e-CAM20_CUXVR

MultiCamera Application User Manual

e-con Systems

Your Product Development Partner

Version 1.7

e-con Systems

1/27/2020

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Contents

Introduction to e-CAM20_CUXVR

e-CAM20_CUXVR has one or four 2 MP color cameras in 4-lane mode (in Jetson Xavier™) or 2 lane (in Jetson TX2™) with S-mount (also known as M12 board lens) lens holder. The S-mount is one of the most commonly used small form-factor lens mounts for board cameras. Each e-CAM20_CUXVR camera contains an 1/2.8" IMX290 CMOS image sensor from Sony® and is interfaced to the J509 connector on the Jetson AGX Xavier™ or interfaced to the J22 connector on the Jetson TX2™ development board.

e-CAM20_CUXVR has a MIPI camera and it requires a custom driver for the Jetson AGX Xavier™/TX2™ development kit. e-con Systems provides the prebuilt driver for this camera along with the camera board. The sample applications such as eCAM_argus_camera and eCAM_Argus_MultiCamera provided by e-con Systems are used for demonstrating some of the features of this camera. One of the unique features of this camera is its extreme low light capability and for this functionality the camera supports two modes:

- Low Conversion Gain (LCG)
- High Conversion Gain (HCG)

Another unique feature is providing frame synchronization by using one camera as master and the remaining cameras as slave which are all interconnected. Currently e-CAM20_CUXVR has support for Master-Slave synchronization in 4-lane setup (in Jetson Xavier™) or 2 lane (in Jetson TX2™).

e-con Systems provides a sample application, called eCAM_Argus_MultiCamera, along with the e-CAM20_CUXVR camera. It is a libargus based video viewer software, fully customized to demonstrate the features of e-CAM20_CUXVR. The main feature of this application is, all four cameras can be simultaneously streamed and recorded in synchronous and asynchronous modes.

This document describes about the usage of application and the special features of the application when it is used with e-CAM20_CUXVR on Linux operating systems.

Description

Each of the IMX290 based camera in e-CAM20_CUXVR can stream five modes, resolutions and frame rates in 4-lane mode in Jetson Xavier™.

The supported resolutions and frame rates in 4-lane mode is listed in below table.

Table 1: Supported Resolutions and Frame Rates in 4-Lane Mode

Bits Per Pixel	FHD (1920 x 1080)	HD (1280 x 720)
12	30 and 60 (HCG/LCG)	60 (LCG)
10	120 (LCG)	120 (LCG)

Each of the IMX290 based camera in e-CAM20_CUXVR can stream five modes, resolutions and frame rates in 4-lane mode in Jetson TX2™.

The supported resolutions and frame rates in 2-lane mode is listed in below table.

Table 1: Supported Resolutions and Frame Rates in 2-Lane Mode

Bits Per Pixel	FHD (1920 x 1080)	HD (1280 x 720)
12	30 and 60 (HCG/LCG)	30 and 60 (LCG)

The camera controls of e-CAM20_CUXVR are as follows:

- Auto exposure (AE) AntiBanding Mode
- AE Lock
- Auto White Balance (AWB) Mode
- Denoise Mode
- Denoise Strength
- Edge Enhance Mode
- Edge Enhance Strength
- ISP Digital Gain Range
- Exposure Time Range
- Sensor Gain Range
- Sensor Frame Rate
- Exposure Compensation

The eCAM_ArgusMultiCamera is a sample libArgus based camera application used to demonstrate the functioning of e-CAM21_CUMI290 module boards in Jetson AGX Xavier™/TX2™ boards.

Using eCAM_Argus_MultiCamera application, you can perform the following:

- Enumerate and list all video capture devices connected.
- Stream all available resolutions, if different resolutions are supported by the device.
- Change controls for all available cameras.
- Capture images in RAW and JPEG formats.
- Record H264 encoded videos.

e-con Systems provides eCAM_Argus_MultiCamera binary file of the application along with source code. Please refer to the *e-CAM20_CUXVR_Release_Notes.pdf* for the compatible Linux distribution version (L4T version).

Identifying the Deliverables

This section describes about identifying the deliverables.

The release package contains the application source code and eCAM_Argus_MultiCamera application executable. The commands and output messages in this manual are represented by different colors as shown in below table.

Table 2: Notation of Colors

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

The steps for identifying the deliverables are as follows:

1. Copy the release package tar file to the home directory of the board.
2. Run the following commands to extract the e-CAM20_CUXVR release package.

```
tar -xaf e-CAM20_CUXVR_JETSON_XAVIER_TX2_<L4T_version>_<release_date>_<release_version>.tar.bz2
cd e-CAM20_CUXVR_JETSON_XAVIER_TX2_<L4T_version>_<release_date>_<release_version>
```

The source code for the eCAM_Argus_MultiCamera application is present in the release package at the following location.

Application/eCAM_Argus_MultiCamera/Source/eCAM_Argus_MultiCamera.tar.bz2

The eCAM_Argus_MultiCamera executable is present in the release package at the following location.

e-CAM20_CUXVR_L4T32.2.1_JP4.2.2_JETSON-XAVIER-TX2_R02_RC3/Applications/Binaries/eCAM_Argus_MultiCamera/eCAM_Argus_MultiCamera

Note: If this folder is not available, untar the binaries package inside release package by using the following command.

```
tar -xmf e-CAM20_CUXVR_L4T32.2.1_JP4.2.2_JETSON-XAVIER-TX2_R02_RC2.tar.bz2
```

Building and Installing MultiCam Application from Source

This section describes about building and installing the eCAM_Argus_MultiCamera application from the source.

