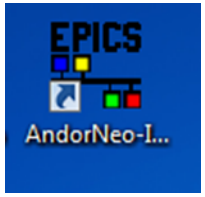
Argonne NATIONAL LABORATORY

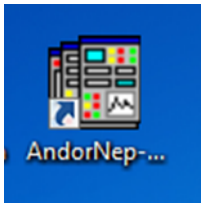
Andor Neo
Detector Pool Guide

U.S. DEPARTMENT OF ENERGY
Office of Science

Quick Start

- Connect power supply and Camera-Link cable to camera and PC.
- Setup Chiller (optional*)
  - Connect Cooling lines
  - Turn on Chiller
- Turn on camera (red button near power cable, you should hear a beep).
- Turn on PC and Login (Windows 7)
  - User Name: .\Andor
  - Password: ********* (ask DP Staff)
- Start Software
  - Start IOC
  - Start MEDM
  - Start ImageJ (optional)





AreaDetector Support:

http://cars9.uchicago.edu/software/epics/areaDetectorDoc.html

*Required if cooling to <-30°c or if you want to turn off the camera fan.

Bit Depth, ROI, binning & Data

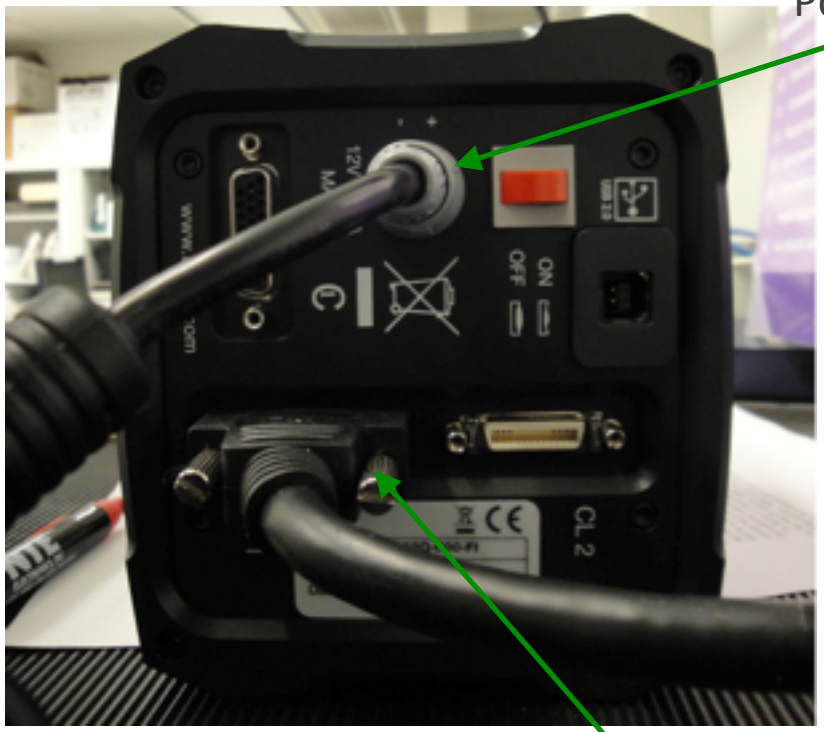
- Bit Depth
  - If you have less than 2k counts/pixel, it is recommended that you use the 11-bit low noise option.
  - 16 bit is really a stitching of two 11 bit readout systems
- ROIs
  - If you are using an ROI it is recommended that you center the ROI on the chip for the highest frame rate.
- Binning
  - Camera supports binning of pixels, however there is a bug that will crash the driver if you do 3x3 binning
- Data
  - At maximum frame rate, bit depth and full chip images, the camera can only collect about 300 images before there is a bottle neck in the readout/camera storage.
  - If you do want continuous images for an extended period, run the camera at ~22 fps, however remember that this will produce ~250 MB/sec

Global vs. Rolling Shutter

- Global Shutter
  - Exposes all pixels and then reads out all pixels, because of this it is a slower frame rate
- Rolling Shutter
  - Continuously is exposing and reading out row of pixels. Not recommended for applications where samples are moving.

