T-10/T-10M/T-10Ws/T-10Wl
LS-100/LS-110
CS-200
CL-200A
CS-100A

The essentials of imaging
ILLUMINANCE METER T-10 Series

Accurate and Easy Measurement of Illuminance
Adapts To Various System Configurations
Modular Systems That Expand With Your Needs

Illuminance Meter T-10 <standard receptor head>

Used for measurement of a wide range of illuminance

\[
\begin{align*}
0.01 & \text{ to } 299,900 \text{ lx} \\
0.001 & \text{ to } 29,990 \text{ fcd}
\end{align*}
\]

Illuminance Meter T-10M <mini receptor head>

Used for measurement of illuminance that cannot be performed with the standard receptor head due to small spaces.
The measuring range is the same as T-10 \( 0.01 \text{ to } 299,900 \text{ lx} \) \( 0.001 \text{ to } 29,990 \text{ fcd} \)
(\( \phi 14 \text{ mm receptor surface, } 1 \text{ m cord} \))

Illuminance Meter T-10Ws (5m cord) / T-10WL (10m cord)

Since the mini receptor head and cord are waterproofed to allow measurement of illuminance under water, this product can be used for control of illuminance in the marine products industry (e.g. fish farming) and outdoor measurement of illuminance on rainy days.

**WIDE RANGE OF APPLICATIONS**

- Lighting engineers and specifiers
- R&D at light products manufacturers
- inspection of light sources at construction sites, government and educational facilities
- maintenance of lights in factories, offices, and hospitals
- electrical product manufacturers
- quality control of light sources at home
- agricultural and forestry industries.

Under water measuring example
Main Features

Provides multi functions and user-friendly features

For basic operation

- Normal measurement of illuminance
- Measurement of illuminance difference
- Measurement of integrated illuminance
- Display of illuminance difference
- Display of illuminance ratio
- Display of integrated illuminance
- Display of integration time
- Display of average illuminance

For advanced operation

- Setting of the reference value
- Color Correction Factor (CCF)
  Improves measurement accuracy of illuminance under certain light sources (e.g. inside an orange-lit tunnel).

Allows connection with a personal computer and continuous recording of illuminance by a recorder
Digital output : Use of the RS232C interface (standard accessory) allows the meter to be connected to a personal computer.
Analog output : Allows the meter to be connected to a recorder for continuous recording of illuminance.

Quick automatic zero adjustment
Turning on the meter will perform zero adjustment (no cap required), allowing immediate measurement of illuminance.

Auto ranging
Range can also be set manually.

LCD back-light
The LCD back-light turns on automatically when illuminance is low.

Uses AA-size batteries.
Measures flickering light sources

Illuminance Measurement System to Meet Various Needs

Allows simple and low-cost multi-point measurement of illuminance (2 to 30 points).

Multi-point illuminance measurement system (9 points)
For projector etc

Multi-point illuminance measurement system (5 points)
For lighting at construction sites
Relative Spectral Response

Ideally, the relative spectral responsivity of the illuminance meter should match $V(\lambda)$ of the human eye for photopic vision. As shown in the graph at left, the relative spectral responsivity of Konica Minolta Illuminance Meters T-10/10M is within 6% ($f^1$) of the CIE spectral luminous efficiency $V(\lambda)$.

CIE; Commission Internationale de l’Eclairage

$f^1$ (CIE’s symbol) ; The degree to which the relative spectral responsivity matches $V(\lambda)$ is characterized by means of the error $f^1$.

Cosine Correction Characteristics

Since the brightness at the measurement plane is proportional to the cosine of the angle at which the light is incident, the response of the receptor must also be proportional to the cosine of the incidence angle. For Konica Minolta Illuminance Meters T-10/10M, the cosine response $f_2$ is within 3%.

The graph at left shows the cosine correction characteristics of Konica Minolta Illuminance Meters T-10/10M. The cosine error of T-10/10M are shown in the table right.

<table>
<thead>
<tr>
<th>Incidence angle (deg.)</th>
<th>Cosine error (within)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10°</td>
<td>± 1%</td>
</tr>
<tr>
<td>30°</td>
<td>± 2%</td>
</tr>
<tr>
<td>50°</td>
<td>± 6%</td>
</tr>
<tr>
<td>60°</td>
<td>± 7%</td>
</tr>
<tr>
<td>80°</td>
<td>± 25%</td>
</tr>
</tbody>
</table>

For a photometer head in an illuminance meter, the deviation in the directional response to the incident radiation is characterized by $f_2(\epsilon, \varphi)$:

$$f_2(\epsilon, \varphi) = \frac{Y(\epsilon, \varphi)}{Y(0, \varphi) \cos \epsilon} - 1$$

where

$Y(\epsilon, \varphi)$ is the signal output as a function of the angle of incidence;

$\epsilon$ is measured with respect to the normal to the measuring plane or optical axis;

$\varphi$ is the Azimuth angle.