The steps to build and install MultiCam application from the source are as follows:

1. Run the following commands to install the dependency libraries.

```
$ sudo apt-add-repository universe
$ sudo apt-get update
$ sudo apt-get install cmake build-essential pkg-config libx11-dev libgtk-3-dev libexpat1-dev libjpeg-dev libgstreamer1.0-dev libgstreamer-plugins-base1.0-dev libv4l-dev v4l-utils
```

Note: If the installation process stops with the **could not get lock /var/lib/dpkg/lock** message, run the following command to remove the file and proceed with the installation.

```
$ sudo rm /var/lib/dpkg/lock
```

2. Run the following commands to enter the source directory.

```
$ cd Application/eCAM_Argus_MultiCamera/Source/
$ tar -xvf eCAM_Argus_MultiCamera.tar.bz2
$ cd eCAM_Argus_MultiCamera/argus/
$ mkdir build && cd build
```

3. Run the following make command to build the MultiCam application from the source.

```
$ cmake ..
$ make -j4
```

4. Run the following make install command to install the build application.

```
$ sudo make install
```

The application will be installed in **/usr/local/bin** location.

Installing Application Executables

This section describes about installing the eCAM_Argus_MultiCamera application executable.

The steps to install prebuilt eCAM_Argus_MultiCamera executable files are as follows:

1. Run the following commands to install the application binaries in Jetson™ board.

```
cd e-CAM20_CUXVR_L4T32.2.1_JP4.2.2_JETSON-XAVIER-TX2_R02_RC2/Applications/Binaries/eCAM_Argus_MultiCamera/
sudo cp eCAM_Argus_MultiCamera /usr/local/bin/eCAM_Argus_MultiCamera
```

   The eCAM_Argus_MultiCamera application executable will be installed to **/usr/local/bin** directory on the Jetson™ board.

   Note: Make sure that the required dependencies listed in *tar –xmf e-CAM20_CUXVR_L4T32.2.1_JP4.2.2_*JETSON-XAVIER-TX2_R02_RC2.tar.bz2

   Building and Installing MultiCam Application from Source section are installed. If the required dependencies are not installed, the eCAM_Argus_MultiCamera binary file will not work properly.

2. Run the following commands to achieve stable frame rate before launching the eCAM_Argus_MultiCamera application in the Jetson™ board.

```
sudo jetson_clocks
sudo /home/max-isp-vi-clks.sh
sudo nvpmodel -m 0
```

Launching the Application

This section describes about launching the eCAM_Argus_MultiCamera application.

The steps to launch the application are as follows:

1. Connect the e-CAM20_CUXVR MIPI camera to the J509 connector on the Jetson AGX Xavier™ or interfaced to the J22 connector on the Jetson TX2™development kit.
2. Run the following command with your IP address of the Jetson™ board to create SSH session from a Linux PC.

   ```
   ssh nvidia@<ip-address>
   ```

   The module drivers for e-CAM20_CUXVR provided by e-con Systems will be loaded automatically during board boot.

3. Run the following command to check whether all the connected cameras are initialized.

   ```
   $ dmesg | grep "Detected IMX290 sensor"
   ```

   The output message appears as shown below.

   ```
   Detected IMX290 sensor
   ```

   The output message indicates that all the cameras connected are initialized properly.

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

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

   The output message appears as shown below.

   ```
   /dev/video<n>
   ```

   Where, <n> represents the number of connected cameras.

   Note: The output messages mentioned in step 3 and step 4 will display the number of times based on the number of connected cameras.

5. Run the following command before starting the application.

   ```
   $ export DISPLAY=:0
   ```

6. Run the following jetson_clocks commands to achieve maximum frame rate before launching the eCAM_Argus_MultiCamera application in the Jetson™ board.

   ```
   $ sudo jetson_clocks
   $ sudo /home/max-vi-isp-clks.sh
   $ sudo nvpmodel -m 0
   ```

7. Run the following command to launch the eCAM_Argus_MultiCamera application from the terminal.

```
$ eCAM_Argus_MultiCamera
```

When application is launched, the menu control will appear in the host PC and video display window will appear on the display connected to the Jetson AGX Xavier™/TX2™ development kit.

To close the application, enter the option to quit from the application provided in the terminal UI or press **Ctrl + C** to effectively disable streaming and then continue to close the application using the terminal UI.

Application Features

This section describes about the MultiCam application features.

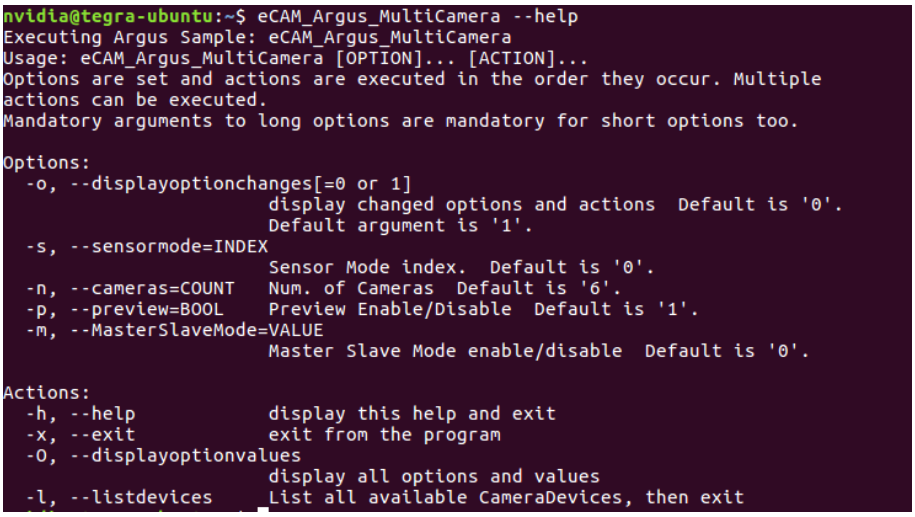
The input features that are supported in the current version of eCAM_Argus_MultiCamera application are as follows:

- Number of Streaming Cameras
- Master Device in Synchronized Mode
- Listing Features of Connected Device

Run the following command to list the command line features.

```
$ eCAM_Argus_MultiCamera --help
```

The features will appear as shown below.



