

pco.edge 4.2 bi

cooled sCMOS camera.

bi back illuminated

lightsheet scanning mode

low light mode

up to **95%**
quantum efficiency

deep cooled
down to $-25\text{ }^{\circ}\text{C}$

compact
design

resolution
2048 x 2048 pixel
with $6.5\text{ }\mu\text{m}$ pixel size

back illuminated
sCMOS sensor

input windows
selectable



1288 
EMVA Standard Compliant

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» sCMOS image sensor

type of sensor	backside illuminated scientific CMOS (bi sCMOS) monochrome
resolution (h x v)	2048 x 2048 active pixel
pixel size (h x v)	6.5 µm x 6.5 µm
sensor format / diagonal	13.3 mm x 13.3 mm / 18.8 mm
shutter mode	rolling shutter (RS) additional feature: lightsheet scanning mode¹
MTF	76.9 lp/mm (theoretical)
fullwell capacity	48 000 e ⁻ 1,800 e ⁻ low light mode
readout noise (typ.)²	1.8 _{med} e ⁻ / 1.9 _{rms} e ⁻ 1.0 _{med} e ⁻ / 1.1 _{rms} e ⁻ low light mode
dynamic range (typ.)	26 667 : 1 (88.5 dB) 1800 : 1 (64 dB) low light mode
quantum efficiency	up to 95 %
spectral range	370 nm ... 1100 nm 190 nm ... 1100 nm UV version
dark current (typ.)	0.2 e ⁻ /pixel/s @ -25 °C sensor temperature
DSNU	0.6 _{rms} e ⁻ 0.4 _{rms} e ⁻ low light mode
PRNU	1.2 % 1.4 % low light mode
anti blooming factor³	> 10 000

¹ Selectable via SDK (software development kit).

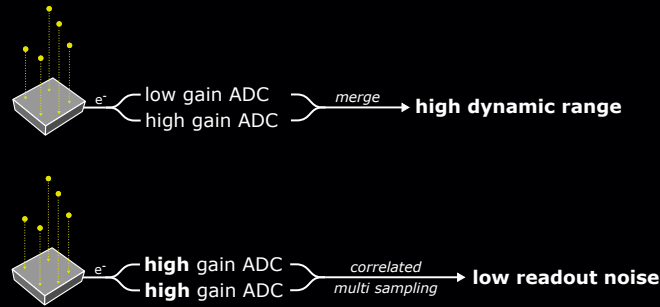
² The readout noise values are given as median (med) and root mean square (rms) values, due to the different noise models, which can be used for evaluation. All values are raw data without any filtering.

³ Based on image sensor datasheet.

low light mode

When the low light mode is activated, both the high and low gain A/D converter are used as high gain, which means they digitize low intensity pixel values only.

The signal within each pixel is simultaneously digitized by two separate A/D conversion units and added up, which is referred to as correlated multi sampling (CMS). This correlation causes a major reduction of the readout noise, though the usable intrascene dynamic range of the sensor is reduced.



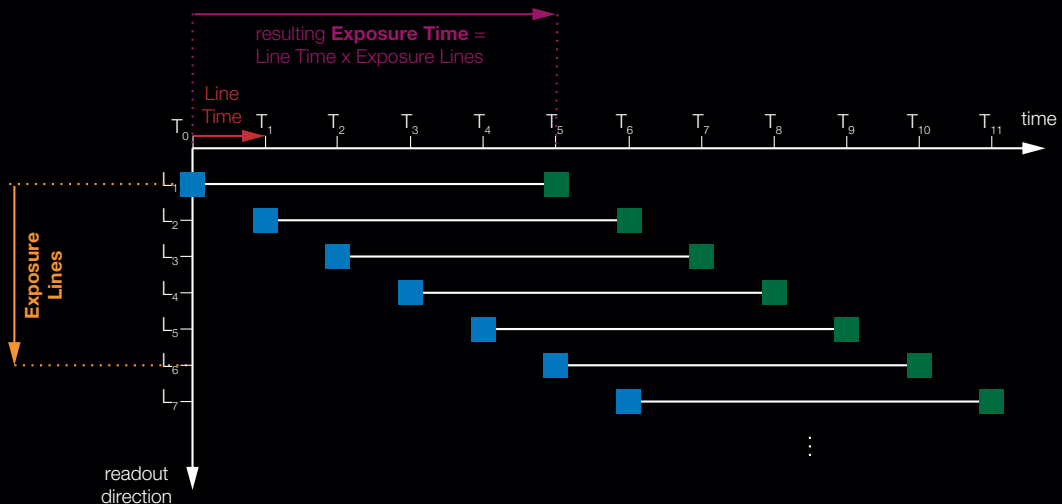
lightsheet scanning mode

The PCO lightsheet scanning mode is a special readout mode dedicated to lightsheet microscopy. It is based on the rolling shutter mode in which the readout direction of the sensor is from top to bottom.

