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Excellence in vision

RELEASE NOTES

Coaxlink

Coaxlink Driver Version 9.0.0

PCI EXPRESS™

CoaXPress

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This documentation is provided with Coaxlink 9.0.0 (doc build 2017-06-20).
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Release Benefits

ADDED SUPPORT FOR 1637 COAXLINK QUAD 3D-LLE

This release adds the support of 1637 Coaxlink Quad 3D-LLE, a quad-connection CXP-6 CoaXPress frame grabber with on-board laser line extraction for 3D profiling.

It generates, in real-time and with zero host CPU usage, 16-bit 3D depth maps using one of the following algorithms: Maximum, Peak, Center of Gravity (COG).

Each second, it is capable of processing 19,000 profiles of from 1024 x 128 images or 38,000 profiles of from 1024 x 64 images.

A precision of 1/256 pixel can be reached with the Peak and the COG algorithms.

IMPROVED SUPPORT OF 4 AREA-SCAN CAMERAS

The I/O Toolbox toolkit of the `4-camera` firmware variant of 1633 Coaxlink Quad G3 has been expanded with 4 instances of the QDC, DIV, MDV and DEL tools. This enables independent triggering configurations for each camera.

Release Specification

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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
1635 Coaxlink Quad G3 DF	KDF	QuadG3DF
1637 Coaxlink Quad 3D-LLE	KQE	Quad3DLLE
1638 Coaxlink Quad CXP-3	KQL	QuadCXP3

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

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.

Firmware Variants per Product

1630 Coaxlink Mono

Firmware Variant	Description	Icon
1-camera	One 1-connection area-scan camera	

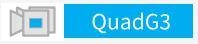
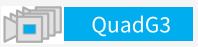
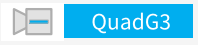
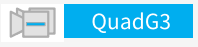
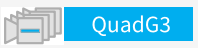
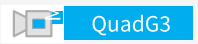
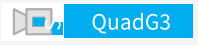
1631 Coaxlink Duo

Firmware Variant	Description	Icon
1-camera	One 1- or 2-connection area-scan camera	
2-camera	One or two 1-connection area-scan cameras	

1632 Coaxlink Quad

Firmware Variant	Description	Icon
1-camera	One 1- or 2- or 4-connection area-scan camera	
2-camera	One or two 1- or 2-connection area-scan cameras	
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	

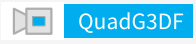
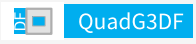
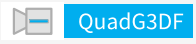
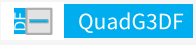
1633 Coaxlink Quad G3

Firmware Variant	Description	Icon
1-camera	One 1- or 2- or 4-connection area-scan camera	
2-camera	One or two 1- or 2-connection area-scan cameras	
4-camera	One or two or three or four 1-connection area-scan cameras	
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	
2-camera, line-scan	One or two 1- or 2-connection line-scan cameras	
4-camera, line-scan	One or two or three or four 1-connection line-scan cameras	
1-slm-camera	Master 4-connection sub-link of an 8-connection area-scan camera	
1-sls-camera	Slave 4-connection sub-link of an 8-connection area-scan camera	

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

Firmware Variant	Description	Icon
1-camera	One 1- or 2-connection area-scan camera	
2-camera	One or two 1-connection area-scan cameras	
1-camera, line-scan	One 1- or 2-connection line-scan camera	

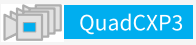
1635 Coaxlink Quad G3 DF

Firmware Variant	Description	Icon
1-camera	One 1- or 2- or 4-connection area-scan camera	
1-df-camera	One 1- or 2- or 4-connection area-scan data-forwarded-camera	
1-camera, line-scan	One 1- or 2- or 4-connection line-scan camera	
1-df-camera, line-scan	One 1- or 2- or 4-connection line-scan data-forwarded-camera	

1637 Coaxlink Quad 3D-LLE

Firmware Variant	Description	Icon
1-camera	One 1-connection area-scan camera	

1638 Coaxlink Quad CXP-3

Firmware Variant	Description	Icon
4-camera	One or two or three or four 1-connection area-scan cameras	

Supported Operating Systems

WINDOWS

OS Name & Version	Additional Information	
Microsoft Windows 7	x86 (32-bit)	Service Pack 1 with KB3033929 and KB2921916 updates
	x86-64 (64-bit)	
Microsoft Windows 8	x86 (32-bit)	-
	x86-64 (64-bit)	
Microsoft Windows 8.1	x86 (32-bit)	-
	x86-64 (64-bit)	
Microsoft Windows 10	x86 (32-bit)	-
	x86-64 (64-bit)	

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	Additional Information	
Linux CentOS 7	x86 (32-bit)	Kernel version 3.10
Linux Ubuntu 14.04	x86 (32-bit)	Kernel version 3.13
	x86-64 (64-bit)	
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

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.

