

FALCON III

Model: FA351V-BV-CL



USER MANUAL

CONTENTS

1. INTRODUCTION	4
1.1 Scope	4
2. CAMERA CARE	4
2.1 Cleaning the Sensor Window	4
3. SPECIFICATION	5
3.1 Camera Overview	5
3.2 Datasheet	5
4. DESIGN OVERVIEW	6
4.1 Mechanical Model	6
4.2 Physical Interface	7
4.3 Power Consumption	7
4.4 Mounting to Microscope	7
4.5 Mounting to a Tripod or Optical Table	7
5. SOFTWARE COMPATIBILITY	8
5.1 XCAP Compatibility	8
5.2 Micromanager Compatibility	8
5.3 LabView Compatibility	8
5.4 Custom Software Interfacing	8
6. CAMERA AND CHILLER SETUP	9
6.1 Connecting Camera to Frame Grabber	9
6.2 Connecting Camera to Chiller	9
6.3 Recommended Coolants for Chiller	9
6.4 Setting the Coolant Temperature for Re-circulation	9
6.5 Draining the Chiller, Camera and Tubing	10
7. FRAME GRABBER AND SYSTEM REQUIREMENTS	11
7.1 Computer/Laptop System Requirements	11
7.2 Frame Grabber Requirements	11
8. XCAP IMAGING SOFTWARE	12
8.1 Downloading and Installing XCAP	12
8.2 Opening the Camera Configuration	12
8.3 Acquiring a Live Image Sequence	14
9. CONTROLLING THE CAMERA (XCAP)	15
9.1 EM Gain	15
9.2 Triggering Modes and Pixel Clock Rate	16
9.3 Region of Interest and Binning	17

9.4 Exposure Time and Frame Period	18
9.5 Maximum Frame Rates	18
9.6 Thermoelectric Cooler (TEC)	19
9.7 Information Tab	20
10. XCAP CONTROL FEATURES	21
10.1 Saving Preset Settings	21
10.2 Contrast Modification (XCAP Std. Only).....	22
11. MICRO-MANAGER	23
11.1 Downloading and Installing Micro-manager (Windows).....	23
11.2 Creating Camera Configuration File.....	24
11.3 Pre-made Configuration File	28
11.4 Imaging and Controlling the Camera	29

1. INTRODUCTION

This document provides detailed instructions for the operation of the Falcon III, Scientific EMCCD camera. Raptor Photonics Limited reserves the right to change this document at any time without notice and disclaims liability for editorial, pictorial or typographical errors.

1.1 Scope

This manual covers the Falcon III digital camera and all applicable components. Raptor recommends that this manual be used to optimize camera operation. Details of the camera's mechanical and electrical interfaces are provided, as well as information on setting the camera up with liquid cooling. Important precautions to be taken when using the camera are also stated.

Detailed information is also provided on each of the cameras control parameters. Each camera control is discussed and explained with the use of XCAP Imaging software, which is the core plug and play software package that is offered with Raptor cameras. An image of the camera is shown in Figure 1.



Figure 1: Complete Camera Module.

2. CAMERA CARE

2.1 Cleaning the Sensor Window

Raptor cameras require no regular maintenance except occasional external cleaning of the sensor window (the glass window between the camera sensor and the microscope or lens). Use optical grade isopropyl to clean this window. A cotton swab can be used, but may leave some fibres on the window, so be careful. To avoid this, you could also use a lens tissue or a cleaning swap such as a texwipe. Forced air can be applied to remove any loose particles. Should any other issues occur please contact your local agent.

CAUTION — The camera's sensor and circuits are sensitive to static discharge. Ensure that you are using a static strap or completely grounded at all times to release any static energy before you clean the window.

CAUTION — Do not use acetone.

3. SPECIFICATION

3.1 Camera Overview

The Falcon III is designed for applications that require high sensitivity, speed and resolution. The camera uses the next generation CCD 351 sensor from e2v with a resolution of 1024 x 1024. High-speed low-noise electronics provide linear response and sensitivity for rapid image capture.

The Camera Link digital interface provides the most stable platform for data transfer and the camera will work on any Camera Link standard frame grabber.

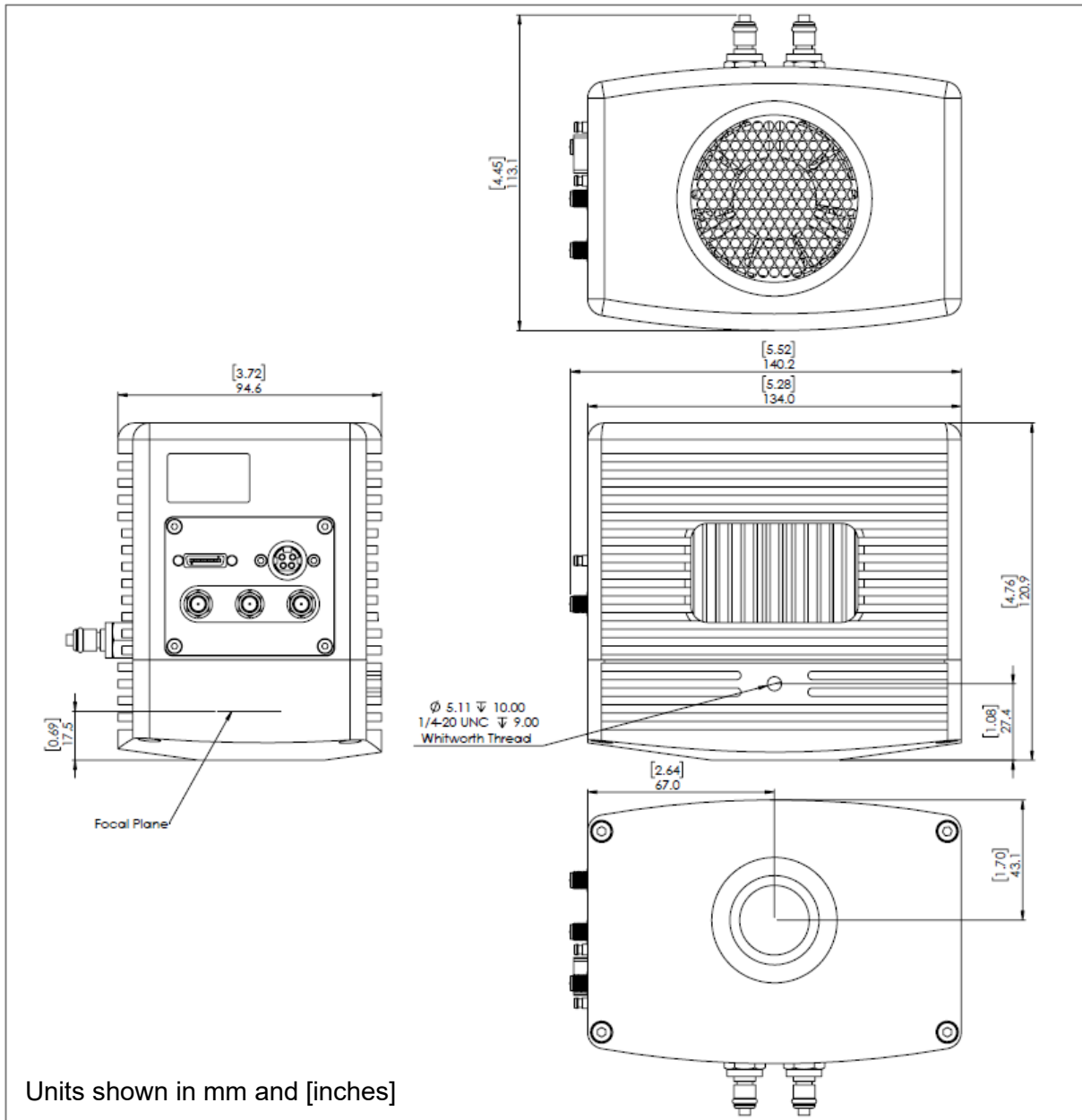
3.2 Datasheet

For the full specification of the Falcon III, the datasheet for the camera can be downloaded from the Raptor Photonics website:

<https://www.raptorphotonics.com/products/falcon-iii/>

4. DESIGN OVERVIEW

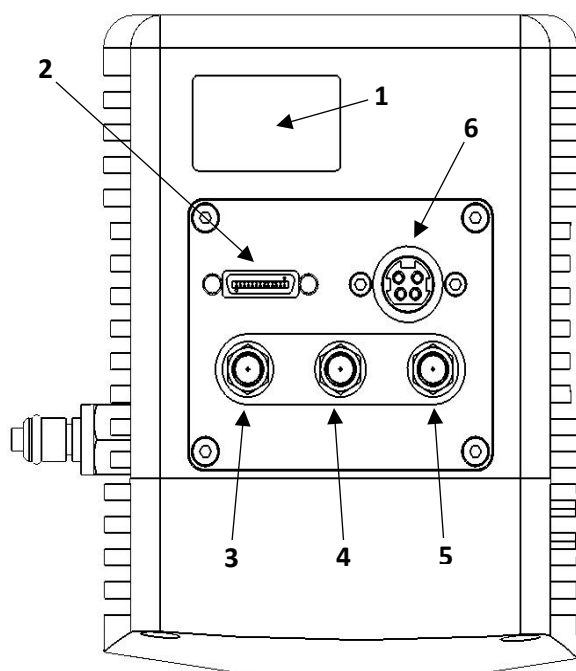
4.1 Mechanical Model



PDF of mechanical model available from our website:

<https://www.raptorphotonics.com/products/falcon-iii/>

4.2 Physical Interface



1. **Label Recess**
2. **3M Camera Link connector**
Part #: 12226-1150-00FR
3. **SMA connector: Trigger Out (Exp).**
Single ended, source impedance = 51 Ω , capable of sinking and sourcing 32mA and will have an output voltage of 3.3v i.e. TTL compatible.
4. **SMA connector: Trigger In.**
Single ended, termination impedance = 510 Ω , capacitive load = 200 pF, TTL compatible.
5. **SMA connector: Trigger Out (Frame).**
Single ended, source impedance = 51 Ω , capable of sinking and sourcing 32mA and will have an output voltage of 3.3v i.e. TTL compatible.
6. **4 Pin KYCON Power Connector**
Part#: KPJX-PM-4S
7. **Water taps**
Part#: CPC; MCD2402

4.3 Power Consumption

The camera input power specification is 12V +/- 10% with a maximum of 27 Watts power dissipation with the TEC cooler switched off. Additional current is required when the cooler power is switched from low to high. The total, maximum steady state, unit power dissipation is < 75W.

