

World's top level capability to detect extremely low luminance

* As a polychromator type spectroradiometer (As of November 2007)

100,000:1 contrast measurement is now possible!

* When the peak luminance is 300 cd/m²

Since the commencement of high-definition TV broadcasting, there is an accelerating proliferation of high-quality display devices which support full HD for reproduction of sharp, high-resolution images. State-of-the-art technology is now achieving tone reproduction with contrasts of 100,000 : 1, offering an almost-real feeling. This has spurred technical competition for reproduction of "blacker blacks" in particular, resulting in the need for an instrument that can measure extremely low luminance.

In addition, the development of various light-emitting devices, including organic electroluminescent (EL) displays as well as conventional LCD and plasma displays, requires more accurate spectrum analysis. The CS-2000 is a polychromator-type spectroradiometer which achieves 100,000 : 1 contrast measurement with the world's top level capability to detect extremely low luminance levels of 0.003 cd/m².

Highly accurate measurement of luminances as low as 0.003 cd/m²

Konica Minolta's original optical design and signal-processing technologies provide accurate measurement of luminance/chromaticity down to extremely low luminances of 0.003 cd/m².

Low-luminance measurements: From 0.003 cd/m²

Measurement accuracy: $\pm 2\%$ (Luminance)

Quick measurements even at low luminance

Designed to thoroughly eliminate mechanical and electrical noise factors, the CS-2000 makes quick measurements with good repeatability possible even at low luminance levels.

Measurement time for 1 cd/m²:

Approx. 5 sec. (FAST mode)

* Konica Minolta's previous model CS-1000: Approx. 123 sec.

Low polarization error

The polarization error generated when using a reflection-type diffraction grating has been minimized to 2% (measuring angle: 1°). This ensures more stable measurements of display devices that use polarization, such as LCDs.

Half bandwidth of 5 nm

A half bandwidth of 5 nm, which is required for colorimetry (JIS Z 8724-1997, CIE122-1996), is ensured for the entire wavelength range, allowing accurate chromaticity measurements.

Selectable measuring angle for measurement of tiny areas

The CS-2000 enables you to select the optimum measuring angle according to the application.

Measuring angle selection: 1°, 0.2°, 0.1°

Minimum measuring area: $\varnothing 0.1$ mm (when the optional close-up lens is attached)



Measurement example:
Measurement of an organic EL illumination panel during development

Practical design

- The operating temperature range of 5 to 35°C ensures reliable operation at temperatures in actual work environments.
- Measurement can be started after a warm-up time of only 30 seconds. (Measuring angle: 1°; Target luminance: 5 cd/m² or more; 23°C)

Stable measurement even of periodic light sources

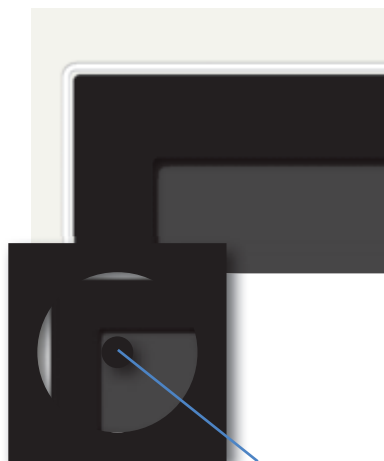
1. Internal synchronization measurement
Measurement at numerically-input frequency
2. External synchronization measurement
Measurement with line input of vertical synchronization signal to instrument
3. Multi-integration mode measurement
Measurement for reducing variations due to unsynchronized measurements or synchronized measurements of sources having irregular light-emission cycles

Measurements of various objects are possible by selecting the best-suited measuring angle.

1° is suitable for

Typical targets such as middle- and large-size display units

- LCD, PDP, or EL display panels
- LCD panels of cellular phones and digital cameras
- Radar and other instrument panels used in airplane cockpits
- Large outdoor display screens



Measuring diameter viewed through viewfinder

0.2° is suitable for

Small light sources such as LEDs

- Car audio systems
- Instrument panels for automobiles
- Lamps, fluorescent tube backlights, and other light sources



0.1° is suitable for

Extremely small light sources or distant lights

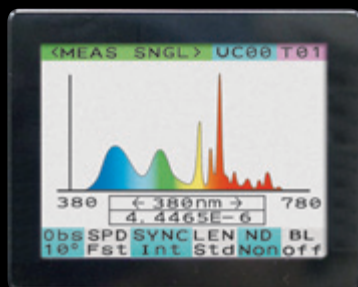
- PDP or LCD pixels
- Cold-cathode tubes
- Brake lamps of automobiles
- Traffic signals



