



Operating Manual

AX Smart Cameras (Embedded Processing)

EN-US

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1 General information

Thanks for purchasing a camera of the Baumer family. This User's Guide describes how to connect, set up and use the camera.



NOTICE

Read this manual carefully and observe the notes and safety instructions!

1.1 Support

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

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1.2 Target group

This User's Guide is intended for experienced users who want to integrate AX Smart Cameras into an image processing system. Programming skills, ideally in Python™ or C++, and knowledge of computer vision are required.

1.3 Intended use

The Baumer AX Smart Camera is a user programmable, Linux based, all-in-one image processing system for many different applications.

It has a compact housing suitable for industrial use and is designed exclusively for indoor use. The use in wet locations is permissible under consideration of the IP protection class.



CAUTION

Use the camera only for its intended purpose!

Any use that is not described in the technical documentation poses dangers and will void the warranty. The risk has to be borne solely by the unit's owner.

1.4 Scope and further reading

This User's Guide will only cover the basics on how the AX Smart Camera is handled.

The provided Operating System and libraries are based on NVIDIA's Jetpack and L4T (Linux® for Tegra®) which in turn is based on Ubuntu® Linux® 18.04.

For detailed information about the Jetson™ hardware and the Jetpack software NVIDIA® provides a lot of documentation. Please refer to this documentation at the NVIDIA® developer websites and forums as required.

For general questions on usage and further help with Ubuntu® Linux®, you can also visit the Ubuntu® help and community pages.

The Linux® image for the AX Smart Cameras can be downloaded from the website: <https://www.baumer.com/ax-software>

1.5 Classification of the safety instructions

In the User's Guide, the safety instructions are classified as follows:

NOTICE

Gives helpful notes on operation or other general recommendations.

CAUTION

Indicates a possibly dangerous situation. If the situation is not avoided, slight or minor injury could result or the device may be damaged.

DANGER

Indicates an immediate imminent danger. If the danger is not avoided, the consequences are death or very serious injury.

1.6 Transport / Storage

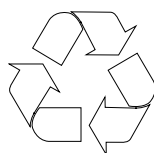
Transport the camera only in the original packaging. When the camera is not installed, then store the camera in original packaging.

1.7 Disposal



Dispose of outdated products with electrical or electronic circuits, not in the normal domestic waste, but rather according to your national law and the directives 2002/96/EC and 2006/66/EC for recycling within the competent collectors.

Through the proper disposal of obsolete equipment will help to save valuable resources and prevent possible adverse effects on human health and the environment.



The return of the packaging to the material cycle helps conserve raw materials and reduces the production of waste. When no longer required, dispose of the packaging materials in accordance with the local regulations in force.

Keep the original packaging during the warranty period in order to be able to pack the device properly in the event of a warranty claim.

1.8 Warranty notes

If it is obvious that the device is / was dismantled, reworked or repaired by other than Baumer technicians, Baumer Optronic will not take any responsibility for the subsequent performance and quality of the device!

1.9 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.

1.10 Conformity

1.10.1 CE



We declare, under our sole responsibility, that the previously described Baumer cameras conform with the directives of the CE.

1.10.2 UR



The camera has been tested by UL (Underwriters Laboratories) and complies with the requirements under **specified installation conditions** of the standards:

- UL 61010-1 Edition 3 - Revision Date: 2016/04/29
- UL 61010-2-201 Edition 2 - Published: 2018/05/14
- CSA C22.2 NO. 61010-1-12 Edition 3 - Update No. 2: 2016/04
- CSA C22.2 NO. 61010-2-201:18 Edition 2 - Published: 2018/02

2 General safety instructions

CAUTION

The installer of the system is responsible for the safety of the system in which the device is integrated.

CAUTION

Observe precautions for handling electrostatic sensitive devices!



CAUTION

Heat accumulation in the device

Heat can damage the device. Provide adequate dissipation of heat. As there are numerous possibilities for installation, Baumer recommends no specific method for proper heat dissipation, but suggest the following principle:

- a) Every form of convection around the device and mounting helps reduce temperature. Prevent heat from becoming trapped!
 - b) Mounting in combination with forced convection may provide proper heat dissipation.
 - c) Avoid mounting onto stainless steel. Stainless steel has a roughly 10-fold lower thermal conductivity compared to aluminium.
 - d) Do not install the device at the end of a profile; this will allow heat to dissipate on both sides (higher temperature drops over a larger area)!
 - e) Do not operate other devices in close proximity to the camera. Their waste heat could additionally heat the camera.
-

3 Camera models

All Baumer cameras of these family are characterized by:

High image quality

- Sony® Pregius™ Sensor for highest image quality
- Low noise, structure free image information
- High sensitivity with large pixel sizes and binning features
- Global shutter architecture for minimized motion blur
- FPGA based, machine vision optimized image signal processor (ISP)

GenICam compatibility

- Fully GenICam™ compatible
- Industrially-compliant process interface and parameter setting capability
- Easy use through provided Baumer neoAPI and GAPI SDK's for Python™ and C++
- GenICam™ compatibility enables many 3rd party machine vision software packages

Computer vision and AI capabilities

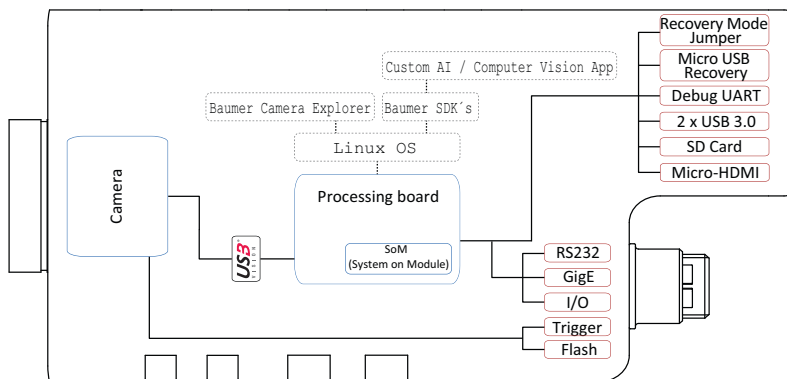
- Powerful NVIDIA® Jetson™ Hardware with ARM® CPU, NVIDIA® GPU and Deep Learning Accelerators (DLA) enables AI and computer vision use cases with high framerates
- Compatible with standard AI frameworks like TensorFlow or Caffe
- Compatible with many standard computer vision frameworks like openCV or scikit-image

Linux® operating system

- Standard development environment
- Huge variety of Ubuntu® packages for every requirement
- Completely customizable as required

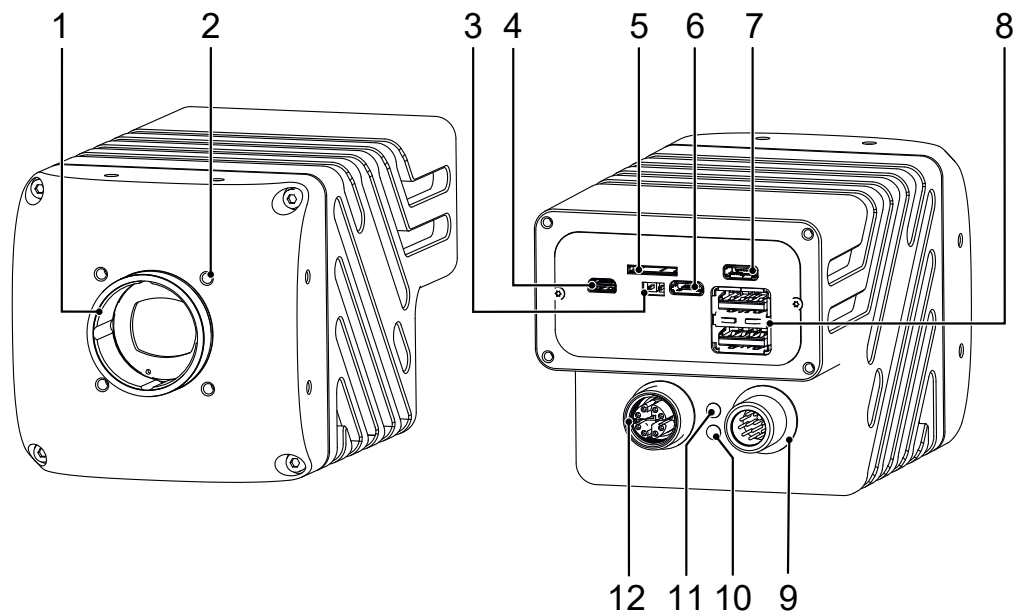
Flexible interfaces

- Hardware-trigger for extremely low latency / jitter triggering
- Synchronized high power outputs for lighting control
- Gigabit Ethernet
- RS232
- USB 3.0
- HDMI



3.1 VAX

3.1.1 General description

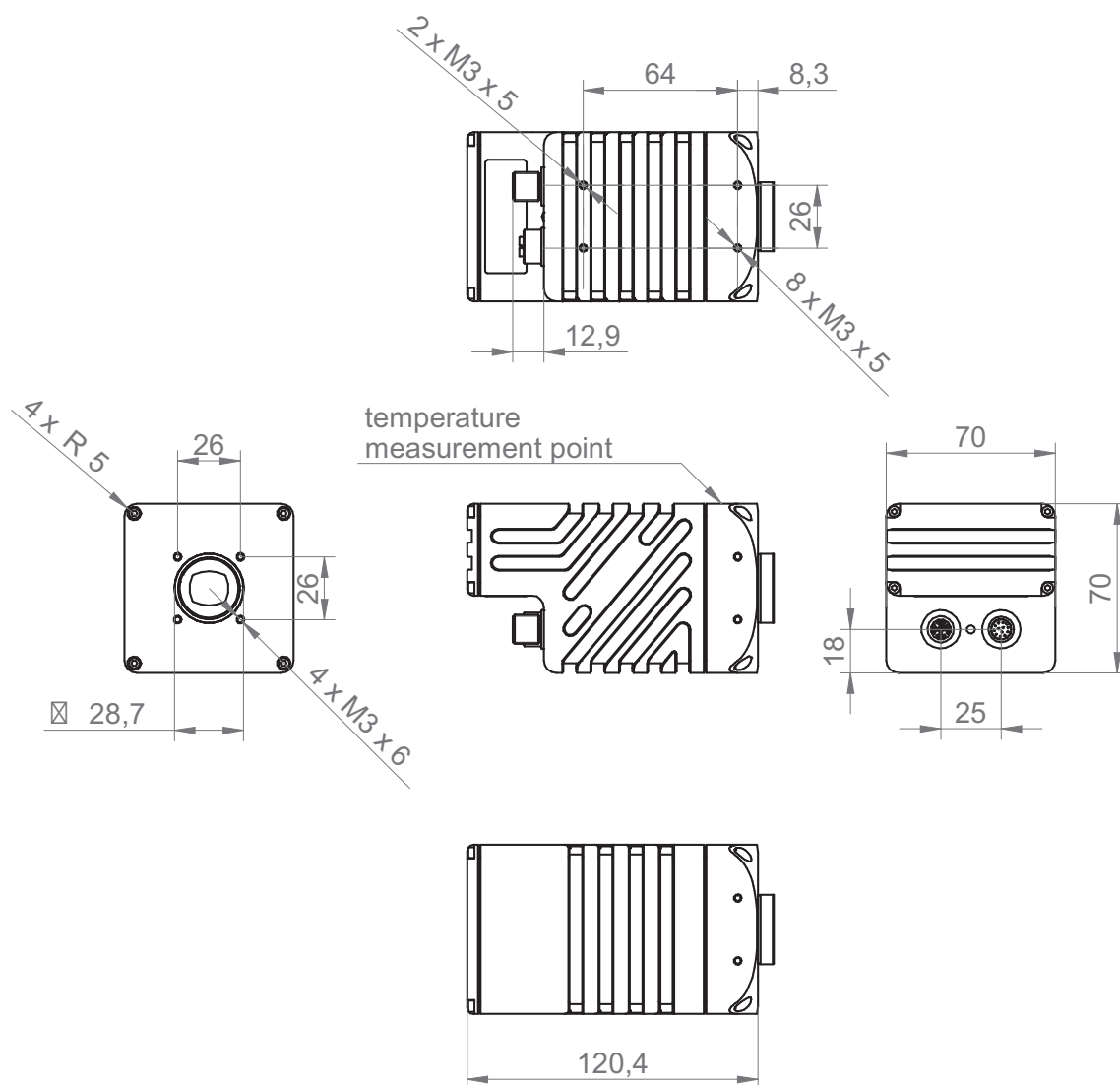


1	Lens mount (C-mount)	2	4 x Tube adapter / front mounting threads
3	Recovery mode jumper	4	Micro HDMI
5	Slot for micro SD card	6	Debug UART
7	Recovery mode (Micro USB)	8	2 x USB3.0 (Type A)
9	Power supply / Digital-IO / RS232	10	Status LED
11	Ethernet LED	12	Gigabit Ethernet Port

3.1.2 Available models

Camera Type	System on Module (SoM)	Sensor Size	Resolution (Width × Height)	Full Frames [max. fps]
Monochrome				
VAX-32M.I.NVN	NVIDIA® Jetson Nano™	1/1.8"	2048 x 1536	55.5
VAX-50M.I.NVX	NVIDIA® Jetson Xavier NX™	2/3"	2448 x 2048	73
Color				
VAX-32C.I.NVN	NVIDIA® Jetson Nano™	1/1.8"	2048 x 1536	55.5
VAX-50C.I.NVX	NVIDIA® Jetson Xavier NX™	2/3"	2448 x 2048	73

3.1.3 Dimensions



4 Installation

⚠ CAUTION

The installer of the system is responsible for the safety of the system in which the device is integrated.

4.1 Wiring (example)

What is included:

- The AX Smart Camera
 - Cover
 - UMO/UM2 jumper
 - M12 dust cover
 - C-Mount dust cover
- preinstalled OS and software

What is not included:

To use the AX Smart Camera further components are required:

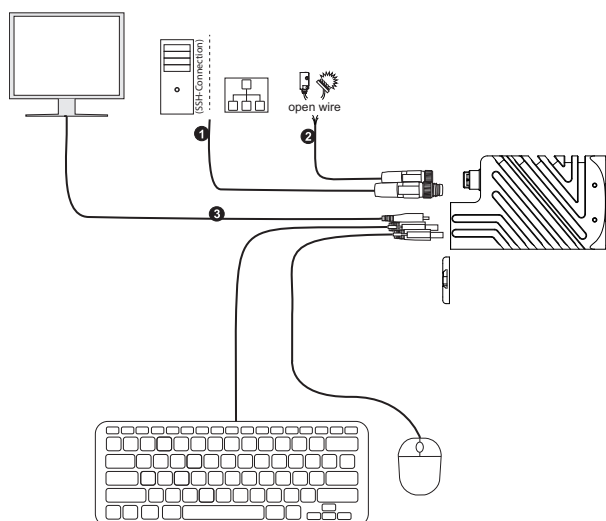
- 24 V Power Supply (min. 25 W)
- M12 power / GPIO cable
- suitable C-Mount lens

To access all features of the AX Smart Cameras we recommend also following:

- USB keyboard and mouse
- HDMI monitor
- Micro HDMI adapter
- M12 X-Coded Ethernet cable
- a computer with internet connection is required for flashing the device
- USB Type A to micro B cable

Baumer provides a large variety of optional accessories which are tested to work with AX Smart Cameras:

- IP67 Tubing System for lens protection
- larger end-lid to cover USB-License-Dongles or small USB Sticks
- Mounting Plate with tripod-thread
- M12 process and Ethernet cables with a variety of specifications and length
- various C-Mount lenses
- various lighting options



- | | | | |
|---|---|---|------------|
| 1 | Ethernet cable (SSH-Connection / Network) | 3 | HDMI cable |
| 2 | Cable for power supply, Digital-IO | | |

4.2 Environmental requirements

Storage temperature	-10 °C (+14 °F) ... +70 °C (+158 °F)
Humidity	10 % ... 90 % non condensing

4.3 Ambient temperature / Heat transmission



CAUTION

Heat accumulation in the device

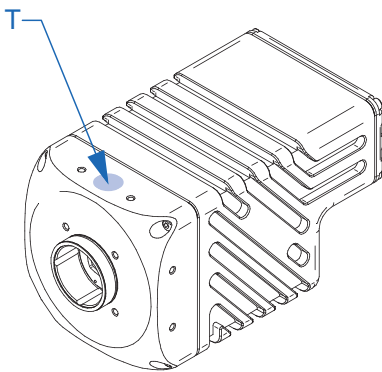
Heat can damage the device. Provide adequate dissipation of heat. As there are numerous possibilities for installation, Baumer recommends no specific method for proper heat dissipation, but suggest the following principle:

- Every form of convection around the device and mounting helps reduce temperature. Prevent heat from becoming trapped!
- Mounting in combination with forced convection may provide proper heat dissipation.
- Avoid mounting onto stainless steel. Stainless steel has a roughly 10-fold lower thermal conductivity compared to aluminum.
- Do not install the device at the end of a profile; this will allow heat to dissipate on both sides (higher temperature drops over a larger area)!
- Do not operate other devices in close proximity to the camera. Their waste heat could additionally heat the camera.

The cooling requirements of the AX Smart Cameras differ widely depending on the computing power required for the application.

Generally, it is always a good idea to mount the AX Smart Camera on a large aluminum profile or similar mounting point to aid heat dissipation.

Further, NVIDIA® provides tools to reduce the maximum power usage and tools to monitor temperatures and computing requirements.



Camera Type	Max. Temperature (T = Measurement Point)
Monochrome	
VAX-32M.I.NVN	65 °C (149 °F)
VAX-50M.I.NVX	60 °C (140 °F)
Color	
VAX-32C.I.NVN	65 °C (149 °F)
VAX-50C.I.NVX	60 °C (140 °F)

Maximum ambient temperature depending on use case

Camera Type	Use case	mounted (45 x 90 mm aluminum profile)	
			not mounted
VAX-32M.I.NVN	Full power usage (CPU, GPU & Camera @ 100%)	53 °C (124.7 °F)	40 °C (104 °F)
VAX-32C.I.NVN			
	Typical power usage (running a typical DNN & Camera)	56 °C (132.8 °F)	46 °C (114.8 °F)
VAX-50M.I.NVX	Full power usage (CPU, GPU & Camera @ 100%)	44 °C (111.2 °F)	27 °C (80.6 °F)
VAX-50C.I.NVX			
	Typical power usage (running a typical DNN & Camera)	52 °C (125.6 °F)	42 °C (107.6 °F)

4.3.1 Emergency shutdown at Overtemperature

To prevent damage on the hardware due to high temperatures, the integrated camera is equipped with an emergency shutdown. The *DeviceTemperatureStatusTransitionSelector* (Category: *DeviceControl*) feature allows you to select different thresholds for temperatures:

- *NormalToHigh*: freely programmable value
- *HighToExceeded*: fixed value (image recording is stopped if exceeded)
- *ExceededToNormal*: freely programmable value, temperature for error-free re-activation of the camera.

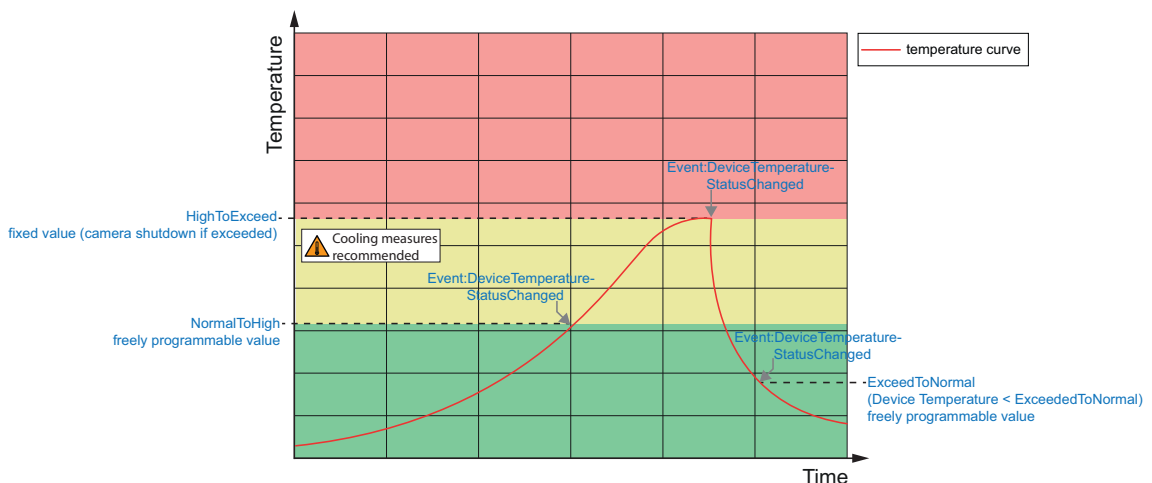
In the *DeviceTemperatureStatusTransition* feature, the temperatures for the programmable temperature transitions are set.

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

If the temperature rises above the value set at *HighToExceed*, the *DeviceTemperatureExceeded* feature is set to *True* and the image recording is stopped.

For further use, the camera must be disconnected from the power supply after cooling down or a *DeviceReset* (Category: *DeviceControl*) should be carried out.

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



Temperatures for emergency shutdown

When the temperature measurement at the internal temperature sensor gives a temperature exceeding the specified values in the following table(s), the *DeviceTemperatureExceeded* feature is set to *True* and the image recording is stopped.

Camera Type	max. Temperature (internal sensor)
Monochrome	
VAX-32M.I.NVN	73 °C (163.4 °F)
VAX-50M.I.NVX	73 °C (163.4 °F)
Color	
VAX-32C.I.NVN	73 °C (163.4 °F)
VAX-50C.I.NVX	73 °C (163.4 °F)

4.3.2 NVIDIA Jetson thermal Management

The integrated NVIDIA® Jetson™ SoM comes with an integrated active thermal management system. If temperatures exceed set boundaries the CPU and/or GPU Cores will reduce their maximum clock frequency as required.

The NVIDIA® tool *tegrastats* can help to monitor the temperatures and clock speeds.

