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X64 Xcelera-HS PX8™

User's Manual

Edition 1.00

Part number OC-X8HM-PUSR0

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Contents

Overview

Product Part Numbers

X64 Xcelera-HS PX8 Board

Item	Product Number
X64 Xcelera-HS PX8 with 512MB memory (256MB framebuffer/256MB processing)	OR-X8H0-RP400
For OEM clients, this manual in printed form, is available on request	OC-X8HM-PUSR0

X64 Xcelera-HS PX8 Software

Item	Product Number
Sapera LT version 6.30 or later (required but sold separately) 1. Sapera LT: Provides everything you will need to build your imaging application. Sapera 7.10 required for full feature support. 2. Current Sapera compliant board hardware drivers 3. Board documentation in PDF format 4. Sapera documentation in PDF and compiled HTML help formats	OC-SL00-0000000
(optional) Sapera Processing Imaging Development Library includes over 600 optimized image processing routines.	Contact Sales at DALSA

X64 Xcelera-HS PX8 Cables & Accessories

Item	Product Number
CMD cable assembly (I/O 15 pin Micro D connector with 6 ft. blunt end cable) This cable assembly connects to J1. (see "J1: CMD15 Female External Signals Connector" on page 69)	OR-X8CC-IO15P
(optional) X64 Xcelera-HS PX8 can be shipped with an External Signals Connector Bracket Assembly, either with a **DB37 or DB25** connector (see the two product numbers below). Either cable, if required, should be specified at the time of order. Note: clients requiring a limited number of I/Os, can also use the CMD15 connector that is on the main bracket..	
DB37 assembly see "External Signals Connector Bracket Assembly (Type 1)" on page 80. This cable assembly connects to J4.	OR-X4CC-IOCAB
DB25 assembly see "External Signals Connector Bracket Assembly (Type 2)" on page 82. Provides direct compatibility with external cables made for products such as the X64-CL iPro. This cable assembly connects to J4.	OR-X4CC-0TIO2
(optional) Power interface cable required when one wants to use 12V or 5V supplied on the IO cable assembly.	OR-COMC-POW03
(optional) CX4 Cable:	Contact Sales at DALSA

About the X64 Xcelera-HS PX8 Frame Grabber

Series Key Features

- Supports area scan or linescan cameras using HS Link
- Monochrome 8-bit pixels
- 2^{nd} CX4 connector (HS Link) to redirect image data to another Xcelera HS-PX8 frame grabber
- Input Trigger and Shaft Encoder inputs
- Time Integration
- Horizontal and Vertical Flip supported on board
- Output Strobe
- RoHS compliant

See "Technical Specifications" on page 61 for detailed information.

User Programmable Configurations

Use the X64 Xcelera-HS PX8 firmware loader function in the DALSA Device manager utility to select firmware for one of the supported modes. Firmware selection is made either during driver installation or manually later on (see "Firmware Update: Manual Mode" on page 13).

For the X64 Xcelera-HS PX8 board the firmware choices are:

- **1 x High Speed Camera** (*installation default selection*)
  Support for one Camera HS-Link port..

ACUPlus: Acquisition Control Unit

ACUPlus consists of a grab controller, pixel packer, and time base generator. ACUPlus provides a flexible acquisition front end for a wide variety of imaging solutions.

ACUPlus acquires variable frame sizes up to 256KB per horizontal line and up to 16 million lines per frame. ACUPlus can also capture an infinite number of lines from a linescan camera without losing a single line of data.

DTE: Intelligent Data Transfer Engine

The X64 Xcelera-HS PX8 intelligent Data Transfer Engine ensures fast image data transfers between the board and the host computer with zero CPU usage. The DTE provides a high degree of data integrity during continuous image acquisition in a non-real time operating system like Windows. DTE consists of multiple independent DMA units, Tap Descriptor Tables, and Auto-loading Scatter-Gather tables.

PCI Express x8 Interface

The X64 Xcelera-HS PX8 is a universal PCI Express x8 board, compliant with the PCI Express 1.1 specification. The X64 Xcelera-HS PX8 board achieves transfer rates up to 1.5 Gbytes/sec.

The X64 Xcelera-HS PX8 board occupies one PCI Express x8 expansion slot and one chassis opening.

Important:

- Older computers may not support the maximum data transfer bandwidth defined for PCI Express x8. Such computers may electrically support only x4 devices even in their x8 slot. The X64 Xcelera-HS PX8 will function correctly in such a computer but at a lower maximum data rate.
- If the computer only has a PCI Express x16 slot, direct installation tests or the computer documentation is required to know if the X64 Xcelera-HS PX8 is supported. It has been seen that many computer motherboards only support x16 products in x16 slots (commonly used with graphic video boards).

Advanced Controls Overview

Visual Indicators

X64 Xcelera-HS PX8 features 3 LED indicators to facilitate system installation and setup, two on the board bracket and one located on the top edge of the board. These indicators provide visual feedback on the board status and camera status.

External Event Synchronization

Trigger inputs and strobe signal are provided to precisely synchronize image captures with external events.

HS-Link Communications ports

One PC independent communication port provides HS-Link controls for camera configurations. This port does not require additional PC resources like free interrupts or I/O address space. Accessible via the board device driver, the communication port presents a seamless interface to Windows-based standard communication applications like HyperTerminal, etc.

Quadrature Shaft Encoder

An important feature for web scanning applications, the Quadrature-Shaft-Encoder inputs allow synchronized line captures from external web encoders.

Development Software Overview

Sapera++ LT Library

Sapera++ LT is a powerful development library for image acquisition and control. Sapera++ LT provides a single API across all current and future DALSA hardware. Sapera++ LT delivers a comprehensive feature set including program portability, versatile camera controls, flexible display functionality and management, plus easy to use application development wizards. Applications are developed using either C++ or .NET frameworks.

Sapera++ LT comes bundled with CamExpert, an easy to use camera configuration utility to create new, or modify existing camera configuration files.

Sapera Processing Library

Sapera Processing is a comprehensive set of C++ classes or .NET classes for image processing and analysis. Sapera Processing offers highly optimized tools for image processing, blob analysis, search (pattern recognition), OCR and barcode decoding.

Installing X64 Xcelera-HS PX8

Warning! (Grounding Instructions)

Static electricity can damage electronic components. Please discharge any static electrical charge by touching a grounded surface, such as the metal computer chassis, before performing any hardware installation.

If you do not feel comfortable performing the installation, please consult a qualified computer technician.

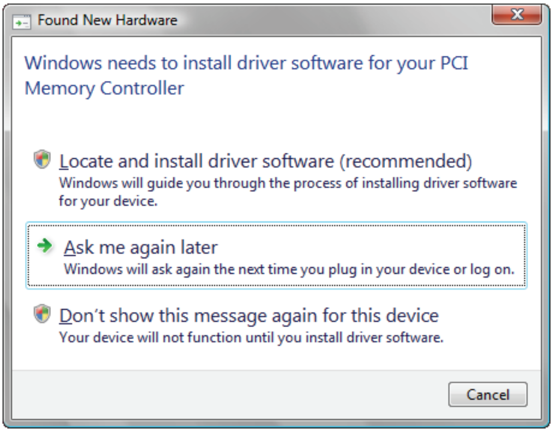
Important: Never remove or install any hardware component with the computer power on. Disconnect the power cord from the computer to disable the power standby mode. This prevents the case where some computers unexpectedly power up when a board is installed.

Installation

Note: to install Sapera LT and the X64 Xcelera-HS PX8 device driver, logon to the workstation as administrator or with an account that has administrator privileges.

The Sapera LT Development Library (or 'runtime library' if application execution without development is preferred) must be installed before the Xcelera-HS PX8 device driver.

- Turn the computer off, disconnect the power cord (disables power standby mode), and open the computer chassis to allow access to the expansion slot area.
- Install the X64 Xcelera-HS PX8 into a free PCI Express x8 expansion slot. Note that some computer's x16 slot may support the X64 Xcelera-HS PX8.
- Close the computer chassis and turn the computer on.
- If using **Windows XP**, Windows will start its **Found New Hardware Wizard**. Click on the **Cancel** button to close the Wizard.
- If using **Windows Vista or Windows 7**, Windows will display its **Found New Hardware dialog**. Click on the default "*Ask me again later*" and continue with the installation. Note that if you select the third option "*Don't show this message again for this device*", you will not be prompted again if the DALSA board is installed in the same computer.



Sapera LT Library Installation

- Insert the DALSA Sapera Essential CD-ROM. If **AUTORUN** is enabled on your computer, the installation menu is presented.
- If **AUTORUN** is not enabled, use Windows Explorer and browse to the root directory of the CD-ROM. Execute **launch.exe** to start the installation menu and install the required Sapera components.
- Continue with the installation of the board driver as described in the next section.
- The installation program will prompt you to reboot the computer.

Refer to *Sapera LT User's Manual* for additional details about Sapera LT.

X64 Xcelera-HS PX8 Driver Installation

The X64 Xcelera-HS PX8 board driver supports installation in a Windows XP, Windows Vista, or Windows 7 system.

- If Sapera was just installed, continue by selecting the X64 Xcelera-HS PX8 driver installation.
- If Sapera was installed previously, insert the DALSA Sapera Essential CD-ROM to now install the board driver. If **AUTORUN** is enabled on your computer, the installation menu is presented. Install the X64 Xcelera-HS PX8 driver.
- If **AUTORUN** is not enabled, use Windows Explorer and browse to the root directory of the CD-ROM. Execute **launch.exe** to start the installation menu and install the X64 Xcelera-HS PX8 driver. During the late stages of the installation, the X64 Xcelera-HS PX8 firmware loader application starts. This is described in detail in the following section.
- If Windows displays any unexpected message concerning the installed board, power off the system and verify that the X64 Xcelera-HS PX8 is installed in the slot properly.

X64 Xcelera-HS PX8 Firmware Loader

After Windows boots, the Device Manager-Firmware Loader program automatically executes at the end of the driver installation and on every subsequent reboot of the computer. It will determine if the X64 Xcelera-HS PX8 requires a firmware update. If firmware is required, a dialog displays and it also allows the user to load firmware for alternate operational modes of the X64 Xcelera-HS PX8 (if made available by DALSA).

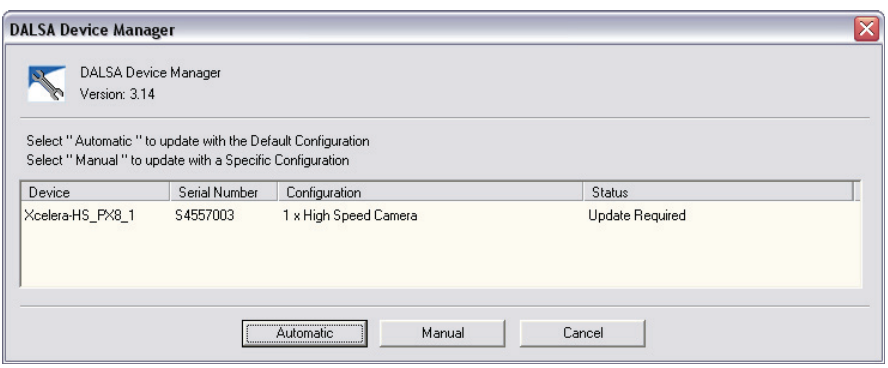
***Important*:** In the very rare case of firmware loader errors please see "Recovering from a Firmware Update Error" on page 27.

Firmware Update: Automatic Mode

Click **Automatic** to update the X64 Xcelera-HS PX8 firmware with the default package. The X64 Xcelera-HS PX8 currently supports one firmware configuration.

See "Series Key Features" on page 7 and "User Programmable Configurations" on page 7 for details on supported modes, which can be selected via a manual firmware update.

If there are multiple X64 Xcelera-HS PX8 boards in the system, all will be updated with new firmware. If any installed X64 Xcelera-HS PX8 board installed in a system already has the correct firmware version, an update is not required. In the following screen shot, a single X64 Xcelera-HS PX8 board is installed in the system and the default configuration is ready to be programmed.



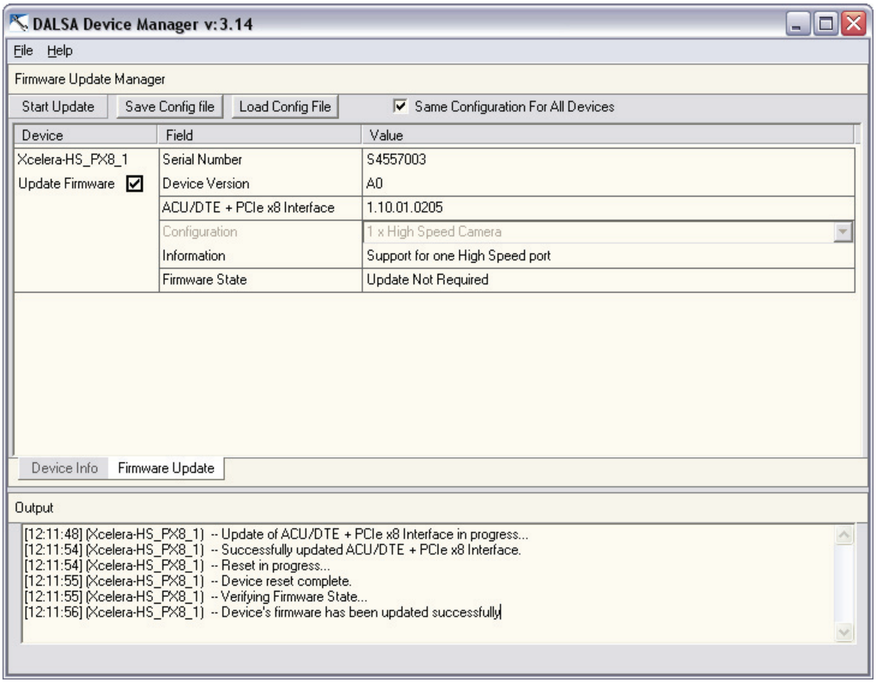
Firmware Update: Manual Mode

Select **Manual** mode to load firmware other then the default version or when, in the case of multiple X64 Xcelera-HS PX8 boards in the same system, if each requires different firmware.

The figure below shows the Device Manager manual firmware screen. Information on all installed X64 Xcelera-HS PX8 boards, their serial numbers, and their firmware components are shown.

A manual firmware update is made as follows:

- Select the X64 Xcelera-HS PX8 to update via the board selection box (if there are multiple boards in the system)
- From the Configuration field drop menu select the firmware version required
- Click on the Start Update button
- Observe the firmware update progress in the message output window
- Close the Device manager program when the device reset complete message is shown.



Executing the Firmware Loader from the Start Menu

If required, the Xcelera-HS PX8 Firmware Loader program can be executed via the Windows Start Menu shortcut **Start • Programs • DALSA • X64 Xcelera-HS PX8 Driver • Firmware Update**. A firmware change after installation would be required to select a different Camera HS-Link configuration mode (if avalable). See "User Programmable Configurations" on page 7.

Upgrading Sapera or Board Driver

When installing a new version of Sapera or a DALSA acquisition board driver in a computer with a previous installation, the current version **must** be un-installed first. Upgrade scenarios are described below.

Board Driver Upgrade Only

Minor upgrades to acquisition board drivers are typically distributed as ZIP files available in the DALSA web site www.dalsa.com/mv. Board driver revisions are also available on the next release of the Sapera Essential CD-ROM.

Often minor board driver upgrades do not require a new revision of Sapera. To confirm that the current Sapera version will work with the new board driver:

- Check the new board driver ReadMe file before installing, for information on the minimum Sapera version required.
- If the ReadMe file does not specify the Sapera version required, contact DALSA Technical Support (see "Technical Support" on page 88).

To upgrade the board driver only:

- Logon the computer as an administrator or with an account that has administrator privileges.
- In **Windows XP**, from the start menu select **Start • Settings • Control Panel • Add or Remove Programs**. Select the DALSA Xcelera board driver and click **Remove**.
- **Windows XP only**:
  - When the driver un-install is complete, reboot the computer.
  - Logon the computer as an administrator again.
- In **Windows Vista and Windows 7**, from the start menu select **Start • Settings • Control Panel • Programs and Features**. Double-click the DALSA Xcelera board driver and click **Remove**.
- Install the new board driver. Run **Setup.exe** if installing manually from a downloaded driver file.
- If the new driver is on a Sapera Essential CD-ROM follow the installation procedure described in " X64 Xcelera-HS PX8 Driver" on page 12.
- Important: You can not install a DALSA board driver without Sapera LT installed on the computer.

Upgrading both Sapera and Board Driver

When both Sapera and the acquisition board driver are upgraded, follow the procedure described below.

- Logon the computeras an administrator or with an account that has administrator privileges.
- In **Windows XP**, from the start menu select **Start • Settings • Control Panel • Add or Remove Programs**. Select the DALSA Xcelera board driver and click **Remove**. Follow by also removing the older version of Sapera LT.
- In **Windows Vista and Windows 7**, from the start menu select **Start • Settings • Control Panel • Programs and Features**. Double-click the DALSA Xcelera board driver and click **Remove**. Follow by also removing the older version of Sapera LT.
- Reboot the computer and logon the computer as an administrator again.
- Install the new versions of Sapera and the board driver as if this was a first time installation. See "Sapera LT Library Installation" on page 12 and " X64 Xcelera-HS PX8 Driver" on page 12 for installation procedures.

Using the HS-Link Serial Control Port

The HS-Link specification includes a serial communication port for direct camera control by the frame grabber (see "CamExpert Quick Start" on page 33). The X64 Xcelera-HS PX8 driver supports this serial communication port either directly or by mapping it to a host computer COM port. Any serial port communication program, such as Windows HyperTerminal, can connect to the camera in use and modify its function modes via its serial port controls. The X64 Xcelera-HS PX8 serial port supports communication speeds from 9600 to 115 kbps.

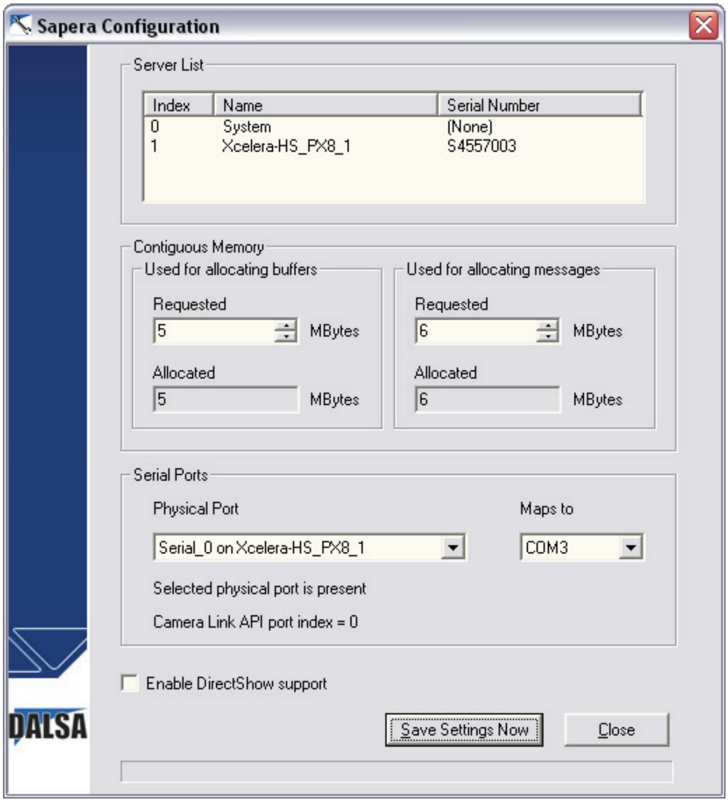
Note: if your serial communication program can directly select the X64 Xcelera-HS PX8 serial port then mapping to a system COM port is not necessary.

