

eGrabber

Camera Link Frame Grabber Handbook



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1. Hardware Setup

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1.1. Precautions for Use of Board Products

Electrostatic Sensitive Device Boards may be damaged by electrostatic discharges. Follow the procedure hereby described and apply any general procedure aimed at reducing the risk associated with electrostatic discharge. Damage caused by improper handling is not covered by the manufacturer's warranty.

Electromagnetic Compatibility AV boards are compliant with electromagnetic compatibility regulatory requirements. To ensure this compliance, the card bracket must be secured with the relevant screw in accordance with the procedure described herein.

Risk of Electrical Shock Do not operate the computer with any enclosure cover removed. During the hardware installation, ensure the AC power cord is unplugged before touching any internal part of the computer.

Risk of Burn Do not touch an operating board. Allow board to cool before handling.

Heating Device It is normal for a board to dissipate some heat during operation. All enclosure covers, including blank brackets, must be fitted correctly to ensure that the fan cools the computer adequately.

Hot Plugging Forbidden Uncontrolled plugging and unplugging of equipment may damage a board. Always switch off the computer and any relevant system device when connecting or disconnecting a cable at the frame grabber or auxiliary board bracket. Failure to do so may damage the card and will void the warranty.

Poor Grounding Protection The computer and the camera can be located in distant areas with individual ground connections. Poor ground interconnection, ground loop or ground fault may induce unwanted voltage between equipment, causing excessive current in the interconnecting cables. This faulty situation can damage the frame grabber or the camera electrical interface. The user must follow proper equipment grounding practices at all ends of the interconnecting cables. In addition, the use of cable assemblies with overall shield solidly connected to the conductive shell of all connectors is recommended. Besides the beneficial effect of cable shielding on electromagnetic compatibility, the shield connection can increase the protection level against grounding problems by temporarily absorbing unwanted fault current.

1.2. PCI Express Card Slot Requirements

For optimal data transfer performance, **PC1628 Grablink Duo** must be plugged into a x4, x8 or x16 PCI Express Gen 2 or Gen 3 card connector providing at least four active lanes.

1.3. PCI Express Card Installation Procedure

1. Switch off the computer and all connected peripherals (monitor, printer...).
2. Discharge any static electricity that could be accumulated by your body. You can achieve this by touching an unpainted metal part of the enclosure of your computer with a bare hand. Make sure that the computer is linked to the AC power outlet with proper earth connection.
3. Disconnect all cables from your computer, including AC power.
4. Open the computer enclosure, according to the manufacturer instructions, to gain access to the PCI Express slots. Locate an available and adequate PCI Express slot.
5. Remove the blank bracket associated with this location. To achieve this, remove the securing screw and keep it aside for later use in the procedure. Keep the blank bracket in a known place for possible re-use.
6. Unwrap the card packing, take the board and carefully hold it. Avoid any contact of the board with unnecessary items, including your clothes.
7. Gently insert the card into the selected PCIe slot, taking care to push it down fully into the slot. If you experience some resistance, remove the board and repeat the operation. You should attempt to make a perfect board-to-slot mechanical alignment for best results. Ensure that the lower part of the bracket is inserted into the corresponding enclosure fastening.
8. Secure the board with the saved screw.
9. **Optional.** When the camera(s) is (are) powered through the camera cable (PoCXP or PoCL) or when the +12 V power output is required on any System I/O connector, connect a 12 V power source to the Auxiliary Power Input connector using an 8-pin PEG cable terminated with a 2x3 plug + 2x1 plug (mandatory when total AUX power exceeds 75 W) or a 6-pin cable.
10. **Optional.** Establish the connections with the Internal GPIO connector(s) as required by the application.
11. **Optional.** When synchronized acquisition is required for cameras attached to different cards, establish the card-to-card link interconnections.
12. Close the computer enclosure according to the manufacturer instructions.

2. Software Setup

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2.1. Software Setup Procedure

2.2. Important Notices

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

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Firmware Revisions



WARNING

eGrabber driver checks the compatibility of the firmware installed on every frame grabber. For those having an incompatible firmware, the GenTL driver exposes 0 (zero) Device.

If the requirement is not satisfied for all the **eGrabber-driven frame grabbers** in your system, it is *mandatory* to apply the Firmware Upgrade procedure prior to using this version of the driver.



NOTE

Starting with eGrabber 25.03, the firmware revision numbers are listed, for each firmware-variant in the [Firmware Variants table](#)

CPU Requirements

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

Image Buffer Limits

Maximum buffer size

0xffffffff0 bytes (4 GiB - 16 B) for all operating systems

Number of buffers

The number of buffers is only limited by available system resources.

NOTE: when using very large numbers of buffers, DSAnnounceBuffer calls can take longer and longer to complete (or even fail with error code GC_ERR_CUSTOM_IOCTL_BUFFER_ANNOUNCE_FAILED). If this happens, the user should set `DmaEngineOptimization=LowMemoryUsage` in the data stream module.

Notice for Linux

Important notification to be read before installing and/or using the product on your Linux PC

- **Memento** must be installed prior to **eGrabber**.
- If the **eGrabber** package is already installed, proceed as follows:
 - Uninstall **eGrabber**.
 - Install **Memento**.
 - Re-install **eGrabber**.
- If NVIDIA RDMA is required, read ["Notice for NVIDIA RDMA" on page 20](#)

Notice for NVIDIA RDMA

NVIDIA RDMA is only supported on Linux.

NVIDIA RDMA samples require a NVIDIA GPU that supports RDMA.

The NVIDIA RDMA samples allocate memory on the GPU and announce this memory using `NvidiaRdmaMemory`.

See the following files in the eGrabber sample programs:

- `cpp/egrabber/samples/503-grabn-cuda-rdma-process.*`
- `cpp/nvidia/egrabber-cuda` with the command line argument `cudaRDMA`

Installation instructions:

- NVIDIA CUDA drivers:
 - Follow the installation instructions from: https://developer.nvidia.com/cuda-downloads?target_os=Linux&target_arch=x86_64&Distribution=Ubuntu&target_version=20.04&target_type=deb_network
- NVIDIA driver sources:
 - These are needed to produce the Module.symvers file associated with the installed nvidia driver. This file will be required to install the eGrabber package
 - Select the appropriate driver from <https://www.nvidia.com/download/index.aspx?lang=en-us>
 - Make sure to download the version that matches the nvidia-<version> already installed in /usr/src/
 - Extract the archive with -x option
 - Change to directory kernel in the extracted archive
 - Run make module
 - The file Module.symvers should have been generated
- eGrabber package
 - Extract the egrabber-linux-x86_64 archive
 - Install the package with the following command:
sudo NVIDIA_KERNEL_PATH=<dir path containing Module.symvers> ./install.sh

The line Enabling NVIDIA RDMA build should appear during the installation of the eGrabber package.

A successful build can be confirmed if the command `lsmod | grep coaxlink` (or `lsmod | grep grablink`) indicates that coaxlink (or grablink) module depends on nvidia.

Notices for macOS

Important notifications to be read before installing the driver on your Mac

Driver types

Install the **Memento** package corresponding to the **eGrabber** driver type:

eGrabber driver package	Memento package
egrabber-macos-aarch64-dext-<MA.MI.RE.BU>.pkg	memento-macos-aarch64-dext-<MA.MI.RE.BU>.pkg
egrabber-macos-aarch64-kext-<MA.MI.RE.BU>.pkg	memento-macos-aarch64-kext-<MA.MI.RE.BU>.pkg
egrabber-macos-x86_64-dext-<MA.MI.RE.BU>.pkg	memento-macos-x86_64-dext-<MA.MI.RE.BU>.pkg
egrabber-macos-x86_64-kext-<MA.MI.RE.BU>.pkg	memento-macos-x86_64-kext-<MA.MI.RE.BU>.pkg



TIP

dext drivers operate in user-mode using the default Full Security policy level. It is not necessary

**WARNING**

eGrabber 25.12 is the last release providing macos-aarch64-kext and macos-x86_64-kext drivers for macOS.

Reduced Security level (only for kext drivers on Mac computers with Apple silicon)

Kernel extensions must be explicitly enabled before the installation of **AV** -aarch64-kext- packages on Mac computers with Apple silicon.

See <https://support.apple.com/fr-be/guide/security/sec8e454101b/web>

To enable kernel extensions on a Mac with Apple silicon:

1. Enter macOS recovery
2. In **Utilities > Startup Security Utility > Security Policy**
 - a. Select **Reduced Security**
 - b. Check **Allow user management of kernel extensions from identified developers**
3. Restart the system

Approval of kernel extension (only for kext drivers on Mac computers with Apple silicon)

After installing **eGrabber** or **Memento AV**-aarch64-kext packages, newly installed **AV** kernel extensions must be approved by the administrator in the **Security and Privacy preferences** and the system needs to be restarted.

2.3. Installing eGrabber

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Installing eGrabber on Windows

1. Read the [Notices for Windows](#)
 2. Open the support page of the **Euresys** website: <https://www.euresys.com/support/>.
- NOTE:** The Euresys website download area may require user authentication. The user ID and password are not obtained, they are chosen by the user. Access is free and unrestricted.
3. Expand the *eGrabber for Coaxlink and Grablink Duo and Gigelink* section to display the file list corresponding to the latest available **eGrabber** release.
 4. Select the egrabber-win-x86_64-25.12.1.*.exe setup file.

5. Launch the installer tool to install the driver files and software tools on your PC.

NOTE: If you have an existing **eGrabber** installation, the installer tool prompts you to uninstall it before being able to continue. Otherwise, it prompts you for the selection of the destination folder.

Installing eGrabber on Linux

1. Read the "Notice for Linux" on page 20

2. Open the support page of the **Euresys** website: <https://www.euresys.com/support/>.

NOTE: The Euresys website download area may require user authentication. The user ID and password are not obtained, they are chosen by the user. Access is free and unrestricted.

3. Expand the *eGrabber for Coaxlink and Grablink Duo and Gigelink* section to display the file list corresponding to the latest available **eGrabber** release.
4. Download the setup file according to the processor architecture:
 - For an installation on AArch64 (64-bit) processor architecture, select the egrabber-linux-aarch64-25.12.1.*.tar.gz setup file.
 - For an installation on x86_64 (64-bit) processor architecture, select the egrabber-linux-x86_64-25.12.1.*.tar.gz setup file.
5. Extract the egrabber-linux-<ARCH>-<VERSION>.tar.gz archive, e.g., with `tar -xaf egrabber-linux-<ARCH>-<VERSION>.tar.gz`
6. Run the installation script: `sudo ./egrabber-linux-<ARCH>-<VERSION>/install.sh`



NOTE

- If you have an existing **eGrabber** installation, the installer tool prompts you to uninstall it before being able to continue. Otherwise, it prompts you for the selection of the destination folder.
- After installation, `sudo /opt/euresys/egrabber/shell/check-install.sh` can be executed to check the eGrabber installation and troubleshoot issues.

Installing eGrabber on macOS

1. Read the "Notices for macOS" on page 21.

2. Open the support page of the **Euresys** website: <https://www.euresys.com/support/>.

NOTE: The Euresys website download area may require user authentication. The user ID and password are not obtained, they are chosen by the user. Access is free and unrestricted.

3. Expand the *eGrabber for Coaxlink and Grablink Duo and Gigelink* section to display the file list corresponding to the latest available **eGrabber** release.
4. Execute the installation procedure according to the processor architecture and the driver type:

Installing dext packages on Mac computers with Apple silicon

1. Download egrabber-macos-aarch64-dext-25.12.1.*.pkg
2. After 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.

The extension installer applications will be launched automatically and will be waiting for the administrator to approve the newly installed **AV** extensions in the [Security and Privacy preferences](#).

3. Launch the installer tool to install the driver files and software tools on your PC.

Installing kext drivers packages on Mac computers with Apple silicon

Step 1. Enable kernel extensions

Kernel extensions must be explicitly enabled before the installation of **AV** -aarch64-kext-packages on Mac computers with Apple silicon.

See <https://support.apple.com/fr-be/guide/security/sec8e454101b/web>

To enable kernel extensions on a Mac with Apple silicon:

1. Enter macOS recovery
2. In [Utilities > Startup Security Utility > Security Policy](#)
 - a. Select [Reduced Security](#)
 - b. Check [Allow user management of kernel extensions from identified developers](#)
3. Restart the system

Step 2 Launch the installer

1. Download egrabber-macos-aarch64-kext-25.12.1.*.pkg
2. After 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.

Step 3. Approve kernel extension

After installing **eGrabber** or **Memento AV** -aarch64-kext packages, newly installed **AV** kernel extensions must be approved by the administrator in the [Security and Privacy preferences](#) and the system needs to be restarted.

Installing kext drivers packages on Mac computers with an Intel processor

1. Download egrabber-macos-x86_64-kext-25.12.1.*.pkg
2. After 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.

Command-Line Installation Procedure

You may want to integrate the boards drivers and eGrabber tools installation into your own application distribution.

eGrabber setup program can be called in command-line mode with your installation options. In this mode, the **eGrabber** installation program does not prompt for user action and does not display any dialog box.

Installation

To perform a command-line installation, call the setup program with the /s flag. The installation is launched in the silent mode, that is no window nor dialog box will appear.

There are a couple of optional flags:

- Use the /a flag to force the installation of all components, including optional ones which are not selected by default.
- Use the /f flag to force the removal of an already installed version before executing the setup file, even if the already installed version is newer.

Installation removal

To automatically remove installed tools, call the setup program with the /u flag.

Use the /s flag to launch the removal program in the silent mode. In this mode, no window nor dialog box will appear.

Reboot during Installation

A reboot may be required after driver installation but will not take place automatically. The reboot must be performed by your application. In this case, the [HKEY_LOCAL_MACHINE\SOFTWARE\Euresys\Common] "RebootNeeded" registry entry should be checked. If it exists and is set to 1, then it should be replaced by 0, and the system must be rebooted.

Error Reporting

After the command line installation, the following registry key is updated and holds the installation status: [HKEY_LOCAL_MACHINE\SOFTWARE\Euresys\Common\LastInstallError].

- The ErrorCode DWORD identifies the error:
 - 0 - There is no error.
 - Any other value - Please contact technical support.
- The Cause string gives a wording of the error.
- The Source string identifies the installer that caused the error.
- The ErrorTime string gives the time and date of the error.

3. Managing Firmware

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3.2. Firmware Manager Tools 28

3.3. Updating and Installing Firmware 30

3.4. Firmware Recovery Switch 31

3.1. What's Firmware?

Firmware

In this context, "firmware" designates the content of the FPGA (Field Programmable Gate Array) device of a card.

It defines the functionality of the card including the PCI Express end-point.

Firmware EEPROM

The FPGA used on **eGrabber-driven frame grabbers** is RAM-based; it needs to be loaded every power up.

Considering that a PCI Express end point must be ready within 150 milliseconds of the power-up time, the FPGA content, must be loaded quickly after having applied power to the card. Therefore, the firmware is stored into a non-volatile flash EEPROM allowing a fast start-up of the FPGA.



TIP

The **eGrabber** driver will never modify the content of the FPGA during operation.

Firmware modifications

Any modification of the FPGA content requires a two-step operation:

1. The new firmware is written into the Flash EEPROM of the card using a firmware management tool.
2. The new firmware is activated by cycling the system power.

3.2. Firmware Manager Tools

eGrabber is delivered with two firmware management tools:

- "Firmware Manager - GUI mode" on page 28 : A graphical user interface tool in **eGrabber Studio**,
- "Firmware Manager - Command line mode" on page 28 : A command-line tool named **Firmware Manager Console**.

Firmware Manager - GUI mode

To open the **Firmware Manager** in GUI mode, select one of the following methods:

- From the Windows Start Menu: click on Firmware Manager shortcut in the **Euresys eGrabber** folder
- From the **Welcome Screen** of **eGrabber Studio**, click on the **Firmware Manager** button.

See also: "Firmware Manager (GUI mode)" section in the eGrabber Studio User Guide for a detailed description.

Firmware Manager - Command line mode

Access

The command-line tool is named `coaxlink-firmware.exe`. It is located in the firmware sub-folder of the eGrabber installation folder.

On Windows, to open the **Firmware Manager** in command-line mode, select one of the following methods:

- From the Windows Start Menu: click on Firmware Manager console shortcut in the **Euresys eGrabber** folder
- Open a command prompt and open in the `C:\Program Files\Euresys\Grabber\firmware` folder

On Linux, to open the **Firmware Manager** in command-line mode:

- Open a command shell in the `/opt/euresys/egrabber/firmware` folder

On macOS, to open the **Firmware Manager** in command-line mode:

- Open a command shell in the `/usr/local/opt/euresys/egrabber/firmware` folder.

Main commands

- Executing `coaxlink-firmware --help` displays a help message describing all the command options.
- Executing `coaxlink-firmware gui` starts the **Firmware Manager (Deprecated)** graphical user interface.

- Executing `coaxlink-firmware list` lists the properties of the firmware installed on each card present in the system.
- Executing `coaxlink-firmware update` updates the firmware.
- Executing `coaxlink-firmware install` installs a new firmware variant.

Unless specified with a `--firmware=FILE` option, the tool uses the embedded library.

3.3. Updating and Installing Firmware



WARNING

Prior to executing this procedure, read the "Important Notices" section of the release notes!

The **eGrabber** driver comes with all the firmware variants for all the **eGrabber-driven frame grabbers**.

1. Determine the firmware variant that fulfills the functional requirements of your application: e.g. '1-camera', '1-camera, line-scan', '2-camera'. Therefore, check the *Firmware Variants per Product* section of the release notes for the firmware variants that are applicable to your card.
2. Launch a [Firmware Manager tool](#) to perform a firmware *update* or to *install* a specific firmware variant on your card(s) using the **Firmware Manager** tool in *GUI mode* with **eGrabber Studio** or the **Firmware Manager Console** in *command-line mode*:
 - a. In **eGrabber Studio**, open the **Firmware Manager** pane:
 - Select the card to update
 - Select the firmware variant to install
 - Proceed with the installation
 - b. In command-line mode, to *update* a variant:
`coaxlink-firmware update`
 - c. In command-line mode, to *install* another firmware variant:
`coaxlink-firmware install '[variant-name]'`
3. Wait until completion of the firmware update



WARNING

Avoid turning off your PC during the firmware update procedure!

4. Repeat the procedure on all your **eGrabber-driven frame grabbers**.
5. **Power off completely your PC** and restart it to activate the newly loaded firmware.

3.4. Firmware Recovery Switch

Switch types and location

The *firmware recovery switch* is implemented with one of the following components:

- 3-pin header and a jumper
- 2-way DIP switch

See also: "Product Layouts" on page 254 in the Handbook to locate the firmware recovery switch. .

Switch positions

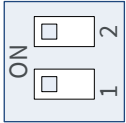
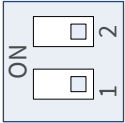
The *firmware recovery switch* has two positions:

Normal position (factory default)

At the next power ON, the latest firmware successfully written into the Flash EEPROM is used to program the FPGA. After FPGA startup completion, the card exhibits the *standard PCI ID* and the driver allows normal operation.

Recovery position

At the next power ON, the last but one firmware successfully written into the Flash EEPROM is used to program the FPGA. After FPGA startup completion, the card exhibits the *recovery PCI ID* and the driver inhibits image acquisition.

Switch type	Normal position	Recovery position
3-pin header and a jumper		
2-way DIP switch		

4. Firmware Variants

This topic shows, for each officially supported product (group), the list of officially available¹ firmware variants provided with **eGrabber 25.12**.

- The **Firmware variant** column shows the name of the firmware variant.
- The **HCMAP** column shows the **Host Connection Map**².
- The **Features** column shows the main features of the firmware variant.
- The **Description** column shows a one-phrase description of the connection scheme.
- The **Rev.** column shows the revision number of the firmware delivered with this release.

PC1633-T Coaxlink Quad G3

Firmware Variant	HCMAP	Features	Description	Rev.
1-camera	1D4	FFC LUT CFA-12	One 1- or 2- or 4-connection area-scan camera	496
1-camera, 4-data-stream	1D4S4		One 1- or 2- or 4-connection area-scan camera, up to 4 data streams	496
1-camera, line-scan	1D4	FFC LUT FLIPX	One 1- or 2- or 4-connection line-scan camera	496
2-camera	2D22	LUT CFA-35-D0	One or two 1- or 2-connection area-scan cameras	496
2-camera, bayer	2D22	CFA-35	One or two 1- or 2-connection area-scan cameras	496
2-camera, line-scan	2D22	LUT	One or two 1- or 2-connection line-scan cameras	496
3-camera	3D211	LUT	One 1- or 2-connection and one or two 1-connection area-scan cameras	496
4-camera	4D1111	LUT	One or two or three or four 1-connection area-scan cameras	496
4-camera, line-scan	4D1111	LUT	One or two or three or four 1-connection line-scan cameras	496

¹ Excluding custom firmware variants

² Specific assignment of the Device connections to the Host connectors

PC3602-T Coaxlink Octo

Firmware Variant	HCMAP	Features	Description	Rev.
1-camera	1D8	LUT CFA-123	One 1- or 2- or 4- or 8-connection area-scan camera	496
1-camera, line-scan	1D8	LUT MI	One 1- or 2- or 4- or 8-connection line-scan camera	499
2-camera	2D44	FFC LUT CFA-125	One or two 1- or 2- or 4-connection area-scan cameras	496
2-camera, line-scan	2D44	LUT FLIPX MI PLANAR	One or two 1- or 2- or 4-connection line-scan cameras	499
3-camera	3D422	LUT	One 1- or 2- or 4-connection and one or two 1- or 2-connection area-scan cameras	496
4-camera	4D2222	LUT	One or two or three or four 1- or 2-connection area-scan cameras	496
4-camera, line-scan	4D2222	LUT MI	One or two or three or four 1- or 2-connection line-scan cameras	499
5-camera	5D41111	LUT	One 1- or 2- or 4-connection and one or two or three or four 1-connection area-scan cameras	496
5-camera, 5D22211	5D22211	LUT	One or two or three 1- or 2-connection and one or two 1-connection area-scan cameras	496
8-camera	8D11111111	LUT	Up to eight 1-connection area-scan cameras	496
8-camera, line-scan	8D11111111	LUT MI	Up to eight 1-connection line-scan cameras	499

PC3621-LH-T Coaxlink Mono CXP-12-LH

Firmware Variant	HCMAP	Features	Description	Rev.
1-camera	1D1	LUT	One 1-connection area-scan camera	496
1-camera, line-scan	1D1	LUT	One 1-connection line-scan camera	496

PC3622-T Coaxlink Duo CXP-12

Firmware Variant	HCMAP	Features	Description	Rev.
1-camera	1D2	LUT CFA-3	One 1- or 2-connection area-scan camera	496
1-camera, line-scan	1D2	LUT	One 1- or 2-connection line-scan camera	496
2-camera	2D11	LUT	One or two 1-connection area-scan cameras	496
2-camera, line-scan	2D11	LUT	One or two 1-connection line-scan cameras	496

PC3623-T Coaxlink Quad CXP-12 Value

Firmware Variant	HCMAP	Features	Description	Rev.
1-camera	1D4	FFC LUT CFA-12 BIN	One 1- or 2- or 4-connection area-scan camera	496
1-camera, line-scan	1D4	FFC LUT BIN MI LT	One 1- or 2- or 4-connection line-scan camera	496
2-camera	2D22	LUT	One or two 1- or 2-connection area-scan cameras	496
2-camera, line-scan	2D22	LUT MI LT	One or two 1- or 2-connection line-scan cameras	499
3-camera	3D211	LUT	One 1- or 2-connection and one or two 1-connection area-scan cameras	496
4-camera	4D1111	LUT	One or two or three or four 1-connection area-scan cameras	496
4-camera, line-scan	4D1111	LUT MI	One or two or three or four 1-connection line-scan cameras	499

Features abbreviations

- *BIN*: Pixel binning
- *CFA-12*: Bayer CFA decoding - Methods 1 and 2
- *CFA-123*: Bayer CFA decoding - Methods 1, 2, and 3
- *CFA-125*: Bayer CFA decoding - Methods 1, 2, and 5
- *CFA-2-S0*: Bayer CFA decoding - Method 2 on Stream0
- *CFA-3*: Bayer CFA decoding - Method 3
- *CFA-35*: Bayer CFA decoding - Methods 3 and Method 5
- *CFA-35-D0*: Bayer CFA decoding - Methods 3 and 5 on Device0
- *FLIPX*: Horizontal image flipping
- *FFC*: Flat-field correction
- *JPEG-S1*: JPEG encoding on Stream1
- *LLE*: Laser line extraction
- *LT*: Mapping of events from the I/O Toolbox to CoaXPress trigger messages LinkTrigger0 and LinkTrigger1
- *LUT*: Lookup table processing
- *MI*: Metadata insertion
- *PLANAR*: RGB to PLANAR_RGB or BGR to PLANAR_BGR conversions

PART I

FUNCTIONAL GUIDE

1. Architecture of eGrabber-driven frame grabbers

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1.1. Main Elements

Quick overview of the main functional elements of eGrabber-driven frame grabbers

GenTL hierarchy

Each functional element of a frame grabber is configured and controlled by GenApi features belonging to a GenTL module.

