

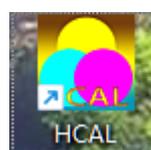
# HUICOLOR

HUICOLOR Irradiance, Luminance colorimeter  
calibration system

User Manual



**Please read carefully,  
before using the instrument.**



## Contents

I. Overview .....	1
1.1 HUICOROR Irradiance/ Luminance colorimeter Calibration Instructions.....	1
II. Calibration of irradiance/ luminance colorimeter(A level) .....	2
2.1 Suitable colorimeters models and scope .....	2
2.2 Calibration methods and steps .....	2
III. Calibration correction of spectral irradiance/luminance colorimeter(B level).....	4
3.1 Suitable colorimeters models and scope .....	4
3.2 Calibration correction methods and steps.....	4
IV. User correction of output data (C level) .....	5
4.1 Suitable colorimeters models and scope .....	5
4.2 User correction methods and steps .....	5

# I. Overview

Irradiance or luminance colorimeter based on multi-channel coated filter or CIEXYZ filter and detector measurement principle usually has CIEXYZ adaptation error, and its testing accuracy may be lower compared to colorimeters based on grating splitting principle. For specific types of light source products (such as LCD panels), in order to improve the testing accuracy of filter type colorimeters, it is usually necessary to perform secondary calibration to achieve the desired testing accuracy.

The LCD panel/OLED panel/miniLED panel industry, standard light source box and other industries have high requirements for the accuracy of irradiance/ luminance, chromaticity coordinates, and color temperature, and need to be consistent with specific brand instrument data. In this case, secondary calibration needs to be performed on the colorimeter to meet the accuracy requirements.

When HUICOROR's irradiance/ luminance colorimeter leaves the factory, the manufacturer has already done calibration and correction work, and stored it in a specific calibration channel (default channel CH0). Users can select the default channel CH0 to accurately measure various light source parameters.

When calibrating colorimeters of HUICLOR, various light sources are considered comprehensively, including LED light sources, daylight sources, fluorescent light sources, laser light sources, LCD screens, etc. The overall testing performance of the colorimeter is relatively good, but the effect may be slightly worse for specific light sources.

HUICOROR produces various types of irradiance/ luminance colorimeters, among which CL350, CL300, CI503, and CI300 are filter based colorimeters. For specific industries (such as LCD panels), the CIEXYZ filter measurement principle for colorimeters can achieve relatively high measurement accuracy through secondary calibration using HCAL software. Typically, the irradiance/ luminance accuracy can reach 3%, and the average color coordinate xy error is 0.003, which can meet the needs of various industries.

The calibration of HUICOLOR's irradiance/ luminance colorimeter can be divided into three levels, as shown in Figure 1. The first level is calibration correction closely related to the detector (Assuming it is A level), the second level is intermediate level calibration correction (Assuming it is B level), and the third level is user correction closely related to the output data (Assuming it is C level). These three levels of calibration have their own application.

The following content provides explanations for the calibration of three levels: A level, B level, and C level.

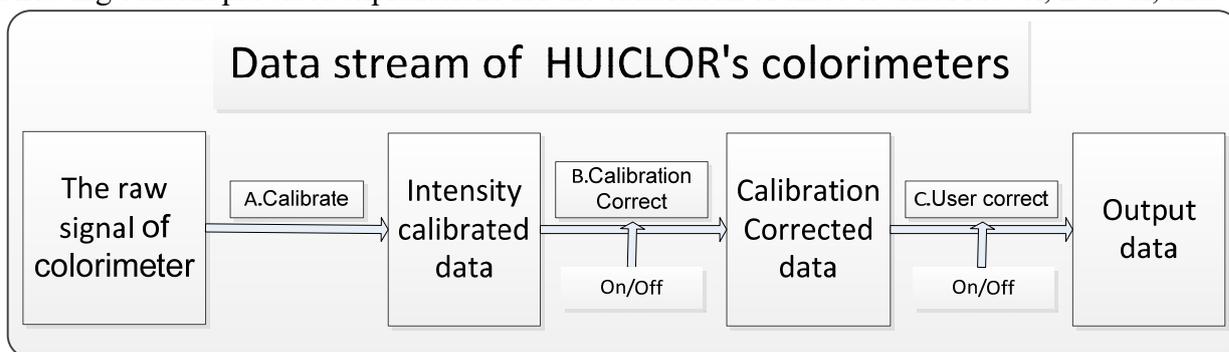


Figure 1

## 1.1 HUICOROR Irradiance/ Luminance colorimeter Calibration Instructions

HUICOROR irradiance/ luminance colorimeters are divided into spectral colorimeters and filter colorimeters according to their measurement principles.

