

HAWK 252

Model: HK252-CL



USER MANUAL

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1. INTRODUCTION

This document provides detailed instructions for the operation of the Hawk 252 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 Hawk 252 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 the camera controls. Important precautions to be taken when using the camera are also stated.

Detailed information is also provided on each of the camera's 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 Hawk 252 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 Hawk 252 is designed for applications that require high sensitivity and resolution (1280 x 1024). The camera is a cooled HD EMCCD, with back-illuminated EMCCD technology, enabling ultimate sensitive imaging ($<50\mu\text{lux}$). 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.

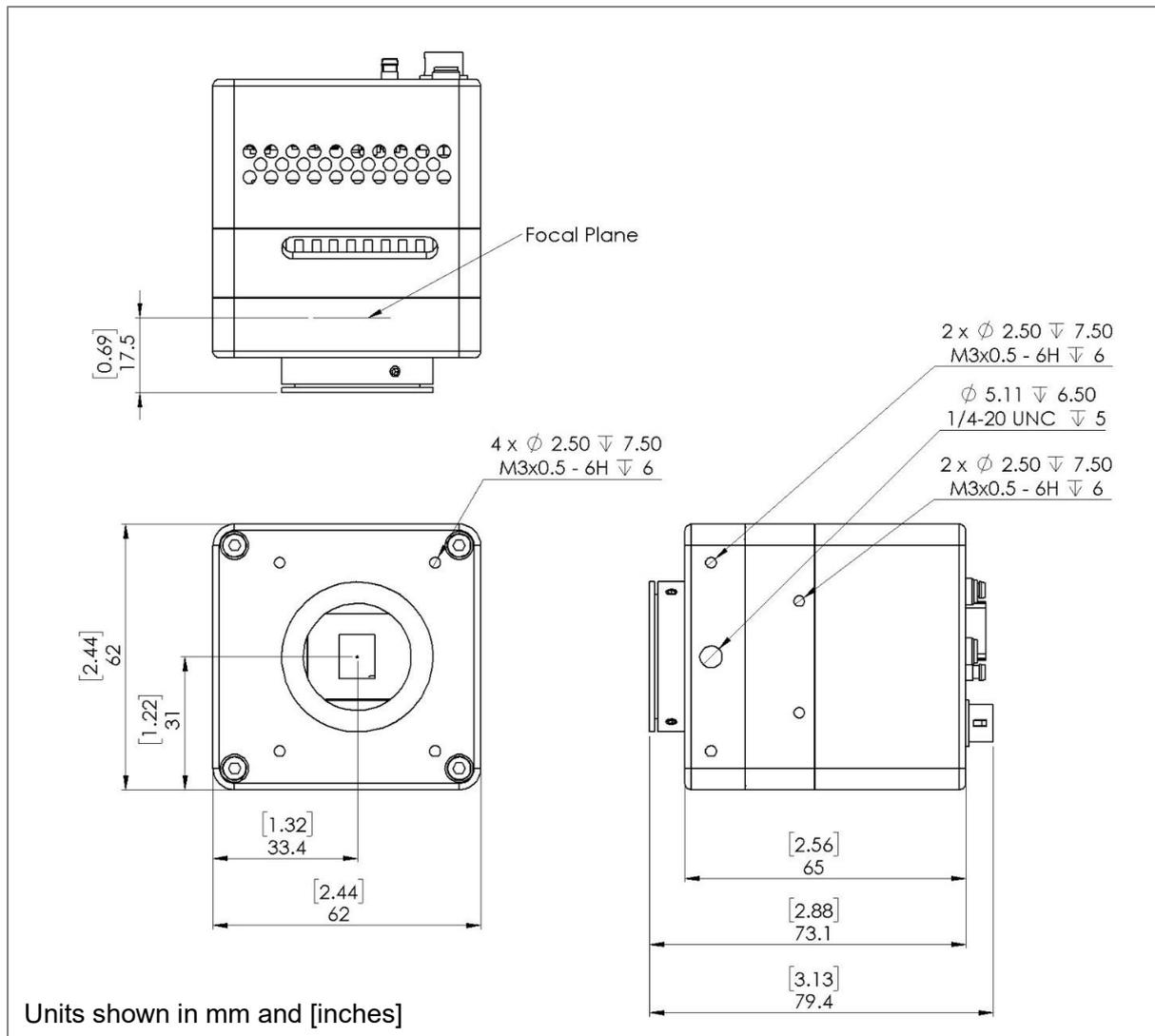
3.2 Datasheet

For the full specification of the Hawk 252, the datasheet for the camera can be downloaded from the Raptor Photonics website:

<https://www.raptorphotonics.com/products/hawk-252/>

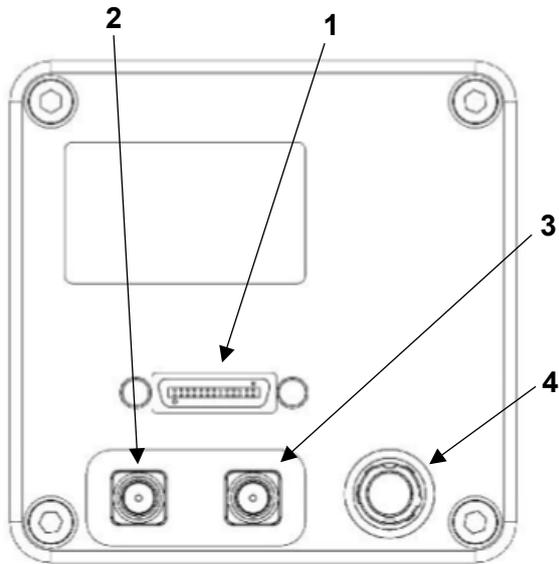
4. DESIGN OVERVIEW

4.1 Mechanical Model



PDF of mechanical model available from our website:
<https://www.raptorphotonics.com/products/hawk-252/>

4.2 Physical Interface



- 1. 3M CameraLink connector (TyOUT)**
Part #: 12226-1150-00FR
- 2. SMA connector: Trigger Out.**
Single ended, source impedance = 51Ω , capable of sinking and sourcing 32mA and will have an output voltage of 3.3v i.e. TTL compatible.
- 3. SMA connector: Trigger In.**
Single ended, termination impedance = 510Ω , capacitive load = 200 pF, TTL compatible.
- 4. 4 Pin Hirose connector**
Part #: HR10A-7R-4PB(73)

4.3 Power Consumption

Unit input power specification is +12V DC +/- 0.5V with <15W power dissipation when the TEC is disabled. An additional 5W may be required if the full drive to the TEC is required. This will be dependent on environmental conditions and the TEC temperature set point.

The set point for the TEC cooling is +15 °C. The TEC power is automatically adjusted to try and achieve the set point temperature. For low ambient temperatures or with additional heat sinking, less than 5W may be applied to the TEC to achieve the set point.

4.4 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 Hawk 252.

5.1 XCAP Compatibility

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

5.2 Custom Software Interfacing

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. Raptor can provide a full ICD with all serial settings and serial commands to control the camera. This, along with the SDK that you obtain, will enable you to integrate the camera into a custom software package.

6. CAMERA SETUP AND REQUIREMENTS

This section will give instruction on setting up the camera with the frame grabber and also states important requirements for the frame grabber and PC.

6.1 Connecting the Camera to the Frame Grabber

The Hawk 252 uses base Camera Link configuration, so therefore requires a frame grabber that supports base Camera Link. The frame grabber that Raptor offer with this camera is the EB1 model from EPIX. When using this frame grabber, one MDR – SDR Camera Link cable is required to connect the camera to the frame grabber.

If demoing the camera with the Mini PC system that Raptor provides, you should connect the left port of the frame grabber to the SDR port on the camera interface. This should be labelled on the mini PC that is sent with the demo kit.

6.2 Computer/Laptop System Requirements

The basic system 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 Owl 640 S uses a base Camera Link interface which can be handled with a x1 PCIe bus and PIXCI EB1 from EPIX, providing roughly 200MB/sec maximum bandwidth. Contact EPIX Inc. for further information regarding minimum computer/laptop specification requirements to run the XCAP Imaging Software.

6.3 Frame Grabber Requirements

It is a minimum requirement to use the EB1 frame grabber model if using EPIX. If using another frame grabber from a different company, the specification of this frame grabber must match that of the EB1 model.

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

7. XCAP IMAGING SOFTWARE

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

7.1 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.

7.2 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.

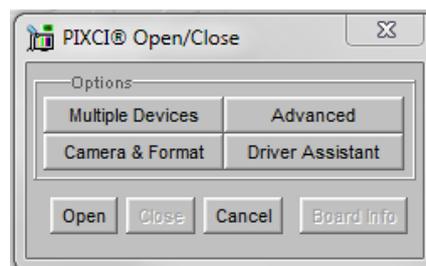


Figure 2: PIXCI Open/Close.

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

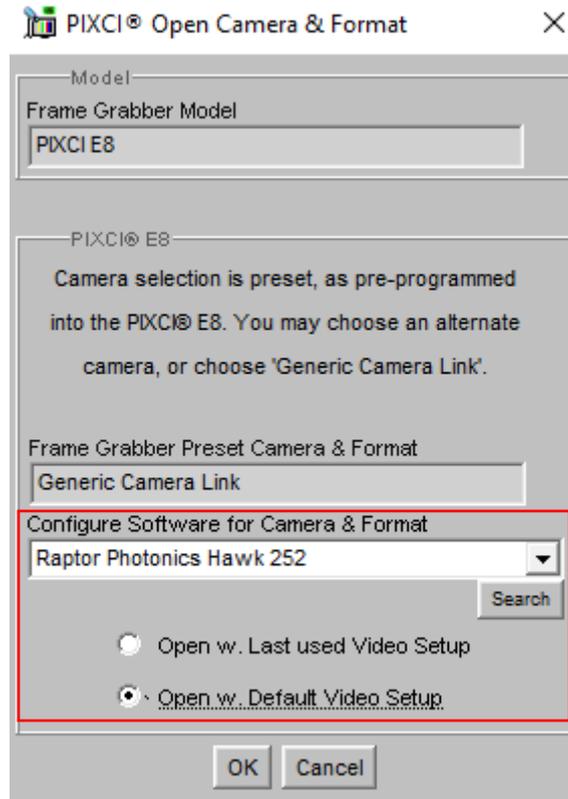


Figure 3: PIXCI Open Camera & Format.

