# X64-CL Express™

## Key Features

- Half-length PCI Express x1 board
- Supports Windows x64-bit
- Simultaneous acquisition from two Camera Link base cameras
- FPGA based processing including Bayer decoding and shading correction
- Supports field proven Trigger-to-Image Reliability framework
- Acquisition pixel clock rates up to 85MHz
- Low cost to high performance ratio
- DALSA Platform Development Advantage – Free Run-time Licensing[1]

TRIGGER-TO-IMAGE RELIABILITY

## Fast, flexible, highly reliable image acquisition

The X64-CL Express is a Camera Link® frame grabber that is based on the PCI Express x1 interface—next generation bus interface technology for the host PCs. PCI-Express is a serial digital interface technology that is specifically designed to offer dedicated bandwidth to each plug-in device while reducing the PCB design complexity.

The X64-CL Express supports up to two independent Base or one Medium Camera Link colour and/or monochrome cameras. Its low cost, combined with its ability to reformat input data from multi-tap area and line scan cameras in addition to its on-board FPGA based processing (including Bayer decoding and real-time shading correction) makes the X64-CL Express an ideal solution for a wide variety of cost-sensitive applications where flexibility, performance, and reliability cannot be compromised.

**DALSA Platform Development Advantage - Free Run-Time Licensing**
The Sapera Essential standard processing tool run-time license is offered at no additional charge when combined with the DALSA frame grabbers. This software run-time license[1] includes access to over 400 image processing functions, area-based (normalized correlation based) template matching tool, blob analysis and lens correction tool.

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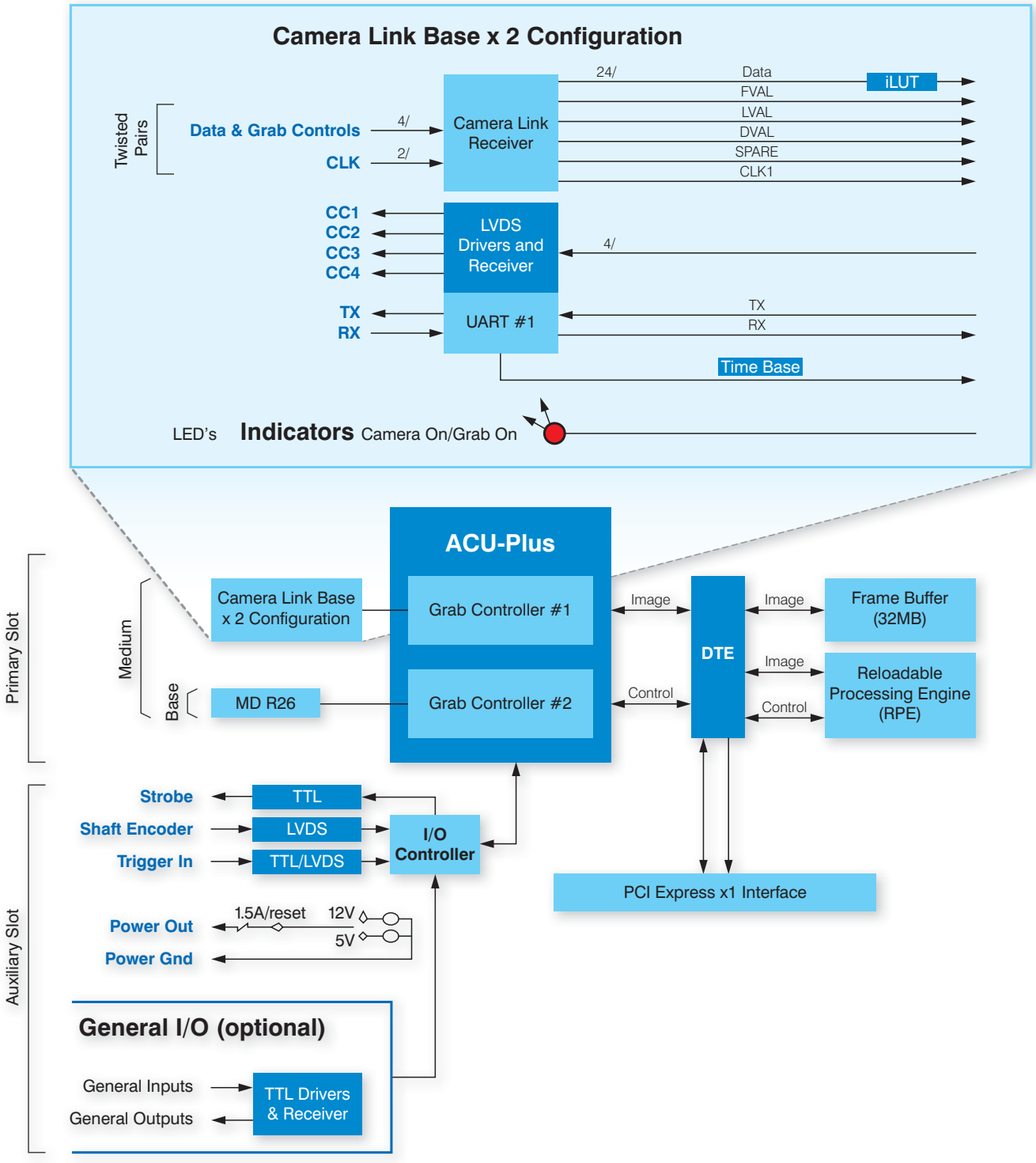
[1] Some conditions and limitations apply, contact DALSA sales for details.