The standard line time value is 12 μ s and it can be set from this camera-specific line time up to 2 ms. Compared to the standard operation mode, the lightsheet scanning mode enables the selection of the parameters "Line Time" and "Exposure Lines". This guarantees an optimized synchronization to an existing lightsheet setup which has no selectable speed or timing. It is possible to set a delay prior to the exposure start ("delay lines").

For more information on the corresponding SDK functions, please read our pco.sdk instruction manual.

selectable parameter: T_x Line Time (12 μ s ... 2 ms) L_x Exposure Lines (1 ... 2048) Start Exposure End Exposure



» camera system

maximum frame rate @ full resolution	40 fps
exposure / shutter time	10 μ s .. 20 s
dynamic range A/D⁴	16 bit
A/D conversion factor	0.8 e ⁻ /DN
pixel scan rate	46.0 MHz
pixel data rate	184.0 Mpixel/s
binning horizontal	x1, x2, x4
binning vertical	x1, x2, x4
region of interest (ROI)	horizontal: steps of 32 pixels vertical: steps of 8 pixels
non linearity	< 0.6 %
cooling method	adjustable: from - 25 °C to + 20 °C peltier with forced air (fan) and water cooling calibration setpoint: - 10 °C
trigger input signals	frame trigger, acquire (SMA connectors)
trigger output signals	exposure, busy (SMA connectors)
data interface	USB 3.1 Gen 1
time stamp	in image (1 μ s resolution)

⁴ The high dynamic signal is simultaneously converted at high and low gain by two 12 bit A/D converters and the two 12 bit values are sophisticatedly merged into one 16 bit value.

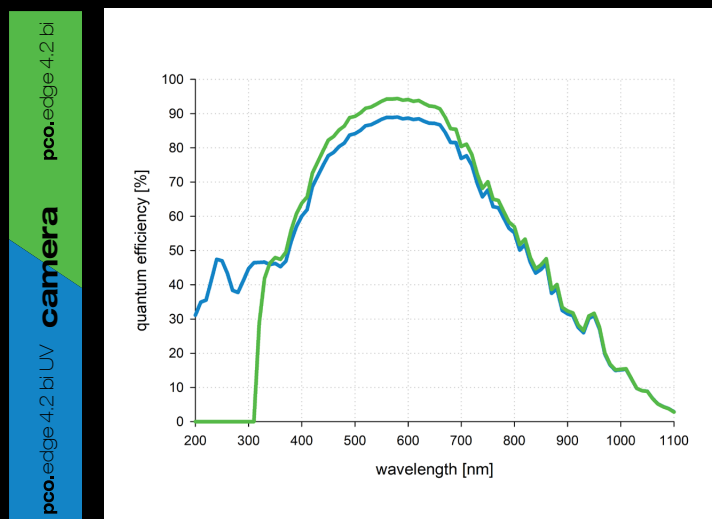
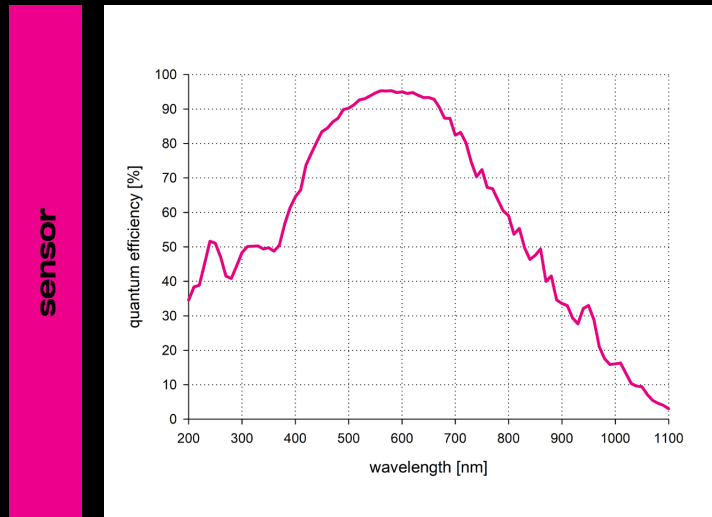
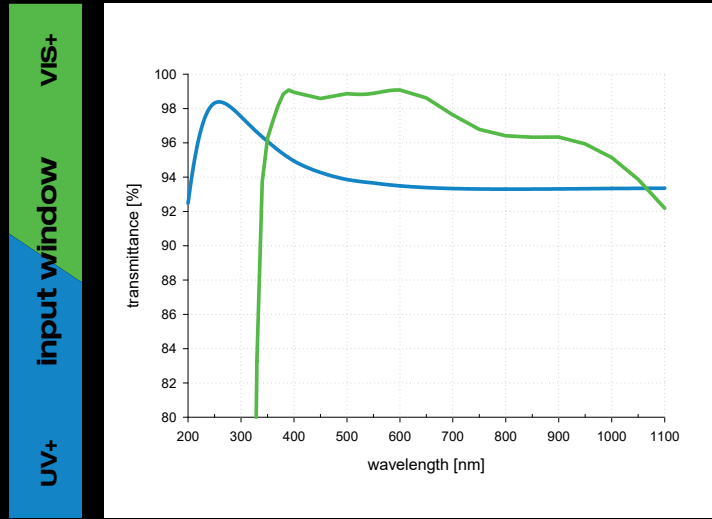
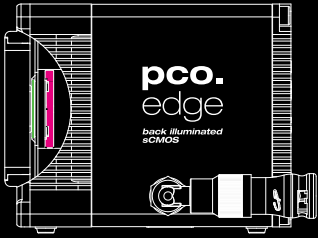
» general