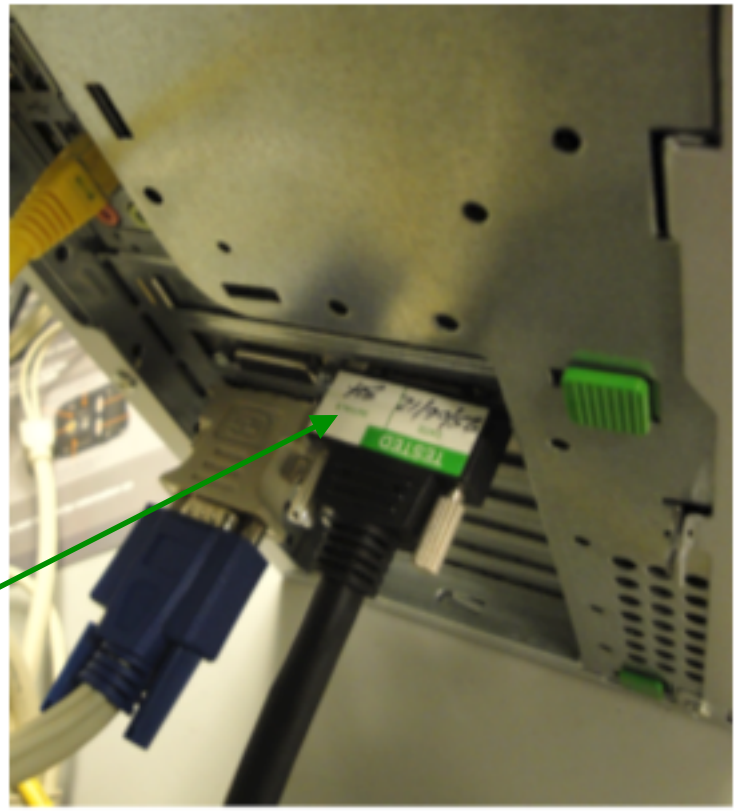
Connections

Power Cable



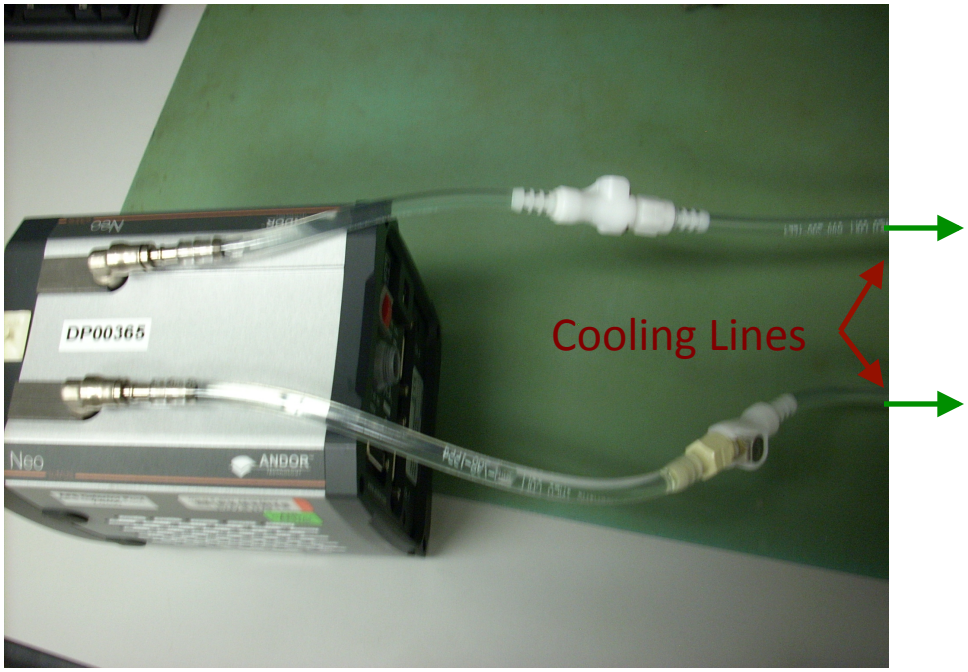
Camera

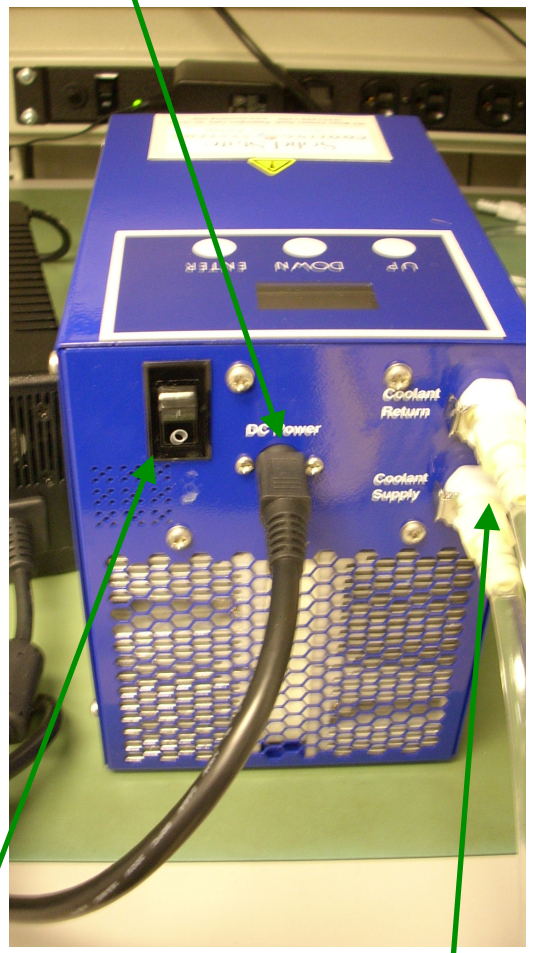
Computer



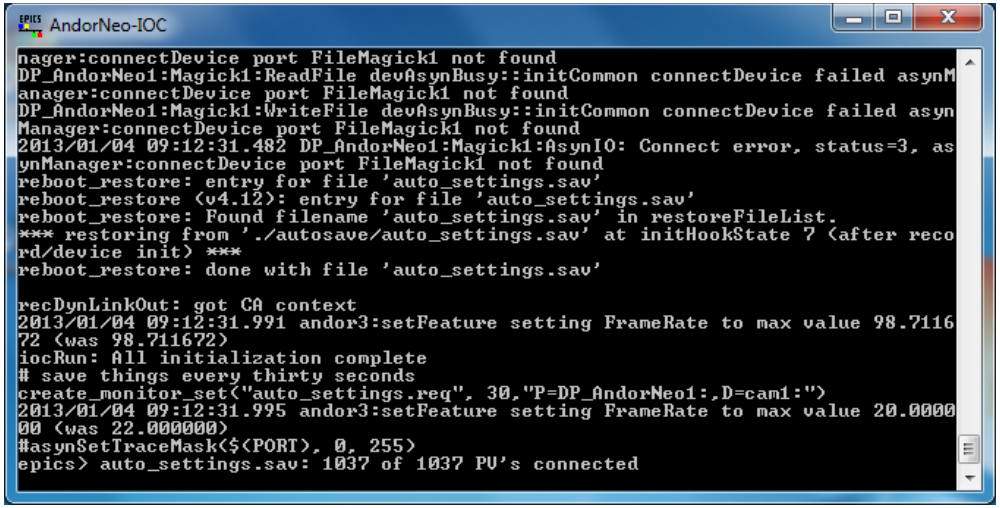
Camera Link Cable

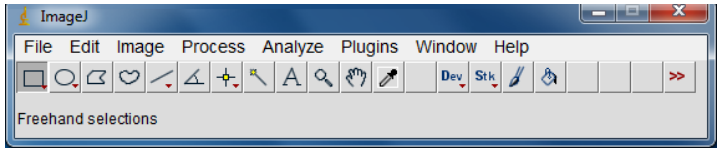
Setup Chiller

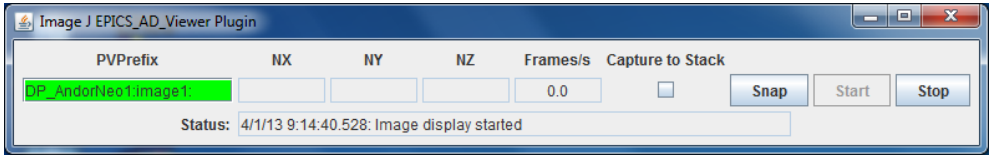


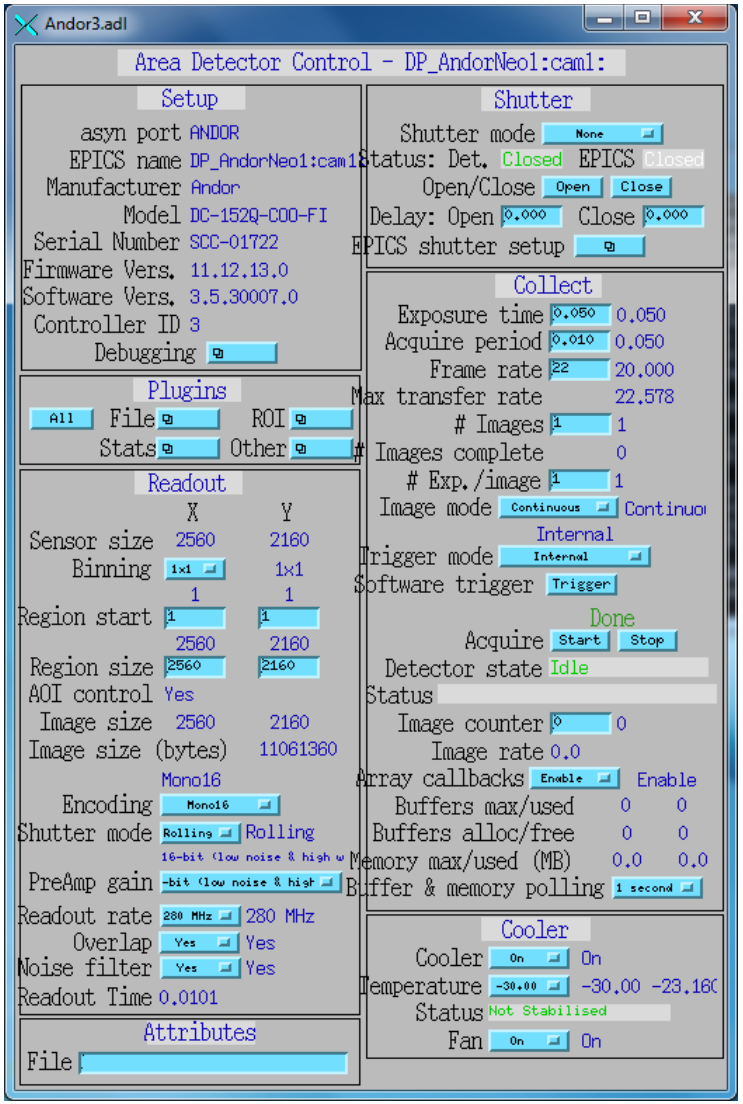


IOC, MEDM & ImageJ





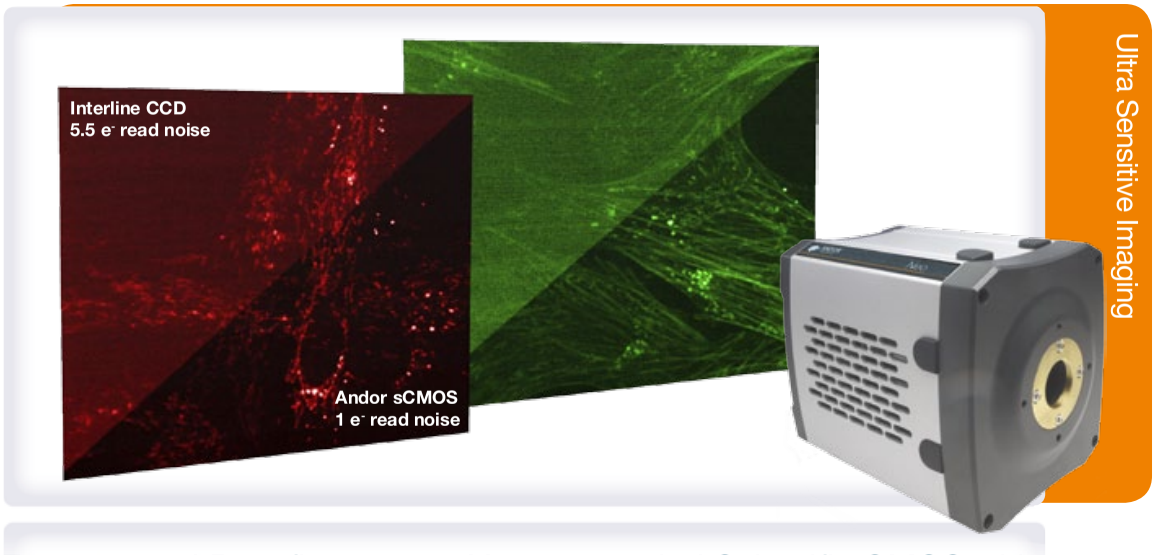




ANDOR™ TECHNOLOGY

Neo sCMOS

5.5 Megapixel, -40°C, 1 e⁻ Noise
Rolling and Global Shutter
Scientific CMOS



Features and Benefits

- **TE cooling to -40°C**