Number of Streaming Cameras

Run the following command to stream the desired number of cameras.

```
$ eCAM_Argus_MultiCamera --cameras=<N>
```

or

```
$ eCAM_Argus_MultiCamera -n <Num of Cameras>
```

The supported formats and resolutions for 4-lane mode in Jetson Xavier™ is listed in below table.

Table 3: Supported Formats and Resolutions in 4-Lane Mode

Format	Resolution	Frame Rate	Sync Mode
RG12	1920 x 1080	30	Enabled
	1920 x 1080	60	Disabled
	1280 x 720	30	Enabled

	1280 x 720	60	Disabled
RG10	1920 x 1080	120	Disabled
	1280 x 720	120	Disabled

The supported formats and resolutions for 2-lane mode in Jetson TX2™/Xavier™ is listed in below table.

Table 3: Supported Formats and Resolutions in 2-Lane Mode

Format	Resolution	Frame Rate	Sync Mode
RG12	1920 x 1080	30	Enabled
	1280 x 720	30	Enabled
	1920 x 1080	60	Disabled
	1280 x 720	60	Disabled

Master Device in Synchronized Mode

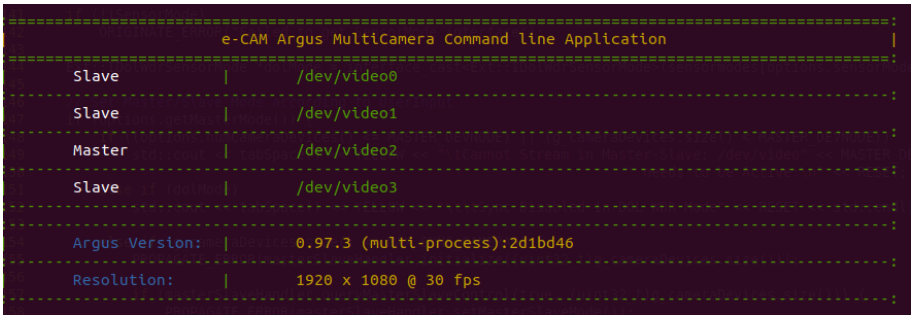
IMX290 camera module can be configured either a master or slave to stream the cameras in a synchronized manner. The camera module provides synchronization in which one camera acts as a master and the other cameras act as slave driven by the master's signal. By default, the application is set to stream in free-running mode. To enable synchronization using Master-Slave mode, run the following command.

```
$ eCAM_Argus_MultiCamera --MasterSlaveMode=<0/1>
```

or

```
$ eCAM_Argus_MultiCamera -m <0/1>
```

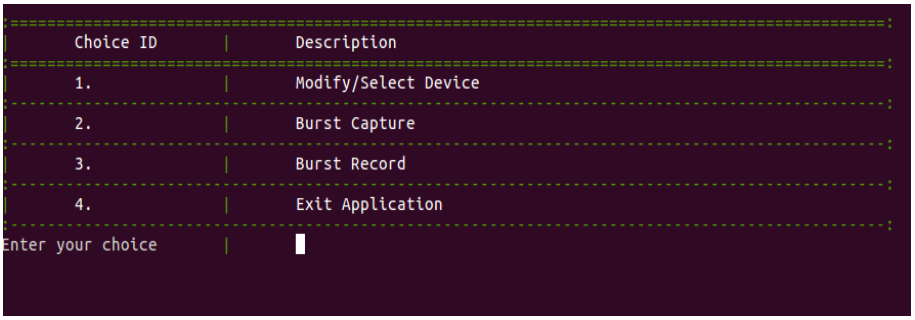
Here, **0** is to disable synchronization and **1** is to enable synchronization. If the application runs in Master-Slave mode, you can view the screen similar to the screen shown below.



Note: By default, video2 acts as Master. Selection of Master camera is not implemented in this release. If the number of devices is selected below video2, they will run in asynchronous mode.

Listing Features of Connected Device

After choosing the device ID, you can view the screen similar to the screen shown below.

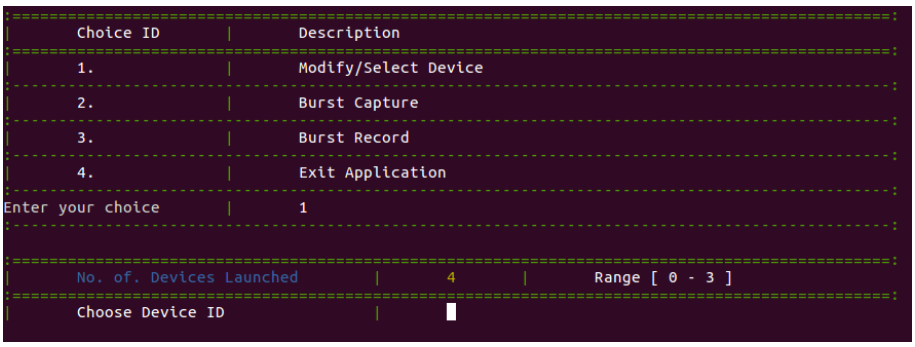


The options to change/modify/utilize the camera modules are as follows:

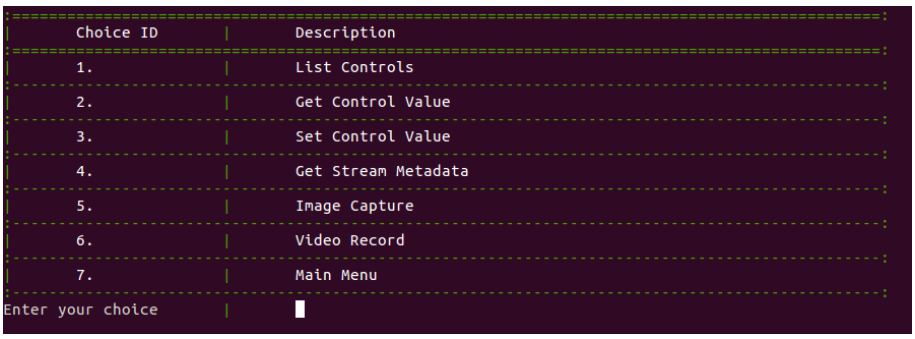
- Modify/Select Device
- Burst Capture
- Burst Record
- Exit Application

Modify/Select Device

When you enter the Choice ID to select the Modify/Select Device option, the Number of Devices Launched will be displayed with the range of input device ID. Enter the option for using the e-CAM20_CUXVR 4-lane quad camera setup, you can view the screen similar to the screen shown below.



