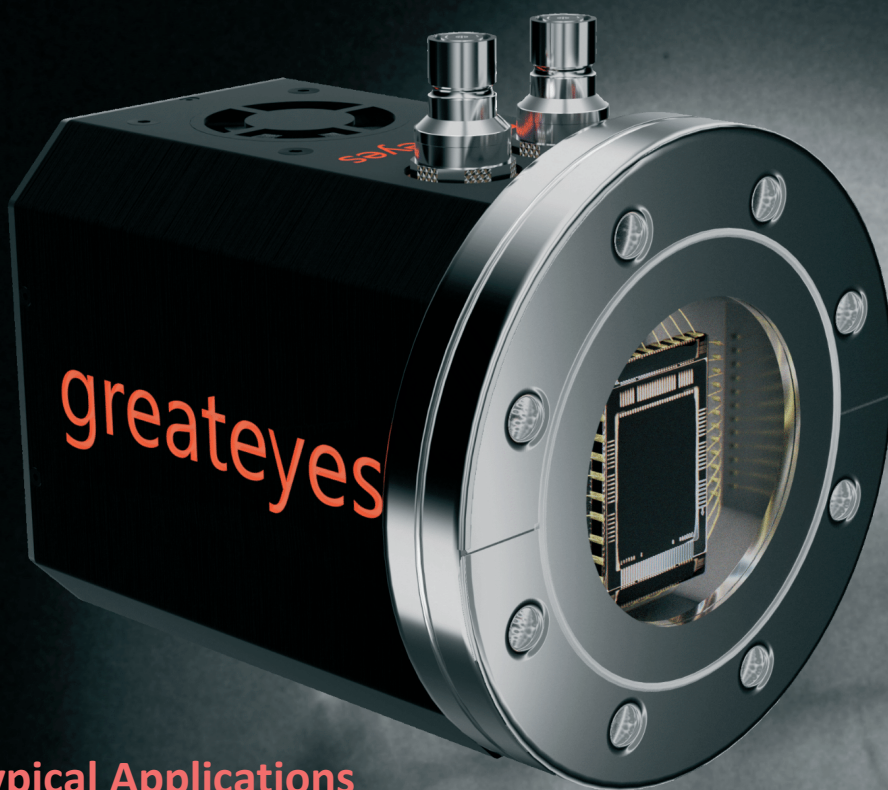


ALEXⁱ

greateyes

DISCOVER WHAT
THE EYE CAN'T SEE

Full-Frame Deep Cooling Scientific **CCD** Camera for Imaging Applications



Typical Applications

X-Ray Tomography
Fourier Transform Holography
X-Ray Fluoroscopy
Coherent Diffraction Imaging
Ptychographic Spectromicroscopy
Grazing-Incidence Small-Angle X-Ray Scattering

Key Specifications

High Quantum Efficiency
Ultra Deep Cooling up to $-100\text{ }^{\circ}\text{C}$
18-bit Dynamic Range
Multi-MHz Readout
Compact Design



BERLIN IS UNIQUE, AND SO IS ALEX WILL YOU BE TOO?



Straight out of Berlin comes **ALEX**, greateyes' new platform for your spectroscopy applications in the VUV, EUV, soft and hard X-Ray range. **ALEX** integrates cutting-edge low-noise electronics and ultra-deep cooling technology while keeping a compact camera design. Multiple readout speeds can be selected supporting pixel rates from 50 kHz up to 5 MHz. True 18-bit AD conversion allows to exploit the full dynamic range of the CCD sensor for highest performance and SNR. **ALEX** is ideally suited for detection of very weak signal intensities where a low-noise floor is paramount. **ALEX** offers unprecedented possibilities for your measurements of tomorrow. The nanoscopic soft X-ray image of a diatom on the front page was made by the group for Imaging and Coherent X-rays of Max Born Institute in collaboration with the X-ray microscopy division of Helmholtz-Zentrum Berlin (BESSY).



Features & Benefits

- **Ultra deep TE cooling up to -100 °C**
lowest dark current for better detection limit
- **GigE & USB 3.0 data interface**
local or remote network operation – your choice!
- **Fast readout speeds up to 5 MHz**
fast frame rates paired with low-noise electronics
- **High QE up to 98%**
very sensitive sensors for low light applications
- **User selectable gain**
balance your detector for best SNR and dynamic range
- **Flexible software options**
camera software and SDKs available



