

KONICA MINOLTA

SPECTRORADIOMETER

CS-3000 SERIES



Provide the same precision and reliability of past Konica Minolta spectroradiometer models with significantly faster operation and support for automation.

The Standard in Measuring Color & Light



Giving Shape to Ideas

Top-of-the-range spectroradiometer models that bring the latest digital technology together with Konica Minolta's long track record of sensor technology.



Equipped with high-speed CPU
Enables command-based measurement in as little as **0.041 second per measurement**
(Under Konica Minolta conditions, with integration time set to 0.005 second)

New color display design reduces impact on darkroom environment
* Equipped with function for turning display OFF during measurement



RS-232C communication at up to **921,600 bps**
Supports long cable connection and Bluetooth adapter* attachment

* Sold separately; adapter powered via RS-232C connector

USB 2.0 communication
Virtual COM port connection enables operating system-independent connection (Windows, Mac or Linux) for command-based operation*

* Communication specifications can be downloaded from the Konica Minolta website below.

<https://www.konicaminolta.com/instruments/download/software/display/index.html>



High precision

CS-3000 Series models continue the tradition of outstanding optical design and signal processing technology of past models while providing the high precision needed for standard value measurement of displays and many other light sources. Even at low luminance levels, they enable precise noise-suppressed measurement over the entire measurement wavelength range with half width values of 5 nm or less as recommended by CIE (CIE 122-1996). In addition to CIE 1931 xy chromaticity, they can also guarantee accuracy at u'v' in the CIE 1976 UCS chromaticity diagram. Chromaticity measurement accuracy (at low luminance of 0.05 cd/m²): x: ±0.0015, y: ±0.001 / u': ±0.0014, v': ±0.0006

Wide dynamic range of measurement (CS-3000 HDR)

Today's displays are constantly evolving to provide ever more vivid and high-quality output. To meet the measurement needs of these advanced devices, model CS-3000 HDR enables precise measurement at the 1° measurement angle often used in standard value measurements. It supports a wide dynamic range spanning ultra-low to high luminance levels. In addition to the LCD and OLED types commonly used today, it can measure standard values in HDR displays that use micro- or mini-LEDs. Luminance range with guaranteed accuracy (for luminance measurement at 1° measurement angle): 0.0001 to 100,000 cd/m²

1°, 0.2°, 0.1° powered measurement angle switching (CS-3000, CS-3000 HDR)

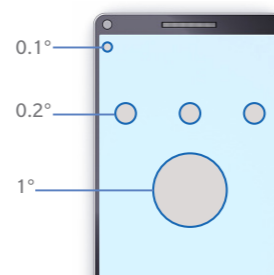
Any of three measurement angle settings can be selected to match the required measurement size. Powered switching supports command-based operation, enabling use in a fully automatic measurement system.

Objective distances and measurement diameters (mm)

Objective distance	Measurement angle		
	1°	0.2°	0.1°
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 objective distance is measured from the front end of the objective lens.

<Example measurement diameters for 500 mm objective distance>

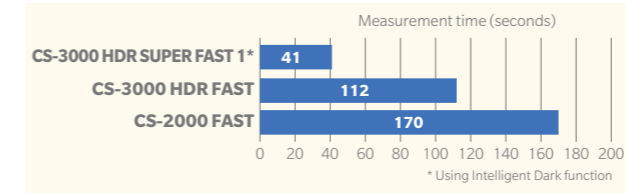


1° : Luminance/chromaticity standard value measurement at display center
0.2° : Multipoint uniformity measurement
0.1° : Edge measurement

Reducing measurement time

Conventional spectroradiometers have been used for low-luminance sequence measurements such as display gamma measurement, low luminance uniformity measurement and display material I-V-L measurement. But conventional equipment can take several hours or longer to complete measurement, creating problems for production or quality control sites, or R&D work. The new functions below enable CS-3000 models to measure significantly faster. For example, gamma measurement can be completed in no more than 25%* of the time needed with conventional equipment.

