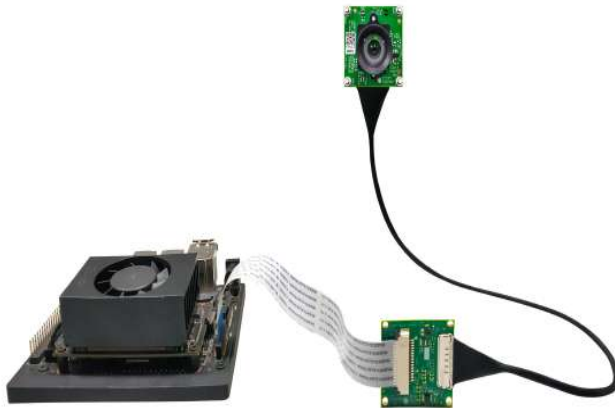
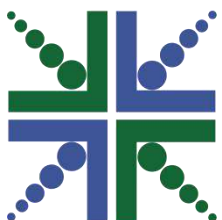


# e-CAM23\_CUNX

## Getting Started Manual



Version 1.0  
e-con Systems  
15/02/2021



**e-con Systems**

Your Product Development Partner

### **Disclaimer**

The specifications of e-CAM23\_CUNX board and instructions on how to use this board with Jetson NX Xavier™ development kits are provided as reference only and e-con Systems reserves the right to edit/modify this document without any prior intimation of whatsoever.

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# Introduction to e-CAM23\_CUNX

e-con Systems is a leading Embedded Product Design Services Company, which is specialized in designing the camera solutions for Jetson™ platforms. In continuation to camera solutions, e-con Systems has developed a new camera board called e-CAM23\_CUNX. This camera board targets the NVIDIA® Jetson Nano™ Xavier NX™ development kits. It can be directly interfaced with Jetson NX Xavier™ development kit through J1 and J9 connectors and with Jetson Nano™ development kit through J13 and J49 connectors.

e-CAM23\_CUNX board connects 2 MP custom lens camera module based on Omnivision® OV2311 CMOS image sensor. This 2 MP monochrome camera has 1/2.9" optical form-factor with global shutter. This camera module is provided with S-mount lens holder (also known as M12 board lens), which is the most used small form-factor lens mounts for board cameras and offers customized optics.

e-CAM23\_CUNX supported resolutions and frame rates as shown in below tables.

**Table 1: Supported Resolutions and Frame Rates of e-CAM23\_CUNX with Xavier™**



Platform	Resolution	Frame Rate (fps) in 10-bit Output	Frame Rate (fps) in 8-bit Output
Xavier	QVGA (320 x 240)	280	280
	VGA (640 x 480)	180	180
	HD (1280 x 720)	90	90
	2MP (1600 x 1300)	40	60

**Maximum Frame Rates in Asynchronous Mode**

This document describes how to interface the e-CAM23\_CUNX board on NVIDIA® Jetson Nano™/Xavier NX™ development kit and how to use the e-CAM23\_CUNX board.

## Prerequisites




The prerequisites are as follows:


-  Host PC with Ubuntu 18.04 (64-bit) to flash the binaries in Jetson NX Xavier™ development kit.
-  Host PC must contain minimum free space of 60 GB in the directory.

## Parts Supplied

The following table lists the parts supplied with the kit.

**Table 2: Parts Supplied**

Parts Supplied	Images	Quantity
Custom Lens Camera Module (e-CAM222_CUMI2311_MOD)		1
Adaptor Board (ACC_NANO_WTB_ADP)		1
15cm FPC Cable		1

15cm IPEX Cable		1
-----------------	--	---

## Description

e-CAM23\_CUNX is a multi-board camera solution for Jetson platforms, which is compatible with NVIDIA® Jetson Nano™/Xavier NX™ development kits. When e-CAM23\_CUNX is interfaced with Jetson NX Xavier™ development kit, it supports maximum of two camera module with 2-Lane MIPI configuration. The module is based on OV2311 CMOS image sensor from OmniVision®. The OV2311 is a 1/2.9" optical form-factor CMOS image sensor with an global shutter.

e-CAM23\_CUNX is a multi-board solution, which has two boards as follows:

- Camera Module (e-CAM222\_CUMI2311\_MOD)
- Adaptor Board (ACC\_NANO\_WTB\_ADP)

The front and rear views of e-CAM222\_CUMI2311\_MOD board and ACC\_NANO\_WTB\_ADP adaptor board are shown in following figures.

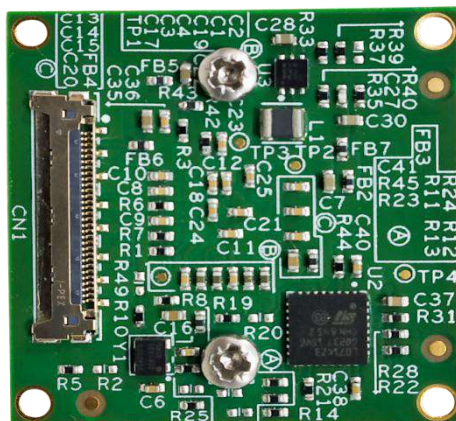


Figure 1: Rear View of e-CAM222\_CUMI2311\_MOD Board



Figure 2: Front View of e-CAM222\_CUMI2311\_MOD Board

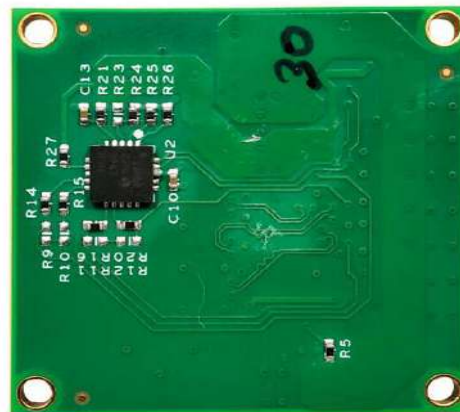


Figure 3: Front View of ACC\_NANO\_ADP Adaptor Board



Figure 4: Rear View of ACC\_NANO\_WTB\_ADP Adaptor Board

e-CAM23\_CUNX camera module has one 30-pin IpeX connector (CN1) for mating with ACC\_NANO\_WTB\_ADP adaptor board. ACC\_NANO\_WTB\_ADP adaptor board acts as a bridge between the camera module and the Jetson Xavier NX development kit. The adaptor board provides the voltages required for camera module. ACC\_NANO\_WTB\_ADP adaptor board consists of 15-pin

FFC connector (CN2), and 30-pin I-pex connector (CN1) through which e-CAM23\_CUNX is connected to NVIDIA® Jetson Nano™/Xavier NX™ development kits over FPC cable of maximum 15 cm length.



