

> United Power for Your Vision Solution.



Seeing beyond the Visible

SWIR-, UV-
& Polarizer Cameras



Image Sensors in TKH Vision Cameras

Wavelength Spectrum & Resolution

UV Polarizer VSWIR SWIR

Resolution [MP]

12.3	exo253ZGE exo253ZU3	Sony IMX253 Polarsens 3.45 µm 4,112 x 3,008	GigE USB3										
8,1	Alvium C/U/G5-812 UV fxo487MCX/MXGE fxo487MCX12-2C	Sony IMX487 2.74 µm 2,856 x 2,848	CSI-2, USB3, GigE, 5GigE CXP-12, 10GigE 2 x CXP-12										
5	Alvium C/U/G5-530 fxo992MCX/MXGE fxo992MCX-T/MXGE-T Goldeye Pro G5-530	Sony IMX992 SenSWIR 3.45 µm 2,592 x 2,056	CIS-2, USB3, 5GigE CXP-12, 10GigE CXP-12, 10GigE 5GigE										
	Alvium G5-508 Pol mono/color exo250ZGE/ZU3	Sony IMX250 Polarsens 3.45 µm 2,448 x 2,048	5GigE GigE, USB3										
	Alvium G5-507 Pol mono/color exo250ZGE/ZU3 GP2507Z	Sony IMX264 Polarsens 3.45 µm 2,448 x 2,048	5GigE GigE, USB3										
3	Alvium C/U/G5-320 fxo993MCX/MXGE fxo993MCX-T/MXGE-T Goldeye Pro G5-320	Sony IMX993 SenSWIR 3.45 µm 2,080 x 1,544	CSI-2, USB3, 5GigE CXP-12, 10GigE CXP-12, 10GigE 5GigE										
1.3	Alvium C/U/G1/G5-130 exo990MG/E/MU3 fxo990MCX G/CL-130 TEC1; IA2108SW	Sony IMX990 SenSWIR 5 µm 1,296 x 1,032	CSI-2, USB3, GigE, 5GigE 10GigE, USB3 CXP-12 GigE, Camera Link, GigE										
0.3	Alvium C/U/G1-030 exo991MG/E Goldeye G/CL-030 TEC1 IA2108SW	Sony IMX991 SenSWIR 5 µm 656 x 520	CSI-2, USB3, GigE GigE GigE, Camera Link GigE										
		Goldeye G/CL-033 TECless Goldeye G/CL-033 TEC1	FPA 640 x 512 15 µm 0.3 MP										
		Goldeye G/CL-032 TEC1 Goldeye G/CL-032 Cool TEC2	FPA 636 x 508 25 µm 0.3 MP										
		Goldeye G/CL-034 TEC1 Goldeye G/CL-034 TEC2	FPA 636 x 508 15 µm 0.3 MP										
		Goldeye G/CL-034 XSWIR 1.9 TEC2	FPA 636 x 508 15 µm 0.3 MP										
		Goldeye G/CL-034 XSWIR 2.2 TEC2	FPA 636 x 508 15 µm 0.3 MP										
0.1		Goldeye G/CL-008 TEC1 Goldeye G/CL-008 Cool TEC1	FPA 320 x 256 30 µm 0.1 MP										
		Goldeye G/CL-008 XSWIR 1.9 TEC2	FPA 320 x 256 30 µm 0.1 MP										
		Goldeye G-008 XSWIR 2.2 TEC2	FPA 320 x 256 30 µm 0.1 MP										

UV



Cameras for the near and mid-UV range between 200 nm and 400 nm are used in many industrial and scientific imaging applications. They are particularly suitable for detecting smallest surface defects, cracks, or irregularities in materials, such as semiconductors, glass, metal, or plastic, invisible to the human eye. But they are also important to qualify laser beams, to capture specific spectral material characteristics, or for detecting corona discharges of powerlines allowing for proactive maintenance and reducing the risk of power outages.

