

e-CAM22\_CUXVR

# Getting Started Manual



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e-con Systems

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**e-con Systems**

Your Product Development Partner

### **Disclaimer**

The specifications of e-CAM22\_CUXVR board and instructions on how to use this board with Jetson AGX 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-CAM22\_CUXVR

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-CAM22\_CUXVR. This camera board targets the NVIDIA® Jetson AGX Xavier™ development kits. It can be directly interfaced with Jetson AGX Xavier™ development kit through a J509 connector.

e-CAM22\_CUXVR 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-CAM22\_CUXVR supported resolutions and frame rates as shown in below tables.

**Table 1: Supported Resolutions and Frame Rates of e-CAM22\_CUXVR with Xavier™**

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

This document describes how to interface the e-CAM22\_CUXVR board on Jetson AGX Xavier™ development kit and how to use the e-CAM22\_CUXVR board.

## Prerequisites





The prerequisites are as follows:

- Host PC with Ubuntu 18.04 (64-bit) to flash the binaries in Jetson AGX 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**

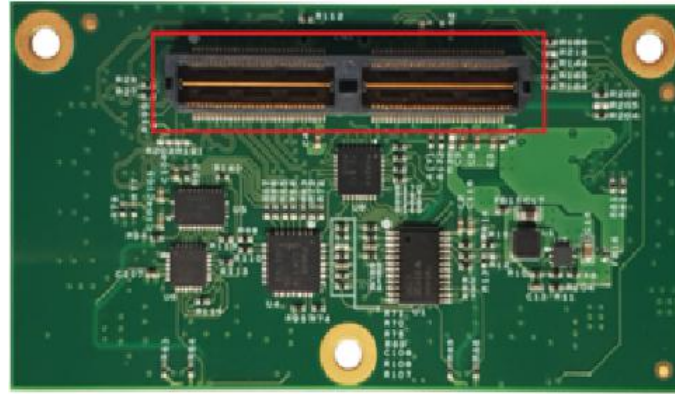
Parts Supplied	Images	Quantity
Base Board (e-CAM30_HEXCUXVR_BASE_BRD)		1
Custom Lens Camera Module (e-CAM220_CUMI327_MOD)		X*
Adaptor Board (e-CAM130_TRICUTX2_ADAPTOR)		X*
Micro-Coaxial Cable		X*

**Note:** X\* above refers to either one or six depending upon the setup purchased.

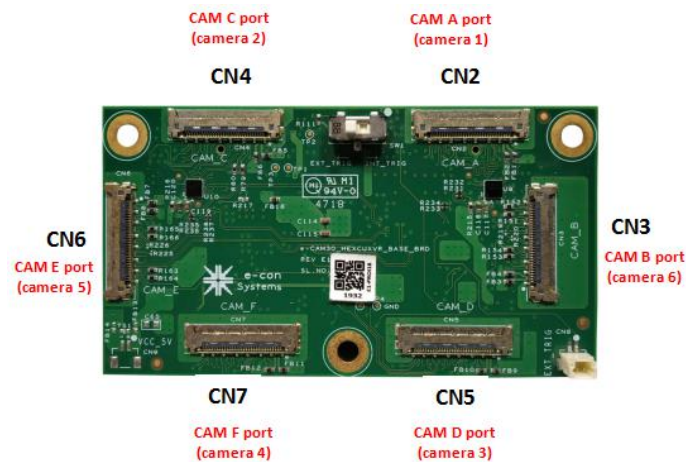
## Description

e-CAM22\_CUXVR is a multi-board camera solution for Jetson platforms, which is compatible with Jetson AGX Xavier™ development kits. When e-CAM22\_CUXVR is interfaced with Jetson AGX Xavier™ development kit, it supports maximum of six cameras modules 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.

The e-CAM30\_HEXCUXVR\_BASE\_BRD base board has one 120-pin Samtec connector (CN1) and six 30-pin micro-coaxial connectors (CN2, CN3, CN4, CN5, CN6 and CN7) as shown in below figures.

