



# EVALUATION KIT (EVK)

CUSTOM CAMERAS FOR MASS PRODUCTION APPLICATIONS



**USER GUIDE**

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# CONTENTS

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<b>PREFACE .....</b>	<b>II</b>
<b>About this Document.....</b>	<b>ii</b>
<b>Conventions Used .....</b>	<b>ii</b>
<b>How to Contact Us .....</b>	<b>ii</b>
<b>CHAPTER 1. INTRODUCTION.....</b>	<b>1</b>
<b>System Architecture .....</b>	<b>1</b>
<b>Types of Cameras and their Resolutions .....</b>	<b>2</b>
<b>Camelot Features .....</b>	<b>2</b>
<b>Potential Applications (Customized to your Needs) .....</b>	<b>2</b>
<b>Terms Used .....</b>	<b>3</b>
Exposure Time .....	3
Binning.....	3
<b>CHAPTER 2. INSTALLING THE CAMELOT EVK .....</b>	<b>4</b>
<b>System Requirements .....</b>	<b>4</b>
<b>Installing the Software and Camera on your PC.....</b>	<b>4</b>
Installing DirectShow (Optional) .....	8
<b>CHAPTER 3. USING THE CAMELOT EVK BASIC CONTROLS .....</b>	<b>9</b>
<b>Loading the Application.....</b>	<b>9</b>
<b>Camera Resolutions and Lense Controls .....</b>	<b>9</b>
Camera Resolution Types.....	9
Lense Controls .....	9
<b>Using the Main Screen Controls .....</b>	<b>10</b>
Start-up or Basic Controls.....	10
Getting Camera Information.....	11
Data Rate Pane .....	11
Capture Control Pane .....	11
Preview Control Pane .....	12
Exposure Control Pane .....	12
Gain Control.....	13
<b>CHAPTER 4. USING THE ADVANCED CONFIGURATION TABS .....</b>	<b>14</b>
<b>Custom Tab.....</b>	<b>14</b>
Capture ROI Pane .....	14
Raw Data Pane.....	16
<b>Processing Tab .....</b>	<b>17</b>
Updating the Firmware .....	17
Sample Callback Pane .....	18
Lookup Table Pane (LUT) .....	18
Miscellaneous Pane .....	19
<b>I/O Control Tab .....</b>	<b>20</b>
General Purpose I/O Pane.....	21
PWM (Pulse-width Modulation) Control Pane.....	21
<b>Sensor Tab .....</b>	<b>22</b>
Test Data Pane.....	22
Miscellaneous Function Pane .....	22
Registers Pane .....	23

## About this Document

This document describes how to use the Camelot Evaluation Kit (EVK).

## Conventions Used

Convention	Example
Names of screens and tabs are shown in <b>Bold</b> font.	Click the <b>Video Controls</b> tab.
Keys on the Operator keyboard are enclosed in square brackets and displayed in <b>Bold</b> font.	Press the <b>[ENTER]</b> .
Action step sequences are shown as	◆ <b>To add a column:</b>

## How to Contact Us

### Website

<http://www.imagine2d.com/>

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[support@imagine2d.com](mailto:support@imagine2d.com)

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[sales@imagine2d.com](mailto:sales@imagine2d.com)

## INTRODUCTION

Camelot is a family of digital cameras for machine vision applications. Using a fast USB2 connection and an embedded digital signal processor, Camelot cameras are capable of performing advanced image processing algorithms in the camera and buffering images internally; this decreases the camera/host bandwidth requirement significantly. The cameras are intended for medical and industrial applications requiring superior image quality and high performance.

This series bases its design on the Blackfin processor for a complete low-power, low-cost system solution for intelligent industrial cameras. While Blackfin's DSP performance brings true intelligence to Camelot machine-vision, ID's technology has enhanced connectivity options using USB 2.0, optional Ethernet, Bluetooth or cellular to provide seamless support for a wide range of machine vision applications.

The combined attributes of the Blackfin processor have enabled the development of a smarter and smaller embedded camera that consumes less power. You are now more able to meet customers' demands for higher levels of industrial image-processing intelligence at a reduced cost, power consumption and physical size.

### System Architecture

Raw data from the sensor is transferred to the Blackfin using the integrated PPI (Parallel Peripheral Interface). Using DMA, the image data is transferred to the BF548 external memory for storage (64Mbytes of external memory) and further processing.



In parallel using high speed DMA, raw data from the external memory such as filters, lookup tables, customized field of views, Bit per pixel reduction, etc. is transferred to the internal memory of the Blackfin for image processing, and then, using a third DMA transfer, processed data is sent via the built-in high speed USB2 Interface with practical effective rates of up to 40Mbytes per second (up to 30 FPS in 1.3Mp, 8 FPS at 5Mp, or much higher rates at VGA). See also, <http://www.imagine2D.com>

The EVK offers a user friendly control interface that enables you to set a specified Region of Interest (ROI), gain, exposure time, frame rate and shutter delay. You can capture stills (single images) in BMP or RAW formats. Added features include LUT conversions, image mirroring and image binning, in the vertical and horizontal directions. For example, ActiveX and TWAIN drivers are also included.

## Types of Cameras and their Resolutions

The Y Row Start and X Column Start are the actual start of pixel information in the exposed frame. When setting a ROI (Region of Interest), the StartX and StartY values must be higher than the values in this chart otherwise black lines/columns are shown.

See also [Capture ROI Pane](#)

[Setting the Video Capture](#) ROI on page 14.

Resolution	Width	Height	Total Raw Pixels	Pixels for RGB24	Y Row Start	X Column Start
<b>1.3 Mp</b>					<b>12</b>	<b>20</b>
Full	1280	1024	1,310,720	3,932,160		
Half	640	512	327,680	983,040		
Quarter	320	256	81,920	245,760		
<b>3 Mp</b>					<b>20</b>	<b>32</b>
Full	2048	1536	3,145,728	9,437,184		
Half	1024	768	786,432	2,359,296		
Quarter	512	384	196,608	589,824		
<b>5 Mp</b>					<b>54</b>	<b>16</b>
Full	2592	1944	5,038,848	15,116,544		
Half	1296	972	1,259,712	377,9136		
Quarter	648	486	314,928	944,784		
<b>WVGA</b>					<b>4</b>	<b>1</b>
Full	752	480	360,960	1,082,880		
Half	376	240	90,240	270,720		
Quarter	188	120	22,560	67,680		

## Camelot Features

- Image processing
- Lookup table colour control
- USB plug and play
- Custom designed to meet your specific needs

## Potential Applications (Customized to your Needs)

- Medical
- Industrial
- Robotics
- Biometrics
- Gauging/measurement
- Identification
- Optical Character Recognition (OCR)
- Presence verification
- Print inspection
- Surface inspection

## Terms Used

### Exposure Time

The Exposure time is the amount of time required until a new frame is available. Exposure time is a function of the camera PIXCLK (pixel clock), shutter width, shutter delay, frame width and binning. For more information refer to the datasheets of each specific sensor.

