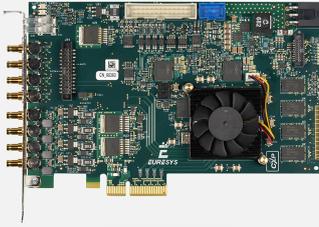


# Coaxlink Quad G3 DF

PCIe 3.0 four-connection CoaXPress frame grabber with Data Forwarding



## At a Glance

- Four CoaXPress CXP-6 inputs and 4 Data Forwarding outputs: 2,500 MB/s camera bandwidth
- PCIe 3.0 (Gen 3) x4 bus: 3,300 MB/s bus bandwidth
- Feature-rich set of 10 digital I/O lines
- Extensive camera control functions
- Memento Event Logging Tool

## Benefits

### CoaXPress Data Forwarding

- Allows to distribute the image processing workload among several host PCs

### 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
- 25 Gbit/s (2,500 MB/s) bandwidth from camera to host PC memory

### Long cable support

- 40 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

Coaxlink uses DIN 1.0/2.3 connectors with push/pull latching system for reliable connections

### 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.
- It provides valuable assistance during application development and debugging, as well as during machine operation.

### **AMD's DirectGMA support**

- Direct transfer of image data to GPU memory.
- Eliminates unnecessary system memory copies, dramatically lowers CPU overhead, and reduces latency, resulting in significant performance improvements in data transfer times for applications using the AMD FirePro W5x00 and above and for 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 500VAC RMS.
- Isolated contact outputs.
- High-speed 5V-compliant TTL inputs/ LVTTTL outputs.

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

- Direct transfer into user-allocated memory
- 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.

### **Line-scan triggering capabilities**

Coaxlink supports continuous web scanning (to inspect infinite, continuously moving surfaces without losing a single line) and discrete object scanning (to acquire the image of objects moving in front of the camera).

- A trigger is used to start the acquisition when the part is in position. Hardware triggers come from the board's I/O lines. Software triggers come from the application.
- After it is started, the acquisition either:
  - Continues indefinitely (for web inspection applications)
  - Continues for a programmable number of lines (to acquire the image of objects of a known length)
  - Continues until an end trigger is received (to acquire the image of objects of a variable length)
- An optional trigger delay is available to postpone the beginning of the acquisition for a programmable number of lines.

### **Line-scan triggering capabilities**

- The Coaxlink frame grabber controls the camera scanning rate based on the signals received from a motion encoder. When the parts move faster, the acquisition line rate of the camera increases. When the parts move slower, the acquisition line rate of the camera decreases.
- The Coaxlink boards interpret A/B signals from quadrature motion encoders to know in which direction (forward or backward) the part is moving.
- Optionally, the Coaxlink can be instructed to acquire lines only when the object is moving forward or only when the object is moving backward.
- A feature called Backward Motion Cancellation stops the acquisition when a backward motion is detected. The line acquisition automatically resumes when the motion is again in the forward direction, at the exact place where the acquisition was interrupted.
- A Rate Converter allows the camera to acquire lines at any programmable resolution lower or higher than the resolution of the motion encoder. This gives the designer incredible freedom and flexibility during the development of the application.
- A Rate Divider allows the camera to acquire lines at a resolution lower than the resolution of the motion encoder. It divides the frequency of the incoming encoder signal by a programmable integer.

### **Flexible line-scan camera operation with the rate converter.**

- The rate converter is a smart, programmable frequency multiplier/divider.
- Used with motion encoders and line-scan cameras, it allows the user to choose the aspect ratio of the pixels in the image.
- It provides a way to calibrate the acquisition chain to easily reach square (1:1 aspect ratio) pixels.

### **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 and Linux drivers available**

## **Applications**

### **MACHINE VISION FOR THE ELECTRONIC MANUFACTURING INDUSTRY**

#### **High speed image acquisition for inspection machines.**

The Coaxlink and Grablink cards are dependable industrial frame grabbers that provide robust and stable image acquisition from the fastest digital cameras available. They feature precise camera control and synchronization functions.

- AOI (Automated Optical Inspection) machines
- 3D SPI (Solder Paste Inspection) machines
- 3D lead/ball inspection machines

#### **Very high resolution line-scan image acquisition for inspection machines**

The Coaxlink and Grablink cards are dependable industrial frame grabbers that provide robust and stable image acquisition from the fastest digital cameras available. They feature precise line-scan camera control and synchronization functions.

- Flat Panel Display inspection
- Solar cell inspection

## **MACHINE VISION FOR THE GENERAL MANUFACTURING INDUSTRIES**

### **High frame rate image acquisition for inspection machines**

Glass inspection: bottles, vials

### **Line-scan image acquisition for surface inspection machines**

The Coaxlink and Grablink cards are dependable industrial frame grabbers that provide robust and stable image acquisition from the fastest digital cameras available. They feature precise line-scan camera control and synchronization functions.

