COLOR METER

CM-200S

This Color Meter is small in size, light in weight, easy to carry. Although complex and advanced, it is convenient to use and operate. Its ruggedness will allow many years of use if proper operating techniques are followed. Please read the following instructions carefully and always keep this manual within easy reach.

1. INTRODUCTION FEATURE

* The meter is an extremely compact, extremely easy-to-use tristimulus colormeter specially designed for measuring the color difference between two colors.
* The meter is designed for measuring the color of no lighting and non-fluorescent sample such as textile, paper, leathers, painting materials, etc. It is the useful tool for the quality control and wide industrial application.
* The measuring head of meter need to touch with color sample without any distance.
* Color difference displayed Δ(L*, a*, b*), Δ(E*ab, C*ab, H*ab), Δ(Y, x, y), Δ(X, Y, Z), Δ(Rs, Gs, Bs) or Δ(WI, YI, Tw)
* Color space displayed (L*, a*, b*), (L*, C*ab, hab), (Y, x, y), (X, Y, Z), (Rs, Gs, Bs) or (WI, YI, Tw).

* Statistical function (Maximum, Minimum, Average and Standard Deviation)
* Color difference tolerance set to perform PASS / WARN / FAIL.
* Store 9 color-difference target colors.
* User calibration function ensures higher accuracy.
* Auto memory (99 sets) & Read function.
* Digital backlight display.
* Auto power off function.
* Can communicate with PC computer for statistics and printing by the optional USB cable and software.

2. SAFETY INFORMATION

Read the following safety information carefully before attempting to operate or service the meter.

2-1 Warning

Do not use this instrument in an explosive atmosphere, such as one containing gasoline fumes. Use in such

an area may result in an explosion.

2-2 Precautions:

a) The meter should be used at temperatures between 0 to 40°C (32 to 104°F). Do not use the meter at temperature outside this range. Also, do not subject the meter to sudden changes in temperature.

b) Do not leave the meter in direct sunlight or near sources of heat, such as stoves, etc.

c) Do not use the meter in extremely dusty areas or areas filled with smoke or chemical fumes.

d) Do not use the meter near equipment which produces a strong magnetic field (such as speakers, large motor, etc.)

e) Do not subject the meter to strong impact or vibration.

2-3 Environmental conditions:

a) Altitude up to 2000 meters.
b) Relative humidity 85% max.

c) Operating Ambient 0 to 40°C

2-4 Maintenance & Clearing:

a) Repairs or servicing that are not covered in this manual and should be performed by qualified personnel only.

b) If the meter becomes dirty, it can be cleaned by wiping with a soft, dry cloth. Do not use benzene, paint thinner, or other chemicals to clean the meter.

c) When servicing, use only specified replacement parts.

d) The meter should be stored at temperature -10 to 40°C (14 to 104°F). Do not store the meter in areas subject to high temperature, high humidity, or where condensation may occur.

e) Do not leave or store the meter in direct sunlight, inside a closed motor vehicle, in the trunk of motor vehicle, or in any other area subject

to extremely high temperatures.

f) Do not store the meter in extremely dust areas or areas filled with smoke or chemical fumes.

3. SPECIFICATIONS

3-1 General Specification:

Display: Triple 4 digit LCD Display.
Auto power off: Approx. 3 minutes.
Data memory capacity: 99 set. (Direct reading from LCD display)
Low battery indication: The ⊞ symbol is displayed on LCD when the battery voltage drops below the operating voltage.
Operating temperature and humidity: 0~40°C(32~104°F), < 85%RH.
Storage temperature and humidity: -10~40°C(14~104°F), < 70%RH.
Power source: 4x1.5 AAA (UM-4) Battery.
Dimensions: 140x73x35mm 5.5x2.9x1.4inches.
Weight: Approx. 220g with battery.

Accessories: Main unit, Measuring head, White calibration card, Carrying case, Instruction manual.

