



MIPI CSI-2 CAMERAS

Alvium CSI-2 Cameras User Guide

V2.7.1

FW 00.08.00.6727174b



Quick links

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- [Contact us on page 17](#)
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Read before use

EN - English

Safety

Before using the camera, read these safety instructions. Observe the warnings at all times. Use the camera only as stated in the [Intended use](#) on page 37.



CAUTION

Risk of burns

A camera in operation can reach temperature levels which could cause burns.



CAUTION

Injury by falling cameras or lenses

A falling camera or lens can cause injury.



CAUTION

Risk of cuts by sharp edges of lens mounts

The threads of the lens mount can have sharp edges.

Intended use

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

Cameras without closed housings

Cameras without housing or with incomplete housing must be shielded against EMC emission by professionals according to local EMC provisions.

DA - Dansk

Sikkerhed

Læs sikkerhedsanvisningerne, før kameraet bruges. Overhold alle advarsler. Brug kun kameraet som anført i [Intended use](#) på side 37.



FORSIGTIG

Forbrændingsfare

Når kameraet bruges, kan det blive meget varmt og forårsage forbrændinger.



FORSIGTIG

Kvæstelser, hvis kameraet eller linser falder ned

Falder kameraet eller linsen ned, kan dette forårsage kvæstelser.



FORSIGTIG

Fare for snitsår på linsemodulets skarpe kanter

Linsemodulets gevind kan have skarpe kanter.

Tilsigtedt brug

Allied Vision produktets tilsigtede brug er en indbygning i et visionssystem, udført af fagfolk. Alle Allied Vision produkter sælges i B2B.

Kameraer uden lukket hus

Kameraer uden hus eller uden komplet hus skal beskyttes mod EMC emissioner iht. lokale EMC bestemmelser.

DE - Deutsch

Sicherheit

Bevor Sie die Kamera benutzen, lesen Sie diese Sicherheitshinweise. Beachten Sie diese Hinweise immer. Verwenden Sie die Kamera nur wie beschrieben in [Intended use](#) auf Seite 37.



VORSICHT

Gefahr von Verbrennungen

Im Betrieb kann die Kamera Temperaturen erreichen, die zu Verbrennungen führen.



VORSICHT

Verletzung durch fallende Kameras oder Objektive

Eine fallende Kamera oder ein fallendes Objektiv kann Verletzungen verursachen.



VORSICHT

Schnitte durch scharfkantige Objektivgewinde

Objektivgewinde können scharfe Kanten haben.

Bestimmungsgemäßer Gebrauch

Allied Vision Produkte sind bestimmt für die Integration in Bildverarbeitungssysteme durch Fachpersonal. Alle Allied Vision Produkte werden in einer B2B-Umgebung verkauft.

Kameras ohne geschlossenes Gehäuse

Für Kameras ohne Gehäuse oder mit unvollständigem Gehäuse muss die Abschirmung gegen EMV-Emissionen gemäß den örtlichen EMV-Bestimmungen durchgeführt werden.

ES - Español

Seguridad

Antes de utilizar la cámara lea estas instrucciones de seguridad. Observe las advertencias en todo momento. Utilice la cámara solo tal y como se estipula en el [Intended use](#) en la página 37.



ATENCIÓN

Riesgo de quemaduras

Una cámara en funcionamiento puede alcanzar temperaturas que podrían provocar quemaduras.



ATENCIÓN

Lesiones en caso de que las cámaras o las lentes se caigan

Si una cámara o una lente se cae puede provocar lesiones.



ATENCIÓN

Riesgo de cortes debido a los bordes afilados del objetivo

Las roscas de los objetivos pueden tener bordes afilados.

Uso previsto

El uso previsto del producto Allied Vision es la integración en el sistema de visión por parte de profesionales. Todos los productos Allied Vision se venden dentro de una relación B2B.

Cámaras sin carcasa cerrada

Las cámaras sin carcasa o con una carcasa incompleta deben protegerse contra las emisiones CEM por parte de profesionales de acuerdo con las disposiciones locales sobre la CEM.

FI - Suomi

Turvallisuus

Lue nämä turvallisuusohjeet ennen kameran käyttöä. Noudata varoituksia joka hetki. Käytä kameraa ainoastaan kohdassa [Intended use](#) sivulla 37 kuvatulla tavalla.



HUOMIO

Palovammojen vaara

Käytössä olevan kameran saavuttamat lämpötilatasot voivat aiheuttaa palovammoja.



HUOMIO

Putoavien kameroiden tai linssien aiheuttamat vammat

Putoava kamera tai linssi voi aiheuttaa vammoja.



HUOMIO

Linssien kiinnikkeiden terävien reunojen aiheuttamien viiltovammojen vaara

Linssin kiinnikkeiden kierteiden reunat voivat olla teräviä.

Käyttötarkoitus

Allied Vision-tuotteen käyttötarkoitus on integrointi kuvajärjestelmiin ammattilaisten toimesta. Kaikki Allied Vision-tuotteet myydään B2B-ympäristössä.

Kamerat, joissa ei ole suljettuja kotelointeja

Ammattilaisten on suojahtava kamerat, joissa ei ole koteloa tai joiden kotelon epätäydellinen, EMC-päästöiltä paikallisten EMC-määräysten mukaisesti.

FR - Français

Sécurité

Veuillez lire ces consignes de sécurité avant d'utiliser la caméra. Respectez continuellement les avertissements. Utilisez la caméra uniquement comme indiqué sous [Intended use](#), page 37.



ATTENTION

Risque de brûlures

Une caméra en service peut atteindre des niveaux de température susceptibles d'entraîner des brûlures.



ATTENTION

Blessures en cas de chute de caméras ou d'objectifs

La chute d'une caméra ou d'un objectif peut entraîner des blessures.



ATTENTION

Risque de coupures sur les bords tranchants des montures d'objectif

Les filetages des montures d'objectif peuvent présenter des bords tranchants.

Utilisation prévue

L'utilisation prévue du produit Allied Vision est son intégration dans des systèmes de vision par le soin de professionnels. Tout produit Allied Vision est vendu dans un cadre B2B.

Caméras sans boîtier fermé

Les caméras sans boîtier fermé ou à boîtier incomplet doivent être blindées contre les émissions CEM par le soin de professionnels conformément aux dispositions CEM locales.

IT - Italiano

Sicurezza

Leggere queste istruzioni per la sicurezza prima di utilizzare la telecamera.
Osservare sempre tutte le avvertenze. Utilizzare la telecamera come descritto alla sezione [Intended use](#) a pagina 37.



ATTENZIONE

Pericolo di ustioni

Durante il funzionamento una telecamera può raggiungere temperature elevate che possono essere causa di ustioni.



ATTENZIONE

Lesioni dovute alla caduta di telecamere o lenti

La caduta di una telecamera o di una lente può causare delle lesioni.



ATTENZIONE

Pericolo di tagliarsi sui bordi affilati degli attacchi della lente

I bordi della filettatura dell'attacco della lente possono essere affilati.

Uso previsto

Il prodotto Allied Vision è concepito per essere integrato in sistemi di monitoraggio in campo professionale. Tutti i prodotti Allied Vision sono venduti in uno scenario B2B.

Telecamere senza custodia chiusa

Le telecamere senza custodia o con una custodia incompleta devono essere protette dalle emissioni elettromagnetiche in ambienti professionali in conformità con le norme CEM nazionali.

JA – 日本語

安全性

本カメラを使用する前に、この安全の手引きをお読みください。常に、警告事項を守ってください。必ず、Intended use 37 ページの通りに、本カメラを使用してください。



注意

やけどの危険性

作動中のカメラは、やけどを引き起こす温度まで熱くなる恐れがあります。



注意

カメラまたはレンズの落下によるけが

カメラまたはレンズが落下すると、けがをする恐れがあります。



注意

レンズマウントの鋭利な端部で切り傷の危険性

レンズマウントのギザギザの部分が鋭利である可能性があります。

用途

Allied Vision製品は、専門家が視覚装置に統合することを意図したものです。すべてのAllied Vision製品は、企業間取り引き用に販売されています。

ハウジングで閉じられていないカメラ

ハウジングのないカメラまたはハウジングが不完全なカメラは、現地の電磁両立性 (EMC) 規定に従い、専門家によって、EMCエミッഷンから保護される必要があります。

NL - Nederlands

Veiligheid

Lees deze veiligheidsinstructies voordat u de camera gaat gebruiken. Neem deze waarschuwingen altijd in acht. Gebruik de camera uitsluitend, zoals aangegeven in het [Intended use](#) op pagina 37.



VOORZICHTIG

Risico van verbranding

Een camera die gebruikt wordt, kan temperatuurwaarden bereiken die brandwonden kunnen veroorzaken.



VOORZICHTIG

Letsel door vallende camera's of lenzen

Een vallende camera of lens kan letsel veroorzaken.



VOORZICHTIG

Risico van snijwonden door scherpe randen van lensbevestigingen

Het Schroefdraad van de lensbevestiging kan scherpe randen hebben.

Beoogd gebruik

Het beoogde gebruik van het Allied Vision-product is de integratie in optische systemen door professionals. Alle Allied Vision-producten worden verkocht in de B2B-markt.

Camera's zonder gesloten behuizing

Camera's zonder behuizing of met een onvolledige behuizing moeten door professionals worden beschermd tegen EMC-straling door EMC-beschermingen ter plaatse.

NO - Norsk

Sikkerhet

Les disse sikkerhetsinstruksene før du bruker kameraet. Følg advarslene til en hvert tid. Bruk kun kameraet i samsvar med [Intended use](#) på side 37.



FORSIKTIG

Risiko for brannskader

Et kamera i bruk kan nå temperaturnivåer som kan forårsake brannskader.



FORSIKTIG

Skade ved fallende kameraer eller linser

Et fallende kamera eller en fallende linse kan forårsake skade.



FORSIKTIG

Risiko for kutt fra skarpe kanter på linsefester

Sporene på linsefestet kan ha skarpe kanter.

Tiltenkt bruk

Den tiltenkte bruken av Allied Vision-produktet er integrering i visjonssystemer av profesjonelle. Alle Allied Vision-produkter selges i en forretning til forretning-situasjon.

Kameraer uten lukkede kamerahus

Kameraer uten kamerahus eller med ufullstendige kamerahus må beskyttes mot EMC-utslipps av fagfolk i henhold til lokale EMC-bestemmelser.

SV - Svenska

Säkerhet

Läs igenom säkerhetsinstruktionerna innan du använder kameran. Var hela tiden särskilt uppmärksam på varningarna. Använd enbart kameran på det sätt som anges i [Intended use](#) på sida 37.



VARNING

Risk för brännskada

En kamera i drift kan komma upp i temperaturer som kan orsaka brännskador.



VARNING

Risk för skador från fallande kameror eller objektiv

Fallande kameror eller objektiv kan försaka skador.



VARNING

Risk för skärsår från vassa kanter på objektivfattningar

Objektivets gängor kan ha vassa kanter.

Avsedd användning

Den avsedda användningen av Allied Vision-produkter är integrering i visionssystem av fackmän. Samtliga Allied Vision-produkter säljs i en B2B-miljö.

Kameror utan slutna kamerahus

Kameror utan eller med ofullständiga kamerahus måste skyddas mot elektromagnetiska emissioner av fackmän enligt lokala bestämmelser för elektromagnetiska emissioner.

ZH - 简体中文版

安全需知

使用本相机前, 请阅读本安全说明书。请务必遵守相关警告 和 [Intended use](#) 于第 37 页。



注意事项

烫伤风险

相机操作过程中温度可能上升并导致烫伤风险。



注意事项

相机或者镜头跌落造成伤害

相机或者镜头可能会跌落并造成伤害。



注意事项

镜头接口的锐利边缘划伤风险

镜头接口螺纹边缘可能较为锐利。

预期用途

Allied Vision 产品的预期用途是由专业人士整合到视觉系统中。所有 Allied Vision 的产品均通过 B2B 渠道销售。

无封闭式外壳相机

使用不带外壳或外壳不完整的相机时, 必须由专业人员根据当地的 EMC 规定, 对其进行 EMC 屏蔽。

Alvium CSI-2 cameras at a glance



Get an overview of Alvium CSI-2 camera documentation:

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Notes



Read this document carefully

Learn to avoid damage to your Alvium CSI-2 camera and use it in the most safe and efficient way.



NOTICE

Damage to camera and embedded hardware by improper handling

Setup and operation for Alvium CSI-2 cameras in embedded systems is different than for cameras in PC-based systems. Components can easily be damaged.

- If you are unfamiliar with embedded systems, be extremely careful.
- Follow the safety notes.
- Follow the instructions in [Installing the hardware](#) on page 184.

Consider for Alvium CSI-2 cameras

Please read the following to better understand your Alvium CSI-2 camera and to setup your application smoothly:

- [Direct Register Access, Video4Linux Access, GenICam for CSI-2 Access: Access modes](#) on page 179
- [Exposure time and frame rates](#) on page 52
- Alvium CSI-2 characteristics: [Performance](#) on page 217
- [User sets](#) on page 164, including supported features, also for triggering
- [Bare board cameras](#) on page 185

Shipping contents

- Alvium CSI-2 camera
- Download Instructions for First Camera Operation document

What else do you need?

This is a selection of helpful downloads:

	Download	Link
Controls and features		
	Alvium CSI-2 Register Controls Reference	www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation
	Alvium Features Reference	www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation
Applications		
	Application notes	www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation
Software downloads		
	Driver for Alvium CSI-2 cameras, code examples, and more	www.alliedvision.com/en/products/software/embedded-software-and-drivers
	Vimba Suite for Windows, Linux, and Linux/ARM, including Vimba SDK , Vimba Viewer , and Vimba Driver Installer for Windows	www.alliedvision.com/software
Firmware update		
	Firmware downloads	www.alliedvision.com/en/support/firmware-downloads
	Vimba Suite for Windows, Linux, and Linux/ARM, including Vimba Firmware Updater	www.alliedvision.com/software
Accessories		
	Accessories , such as interface cables and cards, power and I/O cables, power supplies, lenses, and tripod adapters	www.alliedvision.com/en/support/accessory-documentation
	Alvium Accessory Guide	www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation
STEP files		
	STEP files	Find downloads for your Alvium CSI-2 model at www.alliedvision.com/en/camera-selector

Table 1: Downloads for Alvium CSI-2 cameras

Contact us

Website, email

General

www.alliedvision.com/en/contact
info@alliedvision.com

Distribution partners

www.alliedvision.com/en/avt-locations/avt-distributors

Support

www.alliedvision.com/en/support
www.alliedvision.com/en/about-us/contact-us/technical-support-repair-/rma

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Document history and conventions



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Document history

Version	Date	Remarks
V2.7.1	2022-Apr-12	<ul style="list-style-type: none"> Added notes that Alvium 1800 C-052 and 1800 C-291 currently do not support DPC and FPNC to Image data flow on page 214. Applied editorial changes.
V2.7.0	2022-Mar-17	<p>Firmware version: 00.08.00.6727174b</p> <ul style="list-style-type: none"> Added contents for GenICam for CSI-2 Access at various places, including User sets on page 164. Renamed Alvium 1800 C-030m VSWIR to Alvium 1800 C-030 VSWIR, and Alvium 1800 C-130m VSWIR correspondingly. Updated conditions for Operation for maximum frame rates on page 54 and renamed Operation for medium power consumption on page 56. Updated exposure time ranges by model in Specifications on page 46. Added note about frame rates in triggered mode for Alvium 1500 C-120m/c on page 61. Added Alvium 1800 C-052m/c, 1800 C-291m/c, and 1800 C-500m/c to Alvium 1800 C model specifications on page 77. Added note for non-standard S-Mount hardware options in Sensor position accuracy on page 162. Updated the flow chart and added descriptions for GenICam for CSI-2 Access in Access modes on page 179. Added information on Ignored triggers on page 208. Updated workflow in Image data flow on page 214. Updated workflow in Value changes by control interdependencies on page 219. Applied editorial changes.
V2.6.2	2021-Dec-17	<ul style="list-style-type: none"> Removed icon for compliance with UKCA in Compliance notifications on page 36. (The icon was previously added by mistake.) Removed information on Digital Binning because it is not supported by the current camera driver.
V2.6.1	2021-Nov-23	<ul style="list-style-type: none"> Updated links to accessories. Applied minor editorial changes.

Table 2: Document history (sheet 1 of 5)

Version	Date	Remarks
V2.6.0	2021-Nov-03	<p>Firmware version: 00.07.00.81db3896</p> <ul style="list-style-type: none"> Added 1800 C-030m VSWIR and 1800 C-130m VSWIR models in Specifications on page 46 and in Lenses: Focal length vs. field of view on page 165. Added Digital Binning on page 50. Updated the minimum temperature value for operation and storage from +5 °C to -20 °C. Updated workflow in Image data flow on page 214 for new Digital Binning. Updated diagram in Value changes by control interdependencies on page 219. Removed Limitations for available resolutions from Troubleshooting. Applied minor editorial changes.
V2.5.1	2021-Aug-12	<ul style="list-style-type: none"> Added icon for compliance with UKCA in Compliance notifications on page 36. Applied minor editorial changes.
V2.5.0	2021-Aug-04	<p>Firmware version: 00.06.00.35992</p> <ul style="list-style-type: none"> Added 1500 C-120 to Frame rate jitter on page 218 and Trigger delay with 1500 C-120 cameras on page 208. Added 1500 C-501m/c NIR model in Specifications on page 46. Added 1800 C-511m/c, 1800 C-811m/c, 1800 C-1242m/c, 1800 C-1620m/c, and 1800 C-2040m/c models in Specifications on page 46 and in Lenses: Focal length vs. field of view on page 165. Updated tables with ROI frame rates, including bandwidth per lane in Specifications on page 46. Reduced contents in Access modes on page 179 (previous title: V4L2 controls vs. GenICam features). Applied minor editorial changes.

Table 2: Document history (sheet 2 of 5)

Version	Date	Remarks
V2.4.0	2021-Apr-08	<p>Firmware version: 00.04.00.34658</p> <ul style="list-style-type: none"> Added RAW pixel formats for 10-bit and 12-bit Mono in Specifications on page 46. Added 1800 C-2460m/c models in Specifications on page 46. Updated mass values in Dimensions and mass on page 154. Updated descriptions in Access modes on page 179. Updated instructions for Mounting the camera on page 190. Updated graphic in Value changes by control interdependencies on page 219. Applied minor editorial changes.
V2.3.0	2020-Dec-15	<p>Firmware version: 00.03.00.31919</p> <ul style="list-style-type: none"> Updated ROI frame rates and values for minimum and maximum exposure time in Specifications on page 46. Added content about Pixel format default and naming on page 51. Added values for White balance default on page 153. Updated drawings and dimension values for bare board cameras in Technical drawings on page 154. Updated tables in Access modes on page 179. Added information about Serial numbers of Alvium® chips and bare board cameras on page 186. Added Non-isolated, programmable GPIOs on page 201. Added Triggering on page 204. In Image data flow on page 214, added FPNC support for all models, except for Alvium 1800 C-2050. Added notes about frame rates for rolling shutter cameras run in triggered mode. Added content about Limitations for available resolutions on page 201. Applied minor editorial changes.

Table 2: Document history (sheet 3 of 5)

Version	Date	Remarks
V2.2.0	2020-Jul-22	<p>Firmware version: 00.02.00.29974</p> <ul style="list-style-type: none"> Added Alvium 1800 C-240m/c, 1800 C-508m/c, and 1800 C-1240m/c models. Updated ROI frame rates and pixel formats in Specifications on page 46. Updated Type for Alvium 1500 C-210m/c on page 65. Added QE and spectral response to Alvium 1800 C-2050m/c on page 145. Extended information in Shock and vibration on page 47. Updated spectral response graphic in IR cut filter on page 161. Added Sensor position accuracy on page 162. Added Read before use on page 2. Corrected minor errors.
V2.1.3	2020-Mar-12	<ul style="list-style-type: none"> Corrected maximum exposure times. DPC: Removed specifications into an application note. FPNC: Updated note in Image data flow on page 214.
V2.1.2	2020-Mar-04	Applied minor changes.
V2.1.1	2020-Feb-28	Updated content for shutter types.
V2.1.0	2020-Feb-20	<p>Firmware version: 00.01.03.29478</p> <ul style="list-style-type: none"> Added Alvium 1800 C-319m/c, 1800 C-507m/c, 1800 C-1236m/c, and 1800 C-2050m/c models. Added specifications for DPC. Updated description for sensor shutter types.

Table 2: Document history (sheet 4 of 5)

Version	Date	Remarks
V2.0.0	2020-Jan-06	<p>Firmware version: 00.01.02.28100</p> <ul style="list-style-type: none"> Added Alvium 1500 C-210m/c, 1800 C-040m/c, and 1800 C-158m/c models. Added descriptions for Hue and Saturation in Access modes on page 179. Added Dark current compensation on page 221. Updated technical drawings and dimensions for bare board cameras in Dimensions and mass on page 154. Updated values for power consumption in Specifications on page 46. Restructured contents in Performance on page 217. Applied editorial changes.
V1.1.0	2019-Jul-01	<ul style="list-style-type: none"> Removed separate bit depth for maximum frame rates in Specifications on page 46. Corrected ADC bit depth for Alvium 1500 C-500m/c in Specifications on page 46 and for all models in Image data flow on page 214.
V1.0.0	2019-Jun-04	<p>Firmware version: 00.01.00.26405</p> <p>Release version</p>

Table 2: Document history (sheet 5 of 5)

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 and register names	Names for GenICam features or for camera control registers
Feature and register options	Options for GenICam features or for camera control registers

Table 3: Typographic styles (sheet 1 of 2) (sheet 1 of 2)

Style	Function
<i>Input commands</i>	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 (sheet 2 of 2) (sheet 2 of 2)

Symbols and notes



CAUTION

Risk of burns

Precautions are described



CAUTION

Injury by falling cameras or lenses

Precautions are described



CAUTION

Risk of cuts by sharp edges of lens mounts

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.

GenICam for CSI-2 Access

Selected Alvium 1800 C models support **GenICam for CSI-2 Access**, see [Access modes](#) on page 179. Data in this document applies to all Alvium CSI-2 cameras if not otherwise stated. Data applying to **GenICam for CSI-2 Access** is marked as follows:



Paragraphs and graphics

A gray box with this icon signals that contents apply to **GenICam for CSI-2 Access** only.



Specification headlines

This icon signals that camera models support **GenICam for CSI-2 Access** (in addition to the other access modes).

Tables

Red table border lines signal that data applies to **GenICam for CSI-2 Access** only:

Feature	Specification
Feature 1	This specification applies to all access modes .
Feature 2	This specification applies to GenICam for CSI-2 Access only.

Naming and terms

Controls and features

Most functionalities for Alvium CSI-2 cameras are available as controls, using **Direct Register Access** or **Video4Linux Access**. Equivalent functionalities are available as features, using **GenICam for CSI-2 Access**, adding some more functionalities. **Gain Auto** in the Alvium CSI-2 Register Controls Reference equals **GainAuto** in the Alvium Features Reference.

In this user guide, data relating to features applies to the corresponding controls as well, unless otherwise stated. Therefore, the terms **Control** and **Feature** are used equivalently in this user guide.

ROI and cropping

Cropping is a functionality similar to ROI (region of interest). By using a reduced area of the available sensor, the payload is reduced, increasing frame rates.

With **GenICam for CSI-2 Access**, features, such as `Width`, `Height`, `OffsetX`, and `OffsetY` are used, according to the GenICam SFNC (Standard Features Naming Convention).

With the **other Access modes**, the corresponding controls are used.



Descriptions of controls and features

For the Alvium CSI-2 Register Controls Reference and the Alvium Features Reference, see www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

Camera model naming

Alvium cameras are named to identify model properties.

For example, **Alvium 1500 C-500c** is composed of:

	Alvium	1500	C	500	c
Content element	Camera series	Camera series detail	Interface	Resolution ¹	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

¹Model resolutions may slightly deviate from model naming.

Table 4: Camera model naming

Terms and acronyms

Term or acronym	Description	Reference
adapter board	Printed circuit board (PCB) that connects embedded boards, cameras, and I/Os, dedicated to an individual embedded board	Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation .
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 155
CRA	Chief ray angle	Alvium 1500 C-050m/c on page 57

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

Term or acronym	Description	Reference
EMVA	European Machine Vision Association	www.emva.org
ERS	Electronic rolling shutter, see RS	Shutter types affecting image readout on page 223
ESD	Electrostatic discharge	ESD on page 40
FPC cable	(MIPI CSI-2 FPC cable) Flexible printed circuit cable, component that connects embedded boards and cameras via adapter board	Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation .
FPC connector	Hirose FH55-22S-0.5SH connector	www.hirose.com
FPNC	Fixed pattern noise correction	Image data flow on page 214
fps	Frames per second	Alvium 1500 C-050m/c on page 57
GND	Ground (power)	FPC connector pin assignment on page 199
Gbps	Gigabit per second	Alvium 1500 C-050m/c on page 57
GRRS	Global reset release shutter, see GRS	Shutter types affecting image readout on page 223
GRS	Global reset shutter, see GRRS	Shutter types affecting image readout on page 223
GS	Global shutter	Shutter types affecting image readout on page 223
H × V	Horizontal × Vertical (sensor resolution)	Alvium 1500 C-050m/c on page 57
PCB	Printed circuit board	Connecting FPC cable and FPC connectors on page 187
PCBA	Printed circuit board assembly	PCBAs on page 41
open housing	Camera housing that is open at the back side to be designed into an encompassing housing with other components	Open Housing C-Mount on page 159
QE	Quantum efficiency	Absolute QE on page 59
ROI	Region of interest	V4L2 controls and register controls on page 182
RS	Rolling shutter, see ERS	Shutter types affecting image readout on page 223
SFNC	Standard Features Naming Convention (GenICam)	www.emva.org
S-Mount	M12-Mount	Mounting and focusing S-Mount lenses on page 194

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

Compliance, safety, and intended use



This chapter includes:

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Intended use	37
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Compliance notifications



National regulations on disposal must be followed.

Bare board and open housing cameras

Bare board and open housing cameras are designed for integration and are delivered without closed 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-csi-2-documentation](http://www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation).

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 damaging 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

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Your safety

This section informs about issues related to your personal safety. Descriptions explain how to avoid hazards and operate Alvium CSI-2 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`, using Direct Register Access. 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 190. 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	-20° C to +85° C	See model Specifications on page 46.
Open housing ⁴	-20° C to +65° C		

¹See [Mounting the heat sink](#) on page 189.

²Output by `DeviceTemperature`, using Direct Register Access.

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 6: Operating temperature ranges for Alvium CSI-2 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.
- Reduce high ambient temperature. For example, in outdoor applications with direct sunlight, provide shading by an enclosure.

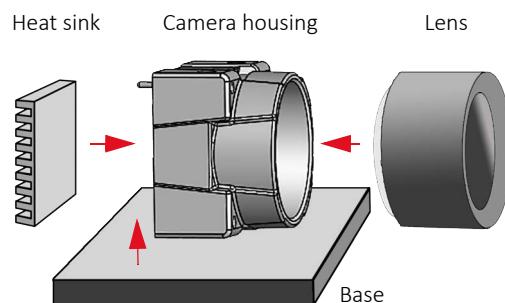


Figure 1: Setup to provide optimum heat dissipation



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-csi-2-documentation.

Camera mounting

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

- Mount the camera according to the instructions in [Mounting open housing cameras](#) on page 191.
- Ensure, shock and vibration do not exceed the specified range, see [Shock and vibration](#) on page 47.
- 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 at www.alliedvision.com/en/about-us/contact-us/technical-support-repair-/rma.

Product safety

To prevent material damage, read the following and understand how to safely handle and operate the camera.

Embedded systems

Setup and operation of Alvium CSI-2 cameras in embedded systems is different than for cameras in PC-based systems. Components can easily be damaged.

If you are unfamiliar with embedded systems, be extremely careful. Follow the instructions in [Installing the hardware](#) on page 184.

Supported embedded boards

We have tested that Alvium CSI-2 cameras can be operated properly with the referenced embedded boards. For information on using these components safely, please see the documentation provided by the manufacturers of the embedded boards.

Electrical connections

The MIPI CSI-2 standard does not specify electrical connections as extensively as the USB or GigE standard. Read specifications carefully.

Allied Vision accessories help to avoid damage to the camera and connected components. See the Alvium Cameras Accessory Guide for suitable accessories. See [Specifications](#) on page 46 and [Installing the hardware](#) on page 184.

Alvium CSI-2 cameras are not protected against damage caused by reverse polarity.

- For specifications, see [FPC connector pin assignment](#) on page 199.
- For instructions to avoid electronics damage, see [Connecting FPC cable and FPC connectors](#) on page 187.

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.

- Housing: use an ESD housing, including the camera, embedded board, adapter board, and MIPI CSI-2 FPC cable.

Cable connections

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

PCBAs

Alvium CSI-2 cameras enable access to PCBAs. Keep away from camera electronics to avoid damage.

Camera power

Operating cameras beyond the specified range damages cameras. Cameras are powered using the FPC connector at a maximum input of 5.5 VDC with maximum 1.5 A, using a limited power source (LPS), according to IEC 62368-1. The camera is not intended to be connected to a DC distribution network.

Only use power supplies that meet the insulation requirement according to PELV or SELV. For details, please refer to IEC 61140.

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.
- You may mount the camera electrically isolated.
- 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-csi-2-documentation.



FPC connectors

Hirose FH55-22S-0.5SH FPC connectors enable compact camera design.

The small-sized connectors are sensitive to mechanical stress and are specified for maximum 20 mating and unmating cycles. Especially if you are inexperienced with this connector, be very cautious. If the FPC connector is broken, the camera must be replaced. To install and operate cameras safely, read this section carefully.

Instructions in [Installing the hardware](#) on page 184 include helpful information to enable proper installation.

- Avoid stress to FPC connectors.
- Allow only the FPC cable to touch conductors.

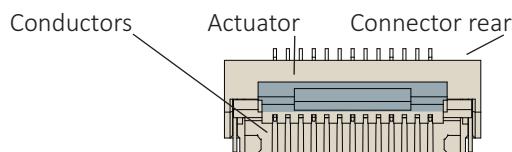


Figure 2: Hirose FH55-22S-0.5SH FPC connector



Additional information

For technical data and more instructions on the Hirose FH55-22S-0.5SH connector, see the manufacturer data sheet at www.hirose.com.

Handling the actuator

- Move the actuator only between 0 degrees (locked position) and 105 degrees (open position).
- Carefully flip the actuator at the middle with your finger nail, see [Connecting FPC cable and FPC connectors](#) on page 187.

MIPI CSI-2 FPC cables



Manufacturing FPC cables or embedded boards

If you want to design your own components to connect Alvium CSI-2 cameras to embedded boards, contact your Allied Vision Sales representative or visit www.alliedvision.com/en/about-us/contact-us/technical-support-repair-/rma.

FPC cable position

Short circuits of the FPC cable can damage the camera or connected hardware.

- Insert the FPC cable into the connector with cable guiding tabs matching the connector's side guides. See [Connecting FPC cable and FPC connectors](#) on page 187.
- Connect the camera and the embedded board (adapter) only as shown by the arrow printed on the FPC cable, see [Connecting FPC cable and FPC connectors](#) on page 187.

FPC cables and stress

Over-stressed FPC cables can damage the camera and connected hardware. When camera and embedded board are twisted against each other or pulled apart from each other with too much force, the FPC cable is over-stressed. Spring contacts of FPC connectors are worn out, causing short circuits and unreliable electrical connections.

- Insert the FPC cable into the FPC connector at 12 degrees to the PCB board surface. See [Connecting FPC cable and FPC connectors](#) on page 187.
- Allow only slight bending of the FPC cable (minimum bending radius: 10 mm).
- Provide strain relief to avoid short cuts and malfunctions.

No hot-plugging for MIPI CSI-2

Alvium CSI-2 cameras do not support hot-plugging. Hot-plugging can destroy the camera and connected hardware by high inrush current.

Disconnect power supplies before connecting FPC cables.

FPC cable signal quality

Noise and electromagnetic interference can disable camera functions.

- Avoid contact to metal surfaces, causing electromagnetic interference.
- Please use cables recommended by Allied Vision.

Handling bare board cameras

Bare board cameras are an electronic assembly without a protective housing. Therefore, they can easily be damaged.

- 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 190.
- 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 190.

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 45 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 CSI-2 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. When no lens is mounted, protect the sensor and filter by a dust cap.

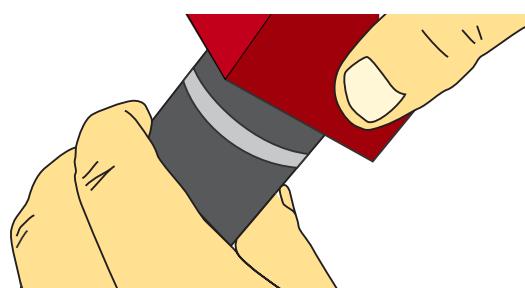
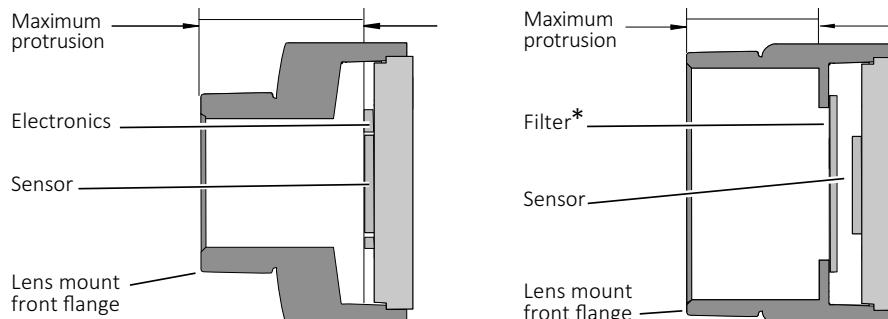


Figure 3: Holding the camera with the lens mount facing the ground

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 4](#) shows maximum protrusion. For details, see [Lens mounts and maximum protrusion](#) on page 160.



*Only color models are equipped with an IR cut filter

Figure 4: Maximum protrusion; S-Mount (left); CS-Mount and C-Mount (right)

For S-Mount lenses, read [Mounting and focusing S-Mount lenses](#) on page 194 to avoid damage to the sensor, electronics, and lens.

Mechanical components

Heat sinks

Heat sinks can be used to cool the camera for safety and to improve image quality. Adhere to the instructions 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 **cooling areas**, see [Mounting the heat sink](#) on page 189.

Specifications



This chapter includes:

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Applied standards



GenICam

GenICam provides a generic access for cameras and devices that is independent of the interface. This enables operating cameras with USB3 Vision, GigE Vision, or CoaXPress interfaces with a common software. With the CSI-2 transport layer for Alvium, MIPI CSI-2 is added.

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.

Selected Alvium 1800 C cameras comply to:

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

MIPI CSI-2

The MIPI (Mobile Industry Processor Interface) CSI (Camera Serial Interface)-2 standard describes a class of MIPI CSI-2 cameras for still image photography and video streaming. Generically, MIPI CSI-2 cameras are operated by Direct Register Access. Alvium CSI-2 cameras have a MIPI CSI-2 interface. They comply with:

- MIPI CSI-2 V1.1
- D-PHY V1.1.

V4L2

The current V4L2 framework is described at linuxtv.org. Allied Vision provides V4L2 drivers. You can download Allied Vision V4L2 drivers from www.alliedvision.com/en/products/software/embedded-software-and-drivers.

Shock and vibration

Alvium closed and open housing cameras were tested 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.

Cameras were inspected before and after the tests. All tests were passed successfully:

Condition	Passed
Mechanics	<ul style="list-style-type: none"> The camera housings showed no deformations. The connections between camera components had not come loose. The sensor position was within the specified tolerances of a new camera.
Camera behavior	Camera functionalities were not affected, no deviations occurred.
Image streaming	Images were streamed without errors.

Table 7: Conditions for passed tests

The conditions for cameras and lenses were the same for all tests. Solid aluminum tubes were used to represent real lenses:

Parameter	Value
Lens dummy length	38 mm
Lens dummy mass	70 g
Center of gravity (CoG) ¹	20 mm

¹For camera and lens dummy assemblies, measured from the lens mount front flange

Table 8: Conditions for lenses

IEC 60068-2-6: Sinusoidal vibration

Frequency	Acceleration	Displacement
10 Hz to 58.1 Hz	Not applicable	1.5 mm
58.1 Hz to 500 Hz	20 g	Not applicable

Table 9: Frequency, acceleration, and displacement for IEC 60068-6 tests

Parameter	Value
Axis	x, y, z
Sweep rate	1 oct/min
Sweep duration per axis [hh:mm:ss]	00:11:17
Number of sweeps	20

Table 10: Other parameters for IEC 60068-6 tests

IEC 60068-2-27: Shock

Parameter	Value
Axis	x, y, z
Acceleration	20 g
Number of shocks per axis	10
Duration per axis	11 ms
Waveform	Half sine

Table 11: Parameters for IEC 60068-2-27 tests

IEC 60068-2-64: Random vibration

Frequency	Acceleration
15 Hz to 500 Hz	$0.05 \text{ g}^2/\text{Hz}$

Table 12: Frequency and acceleration for IEC 60068-2-64 tests

Parameter	Value
Axis	x, y, z
Acceleration RMS (Sigma)	4.9 g
Acceleration peak (Sigma)	14.8 g
Duration per axis [hh:mm:ss]	00:30:00

Table 13: Other parameters for IEC 60068-64 tests

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.

Sony 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.

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.

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.

Pixel format default and naming



GenICam for CSI-2 Access

The **default pixel format** for Alvium CSI-2 cameras is RGB8 for color models and Mono8 for monochrome models.

Pixel formats are named according to the PFNC (Pixel Format Naming Convention), see [GenICam](#) on page 47.

Other access modes

The **default pixel format** for Alvium CSI-2 cameras is RGB888 (RGB3). Monochrome cameras are included to enable quick access on V4L2 where V4L2_PIX_FMT_UYVY is the default. For monochrome cameras, the 3 bytes for RGB are set to a common value, resulting in gray.

Pixel formats are named as extended MIPI CSI-2 definitions.