power delivery	power over USB 3.1 Gen 1 and power connector (24 VDC +/- 10 %)
power consumption	typ. 4.5 W over USB 3.1 Gen 1 and typ. 10.0 W (max. 22.0 W) over power connector
weight	920 g
operating temperature	+ 10 °C ... + 40 °C
operating humidity range	10 % ... 80 % (non-condensing)
storage temperature range	- 10 °C ... + 60 °C
optical interface	F-mount, C-mount
selectable input window	visible UV 1° wedge UV others on request
maximum cable length	5 m
CE / FCC certified	yes

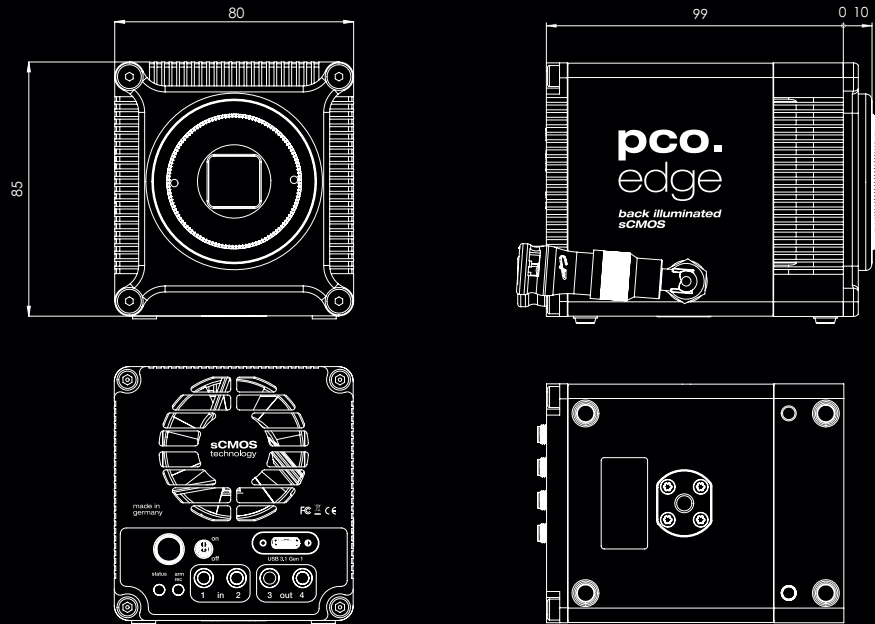
» frame rate table

2048 x 2048	40 fps
2048 x 1024	80 fps
2048 x 512	159 fps
2048 x 256	302 fps
2048 x 128	527 fps
1920 x 1080	76 fps
1600 x 1200	68 fps
1280 x 1024	80 fps
640 x 480	171 fps
320 x 240	320 fps

selectable input windows available



» dimensions



F-mount and C-mount lens adapter are changeable. All dimensions are given in millimeter.

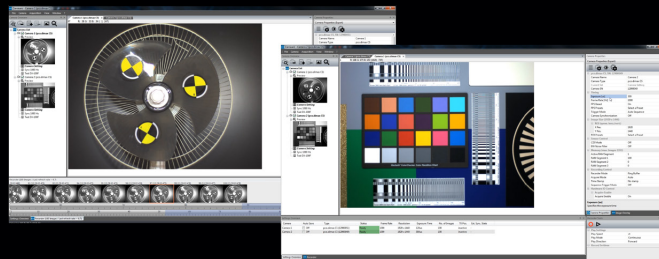
» camera view



» applications

brightfield microscopy | microscopy | fluorescence microscopy | digital pathology | single molecule localization microscopy | lightsheet fluorescence microscopy (LSFM) | calcium imaging | FRET | FRAP | structured illumination microscopy (SIM) | high-speed bright field ratio imaging | high throughput screening | high content screening | biochip reading | TIRF microscopy | spinning disk confocal microscopy | 3D metrology | ophthalmology | photovoltaic inspection | industrial quality inspection | lucky astronomy | bio luminescence | chemo luminescence

» software



With pco.camware you control all camera settings, the image acquisition and the storage of your image data. The pco.sdk is the complementary software development kit. It includes dynamic link libraries for user customization and integration on Windows-PC platforms. Drivers for popular third party software packages are also available for you.

All this items like pco.camware, pco.sdk and third party drivers, are free-to-download at www.pco.de

» third party integrations



contact

pco europe

+49 9441 2005 50
info@pco.de
pco.de

pco america

+1 866 678 4566
info@pco-tech.com
pco-tech.com

pco asia

+65 6549 7054
info@pco-imaging.com
pco-imaging.com

pco china

+86 512 67634643
info@pco.cn
pco.cn



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