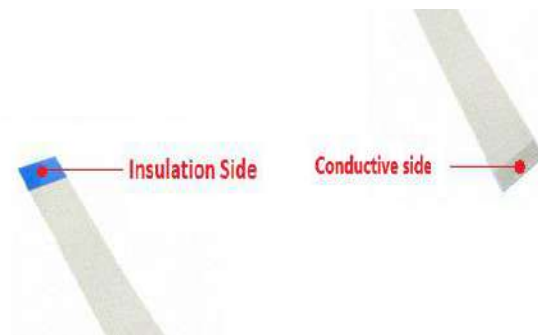
# e-CAM23\_CUNX Board Handling Procedure

This section describes the handling procedure of e-CAM23\_CUNX board.

## Camera Board Connection

e-CAM23\_CUNX is provided with 15cm FPC cable and 15cm IPEX cable, for connecting with NVIDIA® Jetson Nano™/Xavier NX™ camera board.

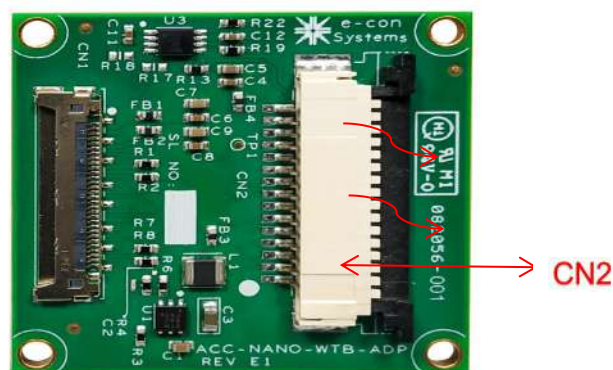
The conductive and insulation side location of the FPC cable is shown in following figure.



**Figure 5: FPC Cable Conductive Side and Insulation Side Location**

The steps to connect the camera board are as follows:

1. Pull-down the actuator at centre with slight force to Unlock the CN2 connector in adaptor board for inserting the FPC cable.



### Figure 6: CN2 Connector Location

CN2 connector has a lock actuator, which is used for locking and unlocking the cable as shown in following figure.

2. Insert the FPC cable to CN2 connector as following figures.

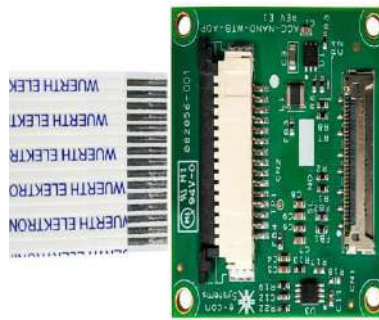


Figure 7: Unlocking CN2 Connector      Figure 8: inserted cable to CN2 Connector Position

3. Insert the ipex cable to CN1 connector.

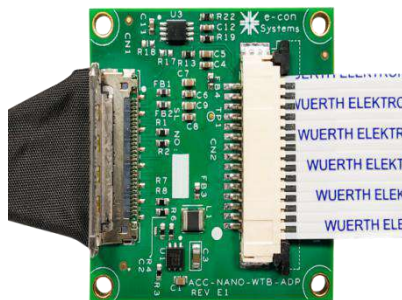


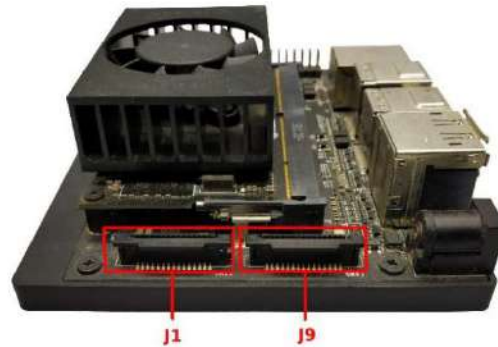
Figure 9: Cable inserted to CN1 Connector      Figure 9: IPEX Cable locked to CN1 Connector

**Note:** Care must be taken, while connecting cable to e-CAM23\_CUNX connector.

**Warning:** If FPC cable is connected in reverse direction to CN2 connector of e-CAM23\_CUNX, it might damage e-CAM23\_CUNX as well as Jetson Xavier NX™ development kits.

## Interfacing with Jetson Xavier NX Development Kit

Jetson Xavier NX™ carrier board has two camera connectors J1 and J9 as shown in following figure.

