

# Coaxlink Mono CXP-12 LH

One-connection CoaXPress CXP-12 frame grabber



## At a Glance

- One CoaXPress CXP-12 connection: 1,250 MB/s camera bandwidth
- PCIe 3.0 (Gen 3) x4 bus: 3,300 MB/s bus bandwidth
- Low-profile card. Delivered with standard and low-profile brackets
- Passive (fanless) heatsink
- Feature-rich set of 10 digital I/O lines
- Extensive camera control functions
- Memento Event Logging Tool

## Benefits

### Low-profile PCIe card

- Delivered with standard and low-profile brackets

### PCIe 3.0 (Gen 3) x4 bus

- 3,300 MB/s sustained bus bandwidth

### Acquire images from the fastest and highest resolution cameras

- Highest data acquisition rate in the industry
- 12.5 Gbit/s (1,250 MB/s) bandwidth from camera to host PC memory

### Long cable support for Coaxlink CXP-12

- 40 meters at CXP-12 speed (12.5 Gbps)
- 72 meters at CXP-6 speed (6.25 Gbps)
- 100 meters at CXP-3 speed (3 Gbps)

### Use standard coaxial cables

- A single inexpensive cable for data transfer, camera control, trigger and power supply
- Top reliability and flexibility, performs in the harshest environments

### Robust connectors

- Micro-BNC (HD-BNC™) connectors for reliable connection
- Trusted push and turn, bayonet-style positive lock
- Allows for quick and easy connects and disconnects

## **Memento Event Logging Tool**

- Memento is an advanced development and debugging tool available for Coaxlink cards.
- Memento records an accurate log of all the events related to the camera, the frame grabber and its driver as well as the application.
- It provides the developer with a precise timeline of time-stamped events, along with context information and logic analyzer view.
- It provides valuable assistance during application development and debugging, as well as during machine operation.

## **Direct GPU transfer**

- Sample programs for AMD DirectGMA and NVIDIA (CUDA) available.
- Direct GPU transfer eliminates unnecessary system memory copies, lowers CPU overhead, and reduces latency, resulting in significant performance improvements in data transfer times for applications.
- Direct capture of image data to GPU memory is available using AMD's DirectGMA. Compatible with AMD FirePro W5x00 and above and all AMD FirePro S series products.

## **General purpose I/O lines**

- Compatible with a wide range of sensors and motion encoders.
- High-speed differential inputs: Quadrature motion encoder support up to 5 MHz.
- Isolated current-sense inputs: 5V, 12V, 24V signaling voltages accepted, up to 50 kHz, individual galvanic isolation up to 250VDC and 170VAC RMS.
- Isolated contact outputs.
- High-speed 5V-compliant TTL inputs/ LVTTTL outputs.

## **High-performance DMA (Direct Memory Access)**

- Direct transfer into user-allocated memory and hardware boards that expose PCI addresses
- Hardware scatter-gather support
- 64-bit addressing capability

## **Area-scan triggering capabilities**

- A trigger is used to start the acquisition when the part is in position. Hardware triggers come from the Coaxlink's I/O lines. Software triggers come from the application.
- An optional trigger delay is available to postpone the acquisition for a programmable time.
- A trigger decimation function allows to skip some of the triggers.
- Camera exposure control allows the application to control the exposure time of the camera.
- When the acquisition starts, at the appropriate timing, the Coaxlink board generates a signal to control an illumination device connected to one of its output lines.

## **The Coaxlink driver includes the following tools:**

- Genicam Browser: An application giving access to the Genicam features exposed by the GenTL Producer(s) in the system.
- GenTL Console: A command-line tool giving access to the functions and commands exposed by the Euresys GenTL Producer.