3-2 Electrical Specifications:

Illuminating/Viewing geometry: 45°/0°: Illumination at 45°, measurement at 0°.
Measuring area: Approx. Φ10mm
Display modes:
　Color difference: Δ(L*, a*, b*), Δ(E*ab, C*ab, H*ab), Δ(Y, x, y), Δ(X, Y, Z), Δ(Rs, Gs, Bs) or Δ(WI, YI, Tw)
　Color space: (L*, a*, b*), (L*, C*ab, hab), (Y, x, y), (X, Y, Z), (Rs, Gs, Bs) or (WI, YI, Tw).
Target color memory: 9 channel; set by measurement or keypad
Measuring range: L*: 5 to 100
Measurement conditions: Observe: CIE 2° Standard Observer.
Illuminant: White LED lamp.
Repeatability: Standard deviation

within ΔE*ab 0.5 (Measurement conditions: Average of measurements of standard white plate).
Minimum interval between measurements: Approx. 2 seconds.

4. PARTS & CONTROLS

4-1 Description of Parts & Control keys

1. LCD: Displays measurement data and setting items.
2. T/ TOL/▼ key:
   1) T : Target color difference measurement mode control key. Press this key one time to enter or exit this mode.
   2) TOL: Target color difference tolerance measurement mode control key. Press this key for 3 seconds to enter or exit this mode.
   3) ▼ key: Scroll to a READ mode or decrease the displayed setting.
3. C /CAL/↵ key:
   1) C : Changes color space control key. Press this key to scroll to change color space in the measurement display.
   2) CAL: White calibration mode control key. Press this key for 3 seconds to enter or

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exit this mode.
   3) ↵ key: Confirms or store the displayed setting.
4. R /MAX/▲ key:
   1) R : Data memory read mode control key. Press this key to enter the read mode, press the measurement switch key to exit this mode.
   2) MAX: Statistical operations (maximum, minimum, average, standard deviation) on stored data mode control key. Press this key for 3 seconds to enter this mode, press the measurement switch key to exit this mode.
   3) ▲ key: Scroll to a READ mode or increase the displayed setting.
5. Measurement switch key:
   1) Press the Measurement switch key to turn on the meter, press the Measurement switch key for 3 seconds to turn off the meter.

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2) Press the Measurement switch key to measure.
6. Backlight key.
7. Data cable interface.
8. Measuring head.
9. Battery cover on the back.

4-2 Description of Display

⟳: Auto power off indication.
PASS, WARN, FAIL: Judgment the color difference tolerance indication.
▭: Low battery indication.
T 8: Color difference target color 1-9 display indication.
SET: Setting mode indication.
CAL W: White calibration mode indication.

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CAL USER: User calibration mode indication.
USER: Use user calibration data perform measurement indication.
MAX R : Statistical operation maximum value display indication.
MIN R : Statistical operation minimum value display indication.
AVG R : Statistical operation average value display indication.
SD R : Statistical operation standard deviation value display indication.
88 M : Last data memory address number indication (01-99).
88 R : Recall data memory address number indication.
88%: Setting the warning level percent of the tolerance (10 to 99%) indication.
X, Y, Z: CIE XYZ color space display indication (XYZ tristimulus values are derived parameters from the red, green, blue colors.).

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Y, x, y, : CIE xyY color space display indication. (Y denotes brightness, x and y denote chromaticity.)
Rs, Gs, Bs: Standard RGB color space display indication. (sRGB).
L*, a*, b*: CIE L*a*b* (CIELAB) color space display indication. (L* denotes lightness, a* and b* denote chromaticity.)
L*, C*ab, hab: CIE LCH color space display indication. (L* denotes lightness, C*ab denotes chroma and hab denotes hue.)
WI, YI, Tw:
   WI (Whiteness Index, CIE D50/2°),
   YI (Yellowness Index, ASTM D1925),
   Tw (Tint Index, CIE D50/2°).
ΔX, ΔY, ΔZ: CIE XYZ color space color difference display indication.
ΔY, Δx, Δz: CIE xyZ color space color difference display indication.
ΔRs, ΔGs, ΔBs: sRGB color space color difference display indication.

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ΔL*, Δa*, Δb*: CIE L*a*b* color space color difference display indication.
ΔE*ab, ΔC*ab, ΔH*ab: CIE LCH color space color difference display indication.
ΔWI, ΔYI, ΔTw: Whiteness index, Yellowness index and Tint index color difference display indication.

