Teledyne DALSA • 880 Rue McCaffrey • St-Laurent, Québec, H4T 2C7 • Canada
https://www.teledynedalsa.com/en/products/imaging/cameras/falcon4-clhs/

FA-ANHS01-V4: Falcon4-CLHS Application Note

Configuring Falcon4-CLHS and Teledyne DALSA Frame Grabbers

For Falcon4-CLHS models with P/N: FA-Hxxx-xxxxx

Overview

Falcon4-CLHS cameras require a connection to a frame grabber to acquire images. This application note describes how to configure a Falcon4-CLHS with a Teledyne DALSA CLHS Xtium2 series frame grabber.

The Falcon4-CLHS supports the CLHS device discovery methodology providing plug-and-play capability. GenICam implementation allows compatibility with Teledyne DALSA or third-party CLHS frame grabbers that support the **CLHS X-Protocol** (CLHS M-Protocol not supported). Teledyne DALSA **Xtium2** series frame grabbers support CLHS X-Protocol.

The Falcon4-CLHS series includes the following models:

- **Falcon4-CLHS M4480** (FA-HM00-M4485, FA-HM10-M4485): 7 data lanes.
- **Falcon4-CLHS M8200** (FA-HM10-M8205): 7 data lanes.
- **Falcon4-CLHS M6200** (FA-HM10-M6205): 7 data lanes.

  (Models above supported by Teledyne DALSA **Xtium2-CLHS PX8** (OR-A8S0-PX870) frame grabber.)

- **Falcon4-CLHS M2240** (FA-HM10-M2245): 4 data lanes.
- **Falcon4-CLHS M4400** (FA-HM11-M4405): 4 data lanes.

  (Models supported by Teledyne DALSA **Xtium2-CLHS PX8** (OR-A8S0-PX870) or **Xtium2-CLHS PX8 LC** (OR-A8S0-PX840) frame grabber.)

	The maximum sustained bandwidth from a Falcon4-CLHS M4480 camera to an Xtium2-CLHS PX8 is up to ~6.7 GB/s (approximately 505 fps at full resolution / 8-bit). To reach the full camera bandwidth (600 fps), two frame grabbers, using data forwarding, are required. For the other Falcon4 models, a single frame grabber can handle the maximum bandwidth of a camera. Refer to the frame grabber documentation for more information.

Requirements & Installation

Prerequisites

The following table lists the recommended Falcon4-CLHS firmware and software for the camera models.

FALCON4-CLHS Model	Falcon4-CLHS Firmware Design	Software SDK
M2240 M4400	Falcon4-CLHS_e2v_11M_STD_Firmware_256.293.cbf or higher	Sapera LT 8.60 (or higher)
M4480	Falcon4-CLHS_e2v_11M_STD_Firmware_256.101.cbf or higher	Sapera LT 8.60 (or higher)
M6200 M8200	Falcon4-CLHS_e2v_37-67M_STD_Firmware_xx.xx.cbf or higher	Sapera LT 8.70 (or higher)

Software

Sapera LT SDK (full version), the image acquisition and control software development kit (SDK) for Teledyne DALSA cameras is available for download from the Teledyne DALSA website:

http://teledynedalsa.com/imaging/support/downloads/sdks/

If the required version is not available, contact your Teledyne DALSA representative.

Sapera LT includes the CamExpert application, which provides a graphical user interface to access camera features for configuration and setup.

Hardware

A frame grabber board such as the Teledyne DALSA Xtium2-CLHS PX8 / PX8 LC is the recommended computer interface.

Falcon4 Model	Teledyne DALSA Frame Grabber	Part Number
M2240 M4400	Xtium2 CLHS PX8	OR-A8S0-PX870
	Xtium2 CLHS PX8 LC	OR-A8S0-PX840
M4480 M6200 M8200	Xtium2 CLHS PX8	OR-A8S0-PX870

Follow the installation instructions from the board's User Manual for the computer requirements, installation, and update of the board driver.

The latest board drivers are available from the Teledyne DALSA website:

https://www.teledynedalsa.com/en/support/downloads-center/device-drivers/

Camera Link HS Cables Overview and Resources

The camera uses a Camera Link HS SFF-8470 (CX4) cable; AOC (Active Optical Connectors) cables are recommended due to the high-bandwidth CLHS X-Protocol (C3 copper cables < 2m may work but are not recommended).

	**Note**: CX4 AOC cables are directional; ensure that the connector labelled "Camera" and "FG" are attached accordingly to the camera and frame grabber.

