Coaxlink

Coaxlink 10.3.1

PCI EXPRESS™

Coa**X**Press

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Contents

1. Release Benefits

Coaxlink 10.3

Flat field correction

This release of Coaxlink adds a flat field correction - FFC - hardware pixel processing stage to specific firmware variants of 1633 Coaxlink Quad G3 and 3602 Coaxlink Octo.

This allows to compensate the differences of light sensitivity between the pixel sensors of a camera, the differences of illumination intensities in the field-of-view and the differences in the transmission of light through the lens.

FFC calibration wizard

This release of Coaxlink adds a sample application to help the calibration of the FFC.

The `ffc-wizard` sample application allows the user to easily compute the gain and the offset coefficients.

Improved firmware update and install operations

The firmware manager in this release of Coaxlink improves significantly the management of the Flash EEPROM for 1633 Coaxlink Quad G3, 1635 Coaxlink Quad G3 DF, 1637 Coaxlink Quad 3D-LLE and 3602 Coaxlink Octo.

The significant speed improvement (factor 2 or 4 among cases) facilitates the firmware install or update operations.

Relaxed image width constraints

This release of Coaxlink relaxes the constraints on the camera `Width` increment steps on 1633 Coaxlink Quad G3, 1635 Coaxlink Quad G3 DF and 3602 Coaxlink Octo .

The significant reduction (down to 2 pixels for some cases) offers more freedom to the selection of the image width.

2. Release Specification

2.1. Products & Accessories

Coaxlink Products

Product	S/N Prefix	Icon
1629 Coaxlink Duo PCIe/104-EMB	KDI	Duo104EMB
1630 Coaxlink Mono	KMO	Mono
1631 Coaxlink Duo	KDU	Duo
1632 Coaxlink Quad	KQU	Quad
1633 Coaxlink Quad G3	KQG	QuadG3
1634 Coaxlink Duo PCIe/104-MIL	KDR	Duo104MIL
1635 Coaxlink Quad G3 DF	KDF	QuadG3DF
1637 Coaxlink Quad 3D-LLE	KQE	Quad3DLLE
1638 Coaxlink Quad CXP-3	KQL	QuadCXP3
3602 Coaxlink Octo	KOC	Octo
3603 Coaxlink Quad CXP-12	KQP	QuadCXP12

Related Accessories

Product	S/N Prefix	Icon
1625 DB25F I/O Adapter Cable		1625
1636 InterPC C2C-Link Adapter	KCC	1636
3300 HD26F I/O module for Coaxlink Duo PCIe/104		3300
3301 Thermal drain (Model 1) for Coaxlink Duo PCIe/104		3301
3302 DIN1.0/2.3 Coaxial cable for Coaxlink Duo PCIe/104		3302
3303 C2C-Link Ribbon Cable		3303
3304 HD26F I/O Adapter Cable		3304
3610 HD26F I/O Extension Module TTL-RS422	EMA	3610
3612 HD26F I/O Extension Module TTL-CMOS5V-RS422	EMC	3612
3613 JTAG Adapter Xilinx for Coaxlink	AXC	3613

Note: *The S/N prefix is a 3-letter string at the beginning of the card serial number.*

Note: *Icons are used in this document for tagging titles of card-specific content.*

2.2. Firmware Variants per Product

1630 Coaxlink Mono

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1-connection area-scan camera	1D1	512 MB	LUT

1631 Coaxlink Duo

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2-connection area-scan camera	1D2	1 GB	LUT
2-camera	One or two 1-connection area-scan cameras	2D11	512 MB	LUT
1-camera, line-scan	One 1- or 2-connection line-scan camera	1D2	1 GB	LUT
2-camera, line-scan	One or two 1-connection line-scan cameras	2D11	512 MB	LUT

1632 Coaxlink Quad

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2- or 4-connection area-scan camera	1D4	1 GB	LUT
2-camera	One or two 1- or 2-connection area-scan cameras	2D22	512 MB	LUT
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	1D4	1 GB	LUT

1633 Coaxlink Quad G3

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2- or 4-connection area-scan camera, 1 data-stream	1D4	1 GB	LUT CFA
			512 MB	FFC LUT CFA
1-camera, 4-data-stream	One 1- or 2- or 4-connection area-scan camera, up to 4 data streams	1D4S4	256 MB	-
2-camera	One or two 1- or 2-connection area-scan cameras	2D22	512 MB	LUT
4-camera	One or two or three or four 1-connection area-scan cameras	4D1	256 MB	LUT
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	1D4	1 GB	LUT
2-camera, line-scan	One or two 1- or 2-connection line-scan cameras	2D22	512 MB	LUT
4-camera, line-scan	One or two or three or four 1-connection line-scan cameras	4D1111	256 MB	LUT
1-slm-camera	Master 4-connection sub-link of an 8-connection area-scan camera	1D8SL4	1 GB	LUT
1-sls-camera	Slave 4-connection sub-link of an 8-connection area-scan camera	1D8SL4	1 GB	LUT

1629 Coaxlink Duo PCIe/104-EMB, 1634 Coaxlink Duo PCIe/104-MIL

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2-connection area-scan camera	1D2	512 MB	LUT
2-camera	One or two 1-connection area-scan cameras	2D11	256 MB	LUT
1-camera, line-scan	One 1- or 2-connection line-scan camera	1D2	256 MB	LUT

1635 Coaxlink Quad G3 DF

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2- or 4-connection area-scan camera	1D4	1 GB	LUT CFA
1-df-camera	One 1- or 2- or 4-connection area-scan data-forwarded-camera	1DF4	1 GB	LUT CFA
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	1D4	1 GB	LUT
1-df-camera, line-scan	One 1- or 2- or 4-connection line-scan data-forwarded-camera	1DF4	1 GB	LUT

1637 Coaxlink Quad 3D-LLE

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2- or 4-connection area-scan camera	1D4	1 GB	LLE

1638 Coaxlink Quad CXP-3

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
4-camera	One or two or three or four 1-connection area-scan cameras	4D1111	128 MB	-

3602 Coaxlink Octo

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2- or 4- or 8-connection area-scan camera	1D8	2 GB	LUT CFA
2-camera	One or two 1- or 2- or 4-connection area-scan cameras	2D44	1 GB	LUT CFA
			512 MB	FFC LUT CFA
4-camera	One or two or three or four 1- or 2-connection area-scan cameras	4D2222	512 MB	LUT
5-camera	One 1- or 2- or 4-connection area-scan camera and one or two or three or four 1-connection area-scan cameras	5D41111	1GB 256 MB	LUT
8-camera	Up to eight 1-connection area-scan cameras	8D11111111	256 MB	LUT
1-camera, line-scan	One 1- or 2- or 4- or 8-connection line-scan camera	1D8	2 GB	LUT
2-camera, line-scan	One or two 1- or 2- or 4-connection line-scan cameras	2D44	1 GB	LUT

3603 Coaxlink Quad CXP-12

Note: *Release 10.3.1 provides only the 1-camera firmware variant of 3603 Coaxlink Quad CXP-12. Please contact us if you need one of the missing firmware variants.*

