Baumer
Passion for Sensors

Operating Manual

VCXG.2 / VCXG.2.XC / VCXG.2.I / VCXU.2
(Gigabit Ethernet / USB3.0)

EN-US

List of contents

1   About this document

1.1   Purpose

This operating manual (subsequently referred to as *manual*) allows the safe and efficient handling of the product .

The manual does not provide instructions on operating the machine in which the product is integrated. Information on this is found in the operating manual of the machine.

The manual is a constituent part of the product. It must be kept in the immediate vicinity of the product and must be accessible to personnel at all times.

Personnel must have carefully read and understood this manual before beginning any work. The basic prerequisite for safe working is compliance with all safety instructions and handling instructions given in this manual.

In addition, the local occupational health and safety regulations and general safety regulations apply.

The illustrations in this manual are examples only. Deviations are at the discretion of Baumer at all times.

1.2   Warnings in this manual

Warnings draw attention to potential personal injury or material damage. The warnings in this manual indicate different hazard levels:

Symbol	Warning term	Explanation
⚠	**DANGER**	Indicates an imminent potential danger with high risk of death or serious personal injury if not being avoided.
	WARNING	Indicates potential danger with medium risk of death or (serious) personal injury if not being avoided.
	CAUTION	Indicates a danger with low risk, which could lead to light or medium injury if not avoided.
	NOTE	Indicates a warning of material damage.
💡	**INFO**	Indicates practical information and tips that enable optimal use of the devices.

1.3   Labels in this manual

Identifier	Usage	Example
Dialog element	Indicates dialog elements.	Click the *OK* button.
Unique name	Indicates the names of products, files, etc.	*Internet Explorer* is not supported in any version.
`Code`	Indicates entries.	Enter the following IP address: `192.168.0.250`

1.4   Liability limitation

All information and notes in this manual have been compiled in accordance with the applicable standards and regulations, the state of the art, and our many years of knowledge and experience.

The manufacturer accepts no liability for damage due to the following reasons:

- Non-observance of the manual
- Improper use
- Use of unqualified personnel
- Unauthorized conversions

The obligations agreed in the delivery contract, the general terms and conditions and the delivery conditions of the manufacturer and its suppliers, as well as the legal regulations valid at the time of conclusion of the contract apply.

1.5   Copyright

Any duplication or reprinting of this documentation, in whole or in part, and the reproduction of the illustrations even in modified form is permitted only with the written approval of Baumer. The information in this document is subject to change without notice.

2   General information

Intended use

This product is a precision device and serves the detection of items, objects, or physical measurement variables and the preparation or provision of measured values as electric variables for the higher-level system.

Unless specifically labeled, this product may not be used in explosive environments.

Commissioning

Assembly, installation, and calibration of this product may only be performed by a specialist.

Installation

Only use the fasteners and fastener accessories intended for this product for installation. Outputs not in use must not be wired. Unused wires of cable outputs must be insulated. Do not go below the permissible cable bending radii. Disconnect the system from power before the product is electrically connected. Use shielded cables to prevent electro-magnetic interference. If the customer assembles plug connections on shielded cables, then EMC-version plug connections should be used and the cable shield must be connected to the plug housing across a large surface area.

Disposal (environmental protection)

Used electrical and electronic devices may not be disposed of in household waste. The product contains valuable raw materials that can be recycled. Therefore dispose of this product at the appropriate collection point. For additional information visit www.baumer.com.

3   Description

3.1   VCXG.2

3.1.1   Conception
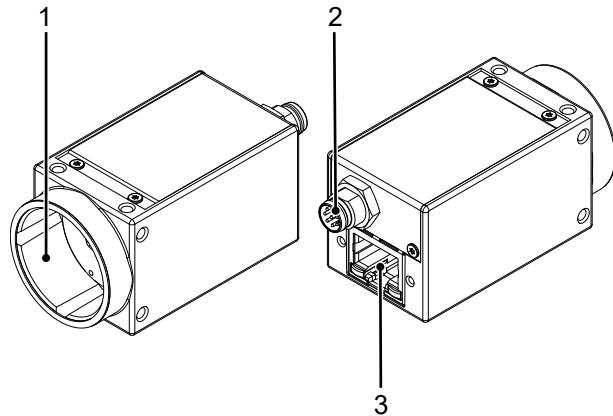
1	Lens mount (C-mount)	2	Power supply / Digital IO
3	Network connection with LEDs		

3.1.2   LED status indicator
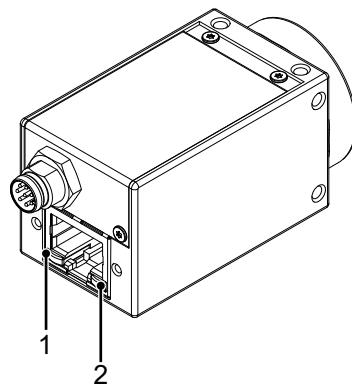
	Signal	Meaning
1	green	Connection active
	green flashing	receiving data
2	yellow	Error
	yellow flashing	Transmitting data

3.1.3 Camera models

Camera type	Sensor size	Resolution (Width × Height)	Max. FPS[1]
Monochrom			
VCXG.2-13M	1/2″	1280 × 1024	145 | 94
VCXG.2-15M	1/1.8″	1440 × 1080	120 | 79
VCXG.2-25M	2/3″	1920 × 1200	59 | 53
VCXG.2-32M	1/1.8″	2048 × 1536	55.5 | 39.5
VCXG.2-51M	2/3″	2448 × 2048	35.5 | 23.5
VCXG.2-51MP	2/3″	2448 × 2048	35 | 24
VCXG.2-57M	1/1.8″	2464 × 2048	25 | 25
VCXG.2-65M.R	1/1.8″	3072 × 2048	29 | 16
VCXG.2-82M	2/3″	2848 × 2832	15 | 15
VCXG.2-124M	1.1″	4096 × 3000	15 | 10
VCXG.2-127M	1/1.1″	4096 × 2992	10 | 10
VCXG.2-201M.R	1″	5472 × 3648	9 | 6
VCXG.2-204M	1/1.1″	4480 × 4496	6 | 6
VCXG.2-241M	1.2″	5312 × 4592	5 | 5
Color			
VCXG.2-13C	1/2″	1280 × 1024	145 | 94
VCXG.2-15C	1/1.8″	1440 × 1080	120 | 79
VCXG.2-25C	2/3″	1920 × 1200	59 | 53
VCXG.2-32C	1/1.8″	2048 × 1536	55.5 | 39.5
VCXG.2-51C	2/3″	2448 × 2048	35.5 | 23.5
VCXG.2-57C	1/1.8″	2464 × 2048	25 | 25
VCXG.2-65C.R	1/1.8″	3072 × 2048	29 | 16
VCXG.2-82C	2/3″	2848 × 2832	15 | 15
VCXG.2-124C	1.1″	4096 × 3000	15 | 10
VCXG.2-127C	1/1.1″	4096 × 2992	10 | 10
VCXG.2-201C.R	1″	5472 × 3648	9 | 6
VCXG.2-204C	1/1.1″	4480 × 4496	6 | 6
VCXG.2-241C	1.2″	5312 × 4592	5 | 5

[1] Image acquisition to the camera's internal memory | Interface

3.1.4 Dimensional drawing

Ill. 1: Dimensional drawing - VCXG
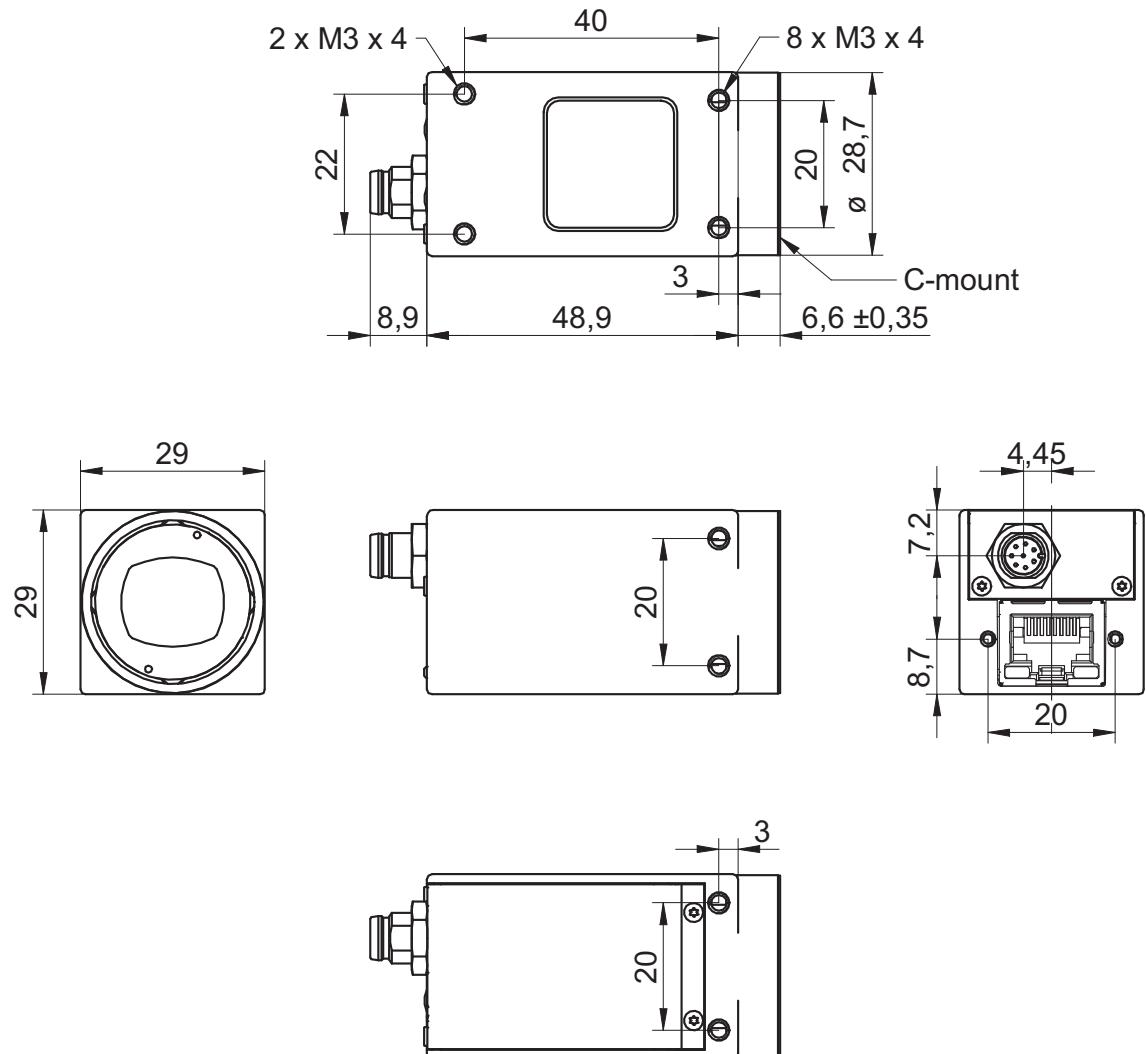
3.2   VCXG.2.XC

3.2.1   Conception
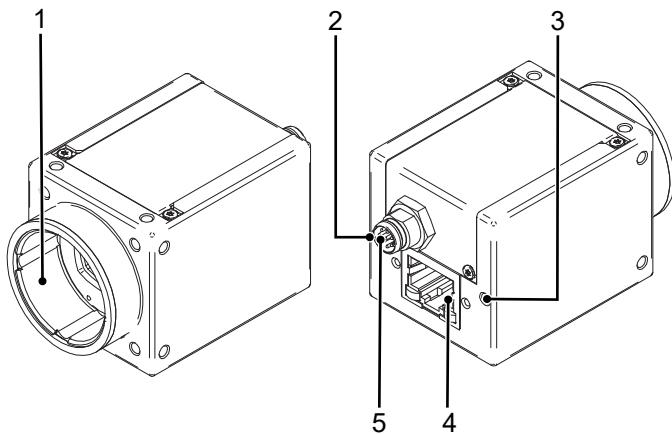
1	Lens mount (C-mount)	2	Cooling channel (inlet)
3	Cooling channel (outlet)	4	Network connection
5	Power supply / Digital IO		

3.2.2   LED status indicator
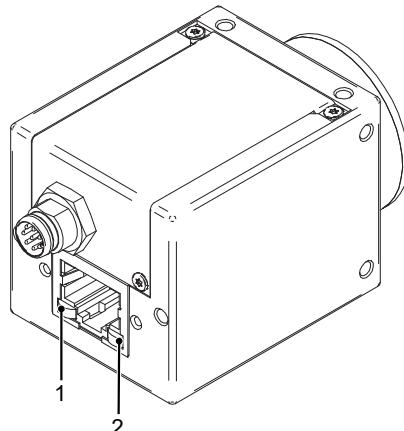
	Signal	Meaning
1	green	Connection active
	green flashing	receiving data
2	yellow	Error
	yellow flashing	Transmitting data

3.2.3   Camera models

Camera type	Sensor size	Resolution (Width × Height)	Max. FPS[1]
Monochrom			
VCXG.2-51M.XC	2/3″	2448 × 2048	35.5 | 23.5
VCXG.2-241M.XC	1.2″	5312 × 4592	5 | 5

[1] Image acquisition to the camera's internal memory | Interface

3.2.4   Dimensional drawing
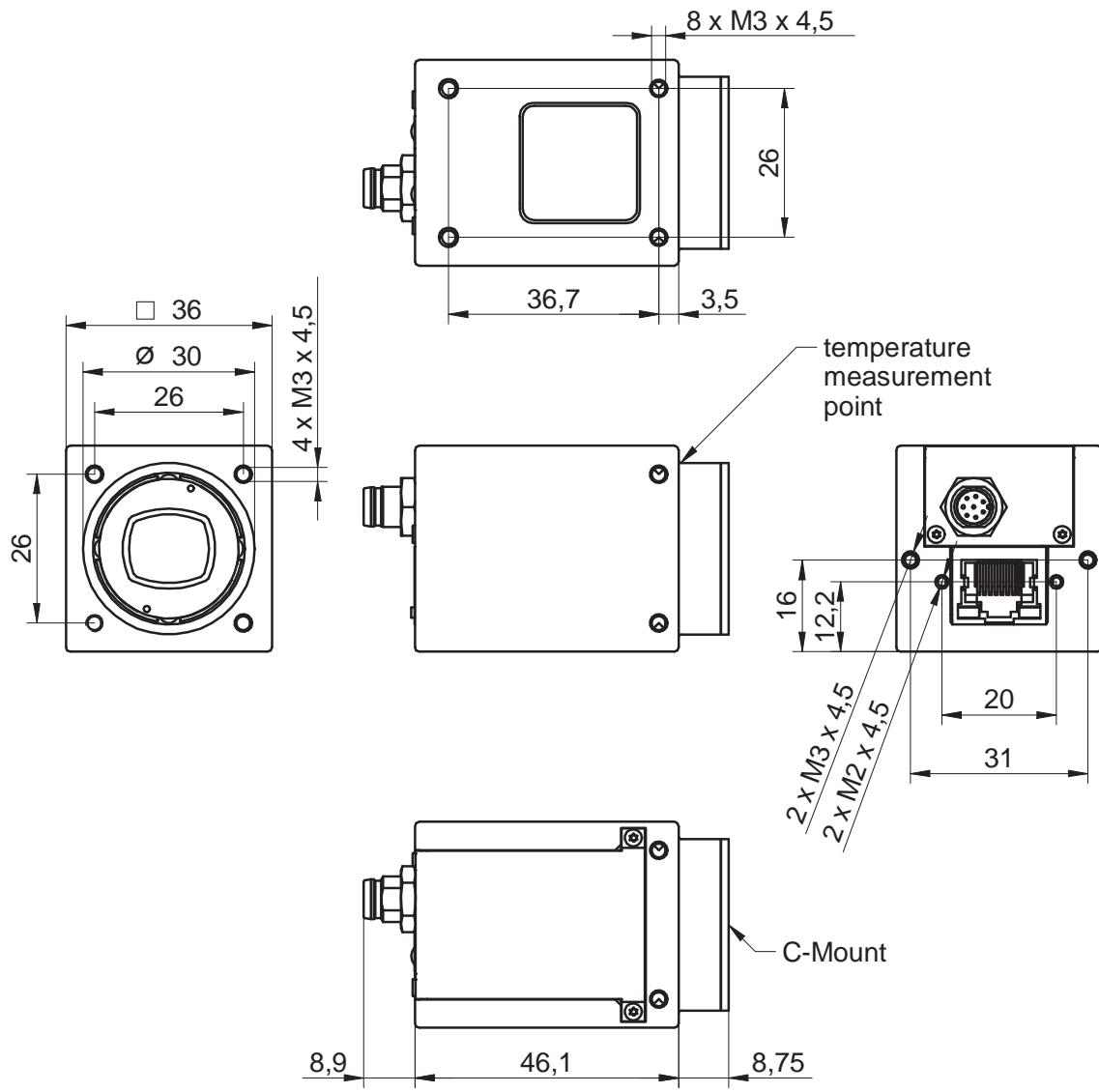
Ill. 2: Dimensional drawing - VCXG.XC

3.3   VCXG.2.I

3.3.1   Conception
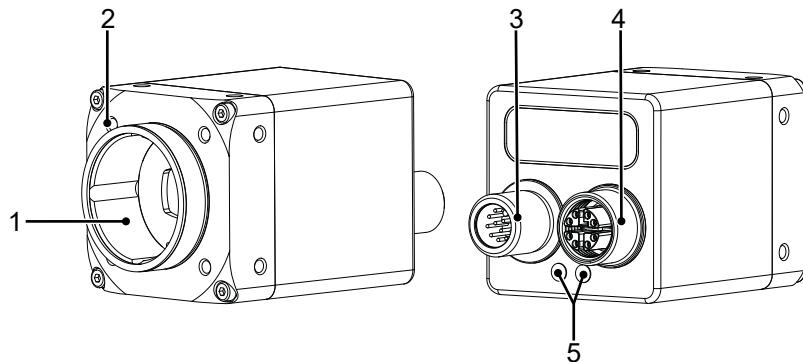
1	Lens mount (C-mount)	2	4 x tube adapter with front mounting threads
3	Power supply / Digital IO	4	Network connection
5	GigE status indicator		

3.3.2   LED status indicator
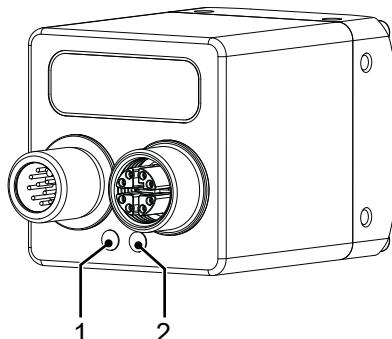
	Signal	Meaning
1	yellow	Error
	yellow flashing	Transmitting data
2	green	Connection active
	green flashing	receiving data

3.3.3 Camera models

Camera type	Sensor size	Resolution (Width × Height)	Max. FPS[1]
Monochrom			
VCXG.2-15M.I	1/1.8″	1440 × 1080	120 | 79
VCXG.2-32M.I	1/1.8″	2048 × 1536	55.5 | 39.5
VCXG.2-51M.I	2/3″	2448 × 2048	35.5 | 23.5
VCXG.2-57M.I	1/1.8″	2464 × 2048	25 | 25
VCXG.2-82M.I	2/3″	2848 × 2832	15 | 15
VCXG.2-127M.I	1/1.1″	4096 × 2992	10 | 10
VCXG.2-201M.R.I	1″	5472 × 3648	9 | 6
VCXG.2-241M.I	1.2″	5312 × 4592	5 | 5
Color			
VCXG.2-15C.I	1/1.8″	1440 × 1080	120 | 79
VCXG.2-32C.I	1/1.8″	2048 × 1536	55.5 | 39.5
VCXG.2-51C.I	2/3″	2448 × 2048	35.5 | 23.5
VCXG.2-57C.I	1/1.8″	2464 × 2048	25 | 25
VCXG.2-82C.I	2/3″	2848 × 2832	15 | 15
VCXG.2-127C.I	1/1.1″	4096 × 2992	10 | 10
VCXG.2-201C.R.I	1″	5472 × 3648	9 | 6
VCXG.2-241C.I	1.2″	5312 × 4592	5 | 5

[1] Image acquisition to the camera's internal memory | Interface

3.3.4 Dimensional drawing

Ill. 3: Dimensional drawing - VCXG.I
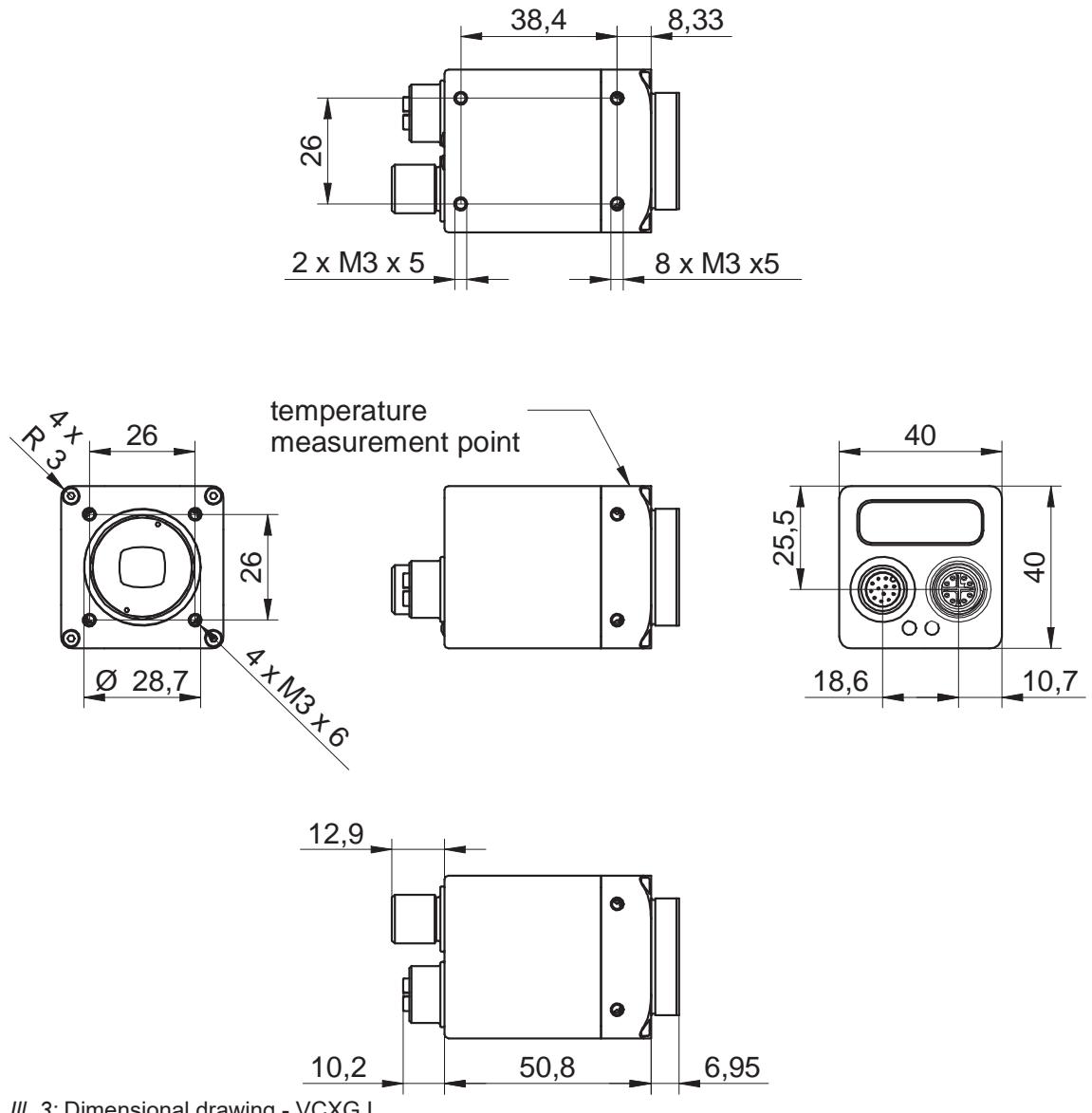
3.4   VCXU.2

3.4.1   Conception
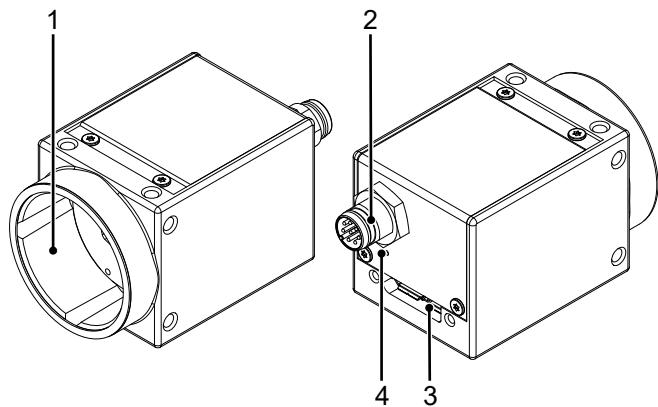
1	Lens connection (C-mount)	2	Digital-IO
3	USB3.0	4	LED

3.4.2   LED status indicator
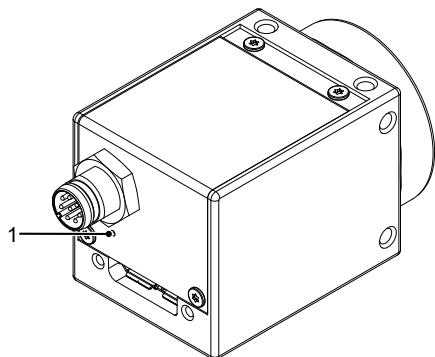
	Signal	Meaning
1	green flashing	Power on
	green continuous	Connection via USB 3.0
	red	Connection via USB 2.0
	yellow	Data traffic
	red flashing	Update

3.4.3   **Camera models**

Camera type	Sensor size	Resolution (Width × Height)	Max. FPS
Monochrom			
VCXU.2-13.M	1/2″	1280 × 1024	222
VCXU.2-15.M	1/2.9″	1440 × 1080	225
VCXU.2-31.M	1/1.8″	2048 × 1536	120
VCXU.2-32.M	1/1.8″	2048 × 1536	55.5
VCXU.2-50.M	2/3″	2448 × 2048	73
VCXU.2-50.MP	2/3″	2448 × 2048	73
VCXU.2-51.M	2/3″	2448 × 2048	35
VCXU.2-57.M	1/1.8″	2464 × 2048	75
VCXU.2-65.M.R	1/1.8″	3072 × 2048	47
VCXU.2-123.M	1.1″	4096 × 3000	31
VCXU.2-127.M	1/1.1″	4096 × 2992	31
VCXU.2-201.M.R	1″	5472 × 3648	15
VCXU.2-241.M	1.2″	5312 × 4592	15
Color			
VCXU.2-13.C	1/2″	1280 × 1024	222
VCXU.2-15.C	1/2.9″	1440 × 1080	225
VCXU.2-31.C	1/1.8″	2048 × 1536	120
VCXU.2-32.C	1/1.8″	2048 × 1536	55.5
VCXU.2-50.C	2/3″	2448 × 2048	73
VCXU.2-51.C	2/3″	2448 × 2048	35
VCXU.2-57.C	1/1.8″	2464 × 2048	75
VCXU.2-65.C.R	1/1.8″	3072 × 2048	47
VCXU.2-123.C	1.1″	4096 × 3000	31
VCXU.2-127.C	1/1.1″	4096 × 2992	31
VCXU.2-201.C.R	1″	5472 × 3648	15
VCXU.2-241.C	1.2″	5312 × 4592	12

3.4.4 Dimensional drawing
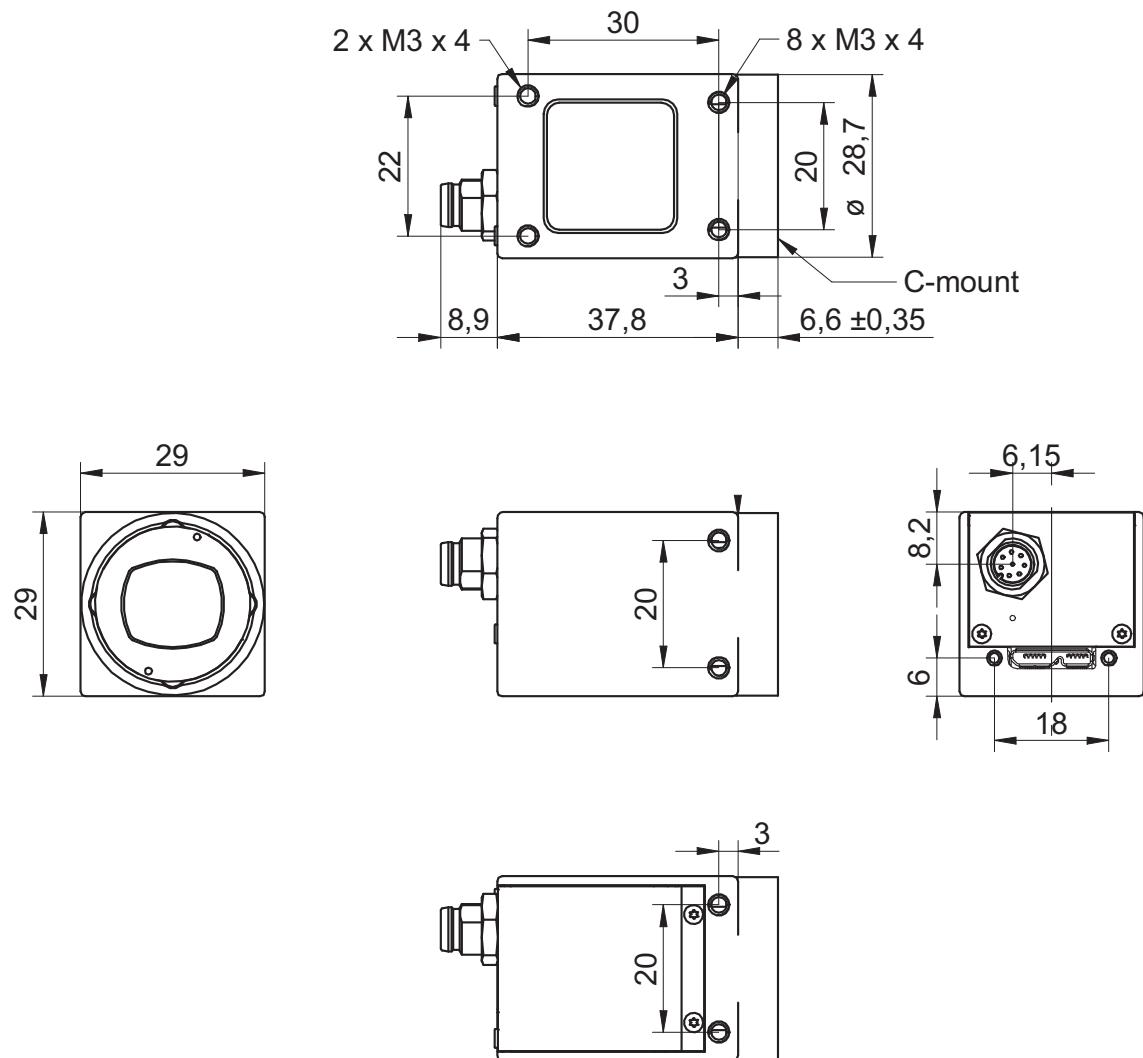
Ill. 4: Dimensional drawing - VCXU

4 Transport and storage

4.1 Transport

NOTICE

Material damage due to improper transport.

a) Ensure maximum diligence when unloading the delivered packages as well as when transporting them inside the company.

b) Note the information and symbols on the packaging.

c) Only remove packaging immediately before mounting.

4.2 Delivery inspection

Upon receipt immediately inspect the delivery for completeness and transport damage.

Claim any defect as soon as it is detected. Damages can only be claimed within the applicable claims deadlines.

In case of externally visible transport damage, proceed as follows:

Instruction:

a) Do not accept the delivery or only with reservations.

b) Note the scope of the damage on the transport documents or the delivery slip of the carrier.

c) Initiate the claim.

5   Installation

5.1   Environmental requirements

Storage temperature	VCXG.2	-10 °C (+14 °F) ... +70 °C (+158 °F)
	VCXG.2.XC	-10 °C (+14 °F) ... +70 °C (+158 °F)
	VCXG.2.I	-10 °C (+14 °F) ... +70 °C (+158 °F)
	VCXU.2	-10 °C (+14 °F) ... +70 °C (+158 °F)
Operating temperature	VCXG.2	0 °C (41 °F) ... 60 °C (140 °F)[1] */** / 65 °C (149 °F)*/**
	VCXG.2.XC	0 °C (32 °F) ... 65 °C (149 °F) */** / 75 °C (167 °F)*/**
	VCXG.2.I	0 °C (32 °F) ... 65 °C (149 °F)*/***
	VCXU.2	0 °C (41 °F) ... 60 °C (140 °F)[1] */** / 65 °C (149 °F)*/**
Humidity		10 % ... 90 % non condensing

[1] VCXU.2-201M.R / C.R

*/ at T (measuring point)

/** Ambient temperatures exceeding the range of 28 °C (82.4 °F) / 34 °C (93.2 °F) / 32 °C (89.6 °F) / 39 °C (102.2 °F) (according to camera model) require heat dissipation.

/*** Ambient temperatures exceeding 45 °C (113 °F), require measures for heat dissipation.

5.2   Mechanical Tests

Baumer cameras are tested towards the following standards to ensure industrial suitability.

Test environment	Standard	Parameter	
Vibration, sinusoidal	IEC 60068-2-6	Continuous oscillation	10-2000 Hz
		Amplitude underneath crossover frequencies	1.5 mm
		Acceleration	10 g
		Test duration	150 min (axis)
Vibration, broad band	IEC 60068-2-64	Frequency range	
		VCXG.2 (.XC) / VCXU.2	10-2000 Hz
		VCXG.2.I	5 - 2000 Hz
		Acceleration	10 g
		Test duration	300 min (axis)
Shock	IEC 60068-2-27	Pulse Time	11 ms / 6 ms
		Acceleration	50 g / 100 g
Shocks	IEC60068-2-29	Pulse Time	2 ms
		Acceleration	100 g
		Number of shocks per direction and axis	5000

Vibrationen
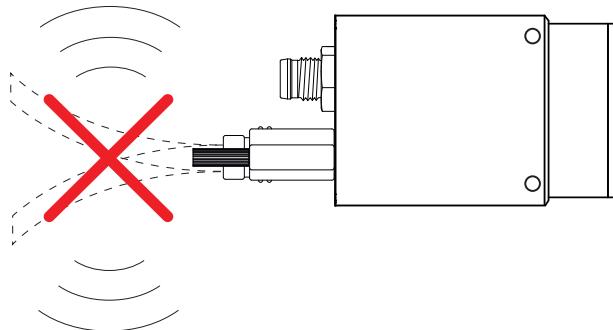
NOTICE

Vibration affecting the camera

Non-decoupled vibration may damage the camera connections.

Secure cables in a way making sure the camera is isolated against vibration.

5.3 Emergency shutdown at Overtemperature

To prevent the hardware from damage by high temperature, the camera features emergency shutdown. Feature *DeviceTemperatureStatusTransitionSelector* (Category: *DeviceControl*) is for selection of different temperature thresholds:

- *NormalToHigh*: freely programmable value
- *HighToExeeded*: fixed value (if exceeded, the sensor for image acquisition is switched off)
- *ExeededToNormal*: freely programmable, temperature for error-free reactivation

Feature *DeviceTemperatureStatusTransition* is for setting the temperatures for the programmed transition temperatures.

The event *EventDeviceTemperatureStatusChanged* is always generated when *DeviceTemperatureStatus* changes.

If temperature rises above the value set at *HighToExeeded*, function *DeviceTemperatureExceeded* is set to *True* followed by sensor switchoff to reduce power consumption; LED status indicator is red static. This usually will reduce temperature. Further rising temperature inside the camera due to ambient temperature may damage the hardware.

For further use, disconnect the camera from power supply after cool down or execute *DeviceReset*.

The sufficient cooling is recognizable when the event *DeviceTemperatureStatusChanged* (Device Temperature < *ExceededToNormal*) is output.

Temperatures for emergency-off

As soon as the temperature measured at the internal temperature sensor is exceeding the values specified in the table below, function *DeviceTemperatureExceeded* is set to *True* and image acquisition stops.

VCXG.2

Camera type	max. temperature (internal sensor)
Monochrom / Color	
VCXG.2-13M / VCXG.2-13C	75 °C (167 °F)
VCXG.2-15M / VCXG.2-15C	75 °C (167 °F)
VCXG.2-25M / VCXG.2-25C	75 °C (167 °F)
VCXG.2-32M / VCXG.2-32C	72 °C (161.6 °F)
VCXG.2-51M / VCXG.2-51C	75 °C (167 °F)
VCXG.2-51MP	75 °C (167 °F)
VCXG.2-57M / VCXG.2-57C	75 °C (167 °F)
VCXG.2-65M.R / VCXG.2-65C.R	72 °C (163.4 °F)
VCXG.2-82M / VCXG.2-82C	75 °C (167 °F)
VCXG.2-124M / VCXG.2-124C	75 °C (167 °F)
VCXG.2-127M / VCXG.2-127C	75 °C (167 °F)
VCXG.2-201M.R / VCXG.2-201C.R	75 °C (167 °F)
VCXG.2-204M / VCXG.2-204C	75 °C (167 °F)
VCXG.2-241M / VCXG.2-241C	75 °C (167 °F)

VCXG.2.XC

Camera type	max. temperature (internal sensor)
Monochrom / Color	
VCXG.2-51M.XC	75 °C (167 °F)
VCXG.2-241M.XC	75 °C (167 °F)

VCXG.2.I

Camera type	max. temperature (internal sensor)
Monochrom / Color	
VCXG.2-15M.I / VCXG.2-15C.I	70 °C (158 °F)
VCXG.2-32M.I / VCXG.2-32C.I	70 °C (158 °F)
VCXG.2-51M.I / VCXG.2-51C.I	70 °C (158 °F)
VCXG.2-57M.I / VCXG.2-57C.I	75 °C (167 °F)
VCXG.2-82M.I / VCXG.2-82C.I	75 °C (167 °F)
VCXG.2-127M.I / VCXG.2-127C.I	75 °C (167 °F)
VCXG.2-201M.R.I / VCXG.2-201C.R.I	75 °C (167 °F)
VCXG.2-241M.I / VCXG.2-241C.I	75 °C (167 °F)

VCXU.2

Camera type	Max. temperature (internal sensor)
Monochrom / Color	
VCXU.2-13M / VCXU.2-13C	75 °C (167 °F)
VCXU.2-15M / VCXU.2-15C	72 °C (161.6 °F)
VCXU.2-31M / VCXU.2-31C	72 °C (161.6 °F)
VCXU.2-32M / VCXU.2-32C	72 °C (161.6 °F)
VCXU.2-50M / VCXU.2-50C	72 °C (161.6 °F)
VCXU.2-50.MP	72 °C (161.6 °F)
VCXU.2-51M / VCXU.2-51C	72 °C (161.6 °F)
VCXU.2-57M / VCXU.2-57C	75 °C (167 °F)
VCXU.2-65M.R / VCXU.2-65C.R	73 °C (163.4 °F)
VCXU.2-123M / VCXU.2-123C	72 °C (161.6 °F)
VCXU.2-127M / VCXU.2-127C	75 °C (167 °F)
VCXU.2-201M.R / VCXU.2-201C.R	75 °C (167 °F)
VCXU.2-241M / VCXU.2-241C	75 °C (167 °F)

5.4   Heat dissipation

NOTICE

Heat accumulation in the device

Heat can damage the device. Ensure adequate heat dissipation. In view of the varied installation options Baumer does not make any recommendation for heat dissipation, but we suggest the following:

a) Any form of convection around device and mounting helps reduce temperature. Prevent any heat accumulation!

b) Mounting combined with forced convection may provide proper heat dissipation.

c) Avoid mounting on stainless steel surfaces. The thermal conductivity of stainless steel is about 10 times worse compared to aluminium.

d) To ensure heat dissipation on both sides, do not install the device at the end of a profile (larger surface for increased temperature reduction)!

e) Do not operate other devices close to the camera. Any waste heat might further heat up the camera.

VCXG.2 / .XC / .R	**VCXG.2.I**	**VCXU.2**
Temperature measuring point (T) / Maximum temperature		
65 °C (149 °F)	65 °C (149 °F)	65 °C (149 °F) 60 °C (140 °F)1 1) VCXU.2-201M.R/C.R
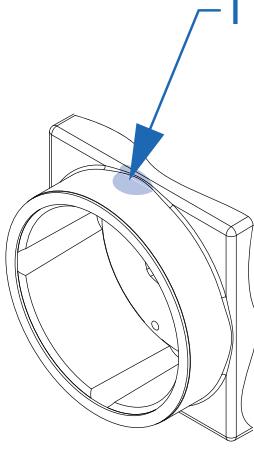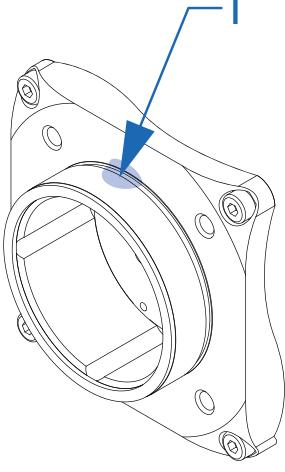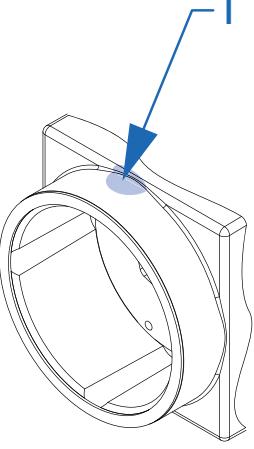
5.4.1   **Cooling channel (VCXG.2.XC only)**

The camera features a housing-integrated cooling channel. This is to feed compressed air or tempering fluid for camera temperature control.

For compressed air / tempering fluid connection (inlet (1) / outlet (2) use male threaded M3 push-in fittings and plastic hoses, e.g. FESTO QSM-M3-3-I and FESTO PUN-H-3x0.5.
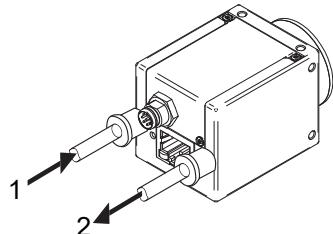
| 1 | Cooling channel (inlet) | 2 | Cooling channel (outlet) |

Cooling by air

The camera was tested with compressed air at 3 bar according to ISO 8573-1:2010 [1:4:2] [Particle:Water:Oil]. Maximum permitted pressure is 6 bar.
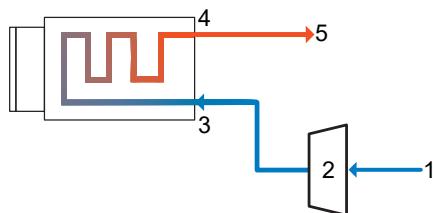
1	cold air	2	Compressor
3	Cooling channel (inlet)	4	Cooling channel (outlet)
5	warm air		

Compressed air contamination and cleanliness classes (ISO 8573-12010)

Class	Particle				Water			Oil
	According to particle size (maximum total of particles per m³)			According to mass	Dew point		Fluid	Fluid, aerosol and vapor
	0.10 - 0.5 microns	0.5 - 1.0 microns	1.0 - 5.0 microns	mg/m³	°C	°F	g/m³	mg/m³
0	As specified by user or supplier and more stringent than Class 1							
1	**≤ 20,000**	**≤ 400**	**≤ 10**	-	≤ -70	≤ -94	-	≤ 0.01
2	≤ 400,000	≤ 6,000	≤ 100	-	≤ -40	≤ -40	-	**≤ 0.1**
3	-	≤ 90,000	≤ 1,000	-	≤ -20	≤ -4	-	≤ 1
4	-	-	≤ 10,000	-	**≤ +3**	**≤ +37**	**-**	-
5	-	-	≤ 100,000	-	≤ +7	≤ +45	-	-
6	-	-	-	0 - ≤ 5	≤ +10	≤ +50	-	-
7	-	-	-	5 - ≤ 10	-	-	≤ 0.5	-

Class	Particle						Water	Oil
8	-	-	-	-	-	-	≤ 5	-
9	-	-	-	-	-	-	≤ 10	-
X	-	-	-	> 10	-	-	> 10	> 5

Cooling by tempering fluid

The tempering fluid efficiently takes the heat away from the camera.
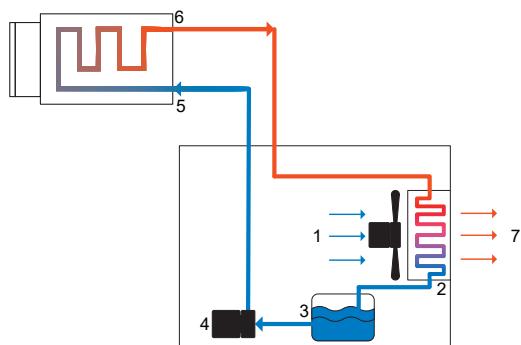
1	cold air	2	Heat exchanger
3	Tank	4	Pump
5	Cooling channel (inlet)	6	Cooling channel (outlet)
7	warm air		

⚠ DANGER

Danger by improper system components

Risk of electric shock. Electric shock can cause fatal or serious injury.

a) The system components, cables, tempering fluid connections and hoses as well as lens must be selected in compliance with operating conditions.

The maximum ambient temperature of +85 °C (185 °F) must not be exceeded neither for the camera nor the components since it is the maximum temperature specified for the connectors (RJ45 and M8). At temperatures below freezing point, ensure tempering fluid supply without any interruptions.

The tempering fluid must meet the following criteria:

- Compatible to aluminum
- must provide bio-growth inhibiting properties
- must contain anti-corrosion agents
- maximum pressure 6 bar
- Recommended fluid temperature range is from 1 °C (33.8 °F)... 50 °C (122 °F), in relation to the ambient temperature
- The camera was tested at a flow rate of 0.9l/h. The flow rate depends on applied the pump performance.

As water bath protection agent we recommend "Aqua Stabil" from Julabo.

5.5 Lens mount

Avoid contamination of the sensor and the lens by dust and airborne particles when mounting the lens to the device!

Therefore the following points are very important:

- Install the camera in an environment that is as dust free as possible!
- Keep the lens mount covered if no lens is attached
- Hold the camera downwards with unprotected sensor.
- Avoid contact with any optical surface of the camera!

5.6 Filter exchange

Color cameras integrate a filter. This filter may limit the sensor use in certain applications.

To replace the filter, proceed as follows.

NOTICE

Dust-contaminated optical surfaces
Prevent filter, sensor and lens from contamination by dust and suspended matter!
Any filter exchange only in a dust-free room and using clean tools!
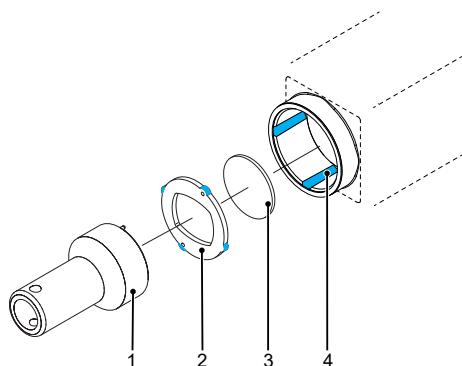
1	Assembly tool	2	Filter support
3	Filter	4	Guide grooves

Instruction:

a) Place the mounting tool (1) into the sensor opening. Place both front pins into the holes provided at the filter support (2).

b) Turn filter support (2) until the lugs can be seen in the guide grooves (4).

c) Remove the filter support (2).

d) Carefully remove the filter (3). When doing so, do not touch the sensor!

e) Insert a new filter into the sensor opening.

f) Replace the filter support (2).

g) Turn the filter support (2) until the lugs are no longer visible in the guide grooves (4).

5.7   Modular tube system (please order separately)

Specific camera models allow for varied *modular tube systems* as lens protection.

INFO

Several additional housings as lens and camera protection are still available for particular camera models.

