2D Color Analyzer
CA-2500

Ideal for display mura (nonuniformity) evaluation and inspection on smartphones and tablet PCs.

Accurately and easily measures the distribution of luminance and chromaticity.
XYZ filters provide high correlation with the spectral response of the human eye.

Instead of the RGB color-separation filters used by digital video cameras, etc., the CA-2500 uses XYZ filters that closely match the CIE 1931 color-matching functions to provide luminance and chromaticity measurements that have high correlation with the spectral response of the human eye.

Comprehensive factory calibration

Each lens is individually factory-calibrated at multiple focal points to correct for sensitivity variations due to the combination of sensor, optical filters, and the lens itself. By using the included calibration data, high-accuracy measurements of luminance and chromaticity distribution can be taken immediately after receiving the product without being restricted to a particular measurement method, subject size or subject brightness.

Even flickering light sources such as OLED televisions or PDP can be measured with good accuracy.

The synchronization frequency (4 to 2,000 Hz) of display devices and pulsed light sources can be input to enable synchronized measurements.

Expanded low-luminance measurement range

The minimum measurable luminance has been improved from 0.1 cd/m² to 0.05 cd/m².

Improved durability

Service life measurement cycles have been increased to approximately 5 times that of the CA-2000.

Interchangeable lenses for measurements of various subjects

Standard, wide-angle, and telephoto lenses (plus two macro rings for the telephoto lens) are available, enabling the optimum lens to be selected according to the particular subject, measurement area, or measurement method.

XYZ filters provide high correlation with the spectral response of the human eye.

Comprehensive factory calibration

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Expanded low-luminance measurement range

Improved durability

Interchangeable lenses for measurements of various subjects
The small, lightweight body lets the CA-2500 be used in a wide variety of fields, such as display, illumination, automotive, aviation, and other industries.

Includes advanced Data Management Software CA-S25w as standard accessory
Advanced functions such as focus assist, positioning assist, and automatic measurement area extraction greatly simplify troublesome measurement preparations and data evaluation.

Includes SDK (software development kit)
The SDK can be used by customers to efficiently create their own software for controlling the CA-2500. SDK for Labview® also available.

Applications
- Simultaneous luminance/chromaticity distribution measurement of multiple small- or medium-sized LCD or organic EL panels
- Luminance/chromaticity measurement of single large-sized LCD or organic EL panels
- Display mura (unevenness) evaluation
- Luminance distribution measurements in illumination field
- Measurements of luminance/correlated color temperature distribution of various light-emitting subjects
- Luminance distribution measurements of automobile instrument panel meters
- Measurement of distribution of luminance and chromaticity on screen image from projectors

Optional Mura Evaluation Software
This optional software uses an exclusive algorithm to enable mura (unevenness) evaluation that more closely correlates with visual evaluation. (Details on later page.)

Dimensions (Unit: mm)
*When standard lens and lens hood are attached
Data Management Software CA-S25w

The included software provides advanced functionality with simple operation to make the entire measurement process easier, from measurement preparations such as focusing and positioning through measurements of luminance and chromaticity distribution to evaluation of measurement results.

GUI assists with normal workflow

Easy-to-understand screens with easy-to-use tools
The new CA-S25w software can also be used with existing CA-2000 instruments. It provides vast improvements over the previous CA-S20w software, while also being able to read data measured and saved using CA-S20w. Visit our website to download the latest CA-S25w free of charge.

Focus assist function
Focus adjustment can be performed easily by viewing the cross-sectional slope of the luminance at the border between bright and dark areas.

When subject is not in focus
When subject is in focus

Positioning assist function
The positioning and orientation (tilt and twist) of the CA-2500 relative to the measurement subject can be easily checked while making fine adjustments, reducing the work and time required to achieve proper positioning and orientation.

Automatic measurement area extraction function
The light-emitting areas of measurement subjects can be automatically extracted and set as evaluation regions. This eliminates the need for manually defining and positioning evaluation regions, reducing the setup time required.

Various data evaluation screens
Pseudocolor display
Luminance and chromaticity distribution can be easily observed.

Spot measurement
The size and number of spots to be evaluated (indicated by black circles in the screen example above) can be freely defined by the user to enable multi-point measurement using the average values of each spot. Up to a maximum of 2500 spots can be defined.

Chromaticity diagram display
Variations in chromaticity can be displayed on the chromaticity diagram display.

