

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

pco.

An Excelitas Technologies Brand

» 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 % | |
| anti blooming factor ³ | > 10,000 | |

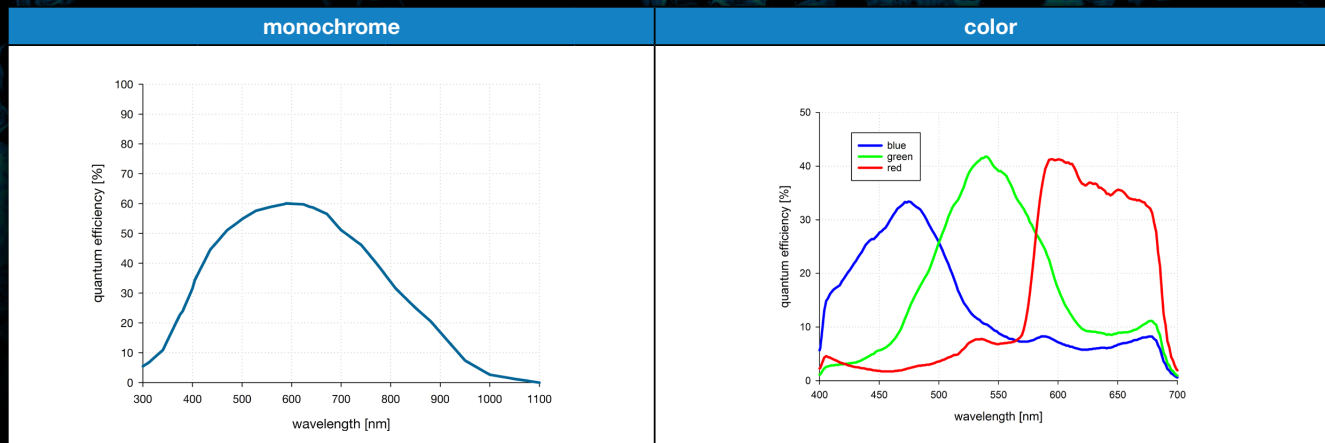
» camera system

| 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 % | |
| 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) | |

» 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



» frame rate table⁶

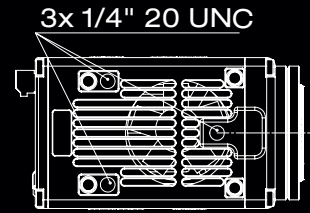
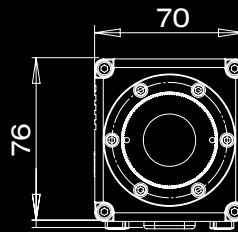
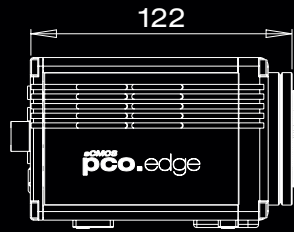
| interfaces » | CLHS FOL | | | USB 3.0 | |
|------------------|-----------|---------|-----------|---------|---------|
| | RS | GS | RS | GS | RS |
| typical examples | fast scan | | slow scan | | |
| 2560 x 2160 | 100 fps | 50 fps | 33 fps | 28 fps | 30 fps |
| 2560 x 1024 | 212 fps | 105 fps | 70 fps | 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

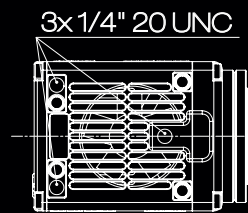
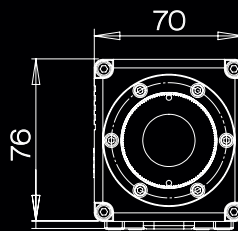
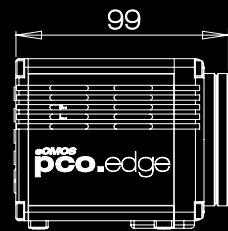
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» dimensions

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.

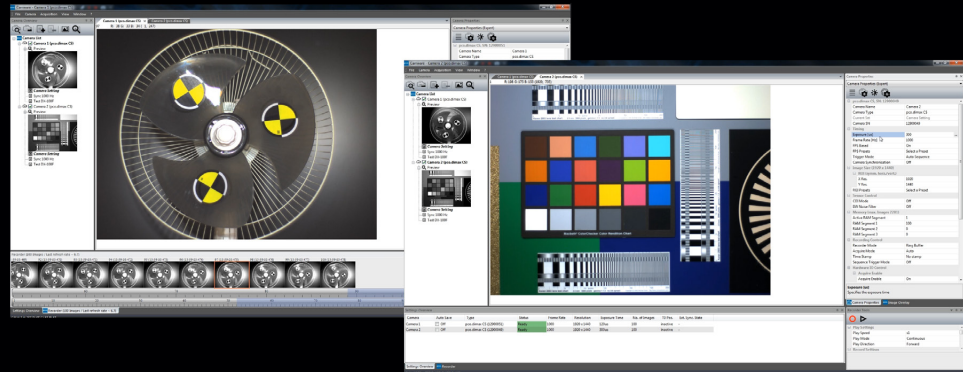


¹ Interframing time 120 ns.
² The readout noise values are given as median (med) and root mean square (rms) values, due to the different noise models, which can be used for evaluation. All values are raw data without any filtering.
³ Based on image sensor data sheet.
⁴ The high dynamic signal is simultaneously converted at high and low gain by two 11 bit A/D converters and the two 11 bit values are sophisticatedly merged into one 16 bit value.
⁵ Measured with C-mount lens adapter.
⁶ Max. fps with centered ROI.

» 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 (TIRF) | spinning disk confocal microscopy | 3D metrology | ophthalmology | photovoltaic inspection | industrial quality inspection | wafer inspection | image intensifier imaging | lucky astronomy | disaster 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



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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