Firmware Variant	Description	Host Connections Map	Stream Buffer Size	Advanced Processing
1-camera	One 1- or 2- or 4-connection area-scan camera, 1 data-stream	1D4	2 GB	LUT CFA
2-camera	One or two 1- or 2-connection area-scan cameras	2D22	1 GB	LUT CFA
4-camera	One or two or three or four 1-connection area-scan cameras	4D1	512 MB	LUT
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	1D4	2 GB	LUT
2-camera, line-scan	One or two 1- or 2-connection line-scan cameras	2D22	1 GB	LUT
4-camera, line-scan	One or two or three or four 1-connection line-scan cameras	4D1111	512 MB	LUT

2.3. CoaXPress Standard Compliance

Coaxlink products together with Coaxlink driver version 5.0 or higher complies with the following versions of the CoaXPress standard:

- CoaXPress Standard 1.0
- CoaXPress Standard 1.1
- CoaXPress Standard 1.1.1 (Partially)
- CoaXPress Standard 2.0 (Partially)

The following deviations to the CoaXPress standards apply:

- **For all versions:** Restrictions to the camera connection schemes. Refer to "Device to Host Connection Maps" on page 35.

- **For version 1.1.1 only:** Partial implementation of the 1.1.1 discovery. Refer to: "CoaXPress 1.1.1 Discovery" on page 34

2.4. Supported Operating Systems

Windows

The Coaxlink driver is designed to support all Windows versions from 7 to 10, including the server versions, on x86 (32-bit) and x86_64 (64-bit) platforms.

This release has been validated with the following Windows versions:

OS Name & Version	Platform	Notes
Microsoft Windows 7	x86 (32-bit)	Service Pack 1 with KB3033929 and KB2921916 updates
Microsoft Windows 8.1	x86 (32-bit)	-
Microsoft Windows 8.1	x86-64 (64-bit)	-
Microsoft Windows 10	x86-64 (64-bit)	Version 1709, a.k.a. Fall Creators Update

Note: *The Coaxlink driver for Windows 10 is signed by Microsoft.*

Note: *Power saving modes of the operating systems (StandBy, Sleep, Suspend...) are not supported.*

Linux

The Coaxlink driver is designed to be distribution-independent on x86, x86_64, and aarch64 platforms. It is expected to work with a wide range of distributions.

This release has been validated with the following distribution(s):

OS Name & Version	Platform	Notes
Linux CentOS 7	x86 (32-bit)	Kernel version 3.10
Linux Ubuntu 14.04	x86 (32-bit)	Kernel version 3.13
Linux Ubuntu 14.04	x86-64 (64-bit)	Kernel version 3.13
Linux Ubuntu 16.04 LTS	aarch64 (64-bit)	Kernel version 3.10.96-tegra
Linux Ubuntu 17.04	x86_64 (64-bit)	Kernel version 4.10
Linux Ubuntu 18.04.1 LTS	x86_64 (64-bit)	Kernel version 4.18.7

Note: *Power saving modes of the operating systems (StandBy, Sleep, Suspend...) are not supported.*

macOS

The Coaxlink driver is designed to support all macOS versions from version 10.12 on x86_64 (64-bit) platforms.

This release has been validated with the following version(s):

OS Name & Version	Platform	Notes
macOS 10.12.6	x86-64 (64-bit)	A.k.a. Sierra
macOS 10.13.4	x86-64 (64-bit)	A.k.a. High Sierra

Note: *The Coaxlink driver for macOS is signed by Euresys using a certificate that has been signed by Apple.*

Note: *Power saving modes of the operating systems (StandBy, Sleep, Suspend...) are not supported.*

2.5. Memento

Memento version 4.0 or later is required when using Coaxlink driver version 4.0 or later.

Memento version 9.5 is required to use the Memento Analyzer.

2.6. Software Tools

| Tool Name	Tool Description
Coaxlink Firmware Manager	Tool for installing or upgrading the firmware embedded on the Coaxlink cards.
GenICam Browser (64-bit)	64-bit version of the GUI tool giving access to all the GenICam features exposed by the GenTL Producer(s) in your system
GenICam Browser	32-bit version of the GenICam browser
GenTL Console (64-bit)	64-bit version of the command-line tool giving access to all the functions and commands exposed by the Euresys GenTL Producer
GenTL Console	32-bit version of the GenTL Console

3. Important Notices

Important notifications to be read before installing and/or using the product on your PC!

3.1. Firmware Version Requirements

Important: *It is **mandatory** to apply the Firmware Upgrade procedure prior to using this version of the driver.*

Note: *The Coaxlink driver checks the compatibility of the firmware installed on every Coaxlink card. For Coaxlink cards having an incompatible firmware, the GenTL driver exposes 0 (zero) Device and the GenICam browser displays a "Firmware too old" error message:*
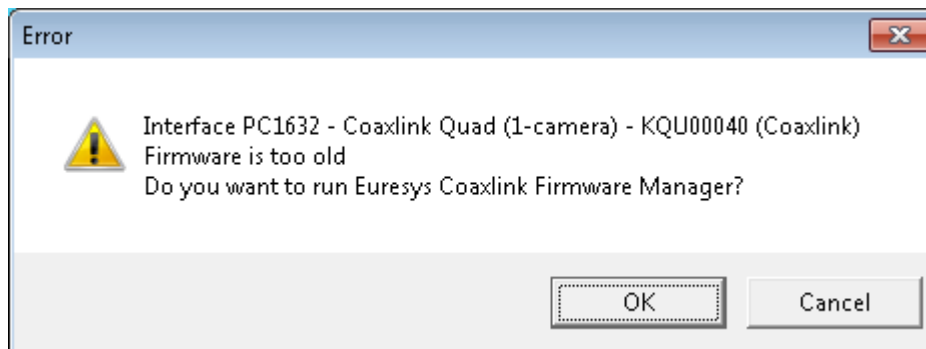
"Firmware too old" error message

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Product/Firmware Variant Combinations	Min. Firmware Version Number
All product/firmware variant combinations	258

3.2. CPU Requirements

The image converter requires a CPU that has the Supplemental Streaming SIMD Extension 3 (SSSE3) instruction set.

3.3. Driver Installation on macOS

Memento and Coaxlink Installers

This notice applies when installing Coaxlink or Memento Euresys drivers on macOS

After `Memento` and `Coaxlink` package files have been downloaded with **Safari**, the usual *double-click* to launch the installer will not let you install the package.

You shall use instead *control+click* and select *Open* to launch the installer. A window will pop up, click then on *Open* to proceed.

macOS High Sierra

This notice applies when installing Coaxlink or Memento Euresys drivers on macOS High Sierra

On macOS High Sierra, the user has to manually approve loading of third-party kernel extensions.

See https://developer.apple.com/library/content/technotes/tn2459/_index.html

The first time `Memento` and `Coaxlink` drivers are installed, their kernel extensions have to be approved.

A window about blocked extensions might pop up during the package installation.