Enter the option to select the required Device ID, and you can view the device specific options as shown below.



The device specific options are as follows:

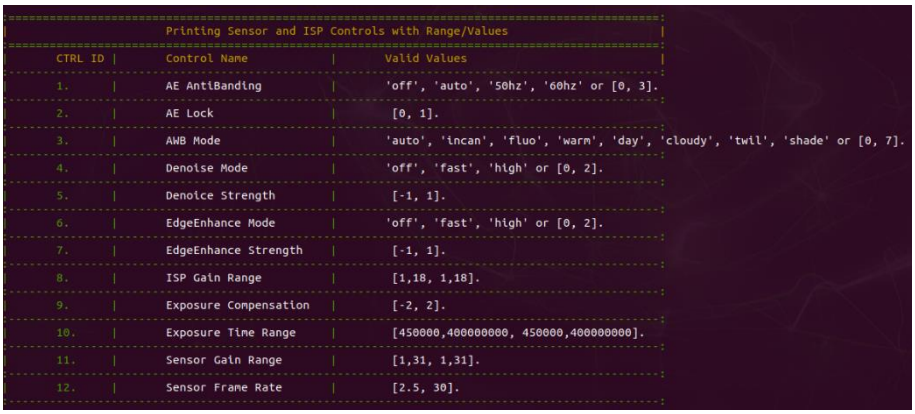
- List/Get/Set Controls
- Get Stream Metadata

- Image Capture
- Video Record
- Main Menu

You can choose the course of action on the selected device.

List/Get/Set Controls

Enter the Choice ID 1 to view the List Controls options. The List Controls option displays the number of controls enumerated in the selected device ID with the minimum and maximum values as shown below.



Printing Sensor and ISP Controls with Range/Values

CTRL ID	Control Name	Valid Values
1.	AE AntiBanding	'off', 'auto', '50hz', '60hz' or [0, 3].
2.	AE Lock	[0, 1].
3.	AWB Mode	'auto', 'incan', 'fluo', 'warm', 'day', 'cloudy', 'twil', 'shade' or [0, 7].
4.	Denoise Mode	'off', 'fast', 'high' or [0, 2].
5.	Denoise Strength	[-1, 1].
6.	EdgeEnhance Mode	'off', 'fast', 'high' or [0, 2].
7.	EdgeEnhance Strength	[-1, 1].
8.	ISP Gain Range	[1,18, 1,18].
9.	Exposure Compensation	[-2, 2].
10.	Exposure Time Range	[450000,400000000, 450000,400000000].
11.	Sensor Gain Range	[1,31, 1,31].
12.	Sensor Frame Rate	[2.5, 30].

When you enter Choice ID 2, the controls in the above figure will appear again followed with options to get the control value by choosing the control ID. To change the control value, you must enter Choice ID 3 instead of 2.

The list of controls are as follows:

- AE AntiBanding
- AE Lock
- AWB Mode
- Denoise Mode
- Denoise Strength
- Edge Enhance Mode
- Edge Enhance Strength
- ISP Gain Range
- Exposure Compensation
- Exposure Time Range
- Sensor Gain Range
- Frame Rate

The values of e-CAM20_CUXVR controls are shown in below table.

Table 4: Values of e-CAM20_CUXVR Controls

Controls	Valid Values	Default Value	Manual Control	Auto Control
AE AntiBanding	Off, auto, 50Hz, 60Hz or [0,3]	Auto	YES	YES
AE Lock	[0,1]	1	YES	NO
AWB Mode	auto, incan, fluo, warm, day, cloudy, twil, shade or [0,7]	Auto	YES	YES
Denoise Mode	Off, fast, high or [0,2]	Off	YES	NO
Denoise Strength	[-1,1]	-1	YES	NO
Edge Enhance Mode	Off, fast, high or [0,2]	Fast	YES	NO
Edge Enhance Strength	[-1, 1]	-1	YES	NO
ISP Gain Range	[1,18] to [1,18]	1,18	YES	YES
Exposure Compensation	[-2, 2]	0	YES	NO
Exposure Time Range	[450000,400000000] to [450000,400000000]	[450000,400000000]	YES	YES
Sensor Gain Range	[1,31] or [1,31]	[1,31]	YES	YES
Sensor Frame rate	2.5,60 (based on Sensor Mode and Sync Mode)	30	YES	NO

AE Antibanding

Enter the option 1 to view the AE Antibanding menu as shown below.

```
|       Choose the Control ID Number     |       1
|       Current AE Antibanding Mode      |       auto
|       Valid Control Values/Range       |       'off', 'auto', '50hz', '60hz' or [0, 3].
|       Enter User Control Value         |       2
|       Updated AE Antibanding Mode      |       50hz
```

The eCAM_Argus_MultiCamera application supports the AE anti-banding modes as follows:

- Auto
- 50Hz
- 60Hz

By default, the AE anti-banding mode is auto.

AE Lock

Enter the option 2 to view the AE Lock menu as shown below.

```
|       Choose the Control ID Number     |       2
|       Current AE Lock                  |       1
|       Valid Control Values/Range       |       [0, 1].
|       Enter User Control Value         |
```

When you select the AE Lock menu, it locks the exposure to current values. By default, the AE Lock is selected.

AWB Mode

Enter the option 3 to view the AWB Mode menu as shown below.

```
|       Choose the Control ID Number     |       3
|       Current AWB Mode                 |       auto
|       Valid Control Values/Range       |       'auto', 'incan', 'fluo', 'warm', 'day', 'cloudy', 'twil', 'shade' or [0, 7].
|       Enter User Control Value         |
```

The eCAM_Argus_MultiCamera application automatically detects the scene temperature and adjusts the white balance. You can also change the AWB modes with the help of the options provided by the eCAM_Argus_MultiCamera application.

