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See3CAM_CX3RDK_e-CAM59CX3

Application User Manual

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See3CAM_CX3RDK_e-CAM59CX3

1 Revision History

Rev No	Date	Major Changes	Author
Initial Draft	05-September-2013	Initial Draft	Shanthakumar
1.1	06-September-2013	Reviewed and added changes	Subbarao
1.2	10-October-2013	Added new features	Shanthakumar
1.3	10-March-2014	Added Changes	Shanthakumar
1.4	07-July-2014	Added Changes on Section 2	Shanthakumar



2 Introduction

Denebola (See3CAM_CX3RDK) is a USB3.0 UVC Reference Design Kit (RDK) developed by e-con Systems using the EZ-USB® CX3 USB3.0 Peripheral controller from Cypress Semiconductors. The Cypress EZ-USB® CX3 is a USB 3.0 peripheral controller that enables developers to add USB 3.0 connectivity to any image sensors compliant with Mobile Industry Processor Interface (MIPI) Camera Serial Interface Type 2 (CSI-2) standard. The Denebola Reference Design Kit developed using EZ-USB® CX3 is a complete Reference Design Kit and has OmniVision OV5640 CMOS image sensor interfaced to it through 2-lane MIPI CSI-2 interface. This is a fully functional camera reference design kit that can stream uncompressed 720p60, 1080p30 and full 5MP@15fps. e-con Systems, a Silver level partner of Cypress Partner program, has developed the reference design kit for EZ-USB® CX3 from Cypress Semiconductors and this kit can be purchased directly from our webstore.

Based on the proven EZ-USB FX3 Platform, CX3 comes with an ARM9 CPU and 512KB SRAM that provides 200 MIPS of computational power. The CX3 supports MIPI CSI-2 version 1.01, up to 4 data lanes with data speed up to 1Gbps per lane, for a total bandwidth of 4 Gbps. CX3 is ideally suited for high-definition or high-speed image-capturing applications. CX3 supports multiple peripheral interfaces such as I2C, SPI, and UART, which can be programmed to support Pan, Tilt and Zoom or other camera control functions.

Denebola RDK is a two-board solution containing base board designed around Cypress CX3 USB3.0 Peripheral controller and the Camera daughter board (part number: e-CAM59CX3) designed using OmniVision OV5640 CMOS image sensor based Autofocus camera module. E-con also plans to support multiple camera sensor daughter boards in the future that can be used to evaluate CX3 performance and also other CMOS Image sensors.

See3CAM_CX3RDK with e-CAM59CX3 is a UVC compliant device and does not require any drivers to be installed on the PC. The native UVC drivers of Windows, Mac and Linux Operating Systems shall be compatible with this camera. E-con also provides the sample application that demonstrates some of the features of this camera. However, this camera can be utilized any DirectShow application such as Skype etc.

3 Scope

e-con provides a sample DirectShow application, called e-CAMView, along with the See3CAM_CX3RDK. The e-CAMView is a typical DirectShow camera application, but customized to demonstrate the features of See3CAM_CX3RDK. This document describes these features of this sample camera application when it is used with See3CAM_CX3RDK.

4 Description

The See3CAM_CX3RDK with e-CAM59CX3 is a USB 3.0 device capable of streaming camera frames VGA @ 60 fps, 720p @ 60 fps, 1080p @ 30fps and 5MP @ 15 fps when connected to USB3.0 host port by leveraging the full throughput of USB3.0. It also supports all the features with a USB 2.0 fallback. However, in USB 2.0, See3CAM_CX3RDK with e-CAM59CX3 can stream only in VGA resolution and at about 30 fps only.



The See3CAM_CX3RDK with e-CAM59CX3 has the following UVC camera controls,

- Brightness
- Contrast
- Hue
- Saturation
- Sharpness
- White Balance (Manual and Automatic)
- Exposure (Manual and Automatic)
- Focus (Manual and Automatic)

All these controls can be controlled using the e-CAMView application which will be explained in the further sections.

This document explains the following things.

- Selecting the supported preview resolutions.
- Selecting the still image resolution.
- Capturing still images.
- Using supported controls.

5 Pre-Requisites

This section describes the high level instructions to install the See3CAM_CX3RDK on a PC. Please refer the Getting Started manual for more detailed installation steps and pictures of the same.

5.1 Installation of the See3CAM_CX3RDK and Drivers

Follow the following steps to initialize the device with the host computer

- Connect the one end of the USB 3.0 cable to the USB 3.0 connector provided at the side of See3CAM_CX3RDK and connect the other end to the USB 3.0 host controller on the computer.
- Move the power switch to on position,
- Once Switched ON, the LED light on the device will glow indicating that See3CAM_CX3RDK is powered up and ready to use.
- As See3CAM_CX3RDK is a generic USB Video Class device windows will automatically detect all the drivers and will be installed. This happens for the first time and from the second time device will be detected immediately by the host PC and will be ready for use.
- To see the preview the e-CAMView application designed for See3CAM_CX3RDK has to be installed. The installation steps are given in the **section 5. Installation of e-CAMView** of the **e-CAMView Installation Manual for See3CAM_CX3RDK_e-CAM59CX3** document.