For characterizing the directional response error by a single factor the characteristic $f_2$ is used:

$$f_2 = \int_0^{2\pi} f_2(\epsilon) |\sin 2\epsilon| d\epsilon$$
### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>Illuminance meter T-10 &lt;standard receptor head&gt;</th>
<th>Illuminance meter T-10M &lt;mini receptor head&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Multi-function digital illuminance meter with detachable receptor head</td>
<td></td>
</tr>
<tr>
<td>Receptor</td>
<td>Silicon photocell</td>
<td></td>
</tr>
<tr>
<td>Relative Spectral Response</td>
<td>Within 6% (f1) of the CIE spectral luminous efficiency ( V(\lambda) )</td>
<td></td>
</tr>
<tr>
<td>Cosine response ( f_2 )</td>
<td>Within 3%</td>
<td></td>
</tr>
<tr>
<td>Cosine Correction Characteristics</td>
<td>Within ±1% at 10° ; Within ±2% at 30° ; Within ±6% at 50° ; Within ±7% at 60° ; Within ±25% at 80°</td>
<td></td>
</tr>
<tr>
<td>Illuminance units</td>
<td>Lux (lx) or foot candles (fcd) (switchable)</td>
<td></td>
</tr>
<tr>
<td>Measuring range</td>
<td>Auto range (manual 5 range at the time of analog output)</td>
<td></td>
</tr>
<tr>
<td>Measuring function</td>
<td>Illuminance (lx), illuminance difference (lx), illuminance ratio(%) , Integrated illuminance(bx-h), integration time(h), average illuminance(lx)</td>
<td></td>
</tr>
<tr>
<td>Measuring range</td>
<td>Illuminance - - - - - - - 0.01 to 299,900 lx 0.001 to 29,990 fcd</td>
<td></td>
</tr>
<tr>
<td>User calibration function</td>
<td>Integrated illuminance - - - 0.01 to 999,900 x 10^3 bx-h 0.001 to 99,990 x 10^3 fcd-h / 0.001 to 9999 h</td>
<td></td>
</tr>
<tr>
<td>Linearity</td>
<td>±2% ±1digit of displayed value</td>
<td></td>
</tr>
<tr>
<td>Temperature/humidity drift</td>
<td>Within ±3% ±1digit (of value displayed at 20°C/68°F ) within operating temperature/humidity range</td>
<td></td>
</tr>
<tr>
<td>Digital output</td>
<td>RS-232C</td>
<td></td>
</tr>
<tr>
<td>Analog output</td>
<td>1mV/digit,3V at maximum reading; Output impedance: 10KΩ; 90% response time: FAST setting: 1ms, SLOW setting: 1s</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>3 or 4 Significant-digit LCD with back-light illumination</td>
<td></td>
</tr>
<tr>
<td>Operating temperature /humidity range</td>
<td>−10 to 40°C, relative humidity 85% or less (at 35°C) with no condensation</td>
<td></td>
</tr>
<tr>
<td>Storage temperature /humidity range</td>
<td>−20 to 55°C, relative humidity 85% or less (at 35°C) with no condensation</td>
<td></td>
</tr>
<tr>
<td>Power source</td>
<td>2 AA-size batteries / AC adapter (optional)</td>
<td></td>
</tr>
<tr>
<td>Battery life</td>
<td>72 hours or longer (when alkaline batteries are used) in continuous measurement</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>69 x 174 x 35 mm (2-6/16x6-14x1-7/16 in.)</td>
<td>69 x 161.5 x 30 mm (2-6/16x6-1/4x1-3/16 in.)</td>
</tr>
<tr>
<td>Weight</td>
<td>200g (7.0 oz.) without battery</td>
<td>205g (7.2 oz.) without battery</td>
</tr>
<tr>
<td>Standard accessories</td>
<td>ø3.5mm(ø1/8 in.) subminiature plug for analog output ; Receptor cap ; Neck strap ; Case ; Battery</td>
<td></td>
</tr>
<tr>
<td>Optional accessories</td>
<td>Receptor head ; Adapter for Multi-point ; AC Adapter</td>
<td></td>
</tr>
</tbody>
</table>

Specifications are subject to change without notice.
Compact, lightweight, easy-to-use SLR luminance meters with a wide measuring range

**Luminance Meter LS-100**

1° acceptance angle,  
Measuring range: 0.001 to 299,900 cd/m²  
(0.001 to 87,530 fL)

**Luminance Meter LS-110**

1/3° acceptance angle,  
Measuring range: 0.01 to 999,900 cd/m²  
(0.01 to 291,800 fL)

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**MAIN FEATURES**

Flareless SLR optical system for accurate measurements

The SLR (single-lens-reflex) optical system allows precise aiming and ensures that the viewfinder shows the exact area to be measured. The optical system is also virtually flareless, eliminating the influence of light from outside the measurement area.

Narrow acceptance angle for measurements of small specimens

Acceptance angles of only 1° for LS-100 and 1/3° for LS-110 allow accurate measurements of small specimen areas. In addition, optional close-up lenses can be used to measure areas as small as 0.3 mm when using LS-100 and 0.4 mm when using LS-110.