Required Memento Versions

Memento Version 4.0 or later is required when using Coaxlink Driver version 4.0 or later.

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

Important Notices

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

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Firmware Update

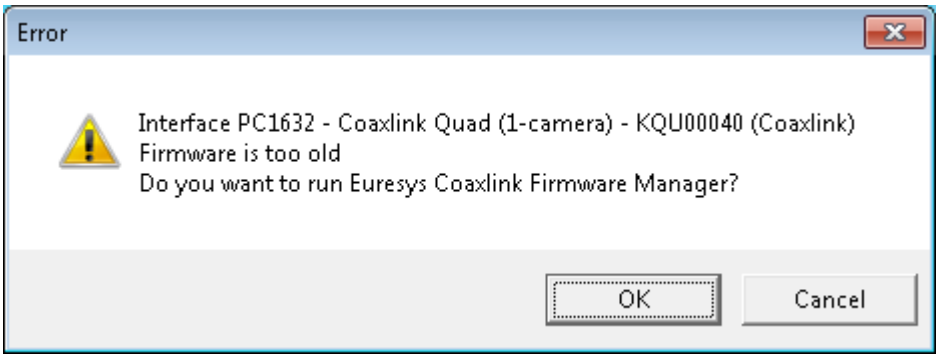
Product/Firmware Variant Combinations	Min. Firmware Version Number
1633 Coaxlink Quad G3 - 4-camera	222
1637 Coaxlink Quad 3D-LLE - 1-camera	221
1638 Coaxlink Quad CXP-3 - 4-camera	219
Other product/firmware variant combinations	217

It is **mandatory** to apply the firmware update procedure prior to using this version of the driver.

Note: The Coaxlink Driver checks the compatibility of the firmware installed on every Coaxlink card.

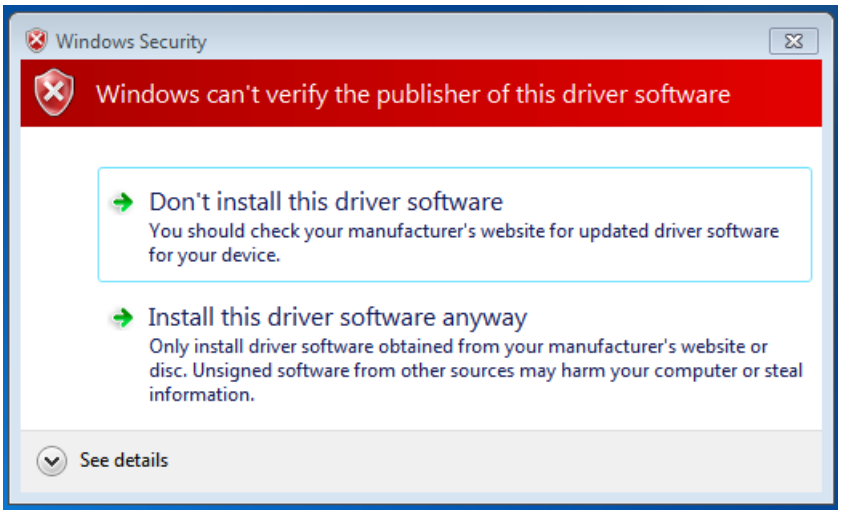
Note: For Coaxlink cards having an incompatible firmware, the GenTL driver exposes 0 (zero) Device and the GenICam browser displays an error message. In both cases, you are invited to run the Euresys Coaxlink Firmware Manager.

GenICam Browser - "Firmware too old" pop-up message



Driver Installation on Microsoft 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.

