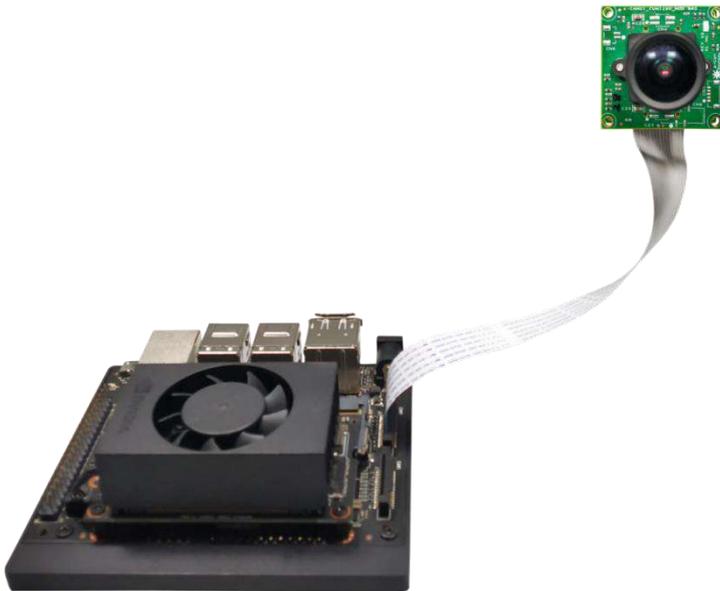


e-CAM21_CUNX

Getting Started Manual



Version 1.0

e-con Systems

27/01/2021



e-con Systems

Your Product Development Partner

Disclaimer

The specifications of e-CAM21_CUNX board and instructions on how to use this board with Jetson Xavier NX 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-CAM21_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-CAM21_CUNX. This camera board targets the NVIDIA® Jetson Xavier NX development kits. It can be directly interfaced with Jetson Xavier NX development kit through J1 and J9 connectors.

e-CAM21_CUNX board connects 2 MP custom lens camera module based on Sony STARVIS® IMX327 CMOS image sensor. This 2 MP color camera has 1/2.8" optical form-factor with electronic rolling shutter and utilizes Jetson™ platforms in-built ISP. 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-CAM21_CUNX supported resolutions and frame rates as shown in below tables.

Table 1: Supported Resolutions and Frame Rates of e-CAM21_CUNX with Xavier™

S. NO	Resolution	Frame Rates (fps)
1	FHD (1920 x 1080)	30
		60
2	HD (1280 x 720)	60

This document describes how to interface the e-CAM21_CUNX board on Jetson Xavier NX development kit and how to use the e-CAM21_CUNX board.

Prerequisites

The prerequisites are as follows:

- Host PC with Ubuntu 18.04 (64-bit) to flash the binaries in Jetson Xavier NX 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-CAM220_CUMI327_MOD) Lens (12702812MPF)		1
Adaptor Board (ACC_NANO_ADAPTOR)		1
15cm FPC Cable		1

Description

e-CAM21_CUNX is a multi-board camera solution for Jetson platforms, which is compatible with Jetson Xavier NX development kits. When e-CAM21_CUNX is interfaced with Jetson Xavier NX development kit, it supports maximum of single camera module with 2-Lane MIPI configuration. The module is based on IMX327 CMOS image sensor from SONY®. The IMX327 is a 1/2.8" optical form-factor CMOS image sensor with an electronic rolling shutter.

e-CAM21_CUNX is a multi-board solution, which has two boards as follows:

- Camera Module (e-CAM220_CUMI327_MOD)
- Adaptor Board (ACC_NANO_ADP)

The front and rear views of e-CAM220_CUMI327_MOD board and ACC_NANO_ADP adaptor board are shown in following figures.

