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Teledyne DALSA • 605 McMurray Road • Waterloo, Ontario, N2V 2E9 • Canada

<https://www.teledynedalsa.com/>

Application Note For Falcon4 Data Forwarding

Overview

This application note demonstrates how to configure the Falcon4 11M to achieve its maximum full frame rate. With one frame grabber the maximum frame rate is limited to 450 fps but with two frame grabbers you can achieve 600 fps.

New Terms Used

Master frame grabber (Master board or Master card) - refer to the frame grabber which is connected directly to the camera. Related terms are *Mast cable, Master interface and Master connection*, etc.

Slave frame grabber (Slave board or Slave card) – refer to the frame grabber which is connected to the Master board. Related terms are *Slave cable, Slave interface and Slave connection*, etc.

Advantages of Dual-Board Imaging

The maximum frame rate of FA-HM11-M4400 camera is 330 fps, and able to achieve this speed with a single frame grabber, such as Xtium2-CLHS_PX8 or Xtium2-CLHS_PX8-LC. The maximum frame rate of **FA-HM10-M4485** camera, however, is 600fps and cannot achieve this speed with any of above single card. With a single Xtium2-CLHS_PX8, the maximum frame rate that can be reached is around 450 KHz. To achieve its maximum speed, you need to use the dual-board data forwarding method using two boards. The specific implementation method is described below.

Note 1

With dual-board method (full frame image divided into two boards), the frame rate maximum can reach up to 600 fps.

Note 2

With the region of interest (ROI), the frame rate can be increased significantly, refer to the camera manual. So that, when an application needs a high frame rate, a single-board-with-ROI configuration can be considered instead of dual-board configuration depending on the size of the ROI.

Hardware and Cabling

Xtium2-CLHS series board can forward data up to five additional boards, but only the data forward to the second board (**dual-board system**) is introduced here.

Also, it can forward data from one PC to another, but we will skip the topic here.

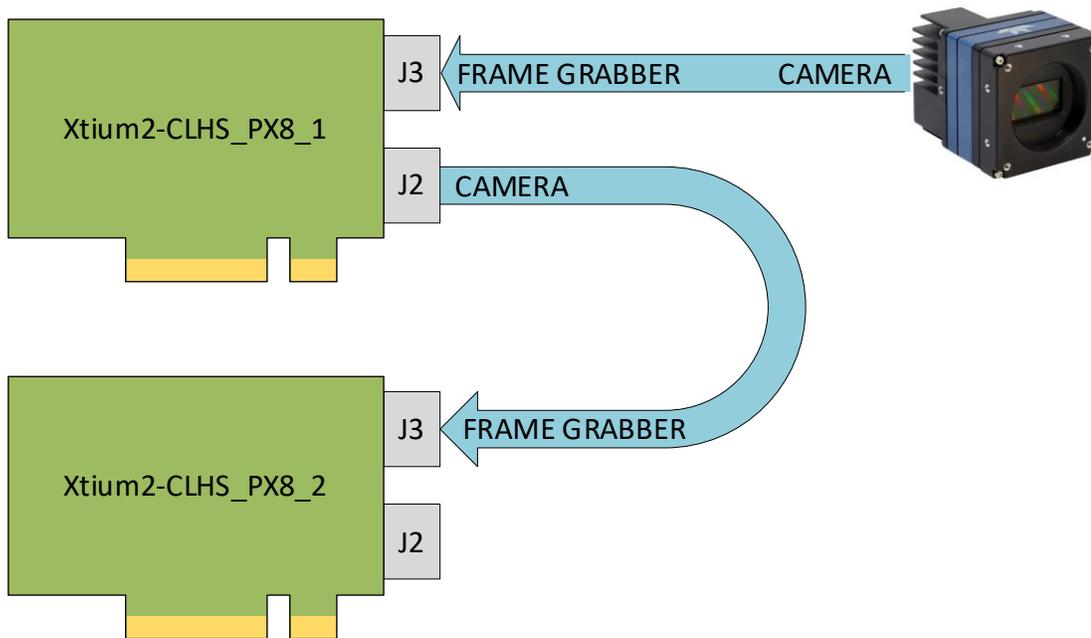
To build a dual-board system, you need to prepare following hardware:

1x computer with two PCI Express Gen 3.0 x8 or x16 slots.