4.4 Mounting to Microscope

The camera has a standard C-mount that should easily screw onto any microscope port.

4.5 Mounting to a Tripod or Optical Table

The camera has a 1/4-20 BSW (Whitworth), threaded hole to mount to a tripod or an optical table.

5. SOFTWARE COMPATIBILITY

This section outlines the options relating to software that are available for the Falcon III camera.

5.1 XCAP Compatibility

Raptor works closely with EPIX who integrate all the Raptor camera models into their XCAP Imaging Software package. XCAP is the core plug and play software package that is offered with Raptor cameras.

5.2 Micromanager Compatibility

The Falcon III can be controlled and imaged using the free open source software package, Micromanager. Using the camera with this software package is discussed in section 11.

5.3 LabView Compatibility

Upon request, Raptor can create a LabView .icd file which can be used to control the camera on National Instruments imaging tool NI MAX. The file may also be useful if attempting to create your own LabView VI.

5.4 Custom Software Interfacing

Raptor works closely with EPIX Inc, who integrates all of our cameras into their software package, XCAP. The EPIX frame grabbers are the models that we offer with our cameras. We offer their Software Development Kit (SDK) for interfacing with custom software (XCLIB). If using a frame grabber from a different company, then you will have to obtain their SDK.

6. CAMERA AND CHILLER SETUP

This section will give instruction on setting up the camera and other components, including connecting to the frame grabber and chiller (if applicable).

6.1 Connecting Camera to Frame Grabber

The camera has the shrunk SDR port on the interface. The main frame grabber that Raptor offer with this camera has the normal MDR port (EPIX EB1). Therefore, one MDR – SDR Camera Link cable is required to connect the camera to this frame grabber.

If demoing the camera with the Mini PC system that Raptor provides, you should connect to the left port of the frame grabber in the Mini PC. This should be stated on the Mini PC.

6.2 Connecting Camera to Chiller

Raptor uses a Chiller from Thermotek, the T257P Precision Chiller. For the datasheet and full user manual from Thermotek, please contact Raptor and we can provide this. The instructions to set up the chiller are as follows:

1. Connect the T257P chiller to the Falcon III using the tubing provided. You will hear a click which indicates a solid connection. The polarity of the tubing connections does not matter.
2. Keep the chiller horizontal and on a level surface.
3. Make sure there is a minimum 12" clearance and free path for flow of air entry and exit at the left side and right side of the T257P chiller prior to operation.
4. Remove the reservoir cap and add coolant to the reservoir until the fluid reaches the bottom of the neck. Please refer to section 6.3 for recommended coolants.
5. Close the cap securely to the reservoir. Make sure not to overfill the reservoir.
6. Install the appropriate end of the power cord into the unit and connect to the mains electricity.

If using another chiller model, please refer to it's manual for start-up instructions.

6.3 Recommended Coolants for Chiller

The recommended coolants are:

Option 1: Distilled Water

Option 2: 95% distilled water and 5% isopropyl alcohol mixture prevents bio growth.

Option 3: 80% distilled water and 20% inhibited Glycol mixture for set temperatures below 5C.

Raptor recommends using option 3. If purchasing the Thermotek model from Raptor or using a demo kit provided by Raptor, there will be inhibited Glycol mixture provided to mix with water.

6.4 Setting the Coolant Temperature for Re-circulation

When powering up the chiller, the screen will immediately give the option to set the temperature of the coolant. It is recommended to set a 20°C set point. After the set point has been configured, selecting start will initiate the coolant re-circulation. For more detailed information on all the operating modes of the T257P Precision Chiller, please refer to the

Thermotek user manual.

WARNING: Please ensure the temperature set point of the chiller is above your ambient dew point, otherwise condensation can form around the sensor package and cause damage.

6.5 Draining the Chiller, Camera and Tubing

If using the Thermotek T257P Precision Chiller, it is recommended that a coolant change be implemented at a minimum, every six months, to keep the system in working order. Based on the amount of use, you may need to perform this more frequently. For more detailed information, please refer to the Thermotek user manual. If using another model of chiller, please refer to its user manual for the recommended time frame for coolant changes.

If finishing the testing of a demo kit, please disconnect the tubing and drain all of the camera, chiller and tubing before sending the equipment back to Raptor. Shorter draining tubes will be supplied with the demo kit. Two draining tubes (with the appropriate mating connectors) need to be connected to both connectors on each of the camera, chiller and tubing to drain each individually.

7. FRAME GRABBER AND SYSTEM REQUIREMENTS

7.1 Computer/Laptop System Requirements

The basic requirement is that the PCIe bus of the system must provide sufficient bandwidth to handle video rate transfers. The amount of bandwidth required depends on the camera in-hand. The Falcon III uses a Base Camera Link interface which can be handled with a x1 PCIe bus and PIXCI EB1, providing roughly 200MB/sec maximum bandwidth. Contact EPIX Inc. for further information regarding minimum computer/laptop specification requirements to run the XCAP Imaging Software.

7.2 Frame Grabber Requirements

If using a computer, it is a minimum requirement to use an PIXCI EB1 frame grabber. If using a frame grabber from another company, the specification requirements of this frame grabber must meet those supplied by the PIXCI EB1 model.

If using a laptop, EPIX offers base Camera Link frame grabbers for a laptop system, such as the ECB1/ECB1-34.

8. XCAP IMAGING SOFTWARE

This section will discuss downloading and installing XCAP, as well as acquiring an initial image using the software package.

8.1 Downloading and Installing XCAP

The latest version of XCAP can be downloaded from the link below:

<http://www.epixinc.com/support/files.php>

please select the appropriate version of XCAP for your computer. Ensure that you download from the section labelled “**Pre-release version with support for the latest cameras and latest PIXCI® imaging boards**”. Open the downloaded file when complete and follow the onscreen instructions in the installation wizard. If a pop-up message appears asking whether to install the PIXCI driver, ensure that you click yes.

8.2 Opening the Camera Configuration

After opening XCAP, select “PIXCI Open/Close” from the “PIXCI” tab from the top menu bar in the main window. A PIXCI Open/Close pop-up box will open as shown in Figure 2.

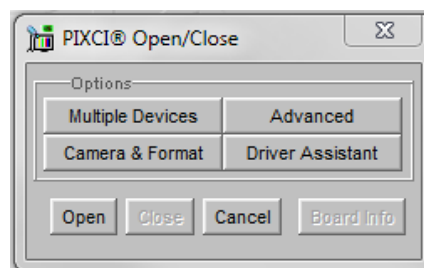


Figure 2: PIXCI Open/Close.

Click on “Camera & Format” that is highlighted in Figure 2 and a “PIXCI Open Camera & Format” box will appear, as shown in Figure 3.

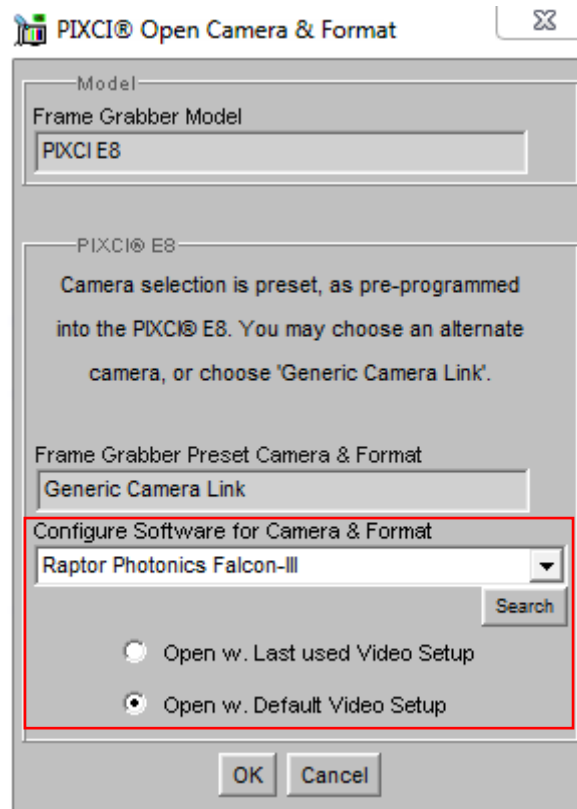


Figure 3: PIXCI Open Camera & Format.