Spectral colorimeters include CL800/CL700 spectrophotometer, CI800/CI700 spectrophotometer, CI820 spectrophotometer, CI810 spectrophotometer, CL500 colorimeter, and CL350 colorimeter.

Filter type colorimeters include CL300 colorimeter, CI300 color analyzer, CL350 colorimeter, CI350 color colorimeter, CI503 color analyzer, and CL503 colorimeter.

Spectral colorimeters typically undergo A and B level calibration, while filter colorimeters typically undergo A and C level calibration.

## II. Calibration of irradiance/ luminance colorimeter(A level)

### 2.1 Suitable colorimeters models and scope

Suitable for all models of HUICOROR’s colorimeters.

**Note 1:** The standard calibration light source must be a full spectrum stable light source, such as halogen lamps, xenon lamps, or combined full spectrum LED light sources, with stability better than 0.3%. Requirements for spectral power distribution of input calibration light source: wavelength range of 350-800, interval of 5nm, SPD unit is mW/m<sup>2</sup>/nm.

**Note 2:** For CIEXYZ filter colorimeter (CI300,CL300,etc.), input CIE X, CIE Y, CIE Z, 700-800nm infrared irradiance sum, and 87 other irrelevant data. (The unit is mW/m<sup>2</sup>/nm, totaling 91 data points, CIEY=Ev or Lv).

### 2.2 Calibration methods and steps

- ① Install HIQC software on the PC.
- ② Turn on the colorimeter and connect it to the PC computer via a USB data cable.
- ③ Open the HIQC software and connect the colorimeter (refer to the HIQC manual).
- ④ As shown in Figures 2-4, select the calibration channel and write the H-level spectral power distribution of the standard lamp or the XYZ+IR data of the CIEXYZ filter colorimeter. (Select the calibration channel according to the user's situation, usually only writing the spectral power distribution of H level)