Go to *Preferences → Security & Privacy* and ensure that **System software from developer "Euresys SA" was blocked from loading.** is not displayed. If so, click on `Allow`.

3.4. Driver Installation on Windows
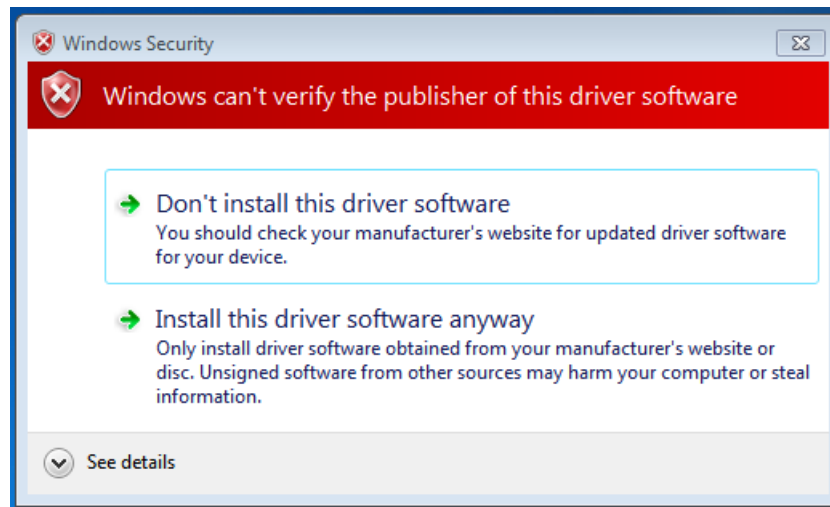
Windows Security warning at driver installation on Microsoft Windows when VeriSign Universal Root CA is missing

This warning occurs when the VeriSign Universal Root CA certificate is missing from the Windows certificate store, which can happen if the system is not connected to the Internet and thus does not receive root certificates updates.

This issue can be solved by installing this missing certificate, which is available in an archive that can be downloaded here, on the Symantec website.
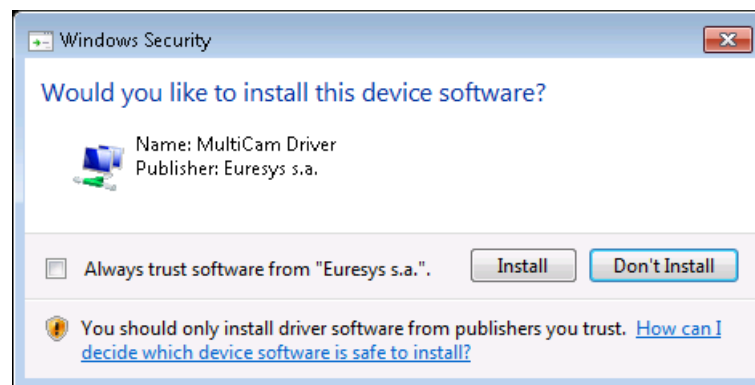
3.5. Driver Installation on Windows 7

Renewal of the "Code Signing For Microsoft Authenticode" certificate for Euresys drivers and SHA-256 support

Microsoft Windows 7 and Microsoft Windows Server 2008 R2 now require at least SP1 as well as some specific Windows updates in order to support SHA-256 certificates.

> **Important:** *The following Windows updates are required and must be installed before using Euresys drivers on Microsoft Windows 7 and Microsoft Windows Server 2008 R2:*

- KB3033929 (provides support for SHA-256 certificates which are required by Microsoft): without this one, a "Windows cannot verify the digital signature for the drivers required for this device" (code 52) error will prevent the Euresys drivers from loading.

- KB2921916: this hot-fix avoids the "Would you like to install this driver software?" dialog to pop up at each driver installation (see picture below), even if the user checked the "Always trust software from "Euresys s.a." check box

"Would you like to install this driver software?" pop-up message

# 3.6. Driver Installation on Windows Server 2016

Configuration requirements for installing Euresys drivers on Windows Server 2016

Notice Applicability

- Coaxlink driver since version 4.7

Notice

When installing Euresys drivers on a fresh install of Windows Server 2016, the UEFI Secure Boot feature must be disabled in BIOS so that the Euresys drivers can be loaded by Windows when Secure Boot is enabled.
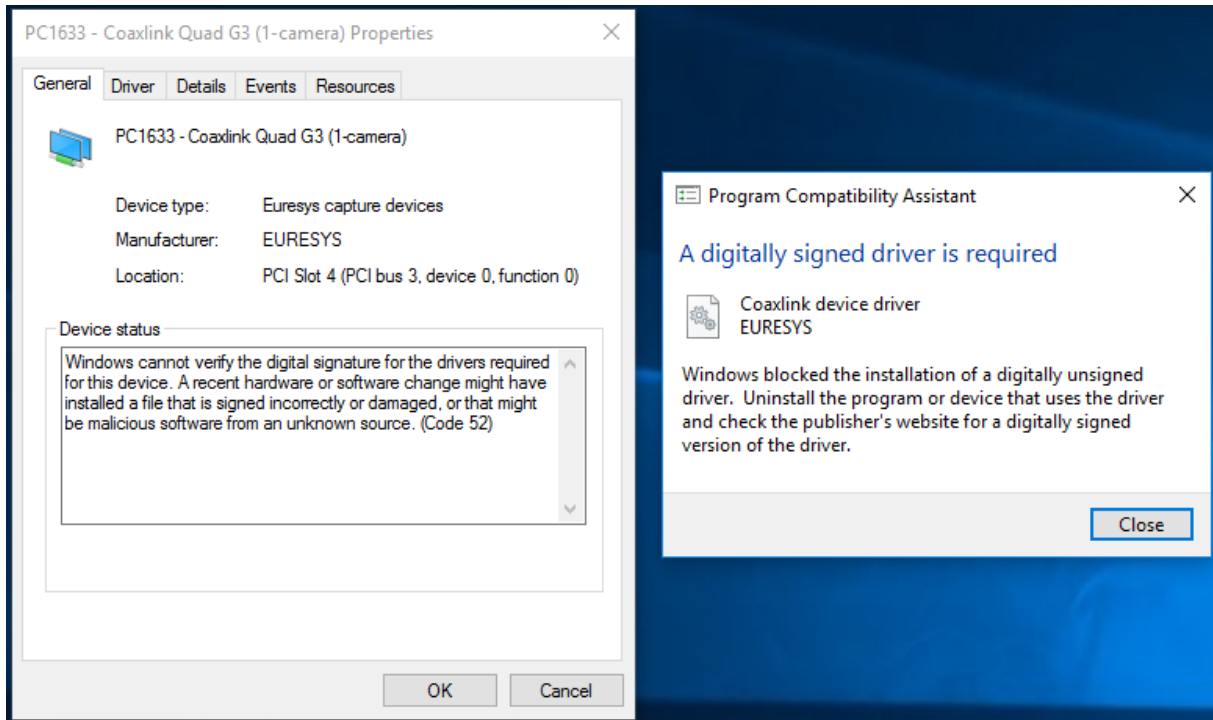
Device Manager error message

3.7. Flash EEPROM Change Note

Several Coaxlink products will undergo a hardware change of the Flash EEPROM control logic.