Using the dropdown menu highlighted, search for “*Raptor Photonics Falcon III*”. Alternatively, you can use the search button and typing Falcon III will bring up the correct configuration. Selecting “*Open w. Default Video Setup*” will open the control panel with all control parameters set to the default states. “*Open w. Last used Video Setup*” will open the control panel with all parameters set at the last known state. Once this option between the two has been selected, click “*Ok*”. To open the camera control panel and imaging window, click “*Open*” in the “*PIXCI Open/Close*” window (Figure 2).

Two windows will now open in XCAP, and imaging window and control panel, as shown in Figure 4.

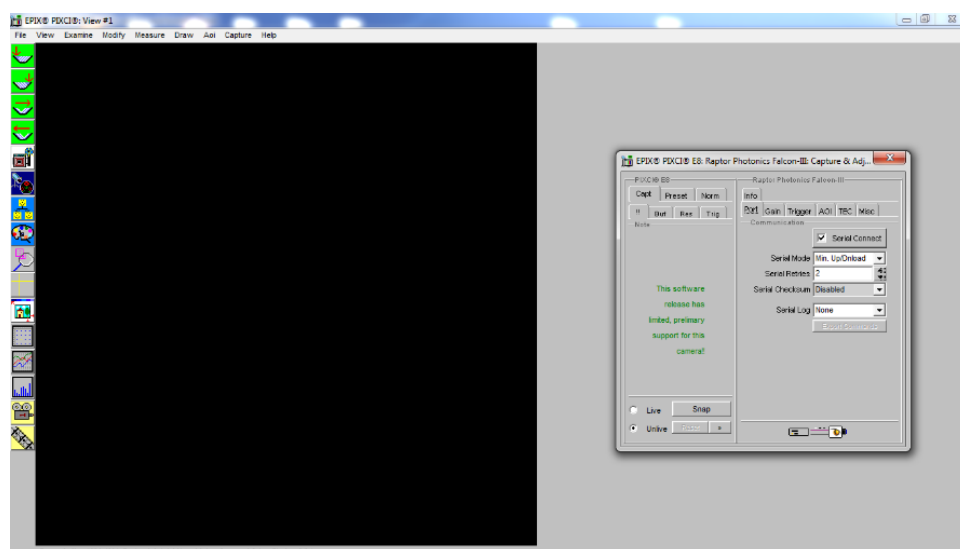


Figure 4: Imaging Window & Control Panel.

8.3 Acquiring a Live Image Sequence

There are two things to observe in the control panel that inform you that the camera is connected and ready to image.

The serial connect checkbox must be ticked in the control panel. This informs you that you have established a serial connection with the camera and can control the camera.

Secondly, the symbol near the bottom right of the control panel will have three moving dots. This indicates that you are obtaining video data from the camera. The imaging statistics displayed directly underneath the imaging window will also inform you if you are receiving a video feed from the camera.

Once you have established a serial connection with the camera and are receiving video data, you can now grab a live image feed. Clicking the “Live” button will grab a live image sequence which you will now see in the imaging window.

For the Falcon III, you will have to enable contrast modification after going live. For instruction on how to do this on XCAP, please refer to section 10.2.

The symbols in the control app discussed above are displayed in Figure 5.

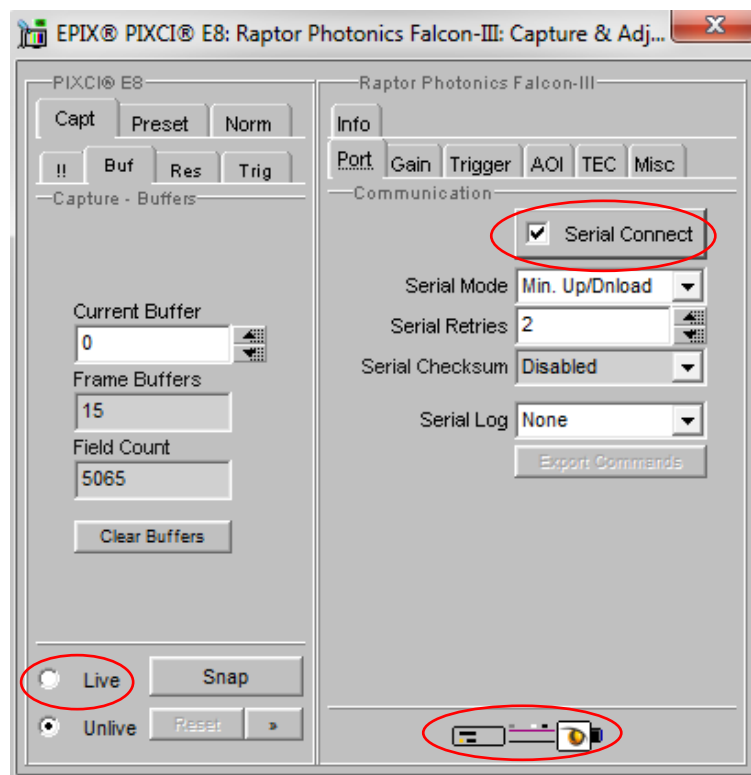


Figure 5: Port Tab – Checking Camera.

9. CONTROLLING THE CAMERA (XCAP)

The sections below will give information on using each control of the Falcon III, giving a description on how to use each control parameter and their effect on the camera's performance. The software used to illustrate the camera controls is XCAP.

9.1 EM Gain

The EM gain applied can be controlled from the “Gain” tab of the XCAP GUI, shown in Figure 6. The user can either manually input a value to apply EM Gain or use the slider bar provided. By default, the EM Gain is set to zero.

The values in the EM Gain slider bar on XCAP are not real/linear gain values. More detailed information on why Raptor does not calibrate “real gain” controls can be seen from the “Understanding Electron Multiplying Gain” technical note from our website:

<https://www.raptorphotonics.com/products/falcon-iii/>

The values on XCAP are the DAC (Digital to Analog Converter) values. During the calibration of the camera, the DAC value vs EM Gain ratio is characterized and stored in memory locations of the camera. The slider is directly controlling the amount of voltage that the EM gain register in the camera is seeing. The relationship of gain to the DAC value is exponential, so up until around 3000 on the slider, there is a minimal gain being applied (roughly in the region of 1-10x). Once you go above 3000, as the gain ramps exponentially, small changes in the slider will equate to larger changes in the gain. A gain of X1000 should be achievable by setting a DAC value of roughly 3500, as long as the camera is water cooled to roughly -60 °C. There isn't any real benefit to using a gain larger than this. For most applications, a gain in the region of X200 is sufficient.

Please note that EM gain should only ever be used when it is required and leaving the EM gain running indefinitely may cause irreparable damage to the camera. EM Gain should only be used during the experimental test. If the camera is in idle mode and not being used, EM Gain should be disabled. Extreme caution must be used when setting the DAC value for the EM Gain. As the relationship between the DAC value and gain is exponential, DAC values greater than 3000 result in large changes of real gain being applied. Using gains in the upper region (3500 – 4096) for longer lengths of time will cause the sensor to age and could cause damage to the camera.

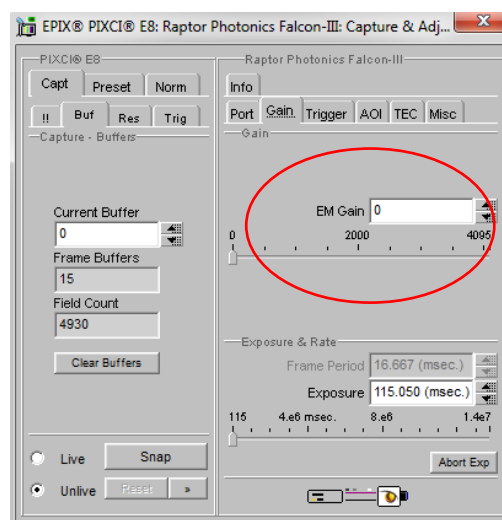


Figure 6: EM Gain.

9.2 Triggering Modes and Pixel Clock Rate

The camera's triggering mode can be toggled from the "Trigger" tab, shown in Figure 7. A summary of the triggering modes is below:

Live – ITR: This is the default mode of the camera, using the internal trigger, Integrate then Read. In this mode, the camera will run at the highest possible frame rate given the current exposure time set. The frame period will be:

$$\text{Frame period} = \text{Exposure time} + \text{Readout time}$$

Using an exposure time of 200µs with a 40MHz pixel readout speed, the maximum frame rate of 31Hz in full frame resolution can be achieved.

Live – FFR: This is fixed frame rate mode. In this mode, the user will be allowed to set a fixed frame period. If an exposure time set is greater than the maximum exposure time for the set frame period, the exposure time will dominate, and the frame period will be increased.

Ext Triggered: This mode sets the camera into external trigger mode. Enabling the external trigger will open the trigger polarity options (rising or falling edge).

There is a slight drop off in the maximum frame rate in external trigger mode. The maximum frame rate achievable in full frame resolution is roughly 29.6Hz.

In ITR mode, the camera is in full control of the trigger and is aware that repeated frames will be requested one after another as quickly as possible. Therefore, the vertical clear is skipped before the start of each acquisition. In external trigger mode, the camera has no knowledge of when the next trigger will arrive, and hence conducts the vertical clear before the beginning of the next exposure. This vertical clear accounts for the slight drop in frame rate in external trigger. The lack of the vertical clear in ITR mode also means that the effective exposure time in ITR mode is closer to exposure time + readout time.

