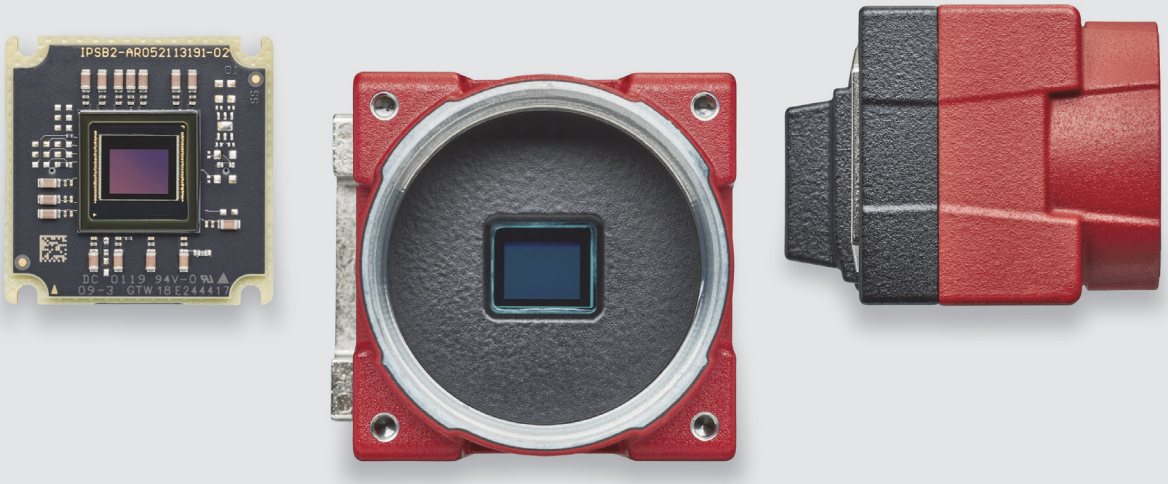
Allied Vision



USB3 Vision Cameras

Alvium USB Cameras

User Guide

V3.1.3

Allied Vision Technologies GmbH // Taschenweg 2a, 07646 Stadtroda / Germany

2020-Mar-12

Alvium USB cameras at a glance

Read this document carefully

Learn to avoid damage to your Alvium USB camera and use it in the most safe and efficient way.

Bandwidth and maximum frame rate

The default bandwidth for Alvium USB is 200 MBps. For some models, you can achieve higher frame rates by increasing values for `DeviceLinkThroughputLimit` and `MaxTransferSize`. See Operating systems and bandwidth on page 136.

Bare board cameras

Bare board cameras offer Alvium camera technology at a low price. If you intend to design an application using bare board cameras, please consider:

- Aligning the sensor to the lens is extremely difficult and expensive. Therefore, we recommend you to do evaluation with housed cameras first.
- Bare board cameras are specialized components. We cannot give all data needed for any application in advance. Please let us partner on applications with bare board cameras to ensure a successful design.

Contents in this document

This document is published before the official market introduction of the new Alvium models and firmware. Any updated information will be provided in the next version of this document.

Shipping contents

- Alvium USB camera
- Alvium USB Cameras Quickstart Guide

What else do you need?

This is a selection of helpful downloads:

Document	Link
Alvium USB Cameras Quickstart Guide (multilingual)	www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation
Alvium Cameras Features Reference	
Alvium Cameras Hardware Options	www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents
Alvium Cameras Accessory Guide	
Optimum Heat Dissipation for Housed Alvium Cameras application note	
Electromagnetic Compatibility for Open Housing Alvium Cameras application note	
Avoiding Ground Loops in Vision Systems application note	
Software	**Link**
Vimba Suite for Windows, Linux, and Linux/Arm, including **Vimba SDK**, **Vimba Viewer**, and **Vimba Driver Installer** for Windows	www.alliedvision.com/software

Table 1: Downloads for Alvium USB cameras

Contact us

Website

General
www.alliedvision.com/en/contact

Distribution partners
www.alliedvision.com/en/about-us/where-we-are

Email

General
info@alliedvision.com

Support
support@alliedvision.com

Sales offices

Europe, Middle East, and Africa	T// +49 36428 677-230
North and South America	Toll-free: +1 877 USA 1394 T// +1 978 225 2030 California: +1 408 721 1965
Asia-Pacific	T// +65 6634 9027
China	T// +86 21 64861133

Headquarters

Allied Vision Technologies GmbH
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07646 Stadtroda, Germany

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Contents

Document history and conventions

This chapter includes:

Document history

Version	Date	Remarks
V3.1.3	2020-Mar-12	• Corrected maximum exposure times. • Added *ExposureActive* signal to the description of sensor shutter modes. • DPC: Removed specifications into an application note. • FPNC: Updated note in Image data flow on page 123.
V3.1.2	2020-Mar-04	Applied minor changes.
V3.1.1	2020-Feb-28	• Updated frame rates and exposure time values. • Added information about frame rates with different triggering modes.
V3.1.0	2020-Feb-20	• Added Alvium 1800 U-319m/c, U-507m/c, U-1236m/c, and U-2050m/c models. • Added specifications for DPC. • Updated description for sensor shutter modes.
V3.0.0	2020-Jan-06	• Added Alvium 1800 U-040m/c, U-158m/c, and U-501m NIR models.
V2.0.0	2019-Oct-18	• Added Alvium 1800 U-050m/c and U-120m/c models. • Updated contents about bandwidth. • Updated screenshots for camera driver installation. • Added Dark current compensation on page 132. • Updated technical drawings and dimensions for bare board in Technical drawings on page 77. • Restructured contents in Troubleshooting and performance on page 128. • Applied editorial changes.
V1.1.0	2019-Jul-01	• Added missing color pixel formats and removed separate bit depth in Specifications on page 27. • Corrected ADC bit depth for Alvium U 1800-500m/c in specifications for Alvium 1800 U-500m/c on page 53 and in Image data flow on page 123.
V1.0.0	2019-Jun-13	Release version

Table 2: Document history

Conventions used in this user guide

To give this document an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

Typographic styles

Style	Function
Emphasis	Programs, or highlighting important things
`Feature names`	Names for GenICam features
`Feature options`	Options for GenICam features
`Input commands`	Text or command to type in by the user, selected menu options, or other selectable options
UIElements	Text that is displayed or output by the system, like parts of the GUI, dialog boxes, buttons, menus, important information, or windows titles
Web addresses and references	Links to webpages and internal cross references

Table 3: Typographic styles

Symbols and notes

CAUTION

Personal injuries

Precautions are described.

NOTICE

Material damage

Precautions are described.

Practical tip

Additional information helps to understand or ease handling the camera.

Avoiding malfunctions

Precautions are described.

Additional information

Web address or reference to an external source with more information is shown.

Naming and terms

Camera model naming

Alvium cameras are named to identify model properties.
For example, **Alvium 1800 U-500c** is composed of:

	Alvium	1800	U	500	c
Content	Camera series	Camera series details	Interface	Resolution	Color/ monochrome
Examples	Alvium	1500: Basic feature set 1800: Advanced feature set or high-performance sensors	C: MIPI CSI-2 U: USB	500: 5.0 MP 050: 0.5 MP	c: color m: monochrome

Table 4: Camera model naming

Hardware options

Alvium USB cameras are available with various options for housing, lens mount, or USB connector position. For ordering, see hardware options and product codes in the Alvium Cameras Hardware Options document at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Terms and acronyms

Term or acronym	Description	Reference
bare board	Camera consisting of electronics and sensor on a common printed circuit board (PCB), to be designed into a housing with heat sink and lens mount	Bare Board on page 78
CRA	Chief ray angle	Alvium 1800 U-500m/c on page 53
EMVA	European Machine Vision Association	www.emva.org
ESD	Electrostatic discharge	ESD on page 21
FCC	Federal Communications Commission	For customers in the USA on page 15
FPNC	Pixed pattern noise correction	Image data flow on page 123
fps	Frames per second	Alvium 1800 U-500m/c on page 53
GenICam	Generic Interface for Cameras, EMVA	www.emva.org
GND	Ground (power)	I/O connector pin assignment on page 116

Table 5: Terms and acronyms (sheet 1 of 2)

Term or acronym	Description	Reference
GPIOs	General purpose inputs and outputs (non-isolated)	GPIOs description on page 117
GRS	Global reset shutter	Shutter types and effects on page 135
H × V	Horizontal × Vertical (sensor resolution)	Alvium 1800 U-500m/c on page 53
KB	Kilobyte	Alvium 1800 U-500m/c on page 53
MBps	Megabytes per second	Alvium 1800 U-500m/c on page 53
open housing	Camera housing that is open at the back side to be designed into an encompassing housing with other components	Open Housing S-Mount on page 80
PCBA	Printed circuit board assembly	PCBAs on page 21
QE	Quantum efficiency	Absolute QE on page 55
ROI	Region of interest	ROI frame rates on page 56
SFNC	Standard Features Naming Convention (GenICam)	www.emva.org
S-Mount	M12-Mount	Mounting and focusing S-Mount lenses on page 106

Table 5: Terms and acronyms (sheet 2 of 2)

Compliance, safety, and intended use

This chapter includes:

Compliance notifications

WEEE-Registration number: DE 59201569

For customers in the USA

Closed housing cameras only: FCC Class B digital device

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

United States of America: Supplier Declaration of Conformity

Alvium USB cameras comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. this device must accept any interference received, including interference that may cause undesired operation.

Party issuing Supplier's Declaration of Conformity

Allied Vision Technologies GmbH
Taschenweg 2a
07646 Stadtroda
Germany
T// +49 (36428) 677-106
quality@alliedvision.com

Responsible Party - U.S. Contact Information

Allied Vision Technologies, Inc.
102 Pickering Way – Suite 502
Exton, PA 19341
USA
T// +1 978 225 2030

Note: changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

For customers in Canada

Closed housing cameras only

This apparatus complies with the Class B limits for radio noise emissions set out in the Radio Interference Regulations.

CAN ICES-3 (B) / NMB-3 (B)

Pour utilisateurs au Canada

Boîtier de caméra fermé seulement

Cet appareil est conforme aux normes classe B pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

CAN ICES-3 (B) / NMB-3 (B)

Bare board and open housing cameras

Bare board and open housing cameras are designed for integration and are delivered with open camera back or without housing on customer's request. Housing design is critical for electromagnetic compatibility (EMC) of the camera.

Requirements for EMC housings

See the Electromagnetic Compatibility for Open Housing Alvium Cameras application note at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Avoid electromagnetic interferences

Interface cables, power cables, and I/O cables are sensitive to electromagnetic interference.

- Use shielded cables only.
- We recommend using cables offered by Allied Vision.
- Avoid coiling.
- We recommend using GPIOs only in environments with low electromagnetic interference.

Moreover, avoid unnecessary bending to prevent damage to the cables.

Intended use

Allied Vision's objective is the development, design, production, maintenance, servicing and distribution of digital cameras and components for image processing. We are offering standard products as well as customized solutions.

Intended use of Allied Vision product is the integration into Vision systems by professionals. All Allied Vision product is sold in a B2B setting.

Allied Vision isn't a legal manufacturer of medical product. Instead, Allied Vision cameras and accessories may be used as components for medical product after design-in by the medical device manufacturer and based on a quality assurance agreement (QAA) between Allied Vision (supplier) and medical device manufacturer (customer). Allied Vision's duties in that respect are defined by ISO 13485, clause 7.2 (customer-related processes, equivalent to ISO 9001, clause 8.2).

Copyright and trademarks

Your safety

This section informs about issues related to your personal safety. Descriptions explain how to avoid hazards and operate Alvium USB cameras safely.

Handling lens mounts

The lens mount thread has sharp edges. Be careful these edges do not cut your skin when mounting or unmounting lenses.

Housed cameras: handling hot cameras

If the mainboard temperature exceeds the specified maximum for more than two seconds, the camera is powered off automatically. The current value for mainboard temperature is output by `DeviceTemperature`. You can use this value to control cooling by software, for example, to control a fan.

However, if you hold the camera in your hands during operation, your skin may get hurt. If you touch the camera when it is heated up, we recommend wearing protective gloves.

Providing optimum heat dissipation

Design bare board and open housing cameras into a heat dissipative housing with a high thermal conductivity. For more information, see Mounting bare board cameras on page 103. Keep the operating temperature in the specified range to enable best image quality and to protect the camera from damage. Temperature values apply to a relative humidity of 0 to 80 percent that is non-condensing.

Hardware option	Housing	Components in the cooling areas[1]	Mainboard[2]
Bare board[3]	Not applicable	+5 °C to +85 °C	See model Specifications on page 27.
Open housing[4]	+5 °C to +65 °C		
Closed housing		Not applicable	

[1] See Mounting the heat sink on page 102.

[2] Output by `DeviceTemperature`

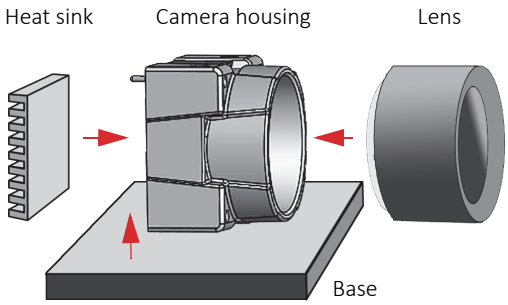
[3] Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please contact support@alliedvision.com.

[4] Temperature values must be observed for the housing **and** for the cooling areas.

Table 6: Operating temperature ranges for Alvium USB cameras

For your safety and to improve camera performance, operate the camera:

- Mounted to a base with a high thermal conductivity
- With lens or other optical components mounted
- With a heat sink mounted that has large surface areas (closed housing cameras include a heat sink)
- Using conductive media for camera and heat sink mounting
- With active cooling of camera, mounting base, and heat sink, such as by ventilation.



More information

For more information on heat dissipation, see the Optimum Heat Dissipation for Housed Alvium Cameras application note at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Camera mounting

Housed cameras must be mounted using the mounting threads. If vibration is higher than specified, cameras can disconnect from the mounting. Falling cameras can hurt you. To avoid personal injury:

- Mount the camera according to the instructions in Mounting housed cameras on page 104.
- Ensure, shock and vibration do not exceed the specified range, see Shock and vibration on page 29.
- Use a lens support if you want to use Heavy lenses.

Heavy lenses

For non-static applications, use lenses with a mass less than 70 grams and a length less than 38 mm, where the center of gravity is 20 mm, measured from the lens mount front flange. For heavier or longer lenses, use a lens support and apply additional tests. For more information, please contact support@alliedvision.com.

Product safety

To prevent material damage, read the following and understand how to safely handle and operate the camera. Get helpful details about electrical connections and learn how to optimize camera performance.

Electrical connections

ESD

ESD is dangerous for electronic devices, especially when tools or hands get in contact with connectors and electronic components. We recommend measures to avoid damage by ESD:

- Unpacking: Remove the camera from its anti-static packaging only when your body is grounded.
- Workplace: Use a static-safe workplace with static-dissipative mat and air ionization.
- Wrist strap: Wear a static-dissipative wrist strap to ground your body.
- Clothing: Wear ESD clothing. Keep components away from your body and clothing. Even if you are wearing a wrist strap, your body is grounded but your clothes are not.
- Bare board and open housing cameras: use a special ESD housing.

Cable connections

Provide sufficient strain relief for all cable connections to avoid short circuits and malfunctions.

PCBAs

Alvium USB cameras enable access to PCBAs. Keep away from camera electronics to avoid damage.

Camera power

Operating the camera beyond the specified range damages the camera. Cameras are powered over USB. Alternatively, cameras can be powered using the I/O connector at a maximum input of 5.5 VDC, using a limited power source (LPS), according to IEC62368-1: 2014 (Second Edition) with maximum 1.5 A. The camera is not intended to be connected to a DC distribution network.

- Make sure that USB 3.0 or 3.1 Gen 1 host controller cards, on-board host controllers, or hubs provide sufficient current supply for the connected cameras.
- We recommend using powered hubs, especially for multi-camera operation.
- For suitable USB accessories, see the Alvium Cameras Accessory Guide.

GPIOs

To avoid damage to the camera, keep maximum input voltage below 5.5 VDC and maximum current below 12 mA per output. See Specifications on page 27 for details. The maximum length for I/O cables must not exceed 30 meters.

Reverse polarity

If Alvium USB cameras are externally powered with reverse polarity, the cameras can be damaged. See I/O connector pin assignment on page 116 for proper external power connections.

JST-cables

JST I/O cables without shielding are designed to be used with bare board or open housing Alvium cameras. The customer is responsible for an EMC compliant design. For applications without an additional EMC housing, please use shielded JST I/O cables with screw lock.

Ground loops

Unsuitable connections can lead to different potentials between the camera system GND and the environmental shield/chassis GND caused by ground loops. This can damage the camera and the connected devices or cause malfunctions.

- Avoid potential differences between the camera housing and GND.
- All wiring must be done by authorized personnel, according to the corresponding technical standards.
- Read the Avoiding Ground Loops in Vision Systems application note.

More information

See the Avoiding Ground Loops in Vision Systems application note at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

USB connections

USB 3.0 and 3.1 Gen 1 host controllers and hubs

To avoid damage to USB 3.0 or 3.1 Gen 1 host controller cards or hubs, make sure these components provide sufficient current supply for the connected cameras. For suitable USB 3.0 accessories, see the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

If suddenly your camera is not recognized anymore, check for a crashed USB hub. Disconnect the USB and power supply cable from the hub. Reconnect both.

USB cables

Proper cable handling enables reliable performance:

- Use only shielded cables to avoid electromagnetic interferences.
- Please use cables recommended by Allied Vision.
- Avoid unnecessary bending to prevent damage to the cables.
- Avoid coiling to prevent electromagnetic interference.

Alvium USB cameras and USB 2.0

If Alvium USB cameras are connected to USB 2.0 ports, they are recognized. They can be operated with reduced performance only if `DeviceLinkThroughputLimit` is set to a value supported by USB 2.0. See Operating systems and bandwidth on page 136. Some pixel formats may not be supported.

Handling bare board cameras

Bare board cameras are an electronic assembly without a protective housing. To avoid damage:

- Handle bare board cameras with extreme care.
- Avoid any mechanical stress to the sensor area.
- Avoid short circuits by keeping away from electronics components.

Observe for mounting bare board cameras:

- Allow mechanical contact only at the mounting area. (This does not apply to the cooling areas.)
- Enable proper cooling at the cooling areas, see Mounting bare board cameras on page 103.
- Give 2 mm minimum clearance above board components.
- Tighten screws at 0.1 Nm maximum torque.
- Follow the instructions in Mounting bare board cameras on page 103.

Optical components

Provide the following conditions to keep dirt and droplets out of the optical system of camera and lens:

- Dust-free environment
- Low relative humidity
- No condensation.

When camera or lens are stored:

- Cover the lens mount with a protection foil or cap.
- Cover front and back lens with caps.

Damage to optical components by conductive media for heat sinks

See Conductive media for heat sinks on page 26 for details.

Sensor

Sensors are sensitive to excessive radiation: focused sunlight, lasers, and X-rays can damage the sensor. Dirt and scratches can damage the sensor as well.

Alvium USB cameras do not need additional cleaning. Cameras are cleaned before shipping. Incorrect cleaning can damage the sensor or the filter. Therefore, never clean the sensor or the filter.

Protect the camera filter and the sensor from dirt, because dirt becomes more visible the closer it gets to the sensor. In addition, keep the back lens clean. Hold the camera with the lens mount facing the ground to keep dirt out of the lens mount.

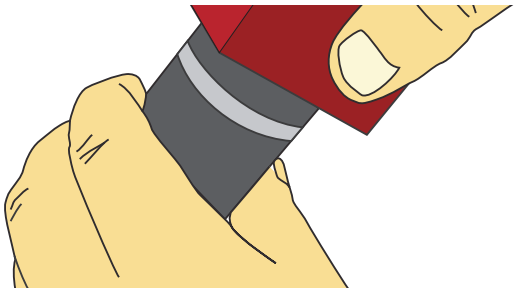
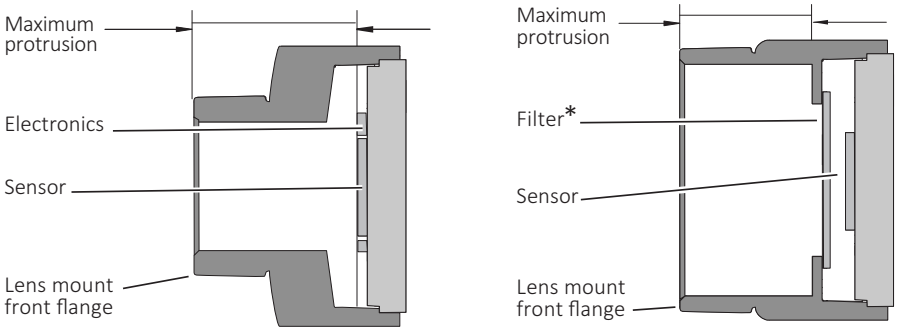


Figure 1: Holding the camera with the lens mount facing the ground

Lenses

Maximum protrusion

The sensor, filter, lens, or camera electronics can be damaged if a lens exceeding maximum protrusion is mounted to the camera. Use lenses with a maximum protrusion within camera specifications. Figure 2 shows maximum protrusion. For details, see Lens mounts and maximum protrusion on page 92.



*Only color models are equipped with an IR cut filter

Figure 2: Maximum protrusion S-Mount (left); CS-Mount and C-Mount (right)

For S-Mount lenses, read Mounting and focusing S-Mount lenses on page 106 to avoid damage to the sensor, the electronics, and lens.

Heat sinks and conductive media

The camera can be damaged by overheating if heat sink or conductive media are not used properly.

Heat sinks

Adhere to the instructions and safety notes provided by the manufacturer of the heat sink.

Conductive media for heat sinks

Some conductive media for heat sinks contain corrosive substances that can damage optical surfaces of the sensor, filter, and lens.

- Cover the optical path of the camera when you apply heat sink compound or adhesive to prevent substances and fumes from damaging optical surfaces.
- Adhere to the instructions and safety notes provided by the manufacturer of the conductive media.
- Ensure that the conductive media is correctly positioned: covering only the components to be cooled.

Cooling areas

See Mounting the heat sink on page 102 for Alvium cameras **cooling areas**.

BIOS drivers

Sometimes, USB component's firmware must be updated before operation, including devices, such as host adapters cards. To avoid damage and to benefit from possible updates to increase performance: Check for BIOS updates related to USB.

Specifications

This chapter includes:

Applied standards

GenICam

GenICam provides a generic access for cameras and devices that is independent of the interface. This enables to operate cameras with USB3 Vision, GigE Vision, or CoaXPress interfaces and Alvium USB cameras with a common software.

GenICam consists of multiple modules for different tasks. Allied Vision cameras and software use these modules, like the SFNC that standardizes feature names and types via an XML file or the transport layer interface (GenTL) used to grab images.

Alvium 1800 U cameras comply to:

- GenICam GenAPI V3.1
- GenICam Standard Features Naming Convention V2.2 (SFNC)
- GenICam Pixel Format Naming Convention V2.0 (PFNC).

USB3 Vision 1.0.1

USB3 Vision standard for cameras and imaging products is based on USB 3.0 standard, using USB 3.0 ports. It provides control over compliant devices by GenICam Applications Programming Interface (API). USB3 Vision standard is administered by the Automated Imaging Association (AIA).

IP class

The following statement applies to closed housing cameras only. Equipped with a lens as intended, the Alvium USB closed housing camera complies with IP30 class according to IEC 60529.

Shock and vibration

Closed and open housing cameras were tested successfully according to the following standards:

- IEC 60068-2-6, sinusoidal vibration testing
- IEC 60068-2-27, shock testing
- IEC 60068-2-64, random vibration testing.

If you need more details, please contact support@alliedvision.com.

Notes on specifications

This section defines the conditions for specifications stated in this chapter..

Sensor

Absolute QE plots

Measurements for color cameras were done with IR cut filter, measurements for monochrome and S-Mount cameras were done without optical filters. With optical filters, QE decreases by approximately 10 percent. The uncertainty in measurement of the QE values is ±10 percent. This is mainly due to uncertainties in the measuring apparatus itself (such as Ulbricht sphere and optometer).

Manufacturing tolerance of the sensor increases overall uncertainty.

ON Semiconductor sensors

The curve in the absolute QE plots shown in this chapter is from the sensor manufacturer data sheet. The information was correct at the time of publishing.

Sony CMOS sensors

Sony provides relative response curves in their sensor data sheets. To create the absolute QE plots shown in this chapter, the relative response was converted to a normalized QE response and then adjusted as per three measured QE values (at 448 nm, 529 nm, 632 nm) for color sensors and one measured QE value (at 529 nm) for monochrome sensors.

Wavelength

The wavelength range in the absolute QE plots reflects the information available in the sensor manufacturer data sheet at the time of publishing. For additional wavelength information, contact the sensor manufacturer.

Spectral response plots

The curves in the spectral response plots shown in this chapter were calculated from measured quantum efficiencies at 448 nm, 529 nm, and 632 nm. The shape of the curve is taken from the sensor data sheet but the values have been adjusted based on these measured values. The uncertainty in measurement of the spectral response values is ±10 percent.

Exposure time and frame rate

Stated values were measured for a maximum bandwidth of 375 MBps for Typical operation, using the following test setup:

Component	Property
Desktop workstation	Dell Precision T5500 Precision (EHW400)
Chipset	Chipset Intel X5520
CPU	Intel Xeon X5670 (6 cores)
CPU frequency	2.93 GHz
RAM	12 GB
Graphics controller	NVIDIA Quadro FX 580
USB controller	Delock U3 PCIe 1XG205-1S Rev. 1.1 (2-port USB 3.0 to PCI Express x1 Gen 2 with Renesas chipset)
Operating system	Windows 7 Ultimate 64-bit SP1
Measured by	Oscilloscope
Measured signal	*ExposureActive*

Table 7: Test setup components

Exposure time values, delays, and ROI frame rates

- **Available values and increments** for exposure time depend on interdependencies between controls, see Value changes by feature interdependencies on page 130. See also Exposure start delay = exposure area – exposure time. on page 122.
- Calculation of maximum frame rates for different ROIs for Alvium USB cameras does not allow to give a formula. **ROI frame rates** were measured for **typical operation** as defined next.

Typical operation

All timing values are based on following parameters:

- Factory settings (camera after startup)
- Minimum exposure time
- Full resolution
- Mono8 pixel format (also for color models)
- Camera operation in freerun mode
- Sensor readout using ADC bit depth
- Without bandwidth limitations.

Bandwidth: Data is measured for six steps in a range of 200 MBps to 375 MBps. The default value for `DeviceLinkThroughputLimit` is 200 MBps for Alvium 1800 U cameras measured as average sensor readout.

Bit depth: Values are measured for Mono8. If you are using color formats or 10-bit or 12-bit pixel formats, frame rates fall below values for Mono8. increasing the `DeviceLinkThroughputLimit` value may increase maximum frame rates.

Triggering

The following table shows how the shutter mode impacts available frame rates:

Sensor type	Shutter mode	Trigger mode	Available frame rates	ROI frame rates
Global shutter	Global shutter	Freerun	Maximum values	Increased values
	Global shutter	External trigger	Maximum values	Increased values
Rolling shutter	Rolling shutter	Freerun	Maximum values	Increased values
	Rolling shutter	External trigger	**Reduced values**	Increased values
	Global reset shutter	Freerun	Maximum values	**No increase**
	Global reset shutter	External trigger	Maximum values	**No increase**

Table 8: Frame rates depending on shutter modes and trigger modes

Achieved frame rates may not match specified values

- Some sensors have an exposure start jitter that may reduce maximum frame rates.
- Your individual setup may cause delays in data transmission.

Bandwidth adjustments

Consider the bandwidth available for camera payload depends on your individual hardware, the operating system, software and drivers, and your application. We recommend you to adjust `DeviceLinkThroughputLimit` and `MaxTransferSize` to your requirements. See Operating systems and bandwidth on page 136.

Interdependencies between ROI and ExposureTime values

Changing parameters for ROI can affect values for `ExposureTime`, such as minimum, maximum, and increments, but `ExposureTime` itself as well. We recommend you to set ROI values before you set values for `ExposureTime`. See Value changes by feature interdependencies on page 130 for details.

`DeviceLinkThroughputLimit` and `MaxTransferSize` can have an impact as well.

Sensor shutter types and triggering

Different shutter types are explained in Shutter types and effects on page 135. Triggering behavior differs between cameras with global shutter (GS) and electronic rolling shutter (ERS). See Triggering on page 120 for details.

Power consumption

Data is given for **typical operation**:

- Factory settings (camera after startup)
- Minimum exposure time
- Maximum frame rate
- Full resolution
- Mono8 pixel format (also for color models)
- Camera operation in freerun mode
- Sensor readout using ADC bit depth
- Without bandwidth limitations.

Dimensions

For your model's dimensions, see Dimensions and mass on page 75.

In manufacturing, camera board and sensor are moved against each other to adjust flange focal distance. The value range for camera length with open housing cameras reflects in the technical drawings. See Technical drawings on page 77.