User calibration and color-correction functions

To increase the versatility of the LS-100 and LS-110, both models are equipped with user calibration and color correction functions. The user calibration function allows the meter to be calibrated to a user-selected standard instead of the preset Konica Minolta standard; this function can also be used to standardize the response of several meters. The color correction function allows the response of the meter to be adjusted when measuring colored specimens.

Luminance ratio and peak luminance measurements

In addition to measurements of present luminance, the LS-100 and LS-110 can also determine the percent ratio of the measured luminance to a luminance value stored in memory as well as the peak luminance or luminance ratio measured.

**RS-232C data communication**

Use of the built-in RS-232C interface allows the meter to be connected to a personal computer.

Lightweight, compact design powered by a single 9V battery for portability  
(Power can also be supplied by optional Data Printer DP-10.)

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**RELATIVE SPECTRAL RESPONSE**

Ideally, the relative spectral responsivity of the luminance meter should match \( \lambda \) of the human eye for photopic vision. As shown in the graph above, the relative spectral responsivity of Konica Minolta Luminance Meters LS-100/LS-110 is close to the CIE spectral luminous efficiency \( V(\lambda) \).

CIE : Commission Internationale de l’Eclairage  
\( \text{CIE} \) symbol: The degree to which the relative spectral responsivity matches \( V(\lambda) \) is characterized by means of the error \( \varepsilon \).

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**REDUCTION OF FLARE**

The degree to which the influence of light from outside the defined measuring area is eliminated is an important factor in the performance of luminance meters. In Konica Minolta Luminance Meters, the flare factor is kept to below 1.5%, even if an object with extremely high luminance is just outside the meter’s measuring area. The graph at right shows the effect when a bright point is moved from A inside the measuring area to B just outside the measuring area. If the measured value at A is defined at 100%, the measured value at B would be less than 0.1%.

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1°(1.3") measuring spot
**SPECIFICATIONS**

<table>
<thead>
<tr>
<th>Model</th>
<th>Luminance Meter LS-100</th>
<th>Luminance Meter LS-110</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>SLR spot luminance meter for measuring light-source and surface brightness</td>
<td></td>
</tr>
<tr>
<td>Measuring angle</td>
<td>1°</td>
<td>1/3°</td>
</tr>
<tr>
<td>Optical system</td>
<td>85mm f/2.8 lens; SLR viewing system; flare factor less than 1.5%</td>
<td></td>
</tr>
<tr>
<td>Angle of view</td>
<td>9°</td>
<td></td>
</tr>
<tr>
<td>Focusing distance</td>
<td>1014mm (40 in.) to infinity</td>
<td></td>
</tr>
<tr>
<td>Minimum measuring area</td>
<td>ø14.4mm</td>
<td>ø4.8mm</td>
</tr>
<tr>
<td>Receptor</td>
<td>Silicon photocell</td>
<td></td>
</tr>
<tr>
<td>Response time</td>
<td>FAST: Sampling time: 0.1s, time to display: 0.8 to 1.0s; SLOW: Sampling time: 0.4s, time to display: 1.4 to 1.6s</td>
<td></td>
</tr>
<tr>
<td>Luminance units</td>
<td>cd/m² or il (switchable)</td>
<td></td>
</tr>
<tr>
<td>Measuring range</td>
<td>FAST: 0.001 to 299,900cd/m² (0.001 to 87,530ill)</td>
<td>FAST: 0.001 to 999,900cd/m² (0.001 to 291,800ill)</td>
</tr>
<tr>
<td></td>
<td>SLOW: 0.001 to 49,990cd/m² (0.001 to 14,590ill)</td>
<td>SLOW: 0.001 to 499,900cd/m² (0.001 to 145,900ill)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>0.001 to 0.999cd/m² (or fl); ±2% ±2 digits of displayed value</td>
<td>0.01 to 9.99cd/m² (or fl): ±2% ±2 digits of displayed value</td>
</tr>
<tr>
<td></td>
<td>1.000cd/m² (or fl) or greater: ±2% ±1 digit of displayed value</td>
<td>10.00cd/m² (or fl) or greater: ±22% ±1 digit of displayed value</td>
</tr>
<tr>
<td>Illuminant A measured at ambient temperature of 20 to 30°C/68 to 86°F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.001 to 0.999cd/m² (or fl); ±0.2% ±2 digits of displayed value</td>
<td>0.01 to 9.99cd/m² (or fl): ±0.2% ±2 digits of displayed value</td>
</tr>
<tr>
<td></td>
<td>1.000cd/m² (or fl) or greater: ±0.2% ±1 digit of displayed value</td>
<td>10.00cd/m² (or fl) or greater: ±0.2% ±1 digit of displayed value</td>
</tr>
<tr>
<td>Temperature/humidity drift</td>
<td>Within ±3% ±1 digit of value displayed at 20°C/68°F within operating temperature/humidity range</td>
<td></td>
</tr>
<tr>
<td>Calibration mode</td>
<td>Minolta standard/user-selected standard (switchable)</td>
<td></td>
</tr>
<tr>
<td>Color correction factor</td>
<td>Set by numerical input; range: 0.001 to 9.999</td>
<td></td>
</tr>
<tr>
<td>Reference luminance</td>
<td>1; set by measurement or numerical input</td>
<td></td>
</tr>
<tr>
<td>Measurement modes</td>
<td>Luminance; luminance ratio; peak luminance or luminance ratio</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>External: 4-digit LCD with additional indications</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Viewfinder: 4-digit LCD with LED backlight</td>
<td></td>
</tr>
<tr>
<td>Data communication</td>
<td>RS-232C: baud rate: 4800bps</td>
<td></td>
</tr>
<tr>
<td>External control</td>
<td>Measurement process can be started by external device connected to data output terminal</td>
<td></td>
</tr>
<tr>
<td>Power source</td>
<td>One 9V battery: power can also be supplied by optional Data Printer DP-10</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>While measuring button is pressed and viewfinder display is lit: 16mA average</td>
<td></td>
</tr>
<tr>
<td></td>
<td>While power is on and viewfinder display is not lit: 6mA average</td>
<td></td>
</tr>
<tr>
<td>Operating temperature/humidity range</td>
<td>0 to 40°C, relative humidity 85% or less (at 35°C) with no condensation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>-10 to 55°C, relative humidity 85% or less (at 35°C) with no condensation</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>79x20x150mm (3-1/8x8-3/16x5-7/8 in.)</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>850g (30 oz.) without battery</td>
<td></td>
</tr>
<tr>
<td>Standard accessories</td>
<td>Lens cap; Eyepiece cap; ND eyepiece filter; 9V battery; Case</td>
<td></td>
</tr>
</tbody>
</table>