Our cameras featuring the IMX487 8MP UV sensor from Sony enable high-resolution UV imaging with low noise at high frame rates, making it possible to reveal smallest in-visible details and to speed-up processes.

Polarizer



Cameras equipped with Sony IMX Polarsens sensors (IMX250/253/264) offer a valuable advantage in polarized imaging, as they can eliminate the need for additional polarizer filters on the lens, making it easier to adapt to various polarization angles without changing or rotating optical polarization filters.

By using polarized image data difficult imaging tasks can be solved, as for example, minimizing obstructing reflections during surface inspections, enhancing contrast to detect shapes and details of (e.g., black) objects with low contrast, or detecting various material properties such as stress, composition, or surface structure.

With our Polarizer cameras you can simplify your polarized imaging setup and focus on capturing high-quality images.

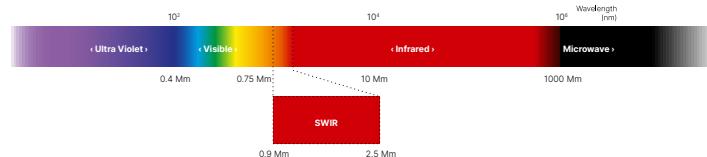
Infrared Imaging



In everyday life, we are constantly exposed to electromagnetic radiation differing in wavelengths such as visible light, ultraviolet light, radio and microwaves, or X-rays. Within the electromagnetic spectrum, infrared radiation is in the range between visible light and microwaves.

It covers a wavelength range from $0.75\text{ }\mu\text{m}$ – $14\text{ }\mu\text{m}$ and is separated into near-infrared (NIR), short-wave infrared (SWIR), mid-wave infrared (MWIR), and long-wave infrared (LWIR).

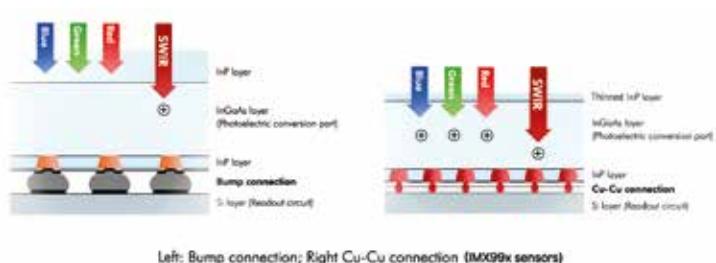
Although infrared radiation in the SWIR region is not visible to the human eye, it interacts with objects in a similar manner as visible light. Thereby, SWIR cameras have the advantage to "see" even at night and under challenging conditions such as fog, haze, or smoke. Another major benefit of SWIR cameras, is their ability to image through glass, making special and often expensive lenses unnecessary as they are required for MWIR or LWIR imaging.



InGaAs Sensor Technology

InGaAs sensors are in several aspects different to monolithic silicon-based sensors. For example, InGaAs sensors:

- consist of two layers - a light-sensitive InGaAs layer and a Silicon-based readout integrated circuit (ROIC).
- have typically more defective and non-uniform pixels, requiring appropriate image correction functions in the camera.
- have a significantly higher dark current, requiring sensor cooling to reduce image noise and enable longer exposure times. For this reason, many sensors are equipped with thermoelectric cooling (TEC) elements.