Alvium 1800 U-040m/c

Feature	Specification	
	1800 U-040m (monochrome)	**1800 U-040c (color)**
Sensor model	Sony IMX287	
Resolution	728 (H) × 544 (V); 0.4 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 1/2.9; 5 mm × 3.8 mm; 6.3 mm diagonal	
Pixel size	6.9 µm × 6.9 µm	
CRA	0 deg	
ADC	12-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono12, Mono12p	Mono8, Mono10, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Maximum image bit depth	12-bit	
Maximum frame rate	281 fps (at ≥200 MBps)	
Exposure time	177 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 24 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed, TriggerControlled, TriggerWidth	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 1.9 W External power: 2.1 W	

Table 9: Alvium 1800 U-040m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-040m/c			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 9: Alvium 1800 U-040m/c specifications (sheet 2 of 2)

Absolute QE

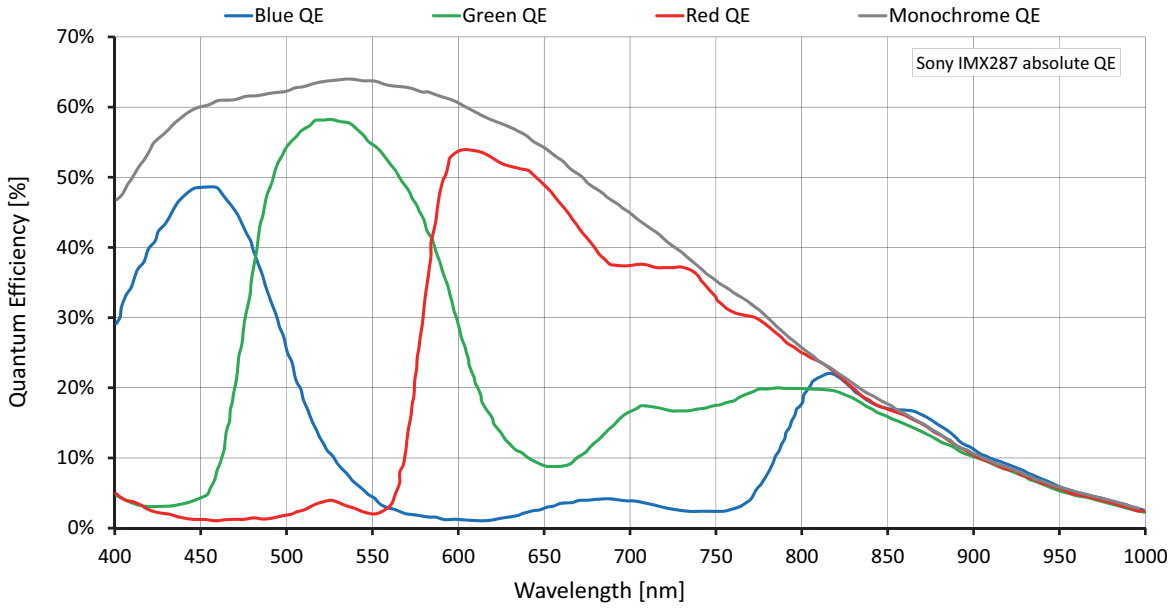


Figure 3: Absolute QE for 1800 U-040m/c (Sony IMX287)

Spectral response

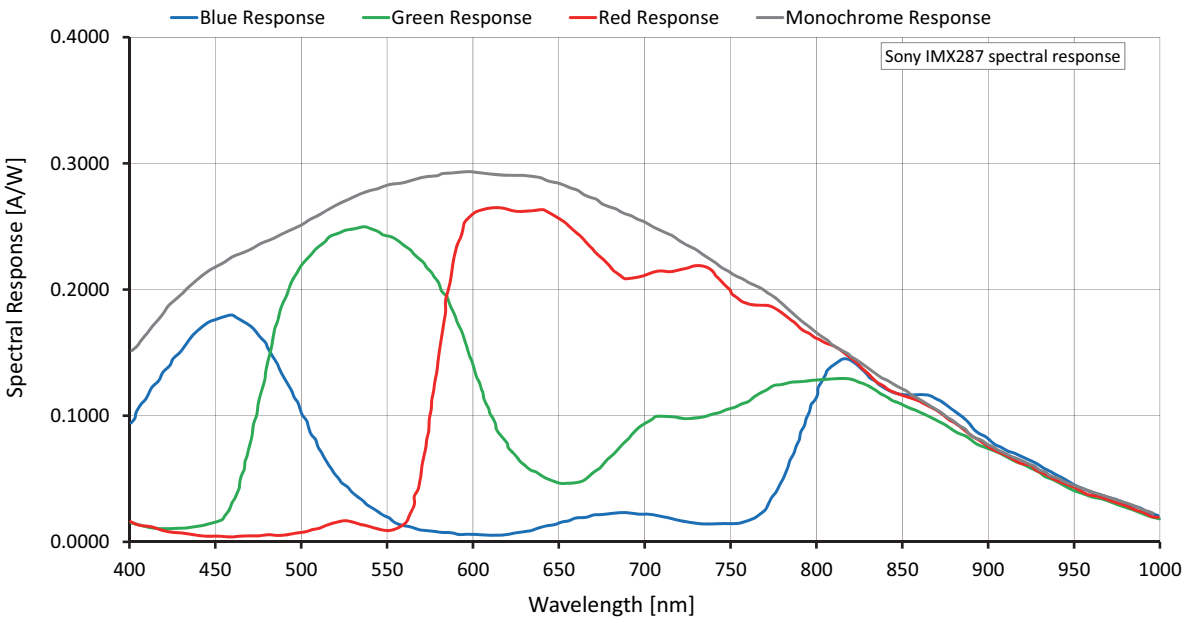


Figure 4: Spectral response for 1800 U-040m/c (Sony IMX287)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 200 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps] at 200 MBps
Full resolution	728	544	396,032	281
VGA	640	480	307,200	312
HVGA	480	320	153,600	436
QVGA	320	240	76,800	543
Maximum × half	728	272	232,960	481
Maximum × minimum	728	8	5,824	1,546
Minimum × maximum	8[1]	544	4,352	287
Minimum × minimum	8[1]	8	64	1,753

[1]Constant for values ≤ 260 pixels

Table 10: ROI frame rates for 1800 U-040m/c at 200 MBps

Alvium 1800 U-050m/c

Feature	Specification	
	1800 U-050m (monochrome)	**1800 U-050c (color)**
Sensor model	ON Semiconductor PYTHON 480	
Resolution	808 (H) × 608 (V); 0.5 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 1/3.6; 3.9 mm × 2.9 mm; 4.9 mm diagonal	
Pixel size	4.8 µm × 4.8 µm	
CRA	1.65 deg	
ADC	10-bit	
Monochrome pixel formats	Mono8 (default), Mono10	Mono8, Mono10
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BGR8, RGB8 (default)
Maximum image bit depth	10-bit	
Maximum frame rate	115 fps (at ≥200 MBps)	
Exposure time	64 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 11.3 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed, TriggerControlled, TriggerWidth	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 1.5 W External power: 1.7 W	

Table 11: Alvium 1800 U-050m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-050m/c			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 11: Alvium 1800 U-050m/c specifications (sheet 2 of 2)

Absolute QE

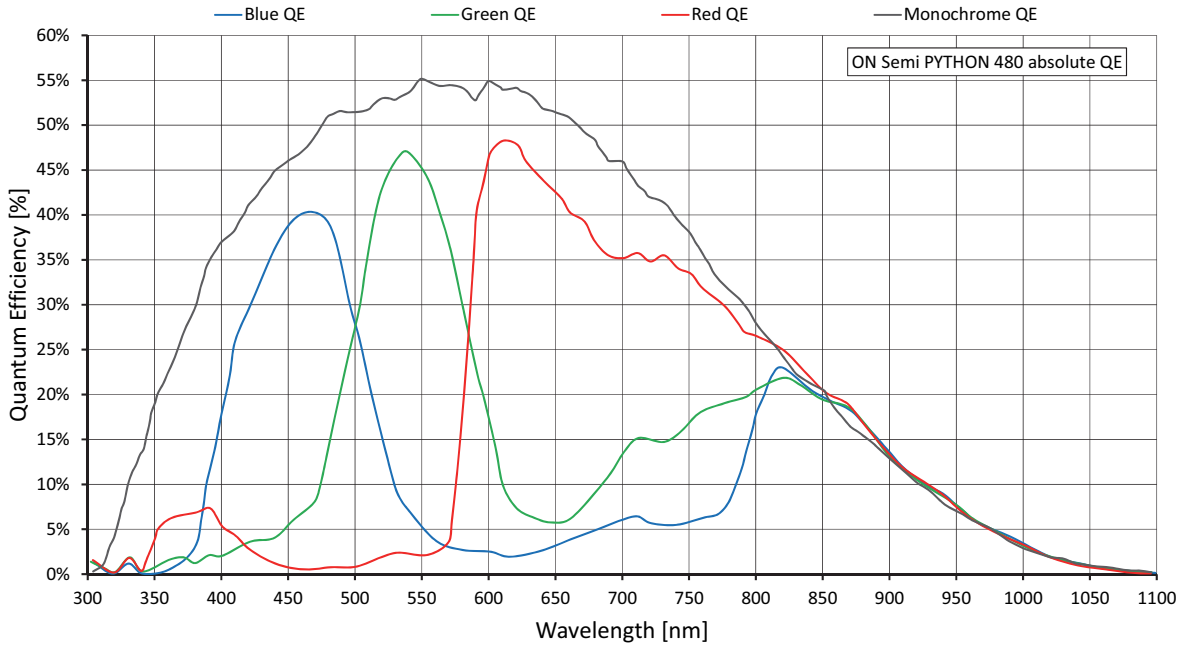


Figure 5: Absolute QE for 1800 U-050m/c (ON Semiconductor PYTHON 480)

Spectral response

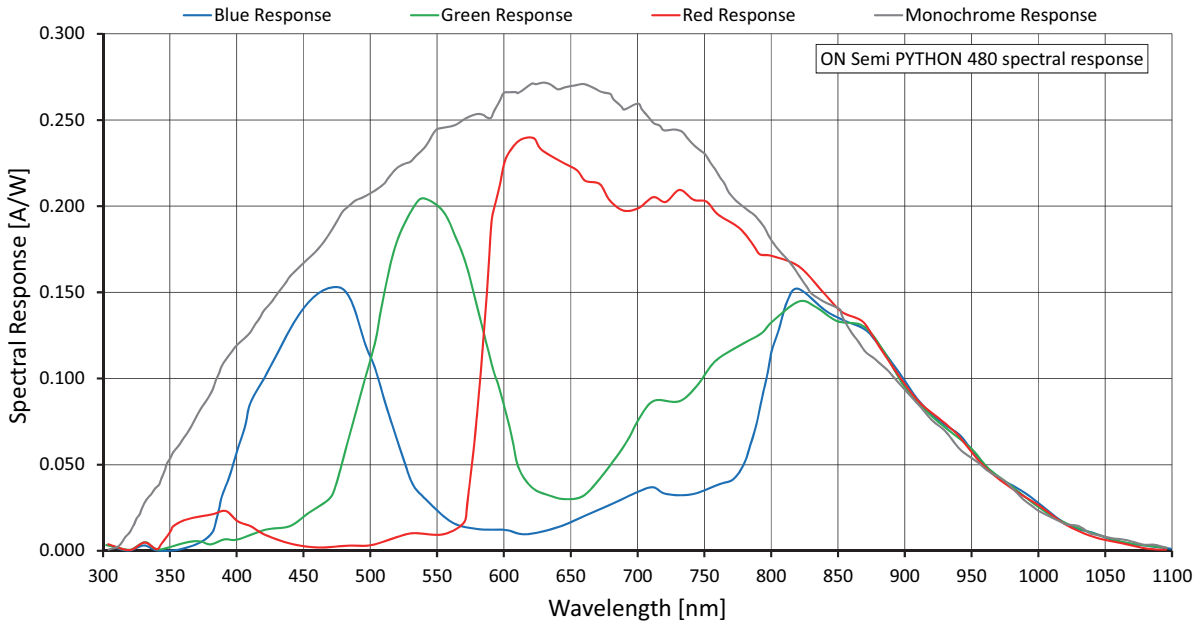


Figure 6: Spectral response for 1800 U-050m/c (ON Semiconductor PYTHON 480)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 200 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps] at 200 MBps
Full resolution	808	608	491,264	115
VGA	640	480	307,200	174
HVGA	480	320	153,600	309
QVGA	320	240	76,800	502
HQVGA	240	160	38,400	758
QQVGA	160	120	19,200	1,030
Maximum × half	808	304	245,632	216
Maximum × minimum	808	8	6,464	1,332
Minimum × maximum	8[1]	608	4,864	712
Minimum × minimum	8[1]	8	64	1,880

[1]Constant for values ≤ 16 pixels

Table 12: ROI frame rates for 1800 U-050m/c at 200 MBps

Alvium 1800 U-120m/c

Feature	Specification	
	1800 U-120m (monochrome)	**1800 U-120c (color)**
Sensor model	ON Semiconductor AR0135CS	
Resolution	1280 (H) × 960 (V); 1.2 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 1/3; 4.8 mm × 3.6 mm; 6.0 mm diagonal	
Pixel size	3.75 µm × 3.75 µm	
CRA	0 deg	
ADC	12-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono12, Mono12p	Mono8, Mono10, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Maximum image bit depth	12-bit	
Maximum frame rate	52 fps (at ≥200 MBps)	
Exposure time	57 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 17.7 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 1.3 W External power: 1.5 W	

Table 13: Alvium 1800 U-120m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-120m/C			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 13: Alvium 1800 U-120m/c specifications (sheet 2 of 2)

Absolute QE

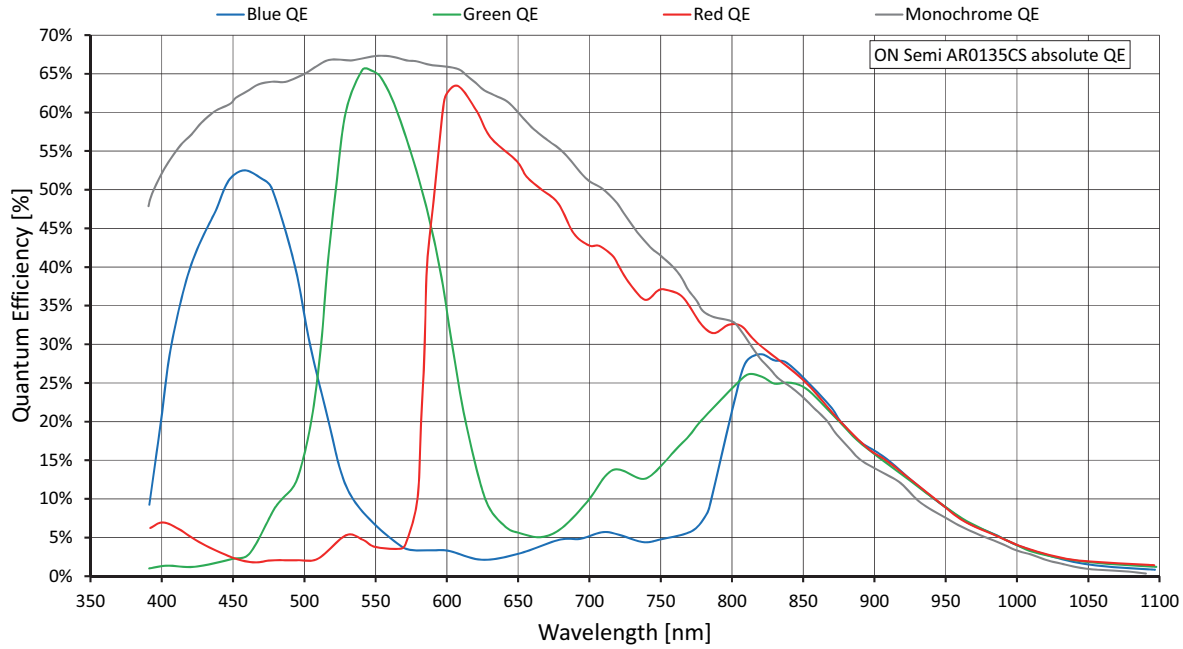


Figure 7: Absolute QE for 1800 U-120m/c (ON Semiconductor AR0135CS)

Spectral response

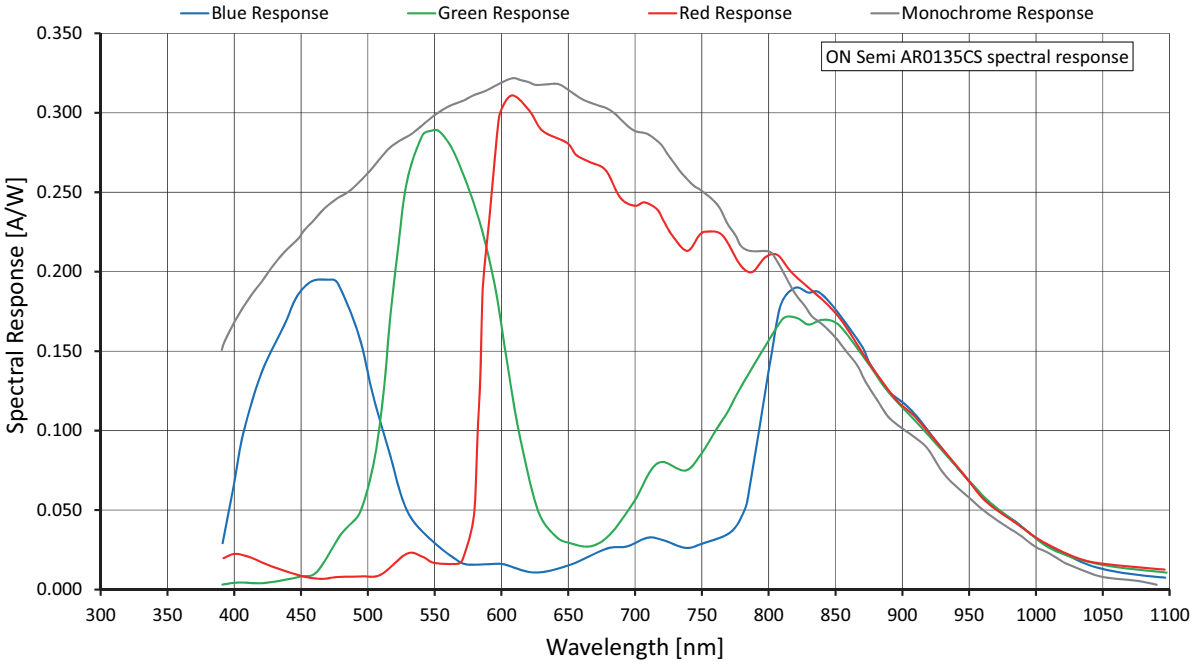


Figure 8: Spectral response for 1800 U-120m/c (ON Semiconductor AR0135CS)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 200 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps] at 200 MBps
Full resolution	1280	960	1,228,800	52
HD	1280	720	921,600	68
XGA	1024	768	78,336	64
SVGA	800	600	480,000	81
VGA	640	480	307,200	99
HVGA	480	320	153,600	142
QVGA	320	240	76,800	181
Maximum × half	1280	480	614,400	99
Maximum × minimum	1280	8	10,240	872
Minimum × maximum	8	960	7,680	52
Minimum × minimum	8	8	64	882

Table 14: ROI frame rates for 1800 U-120m/c at 200 MBps

Alvium 1800 U-158m/c

Feature	Specification	
	1800 U-158m (monochrome)	**1800 U-158c (color)**
Sensor model	Sony IMX273	
Resolution	1456 (H) × 1088 (V); 1.6 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 1/2.9; 5 mm × 3.8 mm; 6.3 mm diagonal	
Pixel size	3.45 µm × 3.45 µm	
CRA	0 deg	
ADC	12-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono12, Mono12p	Mono8, Mono10, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Maximum image bit depth	12-bit	
Maximum frame rate	150 fps (at ≥300 MBps)	
Exposure time	177 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 23.9 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed, TriggerControlled, TriggerWidth	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 2.5 W External power: 2.6 W	

Table 15: Alvium 1800 U-158m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-158m/C			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 15: Alvium 1800 U-158m/c specifications (sheet 2 of 2)

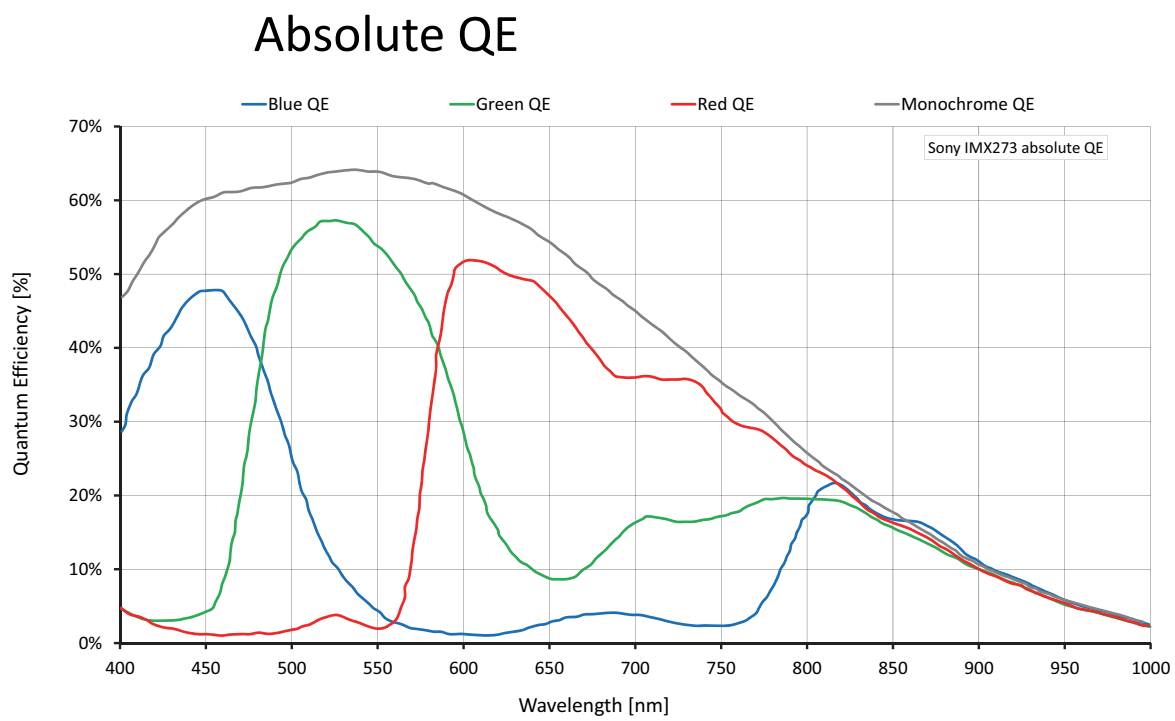


Figure 9: Absolute QE for 1800 U-158m/c (Sony IMX273)

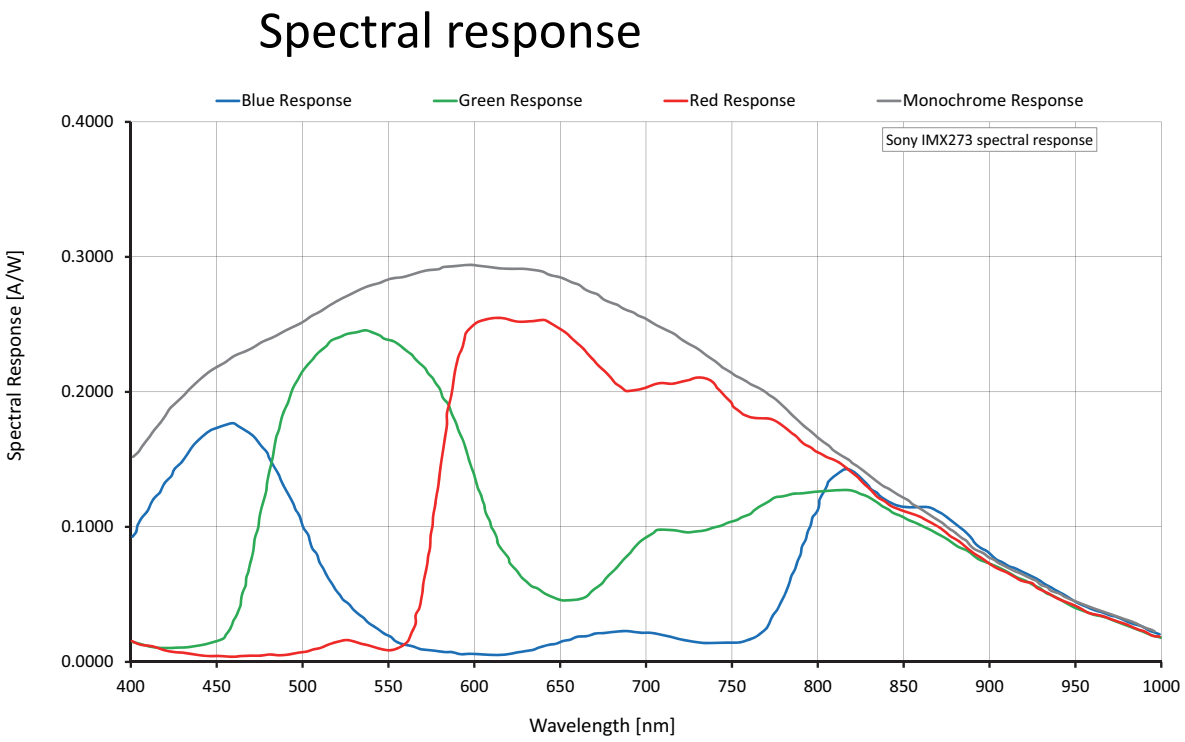


Figure 10: Spectral response for 1800 U-158m/c (Sony IMX273)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 300 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				200 MBps	250 MBps	300 MBps
Full resolution	1456	1088	1,584,128	112	138	150
WXGA+	1440	900	1,296,000	134	166	177
SXGA	1280	1024	1,310,720	134	158	
HD	1280	720	921.600	183	215	
XGA	1024	768	78,336	205		
SVGA	800	600	480,000	256		
VGA	640	480	307,200	313		
HVGA	480	320	153,600	435		
QVGA	320	240	76,800	525		
Maximum × half	1456	544	792,064	203	250	270
Maximum × minimum	1456	8	11,648	1,043	1,207	1,278
Minimum × maximum	8[1]	1088	8,704	155		
Minimum × minimum	8[1]	8	64	1,771		

[1]Constant for values ≤ 260 pixels

Table 16: ROI frame rates for 1800 U-158m/c at 200 to 300 MBps

Alvium 1800 U-319m/c

Feature	Specification	
	1800 U-319m (monochrome)	**1800 U-319c (color)**
Sensor model	Sony IMX265	
Resolution	2064 (H) × 1544 (V); 3.2 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 1/1.8; 7.1 mm × 5.3 mm; 8.9 mm diagonal	
Pixel size	3.45 µm × 3.45 µm	
CRA	0 deg	
ADC	12-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono12, Mono12p	Mono8, Mono10, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Maximum image bit depth	12-bit	
Maximum frame rate	53 fps (at ≥200 MBps)	
Exposure time	175 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 23.9 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed, TriggerControlled, TriggerWidth	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power:2.2 W External power: 2.4 W	

Table 17: Alvium 1800 U-319m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-319m/C			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 17: Alvium 1800 U-319m/c specifications (sheet 2 of 2)

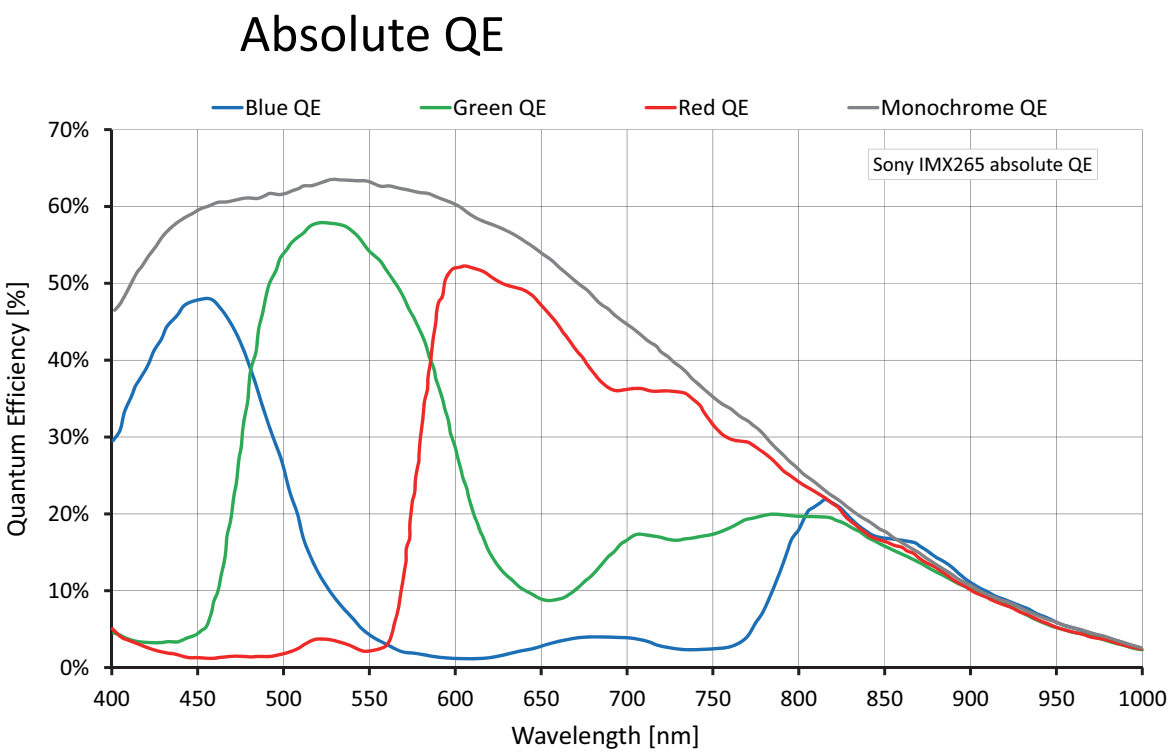


Figure 11: Absolute QE for 1800 U-319m/c (Sony IMX265)

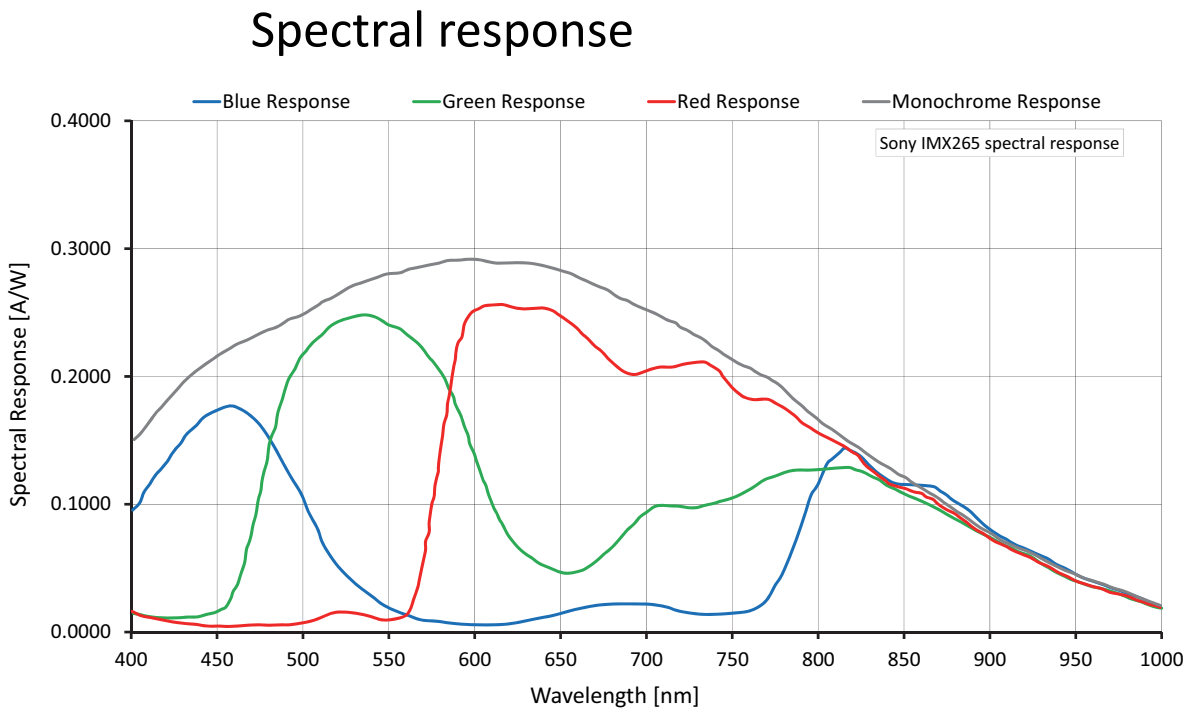


Figure 12: Spectral response for 1800 U-319m/c (Sony IMX265)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 200 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps] at 200 MBps
Full resolution	2064	1544	3,186,816	53
QXGA	2048	1536	3,145,728	53
Full HD	1920	1080	2,073,600	74
UXGA	1600	1200	1,920,000	67
WXGA+	1440	900	1,296,000	88
SXGA	1280	1024	1,310,720	78
HD	1280	720	921.600	108
XGA	1024	768	78,336	102
SVGA	800	600	480,000	128
VGA	640	480	307,200	156
HVGA	480	320	153,600	221
QVGA	320	240	76,800	280
QQVGA	160	120	19,200	459
Maximum × half	2064	772	1,593,408	100
Maximum × minimum	2064	8	16,512	851
Minimum × maximum	8	1544	12,352	53
Minimum × minimum	8	8	64	1,127

Table 18: ROI frame rates for 1800 U-319m/c at 200 MBps

Alvium 1800 U-500m/c

Feature	Specification	
	1800 U-500m (monochrome)	**1800 U-500c (color)**
Sensor model	ON Semiconductor AR0521SR	
Resolution	2592 (H) × 1944 (V); 5.0 megapixels	
Sensor type	CMOS	
Shutter type	Rolling shutter	
Sensor size	Type 1/2.5; 5.7 mm × 4.3 mm; 7.1 mm diagonal	
Pixel size	2.2 µm × 2.2 µm	
CRA	9 deg	
ADC	10-bit	
Monochrome pixel formats	Mono8 (default), Mono10	Mono8, Mono10
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BGR8, RGB8 (default)
Maximum image bit depth	10-bit	
Maximum frame rate	67 fps (at ≥350 MBps)	
Exposure time	7.4 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 24.1 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed	
Power requirements	Power over USB; External power	
Power consumption (typical at 5 VDC)	USB power: 2.2 W External power: 2.4 W	

Table 19: Alvium 1800 U-500m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-500m/c			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board[3]	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[4]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1] See Mounting the heat sink on page 102.