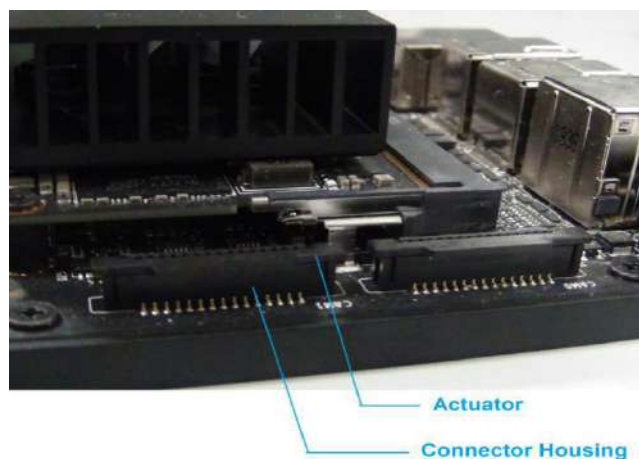


**Figure 11: Camera Connector Location in Jetson Xavier NX Development Kit**

The steps to interface with the Xavier NX™ development kit are as follows:

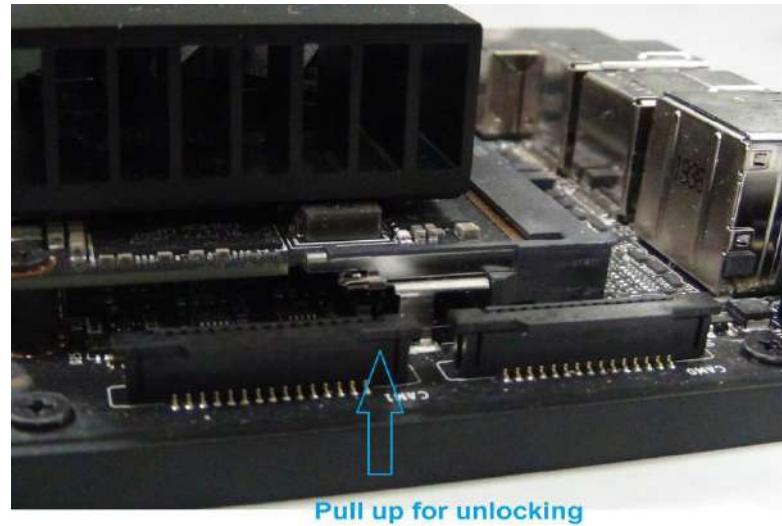
1. Insert the FPC cable on J1 connector of the Jetson Xavier NX™ development kit before powering ON the Jetson Xavier NX™ development Kit. Unlock the J1 connector for inserting the FPC cable.
2. Unlock the J1 connector for inserting the FPC cable.

The location of actuator in Jetson Xavier NX development kit is shown in following figure.