Driver Installation on Microsoft Windows 7

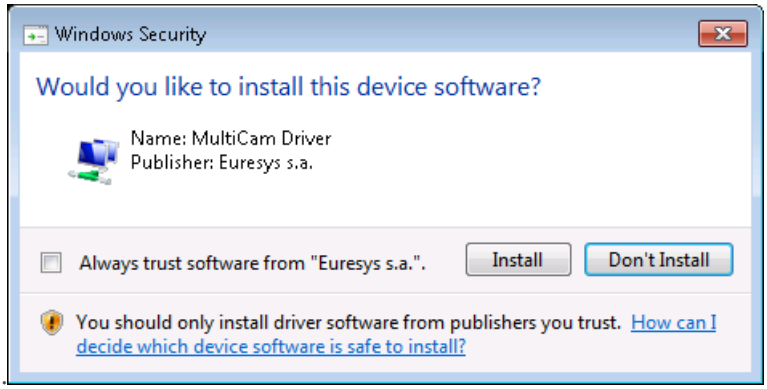
Renewal of the "Code Signing For Microsoft Authenticode" certificate for Euresys drivers and SHA-256 support

Since April 2016, Euresys drivers have been signed with a new SHA-256 code-signing certificate, which is required by Microsoft since January 2016 following its SHA-1 deprecation schedule.

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.

Caution: 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



Driver Installation on Microsoft Windows 10

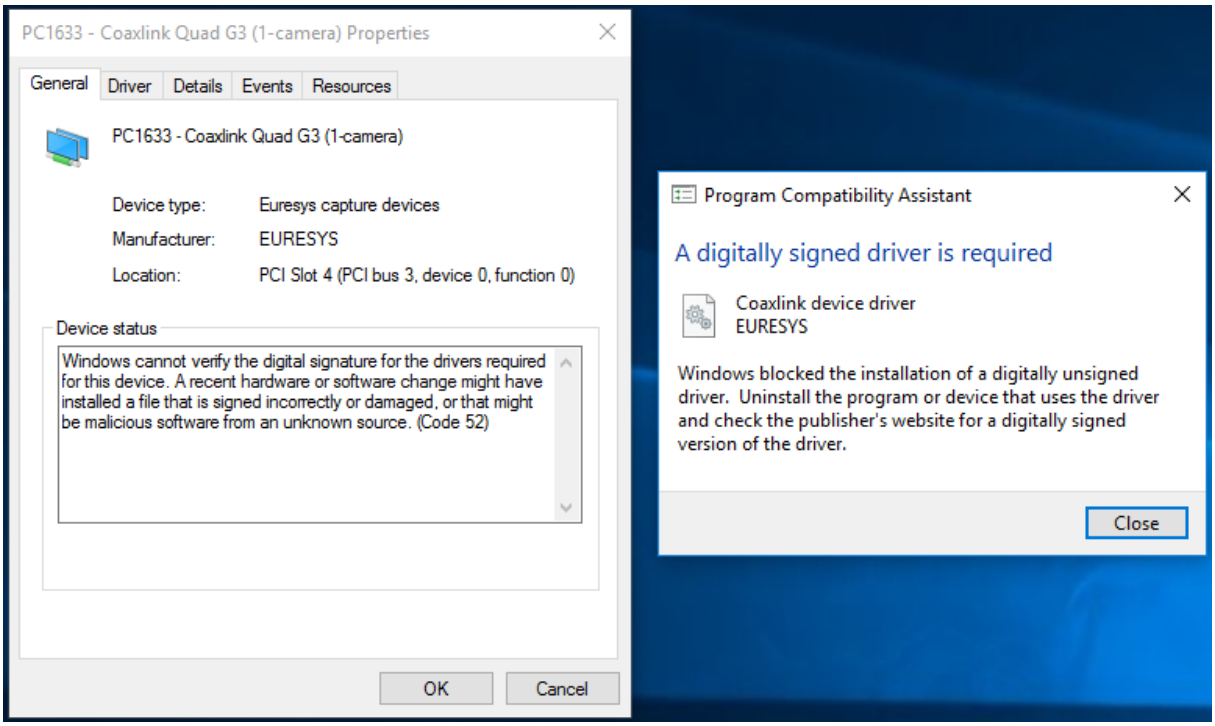
Configuration requirements for installing Euresys drivers on Windows 10 version 1607 (Anniversary Update)

This notice applies to the following Euresys drivers:

- Coaxlink Driver version 4.7 or later,
- Memento Driver version 4.7 or later,
- MultiCam Driver version 6.9.8 or later.