Multi-subject measurement capability
Evaluation of the mura (unevenness) of multiple subjects can now be performed simultaneously. With the previous CA-S20w, the same tone gradation scale was used for all subjects; if subject luminances were very different, adjusting the scale to properly view one subject caused saturation of tones in evaluation areas for other subjects. But with CA-S25w, each evaluation area has its own tone gradation scale which can be individually adjusted according to the subject luminance. This allows the mura of multiple subjects with widely different luminances to be viewed simultaneously on the same screen.

Other convenient functions
Data transfer to Excel®, etc.
The desired range of data or spot values can be selected and transferred to Excel®, Word®, etc. via the clipboard. The various graphs and displays can also be copied and pasted, making it easy to create reports.

Multiple exposure function
By combining measurement data obtained using exposure times optimized for different luminance levels, subjects requiring a wide dynamic range (such as a gray scale) can be easily measured.

CSV file import
Measurement data can be stored in CSV format. The stored CSV-format data can then be imported and displayed in pseudocolor graphs, etc.

User color gamut calibration
User calibration can be performed for each color gamut of the measurement subject, improving chromaticity measurement accuracy when measuring subjects that use multiple colors, such as automobile instrument panels that use LEDs of various colors.
Quantification of luminance and chromaticity mura (unevenness) of various types of displays using 3 original index values: Luminance evaluation value, Color evaluation value, and Generic mura evaluation value.

In the past, it has been difficult to quantitatively define the degree of mura of displays. Mura Evaluation Software CA-Mura processes the measurement data from the 2D Color Analyzer CA-2500 to provide mura values that closely correlate with the degree of mura determined by visual evaluation. The closer these values are to zero, the less mura exhibited by the display.

CA-Mura display example

Shown below are the CA-Mura evaluation data for three kinds of displays with different degrees of mura measured using the 2D Color Analyzer CA-2500. *Sample display images are examples only.

Algorithm

CA-Mura determines the luminance distribution and chromaticity distribution from the XYZ data measured by the 2D Color Analyzer, and applies the spatial characteristics of human vision.

These data are then converted to the L*a*b* color space, and after edge and light/dark processing (for luminance mura) and high-chromaticity processing (for chromaticity mura), the Luminance evaluation value (LEV), Color evaluation value (CEV), and the Generic mura evaluation value (GMEV) based on LEV and CEV are calculated.

Determination of these values is performed using the mura quantitative evaluation method developed by Sony Corporation.
System Diagram

Components other than those shown in the areas shaded are common for all packages.

Measurable object size with typical measurement distances (Width/height of measurement square)

<table>
<thead>
<tr>
<th>Distance (mm)</th>
<th>Standard lens</th>
<th>Wide lens</th>
<th>Telephoto lens</th>
<th>Low magnification macro ring</th>
<th>High magnification macro ring</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Measurement size (mm)</td>
<td>Measurable display size (inches)</td>
<td>Measurement size (mm)</td>
<td>Measurable display size (inches)</td>
<td>Measurement size (mm)</td>
</tr>
<tr>
<td>250</td>
<td>98</td>
<td>4.4</td>
<td>4.8</td>
<td>190</td>
<td>8.6</td>
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<tr>
<td>300</td>
<td>121</td>
<td>5.5</td>
<td>6</td>
<td>235</td>
<td>11</td>
</tr>
<tr>
<td>500</td>
<td>212</td>
<td>9.6</td>
<td>10.4</td>
<td>416</td>
<td>19</td>
</tr>
<tr>
<td>1,000</td>
<td>439</td>
<td>20</td>
<td>22</td>
<td>869</td>
<td>39</td>
</tr>
<tr>
<td>2,000</td>
<td>892</td>
<td>40</td>
<td>44</td>
<td>1,776</td>
<td>80</td>
</tr>
<tr>
<td>3,000</td>
<td>1,345</td>
<td>61</td>
<td>66</td>
<td>2,682</td>
<td>121</td>
</tr>
<tr>
<td>5,000</td>
<td>2,252</td>
<td>102</td>
<td>111</td>
<td>4,495</td>
<td>203</td>
</tr>
</tbody>
</table>

Data Management Software CA-S25w

System Requirements

- **OS**: Windows® 7 Professional 32-bit, 64-bit
- **CPU**: Pentium® 4 2.8 GHz equivalent or higher
- **Memory**: 1,024 MB or more
- **Hard Disk**: Needs free space of at least 80 MB on system drive (where OS is installed)
  - In addition, each lens needs the following free spaces for installing calibration data.
    - For standard lens: approx. 540 MB
    - For wide lens: approx. 470 MB
    - For telephoto lens: approx. 1.3 GB
  - To save measurement data on hard disk, additional free space is required (approx. 110 MB for 10 measurement data)
    - Approx. 1 MB required for setting files containing spot settings, measurement condition settings, etc.
- **Display**: Display capable of at least 1,280 x 768 dots / 65,536 colors (High color, 16-bit)
- **Others**: Optical drive capable of reading CD-ROM (for installing software) and DVD-ROM (for installing calibration data) necessary.
  - **USB port**: For connecting measuring instrument
- **Controllable instruments**: CA-2000; CA-2500
- **Display language**: English, Simplified Chinese, or Japanese (Selectable at time of installation)
Main Specifications CA-2500