Btn. Triggered: This mode enables the user to capture a single exposure. The "Single Exposure" button in the GUI will become active and clicking it will trigger an exposure time and capture.

Pixel Readout Clock Rate: The pixel readout clock rate can also be selected from this tab. The three readout speed options are 10MHz, 20MHz and 40MHz. By default, the camera will be set to the lowest pixel clock rate, 10MHz.

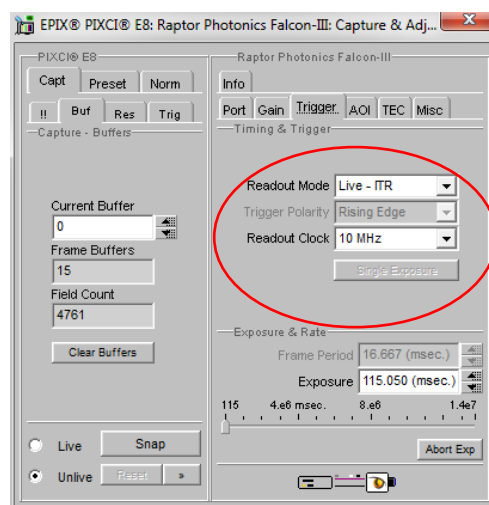


Figure 7: Trigger Tab.

9.3 Region of Interest and Binning

The region of interest and binning can be controlled from the “AOI” tab in the control panel.

A region of interest within the main active region of 1024x1024 may be defined. The ROI is setup using a bank of registers to control the X offset, the ROI width, the Y offset and the ROI height. These parameters are shown pictorially below in Figure 8.

The user must ensure that X offset + ROI width is ≤ 1024 and similarly the Y offset + ROI height is ≤ 1024 . Also, ROI width and ROI height must be > 0 .

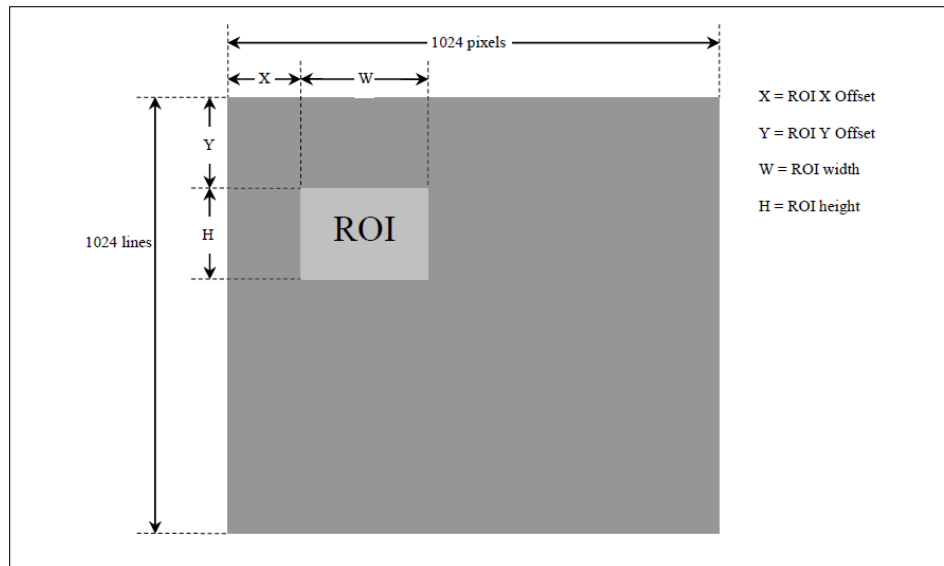


Figure 8: Region of Interest.

Binning can be set from 2x2 to 32x32. The binning options available are dependent on the pixel readout speed selected and are as follows:

10MHz: 2x2, 4x4, 8x8, 16x16, 32x32

20MHz: 2x2, 4x4, 8x8

40MHz: 2x2, 4x4, 8x8

The higher binning factors with the higher readout speeds causes the sensor to overheat and could cause damage. Therefore, they are disabled on XCAP and can only be used at the 10MHz readout speed.

9.4 Exposure Time and Frame Period

The exposure time and frame period controls are active in the control panel under all tabs, except the port and info tabs. Unless “Live – FFR” mode (discussed in section 7.6.2) is active, the frame period will set automatically to the maximum possible given the current exposure time set. The minimum exposure time in the internal trigger is 0 seconds.

If fixed frame rate mode is selected, then the user will now be able to set a fixed frame period. If the exposure time set exceeds the maximum possible under the given frame period, then exposure will dominate, and the frame period will be increased. The frame period and exposure time controls on XCAP are shown in Figure 9.

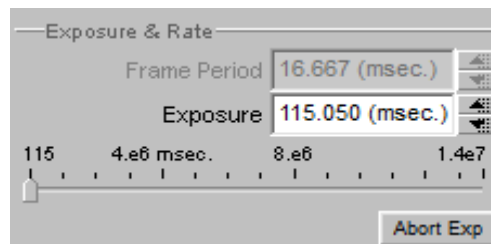


Figure 9: Exposure Time & Frame Period

9.5 Maximum Frame Rates

The maximum frame rates achievable with each binning level at 20MHz and 40MHz in 1024x1024 resolution are shown in the two tables below. These frame rates were measured in with a 0 second exposure time in internal trigger mode.

40MHz Pixel Clock	
Binning Factor	Frame Rate
1x1	31.6
2x2	57.0
4x4	95.4
8x8	143.6

20MHz Pixel Clock	
Binning Factor	Frame Rate
1x1	16.8
2x2	31.8
4x4	57.1
8x8	95.0

9.6 Thermoelectric Cooler (TEC)

The “TEC” tab in the GUI gives the user control over the TEC and fan. The minimum cooling temperature using both the fan and liquid cooling is -70°C. If only using the fan, the minimum cooling temperature is -40°C. In some cases, you may be able to cool as low as -50°C with only the fan. For important information on using the liquid cooling with the chiller, please refer to sections 6.2 – 6.5.

The actual TEC set point of the camera should be within $\pm 2^{\circ}\text{C}$ of the TEC set point set by the user. The sensor temperature will then have a stability of $\pm 0.5^{\circ}\text{C}$ around the actual TEC set point.

The TEC controls in XCAP are shown in Figure 10.

WARNING: Raptor strongly recommends to always use water cooling if possible, especially if using the 40MHz pixel clock speed and EM gain. Using only the fan at 40MHz with EM Gain applied for extended periods of time, can cause the sensor package to overheat and could potentially cause damage.

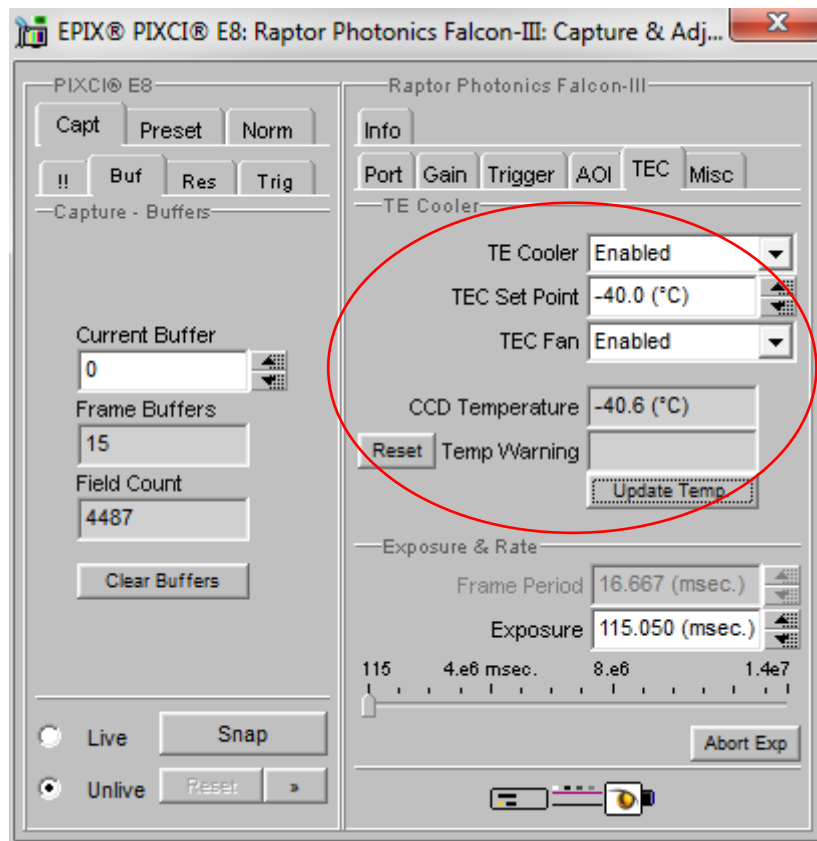


Figure 10: TEC Control Tab.

9.7 Information Tab

The “Info” tab displays the manufacturers data of the camera, such as the firmware version, serial number etc. The sensor and PCB temperature can also be read from this tab. The “Info” tab is shown in Figure 11.