When installing Euresys drivers on a fresh install of Windows 10 version 1607 (Anniversary Update), 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.

The screenshot below shows the error that is displayed in the Device Manager:



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Added Product(s)

Product(s) and or accessories added in Coaxlink Driver 9.0.

COAXLINK DRIVER 9.0

Product Code & Denomination	Description
1637 Coaxlink Quad 3D-LLE	Quad CXP-6 frame grabber with on-board laser line extraction for 3D profiling

Added Firmware Variant(s)

Firmware variant(s) added since Coaxlink Driver 9.0

COAXLINK DRIVER 9.0

Target Product	Firmware Name	Description
1637 Coaxlink Quad 3D-LLE	1-camera	One 1- or 2- or 4-connection area-scan camera

Added/Improved Features

List and description of added or improved features since Coaxlink Driver version 9.0

COAXLINK 9.0

EGrabber

Buffer Management
Added EGrabber method `getBufferData`
Added EGrabber methods `queue(range)` and `resetBufferQueue(range)`

Buffer Management
Added support of ".raw" extension to `saveToDisk` : save raw buffer without any prior conversion.

Sample Programs

EGrabber Sample Programs
Added `get-announced-handles` sample to demonstrate the `getBufferData` method.
Added `queue-buffer-ranges` sample to demonstrate `queue(range)` and `resetBufferQueue(range)` methods.

GenICam Features

Data Stream Module
Added new categories for 1637 Coaxlink Quad 3D-LLE: `LinearFilter`, `Threshold` and `LaserLineExtractor`.
Added feature `StripeArrangement` with values `Geometry_1X_1Y` (regular top-down image) and `Geometry_1X_1YE` (bottom-up image)

Tools

Image Conversion Tools
Added `FormatConverter` method `prepareBuffers` to speed up initial image conversions .
Added support of pixel formats `Coord3D_C8` and `Coord3D_C16`.

GenICam Browser
Added support of pixel formats `Coord3D_C8` and `Coord3D_C16`. These formats are displayed respectively as `Mono8` and `Mono16`.
Added option to save raw buffer data to disk.

gentl.exe
Added support of pixel formats `Coord3D_C8` and `Coord3D_C16`. These formats are displayed respectively as `Mono8` and `Mono16`.
The `genapi` command accepts a new `--hex` flag to show integer values in hexadecimal.
Added support of ".raw" extension when saving images to disk

I/O Toolbox

1633 Coaxlink Quad G3 - 4-camera firmware variant
Added 4 instances of the QDC, DIV, MDV and DEL tools to the toolkit.

Changes

List and description of changes since Coaxlink Driver version 9.0

SINCE COAXLINK DRIVER 9.0

EGRabber Sample Programs
Removed "320-sublink" sample, superseded by "630-sublink" sample.
Moved samples "sublink" and "line-scan-array" from "Advanced" category to "Specific" category.

Breaking Changes

Changes in the API that are not backward compatible.

SINCE COAXLINK DRIVER 7.0.1

ImageConvert
`ImageConvert` handles conversion paths from packed and/or Bayer pixel formats to RGB8/BGR8 in one step.

IFGetDeviceInfo
Changed status value returned by the GenTL function `IFGetDeviceInfo` (to `DEVICE_ACCESS_STATUS_READWRITE`) when the device is not yet open.

SINCE COAXLINK DRIVER 4.6

EGrabber API
Deprecated EGrabber method `announceBuffer` (superseded by announceAndQueue)
Note: The method can still be used by #defining `EURESYS_USE_EGRABBER_DEPRECATED_API`

SINCE COAXLINK DRIVER 4.4.2

GenTL Class
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 `inplace1x2ye` reordering methods instead of `Inplace1x2ye` reordering class

SINCE COAXLINK DRIVER 4.3

Data Stream Module GenICam Feature
`UnpackingMode`: Changed default value to LSB (instead of MSB)

SINCE COAXLINK DRIVER 4.1

Device Module GenICam Features – Cycle Control Category
`CycleHardwareTriggerSource` is deprecated and replaced by `CycleTriggerSource` feature
`CyclePeriodTarget` is deprecated and replaced by `SCycleTargetPeriod`
`CycleSoftwareTrigger` is deprecated and replaced by `StartCycle`

Device Module GenICam Features – Errors Control Category
`ErrorCounter` is deprecated and replaced by `ErrorCount`
`ErrorCounterReset` is deprecated and replaced by `ErrorCountReset`

The deprecated features were removed from the drivers API. Existing applications must be edited, to use the updated feature names.