[2] Output by `DeviceTemperature`

[3] Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please contact support@alliedvision.com.

[4] Temperature values must be observed for the housing **and** for the cooling areas.

Table 19: Alvium 1800 U-500m/c specifications (sheet 2 of 2)

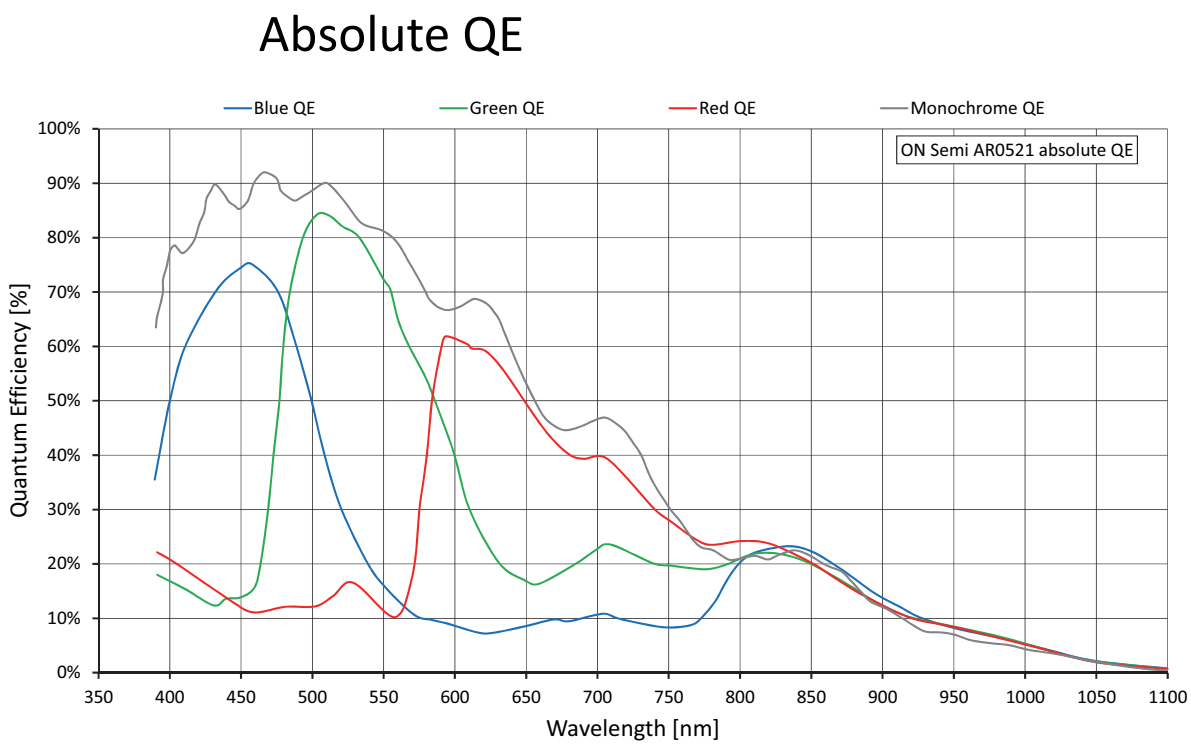


Figure 13: Absolute QE for 1800 U-500m/c (ON Semiconductor AR0521SR)

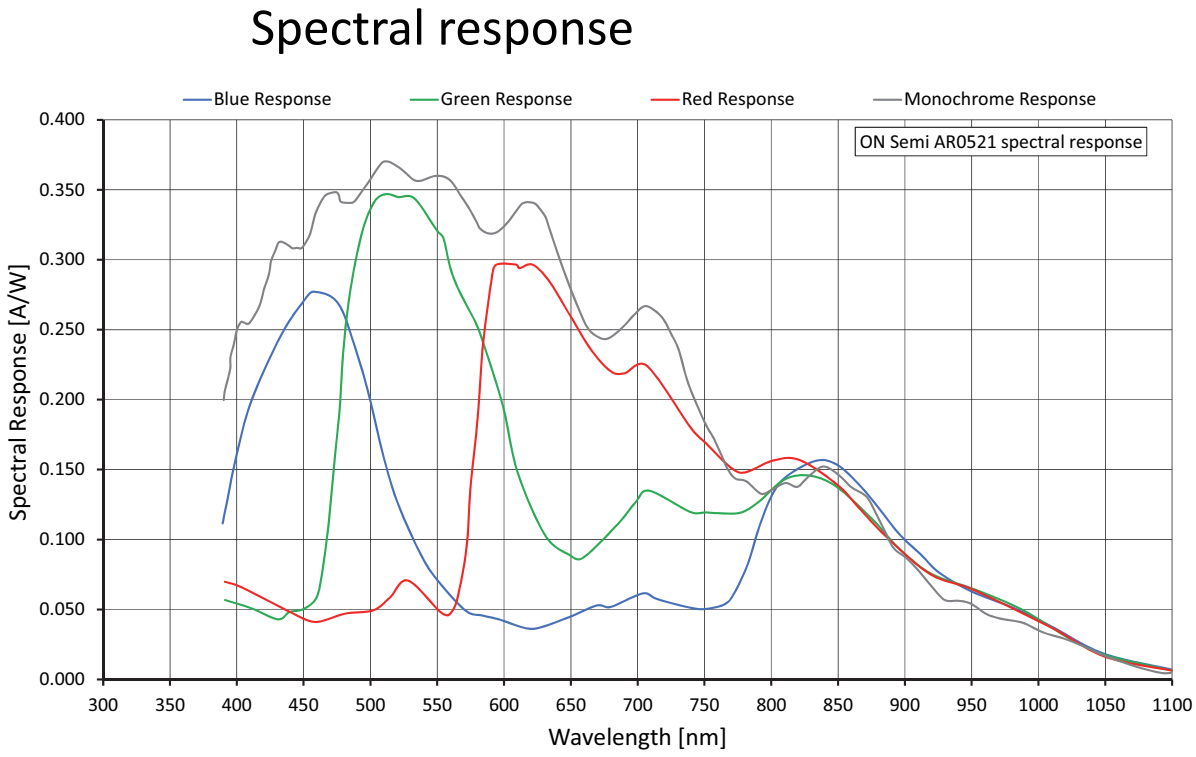


Figure 14: Spectral response for 1800 U-500m/c (ON Semiconductor AR0521SR)

ROI frame rates

200 to 300 MBps

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 350 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				200 MBps	250 MBps	300 MBps
Full resolution	2592	1944	5,038,848	38	48	57
QXGA	2048	1536	3,145,728	61	76	85
Full HD	1920	1080	2,073,600	91	113	118
UXGA	1600	1200	1,920,000	99	108	
WGXGA+	1440	900	1,296,000	141		
SXGA	1280	1024	1,310,720	125		
HD	1280	720	921,600	175		
XGA	1024	768	78,336	165		
SVGA	800	600	480,000	208		
VGA	640	480	307,200	256		
QVGA	320	240	76,800	472		
QQVGA	160	120	19,200	817		
Maximum × half	2592	972	2,519,424	74	93	111
Maximum × minimum	2592	8	20,736	1,168	1,357	1,542
Minimum × maximum	8	1944	15,552	68		
Minimum × minimum	8	8	64	2,613		

Table 20: ROI frame rates for1800 U-500m/c at 200 to 300 MBps

Frame rates for higher bandwidths

Frame rates increase when bandwidth is increased, see 330 to 375 MBps on page 57.

330 to 375 MBps

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 350 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				330 MBps	350 MBps	375 MBps
Full resolution	2592	1944	5,038,848	63	67	
QXGA	2048	1536	3,145,728	85		
Full HD	1920	1080	2,073,600	118		
UXGA	1600	1200	1,920,000	107		
WGXGA+	1440	900	1,296,000	141		
SXGA	1280	1024	1,310,720	125		
HD	1280	720	921,600	175		
XGA	1024	768	78,336	165		
SVGA	800	600	480,000	208		
VGA	640	480	307,200	256		
QVGA	320	240	76,800	472		
QQVGA	160	120	19,200	817		
Maximum × half	2592	972	2,519,424	122	129	130
Maximum × minimum	2592	8	20,736	1,639	1,690	
Minimum × maximum	8	1944	15,552	68		
Minimum × minimum	8	8	64	2,600		

Table 21: ROI frame rates for1800 U-500m/c at 330 to 375 MBps

Alvium 1800 U-501m NIR

Feature	Specification
	1800 U-501m NIR (monochrome)
Sensor model	ON Semiconductor AR0522
Resolution	2592 (H) × 1944 (V); 5.0 megapixels
Sensor type	CMOS
Shutter type	Rolling shutter
Sensor size	Type 1/2.5; 5.7 mm × 4.3 mm; 7.1 mm diagonal
Pixel size	2.2 µm × 2.2 µm
CRA	9 deg
ADC	10-bit
Monochrome pixel formats	Mono8 (default), Mono10
YUV color pixel formats	Not applicable
RGB color pixel formats	Not applicable
Maximum image bit depth	10-bit
Maximum frame rate	67 fps (at ≥350 MBps)
Exposure time	7.4 µs to 10 s (at 200 MBps)
Image buffer (RAM)	256 KB
Non-volatile memory (Flash)	1024 KB
Gain	0 dB to 24.1 dB; 0.1 dB increments
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA
ExposureModes	Timed
Power requirements	Power over USB; External power
Power consumption (typical at 5 VDC)	USB power: 2.2 W External power: 2.4 W

Table 22: Alvium 1800 U-501m NIR specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-501m NIR (monochrome)			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board[3]	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[4]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.

[2]Output by `DeviceTemperature`

[3]Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please contact support@alliedvision.com.

[4]Temperature values must be observed for the housing **and** for the cooling areas.

Table 22: Alvium 1800 U-501m NIR specifications (sheet 2 of 2)

Absolute QE

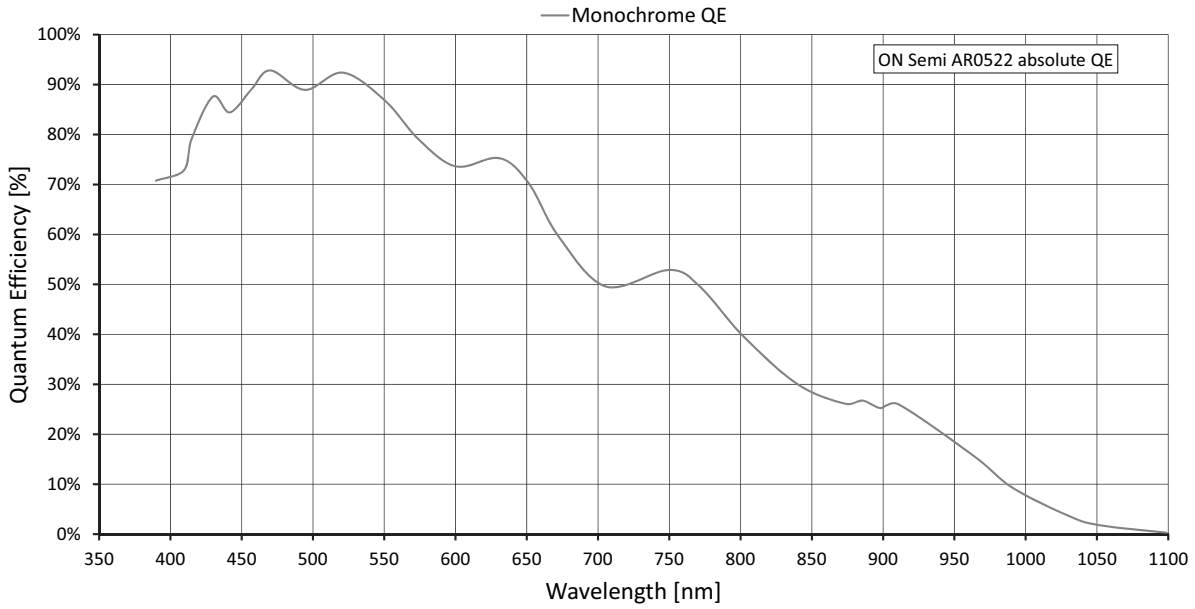


Figure 15: Absolute QE for 1800 U-501m NIR (ON Semiconductor AR0522)

Spectral response

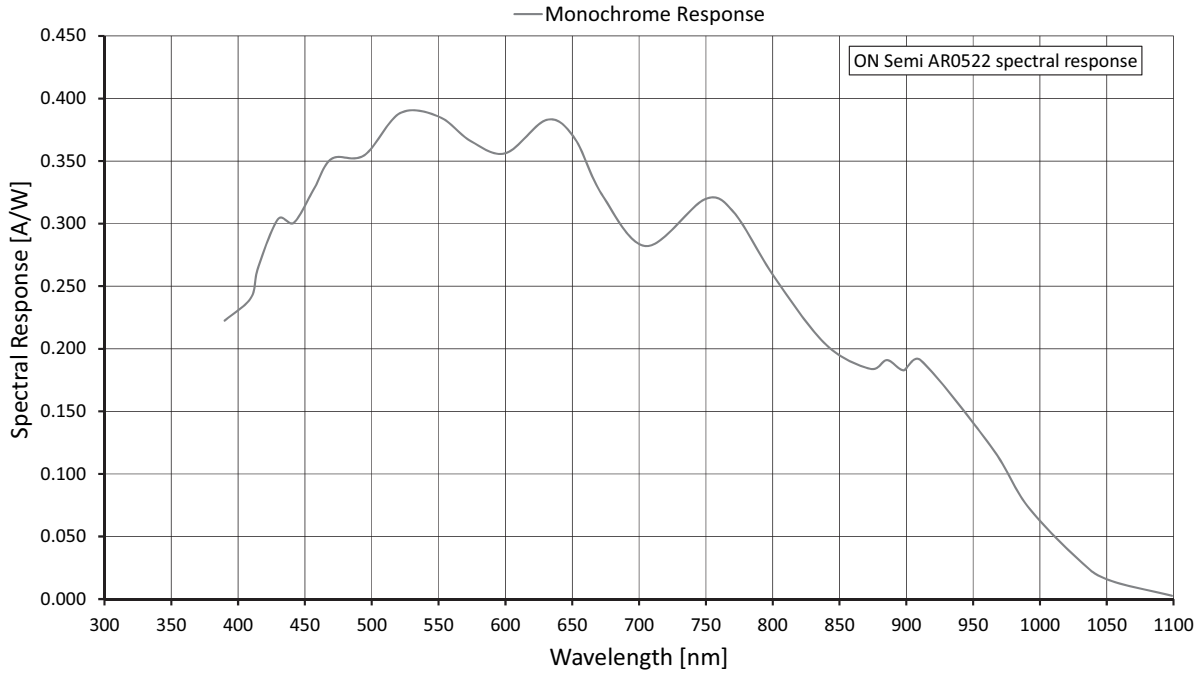


Figure 16: Spectral response for 1800 U-501m NIR (ON Semiconductor AR0522)

ROI frame rates

200 to 300 MBps

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 350 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				200 MBps	250 MBps	300 MBps
Full resolution	2592	1944	5,038,848	38	48	57
QXGA	2048	1536	3,145,728	61	76	85
Full HD	1920	1080	2,073,600	91	113	118
UXGA	1600	1200	1,920,000	99	108	
WGXGA+	1440	900	1,296,000	141		
SXGA	1280	1024	1,310,720	125		
HD	1280	720	921,600	175		
XGA	1024	768	78,336	165		
SVGA	800	600	480,000	208		
VGA	640	480	307,200	256		
QVGA	320	240	76,800	472		
QQVGA	160	120	19,200	817		
Maximum × half	2592	972	2,519,424	74	93	111
Maximum × minimum	2592	8	20,736	1,168	1,357	1,542
Minimum × maximum	8	1944	15,552	68		
Minimum × minimum	8	8	64	2,613		

Table 23: ROI frame rates for 1800 U-501m NIR at 200 to 300 MBps

Frame rates for higher bandwidths

Frame rates increase when bandwidth is increased, see 330 to 375 MBps on page 62.

330 to 375 MBps

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 350 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				330 MBps	350 MBps	375 MBps
Full resolution	2592	1944	5,038,848	63	67	
QXGA	2048	1536	3,145,728	85		
Full HD	1920	1080	2,073,600	118		
UXGA	1600	1200	1,920,000	107		
WGXGA+	1440	900	1,296,000	141		
SXGA	1280	1024	1,310,720	125		
HD	1280	720	921,600	175		
XGA	1024	768	78,336	165		
SVGA	800	600	480,000	208		
VGA	640	480	307,200	256		
QVGA	320	240	76,800	472		
QQVGA	160	120	19,200	817		
Maximum × half	2592	972	2,519,424	122	129	130
Maximum × minimum	2592	8	20,736	1,639	1,690	
Minimum × maximum	8	1944	15,552	68		
Minimum × minimum	8	8	64	2,600		

Table 24: ROI frame rates for 1800 U-501m NIR at 330 to 375 MBps

Alvium 1800 U-507m/c

Feature	Specification	
	1800 U-507m (monochrome)	**1800 U-507c (color)**
Sensor model	Sony IMX264	
Resolution	2464 (H) × 2056 (V); 5.1 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 2/3; 8.5 mm × 7.1 mm; 11.1 mm diagonal	
Pixel size	3.45 µm × 3.45 µm	
CRA	0 deg	
ADC	12-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono12, Mono12p	Mono8, Mono10, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Maximum image bit depth	12-bit	
Maximum frame rate	34 fps (at ≥200 MBps)	
Exposure time	176 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 23.9 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed, TriggerControlled, TriggerWidth	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 2 W External power:2.2 W	

Table 25: Alvium 1800 U-507m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-507m/C			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 25: Alvium 1800 U-507m/c specifications (sheet 2 of 2)

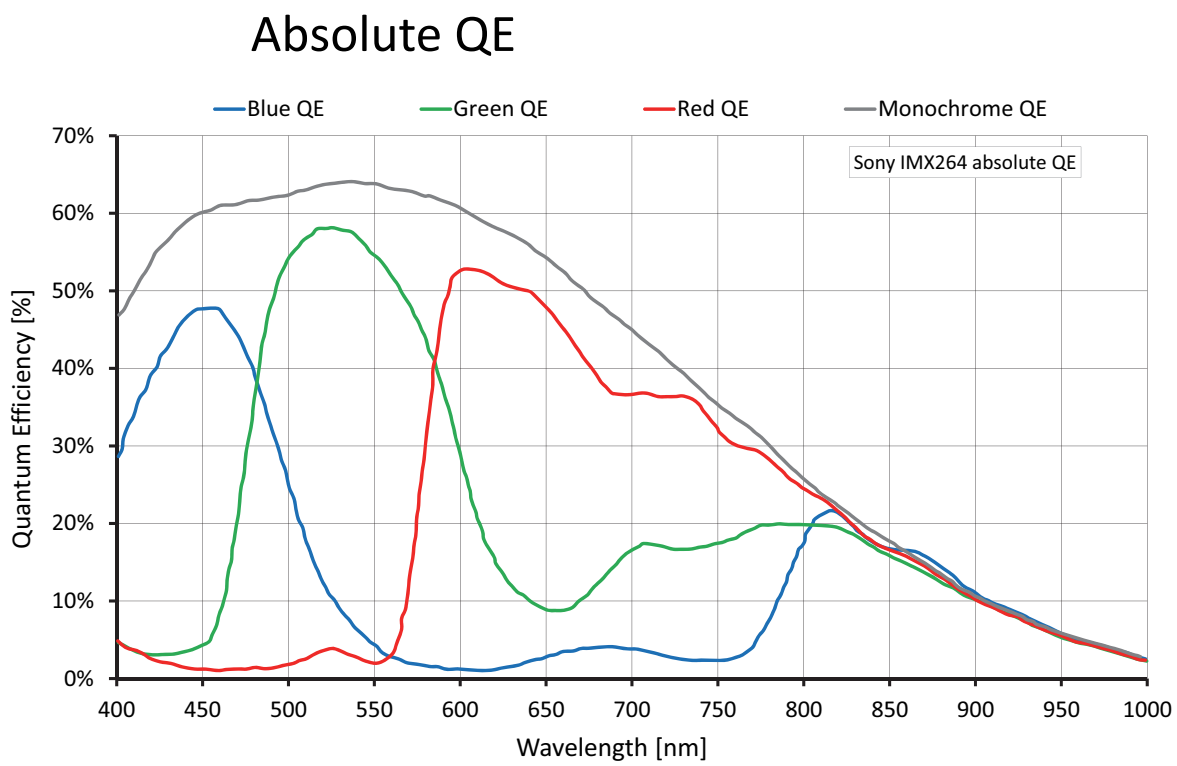


Figure 17: Absolute QE for 1800 U-507m/c (Sony IMX264)

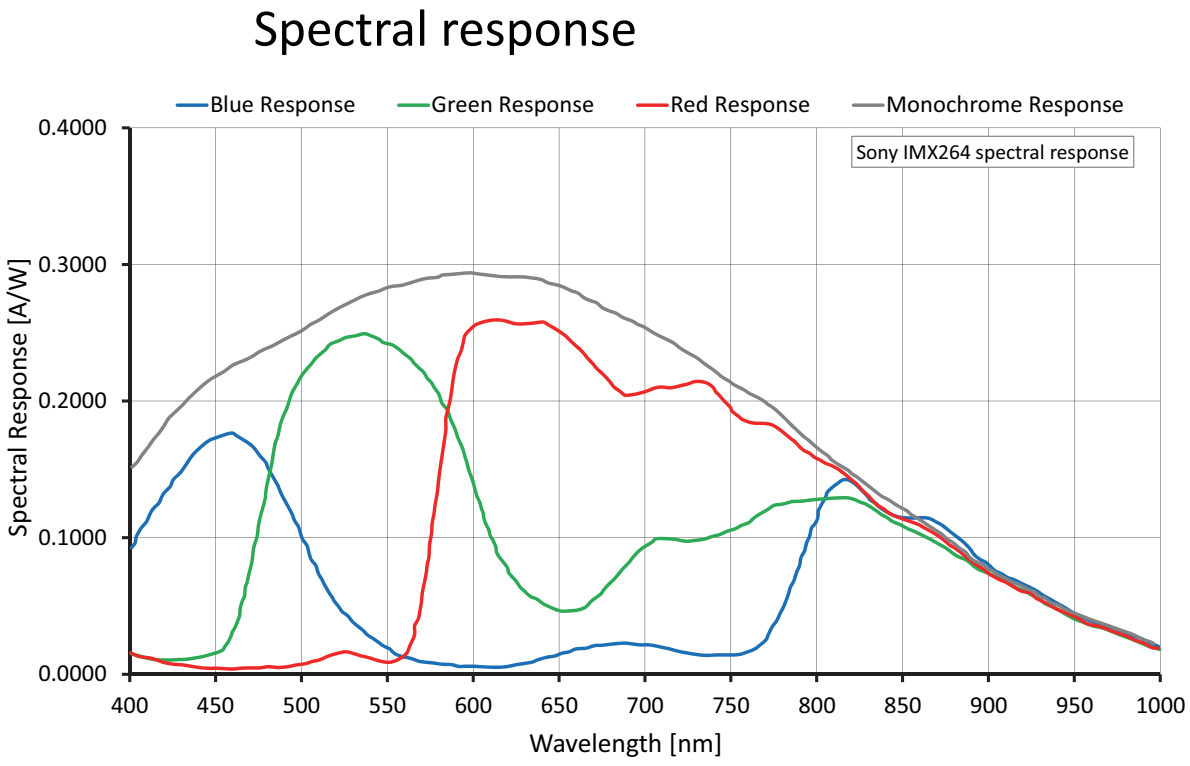


Figure 18: Spectral response for 1800 U-507m/c (Sony IMX264)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 200 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps] at 200 MBps
Full resolution	2464	2056	5,065,984	34
QXGA	2048	1536	3,145,728	45
Full HD	1920	1080	2,073,600	63
UXGA	1600	1200	1,920,000	57
WXGA+	1440	900	1,296,000	75
SXGA	1280	1024	1,310,720	66
HD	1280	720	921.600	92
XGA	1024	768	78,336	87
SVGA	800	600	480,000	109
VGA	640	480	307,200	133
HVGA	480	320	153,600	189
QVGA	320	240	76,800	239
QQVGA	160	120	19,200	392
Maximum × half	2464	1028	2,532,992	65
Maximum × minimum	2464	8	19,712	723
Minimum × maximum	8	2056	16,448	34
Minimum × minimum	8	8	64	971

Table 26: ROI frame rates for 1800 U-507m/c at 200 MBps

Alvium 1800 U-1236m/c

Feature	Specification	
	1800 U-1236m (monochrome)	**1800 U-1236c (color)**
Sensor model	Sony IMX304	
Resolution	4112 (H) × 3008 (V); 12.4 megapixels	
Sensor type	CMOS	
Shutter type	Global shutter	
Sensor size	Type 1; 14.2 mm × 10.4 mm; 17.6 mm diagonal	
Pixel size	3.45 µm × 3.45 µm	
CRA	0 deg	
ADC	12-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono12, Mono12p	Mono8, Mono10, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Maximum image bit depth	12-bit	
Maximum frame rate	22 fps (at ≥300 MBps)	
Exposure time	169 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 23.9 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed, TriggerControlled, TriggerWidth	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 2.9 W External power: 3.1 W	

Table 27: Alvium 1800 U-1236m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-1236m/C			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 27: Alvium 1800 U-1236m/c specifications (sheet 2 of 2)

