pco.edge 4.2

cooled **sCMOS** cameras

lightsheet scanning mode

CLHS FOL USB 3.0

small form factor

high dynamic range
37,500:1

high resolution
2048 x 2048 pixel

high quantum efficiency
up to 82 %

high speed
100 fps

low noise
0.8 electrons

1288
EMVA Standard Compliant

pco.
An Excelitas Technologies Brand

technical specifications

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» sCMOS image sensor

interfaces »	CLHS FOL	USB 3.0
type of sensor	scientific CMOS (sCMOS) monochrome	
resolution (h x v)	2048 x 2048 active pixels	
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) with selectable readout modes	rolling shutter (RS) with selectable readout modes global reset - rolling readout (GR)
MTF	76.9 lp/mm (theoretical)	
fullwell capacity	30,000 e^-	
readout noise (typ.)[1]	0.8 $_{med}$ e^- / 1.3 $_{rms}$ e^- @ slow scan 0.9 $_{med}$ e^- / 1.4 $_{rms}$ e^- @ fast scan	0.8 $_{med}$ e^- / 1.3 $_{rms}$ e^-
dynamic range (typ.)	37,500:1 91.5 dB, slow scan	37,500:1 91.5 dB
quantum efficiency	up to 82 %	
spectral range	300 nm ... 1100 nm	
dark current (typ.)	< 0.6 e^-/pixel/s @ 7 °C sensor temperature	< 0.3 e^-/pixel/s @ 0 °C sensor temperature
DSNU	< 0.3 $_{rms}$ e^-	< 0.3 $_{rms}$ e^-
PRNU	< 0.3 %	< 0.2 %
anti blooming factor [2]	> 10,000	

» camera system

interfaces »	CLHS FOL	USB 3.0
maximum frame rate @ full resolution	100 fps	40 fps
exposure/shutter time	100 µs to 10 s (RS)	100 µs to 20 s (RS) 30 µs to 2 s (GR)
dynamic range A/D[3]	16 bit	
A/D conversion factor	0.46 e-/DN	
pixel scan rate	274.0 MHz fast scan 100.0 MHz slow scan	110.0 MHz
pixel data rate	548.0 MPixel/s fast scan 200.0 MPixel/s slow scan	220.0 MPixel/s
binning horizontal	x1, x2, x4	
binning vertical	x1, x2, x4	
region of interest (ROI)	horizontal: steps of 4 pixels vertical: steps of 1 pixel	horizontal: steps of 4 pixels vertical: steps of 1 pixel
non linearity	< 0.5 %	< 0.6 %
cooling method	7 °C stabilized, selectable: peltier with forced air (fan) or water cooling (both up to 27 °C ambient)	0 °C stabilized, peltier with forced air (fan) or water cooling (both up to 27 °C ambient)
trigger input signals	frame trigger, sequence trigger, programmable input (SMA connectors)	
trigger output signals	exposure, busy, line, programmable output (SMA connectors)	
time stamp	in image (1 µs resolution)	

technical specifications

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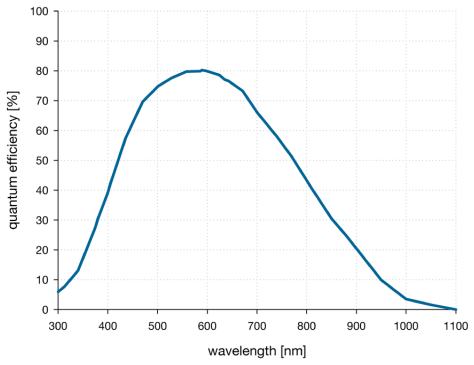
» general

interfaces »	CLHS FOL	USB 3.0
power delivery	24 VDC (+/- 10 %)	
power consumption	32 W max. (typ. 19 W @ 20 °C)	21 W max. (typ. 12 W @ 20 °C)
weight[4]	850 g air-cooled 1060 g water-cooled	800 g
operating temperature	+ 10 °C to + 40 °C	
operating humidity range	10 % to 80 % (non-condensing)	
storage temperature range	- 10 °C to + 60 °C	
optical interface	C-mount & F-mount	
lens remote controller	electronic control for Canon EF lenses only air-cooled camera	not available
maximum cable length	10 km	5 m
CE/FCC certified	yes	