At the top of the hierarchy, there is one *GenTL System Module* per Host PC. It binds all the *GenTL Interface Modules* of a Host PC.

There is one *GenTL Interface Module* for each frame grabber. It binds all the *GenTL Device Modules* of a frame grabber.

There is one *GenTL Device Module* for each camera (or imaging device) attached to a frame grabber. The elements belonging to the imaging device (camera) itself are referred as *Remote Device*. By opposition, the elements belonging to the frame grabber are also referred as *Local Device*.

NOTE: The maximum number of cameras that can be attached to a frame grabber is determined by the installed firmware variant.

There is one *GenTL Data Stream Module* for each data stream delivered by a camera attached to a frame grabber. It gathers the elements involved into the image build-up and transport from the imaging device to a pool of GenTL buffers.

NOTE: The maximum number of data-stream for a camera attached to a frame grabber is determined by the installed firmware variant.

There is one *GenTL Buffer Module* for each image buffer.

Main elements of the Interface Module

General purpose I/O lines

The "[General Purpose I/O](#)" on [page 184](#) block gathers all the I/O ports of the card.

I/O Toolbox

The "[I/O Toolbox](#)" on [page 201](#) block gathers a collection of tools used to build event streams from trigger and encoder devices attached to the I/O port inputs.

NOTE: These elements are common to- (or can be shared by-) all the GenTL Device Modules managed by the frame grabber.

Main elements of the Device Module

Camera and illumination controller

The "[Camera and Illumination Control](#)" on [page 158](#) block is used to control the camera cycle and the illumination strobe. It can be configured to receive real-time (Camera) Cycle trigger events from any I/O Toolbox output stream. It produces two real-time signals: the [Camera Trigger](#) signal, sent to the camera trigger input, and the [Strobe](#) signal, sent to the illumination device associated with the camera.

NOTE: This element is common to- (or can be shared by-) all the GenTL Data Stream Modules related to that imaging device.

Main elements of the Data Stream Module

Image acquisition controller

This block controls the acquisition gate. It can be configured to receive real-time start-of-scan and end-of-scan trigger events from any I/O Toolbox output stream.

Acquisition gate

The "[Acquisition Gate](#)" on [page 95](#) controls the data extraction and filters out the image data that doesn't need to be acquired.

On-board memory

The Image data partitions of the [on-board memory](#) temporarily stores the raw image data together with related metadata such as image size, pixel type, time-stamp...

Pixel Processing

The "[Pixel Processing](#)" on [page 113](#) block performs on-the-fly pixel processing and data formatting.

Image Data Transfer

The "[Image Data Transfer](#)" on [page 139](#) block transfers the image data to the destination buffer.

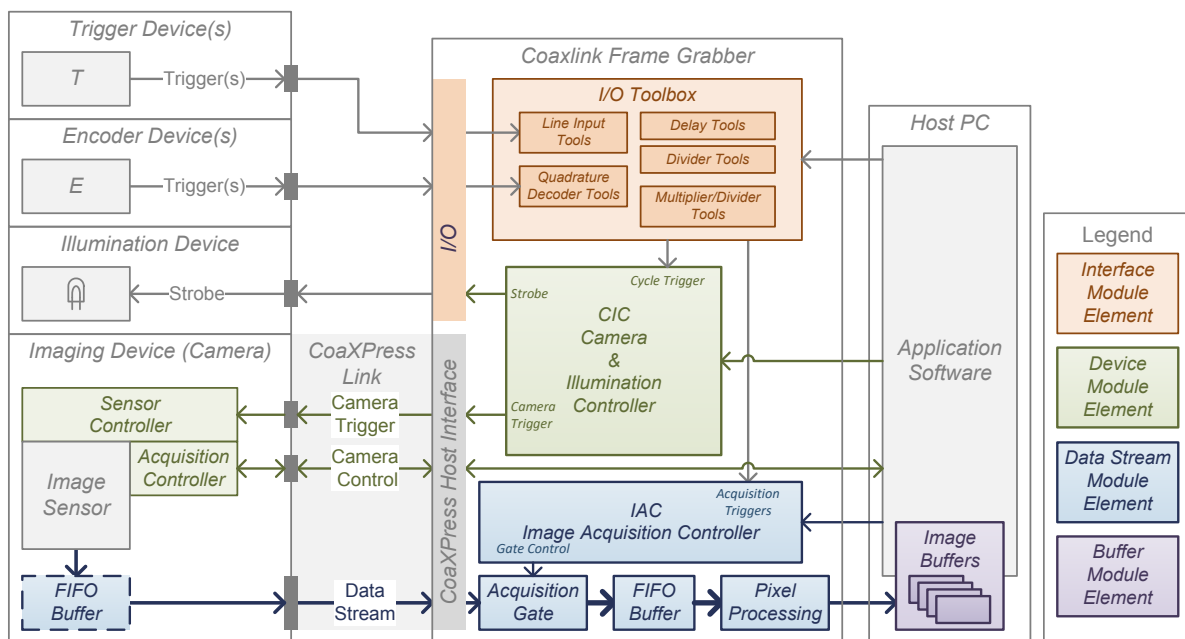
1.2. Block Diagrams



NOTE

In the diagrams hereafter, the main elements are represented by rectangles and their relations are represented by line segments with arrows indicating the direction of the signal or the data flow. The filling color of the rectangle indicates the level in the GenTL hierarchy as described in the legend.

1-camera, 1-data-stream



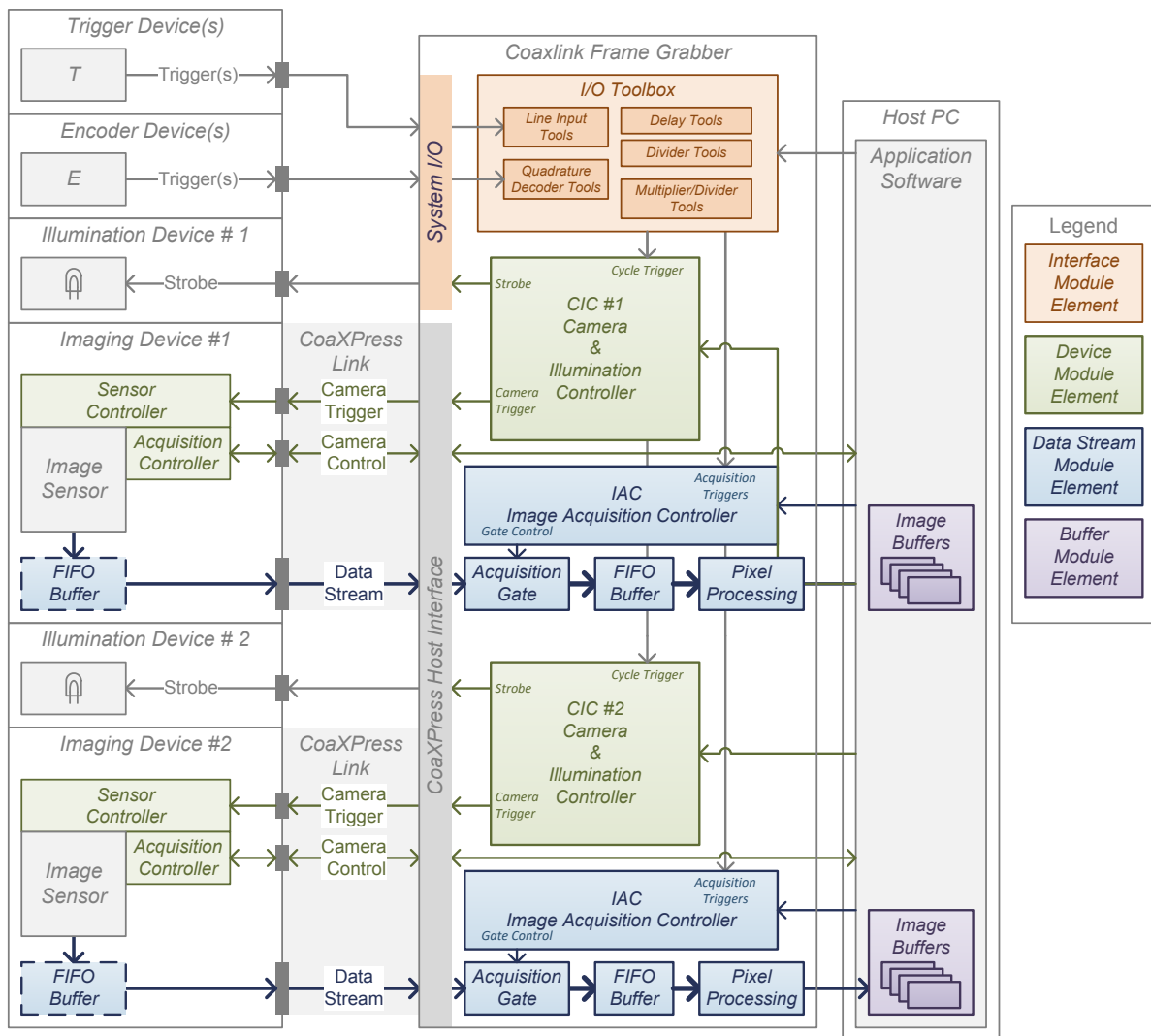
1-camera, 1-data-stream image acquisition system



NOTE

this configuration applies only when a *1-camera* or a *1-camera, line-scan* firmware variant is installed.

2-camera, 1-data-stream



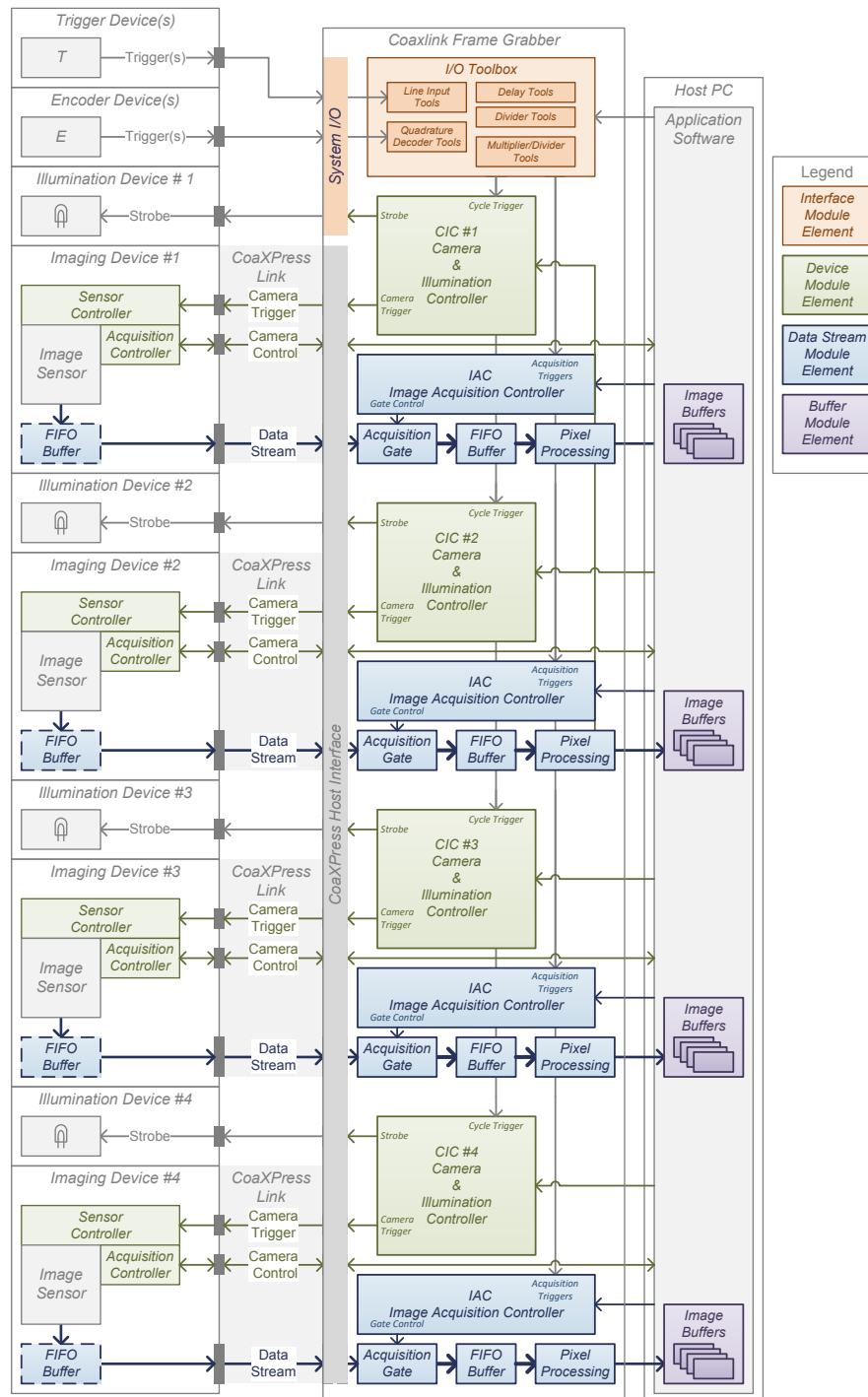
2-camera, 1-data-stream image acquisition system



NOTE

this configuration applies only when a 2-camera or a 2-camera, line-scan firmware variant is installed.

4-camera, 1-data-stream



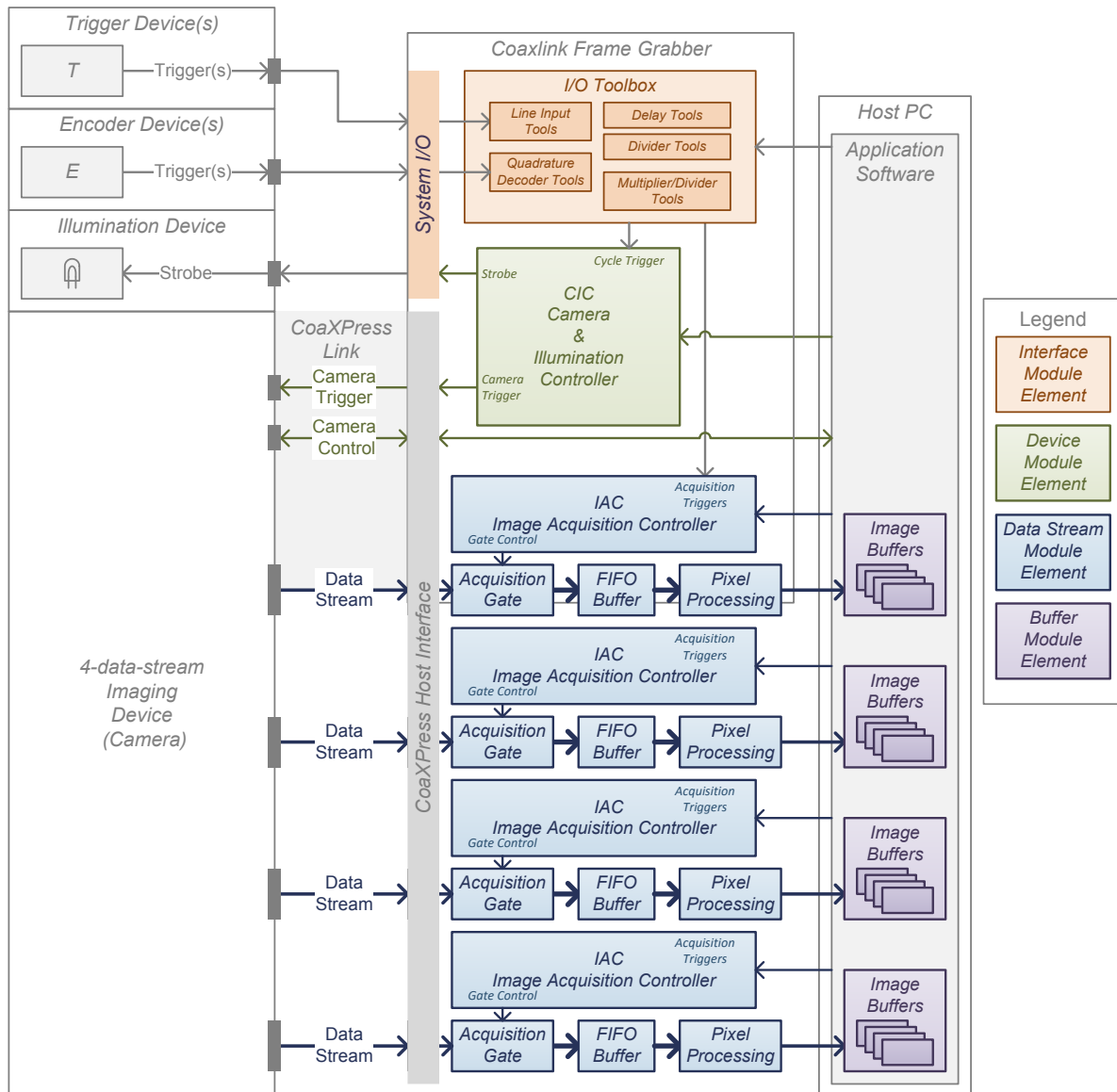
4-camera, 1-data-stream image acquisition system



NOTE

this configuration applies only when a 4-camera or a 4-camera, line-scan firmware variant is installed.

1-camera, 4-data-stream



1-camera, 4-data-stream image acquisition system

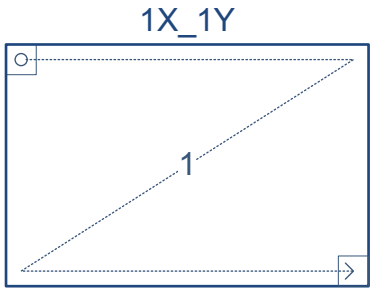


NOTE

this configuration applies only when a 1-camera,4-data-stream firmware variant is installed.

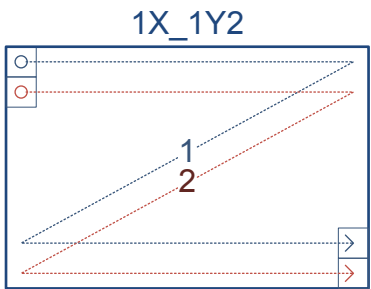
Tap Geometries Reference

1X_1Y Tap Geometry



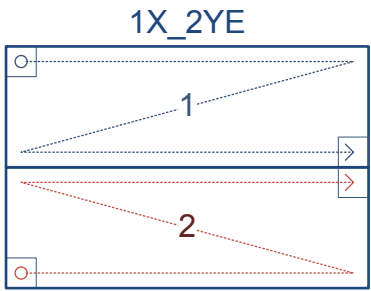
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W	1	1	H	1

1X_1Y2 Tap Geometry



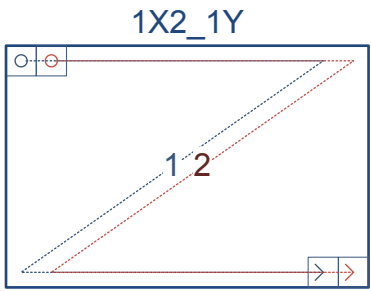
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W	1	1	H-1	2
2	1	W	1	2	H	2

1X_2YE Tap Geometry



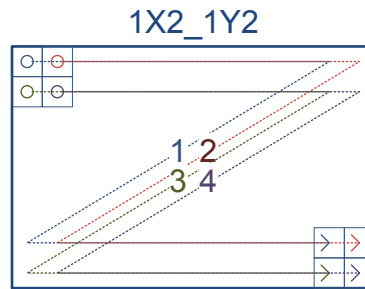
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W	1	1	H/2	1
2	1	W	1	H	H/2 + 1	-1

1X2_1Y Tap Geometry



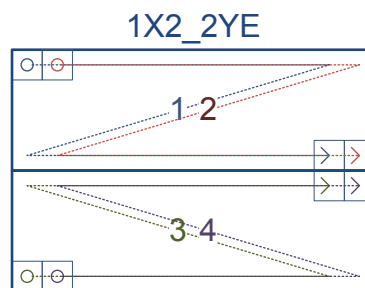
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W-1	2	1	H	1
2	2	W	2	1	H	1

1X2_1Y2 Tap Geometry



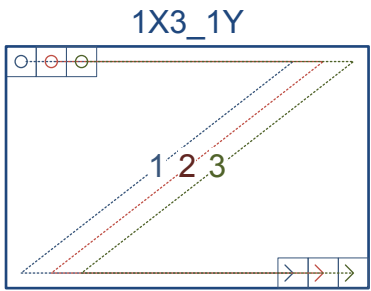
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 1	2	1	H-1	2
2	2	W	2	1	H-1	2
3	1	W - 1	2	2	H	2
4	2	W	2	2	H	2

1X2_2YE Tap Geometry



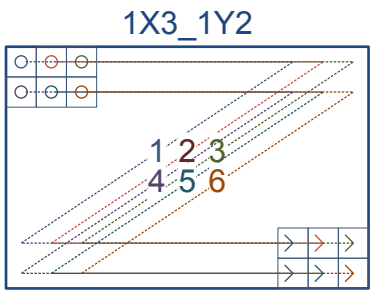
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 1	2	1	H/2	1
2	2	W	2	1	H/2	1
3	1	W - 1	2	H	H/2 + 1	-1
4	2	W	2	H	H/2 + 1	-1

1X3_1Y Tap Geometry



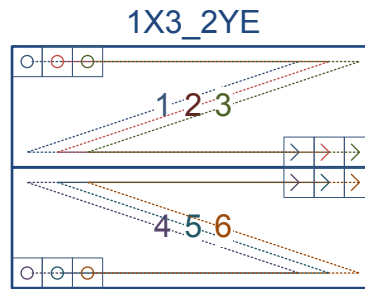
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 2	3	1	H	1
2	2	W - 1	3	1	H	1
3	3	W	3	1	H	1

1X3_1Y2 Tap Geometry



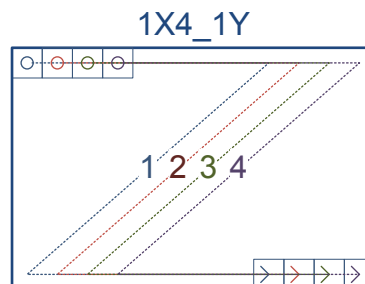
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 2	3	1	H-1	2
2	2	W - 1	3	1	H-1	2
3	3	W	3	1	H-1	2
4	1	W - 2	3	2	H	2
5	2	W - 1	3	2	H	2
6	3	W	3	2	H	2