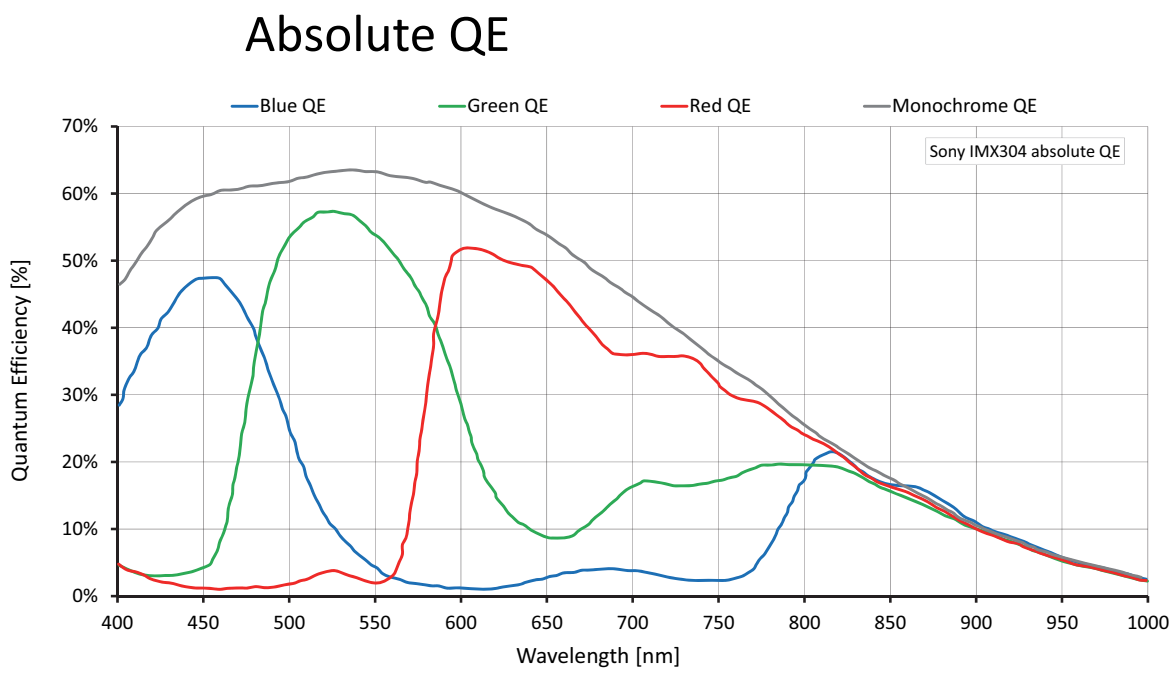


Figure 19: Absolute QE for 1800 U-1236m/c (Sony IMX304)

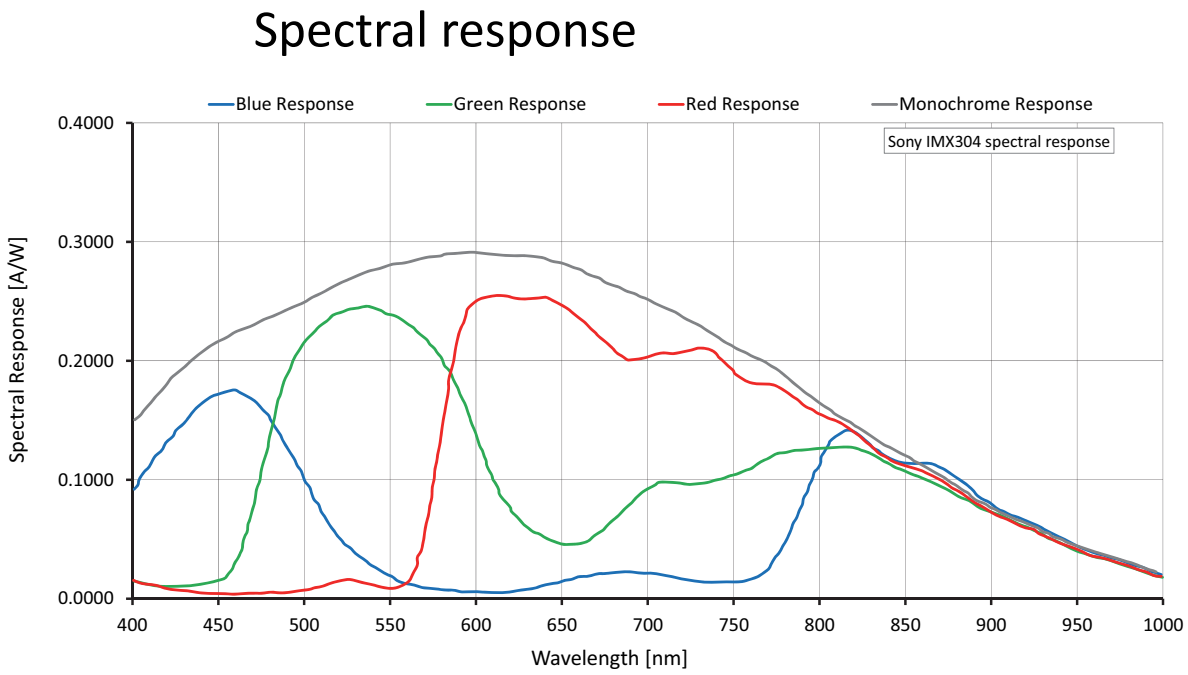


Figure 20: Spectral response for 1800 U-1236m/c (Sony IMX304)

ROI frame rates

Values were measured for **typical operation**, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 300 MBps. Increasing the `DeviceLinkThroughputLimit` value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				200 MBps	250 MBps	300 MBps
Full resolution	4112	3008	12,368,896	15	19	22
QUXGA	3200	2400	9,216,000	24	28	
QSXGA	2560	2048	5,242,880	32		
QXGA	2048	1536	3,145,728	43		
Full HD	1920	1080	2,073,600	60		
UXGA	1600	1200	1,920,000	54		
WXGA+	1440	900	1,296,000	71		
SXGA	1280	1024	1,310,720	63		
HD	1280	720	921.600	88		
XGA	1024	768	78,336	83		
SVGA	800	600	480,000	104		
VGA	640	480	307,200	127		
HVGA	480	320	153,600	179		
QVGA	320	240	76,800	227		
QQVGA	160	120	19,200	370		
Maximum × half	4112	1504	6,184,448	30	37	43
Maximum × minimum	4112	8	32,896	431	499	548
Minimum × maximum	8	3008	24,064	22		
Minimum × minimum	8	8	64	897		

Table 28: ROI frame rates for 1800 U-1236m/c at 200 to 300 MBps

Alvium 1800 U-2050m/c

Feature	Specification	
	1800 U-2050m (monochrome)	**1800 U-2050c (color)**
Sensor model	Sony IMX183	
Resolution	5496 (H) × 3672 (V); 20.2 megapixels	
Sensor type	CMOS	
Shutter type	Rolling shutter or Global reset shutter	
Sensor size	Type 1; 13.1 mm × 8.8 mm; 15.8 mm diagonal	
Pixel size	2.4 µm × 2.4 µm	
CRA	3 deg	
ADC	10-bit	
Monochrome pixel formats	Mono8 (default), Mono10	Mono8, Mono10
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerGR8, BayerGR10, BayerGR10p, BGR8, RGB8 (default)
Maximum image bit depth	10-bit	
Maximum frame rate	17 fps (at ≥375 MBps)	
Exposure time	17 µs to 10 s (at 200 MBps)	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
Gain	0 dB to 27 dB; 0.1 dB increments	
GPIOs	4 programmable GPIOs As direct inputs (push-pull): 0 to 5.5 VDC As direct outputs (push-pull): 0 to 3.3 VDC at 12 mA	
ExposureModes	Timed	
Power requirements	Power over USB; External power	
Power consumption (typical, at 5 VDC)	USB power: 3.2 W External power: 3.4 W	

Table 29: Alvium 1800 U-2050m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 U-2050m/C			
Storage temperature	-10 °C to +70 °C ambient temperature			
Operating temperature	**Hardware option**	**Housing**	**Cooling areas[1]**	**Mainboard[2]**
	Bare board	Not applicable	+5 °C to +85 °C	+5 °C to +85 °C
	Open housing[3]	+5 °C to +65 °C		
	Closed housing	+5 °C to +65 °C	Not applicable	
Relative humidity	0% to 80% (non-condensing)			
Digital interface	Micro-B USB 3.1 Gen 1 interface			
Camera controls	GenICam V2.0 (GenICam Access)			

[1]See Mounting the heat sink on page 102.
[2]Output by `DeviceTemperature`
[3]Temperature values must be observed for the housing **and** for the cooling areas.

Table 29: Alvium 1800 U-2050m/c specifications (sheet 2 of 2)

Absolute QE and spectral response

Contents to follow

We are going to provide the results from the EMVA1288 measurements for QE and spectral response with the next document update.

Thank you for your understanding!

ROI frame rates

200 to 300 MBps

Values were measured for **typical operation** in rolling shutter (RS) mode, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 375 MBps. Increasing the `DeviceLinkThroughputLimit` value may even increase frame rates if supported by the hardware used.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps], in RS mode		
				200 MBps	250 MBps	300 MBps
Full resolution	5496	3672	20,181,312	9[1]	12[1]	14[1]
HSXGA	5120	3200	16,384,000	11	13	16
HXGA	4096	3072	12,582,912		14	17
QUXGA	3200	2400	7,680,000	14	18	21
QSXGA	2560	2048	5,242,880	16	21	25
QXGA	2048	1536	3,145,728	18	23	27
Full HD	1920	1080	2,073,600			
UXGA	1600	1200	1,920,000			
WXGA+	1440	900	1,296,000			
SXGA	1280	1024	1,310,720			
HD	1280	720	921.600			
XGA	1024	768	78,336			
SVGA	800	600	480,000			
VGA	640	480	307,200			
HVGA	480	320	153,600			
QVGA	320	240	76,800			
QQVGA	160	240	19,200			
Maximum × half	5496	1836	10,090,656			
Maximum × minimum	5496	8	43,968			
Minimum × maximum	8	3672	29,376	9	12	14
Minimum × minimum	8	8	64	18	23	27

[1] In GRS mode, this value applies to all ROIs.

Table 30: ROI frame rates for 1800 U-2050m/c at 200 to 300 MBps

Frame rates for higher bandwidths

Frame rates increase when bandwidth is increased, see 330 to 375 MBps on page 74.

330 to 375 MBps

Values were measured for **typical operation** in rolling shutter (RS) mode, using the test setup defined in Exposure time and frame rate on page 30.

To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is 375 MBps. Increasing the `DeviceLinkThroughputLimit` value may even increase frame rates if supported by the hardware used.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps], in RS mode		
				330 MBps	350 MBps	375 MBps
Full resolution	5496	3672	20,181,312	15[1]	16[1]	17[1]
HSXGA	5120	3200	16,384,000	18	19	20
HXGA	4096	3072	12,582,912			21
QUXGA	3200	2400	7,680,000	23	25	26
QSXGA	2560	2048	5,242,880	27	29	31
QXGA	2048	1536	3,145,728	30	32	34
Full HD	1920	1080	2,073,600			
UXGA	1600	1200	1,920,000			
WXGA+	1440	900	1,296,000			
SXGA	1280	1024	1,310,720			
HD	1280	720	921.600			
XGA	1024	768	78,336			
SVGA	800	600	480,000			
VGA	640	480	307,200			
HVGA	480	320	153,600			
QVGA	320	240	76,800			
QQVGA	160	240	19,200			
Maximum × half	5496	1836	10,090,656			
Maximum × minimum	5496	8	43,968			
Minimum × maximum	8	3672	29,376	15	16	17
Minimum × minimum	8	8	64	30	32	34

[1] In GRS mode, this value applies to all ROIs.

Table 31: ROI frame rates for 1800 U-2050m/c at 330 to 375 MBps

Dimensions and mass

Bare board

Feature	Standard	USB 90°
Dimensions (L × W × H [mm])	13 × 26 × 26	13 × 30 × 26
Mass	15 g	15 g

Table 32: Bare board dimensions and mass

Open housing

Open housing	S-Mount	CS-Mount	C-Mount
Flange focal distance, optical [mm]	12.63	12.526	17.526
Thread [mm]	M12 × 0.5	1x32TPI-UNS-2B	1x32TPI-UNS-2B
Maximum protrusion[1] [mm]	11.0	8.6	13.6
Body dimensions (L × W × H [mm])	25 × 29 × 29	25 × 29 × 29	30 × 29 × 29
Mass	45 g	40 g	45 g
[1]For details, see Lens mounts and maximum protrusion.			

Table 33: Open housing dimensions and mass

Open housing 90°

USB 90° open housing	S-Mount	CS-Mount	C-Mount
Flange focal distance, optical [mm]	12.63	12.526	17.526
Thread [mm]	M12 × 0.5	1x32TPI-UNS-2B	1x32TPI-UNS-2B
Maximum protrusion[1] [mm]	11.0	8.6	13.6
Body dimensions (L × W × H [mm])	25 × 32 × 29	25 × 32 × 29	30 × 32 × 29
Mass	45 g	45 g	50 g
[1]For details, see Lens mounts and maximum protrusion.			

Table 34: Open housing 90° dimensions and mass

Closed housing

Closed housing	S-Mount	CS-Mount	C-Mount
Flange focal distance, optical [mm]	12.63	12.526	17.526
Thread [mm]	M12 × 0.5	1x32TPI-UNS-2B	1x32TPI-UNS-2B
Maximum protrusion[1] [mm]	11.0	8.6	13.6
Body dimensions (L × W × H [mm])	33 × 29 × 29	33 × 29 × 29	38 × 29 × 29
Mass	60 g	60 g	60 g
[1]For details, see Lens mounts and maximum protrusion.			

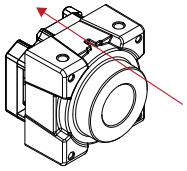
Table 35: Closed housing dimensions and mass

Closed housing 90°

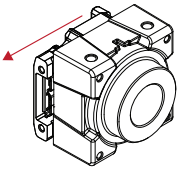
USB 90° closed housing	S-Mount	CS-Mount	C-Mount
Flange focal distance, optical [mm]	12.63	12.526	17.526
Thread [mm]	M12 × 0.5	1x32TPI-UNS-2B	1x32TPI-UNS-2B
Maximum protrusion[1] [mm]	11.0	8.6	13.6
Body dimensions (L × W × H [mm])	33 × 32 × 29	33 × 32 × 29	38 × 32 × 29
Mass	65 g	60 g	65 g
[1]For details, see Lens mounts and maximum protrusion.			

Table 36: Closed housing 90° dimensions and mass

Technical drawings



Standard

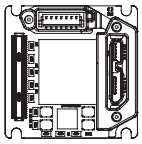
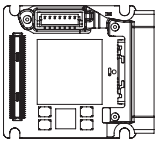


90°

USB connector position

- **Standard**: The connector is at the camera backside. This option is not mentioned in the naming for camera hardware options.
- **90°**: The connector is at the camera left side, as seen from the lens mount. This option is named **90°**.

Alvium USB cameras are available as shown in the following table:

Bare Board	
Standard	**90°**
	
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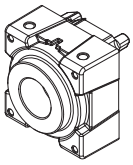
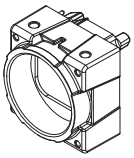
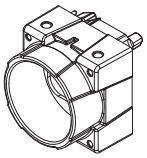
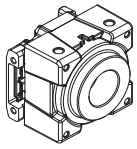
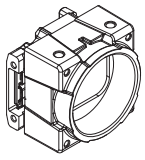
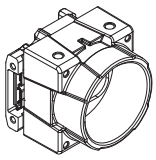
Open Housing					
Standard			**90°**		
S-Mount	CS-Mount	C-Mount	S-Mount	CS-Mount	C-Mount
					
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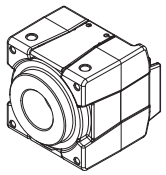
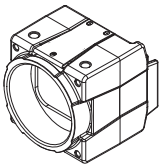
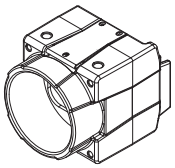
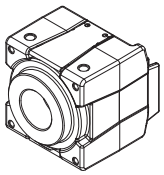
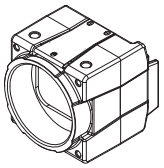
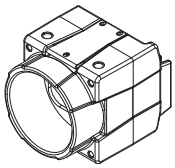
Closed Housing					
Standard			**90°**		
S-Mount	CS-Mount	C-Mount	S-Mount	CS-Mount	C-Mount
					
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Bare Board

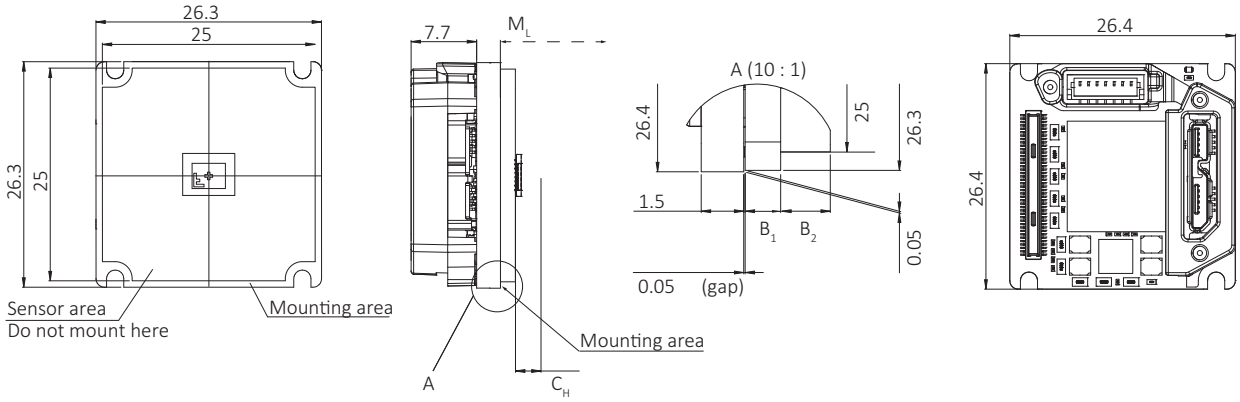


Figure 21: Dimensions for Bare Board

Dimensions that are common between different models are shown in Figure 21, model specific dimensions are listed in Table 37. **Mechanical length** (M_L) defines the mechanical distance from the mounting area to the lens mount front flange. **Electronics thickness** (E_T) relates to the electronic components with maximum thickness, in some cases the sensor.

Camera model	M_L Mechanical length for C-Mount	C_H Components height, incl. the sensor	B_1 Board thickness	B_2 Board thickness
Alvium 1800 U-040m/c	~19.8 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-050m/c	~19.5 mm	1.4 mm	1.25 mm	1.75 mm
Alvium 1800 U-120m/c	~19.6 mm	1.3 mm	1.15 mm	1.15 mm
Alvium 1800 U-158m/c	~19.8 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-319m/c	~19.9 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-500m/c	~19.8 mm	1.6 mm	1.2 mm	1.2 mm
Alvium 1800 U-501m NIR	~19.8 mm	1.6 mm	1.2 mm	1.2 mm
Alvium 1800 U-507m/c	~19.8 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-1236m/c	~19.7 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-2050m/c	~18.6 mm	2.8 mm	1.15 mm	1.05 mm

Table 37: Bare Board; model specific dimensions, nominal values

Mechanical length for S-Mount and CS-Mount

Mechanical length for other mounts is:

- CS-Mount: [C-Mount value] – 5 mm
- S-Mount: depending on your design.

Bare Board 90°

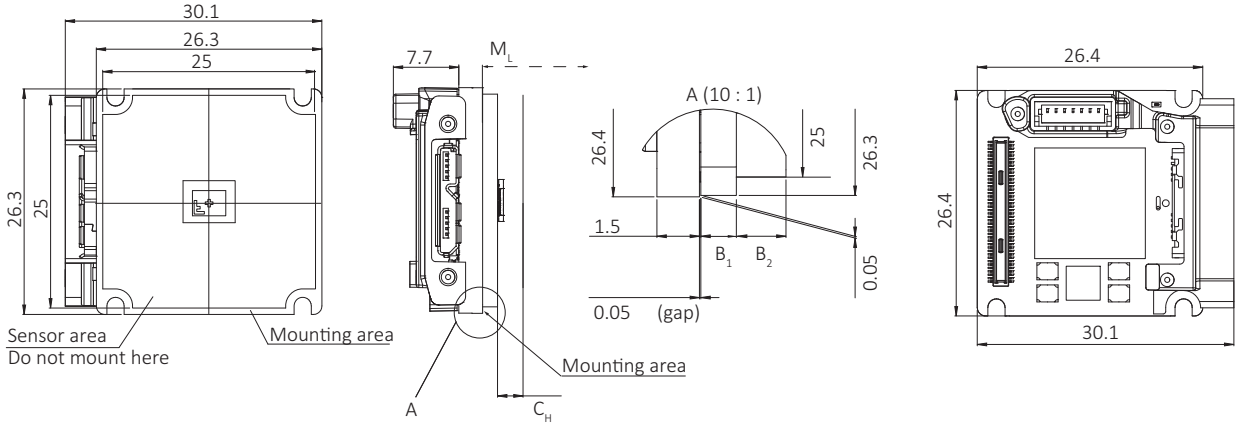


Figure 22: Dimensions for Bare Board 90°

Dimensions that are common between different models are shown in Figure 22, model specific dimensions are listed in Table 38. **Mechanical length** (M_L) defines the mechanical distance from the mounting area to the lens mount front flange. **Electronics thickness** (E_T) relates to the electronic components with maximum thickness, in some cases the sensor.

Camera model	M_L Mechanical length for C-Mount	C_H Components height, incl. the sensor	B_1 Board thickness	B_2 Board thickness
Alvium 1800 U-040m/c	~19.8 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-050m/c	~19.5 mm	1.4 mm	1.25 mm	1.75 mm
Alvium 1800 U-120m/c	~19.6 mm	1.3 mm	1.15 mm	1.15 mm
Alvium 1800 U-158m/c	~19.8 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-319m/c	~19.9 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-500m/c	~19.8 mm	1.6 mm	1.2 mm	1.2 mm
Alvium 1800 U-501m NIR	~19.8 mm	1.6 mm	1.2 mm	1.2 mm
Alvium 1800 U-507m/c	~19.8 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-1236m/c	~19.7 mm	2.2 mm	1.0 mm	1.3 mm
Alvium 1800 U-2050m/c	~18.6 mm	2.8 mm	1.15 mm	1.05 mm

Table 38: Bare Board 90°; model specific dimensions, nominal values

Mechanical length for S-Mount and CS-Mount

Mechanical length for other mounts is:

- CS-Mount: [C-Mount value] – 5 mm
- S-Mount: depending on your design.

