ALVIUM CAMERAS

S-Mount Lenses
User Guide

V1.1.0

S-Mount lenses at a glance

Read this document carefully

Learn to use S-Mount lenses in the most safe and efficient way and avoid damage to Alvium cameras and lenses.

Shipping contents

- S-Mount lens
- Fixing nut

What else do you need?

Technical information and ordering

For all information about Alvium cameras and accessories, see

- for MIPI CSI-2 cameras: www.alliedvision.com/en/support/ technical-documentation/alvium-csi-2-documentation.
- for USB3 Vision cameras: www.alliedvision.com/en/support/technical-documentation/ alvium-usb-documentation.
- Please contact your Allied Vision Sales representative for ordering and for additional information on hardware options for Alvium cameras.
- To find contact information, visit our website: www.alliedvision.com/en/contact.

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Contents

Document history and conventions

This chapter includes:

Document history

Version	Date	Remarks
V1.1.0	2020-Jan-07	• Added IR cut filter spectral transmission on page 12. • Added convention for Lenses naming on page 7. • Applied minor editorial changes.
V1.0.0	2019-May-23	Release version

Table 1: Document history

Conventions used in this user guide

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

Typographical styles

Style	Function
Emphasis	Highlighting important things
Web links and references	Links to webpages and internal cross references

Table 2: Typographical styles

Symbols and notes

CAUTION
Personal injuries
Precautions are described.

NOTICE
Material damage
Precautions are described.

Additional information

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

Lenses naming

S-Mount lenses are named to identify model properties.

For example, **S-2.97-F4-5MP-T1-2.5-IRC** is composed of:

	S	2.97	F4	5MP	T1-2.5	IRC
Content element	Lens mount	Focal length	Aperture (f/#)	Supported pixel resolution	Sensor size	IR-type
Content meaning	S-Mount	2.97 mm	F/4	5 MP*	Type 1/2.5	IR cut filter
*Megapixels						

Table 3: Naming for lenses with an IR cut filter

Correspondingly, **S-2.97-F4-5MP-T1-2.5** is composed of:

	S	2.97	F4	5MP	T1-2.5	
Content element	Lens mount	Focal length	Aperture (f/#)	Supported pixel resolution	Sensor size	IR-type
Content meaning	S-Mount	2.97 mm	F/4	5 MP*	Type 1/2.5	IP-optimized
*Megapixels						

Table 4: Naming for lenses that IR-optimized

Allied Vision

Intended use and safety

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This chapter includes:

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).

Your safety

Threads of the lens and the camera lens mount have sharp edges. Be careful these edges do not cut your skin when handling lenses and lens mounts.

Product safety

To prevent material damage, read the following to understand risks in using S-Mount lenses.

Maximum protrusion

If the lens exceeds maximum protrusion, camera, lens, or electronics can be damaged. Do the following to avoid damage:

- Screw in lenses for Alvium cameras to 11.0 mm maximum protrusion.
- Be very careful when you focus S-Mount lenses. When your object distance requires focusing towards infinity, the camera sensor and the back lens can easily be damaged. We recommend to use a live image to avoid damage.
- See the **Lens position at infinity (approximately)** section for your lens in Specifications on page 11.
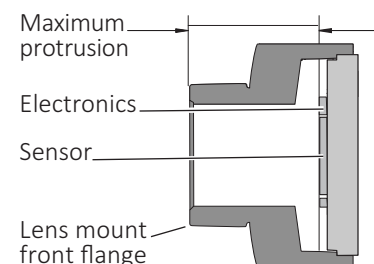- Follow the instruction in Using S-Mount lenses on page 18.

Figure 1: Maximum protrusion

Sensor

Sensors are sensitive to excessive radiation: focused sunlight, lasers, and X-rays can damage the sensor. Dirt and scratches can damage the sensor, too. Alvium cameras with S-Mount lenses are delivered without a filter to protect the sensor.

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

Figure 2: Protecting the sensor from dirt

Protect 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
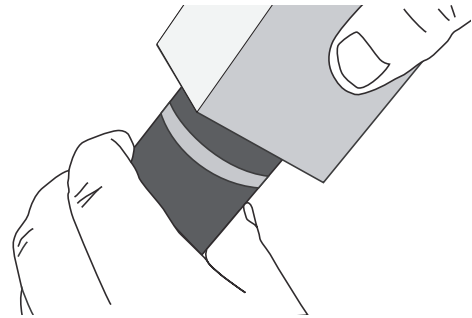
Fixing nuts

If fixing nuts are screwed with too much force, threads are worn out and lenses cannot be locked anymore. Using pinch nose pliers, screw fixing nuts only with enough force to keep the lens in a fixed position.