* Simulation conditions: 100 cd/m² (white); 0.1 cd/m² (black); 64 gradations; W_γ measurement

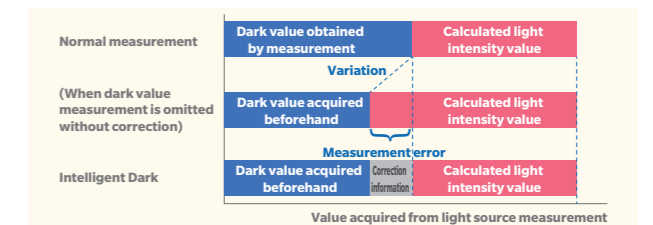


<High-speed modes>

Fast mode: Reduces measurement integration time to about 17% of the time needed in Normal mode.
Super Fast 1 mode: Reduces measurement integration time to about 5% of the time needed in Normal mode.
Super Fast 2 mode: Reduces measurement integration time to about 1% of the time needed in Normal mode.
* These figures do not apply to model CS-2000 Plus.

<Intelligent Dark function>

Highly accurate spectroradiometer measurements can be achieved by measuring both the light source and dark current (dark value) for each data point, and using the difference between the measured values to cancel out the dark value variation. Dark value measurement is sometimes omitted to reduce measurement time, but the dark values may vary over time or in relation to other variables. In this case, the variation will be superimposed on the calculated light intensity values, reducing measurement accuracy. The Intelligent Dark function uses correction information from a sensor unit to correct for the variation, enabling faster measurement and preserving high accuracy without the need for dark value measurement.



<Emission frequency detection/setting function>

(CS-3000, CS-3000 HDR)

A function that detects the display's emission frequency and sets the measurement integration time to an integral multiple of the detected value. Synchronization shifts (mismatches between measurement integration time and emission frequency) can lower repeatability. This function prevents these shifts with no increase in measurement time.

Accessories for various applications; standard software*

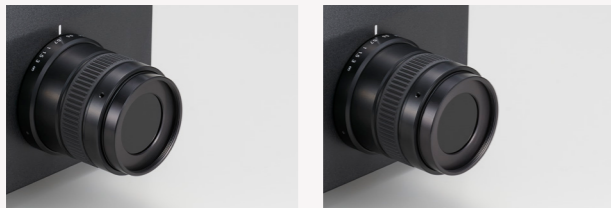
* The standard software can be downloaded free of charge from the Konica Minolta website. Software downloads require input of customer information.

ND filters CS-A40 (1/10) and CS-A41 (1/100)

Externally mounted ND filters that come with calibration data. Used when measuring high luminance levels not supported by the built-in ND filter alone. Two types with different densities are available.

Measurement luminance range with CS-A40 mounted: 0.005 to 50,000 cd/m² (With CS-3000 set to 1° measurement angle)

Measurement luminance range with CS-A41 mounted: 0.05 to 500,000 cd/m² (With CS-3000 set to 1° measurement angle)



Illuminance adapter CS-A43

An adapter that attaches to the lens unit to enable spectral irradiance measurement with a spectrum wavelength width of 5 nm or less, and accuracy conforming to Class AA general illuminance meter of JIS C 1609-1: 2006 (Illuminance Meters Part 1: General Measuring Instruments). The measurement illuminance range can be changed by changing the measurement angle setting on the spectroradiometer. Note that the adapter comes precalibrated as a set together with the spectroradiometer.



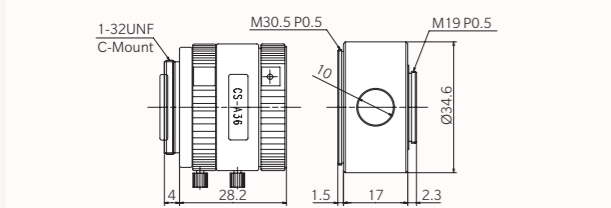
Measurement illuminance range (With CS-3000 HDR in light source A spectrum) Spectroradiometer setting

1°: 0.01 to 1,400,000 lx
0.2°: 0.25 to 35,000,000 lx
0.1°: 1 to 140,000,000 lx

Note that in practice, light source A measurement will have an upper limit of about 100,000 lx due to the effect of heat.