4.4 Mechanical Tests

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

Environmental Testing	Standard	Parameter	
Vibration, sinusoidal	IEC 60068-2-6	Continuous oscillation	10-2000 Hz
		Amplitude underneath crossover frequencies	0,75 mm
		Acceleration	1 g
		Test duration	150 min (axis) 450 min (total)
Vibration, broad band	IEC 60068-2-64	Frequency range	10-2000 Hz
		Acceleration	10 g
		Test duration	5 h (axis) 15 h (total)
Shock	IEC 60068-2-27	Pulse time	11 ms / 6 ms
		Acceleration	50 g / 100 g
Bump	IEC60068-2-29	Pulse Time	2 ms
		Acceleration	100 g

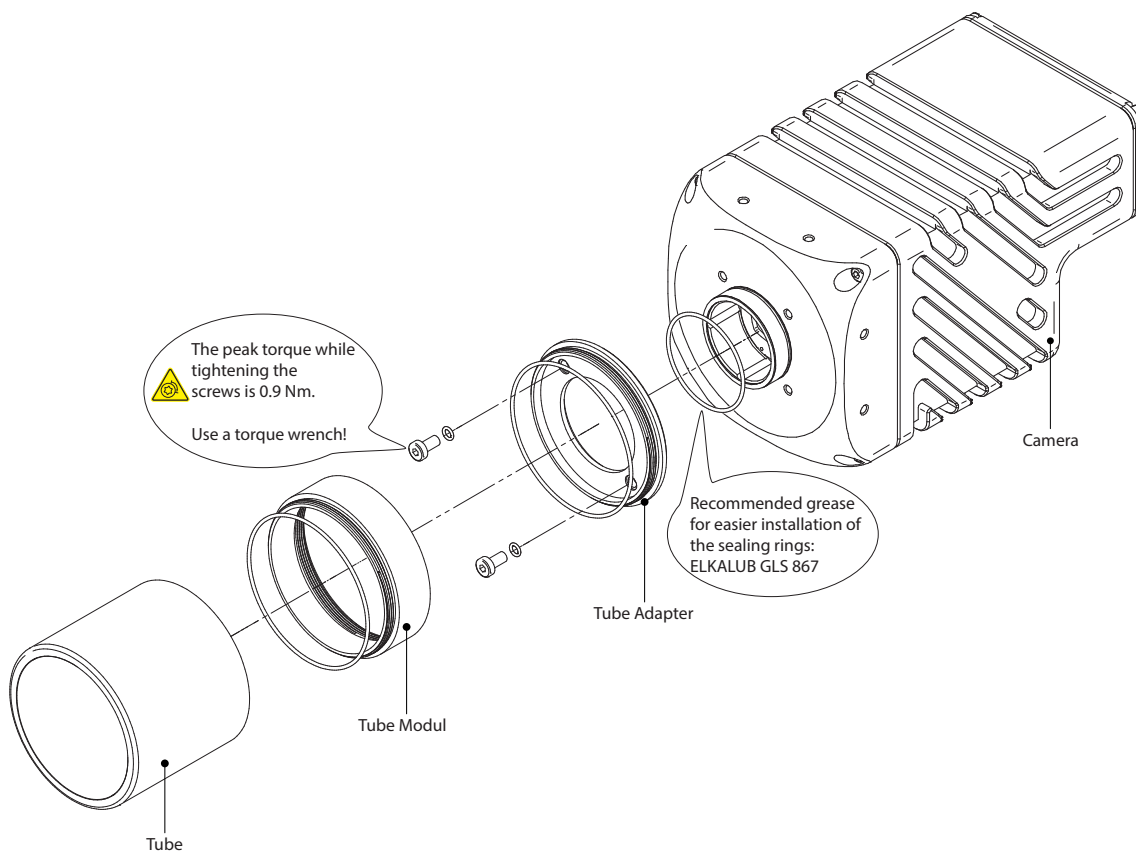
4.5 Lens mounting

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:

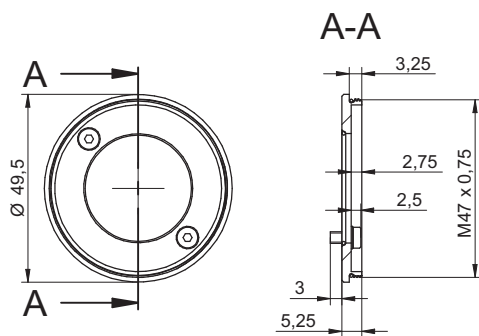
- Install the camera in an environment that is as dust free as possible!
- Keep the C-Mount covered if no lens is attached
- Hold the camera downwards with unprotected sensor.
- Avoid contact with any optical surface of the camera!

4.6 Modular tube system (ordered separately)



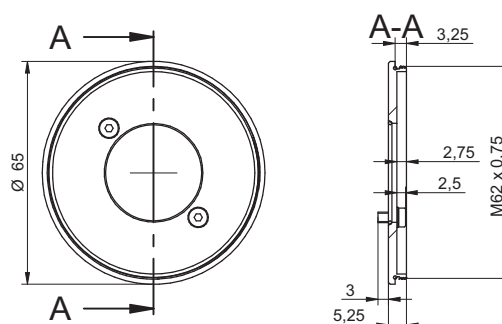
Tube Adapter

M 47

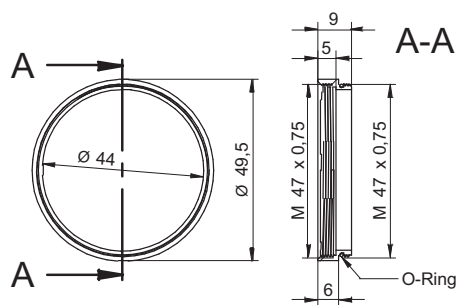


Art. No.: 11185373

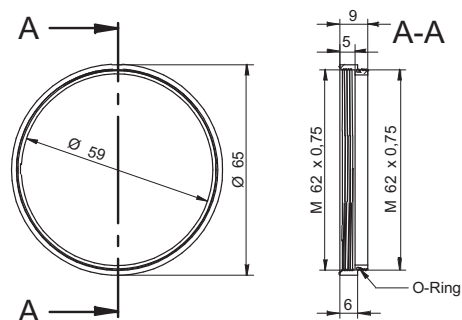
M 62



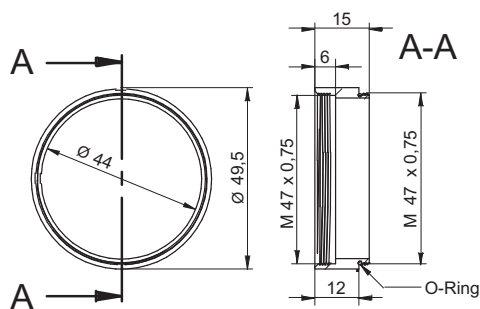
Art. No.: 11185377

Distance Ring**M 47**

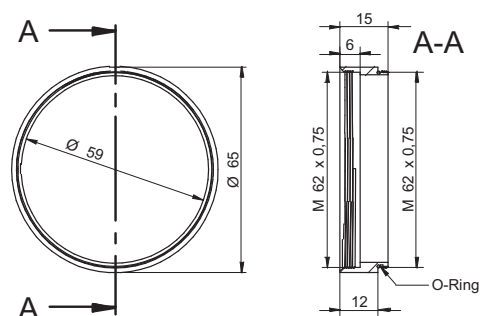
Art. No.: 11185372

M 62

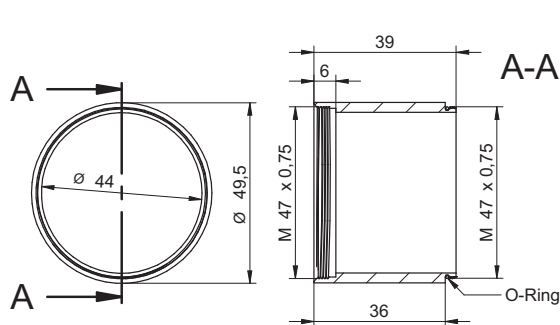
Art. No.: 11185376



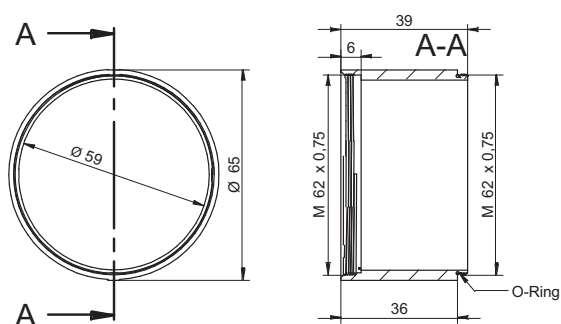
Art. No.: 11185371



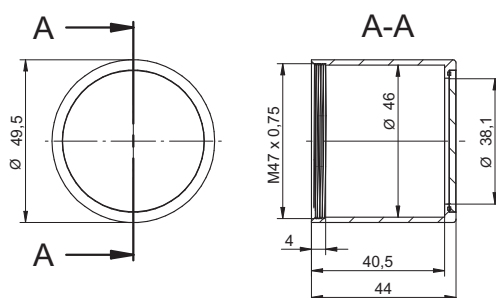
Art. No.: 11185375



Art. No.: 11211571

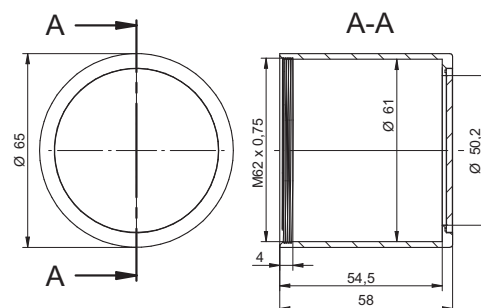


Art. No.: 11198906

Tube**M 47**

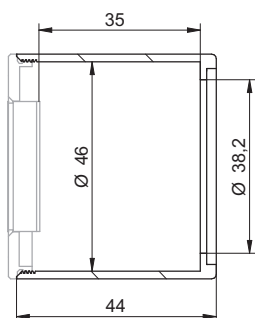
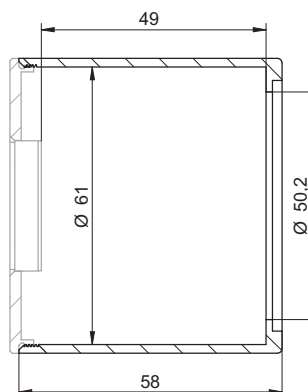
Art. No.: 11185370 (Cover Glass: Acryl)

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

M 62

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

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

Inner dimensions of the Tube**M 47****M 62****4.7 IP Protection classes**

The devices continue working in an industrial environment to meet the requirements of various protection classes.

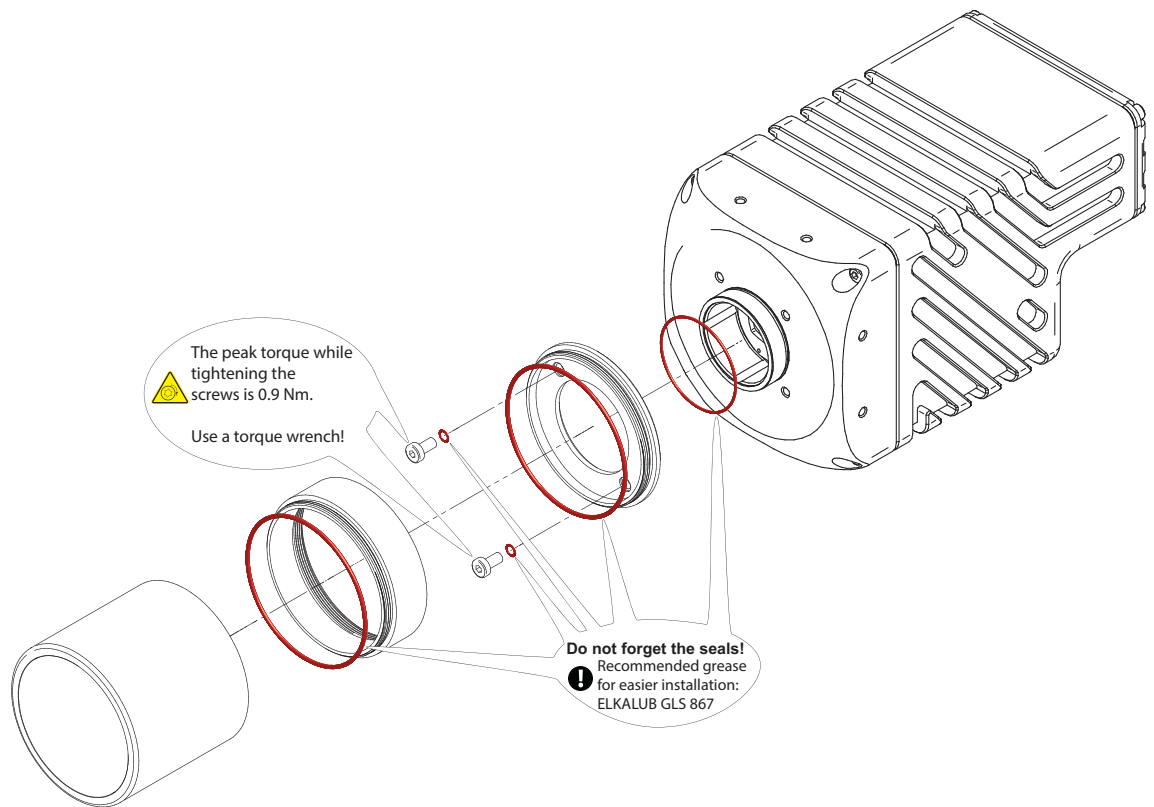
IP40	with mounted lens, cables and port cover
-------------	--

IP67	with mounted tube, cables and port cover
-------------	--

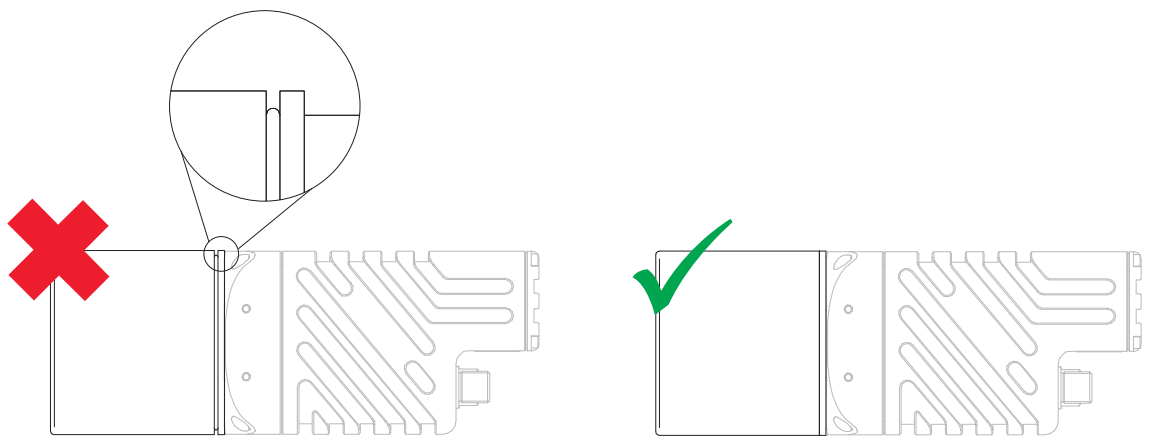
In order to achieve the mentioned IP protection level, please note the following information:

- The tube needs to be screwed on gap-free.
- The M12 connectors or caps need to be tightened with a torque value of 0.4 Nm.
- Use cables that also meets the required IP protection class.
- The cover over unused connections must be installed.

Sealing rings



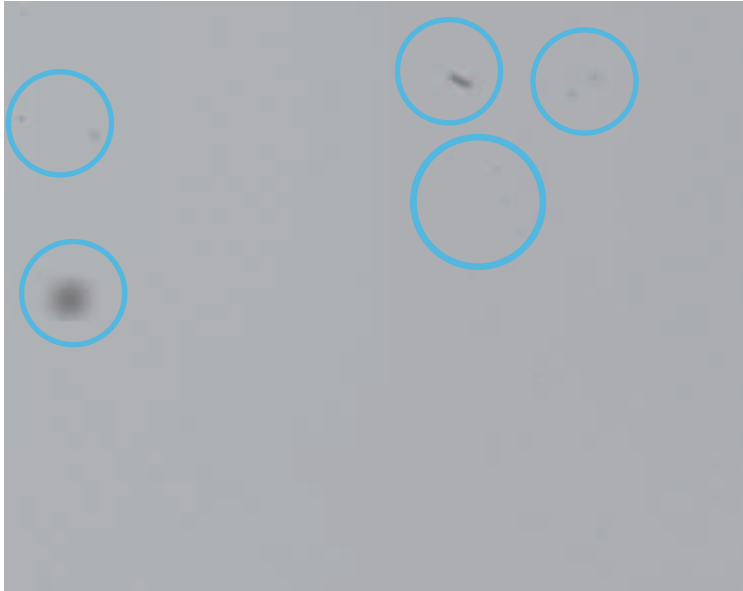
Gap-free assembly



4.8 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

CAUTION

Compressed air for cleaning the camera.

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

CAUTION

Use of volatile solvents for cleaning.

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.

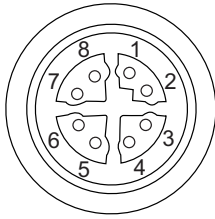
Device materials

Component, part	Material
Camera support	Aluminum (anodized)
Housing center	Aluminum (anodized)
M12 interfaces	copper-zinc alloy (CuZN, nickel-plated)
Light Pipes	Polycarbonate
Cover	Aluminum (anodized)
Screws	galvanized steel / stainless steel
Label	foil composite with aluminum
Seals (not openly accessible)	Gomastit 400

5 Pin Assignment / LED-Signaling

5.1 VAX

5.1.1 Data Interface (Ethernet)



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

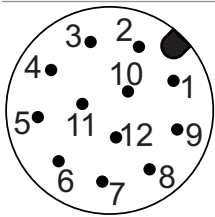
Connector: M12 / 8-pol / x-coded (SACC-CI-M12FS-8CON-L180-10G)

⚠ CAUTION

IP protection level

In order to achieve the mentioned IP protection level, a protective cap must be installed on the unused Ethernet port.

5.1.2 Power and Process interface



1	Power Vcc	brown	7	OUT3	black
2	GND (Power)	blue	8	RS232 TxD	grey
3	IN1 (Camera Line1)	white	9	OUT4	red
4	OUT1 (Camera Line2)	green	10	RS232 RxD	violet
5	IN2	pink	11	GND (IO)	grey-pink
6	OUT2	yellow	12	Power (IO)	red-blue

Connector: M12 / 12-pin / a-coded (SACC-CI-M12MS-12CON-L180)

Shielded cable needs to be used. Cable ordered separately.

5.1.3 Power supply

Class 2 per NEC / Protection Class III

The device is intended to be supplied from an isolated Limited Energy Source per UL61010-1, 3rd ed cl. 9.4 or Limited Power Source per UL60950-1 or Class 2 per NEC.



⚠ DANGER

Use in wet environments requiring IP67 protection

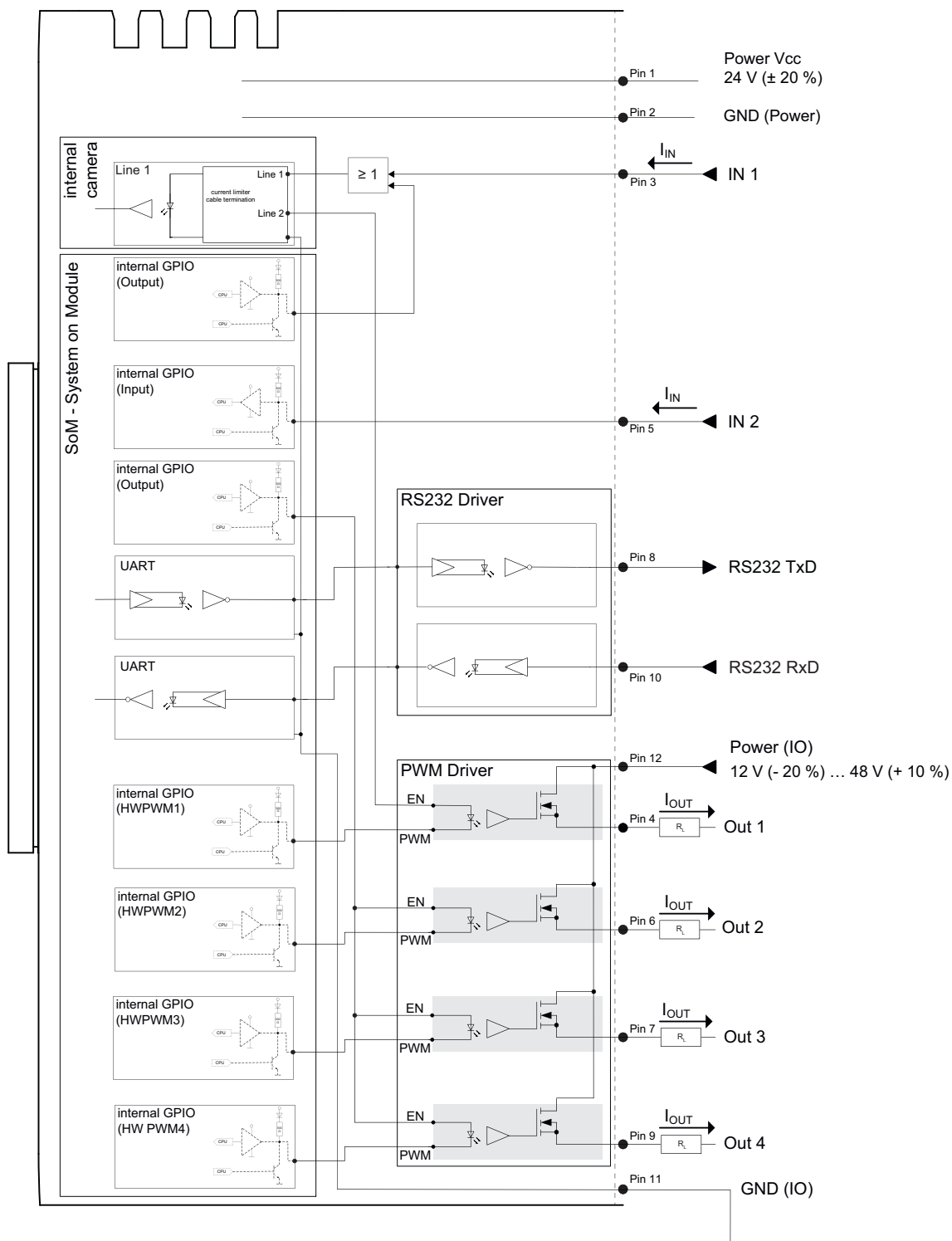
Risk of electric shock. Electric shock can be fatal or cause serious injury.

- Use is only permitted under consideration of pollution degree 2 and overvoltage category 2.
- The M12 connectors must comply with the IEC 61076-2-101 standard.
- The dielectric strength and withstand voltage for the plug / socket combination must be checked according to DIN EN 60664-1:2008-01 for 60 V.