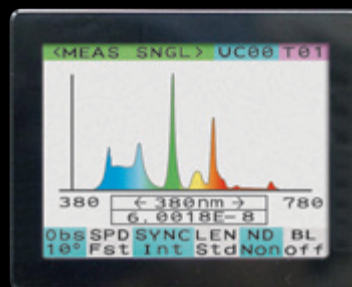
LCD pixels

Measurement Examples

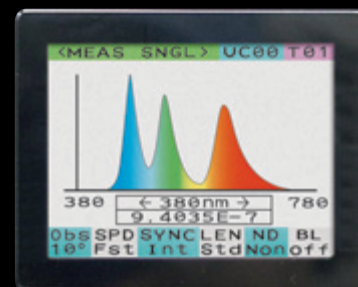
PDP



LCD



Organic EL



Close-up lens for measurement of even tinier areas

(Optional accessory)

Optional close-up lens allows measurements of areas as tiny as $\phi 0.1$ mm. Not only general display units but also small targets can be measured.



Measuring distance vs. measuring area

(Units: mm)

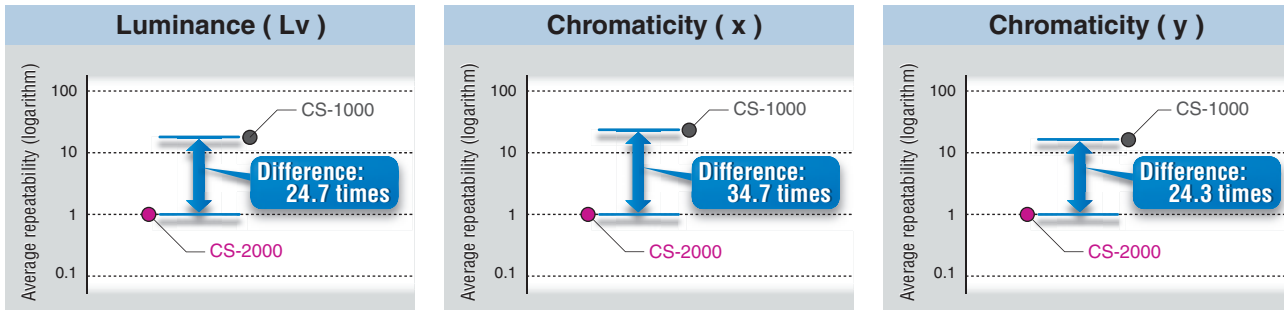
Measuring distance	Measuring angle		
	1°	0.2°	0.1°
When a close-up lens is attached	55.0	$\phi 1.00$	$\phi 0.20$
	70.9	$\phi 1.39$	$\phi 0.28$
350	$\phi 5.00$	$\phi 1.00$	$\phi 0.50$
500	$\phi 7.78$	$\phi 1.56$	$\phi 0.78$
1,000	$\phi 16.66$	$\phi 3.33$	$\phi 1.67$
2,000	$\phi 34.18$	$\phi 6.84$	$\phi 3.42$

* The measuring distance is the distance from the objective lens or the end of the metal frame of the close-up lens.

Comparison of repeatability

* Comparison with Konica Minolta's previous model CS-1000 for target luminance of 0.1 cd/m²

* The y-axis indicates the logarithm when the average of the CS-2000 measured values is assumed to be 1.



High repeatability achieved by an instrument design which thoroughly eliminated mechanical and electrical noise factors.

Measured luminance vs. Measurement times

(Units: sec.)

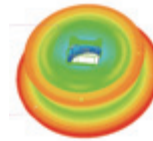
Luminance (cd/m ²)	NORMAL mode	FAST mode
0.003	243	35
0.01	243	35
0.1	155	27
1	19	5
10	4	4
300	3.7	3.7

Measurement subject: Standard light source A

* All time indications are approximate values.

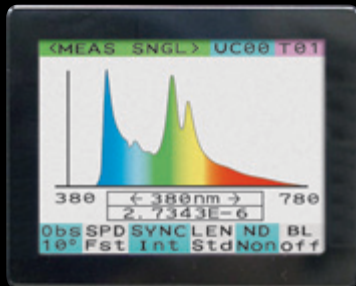
Technology

The optical sensor, which is the heart of the CS-2000, was designed through precise analysis in order to eliminate the influence of thermal distortion of its components on the measurement values.