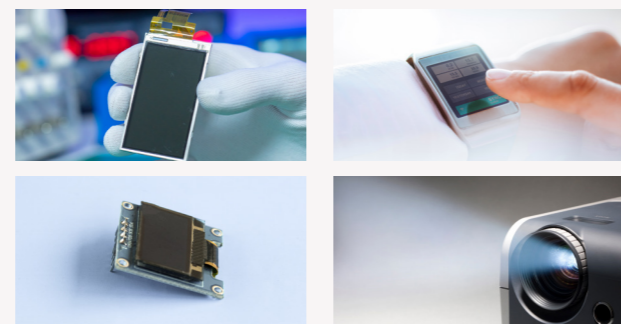
Adapter for CCD camera CS-A36

An adapter used to attach a CCD camera (C mount type; sold separately) to the viewfinder unit. Screws onto the spectroradiometer and CCD camera. Focused by adjusting the focus ring.



Applications

In addition to applications such as TV and smartphone displays, the high-sensitivity, low-noise measurement design enables high-speed, high-precision measurements that use small measurement angles for applications such as microdisplays. Adapts well to vertical installation, with a focus lock function and a design that minimizes differences in measured values due to equipment orientation. Mounting the illuminance adapter (optional accessory) also enables use as a reference for projector measurement.

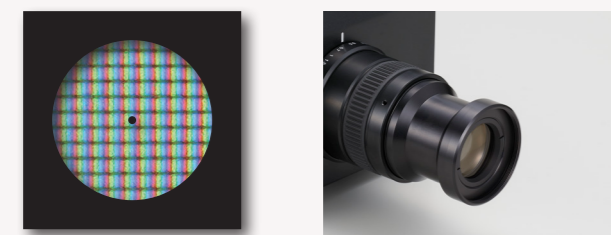


<Vertical installation>



Closeup lens CS-A42

A closeup lens with calibration data used for small-diameter measurement close to the measurement objective.



Objective distances and measurement diameters (mm)

Objective distance	Measurement angle		
	1°	0.2°	0.1°
55.0 (minimum)	Ø1.00	Ø0.20	Ø0.10
70.9 (maximum)	Ø1.39	Ø0.28	Ø0.14

Software for Spectroradiometer CS-S30

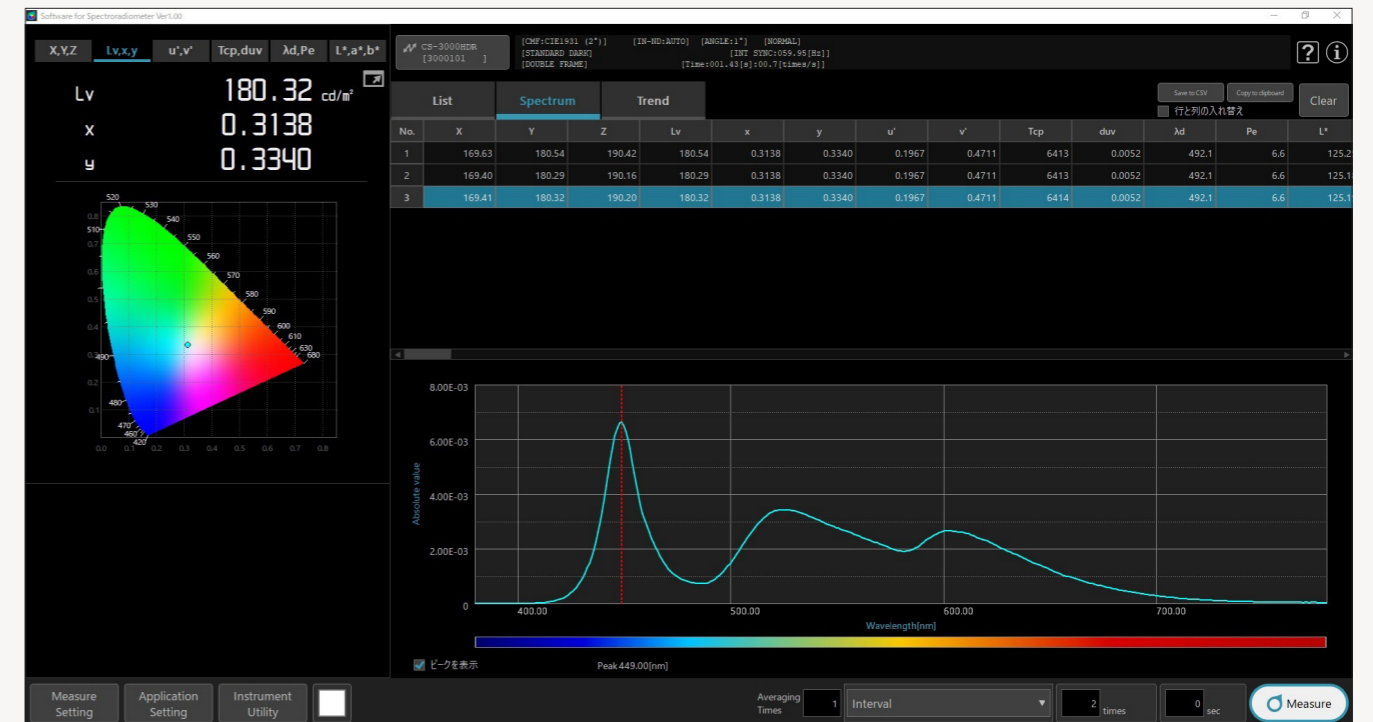
Software enabling CS-3000 Series models to perform computer-controlled measurement. Easy-to-read screen displays enable intuitive operation. Can be downloaded from the link below. <https://www.konicaminolta.com/instruments/download/software/display/index.html>