The X64 Xcelera-HS PX8 serial port is mapped to an available COM port by using the Sapera Configuration tool. Run the program from the Windows start menu: **Start • Programs • DALSA • Sapera LT • Sapera Configuration**.

COM Port Assignment

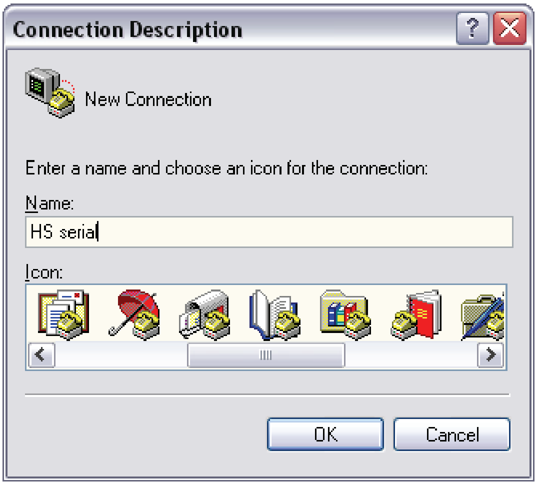
The lower section of the Sapera Configuration program screen contains the serial port configuration menu. Configure as follows:

- Use the **Physical Port** drop menu to select the Sapera board device from all available Sapera boards with serial ports (when more then one board is in the system).
- Use the **Maps to** drop menu to assign an available COM number to that Sapera board serial port.
- Click on the **Save Settings Now** button then the **Close** button. You are prompted to reboot your computer to enable the serial port mapping.
- The X64 Xcelera-HS PX8 serial port, now mapped to COM3 in this example, is available as a serial port to any serial port application for camera control. Note that this serial port is not listed in the **Windows Control Panel•System Properties•Device Manager** because it is a logical serial port mapping.
- An example setup using Windows HyperTerminal follows.

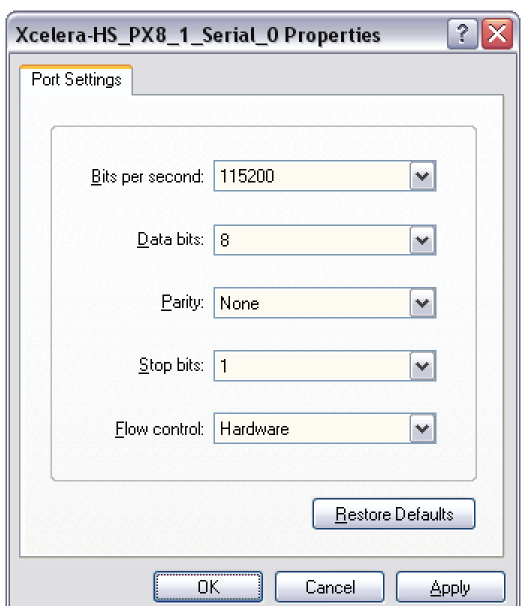


Setup Example with Windows HyperTerminal

- Run HyperTerminal and type a name for the new connection when prompted. Then click OK.
- On the following dialog screen select the port to connect with. The port could be the COM port mapped to the X64 Xcelera-HS PX8 or the COM device as shown in this example.



- HyperTerminal now presents a dialog to configure the COM port properties. Change settings as required by the camera you are connecting to. Note that the X64 Xcelera-HS PX8 serial port does not support hardware flow control.



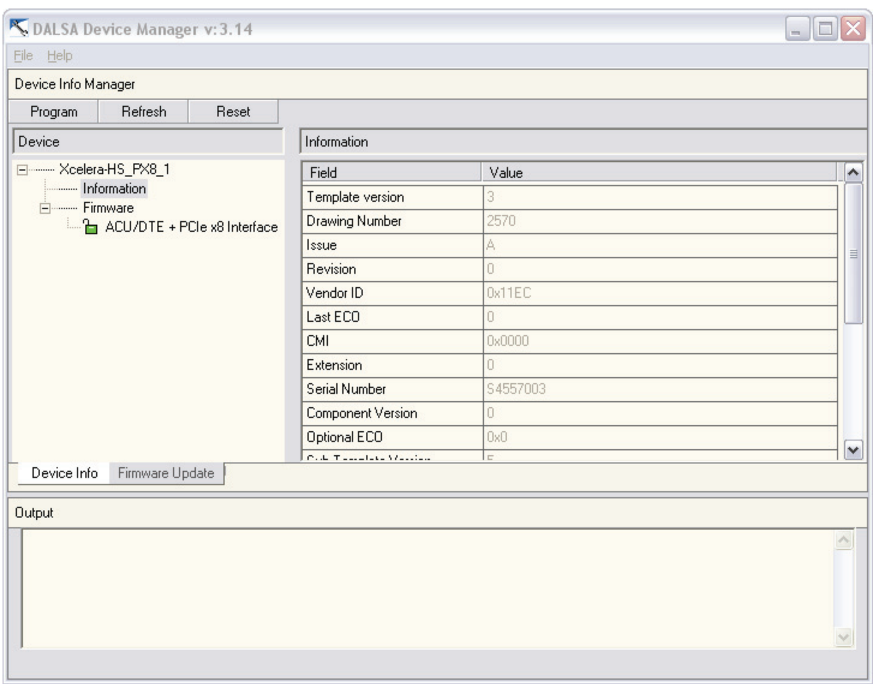
Displaying X64 Xcelera-HS PX8 Board Information

The Device Manager program also displays information about the X64 Xcelera-HS PX8 boards installed in the system. To view board information run the program via the Windows Start Menu shortcut **Start • Programs • DALSA • X64 Xcelera-HS PX8 Device Driver • DeviceManager**.

Device Manager – Board Viewer

The following screen image shows the Device Manager program with the Information/Firmware tab active. The left window displays all Dalsa boards in the system and their individual device components. The right window displays the information stored in the selected board device. This example screen shows the X64 Xcelera-HS PX8 information contained in the EEProm component.

The X64 Xcelera-HS PX8 device manager report file (BoardInfo.txt) is generated by clicking **File • Save Device Info**. This report file may be requested by DALSA Technical Support to aid in troubleshooting installation or operational problems.



Configuring Sapera

Viewing Installed Sapera Servers

The Sapera configuration program (**Start • Programs • DALSA • Sapera LT • Sapera Configuration**) allows the user to see all available Sapera servers for the installed Sapera-compatible boards. The **System** entry represents the system server. It corresponds to the host machine (your computer) and is the only server that should always be present.

Increasing Contiguous Memory for Sapera Resources

The **Contiguous Memory** section lets the user specify the total amount of contiguous memory (a block of physical memory, occupying consecutive addresses) reserved for the resources needed for **Sapera buffers** allocation and **Sapera messaging**. For both items, the **Requested** value dialog box shows the driver default memory setting while the **Allocated** value displays the amount of contiguous memory that has been allocated successfully. The default values will generally satisfy the needs of most applications.

The **Sapera buffers** value determines the total amount of contiguous memory reserved at boot time for the allocation of dynamic resources used for host frame buffer management such as DMA descriptor tables plus other kernel needs. Adjust this value higher if your application generates any out-of-memory error while allocating host frame buffers. You can approximate the amount of contiguous memory required as follows:

- Calculate the total amount of host memory used for frame buffers
  [number of frame buffers • number of pixels per line • number of lines • (2 - if buffer is 10 or 12 bits)].
- Provide 1MB for every 256 MB of host frame buffer memory required.
- Add an additional 1 MB if the frame buffers have a short line length, say 1k or less
  (the increased number of individual frame buffers requires more resources).
- Add an additional 2 MB for various static and dynamic Sapera resources.
- Test for any memory error when allocating host buffers. Simply use the Buffer menu of the Sapera Grab demo program (see "Grab Demo Overview" on page 39) to allocate the number of host buffers required for your acquisition source. Feel free to test the maximum limit of host buffers possible on your host system – the Sapera Grab demo will not crash when the requested number of host frame buffers cannot be allocated.

Host Computer Frame Buffer Memory Limitations

When planning a Sapera application and its host frame buffers used, plus other Sapera memory resources, do not forget the Windows operating system memory needs. Window XP, as an example, should always have a minimum of 128 MB for itself.

A Sapera application using *scatter gather buffers* could consume most of the remaining system memory. When using frame buffers allocated as a *single contiguous memory block*, typical limitations are one third of the total system memory with a maximum limit of approximately 100 MB. See the Buffer menu of the Sapera Grab demo program for information on selecting the type of host buffer memory allocation.

Contiguous Memory for Sapera Messaging

The current value for **Sapera messaging** determines the total amount of contiguous memory reserved at boot time for messages allocation. This memory space is used to store arguments when a Sapera function is called. Increase this value if you are using functions with large arguments, such as arrays and experience any memory errors.

Troubleshooting Problems

Overview

The X64 Xcelera-HS PX8 (and the X64 family of products) has been tested by DALSA in a variety of computers. Although unlikely, installation problems may occur due to the constant changing nature of computer equipment and operating systems. This section describes what the user can verify to determine the problem or the checks to make before contacting DALSA Technical Support.

If you require help and need to contact DALSA Technical Support, make detailed notes on your installation and/or test results for our technical support to review. See "Technical Support" on page 88 for contact information.

Problem Type Summary

X64 Xcelera-HS PX8 problems are either installation types where the board hardware is not recognized on the PCIe bus (i.e. trained) or function errors due to camera connections or bandwidth issues. The following links jump to various topics in this troubleshooting section.

First Step: Check the Status LED

A flashing RED Status LED 1 indicates a computer bus issue (possibly the Gen2 slot error described below), while a solid YELLOW Status LED 1 indicates the board is currently in safe mode. The complete status LED description is available in the technical reference section (see "Status LEDs & LED D2 Functional Description" on page 67).

Possible Installation Problems

- **Hardware PCI bus conflict:** When a new installation produces PCI bus error messages or the board driver doesn't install, it is important to verify that there are no conflicts with other PCI or system devices already installed. Use the DALSA PCI Diagnostic tool as described in "Checking for PCI Bus Conflicts" on page 24. Also verify the installation via the "Windows Device Manager" on page 26.
- **Gen2 slot errors:** There is a PCI bus error message from the computer bios. Follow the instructions "GEN2 Slot Computer Issue" on page 26.
- **Verify Sapera and Board drivers:** If there are errors when running applications, confirm that all Sapera and board drivers are running. See "Sapera and Hardware Windows Drivers" on page 27 for details. In addition, DALSA technical support will ask for the log file of messages by DALSA drivers. Follow the instructions describe in "DALSA Log Viewer" on page 29.
- **Firmware update error:** There was an error during the X64 Xcelera-HS PX8 firmware update procedure. This usually is easily corrected by the user. Follow the instructions "Recovering from a Firmware Update Error" on page 27.

- Installation went well but the board doesn't work or stopped working. Review theses steps described in "Symptoms: CamExpert Detects no Boards" on page 30

Possible Functional Problems

- **Driver Information:** Use the DALSA device manager program to view information about the installed X64 Xcelera-HS PX8 board and driver. See "Driver Information via the Device Manager Program" on page 28.
- **Area scan memory requirements:** The X64 Xcelera-HS PX8 on board memory provides by default two frame buffers large enough for most imaging situations. See "Memory Requirements with Area Scan Acquisitions" on page 30 for details on the on board memory and possible limitations.

Sometimes the problem symptoms are not the result of an installation issue but due to other system issues. Review the sections described below for solutions to various X64 Xcelera-HS PX8 functional problems.

- "Symptoms: X64 Xcelera-HS PX8 Does Not Grab" on page 31
- "Symptoms: Card grabs black" on page 31
- "Symptoms: Card acquisition bandwidth is less than expected" on page 32

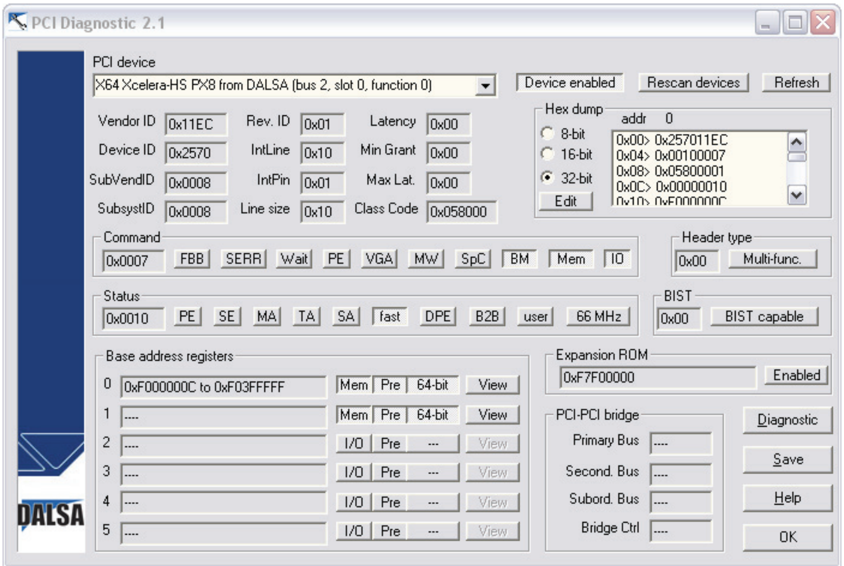
Troubleshooting Procedures

The following sections provide information and solutions to possible X64 Xcelera-HS PX8 installation and functional problems. These topics are summarized in the previous section of this manual.

Checking for PCI Bus Conflicts

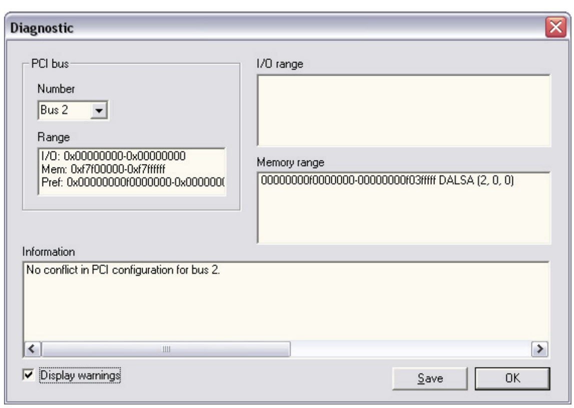
One of the first items to check when there is a problem with any PCI board is to examine the system PCI configuration and ensure that there are no conflicts with other PCI or system devices. The *PCI Diagnostic* program (**cpcidiag.exe**) allows examination of the PCI configuration registers and can save this information to a text file. Run the program via the Windows Start Menu shortcut **Start • Programs • DALSA • Sapera LT • Tools • PCI Diagnostics**.

As shown in the following screen image, use the first drop menu to select the PCI device to examine. Select the device from DALSA. Note the bus and slot number of the installed board (this will be unique for each system unless systems are setup identically). Click on the **Diagnostic** button to view an analysis of the system PCI configuration space.



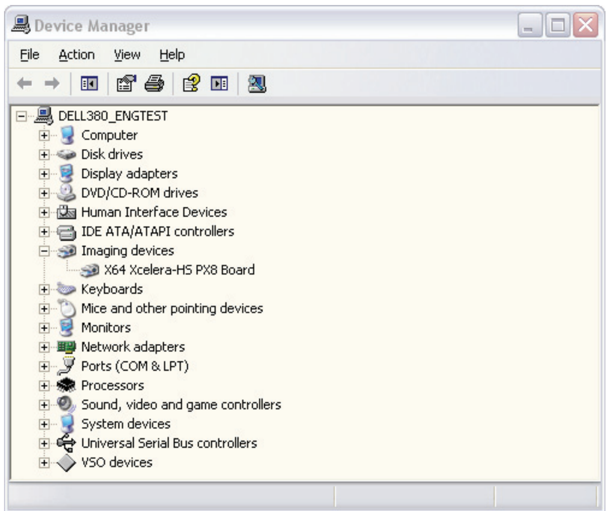
Clicking on the **Diagnostic** button opens a new window with the diagnostic report. From the PCI Bus Number drop menu select the bus number that the X64 Xcelera-HS PX8 is installed in—in this example the slot is bus 1.

The window now shows the I/O and memory ranges used by each device on the selected PCI bus. The information display box will detail any PCI conflicts. If there is a problem, click on the **Save** button. A file named '**pcidiag.txt**' is created (in the Sapera\bin directory) with a dump of the PCI configuration registers. Email this file when requested by the DALSA Technical Support group along with a full description of your computer.



Windows Device Manager

An alternative method to confirm that the X64 Xcelera-HS PX8 board and drive is installed correctly is to use the Windows Device manager tool. Use the Start Menu shortcut **Start • Settings • Control Panel • System • Hardware • Device Manager**. As shown in the following screen images, look for *X64 Xcelera-HS PX8* board under "Imaging Devices". Double-click and look at the device status. You should see "This device is working properly." Go to "Resources" tab and make certain that the device is mapped and has an interrupt assigned to it, without any conflicts.



GEN2 Slot Computer Issue

DALSA engineering has identified cases where the X64 Xcelera-HS PX8 board is not detected when installed in computers using the Intel 5400 chip set. This issue is identified by the status LED 1 flashing red continuously at boot time. By changing the switch SW500-2 position from the default 'OFF' to the 'ON' position before installing the Xcelera in the computer, the PCI error is eliminated. See "SW500: Normal/Safe Boot Mode & GEN2 Slot Workaround" on page 77 for details.

Sapera and Hardware Windows Drivers

If any problem is seen after installation, such as an error message running CamExpert, make certain the appropriate DALSA drivers have started successfully during the boot sequence. Example, click on the **Start • Programs • Accessories • System Tools • System Information • Software Environment** and click on **System Drivers**. Make certain the following drivers have started for the **X64 Xcelera-HS PX8**.

Device	Description	Type	Started
CorX64XceleraHSPX8	X64 Xcelera-HS PX8 messaging	Kernel Driver	Yes
CorLog	Sapera Log viewer	Kernel Driver	Yes
CorMem	Sapera Memory manager	Kernel Driver	Yes
CorPci	Sapera PCI configuration	Kernel Driver	Yes
CorSerial	Sapera Serial Port manager	Kernel Driver	Yes

DALSA Technical Support may request that you check the status of these drivers as part of the troubleshooting process.

