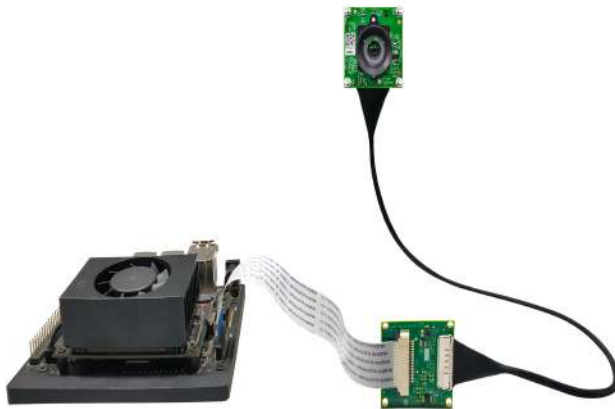


e-CAM23_CUNX

Linux Application User Manual



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Disclaimer

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Introduction to e-CAM23_CUNX

e-CAM23_CUNX is a new MIPI camera board which helps to connect OV2311 camera module to the NVIDIA® Jetson Nano/Xavier NX™ development kit launched by e-con Systems, a leading Embedded Product Design Services Company which specializes in advanced camera solutions. The prebuild driver for this camera along with the camera board is provided by e-con Systems.

e-con Systems provides a sample Video for Linux version 2 (V4L2) application, called `ecam_tk1_guvcview`, along with the e-CAM23_CUNX camera. `ecam_tk1_guvcview` is a V4L2 video viewer and capture software of the camera driver for Jetson Nano/Xavier NX™ development kit. It is customized to demonstrate the features of e-CAM23_CUNX.

This document describes the usage of `ecam_tk1_guvcview` application, and the special features of `ecam_tk1_guvcview` application when it is used with e-CAM23_CUNX.

Description


e-CAM24_CUNX can stream the resolutions and frame rates as listed in below table.

Table 1: Supported Resolutions and Frame Rates of e-CAM23_CUNX




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

Note:

-  The frame rates listed in the above table can be achieved easily in manual exposure.

The camera controls of e-CAM23_CUNX are as follows:

-  Gain
-  Exposure time absolute
-  Frame_sync

The e-CAM_TK1 guvcviewer or ecam_tk1_guvcview is a simple GTK+ interface for capturing and viewing video from the devices supported on the JetsonNano/ Xavier NX™ development kit.

Using e-CAM_TK1 guvcviewer or ecam_tk1_guvcview application, you can perform the following:

- Enumerate and list all video devices connected.
- Display properties of video renderer.
- Change resolution and color space or compression for video stream, if different resolutions are supported by the device.
- Display currently configured values of preview.
- Capture the still images and set the path where still images will be saved.
- Display the average frame rate.

All the above listed properties can be configured by attractive and easy to use Graphical User Interface (GUI).

Please refer to the *e-CAM23_CUNX_Release_Notes_<REV>.pdf* for the compatible Linux distribution version (L4T version).

Launching the Application

This section describes how to launch the `ecam_tk1_guvcview` application.

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

Table 2: Notation of Colors

Color	Notation
Blue	Commands running in development board
Red	Output message in development board

The steps to launch the application are as follows:

1. Connect the e-CAM23_CUNX MIPI camera to the ACC_NANO_WTB_ADP which has to be connected to Jetson Nano development kit through a J13 and J49 connector and Xavier NX™ development kit through a J1 and J9 connector .
2. Power ON the Jetson Nano/Xavier NX™ development kit.

The module drivers of e-CAM23_CUNX provided by e-con Systems will be loaded automatically during the board boot.

3. Run the following command to check whether the camera is initialized.

```
$ dmesg | grep -i "Detected OV2311 sensor"
```

The output message appears as shown below.

```
Detected OV2311 sensor
```

The output message indicates that the camera is initialized properly.

4. Run the following command to check the presence of video node.

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

The output message appears as shown below.

```
video0
```

Please refer to the e-CAM_TK1_GUVCView_Build_and_Install_Guide_<REV>.pdf to install the application in the Linux system.