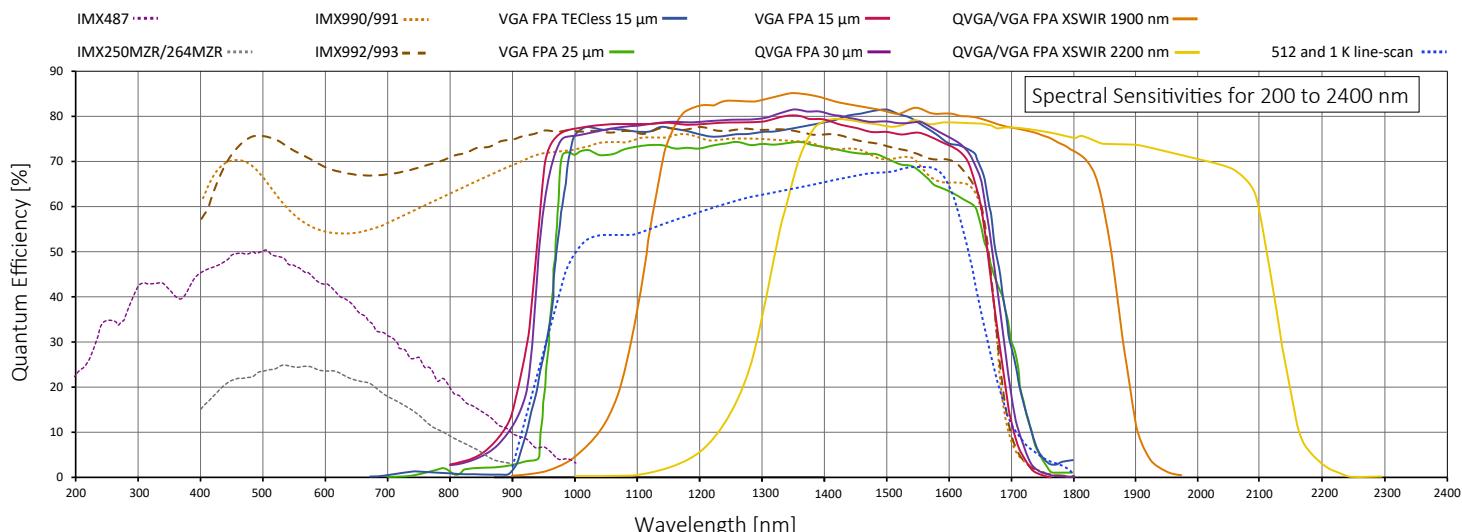


SenSWIR sensor technology

InGaAs sensors with an extended spectral range can also detect wavelengths above $1.7\text{ }\mu\text{m}$. This makes it possible, for example, to capture unique spectral material properties, which is particularly advantageous for sorting applications or for determining material concentrations in composite materials. The most important areas of application therefore include: waste recycling (e.g. plastic sorting), the detection of water content or moisture, and the identification of foreign bodies or contaminants in mixtures.

Sony's InGaAs SWIR sensors with SenSWIR technology enable imaging of wavelengths from $0.4\text{ }\mu\text{m}$ to $1.7\text{ }\mu\text{m}$. The broad spectral range enables users to capture images with high quantum efficiency in the visible as well as the SWIR spectrum with a single camera, reducing overall system costs.

The innovative architecture of the digital InGaAs sensors allows pixel sizes of only $3.45\text{ }\mu\text{m}$ and provides a high image homogeneity due to their copper-to-copper interconnects. The small pixel size is particularly important for SWIR applications with high resolution and precision, such as semiconductor inspection or quality of optics for laser-based measurement systems.



Applications

Food & Beverage



- Food Sorting and Grading
- Package Inspection
- Fill level Detection
- Liquid Inspection

Agriculture & Smart Farming



- Growth Monitoring
- Drones
- Humidity Measurement
- Field Analysis

Security & Traffic



- Surveillance
- Vision Enhancement
- Night Vision

Spectral Imaging



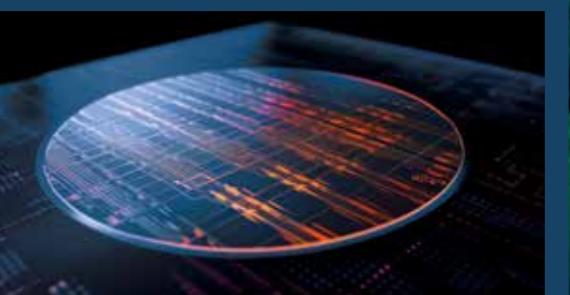
- Hyperspectral Imaging
- Multispectral Imaging
- Material Classification
- Contamination Detection

