

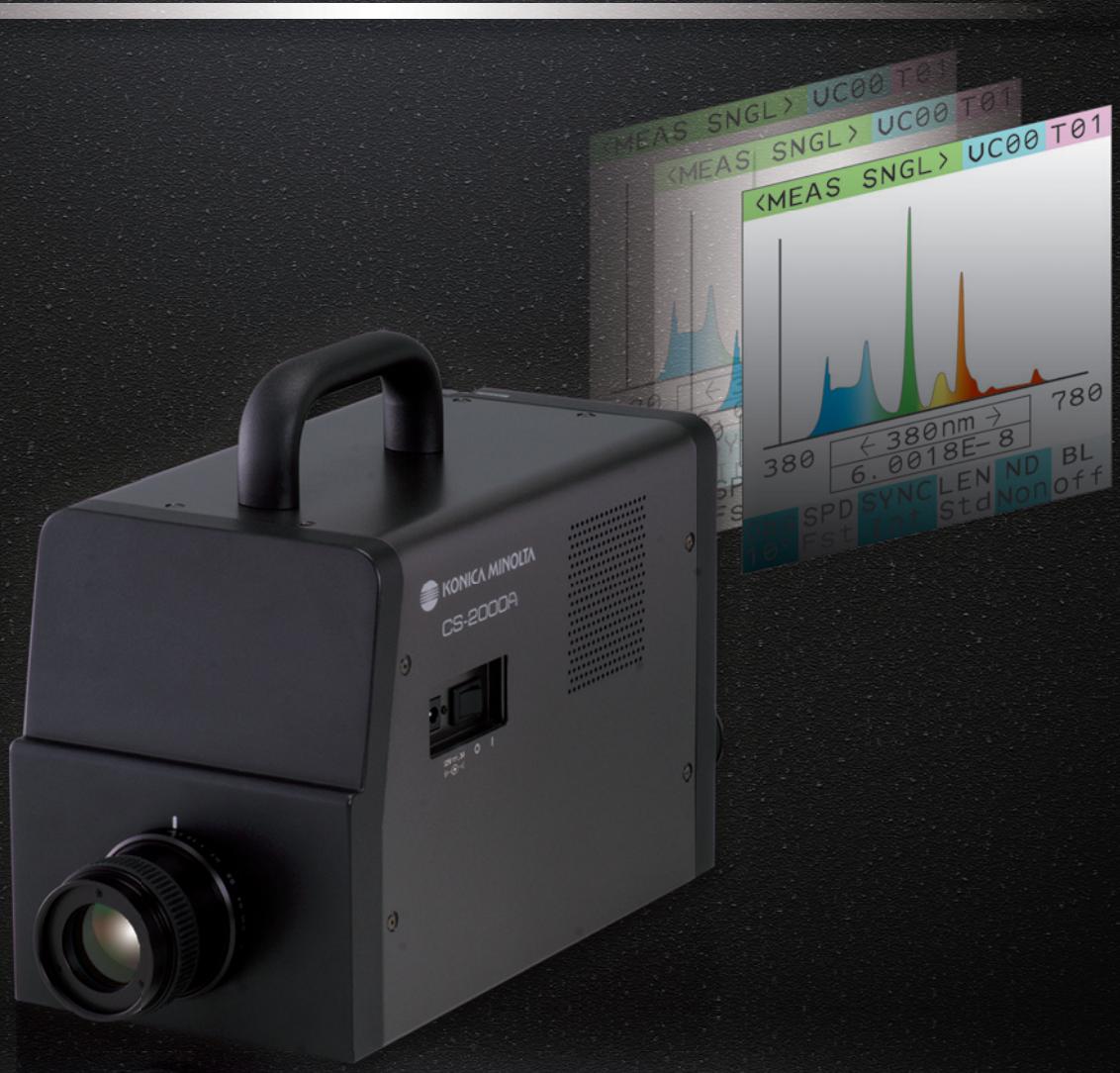


KONICA MINOLTA

Spectroradiometer **CS-2000/2000A**

19

High-End Spectroradiometer with High Accuracy and High Stability



Capable of highly accurate and stable measurements!

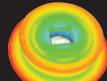
The CS-2000 and CS-2000A accurately measure luminance and chromaticity thanks to an optical design and signal processing found only at Konica Minolta.

This includes thoroughly eliminating mechanical and electrical noise factors in the design to enable high repeatability and rapid-interval measurements from super-faint luminances as low as 0.0005 cd/m^2 .