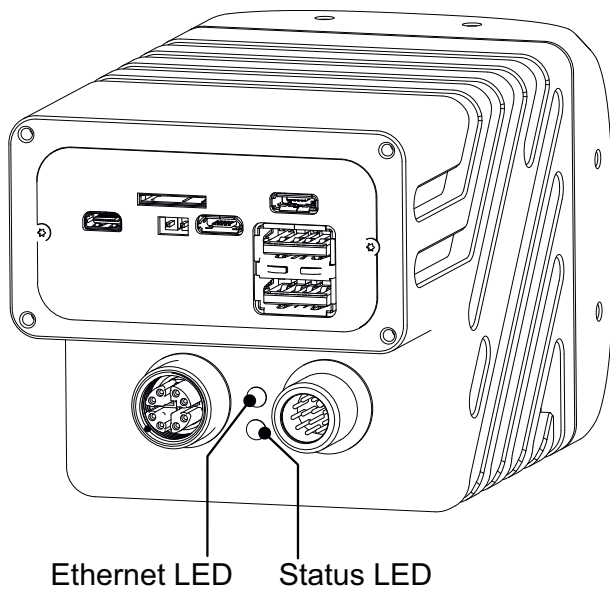
Power Vcc	24 V (± 20 %)
Power IO	12 V (- 20 %) ... 48 V (+ 10 %)

5.1.4

Digital-IO



5.1.5 LED signaling



Description	Signal	Meaning
Ethernet LED	green static	Link active
	orange flash	Data traffic
Status LED	off	Power off / Booting error
	green static	Power on

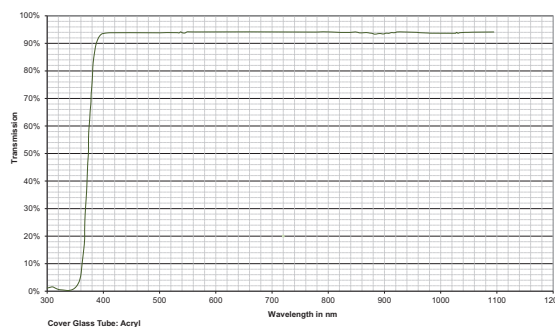
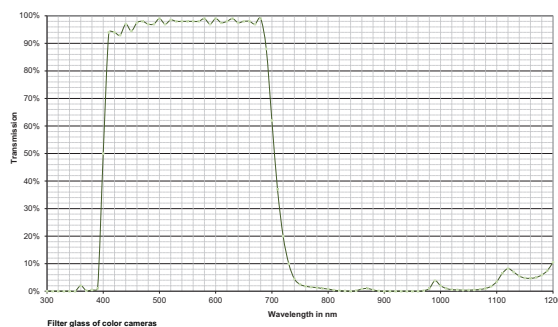
6 Optical specification

6.1 Spectral sensitivity

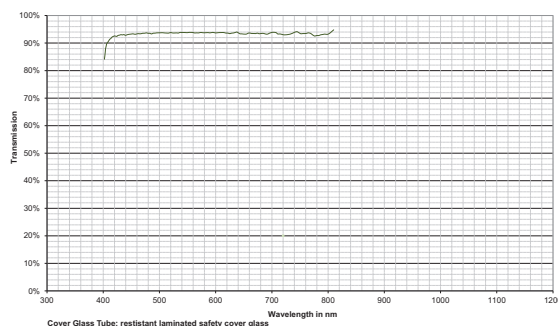
The spectral sensitivity characteristics for cameras of this series are displayed in the following graphs. The characteristic curves for the sensors do not take the characteristics of lenses and light sources without filters into consideration.

Values relating to the respective technical data sheets.

Filter glasses / Cover glasses



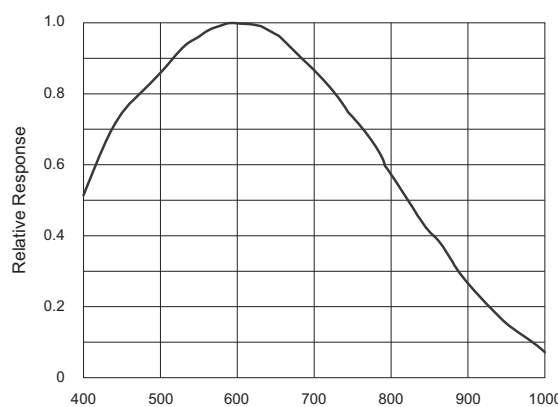
Filter glass color camera



Filter glass Tube Acryl

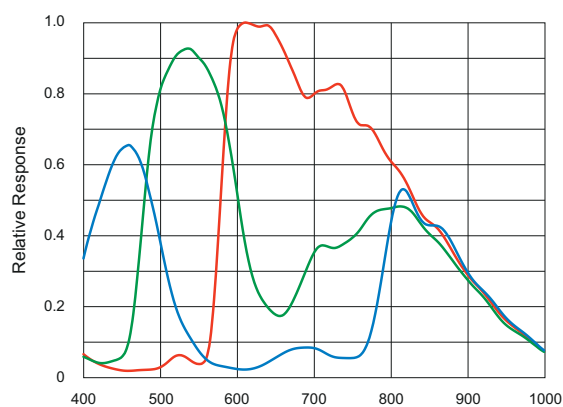
Filter glass Tube laminated safety cover glass

Cameras



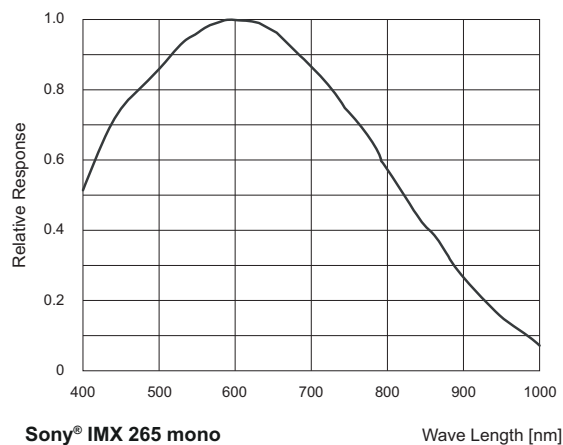
Sony® IMX 250 mono

Spectral sensitivity VAX-32M (IMX265)

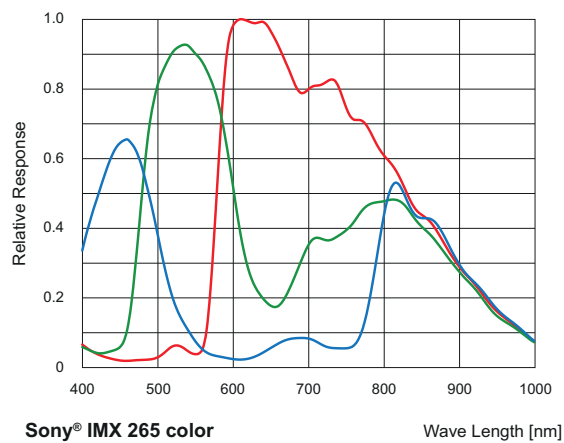


Sony® IMX 250 color

Spectral sensitivity VAX-32C (IMX265)



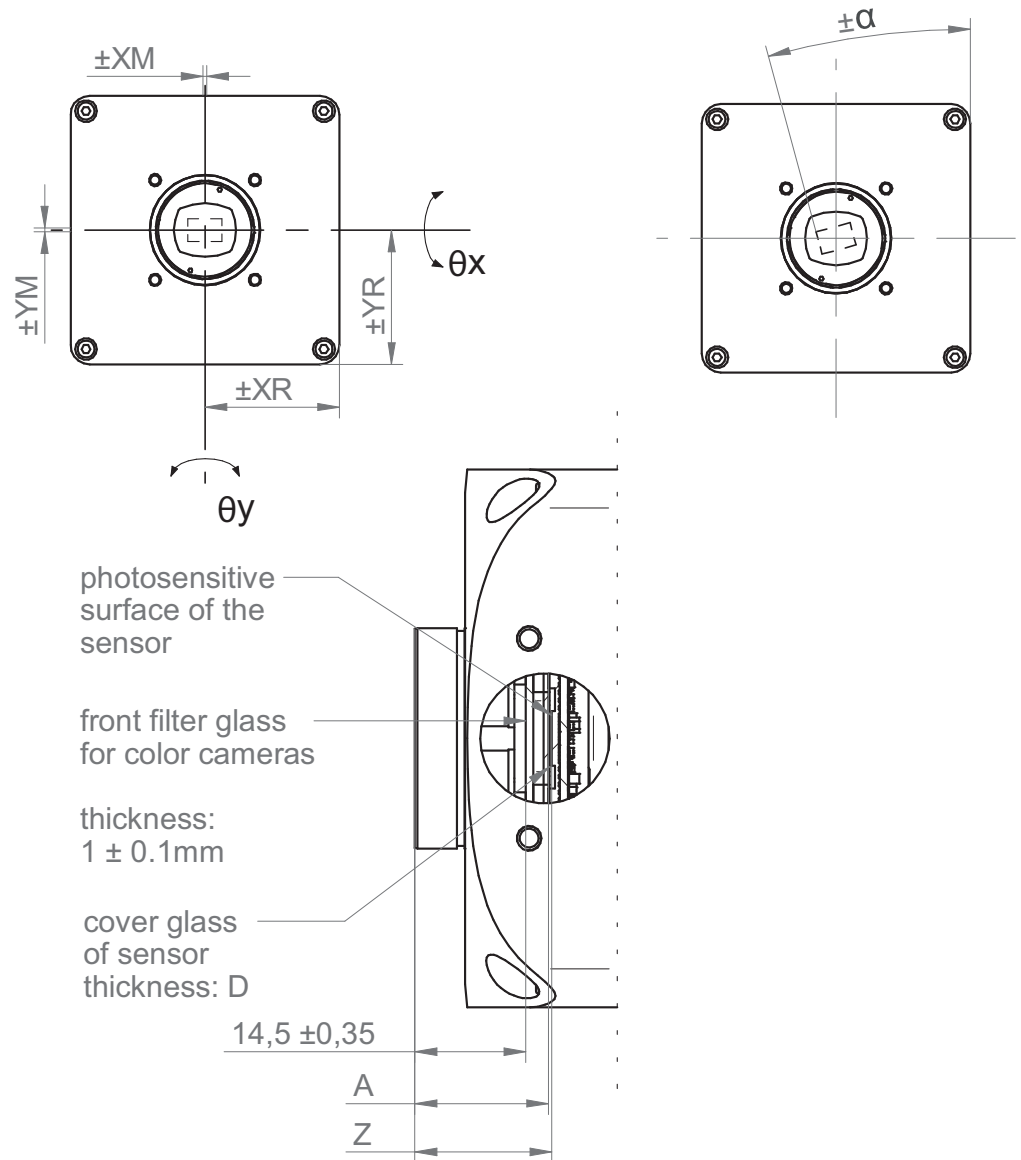
Spectral sensitivity VAX-50M (IMX250)



Spectral sensitivity VAX-50C (IMX250)

6.2 Sensor position accuracy

The typical accuracy by assumption of the root mean square value is displayed in the figure and the table(s) below.



Camera Type	$\pm x_M$ [mm]	$\pm y_M$ [mm]	$\pm x_R$ [mm]	$\pm Y_R$ [mm]	z^{***}_{typ} [mm]	$\pm \alpha_{typ}$ [°]	A ^{***} [mm]	D ^{**} [mm]
VAX-32*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70
VAX-50*	0.17	0.17	0.17	0.17	17.63 ± 0.070	0.6	16.5	0.70

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

7 Software

7.1 Installed OS and software

The AX Smart Camera system image is based on Ubuntu® 18.04 extended with NVIDIA® L4T (Linux® for Tegra®) release 32.4.4 packages. It includes Linux® Kernel 4.9, bootloader, NVIDIA® drivers, flashing utilities, root file system based on Ubuntu® 18.04, and everything else required for the Jetson™ platform.

This image uses LXDE as desktop environment for minimum disk and memory footprint. Additionally, you'll find the Baumer tools to work with the integrated camera:

- *Baumer GAPI & NeoAPI SDK's for C++ and Python™*
- *Baumer Camera Explorer*
- Baumer IO-libs (to control the Digital IO)
- Baumer Code Examples
- Documentation

You are free to install any further packages or components you might require. This is best done using the Linux® `apt-get` command. This also allows you to replace any of our default packages with the ones you prefer.

NOTICE

Risk of data loss

Do not disconnect the AX Smart Camera after change of data from the power supply! Shut down the camera via the operating system or perform a restart via the operating system.

In both cases, the camera is restarted. When the operating system has been loaded, you can disconnect the camera from the power supply.

7.2 Getting started

The AX Smart Cameras can be used similar to a standard Linux PC. That means, that once you connect keyboard, mouse, monitor and a suitable power supply, you can work on it directly. This is the easiest way to get familiar with the AX Smart Cameras.

However, to be more productive, most people will choose to do actual software development on their PC and use a cross compile workflow to create software which can then be transferred and run on the AX Smart Camera.

CAUTION

You have the freedom to do anything on the file system. This includes operations which can render the hardware inaccessible. In those cases you might need to flash the original software back as described.

7.3 Setup assistant

The AX Smart Camera will start to boot into the Linux operating system as soon as a power supply is connected.

When first starting the AX Smart Camera you will be presented with the initial setup assistant. This assistant will guide you through the few necessary steps to set up the AX Smart Camera for further usage. All of the chosen settings can be changed later on.

The AX Smart Cameras can be used similar to a standard Linux PC. That means, that once you connect keyboard, mouse, monitor and a suitable power supply, you can work on it directly. This is the easiest way to get familiar with camera.

Instruction:

- a) Connect all cables.

NOTICE

A System Configuration Wizard starts during initial startup. If no HDMI cable is connected, the system expects input via the DEBUG UART interface.

⚠ CAUTION

The most critical step is the setup of the root user and password. Please ensure that you document this username and password securely. Without that user / password you will not be able to access the camera! Only a complete flashing of the operating system will help in this case, which destroys all data and configuration on the camera.

- b) Activate the power supply.
 - ✓ The operating system boots and the System Configuration Wizard is started.
- c) Follow the instructions of the System Configuration Wizard. The System Configuration Wizard will guide you through the few necessary steps to set up the camera for further usage. All of the chosen settings can be changed later on.
 - ✓ The desktop is loaded. **The setup is not yet complete!**
- d) Shut down the camera via the operating system or perform a restart via the operating system. In both cases, the camera is restarted. When the operating system has been loaded, you can disconnect the camera from the power supply.

Result:

- ✓ The system is set up with your settings.

7.4 First log-in

Once you finished the setup assistant, you can log-in with your chosen user name and password.

After your successful log-in, you will be presented with the *lxde* desktop. This light-weight desktop was chosen because of its low footprint/resource usage and its familiar design/UI. Obviously, you are free to install an alternative desktop if required.

In the start menu in the lower left hand corner you find the usual standards like a file manager (*PCManFM*), editor (*Leafpad*) and terminal (*LXTerminal*).

NOTICE

The file system is read-only when you start the AX Smart Camera! It only appears to be writable through an overlay file system. Please read the further information about working with an overlay file system.

7.5 Check the version of the system image

Baumer will periodically release bugfixes and updates for the system image. Those will be available from the baumer website: <https://www.baumer.com/ax-software>

You can check the file `/etc/vax_release` which contains the current version number. If the image on the website is newer, you can update the image as described in the chapter

Flash the operating system to the Camera [▶ 37].

7.6 The Smart Camera and Baumer software

Pre-installed on the AX Smart Camera is the *Baumer Camera Explorer* which you can run from the start menu. Once the *Camera Explorer* is started you should see a first image from the integrated camera.

The *Camera Explorer* allows you to configure all the settings of the integrated camera and display or record images from the integrated camera. It is also a good tool to troubleshoot any issues which might arise.

Also pre-installed are the Baumer neoAPI and GAPI camera SDK's. Those are used to configure the integrated camera and retrieve images.

The neoAPI is a modern API for GenICam™ compatible cameras, such as the Baumer cameras. It hides much of the complexity typically associated with handling GenICam™ cameras to reduce code complexity and required time for development. The Baumer neoAPI is available for Python™ and C++.

The Baumer GAPI API is the more traditional API which gives you more flexibility for advanced use cases. The Baumer GAPI is only available for C++.

The provided documentation and examples for each API will help you walk the first steps.

Baumer neoAPI Python™ documentation: `/opt/baumer-neoapi-1.1.1-py/docs/`

Baumer neoAPI Python™ examples: `/opt/baumer-neoapi-1.1.1-py/examples/`

Baumer neoAPI C++ documentation: `/opt/baumer-neoapi-1.1.1-cpp/docs/`

Baumer neoAPI C++ examples: `/opt/baumer-neoapi-1.1.1-cpp/examples/`

Baumer GAPI C++ documentation: `/opt/baumer-gapi-2.11.0/docs/`

Baumer GAPI C++ examples: `/opt/baumer-gapi-2.11.0/examples/`

Baumer Camera Explorer: `/opt/baumer-camera-explorer/bin/`

7.7 Change network settings

Another common task is to change the default network settings to suit your application. All settings should be configured with the network manager which can also be configured on terminal using `nmcli`.

For example to configure the first ethernet connection to use static ip call:

```
nmcli c modify Wired\ Connection\ 1 ipv4.addresses "169.254.1.10/16"
ipv4.method manual. This settings are applied after setting the connection up again using:
nmcli c up Wired\ Connection\ 1
```

A simple call to `nmcli` will show you now all available connections and their settings.

Please see the available online documentation for the Gnome Network manager for further details.

7.8 Connect via SSH

After running the setup assistant you can connect to your AX Smart Camera remotely using `ssh` and login with the password you have chosen during the setup.

Connect over Ethernet

For that you have to connect the M12 Ethernet Connector of the AX Smart Camera to a local switch or directly to your working PC.

You need to know the IP of the AX Smart Camera in the network.

```
ssh <login>@<ip-adress>
```

If you prefer, you can also use `ssh` keys to login without password prompt.

Connect over USB-OTG

If you connect the AX Smart Camera using a USB cable on the USB recovery connector to your PC, a simulated network should show up. This network has the IP-address `192.168.55.1`.

```
ssh <login>@192.168.55.1
```

7.9 The overlay file system

For an industrial capable system it is very important, that the system will start up reliably even after a unplanned power loss. However due to the way flash memory is handled, write operations to the file system can corrupt important files or data during power loss.

To protect the file system in such events an overlay file system is established on the AX Smart Camera. This ensures, that no writes are going to the flash memory during operation but changes are instead written to the memory (RAM).

All required mounting actions are done in a *initramfs*. So even while booting no flash corruption can happen.

From the perspective of a user or a running program this is transparent. Anyone can read and write to the file system as they wish. However after a reboot or power-loss all written data will be lost.

The only exception is the `/home/` directory. This is mounted directly and changes here will be written directly to the flash memory. So to save data during operation this directory can be used. However, please ensure, that this data is backed up regularly to avoid data loss.

Disable / Enable the overlays

In order to install software or copy programs or data to the AX Smart Camera you need to disable the overlays.

This is done by creating a "magic" file: `sudo touch /mnt/root-ro/disable-root-ro`

To re-enable the overlays the "magic" file needs to be removed with: `sudo rm /disable-root-ro`

NOTICE

After activating and deactivating the overlay, a restart of the AX Smart Camera is necessary for the changes to take effect. Changes in RAM cannot be saved persistently!

7.10 Install / remove software packages

Many different software packages are available for the AX Smart Camera through the Ubuntu® and NVIDIA® repositories and can be installed as required. To access this repositories the Linux® standard tool `apt-get` is used.

The `apt-get` command allows you to search, install and remove packages and handles dependencies for you.

You can also add your own repositories to the `/etc/apt/sources.list` to install your own software or copy software manually.

If you are not familiar with `apt-get`, please visit one of the many tutorials available online.

7.11 Add / change / remove services

The AX Smart Camera uses the Linux® `system.d` supervisor. This supervisor can be used to start additional provided services or help create your own.

The Debian® online documentation for `system.d` might help you to get started.

7.12 Using the Inputs, Power Outputs and RS232

To control the power-outputs or read the value of inputs the AX Smart Camera provide the `vax_io` libraries for C and Python™. To trigger the internal camera or to use its flashes, the IOs must also be initialized on the VAX Smart Camera via the `vax_io` libraries.

This libraries are located at `/opt/baumer-vax/vax_io`.

Please see the included documentation there for details how to use them.

7.13 The cross-compile tool-chain for the AX Smart Camera

A cross-compiling workflow is in most cases the only effective way to write software for an embedded system like the AX Smart Cameras. To simplify getting started we provide a helper script to configure the cross compile tool-chain and an example.

Condition:

⇒ For this example you'll need a Linux based x86_64 system as your development PC.

Instruction:

- Establish a SSH connection to your AX Smart Camera over USB-OTG or Ethernet.
- Copy the helper script to your development system `scp <login>@<ip-address>:/opt/baumer-vax/cross-toolchain/init-cross-dev.sh`
- Dependencies could show up, please install these.
- Executing the helper script will create the development environment at your current working directory `init-cross-dev.sh -l=<login>@<ip-address>`
 - ✓ As default the example will compile against a SSH mounted AX Smart Camera file system.

NOTICE! If you turn the device off, the compile will fail.

- To allow builds with an unpowered AX Smart Camera omit the option `-o` to create a reduced system root `init-cross-dev.sh -l=<login>@<ip-address> -o`
- To build the example call `make -C build`
- Copy the binary with `scp build/bin/* <login>@<ip-address>:` and execute it on the AX Smart Camera.

7.14 Flash the operating system to the Camera

Baumer provides downloads of the system image for the AX Smart Cameras on the Baumer website. Please check there for the most current image.

If your AX Smart Camera is not accessible, e.g. because you can't remember your root password, you can flash the original image provided by Baumer to regain access.

NOTICE

Flashing a new image to the Baumer AX Smart Camera will delete all files and data. Please backup everything required as there is no way back!

NOTICE

Only flash images from Baumer and pick the right version for your Baumer AX Smart Camera. Do not attempt to flash the original NVIDIA® image, those will not work!

NOTICE

Be sure to perform all steps as described! If the AX Smart Camera is disconnected from the power supply prematurely, the update will fail!

