



Hardware Manual

VisionSensor PV3

Version 1.2 – January 2021

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1 Handling and Safety Instructions



Depending on the operating conditions, the housing temperature can exceed 60 °C. There is a risk of injury!



Caution! LED risk group 2. Do not look directly into the LED flash!



EMC conformity according to EN/IEC 61000-6-2:2005 is qualified for cable lengths ≤ 30 m.



Electrical installation should be executed without power applied to the device and all connected devices.



Please take special note of the voltage range which may be applied to the device. Otherwise, permanent damage to the device may result!



Due to the characteristics and physical principles inside flash memory, **memory cards have a finite lifetime** dictated by the number of write operations. Therefore, take care of the regular write operations to prevent an early flash damage.

2 Introduction

Thank you very much for your interest in our product VisionSensor PV3.

The purpose of this document is to provide as much information as possible about the VisionSensor PV3. How should the connectors and plugs be connected? What is needed in the periphery? These and other questions will be answered here. Should you have other unanswered questions, do not hesitate to contact us. For direct contact to the support, please use our ticket system: <https://imago.freshdesk.com>

The heart of the VisionSensor PV3 is an ARM Cortex-A53 SoC. We deliver the camera with a Debian based Linux OS, which gives the customer the capabilities to use the popular Linux programs/libraries, and currently Debian contains more than 40.000 packets! Therefore, the customer can use even very rare libraries in an easy way.

The VisionSensor PV3 offers two digital inputs and four digital outputs. Furthermore, the VisionSensor PV3 is equipped with a powerful internal LED lighting unit, which is perfect for difficult lighting conditions.

The synergy of e2v 2MP sensors and the IMAGO Frame Grabber Library offer you a solid foundation for future machine vision applications.

2.1 Main features

- Image sensor:
 - e2v EV2S02M / EV2S05M
 - 1920 × 1080 pixels / 2560 × 1936 pixels
 - Monochrome or Bayer pattern
- Internal LED lighting (S-Mount only):
 - Controllable via software
 - Automatic current regulation
- LED ring lighting option available (C-Mount only):
 - Controllable via software
 - Automatic current regulation
- Digital inputs / outputs:
 - 4x digital output
 - 2x digital input
- Ethernet interface 1000 Mbit/s
- SoC: NXP i.MX8M Mini
 - 4× ARM Cortex-A53 1.8 GHz
 - 1 GB or 2 GB LPDDR4 RAM
- Main storage:
 - μSD card (SD, SDHC, SDXC)
- Housing:
 - 21 - 28 V_{DC} power supply
 - Passive cooling without heat sink
- Lens:
 - S-Mount
 - C-Mount option available

2.2 Configurations

The following table shows available features and interfaces for the different models of the VisionSensor PV3:

	S-Mount	C-Mount
Sensor	e2v Snappy 2 MP	e2v Snappy 2 MP or 5 MP
SoC	NXP i.MX8M Mini 4× Cortex-A53, 1.8 GHz	
RAM	1 GB or 2 GB	
Main storage	μSD card ≥ 32 GB	
Ethernet	1× 1000 Mbit/s	
Dig. I/Os	2× IN / 4× OUT	
LED lighting	Four integrated LEDs	Optional LED ring light
Additional options	-	Google Edge TPU (4 TOPS)