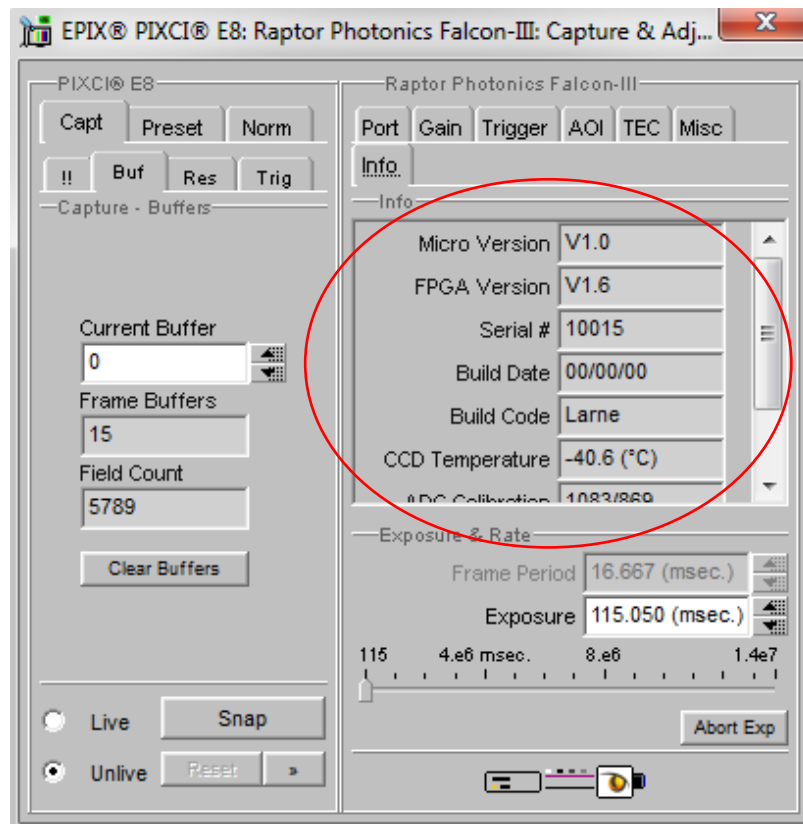


Figure 11: Trigger Tab.

10. XCAP CONTROL FEATURES

XCAP has many different control functions and analytical tools that can be used when imaging the camera. For the full XCAP user guide, please refer to the link below:

http://epixinc.com/manuals/pixci_e14el/index.htm

This section will discuss in detail a few features on XCAP that Raptor thinks would be of immediate use when using the camera.

10.1 Saving Preset Settings

Different camera and frame grabber settings can be saved in the “*Preset*” tab under the PIXCI (relevant frame grabber model number) section of the GUI, as shown in Figure 12.

Up to three different presets can be saved per settings file. If the camera is set to a desired state outside of the default state, clicking “Save 1” will save all the current parameter states that have been set. This can be done a further two times. These camera states can be recalled at any time by using the recall buttons. The overall settings file can then be saved and loaded in this tab also. Three preset states is the maximum number that can be saved in a settings file.

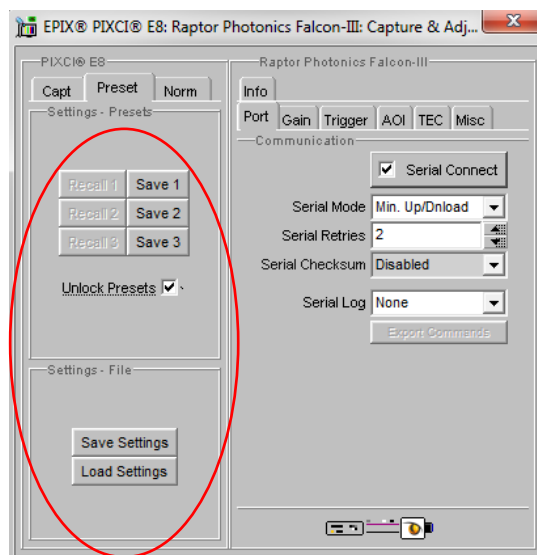


Figure 12: Preset Settings.

10.2 Contrast Modification (XCAP Std. Only)

The image contrast can be modified from the “Contrast Modification” section under the “Modify” tab in the XCAP imaging window. Where to find this control feature is shown in Figure 13. If wanting to view a useable image without any EM gain applied, contrast modification will have to be enabled. Raptor recommends having this enabled at all times when imaging the camera. If applying ROI or binning controls, the contrast modification will have to be re-enabled each time.

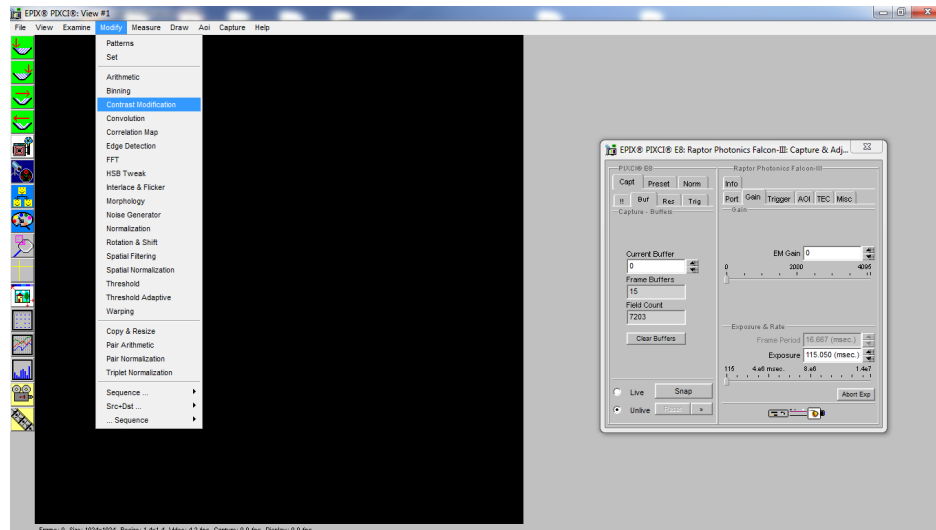


Figure 13: Contrast Modification Location on Toolbar.

In the contrast modification box, that can be seen from Figure 14, select “Stretch Contrast, Histogram Percentile Endpoints” and click “preview”. The contrast modification will now be applied over the live image feed. The contrast can be adjusted using the low and high end percentile point controls. The default settings are usually adequate for most applications.

NOTE: This control feature is only applicable with XCAP Std.

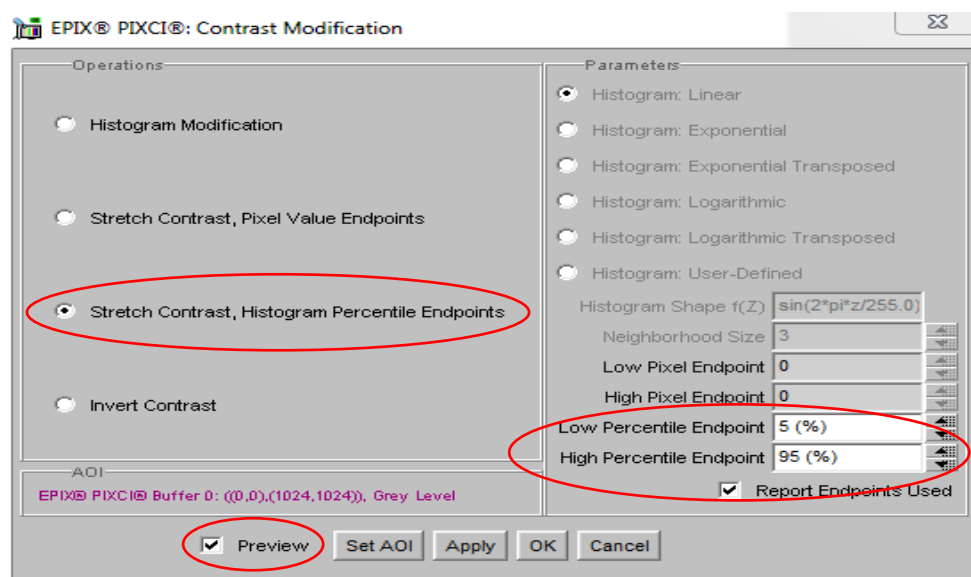


Figure 14: Contrast Modification.

11. MICRO-MANAGER

NOTE: Micro-Manager currently not compatible with demo Mini PCs. XCAP will have to be used to test the camera on demo.

Micro-Manager is a free open source software package that enables you to image and control the Falcon III. Primarily, it is a software package designed for microscopy applications, as the software provides control of microscopes as well as the camera. However, Micro-Manager can also be used to simply image the Falcon III and control each of its parameters.

Micro-Manager is a complete image acquisition and camera & microscope control package, available for Windows. The software package is also available for Mac. However, using the Falcon III with a Mac would most likely be problematic due to the lack of PCIe slot for the frame grabber. Linux can also be used, but there is no precompiled Micro-Manager version available. Windows is the easiest and most common solution to use. Micro-Manager is easy to install and configure and offers a plug and play solution for using the Falcon III. It's also a software framework for implementing advanced and novel imaging procedures, extending functionality, customization and rapid development of specialized imaging applications.

Micro-Manager has been developed at UCSF since the beginning of the project. Starting on October 1, 2015, Micro-Manager is developed and maintained by Open Imaging, a company founded by the Micro-Manager development team.