Using the dropdown menu highlighted, search for “Hawk 252”, which will bring up the Raptor Photonics Hawk 252 camera configuration. Select ok on this 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.

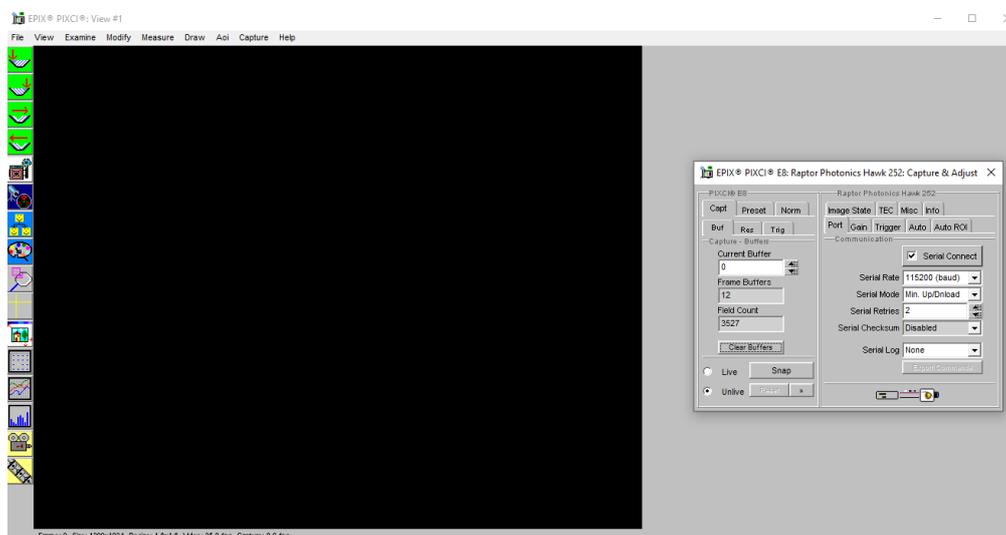


Figure 4: Imaging Window & Control Panel.

7.3 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.

When the camera is grabbing a live image sequence, you should immediately enable contrast modification. Instructions on how to do this can be seen from section 10.2.

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

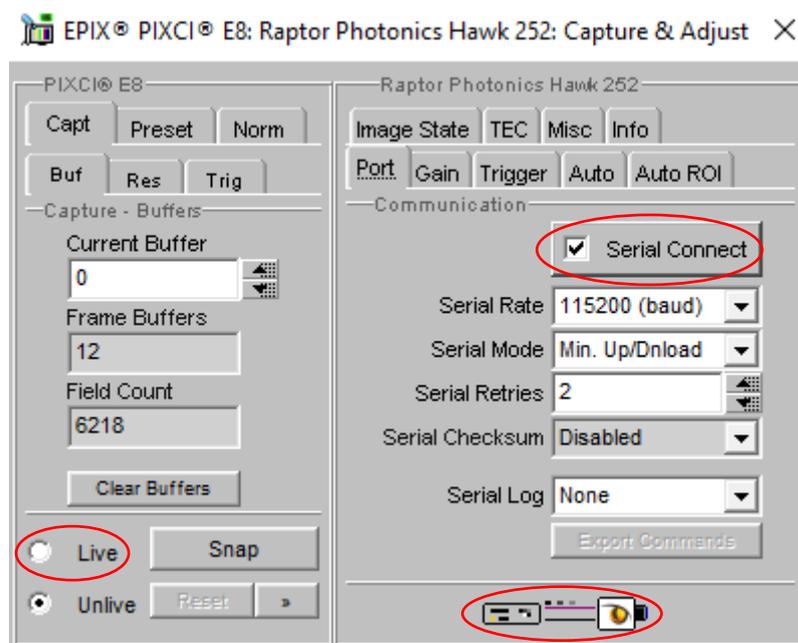


Figure 5: Checking Camera Connection and Acquiring a Live Image.

8. CONTROLLING THE CAMERA (XCAP)

The sections below give information on using each control of the Hawk 252, 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.

8.1 Exposure and Gain Control

The exposure and gain (EM and digital) can be controlled automatically by using the Automatic Light Control (ALC). When the ALC is enabled, the camera will automatically adjust the exposure and gain of the camera based on the ALC parameters set. Adjusting the ALC parameters is discussed in section 8.3.

If the ALC is disabled, the user will be able to select EM and digital gain values. Please take great caution when manually controlling the EM gain. Using excessive levels of EM Gain when not required can possibly cause damage and aging of the sensor. Raptor recommends using the ALC to automatically control the EM gain.

The gain controls are shown in Figure 6.