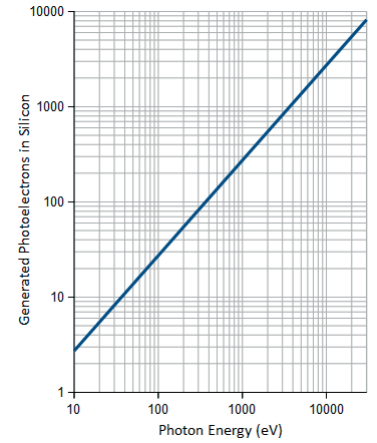
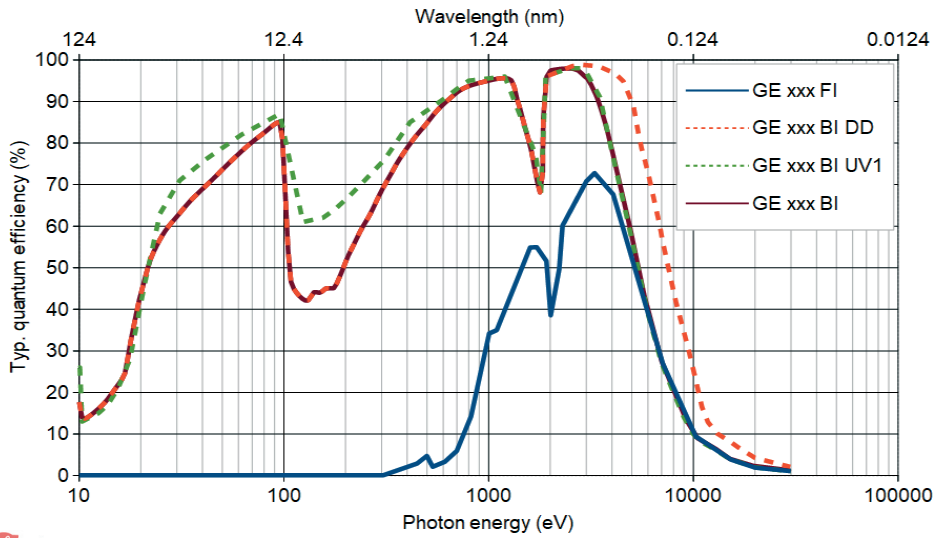
Common specifications

Pixel readout frequency	50 kHz, 250kHz, 1 MHz, 3 MHz (5 MHz for visualization mode; up to 6 speeds)
Readout modes	2 output nodes for 1 Mpx and 4 Mpx camera, 4 output nodes for 16 Mpx camera
AD converter resolution	18-bit
Linearity	Better than 99%
CCD epitaxial thickness	15 µm standard, 40 µm for deep depletion (DD) models
Flange types	ISO-F DN63, knife-edge sealed CF DN63, CF DN100, CF DN160
Vacuum compatibility	With CF flange: 10 ⁻¹⁰ mbar (UHV capability)
Bakeout temperature	Max. +80 °C
Flange - focal plane	1 Mpx with CF DN63: 6 mm; 4 Mpx with CF DN63: 5 mm; 16 Mpx with CF DN160: -27 mm (all distance can be customised)
Temperature monitoring	Two thermistors at CCD sensor and thermoelectric cooler (hot side)
Data link	Gigabit Ethernet, USB 3.0
Software	greateyes Vision software for Windows 7 / 10
SDK and drivers	DLL for Windows; LabVIEW, EPICS, Linux driver (optional)
TTL interface signals	Sync out, shutter out, external trigger in
Operating conditions	Temperature: 0°C to 35°C ambient, relative humidity <80% (non-condensing)
Power supply	1 Mpx & 4 Mpx: 80-264 VAC (typ. 115/230), 47-63 Hz (typ. 50/60), max. 1.1 A (230 V) / 1.9 A (115 V) 16 Mpx: 85-264 VAC (typ. 115/230), 47-63 Hz (typ. 50/60), max. 1.9 A (230 V) / 3.8 A (115 V)
Certification	CE
Dimensions	8.3 cm (3.27") × 10.0 cm (3.94") × 10.9 cm (4.29") (W × H × L, 1 Mpx & 4 Mpx camera body) 13.7 cm (5.39") × 13.7 cm (5.39") × 13.3 cm (5.24") (W × H × L, 16 Mpx camera body)
Weight	2.9 kg (1 Mpx & 4 Mpx, CF DN63) / 4.3 kg (1 Mpx & 4 Mpx, CF DN 100) / 12.5kg (16 Mpx, CF DN160)

ALEXi



The Berlin TV Tower (the tallest building in Germany) and the ALEX square below it are symbols of Berlin and beloved by Berliners.



The mean energy of a photon to generate an electron-hole pair in silicon is 3.66 eV.