Moreover, both models ensure half-bandwidths of 5 nm or less, which is recommended for accurate color measurement (JIS Z 8724-1997, CIE122-1996), across the whole wavelength spectrum.

Technology

In designing the sensor at the core of the CS-2000/2000A, Konica Minolta meticulously analyzed and optimized the optical components in order to prevent any impact on measurement results due to heat strain.



Thermal profile of the sensor block



Repeatability 0.15%
Accuracy (Chromaticity)
 $x : \pm 0.0015$
 $y : \pm 0.001$
* CS-2000A : 0.05 cd/m^2
CS-2000 : 0.1 cd/m^2

Measurement of super-low luminances

Wide luminance measurement range (CS-2000A)

Luminance can be measured between 0.0005 cd/m^2 and 50M cd/m^2 *.

* When the CS-A34 ND filter is attached.



PWM light sources

Stable measurement ensured

1. Internally synchronized measurement

Flashing frequency can be freely set by numerical input.

2. Externally synchronized measurement

Vertical synchronization signals can be input to the instrument over a cable connection.

3. Prolonged exposure measurement

For high-luminance measurements, variations in luminance during unsynchronized readings can be reduced by using the multi-integration mode to prolong exposure without saturating the sensor.

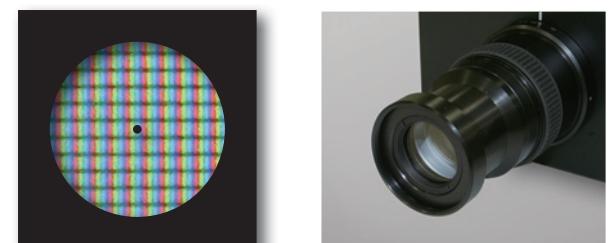
Minimal polarization error

Minimal polarization error

Polarization errors that occur when using a reflective diffraction grating are reduced to a manageable 2% (at a 1° measuring angle), thus enabling stable measurements of display devices that utilize polarized light such as LCDs.

Close-up lens

Close-up lens for measurement of even tinier areas (Optional accessory)



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	Ø1.00	Ø0.20
	70.9	Ø1.39	Ø0.28
350	Ø5.00	Ø1.00	Ø0.50
500	Ø7.78	Ø1.56	Ø0.78
1,000	Ø16.66	Ø3.33	Ø1.67
2,000	Ø34.18	Ø6.84	Ø3.42

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

Camera mounting

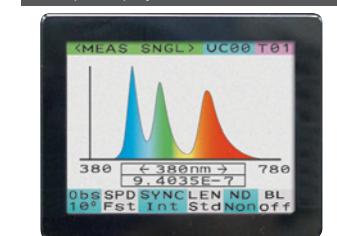
A CCD camera can be mounted on the viewfinder via the CS-A36 adapter (Optional accessory).



Highly visible, easy to use

Highly visible color LCD and easy-to-use operating panel

Example display of OLED measurement



Users can interactively select the required functions.



USB support

New RS-232C support

Easy PC connection via USB



The CS-2000 and CS-2000A support high baud rate RS-232C communication. Both models can be incorporated into automated lines over a 5 or 10 m cable (sold separately).

* CS-S10w does not support RS-232C or wireless communications.

RS-232C support

RS-232C communication at a max. 115,200 bps

Wireless communication support

Wireless communication is possible via an RS-Bluetooth conversion adapter.



* Operation is not guaranteed with all communication adapters on the market.

User-selectable measuring angle (1° , 0.2° , 0.1°)

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



0.2° is suitable for:

Small light sources such as LEDs

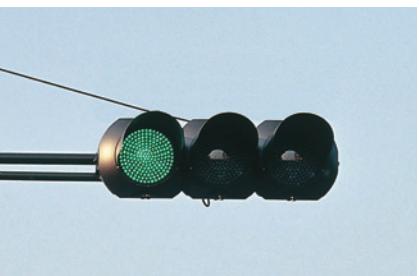
- Car audio systems
- Instrument panels for automobiles
- Lamps, fluorescent tube backlights, and other light sources



0.1° is suitable for:

Extremely small light sources or distant lights

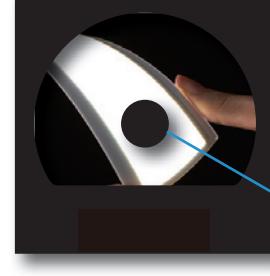
- PDP or LCD pixels
- Cold-cathode tubes
- Brake lamps of automobiles
- Traffic signals