- [Video4Linux Access](#): According to V4L2 definitions.
- [Direct Register Access](#): Alvium CSI-2 cameras output pixel formats according to the MIPI CSI-2 standard.

Naming pattern	Examples
MIPI CSI-2 (FOURCC)	RAW8 (GREY) RGB888 (RGB3)

Table 14: Extended MIPI CSI-2 definitions for pixel format naming

Pixel formats for various standards

MIPI CSI-2	V4L2	V4L2 FOURCC	PFNC
YUV422 8-bit	V4L2_PIX_FMT_UYVY	UYVY	YCbCr422_8_CbYCrY
RGB888	V4L2_PIX_FMT_RGB24	RGB3	RGB8
RAW8	V4L2_PIX_FMT_GREY	GREY	Mono8
RAW10	V4L2_PIX_FMT_Y10	Y10	Mono10
RAW12	V4L2_PIX_FMT_Y12	Y12	Mono12

Table 15: Equivalent pixel formats in various standards



Availability of pixel formats

The availability of pixel formats depends on camera models and the abilities of the connected system.

Exposure time and frame rates

Achieved values deviating from specified values

Values stated in the model specifications show the maximum available on an ideal system, supporting a bandwidth of 1.051 Gbps per lane. Your individual setup may affect available values such as for:

- Minimum and maximum exposure times and increments
- Maximum frame rates, including ROI frame rates
- Image resolution steps.
- **Image resolution steps.** Depending on the available increments, some standard resolutions are not supported. For example, instead of $1,440 \times 900$ pixels for WXGA+, $1,440 \times 904$ pixels are available.
- **Minimum resolution.** Depending on the embedded board, minimum resolution may be greater than stated in tables. For example, instead of 16×16 pixels, the minimum resolution available may be 256×32 pixels.
- We recommend you to set ROI values before you set values for Exposure Time, because interdependencies between controls affect each other. See [Value changes by control interdependencies](#) on page 219.

CSI-2LaneCount and CSI-2ClockFrequency

Alvium cameras require higher bandwidths than supported by only one CSI-2 lane, especially with low CSI-2 clock frequencies. We recommend you to do extensive testing to find the best setup for maximum frame rates, regarding:

- [CSI-2LaneCount](#)
- [CSI-2 ClockFrequency \(CSI-2 Clock\)](#).

Dropped frames or a viewer issue?

Alvium CSI-2 cameras are designed for a maximum bandwidth that does not exceed board abilities. However, if your setup does not provide sufficient bandwidth, frames are dropped. Even if bandwidth is sufficient, embedded boards may not be able to display all images of an image stream. In this case, only the display is affected but no dropped frames occur.

Frame rates with ROI/Cropping

ROI and Cropping work similarly: While ROI is typically used for [GenICam for CSI-2 Access](#), Cropping is typically used for the **other access modes**. By using a reduced area of the available sensor, the payload is reduced, increasing frame rates. This user guide uses the term ROI.

The maximum frame rate which can be achieved depends on various values, such as bandwidth, pixel format, exposure time, and ROI. Calculation of maximum frame rates for different ROIs for Alvium CSI-2 cameras does not allow to give a formula. Data is calculated for [Operation for maximum frame rates](#) on page 54.



Readout modes to reduce the bandwidth

Selected Alvium CSI-2 camera models support various readout modes. This is stated in the tables for ROI frame rates.

If you are using pixel formats that do not require 12-bit sensor readout and you want to achieve higher frame rates, you can select between readout modes for 12-bit, 10-bit, and 8-bit with some Alvium USB camera models. See your model's specifications.

By default, Alvium 1800 U models use the maximum (ADC) bit depth for `SensorBitdepth`. For selected models, *Adaptive* mode switches automatically between 12-bit and 10-bit sensor readout, depending on the bit depth of the selected pixel format. This allows to reduce bandwidth and increase frame rates when only 10-bit is required.

To enable the 8-bit sensor readout mode, you must switch manually, using `SensorBitdepth`. Please observe that the image brightness changes when you switch between 8-bit sensor readout mode and the other sensor readout modes.



Maximum frame rates at different values for `SensorBitDepth`

When the maximum bandwidth supported by USB interface is reached, reducing the value for `SensorBitDepth` does not increase the available maximum frame rate.



Exposure time behavior regarding `ExposureMode`

This section informs about how exposure time behaves in the different exposure modes.

All Alvium cameras have an exposure time offset. The exposure time offset and the exposure time increment depend on sensor and camera characteristics. Both, the exposure time offset and the exposure time increment, can change if `Width`, `PixelFormat`, or values for `CSI-2LaneCount`, or `CSI-2 ClockFrequency` are changed. See [Value changes by control interdependencies](#) on page 219.

`ExposureMode = Timed`

For all Alvium CSI-2 cameras, exposure time can be set by `ExposureTime` or `ExposureAuto`. For this, `ExposureMode` is set to *Timed*.

The selected exposure time is extended automatically:

- If the selected exposure time does not match the available increment, the camera automatically extends the exposure time to the next increment.
- The **exposure time offset is included** in the selected exposure time.

Continued on the next page.



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ExposureMode = TriggerWidth or TriggerControlled

In addition, most global shutter (GS) cameras can control exposure time by the trigger signal, with the `ExposureMode` set to `TriggerWidth` or `TriggerControlled` (using `ExposureStart` and `ExposureStop`).

The trigger controlled exposure time is extended automatically:

- If the trigger controlled exposure time does not match the available increment, the camera automatically extends the exposure time to the next increment.
- Subsequently, the **exposure time offset is added**.

You can use `ExposureActive` to determine the duration of the exposure time offset.

Operation for maximum frame rates

Values for maximum frame rates and for minimum and maximum exposure time in the specification tables are based on following parameters:

- Factory settings (camera after startup)
- Minimum exposure time
- Full resolution
- Pixel format
 - **GenICam for CSI-2 Access:** Mono8 or Bayer8 pixel format
 - **Other access modes:** RAW8 (GREY) for monochrome and color models
- Camera operation in freerun mode
- Without bandwidth limitations.

Frame rates with rolling shutter sensors

The following table shows how the shutter type impacts available frame rates. Reducing the area for ROI reduces readout time. The relations in [Table 16](#) apply only if exposure time is shorter than readout time.

Sensor type	Shutter mode	Trigger mode	Available frame rates	ROI frame rates
Global shutter (GS)	Global shutter (GS)	Freerun	Maximum values	Increased values
	Global shutter (GS)	External trigger	Maximum values	Increased values
Rolling shutter (RS)	Rolling shutter (RS)	Freerun	Maximum values	Increased values
	Rolling shutter (RS)	External trigger	Halved values	Increased values
	Global reset shutter (GRS) ¹	Freerun	Maximum values	No increase
	Global reset shutter (GRS) ¹	External trigger	Maximum values	No increase

¹Available with **GenICam for CSI-2 Access** only

Table 16: Frame rates depending on shutter types and trigger modes



Delays

- For delays, see [Trigger latency](#) on page 206.
- 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.

Sensor shutter types

Differences between global shutter (GS), rolling shutter (RS), and global reset shutter (GRS, **GenICam for CSI-2 Access** only) sensors are explained in [Shutter types affecting image readout](#) on page 223. Triggering behavior differs between cameras with global shutter (GS) and rolling shutter (RS). See [Triggering](#) on page 204 for details.



GenICam
for CSI-2
Access

Digital binning

Selected Alvium 1800 C cameras combine digital horizontal binning and digital vertical binning, for integer values 1 to 8.



Alvium 1800 C models ≥12 MP resolution

If digital horizontal and digital vertical binning are set to 1x and the digital vertical binning value is increased, digital horizontal binning is automatically set to 2x.

Operation for medium power consumption

Values for power consumption in the specification tables are based on following parameters:

- Factory settings (camera after startup)
- Minimum exposure time
- Maximum frame rate
- Full resolution
- Pixel format (monochrome and color models)
 - **GenICam for CSI-2 Access:** Mono8 or Bayer8
 - **Other access modes:** RAW8 (GREY)
- Camera operation in freerun mode
- Without bandwidth limitations.

Dimensions and mass

For your model's dimensions, see [Dimensions and mass on page 154](#).

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 154](#).

Alvium 1500 C model specifications

Alvium 1500 C-050m/c

Feature	Specification	
	1500 C-050m (monochrome)	1500 C-050c (color)
Sensor model	ON Semiconductor PYTHON 480	
Resolution	808 (H) × 608 (V); 0.5 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
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 bit depth	10-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10)	
Maximum frame rate	117 fps, using 1 to 4 lanes	
Exposure time	64 µs to 10 s (1 to 4 lanes)	
Gain	0 dB to 11 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.3 W	

Table 17: Alvium 1500 C-050m/c specifications (sheet 1 of 2)

Feature	Specification			
1500 C-050m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 17: Alvium 1500 C-050m/c specifications (sheet 2 of 2)

Absolute QE

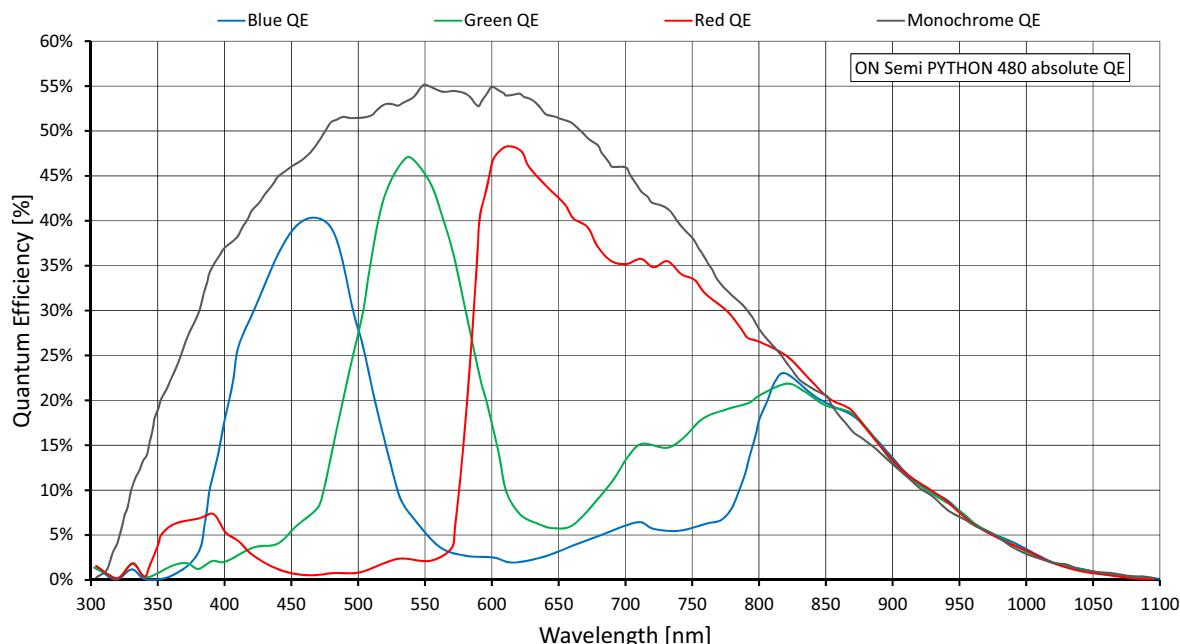


Figure 5: Alvium 1500 C-050m/c (ON Semi PYTHON 480) absolute QE

Spectral response

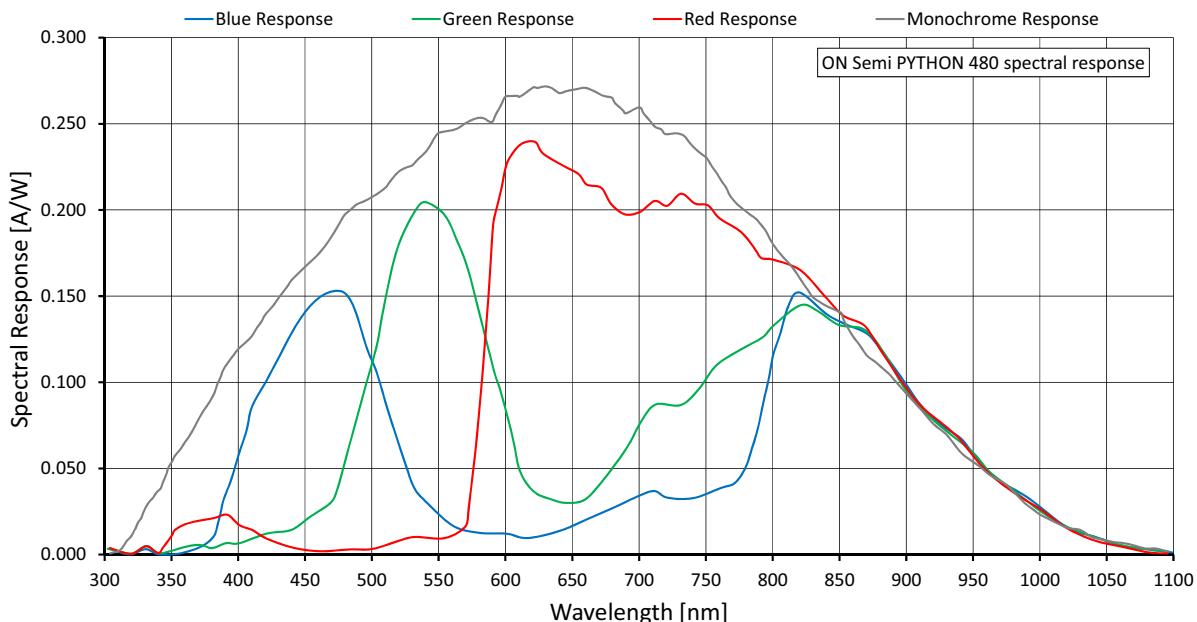


Figure 6: Alvium 1500 C-050m/c (ON Semi PYTHON 480) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 1 lane with 1.051 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	808	608	491,264	117		
SVGA	800	600	480,000	119		
VGA	640	480	307,200	176		
HVGA	480	320	153,600	313		
QVGA	320	240	76,800	514		
HQVGA	240	160	38,400	784		
QQVGA	160	120	19,200	1,069		
Maximum × half	808	304	245,632	219		
Maximum × minimum	808	16	12,928	1,278		
Minimum × maximum	16	608	9,728	726		
Minimum × minimum	16	16	256	1,943		

Table 18: Alvium 1500 C-050m/c ROI frame rates

Alvium 1500 C-120m/c

Feature	Specification	
	1500 C-120m (monochrome)	1500 C-120c (color)
Sensor model	ON Semiconductor AR0135CS	
Resolution	1280 (H) × 960 (V); 1.2 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
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 bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	52 fps ¹ , using 1 to 4 lanes	
Exposure time	57 µs to 1.9 s (1 to 4 lanes)	
Gain	0 dB to 18 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.1 W	

¹In triggered mode, maximum frame rates require minimum exposure times.

Table 19: Alvium 1500 C-120m/c specifications (sheet 1 of 2)

Feature	Specification			
1500 C-120m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 19: Alvium 1500 C-120m/c specifications (sheet 2 of 2)

Absolute QE

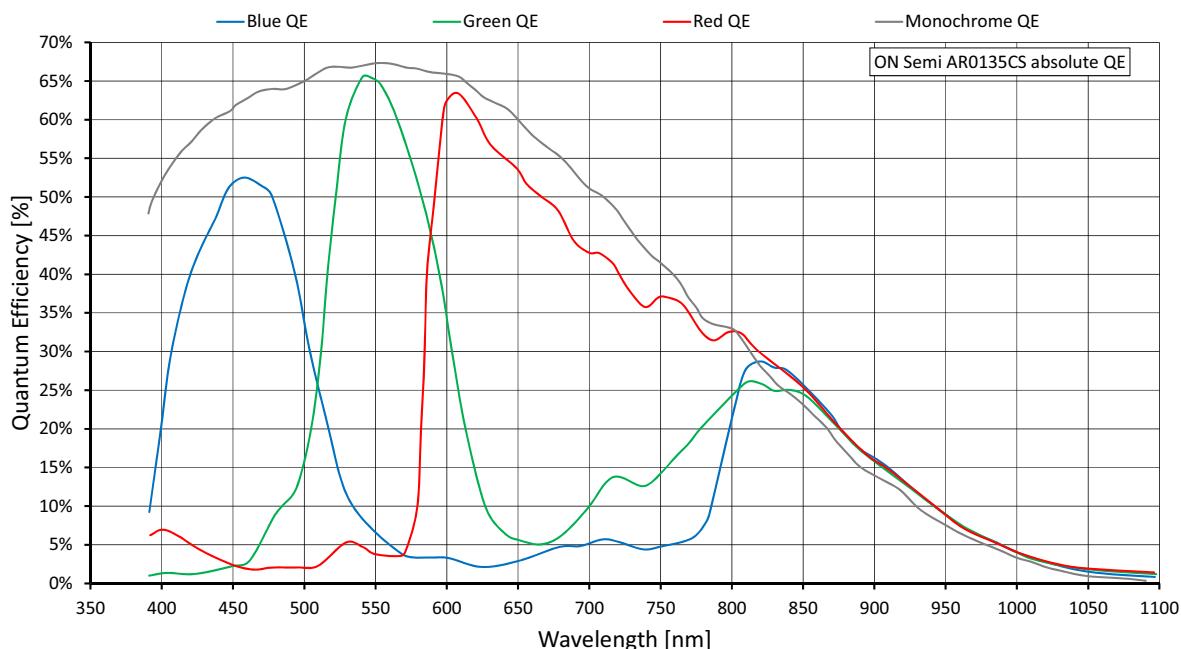


Figure 7: Alvium 1500 C-120m/c (ON Semi AR0135CS) absolute QE

Spectral response

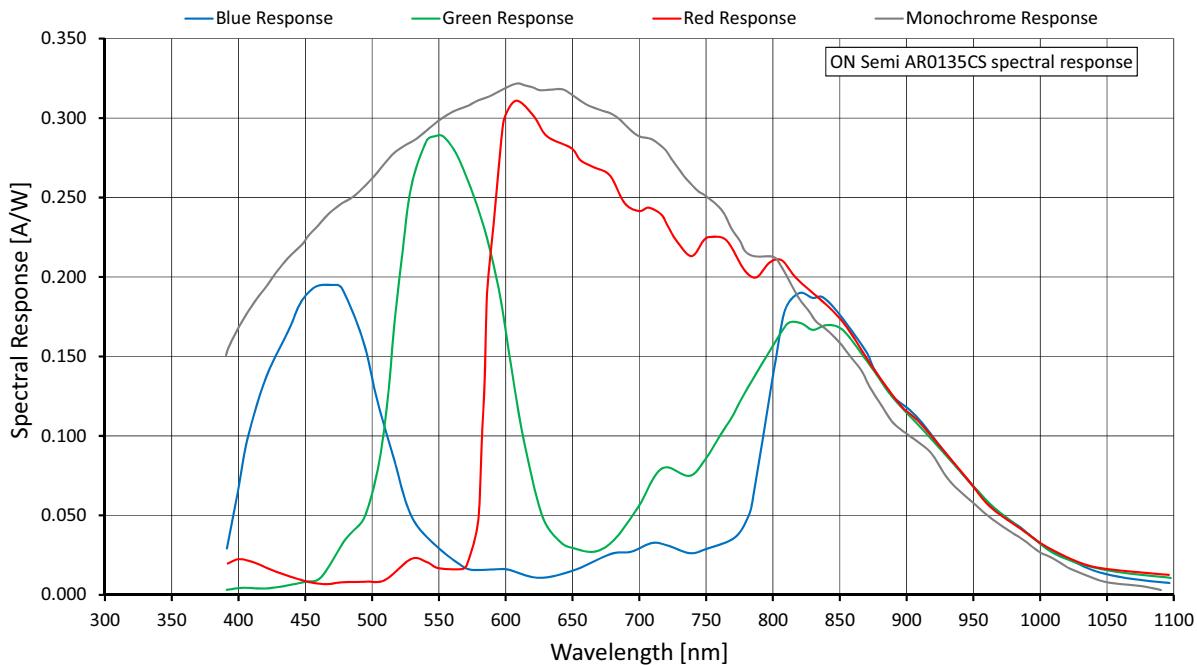


Figure 8: Alvium 1500 C-120m/c (ON Semi AR0135CS) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 1 lane with 1.051 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Alvium 1500 C-120 cameras do not allow overlapping of exposure and readout. **In triggered mode**, the maximum available frame rates may be reduced with long exposure times.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	1,280	960	1,228,800	52		
HD 720	1,280	720	921,600	69		
XGA	1,024	768	786,432	65		
SVGA	800	600	480,000	81		
VGA	640	480	307,200	100		
QVGA	320	240	76,800	160		
QQVGA	160	120	19,200	160		
Maximum × half	1,280	480	614,400	100		
Maximum × minimum	1,280	16	20,480	160		
Minimum × maximum	16	960	15,360	52		
Minimum × minimum	16	16	256	160		

Table 20: Alvium 1500 C-120m/c ROI frame rates

Alvium 1500 C-210m/c

Feature	Specification	
	1500 C-210m (monochrome)	1500 C-210c (color)
Sensor model	ON Semiconductor AR0521SR	
Resolution	1928 (H) × 1088 (V); 2.1 MP	
Sensor type	CMOS	
Shutter type	Rolling shutter (RS)	
Sensor size	Type 1/3.6; 4.2 mm × 2.4 mm; 4.9 mm diagonal	
Pixel size	2.2 µm × 2.2 µm	
CRA	9 deg	
ADC bit depth	10-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10)	
Maximum frame rate	119 fps ¹ , using 2 to 4 lanes	
Exposure time	15 µs to 3.8 s (2 to 4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.9 W	

¹In triggered mode: 59 fps

Table 21: Alvium 1500 C-210m/c specifications (sheet 1 of 2)

Feature	Specification			
1500 C-210m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 21: Alvium 1500 C-210m/c specifications (sheet 2 of 2)

Absolute QE

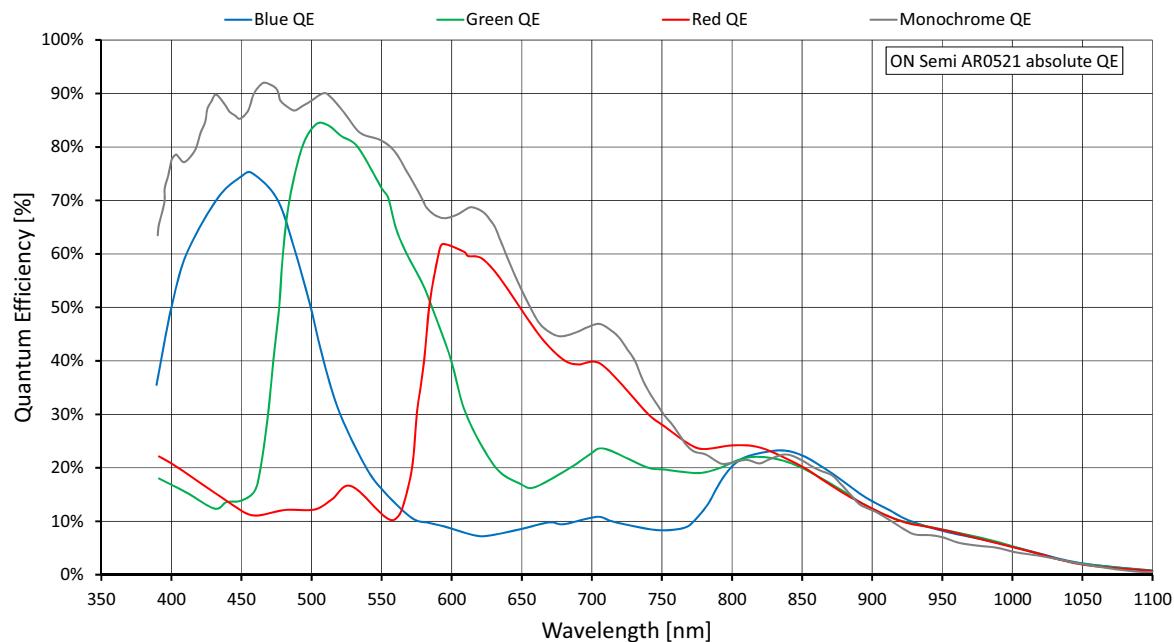


Figure 9: Alvium 1500 C-210m/c (ON Semi AR0521HD) absolute QE

Spectral response

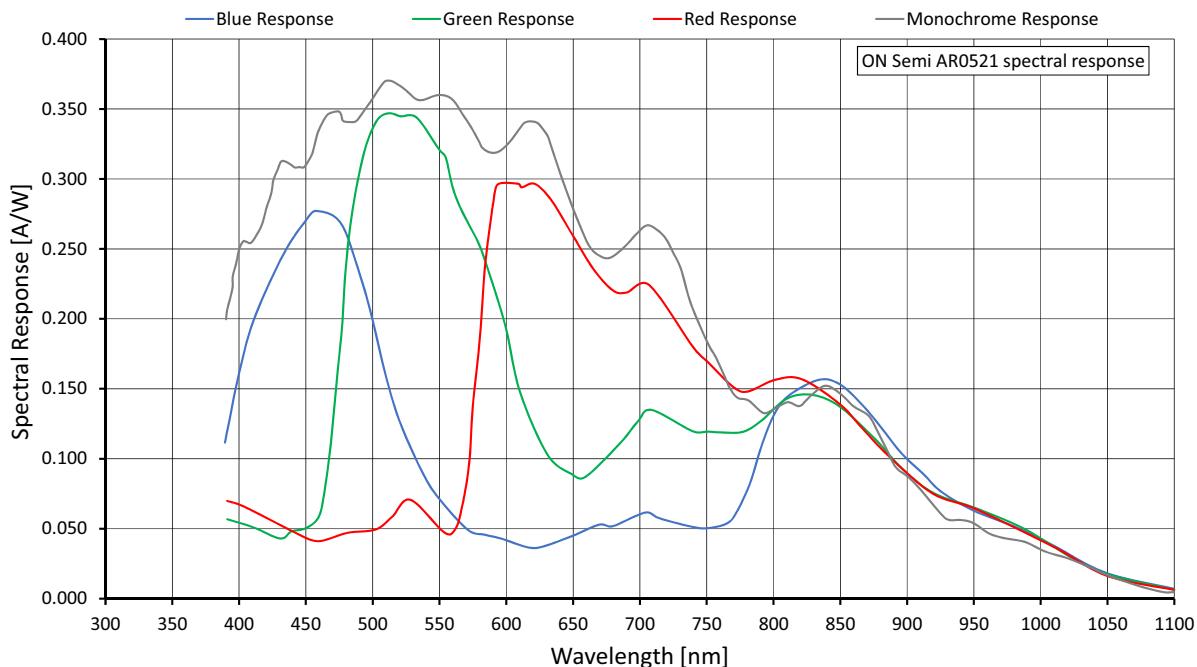


Figure 10: Alvium 1500 C-210m/c (ON Semi AR0521HD) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 2 lanes with 2.102 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	1,928	1,088	2,097,664	119		60
Full HD	1,920	1,080	2,073,600	120		60
WXGA+ ¹	1,440	904 ¹	1,301,760	143		96
SXGA	1,280	1,024	1,310,720	127		96
HD 720	1,280	720	921,600	177		134
XGA	1,024	768	786,432	167		158
SVGA	800	600	480,000	212		
VGA	640	480	307,200	261		
QVGA	320	240	76,800	488		
QQVGA	160	120	19,200	856		
Maximum × half	1,928	544	1,048,832	229		116
Maximum × minimum	1,928	16	30,848	2,062		1,154
Minimum × maximum	16	1,088	17,408	120		
Minimum × minimum	16	16	256	2,474		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 22: Alvium 1500 C-210m/c ROI frame rates



Values in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.

Alvium 1500 C-500m/c

Feature	Specification	
	1500 C-500m (monochrome)	1500 C-500c (color)
Sensor model	ON Semiconductor AR0521SR	
Resolution	2592 (H) × 1944 (V); 5.0 MP	
Sensor type	CMOS	
Shutter type	Rolling shutter (RS)	
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 bit depth	10-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10)	
Maximum frame rate	68 fps ¹ , using 4 lanes	
Exposure time	15 µs to 3.8 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.9 W	

¹In triggered mode: 34 fps

Table 23: Alvium 1500 C-500m/c specifications (sheet 1 of 2)

Feature	Specification			
1500 C-500m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 23: Alvium 1500 C-500m/c specifications (sheet 2 of 2)

Absolute QE

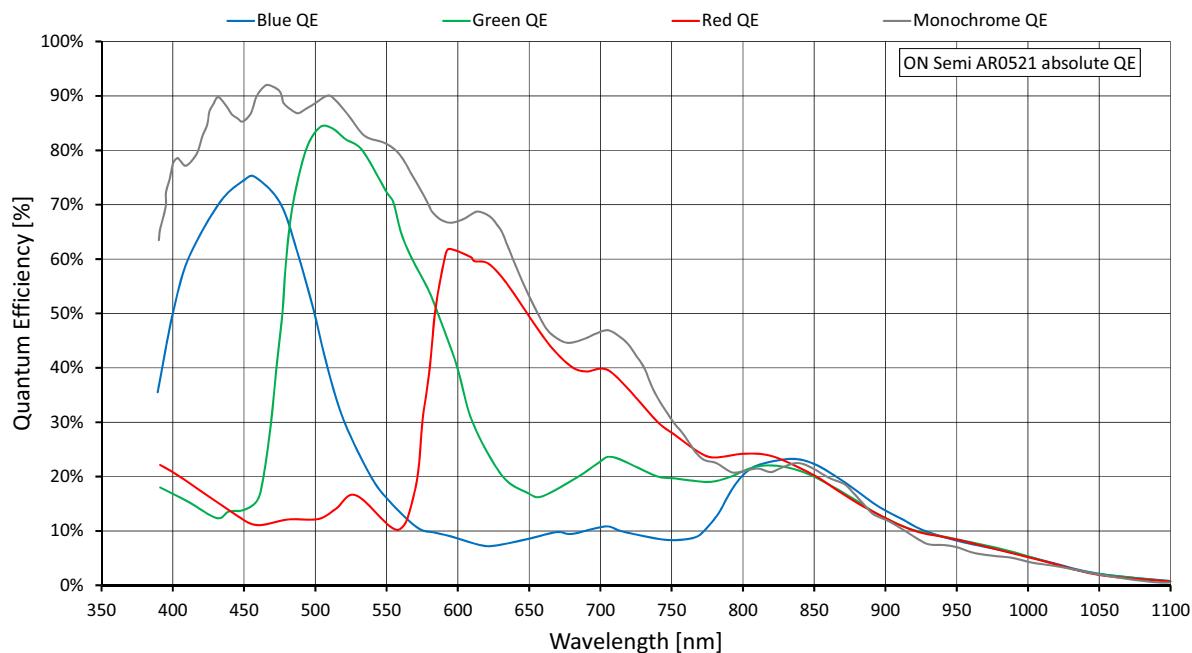


Figure 11: Alvium 1500 C-500m/c (ON Semi AR0521SR) absolute QE

Spectral response

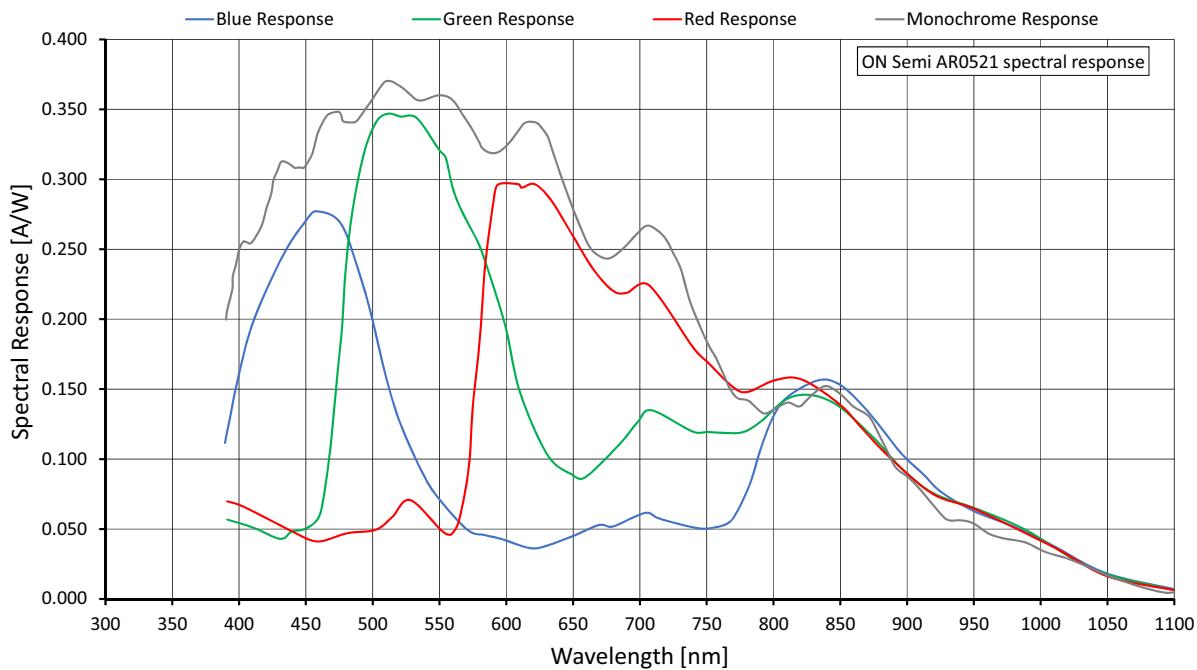


Figure 12: Alvium 1500 C-500m/c (ON Semi AR0521SR) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,592	1,944	5,038,848	68	50	25
WQHD	2,560	1,440	3,686,400	91	68	34
QXGA	2,048	1,536	3,145,728	85	80	40
Full HD	1,920	1,080	2,073,600	120		60
UXGA	1,600	1,200	1,920,000	109		66
WXGA+ ¹	1,440	904 ¹	1,301,760	143		96
SXGA	1,280	1,024	1,310,720	127		96
HD 720	1,280	720	921,600	177		134
XGA	1,024	768	786,432	167		158
SVGA	800	600	480,000	212		
VGA	640	480	307,200	261		
QVGA	320	240	76,800	488		
QQVGA	160	120	19,200	856		
Maximum × half ²	2,592	976 ²	2,529,792	132	98	49
Maximum × minimum	2,592	16	41,472	1,917	1,535	858
Minimum × maximum	16	1,944	31,104	68		
Minimum × minimum	16	16	256	2,474		

¹ Instead of 1,440 × 900

² Instead of 2,592 × 972

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 24: Alvium 1500 C-500m/c ROI frame rates



Values in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.