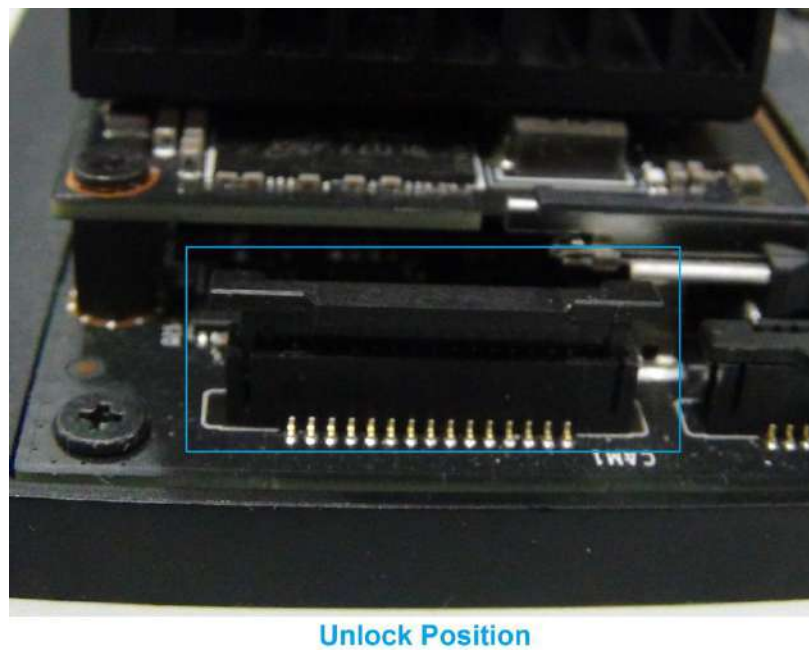


**Figure 12: Jetson Xavier NX Development Kit Camera Connector Actuator Location**

3. Pull-up the actuator at centre with slight force for unlocking the connector as shown in following figures.

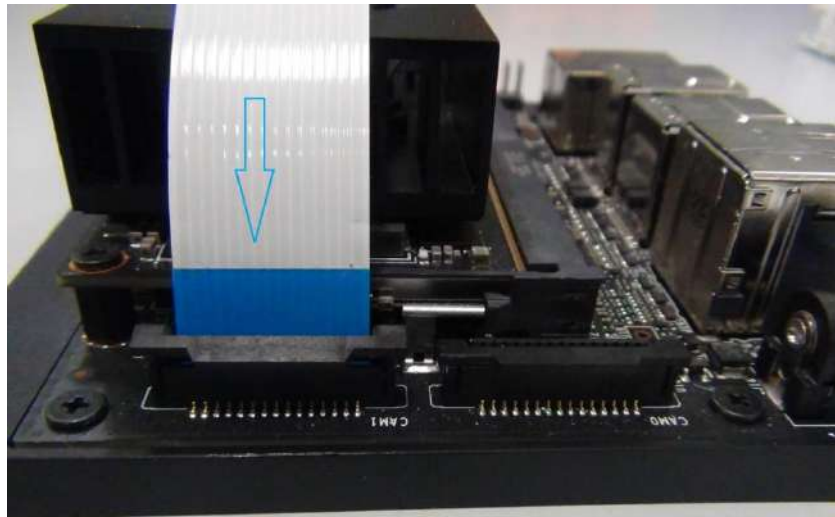


**Figure 13: Unlocking Jetson Xavier Development Kit Camera Connector**



**Figure 14: Unlocked Position of Jetson Xavier Development Kit Camera Connector**

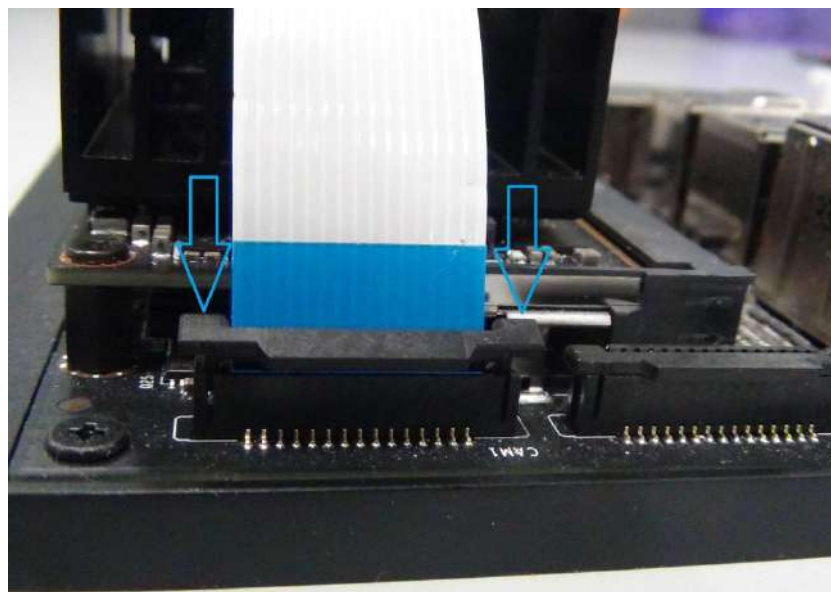
4. Insert the FPC cable to the J1 connector of Jetson Xavier™ development kit as shown in following figure.



**Insert FPC cable**

**Figure 15: FPC Cable insertion to J1 Connector of Jetson Xavier Development Kit**

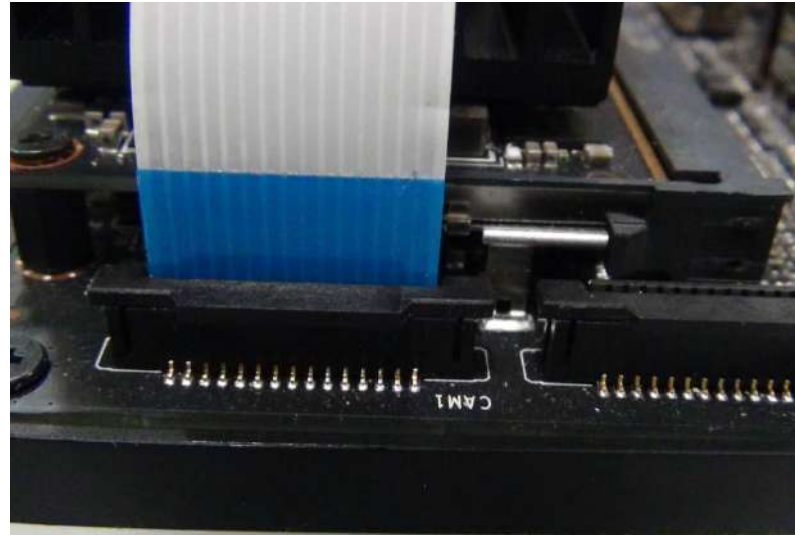
5. Lock the J1 connector by pressing both ends of actuator with same equal force as shown in following figures.



**Press the actuator for locking the cable**

**Figure 16: Locking the FPC Cable**



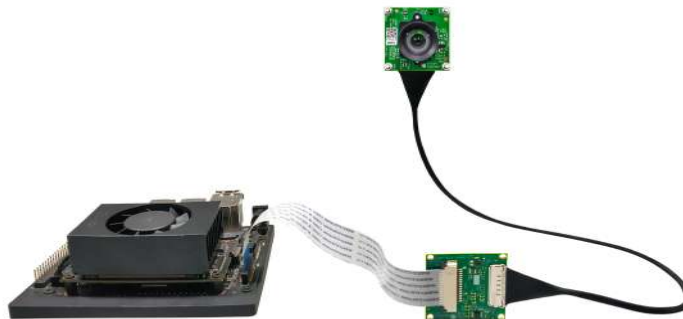


**Cable locked position**

**Figure 17: FPC Cable Locked Position on Jetson Xavier Development Kit**

**Note:** Care must be taken, while connecting cable to camera connector of Jetson Xavier NX™ development kit.

6. Now, e-CAM23\_CUNX is connected to Jetson Xavier NX™ development kit as shown in following figure.



**Figure 19: e-CAM23\_CUNX Setup Interfaced to Jetson Xavier NX Development Kit**

7. Connect power supply to DC jack (J16) to power ON the Jetson Xavier NX™ development kit.



**Figure 20: DC Power Jack Location in Xavier NX Carrier Board**

8. After powering ON the Jetson Xavier NX development kit, the greenish yellow color LED on Jetson Xavier NX development kit will glow. This serves as an indication for power-up of base board as shown in following figure.



**Figure 21: Status LED indicating Jetson Xavier NX Development Kit Powered ON**

## Interfacing with Jetson Nano A02 Development Kit

The procedure for interfacing with Jetson Nano™ A02 development kit is as follows:

1. Insert the FPC cable on J13 connector of the Jetson Nano™ development kit before powering ON the Jetson Nano™ development Kit.

The J13 connector location in the Jetson Nano™ development kit is shown in following figure.