Instruction:

a) Mount the *Modular Tube System* as shown in the illustration below.

b) Baumer recommends ELKALUB GLS 867 grease for easier installation of the sealing rings (5).

c) Tighten the screws (3) with a torque wrench to 0.9 Nm.

d) If you need more space for a lens, use a corresponding distance ring (2).
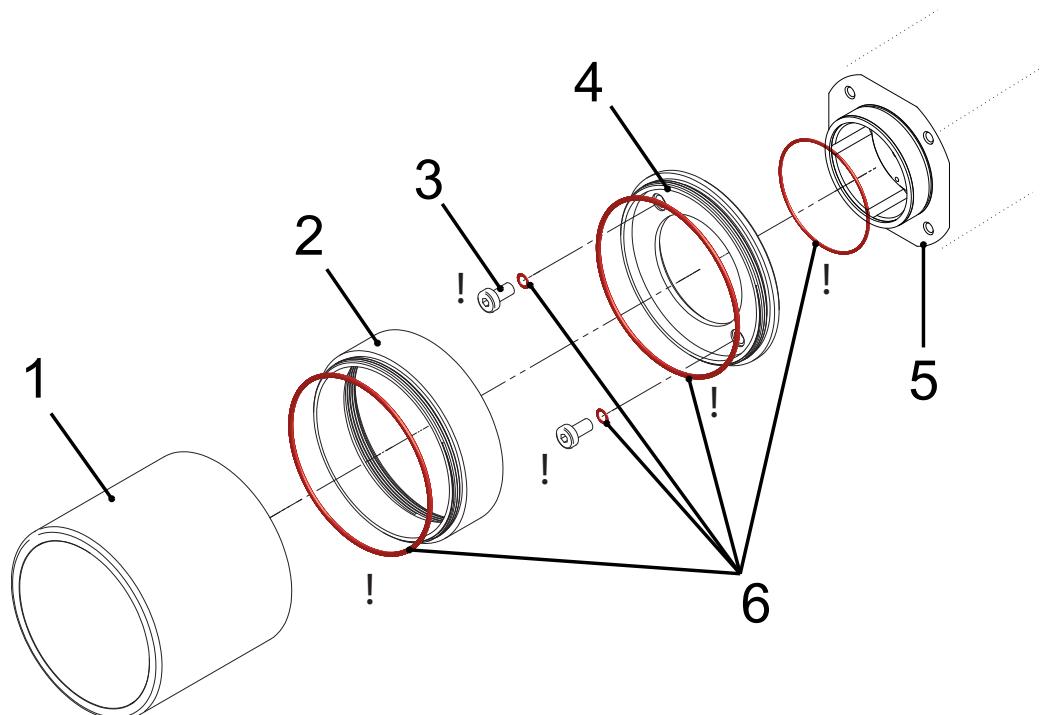
1	Tube	2	Spacer
3	Screw	4	Tube adapter
5	Camera	6	Sealings

Tube adapter

M 47

A-A

Ø 49,5

3,25

2,75

2,5

M47 x 0,75

3

5,25

Art. No.: 11185373

M 62

A-A

3,25

Ø 65

2,75

2,5

M62 x 0,75

3

5,25
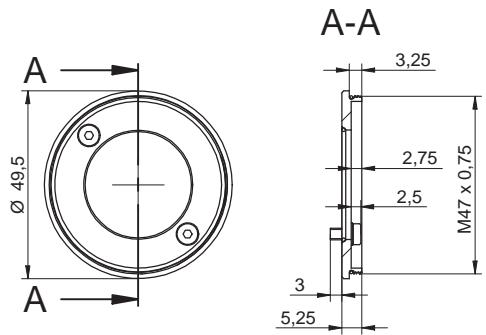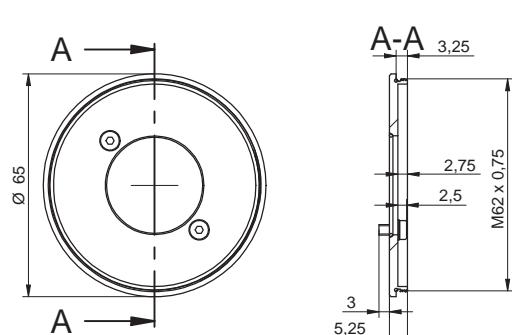
Art. No.: 11185377

M 92

A-A

Ø 95

3,25

2,75

2

M92 x 0,75

3,5

5,25
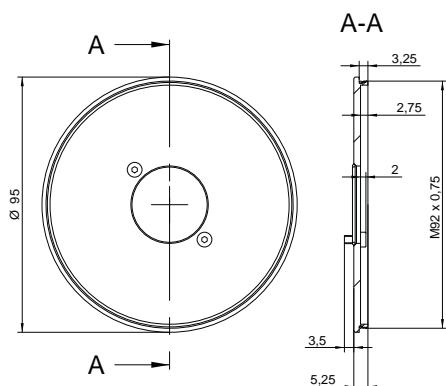
Art. No.: 11704311

Spacer

M 47

Art. No.: 11185372
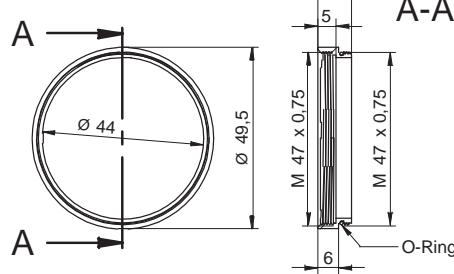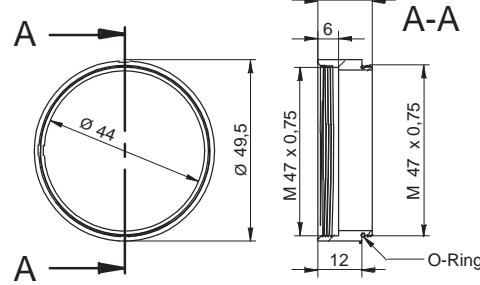
Art. No.: 11185371

Art. No.: 11211571

M 62

Art. No.: 11185376
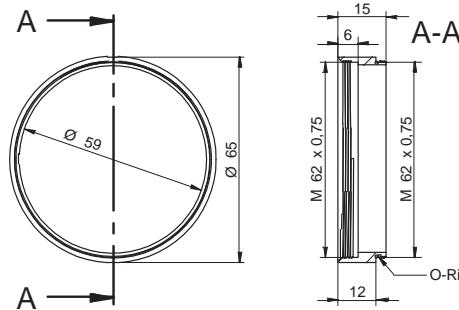
Art. No.: 11185375

Art. No.: 11198906

M 92

A-A

Ø 89
Ø 95

9
4.8
M92 x 0,75
M92 x 0,75
O-Ring
6

Art. No.: 11704395

A-A

Ø 89
Ø 95

15
7.25
M92 x 0,75
M 92 x 0,75
O-Ring
12

Art. No.: 11704397

A-A

Ø 89
Ø 95

39
7.25
M 92 x 0,75
M 92 x 0,75
O-Ring
36
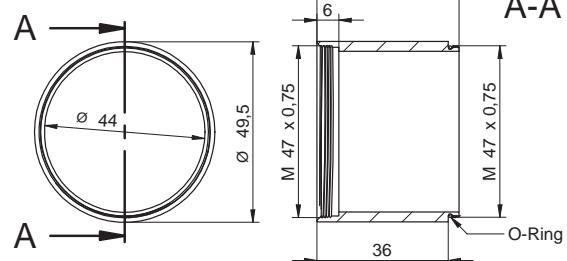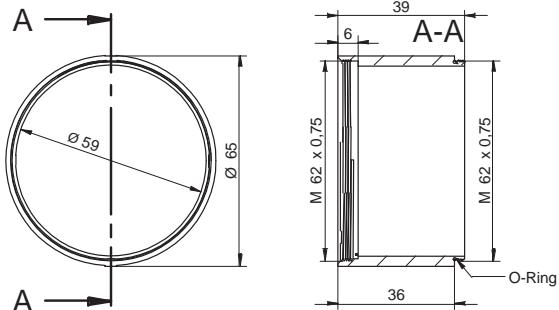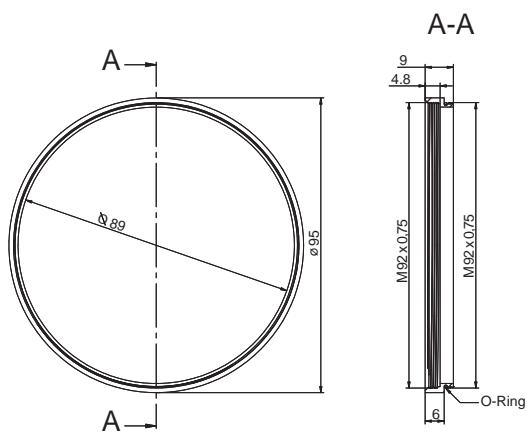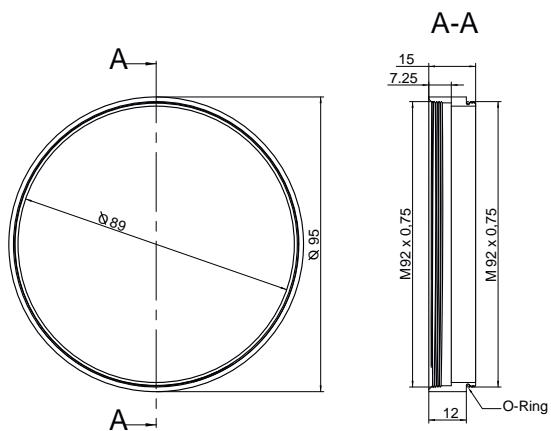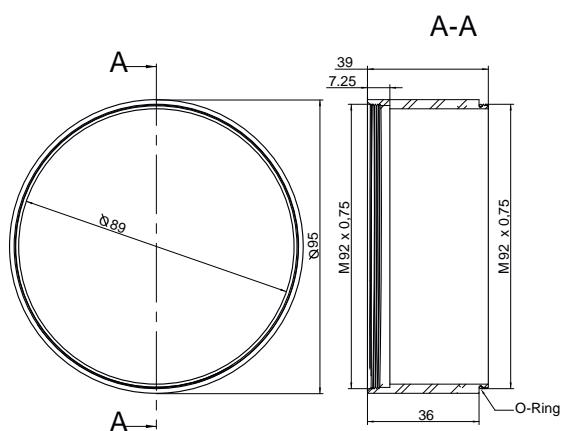
Art. No.: 11704394

Tube

M 47
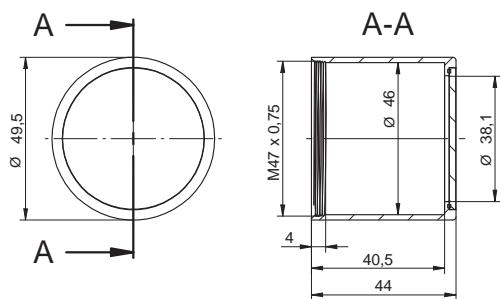
Art. No.: 11185370 (Cover Glass: Acryl)

Art. No.: 11195425 (Cover Glass: restistant laminated safety cover glass)

M 62
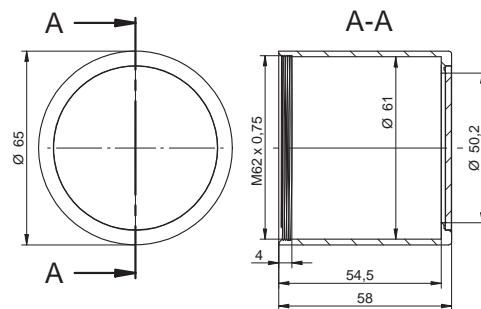
Art. No.: 11185374 (Cover Glass: Acryl)

Art. No.: 11195426 (Cover Glass: restistant laminated safety cover glass)

M 92
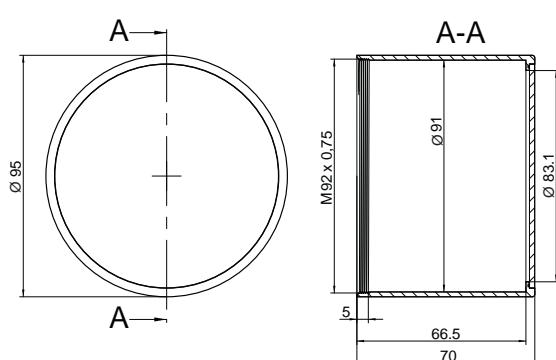
Art. No.: 11704312 / Cover glass: PMMA (Acryl)

Tube: inner dimensions

M 47
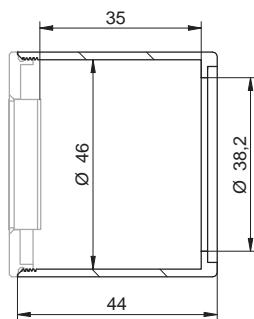
M 62
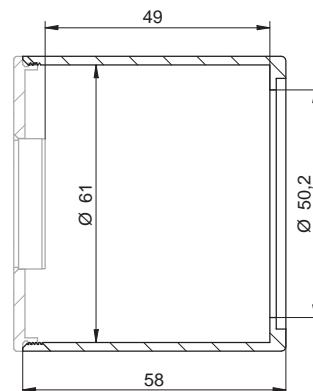
M 92
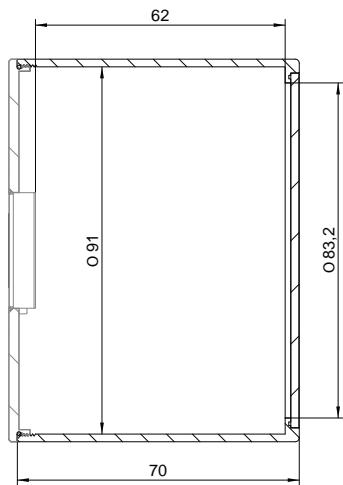
6   Optical specification

6.1   VCXG.2

6.1.1   Sensor position accuracy

Typical precision under assumption of the average square root value is shown in the figure and table(s) below.
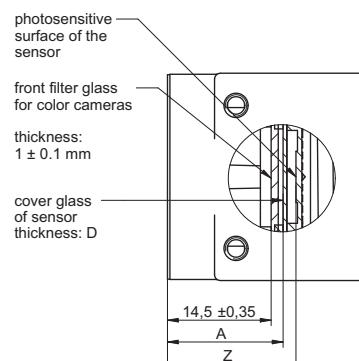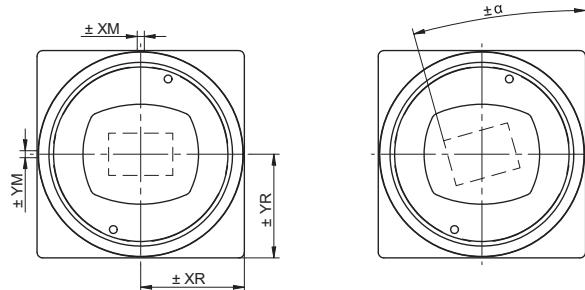
Camera type	± xM [mm]	± yM [mm]	± xR [mm]	± YR [mm]	z***typ [mm]	± αtyp [°]	A*** [mm]	D** [mm]
VCXG.2-13*	0.05	0.05	0.05	0.05	17.55 ± 0.100	0.6	16.6	0.55
VCXG.2-15*	0.07	0.07	0.07	0.07	17.63 ± 0.070	0.6	16.4	0.70
VCXG.2-25*	0.05	0.05	0.05	0.05	17.65 ± 0.070	0.6	16.5	0.55
VCXG.2-32*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXG.2-51*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXG.2-57*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	16.4	0.50
VCXG.2-65*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	16.4	0.50
VCXG.2-82*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50
VCXG.2-124*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXG.2-127*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50
VCXG.2-201*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.6	15.8	0.50
VCXG.2-204*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50
VCXG.2-241*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.6	15.8	0.50

typical accuracy by assumption of the root mean square value

* C or M

** Dimension D in this table is from manufacturer datasheet

*** For color add 0.35 mm to nominal value

6.1.2   Filter glass (color cameras)

Filter glass of color cameras
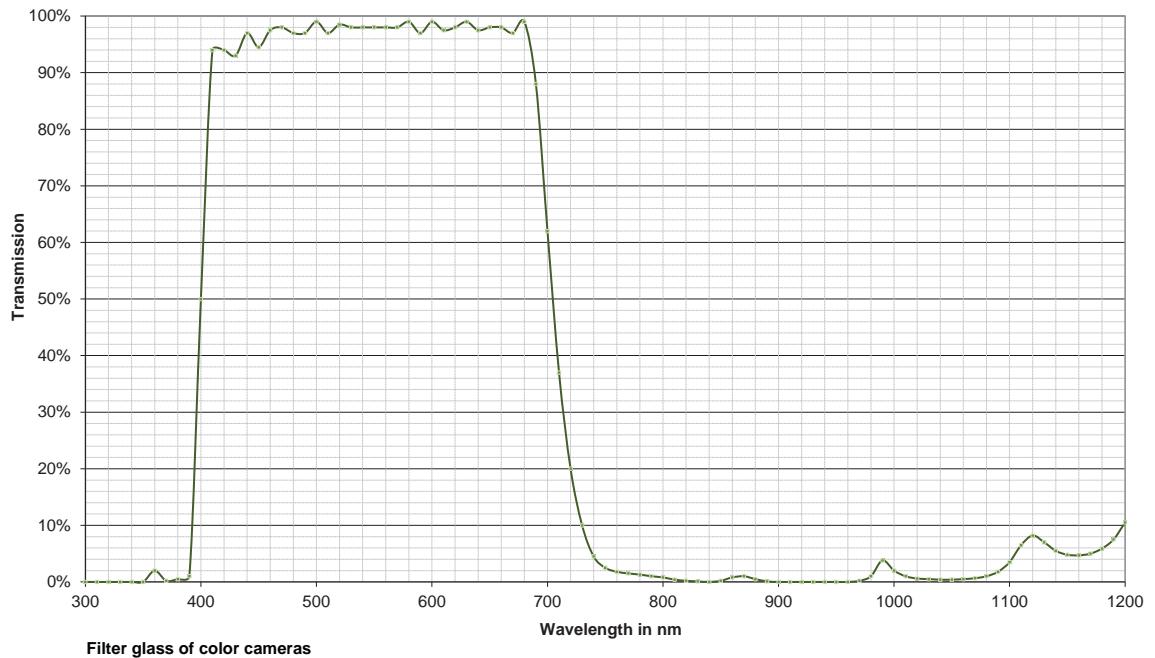
6.1.3   Spectral sensitivity

The following diagrams show the spectral sensitivity characteristics for this camera series. The characteristic curves for the sensors do not take the characteristics of lenses and light sources without filters into consideration.

The values refer to the related data sheets.

Cameras
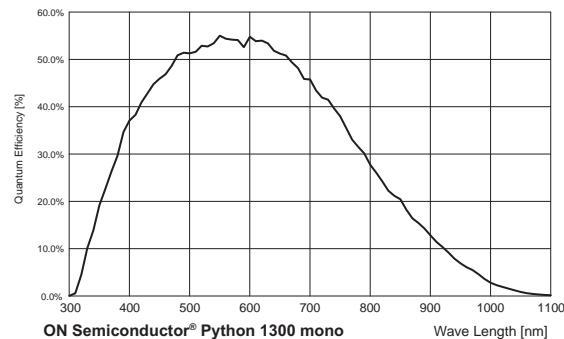
Spectral sensitivity VCXG.2-13M
(PYTHON1300)
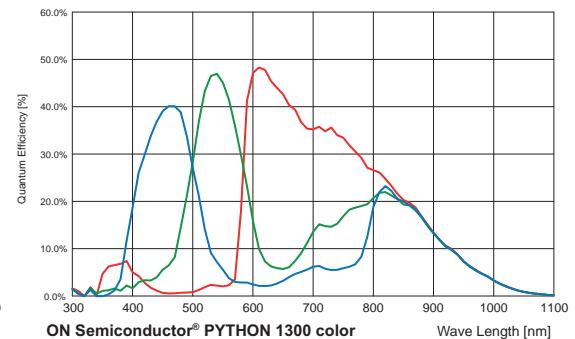
Spectral sensitivity VCXG.2-13C
(PYTHON1300)

Sony® IMX 273 mono Wave Length [nm]
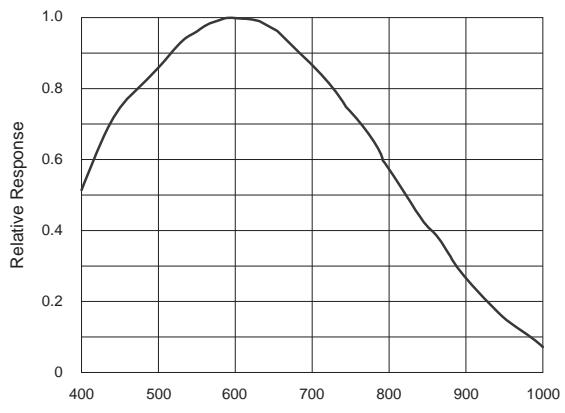
Spectral sensitivity VCXG.2-15M
(Sony® IMX273)

Sony® IMX 273 mono Wave Length [nm]
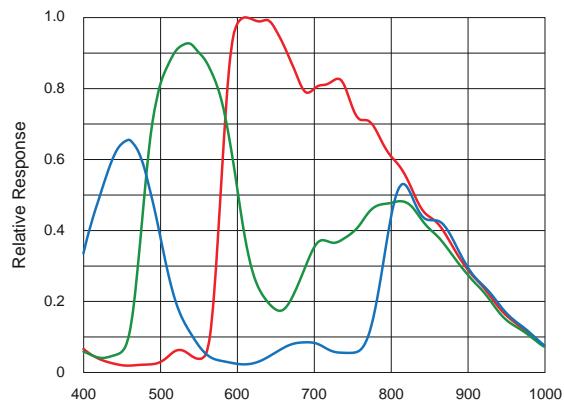
Spectral sensitivity VCXG.2-15C
(Sony® IMX273)

ON Semiconductor® PYTHON 2000 mono Wave Length [nm]
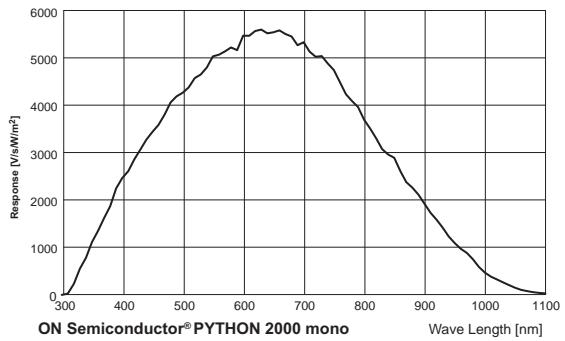
Spectral sensitivity VCXG.2-25M
(PYTHON2000)

ON Semiconductor® PYTHON 2000 color Wave Length [nm]
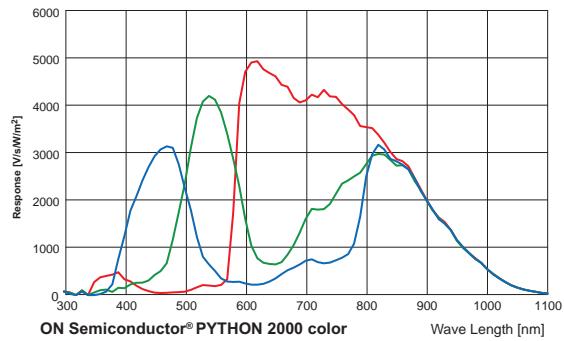
Spectral sensitivity VCXG.2-25C
(PYTHON2000)

Sony® IMX 265 mono Wave Length [nm]
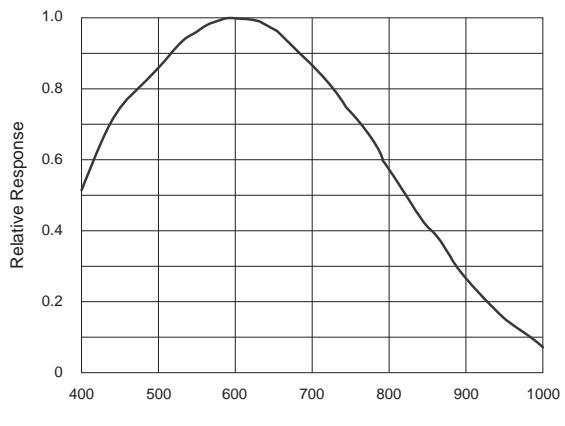
Spectral sensitivity VCXG.2-32M
(Sony® IMX265)

Sony® IMX 265 color Wave Length [nm]
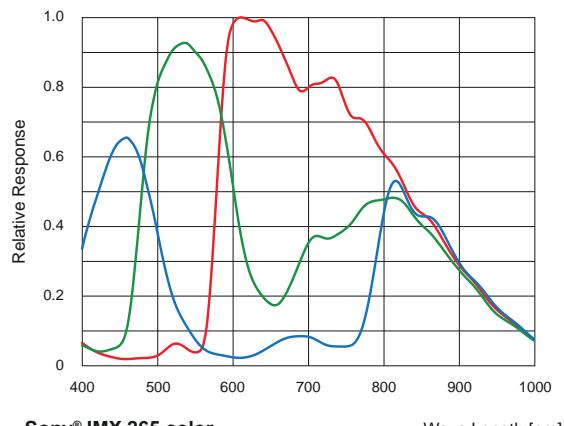
Spectral sensitivity VCXG.2-32C
(Sony® IMX265)
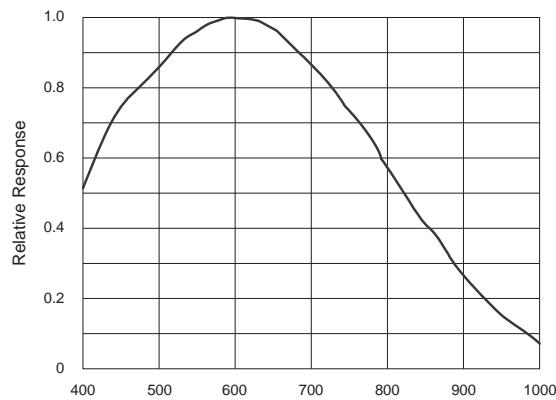
Sony® IMX 264 mono

Spectral sensitivity VCXG.2-51M /
VCXG.2-51MP (Sony® IMX264)
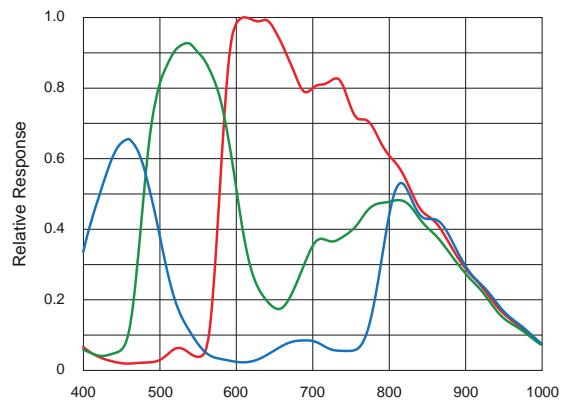
Sony® IMX 264 color

Spectral sensitivity VCXG.2-51C
(Sony® IMX264)
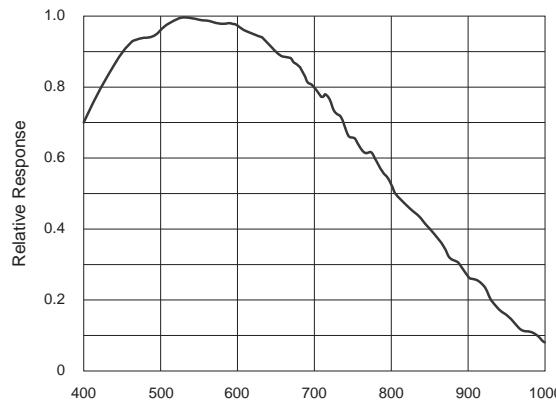
Sony® IMX 548 mono

Spectral sensitivity VCXG.2-57M
(Sony® IMX548)
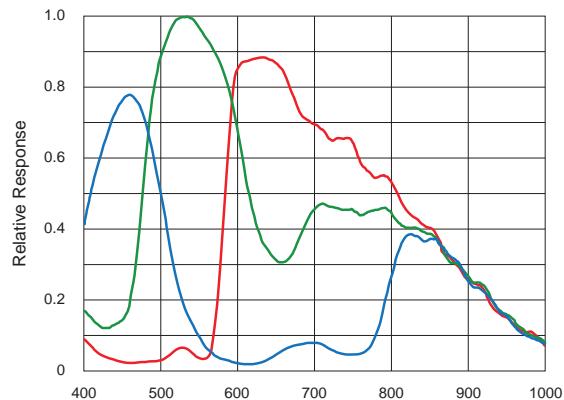
Sony® IMX 548 color

Spectral sensitivity VCXG.2-57C
(Sony® IMX548)
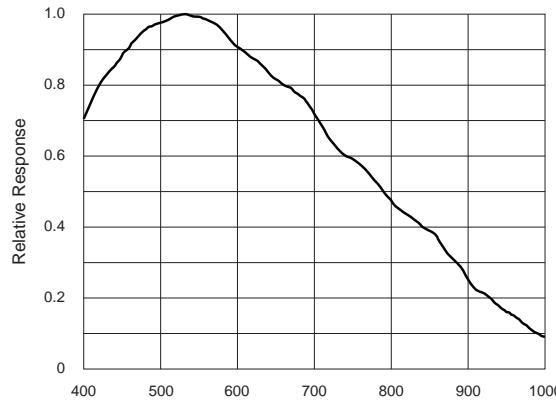
Sony® IMX 178 mono

Spectral sensitivity VCXG.2-65M.R
(Sony® IMX178)
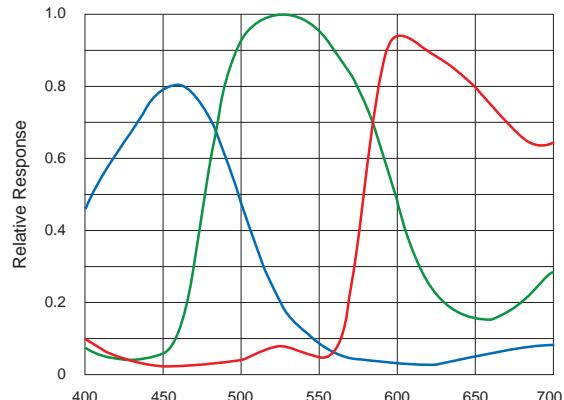
Sony® IMX 178 color

Spectral sensitivity VCXG.2-65C.R
(Sony® IMX178)
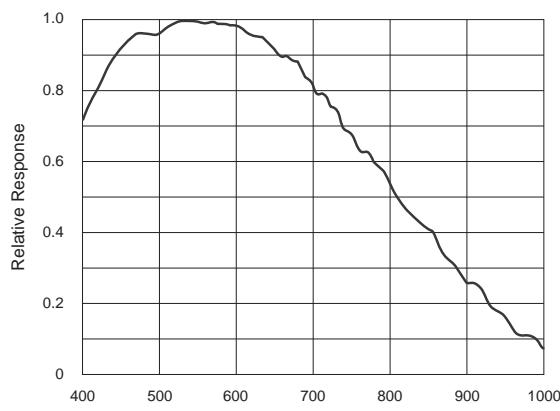
Spectral sensitivity VCXG.2-82M
(Sony® IMX546)
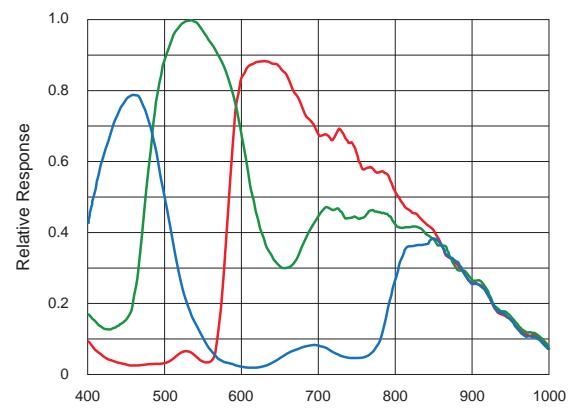
Spectral sensitivity VCXG.2-82C
(Sony® IMX546)
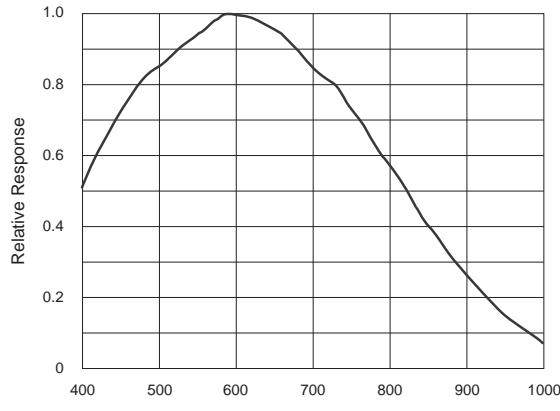
Spectral sensitivity VCXG.2-124M
(Sony® IMX304)
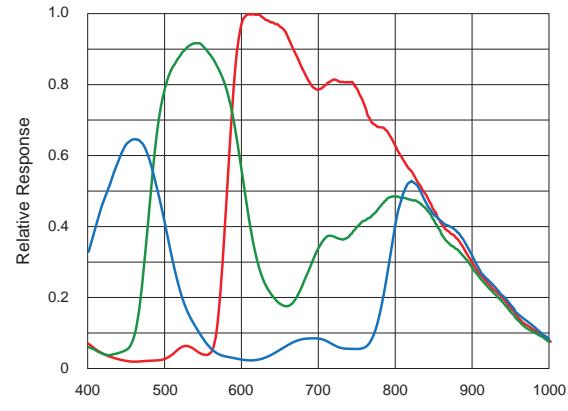
Spectral sensitivity VCXG.2-124C
(Sony® IMX304)
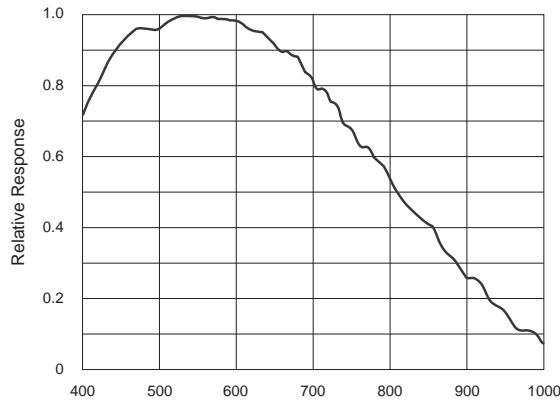
Spectral sensitivity VCXG.2-127M
(Sony® IMX545)
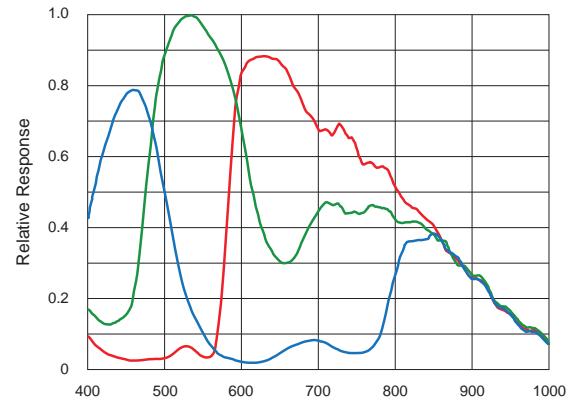
Spectral sensitivity VCXG.2-127C
(Sony® IMX545)

Sony® IMX 183 mono — Wave Length [nm]
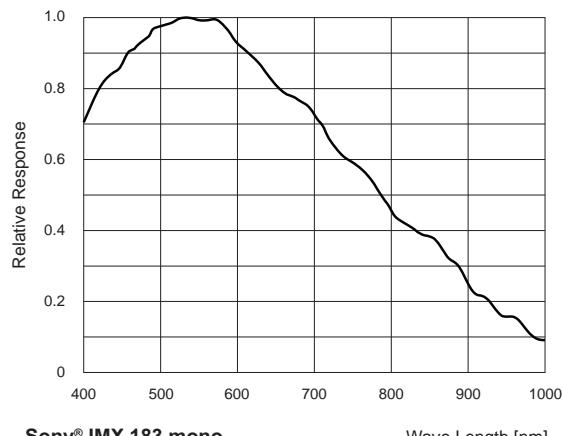
Spectral sensitivity VCXG.2-201M.R
(Sony® IMX183)

Sony® IMX 183 color — Wave Length [nm]
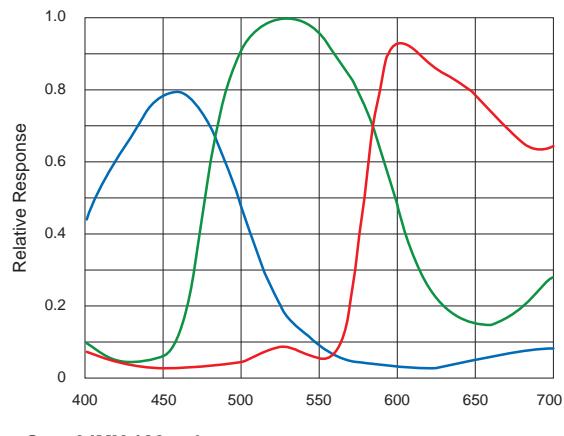
Spectral sensitivity VCXG.2-201C:R
(Sony® IMX183)

Sony® IMX 541 mono — Wave Length [nm]
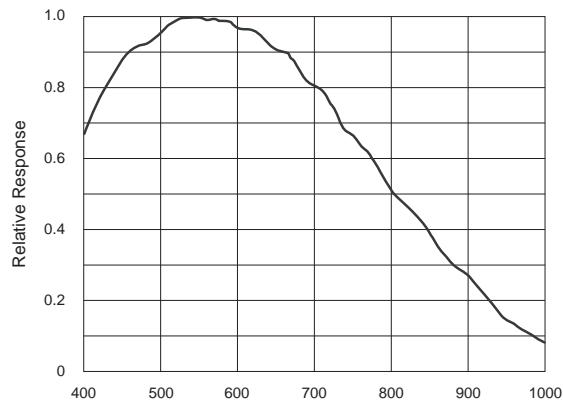
Spectral sensitivity VCXG.2-204M
(Sony® IMX541)

Sony® IMX 541 color — Wave Length [nm]
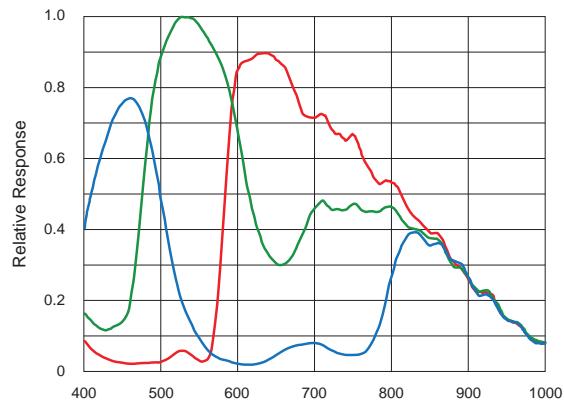
Spectral sensitivity VCXG.2-204C
(Sony® IMX541)

Sony® IMX 540 mono — Wave Length [nm]
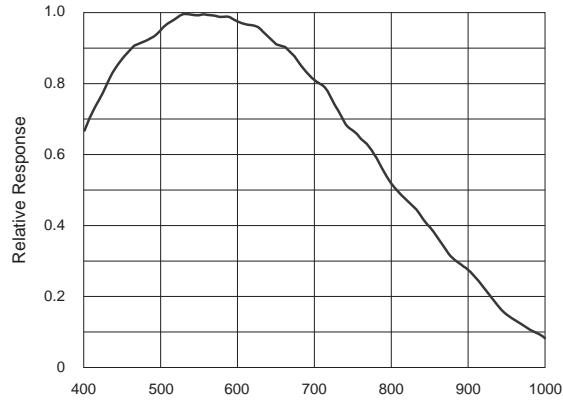
Spectral sensitivity VCXG.2-241M
(Sony® IMX540)

Sony® IMX 540 color — Wave Length [nm]
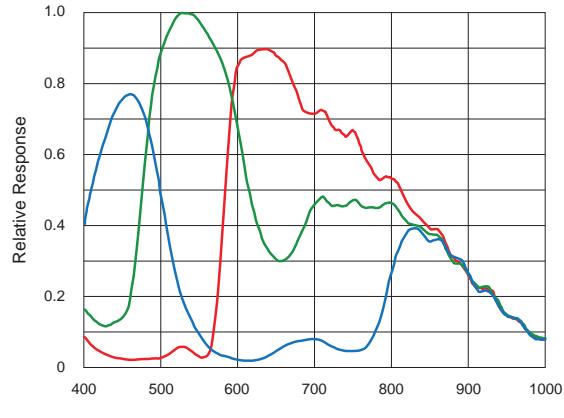
Spectral sensitivity VCXG.2-241C
(Sony® IMX540)

6.2   VCXG.2.XC

6.2.1   Sensor position accuracy

Typical precision under assumption of the average square root value is shown in the figure and table(s) below.
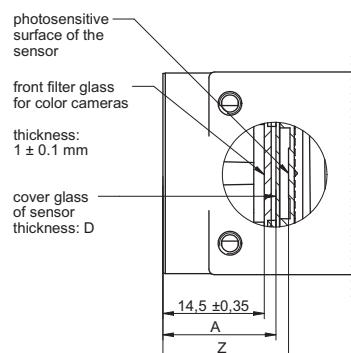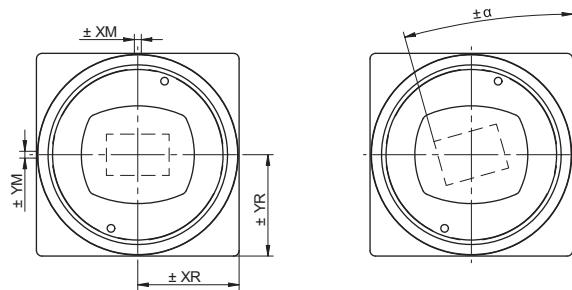
Camera type	± xM [mm]	± yM [mm]	± xR [mm]	± YR [mm]	z***typ [mm]	± αtyp [°]	A*** [mm]	D** [mm]
VCXG.2-51.XC*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXG.2-241.XC*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.6	15.8	0.50

typical accuracy by assumption of the root mean square value

* C or M

** Dimension D in this table is from manufacturer datasheet

*** For color add 0.35 mm to nominal value

6.2.2   Spectral sensitivity

The following diagrams show the spectral sensitivity characteristics for this camera series. The characteristic curves for the sensors do not take the characteristics of lenses and light sources without filters into consideration.

The values refer to the related data sheets.

Cameras
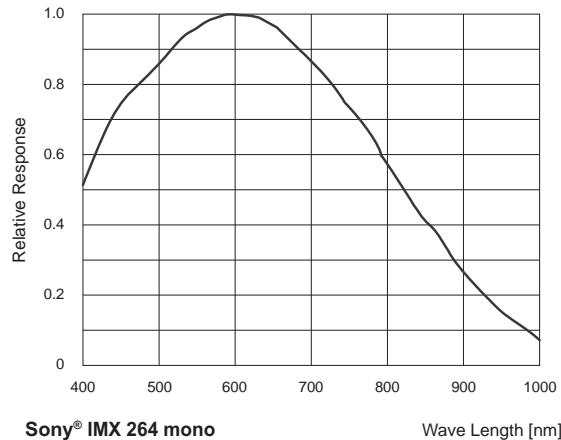
Sony® IMX 264 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-51M.XC
(Sony® IMX264)
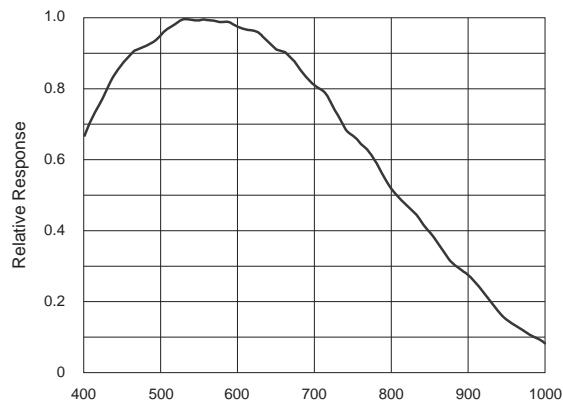
Sony® IMX 540 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-241M.XC
(Sony® IMX540)

6.3 VCXG.2.I

6.3.1 Sensor position accuracy

Typical precision under assumption of the average square root value is shown in the figure and table(s) below.
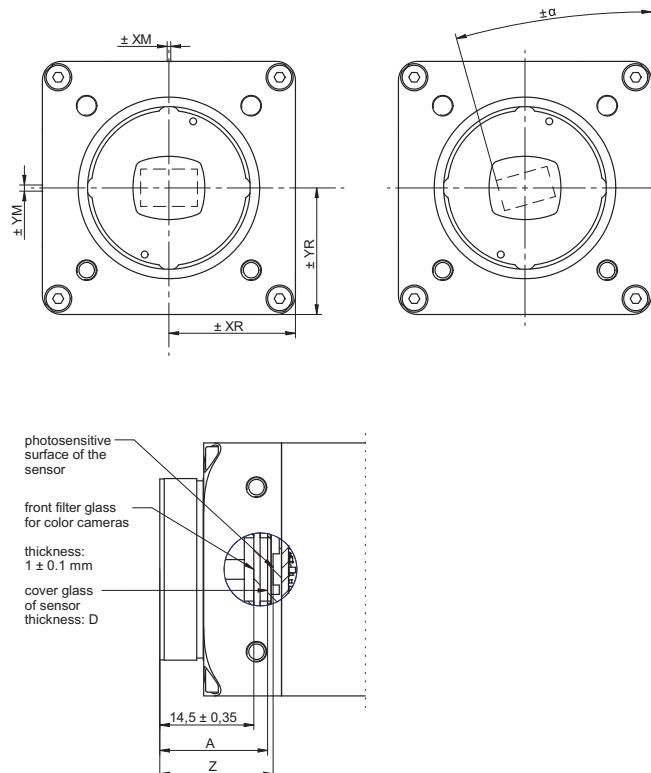
Camera type	± xM [mm]	± yM [mm]	± xR [mm]	± YR [mm]	z***typ [mm]	± αtyp [°]	A*** [mm]	D** [mm]
VCXG.2-15.I*	0.07	0.07	0.07	0.07	17.63 ± 0.070	0.6	16.4	0.70
VCXG.2-32.I*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXG.2-51.I*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXG.2-57.I*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	16.5	0.50
VCXG.2-82.I*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50
VCXG.2-127.I*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50
VCXG.2-201.I*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.6	15.8	0.50
VCXG.2-241.I*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50

typical accuracy by assumption of the root mean square value
* C or M
** Dimension D in this table is from manufacturer datasheet
*** For color add 0.35 mm to nominal value

6.3.2   Filter glass (color cameras)

Filter glass of color cameras

6.3.3   Cover glasses Tubes

Cover Glass Tube: Acrylic
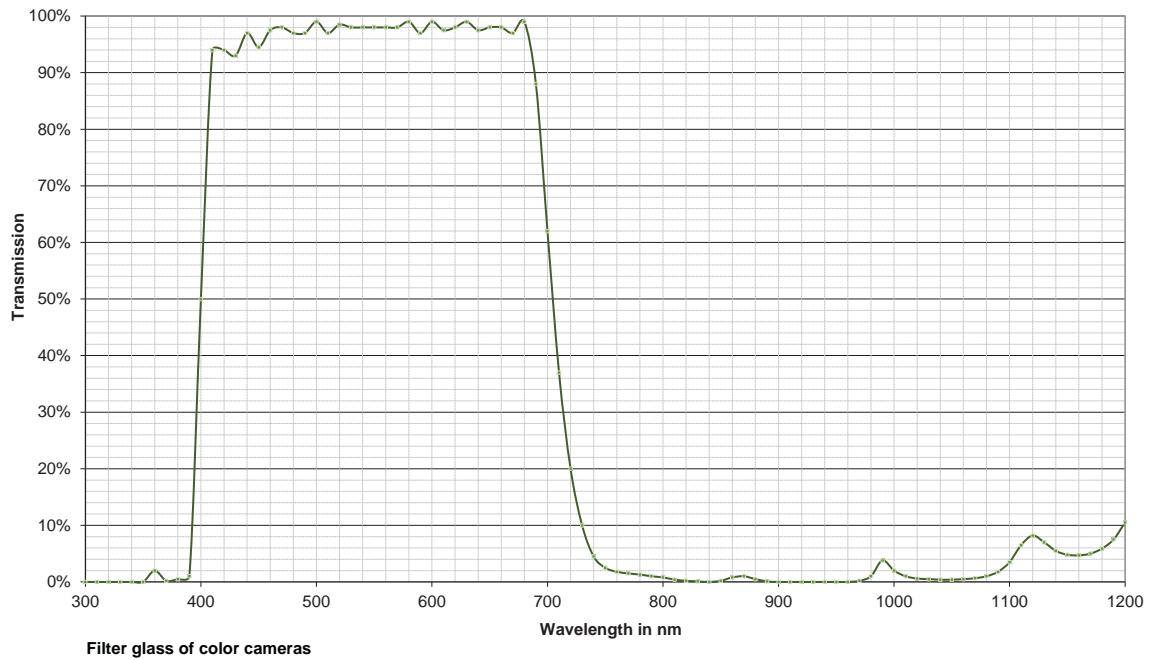
Cover glass tube: resistant laminated safety glass
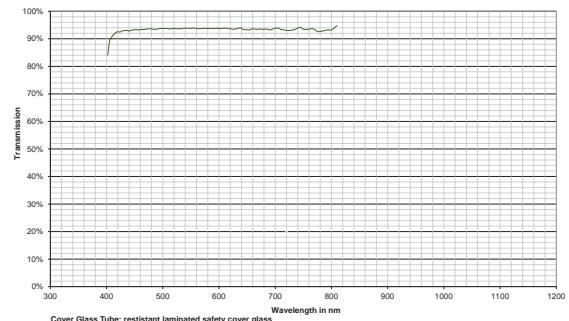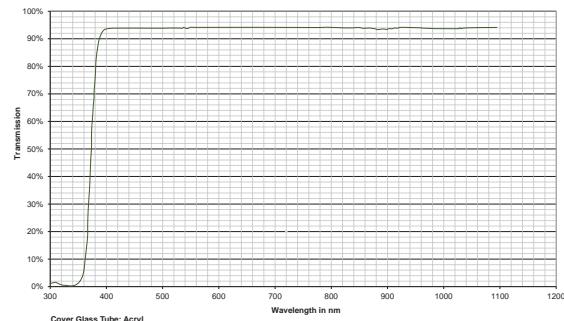
6.3.4   Spectral sensitivity

The following diagrams show the spectral sensitivity characteristics for this camera series. The characteristic curves for the sensors do not take the characteristics of lenses and light sources without filters into consideration.

The values refer to the related data sheets.