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Specifications

This chapter includes:

IR types and lens position

IR-types

S-Mount lenses in this user guide are offered as IR-optimized and IR cut.

IR-type	IR correction effect
IR-optimized	Some optical elements have an optical coating for use in the visible and NIR spectrum.
IR cut	An IR cut filter improves color reproduction and focus (visible with monochrome cameras as well).

Table 5: IR types

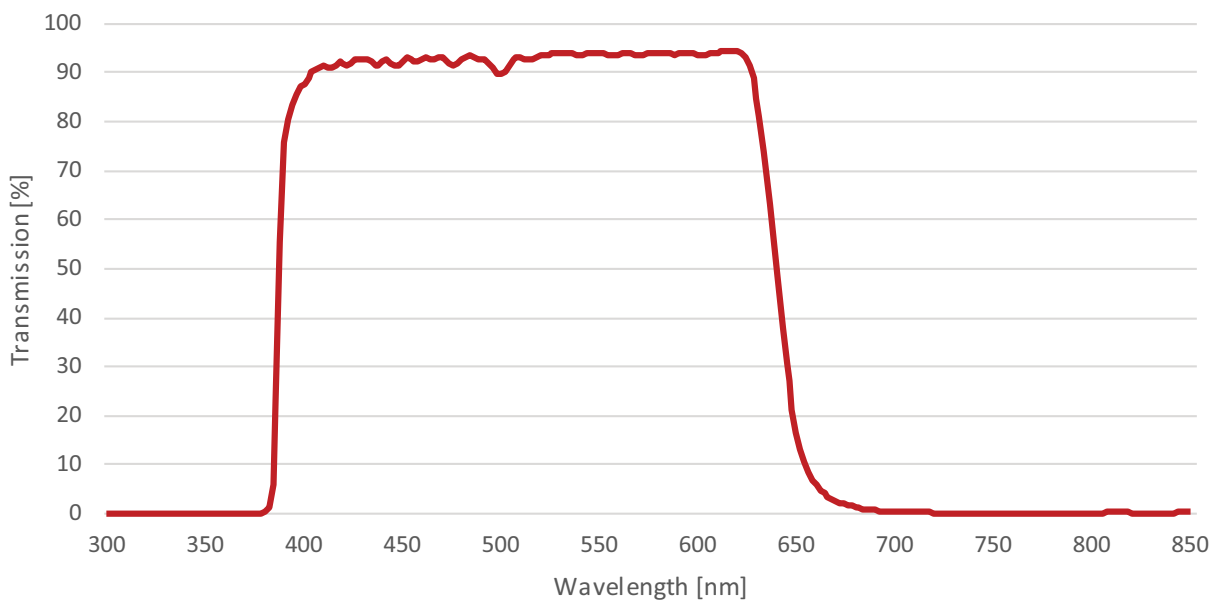## IR cut filter spectral transmission

Figure 3: IR cut filter spectral transmission

Lens position in tables

Tables for **Lens position at infinity** show nominal values.

The nominal value for flange focal distance (optical) is 12.63 mm. In tables for **Lens position at infinity (approximately)**, the value is rounded to 12.6 mm.

S-2.97-F4-5MP-T1-2.5

Feature	S-2.97-F4-5MP-T1-2.5	S-2.97-F4-5MP-T1-2.5-IRC
Product code	12338	12339
Camera mount	S-Mount (M12 × 0.5)	
Sensor size	Type 1/2.5	
Focal length	2.97 mm	
Aperture (f/#)	f/4.0	
Supported pixel resolution	5 megapixels	
Angle of view (diagonal)	102° with Type 1/2.5	
Back focus	3.5 mm	
IR correction type	IR-optimized	IR cut
Relative illumination	>66%	
Distortion	<1%	
Dimensions (diameter × length)	Ø 14 mm × 18.5 mm	Ø 14 mm × 18.1 mm
Mass	<10 g	

Table 6: S-2.97-F4-5MP-T1-2.5 specifications

Lens position at infinity (approximately)

