

XS-8P-X2G2-FF-X8G3-SFF
Multi camera platform

XIMEA Accessories
Technical Manual
Version v260903

Introductions

About this manual

Dear customer,

Thank you for purchasing a product from XIMEA.

We hope that this manual can answer your questions, but should you have any further queries or if you wish to claim a service or warranty case, please contact your local dealer or refer to XIMEA Support on our website: www.ximea.com/support

The purpose of this document is to provide a description of XIMEA Accessories and to describe the correct way to install related software, drivers and run it successfully. Please read this manual thoroughly before operating your new XIMEA Accessories for the first time. Please follow all instructions and observe the warnings.

This document is subject to change without notice.

About XIMEA

XIMEA is one of the worldwide leaders for innovative camera solutions with a 30-year history of research, development and production of digital image acquisition systems. Based in Slovakia, Germany and the US, with a global distributor network, XIMEA offers their cameras worldwide. In close collaboration with customers XIMEA has developed a broad spectrum of technologies and cutting-edge, highly competitive products.

XIMEA's camera centric technology portfolio comprises a broad spectrum of digital technologies, from data interfaces such as USB 2.0, USB 3.1 and PCIe to cooled digital cameras with CCD, CMOS and sCMOS sensors, as well as X-ray cameras.

XIMEA has three divisions – generic machine vision and integrated vision systems, scientific imaging and OEM/custom.

Our broad portfolio of cameras includes thermally stabilized astronomy and x-ray cameras, as well as specialty cameras for medical applications, research, surveillance and defense.

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1 General description

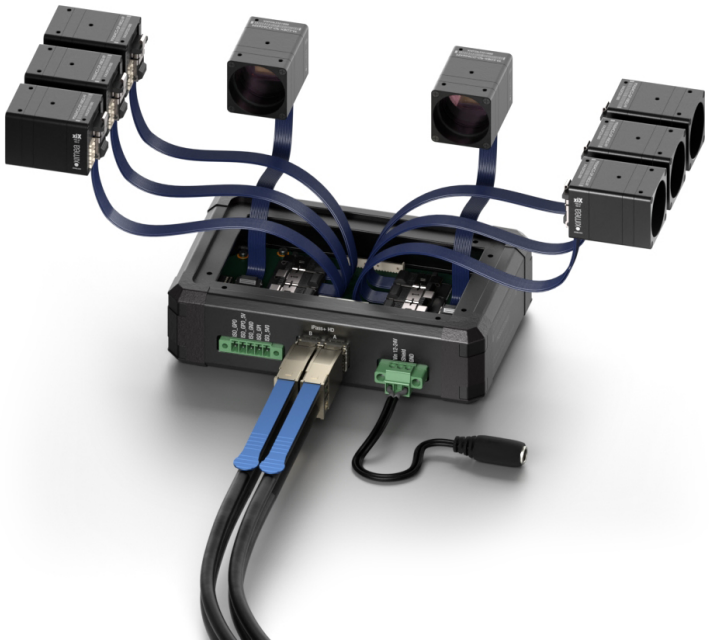


Figure 1: xSWITCH XS-8P-X2G2-FF-X8G3-SFF

The xiSwitch XS-8P-X2G2-FF-X8G3-SFF is a multi-camera platform designed for high-performance synchronization of up to 8 cameras equipped with FireFly connectors from xiX family. FireFly cables (e.g. CBL-ECUE-X4G3-1M0, CBL-ECUE-X4G3-2M0) provide length options of up to 3 m. The power cable for connecting the switch to the power source is included in the delivery kit, see Scope of delivery for details.

The xiSwitch XS-8P-X2G2-FF-X8G3-SFF features:

- Camera ports: 8x PCIe X2G2 FireFly Connectors with 10 Gbit bandwidth each for camera connections
- Host ports: 2x PCIe x8 Gen3 SFF MiniSAS HD connectors with output bandwidth of 64 Gbit
- External power for reliable operation of connected cameras
- Communication, control, and synchronization through IO connector

The power supply operates with a DC voltage range of 12 to 24 V. The basic power consumption of the PCIe switch is 5.25 W with a copper cable connection. Each Optical SFF cable will add 0.9 to 1.2 W, depending on the brand and length.

The xiSwitch XS-8P-X2G2-FF-X8G3-SFF is designed for a wide range of applications, including:

360 panorama, Augmented or Virtual Reality (AR, VR), Autonomous self-driving vehicles, Street/city mapping, Deep learning tasks, Stereo camera systems, 3D scanning, Entertainment, Photogrammetry, FACS scanning, Face and Motion capture, UAV / UAS (drones), Cinematography, Videogrammetry and more.