> **Note:** *The Flash EEPROM is the memory that stores the contents of the Coaxlink's on-board FPGA.*

Affected Products List

Product	S/N Prefix	First Serial Number of New Cards
1629 Coaxlink Duo PCIe/104-EMB	KDI	10,000
1633 Coaxlink Quad G3	KQG	10,000
1633-LH Coaxlink Quad G3 LH	KQH	10,000
1634 Coaxlink Duo PCIe/104-MIL	KDR	10,000
1635 Coaxlink Quad G3 DF	KDF	10,000
1637 Coaxlink Quad 3D-LLE	KQE	10,000

Consequences

Existing applications using a Coaxlink driver prior to version 10.0.0 are required to use a new procedure to install or update the firmware on new boards.

The change has no impact for applications already using Coaxlink driver 10.0.0 or higher.

With the exception of the firmware update, the change has strictly no impact on the product functionality, performance and specifications:

- The hardware design of these new cards, including the CoaXPress interface, PCI Express interface, the FPGA and the I/O, has not been changed.

- The functionality, performance and specification of the new cards is guaranteed to remain unchanged. Once programmed with the corresponding firmware, the new cards remain compatible with all previous versions of the Coaxlink driver.

For further information, refer to the D207EN-Flash EEPROM Change Note PDF document.

4. Release Details

4.1. Added/Improved Features

Coaxlink 10.3

GenICam XML

Reading XML file location 4 bytes at time
Improved handling of cameras that require the XML file location to be read 4 bytes at a time.

This fulfills the following notification in the section 11.2.2 of the CoaXPress 1.1.1 specification: *"The Host does not know the length of the string, so it must read it 4 bytes at a time until it sees the NULL terminator."*

Data Stream Module

PFNC pixel formats
Added more pixel formats to `PixelFormat` of data stream module.

☐ The standard Bayer 14-bit formats supersede Custom ones.

Note: *All PFNC pixel formats defined in the GenICam PFNC.h file published on 2018-11-12 are included.*

Note: *The obsolete custom Bayer 14-bit formats are still available with the prefix Custom.*

GenICam Browser

Enumeration entry description
Show enumeration entry description next to value also for read-only values.

Pixel Processing

Flat Field Correction
Added a hardware flat field correction pixel processing stage to:

☐ the 1-camera firmware variant of 1633 Coaxlink Quad G3

☐ the 2-camera firmware variant of 3602 Coaxlink Octo

The flat field correction - FFC - applies gain and offset coefficients to each pixel of the captured image.

The FFC stage is inserted before the LUT processing and the BAYER CFA decoder stages in the hardware pixel processing.

For more information, refer to Flat Field Correction in the Functional Guide.

GenICam Features

Data Stream Module
Added features `FfcCoefficientPartitionBase`, `FfcCoefficientPartitionSize`, `FfcControl`, `FfcBypass`, `FfcCoefficientsValid` in the new category `FlatFieldCorrection`.
Added feature `PixelComponentCount`
Added `Width.Inc` (increment of feature `Width`) This increment takes into account the pixel format and the Coaxlink firmware line pitch constraints.
For more information, refer to Width Increment Step in the Functional Guide.

CoaXPress Host Interface

DataStream Specification
Added the Width Increment Step specification in the Functional Guide
For 1633 Coaxlink Quad G3 , 1635 Coaxlink Quad G3 DF and 3602 Coaxlink Octo, reduce the width increment step: ☐ to 4 pixels for all 8-bit formats, ☐ to 2 pixels for all 10-, 12-, 14- and 16-bit formats, **Warning:** *This improvement is not available when the hardware Bayer CFA decoder is enabled.* **Note:** *When the `Width`increment is not compatible with the current `Width` value, getting the value of `Width` raises an error. Because the `Width` value is required to compute the payload size, the `PayloadSize` cannot be evaluated and buffers cannot be allocated & announced!*

EGrabber Sample Programs

EGrabber Sample Programs
Added C++ `ffc-wizard` sample application (`samples/cpp/ffcWizard`) with documentation.
Improved "640-mitsubishi-kd6r807cx" sample program
Improved "660-phantom" sample program
Added C# "egrabber-wpf" sample

GenAPI

FFC Support
Added action `load-ffc` to load flat field correction coefficients.
Added `coaxlink://ffc/load.js` to help load flat field correction coefficients from Euresys configuration script.

Firmware Management

Firmware Update/Install and Firmware Install
Increased the speed of firmware update/install operations by a factor 2 on 1633 Coaxlink Quad G3, 1635 Coaxlink Quad G3 DF and 1637 Coaxlink Quad 3D-LLE cards with serial number above 10,000.
Increased the speed of firmware update/install operations by a factor 4 for 3602 Coaxlink Octo

4.2. Solved Issues

Coaxlink 10.3

Features treated as not available in GenICam Browser

Fixed an issue that caused certain features to be wrongly treated as not available.

This issue affected Integer features making references to Float features for which no Increment value was defined. This issue was present in Coaxlink Driver version 9.2 onwards.

Windows installer

Wait for the completion of the uninstallation of a previously installed package when upgrading Coaxlink Windows driver package.

GenAPI Scripts

Fixed a race condition that could lead to a deadlock under certain circumstances.

EGrabber Sample Programs

Fixed "501-all-grabbers-cuda-process" sample program

DelayToolDelayValue.Min is set to 0

Previously, the **Min** property of the **DelayToolDelayValue** was incorrectly set to **0** allowing the application to set **DelayToolDelayValue** to a value out of the operating range of the Delay Tool, leading to undefined behavior such as dropping events.

The Min property of the **DelayToolDelayValue** is:

- **5** when **DelayToolClockSource** is **TIME8NS**
- **1** in other cases.

4.3. Breaking Changes

Changes in the API that are not backward compatible.

Since Coaxlink 10.3

PayLoadSize Behavior

The feature `PayloadSize` is not available anymore when the remote device `Width` is not in line with the data stream `Width.Inc`

Since Coaxlink 10.2

Additional constructor parameter required

The grabber classes (based on EGrabber) instanciated by EGrabbers require the additional constructor parameter (`bool remoteRequired`), please refer to sample "**213-egrabbers**" for details

Since Coaxlink 10

Deprecated functions from namespace `Euresys`

Deprecated the functions `Features`, `RegexFeatures`, `GlobFeatures`, `EnumEntries`, `RegexEnumEntries`, `GlobEnumEntries` from namespace `Euresys`, which are still available by #defining `EURESYS_USE_NS_EURESYS_DEPRECATED_API`.