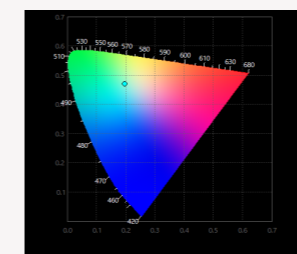
<Features>

Compatible with both Windows and Mac operating systems. Can set and execute a number of different measurement functions, and display graphs of measured values. Supports L*a*b* displays in addition to luminance/chromaticity and spectral graphs. As well as the usual CIE 1931 setting (2° Observer), also enables settings for CIE 1964 (10° Observer) and CIE 170-2:2015 (2° or 10° Observer). Chromaticity values can be calculated using user-specified color matching functions.

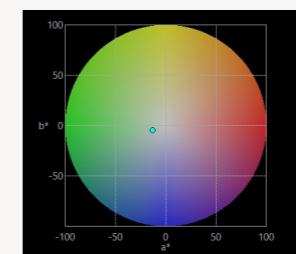
[Main screen]



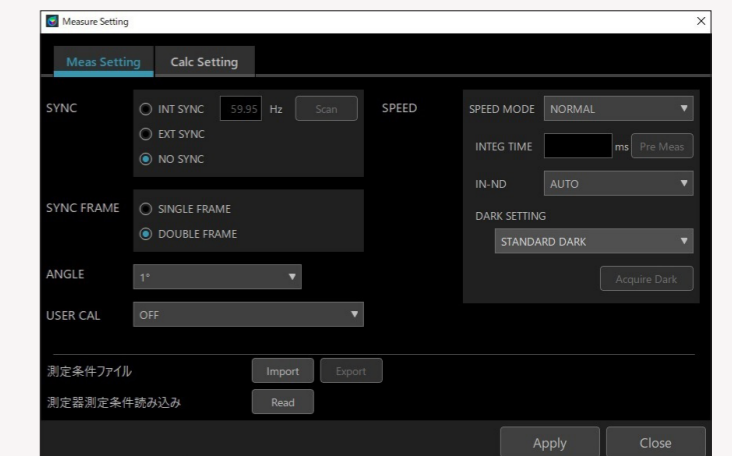
[u'v' graph]



[L*a*b* graph]



[Screen for setting measurement conditions]



<Operating environment requirements>

Operating system: Windows® 11 Pro 64bit, Windows® 10 Pro 64bit, macOS® Ventura, macOS® Monterey, macOS® Big Sur, macOS® Catalina
* The required PC system configuration is the recommended configuration for the operating system above or the specifications below (whichever is more advanced).
CPU: PC with a processor at least as advanced as the Intel® Core™ i Series
Memory: At least 8 GB
Hard disk: At least 200 MB of free space.
At least 100 MB of the hard disk's free space needs to be on the system drive (the drive where the operating system is installed).
Display: Must support at least 1,280 × 768 pixel, 16 bit color display
Other requirements: A USB port supporting at least USB 2.0 is needed for measuring instrument connection. An Internet connection is needed for software downloads.

Series lineup

The CS-3000 Series consists of three models—the flagship CS-3000 HDR, standard CS-3000 and cost-performance CS-2000 Plus. The cost-performance model is an enhanced version of the CS-2000 model in the previous lineup. It adds a high-speed computational CPU and the Intelligent Dark function—a new algorithm that eliminates the need for dark value measurement without sacrificing accuracy or measurement time.