Specifications are subject to change without notice.

**OPTIONAL ACCESSORIES**

**SYSTEM DIAGRAM** (Optional Accessories)

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**Close-Up Lenses**

<table>
<thead>
<tr>
<th>Close-Up Lenses</th>
<th>With LS-100</th>
<th>With LS-110</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.153</td>
<td>ø8.5mm</td>
<td>ø7.7mm</td>
</tr>
<tr>
<td>No.135</td>
<td>ø5.2mm</td>
<td>ø4.8mm</td>
</tr>
<tr>
<td>No.122</td>
<td>ø3.2mm</td>
<td>ø1.6mm</td>
</tr>
<tr>
<td>No.110</td>
<td>ø1.3mm</td>
<td>ø0.4mm</td>
</tr>
</tbody>
</table>

(Theoretical values)

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Angle Finder Vn allows the measuring area and measurement display inside the viewfinder to be seen at an angle of 90° to the normal viewfinder optical axis. Angle Finder Vn can also be focused and the magnification can be set to 1x or 2x.
CHROMA METER CS-200

Accurate measurement Comparable to Spectroradiometers

Perfect match of the spectral response to the CIE color-matching functions
Konica Minolta’s newly-developed spectral fitting method provides tristimulus values (XYZ = red, green, blue) with significantly higher accuracy than that of conventional tristimulus colorimeters. This is achieved by using the output from 40 sensors to calculate the spectral response corresponding to human eye sensitivity (CIE 1931 color-matching functions).
The CS-200 uses 40 sensors for sensitivity covering the entire visible region and multiplies each sensor output by appropriate coefficients. This adjusts the spectral response of the instrument to close to the CIE 1931 color-matching functions.

In addition to the 2° Standard Observer, the 10° Standard Observer (for object-color measurements) can also be selected, which is impossible with conventional tristimulus colorimeters.

Compact and lightweight. Battery power is also possible.
The compact, lightweight and stylish body allows hand-held operation.
The CS-200 can be operated with either four AA batteries (battery indicator function provided) or a special AC adapter.

Selectable measuring angle
While checking the actual subject, you can select the measuring angle easily according to the application (1°, 0.2° and 0.1°).
The aperture mirror eliminates misalignment between the finder target and the actual measuring spot, ensuring accurate aiming.

Measuring distance and measuring area

<table>
<thead>
<tr>
<th>Measuring angle</th>
<th>Minimum measuring area</th>
<th>Maximum measuring area</th>
<th>Minimum measuring distance</th>
<th>Maximum measuring distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Unit: mm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Without a Close-Up Lens</td>
<td>4.7 1.0 0.5</td>
<td>= = =</td>
<td>206</td>
<td>=</td>
</tr>
<tr>
<td>Close-up lens No. 122</td>
<td>2.2 0.5 0.3</td>
<td>4.6 1.0 0.5</td>
<td>128</td>
<td>240</td>
</tr>
<tr>
<td>Close-up lens No. 107</td>
<td>0.8 0.2 0.1</td>
<td>1.1 0.3 0.2</td>
<td>43</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>0.2º aperture</td>
<td>0.1º aperture</td>
<td>0.1º aperture</td>
<td>0.1º aperture</td>
</tr>
</tbody>
</table>

* Measuring distance is the distance from the front edge of the metal lens barrel or close-up lens ring.
CS-S10w Standard Edition allows users to control the CS-200 with a PC to display the list of measured data or to transfer the data to spreadsheet software.