6 Using e-CAMView

To launch the video streaming and capture application e-CAMView click on the **Start -> All Programs -> e-con Systems -> e-CAMView**.

This version of e-CAMView comes with a set of features that can be used to attain the full functionality of See3CAM_CX3RDK. The Menu bar at the top contains few menu items and the lower status bar shows some information. When the application is running, the current preview resolution and the frame rate are displayed in the lower status bar. The following sections describe each of the menu items in detail.

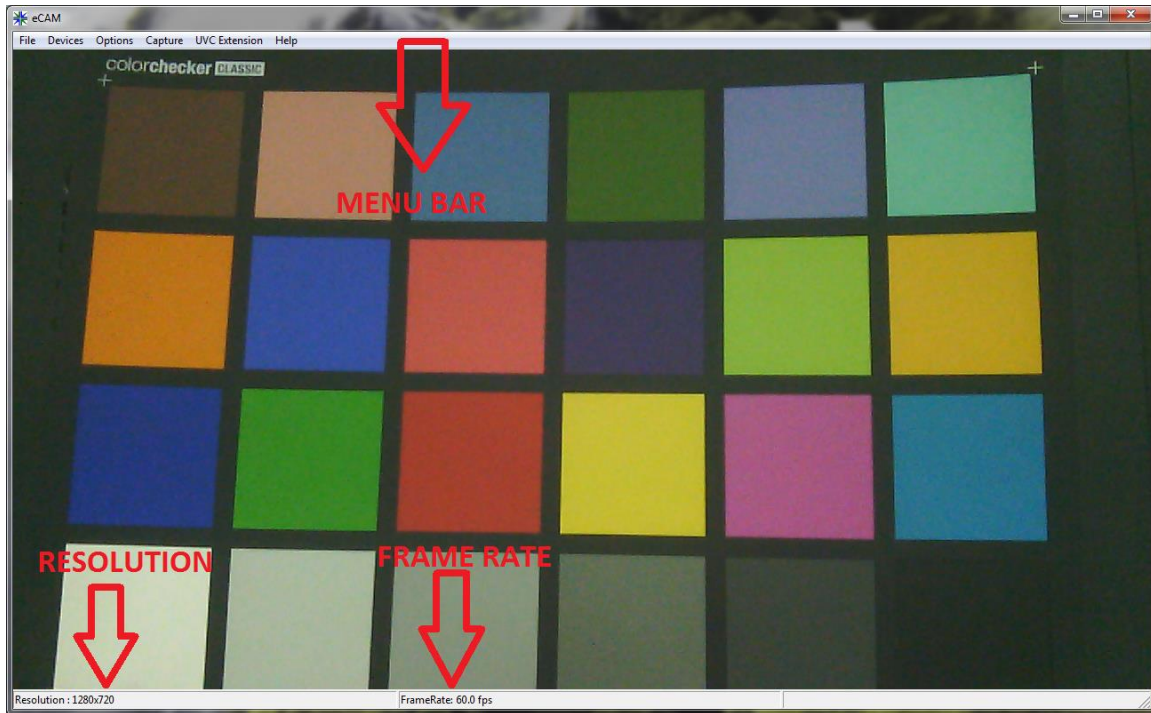


Figure 1: Application launch appearance



6.1 Devices Menu

Devices menu will show the currently connected video devices to host PC and the user can select any video devices attached to the computer. A check mark is placed before the device indicating the video device which is currently streaming. By default See3CAM_CX3RDK with e-CAM59CX3 will be indicated by the name **e-con's CX3 RDK with OV5640**. In case any other video device is connected such as on-board webcam etc., the e-CAMView shall list down those video capture devices as well and the user can switch between the available video capture devices, by selecting the respective device.

There is no audio capture source available with the See3CAM_CX3RDK. The following menu shows only our camera being listed in the Devices menu.