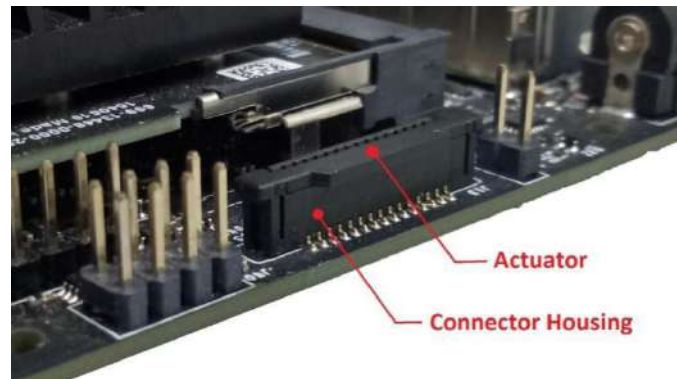


Figure 22: Jetson Nano Development Kit Camera Connector Actuator Location

2. Pull-up the actuator at centre with slight force for unlocking the connector as shown in following figures.

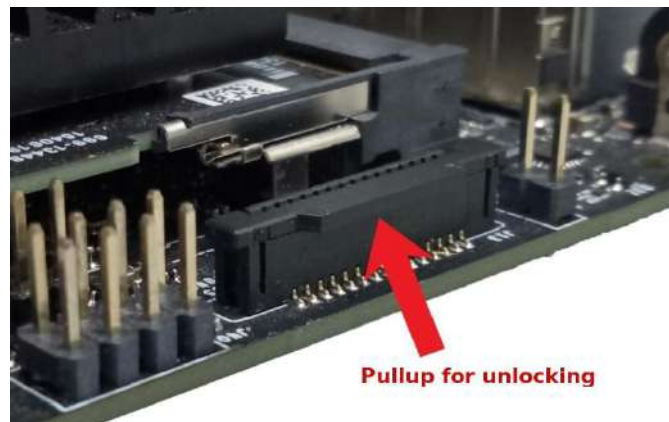
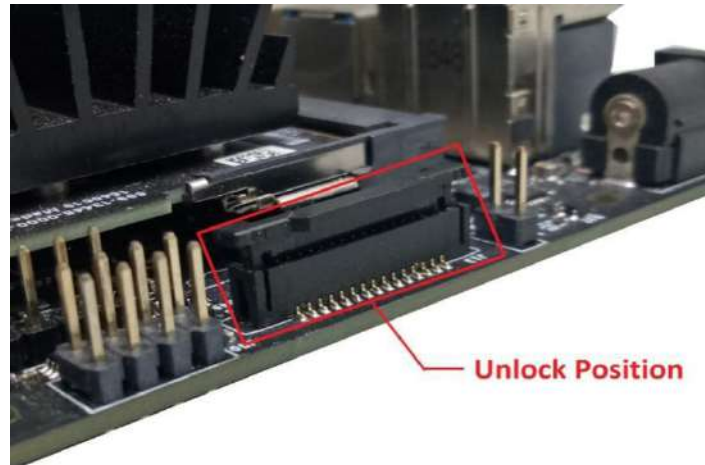


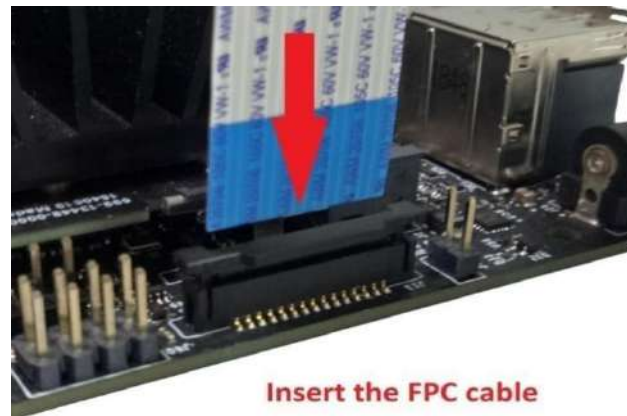
Figure 23: Unlocking Jetson Nano Development Kit Camera Connector





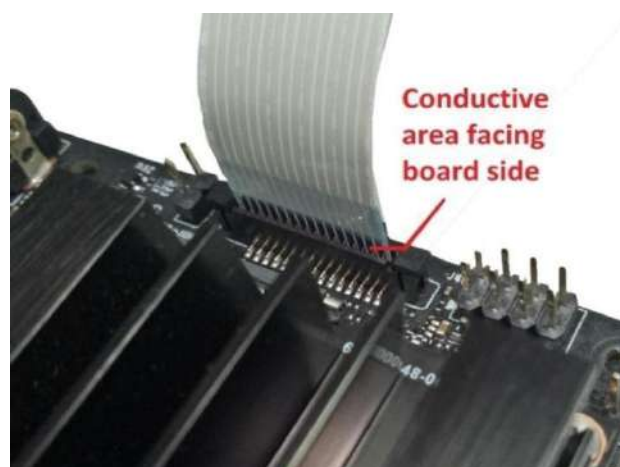
**Figure 24: Unlocked Position of Jetson Nano Development Kit Camera Connector**

3. Insert the FPC cable to the J1 connector of Jetson Xavier NX development kit as shown in following figure.



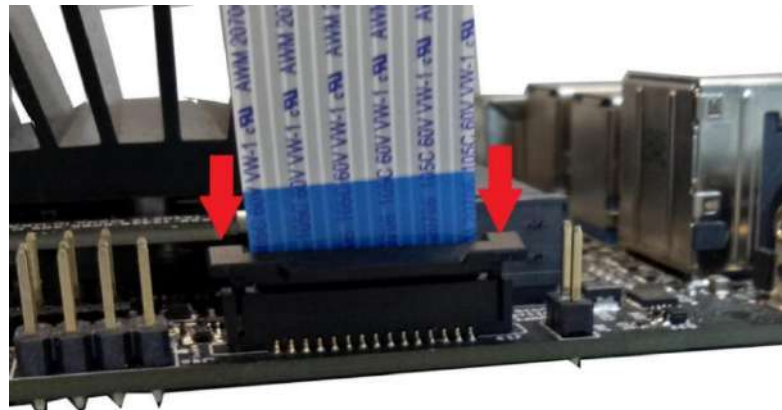
**Figure 25: FPC Cable insertion to J1 Connector of Jetson Nano Development Kit**

The FPC cable must be inserted in conductive side of the cable to face board side as shown in following figure.



