

datasheet

# pco.edge 3.1 USB

scientific CMOS camera

resolution

**3.1 MPixel**

pixel size

**6.5  $\mu\text{m}$  x 6.5  $\mu\text{m}$**

interface

**USB 3.0**



low readout noise  
1.1 e<sup>-</sup> (med)

high speed  
50 fps

high dynamic range  
27 000 : 1

high quantum efficiency  
up to 60 %

high resolution  
2048 x 1536 pixels

## technical data

image sensor	
sensor technology	scientific CMOS (sCMOS)
color type	monochrome color (bayer pattern)
resolution (horizontal x vertical)	2048 px x 1536 px
pixel size (horizontal x vertical)	6.5 μm x 6.5 μm
sensor size (horizontal x vertical)	13.3 mm x 10.0 mm
sensor diagonal	16.6 mm
shutter mode	rolling shutter (RS) with selectable readout direction global reset (GR) global shutter (GS)
modulation transfer function (theoretical max.)	76.9 lp/mm
peak quantum efficiency	60 % @ 600 nm (monochrome)
spectral range	300 nm - 1100 nm (monochrome)
dark current (typ.)	0.5 e <sup>-</sup> /pixel/s @ +5 °C sensor temperature (RS/GR) 0.8 e <sup>-</sup> /pixel/s @ +5 °C sensor temperature (GS)
fullwell capacity	30 000 e <sup>-</sup>
readout noise (typ.) <sup>1</sup>	1.5 e <sup>-</sup> rms (RS/GR) 1.1 e <sup>-</sup> med (RS/GR) 2.9 e <sup>-</sup> rms (GS) 2.7 e <sup>-</sup> med (GS)
dynamic range (intra-scene) <sup>2</sup>	27 000 : 1 (89 dB) (RS/GR) 11 000 : 1 (81 dB) (GS)

<sup>1</sup> 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.

<sup>2</sup> The dynamic range value is calculated with the median value of the readout noise and rounded.

frame rate table		
typical resolutions		
	RS/GR	GS
2048 x 1536	50 fps	50 fps
1920 x 1080	74 fps	72 fps
1280 x 1024	77 fps	75 fps
640 x 480	164 fps	160 fps



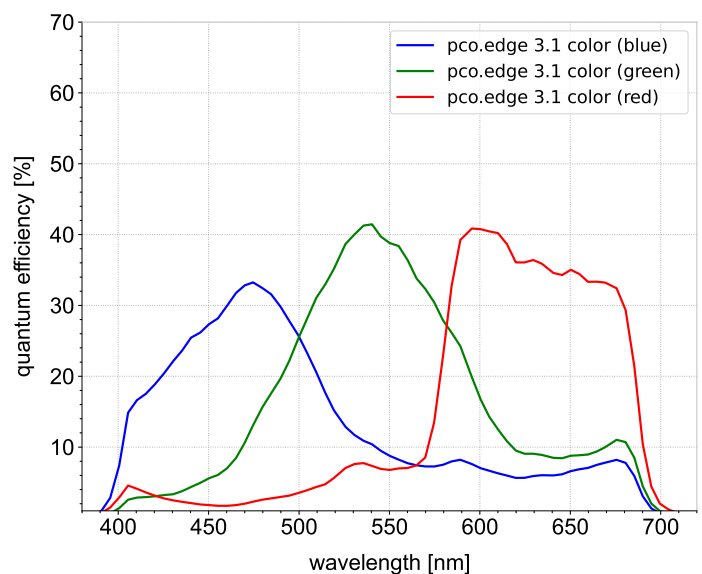
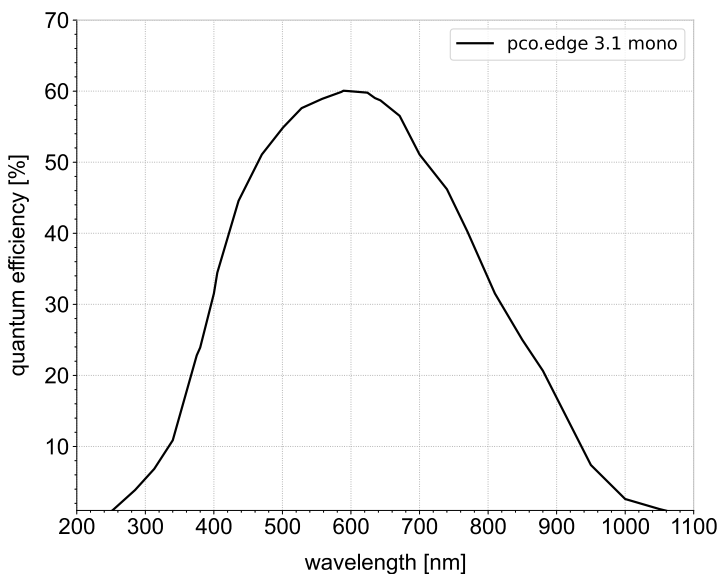
## camera