  Minimization of dark current and pixel blemish
- **1 e⁻ read noise**
  Lower detection limit than any CCD
- **5.5 megapixel sensor format and 6.5 µm pixels**
  Extremely sharp resolution over a 22 mm field of view: Ideal for cell microscopy and astronomy
- **Rolling and Global (Snapshot) shutter**
  Maximum flexibility across all applications
- **Rapid frame rates**
  Sustained: 30 fps full frame
  Burst: 100 fps full frame
- **Dual-Gain amplifiers**
  Extensive dynamic range of 30,000:1 @ 30 fps
- **UltraVac™ [•1]**
  Sustained sensor protection and unequalled cooling with 5 year warranty
- **ROI and pixel binning**
  User-defined ROI (1 pixel granularity) and hardware binning
- **Data flow monitor**
  Innovatively manage acquisition capture rates vs data bandwidth limitations
- **4 GB on-head memory**
  Acquire data bursts at frame rates faster than PC write speed
- **Dynamic Baseline Clamp**
  Ensures quantitative stability
- **iCam**
  Fast exposure switching

Vacuum cooled Scientific CMOS with 1 e⁻ read noise - Rolling and Snapshot exposure

In a unique -40°C vacuum cooled platform, loaded with FPGA intelligence, Andor's Neo sCMOS camera is designed exclusively to drive highest possible sensitivity from this exciting and innovative new technology development.

Unlike any CMOS or CCD technology to come before it, Neo sets radical new benchmarks in its unique ability to simultaneously deliver highest specifications in sensitivity, resolution, speed, dynamic range and field-of-view: true scientific imaging, without compromise. Choice of Rolling and Global (Snapshot) exposure mechanisms ensure maximum application flexibility, the latter providing a 'freeze frame' capture capability that emulates that of an interline CCD.