Except for the WVGA sensor (described below) all the Camelot series cameras use a rolling shutter. Rolling shutters cannot freeze moving objects as well as a global shutter can.

### WVGA (Wide VGA Sensor - 752 x 480 pixels)

The global shutter feature of the WVGA image sensor is able to freeze moving objects as all pixels are exposed in parallel. When using a global shutter all pixels start exposing (integrating charge) simultaneously and stop exposing simultaneously and a new exposure only begins after the readout of all of the pixels is completed.

### Binning

Binning is when rows and columns are skipped (in half and quarter resolutions), each retained pixel takes into account an average of the skipped ones. The binned image may be a bit smoother but the FPS is similar to that obtained for FULL frames at a lower frame rate.

## INSTALLING THE CAMELOT EVK

### System Requirements

These are the system requirements for using the EVK on the target PC.

Component	Minimum Requirement	Optimal Requirements
<b>Processor</b>	Core™2 Duo 2Ghz	Core™2 Quad
<b>Memory (RAM)</b>	1GB	2-4GB
<b>Free Disk Space</b>	1GB	10GB
<b>Display Screen</b>	CRT 17"	TFT 19"-22" 9:16 layout
<b>Operating system</b>	Windows XP Home/Pro	Windows XP Home/Pro

### Installing the Software and Camera on your PC

Camelot software applications and the camera drivers are found on the supplied CD which is used to install the Camelot camera.

**The CD includes a movie, brochure, Camelot presentation, technical documents and the software application.**

**DO NOT CONNECT THE CAMERA TO YOUR PC AT THIS TIME.**

The installation software installs the following components:

- Application information in the registry – needed for the DirectShow version of the application
- ActiveX software component for running the DirectShow version of this application
- CamelotView.exe, CamelotView\_DS.exe and CamelotDll.dll – executables and dynamic link library
- Camelot camera drivers

◆ **To install the Camelot software application and Camera:**

1. **DO NOT** connect the camera to the PC at this time.
2. Insert the installation CD in the CD/DVD drive.

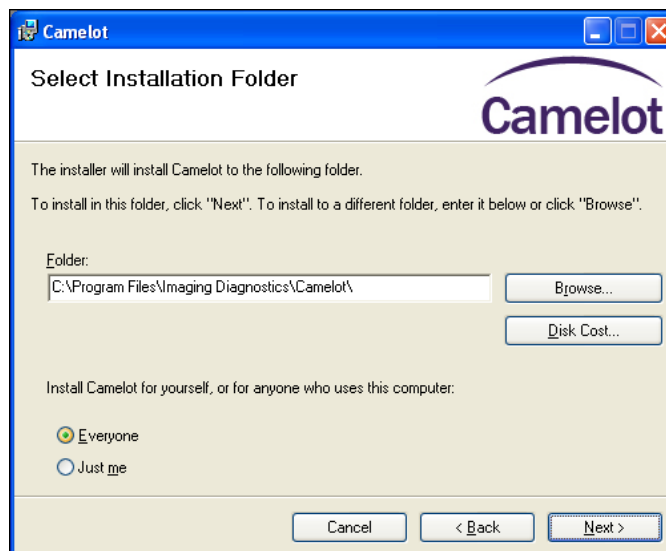
If the following screen doesn't appear automatically, run from the installation CD, **Start\_Here.exe**, or for Windows7, please goto folder **FSCCommand** and run **CamelotSetup.exe**.