11.1 Downloading and Installing Micro-manager (Windows)

Micro-Manager is updated nightly. Raptor recommends downloading the latest nightly build from the link below:

https://micro-manager.org/wiki/Micro-Manager_Nightly_Builds

Select "*Version 1.4 Windows*" under "*Nightly Builds*" and download the latest 64 or 32 bit build, depending on the operating system being used.

After downloading and opening the setup application file, an installation wizard will appear. Micro-Manager will automatically be installed in "*C:\Program Files\Micro-Manager-1.4*". If wanting to store Micro-Manager in another location, you can do this on the second page of the installation wizard. If not, you can simply keep selecting "*Next*" until the "*Install*" option is available on the last page of the installation wizard.

11.2 Creating Camera Configuration File

After loading up Micro-Manager, the start-up configuration window will pop up. The user should ensure that “(none)” or “MMConfig_demo.cfg” is selected from the dropdown list and click “Ok”. This is shown in Figure 15.

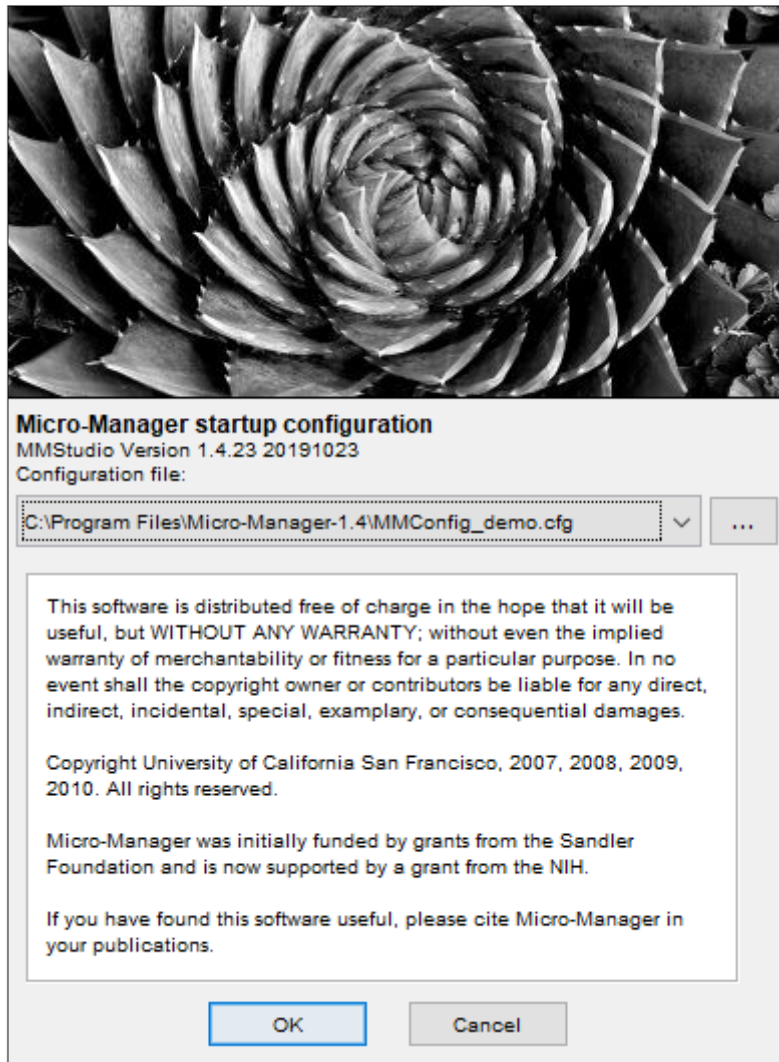


Figure 15: Hardware Configuration Wizard Location.

The main Micro-Manager window will now appear. To access the hardware configuration wizard to create the configuration file, go to the tools tab on the toolbar, shown in Figure 16.

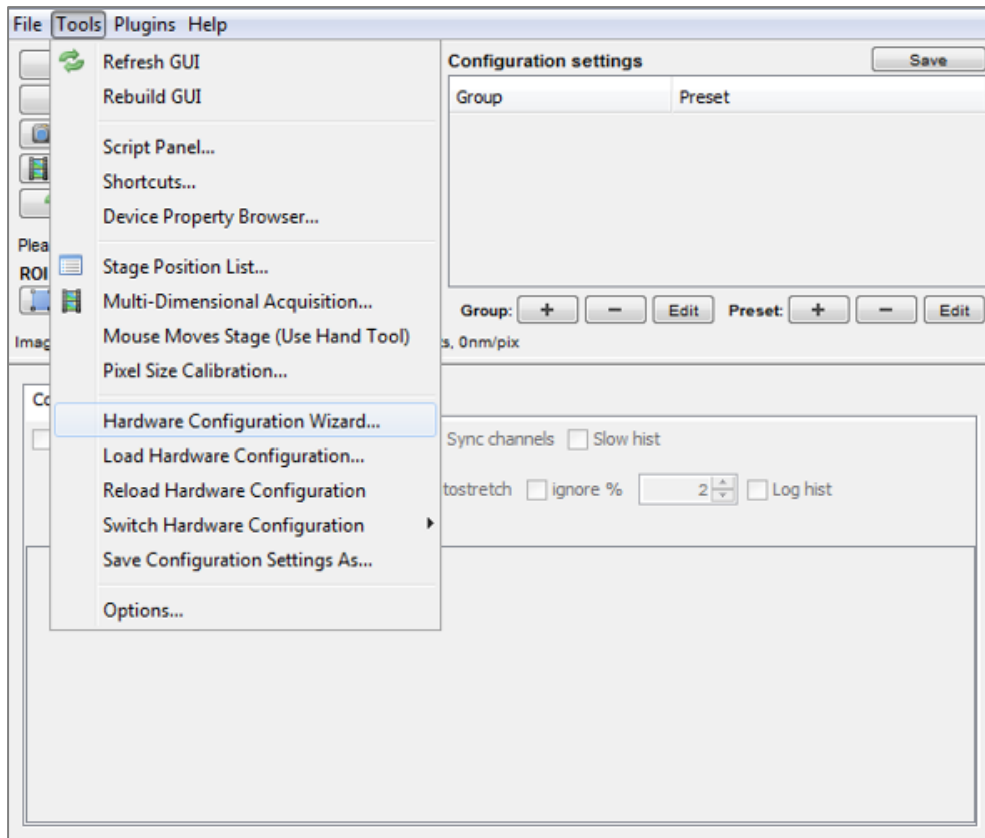


Figure 16: Hardware Configuration Wizard Location.

Figures 17 – 21 outlines the process to create the Falcon III.cfg file. After selecting the Hardware Configuration Wizard from the main toolbar, the wizard will pop up. Ensure “Create new configuration” is enabled and click “Next”.

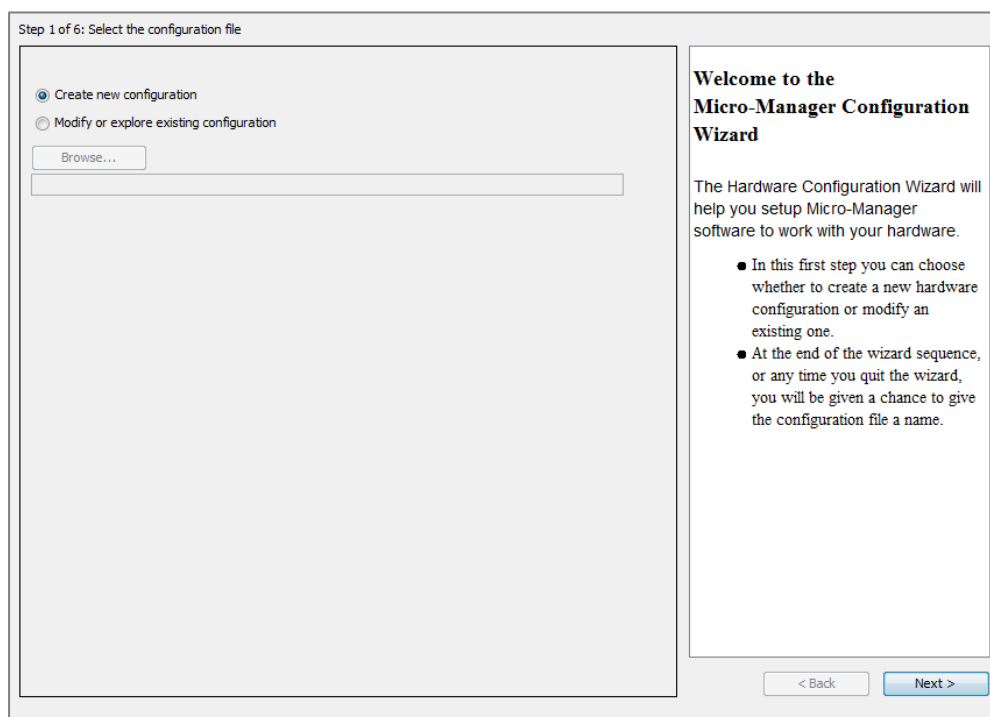


Figure 17: Hardware Configuration Wizard.

Under “Available Devices”, select “Raptor Falcon III Camera” from the “RaptorEPIX” folder.