Steps to flash the AX Smart Camera**Condition:**

- ⇒ Linux based host PC
 - ⇒ USB-A to Micro USB cable (USB-OTG, most Micro USB phone charging cables will work)
 - ⇒ UMO/UM2 jumper
 - ⇒ Power supply
 - ⇒ Monitor, keyboard, mouse
- a) Download the current image for your specific AX Smart Camera from our website here:
<https://www.baumer.com/ax-software>
 - b) Unzip the file to a convenient location on the host PC.
 - c) Switch off the AX Smart Camera power supply.
 - d) Insert the jumper onto the pins at the back (Recovery mode jumper) of the AX Smart Camera.
 - e) Connect the host PC to the Recovery Mode port of the AX Smart Camera.
 - f) Switch the power supply of the AX Smart Camera back on.
 - ✓ The camera should be connected as a slave device (can be checked with `lsusb - a` on the host)
 - g) Change to the folder where you extracted the image on the host PC.
 - h) Connect monitor, keyboard and mouse to the AX Smart Camera.
 - i) Run `./flash.sh` on the host PC.
 - j) Wait until finished, this takes some time.
 - ✓ The following message appears: `*** The target t186ref has been flashed successfully. *** Reset the board to boot from internal eMMC. The flashing is not yet complete!`
 - k) Remove USB-cable and jumper from the AX Smart Camera.
 - l) Run the setup assistant and wait until the desktop is loaded.
 - m) Shut down the camera via the operating system or perform a restart via the operating system. In both cases, the camera is restarted. **When the operating system has been loaded, you can disconnect the camera from the power supply.**

Result:

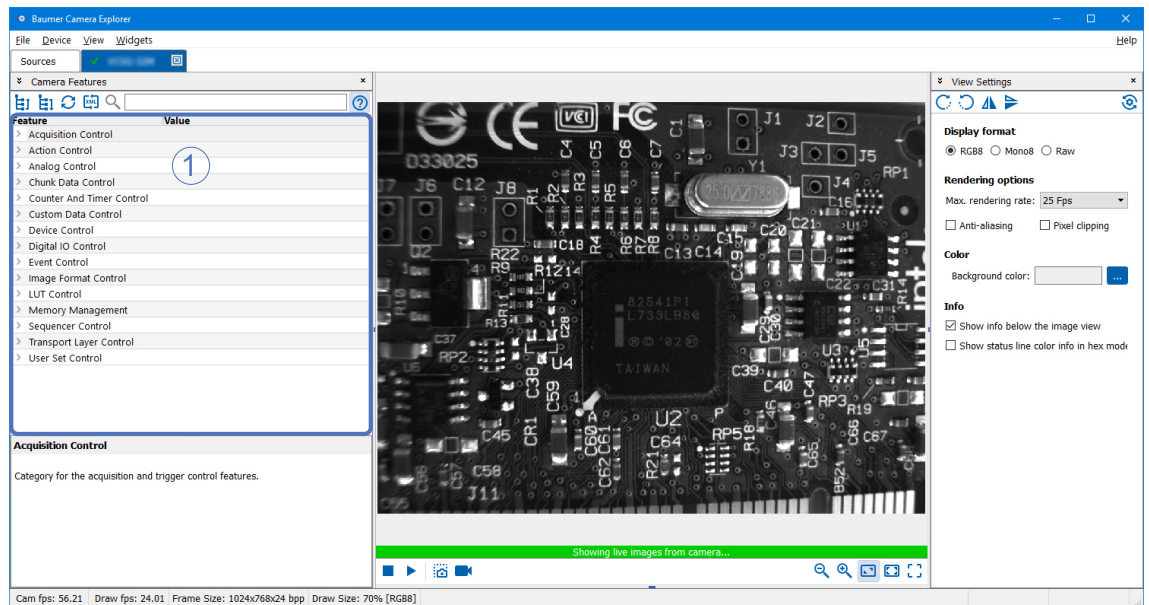
- ✓ Now the AX Smart Camera is usable again.

8 GenICam Camera Features

The camera features are represented by a GenICam™ compliant XML description file. The following chapter describes all available features included there. Most of the camera's features are standardized in the GenICam™ SFNC and must use the name defined there. Specialized features not mapping to an existing GenICam™ SFNC name are included as vendor-specific within the 'Custom' namespace.

The camera features are functional grouped by Category features. This elements can be used by software to display the features in more organized way.

You can view the functionality of your camera in the feature tree (1) of the *Camera Explorer*. Please refer to the appropriate documentation.



8.1 Category: AcquisitionControl

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

8.1.1 AcquisitionAbort

The acquisition abort process is a special case in which the current 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	-

8.1.2 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)

8.1.3 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

8.1.4 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)

8.1.5 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.

NOTICE

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

Name	AcquisitionMode	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	Frames are captured continuously without external events until stopped with the AcquisitionStop command.
	MultiFrame	In this mode a predefined number of frames will be captured after <i>AcquisitionStart</i> . The <i>AcquisitionFrameCount</i> controls the number of captured frames. Then the acquisition is automatically stopped.
	SingleFrame	In this mode the camera is captured one frame after <i>AcquisitionStart</i> . Then the acquisition is stopped.

8.1.6 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.

NOTICE

Certain settings which affect the image format can only be adjusted if the camera is stopped.

This includes:

- *PixelFormat*
- Region of Interest (*OffsetX* / *OffsetY* / *Width* / *Height*)

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

8.1.7 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)

8.1.8 AcquisitionStatusSelector

Selects the internal acquisition signal to read using 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 Device is currently waiting for a trigger for the capture of one or many frames.

8.1.9 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	-

8.1.10 ExposureAuto

Sets the automatic exposure mode when *ExposureMode* is *Timed*. The exact algorithm used to implement this control is device-specific.

Name	ExposureAuto	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	Exposure duration is constantly adapted by the device to maximize the dynamic range.
	Off	Exposure duration is user controlled using ExposureTime.
	Once	Exposure duration is adapted once by the device. Once it has converged, it returns to the Off state.

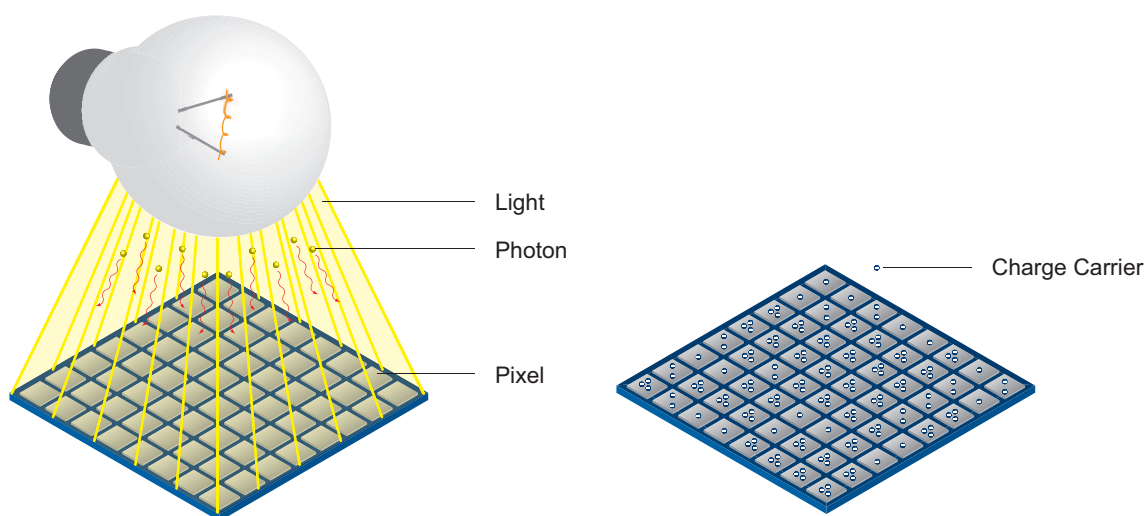
8.1.11 ExposureMode

Sets the operation mode of the Exposure (or shutter).

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

8.1.12 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 (t_{exposure}).

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

NOTICE

It is not possible to use the Sequencer when the *ShortExposureTimeEnable* feature is enabled.

Camera Type	t_{exposure} min [μsec]	t_{exposure} max [sec]
Monochrome		
VAX-32M.I.NVN	1	60
VAX-50M.I.NVX	1	60
VAX-32C.I.NVN	1	60
VAX-50C.I.NVX	1	60

8.1.13 ReadoutMode

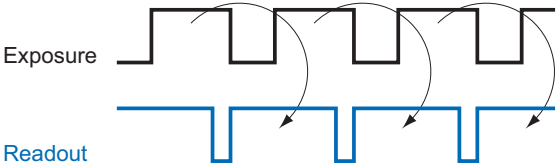
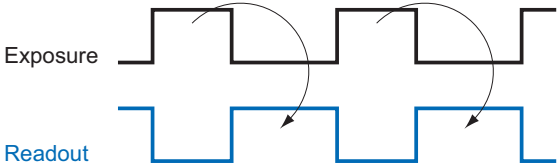
Specifies the operation mode of the readout for the acquisition.

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 (t_{exposure}) can be adjusted by the user, however, the time needed for the read-out (t_{readout}) is determined by the particular sensor and image format in use.

The cameras can be operated sequential or overlapped depending on the mode and the combination of exposure and readout times used:

Overlapped	Sequentiell
In this operation mode, frame (n+1) is exposed whilst frame (n) is being read out.	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

8.1.14 ShortExposureTimeEnable

Controls if short exposure time should be supported.

NOTICE	
It is not possible to use the <i>Sequencer</i> when the feature <i>ShortExposureTimeEnable</i> is enabled.	
Name	ShortExposureTimeEnable
Category	AcquisitionControl
Interface	IBoolean
Access	Read only
Unit	-
Values	true = 1 (On) false = 0 (Off)

8.1.15 TriggerActivation

Specifies the activation mode of the trigger.

Name	TriggerActivation	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	FallingEdge	Specifies that the trigger is considered valid on the falling edge of the source signal.
	RisingEdge	Specifies that the trigger is considered valid on the rising edge of the source signal.

8.1.16 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)	

8.1.17 TriggerMode

Controls if the selected trigger is active.

Name	TriggerMode	
Category	AcquisitionControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Off	Disables the selected trigger.
	On	Enable the selected trigger.

8.1.18 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 accepted immediately after the exposure period.

8.1.19 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.

8.1.20 TriggerSoftware

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

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

8.1.21 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	VAX
All	■
Line0	■
Line1	■
Line2	■
Line3	■
Off	■
Software	■

8.2 Category: AnalogControl

Features in this chapter describes how to influence the analog features of an image, such as gain, black level, brightness correction and gamma.

8.2.1 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 it has converged, it automatically returns to the Off state. The levelling can take several images.
NOTICE! When images are acquired in trigger mode, the white balance affects on the next acquired image.		

8.2.2 BlackLevel

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

Name	BlackLevel
Category	AnalogControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	see table(s) below
Camera Type	Black Level
Monochrome	
VAX-32M	0 ... 255 DN12
VAX-50M	0 ... 255 DN12
Color	
VAX-32C	0 ... 255 DN12
VAX-50C	0 ... 255 DN12

8.2.3 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 or taps.

8.2.4 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.

NOTICE

Increasing the gain factor also increases image noise. Controls the selected gain as an absolute physical value.

Controls the selected gain as an absolute physical value.

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

Camera Type	Gain [dB]
Monochrome	
VAX-32M	0 ... 48
VAX-50M	0 ... 48
Color	
VAX-32C	0 ... 48
VAX-50C	0 ... 48

8.2.5 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.
NOTICE! The levelling can take several images.		

8.2.6 GainSelector

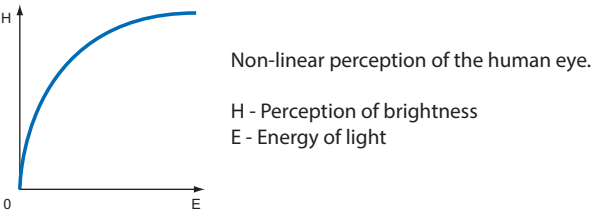
Selects which gain is controlled by the various gain feature.

Name	GainAuto	
Category	AnalogControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	All	All Gain will be applied to all channels or taps.
	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)

8.2.7 Gamma

This feature offer the possibility of compensating nonlinearity in the perception of light by the human eye.

For this correction, the corrected pixel intensity (Y') is calculated from the original intensity of the sensor's pixel (Y_{original}) and correction factor γ using the following formula (in oversimplified version): $Y' = Y_{\text{original}}^\gamma$



The values of the calculated intensities are entered into the Look-Up-Table. Thereby previously existing values within the LUT will be overwritten.

NOTICE

If the LUT feature is disabled on the software side, the gamma correction feature is disabled, too.

NOTICE

For cameras with long readout times may cause visual effects while setting a value for gamma and simultaneous image acquisition, because access to LUT is not locked against the pixel stream.

This can be prevented by stopping the camera (*AcquisitionStop*) before setting.

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

AutoFeature ROI – General Information

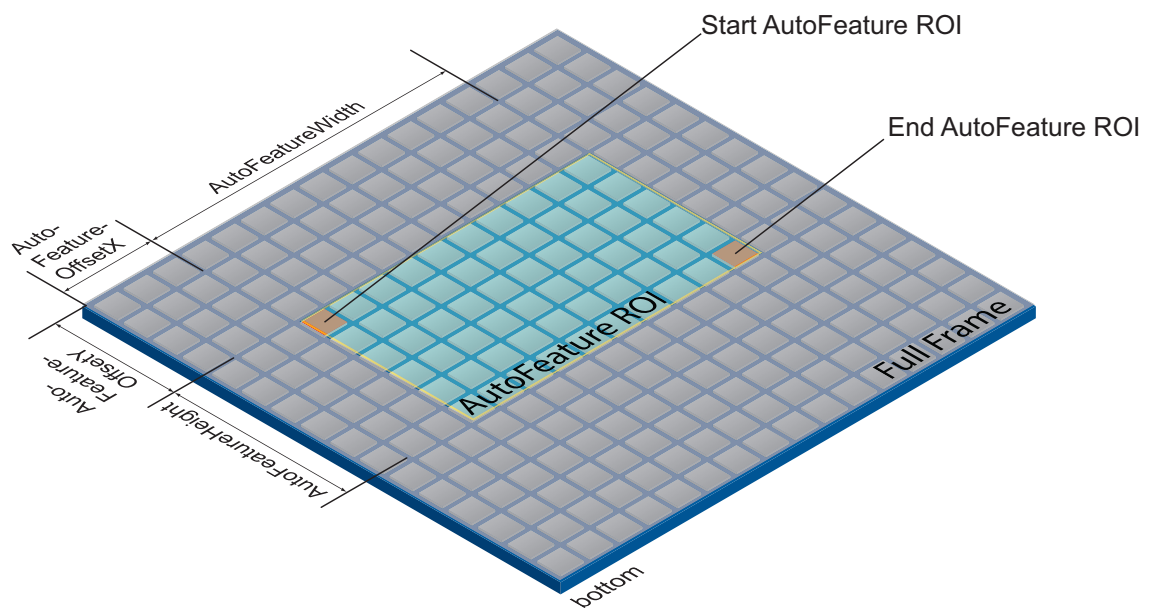
You can use the AutoFeature Region of Interest (ROI) function to predefine a so-called region of interest. This ROI is an area of pixels on the sensor.

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.

The AutoFeature ROI is specified using 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

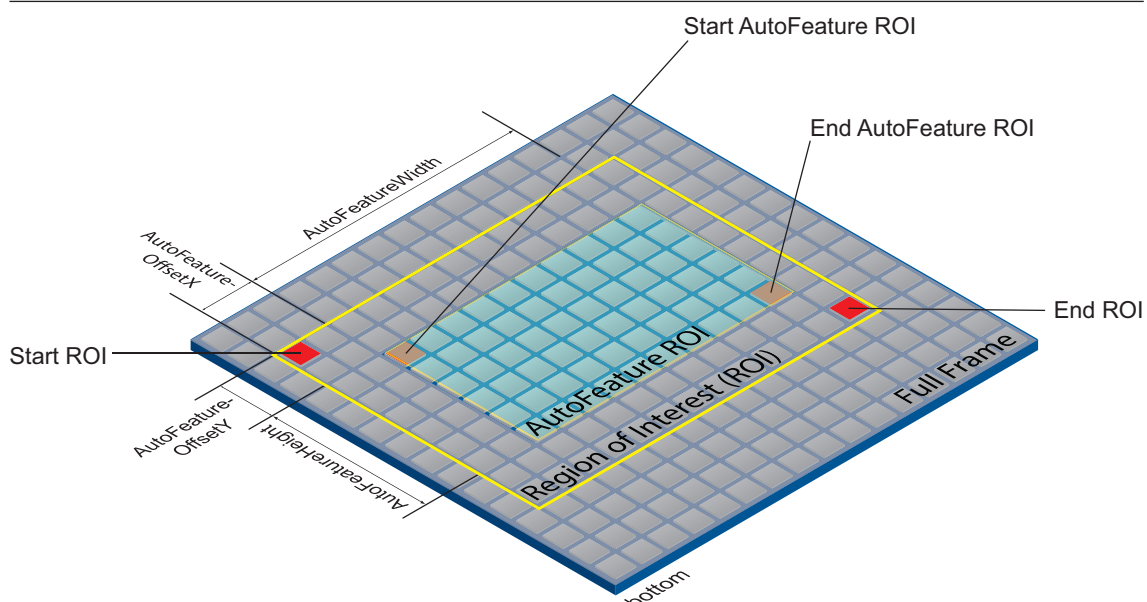


AutoFeature ROI in an ROI

NOTICE

It is possible to set an AutoFeature ROI in an ROI (Category: *ImageFormatControl*). The values that can be set for the AutoFeature ROI are adjusted accordingly.

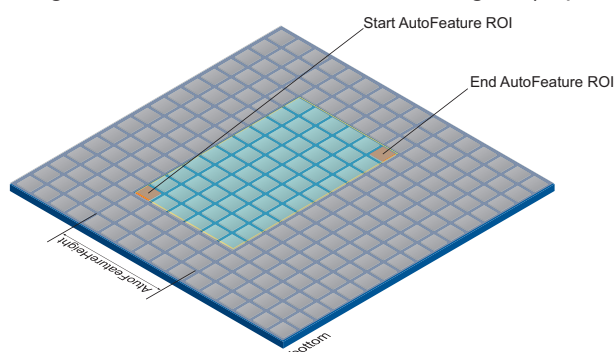
The starting point for *AutoFeatureOffsetX* and *AutoFeatureOffsetY* is determined by the ROI (Category: *ImageFormatControl*).



8.3.1

AutoFeatureHeight

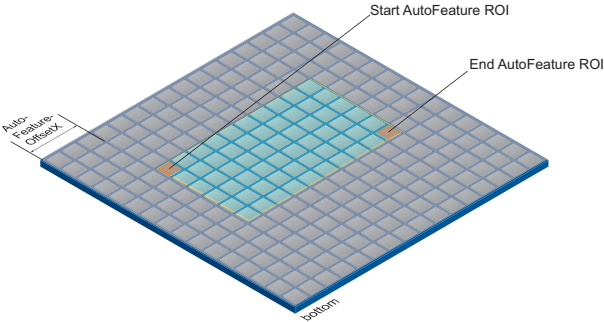
Height of the selected Auto Feature Region (in pixels).



Name	AutoFeatureHeight
Category	AutoFeatureControl
Interface	Integer
Access	Read / Write
Unit	-
Values	Height [▶ 108]

8.3.2 **AutoFeatureOffsetX**

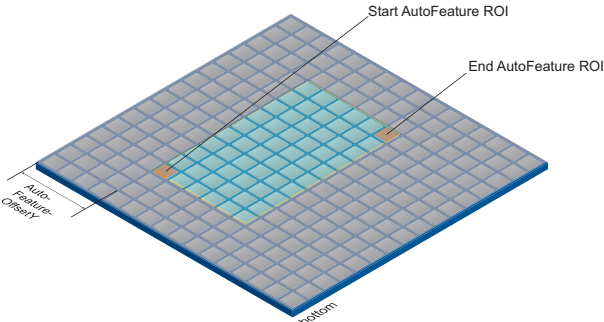
Horizontal offset from the origin to the Auto Feature Region (in pixels).



Name	AutoFeatureOffsetX
Category	AutoFeatureControl
Interface	Integer
Access	Read / Write
Unit	-
Values	0 - depends on <i>AutoFeatureWidth</i>

8.3.3 **AutoFeatureOffsetY**

Vertical offset from the origin to the Auto Feature Region (in pixels).



Name	AutoFeatureOffsetY
Category	AutoFeatureControl
Interface	Integer
Access	Read / Write
Unit	-
Values	0 - depends on <i>AutoFeatureHeight</i>

8.3.4 AutoFeatureRegionMode

Controls the mode of the selected Auto Feature Region (AutoFeature ROI).

NOTICE

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 equal to the selected <i>AutoFeatureRegionReference</i> .
	On	The settings of the selected AutoFeature ROI are user defined. The AutoFeature is useable only if the AutoFeature ROI fits into the <i>AutoFeatureregionReference</i> of the AutoFeature.

8.3.5 AutoFeatureRegionReference

The Reference Region of interest. The Auto Feature Region is part of this region and all Auto Feature Region features are refs to this Reference Region.

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

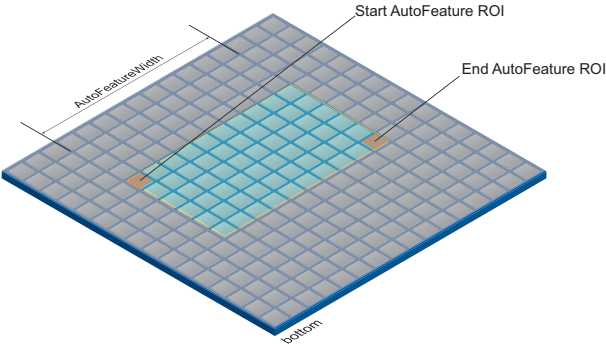
8.3.6 AutoFeatureRegionSelector

Selects the Region of interest to control. The RegionSelector feature allows devices that are able to extract multiple regions out of an image, to configure the features of those individual regions independently.

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

8.3.7 **AutoFeatureWidth**

Width of the selected Auto Feature Region (in pixels).



Name	AutoFeatureWidth
Category	AutoFeatureControl
Interface	Integer
Access	Read / Write
Unit	-
Values	Width [▶ 116]

8.3.8 **BalanceWhiteAutoStatus**

Status of BalanceWhiteAuto.

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

8.3.9 BrightnessAutoNominalValue

Sets the nominal value for brightness in percent of full scale. It will be adjust with consider the setting in *BrightnessAutoPriority*.

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

8.3.10 BrightnessAutoPriority

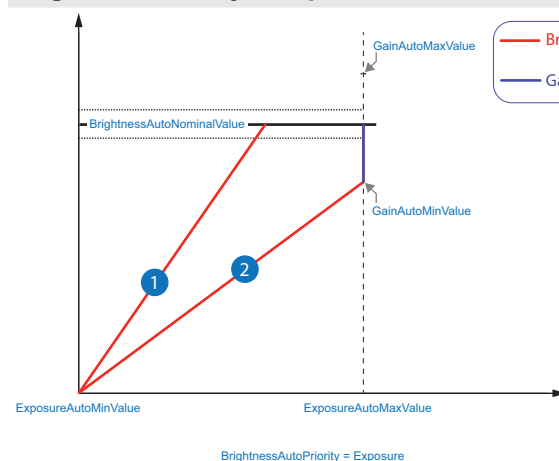
The feature set the highest priority auto feature to adjust the brightness.