Alvium 1500 C-501m/c NIR

Feature	Specification	
	1500 C-501m NIR (monochrome)	1500 C-501c NIR (color)
Sensor model	ON Semiconductor AR0522	
Resolution	2592 (H) × 1944 (V); 5.0 MP	
Sensor type	CMOS	
Shutter type	Rolling shutter (RS)	
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 bit depth	10-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10)	
Maximum frame rate	68 fps ¹ , using 4 lanes	
Exposure time	15 µs to 3.8 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.9 W	

¹In triggered mode: 34 fps

Table 25: Alvium 1500 C-501m/c NIR specifications (sheet 1 of 2)

Feature	Specification			
	1500 C-501m/c NIR			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 25: Alvium 1500 C-501m/c NIR specifications (sheet 2 of 2)

Absolute QE

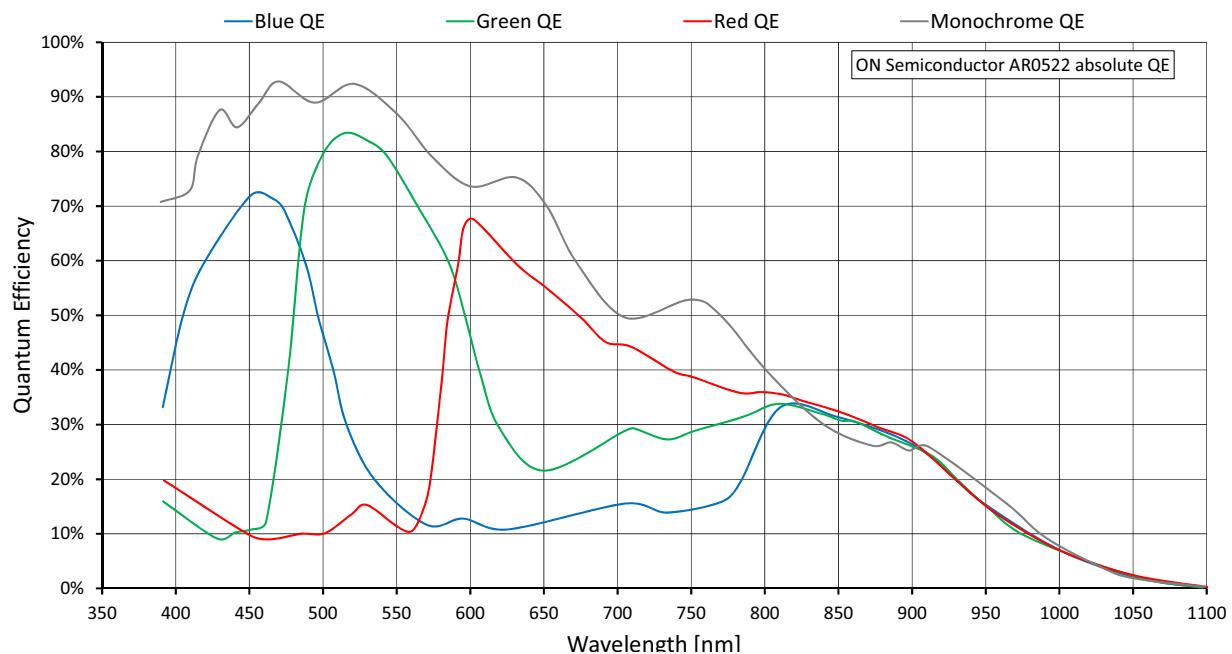


Figure 13: Alvium 1500 C-501m/c NIR (ON Semi AR0522) absolute QE

Spectral response

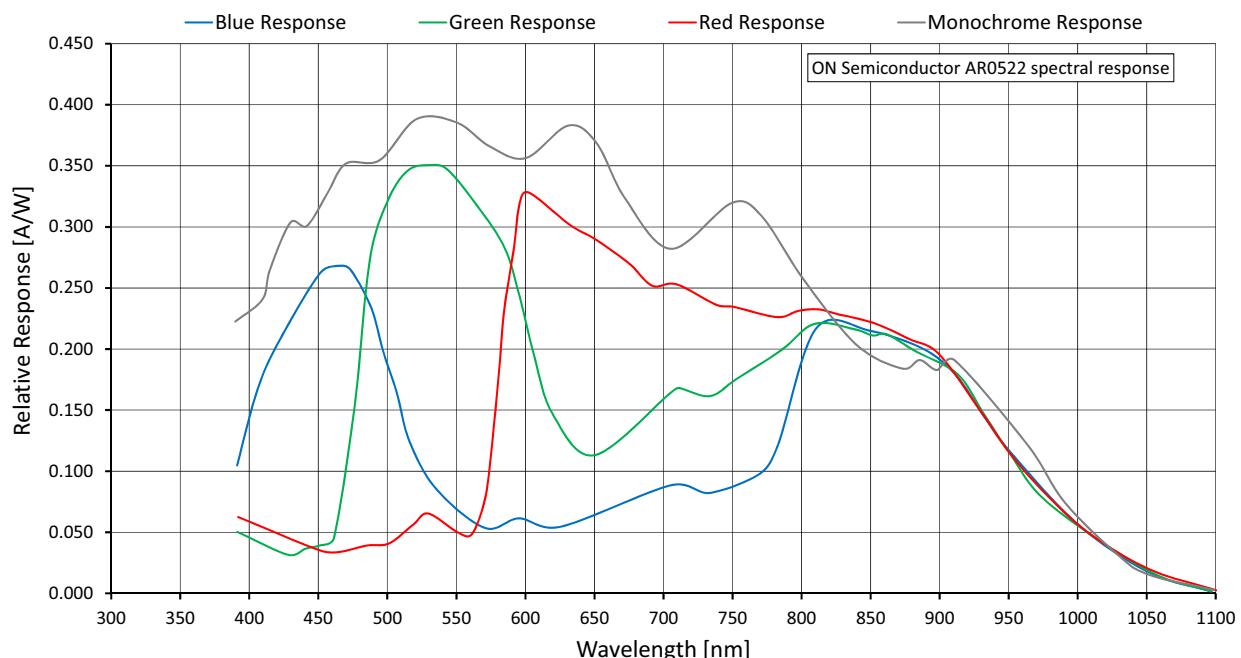


Figure 14: Alvium 1500 C-501m/c NIR (ON Semi AR0522) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,592	1,944	5,038,848	68	50	25
WQHD	2,560	1,440	3,686,400	91	68	34
QXGA	2,048	1,536	3,145,728	85	80	40
Full HD	1,920	1,080	2,073,600	120		60
UXGA	1,600	1,200	1,920,000	109		66
WXGA+ ¹	1,440	904 ¹	1,301,760	143		96
SXGA	1,280	1,024	1,310,720	127		96
HD 720	1,280	720	921,600	177		134
XGA	1,024	768	786,432	167		158
SVGA	800	600	480,000	212		
VGA	640	480	307,200	261		
QVGA	320	240	76,800	488		
QQVGA	160	120	19,200	856		
Maximum × half ²	2,592	976 ²	2,529,792,	132	98	49
Maximum × minimum	2,592	16	41,472	1,917	1,535	858
Minimum × maximum	16	1,944	31,104	68		
Minimum × minimum	16	16	256	2,474		

¹ Instead of 1440 × 900

² Instead of 2,592 × 972

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 26: Alvium 1500 C-501m/c NIR ROI frame rates



Values in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.

Alvium 1800 C model specifications

Alvium 1800 C-030 VSWIR

Feature	Specification
1800 C-030 VSWIR	
Sensor model	Sony IMX991
Resolution	656 (H) × 520 (V); 0.3 MP
Sensor type	InGaAs
Shutter type	Global shutter (GS)
Sensor size	Type 1/4; 3.28 mm × 2.6 mm; 4.1 mm diagonal
Pixel size	5 µm × 5 µm
CRA	0 deg
ADC bit depth	12-bit
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate	130 fps, using 1 to 4 lanes
Exposure time	169 µs to 10 s (1 to 4 lanes)
Gain	0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)	256 KB
Non-volatile memory (Flash)	1024 KB
GPIOs	2 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
Power requirements	Power over MIPI CSI-2
Power consumption (typical, at 5 VDC)	1.8 W

Table 27: Alvium 1800 C-030 VSWIR specifications (sheet 1 of 2)

Feature	Specification			
1800 C-030 VSWIR				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas ¹	Mainboard ²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by `DeviceTemperature`

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 27: Alvium 1800 C-030 VSWIR specifications (sheet 2 of 2)

Relative QE

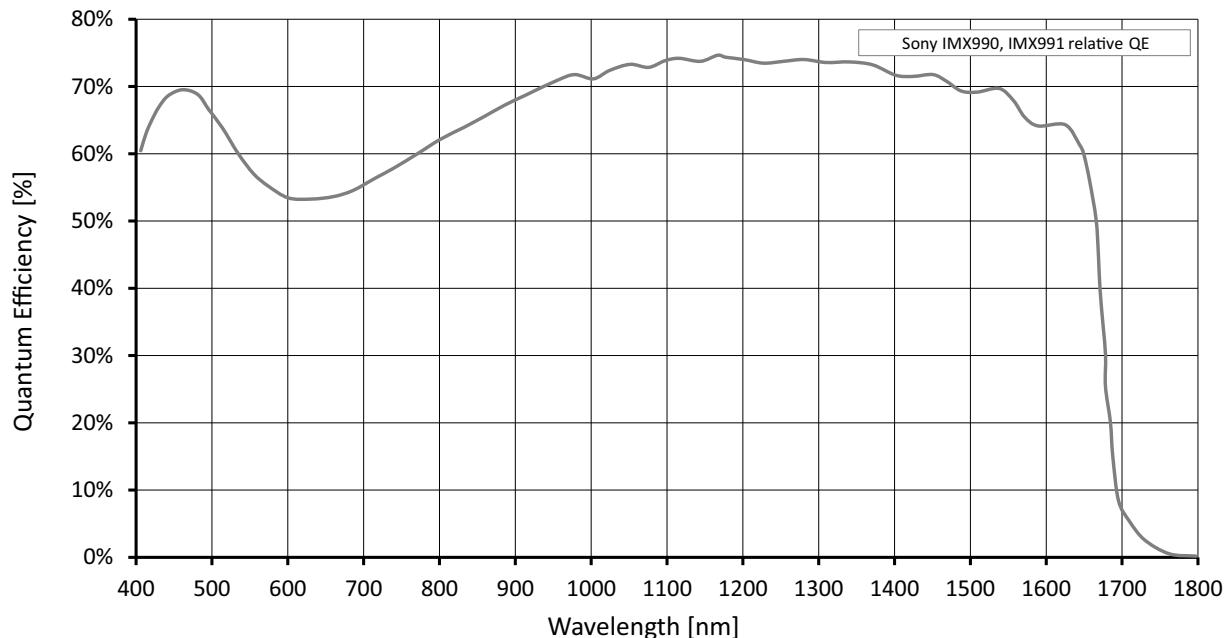


Figure 15: Alvium 1800 C-030 VSWIR (Sony IMX991) relative QE

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 1 lane with 1.051 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	656	520	341,120	130		
VGA	640	480	307,200	140		
HVGA	480	320	153,600	199		
QVGA	320	240	76,800	253		
HQVGA	240	160	38,400	348		
QQVGA	160	120	19,200	428		
Maximum × half ¹	656	264 ¹	170,560	233		
Maximum × minimum	656	16	10,496	985		
Minimum × maximum	16	520	8,320	131		
Minimum × minimum	16	16	256	1,054		

¹Instead of 656 × 260

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 28: Alvium 1800 C-030 VSWIR ROI frame rates

Alvium 1800 C-040m/c

Feature	Specification	
	1800 C-040m (monochrome)	1800 C-040c (color)
Sensor model		Sony IMX287
Resolution		728 (H) × 544 (V); 0.4 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
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 bit depth		12-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		289 fps, using 2 to 4 lanes
Exposure time		179 µs to 10 s (2 to 4 lanes)
Gain		0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.7 W	

Table 29: Alvium 1800 C-040m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-040m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 29: Alvium 1800 C-040m/c specifications (sheet 2 of 2)

Absolute QE

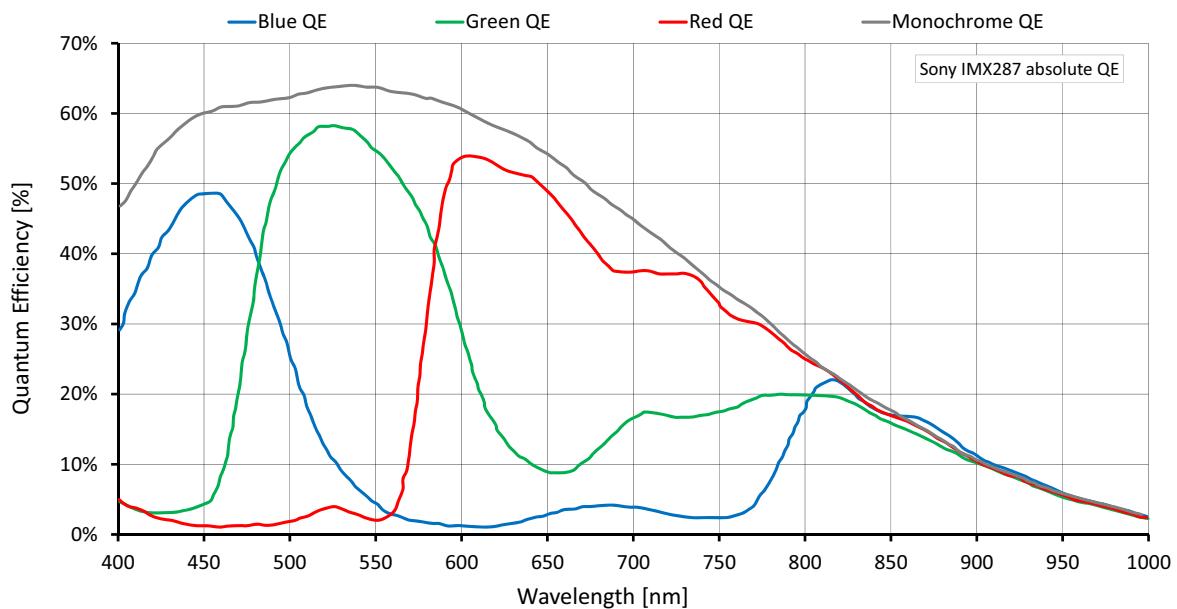


Figure 16: Alvium 1800 C-040m/c (Sony IMX287) absolute QE

Spectral response

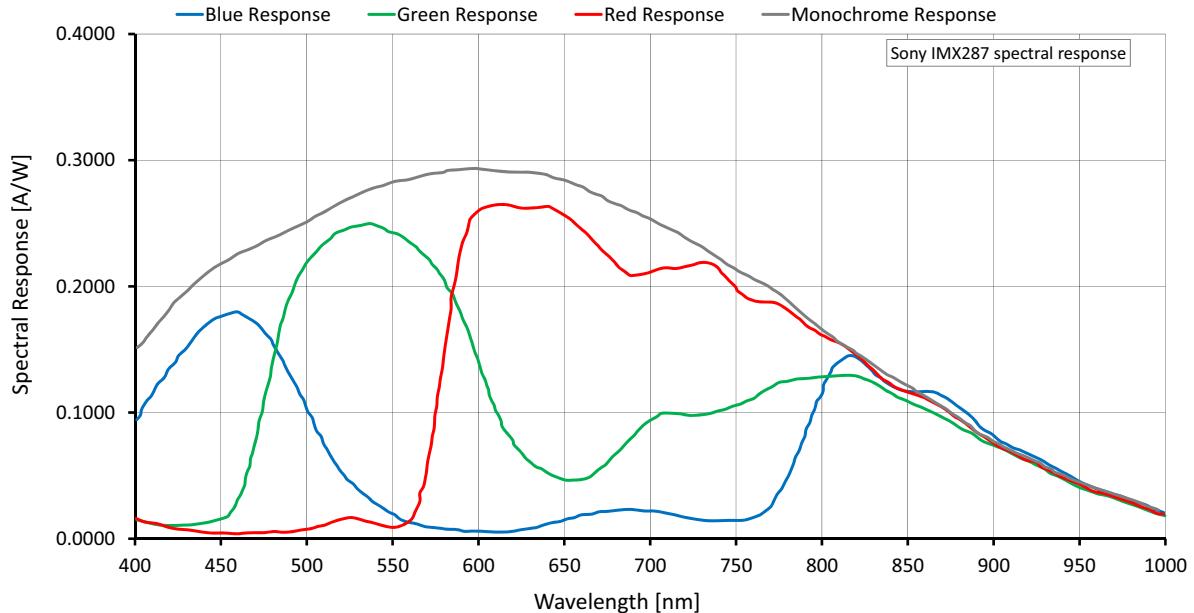


Figure 17: Alvium 1800 C-040m/c (Sony IMX287) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 2 lanes with 2.102 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	728	544	396,032	289		281
VGA	640	480	307,200		322	
HVGA	480	320	153,600		450	
QVGA	320	240	76,800		564	
HQVGA	240	160	38,400		750	
QQVGA	160	120	19,200		896	
Maximum × half	728	272	198,016	503		491
Maximum × minimum	728	16	11,648	1,663		1,645
Minimum × maximum	16	544	8,704		293	
Minimum × minimum	16	16	256		1,810	

Table 30: Alvium 1800 C-040m/c ROI frame rates

Alvium 1800 C-052m/c

Feature	Specification	
	1800 C-052m (monochrome)	1800 C-052c (color)
Sensor model		Sony IMX426
Resolution		816 (H) × 624 (V); 0.5 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
Sensor size		Type 1/1.7; 7.3 mm × 5.6 mm; 9.2 mm diagonal
Pixel size		9.0 µm × 9.0 µm
CRA		0 deg
ADC bit depth		12-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		464 fps, using 4 lanes
Exposure time		170 µs to 10 s (4 lanes)
Gain		0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.8 W	

Table 31: Alvium 1800 C-052m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-052m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [Device Temperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 31: Alvium 1800 C-052m/c specifications (sheet 2 of 2)

Absolute QE, spectral response

Diagrams will be added in a future version of this document.

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [MP]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	816	624	0.509	464	390	208
SVGA	800	600	0.480	474	408	215
VGA	640	480	0.307	569		320
HVGA	480	320	0.154	755		555
QVGA	320	240	0.077	912		912
HQVGA	240	160	0.038	1,137		
QQVGA	160	120	0.019	1,272		
Maximum × half	816	312	0.255	732	623	344
Maximum × minimum	816	16	0.013	1,726	1,547	992
Minimum × minimum	16	16	256 pixels	2,079		

Table 32: Alvium 1800 C-052m/c ROI frame rates

Alvium 1800 C-130 VSWIR

Feature	Specification
1800 C-130 VSWIR	
Sensor model	Sony IMX990
Resolution	1296 (H) × 1032 (V); 1.3 MP
Sensor type	InGaAs
Shutter type	Global shutter (GS)
Sensor size	Type 1/2; 6.4 mm × 5.12 mm; 8.2 mm diagonal
Pixel size	5 µm × 5 µm
CRA	0 deg
ADC bit depth	12-bit
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate	69 fps, using 1 to 4 lanes
Exposure time	171 µs to 10 s (1 to 4 lanes)
Gain	0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)	256 KB
Non-volatile memory (Flash)	1024 KB
GPIOs	2 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
Power requirements	Power over MIPI CSI-2
Power consumption (typical, at 5 VDC)	1.9 W

Table 33: Alvium 1800 C-130 VSWIR specifications (sheet 1 of 2)

Feature	Specification			
1800 C-130 VSWIR				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas ¹	Mainboard ²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 33: Alvium 1800 C-130 VSWIR specifications (sheet 2 of 2)

Relative QE

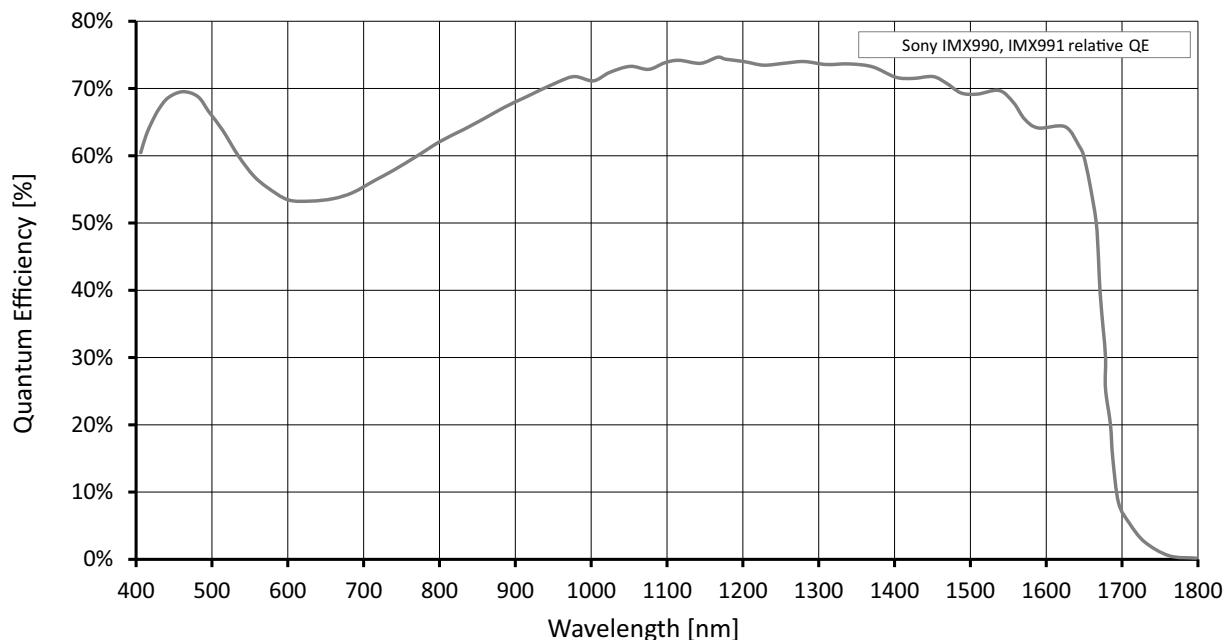


Figure 18: Alvium 1800 C-130 VSWIR (Sony IMX990) relative QE

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 1 lanes with 1.051 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	1,296	1,032	1,337,472	69		
HD 720	1,280	720	921,600	96		
XGA	1,024	768	786,432	91		
SVGA	800	600	480,000	114		
VGA	640	480	307,200	140		
QVGA	320	240	76,800	253		
QQVGA	160	120	19,200	428		
Maximum × half ¹	1,296	520 ¹	673,920	129		
Maximum × minimum	1,296	16	20,736	925		
Minimum × maximum	16	1,032	16,512	69		
Minimum × minimum	16	16	256	1,054		

¹ Instead of 1,296 × 516

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Figure 19: Alvium 1800 C-130 VSWIR ROI frame rates

Alvium 1800 C-158m/c

Feature	Specification	
	1800 C-158m (monochrome)	1800 C-158c (color)
Sensor model		Sony IMX273
Resolution		1456 (H) × 1088 (V); 1.6 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
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 bit depth		12-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		153 fps, using 4 lanes
Exposure time		173 µs to 10 s (4 lanes)
Gain		0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	2.4 W	

Table 34: Alvium 1800 C-158m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-158m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 34: Alvium 1800 C-158m/c specifications (sheet 2 of 2)

Absolute QE

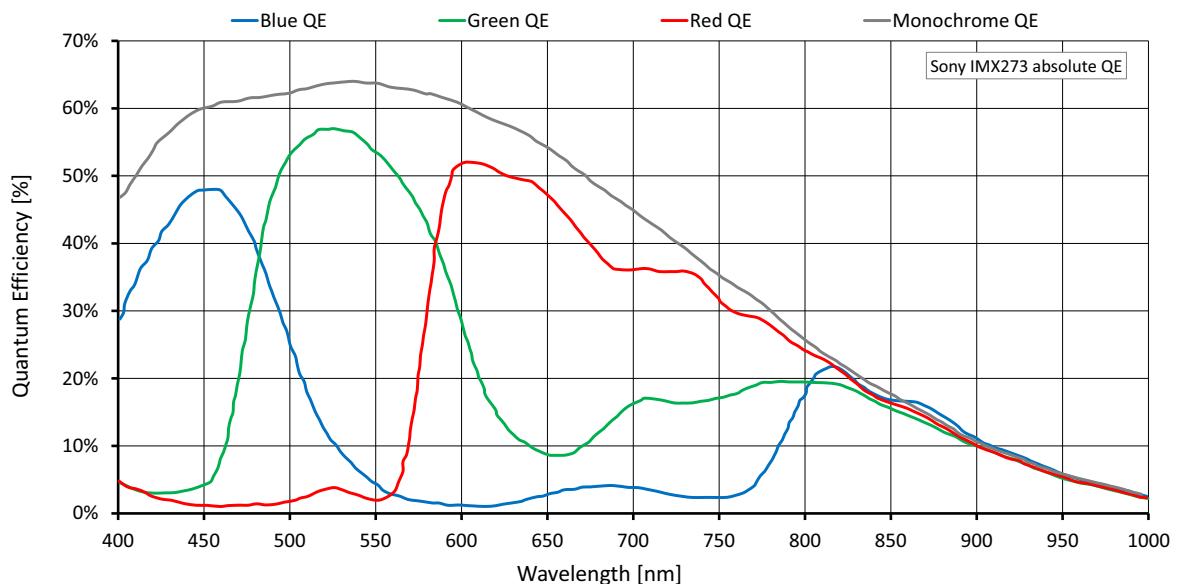


Figure 20: Alvium 1800 C-158m/c (Sony IMX273) absolute QE

Spectral response

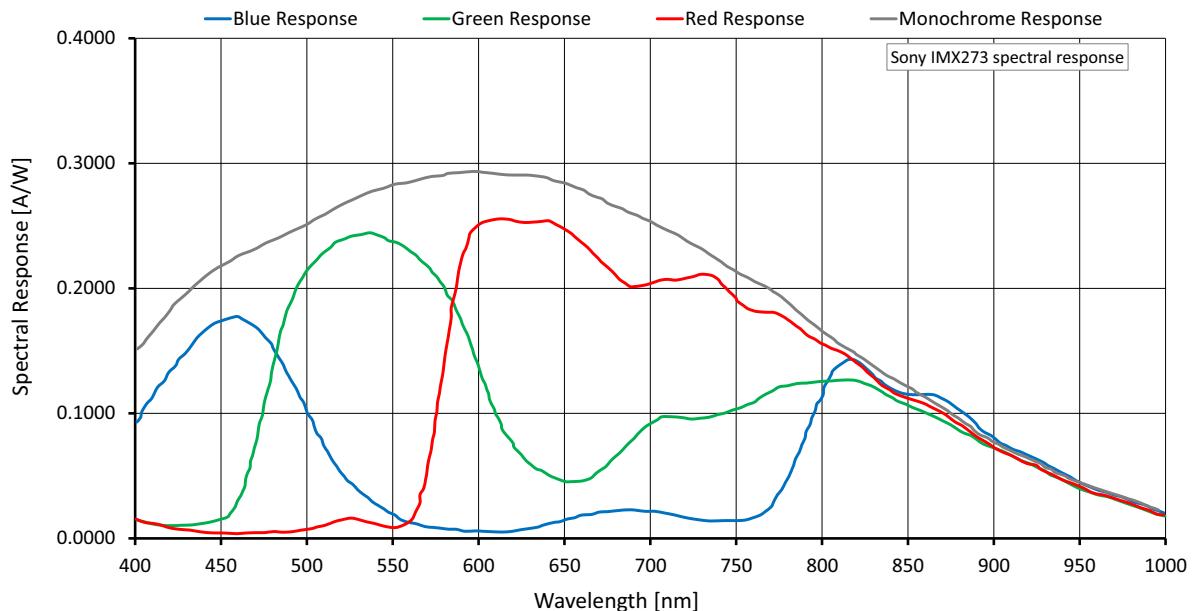


Figure 21: Alvium 1800 C-158m/c (Sony IMX273) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	1,456	1,088	1,584,128	153	149	76
WXGA+ ¹	1,440	904 ¹	1,301,760	181	178	92
SXGA	1,280	1,024	1,310,720	163		92
HD 720	1,280	720	921,600	222		127
XGA	1,024	768	786,432	211		149
SVGA	800	600	480,000	264		235
VGA	640	480	307,200	321		
QVGA	320	240	76,800	564		
QQVGA	160	120	19,200	896		
Maximum × half	1,456	544	792,064	281	273	143
Maximum × minimum	1,456	16	23,296	1,431	1,412	934
Minimum × maximum	16	1088	17,408	157		
Minimum × minimum	16	16	256	1,810		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Figure 22: Alvium 1800 C-158m/c ROI frame rates

Alvium 1800 C-240m/c

Feature	Specification	
	1800 C-240m (monochrome)	1800 C-240c (color)
Sensor model		Sony IMX392
Resolution		1936 (H) x 1216 (V); 2.4 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
Sensor size		Type 1/2.3; 6.7 mm x 4.2 mm; 7.9 mm diagonal
Pixel size		3.45 µm x 3.45 µm
CRA		0 deg
ADC bit depth		12-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		126 fps, using 4 lanes
Exposure time		170 µs to 10 s (4 lanes)
Gain		0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	2.7 W	

Table 35: Alvium 1800 C-240m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-240m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 35: Alvium 1800 C-240m/c specifications (sheet 2 of 2)

Absolute QE

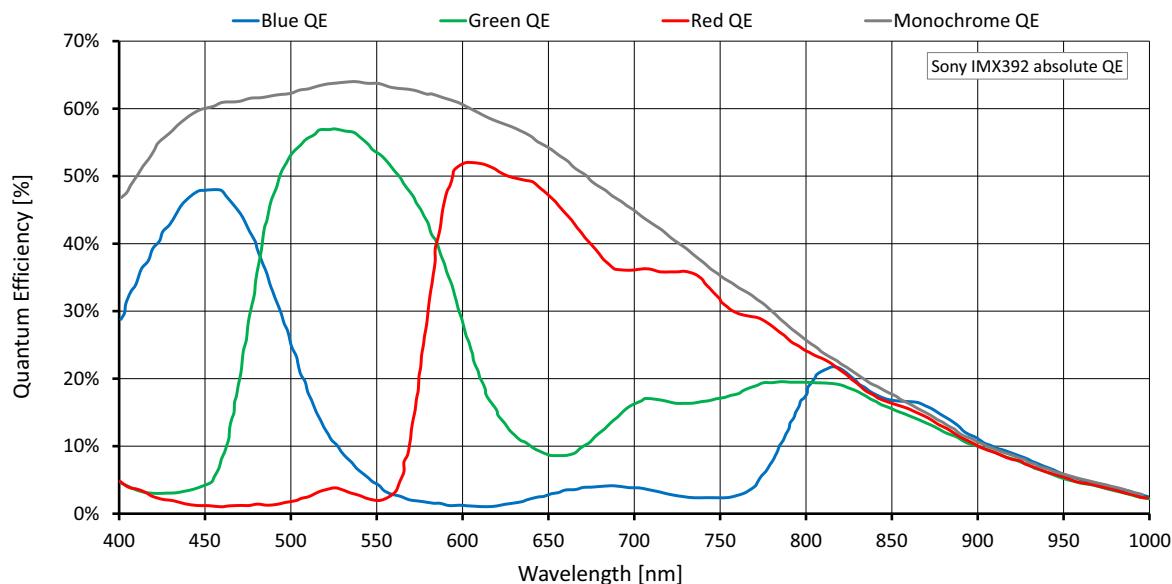


Figure 23: Alvium 1800 C-240m/c (Sony IMX392) absolute QE

Spectral response

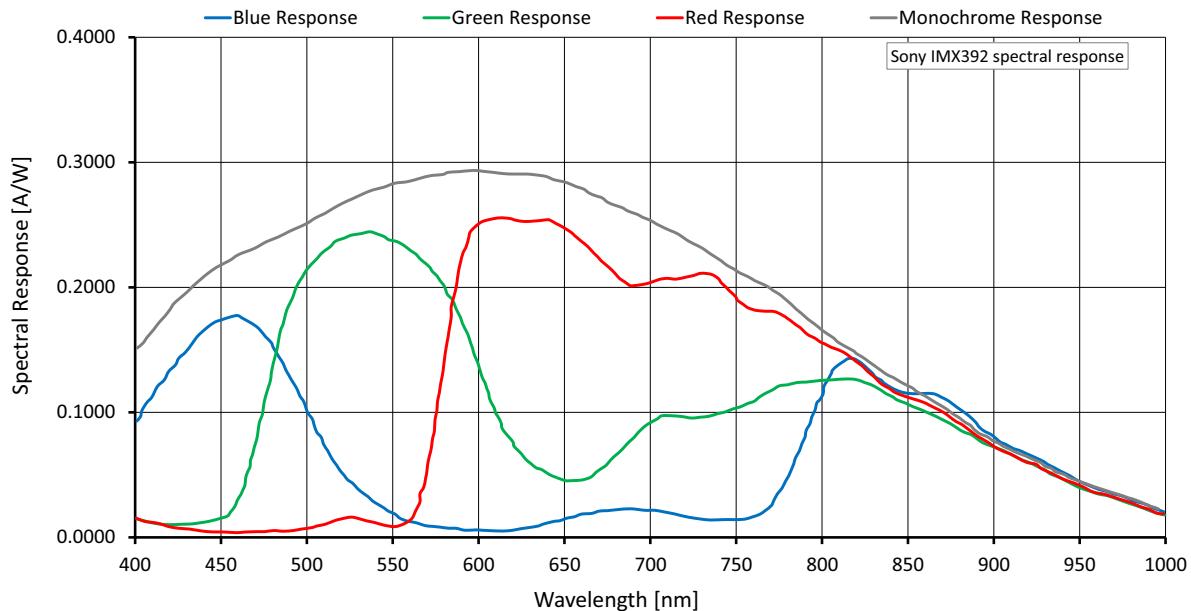


Figure 24: Alvium 1800 C-240m/c (Sony IMX392) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	1,936	1,216	2,354,176	126	102	52
Full HD	1,920	1,080	2,073,600	140	115	59
UXGA	1,600	1,200	1,920,000	128	125	64
WXGA ¹	1,440	904 ¹	1,301,760	166		93
SXGA	1,280	1,024	1,310,720	149		93
HD 720	1,280	720	921,600	204		128
XGA	1,024	768	786,432	194		150
SVGA	800	600	480,000	243		238
VGA	640	480	307,200	297		
QVGA	320	240	76,800	529		
QQVGA	160	120	19,200	862		
Maximum × half	1,936	608	1,177,088	233	191	99
Maximum × minimum	1,936	16	30,976	1,337	1,200	795
Minimum × maximum	16	1,216	19,456	129		
Minimum × minimum	16	16	256	1,858		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 36: Alvium 1800 C-240m/c ROI frame rates

Alvium 1800 C-291m/c

Feature	Specification	
	1800 C-291m (monochrome)	1800 C-291c (color)
Sensor model		Sony IMX421
Resolution		1944 (H) x 1472 (V); 2.9 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
Sensor size		Type 2/3; 8.8 mm x 6.6 mm; 10.8 mm diagonal
Pixel size		4.5 µm x 4.5 µm
CRA		0 deg
ADC bit depth		12-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		114 fps, using 4 lanes
Exposure time		161 µs to 10 s (4lanes)
Gain		0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.8 W	

Table 37: Alvium 1800 C-291m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-291m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [Device Temperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 37: Alvium 1800 C-291m/c specifications (sheet 2 of 2)

Absolute QE, spectral response

Diagrams will be added in a future version of this document.

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [MP]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	1944	1472	2.862	114	84	42
Full HD	1920	1080	2.074	151	113	58
UXGA	1600	1200	1.920	138	122	63
WXGA+ ¹	1440	904 ¹	1.302	178	175	90
SXGA	1280	1024	1.311	160	160	90
HD 720	1280	720	0.922	218	218	124
XGA	1024	768	0.786	207		146
SVGA	800	600	0.480	257		229
VGA	640	480	0.307	311		311
HVGA	480	320	0.154	430		
QVGA	320	240	0.077	535		
HQVGA	240	160	0.038	699		
QQVGA	160	120	0.019	831		
Maximum × half	1944	736	1.431	210	156	80
Maximum × minimum	1944	16	0.031	1,161	974	605
Minimum × maximum	16	1472	0.024	117		
Minimum × minimum	16	16	64 pixels	1,620		

¹Instead of 1,440 × 900

Table 38: Alvium 1800 C-291m/c ROI frame rates

Alvium 1800 C-319m/c

Feature	Specification	
	1800 C-319m (monochrome)	1800 C-319c (color)
Sensor model		Sony IMX265
Resolution		2064 (H) × 1544 (V); 3.2 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
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 bit depth		12-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		53 fps, using 2 to 4 lanes
Exposure time		179 µs to 10 s (2 to 4 lanes)
Gain		0 dB to 24 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	1.9 W	

Table 39: Alvium 1800 C-319m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-319m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 39: Alvium 1800 C-319m/c specifications (sheet 2 of 2)

Absolute QE

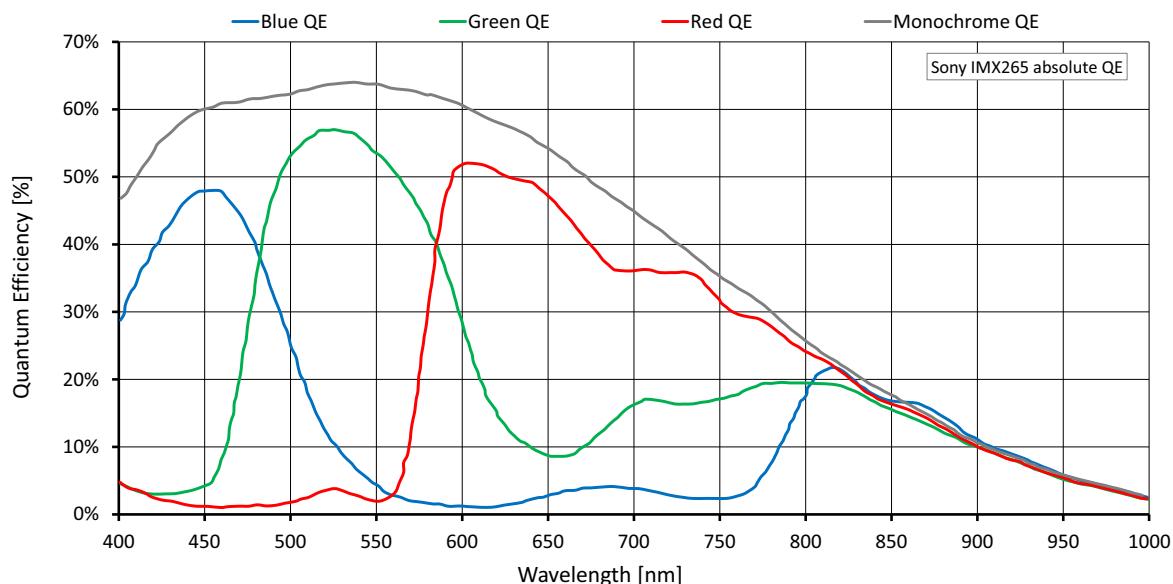


Figure 25: Alvium 1800 C-319m/c (Sony IMX265) absolute QE

Spectral response

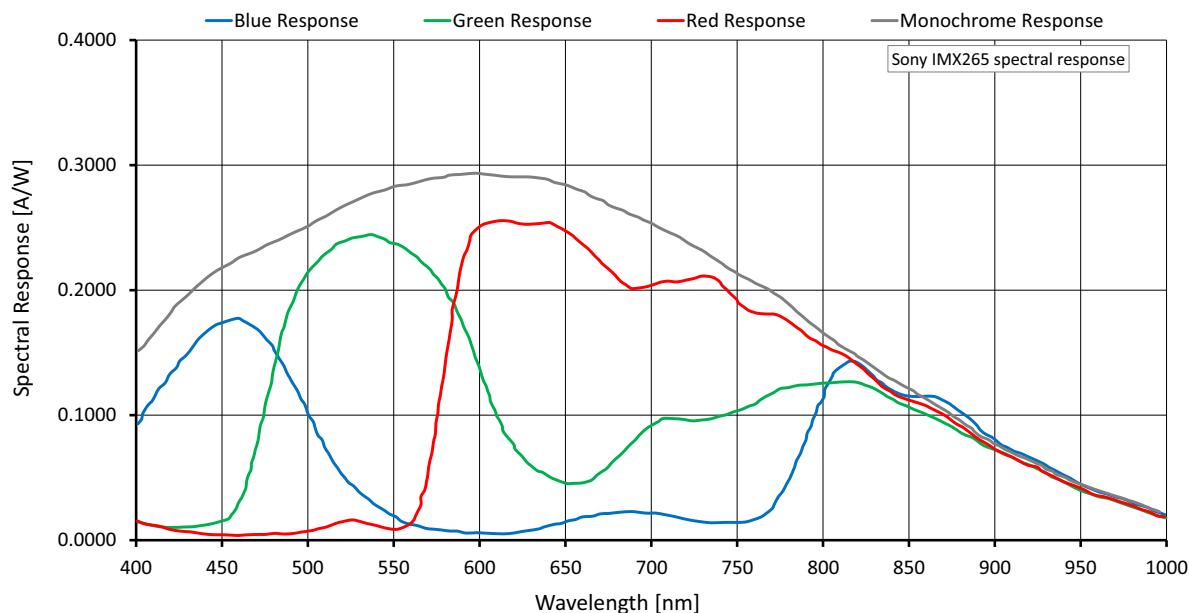


Figure 26: Alvium 1800 C-319m/c (Sony IMX265) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 2 lanes with 2.102 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,064	1,544	3,186,816		53	39
QXGA	2,048	1,536	3,145,728		54	39
Full HD	1,920	1,080	2,073,600		75	59
UXGA	1,600	1,200	1,920,000		68	64
WXGA ¹	1,440	904 ¹	1,301,760		89	
SXGA	1,280	1,024	1,310,720		79	
HD 720	1,280	720	921,600		110	
XGA	1,024	768	786,432		104	
SVGA	800	600	480,000		131	
VGA	640	480	307,200		160	
QVGA	320	240	76,800		289	
QQVGA	160	120	19,200		484	
Maximum × half ²	2,064	776 ²	1,601,664		102	75
Maximum × minimum	2,064	16	33,024		937	755
Minimum × maximum	16	1,544	24,704		54	
Minimum × minimum	16	16	256		1,146	

¹Instead of 1,440 × 900

²Instead of 2,064 × 772

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 40: Alvium 1800 C-319m/c ROI frame rates



Alvium 1800 C-500m/c

Red table border lines signal that **GenICam for CSI-2 Access** is required.