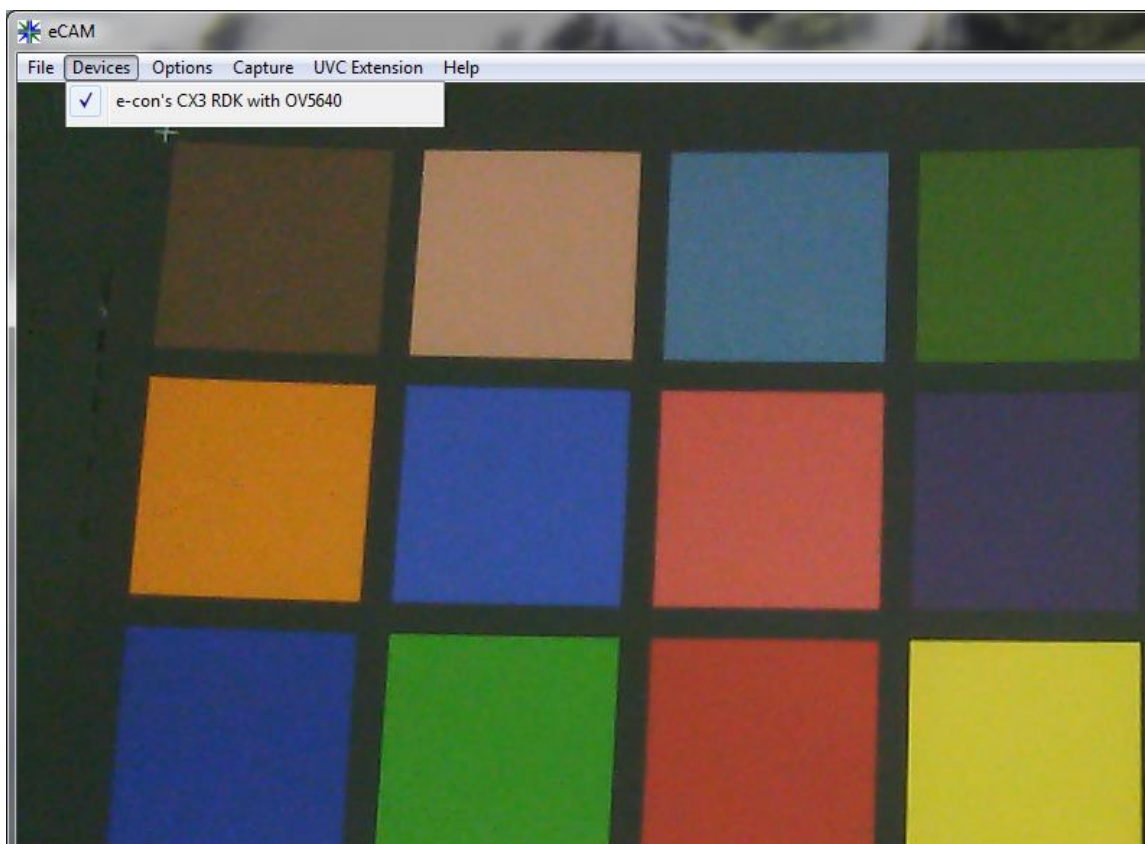


Figure 2: Enumerated Devices list



6.2 Options Menu

The options menu can be used to select the various preview and image resolutions and the controls that are supported by See3CAM_CX3RDK. When clicked the options menu will appear as shown in the snapshot below.

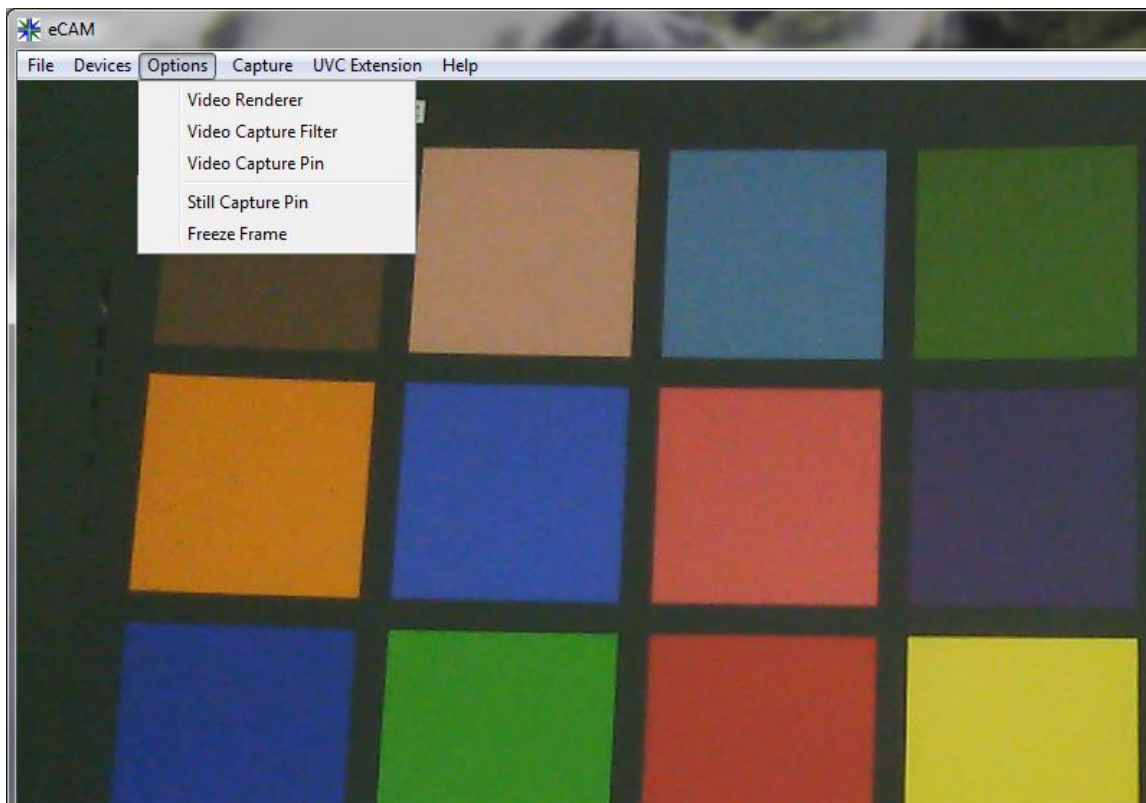


Figure 3: Options Menu

From this Options menu the following options can be selected

- **Video Capture Filter** – to change brightness, contrast, saturation, sharpness, white balance, focus, exposure.
- **Video Capture Pin** – to select various video preview resolutions supported by the device.
- **Still Capture Pin** – to select various still image resolutions supported by the device.

