



# In-vacuum CCD Cameras for VUV, EUV, X-Ray Imaging and Spectroscopy Scientific/Large Format



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## In-vacuum CCD Cameras for VUV, EUV, X-Ray Imaging and Spectroscopy

These in-vacuum CCD cameras for VUV, EUV, X-Ray imaging and spectroscopy are the GE-VAC series, including scientific in-vacuum CCD cameras and large format in-vacuum CCD cameras. It is suitable for Photon Energy Range 5 eV - 20 keV.



We offer a portfolio of scientific in-vacuum cameras for imaging and spectroscopy in the VUV, EUV, soft and hard X-ray range. They are fabricated in stainless steel or aluminium providing excellent vacuum compatibility. A single additional flange integrates electrical and water cooling feedthroughs. Incoming photons are directly detected by the CCD sensor. No external controller is required to operate the detectors.

### Camera Feature

- Compact size
- 16-bit digitization
- Flexible binning and crop modes
- Software adjustable gain settings
- Scientific low-noise CCD sensors
- Single flange for feedthroughs
- Vision software included
- Optimised for UHV compatibility
- Temperature monitoring
- SDK for developers included
- Quantum efficiency up to 98%
- Ext. trigger, shutter, sync signals
- EPICS, LabVIEW or Linux integration

### Camera types

Scientific in-vacuum CCD cameras

- Full well capacity up to 700 ke<sup>-</sup>
- Deep cooling down to -80°C

Large format in-vacuum CCD cameras

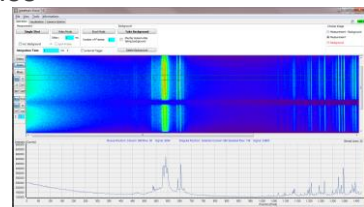
- Full well capacity up to 150 ke<sup>-</sup>
- Deep cooling down to -70°C

### Vision Software

Vision software suite provides access to all camera functionalities. It includes comprehensive visualization, analysis and storage options and supports important features such as wavelength and geometric calibration, crop and burst modes and various file formats. The software runs on 32/64-bit Windows systems. For integration into other systems, a software development kit and drivers are available.

### Software Features

- Supports crop and burst readout modes for higher frame rates and precise time resolution
- Various file formats: JPG, BMP, TXT, TIFF (16-bit), DAT raw data
- Comprehensive visualization and image manipulation routines
- Supports flexible horizontal and vertical binning
- Many drivers available for integration into other systems
- Runs on 32/64-bit Windows systems
- Wavelength and geometric calibration
- Language support in English and German



## Spectral ranges

Scientific in-vacuum CCD cameras

- Vacuum-Ultraviolet (VUV)
- Extreme-Ultraviolet (EUV)
- Soft X-ray
- Hard X-ray
- NIR, VIS, UV

Large format in-vacuum CCD cameras

- Vacuum-Ultraviolet (VUV)
- Extreme-Ultraviolet (EUV)
- Soft X-ray
- Hard X-ray
- Near-infrared (NIR)
- Visible (VIS)
- Ultra-Violet (UV)

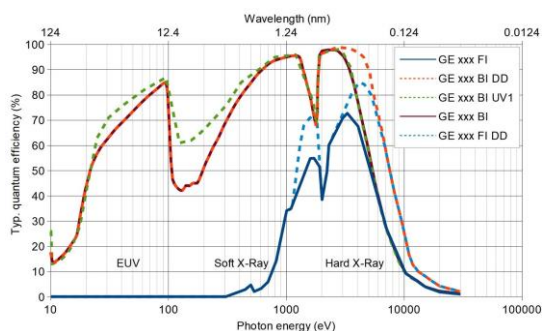
## Choose your camera model

Parameter	Scientific In-vacuum CCD Cameras			Large Format In-vacuum CCD Cameras	
	GE-VAC 1024 1024 series	GE-VAC 1024 256 series	GE-VAC 2048 512 series	GE-VAC 2048 2048 series	
				GE-VAC 2048 2048 FI	GE-VAC 2048 2048 BI DD
Nominal pixel format	1024 x 1024	1024 x 256	2048 x 512	2048 x 2048	
Image area	13.3 mm x 13.3 mm	26.6 mm x 6.7 mm	27.6 mm x 6.9 mm	27.6 mm x 27.6 mm	
Pixel size	13 μm x 13 μm	26 μm x 26 μm	13.5 μm x 13.5 μm	13.5 μm x 13.5 μm	
Full well capacity	100 ke <sup>-</sup> / 120 ke <sup>-</sup> (DD)	500 ke <sup>-</sup> / 700 ke <sup>-</sup> (DD)	100 ke <sup>-</sup>	100 ke <sup>-</sup>	150 ke <sup>-</sup>
Register well capacity	400 ke <sup>-</sup>	1 000 ke <sup>-</sup> / 1 400 ke <sup>-</sup> (DD)	400 ke <sup>-</sup>	400 ke <sup>-</sup>	600 ke <sup>-</sup>
Typ. read noise (e <sup>-</sup> )	@ 500 kHz			@ 500 kHz	
	5.2	FI:7.5   BI:9.7   DD:9	5.7	6.3	
	@ 1 MHz			@ 1 MHz	
	6.6	FI:10.7   BI:12.1   DD:11.6	6.9	8.5	
Dark current @ -80°C	@ 3 MHz			@ 3 MHz	
	9.7	FI:17.3   BI:19.2   DD:18	10.3	14.1	
Gain	0.0003 e <sup>-</sup> /pixel/s 0.017 e <sup>-</sup> /pixel/s (DD)	0.0005 e <sup>-</sup> /pixel/s 0.08 e <sup>-</sup> /pixel/s (DD)	0.0003 e <sup>-</sup> /pixel/s	0.0003 e <sup>-</sup> /pixel/s	0.05 e <sup>-</sup> /pixel/s
CCD sensor type	Front-illuminated (FI), back-illuminated (BI), deep depletion fringe suppression (DD), enhanced back-illuminated (UV1)				