Visit our web site for additional information on the CLHS interface:
https://www.teledynedalsa.com/en/learn/knowledge-center/clhs/

For additional information on cables and their specifications, visit the following web sites and search for "Camera Link HS" cables:

Components Express	http://www.componentsexpress.com/
FiberStore	https://www.fs.com

Camera Power

Cameras with part number FA-HMxx-xxxxx support Power via the Auxiliary Connector (12 to 24 Volt DC). Refer to the Falcon4-CLHS User Manual for cable accessories or mating connector details.

	The frame grabber PoCL (Power-over-Cable) powers the electronics in the Active Optical Cable (AOC) module. This frame grabber feature should not be disabled for normal operation.

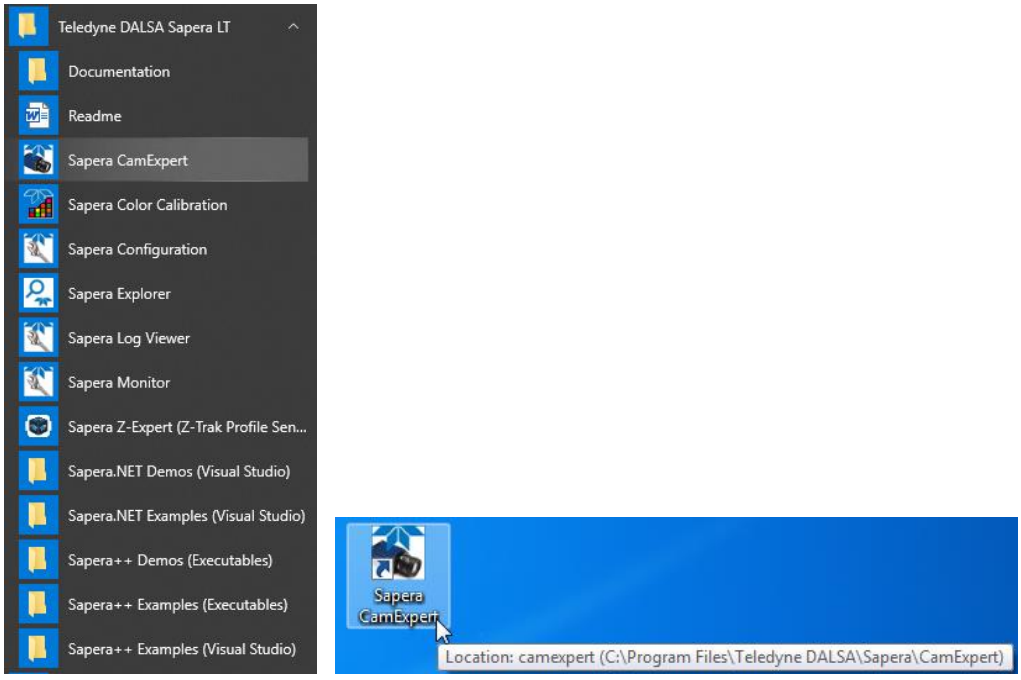
Installation Procedure

The following steps summarize the installation procedure:

- Install the Xtium2-CLHS PX8 (or Xtium2-CLHS PX8 LC) into an available PCI Express x8 Gen3 slot.
- Turn on the computer.
- Download and install the Sapera LT SDK or its runtime library:
  - version 8.60 or newer required for Models M2240, M4480, M4400
  - version 8.70 or newer required for Models M6200, M8200
- Download and install the Xtium2-CLHS PX8 Sapera board driver:
  - version 1.31 or newer required for Models M2240, M4480, M4400
  - version 1.40 or newer required for Models M6200, M8200
- Reboot the computer.
- Connect the Falcon4-CLHS with a CLHS camera cable to the CLHS frame grabber; power the camera using an appropriate power supply.
- The Falcon4-CLHS status LED will indicate power and the Device / Host connection with a steady green color when connected. Refer to the section "Camera Status LED Indicator" in the camera manual for a complete list of Status LED indicators.