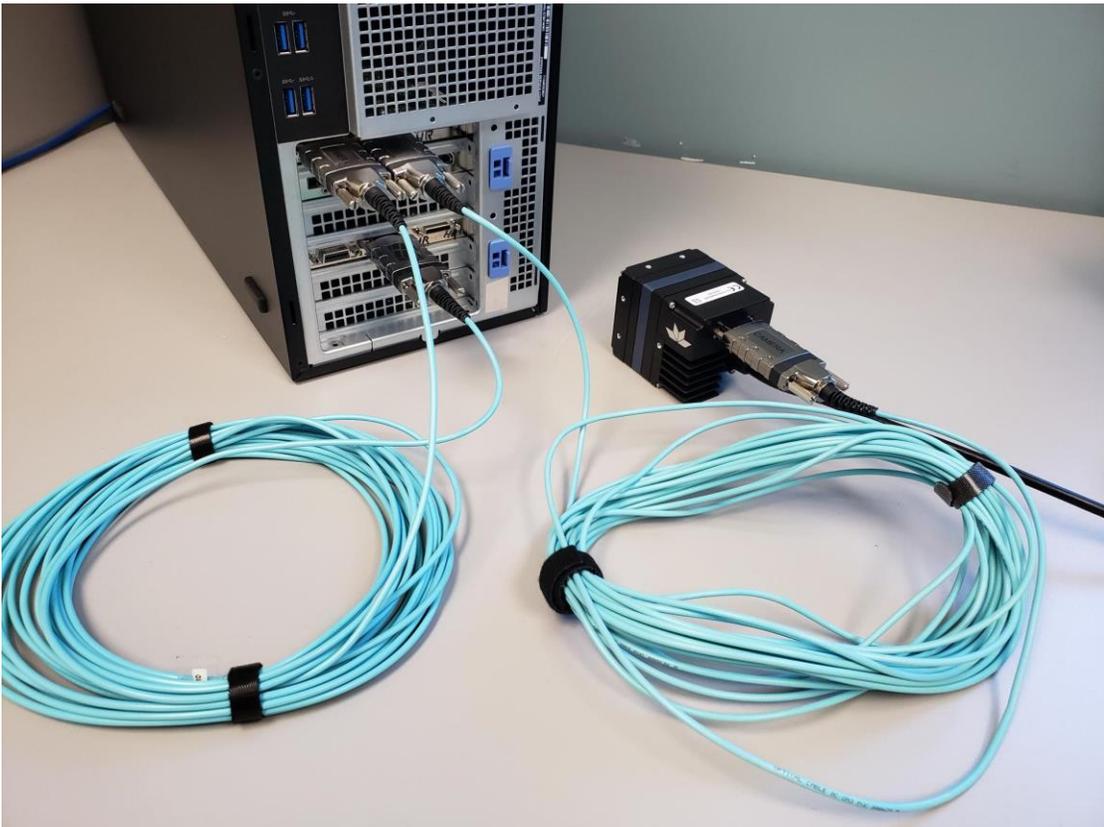
2x Xtium2-CLHS_PX8 (note that the lite version of the frame grabber, the Xtium2-CLHS_PX8-LC, does not meet the needs of this application).

2x AOC cables or 1x AOC cable and 1x copper-based cable.

The following block diagram shows a dual-board data-forwarding configuration.



The following picture shows an example of a physical setup. Two identical CX4 AOC cables are used for both Master and Slave connections.



The following picture is a closer look of the cabling.