Open Housing S-Mount

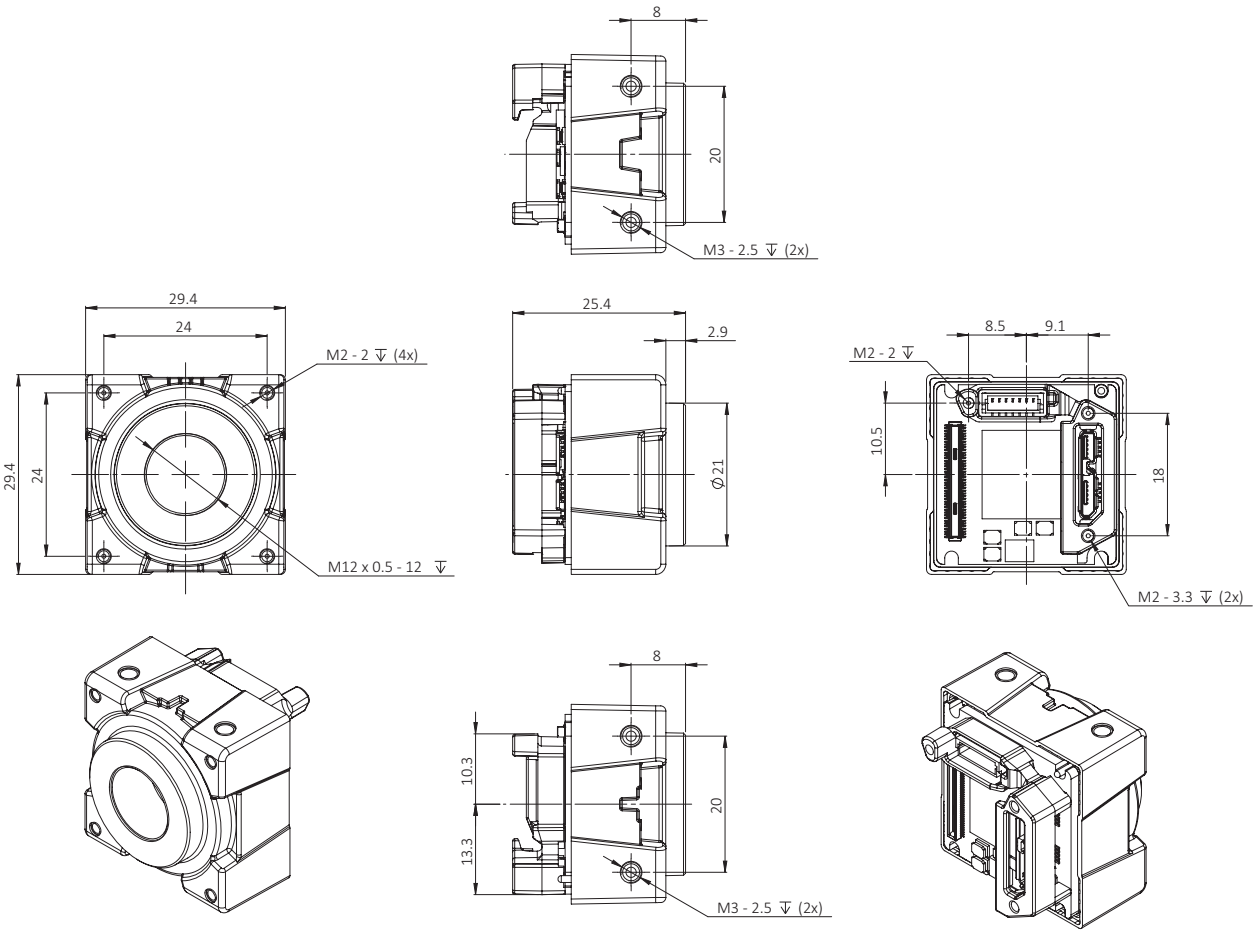


Figure 23: Dimensions for Open Housing S-Mount

Open Housing CS-Mount

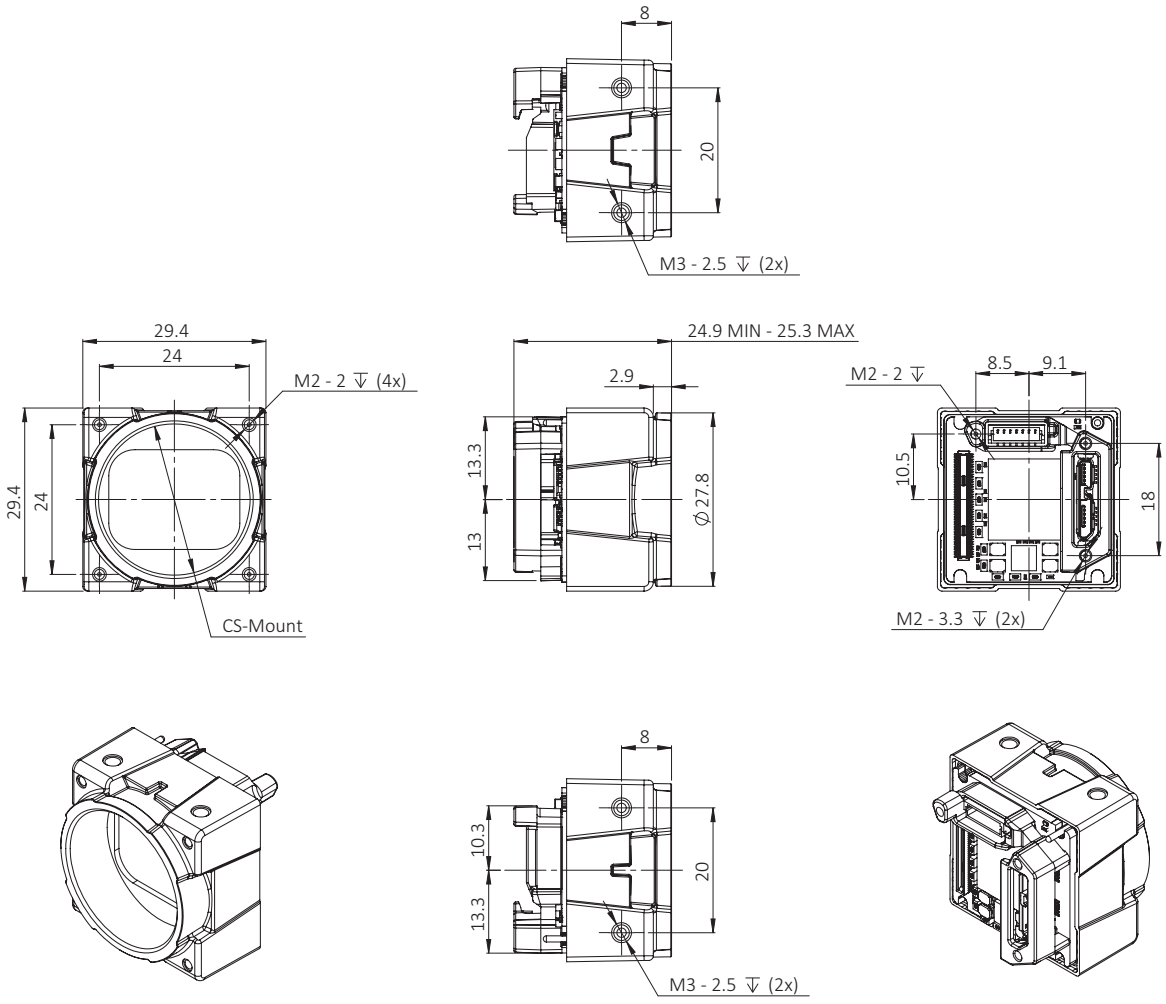


Figure 24: Dimensions for Open Housing CS-Mount

Open Housing C-Mount

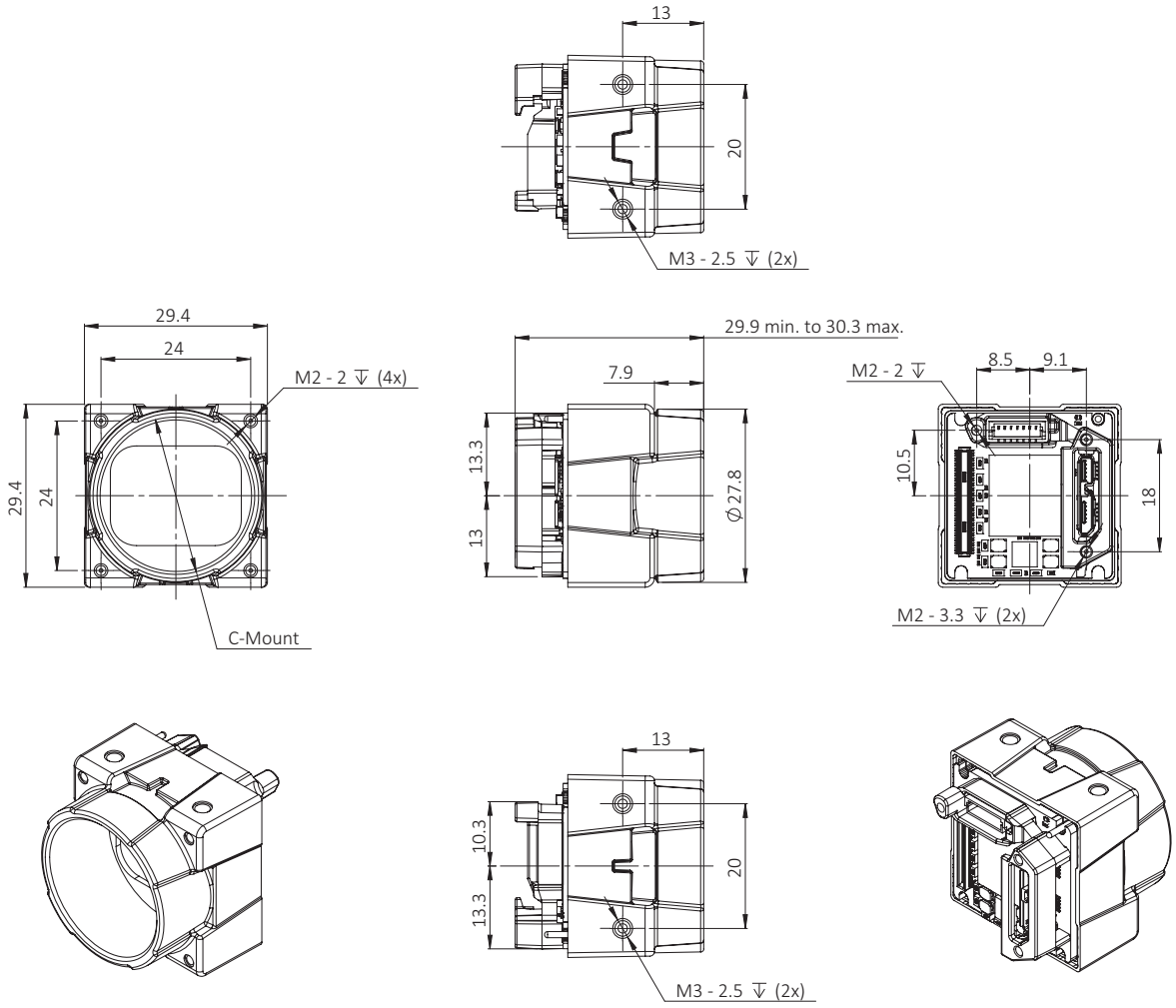


Figure 25: Dimensions for Open Housing C-Mount

Open Housing S-Mount 90°

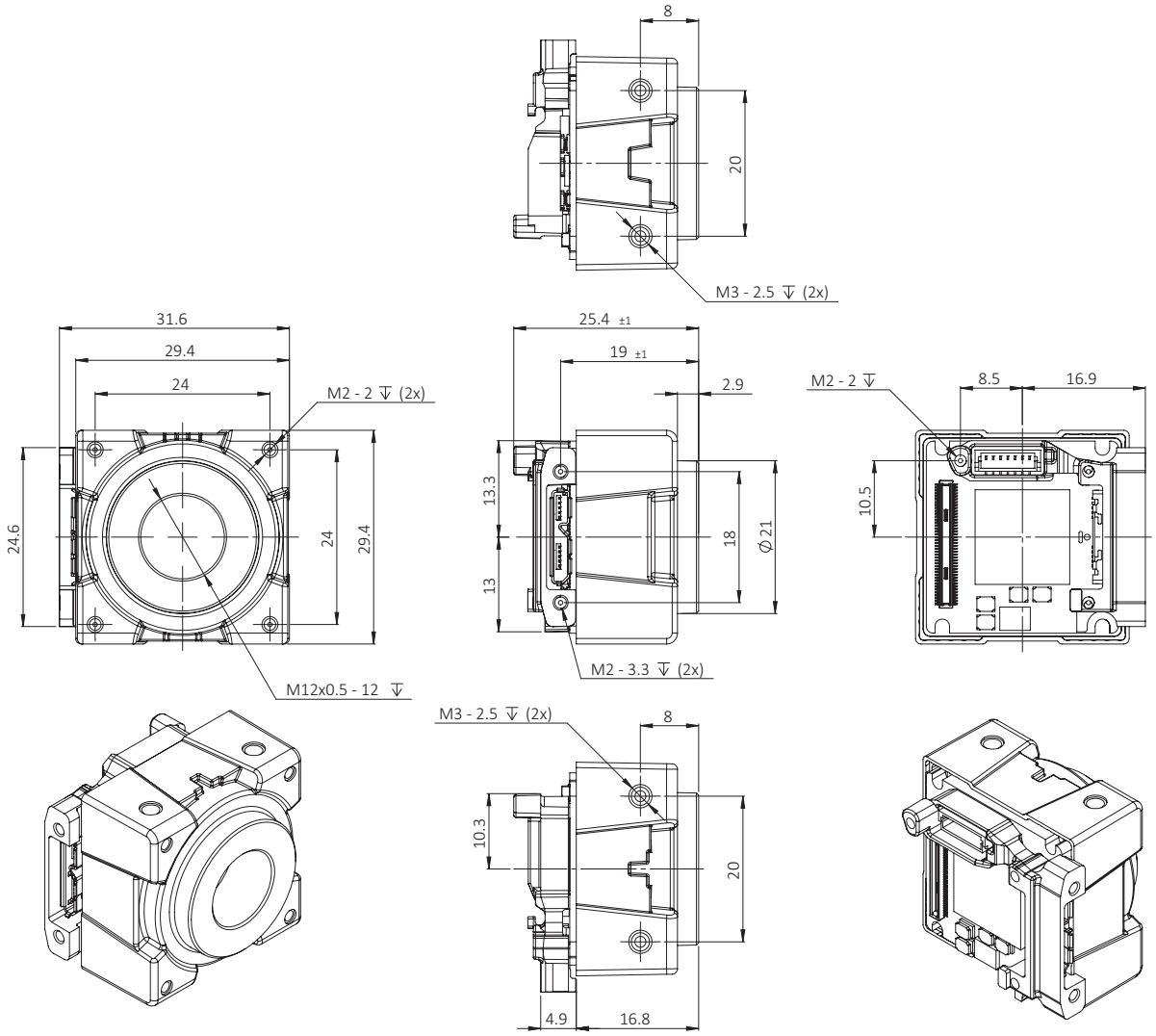


Figure 26: Dimensions for Open Housing S-Mount 90°

Open Housing CS-Mount 90°

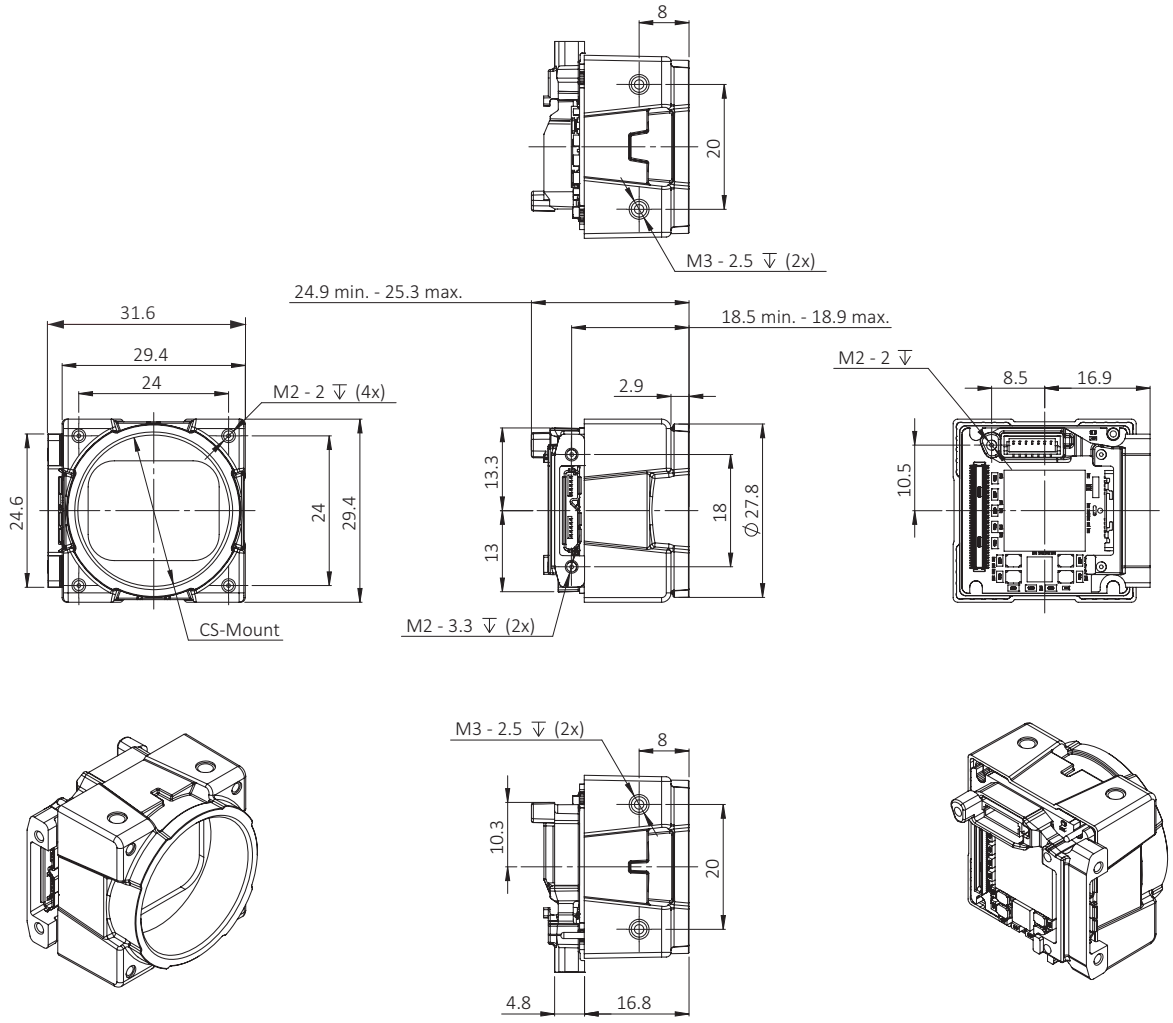


Figure 27: Dimensions for Open Housing CS-Mount 90°

Open Housing C-Mount 90°

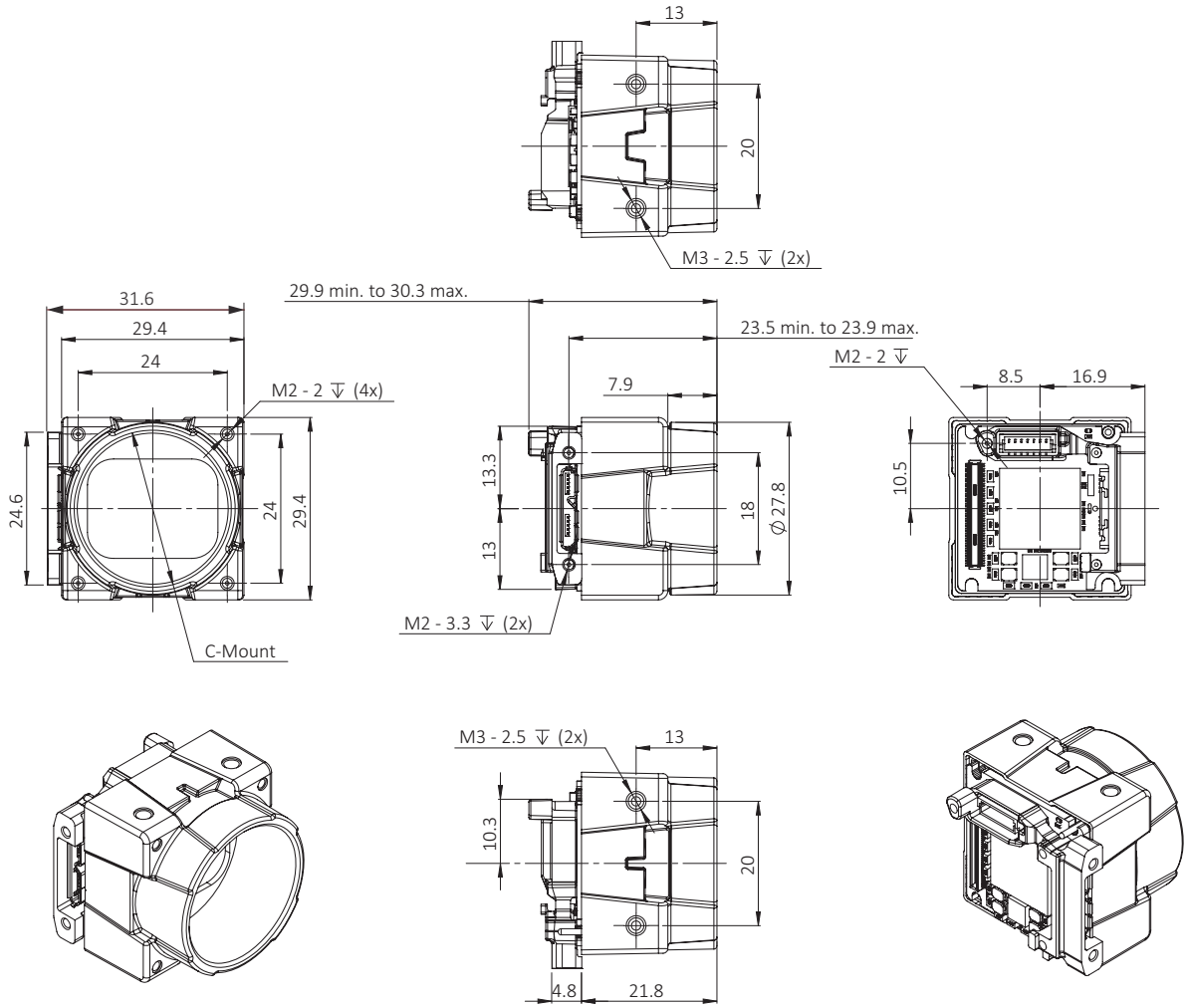


Figure 28: Dimensions for Open Housing C-Mount 90°

Closed Housing S-Mount

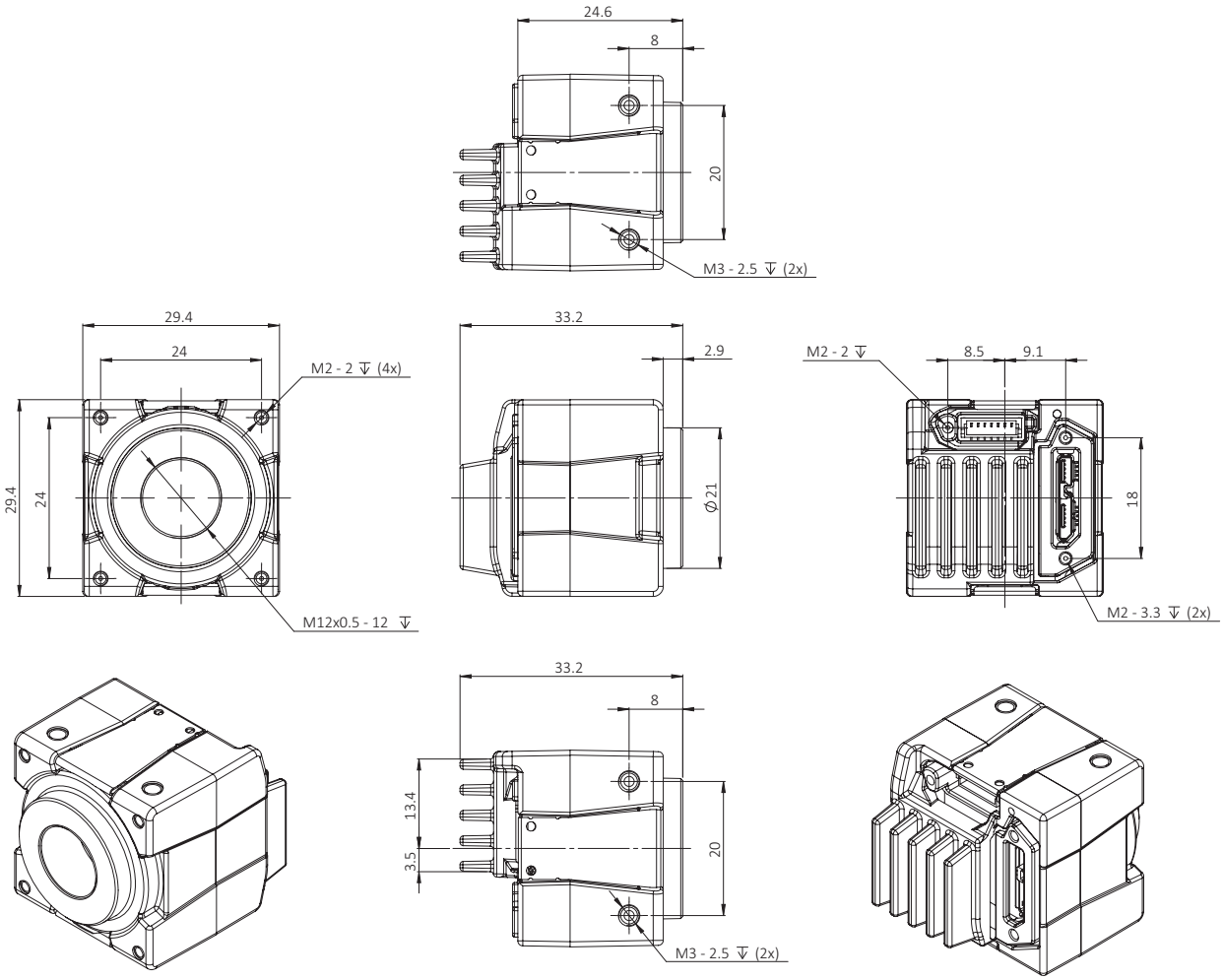


Figure 29: Dimensions for Closed Housing S-Mount

Closed Housing CS-Mount

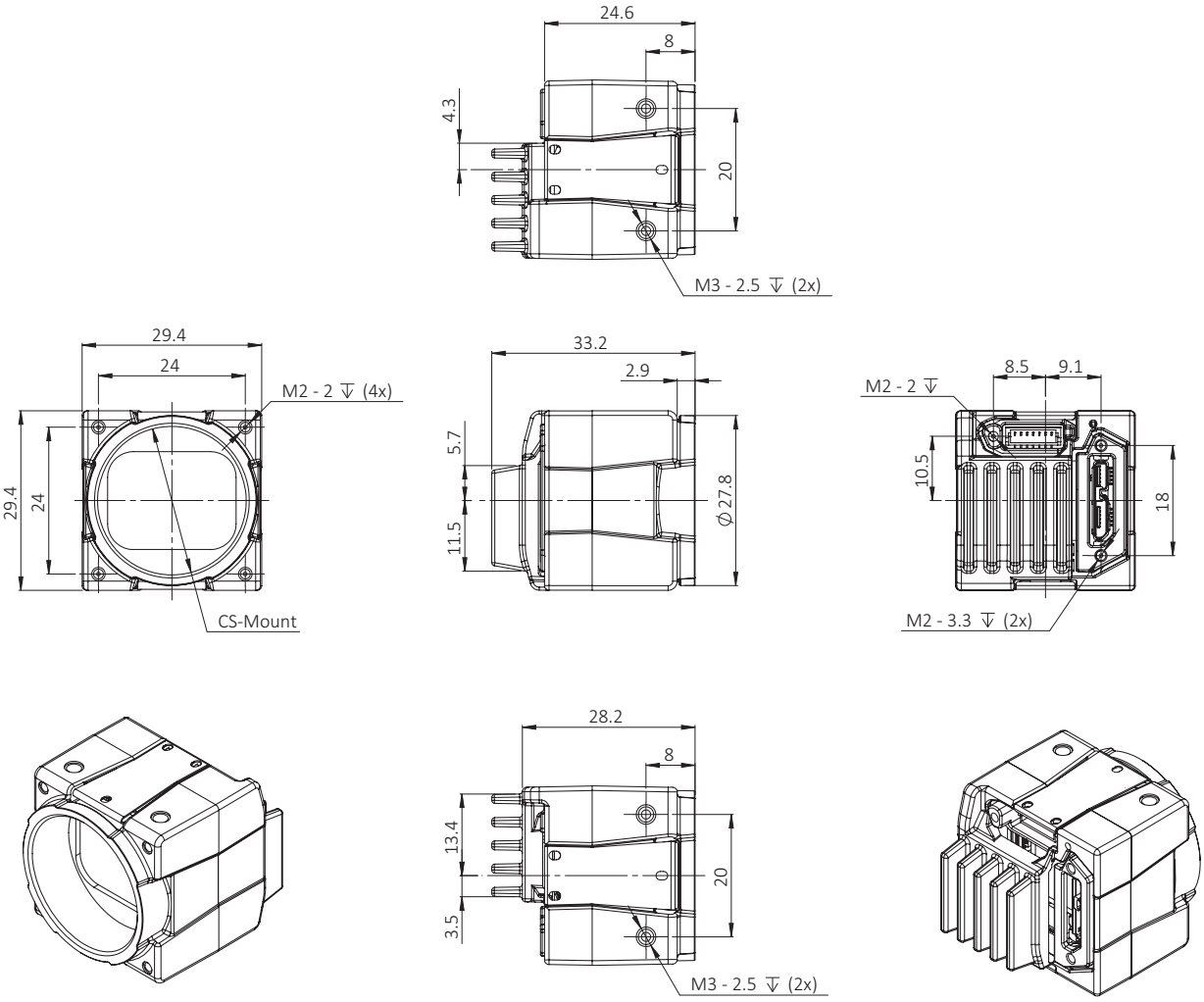


Figure 30: Dimensions for Closed Housing CS-Mount

Closed Housing C-Mount

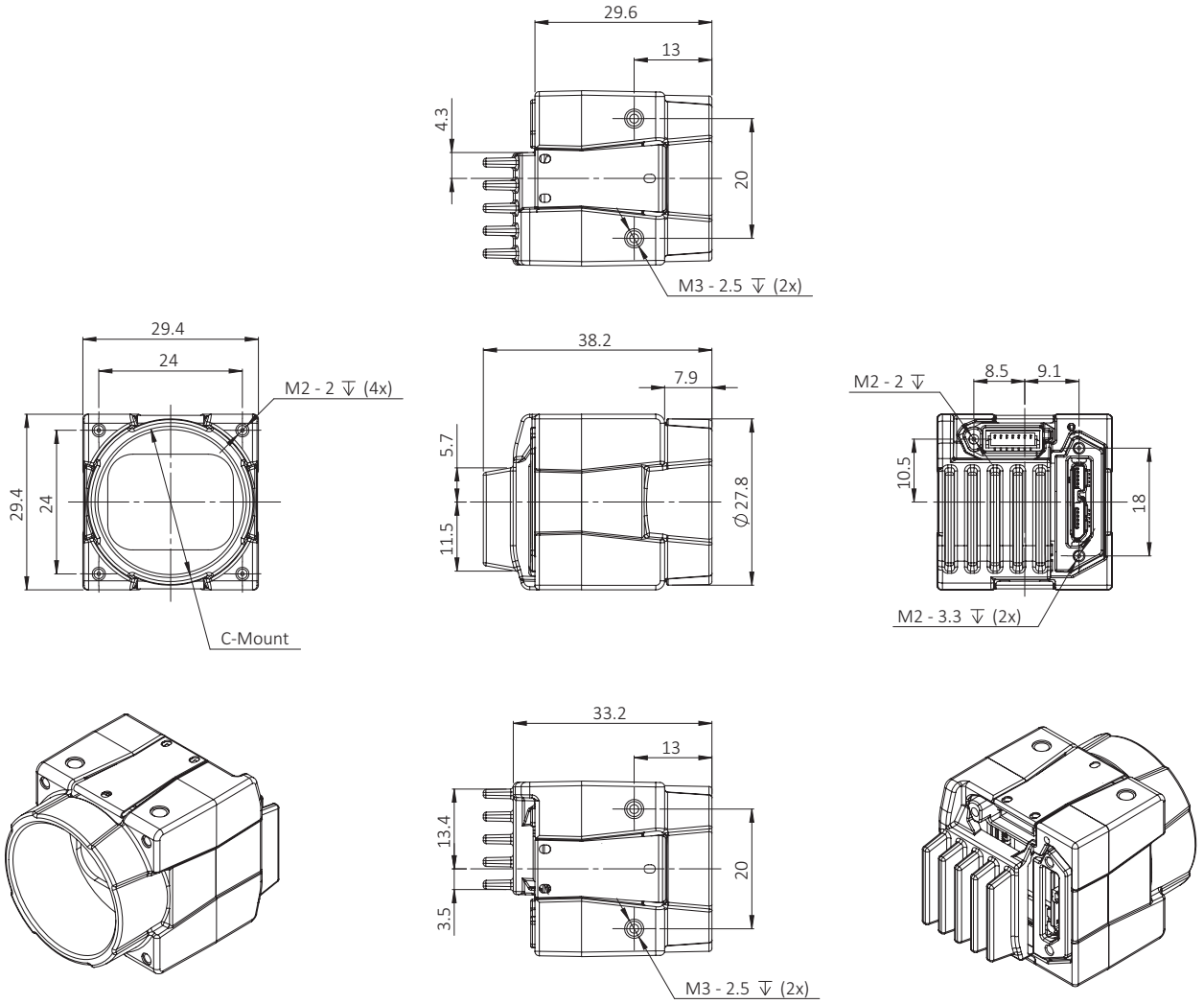


Figure 31: Dimensions for Closed Housing C-Mount

Closed Housing S-Mount 90°

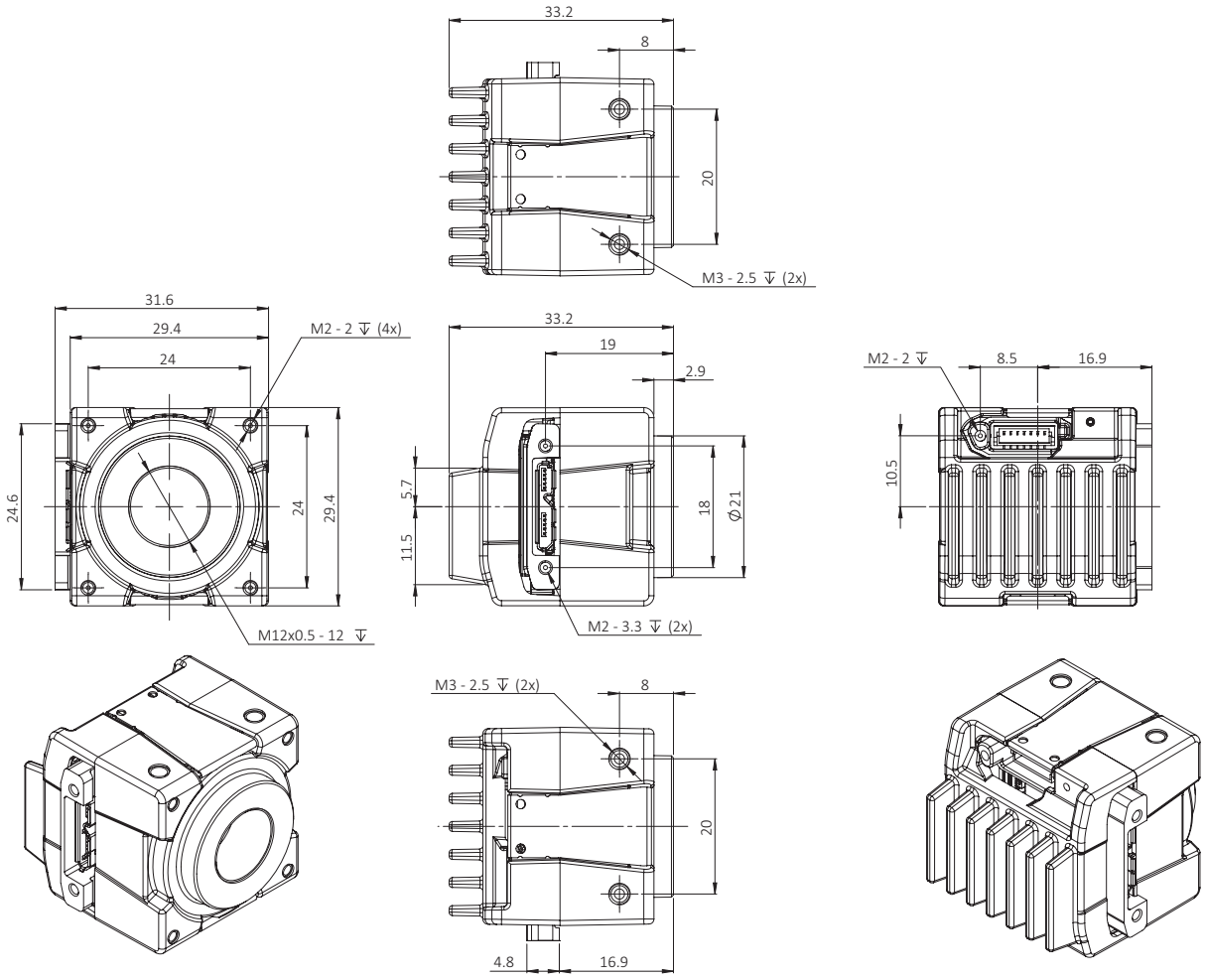


Figure 32: Dimensions for Closed Housing S-Mount 90°

Closed Housing CS-Mount 90°

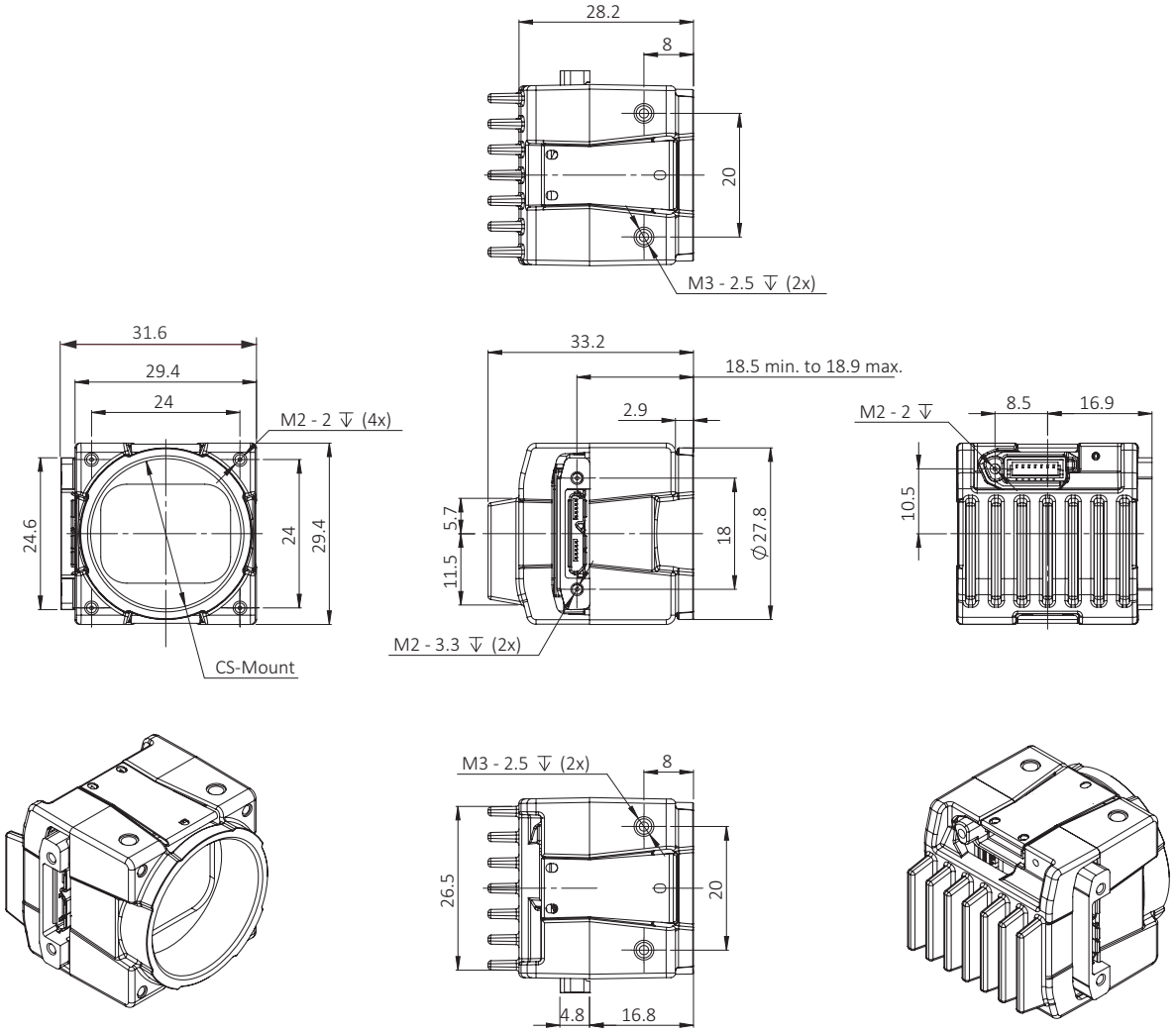


Figure 33: Dimensions for Closed Housing CS-Mount 90°

Closed Housing C-Mount 90°

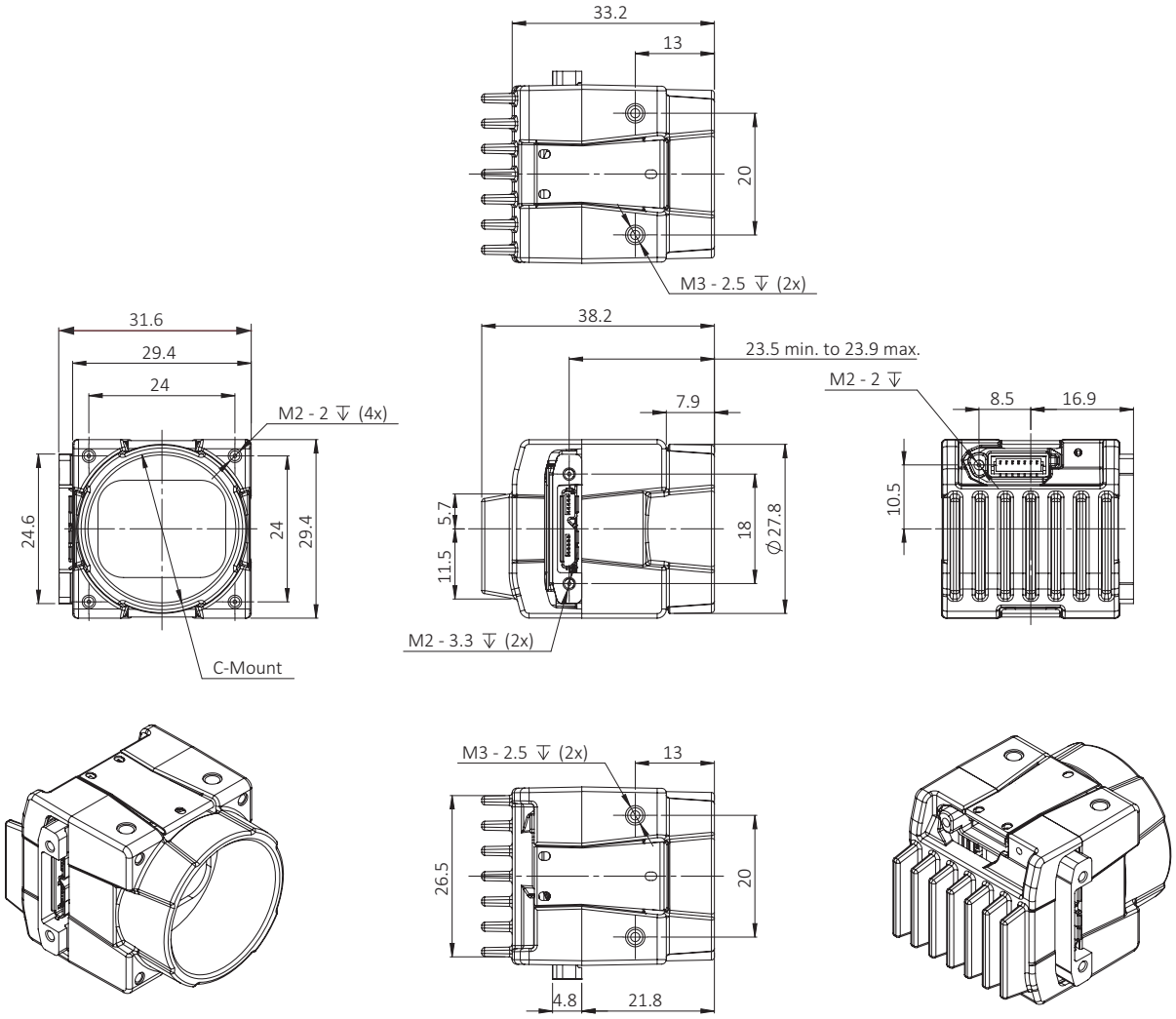
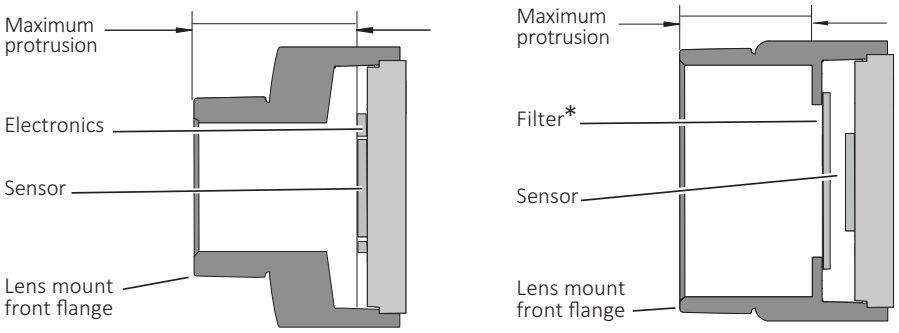


Figure 34: Dimensions for Closed Housing C-Mount 90°

Lens mounts and maximum protrusion

No need to readjust lens mounts

Alvium USB camera mounts are adjusted with high precision during manufacturing. Construction ensures permanent accuracy without need to readjust.



*Only color models are equipped with an IR cut filter

Figure 35: Maximum protrusion S-Mount (left); CS-Mount and C-Mount (right)

Figure 35 shows schematics for maximum protrusion of lenses, Table 39 shows values for maximum protrusion.

NOTICE

Damage to sensor or optics by unsuitable lenses

The sensor, filter, lens, or camera electronics can be damaged if a lens exceeding maximum protrusion is mounted to the camera.

- Use lenses with less than the allowed maximum protrusion, see Table 39.
- See Mounting the lens on page 105.
- For S-Mount lenses, see Mounting and focusing S-Mount lenses on page 106.

Mount	Maximum protrusion
S-Mount	11.0 mm
CS-Mount	8.6 mm
C-Mount	13.6 mm

Table 39: Maximum protrusion for Alvium USB cameras

IR cut filter

Table 40 shows which Alvium models are equipped with an IR cut filter. The filter is permanently installed and cannot be removed.

Color or monochrome model	Bare board	S-Mount	CS-Mount	C-Mount
Color	No filter		Type Hoya C5000 IR cut filter	
Monochrome	No filter			

Table 40: Optical filters availability

Cameras **without** IR cut filter have a higher sensitivity for low-light imaging. Moreover, spectral sensitivity is increased.

Cameras **with** IR cut filter are more accurate in reproduction of color, contrast, and sharpness, as the filter absorbs near-IR wavelengths. See Figure 36 for filter transmission.

Spectral transmission values

The following curve shows typical transmission for type Hoya C5000 IR cut filter. Values may vary slightly by filter lot.

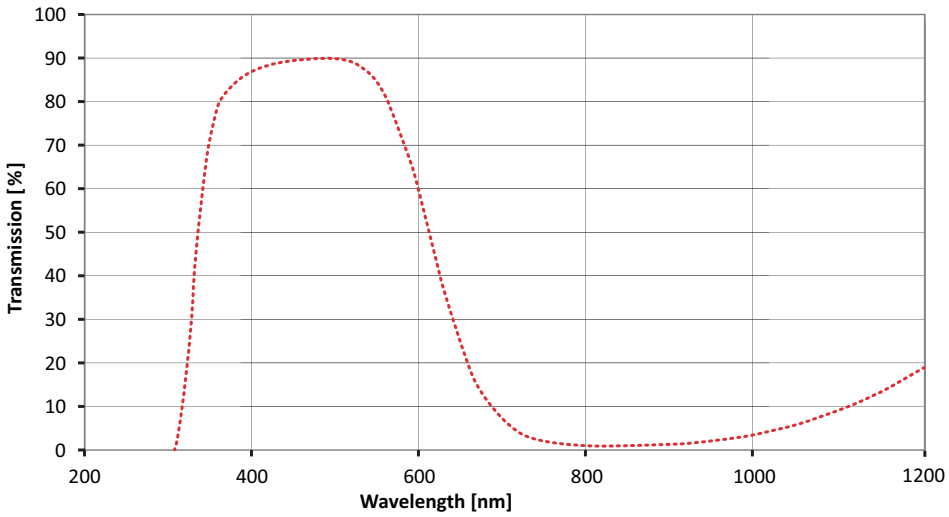


Figure 36: Spectral transmission for type Hoya C5000 IR cut filter

S-Mount lenses with IR cut design

For improved image quality, we recommend using S-Mount lenses that are IR- optimized or that have IR cut coating. See the S-Mount Lenses User Guide at www.alliedvision.com/en/support/technical-documentation/accessory-documentation under Lenses.

Lenses: Focal length vs. field of view

This chapter includes:

About this chapter

This section presents tables that list selected fields of view (FOV) depending on sensor size, distance, and focal length of the lens.

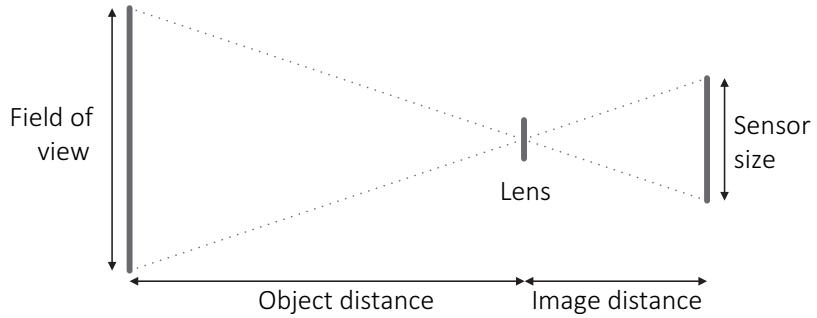


Figure 37: Parameters used in tables for focal length versus FOV

Allied Vision S-Mount lenses

For technical data of Allied Vision S-Mount lenses with dedicated operating instructions, see the S-Mount Lenses User Guide at www.alliedvision.com/en/support/technical-documentation/accessory-documentation under Lenses.

Parameters in tables

The distance to the object is measured from the first principal the plane of the lens to the object. For some lenses, manufacturers do not define the principal plane position. Production spread causes tolerances for all values, including actual focal lengths. Calculations apply for image reproduction without distortion. Therefore, values do not apply for fisheye lenses.

Please ask your Allied Vision Sales representative in case you need more information.

Optical vignetting with certain lenses

Lenses with short focal lengths may show optical vignetting at the edges of the image. Microlenses on the sensor pixels can increase the effect.

For demanding applications, we suggest testing camera and lens to find a suitable setup. If you have questions, please contact your Allied Vision Sales representative.

About S-Mount lenses

Alvium S-Mount models have no filter. We recommend using S-Mount lenses with an integrated IR-cut filter for a better image quality.

Read Mounting and focusing S-Mount lenses on page 106 to avoid damage when using S-Mount lenses.

Focal length vs. field of view

Type 1 = 17.6 mm diagonal

Values apply to **1800 U-1236m/c** cameras.

Focal length [mm]	Field of view (H × V in mm)	
	Object distance = 500 mm	Object distance = 1000 mm
8	872 × 638	1759 × 1287
12	577 × 422	1168 × 854
16	429 × 314	872 × 638
25	270 × 197	553 × 405
35	188 × 138	391 × 286
50	128 × 93	270 × 197
75	80 × 59	175 × 128

Table 41: Focal length versus field of view (type 1 = 17.6 mm sensor cameras)

Type 1 = 15.8 mm diagonal

Values apply to **1800 U-2050m/c** cameras.

Focal length [mm]	Field of view (H × V in mm)	
	Object distance = 500 mm	Object distance = 1000 mm
8	811 × 542	1636 × 1093
12	536 × 358	1086 × 726
16	399 × 267	811 × 542
25	251 × 167	514 × 344
35	175 × 117	364 × 243
50	119 × 79	251 × 167
75	75 × 50	163 × 109
85	64 × 43	142 × 95
100	53 × 35	119 × 79

Table 42: Focal length versus field of view (type 1 = 15.8 mm sensor cameras)

Type 2/3 = 11.1 mm diagonal

Values apply to **1800 U-507m/c** cameras.

Focal length [mm]	Field of view (H × V in mm)	
	Object distance = 500 mm	Object distance = 1000 mm
6	700 × 584	1408 × 1175
8	523 × 436	1054 × 880
12	346 × 288	700 × 584
16	257 × 215	523 × 436
25	162 × 135	332 × 277
35	113 × 94	234 × 196
50	77 × 64	162 × 135

Table 43: Focal length versus field of view (type 2/3 sensor cameras)

Type 1/1.8 = 8.9 mm diagonal

Values apply to **1800 U-319m/c** cameras.

Focal length [mm]	Field of view (H × V in mm)	
	Object distance = 500 mm	Object distance = 1000 mm
4.8	735 × 550	1476 × 1104
6	586 × 439	1180 × 882
8	438 × 328	883 × 661
12	290 × 217	586 × 439
16	215 × 161	438 × 328
25	135 × 101	278 × 208
35	95 × 71	196 × 147
50	64 × 48	135 × 101

Table 44: Focal length versus field of view (type 1/1.8 sensor cameras)

Type 1/2.5 = 7.1 mm diagonal

Values apply to **1800 U-500m/c and 1800 U-501NIR** cameras.

Focal length [mm]	Field of view (H × V in mm)	
	Object distance = 500 mm	Object distance = 1000 mm
2.8	1013 × 759	2031 × 1523
3.6	786 × 590	1578 × 1184
4.8	588 × 441	1182 × 887
6	469 × 352	945 × 709
8	351 × 263	707 × 530
12	232 × 174	469 × 352
16	172 × 129	351 × 263
25	108 × 81	222 × 167

Table 45: Focal length versus field of view (type 1/2.5 sensor cameras)

Type 1/2.9 = 6.3 mm diagonal

Values apply to 1**800 U-040m/c and U-158m/c** cameras.

Focal length [mm]	Field of view (H × V [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
2.8	892 × 667	1789 × 1337
3.6	693 × 518	1390 × 1039
4.8	518 × 387	1041 × 778
6	414 × 309	832 × 622
8	309 × 231	623 × 465
12	204 × 153	414 × 309
16	152 × 114	309 × 231
25	95 × 71	196 × 146

Table 46: Focal length versus field of view (type 1/2.9 sensor cameras)

Type 1/3 = 6 mm diagonal

Values apply to **1800 U-120m/c** cameras.

Focal length [mm]	Field of view (H × V [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
2.8	852 × 639	1709 × 1282
3.6	662 × 496	1329 × 996
4.8	495 × 371	995 × 746
6	395 × 296	795 × 596
8	295 × 221	595 × 446
12	195 × 146	395 × 296
16	145 × 109	295 × 221
25	91 × 68	187 × 140

Table 47: Focal length versus field of view (type 1/3 sensor cameras)

Type 1/3.6 = 4.9 mm diagonal

Values apply to **1800 U-050m/c** cameras.

Focal length [mm]	Field of view (H × V [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
2.8	689 × 517	1381 × 1036
3.6	535 × 401	1073 × 805
4.8	400 × 300	804 × 603
6	319 × 239	643 × 482