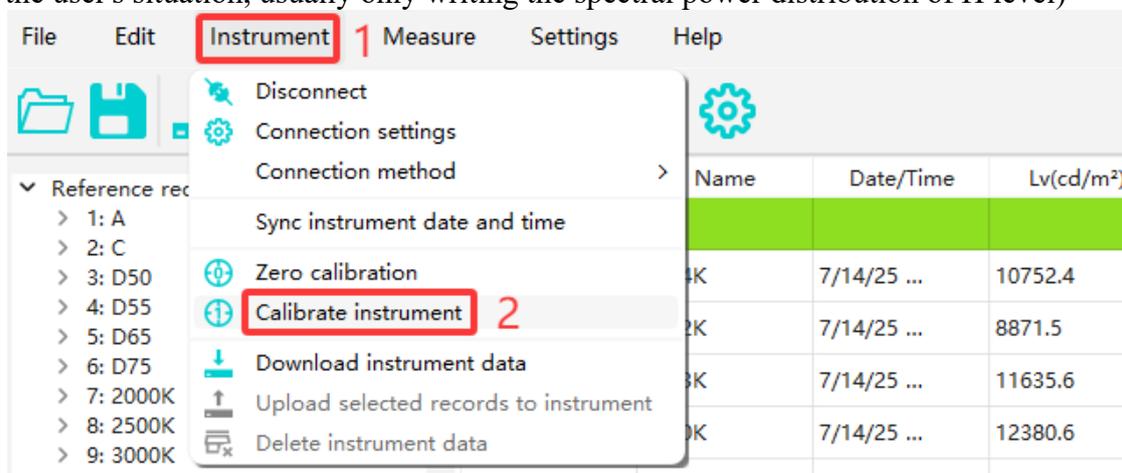


Figure 2

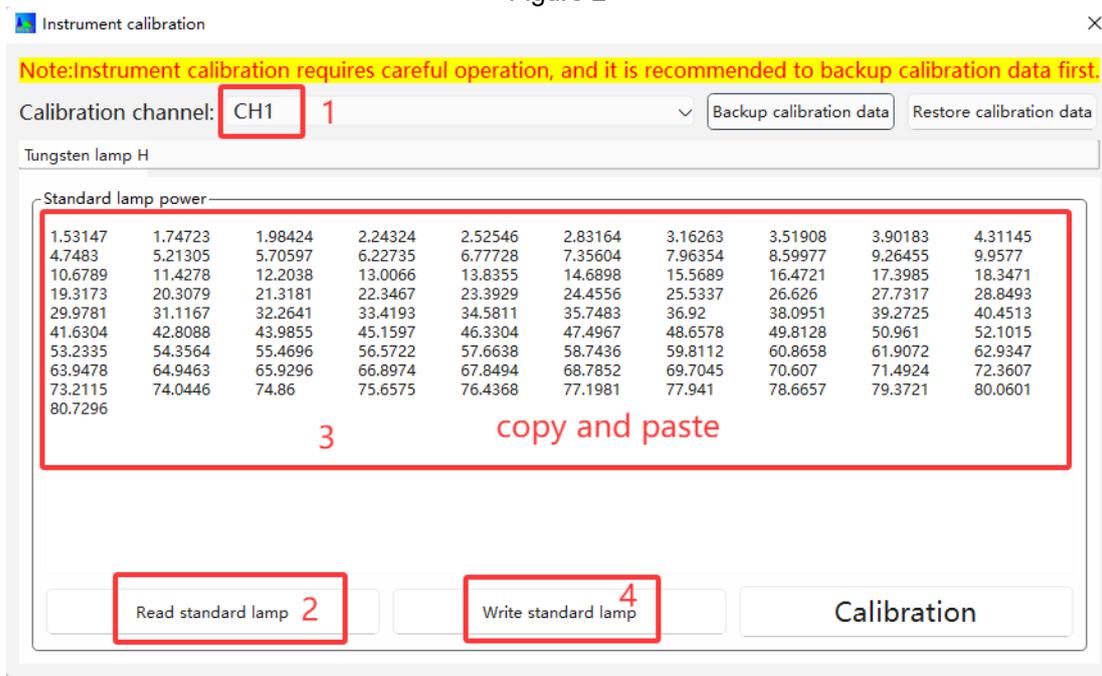


Figure 3

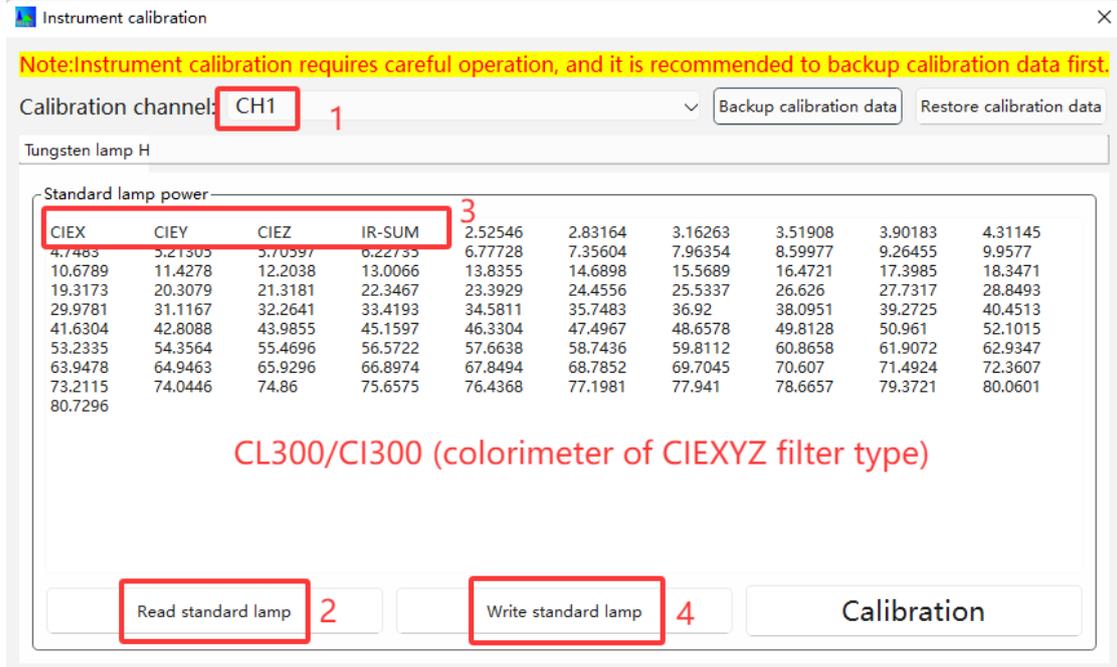


Figure 4

⑤ Unplug the USB data cable of the colorimeter and perform calibration in the darkroom.