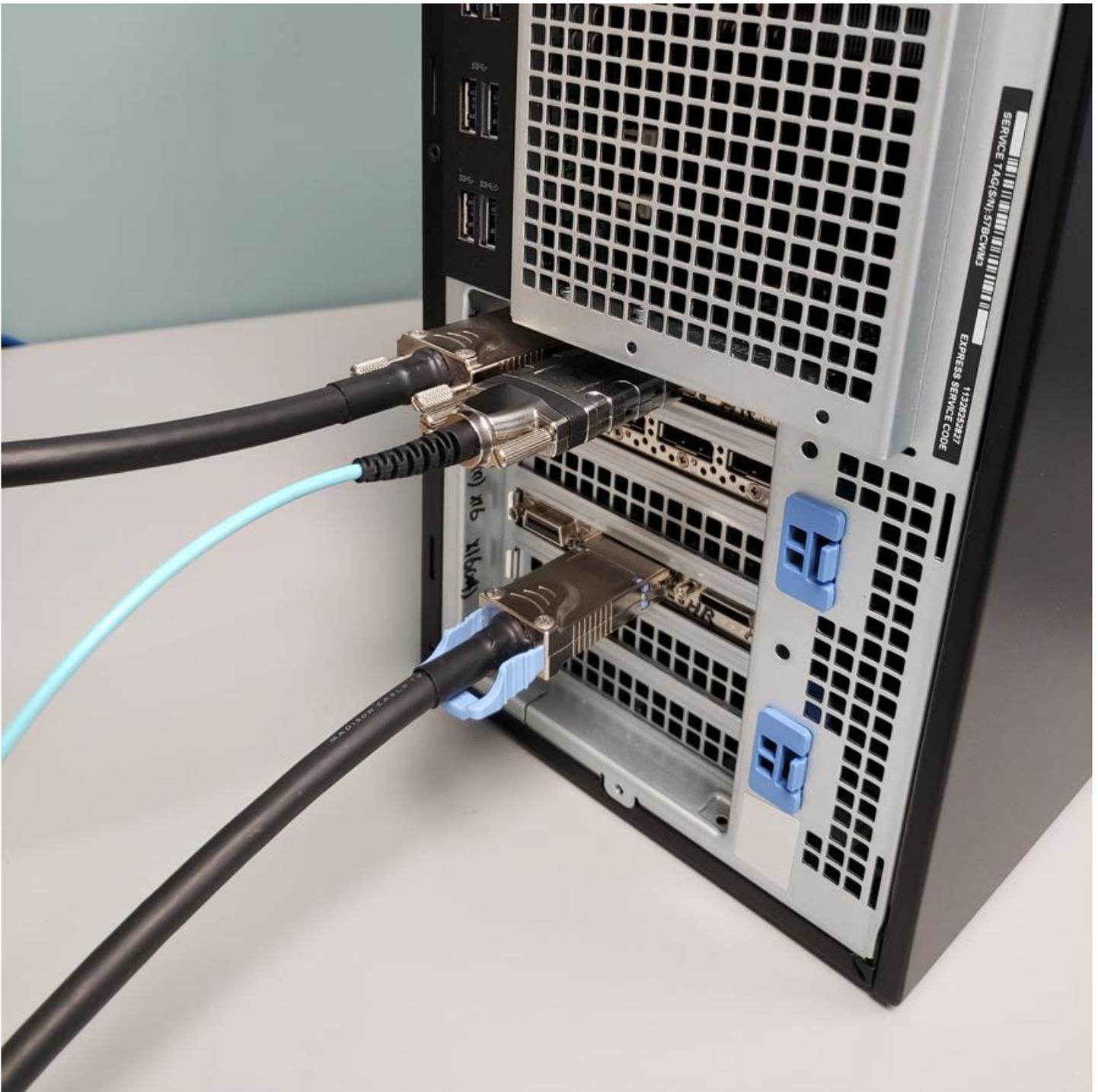
The AOC cable is a directional cable, so make sure to check the terminal mark carefully when connecting. In the *Master connection*, the terminal marked CAMERA must be connected to the camera, and the other terminal marked Frame Grabber (FG) must be connected to the J3 connector (CLHS Input, away from the motherboard) on the Master board.