8	239 × 179	481 × 361
12	158 × 118	319 × 239
16	117 × 88	239 × 179
25	74 × 55	151 × 113

Table 48: Focal length versus field of view (type 1/3.6 sensor cameras)

Installing the camera

This chapter includes:

Touching hot cameras

CAUTION

Burns to the skin

If you hold the camera in your hands during operation, your skin may get hurt.

Wear protective gloves when you touch a camera that is heated up.

Mounting the heat sink

Keep the operating temperature in the specified range to enable best image quality and to protect the camera from damage. We recommend you to equip Alvium bare board and open housing cameras with heat sinks.

Optimizing heat dissipation

For details, see the Optimum Heat Dissipation for Housed Alvium Cameras application note at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

NOTICE

Damage to the camera by heat sinks mounted improperly

- Allow mechanical contact only at the cooling areas.
- Avoid any mechanical stress to the sensor and electronics area.
- Avoid short circuits of the electronics components.

NOTICE

Damage to the sensor, filter, and lens by corrosive substances

Some conductive media for heat sinks contain corrosive substances that can damage optical surfaces of the sensor, filter, and lens.

- Cover the optical path of the camera when you apply heat sink compound or adhesive to prevent substances and fumes from damaging optical surfaces.
- Adhere to the instructions and safety notes provided by the manufacturer of the conductive media.

NOTICE

Damage to camera electronics

Heat sinks can cause short circuits if they are not electrically isolated.

Avoid electrical contact between electronic components by unsuitable heat sinks and thermal conductive media.

Connect components in the cooling areas (blue areas in Figure 38) to a heat sink, following the instructions of the manufacturer of the heat sink and the thermal conductive media. Cooling areas for Alvium USB 90° models are the same as for standard models.

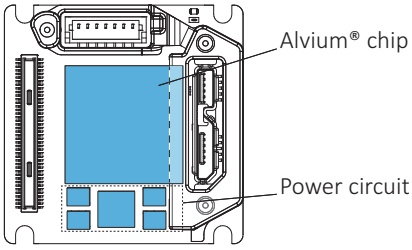


Figure 38: Cooling areas for Alvium USB bare board cameras

Mounting the camera

Mounting bare board cameras

Heat dissipation and electromagnetic compatibility for bare board cameras

For heat dissipation, see the Optimum Heat Dissipation for Housed Alvium Cameras application note.

For electromagnetic compatibility, see the Electromagnetic Compatibility for Open Housing Alvium Cameras application note.

See www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

NOTICE

Damage to the camera by improper mounting

- Allow mechanical contact only at the mounting area.
- Avoid any mechanical stress to the sensor and the electronics area.
- Avoid short circuits of the electronics components.
- Give 2 mm minimum clearance above board components.
- Tighten screws at 0.1 Nm maximum torque.

Schematic drawings in Figure 39 show Alvium USB bare board cameras. Only the mounting area (gray) can be used for mounting. The sensor and electronics area (red) must not be touched nor put at mechanical stress.

a = Mounting hole
b = Mounting hole and chassis ground

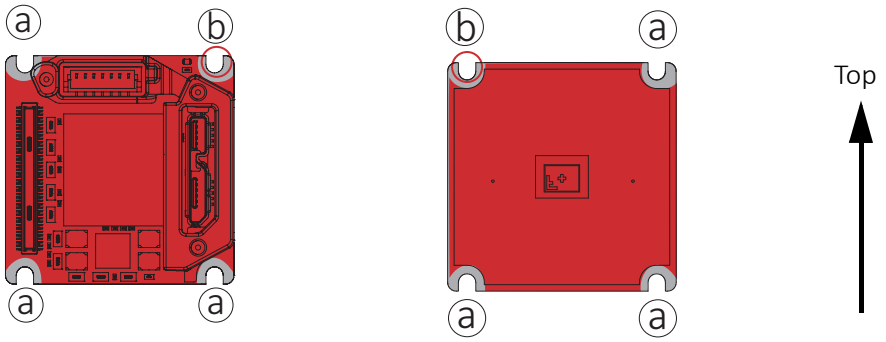


Figure 39: Mounting area of Alvium USB bare board cameras connector side (left); sensor side (right)

Mount the bare board with four M2 screws at 0.1 Nm maximum torque.
Mounting areas for Alvium USB 90° models are the same as for standard models.

Mounting housed cameras

CAUTION

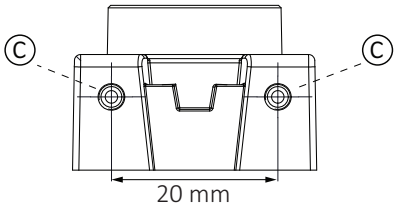
Personal injury by falling cameras

A falling camera can hit your body and hurt you.

- Mount cameras as described in the following instructions.
- Avoid exceeding the maximum range for shock and vibration, see Shock and vibration on page 29

Bottom or top mounting

Camera top and bottom mounting is done the same way.

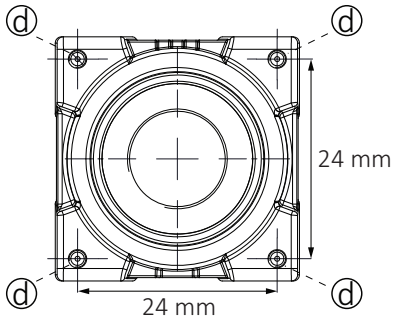


c = Mounting thread M3 ↓2.5

Figure 40: Top and bottom with mounting threads

1. Mount the camera to the base using suitable M3 screws at 0.35 Nm maximum torque for a thread engagement of 2.5 mm between screws and mounting threads, see Figure 40. For technical drawings, see Dimensions and mass on page 75.
2. Continue with Mounting the lens on page 105.

Front mounting



d = Mounting thread M2 ↓2

Figure 41: Camera front with mounting threads

1. Mount the camera to the base using suitable M2 screws at 0.18 Nm maximum torque for a thread engagement of 2 mm between screws and mounting threads, see Figure 41. For technical drawings, see Dimensions and mass on page 75.
   We recommend you to additionally use bottom and top mounting threads for a more solid connection.
2. Continue with Mounting the lens on page 105.

Tripod adapter

For more information, see the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Mounting the lens

Observe the following notes before you mount lenses to Alvium USB cameras.

CAUTION

Cuts to the skin by sharp edges of lens mounts

The threads of the lens mount and the lens itself have sharp edges.

Be careful when mounting or unmounting lenses.

CAUTION

Personal injury by falling lenses

A falling lens can hit your body and hurt you.

Use a lens support for heavy lenses, see Heavy lenses on page 20.

NOTICE

Damage to sensor, optics, or electronics by unsuitable lenses

The sensor, filter, lens, or electronics can be damaged if a lens exceeding maximum protrusion is mounted to the camera.

- Use lenses only up to the specified maximum protrusion, see Lens mounts and maximum protrusion on page 92.
- S-Mount lenses must be screwed into the camera at less than maximum protrusion (11.0 mm), see Mounting and focusing S-Mount lenses on page 106.
- Avoid short S-Mount lenses falling into the camera.

Mounting and focusing S-Mount lenses

Allied Vision S-Mount lenses

For technical data of Allied Vision S-Mount lenses with dedicated operating instructions, see the S-Mount Lenses User Guide at www.alliedvision.com/en/support/technical-documentation/accessory-documentation under Lenses.

This section instructs how to use S-Mount lenses with your camera safely. S-Mount lenses are screwed into the mount to adjust focus. Vibration moves lenses out of position. Several techniques can be used to fasten S-Mount lenses in focus. We recommend using fixing nuts. See instructions in this section.

Fixing nuts

Several manufacturers offer various types of S-Mount fixing nuts. The type shown in the instructions drawings is an example.

We recommend using pinch nose pliers to tighten fixing nuts.

Figure 42 shows how fixing nuts lock S-Mount lenses.

Follow the instructions to lock the lens in focus position.

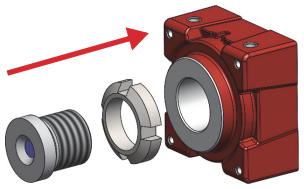


Figure 42: Fixing nut locking an S-Mount lens

NOTICE

Damage to sensor, optics, or electronics by improper handling

If an S-Mount lens is screwed against the sensor or electronics, sensor, lens, or electronics can be damaged.

- Screw in the lens at less than 11.0 mm maximum protrusion.
- Follow the instructions carefully.

Determining the allowed range for the position of the lens

1. Measure the length of the lens.
2. Calculate: **a = c – b**
   a: length of the mounted lens, measured from lens mount front flange
   b: maximum protrusion (11.0 mm)
   c: length of the lens

   See Lens mounts and maximum protrusion on page 92.
3. Set a gauge to the length of (a).

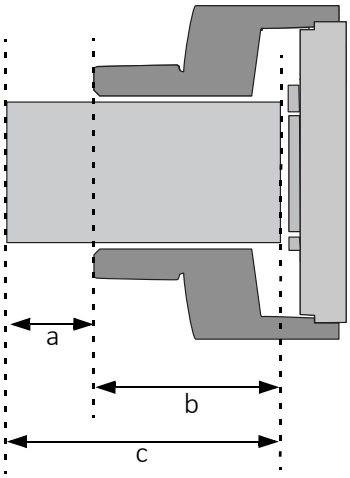


Figure 43: S-Mount lens and maximum protrusion

Mounting the fixing nut to the lens

4. Screw the fixing nut clockwise onto the lens until you can hold the front part (d) of the lens with your finger tips.

Figure 44: Lens and fixing nut

Focusing the lens

5. **Checking (a) with a gauge**, slowly screw the lens clockwise into the lens mount until the image is roughly in focus.
6. Slowly screw in and unscrew the lens until you have found the most accurate focus.

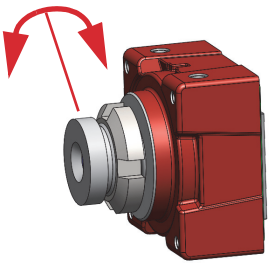


Figure 45: Adjusting focus

NOTICE

Damage to lens threads and fixing nut by excessive force

If the fixing nut is screwed with too much force, threads are worn out and the lens cannot be locked anymore.

Screw fixing nuts hand tight to keep the lens in a fixed position.

Locking focus

Pinch nose pliers are used to screw the fixing nut:

7. Holding the lens in position with one hand, screw the fixing nut clockwise against the lens mount until you feel the lens is locked.

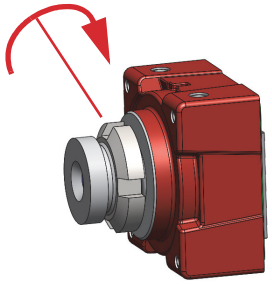


Figure 46: Tightening the fixing nut

Checking focus is set and locked properly

8. Check No.1: Try to rotate the lens with little force in both directions to ensure the lens is safely locked in position.