2 Dimensional drawings

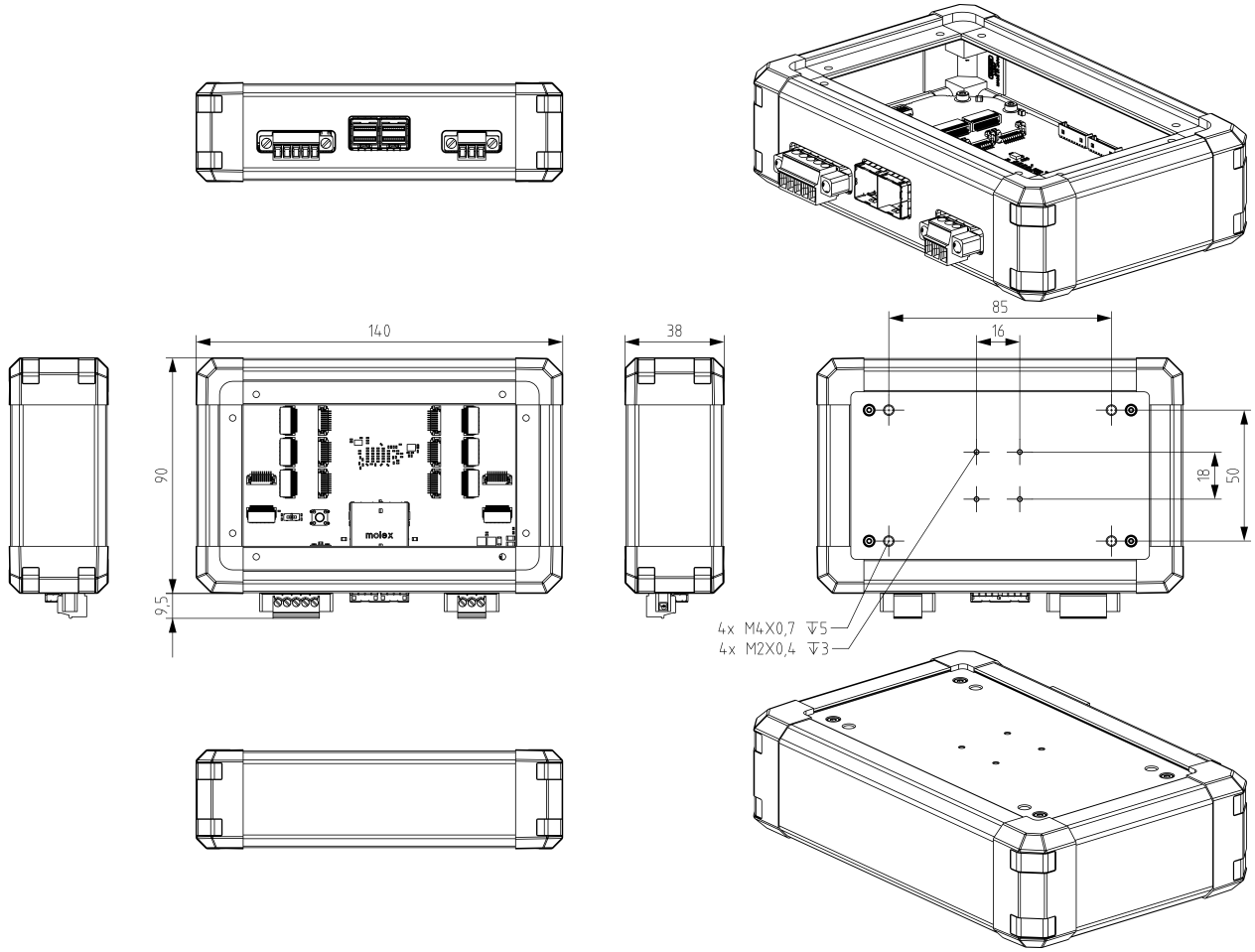


Figure 2: Dimensional drawing of XS-8P-X2G2-FF-X8G3-SFF

Width [W]	Height [H]	Depth [D]	Mass [M]	Material and technology
140 mm	99.5 mm	38 mm	385 g	Extruded aluminum

Table 1: Parameters and mass

3 Configuration

3.1 DIP switches

The numbering of the camera ports (1-8 PCIe) correspond to the number of the respective GPI and GPO dip switches (left side in the figure below). The DIP switches have annotation on their body. The description of DIP switches (GPI, GPO) is written directly on the PCB top layer.