3. Select the **Software Installation** button.

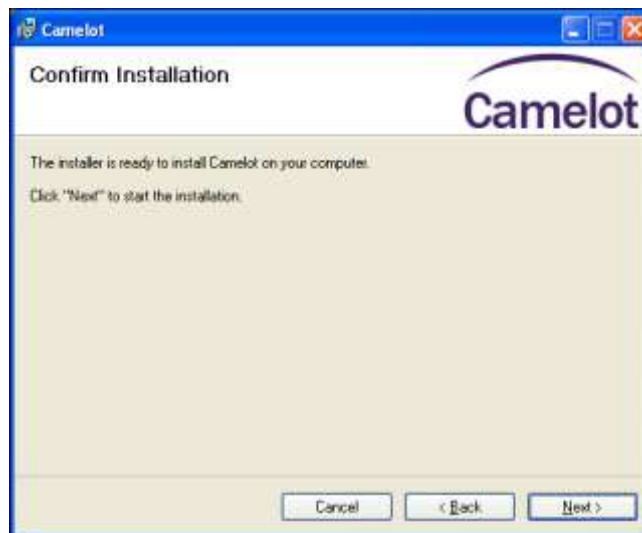


4. Click the **Next >** button.

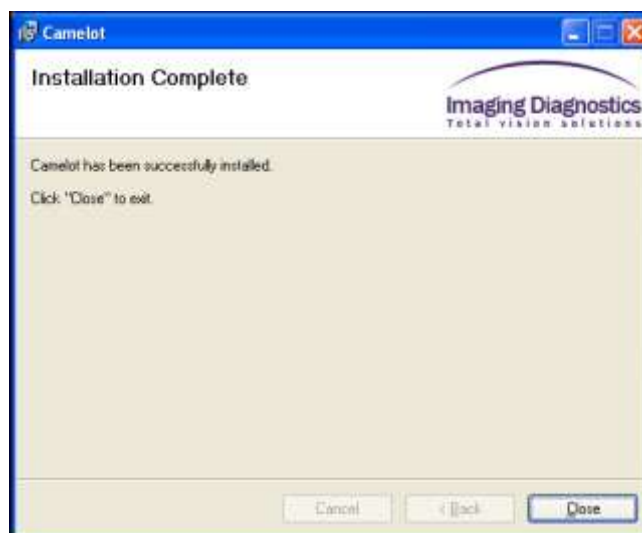
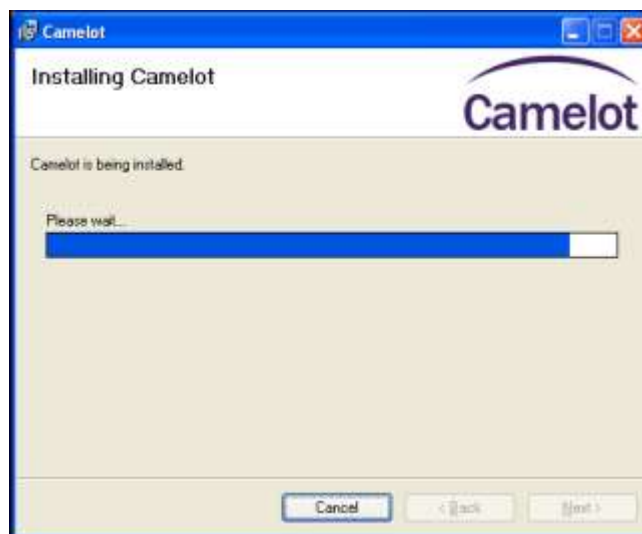


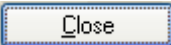
5. Change the installation folder if required (not recommended).  
6. Select **Just me** if you want to restrict access to you alone.

7. Click the  button.



8. Click the  button to confirm the installation.

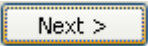


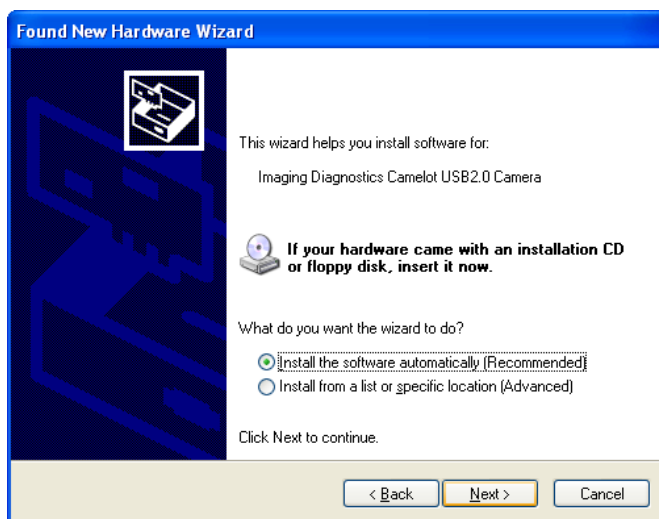
9. Click the  button.

10. Connect the camera to a USB 2.0 port on the computer (Driver installation).



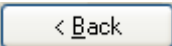
11. Select **No, not this time**.

12. Click the  button.



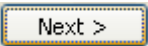
13. Select **Install the software automatically (Recommended)**.

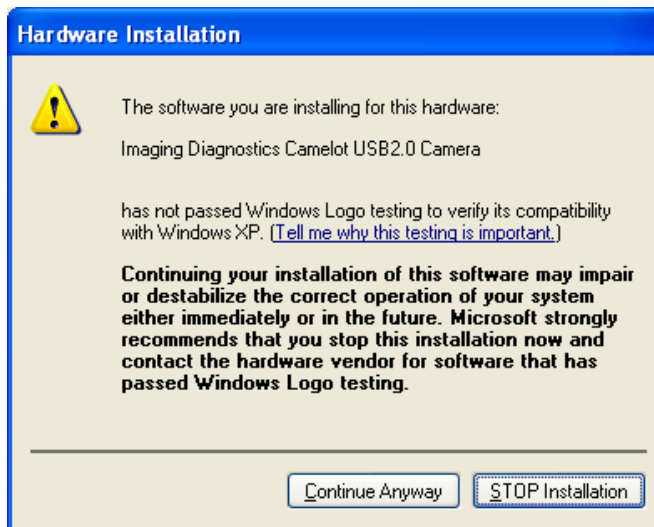
14. **If the driver is not found and the installation stops**, continue to the next step otherwise, skip to step 19.

15. Click the  button to return to the previous screen.

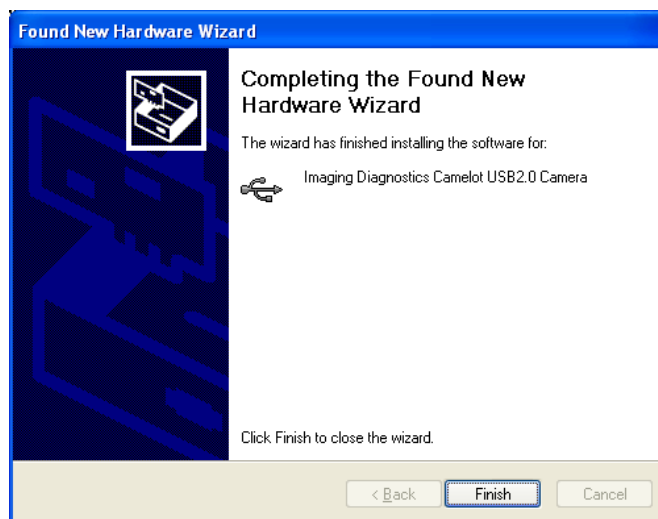
16. This time select **Install from a list or specific location (Advanced)**.


17. Use the  button to navigate to the driver folder:  
**X:\Program Files\Imaging Diagnostics\Camelot\Drivers**  
Where: **X** is the system drive.

18. Click the  button.



19. Click the  button.

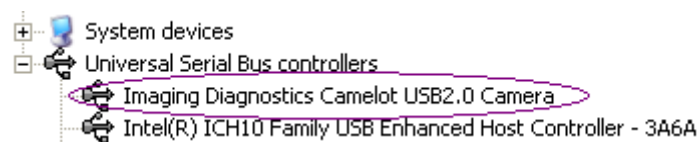


20. Click the  button.

The default installation folder is:

**c:\Program Files\Imaging Diagnostics\Camelot\**

21. The driver can now be seen in the **Device Manager**.



## Installing DirectShow (Optional)

### ◆ To Install DirectShow (optional):


- In order to install the **DirectShow** version of the CamelotView software (DirectShow does not run on Vista), the DirectX redistributable (version 9.0 and higher) must be installed. If not already installed, run the following file from the Camelot installation CD: **Directx\_nov2008\_redist.exe**

## USING THE CAMELOT EVK BASIC CONTROLS

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### Loading the Application

◆ **To load the Camelot EVK software application:**

- From the desktop, double-click the  Camelot application icon.
- OR
- From the **Program** list, click **Camelot 1.28** (or greater).