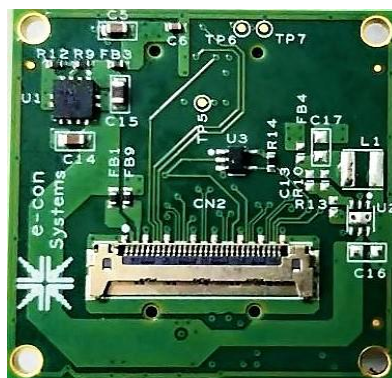


**Figure 1: Rear View of e-CAM30\_HEXCUXVR\_BASE\_BRD Base Board**



**Figure 2: Front View of e-CAM30\_HEXCUXVR\_BASE\_BRD Base Board**

The CN1 connector can be directly mated with J509 connector of Jetson AGX Xavier™ development kit and CN2, CN3, CN4, CN5, CN6, and CN7 connectors can be interfaced with adaptor boards through 30 cm micro-coaxial cable. The rear view of e-CAM130\_TRICUTX2\_ADAPTOR adaptor board is shown in below figure.



**Figure 3: Rear View of e-CAM130\_TRICUTX2\_ADAPTOR Adaptor Board**

Among these connectors, only CN2 (CAM A), CN4 (CAM C), CN5 (CAM E), CN7 (CAM F), CN3 (CAM B) and CN6 (CAM D) are used for connecting camera modules. e-CAM22\_CUXVR operates in asynchronous mode.

# e-CAM22\_CUXVR Board Handling Procedure

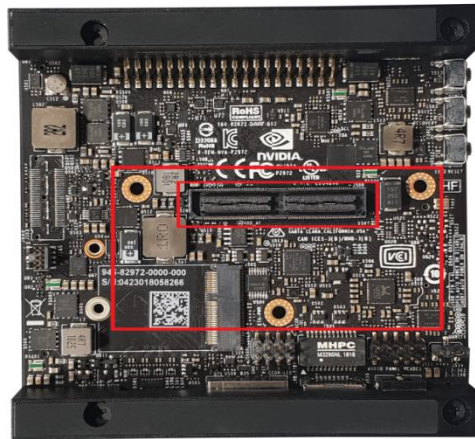
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This section describes the handling procedure of e-CAM22\_CUXVR board.

The procedure to assemble six camera boards are as follows:

1. Insert the CN1 connector of the e-CAM22\_CUXVR board to the camera connector of the Jetson development kit before powering ON the Jetson development kit.

The e-CAM22\_CUXVR base board location in Jetson AGX Xavier™ development kit is shown in following figure. The CN1.1 pin of e-CAM22\_CUXVR must mate with J509.1 pin of Xavier™ development kit.



**Figure 4: e-CAM30\_HEXCUXVR Base Board Location in Jetson AGX Xavier Development Kit**

2. Interface the six adaptor boards to the base board using the supplied six micro-coaxial cables.

The supplied micro-coaxial cable is shown in below figure.