1X3_2YE Tap Geometry



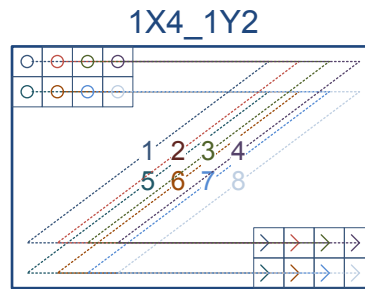
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 2	3	1	H/2	1
2	2	W - 1	3	1	H/2	1
3	3	W	3	1	H/2	1
4	1	W - 2	3	H	H/2 + 1	-1
5	2	W - 1	3	H	H/2 + 1	-1
6	3	W	3	H	H/2 + 1	-1

1X4_1Y Tap Geometry



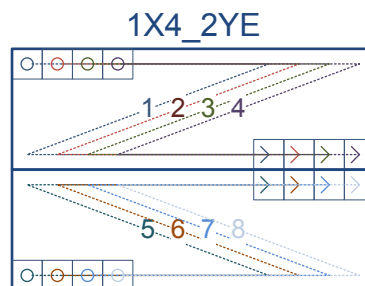
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 3	4	1	H	1
2	2	W - 2	4	1	H	1
3	3	W - 1	4	1	H	1
4	4	W	4	1	H	1

1X4_1Y2 Tap Geometry



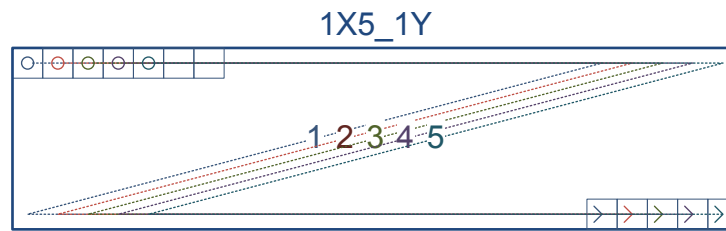
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 3	4	1	H-1	2
2	2	W - 2	4	1	H-1	2
3	3	W - 1	4	1	H-1	2
4	4	W	4	1	H-1	2
5	1	W - 3	4	2	H	2
6	2	W - 2	4	2	H	2
7	3	W - 1	4	2	H	2
8	4	W	4	2	H	2

1X4_2YE Tap Geometry



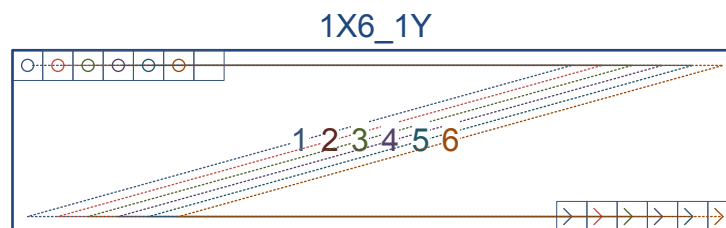
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 3	4	1	H/2	1
2	2	W - 2	4	1	H/2	1
3	3	W - 1	4	1	H/2	1
4	4	W	4	1	H/2	1
5	1	W - 3	4	H	H/2 + 1	-12
6	2	W - 2	4	H	H/2 + 1	-12
7	3	W - 1	4	H	H/2 + 1	-12
8	4	W	4	H	H/2 + 1	-12

1X5_1Y Tap Geometry



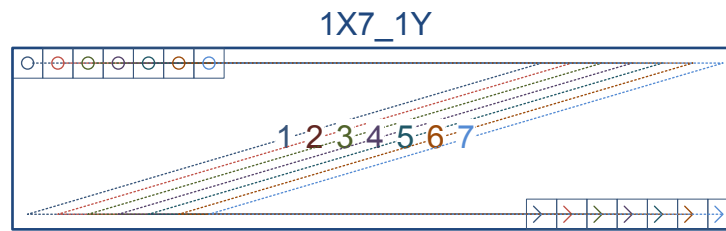
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W-4	5	1	H	1
2	2	W - 3	5	1	H	1
3	3	W - 2	5	1	H	1
4	4	W - 1	5	1	H	1
5	5	W	5	1	H	1

1X6_1Y Tap Geometry



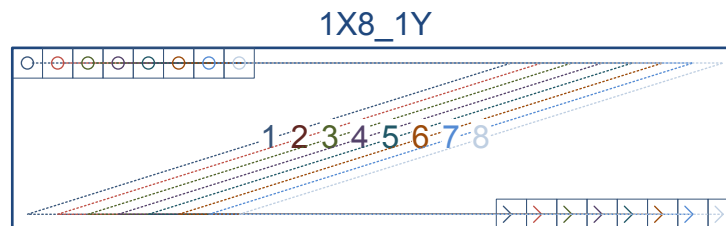
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 5	6	1	H	1
2	2	W - 4	6	1	H	1
3	3	W - 3	6	1	H	1
4	4	W - 2	6	1	H	1
5	5	W - 1	6	1	H	1
6	6	W	6	1	H	1

1X7_1Y Tap Geometry



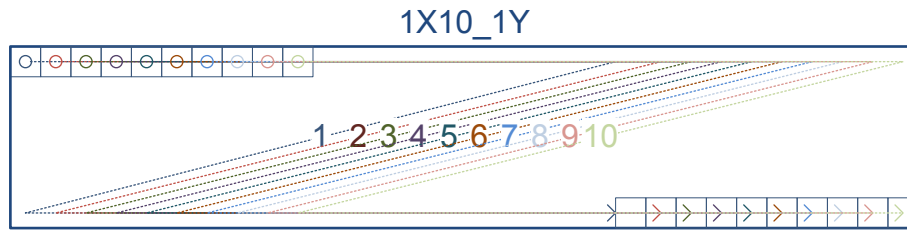
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 6	7	1	H	1
2	2	W - 5	7	1	H	1
3	3	W - 4	7	1	H	1
4	4	W - 3	7	1	H	1
5	5	W - 2	7	1	H	1
6	6	W - 1	7	1	H	1
7	7	W	7	1	H	1

1X8_1Y Tap Geometry



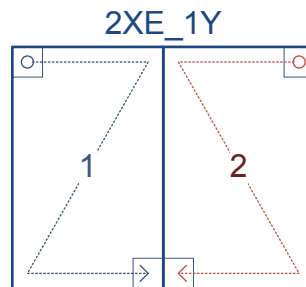
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 7	8	1	H	1
2	2	W - 6	8	1	H	1
3	3	W - 5	8	1	H	1
4	4	W - 4	8	1	H	1
5	5	W - 3	8	1	H	1
6	6	W - 2	8	1	H	1
7	7	W - 1	8	1	H	1
8	8	W	8	1	H	1

1X10_1Y Tap Geometry



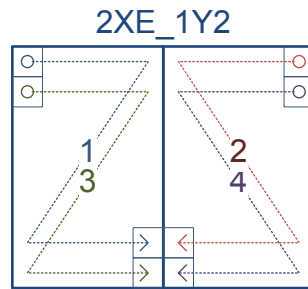
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W - 9	10	1	H	1
2	2	W - 8	10	1	H	1
3	3	W - 7	10	1	H	1
4	4	W - 6	10	1	H	1
5	5	W - 5	10	1	H	1
6	6	W - 4	10	1	H	1
7	7	W - 3	10	1	H	1
8	8	W - 2	10	1	H	1
9	9	W - 1	10	1	H	1
10	10	W	10	1	H	1

2XE_1Y Tap Geometry



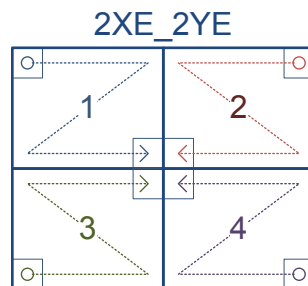
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2	1	1	H	1
2	W	W/2 + 1	-1	1	H	1

2XE_1Y2 Tap Geometry



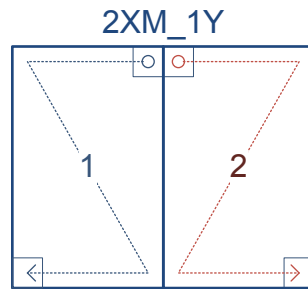
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2	1	1	H - 1	2
2	W	W/2 + 1	-1	1	H - 1	2
3	1	W/2	1	2	H	2
4	W	W/2 + 1	-1	2	H	2

2XE_2YE Tap Geometry



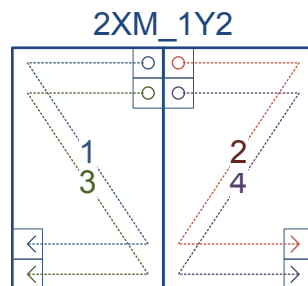
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2	1	1	H/2	1
2	W	W/2 + 1	-1	1	H/2	1
3	1	W/2	1	H	H/2 + 1	-1
4	W	W/2 + 1	-1	H	H/2 + 1	-1

2XM_1Y Tap Geometry



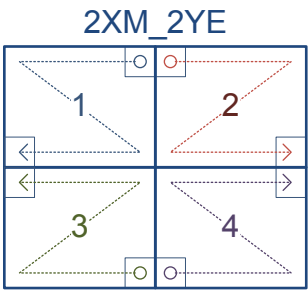
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2$	1	-1	1	H	1
2	$W/2 + 1$	W	1	1	H	1

2XM_1Y2 Tap Geometry



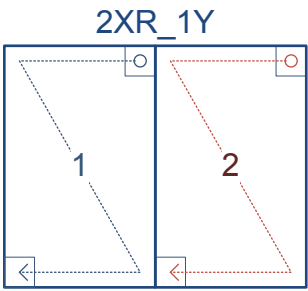
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2$	1	-1	1	$H - 1$	2
2	$W/2 + 1$	W	1	1	$H - 1$	2
3	$W/2$	1	-1	2	H	2
4	$W/2 + 1$	W	1	2	H	2

2XM_2YE Tap Geometry



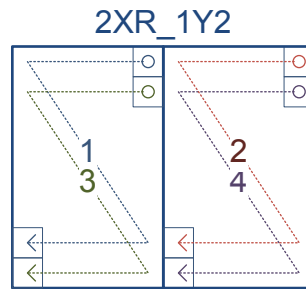
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/2	1	-1	1	H/2	1
2	W/2 + 1	W	1	1	H/2	1
3	W/2	1	-1	H	H/2 + 1	-1
4	W/2 + 1	W	1	H	H/2 + 1	-1

2XR_1Y Tap Geometry



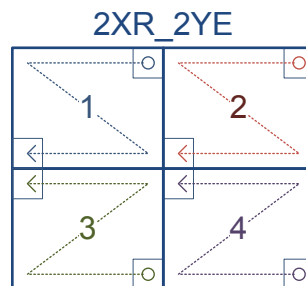
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/2	1	-1	1	H	1
2	W	W/2 + 1	-1	1	H	1

2XR_1Y2 Tap Geometry



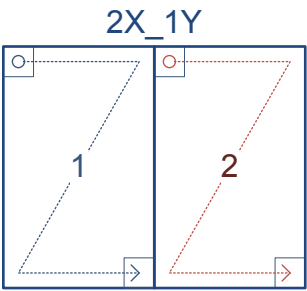
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/2	1	-1	1	H - 1	2
2	W	W/2 + 1	-1	1	H - 1	2
3	W/2	1	-1	2	H	2
4	W	W/2 + 1	-1	2	H	2

2XR_2YE Tap Geometry



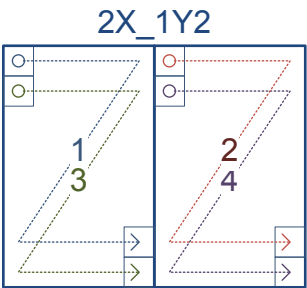
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/2	1	-1	1	H/2	1
2	W	W/2 + 1	-1	1	H/2	1
3	W/2	1	-1	H	H/2 + 1	-1
4	W	W/2 + 1	-1	H	H/2 + 1	-1

2X_1Y Tap Geometry



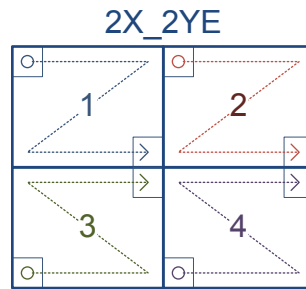
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2	1	1	H	1
2	W/2 + 1	W	1	1	H	1

2X_1Y2 Tap Geometry



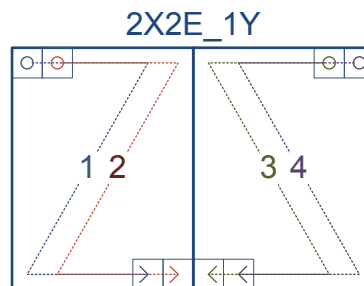
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2	1	1	H - 1	2
2	W/2 + 1	W	1	1	H - 1	2
3	1	W/2	1	2	H	2
4	W/2 + 1	W	1	1	H	2

2X_2YE Tap Geometry



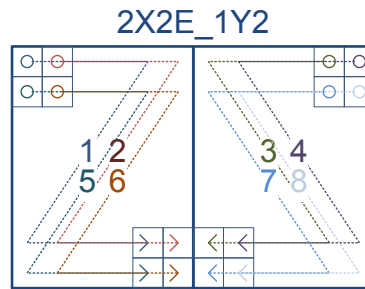
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2	1	1	H/2	1
2	W/2 + 1	W	1	1	H/2	1
3	1	W/2	1	H	H/2 + 1	-1
4	W/2 + 1	W	1	H	H/2 + 1	-1

2X2E_1Y Tap Geometry



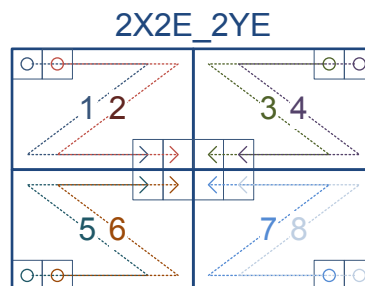
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/2 - 1	2	1	H	1
2	2	W/2	2	1	H	1
3	W - 1	W/2 + 1	-2	1	H	1
4	W	W/2 + 2	-2	1	H	1

2X2E_1Y2 Tap Geometry



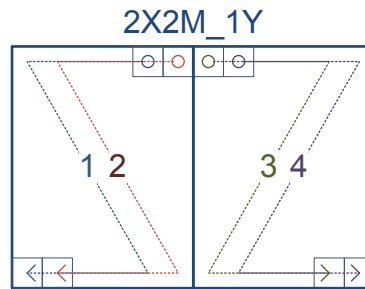
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 1$	2	1	$H-1$	2
2	2	$W/2$	2	1	$H-1$	2
3	$W - 1$	$W/2 + 1$	-2	1	$H-1$	2
4	W	$W/2 + 2$	-2	1	$H-1$	2
5	1	$W/2 - 1$	2	2	H	2
6	2	$W/2$	2	2	H	2
7	$W - 1$	$W/2 + 1$	-2	2	H	2
8	W	$W/2 + 2$	-2	2	H	2

2X2E_2YE Tap Geometry



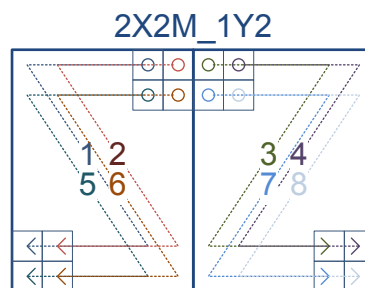
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 1$	2	1	$H/2$	1
2	2	$W/2$	2	1	$H/2$	1
3	$W - 1$	$W/2 + 1$	-2	1	$H/2$	1
4	W	$W/2 + 2$	-2	1	$H/2$	1
5	1	$W/2 - 1$	2	H	$H/2 + 1$	-1
6	2	$W/2$	2	H	$H/2 + 1$	-1
7	$W - 1$	$W/2 + 1$	-2	H	$H/2 + 1$	-1
8	W	$W/2 + 2$	-2	H	$H/2 + 1$	-1

2X2M_1Y Tap Geometry



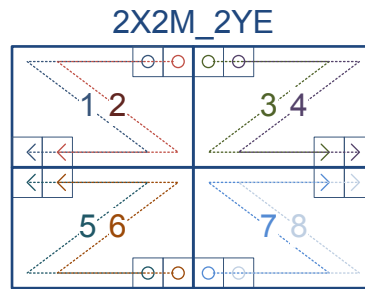
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 1$	1	-2	1	H	1
2	$W/2$	2	-2	1	H	1
3	$W/2 + 1$	$W - 1$	2	1	H	1
4	$W/2 + 2$	W	2	1	H	1

2X2M_1Y2 Tap Geometry



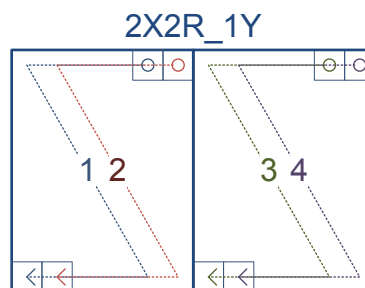
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 1$	1	-2	1	$H-1$	2
2	$W/2$	2	-2	1	$H-1$	2
3	$W/2 + 1$	$W - 1$	2	1	$H-1$	2
4	$W/2 + 2$	W	2	1	$H-1$	2
5	$W/2 - 1$	1	-2	2	H	2
6	$W/2$	2	-2	2	H	2
7	$W/2 + 1$	$W - 1$	2	2	H	2
8	$W/2 + 2$	W	2	2	H	2

2X2M_2YE Tap Geometry



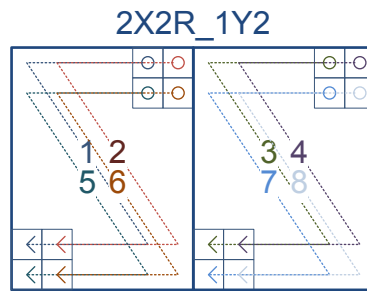
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 1$	1	-2	1	$H/2$	1
2	$W/2$	2	-2	1	$H/2$	1
3	$W/2 + 1$	$W - 1$	2	1	$H/2$	1
4	$W/2 + 2$	W	2	1	$H/2$	1
5	$W/2 - 1$	1	-2	H	$H/2 + 1$	1
6	$W/2$	2	-2	H	$H/2 + 1$	1
7	$W/2 + 1$	$W - 1$	2	H	$H/2 + 1$	1
8	$W/2 + 2$	W	2	H	$H/2 + 1$	1

2X2R_1Y Tap Geometry



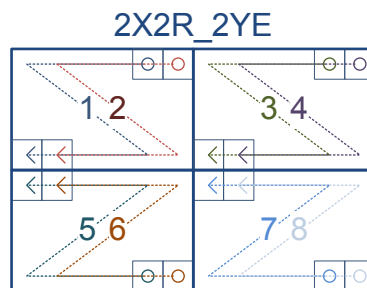
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 1$	1	-2	1	H	1
2	$W/2$	2	-2	1	H	1
3	$W - 1$	$W/2 + 1$	-2	1	H	1
4	W	$W/2 + 2$	-2	1	H	1

2X2R_1Y2 Tap Geometry



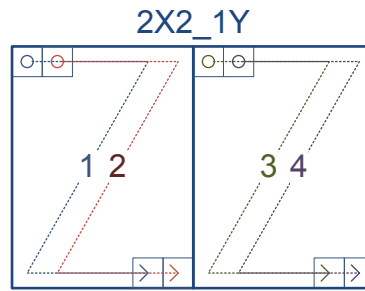
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 1$	1	-2	1	$H-1$	2
2	$W/2$	2	-2	1	$H-1$	2
3	$W - 1$	$W/2 + 1$	-2	1	$H-1$	2
4	W	$W/2 + 2$	-2	1	$H-1$	2
5	$W/2 - 1$	1	-2	2	H	2
6	$W/2$	2	-2	2	H	2
7	$W - 1$	$W/2 + 1$	-2	2	H	2
8	W	$W/2 + 2$	-2	2	H	2

2X2R_2YE Tap Geometry



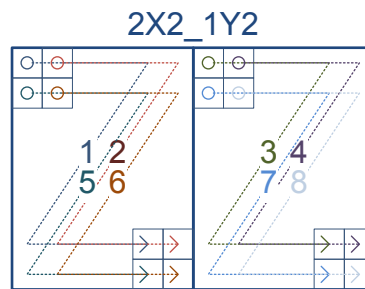
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 1$	1	-2	1	$H/2$	1
2	$W/2$	2	-2	1	$H/2$	1
3	$W - 1$	$W/2 + 1$	-2	1	$H/2$	1
4	W	$W/2 + 2$	-2	1	$H/2$	1
5	$W/2 - 1$	1	-2	H	$H/2 + 1$	1
6	$W/2$	2	-2	H	$H/2 + 1$	1
7	$W - 1$	$W/2 + 1$	-2	H	$H/2 + 1$	1
8	W	$W/2 + 2$	-2	H	$H/2 + 1$	1

2X2_1Y Tap Geometry



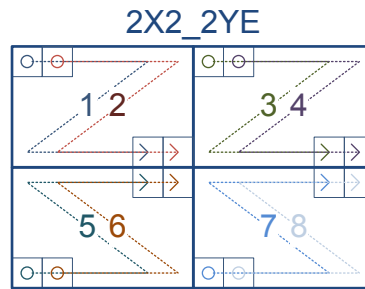
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 1$	2	1	H	1
2	2	$W/2$	2	1	H	1
3	$W/2 + 1$	$W - 1$	2	1	H	1
4	$W/2 + 2$	W	2	1	H	1

2X2_1Y2 Tap Geometry



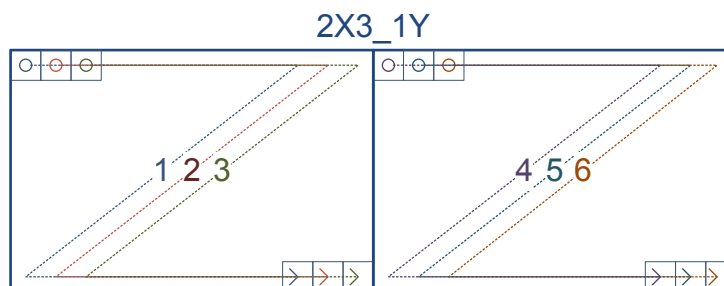
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 1$	2	1	H-1	2
2	2	$W/2$	2	1	H-1	2
3	$W/2 + 1$	$W - 1$	2	1	H-1	2
4	$W/2 + 2$	W	2	1	H-1	2
5	1	$W/2 - 1$	2	2	H	2
6	2	$W/2$	2	2	H	2
7	$W/2 + 1$	$W - 1$	2	2	H	2
8	$W/2 + 2$	W	2	2	H	2

2X2_2YE Tap Geometry



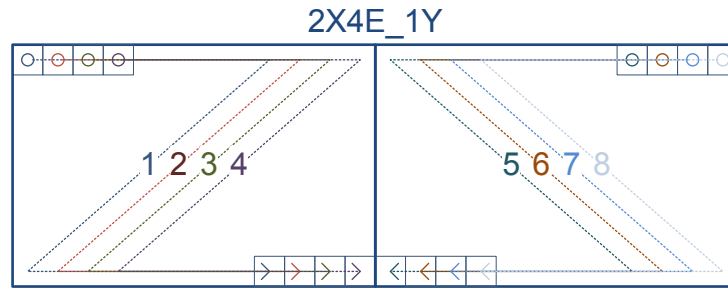
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 1$	2	1	$H/2$	1
2	2	$W/2$	2	1	$H/2$	1
3	$W/2 + 1$	$W - 1$	2	1	$H/2$	1
4	$W/2 + 2$	W	2	1	$H/2$	1
5	1	$W/2 - 1$	2	H	$H/2 + 1$	-1
6	2	$W/2$	2	H	$H/2 + 1$	-1
7	$W/2 + 1$	$W - 1$	2	H	$H/2 + 1$	-1
8	$W/2 + 2$	W	2	H	$H/2 + 1$	-1