### Camera Resolutions and Lense Controls

#### Camera Resolution Types

In this application we relate to two resolution types:

1. Resolution of the camera output
  - a. **FULL** - the camera outputs frames at maximum width and height.
  - b. **HALF** - the camera outputs frames at HALF the width and HALF the height of the FULL sized frame. Thus HALF frames are actually  $\frac{1}{4}$  the size (bytes) of FULL frames.
  - c. **QUARTER** - the camera outputs frames at  $\frac{1}{16}$  the size of a FULL frame, since every three rows and every 3 columns are skipped.
2. Resolution of the **Preview** screen on the PC.
  - a. **FULL** - is the full image received from the camera is displayed as is.
  - b. **HALF** - the image received from the camera is thinned down by skipping every other row and every other column such that only  $\frac{1}{4}$  of the pixels are displayed.
  - c. **QUARTER** - only  $\frac{1}{16}$  of the pixels received from the camera are displayed.

#### NOTE

When using the **DirectShow** application for displaying the video, opening and closing the video windows and changing resolutions, for example, could take a few seconds.

#### Lense Controls

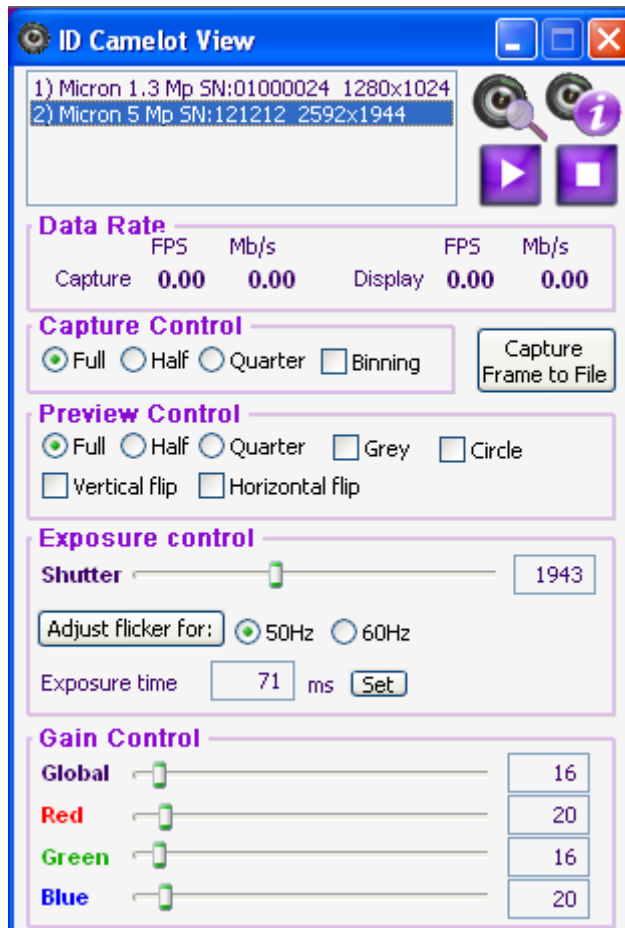
There are three controls on the lens supplied with the EVK.

- **W-T (wide/telescope)** - zoom from wide to telescopic
- **O-C (iris open/close)** - controls how much light is allowed through the lens to brighten or darken the picture
- **N-F (near/far focus)** - finer focusing once the range has been set



## Using the Main Screen Controls

The main screen is displayed when the application loads and contains the basic controls. The advanced functions are accessed by means of tabs. You can save either raw data directly from the camera to a file or a BMP image. (RAW images can also be saved in either 10 or 12 bit resolution. See [Custom Tab](#) on page 14.








**Figure 1: Main Controls**

### Start-up or Basic Controls

These are the basic functions required to control the Camelot application.

**Table 1: Start-up Controls**

Parameter	Description
	Find connected cameras. Your computer is searched for any attached Camelot cameras. It could take some time to find all the connected cameras.
	Displays camera information. HW version and date, FW version and date, Camera unique serial number. See <a href="#">Getting Camera</a> Information on page 11.
	Runs the application and video image display window opens.
	Pauses live video when running.
	Stops the camera's live video and re-initializes the camera.

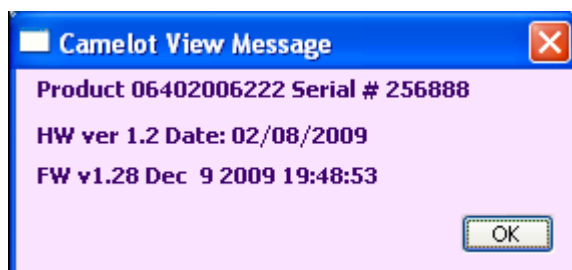
## Getting Camera Information

Use this function when you require a description of the attached cameras.

### ◆ To get camera information:

1. Select the camera from the list.

2. Click the  button.



3. Click the  button to close the window.

## Data Rate Pane

Dynamically displays the data rate (FPS or Frames Per Second and Mb/s values) of the video stream.

**Table 2: Data Rate Pane**

Parameter	Description
<b>Capture</b>	How many FPS captured by the DirectShow filter.
<b>Display</b>	How many FPS were displayed on the PC Preview screen.

## Capture Control Pane

This pane controls the capture parameters. For a more detailed explanation of resolutions, see [Camera Resolutions and Lense Controls](#) on page 9.



**Table 3: Capture Controls Pane**

Parameter	Description
<b>Full</b>	The camera transmits a full sized image.
<b>Half</b>	The camera transmits a 1/4 sized image. (1/2 width x 1/2 height).
<b>Quarter</b>	The camera transmits a 1/16 sized image. (1/4 width x 1/4 height)
<b>Binning</b>	Binning is when skipped rows and columns are averaged into pixel value (in HALF and QUARTER resolutions). See <a href="#">Binning</a> on page 3.
<b>Capture Frame to File</b>	Captures a frame from the video stream. If a frame was previously saved it is displayed. Clicking the <b>Browse</b> button opens the previously selected folder if one was previously selected.