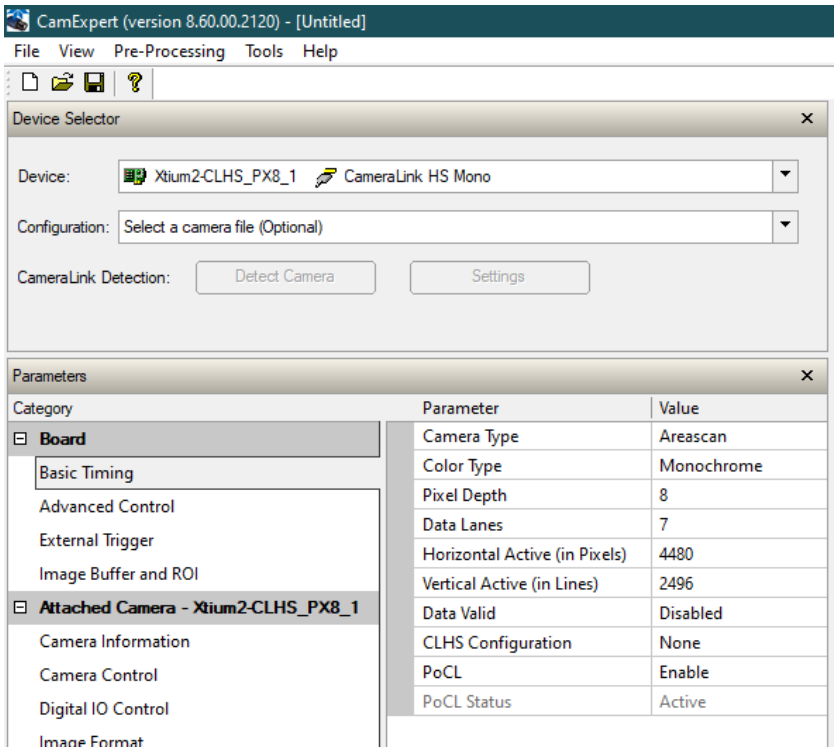
Start Sapera CamExpert

The Sapera CamExpert application is included as part of the Sapera LT SDK. It is Teledyne DALSA's camera and frame grabber interfacing tool that allows you to quickly validate hardware setup, change parameter settings, and test image acquisition. It is available from the Windows **Start** menu or desktop shortcut.

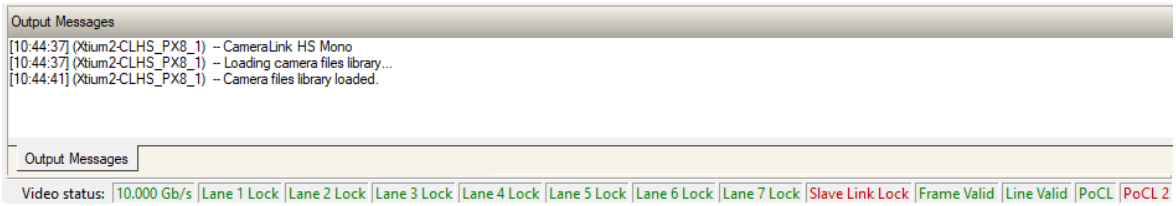


Select the Frame Grabber & Camera

If there is only one Teledyne DALSA frame grabber, the **Device** list automatically has the Xtium2-CLHS PX8 selected and the connected Falcon4-CLHS is also automatically detected as shown in the image below.



CamExpert indicates the status of the data connections and signal integrity between the camera and frame grabber. The CamExpert Video Status bar, below the **Output Messages** window, displays the connection status flags in green (OK) or red (error). The following screen capture shows that the Data Lane signals are correct and Frame Valid and Line Valid signals are active.

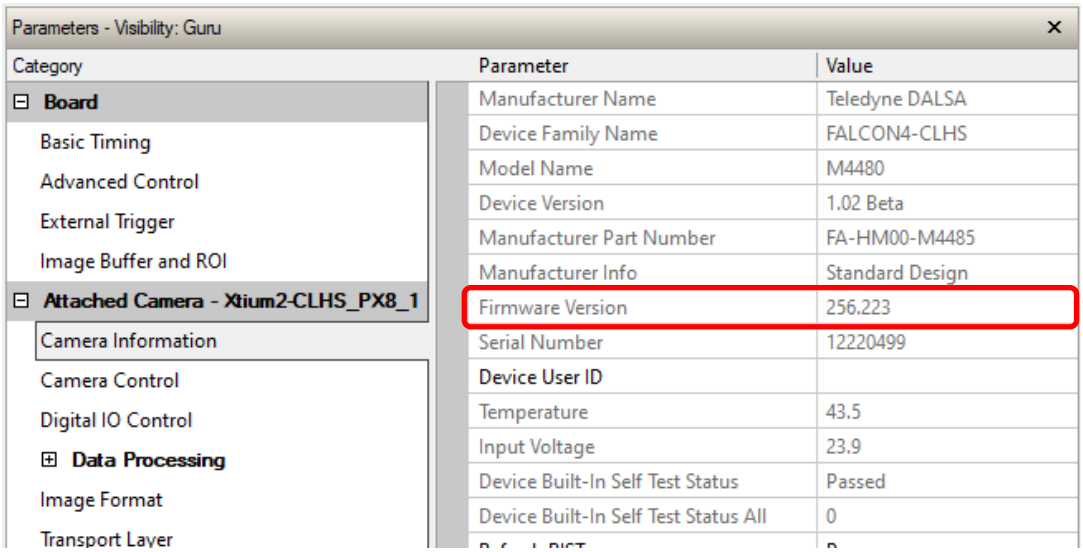


If the Camera is Not Automatically Detected

Verify that the camera is properly powered and that the fiber optic cable is connected correctly to the appropriate connectors on the frame grabber and camera; cables are uni-directional and connectors are labelled "Camera" and "F G" (frame grabber).