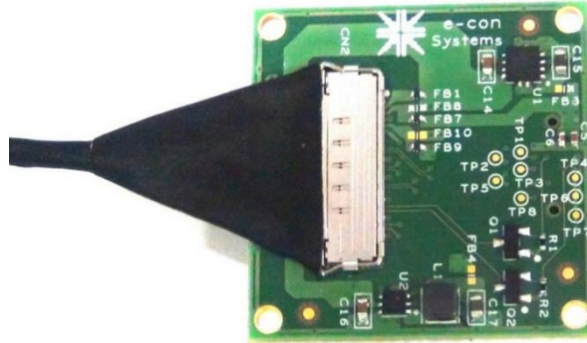


**Figure 5: Micro-Coaxial Cable**



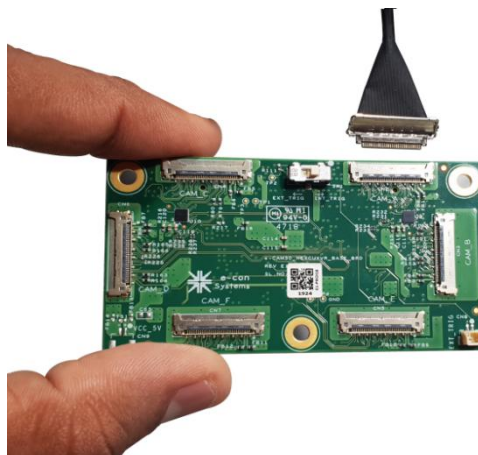
3. Connect the micro-coaxial cable to the adaptor board connector and base board connector.

The micro-coaxial cable connected to the adaptor board connector is shown in below figure.



**Figure 6: Micro-Coaxial Cable connected on Adapter Board Connector**

The location of CAM A connector on the base board is shown in below figure.



**Figure 7: Location of CAM A Connector on Base Board**

The locking and unlocking positions of micro-coaxial cable on the base board CAM A connector is shown in the below figures.



**Figure 8: Unlocking Position of Cable on Base Board CAM A Connector**





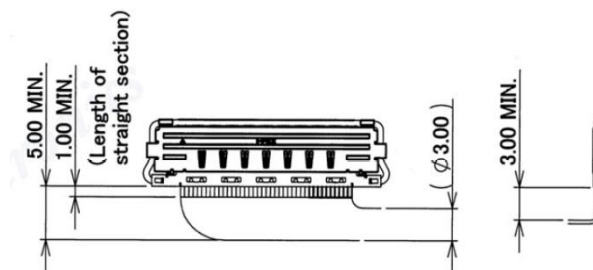
**Figure 9: Locking Position of Cable on Base Board CAM A Connector**



**Figure 10: Micro-Coaxial Cables connected on Base Board Connectors**

**Note:** Care must be taken in connecting the micro-coaxial cables and setting the six camera setups.

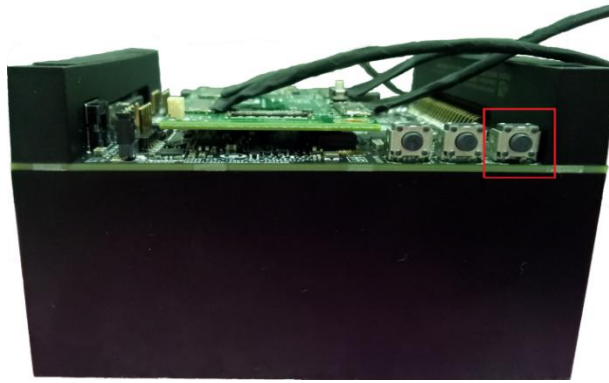
4. Connect the micro-coaxial cable with the recommended bending dimensions as shown in below figure.



**Figure 11: Recommended Bending Dimensions of Micro-Coaxial Cable**

5. Connect 19V, 3.42A supply to DC jack to power-up the Jetson development kit.
6. Press the power switch of Jetson AGX Xavier™ development kit to boot the device.

The location of power switch on the Jetson AGX Xavier™ development kit is shown in below figure.



**Figure 12: Location of Power Switch on Jetson AGX Xavier Development Kit**

After powering ON the Jetson development kit, the White color LED on Jetson AGX Xavier™ development kit will glow. This serves as a power ON indication of base board as shown in following figure.



**Figure 13: Status LEDs indicating Jetson AGX Xavier Development Kit Powered ON**

# Extracting and Flashing e-con provided Binaries

This section describes the extracting and flashing of e-con Systems provided binaries to Jetson Xavier™ development Kit.

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

**Table 3: Notation of Colors**

Color	Notation
Blue	Commands running in Development PC
Red	Output message in Development PC

Before extracting and flashing the e-con provided binaries in Jetson AGX Xavier™ development kit, flash **the Jetpack 4.4** provided by Nvidia, using the SDK manager. Download the SDK manager using the link <https://developer.nvidia.com/nvidia-sdkmanager>

Sign up to an account in NVIDIA developer site to use the SDK manager.