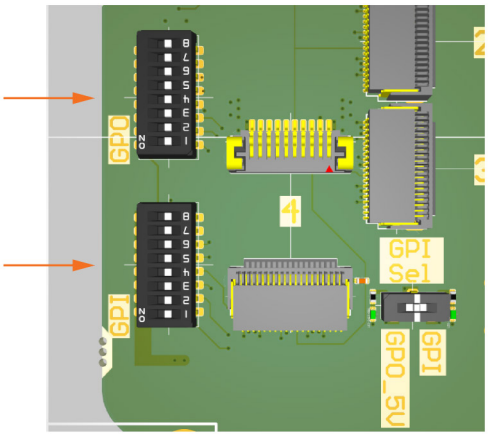


Figure 3: GPI / GPO DIP switches

The switch to select the synchronization mode is in the left bottom area, next to the annotation “GPI Sel” with two possible states - “GPI” and “GPO_5V”. For more information see section IO-subsystem.

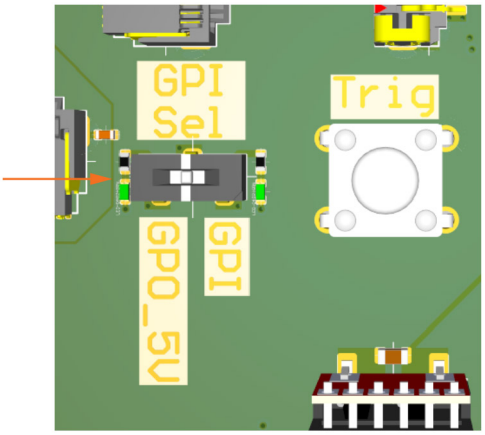


Figure 4: Switch for selecting synchronization mode

4 Connectors

4.1 Location of connectors

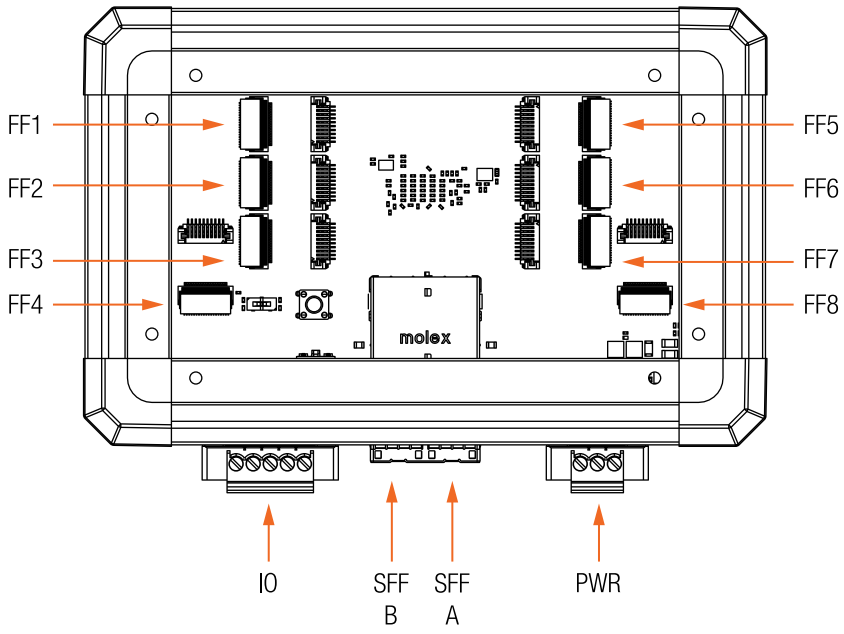


Figure 5: Connectors location

Name	Description
FF1-FF8	FireFly camera connectors, Samtec (UEC5-019-1-H-D-RA-1-A + UCC8-010-1-H-S-1-A)
IO	5-pin IO connector, 1843826
SFF A	PCIe iPass+ HD connector, SFF-8644, connector A
SFF B	PCIe iPass+ HD connector, SFF-8644, connector B
PWR	3-pin Power input connector, 1843800

Table 2: Connectors description

4.2 Data interfaces

4.2.1 FireFly connector

Item	Value
Connector	Samtec (UEC5-019-1-H-D-RA-1-A + UCC8-010-1-H-S-1-A)
Signals	PCIe, IO, GND
Mating cables	Ximea PN: CBL-ECUE-X4G3-1M0, CBL-ECUE-X4G3-2M0

Table 3: FireFly connector description

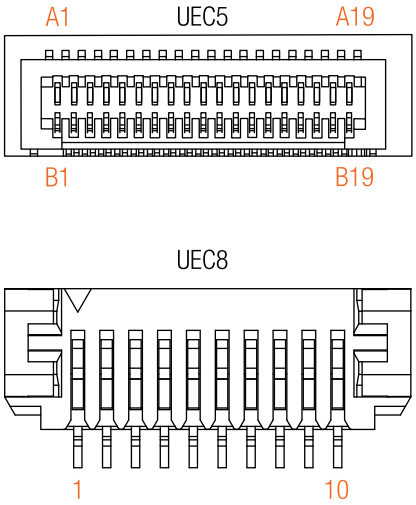


Figure 6: Firefly connector pinout

Pin	Name	Description
1	VCC_TX	TX Power output
2	GND	Ground
3	PRESENTL	Module presence detect
4	SELECT	Signal for selection
5	CPERST	PCIe reset signal
6	CPRSNT	Card presence detect
7	SDA	I2C data line
8	SCL	I2C clock line
9	GND	Ground
10	VCC_RX	RX power output