Upload New Camera Firmware

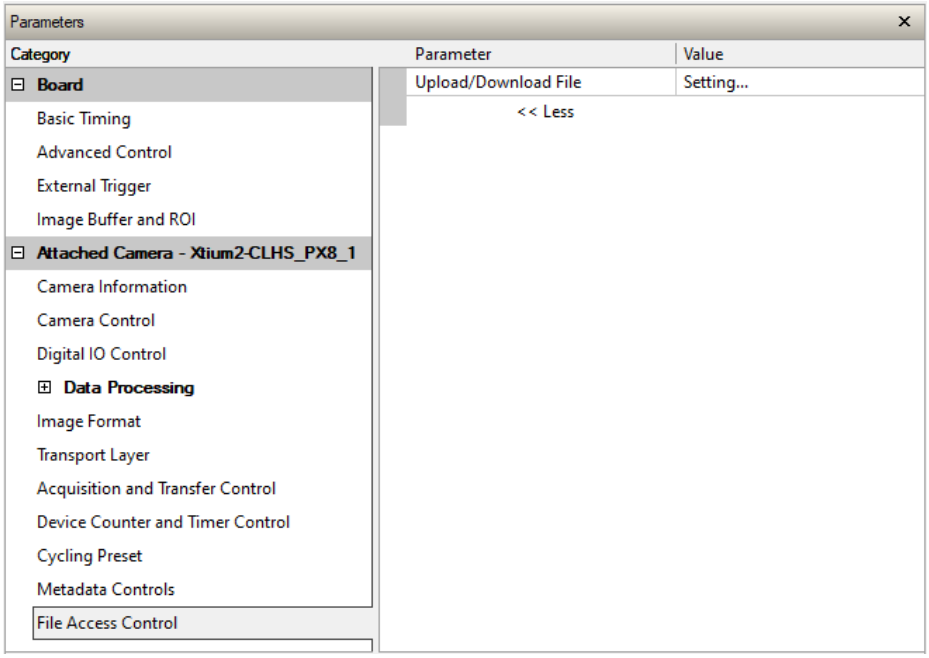
With the Falcon4-CLHS detected the user should upload new firmware if available. Using CamExpert, verify the current camera firmware by selecting the Camera Information category and checking the Firmware Version feature.



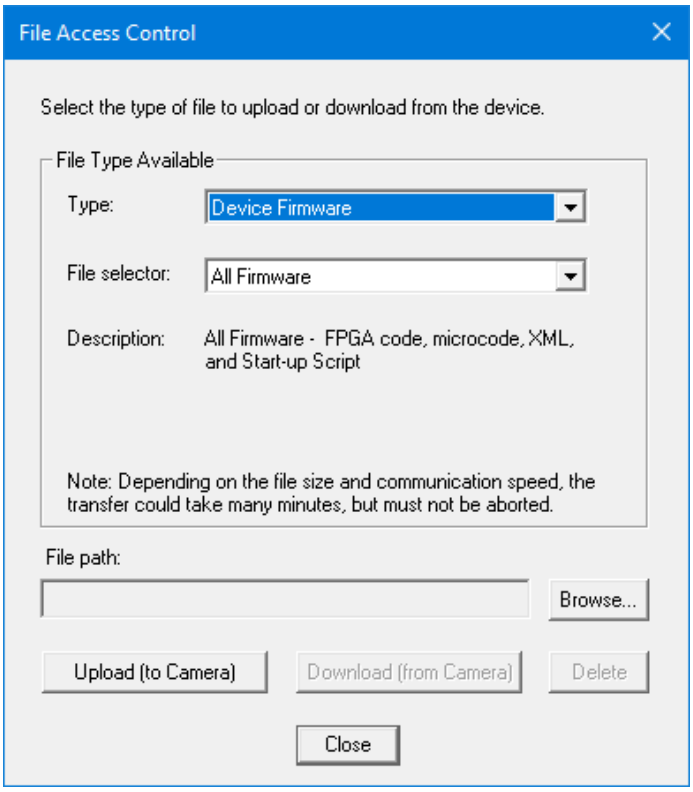
New firmware versions are available in the file download area of the Teledyne DALSA web site. Download the latest release to the computer used with the Falcon4.

To Upload New Firmware

- Select the File Access Control category and click **Setting**.



