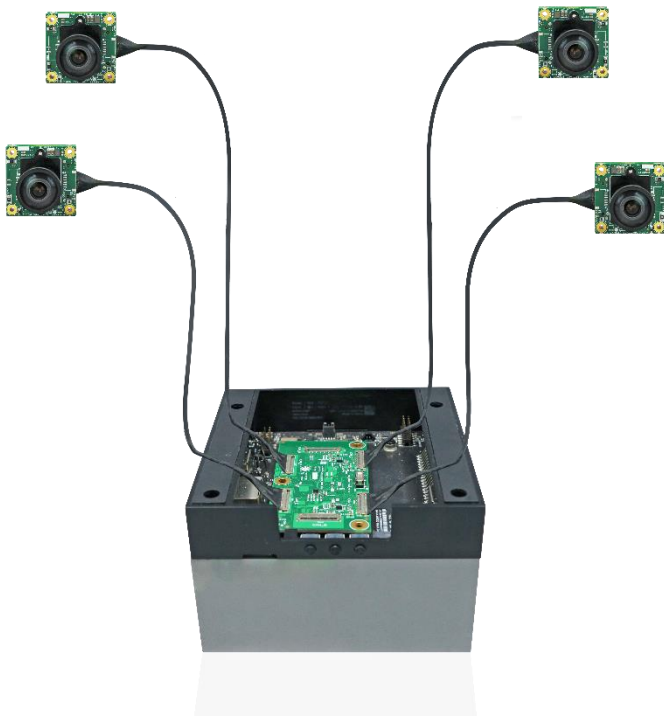


e-CAM56_CUOAGX

Application Note: Trigger Mode



e-con Systems

Think Camera. Think e-con.

Version 1.6

e-con Systems

3/22/2024

Disclaimer

e-con Systems reserves the right to edit/modify this document without any prior intimation of whatsoever.

Contents

INTRODUCTION TO E-CAM56_CUOAGX	3
DESCRIPTION	3
TRIGGER MODE	4
EXTERNAL TRIGGER SETUP FOR E-CAM56_CUOAGX	4
ENABLE TRIGGER FOR E-CAM56_CUOAGX	5
DESCRIPTION	8
TROUBLESHOOTING	9
FAQ	10
SUPPORT	11

Introduction to e-CAM56_CUOAGX

The e-CAM56_CUOAGX is a 5 MP MIPI, global shutter color camera from e-con Systems, a company with over two decades of experience in designing, developing, and manufacturing OEM cameras. The camera can be interfaced to the J509 camera connector of the NVIDIA® Jetson AGX Orin™ development kit.

The e-CAM56_CUOAGX is provided with S-mount lens holder. This color camera delivers RGB RAW10/RAW12 output. The supported resolutions and frame rates are listed in the below table.

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

Resolution	Frame rate/s RAW 10-bit Output	Frame rate/s RAW 12-bit Output
2432 x 2048	79	67
1920 x 1080	142	121
1280 x 720	202	172
640 x 480	280	240

Description

This application note concentrates on the working of external trigger of the e-CAM56_CUOAGX.

The e-CAM56_CUOAGX offers the ability to synchronize the start of the exposure of the frame with this triggering action.

Trigger Mode

The e-CAM56_CUOAGX supports external trigger functionality for camera streaming in trigger mode through CN8 connector.

External Trigger Setup for e-CAM56_CUOAGX

The steps to setup the external trigger setup for the e-CAM56_CUOAGX are as follows:

1. Connect the cable (A02SR02SR30K152A) to the trigger source, pin 1 (for trigger) and pin 2 (for ground).

Note: The external trigger input cable (A02SR02SR30K152A) is not a part of e-con systems deliverables. Please plan on your own if testing requires with an external trigger as an input trigger. Reference cable image shows in *Figure 1*.

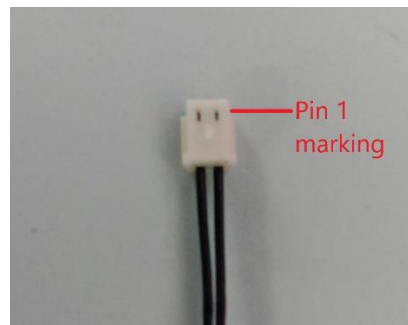


Figure 1: 1 to 1 Mating Cable

2. Connect the Pin 1 of the cable to the Pin 1 of the CN8 connector of e-CAM56_CUOAGX base board as shown in the below figure 2.



Figure 2: Before Connecting 1 to 1 Mating Cable

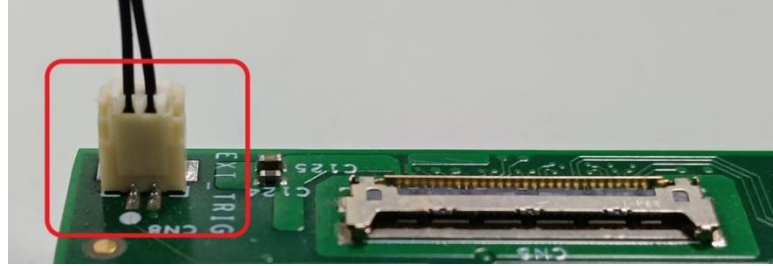


Figure 3: After Connecting 1 to 1 Mating Cable

Warning: Make sure the trigger (Pin1) and ground (Pin2) pins are connected to the respective pins of the connector CN8. Otherwise, it may cause the damage to the board.