⑥ Refer to the calibration section of the manual and perform calibration on the colorimeter. The recommended practice is to perform a zero position calibration on the colorimeter before calibration.

⑦ “Calibration ->Illumination/Brightness Calibration ”enters the calibration interface.

⑧ Click the " Irradiance or Luminance Calibration" button on the colorimeter, enter the password (default is "123456"), and enter the Irradiance or Luminance Calibration interface. Select the standard lamp spectral power distribution level that has been written in step 4, such as H.

⑨ Turn on the standard light, preheat it, and make the standard light emit light steadily. As shown in Figure 5, click the calibration button or MEAS button to start calibrate. When the data is stable, select the user channel CH1, click the save button to save the calibration data, and complete the H-gradient calibration of channel CH1.

⑩ When measuring the sample, select the corresponding channel "CH1", and the above Irradiance or Luminance calibration will take effect.

Note 1: The spectral power distribution intensity levels H/M/L/LL of standard lamps correspond to the high/medium/low/ultra-low light intensity of the same standard lamp, and the intensity level of the light source during calibration should correspond one-to-one with the actual lighting standard light source. Under normal circumstances, it is only used for calibration correction of the H level.

Note 2: When measuring, users should choose the same calibration channel as the above calibration, and the above Irradiance or Luminance calibration will take effect.



Figure 5

### III. Calibration correction of spectral irradiance/luminance colorimeter(B level)

The calibration correction function can adjust the light intensity and color temperature of the current calibration channel. This calibration correction belongs to spectral correction.

For example, given that the irradiance of a standard light source is  $E_{v\_std}$  and the color temperature is  $CCT\_std$ , the irradiance measured by an colorimeter is  $E_{v\_tst}$  and the color temperature is  $CCT\_tst$ .

The correction scaling factors,  $K_{Ev}=E_{v\_std}/E_{v\_tst}$  and  $K_{CCT}=CCT\_std/CCT\_tst$ , are obtained. These factors are then input into the colorimeter, which adjusts the spectrum through optimization algorithms to achieve calibration correction.

#### 3.1 Suitable colorimeters models and scope

Suitable for all spectral models of HUICOROR’s colorimeters, such as CL800/ CL700/ CI800/ CI820/ CI810/ CL350/ CI350, etc.

#### 3.2 Calibration correction methods and steps

- ① The recommended practice is to perform a zero calibration before calibration correct.
- ② Refer to the calibration correct section of the manual and perform calibration correct on the colorimeter.
- ③ “Calibration ->Calibration correct” enters the calibration correct interface, as shown in Figure 6.
- ④ Select the calibration channel CHn, first input the parameters of the standard lamp (Target): Irradiance data  $E_v$  or Luminance data  $L_v$ , and then input the color temperature CCT of the standard lamp.
- ⑤ Turn on the standard light, preheat it, and make the standard light emit light steadily.
- ⑥ Finally, click the calibration button or MEAS button, and the colorimeter will start calibrate. The scale factor  $K$  will be automatically generated. Once the data is stable, click the save button to save the calibration correction.

The calculation method of the proportionality coefficient  $K$  is shown in Figure 7, or it can be directly input as the proportionality coefficient  $K$ .

- ⑦ When measuring the sample, select the corresponding "user channel CHn", and the above calibration correct will take effect.

Note 1: “Calibration correct” can be solved through multiple iterations and executed multiple times until the data meets the requirements.

Note 2: “Calibration correct” is suitable for fine-tuning spectral data, and is suitable for application scenarios where the Irradiance or Luminance error does not exceed 20% and the color temperature deviation does not exceed 10%.

Note 3: The calibration correction factor and calibration channel correspond one-to-one, with a default value of 1, which can be deleted.