NOTICE

When *BrightnessAutoPriority* is set to *GainAuto*, the brightening of the image is first achieved by increasing the gain. This can cause image noise, but the frame rate is not reduced.

Name	BrightnessAutoPriority				
Category	AutoFeatureControl				
Interface	IEnumeration				
Access	Read / Write				
Unit	-				
Values	<table border="0"> <tr> <td>ExposureAuto</td><td>ExposureAuto has highest priority and will be modified first.</td></tr> <tr> <td>GainAuto</td><td>GainAuto has highest priority and will be modified first.</td></tr> </table>	ExposureAuto	ExposureAuto has highest priority and will be modified first.	GainAuto	GainAuto has highest priority and will be modified first.
ExposureAuto	ExposureAuto has highest priority and will be modified first.				
GainAuto	GainAuto has highest priority and will be modified first.				

BrightAutoPriority = ExposureAuto



1

Example 1

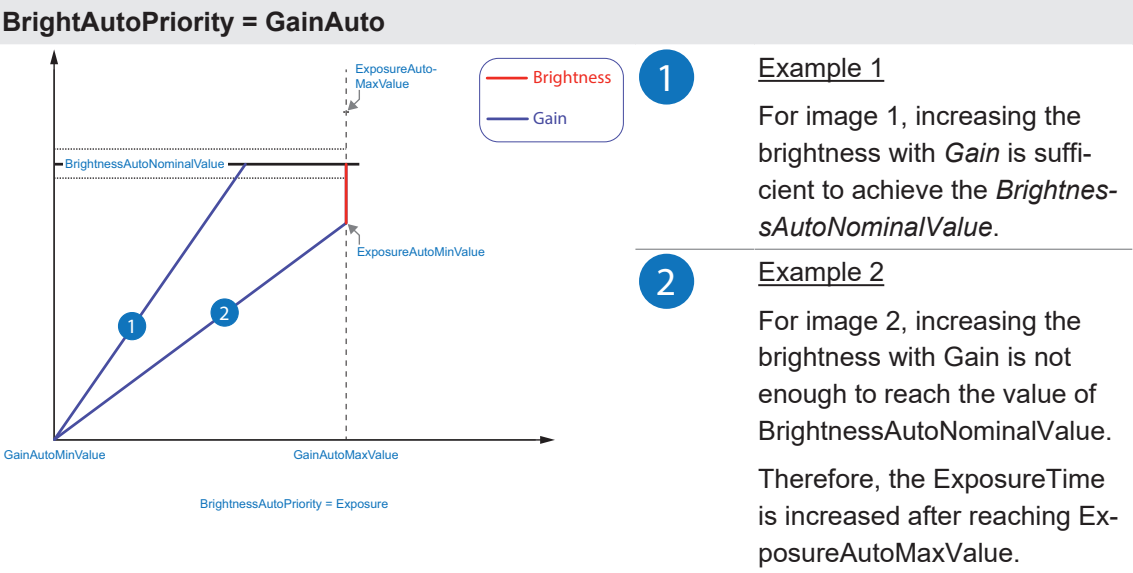
For image 1, increasing the brightness with *ExposureTime* is sufficient to achieve the *BrightnessAutoNominalValue*.

2

Example 2

For image 2, increasing the brightness with *ExposureTime* is not enough to reach the value of *BrightnessAutoNominalValue*.

Therefore, the gain is increased after reaching *ExposureAutoMaxValue*.



8.3.11

ExposureAutoMaxValue

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

Name	ExposureAutoMaxValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	ExposureTime ► 44]

8.3.12

ExposureAutoMinValue

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

NOTICE	
An activated <i>ShortExposureTimeEnable</i> is ignored.	
Name	ExposureAutoMinValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	ExposureTime ► 44]

8.3.13 GainAutoMaxValue

Maximal value of Gain calculable by gain auto algorithm.

Name	GainAutoMaxValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	Gain ▶ 49]

8.3.14 GainAutoMinValue

Minimal value of Gain calculable by gain auto algorithm.

Name	GainAutoMinValue
Category	AutoFeatureControl
Interface	IFloat
Access	Read / Write
Unit	-
Values	Gain ▶ 49]

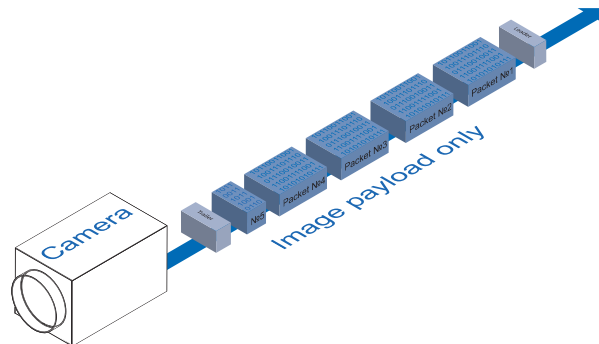
8.4 Category: ChunkDataControl

The chunk is a data packet that is generated by the camera and integrated into the payload (every image), if chunk mode is activated. These data include different settings for the respective image. This integrated data packet contains different image settings. Baumer GAPI can read the Image Info Header (Chunk).

There are three Chunk modes:

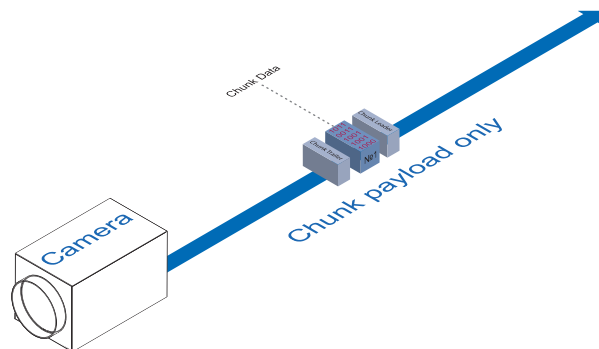
Image Data

Only the image data are transferred, no Chunk data.



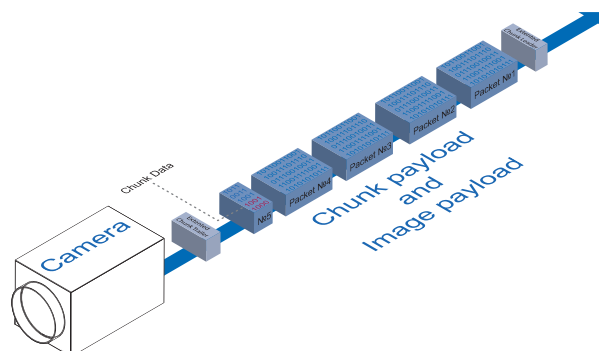
Chunk Data

Only the chunk is transferred, no image data.



Extended Chunk Data

Chunk data and image data are transferred. The Chunk Data are included in the last data packet.



8.4.1 ChunkEnable

Enables the inclusion of the selected chunk data in the payload of the image.

NOTICE

You can choose the desired chunk under *ChunkSelector*.

NOTICE

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

Name	ChunkEnable
-------------	-------------

Category	ChunkDataControl
-----------------	------------------

Interface	IBoolean
------------------	----------

Access	Read / Write
---------------	--------------

Unit	-
-------------	---

Values	true = 1 (On) false = 0 (Off)
---------------	----------------------------------

8.4.2 ChunkModeActive

Activates the inclusion of chunk data in the payload of the image.

NOTICE

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)
---------------	----------------------------------

8.4.3 ChunkSelector

Selects which chunk to enable or control.

Name	ChunkSelector
-------------	---------------

Category	ChunkDataControl
-----------------	------------------

Interface	IEnumeration
------------------	--------------

Access	Read only
---------------	-----------

Unit	-
-------------	---

Values	see table(s) below
---------------	--------------------

Features

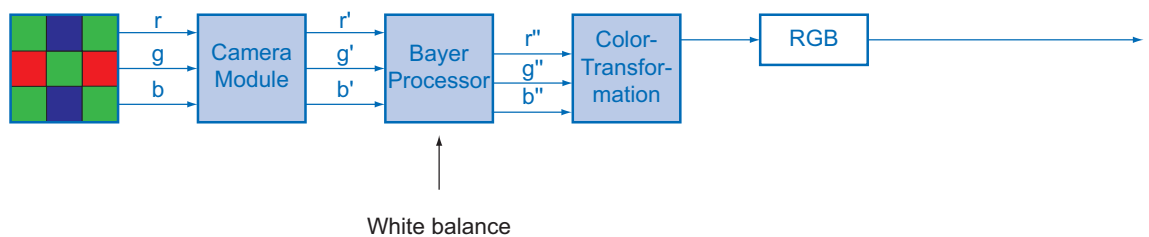
Binning (BinningHorizontal, BinningHorizontalMode, BinningSelector, BinningVertical, BinningVerticalMode)	ImageControl (BrightnessCorrection, DefectPixelCorrection, LUTSelector, LUTEnable, ReverseX, ReverseY)
BlackLevel	LineStatusAll
CounterValue	OffsetX
DeviceTemperature	OffsetY
ExposureTime	PixelFormat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

8.5

Category: ColorTransformationControl (color cameras only)

Category that contains the Color Transformation control features.

Oversimplified, color processing is realized by 4 modules.



The color signals r (red), g (green) and b (blue) of the sensor are amplified in total and digitized within the camera module.

Within the Bayer processor, the raw signals r' , g' and b' are amplified by using of independent factors for each color channel. Then the missing color values are interpolated, which results in new color values (r'' , g'' , b'').

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

8.5.1 ColorTransformationAuto

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

NOTICE

The *ColorTransformationAuto* feature can always be activated and the camera calculates the 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, the matrices in Image Format RAW are not used.

Name	ColorTransformationAuto	
Category	ColorTransformationControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Continuous	Color transformation is constantly adjusted by the device. NOTICE! Color Gains not adjustable.
	Off	Color transformation is user controlled using the various Color-transformation features.
	Once	Color transformation is automatically adjusted once by the device. Once it has converged, it automatically returns to the Off state. NOTICE! Color Gains not adjustable.

8.5.2 ColorTransformationEnable

Activates the selected Color Transformation module.

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

8.5.3 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.

NOTICE

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

Name	ColorTransformationFactoryListSelector	
Category	ColorTransformationControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	OptimizedMatrixFor3000K	Matrix is tuned to the color temperature of 3000K.
	OptimizedMatrixFor5000K	Matrix is tuned to the color temperature of 5000K.
	OptimizedMatrixFor6500K	Matrix is tuned to the color temperature of 6500K.
	OptimizedMatrixFor9500K	Matrix is tuned to the color temperature of 9500K.

8.5.4 ColorTransformationOutputColorSpace

Output the color space of the camera.

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

8.5.5 ColorTransformationResetToFactoryList

Resets the ColorTransformation to the selected *ColorTransformationFactoryList*.

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

8.5.6 ColorTransformationValue

Represents the value of the selected Gain factor inside the Transformation matrix.

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

8.5.7 ColorTransformationValueSelector

Selects the Gain factor of the Transformation matrix to access in 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

8.6 Category: CounterAndTimerControl

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

8.6.1 CounterDuration

Sets the duration (or number of events) before the *CounterEnd* event is generated.

When the counter reaches the *CounterDuration* value, a *CounterEnd* event is generated, the *CounterActive* signal becomes inactive and the counter stops counting until a new trigger happens or it is explicitly reset with *CounterReset*.

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

8.6.2 CounterEventActivation

Selects the Activation mode 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.

8.6.3 CounterEventSource

Select the events that will be the source to increment the Counter.

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

CounterEventSource

Counter1End	Line1
Counter2End	Line2
ExposureActive	FrameTrigger
FrameTransferSkipped	Off
Line0	TriggerSkipped

8.6.4 CounterReset

Does a software reset of the selected counter and starts it. The counter starts counting events immediately after the reset unless a counter trigger is active. *CounterReset* can be used to reset the counter independently from the *CounterResetSource*. To disable the counter temporarily, set `CounterEventSource = Off`.

NOTICE

Note that the value of the counter at time of reset is automatically latched and reflected in the *CounterValueAtReset*.

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

8.6.5 CounterResetActivation

Selects the Activation mode of the Counter Reset Source 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.

8.6.6 CounterResetSource

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

Name	CounterResetSource		
Category	CounterAndTimerControl		
Interface	IEnumeration		
Access	Read / Write		
Unit	-		
Values	see table(s) below		
CounterResetSource			
Counter1End		Line1	
Counter2End		Line2	
ExposureActive		FrameTrigger	
FrameTransferSkipped		Off	
Line0			

8.6.7 CounterSelector

Selects which counter to configure.

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

8.6.8 CounterValue

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

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

8.6.9 CounterValueAtReset

Reads the value of the selected counter when it was reset by a trigger or by an explicit *Counter-Reset* command.

It represents the last counter value latched before resetting the counter.

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

8.6.10 FrameCounter

The *FrameCounter* is part of the Baumer Image Info Header (chunk) and is added to every image if chunk mode is activated. 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.

It is possible to set the *FrameCounter* to a specific value by write this value to the *FrameCounter*.

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

8.6.11 TimerDelay

Sets the duration (in microseconds) of the delay to apply at the reception of a trigger before starting the Timer.

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

8.6.12 TimerDuration

Sets the duration (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)

8.6.13 TimerSelector

Selects which Timer to configure.

Name	TimerSelector
Category	CounterAndTimerControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	Timer1 Selects the Timer 1.

8.6.14 TimerTriggerActivation

Selects the activation mode of the trigger 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.

8.6.15 TimerTriggerSource

Selects the source of the trigger to start the Timer.

Name	TimerTriggerSource	
Category	CounterAndTimerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	see table(s) below	
TimerTriggerSource		
ExposureEnd		Line1
ExposureStart		Off
FrameTransferSkipped		TriggerSkipped
Line0		

8.7 Category: CustomDataControl

The feature contains the category of the custom data related features.

8.7.1 CustomData

The feature holds one byte of custom special data.

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

8.7.2 CustomDataSelector

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

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

8.8 Category: DeviceControl

Category for device information and control.

8.8.1 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.

8.8.2 DeviceEventChannelCount

Indicates the number of event channels supported by the device.

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

8.8.3 DeviceFamilyName

Identifier of the product family of the device.

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

8.8.4 DeviceFirmwareVersion

Version of the firmware in the device.

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

8.8.5 DeviceGenCPVersionMajor

Major version of the GenCP protocol supported by the device.

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

8.8.6 DeviceGenCPVersionMinor

Minor version of the GenCP protocol supported by the device.

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

8.8.7 DeviceLinkCommandTimeout

Indicates the current command timeout of the specific Link.

Name	DeviceLinkCommandTimeout
Category	DeviceControl
Interface	IFloat
Access	Read only
Unit	µs
Values	> 0

8.8.8 DeviceLinkHeartbeatMode

Activate or deactivate the Link's heartbeat.

Name	DeviceLinkHeartbeatMode	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	On	Enables the Link heartbeat.
	Off	Disables the Link heartbeat.

8.8.9 DeviceLinkHeartbeatTimeout

Controls the current heartbeat timeout of the specific Link.

If this time is exceeded without a read access, the camera disconnects itself to be ready for the next connection of another application, or reconnection of the restarted PC application.

The exceedance can be caused, for example, by a crashed software or a CPU overload of the PC.

Name	DeviceLinkHeartbeatTimeout
Category	DeviceControl
Interface	IFloat
Access	Read / Write
Unit	µs
Values	500,000.000000 ... 4,294,967,295,000.000000 (Increment: 1)

8.8.10 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 features.

Name	DeviceLinkSelector
Category	DeviceControl
Interface	Integer
Access	Read / Write
Unit	µs
Values	≥ 0

8.8.11 DeviceLinkSpeed

Indicates the speed of transmission negotiated on the specified link.

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

8.8.12 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	DeviceLinkHeartbeatMode		
Category	DeviceControl		
Interface	Integer		
Access	Read / Write		
Unit	-		
Values	GigE:	1250000 ... 125000000 (Increment: 1250000)	
	USB:	1000000 ... 400000000 (Increment: 1000000)	

8.8.13 DeviceManufacturerInfo

Manufacturer information about the device.

The content might look as follows:

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

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

8.8.14 DeviceModelName

Model of the device.

Name	DeviceModelName		
Category	DeviceControl		
Interface	String		
Access	Read only		
Unit	-		
Values	model name of the camera		

8.8.15 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

8.8.16 DeviceReset

The Device Reset feature corresponds with the camera's switched on and switched off states. Using this means it is no longer necessary to disconnect the power supply.

NOTICE

The execution of this feature may take several seconds.

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

8.8.17 DeviceResetToDeliveryState

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

NOTICE

The settings stored in the camera (e.g. UserSets) will be lost.

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

8.8.18 DeviceSFNCVersionMajor

Major version of the Standard Features Naming Convention that was used to create the device's GenICam XML.

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

8.8.19 DeviceSFNCVersionMinor

Minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML.

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

8.8.20 DeviceSFNCVersionSubMinor

Sub minor version of the Standard Features Naming Convention that was used to create the device's GenICam XML.

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

8.8.21 DeviceScanType

Scan type of the sensor of the device.

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

8.8.22 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.

8.8.23 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	

8.8.24 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)	

8.8.25 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.

8.8.26 DeviceStreamChannelPacketSize

Specifies the stream packet size, in bytes, to send on the selected channel for a Transmitter or specifies the maximum packet size supported by a receiver.

Name	DeviceStreamChannelPacketSize
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	576 ... 9000 (Increment: 2)

8.8.27 DeviceStreamChannelSelector

Selects the stream channel to control.

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

8.8.28 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.

8.8.29 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.

8.8.30 DeviceTLVersionMajor

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

Name	DeviceTLVersionMajor
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	≥ 0

8.8.31 DeviceTLVersionMinor

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

Name	DeviceTLVersionMinor
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	≥ 0

8.8.32 DeviceTLVersionSubMinor

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

Name	DeviceTLVersionSubMinor
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	≥ 0

8.8.33 DeviceTemperature

Device temperature in degrees Celsius (C). It is 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)

8.8.34 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)

8.8.35 DeviceTemperatureSelector

Selects the location within the device, where the temperature will be measured.

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

8.8.36 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.

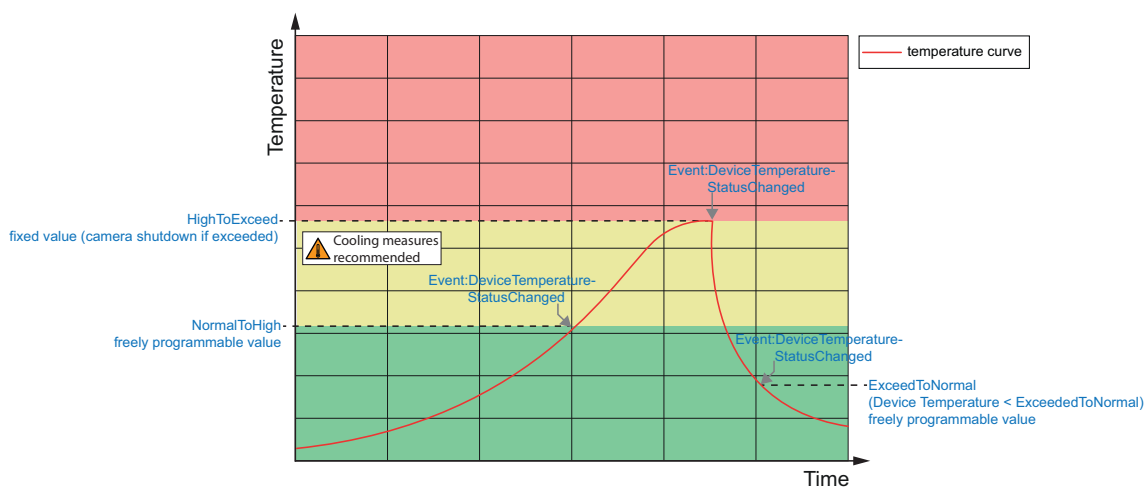
8.8.37 DeviceTemperatureStatusTransition

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

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

8.8.38 DeviceTemperatureStatusTransitionSelector

Selects which temperature transition is controlled by the *DeviceTemperatureStatusTransition* feature.



Name	DeviceTemperatureStatusTransitionSelector	
Category	DeviceControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	ExceededToNormal	Temperature threshold for transition from status Exceeded back to status Normal.
	HighToExceeded	Temperature threshold for transition from status High to status Exceeded.
	NormalToHigh	Temperature threshold for transition from status Normal to status High.

8.8.39 DeviceType

Returns the device type.

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

8.8.40 DeviceUserID

User-programmable device identifier.

NOTICE

The recommended factory default value is an empty string.

Name	DeviceUserID
Category	DeviceControl
Interface	IStrng
Access	Read / Write
Unit	-
Values	e.g. "camera 1" (max. length 64)

8.8.41 DeviceVendorName

Name of the manufacturer of the device.

Name	DeviceVendorName
Category	DeviceControl
Interface	IStrng
Access	Read only
Unit	-
Values	Name of the camera manufacturer

8.8.42 DeviceVersion

Version of the device.

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

8.8.43 ReadOutTime

Readout time in μs for current format settings.

NOTICE

Read Out Time depends on:

- *OffsetY*
- *Height*
- *PixelFormat*
- *SensorBinning*

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

8.8.44 TimestampLatch

Latches the current timestamp counter into *TimestampLatchValue*.

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

8.8.45 TimestampLatchValue

Returns the latched value of the timestamp counter.

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

8.8.46 TimestampLatchValuePtpDays

The feature returns the latched value of the Ptp timestamp in days since 01.01.1970 00:00:00.

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

8.8.47 TimestampLatchValuePtpHours

The feature returns the latched value of the Ptp timestamp in hours since 00:00 AM.

Name	TimestampLatchValuePtpHours
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	0 ... 2147483648 (Increment: 1)

8.8.48 TimestampLatchValuePtpMinutes

The feature returns the latched value of the Ptp timestamp in minutes since the last hour.

Name	TimestampLatchValuePtpMinutes
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	0 ... 2147483648 (Increment: 1)

8.8.49 TimestampLatchValuePtpNanoseconds

The feature returns the latched value of the Ptp timestamp in nanoseconds since the last second.

Name	TimestampLatchValuePtpNanoseconds
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	0 ... 2147483648 (Increment: 1)

8.8.50 TimestampLatchValuePtpSeconds

The feature returns the latched value of the Ptp timestamp counters in seconds since the last minute.

Name	TimestampLatchValueSeconds
Category	DeviceControl
Interface	Integer
Access	Read only
Unit	-
Values	0 ... 2147483648 (Increment: 1)

8.8.51 TimestampReset

Resets the current value of the device timestamp counter.