2X3_1Y Tap Geometry



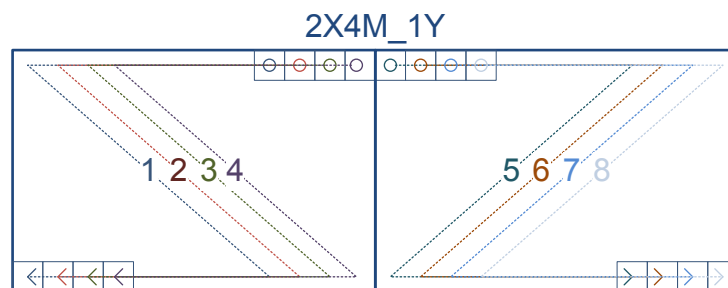
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 2$	3	1	H	1
2	2	$W/2 - 1$	3	1	H	1
3	3	$W/2$	3	1	H	1
4	$W/2 + 1$	$W - 2$	3	1	H	1
5	$W/2 + 2$	$W - 1$	3	1	H	1
6	$W/2 + 3$	W	3	1	H	1

2X4E_1Y Tap Geometry



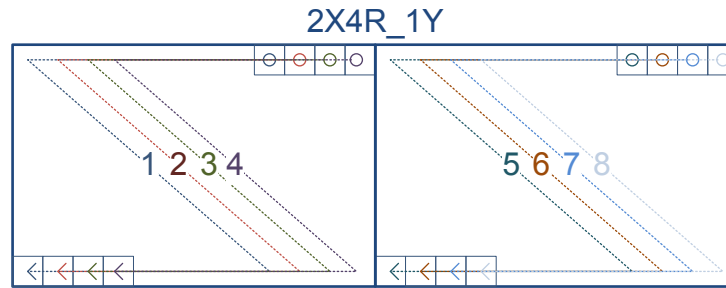
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 3$	4	1	H	1
2	2	$W/2 - 2$	4	1	H	1
3	3	$W/2 - 1$	4	1	H	1
4	4	$W/2$	4	1	H	1
5	$W - 3$	$W/2 + 1$	-4	1	H	1
6	$W - 2$	$W/2 + 2$	-4	1	H	1
7	$W - 1$	$W/2 + 3$	-4	1	H	1
8	W	$W/2 + 4$	-4	1	H	1

2X4M_1Y Tap Geometry



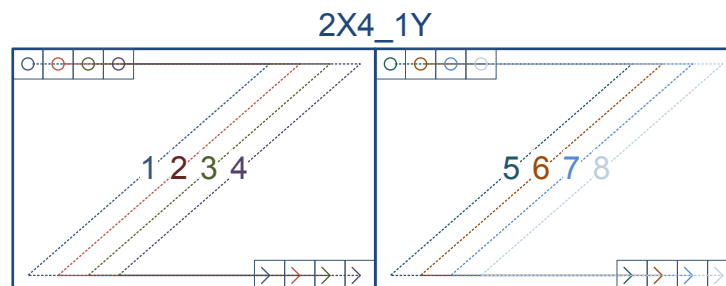
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 3$	1	4	1	H	1
2	$W/2 - 2$	2	4	1	H	1
3	$W/2 - 1$	3	4	1	H	1
4	$W/2$	4	4	1	H	1
5	$W/2 + 1$	$W - 3$	4	1	H	1
6	$W/2 + 2$	$W - 2$	4	1	H	1
7	$W/2 + 3$	$W - 1$	4	1	H	1
8	$W/2 + 4$	W	-4	1	H	1

2X4R_1Y Tap Geometry



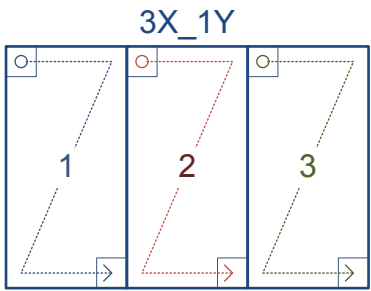
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/2 - 3$	1	4	1	H	1
2	$W/2 - 2$	2	4	1	H	1
3	$W/2 - 1$	3	4	1	H	1
4	$W/2$	4	4	1	H	1
5	$W - 3$	$W/2 + 1$	-4	1	H	1
6	$W - 2$	$W/2 + 2$	-4	1	H	1
7	$W - 1$	$W/2 + 3$	-4	1	H	1
8	W	$W/2 + 4$	-4	1	H	1

2X4_1Y Tap Geometry



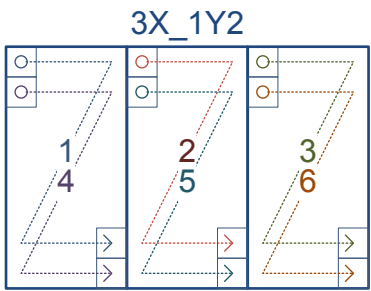
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/2 - 3$	4	1	H	1
2	2	$W/2 - 2$	4	1	H	1
3	3	$W/2 - 1$	4	1	H	1
4	4	$W/2$	4	1	H	1
5	$W/2 + 1$	$W - 3$	4	1	H	1
6	$W/2 + 2$	$W - 2$	4	1	H	1
7	$W/2 + 3$	$W - 1$	4	1	H	1
8	$W/2 + 4$	W	4	1	H	1

3X_1Y Tap Geometry



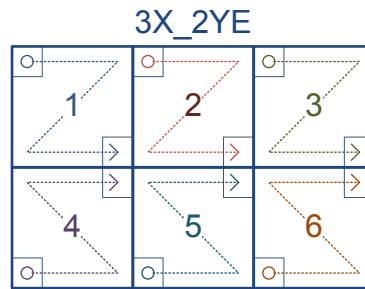
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/3	1	1	H	1
2	W/3 + 1	2W/3	1	1	H	1
3	2W/3 + 1	W	1	1	H	1

3X_1Y2 Tap Geometry



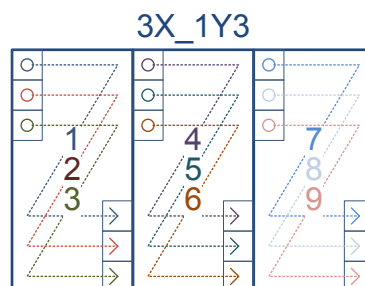
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/3	1	1	H-1	2
2	W/3 + 1	2W/3	1	1	H-1	2
3	2W/3 + 1	W	1	1	H-1	2
4	1	W/3	1	2	H	2
5	W/3 + 1	2W/3	1	2	H	2
6	2W/3 + 1	W	1	2	H	2

3X_2YE Tap Geometry



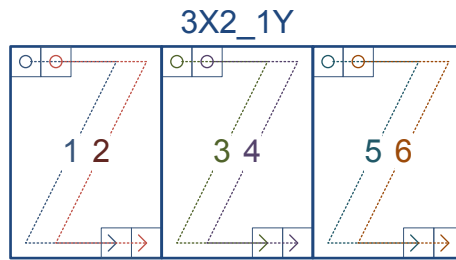
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/3	1	1	H/2	1
2	W/3 + 1	2W/3	1	1	H/2	1
3	2W/3 + 1	W	1	1	H/2	1
4	1	W - 2	3	H	H/2 + 1	-1
5	W/3 + 1	2W/3	1	H	H/2 + 1	-1
6	2W/3 + 1	W	1	H	H/2 + 1	-1

3X_1Y3 Tap Geometry



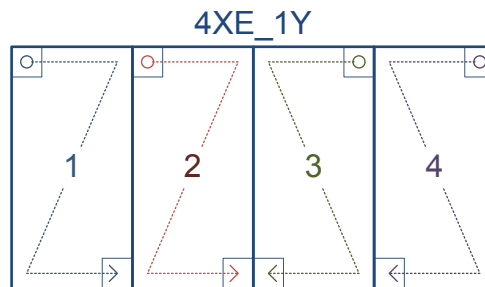
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/3	1	1	H-2	3
2	1	W/3	1	2	H-1	3
3	1	W/3	1	3	H	3
4	W/3 + 1	2W/3	1	1	H-2	3
5	W/3 + 1	2W/3	1	2	H-1	3
6	W/3 + 1	2W/3	1	3	H	3
7	2W/3 + 1	W	1	1	H-2	3
8	2W/3 + 1	W	1	2	H-1	3
9	2W/3 + 1	W	1	3	H	3

3X2_1Y Tap Geometry



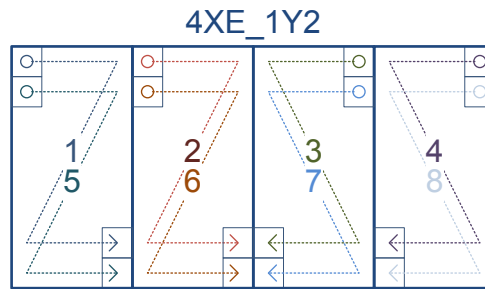
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/3 - 1$	2	1	H	1
2	2	$W/3$	2	1	H	1
3	$W/3 + 1$	$2W/3 - 1$	2	1	H	1
4	$W/3 + 2$	$2W/3$	2	1	H	1
5	$2W/3 + 1$	$W - 1$	2	1	H	1
6	$2W/3 + 2$	W	2	1	H	1

4XE_1Y Tap Geometry



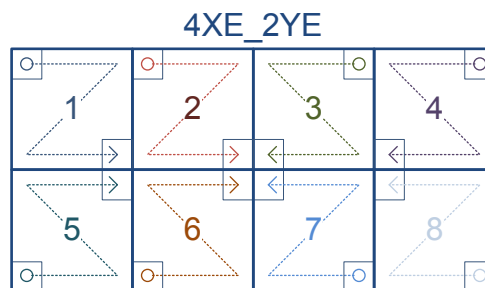
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/4$	1	1	H	1
2	$W/4 + 1$	$W/2$	1	1	H	1
3	$3W/4$	$W/2 + 1$	-1	1	H	1
4	W	$3W/4 + 1$	-1	1	H	1

4XE_1Y2 Tap Geometry



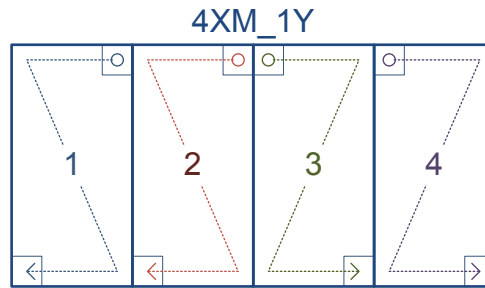
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/4	1	1	H - 1	2
2	W/4 + 1	W/2	1	1	H - 1	2
3	3W/4	W/2 + 1	-1	1	H - 1	2
4	W	3W/4 + 1	-1	1	H - 1	2
5	1	W/4	1	2	H	2
6	W/4 + 1	W/2	1	2	H	2
7	3W/4	W/2 + 1	-1	2	H	2
8	W	3W/4 + 1	-1	2	H	2

4XE_2YE Tap Geometry



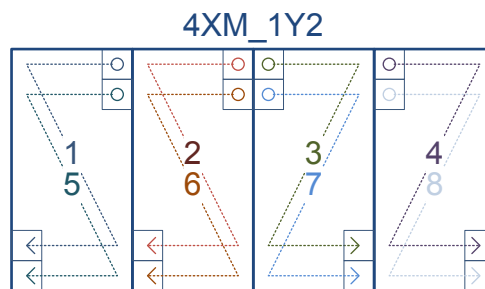
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/4	1	1	H/2	1
2	W/4 + 1	W/2	1	1	H/2	1
3	3W/4	W/2 + 1	-1	1	H/2	1
4	W	3W/4 + 1	-1	1	H/2	1
5	1	W/4	1	H	H/2 + 1	-1
6	W/4 + 1	W/2	1	H	H/2 + 1	-1
7	3W/4	W/2 + 1	-1	H	H/2 + 1	-1
8	W	3W/4 + 1	-1	H	H/2 + 1	-1

4XM_1Y Tap Geometry



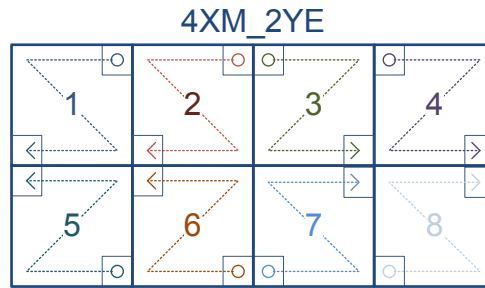
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/4$	1	-1	1	H	1
2	$W/2$	$W/4 + 1$	-1	1	H	1
3	$W/2 + 1$	$3W/4$	1	1	H	1
4	$3W/4 + 1$	W	1	1	H	1

4XM_1Y2 Tap Geometry



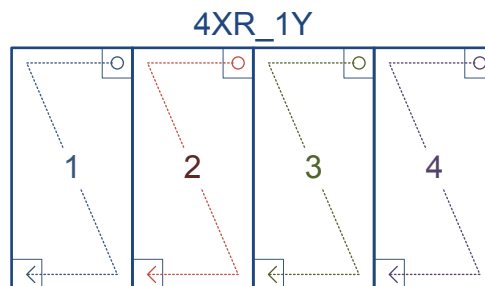
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/4$	1	-1	1	$H - 1$	2
2	$W/2$	$W/4 + 1$	-1	1	$H - 1$	2
3	$W/2 + 1$	$3W/4$	1	1	$H - 1$	2
4	$3W/4 + 1$	W	1	1	$H - 1$	2
5	$W/4$	1	-1	2	H	2
6	$W/2$	$W/4 + 1$	-1	2	H	2
7	$W/2 + 1$	$3W/4$	1	2	H	2
8	$3W/4 + 1$	W	1	2	H	2

4XM_2YE Tap Geometry



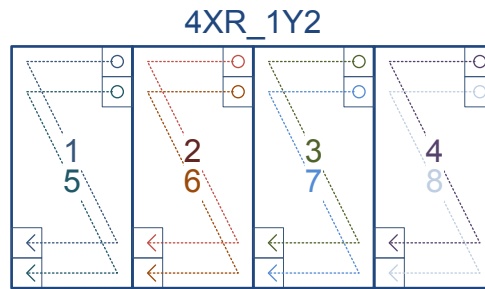
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/4$	1	-1	1	$H/2$	1
2	$W/2$	$W/4 + 1$	-1	1	$H/2$	1
3	$W/2 + 1$	$3W/4$	1	1	$H/2$	1
4	$3W/4 + 1$	W	1	1	$H/2$	1
5	$W/4$	1	-1	H	$H/2 + 1$	-1
6	$W/2$	$W/4 + 1$	-1	H	$H/2 + 1$	-1
7	$W/2 + 1$	$3W/4$	1	H	$H/2 + 1$	-1
8	$3W/4 + 1$	W	1	H	$H/2 + 1$	-1

4XR_1Y Tap Geometry



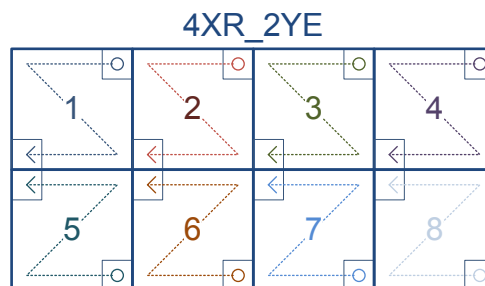
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/4$	1	-1	1	H	1
2	$W/2$	$W/4 + 1$	-1	1	H	1
3	$3W/4$	$W/2 + 1$	-1	1	H	1
4	W	$3W/4 + 1$	-1	1	H	1

4XR_1Y2 Tap Geometry



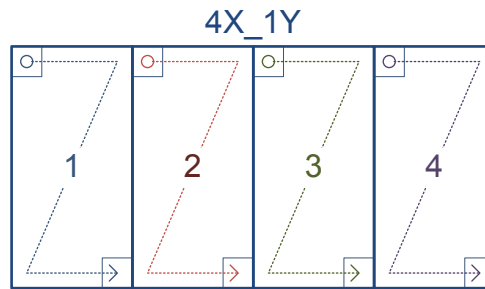
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/4	1	-1	1	H - 1	2
2	W/2	W/4 + 1	-1	1	H - 1	2
3	3W/4	W/2 + 1	-1	1	H - 1	2
4	W	3W/4 + 1	-1	1	H - 1	2
5	W/4	1	-1	2	H	2
6	W/2	W/4 + 1	-1	2	H	2
7	3W/4	W/2 + 1	-1	2	H	2
8	W	3W/4 + 1	-1	2	H	2

4XR_2YE Tap Geometry



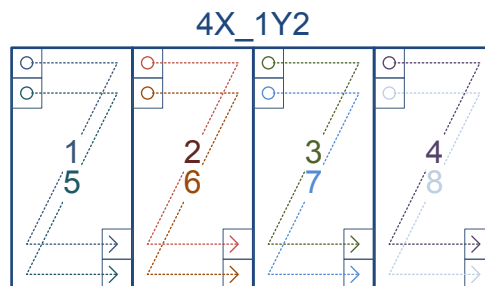
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/4	1	-1	1	H/2	1
2	W/2	W/4 + 1	-1	1	H/2	1
3	3W/4	W/2 + 1	-1	1	H/2	1
4	W	3W/4 + 1	-1	1	H/2	1
5	W/4	1	-1	H	H/2 + 1	-1
6	W/2	W/4 + 1	-1	H	H/2 + 1	-1
7	3W/4	W/2 + 1	-1	H	H/2 + 1	-1
8	W	3W/4 + 1	-1	H	H/2 + 1	-1

4X_1Y Tap Geometry



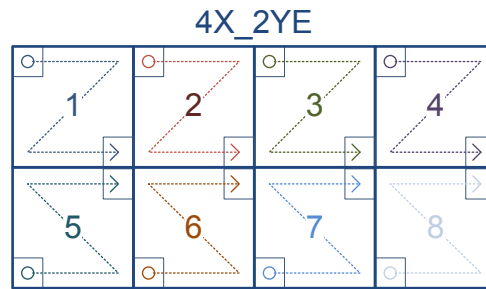
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/4	1	1	H	1
2	W/4 + 1	W/2	1	1	H	1
3	W/2 + 1	3W/4	1	1	H	1
4	3W/4 + 1	W	1	1	H	1

4X_1Y2 Tap Geometry



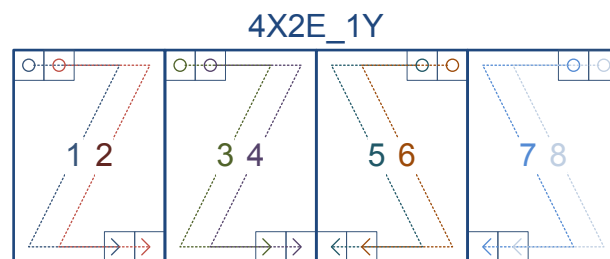
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/4	1	1	H - 1	2
2	W/4 + 1	W/2	1	1	H - 1	2
3	W/2 + 1	3W/4	1	1	H - 1	2
4	3W/4 + 1	W	1	1	H - 1	2
5	1	W/4	1	2	H	2
6	W/4 + 1	W/2	1	2	H	2
7	W/2 + 1	3W/4	1	2	H	2
8	3W/4 + 1	W	1	2	H	2

4X_2YE Tap Geometry



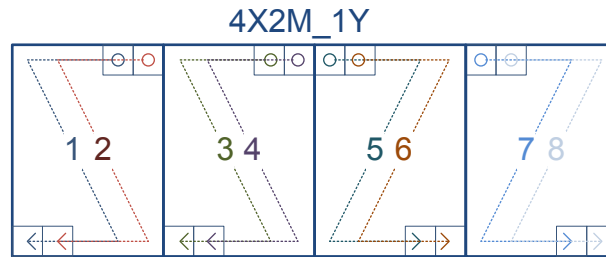
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/4	1	1	H/2	1
2	W/4 + 1	W/2	1	1	H/2	1
3	W/2 + 1	3W/4	1	1	H/2	1
4	3W/4 + 1	W	1	1	H/2	1
5	1	W/4	1	H	H/2 + 1	-1
6	W/4 + 1	W/2	1	H	H/2 + 1	-1
7	W/2 + 1	3W/4	1	H	H/2 + 1	-1
8	3W/4 + 1	W	1	H	H/2 + 1	-1

4X2E_1Y Tap Geometry



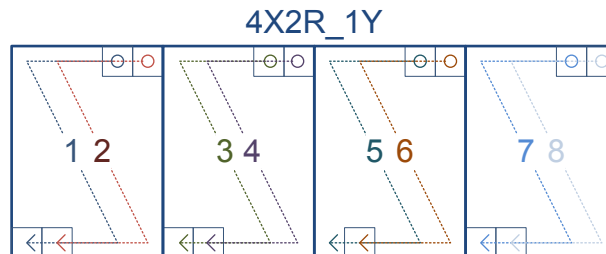
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/4 - 1	2	1	H	1
2	2	W/4	2	1	H	1
3	W/4 + 1	W/2 - 1	2	1	H	1
4	W/4 + 2	W/2	2	1	H	1
5	3W/4 - 1	W/2 + 1	-2	1	H	1
6	3W/4	W/2 + 2	-2	1	H	1
7	W - 1	3W/4 + 1	-2	1	H	1
8	W	3W/4 + 2	-2	1	H	1

4X2M_1Y Tap Geometry



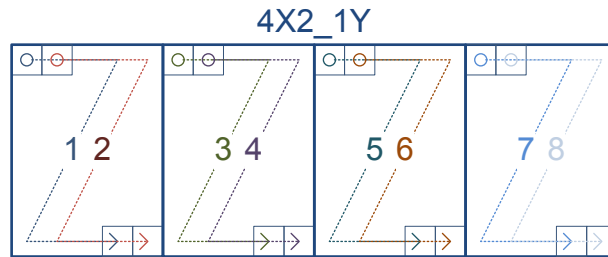
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/4 - 1$	1	-2	1	H	1
2	$W/4$	2	-2	1	H	1
3	$W/2 - 1$	$W/4 + 1$	-2	1	H	1
4	$W/2$	$W/4 + 2$	-2	1	H	1
5	$W/2 + 1$	$3W/4 - 1$	2	1	H	1
6	$W/2 + 2$	$3W/4$	2	1	H	1
7	$3W/4 + 1$	$W - 1$	2	1	H	1
8	$3W/4 + 2$	W	2	1	H	1

4X2R_1Y Tap Geometry



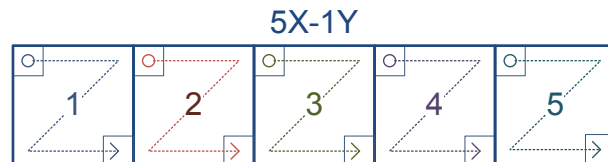
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/4 - 1$	1	-2	1	H	1
2	$W/4$	2	-2	1	H	1
3	$W/2 - 1$	$W/4 + 1$	-2	1	H	1
4	$W/2$	$W/4 + 2$	-2	1	H	1
5	$3W/4 - 1$	$W/2 + 1$	-2	1	H	1
6	$3W/4$	$W/2 + 2$	-2	1	H	1
7	$W - 1$	$3W/4 + 1$	-2	1	H	1
8	W	$3W/4 + 2$	-2	1	H	1

4X2_1Y Tap Geometry



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/4 - 1$	2	1	H	1
2	2	$W/4$	2	1	H	1
3	$W/4 + 1$	$W/2 - 1$	2	1	H	1
4	$W/4 + 2$	$W/2$	2	1	H	1
5	$W/2 + 1$	$3W/4 - 1$	2	1	H	1
6	$W/2 + 2$	$3W/4$	2	1	H	1
7	$3W/4 + 1$	$W - 1$	2	1	H	1
8	$3W/4 + 2$	W	2	1	H	1