Step 1: Choose your camera model

ALEXi Series	ALEX 1024 1024		ALEX 2048 2048		ALEX 4096 4096	
Sensor code	FI BI BI UV1	BI DD	FI BI	BI DD BI UV1	BI	BI UV1
Nominal pixel format	1024 × 1024		2048 × 2048		4096 × 4096	
Image area	13.3 mm × 13.3 mm		27.6 mm × 27.6 mm		61.4 mm × 61.4 mm	
Pixel size	13 μm × 13 μm		13.5 μm × 13.5 μm		15 μm × 15 μm	
CCD sensor cooling	-100 °C to 20 °C		-80 °C to 20 °C		-90 °C to 20 °C	
Full well capacity	100 ke ⁻	120 ke ⁻	100 ke ⁻	150 ke ⁻	150 ke ⁻	350 ke ⁻
Register well / Output node	400 ke ⁻ / -		400 ke ⁻ / -	600 ke ⁻ / -	- / 900 ke ⁻	- / 600 ke ⁻
Typ. read noise (e ⁻)						
@ 50 kHz	2.5		3.8		4.7	2.5
@ 1 MHz	6.5		8.7		9.5	6.3
@ 3 MHz	9.0		13.6		17.0	10.5
Dark current (e ⁻ /pixel/s)	@ -100 °C		@ -80 °C		@ -90 °C	
	0.00015	0.0005	0.0003	0.01	0.00008	0.004
User selectable gain	0.65 counts/e ⁻		0.5 counts/e ⁻ (low noise) 1.5 counts/e ⁻ (high capacity)		0.4 counts/e ⁻ (low noise) 1.2 counts/e ⁻ (high capacity)	
CCD sensor type	Front-illuminated (FI), back-illuminated (BI), deep depletion fringe suppression (DD), enhanced back-illuminated (BI UV1)					
Blemish specifications	Grade 0 or grade 1 (standard) as specified by sensor manufacturer. For more information, please see: https://www.greateyes.de/en/glossar.html					



Step 2: Select interface vacuum flange

Order code	Description
CF1	Knife-edge sealed CF DN63 flange with threaded holes
CF2	Knife-edge sealed CF DN100 flange with through holes
CF3	Knife-edge sealed CF DN160 flange with through holes
CF4	Rotatable, knife-edge sealed CF DN100 flange with through holes

We also provide quick release, rotatable and other flanges of various sizes, please let us know your requirement.

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Step 3: Choose your accessories and software

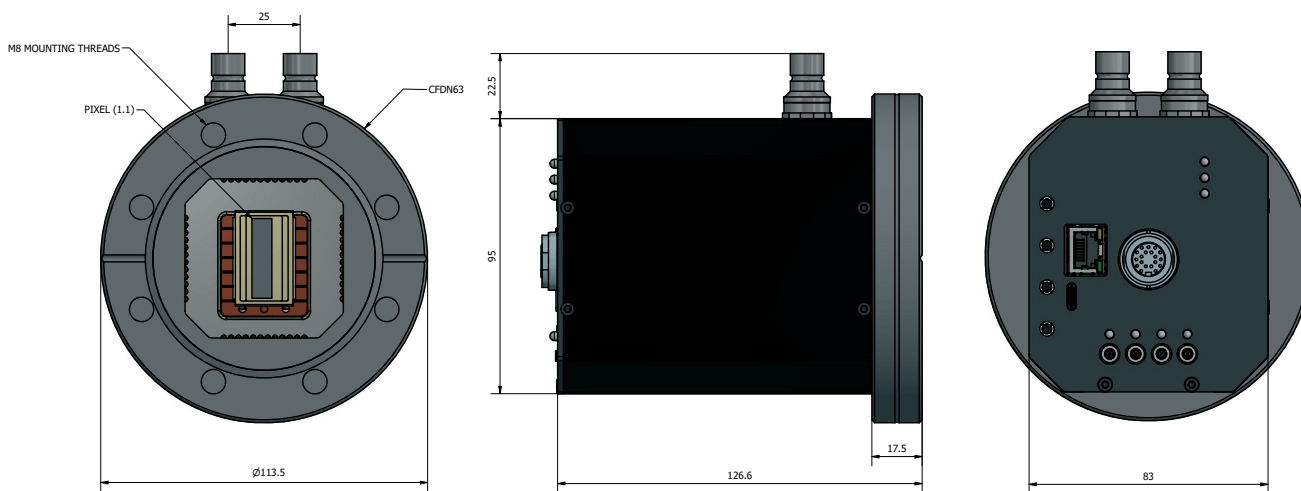
Order code	Description
<i>A) Accessories for imaging purposes</i>	
GE-SR25	25mm shutter for 1 Mpx camera, including shutter driver module
GE-SR45	45mm shutter for 4 Mpx camera, including shutter driver module
<i>B) Accessories for enhanced cooling performance</i>	
GE-CR01	Compact recirculator operating at room temperature for deep camera cooling
GE-CR02	Recirculating water chiller, temperature range -5°C to 30°C for ultra-deep camera cooling
<i>C) Software development kit (SDK) and drivers</i>	
GE-LAB01	LabVIEW driver
GE-EP	EPICS driver
GE-LX01	Linux driver
GE-PYT01	Python SDK



Step 4: Flexible customisation service

With direct and fast response, we provide various customisations and OEM services. For example, other sensor types, the alteration of sensor position/tilt, the modification of camera housing or cooling system, etc. Let us know what **ALEX** you require.

TECHNICAL DRAWINGS*



*Only valid for ALEX 1024 1024 and ALEX 2048 2048. For the drawing of ALEX 4096 4096, please send us an enquiry.



Items included with your camera

GE-VI01	greateyes Vision software suite for Windows
GE-SDK01	SDK for Windows (based on C/C++)
GE-USB5m3	5m USB 3.0 cable type A to type C
GE-GigE5m	5m Ethernet cable
GE-StoB2m	2m SMB to BNC connection cable
GE-POW01	Camera power supply with cabling
GE-ManCam	Camera instruction manual on storage device



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