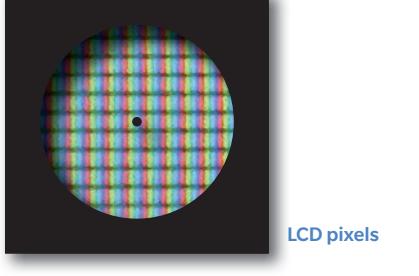
Minimal polarization error

Minimal polarization error

Polarization errors that occur when using a reflective diffraction grating are reduced to a manageable 2% (at a 1° measuring angle), thus enabling stable measurements of display devices that utilize polarized light such as LCDs.



Measuring area viewed through viewfinder



LCD pixels

As a reference instrument

Using as a reference instrument

CS-2000/CS-2000A can be used as a reference instrument for Konica Minolta's other light-measuring instruments in various industrial fields.



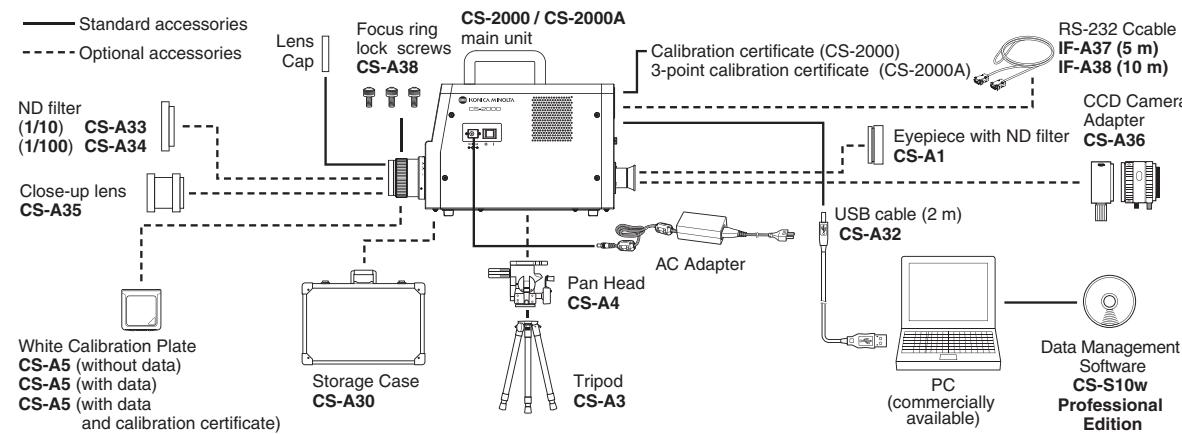
Illuminance spectroradiometer CS-2000A-I (customized product)

The CS-2000A-I is an accurate illuminance spectroradiometer ideal for evaluating projectors and LED or EL lighting. The illuminance adapter can also be removed to use the instrument as a spectroradiometer.

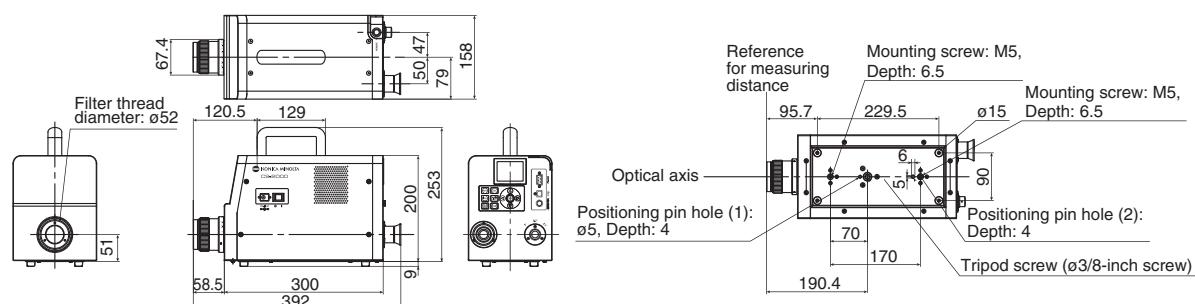


Spectral bandwidth:
5 nm or less (half bandwidth)
Measurement luminance range
Measuring angle 1° : 0.01 lx to 75,000 lx
Measuring angle 0.1° : 1.00 lx to 7,500,000 lx

System Diagram



Dimensions (Units: mm)