The supported AWB modes are as follows:

- Auto
- Incandescent
- Fluorescent
- Warm Fluorescent
- Daylight
- Cloudy Daylight
- Twilight
- Shade

By default, the auto mode is selected.

Note: When the AWB Mode menu is set to auto mode and directly faced under a light source, sometimes the AWB causes a blue tint. To recover, change the camera position and place again.

Denoise Mode

Enter the option 4 to view the Denoise Mode menu as shown below.

```
|       Choose the Control ID Number     |       4
|       Current Denoise Mode             |       off
|       Valid Control Values/Range       |       'off', 'fast', 'high' or [0, 2].
|       Enter User Control Value         |       fast
|       Updated Denoise Mode             |       fast
```

You can select the required denoise modes, by entering the valid values or ranges. The eCAM_Argus_MultiCamera application supports the denoise modes as follows:

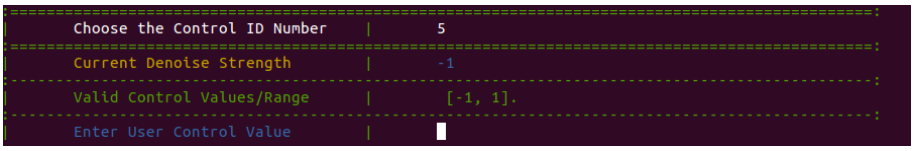
- Off
- Fast
- High Quality

The default denoise mode is fast.

Note: When the denoise mode is set to high quality, there is no significant difference due to the denoising capabilities in the current release.

Denoise Strength

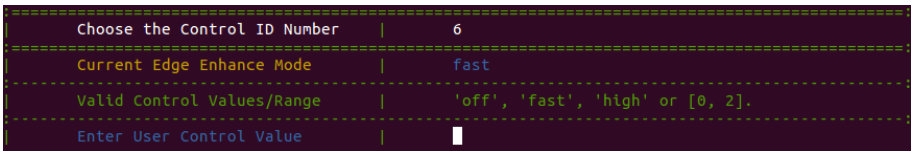
Enter the option 5 to view the Denoise Strength menu as shown below.



You can also change the denoise strength value from a minimum value of -1.0 to a maximum value of 1.0. The default denoise strength value is -1.0.

Edge Enhance Mode

Enter the option 6 to view the Edge Enhance Mode menu as shown below.



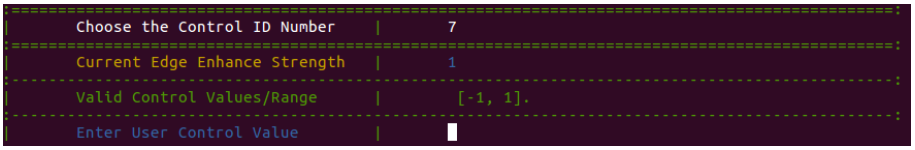
You can select the required edge enhance mode, by entering the valid values or ranges. The eCAM_Argus_MultiCamera application supports the edge enhance modes as follows:

- Off
- Fast
- High Quality

The default edge enhance mode is Fast.

Edge Enhance Strength

Enter the option 7 to view the Edge Enhance Strength menu as shown below.

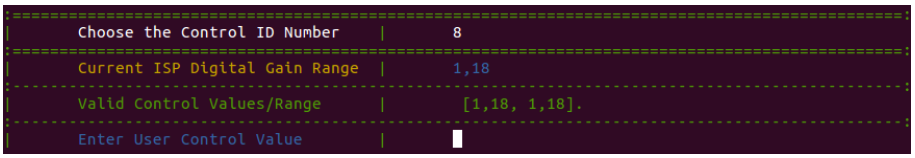


You can also change the edge enhance strength value from a minimum value of -1.0 to a maximum value of 1.0. The default edge enhance strength value is -1.0.

Note: There is not much difference in appearance while changing denoise and edge enhance parameters in this current L4T release. This feature may be supported in the later releases.

ISP Gain Range

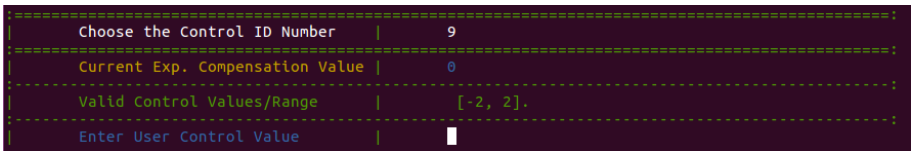
Enter the option 8 to view the ISP Gain Range menu as shown below.



The ISP gain value can be changed from a minimum value of 1 to a maximum value of 18. This gain corresponds to the digital gain additionally provided by the ISP (over and above the sensor gain) and the default value depends upon the luminance of the source. Jetson AGX Xavier™/TX2™ ISP can support a digital gain range of 1 to 256 (amplification factor) corresponding to roughly 0 to 48.16 dB. However, for each of the four cameras in e-CAM20_CUXVR, ISP gain has been restricted to 1 - 18 (amplification factor), including image quality and other performance metrics. To manually set the ISP digital gain to a specific value, you can set both the lower range value and the higher range value to that constant, specific value.

Exposure Compensation

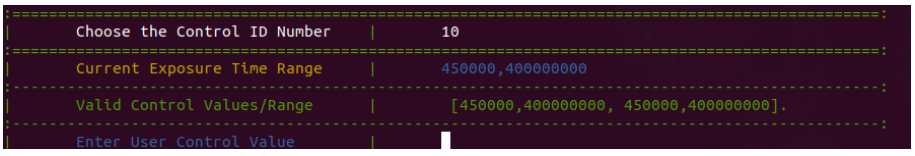
Enter the option 9 to view the Exposure Compensation menu as shown below.