Solved Issues

Solved issues in Coaxlink Driver 9.0

SAMPLES/CS/LIVE EGRABBER SAMPLE PROGRAM

9.0.0: added explicit cleanup of native Euresys.RGBConverter object before native Euresys.GenTL object

SAMPLES/CPP/LIVE EGRABBER SAMPLE PROGRAM

9.0.0: post-build step also copies Euresys configuration file (config.js) to the project directory so that application running or debugging is possible from the Visual Studio environment

Known Issues

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Deviations from the CoaXPress specification

Device to Host Connection

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

Syntax used for naming Host Connection Maps (how the connections of the Host Interface of a card are allocated to the Devices)

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

- <dev-count><dev-type><connection-count-dev$_0$>...<connection-count-dev$_{d-1}$>
- <dev-count> = {1, 2, 4} Number of Devices that can be attached to the Host Interface
- <dev-type> = {D, DF} Type of Devices: D for standard CoaXPress Devices, DF for proprietary Data Forwarding Devices

<connection-count-dev$_i$> = {1, 2, 4}Number of connections available for the Device i.

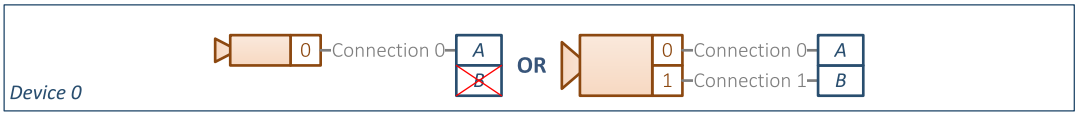
Example: **2D11** designates a Host Connection Map of a Host Interface with 2 standard CoaXPress Devices, each having 1 CoaXPress connection.

HOST CONNECTION MAPS – STANDARD COAXPRESS DEVICES

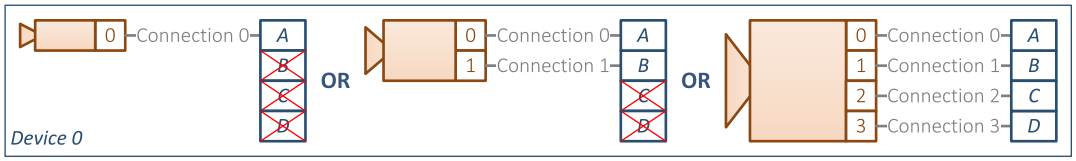
Coaxlink connection schemes for standard CoaXPress devices