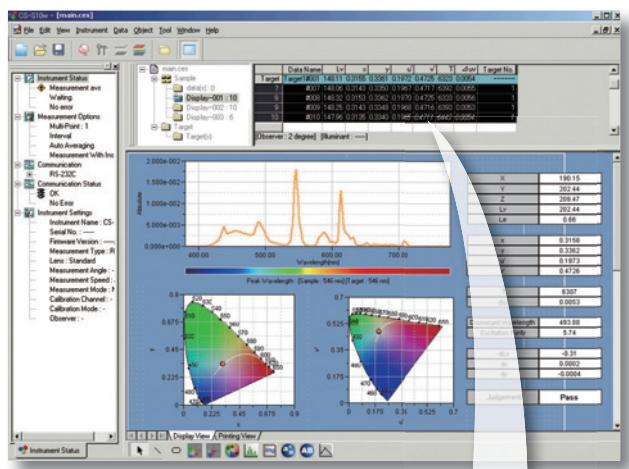


User-friendly standard software

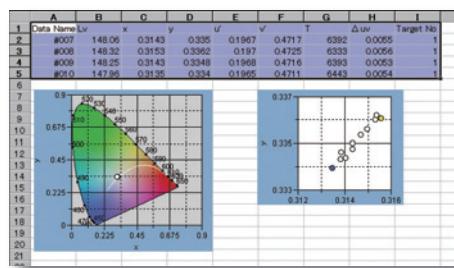
Data Management Software CS-S10w Professional (standard accessory)

With this software, the CS-2000 and CS-2000A 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.



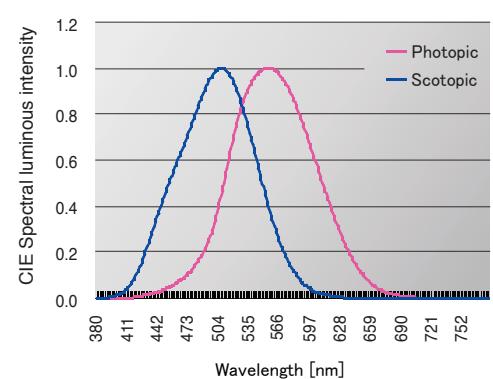
*The instrument must be connected to a PC over USB to use this software.

Scotopic vision measurement

It is known that the sensitivity of human vision shifts to blue region in dark environments, but past instruments did not have a scotopic measurement function. CS-2000A achieves sufficient capability to make it possible with CS-S10w Professional (standard accessory).

Scotopic vision

In the human eye, there are 2 types of photoreceptor cells, which are cone cells and rod cells. Cone cells are sensitive to color and rod cells are sensitive to only brightness. As brightness decreases, the activity of rod cells becomes stronger, and the condition in which only rod cells are working is called scotopic vision. The peak of spectral luminous efficiency of scotopic vision is shifted toward blue from the green peak of photopic vision (vision under brighter conditions) and thus blue objects are perceived to be brighter.



Display	Spectral graph, spectral data list, chromaticity diagram
Color space	L _x y, L _u 'v', L _v uv, XYZ, dominant wavelength, excitation purity, scotopic luminosity
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 on 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® 7 Professional 32-bit, 64-bit
Windows® 8.1 Pro 32-bit, 64-bit
Windows® 10 Pro 32-bit, 64-bit

* The hardware of the computer system to be used must meet or exceed the greater of the recommended system requirements for the compatible OS being used or the following specifications.

CPU	Pentium® III 600 MHz equivalent or faster
Memory	128 MB or more (256 MB or more recommended)
Hard disk	60 MB or more of free space for installation
Display	1,024 x 768, 256 colors minimum
Other	CD-ROM drive for installation, USB port for instrument connection

• 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.