Feature	Specification	
	1800 C-500m (monochrome)	1800 C-500c (color)
Sensor model	ON Semiconductor AR0521SR	
Resolution	2592 (H) × 1944 (V); 5.0 MP	
Sensor type	CMOS	
Shutter type	Rolling shutter (RS)	
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 bit depth	10-bit	
Monochrome pixel formats	Mono8 (default), Mono10, Mono10p	Mono8, Mono10, Mono10p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerRG8, BayerRG10, BayerRG10p, BGR8, RGB8 (default)
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10)	
Maximum frame rate	68 fps ¹ , using 4 lanes	
Exposure time	15 µs to 3.8 s (4 lanes)	
Exposure modes	Timed	
Gain	0 dB to 24 dB; 0.1 dB increments	
Digital binning	Horizontal: 1 to 8 columns; Vertical: 1 to 8 rows	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	

¹In triggered mode: 34 fps

Table 41: Alvium 1800 C-500m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-500m/c			
Power requirements	Power over MIPI CSI-2			
Power consumption (typical, at 5 VDC)	1.9 W			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	-20° C to +85° C
	Open housing ⁵	-20° C to +65° C		
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	GenICam V2.0 (GenICam for CSI-2 Access) V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 41: Alvium 1800 C-500m/c specifications (sheet 2 of 2)

Absolute QE

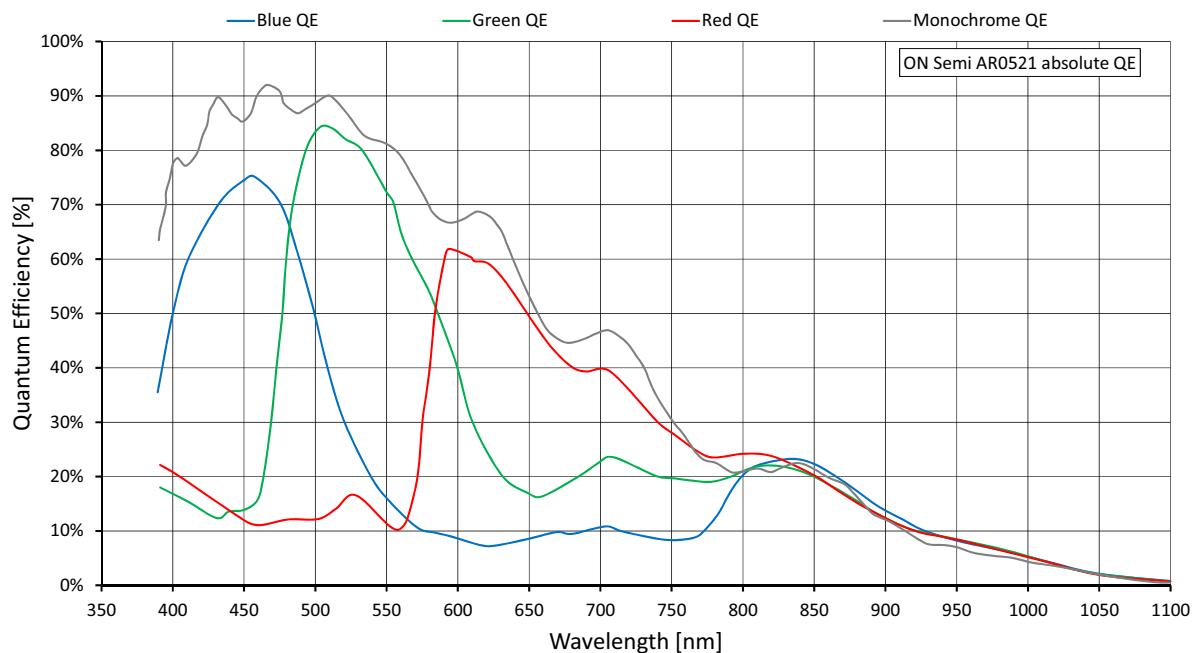


Figure 27: Alvium 1800 C-500m/c (ON Semi AR0521SR) absolute QE

Spectral response

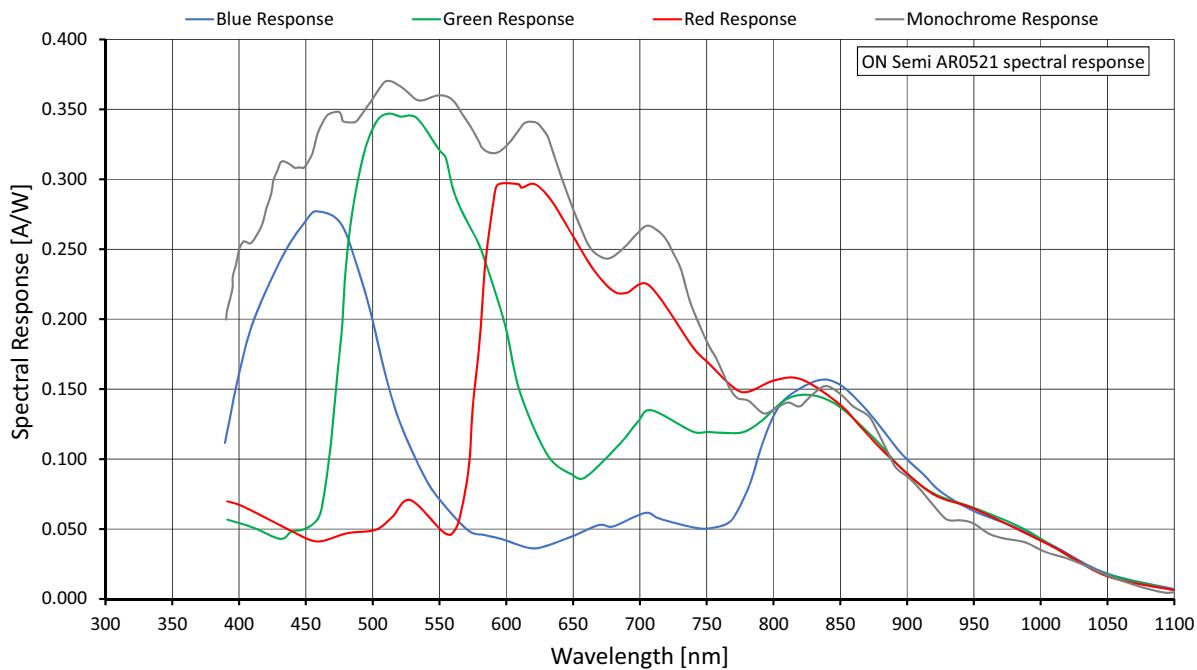


Figure 28: Alvium 1800 C-500m/c (ON Semi AR0521SR) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,592	1,944	5,038,848	68	50	25
WQHD	2,560	1,440	3,686,400	91	68	34
QXGA	2,048	1,536	3,145,728	85	80	40
Full HD	1,920	1,080	2,073,600	120		60
UXGA	1,600	1,200	1,920,000	109		66
WXGA+ ¹	1,440	904 ¹	1,301,760	143		96
SXGA	1,280	1,024	1,310,720	127		96
HD 720	1,280	720	921,600	177		134
XGA	1,024	768	786,432	167		158
SVGA	800	600	480,000	212		
VGA	640	480	307,200	261		
QVGA	320	240	76,800	488		
QQVGA	160	120	19,200	856		
Maximum × half ²	2,592	976 ²	2,529,792	132	98	49
Maximum × minimum	2,592	16	41,472	1,917	1,535	858
Minimum × maximum	16	1,944	31,104	68		
Minimum × minimum	16	16	256	2,474		

¹ Instead of 1,440 × 900

² Instead of 2,592 × 972

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 42: Alvium 1800 C-500m/c ROI frame rates



Values in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.



Alvium 1800 C-507m/c

Red table border lines signal that **GenICam for CSI-2 Access** is required.

Feature	Specification	
	1800 C-507m (monochrome)	1800 C-507c (color)
Sensor model		Sony IMX264
Resolution		2464 (H) × 2056 (V); 5.1 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
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 bit depth		12-bit
Monochrome pixel formats	Mono8 (default), Mono10, Mono10p, Mono12, Mono12p	Mono8, Mono10, Mono10p, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerRG8, BayerRG10, BayerRG10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		34 fps, using 2 to 4 lanes
Exposure time		169 µs to 10 s (2 to 4 lanes)
Exposure modes		Timed, TriggerControlled, TriggerWidth
Gain		0 dB to 24 dB; 0.1 dB increments
Digital binning		Horizontal: 1 to 8 columns; Vertical: 1 to 8 rows
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	

Table 43: Alvium 1800 C-507m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-507m/c			
Power requirements	Power over MIPI CSI-2			
Power consumption (typical, at 5 VDC)	1.9 W			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
	Open housing ⁴	-20° C to +65° C		
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	GenICam V2.0 (GenICam for CSI-2 Access) V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 43: Alvium 1800 C-507m/c specifications (sheet 2 of 2)

Absolute QE

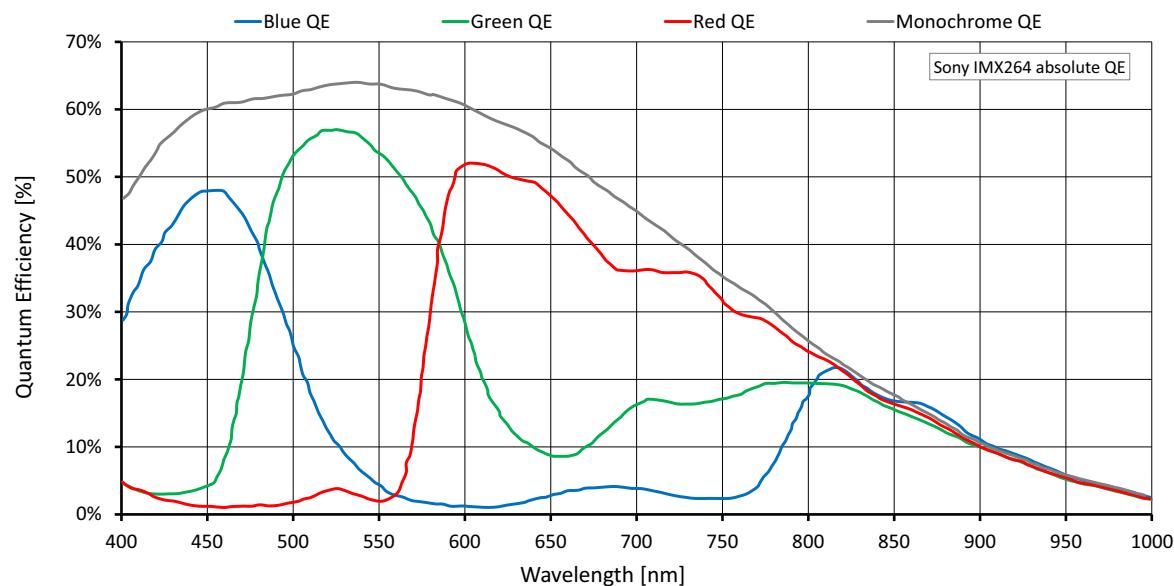


Figure 29: Alvium 1800 C-507m/c (Sony IMX264) absolute QE

Spectral response

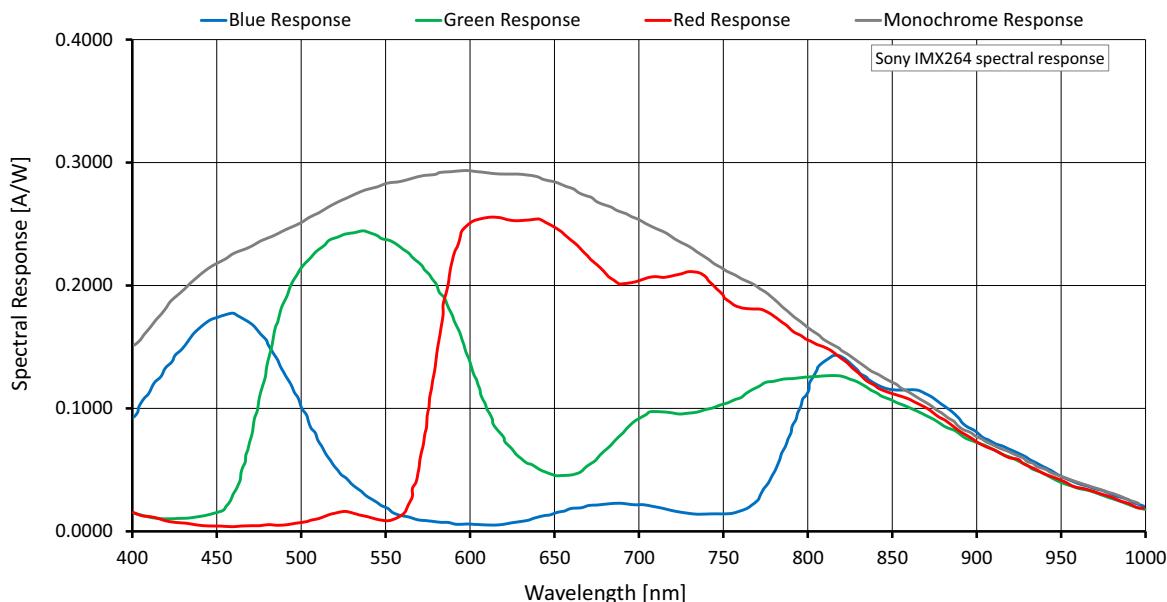


Figure 30: Alvium 1800 C-507m/c (Sony IMX264) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 2 lanes with 2.102 Gbps. Increasing the **CSI-2 Lane Count** value does not increase frame rates.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,464	2,056	5,065,984	34		25
QXGA	2,048	1,536	3,145,728	46		39
Full HD	1,920	1,080	2,073,600	64		59
UXGA	1,600	1,200	1,920,000		58	
WXGA ¹	1,440	904 ¹	1,301,760		76	
SXGA	1,280	1,024	1,310,720		67	
HD 720	1,280	720	921,600		94	
XGA	1,024	768	786,432		89	
SVGA	800	600	480,000		111	
VGA	640	480	307,200		136	
QVGA	320	240	76,800		248	
QQVGA	160	120	19,200		416	
Maximum × half ²	2,464	1,032 ²	2,542,848	66		48
Maximum × minimum	2,464	16	39,424	814		647
Minimum × maximum	16	2,056	32,896		35	
Minimum × minimum	16	16	256		1,001	

¹Instead of 1,440 × 900

²Instead of 2,464 × 1,028

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 44: Alvium 1800 C-507m/c ROI frame rates

Alvium 1800 C-508m/c

Feature	Specification	
	1800 C-508m (monochrome)	1800 C-508c (color)
Sensor model	Sony IMX250LLR	Sony IMX250LQR
Resolution	2464 (H) x 2056 (V); 5.1 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
Sensor size	Type 2/3; 8.5 mm x 7.1 mm; 11.1 mm diagonal	
Pixel size	3.45 µm x 3.45 µm	
CRA	0 deg	
ADC bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	65 fps, using 4 lanes	
Exposure time	169 µs to 10 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	2.8 W	

Table 45: Alvium 1800 C-508m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-508m/C				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 45: Alvium 1800 C-508m/c specifications (sheet 2 of 2)

Absolute QE

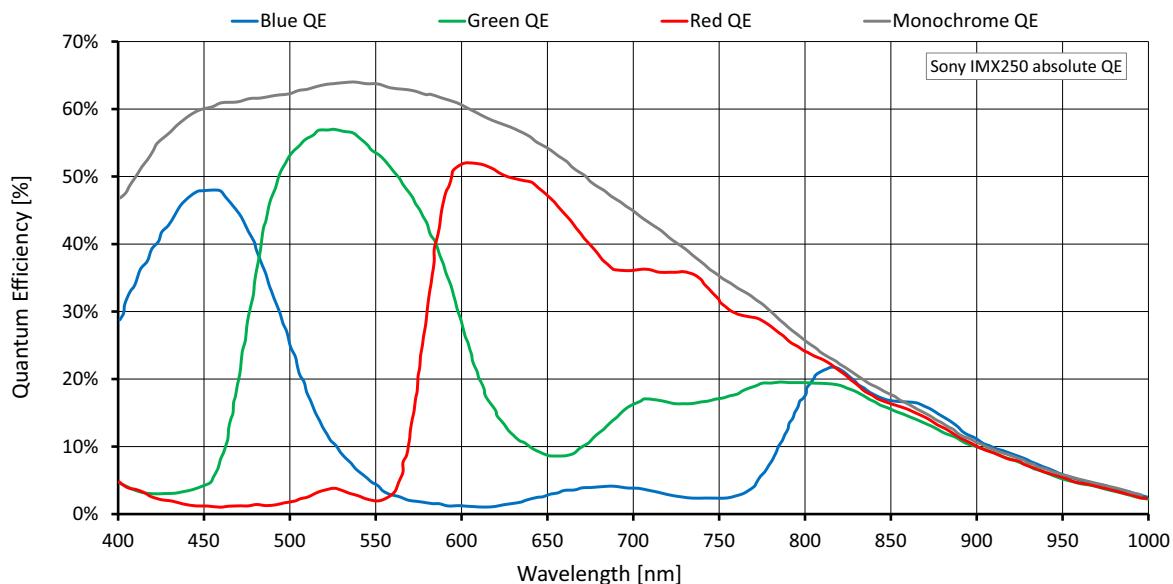


Figure 31: Alvium 1800 C-508m/c (Sony IMX250) absolute QE

Spectral response

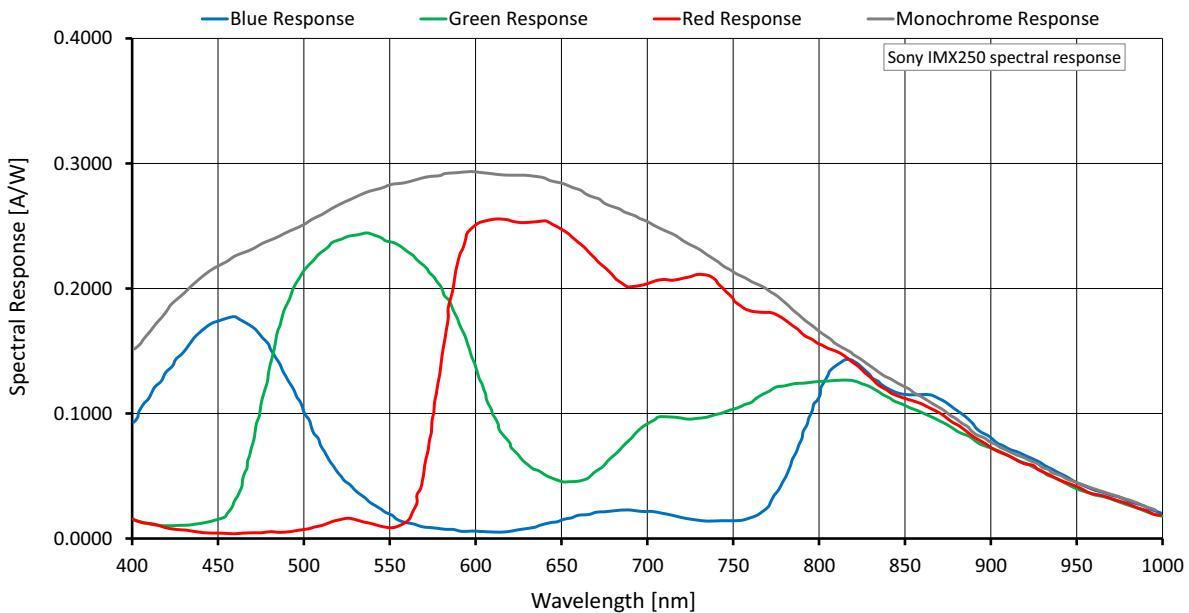


Figure 32: Alvium 1800 C-508m/c (Sony IMX250) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,464	2,056	5,065,984	65	49	24
QXGA	2,048	1,536	3,145,728	86	78	39
Full HD	1,920	1,080	2,073,600	120	115	59
UXGA	1,600	1,200	1,920,000	109		64
WXGA+ ¹	1,440	904 ¹	1,301,760	142		92
SXGA	1,280	1,024	1,310,720	127		92
HD 720	1,280	720	921,600	175		128
XGA	1,024	768	786,432	166		149
SVGA	800	600	480,000	208		
VGA	640	480	307,200	254		
QVGA	320	240	76,800	451		
QQVGA	160	120	19,200	733		
Maximum × half ²	2,464	1,032 ²	2,542,848	124	93	48
Maximum × minimum	2,464	16	39,424	1,111	952	617
Minimum × maximum	16	2,056	32,896	66		
Minimum × minimum	16	16	256	1,580		

¹ Instead of 1,440 × 900

² Instead of 2,464 × 1,028

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 46: Alvium 1800 C-508m/c ROI frame rates



Alvium 1800 C-511m/c

Red table border lines signal that **GenICam for CSI-2 Access** is required.

Feature	Specification	
	1800 C-511m (monochrome)	1800 C-511c (color)
Sensor model	Sony IMX547-AAMJ	Sony IMX547-AAQJ
Resolution	2464 (H) × 2064 (V); 5.1 MP	
Sensor type		CMOS
Shutter type		Global shutter (GS)
Sensor size	Type 1/1.8; 6.75 mm × 5.66 mm; 8.8 mm diagonal	
Pixel size	2.74 µm × 2.74 µm	
CRA		0 deg
ADC bit depth		12-bit
Monochrome pixel formats	Mono8 (default), Mono10, Mono10p, Mono12, Mono12p	Mono8, Mono10, Mono10p, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerRG8, BayerRG10, BayerRG10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate	78 fps, using 4 lanes	
Exposure time	158 µs to 10 s (4 lanes)	
Exposure modes		Timed
Gain	0 dB to 24 dB; 0.1 dB increments	
Digital binning	Horizontal: 1 to 8 columns; Vertical: 1 to 8 rows	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	

Table 47: Alvium 1800 C-511m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-511m/c			
Power requirements	Power over MIPI CSI-2			
Power consumption (typical, at 5 VDC)	3.0 W			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
	Open housing ⁴	-20° C to +65° C		
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	GenICam V2.0 (GenICam for CSI-2 Access) V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 47: Alvium 1800 C-511m/c specifications (sheet 2 of 2)

Absolute QE

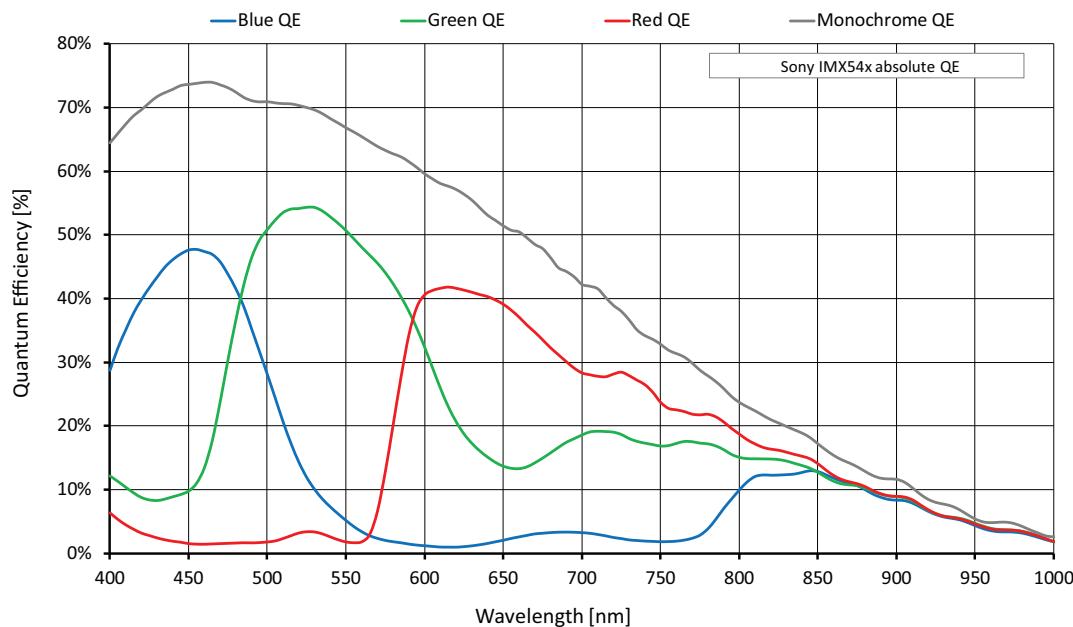


Figure 33: Alvium 1800 C-511m/c (Sony IMX547) absolute QE

Spectral response

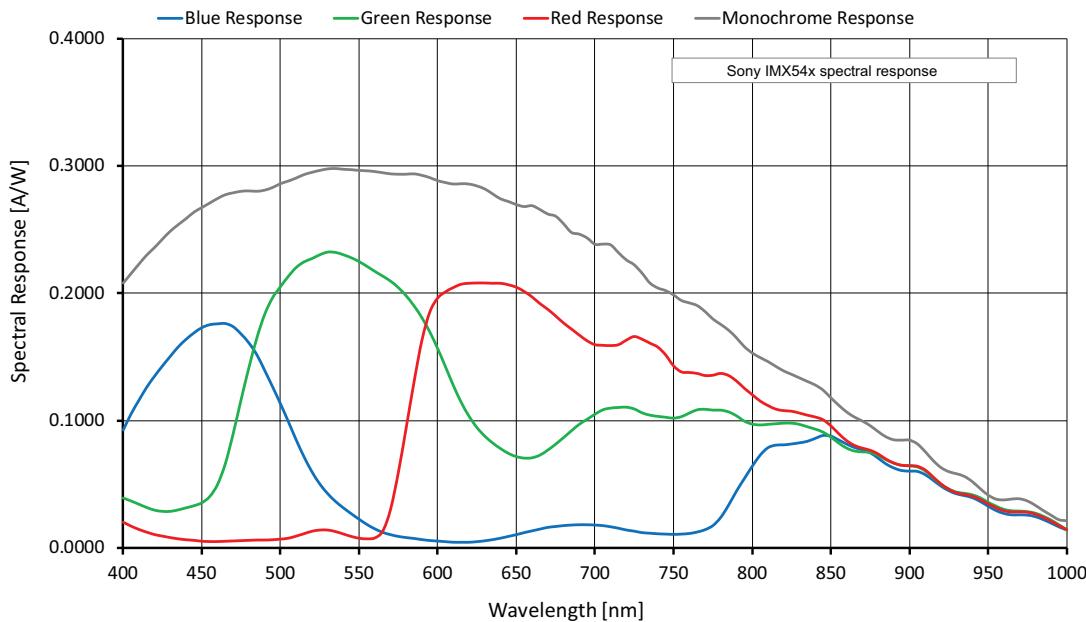


Figure 34: Alvium 1800 C-511m/c (Sony IMX547) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,464	2,064	5,085,696	78	47	23
QXGA	2,048	1,536	3,145,728	103	74	37
Full HD	1,920	1,080	2,073,600	139	107	54
UXGA	1,600	1,200	1,920,000	128	116	59
WXGA+ ¹	1,440	904 ¹	1,301,760	162		84
SXGA	1,280	1,024	1,310,720	147		85
HD 720	1,280	720	921,600	195		114
XGA	1,024	768	786,432	186		134
SVGA	800	600	480,000	227		207
VGA	640	480	307,200		268	
QVGA	320	240	76,800		419	
QQVGA	160	120	19,200		581	
Maximum × half	2,464	1,032	2,542,848	1,44	86	44
Maximum × minimum	2,464	16	39,424	770	514	285
Minimum × maximum	16	2,064	33,024		79	
Minimum × minimum	16	16	256		874	

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 48: Alvium 1800 C-511m/c ROI frame rates

Alvium 1800 C-811m/c

Feature	Specification	
	1800 C-811m (monochrome)	1800 C-811c (color)
Sensor model	Sony IMX546-AAMJ	Sony IMX546-AAQJ
Resolution	2848 (H) × 2848 (V); 8.1 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
Sensor size	Type 2/3; 7.8 mm × 7.8 mm; 11 mm diagonal	
Pixel size	2.74 µm × 2.74 µm	
CRA	0 deg	
ADC bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	58 fps, using 4 lanes	
Exposure time	166 µs to 10 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.1 W	

Table 49: Alvium 1800 C-811m/c specifications (sheet 1 of 2)

Feature	Specification			
1800 C-811m/c				
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 49: Alvium 1800 C-811m/c specifications (sheet 2 of 2)

Absolute QE

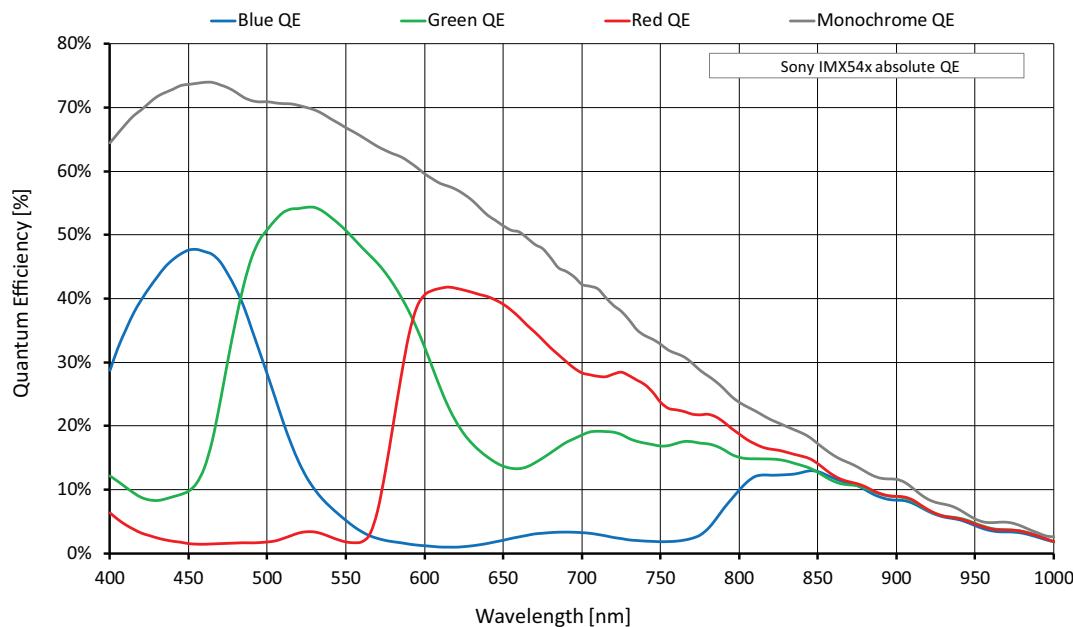


Figure 35: Alvium 1800 C-811m/c (Sony IMX546) absolute QE

Spectral response

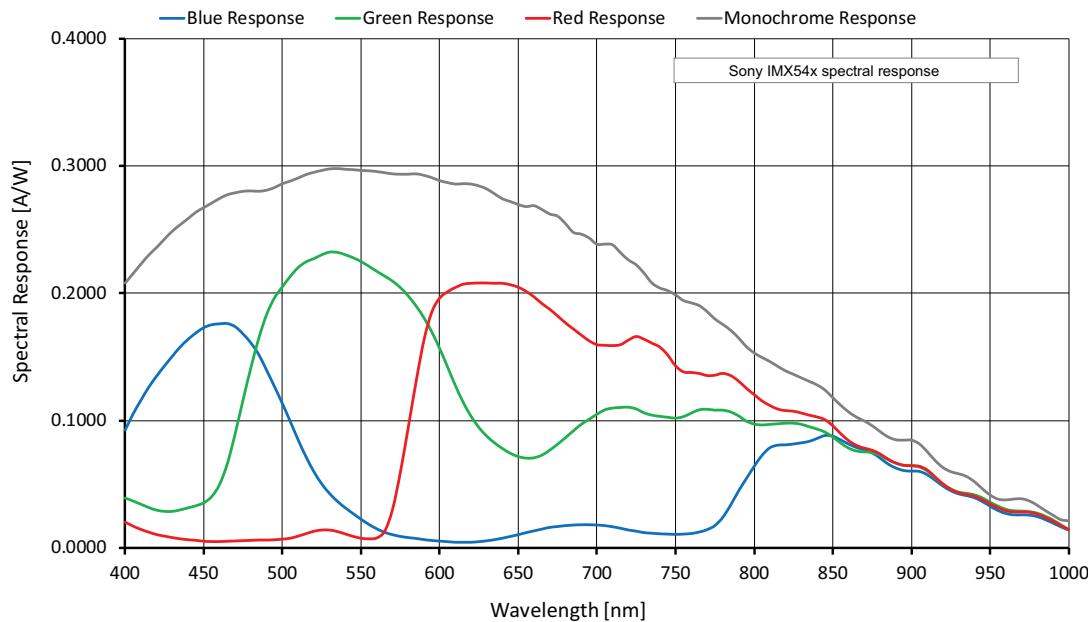


Figure 36: Alvium 1800 C-811m/c (Sony IMX546) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	2,848	2,848	8,111,104	58	30	15
QSXGA	2,560	2,048	5,242,880	79	45	23
WQHD	2,560	1,440	3,686,400	108	62	31
QXGA	2,048	1,536	3,145,728	103	74	37
Full HD	1,920	1,080	2,073,600	139	107	54
UXGA	1,600	1,200	1,920,000	128	116	59
WXGA+ ¹	1,440	904 ¹	1,301,760	162		84
SXGA	1,280	1,024	1,310,720	147		85
HD 720	1,280	720	921,600	195		114
XGA	1,024	768	786,432	186		134
SVGA	800	600	480,000	227		207
VGA	640	480	307,200	268		
QVGA	320	240	76,800	419		
QQVGA	160	120	19,200	581		
Maximum × half	2,848	1,424	4,055,552	109	57	28
Maximum × minimum	2,848	16	45,568	754	450	248
Minimum × maximum	16	2,848	45,568	59		
Minimum × minimum	16	16	256	874		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 50: Alvium 1800 C-811m/c ROI frame rates



Alvium 1800 C-1236m/c

Red table border lines signal that **GenICam for CSI-2 Access** is required.

Feature	Specification	
	1800 C-1236m (monochrome)	1800 C-1236c (color)
Sensor model		Sony IMX304
Resolution		4112 (H) × 3008 (V); 12.4 MP
Sensor type		CMOS
Shutter type		Global shutter (GS)
Sensor size		Type 1.1; 14.2 mm × 10.4 mm; 17.6 mm diagonal
Pixel size		3.45 µm × 3.45 µm
CRA		0 deg
ADC bit depth		12-bit
Pixel formats, GenICam for CSI-2 Access		
Monochrome pixel formats	Mono8 (default), Mono10, Mono10p, Mono12, Mono12p	Mono8, Mono10, Mono10p, Mono12, Mono12p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerRG8, BayerRG10, BayerRG10p, BayerRG12, BayerRG12p, BGR8, RGB8 (default)
Pixel formats, other access modes		
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)
Maximum frame rate		22 fps, using 4 lanes
Exposure time		179 µs to 10 s (4 lanes)
Exposure modes		Timed, TriggerControlled, TriggerWidth
Gain		0 dB to 24 dB; 0.1 dB increments
Digital binning ¹	Horizontal: 1 to 8 columns; Vertical: 1 to 8 rows	

¹Digital vertical binning can be used only when digital horizontal binning is used as well.