Table 4: FireFly connector UCC8 pin assignment

Pin	Name	Description	Pin	Name	Description
A1	GND	Signal and power ground	B1	GND	Signal and power ground
A2	PCIe_PETN_2	PCIe TX differential pair 2	B2	PCIe_PETN_3	PCIe TX differential pair 3
A3	PCIe_PETP_2	PCIe TX differential pair 2	B3	PCIe_PETP_3	PCIe TX differential pair 3
A4	GND	Signal	B4	GND	Signal and power ground
A5	PCIe_PETN_1	PCIe TX differential pair 1	B5	PCIe_PETN_0	PCIe TX differential pair 0
A6	PCIe_PETP_1	PCIe TX differential pair 1	B6	PCIe_PETP_0	PCIe TX differential pair 0
A7	GND	Signal and power ground	B7	GND	Signal and power ground
A8	SPARE	Unused/reserved pin	B8	PWR	Power input
A9	CPERST	PCIe reset signal	B9	PWR	Power input
A10	GND	Signal and power ground	B10	GND	Signal and power ground
A11	ISO_GND	Isolated Ground	B11	ISO_GND	Isolated Ground
A12	ISO_GPI	Isolated Input	B12	ISO_GPO	Isolated Output
A13	GND	Signal and power ground	B13	GND	Signal and power ground
A14	PCIe_PERP_2	PCIe RX differential pair 2	B14	PCIe_PERN_3	PCIe RX differential pair 3
A15	PCIe_PERN_2	PCIe RX differential pair 2	B15	PCIe_PERP_3	PCIe RX differential pair 3
A16	GND	Signal and power ground	B16	GND	Signal and power ground
A17	PCIe_PERP_1	PCIe RX differential pair 1	B17	PCIe_PERN_0	PCIe RX differential pair 0
A18	PCIe_PERN_1	PCIe RX differential pair 1	B18	PCIe_PERP_0	PCIe RX differential pair 0
A19	GND	Signal and power ground	B19	GND	Signal and power ground

Table 5: FireFly connector UEC5 pin assignment

4.2.2 PCIe iPass+ HD connector

Item	Value
Connector	Conn Receptacle MINI-SAS HD RIGHT ANGLE PUSH-IN, 2149966-1, 2x36pos
Signals	Data delivery
Mating cables	Ximea PN: CBL-SFF-X4G3-10M0, CBL-SFF-X4G3-30M0, CBL-SFF-X4G3-50M0

Table 6: PCIe iPass+ HD connector description

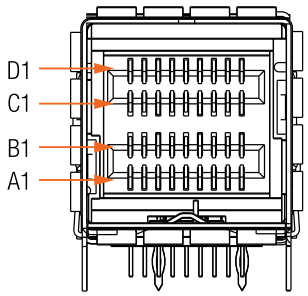


Figure 7: PCIe iPass+ HD SFF connector pinout

Pin	Name	Description	Pin	Name	Description
A1	CADDR	Control Address	C1	CMISCL	Clock line for Control Management Interface
A2	CINT	Control Interrupt	C2	CMISDA	Data line for Control Management Interface
A3	GND	Ground	C3	GND	Ground
A4	PCIe_PERP_0	PCIe RX differential signal (Lane 0)	C4	PCIe_PETP_0	PCIe TX differential signal (Lane 0)
A5	PCIe_PERN_0	PCIe RX differential signal (Lane 0)	C5	PCIe_PETN_0	PCIe TX differential signal (Lane 0)
A6	GND	Ground	C6	GND	Ground
A7	PCIe_PERP_3	PCIe RX differential signal (Lane 3)	C7	PCIe_PETP_3	PCIe TX differential signal (Lane 3)
A8	PCIe_PERN_3	PCIe RX differential signal (Lane 3)	C8	PCIe_PETN_3	PCIe TX differential signal (Lane 3)
A9	GND	Ground	C9	GND	Ground
B1	PWR	Power supply	D1	PWR	Power supply
B2	CBLPRSNT	Cable Present signal	D2	MGTPWR	Multi-Gigabit Transceiver Power
B3	GND	Ground	D3	GND	Ground
B4	PCIe_PERP_1	PCIe RX differential signal (Lane 1)	D4	PCIe_PETP_1	PCIe TX differential signal (Lane 1)
B5	PCIe_PERN_1	PCIe RX differential signal (Lane 1)	D5	PCIe_PETN_1	PCIe TX differential signal (Lane 1)
B6	GND	Ground	D6	GND	Ground
B7	PCIe_PERP_2	PCIe RX differential signal (Lane 2)	D7	PCIe_PETP_2	PCIe TX differential signal (Lane 2)
B8	PCIe_PERN_2	PCIe RX differential signal (Lane 2)	D8	PCIe_PETN_2	PCIe TX differential signal (Lane 2)
B9	GND	Ground	D9	GND	Ground

