

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

FA-ANHS01-v2: 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 plugand- 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): 7 data lane output.

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

• Falcon4-CLHS M4400 (FA-HM01-M4405): 4 data lane output.

Supported by Teledyne DALSA **Xtium2-CLHS PX8 LC** frame grabber (OR-A8S0-PX840).



The maximum sustained bandwidth from a Falcon4-CLHS camera to an Xtium2-CLHS PX8 is ~5.5GB (approximately 505 fps at full resolution); to obtain higher bandwidths two frame grabbers, using data forwarding, are required. Refer to the frame grabber documentation for more information.

Requirements & Installation

Prerequisites

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

Falcon4-CLHS Firmware Design	Software SDK
Falcon4-CLHS_e2v_11M_STD_Firmware_256.101.cbf or higher	Sapera LT 8.60 (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 provide 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.

Follow the installation instructions from the board's User Manual for the computer requirements, installation and updating 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).

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 <u>Falcon4-CLHS User Manual</u> for cable accessories or mating connector details.





The frame grabber PoCL (Power-over-Cable) powers the electronics in the Active Optical Cable (AOC) module, not the camera.

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.
- <u>Download and install the Sapera LT Development Library</u> (version 8.60 or later recommended) or only its 'runtime library'.
- <u>Download and install the Xtium2-CLHS PX8 Sapera board driver</u> (1.31 or later required).
- 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 Selector drop-down menu automatically has the Xtium2-CLHS PX8 selected and the connected Falcon4-CLHS is also automatically detected as shown in the image below.

3	CamExpert (version 8.60.00.2120) - [Untitled]		
Fil	e View Pre-Processing Tools Help		
) 🚔 🖬 🛛 😵		
De	vice Selector		×
D	evice: 💵 Xtium2-CLHS_PX8_1 🖉 Camera	aLink HS Mono	-
0	onfiguration: Select a camera file (Optional)		•
Ca	ameraLink Detection: Detect Camera	Settings	
Pa	rameters		×
Ca	tegory	Parameter	Value
	Board	Camera Type	Areascan
	Basic Timing	Color Type	Monochrome
	Advanced Control	Pixel Depth	8
		Data Lanes	7
	External Trigger	Horizontal Active (in Pixels)	4480
	Image Buffer and ROI	Vertical Active (in Lines)	2496
Ξ	Attached Camera - Xtium2-CLHS_PX8_1	Data Valid	Disabled
	Camera Information	CLHS Configuration	None
	Camera Control	PoCL	Enable
	Digital IO Control	PoCL Status	Active
	Image Format		
	Transport Layer		
	Acquisition and Transfer Control		
	File Access Control		
	File Access Control		

CamExpert indicates the status of the data connections and signal integrity between the camera and frame grabber. The CamExpert lower-right area, below the Output Message 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.

Output Messages
[10:44:37] (Xium2-CLHS_PX8_1) - CameraLink HS Mono [10:44:37] (Xium2-CLHS_PX8_1) - Loading camera files library [10:44:41] (Xium2-CLHS_PX8_1) - Camera files library loaded.
Output Messages
Video status: 10.000 Gb/s Lane 1 Lock Lane 2 Lock Lane 3 Lock Lane 4 Lock Lane 5 Lock Lane 6 Lock Lane 7 Lock Slave Link Lock Frame Valid Line Valid PoCL PoCL 2

If the Camera is Not Automatically Detected

Verify that the camera is properly powered and the fiber optic cable is connected with the appropriate connectors to the frame grabber and camera; cables are unidirectional 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.

Parameters		x
Category	Parameter	Value
Board	Manufacturer Name	Teledyne DALSA
Basic Timing	Device Family Name	FALCON4
Advanced Control	Model Name	M4400
	Device Version	1.0 Beta
External Trigger	Manufacturer Part Number	FA-HM00-M4485
Image Buffer and ROI	Manufacturer Info	Standard Design
Attached Camera - Xtium2-CLHS_PX8_1	Firmware Version	256.83
Camera Information	Serial Number	19900922
Camera Control	Device User ID	
Digital IO Control	LED Color	Red
Image Format	Temperature Monitor	False
2	Temperature	23.7
Transport Layer	Refresh Temperature	Press
Acquisition and Transfer Control	Input Voltage	23.9
File Access Control	Refresh Voltage	Press
	Power-on Status (One)	NO_USER_SETTINGS
	Power-on Status (All)	1,0000,0000,0000,0000
	Refresh BIST	Press
	Restart Camera	Press
	Power-up Configuration	Setting

New firmware versions are available in the <u>file download area of the Teledyne DALSA</u> <u>web site</u>. Download the latest release to the computer used with the Falcon 4.

Upload New Firmware

Parameters			×
Category	Parameter	Value	
Board	Upload/Download File	Setting	
Basic Timing	<< Less		
Advanced Control			
External Trigger			
Image Buffer and ROI			
Attached Camera - Xtium2-CLHS_PX8_1			
Camera Information			
Camera Control			
Digital IO Control			
Image Format			
Transport Layer			
Acquisition and Transfer Control			
File Access Control			

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

• In the File Acces Control dialog, select the file type Device Firmware and click Browse to select the required firmware file.

	file to upload or download from the device.	×	
File Type Availa	ble		
Туре:	Camera User Set 🔹		
	Camera User Set		
File selector:	Device Firmware Look-Up Table		
	Miscellaneous		
Description:	File used to download the factory settings into the host - This must be remove in the Customer XML.		
transfer could	ing on the file size and communication speed, the take many minutes, but must not be aborted.		
File path:	Browse	1	
1	DIDWSE	**	
Upload (to Ca	mera) Download (from Camera) Delete		

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



Important: File upload rates are fixed (as per the CLHS standard) at 20Mbits/s. As an example, a firmware file upload process will take about 2¹/₂ 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.