High dynamic range measurement for next-generation displays

Support for automated systems
Ultra-low luminance measurement of OLED and other self-luminous displays

High-speed, high-precision measurement of various display devices

CS-3000HDR

CS-3000

CS-2000Plus

<Luminance measurement range with guaranteed accuracy (at 1° measurement angle)>

Luminance measurement:

CS-3000HDR 0.0001 to 100,000 cd/m²

CS-3000 0.0005 to 5,000 cd/m²

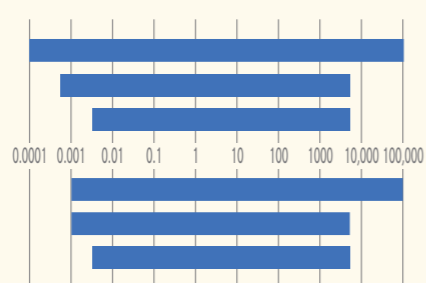
CS-2000Plus 0.003 to 5,000 cd/m²

Chromaticity measurement:

CS-3000HDR 0.001 to 100,000 cd/m²

CS-3000 0.001 to 5,000 cd/m²

CS-2000Plus 0.003 to 5,000 cd/m²



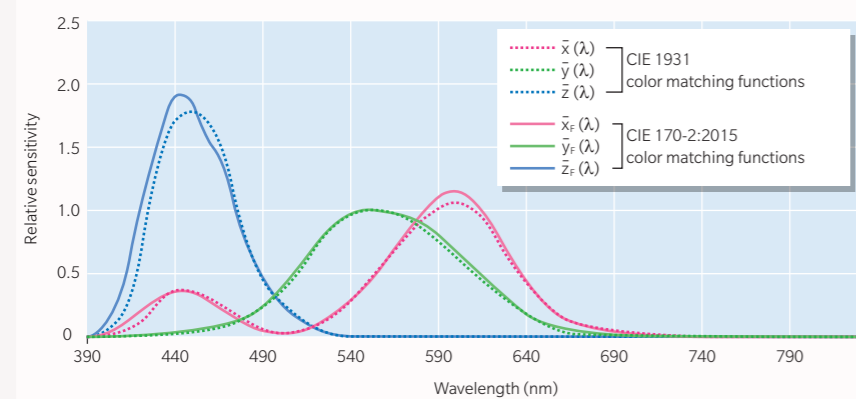
Features	CS-3000HDR	CS-3000	CS-2000Plus
Data compatibility with CS-2000 Series	✓	✓	✓
Intelligent Dark function	✓	✓	✓
Emission frequency detection/setting function	✓	✓	
Normal mode measurement time reduction	✓	✓	
Powered measurement angle switching	✓	✓	

CIE 170-2:2015

CIE 170-2:2015 is a fundamental chromaticity diagram with physiological axes that was announced in 2015 by the International Commission on Illumination (CIE).

When measuring displays with wide color gamuts, the use of CIE 170-2:2015 color matching functions is expected to yield results that more closely reproduce the human visual experience.

<Comparison of CIE 1931 and CIE 170-2:2015 color matching functions>



CS-3000 Series Specifications

*1: Average value of 10 measurements in Normal mode, at temperature of 23°C ± 2°C and maximum relative humidity of 65%.

*2: For 10 measurements in Normal mode, at temperature of 23°C ± 2°C and maximum relative humidity of 65%.

*3: Measurement time during USB cable-based communication with PC. Excludes time needed during measurement for shutter open/close operation and displaying results on LCD screen.

* For items without conditions expressly indicated below, the standard Konica Minolta conditions apply.