**Figure 26: FPC Cable inserted into Jetson Nano Development Kit**

4. Lock the J1 connector by pressing both ends of actuator with same equal force as shown in following figures.



**Press the actuator for locking the cable**

Figure 27: Locking the FPC Cable

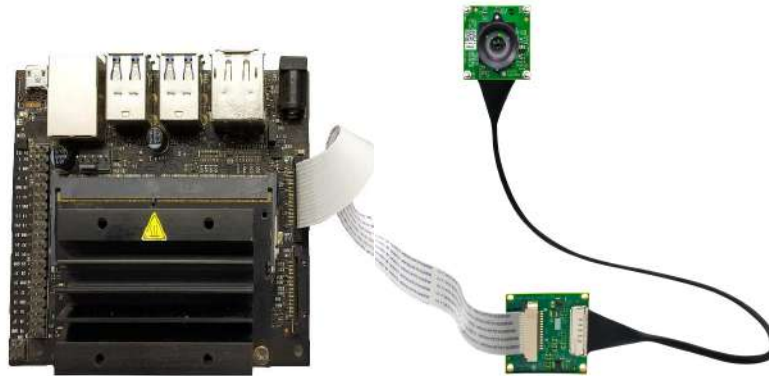


**Cable locked position**

Figure 28: FPC Cable Locked Position on Jetson Nano Development Kit

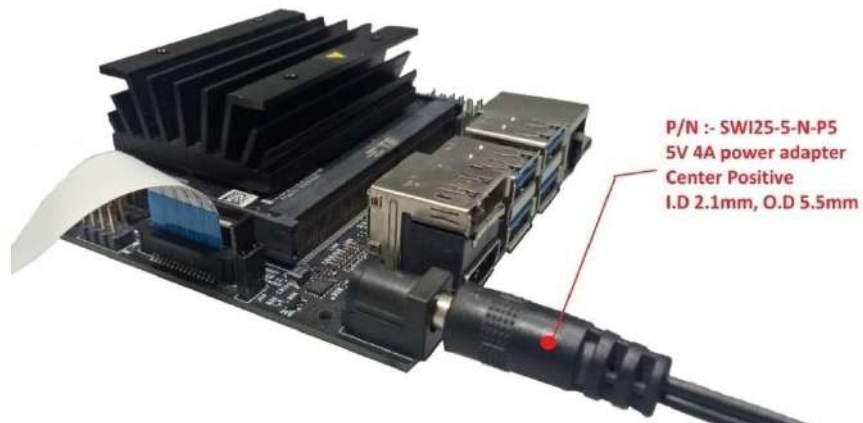
**Note:** Care must be taken, while connecting cable to camera connector of Jetson Xavier NX™ development kit.

5. Now, e-CAM23\_CUNX is connected to Jetson Xavier NX™ development kit as shown in following figure.



**Figure 29: e-CAM23\_CUNX Setup Interfaced to Jetson Nano Development Kit**

6. Connect power supply to DC jack (J16) to power ON the Jetson Xavier NX™ development kit.



**Figure 30: DC Power Jack Location in Jetson Nano Carrier Board**

7. After powering ON the Jetson Xavier NX development kit, the greenish yellow color LED on Jetson Xavier NX development kit will glow. This serves as an indication for power-up of base board as shown in following figure.

Power ON indicating LED

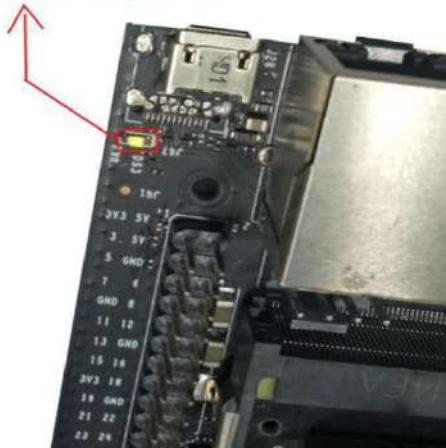


Figure 31: Status LED indicating Jetson Nano Development Kit Powered ON

# Software Quick Setup

This section provides the steps to boot the Jetson™ development kit with the bootable SD card provided with the product for supporting e-CAM23\_CUNX. The bootable SD card connected to the Jetson™ Xavier NX development kit is flashed with the **L4T\_R32.4.4** (aarch64) package which supports Linux distributions for e-CAM23\_CUNX.

For getting the **e-CAM23\_CUNX\_JETSON\_<L4T>\_<DATE>\_<VER>.tar.gz** release package, please contact e-con Systems Sales/Tech support team.

**Note:** To prepare a bootable SD Card, follow the steps mentioned in *Preparing a bootable SD Card* section below.

The commands and output messages in this manual are represented by different colors as shown in following table.

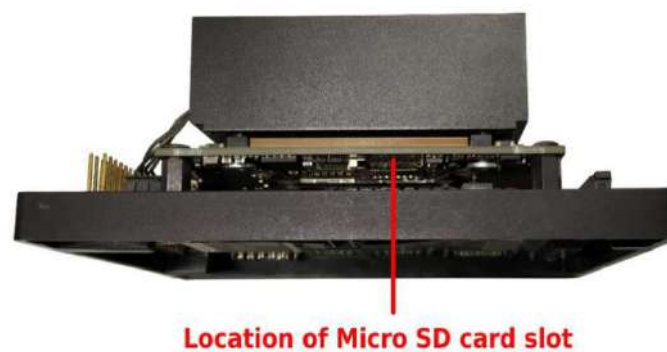
**Table 3: Notation of Colors**

Color	Notation
Blue	Commands running in Host PC
Green	Commands running in Development Board
Orange	Output message in Development Board

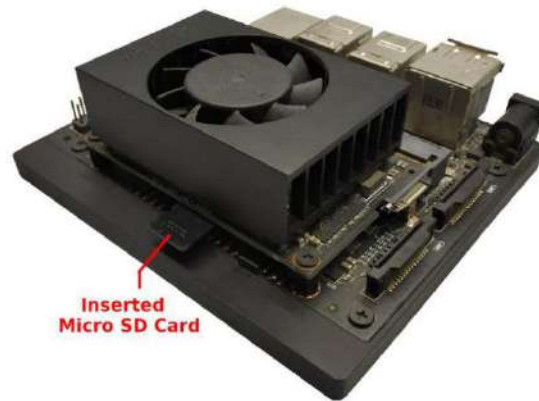
The steps to setup the Jetson Xavier NX™ development kit for e-CAM23\_CUNX camera are as follows:

1. Connect the bootable micro-SD Card to the slot of Jetson Xavier NX™ development kit.

The location of micro-SD card slot on the Jetson Xavier NX™ development kit is shown in the following figure.