The exposure compensation value can be changed from a minimum value of -2 to a maximum value of +2. The default exposure compensation value is set to 0.

Exposure Time Range

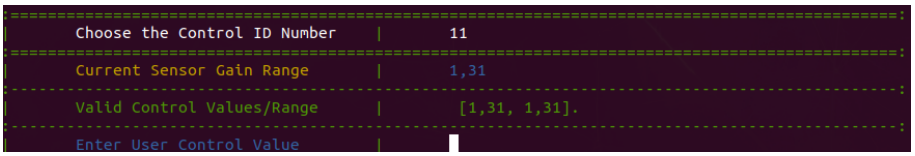
Enter the option 10 to view the Exposure Time Range menu as shown below.



The exposure time range can be changed from a minimum value of 450000 to a maximum value of 400000000 by manually entering the values. Here, the exposure time is denoted in nano seconds (ns) scale. The default exposure set by the application depends upon the luminance of the source. The exposure is controlled by the ISP. However, to set a specific exposure value, you can manually set both the lower and higher range fields to that same specific value.

Sensor Gain Range

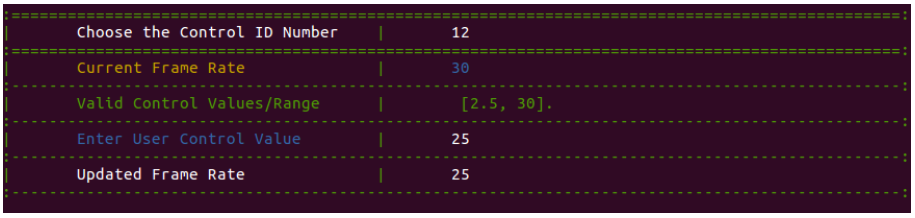
Enter the option 11 to view the Sensor Gain Range menu as shown below.



The sensor gain range can be changed from a minimum value of 1 to a maximum value of 31 which is represented in amplification factor. IMX290 can support a sensor gain range of 1 to 72 dB corresponding to roughly 0 to 3981.0717 (amplification factor). However, in each of the four IMX290 sensor based cameras used in e-CAM20_CUXVR, sensor gain has been restricted to sensor's analog gain, that is, 1 - 30 dB, including image quality and other performance metrics. The default gain value depends upon the luminance of the source. However, to set a specific constant sensor gain value, you can manually set both the lower and higher range fields to that same specific value.

Frame Rate

Enter the option 12 to view the Frame Rate menu as shown below.



The frame rate control can be changed from a minimum value of 1 to the maximum value specified by the sensor mode. The minimum frame rate is restricted to 2.5 fps as the maximum accessible exposure by libArgus is 400 ms.

Note: When the application is launched in synchronized mode, the frame rate control depends upon the master device. Changing the frame rate in master device affects all the remaining devices. The Frame Rate menu is disabled in slave devices.

To manually change the frame rate for individual cameras, you must launch the application in asynchronous mode.

Get Stream Metadata

The Get Stream Metadata option is provided to query the properties of the captured frame. The metadata contains the data as follows:

- Capture API ID
- AE Lock Status
- Frame Duration
- Stream Frame Rate
- ISP Digital gain

- Frame Readout time
- Frame Scene Luminance
- Sensor Gain
- Sensor Exposure Time
- Sensor ISO Sensitivity
- Sensor Timestamp

The stream metadata can be viewed in the terminal UI as shown below:

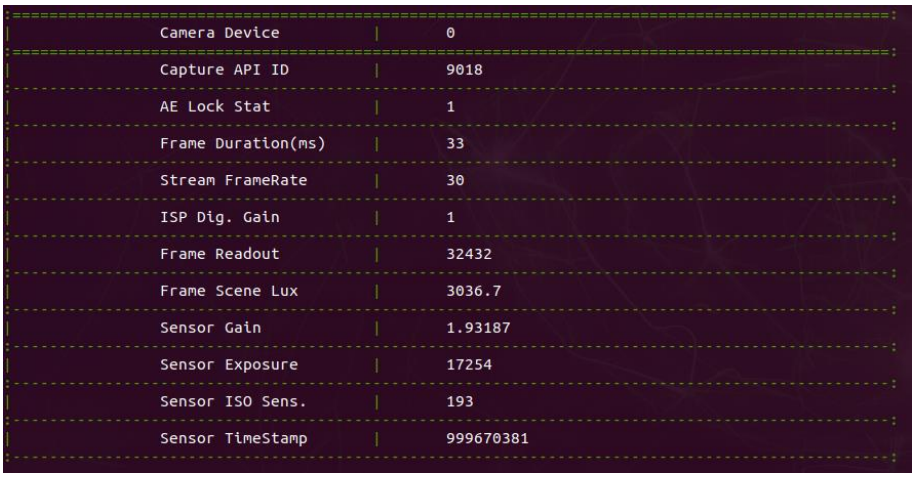
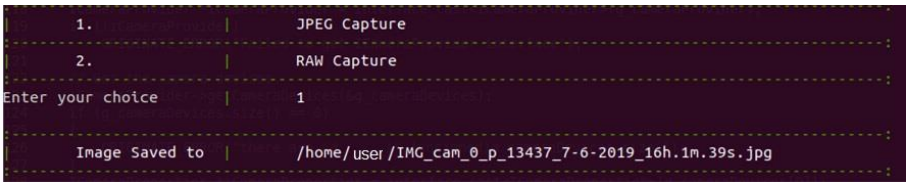


Image Capture

You can capture images from single camera device by entering the option 5 available along with the listing of camera devices. After entering the option, the format in which the image must be saved will be displayed as shown below.



The formats available to save the image are as follows.

- JPEG Capture
- RAW Capture

The format in which the images will be saved is mentioned below.

