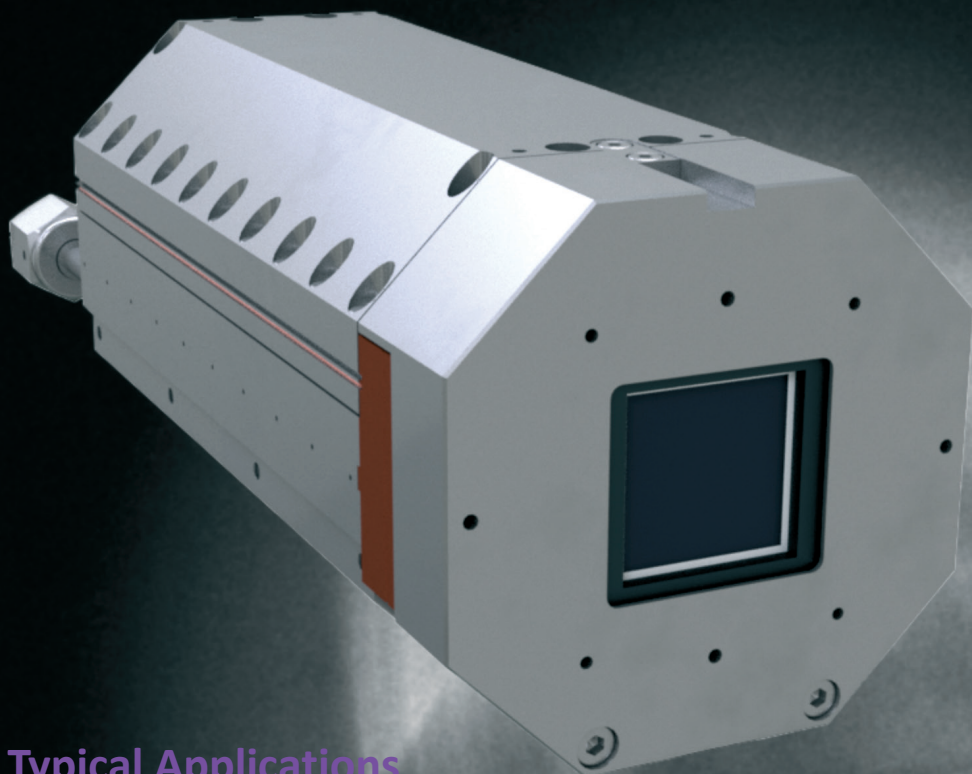


HIGH RESOLUTION  
UP TO  
**16.8**  
MEGAPIXEL  
HIGH RESOLUTION

## Full-Frame Deep Cooling In-vacuum Scientific CCD Camera for Imaging Applications

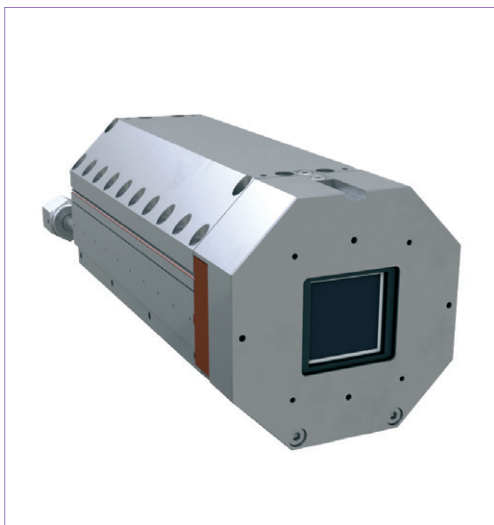


### Typical Applications

- EUV Lithography
- X-Ray Tomography / Fluoroscopy
- Fourier Transform Holography
- X-Ray Diffraction
- X-Ray Phase Contrast Imaging
- Ptychographic Spectromicroscopy
- Grazing-Incidence Small-Angle X-Ray Scattering

### Key Specifications

- UHV Compatibility through Encapsulated Design
- High Quantum Efficiency
- Ultra Deep Cooling down to -100 °C
- 18-bit Dynamic Range
- Multi-MHz Readout
- Compact Design