**Figure 22: Location of Micro SD Card Slot on Jetson Xavier NX Development Kit**



**Figure 23: Inserting Micro SD Card on the Jetson Xavier NX Development Kit**

2. Power ON the Jetson™ development kit.

**Note:** The module drivers for e-CAM23\_CUNX provided by e-con Systems will be loaded automatically during board boot.

## Launching the Application

The steps to be followed in the development board for launching the ecamTk\_guvcview application are as follows:

1. Run the following command to check the presence of camera video node.

```
ls /dev/video*
```

The output message appears as shown below.

```
/dev/video*
```

where (\*) represents the number of cameras connected.

The number of times the output message displayed above must be equal to the number of cameras connected to the Jetson™ development kit.

2. Run the following command to set the power mode to maximum for better performance.

```
$ sudo nvpmode -m 0
```

3. Run the following Jetson™ clocks command before launching the ecam application in the Jetson Xavier NX™ development board.

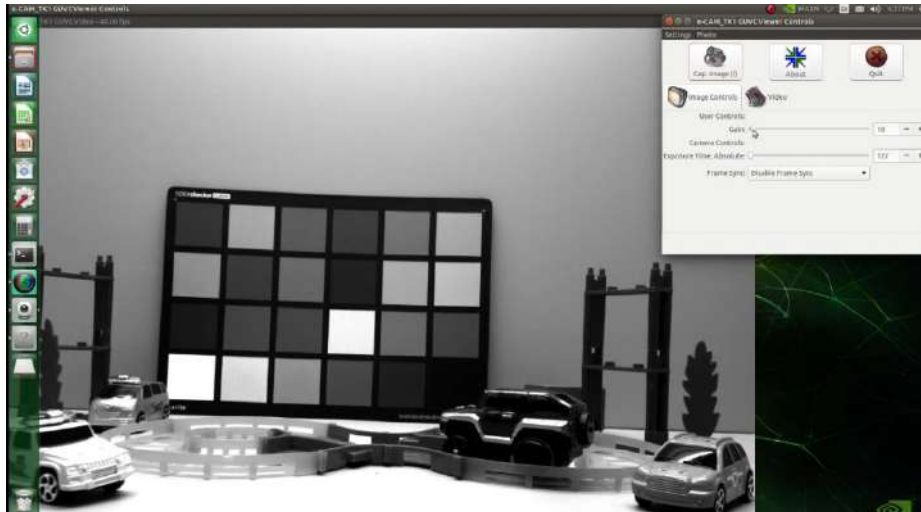
```
$ sudo jetson_clocks
```

4. Run the following command to launch the sample camera application.

```
ecamTk1_guvcview
```

When the application is launched, you can view the screen similar to the screen shown below.





**Figure 24: Initial Window when Application is Launched**

**Note:** The default login credentials for Jetson Xavier NX™ development kit is listed in the following table.

**Table 4: Default Login Credentials**

Fields	Input s
Username	nvidia
Password	nvidia

**Note:** If you are using the bootable SD card provided for e-CAM23\_CUNX, the release package will already be present in **/home/nvidia/Release** directory.

## Preparing a Bootable SD Card

Create a new account or Login to NVIDIA developer account using this [link](#).

The steps to be followed to flash a new SD Card are as follows:

### For Jetson Xavier NX™ Development Kit,

1. Download the Jetson Xavier NX™ developer kit SD card image from NVIDIA® website using <https://developer.nvidia.com/jetson-nx-developer-kit-sd-card-image> link.  
Note: Choose SD card image corresponding to Jetpack 4.4.1
2. Follow the instructions in <https://developer.nvidia.com/embedded/learn/get-started-jetson-xavier-nx-devkit> link to flash the SD Card for Jetson Xavier NX™ development kit.
3. Copy the e-CAM23\_CUNX Release package into the HOME directory of the flashed Jetson™ development kit.

4. Run the following commands to extract the release package in the Jetson Xavier NX™ development kit to obtain the binaries.

```
tar -xaf e-CAM23_CUNX_JETSON_  
<L4T_version>_<release_date>_<release_version>.tar.gz  
cd e-CAM23_CUNX_JETSON_  
<L4T_version>_<release_date>_<release_version>
```

To know more about the release package, please refer to the *e-CAM23\_CUNX\_Release\_Package\_Manifest\_<REV>.pdf*.

5. Run the following commands in the Jetson™ kit.

```
sudo chmod a+x ./install_binaries.sh  
sudo ./install_binaries.sh
```

This script will automatically reboot the Jetson™ kit after flashing the binaries successfully.

**Note:** If you have flashed L4T32.4.4 in Jetson™ board already, you can skip steps 1 and 2.

6. Follow the steps in *Launching the Application* section to launch the application.



# Reference Documents

This section describes the software and hardware documents of e-CAM23\_CUNX. You can download the software and hardware documents from [Developer Resources](#) website.

## Software Documents

The software documents and its description are listed in below table.

**Table 5: Description of Software Documents**

S.N O	What I Need	Documents to Refer
1	Use gstreamer to control the e-CAM23_CUNX camera on the Jetson NX Xavier™ development kit.	e-CAM23_CUNX_Gstreamer_Usage_Guide.pdf
2	Use prebuilt binaries to support e-CAM23_CUNX. Build custom kernel with support for using e-CAM23_CUNX. Upgrade already existing <b>L4T_R32.4.4</b> (aarch64) Linux distribution for Jetson NX Xavier™ to support e-CAM23_CUNX.	e-CAM23_CUNX_Developer_Guide.pdf
3	Information about the directory structure and contents of the release package for e-CAM23_CUNX.	e-CAM23_CUNX_Release_Package_Manifest.pdf

## Hardware Documents

The hardware documents and its description are listed in below table.

