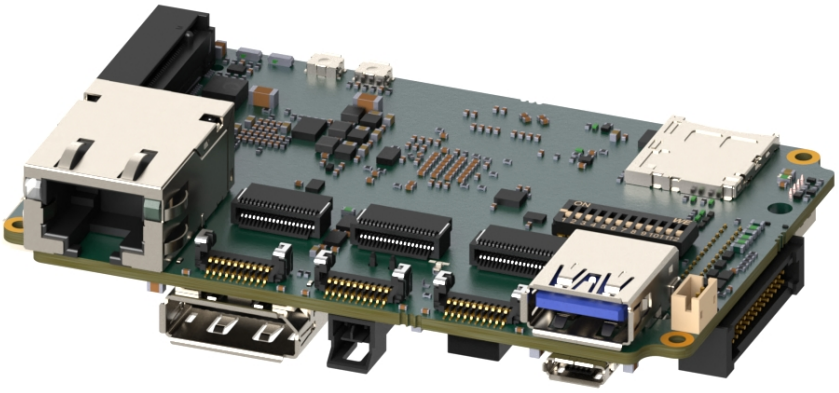
ximea



XEC-NX-3P-X2G3
Embedded carrier board

XIMEA Accessories
Technical Manual
Version v260902

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.

Contact XIMEA

XIMEA is a worldwide operating company

Headquarters, Sales worldwide	Sales America	R&D, Production
XIMEA GmbH Am Mittelhafen 16 48155 Münster Germany	XIMEA Corp. 12600 W Colfax Ave., Suite A-130 Lakewood, CO 80215 USA	XIMEA s.r.o. Lesná 52 900 33 Marianka Slovakia
Tel: +49 (251) 202 408-0 Fax: +49 (251) 202 408-99	Tel: +1 (303) 389-9838 Fax: +1 (303) 202-6350	Tel: +421 (2) 205 104 26 Fax: +421 (2) 205 104 27

Web	www.ximea.com
General inquiries	info@ximea.com
Sales	sales@ximea.com
Support	XIMEA Support

Contents

About this manual ... 2
About XIMEA ... 2
Contact XIMEA ... 2

1 General description ... 4
1.1 Accessories ... 5
1.2 LEDs ... 6

2 Dimensional drawings ... 7

3 Configuration ... 8
3.1 DIP switches ... 9
3.1.1 SW-DIP-12POS ... 9
3.1.2 PCIe ports configuration switch ... 10
3.1.3 SPI Voltage switch ... 11

4 Connectors ... 12
4.1 Location of connectors ... 12
4.2 Data interfaces ... 13
4.2.1 PCIe FireFly connector ... 13
4.2.2 Power connector ... 15
4.2.3 USB 3.2 Gen 2 Type-A connector ... 16
4.2.4 USB 2.0 Micro AB connector ... 16
4.2.5 DisplayPort connector ... 17
4.2.6 Ethernet connector ... 17
4.2.7 Debug UART connector ... 17
4.2.8 Fan connector ... 18
4.2.9 SODIMM connector for Jetson module ... 18
4.3 Digital inputs / outputs (GPIO) interface ... 19
4.3.1 Camera GPIOs ... 19
4.3.2 Jetson GPIOs ... 20
4.3.3 GPIO mapping ... 21

5 Usages ... 25
5.1 Buttons ... 25
5.1.1 Front buttons ... 25

6 Additional information ... 26
6.1 PCIe system overview ... 26
6.2 Known issues ... 26

7 Quickstart guide ... 27
7.1 Hardware setup ... 27
7.1.1 Essential components ... 27
7.1.2 Connecting the components ... 27
7.1.3 Flashing OS (hardware setup) ... 29
7.2 Software setup ... 31
7.2.1 Flashing OS (software setup) ... 31
7.2.2 Modifying OS image ... 37
7.2.3 USB on-the-go (Jetson Orin) ... 39
7.2.4 Enable usage of GPIO6 (Jetson Orin, Jetpack 5.X.X) ... 42
7.2.5 Enable usage of GPIO6 (Jetson Orin, Jetpack 6.X.X) ... 43
7.2.6 Enable direction change of GPIOs on Jetpack 6 with custom pinmux ... 44
7.2.7 All-in-one OS modification for Jetson Xavier ... 44
7.2.8 Installing the XIMEA Software Package ... 44

List of figures ... 45

List of tables ... 46

1 General description

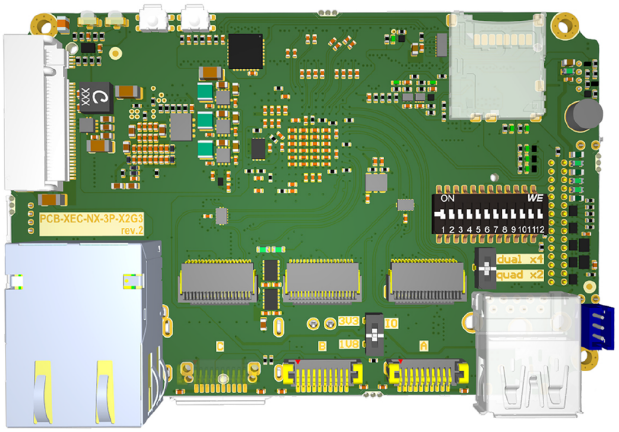


Figure 1: XEC-NX-3P-X2G3 carrier board

Embedded carrier board is designed to connect your xiX cameras to the NVIDIA® Jetson Xavier NX™module. Board is equipped with three Firefly PCIe connectors, a high-speed 10 Gbit/s Ethernet port, and an M.2 slot for NVMe SSDs, this device is tailored to the special requirements of an embedded imaging system.

- NVIDIA Jetson NX carrier board
- Ideal for the operation and synchronization of 3 cameras and more
- 3x PCIe Firefly and 1x M.2 connector configurable in two options:
  - 3x ports for xiX-X2G2 camera and 1x for M.2 (NMVe) streaming 10 Gbits
  - 1x port for xiX-X4G3 camera and 1x for M.2 (NVMe) streaming 32 Gbits
- Peripherals: Ethernet, USB3 Type A, M.2, microSD, GPIO, Display port
- The Host system should be running Ubuntu 18.04, 20.04 or Ubuntu 22.04
- Optional version combined with Orin NX module and fan
- For use with cameras from: xiX, xiX-XL, xiX-Xtreme and xiSpec family

Embedded GPU system with an option to connect several cameras for:

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

Compatible Jetson modules

Module	Note
Jetson Orin NX	SD card slot disabled
Jetson Orin nano	SD card slot disabled
Jetson Xavier NX	Ethernet speed limited to 6 Gbit/s

Table 1: Compatible Jetson modules

1.1 Accessories

Mandatory accessories

Name	Description
CBL-XEC2-PWR-0M15	Power cable
TP-XEC-NX-SET	Thermal pad pack

Table 2: Accessories

3rd party accessories

Name	Description
SEEED STUDIO 110991904	Heatsink for Jetson modules[1]
GST90A19-P1M AC/DC adapter	Power adapter for Jetson kits
CR1220 battery	For RTC clock usage with Jetson Orin NX/nano, must not be used with Xavier NX
VL1120/fcn battery	For RTC clock usage with Jetson Xavier NX, non-standard usage
OTG adapter[2]	For using the microUSB port in OTG mode. (For connecting keyboard, mouse, etc.)

[1]We recommend using this one as some heatsinks have cables that are too short for this carrier board.
[2]USB 2.0 microUSB B (male) to USB A (female)

Table 3: 3rd party accessories

1.2 LEDs

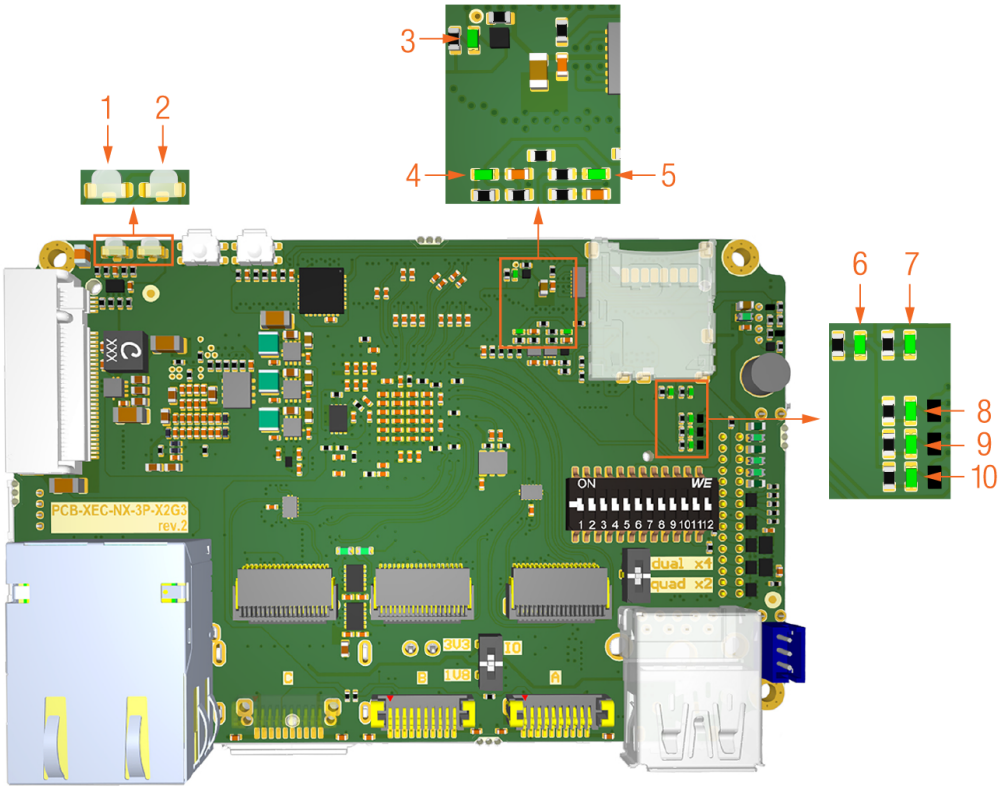


Figure 2: XEC-NX-3P-X2G3-PCA LEDs location

Number	Color	Light ON	Note
1	Red / Green	GPIO 9 is log 0 / GPIO 11 is log 0	-
2	Red / Green	GPIO 2 is log 0 / GPIO 1 is log 0	-
3	Green	PERST of PCIe 0 is active	This lane is PERST lane for FF ports and M.2 port
4	Green	5 V lane is active	-
5	Green	NOP in current revision	-
6	Green	Regulated input voltage is active	Voltage from the power connector after Over/undercurrent protection
7	Green	Unregulated input voltage is active	Voltage from the power connector
8	Green	Jetson is not in a reset state	RST lane of the Jetson module is in log 1, log 0 to reset the Jetson
9	Green	Power enable lane to the Jetson is active	-
10	Green	5 V lane is active	-