For example,

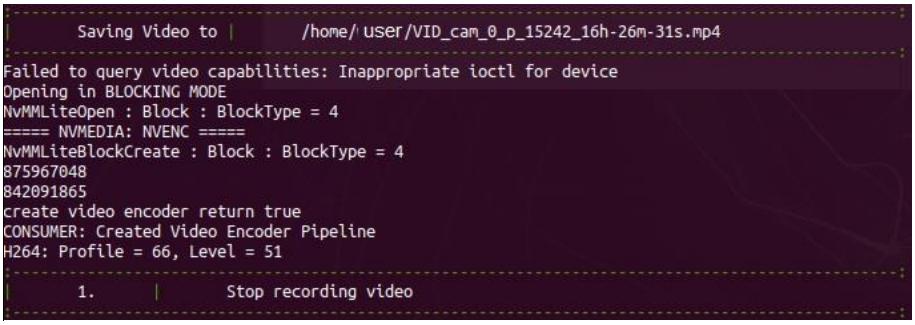
JPEG Image: /home/<username>/IMG_cam_<dev>_p_PID_DD-MM-YY_<time>.jpg

RAW Image: /home/<username>/IMG_cam_<dev>_p_PID_DD-MM-YY_<time>.nv12

Note: The RAW format mentioned refers to the uncompressed YUV planar format output from the ISP.

Video Record

You can record videos from a single camera by entering the option 6 available along with the listing of camera devices. After entering the option, the format in which the video must be recorded will be displayed as shown below.



Or

The supported video recording formats in this application are as follows:

- RAW Frame Dump
- H264 Encoded

The format in which the video recorded is mentioned below.

For example,

RAW: /home/<username>/VID_cam_<dev>_p_PID_<time>.raw

H264: /home/<username>/VID_cam_<dev>_p_PID_<time>.mp4

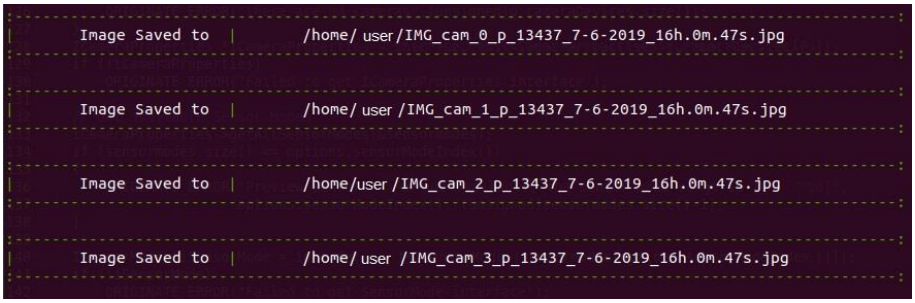
Note: When the RAW Frame Dump format is selected, the timer is restricted to 5 seconds and the video stream automatically closes.

Main Menu

Enter the option 7 to navigate to the main menu.

Burst Capture

The Burst Capture option helps to concurrently capture images from all the devices actively running on the application. When you select the Burst Capture option, you can view the supported formats to save images as shown below.



or

The supported formats to save images are as follows:

- JPEG Capture
- RAW Capture

The format in which the images will be saved is mentioned below.

For example,

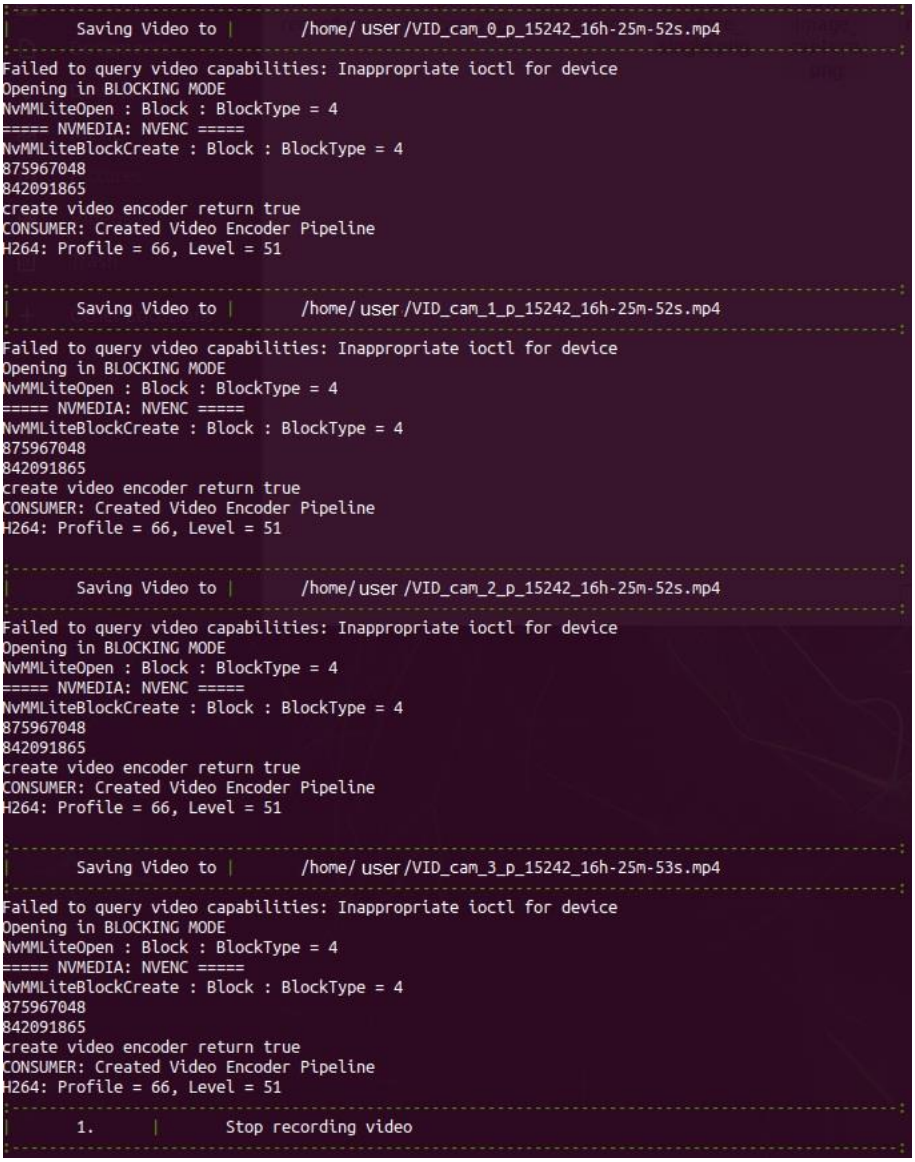
JPEG Image: /home/nvidia/IMG_cam_<dev>_p_PID_DD-MM-YYYY_<time>.jpg

RAW Image: /home/nvidia/IMG_cam_<dev>_p_PID_DD-MM-YYYY_<time>.nv12

Note: The RAW format mentioned refers to the uncompressed YUV planar format output from the ISP.