Scientific & Medical



- OCT
- Microscopy
- Cancer Detection

Semiconductors & Electronics



- Wafer Inspection
- Display Inspection
- PCB Inspection
- Subsurface Inspection

Laser Beam Profiling



- Laser Beam Analysis
- Stability of Laser Signals
- Monitoring of Beam Parameters

Cameras

Alvium Alvium C/U/G1/G5



- Very compact (29mm x 29mm x L), light weight, energy-efficient, and affordable (SWaP-C) camera solution
- High modularity including board-level versions (Flex & Frame) and sensors with removed cover glass
- Support of all TEC-less IMX99x SenSWIR, UV (IMX487), and 5MP Polarsens (IMX264/250) sensors
- Multiple standardized interface options including CSI-2 range extenders FPD-Link III
- 512 MB Burst Mode buffer (5GigE)

Area Scan

Opco	Series	Camera	MP	Resolution	Sensor	Format	Pixel size in μm	fps per interface	Spectral range in nm	Spectrum	Cooling
Allied Vision	Alvium UV	G1/G5/U-C-812 UV	8.1	2,848 x 2,848	Sony IMX487	Type 2/3	2.74 x 2.74	14 / 58 / 51 / 58	200 - 900	UV	-
SVS-Vistek	FXO	fxo487MCX12-2C	8.1	2,848 x 2,848	Sony IMX487	11.1mm (Type 2/3)	2.74 x 2.74	195	200 - 900	UV	-
SVS-Vistek	FXO	fxo487XGE/MCX	8.1	2,840 x 2,840	Sony IMX487	11.1mm (Type 2/3)	2.74 x 2.74	87 / 87	200 - 900	UV	-
SVS-Vistek	EXO	exo253ZGE/ZU3	12.3	4,096 x 3,000	Sony IMX253ZMR (polarized)	1.1 "	3.45 x 3.45	10/30	400 - 1,100	Polarizer	-
Allied Vision	Alvium Polarizer	G5/U/C-508 Pol mono/color	5	2,465 x 2,056	Sony IMX250MZR/MYR (polarized)	Type 2/3	3.45 x 3.46	95 / 84 / 95	400 - 1,100	Polarizer	-
Allied Vision	Alvium Polarizer	G1/G5/U-C-507 Pol mono/color	5	2,464 x 2,056	Sony IMX264MZR/MYR (polarized)	Type 2/3	3.45 x 3.45	23 / 34 / 34 / 34	400 - 1,100	Polarizer	-
SVS-Vistek	EXO	exo250ZGE/ZU3	5	2,448 x 2,048	Sony IMX250MZR (polarized)	2/3 "	3.45 x 3.45	24.5 / 75	400 - 1,100	Polarizer	-
NET	GigPRO	GP2507Z	5	2,464 x 2,056	Sony IMX264MZR (polarized)	Type 2/3	3.45 x 3.45	22	400 - 1,100	Polarizer	-
SVS-Vistek	EXO	exo264ZGE/ZU3	5	2,448 x 2,048	Sony IMX264MZR (polarized)	2/3 "	3.45 x 3.45	24.5 / 35	400 - 1,100	Polarizer	-
Allied Vision	Alvium SWIR	G5/U/C-530	5.3	2,592 x 2,056	Sony IMX992	Type 1/1.4	3.45 x 3.45	84 / 77 / 84	400 - 1,700	VisSWIR	-
Allied Vision	Goldeye Pro	G5-530	5.3	2,592 x 2,056	Sony IMX992	Type 1/1.4	3.45 x 3.45	115	400 - 1,700	VisSWIR	-
SVS-Vistek	FXO	fxo992MXGE-T/MCX-T	5.2	2,560 x 2,048	Sony IMX992	11.4mm	3.45 x 3.45	132.6 / 132.6	400 - 1,700	VisSWIR	TEC1
SVS-Vistek	FXO	fxo992XGE/MCX	5.2	2,560 x 2,048	Sony IMX992	11.4mm	3.45 x 3.45	132.6 / 132.6	400 - 1,700	VisSWIR	-
Allied Vision	Alvium SWIR	G5/U/C-320	3.2	2,080 x 1,544	Sony IMX993	Type 1/1.8	3.45 x 3.45	131 / 125 / 131	400 - 1,700	VisSWIR	-