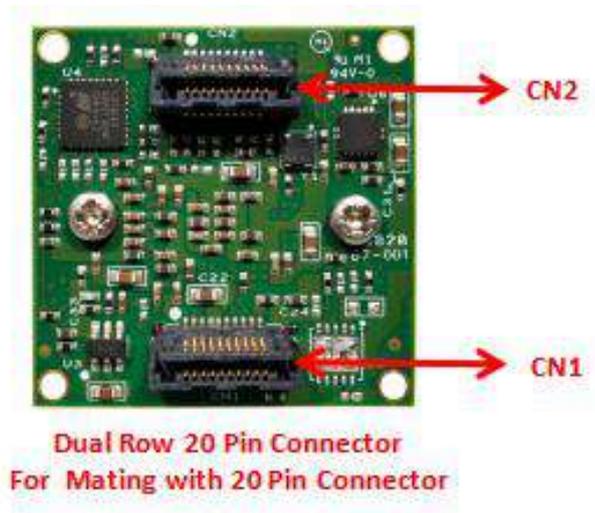


Figure 1: Rear View of e-CAM220_CUMI327_MOD Board



Figure 2: Front View of e-CAM220_CUMI327_MOD Board

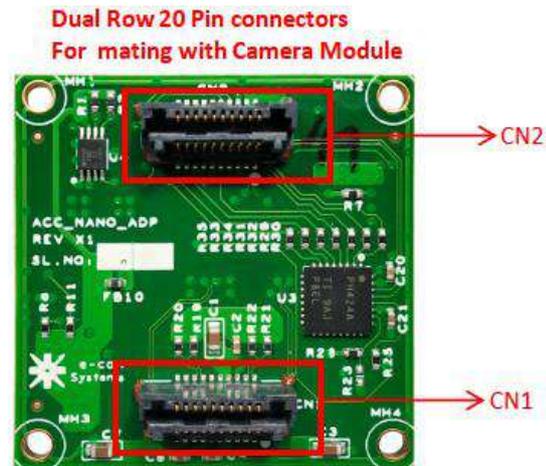


Figure 3: Front View of ACC_NANO_ADP Adaptor Board

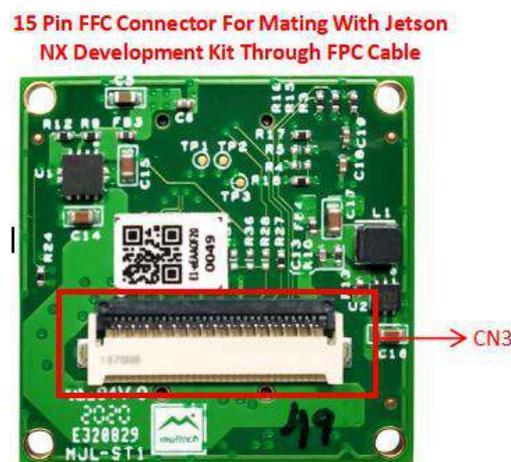


Figure 4: Rear View of ACC_NANO_ADP Adaptor Board

e-CAM21_CUNX camera module has two 20-pin Samtec connectors (CN1 and CN2) for mating with e-CAM21_CUNX adaptor board. e-CAM21_CUNX 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. e-CAM21_CUNX adaptor board consists of 15-pin FFC connector (CN3), through which e-CAM21_CUNX is connected to Jetson Xavier NX™ development kit over FPC cable of maximum 15 cm length.

e-CAM21_CUNX Board Handling Procedure

This section describes the handling procedure of e-CAM21_CUNX board.

Camera Board Connection

e-CAM21_CUNX is provided with 15cm FPC cable, for connecting with Jetson Xavier NX™ camera board.

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

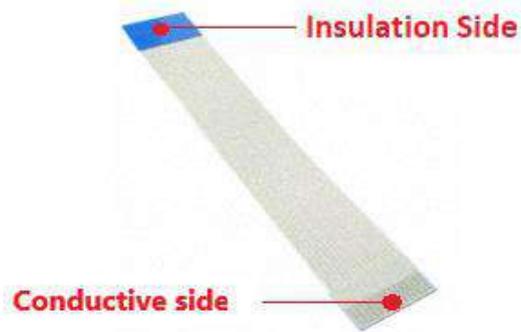


Figure 5: FPC Cable Conductive Side Location

The steps to connect the camera board are as follows:

1. Unlock the CN3 connector in camera board for inserting the FPC cable.

CN3 connector has a rotary lock actuator, which is used for locking and unlocking the cable as shown in following figure.

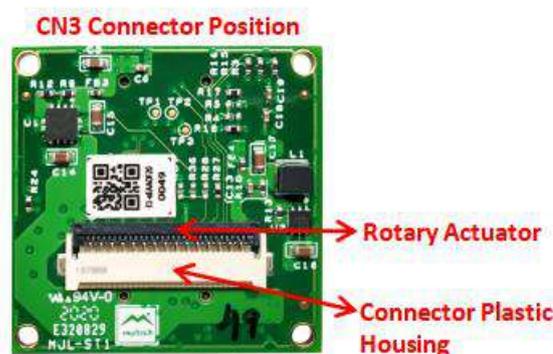


Figure 6: CN3 Connector Location

- Slide the rotary lock actuator from top to bottom for unlocking as shown in following figures.