DALSA




*X64-CL Express—Functional Block Diagram*

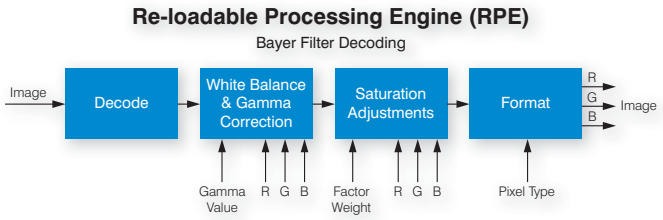
# X64-CL Express™

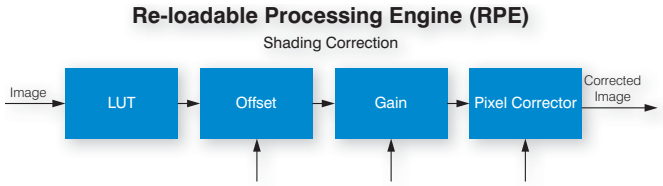
## Windows XP Professional x64 Support

Fully supported on Microsoft Windows® XP Professional and 2000, the X64-CL Express now also supports Microsoft Windows XP Professional x64, a 64-bit operating system for processors with 64-bit extension to x86 architecture'. The 64-bit OS support is especially advantageous for high-performance machine vision applications that require large amounts of memory to store and process long sequences of images. The X64-CL Express is capable of transferring images above and beyond 4GB memory address space thereby utilizing the maximum available physical memory. High-performance machine vision applications such as web surface inspection and wafer inspection require large amounts of data and directly benefit by overcoming the 4GB address space limitation of 32-bit OS.

## Trigger-to-Image Reliability

The X64-CL Express has been built within DALSA's Trigger-to-Image Reliability technology framework. High-speed in-line machine vision applications require tight integration between the trigger, strobe, camera exposure and frame grabber acquisition to ensure data integrity. Trigger-to-Image Reliability leverages DALSA's hardware and software innovations to control, monitor and correct the image acquisition process from the time an external trigger event occurs to the moment the data is sent to the PCI bus, providing traceability when errors do occur and permitting recovery from those errors.




## On-Board Processing Engine

As a part of its standard features set, the X64-CL Express offers an FPGA based image processor called the Re-loadable Processing Engine (RPE). Fast and efficient, the RPE frees up the host CPU from performing tasks such as shading correction and Bayer decoding while delivering images that can be readily used by demanding vision applications without further preprocessing.