### **Line-scan image acquisition for textile inspection**

## **MACHINE VISION FOR THE PRINTING INDUSTRY**

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

- Printing inspection for packages
- Printing inspection for labels

## **VIDEO ACQUISITION AND RECORDING**

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

## **MILITARY & DEFENSE**

### **Unmanned applications, vehicle-based video capture**

The CoaXPress standard allows video transfer to the PC in a few milliseconds. The very low latency of the system will allow the control of land vehicles or remote control of UAVs.

## **VIDEO MONITORING, SURVEILLANCE & SECURITY**

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

CoaXPress is a recent powerful standard providing a high speed interface between the camera and the PC frame grabber. On a highway, high speed cameras can take images in a burst. The sharper images will enhance license plate recognition accuracy.

High frequency real time triggering and exposure time adjustment to the low light situations can be accommodated.

## Specifications

### Mechanical

Form Factor	PCI Express card
Format	Standard profile, half length, 4-lane PCI Express card
Cooling method	Air cooling, fan-cooled heatsink
Mounting	For insertion in a standard height, 4-lane or higher, PCI Express card slot
Connectors	<ul style="list-style-type: none"><li>• 'A', 'B', 'C', 'D' on bracket:<ul style="list-style-type: none"><li>– 4x DIN 1.0/2.3 female connectors</li><li>– CoaXpress host interface</li></ul></li><li>• 'DA', 'DB', 'DC', 'DD' on bracket:<ul style="list-style-type: none"><li>– 4x DIN 1.0/2.3 female connectors</li><li>– CoaXpress data forwarding interface</li></ul></li><li>• 'INTERNAL I/O 2' 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>• '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</li></ul></li><li>• 'C2C LINK' on module:<ul style="list-style-type: none"><li>– 6-pin 2-row 0.1-in header</li><li>– Card to card link</li></ul></li></ul>
Lamp indicators	<ul style="list-style-type: none"><li>• 'A', 'B', 'C', 'D' on bracket:<ul style="list-style-type: none"><li>– 4x bi-color red/green LEDs</li><li>– CoaXpress Host connector indicator lamps</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 lamp</li></ul></li><li>• 'BOARD STATUS LAMP' on PCB:<ul style="list-style-type: none"><li>– Bi-color red/green LED</li></ul></li></ul>
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>
Dimensions	L 167.65 mm x H 111.15 mm L 6.6 in x H 4.38 in

### 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. TBD W (TBD W @ +3.3V, TBD W @ +12V), excluding camera and I/O power output

## Camera / video inputs

Interface standard(s)	CoaXPress 1.0 and 1.1
Connectors	4x DIN1.0/2.3 CXP-6
Status LEDs	1 CoaXPress Host connection status per connector
Number of cameras	<ul style="list-style-type: none"><li>• One 1- or 2- or 4-connection area-scan camera</li><li>• One 1- or 2- or 4-connection line-scan camera</li></ul>
Line-scan cameras supported	Yes
Maximum aggregated camera data transfer rate	25 Gbit/s (2,500 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), and 6.25 GT/s (CXP-6)
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>– 17 W of 24V DC regulated power per CoaXPress connector</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><li>• Line-scan cameras:<ul style="list-style-type: none"><li>– Gray-scale and color RGB</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></ul>

## Area-scan camera control

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>

## Line-scan camera control

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Scan/page trigger	<ul style="list-style-type: none"><li>• Precise control of start-of-scan and end-of-scan triggers.</li><li>• Support of external hardware trigger, with optional delay.</li><li>• Support of infinite acquisition, without missing line, for web inspection applications.</li></ul>
Line trigger	<ul style="list-style-type: none"><li>• Support for quadrature motion encoders, with programmable noise filters, selection of acquisition direction and backward motion compensation.</li><li>• Rate Converter tool for fine control of the pixel aspect ratio: Rate Conversion Ratio in the range 0.001 to 1000 with an accuracy better than 0.1%.</li><li>• Rate Divider tool</li></ul>
Line strobe	<ul style="list-style-type: none"><li>• Accurate control of the strobe position for strobed light sources.</li></ul>

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## On-board processing

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On-board memory	1 GB
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>
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>
Event signaling and counting	<ul style="list-style-type: none"><li>• The application software can be notified of the occurrence of various events:<ul style="list-style-type: none"><li>– Standard event: the EVENT_NEW_BUFFER event notifies the application on newly filled buffers</li><li>– A large set of custom events</li></ul></li><li>• Custom events sources:<ul style="list-style-type: none"><li>– I/O Toolbox events</li><li>– Camera and Illumination control events</li><li>– CoaXPress data stream events</li><li>– CoaXPress host interface events</li></ul></li><li>• Each custom event is associated with a 32-bit counter that counts the number of occurrences</li><li>• The last 3 32-bit context data words of the event context data can be configured with event-specific context data:<ul style="list-style-type: none"><li>– Event-specific data</li><li>– State of all System I/O lines sampled at the event occurrence time</li><li>– Count value of any event counter</li></ul></li></ul>