5. MEASURING PROCEDURE
5-1 Clearing Memory & Disable Auto Power off Function
   1. Press the Measurement switch key for 3 seconds to turn off the meter.
   2. Press and hold down " R " key then press the Measurement switch key to turn on the meter, the " M 88 Clr no" symbol are displayed.
   3. Press ▲ or ▼ key to select the "yes" symbol is displayed.
   4. Press ↵ key to clear the memorized data, the "00 M " symbol will display 1 second and

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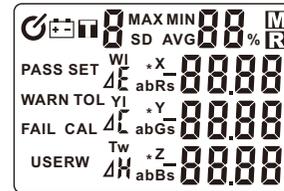
enter the disable auto power off function, the "on APO" symbol is displayed.
   5. The meter will automatically enter sleep mode approx. 3 minutes to save power consumption. Press ▲ or ▼ key to select the auto power off function is "on" or "off".
   6. Press ↵ key to store the setting and the auto power off symbol " ⟳ " will be appear or disappear.

5-2 White Calibration
   When using the meter for long period of time, the displayed value may change depending on changes in the environment. Therefor, in order to achieve accurate measurements, we recommend that white calibration is done regularly using the white calibration card. White calibration

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should also be done before measuring after a long time has passed since the meter was last used.
   Note: White calibration should be done under the same temperature conditions as measurement.
   1. Press the Measurement switch key turn on the meter, the last measured data is displayed.
   2. Press "CAL" key for 3 seconds to enter the white calibration mode, the "CAL W" symbol and the white calibration data are displayed.
   3. Place the measuring head vertically above the middle of the white calibration card.
   4. Press the Measurement switch key to measure, calibration is complete and enter measurement mode.

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Note: Do not move the measuring head during measurement.

5-3 Absolute Measurement

The meter can measure reflected object color with the color space, Yxy, XYZ, sRGB, L*a*b*, L*C*h and (WI, YI, Tw) as the default.

1. Press the Measurement switch key to turn on the meter, the last measured data is displayed.
2. Press "C" key to select the desired measurement color space.
3. Place the measuring head vertically above the specimen.
4. Press the Measurement switch key to measure, the measured data is automatically stored. Up to 99 measurement data sets can be stored. If you do not wish to store data, when the "M" symbol is flicking, press "R" key to delete

the latest stored data.

5. Press "C" key converts the measurement data to other color spaces.

5-4 Color Difference Measurement

This meter can measure the color difference between the target color and a specimen using color spaces, Δ(Yxy), Δ(XYZ), Δ(sRGB), Δ(L*a*b*), Δ(E*C*H*) and Δ(WI, YI, Tw) as the default.

1. Setting the Target Color

Before measuring color difference, you must set the target color in the meter, 9 target colors can be set to nos. T1 to T9.

A. Using the measuring head measured data as the target color.

a) Press the Measurement switch key for 3 seconds to

turn off the meter.

b) Press and hold down "T" key then press the Measurement switch key to turn on the meter to enter the target color setting mode, the "T" symbol is flicking.
c) Press "T" key to select the desired target color numbers from T1 to T9.
d) Press the Measurement switch key to store the choice, the "T" symbol will stop flicking.
e) Press "C" key to select the desired color spaces Yxy or L*a*b*.
f) Place the measuring head vertically above the target color specimen.
g) Press the Measurement

switch key to measure, the measured data is displayed and stored.

h) Repeat the procedure (c) to (g) to continuing to set other target color.
I) Press ↵ key to exit this mode and enter the color difference measurement mode.

B. Setting the target color data by key input

When the target color data setting by key input, the Δ(sRGB) color space can not measurement.

Input ranges for the set values
L*: 5.00~99.99, a* & b*: 0.050~99.99
Y: 1.000~99.99, x & y: 0.010~0.850

a) Press the Measurement switch key 3 seconds to turn off the meter.
b) Press and hold down "T" key then press the Measurement switch key to turn on the meter to enter the target color setting mode, the "T" symbol is flicking.
c) Press "T" key to select the desired target color numbers from T1 to T9.
d) Press "R" key to enter the setting the target color data by key input mode, the "T" symbol will stop flicking.
e) Press "C" key to select the desired color spaces Yxy or L*a*b*.
f) Press the Measurement switch key to store the

choice, the "L*a*b*" symbol will stop flicking (assuming that L*a*b* is choice).

g) Press ▲ and ▼ keys to set the desired value of the L*.
h) Press ↵ key and move to the a* polarity setting.
i) Press ▲ key to set the desired "+" or "-" of the a* value.
j) Press ↵ key and move to the a* value setting.
k) Press ▲ and ▼ keys to set the desired value of the a*.
l) Press ↵ key and move to the b* polarity setting.
m) Press ▲ key to set the desired "+" or "-" of the b* value.
n) Press ↵ key and move to the b* value settings.
o) Press ▲ and ▼ keys to set the

desired value of the b*.

p) Press ↵ key to store the target color setting.
q) Repeat the procedure (c) to (p) to continuing to set other target color.
r) Press ↵ key again to exit this mode and enter the color difference measurement mode.