In the *Slave connection*, the terminal marked CAMERA must be connected to the J2 connector (data forwarding) on the Master board, and the terminal marked Frame Grabber (FG) must be connected to the J3 connector on the Slave board. In other words, the Slave board treats the Master board as if it is a data source - the camera.

To build a data-forwarding system, there is no need hardware changes in the frame grabbers side, meaning that any frame grabber can be Master or Slave depending on your choice. The system automatically assigns the board, which is connected to the camera as Master board, and thus assigns the other one as Slave board.

For the sake of cost-saving, a user may use copper-based cable for data forwarding so long as the cable meets the speed - 10 Gbps.

Note that the copper-based cable length is limited by the high-speed data rate - 10 Gbps. So, you may use the copper-based cable as a Slave cable (short cable is acceptable) and use the AOC cable as a Master cable (longer cable is needed). The following picture shows this combination of cabling – a copper-based cable is used for the Slave connection, and an AOC cable is used for the Master connection.



Note that, unlike the AOC cable, the copper-based cable is a non-polarized cable, meaning that you do not have to tell which terminal should be connected to the camera or the frame grabber.

For more about cables, please refer to Teledyne DALSA website, [Third-Party Components | Teledyne DALSA](#)

Frame Grabbers Configuration

Open two CamExpert applications, and you will find the frame grabber which connected to the camera shown up as Master board and the other shown up as Slave board. This is the result set automatically by the system.

Click on any item in the Board category of the Master interface and load the following CCF file:

[T_FA-HM00-M4485_8Bit-Mono_Master-2240x2496.ccf](#)

Click on any item in the Board category of the Slave interface and load the following CCF file:

[T_FA-HM00-M4485_8Bit-Mono_Slave-2240x2496.ccf](#)

These files can be downloaded from Teledyne DALSA support site - *Camera Configuration Files* category, <https://www.teledynedalsa.com/en/support/downloads-center/camera-configuration-files/>

The following screenshots show two interfaces – the Master and the Slave interfaces (the status bars are extended).

CamExpert (version 8.65.00.2170) - [T_FA-HM00-M4485_8Bit-Mono_Master2240x2496.ccf]

File View Pre-Processing Tools Help

Device Selector

Device: Xtium2-CLHS_PX8_2 CameraLink HS Mono

Config... Select a camera file (Optional)

CameraLink ... Detect Camera Settings

Parameters

Category	Parameter	Value
Board	Device Scan Type	Areascan
	Sensor Color Type	Monochrome
	Input Pixel Size	10 Bits/Pixel
	Sensor Width	4480
	Sensor Height	2496
Attached Camera - Xtium2-...	Acquisition Frame Rate (in Hz)	600.1
	Exposure Mode	Timed
	Exposure Alignment	Synchronous
	Exposure Delay	9.0
	Exposure Time	1600.0
	Exposure Time Actual	1600.0
	Shutter Mode	Global
	Gain Selector	Analoq
	Gain	4.0
	Black Level Selector	Black Level
	Black Level	7.0
	Fast Readout Mode	Active

Feature Display Name: Acquisition Frame Rate (in Hz)
 Description: Specifies the camera internal frame rate.
 Feature Name: AcquisitionFrameRate
 Type: IFloat (SapFeature::TypeDouble)

Values:
 Min: 0.1
 Max: 600.2
 Inc: 0.1

Master Interface

Display

Pixel data not available | Frame/sec: 600.2 f/s | Resolution: 2240 Pixels x 2496 Lines | Monochrome 8-

Output Messages

[15:15:30] -- Grab button was clicked.
 [15:15:45] (Xtium2-CLHS_PX8_2) -- Gain value was changed from 1.000000 to 4

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

The Master interface plays the key role of control – controls the Master board as well as the camera.