<Functions common to Standard and Professional Editions>

- **Color space**: $L_v' x Y_v', L_u' u', L_v T_u v$, XYZ, dominant wavelength
- **Mode selection**: Normal mode, Object color mode
- **Instrument control**: Average measurement, Interval measurement, User calibration
- **Data management**: Reading and saving files, Data management with folders
- **Data evaluation**: Observer/Illuminant settings, Statistics display for each folder, Box tolerance setting

### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>Chroma Meter CS-200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement range</td>
<td>0.01 - 200,000 cd/m² (Measuring angle 1°)</td>
</tr>
<tr>
<td></td>
<td>0.01 - 5,000,000 cd/m² (Measuring angle 0.2°)</td>
</tr>
<tr>
<td></td>
<td>0.01 - 20,000,000 cd/m² (Measuring angle 0.1°)</td>
</tr>
<tr>
<td>Accuracy</td>
<td>150 cd/m² (for Illuminant A) $L_v \pm 2 % \times 1$ digit $x_0 y_0 \pm 0.002$</td>
</tr>
<tr>
<td></td>
<td>(Measuring angle 1°) #1 0.01-0.5 cd/m² (for Illuminant A) $L_v \pm 0.02 % \times 1$ digit $x_0 y_0 \pm 0.004$</td>
</tr>
<tr>
<td></td>
<td>(Temperature: 23°C, C, Relative humidity: 65% max.) 0.5-1 cd/m² (for Illuminant A) $L_v \pm 0.02 % \times 1$ digit $x_0 y_0 \pm 0.007$</td>
</tr>
<tr>
<td></td>
<td>1-10 cd/m² (for Illuminant A) $L_v \pm 2 % \times 1$ digit $x_0 y_0 \pm 0.004$</td>
</tr>
<tr>
<td></td>
<td>10-200 cd/m² (for Illuminant A) $L_u \pm 2 % \times 1$ digit $x_0 y_0 \pm 0.003$</td>
</tr>
<tr>
<td></td>
<td>500 cd/m² (for Illuminant A) $L_v \pm 1 % \times 1$ digit $x_0 y_0 \pm 0.006$</td>
</tr>
<tr>
<td>Repeatability</td>
<td>0.01-1 cd/m² (for Illuminant A) $L_v \pm 0.01 % \times 1$ digit $x_0 y_0 \pm 0.002$ (2 AUTO)</td>
</tr>
<tr>
<td></td>
<td>1-2 cd/m² (for Illuminant A) $L_v \pm 0.5 % \times 1$ digit $x_0 y_0 \pm 0.002$ (2 AUTO)</td>
</tr>
<tr>
<td></td>
<td>2-4 cd/m² (for Illuminant A) $L_u \pm 0.5 % \times 1$ digit $x_0 y_0 \pm 0.001$ (2 AUTO)</td>
</tr>
<tr>
<td></td>
<td>4-8 cd/m² (for Illuminant A) $L_v \pm 0.5 % \times 1$ digit $x_0 y_0 \pm 0.005$ (2 AUTO)</td>
</tr>
<tr>
<td></td>
<td>8-200 cd/m² (for Illuminant A) $L_v \pm 0.1 % \times 1$ digit $x_0 y_0 \pm 0.004$ (2 AUTO)</td>
</tr>
<tr>
<td>Measurement time</td>
<td>AUTO (Automatically set between approx. 1s and 60s)</td>
</tr>
<tr>
<td></td>
<td>LTD.AUTO (Automatically set to approx. 1s or 3s)</td>
</tr>
<tr>
<td></td>
<td>Super-FAST (approx. 0.5 sec/meas.) FAST (approx. 1 sec/meas.)</td>
</tr>
<tr>
<td></td>
<td>SLOW (approx. 3 sec/meas.) Super-SLOW (approx. 12 sec/meas.)</td>
</tr>
<tr>
<td>Measurement method</td>
<td>Spectral method, Grating + linear photo diode array</td>
</tr>
<tr>
<td>Minimum measuring area</td>
<td>0.5 mm</td>
</tr>
<tr>
<td>Minimum measuring distance</td>
<td>0.1 mm (close up lens)</td>
</tr>
<tr>
<td>Observer</td>
<td>2/10 degrees</td>
</tr>
<tr>
<td>Color space</td>
<td>$L_v x y$, $L_u u'$, $L_v T_u v'$, XYZ, dominant wavelength</td>
</tr>
<tr>
<td>Measurement synchronization setting range</td>
<td>Vertical synchronization frequency: 40.00 to 200.00Hz</td>
</tr>
<tr>
<td>Interface</td>
<td>USB 1.1</td>
</tr>
<tr>
<td>Power source</td>
<td>AC adapter or 4 AA-Size Batteries</td>
</tr>
<tr>
<td>Battery life</td>
<td>Approx. 3 hours (continuous measurement / Fast mode / AA-size alkaline cells)</td>
</tr>
<tr>
<td>Size</td>
<td>95 mm (W) x 127 mm (H) x 334 mm (L)</td>
</tr>
<tr>
<td>Weight</td>
<td>1.8 kg (without battery)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>0°C to 40°C, relative humidity 85% or less (at 35°C) with no condensation</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>0°C to 45°C, relative humidity 85% or less (at 35°C) with no condensation</td>
</tr>
</tbody>
</table>