Table 7: PCIe iPass+ HD connector pin assignment

4.2.3 Power connector

Item	Value
Connector	CONN Header Block 3-POS, 3.5MM, Right Angle, 250V/8A, THT, 1843800
Signals	Power, GND
Mating connector	Phoenix Contact 1847068 (CBL-10-01096)[1]

[1]Power cable is part of the ACC-XSWITCH-PCIE kit

Table 8: Power connector description

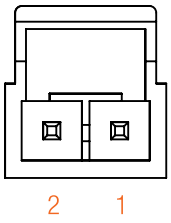


Figure 8: Power connector pinout

Pin	Name	Description
1	Vin 12 to 24 V	Power 12 to 24 V
2	SHLD	Shielding
3	GND	Power supply Ground

Table 9: Power connector pin assigment

4.3 GPIO

4.3.1 GPI / GPO connectors

Item	Value
Connector	CONN-9P-0530470910, Through-hole pin header, 9 positions, 1.25 mm pitch
Signals	GPI / GPO
Mating connector	P1.25 mm pitch wire-to-board receptacle housing with matching crimp terminals

Table 10: GPI / GPO connectors general description

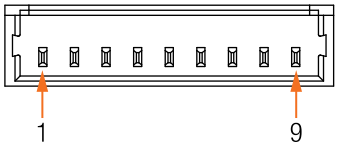


Figure 9: GPI / GPO connectors pinout

GPI connector		GPO connector	
Pin	Name	Pin	Name
1	ISO_GPI 1	1	ISO_GPO 1
2	ISO_GPI 2	2	ISO_GPO 2
3	ISO_GPI 3	3	ISO_GPO 3
4	ISO_GPI 4	4	ISO_GPO 4
5	ISO_GND	5	ISO_GND
6	ISO_GPI 5	6	ISO_GPO 5
7	ISO_GPI 6	7	ISO_GPO 6
8	ISO_GPI 7	8	ISO_GPO 7
9	ISO_GPI 8	9	ISO_GPO 8

Table 11: GPI / GPO connectors pin assigment

4.3.2 External GPIO connector

Item	Value
Connector	CONN Header Block 5-POS, 3.5MM, Right Angle, 250V/8A, THT, 1843826
Signals	IO, GND
Mating connector	Phoenix Contact 1847084

Table 12: External GPIO connector general description

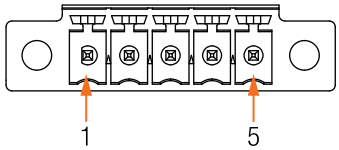


Figure 10: External GPIO connector pinout

Pin	Name	Description
1	ISO_GPO	Open collector output from the selected “master” camera
2	ISO_GPO_5V	Push-pull 5 V output from the selected “master” camera
3	ISO_GND	(common) Isolated Ground for the IO subsystem
4	ISO_GPI	External input trigger signal, 3.3 to 24 V input
5	ISO_5V0	Isolated 5 V power output for IO subsystem[1]

[1]Do not connect external power supply to this pin. Sourcing capability limited to 5 V 400 mA, including power needed for IO subsystem.

Table 13: IO connector pin assigment

5 IO-subsystem

The IO subsystem is designed to enable synchronized operation of connected XIMEA cameras. Synchronization can be achieved either through an external trigger signal or by using a master-slave configuration. An external trigger signal is connected to the input pin ISO_GPI. In the master-slave mode, one of the cameras connected to the switch is designated as the master, while the remaining cameras are synchronized using the output signal from the master camera.

5.1 Internal power supply

To enable synchronization of all connected cameras via either an external trigger or the master camera's output, the switches include an internal 5 V power supply (an isolated 2 W DC/DC converter) that powers the IO subsystem.

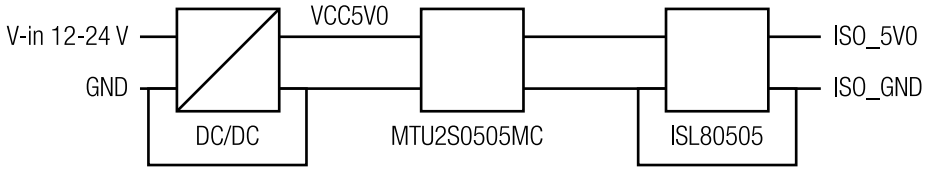


Figure 11: Power supply of IO-subsystem

5.2 Circuitry requirement

All components of the IO subsystem are powered by the two voltage levels: ISO_5V0 and ISO_GND.
ISO_5V0 is generated by the internal power supply.