- In the File Access Control dialog, from the **Type** list select *Device Firmware* and click **Browse** to select the required firmware file.



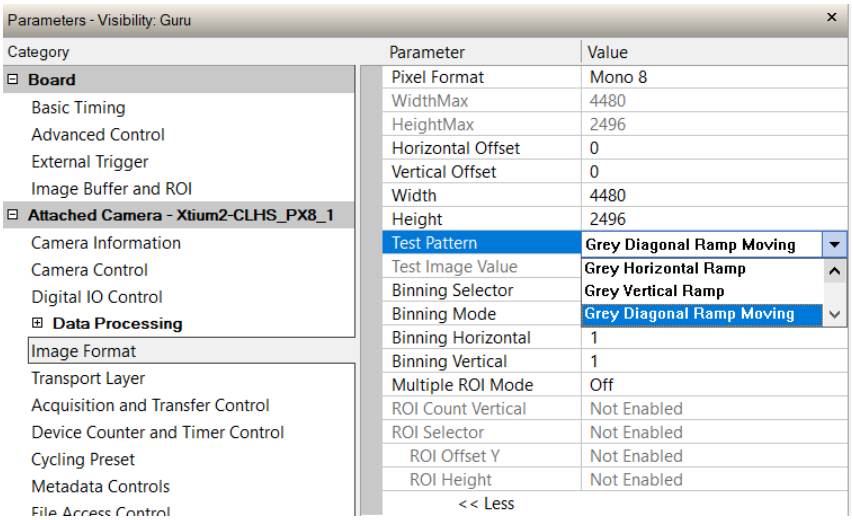
- Click **Upload (to Camera)** and restart the camera when prompted.

	**Important**: File upload rates are fixed (as per the CLHS standard) at 20 Mb/s. As an example, a firmware file upload process will take about 2½ minutes.

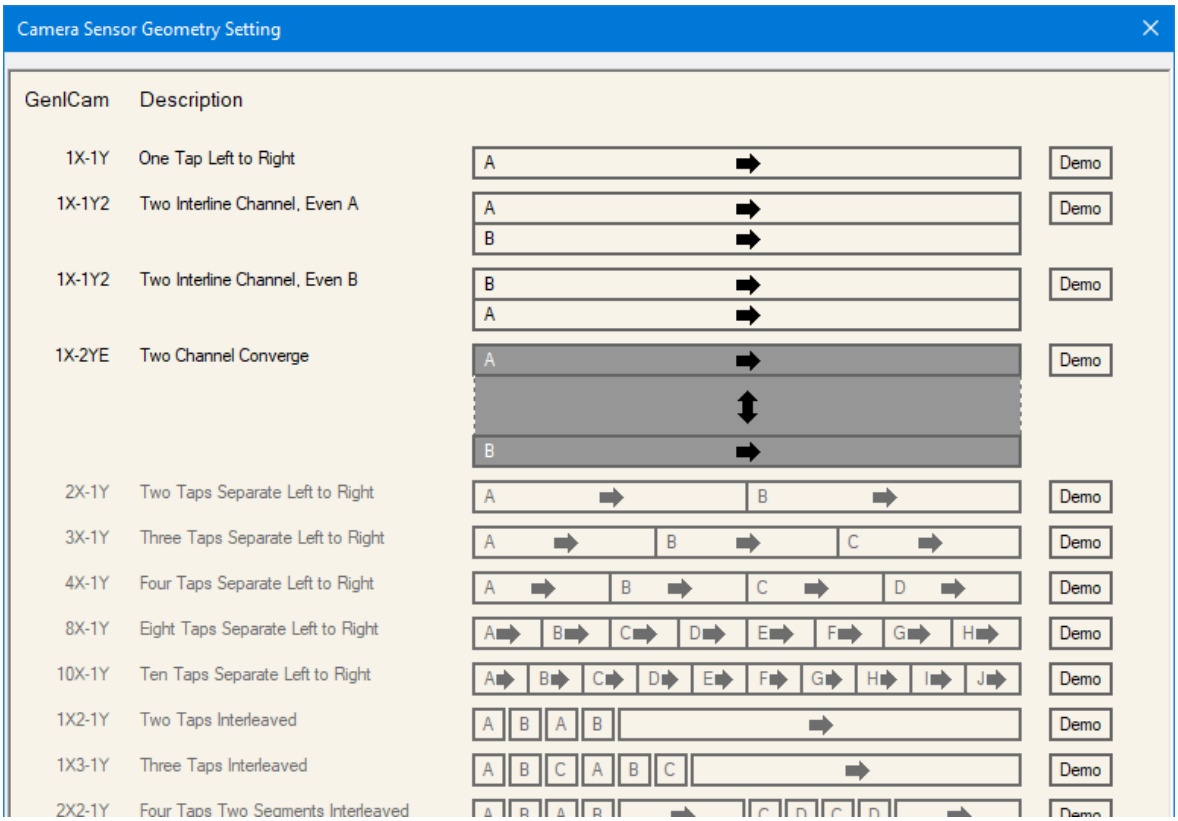
Verify Basic Acquisition

To verify basic acquisition, the camera can output a test pattern to validate that parameter settings are correctly configured between the camera and frame grabber.