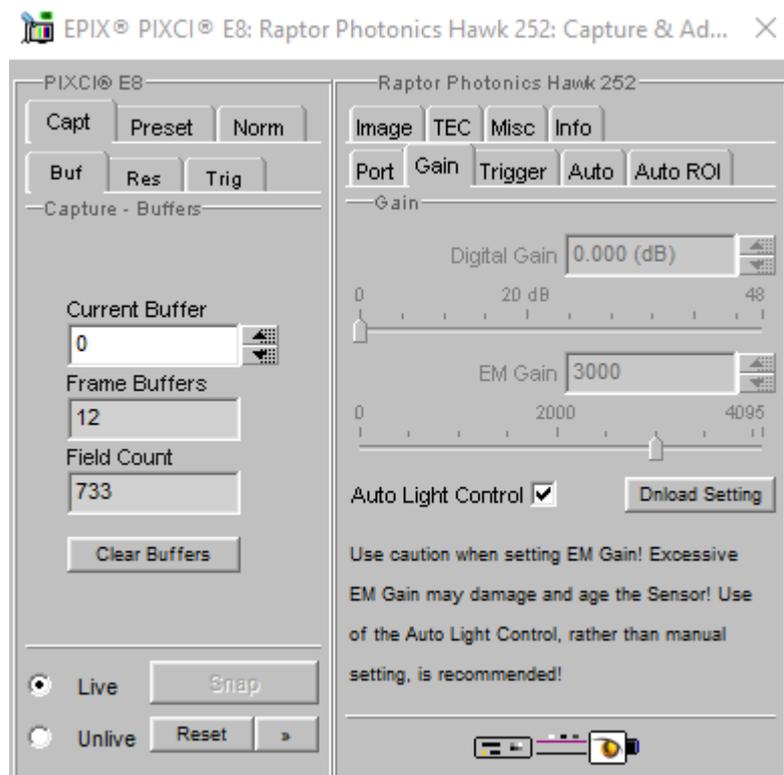


Figure 6: Gain Controls.

8.2 Frame Rate and Triggering Modes

The frame rate state and trigger mode of the camera can be controlled from the “Trigger” tab of the XCAP GUI, shown in Figure 7.

Currently, the camera runs only at 25Hz. This will eventually be adjusted so that a few different discrete frame rate options can be selected.

The trigger state of the camera can also be adjusted. By default, the camera is set to Internal trigger mode, Integrate Then Read. If wanting to externally trigger the camera, this can be performed by selecting “Ext. Trigger” from the “Trigger Mode” dropdown box.

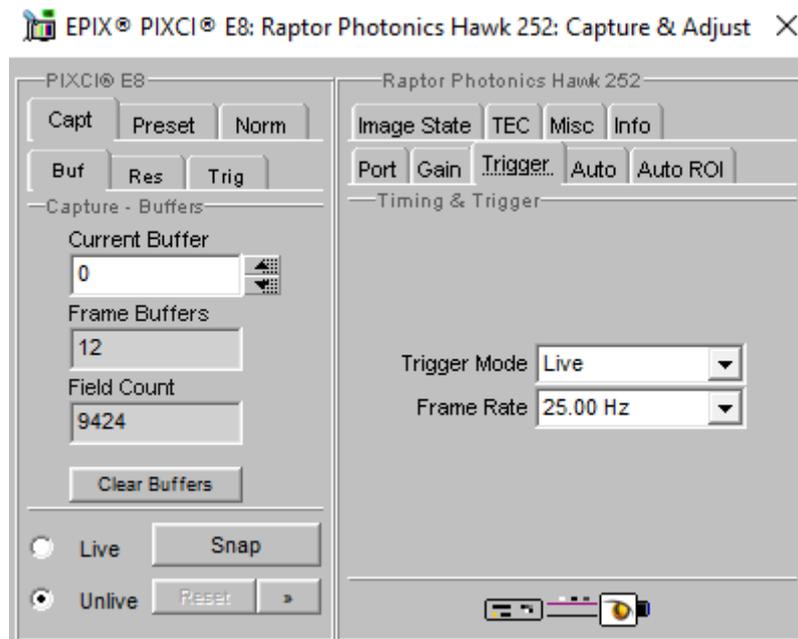


Figure 7: Frame Rate and Trigger Mode Controls.

8.3 Automatic Light Control Adjustment

The ALC can be fine tuned by adjusting a few different parameters. A Region of Interest (ROI) of pixels can also be defined in which to drive the ALC. These controls are discussed below.

8.3.1 Automatic Light Control Parameters

Peak and average video levels are derived and monitored for the active ROI and are used to drive the ALC. The active video level used to compare to the set point can be adjusted from full average to full peak or a percentage of both. The percentage used of the average and peak video levels can be adjusted from the “Auto” tab in the XCAP GUI. An explanation of the average and peak video levels are stated below.

Average Video Level: An average video level is calculated for the active ROI. This value will be calculated in real time, i.e. as pixel data in the ROI is captured from the sensor, it is fed directly to an accumulator. At the end of the frame, the accumulator is divided to give a true average.

Peak Video Level: The peak video is determined from a rolling average of 4 pixels. Current pixel + 3 previous pixels are used to derive a peak value. This peak value is monitored for the ROI and latched at the end of frame.

Selecting a greater percentage from the average will drive the ALC to use greater exposure and gain values. Selecting a greater percentage from the peak will have the opposite effect.