5.3 Synchronization mode selection

Two synchronization modes are available:

- External trigger
- Master-slave mode

The selection between both modes is made via the dip-switch GPI-Select:

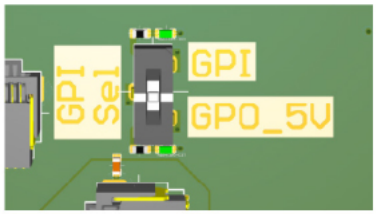


Figure 12: Synchronization mode selector

Position GPI-Sel	Synchronization mode
GPI	External trigger (pin ISO_GPI signal)
GPO_5V0	Master-Slave-Mode (pin ISO_GPO_5V signal)

Table 14: DIP switch mode description

5.4 IO configuration

The xSWITCH is designed to support different synchronization modes of the connected XIMEA cameras.

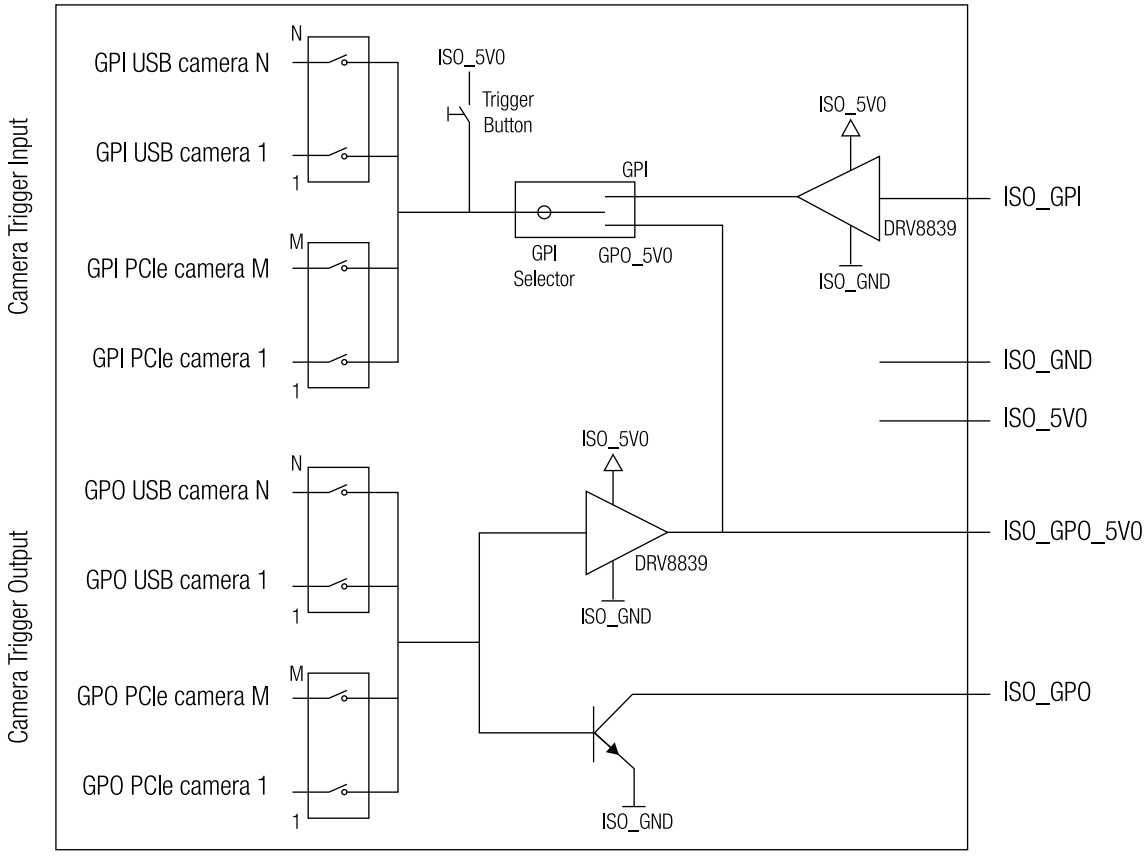


Figure 13: Functional diagram of the IO-system

The interconnected IO ports of the cameras are the optically isolated input and output lines.

5.4.1 Trigger input configuration

To synchronize the cameras, either the IO connector pin ISO_GPI (for external trigger mode) or the internal signal ISO_GPO_5V0 (for master-slave mode) is connected to the GPI pins of the cameras that require synchronization. The specific cameras to be synchronized are defined by configuring their individual DIP switches (GPI USB Camera n or GPI PCIe Camera n). These DIP switches connect the input signal to the corresponding camera's input line.

