

WP690E-Circ WP690ES-Circ Imaging Circadiometer



The World's First Imaging Circadiometer

Description

With 9 Megapixels of resolution, the WP6E-Circ and WP6ES-Circ Series instruments allow for the measurement of the ipRGC, rod, S-, M- and L-cone response to lit scenes. The understanding of human exposure to these light signals can be used to correlate human physiological effects such as hospital recovery times, heart rate, pupil size, alertness, seasonal affective disorder, sleep disorders and melatonin levels. Applications include analyses of lighting, displays and specialty evening and nighttime lighting applications such as hospitals, transportation, offices and other workplaces.

These systems include software controlled, motorized Canon EF lenses. Three irises are calibrated at all focus distances to infinity. As compared to manual lenses, these systems offer improved accuracy, precision and convenience. The WP6ES-Circ includes an integrated spectroradiometer conforming to the CIE S026 requirement to report the spectral data.

Westboro Photonics' [Photometrica® software and add-on packages](#) provide users with the most productive environment for measurement and analysis. All functions can be efficiently automated with the Software Development Kit (SDK).

Sensitive

The Imaging Circadiometer includes an ultrasensitive, Peltier-cooled CCD detector that supports exposures from 8 ms to 4.3 minutes. The very long to short exposures enable measurements from $1 \mu\text{cd}/\text{m}^2$ up to $10 \text{kcd}/\text{m}^2$ thus enabling critical α -Opic measurements in the photopic, mesopic and scotopic adaptation ranges.

Key Features

- Measures the Five CIE S 026/E:2018 α -Opic Radiances
- Up to 12 Megapixels
- Electronic Lens Control
- Optional Integrated Spectroradiometer
- Research Grade Software for Deriving New Light-Related Health Metrics

Applications

- Investigating the probability of circadian disruption
- Blue light uniformity measurements of displays and luminaires
- Evaluating the potential for melatonin onset delay
- Tracking of blue light dosage over time
- Testing of circadian lighting systems and installations