◆ To a capture a frame to file:

1. Click the  button.



2. Browse to the required folder and enter a file name.
3. Select either the  or  button to save a frame.

### Preview Control Pane

This pane controls how the video is viewed on the PC. See the section [Camera Resolutions and Lense Controls](#) on page 9.

**Table 4: Preview Controls Pane**

Parameter	Description
<b>Full</b>	The full sized image that the camera generates is displayed.
<b>Half</b>	The application shrinks the full sized image received from the camera and displays it as a 1/4 sized image. (1/2 W x 1/2 H).
<b>Quarter</b>	The application shrinks the full sized image received from the camera and displays it as a 1/16 sized image. (1/4 W x 1/4 H).
<b>Grey</b>	Changes the image to grey scale.
<b>Circle</b>	Creates a circle using a Windows graphic function. It is an example on how the screen can be customized.
<b>Vertical Flip</b>	Flips the image vertically.
<b>Horiz. Flip</b>	Flip the image horizontally.

### Exposure Control Pane

In the domain of digital photography exposure is a combination of shutter speed and the aperture of the lense.

**Table 5: Exposure Control Pane**

Parameter	Description
<b>Shutter width</b>	Controls how much time each frame is exposed. Similar to the mechanical Iris in the lense. Affects Exposure time (see below). Values are from 1-65,000, though the slider has a range from 1-5,000.
<b>Adjust for 50/60Hz flicker</b>	A ShutterWidth value will be chosen so that the flicker of the indoor lighting (50Hz or 60Hz) is ignored.
<b>Exposure Time</b>	A function of the camera PIXCLK (pixel clock), shutter width, shutter delay, frame width and binning. The value cannot be set lower than the minimal exposure time possible for the sensor. ShutterWidth is affected when a value is set. Value is in ms.

## Gain Control

The camera's gain controls affect how much of each colour is emphasized in the captured frame. The gain can be controlled individually (Red, Green and Blue) or set together when setting the **Global Gain** value. The gain values have been normalized to the range 0-1024.

**All values from 0 - 64 relate to the analogue gain, where:**

- 1 - 32 are **real** gains of 1.0 – 4.0 in increments of 0.125
- 33 - 64 are **real** gains of 4.25 – 8.00 in increments of 0.25

**Values from 65 – 1024 translate as follows:**

- 1.3Mp cameras, 65 - 120 to an **analogue** gain of 9 - 15 (since 120 is the maximum possible value all values above 120 are taken as 120).
- For other cameras, 65 - 1024 to a **digital** gain of 9 – 128

**Table 6: Gain Control Pane**

Parameter	Description
<b>Red Gain</b>	Analog and digital gains for the RED element of each frame. Values range from 0-1024, though the slider ranges from 0-256
<b>Green Gain</b>	Analog and digital gains for the GREEN element of each frame. Values range from 0-1024. , though the slider ranges from 0-256
<b>Blue Gain</b>	Analog and digital gains for the BLUE element of each frame. Values range from 0-1024. , though the slider ranges from 0-256
<b>Global Gain</b>	Sets the Red, Green and Blue gain values (above) to the same value. , though the slider ranges from 0-256

### NOTE

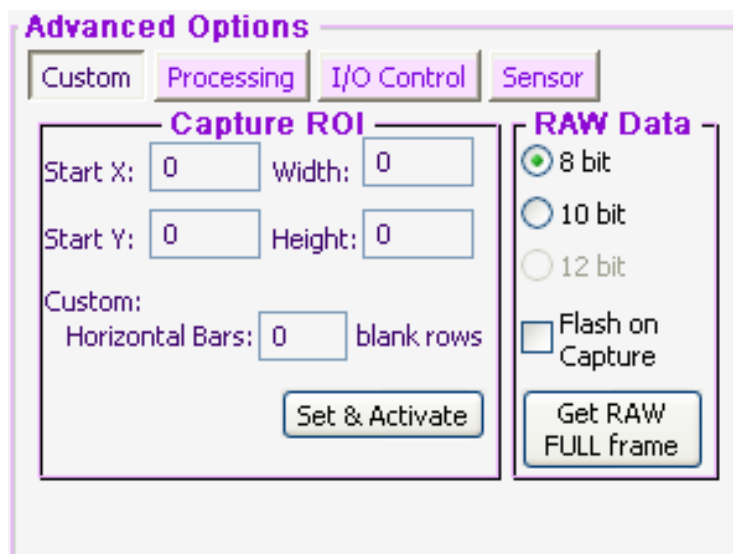
For a more detailed explanation of Analogue and Digital gains see the **Sensor data sheets at** Error! Reference source not found. **on page** Error! Bookmark not defined..

## USING THE ADVANCED CONFIGURATION TABS

These configuration tabs and sections control the advanced video processes.

### Custom Tab

The Custom Viewing tab enables you to change the way the video is viewed. This includes determining the Region of Interest (ROI) or Frame of View (FOV). You can control the actual area of the image captured from the camera to be displayed. This is done by leaving the image at full resolution and transmitting only a sub-rectangle - defined by the upper/left corner coordinates and width and height. See Figure 3 on page 15.



**Figure 2: Custom Tab**

### Capture ROI Pane

#### Setting the Video Capture ROI

This section describes how to set the ROI (Region of Interest).

You can also request Custom ROIs from the camera.  
See Horizontal bars in Table 7 below.

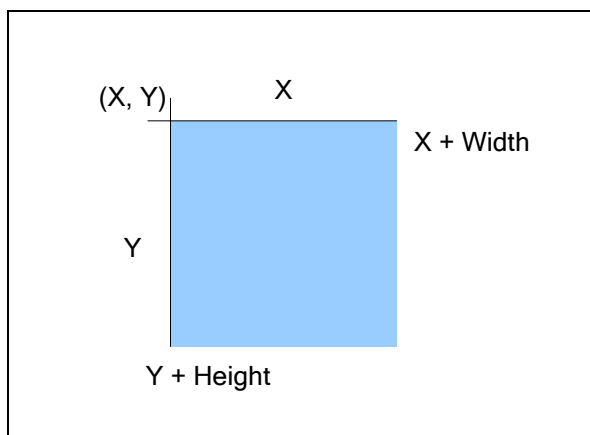
**Table 7: ROI or FOV (Frame of View) Pane**

Parameter	Description
<b>Video Capture ROI</b>	
<b>Start X</b>	<b>X</b> co-ordinate of the top left-hand corner of the sub-frame rectangle. This value shouldn't be lower than the X Column Start value for the sensor. See <b>Error! Reference source not found.</b> on page <b>Error! Bookmark not defined.</b> and <a href="#">Camera Resolution Types</a> on page 9.