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## General Purpose Inputs and Outputs

Number of lines	<ul style="list-style-type: none"><li>• 10 I/O lines:<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></li><li>• 1 additional set of 10 I/O lines with ***TBD*** accessory.</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	<p>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.</p> <ul style="list-style-type: none"><li>• Line Input tool (LIN): Edge detector delivering events on rising or falling edges of any selected input line.</li><li>• Quadrature Decoder tool (QDC): A composite tool including:<ul style="list-style-type: none"><li>– A quadrature edge detector delivering events on selected transitions of selected pairs of input lines.</li><li>– An optional backward motion compensator for clean line-scan image acquisition when the motion is unstable.</li><li>– A 32-bit up/down counter for delivering a position value.</li></ul></li><li>• Divider tool (DIV): to generate an event every nth input events from any I/O toolbox event source.</li><li>• Multiplier/divider tool (MDV): to generate m events every d input events from any I/O toolbox event source.</li><li>• 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).</li></ul>
I/O Toolbox composition	<p>Firmware-dependent I/O toolbox composition:</p> <ul style="list-style-type: none"><li>• 1-camera: 8 LIN, 1 QDC, 1 DIV, 1 MDV, 2 DEL</li><li>• 1-line-scan: 8 LIN, 1 QDC, 1 DIV, 1 MDV, 2 DEL</li></ul>
<b>C2C Link</b>	
Specification	<ul style="list-style-type: none"><li>• Inter-Coaxlink communication link to synchronize image acquisition between cards</li><li>• Synchronization of area-scan acquisition with advanced flow control</li></ul>

## Software

Host PC Operating System	<ul style="list-style-type: none"><li>• Microsoft Windows 10, 8.1, 8, 7</li><li>• Linux Kernel version 3.13, compatible with a wide range of distributions, tested with Ubuntu 14.04</li><li>• 32- and 64-bit versions</li></ul>
APIs	EGrabber class, with C++ and .NET APIs: <ul style="list-style-type: none"><li>• .NET assembly designed to be used with development environments compatible with .NET frameworks version 2.0 or higher</li></ul> GenICam GenTL producer libraries compatible with C/C++ compilers: <ul style="list-style-type: none"><li>• x86 dynamic library designed to be used with ISO-compliant C/C++ compilers for the development of x86 applications</li><li>• x86_64 dynamic library designed to be used with ISO-compliant C/C++ compilers for the development of x86_64 applications</li></ul>
Memento	Compatible with Memento Event Logging tool, version 4.0 and later

## Environmental conditions

Operating ambient air temperature	0 to +50 °C / +32 to +122 °F
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

## Certifications

Electromagnetic - EMC standards	<ul style="list-style-type: none"><li>• The European Council EMC Directive 2004/108/EC</li><li>• The Unites States FCC rule 47 CFR 15</li></ul>
EMC - Emission	<ul style="list-style-type: none"><li>• EN 55022:2010 Class B</li><li>• FCC 47 Part 15 Class B</li></ul>
Flammability	PCB compliant with UL 94 V-0
RoHS	Compliant with the European Union Directive 2011/65/EU (ROHS2)
REACH	Compliant with the European Union Regulation No 1907/2006
WEEE	Must be disposed of separately from normal household waste and must be recycled according to local regulations

## Ordering Information

Product code - Description	1635 - Coaxlink Quad G3 DF
Optional accessories	1625 - I/O Cable for Grablink DualBase and Coaxlink



## AMERICA

### **Euresys Inc.**

27126-B Paseo Espada  
Suite 704  
San Juan Capistrano , CA 92675  
United States  
Phone : +1 949 743 0612  
Mail : sales.americas@euresys.com

## EMEA

### **Euresys SA**

Liège Science Park  
Avenue du Pré-Aily, 14  
4031 Angleur  
Belgium  
Phone : +32 4 367 72 88  
Mail : sales.europe@euresys.com

## ASIA

### **Euresys Pte. Ltd.**

750A Chai Chee Road  
#07-15 Viva Business Park  
Singapore 469001  
Singapore  
Phone : +65 6445 4800  
Mail : sales.asia@euresys.com  
sales.japan@euresys.com

## CHINA

### **Euresys Shanghai Liaison Office**

3/F, 379 Baotun Road  
Huangpu District  
200011 Shanghai  
China  
Euresys上海联络处  
上海市黄浦区保屯路379号3楼  
200011  
Phone : +86 13817814488  
Mail : sales.china@euresys.com

More at [www.euresys.com](http://www.euresys.com)



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