pco.edge 5.5

cooled **sCMOS** cameras

lightsheet scanning mode

CLHS FOL
USB 3.0

small form factor

high dynamic range
30,000:1

high resolution
2560 x 2160 pixel

shutter modes
rolling & global shutter, global reset

high speed
100 fps

low noise
1.0 electrons

1288
EMVA Standard Compliant

technical specifications

pco.edge 5.5

» sCMOS image sensor

interfaces »	CLHS FOL	USB 3.0
type of sensor	scientific CMOS (sCMOS) monochrome or color	
resolution (h x v)	2560 x 2160 active pixel	
pixel size (h x v)	6.5 µm x 6.5 µm	
sensor format/diagonal	16.6 mm x 14.0 mm / 21.8 mm	
shutter mode	rolling shutter (RS) with selectable readout modes, global/snapshot shutter (GS), global reset - rolling readout (GR) additional option: double shutter mode (DS)[1]	rolling shutter (RS) with selectable readout modes, global/snapshot shutter (GS), global reset - rolling readout (GR)
MTF	76.9 lp/mm (theoretical)	
fullwell capacity	30,000 e^-	
readout noise (typ.)[2]	1.0 $_{med}$ e- / 1.4 $_{rms}$ e- @ RS/GR, slow scan 1.1 $_{med}$ e- / 1.5 $_{rms}$ e- @ RS/GR, fast scan 2.2 $_{med}$ e- / 2.5 $_{rms}$ e- @ GS, fast scan	1.0 $_{med}$ e- / 1.4 $_{rms}$ e- @ RS/GR 2.3 $_{med}$ e- / 2.6 $_{rms}$ e- @ GS
dynamic range (typ.)	30,000:1 89.5 dB RS, slow scan	30,000:1 89.5 dB RS
quantum efficiency	> 60 % @ peak	
spectral range	370 nm to 1100 nm	
dark current (typ.)	< 0.6 e^-/pixel/s RS/GR < 0.9 e^-/pixel/s GS @ 7 °C sensor temperature	< 0.5 e^-/pixel/s RS/GR < 0.8 e^-/pixel/s GS @ 5 °C sensor temperature
DSNU	< 0.3 $_{rms}$ e^- RS/GR slow scan < 3.9 $_{rms}$ e^- GS fast scan < 0.3 $_{rms}$ e^- RS/GR fast scan	< 0.3 $_{rms}$ e^- RS/GR < 2.0 $_{rms}$ e^- GS
PRNU	< 0.34 %	< 0.2 %
anti blooming factor[3]	> 10,000	

» camera system

interfaces »	CLHS FOL	USB 3.0
maximum frame rate @ full resolution	100 fps @ RS/GR 50 fps @ GS	30 fps @ RS/GR 28 fps @ GS
exposure/shutter time	500 µs to 2 s RS 10 µs to 100 ms GS 10 µs to 2 s GR	500 µs to 2 s RS 20 µs to 100 ms GS 30 µs to 2 s GR
dynamic range A/D[4]	16 bit	
A/D conversion factor	0.46 e-/DN	
pixel scan rate	286.0 MHz fast scan RS/GS/GR 100.0 MHz slow scan RS/GR	86.0 MHz RS/GR 160.0 MHz GS
pixel data rate	572.0 MPixel/s fast scan RS/GS/GR 200.0 MPixel/s slow scan RS/GR	172.0 MPixel/s RS/GR 320.0 MPixel/s GS
binning horizontal	x1, x2, x4	
binning vertical	x1, x2, x4	
region of interest (ROI)	horizontal: steps of 16 pixels vertical: steps of 1 pixel	horizontal: steps of 4 pixels vertical: steps of 1 pixel
non-linearity	< 0.6 %	< 0.6 %
cooling method	7 °C stabilized, selectable: peltier with forced air (fan) or water cooling (both up to 27 °C ambient)	5 °C stabilized, peltier with forced air (fan) / water cooling (both up to 27 °C ambient)
trigger input signals	2 x programmable inputs (SMA connectors) - Exposure Trigger, Acquire Enable	
trigger output signals	2 x programmable outputs (SMA connectors) - Status Busy, Status Exposure	
time stamp	in image (1 µs resolution)	