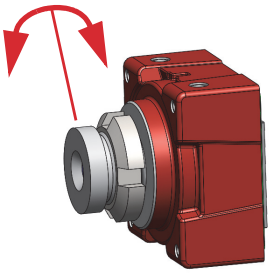


Figure 47: Checking lens is safely locked

9. Check No. 2: S-Mount thread allows a slightly tilted lens position. In this case, focus for a common object plane varies over the image plane.
   If focus is constant over the image plane, you are done.
   If focus varies over the image plane, the lens is tilted. Continue with 10.

10. Loosen the fixing nut.

11. Continue with 6.

    The lens is locked in focus and ready for operation.

Software and driver installation on the host

Easy camera access with Vimba

This section lists general requirements to operate Alvium USB cameras on your system.

To download **Vimba Suite** for Windows, Linux, and Linux/Arm, including **Vimba SDK**, **Vimba Viewer**, and **Vimba Driver Installer** for Windows, see www.alliedvision.com/software.

For more details see **ReleaseNotes_Linux.txt** or **ReleaseNotes_Windows.txt** in the directory of your **Vimba** installation, or see www.alliedvision.com/software.

Required components

Driver installation and OS support

Windows: Please use **Vimba** to install the camera driver. For **Vimba** system requirements and supported Windows versions, see www.alliedvision.com/software.

Linux: Allied Vision does not provide a special driver. For **Vimba** system requirements and supported operating systems, see www.alliedvision.com/software.

You need the following accessories:

- USB 3.0 or 3.1 Gen 1 external host controller card or on-board host controller
- USB 3.0 or 3.1 Type-A to Micro-B cable.

Compatible USB 3.0 or 3.1 Gen 1 accessories

See the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Installing the camera driver using Vimba on a Windows system

Instructions in this chapter describe installation of the camera driver using **Vimba** on a Windows system. On Linux systems, the generic driver for USB3 Vision devices is used.

Unexpected events

Should installation or operation not work properly, see Troubleshooting and performance on page 128.

Using the camera with third-party drivers

Alvium USB cameras may not support third-party drivers. We recommend using the **Vimba** camera driver.

Installing drivers for camera and host adapter

Installing the host adapter and Vimba

1. Install the USB 3.0 or 3.1 Gen 1 host controller card and driver according to the manufacturer's instructions.
2. Download and install **Vimba**:
   www.alliedvision.com/software.
3. Continue with Installing the camera driver.

Installing the camera driver

Connecting the camera to a USB 2.0 port

If the Alvium USB camera is connected to a USB 2.0 port, the **Vimba** driver can be installed and the camera can be configured and operated. But for full performance, the camera must be connected to a USB 3.0 or 3.1 Gen 1 port.

Command line driver installer

Vimba also provides a command line driver installer. For more information about the **Vimba Driver Installer**, see the Vimba Manual, included in the **Vimba** download.

During the **Vimba** installation, select at least **Camera Demonstration** and **Vimba Applications** to operate Alvium USB cameras. If the camera is not recognized or to subsequently change an assigned driver, follow the instructions:

1. Connect your Alvium USB camera to the computer using a USB 3.0 or 3.1 Type-A to Micro-B cable.
2. Start **Vimba Driver Installer** and open the **USB3 Vision Cameras** tab.
   The **Driver Source** is not installed, yet.
   If other USB3 Vision devices are installed, another USB3 Vision driver may be assigned to your camera.
3. Click the Alvium USB camera entry.
   The current **Vimba** driver is offered as a popup (Vimba 3.0.0 in the example).

4. Open **Install driver > USB3 Vision Camera** and click the driver popup.

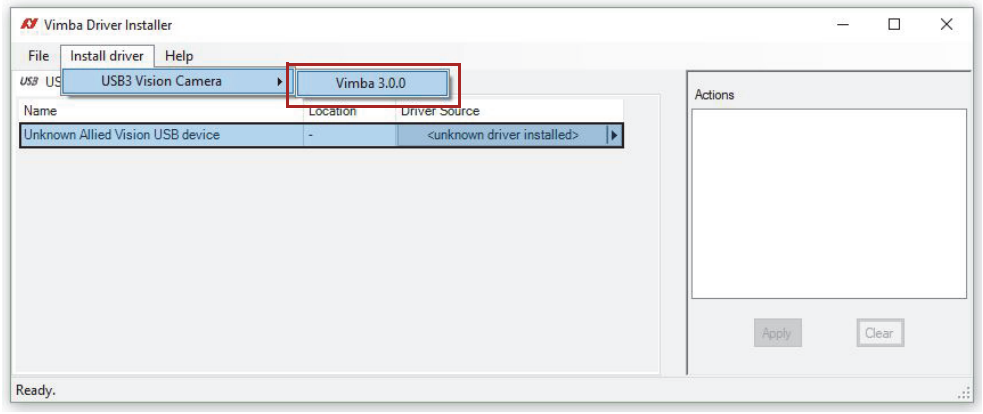


Figure 48: Vimba Driver Installer, camera driver not installed

5. Click **Apply** to install the **Vimba** driver for the camera.

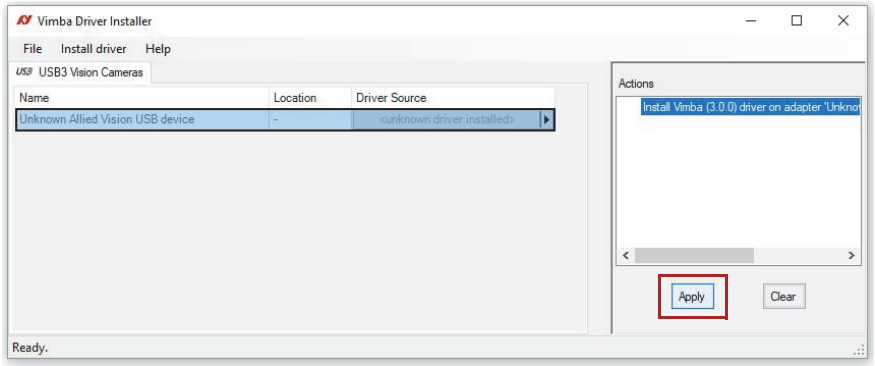


Figure 49: Vimba Driver Installer, driver installation started

The driver has been installed successfully, the camera is recognized.

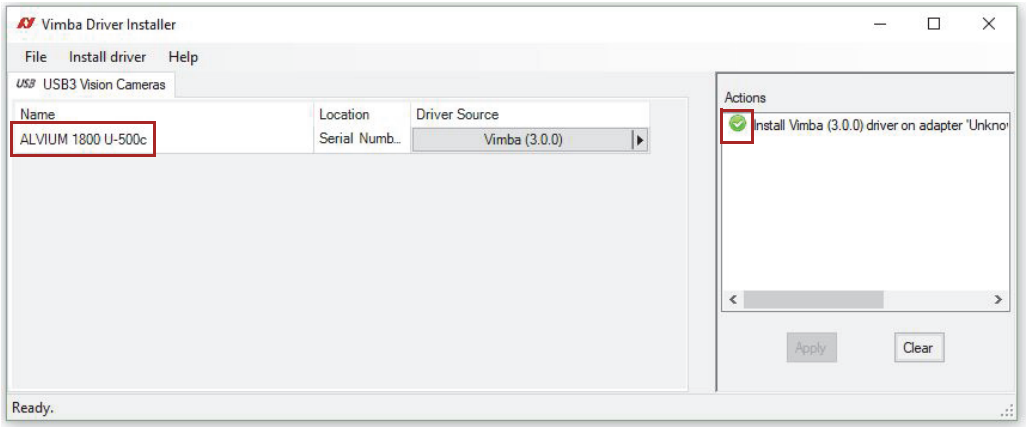


Figure 50: Vimba Driver Installer, driver installed successfully

Manual Vimba Driver installation

Windows: For manual **Vimba** driver installation, see the following instructions.

Installing the camera driver with Windows tools

As an alternative practice, you can install the **Vimba** driver manually. Check for connected USB devices on your Windows system.

Screenshots are examples

The following screenshots were taken on a test system. The view may be different, depending on the configuration of your system.

Under Windows, the **Device Manager** provides an overview of USB resources and connected devices. As long as the **Vimba** USB device driver is not installed, the camera is not recognized.

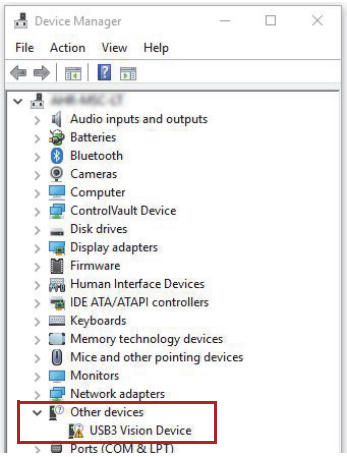


Figure 51: Windows Device Manager, unrecognized USB3 Vision camera

If no **USB3 Vision Device** is shown under the section **Other devices**, continue with action step 1. Otherwise, continue with action step 3.

1. Look at the section **Universal Serial Bus controllers**.
2. Disable the new found **USB Composite Device** and enable it again.
   This creates the entry under the section **Other Devices** as shown in Figure 51.

3. Right-click the unrecognized **USB3 Vision Device** and select *Update driver*.

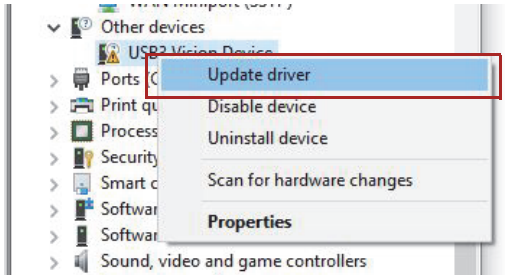


Figure 52: Windows Device Manager, Windows Driver Installer

4. Click: “Browse my computer for driver software”.
5. Select [Your local Vimba directory]\Allied Vision\Vimba_V.x.x\VimbaUSBTL\Driver.
6. Follow the instructions.
   The camera driver is installed successfully.

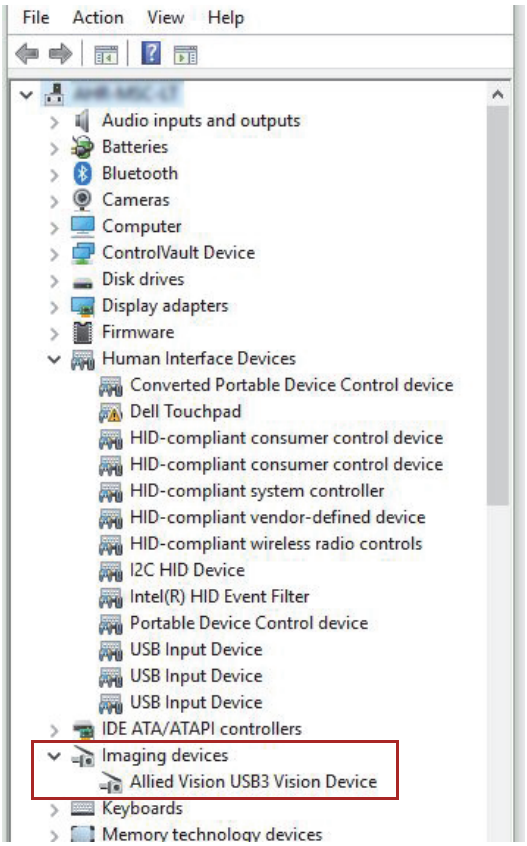
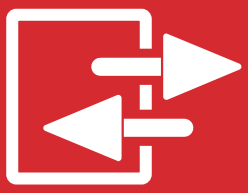


Figure 53: Windows Device Manager, USB3 Vision camera installed successfully

Camera interfaces



This chapter includes:

Recommended accessories

Compatible electronics accessories

See the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Back panel

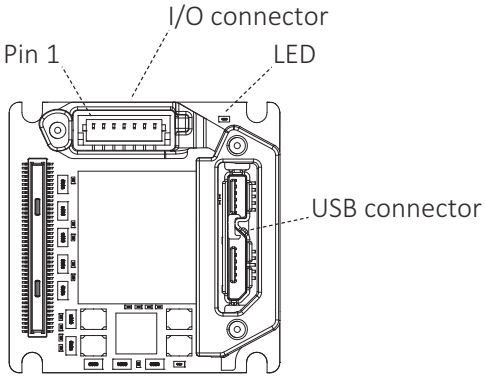


Figure 54: Bare board camera

Interface descriptions

Interface	Section in this user guide
I/O connector	Non-isolated, programmable GPIOs on page 117
Status LED	Status LED on page 119

Table 49: Interface descriptions overview

I/O connector pin assignment

I/O connector details

JST BM07B-SRSS-TBT connector set consists of:
Camera connector: JST BM07B-SRSS-TBT
Cable housing: JST SHR-07V-S
Cable, crimp contacts: JST SSH-003T-P0.2-H

See www.jst.de for details.

I/O cables and electromagnetic interference (EMI)

Consider for I/O cables by Allied Vision:

- 12319 JST I/O cables without screw lock have no shielding and are designed to be used with bare board or open housing Alvium cameras.
- For applications without an additional EMC housing, use shielded cables, such as 12322 JST I/O cables **with screw lock**.

NOTICE

Damage by reverse polarity

If Alvium USB cameras are externally powered with reverse polarity, the cameras can be damaged.

Power Alvium USB cameras according to the specifications described in this section.

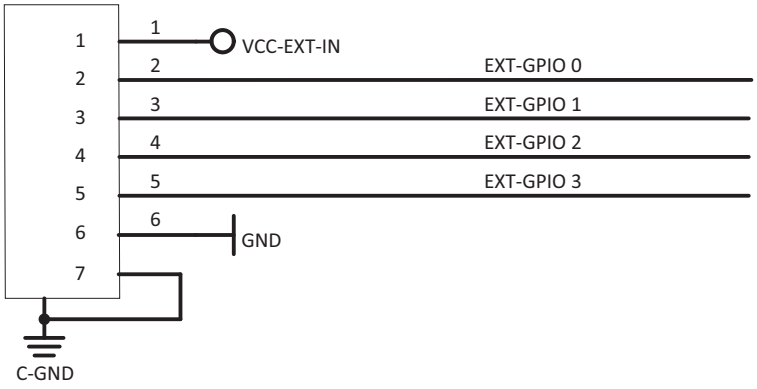


Figure 55: Pin assignment of JST BM07B-SRSS-TBT type I/O connector

Pin	Signal	Direction	Level	Description
1	VCC-EXT-IN	PWR IN	4.5 to 5.5 VDC	Power supply voltage See Camera power on page 21.
2	EXT-GPIO 0	IN/OUT	U_{in} (low) = -0.3 to 0.8 VDC U_{in} (high) = 2.0 to 5.5 VDC U_{out} (low) = 0 to 0.4 VDC U_{out} (high) = 2.4 to 3.3 VDC at max. 12 mA	GPIOs Internal pull-up resistor: 33 kΩ to 63 kΩ
3	EXT-GPIO 1	IN/OUT	See Pin 2, EXT-GPIO 0	
4	EXT-GPIO 2	IN/OUT	See Pin 2, EXT-GPIO 0	
5	EXT-GPIO 3	IN/OUT	See Pin 2, EXT-GPIO 0	
6	GND	PWR	0 VDC	Power supply ground
7	C-GND	PWR	0 VDC	Chassis ground and shielding

Table 50: Pin assignment of the JST BM07B-SRSS-TBT type I/O connector

Non-isolated, programmable GPIOs

I/O cables maximum length

The maximum length for I/O cables must not exceed 30 m.

GPIOs description

The camera has four non-isolated GPIOs that can be configured by software to act as inputs or outputs.

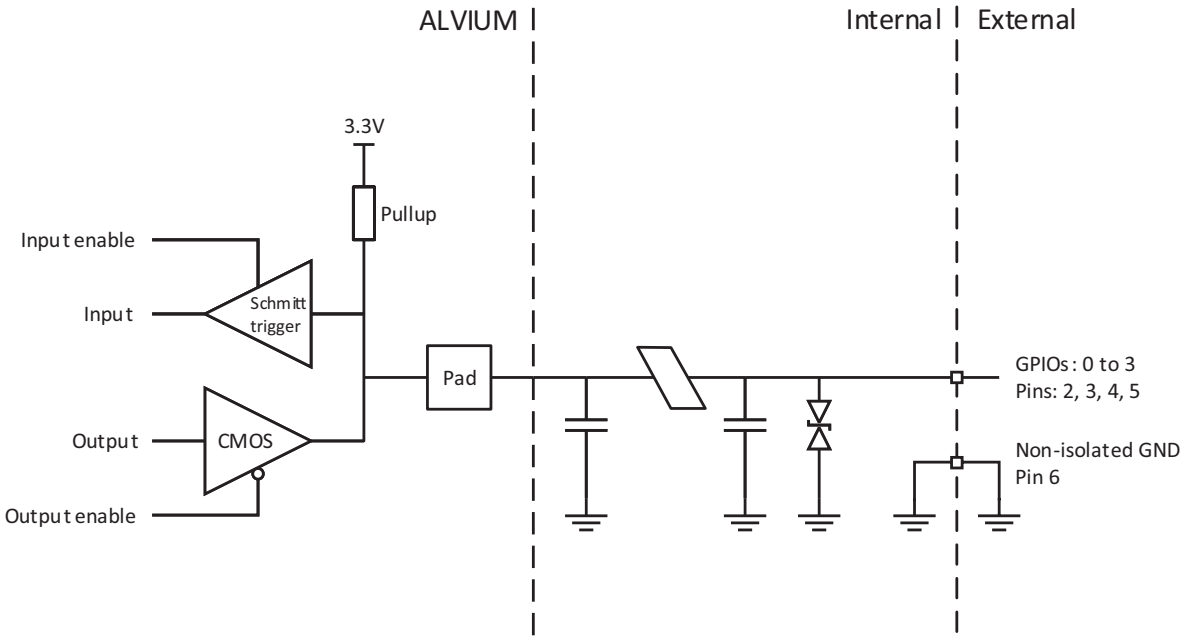


Figure 56: GPIOs block diagram

Input levels

The GPIOs can be connected directly to the system controlling the camera for voltages up to 5.5 VDC. An external resistor is not necessary.

NOTICE

Damage to the camera by high input voltage

Exceeding maximum input voltage can damage the camera.

Keep maximum input voltage below 5.5 VDC.

Parameter	Value
U_{in} (low)	-0.3 to 0.8 VDC
U_{in} (high)	2.0 to 5.5 VDC
Undefined levels	0.8 to 2.0 VDC

Table 51: GPIOs as input, voltage levels

Output levels

NOTICE

Damage to the camera by high output current or voltage

The camera can be damaged when connected to a device that exceeds the specified maximum current or voltage. Consider maximum values:

- Maximum current = 12 mA per output
- Maximum Out VCC = 3.3 VDC

Parameter	Value
External output voltage U_{out} (low, Off state)	0 to 0.4 VDC
External output voltage U_{out} (high, On state)	2.4 to 3.3 VDC
Undefined levels	0.4 to 2.4 VDC
Maximum external output voltage	3.3 VDC
Maximum output current	12 mA

Table 52: GPIOs as output, current and voltage levels

Output voltage in the On state

The voltage level in the On state depends on the load current. Higher currents yield lower voltage.

Status LED

Alvium USB cameras have a green status LED. The following table describes the flashing pattern indicating different events. Inverse flashing: If the LED is already on, it is switched off for a short time.

LED settings

You can define LED settings with the `DeviceIndicatorLuminance` feature:

- A value of *10* enables LED signaling at the highest luminance level.
- Values below *10* reduce the luminance level.
- *0* disables LED signaling.

Normal operation

LED codes	Behavior	Status
	Continuously active	Power on or idle state
	Irregular flashing	Command or image traffic, such as for camera startup
	Four short flashes and code sequence	Error state

Table 53: LED codes for normal operation

Error conditions

Four short flashes followed by another sequence indicate errors. In this case, try the following to get the camera back to normal operation:

1. Restart the camera.
2. If the LED indicates error state again, please contact support@alliedvision.com.

Triggering

This chapter includes:

Trigger signal flow

Figure 57 shows an ideal diagram for the trigger signal flow. The external signal can be a physical source, such as light barrier as hardware trigger or a software trigger. This external signal starts the exposure of a frame. The end of exposure starts the readout. High levels show the active state of a signal.

Features availability

States shown in the following graphic apply to Alvium USB cameras. Not all of the corresponding features may be supported. See the Alvium Cameras Features Reference at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation for details.

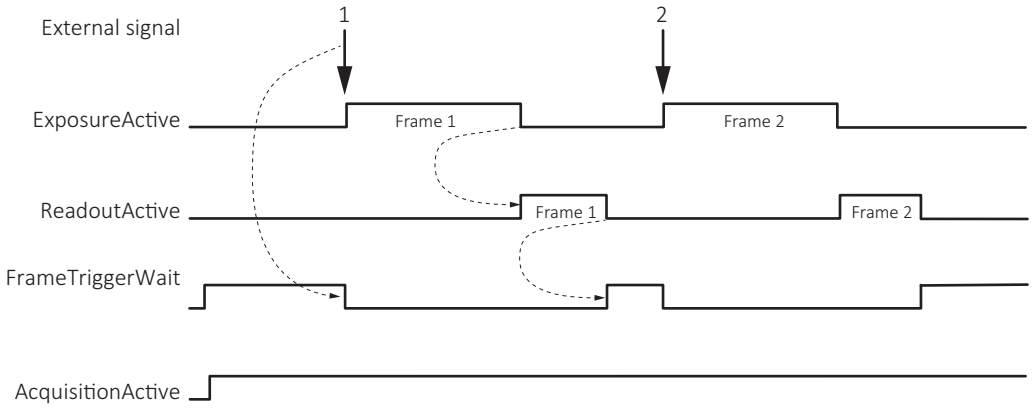


Figure 57: Schematic trigger signal flow

Term	Description
External signal	Electrical trigger signal starting the signal flow
ExposureActive	Exposing a frame
ReadoutActive	Reading out a frame
FrameTriggerWait	Waiting for a trigger
AcquisitionActive	Enables frame acquisition: Expose, read out data, or wait for triggers.

Table 54: Trigger signal flow terms

Trigger latency

In theory, a trigger creates a camera response at speed of light, depending on the cable length. In practice, the computer may add a delay that is mostly unpredictable, especially on Windows systems. In addition, camera electronics and sensors have a delay.

Electronic rolling shutter (ERS) cameras in this document also have exposure delay, depending on camera settings, see Triggering with rolling shutter cameras on page 122. Electronic rolling shutter is commonly called rolling shutter.

Triggering with rolling shutter cameras

This section describes triggering behavior for **1800 U-500m/c, U-501m NIR, and U-2050m/c** cameras with rolling shutter sensor. Figure 58 shows how an external signal triggers exposure and readout for cameras with rolling shutter sensors. Like for global shutter sensors, readout has a constant duration, acquisition must be active to enable exposure, the end of exposure starts readout.

Rolling shutter sensors run in cycles where readout area equals exposure area. Overlapping triggering is not supported. If exposure time is shorter than readout time, exposure starts with a delay:

Exposure start delay = exposure area – exposure time.

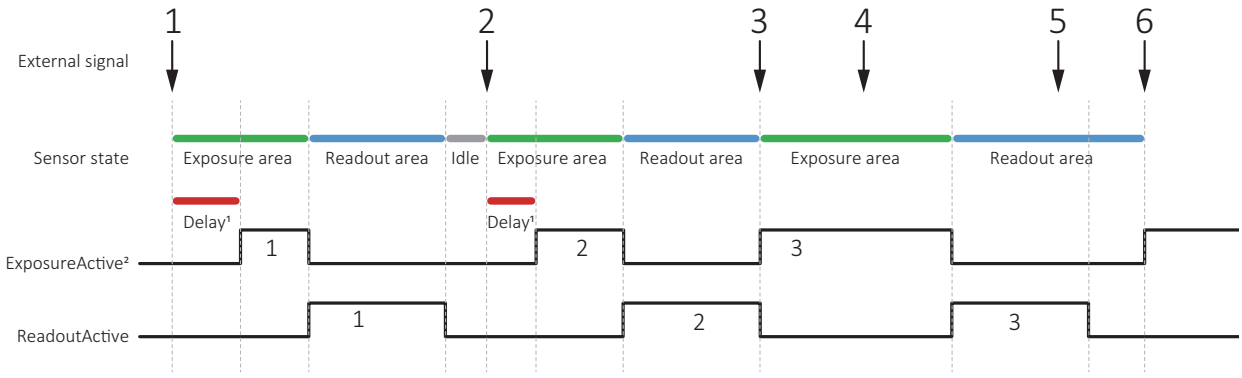


Figure 58: Triggering rolling shutter cameras

No	Conditions	Results
1	Exposure time is shorter than readout time.	Trigger 1 starts exposure 1 with a delay
2	Exposure time is shorter than readout time, but **longer** than for exposure 1.	Trigger 2 starts exposure 2 with a delay **shorter** than for exposure 1.
3	Exposure time is longer than readout time	Trigger 3 starts exposure time without a delay. Because the exposure area is longer, also the readout area is longer than for triggers 1 and 2
4	Exposure area is ongoing.	Trigger 4 is ignored.
5	Readout area is ongoing	Trigger 5 is ignored.
6	Readout area is finished. Exposure time is longer than readout time.	Trigger 6 starts exposure 6 without a delay

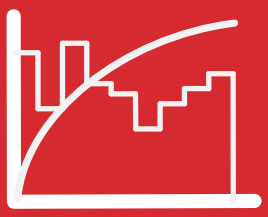
Table 55: Triggering conditions and results

TriggerSelector values for rolling shutter cameras

Cameras with rolling shutter **can** be triggered using ***AcquistionStart***, ***AcquisitionEnd***, or ***FrameStart*** for `TriggerSelector`.

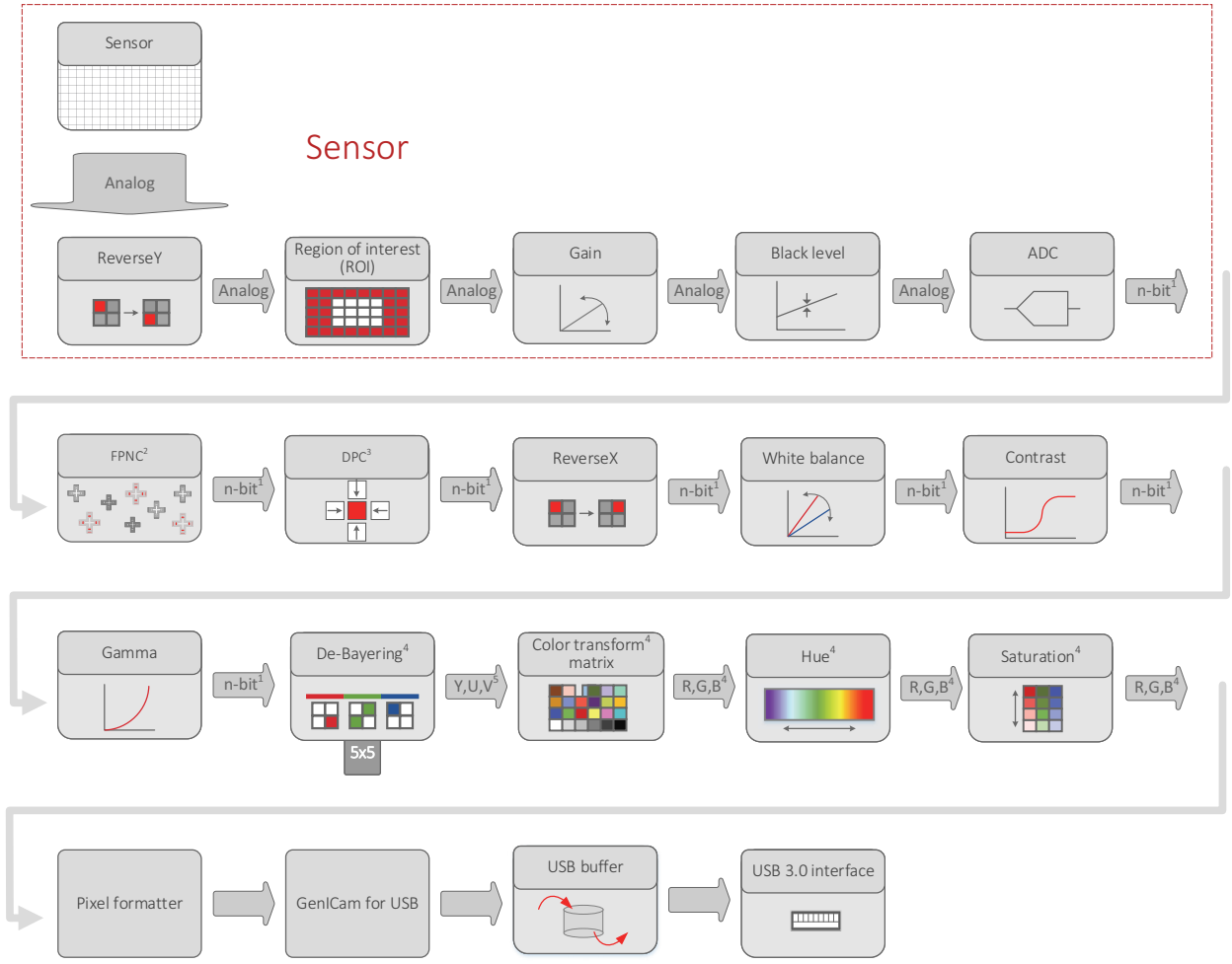
Cameras with rolling shutter **cannot** be triggered using ***ExposureStart*** or ***ExposureEnd*** for `TriggerSelector`.

Image data flow



This chapter includes the image data flow for Alvium USB cameras.

Figure 59 shows image data processing for Alvium USB cameras in general.



[1]Model dependent: See ADC bit depths in Table 56.