The details of each of these options are described below:



6.2.1 Video Capture Filter

The Video Capture Filter submenu of the Options Menu can be used to configure some of the camera parameters of See3CAM_CX3RDK with e-CAM59CX3. Currently the See3CAM_CX3RDK with e-CAM59CX3 supports brightness, contrast, hue, saturation, sharpness control, white balance control and manual exposure. The user can choose the values of these controls of the See3CAM_CX3RDK with e-CAM59CX3.

The various controls that are supported by See3CAM_CX3RDK with e-CAM59CX3 are

- Brightness Control
- Contrast Control
- Hue Control
- Saturation Control
- Sharpness Control
- White Balance Control (Auto & Manual)
- Focus (Auto & Manual)
- Exposure Control (Auto & Manual)

The brightness, contrast, hue, saturation, sharpness, white balance controls are available in the **Video Proc Amp**. The focus, exposure controls are available **Camera Control** tab.

The **Default** button in the tab is used to select the default inbuilt values of all the controls for the See3CAM_CX3RDK with e-CAM59CX3.

Note: Controls other than brightness, contrast, hue, saturation, sharpness, white balance, exposure, focus are not supported and hence cannot be used.

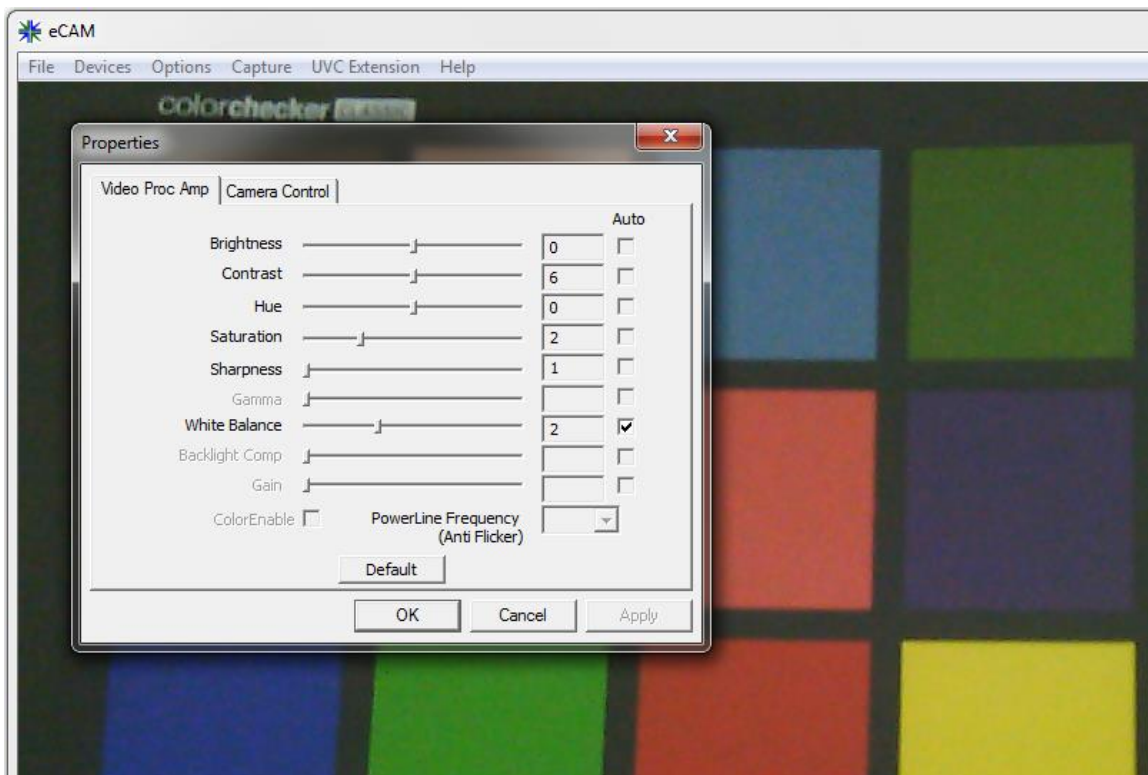


Figure 4: Video Proc Amp properties



6.2.1.1 Brightness Control

The Brightness values can be changed from a minimum value of -6 to +6 by moving the slider, and the exact changes will be reflected immediately in the preview. This brightness control increases the brightness of See3CAM_CX3RDK with e-CAM59CX3. The Default value is 0.

6.2.1.2 Contrast Control

The Contrast values can be changed from a minimum value of 0 to 12 by moving the slider, and the exact changes will be reflected immediately in the preview. This Contrast control increases the Contrast of See3CAM_CX3RDK with e-CAM59CX3. The Default value is 6.

6.2.1.3 Hue Control

The Hue values can be changed from a minimum value of -120 to 120 by moving the slide bar, and the exact changes will be reflected immediately in the preview. This Hue control increases the Hue of the See3CAM_CX3RDK with e-CAM59CX3. The Default value is 0.

6.2.1.4 Saturation Control

The Saturation values can be changed from a minimum value of 0 to 8 by moving the slider, and the exact changes will be reflected immediately in the preview. This Saturation control increases the Saturation of See3CAM_CX3RDK with e-CAM59CX3. The Default value is 4.