ALC Level: The ALC level can also be adjusted to fine tune the ALC. Increasing the level will cause greater exposure and gain values to be set by the ALC. Decreasing the level will have the opposite effect.

Both controls can be adjusted depending on the performance of the ALC in the current imaging scene conditions set.

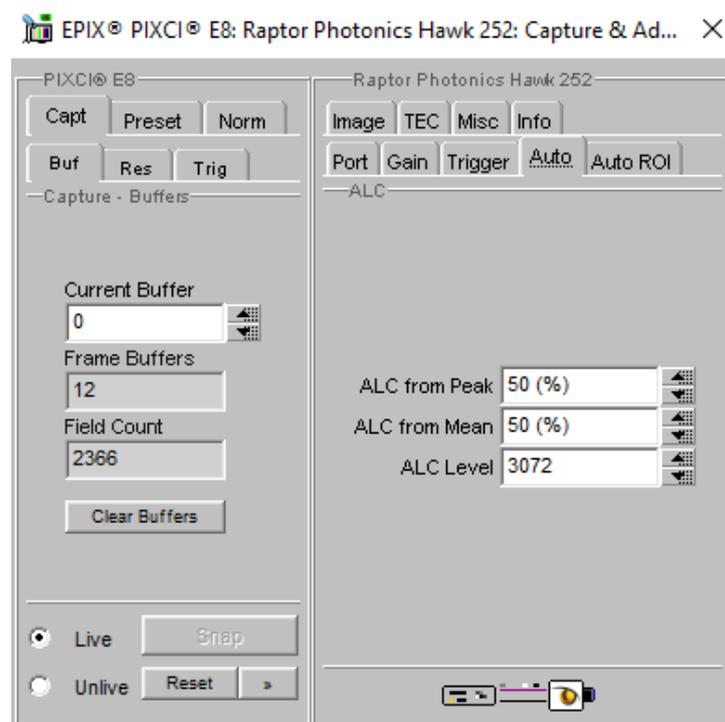


Figure 8: ALC Parameters.

8.3.2 Automatic Light Control Region of Interest

A Region of Interest (ROI) within the main active region of 1280 x 1024 may be defined. This region is used to calculate peak and average video levels to drive the Automatic Light Control (ALC) function of the camera (discussed in section 8.3.1).

The ROI offset and sizes are outlined in Figure 9.

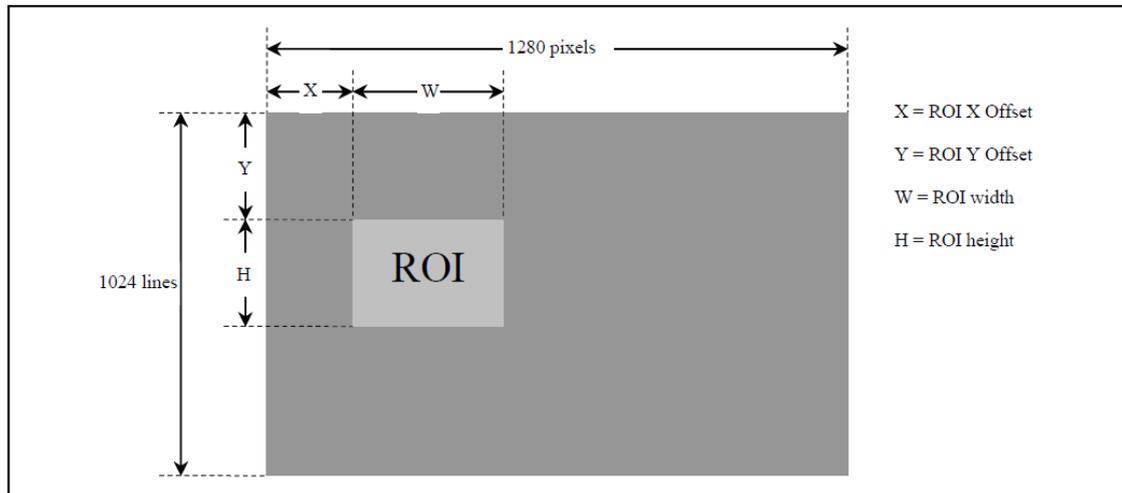


Figure 9: Region of Interest Size and Offset.

The active ROI for the ALC can be adjusted from the “Auto ROI” tab in the XCAP GUI, shown in Figure 10.

The ROI can be moved to within a resolution of 8 pixels in the X and Y axis and the ROI size will have a resolution of 8 pixels. The default ROI settings are shown in Figure 10.

An optional ROI outline feature can be enabled that highlights a 1 pixel wide box around the active ROI set. This can be enabled by selecting “ROI Box” from the “ROI Highlight” dropdown box.