[2]Factory preset for FPNC = Fixed Pattern Noise Correction
currently only available for 1800 U-050m/c and 1800 U-120m/c

[3]Factory preset for DPC = Defect pixel correction,
currently not available for 1800 U-2050m/c

[4]Color models only

[5]For monochrome models: Y

Figure 59: Image data flow of Alvium USB cameras

Camera model	ADC bit depth
Alvium 1800 U-040m/c	12-bit
Alvium 1800 U-050m/c	10-bit
Alvium 1800 U-120m/c	12-bit
Alvium 1800 U-158m/c	12-bit
Alvium 1800 U-319m/c	12-bit
Alvium 1800 U-500m/c	10-bit
Alvium 1800 U-501m NIR	10-bit
Alvium 1800 U-507m/c	12-bit
Alvium 1800 U-1236m/c	12-bit
Alvium 1800 U-2050m/c	10-bit

Table 56: ADC bit depth by model

Firmware update

This chapter describes how firmware is updated on Alvium USB cameras.

Please note

You should update firmware only to change camera functions or fix known issues.

Consider: Any firmware update may not only add new features to a camera or fix known issues. It may also replace previous features or change camera characteristics. See firmware release notes for details.

Keep the camera connected

- Keep the camera and the computer running while you are executing a firmware update.
- If the camera is powered down during firmware update, the camera firmware may get into a non-functional state.

Firmware update with Vimba

We recommend you to install **Vimba** completely.

Vimba Driver Installer

Windows: By default, **Vimba Driver Installer** is installed as well.

1. Download and install **Vimba**.
   The download includes the **Vimba Firmware Updater** and the Vimba Manual.
2. To update the firmware, follow the instructions of the Vimba Manual.

Downloads

- For Vimba, see www.alliedvision.com/software.
- For firmware updates, see www.alliedvision.com/en/support/firmware.

We recommend you to use the **Vimba Firmware Updater** for easy handling.
If you want to update the firmware without installing **Vimba**, please contact support@alliedvision.com.

If firmware update fails,

- The camera is shown as “Fallback” on the USB bus.
- The camera is not recognized by **Vimba Viewer**.
- You can repeat firmware update.

Should the firmware update not succeed, please contact support@alliedvision.com.

Troubleshooting and performance

This chapter includes:

Optimizing performance

Frame rate jitter

Affected models: **Alvium 1800 U-120m/c, U-500m/c, U-501m NIR, and U-2050m/c**

Generally, some parameters can be changed during exposure without affecting the timing. When the camera is operated in freerun mode without triggering, changing parameters during exposure leads to a frame rate jitter.

When parameters are entered, the next frame starts only after readout and sensor reconfiguration delay are finished. When the camera is run in `ExposureAuto` mode, the actual frame rate is less than the calculated value for the corresponding exposure time. Consider frame rate jitter for your application.

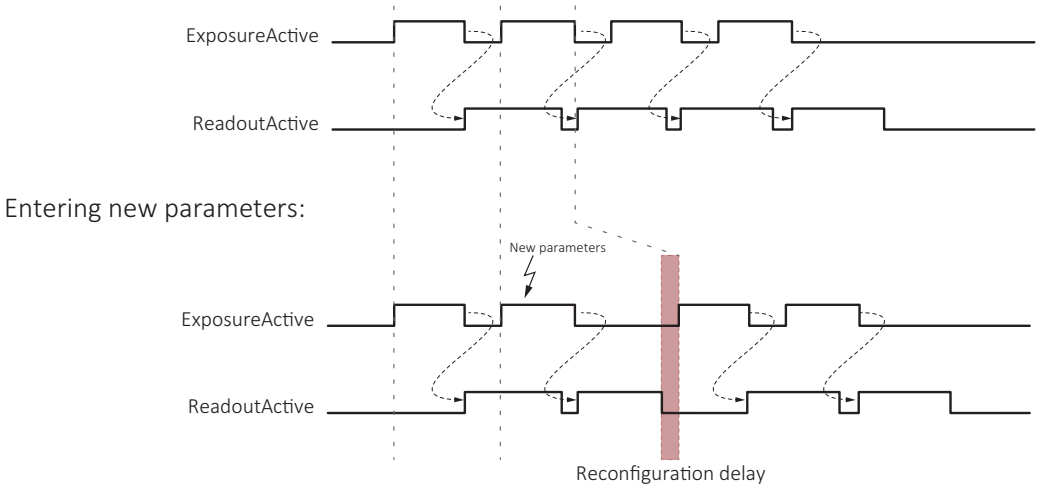


Figure 60: Delayed exposure due to parameter changes

Value changes by feature interdependencies

The conversion between time and clock cycles affects control values. Features for pixel format, bandwidth, ROI, exposure time, and triggering are related to each other. Changing values for one feature can change values for another feature. For example, frame rates can be reduced when `PixelFormat` is changed subsequently. Figure 61 shows the interdependencies.

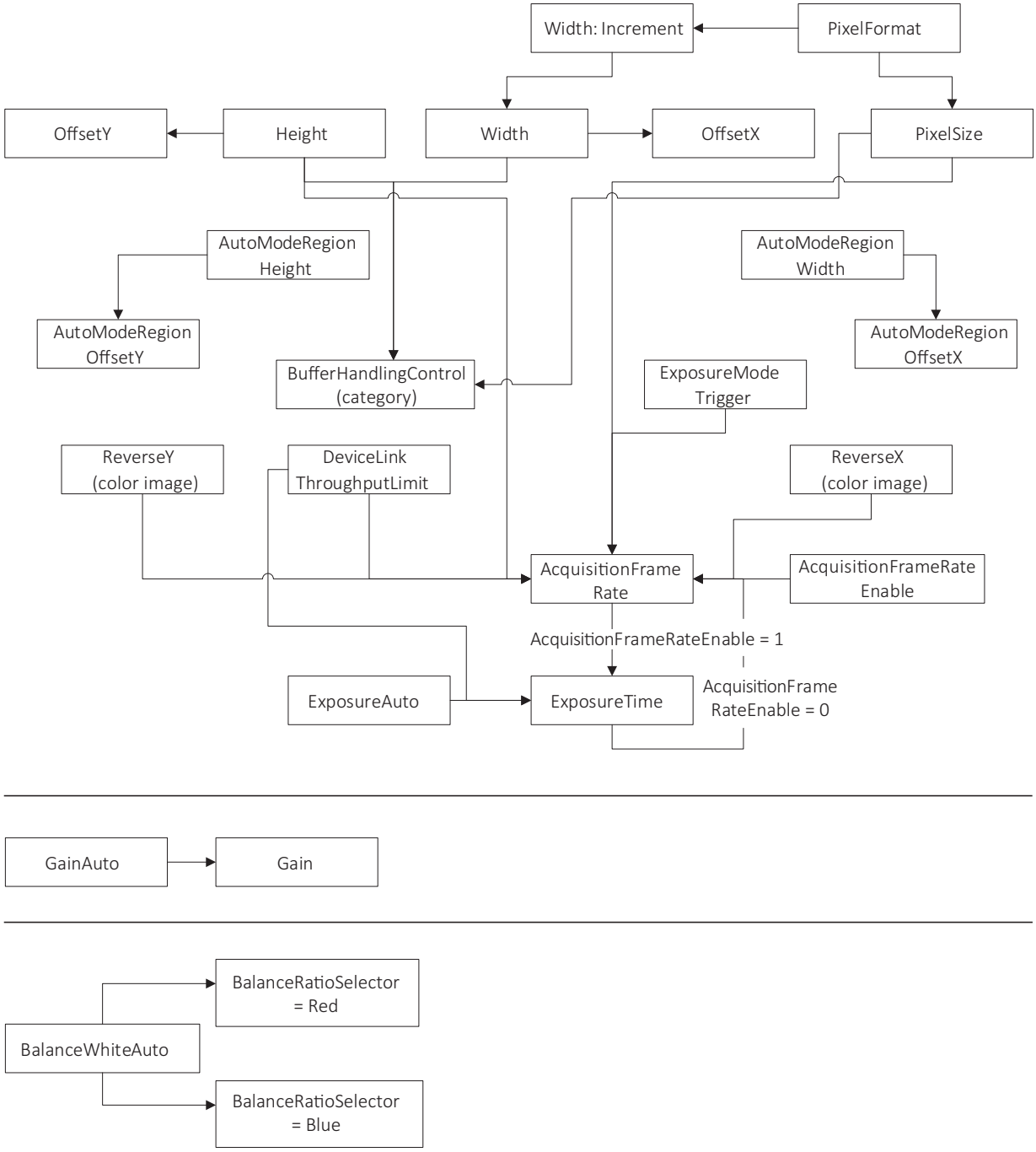


Figure 61: Interdependencies between features

Effects for the related features

Changing one control's value affects other control's values, such as:

If: `Width` value is changed.

Then: Other values may be affected, such as for `AcquisitionFrameRate` and `ExposureTime`.

We recommend you to consider:

- The more features you adjust, the more current values deviate from previously set values.
- The same effects that apply to `ExposureTime`, also apply to `AutoExposure`.
- To avoid readjustments, apply settings in the order shown in Figure 61.

Impact by other features

Impact by	Result	
	Exposure time values	**Frame rate**
`AcquisitionFrameRate`	Not affected	Affected
`ExposureTime`	Affected as expected	Affected
`DeviceLinkThroughputLimit`	Affected	Affected
`Height`	Not affected	Affected
`Width`	May be affected	May be affected

Table 57: Impact by other features

Dark current compensation

All sensors accumulate dark current in the pixels. Dark current increases the signal level and black level. Most sensors in Alvium USB cameras compensate for this.

For **Alvium 1800 U-050m/c** with PYTHON 480 sensor, see Black level compensation for certain sensors on page 134.

If cameras are operated at high temperatures or exposure times, compensation reaches its limits. The typical compensation mechanism uses a **margin** to compensate for dark current. This works only until dark current reaches the size of the margin. The following table shows the relation of the margin and accumulated dark current for a pixel in 8-bit mode with a maximum value of 255.

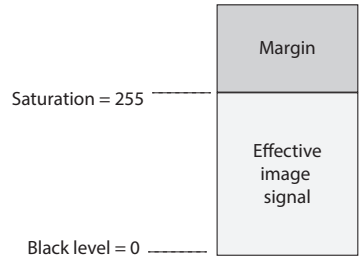
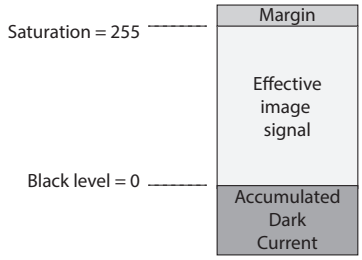
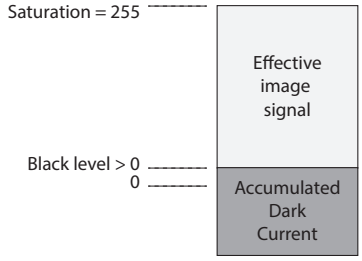
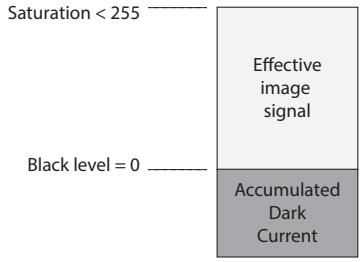
Effective signal versus noise	Description
	The pixel has accumulated no dark current, the margin has maximum size.
	The pixel has accumulated some dark current, reducing the size of the margin.
The following images show a pixel that has accumulated a higher dark current than the margin.	
	The pixel has accumulated dark current, the margin reduces to 0. **Type 1 compensation** • Dark current compensation is stopped. • Dark current increases the black level. • Fixed pattern noise increases.
	The pixel has accumulated dark current, the margin reduces to 0. **Type 2 compensation** (Typically used for sensor-internal compensation, often in the analog domain.) • Dark current compensation stays active. • Maximum saturation signal decreases. • Fixed pattern noise increases.

Table 58: Accumulated dark current affecting the effective image signal

Additional compensation

If compensation limits are reached and you cannot decrease operating temperature or exposure time, what can you do to keep signal quality high?

Measures for type 1 compensation

Alvium 1800 U-050m/c support compensation type 1. For additional compensation, see Black level compensation for certain sensors on page 134.

Typically, there is no measure to improve the image signal.
The rising black level shifts black and dark gray values to gray.

Measures for type 2 compensation

All other Alvium camera models support compensation type 2.

You can increase the margin size by using gain, with the following side effects:

- To give space to a larger margin, the effective pixel capacity decreases.
- White and light gray values are shifted down to gray.

Black level compensation for certain sensors

Because the PYTHON 480 sensor does not have a dark current compensation, **Alvium 1800 U-050m/c** cameras have a typical black level value drift, depending on exposure time and `DeviceTemperature` (measured at the mainboard). The black level compensation adjusts this effect as shown in Table 59.

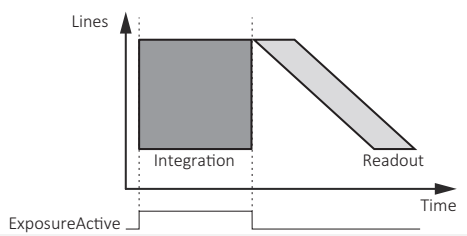
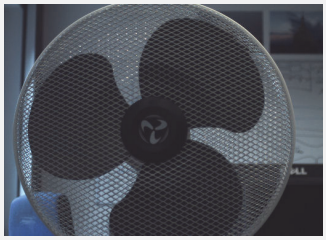
Temperature [°C]	ExposureTime [ms]							
	1	10	50	100	250	500	750	1,000
35								
40								
45								
50								
55								
60								
65								
70								
75								
	Full compensation							
	Basic compensation							

Table 59: Exposure time and temperature affecting black level compensation

Should additional compensation be needed, we recommend cooling the camera.

Shutter types and effects

Some Alvium USB camera models are operated using global shutter (GS):

Property	Line readout	Moving image
Global shutter		

Other models use electronic rolling shutter (ERS). Alvium 1800 U-2050 models with Sony IMX183 sensor offer global reset shutter (GRS) in addition:

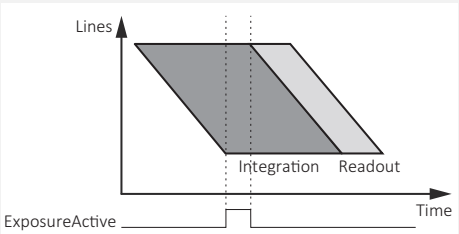
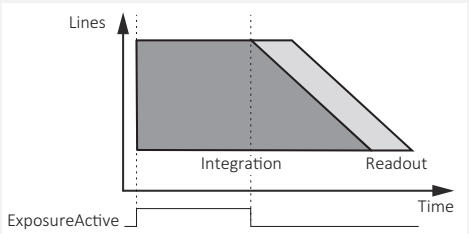
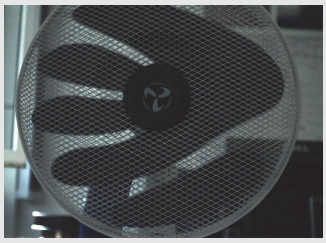
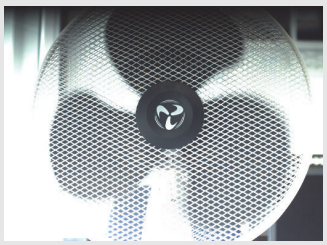
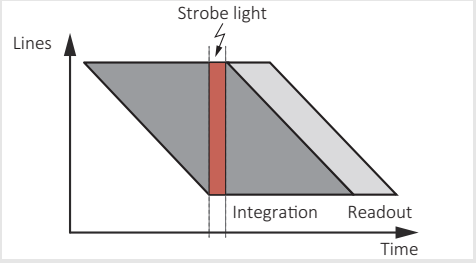
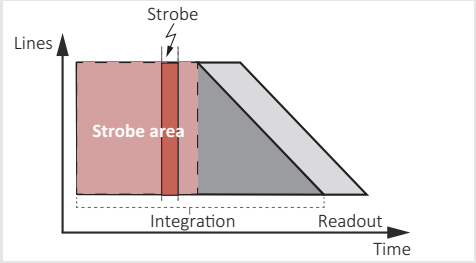
Property	Rolling shutter	Global reset shutter
Line readout		
Line exposure start	Deferred from line to line	Common for all lines
Line exposure time	Common for all lines	Increases from line to line
Image acquisition of moved objects		
Image brightness	Constant over the image	Varying over the image
Moving objects	Distorted shape	Shape without distortion
Typical application	Static objects	Moving objects
Compensation	Use an additional mechanical or use a strobe light:	
		

Table 60: Shutter types and effects

Operating systems and bandwidth

If the camera data output exceeds the bandwidth supported by the host computer, images may be corrupted. This section gives some background information to enable proper image transfer.

Sensor data output and camera data output

For cameras with an image buffer, the required bandwidth for image acquisition can be estimated for a given frame rate, pixel format, and resolution by over-the thumb calculations. Alvium cameras do not have an image buffer.

Figure 62 shows the bandwidth for a higher (1) and a lower (2) value for `DeviceLinkThroughputLimit`.

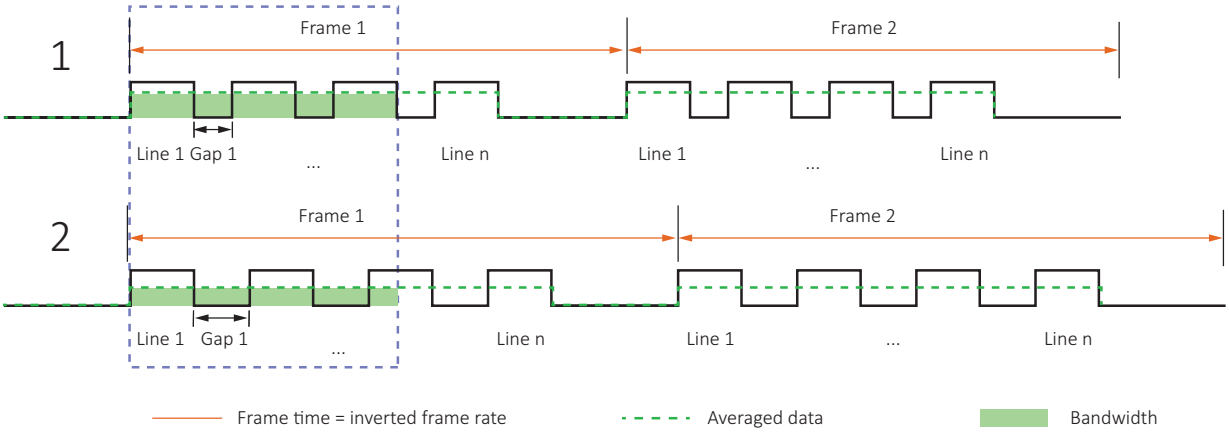


Figure 62: Sensor data output and camera data output

- Cameras **without** an image buffer like Alvium: Data is averaged over the line time.
- Cameras **with** an image buffer: Data rate is averaged over the frame time.
- Using `DeviceLinkThroughputLimit`: Reduced the maximum line data rate.

`DeviceLinkThroughputLimit` controls the maximum bandwidth of the data streamed out by the camera. When the value for this feature is reduced, the gaps between the lines are increased. This reduces the frame rate and therefore the bandwidth.

Additionally, you may reduce the frame rate to reduce bandwidth.

Consider that **Vimba Viewer** does not gray out values that exceed the bandwidth supported by the host computer.

More information on DeviceLinkThroughputLimit

For more information on `DeviceLinkThroughputLimit`, see the Alvium Cameras Features Reference at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation.

Hardware and bandwidth

For a smooth data transfer of USB3 Vision cameras, the host computer must be equipped with a high-bandwidth USB controller. Hubs should support high bandwidths as well.

Suitable USB 3.0 accessories

See www.alliedvision.com/en/products/accessories for suitable USB 3.0 or 3.1 Gen 1 host controller cards and cables or contact your Allied Vision Sales representative.

Vimba settings

During freerun, Alvium cameras do not automatically adapt the frame rate to the USB controller's limits. If the data rate is too high for your USB controller, it receives corrupted frames. The image transfer status in **Vimba Viewer** is signaled as **Running**. However, the corrupted frames are not displayed.

For Linux

To ensure compatibility with older Linux versions, the default value of `MaxTransferSize` in the **Vimba USBTL** (USB Transport Layer) is not very high.

To optimize the performance, adjust the value of the VimbaUSBTL.xml file:

1. In the Vimba program folder, open VimbaUSBTL.
2. Depending on your system, the XML file is located in, for example, Bin/x86_64bit/VimbaUSBTL.xml.
3. Open the XML file and find `MaxTransferSize`.
4. Per default, the value is commented out. Delete the XML comments to activate the value.

Replace the **Vimba** default value (32768) for **Linux** by the default value (262144) for **Windows**.

Performance on reference systems

We have tested available frame rates on real systems, using an embedded board and a desktop PC. Cameras were operated in `AquisitionMode` = *`Continuous`*, frame rates were measured using **Vimba Viewer**.

Hardware and software

Camera	Specification
Model	Alvium 1800 U-500c
Firmware version	1.0.25857

Table 61: Camera model and firmware

System component	Linux desktop system	Linux embedded system
Mainboard	Dell Precision T5600	NVIDIA Jetson TX2
CPU	Intel Xeon E5-2609 0 (4 cores)	ARMv8 (2x rev 0, 4x rev 3, 4 cores)
CPU frequency	2.40 GHz	2.0 GHz
RAM	8 GB	8 GB
Graphics controller	NVIDIA Quadro NVS 295	On-board
USB controller	ExSys EX-11092-2 (upper PCIe port)	On-board
Operating system	Ubuntu 18.04 64-bit, Kernel 4.15	Ubuntu 16.04 64-bit, Kernel 4.4

Table 62: Host computer hardware and operating system

Operating system and feature values

Feature	Linux desktop system	Linux embedded system
DeviceLinkThroughputLimit[1]	400000000 (400 MBps)	450000000 (450 MBps)
MaxTransferSize[2]	262144	
MaxTransferCount[2]	31 (default)	
[1]Camera feature [2]VimbaUSBTL.xml		

Table 63: Operating system and feature values

Frame rates and CPU payload

Property	Linux desktop system	Linux embedded system
Pixel format	RGB8	
Image size	2592 × 1944	
Frame rate	25.7 fps	28.6 fps
CPU payload	30% (4 cores)	50% (4 cores)

Table 64: CPU payload for RGB8

Property	Linux desktop system	Linux embedded system
Pixel format	Mono8	
Image size	2592 × 1944	
Frame rate	67.5 fps	67.5 fps
CPU payload	35% (4 cores)	55% (4 cores)

Table 65: CPU payload for Mono8

Dividing bandwidth between devices on a common USB 3.0 or 3.1 Gen 1 bus

Ideal setup for two cameras

Preconditions

- Control traffic is ignored.
- The possibility of the host being busy with other tasks is ignored.
- Cameras share 100 percent bus bandwidth.
- Cameras need 100 percent bus bandwidth in total.
- Cameras stream in the same way because they are the same model and have identical settings.
- No other device is connected.

Result

- Bandwidth is divided by two, cameras get assigned 50 percent bandwidth each.
  For three cameras, the bandwidth is 33.3 percent each.
- If one camera sends no data, the other camera will be assigned 100 percent bandwidth. To always assign 50 percent to both cameras, they have to be controlled to use no more than 50 percent bandwidth each.
- If the computer cannot process the images received from a camera, images are corrupted.

Best practice for bandwidth management

- To assign maximum bandwidth to a camera, make sure your camera is the only device on the bus.
- Avoid devices, such as a monitor or a mouse, sharing bandwidth with the USB camera connected to the same bus.
- For maximum bandwidth, use a current version host controller card.
  See the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.
- USB3 Vision devices use bulk transfer. Avoid using other transfer modes.
- Control bandwidth by assigning the desired amount to the separate cameras.

Cascading hubs divide bandwidth

The following example applies to standard behavior without individual settings. The graphics show bandwidth distribution on a common bus. Three cameras try to use full bandwidth at the same time. If one camera is inactive, the host will provide its share to the others until this camera sends data again.

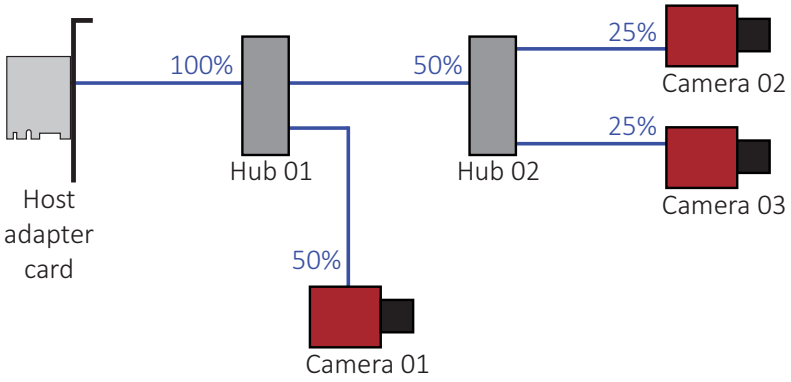


Figure 63: Bandwidth assignment for cascading hubs

Troubleshooting common issues

This section is about unexpected events with the operation of Alvium USB cameras. The events are ordered from general to detail:

- Camera recognition
- Unexpected events
- Performance
- Radio signal interference

Each entry consists of:

- Observed unwanted event, numbered for easier handling
- Short description of the solution
- Step-by-step instructions to resolve the issue.

Hardware installation

For background information, see Installing the camera on page 100.

Camera recognition

How can I make the computer and Vimba Viewer recognize the camera?

1. Check if the **hardware** supports your USB camera.

See the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Windows only

2. Check if your computer has an appropriate **USB 3.0 or 3.1 Gen 1 host controller driver** installed.

Windows 8 and later OS provide a USB 3.0 or 3.1 Gen 1 host controller driver. On a properly installed OS, no problems should occur.

Windows 7 and earlier OS do not provide a USB 3.0 or 3.1 Gen 1 host controller driver.
To install the host controller card:

1. Download the manufacturer USB 3.0 or 3.1 Gen 1 host controller driver. Install the driver on your computer.

Result: The installed driver enables the host controller.

Windows only

3. Check if the **USB3 Vision device driver** is properly installed and assigned to the camera.

Follow the instructions in Installing the host adapter and Vimba on page 110.

4. The camera, **connected to a USB 3.0 or 3.1 Gen 1 hub**, is not recognized anymore. Check if the USB 3.0 or 3.1 Gen 1 hub has crashed.

   1. Disconnect the USB and power supply cable from the hub.
   2. Reconnect both.

   Result: The camera is recognized again.

5. The camera, **connected directly to the computer**, is not recognized anymore. Check if a hub included in the **USB host controller** has crashed.

   1. In the **Device Manager**, deactivate the host controller.
      For **Windows**, see Installing the camera driver with Windows tools on page 112.
   2. Reactivate the host controller.

   Result: The camera is recognized again.

Unexpected events

How do I get the camera back to normal operation?

1. Check if an error is shown by the **camera** Status LED.

   If: The status LED signals four short flashes followed by another sequence.
   Then: Restart the camera.
   If: If the status LED again signals 4 flashes.
   Then: Please contact support@alliedvision.com.

2. Check if **power cables**, such as cables with a high current in the environmental setup, **harmfully interfere with camera cables**.

   If: Any camera cable crosses or goes parallel with a power cable.
   Then: Separate camera cables from power cables.

3. Make sure the **camera is intact**.
   For this, exclude issues of the cable or the connected computer:

   1. Connect the camera with a **different cable** to a **different computer**.
   If: The camera works properly.
   Then: The camera is intact, but your previous computer or cable has a defect. Continue with 2.
   If: The camera does not work properly.
   Then: Most likely, the camera has a defect. Please contact Allied Vision support.
   2. Connect the camera with the **previous cable** to the **different computer**.
   If: The camera works properly.
   Then: Replace the cable.
   3. Connect the camera with the **replaced cable** to the **previous computer**.
   If: The camera does not work properly.
   Then: Check the computer to fix the issue.

4. **Why does the camera not transfer images after restart?**
   This may happen if the value for `DeviceLinkThroughputLimit` is increased above the bandwidth supported by the host system.

   Check if sufficient bandwidth is assigned to the camera. See Operating systems and bandwidth on page 136.

Performance

How can I improve camera performance?

1. Check if the **hardware** sufficiently supports your USB camera.

   See the Alvium USB Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

2. Check if the **camera shares the bus with other devices** reducing the available bandwidth.

   Connect the camera to an individual bus, not shared by other devices.
   For more information, see Dividing bandwidth between devices on a common USB 3.0 or 3.1 Gen 1 bus on page 140.

3. Check if the **camera is connected to cascading hubs**, reducing the available bandwidth.

   Attach devices directly to a separate USB 3.0 or 3.1 Gen 1 bus. If you want cameras to share a common bus, use only a single hub to attach devices. For more information, see Dividing bandwidth between devices on a common USB 3.0 or 3.1 Gen 1 bus on page 140.

4. Check if all your USB **accessories support USB 3.0 or 3.1 Gen 1**.

   For recommended USB accessories, see the Alvium Cameras Accessory Guide www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

Radio signal interference

How can I avoid radio signal interference from wireless devices?

Ensure camera installation complies with **Electromagnetic Compatibility**.

Wireless devices and USB 3.0 or 3.1 Gen 1 commonly use 2.4 GHz frequency (WLAN includes 2.4, 3.6, and 4.9 GHz).

Even USB 3.0 and 3.1 Gen 1 cables can interfere harmfully with other electromagnetic devices. For example, despite shielding, a USB 3.0 or 3.1 Gen 1 cable can interfere with a wireless mouse. Tests have shown an increase of the noise floor up to 20 dB for the affected devices.

- To enable maximum bandwidth, 2.4 GHz radio frequencies must be avoided; therefore, use **maximum shielded cables only**.
- Keep **maximum distance** between your Alvium USB camera setup and interfering devices.
- Use **high-gain antennas** to reduce power of the radio signals.

For tested USB accessories, see the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-usb-documentation under Additional documents.

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