### Hardware Bayer Decoding

Configured to decode Bayer Mosaic Filter images, the RPE supports Base and Medium cameras in a multitude of tap configurations. Designed with flexibility in mind, the X64-CL Express can handle various Bayer patterns and provides control for gamma correction and white balance to produce accurate RGB images. To further facilitate the needs of high performance colour applications, the X64-CL Express can capture and convert images from 8, 10, and 12-bit Bayer cameras.

### Real-Time Shading Correction

To overcome the image artifacts caused by non-uniform illumination, non-uniform sensor response, dark current, and defective pixel elements, the X64-CL Express can be configured to perform real-time shading correction. Capable of supporting Base and Medium configurations, the shading correction engine is user configurable and comes bundled with a calibration utility to generate gain and offset maps.

### Input Lookup Tables (iLUTs)

The X64-CL Express features input lookup tables for Base and Medium monochrome and colour RGB cameras. Available for 8, 10 and 12-bit cameras area and line scan cameras; the iLUTs are dynamically loadable and are fully user programmable. The input lookup tables can be used for image thresholding, gamma correction or simply pixel format conversion, simplifying subsequent image processing steps.

## Optimized Data-Transfer

Delivering fast and secure data transfers with zero CPU usage, the X64-CL Express's Data Transfer Engine (DTE) features a high speed memory interface, multiple independent Direct Memory Access (DMA) controllers, and on-board tap descriptors. The X64-CL Express's DTE supports Windows XP Professional x64 memory models. This allows the DTE to transfer long sequences of images in real-time to memory locations above and beyond 4GB address space without any special modes or OS configurations.

The DTE also performs real-time input tap adjustments for direction (tap reversal/inversion), pixel overlap and under lap. This enables the DTE to deliver images that are ready for processing and liberating the host CPU for image analysis tasks. In addition, the DTE performs autonomous and robust image transfers to ensure data integrity during continuous image acquisition in non-real-time operating systems, such as Windows® 2000, Windows® XP Professional and Windows XP

# X64-CL Express™

Professional x64.

## Simplified Set-up and Operation

### Visual Status LED

The X64-CL Express further facilitates ease-of-use by utilizing visual status LEDs, mounted on the card's bracket, to simplify system installation and setup. A status indicator LED provides visual feedback when the correct camera connection is made and when a grab is in progress. These visual indicators allow developers to instantly recognize if cabling has been correctly set up greatly facilitating the diagnostic process.

### Trigger Input/Strobe Output

The X64-CL Express features trigger input along with a strobe control output signals, to synchronize image captures with external events.

### Shaft-Encoder

The Quadrature shaft-encoder input, enables the X64-CL Express to acquire images from line scan cameras synchronously to the speed of the web. Higher quality images make processing more accurate and tolerant to motion artifacts.

### General Purpose I/Os

The X64-CL Express offers optional opto-coupled input modules for demanding industrial environments. These interrupt-driven, general-purpose input and output controls allow X64-CL Express boards to react to external inputs more rapidly and predictably to increase the quality of acquired images.

### Serial Communications Ports

The X64-CL Express features two independent onboard serial communication ports that provide integrated support for camera control and setup for machine vision applications. PC-independent in nature, this communication port can be used with off-the-shelf communication utilities such as HyperTerminal to control and configure Camera Link cameras with ease and without requiring additional external cabling.

## Software Support

### Image Acquisition and Control

The X64-CL Express is supported by DALSA's Sapera™ Essential software libraries for image acquisition and control. Using Microsoft .Net and Visual Studio 6.0 development environment, Sapera Essential applications can be developed using C++ classes, C DLL or ActiveX controls under Windows® 2000, Windows® XP, and Windows XP Professional x64 platforms. An integral part of DALSA's stringent Trigger-to-Image Reliability technology framework, Sapera Essential supports the full suite of DALSA's hardware platforms. In addition, the Sapera Essential includes powerful diagnostics and setup utilities for application development, custom camera configurations and system deployment.

### Image Processing and Analysis

DALSA's Sapera™ Processing software library is a set of high performance C++ classes for image processing and analysis for machine vision applications. Sapera Processing library includes over 300 image processing functions and offers powerful pattern matching, optical character recognition, bar code and blob analysis tools.