Table 51: Alvium 1800 C-1236m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-1236m/c			
Image buffer (RAM)	256 KB			
Non-volatile memory (Flash)	1024 KB			
GPIOs	2 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			
Power requirements	Power over MIPI CSI-2			
Power consumption (typical, at 5 VDC)	2.6 W			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	+5 °C to +88 °C
	Open housing ⁵	-20° C to +65° C		
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	GenICam V2.0 (GenICam for CSI-2 Access) V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 51: Alvium 1800 C-1236m/c specifications (sheet 2 of 2)

Absolute QE

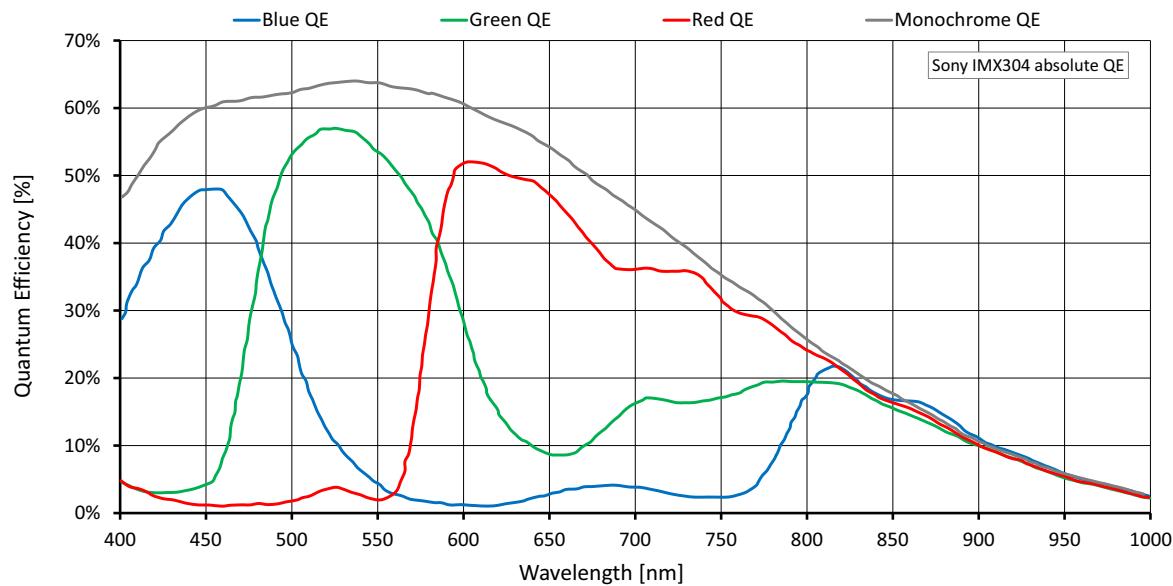


Figure 37: Alvium 1800 C-1236m/c (Sony IMX304) absolute QE

Spectral response

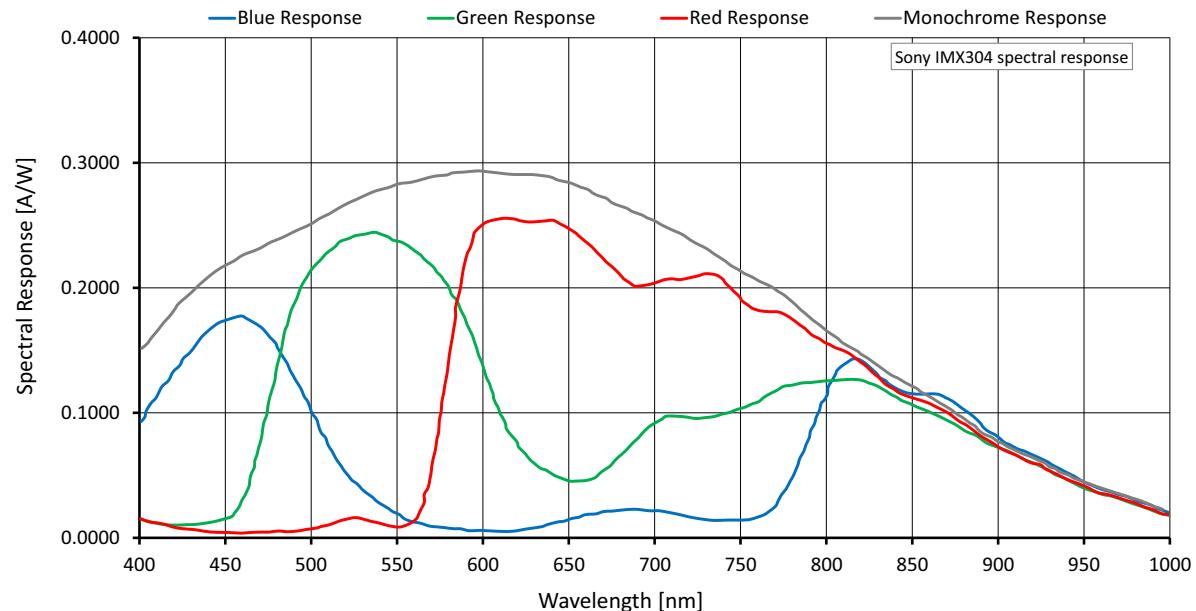


Figure 38: Alvium 1800 C-1236m/c (Sony IMX304) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	4,112	3,008	12,368,896	22	20	10
UHD 4K	3,840	2,160	8,294,400	31	30	15
QSXGA	2,560	2,048	5,242,880	33		24
WQHD	2,560	1,440	3,686,400	46		33
QXGA	2,048	1,536	3,145,728	44		39
Full HD	1,920	1,080	2,073,600	61		59
UXGA	1,600	1,200	1,920,000		55	
WXGA+ ¹	1,440	904 ¹	1,301,760		72	
SXGA	1,280	1,024	1,310,720		65	
HD 720	1,280	720	921,600		90	
XGA	1,024	768	786,432		85	
SVGA	800	600	480,000		106	
VGA	640	480	307,200		130	
QVGA	320	240	76,800		235	
QQVGA	160	120	19,200		392	
Maximum × half	4,112	1,504	6,184,448	44	40	20
Maximum × minimum	4,112	16	65,792	640	601	375
Minimum × maximum	16	3,008	48,128		23	
Minimum × minimum	16	16	256		923	

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 52: Alvium 1800 C-1236m/c ROI frame rates

Alvium 1800 C-1240m/c

Feature	Specification	
	1800 C-1240m (monochrome)	1800 C-1240c (color)
Sensor model		Sony IMX226
Resolution		4024 (H) x 3036 (V); 12.2 MP
Sensor type		CMOS
Shutter type		Rolling shutter (RS)
Sensor size		Type 1/1.7; 7.4 mm x 5.6 mm; 9.33 mm diagonal
Pixel size		1.85 µm x 1.85 µm
CRA		0 deg
ADC bit depth		10-bit
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10)
Maximum frame rate		41 fps ¹ , using 4 lanes
Exposure time		26 µs to 10 s (4 lanes)
Gain		0 dB to 27 dB; 0.1 dB increments
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	2.9 W	

¹In triggered mode: 20 fps

Table 53: Alvium 1800 C-1240m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-1240m/c			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	+5 °C to +88 °C
	Open housing ⁵	-20° C to +65° C		
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 53: Alvium 1800 C-1240m/c specifications (sheet 2 of 2)

Absolute QE

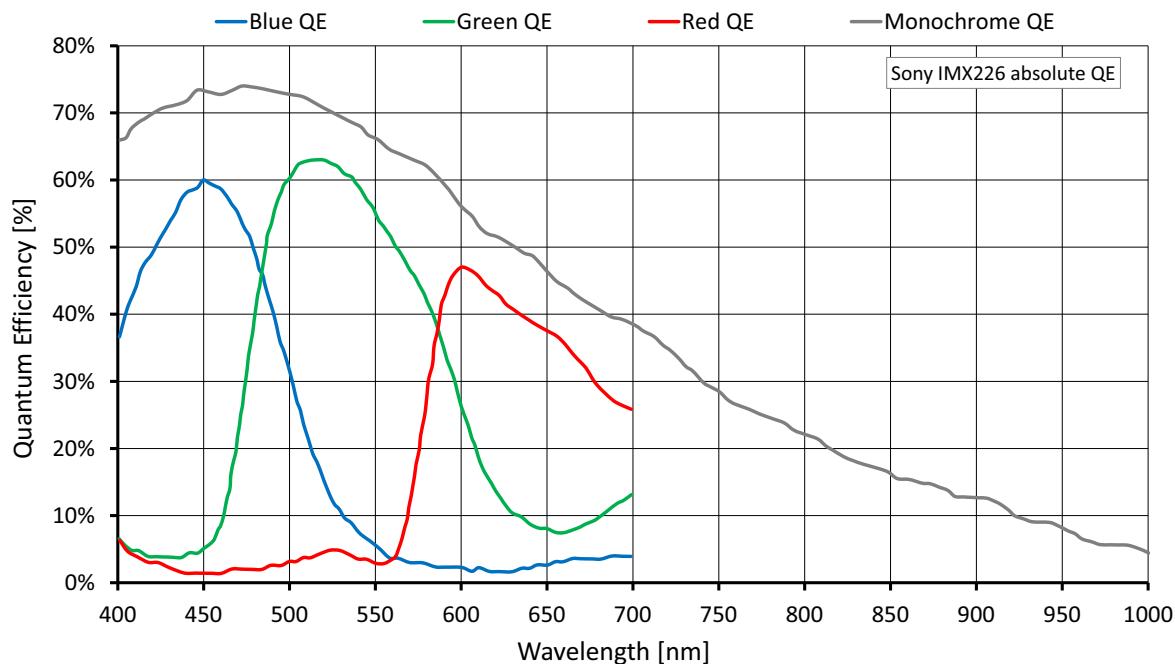


Figure 39: Alvium 1800 C-1240m/c (Sony IMX226) absolute QE

Spectral response

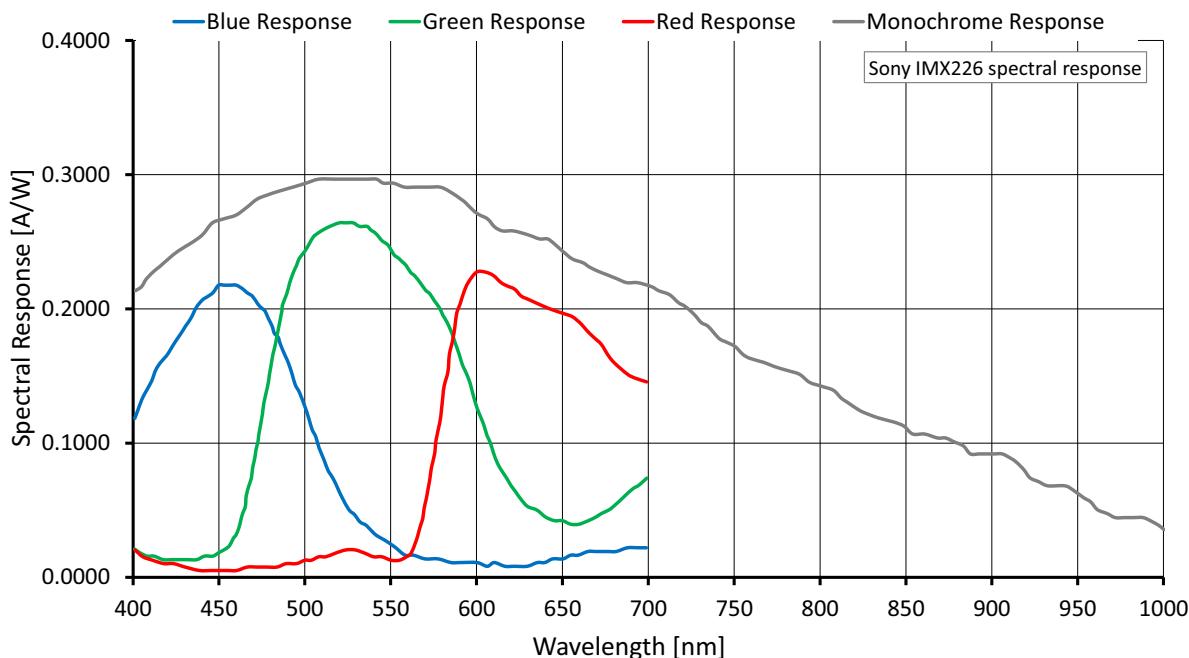


Figure 40: Alvium 1800 C-1240m/c (Sony IMX226) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	4,024	3,036	12,216,864			
UHD 4K	3,840	2,160	8,294,400			
QSXGA	2,560	2,048	5,242,880			
WQHD	2,560	1,440	3,686,400			
QXGA	2,048	1,536	3,145,728			
Full HD	1,920	1,080	2,073,600			
UXGA	1,600	1,200	1,920,000			
WXGA+ ¹	1,440	904 ¹	1,301,760			
SXGA	1,280	1,024	1,310,720			
HD 720	1,280	720	921,600	41	20	10
XGA	1,024	768	786,432			
SVGA	800	600	480,000			
VGA	640	480	307,200			
QVGA	320	240	76,800			
QQVGA	160	120	19,200			
Maximum × half ²	4,024	1,520 ²	6,116,480			
Maximum × minimum	4,024	16	64,384			
Minimum × maximum	16	3,036	48,576			
Minimum × minimum	16	16	256			

¹ Instead of 1,440 × 900

² Instead of 4,024 × 1,518

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 54: Alvium 1800 C-1240m/c ROI frame rates



Values in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.

Alvium 1800 C-1242m/c

Feature	Specification	
	1800 C-1242m (monochrome)	1800 C-1242c (color)
Sensor model	Sony IMX545-AAMJ	Sony IMX545-AAQJ
Resolution	4128 (H) × 3008 (V); 12.4 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
Sensor size	Type 1/1.1; 11.31 mm × 8.24 mm; 14 mm diagonal	
Pixel size	2.74 µm × 2.74 µm	
CRA	0 deg	
ADC bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	39 fps, using 4 lanes	
Exposure time	168 µs to 10 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.2 W	

Table 55: Alvium 1800 C-1242m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-1242m/c			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 55: Alvium 1800 C-1242m/c specifications (sheet 2 of 2)

Absolute QE

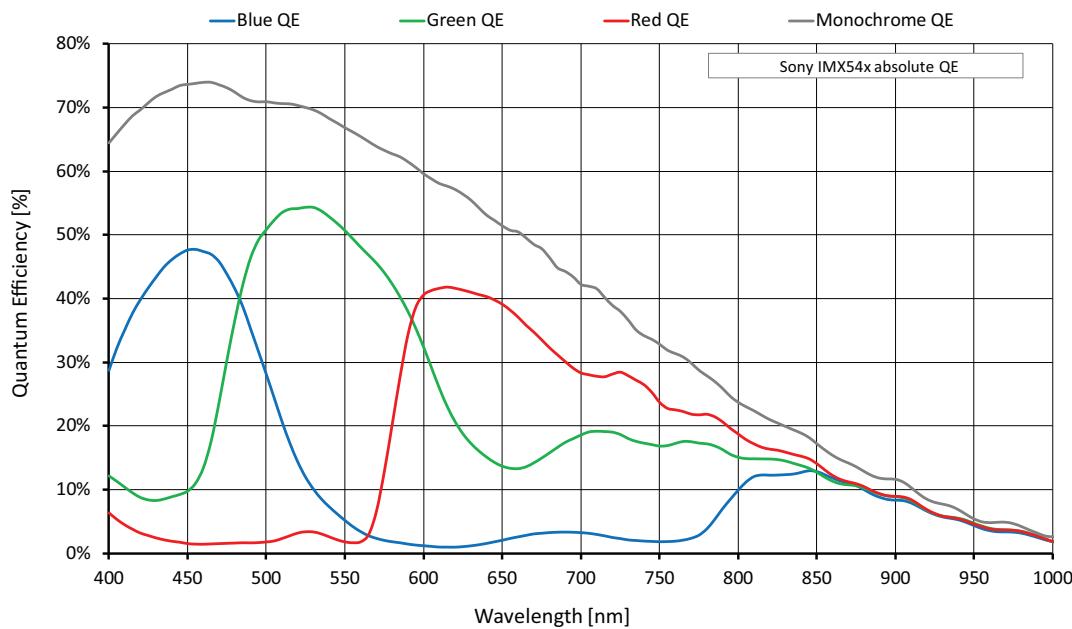


Figure 41: Alvium 1800 C-1242m/c (Sony IMX545) absolute QE

Spectral response

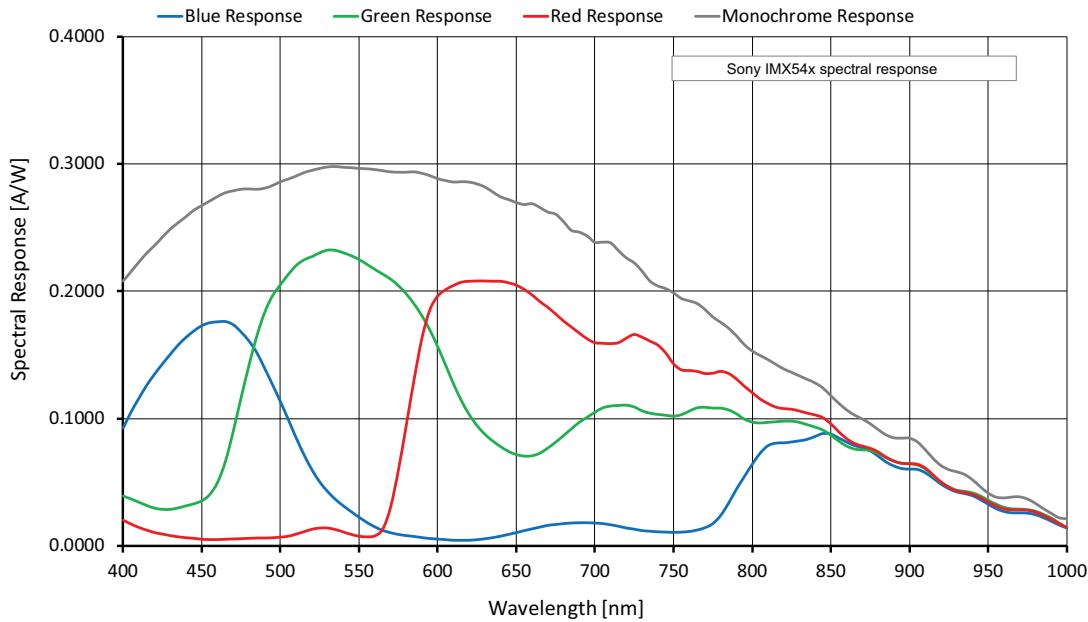


Figure 42: Alvium 1800 C-1242m/c (Sony IMX545) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	4,128	3,008	12,417,024	39	20	10
UHD 4K	3,840	2,160	8,294,400	55	29	14
QSXGA	2,560	2,048	5,242,880	58	46	23
WQHD	2,560	1,440	3,686,400	80	63	32
QXGA	2,048	1,536	3,145,728	76	74	37
Full HD	1,920	1,080	2,073,600	103		55
UXGA	1,600	1,200	1,920,000	95		60
WXGA+ ¹	1,440	904 ¹	1,301,760	121		85
SXGA	1,280	1,024	1,310,720	109		86
HD 720	1,280	720	921,600	146		116
XGA	1,024	768	786,432	139		136
SVGA	800	600	480,000	170		
VGA	640	480	307,200	202		
QVGA	320	240	76,800	324		
QQVGA	160	120	19,200	461		
Maximum × half	4,128	1,504	6,208,512	74	38	19
Maximum × minimum	4,128	16	66,048	588	347	190
Minimum × maximum	16	3,008	48,128	41		
Minimum × minimum	16	16	256	730		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 56: Alvium 1800 C-1242m/c ROI frame rates

Alvium 1800 C-1620m/c

Feature	Specification	
	1800 C-1620m (monochrome)	1800 C-1620c (color)
Sensor model	Sony IMX542-AAMJ	Sony IMX542-AAQJ
Resolution	5328 (H) × 3040 (V); 16.2 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
Sensor size	Type 1.1; 14.6 mm × 8.33 mm; 16.8 mm diagonal	
Pixel size	2.74 µm × 2.74 µm	
CRA	0 deg	
ADC bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	30 fps, using 4 lanes	
Exposure time	155 µs to 10 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.8 W	

Table 57: Alvium 1800 C-1620m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-1620m/c			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 57: Alvium 1800 C-1620m/c specifications (sheet 2 of 2)

Absolute QE

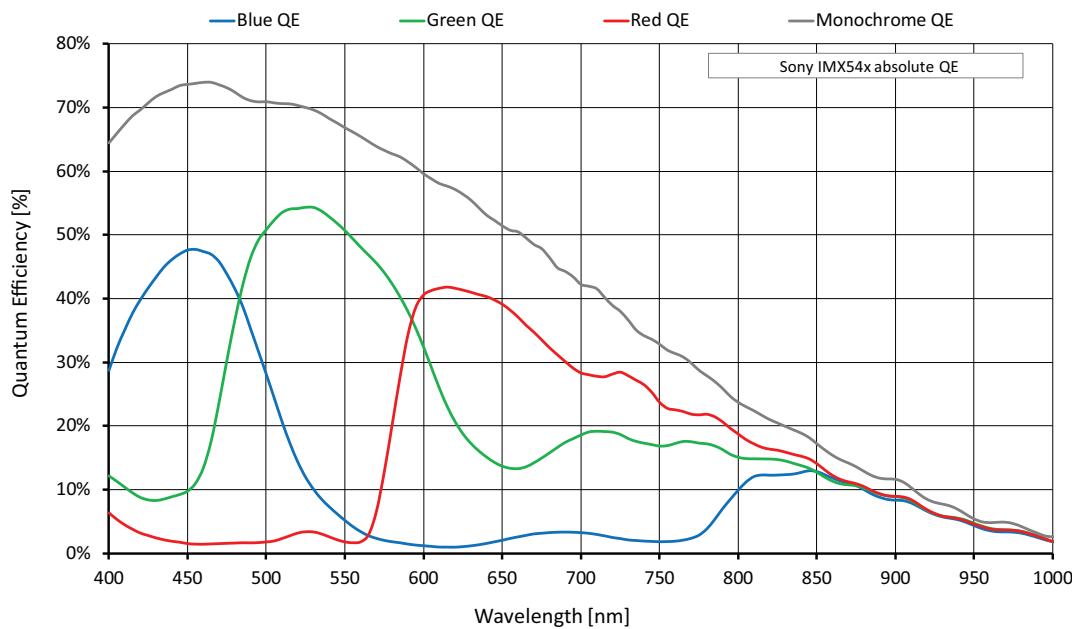


Figure 43: Alvium 1800 C-1620m/c (Sony IMX542) absolute QE

Spectral response

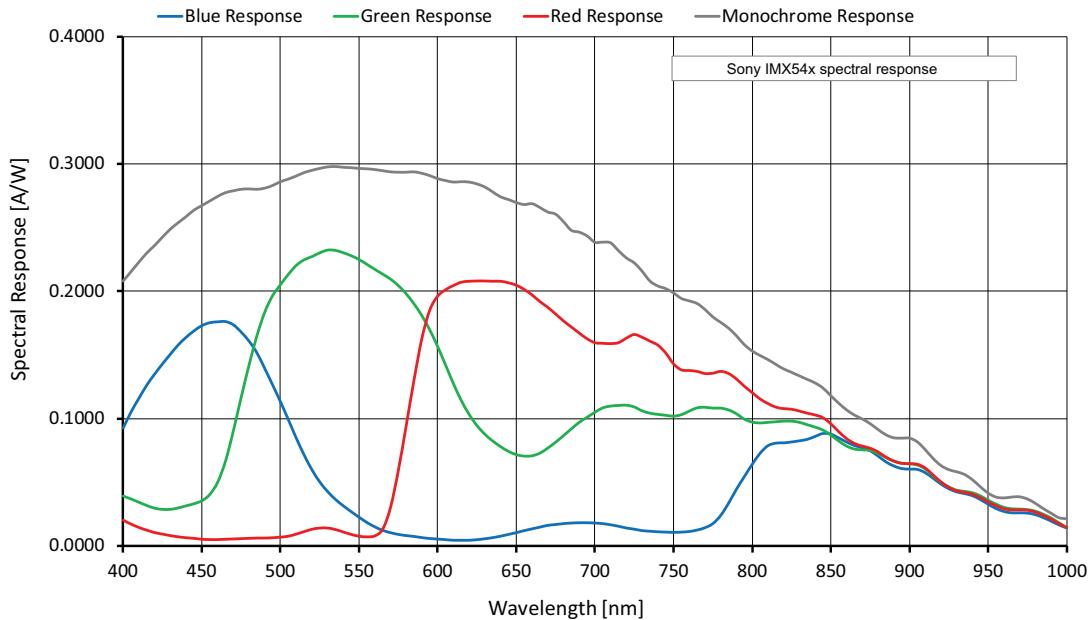


Figure 44: Alvium 1800 C-1620m/c (Sony IMX542) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	5,312	3,040	16,148,480	30	15	7
UHD 4K	3,840	2,160	8,294,400	44	29	14
QSXGA	2,560	2,048	5,242,880	46		23
WQHD	2,560	1,440	3,686,400	64		32
QXGA	2,048	1,536	3,145,728	61		38
Full HD	1,920	1,080	2,073,600	83		56
UXGA	1,600	1,200	1,920,000	76		61
WXGA+ ¹	1,440	904 ¹	1,301,760	98		86
SXGA	1,280	1,024	1,310,720	88		87
HD 720	1,280	720	921,600	119		118
XGA	1,024	768	786,432	113		
SVGA	800	600	480,000	139		
VGA	640	480	307,200	166		
QVGA	320	240	76,800	272		
QQVGA	160	120	19,200	399		
Maximum × half	5,312	1,520	8,074,240	58	29	14
Maximum × minimum	5,312	16	84,992	516	306	169
Minimum × maximum	16	3,040	48,640	32		
Minimum × minimum	16	16	256	669		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 58: Alvium 1800 C-1620m/c ROI frame rates

Alvium 1800 C-2040m/c

Feature	Specification	
	1800 C-2040m (monochrome)	1800 C-2040c (color)
Sensor model	Sony IMX541-AAMJ	Sony IMX541-AAQJ
Resolution	4512 (H) × 4512 (V); 20.4 MP	
Sensor type	CMOS	
Shutter type	Global shutter (GS)	
Sensor size	Type 1.1; 12.36 mm × 12.36 mm; 17.5 mm diagonal	
Pixel size	2.74 µm × 2.74 µm	
CRA	0 deg	
ADC bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	24 fps, using 4 lanes	
Exposure time	157 µs to 10 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.7 W	

Table 59: Alvium 1800 C-2040m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-2040m/c			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas¹	Mainboard²
	Bare board ³	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

¹See [Mounting the heat sink](#) on page 189.

²Output by [DeviceTemperature](#)

³Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

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

Table 59: Alvium 1800 C-2040m/c specifications (sheet 2 of 2)

Absolute QE

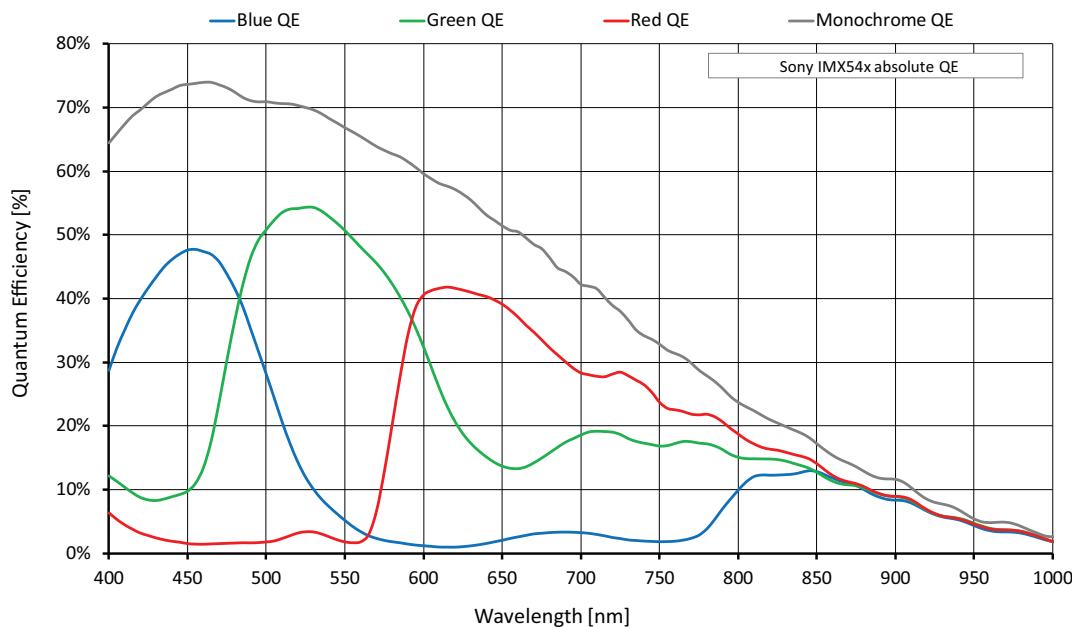


Figure 45: Alvium 1800 C-2040m/c (Sony IMX541) absolute QE

Spectral response

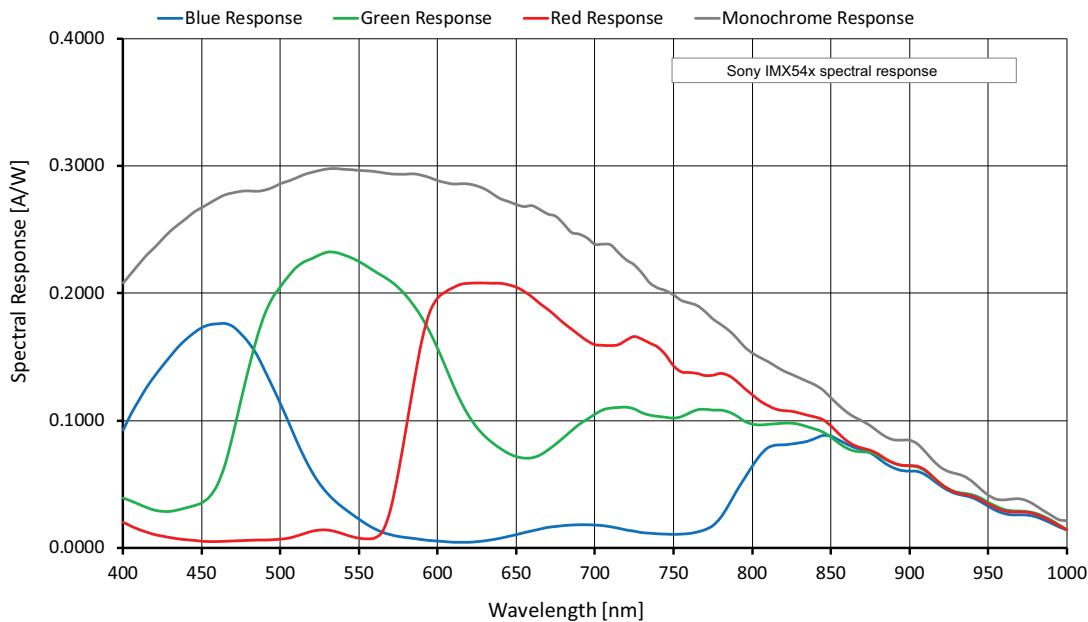


Figure 46: Alvium 1800 C-2040m/c (Sony IMX541) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	4,512	4,512	20,358,144	24	12	6
HXGA	4,096	3,072	12,582,912	37	19	10
UHD 4K	3,840	2,160	8,294,400	51	29	14
QSXGA	2,560	2,048	5,242,880	54	46	23
WQHD	2,560	1,440	3,686,400	75	64	32
QXGA	2,048	1,536	3,145,728	71		38
Full HD	1,920	1,080	2,073,600	97		55
UXGA	1,600	1,200	1,920,000	89		61
WXGA+ ¹	1,440	904 ¹	1,301,760	114		86
SXGA	1,280	1,024	1,310,720	102		87
HD 720	1,280	720	921,600	138		118
XGA	1,024	768	786,432	131		
SVGA	800	600	480,000	161		
VGA	640	480	307,200	193		
QVGA	320	240	76,800	314		
QQVGA	160	120	19,200	458		
Maximum × half	4,512	2,256	10,179,072	47	24	12
Maximum × minimum	4,512	16	72,192	591	354	196
Minimum × maximum	16	4,512	72,192	25		
Minimum × minimum	16	16	256	758		

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 60: Alvium 1800 C-2040m/c ROI frame rates



Alvium 1800 C-2050m/c

Red table border lines signal that **GenICam for CSI-2 Access** is required.

Feature	Specification	
	1800 C-2050m (monochrome)	1800 C-2050c (color)
Sensor model		Sony IMX183
Resolution		5376 (H) × 3672 (V); 19.7 MP
Sensor type		CMOS
Shutter type		Rolling shutter (RS)
Sensor size		Type 1; 13.1 mm × 8.8 mm; 15.86 mm diagonal
Pixel size		2.4 µm × 2.4 µm
CRA		3 deg
ADC bit depth		10-bit
Monochrome pixel formats	Mono8 (default), Mono10, Mono10p	Mono8, Mono10, Mono10p
YUV color pixel formats	Not applicable	YCbCr411_8_CbYYCrYY, YCbCr422_8_CbYCrY, YCbCr8_CbYCr
RGB color pixel formats	Not applicable	BayerRG8, BayerRG10, BayerRG10p, BGR8, RGB8 (default)
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats		Default: RGB888 (RGB3)
RAW pixel formats		RAW8 (GREY), RAW10 (Y10)
Maximum frame rate		25 fps ¹ , using 4 lanes
Exposure time		34 µs to 10 s (4 lanes)
Exposure modes		Timed
Gain		0 dB to 27 dB; 0.1 dB increments
Digital binning		Horizontal: 1 to 8 columns; Vertical: 1 to 8 rows
Image buffer (RAM)		256 KB
Non-volatile memory (Flash)		1024 KB
GPIOs	2 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	

¹In triggered mode: 12 fps

Table 61: Alvium 1800 C-2050m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-2050m/c			
Power requirements	Power over MIPI CSI-2			
Power consumption (typical, at 5 VDC)	2.9 W			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	+5 °C to +88 °C
	Open housing ⁵	-20° C to +65° C		
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	GenICam V2.0 (GenICam for CSI-2 Access) V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 61: Alvium 1800 C-2050m/c specifications (sheet 2 of 2)

Absolute QE

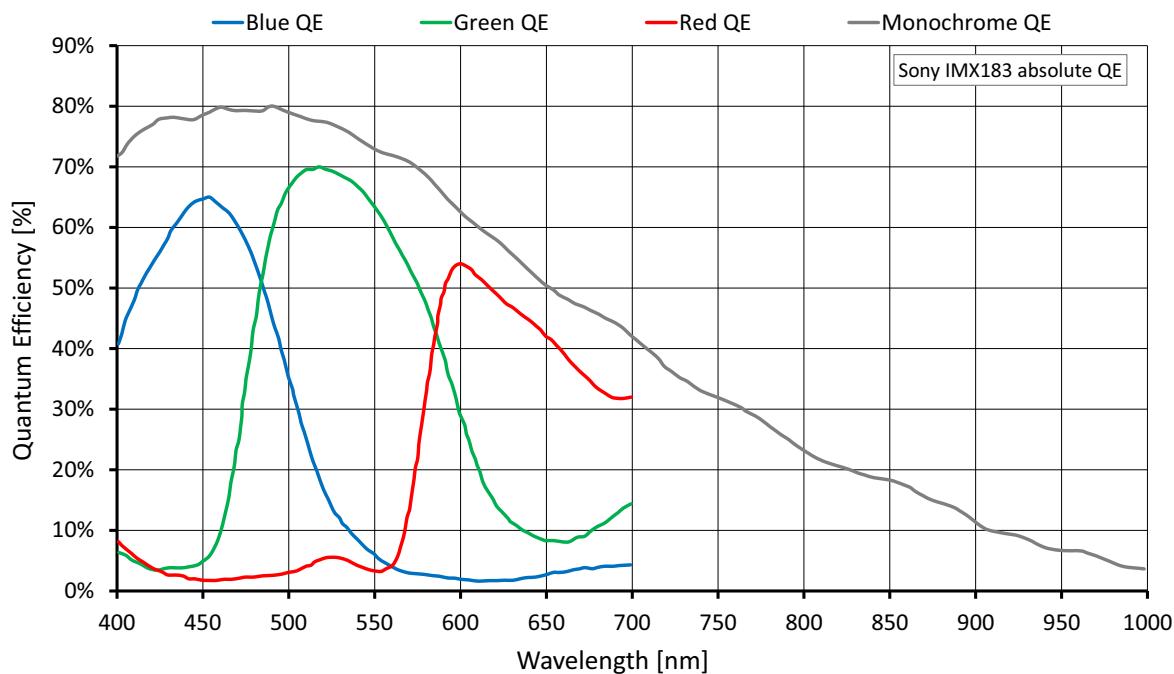


Figure 47: Alvium 1800 C-2050m/c (Sony IMX183) absolute QE

Spectral response

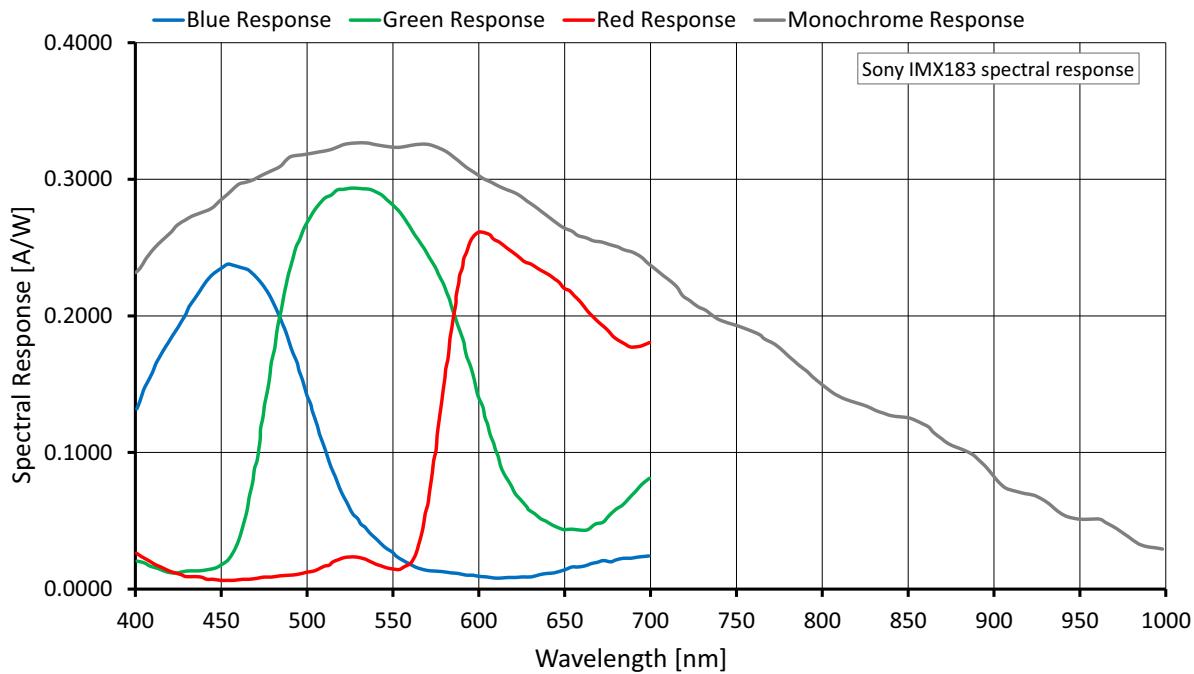


Figure 48: Alvium 1800 C-2050m/c (Sony IMX183) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	5,376	3,672	19,740,672	25	12	6
HXGA	4,096	3,072	12,582,912	29	15	7
UHD 4K	3,840	2,160	8,294,400	41	21	10
QSXGA	2,560	2,048	5,242,880	43	22	11
WQHD	2,560	1,440	3,686,400			
QXGA	2,048	1,536	3,145,728			
Full HD	1,920	1,080	2,073,600			
UXGA	1,600	1,200	1,920,000			
WXGA+ ¹	1,440	904 ¹	1,301,760			
SXGA	1,280	1,024	1,310,720			
HD 720	1,280	720	921,600			
XGA	1,024	768	786,432	48	24	12
SVGA	800	600	480,000			
VGA	640	480	307,200			
QVGA	320	240	76,800			
QQVGA	160	120	19,200			
Maximum × half ²	5,376	1,840 ²	9,891,840			
Maximum × minimum	5,376	16	86,016			
Minimum × maximum	16	3,672	58,752	25	12	6
Minimum × minimum	16	16	256	48	24	12

¹ Instead of 1,440 × 900

² Instead of 5,376 × 1,836

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 62: Alvium 1800 C-2050m/c ROI frame rates



Values in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.