technical specifications

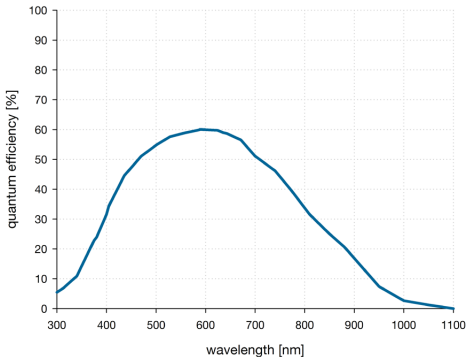
pco.edge 5.5

» general

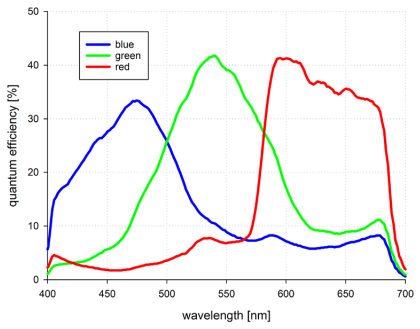
interfaces »	CLHS FOL	USB 3.0
power delivery	24 VDC (+/- 10 %)	
power consumption	32 W max. (typ. 19 W @ 20 °C)	21 W max. (typ. 12 W @ 20 °C)
weight[5]	850 g air-cooled 1060 g water-cooled	800 g
operating temperature	+10 °C to +40 °C	
operating humidity range	10 % to 80 % (non-condensing)	
storage temperature 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



color



» frame rate table[6]

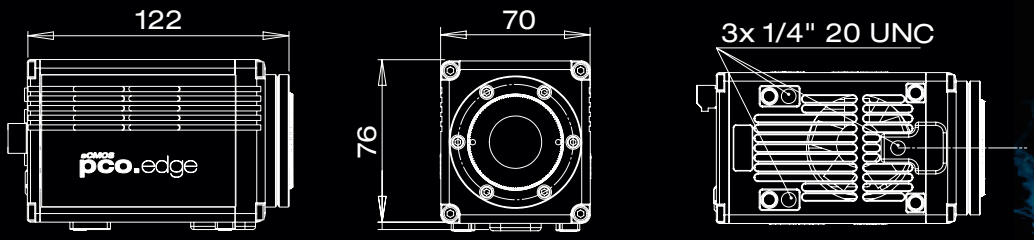
interfaces »	CLHS FOL			USB 3.0	
typical examples	RS	GS	RS	GS	RS
	fast scan		slow scan		
2560 x 2160	100 fps	50 fps	33 fps	28 fps	30 fps
2560 x 1024	212 fps	105 fps	70 fps	59 fps	63 fps
2560 x 512	422 fps	208 fps	140 fps	117 fps	126 fps
2560 x 256	838 fps	409 fps	279 fps	232 fps	248 fps
2560 x 128	1651 fps	789 fps	550 fps	455 fps	481 fps
1920 x 1080	201 fps	100 fps	67 fps	56 fps	60 fps
1600 x 1200	181 fps	90 fps	60 fps	50 fps	54 fps
1280 x 1024	212 fps	105 fps	70 fps	59 fps	63 fps
640 x 480	450 fps	222 fps	150 fps	125 fps	134 fps
320 x 240	893 fps	436 fps	297 fps	247 fps	264 fps

technical specifications

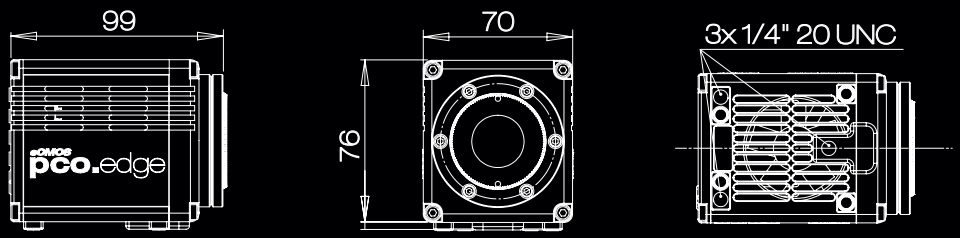
pco.edge 5.5

» 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] Interframing time 120 ns.
[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 data sheet.
[4] 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.
[5] Measured with C-mount lens adapter.
[6] Max. fps with centered ROI.

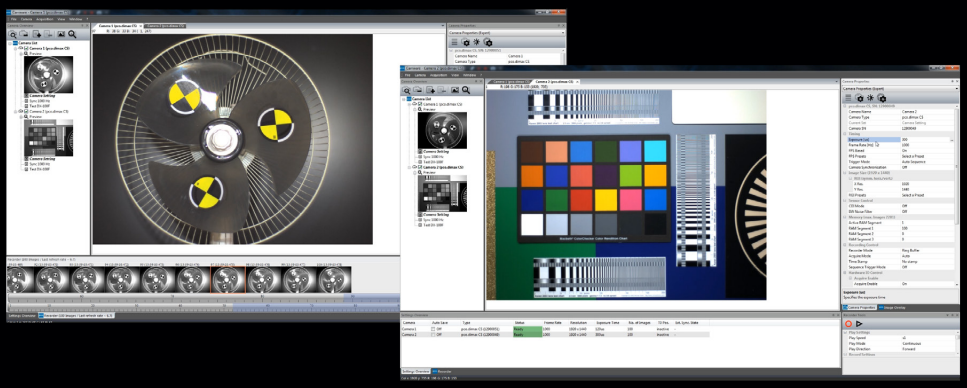
technical specifications

pco.edge 5.5

» 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 | desaster recovery | tunnel inspection | 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 these 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 | Leica MICROSYSTEMS