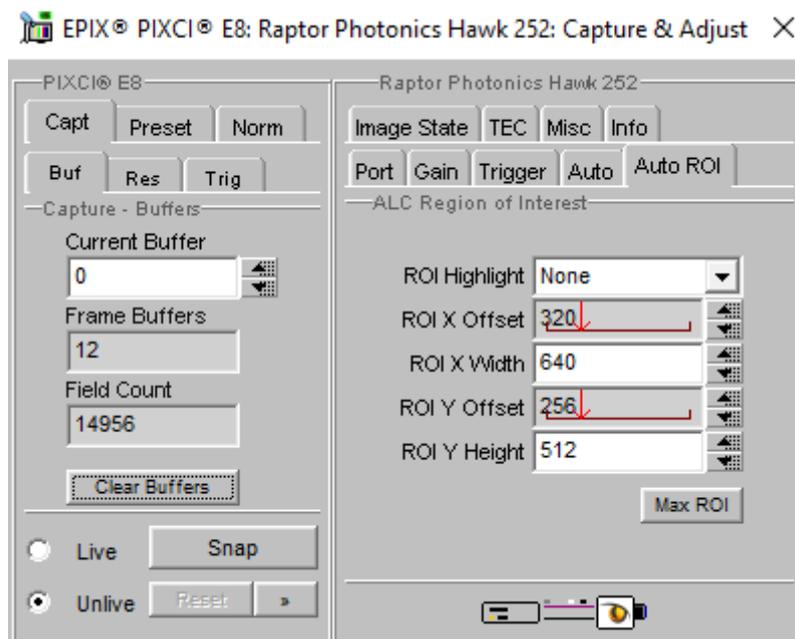


Figure 10: Region of Interest Size and Offset Controls.

8.4 Image State

The image state of the camera can be adjusted from the “Image State” tab in XCAP. The camera has four different image state options:

- Gain Corrected
- Raw Data
- Test Pattern 1
- Test Pattern 2

By default, the camera will be running in “Gain Corrected” which is what Raptor recommends using the camera in. If wanting to obtain the raw data from the camera without the gain correction, the “Raw Data” state can be used.

There are two different test patterns which can also be enabled.

This controls are shown in Figure 11.

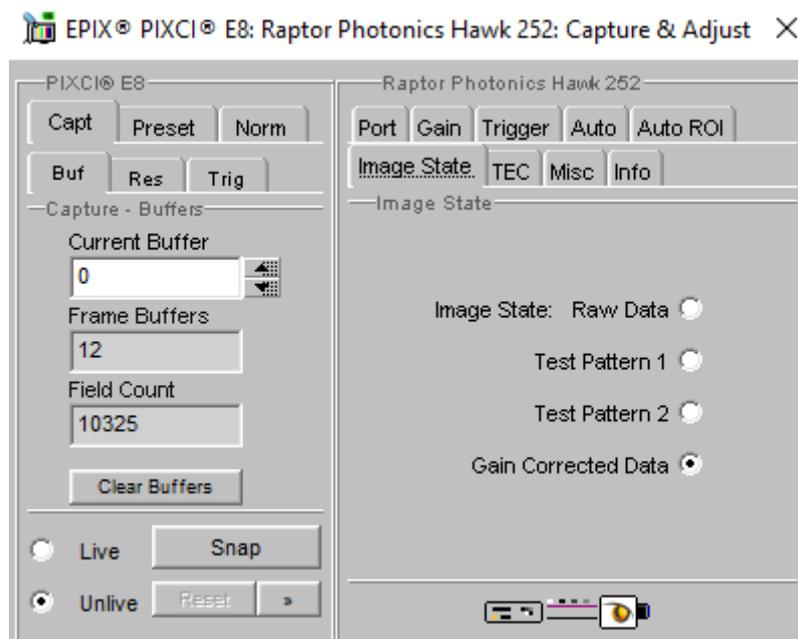


Figure 11: Image State Control.

8.5 Thermoelectric Cooler

The Thermoelectric Cooler (TEC) can be controlled from the “TEC” tab of the XCAP GUI, as shown in Figure 11.

By default, the TEC will be enabled and set to 15 °C. This is the optimum temperature of the camera and the sensor temperature that the gain correction is performed. Raptor recommends keeping the TEC set point at 15 °C. The TEC set point can be set lower, but there is a delta limit between the sensor and PCB temperature. Therefore, there will have to be adequate heat sinking if wanting to use a lower set point. If imaging in an ambient around room temperature, it may be difficult to hold a set point lower than 15 °C.

The sensor temperature can also be read back by clicking “*Update Temp*”.