Recovering from a Firmware Update Error

This procedure is required if any failure occurred while updating the X64 Xcelera-HS PX8 firmware on installation or during a manual firmware upgrade. On the rare occasion the board has corrupted firmware, any Sapera application such as CamExpert or the grab demo program will not find an installed board to control.

Possible reasons for firmware loading errors or corruption are:

- Computer system mains power failure or deep brown-out.
- PCI bus or checksum errors.
- PCI bus timeout conditions due to other devices.
- User forcing a partial firmware upload using an invalid firmware source file.

When the X64 Xcelera-HS PX8 firmware is corrupted, executing a manual firmware upload will not work because the firmware loader can not communicate with the board. In an extreme case, corrupted firmware may even prevent Windows from booting.

Solution: The user manually forces the board to initialize from 'safe' firmware designed only to allow driver firmware uploads. When the firmware upload is complete, the board is then rebooted to initialize in its normal operational mode.

- Note that this procedure may require removing the X64 Xcelera-HS PX8 board several times from the computer.
- ***Important***: Referring to the board's user manual (in the connectors and jumpers reference section), identify the configuration switch location. The Boot Recovery Mode switch for the X64 Xcelera-

HS PX8 is SW500-1 (see "SW500: Normal/Safe Boot Mode & GEN2 Slot Workaround" on page 77).

- Shut down Windows and power OFF the computer.
- Move the switch SW500-1 to ON, for the boot recovery mode position. (The default position is SW500-1 to OFF for normal operation).
- Power on the computer. Windows will boot normally.
- When Windows has started, do a manual firmware update procedure to update the firmware again (see "Executing the Firmware Loader from the Start Menu" on page 14).
- When the update is complete, shut down Windows and power off the computer.
- Set the SW500-1 switch back to the OFF position (i.e. default position) and power on the computer once again.
- Verify that the frame grabber is functioning by running a Sapera application such as CamExpert. The Sapera application will now be able to communicate with the X64 Xcelera-HS PX8 board.

Driver Information via the Device Manager Program

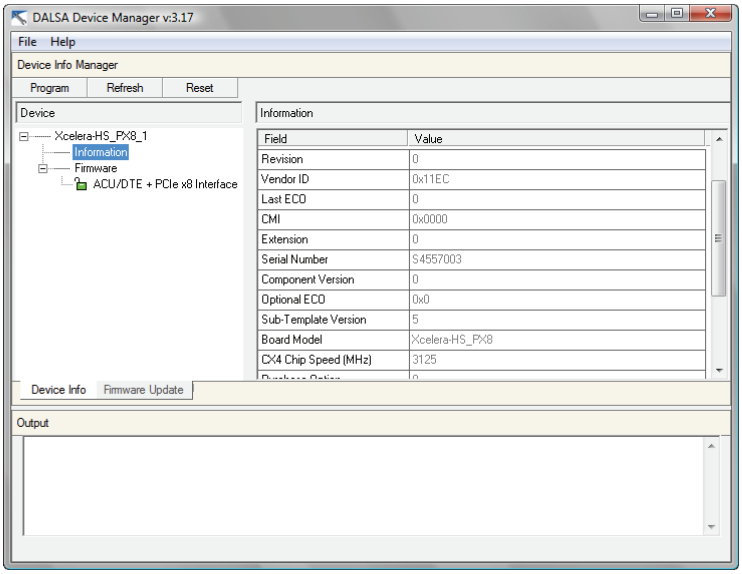
The Device Manager program provides a convenient method of collecting information about the installed X64 Xcelera-HS PX8. System information such as operating system, computer CPU, system memory, PCI configuration space, plus X64 Xcelera-HS PX8 firmware information can be displayed or written to a text file (default file name – BoardInfo.txt). Note that this program is also used to manually upload firmware to the X64 Xcelera-HS PX8 (described elsewhere in this manual).

Execute the program via the Windows Start Menu shortcut **Start • Programs • DALSA • X64 Xcelera-HS PX8 Device Driver • CorDeviceManager**. If the Device Manager program does not run, it will exit with a message that the board was not found. Since the X64 Xcelera-HS PX8 board must have been in the system to install the board driver, possible reasons for an error are:

- Board was removed
- Board driver did not start or was terminated
- PCI conflict after some other device was installed

Information Window

The following figure shows the Device Manager information screen. Click to highlight one of the board components and the information for that item is shown on the right hand window, as described below.



- Select **Information** to display identification and information stored in the X64 Xcelera-HS PX8 firmware.
- Select **Firmware** to display version information for the firmware components.
- Select one of the firmware components to load *custom* firmware when supplied by DALSA engineering for a future feature.
- Click on **File • Save Device Info** to save all information to a text file. Email this file when requested by Technical Support.

DALSA Log Viewer

The third step in the verification process is to save in a text file the information collected by the Log Viewer program. Run the program via the Windows Start Menu shortcut **Start • Programs • DALSA • Sapera LT • Tools • Log Viewer**.

The Log Viewer lists information about the installed DALSA drivers. Click on File • Save and you will be prompted for a text file name to save the Log Viewer contents. Email this text file to DALSA Technical Support when requested or as part of your initial contact email.

Memory Requirements with Area Scan Acquisitions

The X64 Xcelera-HS PX8 allocates by default two frame buffers in onboard memory, each equal in size to the acquisition frame buffer. This double buffering memory allocation is automatic at the driver level. The X64 Xcelera-HS PX8 driver uses two buffers to ensure that the acquired video frame is complete and not corrupted in cases where the image transfer to host system memory may be interrupted and delayed by other host system processes. That is, the image acquisition to one frame buffer is not interrupted by any delays in transfer of the other frame buffer (which contains the previously acquired video frame) to system memory.

The total size of the two internal frame buffers must be somewhat smaller than the total onboard memory due to memory overhead required for image transfer management. When the X64 Xcelera-HS PX8 does not have enough onboard memory for two frame buffers, the driver memory manager will reduce the size in increments of video lines for the 2 buffers, to the maximum that can fit.

Note that in this situation, it is best to specify a single on-board buffer in order to increase the size of image that can be buffered on-board before a video line wraparound occurs during the acquisition. In this specific situation the image transfers to the host memory buffer can not take advantage of a dual on-board buffer during image transfer, therefore the image transfer is subject to PCIe bandwidth limitations.

Symptoms: CamExpert Detects no Boards

- When starting CamExpert, if no DALSA board is detected, CamExpert will start in offline mode. There is no error message and CamExpert is functional for creating or modifying a camera configuration file. If CamExpert should have detected the installed board, troubleshoot the installation problem as described below.

Troubleshooting Procedure

When CamExpert detects no installed DALSA board, there could be a hardware problem, a PnP problem, a PCI problem, a kernel driver problem, or a software installation problem.

- Make certain that the card is properly seated in PCIe slot.
- Perform all installation checks described in this section before contacting Technical Support.
- Try the board in a different PCIe slot if available.

Symptoms: X64 Xcelera-HS PX8 Does Not Grab

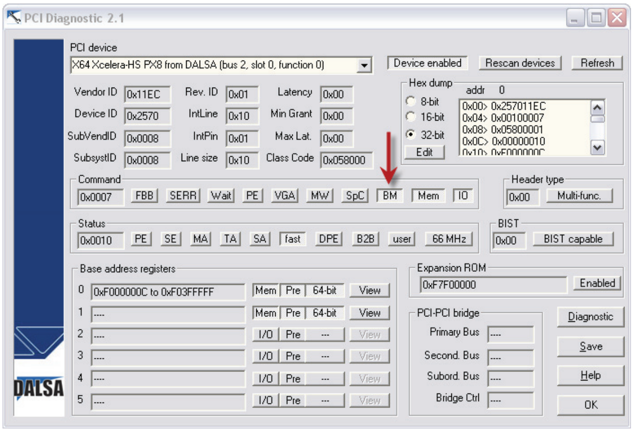
You are able to start Sapera CamExpert but you do not see an image and the frame rate displayed is 0.

- Verify power is connected to the camera.
- Verify the camera and timing parameters with the camera in free run mode.
- Verify you can grab with the camera in free run mode.
- Make certain that you provide an external trigger if the camera configuration file requires one. Use the software trigger feature of CamExpert if you do not have a trigger source.
- Make certain that the camera is properly connected to the cable.
- Make certain that the camera is configured for the proper mode of operation. This must match the camera configuration file. Refer to your camera datasheet.
- Try to snap one frame instead of continuous grab.
- Perform all installation checks described in this section before contacting Technical Support.
- Use the Sapera Monitor tool to see which events (if any) are generated by the board.

Symptoms: Card grabs black

You are able to use Sapera CamExpert, the displayed frame rate is as expected, but the display is always black.

- Set your camera to manual exposure mode and set the exposure to a longer period, plus open the lens iris.
- Try to snap one frame instead of continuous grab.
- This problem is sometimes caused by a PCIe transfer issue. No PCIe transfer takes place, so the frame rate is above 0 but nevertheless no image is displayed in CamExpert.
- Make certain that BUS MASTER bit in the PCIe configuration space is activated. Look in PCI Diagnostics for **BM** button under “Command” group. Make certain that the **BM** button is activated.



- Perform all installation checks described in this section before contacting Technical Support.

Symptoms: Card acquisition bandwidth is less than expected

The X64 Xcelera-HS PX8 acquisition bandwidth is less than expected.

- Review the system for problems or conflicts with other expansion boards or drivers.
- Remove other PCI Express, PCI-32 or PCI-64 boards and check acquisition bandwidth again. Engineering has seen this case where other PCI boards in some systems cause limitations in transfers. Each system, with its combination of system motherboard and PCI boards, will be unique and will need to be tested for bandwidth limitations affecting the imaging application.
- Is the X64 Xcelera-HS PX8 installed in a PCI Express x16 slot?
  Note that some computer's x16 slot may only support non x16 boards at x1 or not at all. Check the computer documentation or test an X64 Xcelera-HS PX8 installation.

CamExpert Quick Start

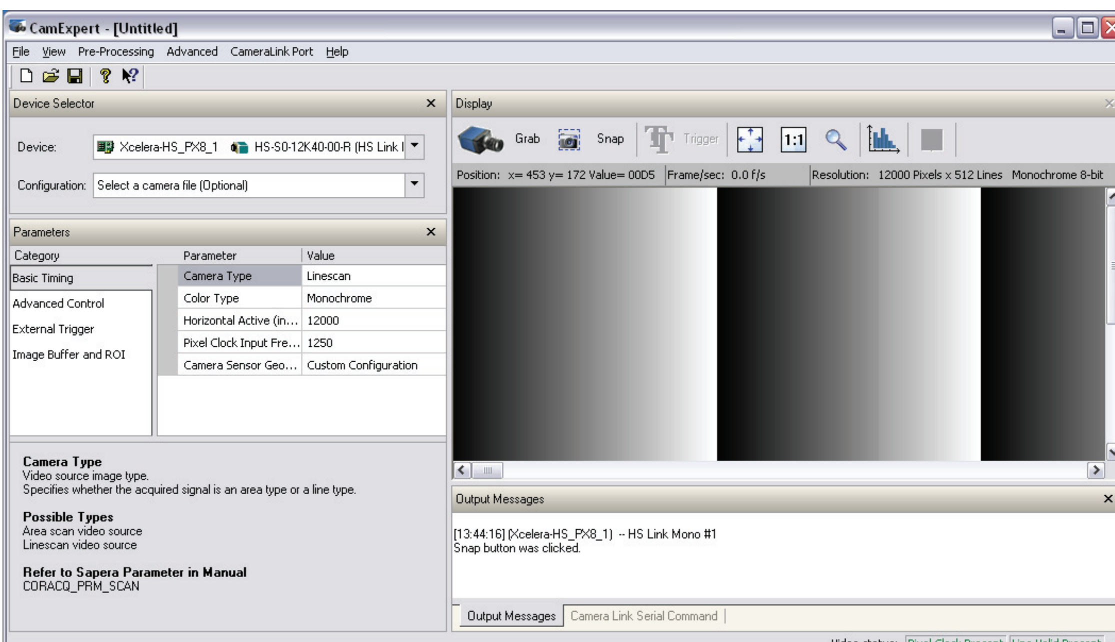
Interfacing Cameras with CamExpert

CamExpert is the camera interfacing tool for frame grabber boards supported by the Sapera library. CamExpert generates the Sapera camera configuration file (*yourcamera.ccf*) based on timing and control parameters entered. For backward compatibility with previous versions of Sapera, CamExpert also reads and writes the *.cca and *.cvi camera parameter files.

Every Sapera demo program starts by a dialog window to select a camera configuration file. Even when using the X64 Xcelera-HS PX8 with common video signals, a camera file is required. Therefore CamExpert is typically the first Sapera application run after an installation. Obviously existing .ccf files can be copied to the new installation when similar cameras are used.

CamExpert Example with a DALSA HS Camera

The image below shows CamExpert controlling the X64 Xcelera-HS PX8. The camera outputs monochrome 8-bit video on an HS-Link interface. After selecting the camera model, the timing parameters are displayed and the user can test by clicking on *Grab*. Descriptions of the CamExpert window follow the image.



CamExpert groups parameters into functional categories. The parameters shown depend on the frame grabber used and what camera is connected. The parameter values are either the camera defaults or the last stored value when the camera was used. The descriptions below are with the Xcelera-HS PX8 and the DALSA HS camera.

- **Device Selector:** Two drop menus to select which device and which saved configuration to use.
  - **Device:** Select which acquisition device to control and configure a camera file for. Required in cases where there are multiple boards in a system and also when one board supports multiple acquisition types. Note in this example, the X64 Xcelera-HS PX8 was installed with firmware to support a monochrome HS-Link cameras.
  - **Configuration:** Select the timing for a specific camera model included with the Sapera installation or a standard video standard. The *User's* subsection is where created camera files are stored.

- **Parameter Groups:** Select a function category and change parameter values as required. Descriptions for the camera parameters change dependent on the camera.
  - **Basic Timing group:** Basic parameters used to define the timing of the camera. Select the Camera Type, Color Mode, Horizontal active resolution, Vertical Resolution (for area scan sensors), Pixel Clock frequency, Camera sensor readout type, etc. dependent on the camera selected. This group is sufficient to configure a free-running camera.
  - **Advanced Controls:** Advanced parameters used to configure camera control mode and strobe output.
  - **External Trigger:** Parameters to configure the external trigger characteristics.
  - **Image Buffer and ROI:** Control of the host buffer dimension and format.

- **Display:** An important component of CamExpert is its live acquisition display window which allows immediate verification of timing or control parameters without the need to run a separate acquisition program. **Grab** starts continuous acquisition (button then toggles to **Freeze** to stop). **Snap** is a single frame grab. **Trigger** is a software trigger to emulate an external source.
- **Output Messages and Video Status Bar:** Events and errors are logged for review. Camera connection status is displayed where green indicates signal present.
- **Camera Link Serial Command:** Select this Tab to open a serial command port to the camera. This allows the user to issue configuration commands if supported by the camera. DALSA HS-Link cameras support serial port commands, such as H to get a list of supported commands or GCP to get current camera parameters.

For context sensitive help click on the  button then click on a camera configuration parameter. A short description of the configuration parameter will be shown in a popup. Click on the  button to open the help file for more descriptive information on CamExpert.

CamExpert Demonstration and Test Tools

The CamExpert utility also includes a number of demonstration features which make CamExpert the primary tool to configure, test and calibrate your camera and imaging setup. Display tools include, image pixel value readout, image zoom, and line profiler.

Camera Types & Files

The X64 Xcelera-HS PX8 supports digital area scan or line scan cameras using the HS-Link interface standard. Contact DALSA or browse our web site [www.dalsa.com/mv] for the latest information and application notes on X64 Xcelera-HS PX8 supported cameras.

Camera Files Distributed with X64 Xcelera-HS PX8 driver

The X64 Xcelera-HS PX8 driver includes 3 camera configuration files for the Piranha HS 12k that describes one Master frame grabber and 2 Slave frame grabbers.

Camera Files Distributed with Sapera

The Sapera distribution CDROM includes camera files for a selection of supported cameras. Using the Sapera CamExpert program, you may use the camera files (CCA) provided to generate a camera configuration file (CCF) that describes the desired camera and frame grabber configuration..

DALSA continually updates a camera application library composed of application information and prepared camera files, ready to download. Camera files are ASCII text and can be read with Windows Notepad on any computer without having Sapera installed.

Overview of Sapera Acquisition Parameter Files (*.ccf or *.cca/*.cvi)

Concepts and Differences between the Parameter Files

There are two components to the legacy Sapera acquisition parameter file set: CCA files (also called cam-files) and CVI files (also called VIC files, i.e. video input conditioning). **Sapera LT 5.0** introduces a new camera configuration file (**CCF**) that combines the CCA and CVI files into one file.

Typically, a camera application will use a CCF file per camera operating mode. An application can also have multiple CCF files so as to support different image format modes supported by the camera or sensor (such as image binning or variable ROI).

CCF File Details

Files using the ".CCF" extension, (Camera Configuration files), are essentially the camera (CCA) and frame grabber (CVI) parameters grouped into one file for easier configuration file management. This is the default Camera Configuration file used with Sapera LT 5.0 and the CamExpert utility.

CCA File Details

DALSA distributes camera files using the legacy ".CCA" extension, (CAMERA files), which contain all parameters describing the camera video signal characteristics and operation modes (what the camera outputs). The Sapera parameter groups within the file are:

- Video format and pixel definition.
- Video resolution (pixel rate, pixels per line, lines per frame).
- Synchronization source and timing.
- Channels/Taps configuration.
- Supported camera modes and related parameters.
- External signal assignment.

CVI File Details

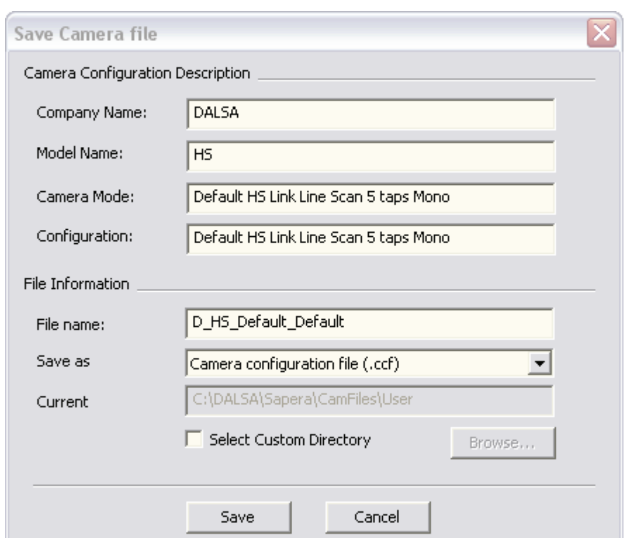
Legacy files using the ".CVI" extension contain all operating parameters related to the frame grabber board – what the frame grabber can actually do with camera controls or incoming video. The Sapera parameter groups within the file are:

- Activate and set any supported camera control mode or control variable.
- Define the integration mode and duration.
- Define the strobe output control.
- Allocate the frame grabber transfer ROI, the host video buffer size and buffer type (RGB888, RGB101010, MONO8, MONO16).
- Configuration of line/frame trigger parameters such as source (internal via the frame grabber /external via some outside event), electrical format (TTL, RS-422, OPTO-isolated), and signal active edge or level characterization.