Figure 7: Unlocking CN3 Connector



Unlock Position

Figure 8: CN3 Unlocked Connector Position

- Insert the FPC cable to CN3 connector.

The conductive side of the cable must face board side or top marking on cable must match top marking of connector as shown in following figure.



Figure 9: Cable inserted to CN3 Connector of e-CAM21_CUNX

- Lock the CN3 connector by pushing the rotary lock actuator from bottom to top for locking as shown in the following figure.



Figure 10: e-CAM21_CUNX CN3 Connector Locked with Cable

Note: Care must be taken, while connecting cable to e-CAM21_CUNX connector.

Warning: If FPC cable is connected in reverse direction to CN3 connector of e-CAM21_CUNX, it might damage e-CAM21_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.

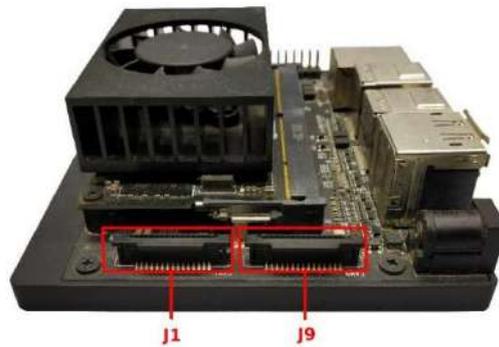


Figure 11: Camera Connector Location in Jetson Xavier NX Development Kit