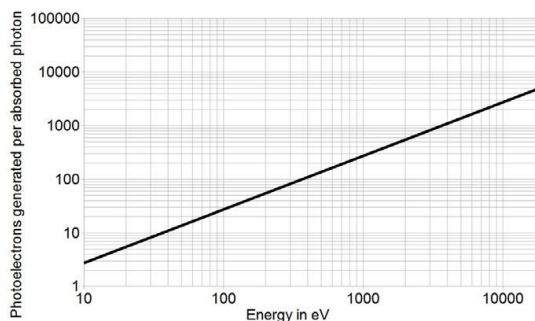
## Choose your accessories and software

Order code	Description
<b>A) Subpixel resolution enhancement</b>	
New GE-S xxx xxx series	Increased spatial resolution
<b>B) Accessories for cooling</b>	
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
<b>C) Software development kit (SDK) and drivers</b>	
GE-SDK01	SDK for Windows compatible (based on C/C++)
GE-LAB01	LabVIEW driver
GE-EP	EPICS driver
GE-LX01	Linux driver

## Quantum efficiency curves



QE of the GE-VAC series



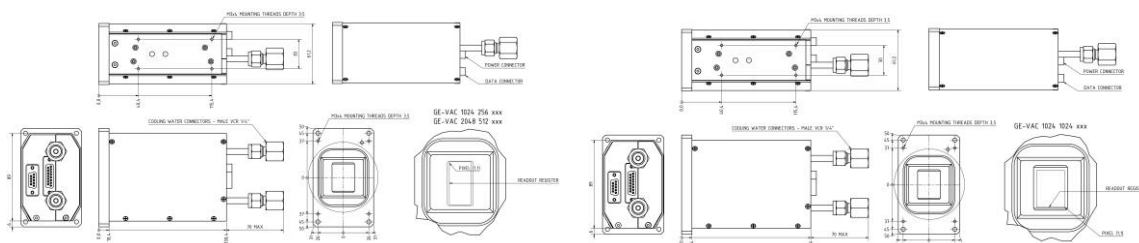
## Specifications

Parameter	Scientific In-vacuum CCD Cameras	Large Format In-vacuum CCD Cameras
Pixel readout frequency	500 kHz, 1 MHz, 3 MHz	
AD converter resolution	16-bit, 18-bit (optional)	
Linearity	Better than 99%	
CCD epitaxial thickness	15 µm standard, 40 µm for deep depletion models	
Feedthrough flange	CF DN63 with integrated electrical feedthroughs sub-D 15pin and sub-D 9pin (male/male) plus feedthrough tubes for water cooling with VCR 1/4" female connectors on vacuum side	
Vacuum compatibility	from 1 x 10 <sup>-3</sup> mbar to 1 x 10 <sup>-8</sup> mbar	
Bakeout temperature	Max. +80°C	
Distance flange - focal plane	10.0 mm	9.0 mm
CCD sensor cooling	min. -80°C to 20°C, liquid cooling	Min. -70°C to 20°C, liquid cooling
Temperature monitoring	CCD sensor and heat dissipation system	Temperature monitoring
Data link	USB 2.0	
Software	Vision software for Windows 7 / 10	
SDK and drivers	DLL for Windows 7 / 10; LabVIEW, EPICS, Linux driver (optional)	
TTL interface signals	Sync out, shutter out, external trigger in	
Power supply	110-240 VAC, 50-60 Hz, max. 1 A	
Certification	CE	
Dimensions	6.2 cm (2.44") x 10.0 cm (3.94") x 13.2 cm (5.20") (W x H x L)	
Weight	2300g	
Blemish specifications	Grade 0 or grade 1 (standard) as specified by sensor manufacturer	

## Items delivered together with each in-vacuum camera

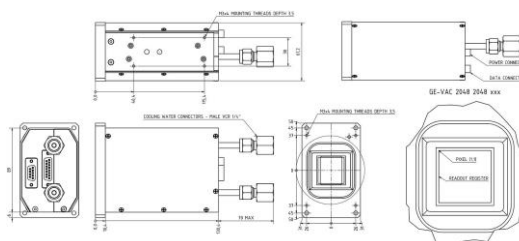
GE-InFi	CF DN63 flange with feedthroughs sub-D 15pin (male/male) + sub-D 9pin (male/male) and feedthrough tubes for water cooling with VCR female 1/4" on vacuum side
GE-VacP or GE-VacP2	2 x in-vacuum hoses, formed bellow 1/4", VCR male/female, 305 mm or 1200 mm length
GE-POW01	Camera power supply
GE-VacCab	2 x in-vacuum PTFE cables Sub-D 15pin and Sub-D 9pin, each male/female, length adapted to in-vacuum hoses
GE-CabSp	Air side cable from Sub-D 9pin female to USB and BNC trigger-in + sync output
GE-ManCam	Air side cable from Sub-D 15pin female to Sub-D 15pin male for power supply box
GE-ManCam	Camera instruction manual on storage device

## Technical drawings



GE-VAC 1024 256 series/  
GE-VAC 2048 512 series

GE-VAC 1024 1024 series



GE-VAC 2048 2048 series