» quantum efficiency

monochrome



» frame rate table[5]

interfaces »	CLHS FOL		USB 3.0
typical examples	fast scan	slow scan	
2048 x 2048	100 fps	35 fps	40 fps
2048 x 1024	200 fps	70 fps	80 fps
2048 x 512	400 fps	140 fps	160 fps
2048 x 256	800 fps	281 fps	315 fps
2048 x 128	1600 fps	562 fps	610 fps
1920 x 1080	189 fps	66 fps	76 fps
1600 x 1200	170 fps	60 fps	69 fps
1280 x 1024	200 fps	70 fps	80 fps
640 x 480	420 fps	150 fps	170 fps
320 x 240	853 fps	300 fps	335 fps

technical specifications

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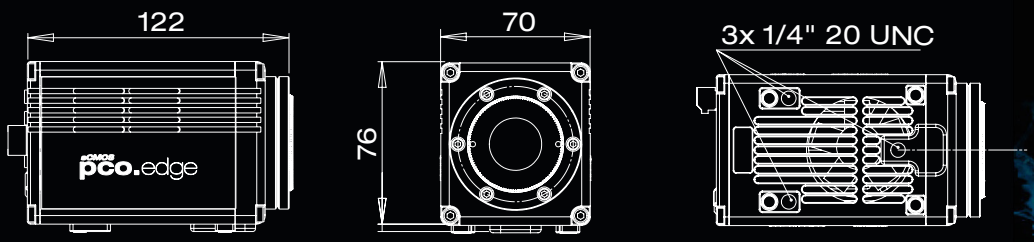
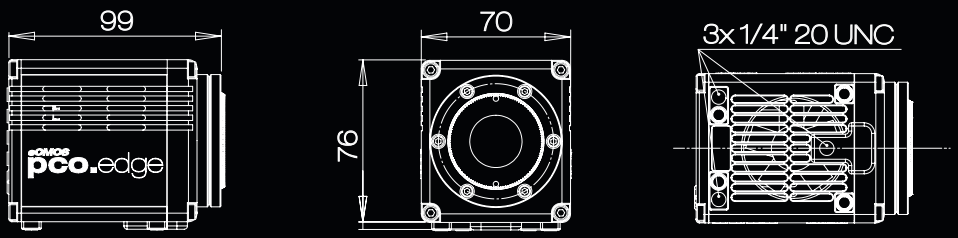
» dimensions

pco.edge CLHS FOL



pco.edge USB 3.0



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

» camera rear view

CLHS FOL
air-cooled

water-cooled

USB 3.0
air-cooled/water-cooled

» lens remote controller

The optional Canon lens control adapter enables the user to connect electronic EF- and EF-S Canon lenses allowing to remote control focus and aperture of those lenses.

[1] 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.
[2] Based on image sensor data sheet.
[3] The high dynamic signal is simultaneously converted at high and low gain by two 11 bit A/D converters and the two 11 bit values are sophistically merged into one 16 bit value.
[4] Measured with C-mount interface.
[5] Max. fps with centered ROI.

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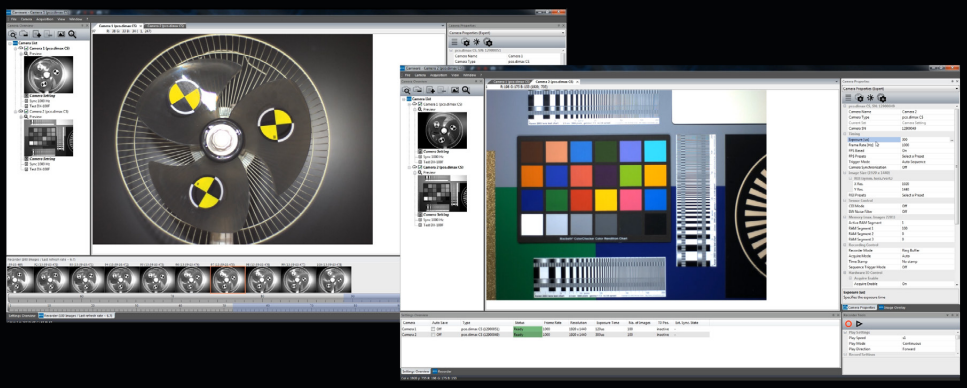
» applications

bright-field microscopy | fluorescence microscopy | digital pathology | single molecule localization microscopy (SMLM) – PALM, STORM, dSTORM, GSDIM | lightsheet fluorescence microscopy (LSFM) | structured illumination microscopy (SIM) | calcium imaging | förster resonance energy transfer (FRET) | fluorescence recovery after photobleaching (FRAP) | high-speed bright-field ratio imaging | high throughput screening | high content screening | biochip reading | total internal reflection microscopy (TITF) | spinning disk confocal microscopy | 3D metrology | ophthalmology | photovoltaic inspection | industrial quality inspection | wafer inspection | image intensifier imaging | lucky astronomy | particle tracking velocimetry (PTV)

» 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

LabVIEW | MathWorks | µ-Manager The Open Source Microscopy Software | VisiView® | python | Nikon | ZEISS | Linux

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