

# LumiTop 4000

Spectrally enhanced imaging colorimeter



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# Technical specifications

LumiTop 4000							
Measurement quantities							
2D	Luminance, color						
Spot	Spectrum, luminance, color, flicker						
Camera specifications							
Effective resolution (h x v)	~ 4096 x 3000 pixels (12 megapixels)						
Pixel size	3.45 $\mu\text{m}$ x 3.45 $\mu\text{m}$						
AD converter	12 bit						
Size CMOS sensor	1.1" (17.52 mm diagonal)						
General specifications							
Interface CAS	USB, PCIe						
Interface camera	Gigabit Ethernet						
Operating system	Windows 7/10 (64 bit)						
Dimensions (l x w x h) <sup>1)</sup>	274 mm x 192 mm x 119 mm						
Weight <sup>2)</sup>	4.0 kg						
Power supply	12 V						
Operating temperature range	15 – 35 °C						
Measurement range <sup>3)</sup>							
Measurement range CAS <sup>4)</sup>	L = 0.02 cd/m <sup>2</sup> – 500,000 cd/m <sup>2</sup>						
Measurement range 2D <sup>5)</sup>	L = 0.02 cd/m <sup>2</sup> – 27,000 cd/m <sup>2</sup>						
Accuracy and precision		Luminance		Color			
Accuracy of CAS	±3.5 % <sup>6)</sup>		±0.0015 <sup>7)</sup>				
Accuracy of camera (rel. to CAS) <sup>8)</sup>	±0.4 %		±0.002				
Instrumental precision CAS <sup>9)</sup>	±0.1 %		±0.0002				
Instrumental precision camera <sup>9)</sup>	±0.04 %		±0.00015				
Polarization sensitivity <sup>10)</sup>	±2.0 %		±0.002				
Camera uniformity (RNU) <sup>11)</sup>	±0.35 %		±0.0013				
Measurement time <sup>12)</sup>							
Measurement time hybrid mode	0.7 s						
Measurement time camera only	0.7 s						
Flicker							
Flicker range	5 cd/m <sup>2</sup> – ca. 600 cd/m <sup>2</sup>						
Flicker accuracy <sup>13)</sup>	±1dB						
Flicker instrumental precision <sup>13) 14)</sup>	±0.02 dB						
Lens 29 mm							
Aperture	f/2.8						
Spot size and field of view at selected working distances							
Working distance <sup>15)</sup> [mm]	385	400	500	700	800	1000	1200
Spot size [mm]	11.0	11.5	14.9	21.7	25.1	31.9	38.6
Field of view [mm]	156 x 114	163 x 119	211 x 155	307 x 225	355 x 260	450 x 330	546 x 400
Field of view diagonal [in]	7.6	8.0	10.3	15.0	17.3	22.0	26.6

<sup>1)</sup> Inclusive lens and fiber exit.

<sup>2)</sup> Without CAS, with mode mixer.

<sup>3)</sup> Neutral density filters (OD 0.3/0.6/0.9) are available for increasing the upper measurement limit or measuring modulated light sources.

<sup>4)</sup> Lower measurement limit based on a signal to noise ratio of 10:1 for 65 s exposure time. Upper measurement limit based on a signal level < 80 % for a white (non-modulated) LED light source using an optical density filter OD4 and an exposure time of 10 ms.

<sup>5)</sup> Lower measurement limit based on a signal to noise ratio of 10:1 for 10 seconds exposure time. Upper measurement limit based on a signal level < 80 % for a white (non-modulated) LED light source using an exposure time of 27  $\mu\text{s}$ .

<sup>6)</sup> Immediately after calibration relative to calibration standard.

<sup>7)</sup> Immediately after calibration.

<sup>8)</sup> Typical value for maximum deviation over the FOV relative to the CAS spot; calculated for an image with 21 pixels cropped at each edge and 13 by 13 pixel binning (34 averages) immediately after calibration with reference used for flat-field correction.

<sup>9)</sup>  $2\sigma$  of repeated measurements of one instrument (L  $\approx$  100 cd/m<sup>2</sup>, autoexposure).

<sup>10)</sup> Maximum deviation from average of repeated CAS measurements with a linear polarized light source and varying polarization angle.

<sup>11)</sup> RNU (response non-uniformity) is defined as 99.7 % percentile of the deviation of the mean image value; calculated for an image with 21 pixels cropped at each edge and 13 by 13 pixel binning (34 averages) immediately after calibration with reference used for flat-field correction.

<sup>12)</sup> Time between beginning of two subsequent measurements using the SDK; Determined with a camera exposure time of 10 ms and CAS exposure time of 200 ms for a white LED (L  $\approx$  500 cd/m<sup>2</sup>). Depends on PC processing capability.

<sup>13)</sup> L  $\approx$  150 cd/m<sup>2</sup>, 30Hz, 10 % sine wave.

<sup>14)</sup>  $2\sigma$  of repeated measurements of one instrument.

<sup>15)</sup> Distance between DUT and front plate of LumiTop 4000.