2.3 Block Diagram

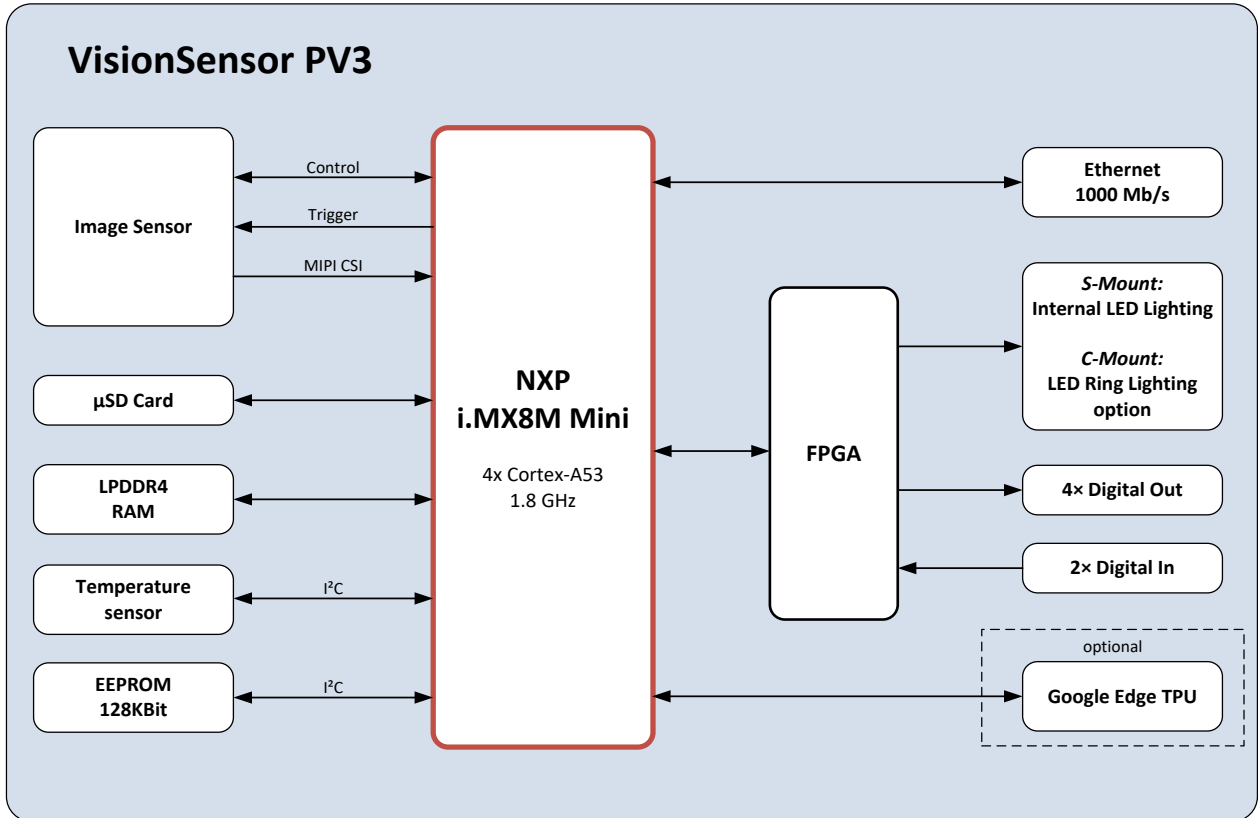


Figure 1: VisionSensor PV3 block diagram

3 Operating Conditions

Power Supply:

Parameter	Min.	Typ.	Max.	Unit
Supply voltage	21	24	28	V
Supply current (@24V)			0.5	A

Digital Input:

Parameter	Min.	Typ.	Max.	Unit
Input voltage range	0		25	V
Rising edge threshold voltage	7.4		9.4	V
Falling edge threshold voltage	4.7		6.3	V
Input resistance		15.5		kΩ

Digital Output:

Parameter	Min.	Typ.	Max.	Unit
Output current			50	mA
Output high voltage		$V_{Supply} - 0.2$		V

Environment:

Parameter	Value	Unit
Weight, including cable	125	g
Operating temperature	5 ... 45	°C
Operating humidity, relative, non-condensing	5 ... 95	%
Storage temperature	-30 ... +70	°C
Storage humidity, relative, non-condensing	5 ... 95	%

4 Interfaces

4.1 Power and I/O

A non-shielded, 0.5 meter cable with an M12 8-pin connector is used for power supply and I/O signals.

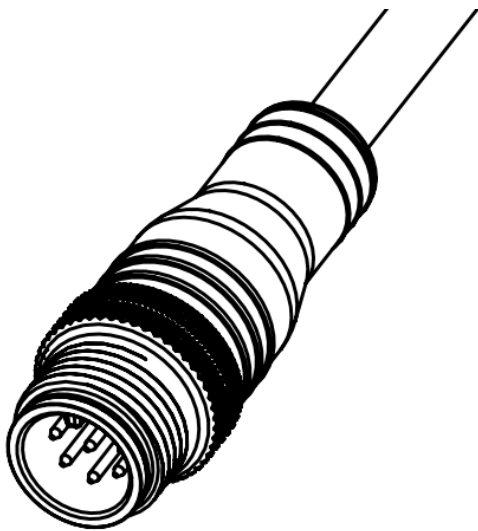


Figure 2: Power supply and I/O cable

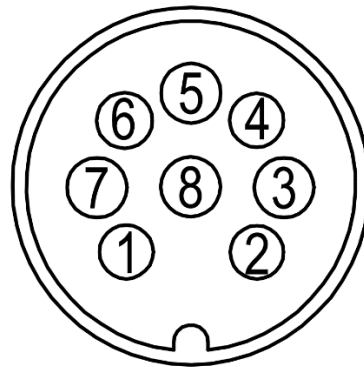


Figure 3: Pin assignment M12 connector

Pin	Function
1	Power (21V-28V)
2	GND
3	Digital IN0
4	Digital IN1
5	Digital OUT3
6	Digital OUT0
7	Digital OUT1
8	Digital OUT2

