

AR/VR Display Testing



umiTop 4000

Linstrume

NEW

Linstrur

LumiTop 5300

Periscopic and straight AR/VR lens for the unique LumiTop imaging colorimeter. Characterization of Near-Eye Displays in AR and VR headsets. Human-eye inspired lens – Large field of view & variable pupil sizes Adjustable focus distance for multiple test applications.

01 \\ Augmented and virtual reality (AR/VR) testing

LumiTop AR/VR brings speed and absolute photometric accuracy to near-eye displays!

Instrument Systems AR/VR lens for LumiTop imaging colorimeters is specifically designed for production testing of near-eye displays (NEDs) in virtual and augmented reality headsets. The optical design mimics the human eye and measures color and luminance exactly as seen by the user. A large field of view, various pupil sizes and adjustable focus distance enable a wide range of testing applications. The straight and periscopic lens design ensures optimum access to the NED.





LumiTop with AR/VR lens

- ▲ LumiTop accuracy and speed
- >120° FoV
- Adjustable focus 0.5 m 1.5 m (other on request)
- ▲ Various pupil sizes
- ▲ Space for "2-eyes" measurement

In addition to the straight design, the periscope lens enables an optimal measurement position even under the tight spatial constraints of fully assembled head-mounted devices. Parallel operation of two LumiTops is also possible to measure both NEDs simultaneously.

User experience of true colors and luminance

- High resolution camera to avoid Moiré effects
- Optimized lens design to measure what the human eye sees
- Fast photometer and trigger for synchronization and control of modulated light sources

LumiTop with AR/VR lens delivers highly reproducible, traceable and accurate color and luminance measurements to provide the best displays for augmented and virtual reality.

02 \\ Technical specifications

Model	LumiTop 4000 AR/VR (preliminary)	LumiTop 5300 AR/VR (preliminary)
Measurement quantities		
2D	Luminance, color	
Spot	Spectrum, luminance, color, flicker	
General specifications		
Operating system	Windows 7/10 (64 bit)	
Dimensions (I x w x h) 1)	With periscope lens: 452 mm x 190 mm x 180 mm WIth straight lens: 527 mm x 190 mm x 180 mm	
Weight 2)	5.4 kg	
Power supply	24 V	
Operating temperature range	15 – 35 °C	
Camera specifications		
Effective resolution (h x v)	4096 x 3000 pixels (12 megapixels, CMOS)	5312 x 4600 pixels (24 megapixels, CMOS)
AD converter	12 bit	
Interface camera	Gigabit Ethernet, M12 12-Pin Female	
Measurement range 2D 3) 4)	$L = 0.012 \text{ cd/m}^2 - 170,000 \text{ cd/m}^2$	
Angular Resolution	> 30 px/deg (average over FOV)	> 40 px/deg (average over FOV)
Lens specifications		
Field of View (FOV) (H x V)	120° x 85°	120° x 105°
Adjustable focus distance	0.5 m – 1.5 m (other on request)	
Entrance Pupil 15)	1.0 – 3.6 mm	
Measurement time 8)		
Measurement time hybrid mode 0.7 s		
Measurement time camera only	0.7 s	
Accuracy and precision	Luminance	Color
Accuracy of camera (rel. to CAS) ⁵⁾	±0.4 %	±0.002
Instrumental precision camera 6)	±0.03 %	±0.0001
Camera uniformity (RNU) 7)	±0.35 %	±0.0013
CAS specifications	CAS 140D	
Interface CAS	USB, Gigabit Ethernet	
Measurement range CAS ^{3) 9)}	$L = 0.003 \text{ cd/m}^2 - 4 \text{ x } 10^7 \text{ cd/m}^2$	
Accuracy and precision	Luminance	Color
Accuracy of CAS	±3.0 % ¹⁰⁾	±0.0015 ¹¹⁾
Instrumental precision CAS ⁶⁾	±0.1 %	±0.0001
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	

Instrument Systems is continually working on the further development of its products. Technical changes, errors and misprints do not justify claims for damages. For all other purposes, our Terms and Conditions of Business shall be applicable.

¹⁾ Inclusive lens and fiber exit.

2) Without CAS, with mode mixer.

³⁾ Contact us for extended measurement range options.

4) Lower measurement limit based on a signal to noise ratio of 10:1 for maximum exposure time of 10 seconds. Upper measurement limit based on a Y channel signal level < 80 % for a white (non-modulated) LED light source using a minimum exposure time of 28 µs.

- Typical value for maximum deviation over the FOV relative to the CAS spot; calculated for an image with 21 pixels cropped at each edge binning (34 averages).
- $^{6)}$ 2σ of repeated measurements of one instrument (L \approx 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 21 pixels cropped at each edge 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 \approx 500 cd/m²). Depends mainly on PC processing capability.
- Lower measurement limit based on a signal to noise ratio of 10:1 for maximum exposure times 65 s for CAS 140D. Upper measurement limit based on a signal level < 80 %for a white (non-modulated) LED light source using a CAS internal optical density filter OD4 and minimum exposure time of 4 ms (CAS 140D). Values valid for 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.
- $^{\rm 13)}$ L \approx 150 cd/m², 30 Hz, 10 % sine wave.
- $^{14)}$ 2σ of repeated measurements of one instrument.

¹⁵⁾ The entrance pupil is exchangeable. Standard sizes are: 1.0 mm, 1.5 mm, 2.0 mm, 2.5 mm, 3.0 mm and 3.6 mm.

Live Demo: AR/VR Testing with LumiTop Imaging Colorimeter



Presentation: LumiTop for AR/VR Testing



KONICA MINOLTA Group

Instrument Systems GmbH

Kastenbauerstr. 2 81677 Munich, Germany ph: +49 (0)89 45 49 43-58 fax: +49 (0)89 45 49 43-11 info@instrumentsystems.com www.instrumentsystems.com

We bring quality to light.

LumiTopARVR_en_V2.0