### SYSTEM DIAGRAM

- **Standard accessories**
- **Optional accessories**

### DIMENSIONS

- **Fiber thread diameter (φ): 0.5 mm**
- **For tripod screw**
- **For M5 screw**

---

#1 23°C ±2°C $L_v = 0.01-10$ cd/m², SLOW, average of 30 measurements

#2 At 0.2° measuring angle, the amount of received light is approx. 1/25 of that for 1°. Therefore, the repeatability becomes the same as that for 1° with 25 times lower luminance. At 0.1° measuring angle, the amount of received light is approx. 1/100 of that for 1°. Therefore, the repeatability becomes the same as that for 1° with 100 times lower luminance.
**CHROMA METER CL-200A**

**De facto industry standard for measuring color temperature!**

Can also measure illuminance (JIS AA class)

**MAIN FEATURES**

Compact and easy to carry
The CL-200A’s compact body fits in your palm. Battery-powered so it can be taken along and used anywhere.

Detachable receptor head
The receptor head can be detached and then connected to the main body using a normal LAN cable, making it easy to install the sensor in an inspection system. *Optional Adapter Units required for receptor head and main body.

Data transfer using main body buttons
When using the CL-200A with Data Management Software CL-S10w (included), measurements can be taken and data transferred to Excel using the main body buttons as well as computer keys.

**Application examples**

**For lighting production and adjustment**
When using various types of light sources in a room or open space, it is sometimes necessary to check the color of the lighting. By using the CL-200A, it is possible to adjust the lighting color so that the food in a restaurant looks delicious.

**For evaluating light source**
Evaluation of the light distribution of LED illumination modules or the light distribution of lighting fixtures can be evaluated.

**For projector light-source research and color inspection**
The CL-200A can be used to measure the white balance and uniformity of microprojectors, etc., with internal LED light sources. The ability to connect multiple receptors using LAN cables enables measurement of not only a single point in the center, but up to a maximum of 50 points over the entire projected area.

**For LED billboard development and maintenance**
The CL-200A enables quality control of the LED module or digital signage to be performed easily. If modules with different color tones are used together, the billboard will look mottled. By measuring the chromaticity and color temperature of modules using the CL-200A and selecting modules based on their output values, billboard uniformity can be achieved.

**Special functions**

**S10w (included), measurements**
When using the CL-200A with Data Management Software CL-S10w (Standard accessory), color variations, the top topic in the LED industry, can be quantified and a ranking function is also provided.

**Multi-point measurement and use calibration also possible**
Multi-point measurement is possible using up to 30 receptor heads. User calibration function enables compensation of measurement values to match a desired standard. Calibration can be performed by two methods. Single-point calibration or RGB calibration.

**Main specifications of Data Management Software CL-S10w**

- **Easy, convenient Excel® add-in software included**
  - Data Management Software CL-S10w (standard accessory)

- **Measurement data from the CL-200A can be transferred directly into Excel®**. The transformed data can then be managed freely within Excel®.

- **Includes LED ranking**
  - Color variations, the top topic in the LED industry, can be quantified and a ranking function is also provided.

- **JIS correlated color**
  - Correlated color temperature is determined using the equations defined by JIS (Japanese Industrial Standard).

- **Multi-point measurement and use calibration also possible**
  - Multi-point measurement is possible using up to 30 receptor heads. User calibration function enables compensation of measurement values to match a desired standard. Calibration can be performed by two methods. Single-point calibration or RGB calibration.

**For accurate measurement of color temperature, use the CL-200A!**

**Measurement accuracies of CL-200A and photographic color meter**
When measuring light sources with non-continuous spectrums such as LEDs, etc., accurate illuminance color temperature is particularly required. The CL-200A can measure color temperature accurately.

**Photographic color meter**
In order to take more beautiful pictures, it is sometimes necessary to attach filters in front of the camera lens to compensate for the color of the light illuminating the subject. A photographic color meter is usually used to select the appropriate filters, with the sensitivity of its sensors adjusted to match that of the film or digital camera sensor. In addition, because it uses photographic color temperature, which is calculated based mostly on the blue/red balance of the illumination, large errors may occur if it is used to measure light sources with non-continuous spectrums.

**[Actual measurement data for daylight-color LED bulb]**

- **Color temperature**
  - **When a blackbody is heated, it begins to emit light, and as the temperature increases the color of the emitted light changes from red to yellow to white. Since the color of the emitted light is determined by the temperature of the blackbody, the color of the light emitted by the blackbody can be expressed using color temperature. The color temperature of the blackbody is calculated using the Planckian locus. For example, a 7000K color would be the color of the light emitted by a blackbody heated to 7000K.** Figure 1 shows the color of light emitted by a blackbody at various temperatures plotted on an x-y chromaticity diagram. This curve is called the “blackbody locus.” **Color temperature** increases as a color on this blackbody locus.