## LOWEST OUTGASSING RATE & DEEPEST COOLING

**LOTTE** in-vacuum CCD camera is the latest innovation from greateyes. **LOTTE** can be submerged, operated and positioned freely inside a vacuum chamber. Utilising scientific-grade back-illuminated CCD sensors for the detection of EUV, VUV and X-ray signals, **LOTTE** is equipped with a novel and advanced cooling concept enabling detector temperatures as low as  $-100\text{ }^{\circ}\text{C}$ . It is furthermore driven by the most powerful and versatile true 18-bit electronic platform available for in-vacuum use. This guarantees ultra low noise performance. One key feature that differentiates **LOTTE** from its nearest rivals is an innovative encapsulated stainless-steel housing, assuring extremely low outgassing at all times. The special design and unprecedented performance make the **LOTTE** a unique companion for demanding low-light scientific research applications. Additional handy features are further improving the user experience and adding true value.



### Features & Benefits

- **Ultra deep TE cooling down to  $-100\text{ }^{\circ}\text{C}$**   
lowest dark current for better detection limit
- **GigE data interface**  
local or remote network operation – your choice!
- **Fast readout speeds up to 5 MHz**  
fast frame rates paired with low-noise electronics
- **UHV Compatibility**  
encapsulated design delivers the lowest outgassing rate
- **High QE up to 98%**  
very sensitive sensors for low light applications
- **Flexible software options**  
camera software and SDKs available



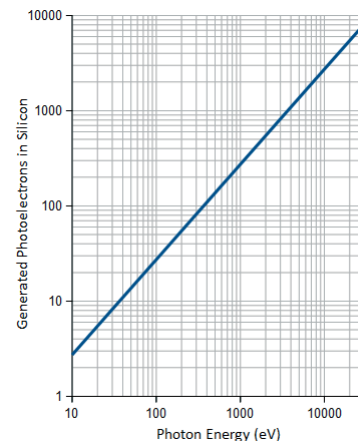
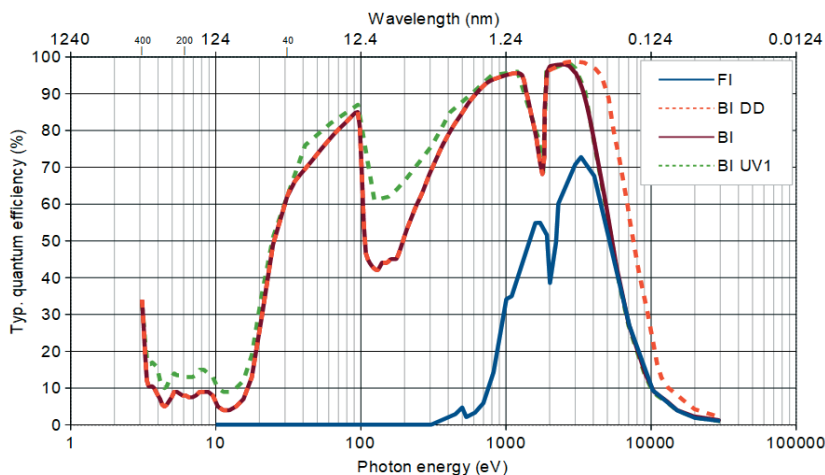
### Common specifications