# X64-CL Express™

## Specifications*

| Function | Description |
|---|---|
| **Board** | Camera Link Specifications Rev 1.10 compliant<br>Half length PCI Express Ver. 1.00 compliant |
| **Acquisition** | Supports two independent Base or one Medium Camera Link area or line scan cameras<br>Acquisition pixel clock rates up to 85MHz |
| **Resolution** | Horizontal Size (min/max): 8 byte/256K bytes<br>Vertical Size (min/max):<br>1 line/infinite lines for line-scan cameras<br>1 line/16 million lines/frame for area-scan cameras<br>Variable length frame size from 1 to 16 million lines for area-scan cameras<br>32MB on-board frame buffer memory<br>Integrated advanced tap reversal engine allows independent tap formatting |
| **Pixel Format and Tap configurations** | Supports Camera Link tap configurations for 8, 10, or 12 bit mono, RGB and Bayer cameras:<br>For 1 Medium or two Base cameras in any of the following combinations—3x8 bit/tap, 2x10 bit/tap, 2x12 bit/tap, 1x14 bit/tap, 1x16 bit/tap, & 1x24 bit/RGB<br>For Medium camera—4x8 bit/tap, 4x10 bits/tap, 4x12 bit/tap, 1x30 bit/RGB, & 1x36 bit/tap[1] |
| Transfers | Real-time transfers to system memory<br>PCI Express x1—255MB/sec<br>Intelligent Data-Transfer-Engine automatically loads scatter-gather and tap description tables fro the host memory without CPU intervention |
| **On-board Processing** | |
| Bayer Mosaic Filter | Hardware Bayer Engine supports one 8, 10 or 12 bit Bayer camera input<br>Bayer output format supports 8 or 10 bit RGB/pixel<br>Zero host CPU utilization for Bayer conversion |
| Shading Correction | On the fly Flat-line and Flat-field correction with dead-pixel replacement<br>Supports two independent monochrome cameras concurrently<br>User programmable calibration gain/offset maps |
| Input Lookup Tables | Per Camera Input |
| *Monochrome* | For each input one 256x8 bit, 1024x10 bit, 1024x8 bit, 4096x12 bit, 4096x10 bit or<br>4096x8 bit iLUTs per camera input |
| *Colour* | 3x256x8-bit for Base Camera Link and 3x1024x10-bit or 3x4096x12-bit for Medium Camera Link RGB cameras |

| Function | Description |
|---|---|
| **Controls** | Comprehensive event notification includes end/frame/transfer<br>Independent timing control logic for up to two Camera Link cameras<br>Two independent TTL/LVDS trigger inputs programmable as active high or low (edge or level trigger)<br>Two independent TTL Strobes outputs<br>Two PC independent serial communications ports provide seamless interface to MS Windows applications<br>Quadrature (AB) shaft-encoder inputs for external web synchronization |
| **Options** | Optional general purpose IO module supports:<br>8 inputs and 8 TTL outputs<br>inputs support TTL and 24V operations<br>TTL outputs support PNP and NPN operations[2] |
| **Power Output** | Power-on-reset fused +12V/+5V DC output at 1.5A |
| **Software** | Microsoft Windows 2000, Windows XP Professional, Windows XP Professional x64<br>Full support of DALSA's Sapera Essential and Sapera Processing software libraries<br>Application development using C++ DLLs and ActiveX controls with Microsoft Visual Studio<br>Microsoft .Net Compatible |
| **System Requirements** | PCI-Express x1 or higher lane width compliant system and 64MB system memory |
| **Dimensions** | 6.6" (16.7cm) Length X 4.35" (11cm) Height |
| **Temperature** | 0°C (32°F) to 50°C (122°F)<br>Relative Humidity: up to 95% (non-condensing) |
| **Markings** | FCC Class B–Approved<br>CE–Approved |

**Notes:**
1. Output pixel format limited to RGB30 only
2. Optional module requires separate PCI or PCIe slot

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