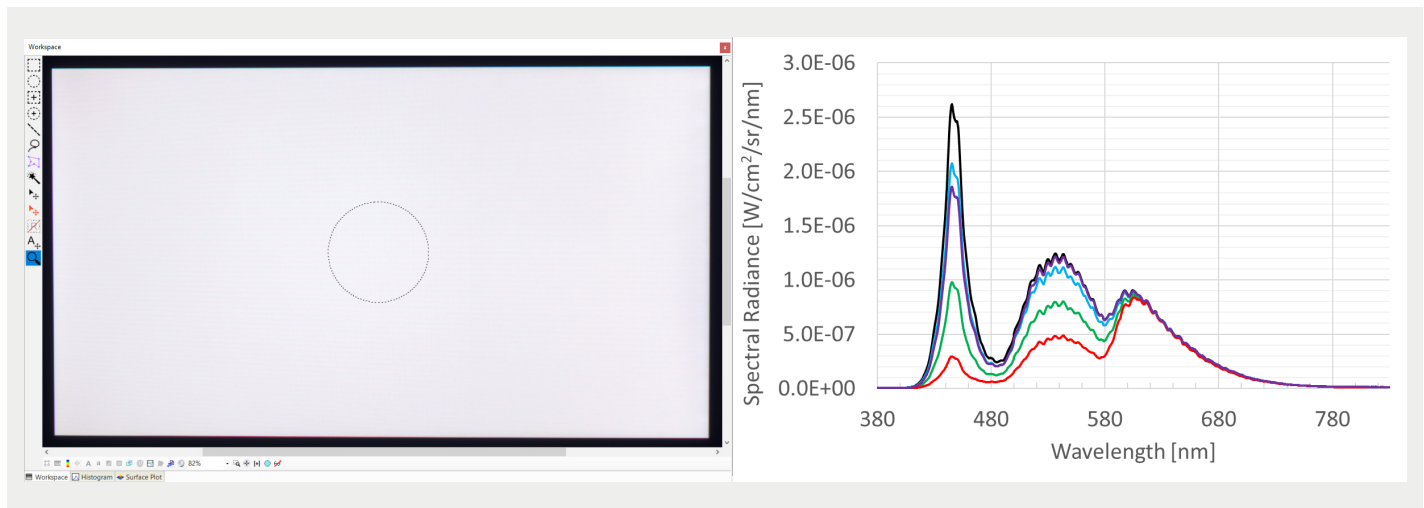
Imaging Circadiometer

Automatic α -Optic Radiance Correction

The WP690ES-Circ has the benefit of a spot spectroradiometer and an Imaging Circadiometer in the same instrument. The Imaging Circadiometer accuracy is improved to the level of the spectroradiometer by automatic correction. The spectral data also provides radiometric information and other measurement insights. To fulfill the measurement requirements of the CIE S 026/E:2018 standard, as well as those of modern displays and lighting, Westboro Photonics offers the S3 high performance spectroradiometer with excellent dynamic range, linearity, stray light suppression and signal-to-noise ratio. Westboro Photonics can also work with other fiber optic spectroradiometers; contact us for details.



WP690ES-Circ with arm for fiber optic spectrometer.

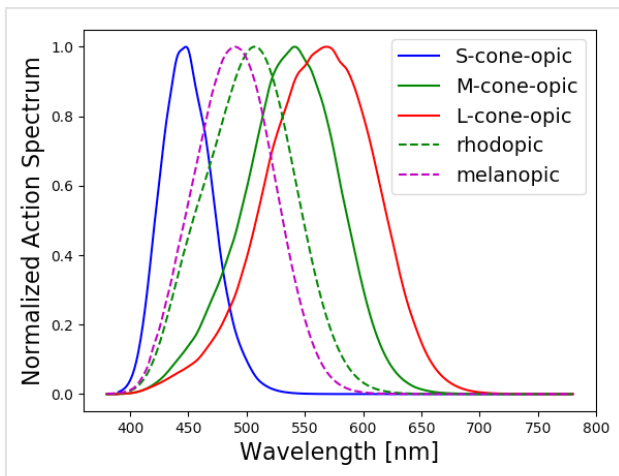


(Left) Imaging Circadiometer measurement of a white display. Spectroradiometer measurement location is shown by the circle.
 (Right) Spectral measurements of five methods to reduce blue light content in a modern mobile display.

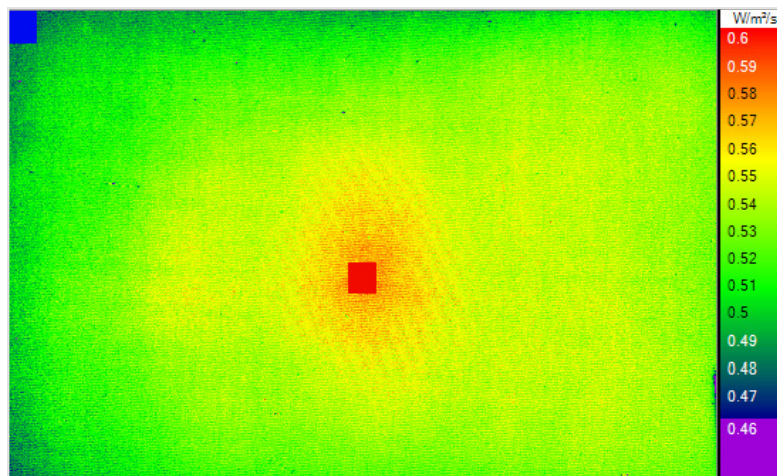
Reliable and Simplified

The WP690ES-Circ combines all the measurement data you really need: spot spectral radiance and imaging alpha-optic radiance in one measurement document with software to make sense of it all. The integrated combination is more convenient and reliable than using two separate instruments and two separate software packages to manage the data.