## **Compliant with Genicam Including support for**

- GenApi
- The Standard Feature Naming Convention (SFNC)
- GenTL

## **Windows, Linux and macOS drivers available**

- Including support for Intel 32-bit and 64-bit platforms as well as ARM 64-bit platforms

## Applications

### Machine Vision for the Electronic Manufacturing Industry

- High speed image acquisition for AOI, 3D SPI, 3D lead/ball inspection machines.
- Very high resolution line-scan image acquisition for Flat Panel Display inspection and solar cell inspection
- Mark inspection

### Machine Vision for the General Manufacturing Industries

- High frame rate image acquisition for inspection machines
- Line-scan image acquisition for surface inspection machines
- Line-scan image acquisition for textile inspection
- Image acquisition for robots

### Machine Vision for the Printing Industry

- High speed line-scan image acquisition for printing inspection machines

### Video Acquisition and Recording

- High-frame-rate video acquisition for motion analysis and recording

### Video Monitoring, Surveillance & Security

- Transmission and acquisition of high-definition video over long coaxial cables for traffic surveillance, monitoring and control

## Specifications

### Mechanical

Format	Low profile, half length, 4-lane PCI Express card
Cooling method	Air-cooling, fanless
Mounting	<ul style="list-style-type: none"><li>• For insertion in a 4-lane or higher, PCI Express card slot.</li><li>• Delivered with standard- and low-profile brackets for insertion in a standard- or a low-profile chassis.</li></ul>
Connectors	<ul style="list-style-type: none"><li>• 'A' on bracket:<ul style="list-style-type: none"><li>– Micro-BNC female connector</li><li>– CoaXPress host interface</li></ul></li><li>• 'EXTERNAL I/O 1' on bracket:<ul style="list-style-type: none"><li>– 15-pin 3-row high-density female sub-D connector</li><li>– I/O lines and power output</li></ul></li><li>• 'INTERNAL I/O 1' on PCB:<ul style="list-style-type: none"><li>– 26-pin 2-row 0.1" pitch pin header with shrouding</li><li>– I/O lines and power output</li></ul></li><li>• 'I/O EXTENSION' on PCB:<ul style="list-style-type: none"><li>– 26-pin 2-row 0.05" pitch pin header with shrouding</li><li>– I/O extension lines and power output</li></ul></li><li>• 'AUXILIARY POWER INPUT' on module:<ul style="list-style-type: none"><li>– 6-pin PEG power socket</li><li>– 12 VDC power input for PoCXP camera(s) and I/O power</li></ul></li><li>• 'C2C-LINK' on module:<ul style="list-style-type: none"><li>– 6-pin 2-row 0.1" header</li><li>– Card to card link</li></ul></li></ul>

LED indicators	<ul style="list-style-type: none"> <li>• 'A' on bracket: <ul style="list-style-type: none"> <li>– Bi-color red/green LED</li> <li>– CoaXPress Host connector indicator</li> </ul> </li> <li>• 'FPGA STATUS LAMP' on PCB: <ul style="list-style-type: none"> <li>– Bi-color red/green LED</li> <li>– FPGA status indicator</li> </ul> </li> <li>• 'BOARD STATUS LAMP' on PCB: <ul style="list-style-type: none"> <li>– Bi-color red/green LED</li> <li>– Board status indicator</li> </ul> </li> </ul>
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Switches	'RECOVERY' on card PCB: <ul style="list-style-type: none"> <li>• 3-pin 1-row 0.1" header</li> <li>• Firmware emergency recovery</li> </ul>
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Dimensions	L 167.65 mm x H 68,90 mm L 6.6 in x H 2.71 in
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Weight	160 g, 5.64 oz
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## Host bus

Standard	PCI Express 3.0
Link width	<ul style="list-style-type: none"> <li>• 4 lanes</li> <li>• 1 lane or 2 lanes with reduced performance</li> </ul>
Link speed	<ul style="list-style-type: none"> <li>• 8.0 GT/s (PCIe 3.0)</li> <li>• 5.0 GT/s (PCIe 2.0) with reduced performance</li> </ul>
Maximum payload size	512 bytes
DMA	32- and 64-bit
Peak delivery bandwidth	3,900 MB/s
Effective (sustained) delivery bandwidth	3,350 MB/s (Host PC motherboard dependent)
Power consumption	Typ. 11.5 W (3 W @ 3.3 V + 8.5 W @ 12 V), excluding camera and I/O power output

