; the photosynthetic photon flux density of green light PPFD-G is the integral sum of photosynthetic photon flux density in the wavelength range of 500 ~ 600 nm; the photosynthetic photon flux density of blue light PPFD-B is the integral sum of photosynthetic photon flux density in the wavelength range of 400 ~ 500 nm.; the photosynthetic photon flux density of far-red light PPFD-FR is the integral sum of photosynthetic photon flux density in the wavelength range of 700 ~ 780 nm; the photosynthetic photon flux density of infrared light PPFD-IR is the integral sum of photosynthetic photon flux density in the wavelength range greater than 700 nm.

5.2.15 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.

5.2.16 Safety of Lamps

The safety of the lamp system can test the illumination Ev, ultraviolet radiation illumination UVA, ultraviolet index UVI, ultraviolet hazard weighted irradiance Es-uv, retinal blue light hazard weighted irradiance Es-B, blue light hazard level RG (BLH), allowable exposure time (S), as shown in Fig 28.

Note: the wavelength range of UVA is $315 \sim 400$ nm, and the wavelength range of UVI is 280~400nm. When the instrument supports a narrow wavelength range (for example $360 \sim 780$ nm), the measured values of UVA and UVI will be lower than the real ones.

5.2.17 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 47, 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 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 $2 \sim 10$.

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.

Meas.	▣ 18:12
Measure Mode	🔄
Exposure Speed	Ⓐ
Average Times	1
Continue Times	1
Continue Interval	5s
Modbus Slave Address	1

Display	▣ 19:03
Wave Length Range	350~800
Contrast Mode	✓
xy Diagram	✓
u'v' Diagram	✓
CRI Histogram	✓
CRI Radar Chart	✓

Fig. 47 Meas. Settings   Fig.48 Display settings.

5.3.5 Modbus Slave Address

If the instrument is configured on the auto pipeline and needs Modbus communication, the corresponding Modbus address can be set.

5.4 Display settings

"Main Menu->Display" enters the display interface, as shown in Fig. 49, 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 320 ~ 800 nm, 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

Click "Main Menu->System" to enter the system interface, as shown in Figs.49 and 50.
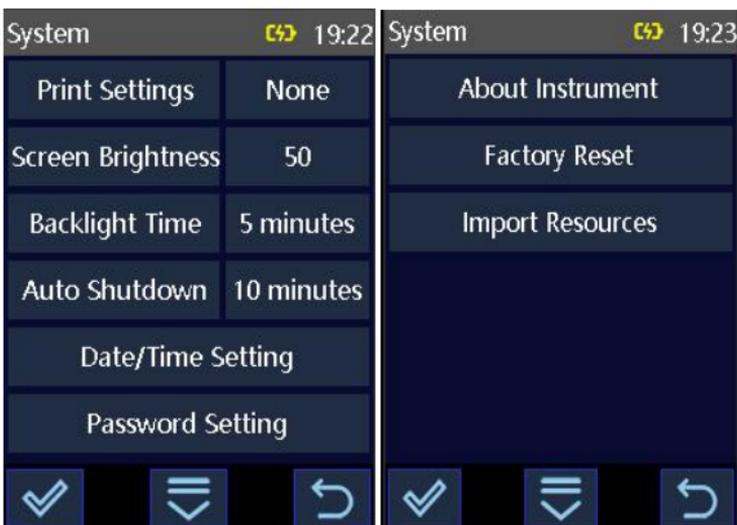

Fig. 49 System Settings 1

Fig. 50 System Settings 2

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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 illuminance unit: lx (lux), and customs can choose candlelight (FC).

The default irradiance unit o : milliwatt / square meter / nanometer (mW / m² /nm).

The default integral irradiance unit : milliwatts / cm² (mW / cm²), integral irradiance (also including weighted integral irradiance) refers to the sum of irradiance within a certain wavelength range, such as radiation illumination Ee ,visible light irradiance Evis, ultraviolet UVA, photosynthetically active radiation PAR and chlorophyll A weighted irradiance E-ch A/ E-ch B, etc.

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

The default unit of photosynthetic photon density PPFD/ effective photon flux density YPFD of plant growth lamp/： micromole/square meter/second (umol/ m² /s).

The default unit of photosynthetic photon flux density conversion ratio Kppfv of plant growth lamp: umol/s/klm.

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.

$$(1-\frac{Emax-Emin}{Eavg})\times100\% \qquad \text{-----------5-1}$$

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

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

Illumination calibration and calibration correction are related to the accuracy of the test data and need to be carefully operated. Illumination 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 ver., software ver., and probe SN code 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 3.3.2.