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

1. Unlock the J9 connector for inserting the FPC cable.

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

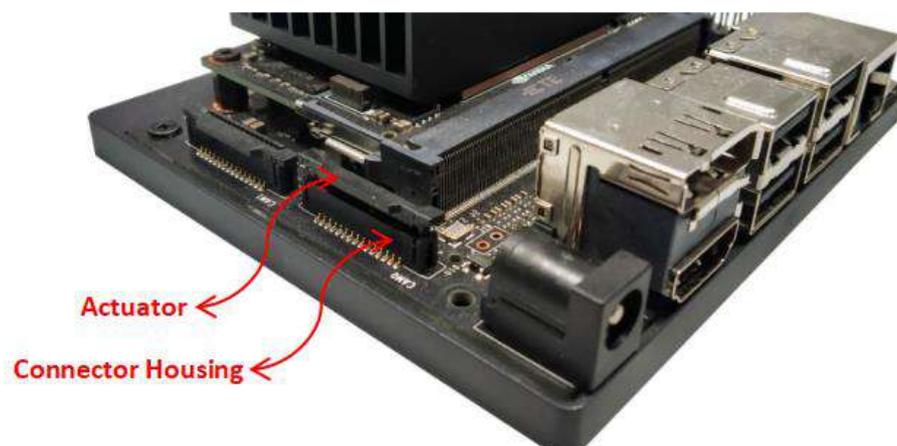


Figure 12: Jetson Xavier NX Development Kit Camera Connector Actuator Location

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

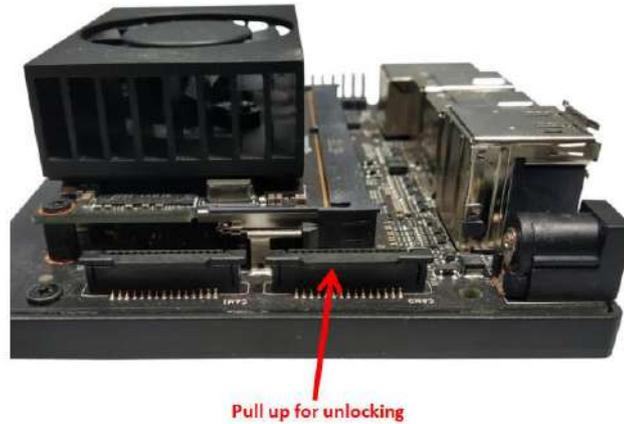


Figure 13: Unlocking Jetson Xavier NX Development Kit Camera Connector

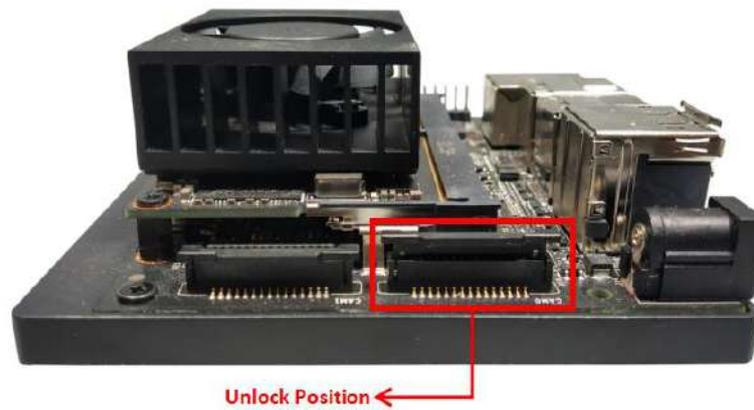


Figure 14: Unlocked Position of Jetson Xavier NX Development Kit Camera Connector

3. Insert the FPC cable to the J9 connector of Jetson Xavier NX development kit as shown in following figure.

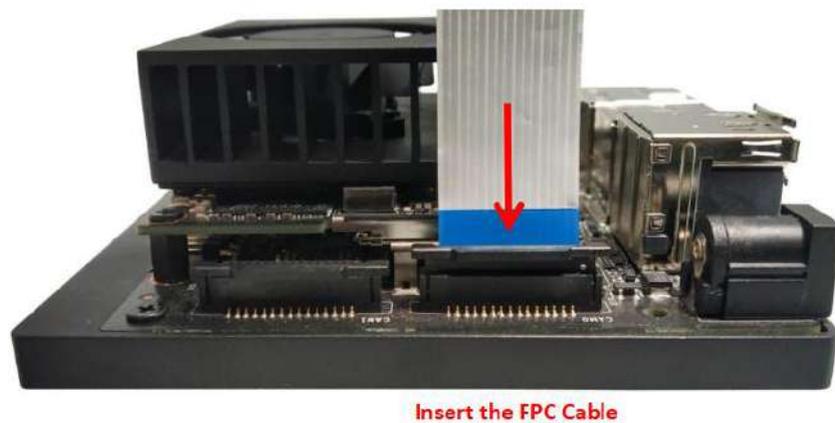


Figure 15: FPC Cable insertion to J9 Connector of Jetson Xavier NX Development Kit