Model		CS-3000HDR	CS-3000	CS-2000Plus		
Measurement wavelength range		380 to 780 nm				
Wavelength resolution		0.9 nm/pixel				
Display wavelength interval		1.0 nm				
Wavelength precision		±0.3 nm (center-of-gravity wavelength mercury cadmium lamp: 435.8 nm, 546.1 nm, 643.8 nm)				
Spectrum wavelength width		5 nm max. (half width value)				
Measurement angle		1°, 0.2°, 0.1°				
Minimum measurement diameter	1°	Ø5 mm	(Ø1 mm with closeup lens)			
	0.2°	Ø1 mm	(Ø0.2 mm with closeup lens)			
	0.1°	Ø0.5 mm	(Ø0.1 mm with closeup lens)			
Minimum objective distance		350 mm (55 mm with closeup lens)				
Minimum radiance display		0.00002 cd/m ²				
Minimum spectral radiance display		1.0 × 10 ⁻⁹ W/(sr·m ² ·nm)				
Luminance range with guaranteed accuracy (Light source A)	1°	0.0001 to 100,000 cd/m ²	0.0005 to 5,000 cd/m ²	0.003 to 5,000 cd/m ²		
	0.2°	0.0025 to 2,500,000 cd/m ²	0.0125 to 125,000 cd/m ²	0.075 to 125,000 cd/m ²		
	0.1°	0.01 to 10,000,000 cd/m ²	0.05 to 500,000 cd/m ²	0.3 to 500,000 cd/m ²		
Luminance (Light source A)	Accuracy*1	±5% (0.0001 to 0.0004 cd/m ²)		±2%		
		±2% (0.0004 to 10,000,000 cd/m ²)		±2%		
		1°	≥ 0.0001 cd/m ²	5%	-	
			≥ 0.0004 cd/m ²	1.5%	1.5% (≥ 0.0005 cd/m ²)	
			≥ 0.001 cd/m ²	0.7%	-	
			≥ 0.003 cd/m ²	0.25%	0.40%	
	≥ 0.05 cd/m ²		0.15%	0.3% (≥ 0.05 cd/m ²)		
	0.2°	≥ 0.0025 cd/m ²	5%	-		
		≥ 0.01 cd/m ²	1.5%	1.5% (≥ 0.0125 cd/m ²)		
		≥ 0.025 cd/m ²	0.7%	-		
		≥ 0.075 cd/m ²	0.25%	0.40%		
		≥ 1.25 cd/m ²	0.15%	0.3% (≥ 1.25 cd/m ²)		
0.1°	≥ 0.01 cd/m ²	5%	-			
	≥ 0.04 cd/m ²	1.5%	1.5% (≥ 0.05 cd/m ²)			
	≥ 0.1 cd/m ²	0.7%	-			
	≥ 0.3 cd/m ²	0.25%	0.40%			
	≥ 5 cd/m ²	0.15%	0.3% (≥ 5 cd/m ²)			
Chromaticity (Light source A)	Accuracy*1	1°	≥ 0.001 cd/m ²	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011	x : ±0.003 y : ±0.003 u' : ±0.0033 v' : ±0.0016 (≥ 0.003 cd/m ²) x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011 (≥ 0.005 cd/m ²)
		1°	≥ 0.05 cd/m ²	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006 (≥ 0.075 cd/m ²) x : ±0.0033 y : ±0.0033 v' : ±0.0016 (≥ 0.075 cd/m ²)
		0.2°	≥ 0.025 cd/m ²	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011 (≥ 0.125 cd/m ²) x : ±0.0022 y : ±0.0022 v' : ±0.0011 (≥ 0.125 cd/m ²)
		0.2°	≥ 1.25 cd/m ²	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006 (≥ 0.3 cd/m ²) x : ±0.0033 y : ±0.0033 v' : ±0.0016 (≥ 0.3 cd/m ²)
		0.1°	≥ 0.1 cd/m ²	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011	x : ±0.002 y : ±0.002 u' : ±0.0022 v' : ±0.0011 (≥ 0.5 cd/m ²) x : ±0.0022 y : ±0.0022 v' : ±0.0011 (≥ 0.5 cd/m ²)
		0.1°	≥ 5 cd/m ²	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006	x : ±0.0015 y : ±0.001 u' : ±0.0014 v' : ±0.0006 (≥ 0.3 cd/m ²) x : ±0.0033 y : ±0.0033 v' : ±0.0016 (≥ 0.3 cd/m ²)
	Repeatability (2σ)*2	1°	≥ 0.001 cd/m ²	x : 0.0030 y : 0.0035 u' : 0.0024 v' : 0.0014	x : 0.0030 y : 0.0035 u' : 0.0024 v' : 0.0014	-