## Camera / video inputs

Interface standard(s)	CoaXPress 1.0, 1.1, 1.1.1 and 2.0
Connectors	1 micro-BNC 75 Ohms (also known as HD-BNC™) CXP-12
Status LEDs	One CoaXPress Host connection status LED per connector
Number of cameras	One 1-connection area-scan camera
Maximum aggregated camera data transfer rate	12.5 Gbit/s (1,250 MB/s)
Supported CXP down-connection speeds	1.25 GT/s (CXP-1), 2.5 GT/s (CXP-2), 3.125 GT/s (CXP-3), 5 GT/s (CXP-5), 6.25 GT/s (CXP-6), 10.0 GT/s (CXP-10), and 12.5 GT/s (CXP-12)
Number of CXP data streams (per camera)	1 data stream per camera
Maximum CXP stream packet size	16,384 bytes
PoCXP (Power over CoaXPress)	<ul style="list-style-type: none"> <li>• PoCXP Safe Power: <ul style="list-style-type: none"> <li>– 25 W of 24V DC regulated power</li> <li>– PoCXP Device detection and automatic power-on</li> <li>– Overload and short-circuit protections</li> </ul> </li> <li>• On-board 12V to 24V DC/DC converter</li> <li>• A +12V power source must be connected to the AUXILIARY POWER INPUT connector using a 6-pin PEG cable</li> </ul>

Camera types	<ul style="list-style-type: none"> <li>• Area-scan cameras: <ul style="list-style-type: none"> <li>– Gray-scale and color (RGB and Bayer CFA)</li> <li>– Single-tap (1X-1Y) progressive-scan</li> </ul> </li> </ul>
Camera pixel formats supported	Raw, Monochrome, Bayer, RGB, and RGBA (PFNC names): <ul style="list-style-type: none"> <li>• Raw</li> <li>• Mono8, Mono10, Mono12, Mono14, Mono16</li> <li>• BayerXX8, BayerXX10, BayerXX12, BayerXX14, BayerXX16 where XX = GR, RG, GB, or BG</li> <li>• RGB8, RGB10, RGB12, RGB14, RGB16</li> <li>• RGBA8, RGBA10, RGBA12, RGBA14, RGBA16</li> <li>• YCbCr601_422_8, YCbCr601_422_10</li> <li>• YCbCr709_422_8, YCbCr709_422_10</li> <li>• YUV422_8, YUV422_10</li> </ul>

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### Area-scan camera control

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Trigger	<ul style="list-style-type: none"> <li>• Precise control of asynchronous reset cameras, with exposure control.</li> <li>• Support of camera exposure/readout overlap.</li> <li>• Support of external hardware trigger, with optional delay and trigger decimation.</li> </ul>
Strobe	<ul style="list-style-type: none"> <li>• Accurate control of the strobe position for strobed light sources.</li> <li>• Support of early and late strobe pulses.</li> </ul>

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### On-board processing

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On-board memory	512 MB
Image data stream processing	<ul style="list-style-type: none"> <li>• Unpacking of 10-/12-/14-bit to 16-bit with selectable justification to LSB or MSb</li> <li>• Optional swap of R and B components</li> <li>• Little endian conversion</li> </ul>
Input LUT (Lookup Table)	Only available for monochrome cameras: <ul style="list-style-type: none"> <li>• 8 to 8 bits</li> <li>• 10 to 8, 10 or 16 bits</li> <li>• 12 to 8, 12 or 16 bits</li> </ul>
Data stream statistics	<ul style="list-style-type: none"> <li>• Measurement of: <ul style="list-style-type: none"> <li>– Frame rate (Area-scan only)</li> <li>– Line rate</li> <li>– Data rate</li> </ul> </li> <li>• Configurable averaging interval</li> </ul>

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## Event signaling and counting