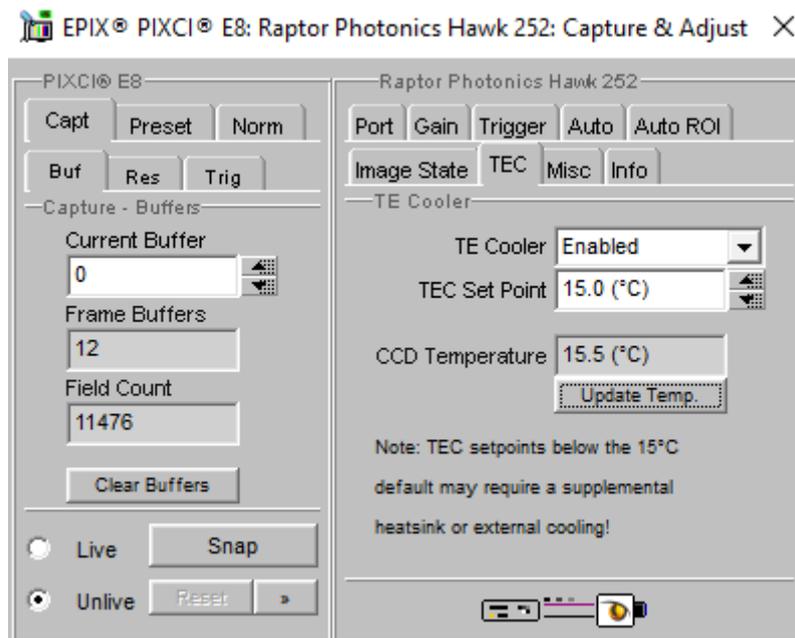


Figure 12: Thermoelectric Cooler.

8.6 Horizontal Flip and Micro Reset

The “Misc” tab on XCAP has the controls for the horizontal flip and the micro reset, shown in Figure 13.

By default, the camera will have horizontal flip enabled, which flips the image in the Y axis. There is also a button that enables a micro reset of the camera if required.

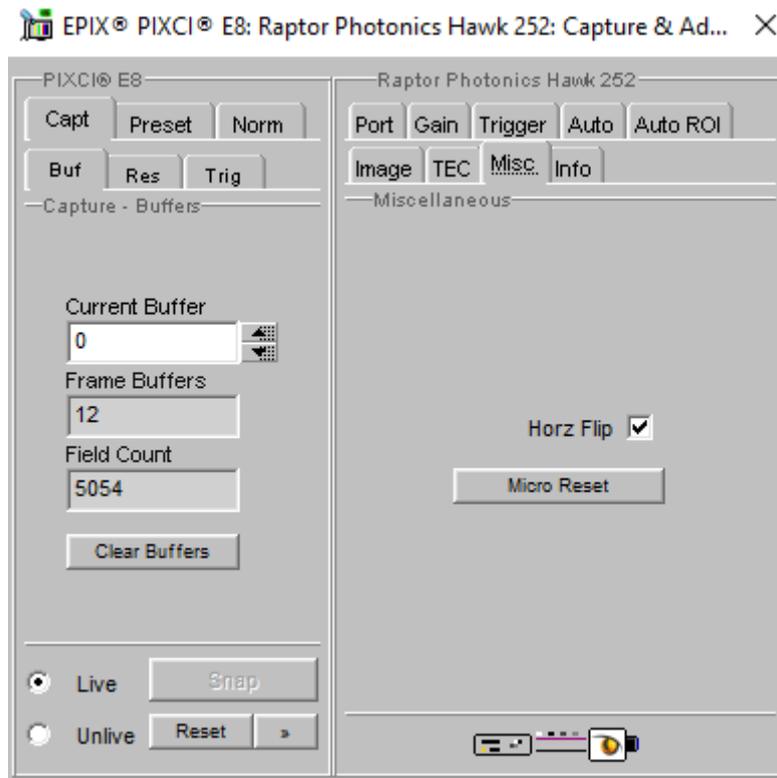


Figure 13: Miscellaneous Tab.

8.7 Manufactures Data

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 14.

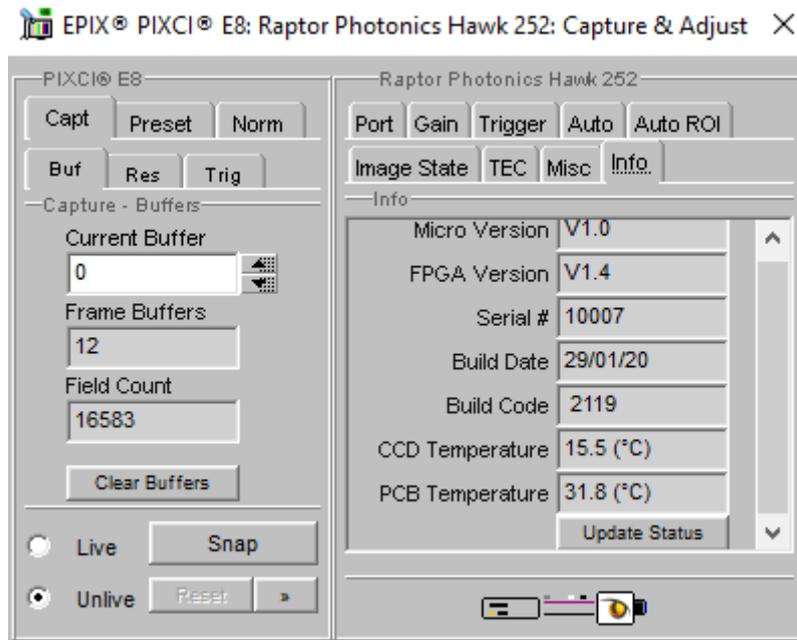


Figure 14: Manufactures Data.

9. 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_e14e1/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.

9.1 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.