**Table 6: Description of Hardware Documents**

S.N O	Documents Name	Description
1	e-CAM23_CUNX_Datasheet.pdf	Describes the feature,

		connector pin-out details and mechanical dimensions of e-CAM23_CUNX.
2	e-CAM222_CUMI2311_MOD_Datasheet.pdf	Describes the features and specification of e-CAM222_CUMI2311_MOD camera module.
3	e-CAM23_CUNX_Lens_Datasheet.pdf	Describes the optical specification of lenses used in e-CAM23_CUNX.
4	e-CAM222_CUMI2311_MOD_3D.stp	3D file for e-CAM222_CUMI2311_MOD board.

# Troubleshooting

In this section, you can view the commonly occurring issues and their troubleshooting steps.

## **Can I boot the Jetson Nano/ Xavier NX™ development kit directly from the SD card shipped with the product?**

Yes, the SD card shipped with the product is bootable SD Card. And the release package will be available in `/home/nvidia/Release` path of root filesystem.

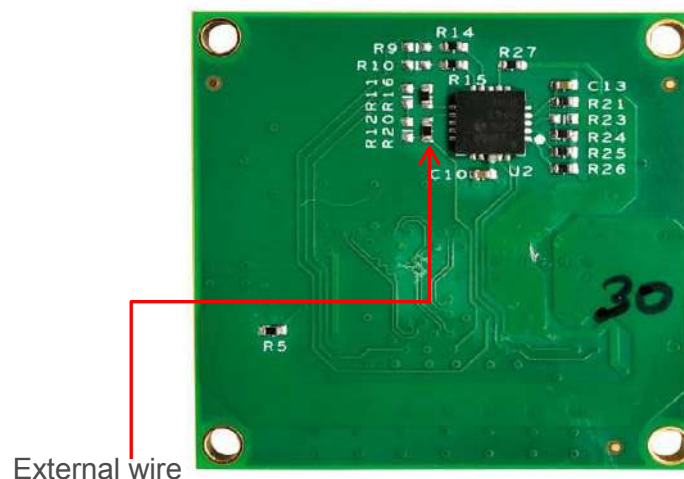
## **The camera module is not getting loaded, when booting with the SD card prepared using the Preparing Bootable SDCard section of e-CAM23\_CUNX Getting Started Manual**

Note: The camera module is not getting loaded because a different DTB is loaded during boot. This is known behaviour, due to backward compatibility issues of Jetpack-4.5. If Jetpack 4.5 (L4T 32.5) is already flashed, please revert to the older Jetpack-4.4 version using Nvidia's SDK Manager or using the flash script provided in the L4T Driver Package. Please follow the `e-CAM23_CUNX_Developer_Guide_<REV>.pdf` to setup the Jetson Nano™/Xavier™ NX development kit for using e-CAM23\_CUNX.

Note: Please refer the “Troubleshooting” section in the documents for the description of the limitations.

## **Can I Stream the module with Jetson Nano/Xavier NX™ development kit directly by swithcing in application provided with the product?**

No, you have to take out an external wireout from ACC\_NANO\_WTB\_ADP board as shown below



## 1. Do e-con Systems have any plan to support longer length cable?

e-con Systems provide a very flexible 15 cm FPC cable and 15 cm Ipex cable along with this kit. For customization, please write to [camerasolutions@e-consystems.com](mailto:camerasolutions@e-consystems.com) with your requirement.

## 2. Does e-CAM23\_CUNX camera support OpenCV?

e-CAM23\_CUNX works using Video for Linux version 2 (V4L2) APIs and is V4L2 compliant. So, any V4L2 based application can be used to access this camera. OpenCV is also compatible since it uses V4L2 to access the camera.

Please refer to [https://www.e-consystems.com/Articles/Camera/accessing\\_cameras\\_in\\_opencv\\_with\\_high\\_performance.asp](https://www.e-consystems.com/Articles/Camera/accessing_cameras_in_opencv_with_high_performance.asp) for detailed information about OpenCV support in e-con Systems cameras.

## 3. How can I get the updated package?

Please contact e-con's Sales/Tech Support team for release package.

# What's Next?

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After understanding the specifications of camera daughter board and instructions on how to use this daughter board with Jetson Xavier NX™ development kit, you can refer to the following documents to understand more about e-CAM23\_CUNX.

- *e-CAM23\_CUNX Developer Guide*
- *e-CAM23\_CUNX Linux App User Manual*

# Glossary

---

**API:** Application Program Interface.

**ARM:** Advanced RISC Machines.

**CMOS:** Complementary Metal Oxide Semiconductor.

**CSI:** Camera Serial Interface.

**eMMC:** Embedded Multi-media Card.

**2MP:** 2MegaPixel.

**GUI:** Graphical User Interface.

**HD:** High Definition (Industry name for 1280 x 720 resolution).

**ISP:** Image Signal Processor.

**L4T:** Linux for Tegra.

**LED:** Light Emitting Diode.

**MIPI:** Mobile Industry Processor Interface.

**RISC:** Reduced Instruction Set Computer.

**USB:** Universal Serial Bus.

**V4L2:** Video for Linux version2 is a collection of device drivers and API for supporting real-time video capture on Linux systems.

# Support

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## Contact Us

If you need any support on e-CAM23\_CUNX product, please contact us using the Live Chat option available on our website - <https://www.e-consystems.com/>

## Creating a Ticket

If you need to create a ticket for any type of issue, please visit the ticketing page on our website - <https://www.e-consystems.com/create-ticket.asp>

## RMA

To know about our Return Material Authorization (RMA) policy, please visit the RMA Policy page on our website - <https://www.e-consystems.com/RMA-Policy.asp>

## General Product Warranty Terms

To know about our General Product Warranty Terms, please visit the General Warranty Terms page on our website - <https://www.e-consystems.com/warranty.asp>

## Revision History

Rev	Date	Description	Author
1.0	15-Feb-2021	Initial draft	AE Team