5. Run the following commands to check and set the power mode to maximum for better performance.

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

6. Run the following Jetson clocks command to achieve maximum frame rate before launching the ecamTk1_guvcview application in the Jetson Nano/Xavier NX™ development kit.

```
$ sudo jetson_clocks
```

7. Run the following command to launch the ecamTk1_guvcview application.

```
$ /usr/local/ecamTk1/bin/ecamTk1_guvcview --  
device=/dev/video<X>
```

Note: Replace **X** in **/dev/video<X>** with appropriate number to stream from respective camera for Jetson Nano/Xavier NX™ kit. When entering the command in terminal, the screen appears as shown below.

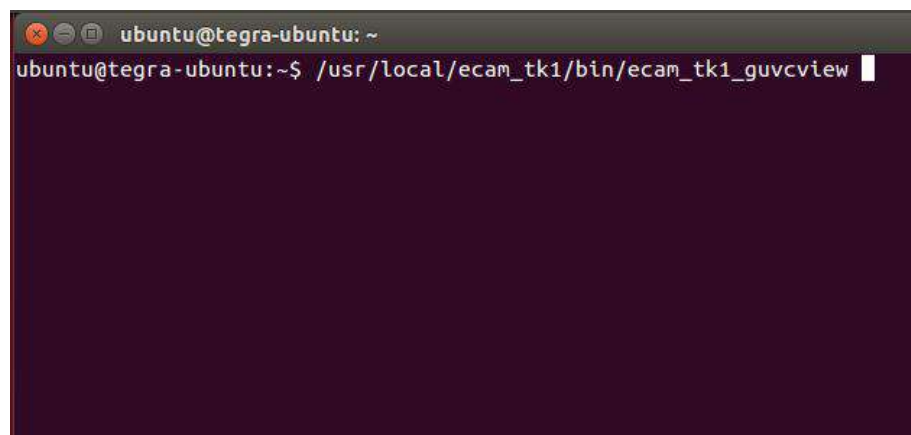


Figure 1: Terminal Window

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

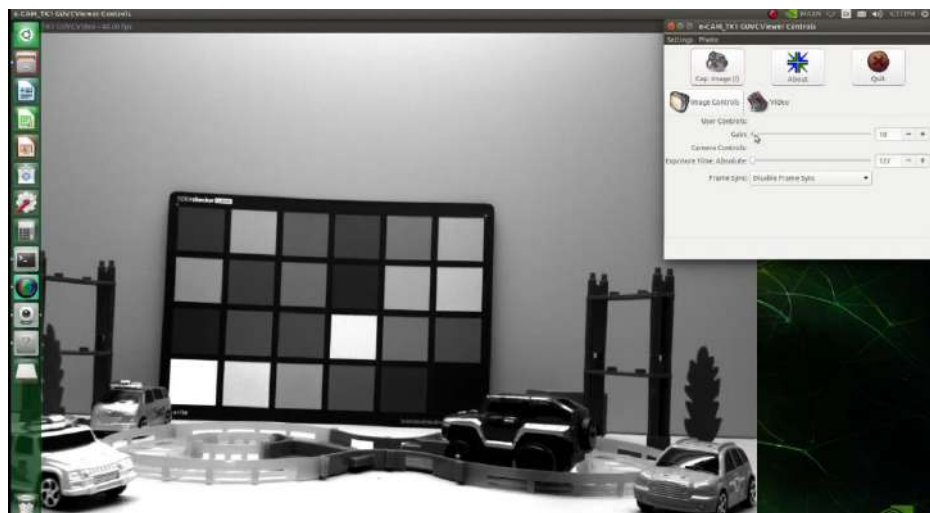


Figure 2: Initial Window Appearance

Application Features

This section describes the controls that are supported in the current version of ecam_tk1_guvcview application for e-CAM23_CUNX.