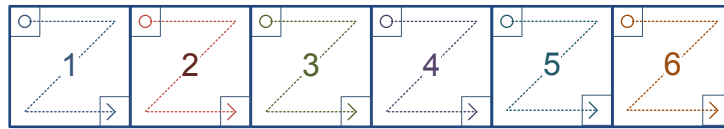
5X_1Y Tap Geometry



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/5$	1	1	H	1
2	$W/5 + 1$	$2W/5$	1	1	H	1
3	$2W/5 + 1$	$3W/5$	1	1	H	1
4	$3W/5 + 1$	$4W/5$	1	1	H	1
5	$4W/5 + 1$	W	1	1	H	1

6X_1Y Tap Geometry

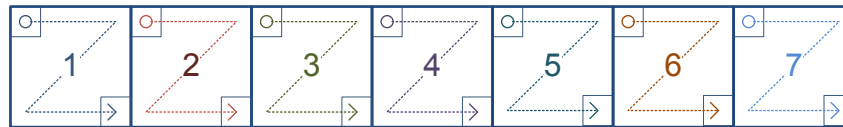
6X-1Y



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/6	1	1	H	1
2	W/6 + 1	2W/6	1	1	H	1
3	2W/6 + 1	3W/6	1	1	H	1
4	3W/6 + 1	4W/6	1	1	H	1
5	4W/6 + 1	5W/6	1	1	H	1
6	5W/6 + 1	W	1	1	H	1

7X_1Y Tap Geometry

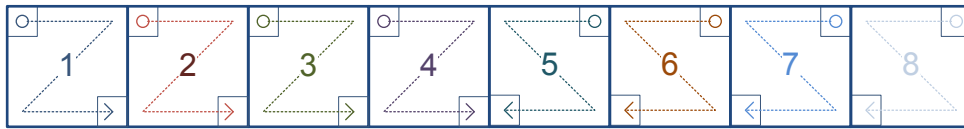
7X-1Y



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/7	1	1	H	1
2	W/7 + 1	2W/7	1	1	H	1
3	2W/7 + 1	3W/7	1	1	H	1
4	3W/7 + 1	4W/7	1	1	H	1
5	4W/7 + 1	5W/7	1	1	H	1
6	5W/7 + 1	6W/7	1	1	H	1
7	6W/7 + 1	W	1	1	H	1

8XE_1Y Tap Geometry

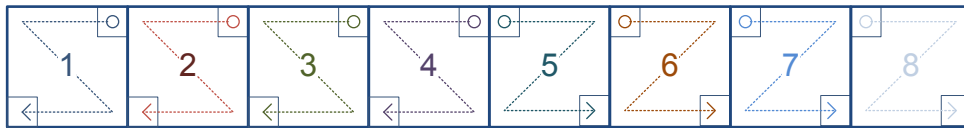
8XE-1Y



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	W/8	1	1	H	1
2	W/8 + 1	2W/8	1	1	H	1
3	2W/8 + 1	3W/8	1	1	H	1
4	3W/8 + 1	4W/8	1	1	H	1
5	5W/8	4W/8 + 1	-1	1	H	1
6	6W/8	5W/8 + 1	-1	1	H	1
7	7W/8	6W/8 + 1	-1	1	H	1
8	W	7W/8 + 1	-1	1	H	1

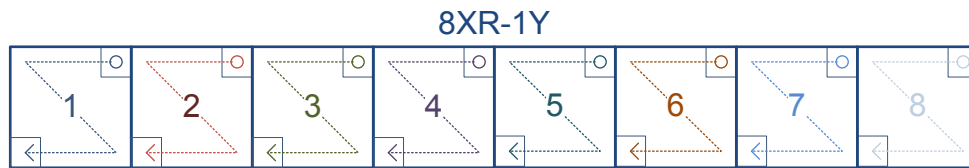
8XM_1Y Tap Geometry

8XM-1Y



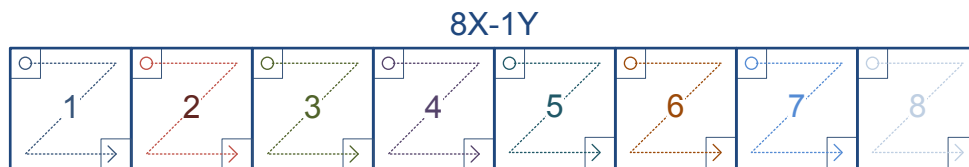
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	W/8	1	-1	1	H	1
2	2W/8	W/8 + 1	-1	1	H	1
3	3W/8	2W/8 + 1	-1	1	H	1
4	4W/8	3W/8 + 1	-1	1	H	1
5	4W/8 + 1	5W/8	1	1	H	1
6	5W/8 + 1	6W/8	1	1	H	1
7	6W/8 + 1	7W/8	1	1	H	1
8	7W/8 + 1	W	1	1	H	1

8XR_1Y Tap Geometry



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/8$	1	-1	1	H	1
2	$2W/8$	$W/8 + 1$	-1	1	H	1
3	$3W/8$	$2W/8 + 1$	-1	1	H	1
4	$4W/8$	$3W/8 + 1$	-1	1	H	1
5	$5W/8$	$4W/8 + 1$	-1	1	H	1
6	$6W/8$	$5W/8 + 1$	-1	1	H	1
7	$7W/8$	$6W/8 + 1$	-1	1	H	1
8	W	$7W/8 + 1$	-1	1	H	1

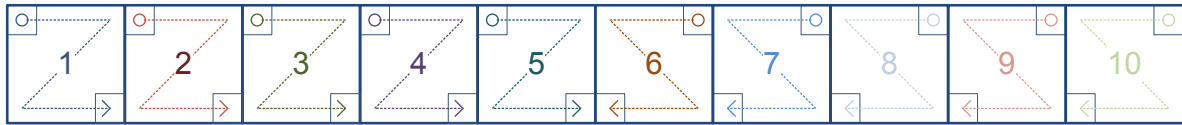
8X_1Y Tap Geometry



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/8$	1	1	H	1
2	$W/8 + 1$	$2W/8$	1	1	H	1
3	$2W/8 + 1$	$3W/8$	1	1	H	1
4	$3W/8 + 1$	$4W/8$	1	1	H	1
5	$4W/8 + 1$	$5W/8$	1	1	H	1
6	$5W/8 + 1$	$6W/8$	1	1	H	1
7	$6W/8 + 1$	$7W/8$	1	1	H	1
8	$7W/8 + 1$	W	1	1	H	1

10XE_1Y Tap Geometry

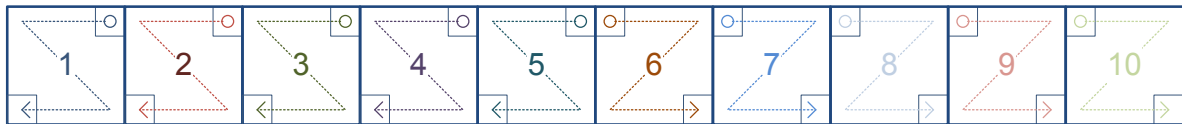
10XE-1Y



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/10$	1	1	H	1
2	$W/10 + 1$	$2W/10$	1	1	H	1
3	$2W/10 + 1$	$3W/10$	1	1	H	1
4	$3W/10 + 1$	$4W/10$	1	1	H	1
5	$4W/10 + 1$	$5W/10$	1	1	H	1
6	$6W/10$	$5W/10 + 1$	-1	1	H	1
7	$7W/10$	$6W/10 + 1$	-1	1	H	1
8	$8W/10$	$7W/10 + 1$	-1	1	H	1
9	$9W/10$	$8W/10 + 1$	-1	1	H	1
10	W	$9W/10 + 1$	-1	1	H	1

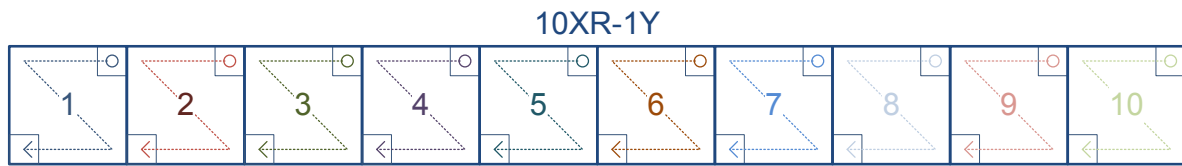
10XM_1Y Tap Geometry

10XM-1Y



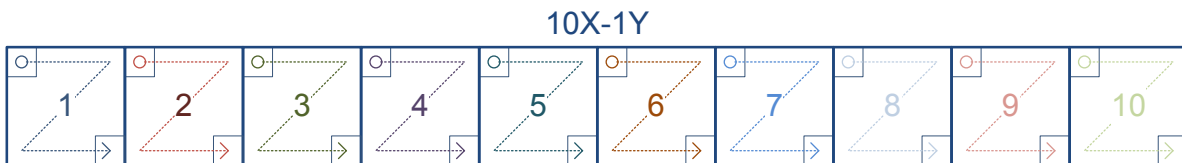
Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/10$	1	-1	1	H	1
2	$2W/10$	$W/10 + 1$	-1	1	H	1
3	$3W/10$	$2W/10 + 1$	-1	1	H	1
4	$4W/10$	$3W/10 + 1$	-1	1	H	1
5	$5W/10$	$4W/10 + 1$	-1	1	H	1
6	$5W/10 + 1$	$6W/10$	1	1	H	1
7	$6W/10 + 1$	$7W/10$	1	1	H	1
8	$7W/10 + 1$	$8W/10$	1	1	H	1
9	$8W/10 + 1$	$9W/10$	1	1	H	1
10	$9W/10 + 1$	W	1	1	H	1

10XR_1Y Tap Geometry



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	$W/10$	1	-1	1	H	1
2	$2W/10$	$W/10 + 1$	-1	1	H	1
3	$3W/10$	$2W/10 + 1$	-1	1	H	1
4	$4W/10$	$3W/10 + 1$	-1	1	H	1
5	$5W/10$	$4W/10 + 1$	-1	1	H	1
6	$6W/10$	$5W/10 + 1$	-1	1	H	1
7	$7W/10$	$6W/10 + 1$	-1	1	H	1
8	$8W/10$	$7W/10 + 1$	-1	1	H	1
9	$9W/10$	$8W/10 + 1$	-1	1	H	1
10	W	$9W/10 + 1$	-1	1	H	1

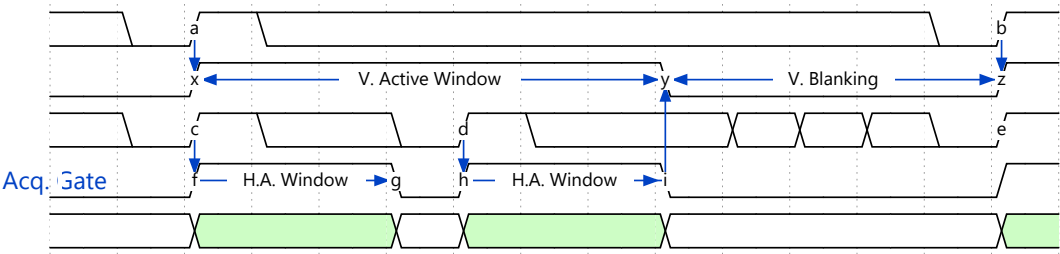
10X_1Y Tap Geometry



Tap#	X Start	X End	Step X	Y Start	Y End	Step Y
1	1	$W/10$	1	1	H	1
2	$W/10 + 1$	$2W/10$	1	1	H	1
3	$2W/10 + 1$	$3W/10$	1	1	H	1
4	$3W/10 + 1$	$4W/10$	1	1	H	1
5	$4W/10 + 1$	$5W/10$	1	1	H	1
6	$5W/10 + 1$	$6W/10$	1	1	H	1
7	$6W/10 + 1$	$7W/10$	1	1	H	1
8	$7W/10 + 1$	$8W/10$	1	1	H	1
9	$8W/10 + 1$	$9W/10$	1	1	H	1
10	$9W/10 + 1$	W	1	1	H	1

Area Scan Configuration

When **FvalLvalMode** is set to **AreaScan**, the FVAL and LVAL enable signals are used as follows:



FVAL/LVAL timing diagram (FvalLvalMode=AreaScan)

Signal	Usage
FVAL	• The rising edge (a,b) opens the <i>Vertical Active Window</i>. • The falling edge is ignored. • The <i>Vertical Active Window</i> closes after having acquired the specified number of lines (2 in this example).
LVAL	• Each rising edge (c, d) within the <i>Vertical Active Window</i> opens the <i>Horizontal Active Window</i> (f,h) and starts the acquisition of one line of pixels data. • The falling edge is ignored. • The <i>Horizontal Active Window</i> closes after having acquired the specified number of pixels (g,i).

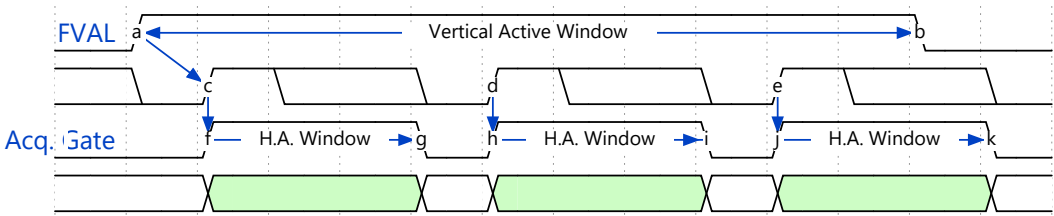
See also: FVAL Enable Signal for a detailed description of the Vertical Active Window and the FVAL anti-glitch filter

See also: LVAL Enable Signal for a detailed description of the Horizontal Active Window and the LVAL anti-glitch filter

See also: DVAL Enable Signal for a description of the DVAL gating

Frame Cover Configuration

When **FvalLvalMode** is set to **FrameCover**, the FVAL and LVAL enable signals are used as follows:



FVAL/LVAL timing diagram (**FvalLvalMode**=**FrameCover**)

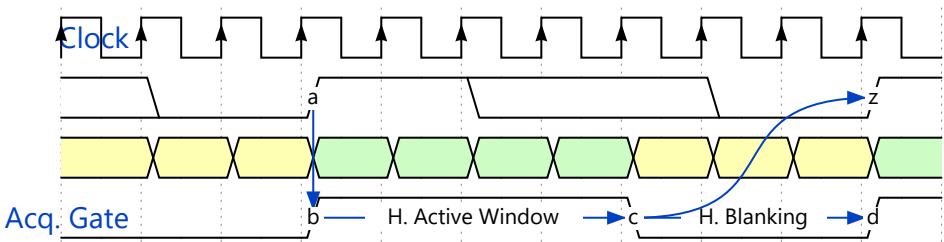
Signal	Usage
FVAL	• The rising edge (a) opens the <i>Vertical Active Window</i>. • The falling edge (b) closes the <i>Vertical Active Window</i>.
LVAL	• Each rising edge (c, d, e) within the <i>Vertical Active Window</i> opens the <i>Horizontal Active Window</i> (f,h,i) and starts the acquisition of one line of pixels data. • The falling edge is ignored. • The <i>Horizontal Active Window</i> closes after having acquired the specified number of pixels (g,i,k).

See also: LVAL Enable Signal for a detailed description of the Horizontal Active Window and the LVAL anti-glitch filter

See also: DVAL Enable Signal for a description of the DVAL gating

Line Scan Configuration

When **FvalLvalMode** is set to **LineScan**, the LVAL enable signal is used as follows:



LVAL timing diagram (**FvalLvalMode**=**LineScan**)

Signal	Usage
FVAL	• The signal is ignored
LVAL	• Each rising edge (a, z) within the <i>Scan Length</i> opens the <i>Horizontal Active Window</i> (b,d) and starts the acquisition of one line of pixels data.

Signal	Usage
	• The falling edge is ignored. • The <i>Horizontal Active Window</i> closes (c) after having acquired the specified number of pixels.

See also: ["Line-scan Acquisition Principles" on page 98](#) for a definition of the Scan Length

See also: LVAL Enable Signal for a detailed description of the Horizontal Active Window and the LVAL anti-glitch filter

See also: DVAL Enable Signal for a description of the DVAL gating

1.3. Generic Control Protocol

Introduction

GenCP (Generic Control Protocol) is a GenICam standard protocol that the **PC1628 Grablink Duo** supports to control and communicate with a GenCP camera. It is a packet-based protocol to read and write registers in the register-based camera.

PC1628 Grablink Duo operates GenCP over the Camera Link serial communication port.

GenCP allows the integration of a device into GenICam, which simplifies and standardizes the process of configuring a Camera Link camera, by interfacing the registers of the camera to the GenICam GenApi module.

Configuration

To enable GenCP communication with the camera, the three following features of the Interface GenApi module can be configured:

- **DeviceControlProtocol**: specifies the protocol used to control the remote device. Set **DeviceControlProtocol=GenCP** on the desired device using **DeviceSelector**.
- **GenCPSerialBaudRate**: specifies the baud rate at which the **PC1628 Grablink Duo** initiates the GenCP serial communication. By default, **GenCPSerialBaudRate=Detect** which allows the grabber to automatically detect the current baud rate of the camera. This feature can also be manually set to a specific baud rate value, which must match the baud rate configuration of the camera. Note that mismatched baud rates may result in serial connection errors. **Detect** can be useful if you are unsure about the camera's baud rate configuration.
- **GenCPSerialBaudRateMaximize**: specifies whether baud rate should be maximized after the GenCP communication has been established. By default, **GenCPSerialBaudRateMaximize=True** which will increase baud rate to the maximum supported by both the grabber and the camera (**PC1628 Grablink Duo** supports maximum 230400 Bd).

Updating device list

To apply the new **DeviceControlProtocol** setting and enable the GenCP device, the device list must be updated by calling the GenTL function **IFUpdateDeviceList**. Without a call to **IFUpdateDeviceList**, **DeviceControlProtocol** will not be updated for the device(s).

NOTE: The feature **DeviceUpdateList** of the interface module, which has the same function as **IFUpdateDeviceList**, can also be executed to update the device list.

NOTE: A call to **IFUpdateDeviceList** does not affect any instantiated Device modules. To update the **DeviceControlProtocol** for an already opened device module, close the module before calling **IFUpdateDeviceList**.

NOTE: To reset default configuration using the virtual remote device of **PC1628 Grablink Duo**, the same procedure can be followed but with **DeviceControlProtocol=Default**.

Initializing GenCP communication

After updating the device list, the GenCP device can be opened: the device starts initializing GenCP communication with the camera. Baud rate will be configured according to the features `GenCPSerialBaudRate` and `GenCPSerialBaudRateMaximize` of the interface.

Controlling the GenCP device

In the Device module, the category GenCP contains the following features:

- `GenCPConnectionStatus`: shows the current status of the GenCP connection to the camera. If `GenCPConnectionStatus=NotOK`, the command `GenCPSerialBaudRateDetect` may be executed to try recovering baud rate and serial connection to the camera.
- `GenCPSerialBaudRate`: baud rate used to communicate with the GenCP camera.
- `GenCPSerialBaudRateDetect`: command to detect baud rate of the GenCP camera. This command may be useful to recover baud rate in case of a connection loss with the camera.
- `GenCPSerialBaudRateMaximize`: command to increase baud rate to the maximum supported by both grabber and camera.
- `GenCPMaxPacketSize`: Maximum packet size used to communicate with the GenCP camera. If a GenCP packet command failed with the maximum packet size, the grabber may attempt to resend the failed command with a decreased `GenCPMaxPacketSize`.

1.4. Partition Schemes

One device, one 'Image data' partition

Applies to the following firmware variants of PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value:

 Duo	(1-camera), (1-camera, line-scan)
 QuadG3	(1-camera, line-scan)
 Octo	(1-camera), (1-camera, line-scan)
 Mono12LH	(1-camera), (1-camera, line-scan)
 Duo12	(1-camera), (1-camera, line-scan)
 Value12	(1-camera, line-scan)

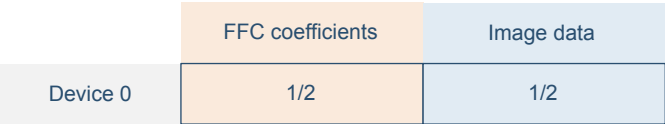


1D partition scheme

One device, two partitions per device: 'FFC coefficients' and 'Image data'

Applies to the following firmware variants of PC1633-T Coaxlink Quad G3 and PC3623-T Coaxlink Quad CXP-12 Value:

 QuadG3	(1-camera)
 Value12	(1-camera)



1D_FFC partition scheme

Two devices, one 'Image data' partition per device

Applies to the following firmware variants of PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value:

Duo

 (2-camera), (2-camera, line-scan)

QuadG3

 (2-camera), (2-camera, bayer), (2-camera, line-scan)

Octo

 (2-camera, line-scan)

Duo12

 (2-camera), (2-camera, line-scan)

Value12

 (2-camera), (2-camera, line-scan)

	Image data
Device 0	1/2
Device 1	1/2

2D partition scheme

Two devices, two partitions per device: 'CustomLogic' and 'Image data'

Applies to the following firmware variants of PC3602-T Coaxlink Octo:

Octo

 (2-camera, line-scan, custom-logic)

	CustomLogic	Image data
Device 0	1/4	1/4
Device 1	1/4	1/4

2D_CL partition scheme

Two devices, two partitions per device: 'FFC coefficients' and 'Image data'

Applies to the following firmware variants of PC3602-T Coaxlink Octo:

 (2-camera)

	FFC coefficients	Image data
Device 0	1/4	1/4
Device 1	1/4	1/4

2D_FFC partition scheme

Three devices, one 'Image data' partition per device

Applies to the following firmware variants of PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo and PC3623-T Coaxlink Quad CXP-12 Value:

 (3-camera)

 (3-camera)

 (3-camera)

	Image data
Device 0	1/2
Device 1	1/4
Device 2	1/4

3D partition scheme

Four devices, one 'Image data' partition per device

Applies to the following firmware variants of PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo and PC3623-T Coaxlink Quad CXP-12 Value:

 QuadG3 (4-camera), (4-camera, line-scan)

 Octo (4-camera), (4-camera, line-scan)

 Value12 (4-camera), (4-camera, line-scan)

	Image data
Device 0	1/4
Device 1	1/4
Device 2	1/4
Device 3	1/4

4D partition scheme

Four data streams, one 'Image data' partition per data stream

Applies to the following firmware variants of PC1633-T Coaxlink Quad G3:

 QuadG3 (1-camera, 4-data-stream)

	Image data
Stream0	1/4
Stream1	1/4
Stream2	1/4
Stream3	1/4

4S partition scheme

Five devices, one 'Image data' partition per device, 5D22211 scheme

Applies to the following firmware variants of PC3602-T Coaxlink Octo:

 (5-camera, 5D22211)

	Image data
Device 0	1/4
Device 1	1/4
Device 2	1/4
Device 3	1/8
Device 4	1/8

5D22211 partition scheme

Five devices, one 'Image data' partition per device, 5D41111 scheme

Applies to the following firmware variants of PC3602-T Coaxlink Octo:

 (5-camera)

	Image data
Device 0	1/2
Device 1	1/8
Device 2	1/8
Device 3	1/8
Device 4	1/8

5D4111 partition scheme

Six devices, one 'Image data' partition per device, 6D221111 scheme

Applies to the following firmware variants of PC3602-T Coaxlink Octo:

 (5-camera)

	Image data
Device 0	1/4
Device 1	1/4
Device 2	1/8
Device 3	1/8
Device 4	1/8
Device 5	1/8

6D22111 partition scheme

Eight devices, one 'Image data' partition per device

Applies to the following firmware variants of PC3602-T Coaxlink Octo:

 (8-camera), (8-camera, line-scan)

	Image data
Device 0	1/8
Device 1	1/8
Device 2	1/8
Device 3	1/8
Device 4	1/8
Device 5	1/8
Device 6	1/8
Device 7	1/8

8D partition scheme

2. Acquisition Gate

The *Acquisition Gate* controls the image data extraction from the *Image data* partition of the on-board memory. It discards the image data that doesn't need to be acquired and fed to the "Pixel Processing" on page 113 chain.