5.4.2 Trigger output configuration

One camera can be selected — and only one should be selected — to generate the output signal by configuring its specific DIP switch (GPO USB Camera n or GPO PCIe Camera n). This output signal can be used to:

- Trigger all cameras connected to the same switch
- Trigger external devices (e.g., another xSWITCH)

The selected output signal will be connected to the internal and external signal ISO_GPO / ISO_GPO_5V0.

5.5 Signal level

5.5.1 ISO_GPI signal level

The signal level of the GPI is described in the following table:

V-in-min [V]	V-in-max [V]	State
0	<0.4	Off (0)
0.4	2.5	Transient
>2.5	24	On (1)

Table 15: Digital trigger input ISO_GPI, signal levels

Note: The Input level **V-in** represents the amplitude of the input signal. Voltage levels referenced to common ground ISO_GND

5.5.2 ISO_GPO signal level

The digital output ISO_GPO type is Open Collector NPN, the maximum usable open circuit voltage level is 24 V.

5.5.3 ISO_GPO_5V0 signal level

The signal level of the ISO_GPO_5V0 is described in the following table:

Logic status	V-out [V]
Off (0)	0.0
On (1)	5.0

Table 16: Digital output ISO_GPO_5V0, signal levels

Note: The Output level **V-out** represents the amplitude of the input signal. The voltage levels refer to ISO_GND

6 Usages

6.1 Buttons

Two buttons are soldered onto the switch. The trigger button is located on the left side of the switch, while the second button, the PCIe reset button, is located on the bottom-right side.

6.1.1 Trigger button

This button can be used to generate a trigger pulse on the GPI-Selector output position to test the GPI configuration.
A rising edge trigger pulse (0V -> 5V) will be generated.

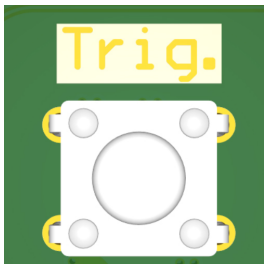


Figure 14: Trigger button

6.1.2 PCIe reset button

Pressing this button will result in reset of the xSWITCH PCIe bus and all connected cameras.

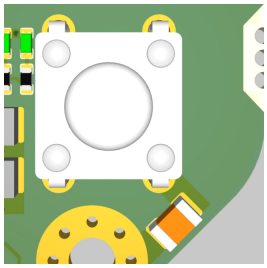


Figure 15: PCIe reset button

Note: This PCIe reset button is for debugging purposes only.

7 Additional information

7.1 Handling precautions

7.1.1 ESD precautions

Semiconductor components are particularly sensitive to electrostatic discharge (ESD). Therefore, take the following precautions:

1. Maintain relative humidity in the working environment between 40% and 70%. The use of an apparatus for ion generation may be needed to remove electricity.

2. Ensure that all conveyors, solder vessels, soldering irons, and peripheral equipment are electrically grounded.

3. Use rings or bracelets connected to ground through high resistance (on the level of 1 MΩ). Wearing ESD clothing and footwear, using conductive floor mats, and implementing other measures to minimize electrostatic discharge is recommended.

4. Avoid using Styrofoam or other highly static-prone materials for storing completed board assemblies.

7.1.2 Heat dissipation

All xSWITCH models are very compact, high-performance devices. Although the xSWITCH models are designed to be power efficient, the high component packing density can lead to elevated temperatures. In particular, the PCIe switch component located on the bottom side of the main PCB generates a significant amount of heat during operation. As a result, the entire unit may heat up.

Adequate heat dissipation must therefore be ensured, for example by providing sufficient thermal contact to a heat sink or by adding active or passive cooling, if required.

7.2 Scope of delivery

- The switch XS-8P-X2G2-FF-X8G3-SFF
- A Power cable (CBL-10-01096), one DC power input socket female (OD5.5/ID2.1, Center +) with 3-pin Power-mating-connector Phoenix Contact 1847068
- A 5-pin IO-mating-connector Phoenix Contact 1847084
- A screwdriver (MECH-SCRDRW-2.5MM-50MM)

7.3 Cables

7.3.1 CBL-SFF-X4G3-10M0

The cable is available in 30 m, and 50 m lengths. PCIe Gen3 x4 fiber SFF cable (SFF-8644) is a high-speed optical connection used to link PCIe devices over longer distances. It uses Corning ClearCurve glass fiber (OM3, 850 nm) and provides four bi-directional data lanes, reaching up to 12 Gbps per lane (48 Gbps in total).



Figure 16: CBL-SFF-X4G3-10M0

7.3.2 CBL-SFF-X4G3-COP-5M0

The CBL-SFF-X4G3-30M0 is a PCIe Gen3 x4 copper cable (SFF-8644) designed to connect compatible XIMEA products. Cable provides four data lanes with speeds of up to 12 Gbps per lane (48 Gbps total). The cable length is 5 m, making it suitable for short-distance, high-bandwidth camera connections.