Table 4: XEC-NX-3P-X2G3-PCA LEDs description

2 Dimensional drawings

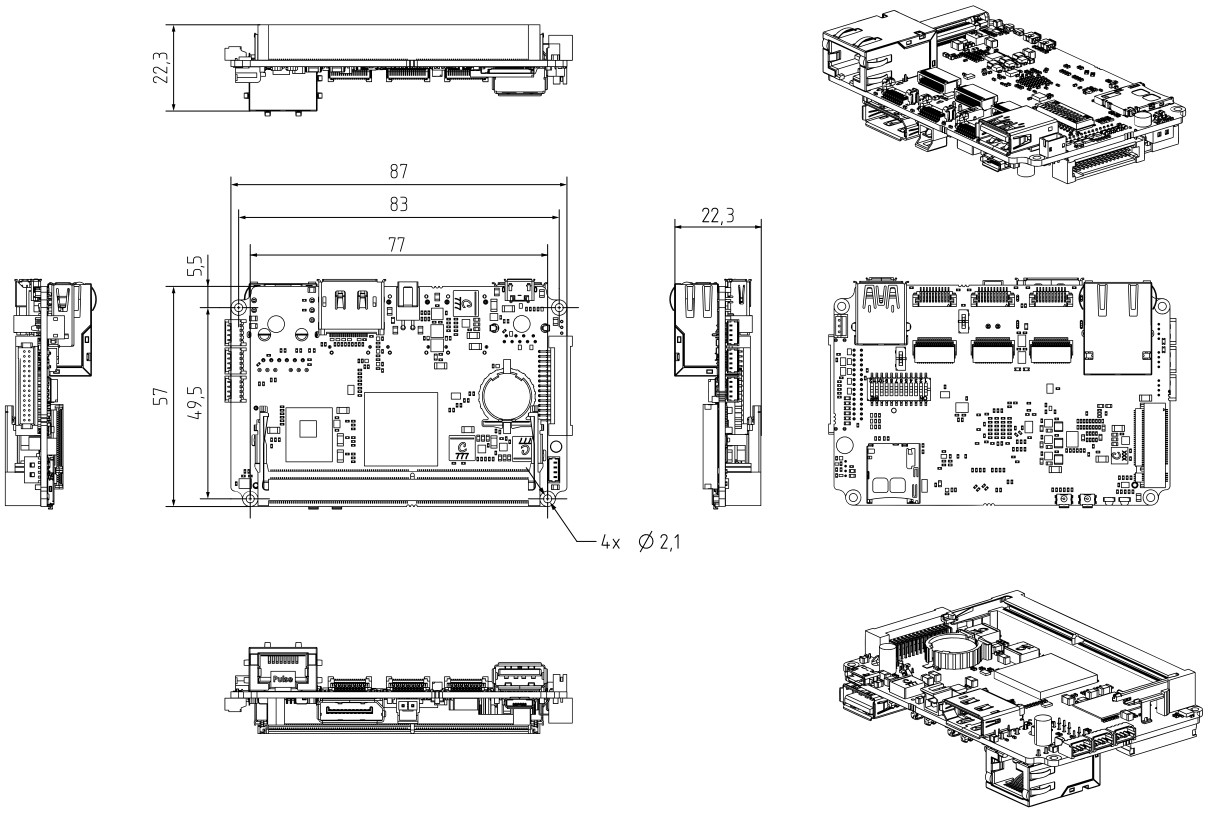


Figure 3: Dimensional drawing of XEC-NX-3P-X2G3

Width [W]	Height [H]	Depth [D]	Mass [M]
87 mm	57 mm	22.3 mm	52 g

Table 5: Parameters

3 Configuration

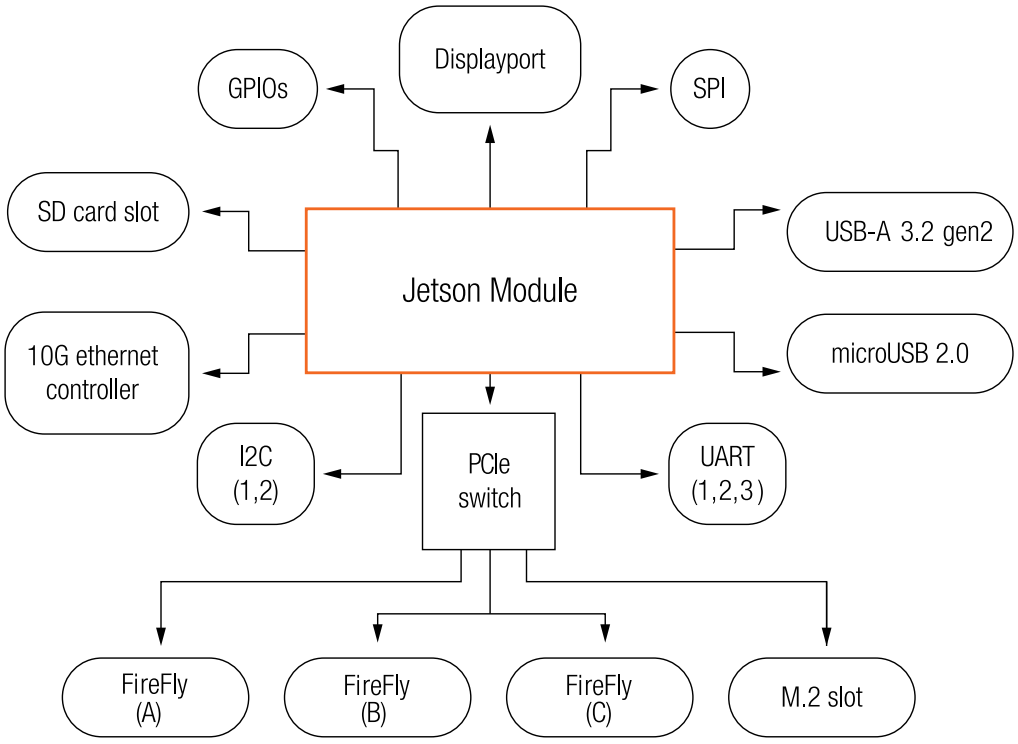


Figure 4: Functional schematic

3.1 DIP switches

3.1.1 SW-DIP-12POS

SW-DIP-12POS consists of 12 individual switches:

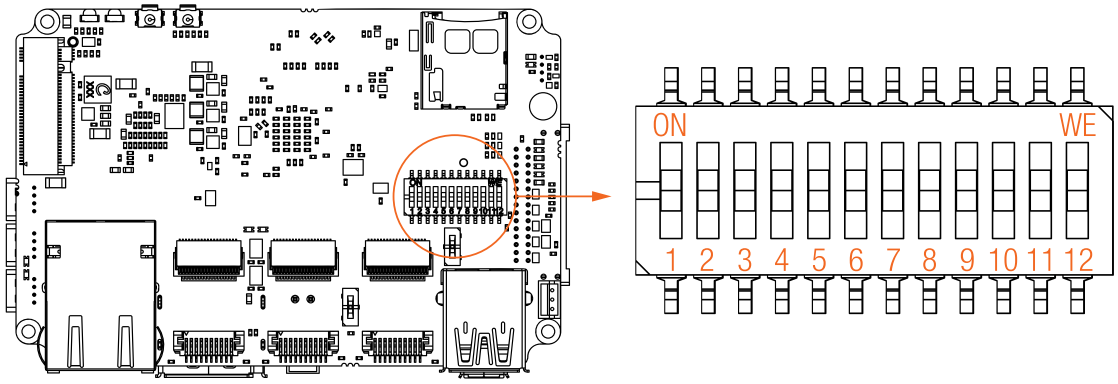


Figure 5: DIP switch 1

DIP switch	UP	DOWN	Description
1	ISO GND -> GND	NC	Connects common ISO GND pin of FireFly (FF) ports to board GND
2	FF-A GPO ISO -> FF-A GPO 5 V	NC	Connects GPO ISO pin from FF-A to GPO lane[1]
3	FF-B GPO ISO -> FF-B GPO 5 V	NC	Connects GPO ISO pin from FF-B to GPO lane[1]
4	FF-C GPO ISO -> FF-C GPO 5 V	NC	Connects GPO ISO pin from FF-C to GPO lane[1]
5	FF-A GPO 5 V -> FF-C GPO 5 V	NC	Connects GPO 5 V lane from FF-A[2] to GPI ISO lane of FF-A
6	FF-B GPO 5 V -> FF-C GPO 5 V	NC	Connects GPO 5 V lane from FF-A[2] to GPI ISO lane of FF-B
7	FF-C GPO 5 V -> FF-C GPO 5 V	NC	Connects GPO 5 V lane from FF-A[2] to GPI ISO lane of FF-C
8	GPIO7 5 V -> FF-A GPI ISO	NC	Connects GPIO 7[3] to GPI ISO pin of Firefly A
9	GPIO7 5 V -> FF-B GPI ISO	NC	Connects GPIO 7[3] to GPI ISO pin of Firefly B
10	GPIO7 5 V -> FF-C GPI ISO	NC	Connects GPIO 7[3] to GPI ISO pin of Firefly C
11	Force recovery mode	NC	Puts the Jetson into Force recovery mode (ready for flashing)[4]
12	GPIO13 log0	NC	Connects GPIO13 pin to ground

[1]stepped up to 5 V push-pull logic
[2]from DIP switch 2
[3]stepped up to 5 V logic
[4]The pin is scanned during powerup.

Table 6: DIP switch 1 description

3.1.2 PCIe ports configuration switch

The Port configuration switch can be used to configure the PCIe ports. There are two possible settings:

Dual x4 – only Firefly port A and M.2 are enabled with four lanes each

Quad x2 – all ports enabled with two lanes each

The XEC-NX-3P-X2G3's PCIe ports offer two configurations: "Dual x4" mode activates the M.2 and Firefly port A with PCIe x4 bandwidth, disabling Firefly ports B and C. In "Quad x2" mode, all ports are enabled with PCIe x2 bandwidth.

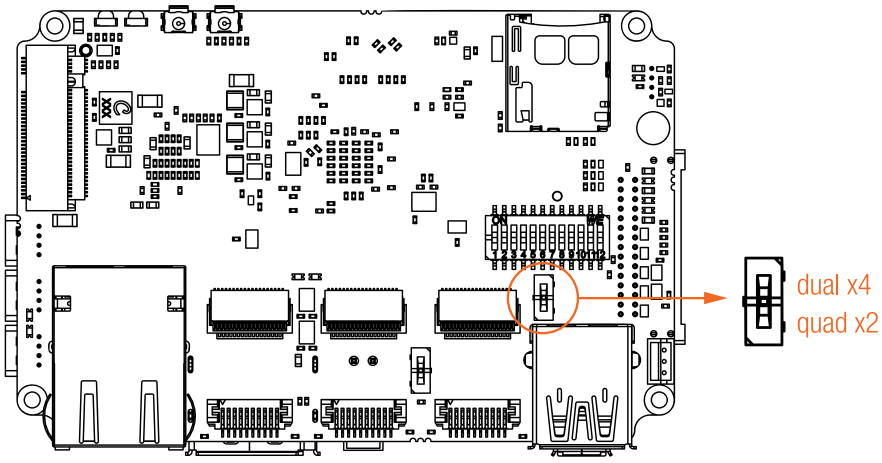


Figure 6: Port configuration switch

DIP switch position	Mode	Description
Pos. UP	PCIe ports x4 mode	In UP position M.2 port and Firefly A are enabled, using PCIe x4 each
Pos. DOWN	PCIe ports x2 mode	In DOWN position M.2 port and all Firefly ports are enabled, each using PCIe x2

Table 7: Port configuration switch description

3.1.3 SPI Voltage switch

The SPI voltage switch configures the voltage for the SPI interface of the Jetson module, which can be set to either 1.8 V or 3.3 V.