2. Measuring the color difference

A. Setting a new target color number before every measurement.

a) Press the Measurement switch key for 3 seconds to turn off the meter.
b) Press and hold down "T" key then press the measurement switch key to turn on the meter to enter the target color

setting mode, the "T" symbol is flicking.

c) Press "T" key to select the desired target color numbers from T1 to T9.
d) Press ↵ key to enter the measuring the color difference mode, the "T" symbol will stop flicking.
e) Place the measuring head vertically above the specimen.
f) Press the Measurement switch key to measure, the measured data is automatically stored. Up to 99 measurement data sets can be stored. If you do not wish to store data, when the "M" symbol is flicking, press "R" key to delete the latest

stored data.

g) Press "C" key converts the measurement data to other color spaces.

h) Press "T" key one time to exit the color difference measurement mode, the "T" symbol is disappeared.

i) Press "C" key to view the measured absolute data to other color spaces.

j) Press "T" key again to enter the color difference measurement mode.

B. Selecting a pre – existing target color number before measurement.

a) Press the Measurement switch key to turn on the meter, the last measured data is displayed.

b) Press "T" key to turn on the color difference measurement mode, the pre – existing target color number and data are displayed.

c) Place the measuring head vertically above the specimen.

d) Press the Measurement switch key to measure, the measured data is automatically stored. Up to 99 measurement data sets can be stored. If you do not wish to store data, when the "M" symbol is flicking, press "R" key to delete the latest stored data.

e) Press "C" key converts the measurement data to other color spaces.

f) Press "T" key one time to exit the color difference measurement mode, the "T" symbol is disappeared.

g) Press "C" key to view the measured absolute data to other color spaces.

h) Press "T" key again to enter the color difference mode.

5-5 Displaying the Stored Data

1. Press the Measurement switch key to turn on the meter, the last measured data is displayed.

2. Press "R" key to enter the read mode, the "R" symbol is displayed.

3. Press ▲ and ▼ key to select the desired memory address number.

4. Press "C" key to select the desired color spaces.

5. Press the Measurement switch key

to exit this mode.

5-6 Statistical Operations on Stored Data

This meter can perform statistical operations (maximum, minimum, average and standard deviation) on stored data (only performed on the L*a*b* color space).

1. Press the Measurement switch key to turn on the meter, the last measured data is displayed.

2. Press "R" key for 3 seconds to enter the statistical operation mode, the "MAX R" symbol is displayed.

3. Press ↵ key to circulate the result of the statistical operation for the L*a*b* reading of Maximum (MAX R), Minimum (MIN R), Average (AVG R) and Standard deviation (SD R).

4. Press the Measurement switch key to exit this mode.

5-7 Setting the color Difference Tolerance

This meter can make judgments on a color difference tolerance for the L*a*b* measurement value of the target color.

When measuring color difference, if the measuring value is within the color difference tolerance set for the target color, "PASS" is displayed, if it is within the color difference tolerance, but exceeds the warning level, "WARN" is displayed, if it is exceeds the color difference tolerance, "FAIL" is displayed. It is possible to judge whether the data is close to the tolerance by setting an appropriate warning level (i.e. what percent of the tolerance). Input

ranges for the set values

ΔL*, Δa*, Δb*, ΔE*ab: ±0.050 to ±80.00

Warning level: 10% to 99%

1. Press the Measurement switch key for 3 seconds to turn off the meter

2. Press and hold down "T" key then press the Measurement switch key to turn on the meter and enter the color difference tolerance setting mode, the "SET TOL" symbol is displayed.