Saving a Camera File

Use CamExpert to save a camera file (*.ccf) usable with any Sapera demo program or user application. An example would be a camera file which sets up parameters for a free running camera (i.e. internal trigger) with exposure settings for a good image with common lighting conditions.

When CamExpert is setup as required, click on **File•Save As** to save the new .ccf file. The dialog that opens allows adding details such as camera information, mode of operation, and a file name for the .ccf file. The following image is a sample for a DALSA HS-Link camera. Note the default folder where user camera files are saved.



Camera Interfacing Check List

Before interfacing a camera from scratch with CamExpert:

- Confirm that DALSA has not already published an application note with camera files [www.dalsa.com/mv].
- Confirm that the correct version or board revision of X64 Xcelera-HS PX8 is used. Confirm that the required firmware is loaded into the X64 Xcelera-HS PX8.
- Confirm that Sapera does not already have a .cca file for your camera installed on your hard disk. If there is a .cca file supplied with Sapera, then use CamExpert to automatically generate the .ccf file with default parameter values matching the frame grabber capabilities.
- Check if the Sapera installation has a similar type of camera file. A similar .cca file can be loaded into CamExpert where it is modified to match timing and operating parameters for your camera, and lastly save them as Camera Configuration file (.ccf).
- Finally, if your camera type has never been interfaced, run CamExpert after installing Sapera and the acquisition board driver, select the board acquisition server, and manually enter the camera parameters.

Sapera Demo Applications

Grab Demo Overview

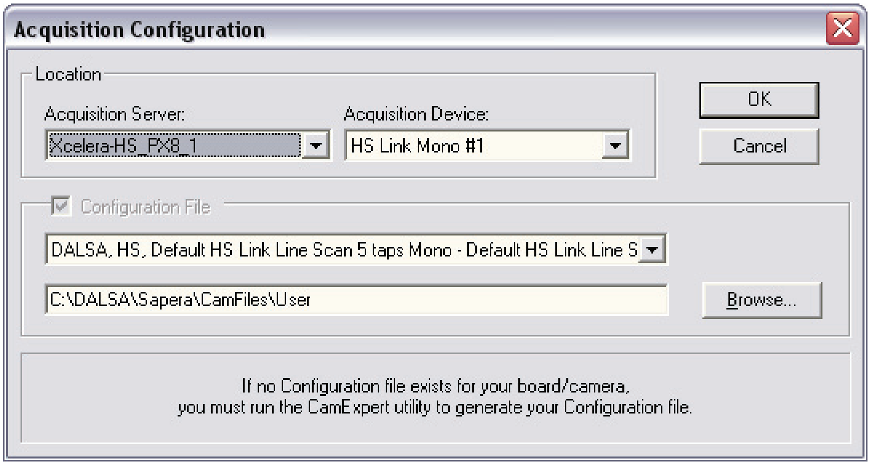
Program	**Start•Programs•DALSA•Sapera LT•Demos•Frame Grabbers•Grab Demo**
Program file	**\DALSA\Sapera\Demos\Classes\vc\GrabDemo\Release\GrabDemo.exe**
Workspace	**\DALSA\Sapera\Demos\Classes\vc\SapDemos.dsw**
.NET Solution	**\DALSA\Sapera\Demos\Classes\vc\SapDemos_2003.sln** **\DALSA\Sapera\Demos\Classes\vc\SapDemos_2005.sln** **\DALSA\Sapera\Demos\Classes\vc\SapDemos_2008.sln**
Description	This program demonstrates the basic acquisition functions included in the Sapera library. The program allows you to acquire images, either in continuous or in one-shot mode, while adjusting the acquisition parameters. The program code may be extracted for use within your own application.
Remarks	This demo is built using Visual C++ 6.0. It is based on Sapera C++ classes. See the Sapera User's and Reference manuals for more information.

Using the Grab Demo

Server Selection

Run the demo from the start menu **Start•Programs•Sapera LT•Demos•Frame Grabbers•Grab Demo**.

The demo program first displays the acquisition configuration menu. The first drop menu displayed permits selecting from any installed Sapera acquisition servers (installed DALSA acquisition hardware using Sapera drivers). The second drop menu permits selecting from the available input devices present on the selected server.



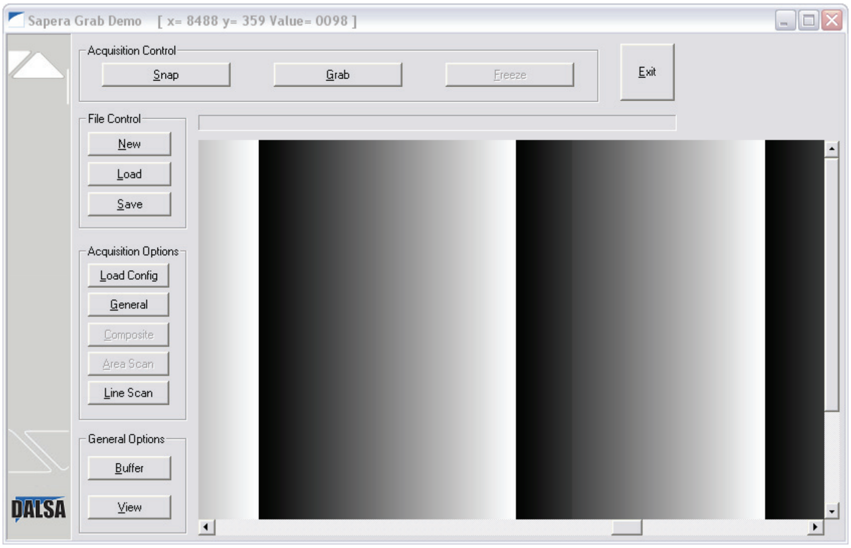
CCF File Selection

The acquisition configuration menu is also used to select the required camera configuration file for the connected camera. Sapera camera files contain timing parameters and video conditioning parameters. The default folder for camera configuration files is the same used by the CamExpert utility to save user generated or modified camera files.

Use the Sapera CamExpert utility program to generate the camera configuration file based on timing and control parameters entered. The CamExpert live acquisition window allows immediate verification of those parameters. CamExpert reads both Sapera *.cca and *.cvi for backward compatibility with the original Sapera camera files.

Grab Demo Main Window

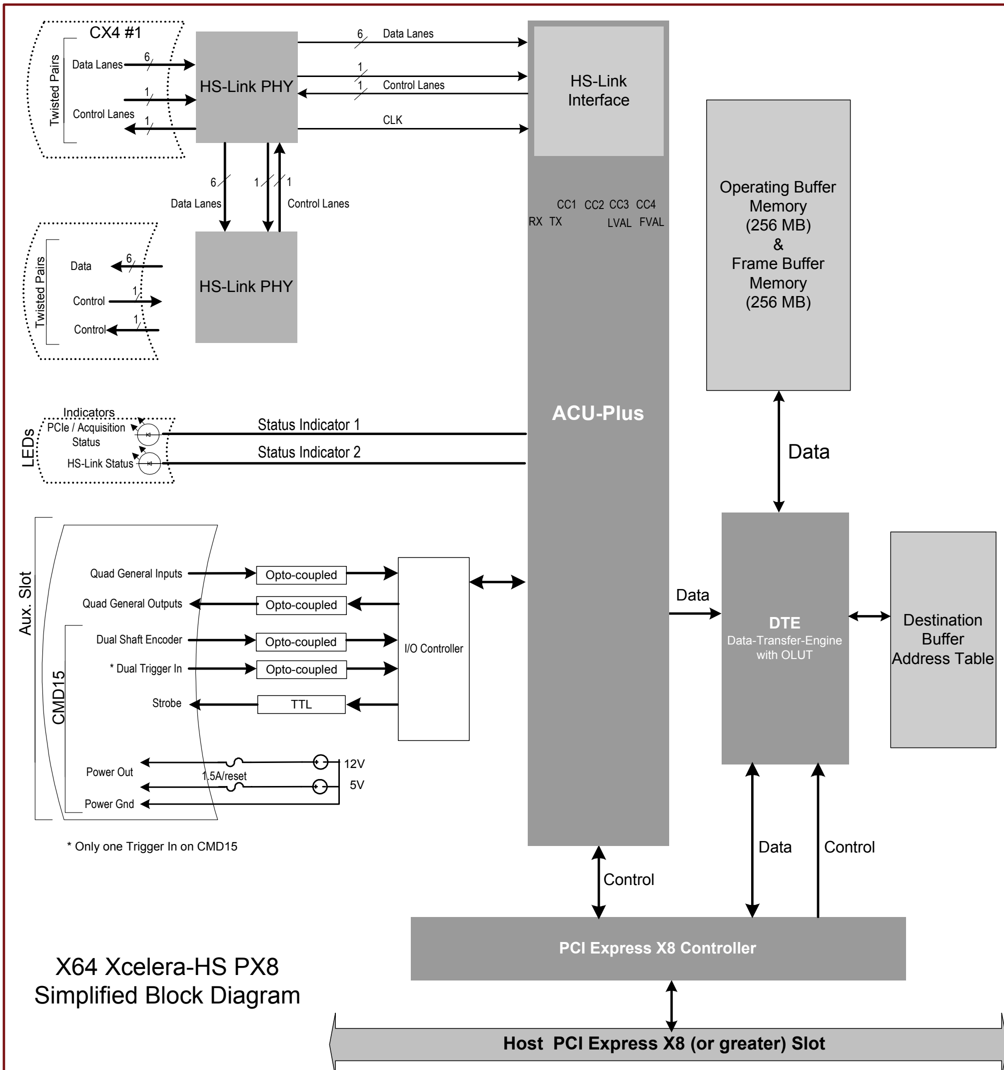
The Grab Demo program provides basic acquisition control for the selected frame grabber. Frame buffer defaults are defined by the loaded camera file (.ccf).



Refer to the Sapera LT User's Manual (OC-SAPM-USER), in section "Demos and Examples – Acquiring with Grab Demo", for more information on the Grab Demo.

X64 Xcelera-HS PX8 Reference

Block Diagram



X64 Xcelera-HS PX8 Simplified Block Diagram

Acquisition Timing

The HSLink acquisition timing specification will be published by the HSLink consortium.

Line Trigger Source Selection for Linescan Applications

Line scan imaging applications require some form of external event trigger to synchronize line scan camera exposures to the moving object. This synchronization signal is either an external trigger source (one exposure per trigger event) or a shaft encoder source composed of a single or dual phase (quadrature) signal. The X64 Xcelera-HS PX8 shaft encoder inputs provide additional functionality with pulse drop or pulse multiply support.

The following table describes the line trigger source types supported by the X64 Xcelera-HS PX8. Refer to the Sapera Acquisition Parameters Reference Manual (OC-SAPM-APR00) for descriptions of the Sapera parameters.

CORACQ_PRM_EXT_LINE_TRIGGER_SOURCE

The following table defines the trigger input source parameter values specific to the Xcelera-HS PX8.

PRM Value	Active Shaft Encoder Input
0	Default
1	Use phase A
2	Use phase B
3	Use phase A & B
4	From Board Sync
5	Phase A & B, shaft encoder after pulse drop/multiply output to Board Sync
6	Phase A & B, camera line trigger output to Board Sync
7	Phase A & B, camera line trigger output to Board Sync only while grabbing

CORACQ_PRM_EXT_LINE_TRIGGER_SOURCE full description relative to trigger type and X64 Xcelera-HS PX8 configuration used:

PRM Value	X64 Xcelera-HS PX8 configuration & camera input used	External Line Trigger Signal used	External Shaft Encoder Signal used
		if CORACQ_PRM_EXT_LINE_TRIGGER_ENABLE = *true*	*if* CORACQ_PRM_SHAFT_ENCODER_ENABLE =*true*
0	Camera #1	Shaft Encoder Phase A	Shaft Encoder Phase A & B
1	Camera #1	Shaft Encoder Phase A	Shaft Encoder Phase A
2	Camera #1	Shaft Encoder Phase B	Shaft Encoder Phase B
3, 5, 6, 7	Camera #1	n/a	Shaft Encoder Phase A & B
4	Camera #1	From Board Sync	From Board Sync

See "

Connecting External Signals to the X64 Xcelera-HS PX8" on page 68 for shaft encoder input connector details.

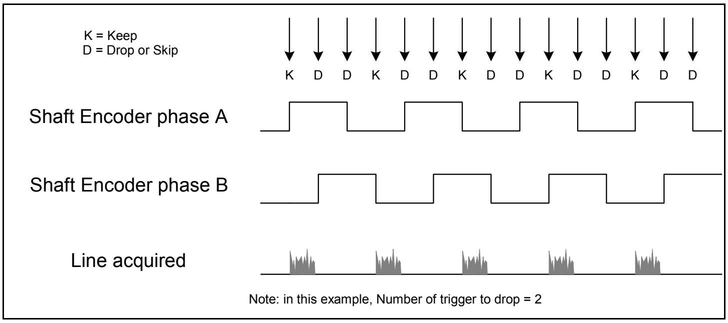
CVI/CCF File Parameters Used

- External Line Trigger Source = prm value
- External Line Trigger Enable = true/false
- Shaft Encoder Enable = true/false

Shaft Encoder Interface & Timing

Web inspection systems with variable web speeds typically provide one or two synchronization signals from a web mounted encoder to coordinate trigger signals. These trigger signals are used by the acquisition line scan camera. The X64 Xcelera-HS PX8 supports single or dual shaft encoder signals. Dual encoder signals are typically 90 degrees out of phase relative to each other and provide greater web motion resolution.

When enabled, the camera is triggered and acquires one scan line for each shaft encoder pulse edge. To optimize the web application, a second Sapera parameter defines the number of triggers to skip between valid acquisition triggers. The figure below depicts a system where a valid camera trigger is any pulse edge from either shaft encoder signal. After a trigger the two following triggers are ignored (as defined by the Sapera pulse drop parameter).



Note that camera file parameters are best modified by using the Sapera CamExpert program.

Dual Balanced Shaft Encoder Inputs:

- Input 1
  - Connector J1: Pin 2 (Phase A +) & Pin 10 (Phase A -)
  - Connector J4: Pin 23 (Phase A +) & Pin 24 (Phase A -)
- Input 2
  - Connector J1: Pin 3 (Phase B+) & Pin 11 (Phase B-)
  - Connector J4: Pin 25 (Phase B +) & Pin 26 (Phase B -)
- For complete information on J1 see "J1: CMD15 Female External Signals Connector” on page 69.
- For complete information on J4 see "J4: External Signals Connector” on page 70 and "External Signals Cabling Options for J4” on page 79

CVI/CCF File Parameters Used

Shaft Encoder Enable = X, where:

- If X = 1, Shaft Encoder is enabled
- If X = 0, Shaft Encoder is disabled

Shaft Encoder Pulse Drop = X, where:

- X = number of trigger pulses ignored between valid triggers

For information on camera configuration files see the Sapera Acquisition Parameters Reference Manual (OC-SAPM-APR00).

Virtual Frame Trigger for Line Scan Cameras

When using line scan cameras a frame buffer is allocated in host system memory to store captured video lines. To control when a video line is stored as the first line in this "virtual" frame buffer, an external frame trigger signal is used. The number of lines sequentially grabbed and stored in the virtual frame buffer is controlled by the Sapera vertical cropping parameter.

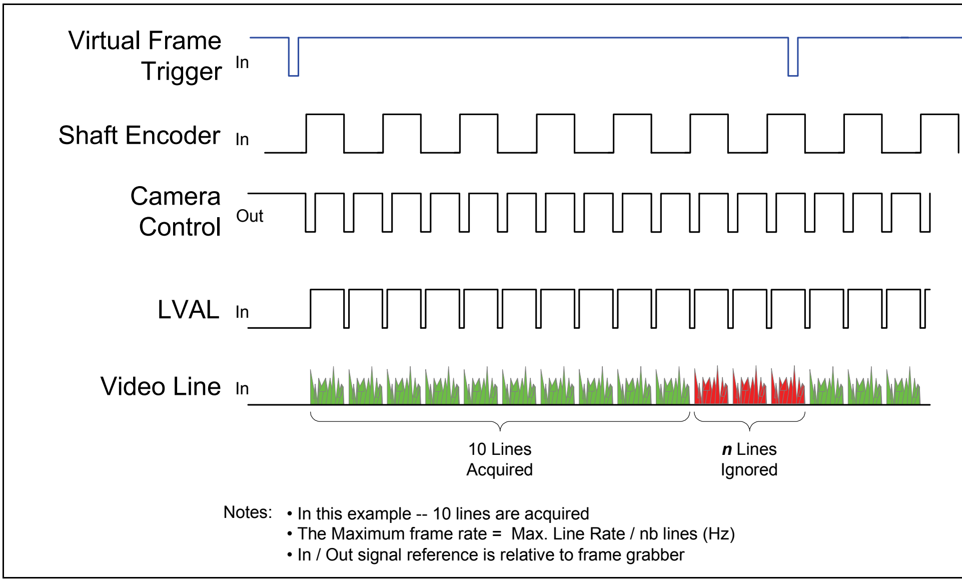
Virtual Frame Trigger Timing Diagram

The following timing diagram shows an example of grabbing 10 video lines from a line scan camera and the use of a virtual frame trigger to define when a video line is stored at the beginning of the virtual frame buffer. The virtual frame trigger signal (generated by some external event) is input on the X64 Xcelera-HS PX8 trigger input.

- Virtual frame trigger can be 24V industry standard, TTL 5V or RS-422 and be rising or falling edge active, active high or low, or double pulse rising or falling edge.
- Virtual frame trigger control is configured for rising edge trigger in this example.
- Virtual frame trigger connects to the X64 Xcelera-HS PX8 via the External Trigger Input 1 & 2 balanced inputs:
  - Trigger Input #1 on connector J1: pin 1 (+) and 9 (-)
  - Trigger Input #1 on connector J4: pin 19 (+) and pin 20 (-)
  - Trigger Input #2 on connector J4: pin 21 (+) and 22 (-) for input #2
- Camera control signals are output to the camera to trigger at all times in order to keep the camera running and avoid bad acquired lines at the beginning of a virtual frame.
- The camera control signals are either based on timing controls input on one or both X64 Xcelera-HS PX8 shaft encoder inputs or line triggers generated internally by the X64 Xcelera-HS PX8.
- The number of lines captured is specified by the Sapera vertical cropping parameter.

Synchronization Signals for a Virtual Frame of 10 Lines.