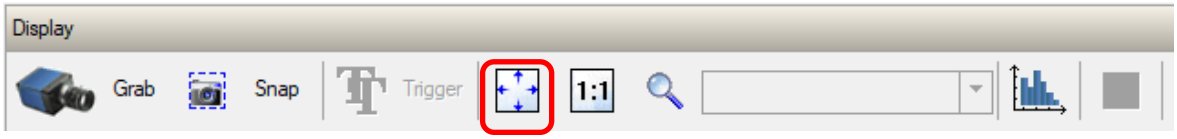
- In the Image Format category, select Test Pattern – *Grey Diagonal Ramp Moving*.



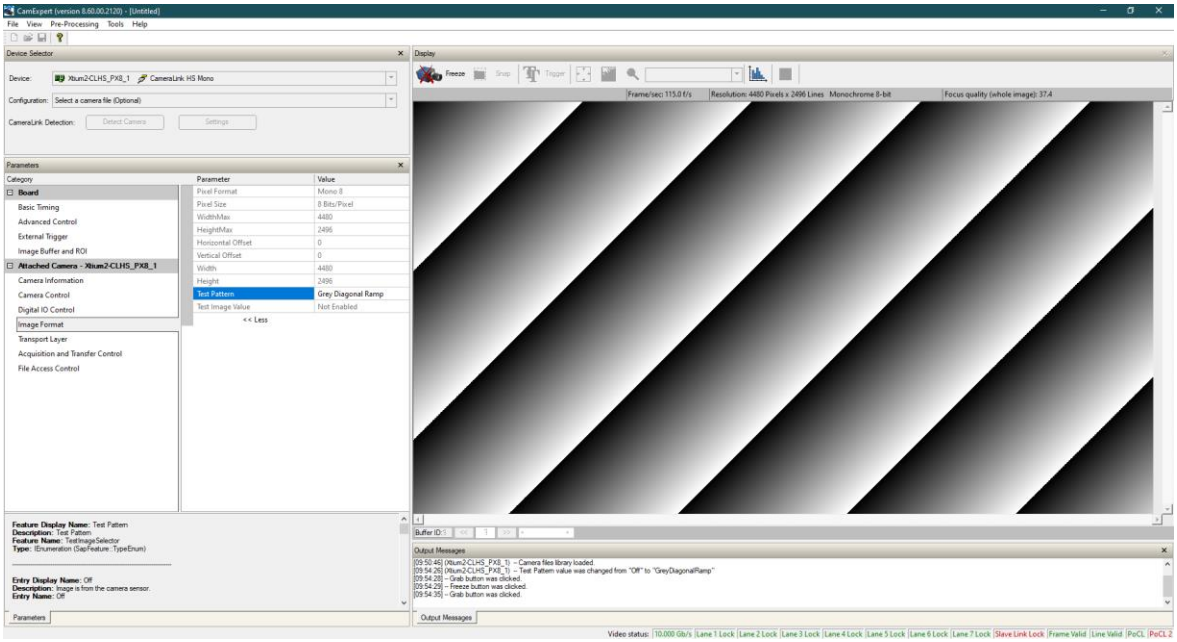
- (For models M6200 & M8200 only) In the Basic Timing board category, click the Camera Sensor Geometry Setting value, and select *1X-2YE Two Channel Converge* as depicted.



- On the Display toolbar, click **Fit to Screen** to view the complete acquisition in the display window (the actual acquisition data is unmodified).



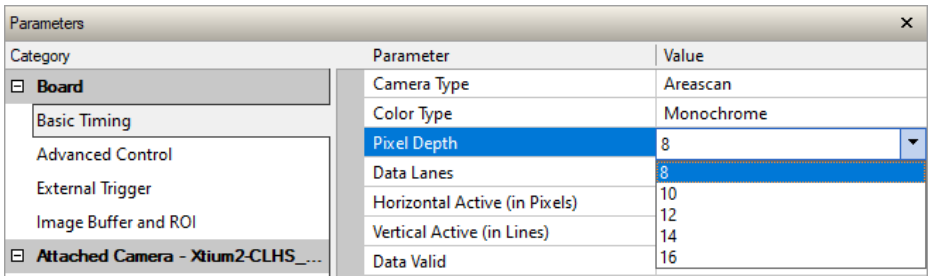
- Click **Grab** to view the diagonal ramp acquisition.