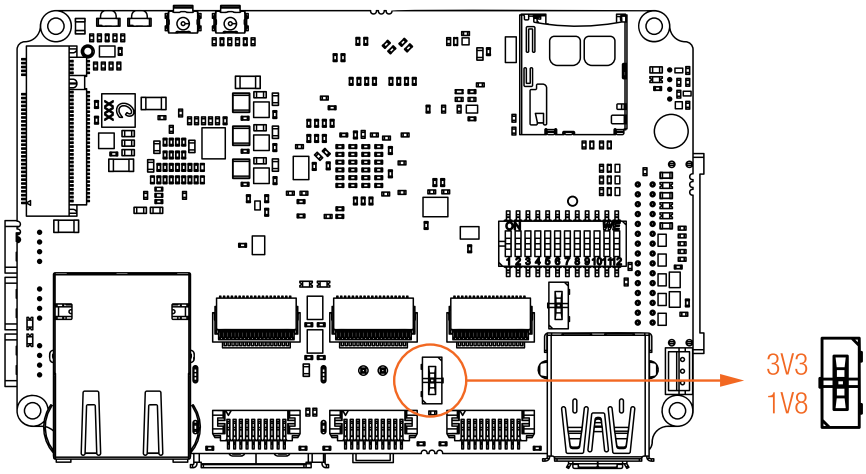


Figure 7: SPI voltage switch

DIP switch	Pos. UP	Pos. DOWN	Notes
1	SPI 3 V 3 level	SPI 1 V 8 level	Changes voltage level of SPI bus

Table 8: SPI voltage switch description

4 Connectors

4.1 Location of connectors

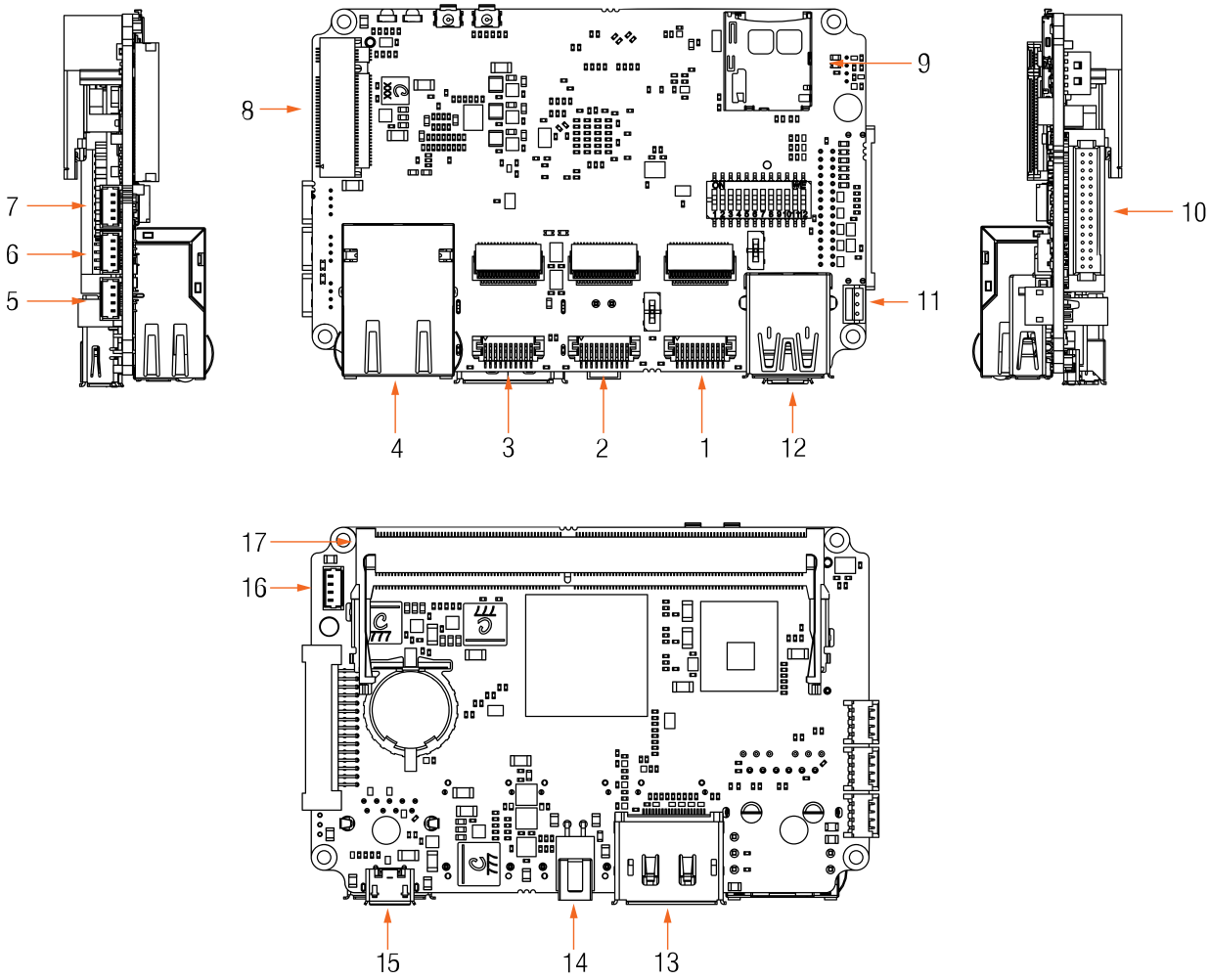


Figure 8: Location of connectors

Num.	Connector	Num.	Connector
1	FireFly connector A (FF-A)	10	Jetson GPIO connector
2	FireFly connector B (FF-B)	11	Debug UART header
3	FireFly connector C (FF-C)	12	USB 3.2 gen 2 type A port (10 Gbit)
4	LAN port	13	Display port
5	GPIO for FF connector A	14	Power connector
6	GPIO for FF connector B	15	USB 2.0 Micro AB connector
7	GPIO for FF connector C	16	Jetson fan connector header
8	M.2 key M port for SSD (form factor 2280)	17	SODIMM connector for Jetson modules
9	SD card slot		

Table 9: Description of connectors

4.2 Data interfaces

4.2.1 PCIe FireFly connector

Item	Value
Connector	Samtec (UEC5-019-1-H-D-RA-1-A + UCC8-010-1-H-S-1-A)
Signals	PCIe X4 Gen3; Power input; Optoisolated IO
Mating Connector	Samtec ECUE, PCUO
Mating Cable	XIMEA PN: CBL-ECUE-X4G3-1M0, CBL-ECUE-X4G3-2M0, CBL-ECUE-X4G3-3M0

Table 10: FireFly connector, general description

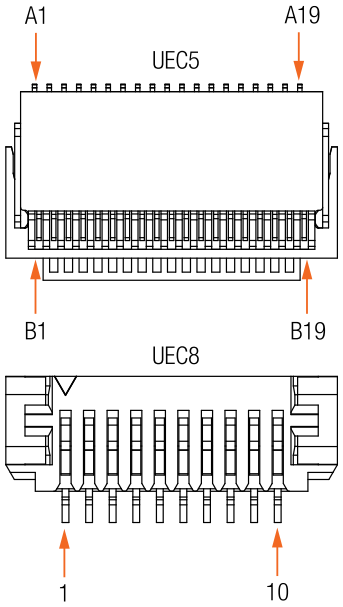


Figure 9: Firefly connectors pinout

Pin	Name	Type	Pin	Name	Type
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	IN1	Optically isolated Digital Input (IN)	B8	OUT1	Optically isolated Digital Output (OUT)
A9	IN1_GND	Ground for opto-isolated Input 1	B9	OUT1_GND	Ground for opto-isolated Output 1
A10	GND	Signal and power ground	B10	GND	Signal and power ground
A11	PCIe_RST0_N_IN	PCIe reset	B11	PWR	Power input
A12	NC	None	B12	PWR	Power input
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 11: FireFly connector (UEC5) pin assignment

Pin	Name	Type
1	VCC_TX	Power output
2	GND	Ground
3	NC	None
4	NC	None
5	PCIe_RST0_N_IN	PCIe reset
6	NC	None
7	NC	None
8	NC	None
9	OUT1	Optically isolated Digital Output (OUT)
10	VCC_RX	Power output

Table 12: FireFly connector (UEC8) pin assignment

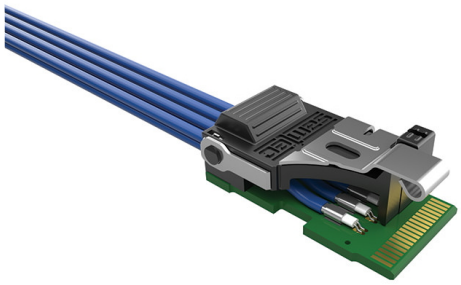


Figure 10: CBL-ECUE-X4G3-1M0

1.0 / 2.0 / 3.0 meters

The FireFly™ copper flat ribbon cable supports PCIe Gen3 x4 lanes and delivers performance of up to 28 Gbps. Cables are bidirectional and flexible with 12 differential pairs. Both sides of the cable are equipped with locking mechanism.

Note: The FireFly cable is not part of the kit. However, it can be purchased on our website.
For more information, see FireFly cable PCIe Gen.3 x4.

4.2.2 Power connector

Item	Value
Connector	CONN-2P-1053131202 - 2-position header, through-hole, right angle
Signals	Power - VCC, GND
Mating Cable	XIMEA PN: CBL-XEC2-PWR-0M15, 0.15 m XEC2 power cable, 2-position,

Table 13: Power connector, general description

The CBL-XEC2-PWR-0M15 power cable is supplied with the xEC2 to connect the power supply PSU-GSM60B24-P1J.

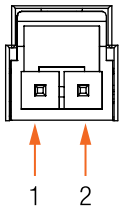


Figure 11: Power connector pinout

Pin	Name	Description
1	12-24 V	Power input (12 to 24 V)
2	GND	Ground

Table 14: Power connector connector pin assignment

4.2.3 USB 3.2 Gen 2 Type-A connector

Item	Value
Connector	USB 3.2 (USB 3.2 Gen 2, Superspeed) Receptacle Connector 9 Position Through Hole, Right Angle
Signals	USB 3.2 Gen 2 (Superspeed) - Power, Ground, USB 2.0 differential pair (D+/D–)
Mating Connectors	Standard USB 3.2 Type-A Connector - Plug type, compatible with USB 3.0/3.1 Gen 1 receptacles

Table 15: USB Type-A connector, general description

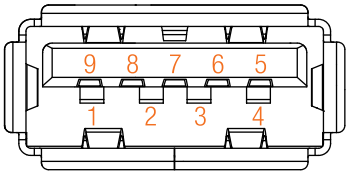


Figure 12: USB3 Type-A pinout

Pin	Signal	Description
1	VBUS	Power supply 5 V
2	D-	USB 2.0 differential data line neg.
3	D+	USB 2.0 differential data line pos.
4	GND	Ground return for power and signal
5	SSRX-	SuperSpeed receive differential pair neg.
6	SSRX+	SuperSpeed receive differential pair pos.
7	GND	Ground return for power and signal
8	SSTX-	SuperSpeed transmit differential pair neg.
9	SSTX+	SuperSpeed transmit differential pair pos.

Table 16: USB Type-A pin assignment

4.2.4 USB 2.0 Micro AB connector

Item	Value
Connector	USB 2.0 Micro AB Receptacle - 5-position connector, surface-mount with through-hole shield tabs, right angle
Signals	Standard, USB 2.0 - VBUS, D+, D–, ID, and GND
Mating Cable	ADAPTER-OTG-USB2 - OTG adapter cable, USB 2.0 Type-A female to Micro-B male, 0.42 ft (128.02 mm), shielded

Table 17: USB 2.0 Micro AB connector, general description

4.2.5 DisplayPort connector

Item	Value
Connector	CONN-0472720001 – DisplayPort receptacle connector, 20 positions, surface-mount, right angle
Signals	DisplayPort – high-speed differential pairs for main lanes, AUX channel, HPD, Configuration channel, PWR
Mating Cable	Standard DisplayPort plug

Table 18: DisplayPort connector, general description

4.2.6 Ethernet connector

Item	Value
Connector	CONN-JTH-0024NL - RJ45 Magjack connector, 1 port, 10GBASE-T, AutoMDIX support, vertical through-hole (THT)
Signals	Ethernet 10GBASE-T - differential transmit and receive pairs, integrated magnetics, LED indicators, SHLD/GND connections
Mating Cable	Standard RJ45 plug

Table 19: Ethernet connector, general description

4.2.7 Debug UART connector

Item	Value
Connector	CONN-B3B-ZR(LF)(SN), 3 Positions Header (1.50 mm) Through Hole Tin-Lead
Signals	Debug UART (TX, RX, GND)
Mating Cable	CBL-A03ZR03ZR28H102B, JST JUMPER 03ZR-8M-P SR Series, 3 CIRCUIT, 1.0 mm pitch

Table 20: Debug UART connector, general description

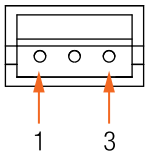


Figure 13: Debug UART connector pinout

Pin	Name	Description
1	UART2 TX	UART transmitter
2	GND	Ground
3	UART2 RX	UART receiver

Table 21: Debug UART connector pin assignment

4.2.8 Fan connector

Item	Value
Connector	CONN HEADER 4POS 1.25 MM TOP ENTRY THT - 4-position through-hole header, 1.25 mm pitch, top entry
Signals	Fan power and control - VCC, GND, Tach, PWM
Compatible Heatsink	Seeed studio 110991904 Aluminum heatsink with fan for Jetson Orin NX / Orin Nano / Xavier NX Module