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

8.9 Category: DigitalIOControl

Category that contains the digital input and output control features.

NOTICE

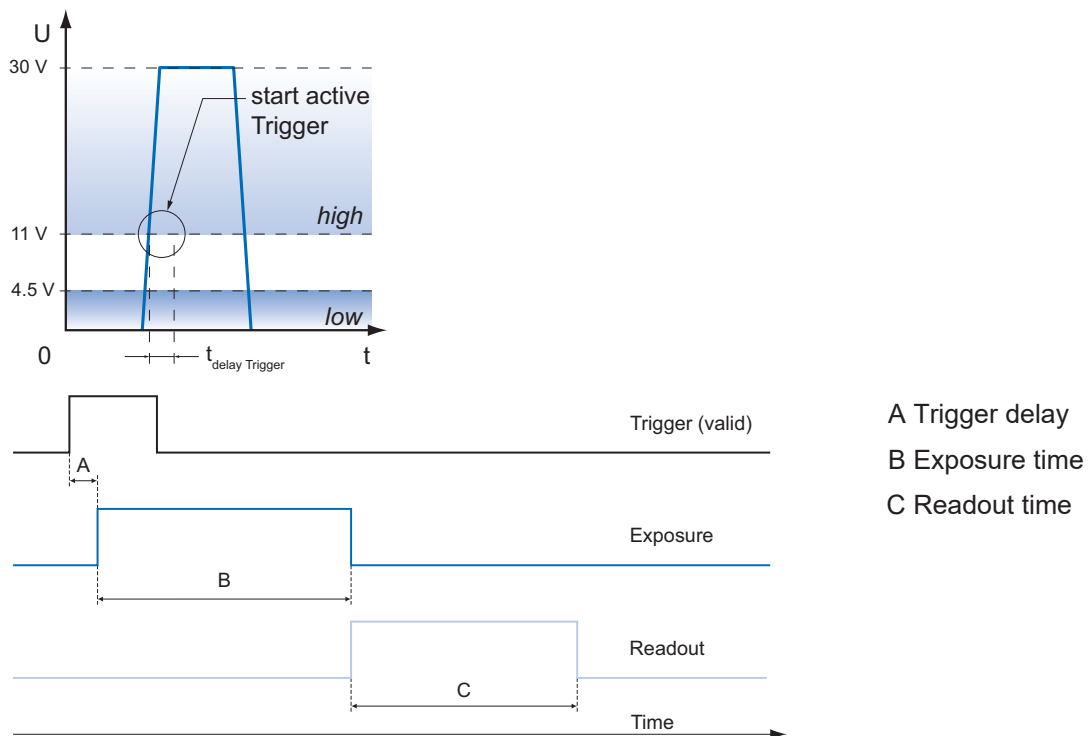
Functional range of the VAX

Compared to other Baumer cameras, the full range of features of this category are not displayed in the Baumer Camera Explorer.

See the description of the Baumer `IO_lib` (Python™ and C++ Libraries) for more information about usage the I/Os.

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.

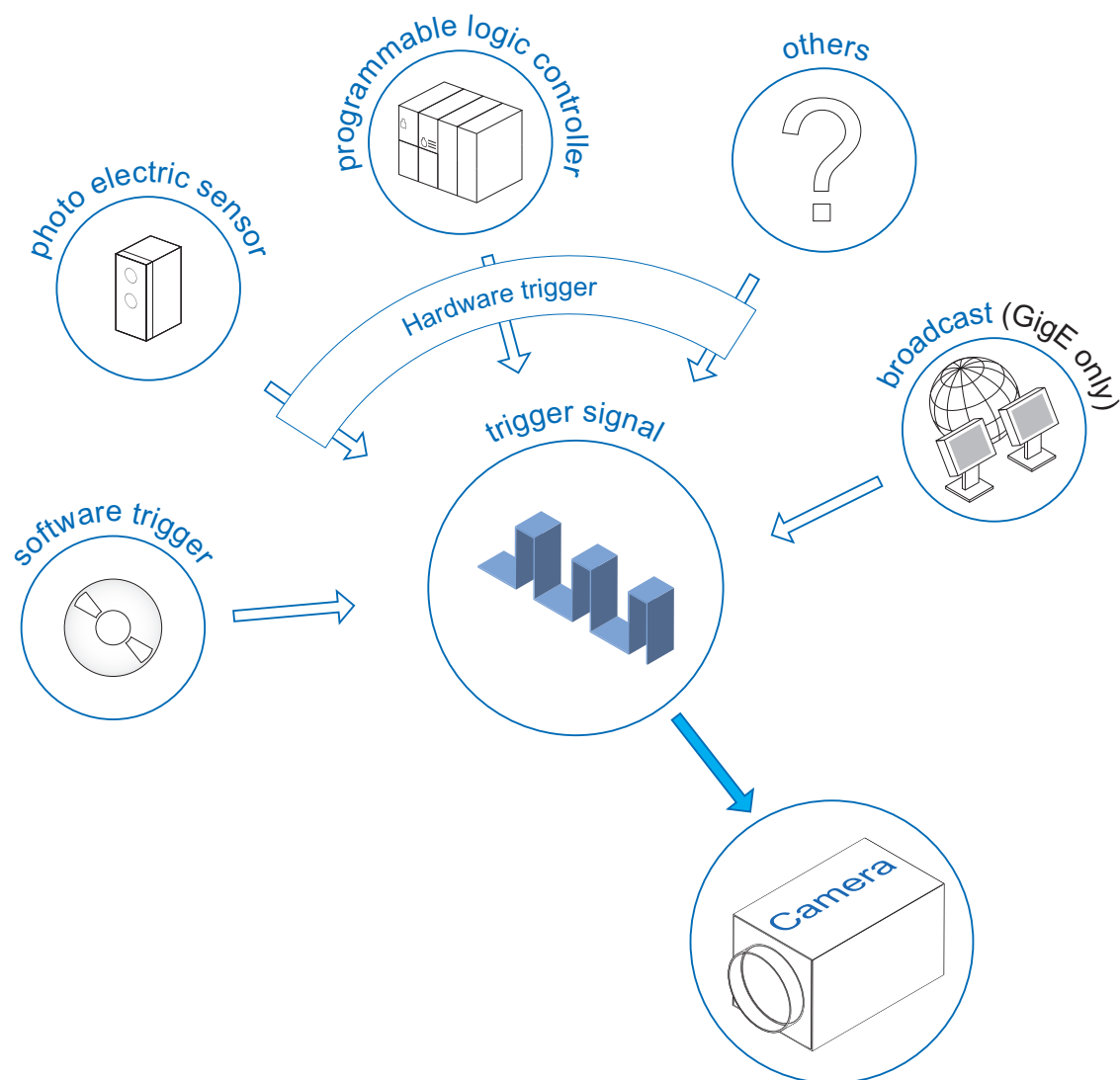


Trigger delay – General Information

The trigger delay 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 is activated, the hardware trigger is activated by default.

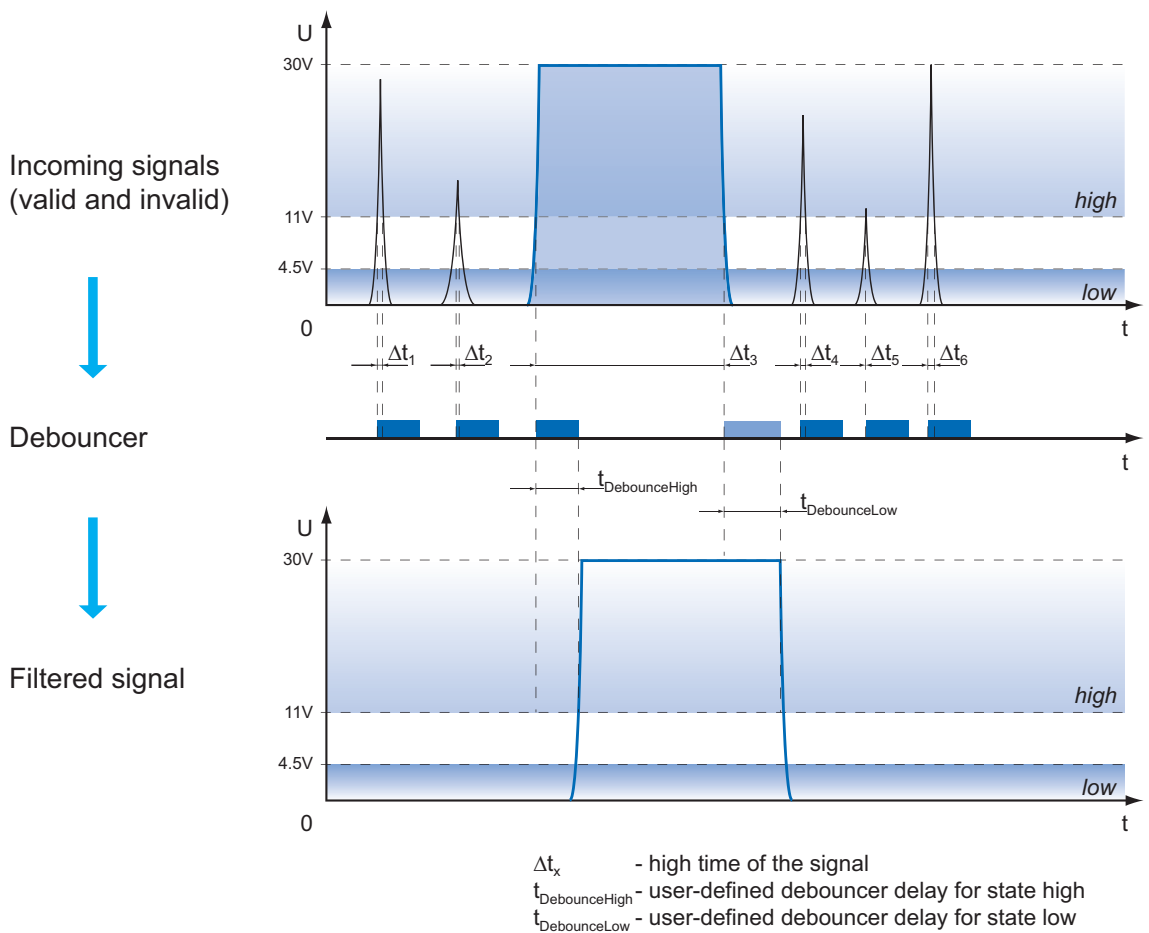
Debouncer (LineDebouncerHighTimeAbs / LineDebouncerLowTimeAbs)

The basic idea behind this feature was to separate interfering signals (short peaks) from valid square wave signals, which can be important in industrial environments. Debouncing means that invalid signals are filtered out, and signals lasting longer than a user-defined testing time $t_{\text{DebounceHigh}}$ will be recognized and routed to the camera to induce a trigger.

In order to detect the end of a valid signal and filter out possible jitters within the signal, a second testing time $t_{\text{DebounceLow}}$ was introduced. The timing for this can also be adjusted by the user. If the signal value falls to state low and does not rise within $t_{\text{DebounceLow}}$, this is recognized as the end of the signal.

NOTICE

Please note that the edges of valid trigger signals are shifted by $t_{\text{DebounceHigh}}$ and $t_{\text{DebounceLow}}$! Depending on these two timings, the trigger signal may be temporally stretched or compressed.



8.9.1 LineDebouncerHighTimeAbs

Sets the absolute value of the selected line debouncer time in microseconds for switch from low to high.

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

8.9.2 LineDebouncerLowTimeAbs

Sets the absolute value of the selected line debouncer time in microseconds for switch from high to low.

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

8.9.3 LineInverter

Controls the inversion of the signal of the selected input or output Line.

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

8.9.4 LineMode

Controls if the physical Line is used to Input or Output a signal.

Name	LineMode
Category	DigitalIOControl
Interface	IEnumeration
Access	Read only
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.

8.9.5 LineSelector

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

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

NOTICE

Line0 and Line3 are selectable, but without function.

Linesource

Line1

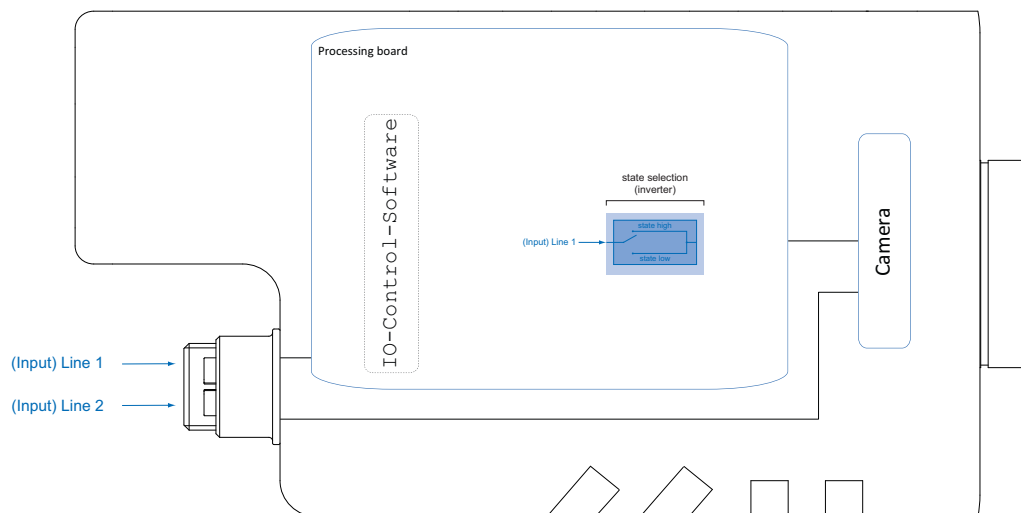
Line2

8.9.6 LineSource

Selects which internal acquisition or I/O source signal to output on the selected Line.

Input

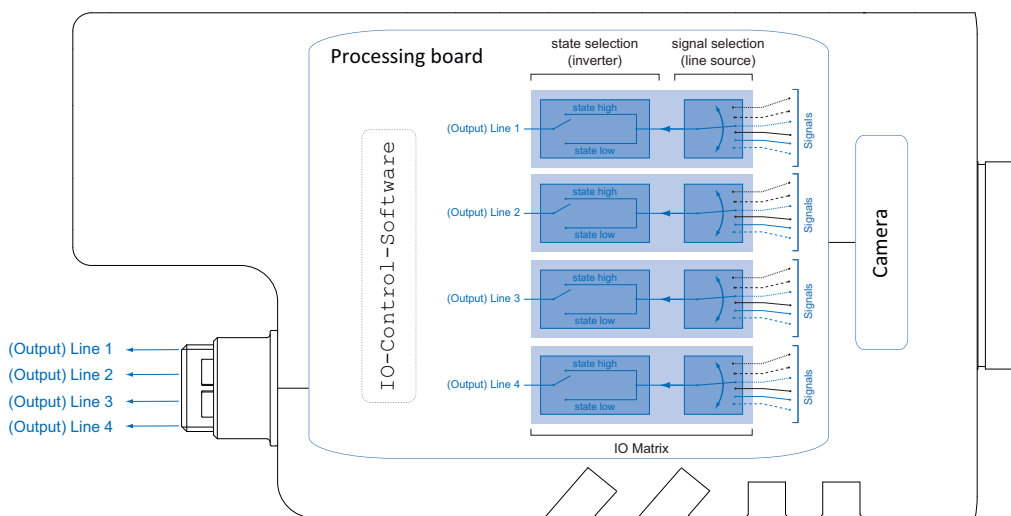
The defined signals will have no direct effect, but can be analyzed and processed on the software side and used for controlling the camera.



Output

Selects which internal acquisition or I/O source signal to output on the selected Line.

With this feature, Baumer gives you the option to wire the output connectors to internal signals that are controlled on the software side.



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

LineSource (Signals)

ExposureActive	Device is doing the exposure of a Frame (or Line).
Off	Line output is disabled.
Line 0	Device is currently waiting for signal of input line 0.
Line 1	Device is currently waiting for signal of input line 1.
ReadoutActive	Device is doing the readout of a Frame.
Timer1Active	The chosen Timer is in active state.
TriggerReady	Device is ready for trigger.
UserOutput1	The chosen User Output Bit state as defined by its current <i>UserOutput-Value</i> .
UserOutput2	The chosen User Output Bit state as defined by its current <i>UserOutput-Value</i> .
UserOutput3	The chosen User Output Bit state as defined by its current <i>UserOutput-Value</i> .
UserOutput4	The chosen User Output Bit state as defined by its current <i>UserOutput-Value</i> .

8.9.7 LineStatus

Returns the current status of the selected input or output Line.

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

8.9.8 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)

8.9.9 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.

8.9.10 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)

8.9.11 UserOutputValueAll

Sets the value of all the bits of the User Output register.

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

8.10 Category: EventControl

This chapter describes how to control the generation of Events to the host application. An Event is a message that is sent to the host application to notify it of the occurrence of an internal event.

General Information

The asynchronous message channel is described in the GigE Vision® standard and offers the possibility of event signaling. There is a timestamp (64 bits) for each announced event, which contains the accurate time the event occurred. Each event can be activated and deactivated separately.

Each event can be activated and deactivated separately (*EventSelector*).

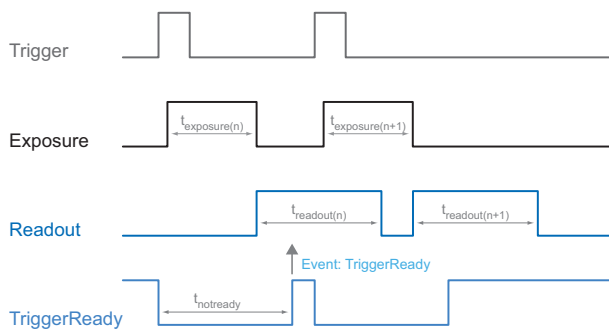
The charts below show some timings for the event signaling by the asynchronous message channel. Vendor-specific events are explained.

Event: EventLost

This signal can be put out when a selected event was lost. The cause may be that too many events occurs.

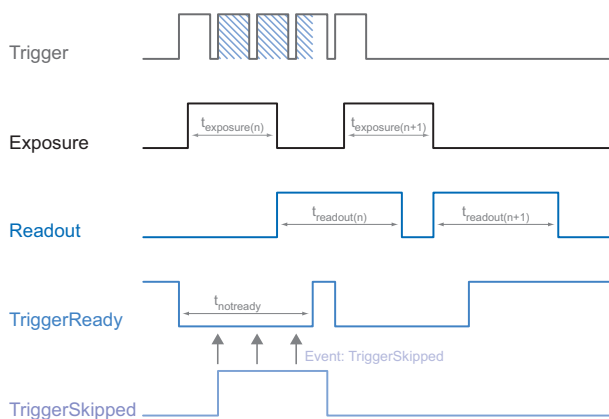
Event: TriggerReady

This event signals whether the camera is able to process incoming trigger signals or not.



Event: TriggerSkipped

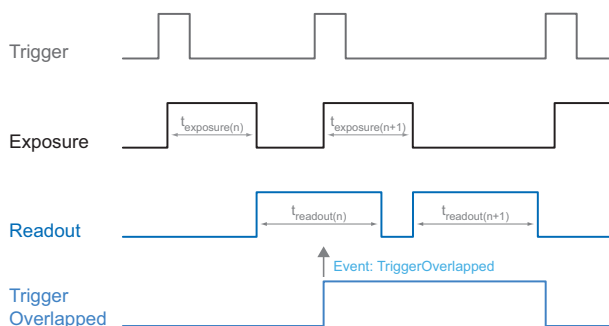
If the camera is unable to process incoming trigger signals, which means the camera should be triggered within the interval t_{notready} , these triggers are skipped. On Baumer cameras the user will be informed about this fact by means of the event *TriggerSkipped*.



Event: TriggerOverlapped

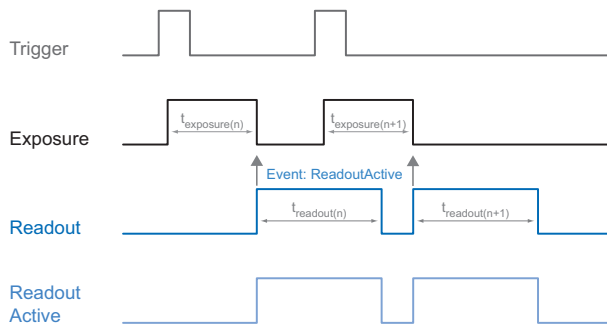
This signal is active, as long as the sensor is exposed and read out at the same time, which means the camera is operated overlapped.

Once a valid trigger signal occurs not within a readout, the *TriggerOverlapped* signal changes to state low.

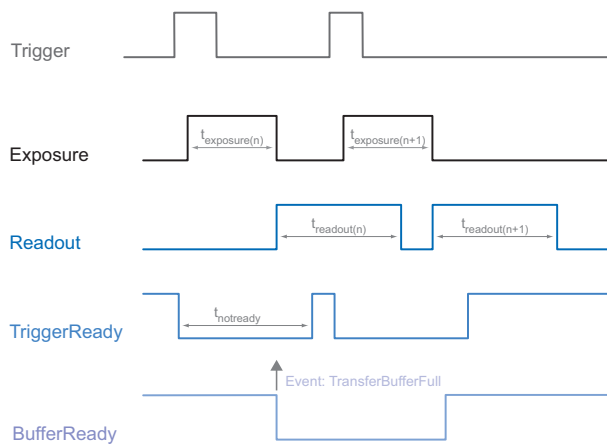


Event: ReadoutActive

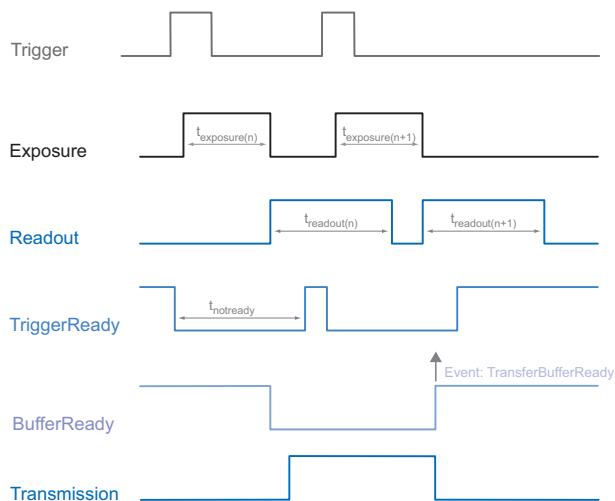
While the sensor is read out, the camera signals this by means of *ReadoutActive*.

**Event: TransferBufferFull**

This event is issued only in trigger mode. It signals that no buffer is available.

**Event: TransferBufferReady**

This event is issued only in trigger mode. It signals that buffer available.