Install the SDK Manager in the host PC using the command below:

```
sudo apt-get install ./sdkmanager
[version].[build#].deb
```

After installing the SDK manager in the host PC, follow the instructions in the link <https://docs.nvidia.com/sdk-manager/install-with-sdcm-jetson/index.html>.

Get the release package, “e-CAM22\_CUXVR\_JETSON\_XAVIER\_<L4T>\_<RELEASE\_DATE>\_<VERSION>.tar.gz” from the following FTP location,

```
User Name : e-cam22-cuxvr@ftp.e-consystems.com
Password  : Cemuvr1120%!
Hostname  : ftp.e-consystems.com
```

Copy the release package into the HOME Directory of the flashed Jetson AGX Xavier™ development kit.

To extract and flash the binaries, follow these steps:

- Run the following commands to extract the release package in the Jetson development kit to obtain the binaries

```
tar -xaf e-
CAM22_CUXVR_JETSON_XAVIER_<L4T>_<RELEASE_DATE>_<VERSIO
N >.tar.gz

cd e-
CAM22_CUXVR_JETSON_XAVIER_<L4T>_<RELEASE_DATE>_<VERSIO
N >
```

The folder contains the necessary tools to immediately flash the binaries in Jetson Xavier™ with the kernel, camera drivers, and application.

Run the following commands in the Jetson™ kit.

```
cd <path_to_home_directory>
sudo chmod +x ./install_binaries_<version>.sh
sudo ./install_binaries_<version>.sh
```

After the successful installation the board will reboot and the Jetson™ Development Kit is ready to use with e-CAM22\_CUXVR.

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

1. Run the following command to check whether all the required number of cameras are initialized.

```
dmesg | grep "Detected IMX327 sensor"
```

The output message for a camera setup appears as shown below.

```
Detected IMX327 sensor
```

Above message is for single camera setup. For more than one camera, number of message will be equal to the number of camera connected, The output message indicates that all cameras are initialised properly.

2. Run the following command to check the presence of video nodes.

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

The output message for a camera setup appears as shown below.

```
video0
```

Above message is for single camera setup. For more than one camera, number of message will be equal to the number of camera connected.

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

```
$ sudo nvpmodel -m 0
```

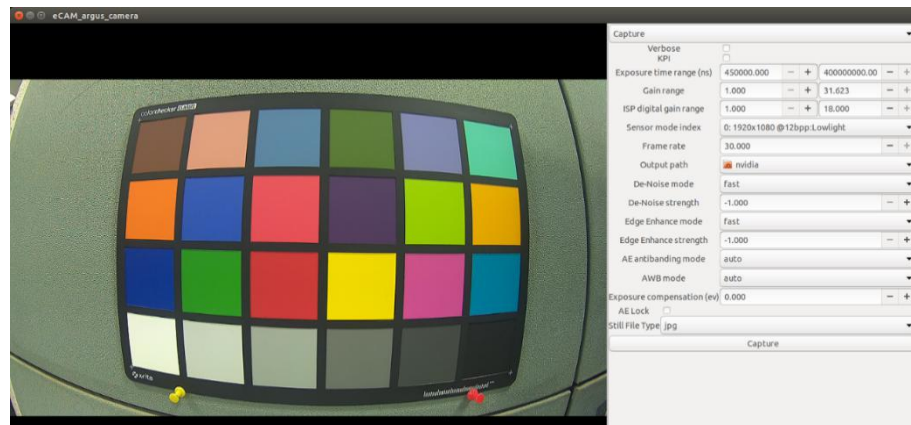
4. Run the following Jetson clocks and max-clocks shell scripts before launching the eCAM\_Argus\_MultiCamera or eCAM\_argus\_camera application in the Jetson AGX Xavier™ development board.