Parameter	Description
<b>Width</b>	Width of the sub-frame rectangle.
<b>Start Y</b>	<b>Y</b> co-ordinate of the top left-hand corner of the sub-frame rectangle. This value shouldn't be lower than the Y Row Start value for the sensor See <b>Error! Reference source not found.</b> on page <b>Error! Bookmark not defined.</b> and <a href="#">Camera Resolution Types</a> on page 9
<b>Height</b>	Height of the sub-frame rectangle.
<b>Custom</b>	
<b>Horizontal Bars</b>	Number of blank lines between two horizontal blocks of video sent from the camera. <b>This number must be divisible by 4.</b> The number of blank rows determines how many rows of video the camera must output from the top and bottom of the screen. The rest of the rows aren't sent from the camera. This is done in order to preserve the FULL resolution, high FPS and therefore only viewing the areas required.
<b>Set &amp; Activate</b>	If sub-frame coordinates are valid the preview display is updated accordingly. <b>The values cannot be zero or larger than the actual image dimensions.</b>

◆ **To set the video capture regions:**

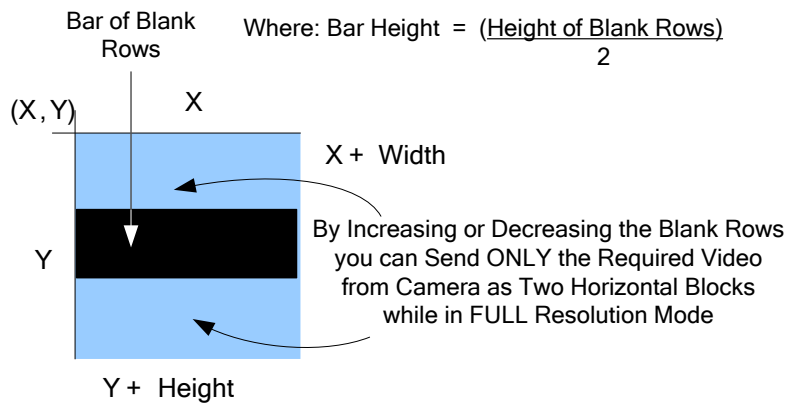
1. Set the **Capture ROI** or the **Custom ROI** parameters.
2. Click the  button.



**Figure 3: ROI Image Subset (Windowing)**

### Sending Only Required Video when in FULL Resolution

You can also send only the required parts of a FULL resolution picture keeping the FPS high by using the method shown below. See the explanation for Horizontal Bars in Table 7 above



## Raw Data Pane

### Setting the Raw Data

Clicking the  data button captures full frames from the camera, though preview can be with half or quarter resolution. Raw unprocessed 12-bit and 10-bit data, can be specified.

◆ **To set the raw data snapshot:**

1. Select a **RAW** data precision as 8, 10 or 12 bit.
2. Select **Flash on Capture** if required.
3. Click the  button.

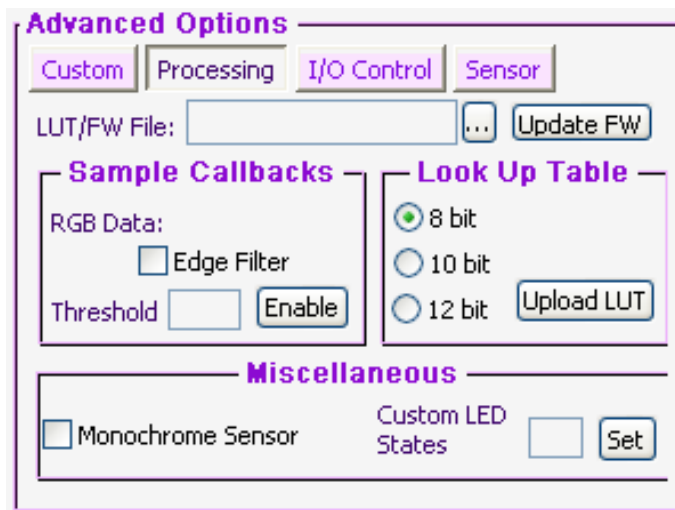
The information is saved to a file, the name of which is displayed in a pop-up dialog.

**Table 8: Get Raw Data Pane**

Parameter	Description
<b>8, 10 and 12 bit</b>	RAW data is in FULL resolution. 8 bit = all cameras 10 bit = 1.3, 3 and 5 Mp and WVGA 12 bit = 5 Mp
<b>Flash on Capture</b>	If the optional flash is built-in, it flashes when a Raw frame is captured.
<b>Get RAW Data</b>	Streams one frame of RAW, FULL resolution data from the camera. A Call-back function is set (by default) for dealing with RawFullData. See <a href="#">Sample Callback Pane</a> on page 18 and refer to the EVK API for more details.

## Processing Tab

This tab enables you to update the camera's firmware, load a lookup table (LUT), and enable the **Callback** functions.



**Figure 4: Processing Tab**

### Updating the Firmware

The **Camelot\_XXX.ldr** file is an Analog™ loader file used to update the firmware. The firmware can be updated using either your own **\*.ldr** file or one downloaded from our website.

#### WARNING

This function uploads data to the camera – an operation that could render it non-functional if an invalid custom LDR file is being used.

For this reason, in order to check a new **\*.ldr** file that has not yet been validated by us at Imaging Diagnostics, please send it to us for validation to assure that the camera boots after loading your file:

[support@imagine2d.com](mailto:support@imagine2d.com)

#### IMPORTANT NOTE

We periodically provide update versions for the camera's Firmware which you can download from our website <http://www.imagine2d.com/>.