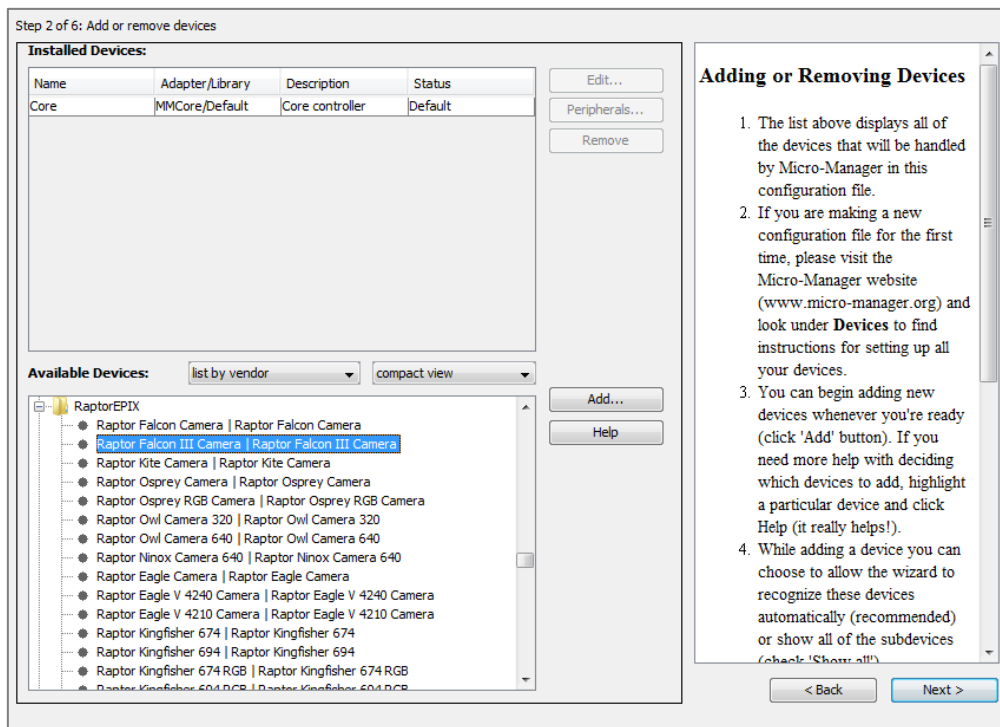


Figure 18: Available Devices.

After selecting the Falcon III, a pop up window will appear with the device and property values stated in Figure 19. Click “Ok”.

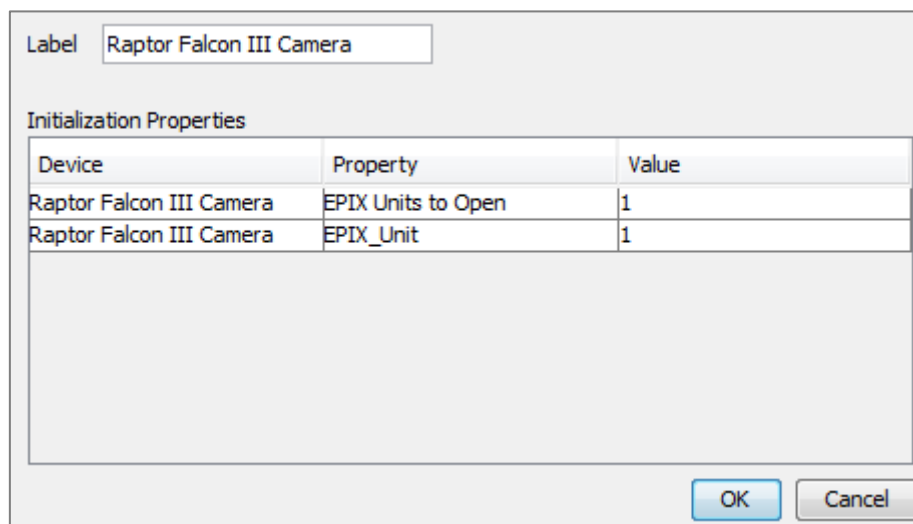


Figure 19: Device and Property Values.

Under “Installed Devices”, the Falcon III will now be listed (Figure 20). If the software froze on the last stage or an error occurs and the camera is not listed under the installed devices section, then there is an issue with the camera connection, either with the Camera Link or power connection.

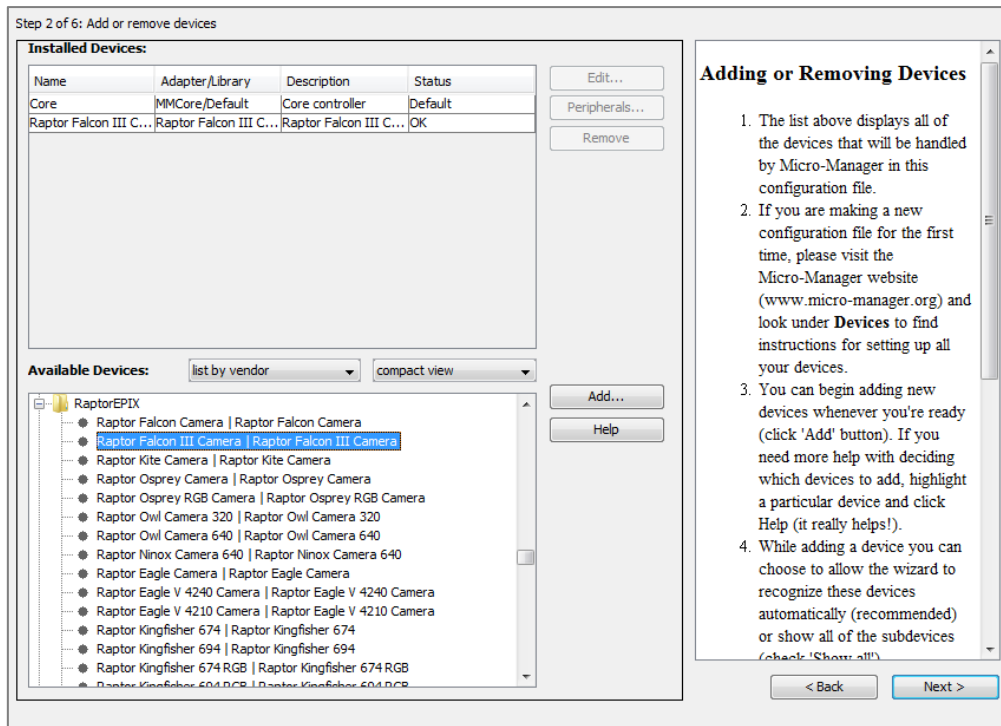


Figure 20: Installed Devices.

The user should now click “Next” multiple times until reaching the window shown in Figure 21. Once at this stage, the final step is to choose the name of the configuration file and where to store it. The common place is to store in the Micro-Manager-1.4 folder, usually stored in “C:\Program Files\Micro-Manager”. After selecting the name and location, click “Finish”.

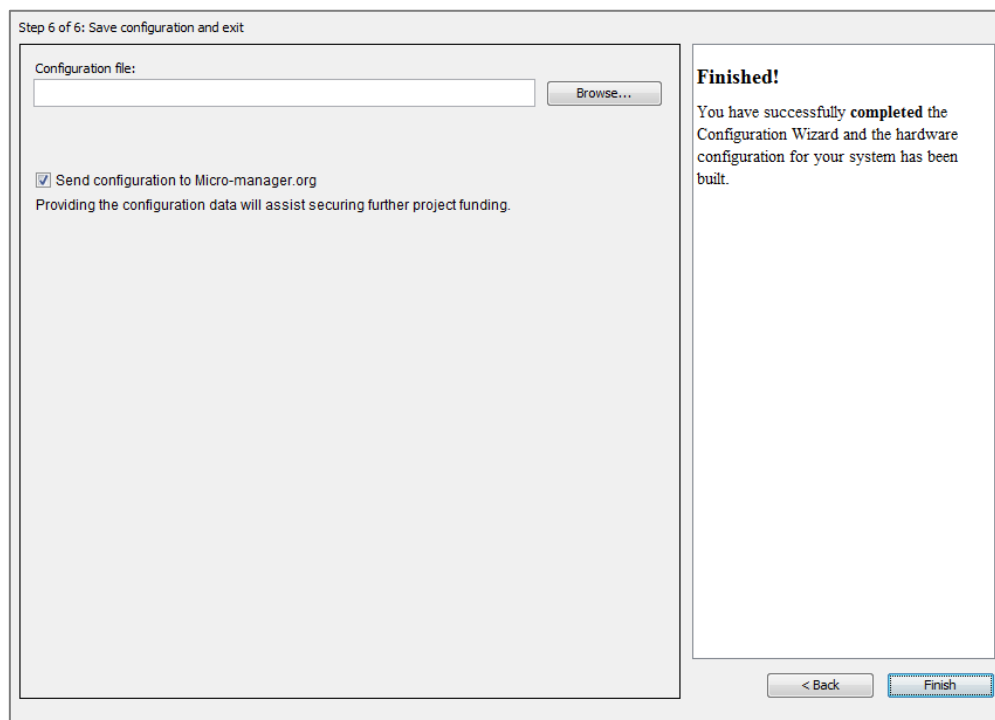


Figure 21: Installed Devices.

After finishing the steps outlined above, the user will now be redirected back to the main Micro-Manager window where you can now image and control the camera.

11.3 Pre-made Configuration File

Raptor can supply a premade configuration file that has already been created, with all important controls extracted from the device property browser (Figure 24) to the main Micro-Manager window. To obtain this, please contact Raptor or your local distributor.