Cameras
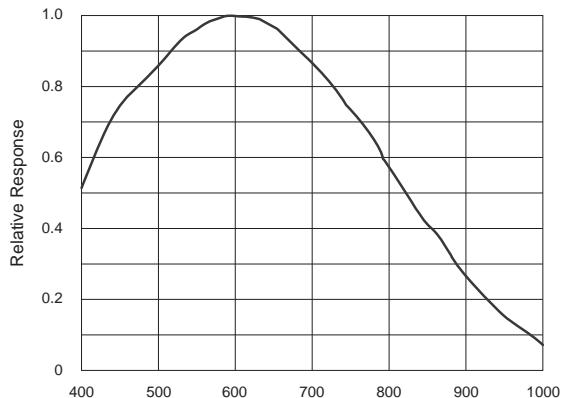
Sony® IMX 273 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-15M.I
(Sony® IMX273)
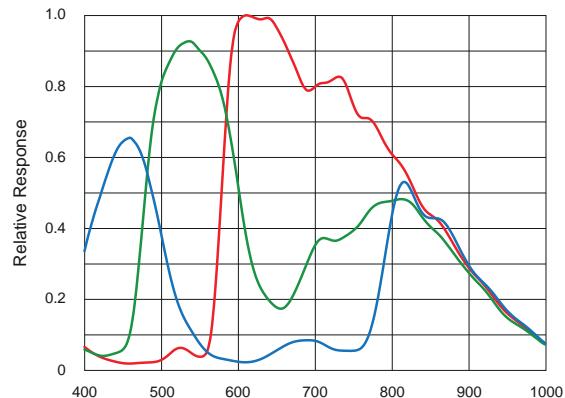
Sony® IMX 273 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-15C.I
(Sony® IMX273)
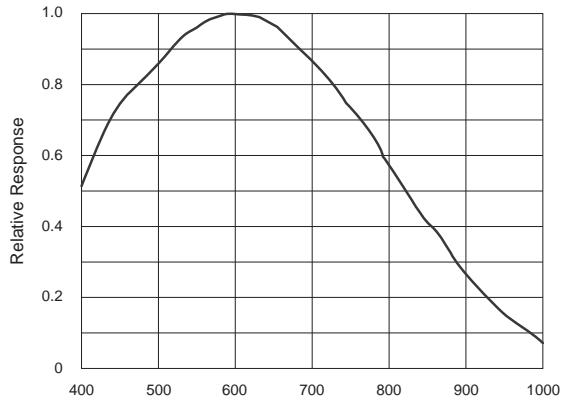
Sony® IMX 265 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-32M.I
(Sony® IMX265)
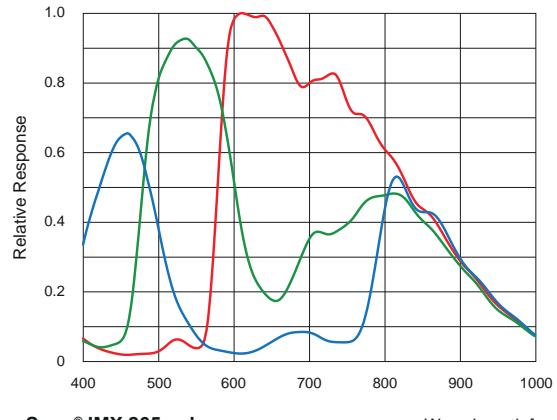
Sony® IMX 265 color   Wave Length [nm]

Spectral sensitivity VCXG.2-32C.I
(Sony® IMX265)
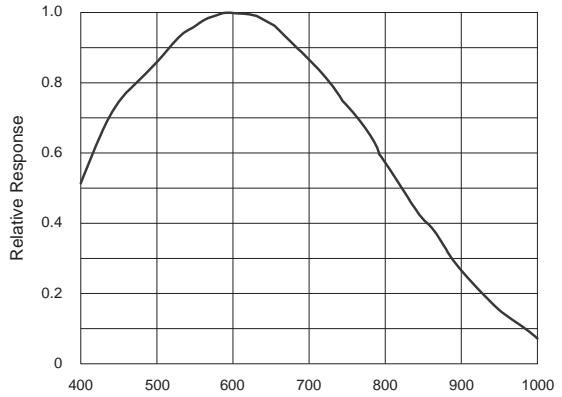
Sony® IMX 264 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-51M.I
(Sony® IMX264)
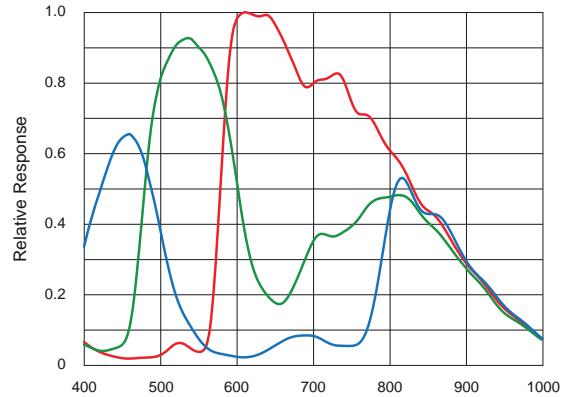
Sony® IMX 264 color   Wave Length [nm]

Spectral sensitivity VCXG.2-51C.I
(Sony® IMX264)
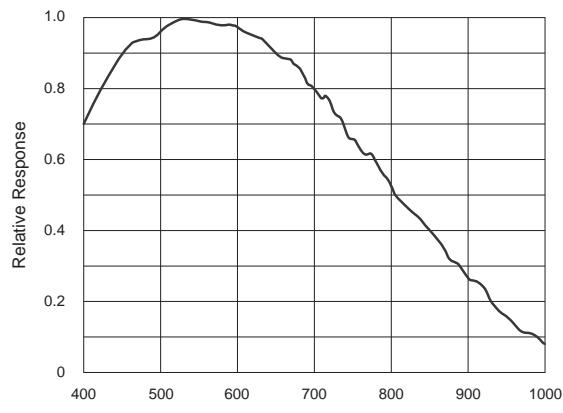
Sony® IMX 548 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-57M.I
(Sony® IMX548)
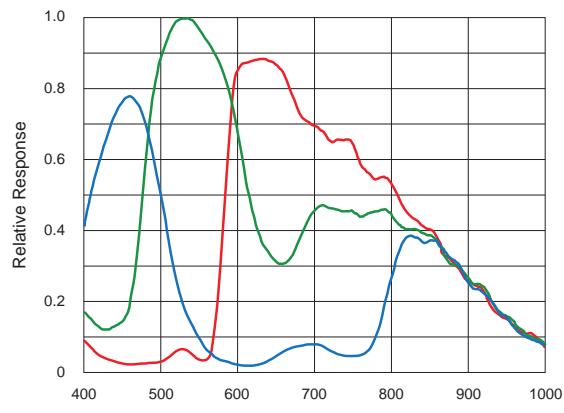
Sony® IMX 548 color   Wave Length [nm]

Spectral sensitivity VCXG.2-57C.I
(Sony® IMX548)
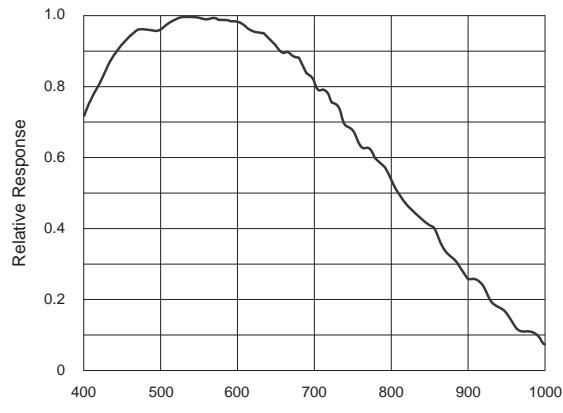
Sony® IMX 546 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-82M.I
(Sony® IMX546)
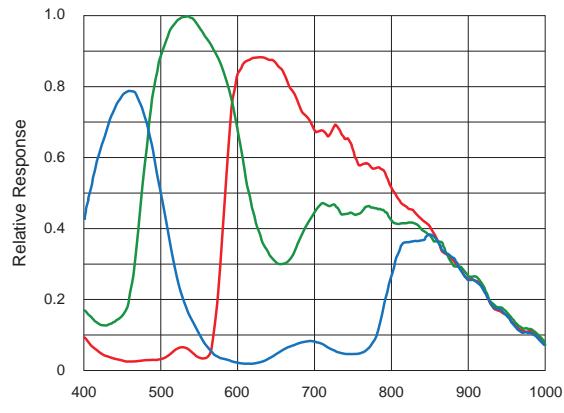
Sony® IMX 546 color   Wave Length [nm]

Spectral sensitivity VCXG.2-82C.I
(Sony® IMX546)
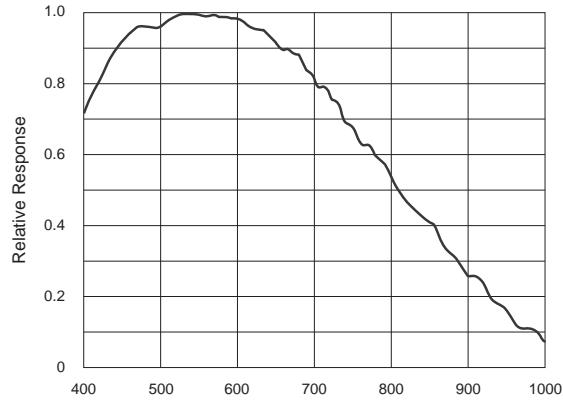
Sony® IMX 545 mono   Wave Length [nm]

Spectral sensitivity VCXG.2-127M.I
(Sony® IMX545)
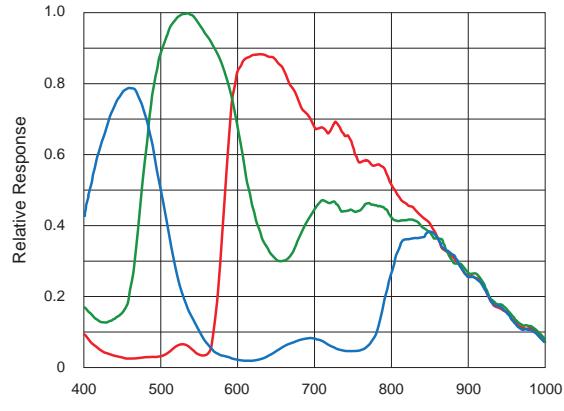
Sony® IMX 545 color   Wave Length [nm]

Spectral sensitivity VCXG.2-127C.I
(Sony® IMX545)
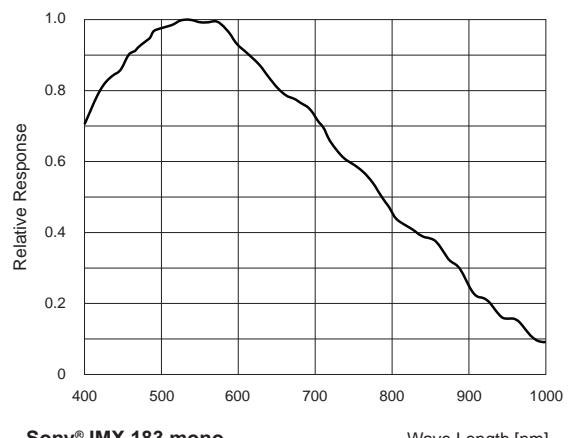
Sony® IMX 183 mono

Spectral sensitivity VCXG.2-201M.R.I
(Sony® IMX183)
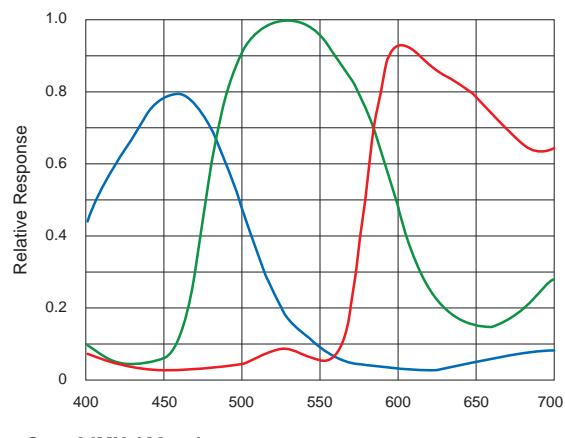
Sony® IMX 183 color

Spectral sensitivity VCXG.2-201C:R.I
(Sony® IMX183)
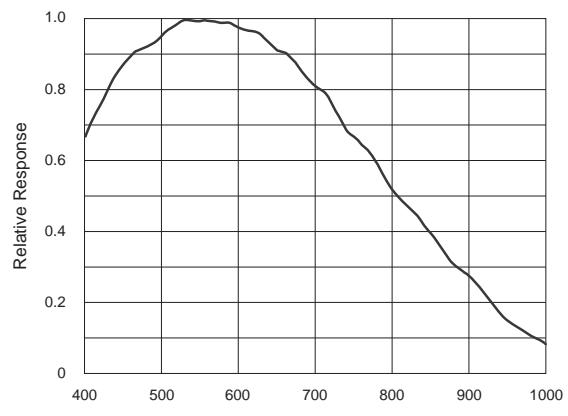
Sony® IMX 540 mono

Spectral sensitivity VCXG.2-241M.I
(Sony® IMX540)
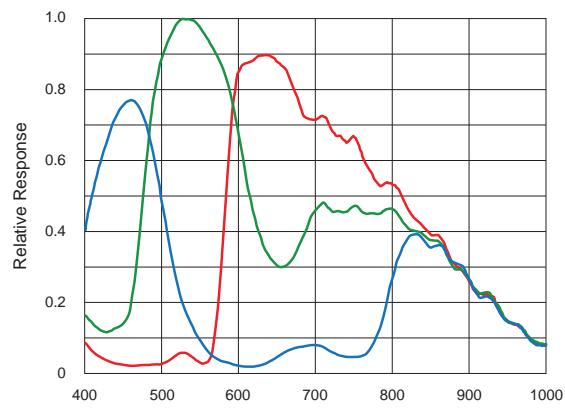
Sony® IMX 540 color

Spectral sensitivity VCXG.2-241C.I
(Sony® IMX540)

6.4   **VCXU.2**

6.4.1   **Sensor position accuracy**

Typical precision under assumption of the average square root value is shown in the figure and table(s) below.
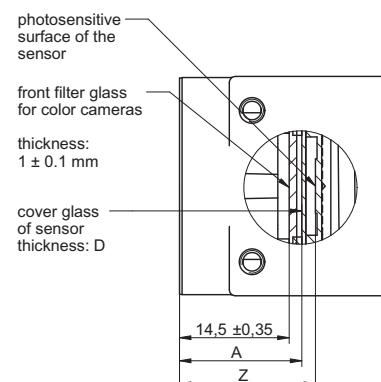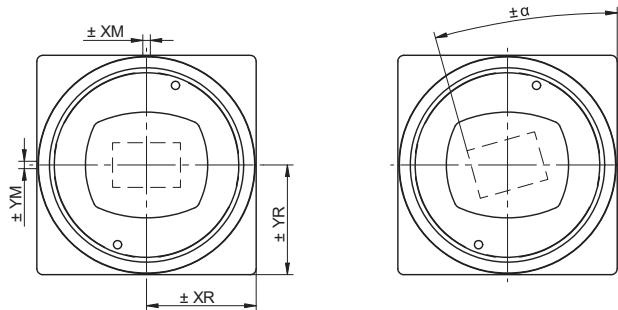
Camera type	± xM [mm]	± yM [mm]	± xR [mm]	± YR [mm]	z***typ [mm]	± αtyp [°]	A*** [mm]	D** [mm]
VCXU.2-13*	0.05	0.05	0.05	0.05	17.55 ± 0.100	0.6	16.6	0.55
VCXU.2-15*	0.07	0.07	0.07	0.07	17.63 ± 0.070	0.6	16.4	0.70
VCXU.2-31*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXU.2-32*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXU.2-50*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXU.2-51*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXU.2-57*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	16.4	0.50
VCXU.2-65*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	16.4	0.50
VCXU.2-123*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VCXU.2-127*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.4	15.8	0.50
VCXU.2-201*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.6	15.8	0.50
VCXU.2-241*	0.06	0.06	0.06	0.06	17.63 ± 0.070	0.6	15.8	0.50

typical accuracy by assumption of the root mean square value

* C or M

** Dimension D in this table is from manufacturer datasheet

*** For color add 0.35 mm to nominal value

6.4.2 Filter glass (color cameras)

Filter glass of color cameras
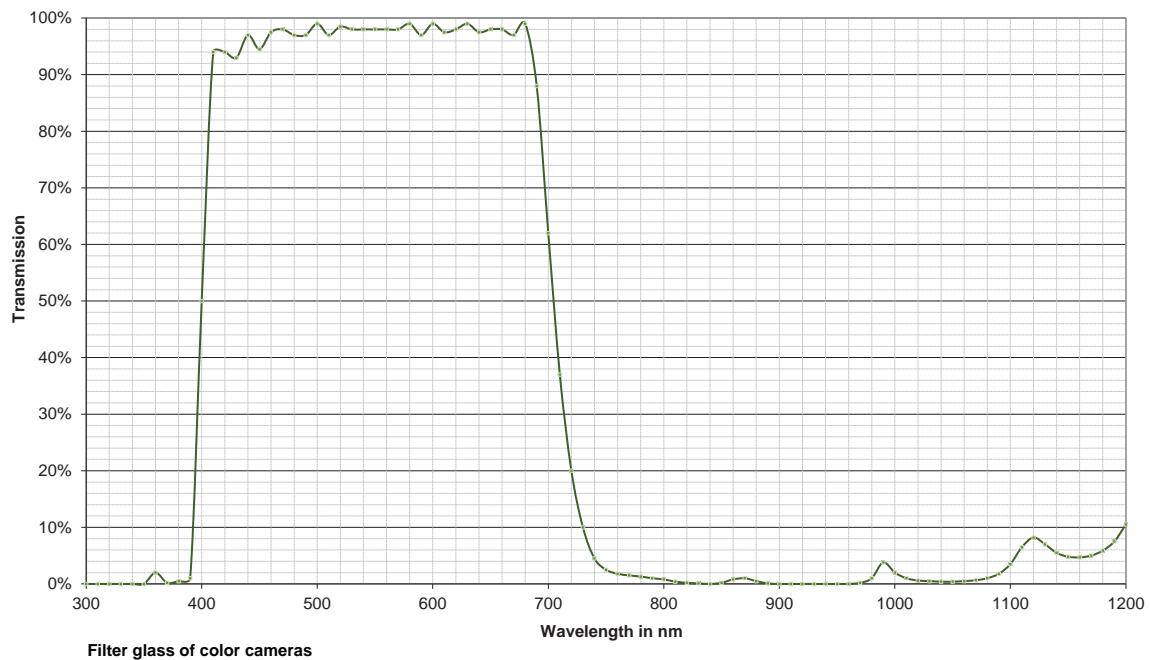
6.4.3 Spectral sensitivity

The following diagrams show the spectral sensitivity characteristics for this camera series. The characteristic curves for the sensors do not take the characteristics of lenses and light sources without filters into consideration.

The values refer to the related data sheets.

Cameras
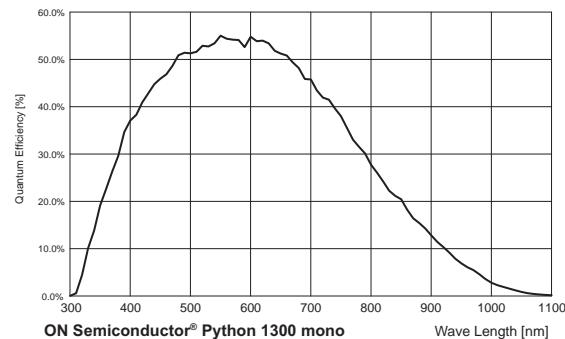
Spectral sensitivity VCXU.2-13M
(PYTHON1300)
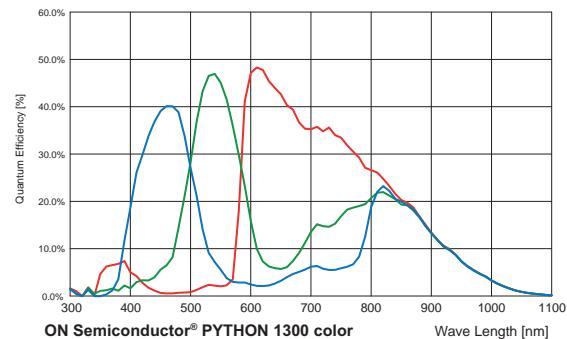
Spectral sensitivity VCXU.2-13C
(PYTHON1300)
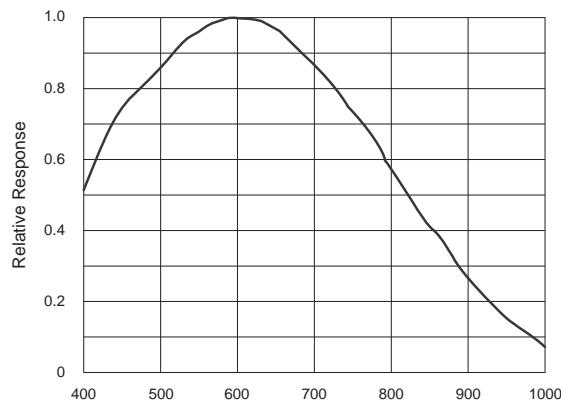
Spectral sensitivity VCXU.2-15M
(Sony® IMX273)
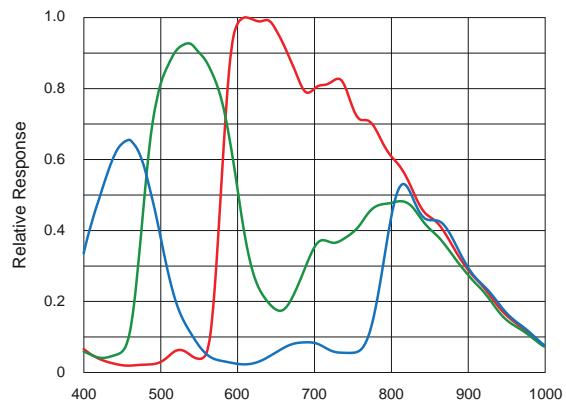
Spectral sensitivity VCXU.2-15C
(Sony® IMX273)
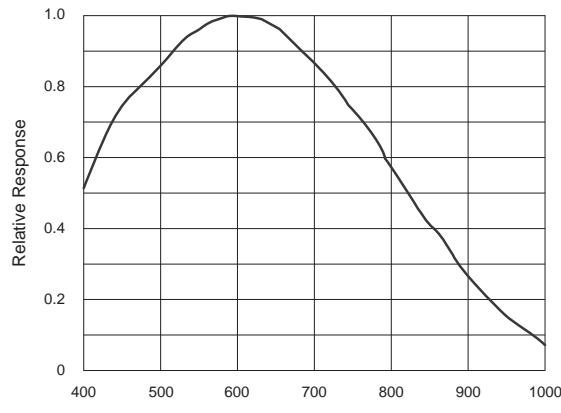
Spectral sensitivity VCXU.2-31M
(Sony® IMX252)
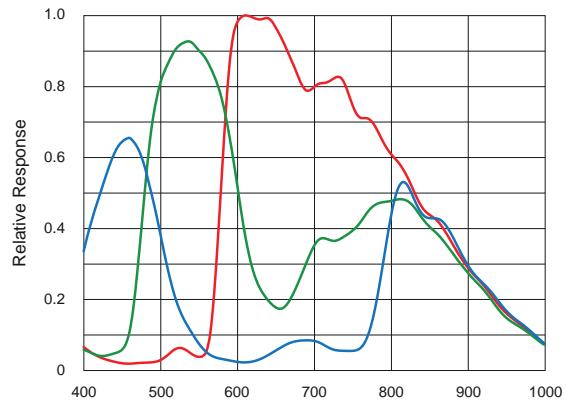
Spectral sensitivity VCXU.2-31C
(Sony® IMX252)
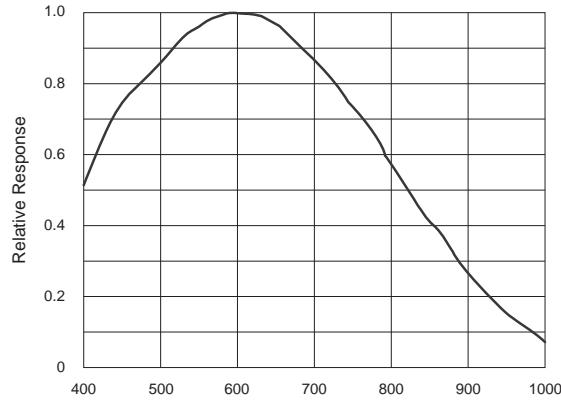
Spectral sensitivity VCXU.2-32M
(Sony® IMX265)
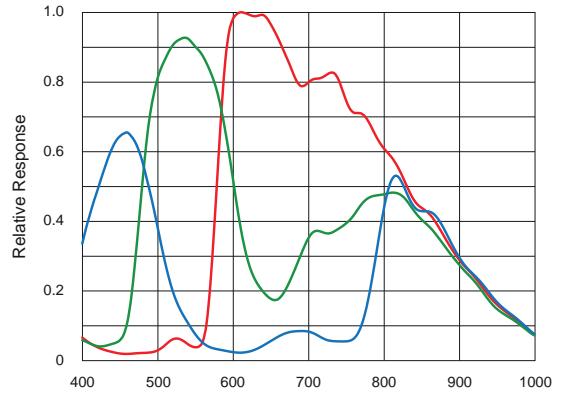
Spectral sensitivity VCXU.2-32C
(Sony® IMX265)
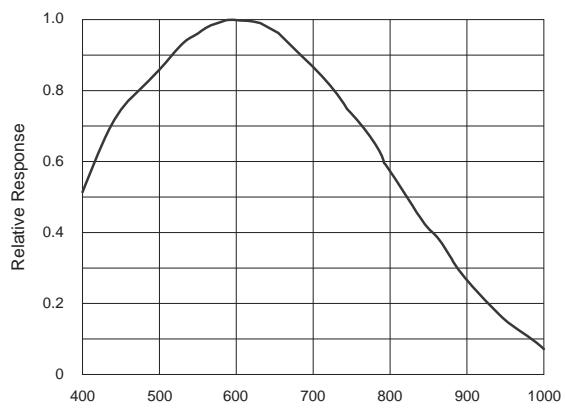
Sony® IMX 250 mono

Spectral sensitivity VCXU.2-50M
(Sony® IMX250)
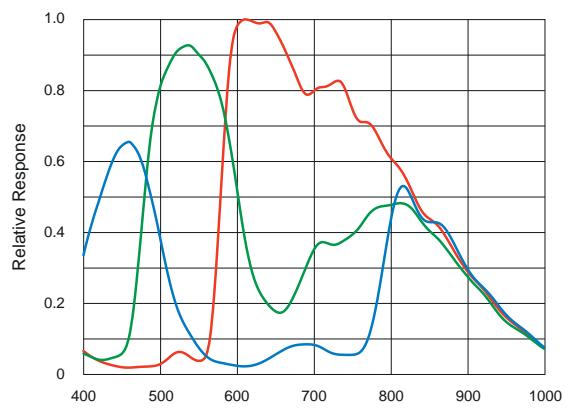
Sony® IMX 250 color

Spectral sensitivity VCXU.2-50C
(Sony® IMX250)
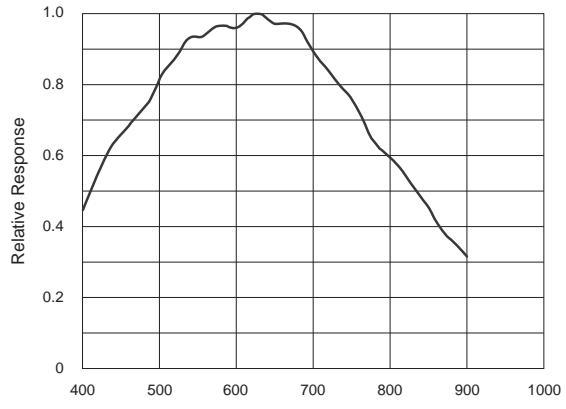
Sony® IMX 250MZR-C

Spectral sensitivity VCXU.2-50MP
(Sony® IMX250MZR-C)
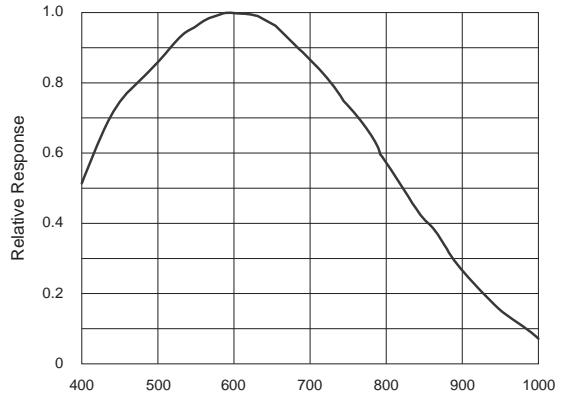
Sony® IMX 264 mono

Spectral sensitivity VCXU.2-51M
(Sony® IMX264)
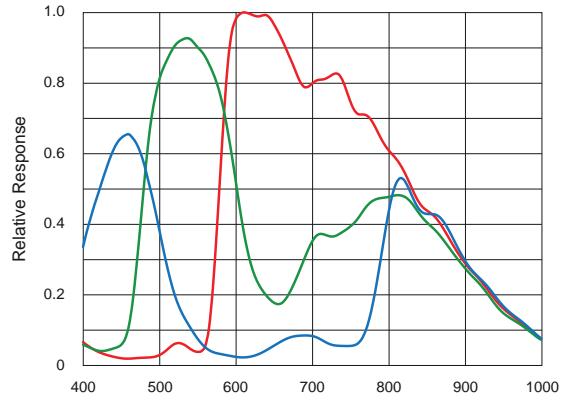
Sony® IMX 264 color

Spectral sensitivity VCXU.2-51C
(Sony® IMX264)

Sony® IMX 548 mono Wave Length [nm]
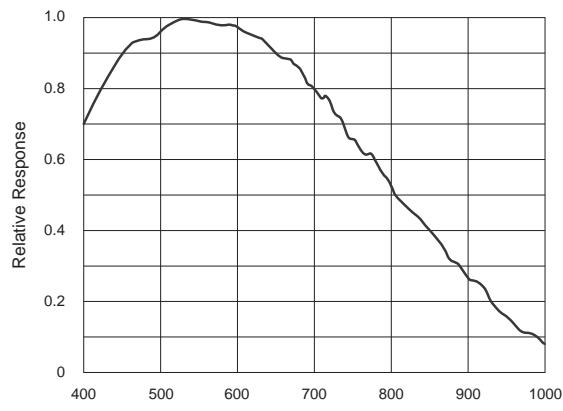
Spectral sensitivity VCXU.2-57M
(Sony® IMX548)

Sony® IMX 548 color Wave Length [nm]
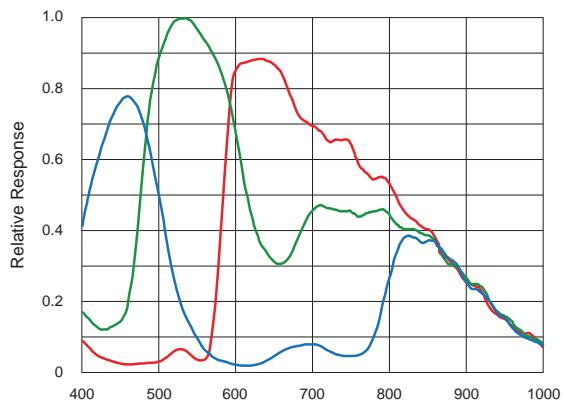
Spectral sensitivity VCXU.2-57C
(Sony® IMX548)

Sony® IMX 178 mono Wave Length [nm]
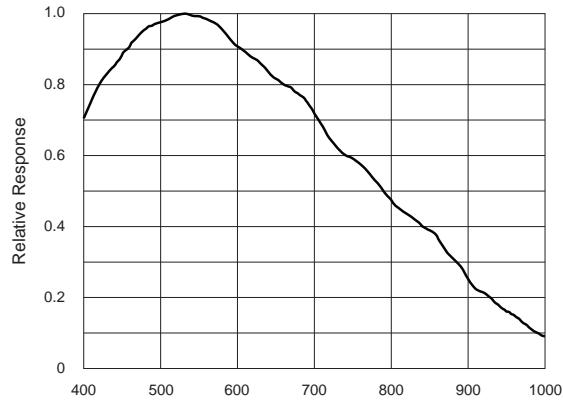
Spectral sensitivity VCXU.2-65M.R
(Sony® IMX178)

Sony® IMX 178 color Wave Length [nm]
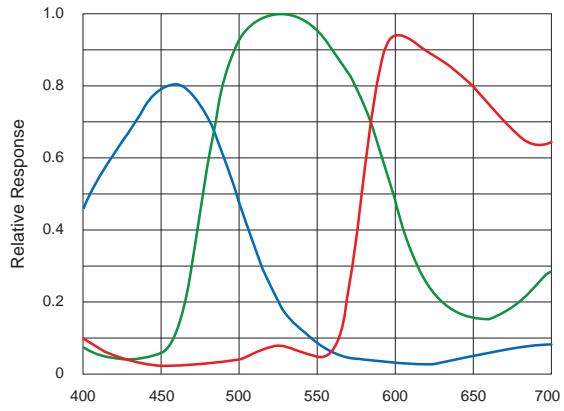
Spectral sensitivity VCXU.2-65C.R
(Sony® IMX178)

Sony® IMX 253 mono Wave Length [nm]
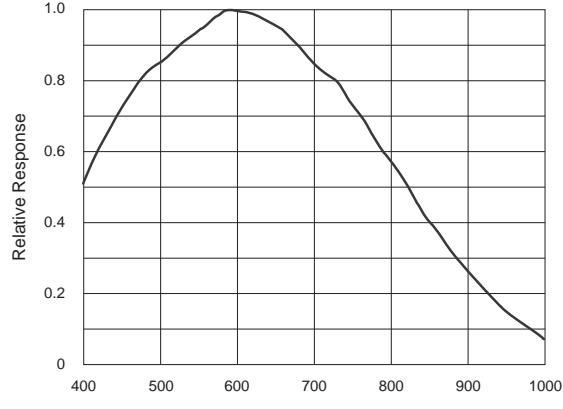
Spectral sensitivity VCXU.2-123M
(Sony® IMX253)

Sony® IMX 253 color Wave Length [nm]
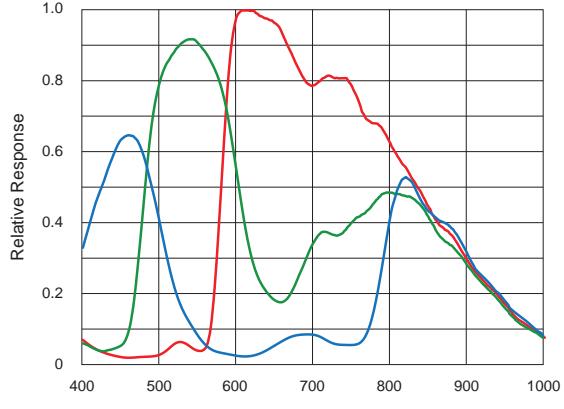
Spectral sensitivity VCXU.2-123C
(Sony® IMX253)
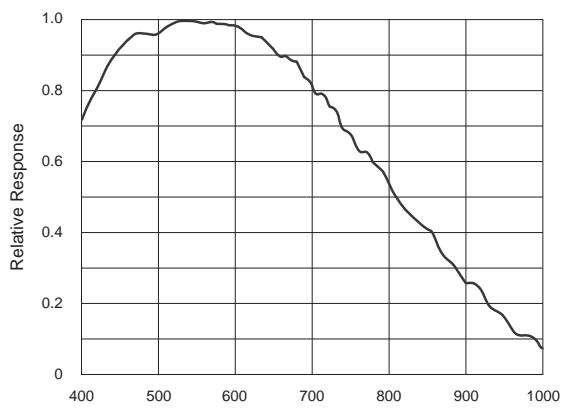
Spectral sensitivity VCXU.2-127M
(Sony® IMX545)
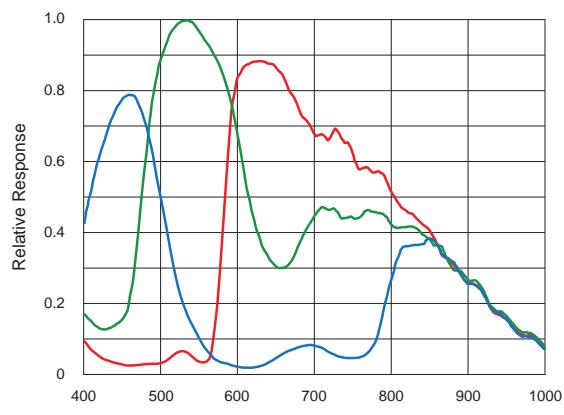
Spectral sensitivity VCXU.2-127C
(Sony® IMX545)
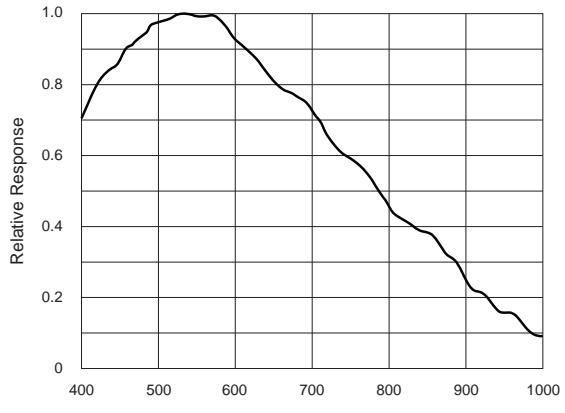
Spectral sensitivity VCXU.2-201M.R
(Sony® IMX183)
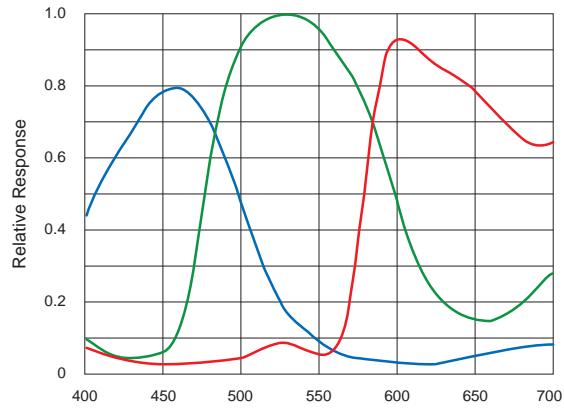
Spectral sensitivity VCXU.2-201C.R
(Sony® IMX183)
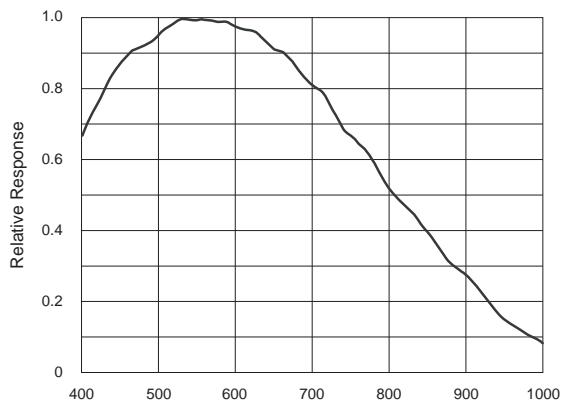
Spectral sensitivity VCXU.2-241M
(Sony® IMX540)
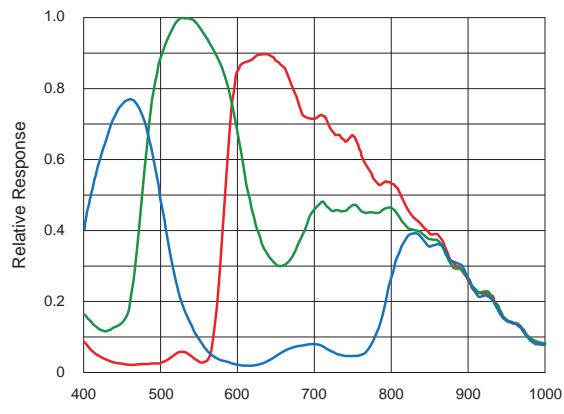
Spectral sensitivity VCXU.2-241C
(Sony® IMX540)

7   Electrical installation

7.1   General instructions for electric installation

> **NOTICE**
>
> **Device damage due to faulty power supply.**
>
> The device can be damaged due to faulty power supply.
>
> a) Operate the device only with protected low voltage and safe electrical isolation of protection class III.

> **NOTICE**
>
> **Device damage or unintended operation due to work on live parts.**
>
> Any wiring work on live parts may lead to unintentional operation.
>
> a) Prior to performing any wiring work disconnect power supply.
>
> b) Only connect or disconnect any terminals when not live.

7.2   VCXG.2

7.2.1   Pin assignment

Power supply / Digital IO

1	GPIO (Line2)	2	Power V_{CC} (12 … 24 VDC ± 20%)
3	IN1 (Line0)	4	GND IN1
5	Power V_{CC} (OUT1)	6	OUT1 (Line3)
7	GND (Power, GPIO)	8	GPIO (Line1)

Cable core colors (cable not included in delivery)

1	WH – White	2	BN – Brown
3	GN – Green	4	YE – Yellow
5	GY – Grey	6	PK – Pink
7	BU – Blue	8	RD – Red

Ethernet interface

1	MX1+	2	MX1-
3	MX2+	4	MX3+
5	MX3-	6	MX2-
7	MX4+	8	MX4-

> **NOTICE**
>
> **Power supply via PoE and digital IO connection**
>
> The camera supports power supply via PoE (Power over Ethernet) IEEE 802.3af Clause 33, 48V.
>
> Parallel power supply via Ethernet interface and digital IO port is subject to deviations and tolerances. These might damage the camera.
>
> a) Only use a single form of power supply!

NOTICE

Damage caused by incorrect tightening torque

Tighten connector for power supply / digital IO at a torque of 0.2 Nm. Appropriate tools are available from Baumer.

NOTICE

Ethernet interface damage by inappropriate connectors

The camera features TYPE090 Ethernet interface. Using any other connector than TYPE090 could damage the connection.

a) Only use cables with TYPE090 connector.

Ground connection (1)

	TYPE090	TYPE110 (Do not use!)
A1	9.0 mm (-0.50 + 0.00)	11.0 mm (-0.47 + 0.00)
B1	4.25 mm (-1.00 + 0.25)	4.25 mm (-1.00 + 0.25)

Ground female connector (2)

	TYPE090
A2	9.0 mm (-0.00 + 1.00)
B2	4.5 mm (-0.00 + 1)

7.2.2   **Digital IO**
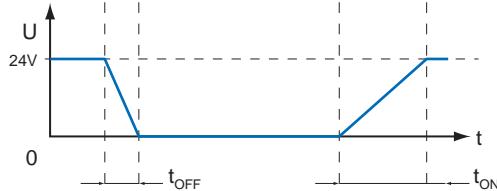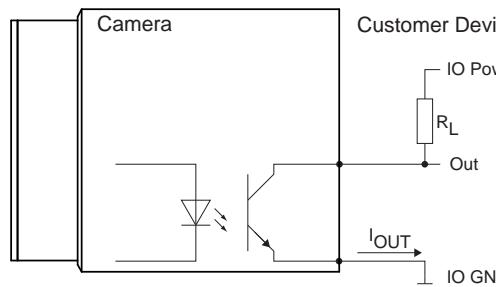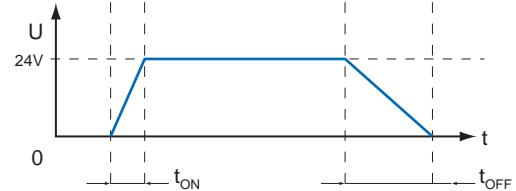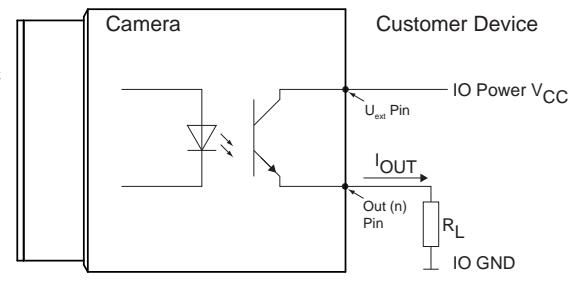
Digital Output: *Low Active*   Digital Output: *High Active*
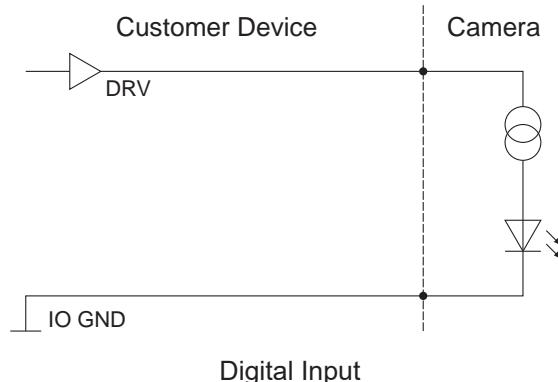
Digital Input

7.2.3   **GPIO (General Purpose Input / Output)**

Line1 and *Line2* are GPIOs and can be both *Input* and *Output*.

Input: (0 ... .0.8 V low, 2.0 ... 30 V high).

Output:(0 ... .0.4 V low, 2.4 ... 3.3 V high), @ 1 mA load (high) / 50 mA sink (low)

NOTICE

Overvoltage, undervoltage or inverted polarity can result in defect!
General Purpose IOs (GPIOs) are not potential-free and do not feature overvoltage power off.
Incorrect wiring, overvoltage, undervoltage or reverse polarity can damage the electronics.
GPIO power supply VCC: 3.3 V DC
Load resistance for TTL high level: approx. 2.7 kΩ

GPIO configuration is by default an in the camera as *Input*. They have to assigned to
GPIO_GND if not used or configured as *Output*. Configuration as *Output* by default (saved in
User Set) is feasible.

7.3   VCXG.2.XC

7.3.1   Pin assignment

Power supply / Digital IO

1	GPIO (Line2)	2	Power V_{CC} (12 … 24 VDC ± 20%)
3	IN1 (Line0)	4	GND IN1
5	Power V_{CC} (OUT1)	6	OUT1 (Line3)
7	GND (Power, GPIO)	8	GPIO (Line1)

Cable core colors (cable not included in delivery)

1	WH – White	2	BN – Brown
3	GN – Green	4	YE – Yellow
5	GY – Grey	6	PK – Pink
7	BU – Blue	8	RD – Red

Ethernet interface

1	MX1+	2	MX1-
3	MX2+	4	MX3+
5	MX3-	6	MX2-
7	MX4+	8	MX4-

NOTICE

Power supply via PoE and digital IO connection

The camera supports power supply via PoE (Power over Ethernet) IEEE 802.3af Clause 33, 48V.

Parallel power supply via Ethernet interface and digital IO port is subject to deviations and tolerances. These might damage the camera.

a) Only use a single form of power supply!

NOTICE

Damage caused by incorrect tightening torque

Tighten connector for power supply / digital IO at a torque of 0.2 Nm. Appropriate tools are available from Baumer.

NOTICE

Ethernet interface damage by inappropriate connectors

The camera features TYPE090 Ethernet interface. Using any other connector than TYPE090 could damage the connection.

a) Only use cables with TYPE090 connector.

Ground connection (1)

	TYPE090	TYPE110 (Do not use!)
A1	9.0 mm (-0.50 + 0.00)	11.0 mm (-0.47 + 0.00)
B1	4.25 mm (-1.00 + 0.25)	4.25 mm (-1.00 + 0.25)

Ground female connector (2)

	TYPE090
A2	9.0 mm (-0.00 + 1.00)
B2	4.5 mm (-0.00 + 1)

7.3.2   **Digital IO**

Digital Output: *Low Active*   Digital Output: *High Active*
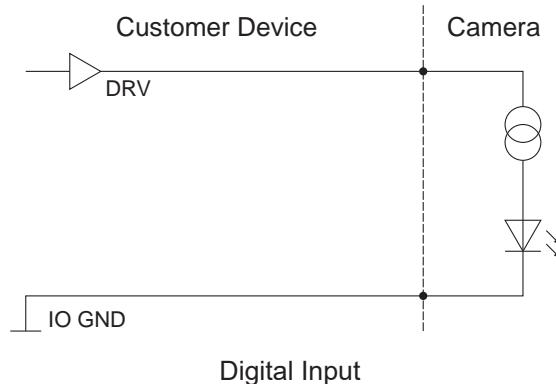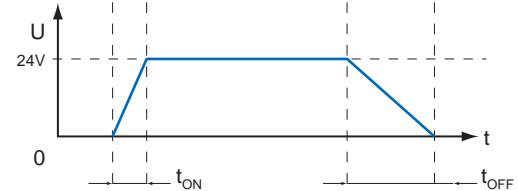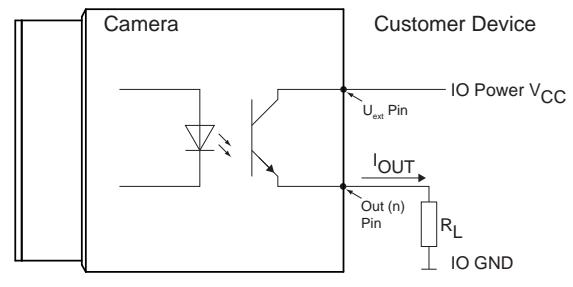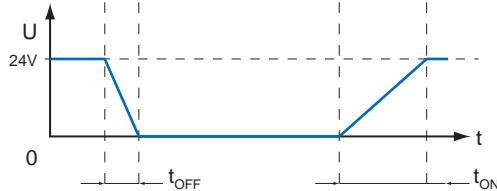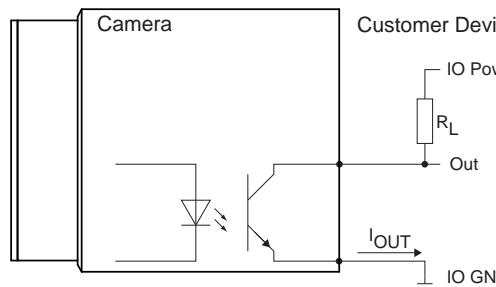
Digital Input

7.3.3   GPIO (General Purpose Input / Output)

Line1 and *Line2* are GPIOs and can be both *Input* and *Output*.

Input: (0 ... .0.8 V low, 2.0 ... 30 V high).

Output:(0 ... .0.4 V low, 2.4 ... 3.3 V high), @ 1 mA load (high) / 50 mA sink (low)

> **NOTICE**
>
> **Overvoltage, undervoltage or inverted polarity can result in defect!**
> *General Purpose IOs (GPIOs)* are not potential-free and do not feature overvoltage power off.
> Incorrect wiring, overvoltage, undervoltage or reverse polarity can damage the electronics.
> GPIO power supply VCC: 3.3 V DC
> Load resistance for TTL high level: approx. 2.7 kΩ
>
> GPIO configuration is by default an in the camera as *Input*. They have to assigned to
> GPIO_GND if not used or configured as *Output*. Configuration as *Output* by default (saved in
> *User Set*) is feasible.

7.4 VCXG.2.I

7.4.1 Pin assignment

Stromversorgung / Digital-IO
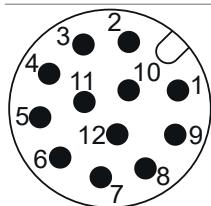
1	Power V_{CC} (12 … 24 VDC ± 20%)		2	GND (Power)
3	IN1 (Line0)		4	OUT1 (Line4)
5	IN2 (Line1)		6	OUT2 (Line5)
7	OUT3 (Line6)		8	IN3 (Line2)
9	OUT4 (Line7)		10	IN4 (Line3)
11	GND (IO)		12	Power (IO)

Cable core colors (cable not included in delivery)

1	BN – Brown	2	BU – Blue
3	WH – White	4	GN – Green
5	PK – Pink	6	YE – Yellow
7	BK – Black	8	GY – Grey
9	RD – Red	10	VT – Violet
11	GY-PK – Grey Pink	12	RD-BU – Red Blue

Ethernet interface
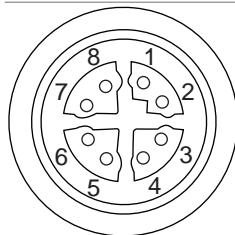
1	MX1+	2	MX1-
3	MX2+	4	MX2-
5	MX4+	6	MX4-
7	MX3-	8	MX3+-

NOTICE

Power supply via PoE and digital IO connection

The camera supports power supply via PoE (Power over Ethernet) IEEE 802.3af Clause 33, 48V.