6.2.1.5 Sharpness Control

The Sharpness values can be changed from a minimum value of 1 to 5 by moving the slider, and the exact changes will be reflected immediately in the preview. This Sharpness control increases the Sharpness of See3CAM_CX3RDK with e-CAM59CX3. The Default value is 1.

6.2.1.6 WhiteBalance Control

The Manual White Balance can be selected by uncheck the check box near the white balance control. The Manual White Balance values can be changed from a minimum value of 1 to 4 by moving the slider, and the exact changes will be reflected immediately in the preview. The Default value is 2.

The Auto WhiteBalance can be selected by selecting the check box near the white balance control. In the manual white balance mode, few preset modes are supported.

The Manual White Balance modes supported are,

- Daylight
- Incandescent
- Fluorescent
- Cloudy



6.2.1.7 Focus Control – Manual

The See3CAM_CX3RDK with e-CAM59CX3 supports manual focus control which can be controlled using the Camera Control tab of the Video Capture Filter submenu. The Manual focus can be selected by uncheck the check box near the focus control. The Manual Focus values can be changed from a minimum value of 0 to 250 by moving the slider, and the exact changes will be reflected immediately in the preview. This Manual Focus control changes the focus lens position of See3CAM_CX3RDK with e-CAM59CX3. The Default value is 0.

6.2.1.8 Focus Control – Auto

The See3CAM_CX3RDK with e-CAM59CX3 supports Auto focus control which can be controlled using the Camera Control tab of the Video Capture Filter submenu. The Auto Focus can be selected by selecting the check box near the focus control. This Auto Focus control changes the focus lense position automatically for providing the focused preview.

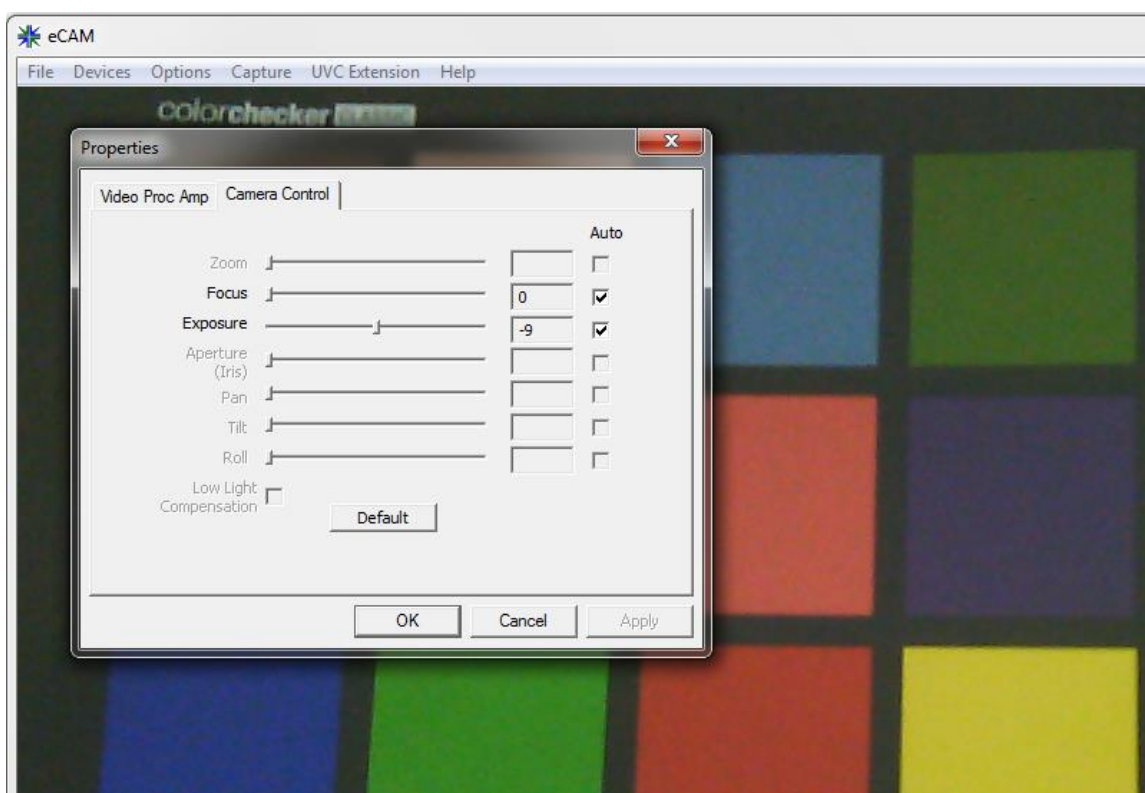


Figure 5: Camera Control



6.2.1.9 Exposure Control – Manual

The See3CAM_CX3RDK with e-CAM59CX3 supports manual exposure control which can be controlled using the Camera Control tab of the Video Capture Filter submenu. The Manual Exposure can be selected by uncheck the check box near the Exposure control. The Manual Exposure values can be changed from a minimum value of -13 to -5 by moving the slider, and the exact changes will be reflected immediately in the preview. This Manual Exposure control increases the Exposure of See3CAM_CX3RDK with e-CAM59CX3. The Default value is -9.