Alvium 1800 C-2460m/c

Feature	Specification	
	1800 C-2460m (monochrome)	1800 C-2460c (color)
Sensor model	Sony IMX540-AAMJ	Sony IMX540-AAQJ
Resolution	5328 (H) × 4608 (V); 24.6 MP	
Sensor type		CMOS
Shutter type		Global shutter (GS)
Sensor size	Type 1.2; 14.60 mm × 12.63 mm; 19.3 mm diagonal	
Pixel size	2.74 µm × 2.74 µm	
CRA	0 deg	
ADC bit depth	12-bit	
YUV color pixel formats	Not applicable	YUV422 8-bit (UYVY)
RGB color pixel formats	Default: RGB888 (RGB3)	
RAW pixel formats	RAW8 (GREY), RAW10 (Y10), RAW12 (Y12)	
Maximum frame rate	20 fps, using 4 lanes	
Exposure time	155 µs to 10 s (4 lanes)	
Gain	0 dB to 24 dB; 0.1 dB increments	
Image buffer (RAM)	256 KB	
Non-volatile memory (Flash)	1024 KB	
GPIOs	2 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	
Power requirements	Power over MIPI CSI-2	
Power consumption (typical, at 5 VDC)	3.8 W	

Table 63: Alvium 1800 C-2460m/c specifications (sheet 1 of 2)

Feature	Specification			
	1800 C-2460m/c			
Storage temperature	-20° C to +85° C ambient temperature			
Operating temperature	Hardware option	Housing	Cooling areas²	Mainboard³
	Bare board ⁴	Not applicable	-20° C to +85° C	-20° C to +85° C
Relative humidity	0% to 80% (non-condensing)			
Digital interface	MIPI CSI-2 D-PHY V1.1; 1, 2, or 4 lanes; maximum 1.051 Gbps per lane			
Camera controls	V4L2 controls (Video4Linux Access), Direct Register Access			

²See [Mounting the heat sink](#) on page 189.

³Output by [DeviceTemperature](#)

⁴Ensure that the sensor is operated in the temperature range specified by the manufacturer. For any questions, please visit www.alliedvision.com/en/support.

⁵Temperature values must be observed for the housing **and** for the cooling areas.

Table 63: Alvium 1800 C-2460m/c specifications (sheet 2 of 2)

Absolute QE

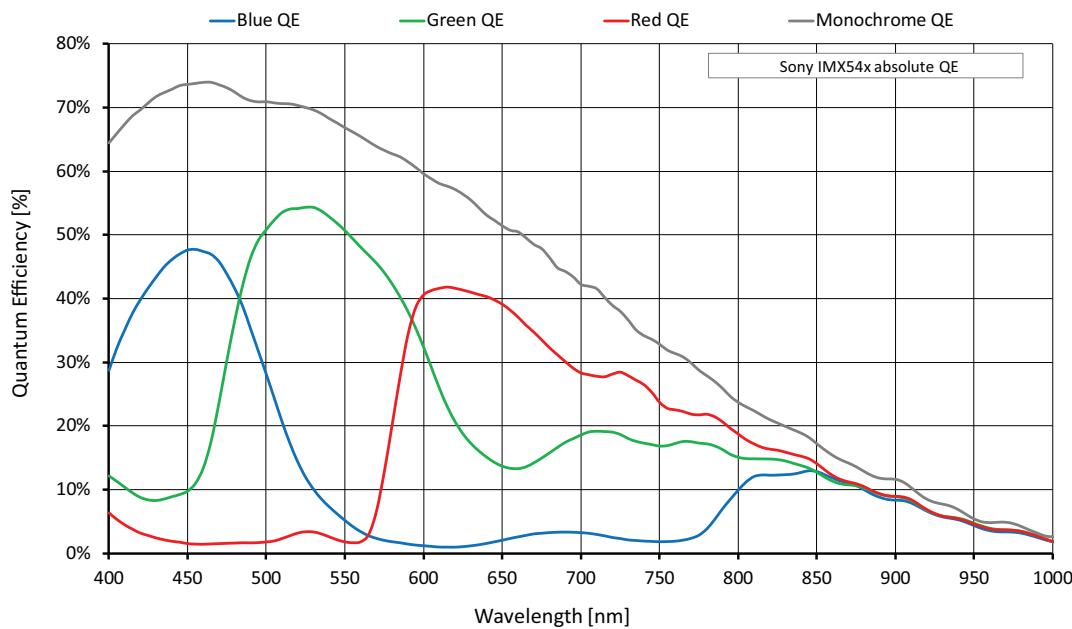


Figure 49: Alvium 1800 C-2460m/c (Sony IMX540) absolute QE

Spectral response

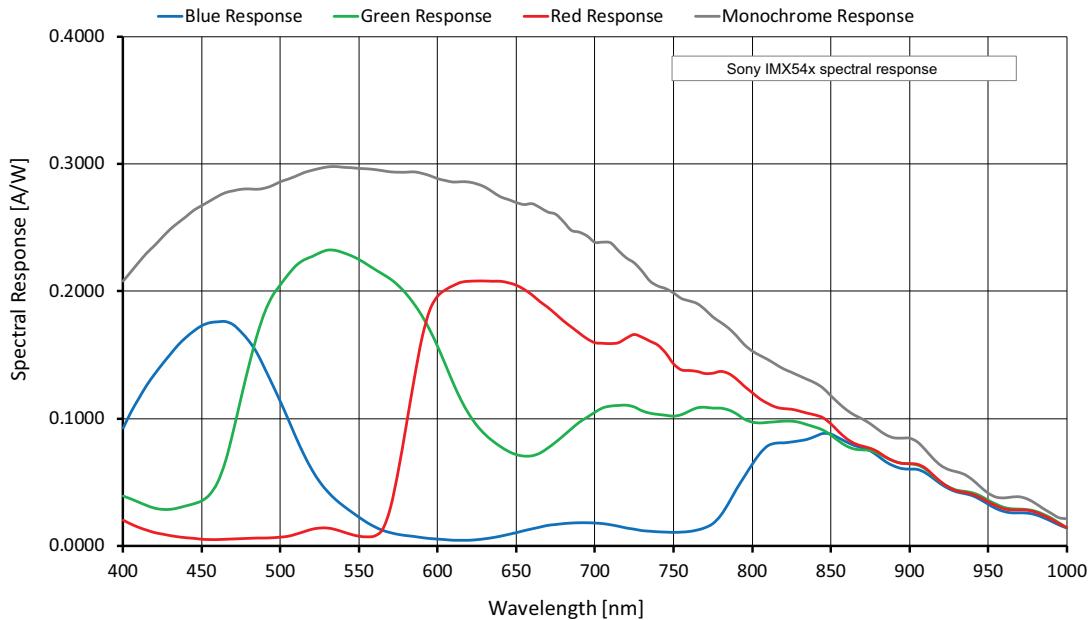


Figure 50: Alvium 1800 C-2460m/c (Sony IMX540) spectral response

Frame rates with Cropping

Values were calculated as defined in [Frame rates with ROI/Cropping on page 52](#) and in [Operation for maximum frame rates on page 54](#).

Frame rates at maximum bandwidth calculates for 1.051 Gbps per lane. To reach the maximum frame rate available for typical operation, the bandwidth for image traffic is at 4 lanes with 4.204 Gbps.

Image format	Width [pixels]	Height [pixels]	ROI area [pixels]	Frame rate [fps]		
				4-lane	2-lane	1-lane
				4.204 Gbps	2.102 Gbps	1.051 Gbps
Full resolution	5,328	4,608	24,551,424	20	10	5
HSXGA	5,120	4,096	20,971,520	24	12	6
HXGA	4,096	3,072	12,582,912	31	19	10
UHD 4K	3,840	2,160	8,294,400	44	29	14
QSXGA	2,560	2,048	5,242,880	46		23
WQHD	2,560	1,440	3,686,400	64		32
QXGA	2,048	1,536	3,145,728	61		38
Full HD	1,920	1,080	2,073,600	83		56
UXGA	1,600	1,200	1,920,000	76		61
WXGA+	1,440	904	1,301,760	98		86
SXGA	1,280	1,024	1,310,720	88		87
HD 720	1,280	720	921,600	119		118
XGA	1,024	768	786,432		113	
SVGA	800	600	480,000		139	
VGA	640	480	307,200		166	
QVGA	320	240	76,800		272	
QQVGA	160	120	19,200		399	
Maximum × half	5,328	2,304	12,275,712	39	20	10
Maximum × minimum	5,328	16	85,248	514	305	168
Minimum × maximum	16	4,608	73,728		21	
Minimum × minimum	16	16	256		669	

¹ Instead of 1,440 × 900

Due to increments, some resolutions are not available. In this case, frame rates were calculated for the next available resolution.

Table 64: Alvium 1800 C-2460m/c ROI frame rates

White balance default

Alvium color cameras are balanced for neutral color reproduction with an illumination of 5000 °K (warm daylight). [Table 65](#) shows default values for the red and blue channel by model.

For different illuminations, use auto white balance or adapt the color channel values manually. See the descriptions in [Access modes](#) on page 179 for details.

Alvium model	Sensor model	Red channel value	Blue channel value
1500 C-050c	ON Semiconductor PYTHON 480	1.930	1.500
1500 C-120c	ON Semiconductor AR0135CS	1.760	1.650
1500 C-210c	ON Semiconductor AR0521SR	2.120	1.520
1500 C-500c	ON Semiconductor AR0521SR	2.120	1.520
1500 C-501c NIR	ON Semiconductor AR0522	1.500	1.770
1800 C-040c	Sony IMX287	2.360	2.030
1800 C-052c	Sony IMX426	2.290	2.000
1800 C-158c	Sony IMX273	2.355	2.100
1800 C-240c	Sony IMX392	2.355	2.100
1800 C-291c	Sony IMX421	2.290	2.000
1800 C-319c	Sony IMX265	2.355	2.100
1800 C-500c	ON Semiconductor AR0521SR	2.120	1.520
1800 C-507c	Sony IMX264	2.355	2.100
1800 C-508c	Sony IMX250	2.355	2.100
1800 C-511c	Sony IMX547	2.870	2.000
1800 C-811c	Sony IMX546	2.870	2.000
1800 C-1236c	Sony IMX304	2.355	2.100
1800 C-1240c	Sony IMX226	2.620	1.810
1800 C-1242c	Sony IMX545	2.870	2.000
1800 C-1620c	Sony IMX542	2.870	2.000
1800 C-2040c	Sony IMX541	2.870	2.000
1800 C-2050c	Sony IMX183	2.660	1.830
1800 C-2460c	Sony IMX540	2.870	2.000

Table 65: Alvium default values for color channels



Monochrome and VSWIR models

White balance default does not apply to monochrome and VSWIR models.

Dimensions and mass

Bare board cameras	Specification
Dimensions (L × W × H [mm])	[Model specific] × 26 × 26
Mass [g]	10 g

Table 66: Bare board dimensions and mass

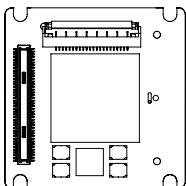
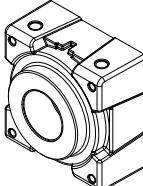
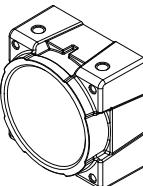
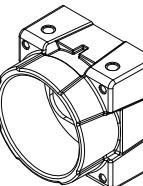
Open housing cameras	S-Mount	CS-Mount	C-Mount
Flange focal distance, optical [mm]	12.63	12.526	17.526
Thread	M12 mm × 0.5 mm	1"-32tpi UNS-2B	1"-32tpi UNS-2B
Maximum protrusion ¹ [mm]	11.0	8.6	13.6
Body dimensions (L × W × H [mm])	20 × 29 × 29	21 × 29 × 29	26 × 29 × 29
Mass	40 g	40 g	40 g

¹For details, see [Lens mounts and maximum protrusion](#).

Table 67: Housing dimensions and mass

Technical drawings

Alvium CSI-2 cameras are available with the following housing options:

			
Option	Bare Board	Open Housing S-Mount	Open Housing CS-Mount
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Bare Board

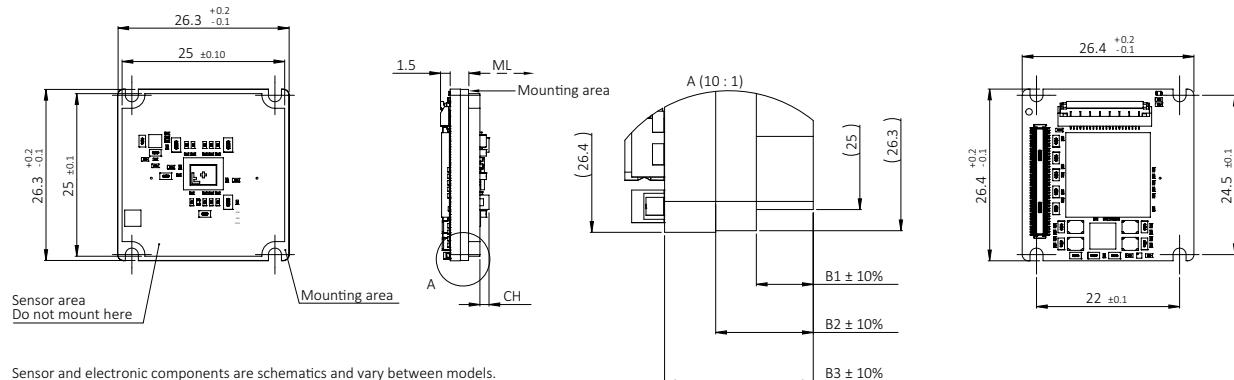


Figure 51: Bare Board dimensions

Dimensions that are common between different models are shown in [Figure 51](#), model specific dimensions are listed in [Table 68](#). **Mechanical length** (ML) defines the mechanical distance from the mounting area to the lens mount front flange, without optical filter. **Components height** (CH) relates to the electronic components with maximum height, sometimes the sensor.



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.

Camera model	ML: Mechanical length* for C-Mount	CH: Components height, incl. the sensor	B1: Board thickness	B2: Board thickness	B3: Board thickness
Alvium 1500 C-050m/c	19.604 mm	1.40 mm	1.75 mm	3.00 mm	4.55 mm
Alvium 1500 C-120m/c	19.689 mm	1.44 mm	1.25 mm	2.40 mm	3.95 mm
Alvium 1500 C-210m/c	19.739 mm	1.67 mm	1.30 mm	2.40 mm	3.95 mm
Alvium 1500 C-500m/c	19.739 mm	1.67 mm	1.30 mm	2.40 mm	3.95 mm
Alvium 1500 C-501m/c NIR	19.739 mm	1.67 mm	1.30 mm	2.40 mm	3.95 mm
Alvium 1800 C-030 VSWIR	19.613 mm	2.87 mm	1.25 mm	2.20 mm	3.75 mm
Alvium 1800 C-040m/c	19.897 mm	2.27 mm	1.20 mm	2.20 mm	3.75 mm
Alvium 1800 C-052m/c	19.713 mm	2.87 mm	1.10 mm	2.20 mm	3.77 mm
Alvium 1800 C-130 VSWIR	19.613 mm	2.87 mm	1.25 mm	2.20 mm	3.75 mm
Alvium 1800 C-158m/c	19.897 mm	2.27 mm	1.20 mm	2.20 mm	3.75 mm
Alvium 1800 C-240m/c	19.929 mm	2.27 mm	1.25 mm	2.20 mm	3.75 mm

*Theoretical values

Table 68: Bare Board model specific dimensions and nominal values (sheet 1 of 2)

Camera model	ML: Mechanical length* for C-Mount	CH: Components height, incl. the sensor	B1: Board thickness	B2: Board thickness	B3: Board thickness
Alvium 1800 C-291m/c	19.713 mm	2.87 mm	1.10 mm	2.20 mm	3.77 mm
Alvium 1800 C-319m/c	19.929 mm	2.27 mm	1.25 mm	2.20 mm	3.75 mm
Alvium 1800 C-500m/c	19.739 mm	1.67 mm	1.30 mm	2.40 mm	3.95 mm
Alvium 1800 C-507m/c	19.929 mm	2.27 mm	1.25 mm	2.20 mm	3.75 mm
Alvium 1800 C-508m/c	19.929 mm	2.27 mm	1.25 mm	2.20 mm	3.75 mm
Alvium 1800 C-511m/c	19.613 mm	2.88 mm	1.00 mm	2.20 mm	3.75 mm
Alvium 1800 C-811m/c	19.613 mm	2.88 mm	1.00 mm	2.20 mm	3.75 mm
Alvium 1800 C-1236m/c	19.829 mm	2.27 mm	1.15 mm	2.20 mm	3.75 mm
Alvium 1800 C-1240m/c	19.763 mm	2.20 mm	1.15 mm	2.20 mm	3.75 mm
Alvium 1800 C-1242m/c	19.613 mm	2.88 mm	1.00 mm	2.20 mm	3.75 mm
Alvium 1800 C-1620m/c	19.613 mm	2.88 mm	1.00 mm	2.20 mm	3.75 mm
Alvium 1800 C-2040m/c	19.613 mm	2.88 mm	1.00 mm	2.20 mm	3.75 mm
Alvium 1800 C-2050m/c	19.663 mm	2.87 mm	1.05 mm	2.20 mm	3.75 mm
Alvium 1800 C-2460m/c	19.613 mm	2.88 mm	1.00 mm	2.20 mm	3.75 mm

*Theoretical values

Table 68: Bare Board model specific dimensions and nominal values (sheet 2 of 2)

Open Housing S-Mount

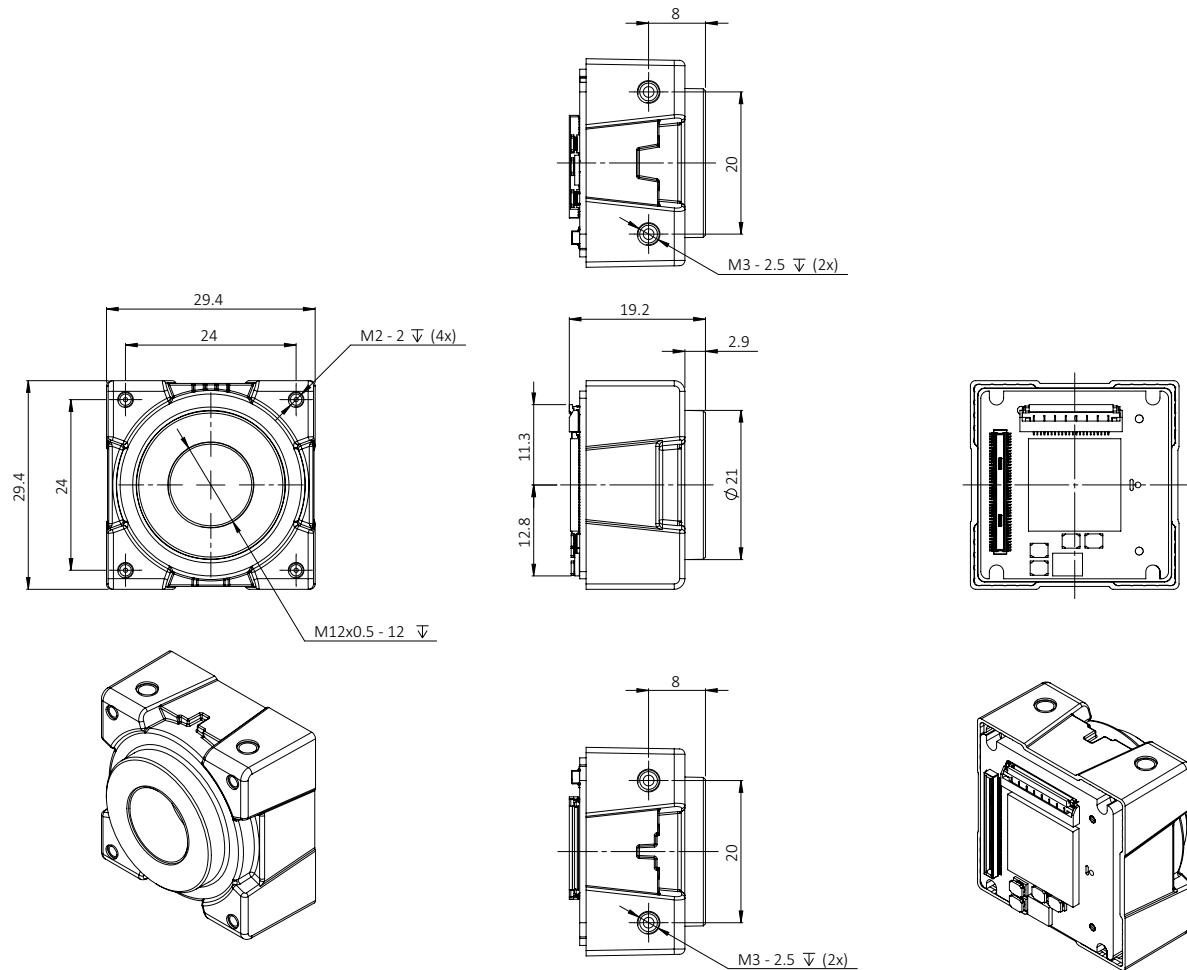


Figure 52: Open Housing S-Mount dimensions

Open Housing CS-Mount

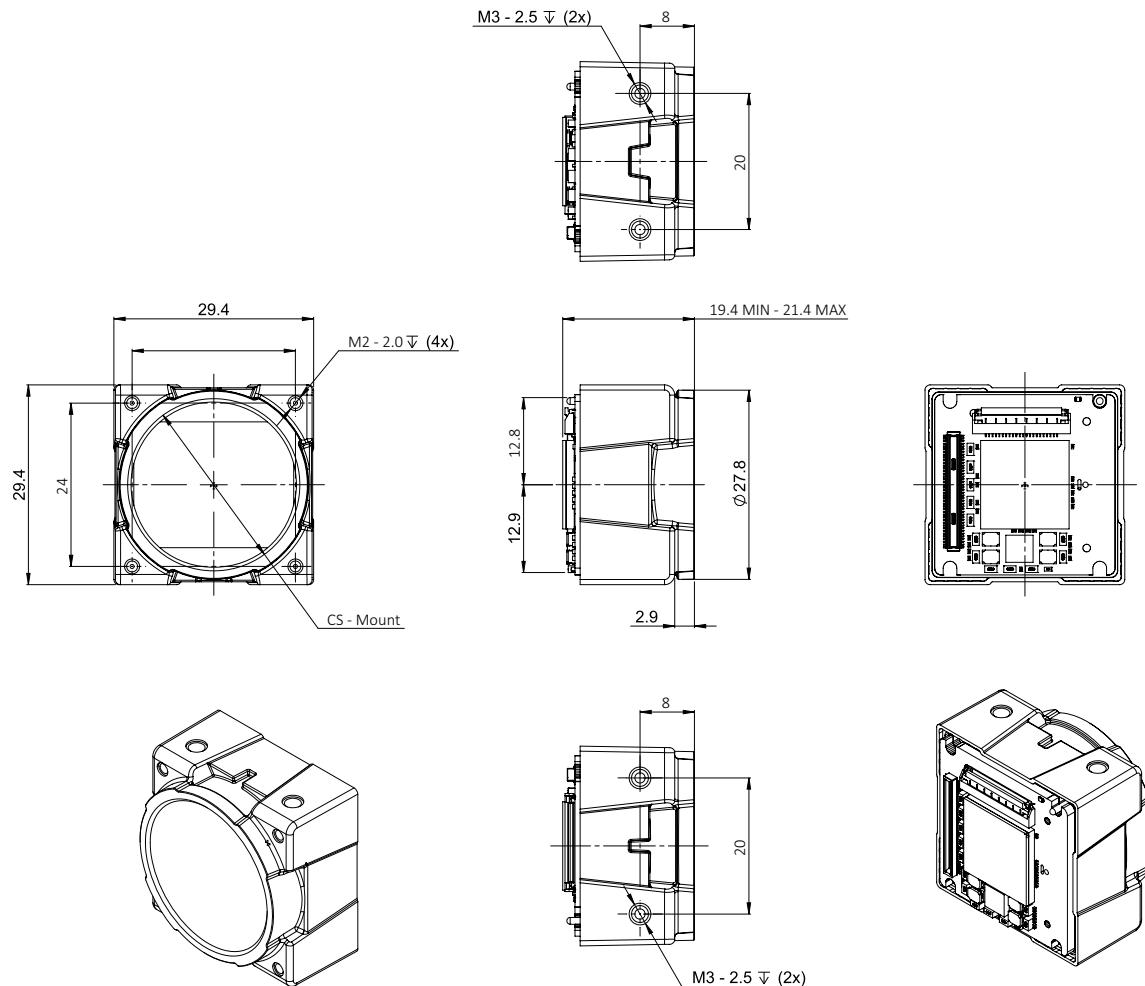


Figure 53: Open Housing CS-Mount dimensions

Open Housing C-Mount

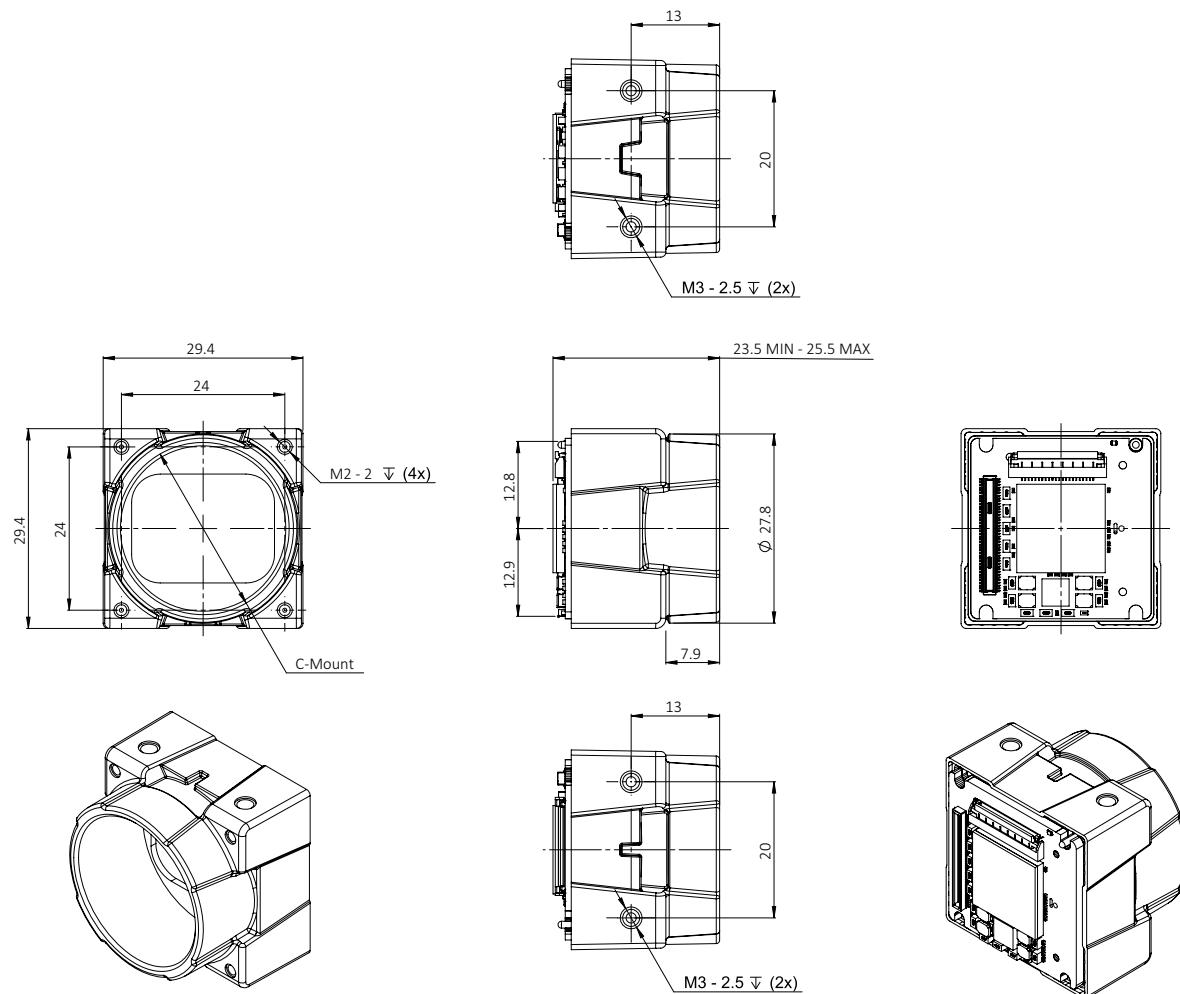


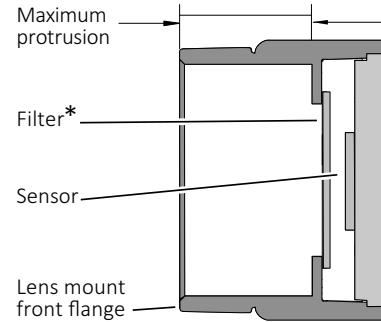
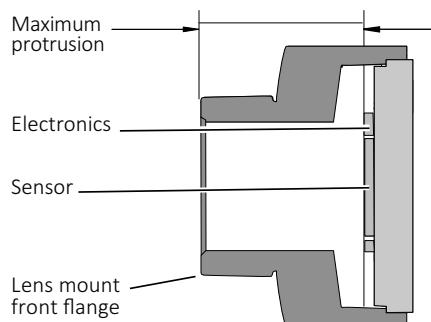
Figure 54: Open Housing C-Mount dimensions

Lens mounts and maximum protrusion



No need to readjust lens mounts

Alvium CSI-2 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 55: Maximum protrusion S-Mount (left); CS-Mount and C-Mount (right)

Figure 55 shows schematics for maximum protrusion of lenses, Table 69 shows values for maximum protrusion.



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 with less than the allowed maximum protrusion, see [Table 69](#).
- See [Mounting the lens](#) on page 193.
- For S-Mount lenses, see [Mounting and focusing S-Mount lenses](#) on page 194.

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

Table 69: Alvium CSI-2 cameras maximum protrusion

IR cut filter

Table 70 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 C-5000 IR cut filter
Monochrome and VSWIR			No filter	

Table 70: Optical filter 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 56](#) for filter transmission.



Spectral transmission values

The following curve shows typical transmission for type Hoya C-5000 IR cut filter. Values may vary slightly by filter lot.

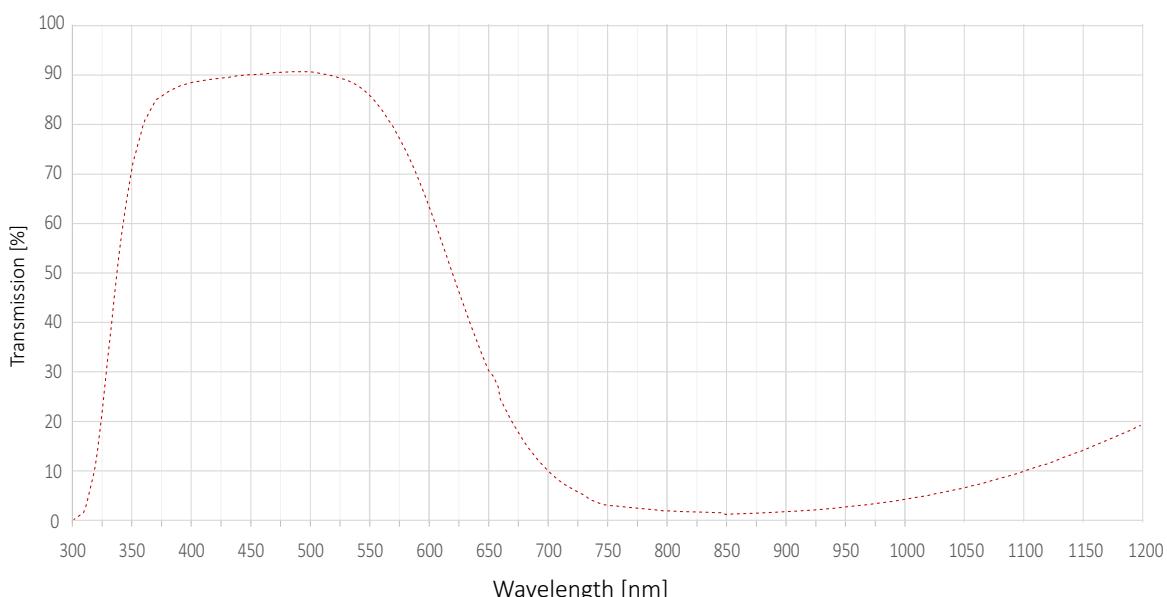


Figure 56: Type Hoya C-5000 IR cut filter spectral transmission

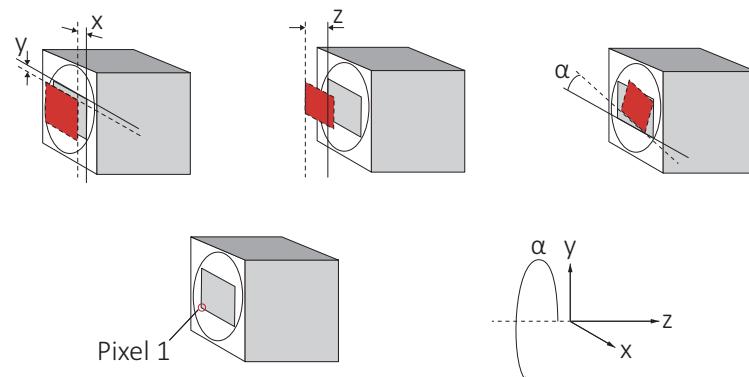


S-Mount lenses with IR cut design

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/fileadmin/content/documents/products/accessories/lenses/Allied_Vision/User_Guide/S-Mount-Lenses_User-Guide.pdf.

Sensor position accuracy

Sensor shift and rotation



Gray rectangle: Reference sensor position **Red rectangle:** Current position
Straight line: Reference edge **Dotted line:** Current reference edge

The orientation of the z-axis deviates from scientific conventions to define tolerances of the flange focal distance.

Figure 57: Sensor shift and rotation

The following table defines the manufacturing accuracy for sensor positioning.

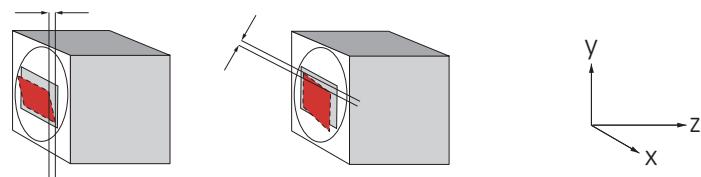
Criteria	Subject	Properties
Alignment method		Optical alignment of the photosensitive sensor area into the camera front module (lens mount front flange)
Reference Points	Sensor	Center of the pixel area (photo sensitive cells)
	Camera	Center of the lens mount
Accuracy	x/y-axis ^{1,2}	$\pm 150 \mu\text{m}$ (sensor shift)
	z	0 to -100 μm (optical back focal length)
	α^1	± 0.5 deg (sensor rotation as the deviation from the parallel to the camera bottom)

¹We cannot measure or guarantee these values for **non-standard S-Mount hardware options** that are manufactured on customer request for: Alvium 1800 C-052, C-291, C-507,C-508, C-811, C-1236, C-1242, C-1620, C-2040,C-2050, and C-2460.

²For Alvium 1800 C-2050 models, the complete offset is $\pm 200 \mu\text{m}$, common tolerances do not have to be added.

Table 71: Alvium CSI-2 cameras, criteria of sensor position accuracy

Sensor tilt



Gray rectangle: Reference sensor position **Red rectangle:** Current position

Figure 58: Sensor tilt

The following table defines sensor tilt as the variance between highest and lowest pixel of a sensor along the z-axis, measured in micrometers.

Alvium model	Pixel size	Maximum tilt
Alvium 1500 C-050m/c	4.8 µm × 4.8 µm	47 µm
Alvium 1500 C-120m/c	3.75 µm × 3.75 µm	29 µm
Alvium 1500 C-210m/c	2.2 µm × 2.2 µm	15 µm
Alvium 1500 C-500m/c	2.2 µm × 2.2 µm	15 µm
Alvium 1500 C-501m/c NIR	2.2 µm × 2.2 µm	15 µm
Alvium 1800 C-030 VSWIR	5 µm × 5 µm	50 µm
Alvium 1800 C-040m/c	6.9 µm × 6.9 µm	95 µm
Alvium 1800 C-052m/c	9 µm × 9 µm	36 µm
Alvium 1800 C-130 VSWIR	5 µm × 5 µm	50 µm
Alvium 1800 C-158m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-240m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-291m/c	4.5 µm × 4.5 µm	18 µm
Alvium 1800 C-319m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-500m/c	2.2 µm × 2.2 µm	15 µm
Alvium 1800 C-507m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-508m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-511m/c	2.74 µm × 2.74 µm	18 µm
Alvium 1800 C-811m/c	2.74 µm × 2.74 µm	18 µm
Alvium 1800 C-1236m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-1240m/c	2.74 µm × 2.74 µm	18 µm
Alvium 1800 C-1242m/c	3.45 µm × 3.45 µm	24 µm
Alvium 1800 C-1640m/c	2.74 µm × 2.74 µm	18 µm
Alvium 1800 C-2040m/c	2.74 µm × 2.74 µm	18 µm
Alvium 1800 C-2050m/c	2.4 µm × 2.4 µm	12 µm
Alvium 1800 C-2460m/c	2.74 µm × 2.74 µm	18 µm

Table 72: Sensor tilt



User sets

Supported features

UserSet features enable to store individual settings on selected Alvium 1800 C cameras. These user sets can be loaded by default, without needing to set values by software after every restart of the camera. Or they can be used to switch between different settings, for example, to adjust from daylight to artificial light.