- **Correlated color temperature**
  - **Since the color of white light emitted by illumination equipment and displays is generally close to the blackbody locus, the color of such light sources is normally expressed using “color temperature.” However, the color of such light sources is not directly on the blackbody locus. Because of this, an easier way to express the color of light sources is needed.** This is called “correlated color temperature.” Figure 2 shows the correlated color temperature of light sources. It can be seen that the correlated color temperature is a linear function of color temperature, but the difference from the blackbody locus, normally in terms of Δu’v’, is large due to the difference between the Planckian locus and the CIE 1964 Color Matching Function.

**Figure 1: Black body locus on x-y chromaticity diagram**

**Figure 2: Close-up of black body locus on x-y chromaticity diagram showing correlated color temperature region**

**For information on luminance meter performance, see p.3.**

- **For information on luminance meter performance, see p.3.**
For accurate measurements of color temperature, use the CL-200A!

Measurement accuracies of CL-200A and photographic color meter

When measuring light sources with non-continuous spectrums such as LEDs, etc., accurate illumination color temperature is particularly required. The CL-200A can measure color temperature accurately.

**CL-200A**

The CL-200A has sensors that closely match the color-matching functions defined by the CIE (International Commission on Illumination), enabling precise color measurement. The measurement results can be displayed in various color notations such as “Correlated color temperature and Δuv” according to the application.

Photographic color meter

In order to take more beautiful pictures, it is sometimes necessary to attach filters in front of the camera lens to compensate for the color of the light illuminating the subject. A photographic color meter is a meter used to select the appropriate filters, with the sensitivity of its sensors adjusted to match that of the film or digital camera sensor. In addition, because it uses photographic color temperature, which is calculated based mostly on the blue/red balance of the illumination, large errors may occur if it is used to measure light sources with non-continuous spectrums.

[Actual measurement data for daylight-color LED bulb]

<table>
<thead>
<tr>
<th>Measured color temperature</th>
<th>Color-temperature difference from standard-instrument measured value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Our company's standard instrument</td>
<td>5045</td>
</tr>
<tr>
<td>CL-200A</td>
<td>5011</td>
</tr>
<tr>
<td>Photographic color meter</td>
<td>5600</td>
</tr>
</tbody>
</table>

**Color temperature and correlated color temperature**

When an ideal blackbody* is heated, it begins to emit light, and as the temperature increases the color of the emitted light changes from red to yellow to white. Since the color of the emitted light is determined by the temperature of the blackbody, the color of the light emitted by the blackbody can be expressed as the absolute temperature of the blackbody (in Kelvin). This color notation scale is called “color temperature.” For example, a 7000K color would be the color of the light emitted by a blackbody heated to 7000K. Figure 1 shows the color of light emitted by a blackbody at various temperatures plotted on an xy chromaticity diagram. This curve is called the "blackbody locus," and "color temperature" expresses a color on this blackbody locus.

**Correlated color temperature**

Since the color of white light emitted by illumination equipment and displays is generally close to the blackbody color, the color of such light sources is normally expressed using "color temperature". However, the color of such light sources is not directly on the blackbody locus. Because of this, a way to enable similar color expression for colors within a larger region close to the blackbody locus was devised. This is called "correlated color temperature", and the larger region is shown by the isotherms on the xy chromaticity diagram in Figure 2. To accurately express the correlated color temperature of a light-source color, it is necessary to state not only the correlated color temperature but the difference from the blackbody locus, normally in terms of Δuv.

---

*Blackbody

An ideal radiator. A body which completely absorbs all incident electromagnetic radiation.

Although a perfect blackbody does not actually exist, coal is a familiar object that acts similarly.
A compact, lightweight, battery-powered instrument with a 1° measurement angle for high-accuracy non-contact measurements of the luminance and chromaticity of light sources and reflective subjects

**EASY-TO-READ DISPLAY**

Viewfinder Image
- Measuring area (1°)
- Field of view (9°)
- Measured luminance (cd/m² or fL)

External display
- Measured value
- Measurement mode

**MAIN APPLICATIONS**

**Light-Source Measurements**
- Luminance and chromaticity of small light sources such as LEDs, miniature neon lamps, etc.
- Luminance and chromaticity of general light sources such as tungsten lamps, fluorescent lamps, etc.
- Luminance and chromaticity of traffic signals, airport guidance lights, emergency exit signs, etc.

**Reflective-Subject Measurements**
- Color measurements of subjects which cannot be measured by contact methods, such as distant building walls, just-painted surfaces, subjects with complicated shapes, or subjects which should not be touched for sanitary reasons.

**Display Measurements**
- Luminance and chromaticity of color TVs and CRTs
- Luminance measurements of monochrome TVs and SRTs
- Luminance and chromaticity of projection TVs and video projectors.

**MAIN FEATURES**

Compact and lightweight

**Measurements of subjects at a distance**
SLR (single-lens-reflex) viewing system and flare-free optical system provide accurate measurements of subjects at a distance with virtually no influence from light outside the measurement area.