Two options to fix user code:

- **Recommended change** Replace all occurrences of:
  - □ `Euresys::Features()` by `Euresys::query::features()`
  - □ `Euresys::RegexFeatures(re)` by `Euresys::query::features().regex(re)`
  - □ `Euresys::GlobFeatures(g)` by `Euresys::query::features().glob(g)`
  - □ `Euresys::EnumEntries(f)` by `Euresys::query::enumEntries(f)`
  - □ `Euresys::RegexEnumEntries(f,re)` by `Euresys::query::enumEntries(f).regex(re)`
  - □ `Euresys::GlobEnumEntries(f,g)` by `Euresys::query::enumEntries(f).glob(g)`

1. Or add `#define EURESYS_USE_NS_EURESYS_DEPRECATED_API` before `#include <EGrabber.h>` (or `#include <EGenTL.h>`), a quick fix that doesn't require changing source code.

Since Coaxlink 9.3.1

Removed data stream event counts from the list of possible contexts of device event notifications

Removed data stream event counts from the list of possible contexts of device event notifications.

`StartOfCameraReadoutEventCount`, `EndOfCameraReadoutEventCount`, `StartOfScanEventCount`, `EndOfScanEventCount`, `RejectedFrameEventCount`, and `RejectedScanEventCount` are no longer valid values for `EventNotificationContext1`, `EventNotificationContext2`, and `EventNotificationContext3` in the device module.

Since Coaxlink 9.3

Reset of StartOfScanTriggerSource, EndOfScanTriggerSource and ScanLength features

Data stream features `StartOfScanTriggerSource`, `EndOfScanTriggerSource` and `ScanLength` are now reset by the data stream feature `StreamReset`. Previously, they were reset by the device feature `DeviceReset`.

Since Coaxlink 9.2

GenAPI Features Range Checking

Range checking will prevent applications from setting forbidden values to camera features. A meaningful error will be reported if such an event should happen.

Since Coaxlink 9.1.1

Camera Model - Exposure Time Range Boundaries

When `ExposureTimeMin` and/or `ExposureTimeMax` are/is set, the order in which the features `ExposureTimeMin`, `ExposureTimeMax` and `ExposureTime` are set is imposed by the constraints.

Since Coaxlink 7.1.1

GenTL 1.5 Header File

Moved to standard GenTL 1.5 header file (was previously GenTL 1.4):

- GenTL 1.5 changed namespace from `GenICam::Client` to `GenTL`,

- Coaxlink custom GenTL definitions have been moved accordingly from the namespace `GenICam::Client::Euresys` to namespace `GenTL::EuresysCustomGenTL`,

- replaced header file `GenTL_v1_4.h` by `GenTL_v1_5.h`,

- replaced header file `GenTL_v1_4_EuresysCustom.h` by `GenTL_v1_5_EuresysCustom.h`.

Euresys::GenTL Class Renaming

Renamed the class `Euresys::GenTL` into `Euresys::EGenTL` to avoid name conflicts with the new standard GenTL 1.5 namespace `GenTL`. This will impact any code using the class `Euresys::GenTL`:

- renamed header file `EuresysGenTL.h` into `EGenTL.h`,

- renamed header file `EuresysGenTLErrors.h` into `EGenTLErrors.h`,

- `Euresys::EGenTL` is now declared in header file `EGenTL.h`.

Deprecated Euresys::SharedGenTL Class

Deprecated the class `Euresys::SharedGenTL`, which is still available by defining `EURESYS_USE_SHAREDGENTL_DEPRECATED_API`.

Two options to fix user code:

- **Recommended change** Replace all occurrences of `Euresys::SharedGenTL` by `Euresys::EGenTL`,

- Or add `#define EURESYS_USE_SHAREDGENTL_DEPRECATED_API` before `#include <EGrabber.h>`, a quick fix that doesn't require changing source code.

GenTL 1.5 Changes

Announcing or revoking buffers while acquiring returns the error code `GC_ERR_BUSY` (was `GC_ERR_RESOURCE_IN_USE` for GenTL 1.4)

Revoking a queued buffer returns the error code `GC_ERR_BUSY` (was `GC_ERR_RESOURCE_IN_USE` for GenTL 1.4)

New device access status values (defined by GenTL 1.5) returned by the GenTL functions `IFGetDeviceInfo` and `DevGetInfo` for the command `DEVICE_INFO_ACCESS_STATUS`:

- `DEVICE_ACCESS_STATUS_OPEN_READWRITE`: when the device is opened by the current producer with read/write access

- `DEVICE_ACCESS_STATUS_OPEN_READONLY`: when the device is opened by the current producer with read-only access

Since Coaxlink 7.0.0

OemSafetyKey Length

The length of `ProgramOemSafetyKey` and `CheckOemSafetyKey` is now limited by a user-configurable `MaximumOemKeyLength` (4096 characters by default)

LUT Configuration Locking

LUT configuration features (datastream) are locked while grabbing.

CIC Features Availability

Features related to the CIC (device) are not available when `CameraControlMethod` is `NC` or `EXTERNAL`

Since Coaxlink 4.6.1

EGrabber API

Deprecated EGrabber method `announceBuffer` (superseded by `announceAndQueue`).

Two options to fix user code:

- **Recommended change** Replace all occurrences of `announceBuffer` by `announceAndQueue(GenTLMemory(...))` or `announceAndQueue(UserMemory(...))`,

- Or add `#define EURESYS_USE_EGRABBER_DEPRECATED_API` before `#include <EGrabber.h>`.

Since Coaxlink 4.5.1

Euresys Name Space for EGrabber Classes

EGrabber C++ classes now belong to `Euresys` namespace.

Two options to fix user code:

- **Recommended change** Replace each occurrence of `EGrabber` by `Euresys::EGrabber`,

- Or add `using namespace Euresys;` after `#include <EGrabber.h>`.

Since Coaxlink 4.4.1

EGrabber API

The API of `EGrabber` .NET classes have changed since Coaxlink 4.4.0 beta

`GenTL` class now behaves like `SharedGenTL`, which is what most users need

- The `GenTL` constructor accepts a new argument, named `shared`, which can be used to revert to the old behavior.

RGBConverter.h

Added `inplace1x2yeReordering` methods instead of `Inplace1x2yeReordering` class

- User code needs to be adapted to call `inplace1x2yeReordering` instead of creating an `Inplace1x2yeReordering` instance, please see `include/RGBConverter.h` for a code sample.

Since Coaxlink 4.4.0

.NET Assembly

Added new assembly exposing `EGrabber` classes, previous `CoaxlinkGrabber` classes are removed from the assembly.

EGrabber

Deprecated `getInfoString` methods (replaced by `getInfo`).

Two options to fix user code:

- **Recommended change** Replace all occurrences of `getInfoString<module>` (and `getBufferInfoString`) by `getInfo<module, std::string>` (and `getBufferInfo<std::string>`)

- Or add `#define EURESYS_USE_EGRABBER_DEPRECATED_API` before `#include <EGrabber.h>`.

GenTL C++ class

Deprecated `bayerConvert`

Though the function `bayerConvert` is superseded by the image converter, it is still possible to use it, if required please add `#define EURESYS_USE_BAYER_DEPRECATED_API` before `#include <EuresysGenTL.h>` or `#include <EGrabber.h>`

Since Coaxlink 4.3

Data Stream Module GenICam Feature

`UnpackingMode`: Changed default value to LSB (instead of MSB)

Since Coaxlink 4.1

Device Module Features

Merged `CycleTriggerSource` and `CycleHardwareTriggerSource` features.