5.6.3 Illuminance Calibration

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

5.6.4 CAL Channel

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

6. Technical Parameters

Product	800 series SPECTRAL IRRADIANCE COLORIMETER		
Model	SPECTRAL SERIES-Plus	SPECTRAL SERIES-Pro	SPECTRAL SERIES-Basic
Standard	GB/T 7922 ,GB/T 5700,GB/T 5702,JJG 245,GB/T 24824,GB／T 36979,ANSI C78 377, GB 50034,CIE S 009,GB／T 20145,GB/T 9473,CIE S 025,GBT 32655,GB/T 15609		
Wavelength	350～800nm	360～780nm	380～780nm
Wavelength Interval	1nm		
Spectrophoto-metric Mode	Concave Grating		
Range	Lv:0.1～200000lx, CCT:1000～100000K		
Accuracy (Light source A)	Ev:±4％±1 display value xy:±0.0015(10～200000lx) / xy:±0.002 (5～10lx)		
Repeatability (Light source A)	Ev:0.5％±1 display value xy:0.0005(500～200000lx) / xy:0.001(100～500lx) xy:0.002(20～100lx) / xy:0.004(5～20lx)		
Cosine Response	Ev:<=3％		
Measurement Mode	Auto mode,Flash mode,Continuous/Average mode,Flicker**(no function in Basic and Pro)**		
Measuring Time	Auto mode:0.2～10 s		
Observer Angle	2°(CIE1931)		
Color Space	Spectrum,CIE XYZ, Ev xy, Ev u'v'		
Colorimetric Index	1.Ev,CCT(K),CRI;CIE31x,y;CIE76u',v';CIE31X,Y,Z;Duv,SDCM,S/P,White Balance; Peak(nm),Center(nm),Centroid(nm);λd,PE,PC;I(cd);Transmittance; Ee,Evis,Euv,Eb,Eg,Er,Efr,Eir,Erb,R(%),G(%),B(%); 2.PAR,PPFD,YPFD,Kppfv,PPFD-uv,PPFD-R,PPFD-G,PPFD-B,PPFD-FR, PPFD-IR,E-ch A and E-ch B,E-p,Erb-p; 3.Flicker(Hz),Modulation(%);**(no function in Basic and Pro)** 4.Display screen Gamut,Gamut Area(%),ΔCuv;5 Points/9 Points Uniformity; 5.CQS CRI,Color Fidelity Qf,Gamut Index Qg and Qp; TM-30 Color Fidelity Rf and Gamut Index Rg;TLCI-2012**(no function in Basic and Pro)**; 6.UVA,UVI,Es-uv,Es-B,RG(BLH),PermitTime(S);**(no function in Basic and Pro)** 7.CIE31 xy diagram,CIE76 u'v' diagram,CRI/CQS histogram,CRI/CQS radar chart, MacAdam ellipse diagram,White Balance diagram		
Data Storage	10000 Pcs(Including reference)	8000 Pcs(Including reference)	6000 Pcs(Including reference)
Dimension	L*W*H=154X62X37mm		
Weight	about 200g		
Battery	Li-ion battery,3.7V,4000mAh(8000 measurements within 24 hours)		
Display	2.8-inch TFT color LCD, Capacitive Touch Screen		
Data Port	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,Electronic manual,PC Software(Download from website), Protective Cover, Wrist strap,Wiping cloth		