Area-scan acquisition

The gate opens and closes at frame boundaries based on the application's calls of the DSStartAcquisition and DSStopAcquisition functions.



NOTE

The Camera and Illumination Controller indirectly controls the acquisition gating by issuing Camera Triggers using various schemes.

See also: "Area-scan Acquisition" on page 96 for more information and configuration instructions.

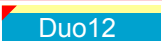
Line-scan acquisition

The gate opens and closes at line boundaries according to the application DSStartAcquisition and DSStopAcquisition function calls and, according to the settings of the Image Acquisition Controller, to the Start-of-scan and the End-of-scan triggers.

See also: "Line-scan Acquisition" on page 97 for more information and configuration instructions.

3. Area-scan Acquisition

Applies to the following firmware variants of PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value:

 Duo	(1-camera), (2-camera)
 QuadG3	(1-camera), (1-camera, 4-data-stream), (2-camera), (2-camera, bayer), (3-camera), (4-camera)
 Octo	(1-camera), (1-camera, custom-logic), (2-camera), (3-camera), (4-camera), (5-camera), (5-camera, 5D22211), (6-camera), (8-camera)
 Mono12LH	(1-camera)
 Duo12	(1-camera), (2-camera)
 Value12	(1-camera), (2-camera), (3-camera), (4-camera)

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3.1. Area-scan Acquisition Principles

Area-scan imaging

The expression “Area-scan imaging” designates machine vision applications where images are obtained from a camera delivering 1 image frame every camera cycle.

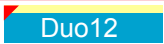
GenTL buffer filling rules – Area-scan firmware variants

In area-scan imaging, GenTL buffers are filled according to the following rules:

- The first acquired line data of a frame is, by default, stored at the beginning of a new buffer. When vertical image flipping is enabled by setting **StripeArrangement** to **Geometry_1X_1YE**, the first acquired line data of a frame is stored at the location of the last full line of a new buffer.
- When image transfer to host memory is done, the buffer, possibly partially filled, is made available to the application for processing.
- When the remaining space of a buffer is not sufficient to store a complete frame, the remaining data is handled according to the "[Area-scan Acquisition Principles](#)" on page 96.

4. Line-scan Acquisition

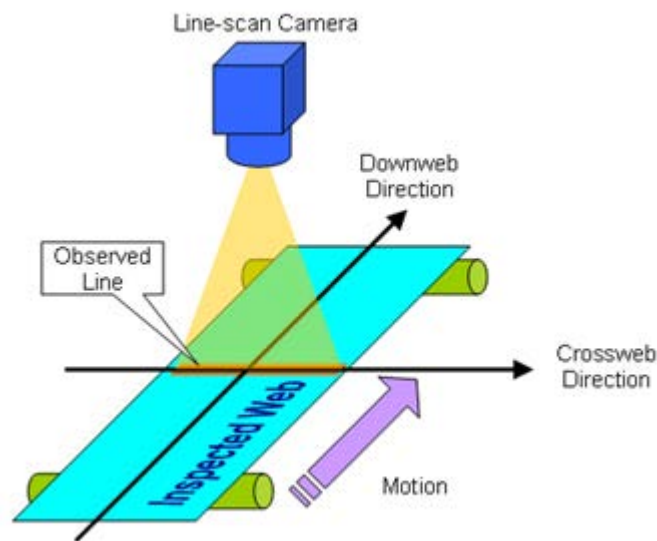
Applies to the following firmware variants of PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value:

	(1-camera, line-scan), (2-camera, line-scan)
	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan)
	(1-camera, line-scan), (2-camera, line-scan), (2-camera, line-scan, custom-logic), (4-camera, line-scan), (8-camera, line-scan)
	(1-camera, line-scan)
	(1-camera, line-scan), (2-camera, line-scan)
	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan)

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4.1. Line-scan Acquisition Principles

Line-scan imaging



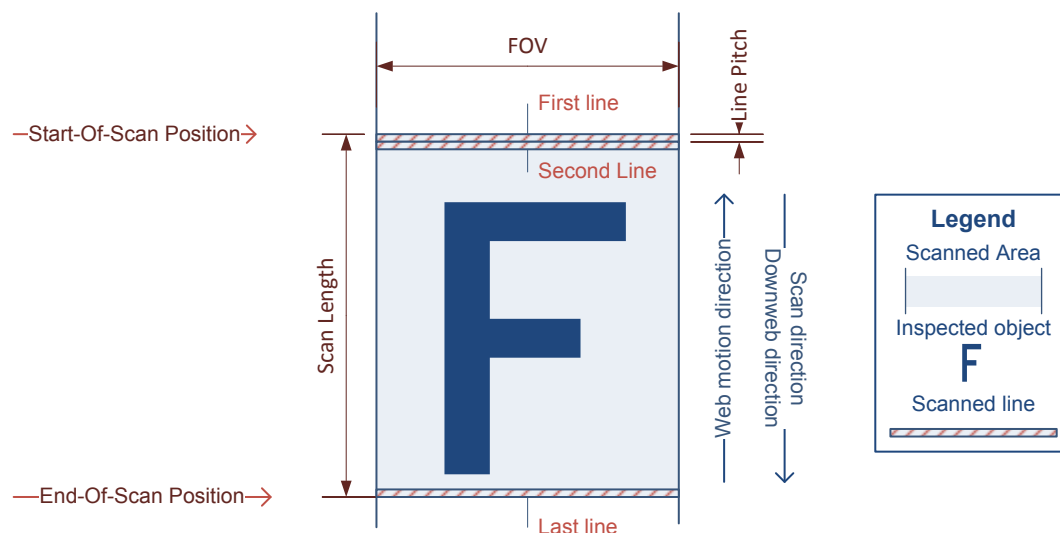
Typical line-scan imaging system

The expression “Line-scan imaging” designates machine vision applications where 2-D images are obtained by the combination of successive image lines captured from a 1-D imaging device that moves relatively to the object.

In line-scan imaging:

- The imaging device is often, but not necessarily, a line-scan camera.
- The inspected object is often a continuous web, it can also be discrete objects having fixed or variable size.
- The inspected web moves relatively to the camera. The motion speed during the acquisition can be fixed or variable.
 - The *cross-web direction* or *transverse direction* is the axis on the web plane that is observed by the camera.
 - The *down-web direction* or *axial direction* is the motion direction of the inspected web relatively to the camera.

Scanning area



Scanning area definitions

The scanning area is a 2-D area on the web having a width equal to FOV and a length equal to Scan Length.

In the cross-web direction (horizontal direction in the above drawing), the scanning area is delimited by the field of view – FOV – of the camera.

In the down-web direction (vertical direction in the above drawing), the scanning area is delimited by the start-of-scan and the end-of-scan positions. The line pitch¹ is determined by the ratio between the web speed and the camera line rate.

The *field of view* – FOV – of a line-scan camera is determined only by the optical setup and the sensor geometrical properties.

The *start-of-scan position* is a position on the web corresponding to the scan-line boundary preceding the first acquired line.

The *end-of-scan position* is a position on the web corresponding to the scan-line boundary following the last acquired line.

Most of the line-scan cameras are delivering a single row of pixels every camera cycle. Consequently, *multiple camera cycles* are necessary to build-up the object image.

NOTE: In this context, the "line pitch" term is a geometrical property. In other sections of this documentation, the term LinePitch² is a memory offset between two consecutive lines in a GenTL Buffer.

¹In the imaging device context, refers to the distance between two consecutive scan lines in an image sensor. For line-scan imagers, "Line Pitch" is determined by the relative displacement between the camera and the object during a camera cycle period.

²In the context of a GenTL image buffer, represents the memory offset between two adjacent pixels along a vertical axis. Also known as buffer width.

Pixel aspect ratio control

Unlike area-scan imaging, line-scan imaging allows the application to control the image pixel aspect ratio.

In the large majority of cases, the imaging application requires a constant, and preferably a 1:1 image pixel aspect ratio.

The cross-web pitch being locked by the sensor pitch and the optical magnification factor, the image pixel aspect ratio is controllable only through the following methods:

Constant camera cycle method

In this method, the camera operates at a constant cycle rate and the frame grabber captures all the successive lines delivered by the camera.

Variable camera cycle method

In this method, the *web speed is variable* and the *camera cycle rate is kept proportional to the web speed*.

The frame grabber builds the object image by capturing all the successive lines delivered by the camera.

This method requires:

- A *motion encoder* for measuring the web speed.
- A *real-time processing* of the motion encoder events to build a camera trigger at a rate that is *proportional* to the motion encoder events rate.

Having a proportional rate can be achieved by a *divider tool* or a *multiplier/divider tool*:

- The "[Divider Tool](#)" on [page 220](#) decimates the input rate by an integer value, it delivers 1 out of N incoming events.
- The "[Multiplier/Divider Tool](#)" on [page 221](#) enables fine control of the image pixel aspect ratio by allowing any rate conversion ratio value – RCR – in the range 0.001 to 1000 with an accuracy better than 0.1% of the RCR value.

Image acquisition with line-scan imaging devices

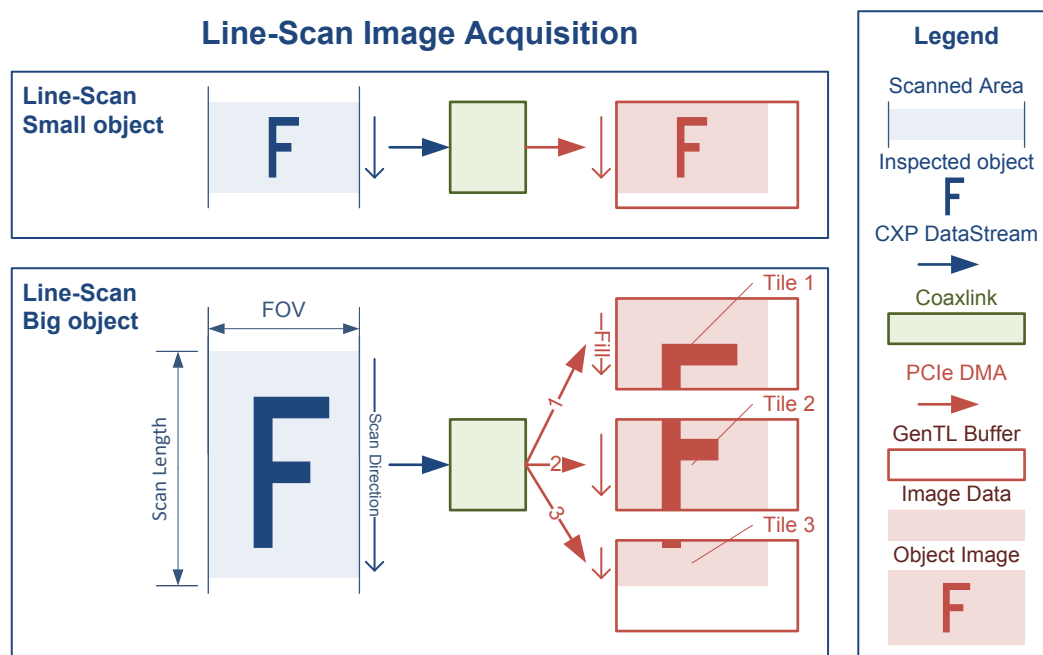


Image capture of small and large objects

For the transmission on the CoaXPress link, (most of) the line-scan cameras use *one CoaXPress Image Data Stream*.

Regarding the delivery methods of the image data, two cases are to be considered:

- For small objects, the object image data are delivered into a *single GenTL buffer*.
- For big objects, the object image data are delivered into *multiple GenTL buffers*.

In both cases, the image data are delivered through a single PCIe DMA channel and the transmission latency is low: “one image line”.

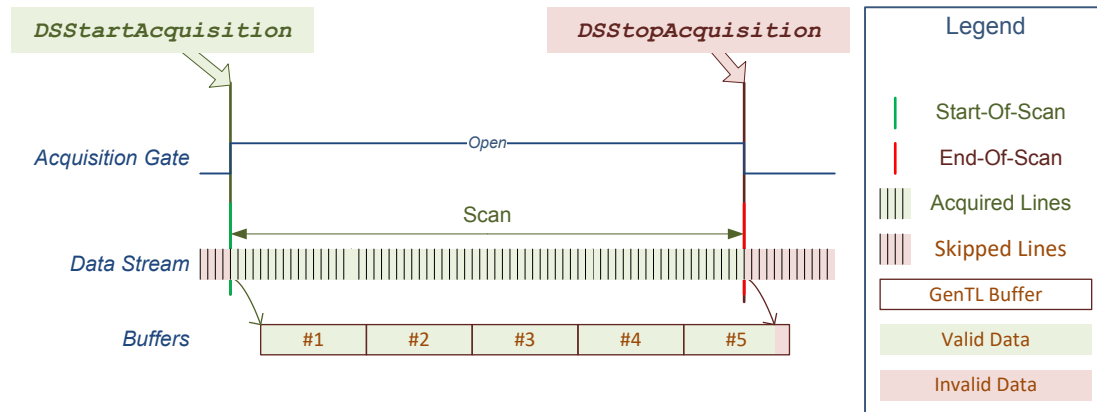
GenTL buffer filling rules – Line-scan firmware variants

In line-scan imaging, GenTL buffers are filled according to the following rules:

- The first acquired line data of a scan is, by default, stored at the beginning of a new buffer. When vertical image flipping is enabled by setting **StripeArrangement** to **Geometry_1X_1YE**, the first acquired line data of a scan is stored at the location of the last full line of a new buffer.
- A buffer contains an integer number of image lines data.
- When the remaining space of a buffer is not sufficient to store a an image line data, the remaining data is handled according to the "[Line-scan Acquisition Principles](#)" on page 98.
- When the last line data of a scan is acquired, the last buffer, possibly partially filled, is made available to the application for processing.

4.2. Line-scan Acquisition Use cases

Scanning of continuous objects



Scanning of continuous objects

This case applies to the image scanning of **continuous objects**.

The acquisition controller is configured as follows:

- **StartOfScanTriggerSource** = **Immediate**.
- **EndOfScanTriggerSource** = **StopScan**.

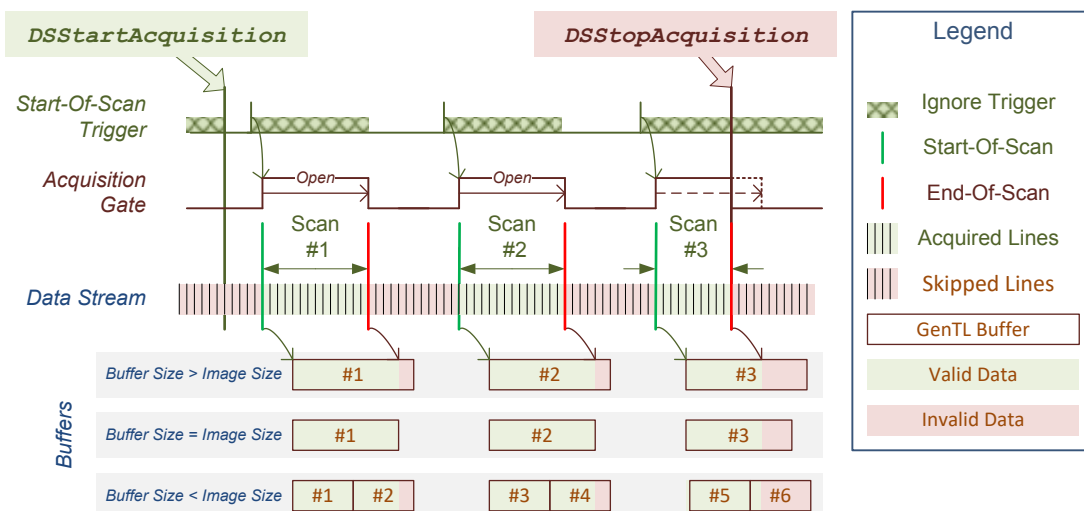
When the DSStartAcquisition function is called, the scanning starts at the next line boundary.

The acquisition gate closes when the application calls the DSStopAcquisition function.

Depending on the allocated buffer size and the scanning duration, the object image fits in a single buffer or requires multiple buffers.

Each buffer is delivered to the application as soon as it is filled. The last buffer, likely partially filled, is delivered as soon as the last image data are written.

Fixed-length scanning of discrete objects



Scanning of discrete objects with a common scan length

The **eGrabber** acquisition controller is configured as follows:

- **StartOfScanTriggerSource** = **StartScan** or any applicable I/O Toolbox event output, for instance: **LIN1**.
- **EndOfScanTriggerSource** = **ScanLength**.
- **ScanLength** is any positive number representing the number of lines required to capture the object image entirely.

When the **DSSStartAcquisition** function is called, the start-of-scan trigger of the acquisition controller is armed.

Then, the acquisition controller waits for the first occurrence of a valid start-of-scan trigger event.

A valid start-of-scan event can be generated:

- By the application using a **StartScan** command.
- By the selected hardware event source, if specified by **StartOfScanTriggerSource**.

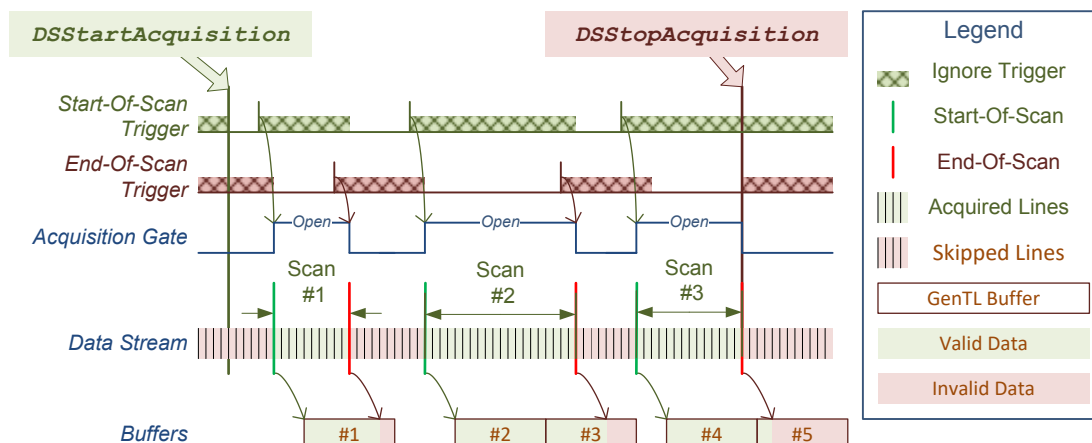
The acquisition controller ignores any Start-of-Scan trigger event while a scanning is in progress.

The acquisition gate opens at the first line boundary following a start-of-scan event.

The acquisition gate closes automatically after the specified number of lines have been acquired or anticipatively when the application calls the **DSSStopAcquisition** function.

Depending on the allocated buffer size, the object image fits in a single buffer or requires multiple buffers. Each buffer is delivered to the application as soon as it is filled. At the end-of-scan, partially filled buffers are immediately delivered. The following image acquisition always begins with a new buffer.

Variable-length scanning of discrete objects



Scanning of discrete objects requiring a variable scan length

The **eGrabber** acquisition controller is configured as follows:

- **StartOfScanTriggerSource** = **StartScan** or any applicable I/O Toolbox event output, for instance: **LIN1**.
- **EndOfScanTriggerSource** = **StopScan** or any applicable I/O Toolbox event output, for instance: **LIN2**.

When the **DSStartAcquisition** function is called, the start-of-scan trigger of the acquisition controller is armed.

Then, the acquisition controller waits for the first occurrence of a valid start-of-scan trigger event.

A valid start-of-scan event can be generated:

- By the application using a **StartScan** command.
- By the selected hardware event source, if specified by **StartOfScanTriggerSource**.

The acquisition controller ignores any Start-of-Scan trigger event while a scanning is in progress.

The acquisition gate opens at the first line boundary following a start-of-scan event.

The acquisition gate closes at the first line boundary following a valid end-of-scan event or immediately when the application calls the **DStopAcquisition** function.

A valid end-of-scan event can be generated:

- By the application using a **StopScan** command.
- By the selected hardware event source, if specified by **EndOfScanTriggerSource**.

The acquisition controller ignores any End-of-Scan trigger event when no scanning is in progress.

Depending on the allocated buffer size, the object image fits in a single buffer or requires multiple buffers. Each buffer is delivered to the application as soon as it is filled. At the end-of-scan, partially filled buffers are immediately delivered. The next image acquisition always begins with a new buffer.

4.3. Metadata Insertion

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC3602-T Coaxlink Octo** and **PC3623-T Coaxlink Quad CXP-12 Value**:

 Duo	(1-camera, line-scan), (2-camera, line-scan)
 Octo	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan), (8-camera, line-scan)
 Value12	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan)

Introduction

The Metadata Insertion feature allows line-scan applications to insert metadata into a buffer.

Two types of metadata can be inserted into a buffer:

- *Buffer metadata*: 4x32-bit metadata are inserted into an internal header information of the buffer;
- *Line metadata*: 4x32-bit metadata are inserted at the end of each image line within the buffer.

These two types of metadata can be inserted independently or simultaneously.

Requirements

Only available on grabber-controlled cycle-start camera control methods (RG and RC).

The metadata are sampled on the `CycleStart` events of the CIC:

- Buffer metadata are sampled on the `CycleStart` event that initiates the first line of the buffer
- Line metadata are sampled on each `CycleStart` event

Configuration

The `MetadataInsertion` category of the Data Stream module contains the features for configuring metadata insertion.

Each `MetadataInsertion` feature responsible for configuring metadata insertion must be set before starting an acquisition.

When an acquisition is started, the features are locked.

Activation of the metadata

- `BufferMetadataInsertionEnable`: Boolean feature to enable/disable the insertion of 4x32-bit (16 bytes) metadata for the buffer
- `LineMetadataInsertionEnable`: Boolean feature to enable/disable the insertion of 4x32-bit (16 bytes) metadata at the end of each image line

Enabling the insertion of buffer metadata does not affect the payload size of the buffer.

However, enabling the insertion of line metadata does affect the payload size of the buffer.

When `LineMetadataInsertionEnable = True`, the data stream feature `LineWidth` is automatically increased by 16 to count for the size of the line metadata, which in turn may increase the data stream `PayloadSize` (or consume some of the padding part of the buffer, if used).

NOTE: the size of the padding on a line, is always the difference between `LinePitch` and `LineWidth`, if `LinePitch > LineWidth`. When padding is added together with line metadata insertion, the padding part is located after the line metadata (image line - line metadata - padding).

See also: [Image Data Padding](#).



TIP

Enable "[Trigger to Line Latency Compensation](#)" on page 110 to properly correlate line-data with line-triggers.

Contents of the metadata

The metadata can contain GPC values, QDC positions, and/or I/O line states.

The contents of the metadata are configured with the features `MetadataContent<N>`, where `N` represents the offset, from 0 to 3, of one 32-bit metadata within a chunk of 128-bit metadata.

These four features describe the contents to be reported in both the buffer and line metadata.

The features can report the following contents:

`MetadataContent0`

- `GPC1Value`: Value of General Purpose Counter 1
- `GPC1LatchedValue`: Latched value of General Purpose Counter 1
- `QDC1Position`: Position of Quadrature Decoder Tool 1

`MetadataContent1`

- `GPC2Value`: Value of General Purpose Counter 2
- `GPC2LatchedValue`: Latched value of General Purpose Counter 2
- `QDC2Position`: Position of Quadrature Decoder Tool 2 (if available)

`MetadataContent2`

- `GPC3Value`: Value of General Purpose Counter 3
- `GPC3LatchedValue`: Latched value of General Purpose Counter 3
- `QDC3Position`: Position of Quadrature Decoder Tool 3 (if available)
- `LineStatusAllHi`: High 32-bit part of `LineStatusAll`

`MetadataContent3`

- `GPC4Value`: Value of General Purpose Counter 4
- `GPC4LatchedValue`: Latched value of General Purpose Counter 4
- `QDC4Position`: Position of Quadrature Decoder Tool 4 (if available)
- `LineStatusAll`: Low 32-bit part of `LineStatusAll`

On `CycleStart` event, the selected contents are sampled. Their values will be inserted in the buffer and/or the line metadata.