The following timing diagram shows the relationship between an External Frame Trigger input, External Shaft Encoder input (one phase used with the second terminated), and camera control output to the camera.



CVI File (VIC) Parameters Used

The VIC parameters listed below provide the control functionality for virtual frame reset. Applications either load pre-configured .cvi files or change VIC parameters directly during runtime.

Note that camera file parameters are best modified by using the Sapera CamExpert program.

External Frame Trigger Enable = X, where: (with Virtual Frame Trigger enabled)

- If X = 1, External Frame Trigger is enabled
- If X = 0, External Frame Trigger is disabled

External Frame Trigger Detection = Y, where: (with Virtual Frame Trigger edge select)

- If Y= 1, External Frame Trigger is active low
- If Y= 2, External Frame Trigger is active high
- If Y= 4, External Frame Trigger is active on rising edge
- If Y= 8, External Frame Trigger is active on falling edge
- If Y= 32, External Frame Trigger is dual-input rising edge
- If Y= 64, External Frame Trigger is dual-input falling edge

External Frame Trigger Level = Z, where: (with Virtual Frame Trigger signal type)

- If Z= 2, External Frame Trigger is a RS-422 signal

For information on camera files see the Sapera Acquisition Parameters Reference Manual (OC-SAPM-APR00).

Sapera Acquisition Methods

Sapera acquisition methods define the control and timing of the camera and frame grabber board. Various methods are available, grouped as:

- Camera Trigger Methods (method 1 and 2 supported)
- Camera Reset Methods (method 1 supported)
- Line Integration Methods (method 1 through 4, 7 supported)
- Time Integration Methods (method 1 through 9 supported)
- Strobe Methods (method 1 through 4 supported)

Refer to the Sapera LT Acquisition Parameters Reference manual (OC-SAPM-APR00) for detailed information concerning camera and acquisition control methods.

Trigger To Image Reliability

Trigger-to-image reliability incorporates all stages of image acquisition inside an integrated controller to increase reliability and simplify error recovery. The trigger-to-image reliability model brings together all the requirements for image acquisition to a central management unit. These include signals to control camera timing, on-board FIFO memory to compensate for PCI bus latency, and comprehensive error notification. Whenever the X64 Xcelera-HS PX8 detects a problem, the user application is immediately informed and can take appropriate action to return to normal operation.

The X64 Xcelera-HS PX8 is designed with a robust ACU (Acquisition and Control Unit). The ACU monitors in real-time, the acquisition state of the input plus the DTE (Data Transfer Engine), which transfers image data from on-board FIFO memory into PC memory. In general these management processes are transparent to end-user applications. With the X64 Xcelera-HS PX8, applications ensure trigger-to-image reliability by monitoring events and controlling transfer methods as described below:

Supported Events and Transfer Methods

The following acquisition and transfer events are supported. Event monitoring is a major component to the Trigger-to-Image Reliability framework.

Acquisition Events

Acquisition events are related to the acquisition module. They provide feedback on the image capture phase.

- **External Trigger** (Used/Ignored)
  Generated when the external trigger pin is asserted, usually indicating the start of the acquisition process. There are 2 types of external trigger events: 'Used' or 'Ignored'. Following an external trigger, if the event generates a captured image, an External Trigger Used event will be generated (CORACQ_VAL_EVENT_TYPE_EXTERNAL_TRIGGER).
  If there is no captured image, an External Trigger Ignored event will be generated (CORACQ_VAL_EVENT_TYPE_EXTERNAL_TRIGGER_IGNORED). An external trigger event will be ignored if the rate at which the events are received are higher than the possible frame rate of the camera.
- **Start of Frame**
  Event generated, during acquisition, when the start of a video frame is detected by the board acquisition hardware. The Sapera event value is CORACQ_VAL_EVENT_TYPE_START_OF_FRAME.
- **End of Frame**
  Event generated, during acquisition, when the end of a video frame is detected by the board acquisition hardware. The Sapera event value is CORACQ_VAL_EVENT_TYPE_END_OF_FRAME.
- **Data Overflow**
  The Data Overflow event indicates that there is not enough bandwidth for the acquired data to be transferred without loss. This is usually caused by limitations of the acquisition module and should never occur.
  The Sapera event value is CORACQ_VAL_EVENT_TYPE_DATA_OVERFLOW.
- **Frame Valid**
  Event generated when the start of a video frame is detected by the board acquisition hardware. Acquisition does not need to be active, therefore this event can verify a valid signal is connected. The Sapera event value is CORACQ_VAL_EVENT_TYPE_VERTICAL_SYNC.
- **Pixel Clock** (Present/Absent)
  Event generated on the transition from detecting or not detecting a pixel clock signal. The Sapera event values are CORACQ_VAL_EVENT_TYPE_NO_PIXEL_CLK and CORACQ_VAL_EVENT_TYPE_PIXEL_CLK.
- **Frame Lost**
  The Frame Lost event indicates that an acquired image could not be transferred to on-board memory. An example of this case would be if there are no free on-board buffers available for the new image. This may be the case if the image transfer from onboard buffers to host PC memory cannot be sustained due to bus bandwidth issues.
  The Sapera event value is CORACQ_VAL_EVENT_TYPE_FRAME_LOST.

- **Vertical Timeout**
  This event indicates a timeout situation where a camera fails to output a video frame after a trigger. The Sapera event value is CORACQ_VAL_EVENT_VERTICAL_TIMEOUT.
- **Link Error**
  This event indicates a transmission error has been detected. The Sapera event value is CORACQ_VAL_EVENT_LINK_ERROR.

Transfer Events

Transfer events are the ones related to the transfer module. Transfer events provide feedback on image transfer from on-board FIFO memory to PC memory frame buffers.

- **Start of Frame**
  The Start of Frame event is generated when the first image pixel is transferred from the on-board FIFO into PC memory.
  The Sapera event value is CORXFER_VAL_EVENT_TYPE_START_OF_FRAME.
- **End of Frame**
  The End of Frame event is generated when the last image pixel is transferred from the on-board FIFO into PC memory.
  The Sapera event value is CORXFER_VAL_EVENT_TYPE_END_OF_FRAME.
- **End of Line**
  The End of Line event is generated after a video line is transferred to a PC buffer.
  The Sapera event value is CORXFER_VAL_EVENT_TYPE_END_OF_LINE.
- **End of N Lines**
  The End of N Lines event is generated after a set number of video lines are transferred to a PC buffer. The Sapera event value is CORXFER_VAL_EVENT_TYPE_END_OF_NLINES.
- **End of Transfer**
  The End of Transfer event is generated at the completion of the last image being transferred from the on-board FIFO into PC memory. To complete a transfer, a stop must be issued to the transfer module (if transfers are already in progress). If a transfer of a fixed number of frames was requested, the transfer module will stop transfers automatically. The Sapera event value is CORXFER_VAL_EVENT_TYPE_END_OF_TRANSFER.

Trigger Signal Validity

External trigger signal noise is easily ignored by the ACU with its programmable debounce control. A parameter is programmed for the minimum pulse duration considered as a valid external trigger pulse. Refer to "Note 3: External Trigger Input Specifications" on page 72 for more information.

Supported Transfer Cycling Methods

The X64 Xcelera-HS PX8 supports the following transfer cycle modes which are either synchronous or asynchronous. These definitions are from the Sapera Basic Reference manual.

- CORXFER_VAL_CYCLE_MODE_SYNCHRONOUS_WITH_TRASH
  Before cycling to the next buffer in the list, the transfer device will check the next buffer's state. If its state is full, the transfer will be done in the trash buffer which is defined as the last buffer in the list; otherwise, it will occur in the next buffer. After a transfer to the trash buffer is done, the transfer device will check again the state of the next buffer. If it is empty, it will transfer to this buffer otherwise it will transfer again to the trash buffer.
- CORXFER_VAL_CYCLE_MODE_SYNCHRONOUS_NEXT_EMPTY_WITH_TRASH
  Before cycling to the next buffer in the list, the transfer device will check the next buffer's state. If its state is full, the next buffer will be skipped, and the transfer will be done in the trash buffer, which is defined as the last buffer in the list; otherwise it will occur in the next buffer. After a transfer to the trash is done, the transfer device will check the next buffer in the list, if its state is empty, it will transfer to this buffer otherwise it will skip it, and transfer again to the trash buffer.
- CORXFER_VAL_CYCLE_MODE_ASYNCHRONOUS
  The transfer device cycles through all buffers in the list without concern about the buffer state.

X64 Xcelera-HS PX8 Supported Parameters

The tables below describe the Sapera capabilities supported by the X64 Xcelera-HS PX8 (i.e. default firmware is loaded). Unless specified, each capability applies to both boards or all mode configurations and all acquisition modes.

The information here is subject to change. Capabilities should be verified by the application because new board driver releases may change product specifications.

Specifically the X64 Xcelera-HS PX8 family is described in Sapera as:

- Board Server: Xcelera-HS_PX8_1
- Acquisition Module: *dependent on firmware used*

Camera Related Capabilities

Capability	Values
CORACQ_CAP_CONNECTOR_TYPE	CORACQ_VAL_CONNECTOR_TYPE_CX4 (0x8)

Camera Related Parameters

Parameter	Values
CORACQ_PRM_CHANNEL	max = 1 channel
CORACQ_PRM_FRAME	CORACQ_VAL_FRAME_PROGRESSIVE (0x2)
CORACQ_PRM_INTERFACE	CORACQ_VAL_INTERFACE_DIGITAL (0x2)
CORACQ_PRM_SCAN	CORACQ_VAL_SCAN_AREA (0x1) CORACQ_VAL_SCAN_LINE (0x2)
CORACQ_PRM_SIGNAL	CORACQ_VAL_SIGNAL_DIFFERENTIAL (0x2)
CORACQ_PRM_VIDEO	CORACQ_VAL_VIDEO_MONO (0x1)
CORACQ_PRM_PIXEL_DEPTH	8 bits, # LUT = 0,
CORACQ_PRM_VIDEO_STD	CORACQ_VAL_VIDEO_STD_NON_STD (0x1)
CORACQ_PRM_FIELD_ORDER	CORACQ_VAL_FIELD_ORDER_NEXT_FIELD (0x4)
CORACQ_PRM_HACTIVE	min = 1 pixel max = 16777215 pixel step = 1 pixel
CORACQ_PRM_HSYNC	min = 4 pixel max = 4294967295 pixel step = 1 pixel
CORACQ_PRM_VACTIVE	min = 1 line max = 16777215 line step = 1 line
CORACQ_PRM_VSYNC	min = 0 line max = 4294967295 line step = 1 line
CORACQ_PRM_TIME_INTEGRATE_METHOD	CORACQ_VAL_TIME_INTEGRATE_METHOD_1 (0x1) CORACQ_VAL_TIME_INTEGRATE_METHOD_2 (0x2) CORACQ_VAL_TIME_INTEGRATE_METHOD_3 (0x4) CORACQ_VAL_TIME_INTEGRATE_METHOD_4 (0x8) CORACQ_VAL_TIME_INTEGRATE_METHOD_5 (0x10) CORACQ_VAL_TIME_INTEGRATE_METHOD_6 (0x20) CORACQ_VAL_TIME_INTEGRATE_METHOD_7 (0x40) CORACQ_VAL_TIME_INTEGRATE_METHOD_8 (0x80) CORACQ_VAL_TIME_INTEGRATE_METHOD_9 (0x100)
CORACQ_PRM_CAM_TRIGGER_METHOD	CORACQ_VAL_CAM_TRIGGER_METHOD_1 (0x1) CORACQ_VAL_CAM_TRIGGER_METHOD_2 (0x2)
CORACQ_PRM_CAM_TRIGGER_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_CAM_TRIGGER_DURATION	min = 1 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_CAM_RESET_METHOD	CORACQ_VAL_CAM_RESET_METHOD_1 (0x1)
CORACQ_PRM_CAM_RESET_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_CAM_RESET_DURATION	min = 1 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_CAM_NAME	Default HS Link Line Scan 5 tap Mono

CORACQ_PRM_LINE_INTEGRATE_METHOD	CORACQ_VAL_LINE_INTEGRATE_METHOD_1 (0x1) CORACQ_VAL_LINE_INTEGRATE_METHOD_2 (0x2) CORACQ_VAL_LINE_INTEGRATE_METHOD_3 (0x4) CORACQ_VAL_LINE_INTEGRATE_METHOD_4 (0x8) CORACQ_VAL_LINE_INTEGRATE_METHOD_7 (0x40)
CORACQ_PRM_LINE_TRIGGER_METHOD	CORACQ_VAL_LINE_TRIGGER_METHOD_1 (0x1)
CORACQ_PRM_LINE_TRIGGER_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_LINE_TRIGGER_DELAY	min = 0 µs max = 65535 µs step = 1 µs
CORACQ_PRM_LINE_TRIGGER_DURATION	min = 0 µs max = 65535 µs step = 1 µs
CORACQ_PRM_TAPS	min = 1 tap, max = 6 tap, step = 1 tap (* only 5 and 6 taps supported)
CORACQ_PRM_TAP_OUTPUT	CORACQ_VAL_TAP_OUTPUT_SEGMENTED (0x2)
CORACQ_PRM_TAP_1_DIRECTION	CORACQ_VAL_TAP_DIRECTION_LR (0x1) CORACQ_VAL_TAP_DIRECTION_UD (0x4) CORACQ_VAL_TAP_DIRECTION_FROM_TOP (0x10)
CORACQ_PRM_TAP_2_DIRECTION	CORACQ_VAL_TAP_DIRECTION_LR (0x1) CORACQ_VAL_TAP_DIRECTION_UD (0x4) CORACQ_VAL_TAP_DIRECTION_FROM_TOP (0x10)
CORACQ_PRM_TAP_3_DIRECTION	CORACQ_VAL_TAP_DIRECTION_LR (0x1) CORACQ_VAL_TAP_DIRECTION_UD (0x4) CORACQ_VAL_TAP_DIRECTION_FROM_TOP (0x10)
CORACQ_PRM_TAP_4_DIRECTION	CORACQ_VAL_TAP_DIRECTION_LR (0x1) CORACQ_VAL_TAP_DIRECTION_UD (0x4) CORACQ_VAL_TAP_DIRECTION_FROM_TOP (0x10)
CORACQ_PRM_TAP_5_DIRECTION	CORACQ_VAL_TAP_DIRECTION_LR (0x1) CORACQ_VAL_TAP_DIRECTION_UD (0x4) CORACQ_VAL_TAP_DIRECTION_FROM_TOP (0x10)
CORACQ_PRM_TAP_6_DIRECTION	CORACQ_VAL_TAP_DIRECTION_LR (0x1) CORACQ_VAL_TAP_DIRECTION_UD (0x4) CORACQ_VAL_TAP_DIRECTION_FROM_TOP (0x10)
CORACQ_PRM_CHANNELS_ORDER	CORACQ_VAL_CHANNELS_ORDER_NORMAL (0x1)
CORACQ_PRM_LINESCAN_DIRECTION	Not available
CORACQ_PRM_LINESCAN_DIRECTION_POLARITY	Not available
CORACQ_PRM_CAM_LINE_TRIGGER_FREQ_MIN	1 Hz
CORACQ_PRM_CAM_LINE_TRIGGER_FREQ_MAX	16777215 Hz
CORACQ_PRM_CAM_TIME_INTEGRATE_DURATION_MIN	1 µs
CORACQ_PRM_CAM_TIME_INTEGRATE_DURATION_MAX	65535000 µs
CORACQ_PRM_CONNECTOR_HD_INPUT (*)	Default = 0
CORACQ_PRM_CONNECTOR_VD_INPUT (*)	Default = 0
CORACQ_PRM_CONNECTOR_RESET_TRIGGER_INPUT (*)	Default = 0
CORACQ_PRM_TIME_INTEGRATE_PULSE1_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_TIME_INTEGRATE_PULSE1_DELAY	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_TIME_INTEGRATE_PULSE1_DURATION	min = 0 µs max = 65535000 µs step = 1 µs

CORACQ_PRM_CAM_IO_CONTROL (*)	
CORACQ_PRM_CONNECTOR_EXPOSURE_INPUT (*)	Default = 0
CORACQ_PRM_TIME_INTEGRATE_PULSE0_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_TIME_INTEGRATE_PULSE0_DELAY	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_TIME_INTEGRATE_PULSE0_DURATION	min = 1 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_LINE_INTEGRATE_PULSE1_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_LINE_INTEGRATE_PULSE1_DELAY	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_LINE_INTEGRATE_PULSE1_DURATION	min = 1 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_LINE_INTEGRATE_PULSE0_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_LINE_INTEGRATE_PULSE0_DELAY	min = 0 µs max = 65535 µs step = 1 µs
CORACQ_PRM_LINE_INTEGRATE_PULSE0_DURATION	min = 1 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_CONNECTOR_LINE_TRIGGER_INPUT (*)	Default = 0
CORACQ_PRM_CONNECTOR_LINE_INTEGRATE_INPUT (*)	Connector #1, type 2, pin #1
CORACQ_PRM_CONNECTOR_LINESCAN_DIRECTION_INPUT (*)	Default = 0
CORACQ_PRM_BAYER_ALIGNMENT	Not available
CORACQ_PRM_CAM_CONTROL_DURING_READOUT	TRUE FALSE

VIC Related Parameters

Parameter	Values
CORACQ_PRM_CAMSEL	CAMSEL_MONO = from 0 to 0
CORACQ_PRM_PIXEL_MASK	Not available
CORACQ_PRM_CROP_LEFT	min = 0 pixel max = 16777215 pixel step = 16 pixel
CORACQ_PRM_CROP_TOP	min = 0 line max = 16777215 line step = 1 line
CORACQ_PRM_CROP_WIDTH	min = 16 pixel max = 16777215 pixel step = 16 pixel

CORACQ_PRM_CROP_HEIGHT	min = 1 line max = 16777215 line step = 1 line
CORACQ_PRM_DECIMATE_METHOD	CORACQ_VAL_DECIMATE_DISABLE (0x1)
CORACQ_PRM_LUT_ENABLE	FALSE
CORACQ_PRM_LUT_NUMBER	Default = 0
CORACQ_PRM_STROBE_ENABLE	TRUE FALSE
CORACQ_PRM_STROBE_METHOD	CORACQ_VAL_STROBE_METHOD_1 (0x1) CORACQ_VAL_STROBE_METHOD_2 (0x2) CORACQ_VAL_STROBE_METHOD_3 (0x4) CORACQ_VAL_STROBE_METHOD_4 (0x8)
CORACQ_PRM_STROBE_POLARITY	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2)
CORACQ_PRM_STROBE_DURATION	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_STROBE_DELAY	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_TIME_INTEGRATE_ENABLE	TRUE FALSE
CORACQ_PRM_TIME_INTEGRATE_DURATION	min = 1 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_CAM_TRIGGER_ENABLE	TRUE FALSE
CORACQ_PRM_CAM_RESET_ENABLE	TRUE FALSE
CORACQ_PRM_OUTPUT_FORMAT	CORACQ_VAL_OUTPUT_FORMAT_MONO8
CORACQ_PRM_EXT_TRIGGER_ENABLE	CORACQ_VAL_EXT_TRIGGER_OFF (0x1) CORACQ_VAL_EXT_TRIGGER_ON (0x8)
CORACQ_PRM_VIC_NAME	Default HS Link Line Scan 5 taps Mono
CORACQ_PRM_LUT_MAX	0
CORACQ_PRM_EXT_TRIGGER_DETECTION	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2) CORACQ_VAL_RISING_EDGE (0x4) CORACQ_VAL_FALLING_EDGE (0x8)
CORACQ_PRM_LUT_FORMAT	Not available
CORACQ_PRM_LINE_INTEGRATE_ENABLE	TRUE FALSE
CORACQ_PRM_LINE_INTEGRATE_DURATION	min = 1 pixel max = 16777215 pixel step = 1 pixel
CORACQ_PRM_LINE_TRIGGER_ENABLE	TRUE FALSE
CORACQ_PRM_EXT_FRAME_TRIGGER_ENABLE	TRUE FALSE