<b>max. frame rate @ full resolution</b>	50 fps (RS/GR/GS)
<b>exposure time range</b>	500 $\mu$ s - 2 s (RS) 30 $\mu$ s - 2 s (GR) 20 $\mu$ s - 100 ms (GS)
<b>dynamic range A/D<sup>1</sup></b>	16 bit
<b>conversion factor<sup>2</sup></b>	0.46 e-/DN
<b>pixel rate</b>	210 MPixel/s (RS/GR) 408 MPixel/s (GS)
<b>region of interest (ROI)</b>	horizontal: steps of 4 columns (min. 64) vertical: steps of 1 row (min. 16)
<b>binning</b>	horizontal: x2, x4 (sum) vertical: x2, x4 (sum)
<b>non-linearity</b>	< 0.6 %
<b>dark signal non-uniformity (DSNU)</b>	< 0.3 e- rms (RS/GR) < 2.0 e- rms (GS)
<b>photo response non-uniformity (PRNU)</b>	< 0.2 %
<b>cooling temperature image sensor</b>	+5 °C stabilized (up to +27 °C ambient temperature)
<b>cooling method</b>	forced air
<b>trigger input signals</b>	external exposure start, external exposure control, sequence trigger, acquire enable
<b>status output signals</b>	exposure, busy, line
<b>input / output signal connectors</b>	SMA
<b>time stamp</b>	in image (1 $\mu$ s resolution)
<b>data interface</b>	USB 3.0

<sup>1</sup> 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.

<sup>2</sup> According to EMVA1288, the conversion factor equals the inverse of the system gain and can be operational mode dependent.

## quantum efficiency



### general

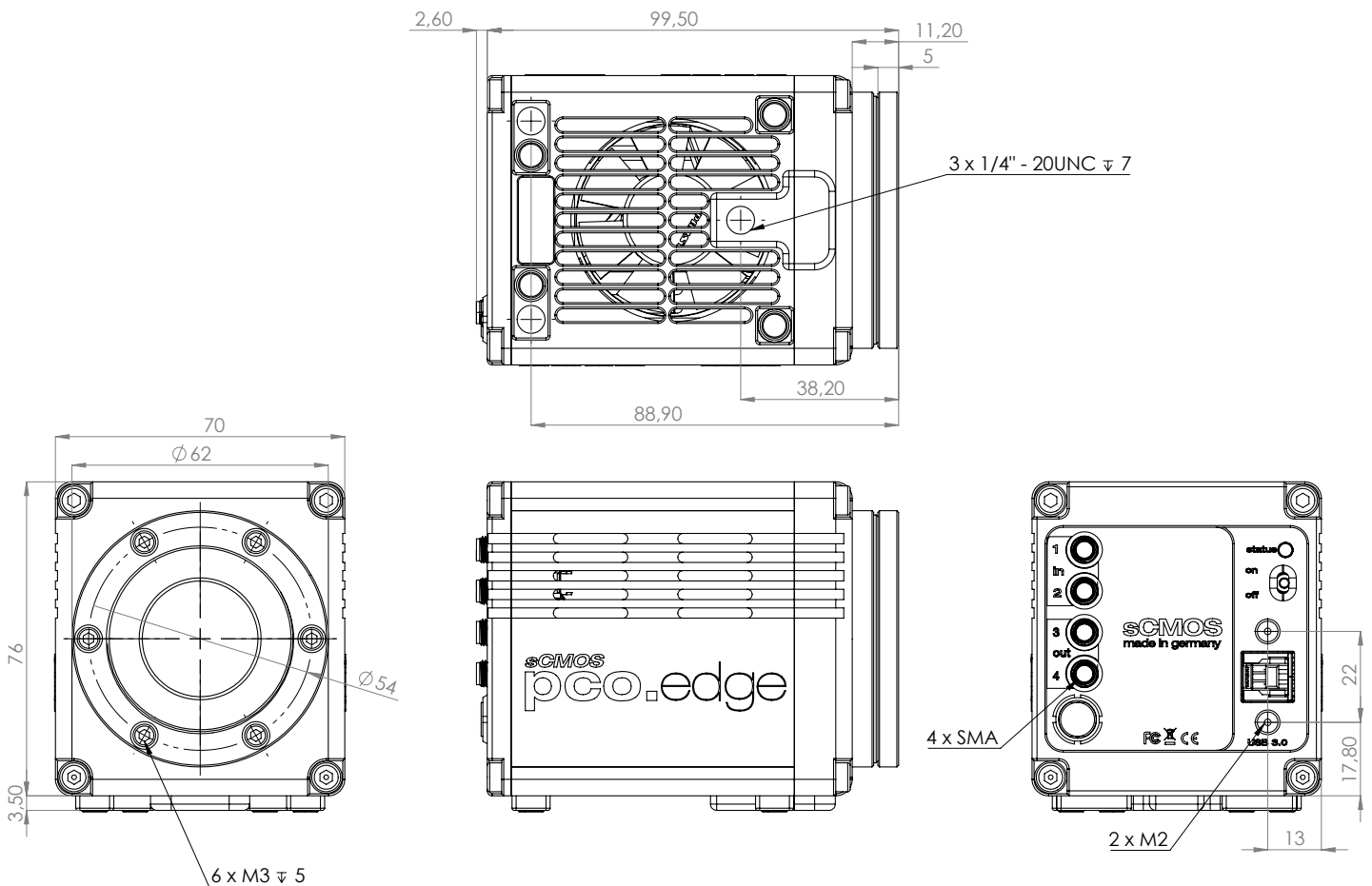
power supply	24 VDC (±10 %)
power consumption	max. 21 W
weight	0.65 kg
dimensions (height x width x length)	76 mm x 70 mm x 99.5 mm
operating temperature range	+10 °C to +40 °C
storage temperature range	-10 °C to +60 °C
humidity range (non-condensing)	10 % to 80 % (recommended < 65 %)
certifications	CE, FCC, UKCA, KC