Renamed `CycleSoftwareTrigger` into `StartCycle`.

Renamed `CyclePeriodTarget` into `CycleMinimumPeriod`.

Renamed `ErrorCounter` into `ErrorCount`.

Renamed `ErrorCounterReset` into `ErrorCountReset`.

Removed backward compatibility for deprecated features: `TriggerSource`, `TargetFramePeriod`, `ExposureRecovery`.

5. Development Tools

The Coaxlink driver is supplied as GenICam GenTL producer libraries (coaxlink.cti):

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

- An x86_64 dynamic library designed to be used with ISO-compliant C/C++ compilers for the development of x86_64 applications.

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

- A .NET assembly designed to be used with development environments compatible with .NET frameworks version 2.0 or higher.

The Coaxlink cards should be usable with any development tool that supports at least one of these interfaces.

6. Known Issues

6.1. Deviations from the CoaXPress specification

CoaXPress 1.1.1 Discovery

The **10.1.3 Discover Devices and Connection Topology** paragraph of the CoaXPress 1.1.1 standard claims:

"The Host shall read the `ConnectionConfigDefault` *register to find the number of expected connections. It shall then write to the* `ConnectionConfig` *register to enable the number of connections read from* `ConnectionConfigDefault`*. However it shall not change from the discovery rate at this stage."*

The **10.3.33 ConnectionConfig** paragraph of the CoaXPress 1.1.1 standard claims:

"This register shall hold a valid combination of the Device connection speed and number of active downconnections. Writing to this register shall set the connection speeds on the specified connections, and the high speed upconnection, if supported. If the new ConnectionConfig value results in a change of connection speed, the Device shall acknowledge the ConnectionConfig access at the original connection speed. Therefore it shall acknowledge the access before changing connection speed."

> **Note:** *Not all theoretical combinations of connection speed and number of connections may be usable. One register is used to ensure that the two variables are set simultaneously. The XML file and product documentation give valid combinations for the Device. A connection reset sets the value corresponding to the selected discovery rate and one connection.*

Considering that:

1. the above paragraphs disagree on the value that should be written to the `ConnectionConfig` register,

2. changing the behavior to respect CoaXPress 1.1.1 statements causes issues with some cameras,

the CoaXPress discovery procedure of the Coaxlink driver is not modified to comply with CoaXPress 1.1.1.

At the end of the discovery procedure, the Coaxlink driver sets the speed and the number of the connections of the CoaXPress Link according to the settings of `ConnectionConfigDefault` register of the camera.

Device to Host Connection Maps

The CoaXPress standard suggests that Devices (cameras or data forwarding devices) can be connected to the Host (frame grabber) using a free connection scheme.

Instead, the Host Interface of Coaxlink requires a specific assignment of the Device connections to the Host connectors. Such assignment is named **Host Connection Map**.

The Host Connection Map is hard-coded in the product/firmware variant. The Coaxlink product and firmware variant must be selected according to the required mapping!

Host Connection Map Naming Convention

The **Host Connection Map** or **HCMAP** designates how the connections of the Host Interface of a Coaxlink card are allocated to the Devices (cameras).

A Host Connection Map - HCMAP - is designated by an acronym using the following Euresys proprietary naming convention:

```
<dev#><dev-type>[<str#>S]{<con#>...<con#>}[<SL-con#>]
```

where:

- `<dev#>` declares the maximum number of Devices (cameras) that can be attached to the Host Interface.
    - `1` for a single-device Host interface
    - `2` for a 2-device Host interface
    - …
- `<dev-type>` declares the device type.
    - `D` for standard CoaXPress devices
    - `DF` for virtual devices used in the Data Forwarding schemes
- `<con#>` declares the number of connections available for each device. *This field is repeated once for each device.*
    - 1 for a single-connection device
    - 2 for 2-connection device
    - …
- `<str#>S` declares the maximum number of data streams allowed by a device.
    - This field is omitted when there is only 1 stream
    - 4S for a up to 4 data-streams per device
- `SL<-con#>` declares the number connections per sub-link.
    - *This field is omitted when there are no sub-links.*
   - `SL4` for a 4-connection sub-links

Examples

HCMAP **2D22** designates a Host Interface with 2 standard 1-data-stream CoaXPress Devices and 2 connections for each device.

HCMAP **1D4S4** designates a Host Interface with 1 standard CoaXPress Devices, up to 4 data streams, and 4 connections per device.
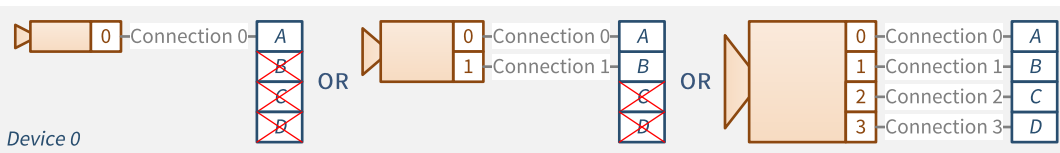
Standard CoaXPress Devices - One-camera Host Connection Maps (1D1, 1D2, 1D4, 1D8)
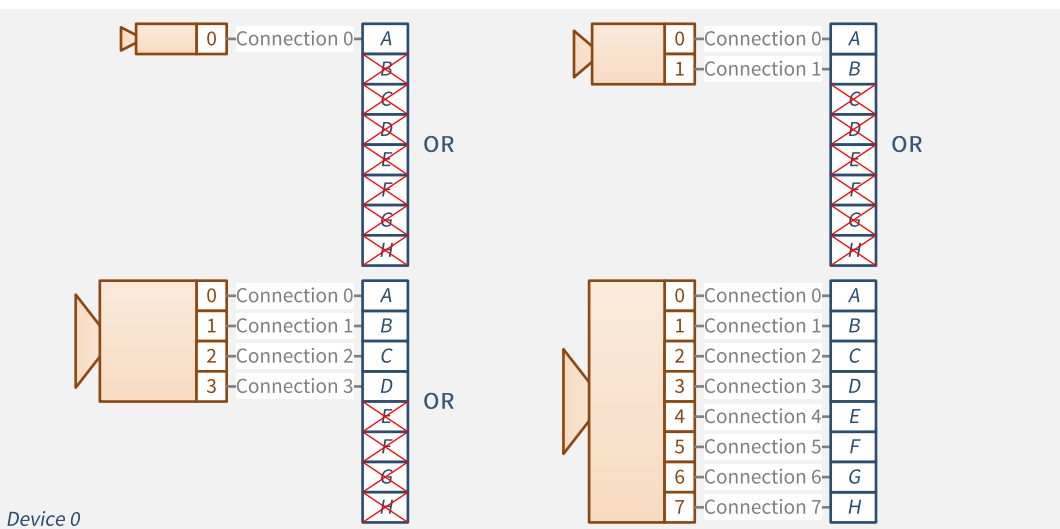