CORACQ_PRM_EXT_FRAME_TRIGGER_DETECTION	CORACQ_VAL_ACTIVE_LOW (0x1) CORACQ_VAL_ACTIVE_HIGH (0x2) CORACQ_VAL_RISING_EDGE (0x4) CORACQ_VAL_FALLING_EDGE (0x8) CORACQ_VAL_DOUBLE_PULSE_RISING_EDGE (0x20) CORACQ_VAL_DOUBLE_PULSE_FALLING_EDGE (0x40)
CORACQ_PRM_EXT_LINE_TRIGGER_ENABLE	TRUE FALSE
CORACQ_PRM_EXT_LINE_TRIGGER_DETECTION	CORACQ_VAL_RISING_EDGE (0x4)
CORACQ_PRM_SNAP_COUNT	min = 1 max = 65535 step = 1
CORACQ_PRM_INT_LINE_TRIGGER_ENABLE	TRUE FALSE
CORACQ_PRM_INT_LINE_TRIGGER_FREQ	Default = 5000 Hz
CORACQ_PRM_LINESCAN_DIRECTION_OUTPUT (*)	Not available
CORACQ_PRM_BIT_ORDERING	CORACQ_VAL_BIT_ORDERING_STD (0x1)
CORACQ_PRM_EXT_TRIGGER_LEVEL	CORACQ_VAL_LEVEL_TTL (0x1) CORACQ_VAL_LEVEL_422 (0x2)
CORACQ_PRM_STROBE_LEVEL	CORACQ_VAL_LEVEL_TTL (0x1)
CORACQ_PRM_EXT_FRAME_TRIGGER_LEVEL	CORACQ_VAL_LEVEL_TTL (0x1) CORACQ_VAL_LEVEL_422 (0x2)
CORACQ_PRM_EXT_LINE_TRIGGER_LEVEL	CORACQ_VAL_LEVEL_422 (0x2)
CORACQ_PRM_INT_LINE_TRIGGER_FREQ_MIN	245 Hz
CORACQ_PRM_INT_LINE_TRIGGER_FREQ_MAX	500000 Hz
CORACQ_PRM_SHAFT_ENCODER_DROP	min = 0 tick max = 255 tick step = 1 tick
CORACQ_PRM_SHAFT_ENCODER_ENABLE	TRUE FALSE
CORACQ_PRM_EXT_TRIGGER_FRAME_COUNT	min = 1 max = 65534 step = 1
CORACQ_PRM_INT_FRAME_TRIGGER_ENABLE	TRUE FALSE
CORACQ_PRM_INT_FRAME_TRIGGER_FREQ	min = 1 milli-Hz max = 1073741823 milli-Hz step = 1 milli-Hz
CORACQ_PRM_STROBE_DELAY_2	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_FRAME_LENGTH	CORACQ_VAL_FRAME_LENGTH_FIX (0x1) CORACQ_VAL_FRAME_LENGTH_VARIABLE (0x2)
CORACQ_PRM_FLIP	CORACQ_VAL_FLIP_OFF (0x00) CORACQ_VAL_FLIP_HORZ (0x01)
CORACQ_PRM_EXT_TRIGGER_DURATION	min = 0 µs max = 255 µs step = 1 µs
CORACQ_PRM_TIME_INTEGRATE_DELAY	min = 0 µs max = 65535000 µs step = 1 µs

CORACQ_PRM_CAM_RESET_DELAY	min = 0 µs max = 0 µs step = 1 µs
CORACQ_PRM_CAM_TRIGGER_DELAY	min = 0 µs max = 65535000 µs step = 1 µs
CORACQ_PRM_SHAFT_ENCODER_LEVEL	CORACQ_VAL_LEVEL_422 (0x2)
CORACQ_PRM_EXT_FRAME_TRIGGER_SOURCE (*)	min = 0 max = 5 step = 1
CORACQ_PRM_EXT_LINE_TRIGGER_SOURCE (*)	min = 0 max = 7 step = 1
CORACQ_PRM_EXT_TRIGGER_SOURCE (*)	min = 0 max = 5 step = 1
CORACQ_PRM_SHAFT_ENCODER_MULTIPLY	min = 1 max = 32 step = (2**N)
CORACQ_PRM_EXT_TRIGGER_DELAY	min = 0 max = 65535000 step = 1
CORACQ_PRM_EXT_TRIGGER_DELAY_TIME_BASE	CORACQ_VAL_TIME_BASE_LINE (0x4)
CORACQ_PRM_EXT_TRIGGER_IGNORE_DELAY	min = 0 max = 65535000 step = 1
CORACQ_PRM_EXT_TRIGGER_SOURCE_STR	[0] = Automatic [1] = From External Trigger #1 [2] = From External Trigger #2 [3] = From Board Sync [4] = To Board Sync [5] = Pulse to Board Sync
CORACQ_PRM_EXT_LINE_TRIGGER_SOURCE_STR	[0] = Automatic [1] = From Shaft Encoder Phase A [2] = From Shaft Encoder Phase B [3] = From Shaft Encoder Phase A & B [4] = From Board Sync [5] = To Board Sync [6] = Pulse to Board Sync [7] = To Board Sync When Grabbing
CORACQ_PRM_VERTICAL_TIMEOUT_DELAY	min = 0 max = 16383000 step = 1

ACQ Related Parameters

Parameter	Values
CORACQ_PRM_LABEL	HS Link Mono #1
CORACQ_PRM_EVENT_TYPE	CORACQ_VAL_EVENT_TYPE_START_OF_FRAME (0x80000) CORACQ_VAL_EVENT_TYPE_END_OF_FRAME (0x800000) CORACQ_VAL_EVENT_TYPE_EXTERNAL_TRIGGER (0x1000000) CORACQ_VAL_EVENT_TYPE_VERTICAL_SYNC (0x2000000) CORACQ_VAL_EVENT_TYPE_NO_PIXEL_CLK (0x40000000) CORACQ_VAL_EVENT_TYPE_PIXEL_CLK (0x80000000) CORACQ_VAL_EVENT_TYPE_FRAME_LOST (0x8000) CORACQ_VAL_EVENT_TYPE_DATA_OVERFLOW (0x4000) CORACQ_VAL_EVENT_TYPE_EXTERNAL_TRIGGER_IGNORED (0x2000) CORACQ_VAL_EVENT_TYPE_VERTICAL_TIMEOUT (0x40) CORACQ_VAL_EVENT_TYPE_LINK_ERROR (0x10)
CORACQ_PRM_SIGNAL_STATUS	CORACQ_VAL_SIGNAL_HSYNC_PRESENT CORACQ_VAL_SIGNAL_VSYNC_PRESENT CORACQ_VAL_SIGNAL_PIXEL_CLK_PRESENT
CORACQ_PRM_DETECT_HACTIVE	Available
CORACQ_PRM_DETECT_VACTIVE	Available
CORACQ_PRM_FLAT_FIELD_ENABLE	Not available
CORACQ_CAP_SERIAL_PORT_INDEX	Supported

Servers and Resources

The following table describes the X64 Xcelera-HS PX8 board

Servers	Resources			
Name	**Type**	**Name**	**Index**	**Description**
Xcelera-HS_PX8_1 (default firmware)	Acquisition	HS Link Mono #1	0	Monochrome output, Camera #1

Technical Specifications

X64 Xcelera-HS PX8 Board Specifications

X64 Xcelera-HS PX8 Dimensions

Approximately 6.5 in. (16.6 cm) wide by 4 in. (10 cm) high.

Digital Video Input & Controls

Input Type	Camera HS-Link Specifications Rev 0.1 compliant
Common Pixel Formats	HS-Link tap configuration for 8-bit mono
Tap Format Details	5- 6 Tap(s) – 8-bit mono
Scanning	Area scan and Line scan: Progressive, Multi-Tap
Scanning Directions	Left to Right, Up-Down, From Top
Resolution *note: these are X64 Xcelera-HS PX8 maximums, not HS-Link specifications*	Horizontal Minimum: 8 Pixels per tap (8-bits/pixel) Horizontal Maximum: 8-bits/pixel x 256K Pixels/line Vertical Minimum: 1 line Vertical Maximum: up to 16,000,000 lines—for area scan sensors infinite line count—for linescan sensors
Data Clock	3.125 GHz
Image Buffer	Available with 256 MB
Bandwidth to Host System	Approximately 1.5 GB/s.
Serial Port	Supports communication speeds from 9600 to 115 kbps

Camera Controls	Compliant with DALSA Trigger-to-Image Reliability framework Comprehensive event notifications, (see "Trigger to Image Reliability" on page 49) Timing control logic for EXSYNC, PRIN and strobe signals Dual independent opto-coupled external trigger inputs programmable as active high or low (edge or level trigger, where pulse width minimum is 100ns) External trigger latency less than 1 µsec. One TTL Strobe output Quadrature (AB) shaft-encoder inputs for external web synchronization (opto-coupler maximum frequency for any shaft encoder input is 200 KHz) 4 opto-coupled general inputs (5V/24V) 4 opto-coupled general outputs
Processing	None

Host System Requirements

General System Requirements for the X64 Xcelera-HS PX8

- PCI Express x8 slot compatible
- On some computers the X64 Xcelera-HS PX8 may function installed in a x16 slot. The computer documentation or direct testing is required.

Operating System Support

Windows XP, Windows Vista and Windows 7, 32-bit or 64-bit

Environment

Ambient Temperature:	10° to 50° C (operation) 0° to 70° C (storage)
Relative Humidity:	5% to 90% non-condensing (operating) 0% to 95% (storage)

Power Requirements

+3.3V:	1.5A (standby) 1.5A (during acquisition)
+12V:	1.2A (standy) 1.5A (during acquisition)

EMI Certifications

DALSA

EC & FCC DECLARATION OF CONFORMITY

We : DALSA Montreal Inc.
7075 Place Robert-Joncas, Suite 142,
St. Laurent, Quebec, Canada H4M 2Z2

Declare under sole legal responsibility that the following products conform to the protection requirements of council directive 89/336 EEC on the approximation of the laws of member states relating to electromagnetic compatibility, as amended by directive 93/68/EEC:

FRAME GRABBER BOARD: **Xcelera –HS PX8**

The products to which this declaration relates are in conformity with the following relevant harmonized standards, the reference numbers of which have been published in the Official Journal of the European Communities:

EN55022 :2006
EN61000-4-2: 1995A1: 1998 A2: 2001
EN61000-4-3: 2006
EN61000-4-4: 2004
EN61000-4-6: 2009

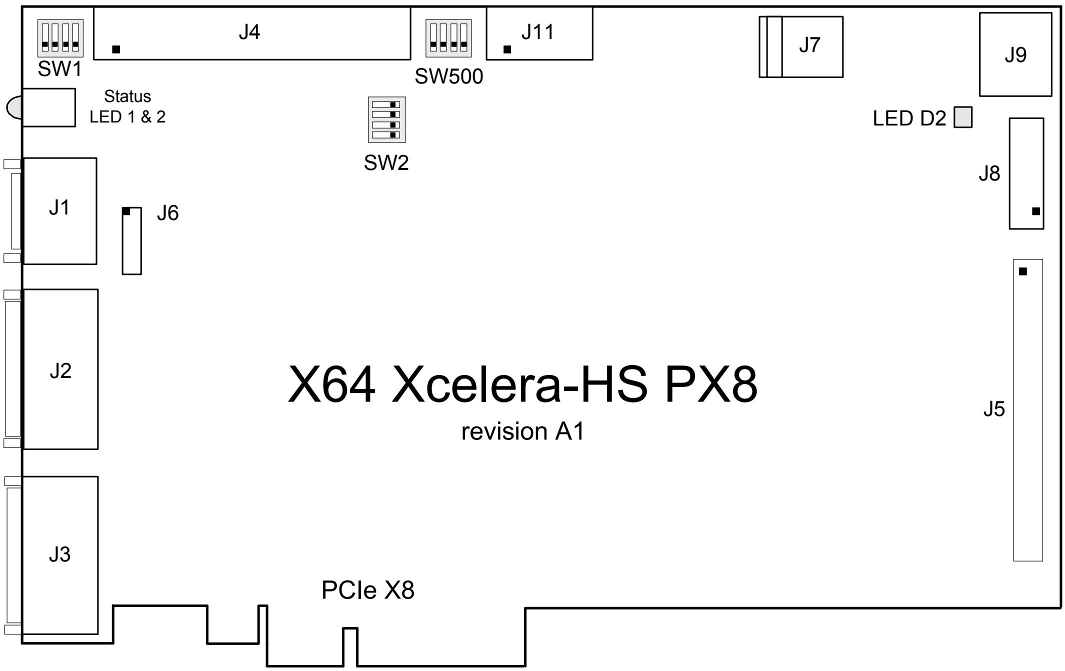
Further declare under our sole legal responsibility that the product listed conforms to the code of federal regulations CFR 47 part 15 for a class A product.

St. Laurent, Canada	2010/05/26	
Location	Date	Eric Carey, ing Director, Research & Development

Connector and Switch Locations

Below are drawings for the various board revisions released by DALSA, where the most current is shown first. A table following each drawing provides a short description of each connector and switch. Details are provided in this section.

X64 Xcelera-HS PX8 revision A1 Layout Drawing

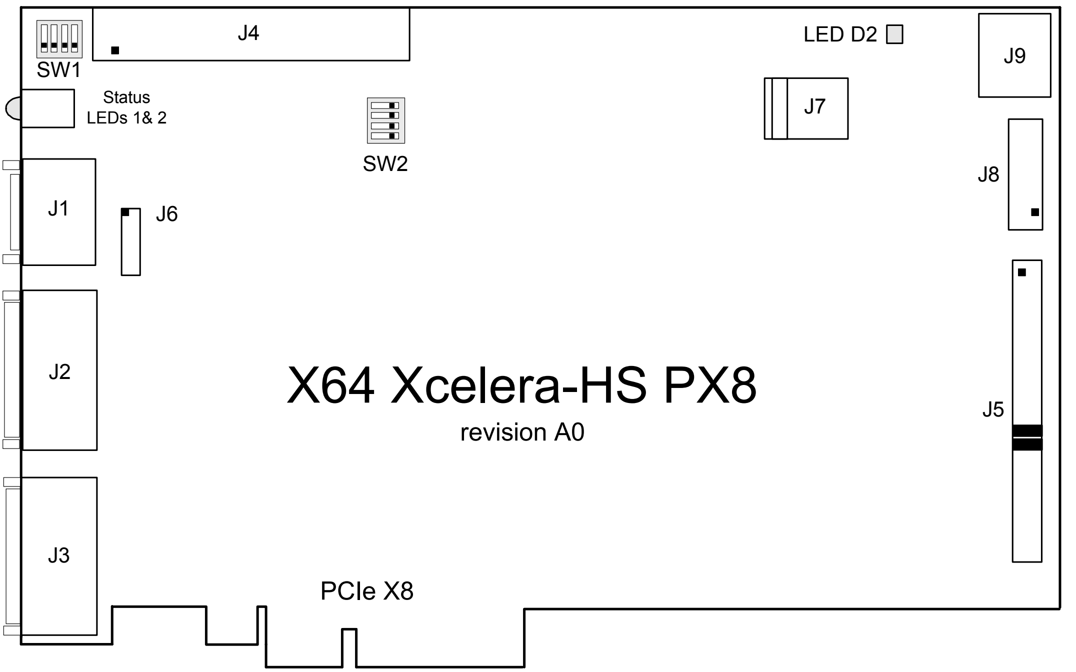


Connector, Switch Description List (revision A1)

The following table lists components on the X64 Xcelera-HS PX8 board. Detailed information follows for connectors or switches the end user may have need of.

Location	Description	Location	Description
J1	External Signals connector CMD15	J7	PC power to IO interface
J2	HS-Link INPUT connector	J9	Multi Board Sync
J3	HS-Link OUTPUT connector	J5, J6, J8	Reserved
J4	External signals connector	SW1, SW2, SW500	Configuration micro-switches
J11	Reserved	Status LEDs	refer to text
		LED D2	refer to text

X64 Xcelera-HS PX8 revision A0 Layout Drawing

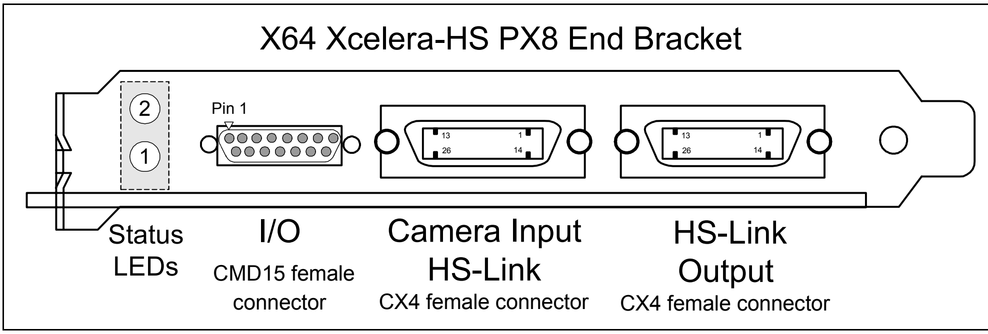


Connector, Switch Description List (revision A0)

The following table lists components on the X64 Xcelera-HS PX8 board. Detailed information follows for connectors or switches the end user may have need of.