Event: DeviceTemperatureStatusChanged

To prevent damage on the hardware due to high temperatures, the camera is equipped with an emergency shutdown. The *DeviceTemperatureStatusTransitionSelector* (Category: *DeviceControl*) feature allows you to select different thresholds for temperatures:

- *NormalToHigh*: freely programmable value
- *HighToExceeded*: fixed value (camera shutdown if exceeded)
- *ExceededToNormal*: freely programmable value, temperature for error-free re-activation of the camera

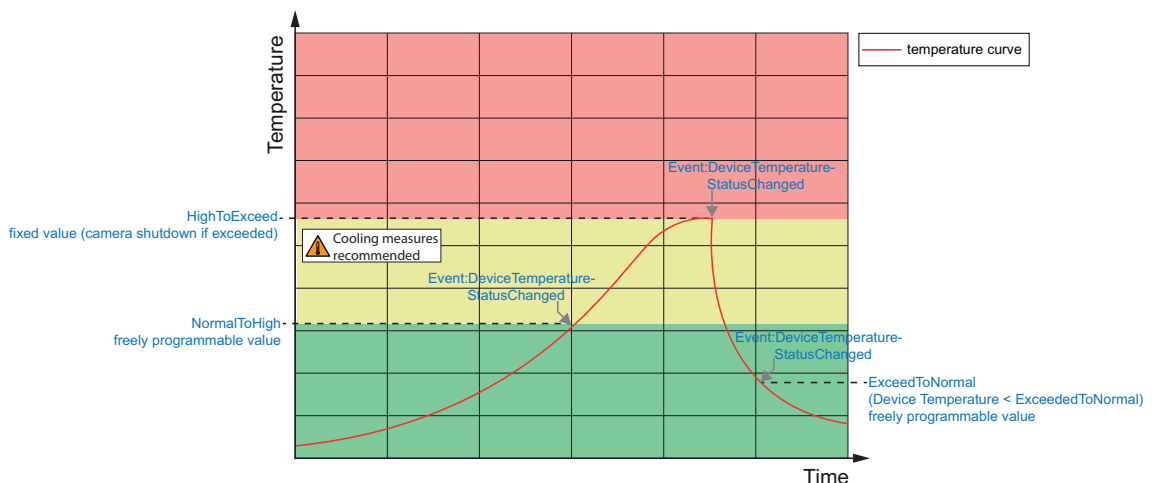
In the *DeviceTemperatureStatusTransition* feature, the temperatures for the programmable temperature transitions are set.

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

If the temperature rises above the value set at *HighToExceeded*, the *DeviceTemperatureExceeded* feature is set to True, the image recording is stopped, and the LED is set to red.

For further use, the camera must be disconnected from the power supply after cooling down or a device reset should be carried out.

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



8.10.1 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	The selected Event notification is disabled.
	On	The selected Event notification is enabled.

8.10.2 EventSelector

Selects which Event to signal to the host application.

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

Events

DeviceTemperatureStatusChanged

EventLost

ExposureEnd

ExposureStart

FrameEnd

FrameStart

FrameTransferSkipped

Line0..3 FallingEdge

Line0..3 RisingEdge

TransferBufferFull

TransferBufferReady

TriggerOverlapped

TriggerReady

TriggerSkipped

8.10.3 LostEventCounter

Counts lost events.

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

8.11 Category: ImageFormatControl

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

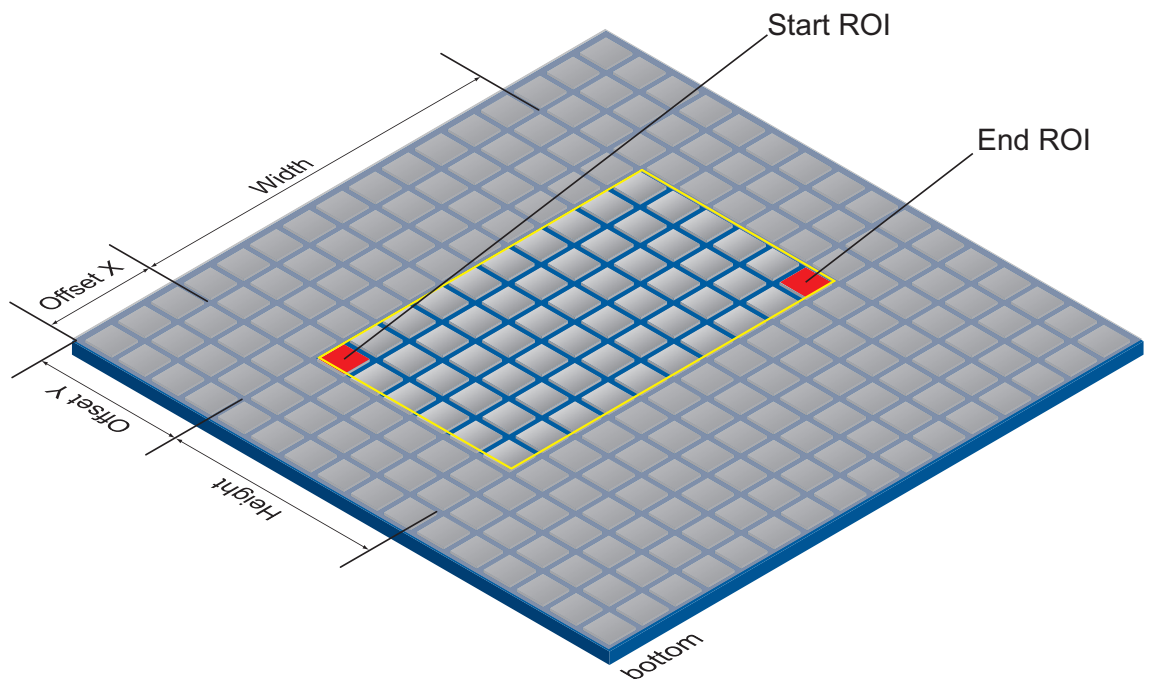
General Information - Region of Interest (OffsetX / OffsetY / Width / Height)

You can use the **Region of Interest (ROI)** function to predefine a so-called region of interest. This ROI is an area of pixels on the sensor. When an image is acquired, only the information regarding these pixels is transferred to the PC. Not all of the lines on the sensor are read out, which therefore decreases the readout time (t_{readout}). This increases the frame rate.

This function is used if only a particular region of the field of view is of interest. It also reduces the resolution.

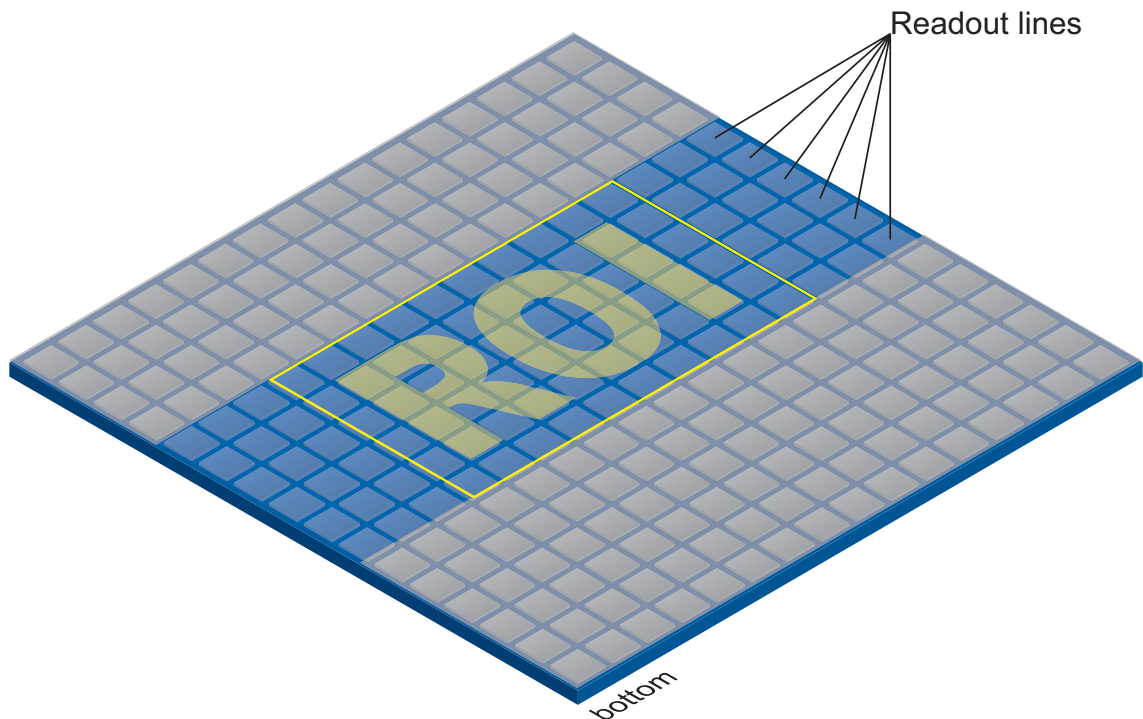
The ROI is specified using four values:

- *OffsetX* - x-coordinate of the first relevant pixel
- *OffsetY* - y-coordinate of the first relevant pixel
- *Width* - horizontal size of the ROI
- *Height* - vertical size of the ROI



ROI Readout

In the illustration below, the readout time would decrease to 40% of a full frame readout.



General Information - Binning (BinningHorizontal / BinningVertical)

On digital cameras, you can find several operations for progressing sensitivity. One of them is the so-called *Binning*. Here, the charge carriers of neighboring pixels are aggregated. Thus, the progression is greatly increased by the amount of binned pixels. By using this operation, the progression in sensitivity is coupled to a reduction in resolution. Higher sensitivity enables shorter exposure times.

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

In unidirectional binning, vertically or horizontally neighboring pixels are aggregated and reported to the software as one single "superpixel".

In bidirectional binning, a square of neighboring pixels is aggregated.

NOTICE

Occuring deviations in brightness after binning can be corrected with Brightness Correction function.

Monochrome Binning

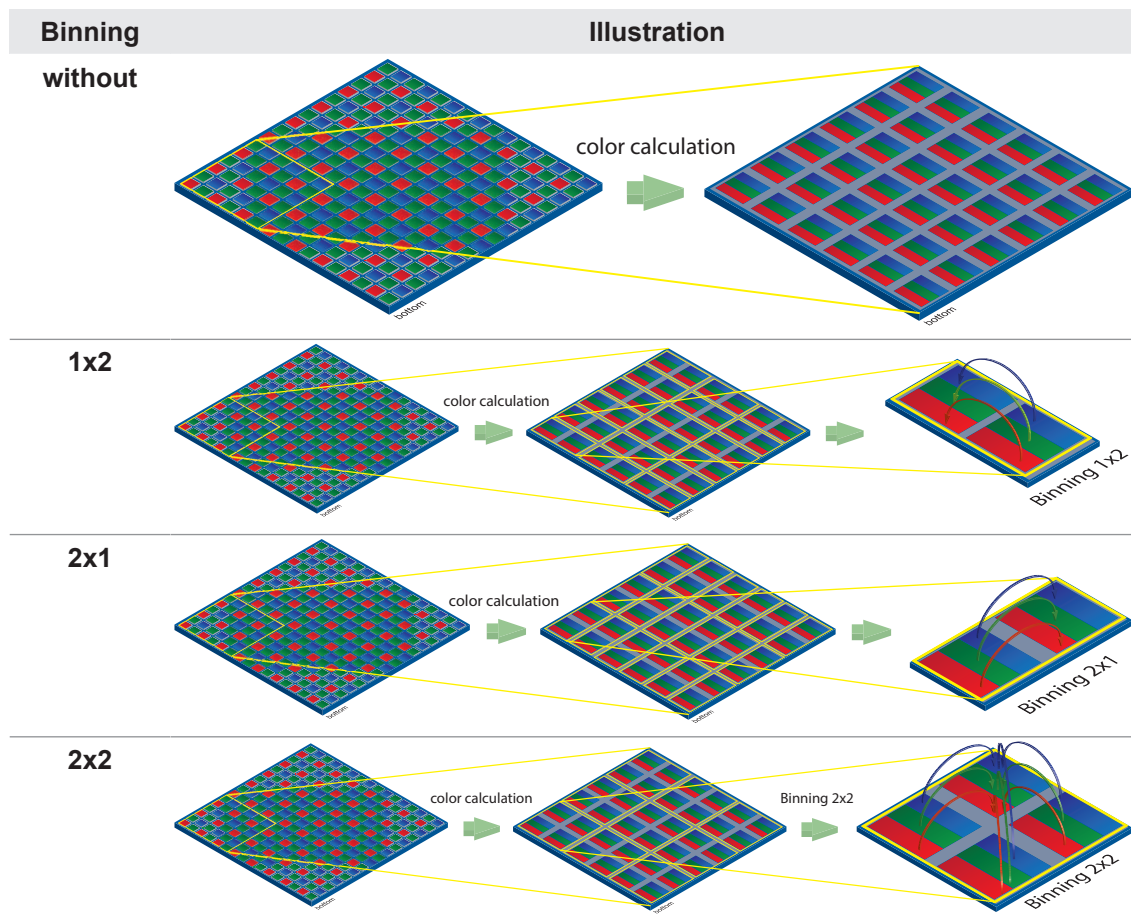
Binning	Illustration	Output
without Full frame image, no binning of pixels.		
1x2 Vertical binning causes a vertically compressed image with doubled brightness.		
2x1 Horizontal binning causes a horizontally compressed image with doubled brightness.		
2x2 Bidirectional binning causes both a horizontally and vertically compressed image with quadruple brightness.		

Color Binning

Color Binning is calculating on the camera (no higher frame rates) – The sensor does not support this binning operation.

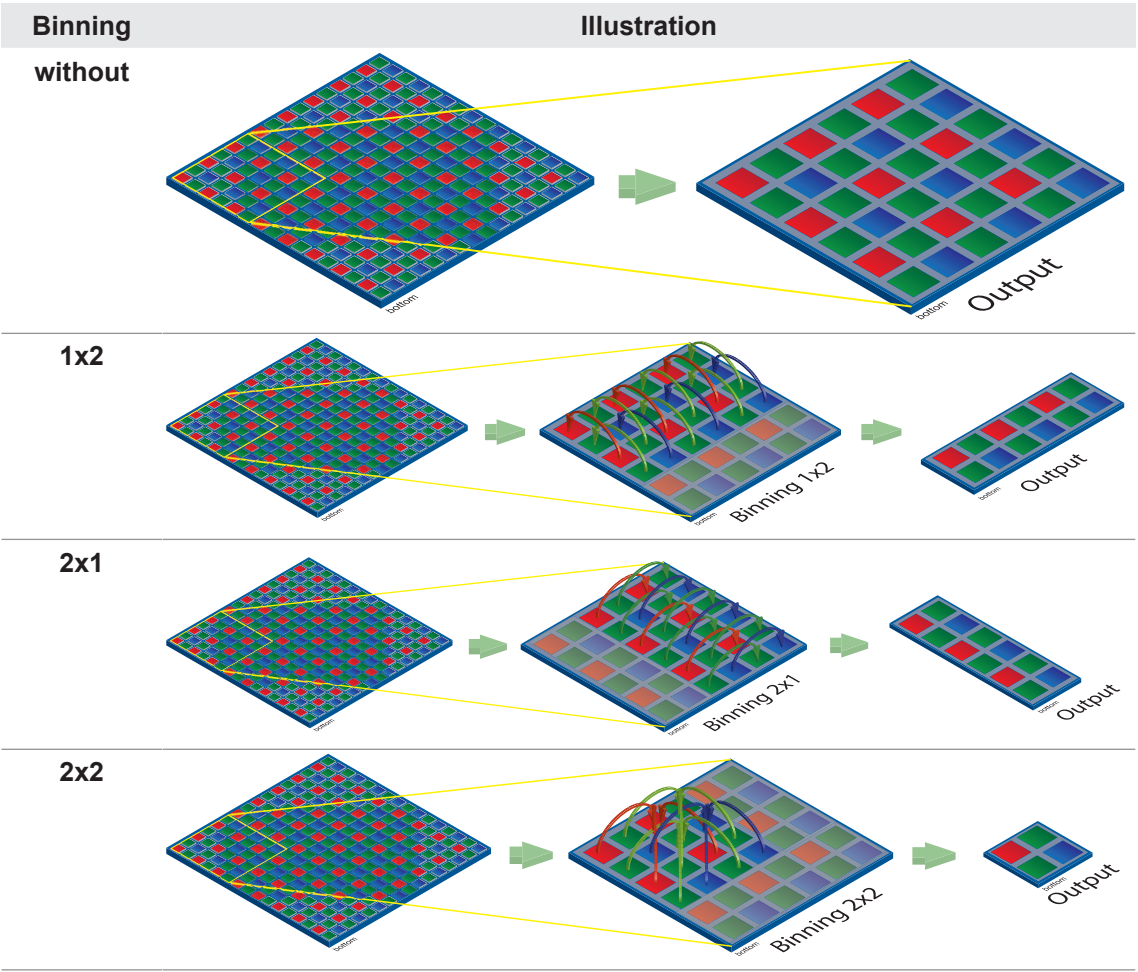
Color calculated pixel formats

In pixel formats, which are not raw formats (e.g. RGB8), the three calculated color values (R, G, B) of a pixel will be added with those of the corresponding neighbor pixel during binning.



RAW pixel formats

In the raw pixel formats (e.g. BayerRG8) the color values of neighboring pixels with the same color are combined.



8.11.1

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	Integer
Access	Read / Write
Unit	-
Values	see table(s) below (Increment: 1)

Camera Type	BinningSelector [Region0]	BinningSelector [Sensor]
Monochrome		
VAX-32M	1 ... 2	1 ... 1
VAX-50M	1 ... 2	1 ... 1
Color		
VAX-32C	1 ... 2	1 ... 1
VAX-50C	1 ... 2	1 ... 1

8.11.2 BinningHorizontalMode

Sets the mode to use to combine horizontal photo-sensitive cells 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.

8.11.3 BinningSelector

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

Name	BinningSelector	
Category	ImageFormatControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Region0	Selected feature will control the region 0 (FPGA) binning.
	Sensor	Selected features will control the sensor binning.

8.11.4 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	Integer
Access	Read / Write
Unit	-
Values	see table(s) below (Increment: 1)

Camera Type	BinningSelector [Region0]	BinningSelector [Sensor]
Monochrome		
VAX-32M	1 ... 2	1 ... 1
VAX-50M	1 ... 2	1 ... 1
Color		
VAX-32C	1 ... 2	1 ... 1
VAX-50C	1 ... 2	1 ... 1

8.11.5 BinningVerticalMode

The response from the combined cells will be averaged, resulting in increased signal/noise ratio.

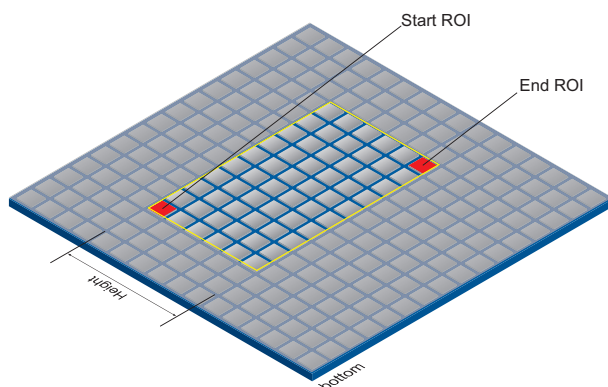
Name	BinningVerticalMode	
Category	ImageFormatControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Average	The response from the combined cells will be averaged, resulting in increased signal/noise ratio.
	Sum	The response from the combined cells will be added, resulting in increased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

8.11.6 Height

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

NOTICE

The sum of *OffsetY* and Height must be smaller or equal than *HeightMax*.



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

Camera Type	Values [Pixel]
Monochrome	
VAX-32M	1 ... 1536 (Increment: 1)
VAX-50M	1 ... 2048 (Increment: 1)
Color	
VAX-32C	1 ... 1536 (Increment: 1)
VAX-50C	1 ... 2048 (Increment: 1)

8.11.7 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	Integer
Access	Read only
Unit	-
Values	see table(s) below

Camera Type	Values [Pixel]
Monochrome	
VAX-32M	1536
VAX-50M	2048
Color	
VAX-32C	1536
VAX-50C	2048

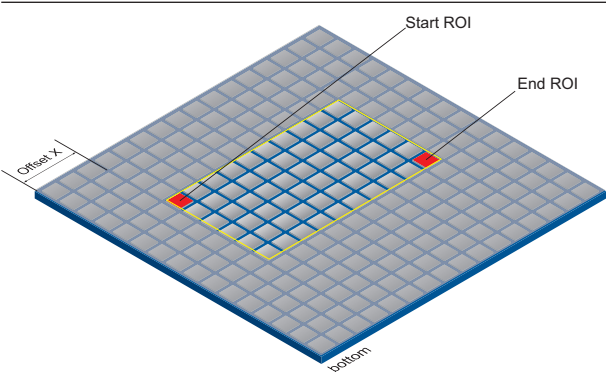
8.11.8

OffsetX

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

NOTICE

The sum of *OffsetX* and *WidthMax* must be smaller or equal than *WidthMax*.



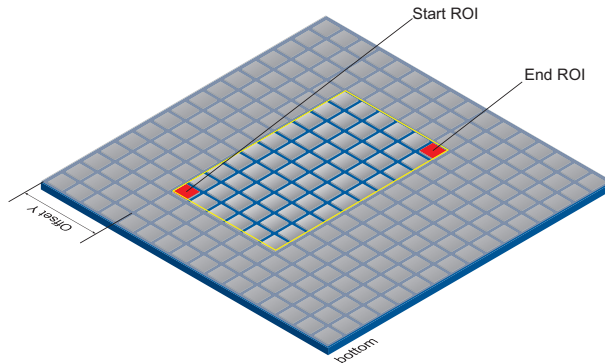
Name	OffsetX
Category	ImageFormatControl
Interface	Integer
Access	Read / Write
Unit	-
Values	0 ... depends on <i>Width</i>

8.11.9 OffsetY

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

NOTICE

The sum of *OffsetY* and *Height* must be smaller or equal than *HeightMax*.

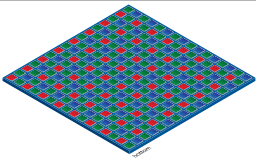
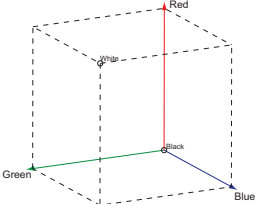


Name	OffsetY
Category	ImageFormatControl
Interface	Integer
Access	Read / Write
Unit	-
Values	0 ... depends on <i>Height</i>

8.11.10 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.