Table 22: Fan connector, general description

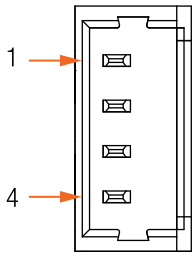


Figure 14: Fan connector pinout

Pin	Name	Description
1	GND	Ground
2	5 V	Power input (5 V)
3	TACH	Tachometric signal
4	PWM	Pulse width modulation

Table 23: Fan connector pin assignment

4.2.9 SODIMM connector for Jetson module

Item	Value
Connector	CONN-2309413-1 - SODIMM type socket for NVIDIA Jetson Xavier NX Module, 260-pin, 9.2 mm height
Signals	High-speed digital interfaces, power, control, and peripheral signals for Jetson Orin NX / Xavier NX SOM
Mating Board	JETSON-ORIN-NX-16GB, Jetson Orin NX 16 GB System-on-Module (SOM)

Table 24: SODIMM connector, general description

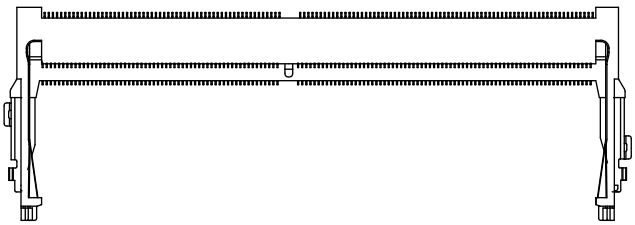


Figure 15: SODIMM connector

4.3 Digital inputs / outputs (GPIO) interface

4.3.1 Camera GPIOs

Each FireFly connector has its own GPIO connector. To identify which GPIO connector corresponds to which FireFly, they are marked with the letters A, B, and C in the “Description of connectors” table. For reference, see section Location of connectors.

Item	Value
Connector	CONN-4P-0530480410 - 4-position header, 1.25 mm pitch, side entry, through-hole, right angle
Signals	camera GPIO, GND
Mating Connectors	0510210400 - 4-position rectangular receptacle housing, 1.25 mm pitch

Table 25: IO connector for firefly cameras, general description

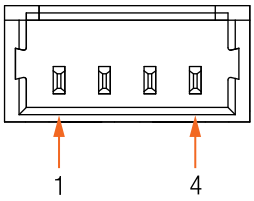


Figure 16: IO (for FF connectors) connector pinout

Pin	Name	Type
1	GPO ISO	Opto-isolated output
2	ISO GND	Isolated ground for the IO subsystem
3	GPI ISO	Opto-isolated input
4	GPO 5 V	Opto-isolated output (GPO ISO stepped up to 5 V push pull logic)

Table 26: FF GPIO pin assignment

Note: Camera IO cable is not part of the Kit.

4.3.2 Jetson GPIOs

Item	Value
Connector	CONN-TFM-115-01-S-D-RE1-W - 30-position header, 0.050" (1.27 mm) pitch, through-hole, right angle
Signals	General Purpose I/O (GPIO), power, and control interfaces for Jetson module
Mating Cable	SFSD-15-28-H-10.00-SR - Samtec Tiger Eye 30-pos cable assembly, rectangular socket to individual wire leads

Table 27: Jetson GPIO connector, general description

The SFSD-15-28-H-10.00-SR cable gives users access to the GPIOs of the Jetson module and the supply voltages on the board.

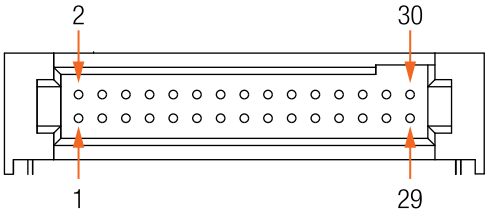


Figure 17: IO connector pinout

Pin	Name	Description	Pin	Name	Description
1	VCC_CONN	Voltage from the input power connector (12 to 24 V)	16	UART0_1V8_RTS	UART 0 RTS (1.8 V)
2	VCC_CONN	Voltage from the input power connector (12 to 24 V)	17	UART0_1V8_CTS	UART 0 CTS (1.8 V)
3	VCC5V0	5 V	18	UART0_1V8_RX	UART 0 RX (1.8 V)
4	GND	Ground	19	UART0_1V8_TX	UART 0 TX (1.8 V)
5	VCC3V3	3.3 V	20	UART1_1V8_RX	UART 1 RX (1.8 V)
6	GND	Ground	21	UART1_1V8_TX	UART 1 TX (1.8 V)
7	VCC1V8	1.8 V	22	SPI_MISO	SPI MISO
8	TX_RTC_BAT	Voltage from RTC battery	23	SPI_CLK	SPI CLK
9	NC	-	24	SPI_MOSI	SPI MOSI
10	GPIO7_5V0	GPIO7 (stepped up to 5 V logic)	25	SPI_CS0#	SPI CS 0
11	GPIO3		26	SPI_CS1#	SPI CS 1
12	GPIO4		27	I2C1_3V3_SCL	I^2C 1 SCL (3.3 V)
13	GPIO5		28	I2C1_3V3_SDA	I^2C 1 SDA (3.3 V)
14	GPIO6		29	I2C2_1V8_SCL	I^2C 2 SCL (1.8 V)
15	GPIO7		30	I2C2_1V8_SDA	I^2C 2 SDA (1.8 V)

Table 28: IO pin assignment

4.3.3 GPIO mapping

There are four parts of Jetson-kit that contain GPIO pins.

- GPIO header
- Dip switches
- Buttons
- LEDs

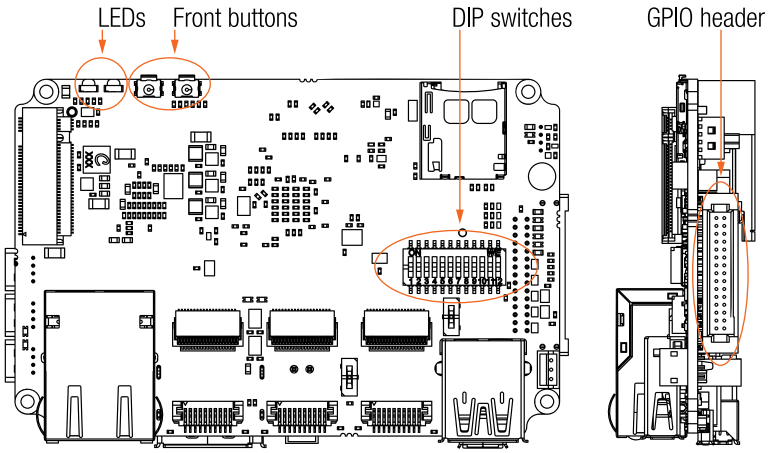


Figure 18: XEC-NX-3P-X2G3-ORIN-16GB-KIT parts containing GPIO pins

GPIO Pin mappings

Note: GPIO pins use 1V8 logic.

GPIO mapping - GPIO header

GPIO header Pin number	GPIO name	SOC Pin number	GPIO label	GPIO chip/device name	GPIO offset
11	GPIO3	126	PCC.00	gpiochip1	12
12	GPIO4	127	PCC.01	gpiochip1	13
13	GPIO5	128	PCC.02	gpiochip1	14
14	GPIO6	130	PCC.03	gpiochip1	15
15	GPIO7	206	PG.06	gpiochip0	41

Table 29: GPIO header mapping

GPIO mapping - Dip switches

GPIO header Pin number	GPIO name	SOC Pin number	GPIO label	GPIO chip/device name	GPIO offset
12	GPIO13	228	PH.00	gpiochip0	43

Table 30: GPIO mapping - Dip switches

GPIO mapping - Buttons

Note: The buttons use inverted logic: 0 indicates not pressed, and 1 indicates pressed. See Front buttons

Description	GPIO name	SOC Pin number	GPIO label	GPIO chip/device name	GPIO offset
Outer button (1)	GPIO10	212	PEE.02	gpiochip1	25
Inner button (2)	GPIO12	218	PN.01	gpiochip0	85

Table 31: GPIO mapping - Buttons

Note: The pins are not configured to detect interrupts by default. If interrupt functionality is required on specific pins, please contact XIMEA support for assistance.

GPIO mapping - LEDs

Description	GPIO name	SOC Pin number	GPIO label	GPIO chip/device name	GPIO offset
Outer LED red (LED 1)	GPIO9	211	PAC.06	gpiochip0	144
Outer LED green (LED 1)	GPIO11	216	PQ.06	gpiochip0	106
Inner LED red (LED 2)	GPIO2	124	PP.06	gpiochip0	98
Inner LED green (LED 2)	GPIO1	118	PQ.05	gpiochip0	105

Table 32: GPIO mapping - LEDs

For the precise location of the LEDs mentioned in the table above, refer to the ?? section.

UART

There are three UART units total:

- Debug UART
- UART0 with RTS# and CTS# pins
- UART1

Note: The UART uses 1V8 logic.

Debug UART

In /dev/ debug UART is **ttyTCU0**.

Parameter	Value
Baud rate	115200
Data bits	8
Stop bits	1
Parity	None

Table 33: Debug UART parameter table

UART0

In ls /dev/ the UART0 is device **ttyTHS3**.

GPIO header Pin number	Function
16	RTS#
17	CTS#
18	RX
19	TX

Table 34: GPIO mapping - UART0

Note: The mapping to ttyTHS3 is available from Tegra image 2026-02-10. Tegra image 2025-12-17 has UART0 mapped to ttyS3.

UART1

In ls /dev/ the UART1 is device **ttyTHS1**

GPIO header Pin number	Function
20	TX
21	RX

Table 35: GPIO mapping - UART1

I²C

Jetson Orin NX has three I²C buses:

- I²C0 - NC on Jetson kit
- I²C1
- I²C2

Note: I²C1 uses 3V3 logic, and I²C2 uses 1V8 logic.

I²C1

In ls /dev/ the I²C1 is device **i2c-7**

GPIO header Pin number	Function
27	SCL
28	SDA

Table 36: GPIO mapping - I2C1

I²C2

In ls /dev/ the I²C2 is device **i2c-0**

GPIO header Pin number	Function
29	SCL
30	SDA

Table 37: GPIO mapping - I2C2

SPI

Jetson-kit has a single SPI routed to the GPIO header. The SPI has settable logic level - 1V8 or 3V3, switchable with DIP switch.

In /dev/ the SPI is device **spidev0.0** (Chip select 0) and **spidev0.1** (Chip select 1).

GPIO header Pin number	Function
22	MISO
23	CLK
24	MOSI
25	CS0
26	CS1

Table 38: GPIO mapping - SPI

5 Usages

5.1 Buttons

5.1.1 Front buttons

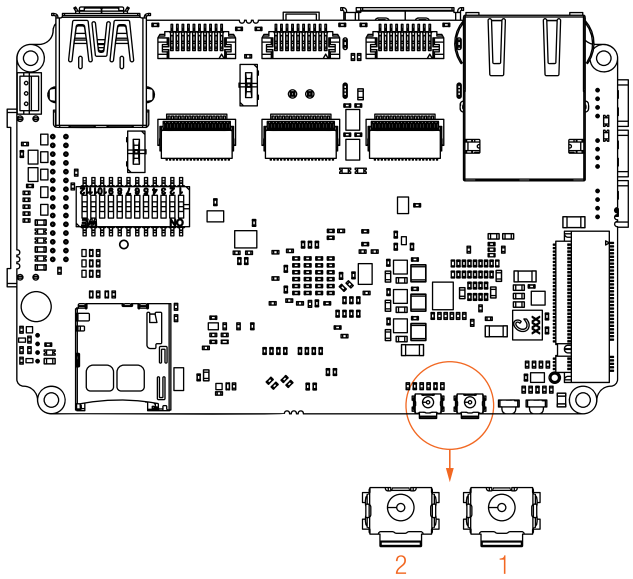


Figure 19: Front buttons location

Number	NOT Pressed	Pressed
1 (Outer button)	GPIO10 is log 0	GPIO10 is log 1
2 (Inner button)	GPIO12 is log 0	GPIO12 is log 1

Table 39: Buttons description

6 Additional information

6.1 PCIe system overview

6.2 Known issues

- Most NVMe SSDs will heat up quickly and throttle down when used without additional cooling.
- Some SSDs are not properly detected when the board is configured to Quad x2 mode.
- In Jetpack 5.X.X there is a known issue which causes PCIe devices behind PCIe switches to have lower than expected bandwidth. This affects the write speed on SSDs.