Table 1: Pin assignment M12 connector

4.1.1 Digital I/Os

The following illustration shows the electrical equivalent circuit for the digital input and output signals:

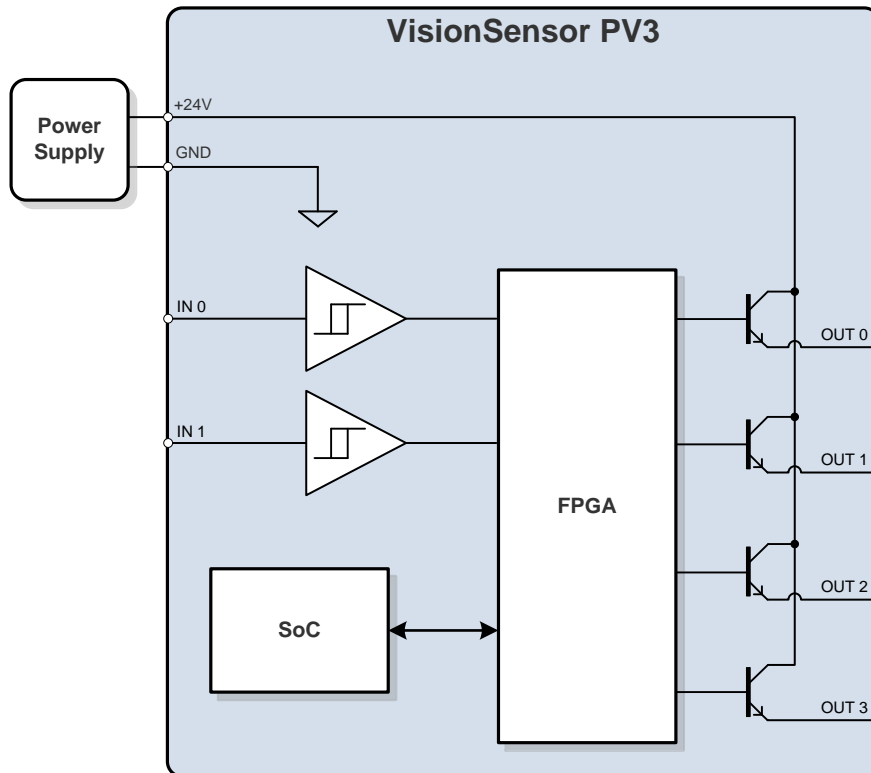


Figure 4: Simplified digital I/O circuit

The input signals use a Schmitt trigger circuit with the power supply GND as voltage reference.

The digital output circuit uses open-emitter configuration. All outputs are internally supplied by the 24V power input.

4.2 1000 Mbit/s Ethernet

A shielded 0.5 m Ethernet cable with a M12 8-pin X-coded connector is used for network communication.

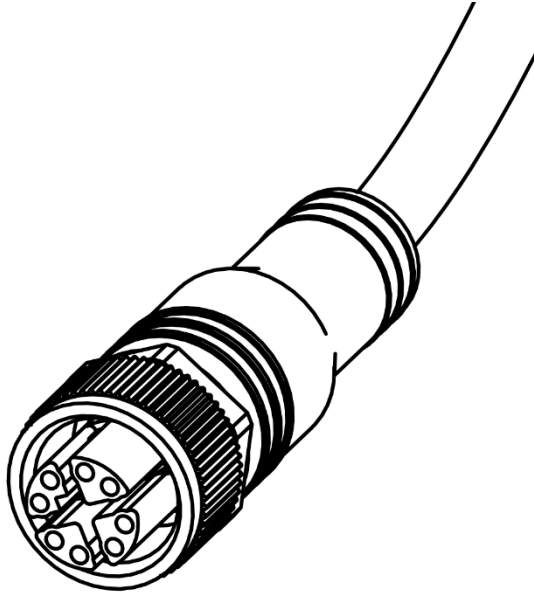


Figure 5: Ethernet cable

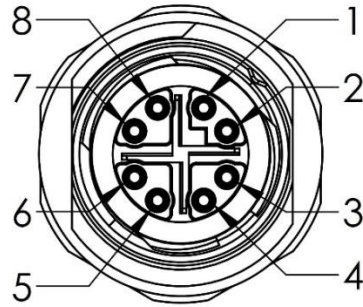


Figure 6: Pin assignment M12 connector

PIN	Function
1	D1+
2	D1-
3	D2+
4	D2-
5	D4+
6	D4-
7	D3-
8	D3+

Table 2: Pin assignment M12 connector

We recommend using shielded cables, for example:

Length	Product	IMAGO order code
1 m	Phoenix contact 1407471 "NBC-MSX/ 1,0-94F/R4AC SCO"	10007049
2 m	Phoenix contact 1407472 "NBC-MSX/ 2,0-94F/R4AC SCO"	10007050
5 m	Phoenix contact 1407473 "NBC-MSX/ 5,0-94F/R4AC SCO"	10008076

4.3 Status LEDs

The VisionSensor PV3 is equipped with two status LEDs, namely “ETH” and “PWR”. The meaning of each status LED and its color is listed in the tables below.