3. Press ▲ or ▼ key to set the desired value, press ↵ key to store the setting and move to next setting. Repeat this procedure until the ΔL*, Δa*, Δb*, ΔE*ab and the percent of the tolerance for the warning level are all setting finished.

4. Press ↵ key to store the setting

and exit this mode.

5-8 Judgment the Color Difference Tolerance Measurement

1. Press the Measurement switch key for 3 seconds to turn off the meter.

2. Press and hold down "T" key then press the Measurement switch key to turn on the meter to enter the target color setting mode, the "T" symbol is flicking.

3. Press "T" key to select the desired target color numbers from "T" 1 to "T" 9.

4. Press ↵ key to enter the measuring the color difference mode, the "T" symbol will stop flicking.

5. Press "T" key for 3 seconds to turn on the judgment color difference tolerance function, the "TOL" symbol and the ΔL* setting

values are displayed.

6. Press the Measurement switch key to display the Δa* setting values.

7. Press the Measurement switch key to display the Δb* setting values.

8. Press the Measurement switch key to display the ΔE*ab setting values.

9. Press the Measurement switch key to display the warning level % setting value and enter the judgment color difference tolerance measurement mode.

10. Place the measuring head vertically above the specimen.

11. Press the Measurement switch key to measure, the measured data is automatically stored. Up to 99 measurement data sets can be

stored. If you do not wish to store data, when the "M" symbol is flicking, press "R" key to delete the latest stored data.

12. When the measured value is within the color difference tolerance, the "PASS" symbol is displayed. When the measured value is within the color difference tolerance, but exceeds the warning level, the "WARN" symbol is displayed. When the measured value exceeds the color difference tolerance, the "FAIL" symbol is displayed.

13. Press "C" key converts the measurement data to other color spaces. When the "WARN" or "FAIL" symbol is displayed, the $\Delta L*$, $\Delta a*$, $\Delta b*$ or $\Delta E*ab$ measured value is flicking if it is

exceed the tolerance.

14. Press "T" key for 3 seconds to exit this mode.

5-9 User Calibration

This function allows the user sets the "valued" reference specimen already in possession as the user calibration data to be used to correct indicated values during measurement.

1. User calibration procedure
   There are two color spaces which can be used as user calibration data: Yxy, L*a*b*.
   a) Perform the white calibration procedure, see 5-2 "white calibration".
   b) Press "C" key for 3 seconds to enter the white calibration mode, the "CAL W" symbol is displayed.
   c) Press ↵ key to enter the user

calibration mode, the "CAL USER" symbol is displayed.

d) Press ▲ or ▼ key to select the "L*a*b*" or the "Yxy" color spaces as user calibration data.

e) Press ↵ key move to next setting, press ▲ and ▼ keys to set the desired value or polarity + or – select.
   Repeat this procedure until the "L*, a*, b*" or the "Yxy" value are all setting finished.

f) Press ↵ key to store the setting, the "USER" symbol is flicking.

g) Place the measuring head vertically above the reference specimen.

h) Press the Measurement switch key to measure, user calibration is complete and to enter user

calibration measurement mode, the "USER" symbol is displayed.

2. User calibration measurement
   a) Press "C" key for 3 seconds to enter the white calibration mode, the "CAL W" symbol is displayed.
   b) Press ▲ or ▼ key to select turn on ("on" is displayed) or off ("OFF" is displayed) the user calibration measurement function.
   c) Press ↵ key to store the choice and return to measurement mode.

Note: When setting or canceling user calibration, you must set the target color again. The target color is not corrected using user calibration performed after

measurement.

6. BATTERY REPLACEMENT

1. As battery power is not sufficient, LCD will display the symbol . The old batteries shall be replaced.

2. Open battery cover then take out the battery from instrument and replace with new ones according to battery polarity instructions.

3. Put back the battery cover.

4. Prevention of battery fluid leakage:
   1) When the voltage is low, please remove the batteries out of meter to prevent the possibility of battery fluid leakage damage.
   2) When the meter will not be in use for the long period of time, please remove the batteries out

of meter to prevent the possibility of battery fluid leakage damage.

7. USB INTERFACE, SOFTWARE INSTALLATION AND OPERATION

* For the detailed instruction please refer to the content of attached CD-ROM, which has the complete instruction of software operation and relevant information.

* Protocol: are enclosed within the content of CD-ROM, please open the CD-ROM for details.