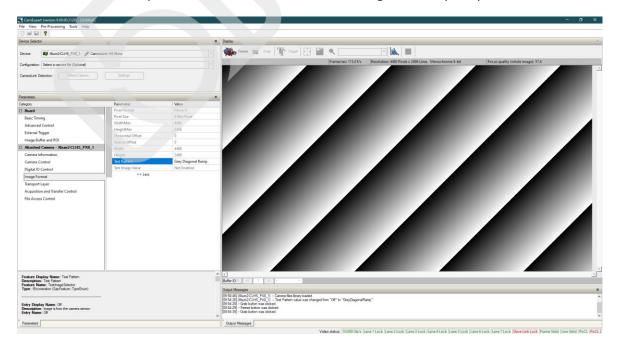
• In the Image Format category, select the Test Pattern output – Grey Diagonal Ramp.

Parameters		×			
Category	Parameter	Value			
🗆 Board	Pixel Format	Mono 8			
Basic Timing	Pixel Size	8 Bits/Pixel			
-	WidthMax	4480			
 Board Basic Timing Advanced Control External Trigger Image Buffer and ROI Attached Camera - Xtium2-CLHS_PX8_1 Camera Information Camera Control Digital IO Control Image Format 	HeightMax	2496			
	Horizontal Offset	0			
Image Buffer and ROI	Vertical Offset	0			
Attached Camera - Xtium2-CLHS_PX8_1	Width	4480			
Camera Information	Height	2496			
Camera Control	Test Pattern	Grey Diagonal Ramp 🛛 🔻			
Digital IO Control	Test Image Value	Off			
Image Format	< Less	Grey Horizontal Ramp Grey Vertical Ramp			
Transport Layer		Grey Diagonal Ramp Constant			
Acquisition and Transfer Control					
File Access Control					

• In CamExpert, click the **Fit to Screen** button to view the complete acquisition in the display window (the actual acquisition data is unmodified).



• Click on the CamExpert "Grab" button 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:

Parameters			×
Category	Parameter	Value	
∃ Board	Camera Type	Areascan	
Basic Timing	Color Type	Monochrome	
Advanced Control	Pixel Depth	8	-
	Data Lanes	8	
External Trigger	Horizontal Active (in Pixels)	10	
Image Buffer and ROI	Vertical Active (in Lines)	14	
Attached Camera - Xtium2-CLHS	Data Valid	16	

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

rameters		×
tegory	Parameter	Value
Board	Image Width (in Pixels)	4480
Basic Timing	Image Height (in Lines)	2496
ategory	Image Left Offset (in Pixels)	0
	Image Top Offset (in Lines)	0
	Image Buffer Format	Monochrome 8-bits
Image Buffer and ROI	Image Flip	Monochrome 8-bits
_		Monochrome 16-bits Monochrome 8-bit (2 planes) Monochrome 8-bit (3 planes)
Camera Control		Monochrome 8-bit (4 planes)

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

Parameters		×
Category	Parameter	Value
Board	Pixel Format	Mono 8
Basic Timing	Pixel Size	8 Bits/Pixel
Advanced Control	WidthMax	4480
External Trigger Image Buffer and ROI	HeightMax	2496
	Horizontal Offset	0
	Vertical Offset	0
Attached Camera - Xtium2-CLHS_PX8_1	Width	4480
Camera Information	Height	2496
Camera Control	Test Pattern	Off
Digital IO Control	Test Image Value	Not Enabled
Image Format	<< Less	
Transport Layer		
Acquisition and Transfer Control		
File Access Control		

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

Pa	rameters		3	×
Ca	tegory	Parameter	Value	
⊡	Board	XML Major Version	100	
	Basic Timing	XML Minor Version	0	
	Advanced Control	CLHS Discovery	Discovery Enabled	
		Next CLHS Device Configuration	One Cable Seven Lanes	s
	External Trigger	Refresh GenCP Status	Press	
	Image Buffer and ROI	Last GenCP Status	Good	
Ξ	Attached Camera - Xtium2-CLHS	<< Less		
	Camera Information			
	Camera Control			
	Digital IO Control			
	Image Format			
	Transport Layer			
	Acquisition and Transfer Control			
	File Access Control			
	I			

When the imaging setup is validated and working correctly:

- Use CamExpert to explore the Falcon 4 camera feature set and the Xtium-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.

Pa	rameters		×
Ca	tegory	Parameter	Value
-	Board	Device Scan Type	Areascan
	Basic Timing	Sensor Color Type	Monochrome
	Advanced Control	Input Pixel Size	10 Bits/Pixel
	External Trigger Image Buffer and ROI	Sensor Width	4480
		Sensor Height	2496
		Acquisition Fram	115.0
B	Attached Camera - Xtiu	Exposure Mode	Timed
	Camera Information	Exposure Alignm	Synchronous
	Camera Control	Exposure Delay	0.0
	Digital IO Control	Exposure Time	1828.0
	E data Processing	Exposure Time A	1831.0
	-	Shutter Mode	Global
	Image Format	Gain Selector	Analog
	Transport Layer	Gain	1.0
	Acquisition and Transfer C	Black Level Select	Black Level
	Device Counter and Timer	Black Level	0
	Device Event Control	Fast Readout Mode	NO NO
	File Access Control	<< Less	

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).	