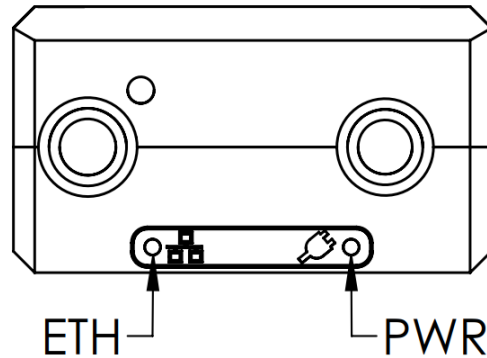


Figure 7: VisionSensor PV3 status LEDs

PWR LED	State
Green	Power on
Red	Digital IN0 signal active

Table 3: PWR LED states

ETH LED	State
Green	Ethernet link is up
Red	Ethernet activity

Table 4: ETH LED states

5 Image sensors

This chapter will give you a short overview of the available sensors for the VisionSensor PV3. On the next pages, you will find more detailed information for each sensor.

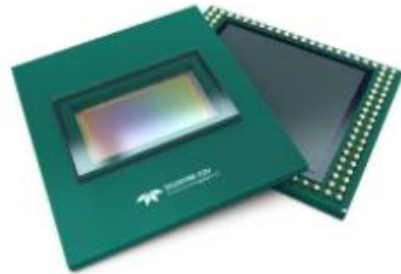
	e2v Snappy 2M EV2S02MB / EV2S02MC	e2v Snappy 5M EV2S05MB / EV2S05MC
Size	1/3"	1/1.8"
Resolution	1920 × 1080	2560 × 1936
Framerate (full resolution)	115 fps	54 fps
Framerate (VGA)	249 fps	
Type	Monochrome or Bayer pattern	

Table 5: Sensor overview

5.1 e2v Snappy

Overview:

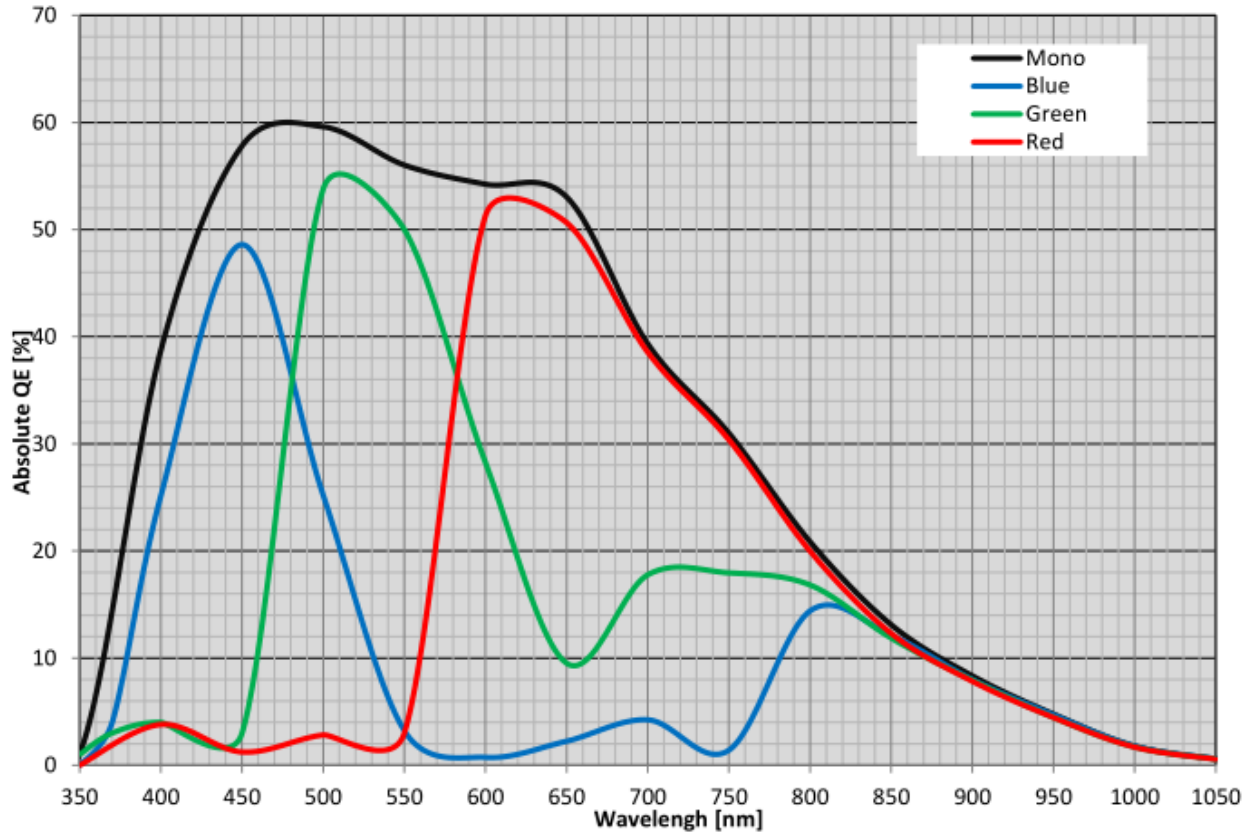
- 2 MP and 5 MP version available
- Monochrome or RGB Bayer pattern
- Global shutter
- Partial scan function (ROI) to increase frame rate
- 12-bit ADC with 8 bit image readout
- External synchronization via digital inputs
- Easy-to-use software API