General Purpose Counter (GPC)

Four 32-bit *General Purpose Counters* can be used in various ways, e.g., to count the number of occurrences of a particular event, to implement a differential counter between two event streams, or even to latch a counter on a particular event. The latch functionality can be useful for permanent period measurements.

The GPCs are selected through `GeneralPurposeCounterSelector` and enabled/disabled with `GeneralPurposeCounterEnable`.

Up to three event sources can be set to define the behavior of a GPC:

- `GeneralPurposeCounterIncrementSource`: selects an event stream used as trigger to increment the selected GPC
- `GeneralPurposeCounterDecrementSource`: selects an event stream used as trigger to decrement the selected GPC
- `GeneralPurposeCounterLatchAndResetSource`: selects an event stream used as trigger to latch and reset the selected GPC

When `GeneralPurposeCounterEnable=False`, the selected counter is reset.

Example 1

To count the difference between `CycleStart` and `StartOfLine` with GPC1:

- Set `GeneralPurposeCounterSelector` to `GPC1`.
- Set `GeneralPurposeCounterIncrementSource` to `CycleStart`.
- Set `GeneralPurposeCounterDecrementSource` to `StartOfLine`.
- Set `GeneralPurposeCounterLatchAndResetSource` to `NONE`.
- Set `GeneralPurposeCounterEnable` to `True`.

To report the value of GPC1 in the metadata:

- Set `MetadataContent0` to `GPC1Value`.

NOTE: the value of this GPC in the metadata will always be greater than 0. That is because the GPC is sampled on `CycleStart`, while `StartOfLine` will always happen after `CycleStart`.

Example 2

To measure the cycle period with GPC2:

- Set `GeneralPurposeCounterSelector` to `GPC2`.
- Set `GeneralPurposeCounterIncrementSource` to `TIME16NS`.
- Set `GeneralPurposeCounterDecrementSource` to `NONE`.
- Set `GeneralPurposeCounterLatchAndResetSource` to `CycleStart`.
- Set `GeneralPurposeCounterEnable` to `True`.

To report the latched value of GPC2 in the metadata:

- Set `MetadataContent1` to `GPC2LatchedValue`.

Getting metadata

- To get the buffer metadata of a buffer, use the commands `BUFFER_INFO_CUSTOM_BUFFER_METADATA_<N>` from `BUFFER_INFO_CUSTOM_CMD_LIST`, where N is the offset from 0 to 3.

The commands return the 32-bit inserted buffer metadata at offset N.

If no buffer metadata was inserted in the buffer, `BUFFER_INFO_CUSTOM_BUFFER_METADATA_<N>` commands return `GC_ERR_NOT_AVAILABLE`.

- To get the line metadata of a buffer, use the command `BUFFER_INFO_CUSTOM_LINE_METADATA_BASE` from `BUFFER_INFO_CUSTOM_CMD_LIST`.

The command returns a pointer to the base address of the inserted line metadata.

If no line metadata was inserted in the buffer, `BUFFER_INFO_CUSTOM_LINE_METADATA_BASE` command returns 0.

- To get the type of content of an inserted metadata in a buffer, use the commands `BUFFER_INFO_CUSTOM_METADATA_CONTENT_<N>` from `BUFFER_INFO_CUSTOM_CMD_LIST`, where N is the offset from 0 to 3.

The commands return an integer that identify the type of content that the buffer and/or line metadata contain at offset N.

The values returned by the `BUFFER_INFO_CUSTOM_METADATA_CONTENT_<N>` commands are translated as follows:

Value	<code>BUFFER_INFO_CUSTOM_METADATA_CONTENT_0</code>	<code>BUFFER_INFO_CUSTOM_METADATA_CONTENT_1</code>	<code>BUFFER_INFO_CUSTOM_METADATA_CONTENT_2</code>	<code>BUFFER_INFO_CUSTOM_METADATA_CONTENT_3</code>
1	GPC1Value	GPC2Value	GPC3Value	GPC4Value
2	GPC1LatchedValue	GPC2LatchedValue	GPC3LatchedValue	GPC4LatchedValue
3	QDC1Position	QDC2Position	QDC3Position	QDC4Position
4			LineStatusAllHi	LineStatusAll

If neither buffer nor line metadata were inserted, `BUFFER_INFO_CUSTOM_METADATA_CONTENT_<N>` commands return `GC_ERR_NOT_AVAILABLE`.

See also: [cpp/330-metadata-insertion sample program](#)

4.4. Trigger to Line Latency Compensation

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC3602-T Coaxlink Octo** and **PC3623-T Coaxlink Quad CXP-12** Value:

 Duo	(1-camera, line-scan), (2-camera, line-scan)
 Octo	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan), (8-camera, line-scan)
 Value12	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan)

What is trigger to line latency?

As described in the "[Camera Control Principles](#)" on [page 159](#) section, a camera cycle is composed of two consecutive phases: Exposure and Readout.

Some cameras require additional time to process and transmit the processed line data to the frame grabber. This time is named *trigger to line latency*.

When the latency becomes significant (when compared to the camera cycle time) the association between a line trigger and the corresponding data is not anymore possible.

Line trigger latency compensation logic

When enabled, the compensation logic evaluates the delay and retards the execution of the `StartOfScan` and/or the `EndOfScan` events to ensure the line data are correlated.

Latency compensation control

The *line trigger latency compensation logic* is configurable via the `TriggerToLineLatencyCompensation` GenApi feature in the DataStream Module.

Possible values are:

- **Disable**: Disable latency compensation
- **Enable**: Enable latency compensation for `StartOfScan` and `EndOfScan` events.
- **EnableForStartOfScanOnly**: Enable latency compensation for `StartOfScan` events only.
- **EnableForEndOfScanOnly**: Enable latency compensation for `EndOfScan` events only.

The default value is **Disable**.



TIP

Enable line trigger latency compensation when [metadata insertion](#) is enabled!

5. Image Format Control

5.1. RGB Horizontal Planar Conversion 111

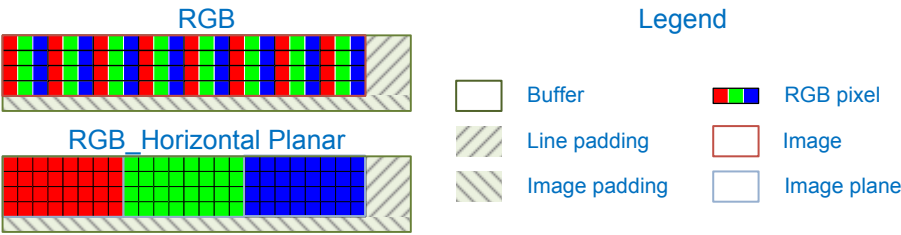
5.1. RGB Horizontal Planar Conversion

Applies to the following firmware variants of PC1628-T Grablink Duo and PC3602-T Coaxlink Octo:

-  Duo (1-camera, line-scan), (2-camera, line-scan)
-  Octo (2-camera, line-scan)

Providing that all "Requirements" on page 111 are fulfilled, image data streams can be configured to convert an incoming RGB/BGR pixel format into a RGB/BGR Horizontal Planar format: a AV proprietary image format.

Description



RGB* to RGB*_HorizontalPlanar conversion

When the RGB Horizontal Planar Conversion is enabled, the pixel components of each image line are grouped by color and placed one after the other (see above drawing).

When all lines are acquired, the buffer contains three distinct 2-D areas, named image planes. Images planes have the same width and height dimensions (in pixels) as the original image.

NOTE: Line padding and image padding (if any) are allowed.

Requirements

- The conversion is only applicable when all the following requirements are fulfilled:
1. Featured firmware variant (see list in the 'Applies to' section above)
 2. RGB color cameras delivering 3-component pixel data in RGB or BGR components order having 8-, 10-, 12-, 14- or 16-bit per component

3. Data Stream Module > PixelProcessing Category > UnpackingMode is not set to Off
4. The image width doesn't exceed the following limit:

Product	Bit depth	Max width [pixels]
PC3602-T Coaxlink Octo	8-bit	32,600
	10...16-bit	16,300

Activation

The conversion is enabled through the Data Stream Module > ImageFormatControl Category > PlanarRGB GenApi feature :

- When set to **Disable** (default settings), the conversion is disabled.
- When set to **Enable**, the conversion is enabled.



NOTE

This feature can only be activated or de-activated when the data-stream is inactive.

6. Pixel Processing

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6.2. Lookup Table Processing 116

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6.1. Pixel Unpacking and Alignment

Introduction

The pixel data processor is capable of unpacking and aligning 10-bit, 12-bit, and 14-bit pixel component data to 16-bit data containers.

The unpacking and the alignment operations are user-configurable through the **UnpackingMode** GenApi feature.

On **Coaxlink frame grabbers**, three options are available:

- **Lsb**: Unpacking and alignment to lsb (Default setting since release 4.3)
- **Msb**: Unpacking and alignment to msb
- **Off**: No unpacking

Unpacking and alignment to lsb

The significant bits of the pixel component data are aligned to the *least significant bit* of the data container. Padding '0' bits are put as necessary in the *most significant bits* to reach the next 8-bit boundary.

- 10-bit pixels: 0000 00<pp pppp pppp>
- 12-bit pixels: 0000 <pppp pppp pppp>
- 14-bit pixels: 00<pp pppp pppp pppp>

NOTE: Unpacking to lsb doesn't modify the pixel component value.

NOTE: Unpacking 10-bit, 12-bit, and 14-bit pixel components increases the amount of data by 160%, 133%, and 114% respectively!

NOTE: Unpacking 8-bit and 16-bit pixel components is a neutral operation. The size of the data container is unchanged (one byte for 8-bit pixel components; two bytes for 16-bit pixel components) and the data bits are not modified.

Unpacking and alignment to msb

The significant bits of the pixel component data are aligned to the *most significant bit* of the data container. Padding '0' bits are put as necessary in the *least significant bits* to reach the next 8-bit boundary.

- 10-bit pixels: <pppp pppp pp>00 0000
- 12-bit pixels: <pppp pppp pppp> 0000
- 14-bit pixels: <pppp pppp pppp pp>00

NOTE: Unpacking 10-bit, 12-bit, and 14-bit pixel components to msb multiplies the pixel component value by 64, 16, and 4 respectively.

NOTE: Unpacking 10-bit, 12-bit, and 14-bit pixel components increases the amount of data by 160%, 133%, and 114% respectively!

NOTE: Unpacking 8-bit and 16-bit pixel components is a neutral operation. The size of the data container is unchanged (one byte for 8-bit pixel components; two bytes for 16-bit pixel components) and the data bits are not modified.

No unpacking (Coaxlink frame grabbers only)

The packed image data transmitted by the camera through the CoaXPress Link is delivered as is to the output buffer.

NOTE: Keeping packed image data for 10-bit, 12-bit, and 14-bit pixels avoids wasting PCI bandwidth for the transmission of padding zero's.

NOTE: This option is only available for cameras delivering monochrome and Bayer CFA pixels when pixel processing is bypassed!

6.2. Lookup Table Processing

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo**, **PC3621-LH-T Coaxlink Mono CXP-12-LH**, **PC3622-T Coaxlink Duo CXP-12** and **PC3623-T Coaxlink Quad CXP-12 Value**:

Duo	(1-camera), (1-camera, line-scan), (2-camera), (2-camera, line-scan)
QuadG3	(1-camera), (1-camera, line-scan), (2-camera), (2-camera, line-scan), (3-camera), (4-camera), (4-camera, line-scan)
Octo	(1-camera), (1-camera, custom-logic), (1-camera, line-scan), (2-camera), (2-camera, line-scan), (2-camera, line-scan, custom-logic), (3-camera), (4-camera), (4-camera, line-scan), (5-camera), (5-camera, 5D22211), (6-camera), (8-camera), (8-camera, line-scan)
Mono12LH	(1-camera), (1-camera, line-scan)
Duo12	(1-camera), (1-camera, line-scan), (2-camera), (2-camera, line-scan)
Value12	(1-camera), (1-camera, line-scan), (2-camera), (2-camera, line-scan), (3-camera), (4-camera), (4-camera, line-scan)

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Introduction to LUT Processing

eGrabber-driven frame grabbers provide lookup table processing for monochrome pixel formats exclusively!

See also: ["Monochrome Lookup Table Processing" on page 118](#) for a detailed description.

The **eGrabber** driver provides four methods to define the content of lookup tables.

See also: ["LUT Content Definition" on page 119](#)

See also: ["LUT Setup Procedure" on page 126](#) to setup lookup tables.

Monochrome Lookup Table Processing

Configurations

The following table lists all the available lookup table configurations for monochrome pixels:

Configuration	Input Pixel Format [PFNC]	Input bits	Output bits
M_8x8	Mono8, Raw	8	8
M_10x8	Mono10	10	8
M_10x10			10
M_10x16			16
M_12x8	Mono12	12	8
M_12x12			12
M_12x16			16



NOTE

Monochrome 8-bit pixels can be transformed into monochrome 8-bit pixels, monochrome 10-bit pixels can be transformed into monochrome 8-bit, 10-bit or 16-bit pixels and, monochrome 12-bit pixels can be transformed into monochrome 8-bit, 12-bit or 16-bit pixels.

Lookup Table Data Sets

A *lookup table data set* is defined as the set of data required to configure one lookup table for each component of a pixel. In the case of monochrome pixels, a lookup table data set includes only one single lookup table content.

The number of lookup table data sets that can be uploaded depends on the lookup table configuration:

Configuration	Data Sets
M_8x8	16
M_10x8, M_10x10, M_10x16	4
M_12x8, M_12x12, M_12x16	1

LUT Content Definition

Methods

The **eGrabber** driver provides four methods to define the content of a lookup table.

Response Control

The *Response Control* method defines the transfer function of a lookup table by means of four parameters: "[Brightness](#)" on page 120, "[Contrast](#)" on page 121, "[Visibility](#)" on page 122 and "[Negative](#)" on page 123.

The **Brightness** and **Contrast** parameters provide controls similar to the brightness and contrast controls of a television monitor.

The **Visibility** parameter provides control to smoothly reshape the transfer function to cover the full input range.

The **Negative** parameter allows transforming an image into its negative image.

Emphasis

The *Emphasis* method defines the transfer function of a lookup table by means of two parameters: "[Emphasis](#)" on page 124 and "[Negative](#)" on page 123.

It allows transforming an image using a power-law expression also known as γ – Gamma – function.

The **Negative** parameter allows transforming an image into its negative image.

Threshold

The *Threshold* method defines a double threshold transformation law by means of five parameters: "[SlicingLevel](#), [SlicingBand](#), [LightResponse](#), [BandResponse](#) and [DarkResponse](#)" on page 125.

Table

The *Table* method defines the transfer function of a lookup table in a tabular form.

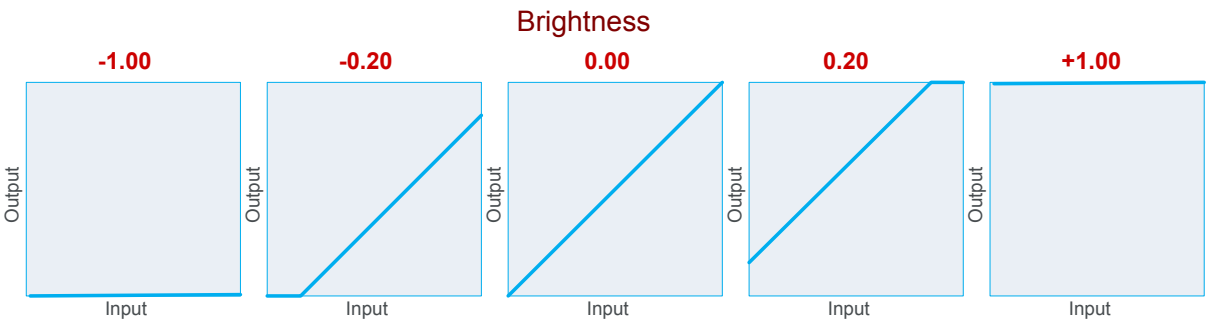
Parameters

Brightness

The **Brightness** parameter exclusively applies to the "Response Control" on page 119 lookup table definition method.

It implements a control similar to the brightness control of a television monitor.

Brightness	Note
-1.00	Minimum value. Darkest output. The whole input range data gets transformed into the full black. This rule applies for any chosen Contrast value.
0.00	Default value. Any increase in the brightness towards +1.00 results into a lighter output. Any decrease of the brightness towards -1.00 results into a darker output.
+1.00	Maximum value. Lightest output. The whole input range data gets transformed into the full white. This rule applies for any chosen Contrast value.



Effect of **Brightness** when all other controls are set to their default value:
Contrast = 1.00; Visibility = 0.00; Negative = FALSE.

Contrast

The **Contrast** parameter exclusively applies to the "Response Control" on page 119 lookup table definition method.

It implements a control similar to the contrast control of a television monitor.

The slope of the transformation law is the gain, which is non-linearly controlled from the **Contrast** parameter.

Mathematically, the relationship is:

$$\text{Gain} = 10^{2 \times (\text{Contrast} - 1)}$$

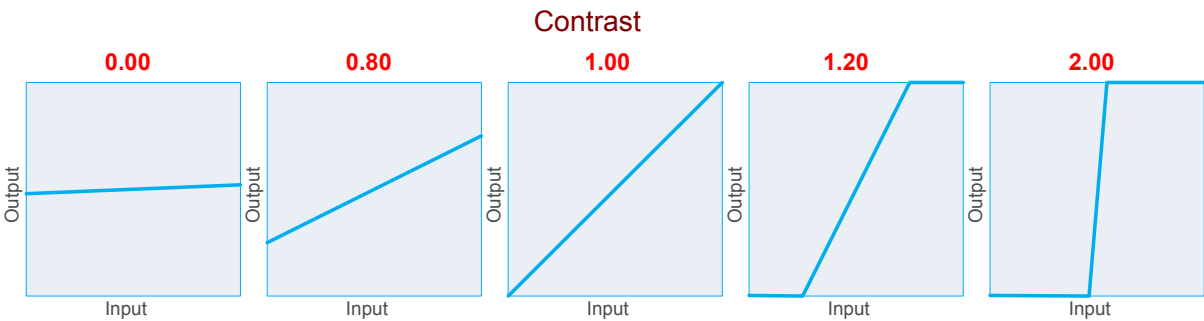
Contrast	Gain	Note
0.00	0.01	Min. Contrast value; smallest gain
1.00	1	Default Contrast value;unity gain
2.00	100	Max. Contrast value; largest gain

To achieve a required given gain, the contrast control should be set to:

$$\text{Contrast} = 1 + (\log_{10} \text{Gain})/2$$

If the required gain is expressed in decibels (dB):

$$\text{Contrast} = 1 + \text{Gain(dB)}/40$$



Effect of **Contrast** when all other controls are set to their default value:
Brightness = 0.00; Visibility = 0.00; Negative = FALSE

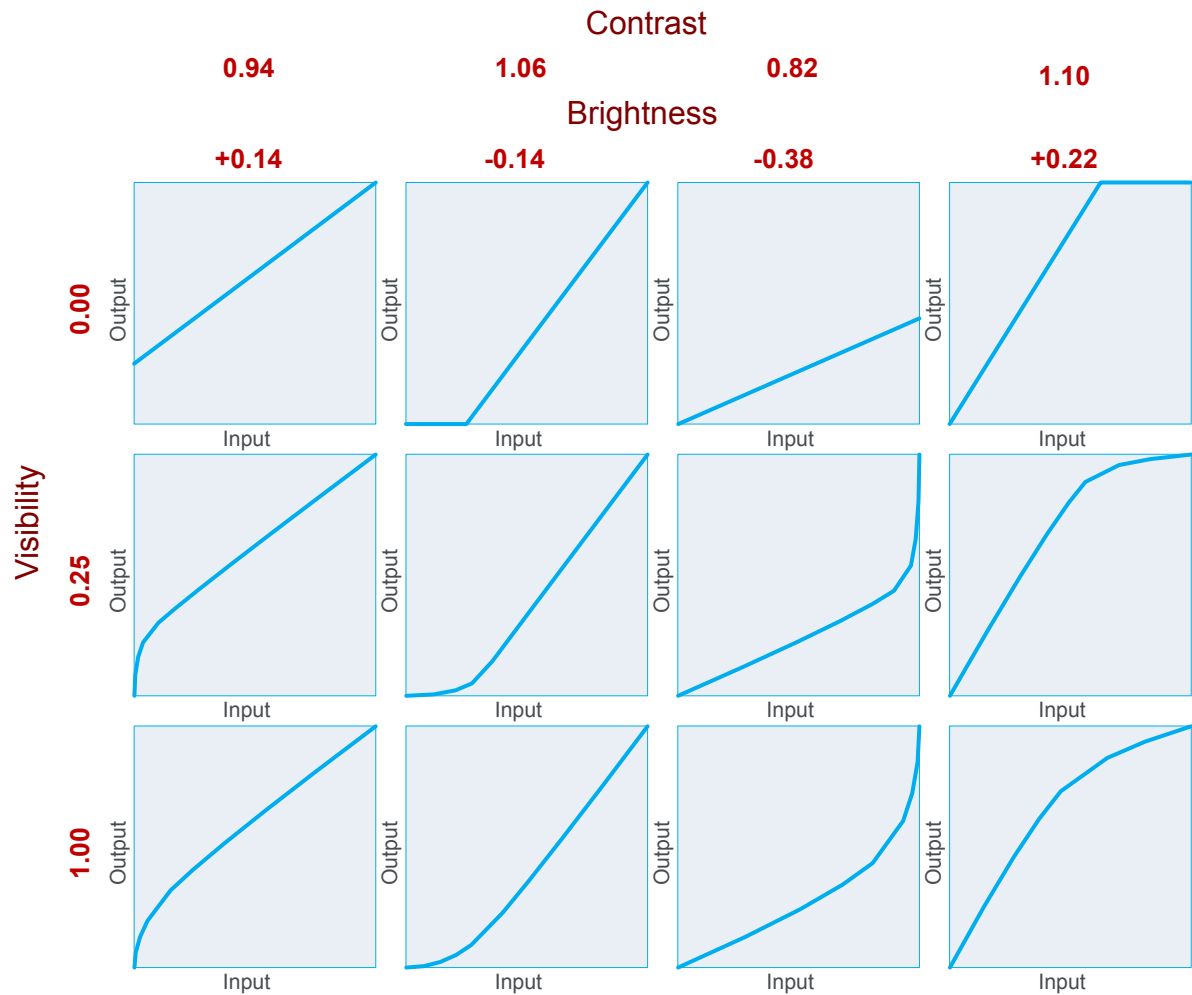
Visibility

The **Visibility** parameter exclusively applies to the **"Response Control"** on page 119 lookup table definition method.

The operation of **Contrast** and **Brightness** parameters occasionally removes some part of the input dynamics. Very dark regions of the image can be transformed into full black, and become invisible. This holds true for very bright regions, clipping to full white.

The **Visibility** parameter has been created to smoothly reveal these hidden parts in the image.

Visibility	Gain	Note
0.00	0.01	Minimum and default value. This generates the piecewise linear transformation curves. Choosing values closer to +1 generates smoother curves.
1.00	100	Maximum value.



