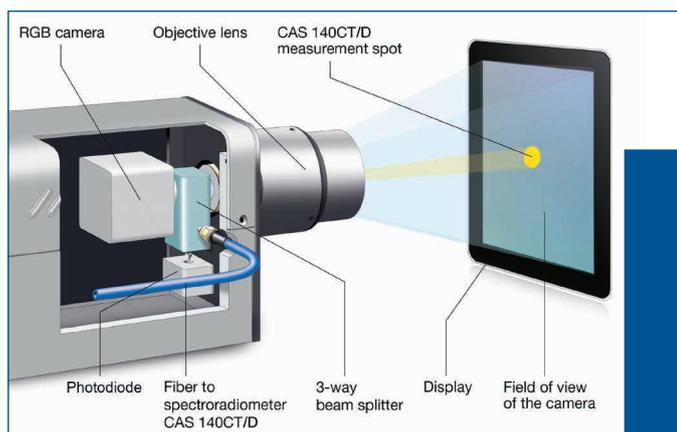


LumiTop 2700/4000

Spectrally enhanced imaging colorimeter



We bring quality to light.



◀ Design concept of the LumiTop 2700/4000.

Product highlights

- ▲ 2D measurements with unprecedented accuracy due to high-end reference spectroradiometer CAS 140CT/D
- ▲ 3-in-1 measurement solution (spectroradiometer, RGB camera and flicker diode)
- ▲ Easy integration in production lines
- ▲ No golden sample calibrations are needed
- ▲ Most detailed spectral information

\\ Lab specs meet production speed

The LumiTop 2700/4000 combines the accuracy of Instrument Systems' well-known spectroradiometers CAS 140CT/D with the obvious advantages of imaging colorimetry.

Principle: Fast and accurate

With the help of a polarization insensitive, three-way beam splitter, the LumiTop 2700/4000 merges an RGB CCD/CMOS camera and a flicker diode with the high-end spectroradiometer of the CAS series. This innovative design allows for simultaneous measurements of all components, which may result in significant time-savings.

At the same time, the extremely accurate spectral information of the spectroradiometer measurement is used as reference for the camera measurement. This guarantees spectroradiometric accuracy across the whole 2D image.

As a result, the LumiTop 2700/4000 not only performs fast 2D measurements with unprecedented accuracy but also offers all the advantages of classical imaging colorimetry.

Perfect for production

Because of this combination, the LumiTop 2700/4000 is perfect for use in display production lines or quality control, where the benefits and capabilities of both, the accurate spot measurement of spectroradiometers and the lateral resolution of camera measurements are highly valued.

All-in-one solution

Many different test applications can now be organized in a single test station:

- ▲ Measurement of luminance and color
- ▲ Evaluation of color and luminance uniformity or Mura effects
- ▲ Contrast measurement
- ▲ Analysis of white balance or color gamut
- ▲ Flicker and luminance modulation measurement
- ▲ Analysis of the acquired spectra

Easy to integrate into production lines

The LumiTop 2700/4000 is integrated in Instrument Systems' comprehensive new software „LumiSuite”, which comes with a user-friendly GUI for laboratory applications and a powerful

software development kit for easy implementation into any production line. The spectra measured as reference for the camera can be analyzed in more detail using Instrument Systems' well-known software SpecWin Pro.

Independent of display technology

Due to the high absolute accuracy of the CAS spectroradiometer that is used as reference during each measurement, the performance of the solution is excellent for any display technology (or any other homogeneous samples). Moreover no golden sample or user calibrations are needed. This makes the solution particularly favorable when OLEDs or other narrow-banded light sources have to be investigated where classical imaging colorimeters based on XYZ filter technologies reach their limits.

Modularity

The LumiTop 2700/4000 is designed as a modular accessory to the spectroradiometers CAS 140CT or D. Thus the same spectroradiometers can also be used with the telescopic optics TOP 150 or TOP 200 or vice versa.

Technical specifications

	LumiTop 2700	LumiTop 4000
Measurement quantities		
2D	Luminance, color	
Spot	Spectrum, luminance, color, flicker	
General specifications		
Operating system	Windows 7/10 (64 bit)	
Dimensions (l x w x h) ¹⁾	274 mm x 192 mm x 112 mm	274 mm x 192 mm x 119 mm
Weight ²⁾	3.7 kg	4.0 kg
Power supply	12 V	
Operating temperature range	15 – 35 °C	