Location	Description	Location	Description
J1	External Signals connector CMD15	J7	PC power to IO interface
J2	HS-Link INPUT connector	J9	Multi Board Sync
J3	HS-Link OUTPUT connector	J5, J6, J8	Reserved (refer to text for J5 jumpers)
J4	External signals connector	SW1, SW2,	Configuration micro-switches
Status LEDs	refer to text	LED D2	refer to text

X64 Xcelera-HS PX8 End Bracket Detail

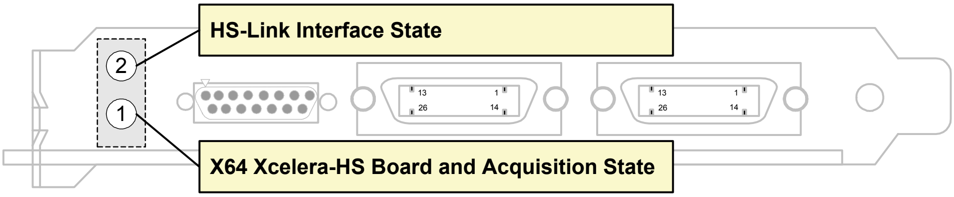


The hardware installation process is completed with the connection of a supported camera to the X64 Xcelera-HS PX8 board using a CX4 cable cables (see "Product Part Numbers" on page 5).

- The X64 Xcelera-HS PX8 board supports one camera with a CX4 connector.
- Connect the camera to the HS-Link Input with a CX4 cable (Thumbscrew style).
- When forwarding the camera data to a 2nd frame grabber, connect a short CX4 cable between the HS-Link Output of the 1st frame grabber to the HS-Link input of the 2nd frame grabber. For data forwarding, cable length should not exceed 10 meters.

Contact DALSA or browse our web site [www.dalsa.com/mv]for the latest information on X64 Xcelera-HS PX8 supported cameras.

Status LEDs & LED D2 Functional Description



Status LEDs 1 & 2 are located on the end bracket. LED D2 is located on the board component side and visible with the computer case open (see board layout drawings).

Status LED 1 Description

LED 1 indicates the X64 Xcelera-HS board and acquisition state, but not the state of the HS-Link itself which is treated as a separate logical block. Refer to the block diagram (see "Block Diagram" on page 43)

Color	State	Description
Red	Flashing	Can occur at boot time, when there is no camera connected to the HS-Link input (J2). This indicates that the board PCIe interface was not trained properly by the computer (terminology defined by the PCI Express specification). The board is not detected by the computer in this condition. If this occurs, try installing the board in a different computer or contact DALSA technical support.
Green	Steady	No line valid signal detected.
Green	Slow Flashing ~2 Hz	Line valid signal detected.
Green	Fast Flashing ~16 Hz	Acquisition in progress.
Yellow	Steady	Board has booted in Safe Mode.

Status LED 2 Description

Color	State	Description
Red/Green	Flashing	Looking for Link
Green	Steady	Link Up
Orange	Steady	Link Up but invalid and/or incompatible HS-Link configuration detected

Note: Driver must be installed and running for LED 2 to be in a valid state.

LED D2 Description

Color/State	Description
RED Solid	FPGA Firmware not Loaded (load error)
GREEN Solid	Normal FPGA Firmware Loaded
BLUE Solid	Safe mode FPGA Firmware Loaded
Flashing Green / Blue	Production FPGA Firmware Loaded
Flashing Blue	PCIe Training issue (board is not visible in the PCI Diagnostic output)

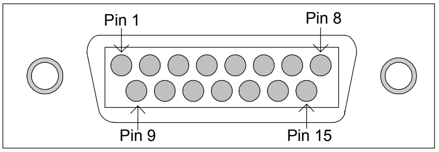
Connecting External Signals to the X64 Xcelera-HS PX8

Two connectors are provided for external signals. J1 (J1: CMD15 Female External Signals Connector)is located on the board bracket and provides a subset of the available signals (one trigger input, one general input, one strobe output, and shaft encoder inputs), while the internal connector J4 (J4: External Signals Connector) provides all the I/O signals available with the X64 Xcelera-HS PX8. The following two sections define the pin-outs for these connectors, followed with the electrical specifications.

J1: CMD15 Female External Signals Connector

This connector provides the commonly used external signals, such as external trigger and strobe output directly from the board bracket.

The following table defines the signals and the connector pinout. Also included is the wiring color code for the blunt-end cable available from DALSA, (cable assembly **OR-X8CC-IO15P**, see Product Part Numbers). **Important:** These signals are also available on J4. Connect to one or the other but never both when using the same signal.



Cable Wire color	Description	Pin	Pin	Description	Cable Wire color
BLK	External Trigger Input 1 + (see note 3)	1	9	External Trigger Input 1 -	GRY
BRN	Shaft Encoder Phase A + (see note 4)	2	10	Shaft Encoder Phase A -	WHT
RED	Shaft Encoder Phase B +	3	11	Shaft Encoder Phase B -	W/BLK
ORG	General Input 1 + (see note 1)	4	12	General Input 1 -	W/BRN
YEL	Ground	5	13	Strobe Output 1 (see note 5)	W/RED
GRN	Ground	6	14	Power Output 5 Volts, 1.5A max (see note 6)	W/ORG
BLU	Ground	7	15	Power Output 12 Volts, 1.5A max	W/YEL
VIO	Ground	8	Shell	Shielding connected to ground	shield

J4: External Signals Connector

The following table defines the signals and the connector pinout. A subset of these signals are also available on J1. Connect to one or the other but never both when the signal is the same.

J4 Pin Header Numbering Detail

2	4	...	38	40
1	3	...	37	39

J4 Signal Descriptions

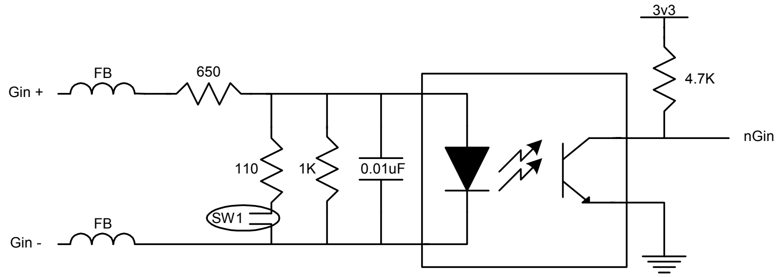
Description	Pin #	Pin #	Description
Ground	1	2	Ground
General Input 1 +	3	4	General Input 1 - (see note 1)
General Input 2 +	5	6	General Input 2 -
General Input 3 +	7	8	General Input 3 -
General Input 4 +	9	10	General Input 4 -
General Output 1 +	11	12	General Output 1 - (see note 2)
General Output 2 +	13	14	General Output 2 -
General Output 3 +	15	16	General Output 3 -
General Output 4 +	17	18	General Output 4 -
External Trigger Input 1 +	19	20	External Trigger Input 1 - (see note 3)
External Trigger Input 2 +	21	22	External Trigger Input 2 -
Shaft Encoder Phase A +	23	24	Shaft Encoder Phase A - (see note 4)
Shaft Encoder Phase B +	25	26	Shaft Encoder Phase B -
Ground	27	28	Strobe Output 1 (see note 5)
Ground	29	30	Reserved
Ground	31	32	Ground
Power Output 5 Volts, 1.5A max	33	34	Power Output 5 Volts, 1.5A max (see note 6)
Power Output 12 Volts, 1.5A max	35	36	Power Output 12 Volts, 1.5A max
Ground	37	38	Ground
Ground	39	40	Ground

I/O Electrical Specifications

The electrical and timing specifications for all I/O signals are defined below. In general these specifications are common across many Xcelera products but DALSA reserves the right to make changes without notice (assuming the change is backward compatible with previous Xcelera installations).

Note 1: General Inputs Specifications

Each of the four General Inputs are opto-coupled and able to connect to differential signals (RS-422) or single ended source signals. These inputs generate individual interrupts and are read by the Sapera application. The following figure is typical for each Genera Input.

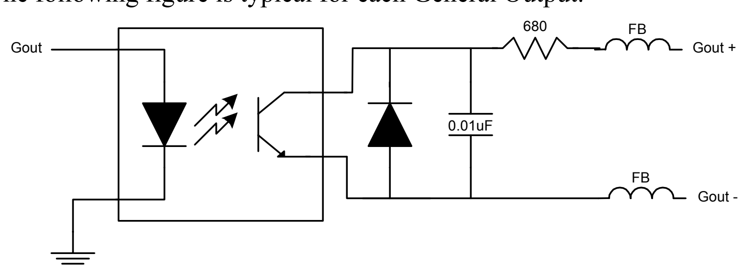


Input Details:

- For single ended signals, the Gin- pin is connected to ground. The switch point is ~10V by default and can be change to ~2V with **SW1**.
- Each input has a ferrite bead plus a 650 ohm series resistor on the opto-coupler anode.
- The 1K resistor and 0.01uF capacitor provide high frequency noise filtering.
- Maximum input voltage is 26V.
- Maximum input signal frequency is 25 KHz.

Note 2: General Outputs Specifications

Each of the four General Outputs are opto-coupled. Each output is an isolated open-collector NPN transistor switch. The following figure is typical for each General Output.

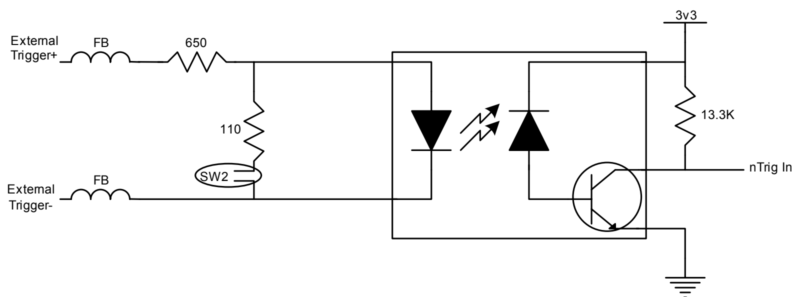


Output Details:

- Each output has ferrite beads plus a 680 ohm series resistor on the cathode (+) connection.
- The diode and capacitor provide reverse voltage protection and noise filter
- Maximum output device differential voltage is 25V.
- Maximum output device sink current is 35mA with 25V output differential.
- Maximum reverse voltage is 25V.
- Maximum output switching frequency is limited by driver and register access on the PCIe bus.

Note 3: External Trigger Input Specifications

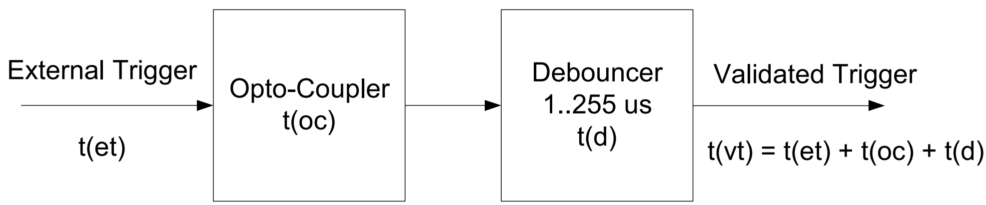
The two Trigger Inputs are opto-coupled and compatible to differential signals (RS422) or single ended source signals. The following figure is typical for each External Trigger Input.



- For single ended signals, the External Trigger - pin is connected to ground. The switch point is ~2V by default to support TTL 5V signals and can be changed to switch at ~10V with **SW2** to support 24V industry standard signals.
- For RS422 differential signals, switch point must be selected to ~2V.
- Maximum external signal input voltage is 26V, irrelevant of the selected switch point.
- The incoming trigger pulse is "debounced" to ensure that no voltage glitch is detected as a valid trigger pulse. This debounce circuit time constant can be programmed from 1µs to 255µs. Any pulse smaller than the programmed value is blocked and therefore not seen by the acquisition circuitry. If no debouncing value is specified (value of 0µs), the minimum value of 1µs will be used.
- Each input has a ferrite bead plus a 650 ohm series resistor on the opto-coupler anode.
- Maximum input signal frequency is 100 KHz.
- Opto-coupler response time is 0.5µs for a rising signal.
- Opto-coupler response time is 4.2µs for a falling signal.
- Refer to Sapera parameters:
  CORACQ_PRM_EXT_TRIGGER_SOURCE
  CORACQ_PRM_EXT_TRIGGER_ENABLE
  CORACQ_PRM_EXT_TRIGGER_LEVEL

CORACQ_PRM_EXT_FRAME_TRIGGER_LEVEL
CORACQ_PRM_EXT_TRIGGER_DETECTION
CORACQ_PRM_EXT_TRIGGER_DURATION

- See also *.cvi file entries:
  External Trigger Level, External Frame Trigger Level, External Trigger Enable, External Trigger Detection.
- External Trigger Input 2 used for two pulse external trigger with variable frame length line scan acquisition.



External Trigger Input Validation & Delay

Let	t(et) = time of external trigger in µs t(vt) = time of validated trigger in µs t(oc) = time opto-coupler takes to change state t(d) = debouncing duration from 1 to 255µs
trigger high	For an active high external trigger, t(oc) = 0.5µs: t(vt) = t(et) + 0.5µs + t(d)
trigger low	For an active low external trigger, t(oc) = 4.2µs: t(vt) = t(et) + 4.2µs + t(d)

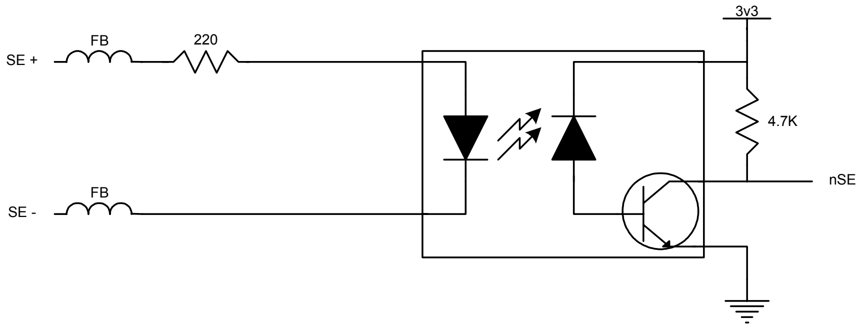
Note: DALSA recommends using an active high external trigger to minimize the time it takes for the opto-coupler to change state. Specifically, the opto-coupler response time is 0.5µs for active high compared to 4.2µs for active low.

If the duration of the external trigger is > t(oc) + t(d), then a valid acquisition trigger is detected. Therefore, the external pulse with active high polarity must be at least 1.5µs (if debounce time is set to 1) in order to be acknowledged. Any pulse larger than 5.2µs is always considered valid.

It is possible to emulate an external trigger using the software trigger which is generated by a function call from an application.

Note 4: Shaft Encoder Input Specifications

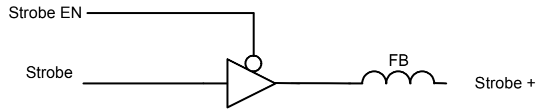
Dual Quadrature Shaft Encoder Inputs (phase A and phase B) are opto-coupled and able to connect to differential signals (RS-422) or single ended TTL 5V source signals. The following figure is typical for each input.



- For single ended TTL 5V signals, the SE- pin is connected to ground. The switch point is ~2V.
- Maximum input voltage that can be applied is 6V.
- Each input has a ferrite bead plus a 220 ohm series resistor on the opto-coupler anode.
- Maximum input signal frequency is 200 KHz.
- Opto-coupler response time is 0.25µs for a rising signal.
- Opto-coupler response time is 2.8µs for a falling signal.
- See "Line Trigger Source Selection for Linescan Applications" on page 44 for more information.
- Refer to Sapera parameters:
  CORACQ_PRM_SHAFT_ENCODER_ENABLE CORACQ_PRM_SHAFT_ENCODER_DROP
  or refer to CORACQ_PRM_EXT_LINE_TRIGGER_ENABLE
  CORACQ_PRM_EXT_LINE_TRIGGER_DETECTION
  CORACQ_PRM_EXT_LINE_TRIGGER_LEVEL (fixed at RS-422)
  CORACQ_PRM_EXT_LINE_TRIGGER_SOURCE
- See also *.cvi file entries:
  Shaft Encoder Enable, Shaft Encoder Pulse Drop
  or see External Line Trigger Enable, External Line Trigger Detection, External Line Trigger Level, External Line Trigger Source.

Note 5: Strobe Output Specifications

One TTL Strobe output is provided. The following figure is typical for the strobe out.



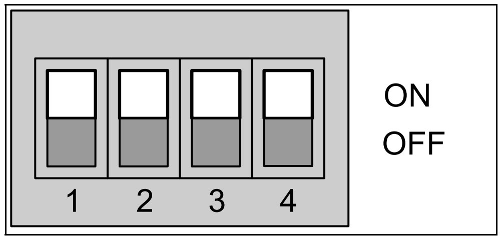
- Each strobe output is a tri-state driver, enabled by software.
- Each strobe output is 5V TTL level.
- Each output has a ferrite bead.
- Maximum source current is 32mA typical.
- Maximum sink current is 32mA typical.
- Output switching is < 4.2ns typical.
- Refer to Sapera Strobe Methods parameters:
  CORACQ_PRM_STROBE_ENABLE
  CORACQ_PRM_STROBE_POLARITY
  CORACQ_PRM_STROBE_LEVEL
  CORACQ_PRM_STROBE_METHOD
  CORACQ_PRM_STROBE_DELAY
  CORACQ_PRM_STROBE_DURATION
- See also *.cvi file entries:
  Strobe Enable, Strobe Polarity, Strobe Level, Strobe Method, Strobe Delay, Strobe Duration.

Note 6: DC Power Details

- Connect the PC floppy drive power connector to J7 so as to supply DC power to the External Signal connectors. Both 5Vdc and 12Vdc are available on J1 or on the DB37 External Signals Bracket Assembly.
- Both the 5Volt and 12Volt power pins have a 1.5 amp re-settable fuse on the board. If the fuse is tripped, turn off the host computer power. When the computer is turned on again, the fuse is automatically reset.

Configuration Micro-switches

Three sets of 4 switches are used for user configurations not controlled by software. The following figure is a typical view of each switch set, shown with the individual switch set in the OFF position. Following the figure, each of the three switch sets is described. Refer to the board component layout for their positions ("Connector and Switch Locations" on page **64**).



SW1, SW2, SW500 Component View

SW1: General Inputs Signal Switch Point

For each general input, select the threshold voltage detected as a logic high signal. See "J1: CMD15 Female External Signals Connector" on page **69**.

SW1 Switch Number	Assigned to	OFF Position	ON Position (default)
1	general input 1	Logic Transition at ~2 volts (preferred for differential signals)	Logic Transition at ~10 volts
2	general input 2		
3	general input 3		
4	general input 4		

SW2: Trigger Inputs Signal Switch Point

For each trigger input, select the threshold voltage detected as a logic high signal. See "J1: CMD15 Female External Signals Connector" on page **69**.

SW2 Switch Number	Assigned to	OFF Position (default)	ON Position
1	trigger input 1	Logic Transition at ~2 volts (preferred for differential signals)	Logic Transition at ~10 volts
2	trigger input 2		
3	NA		
4	NA		

SW500: Normal/Safe Boot Mode & GEN2 Slot Workaround

The X64 Xcelera-HS PX8 powers up either in its normal state or a 'Safe Boot' mode required to load firmware under certain conditions. See the notes for SW500-1 following the table for details.

Note: On **Rev A0** of the board, this function is controlled by jumpers on J5. See below for more information.