Specifications Summary

Active pixels (W x H)	**2560 x 2160 (5.5 Megapixel)**
Sensor size	**16.6 x 14.0 mm (21.8 mm diagonal)**
Pixel size (W x H)	**6.5 µm**
Pixel well depth (typical)	**30,000 e⁻**
Pixel readout rate (MHz)	**560, 200**
Read noise	**1 e⁻**
Maximum cooling	**-40°C**
Maximum burst frame rate	**100 fps @ full frame**
Readout Modes	**Rolling and Snapshot shutter**

System Specifications[*2]

Sensor type	Front Illuminated Scientific CMOS	
Active pixels (W x H)	2560 x 2160 (5.5 Megapixel)	
Sensor size	16.6 x 14.0 mm, 21.8 mm diagonal	
Pixel size (W x H)	6.5 µm	
Pixel readout rate (MHz)	560 (280 MHz x 2 sensor halves) 200 (100 MHz x 2 sensor halves)	
Read noise (e^-) [*3]	**Rolling Shutter**	**Global Shutter**
200 MHz	1	2.3
560 MHz	1.3	2.5
Minimum temperature air cooled [*4] **Minimum temperature coolant**	-30°C -40°C	
Dark current, e^-/pixel/sec [*5]		
@ -30°C	0.07	
@ -40°C	0.03	
Data range	11 bit and 16 bit	
Maximum Quantum Efficiency	57%	
Readout modes	Rolling Shutter and Global (Snapshot) Shutter	
Internal memory buffer size	4 GB	
Maximum burst frame rates **2560 x 2160 (full frame)** **128 x 128 ROI**	 100 fps Rolling Shutter, 49 fps Global (Snapshot) Shutter 1,616 fps Rolling Shutter, 710 fps Global (Snapshot) Shutter	
Pixel well depth (e^-)	30,000	

Advanced Performance Specifications[*2]

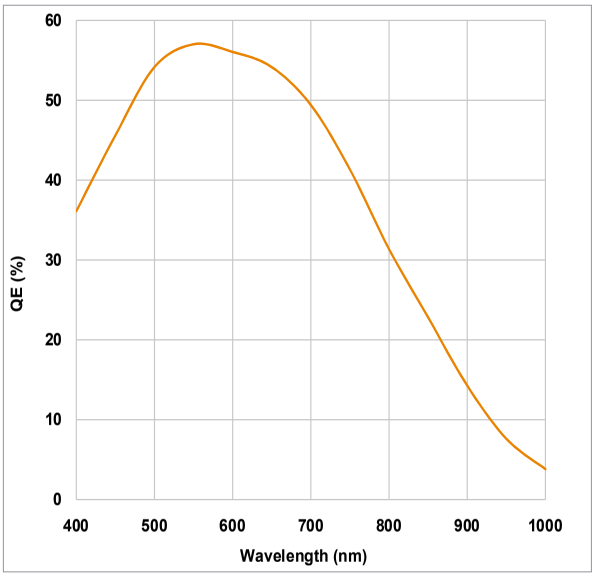
Maximum dynamic range	30,000:1
Linearity (%, maximum) [*6]	Better than 99%
MTF (Nyquist @ 555 nm)	45%
Photon Response Non-Uniformity (PRNU)	< 0.5%
Pixel binning	Hardware binning: 2 x 2, 3 x 3, 4 x 4, 8 x 8
Pre-defined Region of Interest	4 MP, 3 MP, HD, 1.4 MP, 528 x 512, 240 x 256, 144 x 128
User defined ROI granularity	1 pixel *
I/O	External Trigger, Fire, Arm
Trigger modes	Internal, External, External Start, External Exposure, Software Trigger
System window type	Single window with double-sided AR coating
Hardware timestamp accuracy	25 ns
Anti-blooming factor	x 10,000