1D1 Connection Map

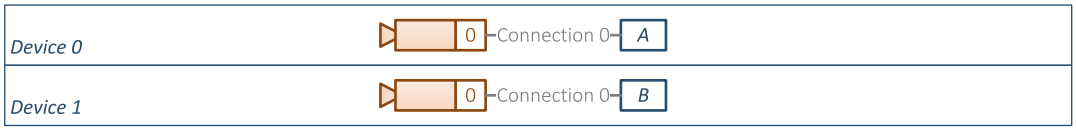
1D2 Connection Map



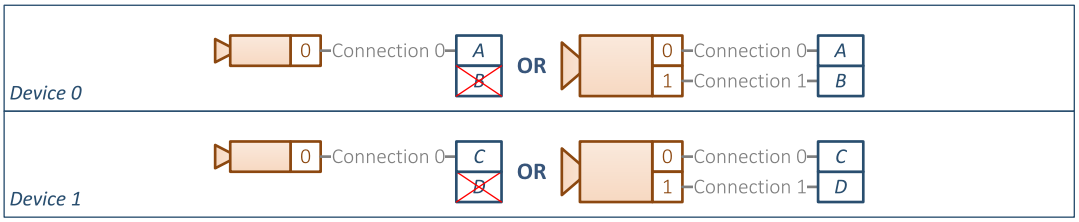
1D4 Connection Map



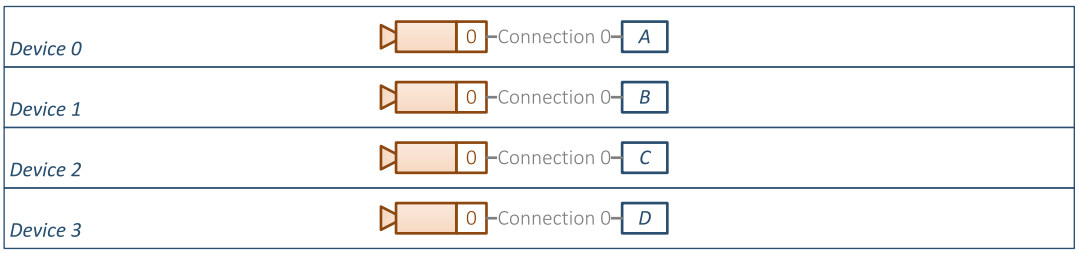
2D11 Connection Map



2D22 Connection Map



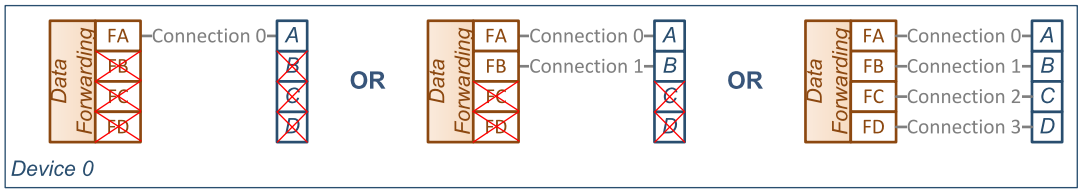
4D1111 Connection Map



HOST CONNECTION MAPS – DATA FORWARDING DEVICES

Coaxlink connection schemes for proprietary Data Forwarding Devices

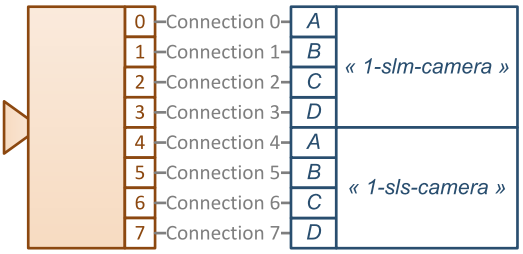
1DF4 Connection Map



HOST CONNECTION MAPS – SUB-LINK DEVICES

Coaxlink connection schemes for CoaXPress devices using sub-links

1D8SL4 Connection Map



FIRMWARE VARIANT & PRODUCT VS. HOST CONNECTION MAP

The Coaxlink product and firmware variant must be selected according to the required Host Connection Map:

Host Connection Map	Product(s)	Firmware variant(s)
1D1	Mono	
1D2	Duo	
	Duo104EMB	
1D4	Quad QuadG3 QuadG3DF	
	Quad3DLLE	
1DF4	QuadG3DF	
1D8SL4	QuadG3	
2D11	Duo Duo104EMB	

Host Connection Map	Product(s)	Firmware variant(s)
2D22	Quad	
	QuadG3	
4D1111	QuadCXP3	
	QuadG3	

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:

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

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`.

Deviations from the PCIe 3.0 specification

1633 Coaxlink Quad G3 operates only at PCIe 2.0 and PCIe 3.0 link speeds. It cannot be used when inserted in PCIe revision 1.x slots.

`aarch64` ARM processor architecture Issues

COAXLINK FIRMWARE MANAGER ON `aarch64` ARM PROCESSOR ARCHITECTURE

The `gui` mode of the Euresys Coaxlink Firmware Manager application is not available for the aarch64 ARM processor architecture.

Execute the following command line to display a help message describing all the command options:

```
coaxlink-firmware.exe --help
```

IMAGE CONVERTERS ON `aarch64` ARM PROCESSOR ARCHITECTURE

The image conversion functions don't use the ARM NEON general-purpose SIMD engine.