Allied Vision	Goldeye Pro	G5-320	3.2	2,080 x 1,544	Sony IMX993	Type 1/1.8	3.45 x 3.45	157	400 - 1,700	VisSWIR	-
SVS-Vistek	FXO	fxo993MXGE/MCX	3.1	2,048 x 1,536	Sony IMX993	8.9mm	3.45 x 3.45	173.4 / 173.4	400 - 1,700	VisSWIR	-
SVS-Vistek	FXO	fxo993MXGE-T/MCX-T	3.1	2,048 x 1,536	Sony IMX993	8.9mm	3.45 x 3.45	173.4 / 173.4	400 - 1,700	VisSWIR	TEC1
Allied Vision	Alvium SWIR	G1/G5/U-C-130	1.3	1,298 x 1,032	Sony IMX990	Type 1/2	5 x 5	88 / 130 / 130 / 130	400 - 1,700	VisSWIR	-
NET	Iam	IA2108SW	1.3	1,298 x 1,032	Sony IMX990	Type 1/2	5 x 5	69	400 - 1,700	VisSWIR	-
SVS-Vistek	EXO	exo990MGE/MU3	1.3	1,280 x 1,024	Sony IMX990	8.2mm (Typ 1/2)	5 x 5	94.4 / 125.4	400 - 1,700	VisSWIR	-
SVS-Vistek	FXO	fxo990MCX	1.3	1,280 x 1,024	Sony IMX990	8.2mm (Typ 1/2)	5 x 5	134	400 - 1,700	VisSWIR	-
Allied Vision	Gol	G/CL-130 TEC1	1.3	1,280 x 1,024	Sony IMX990	Type 1/2	5 x 5	94 / 94	400 - 1,700	VisSWIR	TEC1
Allied Vision	Alvium SWIR	G1/U/C-030	0.3	656 x 520	Sony IMX991	Type 1/4	5 x 5	249 / 249 / 249	400 - 1,700	VisSWIR	-
Allied Vision	Goldeye	G/CL-030 TEC1	0.3	656 x 520	Sony IMX991	Type 1/4	5 x 5	234 / 234	400 - 1,700	VisSWIR	TEC1
NET	Iam	IA2010SW	0.3	656 x 520	Sony IMX991	Type 1/4	5 x 5	249	400 - 1,700	VisSWIR	-
SVS-Vistek	EXO	exo991MGE	0.3	640 x 512	Sony IMX991	4.1mm (Typ 1/4)	5 x 5	260	400 - 1,700	VisSWIR	-
Allied Vision	Goldeye	G/CL-033 TECless	0.3	640 x 512	FPA 640 x 512	Type 1	15 x 15	301 / 301	900 - 1,700	SWIR	-
Allied Vision	Goldeye	G/CL-033 TEC1	0.3	640 x 512	FPA 640 x 512	Type 1	15 x 15	301 / 301	900 - 1,700	SWIR	TEC1
Allied Vision	Goldeye	G/CL-032 TEC1	0.3	636 x 508	FPA 636 x 508	Type 4/3	25 x 25	100 / 100	900 - 1,700	SWIR	TEC1
Allied Vision	Goldeye	G/CL-034 TEC1	0.3	636 x 508	FPA 636 x 508	Type 1	15 x 15	303 / 303	900 - 1,700	SWIR	TEC1
Allied Vision	Goldeye	G/CL-034 TEC2	0.3	636 x 508	FPA 636 x 508	Type 1	15 x 15	303 / 303	900 - 1,700	SWIR	TEC2
Allied Vision	Goldeye	G/CL-032 Cool TEC2	0.3	636 x 508	FPA 636 x 508	Type 4/3	25 x 25	100 / 100	900 - 1,700	SWIR	TEC2
Allied Vision	Goldeye	G/CL-034 XSWIR 1.9 TEC2	0.3	636 x 508	FPA 636 x 508	Type 1	15 x 15	303 / 303	1100 - 1900	XSWIR	TEC2
Allied Vision	Goldeye	G/CL-034 XSWIR 2.2 TEC2	0.3	636 x 508	FPA 636 x 508	Type 1	15 x 15	303 / 303	1200 - 2,200	XSWIR	TEC2
Allied Vision	Goldeye	G/CL-008 Cool TEC1	0.1	320 x 256	FPA 320 x 256	Type 1	30 x 30	344 / 344	900 - 1,700	SWIR	TEC1
Allied Vision	Goldeye	G/CL-008 TEC1	0.1	320 x 256	FPA 320 x 256	Type 1	30 x 30	344 / 344	900 - 1,700	SWIR	TEC1
Allied Vision	Goldeye	G/CL-008 XSWIR 1.9 TEC2	0.1	320 x 256	FPA 320 x 256	Type 1	30 x 30	344 / 344	1100 - 1,900	XSWIR	TEC2
Allied Vision	Goldeye	G-008 XSWIR 2.2 TEC2	0.1	320 x 256	FPA 320 x 256	Type 1	30 x 30	344 / 344	1200 - 2,200	XSWIR	TEC2