Issue: On Jetpack 6.X.X a device connected to microUSB (OTG) port can only be detected is the USB 3.2 port is active

Reason: The OS is auto-suspending the USB 2.0 port

Solution: Disable auto-suspend by:

```
sudo su
echo on > /sys/bus/usb/devices/usb1/power/control
```

For a permanent solution append file `/etc/systemd/nv.sh` with:

```
echo on | sudo tee /sys/bus/usb/devices/usb1/power/control
```

7 Quickstart guide

7.1 Hardware setup

7.1.1 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.

- Jetson module with fan attached
- The carrier board itself
- M2 screws
- TP-XEC-NX-SET thermal pack (provided)
- CBL-XEC2-PWR-0M15 power cable
- (Optional) NVME SSD
- A power adapter of sufficient voltage
- USB2.0 USB A -> microUSB B cable
- x86_x64 PC with Ubuntu 18, 20 or 22 (Ubuntu 20 allows for the widest amount of JetPack versions, as of 2024)
- Other optional accessories as per Technical manual

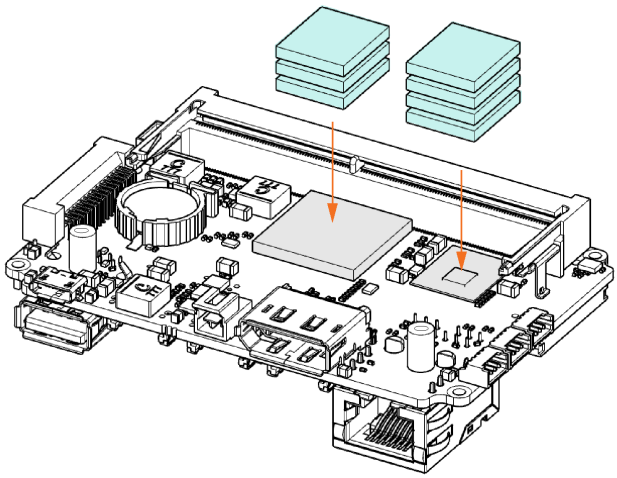
You will need an NVIDIA Jetson module with an appropriate heatsink as the central component of your system. A 24 V power supply unit that can supply at least 2.5 A is also required, though actual power consumption may vary with use. If expanded storage is needed, an NVMe SSD tailored to your use case will be suitable.

For flashing the operating system onto the Jetson module, a separately procured USB micro-B cable will be necessary. Your host system should be running Ubuntu 18.04 or newer, with internet access to download required software packages.

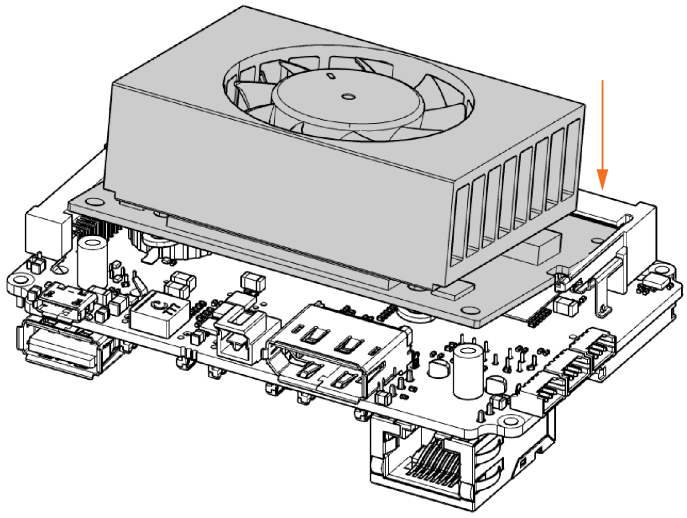
7.1.2 Connecting the components

Assembly

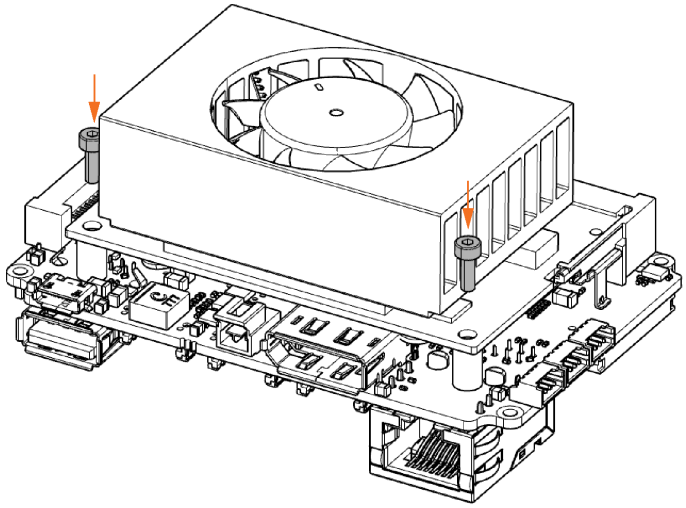
- Place thermal pads from TP-XEC-NX-SET on the (left) PEX switch (3x 1x1 cm) and the (right) ethernet controller (4x 1 x 1 cm)



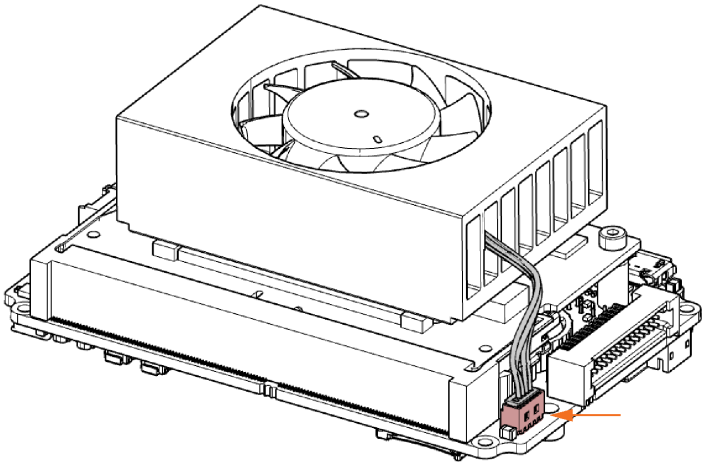
- Insert the Jetson module into the SODIMM slot



- Push down on the Jetson module until you hear a click sound and screw the Jetson module in place

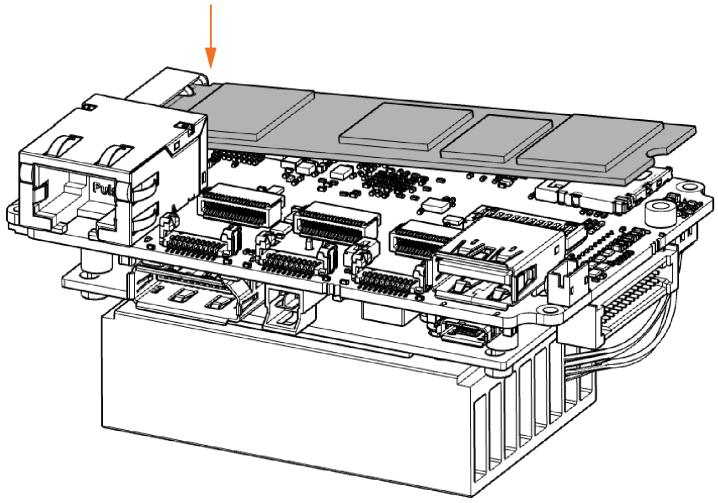


- Connect the fan to the carrier board

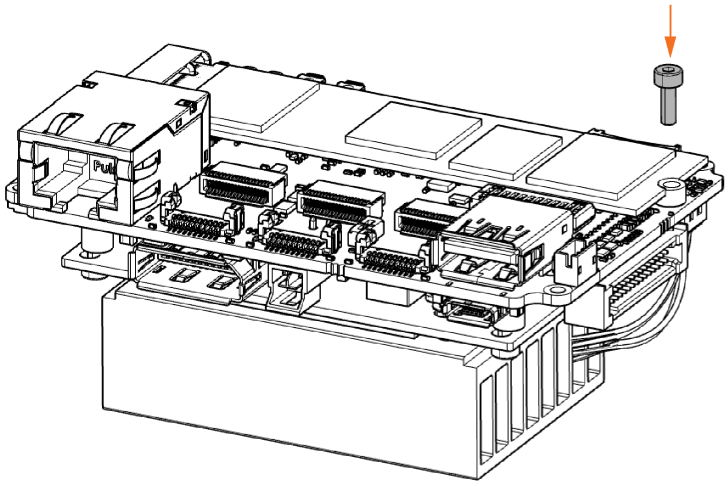


(Optional) Insert NVMe SSD into the M.2 slot.

- Turn the Carrier board over on its bottom side and insert the SSD into the M.2 slot

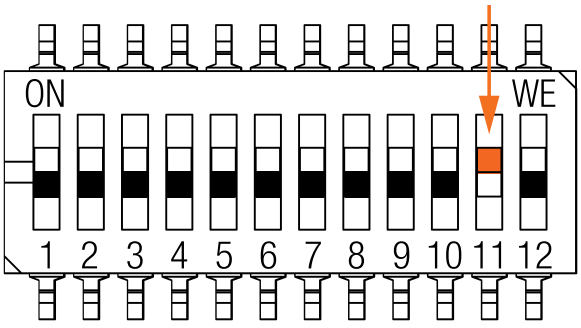


- Press down the SSD and screw it in place

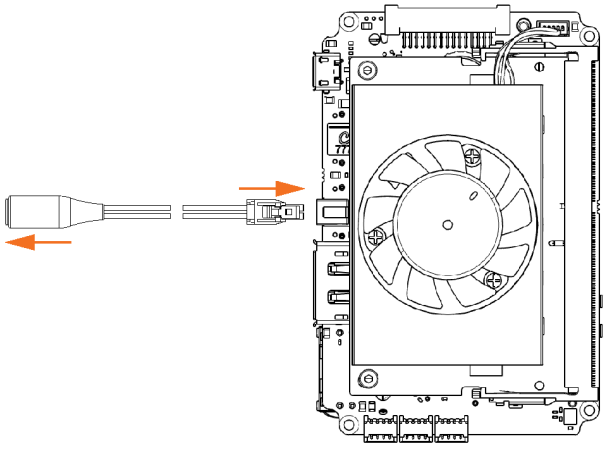


7.1.3 Flashing OS (hardware setup)

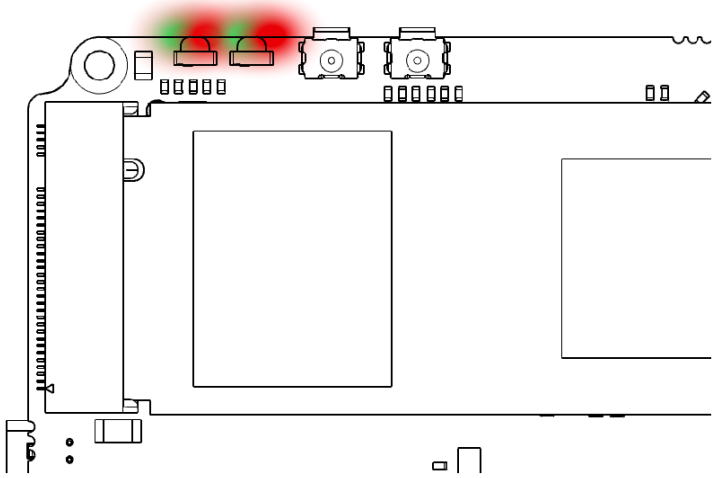
- Put the Jetson into Force recovery mode -> put DIP switch number 11 into the UP position