#### Downloads Contain

- **CamelotFilter.ax** – DirectShow filter containing functions that access and communicate with the camera. This file must be placed in the **X:\Windows\System32** (where X: is the ??)
- **CamelotView.exe** – the **SampleApplication** executable.
- **CamelotDll.dll** – a dynamic link library which must be placed in the same directory in which the executable is run.
- **CamelotView\_DS.exe** – the **SampleApplication' DirectShow version**.
- **CamelotView.zip** – contains the latest update sources.
- **Camelot\_XXX.ldr** – is the loader file with the new code for the camera. This file must be loaded using the example application (Update FW) or by calling the API function and supplying the path to the file.
- **BDR\_debugger.exe** – a debugger window that can be used when programming to debug application. **See the EVK API for more details.**

### ◆ To update the Firmware:

1. Select the FW file using the **Browse** button.
2. Click the  button.

**Table 9: Update Firmware Controls**

Parameter or Button	Description
<b>LUT/FW File</b>	Use the Browse button to select a LUT or FW file.
<b>Update Firmware Button</b>	<b>REMEMBER to ONLY upload LDR files that have been validated by us first.</b> Enables you to update the selected camera firmware. Use the Browse button to select the FW update file.

## Sample Callback Pane

### Setting the Callback Parameters

#### NOTE

Call-back functions provide additional standard or proprietary processing.

### ◆ To setup the Callback parameters:

1. Select the **Callback** function.
2. Click the  button.

Callback functions are either enabled (if selected) or disabled (if cleared).

**Table 10: Callback Functions Pane**

Parameter or Button	Description
<b>RGB Data Edge Filter</b>	An algorithm used in image processing and computer vision to identify points in a digital image at which the image brightness changes sharply, or an edge.
<b>Threshold</b>	Value used by the enabled filter.
<b>Enable Button</b>	Enables the selected call-back function.

## Lookup Table Pane (LUT)

### Uploading the Lookup Table (LUT)

#### ◆ To upload the LUT (lookup table):

1. Select the LUT file to upload using the **Browse** button.
2. Set the **Lookup Table** parameters.
3. Choose 8, 10 or 12 bit (the LUT output to the PC is 8 bits).
4. Click the  button.

With 5Mp cameras, change the PLL rate (LINK to PL rate) to 48MHz before running a LUT. See also [PLL Rate](#) in Table 17 on page 23.

5. Click the **Run** button.

The picture is now a LUT translation of the camera's captured image.

**Table 11: Look Up Table Pane**

Parameter or Button	Description
<b>8, 10 and 12 bits</b>	LUT output to the PC is 8 bits only. 10 bit = 1.3, 3,5 Mp and WVGA(1024 values) 12 bit = 5 Mp (4096 values)
<b>Upload LUT</b>	Select a LUT file and upload it to the camera. This provides required image colour transformation. The file is checked for syntax before it is uploaded.

### What is a LUT (Look-up Table)

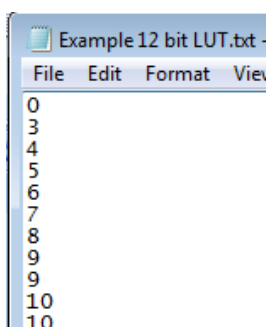
The Look-up Table converts the image pixel resolution from the camera's actual output (8, 10 or 12 bits) to an 8-bit format where the highest value is 255. This is done by assigning the same 8-bit values to ranges of higher bit values as shown in the examples below.

**Table 12: 10 and 12 bit LUT Pane**

10 bit Image	8 bit	12 bit Image	8 bit
0 - 5	0	0 - 2	0
6 - 8	1	3	1
9 - 11	2	4	2
12 - 13	3	5	3
14	4	6	4
15 - 16	5	7	5
17	6	8	6
19	7	9	7
20	8	10 -13	8
...	...	14 - 16	9
		17	10
		...	...
1021 - 1024	255	4090 - 4096	255

The conversion to 8 bits always ends with a value of 255.

An example is shown below of a 12-bit LUT.



### Miscellaneous Pane

#### NOTE

To fully utilize the LED state functions, a separate optional board is required.

### Setting Up the Miscellaneous Parameters

This is another advanced function that enables you to control the camera and the optional LED feature. The LEDs are lit according to the current state, which is changed by clicking an optional external GPIO button. These optional GPIO and LED features need an optional board, which can be supplied with a camera on request.

**The actual LED states are programmed into the camera.**

◆ **To setup the Miscellaneous parameters:**

1. Select how many LED states are programmed in the camera.
2. Select if the sensor is monochrome.

If you select Monochrome, the Bayer conversion is not performed and the picture is converted from an 8-bit greyscale to a 24-bit greyscale. This saves display time and shouldn't have any impact on the actual picture quality.

**Table 13: Miscellaneous Pane**

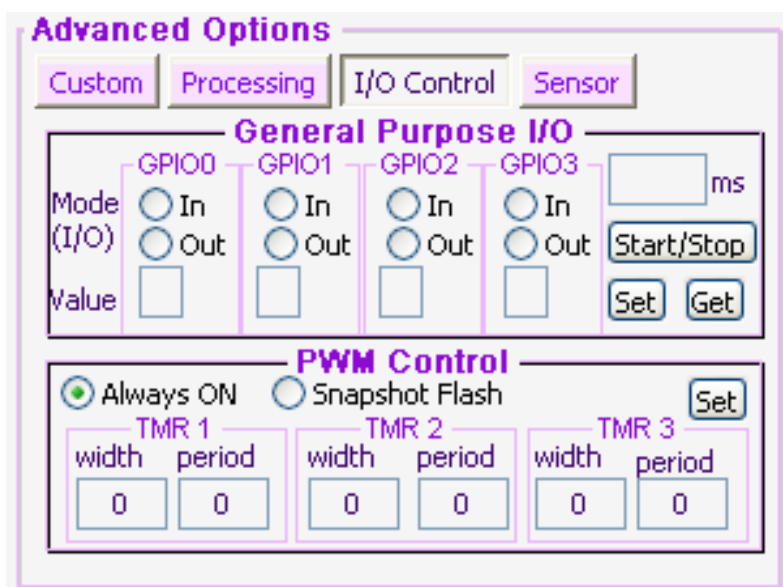
Parameter or Button	Description
<b>LED States</b>	Amount of LED states programmed in the camera
<b>Monochrome Sensor</b>	When selected 256 shades of grey are used. It is NOT ONLY black and white which uses a 2 bit scale.