Line Scan

Opco	Series	Camera	Resolution	Sensor	Sensor width in mm	Pixel size in μm	Line rate	Spectral range in nm	Spectrum	Cooling
Chromasens	allPIXA SWIR	allPIXA SWIR 1K GigE	1 x 1,024	1K pixel InGaAs linear image sensor	12.8	12.5 x 12.5	40kHz	950 - 1,700 nm	SWIR	-
Chromasens	allPIXA SWIR	allPIXA SWIR 512 GigE	1 x 512	512 pixel InGaAs linear image sensor	12.8	25 x 25	40kHz	950 - 1,700 nm	SWIR	-

Opco	Series	Camera	Resolution	Sensor	Sensor width in mm	Pixel size in μm	Line rate	Spectral range in nm	Spectrum	Cooling

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► United Power for Your Vision Solution.



TKH Vision is a global group of machine vision technology leaders providing complementing 2D and 3D vision components and solutions. With a distinct customer-centric approach, the machine vision experts prioritize tailoring solutions to various customer needs, fostering enduring relationships built on trust and excellence.

● TKH Vision companies ● Sales Partners



Innovative and forward-thinking 2D and 3D vision components and solutions

	Allied Vision	chromasens	euresys	MIKROTRON	LMI TECHNOLOGIES	nerian	net
Area Scan	✓			✓	✓	✓	✓
Line Scan		✓			✓		
3D		✓			✓	✓	
Embedded	✓				✓	✓	✓
High Speed		✓			✓	✓	✓
SWIR	✓	✓		✓			
UV	✓	✓		✓			
Polarized	✓	✓		✓			
Frame Grabber			✓				
IP Core			✓				

¹Based on 3D line scan and area scan cameras

	Allied Vision	chromasens	euresys	MIKROTRON	LMI TECHNOLOGIES	nerian	net
Camera Link	✓	✓		✓	✓	✓	
CoaXPress	✓	✓		✓	✓	✓	
GigE ² Vision	✓	✓		✓	✓	✓	
USB3	✓			✓	✓		
CSI-2	✓					✓	
GigE		✓				✓	✓

²1GigE, 5GigE, 10GigE, 25GigE

³Profinet Support, ModBus, ASCII and EthernetIP protocols

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www.lmi3d.com

NET GmbH

Finning, Germany
www.net-gmbh.com

SVS-Vistek GmbH

Gilching, Germany
www.svs-vistek.com



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