Pixel readout frequency	50/100/250/500 kHz, 1 MHz, 3 MHz (5 MHz visualization mode; up to 20 MHz by multi-output)
Readout modes	2 output nodes for 1k1k & 2k2k cameras, 4 output nodes for 2k2k plus & 4k4k cameras
AD converter resolution	18 bit
Linearity	Better than 99%
CCD epitaxial thickness	15 $\mu\text{m}$ standard, 40 $\mu\text{m}$ for deep depletion (DD) models
Feedthrough Flange	CF DN100 flange with D-sub electrical feedthrough connectors and 6 mm liquid feedthrough tubes (airside: G 1/4 fitting female, vacuum side: VCR 1/4 fitting female)
Vacuum compatibility	$10^{-9}$ mbar (UHV capability)
Bakeout temperature	Max. $+80\text{ }^{\circ}\text{C}$
Flange - focal plane	1k1k camera: 6 mm; 2k2k, 2k2k plus & 4k4k cameras: 5 mm (all distances can be customised)
Temperature monitoring	Two thermistors at CCD sensor and thermoelectric cooler (hot side)
Data link	Gigabit Ethernet
Software	greateyes Vision software for Windows 7 / 10
SDK and drivers	DLL for Windows; LabVIEW, EPICS, Linux, Python, Tango driver (optional)
TTL interface signals	1 Exposure out, 1 Trigger in
Power supply	1k1k & 2k2k: 80-264 VAC (typ. 115/230), 47-63 Hz (typ. 50/60), max. 1.1 A (230 V) / 1.9 A (115 V) 2k2k plus & 4k4k: 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 W x H x L [mm]	rc versions: 98 x 90 x 235 (1k1k, 2k2k & 2k2k plus cameras) / 98 x 90 x 236 (4k4k cameras) sc versions: 90 x 127 x 189 (1k1k, 2k2k & 2k2k plus cameras) / 94 x 127 x 190 (4k4k cameras)
Weight	rc versions: 4.9 kg (1k1k, 2k2k & 2k2k plus) / 5.1 kg (4k4k)   sc versions: 5.0 kg / 5.1 kg

# LOTTE-i



In the late 17th century queen Sophia Charlotte - nicknamed LOTTE - laid the foundation stone of Berlin's most famous palace "Schloss Charlottenburg".



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



## Step 1: Choose your camera model

LOTTE-i Series	LOTTE-i 1k1k		LOTTE-i 2k2k		LOTTE-i 2k2k plus	LOTTE-i 4k4k	
Sensor code	FI BI BI UV1	BI DD	FI BI	BI DD BI UV1	BI	BI	BI DD BI UV1
Usable pixels (columns x rows)	1024 x 1024 (FI) 1056 x 1027 (others)		2048 x 2052		2048 x 2064	4096 x 4112	
Active image area	13.3 mm x 13.3 mm		27.6 mm x 27.6 mm		30.7 mm x 30.7 mm	61.4 mm x 61.4 mm	
Pixel size	13 μm x 13 μm		13.5 μm x 13.5 μm		15 μm x 15 μm	15 μm x 15 μm	
CCD sensor cooling	-100 °C to 20 °C		-80 °C to 20 °C		-80 °C to 20 °C	-80 °C to 20 °C	
Full well capacity	100 ke <sup>-</sup>	120 ke <sup>-</sup>	100 ke <sup>-</sup>	150 ke <sup>-</sup>	150 ke <sup>-</sup>	150 ke <sup>-</sup>	350 ke <sup>-</sup>
Register well / Output node	400 ke <sup>-</sup> / -		400 ke <sup>-</sup> / -	600 ke <sup>-</sup> / -	- / 900 ke <sup>-</sup>	- / 900 ke <sup>-</sup>	- / 600 ke <sup>-</sup>
Typ. read noise (e <sup>-</sup> )							
@ 50 kHz	2.8		3.4		4.6	4.6	
@ 1 MHz	6.4		7.0		8.5	8.5	
@ 3 MHz	10.9		13.6		17.0	17.0	
Typ. dark current (e <sup>-</sup> /pixel/s)	@ -80 °C		@ -80 °C		@ -80 °C	@ -80 °C	
	0.0003	0.015	0.0003	0.015	0.0001	0.0001	0.006
Gain (counts/e <sup>-</sup> ):							
Standard mode	1		1		0.6	0.6	
High capacity mode	-		0.34		0.2	0.2	
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: <a href="https://www.greateyes.de/en/glossar.html">https://www.greateyes.de/en/glossar.html</a>						



## Step 2: Choose your camera design

"rc" Version	"sc" Version
 <ul style="list-style-type: none"> <li>• Compact in diameter, camera body fits into 6 inch tube</li> <li>• Electrical and water connectors on the rear side</li> </ul> <p>Order code: LOTTE-i <u>2k2k BI UV1</u> rc</p>	 <ul style="list-style-type: none"> <li>• Camera length only 189 mm</li> <li>• Electrical and water connectors on the bottom side</li> </ul> <p>Order code: LOTTE-i <u>1k1k BI DD</u> sc</p>