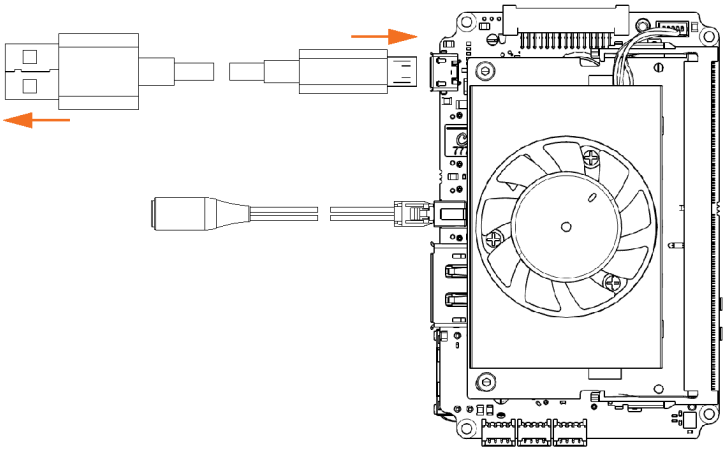
- Insert CBL-XEC2-PWR-0M15 into the power connector
- Plug the carrier board into the power adapter



- Both front LEDs should be on, shining both (Orin) or partially (Xavier) red and green



- Plug the USB 2.0 cable into the microUSB port
- Plug the other end into your x86_x64 PC running Ubuntu



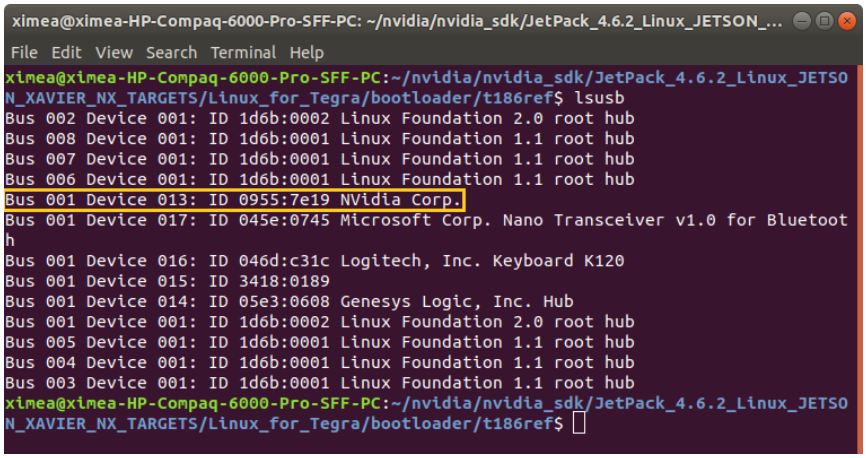
The Jetson should be now recognised by the pc.

7.2 Software setup

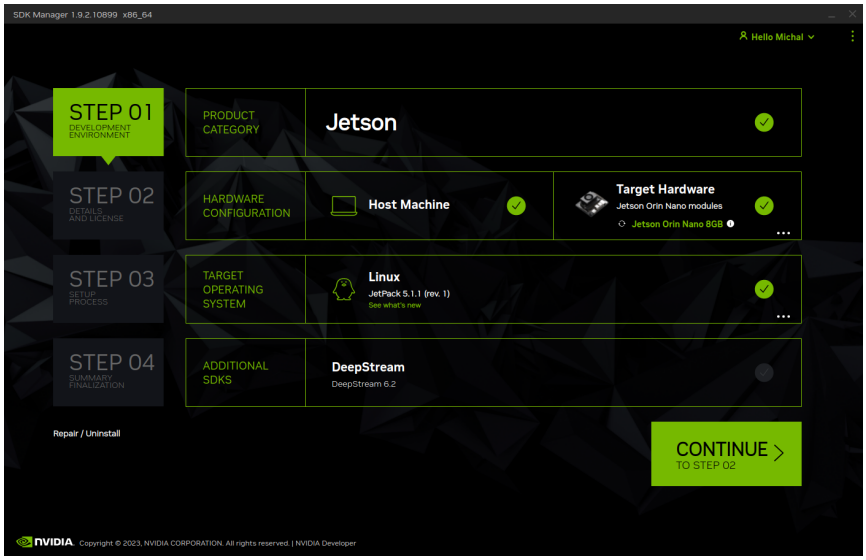
7.2.1 Flashing OS (software setup)

- Run in terminal -> `lsusb`

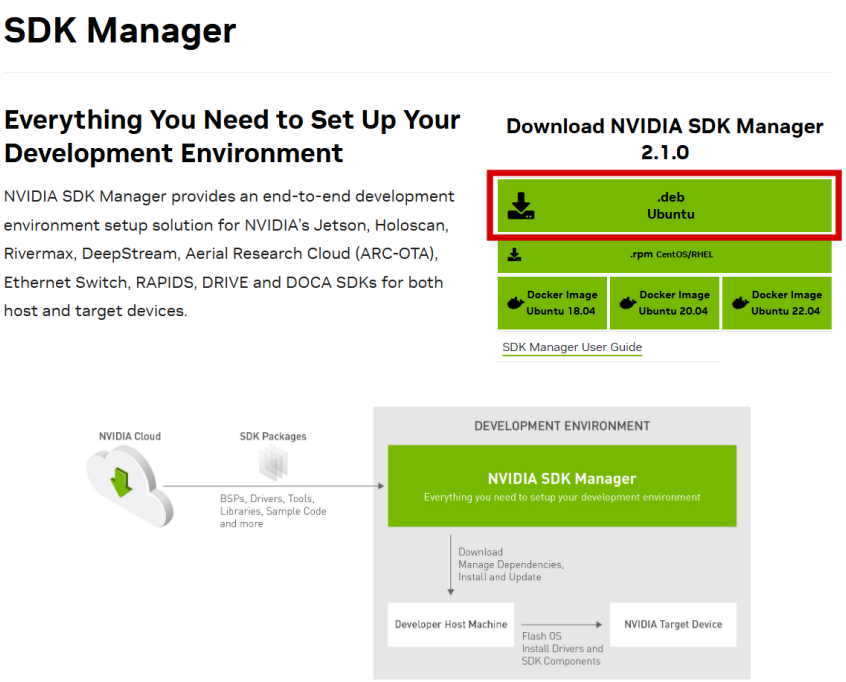
  Output:



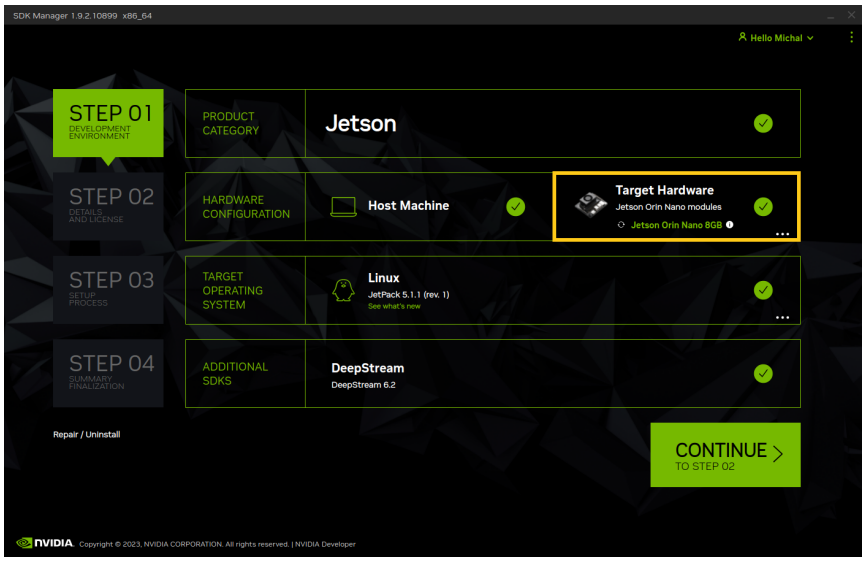
- Open Nvidia SDK manager



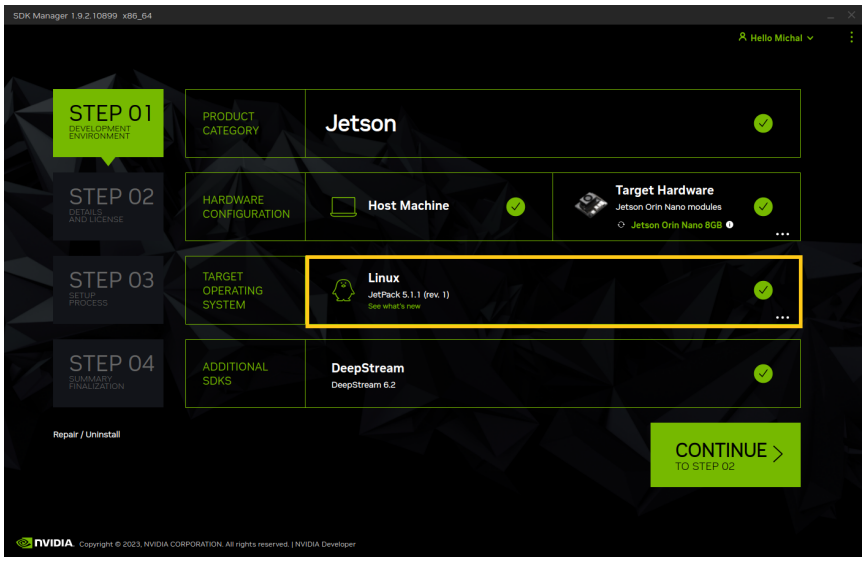
In case it is not already installed, download the SDK manager package from: SDK Manager



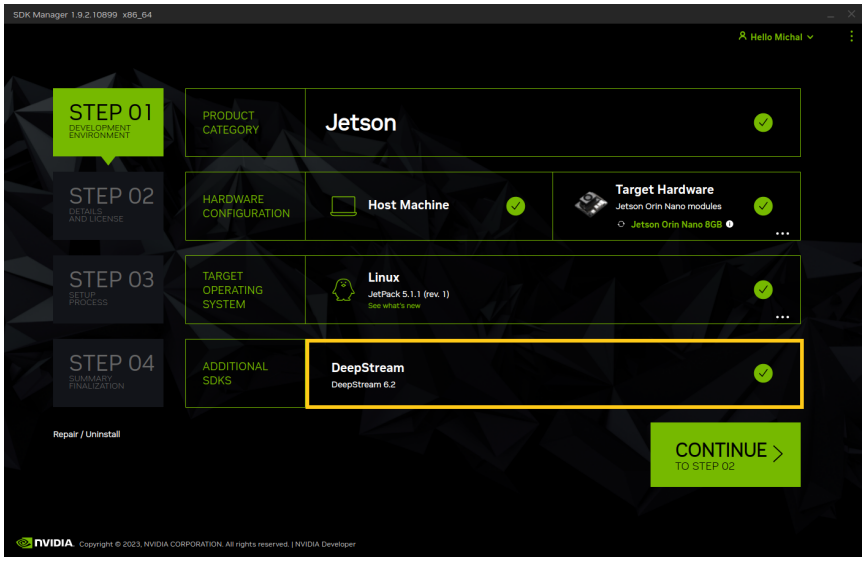
- Install it with running in terminal -> `sudo dpkg -i [name of the downloaded package]`
- Manually choose the type of your Jetson in case it has not been done in the previous step