3. After connecting the cable with the trigger source, move the switch **SW1** to external trigger (EXT_TRIG) side position. Refer the below image for the switch position.



Figure 4: External trigger switch position in e-CAM56_CUOAGX Base board

Enable Trigger for e-CAM56_CUOAGX

The trigger mode of the sensor can be enabled or disabled using the v4l2-ctl command or Trigger control in eCAM_argus_camera application. For Trigger control details please refer “e-CAM56_CUOAGX_eCAM_Argus_Camera_App_User_Manual_Rev_<ver>.pdf”

To check available camera controls of the e-CAM56_CUOGAX run the below command in the terminal,

```
$ v4l2-ctl -L
```

```

group_hold 0x009a2003 (bool) : default=0 value=0 flags=execute-on-write
hdr_enable 0x009a2004 (intmenu): min=0 max=1 default=0 value=0
0: 0 (0x0)
1: 1 (0x1)
fuse_id 0x009a2007 (str) : min=0 max=6 step=2 value='' flags=read-only, has-payload
sensor_mode 0x009a2008 (int64) : min=0 max=2 step=1 default=0 value=0 flags=slider
gain 0x009a2009 (int64) : min=0 max=240 step=1 default=1 value=0 flags=slider
exposure 0x009a200a (int64) : min=449 max=400000 step=1 default=14925 value=449 flags=slider
frame_rate 0x009a200b (int64) : min=2500000 max=67000000 step=1 default=67000000 value=2500000 fl
trigger 0x009a200f (bool) : default=0 value=0 flags=execute-on-write
trigger_frequency 0x009a2010 (intmenu): min=0 max=1 default=0 value=0
0: 30 (0x1e)
1: 60 (0x3c)
bypass_mode 0x009a2064 (intmenu): min=0 max=1 default=0 value=0
0: 0 (0x0)
1: 1 (0x1)
override_enable 0x009a2065 (intmenu): min=0 max=1 default=0 value=0
0: 0 (0x0)
1: 1 (0x1)
height_align 0x009a2066 (int) : min=1 max=16 step=1 default=1 value=1
size_align 0x009a2067 (intmenu): min=0 max=2 default=0 value=0
0: 1 (0x1)
1: 65536 (0x10000)
2: 131072 (0x20000)
sensor_signal_properties 0x009a2069 (u32) : min=0 max=4294967295 step=1 default=0 [30][18] flags=read-only, h
sensor_image_properties 0x009a206a (u32) : min=0 max=4294967295 step=1 default=0 [30][16] flags=read-only, h
sensor_control_properties 0x009a206b (u32) : min=0 max=4294967295 step=1 default=0 [30][44] flags=read-only, h
sensor_dv_timings 0x009a206c (u32) : min=0 max=4294967295 step=1 default=0 [30][16] flags=read-only, h
low_latency_mode 0x009a206d (bool) : default=0 value=0
preferred_stride 0x009a206e (int) : min=0 max=65535 step=1 default=0 value=0
sensor_modes 0x009a2082 (int) : min=0 max=30 step=1 default=30 value=2 flags=read-only

```

Figure 5: v4l2 controls list

Note: By default, trigger mode of the e-CAM56_CUOAGX is disabled.

To check the trigger control value, run the below command.

```
$ v4l2-ctl -L | grep "trigger"
```

```
trigger 0x009a200f (bool) : default=0 value=0 flags=execute-on-write
```

Figure 2: v4l2 control for trigger

The external trigger can be enabled by running v4l2-ctl command with the **trigger control** value to 1 using the below command.

```
$ v4l2-ctl -c trigger=1
```

During the trigger mode, the sensor will be waiting for an external trigger pulse. To start streaming, the trigger signal with minimum of 2V logic high to low falling edge pulse should be given to the pin1 of CN8 connector of the e-CAM56_CUOAGX base board.

The input trigger pulse frequency decides the frame rate of the camera and the low pulse width of the input trigger signal decides the exposure time of the camera.

For example, if a user wants to stream the camera in 2432x2048 @20fps with 20ms exposure, the user needs to provide the input trigger pulse of 20Hz with 20ms low pulse time.

The timing diagram for the above example is shown below.