The controls supported in ecam_tk1_guvcview application are as follows:


-  [Image Controls Tab](#)
-  [Video Tab](#)
-  [Cap. Image \(I\) Button](#)
-  [About Button](#)
-  [Quit Button](#)

Image Controls Tab

When selecting the **Image Controls** tab, you can view the available controls as shown below.

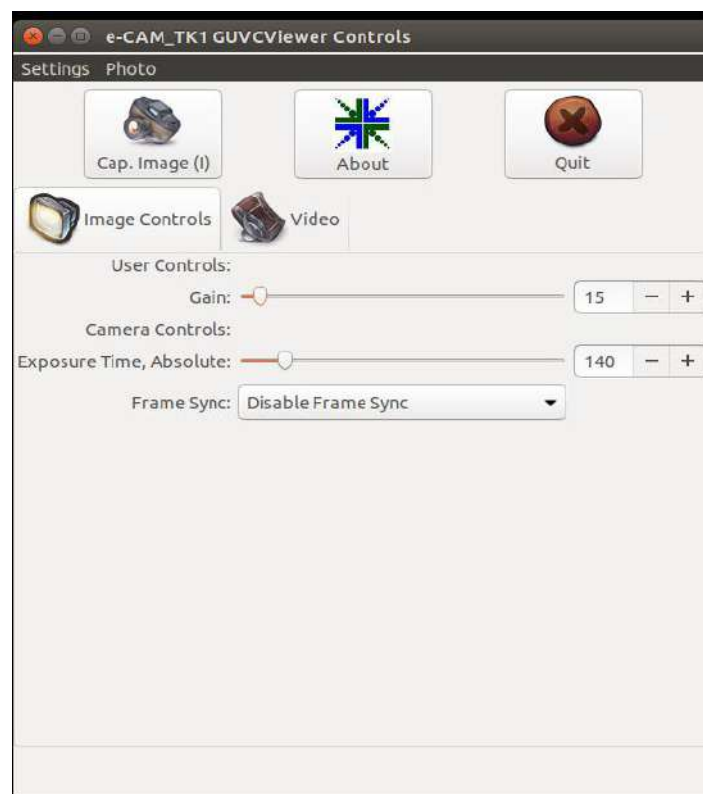





Figure 3: Image Controls Tab

The controls available in **Image Controls** tab are as follows:

-  [Gain](#)
-  [Exposure time absolute](#)
-  [Frame sync](#)

You can move the slider and configure the preview settings according to your needs. The sliders whose labels are not greyed can only be configured. The value being set will be displayed in the text box based on the position of the slider. As soon as the slider is moved to configure the values, the preview property will change at that instance.

The values of e-CAM23_CUNX controls are listed in below table.

Table 3: Values of e-CAM23_CUNX Controls

Controls	Minimum Value	Maximum Value	Default Value	Manual Control	Auto Control
Gain	1	240	1	YES	NO
Exposure time absolute	1 (100 μ s)	1000(100 ms)	312 (31.2 ms)	YES	NO
Frame_sync	0	2	0	YES	NO

Gain

The gain values can be changed from a minimum value of 1 to 240 by moving the slider. The changes are updated in the preview only when exposure control is set to manual mode. The default value is 1.

Exposure

The exposure value could be manually changed by moving the slider. e-CAM23_CUNX supports exposure values ranging from 100 μ s to 100 ms which is represented as 1 to 1000 in the slider. The exposure values are configured inside the CMOS image sensor based on the sensor configuration and clock configuration details. The default manual exposure value will be 140 that is 14..0 ms.

To obtain a good low light performance, it is essential to change the exposure according to the change in lighting conditions.

The exposure value applied in the sensor in ms is 1/10 of the set value as listed in below table.

Table 4: Exposure Value-Exposure Time Mapping

Exposure Value	Exposure Time
1	0.1 ms
2	0.2 ms
3	0.3 ms
.	.
.	.
10	1 ms
11	1.1 ms
12	1.2 ms
.	.
.	.
100	10 ms
.	.

.	.
1000	100 ms

When the exposure time period is more than the time period of camera frame, it cannot get the frame or the frame will get corrupted in sync mode, so while using in sync mode the exposure has to be set with in the limits shown in below table tested for 30 hz and 60 hz pwm.