Details:

		EV2S02M	EV2S05M
Sensor	Technology	CMOS	
	Sensor Size	1/3"	1/1.8"
	Resolution	1920 x 1080 pixels	2560 x 1936 pixels
	Framerate (full resolution)	115 fps	55 fps
	Partial Scan	Yes	
	Color	Monochrome or Bayer pattern	
	Pixel Size	2.8 μm x 2.8 μm	
	A/D Converter	12-bit ADC with 8 bit image readout	
	Exposure	16 μs ... 0.5 s	
Trigger	Acquisition Modes	Global shutter with overlapped integration and readout	
	Trigger Modes	Free run, SW trigger or HW trigger	
	Exposure Indicator Output	Yes	

Quantum Efficiency



6 Assembly and Disassembly (S-Mount)

6.1 Changing the SD Card

Every VisionSensor PV is shipped with a preinstalled SD card. Software updates can normally be installed remotely over Ethernet.

In order to change the SD card, the lens / LED cover has to be removed first as shown in the picture below:

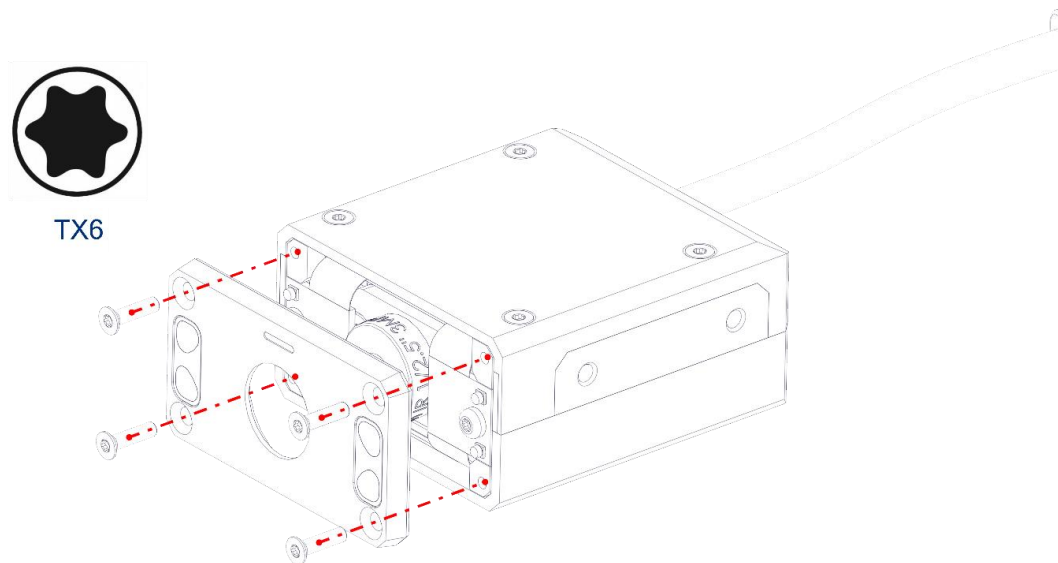


Figure 8: Removing the lens / LED cover

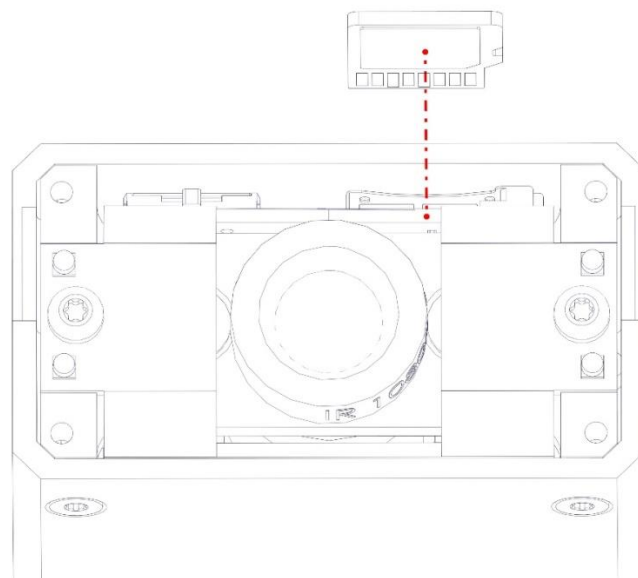


Figure 9: Changing the SD card

6.2 Adjusting the Focus

To adjust the focus, you must first remove the hexagon socket set screw located on the back of the camera.

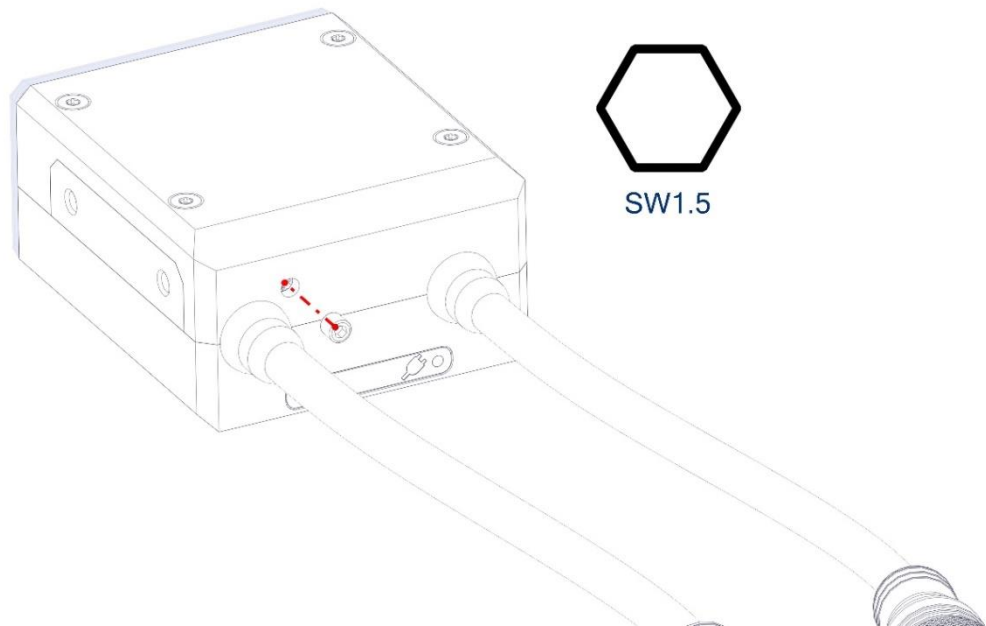


Figure 10: Removing the hexagon socket set screw

If you screw clockwise, the focusing plane will get closer to the camera.

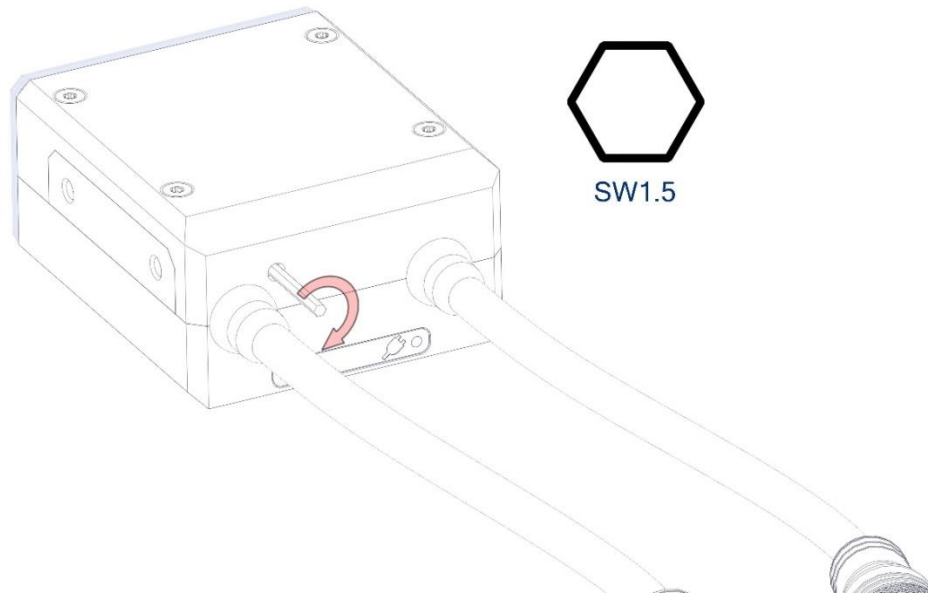


Figure 11: Adjusting the focus

If you screw counter-clockwise, the focusing plane will get more distant.