Figure 17: CBL-SFF-X4G3-COP-5M0

7.3.3 CBL-ECUE-X4G3-1M0/2M0/3M0

The FireFly copper cables are bidirectional and flexible. PCIe Gen3 x4 lanes with performance to 28 Gbps, 12 differential pairs. Both sides are equipped with locking mechanism. The cable is available in 1 m ,2 m, and 3 m lengths. The EMI/EMC performance should be evaluated by customer.

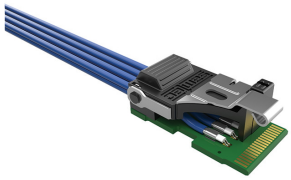


Figure 18: CBL-ECUE-X4G3-1M0

8 Quickstart guide

8.1 Hardware setup

8.1.1 Essential components

It is important that the power is turned off when inserting/detaching the cables. General ESD precautions need to be applied. Failing this requirement may lead to product damage.

The xiSwitch with all connected cameras needs to be plugged in and supplied with power when the computer is booted up before use.

- XS-8P-X2G2-FF-X8G3-SFF multi camera platform
- Power cable: Cable with one DC power input socket female (OD5.5/ID2.1, Center +)
- Camera cable: Firefly ECUE copper cable (e.g. CBL-ECUE-X4G3-xM0)
- XIMEA cameras with PCIe FireFly interface
- Host cable: SFF-8644 cable (e.g. CBL-SFF-X4G3-10M0)
- Host PC

Note: Two X4G3 SFF cables are required for X8G3 devices for proper use and data transfer.

8.1.2 Connecting the components

Step 1. Ensure the power supply and the computer are turned off before connecting any cables.
The order of cable connections is not strictly specified.

Step 2. After all other cables are connected, connect the XS-8P-X2G2-FF-X8G3-SFF to the power supply.

Step 3. Power on the computer.

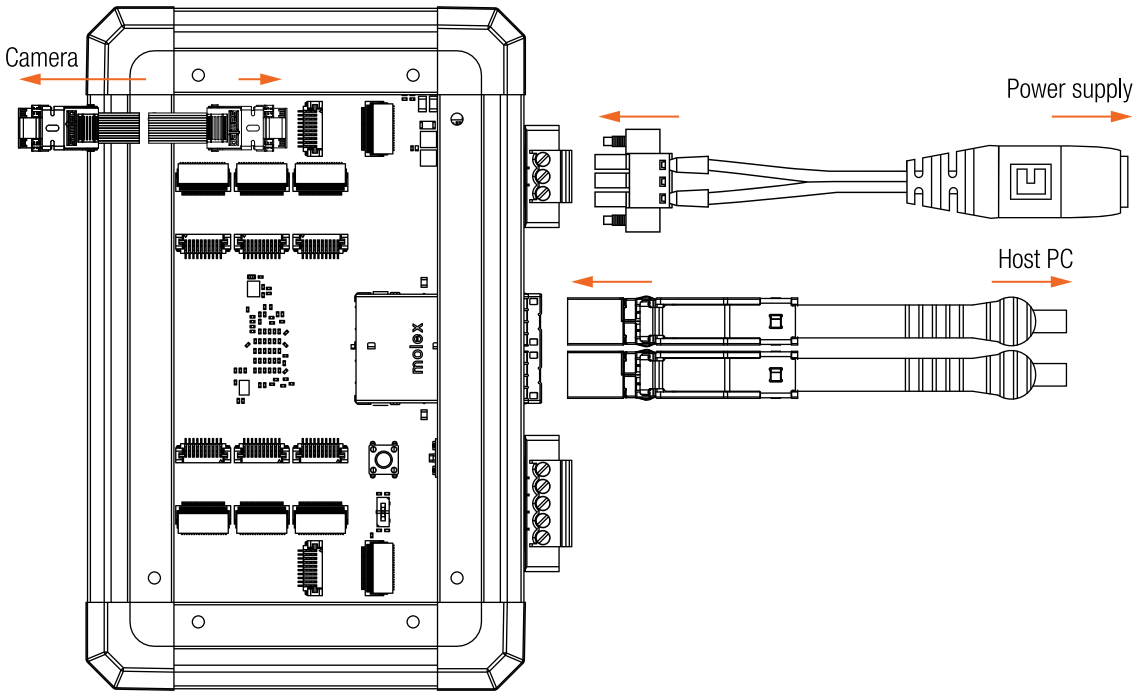


Figure 19: XS-8P-X2G2-FF-X8G3-SFF cable connection

For more information about XS-8P-X2G2-FF-X8G3-SFF please contact: sales@ximea.com.

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