1D1 host connection map
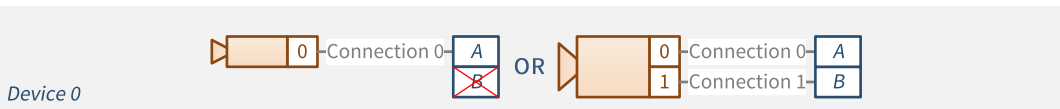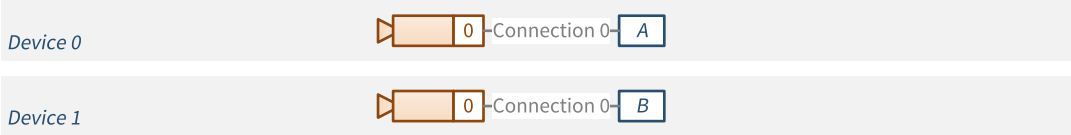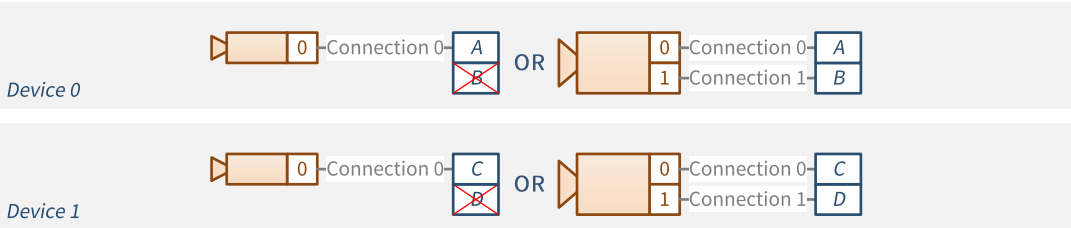

1D2 host connection map
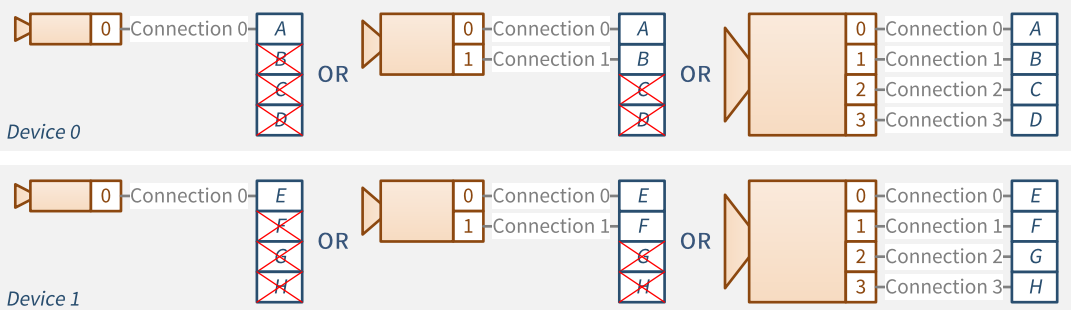

1D4 host connection map

1D8 host connection map

Standard CoaXPress Devices - Two-camera Host Connection Maps (2D11, 2D22, 2D44)
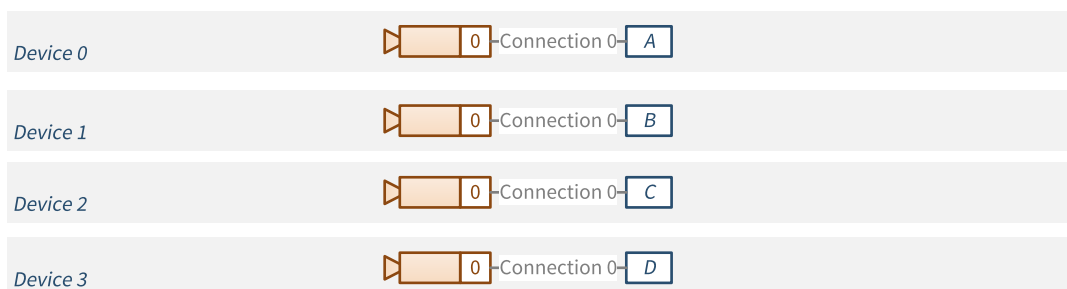