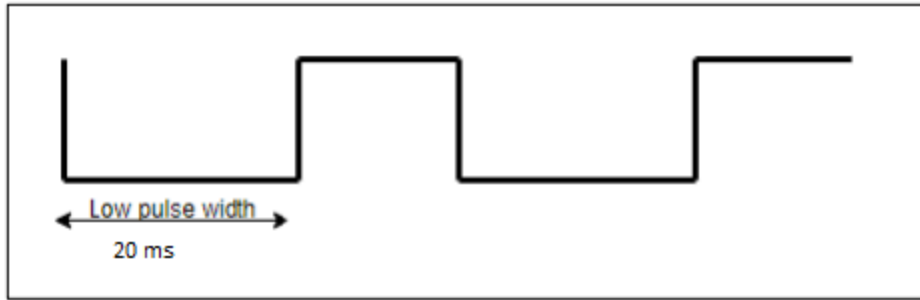


Figure6: trigger pulse timing diagram

The input trigger frequency should be less than or equal to the streaming resolution's maximum frame rate.

Example: For 2432*2048 resolution maximum supported FPS is 67 in 12-bit mode. So, user must give input period less than or equal to 67 HZ.

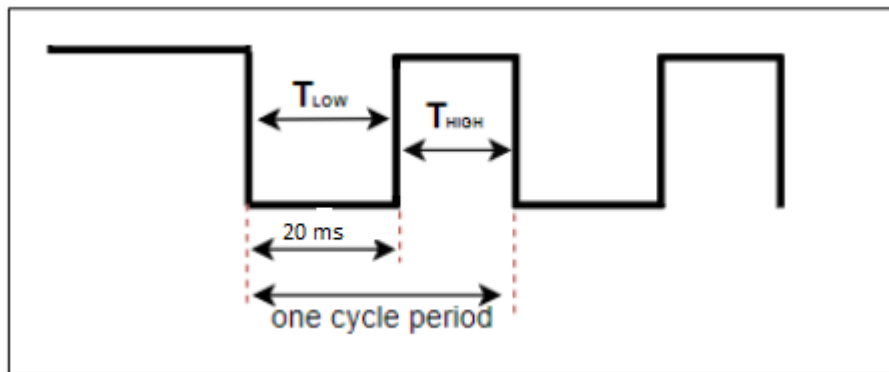


Figure7: Timing diagram for Exposure trigger

One cycle period = $1 / (\text{Number of frames per second})$.

T_{LOW} = Required exposure time.

T_{HIGH} = One cycle period – T_{LOW} .

Table 2: Timing diagram parameters

Description	Symbol	Min	Max	unit
Pulse width	$T_{LOW} + T_{HIGH}$	1	-	ms

Note: We have tested the minimum exposure time up to 10ms.

To capture the frames in trigger mode using v4l2-ctl follow the below command.

```
$ v4l2-ctl --stream-mmap -v
width=2432,height=2048,pixelformat='RG12' -c
bypass_mode=0 -c trigger=1 --stream-count=1 --stream-
to=<file_name>
```


Description

This section describes about the pin description of e-CAM56_CUOAGX.

In trigger mode, the TRIG pin of the GPIO header in the camera is used for input trigger pulse.

The pin-out details of adaptor board trigger connector (CN8) are listed in the below table.

Table 3: Pin-out Details of Adaptor Board Trigger Connector

CN8 Pin No	Signal Name	Pin Type	Description
1*	TRIGGER	INPUT	3.3V I/O trigger input to the camera
2	GND	POWER	Ground signal for digital and analog

***Note on TRIG Pin:** If external trigger is enabled, the trigger pulses must be provided to this pin to get the frames. Pin 1 of CN8 is used to control the exposure time of the frame. The voltage levels of high and low logic of pins are listed in the below table.

Table 4: Pin Voltage Levels

Symbol	Parameter	Min	Typical	Max	Unit
V _{IL}	Input voltage LOW	-	-	0.8	V
V _{IH}	Input voltage HIGH	2	-	3.3	V

For example, to stream e-CAM56_CUOAGX camera at 30fps in trigger mode, the input trigger frequency should be 30Hz and to get an exposure time of 10ms, the low pulse period of the input trigger shall be nearer to 10ms.

Troubleshooting

1. **What to do when stream got stuck when streaming with eCAM_argus_camera application and the trigger is disconnected and connected again**

This is a known limitation. To recover the application, run the following command.

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

FAQ

1. What voltage is required for the trigger input?

The trigger input requires a voltage range of 2V to 3.3V.

2. In which state does the trigger operate, High or Low?

Normally, the trigger should be held in a HIGH state. To start exposing, the trigger signal must be maintained in the LOW state according to the required exposure time.

Contact Us

If you need any support on e-CAM56_CUOAGX 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.econsystems.com/warranty.asp>

Revision History

Rev	Date	Description	Author
1.0	22-Aug-2023	Initial Draft	Camera Dev Team
1.1	29-Sep-2023	Updated 1-1 mating cable details	Camera Dev Team
1.2	20-October-2023	Updated with 2-lane configuration and new resolution 2432x2048	Camera Dev Team
1.3	31-October-2023	Updated the trigger setup and v4l2 control details	Camera Dev Team
1.4	16-November-2023	Updated the supported resolutions and v4l2 controls list	Camera Dev Team
1.5	10-March-2024	2Lane MIPI support removed	Camera Dev Team
1.6	22-March-2024	Updated product image in home page	Camera Dev Team