SW500 Switch Number	Assigned to	OFF Position (default)	ON Position
1	Boot Mode	Normal	Safe
2	GEN2 Slot Workaround	Disable	Active
3	reserved		
4	reserved		

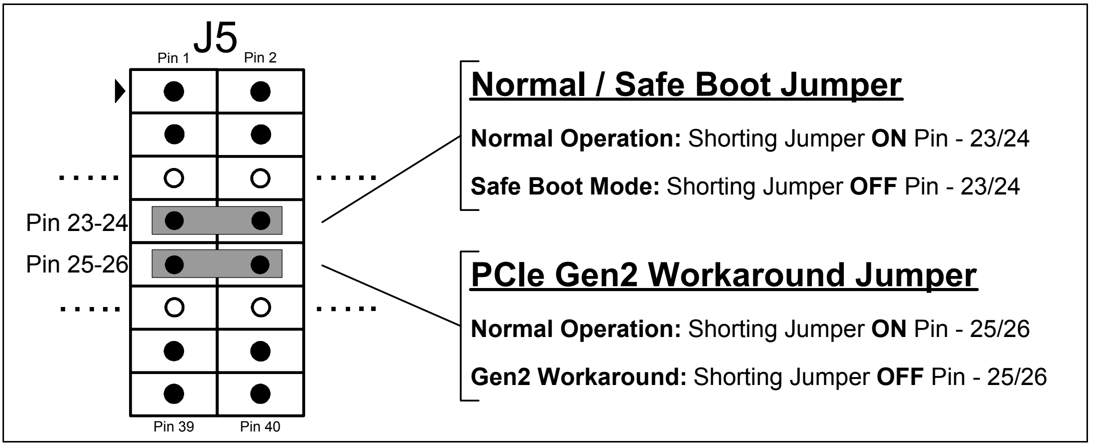
SW500-1 Boot Mode Details

- **Normal Mode:** Board powers up in the normal operating mode.
- **Safe Mode:** With the computer off, move the switch to the ON position. This mode is required if any problems occurred while updating firmware. With the switch in the ON position, power on the computer and update the firmware again. When the update is complete, power off the computer and move the switch to the OFF position. Power on the computer once again for normal operation. (See "Recovering from a Firmware Update Error" on page 27).

SW500-2 GEN2 Slot Workaround Details

- **Normal Mode:** Normal operation of the Xcelera-HS PX8.
- **GEN2 Slot Workaround:** In computers with GEN2 slots and the Intel 5400 chipset. There have been circumstances where the board is not detected properly. This issue is identified by the status LED 1 that keeps on flashing red at boot time. In one example, with a Dell T5400 or T7400 computer, the following message was displayed by the computer BIOS:
  "Alert! Error initializing PCI Express slot".
  - Therefore when using such a computer, with the Xcelera SW500-2 in the ON position, the computer should boot normally and the Xcelera should function. If this is not the case, please contact "Technical Support" on page 88 with details about your computer.

For Revision A0 Boards Only: J5 Normal/Safe Boot Mode & GEN2 Slot Workaround



J2 HS-Link Input / J3 HS-Link Output Connectors

For the HS-Link connectors, pin-outs are not provided. Camera connections should be made with manufactured cables such as recommended by DALSA (Product Part Numbers).

HS-Link Camera Control Signal Overview

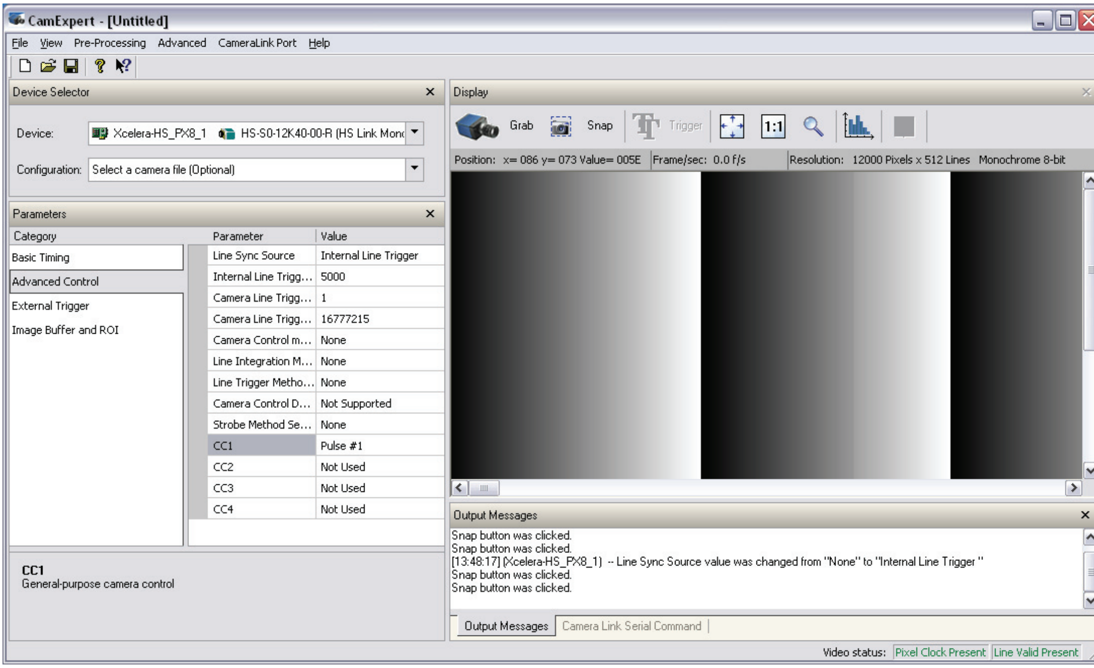
There are four general-purpose camera controls available.

- Camera Control 1 (CC1)
- Camera Control 2 (CC2)
- Camera Control 3 (CC3)
- Camera Control 4 (CC4)

Each camera manufacture is free to define the signals input on any one or all four control signals. These control signals are used either as camera control pulses or as a static logic state. Control signals not required by the camera are simply assigned as not used. Refer to your camera's user manual for information on what control signals are required.

Note: The X64 Xcelera-HS PX8 pulse controller has a minimum resolution of 100ns for line trigger signals (applies to linescan cameras), and resolution of 1µs for all other signal. When configuring the Camera Link control signals such as exposure control, etc. use values in increments of 1 µs.

The X64 Xcelera-HS PX8 can assign any camera control signal to the appropriate HS-Link control. The following screen shot shows the Sapera CamExpert dialog where Camera Link controls are assigned.



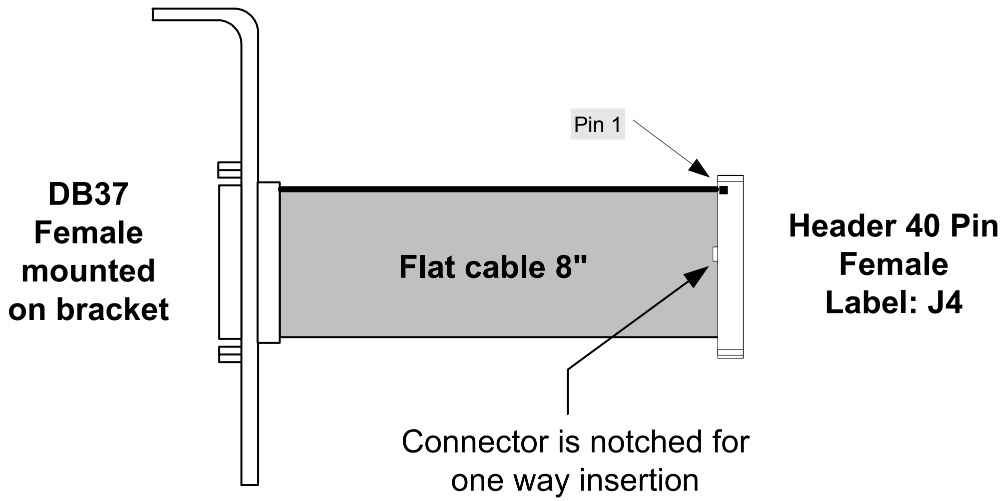
External Signals Cabling Options for J4

Two I/O connector bracket options are available for the J4 connector header on the X64 Xcelera-HS PX8 board. The "Type 1" cable assembly allows connection to all available I/O signals. The "Type 2" cable assembly provides a subset of the signals that uses a different connector compared to J1 external signals connector.

External Signals Connector Bracket Assembly (Type 1)

The External Signals bracket (OC-X4CC-IOCAB) provides a simple way to bring out the signals from the External Signals Connector J4 to a bracket mounted DB37. Install the bracket assembly into an adjacent PC expansion slot and connect the free cable end to the board's J4 header. When connecting to J4, make sure that the cable pin 1 goes to J4 pin 1 (see the layout drawing "X64 Xcelera-HS PX8 revision A1 Layout Drawing" on page 64).

External Signals Connector Bracket Assembly (Type 1) Drawing



External Signals Connector Bracket Assembly (Type 1) Pinout

The following table defines the signal pinout on the DB37 connector. Refer to the table "J4: External Signals Connector" on page 70 for signal descriptions.

DB37 Pin Number	Signal	J4 Connector Pin Number
1	Ground	1
20	Ground	2
2	General Input 1 +	3
21	General Input 1 -	4
3	General Input 2 +	5
22	General Input 2 -	6
4	General Input 3 +	7
23	General Input 3 -	8
5	General Input 4 +	9
24	General Input 4 -	10
6	General Output 1 +	11
25	General Output 1 -	12
7	General Output 2 +	13
26	General Output 2 -	14
8	General Output 3 +	15
27	General Output 3 -	16
9	General Output 4 +	17
28	General Output 4 -	18
10	External Trigger Input 1 +	19
29	External Trigger Input 1 -	20
11	External Trigger Input 2 +	21
30	External Trigger Input 2 -	22
12	Shaft Encoder Phase A +	23
31	Shaft Encoder Phase A -	24
13	Shaft Encoder Phase B +	25
32	Shaft Encoder Phase B -	26
14	Ground	27
33	Strobe Output 1	28
15	Ground	29
34	Strobe Output 2	30

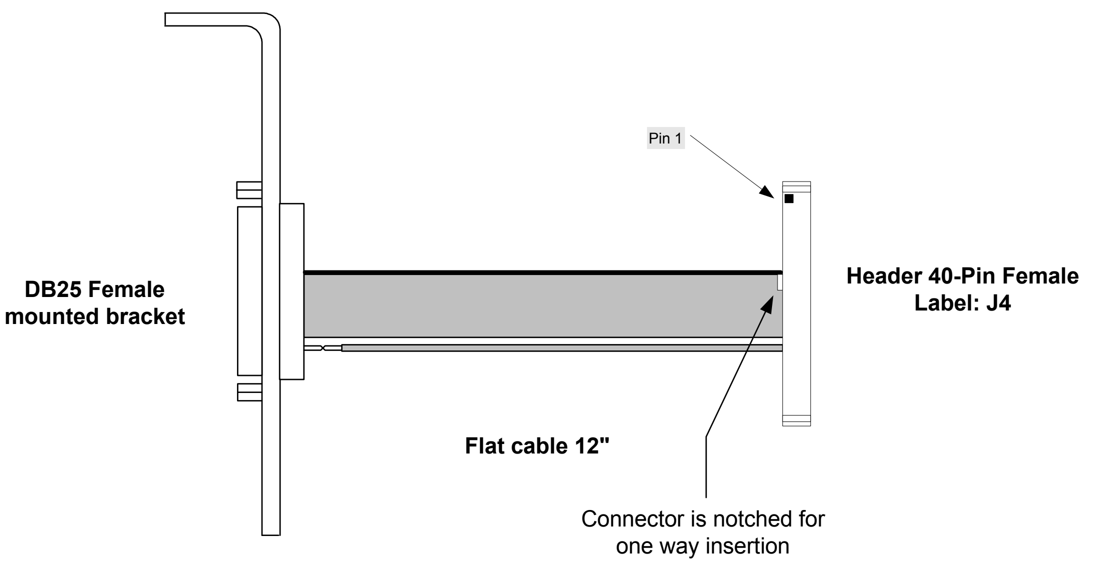
16	Ground	31
35	Ground	32
17	+5V	33
36	+5V	34
18	+12V	35
37	+12V	36
19	Ground	37
—	—	38
—	—	39
—	—	40

External Signals Connector Bracket Assembly (Type 2)

The External Signals bracket (OR-X4CC-0TIO2) provides a simple way to bring out the signals from the External Signals Connector J4 to a bracket mounted DB25. External cables designed for the DALSA X64 Xcelera-HS PX8 can be connected directly.

Install the bracket assembly into an adjacent PC expansion slot and connect the free cable end to the board's J4 header. When connecting to J4, make sure that the cable pin 1 goes to J4 pin 1 (see the layout drawing "X64 Xcelera-HS PX8 revision A1 Layout Drawing" on page 64).

External Signals Connector Bracket Assembly (Type 2) Drawing



External Signals Connector Bracket Assembly (Type 2) Pinout

The following table defines the signal pinout on the DB25 connector. Refer to the table "J4: External Signals Connector" on page 70 for signal descriptions.

DB25 Pin Number	Signal	J4 Connector Pin Number
6	External Trigger Input 1 +	19
19	External Trigger Input 1 -	20
7	External Trigger Input 2 +	21
20	External Trigger Input 2 -	22
8	Shaft Encoder Phase A +	23
21	Shaft Encoder Phase A -	24
9	Shaft Encoder Phase B +	25
22	Shaft Encoder Phase B -	26
11	Strobe Output 1	28
24	Ground	29
10	Strobe Output 2	30
14	Ground	31
15	Ground	38
16	Ground	39
25	Ground	40

J9: Board Sync

Interconnects multiple X64 Xcelera boards to synchronize acquisitions to one trigger or event. The trigger source can be either an external signal or internal software trigger. The board receiving the trigger is the Master board. while the boards receiving the control signal from the Master board are Slaves.

- **Hardware Connection:** Interconnect two, three, or four X64 Xcelera boards via their J9 connector. The 4 pin cable is wired one to one — i.e. no crossed wires. The cable must be as short as possible and the boards must be in the same system.
- **Master Board Software Setup:** Choose one X64 Xcelera as master. The Sapera parameter CORACQ_PRM_EXT_TRIGGER_SOURCE is set to either *Mode 1–Output to Board Sync* or *Mode 2–Control pulse to Board Sync*. See Sapera documentation for more details.
- **Slave Board Software Setup:** The Sapera parameter CORACQ_PRM_EXT_TRIGGER_SOURCE is set to *From Board Sync*.
- **Test Setup:** The control application starts the acquisition on all slave boards. The acquisition process is now waiting for the control signal from the master board. The master board acquisition is triggered and the acquisition start signal is sent to each slave board (with ~0.8µs delay max).

Contact Technical Support for additional information.

Connecting Multiple X64 Xcelera-HS PX8 Boards to one Camera

Multiple X64 Xcelera-HS PX8 boards can simultaneously process image data from one HS Link camera. The X64 Xcelera-HS PX8 board provides an HS-Link output which feeds the acquisition to a second board, which can then feed a third, etc.

Feature highlights are:

- Split image processing across multiple X64 Xcelera-HS PX8 boards.
- Up to 6 boards can be chained to one camera.
- X64 Xcelera-HS PX8 boards can be in one computer or multiple computers.
- The HS-Link output is the whole frame acquired — each X64 Xcelera-HS PX8 board in the chain receives a complete image.
- Each X64 Xcelera-HS PX8 board can perform a task or process either on the whole frame or a selected ROI, without effect on the camera image sent to other boards in the chain.

Cabling:

Physical connections between X64 Xcelera-HS PX8 boards is via HS-Link cables (CX4 connectors). Simply connect the camera to the first X64 Xcelera-HS PX8 board and then connect the HS-Link output to the HS-Link camera input of the next board. Repeat for any other X64 Xcelera-HS PX8 boards used. See "X64 Xcelera-HS PX8 End Bracket Detail" on page 66.

HS-Link cables can be any length required to inter-connect each X64 Xcelera-HS PX8 board (subject to the 10 meter maximum cable length of the HS-Link specification).

Application setup:

- The camera is connected to the X64 Xcelera-HS PX8 board defined as "**Master**".
- Only the Master board controls the camera.
- Each X64 Xcelera-HS PX8 board receiving daisy chained video is defined as a "**Slave**".
- Slave boards do not command the camera..
- Camera file (CCF) parameters define Master and Slave boards.
- For a Slave board, the CCF file must include a ‘Custom Parameters’ section with the following parameter defined, where ‘n’ is replaced by the slave order number in the system (value 1 .. max slave):
  [Custom Parameters]
  Parameter_0=0x107, 0xc64, n, “Slave n”
- Triggered acquisitions can require use of the board's multi-board sync capability. See "J9: Board Sync" on page 84.

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Glossary of Terms

Bandwidth
Describes the measure of data transfer capacity. PCI devices must share the maximum PCI bus bandwidth when transferring data to and from system memory or other devices.

CAM
Sapera camera file that uses the file extension CCA by default. Files using the CCA extension, also called CAM files (CAMERA files), contain all parameters which describe the camera video signal characteristics and operation modes (i.e. what the camera outputs).

Channel
Camera data path that includes all parts of a video line.

Checksum
A value used to ensure data is stored without error. It is created by calculating the binary values in a block of data using some algorithm and storing the results with the data.

Contiguous memory
A block of physical memory, occupying consecutive addresses.

Firmware
Software such as a board driver that is stored in nonvolatile memory mounted on that board.

Frame buffer
An area of memory used to hold a frame of image data. A frame buffer may exist on the acquisition hardware or be allocated by the acquisition hardware device driver in host system memory.

Grab
Acquiring an image frame by means of a frame grabber.

Host
Refers to the computer system that supports the installed frame grabber.

Host buffer
Refers to a frame buffer allocated in the physical memory of the host computer system.

LSB
Least Significant Bit in a binary data word.

MSB

Most Significant Bit in a binary data word.

PCIe

Peripheral Component Interconnect Express. The PCIe bus is a high-performance expansion bus intended for interconnecting add-in boards, controllers, and processor/memory systems.

Pixel

Picture Element. The number of pixels describes the number of digital samples taken of the analog video signal. The number of pixels per video line by the number of active video lines describes the acquisition image resolution. The binary size of each pixel (i.e., 8-bits, 15-bits, 24-bits) defines the number of gray levels or colors possible for each pixel.

Scatter Gather

Host system memory allocated for frame buffers that is virtually contiguous but physically scattered throughout all available memory.

Tap

Data path from a camera that includes a part of or whole video line. When a camera tap outputs a partial video line, the multiple camera tap data must be constructed by combining the data in the correct order.

VIC

Sapera camera parameter definition file that uses the file extension CVI by default. Files using the CVI extension, also know as VIC files, contain all operating parameters related to the frame grabber board (i.e. what the frame grabber can actually do with camera controls or incoming video).

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