6.2.1.10 Exposure Control – Auto

The See3CAM_CX3RDK with e-CAM59CX3 supports Auto exposure control which can be controlled using the Camera Control tab of the Video Capture Filter submenu. The Auto Exposure can be selected by selecting the check box near the exposure control. This Auto Exposure control changes the exposure automatically.



6.2.2 Video Capture Pin

The Video Capture Pin is the submenu of the Options Menu and it is used to select the various supported resolutions by See3CAM_CX3RDK with e-CAM59CX3.

- To change the resolution the user can select any one of the resolutions from the **Output Size** list box.
- To change the color format of the preview the user can select one of the color formats from the **Color Space / Compression** list box. The See3CAM_CX3RDK with e-CAM59CX3 supports only YUV color format.

The frame rate supported by the current resolution will appear in the **Frame Rate** text box.

Currently See3CAM_CX3RDK with e-CAM59CX3 supports only **YUV2** color format and in this format four resolutions are supported in USB3.0 and one resolution is supported in USB2.0;

- 640 x 480 at 60 fps in USB 3.0 and 30 fps in USB 2.0.
- 1280 x 720 at 60 fps in USB 3.0.
- 1920 x 1080 at 30fps in USB 3.0.
- 2592 x 1944 at 15 fps in USB 3.0.

Note1: While changing the preview resolution, the preview will be stopped and resume once again when the resolution is selected and the **OK** button is pressed.

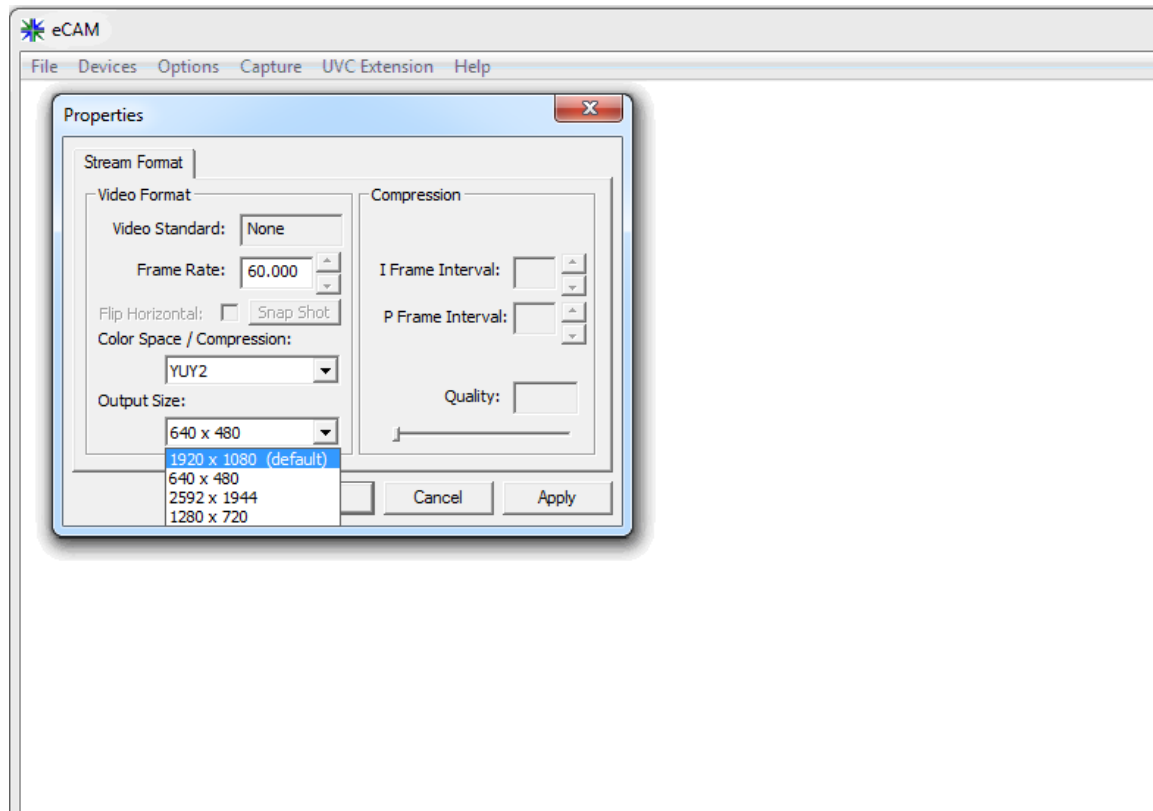


Figure 6: Video Capture Pin



6.2.3 Still Capture Pin

The Still Capture Pin submenu of the Options Menu is used to select the various resolutions supported by See3CAM_CX3RDK with e-CAM59CX3 for taking still images. One of the important features of See3CAM_CX3RDK with e-CAM59CX3 is that a still image of any resolution can be taken from any preview resolution. The e-CAMView application will save the images in **Bitmap(.bmp)** format in the user specified location.

- To change the resolution the user can select any one of the resolutions from the **Output Size** list box.
- To change the color format of the preview the user can select one of the color formats from the **Color Space / Compression** list box.

The See3CAM_CX3RDK with e-CAM59CX3 supports only YUV2 color format and in this format only one resolution is supported.

- 2592 x 1944.