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

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

```
$ argus_camera
```

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



**Figure 14: Initial Window Appearance when Application is Launched**

# Reference Documents

This section describes the software and hardware documents of e-CAM22\_CUXVR. 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	What I Need	Documents to Refer
1	Use gstreamer to control the e-CAM22_CUXVR camera on the Jetson AGX Xavier™ development kit.	e-CAM22_CUXVR_Gstreamer_Usage_Guide.pdf
2	Use prebuilt binaries to support e-CAM22_CUXVR. Build custom kernel with support for using e-CAM22_CUXVR. Upgrade already existing <b>L4T_R32.4.3(aarch64)</b> Linux distribution for Jetson AGX Xavier™ to support e-CAM22_CUXVR.	e-CAM22_CUXVR_Developer_Guide.pdf
3	Information about the directory structure and contents of the release package for e-CAM22_CUXVR.	e-CAM22_CUXVR_Release_Package_Manifest.pdf

### Documents

## Hardware Documents

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

Table 5: Description of Hardware Documents

S.N O	Documents Name	Description
1	e-CAM22_CUXVR_Datasheet_Rev1.2.pdf	Describes the feature, connector pin-out details

		and mechanical dimensions of e-CAM22_CUXVR.
2	e-CAM220_CUMI327_MOD_Datasheet_Rev1.0.pdf	Describes the features and specification of e-CAM220_CUMI327_MOD camera module.
3	e-CAM22_CUXVR_Lens_Datasheet_Rev1.0.pdf	Describes the optical specification of lenses used in e-CAM22_CUXVR.
4	e-CAM30_HEXCUXVR_BASE_REVX1_3D file.sdp	3D file for e-CAM130_CUXVR base board.
5	e-CAM130_TRICUTX2_ADAPTOR_3D.sdp	3D file for e-CAM130_CUXVR adaptor board.
6	e-CAM220_CUMI327_MOD_3D.sdp	3D file for e-CAM220_CUMI327_MOD board.



# Troubleshooting

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

**I have flashed the Jetson AGX Xavier™ board with quick start package. After flashing, the board is not booting, or the display is blank. How to solve this issue?**

To solve this issue, please try the following:

- Use the correct command with sudo permission whenever required to extract the package.
- Use Ubuntu 18.04 64-bit for flashing.
- Maintain enough free space in hard disk before flashing.

# FAQ

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**1. Does e-con Systems support longer length cable?**

e-con Systems provide a very flexible and robust 30 cm micro-coaxial cable along with this kit. For customization, please write to [camerasolutions@e-consystems.com](mailto:camerasolutions@e-consystems.com) with your requirement.

**2. Can I boot the Jetson AGX Xavier™ development kit directly from the SD card shipped with the product?**

No, the SD card shipped with the product has the release package in .zip format. Since it is not a bootable SD card, it cannot be used to boot the Jetson AGX Xavier™ development kit. For customization, please write to [camerasolutions@e-consystems.com](mailto:camerasolutions@e-consystems.com) with your requirement.

**3. Does e-CAM22\_CUXVR camera support OpenCV?**

e-CAM22\_CUXVR works using libArgus, Video for Linux version2 (V4L2) APIs and is V4L2 compliant. There are many samples in tegra\_multimedia\_api on linking OpenCV with Argus. Also, 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.

**4. How can I get the updated package?**

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

**5. Can I connect cameras in any of available six connectors?**

yes, please refer to [Figure 2](#) to connect the cameras. If there is an improper connection, the camera driver will not be loaded properly.

# 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 AGX Xavier™ development kit, you can refer to the following documents to understand more about e-CAM22\_CUXVR.

- *e-CAM22\_CUXVR Developer Guide*

# Glossary

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**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-CAM22\_CUXVR 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-Oct-2020	Initial draft	Camera Team
1.1	29-Oct-2020	Corrected Framerate Details	Camera Team