Fig. 51 800 series specifications

Product	500 series IRRADIANCE COLORIMETER		
Model	FILTERS series-Plus	FILTERS series-Pro	FILTERS series-Basci
Standard	GB/T7922,GB/T5700,GB/T5702,JJG 245,GB/T24824,GB/T36979,ANSI C78 377,GB50034,GB/T15609		
Wavelength	400～700nm, 910nm(HalfWidth	400～700nm	400～700nm
Wavelength	1nm	1nm	/
Spectrophoto-metric Mode	Multichannel Filter+CMOS	Multichannel Filter+CMOS	CIEXYZ Filter+CMOS
Ev Range	1～200000lx		
Accuracy (Light source A)	Ev:±5％±1 display value xy:±0.002(10～200000lx) / xy:±0.0025 (5～10lx)		
Repeatability (Light source A)	Ev:0.5％±1 display value xy:0.001(500～200000lx)/xy:0.002(100～500lx) xy:0.003(20～100lx)/ xy:0.005(5～20lx)		
Cosine Response	Ev:<=5％		
Measurement Mode	Auto mode,Flash mode,Continuous mode, Average mode,Flicker**(no function in Basic and Pro)**		
Measuring Time	Auto mode:0.1~10 s		
Observer Angle	2°(CIE1931)		
Color Space	CIE XYZ, Ev xy, Ev u'v',Spectrum**(no function in Basic and Pro)**		
Colorimetric Index	1.Ev,CCT(K);CIE31x,y;CIE76u',v';CIE31X,Y,Z;Duv,SDCM,White Balance;λ d,Pe,Pc;I(cd);Transmittance; Peak(nm),Center(nm),Centroid(nm),CRI,S/P,Ee,Eb,Eg,Er,Erb,R(%),G(%),B(%)**(no function in Basic);** 2.Display screen Gamut,Gamut Area(%),ΔCuv;5 Points/9 Points Uniformity; 3.CRI/Ra;**(no function in Basic)** 4.CIE31 xy diagram,CIE76 u'v' diagram,MacAdam ellipse diagram; CRI/CQS histogram,CRI/CQS radar chart,White Balance diagram**(no function in Basic)**		
Data Storage	Sample 2000 Pcs(Including reference CCT records（D65/A/C/5000K）)		
Dimension	L*W*H=154X62X39mm		
Weight	about 192g		
Battery	Li-ion battery,3.7V,4000mAh(8000 measurements within 24 hours)		
Display	2.8-inch TFT color LCD, Capacitive Touch Screen		
Data Port	Type C USB，Bluetooth 5.0(Customizable WIFI)		
Language	English, Chinese		
Operating Environment	-10~40℃(0~85%RH/no condensing)		
Storage	-20~50℃(0~85%RH/no condensing)		
Standard Accessory	Power adapter,USB cable,Electronic manual,PC Software(Download from website), Protective Cover, Wrist strap,Wiping cloth		

Fig. 52 500 series specifications

Appendix

Terminology description

Num	Abb.	Description	Num	Abb.	Description
1	Ev	Illuminance	35	G(%)	ratio of green and visible irradiance
2	x	chromaticity(CIE1931) x	36	B(%)	ratio of blue and visible irradiance
3	y	chromaticity(CIE1931) y	37	PAR	photosynthetically active radiation
4	CCT(K)	correlated color temperature	38	PPFD	photosynthetical photon flux density
5	u'	chromaticity(1976UCS) u'	39	YPFD	yield photon flux density
6	v'	chromaticity(1976UCS) v'	40	Kppfv	photometric conversion coefficient
7	u	chromaticity(1960UCS) u	41	PPFD-uv	uv photosynthetical photon flux density(100~400nm)
8	v	chromaticity(1960UCS) v	42	PPFD-R	red photosynthetical photon flux density(600~700nm)
9	X	psychophysical color specification X	43	PPFD-G	green photosynthetical photon flux density(500~600nm)
10	Y	psychophysical color specification Y	44	PPFD-B	bulue photosynthetical photon flux density(400~500nm)
11	Z	psychophysical color specification Z	45	PPFD-FR	far red photosynthetical photon flux density(700~780nm)
12	Duv	the closest distance from the Planckian locus on 1960UCS	46	PPFD-IR	infrared photosynthetical photon flux density(780~2500nm)
13	SDCM	Chromaticity Tolerances	47	E-ch A	the weighted irradiance of chlorophyll A
14	S/P	ratio of Scotopic and photopic	48	E-ch B	the weighted irradiance of chlorophyll B
15	Peak (nm)	peak wavelength	49	E-p	photosynthetic irradiance
16	Center (nm)	Center wavelength	50	Erb-p	ratio of red and blue irradiance in plant
17	Centroid(nm)	Centroid wavelength	51	Flicker (Hz)	Flicker frequency
18	λd(nm)	dominant wavelength/complementary wavelength	52	Modulation(%)	modulation depth
19	PE(%)	excitation purity	53	Gamut	color gamut
20	PC(%)	colorimetric purity	54	Gamut(%)	Gamut Area(%)
21	Half Width	half width(of spectral line)	55	ΔCuv	
22	Ra	CRI-Ra(color rendering index)	56	Uniformity	Uniformity
23	R1~R15	CRI-Ri(color rendering index)	57	Qa-CQS	
24	Ee	irradiance	58	Qf-CQS	Color Fidelity
25	Evis	visible irradiance(380~780nm)	59	Qg-CQS	Gamut Index
26	Euv	uv irradiance(100~400nm)	60	Qp-CQS	color Preference Scale
27	Eb	blue irradiance(380~500nm)	61	Rf-TM-30	Color Fidelity
28	Eg	green irradiance(500~600nm)	62	Rg-TM-30	Gamut Index
29	Er	red irradiance(600~780nm)	63	TLCI-2012	Television Lighting Consistency Index
30	Efr	far red irradiance(700~780nm)	64	UVI	index of UV
31	Eir	infrared irradiance(780~2500nm)	65	Es-uv	Weighted irradiance of photochemical ultraviolet hazards
32	UVA	uva irradiance	66	Es-B	Weighted irradiance of blue light hazard
33	Erb	ratio of red and blue irradiance	67	RG(BLH)	blue light hazard (BLH)risk group
34	R(%)	ratio of red and visible irradiance	68	PermitTime(S)	The permissible time for exposure to ultraviolet or blue radiation