Burst Record

The Burst Record option helps to concurrently record H264 encoded videos from all the active devices running on the application. When you select the Burst Record option, you can view the screen similar to the screen shown below.



Note: The Burst Record option is disabled for 1080p at 60 fps, due to the encoder performance issue and this feature is only provided for 1080p and 720p at 30 fps.

Exit Application

Enter the Choice ID 4 to exit the application.

Troubleshooting

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

When one of the camera's frame rate is set to a lower value, why all the cameras preview frame rate become lower irrespective of synchronization?

When the preview is enabled, a common display renderer is used which handles a composite buffer to stream the cameras. This limitation causes the cameras preview frame rate to look similar.

For example, if there are three cameras connected having the exposure time as 30 ms and one camera is set to 100 ms, then the overall preview frame rate will be 10 fps.

Note: The application can be opened with preview disabled.

When the application run in Master-Slave/synchronize mode, the preview continuously flickers for one of the cameras?

The master camera's signals are used to drive the slave cameras. Ensure that the cables are intact and there is no interference in the cables. If the cables are not properly fixed, there might be a lot of frames out of synchronization.

When I capture a JPEG image and leave the application on free running for one or two hours, I am getting a JPEG encoder timeout?

This is known limitation. Once the JPEG encoder timeout occurs, the streaming will be fine. But when you try to capture an image, the application would hang.

To recover the application, you must kill the application and run the following command.

```
$ sudo service nvargus-daemon restart
```

Why there is no difference while changing edge enhancement and denoise options?

The current L4T release in Xavier™/TX2™ does not support edge enhancement and denoise options. This may be supported in the future release.

1. **Why I am not able to view the Burst Record option when I try to stream the camera in 60 fps mode?**

   There is a performance limitation which causes artifacts while trying to stream and record all four cameras simultaneously at 1080p 60 and 120 fps in Jetson Xavier™/TX2™. Therefore, e-con Systems have limited the burst record feature to 30 fps.

2. **Why the preview frame rate becomes slow when I record videos using camera? Why the recorded video plays very fast?**

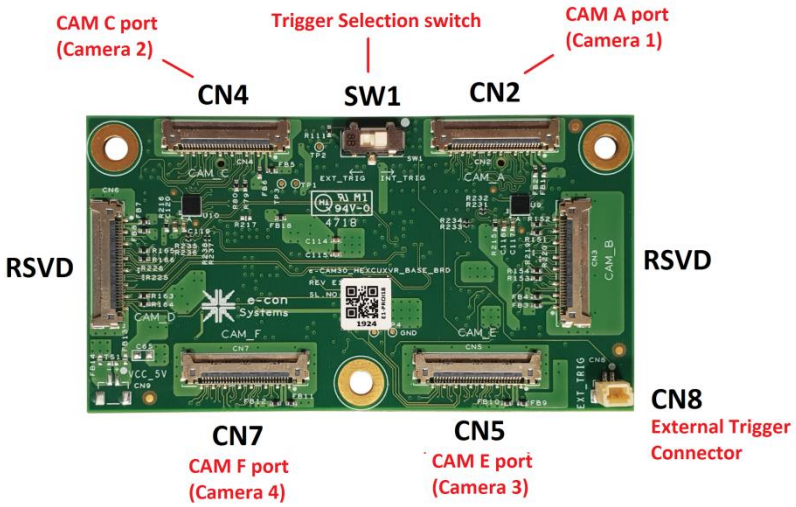
   You must run the following commands before opening the application.

```
$ sudo jetson_clocks
$ sudo /home/max-isp-vi-clks.sh
$ sudo nvpmodel -m 0
```

   If the required clock is not provided to the ISP and VI, the performance issues might occur while streaming and recording simultaneously.

3. **I bought either one or four cameras, can I connect in any available six camera connectors?**

   No, you must connect the four cameras to CAM A, CAM C, CAM E and CAM F ports. To connect the cameras to the respective ports, you can refer the following figure.



What's Next?

After understanding the usage of MultiCam application, you can refer to the *e-CAM20_CUXVR Release Notes* to understand more about e-CAM20_CUXVR.

Glossary

CMOS: Complementary Metal Oxide Semiconductor.

DTB: Device Tree Blob.

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

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

ISP: Image Signal Processor.

MIPI: Mobile Industry Processor Interface.

SSH: Secure Shell.

UYVY: YUV422 16-bit image format with UYVY ordering.

Support

Contact Us

If you need any support on e-CAM20_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	15-May-2019	Initial Draft	Camera Dev. Team
1.1	07-June-2019	Updated controls and added stream metadata	Camera Dev. Team
1.2	25-June-2019	Updated Troubleshooting	Camera Dev. Team
1.3	28-June-2019	Updated Video Record Section	Camera Dev. Team
1.4	09-July-2019	Modified for four-camera setup	Camera Dev. Team
1.5	29-July-2019	Added four camera setup support for Jetson TX2™	Camera Dev. Team
1.6	13-November-2019	New Release package structure and minor changes	Camera Dev. Team
1.7	27-January-2020	Updated mode tables for tx2/Xavier	Camera Dev. Team