Table 7 defines values for the position of the lens when focused to infinity. We recommend using a minimum thread engagement length of 1.0 mm (two 360 degree turns). Below this length, lens mounting is not stable enough.
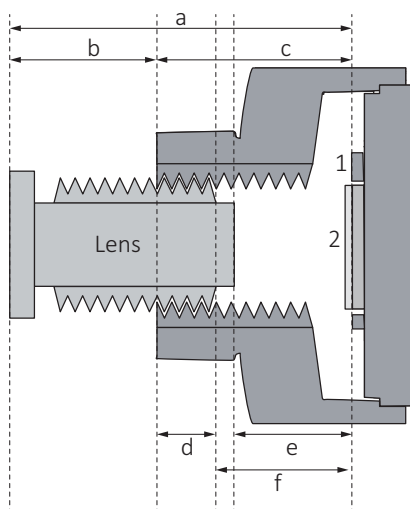
ID	Component or distance type	IR-optimized	IR cut
1	Electronics component	-	
2	Sensor with cover glass	-	
a	Lens front to sensor[1] distance	20.6 mm	
b	Lens front to front flange distance	8.0 mm	8.5 mm
c	Flange focal distance (optical) [1]	12.6 mm	
d	Thread engagement length	8.7 mm	
e	Lens back to sensor distance	2.1 mm	
f	Lens thread end to sensor[1] distance	3.9 mm	

[1] Optical distance measured to the active sensor surface, disregarding microlenses and cover glass.

Table 7: S-2.97-F4-5MP-T1-2.5 lens position at infinity (with schematic drawing)

S-4.1-F3-5MP-T1-2.5

Feature	S-4.1-F3-5MP-T1-2.5	S-4.1-F3-5MP-T1-2.5-IRC
Product code	12340	12341
Camera mount	S-Mount (M12 × 0.5)	
Sensor size	Type 1/2.5	
Focal length	4.1 mm	
Aperture (f/#)	f/3.0	
Supported pixel resolution	5 megapixels	
Angle of view (diagonal)	82° with Type 1/2.5	
Back focus	5.3 mm	
IR correction type	IR-optimized	IR cut
Relative illumination	>70%	
Distortion	<0.4%	
Dimensions (diameter × length)	Ø 14 mm × 17.9 mm	Ø 14 mm × 17.8 mm
Mass	<10 g	

Table 8: S-4.1-F3-5MP-T1-2.5 specifications

Lens position at infinity (approximately)

Table 9 defines values for the position of the lens when focused to infinity. We recommend using a minimum thread engagement length of 1.0 mm (two 360 degree turns). Below this length, lens mounting is not stable enough.
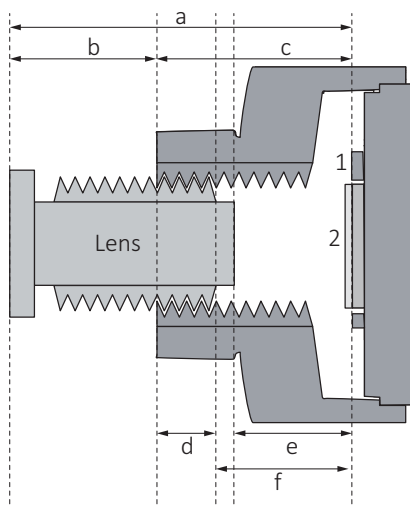
ID	Component or distance type	IR-optimized	IR cut
1	Electronics component	-	
2	Sensor with cover glass	-	
a	Lens front to sensor[1] distance	21.8 mm	
b	Lens front to front flange distance	9.2 mm	9.7 mm
c	Flange focal distance (optical) [1]	12.6 mm	
d	Thread engagement length	6.9 mm	
e	Lens back to sensor distance	4.1 mm	
f	Lens thread end to sensor[1] distance	5.7 mm	

[1]Optical distance measured to the active sensor surface, disregarding microlenses and cover glass.

Table 9: S-4.1-F3-5MP-T1-2.5 lens position at infinity (with schematic drawing)

S-6-F1.8-5MP-T1-2.5

Feature	S-6-F1.8-5MP-T1-2.5	S-6-F1.8-5MP-T1-2.5-IRC
Product code	12342	12343
Camera mount	S-Mount (M12 × 0.5)	
Sensor size	Type 1/2.5	
Focal length	6 mm	
Aperture (f/#)	f/1.8	
Supported pixel resolution	5 megapixels	
Angle of view (diagonal)	61.5° with Type 1/2.5	
Back focus	9.6 mm	
IR correction type	IR-optimized	IR cut
Relative illumination	>64%	
Distortion	<-12%	
Dimensions (diameter × length)	Ø 14 mm × 18.8 mm	Ø 14 mm × 18.6 mm
Mass	<10 g	

Table 10: S-6-F1.8-5MP-T1-2.5 specifications

Lens position at infinity (approximately)