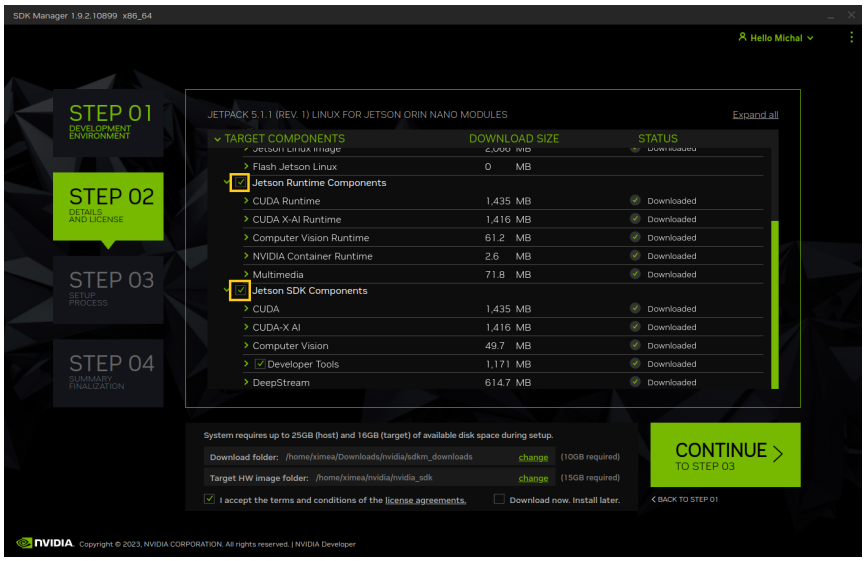
- Select the appropriate Jetpack version



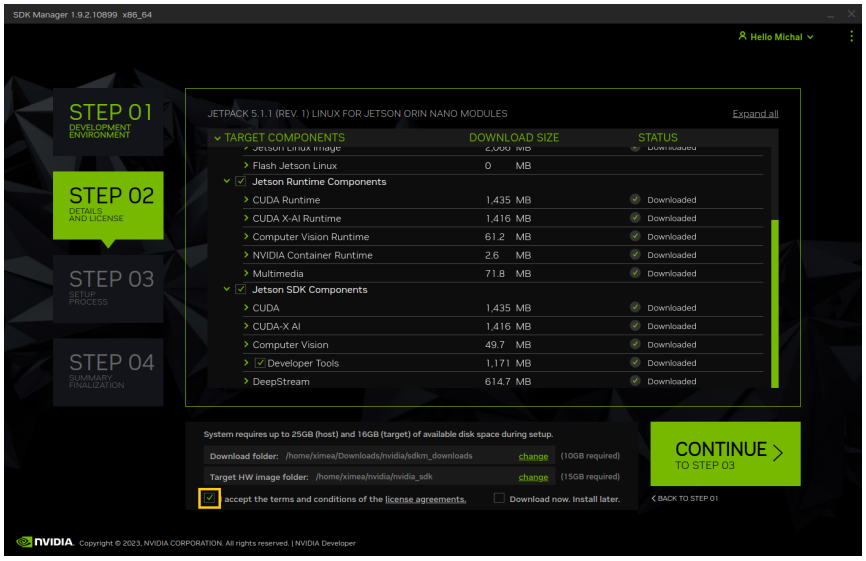
- Tick/untick additional SDK components



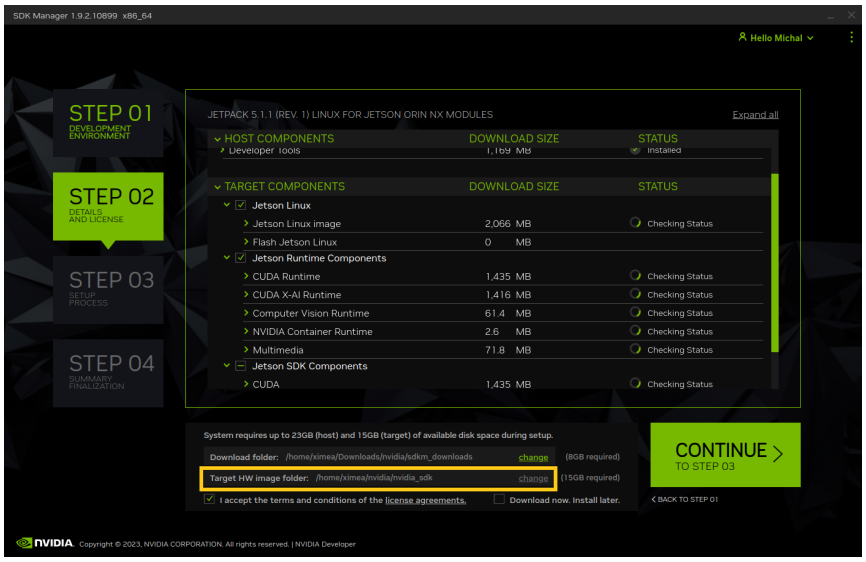
- Press Continue to step 2
- Tick/untick SDK components you want/don't want to install



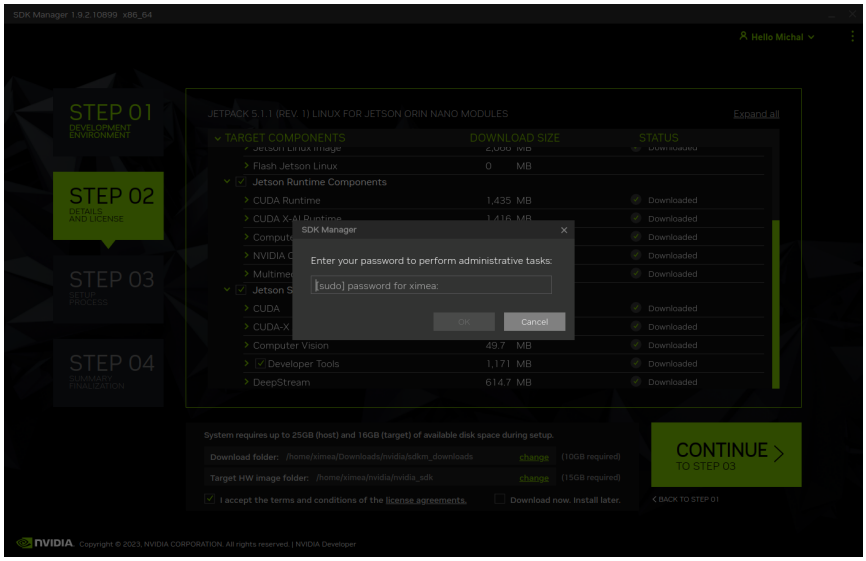
- Accept terms and conditions



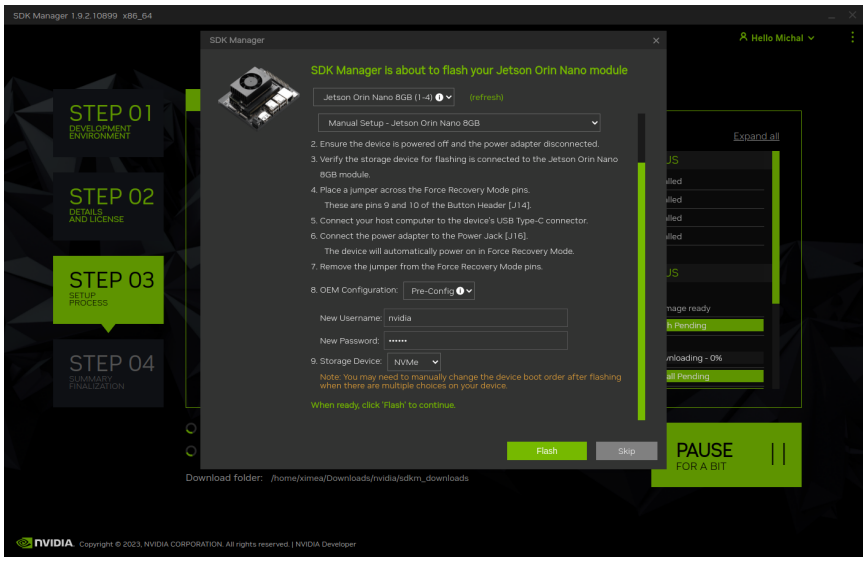
- Note down the location of Target HW image folder



- Press Continue to step 3
- Insert password



- Wait until the SDK manager is ready for flashing
- A prompt should now appear



Now we can do some modifications to the ready-for-flashing OS image:

For Jetson Orin:

- (Mandatory) Modify settings for carrier board eeprom as there isn't any
- (Optional) Activate USB on-the-go mode for the microUSB port
- (Optional) Enable usage of GPIO6 pin

For Jetson Xavier:

- (Mandatory) Use our all-in-one OS image modification that activates Displayport, USB on-the-go and the SD card slot

- After the modifications, input username & password and select appropriate Storage Device.

Device name	Note
SD card	Only available on Orin nano devkit version (SKU 0005)
NVMe	Using M.2 SSD as a storage device
USB	Using USB storage device

Table 40: Selecting storage device

- Click Flash

7.2.2 Modifying OS image

The OS image is in the following location:

`<Target HW image folder>/<JetPack version>_<Target Hardware>_TARGETS/Linux_for_Tegra`

e.g.

`/home/ximea/nvidia/nvidia_sdk/JetPack_5.1.3_Linux_JETSON_ORIN_NANO_TARGETS/Linux_for_Tegra`

EEPROM settings (Jetson Orin)

- Go to the Linux for Tegra folder with the OS image
  - If using Jetpack 6.X.X -> `cd ./bootloader/generic/BCT/`
  - If using Jetpack 5.X.X -> `cd ./bootloader/t186ref/BCT/`
- Open file `tegra234-mb2-bct-misc-p3767-0000.dts` in a text editor and modify line 13 (or equivalent line)

  from -> `cvb_eeprom_read_size = <0x100>;`

  to -> `cvb_eeprom_read_size = <0x0>;`

  Result:

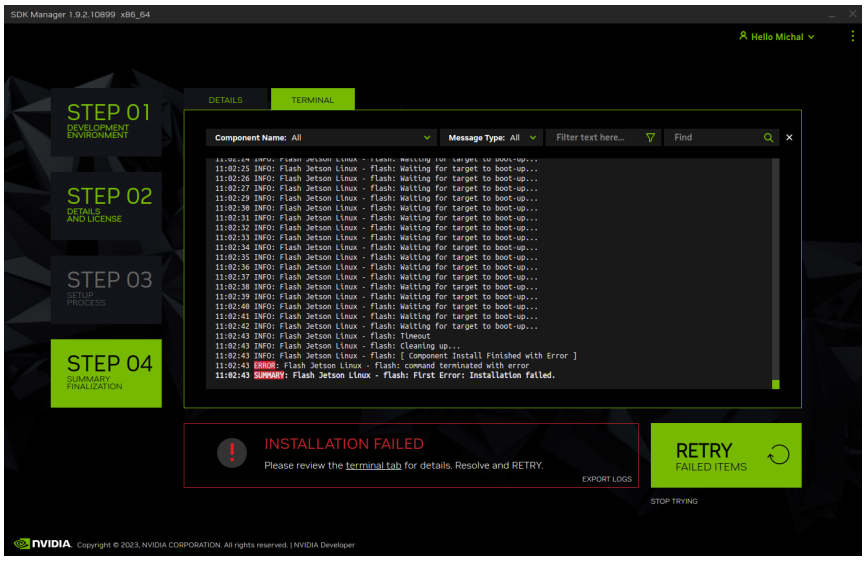
```
/dts-v1/;

#include "tegra234-mb2-bct-common.dtsi"

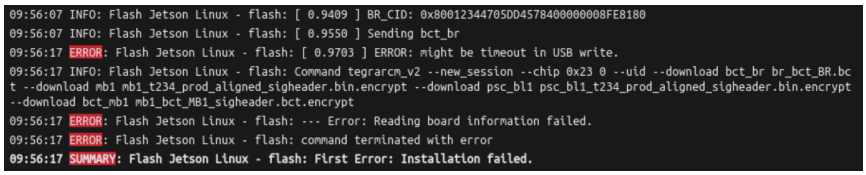
/ {
        mb2-misc {
                eeprom {
                        cvm_eeprom_i2c_instance = <0>;
                        cvm_eeprom_i2c_slave_address = <0xa0>;
                        cvm_eeprom_read_size = <0x100>;
                        cvb_eeprom_i2c_instance = <0x0>;
                        cvb_eeprom_i2c_slave_address = <0xae>;
                        cvb_eeprom_read_size = <0x0>;
                };
        };
};
```

Not applying this modification leads to the following errors:

Jetpack 5.X.X:



Jetpack 6.X:



7.2.3 USB on-the-go (Jetson Orin)

Identify which device tree file is used by your Jetson module:

Device name	Device SKU	JetPack 6.X.X device tree filename	JetPack 5.X.X device tree filename
Orin NX 16 GB	0000	tegra234-p3768-0000+p3767-0000-nv.dtb	tegra234-p3767-0000-p3768-0000-a0.dtb
Orin NX 8 GB	0001	tegra234-p3768-0000+p3767-0001-nv.dtb	tegra234-p3767-0001-p3768-0000-a0.dtb
Orin Nano 8 GB	0003	tegra234-p3768-0000+p3767-0003-nv.dtb	tegra234-p3767-0003-p3768-0000-a0.dtb
Orin Nano 4 GB	0004	tegra234-p3768-0000+p3767-0004-nv.dtb	tegra234-p3767-0004-p3768-0000-a0.dtb
Orin Nano 8 GB[1]	0005	tegra234-p3768-0000+p3767-0005-nv.dtb	tegra234-p3767-0003-p3768-0000-a0.dtb

[1] developer kit version

Table 41: Jetson modules

Note down the device tree filename for your Orin module and JetPack version.