Parallel power supply via Ethernet interface and digital IO port is subject to deviations and tolerances. These might damage the camera.

a) Only use a single form of power supply!

7.4.2 Digital-IO
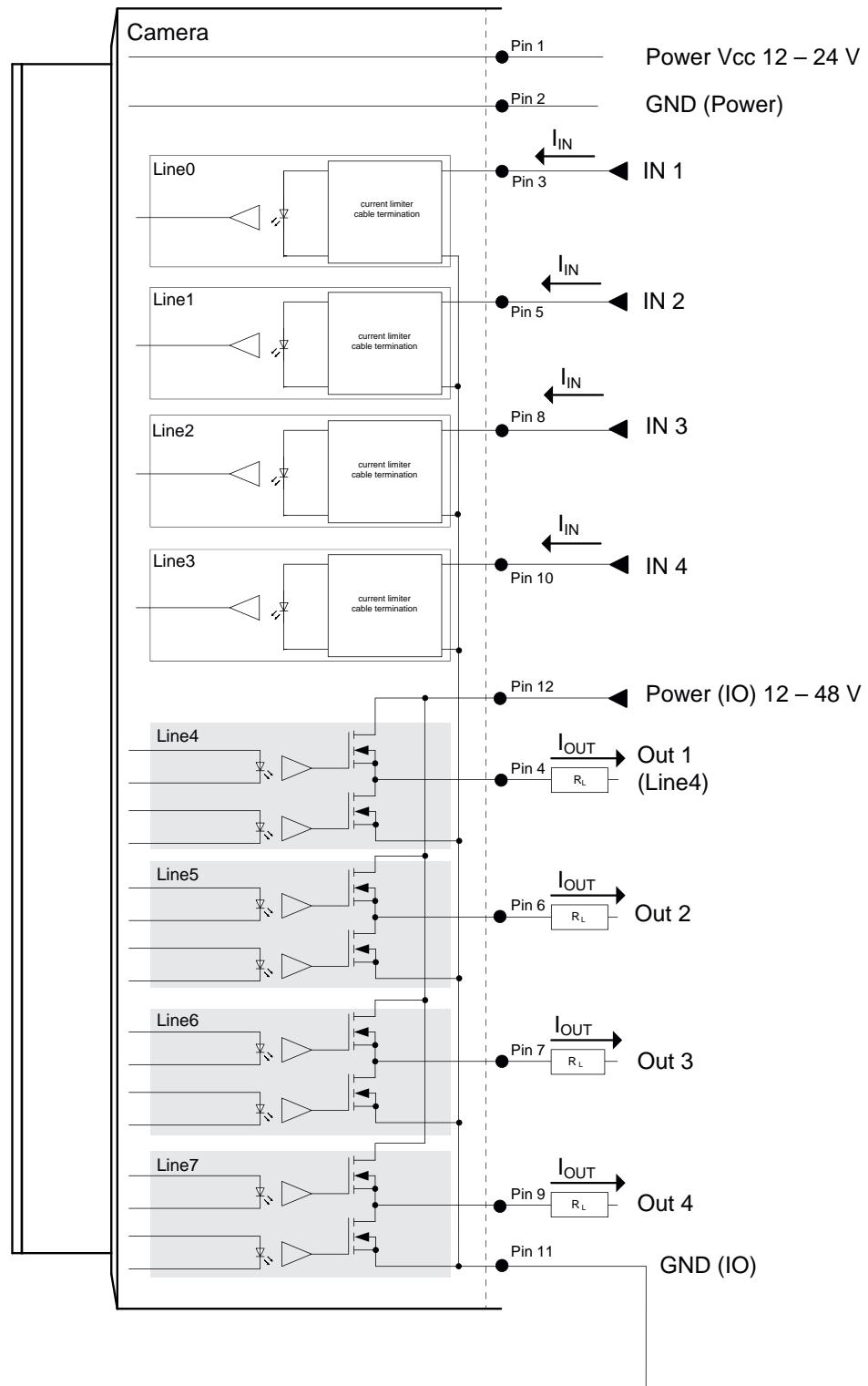
7.5   VCXU.2

7.5.1   Pin assignment

Digital IO
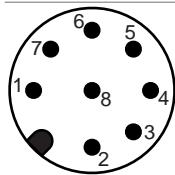
1	GPIO (Line2)	2	not connected
3	IN1 (Line0)	4	GND IN1
5	Power V_{CC} (OUT1)	6	OUT1 (Line3)
7	GND (Power, GPIO)	8	GPIO (Line1)

Cable core colors (cable not included in delivery)

1	WH – White	2	BN – Brown
3	GN – Green	4	YE – Yellow
5	GY – Grey	6	PK – Pink
7	BU – Blue	8	RD – Red

USB 3.0 interface (Micro B)

1	VBUS	2	D-
3	D+	4	ID
5	GND	6	MicB_SSTX-
7	MicB_SSTX+	8	GND_DRAIN
9	MicB_SSRX-	10	MicB_SSRX+

7.5.2   **Digital IO**

Digital Output: *Low Active*

Digital Output: *High Active*

Digital Input

7.5.3   GPIO (General Purpose Input / Output)

Line1 and *Line2* are GPIOs and can be both *Input* and *Output*.

Input: (0 ... .0.8 V low, 2.0 ... 30 V high).

Output:(0 ... .0.4 V low, 2.4 ... 3.3 V high), @ 1 mA load (high) / 50 mA sink (low)

NOTICE

Overvoltage, undervoltage or inverted polarity can result in defect!
General Purpose IOs (GPIOs) are not potential-free and do not feature overvoltage power off.
Incorrect wiring, overvoltage, undervoltage or reverse polarity can damage the electronics.
GPIO power supply VCC: 3.3 V DC
Load resistance for TTL high level: approx. 2.7 kΩ

GPIO configuration is by default an in the camera as *Input*. They have to assigned to GPIO_GND if not used or configured as *Output*. Configuration as *Output* by default (saved in *User Set*) is feasible.

Input

Output

GPIO
Pin 1 / 8

High:
2.0 V .. 30 V

Low:
0 V .. 0.8 V

GND GPIO
Pin 7

GPIO
Pin 1 / 8

High:
2.4 .. 3.3 V

I sink max.
= 50 mA

Low:
0 V .. 0.4 V

GND GPIO
Pin 7

8   Maintenance

The sensor is maintenance-free. No special preventive maintenance is required. Regular cleaning and visual inspection of the plug connections are recommended.

8.1   Cleaning

Due to its compact design, the device is characterized by almost maintenance-free operation. When used for the intended purpose, it is possible that the device may need to be cleaned from time to time. Very clean optical surfaces (cover glass) are required for the consistent and reproducible operation of the device.

The device requires cleaning if the captured frames resemble the following example. In order to test the camera, capture a homogenous image (test target could be a white sheet of paper).

Filter / Cover glass sensor

NOTICE
Cleaning with compressed air
Compressed air may force dust into the camera.
Never use compressed air to clean the filter / cover glass!
Use a soft, lint free cloth dampened with a small amount of pure methanol for cleaning.

Housing

NOTICE
Cleaning with volatile solvents
Volatile solvents can damage the surface of the camera.
Never use volatile solvents (benzene, thinner) for cleaning!
Use a soft, dry cloth to clean the surface of the camera housing. To remove persistent stains, use a soft cloth dampened with a small quantity of neutral detergent. Then wipe dry

Tube cover glass

For cleaning, use a soft, lint-free cloth to clean the surface of the tube cover glass with a gentle pressure, without scratching.

To clean stubborn dirt, commonly available window cleaning agent is recommended.

- Ensure that no residues of the cleaning agent or scratches remain on the glass. These can permanently damage the reproducibility of the results from the device.
- As so many cleaning agents are available, we hope you understand that we cannot test every single one. Resistance to cleaning agents and areas of use depends upon the specific application.
- Cleaning agents must be tested on an discreet area of the device under application conditions to evaluate if they are suitable.

9 Troubleshooting

9.1 Support

In case of any questions please contact our Technical & Application Support Center.

Worldwide

Baumer Optronic GmbH

Badstrasse 30

DE - 01454 Radeberg

www.baumer.com

Tel.: +49 (0)3528 4386 845

support.cameras@baumer.com

9.2 Accessories

You can find accessories at the website at:

https://www.baumer.com

10　Software

10.1　Baumer GAPI

Baumer GAPI stands for Baumer **G**eneric **A**pplication **P**rogramming **I**nterface. With this API Baumer offers an interface for fast and easy integration of Baumer industrial cameras in C++, C and C# (Windows only®). The software interface allows for switchover to other camera models.

The API supports Windows®, Linux® and ARM®-based platforms.

For more information, please visit: https://www.baumer.com/vision/software

10.2　Baumer neoAPI

The neoAPI is a high-performant and user-friendly API for camera integration. Using few code lines only, it enables fast integration of Baumer cameras into C++, C# and Python™.

The API supports Windows®, Linux® and ARM®-based platforms.

For more information, please visit: https://www.baumer.com/neoAPI

10.3　Baumer Camera Explorer

Easy-to-use Baumer *Camera Explorer* allows for camera evaluation and configuration within the least amount of time. It helps get to know and try the diversified functions of the Baumer cameras for configuration to the application.

Baumer *Camera Explorer* supports Windows®, Linux® and ARM®-based platforms.

For more information, please visit: https://www.baumer.com/camera-explorer

10.4　3rd Party Software

Strictly adhering to the GenICam™ standard, Baumer is in a position to offer the 3rd party software for use with this camera series.

A current listing of 3rd party software that has been successfully tested with Baumer cameras is accessible at: https://www.baumer.com/c/14180.

11   GenICam Camera Features

A GenICam™-compliant XML-description file presents the camera's Features. The following chapter describes all included and accessible functions. Most of the camera's functions are standardized in *GenICam™ SFNC* and must use the name defined in there. Particular Features, which cannot be assigned to an existing *GenICam™ SFNC* name come as vendor-specific in the "Custom" namespace.

The Features are clustered in categories according to their function. The software uses them to present the functions more clearly.

You can see your camera's Features functionalities in *Feature Tree* (1) of the *Camera Explorer*. Please refer to the appropriate documentation.
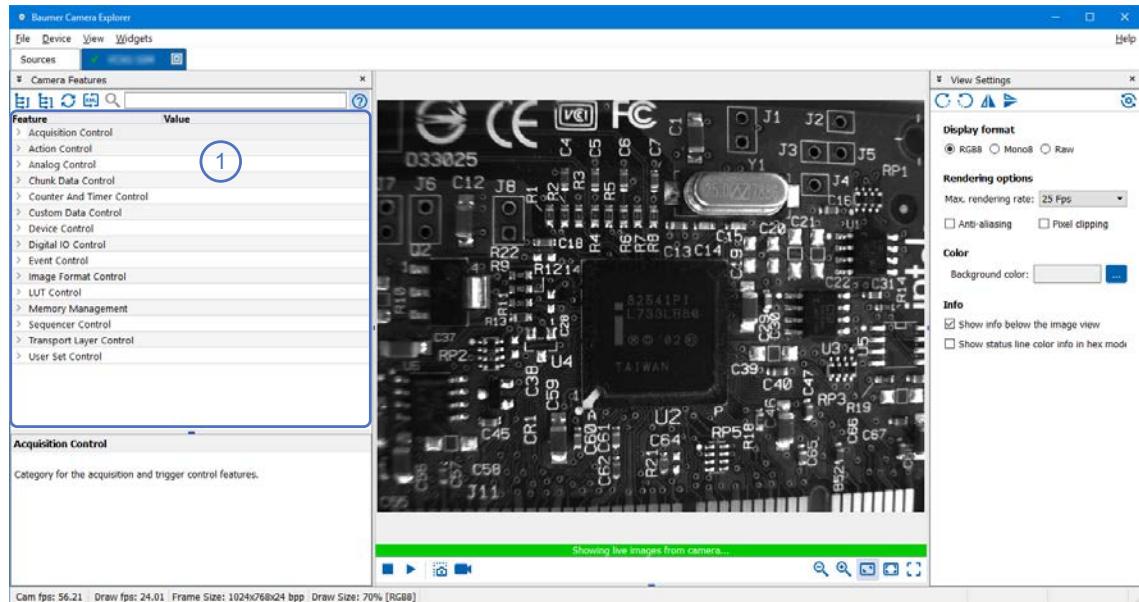
11.1   Category: AcquisitionControl

This chapter describes all features related to image acquisition, including the trigger and exposure control.

11.1.1   AcquisitionAbort

The abort of the image acquisition is a special case, where the ongoing acquisition is stopped. If an exposure is running, the exposure is aborted immediately and the image is not read out.

Name	AcquisitionAbort
Category	AcquisitionControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.1.2   **AcquisitionFrameCount**

Number of frames to acquire in MultiFrame Acquisition mode.

Name	AcquisitionFrameCount
Category	AcquisitionControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	1 - 65535 (Increment: 1)

11.1.3   **AcquisitionFrameRate**

Controls the acquisition rate (in Hertz) at which the frames are captured.

Name	AcquisitionFrameRate
Category	AcquisitionControl
Interface	IFloat
Access	Read / Write
Unit	Hz
Values	depends on camera

11.1.4   **AcquisitionFrameRateEnable**

Enables the acquisition at the framerate specified by AcquisitionFrameRate.

Name	AcquisitionFrameRateEnable
Category	AcquisitionControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.1.5   AcquisitionMode

Sets the acquisition mode of the device. It defines mainly the number of frames to capture during an acquisition and the way the acquisition stops.

INFO

The camera must be stopped before this feature can be edited.

Name	AcquisitionMode	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	Without external events, image acquisition continues until stop by command *AcquisitionStop*.
	MultiFrame	In this mode a predefined number of frames will be captured after *AcquisitionStart*. The *AcquisitionFrameCount* controls the number of captured frames. Next acquisition stops automatically.
	Single-Frame	In this mode the camera will acquire another image after *AcquisitionStart*. Next acquisition stops.

11.1.6   AcquisitionStart

Once image acquisition has started, the camera processes the images in three steps:

1.   Determining the current set of image parameters

2.   Sensor exposure

3.   Readout from the sensor

This process is then repeated until the camera is stopped.

Name	AcquisitionStart
Category	AcquisitionControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.1.7   AcquisitionStatus

Reads the state of the internal acquisition signal selected using AcquisitionStatusSelector.

Name	AcquisitionStatus
Category	AcquisitionControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.1.8   AcquisitionStatusSelector

Selects the internal acquisition signal to be read by *AcquisitionStatus*.

Name	AcquisitionStatusSelector	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Acquisition Active	Device is currently doing an acquisition of one or many frames.
	Acquisition Trigger Wait	Camera awaits *Trigger* to acquire a single or several images.

11.1.9   AcquisitionStop

Stops the acquisition of the device at the end of the current frame.

Name	AcquisitionStop
Category	AcquisitionControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.1.10   ExposureAuto

Sets exposure mode to automatic if *ExposureMode = Timed*. The exact algorithm used for implementation is device-specific.

Name	ExposureAuto	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	The camera is continuously adapting the exposure time for maximized dynamic range.
	Off	Exposure duration is user controlled using ExposureTime.
	Once	Exposure time is adapted once. Once it has converged, it returns to the Off state.

11.1.11   ExposureMode

Sets the operation mode of the Exposure.

Name	ExposureMode	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Timed	Time-controlled exposure. The exposure duration time is set using the *ExposureTime* or *ExposureAuto* features and the exposure starts with the *FrameStart* or *LineStart*.

11.1.12   ExposureTime

On exposure of the sensor, the inclination of photons produces a charge separation on the semiconductors of the pixels. This results in a voltage difference, which is used for signal extraction.
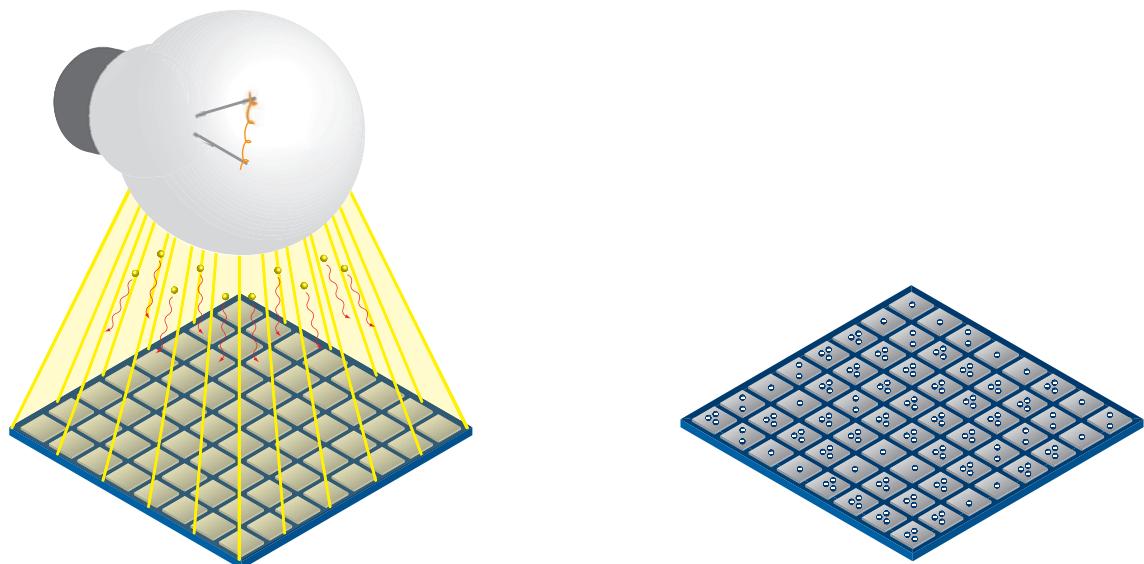
The signal strength is influenced by the incoming amount of photons. It can be increased by increasing the exposure time (texposure).

Name	ExposureTime
Category	AcquisitionControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	see table(s) below

💡 **INFO**

Only for cameras with Rolling Shutter sensors!

ExposureTime is modified by sensor reconfiguration.

If the modification occurs during a sensor readout, the update will be delayed until the end of the current readout.

INFO

Sequencer will not be accessible if function *ShortExposureTimeEnable* is enabled.

VCXG.2

	Texposure min [µsec][1]	Tnon-selectable range[2] [µsec]	Texposure min [µsec] (Default)	Texposure max [sec]
Monochrom				
VCXG.2-13M	-	-	20	1
VCXG.2-15M	1	-	15	60
VCXG.2-25M	-	-	20	1
VCXG.2-32M	1	-	15	60
VCXG.2-51M	1	-	15	60
VCXG.2-51MP	1	-	15	60
VCXG.2-57M	1	4-19	20	60
VCXG.2-65M.R	-	-	16* / 34**	16.3* / 60**
VCXG.2-82M	1	4 - 22	23	60
VCXG.2-124M	1	-	15	60
VCXG.2-127M	1	4 - 14	31	60
VCXG.2-201M.R	-	-	29* / 58**	60* / 60**
VCXG.2-204M	1	4 - 33	34	60
VCXG.2-241M	1	4 - 38	39	60
Color				
VCXG.2-13C	-	-	20	1
VCXG.2-15C	1	-	15	60
VCXG.2-25C	-	-	20	1
VCXG.2-32C	1	-	15	60
VCXG.2-51C	1	-	15	60
VCXG.2-57C	1	4-19	20	60
VCXG.2-65C.R	-	-	16* / 34**	16.3* / 60**
VCXG.2-82C	1	4 - 22	23	60
VCXG.2-124C	1	-	15	60
VCXG.2-127C	1	4 - 30	31	60
VCXG.2-201C.R	-	-	29* / 58**	60* / 60**
VCXG.2-204C	1	4 - 33	34	60
VCXG.2-241C	1	4 - 38	39	60

[1] only if *ShortExposureTimeEnable* is enabled

[2] Range (*ExposureTimeGapMin – ExposureTimeGapMax*) only relevant if *ShortExposure-TimeEnable* is enabled

*) Shutter Mode: *Global Reset*

**)Shutter Mode: *Rolling Shutter (Default)*

VCXG.2.XC

	Texposure min [μsec][1]	Tnon-selectable range[2] [μsec]	Texposure min [μsec] (Default)	Texposure max [sec]
Monochrom				
VCXG.2-51M.XC	1	-	15	60
VCXG.2-241M.XC	1	4 - 38	39	60

[1] only if *ShortExposureTimeEnable* is enabled

[2] Range (*ExposureTimeGapMin – ExposureTimeGapMax*) only relevant if *ShortExposureTimeEnable* is enabled

VCXG.2.I

	Texposure min [μsec][1]	Tnon-selectable range[2] [μsec]	Texposure min [μsec] (Default)	Texposure max [sec]
Monochrom				
VCXG.2-15M.I	1	-	15	60
VCXG.2-32M.I	1	-	15	60
VCXG.2-51M.I	1	-	15	60
VCXG.2-57M.I	1	4-19	20	60
VCXG.2-82M.I	1	4 - 22	23	60
VCXG.2-127M.I	1	4 - 30	31	60
VCXG.2-201M.R.I	-	-	29* / 58**	60* / 60**
VCXG.2-241M.I	1	4 - 38	39	60
Color				
VCXG.2-15C.I	1	-	15	60
VCXG.2-32C.I	1	-	15	60
VCXG.2-51C.I	1	-	15	60
VCXG.2-57C.I	1	4-19	20	60
VCXG.2-82C.I	1	4 - 22	23	60
VCXG.2-127C.I	1	4 - 30	31	60
VCXG.2-201C.R.I	-	-	29* / 58**	60* / 60**
VCXG.2-241C.I	1	4 - 38	39	60

[1] only if *ShortExposureTimeEnable* is enabled

[2] Range (*ExposureTimeGapMin – ExposureTimeGapMax*) only relevant if *ShortExposureTimeEnable* is enabled

*) Shutter Mode: *Global Reset*

**)Shutter Mode: *Rolling Shutter (Default)*

VCXU.2

	Texposure min [µsec]¹⁾	Tnon-selectable range²⁾ [µsec]	Texposure min [µsec] (Default)	Texposure max [sec]
Monochrom				
VCXU.2-13.M	-	-	20	1
VCXU.2-15.M	1	-	15	60
VCXU.2-31.M	1	-	15	60
VCXU.2-32.M	1	-	15	60
VCXU.2-50.M	1	-	15	60
VCXU.2-50.MP	1	-	15	60
VCXU.2-51.M	1	-	15	60
VCXU.2-57.M	1	4 - 9	10	60
VCXU.2-65.M.R	-	-	10* / 22**	10.16* / 60**
VCXU.2-123.M	1	-	15	60
VCXU.2-127.M	1	4 – 14	15	60
VCXU.2-201.M.R	-	-	29* / 29**	60* / 60**
VCXU.2-241.M	1	4 - 16	17	60
Color				
VCXU.2-13.C	-	-	20	1
VCXU.2-15.C	1	-	15	60
VCXU.2-31.C	1	-	15	60
VCXU.2-32.C	1	-	15	60
VCXU.2-50.C	1	-	15	60
VCXU.2-51.C	1	-	15	60
VCXU.2-57.C	1	4 - 9	10	60
VCXU.2-65.C.R	-	-	10* / 22**	10.16* / 60**
VCXU.2-123.C	1	-	15	60
VCXU.2-127.C	1	4 - 14	15	60
VCXU.2-201.C.R	-	-	29* / 29**	60* / 60**
VCXU.2-241.C	1	4 - 16	17	60

¹⁾ only if *ShortExposureTimeEnable* is enabled

²⁾ Range (*ExposureTimeGapMin – ExposureTimeGapMax*) only relevant if *ShortExposure-TimeEnable* is enabled

*) Shutter Mode: *Global Reset*

**)Shutter Mode: *Rolling Shutter (Default)*

11.1.13   ExposureTimeGapMax

Returns the maximum value of the exposure time gap.

Name	ExposureTimeGapMax
Category	AcquisitionControl
Interface	IFloat
Access	Read only
Unit	µs
Values	0 - 2,000,000.000000 (Increment: 1.00)

11.1.14   ExposureTimeGapMin

Returns the minimum value of the exposure time gap.

Name	ExposureTimeGapMin
Category	AcquisitionControl
Interface	IFloat
Access	Read only
Unit	µs
Values	0 - 2,000,000.000000 (Increment: 1.00)

11.1.15 ReadoutMode

Specifies the operation mode of the readout for the acquisition.

Image acquisition consists of two separate procedures carried out in succession.

Exposing the pixels on the photosensitive surface of the sensor is only the first part of the image acquisition process. Once this first step is completed, the pixels are read out.

The exposure time (*texposure*) can be adjusted by the user, however, the time needed for the readout (*treadout*) is determined by the particular sensor and image format in use.

Depending on mode and the combination of exposure and reading times, the cameras can operate in *Sequential* or *Overlapped*:

Overlapped	Sequential
In this operation mode, an image is being exposed whilst Frame (n) is being read.	Here, the time intervals are long enough for the exposure and readout to be processed successively.

Name	ReadoutMode	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Overlapped	Overlapped ReadoutMode.
	Sequential	Sequential ReadoutMode.

11.1.16 ShortExposureTimeEnable

Controls if short exposure time should be supported.

INFO

Sequencer will not be accessible if function *ShortExposureTimeEnable* is enabled.

Name	ShortExposureTimeEnable
Category	AcquisitionControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.1.17   TriggerActivation

Specifies the activation mode of the trigger.

Name	TriggerActivation	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	FallingEdge	*Trigger* valid at falling edge of source signal.
	RisingEdge	*Trigger* valid at rising edge of source signal.

11.1.18   TriggerDelay

Specifies the delay in microseconds (μs) to apply after the trigger reception before activating it.

Name	TriggerDelay
Category	AcquisitionControl
Interface	IEnumeration
Access	Read / Write
Unit	μs
Values	0 - 2,000,000.000000 (Increment: 1.00)

11.1.19   TriggerMode

Controls if the selected *Trigger* is active.

Name	TriggerMode	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	Disables selected *Trigger*.
	On	Enables selected *Trigger*.

Rolling Shutter cameras

With cameras featuring Rolling Shutter sensor, *TriggerMode* depends on *SensorShutterMode*.

Trigger Mode = On		Trigger Mode = Off	
ShutterMode	**ReadoutMode**	**ShutterMode**	**ReadoutMode**
GlobalReset	Non-overlapped	GlobalReset	Non-overlapped
Rolling	Non-overlapped	Rolling	Overlapped

11.1.20   TriggerOverlap

Specifies the type trigger overlap permitted with the previous frame.

Name	TriggerOverlap	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Read Out	*Trigger* is adopted immediately after exposure time.

11.1.21   TriggerSelector

Selects the type of trigger to configure.

Name	TriggerSelector	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Frame Start	Selects the type of trigger to configure.

11.1.22   TriggerSoftware

Generates an internal trigger. TriggerSource must be set to Software.

Name	TriggerSoftware
Category	AcquisitionControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.1.23   TriggerSource

Specifies the internal signal or physical input Line to use as the trigger source. The selected trigger must have its *TriggerMode* set to *On*.

Name	TriggerSource
Category	AcquisitionControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

TriggerSource	VCXG.2	VCXG.2.XC	VCXG.2.I	VCXU.2
All	■	■	■	■
Counter1End	■	■	■	■
Counter2End	■	■	■	■
Line0	■	■	■	■
Line1	■	■	■	■
Line2	■	■	■	■
Line3	■	■	■	■
Line4	□	□	■	□
Line5	□	□	■	□
Line6	□	□	■	□
Line7	□	□	■	□
Off	■	■	■	■
Software	■	■	■	■

11.2   Category: ActionControl (GigE only)

Category containing the Action Control functions.

General Information

The basic idea behind this function was realizing simultaneous trigger for multiple cameras.

For doing so, a broadcast Ethernet package was implemented. This package can act as trigger or be used for other actions.

The individual network components provide different latencies and jitter, so Ethernet trigger is not as synchronous as hardware trigger. However, network applications can handle jitter.

Action Command is transmitted as broadcast. Furthermore, several cameras can be grouped together, so that not each connected camera will respond to Action Commands.

Action Commands include the following information:
- *Device Key* - as device-specific authorization for responding to the Action Command
- *Action ID* - as action signal identification
- *Group Key* - for action trigger addressing individual device groups
- *Group Mask* - to extend the range of individual device groups

Example: Triggering multiple cameras

The following illustration shows three cameras with synchronous trigger by software application.
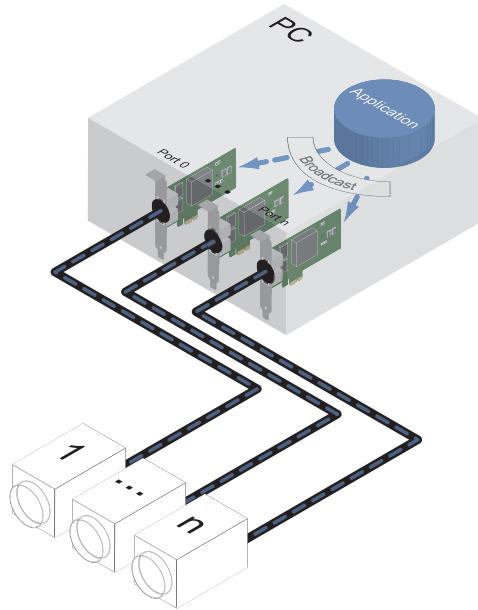
11.2.1   ActionDeviceKey

Provides the device key that allows the device to check the validity of action commands. The device internal assertion of an action signal is only authorized if the ActionDeviceKey and the action device key value in the protocol message are equal.

Name	ActionDeviceKey
Category	ActionControl
Interface	IInteger
Access	Write only
Unit	HexNumber
Values	0 - 4294967295 (Increment: 1)

11.2.2   ActionGroupKey

Provides the key that the device will use to validate the action on reception of the action protocol message.

Name	ActionGroupKey
Category	ActionControl
Interface	IInteger
Access	Read / Write
Unit	HexNumber
Values	0 - 4294967295 (Increment: 1)

11.2.3   ActionGroupMask

Provides the mask that the device will use to validate the action on reception of the action protocol message.

Name	ActionGroupMask
Category	ActionControl
Interface	IInteger
Access	Read / Write
Unit	HexNumber
Values	0 - 4294967295 (Increment: 1)

11.2.4   ActionSelector

Selects to which Action Signal further Action settings apply.

Name	ActionSelector
Category	ActionControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	1 - 1 (Increment: 1)

11.3   Category: AnalogControl

Features in this chapter describes how to influence the analog features of an image, such as Gain, BlackLevel and Gamma.

11.3.1   BalanceWhiteAuto (color cameras only)

Controls the mode for automatic white balancing between the color channels. The white balancing ratios are automatically adjusted.

Name	BalanceWhiteAuto	
Category	AnalogControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	White balancing is constantly adjusted by the device.
	Off	White balancing is off.
	Once	White balancing is automatically adjusted once by the device. Once converged, it automatically returns to the *Off* state. The levelling can take several images.
		When images are acquired in *TriggerMode*, the white balance affects on the next acquired image.

11.3.2 **BlackLevel**

Controls the analog black level as an absolute physical value. This represents a offset applied to the video signal.

Name	BlackLevel
Category	AnalogControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2

Camera type	BlackLevel
Monochrom / Color	
VCXG.2-13M / VCXG.2-13C	0 ... 63 DN10
VCXG.2-15M / VCXG.2-15C	0 ... 255 DN12
VCXG.2-25M / VCXG.2-25C	0 ... 63 DN10
VCXG.2-32M / VCXG.2-32C	0 ... 255 DN12
VCXG.2-51M / VCXG.2-51C	0 ... 255 DN12
VCXG.2-51MP	0 ... 255 DN12
VCXG.2-57M / VCXG.2-57C	0 ... 255 DN12
VCXG.2-65M.R / VCXG.2-65C.R	0 ... 255 DN12
VCXG.2-82M / VCXG.2-82C	0 ... 255 DN12
VCXG.2-124M / VCXG.2-124C	0 ... 255 DN12
VCXG.2-127M / VCXG.2-127C	0 ... 255 DN12
VCXG.2-201M.R / VCXG.2-201C.R	0 ... 255 DN12
VCXG.2-204M / VCXG.2-204C	0 ... 255 DN12
VCXG.2-241M / VCXG.2-241C	0 ... 255 DN12

VCXG.2.XC

Camera type	BlackLevel
Monochrom	
VCXG.2-51M.XC	0 ... 255 DN12
VCXG.2-241M.XC	0 ... 255 DN12

VCXG.2.I

Camera type	BlackLevel
Monochrom / Color	
VCXG.2-15M.I / VCXG.2-15C.I	0 ... 255 DN12
VCXG.2-32M.I / VCXG.2-32C.I	0 ... 255 DN12
VCXG.2-51M.I / VCXG.2-51C.I	0 ... 255 DN12
VCXG.2-57M.I / VCXG.2-57C.I	0 ... 255 DN12

Camera type	BlackLevel
VCXG.2-82M.I / VCXG.2-82C.I	0 ... 255 DN12
VCXG.2-127M.I / VCXG.2-127C.I	0 ... 255 DN12
VCXG.2-201M.R.I / VCXG.2-201C.R.I	0 ... 255 DN12
VCXG.2-241M.I / VCXG.2-241C.I	0 ... 255 DN12

VCXU.2

Camera type	BlackLevel
Monochrom / Color	
VCXU.2-13M / VCXU.2-13C	0 ... 63 DN10
VCXU.2-15M / VCXU.2-15C	0 ... 255 DN12
VCXU.2-31M / VCXU.2-31C	0 ... 255 DN12
VCXU.2-32M / VCXU.2-32C	0 ... 255 DN12
VCXU.2-50M / VCXU.2-50C	0 ... 255 DN12
VCXU.2-50.MP	0 ... 255 DN12
VCXU.2-51M / VCXU.2-51C	0 ... 255 DN12
VCXU.2-57M / VCXU.2-57C	0 ... 255 DN12
VCXU.2-65.M.R / VCXU.2-65.C.R	0 ... 255 DN12
VCXU.2-123M / VCXU.2-123C	0 ... 255 DN12
VCXU.2-127M / VCXU.2-127C	0 ... 255 DN12
VCXU.2-201.M.R / VCXU.2-201.C.R	0 ... 255 DN12
VCXU.2-241M / VCXU.2-241C	0 ... 255 DN12

11.3.3   BlackLevelSelector

Selects which Black Level is controlled by the various Black Level features.

Name	BlackLevelSelector	
Category	AnalogControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	All	Black Level will be applied to all channels.

11.3.4   **Gain**

Motion blur is unacceptable in high quality image acquisition. Exposure times are therefore limited. However, this results in low output signals from the camera and dark images. To solve this issue, the signals can be amplified by a user-defined gain factor within the camera.

INFO
Increasing the *Gain* will increase image noise.

Name	Gain
Category	AnalogControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2

Camera type	Gain [db]
Monochrom / Color	
VCXG.2-13M / VCXG.2-13C	0 ... 18 / 0 ... 12
VCXG.2-15M / VCXG.2-15C	0 ... 48
VCXG.2-25M / VCXG.2-25C	0 ... 18 / 0 ... 12
VCXG.2-32M / VCXG.2-32C	0 ... 48
VCXG.2-51M / VCXG.2-51C	0 ... 48
VCXG.2-51MP	0 ... 48
VCXG.2-57M / VCXG.2-57C	0 ... 48
VCXG.2-65M.R / VCXG.2-65C.R	0 ... 48
VCXG.2-82M / VCXG.2-82C	0...18
VCXG.2-124M / VCXG.2-124C	0 ... 48
VCXG.2-127M / VCXG.2-127C	0 ... 48
VCXG.2-201M.R / VCXG.2-201C.R	0 ... 20
VCXG.2-204M / VCXG.2-204C	0 ... 48
VCXG.2-241M / VCXG.2-241C	0 ... 48

VCXG.2.XC

Camera type	Gain [db]
Monochrom	
VCXG.2-51M.XC	0 ... 48
VCXG.2-241M.XC	0 ... 48

VCXG.2.I

Camera type	Gain [db]
Monochrom / Color	
VCXG.2-15M.I / VCXG.2-15C.I	0 ... 48
VCXG.2-32M.I / VCXG.2-32C.I	0 ... 48
VCXG.2-51M.I / VCXG.2-51C.I	0 ... 48
VCXG.2-57M / VCXG.2-57C	0 ... 48
VCXG.2-82M.I / VCXG.2-82C.I	0...18
VCXG.2-127M.I / VCXG.2-127C.I	0 ... 48
VCXG.2-201M.R.I / VCXG.2-201C.R.I	0 ... 20
VCXG.2-241M.I / VCXG.2-241C.I	0 ... 48

VCXU.2

Camera type	Gain [db]
Monochrom / Color	
VCXU.2-13M / VCXU.2-13C	0 ... 18 / 0 ... 12
VCXU.2-15M / VCXU.2-15C	0 ... 48
VCXU.2-31M / VCXU.2-31C	0 ... 48
VCXU.2-32M / VCXU.2-32C	0 ... 48
VCXU.2-50M / VCXU.2-50C	0 ... 48
VCXU.2-50.MP	0 ... 48
VCXU.2-51M / VCXU.2-51C	0 ... 48
VCXU.2-57M / VCXU.2-57C	0 ... 48
VCXU.2-65M.R / VCXU.2-65C.R	0 ... 48
VCXU.2-123M / VCXU.2-123C	0 ... 48
VCXU.2-127M / VCXU.2-127C	0 ... 48
VCXU.2-201M.R / VCXU.2-201C.R	0 ... 20
VCXU.2-241M / VCXU.2-241C	0 ... 48

11.3.5   GainAuto

Sets the automatic gain control (AGC) mode. The exact algorithm used to implement AGC is device-specific.

Name	GainAuto	
Category	AnalogControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	Gain is constantly adjusted by the device.
	Off	Gain is User controlled using Gain.
	Once	Gain is automatically adjusted once by the device. Once it has converged, it automatically returns to the Off state. The levelling can take several images.

11.3.6   GainSelector

Selects which gain is controlled by the various gain feature.

Name	GainAuto	
Category	AnalogControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	All	All Gain will be applied to all channels.
	Blue	Gain will be applied to the blue channel. (color cameras only)
	Green Blue	GreenBlue Gain will be applied to the green blue channel. (color cameras only)
	Green Red	Gain will be applied to the green red channel. (color cameras only)
	Red	Gain will be applied to the red channel. (color cameras only)

11.3.7   **Gamma**

This function compensates any nonlinearity in human eye light perception.

For this correction, the corrected pixel intensity (Y') is calculated from the original intensity of the sensor's pixel ($Y_{original}$) and correction factor ɣ using the following formula (in oversimplified version): $Y' = Y^{ɣ}_{original}$
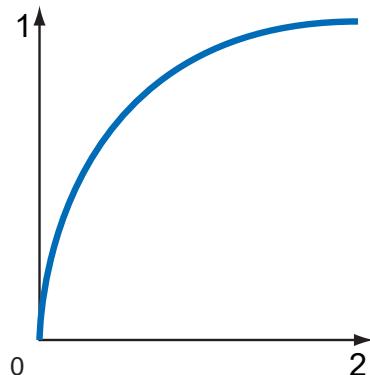
Ill. 5: Non-linear-perception of the human eye

1	Perception of brightness	2	Energy of light

The values of the calculated intensities are entered in Look-Up-Table. This will overwrite any existing values in LUT.

INFO

If function *LUT* is disabled by software, the gamma correction function is disabled as well.

INFO

Setting the gamma value at simultaneous image acquisition may cause visual effects in cameras with long readout time, since access to *LUT* is not locked against the pixel stream.

This behavior can be avoided by camera stop prior to the setting (*AcquisitionStop*).

Name	Gamma
Category	AnalogControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	0.1 - 2.0 (Increment: 0.10)

11.4   Category: AutoFeatureControl

Category containing the functions for automatic adjustment.

General Information

Various auto functions are available to affect the automatic adjustment of image brightness. Two methods are described below.

BrightAutoPriority = ExposureAuto		
	1	<u>Example 1</u> For image 1, it will suffice increasing brightness using *ExposureTime* to achieve the value of *BrightnessAutoNominalValue*.
	2	<u>Example 2</u> For image 2, increasing brightness using *ExposureTime* will not suffice to achieve the value of *BrightnessAutoNominalValue*. Therefore,*Gain* is increased after reaching *ExposureAutoMaxValue*.

BrightAutoPriority = GainAuto		
	1	<u>Example 1</u> For image 1, it will suffice increasing brightness using *Gain* to achieve the value in *BrightnessAutoNominalValue*.
	2	<u>Example 2</u> For image 2, increasing brightness using *Gain* will not suffice to achieve the value in *BrightnessAutoNominalValue*. Therefore,*ExposureTime* is increased after reaching *ExposureAutoMaxValue*.

AutoFeature ROI – General Information

Function *AutoFeature Region of Interest (ROI)* is used to define a so-called Region of Interest ROI. The *ROI* is a defined range of sensor pixels.

This function is used if only the image data (e.g. brightness) of a particular region of the image is of interest. The calculated corrections will be applied to the entire image.

AutoFeature ROI is specified by four values:

- *AutoFeatureOffsetX* - x-coordinate of the first relevant pixel
- *AutoFeatureOffsetY* - y-coordinate of the first relevant pixel
- *AutoFeatureWidth* – horizontal size of the region
- *AutoFeatureHeight* – vertical size of the region

AutoFeature ROI in full frame
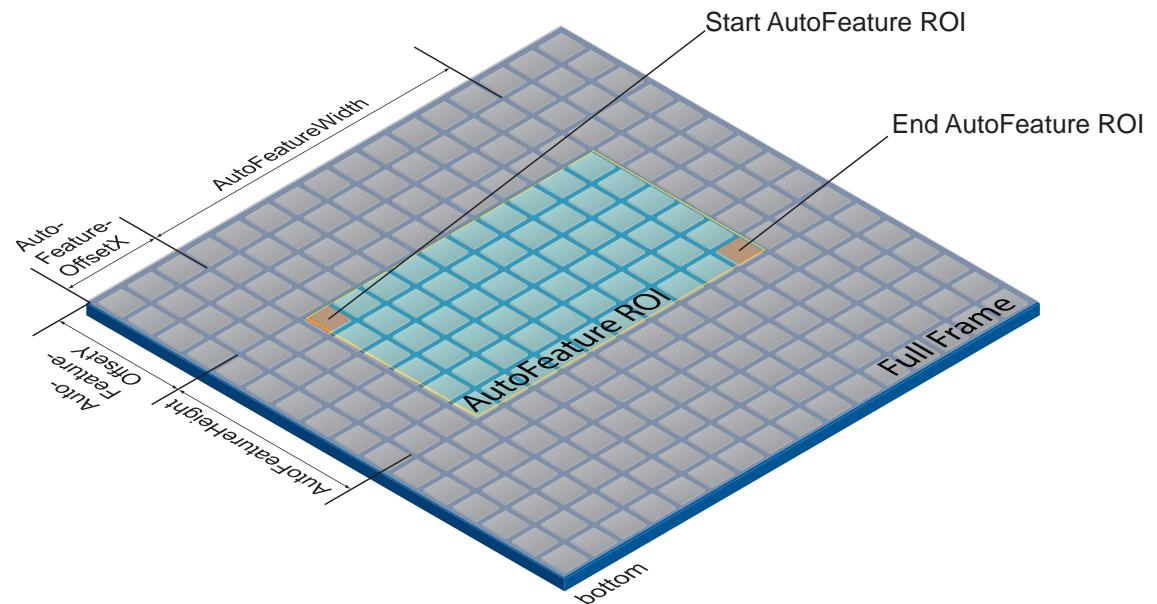
AutoFeature ROI in an ROI

INFO

AutoFeature ROI can be set in *ROI* (*Category: ImageFormatControl*). The settings permitted for *AutoFeature ROI* are adjusted accordingly.

Starting point for *AutoFeatureOffsetX* and *AutoFeatureOffsetY* is defined by *ROI* (*Category: ImageFormatControl)*.
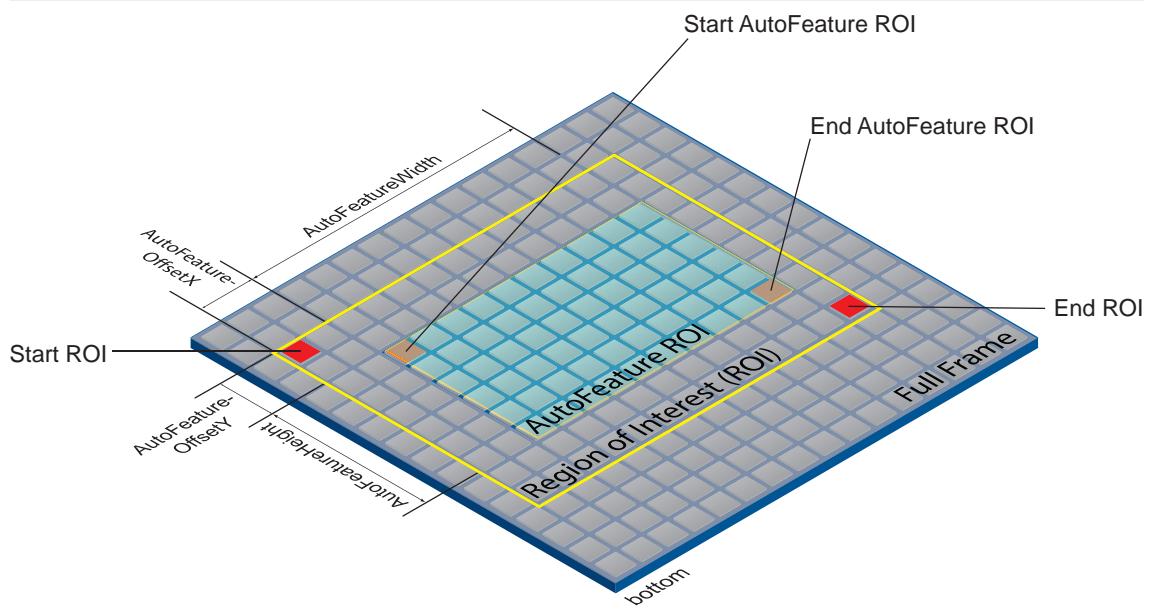
11.4.1   AutoFeatureHeight

Height of the selected Auto Feature Region (in pixels).
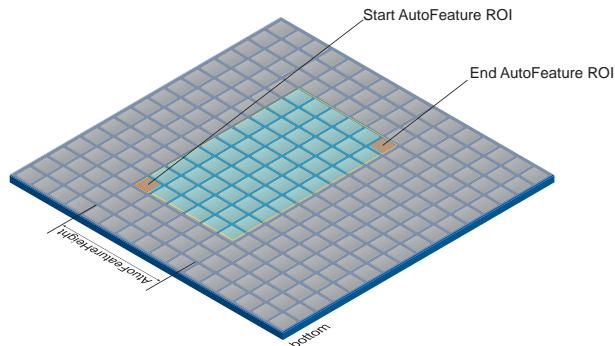
Name	AutoFeatureHeight
Category	AutoFeatureControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	*Height [▶ 165]*

11.4.2   AutoFeatureOffsetX

Horizontal offset from the origin to the Auto Feature Region (in pixels).
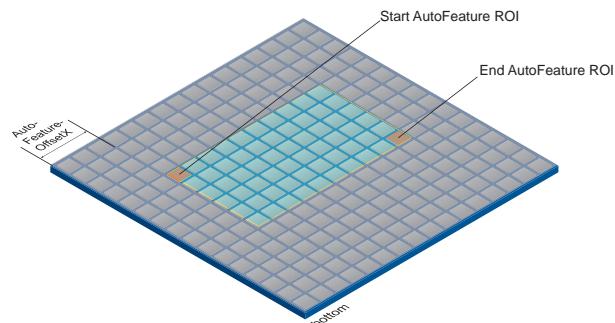
Name	AutoFeatureOffsetX
Category	AutoFeatureControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 - depends on *AutoFeatureWidth*

11.4.3   AutoFeatureOffsetY

Vertical offset from the origin to the Auto Feature Region (in pixels).
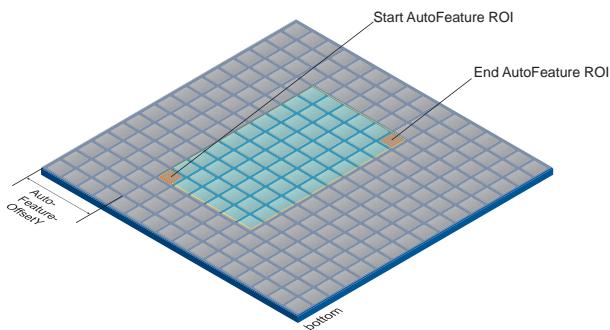
Name	AutoFeatureOffsetX
Category	AutoFeatureControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 - depends on *AutoFeatureHeight*

11.4.4   AutoFeatureRegionMode

Controls the mode for the selected area (*AutoFeature ROI*).

INFO

The camera must be stopped before this feature can be edited.

Name	AutoFeatureRegionMode	
Category	AutoFeatureControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	All settings of the selected *AutoFeature ROI* are automatically the same as the selected *AutoFeatureRegionReference*.
	On	The settings of the selected *AutoFeature ROI* are user defined. The *AutoFeature* is only accessible if the *AutoFeature ROI* is within the *AutoFeatureregionReference* of the *AutoFeature*.

11.4.5   AutoFeatureRegionReference

Defines *Reference ROI*. *Auto Feature Region* is part of this region, every *Auto Feature Region* will refer to the *Reference Region*.

Name	AutoFeatureRegionReference	
Category	AutoFeatureControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Region0	The selected *Auto Feature Region* refers to *Region 0*.