Table 11 defines values for the position of the lens when focused to infinity. We recommend using a minimum thread engagement length of 1.0 mm (two 360 degree turns). Below this length, lens mounting is not stable enough.
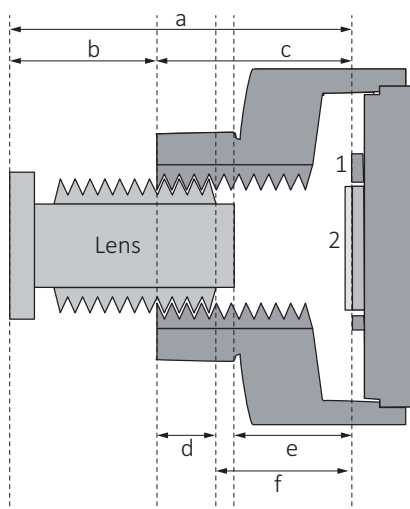
ID	Component or distance type	IR-optimized	IR cut
1	Electronics component	-	
2	Sensor with cover glass	-	
a	Lens front to sensor[1] distance	26.2 mm	
b	Lens front to front flange distance	13.6 mm	13.4 mm
c	Flange focal distance (optical) [1]	12.6 mm	
d	Thread engagement length	2.7 mm	
e	Lens back to sensor distance	8.4 mm	
f	Lens thread end to sensor[1] distance	9.9 mm	

[1]Optical distance measured to the active sensor surface, disregarding microlenses and cover glass.

Table 11: S-6-F1.8-5MP-T1-2.5 lens position at infinity (with schematic drawing)

S-8-F1.8-5MP-T1-2.5

Feature	S-8-F1.8-5MP-T1-2.5	S-8-F1.8-5MP-T1-2.5-IRC
Product code	12344	12345
Camera mount	S-Mount (M12 × 0.5)	
Sensor size	Type 1/2.5	
Focal length	8 mm	
Aperture (f/#)	f/1.8	
Supported pixel resolution	5 megapixels	
Angle of view (diagonal)	48° with Type 1/2.5	
Back focus	7.8 mm	
IR correction type (S-8-F1.8-5MP-T1-2.5)	IR-optimized	IR cut
Relative illumination	>68%	
Distortion	<-7%	
Dimensions (diameter × length)	Ø 14 mm × 19.5 mm	Ø 14 mm × 21.2 mm
Mass	<10 g	

Table 12: S-8-F1.8-5MP-T1-2.5 specifications

Lens position at infinity (approximately)

Table 13 defines values for the position of the lens when focused to infinity. We recommend using a minimum thread engagement length of 1.0 mm (two 360 degree turns). Below this length, lens mounting is not stable enough.
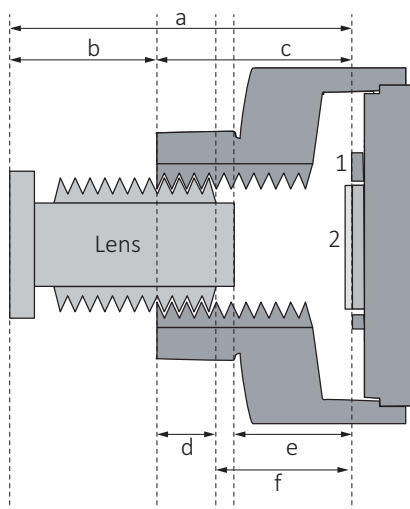
ID	Component or distance type	IR-optimized	IR cut
1	Electronics component	-	
2	Sensor with cover glass	-	
a	Lens front to sensor[1] distance	26.2 mm	
b	Lens front to front flange distance	13.6 mm	14.0 mm
c	Flange focal distance (optical) [1]	12.6 mm	
d	Thread engagement length	3.9 mm	
e	Lens back to sensor distance	7.1 mm	
f	Lens thread end to sensor[1] distance	8.7 mm	

[1]Optical distance measured to the active sensor surface, disregarding microlenses and cover glass.

Table 13: S-8-F1.8-5MP-T1-2.5 lens position at infinity (with schematic drawing)

S-12-F2.8-5MP-T1-2.5

Feature	S-12-F2.8-5MP-T1-2.5	S-12-F2.8-5MP-T1-2.5-IRC
Product code	12346	12347
Camera mount	S-Mount (M12 × 0.5)	
Sensor size	Type 1/2.5	
Focal length	12 mm	
Aperture (f/#)	f/2.8	
Supported pixel resolution	5 megapixels	
Angle of view (diagonal)	33° with Type 1/2.5	
Back focus	8.57 mm	
IR correction type	IR-optimized	IR cut
Relative illumination	>82.5%	
Distortion	<-1.75%	
Dimensions (diameter × length)	Ø 14 mm × 10.2 mm	Ø 14 mm × 11.4 mm
Mass	<10 g	

