Operation Manual
CLRM-200
High-Quality Portable Colorimeter

PLEASE READ THIS MANUAL CAREFULLY BEFORE OPERATION

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MRC.VER.01-10.13
Operating Instruction of Universal Test Components

Application: used to test liquid reagent, paste (such as ketchup and coating), powder (such as coffee), etc.

I. Component Structure

The structure of universal test components is shown in Figure 1.

① Base; ② Baffle; ③ Square Integrator; (31) Measuring Port of the Square Integrator ④ Cuvette; ⑤ Cover Plate; ⑥ Push Plate; ⑦ Screw

Figure 1 The Structure of Universal Test Components

II. Usage

The usage of universal test components is shown in Figure 2.
i. Place CLRM310 colorimeter according to Figure 2. The measuring port of CLRM310 is butted up against that of square integrator, as shown in Figure 3. Then, use ⑥ push plate to hold CLRM310 colorimeter and tighten ⑦ the screw. Check whether CLRM310 colorimeter is loose or not. If it is loose, please re-tighten the screw.

ii. Put the ④ Cuvette into the ③ Square Integrator. There are two matte surfaces in the cuvette. Please only touch these two matte surfaces when hold the cuvette. In addition, there are two transparent surfaces which engraved with “MAX” and “MIN”. Please put one surface against the measuring port of the square integrator, as shown in Figure 3.

iii. Put ④ the Cuvette into ③ the Square Integrator. Cover the ⑤ cover plate. There is an arrow icon in the cover plate. Meanwhile, square integrator also has an arrow icon. Please make sure the location of these two arrows is consistent.

After finishing the above steps, you can start the measurement.
Figure 2 The Matching Between CLRM310 Colorimeter and Universal Test Components

Figure 3 The Local Matching Between CLRM310 Colorimeter and Universal Test Components

III. Notes

i. Keep the square integrator clean. After finishing the measurement, please cover the cover plate and keep the square integrator closed.

ii. Protect those two transparent surfaces of the cuvette from scratching and soiling.

iii. The amount of the object in cuvette must be between “MAX” and “MIN”.

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**Product Description**

200 colorimeter is researched and developed in accordance with CIE (International Commission on Illumination) and CNS (China National Standards). 200 colorimeter is a high precise colorimeter with simple user interface and stable performance. It can be powered by both Li-ion battery and external DC power supply.

White and black calibration is not required for 200 colorimeter which greatly simplifies the measuring steps.

200 colorimeter adopts illumination locating which brings out more precise and quicker locating.

200 adopts complex advanced algorithms which make measurement performance more stable, more accurate and more compatible.

**Cautions**

- This colorimeter is a precise measuring instrument. Please avoid dramatic changes of external environment when measuring. These changes, including the flicker of surrounding light, the rapid change of temperature, will affect the measuring accuracy.

- Keep the instrument balanceable; make sure the measuring aperture cling to the test sample, and no shaking or shifting when measuring. Please prevent the colorimeter from fierce collision or crash.

- This instrument is not waterproof. Do not use it in high humidity environment or in water.

- Keep the colorimeter clean. Avoid dust, powder or solid particles entering the measuring aperture and the instrument.

- Replace the white calibration cover and put the colorimeter into instrument cabinet when not in use.

- Please take out the battery to prevent the colorimeter from damage if you don't use it for a long time.

- Please keep the colorimeter in a cool dry place.

- Any unauthorized changes to the colorimeter are not permitted, or it will affect the measuring accuracy, even cause irreversible damage.
I. Button Description

The following is a brief introduction of the buttons. We will give more detailed information about its function separately in next chapters.

Figure 1 Button Function

Button Function Introduction
1. Testing
2. Menu
3. Up/Print
4. Down/Save
5. Enter
6. Back
II. Interface Description

![Interface Description Diagram](image_url)

**Interface Description**

1. **Power Switch**: Press the button to turn on the colorimeter. Press the button again. The button will pop up. Then the colorimeter is turned off.

2. **DC Interface**: Connect with AC adapter. It is used to connect to external power source. The specification of external power source is 5V=2A.

3. **USB Interface / RS-232 Interface**: This interface is a common interface. The instrument automatically judges the connection status. USB interface is used to transfer data to PC. Its baud rate is 115200bps. RS-232 interface is used to connect to the printer; its baud rate is 19200bps.

*Note: When connecting to external power source, please press the power switch to start the instrument.*

III. Battery Description and Installation
Please use original Li-ion battery. Do not use other batteries, or it will cause irreversible damage.