2D11 host connection map
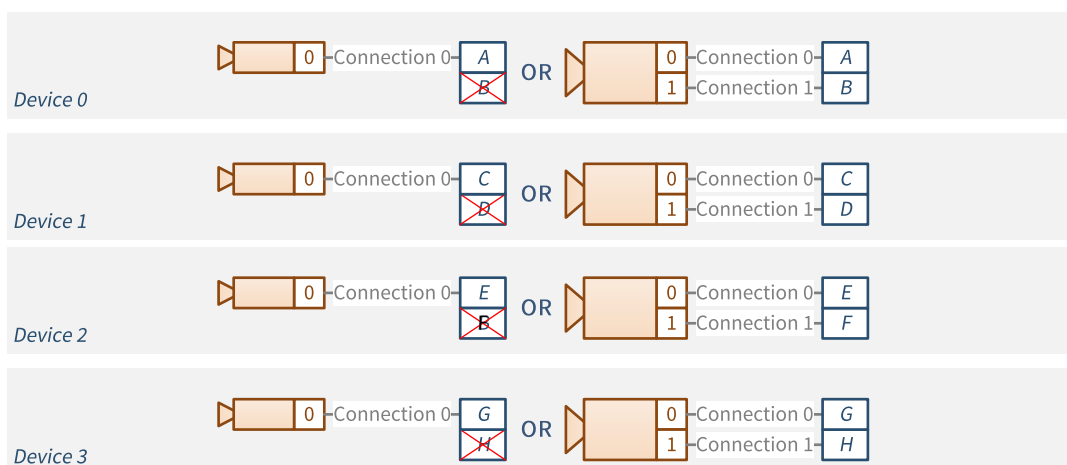

2D22 host connection map

2D44 host connection map

Standard CoaXPress Devices - Four-camera Host Connection Maps (4D1111, 4D2222)
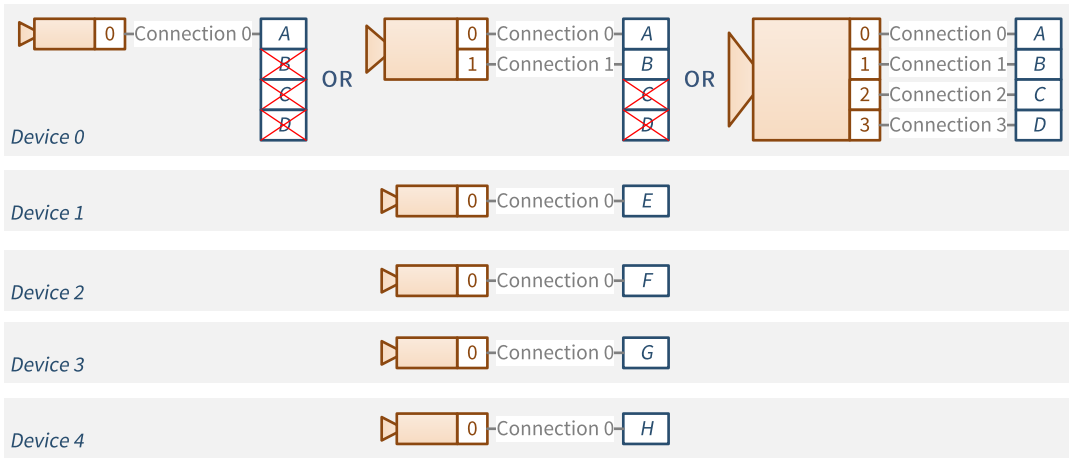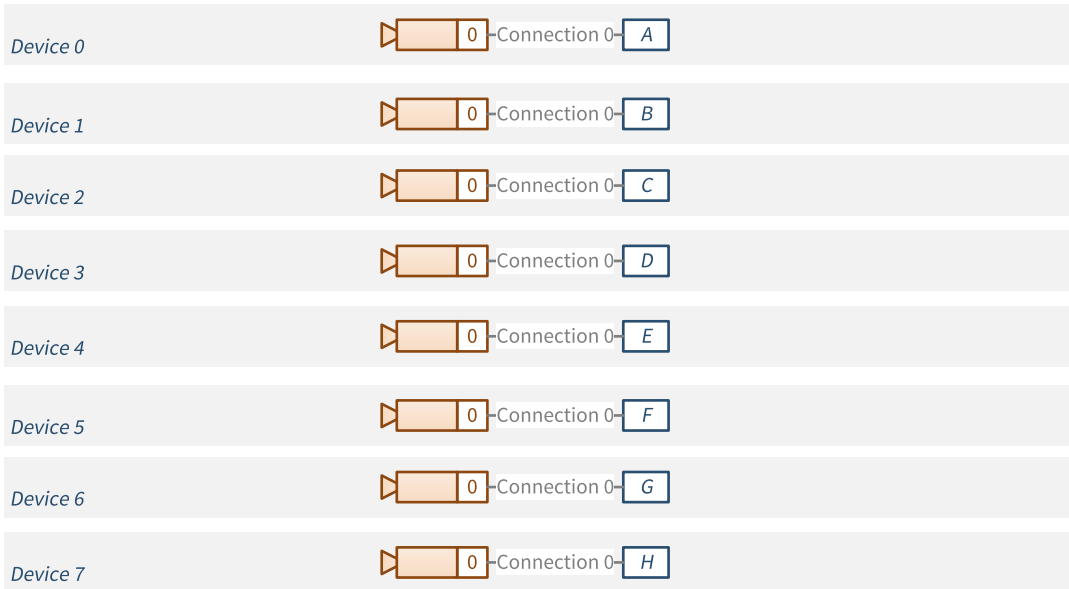

4D1111 host connection map

4D2222 host connection map

Standard CoaXPress Devices - Five- and Eight-camera Host Connection Maps (5D41111, 8D1111111)

5D41111 host connection map

8D11111111 host connection map

6.2. Deviations from the GenTL specification

EventKill

The GenTL specification states that:

- In case of multiple pending wait operations `EventKill` causes one wait operation to return with a `GC_ERR_ABORT` error code.

- This means that if more than one thread waits for an event, the `EventKill` function terminates only one wait operation and other threads will continue execution.

- Therefore in order to cancel all pending wait operations `EventKill` must be called as many times as wait operations are pending.

- In case this function is called while no wait operation was pending the next call to `EventGetData` will return a `GC_ERR_ABORT`.

This specification is nothing but the behavior description of a particular implementation based on a Windows auto-reset event.

This implementation is prone to race conditions: calling `EventKill` N times in a row to kill exactly N waiting threads is not guaranteed to work as expected because signaling an event that is already in the signaled state has no effect. In other words, some of the `EventKill` calls could have no effect.

`EventKill` as specified is not easy to use: How many `EventKill` calls are required? How many `EventGetData` calls should we expect to return `GC_ERR_ABORT`? Note that race conditions affect these questions.

The Euresys GenTL implementation solves these issues, but differs slightly:

- `EventKill` aborts all pending wait operations on the event handle.

- `EventKill` has no impact on subsequent wait operations.

DSStopAcquisition

The GenTL specification states that:

- Each call to `DSStartAcquisition` must be accompanied by a call to `DSStopAcquisition`.

- Argument `iNumToAcquire` passed to `DSStartAcquisition` sets the number of filled/delivered buffers after which the acquisition engine stops automatically.

- There must be a call to `DSStopAcquisition` accompanying each call to `DSStartAcquisition` even though the stream already stopped because the number of frames to acquire was reached.

- `DSStopAcquisition` returns `GC_ERR_RESOURCE_IN_USE` when the acquisition engine has already been terminated or has not been started.

The reasons for this behavior is not clear.

The Euresys GenTL implementation differs slightly:

- `DSStopAcquisition` will not return `GC_ERR_RESOURCE_IN_USE` if the data stream hasn't been started.

- `DSStopAcquisition` will not return `GC_ERR_RESOURCE_IN_USE` if the data stream has already been stopped by a prior call to `DSStopAcquisition`.

- `DSStopAcquisition` will not return `GC_ERR_RESOURCE_IN_USE` if the data stream has stopped automatically after `iNumToAcquire` images have been captured.

In other words, `DSStopAcquisition` is idempotent.

With the Euresys implementation, it is not necessary to treat some errors as normal, and race conditions (between `DSStopAcquisition` and the automatic stop of the data stream are avoided. Furthermore, if the data stream has stopped automatically after acquiring `iNumToAcquire` images, `DSStartAcquisition` can be called without first calling `DSStopAcquisition`.

6.3. Deviations from the PCIe 3.0 specification

Applies to: QuadG3 QuadG3DF

1633 Coaxlink Quad G3 and 1635 Coaxlink Quad G3 DF operate only at PCIe 2.0 and PCIe 3.0 link speeds.

These products cannot be used when inserted in PCIe revision 1.x slots.

6.4. Functional Limitations

`aarch64` ARM Processor Architecture

Image Converters

The image conversion functions for the `aarch64` ARM processor architecture don't use the ARM NEON general-purpose SIMD engine.

1638 Coaxlink Quad CXP-3

Applies to: QuadCXP3

Pixel Unpacking

1638 Coaxlink Quad CXP-3 doesn't allow to disable the pixel unpacking by setting **Unpacking** to **Off**. Both **Msb** and **Lsb** unpacking modes are supported.

10-bit, 12-bit and 14-bit pixels are always unpacked to 16-bit

Color Components Swap

1638 Coaxlink Quad CXP-3 doesn't allow to swap the red (first-) and the blue (last-) color component by setting **RedBlueSwap** to **True**.

4:2:2 Pixel formats

1638 Coaxlink Quad CXP-3 doesn't support YCbCr 4:2:2 and YUV 4:2:2 pixel formats.