User sets support all features except for:

- Selectors
- Command features
- Read-only features
- Features that do not apply to the corresponding interface, such as USB related features on a CSI-2 camera
- Features in the `LUTControl` category.

Trigger features and UserSetDefault

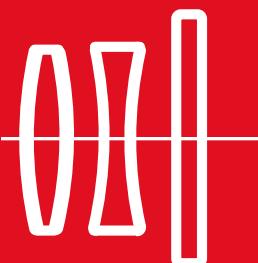
Trigger features are reset to default values when the default user set is loaded.

Column `UserSetLoad` displays how user values are affected when the command for `UserSetLoad` is executed.

Feature	Default value	UserSetDefault
<code>TriggerActivation</code>	<i>RisingEdge</i>	Default value
<code>TriggerMode</code>	<i>Off</i>	Default value
<code>TriggerSelector</code>	<i>AcquisitionStart</i>	User value
<code>TriggerSoftware</code>	[Command]	Not applicable
<code>TriggerSource</code>	<i>Software</i>	Default value

Table 73: Trigger features being reset

Lenses: Focal length vs. field of view



This chapter includes:

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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.

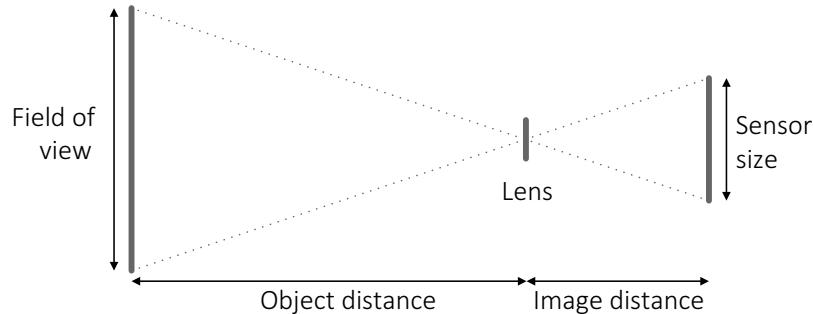


Figure 59: Parameters used in tables for focal length versus FOV



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/fileadmin/content/documents/products/accessories/lenses/Allied_Vision/User_Guide/S-Mount-Lenses_User-Guide.pdf.

Parameters in tables

The distance to the object is measured from the first principal 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 CSI-2 models with S-Mount have no filter. For typical applications, 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 194 to avoid damage when using S-Mount lenses.

Focal length vs. field of view

Alvium 1500 C-050m/c

Values for 1500 C-050m/c cameras (aspect ratio 1:1.34) with Type 1/3.6 (4.9 mm diagonal) sensors:

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 74: Focal length versus field of view for Alvium 1500 C-050m/c

Alvium 1500 C-120m/c

Values for 1500 C-120m/c cameras with Type 1/3 (6.0 mm diagonal) sensors:

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 75: Focal length versus field of view for Alvium 1500 C-120m/c

Alvium 1500 C-210m/c

Values for 1500 C-210m/c cameras (aspect ratio 1:1.75) with Type 1/3.6 (4.9 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
2.8	746 × 426	1496 × 855
3.6	579 × 331	1162 × 664
4.8	433 × 248	871 × 498
6	346 × 198	696 × 398
8	258 × 148	521 × 298
12	171 × 98	346 × 198
16	127 × 73	258 × 148
25	80 × 46	164 × 94

Table 76: Focal length versus field of view for Alvium 1500 C-210m/c

Alvium 1500 C-500m/c, 1500 C-501m/c NIR

Values for 1500 C-500m/c and 1500 C-501m/c NIR cameras with Type 1/2.5 (7.1 mm diagonal) sensors:

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 77: Focal length versus field of view for Alvium 1500 C-500m/c and 1500 C-501m/c NIR

Alvium 1800 C-030 VSWIR

Values for 1800 C-030 VSWIR cameras with Type 1/4 (4.1 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
4	407 × 322	817 × 647
5	775 × 773	1557 × 1553
6	644 × 642	1296 × 1293
8	481 × 480	970 × 968
12	318 × 317	644 × 642
16	237 × 236	481 × 480
25	149 × 148	305 × 304
35	104 × 104	216 × 215
50	70 × 70	149 × 148

Table 78: Focal length versus field of view for Alvium 1800 C-030 VSWIR

Alvium 1800 C-040m/c

Values for 1800 C-040m/c cameras with Type 1/2.9 (6.3 mm diagonal) sensors:

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 79: Focal length versus field of view for Alvium 1800 C-040m/c

Alvium 1800 C-052m/c

Values for 1800 C-052m/c cameras with Type 1/1.7 (9.2 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
5	671 × 560	1348 × 1125
6	558 × 466	1122 × 937
8	417 × 348	840 × 701
12	275 × 230	558 × 466
16	205 × 171	417 × 348
25	129 × 107	264 × 221
35	90 × 75	187 × 156
50	61 × 51	129 × 107

Table 80: Focal length versus field of view for Alvium 1800 C-052m/c

Alvium 1800 C-130 VSWIR

Values for 1800 C-130 VSWIR cameras with Type 1/2 (8.2 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
5	671 × 560	1348 × 1125
6	558 × 466	1122 × 937
8	417 × 348	840 × 701
12	275 × 230	558 × 466
16	205 × 171	417 × 348
25	129 × 107	264 × 221
35	90 × 75	187 × 156
50	61 × 51	129 × 107

Table 81: Focal length versus field of view for Alvium 1800 C-130 VSWIR

Alvium 1800 C-158m/c

Values for 1800 C-158m/c cameras with Type 1/2.9 (6.3 mm diagonal) sensors:

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 82: Focal length versus field of view for Alvium 1800 C-158m/c

Alvium 1800 C-240m/c

Values for 1800 C-240m/c cameras with Type 1/2.3 (7.9 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
4.8	691 × 433	1389 × 871
6	552 × 346	1110 × 696
8	412 × 258	831 × 521
12	272 × 171	552 × 346
16	203 × 127	412 × 258
25	127 × 80	261 × 164
35	89 × 56	185 × 116
50	60 × 38	127 × 80

Table 83: Focal length versus field of view for Alvium 1800 C-240m/c

Alvium 1800 C-291m/c

Values for 1800 C-291m/c cameras with Type 2/3 (10.8 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
6	644 × 642	1296 × 1293
8	481 × 480	970 × 968
12	318 × 317	644 × 642
16	237 × 236	481 × 480
25	149 × 148	305 × 304
35	104 × 104	216 × 215
50	70 × 70	149 × 148

Table 84: Focal length versus field of view for Alvium 1800 C-291m/c

Alvium 1800 C-319m/c

Values for 1800 C-319m/c cameras with Type 1/1.8 (8.9 mm diagonal) sensors:

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 85: Focal length versus field of view for Alvium 1800 C-319m/c

Alvium 1800 C-500m/c

Values for 1800 C-500m/c cameras with Type 1/2.5 (7.1 mm diagonal) sensors:

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 86: Focal length versus field of view for Alvium 1800 C-500m/c

Alvium 1800 C-507m/c, 1800 C-508m/c

Values for 1800 C-507m/c and 1800 C-508 cameras with Type 2/3 (11.1 mm diagonal) sensors:

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 87: Focal length versus field of view for Alvium 1800 C-507m/c and 1800 C-508m/c

Alvium 1800 C-511m/c

Values for 1800 C-511m/c cameras with Type 1/1.8 (8.8 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
5	671 × 560	1348 × 1125
6	558 × 466	1122 × 937
8	417 × 348	840 × 701
12	275 × 230	558 × 466
16	205 × 171	417 × 348
25	129 × 107	264 × 221
35	90 × 75	187 × 156
50	61 × 51	129 × 107

Table 88: Focal length versus field of view for Alvium 1800 C-511m/c

Alvium 1800 C-811m/c

Values for 1800 C-811m/c cameras Type 2/3 (11 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
5	773 × 773	1553 × 1553
6	642 × 642	1293 × 1293
8	480 × 480	968 × 968
12	317 × 317	642 × 642
16	236 × 236	480 × 480
25	148 × 148	304 × 304
35	104 × 104	215 × 215
50	70 × 70	148 × 148

Table 89: Focal length versus field of view for Alvium 1800 C-811m/c

Alvium 1800 C-1236m/c

Values for 1800 C-1236m/c cameras with Type 1.1 (17.6 mm diagonal) sensors:

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 90: Focal length versus field of view for Alvium 1800 C-1236m/c

Alvium 1800 C-1240m/c

Values for 1800 C-1240m/c cameras with Type 1/1.7 (9.33 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
4.8	763 × 578	1534 × 1161
6	609 × 461	1226 × 928
8	455 × 344	918 × 694
12	301 × 228	609 × 461
16	224 × 169	455 × 344
25	141 × 106	289 × 218
35	98 × 74	204 × 154
50	67 × 50	141 × 106

Table 91: Focal length versus field of view for Alvium 1800 C-1240m/c

Alvium 1800 C-1242m/c

Values for 1800 C-1242m/c cameras with Type 1/1.1 (14 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
6	931 × 679	1874 × 1365
8	696 × 507	1403 × 1022
12	460 × 335	931 × 679
16	342 × 249	696 × 507
25	215 × 157	441 × 321
35	150 × 109	312 × 227
50	102 × 74	215 × 157
75	64 × 47	139 × 102

Table 92: Focal length versus field of view for Alvium 1800 C-1242m/c

Alvium 1800 C-1620m/c

Values for 1800 C-1620m/c cameras with Type 1.1 (16.8mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
5	1445 × 825	2905 × 1658
6	1202 × 686	2419 × 1380
8	898 × 512	1810 × 1033
12	594 × 339	1202 × 686
16	442 × 252	898 × 512
25	277 × 158	569 × 325
35	194 × 111	403 × 230
50	131 × 75	277 × 158
75	83 × 47	180 × 103

Table 93: Focal length versus field of view for Alvium 1800 C-1620m/c

Alvium 1800 C-2040m/c

Values for 1800 C-2040m/c cameras with Type 1.1 (17.5 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
6	1018 × 1018	2048 × 2048
8	760 × 760	1533 × 1533
12	503 × 503	1018 × 1018
16	374 × 374	760 × 760
25	235 × 235	482 × 482
35	164 × 164	341 × 341
50	111 × 111	235 × 235
75	70 × 70	152 × 152
85	60 × 60	133 × 133

Table 94: Focal length versus field of view for Alvium 1800 C-2040m/c

Alvium 1800 C-2050m/c

Values for 1800 C-2050m/c cameras with Type 1 (15.8 mm diagonal) sensors:

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 95: Focal length versus field of view for Alvium 1800 C-2050m/c

Alvium 1800 C-2460m/c

Values for 1800 C-2460m/c cameras with Type 1.2 (19.3 mm diagonal) sensors:

Focal length [mm]	Field of view (H × V in [mm])	
	Object distance = 500 mm	Object distance = 1000 mm
8	898 × 776	1810 × 1566
12	594 × 513	1202 × 1040
16	442 × 382	898 × 776
25	277 × 240	569 × 492
35	194 × 168	403 × 348
50	131 × 114	277 × 240
75	83 × 72	180 × 156

Table 96: Focal length versus field of view for Alvium 1800 C-2460m/c

Access modes



This chapter includes:

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Notes on GenICam for CSI-2 Access	180
V4L2 controls and register controls.....	182
GenICam features	182

Overview

The driver for Alvium CSI-2 cameras supports different access modes to suit the various requirements of individual applications:

CSI-2 access mode	Supported models	Description
Direct Register Access 	All	Controls the camera by reading from and writing to registers, using an embedded board or an FPGA. See the Alvium CSI-2 Register Controls Reference document at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation .
Video4Linux Access 	All	Controls the camera by V4L2 controls, using the Allied Vision driver for CSI-2 cameras directly. Existing PC-based machine vision applications can be scaled down to V4L2 on lean embedded systems, reducing power consumption and costs.
GenICam for CSI-2 Access 	Alvium 1800 C-500, C-507, C-511, C-1236, C-2050 See below ¹	Controls the camera by GenICam features, using the Allied Vision driver for CSI-2 cameras directly. Alvium CSI-2 cameras can be used to replace other cameras on existing PC-based machine vision applications, reducing power consumption and costs. See the Alvium Features Reference document at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation .

¹Only a few models currently support **GenICam for CSI-2 Access**. Other 1800 C models may also support this access mode but have not been officially released for it.

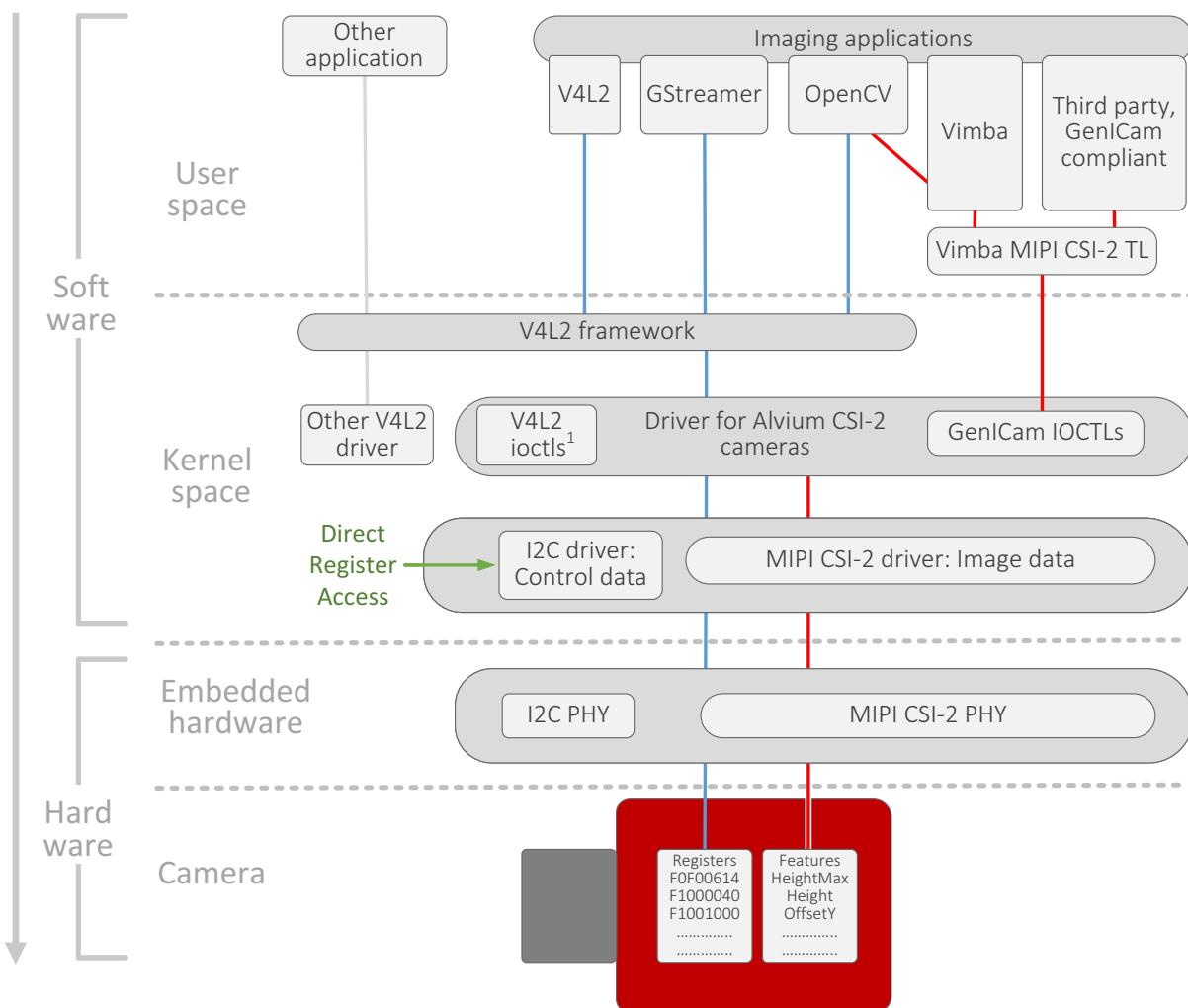
Table 97: Access modes overview

Figure 60 on page 181 shows how cameras are controlled using the different access modes.

Notes on GenICam for CSI-2 Access

Before using **GenICam for CSI-2 Access**, see [GenICam for CSI-2 Access- Camera operation](#) on page 183 for smooth operation.

Data flow



Legend

- Video4Linux Access
- GenICam for CSI-2 Access

¹ ioctl() = ioctl() function

Figure 60: Camera control using the different access modes

Direct Register Access: Data is read from and written to registers directly.

Video4Linux Access: V4L2 controls registers are used.

GenICam for CSI-2 Access: GenICam features are used.

V4L2 controls and register controls

Embedded applications often use V4L2 controls provided with the Linux kernel to operate and configure the camera.



V4L2 controls - general information

Consider that V4L2 controls change through the Linux kernel development. The driver for Alvium CSI-2 cameras currently supports kernel 4.9.140. For embedded board adapters, see CSI-2 accessories at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

For a description of V4L2 controls related to the **current kernel version**, see <https://linuxtv.org>.



V4L2 controls - reference for camera specific information

Almost every register control has an equivalent V4L2 control. For applications based on V4L2 Access, we recommend using the Direct Register Access Reference for camera specific information.

www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

GenICam features

Machine vision applications typically use GenICam SFNC features enabled by a transport layer communicating between a software development kit (SDK) and the interface driver. Selected Alvium 1800 C models support GenICam.



GenICam features - descriptions

For GenICam feature descriptions, see the Alvium Features Reference at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

GenICam for CSI-2 Access - Camera operation

Need to restart the embedded board

Whenever you change between different access modes:

- You must restart the embedded board.
- Closing the application while the camera is streaming is not sufficient.

Device reset

The `DeviceReset` command does not work.

User sets

Settings, including user sets are not transferred between the access modes.

Before you switch from **GenICam for CSI-2 Access** to another access mode, disable individual user sets. Set `UserSetDefault` and `UserSetSelector` to `Default` to enable factory settings.

Camera ramp up

Frame rates and CPU load

When you start streaming Alvium CSI-2 cameras with a GenICam compliant viewer, the maximum frame rate may not be achieved for maximum resolution at first. In addition, the CPU load may increase significantly. After a few minutes, the stream has stabilized, the maximum frame rate is achieved, and the CPU load decreases by 20%.

Lost frames with Python API

If the camera is operated at high frame rates and low exposure times, initial frames may get lost.

Installing the hardware



This chapter includes:

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Scope of instructions	185
Bare board cameras	185
Connecting FPC cable and FPC connectors	187
Mounting the heat sink.....	189
Mounting the camera	190
Mounting the lens.....	193

Touching hot cameras



CAUTION

Risk of burns

A camera in operation can reach temperature levels which could cause burns.

- Wear protective gloves when you touch a camera that is heated up.
- Ensure proper cooling of the camera.

Scope of instructions

Software installation



Software downloads and documentation

This chapter describes hardware installation only. For information on supported Linux distributions and embedded boards, drivers, libraries, and programming examples, see www.alliedvision.com/en/products/software/embedded-software-and-drivers.

Hardware installation

This chapter instructs on using Alvium CSI-2 cameras safely and effectively. However, we cannot provide complete information. The MIPI CSI-2 standard does not specify electrical connections as extensively as USB or GigE standard. Therefore, instructions on camera connections can be general only.

Bare board cameras

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 with you for bare board camera applications to ensure a successful design.

Serial numbers of Alvium® chips and bare board cameras

Bare board cameras do not have enough space for a label with all the required information. Therefore, they are shipped with a 25 mm × 25 mm sandwich label on the blister pack. This label shows, for example:

- Product code: 11500 for a 1500 C-210c Bare Board camera
- Alvium® chip SN (serial number): 183603543
- Camera SN (serial number): R7QW5 as digits and 2D code.

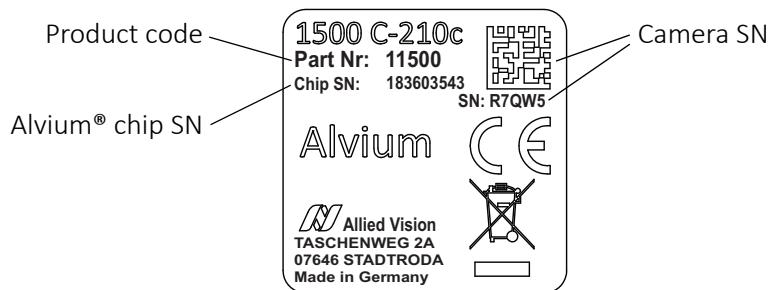


Figure 61: Sandwich label on blister packs shipped for bare board cameras

Before operating the camera, we recommend you to pull the sandwich label off the blister pack and stick it close to the camera.

If the label is lost, please read out with your smart phone the serial number of the Alvium® chip from the 2D code (a). With this number, we can look up the serial number of the camera in our database.

If your smart phone cannot read the 2D code: Combine the four digits (b) with the five digits (c). In the example, the serial number is 183603543.

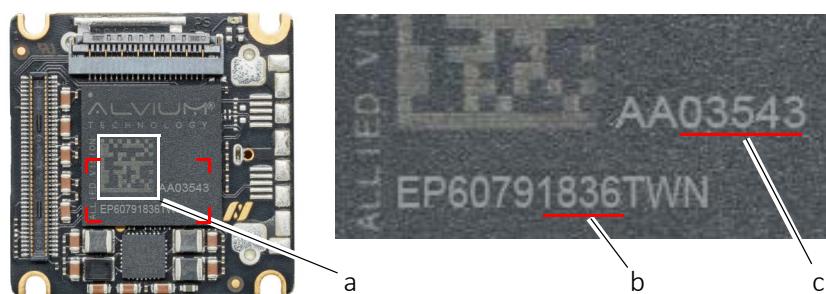


Figure 62: Alvium® chip imprint version 1 with detail view (right)

Future bare board cameras follow the convention shown in [Figure 63](#). String (d) is the serial number, in the example, it is 205203543.

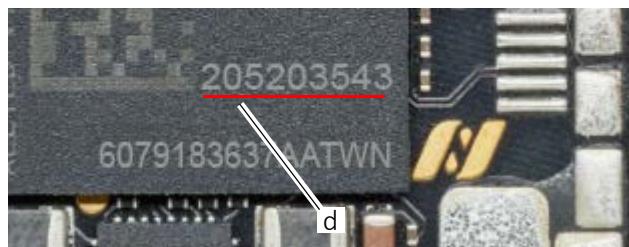


Figure 63: Alvium® chip imprint version 2

Connecting FPC cable and FPC connectors



Connecting Alvium CSI-2 cameras to embedded boards

- For evaluation, Allied Vision offers components to connect Alvium CSI-2 cameras to embedded boards. **Adapter boards** provide common pinning and voltage for connections to the camera using **FPC cables**. See the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.
- If you want to design your own components to connect Alvium CSI-2 cameras to embedded boards, contact your Allied Vision Sales representative or visit www.alliedvision.com/en/support.

[Figure 64](#) shows how the FPC cable connects to the FPC connector.

Follow the instructions to connect the FPC cable to the camera and to the embedded board.

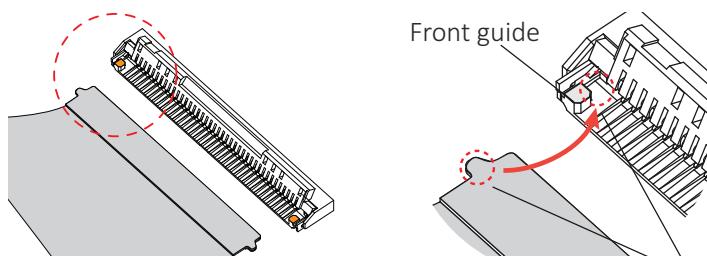


Figure 64: FPC cable and FPC connector (open position)

- Opening the FPC connector:
With your fingernail*, flip the actuator to open position at 105 degrees to the PCB surface, see [Figure 65](#).

*Or a plastic tool, because metal tools can damage the actuator.

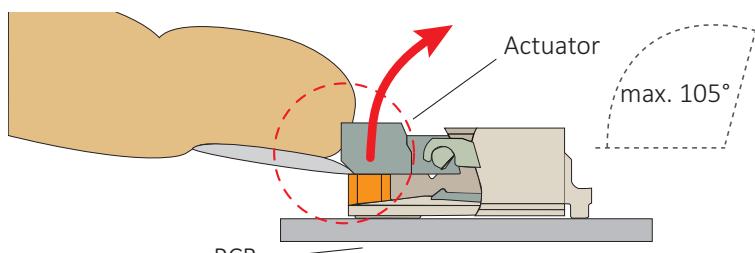


Figure 65: Opening the FPC connector


NOTICE
Damage to the camera by reverse polarity

If Alvium CSI-2 cameras are powered with reverse polarity, camera electronics is damaged.

- Before connecting camera power and I/O power, carefully read [FPC connector pin assignment](#) on page 199.
- Connect the cable as shown in this section.

Embedded
board or
adapter board



Figure 66: FPC cable and image data direction

2. **Ensuring proper cable direction between host and camera**, take the FPC cable with conductors facing the FPC connector conductors (see [Figure 67](#)).

3. **Inserting the FPC cable:**
At a horizontal angle of 90 degrees to the connector's rear (see [Figure 67](#)) and at a vertical angle of 12 degrees to the PCB (see [Figure](#)), slowly insert the FPC cable into the actuator...

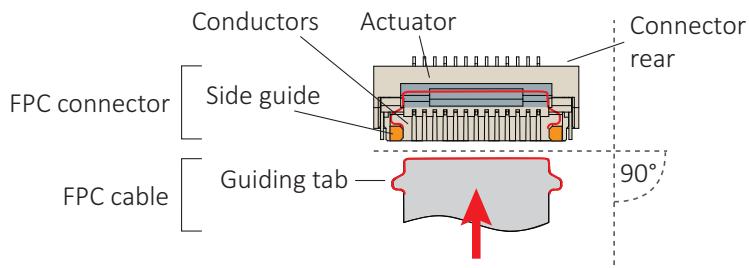


Figure 67: FPC cable and FPC connector

4. ...until cable guiding tabs are caught between connector rear and side guides (see [Figure 67](#)). Pull the cable slightly to ensure guiding tabs are properly engaged.
5. Holding the FPC cable in position, flap down the actuator to closed position (see [Figure](#)).

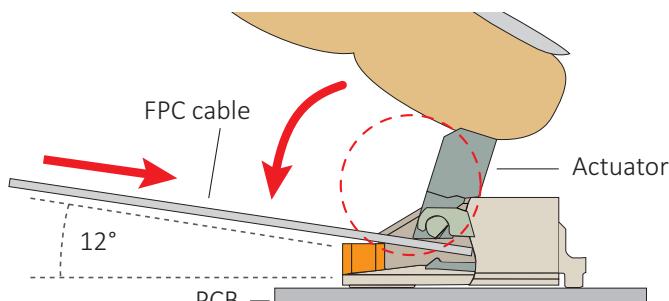


Figure 68: Engaging the FPC cable in the FPC connector


NOTICE
Damage to FPC connectors

A bended FPC cable can break the FPC connector's actuator.
Provide sufficient strain relief at both ends of the cable.

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-csi-2-documentation.



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 69) to a heat sink, following the instructions of the manufacturer of the heat sink and the thermal conductive media.

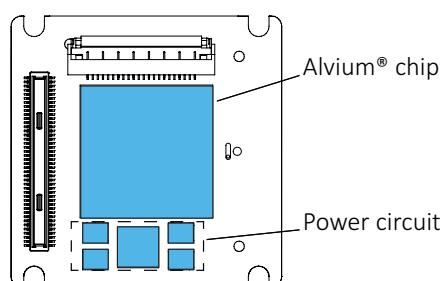


Figure 69: Cooling areas for Alvium CSI-2 bare board cameras

Mounting the camera



CAUTION

Injury by falling cameras or lenses

A falling camera or lens can cause injury.

- Ensure proper mounting of cameras and lenses, especially for dynamic applications.
- Mount cameras as described in the instructions.
- Always make sure the mounting threads are intact.
- Fasten screws with maximum torque, using the entire thread engagement. For less thread engagement, see [Adapting maximum torque values](#) on page 192.
- We recommend you to apply thread locking.
- Use a lens support for heavy lenses.

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-csi-2-documentation.

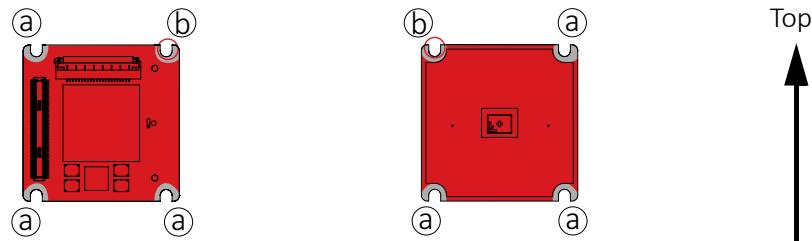


NOTICE

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 70](#) show the Alvium CSI-2 bare board camera. 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 70: Mounting area of Alvium CSI-2 bare board cameras
connector side (left); sensor side (right)*

Mount the bare board with four M2 screws at 0.1 Nm maximum torque.

Mounting open housing cameras

Bottom or top mounting

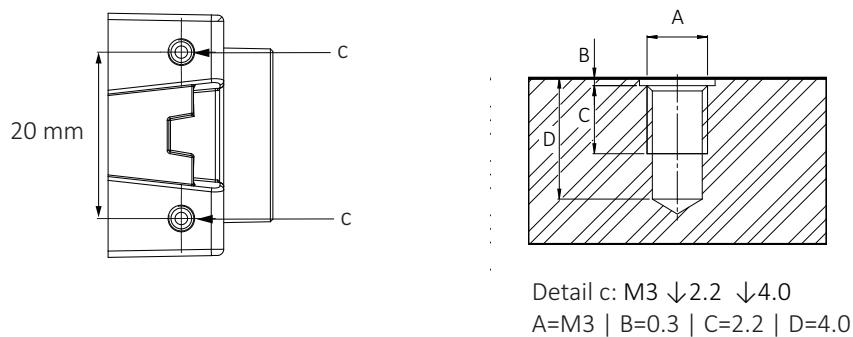
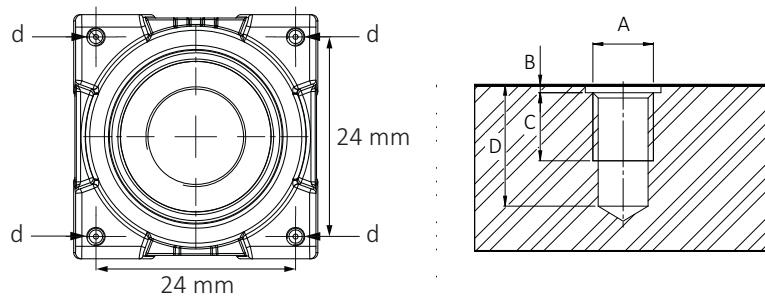


Figure 71: Top and bottom and mounting threads (c)

The maximum torque value applies only if the entire thread engagement is used. For other values, see [Adapting maximum torque values](#) on page 192.

1. Mount the camera to the base using suitable M3 screws at 0.51 Nm maximum torque for a thread engagement (C) of 2.2 mm between screws and mounting threads, see [Figure 71](#). For technical drawings, see [Dimensions and mass](#) on page 154.
2. Continue with [Mounting the lens](#) on page 193.

Front mounting



Detail d: Mounting thread M2 ↓1.7 ↓3.3
 $A=M2$ | $B=0.3$ | $C=1.7$ | $D=3.3$

Figure 72: Camera front with mounting threads (d)

The maximum torque value applies only if the entire thread engagement is used. For other values, see [Adapting maximum torque values](#) on page 192.

1. Mount the camera to the base using suitable M2 screws at 0.17 Nm maximum torque for a thread engagement (C) of 1.7 mm between screws and mounting threads, see [Figure 72](#). For technical drawings, see [Dimensions and mass](#) on page 154.
 We recommend you to additionally use bottom and top mounting threads for a more solid connection.
2. Continue with [Mounting the lens](#) on page 193.

Adapting maximum torque values

The total bolt length composes of the mounting holes length and the height of your mounting base.

For using less than the stated length of thread engagement, calculate maximum torque as follows:

$$\frac{\text{Current length of thread engagement}}{\text{Length of thread engagement in table}} \times \text{Torque in table} = \text{Current torque}$$

Example for a length of thread engagement of **1.4 mm** instead of 1.7 mm:
 $1.4 \text{ mm} / 1.7 \text{ mm} \times 0.17 \text{ Nm} = 0.14 \text{ Nm}$

Thread group	Thread position	Thread type	Total protrusion	Length of thread engagement	Maximum torque
d	Front mounting	M2	2 mm	1.7 mm	0.17 Nm
d	Front mounting	M2	2 mm	1.4 mm	0.14 Nm

Table 98: Adjusting maximum torque values

To ensure that the bolts do not become loose over time, we recommend you to use means for securing bolts, such as screw locking varnish.



Tripod adapter

For more information, see the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

Mounting the lens

Observe the following notes before you mount lenses to Alvium CSI-2 cameras.



CAUTION

Injury by falling cameras or lenses

A falling camera or lens can cause injury.

- Ensure proper mounting of cameras and lenses, especially for dynamic applications.
- Mount cameras as described in the instructions.
- Use a lens support for heavy lenses.



CAUTION

Risk of cuts by sharp edges of lens mounts

The threads of the lens mount can have sharp edges.

Be careful when mounting or unmounting lenses.



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 160.
- 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 194.
- 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/fileadmin/content/documents/products/accessories/lenses/Allied_Vision/User_Guide/S-Mount-Lenses_User-Guide.pdf.

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.



Drawings and fixing nuts

Drawings in the instructions are schematic.

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 73](#) shows how fixing nuts lock S-Mount lenses.

Follow the instructions to lock the lens in focus position.

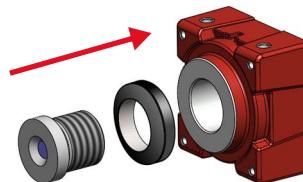


Figure 73: Fixing nut locking an S-Mount lens



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 (11.0mm)
 c: length of the lens

See [Lens mounts and maximum protrusion](#) on page 160.

3. Set a gauge to the length of (a).

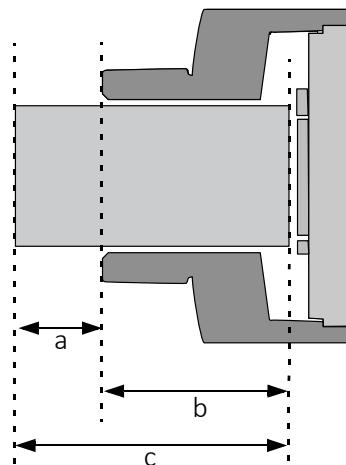


Figure 74: S-Mount lens and protrusion

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 75: 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.

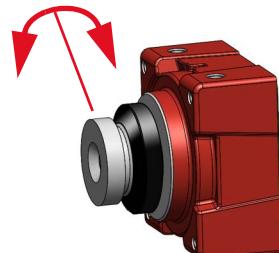


Figure 76: Adjusting focus


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.

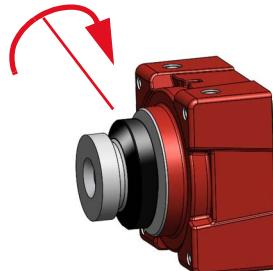


Figure 77: Tightening the fixing nut

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.

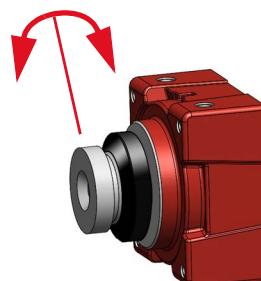


Figure 78: Checking lens is safely locked

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.

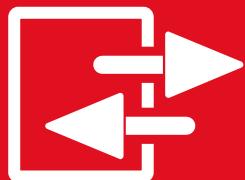
If focus varies over the image plane, the lens is tilted. Continue with 10.

10. Loosen the fixing nut.

11. Continue with 6.

The lens is locked in focus and ready for operation.

Camera interfaces



This chapter includes:

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Recommended accessories



Compatible electronics accessories

For more information, see the Alvium Cameras Accessory Guide at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

Back panel

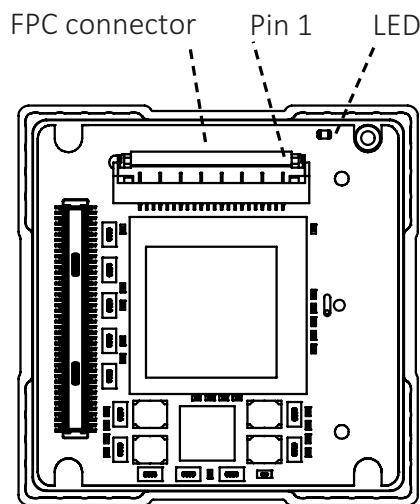


Figure 79: Camera back panel

For connector pin assignment, see [FPC connector pin assignment](#) on page 199.

FPC connector pin assignment

Alvium CSI-2 cameras have a 22-pin Hirose FH55-22S-0.5SH connector.



NOTICE

Damage to the camera by reverse polarity

If Alvium CSI-2 cameras or camera I/Os are powered with reverse polarity, camera electronics can be damaged.

Observe polarity for camera and I/O power.



More information on Hirose FH55-22S-0.5SH connector

For technical data and more instructions on the Hirose FH55-22S-0.5SH connector, see the manufacturer data sheet at www.hirose.com.