Please take out the battery to prevent the colorimeter from the damage of battery leakage if you don’t use it for a long time.

When using external power source or connecting USB interface to PC, if you press the power switch, it will charge the Li-ion battery. If you don’t want to charge the battery, please take out the battery.

When charging the battery, dynamic battery icon will display on the top right corner of “Standard Measurement” and “Sample Measurement” interfaces. In figure 3, the charging icon displays in “Standard Measurement” interface; if no charging, the dynamic icon will not appear.

![Figure 3 Charging Icon](image-url)
Installing Battery

When installing battery, be sure the power switch is popped out (The power source of colorimeter is cut off). Then remove the battery cover.

Insert the Li-ion battery into battery compartment and push it gently in right direction.

Put the battery cover on Li-ion battery, and then push it up.

Battery Specification: Li-ion 3.7V==0.5A.
IV. 200 Colorimeter Operating Instruction

(1) Turning Power On

1. Preparations Before Power On
   a) Check whether there is battery powered or external power supply.
   b) Make sure the white calibration cover is connected to the instrument and well installed. If it is loose or the white calibration cover isn't well installed, you must put the cover on and be sure it is connected to the instrument tightly.

2. Turning Power On
   Press the power switch on the back side of the instrument, the LCD screen will display MRC logo. After a few seconds, it will enter Standard Measurement interface automatically, and the default display is L*a*b*C*H.

3. White Calibration and Black Calibration

   Note: White and black calibration is not required for 200 colorimeter. Only when the measured data are not accurate enough, manual calibration is needed.

   After turning on 200 colorimeter, press “Menu” to enter the main menu, as shown in Figure 5. Select “Calibrate” to enter White and Black Calibration interface, as shown in Figure 6.

   Be sure the white calibration cover is well installed. Selecting “White Calibration” and press “Enter” button, the instrument will prompt you to place the white calibration plate. Then press “Enter” or “Testing” key to start white calibration.

   Be sure the white calibration cover is removed. Select “Black Calibration” and press “Enter”. The instrument will prompt you to direct the measuring aperture to the air. Press “Enter” again or press “Testing” key to start black calibration.

   Note: When starting black calibration, direct the measuring port to the air. Be sure the black calibration is performing in a dark, no bright light source environment. Keep the measuring port more than 3m away from any reflective items (hands, desks, walls etc.).

   By then, manual white calibration and black calibration are completed.
(II) Measurement

1. Locating and Measuring Method

200 colorimeter is locating through the facula. The method: enter “Standard Measurement” or “Sample Measurement” interface, press the “Testing” key and hold it. The facula will appear at the moment. You can observe the matching status between the facula and the measured sample. At the same time, hold the measuring aperture close to the measured sample and adjust it. Then the alignment is achieved.

After the locating, release “Testing” button. The instrument will finish sample testing in approx. 1 sec and display color parameters of the measured sample.

2. Standard Measurement

There are two conditions about standard measurement. One is performing standard measurement after power on; another is after completing sample
measurement or other operations, press “Back” button continuously to enter standard measurement.

**a) Standard Measurement after Power On**

After power on, the colorimeter will display “Standard Measurement”, as shown in Figure 7. Then, align measuring aperture to the standard, press “Testing” key, the screen will display color parameters of this standard. Press “Enter” button, the instrument will enter “Sample Measurement” interface.

![Figure 7 Standard Measurement Interface](image)

**b) Standard Measurement after Completing Sample Measurement or Other Operations**

After completing sample measurement or other operations, the instrument may display an interface. At this moment, press “Back” button repeatedly until the interface back to “Standard Measurement” interface, as shown in Figure 7. Then, perform standard measurement according to step a).

**3. Sample Measurement**

After completing standard measurement, press “Enter” button, the instrument will enter “Sample Measurement” interface automatically, as shown in Figure 8. Align the measuring aperture to the test sample to perform sample measurement.
Note: During the measurement (Approx. 1 sec), all buttons are ineffective.

(III) Save Data

There are two methods to save data.

1. Auto Save

Press "MENU" button to enter the main menu, as shown in Figure 5. Select “Settings” to enter an interface shown in Figure 9. Select “Auto Save” to enter status setting interface, as shown in Figure 10. Select “On” and press “Enter” button to save the setting. After completing this setting, the measurement data will be saved automatically.
2. Manual Save

In Figure 10, select “Off”, then the data will not be saved automatically. If you want to save data when measuring, please press “Down/Save” button after each measurement.