11.4.6 AutoFeatureRegionSelector

Selects which *Region of Interest* to be controlled. Function *RegionSelector* enables devices capable of extracting multiple ROI from a frame out of an image, to configure the functions of those individual regions independently.

Name	AutoFeatureRegionSelector	
Category	AutoFeatureControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	BalanceWhiteAuto	Selected functions will control the region for *BalanceWhiteAuto* and *ColorTransformationAuto* algorithm.
	BrightnessAuto	Selected functions will control the region for *GainAuto* and *ExposureAuto* algorithm.

11.4.7 AutoFeatureWidth

Width of the selected Auto Feature Region (in pixels).
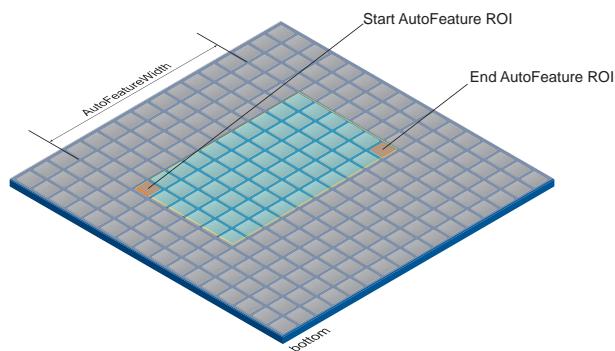
Name	AutoFeatureWidth
Category	AutoFeatureControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	*Width [▷ 178]*

11.4.8   **BalanceWhiteAutoStatus**

Status of *BalanceWhiteAuto*.

Name	BalanceWhiteAutoStatus	
Category	AutoFeatureControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	ColorGainsTooHigh	The *BalanceWhiteAuto* calculation failed since at least one of the calculated color gains exceeds the maximum value.
	Initial	*BalanceWhiteAuto* has never been started.
	Start	*BalanceWhiteAuto* is waiting for statistics data.
	Success	The last *BalanceWhiteAuto* calculation was successful.
	Underrun	The *BalanceWhiteAuto* calculation failed since at least one color-channel shows invalid statistic data.

11.4.9   **BrightnessAutoNominalValue**

Sets the nominal value for brightness in percent of full scale. It will be adjusted according to parameterization in *BrightnessAutoPriority*.

Name	BrightnessAutoNominalValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	5 - 95 (Increment: 1)

11.4.10   **BrightnessAutoPriority**

The function set the highest priority auto function to adjust the brightness.

INFO

Provided *BrightnessAutoPriority* is set to *GainAuto*, image brightness can be increased by a higher value in *Gain*. Though this can cause image noise, but the Framerate will not be reduced.

BrightAutoPriority = ExposureAuto

① **Example 1**

For image 1, increasing brightness using *ExposureTime* will suffice to achieve the value in *BrightnessAutoNominalValue*.

② **Example 2**

For image 2, increasing brightness using *ExposureTime* will not suffice to achieve the value in *BrightnessAutoNominalValue*.

Therefore, *Gain* is increased after reaching *ExposureAutoMaxValue*.

BrightAutoPriority = GainAuto

① **Example 1**

For image 1, increasing brightness using *Gain* will suffice to achieve the value in *BrightnessAutoNominalValue*.

② **Example 2**

For image 2, increasing brightness using *Gain* will not suffice to achieve the value in *BrightnessAutoNominalValue*.

Therefore, *ExposureTime* is increased after reaching *ExposureAutoMaxValue*.

Name	BrightnessAutoPriority	
Category	AutoFeatureControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	ExposureAuto	*ExposureAuto* has highest priority and will be modified first.
	GainAuto	*GainAuto* has highest priority and will be modified first.

11.4.11   ExposureAutoMaxValue

Maximal value of *ExposureTime* calculable by exposure auto algorithm.

Name	ExposureAutoMaxValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	*ExposureTime [▶ 81]*

11.4.12   ExposureAutoMinValue

Minimal value of *ExposureTime* calculable by exposure auto algorithm.

INFO

Enabled *ShortExposureTimeEnable* will be ignored.

Name	ExposureAutoMinValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	*ExposureTime [▶ 81]*

11.4.13   GainAutoMaxValue

Maximal value of *Gain* calculable by gain auto algorithm.

Name	GainAutoMaxValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	*Gain [▶ 94]*

11.4.14   GainAutoMinValue

Minimal value of *Gain* calculable by gain auto algorithm.

Name	GainAutoMinValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	*Gain [▶ 94]*

11.5   Category: ChunkDataControl

Chunk is camera-generated data packet which is integrated into the *Payload* every image with m *Chunk* ode being enabled. This integrated data packet contains different image settings. Baumer GAPI can read out *Chunk (Image Info Header)*.

There are three modes:

Image Data

Only image data is transferred, no *Chunk* data.
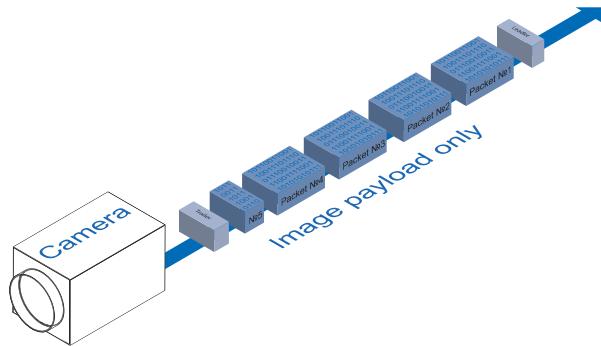
Chunk

Only *Chunk* data are transferred, no image data.
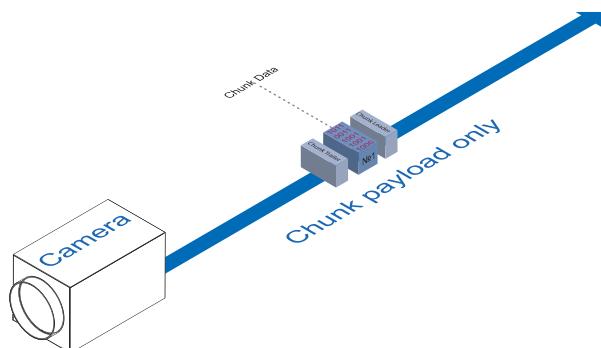
Extended Chunk

Chunk and image data are transmitted. The *Chunk* data are included in the last data packet.
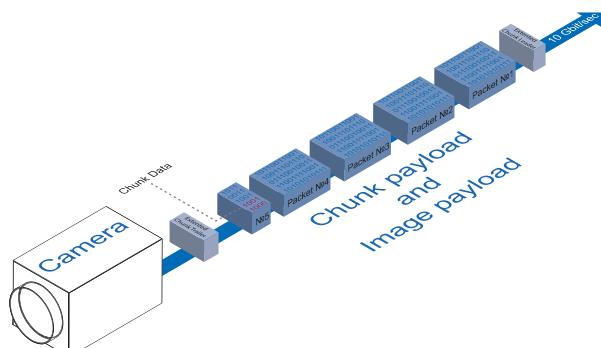
11.5.1   ChunkEnable

Enables the inclusion of the selected *Chunk* data in the *Payload* of the image.

INFO
The camera must be stopped before this feature can be edited.

INFO
Use *ChunkSelector* to select the required *Chunk*.

Name	ChunkEnable
Category	ChunkDataControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.5.2   ChunkModeActive

Enables data inclusion of *Chunk* into *Payload* of the image.

INFO
The camera must be stopped before this feature can be edited.

Name	ChunkModeActive
Category	ChunkDataControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.5.3   ChunkSelector

Selects which *Chunk* to enable or control.

Name	ChunkSelector
Category	ChunkDataControl
Interface	IEnumeration
Access	Read only
Unit	-
Values	see table(s) below

VCXG.2

Values (Features)	
Binning (BinningHorizontal, BinningHorizontalMode, BinningSelector, BinningVertical, BinningVerticalMode)	ImageControl (BrightnessCorrection, DefectPixelCorrection, LUTSelector, LUTEnable, ReverseX, ReverseY)
BlackLevel	LineStatusAll
CounterValue	OffsetX
DeviceTemperature	OffsetY
ExposureTime	PixelFormat
FrameID	SequencerSetActive
Gain	Timestamp
Height	Width
Image	

VCXG.2.XC

Values (Features)	
Binning (BinningHorizontal, BinningHorizontalMode, BinningSelector, BinningVertical, BinningVerticalMode)	ImageControl (BrightnessCorrection, DefectPixelCorrection, LUTSelector, LUTEnable, ReverseX, ReverseY)
BlackLevel	LineStatusAll
CounterValue	OffsetX
DeviceTemperature	OffsetY
ExposureTime	PixelFormat
FrameID	SequencerSetActive
Gain	Timestamp
Height	Width
Image	

VCXG.2.I

Values (Features)	
Binning (BinningHorizontal, BinningHorizontalMode, BinningSelector, BinningVertical, BinningVerticalMode)	ImageControl (BrightnessCorrection, DefectPixelCorrection, LUTSelector, LUTEnable, ReverseX, ReverseY)
BlackLevel	LineStatusAll
CounterValue	OffsetX
DeviceTemperature	OffsetY
ExposureTime	PixelFormat
FrameID	SequencerSetActive
Gain	Timestamp
Height	Width
Image	

VCXU.2

Values (Features)	
Binning (BinningHorizontal, BinningHorizontalMode, BinningSelector, BinningVertical, BinningVerticalMode)	ImageControl (BrightnessCorrection, DefectPixelCorrection, LUTSelector, LUTEnable, ReverseX, ReverseY)
BlackLevel	LineStatusAll
CounterValue	OffsetX
DeviceTemperature	OffsetY
ExposureTime	PixelFormat
FrameID	SequencerSetActive
Gain	Timestamp
Height	Width
Image	

11.6   Category: ColorTransformationControl (color cameras only)

Category that contains the color transformation control functions.

The color processing is realized by 4 modules.

White balance
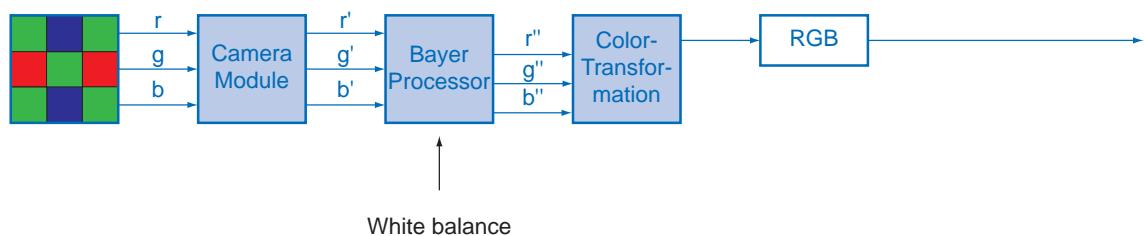
The sensor color signals r (red), g (green) and b (blue) are amplified in total and digitized within the Camera Module.

Within the *Bayer Processor*, the raw signals r', g' and b' are amplified by color-channel- specific factors. Next is interpolating the missing color values which will generate new ones (r'', g'', b'').

Color Transformation is next. Here, the previously generated color signals r'', g'' and b'' are converted to optimized RGB (color adjustment as physical balance of the spectral sensitivities).

11.6.1   ColorTransformationAuto

Controls the mode for automatic adjusting the gains of the active transformation matrix.

INFO

Function *ColorTransformationAuto* can always be enabled which will make the camera calculate appropriate color matrices.

If the range of the estimated illumination to the measured reference illuminations exceeds a certain threshold, a white balance is triggered even if *BalanceWhiteAuto = off*.

However, matrices in image format *RAW* are not applied.

Name	ColorTransformationAuto	
Category	ColorTransformationControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	Color conversion is constantly adjusted by the camera. *Color Gains* not adjustable.
	Off	Color transformation is user controlled using the various Color transformation functions.
	Once	Color conversion setting is automatically one-time by the camera. Once converged, it automatically returns to the *Off* state. *Color Gains* not adjustable.

11.6.2   ColorTransformationEnable

Activates the selected Color Transformation module.

Name	ColorTransformationEnable
Category	ColorTransformationControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.6.3 ColorTransformationFactoryListSelector

Selects the *OptimizedMatrix* for the desired color temperature. All calculated color values are based on the sRGB color space.

When setting an *OptimizedMatrix*, the *ColorGains* are also set for the white point matching the light.

💡 **INFO**
We recommend to carry out a white balance after setting a matrix.

Name	ColorTransformationFactoryListSelector
Category	ColorTransformationControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	See table(s) below

VCXx.2

Values	Description
OptimizedMatrixFor3000K	Matrix is set to color temperature 3000K.
OptimizedMatrixFor5000K	Matrix is set to color temperature 5000K.
OptimizedMatrixFor6500K	Matrix is set to color temperature 6500K.
OptimizedMatrixFor9500K	Matrix is set to color temperature 9500K.

11.6.4 ColorTransformationOutputColorSpace

Output the color space of the camera.

Name	ColorTransformationOutputColorSpace
Category	ColorTransformationControl
Interface	IString
Access	Read only
Unit	-
Values	Color space

11.6.5 ColorTransformationResetToFactoryList

Resets *ColorTransformation* to the selected *ColorTransformationFactoryList*.

Name	ColorTransformationResetToFactoryList
Category	ColorTransformationEnable
Interface	ICommand
Access	Write
Unit	-
Values	-

11.6.6   ColorTransformationValue

Represents the selected *Gain* within the *Transformation matrix*.

Name	ColorTransformationValue
Category	ColorTransformationControl
Interface	IFloat
Access	Read only
Unit	-
Values	-8.0 – 8.0 (Increment: 1.00)

11.6.7   ColorTransformationValueSelector

Selects *Gain* of *Transformation matrix* to be accessed to within the selected *Color Transformation module*.

Name	ColorTransformationValueSelector	
Category	ColorTransformationControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Gain00	
	Gain01	
	Gain02	
	Gain10	
	Gain11	
	Gain12	
	Gain20	
	Gain21	
	Gain22	

11.7   Category: CounterAndTimerControl

This chapter lists all features that relates to control and monitoring of Counters and Timers.

11.7.1   CounterDuration

Sets the time (or number) of events prior to generating event *CounterEnd*.

Counter reaching the *CounterDuration* value will output a *CounterEnd* event, the *CounterActive* signal is enabled and *Counter* stops counting until new trigger or explicit reset by *CounterReset*.

Name	CounterDuration
Category	CounterAndTimerControl
Interface	IString
Access	Read / Write
Unit	-
Values	0 ... 65535 (Increment: 1)

11.7.2   CounterEventActivation

Selects the activation mode for the *Event Source* signal.

Name	CounterEventActivation	
Category	CounterAndTimerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	RisingEdge	Counts on the rising edge of the signal.
	FallingEdge	Counts on the falling edge of the signal.
	AnyEdge	Counts on the falling or rising edge of the selected signal.

11.7.3   CounterEventSource

Select the event that will be the source to increase *Counter*.

Name	CounterEventSource
Category	CounterAndTimerControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

CounterEventSource	VCXG.2	VCXG.2XC	VCXG.2.I	VCXU.2
Counter1End	■	■	■	■
Counter2End	■	■	■	■
ExposureActive	■	■	■	■
FrameTransferSkipped	■	■	■	■
FrameTrigger	■	■	■	■
Line0	■	■	■	■
Line1	■	■	■	■
Line2	■	■	■	■
Line3	□	□	■	□
Off	■	■	■	■
TriggerSkipped	■	■	■	■

11.7.4   CounterReset

Executes software reset and start of the selected *Counter*. *Counter* starts counting events im-
mediately after reset unless *Counter Trigger* trigger is active. *CounterReset* is to reset *Counter*
independently of *CounterResetSource*. To disable *Counter* temporarily, set *Coun-
terEventSource = Off*.

INFO

Note that the value of *Counter* at time of reset is automatically saved and reflects in *CounterVal-
ueAtReset*.

Name	CounterReset
Category	CounterAndTimerControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.7.5   CounterResetActivation

Selects the activation mode of the *CounterResetSource* signal.

Name	CounterResetActivation	
Category	CounterAndTimerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	RisingEdge	Resets the counter on the rising edge of the signal.
	FallingEdge	Resets the counter on the falling edge of the signal.
	AnyEdge	Resets the counter on the falling or rising edge of the selected signal.

11.7.6   CounterResetSource

Selects the signals that will be the source to reset *Counter*.

Name	CounterResetSource
Category	CounterAndTimerControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2

CounterResetSource	
Counter1End	Line1
Counter2End	Line2
Line0	Off

VCXG.2.XC

CounterResetSource	
Counter1End	Line1
Counter2End	Line2
Line0	Off

VCXG.2.I

CounterResetSource	
Counter1End	Line2
Counter2End	Line3
Line0	Off
Line1	

VCXU.2

CounterResetSource	
Counter1End	Line1
Counter2End	Line2
Line0	Off

11.7.7   CounterSelector

Selects which *Counter* to configure.

Name	CounterSelector	
Category	CounterAndTimerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Counter1	Selects Counter 1.
	Counter2	Selects Counter 2.

11.7.8   CounterValue

Reads or writes the current value of the selected *Counter*. Writing to *CounterValue* is typically used to define the start value.

Name	CounterValue
Category	CounterAndTimerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 65535 (Increment: 1)

11.7.9   CounterValueAtReset

Reads the value of the selected *Counter* when being reset by trigger or explicit *CounterReset* command.

It represents the last *Counter* value saved before *Counter* reset.

Name	CounterValueAtReset
Category	CounterAndTimerControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 65535 (Increment: 1)

11.7.10   FrameCounter

FrameCounter is part of *Chunk (Baumer Image Info Header)* and added to every frame if *Chunk Mode* is enabled. It is generated by the hardware and can be used to verify that each of the camera's images is transmitted to the PC and received in the right order.

FrameCounter can be set to a defined value by writing it into the *FrameCounter*.

Name	FrameCounter
Category	CounterAndTimerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.7.11   TimerDelay

Defines the delay time (in microseconds) to be applied at trigger reception prior to starting the *Timer*.

Name	TimerDelay
Category	CounterAndTimerControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	0 ... 2,000,000.000000 (Increment: 1.00)

11.7.12   TimerDuration

Defines the time (in microseconds) of the *Timer* pulse.

Name	TimerDuration
Category	CounterAndTimerControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	10.000000 ... 2,000,000.000000 (Increment: 1.00)

11.7.13   TimerSelector

Selects which *Timer* to configure.

Name	TimerSelector	
Category	CounterAndTimerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Timerx	Selects Timer x.

11.7.14   TimerTriggerActivation

Selects the trigger activation mode to start the *Timer*.

Name	TimerTriggerActivation	
Category	CounterAndTimerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	RisingEdge	Starts counting on the rising edge of the selected trigger signal.
	FallingEdge	Starts counting on the falling edge of the selected trigger signal.
	AnyEdge	Starts counting on the falling or rising edge of the selected trigger signal.

11.7.15   TimerTriggerSource

Selects the trigger source to start the *Timer*.

Name	TimerTriggerSource
Category	CounterAndTimerControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2

TimerTriggerSource	
Action1	Line0
ExposureEnd	Off
ExposureStart	Software
FrameTransferSkipped	TriggerSkipped

VCXG.2.XC

TimerTriggerSource	
Action1	Line0
ExposureEnd	Off
ExposureStart	Software
FrameTransferSkipped	TriggerSkipped

VCXG.2.I

TimerTriggerSource	
Action1	Line2
ExposureEnd	Line3
ExposureStart	Off
FrameTransferSkipped	Software
Line0	TriggerSkipped
Line1	

VCXU.2

TimerTriggerSource	
ExposureEnd	Off
ExposureStart	Software
FrameTransferSkipped	TriggerSkipped
Line0	

11.8   Category: CustomDataControl

The category contains the custom data specific features.

11.8.1   CustomData

The feature holds one byte of custom special data.

Name	CustomData
Category	CustomDataControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0x0 ... 0xFF (Increment: 1)

11.8.2   CustomDataConfiguration

Controls whether the configuration mode for user-defined data is enabled.

Name	CustomDataConfiguration	
Category	CustomDataControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	Disables configuration mode for user-defined data.
	On	Enables configuration mode for user-defined data.

11.8.3   CustomDataSelector

The feature selects the index of the custom data byte array.

Name	CustomData
Category	CustomDataControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 127 (Increment: 1)

11.9   Category: DeviceControl

Category for device information and control.

11.9.1   DeviceCharacterSet

Character set used by the strings of the device`s bootstrap registers.

Name	DeviceCharacterSet	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	ASCII	Device use ASCII character set.
	UTF16	Device use UTF16 character set.
	UTF8	Device use UTF8 character set.

11.9.2   DeviceEventChannelCount

Indicates the number of camera-supported *Event Channel*.

Name	DeviceEventChannelCount
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.9.3   DeviceFamilyName

Identifier of the product family of the device.

Name	DeviceFamilyName
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	device family name

11.9.4   DeviceFirmwareVersion

Version of the firmware in the device.

Name	DeviceFirmwareVersion
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	e.g. CID:000057/PID:11194280

11.9.5   DeviceGenCPVersionMajor

Major version of the GenCP protocol supported by the device.

Name	DeviceGenCPVersionMajor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 65535 (Increment: 1)

11.9.6   DeviceGenCPVersionMinor

Minor version of the GenCP protocol supported by the device.

Name	DeviceGenCPVersionMinor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 65535 (Increment: 1)

11.9.7   DeviceLinkSelector

Selects which Link of the device to control.

Generally, a device has only one Link that can be composed of one or many connections. But if there are many, this selector can be used to target a particular Link of the device with certain functions.

Name	DeviceLinkSelector
Category	DeviceControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.9.8   DeviceLinkSpeed

Indicates the speed of transmission negotiated on the specified link.

Name	DeviceLinkSpeed
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	Bps
Values	≥ 0

11.9.9   DeviceLinkThroughputLimit

Limits the maximum bandwidth of the data that will be streamed out by the device on the selected Link. If necessary, delays will be uniformly inserted between transport layer packets in order to control the peak bandwidth.

Name	DeviceLinkThroughputLimit	
Category	DeviceControl	
Interface	IInteger	
Access	Read / Write	
Unit	-	
Values	GigE:	1.250.000 ... 1.250.000.000 (Increment: 12.500.000)
	5GigE:	1.250.000 ... 6.250.000.000 (Increment: 12.500.000)
	10GigE:	1.250.000 ... 1.250.000.0000 (Increment: 12.500.000)
	USB3:	1.000.000 ... 4.000.000.000 (Increment: 1000000)

11.9.10   DeviceManufacturerInfo

Manufacturer information about the device.

The content might look as follows:

Firmware (F) / FPGA (C) / BL3-Version (BL)

Name	DeviceManufacturerInfo
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	e. g. F:00007F9A/C:0180802D/BL3.8:00000081

11.9.11   DeviceModelName

Model name of the device.

Name	DeviceModelName
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	Model name of the device.

11.9.12   DeviceRegistersEndiannes

Endianess of the register of the device.

Name	DeviceRegisterEndiannes	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Big	Device registers are big Endian.
	Little	Device registers are little Endian.

11.9.13   DeviceReset

Resets the device to its power up state.

INFO

The execution of this feature may take several seconds.

Name	DeviceReset
Category	DeviceControl
Interface	IComand
Access	Write only
Unit	-
Values	-

11.9.14   DeviceResetToDeliveryState

By executing this feature, the camera is set to the factory settings.

INFO

The camera-stored settings (e.g. *UserSets*) will be lost.

Name	DeviceResetToDeliveryState
Category	DeviceControl
Interface	IComand
Access	Write only
Unit	-
Values	-

11.9.15   DeviceSFNCVersionMajor

Primary version of *Standard Features Naming Convention* used to create the device GenICam XML(**X**.x.x).

Name	DeviceSFNCVersionMajor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 9223372036854775807 (Increment: 1)

11.9.16   DeviceSFNCVersionMinor

Minor version of *Standard Features Naming Convention* used to create the device *GenICam XML*(x.**X**.x.).

Name	DeviceSFNCVersionMinor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 9223372036854775807 (Increment: 1)

11.9.17   DeviceSFNCVersionSubMinor

Sub version of *Standard Features Naming Convention*, used to create the device *GenICam XML*(x.x.**X**).

Name	DeviceSFNCVersionSubMinor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 9223372036854775807 (Increment: 1)

11.9.18   DeviceScanType

Scan type of the sensor of the device.

Name	DeviceScanType	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Areascan	2D Sensor.

11.9.19   DeviceSensorType

This feature specifies the type of the sensor.

Name	DeviceSensorType	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	CCD	CCD sensor.
	CMOS	CMOS sensor.

11.9.20   DeviceSerialNumber

Device`s serial number. This string is a unique identifier of the device.

Name	DeviceSerialNumber
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	e.g. 1117281217

11.9.21   DeviceStreamChannelCount

Indicates the number of streaming channels supported by the device.

Name	DeviceStreamChannelCount
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.9.22   DeviceStreamChannelEndianness

Endianness of multi-byte pixel data for this stream.

Name	DeviceStreamChannelEndianness	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Big	Endianness of multi-byte pixel data for this stream is big Endian.
	Little	Endianness of multi-byte pixel data for this stream is little Endian.

11.9.23   DeviceStreamChannelSelector

Selects which *Stream Channel* to control.

Name	DeviceStreamChannelSelector
Category	DeviceControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.9.24   **DeviceStreamChannelType**

Reports the type of the *Stream Channel*.

Name	DeviceStreamChannelType	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Receiver	Data stream receiver channel.
	Transmitter	Data stream transmitter channel.

11.9.25   **DeviceTLType**

Transport Type of the device.

Name	DeviceTLType	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	GigEVision	GigE Vision.
	USB3Vision	USB3 Vision.
	CameraLink	Camera Link.

11.9.26   **DeviceTLVersionMajor**

Major version of the Transport Layer (GigE Vision® version) of the device.

Name	DeviceTLVersionMajor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0 (**X**.x.x.)

11.9.27   **DeviceTLVersionMinor**

Minor version of the Transport Layer (GigE Vision® version) of the device.

Name	DeviceTLVersionMinor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0 (x.**X**.x.)

11.9.28 DeviceTLVersionSubMinor

Minor version of the Transport Layer (GigE Vision® version) of the device.

Name	DeviceTLVersionSubMinor
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0 (x.x.**X**)

11.9.29 DeviceTemperature

Device temperature in degrees Celsius (°C). Measured at the location selected by *DeviceTemperatureSelector*.

Name	DeviceTemperature
Category	DeviceControl
Interface	IFloat
Access	Read only
Unit	°C
Values	Device specific (e.g. -127.0 ... 127.0)

11.9.30 DeviceTemperatureExceeded

Returns if the device operates in critical temperature range.

Name	DeviceTemperatureExceeded
Category	DeviceControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.9.31 DeviceTemperatureSelector

Selects the temperature measuring point.

Name	DeviceTemperatureSelector	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	InHouse	Temperature inside the camera housing.

11.9.32   DeviceTemperatureStatus

Returns the current temperature status of the device.

Name	DeviceTemperatureStatus	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Exceeded	Device operates in critical temperature range.
	High	Device operates in increased temperature range.
	Normal	Device operates in normal temperature range.

11.9.33   DeviceTemperatureStatusTransition

Temperature threshold for selected status transition (*DeviceTemperatureStatusTransitionSelector*) in degrees Celsius (°C).

Name	DeviceTemperatureStatusTransition
Category	DeviceControl
Interface	IInteger
Access	Read / Write
Unit	°C
Values	-126.0 ... 72.0

11.9.34   DeviceTemperatureStatusTransitionSelector

Defines the temperature transition to be controlled by the *DeviceTemperatureStatusTransition* function.

Name	DeviceTemperatureStatusTransitionSelector
Category	DeviceControl
Interface	IEnumeration
Access	Read / Write
Unit	-

Values	ExceededToNor-mal	Temperature threshold for transition when going back from status *Exceeded* to *Normal*.
	HighToExceeded	Temperature threshold for transition from status *High* to status *Exceeded*.
	NormalToHigh	Temperature threshold for transition from status *Normal* to status *High*.

11.9.35   DeviceType

Returns the device type.

Name	DeviceType	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read ony	
Unit	-	
Values	Transmitter	Data stream transmitter device.

11.9.36   DeviceUserID

User-programmable device identifier.

Name	DeviceUserID
Category	DeviceControl
Interface	IString
Access	Read / Write
Unit	-
Values	GiGE: 16Byte USB: 64Byte e.g. "Camera 1

11.9.37   DeviceVendorName

Name of the manufacturer of the device.

Name	DeviceVendorName
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	Manufacturer name.

11.9.38 DeviceVersion

Version of the device.

Name	DeviceVersion
Category	DeviceControl
Interface	IString
Access	Read only
Unit	-
Values	e.g. R2.0.0

11.9.39 ReadOutTime

Readout time of one image from the sensor in μs, with the current image settings.

INFO

ReadOutTime depends on:
- *OffsetY*
- *Height*
- *PixelFormat*
- *SensorBinning*

Name	ReadOutTime
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	μs
Values	0 ... 65535 (Increment: 1)

11.9.40 TimestampLatch

Saves current timestamp into *TimestampLatchValue*.

Name	TimestampLatch
Category	DeviceControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.9.41   **TimestampLatchValue**

Returns the saved value of counter *Timestamp*.

Name	TimestampLatchValue
Category	DeviceControl
Interface	IInteger
Access	Read only
Unit	ns
Values	0 ... 9223372036854775807 (Increment: 8 (GigE) / 10 (USB))

11.9.42   **USB2SupportEnable (USB cameras only)**

Enable or disable the streaming support for USB 2.0.

NOTICE

Activation of the image transmission with USB2 connection

If the camera is connected to an USB 2.0 port image transmission is disabled by default. The camera consumes more than 2.5W which is the maximum allowed by the USB 2.0 specification. But there is a possibility to activate the image transmission at your own risk!

This activation could damage your computer´s hardware!

Steps to enable image transmission

Instruction:

a) Open the camera in *Camera Explorer*.

b) Select profile *GenICam Guru* (only *Camera Explorer* < v3.0).

c) Enable the feature *USB2SupportEnable* in category *DeviceControl*.

d) Disconnect the data connection of the camera to the USB 2.0 port.

e) Connect the data connection of the camera to the USB 2.0 port.

Result:

✓ Images will be transmitted via the USB 2.0 port.

Name	USB2SupportEnable
Category	DeviceControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.10   Category: DigitalIOControl

Category that contains the digital input and output control functions.

Trigger – General Information

Trigger signals are used to synchronize the camera exposure and a machine cycle or, in case of a software trigger, to take images at predefined time intervals. Different trigger sources can be used here.

A Trigger delay

B Exposure time

C Readout time
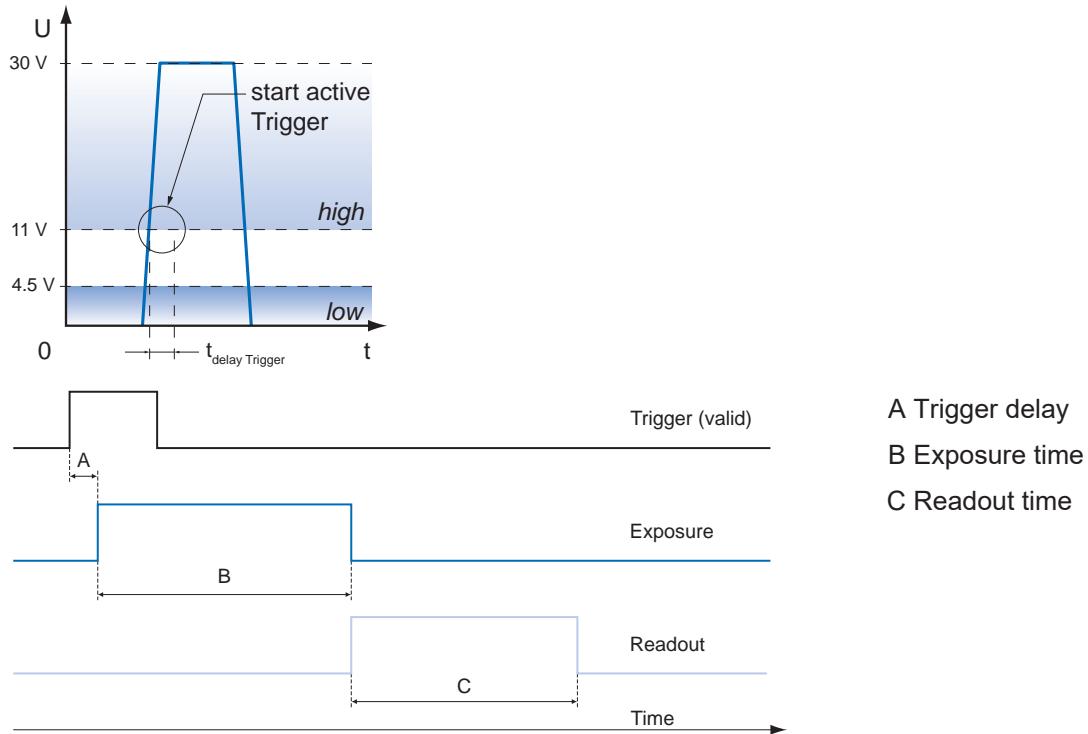
Trigger delay – General Information

The trigger delay (*TriggerDelay*) is a flexible user-defined delay between the given trigger impulse and the image capture. The delay time can be set between 0 μs and 2.0 s in increments of 1 μs. Where there are multiple triggers during the delay, the triggers will also be stored and delayed. The buffer is able to store up to 512 trigger signals during the delay.

Your benefits:

- No need for an external trigger sensor to be perfectly aligned
- Different objects can be captured without hardware changes

Trigger Source (examples of possible trigger sources)
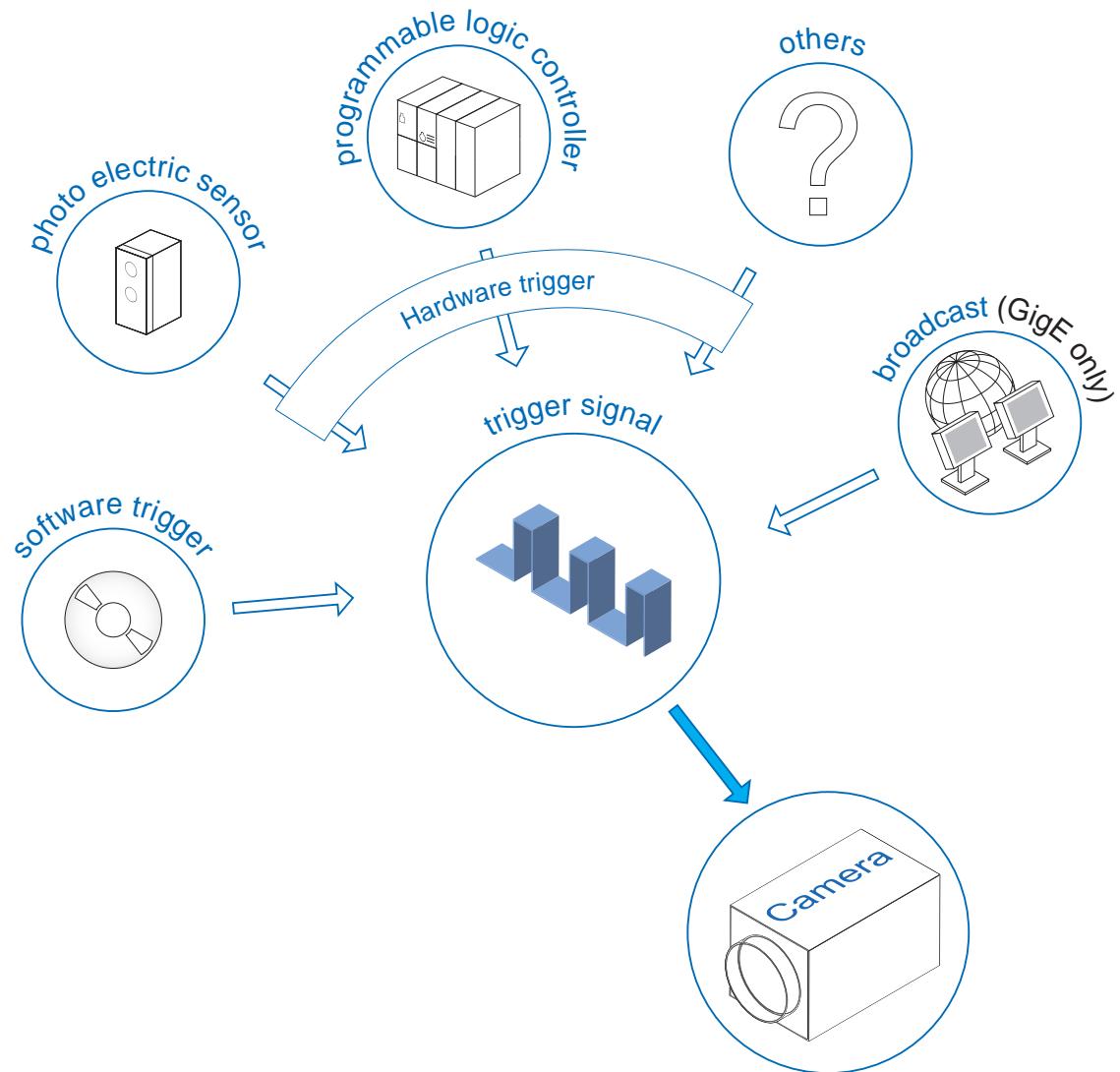
Each trigger source must be activated separately. When the trigger mode (*TriggerMode*) is activated, the hardware trigger is activated by default.

Debouncer (*LineDebouncerHighTimeAbs* / *LineDebouncerLowTimeAbs*)

The basic idea behind this functions was to separate interfering signals (short peaks) from valid square wave signals, which can be important in industrial environments. Debounce will filter invalid signals while others exceeding the user-defined time *tDebounceHigh* will be recognized and transferred to the camera to induce a trigger.

Second test time *tDebounceLow* was realized to detect valid signals and filter any jitter. The point in time is user-defined. If the signal value falls to state *low* and does not rise within *tDebounceLow*, this is recognized as the end of the signal.

INFO

Please note that the edges of valid trigger signals are shifted by *tDebounceHigh* and *tDebounceLow*!

Depending on these two points in time, the trigger signal can be temporally extended or compressed.

Δt_x - high time of the signal
$t_{DebounceHigh}$ - user-defined debouncer delay for state high
$t_{DebounceLow}$ - user-defined debouncer delay for state low
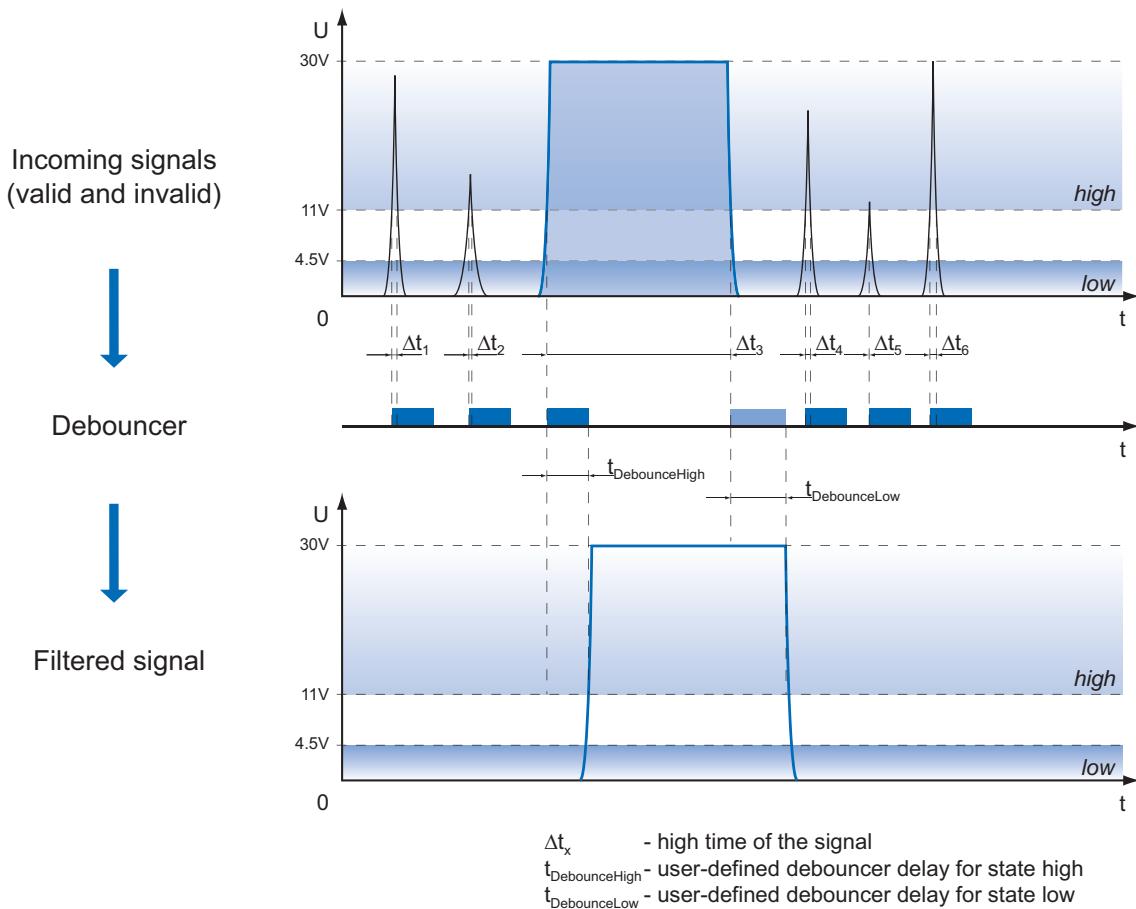
11.10.1   LineDebouncerHighTimeAbs

Defines the absolute value of the selected line debounce time in microseconds for switching from *low* to *high*.

Name	LineDebouncerHighTimeAbs
Category	DigitalIOControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	0.000000 - 5,000.000000 (Increment: 1.00)

11.10.2   LineDebouncerLowTimeAbs

Sets the absolute value of the selected line debounce time in microseconds for switching from *high* to *low*.

Name	LineDebouncerLowTimeAbs
Category	DigitalIOControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	0.000000 - 5,000.000000 (Increment: 1.00)

11.10.3   LineFormat

Controls the current electrical format of the selected physical Input or Output.

LineFormat switchover will adapt the output behavior to the respective system.

INFO

In all modes the supply voltage for the Outputs (Pin 11, 12) must to be connected for function!

Name	LineFormat
Category	DigitalIOControl
Interface	IEnnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

The following Line Formats are available for each Output:

Line Format	Description	Circuit
Push-Pull	This mode is used to create steep sharp edges for dynamic switching operations. Advantage: Steep flanks in both directions. Disadvantage: For long cable more susceptible to ground bounce and potential differences.	
Open-Source	Typical applications for this mode are: PLC input, control of illumination connected to ground. Advantage: Stable at long cable lengths and potential differences. Disadvantage: The falling edge has a lower slope due to parasitic capacitances. Switching off is slower due to this lower slope.	
Open-Drain	A typical case of application for this mode is a illumination control connected to plus. Advantage: Stable at long cable lengths and potential differences. Disadvantage: The rising edge has a lower slope due to parasitic capacitances. Switching off is slower due to this lower slope.	

Line Format	Description	Circuit
Tri-State	In this mode, the output is disabled.	
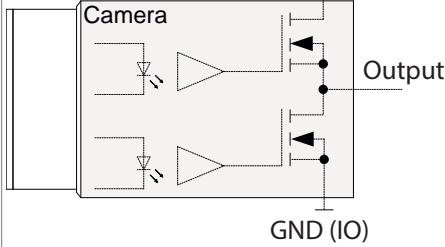
11.10.4   LineInverter

Controls signal inversion of the selected line *Input* or *Output*.

Name	LineInverter
Category	DigitalIOControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.10.5   LineMode

Controls if the physical Line is used to input or output a signal.

Name	LineMode	
Category	DigitalIOControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Input	The selected physical line is used to input an electrical signal.
	Output	The selected physical line is used to output an electrical signal.

11.10.6   LinePWMConfigurationMode

Activates the Features *LinePWMMaxDuration* and *LinePWMMaxDutyCycle*.

Name	LinePWMConfigurationMode	
Category	DigitalIOControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	Disables the *PWM configuration mode*.
	On	Enables the *PWM configuration mode*.

Function *Pulse Width Modulated Outputs (PWM)* is for lighting system control or control of any illumination directly connected to the camera.

The set *LineSource* serves as controller signal.

NOTICE

Erroneous settings can destroy the illumination!
The outputs of the camera are protected against destruction. Please follow the information in the data sheets for your illumination. Contact the manufacturer of the illumination if you are unsure about admissible parameters.

Setting a output to a specific illumination

Condition:

⇨ Correctly connected illumination

Instruction:

a) Set *LinePWMConfigurationMode* to *true*.

b) Set at *LinePWMMaxDutyCycle* and *LinePWMMaxDuration* the maximum admissible parameters of your illumination (e.g. Falcon FLDR-i90B-IR24). `LinePWMMaxDutyCycle = 10 % / LinePWMMaxDuration = 10 ms`

c) Set *LinePWMConfigurationMode* to *false*.

Result:

✓ The values set in step b) are now the max. admissible parameters.

INFO

Using the settings of the above example (`LinePWMMaxDutyCycle = 10 % / LinePWMMax-Duration = 10 ms`) means that the connected lighting must be disabled for 90 ms. Consequently, 10 Hz suffice for triggering. Using a higher trigger frequency would start image acquisition by the camera, but not the camera-connected lighting. This will protect the lighting system.

⚠ DANGER

Use in humid environments requires protection class IP67
Risk of electric shock. Electric shock can cause fatal or serious injury.

a) Use only permitted if compliant to pollution degree 2 and overvoltage category 2.

b) The M12 connectors must comply with the IEC 61076-2-101 standard.

c) Tests of the dielectric strength and withstand voltage of the combination connector-mating connector must consider 60 V in compliance with DIN EN 60664-1:2008-01.

Electrical specifications (Output Line 4 ... Line 7) (VCXG.2.I)	
U_{EXT}:	12 V - 20 % … 48 V + 10 % DC
I_{OUT}:	- max. 1.5 A permanent in total or per each output
	- Pulse 40 % of the period, max. 2.5 A (t_{ON} max 1 s)
	- t_{ON} = < 0.2 µs / t_{OFF} = < 0.2 µs
	- max. Frequency: 500 kHz

INFO

In case of overload or short circuit, the outputs are disabled. To re-enable the outputs, disconnect Power (IO) (pin 12) from power supply or execute *DeviceReset*.

11.10.7   LinePWMDuration

Sets the pulse time in µs, with which the illumination is pulsed.

Name	LinePWMDuration
Category	DigitalIOControl
Interface	IInteger
Access	Read / Write
Unit	µs
Values	1 - 5000 (Increment: 1)

11.10.8   LinePWMDutyCycle

Sets the duty cycle (ratio of pulse duration to period time duration) in %. This value is specified by the connected illumination.

Name	LinePWMDutyCycle
Category	DigitalIOControl
Interface	IInteger
Access	Read / Write
Unit	%
Values	1 - 100 (Increment: 1)

11.10.9   LinePWMMaxDuration

Sets the maximum *LinePWMDuration* time in µs. This parameter is specified by the connected illumination system.

Name	LinePWMMaxDuration
Category	DigitalIOControl
Interface	IInteger
Access	Read / Write
Unit	µs
Values	1 - 50000 (Increment: 1)

11.10.10   LinePWMMaxDutyCycle

Sets the maximum *LinePWMDutyCycle* in %. This parameter is specified by the connected illumination system.

Name	LinePWMMaxDutyCycle
Category	DigitalIOControl
Interface	IInteger
Access	Read / Write
Unit	%
Values	1 - 100 (Increment: 1)

11.10.11   LinePWMMode

Selects the PWM mode of the selected *Output* line.

Name	LinePWMMode	
Category	DigitalIOControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Fixed Frequency	The selected *Output* generates a permanent pulse frequency beginning with every transition from 0 to 1 and ending with every transition from 1 to 0.
	Off	*PWMMode* is off. *Output* reaction is the same as of standard *Output*.
	OnePulse	The selected *Output* generates one pulse with every transition from 0 to 1.

Time diagrams of *PWMModes*:
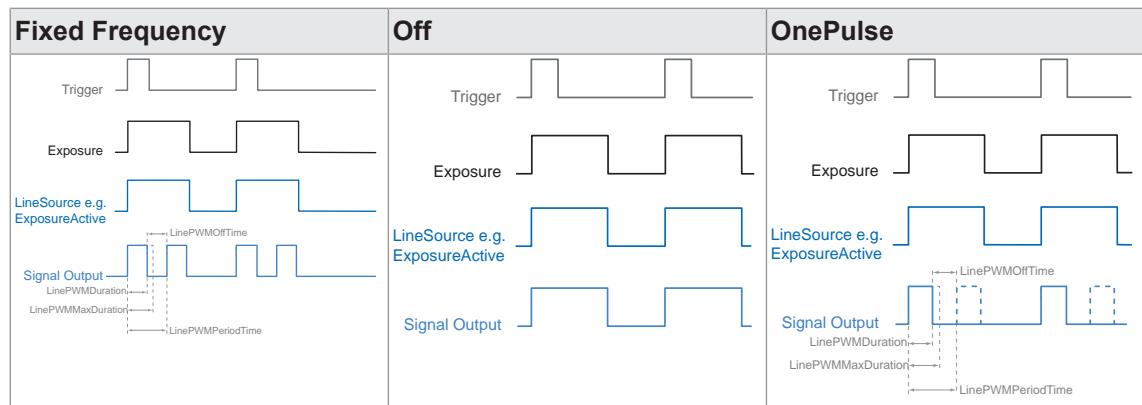
11.10.12   LinePWMOffTime

Switch-off time in microseconds included in the PWM period.

Name	LinePWMOffTime
Category	DigitalIOControl
Interface	IInteger
Access	Read only
Unit	µs
Values	PWM setting -specific.

11.10.13   LinePWMPeriodTime

Entire period duration in µs.

Name	LinePWMPeriodTime
Category	DigitalIOControl
Interface	IInteger
Access	Read only
Unit	µs
Values	PWM setting -specific.

11.10.14   LinePWMVersion

PWM module version.