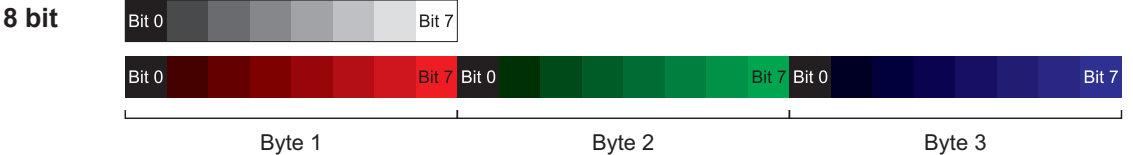
RAW	Raw data format. Here the data stored without processing.	
Bayer	Raw data format of color sensors. Color filters are placed on these sensors in a checkerboard pattern, generally in a 50 % green, 25 % red and 25 % blue array.	
Mono	Monochrome. The color range of mono images consists of shades of a single color. In general, shades of gray or black-and-white are synonyms for monochrome.	
RGB	Color model, in which all detectable colors are defined by three coordinates. R ed, G reen and B lue. The three coordinates are displayed within the buffer in order R, G, B.	
BGR	At BGR the interface of the camera mirrors the order of transmission of the color channels from RGB to BGR. This can save processing power on the computer, because these data can be processed by the graphic card without conversion.	

Pixel depth - General Information

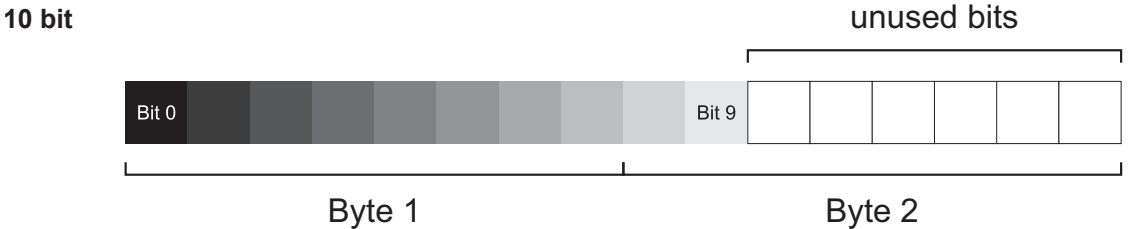
In general, pixel depth defines the number of possible different values for each color channel. Mostly this will be 8 bit, which means 28 different "colors".

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

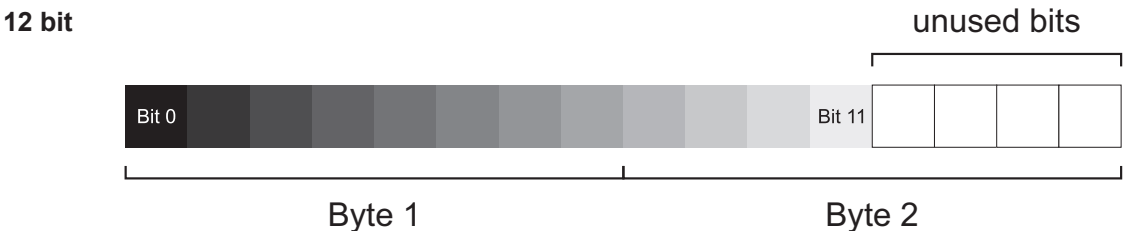
Two bytes are needed for transmitting more than 8 bits per pixel - even if the second byte is not completely filled with data. In order to save bandwidth, the packed formats were introduced to Baumer cameras. In this formats, the unused bits of one pixel are filled with data from the next pixel.



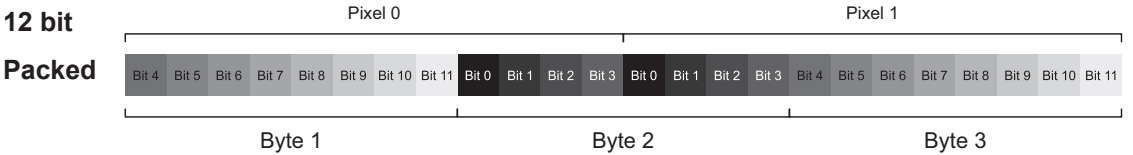
Bit string of Mono 8 bit and RGB 8 bit.



Spreading of Mono 10 bit over 2 bytes.



Spreading of Mono 12 bit over two bytes.



Spreading of two pixels in Mono 12 bit over three bytes (packed mode).

NOTICE

The camera must be stopped before *PixelFormat* can be set.

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

Camera Type	Mono8	Mono10	Mono12	Mono12p	Bayer RG8	Bayer RG10	Bayer RG12	Bayer G12p	RGB8	BGR8
Monochrome										
VAX-32M	■	■	■	■	□	□	□	□	□	□
VAX-50M	■	■	■	■	□	□	□	□	□	□
Color										
VAX-32C	■	■	■	■	■	■	■	■	■	■
VAX-50C	■	■	■	■	■	■	■	■	■	■

8.11.11 ReverseX (mono cameras / pixel formats only)

Flip horizontally the image sent by the device. The Region of interest is applied before the flipping.

NOTICE

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

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

8.11.12 ReverseY (monochrome cameras / pixel formats only)

Flip vertically the image sent by the device. The Region of interest is applied before the flipping.

NOTICE

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

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

8.11.13 SensorHeight

Effective height of the sensor in pixels.

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

8.11.14 SensorName

Product name of the imaging Sensor.

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

8.11.15 SensorPixelHeight

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

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

8.11.16 SensorPixelWidth

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

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

8.11.17 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	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.

8.11.18 SensorWidth

Effective width of the sensor in pixels.

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

8.11.19 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	
<hr/>		
GreyDiagonalRamp	Image is filled diagonally with an image that goes from the darkest possible value to the brightest.	
GreyDiagonalRampHorizontalAnd-VerticalLineMoving	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.
GreyVerticalRampHorizontalAndVerticalLineMoving	Image is filled vertically with an image that goes from the darkest possible value to the brightest with moving horizontal and vertical lines.
GreyVerticalRampHorizontalLineMoving	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.

8.11.20

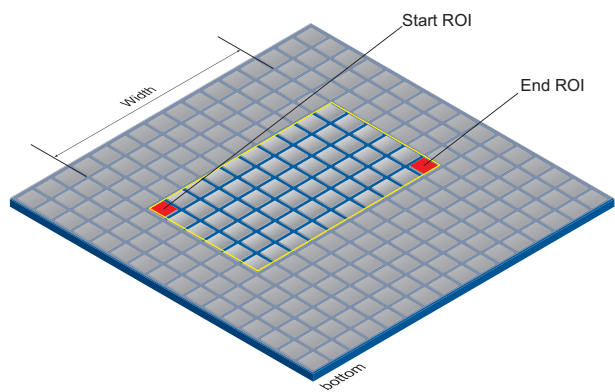
TestPatternGeneratorSelector

Selects which test pattern generator is controlled by the *TestPattern* feature.

Name	SensorShutterMode
Category	ImageFormatControl
Interface	IEnumeration
Access	Read / Write
Unit	-
Values	ImageProcessor <i>TestPattern</i> feature will control the image processor. Sensor Processor <i>TestPattern</i> feature will control the sensor processor.

8.11.21 Width

Width of the image provided by the device (in pixels).



Name	Width
Category	ImageFormatControl
Interface	Integer
Access	Read / Write
Unit	-
Values	see table(s) below
Camera Type	Values [Pixel]
Monochrome	
VAX-32M	16 ... 2048 (Increment: 16)
VAX-50M	16 ... 2448 (Increment: 16)
Color	
VAX-32C	16 ... 2048 (Increment: 16)
VAX-50C	16 ... 2448 (Increment: 16)

8.11.22 WidthMax

Maximum width of the image (in pixels). The dimension is calculated after horizontal binning, decimation or any other function changing the horizontal dimension of the image.

Name	WidthMax
Category	ImageFormatControl
Interface	Integer
Access	Read only
Unit	-
Values	Resolution of the sensor in X-direction / see table(s) below

Camera Type	Values [Pixel]
Monochrome	
VAX-32M	2048
VAX-50M	2448
Color	
VAX-32C	2048
VAX-50C	2448

8.12 Category: LUTControl

Features in this chapter describe the Look-up table (LUT) related features. For LUT related features, certain values are stored in the camera. This includes the coordinates of defective pixels so that they can be corrected.

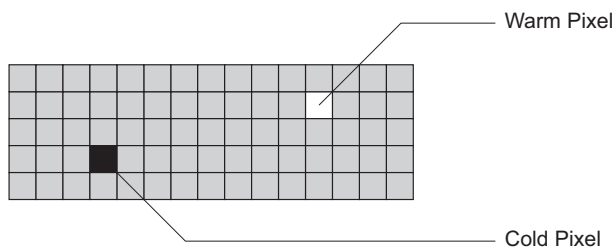
Pixel Correction - General Information

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.

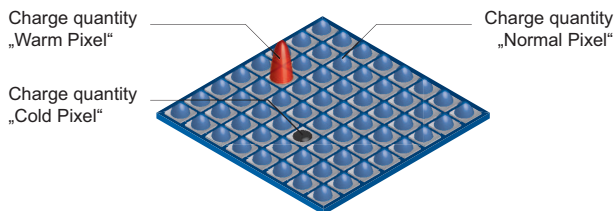
The occurrence of these defect pixels is unavoidable and intrinsic to the manufacturing and aging process of the sensors.

The operation of the camera is not affected by these pixels. They only appear as brighter (warm pixel) or darker (cold pixel) spots on the recorded image.

Distinction of "hot" and "cold" pixels within the recorded image.



Charge quantity of "hot" and "cold" pixels compared with "normal" pixels:



Correction Algorithm (Pixel Correction)

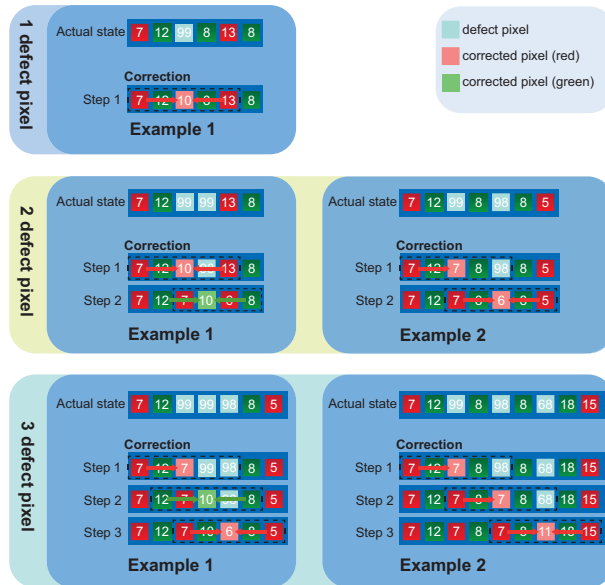
On Baumer cameras the problem of defect pixels is solved as follows:

- 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

NOTICE

The addition of defect pixels must be done in Full Frame (without *Binning* / *Width* / *Height* / *OffsetX* / *OffsetY*), in raw data format and without activated color calculation.

- Start the Camera Explorer. Connect to the camera.
- Select the profile GenICam Guru (only Camera Explorer < v3.0).
- Open the category *LUTControl*.
- Locate an empty *DefectPixelListIndex*.
`DefectPixelListEntryPosX = 0 | DefectPixelListEntryPosY = 0`
- Determine the coordinates of the defect pixel. Keep the mouse pointer over the defect pixel. The coordinates of the defect pixel is displayed in the status bar. For simplification, you can enlarge the image.
- Enter the determined coordinates for X (*DefectPixelListEntryPosX*) and Y (*DefectPixelListEntryPosY*).
- Activate the registered *DefectPixelListIndex*.
`DefectPixelListEntryActive = True`
- Stop the camera and start them again to take over the updated coordinates.

Result:

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

8.12.1 DefectPixelCorrection

Enable the correction of defect pixels.

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

8.12.2 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)

8.12.3 DefectPixelListEntryPosX

X position of the defect pixel.

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

8.12.4 DefectPixelListEntryPosY

Y position of the defect pixel.

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

8.12.5 DefectPixelListIndex

Index to the pixel correction list.

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

8.12.6 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.

8.12.7 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 value of the feature Gamma.
	Userdefined LUT The content of the selected LUT is user defined.

8.12.8 LUTEnable

Activates the selected The Look-Up-Table (LUT) It contains 2^{12} (4096) values for the available levels. These values can be adjusted by the user.

For color cameras the LUT is applied for all color channels together.

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

8.12.9 LUTIndex

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

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

8.12.10 LUTSelector

Selects which LUT to control.

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

8.12.11 LUTValue

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

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

8.13 Category: Memory Management

Category to support the cameras buffer management in memory.

8.13.1 MemoryMaxBlocks

Maximum count of disposal memory blocks.

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

8.14 Category: SequencerControl

Category for the Sequencer Control features.

The Sequencer enables the possibility of image series recording including automated re-parameterization of the camera based on different events and signals. Therefore the desired camera settings for each step are 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 features the path related features are also part of a sequencer set.

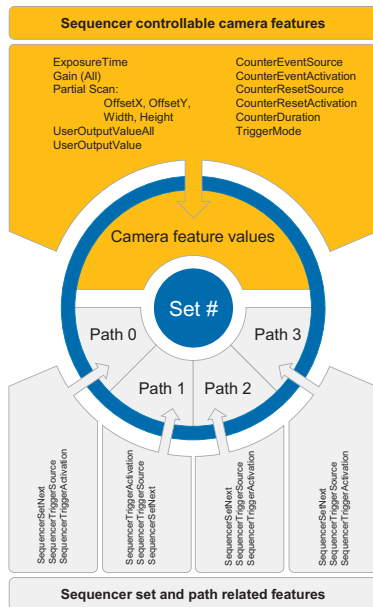
Sequencer sets

Sequencer sets combine camera features – comparable with a user set – and sequencer (set and path) related parameters.

Settings for several camera features such as:

- Exposure time
- Gain
- Region of Interest (*OffsetX / OffsetY / Width / Height*)
- User output
- Counter

can be controlled by the sequencer and thus stored to a sequencer set as well as information for the set switch-over via four different paths.



Each path involves:

- the destination for the set switch-over that is mapped by the *SequencerSetNext* feature
- the signal, whose change of state is used for triggering the set switch-over and that is mapped as *SequencerTriggerSource*
- the change of state triggering the set switch-over and that is mapped as *SequencerTriggerActivation*

As with user sets the camera's current settings are overwritten once a sequencer set is loaded and the sequencer is activated.

Sequencer configuration

In order to avoid overwriting current camera settings while configuring a sequencer, the camera needs to be set to the sequencer configuration mode.

Once the camera is set to the sequencer configuration mode, the individual sequencer sets can be selected via the *SequencerSetSelector*, configured and saved by executing *SequencerSet-Save*.

Starting the configured sequence requires to switch the sequencer configuration mode off and to enable the sequencer mode.

8.14.1

SequencerConfigurationMode

Controls if the sequencer configuration mode is active.

Name	SequencerConfigurationMode	
Category	SequencerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	On	Enables the sequencer configuration mode.
	Off	Disables the sequencer configuration mode.

8.14.2 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)

8.14.3 SequencerFeatureSelector

Selects the camera features that are controlled by the sequencer.

Name	SequencerFeatureSelector	
Category	SequencerControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	CounterDuration	Sets the duration (or number of events) before the CounterEnd event is generated.
	CounterEventActivation	Selects the Activation mode Event Source signal.
	CounterEventSource	Select the events that will be the source to increment the Counter.
	CounterResetActivation	Selects the Activation mode of the Counter Reset Source signal.
	CounterResetSource	Selects the signals that will be the source to reset the Counter.
	ExposureMode	Sets the operation mode of the Exposure (or shutter).
	ExposureTime	Returns the exposure time used to capture the image.
	Gain	Controls the selected gain as an absolute physical value.
	Height	Height of the image provided by the device (in pixels).
	OffsetX	Horizontal offset from the origin to the region of interest (in pixels).
	OffsetY	Vertical offset from the origin to the region of interest (in pixels).
	TriggerMode	Controls if the selected trigger is active.
	UserOutputValue	Sets the value of the bit selected by UserOutputSelector.
	UserOutputValueAll	Sets the value of all the bits of the User Output register.
	Width	Width of the image provided by the device (in pixels).

8.14.4 SequencerMode

Controls if the sequencer mechanism is active.

NOTICE

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 the sequencer.
	Off	Disables the sequencer.

8.14.5 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)	

8.14.6 SequencerSetActive

Contains the currently active sequencer set.

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

8.14.7 SequencerSetLoad

Loads the sequencer set selected by *SequencerSetSelector* in the device.

Name	SequencerSetLoad
Category	SequencerControl
Interface	ICommand
Access	Write only
Unit	-
Values	-

8.14.8 SequencerSetNext

Specifies the next sequencer set.

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

8.14.9 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	-

8.14.10 SequencerSetSelector

Selects the sequencer set to which further feature settings applies.

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

8.14.11 SequencerSetStart

Sets the initial/start sequencer set, which is the first set used within a sequencer.

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

8.14.12 SequencerTriggerActivation

Defines the signals edge that triggers the sequencer.

Name	SequencerTriggerActivation	
Category	SequencerControl	
Interface	Enumeration	
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	Specifies that the trigger is considered valid as long as the level of the source signal is high.
	LevelLow	Specifies that the trigger is considered valid as long as the level of the source signal is low.
	RisingEdge	Specifies that the trigger is considered valid on the rising edge of the source signal.

8.14.13 SequencerTriggerSource

Specifies the internal signal or physical input line to use as the sequencer trigger source.

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

NOTICE

Line2 is selectable, but without function.

Values	Off	Disables the sequencer trigger.
	Counter1End	Starts with the reception of the Counter End.
	Counter2End	Starts with the reception of the Counter End.
	Line1	Specifies Line 1 as external trigger source.
	ExposureActive	Starts with the reception of the Exposure Active.
	ReadOutActive	Starts with the reception of the Read Out Active.
	Timer1End	Starts with the reception of the Timer End.

8.15 Category: TransportLayerControl

This chapter provides the Transport Layer control features.

8.15.1 EnergyEfficientEthernetEnable

Controls whether the Energy Efficient / Green Ethernet mode (802.3az) in the PHY is activated or not.

NOTICE

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)

8.15.2 PayloadSize

Provides the number of bytes transferred for each image or chunk on the stream channel at the current settings. This includes any end-of-line, end-of-frame statistics or other stamp data. This is the total size of data payload for a data block.

Name	PayloadSize
Category	TansportLayerControl
Interface	Integer
Access	Read only
Unit	Byte
Values	0 ... depends on current settings (Increment: 1)

8.15.3 Category: TransportLayerControl → USB3Vision

Category that contains the features pertaining to the USB3 Vision transport layer of the device.

NOTICE

The camera module is internally connected to the Processing Board via USB3.0. Therefore, this category is visible on the VAX even if it has a GigE port.

8.15.3.1 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.

8.15.3.2 SIControl

Controls streaming operation.

Name	SIControl	
Category	TansportLayerControl → USB3Vision	
Interface	IEnumeration	
Access	Read only	
Unit	-	
Values	StreamDisabled	Disable Streaming.
	StreamEnabled	Enable Streaming.

8.15.3.3 SIPayloadFinalTransfer1Size

Size of first final Payload Transfer.

Name	SIPayloadFinalTransfer1Size	
Category	TansportLayerControl → PtpControl	
Interface	IInteger	
Access	Read only	
Unit	-	
Values	0 - 4294967295 (Increment: 1)	

8.15.3.4 SIPayloadFinalTransfer2Size

Size of second final Payload Transfer.

Name	SIPayloadFinalTransfer2Size
Category	TansportLayerControl → PtpControl
Interface	Integer
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

8.15.3.5 SIPayloadTransferCount

Expected number of Payload Transfers.

Name	SIPayloadTransferCount
Category	TansportLayerControl → PtpControl
Interface	Integer
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

8.15.3.6 SIPayloadTransferSize

Expected size of a single Payload Transfer.

Name	SIPayloadTransferSize
Category	TansportLayerControl → PtpControl
Interface	Integer
Access	Read only
Unit	-
Values	0 - 4294967295 (Increment: 1)

8.16 Category: UserSetControl

Category that contains the user set control features. It allows loading or saving factory or user-defined settings.

Loading the factory default user set guarantees a state where a continuous acquisition can be started using only the mandatory features.

These user sets are stored within the camera and can be loaded, saved and transferred to other cameras.

By using user set *Default* one of these four user sets can be set as the default, which means that the camera starts up with these adjusted parameters.

8.16.1 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.

Selects the feature Use rSet to load and make active by default when the device is reset. The factory settings are stored in the user set Default. This is the only user set that cannot be edited.

NOTICE

All saved user sets can be set as default.

Name	UserSetDefault	
Category	UserSetControl	
Interface	IEnumeration	
Access	Read / Write	
Unit	-	
Values	Default	Select the factory setting 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).

8.16.2 UserSetFeatureEnable

Enables the selected feature and make it active in all the UserSets.

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

8.16.3 UserSetFeatureSelector

Selects which individual UserSet feature to control.

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

Features		
AcquisitionFrameCount	DeviceLinkThroughputLimit	OffsetY
AcquisitionFrameRate	DeviceTemperatureStatus-Transition	PixelFormat
AcquisitionFrameRate-Enable	EventNotification	ReadoutMode
AcquisitionMode	ExposureAuto	ReverseX
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	

8.16.4 UserSetLoad

Loads the UserSet specified by *UserSetSelector* to the device and makes it active.

NOTICE

Loading a UserSet requires the stop of the camera.

Name	UserSetLoad
-------------	-------------

Category	UserSetControl
-----------------	----------------

Interface	ICommand
------------------	----------

Access	Write only
---------------	------------

Unit	-
-------------	---

Values	-
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8.16.5 UserSetSave

Save the User Set specified by *UserSetSelector* to the non-volatile memory of the device.

NOTICE

The factory settings are stored in the user set Default. This is the only user set that cannot be edited. Select at *UserSetSelector* *UserSet1*, *UserSet2* or *UserSet3*.

Name	UserSetSave
-------------	-------------

Category	UserSetControl
-----------------	----------------

Interface	ICommand
------------------	----------

Access	Write only
---------------	------------

Unit	-
-------------	---

Values	-
---------------	---

8.16.6 UserSetSelector

Selects the Feature User Set to load, save or configure.

NOTICE

The factory settings are stored in the user set *Default*. This is the only user set that cannot be edited.

Name	UserSetSelector
-------------	-----------------

Category	UserSetControl
-----------------	----------------

Interface	IEnumeration
------------------	--------------

Access	Read / Write
---------------	--------------

Unit	-
-------------	---

Values	Default	Select the factory setting 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.