(IV) Connect 200 Colorimeter to the PC

Press “MENU” button to enter the main menu, as shown in Figure 5. Then, select “Comm” to enter an interface shown in Figure 11. Follow the instruction information mentioned in the interface to connect 200 colorimeter to the PC with USB cable. When the communication is successful, the instrument will enter “Communicating...” interface, as shown in Figure 12.
Only when the colorimeter is in “Standard Measurement”, “Sample Measurement” or “Record” interfaces, you can print data through the printer. Connect colorimeter to the printer. When the colorimeter is in one of the above interfaces, press and hold (about 5 second) “Up /Print” button to start the printer.
V. System Function Description

Except “Standard Measurement” and “Sample Measurement” interfaces, you should enter other function interfaces through the main menu. Main menu is shown in Figure 13.

1. Record and Standard Entering

a) Record
Select “Record” in main menu to enter “Standard Record”, as shown in Figure 14. The figure shows the standard parameters. You can check different standard data through “Up” and “Down”. In figure 15, “T002” is a standard number. After selecting a standard, you can press “Enter” to check sample parameters and color difference parameters, as shown in Figure 15. You can check different data through “Up” and “Down”. No.001 in Figure 15 is the serial number of sample measurement.
Note: “↖Delete *” means press Back key “↖” and hold it for 3 seconds, then the record will be deleted.

<table>
<thead>
<tr>
<th>Sample Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Figure 15 Sample Parameters under the T002 Standard

b) Standard Entering
In some cases, it's needed to measure color difference under a saved standard. Then, you can select “Record” in main menu to enter standard sample records interface. You can search the needed standard data through “Up” and “Down”. After finding it, press “Menu” button, and then the standard record is entered to the measurement interface, press “Enter”, you can perform sample measurement under this standard.

c) Sample Record Entered to a Standard
In some cases, it's needed to use a stored sample as a standard. Then, you can select “Record” to enter sample records interface, as shown in Figure 15. You can search the needed sample data through “Up” and “Down”. After finding it, press “Menu” button, and then the sample record is entered to the measurement interface as a standard, press “Enter”, you can perform the color measurement under this standard.

2. Calibration
After turning on 200 colorimeter, press “MENU” to enter the main menu, as shown in Figure 13. Select “Calibrate” to enter manual white calibration and black calibration interface, as shown in Figure 16.

Be sure the white calibration cover is well installed on the instrument. Select “White Calibration” and press “Enter” button, the interface will prompt you to put away the white calibration cover, then press “enter” again or press “Testing” key to perform white calibration. Before performing black calibration, be sure the white calibration cover has been removed. Select “Black Calibration” and press “Enter” button, the instrument will prompt you to direct the measuring aperture to the air, press “Enter” again or press “Testing” key to perform black calibration.
Note: When performing black calibration, direct the measuring port to the air. Be sure the black calibration is starting in a dark, no bright light source environment. Keep the measuring port more than 3m away from any reflective items (hands, desks, walls etc.).

Then, manual white calibration and black calibration are completed.

![Calibration Interface](image)

Figure 16 Calibration Interface

3. **Tolerance Setting**

Select “Tolerance” in main menu to enter tolerance setting interface, as shown in Figure 17. You can add or subtract the number in which the cursor is positioned through “Up” and “Down” button. After setting the number to the needed one, press “Enter” button, the cursor will jump to the last number. When the cursor is in the last number, press “Enter” button to save the settings and return to the main menu.

If you don’t want to set or modify the tolerance, you can press “Back” button to return to the main menu.
4. **USB Communication**
Select “Comm” in the main menu to enter an interface shown in Figure 18. According to the prompt, connect 200 colorimeter to the PC with USB cable. When the communication is successful, the instrument will enter “Communicating...” interface, as shown in Figure 19.
5. **Delete Records**
Select “Delete” in main menu to enter the interface shown in Figure 20. There are two options: “Delete All Samples” and “Delete All Records”.

**a) Delete All Samples**
When select “Delete All Samples”, it will delete all samples in the instrument and save the standard records. Then, the instrument will display a warning interface, as shown in Figure 20. Press “Enter”, all sample data will be deleted, but the standard records are still retained.

**b) Delete All Records**
When select “All Records Delete”, all records in the instrument will be deleted, including all standard records and all sample records. Then, the instrument will display a warning interface, as shown in Figure 21. Press “Enter” button, all records in the instrument will be deleted.
6. Language Selection

Select “Language” in the main menu to enter an interface shown in Figure 22. You can select the language according to your need by pressing “Up” and “Down” buttons. Press “Enter” to save the settings and return to the main menu.
7. **Display Mode**
Select “Display” in the main menu to enter an interface, as shown in Figure 23. You can select different color spaces according to your need. This selection will change the display in “Standard Measurement” and “Sample Measurement” interfaces. You can make settings by pressing “Up” and “Down” button. Then press “Enter” to save the settings and return to the main menu.