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

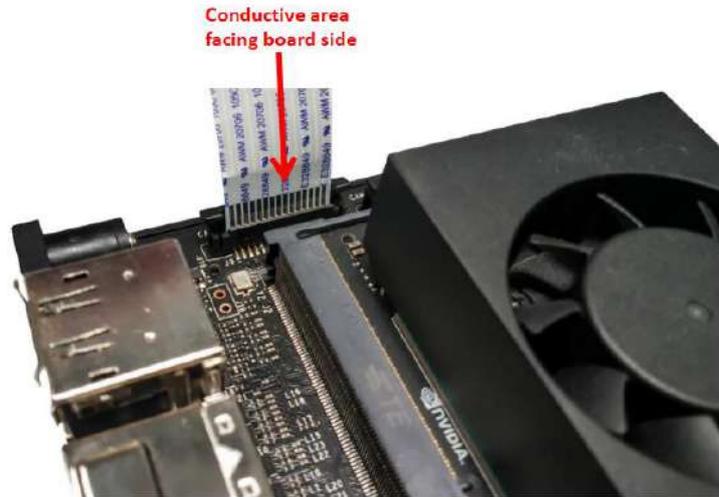


Figure 16: FPC Cable inserted into Jetson Xavier NX Development Kit

4. Lock the J9 connector by pressing both ends of actuator with same equal force as shown in following figures.

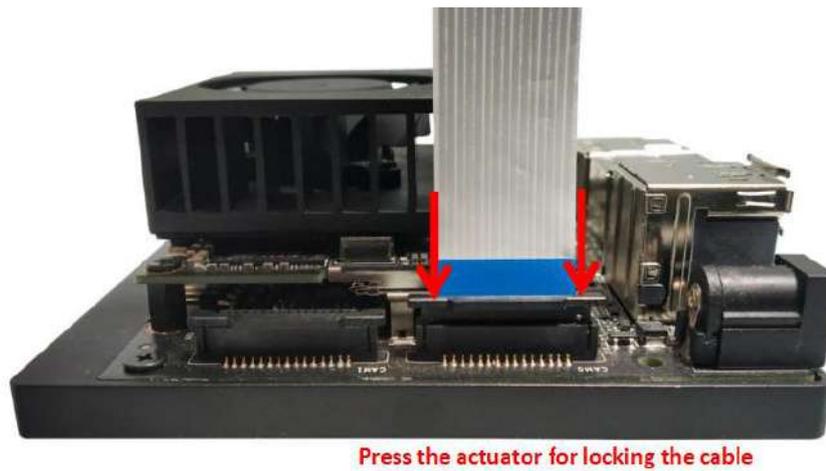


Figure 17: Locking the FPC Cable

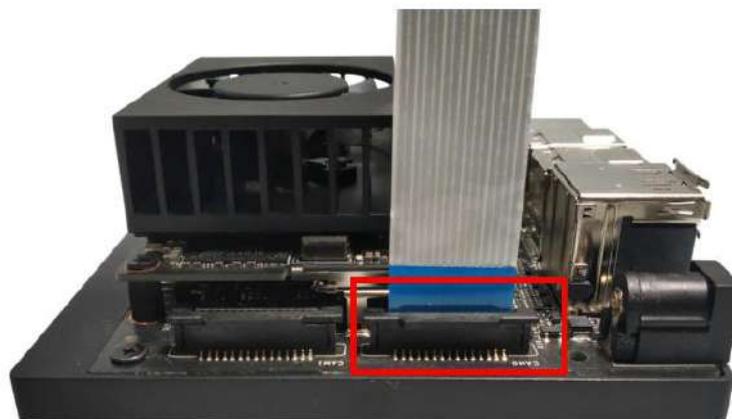


Figure 18: FPC Cable Locked Position on Jetson Xavier NX Development Kit

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

5. Now, e-CAM21_CUNX is connected to Jetson Xavier NX™ development kit as shown in following figure.

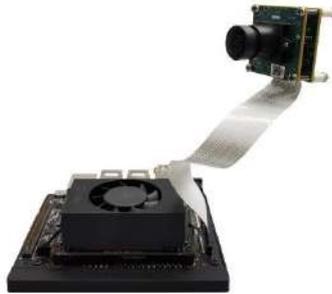


Figure 19: e-CAM21_CUNX Setup Interfaced to Jetson Xavier NX Development Kit

6. 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

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

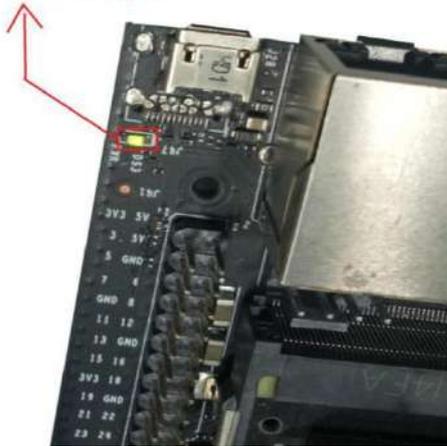


Figure 21: Status LED indicating Jetson Xavier NX Development Kit Powered ON

Software Quick Setup

This section provides the steps to boot the Jetson™ development kit with the bootable SD card for supporting e-CAM21_CUNX. The bootable SD card connected to the Jetson™ Xavier NX development kit is flashed with the **L4T_R32.4.3** (aarch64) package which supports Linux distributions for e-CAM21_CUNX.

For getting the **e-CAM21_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-CAM21_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 Xavier NX™ development kit.

Note: The module drivers for e-CAM21_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 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 Xavier NX development kit.

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

```
$ sudo nvpmode1 -m 0
```

3. Run the following Jetson™ clocks and max-clocks shell scripts command before launching the eCAM_argus_camera application in the Jetson Xavier NX™ development board.

```
$ sudo jetson_clocks  
$ sudo /home/max-isp-vi-clks.sh
```