- The application software can be notified of the occurrence of various events:
  - Standard event: the EVENT\_NEW\_BUFFER event notifies the application of newly filled buffers
  - A large set of custom events
- Custom events sources:
  - I/O Toolbox events
  - Camera and Illumination control events
  - CoaXPress data stream events
  - CoaXPress host interface events
- Each custom event is associated with a 32-bit counter that counts the number of occurrences
- The last three 32-bit context data words of the event context data can be configured with event-specific context data:
  - Event-specific data
  - State of all System I/O lines sampled at the event occurrence time
  - Value of any event counter

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## General Purpose Inputs and Outputs

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Number of lines	<p>10 I/O lines:</p> <ul style="list-style-type: none"><li>• 2 differential inputs (DIN)</li><li>• 2 singled-ended TTL inputs/outputs (TTLIO)</li><li>• 4 isolated inputs (IIN)*</li><li>• 2 isolated outputs (IOUT)*</li></ul> <p>NOTE: Only 2 IIN and 1 IOUT lines are available on the EXTERNAL I/O connector.</p> <p>NOTE: The number of I/O lines can be extended using I/O modules attached to the I/O EXTENSION connector.</p>
Usage	<ul style="list-style-type: none"><li>• Any I/O input lines can be used by any LIN tool of the I/O Toolbox</li><li>• Selected pairs of I/O input lines can be used by any QDC tool of the I/O toolbox to decode A/B signals of a motion encoder</li><li>• The LIN and QDC tools outputs can be further processed by the other tools (DIV, MDV, DEL) of the I/O toolbox to generate any of the following "trigger" events:<ul style="list-style-type: none"><li>– The "cycle trigger" of the Camera and Illumination controller</li><li>– The "cycle sequence trigger" of the Camera and Illumination controller</li></ul></li></ul>
Electrical specifications	<ul style="list-style-type: none"><li>• DIN: High-speed differential inputs compatible with ANSI/EIA/TIA-422/485 differential line drivers and complementary TTL drivers</li><li>• TTLIO: High-speed 5V-compliant TTL inputs or LVTTTL outputs, compatible with totem-pole LVTTTL, TTL, 5V CMOS drivers or LVTTTL, TTL, 3V CMOS receivers</li><li>• IIN: Isolated current-sense inputs with wide voltage input range up to 30V, compatible with totem-pole LVTTTL, TTL, 5V CMOS drivers, RS-422 differential line drivers, potential free contacts, solid-state relays and opto-couplers</li><li>• IOUT: Isolated contact outputs compatible with 30V / 100mA loads</li></ul>
Filter control	<ul style="list-style-type: none"><li>• Glitch removal filter available on all System I/O input lines</li><li>• Configurable filter time constants:<ul style="list-style-type: none"><li>– for DIN and TTLIO lines: 50 ns, 100 ns, 200 ns, 500 ns, 1 <math>\mu</math>s</li><li>– for IIN lines: 500 ns, 1 <math>\mu</math>s, 2 <math>\mu</math>s, 5 <math>\mu</math>s, 10 <math>\mu</math>s</li></ul></li></ul>
Polarity control	Yes
Power output	Non-isolated, +12V, 1A, with electronic fuse protection

## I/O Toolbox tools

The I/O Toolbox is a configurable interconnection of tools that generates events (usually triggers) from input lines. The composition of the toolset is product- and firmware-dependent.

- Line Input tool (LIN): Edge detector delivering events on rising or falling edges of any selected input line.
- Quadrature Decoder tool (QDC): A composite tool including:
  - A quadrature edge detector delivering events on selected transitions of selected pairs of input lines.
  - An optional backward motion compensator for clean line-scan image acquisition when the motion is unstable.
  - A 32-bit up/down counter for delivering a position value.
- Divider tool (DIV): to generate an event every nth input events from any I/O toolbox event source.
- Multiplier/divider tool (MDV): to generate m events every d input events from any I/O toolbox event source.
- Delay tool (DEL): to delay up to 16 events from one or two I/O toolbox event sources, by a programmable time or number of motion encoder ticks (any QDC events).
- User Actions Scheduler tool (UAS): to delegate the execution of User Actions at a scheduled time or encoder position. Possible user actions include setting low/high/toggle any bit of the User Output Register or generation of any User Events.