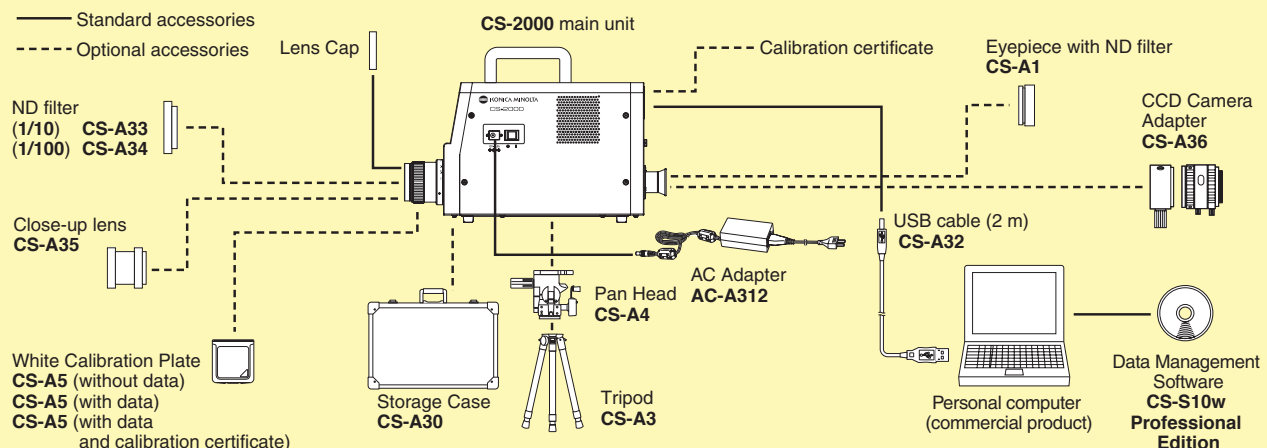
Thermal analysis diagram of the sensor block

Projector



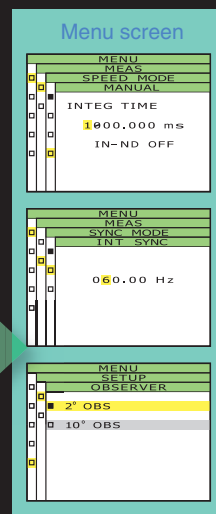
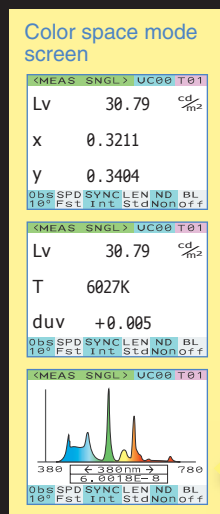
Measurement example:
A display panel with a high contrast ratio (Image)

System Configuration



Easy operation with color LCD screen and simple operation panel

The color LCD screen and operation panel are located at the rear of the instrument. The simply arranged operation panel enables intuitive selection of necessary functions.



Simple operation
The desired function can be called intuitively.

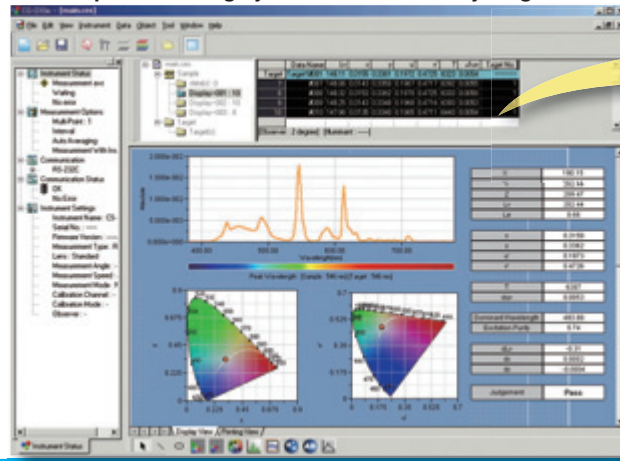
Easy connection via USB



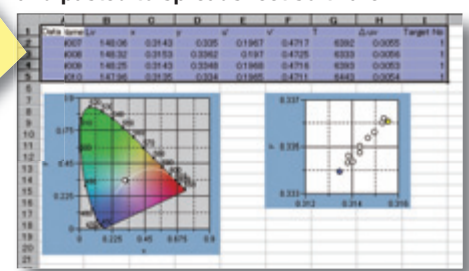
Data Management Software CS-S10w Professional (standard accessory)

With this software, the CS-2000 can be controlled from a personal computer to display measured data in various graphs or lists, to transfer data to spreadsheet software, or to copy-and-paste data. CS-S10w offers various data management, analysis and evaluation options to assist in research and development or quality control.

Template showing xy and u'v' chromaticity diagrams



Multiple data objects can be copied and pasted to spreadsheet software.



- Windows® is a trademark or registered trademark of Microsoft Corporation in the USA and other countries.
- Pentium® is a trademark of Intel Corporation in the USA and other countries.