			≥ 0.003 cd/m ²	x : 0.0010 y : 0.0015 u' : 0.0009 v' : 0.0006	x : 0.0010 y : 0.0015 u' : 0.0009 v' : 0.0006	x : 0.002 y : 0.002 u' : 0.0016 v' : 0.0008 (≥ 0.005 cd/m ²) x : 0.001 y : 0.001 u' : 0.0008 v' : 0.0004 (≥ 0.005 cd/m ²)
			≥ 0.1 cd/m ²	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002
		0.2°	≥ 0.025 cd/m ²	x : 0.0030 y : 0.0035 u' : 0.0024 v' : 0.0014	x : 0.0030 y : 0.0035 u' : 0.0024 v' : 0.0014	-
			≥ 0.075 cd/m ²	x : 0.0010 y : 0.0015 u' : 0.0009 v' : 0.0006	x : 0.0010 y : 0.0015 u' : 0.0009 v' : 0.0006	x : 0.002 y : 0.002 u' : 0.0016 v' : 0.0008 (≥ 0.125 cd/m ²) x : 0.001 y : 0.001 u' : 0.0008 v' : 0.0004 (≥ 0.125 cd/m ²)
			≥ 2.5 cd/m ²	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002
0.1°	≥ 5 cd/m ²	x : 0.0004 y : 0.0004 u' : 0.0003 v' : 0.0002	x : 0.0004 y : 0.0004 u' : 0.0003 v' : 0.0002	x : 0.0004 y : 0.0004 u' : 0.0003 v' : 0.0002		
	≥ 0.1 cd/m ²	x : 0.0030 y : 0.0035 u' : 0.0024 v' : 0.0014	x : 0.0030 y : 0.0035 u' : 0.0024 v' : 0.0014	-		
	≥ 0.3 cd/m ²	x : 0.0010 y : 0.0015 u' : 0.0009 v' : 0.0006	x : 0.0010 y : 0.0015 u' : 0.0009 v' : 0.0006	x : 0.002 y : 0.002 u' : 0.0016 v' : 0.0008 (≥ 0.5 cd/m ²) x : 0.001 y : 0.001 u' : 0.0008 v' : 0.0004 (≥ 0.5 cd/m ²)		
0.1°	≥ 10 cd/m ²	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002	x : 0.0006 y : 0.0006 u' : 0.0005 v' : 0.0002		
	≥ 20 cd/m ²	x : 0.0004 y : 0.0004 u' : 0.0003 v' : 0.0002	x : 0.0004 y : 0.0004 u' : 0.0003 v' : 0.0002	x : 0.0004 y : 0.0004 u' : 0.0003 v' : 0.0002		
	≥ 50 cd/m ²	x : 0.0003 y : 0.0003 u' : 0.0002 v' : 0.0001	x : 0.0003 y : 0.0003 u' : 0.0002 v' : 0.0001	x : 0.0003 y : 0.0003 u' : 0.0002 v' : 0.0001		
Polarization error		2% max. (400 to 780 nm) at 1° setting; 3% max. (400 to 780 nm) at 0.2° or 0.1° setting				
Integration time		0.005 to 92 seconds (Normal mode) 0.005 to 16 seconds (Fast mode)				
Measurement time	Standalone	Minimum of 1 second or less (Manual mode) to approx. 190 seconds (Normal mode) or maximum of approx. 242 seconds (Manual mode)				
	Communication*3	CS-3000HDR, CS-3000: Approx. 0.07 second CS-2000Plus: Approx. 0.08 second (when Manual mode, 33.333 ms and Intelligent Dark function are set)				
Color modes		Lvxy, Lvu'v', LvTuvv, XYZ, spectrograph, main wavelength, excitation purity				
Color matching functions		CIE 1931 (2° field of view), CIE 1964 (10° field of view), CIE 170-2:2015 (2°, 10°), user-specified color matching functions (supported by measurement software)				
Function for detecting/setting optical frequency of measurement objective		Yes				
Measurement angle switching		Powered				
Interfaces		USB 2.0; RS-232C				
Operating temperature and humidity range		5 to 30°C, 80% RH max. (no condensation)				
Storage temperature and humidity range		0 to 35°C, 80% RH max. (no condensation)				
Power supply		Dedicated AC adapter (100 to 240 V, 50/60 Hz)				
Power consumption		Approx. 20 W				
Size		Spectroradiometer: 158 × 262 × 392 (W × H × D) mm				
Weight		Approx. 7.0 kg				