![Figure 23 Display Mode Interface](image)

8. **Average Measurement**
Select “Average” in the main menu to enter an interface shown in Figure 24. You can set the number of average measurements according to your need. You can add or subtract the times by pressing “Up” and “Down” buttons. Press “Enter” to save the settings and return to the main menu. When the number is set to “01”, the instrument will only make single measurement, and will not perform average measurement. The instrument is defaulted to one time measurement.

![Figure 24 Average Measurement Setting Interface](image)
9. **Function Setting**
Select “Settings” in the main menu to enter an interface shown in Figure 25. You can select the object according to your need by pressing “Up” and “Down” buttons. Press “Enter” to enter the corresponding setting interface. After completing these settings, press “Enter” button to save the settings and return to the previous menu.

![Figure 25 Other Settings Interface](image)

a) Select “Settings” - “Auto Save” to enter an interface shown in Figure 26. This interface enables you to set measured data automatically or not. Select “Open”, each sample data and standard data will be saved automatically. Select “OFF”, data will not be saved automatically.

![Figure 26 Auto Save Interface](image)

b) Select “Time” to enter time setting interface, as shown in Figure 27. You can
make settings by pressing the button “Up” and “Down”, then press “Enter” to enter corresponding setting interface, as shown in Figure 28, Figure 29, Figure 30 and Figure 31. In Figure 28 and Figure 29, you can set display format of time and date by pressing “Up” and “Down”. Press “Enter” to save the settings and return to the previous menu.

If you don’t want to set or modify time and date, you can press “Back” button to return to the main menu.

![Figure 27 Time Setting Interface](image)

![Figure 28 Set Time](image)
c) Select “Settings” - “Print Setting” to enter an interface shown in Figure 32. This interface is used for selecting print mode. After connecting the instrument to the printer, if select “Open” and save it, the printer will print the measured data automatically after each measurement. If select “Off” and
save it, you need to press and hold “Up/Print” button to print the measured data after each measurement.

d) Select “Settings” - “Backlight Time” to enter an interface shown in Figure 33. When the instrument is in idle state, you can set the backlight time to save electricity consumption.

e) Select “Settings” - “Brightness Setting” to enter an interface shown in Figure 34. This interface is used to set the backlight brightness to help users to use this instrument in different environments.
f) Select “Settings” - “Power Management” to enter an interface shown in Figure 35. You can check battery capacity through this interface.

![Brightness Setting Interface](image)

**Figure 34 Brightness Setting Interface**

![Battery Capacity Interface](image)

**Figure 35 Battery Capacity Interface**

g) Select “Settings” - “Restore Factory Set” to enter an interface shown in Figure 36. Press “Enter” button. The instrument will restore to factory default setting and clear all records.
Warning! All settings restore factory status
All records will be deleted permanently.

Figure 36 Restore Factory Set
VI. Product Parameters

1. Product Features

- This instrument adopts illumination locating, fully considers users’ need and adheres to user-friendly design. It has original illumination locating.

- White and black calibration is not required for 200 colorimeter. This function can ensure the precision of this instrument, and it eliminates complex manual white and black calibration which greatly improves the convenient use of the colorimeter. You only need to turn on the colorimeter before performing measurements.

- The standard deviation of this colorimeter is $\Delta E^{*ab}<0.08$ (Average of 30 measurements of standard white calibration plate.).

- The colorimeter adopts international standard illuminate D65.

