

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



Typical Applications

- Soft X-Ray Spectroscopy
- Plasma Emission Spectroscopy
- High Harmonic Generation Spectroscopy
- NEXAFS Spectroscopy
- Resonant Inelastic X-Ray Scattering

Key Specifications

- UHV Compatibility through Encapsulated Design
- High Quantum Efficiency
- Ultra Deep Cooling up down $-100\text{ }^{\circ}\text{C}$
- 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 °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 °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

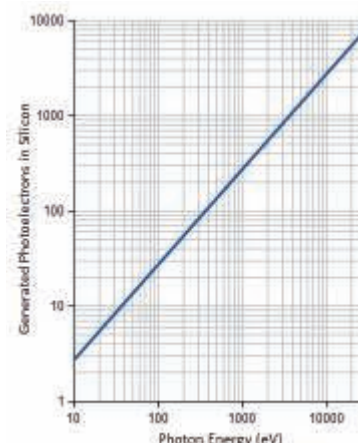
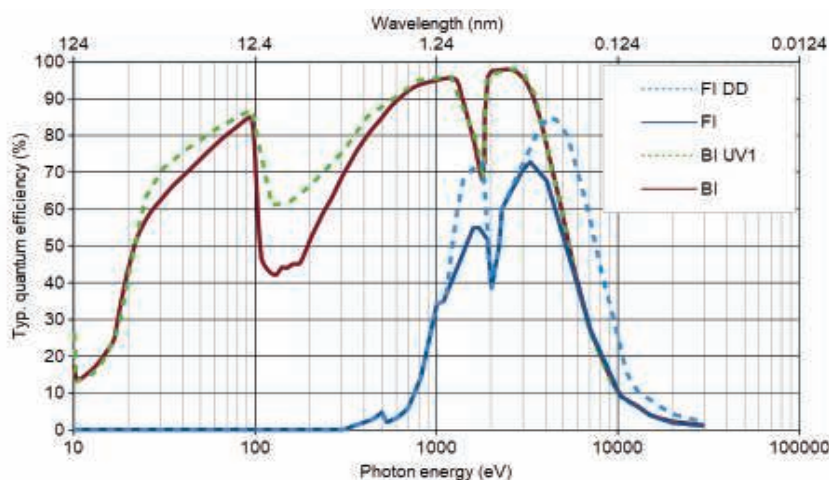


Common specifications

Pixel readout frequency	50/100/250/500 kHz, 1 MHz, 3 MHz (5 MHz visualization mode; up to 20 MHz by multi-output)
AD converter resolution	18-bit
Linearity	Better than 99%
CCD epitaxial thickness	15 µm standard, 40 µm 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 °C
Flange - focal plane	6 mm (can be customised)
CCD sensor cooling	-100 °C to 20 °C (liquid cooling only)
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	80-264 VAC (typ. 115/230), 47-63 Hz (typ. 50/60), max. 1.1 A (230 V) / 1.9 A (115 V)
Certification	CE
Dimensions, W x H x L	rc version: 98 mm x 90 mm x 235 mm sc version: 90 mm x 127 mm x 189 mm
Weight	rc version: 4.4 kg sc version: 4.6 kg



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-s Series	LOTTE-s 1k256			LOTTE-s 2k512	
Sensor code	FI FI DD BI UV1			FI BI BI UV1	
Usable pixels (columns × rows)	1024 × 255			2048 × 515	
Active image area	26.6 mm × 6.7 mm			27.6 mm × 6.9 mm	
Pixel size	26 μm × 26 μm			13.5 μm × 13.5 μm	
Full well capacity	500 ke ⁻ / 700 ke ⁻ (DD)			100 ke ⁻	
Register well capacity	1 000 ke ⁻ / 1 400 ke ⁻ (DD)			400 ke ⁻	
Typ. read noise (e ⁻)	FI	BI	DD		
@ 50 kHz	4.2	6.0	5.4	3.5	
@ 1 MHz	12.0	13.1	12.3	6.8	
@ 3 MHz	25.0	26.0	25.0	10.7	
Typ. dark current (e ⁻ /pixel/s)	@ -100 °C 0.0004 / 0.005 (DD)			@ -100 °C 0.00025	
Gain (counts/e ⁻): Standard mode	0.4 counts/e ⁻			1 counts/e ⁻	
High capacity mode	-			0.34 counts/e ⁻	
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: Choose your camera design

"rc" Version	"sc" Version
 <ul style="list-style-type: none"> • Compact in diameter, camera body fits into 6 inch tube • Electrical and water connectors on the rear side <p>Order code: LOTTE-s <u>2k512</u> <u>BI UV1</u> rc</p>	 <ul style="list-style-type: none"> • Camera length only 189 mm • Electrical and water connectors on the bottom side <p>Order code: LOTTE-s <u>1k256</u> <u>FI DD</u> sc</p>



Step 3: Choose your accessories and software

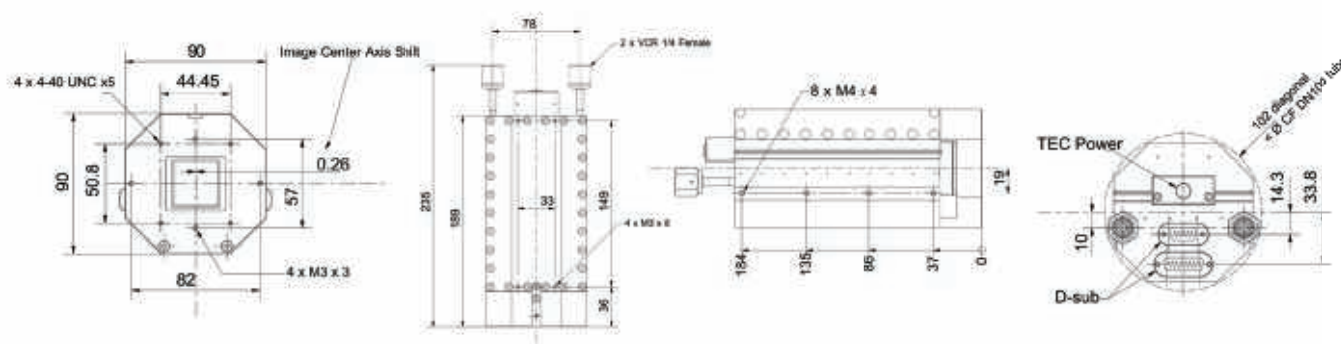
Order code	Description
<i>A) Accessories for imaging purposes</i>	
GE-SR35	35mm in-vacuum shutter, including shutter driver module
<i>B) Accessories for cooling performance (LOTTE series can only be cooled by liquid cooling)</i>	
GE-CR01	Compact liquid cooling, circulating the coolant at room temperature 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 2k2k 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



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