### optical interface

direct mounting distance	11.1 mm (±10 %)
lens mounting	C-mount, F-mount
optional lens mounting	TFL-mount

Configure your optical setup with our **MachVis Lens Selector** online tool.

### dimensions



outlines of pco.edge 3.1 USB (all dimensions given in mm)

## software

### Your first choice is pco.camware:

Our main camera control software enables control of most camera settings and facilitates image acquisition and storage.

You can customize it exactly to your needs using different layouts, styles and features.

### You prefer to use a different software:

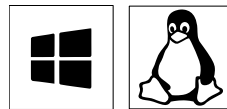
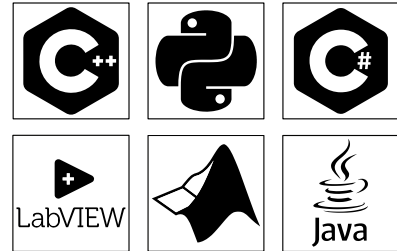
Our cameras integrate with a range of third-party software applications.

In microscopy we offer dedicated support for  $\mu$ Manager, while ensuring compatibility with other software maintained by their providers.

### You want to create your own application:

We feature a wide range of software development kits (SDK) for various programming languages, such as C++, Python, C#, LabVIEW, Matlab, and Java.

If you are looking for more general SDKs, we present pco.sdk and pco.recorder, our low-level SDKs with C interface.



Our software is available for Windows and Linux platforms.

Visit our **website** for detailed information, installation guidance, and Github projects.

## areas of application

3D metrology | biochip reading | calcium imaging | digital pathology | fluorescence microscopy | fluorescence recovery after photobleaching (FRAP) | Förster resonance energy transfer (FRET) | high-content screening | high-speed brightfield ratio imaging | high-throughput screening | lightsheet fluorescence microscopy (LSFM) | lucky astronomy | ophthalmology | photovoltaic inspection | single molecule localization microscopy (SMLM) – PALM, STORM, dSTORM, GSDIM | spinning disk confocal microscopy | structured illumination microscopy (SIM) | super-resolution microscopy | total internal reflection fluorescence microscopy (TIRF) | widefield microscopy

### ordering information

<b>pco.edge 3.1 USB</b>	85108072433	camera system, 2048 x 1536 pixel, monochrome, global and rolling shutter, USB 3.0 interface, air cooling
<b>pco.edge 3.1 C USB</b>	85108072441	camera system, 2048 x 1536 pixel, color, global and rolling shutter, USB 3.0 interface, air cooling

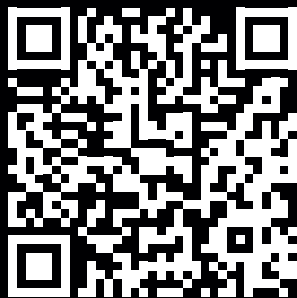
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