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### I/O Toolbox composition

8 LIN, 1 QDC, 1 DIV, 1 MDV, 2 DEL, 1 UAS

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## C2C-Link

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### Description

- Accurate synchronization of the trigger and the start-of-exposure of multiple grabber-controlled area-scan cameras.
- Accurate synchronization of the start-of-cycle, start-of-scan and end-of-scan of multiple grabber-controlled line-scan cameras.

### Specification

- C2C-Link synchronizes cameras connected to:
  - the same Coaxlink card
  - to different cards in the same PC (requires an accessory cable such as the "3303 C2C-Link Ribbon Cable" or a custom-made C2C-Link cable)
  - to different cards in different PCs (requires one "1636 InterPC C2C-Link Adapter" for each PC and one RJ 45 CAT 5 STP straight LAN cable for each adapter but the last one)
- Maximum distance:
  - 60 cm inside a PC
  - 1200 m cumulated adapter to adapter cable length
- Maximum trigger rate:
  - 2.5 MHz for configurations using a single PC, or up to 10 PCs and 100 m total C2C-Link cable length
  - 200 kHz for configurations up to 32 PCs and 1200m total C2C-Link cable length
- Trigger propagation delay from master to slave devices:
  - Less than 10 ns for cameras on the same Coaxlink card or on different Coaxlink cards in the same PC
  - Less than 265 ns for cameras on different Coaxlink cards in different PCs (3 PCs and 40m total C2C-Link cable length)

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## Software

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### Host PC Operating System

- Microsoft Windows 10, 8.1, 7 for x86 (32-bit) and x86-64 (64-bit) processor architectures
- Linux for x86 (32-bit), x86-64 (64-bit) and aarch64 (64-bit) processor architectures
- macOS for x86-64 (64-bit) processor architecture

Refer to release notes for details

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## APIs

EGrabber class, with C++ and .NET APIs:

- .NET assembly designed to be used with development environments compatible with .NET frameworks version 4.0 or higher

GenICam GenTL producer libraries compatible with C/C++ compilers:

- x86 dynamic library designed to be used with ISO-compliant C/C++ compilers for the development of x86 applications
- x86\_64 dynamic library designed to be used with ISO-compliant C/C++ compilers for the development of x86\_64 applications
- aarch64 dynamic library designed to be used with ISO-compliant C/C++ compilers for the development of aarch64 applications

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## Environmental conditions

Operating ambient air temperature 0 to +55 °C / +32 to +131 °F, with minimum 150 LFM (Linear Feet per Minute) required airflow

Operating ambient air humidity 10 to 90% RH non-condensing

Storage ambient air temperature -20 to +70 °C / -4 to +158 °F

Storage ambient air humidity 10 to 90% RH non-condensing

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## Certifications

Electromagnetic - EMC standards

- European Council EMC Directive 2004/108/EC
- United States FCC rule 47 CFR 15

EMC - Emission

- EN 55022:2010 Class B
- FCC 47 Part 15 Class B

EMC - Immunity

- EN 55024:2010 Class B
- EN 61000-4-3
- EN 61000-4-4
- EN 61000-4-6

Flammability PCB compliant with UL 94 V-0

RoHS European Union Directive 2015/863 (ROHS3)

REACH European Union Regulation 1907/2006

WEEE Must be disposed of separately from normal household waste and must be recycled according to local regulations

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## Ordering Information

Product code - Description

- 3621-LH - Coaxlink Mono CXP-12 LH

Optional accessories

- 1625 - DB25F I/O Adapter Cable
- 1636 - InterPC C2C-Link Adapter
- 3303 - C2C-Link Ribbon Cable
- 3304 - HD26F I/O Adapter Cable
- 3610 - HD26F I/O Extension Module TTL-RS422
- 3612 - HD26F I/O Extension Module TTL-CMOS5V-RS422
- 3614 - HD26F I/O Extension Module - Standard I/O Set