* Minimum ROI height 12 rows

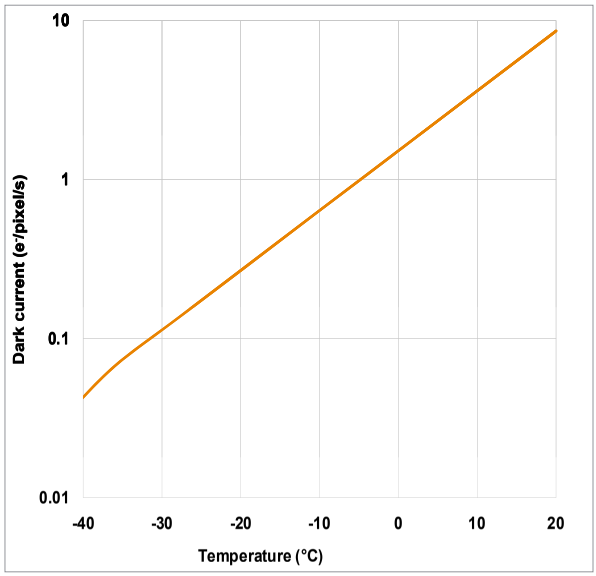
Maximum Frame Rate Table[*7]

Array Size	Cameralink - 3-tap		Burst to 4 GB Internal Memory	
	Rolling Shutter	Global (Snapshot) Shutter	Rolling Shutter	Global (Snapshot) Shutter
2560 x 2160 (full frame)	**30**	**30**	**100**	**50**
2048 x 2048	**39**	**39**	**104**	**52**
1392 x 1040	**80**	**80**	**204**	**100**
512 x 512	**181**	**161**	**412**	**200**
128 x 128	**1,098**	**711**	**1,616**	**711**

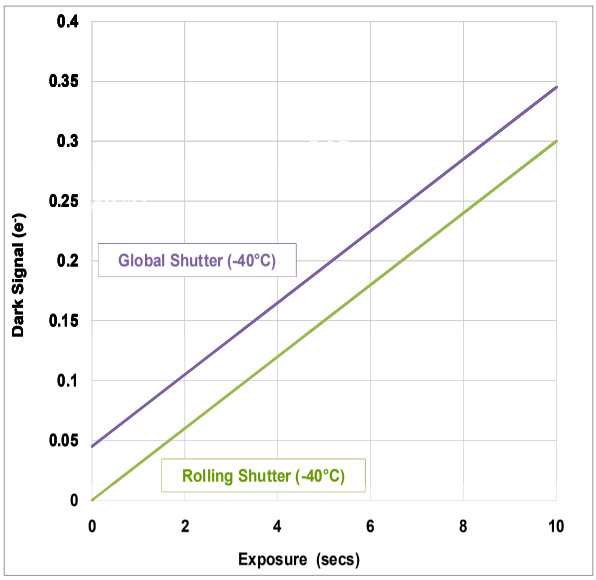
Quantum Efficiency (QE) Curve[8]



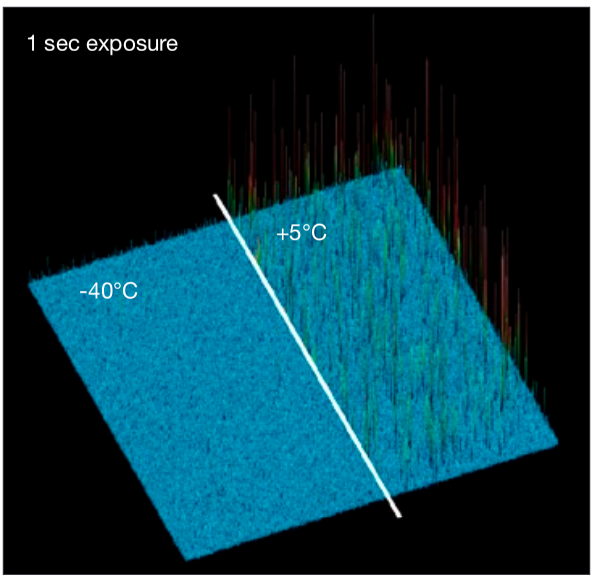
Dark Current vs Cooling Temperature[5]