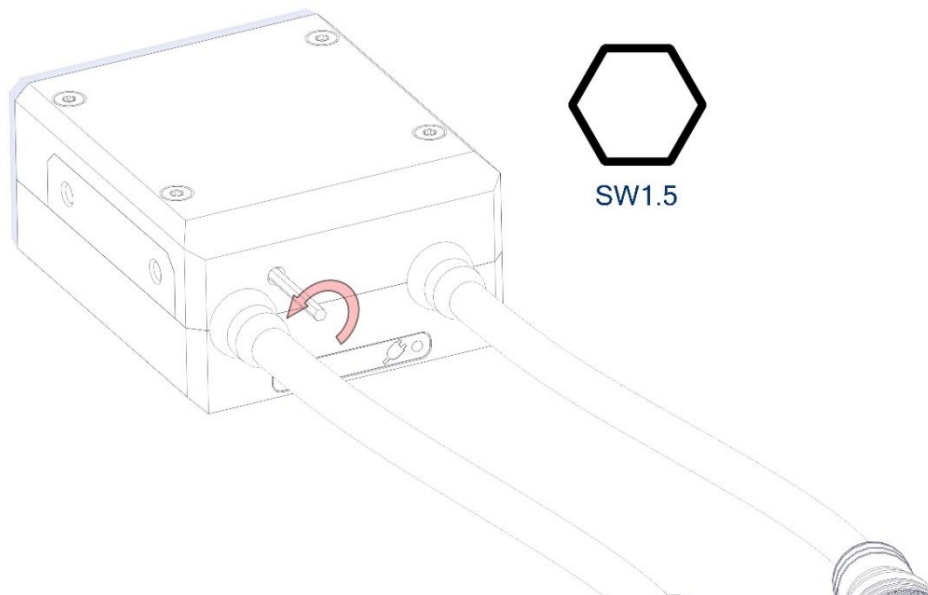
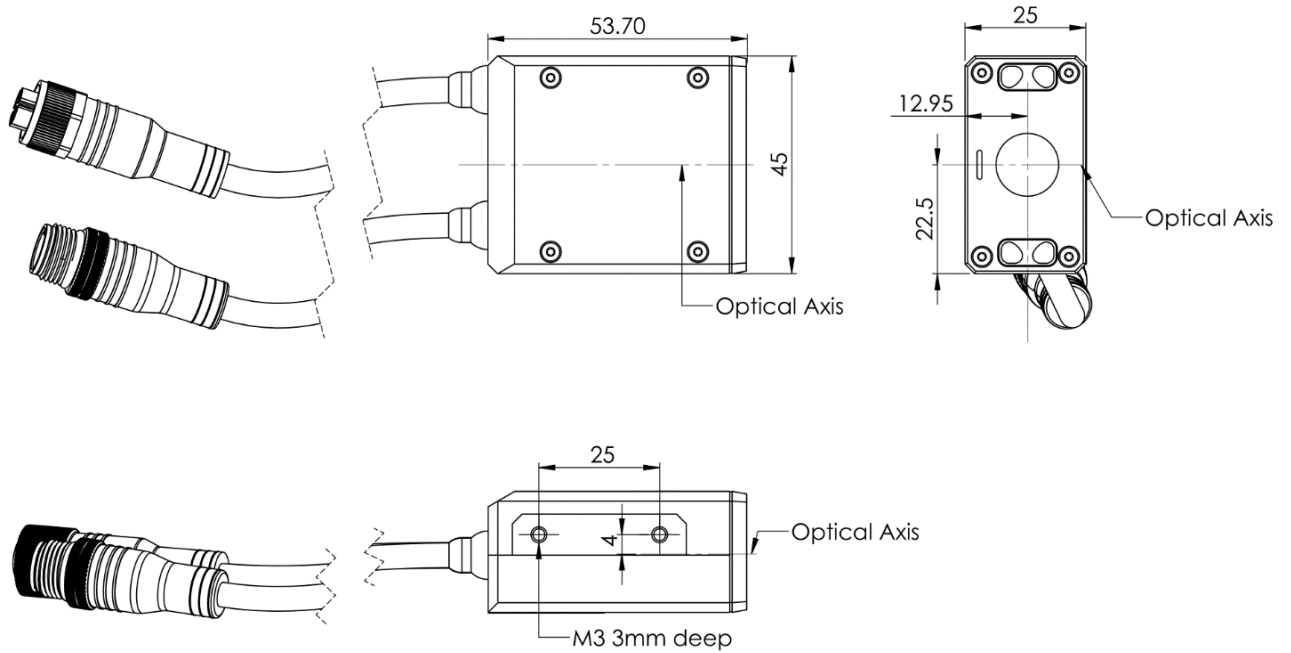