## Step 3: Choose your accessories and software

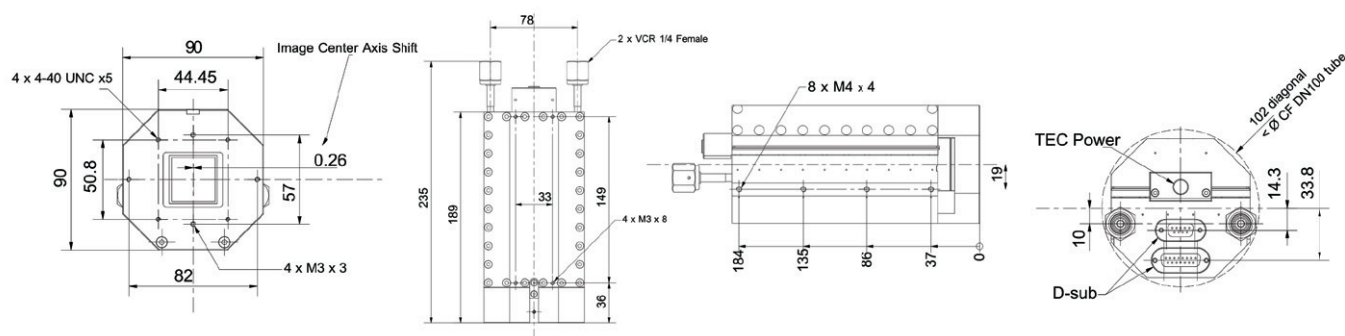
Order code	Description
<i>A) Accessories for imaging purposes</i>	
GE-SR25	25mm in-vacuum shutter for 1k1k camera, including shutter driver module
GE-SR45	45mm in-vacuum shutter for 2k2k & 2k2k plus cameras, including shutter driver module
<i>B) Accessories for cooling performance (LOTTE series can only be cooled by liquid cooling)</i>	
GE-CR01	Compact liquid cooling, circulating the coolant at room temperature for deep camera cooling
GE-CR02	Recirculating water chiller, PID control with temp. from 5°C to 30°C for ultra-deep camera cooling
GE-VacP01	2 × in-vacuum hoses, formed bellow 1/4", VCR male/female, 305 mm (standard accessory)
GE-VacP02	2 × in-vacuum hoses, formed bellow 1/4", VCR male/female, 1200 mm (upon request)
<i>C) Software development kit (SDK) and drivers</i>	
GE-LX01	SDK for Linux (C/C++ based)
GE-PYT01	Python driver
GE-LAB01	LabVIEW driver
GE-EP	EPICS driver
GE-TAN	Tango driver



## 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 **LOTTE** you require.

### TECHNICAL DRAWINGS\*



\*Only valid for LOTTE-i 1k1k, 2k2k & 2k2k plus cameras. For other drawings, please send us an enquiry.



### Items included with your camera

GE-InFI02	CF DN100 flange with electrical & liquid feedthroughs
GE-VacP01	2 × in-vacuum hoses for cooling
GE-VacCab	2 × in-vacuum PTFE D-sub cables
GE-VI01	greateyes Vision software (Windows)
GE-SDK01	SDK for Windows (C/C++ based)
GE-GigE10m	10m Ethernet cable
GE-StoB2m	2m SMB to BNC connection cable × 2
GE-POW01	Camera power supply with cabling
GE-ManCam	Camera instruction manual



Subscribe to newsletter



greateyes GmbH  
Justus-von-Liebig-Str. 2  
12489 Berlin  
Germany



Phone: +49 30 912075 250  
Fax: +49 30 912075 251



Web: [www.greateyes.de](http://www.greateyes.de)  
E-mail: [info@greateyes.de](mailto:info@greateyes.de)

For a list of representatives and distributors, please visit our website.



Follow us on LinkedIn