**Measurements of small subjects**
1° measurement angle allows measurements of subjects as small as ø14.4mm (at a subject distance of 1014mm); by using optional Close-Up Lenses, subjects as small as ø1.3mm can be measured.

Color difference can also be measured

Calibration to a user-selected reference is also possible

Luminance units of cd/m² or fL can be selected
SPECIFICATIONS

Model: Chroma Meter CS-100A
Type: SLR spot colorimeter for measuring light-source and surface luminance and chromaticity

Measuring angle: 1°
Optical system: 85mm f/2.8 lens; SLR viewing system; flare factor less than 1.5%

Angle of view: 5° with 1° measurement area indication

Focusing distance: 1014mm (40 in.) to infinity
Receptors: 3 silicon photocells filtered to detect primary stimulus values for red, green and blue light

Spectral response: Closely matches CIE 1931 Standard Observer curves (x̄, ȳ, and z̄)

Response time: FAST: Sampling time: 0.1s, Time to display: 0.8 to 1.0s; SLOW: Sampling time: 0.4s, Time to display: 1.4 to 1.6s

Luminance units: cd/m² or fL (switchable)

Measuring range: FAST: 0.01 to 299,000cd/m² (0.01 to 87,530fL); SLOW: 0.01 to 49,900cd/m² (0.01 to 14,500fL)

Accuracy:
- Luminance (Y): ±2% of reading ±1 digit
- Colorimetry (x,y): ±0.004 (Illuminant A measured at ambient temperature of 18 to 28°C/64 to 82°F)

Repeatability:
- Luminance (Y): ±0.2% of reading ±1 digit
- Colorimetry (x,y): FAST: ±100cd/m² or above: ±0.001; 48.1 to 99.9cd/m²: ±0.002 below 48.1cd/m²: below measurement range
- SLOW: ±25.0cd/m² or above: ±0.001; 12.0 to 24.9cd/m²: ±0.002 below 12.0cd/m²: below measurement range

Target value:
- 1: set by measurement or numerical input

Measurement modes:
- Absolute color: Y; color difference: d(YY)

Display:
- External: LCD; 3 values (Y, x, and y) of 3 digits each with additional indications
- Viewfinder: 3-digit LCD (showing luminance value Y) with LED backlight

Data communication:
- RS-232C; baud rate: 4800bps

External control:
- Measurement process can be started by external device connected to data output terminal

Power source:
- One 9V battery; power can also be supplied via data output terminal

Operating temperature/humidity range:
- 0 to 40°C, relative humidity 85% or less (at 35°C) with no condensation

Storage temperature/humidity range:
- -20 to 55°C, relative humidity 85% or less (at 35°C) with no condensation

Dimensions:
- 79x208x154mm (3-1/8x8-3/16x6-1/16 in.)

Weight:
- 890g (2 lb.) without battery

Standard accessories:
- Lens cap; Eyepiece cap; Protective filter, ND eyepiece filter; 9V battery; Chromaticity chart; Case

Specifications are subject to change without notice.

OPTIONAL ACCESSORIES

SYSTEM DIAGRAM (Optional Accessories)

Close-Up Lenses
- No. 110
- No. 135
- No. 153

Angle Finder VN
- Angle Finder VN allows the measuring area and measurement display inside the viewfinder to be seen at an angle of 90° to the normal viewfinder optical axis. Angle Finder VN can also be focused and the magnification can be set to 1x or 2x.

Data Management Software

CS-S10w Professional (Optional accessory)

Color space:
- L* x y, L* u’ v’, L* T,u,v , XYZ, dominant wavelength

Mode selection:
- Normal mode, Object color mode, Contrast mode
- RGB mode, RGB & contrast mode

Instrument control:
- Average measurement, Interval measurement

Data management:
- Reading and saving files, Data management with folders
- Creating, saving and loading templates

Data evaluation:
- Box tolerance setting, Multiple-point measurement, uniformity display, contrast display and polygon tolerance setting for display evaluation

Dimensions:
- Units: mm

System requirements:
- Operating system:
  - Windows® XP Professional 32-bit SP3, 64-bit SP2
  - Windows® Vista Business 32-bit, 64-bit
  - Windows® 7 Professional 32-bit, 64-bit
- CPU:
  - Pentium® IV 600 MHz equivalent or higher
- Memory:
  - 128 MB min. (256 MB or more recommended)
- Hard disk:
  - 60 MB or more space required for installation
- Display:
  - 1124 X 768, 256 colors or more
- Other:
  - CD-ROM drive, USB port

Windows® and Pentium® are trademarks of Microsoft Corporation in the USA and other countries.

Pentium® is a trademark of Intel Corporation in the USA and other countries.
SAFETY PRECAUTIONS

For correct use and for your safety, be sure to read the instruction manual before using the instrument.

- Always connect the instrument to the specified power supply voltage. Improper connection may cause a fire or electric shock.
- Be sure to use the specified batteries. Using improper batteries may cause a fire or electric shock.

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