## I/O Control Tab

General purpose registers and PWM control.

**NOTE**

To fully utilize the PWM, GPIO and LED state functions, a separate optional board is required.



**Table 14: General Purpose I/O Pane**

Parameter	Description
<b>In</b>	IN direction – value can only be read.
<b>Out</b>	OUT direction - Value can be set and/or read.
<b>Value</b>	0 or 1 – low/high.
<b>Set Button</b>	Sets the entered directions and values in the actual GPIO register.
<b>Get Button</b>	Reads the values of the selected GPIO registers according to the selected directions.
<b>Ms</b>	For how many milliseconds to wait before next cycle.
<b>Start/Stop</b>	Starts and Stops the cycle of setting GPIO-0 to 1, taking snapshot and waiting the set <b>ms</b> value.

## General Purpose I/O Pane

### NOTE

To fully utilize the PWM, GPIO and LED state functions, a separate optional board is required.

#### ◆ To use the General Purpose I/O pane:

1. Click the  button to see the current state of the GPIO pins.
2. Select the GPIO pin and choose the direction of the pin - **IN** or **OUT**.
3. Enter a value (0 or 1) if the pin's direction is **OUT**.
4. Click the  button to set the data.

The Start/Stop option is provided for running an optional motor that is attached to GPIO-0. When the motor stops (after x ms), a snapshot is taken.

## PWM (Pulse-width Modulation) Control Pane

Here Pulse-width modulation (PWM) is used to modulate the duty cycle, to control the amount of power sent to a load. In this case it is used primarily for the brightness of the illumination LEDs (lamps), or any other optionally connected device.

### NOTE

To fully utilize the PWM, GPIO and LED state functions, a separate optional board is required.

#### ◆ To use the PWM Control pane:

1. Select **Always ON** or **Snapshot Flash**.
2. Select a timer.
3. Enter **Width** and **Period** values.
4. Click the  button

**Table 15: PWM Control Pane**

Parameter	Description
<b>Always ON</b>	(Optional) LEDs or any illumination device (or other PWM devices) that is constantly ON.
<b>Snapshot Flash</b>	(Optional) LEDs or any illumination device (or other PWM devices) that are turned on when a Snapshot or RAW FULL frame is requested.
<b>TMR Width</b>	(Optional) A value that together with the TMR period controls the PWM Duty Cycle and that of the connected load. A LED is lit during the PWM duty cycle.
<b>TMR Period</b>	(Optional) The amount of units in the Total PWM period.
<b>Set Button</b>	Sets the entered values in the camera.

## Sensor Tab

The **Sensor** tab enables you to both query and modify the sensor's registers.

### Test Data Pane

#### ◆ To use the Test Data pane:

1. Select **Test Data** parameters.
2. Select **Enable**.
3. Click the  button.

**Table 16: Test Data Pane**

Parameter	Description
<b>Pattern</b>	<b>5Mp cameras</b> - 0-8 (as defined in the Micron datasheet). <b>Other cameras</b> - 0
<b>R/Genrl</b>	<b>5Mp camera</b> - Value according to pattern type. <b>Other cameras</b> - constant value which is output and its complement.
<b>G</b>	<b>5Mp camera</b> - Value according to pattern type. <b>Other cameras</b> - not applicable.
<b>B</b>	<b>5Mp camera</b> - Value according to pattern type. <b>Other cameras</b> - not applicable.
<b>Bar Width</b>	<b>5Mp camera</b> - You can change the test pattern bar width.
<b>Set Button</b>	<b>5Mp camera</b> - After selecting a Pattern Type and entering data a constant test pattern is displayed. <b>Other cameras</b> - After entering data in the <b>R/Genrl</b> data box a test pattern is displayed.

### Miscellaneous Function Pane

#### ◆ To use the Miscellaneous pane:

1. Select **Sensor Light Enable** if required.

Optional lights on the sensor board are lit. If **Flash in Snapshot** mode is selected, lights are only lit when a snapshot is captured.

2. Select **Enter Snapshot Mode** if required and use the  button to take a snapshot.

The  button mimics an external trigger that can be optionally added to the camera.

3. Enter a **PLL** rate value and then click the  button.

Presently, only values of 96MHz and 48MHz are available and only the 5Mp sensor is affected.

**The PLL rate must be changed before using LUT for the 5Mp camera.**

**Table 17: Miscellaneous Pane**

Parameter	Description
<b>Sensor Light Enable</b>	Enables the camera's low intensity LED (Optional). Can be included as an option.
<b>Enter Snapshot Mode</b>	Enters Snapshot mode. Camera stops outputting live video and waits for a Snapshot trigger.
<b>Snap</b>	Triggers a snapshot. An external trigger on the unit can be included as an option.
<b>PLL Rate</b>	An advanced option to change the Chip's clock rate. Only applicable to the 5Mp camera. Default is 96MHz. If using 12-bit LUT on a 5Mp camera, PLL rate must be changed to 48MHz for correct operation.
<b>Set Button</b>	Set the PLL Rate specified.

## Registers Pane

You can get or set the values of the registers.

### WARNING

**Changing the register values could cause the software application to stop working. Please consult the sensor's Data Sheet before accessing sensor's registers.**

## Registers Pane

### ◆ To read a register:

1. In the **Register** pane, enter a hexadecimal register address (**addr**)
2. Click the  button to see the register's current value.

### ◆ To write to a register:

1. In the **Register** pane, enter a hexadecimal register address and a value.
2. Click the  button.

**Table 18: Registers Pane**

Parameter	Description
<b>Addr and Value</b>	<b>Use caution when changing the registers as the application may hang.</b> Use the <b>Get</b> button to read the registers and the <b>Set</b> button to change their values.
<b>Get</b>	Fetches the selected register data in hexadecimal format.
<b>Set</b>	Sets the selected register data in hexadecimal format.
<b>Get Values</b>	Dumps defined registers to a text file named <b>c:\regVals_SENSOR_TYPE_SERIAL_NUM</b>

### Website

<http://www.imagine2d.com/>

### Support

We would appreciate any feedback you have about the Camelot EVK.

[support@imagine2d.com](mailto:support@imagine2d.com)

### Sales

Please contact us if we can assist you in building your own custom applications.

[sales@imagine2d.com](mailto:sales@imagine2d.com)



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