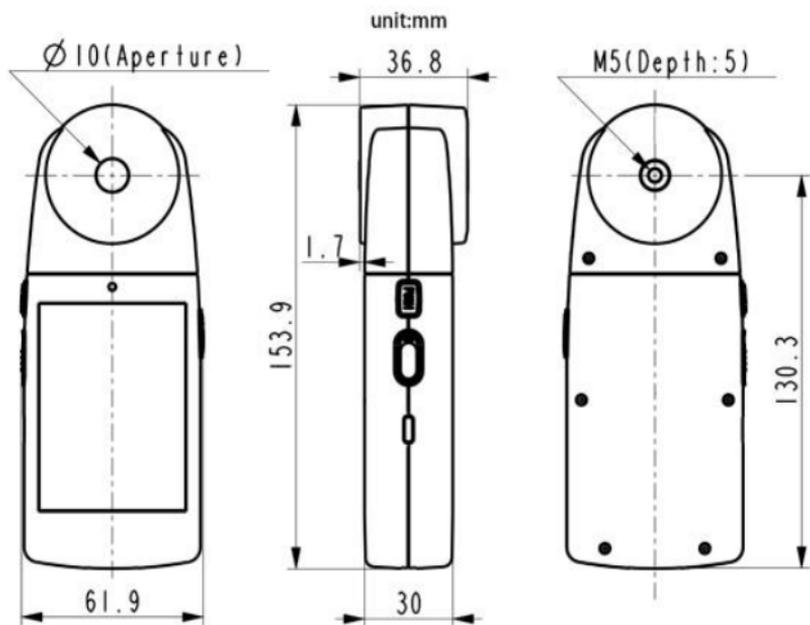Fig. 53 Terminology Description

Outline Dimension

unit:mm

Ø10(Aperture)
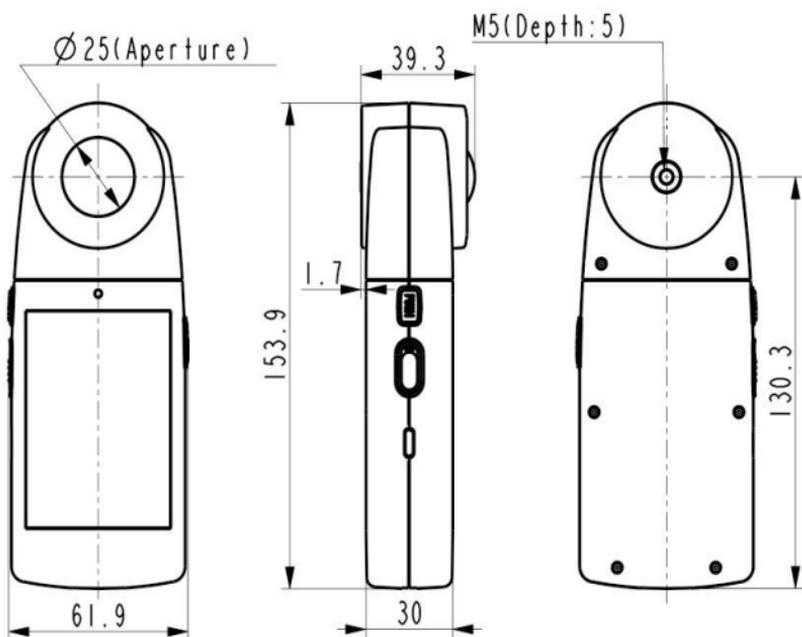
36.8

M5(Depth:5)

1.7

153.9

130.3

61.9

30

Fig. 54 Dimensions of 800

Ø25(Aperture)

39.3

M5(Depth:5)

1.7

153.9

130.3

61.9

30

Fi

g. 55 Dimensions of 500

Please keep the manual properly for reference.