CamExpert (version 8.65.00.2170) - [T_FA-HM00-M4485_8Bit-Mono_Slave-2240x2496.ccf]

File View Pre-Processing Tools Help

Device Selector

Device: Xtium2-CLHS_PX8_1 CameraLink HS Mono

Configu... Select a camera file (Optional)

CameraLink ... Detect Camera Settings

Parameters

Category	Parameter	Value
Basic Timing	Camera Type	Areascan
Advanced Control	Color Type	Monochrome
External Trigger	Pixel Depth	8
Image Buffer and ROI	Data Lanes	7
	Horizontal Active (in Pixels)	4480
	Vertical Active (in Lines)	2496
	Data Valid	Disabled
	CLHS Configuration	None
	PoCL	Enable
	PoCL Status	Active

Display

Pixel data not available

Frame/sec: 600.2 f/s Resolution: 2240 Pixels x 2496 Lines Monochrome 8-b

Output Messages

[15:15:32] -- Grab button was clicked.

Parameters 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

Slave Interface

The Slave interface plays auxiliary role. It is an extension of Master interface; its key role is to define the size of the image that the Slave board receives.

The FA-HM10-M4485 camera's resolution is 4480x2496. Let's say we split the image in half vertically (of course you can split the image into different proportions), and each frame grabber receives them, respectively. To do so, the key settings are:

In the Master frame grabber, set the *Horizontal Active Pixels* to 2240 (=4480/2).

Category	Parameter	Value
Board	Camera Type	Areascan
	Color Type	Monochrome
	Pixel Depth	8
	Data Lanes	7
	Horizontal Active (in Pixels)	2240
	Vertical Active (in Lines)	2496
	Data Valid	Disabled
	CLHS Configuration	None
	PoCL	Enable
	PoCL Status	Active

In the Slave frame grabber, set the *Horizontal Active Pixels* to 4480 (=full range).

Category	Parameter	Value
Attached Camera - Xtium2-...	Camera Type	Areascan
	Color Type	Monochrome
	Pixel Depth	8
	Data Lanes	7
	Horizontal Active (in Pixels)	4480
	Vertical Active (in Lines)	2496
	Data Valid	Disabled
	CLHS Configuration	None
	PoCL	Enable
	PoCL Status	Active

With these settings, the Master takes the left 2240 x 2496 image, and the Slave takes (4480-2240) x 2496 image. In other words, the Master takes the left half, and the Slave takes the right half.

Finally, set the *Fast Readout Mode* to **Active**, and set the *Acquisition Frame Rate* to 600 Hz.

Category	Parameter	Value
Board	Device Scan Type	Areascan
Basic Timing	Sensor Color Type	Monochrome
Advanced Control	Input Pixel Size	10 Bits/Pixel
External Trigger	Sensor Width	4480
Image Buffer and ROI	Sensor Height	2496
	Acquisition Frame Rate (in Hz)	600.1
Attached Camera - Xtium2-...	Exposure Mode	Timed
Camera Information	Exposure Alignment	Synchronous
Camera Control	Exposure Delay	9.0
Digital IO Control	Exposure Time	1600.0
Data Processing	Exposure Time Actual	1600.0
Image Format	Shutter Mode	Global
Transport Layer	Gain Selector	Analog
Acquisition and Transfer Co...	Gain	4.0
Device Counter and Timer ...	Black Level Selector	Black Level
Cycling Preset	Black Level	7.0
File Access Control	Fast Readout Mode	Active
	<< Less	

Now, it should be able to grab images at its highest speed – 600 fps.

Further Supports

Should you have further questions, please feel free to contact your local TCS (Technical Customer Support) team.