Table 14: S-12-F2.8-5MP-T1-2.5 specifications

Lens position at infinity (approximately)

Table 15 defines values for the position of the lens when focused to infinity. We recommend using a minimum thread engagement length of 1.0 mm (two 360 degree turns). Below this length, lens mounting is not stable enough.
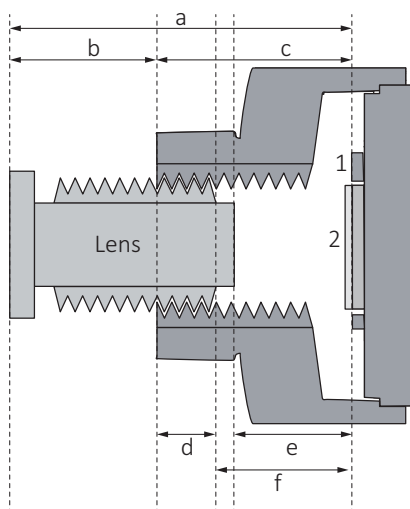
ID	Component or distance type	IR-optimized	IR cut
1	Electronics component	-	
2	Sensor with cover glass	-	
a	Lens front to sensor[1] distance	17.5 mm	
b	Lens front to front flange distance	4.9 mm	5.6 mm
c	Flange focal distance (optical)[1]	12.6 mm	
d	Thread engagement length	5.0 mm	
e	Lens back to sensor distance	7.6 mm	
f	Lens thread end to sensor[1] distance	7.6 mm	

[1]Optical distance measured to the active sensor surface, disregarding microlenses and cover glass.

Table 15: S-12-F2.8-5MP-T1-2.5 lens position at infinity (with schematic drawing)

Using S-Mount lenses

Learn how to use S-Mount lenses.

Mounting and focusing S-Mount lenses

This section instructs on using Allied Vision S-Mount lenses with Alvium cameras safely. **Actual fixing nuts may vary from the instruction drawings**.
We recommend using pinch nose pliers to tighten fixing nuts.

Figure 4 shows how fixing nuts lock S-Mount lenses.

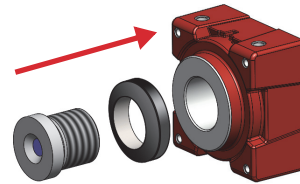Follow the instructions to lock the lens in focus position.

Figure 4: Fixing nut locking an S-Mount lens

CAUTION
Cuts to the skin by sharp edges of lens mounts

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

Be careful when mounting or unmounting lenses.

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.

Follow the instructions carefully.

Mounting the fixing nut to the lens

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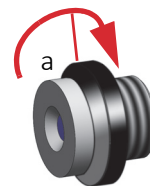

Figure 5: Lens and fixing Nut

Focusing the lens

Focus by live image. Avoid to screw in the lens deeper than for infinity focus. For a rough estimation, see Specifications on page 11.

2. Slowly screw the lens clockwise into the lens mount until the image is roughly in focus.

3. Slowly screw in and unscrew the lens until you have found the most accurate focus.
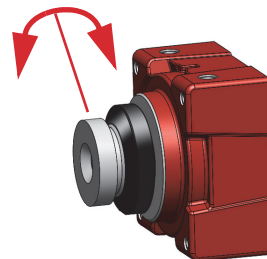

Figure 6: Adjusting focus

> **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 fix position.

Locking focus

Pinch nose pliers are used to screw the fixing nut:

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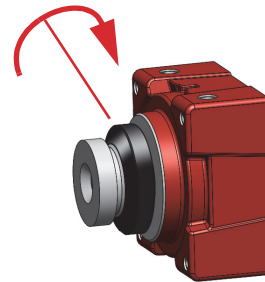
Figure 7: Locking the fixing nut

Checking focus is set and locked properly

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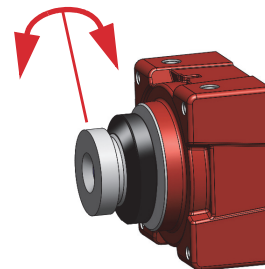
Figure 8: Checking lens is safely locked

6. Check No. 2:
   The S-Mount thread allows a slightly tilted lens position. In this case, the focus for a common object plane varies over the image plane.
   If the focus is constant over the image plane, you are done.
   If the focus varies over the image plane, the lens is tilted. Continue with 7.

7. Loosen the fixing nut.

8. Continue with 3.

   The lens is locked in focus and ready for operation.