Display	Spectral graph, spectral data list, chromaticity diagram
Color space mode	$L_x, xy, L_u, v', L_v, T_{\Delta uv}, XYZ$, dominant wavelength, excitation purity
Calculation	Four basic arithmetic operations and function processing of spectral data
Mode selection	Normal mode, contrast mode, RGB mode, RGB & contrast mode, object color mode
Instrument control	Averaging measurement, interval measurement, user calibration
Data management	Reading/saving files; managing data by using folders; creating, saving and reading templates with various graphs designed and laid-out by users; displaying data with graphs
Data evaluation	Observer/illuminant setting, color rendering property evaluation, statistic value display for each folder, box tolerance setting, multiple point setting for display evaluation, non-uniformity (mura) display, contrast display, polygonal tolerance setting

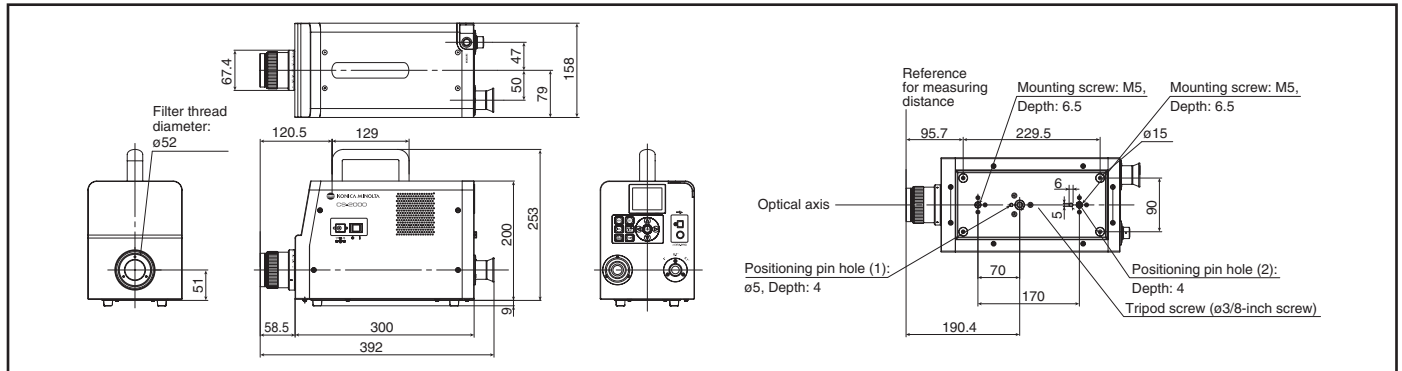
System requirements	
OS	Windows® 2000 Professional SP4, Windows® XP Professional SP2/x64 Edition, Windows® Vista Business 32-bit (x86)/64-bit (x64)
CPU	Pentium® III 600 MHz equivalent or faster (recommended)
Memory	128 MB or more (256 MB or more recommended)
Hard disk	60 MB or more of free space for installation
Display	1024 x 768, 256 colors minimum
Other	CD-ROM drive for installation, USB port for instrument connection