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

```
eCAM_argus_camera
```

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

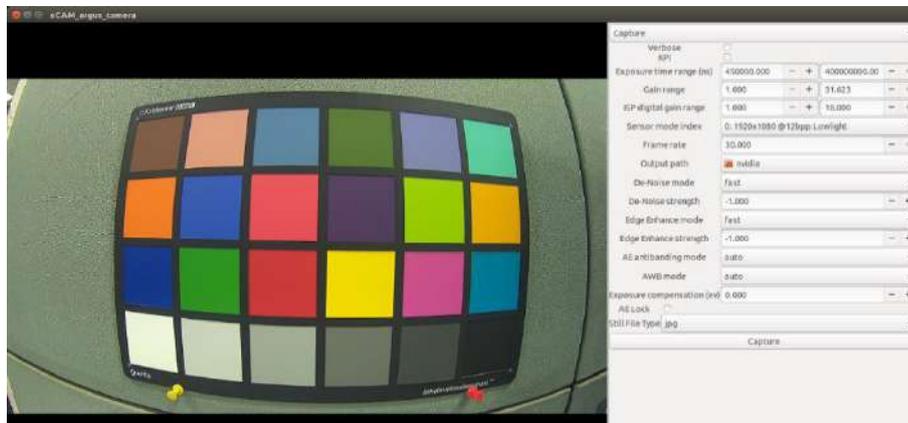


Figure 24: Initial Window when Application is Launched

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

Table 4: Default Login Credentials

Fields	Inputs
Username	nvidia
Password	nvidia

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-44> link.
Note: Choose SD card image corresponding to Jetpack 4.4
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-CAM21_CUNX Release package into the HOME directory of the flashed Jetson Xavier NX 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-CAM21_CUNX_JETSON_  
<L4T_version>_<release_date>_<release_version>.tar.gz  
cd e-CAM21_CUNX_JETSON_  
<L4T_version>_<release_date>_<release_version>
```

To know more about the release package, please refer to the *e-CAM21_CUNX_Release_Package_Manifest_<REV>.pdf*.

5. Run the following commands in the Jetson Xavier NX kit.

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

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

Note: If you have flashed L4T32.4.3 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-CAM21_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.

S.NO	Documents to Refer	What I Need
1	e-CAM21_CUNX_Gstreamer_Usage_Guide.pdf	Use gstreamer to control the e-CAM21_CUNX camera on the Jetson Xavier NX development kit.
2	e-CAM21_CUNX_Developer_Guide.pdf	Use prebuilt binaries to support e-CAM21_CUNX. Build custom kernel with support for using e-CAM21_CUNX. Upgrade already existing L4T_R32.4.3 (aarch64) Linux distribution for Jetson Xavier NX to support e-CAM21_CUNX.
3	e-CAM21_CUNX_Release_Package_Manifest.pdf	Information about the directory structure and contents of the release package for e-CAM21_CUNX.
4	e-CAM21_CUNX_eCAM_Argus_Camera_Build_and_Install_Guide_<REV>.pdf	Build and install the GUI based eCAM_argus_camera application.
5.	e-CAM21_CUNX_e-CAM_Argus_App_User_Manual_<REV>.pdf	View the single camera stream and change the camera controls using GUI.

Table 5: Description of Software Documents

Hardware Documents

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

Table 6: Description of Hardware Documents

S.NO	Documents Name	Description
1	e-CAM21_CUNX_Datasheet.pdf	Describes the feature, connector pin-out details and mechanical dimensions of e-CAM21_CUNX.
2	e-CAM220_CUMI327_MOD_Datasheet.pdf	Describes the features and specification of e-CAM220_CUMI327_MOD camera module.
3	e-CAM21_CUNX_Lens_Datasheet.pdf	Describes the optical specification of lenses used in e-CAM21_CUNX.
4	e-CAM220_CUMI327_MOD_3D.stp	3D file for e-CAM220_CUMI327_MOD board.

Troubleshooting

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

Can I Connect the camera to any one of the camera port present in the Jetson Xavier NX™ development kit ?

Yes, you can connect the camera to either J1 or J9 Connector port available in Jetson Xavier NX™ development kit.

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

e-con Systems provide a very flexible 15 cm FPC cable along with this kit. For customization, please write to camerasolutions@e-consystems.com with your requirement.

2. Does e-CAM21_CUNX camera support OpenCV?

e-CAM21_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 for detailed information about OpenCV support in e-con Systems cameras.

3. How can I get the updated package?

Please login to the [Developer Resources](#) website and download the latest release package.

What's Next?

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-CAM21_CUNX.

- *e-CAM21_CUNX Developer Guide*
- *e-CAM21_CUNX_e-CAM_Argus_App_User_Manual*

API: Application Program Interface.

ARM: Advanced RISC Machines.

CMOS: Complementary Metal Oxide Semiconductor.

CSI: Camera Serial Interface.

eMMC: Embedded Multi-media Card.

FHD: Full HD (Industry name for 1920 x 1080 resolution).

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.

Contact Us

If you need any support on e-CAM21_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	27-Jan-2021	Initial draft	Application Engineering Team