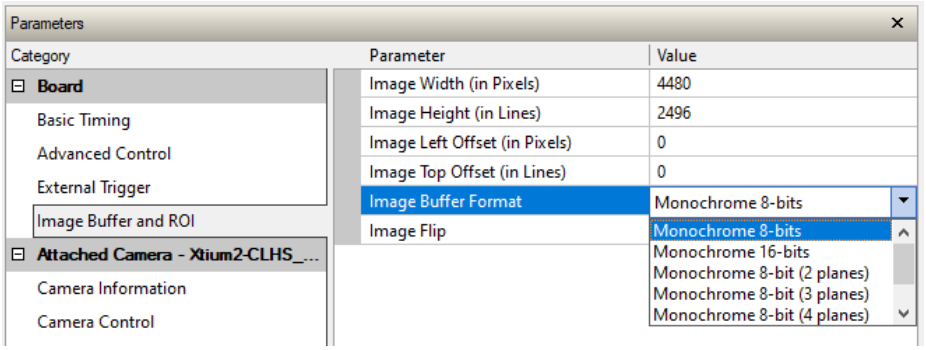
Key features to verify include:

- Data Lanes
- Image Format (pixel depth, pixel format, image height and width)

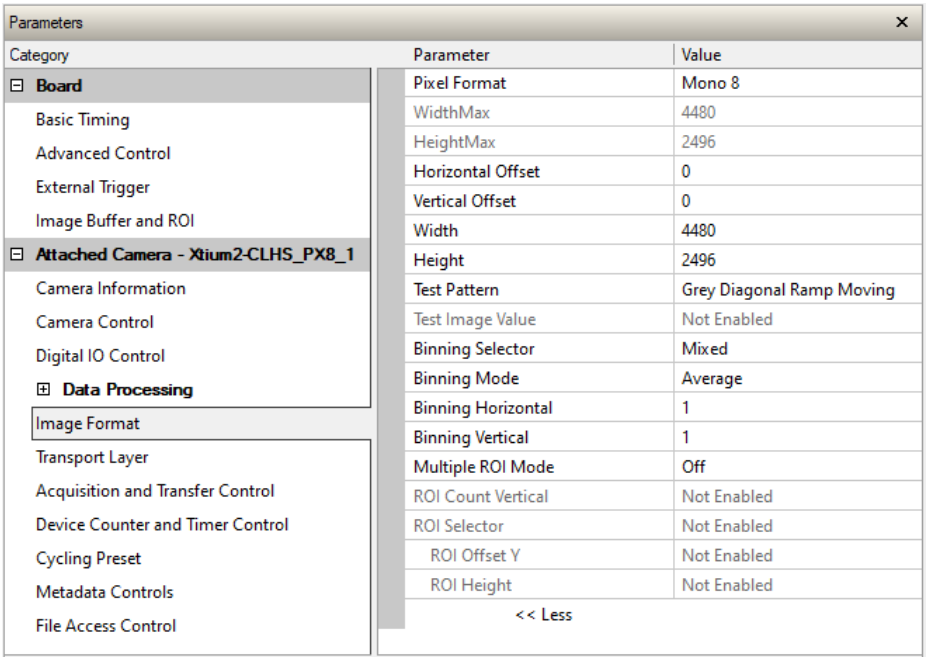
For example, for frame grabbers, the Basic Timing category includes the Data Lanes and Pixel Depth parameters:



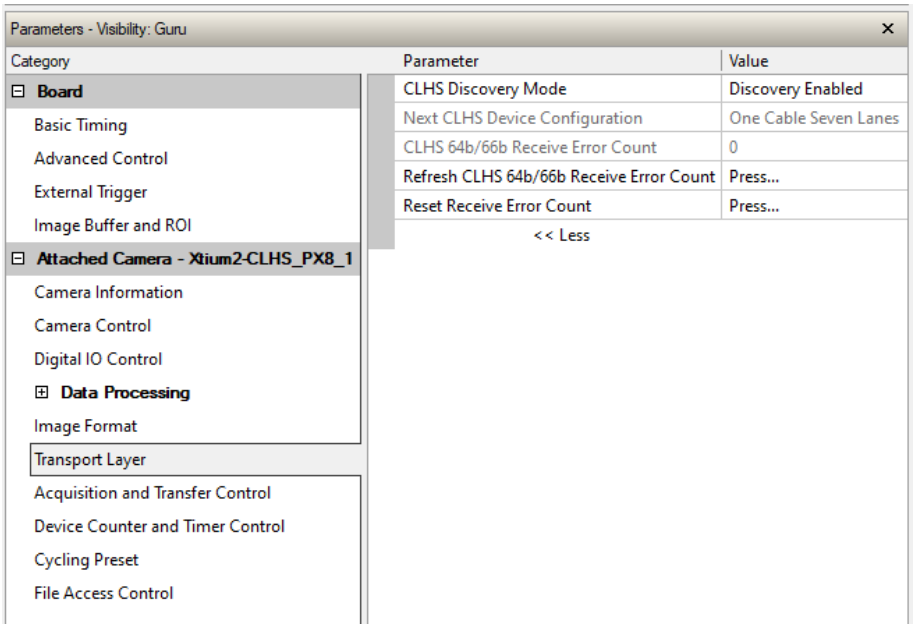
The Image Buffer and ROI categories include the Image Width, Image Height, and Image Buffer format parameters.