WP6ES IMAGING SPECTRAL CIRCADIOMETER	SPOT SPECTRORADIOMETER AND SEPARATE IMAGING CIRCADIOMETER
The imaging paths for both the circadiometer and spectro-radiometer match, thereby assuring that the compared measurement locations and geometries precisely correlate.	Spot sizes, locations and measurement angles can differ, making correlation problematic.
The spectral measurement is acquired immediately following the circadiometer measurement. The measurement speed of the WP6ES-Circ minimizes sample radiance drift.	Measurements cannot be closely sequenced in time as one instrument needs to be mechanically replaced by the other in the imaging path.
All measurements are fast and the corrections are automatic.	Correction method is time consuming and is done infrequently.



CIE S 026/E:2018 α -opic action spectra.



Uniformity analysis of a modern mobile display. Red and blue boxes mark the highest and lowest areas of ipRGC radiance respectively.

SPECTRORADIOMETER MODEL	S3
Detector	Back-thinned CCD
Number of Pixels	1024 x 58
Wavelength Range	380-1100 nm
Optics	Symmetrical Czerny-Turner, 100 mm focal length
Digital Resolution	16 bit
Data Point Interval	0.7 nm
Spectral Bandwidth	2.9 nm
Wavelength Accuracy	± 0.5 nm
Stray Light (150 nm to the left of red LED peak, unweighted spectrum)	0.000 04
Integration Time	5.2 ms - 65 s
Linearity	0.8 %
Cooling	TE Cooled, stabilized at 5°C
Radiance Range	4×10^{-6} to $60 W/m^2/sr$
Radiance Accuracy (vs. NIST luminance standard)	3 %
Radiance Repeatability	0.2 %
Measurement Capabilities	S-, M-, L-Cone, Rod, ipRGC Radiances, Luminance, Chromaticity
PC Interface	USB 3.0 or GigE
Dimensions (H, W, D)	185 x 161 x 185 mm
Power Consumption	12 VDC, 1.5 A
Weight	3.5 kg
Compliance	RoHS, CE

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Intrinsic Circadiometer Measurements

- S-cone radiance ($W/m^2/sr$)
- M-cone radiance ($W/m^2/sr$)
- L-cone radiance ($W/m^2/sr$)
- Rhodopic radiance ($W/m^2/sr$)
- ipRGC or “melanopic” radiance ($W/m^2/sr$)

Derived Measurements

- X_{10}, Y_{10}, Z_{10} (10-degree tristimulus)
- CCT, xy (and other colorimetric stats from X_{10}, Y_{10}, Z_{10})
- sRGB (from X_{10}, Y_{10}, Z_{10})
- M/P (melanopic-photopic ratio)

TECHNICAL SPECIFICATIONS*

MODEL		WP690E-CIRC
Model		WP690E-Circ
Model with Integrated Spectroradiometer		WP690ES-Circ
Sensor Model with, Diagonal Size, Pixel Pitch		Sony ICX814, 16.0 mm, 3.69 μm
Sensor Type		16-bit, interline transfer CCD image sensor with microlens
Sensor Megapixels		9.1
Pixel Array		3388 x 2712
High Dynamic Range (multi-exposure)		> 1 000 000:1
EF Lenses: Field of View (H x V)	14 mm	40° x 48°
	24 mm	23° x 29°
	35 mm	16° x 21°
	50 mm	11° x 14°
	100 mm	6° x 7°
Scotopic Radiance [$W/m^2/sr$]	Limit of Det.	1×10^{-8}
	SNR = 60	1×10^{-7}
	SNR = 100	2×10^{-7}
	Rad. Max*	8.5
	Rad. Max with ND	850
Communication Interface		USB2
Power		12 V, 24 W max.
Dimensions Excluding Lens (H x W x D)		160 mm x 146 mm x 78 mm
Weight		3.1 kg with typical lens, 2.8 kg without lens
Operating Temperature		5°C to 35°C
Operating Humidity		10 % to 90 % (no condensation)

* Specifications are subject to change

** not including optional ND filters