Dark Signal vs Exposure Time (Rolling and Global Shutter Modes)[9]



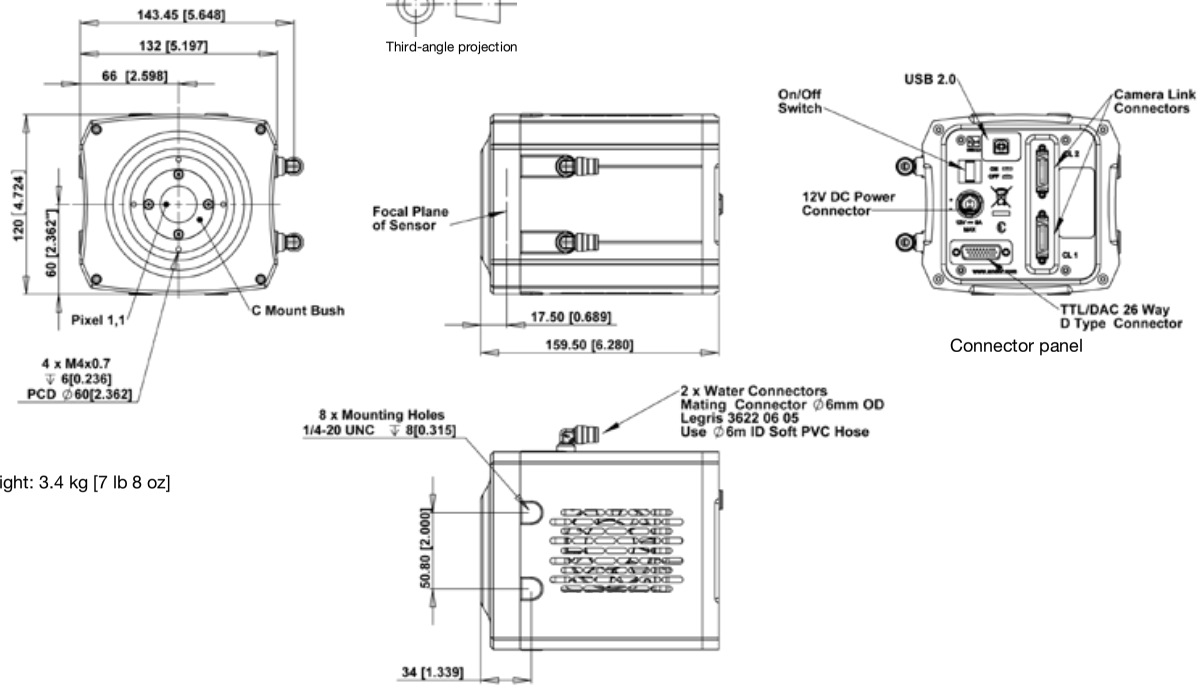
Hot Pixels v Cooling Temperature



Comparison of hot pixel blemishes at cooling temperatures of +5°C and -40°C @ 1s exposure time; rolling shutter readout mode.

Product Drawings

Dimensions in mm [inches]



Weight: 3.4 kg [7 lb 8 oz]

Connecting to the Neo

Camera Control
Camera link (dual connectors are fitted to allow future upgrades to a higher bandwidth solution)

TTL / Logic
Connector type: 26 way D Type with TTL I/Os for External Trigger, Fire Pulse and Arm

Firmware updates through USB

Minimum cable clearance required at rear of camera
90 mm

Regulatory Compliance

Compliant with the requirements of the EU EMC and LV Directives through testing to EN 61326-1 and EN 61010-1

External power supply PSE-approved

QE v Fluorophore Emissions