Note1: While changing the still image resolution, the preview will be stopped and resume once again when the resolution is selected and the **OK** button is pressed.

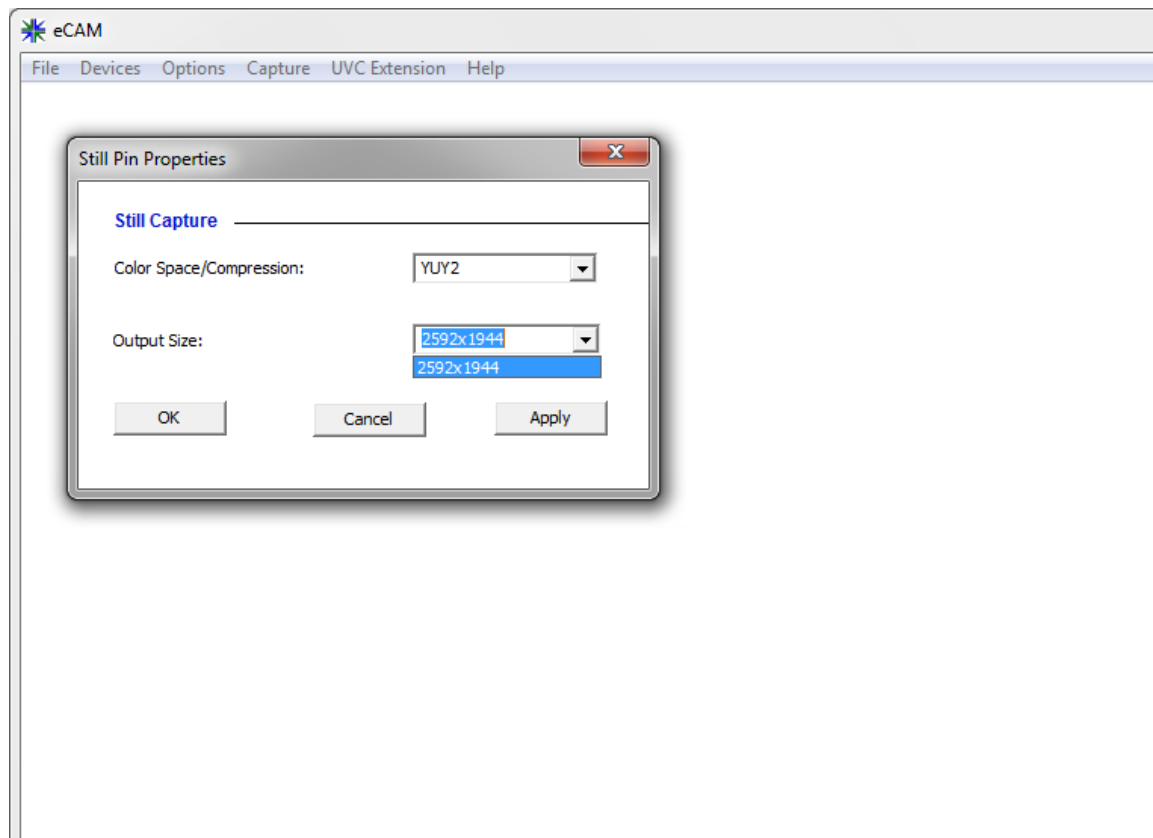


Figure 7: Still capture pin



6.3 Capture Menu

The Capture Menu is used to capture the image by using the e-CAMView application. It can also be used to select the Still image capture path where the images will be saved. By default the e-CAMView will set the Desktop as the image storage path for easy access, but the user can change to any location by using the still path option.

To take an image the user can either click the **Get Still** option or press the **Enter** key of the keyboard with the e-CAMView application being in focus. The image will be captured and stored in the location specified by the user. The image resolution and format shall be as per the selection made by the user during the Still Pin configuration page.