Model
- CA-2500S
- CA-2500W
- CA-2500T

Receptor
- CCD image sensor (monochrome); 2/3-inch; Effective number of pixels: 1,000 x 1,000 pixels; Equipped with XYZ filter (closely matches CIE 1931 (CIE xy, L) function) and ND filter.

Lens
- Interchangeable: Standard, wide, and telephoto lenses; low-magnification and high-magnification macro rings (for use with telephoto lens).

Measurement points (Resolution)
- 980 x 980 (490 x 490 or 196 x 196 selectable by using Data Management Software CA-2526).

Color indication modes
- XYZ, Lxy, LuvV, TavV, Dominant wavelength, Excitation purity, L∗ contrast.

Display modes
- Pseudocolor, Chromaticity diagram, Spot, Cross section, Color difference.

Measurement sizes (length per side of square) (1)
- Standard lens
  - Approx. 98 mm or more (depending on the distance)
  - Approx. 145 mm or more (depending on the distance)
  - Approx. 115 mm or more (depending on the distance)

- Telephoto lens
  - Approx. 57 mm (Fixed)
  - Approx. 72 mm (Fixed)

Measureable size for typical measurement distances (size/distance)
- 98 mm / 250 mm
- 210 mm / 500 mm
- 440 mm / 1,000 mm
- 890 mm / 2,000 mm

Measureable size for typical measurement distances (including ND filter use)
- 0.05 - 100,000 cd/m²
- 0.05 - 100,000 cd/m²
- 0.25 - 100,000 cd/m²
- 0.25 - 100,000 cd/m²
- 0.5 - 100,000 cd/m²

Measurement time (2)
- Single: Approx. 5 sec. or more; 4-time integration: Approx. 6 sec. or more; 16-time integration: Approx. 10 sec. or more; 64-time integration: Approx. 20 sec. or more.

Accuracy (3)
- Luminance: ±2 %
- Chromaticity: ±0.005
- Inter-point error (5)
  - Chromaticity (a6) ±2 %
  - Chromaticity (a7) ±3 %

Repeatability (4)
- Luminance: ±0.5 %
- Chromaticity: ±0.001

Other functions
- Measurement sync (Synchronization frequency selectable), User calibration, Integration function.

Interface
- USB 2.0 or higher.

Storage temperature / humidity range (8)
- 10-30°C, Relative humidity 70% or less/No condensation.

Weight
- Approx. 300 g

Power
- AC Adapter 100-240 V, ~, 0.7 A, 50-60 Hz.

CAUTIONS REGARDING TEMPERATURE / HUMIDITY CONDITIONS FOR CA-2500

It is recommended that the instrument be used and stored under standard conditions (Temperature: 23°C; Relative humidity: 40%), and that areas subject to high temperature and/or humidity be avoided. In addition, in order to maintain the measurement accuracy of this instrument, it is recommended that it be inspected regularly about once a year. For details on having the instrument inspected, please contact the nearest Konica Minolta authorized service facility.

Even if the product is used within the specified operating temperature/humidity range or stored within the specified storage temperature/humidity range, the displayed values may be affected by long-term conditions of use or storage.

If the instrument is left under the following high-temperature conditions for a long period of time, the displayed values may change as follows:

- Temperature: 30°C; Relative humidity: 70%; Period under these conditions: 720 hours (30 days)

Accuracy: Luminance: ±0.5%; Chromaticity: ±0.003

- Temperature: 39°C; Relative humidity: 55%; Period under these conditions: 336 hours (14 days)

Accuracy: Luminance: ±1%; Chromaticity: ±0.006

These differences in display values are due to the instrument materials and/or components being affected by the temperature and humidity conditions of long-term use or storage. In particular, optical filters are easily affected by temperature or humidity. Although measures have been taken to improve resistance to temperature/humidity changes, the accumulated effect of long-term use or storage may affect the displayed values.

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Some lamp control methods may make accurate measurements difficult. For details, please contact your nearest Konica Minolta sales office or dealer.

If you have any questions about specifications, please contact your Konica Minolta representative.

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