Camera specifications				
Effective resolution (h x v)	2750 x 2200 (6.1 megapixels, CCD)		4096 x 3000 pixels (12 megapixels, CMOS)	
Pixel size	4.54 µm x 4.54 µm		3.45 µm x 3.45 µm	
AD converter	12 bit			
Size sensor	1" (16.0 mm diagonal)		1.1" (17.52 mm diagonal)	
Interface camera	Gigabit Ethernet			
Measurement range 2D ^{3) 4)}	L = 0.005 cd/m ² - 5,000 cd/m ²		L = 0.02 cd/m ² - 270,000 cd/m ²	
Accuracy and precision	Luminance	Color	Luminance	Color
Accuracy of camera (rel. to CAS) ⁵⁾	±0.4 %	±0.0015	±0.4 %	±0.002
Instrumental precision camera ⁶⁾	±0.04 %	±0.0002	±0.04 %	±0.0002
Camera uniformity (RNU) ⁷⁾	±0.35 %	±0.0013	±0.35 %	±0.0013
Measurement time⁸⁾				
Measurement time hybrid mode	0.5 s		0.7 s	
Measurement time camera only	0.5 s		0.7 s	

	CAS 140CT	CAS 140D
Interface CAS	USB, PCIe	USB, PCIe, Gigabit Ethernet
Measurement range CAS ^{3) 9)}	L = 0.02 cd/m ² - 6 x 10 ⁷ cd/m ²	L = 0.005 cd/m ² - 4 x 10 ⁷ cd/m ²
Accuracy and precision	Luminance	Color
Accuracy of CAS	±3.5 % ¹⁰⁾	±0.0015 ¹¹⁾
Instrumental precision CAS ⁶⁾	±0.1 %	±0.0002
Polarization sensitivity ¹²⁾	±2.0 %	±0.002

Flicker specifications	
Flicker range	5 cd/m ² - ca. 600 cd/m ²
Flicker accuracy ¹³⁾	±1 dB
Flicker instrumental precision ^{13) 14)}	±0.02 dB

Spot size and field of view at selected working distances for 29 mm lens (f/2.8)							
Working distance ¹⁵⁾ [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
LumiTop 2700							
Field of view [mm]	138 x 110	144 x 115	187 x 149	271 x 217	313 x 251	398 x 319	482 x 387
Field of view diagonal [in]	7.0	7.3	9.4	13.7	15.8	20.1	24.3
LumiTop 4000							
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

¹⁾ Inclusive lens and fiber exit.

²⁾ Without CAS, with mode mixer.

³⁾ External neutral density filters on the lens (OD 0.3/0.6/0.9) are available for increasing the upper measurement limit or measuring modulated light sources.

⁴⁾ Lower measurement limit based on a signal to noise ratio of 10:1 for maximum exposure time (60 seconds LumiTop 2700 / 10 seconds LumiTop 4000). Upper measurement limit based on a signal level < 80 % for a white (non-modulated) LED light source using for minimum exposure time (1 ms LumiTop 2700 / 27 µs LumiTop 4000).

⁵⁾ Typical value for maximum deviation over the FOV relative to the CAS spot; calculated for an image with 16 pixels (LumiTop 2700) / 21 pixels (LumiTop 4000) cropped at each edge and 10 by 10 pixels (LumiTop 2700) / 13 by 13 pixels (LumiTop 4000) binning (34 averages) immediately after calibration with reference used for flat-field correction.

⁶⁾ 2σ of repeated measurements of one instrument (white LED, L ≈ 100 cd/m², autoexposure).

⁷⁾ RNU (response non-uniformity) is defined as 99.7 % percentile of the deviation of the mean image value; calculated for an image with 16 pixels (LumiTop 2700) / 21 pixels (LumiTop 4000) cropped at each edge and 10 by 10 pixels (LumiTop 2700) /

13 by 13 pixels (LumiTop 4000) binning (34 averages) immediately after calibration with reference used for flat-field correction.

⁸⁾ Time between beginning of two subsequent measurements using the SDK; determined with a camera exposure time of 20 ms and CAS exposure time of 200 ms for a white LED (L ≈ 500 cd/m²). Depends mainly on PC processing capability.

⁹⁾ Lower measurement limit based on a signal to noise ratio of 10:1 for maximum exposure time of 65 s. Upper measurement limit based on a signal level < 80 % for a white (non-modulated) LED light source using an optical density filter OD4 and minimum exposure time (10 ms CAS 140CT / 4 ms CAS 140D). Values valid for CAS 140CT with 100 µm and CAS 140D with 250 µm slit width.

¹⁰⁾ Immediately after calibration relative to calibration standard.

¹¹⁾ Immediately after calibration.

¹²⁾ Maximum deviation from average of repeated CAS measurements with a linear polarized light source and varying polarization angle.

¹³⁾ L ≈ 150 cd/m², 30 Hz, 10 % sine wave.

¹⁴⁾ 2σ of repeated measurements of one instrument.

¹⁵⁾ Distance between DUT and front plate of LumiTop.

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