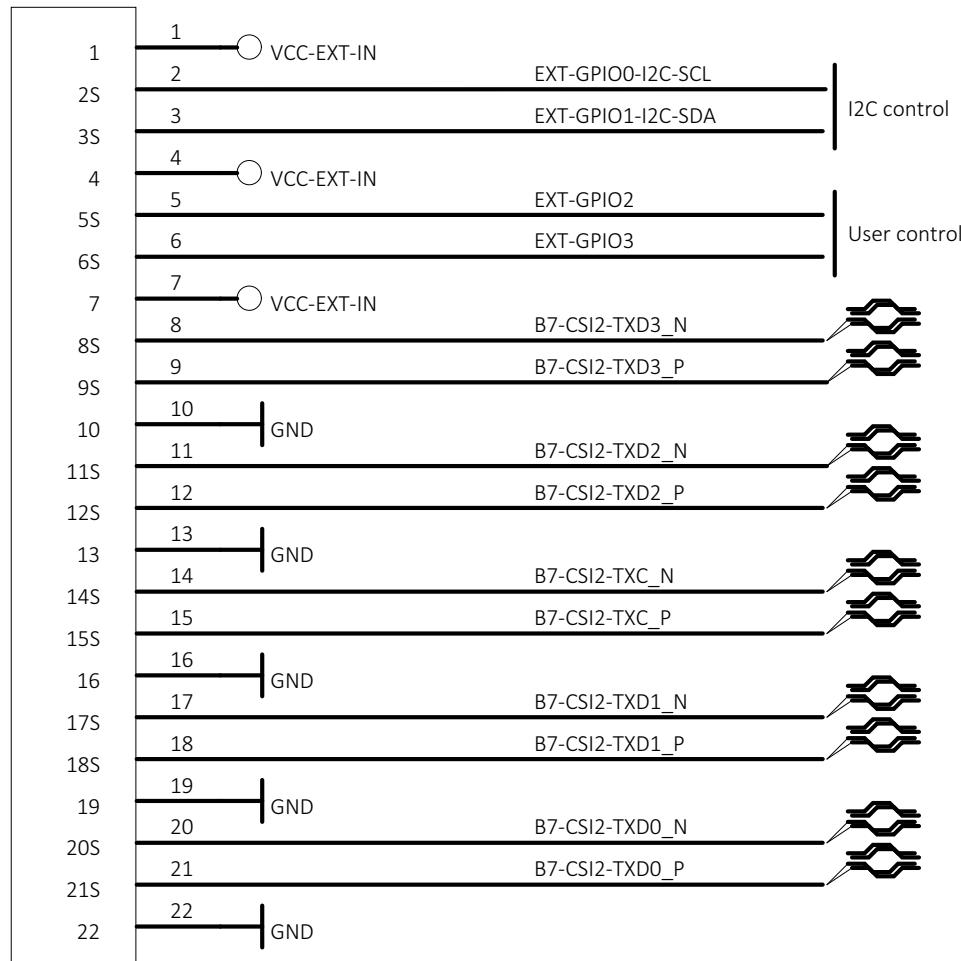


Figure 80: Camera Hirose FH55-22S-0.5SH connector pin assignment

Pin	Signal	Direction	Level	Description
1	VCC-EXT-IN	PWR IN	4.5 to 5.5 VDC	Power supply voltage Maximum input current: 1.5 A
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 12 mA	I2C Control Internal pull-up resistor: 33 to 63 kΩ
3	EXT-GPIO 1	IN/OUT		See Pin 2, EXT-GPIO 0
4	VCC-EXT-IN	PWR IN	4.5 to 5.5 VDC	Power supply voltage Maximum input current: 1.5 A
5	EXT-GPIO 2	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 12 mA	GPIO Internal pull-up resistor: 33 to 63 kΩ
6	EXT-GPIO 3	IN/OUT		See Pin 5, EXT-GPIO 2
7	VCC-EXT-IN	PWR IN	4.5 to 5.5 VDC	Power supply voltage Maximum input current: 1.5 A
8	CSI2-TXD3_N	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 3 negative rail
9	CSI2-TXD3_P	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 3 positive rail
10	GND	PWR	0 VDC	Power supply ground
11	CSI2-TXD2_N	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 2 negative rail
12	CSI2-TXD2_P	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 2 positive rail
13	GND	PWR	0 VDC	Power supply ground
14	CSI2-TXC_N	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX clock lane negative rail
15	CSI2-TXC_P	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX clock lane positive rail
16	GND	PWR	0 VDC	Power supply ground
17	CSI2-TXD1_N	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 1 negative rail
18	CSI2-TXD1_P	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 1 positive rail
19	GND	PWR	0 VDC	Power supply ground
20	CSI2-TXDO_N	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 0 negative rail
21	CSI2-TXDO_P	OUT	According to MIPI CSI-2 D-PHY V1.1	CSI-2 TX data lane 0 positive rail
22	GND	PWR	0 VDC	Power supply ground

Table 99: Camera FPC connector pin assignment

Non-isolated, programmable GPIOs



Available GPIOs

From four GPIOs, I2C uses two GPIOs for control traffic. Therefore, only two GPIOs are available for user control of the camera.



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.

Alvium GPIOs use the push-pull technology to switch the signal level between low and high. For low levels, the signal is "pulled" down towards ground level. For high levels, the signal is "pushed" up towards VCC level.

Alvium GPIOs feature the CMOS push-pull output drivers and Schmitt trigger inputs with an internal pull-up resistor and a filter circuit, shown in [Figure 81](#). The push-pull GPIOs are able to source or sink current from an external pin.

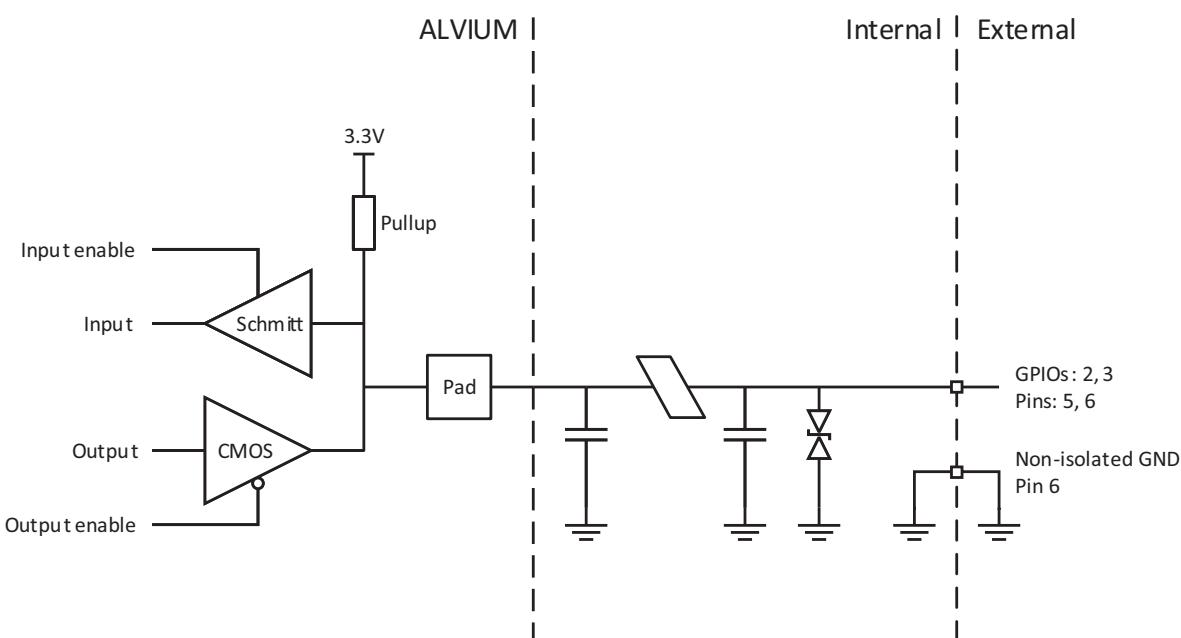


Figure 81: GPIOs block diagram

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 100: 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:

- Max. current = 12 mA per output
- Max. Out VCC = 3.3 VDC

Parameter	Value
External output voltage U_{out} (low)	0 to 0.4 VDC
External output voltage U_{out} (high)	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 101: GPIOs as output, current and voltage levels



Output voltage for U_{out} (high) = On state

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

Status LED

Alvium CSI-2 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.

Normal operation

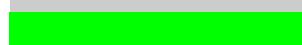
LED codes	Behavior	Status
	Continuously active	Power on or idle state
	Irregular flashing	Command or image traffic, such as for camera startup
	Four short flashes and code sequence	Error state

Table 102: 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 again indicates error state after restart, please contact support at www.alliedvision.com/en/about-us/contact-us/technical-support-repair-/rma.

Triggering



This chapter includes:

Availability of triggering controls for CSI-2	205
Trigger signal flow	205
Trigger latency.....	206
Triggering with rolling shutter cameras.....	206

Availability of triggering controls for CSI-2

Alvium CSI-2 cameras can be triggered by the following boards:

- NVIDIA Jetson AGX Xavier Developer Kit
- NVIDIA Jetson Nano Developer Kit
- NVIDIA Jetson TX2 Developer Kit
- NVIDIA Jetson Xavier NX Developer Kit.



Downloads

Some boards have restrictions. For more information, go to the examples repository on <https://github.com/alliedvision>.

Use the NVIDIA Jetson driver provided at https://github.com/alliedvision/linux_nvidia_jetson



Trigger controls description

For more information on triggering controls, see the Alvium CSI-2 Register Controls Reference at www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation.

The current firmware supports Frame Start Trigger controls by software or external line signals. Other trigger controls known from GenICam features are not supported.

Some controls may not be supported by all camera models.

Trigger signal flow

[Figure 82](#) shows an ideal diagram for the trigger signal flow for Alvium CSI-2 cameras. 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. The different **signals display the workflow**, not user controls.

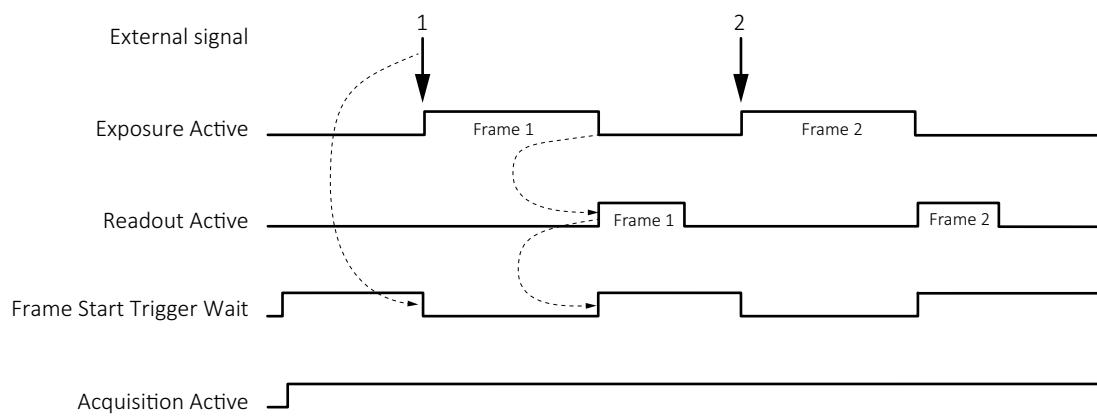


Figure 82: Trigger signal flow

Term	Description
External signal	Electrical trigger signal starting the signal flow
Exposure Active	Exposing a frame
Readout Active	Reading out a frame
Frame Start Trigger Wait	Waiting for a trigger
Acquisition Active	Enables frame acquisition: Expose, read out data, or wait for triggers.

Table 103: Trigger signal flow, legend

Trigger latency

In theory, a trigger creates an immediate response of the camera, depending on the cable length. In practice, the computer may add a delay that is mostly unpredictable. In addition, camera electronics and sensors have a delay. Rolling shutter (RS) cameras in this document also have exposure delay, depending on camera settings, see [Triggering with rolling shutter cameras](#) on page 206.



Trigger features and UserSetDefault

See [Trigger features and UserSetDefault](#) on page 164.

Triggering with rolling shutter cameras

This section describes triggering behavior for **1500 C-210m/c** and **C-500m/c**, and for **1800 C-1240m/c** and **C-2050m/c**. [Figure 83](#) shows how an external signal triggers exposure and readout for cameras with rolling shutter (RS) sensors. Like for global shutter (GS) sensors, readout has a constant duration, acquisition must be active to enable exposure, the end of exposure starts readout.

Rolling shutter (RS) 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.



Signals and controls

The signals displayed in [Figure 83](#) represent logical states, not user controls.

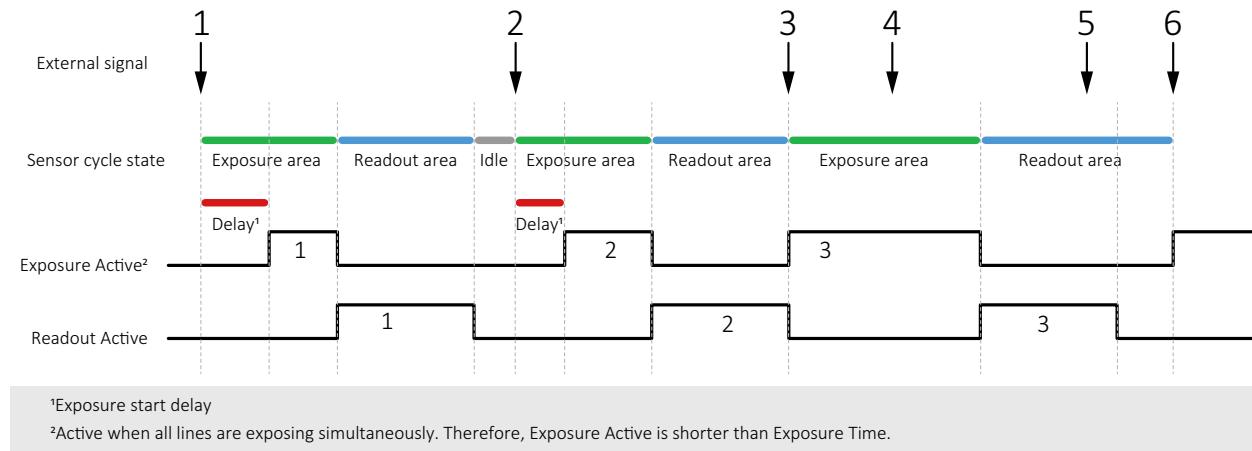


Figure 83: Triggering rolling shutter (RS) cameras

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 104: Triggering conditions and results




TriggerSelector values for rolling shutter (RS) cameras

Cameras with rolling shutter (RS) **can** be triggered using *AcquisitionStart*, *AcquisitionEnd*, or *FrameStart* for *TriggerSelector*.

Cameras with rolling shutter (RS) **cannot** be triggered using *ExposureStart* or *ExposureEnd* for *TriggerSelector*.



Frame rates in triggered mode

When rolling shutter cameras are operated in triggered mode, the values for maximum frame rate reached in free run mode are cut in half.

Ignored triggers

Alvium 1500 C-210m/c, C-500m/c, 1800 C-1240m/c, 1800 C-2050m/c

Changing parameters while acquisition is active leads to ignored triggers until the parameters get active.

Trigger delay with 1500 C-120 cameras

If sensor related parameters are changed **directly before** sending an external trigger, the trigger delay can be increased. This relates to [Frame rate jitter](#) on page 218.

Firmware update



1100110100
1101011010
1100110010
0101111010
- - 00011010

This chapter describes how firmware is updated on Alvium CSI-2 cameras:

Please note	210
Preparing firmware updates	210
Updating the firmware.....	211
Error handling	213

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.



Use only suitable firmware

If unsuitable firmware is used, the camera may get into a non-functional state.

- Only update to newer versions. Do not downgrade firmware to an older version, unless this has been explicitly communicated.
- We recommend updating the firmware to the next increment version only. Skipping versions may cause issues.

Preparing firmware updates

To update the firmware, the Vimba Suite must be downloaded completely.



Downloads

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

1. Download and install **Vimba Suite**.
2. Download the firmware (AVF file).
3. Connect your Alvium camera to the embedded board.
4. Execute VimbaFirmwareUpdater.elf file.
The **Vimba Firmware Updater** window opens, displaying your camera and the installed firmware version.
5. Continue with [Updating the firmware](#) on page 211.

Updating the firmware



Screenshots

The following instruction shows the firmware update on a **Linux** system. On **Linux** systems with other skins and on **Windows**, the GUI will look different.

If you are using command lines, you can derive the workflow from this instruction.

1. Click **Open** to select the firmware for the update..

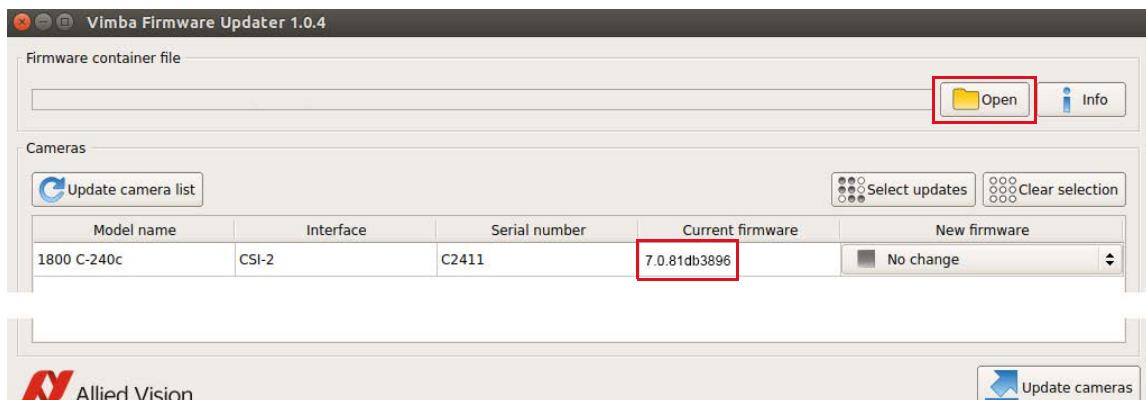


Figure 85: The camera and installed firmware are displayed

2. Select the firmware for the update from the drop-down menu.

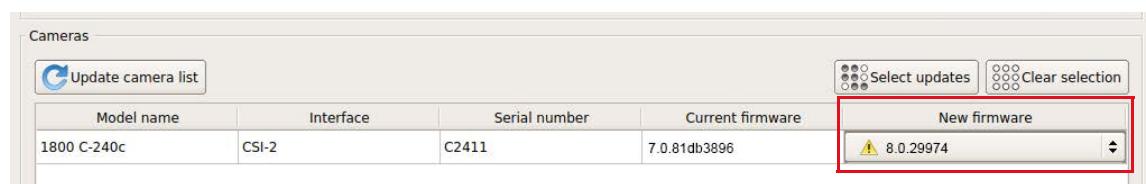


Figure 86: The firmware version is selected

3. Click **Update cameras**.



Figure 87: The update is being prepared

4. Click **OK** to confirm.



Figure 88: The command to update the firmware is confirmed

The update progress is displayed.

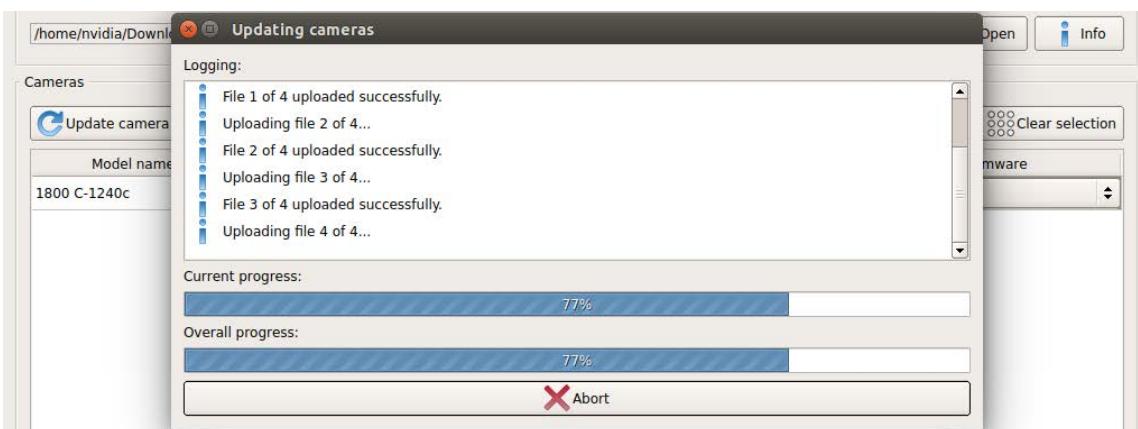


Figure 89: The update progress is displayed

5. Click **Close** to confirm the completion of the update.

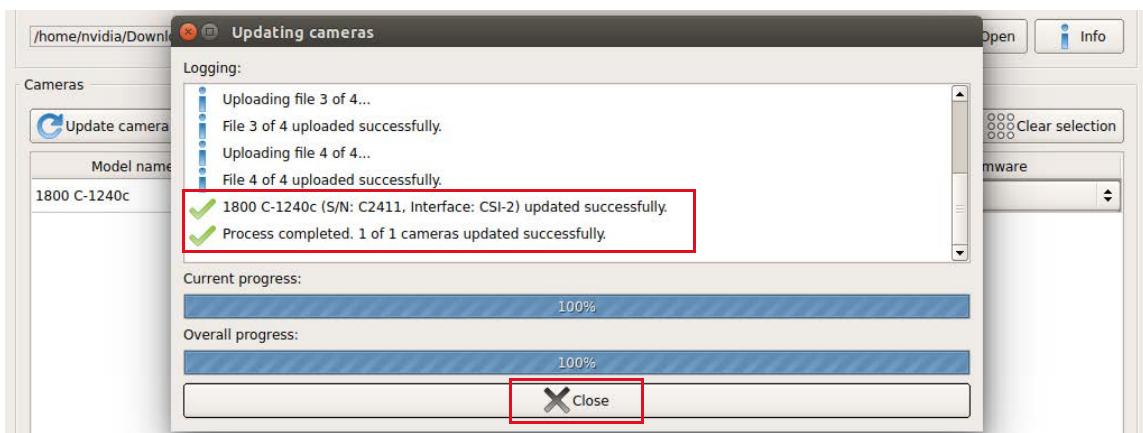


Figure 90: The update has been successfully completed

The camera is displayed with the updated firmware version.

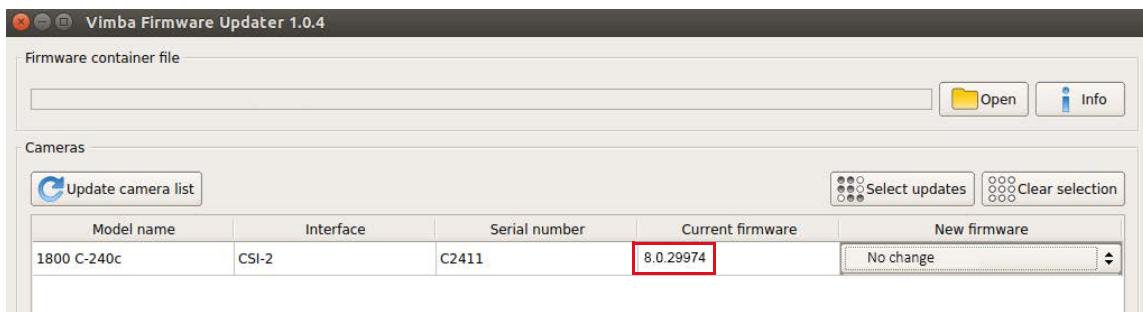


Figure 91: The updated firmware version is displayed

Error handling

If firmware update fails,

- The camera is shown as “Fallback” on the CSI-2 interface.
- The camera is recognized by viewer applications but can not be used for streaming.
- You can repeat the firmware update.

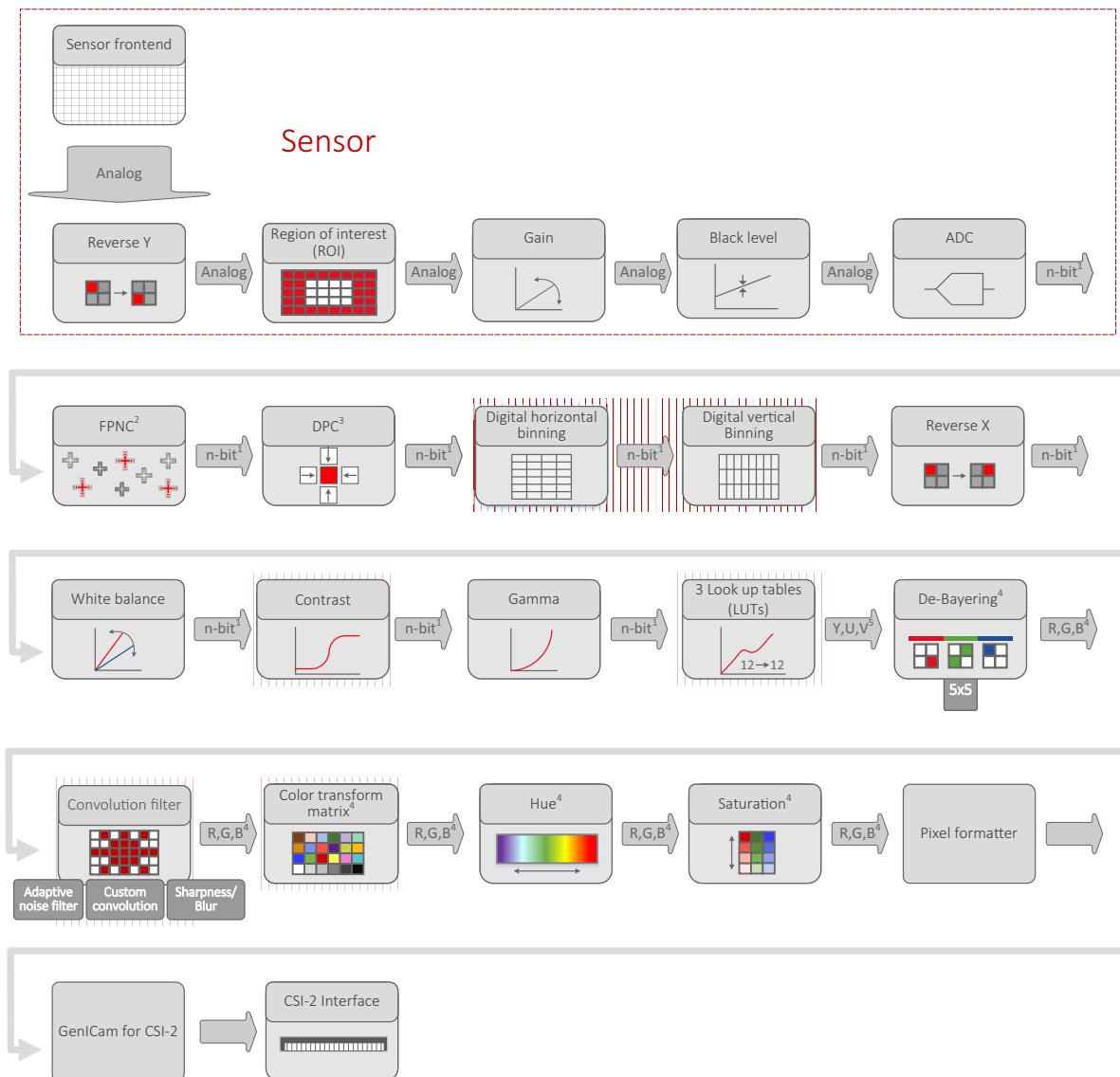
Should the firmware update not succeed, please contact support at www.alliedvision.com/en/about-us/contact-us/technical-support-repair-/rma.

Image data flow



This chapter includes an image data flow of Alvium CSI-2 cameras.

Figure 92 shows image data processing in Alvium CSI-2 cameras in general.



|||||| **GenICam for CSI-2 Access** only (selected Alvium 1800 C models)

¹ Model dependent: See ADC bit depths in [Specifications](#) on page 46.

² Factory preset for FPNC = Fixed pattern noise correction

FPNC is **currently not supported** by Alvium 1800 C-052, 1800 C-291, 1800 C-2050.

³ Factory preset for DPC = Defect pixel correction

DPC is **currently not supported** by for Alvium 1800 C-052, 1800 C-291.

⁴ Color models only

⁵ For monochrome models: Y only

Figure 92: Image data flow of Alvium CSI-2 cameras



Descriptions for controls and features

The shown functionalities represent controls or groups of controls:

- For V4L2 controls, see www.linuxtv.org.
- For register controls, see the Alvium CSI-2 Register Controls Reference. See www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation for details.
- For GenICam features, see the Alvium Features Reference. See www.alliedvision.com/en/support/technical-documentation/alvium-csi-2-documentation for details.

Performance



This chapter includes:

Image transfer with rolling shutter cameras	218
Frame rate jitter	218
Control value changes on a streaming camera	219
Value changes by control interdependencies.....	219
Dark current compensation.....	221
Shutter types affecting image readout.....	223

Image transfer with rolling shutter cameras

Alvium 1500 C-210m/c, C-500m/c, 1800 C-1240m/c, and 1800 C-2050m/c

If acquisition is started and stopped in a short sequence, no image is transferred to the host. The duration cannot be predicted, because it depends on various factors.

Frame rate jitter

Alvium 1500 C-120m/c, C-210m/c, C-500m/c, 1800 C-1240m/c, 1800 C-2050m/c

Generally, some parameters can be changed during exposure without affecting the timing. For models with ON Semiconductor AR sensors and rolling shutter sensors, a different behavior must be considered for **camera operation in freerun mode without triggering**:

Changing parameters during exposure leads to 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, including a gap between **ExposureActive** signals.

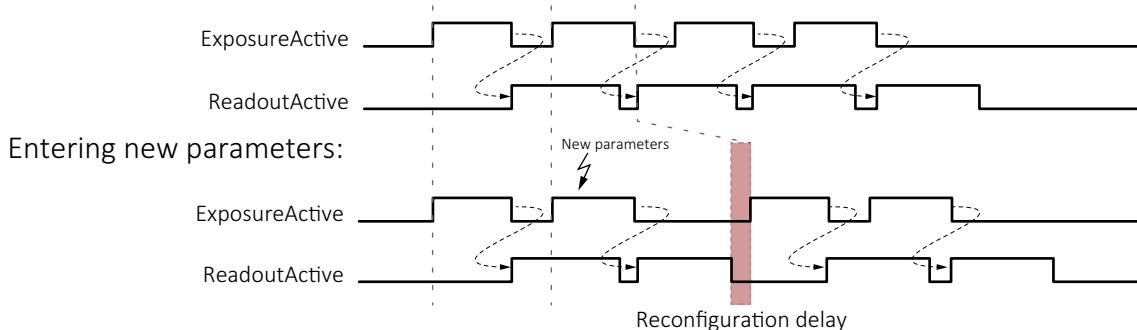


Figure 93: Delayed exposure due to parameter changes



Parameter changes in triggered mode

See [Ignored triggers](#) on page 208 for more information.

Control value changes on a streaming camera

Only some controls can be adjusted while the camera is streaming, these include:

BlackLevel	Gain	OffsetY
ExposureAuto	GainAuto	WhiteBalanceAuto
ExposureTime	OffsetX	

This list is not complete and will be updated in future document versions.



Latencies

Consider that value changes become effective with latencies based on the sensor and its operation mode (triggered or free run, frame rate).

Value changes by control interdependencies

The conversion between time and clock cycles affects control values. Controls for pixel format, bandwidth, ROI, and exposure time are related to each other. Changing values for one control can change values for another control. For example, frame rates can be reduced when **MIPi Data Format** is changed subsequently. [Figure 94](#) shows the interdependencies.

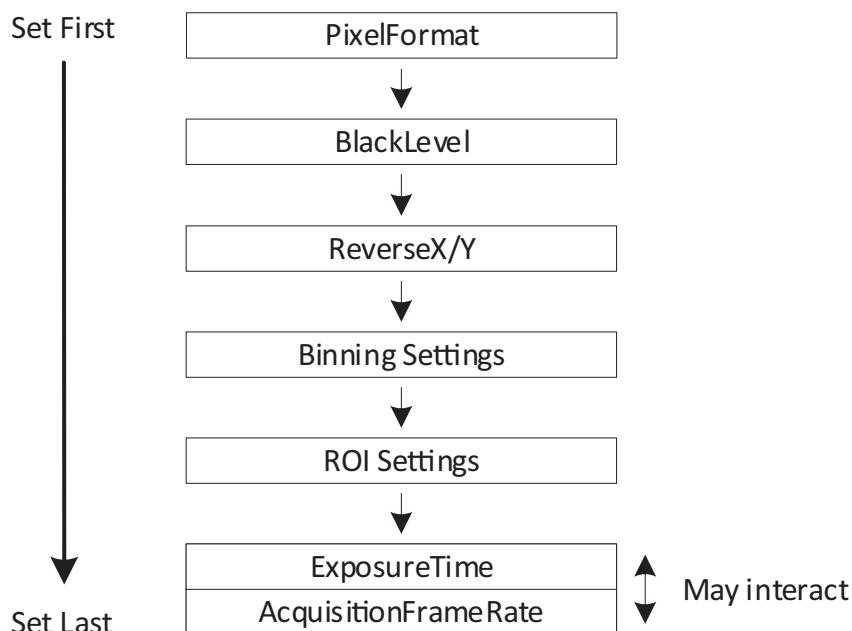


Figure 94: Interdependencies between controls

Effects for the interdependent controls

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

If: **Height** value is changed.

Then: Other values may be affected, such as for **ExposureTime**.

We recommend you to consider:

- The more controls you adjust, the more current values deviate from previously set values.
- The same effects that apply to **ExposureTime**, also apply to **ExposureAuto**.
- To avoid readjustments, apply settings in the order shown in [Figure 94](#).

Impact by other controls

Input	Output	
	Exposure time values	Frame rate
ExposureTime	Affected as expected	Affected
CSI-2LaneCount	Affected	Affected
Height	Not affected	Affected
Width	May be affected	May be affected

Table 105: Impact by other controls

Exposure times and frame rates with Sony IMX rolling shutter cameras

Affected models: **Alvium 1800 C-1240 m/c and C-2050m/c**

Generally, long exposure times result in low frame rates because one is roughly the inverse of the other. With Alvium IMX RS cameras

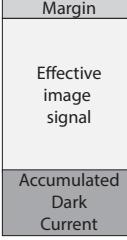
- The range of available frame rates depends on the exposure time.
- The exposure time must be increased when low frame rates are used.
- The available range for frame rate values depends on the exposure time. If by changing the exposure time, the previous frame rate is moved out of the available range, the frame rate is adjusted automatically.

Dark current compensation

All sensors accumulate dark current in the pixels. Dark current increases the signal level and black level. Most sensors in Alvium CSI-2 cameras compensate for this.

For **Alvium 1500 C-050m/c** with the ON Semi PYTHON 480 sensor, see [Black level compensation for 1500 C-050m/c](#) on page 222.

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
 Saturation = 255 Black level = 0	The pixel has accumulated no dark current, the margin has maximum size.
 Saturation = 255 Black level = 0	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.

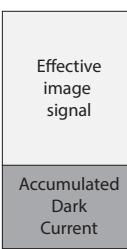
 Saturation = 255 Black level > 0	The pixel has accumulated dark current, the margin reduces to 0. Type 1 compensation <ul style="list-style-type: none"> Dark current compensation is stopped. Dark current increases the black level. Fixed pattern noise increases.
 Saturation < 255 Black level = 0	The pixel has accumulated dark current, the margin reduces to 0. Type 2 compensation (Typically used for sensor-internal compensation, often in the analog domain.) <ul style="list-style-type: none"> Dark current compensation stays active. Maximum saturation signal decreases. Fixed pattern noise increases.

Table 106: 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 1500 C-050m/c supports compensation type 1. For additional compensation, see [Black level compensation for 1500 C-050m/c](#) on page 222.

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 1500 C-050m/c

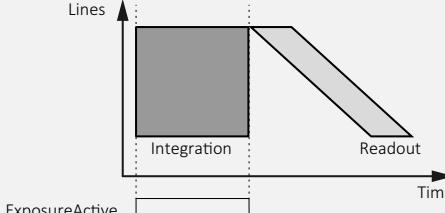
Because the ON Semi PYTHON 480 sensor does not have a dark current compensation, **Alvium 1500 C-050m/c** cameras have a typical black level value drift, depending on exposure time and **DeviceTemperature** (measured at the mainboard). [Table 107](#) shows the effect of the black level compensation. Should additional compensation be needed, we recommend cooling the camera.

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

Table 107: Exposure time and temperature affecting black level compensation

Shutter types affecting image readout

Some Alvium CSI-2 camera models are operated using global shutter (GS).

Property	Line readout	Moving image
Global shutter (GS)		

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

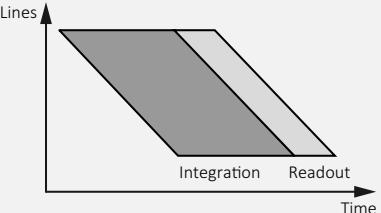
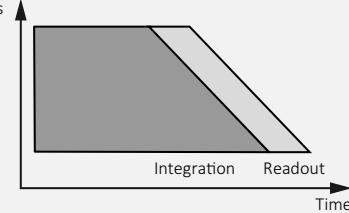
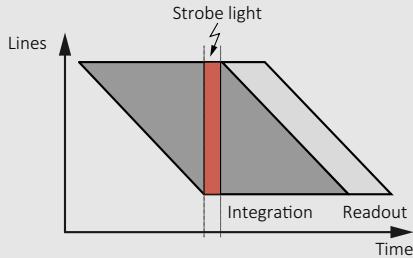
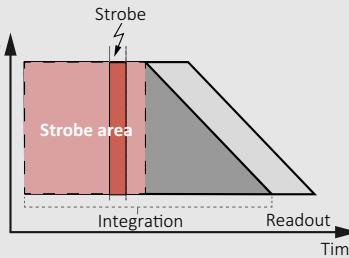
Property	Rolling shutter (RS)	Global reset shutter (GRS)
Line readout		
Line exposure start	Deferred from line to line	Common for all lines
Line exposure time	Common for all lines	Increases from line to line
Image acquisition of moving objects		
Image brightness	Constant over the image	Varying over the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

Table 108: Shutter types affecting image readout

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