When the Falcon III configuration file has been obtained (Falcon III.cfg), it will have to be stored in the Micro-Manager folder to access it. If the Micro-Manager download was stored in the default section, the configuration file should be stored in the same location:

C:\Program Files\Micro-Manager-1.4\Falcon III.cfg

If the software download was stored in a different location during installation, then the configuration file should be stored there.

After performing this process and loading Micro-Manager, the Falcon III.cfg file should be listed in the dropdown box of the Start-up Configuration window, as seen from Figure 22. Select this file and click “Ok”.

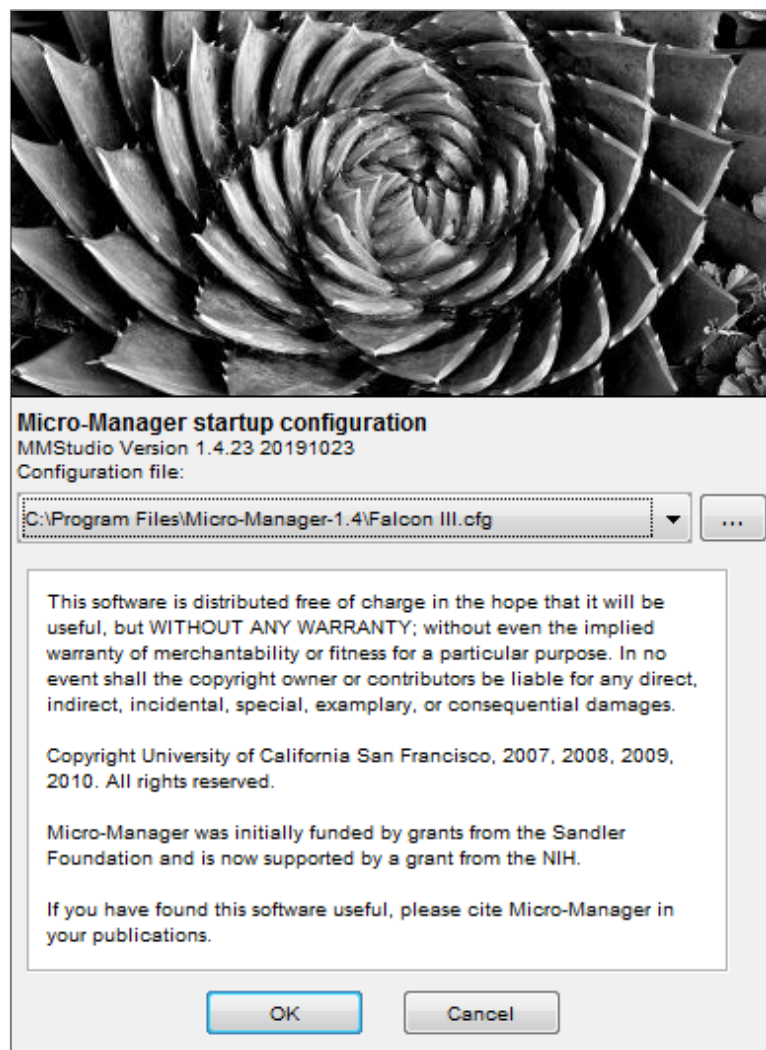


Figure 22: Installed Devices.

11.4 Imaging and Controlling the Camera

The full Micro-Manager User Guide can be obtained from the link below:

https://micro-manager.org/wiki/Micro-Manager_User%27s_Guide

This user guide gives a full breakdown on using all features and analytical tools of Micro-Manager.

To access the controls of the camera, select “*Device Property Browser*” from the “*Tools*” tab on the toolbar of the main Micro-Manager window, shown in Figure 23.

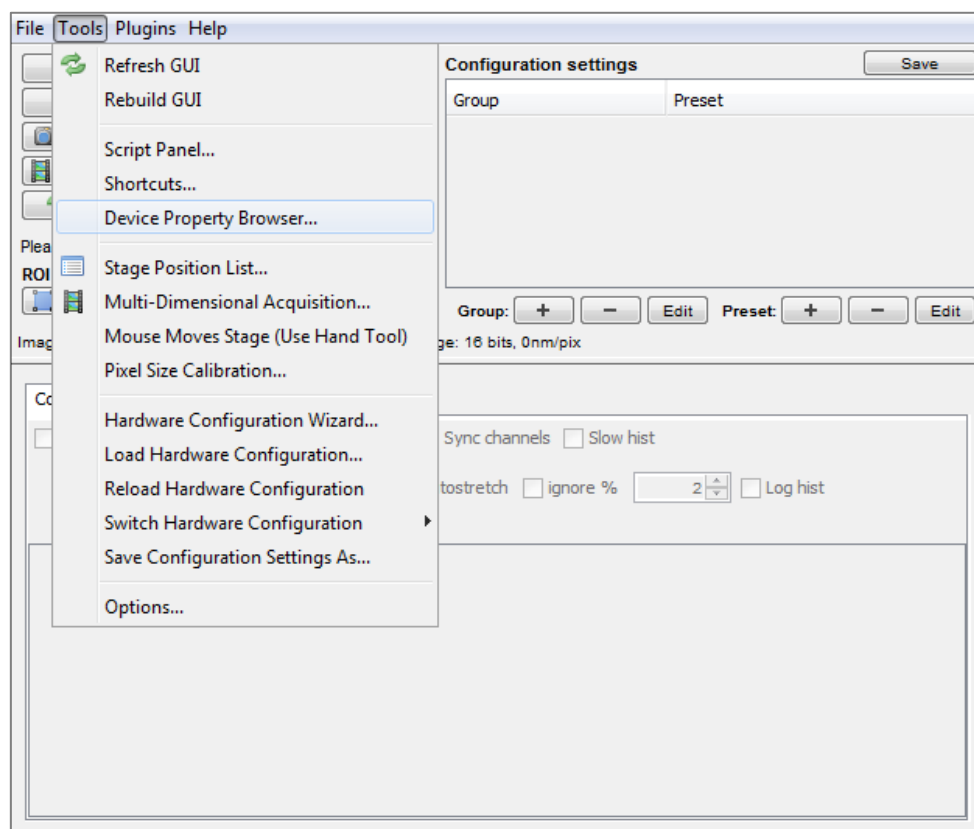


Figure 23: *Device Property Browser Location.*

The device property browser will now open which gives a detailed list of all camera controls available, shown in Figure 24.

<input checked="" type="checkbox"/> Show cameras	Refresh!
<input checked="" type="checkbox"/> Show shutters	
<input checked="" type="checkbox"/> Show stages	<input checked="" type="checkbox"/> Show read-only properties
<input checked="" type="checkbox"/> Show discrete changers	
<input checked="" type="checkbox"/> Show other devices	

Property	Value
Raptor Falcon III Camera-Binning	1
Raptor Falcon III Camera-BitDepth	16
Raptor Falcon III Camera-Build Info	Larne 12/3/2019
Raptor Falcon III Camera-CCD X Pixels	1,024
Raptor Falcon III Camera-CCD Y Pixels	1,024
Raptor Falcon III Camera-CameraID	10020
Raptor Falcon III Camera-CameraName	Falcon III
Raptor Falcon III Camera-Description	RaptorEPIX Device Adapter
Raptor Falcon III Camera-Device Adapter	v1.14.5, 1/27/2020
Raptor Falcon III Camera-EMGain	0
Raptor Falcon III Camera-EPIX Driver	PIXCI(R) 64 Bit Driver V3.8.01 [20.01.21.152518]
Raptor Falcon III Camera-EPIX Library	PIXCI(R) 64 Bit Library 3.08.00 [15.08.31]
Raptor Falcon III Camera-EPIX Model	PIXCI(R) E8 Imaging Board
Raptor Falcon III Camera-EPIX Unit	1
Raptor Falcon III Camera-Exposure	25
Raptor Falcon III Camera-Exposure Max	1,000
Raptor Falcon III Camera-Ext. Trigger	Live: Integrate Then Read
Raptor Falcon III Camera-FPGA Version	1.7
Raptor Falcon III Camera-Force Update	Off
Raptor Falcon III Camera-Frame Average	1
Raptor Falcon III Camera-Frame Interval (ms)	0
Raptor Falcon III Camera-Frame Rate (FPS)	1
Raptor Falcon III Camera-Micro Reset	Off
Raptor Falcon III Camera-Micro Version	1
Raptor Falcon III Camera-Name	Raptor Falcon III Camera
Raptor Falcon III Camera-PixelType	16 bit
Raptor Falcon III Camera-ROI Use	On
Raptor Falcon III Camera-ROI X	0
Raptor Falcon III Camera-ROI X Size	1,024
Raptor Falcon III Camera-ROI Y	0
Raptor Falcon III Camera-ROI Y Size	1,024
Raptor Falcon III Camera-Readout Rate (MHz)	10
Raptor Falcon III Camera-TE Cooler	Off
Raptor Falcon III Camera-TFC Fan	On

Figure 24: Device Property Browser.

To understand each control parameter of the Falcon III, please refer to section 9 that gives detailed and important information of using each camera control and the effect that it has on the camera performance. Please Note that the controls in Micro-Manager are listed in alphabetical order.



CORPORATE HEADQUARTERS

Raptor Photonics LTD
Willowbank Business Park
Larne, Co Antrim
BT40 2SF
Northern Ireland
PH: +44 2828 270141

www.raptorphotonics.com