Main specifications of CS-2000/2000A

Model		CS-2000/2000A		
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)	CS-2000	0.003 to 5,000 cd/m ²	0.075 to 125,000 cd/m ²	0.3 to 500,000 cd/m ²
	CS-2000A	0.0005 to 5,000 cd/m ²	0.0125 to 125,000 cd/m ²	0.05 to 500,000 cd/m ²
Minimum measuring area		ø5 mm (ø1 mm when using close-up lens)	ø1 mm (ø0.2 mm when using close-up lens)	ø0.5 mm (ø0.1 mm when using close-up lens)
Minimum measuring distance		350 mm (55 mm when using close-up lens)		
Minimum spectral radiance display		1.0x10 ⁻⁹ W/sr·m ² ·nm		
Accuracy: Luminance (Standard light source A)*1		±2%		
CS-2000	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 (0.05 cd/m ² or more)	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 (5 cd/m ² or more)	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 (50 cd/m ² or more)
	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	x,y : 0.002 (0.003 to 0.005 cd/m ²) x,y : 0.001 (0.005 to 0.1 cd/m ²) x,y : 0.0006 (0.1 to 0.2 cd/m ²) x,y : 0.0004 (0.2 to 5,000 cd/m ²)	x,y : 0.002 (0.075 to 0.125 cd/m ²) x,y : 0.001 (0.125 to 2.5 cd/m ²) x,y : 0.0006 (2.5 to 5 cd/m ²) x,y : 0.0004 (5 to 125,000 cd/m ²)	x,y : 0.002 (0.3 to 0.5 cd/m ²) x,y : 0.001 (0.5 to 10 cd/m ²) x,y : 0.0006 (10 to 20 cd/m ²) x,y : 0.0004 (20 to 500,000 cd/m ²)
CS-2000A	Accuracy: Chromaticity (Standard light source A)*1	x,y : ±0.002 (0.001 to 0.05 cd/m ²) x : ±0.0015 (0.05 cd/m ² or more) y : ±0.001 (0.05 cd/m ² or more)	x,y : ±0.002 (0.025 to 1.25 cd/m ²) x : ±0.0015 (1.25 cd/m ² or more) y : ±0.001 (5 cd/m ² or more)	x,y : ±0.002 (0.1 to 5 cd/m ²) x : ±0.0015 (5 cd/m ² or more) y : ±0.001 (50 cd/m ² or more)
	Repeatability: Luminance (2σ) (Standard light source A)*2	1.5% (0.0005 to 0.001 cd/m ²) 0.7% (0.001 to 0.003 cd/m ²) 0.25% (0.003 to 0.05 cd/m ²) 0.15% (0.05 to 5,000 cd/m ²)	1.5% (0.0125 to 0.025 cd/m ²) 0.7% (0.025 to 0.075 cd/m ²) 0.25% (0.075 to 1.25 cd/m ²) 0.15% (1.25 to 125,000 cd/m ²)	1.5% (0.05 to 0.1 cd/m ²) 0.7% (0.1 to 0.3 cd/m ²) 0.25% (0.3 to 5 cd/m ²) 0.15% (5 to 500,000 cd/m ²)
	Repeatability: Chromaticity (2σ) (Standard light source A)*2	x : 0.003 y : 0.0035 (0.001 to 0.003 cd/m ²) x : 0.001 y : 0.0015 (0.003 to 0.1 cd/m ²) x,y : 0.0006 (0.1 to 0.2 cd/m ²) x,y : 0.0004 (0.2 to 5,000 cd/m ²)	x : 0.003 y : 0.0035 (0.025 to 0.075 cd/m ²) x : 0.001 y : 0.0015 (0.075 to 2.5 cd/m ²) x,y : 0.0006 (2.5 to 5 cd/m ²) x,y : 0.0004 (5 to 125,000 cd/m ²)	x : 0.003 y : 0.0035 (0.1 to 0.3 cd/m ²) x : 0.001 y : 0.0015 (0.3 to 10 cd/m ²) x,y : 0.0006 (10 to 20 cd/m ²) x,y : 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		CS-2000 : Approx. 2 sec. minimum (Manual mode) to 243 sec. maximum (Normal mode)	CS-2000A : Approx. 2 sec. minimum (Manual mode) to 247 sec. maximum (Normal mode)	
Color space		L _a x _b , L _a u'v', L _a TΔuv, XYZ, spectral graph, dominant wavelength, excitation purity, scotopic luminosity (with CS-S10w Professional)		
Interface		USB 1.1, RS-232C		
Operation temperature/humidity range		CS-2000 : 5 to 35°C, relative humidity 80% or less with no condensation	CS-2000A : 5 to 30°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		Dedicated AC Adapter (100 - 240 V~), 50/60 Hz		
Current consumption		Approx. 20 W		
Size (W x H x D)		158 x 262 x 392 mm (Main unit), ø70 x 95 mm (Lens)		
Weight		Approx. 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.



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 appearance shown herein are subject to change without notice.
- Some lighting control methods may make accurate measurements difficult. For details, please contact your nearest Konica Minolta sales office or dealer.



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<http://konicaminolta.com/instruments/network>

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