RESOLUTION	30HZ		60Hz	
	GRAY8	Y16	GRAY8	Y16
320x240	337	337	164	164
640x480	337	337	164	164
1280x720	255	337	85	164
1600x1300	89	179	9	(Not supported above 40Hz)

Note:


- When the exposure time period is more than the time period of camera frame, the frame rate will drop.
- Controls are global across all resolutions and formats, and hence changing the control values will reflect the changes in both the formats and resolutions.

Frame_sync

Frame sync control is to shift between the asynchronous mode and synchronous mode(trigger mode)

Video Tab

On selecting the **Video** tab, the video renderer properties will be displayed. You can adjust the video preview settings in the **Video** tab. The features supported in **Video** tab are as follows:

-  [Device Selection](#)
-  [Frame Rate](#)

[Video Capture Properties](#)

Device Selection

When you click the **Device** drop-down list box, you can view the connected device as shown below.



Figure 9: Device Connected

Frame Rate

The frame rate of the preview can be viewed by selecting the **Show** check box in the **Video** tab. Before selecting the **Show** check box, you can view the screen similar to the screen shown below.



Figure 10: Selecting Show to Display Frame Rate

After selecting the **Show** check box, the frame rate will be displayed in the top of the preview window as shown below.

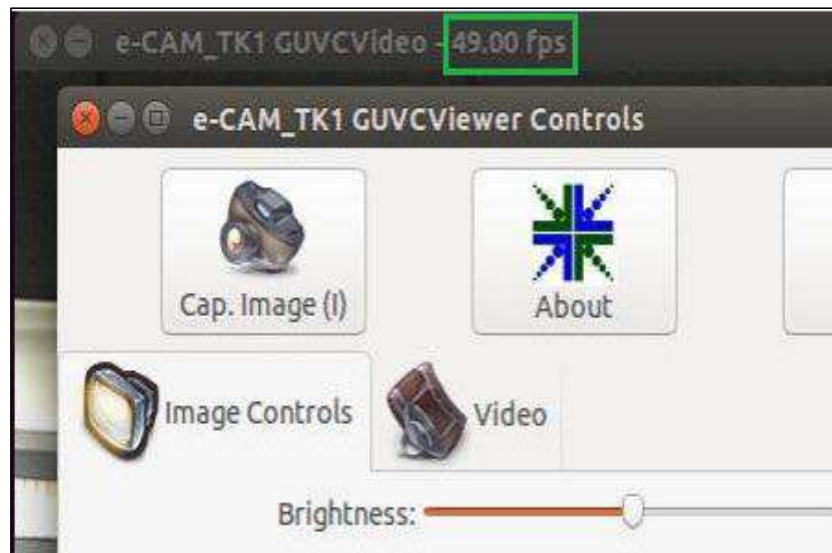


Figure 11: Displaying Frame Rate in Preview Window

Note: The frame rate will be affected by various environmental parameters.

Video Capture Properties

You can configure the output size (resolution) of stream format. Currently e-CAM23_CUNX supports GRAY8 and Y16 output formats. In both formats, four resolutions are supported. When you click the **Resolution** drop-down list box, you can view the supported resolutions as shown below.



Figure 12: Supported Video Resolutions

When you click the camera Output drop-down list box, you can view the supported formats as shown below.



Figure 13: Supported Video Formats

you click the device drop-down list box, you can view the available devices for streaming and select from it as shown below.



Figure 14: Supported camera devices

The supported resolutions in format are listed in below table.

Table 6: Supported Format and Resolutions

Platform	Resolution	Frame Rate (fps) in 10-bit Output	Frame Rate (fps) in 8-bit Output
		Y16	GRAY8
Xavier NX/Nano	QVGA (320 x 240)	280	280
	VGA (640 x 480)	180	180
	HD (1280 x 720)	90	90
	2MP (1600 x 1300)	40	60

Cap. Image (I) Button

The **Cap. Image (I)** button allows you to capture the still image of the selected device in the **Device** drop-down list box and select the path to store the image. The features supported in **Cap. Image (I)** button are as follows:

-  [Still Image Capture](#)
-  [Still File Path](#)

Still Image Capture

You can click the **Cap. Image (I)** button in the top of the control panel to capture the still image. You can view the screen similar to the screen shown below.