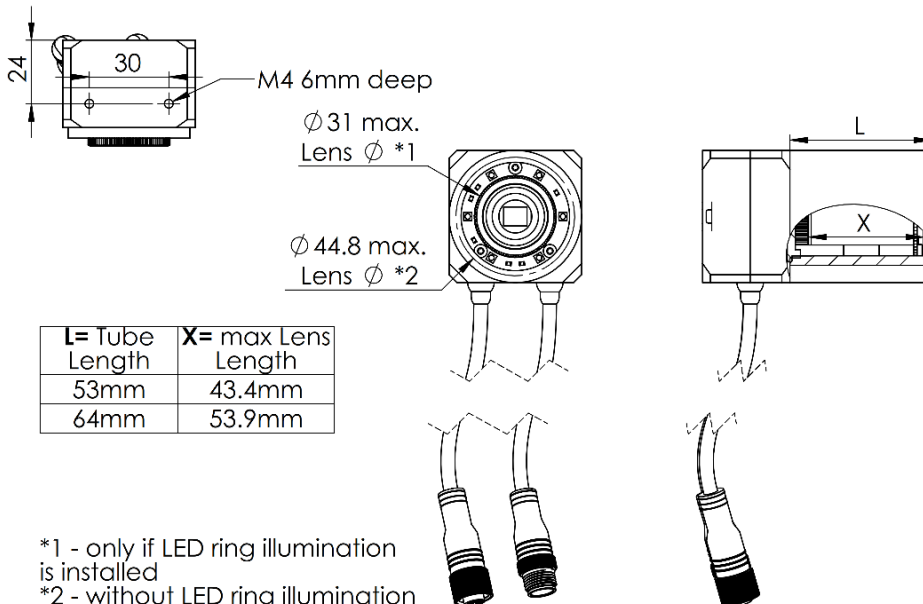
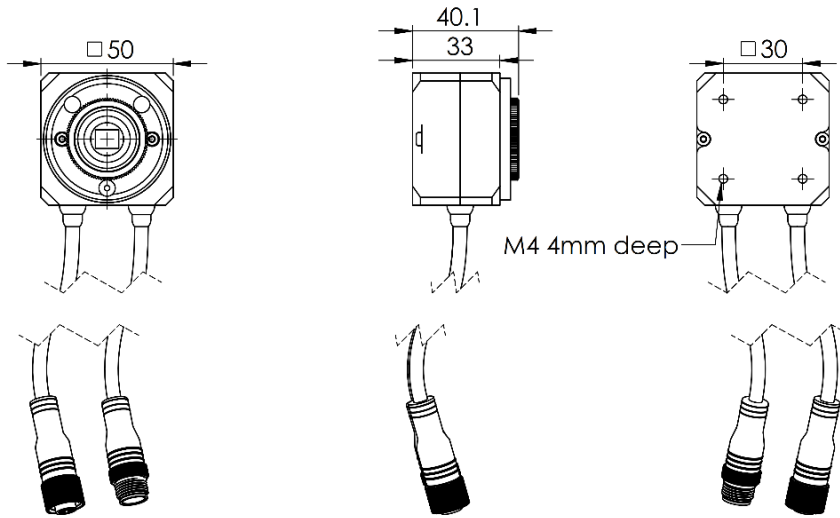
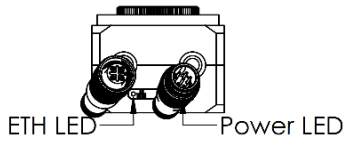
Figure 12: Adjusting the focus

7 Mechanical Drawings

7.1 S-Mount



7.2 C-Mount



8 Support

Finally, if you have any open questions, the IMAGO support team is happy to assist you in any cases. For direct contact to the support, please use our ticket system: <https://imago.freshdesk.com>

Also, visit our IMAGO Download Portal: <https://www.imago-technologies.com/support>

- Get access to the latest SDKs and documentation
- Get access to the latest Linux releases for the VisionSensor

9 History

Revision	Date	Changes
1.2	January-2021	<ul style="list-style-type: none">- Add Snappy 5 MP version- Update Operating conditions
1.1	August-2020	<ul style="list-style-type: none">- Added new drawings and C-Mount version
1.0	June-2020	<ul style="list-style-type: none">- First release