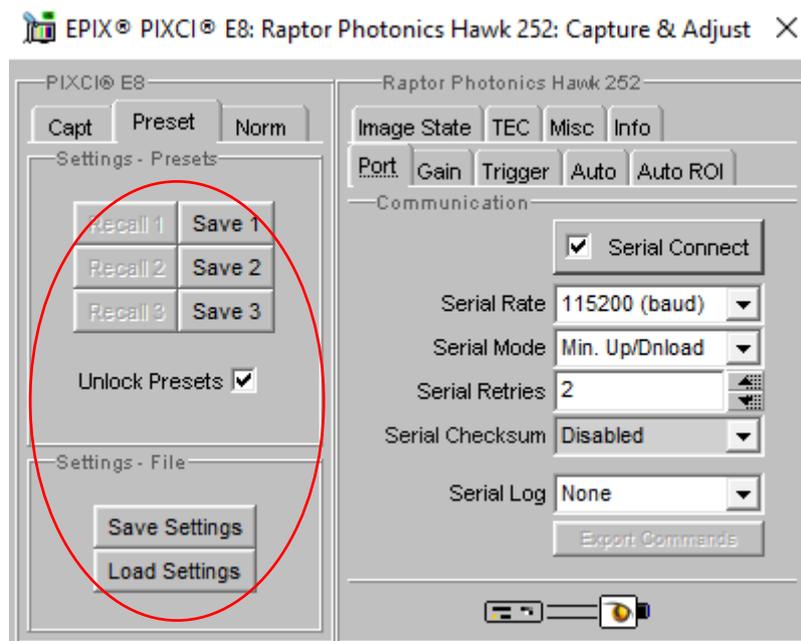


Figure 15: Preset Settings.

9.2 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.

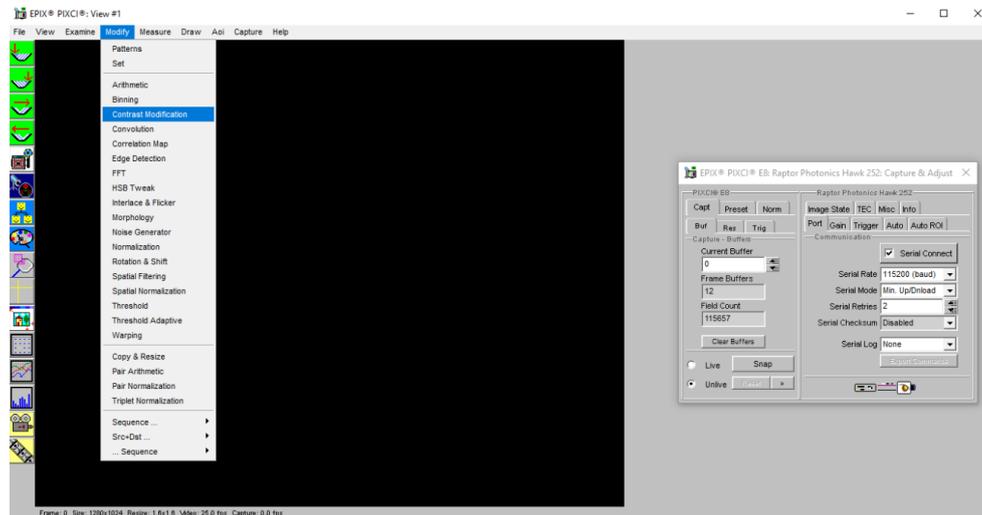


Figure 15: Contrast Modification Location on Toolbar.

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.

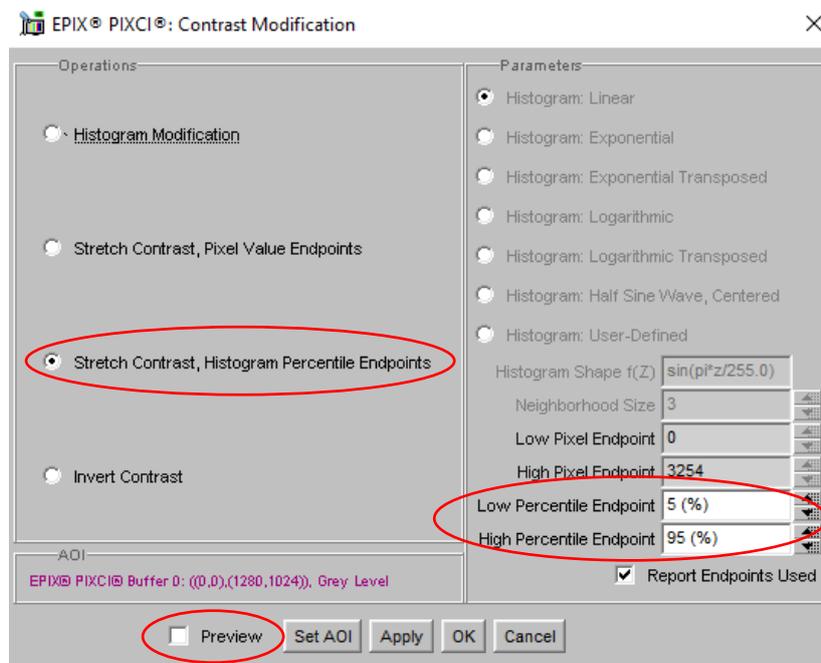


Figure 16: Contrast Modification.



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