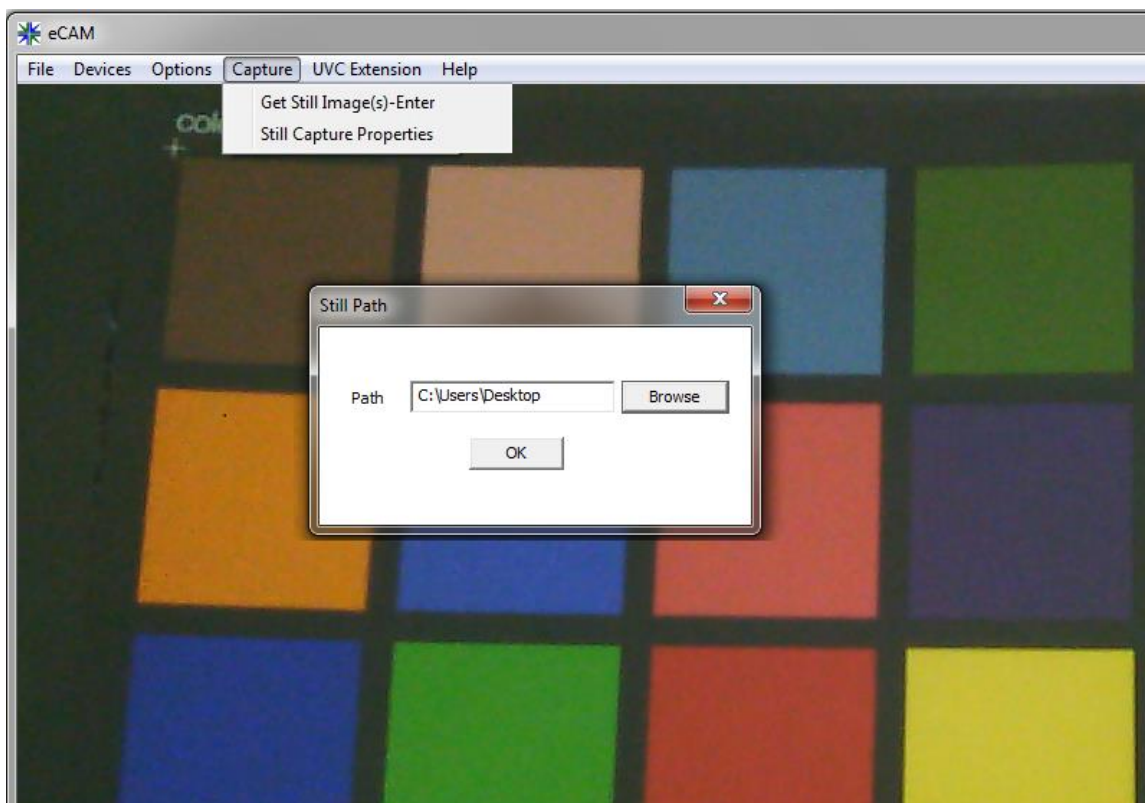


Figure 8: Capture menu



6.4 Extension Unit Menu

The Extension Unit has some additional controls and features and these not quite common controls and hence they are not included in the standard UVC controls, but listed as UVC Extension controls. Currently Extension Unit is not supported for the See3CAM_CX3RDK with e-CAM59CX3.

6.5 Help Menu

The Help Menu can be used to obtain the version information of e-CAMView application installed in the computer.

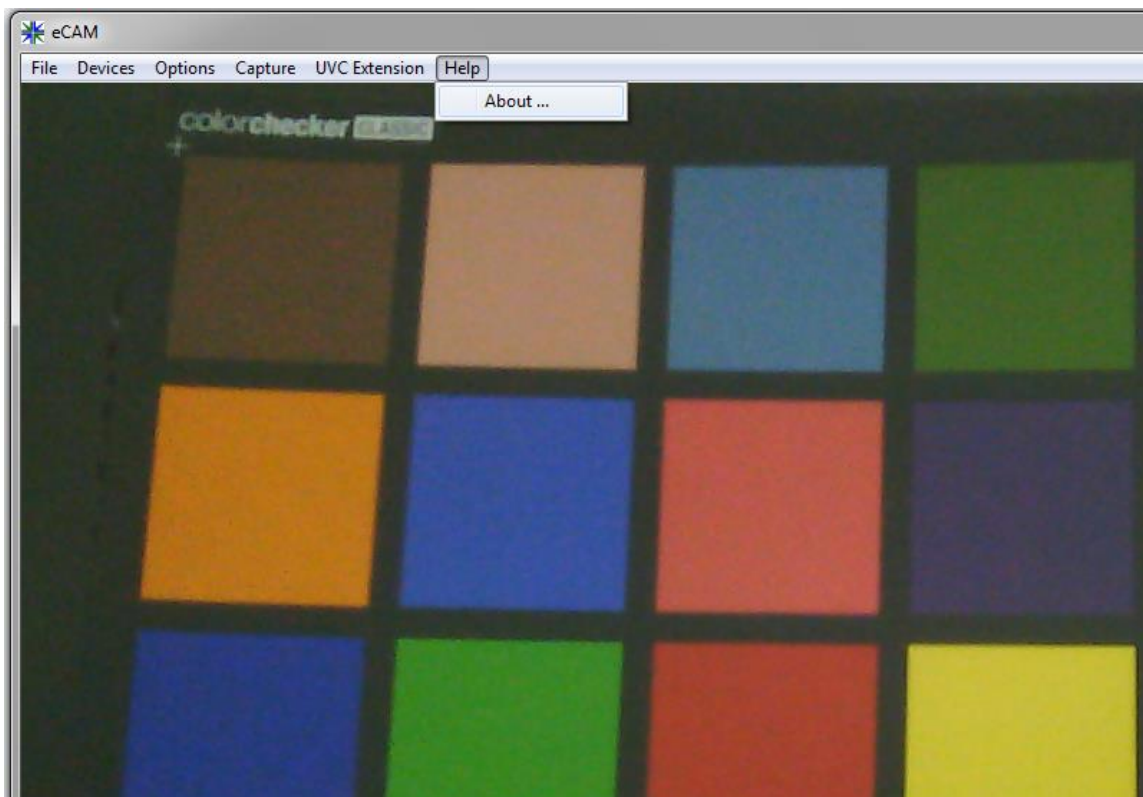


Figure 9: Help menu

7 Conclusion

This document provides the basic steps involved in using the e-CAMView application and See3CAM_CX3RDK with e-CAM59CX3 in the appropriate modes. For additional information on the usage of See3CAM_CX3RDK with e-CAM59CX3 refer the specific documents provided.