- Go to -> `Linux_for_Tegra/kernel/dtb`
- Decompile the appropriate device tree

  `dtc <noted filename> -o temp.dts`

  e.g. for Jetson Orin nano 8 GB on JetPack 5.1.3:

  `dtc tegra234-p3767-0003-p3768-0000-a0.dtb -o temp.dts`
- Open the decompiled device tree in a text editor and find line with `otg`



If using Jetpack 6.X.X, insert the following lines:

```
        connector {
           compatible = "gpio-usb-b-connector";
           label = "micro-USB";
           type = "micro";
           vbus-gpio = <0xe5 0x99 0x01>;
       };
```

Result:

```
            usb2-0 {
                status = "okay";
                mode = "otg";
                vbus-supply = <0xe9>;
                usb-role-switch;

                connector {
                    compatible = "gpio-usb-b-connector";
                    label = "micro-USB";
                    type = "micro";
                    vbus-gpio = <0xe5 0x99 0x01>;
                };

                port {

                    endpoint {
                        remote-endpoint = <0xea>;
                        phandle = <0xf7>;
                    };
                };
            };
```

- Rename the original device tree file to something else (as a backup)

  `mv <noted filename> <different filename>`

  e.g. `mv tegra234-p3767-0003-p3768-0000-a0.dtb tegra234-p3767-0003-p3768-0000-a0_old.dtb`

- Compile the modified device tree

  `dtc temp.dts -o <noted filename>`

  e.g. `dtc temp.dts -o tegra234-p3767-0003-p3768-0000-a0.dtb`

If using Jetpack 5.X.X, insert the following lines:

```
connector {
   compatible = "gpio-usb-b-connector";
   label = "micro-USB";
   type = "micro";
   vbus-gpio = <0x50 0x99 0x01>;
   id-gpio = <0x50 0x84 0x00>;
};
```

Result:

```
usb2-0 {
   status = "okay";
   mode = "otg";
   vbus-supply = <0x2b6>;
   usb-role-switch;

   connector {
       compatible = "gpio-usb-b-connector";
       label = "micro-USB";
       type = "micro";
       vbus-gpio = <0x50 0x99 0x01>;
       id-gpio = <0x50 0x84 0x00>;
   };

   port {

       endpoint {
           remote-endpoint = <0x2b7>;
           phandle = <0x69>;
       };
   };
};
```

- Rename the original device tree file to something else (as a backup)

  `mv <noted filename> <different filename>`

  e.g. `mv tegra234-p3767-0003-p3768-0000-a0.dtb tegra234-p3767-0003-p3768-0000-a0_old.dtb`

- Compile the modified device tree

  `dtc temp.dts -o <noted filename>`

  e.g. `dtc temp.dts -o tegra234-p3767-0003-p3768-0000-a0.dtb`

7.2.4 Enable usage of GPIO6 (Jetson Orin, Jetpack 5.X.X)

GPIO6 is by default being used by i2c cam muxer, a feature which is not implemented on this carrier board - GPIO6 is used as a standard GPIO pin. Therefore, a modification of the i2c cam muxer settings is needed.

- Follow steps 1-3 from the USB on-the-go (Jetson Orin) section
- In the decompiled device tree, find line with `mux-gpios`

```
   cam_i2cmux {
      compatible = "i2c-mux-gpio";
      #address-cells = <0x01>;
      #size-cells = <0x00>;
-->   mux-gpios = <0x51 0x13 0x00>;
      i2c-parent = <0x2c6>;
      status = "okay";

      i2c@0 {
          reg = <0x00>;
          #address-cells = <0x01>;
          #size-cells = <0x00>;
          status = "okay";
          phandle = <0x48d>;
```

- Modify this line to -> `mux-gpios = <0x51 0x16 0x00>;`

  Result:

```
   cam_i2cmux {
      compatible = "i2c-mux-gpio";
      #address-cells = <0x01>;
      #size-cells = <0x00>;
      mux-gpios = <0x51 0x16 0x00>;
      i2c-parent = <0x2c6>;
      status = "okay";

      i2c@0 {
          reg = <0x00>;
          #address-cells = <0x01>;
          #size-cells = <0x00>;
          status = "okay";
          phandle = <0x48d>;
```

7.2.5 Enable usage of GPIO6 (Jetson Orin, Jetpack 6.X.X)

- Go to `Linux_for_Tegra/kernel/dtb`
- Decompile file -> `dtc tegra234-p3768-0000+p3767-0000-dynamic.dtbo -o temp2.dts`
- Open the decompiled file in a text editor and find line with `mux-gpios`

```
bus@0 {

        cam_i2cmux {
                status = "okay";
                compatible = "i2c-mux-gpio";
                #address-cells = <0x01>;
                #size-cells = <0x00>;
                i2c-parent = <0xffffffff>;
-->             mux-gpios = <0xffffffff 0x13 0x00>;

                i2c@0 {
                        status = "okay";
                        reg = <0x00>;
                        #address-cells = <0x01>;
                        #size-cells = <0x00>;

                        rbpcv2_imx219_a@10 {
                                reset-gpios = <0xffffffff 0x3e 0x00>;
                        };
                };
```

- Modify this line to -> `mux-gpios = <0xffffffff 0x16 0x00>;`

  Result:

```
cam_i2cmux {
   status = "okay";
   compatible = "i2c-mux-gpio";
   #address-cells = <0x01>;
   #size-cells = <0x00>;
   i2c-parent = <0xffffffff>;
   mux-gpios = <0xffffffff 0x16 0x00>;

   i2c@0 {
       status = "okay";
       reg = <0x00>;
       #address-cells = <0x01>;
       #size-cells = <0x00>;

       rbpcv2_imx219_a@10 {
           reset-gpios = <0xffffffff 0x3e 0x00>;
       };
   };
```

- Rename the original file to something else (as a backup)

  `mv tegra234-p3768-0000+p3767-0000-dynamic.dtbo <different filename>`

- Compile the modified file

  `dtc temp2.dts -o tegra234-p3768-0000+p3767-0000-dynamic.dtbo`

7.2.6 Enable direction change of GPIOs on Jetpack 6 with custom pinmux

On Jetpack 6, the GPIO pins need to have specified allowed directions via pinmux. We generated a custom pinmux file for this carrier board to allow full control of avaiable GPIOs - tegra234-mb1-bct-pinmux-p3767-dp-a03.dtsi

Install it with:

- Go to `Linux_for_Tegra/bootloader/generic/BCT`
- Rename the existing pinmux to a different name for backup

```
mv tegra234-mb1-bct-pinmux-p3767-dp-a03.dtsi <different filename>
```

e.g.

```
mv tegra234-mb1-bct-pinmux-p3767-dp-a03.dtsi tegra234-mb1-bct-pinmux-p3767-dp-a03_old.dtsi
```

- Copy the downloaded pinmux file into `Linux_for_Tegra/bootloader/generic/BCT` and `Linux_for_Tegra/bootloader`, replacing any existing files with the same name.

7.2.7 All-in-one OS modification for Jetson Xavier

This OS modification is based and tested on Jetpack 5.1.4.

- Download the necessary files:

  Modified device tree files

  – tegra194-p3668-0000-p3509-0000.dtb
  – tegra194-p3668-0001-p3509-0000.dtb
  – tegra194-p3668-all-p3509-0000.dtb
  – tegra194-p3668-p3509-overlay.dtbo

  Modified pinmux

  – tegra19x-mb1-padvoltage-p3668-a01.cfg
  – tegra19x-mb1-pinmux-p3668-a01.cfg

- In `Linux_for_Tegra/kernel/dtb` folder replace the original files

  ```
  tegra194-p3668-0000-p3509-0000.dtb
  tegra194-p3668-0001-p3509-0000.dtb
  tegra194-p3668-all-p3509-0000.dtb
  tegra194-p3668-p3509-overlay.dtbo
  ```

  with the ones downloaded (the modified device tree files)

- In `Linux_for_Tegra/bootloader/t189ref/BCT` replace the original files:

  ```
  tegra19x-mb1-padvoltage-p3668-a01.cfg
  tegra19x-mb1-pinmux-p3668-a01.cfg
  ```

  with the files downloaded (the modified pinmux files).

Now you can continue flashing with sdk manager as usual.

Note: This OS patch is designed to enable SD card as a storage device, but not as a boot device.

7.2.8 Installing the XIMEA Software Package

Once the installation is finished, you will be able to login to the Jetson system. You can do so either with a directly attached keyboard and monitor or via ssh. To install the XIMEA Software package on the Jetson, follow the installation instructions provided on the XIMEA website.

For more information about XEC-NX-3P-X2G3 please contact: sales@ximea.com.

List of Figures

1 XEC-NX-3P-X2G3 carrier board 4
2 XEC-NX-3P-X2G3-PCA LEDs location 6
3 Dimensional drawing of XEC-NX-3P-X2G3 7
4 Functional schematic 8
5 DIP switch 1 9
6 Port configuration switch 10
7 SPI voltage switch 11
8 Location of connectors 12
9 Firefly connectors pinout 13
10 CBL-ECUE-X4G3-1M0 15
11 Power connector pinout 15
12 USB3 Type-A pinout 16
13 Debug UART connector pinout 17
14 Fan connector pinout 18
15 SODIMM connector 18
16 IO (for FF connectors) connector pinout 19
17 IO connector pinout 20
18 XEC-NX-3P-X2G3-ORIN-16GB-KIT parts containing GPIO pins 21
19 Front buttons location 25

List of Tables

1 Compatible Jetson modules 4
2 Accessories 5
3 3rd party accessories 5
4 XEC-NX-3P-X2G3-PCA LEDs description 6
5 Parameters 7
6 DIP switch 1 description 9
7 Port configuration switch description 10
8 SPI voltage switch description 11
9 Description of connectors 12
10 FireFly connector, general description 13
11 FireFly connector (UEC5) pin assignment 14
12 FireFly connector (UEC8) pin assignment 14
13 Power connector, general description 15
14 Power connector connector pin assignment 15
15 USB Type-A connector, general description 16
16 USB Type-A pin assignment 16
17 USB 2.0 Micro AB connector, general description 16
18 DisplayPort connector, general description 17
19 Ethernet connector, general description 17
20 Debug UART connector, general description 17
21 Debug UART connector pin assignment 17
22 Fan connector, general description 18
23 Fan connector pin assignment 18
24 SODIMM connector, general description 18
25 IO connector for firefly cameras, general description 19
26 FF GPIO pin assignment 19
27 Jetson GPIO connector, general description 20
28 IO pin assignment 20
29 GPIO header mapping 21
30 GPIO mapping - Dip switches 21
31 GPIO mapping - Buttons 22
32 GPIO mapping - LEDs 22
33 Debug UART parameter table 23
34 GPIO mapping - UART0 23
35 GPIO mapping - UART1 23
36 GPIO mapping - I2C1 24
37 GPIO mapping - I2C2 24
38 GPIO mapping - SPI 24
39 Buttons description 25
40 Selecting storage device 36
41 Jetson modules 39

XIMEA GmbH
Am Mittelhafen 16 • 48155 Münster • Germany • www.ximea.com
© Copyright, XIMEA GmbH, All rights reserved