- This colorimeter has various color spaces. The users can select it according to their needs.
# 2. Product Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>CLRM200</td>
</tr>
<tr>
<td>Display Mode</td>
<td>CIE L<em>a</em>b <em>C</em>H* ; CIE L<em>a</em>b</td>
</tr>
<tr>
<td>Color Difference Formula</td>
<td>ΔE*ab</td>
</tr>
<tr>
<td>Illuminating/viewing geometry</td>
<td>8/d (8°illumination angle/diffuse viewing)</td>
</tr>
<tr>
<td>Light Source</td>
<td>LED blue light excitation</td>
</tr>
<tr>
<td>Detector</td>
<td>Silicon photoelectric diode</td>
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<tr>
<td>Measuring Aperture</td>
<td>Φ8mm</td>
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<tr>
<td>Measuring Conditions</td>
<td>Observer: CIE 10° Standard Observer</td>
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<tr>
<td></td>
<td>Illuminant: CIE Standard Illuminant D65</td>
</tr>
<tr>
<td>Measuring Range</td>
<td>L: 0 to 100</td>
</tr>
<tr>
<td>Repeatability</td>
<td>Standard deviation within ΔE*ab 0.08</td>
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<tr>
<td></td>
<td>(Measurement Conditions: Average of 30 measurements of standard white plate)</td>
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<tr>
<td>Storage</td>
<td>100 pcs standard samples; 20000 pcs test samples</td>
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<tr>
<td>Minimum Interval Between Measurement</td>
<td>Approx. 1 sec</td>
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<tr>
<td>Battery Life</td>
<td>More than 3000 measurements</td>
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<tr>
<td>Lamp Life</td>
<td>more than 1.6 million times in 5 years</td>
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<td>Display</td>
<td>TFT True-color; 2.8 inch@(16:9)</td>
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<tr>
<td>Interface</td>
<td>Model B: USB</td>
</tr>
<tr>
<td></td>
<td>RS-232: Baud rate 19200bps</td>
</tr>
<tr>
<td>Operating Temperature Range</td>
<td>-10°C to 40°C (32°F to 104°F)</td>
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<tr>
<td>Storage Temperature</td>
<td>-20°C to 50°C (-4°F to 122°F)</td>
</tr>
<tr>
<td>Humidity Range</td>
<td>less than 85% relative humidity, no condensation</td>
</tr>
<tr>
<td>Weight</td>
<td>500g</td>
</tr>
<tr>
<td>Dimensions</td>
<td>205 x 70 x 100 mm</td>
</tr>
<tr>
<td>Size of the Packing</td>
<td>435 x 205 x 345mm</td>
</tr>
<tr>
<td>Standard Accessories</td>
<td>AC Adapter; Li-ion Battery; Operation Manual; Software CD; USB Cable; White Calibration Cover; Φ8mm Measuring Aperture</td>
</tr>
<tr>
<td>Optional Accessories</td>
<td>Mini-printer; Printer Cable</td>
</tr>
</tbody>
</table>

*Note: The specifications are subject to change without notice.*
Appendix

1. The Color of Objects

There are three major elements to perceive color: light, object and observer. Any change of these three elements will influence the observer’s color perception. When the light source and the observer don’t change, then the object will determine the observer’s color perception.

Objects can affect the final color perception because the reflectance spectra (transmittance spectra) of the object have modulated the light source spectrum. Different objects have different reflectance spectra (transmittance spectra). The light source spectrum modulates the reflectance spectra (transmittance spectra) of different objects to obtain different results. The observer is the same, so it shows different colors. The theory is shown in the figure below.

\[
\begin{align*}
L &= 70.95 \\
a &= 69.72 \\
b &= 40.35
\end{align*}
\]
2. Human Eyes to Distinguish Colors

The color difference unit, NBS, is derived from the unit of color difference formula which is established by Judd-Hunter. In 1939, the American Bureau of Standards adopts this color difference formula and calculates the color difference according to it. When the absolute value is 1, it is called “The NBS Color Difference Unit”.

Since then, people would consciously adjust the later color difference formulas to be similar with the NBS units. The formulas such as Hunter Lab, CIE LAB and CIE LUV are generally similar to NBS (not exactly the same), therefore, do not mistake the color difference units calculated by other color difference formulas are all NBS.

In national standards GB7705-87 (lithograph), GB7706-87 (letterpress), GB7707-87 (gravure) which promulgated by the National Bureau of Standards, the color printings rating in the same batch and same color according to color difference are defined as follows: General Product $\Delta E^{ab} \leq 5.00 \sim 6.00$, Fine Product $\Delta E^{ab} \leq 4.00 \sim 5.00$. Meanwhile, this quality standard is considered as a qualification for state enterprises promotion.

<table>
<thead>
<tr>
<th>NBS Unit Color Difference</th>
<th>Perception Degree of Color Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>0. 0~0.50</td>
<td>The Tiny Color Difference: Travel</td>
</tr>
<tr>
<td>0.5~1.51</td>
<td>The Smaller Color Difference: slight</td>
</tr>
<tr>
<td>1.5~3</td>
<td>The Small Color Difference: Noticeable</td>
</tr>
<tr>
<td>3~6</td>
<td>The Big Color Difference: appreciable</td>
</tr>
<tr>
<td>Above 6</td>
<td>The Bigger Color Difference: much</td>
</tr>
</tbody>
</table>