Name	LinePWMVersion
Category	DigitalIOControl
Interface	IString
Access	Read only
Unit	-
Values	e.g. 2.0.0

11.10.15   LineSelector

Selects the physical line (or pin) of the external device connector to configure.

Name	LineSelector
Category	DigitalIOControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	see table(s) below

LineSelector	VCXG.2	VCXG.2XC	VCXG.2.I	VCXU.2
Line0	■	■	■	■
Line1	■ (GPIO)	■ (GPIO)	■	■ (GPIO)
Line2	■ (GPIO)	■ (GPIO)	■	■ (GPIO)
Line3	■	■	■	■
Line4	□	□	■	□
Line5	□	□	■	□
Line6	□	□	■	□
Line7	□	□	■	□

11.10.16   LineSource

Selects which internal signals are output at the selected *Line*.

Name	LineSource
Category	DigitalIOControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

Linesource	VCXG.2	VCXG.2XC	VCXG.2.I	VCXU.2
ExposureActive	■	■	■	■
Off	■	■	■	■
ReadoutActive	■	■	■	■
Timer1Active	■	■	■	■
TriggerReady	■	■	■	■
UserOutput1	■	■	■	■
UserOutput2	■	■	■	■
UserOutput3	■	■	■	■
UserOutput4	□	□	■	□

ExposureActive

This signal is managed by exposure of the sensor.

Furthermore, the falling edge of the *ExposureActive* signal can be used to trigger a movement of the inspected objects. Due to this fact, the span time used for the sensor readout *treadout* can be used optimally in industrial environments.

Depending on Sensor Shutter Mode (only cameras with Rolling Shutter sensors), the *ExposureActive* signal is active at different times.

Sensor Shutter Mode: Global Reset

In Sensor Shutter Mode: Global Reset *tTriggertDelay* is constant and independent of image settings.
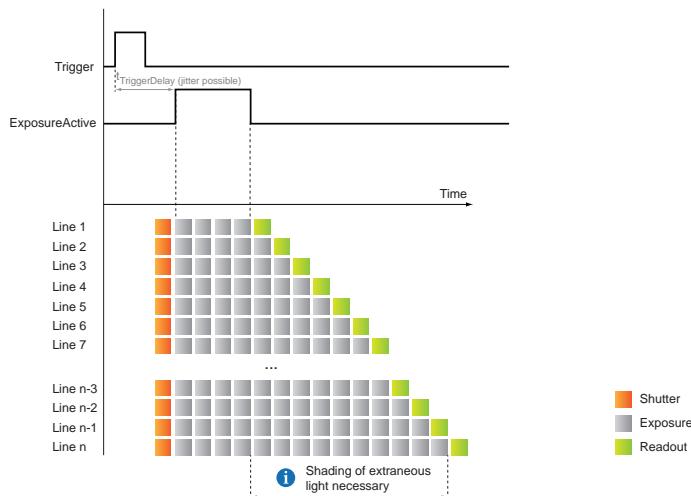
Sensor Shutter Mode: Rolling Shutter

In Sensor Shutter Mode: Rolling Shutter *tTriggertDelay* is not constant (expect texposure < tReadout).

tTriggerDelay depends on image settings like:

- ExposureTime
- PixelFormat
- ...
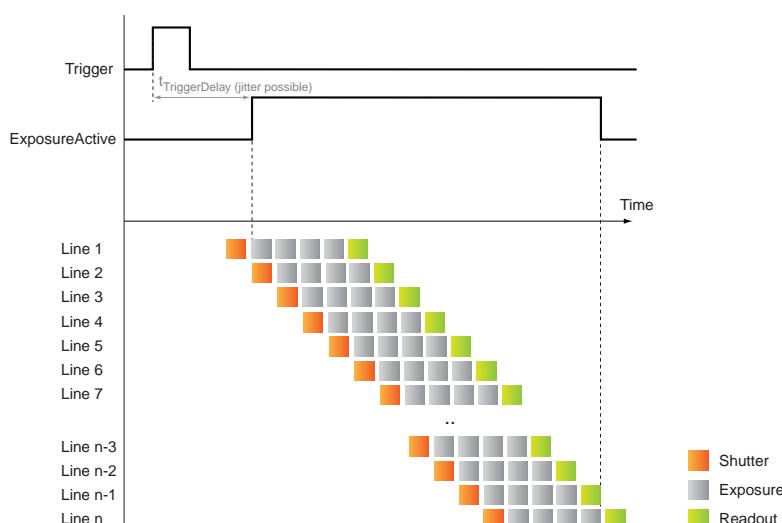
11.10.17   LineStatus

Returns the current status of the selected *Input* or *Output*.

Name	LineStatus
Category	DigitalIOControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.10.18   LineStatusAll

Returns the current status of all available Line signals at time of polling in a single bitfield.

Name	LineStatusAll
Category	DigitalIOControl
Interface	IInteger
Access	Read only
Unit	-
Values	Devices-Specific (HexNumber)

11.10.19   UserOutputSelector

Selects which bit of the User Output register will be set by UserOutputValue.

Name	UserOutputSelector	
Category	DigitalIOControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	UserOutput1	Selects the bit 0 of the User Output register.
	UserOutput2	Selects the bit 1 of the User Output register.
	UserOutput3	Selects the bit 2 of the User Output register.
	UserOutput4	Selects the bit 3 of the User Output register.

11.10.20   UserOutputValue

Sets the value of the bit selected by *UserOutputSelector*.

Name	UserOutputValue
Category	DigitalIOControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On) false = 0 (Off)

11.10.21   UserOutputValueAll

Sets the values of all bits under the *User Output* register.

Name	UserOutputValueAll
Category	DigitalIOControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.11 Category: EventControl

This chapter describes how to control the *Events* generation for host application. *Event* is a message sent to the host application to notify the presence of an internal event.

General Information

The asynchronous message channel is described in the GigE Vision standard® and can optionally be used to signal events. Every *Event* is assigned a timestamp (64 bits) with the exact point in time the event has occurred. Every *Event* can be separately enabled and disabled (*EventSelector*).

Event: EventLost

Event is output if a selected *Event* was lost. The cause may be too many *Events* having occurred.

Event: TriggerReady

Event signal whether the camera is able of processing incoming trigger signals or not.
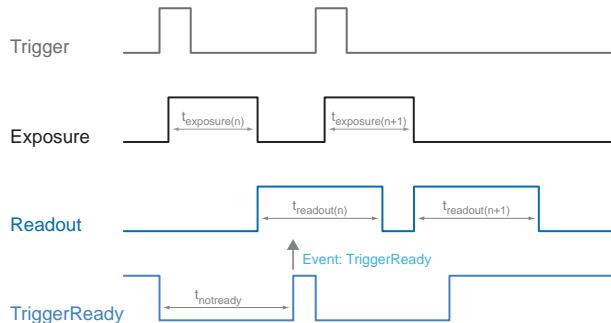
Event: TriggerSkipped

If the camera is unable to process incoming trigger signals, meaning camera trigger should be within the *tnotready* interval , these trigger signals are skipped. This will be indicated to the user by event *TriggerSkipped*..
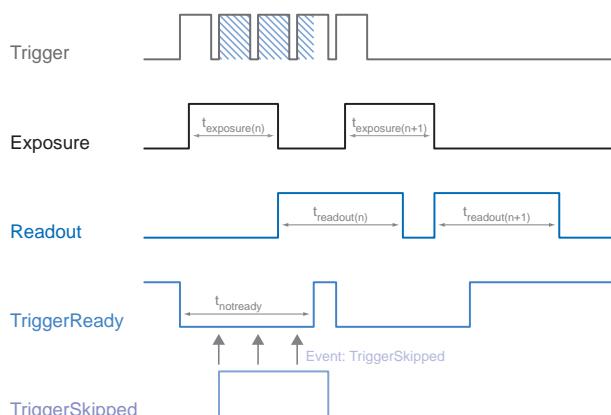
Event: TriggerOverlapped

This *Event* is active as long as the sensor is under exposure with parallel read out, i.e. camera operation utilizes *Overlapped*.

A valid trigger signal event outside a sensor readout operation will change the *TriggerOverlapped* signal to *Low*.
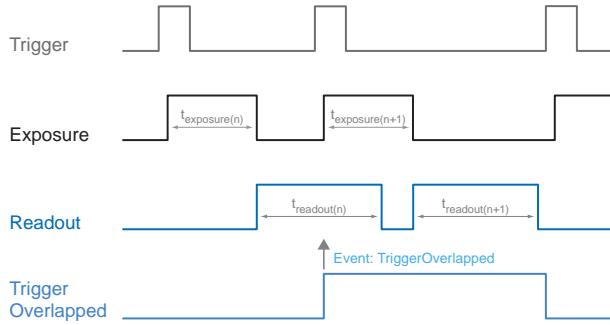
Event: ReadoutActive

While the sensor is read out, the camera signals this by means of *ReadoutActive*.
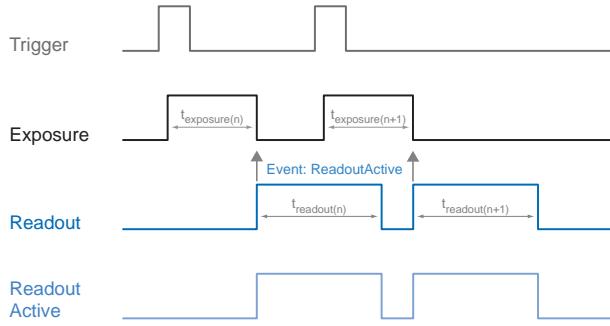
Event: TransferBufferFull

Event is only output at *TriggerMode*. It signals that no buffer is available.
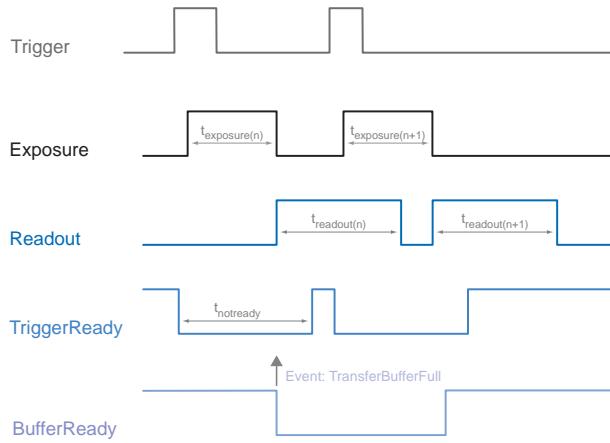
Event: TransferBufferReady

Event is only output at *TriggerMode*. Signals buffer availability.

Trigger

Exposure $t_{exposure(n)}$ $t_{exposure(n+1)}$

Readout $t_{readout(n)}$ $t_{readout(n+1)}$

TriggerReady $t_{notready}$

                                                        Event: TransferBufferReady

BufferReady

Transmission
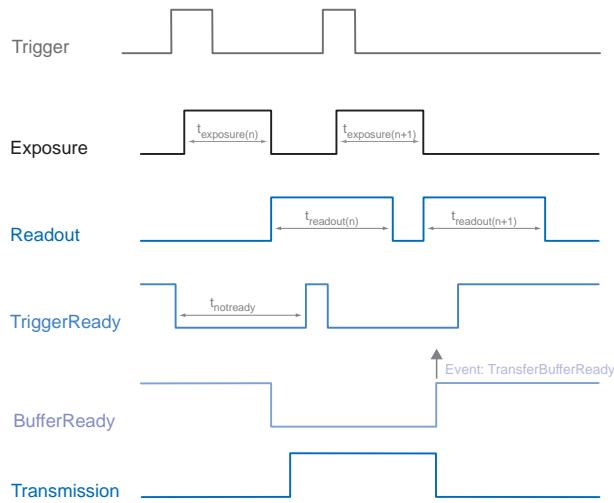
Event: DeviceTemperaturStatusChanged

To prevent the hardware from damage by high temperature, the camera features emergency shutdown. Feature *DeviceTemperatureStatusTransitionSelector* (Category: *DeviceControl*) is for selection of different temperature thresholds:

- *NormalToHigh*: freely programmable value
- *HighToExeeded*: fixed value (if exceeded, the sensor for image acquisition is switched off)
- *ExeededToNormal*: freely programmable, temperature for error-free reactivation

Feature *DeviceTemperatureStatusTransition* is for setting the temperatures for the programmed transition temperatures.

The event *EventDeviceTemperatureStatusChanged* is always generated when *DeviceTemperatureStatus* changes.

If temperature rises above the value set at *HighToExeeded*, function *DeviceTemperatureExceeded* is set to *True* followed by sensor switchoff to reduce power consumption; LED status indicator is red static. This usually will reduce temperature. Further rising temperature inside the camera due to ambient temperature may damage the hardware.

For further use, disconnect the camera from power supply after cool down or execute *DeviceReset*.

The sufficient cooling is recognizable when the event *DeviceTemperatureStatusChanged* (Device Temperature < *ExceededToNormal*) is output.

11.11.1 EventNotification

Activate or deactivate the notification to the host application of the occurrence of the selected *Event*.

Name	EventNotification	
Category	EventControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	Selected reporting disabled via *Event*.
	On	Selected reporting enabled via *Event*.

11.11.2 EventSelector

Selects which *Event* is to be reported to the host application.

Name	EventSelector
Category	EventControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

EventSelector	VCXG.2	VCXG.2XC	VCXG.2.I	VCXU.2
DeviceTemperatureStatus-Changed	■	■	■	■
EventLost	■	■	■	■
ExposureEnd	■	■	■	■
ExposureStart	■	■	■	■
FrameEnd	■	■	■	■
FrameStart	■	■	■	■
FrameTranferSkipped	■	■	■	■
Error	■	■	■	□

EventSelector	VCXG.2	VCXG.2XC	VCXG.2.I	VCXU.2
GigEVisionHeartbeatTime-Out	■	■	■	□
Line0..3 FallingEdge	■	■	■ (0..7)	■
Line0..3 RisingEdge	■	■	■ (0..7)	■
TransferBufferFull	■	■	■	■
TransferBufferReady	■	■	■	■
TriggerOverlapped	■	■	■	■
TriggerReady	■	■	■	■
TriggerSkipped	■	■	■	■

11.11.3 LostEventCounter

Counts lost Events.

Name	LostEventCounter
Category	EventControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 9223372036854775807 (Increment: 1)

11.12 Category: ImageFormatControl

This chapter describes how to influence and determine the image format control features.

General Information - Region of Interest (OffsetX / OffsetY / Width / Height)

Function *Region of Interest (ROI)* is used to predefine a so-called *Region of Interest*. This *ROI* is a defined range of sensor pixels. At image acquisition, only this pixel-specific information is transferred to PC. Not all of the lines on the sensor are read out, which therefore decreases the readout time (*treadout*). This allows for increased frame rates.

This function is used if only a particular region in the field of view is of interest. Further it will reduce resolution.

The ROI is specified by four values:
- *OffsetX* - x-coordinate of the first relevant pixel
- *OffsetY* - y-coordinate of the first relevant pixel
- *Width* - horizontal ROI size
- *Height* - vertical ROI size

Start ROI

End ROI

Width

Offset X

Offset Y

Height

bottom
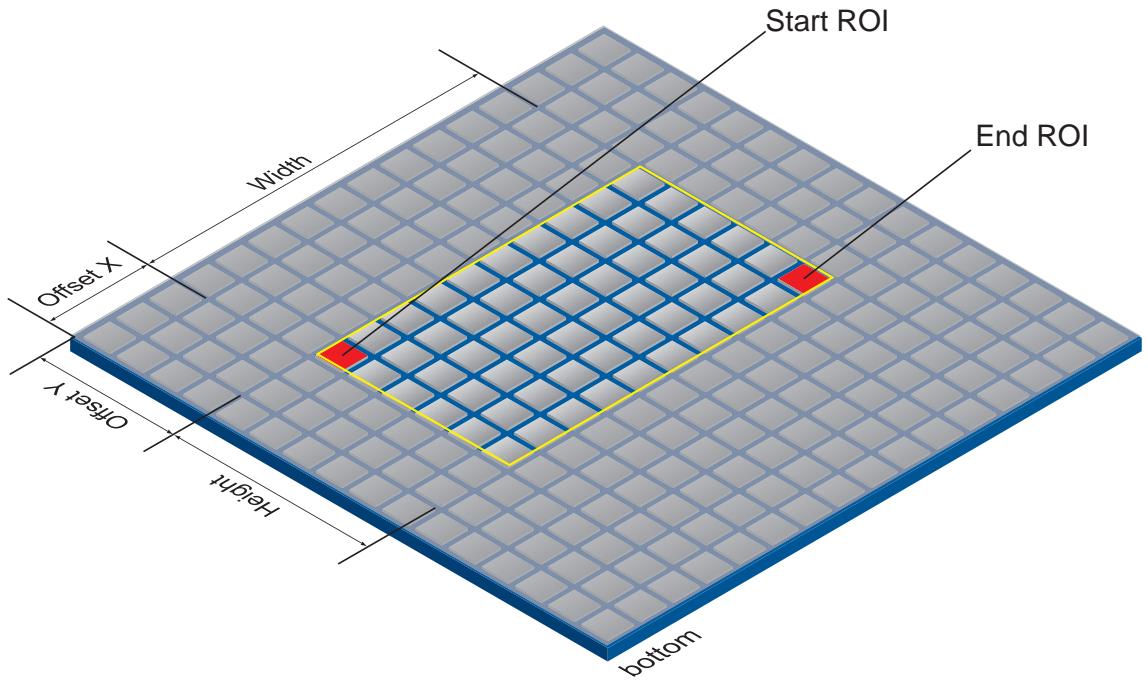
ROI Readout

In the illustration below, the readout time would be cut down to 40% of full frame readout.

Readout lines

bottom
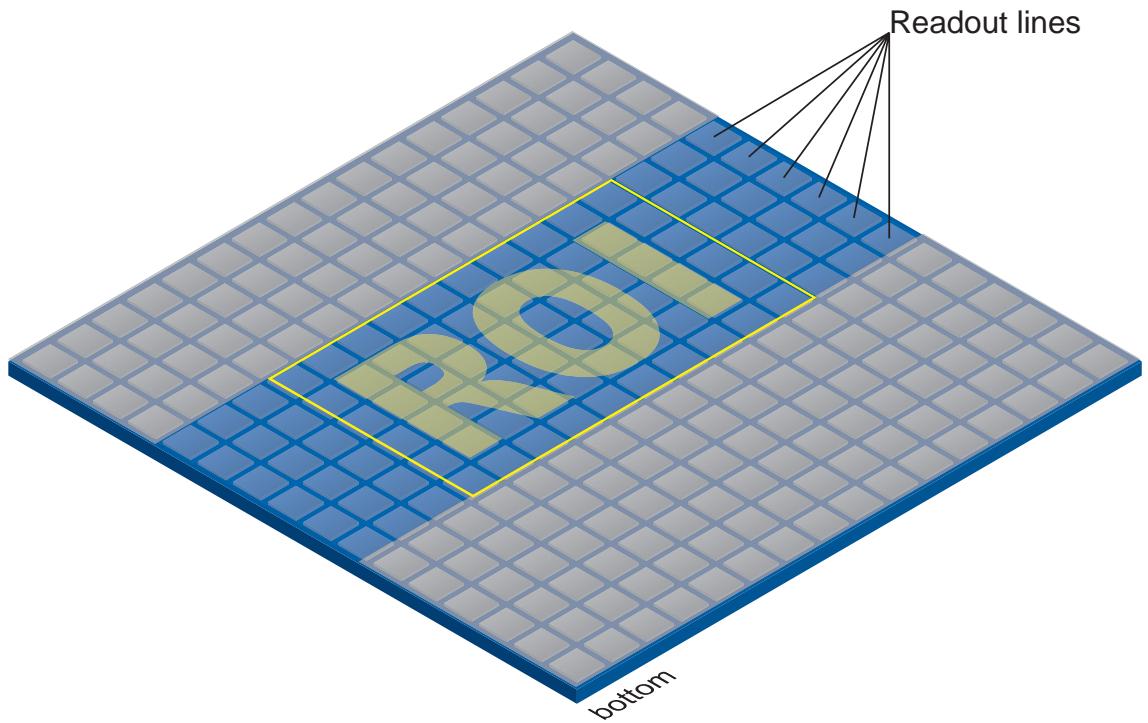
General Information - Binning (BinningHorizontal / BinningVertical)

On digital cameras, you can find several operations for progressing sensitivity. One of them is the so-called *Binning*. It clusters the charge carriers of neighboring pixels. This method implicates higher sensitivity and reduced resolution. Higher sensitivity allows for shorter exposure times.

Baumer cameras support three *Binning* types - vertical, horizontal and bidirectional.

In unidirectional *Binning*, vertically or horizontally neighboring pixels are clustered and reported to the software as a single "superpixel".

Bidirectional *Binning* clusters, a square of neighboring pixels.

INFO

Deviations in brightness after *Binning* can be corrected with function *Brightness Correction*.

Monochrome Binning

without

Full frame image, no binning of pixels.
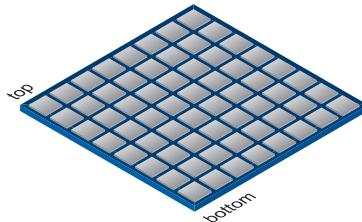
1x2

Vertical binning would produce a vertically compressed image with twice the brightness.
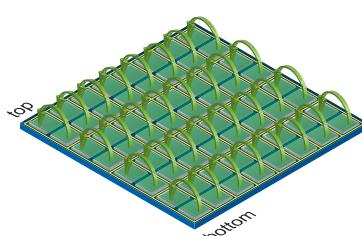
2x1

Horizontal binning would produce a horizontally compressed image with twice the brightness.
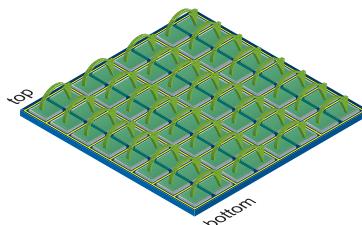
2x2

Bidirectional binning would produce both a horizontally and vertically compressed image with four times the brightness.
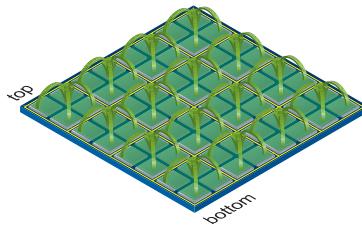
Color Binning

Color Binning is processed by the camera (no higher frame rates) – The sensor does not support this binning option.

Color calculated pixel formats

Pixels which are not in RAW format (e.g. *RGB8*), the three calculated color values (R, G, B) of a pixel will be added those of the related neighbor pixel during binning.

Binning	Illustration
without	
1x2	
2x1	
2x2	
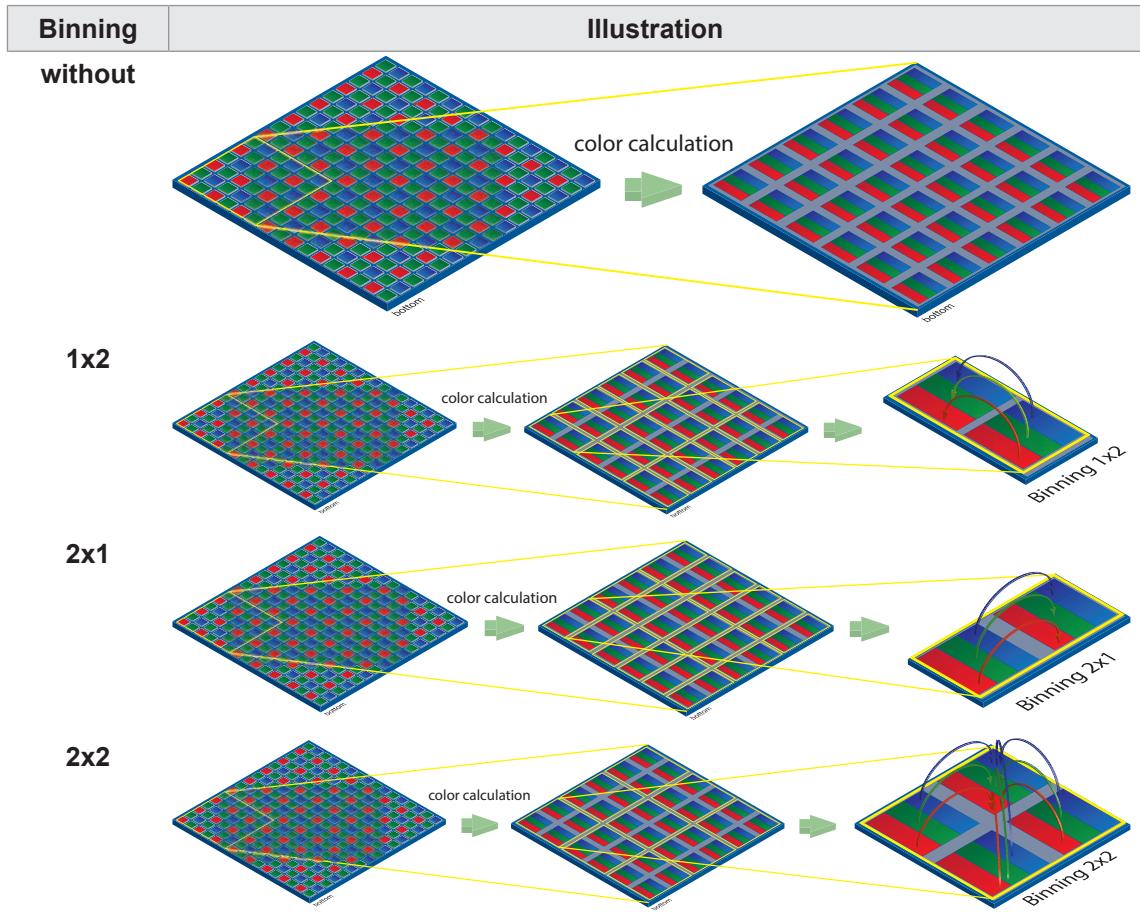
RAW pixel formats

RAW pixel formats (e.g. *BayerRG8*) cluster the color values of neighboring pixels of the same color.

Binning	Illustration
without	
1x2	
2x1	
2x2	
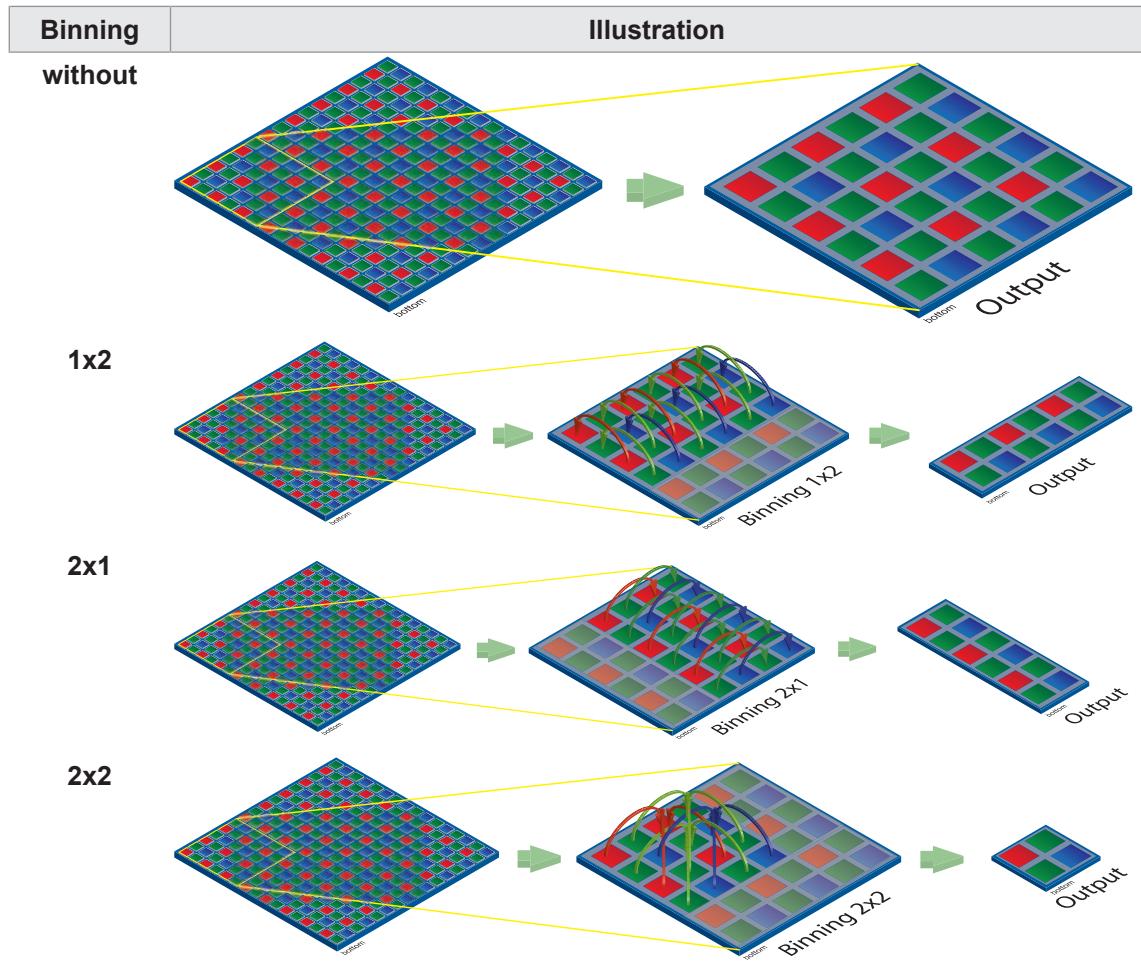
11.12.1   BinningHorizontal

Number of horizontal photo-sensitive cells to combine together. This increases the intensity (or signal to noise ratio) of the pixels and reduces the horizontal resolution (width) of the image.

Name	BinningHorizontal
Category	ImageFormatControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	see table(s) below (Increment: 1)

VCXG.2 / VCXG.2.XC / VCXG.2.I

INFO

With VCXG.2-15M, *Binning* is calculated in the sensor. In contrast to *Binning* in the FPGA, sensor *Binning* allows for higher frame rates.

Camera type	BinningSelector [Region0]	BinningSelector [Sensor]
Monochrom		
VCXG.2-13M	1 ... 2	1 ... 1
VCXG.2-15M	1 ... 2	1 ... 2*
VCXG.2-25M	1 ... 2	1 ... 1
VCXG.2-32M / .I	1 ... 2	1 ... 1
VCXG.2-51M / .XC / .I	1 ... 2	1 ... 1
VCXG.2-51MP	1 ... 2	1 ... 1
VCXG.2-57M / .I	1 ... 2	1 ... 1
VCXG.2-65M.R	1 ... 2	1 ... 1
VCXG.2-82M / .I	1 ... 2	1 ... 2
VCXG.2-124M	1 ... 2	1 ... 1
VCXG.2-127M / .I	1 ... 2	1 ... 2
VCXG.2-201M.R / .I	1 ... 2	1 ... 1
VCXG.2-204M	1 ... 2	1 ... 2
VCXG.2-241M / .XC / .I	1 ... 2	1 ... 2
Color		
VCXG.2-13C	1 ... 2	1 ... 1
VCXG.2-15C	1 ... 2	1 ... 1
VCXG.2-25C	1 ... 2	1 ... 1
VCXG.2-32C / .I	1 ... 2	1 ... 1
VCXG.2-51C / .I	1 ... 2	1 ... 1
VCXG.2-57C / .I	1 ... 2	1 ... 1
VCXG.2-65C.R	1 ... 2	1 ... 1
VCXG.2-82C / .I	1 ... 2	1 ... 1
VCXG.2-124C	1 ... 2	1 ... 1
VCXG.2-127C / .I	1 ... 2	1 ... 1
VCXG.2-201C.R / .I	1 ... 2	1 ... 1
VCXG.2-204C	1 ... 2	1 ... 1
VCXG.2-241C / .I	1 ... 2	1 ... 1

*) *BinningVertical* is also set to 2

VCXU.2

INFO

With VCXU.2-15M, VCXU.2-123M binning *Binning* is calculated in the sensor. In contrast to *Binning* in the FPGA, sensor *Binning* enables higher frame rates.

Camera type	BinningSelector [Region0]	BinningSelector [Sensor]
Monochrom		
VCXU.2-13M	1 ... 2	1 ... 1
VCXU.2-15M	1 ... 2	1 ... 2*
VCXU.2-31M	1 ... 2	1 ... 1
VCXU.2-32M	1 ... 2	1 ... 1
VCXU.2-50M	1 ... 2	1 ... 1
VCXU.2-50MP	1 ... 2	1 ... 1
VCXU.2-51M	1 ... 2	1 ... 1
VCXU.2-57M	1 ... 2	1 ... 1
VCXU.2-65M.R	1 ... 2	1 ... 1
VCXU.2-123M	1 ... 2	1 ... 2*
VCXU.2-127M	1 ... 2	1 ... 2
VCXU.2-201M.R	1 ... 2	1 ... 1
VCXU.2-241M	1 ... 2	1 ... 2
Color		
VCXU.2-13C	1 ... 2	1 ... 1
VCXU.2-15C	1 ... 2	1 ... 1
VCXU.2-31C	1 ... 2	1 ... 1
VCXU.2-32C	1 ... 2	1 ... 1
VCXU.2-50C	1 ... 2	1 ... 1
VCXU.2-51C	1 ... 2	1 ... 1
VCXU.2-57C	1 ... 2	1 ... 1
VCXU.2-65C.R	1 ... 2	1 ... 1
VCXU.2-123C	1 ... 2	1 ... 1
VCXU.2-127C	1 ... 2	1 ... 1
VCXU.2-201C.R	1 ... 2	1 ... 1
VCXU.2-241C	1 ... 2	1 ... 1

*) *BinningVertical* is also set to 2

11.12.2 BinningHorizontalMode

Sets the mode to use to combine horizontal pixel together when *BinningHorizontal* is used.

Name	BinningHorizontalMode	
Category	ImageFormatControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Average	The response from the combined cells will be averaged, resulting in increased signal/noise ratio.
	Sum	The response from the combined cells will be added, resulting in increased sensitivity.

11.12.3 BinningSelector

Selects which binning engine is controlled by the *BinningHorizontal* and *BinningVertical* features.

Name	BinningSelector
Category	ImageFormatControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

Values	Description
Region0	The *Binning* is calculated in the FPGA.
Sensor	*Binning* is calculated in the sensor (only monochrome).

11.12.4 BinningVertical

Number of vertical photo-sensitive cells to combine together. This increases the intensity (or signal to noise ratio) of the pixels and reduces the vertical resolution (height) of the image.

Name	BinningVertical
Category	ImageFormatControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	see table(s) below (Increment: 1)

VCXG.2 / VCXG.2.XC / VCXG.2.I

INFO

With VCXG.2-15M,*Binning* is calculated in the sensor. In contrast to *Binning* in the FPGA, sensor *Binning* allows for higher frame rates.

Camera type	BinningSelector [Region0]	BinningSelector [Sensor]
Monochrom		
VCXG.2-13M	1 ... 2	1 ... 1
VCXG.2-15M	1 ... 2	1 ... 2*
VCXG.2-25M	1 ... 2	1 ... 1
VCXG.2-32M / .I	1 ... 2	1 ... 1
VCXG.2-51M / .XC / .I	1 ... 2	1 ... 1
VCXG.2-51MP	1 ... 2	1 ... 1
VCXG.2-57M / .I	1 ... 2	1 ... 1
VCXG.2-65M.R	1 ... 2	1 ... 1
VCXG.2-82M / .I	1 ... 2	1 ... 2
VCXG.2-124M	1 ... 2	1 ... 1
VCXG.2-127M / .I	1 ... 2	1 ... 2
VCXG.2-201M.R / .I	1 ... 2	1 ... 1
VCXG.2-204M	1 ... 2	1 ... 2
VCXG.2-241M / .XC / .I	1 ... 2	1 ... 2
Color		
VCXG.2-13C	1 ... 2	1 ... 1
VCXG.2-15C	1 ... 2	1 ... 1
VCXG.2-25C	1 ... 2	1 ... 1
VCXG.2-32C / .I	1 ... 2	1 ... 1
VCXG.2-51C / .I	1 ... 2	1 ... 1
VCXG.2-57C / .I	1 ... 2	1 ... 1
VCXG.2-65C.R	1 ... 2	1 ... 1
VCXG.2-82C / .I	1 ... 2	1 ... 1
VCXG.2-124C	1 ... 2	1 ... 1
VCXG.2-127C / .I	1 ... 2	1 ... 1
VCXG.2-201C.R / .I	1 ... 2	1 ... 1
VCXG.2-204C	1 ... 2	1 ... 1
VCXG.2-241C / .I	1 ... 2	1 ... 1

[*] *BinningHorizontal* is also set to 2

VCXU.2

INFO

With VCXU.2-15M, VCXU.2-123M binning *Binning* is calculated in the sensor. In contrast to *Binning* in the FPGA, sensor *Binning* enables higher frame rates.

Camera type	BinningSelector [Region0]	BinningSelector [Sensor]
Monochrom		
VCXU.2-13M	1 ... 2	1 ... 1
VCXU.2-15M	1 ... 2	1 ... 2*
VCXU.2-31M	1 ... 2	1 ... 1
VCXU.2-32M	1 ... 2	1 ... 1
VCXU.2-50M	1 ... 2	1 ... 1
VCXU.2-50MP	1 ... 2	1 ... 1
VCXU.2-51M	1 ... 2	1 ... 1
VCXU.2-57M	1 ... 2	1 ... 1
VCXU.2-65M.R	1 ... 2	1 ... 1
VCXU.2-123M	1 ... 2	1 ... 2*
VCXU.2-127M	1 ... 2	1 ... 2
VCXU.2-201M.R	1 ... 2	1 ... 1
VCXU.2-241M	1 ... 2	1 ... 2
Color		
VCXU.2-13C	1 ... 2	1 ... 1
VCXU.2-15C	1 ... 2	1 ... 1
VCXU.2-31C	1 ... 2	1 ... 1
VCXU.2-32C	1 ... 2	1 ... 1
VCXU.2-50C	1 ... 2	1 ... 1
VCXU.2-51C	1 ... 2	1 ... 1
VCXU.2-57C	1 ... 2	1 ... 1
VCXU.2-65C.R	1 ... 2	1 ... 1
VCXU.2-123C	1 ... 2	1 ... 1
VCXU.2-127C	1 ... 2	1 ... 1
VCXU.2-201C.R	1 ... 2	1 ... 1
VCXU.2-241C	1 ... 2	1 ... 1

*) *BinningHorizontal* is also set to 2

11.12.5   BinningVerticalMode

Sets the mode used to combine vertical pixels when *BinningVertical* is used.

Name	BinningVerticalMode	
Category	ImageFormatControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Average	The response from the combined cells will be averaged, resulting in increased signal/noise ratio.
	Sum	The response from the combined cells will be added, resulting in increased sensitivity.

11.12.6   Category: ImageFormatControl → CalibrationControl (MP cameras only)

Category comprising the polarization control features.

General information - Polarization

Polarization is used to reduce or eliminate unwanted reflections from surfaces such as water, glass or metal. Polarization filters make incident light oscillate in a specific direction of polarization.

The Baumer polarization camera features a metal grid-coated sensor to filter the polarization information onto a 2 x 2 pixel field (0°, 45°, 90° and 135°).

The polarization information is calculated by intensity divergence. This eliminates the need for an extra polarization filter.

The camera provides the raw polarization information. Calculation is done in *Baumer GAPI SDK*.
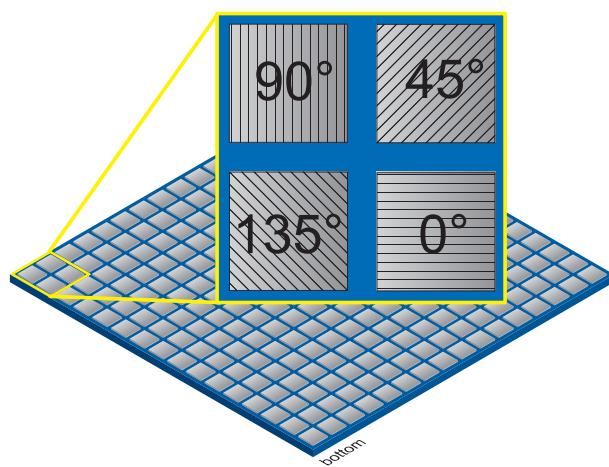
Ill. 6: Polarization filter on the 2 x 2 pixel field

Depending on the variant, the following data can be calculated by *Baumer GAPI SDK* :

Baumer GAPI v2.9	Baumer GAPI v2.10	Baumer GAPI v2.11	Baumer GAPI v2.12
ADOLP	ADOLP	ADOLP	ADOLP
AOP	AOP	AOP	AOP

Baumer GAPI v2.9	Baumer GAPI v2.10	Baumer GAPI v2.11	Baumer GAPI v2.12
DOLP	DOLP	DOLP	DOLP
Intensity	Intensity	Intensity	Intensity
	POL0	POL0	POL0
	POL45	POL45	POL45
	POL90	POL90	POL90
	POL135	POL135	POL135
	POLMIN	POLMIN	POLMIN
	POLMAX	POLMAX	POLMAX
			POL
			UNPOL

Description of the computable data:

Data	Description
ADOLP	*ADOLP (Azimuthally Dependent Ordinary Linear Polarization)* shows both *AOP* and *DOLP* at the same time in false colors.
AOP	AOP *(Angle of Polarization)* is the angle of maximum polarization. The image represents the angle in different degrees of brightness.
DOLP	*DOLP (Degree of Linear Polarization)* is the linear polarization degree of total incident light throughout the 2 x 2 pixel field. The brighter the image areas, the higher the amount of linear polarization.
Intensity	Here, after having offset the brightness values of all four pixels against each other, they are output as image.
POL0	The brightness information by *Pixel 0°* is output as image. The image is scaled to the original resolution.
POL45	The brightness information by *Pixel 45°* is output as image. The image is scaled to the original resolution.
POL90	The brightness information by *Pixel 90°* is output as image. The image is scaled to the original resolution.
POL135	The brightness information by *Pixel 135°* is output as image. The image is scaled to the original resolution.
POLMIN	The output image is the brightness information of the pixel with least polarization out of the 2 x 2 pixel field. The image is scaled to the original resolution.
POLMAX	The output image is the brightness information of the pixel with maximum polarization out of the 2 x 2 pixel field. The image is scaled to the original resolution.
POL	*POL (Polarized)* indicates the total amount of polarized light. The brighter the image area, the higher the amount of polarized light.
UNPOL	*UNPOL (Unpolarised)* indicates the amount of non-polarized light. The brighter the image area, the higher the amount of non-polarized light.

11.12.6.1 CalibrationAngleOfPolarizationOffset

Adds a calibration offset to compensate for an individual "roll" angle of the camera, introduced by mounting tolerances. The offset is added to all type of output data that incorporates an angle, like false color representation and angle of polarization data. The offset is without effect to raw data and to degree of linear polarization data.

Name	CalibrationAngleOfPolarizationOffset
Category	ImageFormatControl → CalibrationControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	-180 ... 179.9 (Increment: 0.1)

11.12.6.2 CalibrationEnable

Activates the calibration of the four polarized light channels by applying matrix calculations and an angle offset.

Name	CalibrationEnable
Category	ImageFormatControl → CalibrationControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.12.6.3 CalibrationMatrixValue

Represents the value of the selected gain factor inside the calibration matrix.

Name	CalibrationMatrixValue
Category	ImageFormatControl → CalibrationControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	-8 ... 7.9999999627470970154 (Increment: 0.00001)

11.12.6.4   CalibrationMatrixValueSelector

Selects the gain factor of the calibration matrix.

Name	CalibrationMatrixValueSelector	
Category	ImageFormatControl → CalibrationControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Gain	Gain00 ... Gain23

11.12.7   ComponentEnable (MP cameras only)

Controls, if streaming of the component selected by feature ComponentSelector is active.

Name	ComponentEnable
Category	ImageFormatControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.12.8   ComponentSelector (MP cameras only)

Selects, which data acquisition component to use.

Name	ComponentSelctor	
Category	ImageFormatControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	PolarizedRaw	Acquisition of polarized light intensity. The polarizing filters are arranged in a 2-by-2 pattern: 135° and 0° on even lines, 90° and 45° on odd lines. The raw data is unprocessed.

11.12.9   **Height**

Height of the image provided by the device (in pixels). The selected value changes with the change of *Binning*.

INFO

The sum of *OffsetY* and *Height* must be smaller or equal than *HeightMax*.
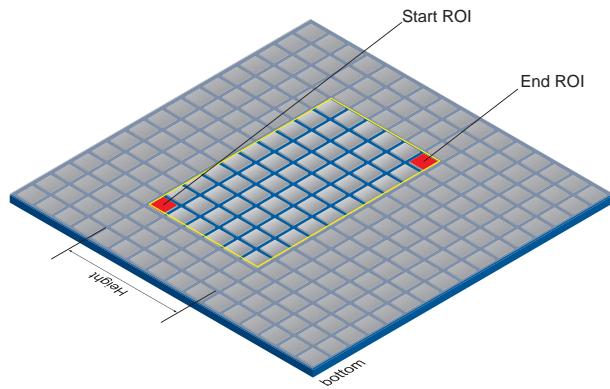
Name	Height
Category	ImageFormatControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.XC / VCXG.2.I

Camera type	Values [Pixel]
Monochrom	
VCXG.2-13M	1 ... 1024 (Increment: 1)
VCXG.2-15M	1 ... 1080 (Increment: 1)
VCXG.2-25M	1 ... 1200 (Increment: 1)
VCXG.2-32M / .I	1 ... 1536 (Increment: 1)
VCXG.2-51M / .XC / .I	1 ... 2048 (Increment: 1)
VCXG.2-51MP	1 ... 2048 (Increment: 1)
VCXG.2-57M / .I	1 ... 2048 (Increment: 1)
VCXG.2-65M.R	2 ... 2048 (Increment: 2)
VCXG.2-82M / .I	1 ... 2832 (Increment: 1)
VCXG.2-124M	1 ... 3000 (Increment: 1)
VCXG.2-127M / .I	1 ... 2992 (Increment: 1)
VCXG.2-201M.R / .I	2 ... 3648 (Increment: 2)
VCXG.2-204M	1 ... 4496 (Increment: 1)
VCXG.2-241M / .XC / .I	1 ... 4592 (Increment: 1)
Color	
VCXG.2-13C	2 ... 1024 (Increment: 2)
VCXG.2-15C	2 ... 1080 (Increment: 2)

Camera type	Values [Pixel]
VCXG.2-25C	2 ... 1200 (Increment: 2)
VCXG.2-32C / .I	2 ... 1536 (Increment: 2)
VCXG.2-51C / .I	2 ... 2048 (Increment: 2)
VCXG.2-57C / .I	2 ... 2048 (Increment: 2)
VCXG.2-65C.R	4 ... 2048 (Increment: 4)
VCXG.2-82C / .I	2 ... 4832 (Increment: 2)
VCXG.2-124C	4 ... 3000 (Increment: 2)
VCXG.2-127C / .I	2 ... 2992 (Increment: 2)
VCXG.2-201C.R / .I	4 ... 3648 (Increment: 4)
VCXG.2-204C	2 ... 4496 (Increment: 2)
VCXG.2-241C / .I	2 ... 4592 (Increment: 2)

VCXU.2

Camera type	Values [Pixel]
Monochrom	
VCXU.2-13M	1 ... 1024 (Increment: 1)
VCXU.2-15M	1 ... 1080 (Increment: 1)
VCXU.2-31M	1 … 1536 (Increment: 1)
VCXU.2-32M	1 … 1536 (Increment: 1)
VCXU.2-50M	1 … 2048 (Increment: 1)
VCXU.2-50MP	1 … 2048 (Increment: 1)
VCXU.2-51M	1 … 2048 (Increment: 1)
VCXU.2-57M	1 ... 2048 (Increment: 1)
VCXU.2-65M.R	2 ... 2048 (Increment: 2)
VCXU.2-123M	1 … 3000 (Increment: 1)
VCXU.2-127M	1 ... 2992 (Increment: 1)
VCXU.2-201M.R	2 ... 3648 (Increment: 2)
VCXU.2-241M	2 ... 4592 (Increment: 2)
Color	
VCXU.2-13C	2 ... 1024 (Increment: 2)
VCXU.2-15C	2 ... 1080 (Increment: 2)
VCXU.2-31C	2 … 1536 (Increment: 2)
VCXU.2-32C	2 … 1536 (Increment: 2)
VCXU.2-50C	2 … 2048 (Increment: 2)
VCXU.2-51C	2 … 2048 (Increment: 2)
VCXU.2-57C	2 ... 2048 (Increment: 2)
VCXU.2-65C.R	4 ... 2048 (Increment: 4)
VCXU.2-123C	2 … 3000 (Increment: 2)
VCXU.2-127C	2 ... 2992 (Increment: 2)
VCXU.2-201C.R	4 ... 3648 (Increment: 4)

Camera type	Values [Pixel]
VCXU.2-241C	2 ... 4592 (Increment: 2)

11.12.10   HeightMax

Maximum height of the image (in pixels). This dimension is calculated after *Vertical Binning*, *Decimation* or any other function changing the vertical dimension of the image.

Name	HeightMax
Category	ImageFormatControl
Interface	IInteger
Access	Read only
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.XC / VCXG.2.I

Camera type	Values [Pixel]
Monochrom	
VCXG.2-13M	1024
VCXG.2-15M	1080
VCXG.2-25M	1200
VCXG.2-32M / .I	1536
VCXG.2-51M / .XC / .I	2048
VCXG.2-51MP	2048
VCXG.2-57M / .I	2048
VCXG.2-65M.R	2048
VCXG.2-82M / .I	2832
VCXG.2-124M	3000
VCXG.2-127M / .I	2992
VCXG.2-201M.R / .I	3648
VCXG.2-204M	4496
VCXG.2-241M / .XC / .I	4592
Color	
VCXG.2-13C	1024
VCXG.2-15C	1080
VCXG.2-25C	1200
VCXG.2-32C / .I	1536
VCXG.2-51C / .I	2048
VCXG.2-57C / .I	2048
VCXG.2-65C.R	2048
VCXG.2-82C / .I	4832
VCXG.2-124C	3000
VCXG.2-127C / .I	2992

Camera type	Values [Pixel]
VCXG.2-201C.R / .I	3648
VCXG.2-204C	4496
VCXG.2-241C / .I	4592

VCXU.2

Camera type	Values [Pixel]
Monochrom	
VCXU.2-13M	1024
VCXU.2-15M	1080
VCXU.2-31M	1536
VCXU.2-32M	1536
VCXU.2-50M	2048
VCXU.2-50MP	2048
VCXU.2-51M	2048
VCXU.2-57M	2048
VCXU.2-65M.R	2048
VCXU.2-123M	3000
VCXU.2-127M	2992
VCXU.2-201M.R	3648
VCXU.2-241M	4592
Color	
VCXU.2-13C	1024
VCXU.2-15C	1080
VCXU.2-31C	1536
VCXU.2-32C	1536
VCXU.2-50C	2048
VCXU.2-51C	2048
VCXU.2-57C	2048
VCXU.2-65C.R	2048
VCXU.2-123C	3000
VCXU.2-127C	2992
VCXU.2-201C.R	3648
VCXU.2-241C	4592

11.12.11   **OffsetX**

Horizontal offset from the origin to the region of interest (in pixels).