Figure 12: Capture Still Image

By default, the image will be saved in the home directory. You can configure the folder to save the images. The default name for captured image file is guvcview_image.jpg.

Note: To capture an image of another resolution, you must switch the preview to that resolution. Unlike Windows, the Linux kernel does not support cross resolution images.

Still File Path

To create a folder for saving the captured images, click **Photo > File** as shown below.



Figure 13: Save File Dialog Box to set the Still Image Folder

A **Save File** dialog box will appear for selecting the file format to save the captured image. You can also browse to the required directory and set the file name, so that the captured images will also be saved in that folder.

About Button

When you click the **About** button, you can view the details of e-CAM_TK1 GUVViewer application as shown below.

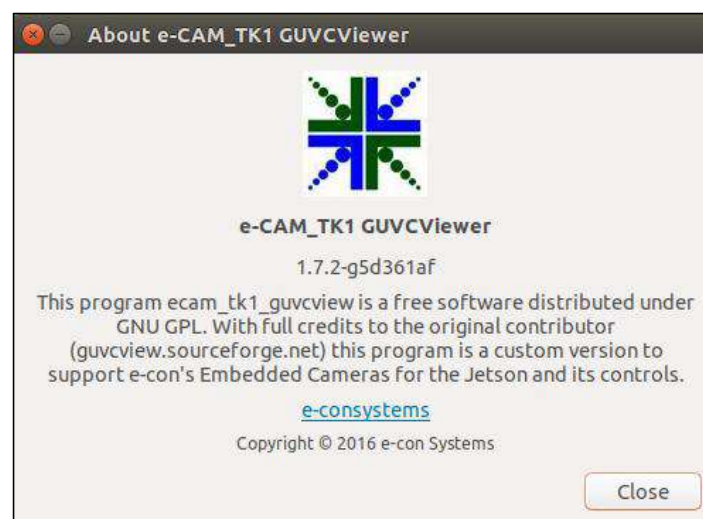


Figure 14: About e-CAM_TK1 GUVViewer

Quit Button

When you click the **Quit** button, you can exit the e-CAM_TK1 GUVViewer application.

Troubleshooting

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

In lower exposure value, setting a higher gain value causes a blue noise in higher resolutions.

This is a known issue. You need to either reduce the gain value or increase the exposure value to recover from this issue.

How to recover if black screen appears in ecam_tk1_guvcview camera window?

This is a known issue. If this issue occurs, it will auto recover in few seconds and if still not able to recover in few seconds, please restart the application.

How to recover if image struck in triggermode in ecam_tk1_guvcview camera window.

This is a known issue. You need to reduce the exposure_time absolute to recover the streaming if still not able to recover then try changing to lower resolution available preferably VGA or QVGA resolution.

FAQ

What's Next?

After understanding the usage of `ecam_tk1_guvcview` application, you can refer to the following documents to understand more about e-CAM23_CUNX.

-  *e-CAM_TK1-GUVCView Build and Install Guide*
-  *e-CAM23_CUNX Release Notes*

Glossary

API: Application Program Interface.

CMOS: Complementary Metal Oxide Semiconductor.

2MP: 2Mega Pixel.

GIMP: GNU Image Manipulation Program.

GNU: GNU's Not Unix.

GTK: GIMP Toolkit.

GUI: Graphical User Interface.

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

L4T: Linux for Tegra.

MIPI: Mobile Industry Processor Interface.

ROI: Region of Interest.

VGA: Video Graphics Array (Industry name for 640 x 480 resolution).

V4L2: Video for Linux version 2 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-CAM24_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-Dec-2020	Initial draft	Camera Dev Team
2.0	30-Dec-2020	NANO support Added	Camera Dev Team