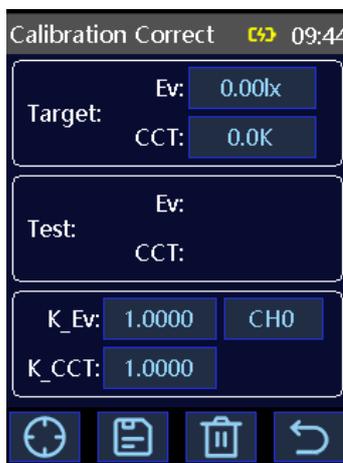


Figure 6

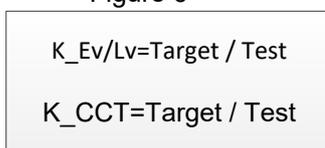


Figure 7

## IV. User correction of output data (C level)

The manufacturer has already calibrated the irradiance/ luminance colorimeter according to industry standards when it leaves the factory, which can meet the requirements of conventional irradiance/ luminance measurement (engineering lighting, LED lighting, etc.).

If users have high-end irradiance/ luminance colorimeters such as CA410, CS2000, CS3000, CL500A, BM-7, or HUICOROR's CL800/CI800, they can use these colorimeters as standard machines. Choose a low-cost CIEXYZ filter measurement principle irradiance/ luminance colorimeter as the calibration machine. The calibrated colorimeter can achieve high measurement accuracy and can be widely used on production lines, greatly saving costs.

For example, Samsung's X model monitor production line requires a full inspection of the monitor's luminance, color gamut, and color coordinates. The user selects one CS2000 as the standard luminance and 20 HUICOROR's CI503 color analyzers as the calibration machines. The user selected white color (255/255/255), red color (R255), green color (G255), and blue color (B255) as typical samples for the LCD. The CI503 colorimeter was calibrated using HCAL software. The calibrated CI503 color analyzer tested the full color range of the X model display, with an average luminance error of 2.2% and an average chromaticity coordinate xy error of 0.0024.

HCAL color calibration software is more suitable for measuring the luminance of LCD products. Please refer to the HCAL user manual for instructions on how to use it.

### 4.1 Suitable colorimeters models and scope

Suitable for HUICOROR's filter type irradiance/ luminance colorimeters, such as CL300/ CI300/ CL350/ CI350/ CI503/ CI510, etc

### 4.2 User correction methods and steps

- ① Install HCAL software on the PC.
- ② Turn on the colorimeter and connect it to the PC via a USB data cable.
- ③ Open the HCAL software, connect the colorimeter, and select the corresponding serial port, as shown in Figure 8 and Figure 10.
- ④ Select the calibration mode (usually multi-point calibration), choose the calibration channel or default.
- ⑤ Input the block data of the standard colorimeter or conduct direct testing.
- ⑥ Click on 'Measurement of Tst Colorimeter', the HCAL software will drive the LCD to show the color block image, and the Tst Colorimeter will measure the color.
- ⑦ When the sample data collection/input is completed, click "Write Calibration Data to Colorimeter", and HCAL software will automatically generate calibration factors and write them into the colorimeter.
- ⑧ Alternatively, users can generate their own calibration factors, copy them to the coefficient area, and click "Write Calibration factor".
- ⑨ After the colorimeter calibration is completed, turn on the "User Calibration" mode on the colorimeter, and the above user correction will take effect, as shown in Figure 9.



Figure 8



Figure 9

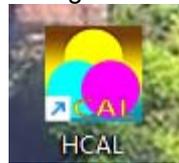


Figure 10

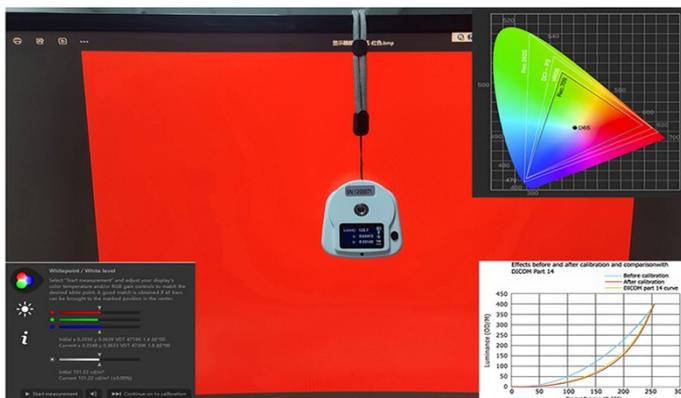
## SPECTRAL IRRADIANCE COLORIMETER



## SPECTRAL LUMINANCE COLORIMETER/ COLOR ANALYZER



## Screen Color Calibrator



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Please keep the manual properly for reference.