💡 **INFO**

The sum of *OffsetX* and *Width* must be smaller or equal than *WidthMax*.
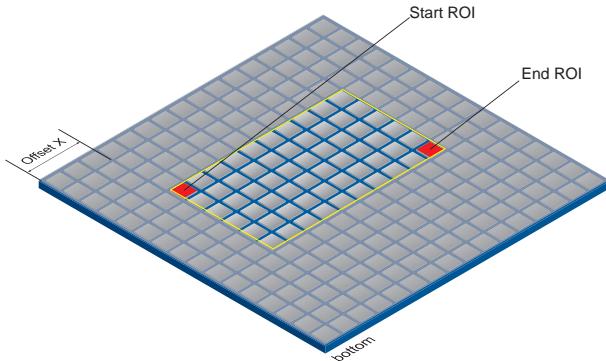
Name	OffsetX
Category	ImageFormatControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 … depends on *Width*

11.12.12   **OffsetY**

Vertical offset from the origin to the region of interest (in pixels).

💡 **INFO**

The sum of *OffsetY* and *Height* must be smaller or equal than *HeightMax*.
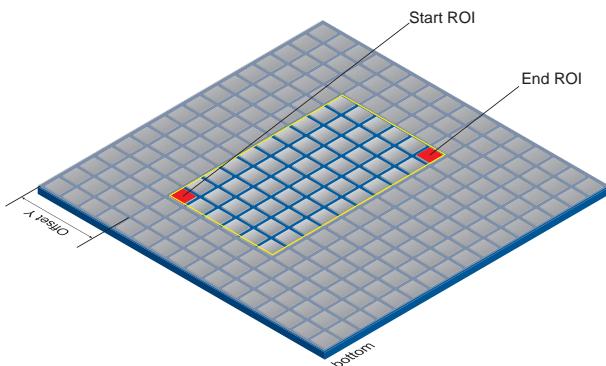
Name	OffsetY
Category	ImageFormatControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 … depends on *Height*

11.12.13 PixelFormat

PixelFormat - General Information

Format of the pixels provided by the device. It represents all the information provided by Pixel-Coding, PixelSize, PixelColorFilter combined in a single feature.

RAW Raw data format. Here the data stored without processing.

Bayer Raw data format of color sensors. Color filters are placed on these sensors in a checkerboard pattern, generally in a 50 % green, 25 % red and 25 % blue array.
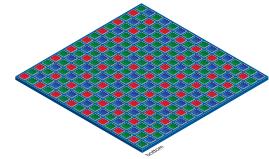
Mono Monochrome. The color range of monochrome images consists of shades of a single color. Shades of gray as well as black and white are generally considered synonyms for monochrome.

RGB Color model, in which all detectable colors are defined by three coordinates. Red, Green and Blue.

The buffer provides the three coordinates in sequence R, G, B.
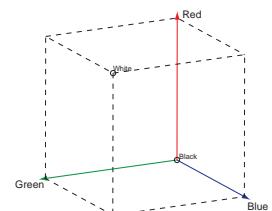
BGR At BGR the camera interface is mapping in the transmission sequence of the color channels from RGB to BGR.

This may save processing effort to the computer, since this data can be processed by the graphic card without conversion.

Pixel depth - General Information

In general, pixel depth defines the number of possible different values for each color channel. Typically 8 bits, which means 2^8 different "colors".

For RGB or BGR these 8 bits per channel equal 24 bits overall.

Transmission of more than 8 bits per pixel requires two bytes - even if data do not completely fill the second byte. To save bandwidth, the Baumer cameras support packed formats. These formats fill any non-used bits of a pixel with the data of the following pixel.

8 bit Bit string of 8 bits and RGB 8 bits
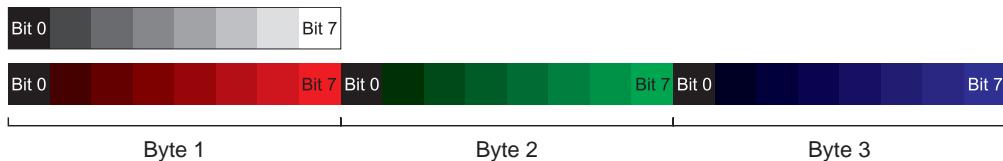
10 bit Spreading 10 bits over 2 bytes.
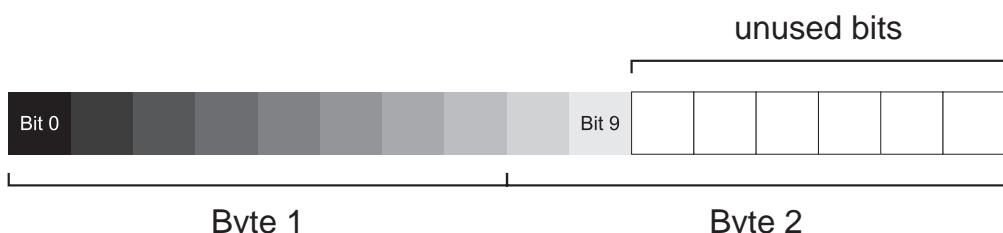
12 bit   Spreading 12 bits over two bytes.

unused bits

| Bit 0 | | | | | | | | | | | Bit 11 | | | | |

Byte 1   Byte 2
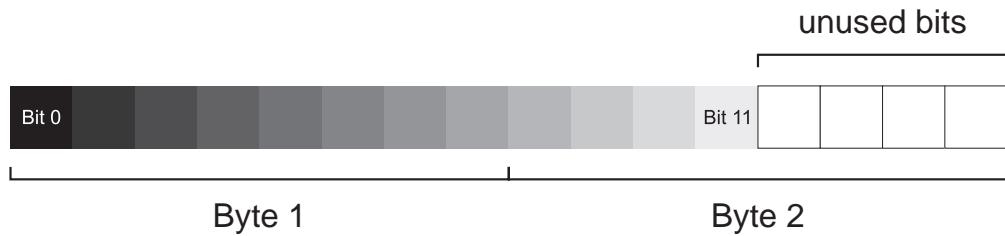
12 bit (Packed)   Spreading two pixels in 12 bits over three bytes (packed mode).

Pixel 0   Pixel 1

| Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 | Bit 9 | Bit 10 | Bit 11 | Bit 0 | Bit 1 | Bit 2 | Bit 3 | Bit 0 | Bit 1 | Bit 2 | Bit 3 | Bit 4 | Bit 5 | Bit 6 | Bit 7 | Bit 8 | Bit 9 | Bit 10 | Bit 11 |

Byte 1   Byte 2   Byte 3
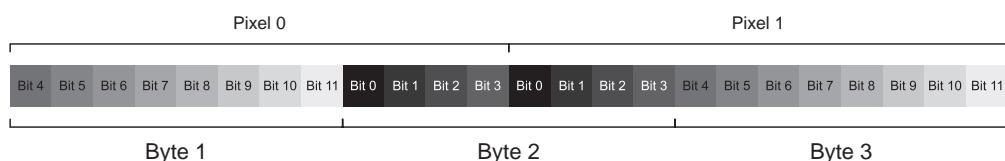
INFO

The camera must be stopped before this feature can be edited.

Name	PixelFormat
Category	ImageFormatControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.XC / VCXG.2.I

Camera type	Mono8	Mono10	Mono12	Mono12p	Bayer RG8	Bayer RG10	Bayer RG12	Bayer G12p	RGB8	BGR8
Monochrome										
VCXG.2-13M	■	■	□	□	□	□	□	□	□	□
VCXG.2-15M	■	■	■	■	□	□	□	□	□	□
VCXG.2-25M	■	■	□	□	□	□	□	□	□	□
VCXG.2-32M / .I	■	■	■	■	□	□	□	□	□	□
VCXG.2-51M / .XC / .I	■	■	■	■	□	□	□	□	□	□
VCXG.2-51MP	■	■	■	■	□	□	□	□	□	□
VCXG.2-57M / .I	■	■	■	■	□	□	□	□	□	□
VCXG.2-65M.R	■	■	■	■	□	□	□	□	□	□
VCXG.2-82M / .I	■	■	□	□	□	□	□	□	□	□
VCXG.2-124M	■	■	■	■	□	□	□	□	□	□
VCXG.2-127M / .I	■	■	■	■	□	□	□	□	□	□
VCXG.2-201M.R / .I	■	■	■	■	□	□	□	□	□	□
VCXG.2-204M	■	■	■	■	□	□	□	□	□	□

Camera type	Mono8	Mono10	Mono12	Mono12p	Bayer RG8	Bayer RG10	Bayer RG12	Bayer G12p	RGB8	BGR8
VCXG.2-241M / .XC / .I	■	■	■	■	□	□	□	□	□	□
Color										
VCXG.2-13C	■	■	□	□	■	■	□	□	■	■
VCXG.2-15C	■	■	■	■	■	■	■	■	■	■
VCXG.2-25C	■	■	□	□	■	■	□	□	■	■
VCXG.2-32C / .I	■	■	■	■	■	■	■	■	■	■
VCXG.2-51C / .I	■	■	■	■	■	■	■	■	■	■
VCXG.2-57C / .I	■	■	■	■	■	■	■	■	■	■
VCXG.2-65C.R	■	■	■	■	■	■	■	■	■	■
VCXG.2-82C / .I	■	■	■	■	■	■	■	■	■	■
VCXG.2-124C	■	■	■	■	■	■	■	■	■	■
VCXG.2-127C / .I	■	■	■	■	■	■	■	■	■	■
VCXG.2-201C.R / .I	■	■	■	■	■	■	■	■	■	■
VCXG.2-204C	■	■	■	■	■	■	■	■	■	■
VCXG.2-241C / .I	■	■	■	■	■	■	■	■	■	■

VCXU.2

Camera type	Mono8	Mono10	Mono12	Mono12p	Bayer RG8	Bayer RG10	Bayer RG12	Bayer G12p	RGB8	BGR8
Monochrome										
VCXU.2-13M	■	■	□	□	□	□	□	□	□	□
VCXU.2-15M	■	■	■	■	□	□	□	□	□	□
VCXU.2-31M	■	■	■	■	□	□	□	□	□	□
VCXU.2-32M	■	■	■	■	□	□	□	□	□	□
VCXU.2-50M	■	■	■	■	□	□	□	□	□	□
VCXU.2-50MP	■	■	■	■	□	□	□	□	□	□
VCXU.2-51M	■	■	■	■	□	□	□	□	□	□
VCXU.2-57M	■	■	■	■	□	□	□	□	□	□
VCXU.2-65M.R	■	■	■	■	□	□	□	□	□	□
VCXU.2-123M	■	■	■	■	□	□	□	□	□	□
VCXU.2-127M	■	■	■	■	□	□	□	□	□	□
VCXU.2-201M.R	■	■	■	■	□	□	□	□	□	□
VCXU.2-241M	■	■	■	■	□	□	□	□	□	□
Color										
VCXU.2-13C	■	■	□	□	■	■	□	□	■	■

Camera type	Mono8	Mono10	Mono12	Mono12p	Bayer RG8	Bayer RG10	Bayer RG12	Bayer G12p	RGB8	BGR8
VCXU.2-15C	■	■	■	■	■	■	■	■	■	■
VCXU.2-31C	■	■	■	■	■	■	■	■	■	■
VCXU.2-32C	■	■	■	■	■	■	■	■	■	■
VCXU.2-50C	■	■	■	■	■	■	■	■	■	■
VCXU.2-51C	■	■	■	■	■	■	■	■	■	■
VCXU.2-57C	■	■	■	■	■	■	■	■	■	■
VCXU.2-65C.R	■	■	■	■	■	■	■	■	■	■
VCXU.2-123C	■	■	■	■	■	■	■	■	■	■
VCXU.2-127C	■	■	■	■	■	■	■	■	■	■
VCXU.2-201C.R	■	■	■	■	■	■	■	■	■	■
VCXU.2-241C	■	■	■	■	■	■	■	■	■	■

11.12.14   ReverseX (monochrome cameras/pixel formats only)

Flips the image in horizontal direction. *Region of Interest* is applied prior to flipping.

INFO
The camera must be stopped before this feature can be edited.

Name	ReverseX
Category	ImageFormatControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.12.15   ReverseY (monochrome cameras / pixel formats only)

Flips the image in vertical direction. *Region of Interest* is applied prior to flipping.

INFO
The camera must be stopped before this feature can be edited.

Name	ReverseY
Category	ImageFormatControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.12.16   SensorHeight

Effective height of the sensor in pixels.

Name	SensorHeight
Category	ImageFormatControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 65535 (Increment: 1)

11.12.17   SensorName

Product name of the imaging sensor.

Name	SensorName
Category	ImageFormatControl
Interface	IString
Access	Read only
Unit	-
Values	e.g. IMX264

11.12.18   SensorPixelHeight

Physical size (pitch) in the y direction of a photo sensitive pixel unit.

Name	SensorPixelHeight
Category	ImageFormatControl
Interface	IFloat
Access	Read only
Unit	µm
Values	0.000000 ... 255.000000 (Increment: 1)

11.12.19   SensorPixelWidth

Physical size (pitch) in the x direction of a photo sensitive pixel unit.

Name	SensorPixelWidth
Category	ImageFormatControl
Interface	IFloat
Access	Read only
Unit	µm
Values	0.000000 ... 255.000000 (Increment: 1)

11.12.20   SensorShutterMode

Sets the sensor shutter mode of the camera. The sensor shutter mode depends on the *Trigger-Mode*.

Name	SensorShutterMode
Category	ImageFormatControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	See table(s) below

INFO

Only for camera with rolling shutter sensors!

Observe the following for switching between *GlobalReset* and *Rolling* t:

  a) ExposureAuto = Off

  b) GainAuto = Off

Values	
GlobalReset	The shutter opens at the same time for all pixels but ends in a sequential manner. The pixels are exposed for different lengths of time.
Rolling	The shutter opens and closes sequentially for groups (typically lines) of pixels. All the pixels are exposed for the same length of time but not at the same time.
Global	The shutter opens and closes at the same time for all pixels. All the pixels are exposed for the same length of time at the same time.

Global Reset - General Information

Cameras with Rolling-Shutter sensor and enabled shutter mode *GlobalReset*, start all frame lines simultaneously at exposure, however the end of exposure is delayed by the offset in the previously read line. The exposure time for each line gradually lengthens. Data readout for each line begins immediately at line exposure. Readout time for each line is the same, but times of beginning and ending are staggered.

This shutter mode provides the benefit of reduced image artifacts that are typical for Rolling Shutter. However, since exposure covers the entire image, brightness may gradually increase from image top to bottom.

Trigger

$t_{TriggerDelay}$

Time

Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
Line 7

...

Line n-3
Line n-2
Line n-1
Line n

Shutter
Exposure
Readout
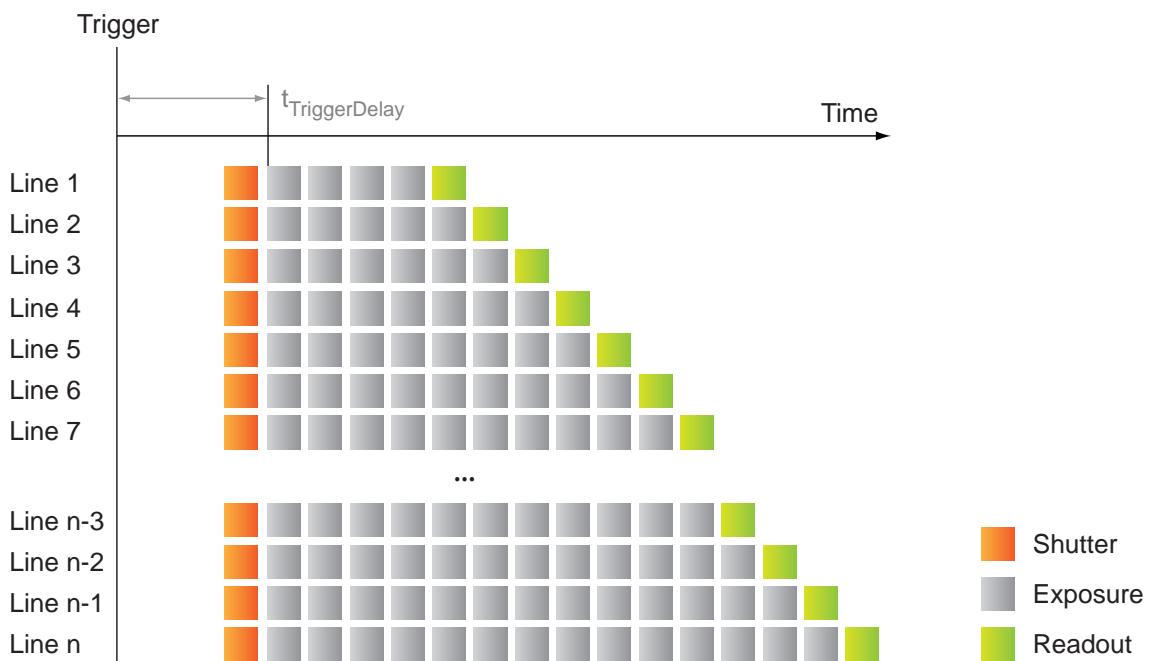
Rolling Shutter - General Information

INFO

Due to technical issues of *Rolling Shutter*, flash control related to *ExposureTime* does not make sense. Such cameras should be used in a continuously illuminated environment.

Cameras with Rolling Shutter sensor and enabled shutter mode *RollingShutter* start exposure at an offset which corresponds to the readout time of each frame line. Exposure time for each line is the same, but times of beginning and ending are staggered. Data readout for each line begins immediately at line exposure. Readout time for each line is the same, but times of beginning and ending are staggered.

Rolling Shutter provides the benefit of increased sensitivity. However, because exposure starts at different times throughout the frame, there are known artifacts such as skew, wobble, and partial exposure.

Trigger

$t_{TriggerDelay}$

Time

Line 1
Line 2
Line 3
Line 4
Line 5
Line 6
Line 7

...

Line n-3
Line n-2
Line n-1
Line n

Shutter
Exposure
Readout
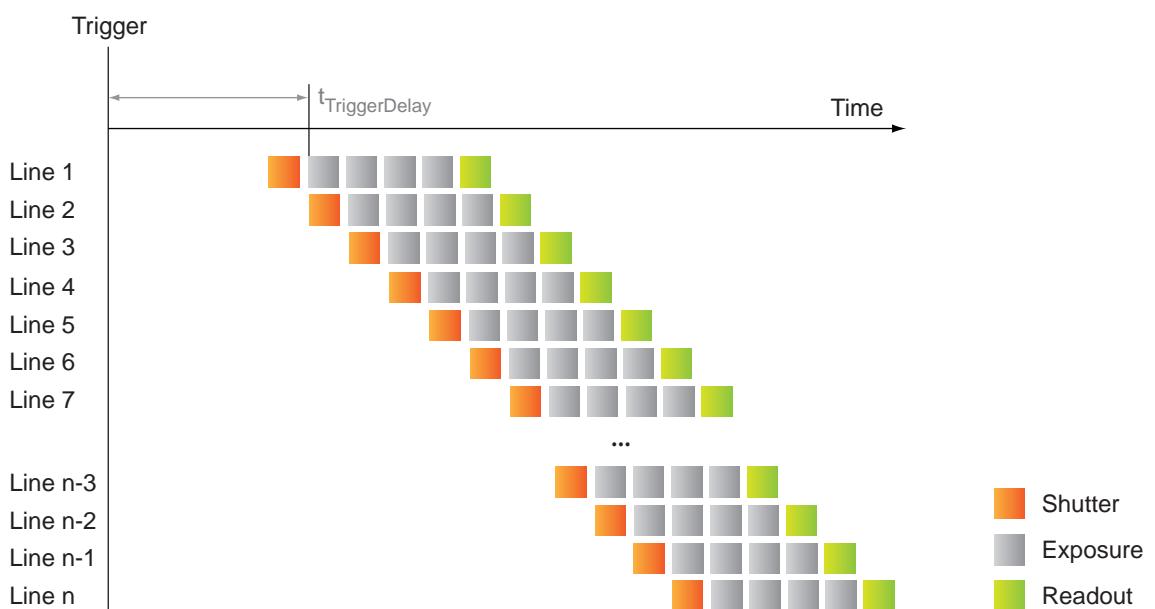
11.12.21   SensorWidth

Effective width of the sensor in pixels.

Name	SensorWidth
Category	ImageFormatControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 65535 (Increment: 1)

11.12.22   TestPattern

Selects the type of test pattern that is generated by the device as image source.

Name	TestPattern
Category	ImageFormatControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

GreyDiagonalRamp	Image is filled diagonally with an image that goes from the darkest possible value to the brightest.
GreyDiagonalRampHorizontalAndVerticalLineMoving	Image is filled diagonally with an image that goes from the darkest possible value to the brightest with moving horizontal and vertical lines.
GreyDiagonalRampHorizontalLineMoving	Image is filled diagonally with an image that goes from the darkest possible value to the brightest with moving horizontal lines.
GreyDiagonalRampVerticalLineMoving	Image is filled diagonally with an image that goes from the darkest possible value to the brightest with moving vertical lines.
GreyHorizontalRamp	Image is filled horizontally with an image that goes from the darkest possible value to the brightest.
GreyHorizontalRampHorizontalAndVerticalLineMoving	Image is filled horizontally with an image that goes from the darkest possible value to the brightest with moving horizontal and vertical lines.
GreyHorizontalRampHorizontalLineMoving	Image is filled horizontally with an image that goes from the darkest possible value to the brightest with moving horizontal lines.
GreyHorizontalRampVerticalLineMoving	Image is filled horizontally with an image that goes from the darkest possible value to the brightest with moving vertical lines.
GreyVerticalRamp	Image is filled vertically with an image that goes from the darkest possible value to the brightest.

GreyVerticalRampHorizontalAnd-VerticalLineMoving	Image is filled vertically with an image that goes from the darkest possible value to the brightest with moving horizontal and vertical lines.
GreyVerticalRampHorizon-talLineMoving	Image is filled vertically with an image that goes from the darkest possible value to the brightest with moving horizontal lines.
GreyVerticalRampVerticalLineMoving	Image is filled vertically with an image that goes from the darkest possible value to the brightest with moving vertical lines.
HorizontalAndVerticalLineMoving	Image is filled with moving horizontal and vertical lines.
HorizontalLineMoving	Image is filled with moving horizontal lines.
Off	Image is coming from the sensor.
VerticalLineMoving	Image is filled with moving vertical lines.

11.12.23   TestPatternGeneratorSelector

Selects which test pattern generator is controlled by function *TestPattern*.

Name	SensorShutterMode	
Category	ImageFormatControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	ImageProcessor	TestPattern function will control the image processor.
	SensorProcessor	TestPattern function will control the sensor processor.

11.12.24   Width

Width of the image provided by the device (in pixels).
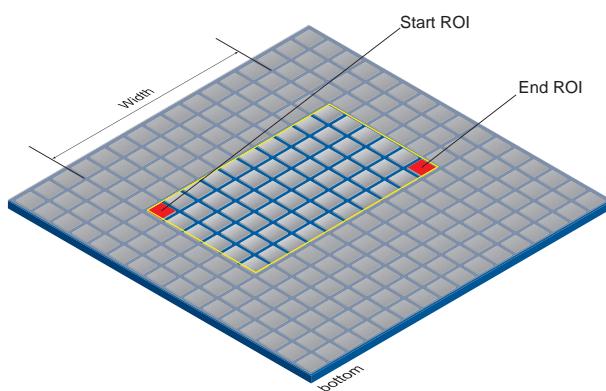
Name	Width
Category	ImageFormatControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.XC / VCXG.2.I

Camera type	Values [Pixel]
Monochrom	
VCXG.2-13M	24 ... 1280 (Increment: 8)
VCXG.2-15M	16 ... 1440 (Increment: 32)
VCXG.2-25M	48 ... 1920 (Increment: 16)
VCXG.2-32M / .I	16 ... 2048 (Increment: 16)
VCXG.2-51M / .XC / .I	16 ... 2448 (Increment: 16)
VCXG.2-51MP	16 ... 2448 (Increment: 16)
VCXG.2-57M / .I	16 ... 2464 (Increment: 16)
VCXG.2-65M.R	16 ... 3072 (Increment: 16)
VCXG.2-82M / .I	32 ... 2848 (Increment: 32)
VCXG.2-124M	16 ... 4096 (Increment: 16)
VCXG.2-127M / .I	32 ... 4096 (Increment: 32)
VCXG.2-201M.R / .I	32 ... 5472 (Increment: 32)
VCXG.2-204M	32 ... 4480 (Increment: 32)
VCXG.2-241M / .XC / .I	32 ... 5312 (Increment: 32)
Color	
VCXG.2-13C	24 ... 1280 (Increment: 8)
VCXG.2-15C	16 ... 1440 (Increment: 32)
VCXG.2-25C	48 ... 1920 (Increment: 16)
VCXG.2-32C / .I	16 ... 2048 (Increment: 16)
VCXG.2-51C / .I	16 ... 2448 (Increment: 16)
VCXG.2-57C / .I	16 ... 2464 (Increment: 16)
VCXG.2-65C.R	16 ... 3072 (Increment: 16)
VCXG.2-82C / .I	32 ... 2848 (Increment: 32)
VCXG.2-124C	16 ... 4096 (Increment: 16)
VCXG.2-127C / .I	32 ... 4096 (Increment: 32)
VCXG.2-201C.R / .I	32 ... 5472 (Increment: 32)
VCXG.2-204C	32 ... 4480 (Increment: 32)
VCXG.2-241C / .I	32 ... 5312 (Increment: 32)

VCXU.2

Camera type	Values [Pixel]
Monochrom	
VCXU.2-13M	32 ... 1280 (Increment: 16)
VCXU.2-15M	16 ... 1440 (Increment: 32)
VCXU.2-31M	16 ... 2048 (Increment: 16)
VCXU.2-32M	16 ... 2048 (Increment: 16)
VCXU.2-50M	16 ... 2448 (Increment: 16)
VCXU.2-50MP	16 ... 2448 (Increment: 16)

Camera type	Values [Pixel]
VCXU.2-51M	16 ... 2448 (Increment: 16)
VCXU.2-57M	16 ... 2464 (Increment: 16)
VCXU.2-65M.R	16 ... 3072 (Increment: 16)
VCXU.2-123M	16 ... 4096 (Increment: 16)
VCXU.2-127M	32 ... 4096 (Increment: 32)
VCXU.2-201M.R	16 ... 5472 (Increment: 16)
VCXU.2-241M	32 ... 5312 (Increment: 32)
Color	
VCXU.2-13C	32 ... 1280 (Increment: 16)
VCXU.2-15C	16 ... 1440 (Increment: 32)
VCXU.2-31C	16 ... 2048 (Increment: 16)
VCXU.2-32C	16 ... 2048 (Increment: 16)
VCXU.2-50C	16 ... 2448 (Increment: 16)
VCXU.2-51C	16 ... 2448 (Increment: 16)
VCXU.2-57C	16 ... 2464 (Increment: 16)
VCXU.2-65C.R	16 ... 3072 (Increment: 16)
VCXU.2-123C	16 ... 4096 (Increment: 16)
VCXU.2-127C	32 ... 4096 (Increment: 32)
VCXU.2-201C.R	16 ... 5472 (Increment: 16)
VCXU.2-241C	32 ... 5312 (Increment: 32)

11.12.25   WidthMax

Maximum width of the image (in pixels). Dimension is calculated after *Horizontal Binning*, *Decimation* or having executed any other function that would change the horizontal image dimension.

Name	WidthMax
Category	ImageFormatControl
Interface	IInteger
Access	Read only
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.XC / VCXG.2.I

Camera type	Values [Pixel]
Monochrom	
VCXG.2-13M	1280
VCXG.2-15M	1440
VCXG.2-25M	1920
VCXG.2-32M / .I	2048
VCXG.2-51M / .XC / .I	2448

Camera type	Values [Pixel]
VCXG.2-51MP	2448
VCXG.2-57M / .I	2464
VCXG.2-65M.R	3072
VCXG.2-82M / .I	2848
VCXG.2-124M	4096
VCXG.2-127M / .I	4096
VCXG.2-201M.R / .I	5472
VCXG.2-204M	4480
VCXG.2-241M / .XC / .I	5312
Color	
VCXG.2-13C	1280
VCXG.2-15C	1440
VCXG.2-25C	1920
VCXG.2-32C / .I	2048
VCXG.2-51C / .I	2448
VCXG.2-57C / .I	2464
VCXG.2-65C.R	3072
VCXG.2-82C / .I	2848
VCXG.2-124C	4096
VCXG.2-127C / .I	4096
VCXG.2-201C.R / .I	5472
VCXG.2-204C	4480
VCXG.2-241C / .I	5312

VCXU.2

Camera type	Values [Pixel]
Monochrom	
VCXU.2-13M	1280
VCXU.2-15M	1440
VCXU.2-31M	2048
VCXU.2-32M	2048
VCXU.2-50M	2448
VCXU.2-50MP	2448
VCXU.2-51M	2448
VCXU.2-57M	2464
VCXU.2-65M.R	3072
VCXU.2-123M	4096
VCXU.2-127M	4096
VCXU.2-201M.R	5472
VCXU.2-241M	5312

Camera type	Values [Pixel]
Color	
VCXU.2-13C	1280
VCXU.2-15C	1440
VCXU.2-31C	2048
VCXU.2-32C	2048
VCXU.2-50C	2448
VCXU.2-51C	2448
VCXU.2-57C	2464
VCXU.2-65C.R	3072
VCXU.2-123C	4096
VCXU.2-127C	4096
VCXU.2-201C.R	5472
VCXU.2-241C	5312

11.13   Category: LUTControl

Functions in this chapter describe the *Look-up table (LUT)* related functions. Particular parameters of the *LUT* functions are saved to the camera. This includes the coordinates of defective pixels so that they can be corrected.

Pixel Correction - General Information

There is a certain probability of abnormal pixels – so-called defect pixels – occurring within sensors from all manufacturers. The charge quantity of these pixels is not linearly dependent on the exposure time.

The occurrence of these defect pixels is unavoidable and intrinsic to the manufacturing and aging process of the sensors.

The operation of the camera is not affected by these pixels. They only appear as brighter (*hot pixel*) or darker (*cold pixel*) spots on the recorded image.
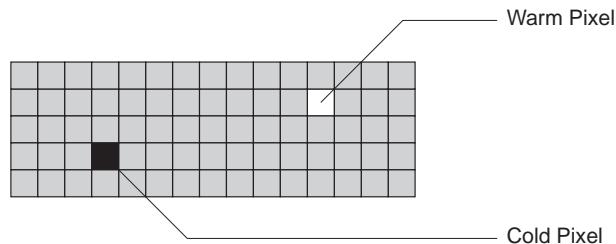
Charge quantity of "hot" and "cold" pixels compared with "normal" pixels:
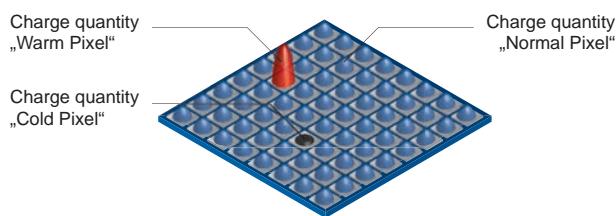
Correction Algorithm (Pixel Correction)

On Baumer cameras the problem of defect pixels is solved as follows:

- Possible defect pixels are identified during the production process of the camera.
- The coordinates of these pixels are stored in the factory settings of the camera.

Once the sensor readout is completed, correction takes place:

- Before any other processing, the values of the neighboring pixels on the left and the right side of the defect pixels, will be read out. (within the same bayer phase for color)
- Then the average value of these 2 pixels is determined to correct the first defect pixel
- Finally, the value of the defect pixel is corrected by using the previously corrected pixel and the pixel of the other side of the defect pixel.

Examples for the correction of defect pixels
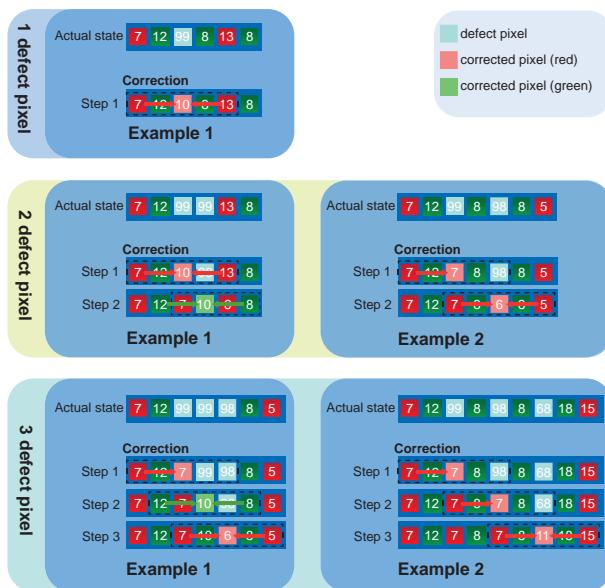
Add Defect Pixel to Defect Pixel List with Baumer Camera Explorer

INFO

The addition of defect pixels must be done in full frame (without *Binning* / *Width* / *Height* / *Off-setX* / *OffsetY*), in raw data format and without activated color calculation.

Instruction:

a) Start the *Camera Explorer*. Connect to the camera.

b) Select profile *GenICam Guru* (only *Camera Explorer* < v3.0).

c) Open the category *LUTControl*.

d) Locate an empty *DefectPixelListIndex.*
   (DefectPixelListEntryPosX = 0 | DefectPixelListEntryPosY = 0)

e) Determine the coordinates of the defect pixel. Keep the mouse pointer over the defect pixel. The coordinates of the faulty pixel are provided in the status bar. For your convenience, you can enlarge the image.

f) Enter the determined coordinates for X (*DefectPixelListEntryPosX*) and Y (*DefectPixelLis-tEntryPosY*).

g) Activate the registered *DefectPixelListIndex*.
   DefectPixelListEntryActive = True

h) Stop the camera and start them again to take over the updated coordinates.

Result:

✓ You have added a defective pixel to the defect pixel list.

11.13.1 DefectPixelCorrection

Enable the correction of defect pixels.

Name	DefectPixelCorrection
Category	LUTControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.13.2 DefectPixelListEntryActive

Determines if the pixel correction is active for the selected entry.

Name	DefectPixelListEntryActive
Category	LUTControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.13.3 DefectPixelListEntryPosX

X position of the defect pixel.

Name	DefectPixelListEntryPosX
Category	LUTControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... Resolution of the sensor in X-direction (Increment: 1)

11.13.4 DefectPixelListEntryPosY

Y position of the defect pixel.

Name	DefectPixelListEntryPosY
Category	LUTControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... Resolution of the sensor in Y-direction (Increment: 1)

11.13.5   DefectPixelListIndex

Index to the pixel correction list.

Name	DefectPixelListIndex
Category	LUTControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 511 (Increment: 1)

11.13.6   DefectPixelListSelector

Selects which Defect Pixel List to control.

Name	DefectPixelListSelector	
Category	LUTControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Pixel	Selects Defect Pixel List for defect pixels.

11.13.7   LUTContent

Describes the content of the selected *LUT*.

Name	LUTContent	
Category	LUTControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Gamma	The content of the selected *LUT* is defined by the parameter in the *Gamma* feature.
	Userdefined LUT	The content of the selected *LUT* is user-defined.

11.13.8   LUTEnable

Enables the selected *LUT*. It contains 2^{12} (4096) values for the available levels. These values can be adjusted by the user.

Color cameras apply *LUT* to all color channels together.

Name	LUTEnable
Category	LUTControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.13.9   LUTIndex

Control index (Offset) of the coefficient to access in the selected *LUT*.

Name	LUTIndex
Category	LUTControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 4095 (Increment: 1)

11.13.10   **LUTSelector**

Selects which *LUT* to control.

Name	LUTSelector	
Category	LUTControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Luminance	Select Luminance LUT.

11.13.11   **LUTValue**

Returns the value at entry *LUTIndex* of the *LUT* selected by *LUTSelector*.

Name	LUTValue
Category	LUTControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 4095 (Increment: 1)

11.14   Category: MemoryManagement

Category containing the memory management functions.

11.14.1   **MemoryMaxBlocks**

Maximum count of disposal memory blocks.

Name	MemoryMaxBlocks
Category	MemoryManagement
Interface	IInteger
Access	Read only
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.15   Category: SequencerControl

Category for the *Sequencer* Control functions.

The *Sequencer* enables acquisition of an image series with automated camera re-parameterization based on events and signals. For doing so, the camera parameterization of each step is stored in so called *Sequencer Sets*.

Stringing together a number of these *Sequencer Sets* results in a sequence. The connection of sequences is done by using different paths. Alongside the camera functions the path related functions are also part of a *Sequencer Set*.

Sequencer Sets

Sequencer Sets combine camera features – similar to *User Set* – and *Sequencer* (set and path) related parameters.

Parameterization of several camera functions can be controlled via *Sequencer* and saved to *Sequencer Set*. Information for switching via different paths is also stored.

This camera functions can be:

- *ExposureTime*
- *Gain*
- *Region of Interest (OffsetX / OffsetY / Width / Height)*
- *UserOutput*
- *Counter*
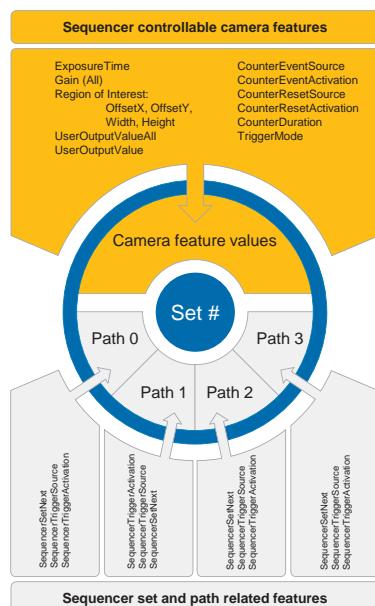
Each path involves:

- the destination for the set switch-over mapped in feature *SequencerSetNext*
- the signal change of state acting as switchover trigger and mapped as *SequencerTriggerSource*
- the change of state acting as switch-over trigger and mapped as *SequencerTriggerActivation*

Similar to *User Sets* the camera's current parameterization will be overwritten when loading *Sequencer Set* and activating *Sequencer*.

Sequencer configuration

In order to avoid overwriting current camera settings during *Sequencer* configuration, the camera requires reparameterization to *SequencerConfigurationMode*.

If camera is set to *SequencerConfigurationMode*, individual *Sequencer Sets* can be selected via *SequencerSetSelector* for configuration and saved by executing *SequencerSetSave*.

Starting the configured sequence requires switching the *SequencerConfigurationMode = off* to enable *SequencerMode*.

11.15.1   SequencerConfigurationMode

Controls if the *SequencerConfigurationMode* is enabled.

Name	SequencerConfigurationMode	
Category	SequencerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	On	Enables *SequencerConfigurationMode*.
	Off	Disables *SequencerConfigurationMode*.

11.15.2   SequencerFeatureEnable

Enables the selected feature and make it active in all the *Sequencer Sets*.

Name	SequencerFeatureEnable
Category	SequencerControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.15.3   SequencerFeatureSelector

Selects the camera features that are controlled by the *Sequencer*.

Name	SequencerFeatureSelector
Category	SequencerControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.XC / VCXG.2.I / VCXU.2

Values (Features)	
CounterDuration	LinePWMDuration*

Values (Features)	
CounterEventActivation	LinePWMDutyCycle*
CounterEventSource	LinePWMMode*
CounterResetActivation	OffsetX
CounterResetSource	OffsetY
ExposureMode	TriggerMode
ExposureTime	UserOutputValue
Gain	UserOutputValueAll
Height	Width

*) only VCXG.2-51M/C.I (≥ Rel. 4.2)

11.15.4   SequencerMode

Controls if *Sequencer* is enabled.

☼ **INFO**
To use this feature, the features *BalanceWhiteAuto* (color cameras only) and *SequencerConfigurationMode* must be = *off*.
To write this feature, set *TLParamsLocked = 0*.

Name	SequencerMode	
Category	SequencerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	On	Enables *Sequencer*.
	Off	Disables *Sequencer*.

11.15.5   SequencerPathSelector

Selects the path that contains the settings coming afterward.

Name	SequencerPathSelector
Category	SequencerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 3 (Increment: 1)

11.15.6   SequencerSetActive

Contains the currently active *Sequencer Set*.

Name	SequencerSetActive
Category	SequencerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 127 (Increment: 1)

11.15.7   SequencerSetLoad

Loads the *Sequencer Set* selected with *SequencerSetSelector*.

Name	SequencerSetLoad
Category	SequencerControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.15.8   SequencerSetNext

Specifies the next *Sequencer Set*.

Name	SequencerSetNext
Category	SequencerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 127 (Increment: 1)

11.15.9   SequencerSetSave

Saves the current device state to the *Sequencer Set* selected by the *SequencerSetSelector*.

Name	SequencerSetSave
Category	SequencerControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.15.10   SequencerSetSelector

Selects *Sequencer Set* to which related function parameters will apply.

Name	SequencerSetSelector
Category	SequencerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 127 (Increment: 1)

11.15.11   SequencerSetStart

Sets the start *Sequencer Set*, which is the first set used.

Name	SequencerSetStart
Category	SequencerControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 127 (Increment: 1)

11.15.12   SequencerTriggerActivation

Defines the signals edge to trigger *Sequencer*.

Name	SequencerTriggerActivation	
Category	SequencerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	AnyEdge	Specifies that the trigger is considered valid on the falling or rising edge of the source signal.
	FallingEdge	Specifies that the trigger is considered valid on the falling edge of the source signal.
	LevelHigh	Defines trigger applied as long as source signal is on *high*.
	LevelLow	Defines trigger applied as long as source signal is on *low*.
	RisingEdge	Specifies that the trigger is considered valid on the rising edge of the source signal.

11.15.13   SequencerTriggerSource

Specifies the internal signal or Input to use as trigger source for the Sequencer.

Name	SequencerTriggerSource
Category	SequencerControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2 / VCXG.2.I / VCXU.2

Values	
Off	Disabled.
Counter1End	Starts receiving *Counter End*.
Counter2End	Starts receiving *Counter End*.
Line0	Specifies *Line0* as external trigger source.
Line1	Specifies *Line1* as external trigger source.
Line2	Specifies *Line2* as external trigger source.
Line3*	Specifies *Line3* as external trigger source.
ExposureActive	Starts receiving *Exposure Active*.
ReadOutActive	Starts receiving *Read Out Active*.
Timer1End	Starts receiving *Timer End*.

*) VCXG.2.I only

11.16   Category: TestControl

Category for test control functions.

11.16.1   TestPendingAck

Test of device *PendingAck* function.

Name	TestPendingAck
Category	TestControl
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.17   Category: TransportLayerControl

This chapter provides the *Transport Layer* control functions.

11.17.1   EnergyEfficientEthernetEnable (GigE only)

Controls whether the Energy Efficient / Green Ethernet mode (802.3az) is enabled or disabled.

INFO

A device reboot is needed for changes to take effect.

Name	EnergyEfficientEthernetEnable
Category	TansportLayerControl
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2   Category: GigEVision

Category that contains the features pertaining to the GigE Vision transport layer of the device.

11.17.2.1   GVSPConfigurationBlockID64Bit

Enables the 64 bit block ID length.

Name	GVSPConfigurationBlockID64Bit
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.2   GevCCP

Controls the device access privilege of an application.

Name	GevCCP	
Category	TansportLayerControl → GigEVision	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	OpenAccess	Open Access.
	ExclusiveAccess	Exclusive Access.
	ControlAccess	Control Access.

11.17.2.3   GevCurrentDefaultGateway

Reports the default gateway IP address to be used on the given logical link.

Name	GevCurrentDefaultGateway
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	IP address

11.17.2.4   GevCurrentIPAddress

Reports the IP address for the given logical link.

Name	GevCurrentIPAddress
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	IP address

11.17.2.5   GevCurrentIPConfigurationDHCP

Controls whether the DHCP IP configuration scheme is activated on the given logical link.

Name	GevCurrentIPConfigurationDHCP
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.6   GevCurrentIPConfigurationLLA

Controls whether the Link Local Address IP configuration scheme is activated on the given logical link.

Name	GevCurrentIPConfigurationLLA
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.7   GevCurrentIPConfigurationPersistentIP

Controls whether the PersistentIP configuration scheme is activated on the given logical link.

Name	GevCurrentIPConfigurationPersistentIP
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.8   GevCurrentSubnetMask

Reports the subnet mask of the given logical link.

Name	GevCurrentSubnetMask
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	IP address

11.17.2.9   GevFirstURL

Indicates the first URL to the GenICam XML device description file. The First URL is used as the first choice by the application to retrieve the GenICam XML device description file.

Name	GevFirstURL
Category	TansportLayerControl → GigEVision
Interface	IString
Access	Read only
Unit	-
Values	URL

11.17.2.10   GevGVCPExtendedStatusCodes

Enables the generation of extended status codes.

Name	GevGVCPExtendedStatusCodes	
Category	TansportLayerControl → GigEVision	
Interface	IBoolean	
Access	Read / Write	
Unit	-	
Values	true = 1 (On)	
	false = 0 (Off)	

11.17.2.11   GevGVCPExtendedStatusCodesSelector

Selects the GigE Vision version to control extended status codes for.

Name	GevGVCPExtendedStatusCodesSelector	
Category	TansportLayerControl → GigEVision	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Version1_1	Version1_1.
	Version2_0	Version2_0.

11.17.2.12   GevGVCPPendingAck

Enables the generation of PENDING_ACK.

Name	GevGVCPPendingAck
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.13   GevIPConfigurationStatus

Reports the current IP configuration status.

Name	GevIPConfigurationStatus	
Category	TansportLayerControl → GigEVision	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	None	None.
	PersistentIP	Persistent IP.
	DHCP	DHCP.
	LLA	LLA.
	ForceIP	Force IP.

11.17.2.14   GevInterfaceSelector

Selects which logical link to control.

Name	GevInterfaceSelector
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0 (Increment: 1)

11.17.2.15   GevMACAddress

MAC address of the logical link.

Name	GevMACAddress
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0

11.17.2.16   GevMCDA

Controls the destination IP address for the message channel.

Name	GevMCDA
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.17   GevMCPHostPort

Controls the port to which the device must send messages.

Name	GevMCPHostPort
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 … 65535 (Increment: 1)

11.17.2.18   GevMCRC

Controls the number of retransmissions allowed when a message channel message times out.

Name	GevMCRC
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.19 GevMCSP

This feature indicates the source port for the message channel.

Name	GevMCSP
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0

11.17.2.20 GevMCTT

Provides the transmission timeout value in milliseconds.

Name	GevMCTT
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	ms
Values	> 0

11.17.2.21 GevNumberOfInterfaces

Indicates the number of logical links supported by this device.

Name	GevNumberOfInterfaces
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	> 0

11.17.2.22 GevPAUSEFrameReception

Controls whether incoming PAUSE Frames are handled on the given logical link.

Name	GevPAUSEFrameReception
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On) false = 0 (Off)

11.17.2.23   GevPersistentDefaultGateway

Controls the persistent default gateway for this logical link. It is only used when the device boots with the Persistent IP configuration scheme.

Name	GevPersistentDefaultGateway
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.24   GevPersistentIPAddress

Controls the Persistent IP address for this logical link. It is only used when the device boots with the Persistent IP configuration scheme.

Name	GevPersistentIPAddress
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.25   GevPersistentSubnetMask

Controls the Persistent subnet mask associated with the Persistent IP address on this logical link. It is only used when the device boots with the Persistent IP configuration scheme.

Name	GevPersistentSubnetMask
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.26   GevPrimaryApplicationIPAddress

Returns the address of the primary application.

Name	GevPrimaryApplicationIPAddress
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0

11.17.2.27   GevPrimaryApplicationSocket

Returns the UDP source port of the primary application.

Name	GevPrimaryApplicationSocket
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read only
Unit	-
Values	≥ 0

11.17.2.28   GevPrimaryApplicationSwitchoverKey

Controls the key to use to authenticate primary application switchover requests.

Name	GevPrimaryApplicationSwitchoverKey
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Write only
Unit	-
Values	≥ 0

11.17.2.29   GevSCDA

Controls the destination IP address of the selected stream channel to which a GVSP transmitter must send data stream or the destination IP address from which a GVSP receiver may receive data stream.

Name	GevSCDA
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.30   GevSCFTD

This feature indicates the delay (in timestamp counter unit) to insert between each block (image) for this stream channel.

Name	GevSCFTD
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	0 ... 4294967295 (Increment: 1)

11.17.2.31   GevSCPD

Controls the delay (in timestamp counter unit) to insert between each packet for this stream channel. This can be used as a crude flow-control mechanism if the application or the network infrastructure cannot keep up with the packets coming from the device.

Name	GevSCPD
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.32   GevSCPHostPort

Controls the port of the selected channel to which a GVSP transmitter must send data stream or the port from which a GVSP receiver may receive data stream. Setting this value to 0 closes the stream channel.

Name	GevSCPHostPort
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0

11.17.2.33   GevSCPInterfaceIndex

Index of the logical link to use.

Specific streams might be hard-coded to specific logical links. Therefore this field might be read-only on certain devices.