For the Falcon4-CLHS, the Image Format category provides the required feature settings.



The Transport Layer category includes the Next CLHS Device Configuration feature, which describes the camera cable and data lanes.



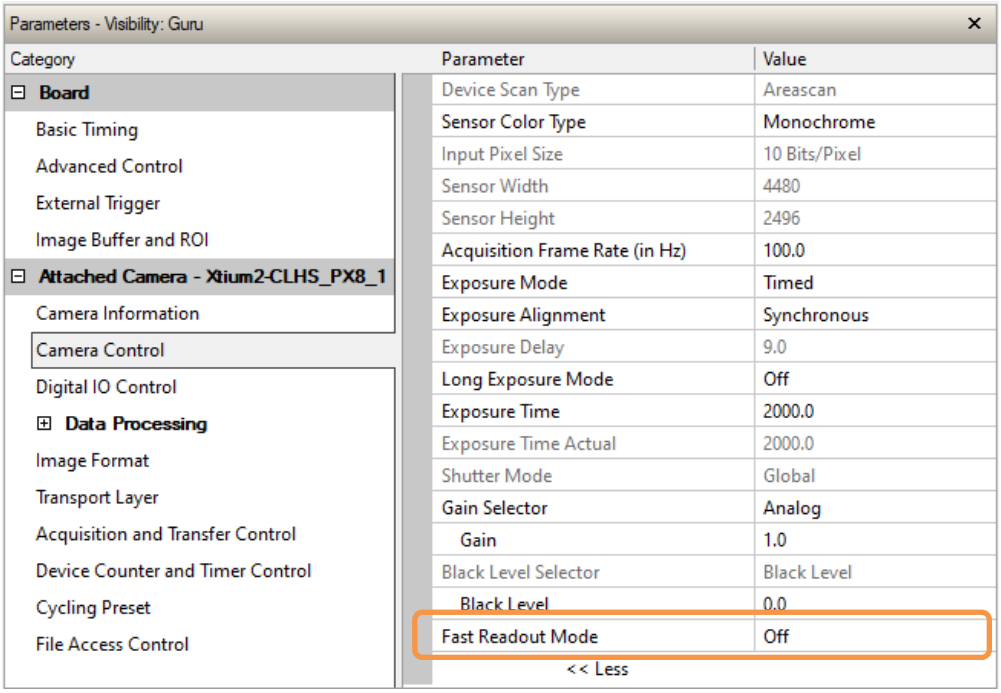
When the imaging setup is validated and working correctly:

- Use CamExpert to explore the Falcon4 camera feature set and the Xtium2-CLHS PX8 / PX8 LC parameter set.
- Use the individual product's User Manuals to explore the capabilities of this imaging system pair.
- Develop your custom imaging application with the Sapera LT API.

Fast Readout Mode

The Fast Readout Mode feature (available in the Camera Control category) determines the sensor readout rate. When enabled, the sensor readout is faster, allowing for a higher maximum frame rate.

Note that the Fast ReadOut Mode feature is only available in the Falcon4-CLHS M4400 and M4480 models.



The recommended Fast Readout Mode enable state depends on the frame grabber configuration and acquisition scenario:

Frame Grabber Configuration	Fast Readout Mode
Single Xtium2-CLHS PX8 frame grabber Acquiring and SUSTAINING HIGH frame rate capture (for example, 505 fps in full resolution).	Off
Single Xtium2-CLHS PX8 frame grabber Acquiring in short bursts at very high-speed frame rate capture (for example, triggered camera acquisition at maximum frame rate to capture a sequence of a few frames (less than the number of frame grabber image buffers)).	Active
2 Xtium2-CLHS PX8 frame grabbers with data forwarding Acquiring and SUSTAINING frame rate capture (for example, greater than 505 fps in full resolution).	