Major specifications of CS-2000

Model	CS-2000		
Wavelength range	380 to 780 nm		
Wavelength resolution	0.9 nm/pixel		
Display wavelength bandwidth	1.0 nm		
Wavelength precision	±0.3 nm (Median wavelength: 435.8 nm, 546.1 nm, 643.8 nm; Hg-Cd lamp)		
Spectral bandwidth	5 nm or less (half bandwidth)		
Measuring angle (selectable)	1°	0.2°	0.1°
Measurement luminance range (Standard light source A)	0.003 to 5,000 cd/m ²	0.075 to 125,000 cd/m ²	0.3 to 500,000 cd/m ²
Minimum measuring area	∅5 mm (∅1 mm when using close-up lens)	∅1 mm (∅0.2 mm when using close-up lens)	∅0.5 mm (∅0.1 mm when using close-up lens)
Minimum measuring distance	350 mm (55 mm when using close-up lens)		
Minimum luminance display	0.00002 cd/m ²		
Accuracy: Luminance (Standard light source A)*1	±2%		
Accuracy: Chromaticity (Standard light source A)*1	x,y :±0.003 (0.003 to 0.005 cd/m ²) x,y :±0.002 (0.005 to 0.05 cd/m ²) x :±0.0015 (0.05 cd/m ² or more) y :±0.001	x,y :±0.003 (0.075 to 0.125 cd/m ²) x,y :±0.002 (0.125 to 1.25 cd/m ²) x :±0.0015 (1.25 cd/m ² or more) y :±0.001	x,y :±0.003 (0.3 to 0.5 cd/m ²) x,y :±0.002 (0.5 to 5 cd/m ²) x :±0.0015 (5 cd/m ² or more) y :±0.001
Repeatability: Luminance (2σ) (Standard light source A)*2	0.4% (0.003 to 0.05 cd/m ²) 0.3% (0.05 to 0.1 cd/m ²) 0.15% (0.1 to 5,000 cd/m ²)	0.4% (0.075 to 1.25 cd/m ²) 0.3% (1.25 to 2.5 cd/m ²) 0.15% (2.5 to 125,000 cd/m ²)	0.4% (0.3 to 5 cd/m ²) 0.3% (5 to 10 cd/m ²) 0.15% (10 to 500,000 cd/m ²)
Repeatability: Chromaticity (2σ) (Standard light source A)*2	0.002 (0.003 to 0.005 cd/m ²) 0.001 (0.005 to 0.1 cd/m ²) 0.0006 (0.1 to 0.2 cd/m ²) 0.0004 (0.2 to 5,000 cd/m ²)	0.002 (0.075 to 0.125 cd/m ²) 0.001 (0.125 to 2.5 cd/m ²) 0.0006 (2.5 to 5 cd/m ²) 0.0004 (5 to 125,000 cd/m ²)	0.002 (0.3 to 0.5 cd/m ²) 0.001 (0.5 to 10 cd/m ²) 0.0006 (10 to 20 cd/m ²) 0.0004 (20 to 500,000 cd/m ²)
Polarization error	1°: 2% or less (400 to 780 nm); 0.1° and 0.2°: 3% or less (400 to 780 nm)		
Integration time	Fast: 0.005 to 16 sec.; Normal: 0.005 to 120 sec.		
Measurement time	1 sec. minimum (Manual mode) to 243 sec. maximum (Normal mode)		
Color space mode	L _{xy} , L _{u'v'} , L _v TΔuv, XYZ, spectral graph, dominant wavelength, excitation purity		
Interface	USB 1.1		
Operating temperature/humidity range	5 to 35°C, relative humidity 80% or less with no condensation		
Storage temperature/humidity range	0 to 35°C, relative humidity 80% or less with no condensation		
Power	AC adapter (100 - 240 V _~ , 50/60 Hz)		
Current consumption	Approx. 20 W		
Size	158 (W) x 262 (H) x 392 (D) mm		
Weight	6.2 kg		

*1: Average of 10 measurements in Normal mode at a temperature of 23±2°C and a relative humidity of 65% or less.
*2: 10 measurements in Normal mode at a temperature of 23±2°C and a relative humidity of 65% or less.

Outer dimensions (Units: mm)



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.

The specifications and drawings given here are subject to change without prior notice.
- If you have any questions about specifications, please contact your Konica Minolta representative.



<p>KONICA MINOLTA SENSING, INC. Konica Minolta Sensing Americas, Inc. Konica Minolta Sensing Europe B.V.</p>	<p>Osaka, Japan New Jersey, U.S.A. European Headquarter /BENELUX German Office French Office UK Office Italian Office Belgian Office Swiss Office Nordic Office Austrian Office Polish Office</p>	<p>Phone : 888-473-2656(in USA), 201-236-4300(outside USA) Nieuwegein, Netherland München, Germany Roissy CDG, France Milton Keynes, United Kingdom Milan, Italy Zaventem, Belgium Dietikon, Switzerland Västra Frölunda, Sweden Wien, Austria Warszawa, Poland</p>	<p>Fax : 201-785-2480 +31(0)30 248-1280 +49(0)89 630267-9799 +33(0)1 493-84771 +44(0)1908 540-629 +39 02 39011.425 +32 (0)2 7170 933 +41(0)43 322-9800 +46(0)31 7099464 +43(0)1 87882-430 +48(0)22 56033-00</p>
<p>Konica Minolta (CHINA) Investment Ltd.</p>	<p>SE Sales Division SE Beijing Office SE Guangzhou Office</p>	<p>Shanghai, China Beijing, China Guangzhou, China Singapore Seoul, Korea</p>	<p>Phone : +86-021-5489 0202 +86-010-8522 1551 +86-020-3826 4220 +65 6563-5533 +82(0)2-523-9726</p>
<p>Konica Minolta Sensing Singapore Pte Ltd. KONICA MINOLTA SENSING, INC.</p>	<p>Seoul Office</p>	<p>Seoul, Korea</p>	<p>Fax : +86-021-5489 0005 +86-010-8522 1241 +86-020-3826 4223 +65 6560-9721 +82(0)2-523-9729</p>