Name	GevSCPInterfaceIndex
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / (Write)
Unit	-
Values	0 ... 3 (Increment: 1)

11.17.2.34   GevSCPSDoNotFragment

The state of this feature is copied into the "do not fragment" bit of IP header of each stream packet. It can be used by the application to prevent IP fragmentation of packets on the stream channel.

Name	GevSCPSDoNotFragment
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.35   GevSCPSFireTestPacket

Sends a test packet. When this feature is set, the device will fire one test packet. The "don't fragment" bit of IP header must be set for this test packet.

Name	GevSCPSFireTestPacket
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read / Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.36   GevSCPSPacketSize

Specifies the stream packet size, in bytes, to send on the selected channel for a GVSP transmitter or specifies the maximum packet size supported by a GVSP receiver.

Name	GevSCPSPacketSize
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	Byte
Values	> 0 (Increment: 2)

11.17.2.37   GevSCSP

Indicates the source port of the stream channel.

Name	GevSCSP
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0 (Increment: 1)

11.17.2.38   GevSecondURL

Indicates the second URL to the GenICam XML device description file. This URL is an alternative if the application was unsuccessful to retrieve the device description file using the first URL.

Name	GevSecondURL
Category	TansportLayerControl → GigEVision
Interface	IString
Access	Read only
Unit	-
Values	URL

11.17.2.39   GevStreamChannelSelector

Selects the stream channel to control.

Name	GevStreamChannelSelector
Category	TansportLayerControl → GigEVision
Interface	IInteger
Access	Read / Write
Unit	-
Values	≥ 0 (Increment: 1)

11.17.2.40   GevSupportedOption

Returns if the selected GEV option is supported.

Name	GevSupportedOption
Category	TansportLayerControl → GigEVision
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.2.41   GevSupportedOptionSelector

Selects the GEV option to interrogate for existing support.

Name	GevSupportedOptionSelector
Category	TansportLayerControl → GigEVision
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	camera dependent values

11.17.2.42   InterfaceSpeedMode

Show the interface speed mode as string.

Name	InterfaceSpeedMode	
Category	TansportLayerControl → GigEVision	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Ethernet100Mbps	Operation at 100 Mbps.
	Ethernet10Gbps	Operation at 10 Gbps.
	Ethernet1Gbps	Operation at 1 Gbps.
	Ethernet2_5Gbps	Operation at 2.5 Gbps.
	Ethernet5Gbps	Operation at 5 Gbps.

11.17.3   PayloadSize

Provides the number of bytes transferred for every image or *Chunk* on the Stream Channel with current parameterization. Total size of data payload for a data block.

Name	PayloadSize
Category	TansportLayerControl
Interface	IInteger
Access	Read only
Unit	Byte
Values	0 ... depends on current parameterization (Increment: 1)

11.17.4   Category: PtpControl

Category that contains the features related to the Precision Time Protocol (PTP) of the device.

General Information

IEEE 1588 Precision Time Protocol (PTP) manages clock synchronization of multiple devices across an Ethernet network. On a local area network, it achieves clock accuracy in the sub-microsecond range, making it suitable for measurement and control systems.

PTP was designed to improve on existing clock synchronization methods such as Network Time Protocol (NTP) and Global Positioning System (GPS). NTP suffers from poor accuracy, often quoted to be several milliseconds using a fast Ethernet network. GPS provides nanosecond precision using atomic clock and satellite triangulation; however, it is an expensive component to incorporate into a camera.

PTP provides microsecond precision without increasing component cost, providing better accuracy than NTP at a lower cost than GPS.

The diagram below shows the steps taken to synchronize the slave clock to that of the master.
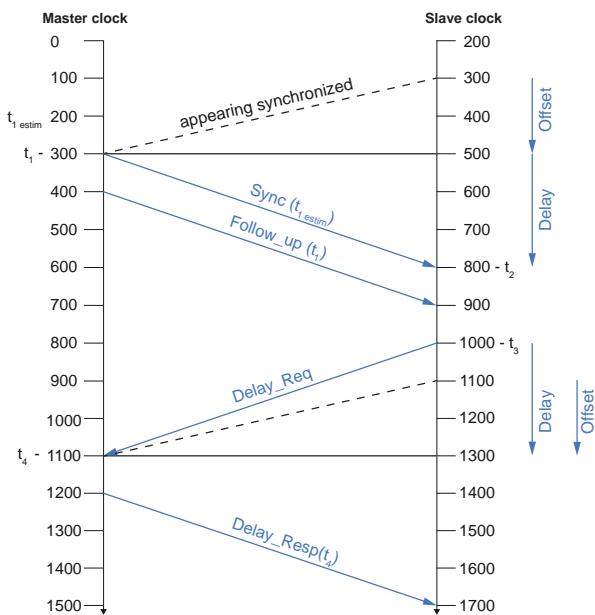
PTP synchronization

Synchronization begins when the device configured as the Master PTP clock transmits a Sync telegram using multicast messaging. Devices configured as Slave PTP clocks calculate the time difference between their clock and the Master PTP clock, and adjust accordingly.

Slave clock frequencies are constantly adjusted, through follow up and delay messages, to keep their clock value as close as possible to the master clock. While all slave clocks are within 1 µs of the master, PTP sync is achieved.

Network Topology without GPS Glock

Achieving PTP synchronization between multiple cameras requires all cameras to be on the same network/subnet. The IEEE 1588 best master clock algorithm will select a camera as the master clock. Each camera will synchronize to this master clock.

This restriction is due to the current inability of any network card hardware to forward PTP sync multicast packets between ports within the 1 μs requirement.
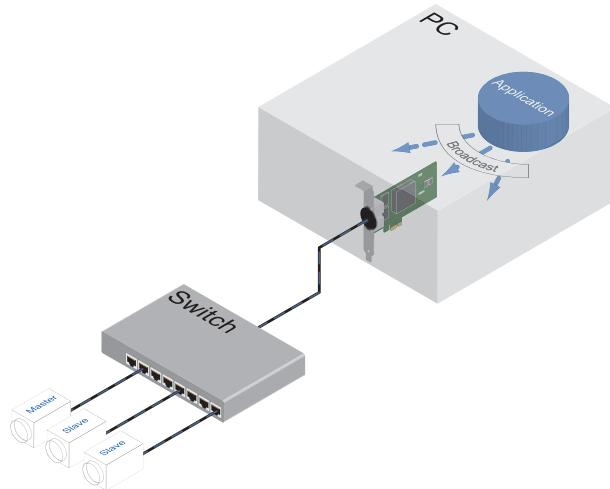
Network Topology with GPS Clock

The cameras can be synchronized to a GPS timer, allowing "real world time" synchronization. Configure PtpMode on all of the cameras to Slave or Auto. In Auto, the IEEE 1588 best master clock algorithm will elect the GPS clock as the master. Each camera will synchronize to the GPS master clock.

☀ **INFO**
To ensure a reliable synchronization, the GPS master clock must be configured with a Sync interval between 0.5 s and 2 s (according to the Default PTP profile for use with the delay request-response mechanism).
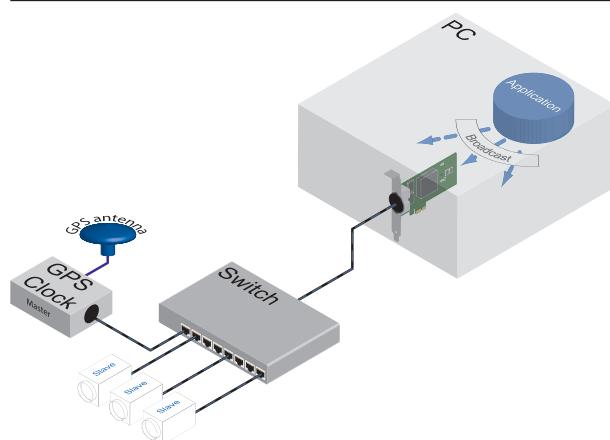
11.17.4.1   PtpClockAccuracy

Indicates the expected accuracy of the device PTP clock when it is the grandmaster, or in the event it becomes the grandmaster.

Name	PtpClockAccuracy
Category	TansportLayerControl → PtpControl
Interface	IEnumeration
Access	Read only
Unit	-
Values	Specification of accuracy

11.17.4.2   PtpClockID

Returns the latched clock ID of the PTP device. PTP Parent Clock ID.

INFO

Byte 0 of the IEEE ClockIdentity field is mapped to the MSB.

Name	PtpClockID
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	MacAdress
Values	80-00-00-00-00-00 ... 7F-FF-FF-FF-FF-FF-FF-FF (Increment: 1)

11.17.4.3   PtpDataSetLatch

Latches the current values from the device's PTP clock data set.

Name	PtpDataSetLatch
Category	TansportLayerControl → PtpControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.17.4.4   PtpEnable

Enables Precision Time Protocol (PTP).

INFO

To write this feature, set `TLParamsLocked = 0`.

Name	PtpEnable
Category	TansportLayerControl → PtpControl
Interface	IBoolean
Access	Read/Write
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.17.4.5   PtpGrandmasterClockID

Returns the latched Grandmaster Clock ID of the PTP device. Grandmaster Clock ID is the clock ID of the current one.

INFO

Byte 0 of the IEEE ClockIdentity field is mapped to the MSB.

Name	PtpGrandmasterClockID
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	MacAdress
Values	80-00-00-00-00-00 ... 7F-FF-FF-FF-FF-FF-FF-FF (Increment: 1)

11.17.4.6   PtpMode

Selects the PTP clock type that the device will act as.

Name	PtpMode	
Category	TansportLayerControl → PtpControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Auto	The device uses the IEEE 1588 best master clock algorithm to identify *Master* and *Slave* devices. Should the device not be the best *Master*, it will act as a *PTP-Slave*.
	Slave	The device clock will only act as *PTP-Slave* for alignment to the master clock.

11.17.4.7   PtpOffsetFromMaster

Returns the latched offset from the PTP master clock in nanoseconds.

Name	PtpOffsetFromMaster
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	ns
Values	-9223372036854775808 ... 9223372036854775808 (Increment: 1)

11.17.4.8   PtpParentClockID

Returns the latched *Clock-ID* of the PTP device. The parent *Clock-ID* is the *Clock-ID* of the current *Master-Clock*.

INFO

Byte 0 of the IEEE ClockIdentity field is mapped to the MSB.

Name	PtpParentClockID
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	MacAdress
Values	80-00-00-00-00-00 ... 7F-FF-FF-FF-FF-FF-FF-FF (Increment: 1)

11.17.4.9   PtpServoStatus

Returns the latched state of the servo clock.

INFO

PTPServoStatus may change temporarily when changing the IP address.

Name	PtpServoStatus	
Category	TansportLayerControl → PtpControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Unknown	No device-specific value available to describe the current state of the clock servo.
	Locked	Servo is in the locked state.

11.17.4.10   **PtpStatus**

Returns the latched state of the *PTP-Clock*.

Name	PtpStatus	
Category	TansportLayerControl → PtpControl	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	Disabled	PTP disabled.
	Faulty	The fault state of the protocol.
	Initializing	PTP is being initialized.
	Listening	Device is listening for other PTP enabled devices.
	Master	Device acting as master clock.
	Passive	If there are 2 or more devices with *PtpMode = Master*, this device has an inferior clock and is not synchronized to master.
	Pre_Master	The port behaves in all respects as if it were in the master state, except that it does not put any messages on its communication path except for *Pdelay_Req*, *Pdelay_Resp*, *Pdelay_Resp_Follow_Up*, signaling or management messages.
	Slave	PTP synchronization between this device and master is achieved.
	Uncalibrated	PTP synchronization not yet achieved.

11.17.5   Category: TransportLayerControl → USB3Vision

Category that contains the features pertaining to the USB3 Vision transport layer of the device.

11.17.5.1   InterfaceSpeedMode

Show the interface speed mode as string.

Name	InterfaceSpeedMode	
Category	TansportLayerControl → USB3Vision	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	FullSpeed	USB operation at 12 Mbps.
	HighSpeed	USB operation at 480 Mbps.
	LowSpeed	USB operation at 1.5 Mbps.
	SuperSpeed	USB operation at 5 Gbps.

11.17.5.2   SIControl

Controls streaming operation.

Name	SIControl	
Category	TansportLayerControl → USB3Vision	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	StreamDisabled	Disable Streaming.
	StreamEnabled	Enable Streaming.

11.17.5.3   SIPayloadFinalTransfer1Size

Size of first final Payload Transfer.

Name	SIPayloadFinalTransfer1Size
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

11.17.5.4   SIPayloadFinalTransfer2Size

Size of second final Payload Transfer.

Name	SIPayloadFinalTransfer2Size
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

11.17.5.5   SIPayloadTransferCount

Expected number of Payload Transfers.

Name	SIPayloadTransferCount
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

11.17.5.6   SIPayloadTransferSize

Expected size of a single Payload Transfer.

Name	SIPayloadTransferSize
Category	TansportLayerControl → PtpControl
Interface	IInteger
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

11.18   Category: UserSetControl

Category including features for *User Sets* control. It allows loading or saving factory or user-defined settings.

Loading the factory default *User Sets* guarantees a state enabling continuous acquisition start by the mandatory features only.

These *User Sets* are stored to the camera and can be loaded, saved and transferred to other cameras.

11.18.1   UserSetDefault

Four *User Sets* are available for this camera. *User Set 1, User Set 2, User Set 3* are user-specific and can contain user-definable parameters.

The factory settings are stored in the *User Set: Default*. This is the only *User Set* that cannot be edited.

Name	UserSetDefault	
Category	UserSetControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Default	Select the factory predefined *User Set*.
	User Set 1	Select the *User Set 1* (available when saved).
	User Set 2	Select the *User Set 2* (available when saved).
	User Set 3	Select the *User Set 3* (available when saved).

11.18.2   UserSetFeatureEnable

Activates the feature selected with *UserSetFeatureSelector*.

Name	UserSetFeatureEnable
Category	UserSetControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On)
	false = 0 (Off)

11.18.3   UserSetFeatureSelector

Selects which individual feature is to be controlled.

Name	UserSetFeatureSelector
Category	UserSetControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	see table(s) below

VCXG.2 / VCXG.2.I / VCXG.2.XC

Features		
AcquisitionFrameCount	DeviceLinkThroughputLimit	OffsetY
AcquisitionFrameRate	DeviceTemperatureStatus-Transition	PixelFormat
AcquisitionFrameRate-Enable	EventNotification	ReadoutMode
AcquisitionMode	ExposureAuto	ReverseX
ActionDeviceKey	ExposureAutoMaxValue	ReverseY
ActionGroupKey	ExposureAutoMinValue	SensorShutterMode
ActionGroupMask	ExposureMode	SequencerSetNext
AutoFeatureHeight	ExposureTime	SequencerSetStart
AutoFeatureOffsetX	FrameCounter	SequencerTrigger-Activation
AutoFeatureOffsetY	Gain	SequencerTriggerSource
AutoFeatureWidth	GainAuto	TestPattern
BalanceWhiteAuto	GainAutoMaxValue	TimerDelay
BinningHorizontal	GainAutoMinValue	TimerDuration
BinningHorizontalMode	Gamma	TimerTriggerActivation
BinningVertical	Height	TimerTriggerSource
BinningVerticalMode	LUTContent	TriggerActivation
BlackLevel	LUTEnable	TriggerDelay
BrightnessAutoNominalValue	LUTValue	TriggerMode
BrightnessAutoPriority	LineDebouncerHigh-TimeAbs	TriggerSource
ChunkEnable	LineDebouncerLow-TimeAbs	UserOutputValue
ChunkModeActive	LineInverter	UserOutputValueAll
ColorTransformationAuto	LineMode	Width
CounterDuration	LinePWMDuration[1]	
CounterEventActivation	LinePWMMaxDuration[1]	
CounterEventSource	LinePWMMode[1]	
CounterResetActivation	LineSource	
CounterResetSource	OffsetX	
DefectPixelCorrection	LinePWMMode[1]	

[1] only VCXG.2.I

VCXU.2

Features		
AcquisitionFrameCount	DeviceLinkThroughputLimit	OffsetY
AcquisitionFrameRate	DeviceTemperatureStatus-Transition	PixelFormat
AcquisitionFrameRate-Enable	EventNotification	ReadoutMode
AcquisitionMode	ExposureAuto	ReverseX

Features		
AutoFeatureHeight	ExposureAutoMaxValue	ReverseY
AutoFeatureOffsetX	ExposureAutoMinValue	SensorShutterMode
AutoFeatureOffsetY	ExposureMode	SequencerSetNext
AutoFeatureWidth	ExposureTime	SequencerSetStart
BinningHorizontal	FrameCounter	SequencerTrigger-Activation
BinningHorizontalMode	Gain	SequencerTriggerSource
BinningVertical	GainAuto	TestPattern
BinningVerticalMode	GainAutoMaxValue	TimerDelay
BlackLevel	GainAutoMinValue	TimerDuration
BrightnessAutoNominalValue	Gamma	TimerTriggerActivation
BrightnessAutoPriority	Height	TimerTriggerSource
ChunkEnable	LUTContent	TriggerActivation
ChunkModeActive	LUTEnable	TriggerDelay
ColorTransformationAuto	LUTValue	TriggerMode
CounterDuration	LineDebouncerHigh-TimeAbs	TriggerSource
CounterEventActivation	LineDebouncerLow-TimeAbs	UserOutputValue
CounterEventSource	LineInverter	UserOutputValueAll
CounterResetActivation	LineMode	Width
CounterResetSource	LineSource	
DefectPixelCorrection	OffsetX	

11.18.4 UserSetLoad

Loads the *UserSetSelector* specified by *User Set* to the device and activates device.

INFO

The camera must be stopped before this feature can be edited.

Name	UserSetLoad
Category	UserSetControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.18.5   UserSetSave

Save the *UserSetSelector* specified by *User Set* to the non-volatile device memory.

INFO

Default settings are stored in *User Set*: *Default*. This is the only *User Set* that cannot be edited. To save the configuration select at *UserSetSelector* (*UserSet1, UserSet2* or *UserSet3*).

Name	UserSetSave
Category	UserSetControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.18.6   UserSetSelector

Selects the *User Set* to load, save or configure.

INFO

Default settings are stored in *User Set*: *Default*. This is the only *User Set* that cannot be edited. To save the configuration select at *UserSetSelector* (*UserSet1, UserSet2* or *UserSet3*).

Name	UserSetSelector	
Category	UserSetControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Default	Select the factory predefined *User Set*.
	User Set 1	Select the *User Set 1*.
	User Set 2	Select the *User Set 2*.
	User Set 3	Select the *User Set 3*.

11.19   Category: boCalibrationData

Category for functions of calibration data.

INFO

Calibration setting

Calibration is not in the camera and either via *Camera Explorer*. Enter here the category parameters to be determined in the application environment by external software (e.g. *OpenCV*). This calibration data is saved non-volatile to the camera.

For calibration, the camera provides image together with stored calibration data. Calibration must be performed using external software.

11.19.1   boCalibrationAngularAperture

Angular lens aperture as the angular lens size as seen from the focal point in degrees.

Name	boCalibrationAngularAperture
Category	boCalibrationData
Interface	IFloat
Access	Read / Write
Unit	°
Values	0.000000 … 360.000000 (Increment: 1.00)

11.19.2   boCalibrationDataConfigurationMode

Controls whether *boCalibrationDataConfigurationMode* is active.

Name	boCalibrationDataConfigurationMode	
Category	boCalibrationData	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	Disables *boCalibrationDataConfigurationMode*.
	On	Enables *boCalibrationDataConfigurationMode*.

11.19.3   boCalibrationDataSave

Save the current calibration data to the non-volatile device memory.

Name	boCalibrationDataSave
Category	boCalibrationData
Interface	ICommand
Access	Write only
Unit	-
Values	-

11.19.4   boCalibrationDataVersion

Version of the optical controller.

Name	boCalibrationDataVersion
Category	boCalibrationData
Interface	IString
Access	Read only
Unit	-
Values	-

11.19.5   boCalibrationFocalLength

Focal length in millimeters (mm).

Name	boCalibrationFocalLength
Category	boCalibrationData
Interface	IFloat
Access	Read / Write
Unit	mm
Values	0.000000 … 4,294,967,296.000000 (Increment: 1.00)

11.19.6   boCalibrationMatrixSelector

Selection of the calibration matrix.

Name	boCalibrationMatrixSelector	
Category	boCalibrationData	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Camera Matrix	Selection of the camera matrix.
	New Camera Matrix	Selection of the camera matrix considering the geometric distortion.

11.19.7   boCalibrationMatrixValue

Selected value of the calibration matrix.

Name	boCalibrationMatrixValue
Category	boCalibrationData
Interface	IFloat
Access	Read only
Unit	-
Values	-3.40282e+38 … 3.40282e+38 (Increment: 1.00)

11.19.8   boCalibrationMatrixValueSelector

Value selector of the calibration matrix.

Name	boCalibrationMatrixValueSelector	
Category	boCalibrationData	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Value 11	Selects the matrix value in row 1 column 1.
	Value 12	Selects the matrix value in row 1 column 2.
	Value 13	Selects the matrix value in row 1 column 3.
	Value 21	Selects the matrix value in row 2 column 1.
	Value 22	Selects the matrix value in row 2 column 2.
	Value 23	Selects the matrix value in row 2 column 3.
	Value 31	Selects the matrix value in row 3 column 1.
	Value 32	Selects the matrix value in row 3 column 2.
	Value 33	Selects the matrix value in row 3 column 3.

11.19.9   boCalibrationVectorSelector

Selects the calibration vector.

Name	boCalibrationVectorSelector	
Category	boCalibrationData	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	rvec	Selects the output rotation vector.
	tvec	Selects the translation vector.

11.19.10   boCalibrationVectorValue

Value of the selected calibration vector.

Name	boCalibrationVectorValue
Category	boCalibrationData
Interface	IFloat
Access	Read only
Unit	-
Values	-3.40282e+38 … 3.40282e+38 (Increment: 1.00)

11.19.11   boCalibrationVectorValueSelector

Selects value selector for calibration vector.

Name	boCalibrationVectorValueSelector	
Category	boCalibrationData	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Value 1	Selects vector value 1.
	Value 2	Selects vector value 2.
	Value 3	Selects vector value 3.

11.19.12   boGeometryDistortionValue

Selected geometric distortion value.

Name	boGeometryDistortionValue
Category	boCalibrationData
Interface	IFloat
Access	Read only
Unit	-
Values	-3.40282e+38 … 3.40282e+38 (Increment: 1.00)

11.19.13   boGeometryDistortionValueSelector

Selector for geometric distortion.

Name	boGeometryDistortionValueSelector	
Category	boCalibrationData	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	k1	Selects geometric distortion value k1.
	k2	Selects geometric distortion value k2.
	k3	Selects geometric distortion value k3.
	p1	Selects geometric distortion value p1
	p2	Selects geometric distortion value p2.

12   USB interface functionality

12.1   Device information

This device information is part of the camera's *USB-Descriptors*.

Included information:

- Manufacturer ID (*VID*)
- Product ID (*PID*)
- General unique identifier (*GUID*)
- Name of device manufacturer (*Manufacturer*)
- Serial number (*iSerialNumber*)

Camera type	Baumer USB Vendor ID [Hexadecimal]	Baumer USB Product ID [Hexadecimal]
VCXU.2	2825	0171

13 GigE interface functionality

13.1 packet size and Maximum Transmission Unit (MTU)

Network packets can be of different sizes. The size depends on the network components used. When using GigE Vision®-compatible devices, it is generally recommended to use larger packages. First, there is less overhead per packet and second larger packets reduce CPU load.

The size of UDP packets can vary from 576 bytes to MTU.

MTU describes the maximum packet size which all involved network components can process.

According to the GigE network standard, modern network hardware supports 1500 bytes packet size. "Jumboframes" simply mean a packet size of more than 1500 bytes.

Baumer cameras are capable of MTU processing up to 16384 bytes.

13.2 Inter Packet Gap (IPG)

For optimal results in image transmission, some Ethernet-specific factors must be taken into account.

When starting image transfer at a camera, data packets are transferred with maximum transfer speed. In compliance with the network standard, Baumer cameras operate on a 12-byte minimum distance between every packet. This gap is referred to as *Inter Packet Gap (IPG)*. Further to the minimum *IPG*, The GigE Vision®-standards defines that *IPG* must enable scaling (.i.e. hast to be user-defined).

INFO
According to the Ethernet standard, the IPG must not be inferior to 12 bytes.
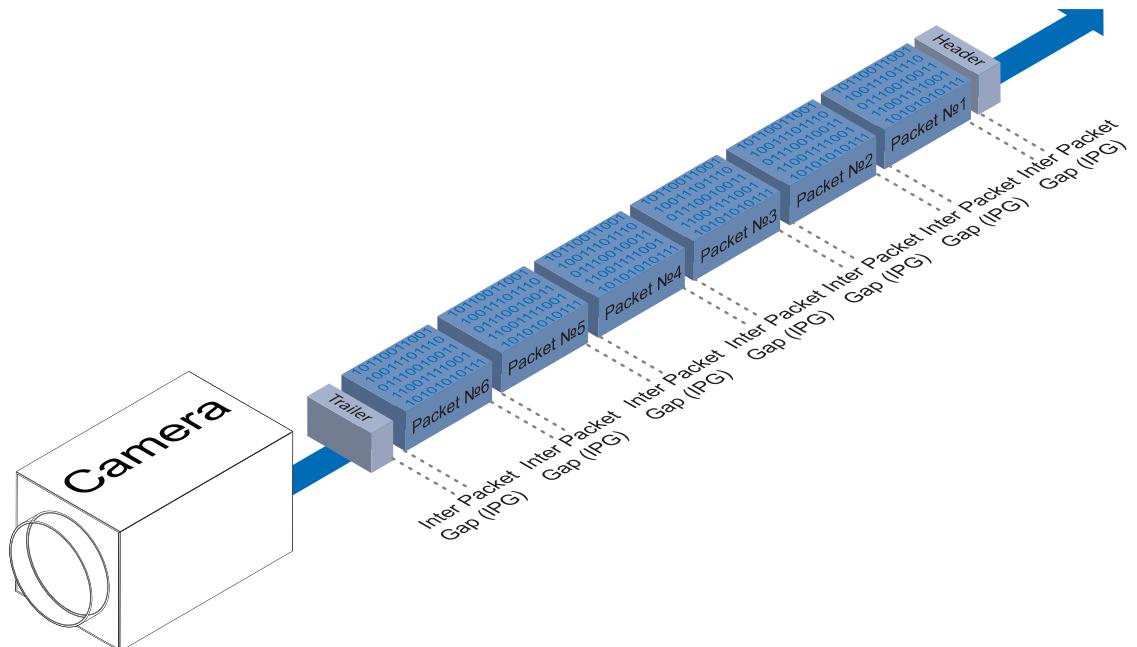
Example 1: Multicamera operation - Minimum IPG

A minimum IPG will have images transmitted at maximum speed. This means full network load, even at a frame rate of 1 fps. Such "bursts" may cause overload to individual network components which results into packet loss. This applies particularly to the use of multiple cameras.

Two cameras transmitting images in parallel can cause such burst at a transmission rate of 2 Gbits/sec. The data must be buffered to the switch for subsequent transfer at a speed of 1 Gbit/s. According to internal buffer switch properties, this would do without any problems with up to n cameras (n ≥ 1). More cameras would cause packet loss. Nevertheless, lost packets can be regained by appropriate Resend mechanism, which however adds load to the network components.
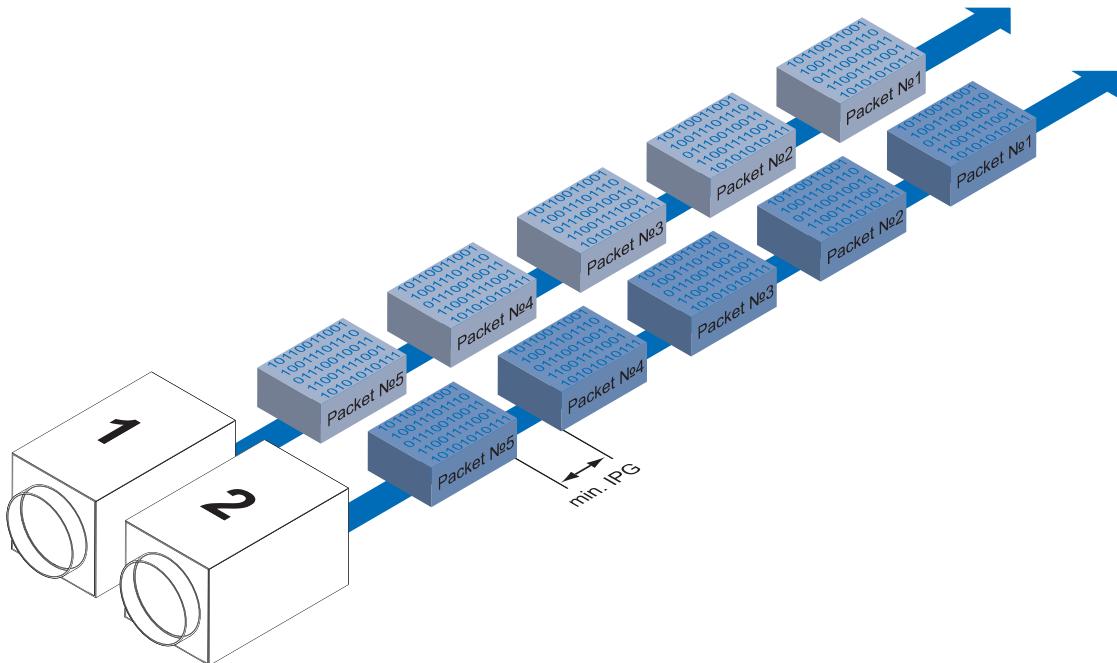
Example 2: Multicamera operation - Optimal IPG (GigE)

Better optimize IPG size.

```
Optimal IPG [byte] = (number of cameras-1)*packet size + 2 × minimum
IPG
```

This way, both data packets can be transmitted one after another other (zipper method) without the need for buffering by switch.

The IPG is mapped in the camera using the *GevSCPD* function. Observe the specified unit. Conversion may be required.
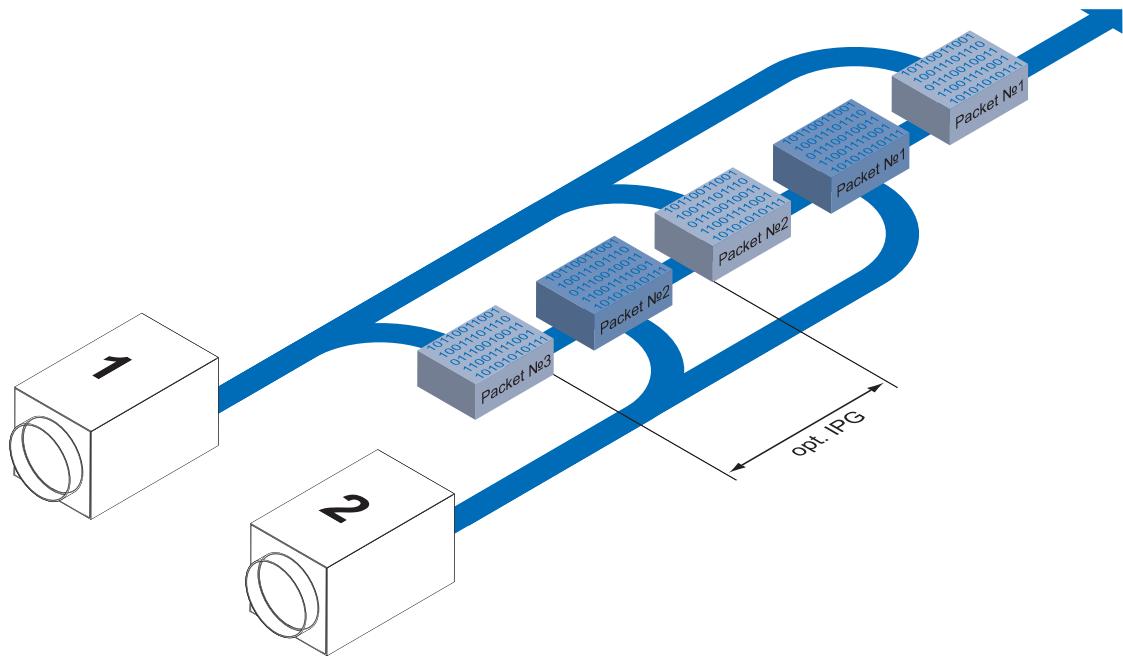
13.3 Frame Transmission Delay

Another approach to packet sorting in multi-camera operation is *Frame Transmission Delay*. Saving the currently acquired image to the camera and starting transfer at the predefined delay allows for transmission to PC of all frames at once.

For process-specific reasons, all cameras will stop image acquisition at the same time. Now, the cameras do not transmit their images all at once, but - according to the specified transmission delays - one after the other. In doing so, the first camera immediately starts transmission, i.e. with "0" delay.

The following scenario is an example:
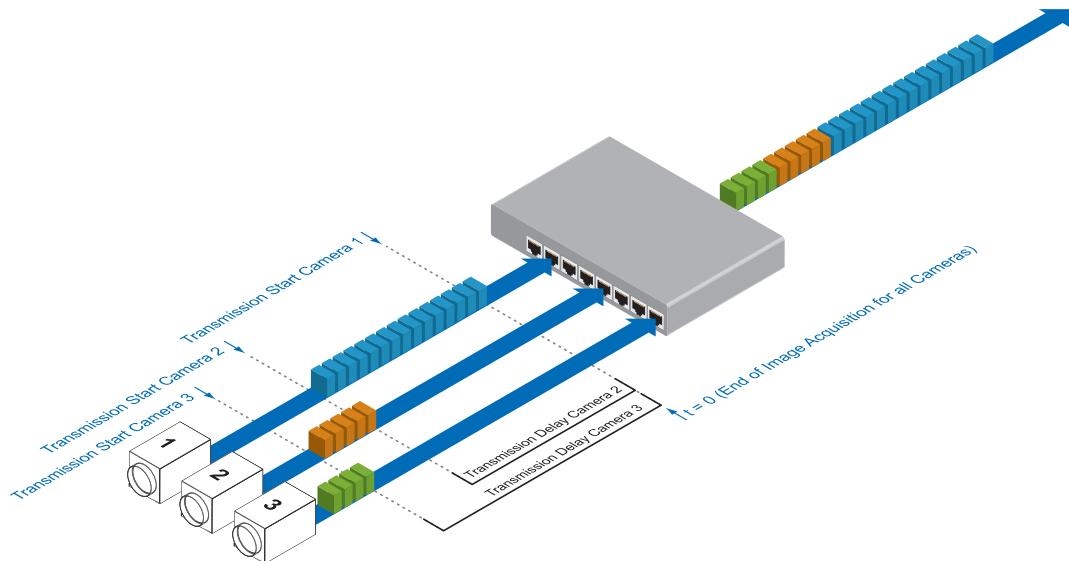
Time savings in multi-camera operation

As already mentioned, feature *Frame Transmission Delay* is particularly intended for multi-camera operation and using different camera models. This would particularly speed up image transmission of individual cameras:
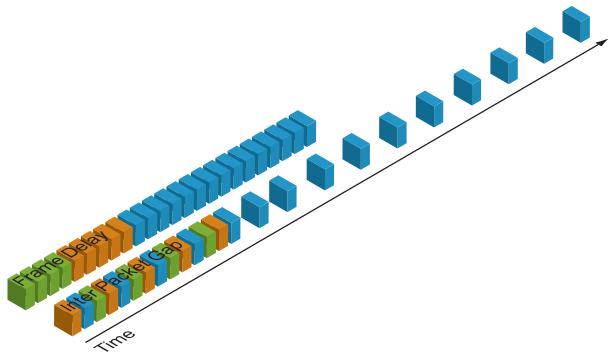
In the above example, using *Inter Packet Gap* results in time savings of approx. 45% (in relation to overall transmission of three images) compared to *Inter Packet Gap*.

Configuration Example (GigE)

The following parameters are known for the three cameras in use:

Camera	Resolution [Pixel]	Pixel depth [bit]	Data volume [bit]	Readout Time [ms]	Transfer Time [ms]
1	1392 x 1040	8	11581440	50	≈ 11.6
2	776 x 582	8	3613056	15.5	≈ 3.6
3	656 x 494	8	2592512	11	≈ 2.6

For resolution and Readout Time (*treadout*) please refer to the related technical data sheet (TDS). The example uses full screen resolution.

All cameras are manually set the same value in Exposure Time (*texposure*).

The resulting data volume is calculated as follows:

```
Resulting data volume = horizontal pixels × vertical pixels × pixel
depth
```

Transfer time (ttransferGigE) is calculated as follows:

```
Transmission time = Resulting data volume / (1000 × 1000) [ms]
```

All cameras are triggered simultaneously.

Transmission delay is implemented in the form of a counter which runs immediately when starting sensor readout.

A	All cameras start exposure	B	all cameras are ready for transmission
C	Camera 2 starting transmission	D	Camera 3 starting transmission
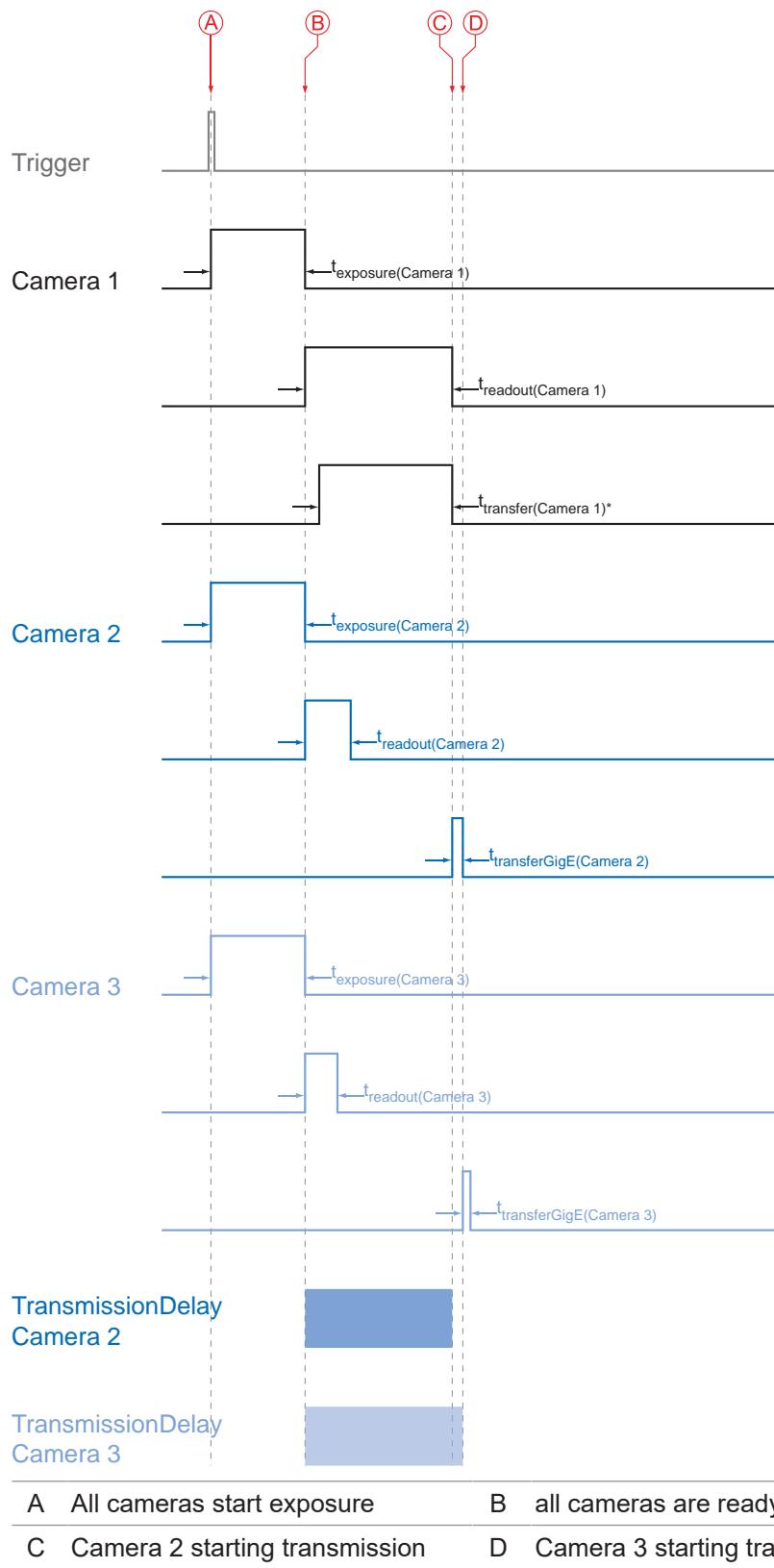
Transmission delay is calculated as follows:

$$t_{TransmissionDelay(Camera\ n)} = t_{exposure(Camera\ 1)} + t_{readout(Camera\ 1)} - t_{exposure(Camera\ n)} + \sum_{n\geq3}^{n} t_{transferGigE(Camera\ n-1)}$$

Transmission delays of camera 2 and 3 are calculated as follows:

$$tTransmissionDelay_{(Camera\ 2)} = t_{exposure(Camera\ 1)} + t_{readout(Camera\ 1)} - t_{exposure(Camera\ 2)}$$

$$t\text{TransmissionDelay}_{(Camera\ 3)} = t_{exposure(Camera\ 1)} + t_{readout(Camera\ 1)} - t_{exposure(Camera\ 3)} + t\text{transferGige}_{(Camera\ 2)}$$

Consequently:

$$t_{TransmissionDelay(Camera\ 2)} = 32\ msec + 50\ msec - 32\ msec = 50\ msec$$

$$t_{TransmissionDelay(Camera\ 3)} = 32\ msec + 50\ msec - 32\ msec + 2.6\ msec = 52.6\ msec$$

13.4   Multicast

Multicasting allows for transmission of data packets to multiple addresses - without multiplying the bandwidth between camera and multicast device (e.g. router or switch).

The data is sent to an intelligent network node, a IGMP (Internet Group Management Protocol)-enabled switch or router, and distributed to the group of recipients with the specific address range.

In the below example illustration, multicast is used for separate processing of image and message data at two individual PCs.

INFO

For multicasting, Baumer suggests an address range from `232.0.1.0` to `232.255.255.255`.
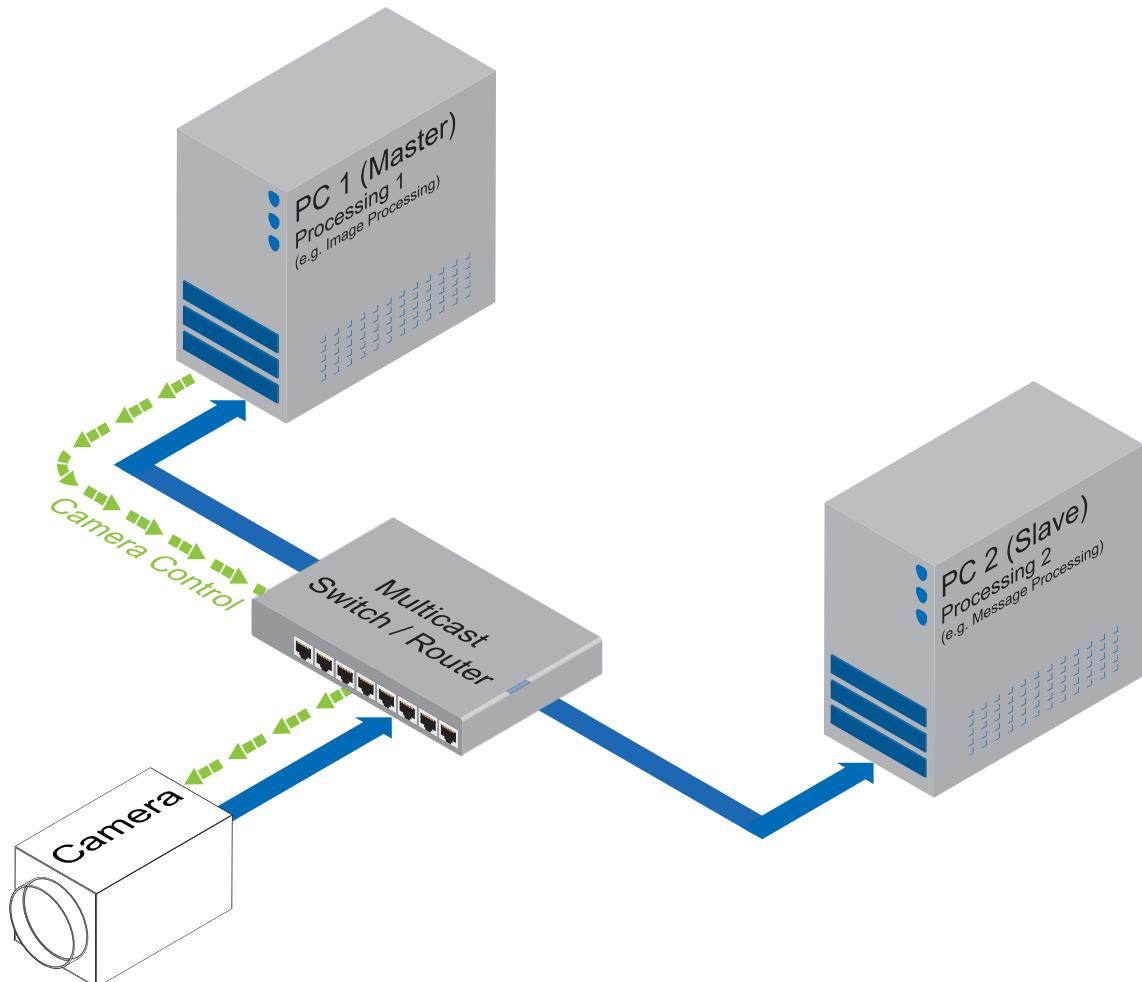
13.5 IP-Konfiguration

The device applies IP address according to the priorities shown.
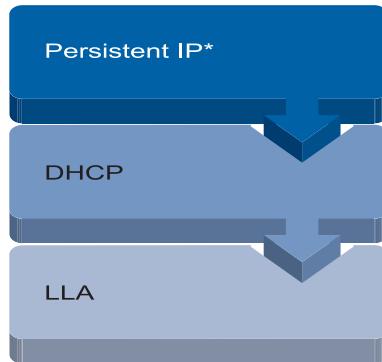
*) This function (*GevCurrentIPConfigurationPersistentIP*) is deactivated by default.

13.5.1 Persistent IP

A persistent IP is permanently assigned. Validity unlimited. This function is disabled by default. Activate the function via the function *GevCurrentIPConfigurationPersistentIP*.

INFO
Make sure PC and camera are operated in the same subnet.

13.5.2 DHCP (Dynamic Host Configuration Protocol)

DHCP is for automated assignment of network parameters such as IP addresses, subnet masks and gateways.

Once connected to a DHCP-enabled network with DHCP server, the camera will be assigned the appropriate IP configurations.

13.5.3 LLA (Link-Local-Address)

LLA (Link-Local Address) refers to an IP address range from `169.254.0.1` to `169.254.254.254` and is utilized for automated IP address assignment, if no other method of IP assignment is available.

The IP address host-defined by pseudo-random number generator operating in the above IP range.

Once an address has been selected, it is transmitted to the network together with an ARP query (Address Resolution Protocol) to verify whether the address does already exist. Depending on the answer (i.e. does not already exist), the device is assigned the IP address or the process will repeat.

This may take some time - the GigE Vision® standard specifies that connection setup via LLA should not take longer than 40 seconds, in the worst case it can take up to several minutes.

13.5.4   Force IP (Static IP)

Faults in operation can lead to connection errors between PC and camera.

In this case, *Force IP (Static IP)* may present a final solution. The Force IP feature will transmit IP address and subnet mask to the camera's MAC address. These settings are sent without verification and immediately applied by the client. They remain valid until camera power off.

13.6   Packet Resend

Since the GigE Vision® standard requires UDP - i.e. stateless user datagram protocol - for data transmission, there must be a feature to secure "lost" data.

A resend request is initiated if one or more packets are corrupted during transmission and subsequently discarded - due to incorrect checksum.

Thee are three scenarios:

Standard case

In smooth data transfer, all packets are transferred from the camera to the PC in correct order. This is assumed to be true at more than 99%.

Error 1: Lost packets in the data stream

If one or more packets are lost within the data stream, this is identified by packet number n being not followed by packet number (n+1). In this case, the application transmits a resend request (A). After this request, the camera transmits the next packet and again the lost packet (B).
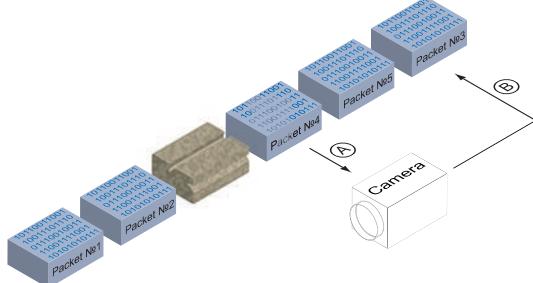
In our example, packet no. 3 was lost. This error is detected on packet #4 triggering the resend request. The camera then transmits packet No. 5, followed by resending packet No. 3.

Error 2: Lost packet at the end of data stream

In case of a failure at the end of the data stream, the application waits for incoming packets for a predefined time. After this time has elapsed, the request to resend is triggered and the "lost" packets are resent.
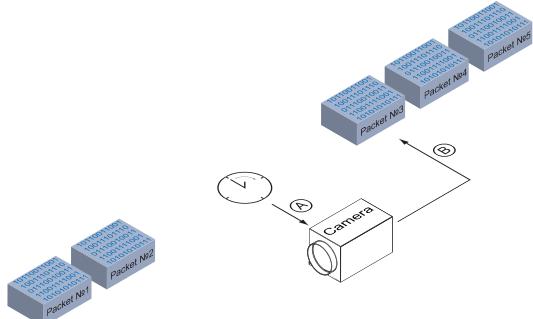
In our example, the packets from No. 3 to No. 5 are lost. This error is detected after the prede-fined time has elapsed and the retransmission request (A) is triggered. The camera then sends packets No. 3 to No. 5 (B) again to complete the image transfer.

The resend mechanism will continue until:

- all packages have reached the PC
- the maximum number of retransmissions of the retransmit is reached
- the timeout for resending has occurred or
- the camera returns an error

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