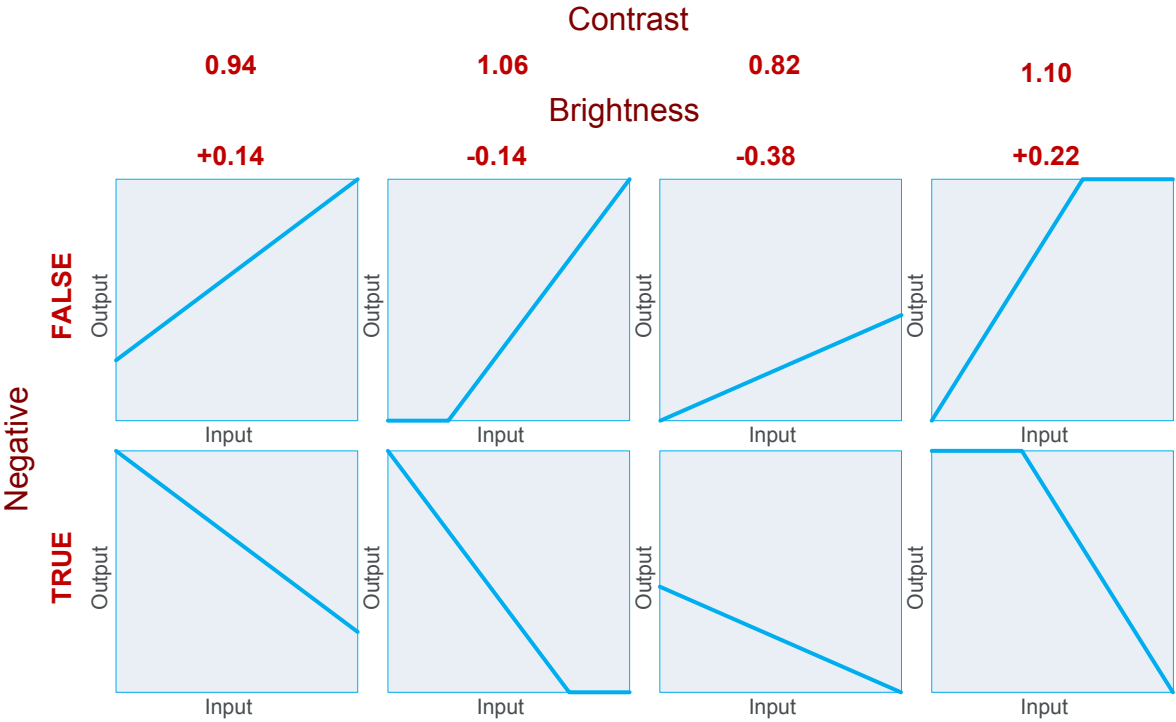
Effect of **Visibility** for typical values of **Contrast** and **Brightness** parameters assuming that
Negative = FALSE

Negative

The **Negative** parameter applies to both the "Response Control" on page 119 and the "Emphasis" on page 119 lookup table definition methods.

This control allows transforming an image into its negative image, where the lightest areas of the image appear darkest and the darkest areas appear lightest.

Negative	Note
FALSE	Default value.
TRUE	The transformation table is mirrored around a vertical axis in the graphs. This swaps the black and white values, and gives rise to a photographic negative effect.



Effect of **Negative** for typical values of other controls

Emphasis

The **Emphasis** parameter exclusively applies to the "Emphasis" on page 119 lookup table definition method.

It allows transforming an image using a power-law expression:

$$\text{Output} = \text{Input}^\gamma$$

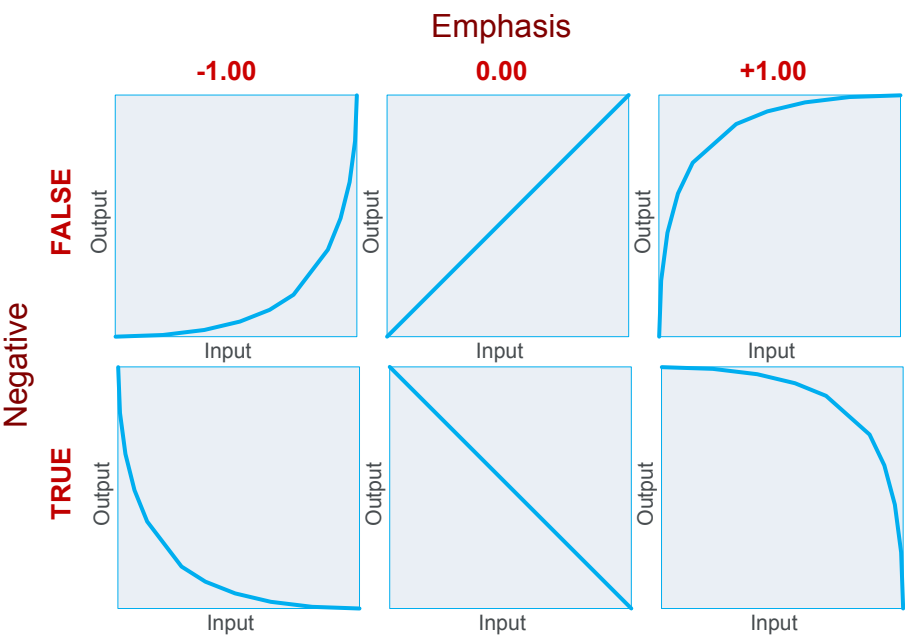
The γ – Gamma – exponent is mathematically linked to Emphasis by:

$$\gamma = 10^{-\text{Emphasis}}$$

Emphasis	Gamma	Note
1.00	0.1	Max. Emphasis value; smallest γ value
0.00	1	Default Emphasis value; linear law
-1.00	10	Min. Emphasis value; largest γ value

To achieve a required given γ , **Emphasis** should be set to:

$$\text{Emphasis} = -\log_{10}\gamma$$



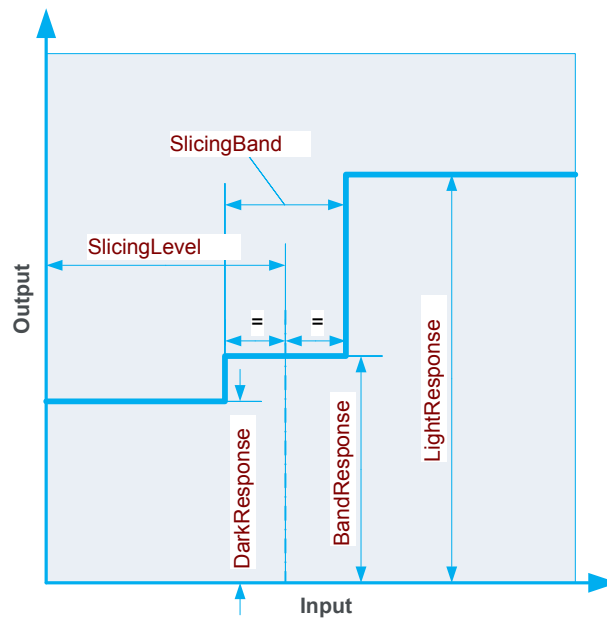
Emphasis effect for typical values of **Emphasis** and both values of **Negative**

SlicingLevel, SlicingBand, LightResponse, BandResponse and DarkResponse

SlicingLevel, SlicingBand, LightResponse, BandResponse and DarkResponse parameters exclusively apply to the "Threshold" on page 119 lookup table definition method.

As shown on the next figure, the parameters set defines a double threshold transformation law.

Parameter	Minimum Value	Default Value	Maximum Value
SlicingLevel	0.00	0.50	1.00
SlicingBand	0.00	0.50	1.00
LightResponse	0.00	0.75	1.00
BandResponse	0.00	0.50	1.00
DarkResponse	0.00	0.25	1.00



Double threshold transfer function



NOTE

SlicingLevel specifies the mean value of both thresholds in the input range.

LUT Setup Procedure

To setup the lookup table processing, proceed as follows:

1. Disable the lookup table
2. Define the lookup table configuration
3. Define the content of the lookup table
4. Upload the lookup table content into a specified lookup table data set
5. Enable the lookup table with a specified data set

Disabling the lookup table

To disable the lookup table:

- Set the **LUTEnable** feature to a **Off**.

Defining the lookup table configuration

To define the lookup table configuration, set the **LUTConfiguration** feature according to:

- The camera pixel type and bit depth
- The required output bit depth.

See also: "Monochrome Lookup Table Processing" on page 118 for configurations applicable to monochrome pixels.



NOTE

The lookup table configuration must be set prior to any other action.

Defining the lookup table content

See also: "LUT Content Definition" on page 119 for a description of the parametric and tabular methods used for defining a lookup table content.



NOTE

At least one lookup table set must be defined.

Upload a lookup table content

To upload a lookup table content in one operation:

- Select a lookup table data set to access by assigning the appropriate value to the **LUTSet** feature. For instance **Set1**.
- Set the **LUTIndex** feature to **0**.
- Write a string of **LUTLength** values to the **LUTValue** feature.



NOTE

The application may also selectively upload any individual lookup table entry or any block of consecutive lookup table entries.

Reading back a lookup table data set

To read back the lookup table data set in one operation:

- Select a lookup table data set to access by assigning the appropriate value to the **LUTSet** feature. For instance Set1.
- Set the **LUTIndex** feature to 0.
- Set the **LUTReadBlockLength** feature to the value returned by **LUTLength**.
- Get a string of **LUTReadBlockLength** values from the **LUTValue** feature.



NOTE

The application may also selectively read any lookup table entry individually or any block of consecutive entries.

Enabling the lookup table

To enable the lookup table:

- Set the **LUTEnable** feature to a value designating the lookup table data set to use.

Configuration Script Example

The following script is an example illustrating how to configure the lookup table for monochrome 8-bit to 8-bit operation and to define and upload 4 lookup table data sets using different lookup table definition methods.

```
function configure(g) {
  // Disable the lookup table
  g.StreamPort.set('LUTEnable', 'Off');
  // Configure the lookup table
  g.StreamPort.set('LUTConfiguration', 'M_8x8');

  // Build lookup table data set 1: response control
  g.StreamPort.set('LUTSet', 'Set1');
  require('coaxlink://lut/response-control')(g, { Contrast: 0.94
    , Brightness: 0.14
    , Visibility: 0.25
    , Negative: false });

  // Build lookup table data set 2: emphasis
  g.StreamPort.set('LUTSet', 'Set2');
  require('coaxlink://lut/emphasis')(g, { Emphasis: 0.5
    , Negative: true });

  // Build lookup table data set 3: threshold
  g.StreamPort.set('LUTSet', 'Set3');
  require('coaxlink://lut/threshold')(g, { SlicingLevel: 0.5
    , SlicingBand: 0.5
    , LightResponse: 0.75
    , BandResponse: 0.5
    , DarkResponse: 0.25 });

  // Build lookup table data set 4: table
  g.StreamPort.set('LUTSet', 'Set4');
  var i;
  for (i = 0; i < 256; ++i) {
    g.StreamPort.set('LUTIndex', i);
    g.StreamPort.set('LUTValue', String(255 - i));
  }
}
configure(grabbers[0]);
```

6.3. Bayer CFA Decoding

Applies to the following firmware variants of PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value:

 Duo	(1-camera), (2-camera)
 QuadG3	(1-camera), (2-camera), (2-camera, bayer)
 Octo	(1-camera), (2-camera)
 Duo12	(1-camera)
 Value12	(1-camera)

Bayer CFA Decoding Methods	130
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Bayer CFA Decoding Methods

Various Bayer CFA decoding methods are defined to transform the raw Bayer CFA data stream issued by the camera into an RGB color data stream

CFA decoding method 1

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo** and **PC3623-T Coaxlink Quad CXP-12**
Value:

 Duo	(1-camera), (2-camera)
 QuadG3	(1-camera)
 Octo	(1-camera), (2-camera)
 Value12	(1-camera)

The CFA decoding method 1 also known as "Legacy method" uses a 3 x 3 kernel and a linear interpolation method to compute the missing color components.

See also: ["Advanced and Legacy Methods" on page 134](#) for an extensive description

CFA decoding method 2

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo** and **PC3623-T Coaxlink Quad CXP-12**
Value:

 Duo	(1-camera), (2-camera)
 QuadG3	(1-camera)
 Octo	(1-camera), (2-camera)
 Value12	(1-camera)

The CFA decoding method 2 also known as "Advanced method" uses a 3 x 3 kernel and an advanced interpolation method to compute the missing color components.

See also: ["Advanced and Legacy Methods" on page 134](#) for an extensive description

CFA decoding method 3

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo** and **PC3622-T Coaxlink Duo CXP-12**:

 (2-camera), (2-camera, bayer)

 (1-camera)

 (1-camera)

The CFA decoding method 3 uses a 5 x 5 kernel and a gradient-based interpolation method to compute the missing color components.



WARNING

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3**:

 (2-camera)

The Method 3 decoder is only available for Device0.

CFA decoding method 5

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3** and **PC3602-T Coaxlink Octo**:

 (2-camera), (2-camera, bayer)

 (2-camera)

The CFA decoding method 5 uses a 2x2 average-based interpolation method to compute the missing color components.



WARNING

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3**:

 (2-camera)

The Method 5 decoder is only available for Device0.

Requirements and Performances

Scanning geometry

Bayer CFA decoding is only available for 1X_1Y progressive-scan geometry.

Maximum line length

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3** and **PC3622-T Coaxlink Duo CXP-12**:

 (2-camera), (2-camera, bayer)

 (1-camera)

The maximum line length is 8,192 pixels.

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo** and **PC3623-T Coaxlink Quad CXP-12 Value**:

 (1-camera)

 (1-camera)

 (1-camera)

The maximum line length is 16,384 pixels.

Applies to the following firmware variants of **PC3602-T Coaxlink Octo**:

 (2-camera)

The maximum line length is 32,768 pixels.

Peak pixel processing rate

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3**:

 (2-camera), (2-camera, bayer)

The peak pixel processing rate (per stream) is 1,000,000,000 pixels/second.

Applies to the following firmware variants of **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo** and **PC3622-T Coaxlink Duo CXP-12**:

 (1-camera)

 (2-camera)

 (1-camera)

The peak pixel processing rate (per stream) is 1,108,000,000 pixels/second.

Applies to the following firmware variants of **PC3602-T Coaxlink Octo** and **PC3623-T Coaxlink Quad CXP-12 Value**:

 (1-camera)

 (1-camera)

The peak pixel processing rate (per stream) is 2,216,000,000 pixels/second.

PCIe performance

PCI Express Interface	Sustainable PCIe data rate	RGB8	RGB10, RGB12, RGB14, RGB16
4-lane Rev 3.0 PCIe end-point	3,350 MB/s typical	~1,117 Mpixels/s	~558 MPixels/s
8-lane Rev 3.0 PCIe end-point	6,700 MB/s typical	~2,238 Mpixels/s	~1,117 Mpixels/s



NOTE

When configured to deliver RGB8 pixels, the [PCI Express Interface](#) is capable to sustain the highest CFA decoder pixel rate!

For 10-, 12-, 14- and 16-bit bit depths, the sustainable data output rate is further limited by the performances of the [PCI Express Interface](#) on the Host PC.

Latency

The hardware CFA decoder performs on-the-fly conversion with a negligible latency when the data throughput is NOT limited by the available PCI Express bandwidth!

Advanced and Legacy Methods

This topic describes two Bayer CFA decoding methods respectively named **Legacy** and **Advanced**.

The two methods transform the raw Bayer CFA data stream issued by the camera into an RGB color data stream using a 3x3 kernel. The missing pixel components are reconstructed from the nearest components.

The **Legacy** interpolation method computes the missing color components by applying exclusively the Mean() function.

The **Advanced** interpolation method computes the missing color components using the Mean() and the Median() functions. It eliminates the aliasing effect on the highly contrasted sharp transitions in the image.

Functions Definitions

The min() function returns the lowest integer value from a set of 2 integer values.

The max() function returns the highest integer value from a set of 2 integer values.

The mean() function returns one integer value that represents the mean value of 2 integers. It is computed as follows:

Function	Mean(a,b)
<i>Formula</i>	$(a + b + 1) >> 1$

The median() function returns a set of two integer values that are the two median values of a set of four integers. It is computed as follows:

Function	Median(a,b,c,d)
<i>Value 1 formula</i>	$\text{Min} [\text{Max}(a,b); \text{Max}(c,d)]$
<i>Value 2 formula</i>	$\text{Max} [\text{Min}(a,b); \text{Min}(c,d)]$

Decoder operation

For each pixel of the source image, the CFA decoder computes two missing color components from surrounding pixels.

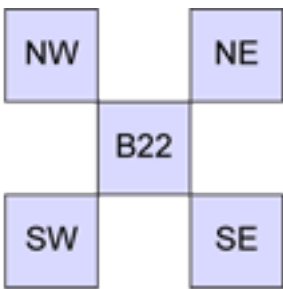
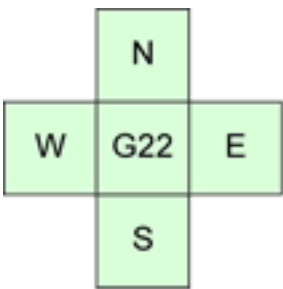
The text hereafter describes how the 4 central pixels located at positions 22, 32, 23 and 33 of a 4 x 4 Bayer CFA array are computed:

B11	G21	B31	G41
G12	R22	G32	R42
B13	G23	B33	G43
G14	R24	G34	R44

The relative positions of the surrounding pixels are identified by compass markings:

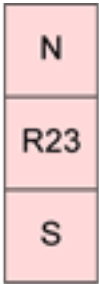
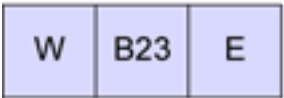
NW	N	NE
W		E
SW	S	SE

Formulas for position 22



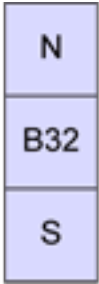
Component	Method	Formula
R22	Legacy, Advanced	R22
G22	Legacy	Mean[Mean(N,S), Mean(W,E)]
	Advanced	Mean[Median(N, S, E, W)]
B22	Legacy	Mean[Mean(NW, SW), Mean(NE, SE)]
	Advanced	Mean[Median(NW, SW, NE, SE)]

Formulas for position 23



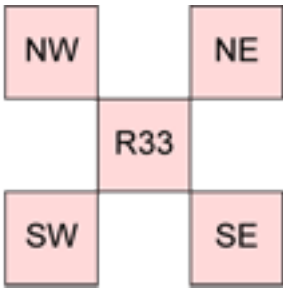
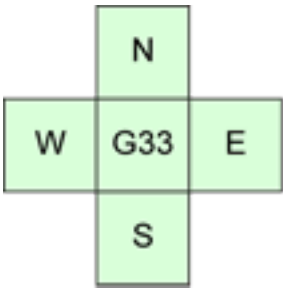
Component	Method	Formula
R23	Legacy, Advanced	Mean(N,S)
G23	Legacy, Advanced	G23
B23	Legacy, Advanced	Mean(W,E)

Formulas for position 32



Component	Method	Formula
R32	Legacy, Advanced	Mean(W,E)
G32	Legacy, Advanced	G32
B32	Legacy, Advanced	Mean(N,S)

Formulas for position 33



Component	Method	Formula
R33	Legacy	Mean[Mean(NW, SW), Mean(NE, SE)]
	Advanced	Mean[Median(NW, SW, NE, SE)]
G33	Legacy	Mean[Mean(N,S), Mean(W,E)]
	Advanced	Mean[Median(N, S, E, W)]
R33	Legacy, Advanced	B33

6.4. Pixel Components Swapping

The image data stream pixel processor can be configured to swap the first and the third component data of 3-component pixels.

The swapping is controlled through the **RedBlueSwap** boolean GenApi feature:

- When set to **False** (default settings), the original component order is preserved
- When set to **True**, the first and the third components are swapped.

The function is available for image acquisition from:

- RGB color cameras delivering 3-component pixel data,
- RGBa color cameras delivering 4-component pixel data,
- BAYER CFA color cameras providing that the BAYER CFA decoding is enabled.

7. Image Data Transfer

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7.1. Buffer Filling Rules

A DMA engine transfers the processed image data over the PCI Express bus to the allocated GenTL buffers according to rules that are different for line-scan and area-scan image acquisition.

Area-scan firmware variants

In area-scan imaging, GenTL buffers are filled according to the following rules:

- The first acquired line data of a frame is, by default, stored at the beginning of a new buffer. When vertical image flipping is enabled by setting **StripeArrangement** to **Geometry_1X_1YE**, the first acquired line data of a frame is stored at the location of the last full line of a new buffer.
- When image transfer to host memory is done, the buffer, possibly partially filled, is made available to the application for processing.
- When the remaining space of a buffer is not sufficient to store a complete frame, the remaining data is handled according to the "[BufferFilledRule settings](#)" on page 140.

Line-scan firmware variants

In line-scan imaging, GenTL buffers are filled according to the following rules:

- The first acquired line data of a scan is, by default, stored at the beginning of a new buffer. When vertical image flipping is enabled by setting **StripeArrangement** to **Geometry_1X_1YE**, the first acquired line data of a scan is stored at the location of the last full line of a new buffer.
- A buffer contains an integer number of image lines data.
- When the remaining space of a buffer is not sufficient to store an image line data, the remaining data is handled according to the "[BufferFilledRule settings](#)" on page 140.
- When the last line data of a scan is acquired, the last buffer, possibly partially filled, is made available to the application for processing.

BufferFilledRule settings

Discard remaining data

When **BufferFilledRule** is set to **DiscardRemainingData**, the remaining data is discarded.



NOTE

- Default settings for area-scan acquisition.
- Only available for selected line-scan firmware variants.

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo**, **PC3621-LH-T Coaxlink Mono CXP-12-LH**, **PC3622-T Coaxlink Duo CXP-12** and **PC3623-T Coaxlink Quad CXP-12 Value**:

 Duo	(1-camera), (1-camera, line-scan), (2-camera), (2-camera, line-scan)
 QuadG3	(1-camera), (1-camera, 4-data-stream), (2-camera), (2-camera, bayer), (3-camera), (4-camera)
 Octo	(1-camera), (1-camera, custom-logic), (1-camera, line-scan), (2-camera), (2-camera, line-scan), (3-camera), (4-camera), (4-camera, line-scan), (5-camera), (5-camera, 5D22211), (6-camera), (8-camera), (8-camera, line-scan)
 Mono12LH	(1-camera)
 Duo12	(1-camera), (2-camera)
 Value12	(1-camera), (1-camera, line-scan), (2-camera), (2-camera, line-scan), (3-camera), (4-camera), (4-camera, line-scan)

Continue in a next buffer (Default settings for line-scan acquisition)

When **BufferFilledRule** is set to **ContinueInNextBuffer**, the acquisition continues into a new buffer and the filled buffer is made available to the application for processing. This setting is also available on selected area-scan firmware-variants.



NOTE

- Default settings for line-scan acquisition.
- Only available for selected area-scan firmware variants.

Applies to the following firmware variants of **PC1628-T Grablink Duo**, **PC1633-T Coaxlink Quad G3**, **PC3602-T Coaxlink Octo**, **PC3621-LH-T Coaxlink Mono CXP-12-LH**, **PC3622-T Coaxlink Duo CXP-12** and **PC3623-T Coaxlink Quad CXP-12 Value**:

 Duo	(1-camera, line-scan), (2-camera, line-scan)
 QuadG3	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan)
 Octo	(1-camera, line-scan), (2-camera, line-scan), (2-camera, line-scan, custom-logic), (4-camera, line-scan), (8-camera, line-scan)
 Mono12LH	(1-camera, line-scan)
 Duo12	(1-camera, line-scan), (2-camera, line-scan)
 Value12	(1-camera, line-scan), (2-camera, line-scan), (4-camera, line-scan)

7.2. Image Limits

Image width

Condition(s)	Min	Max	Unit
All area-scan variants	TBD	TBD	Pixels
All line-scan variants	1024	TBD	Pixels

Image height

Condition(s)	Min	Max	Unit
All area-scan variants	TBD	TBD	Pixels
All line-scan variants	1024	TBD	Pixels

7.3. Image Data Padding

The DMA engine provides the capability to organize the data differently in the buffer by adding line padding or stripe padding.



NOTE

For driver versions prior to 6.2, the DMA engine was transferring the whole image data as a single 1D entity regardless the 2D structure: the lines of processed image data are concatenated into the destination buffer.

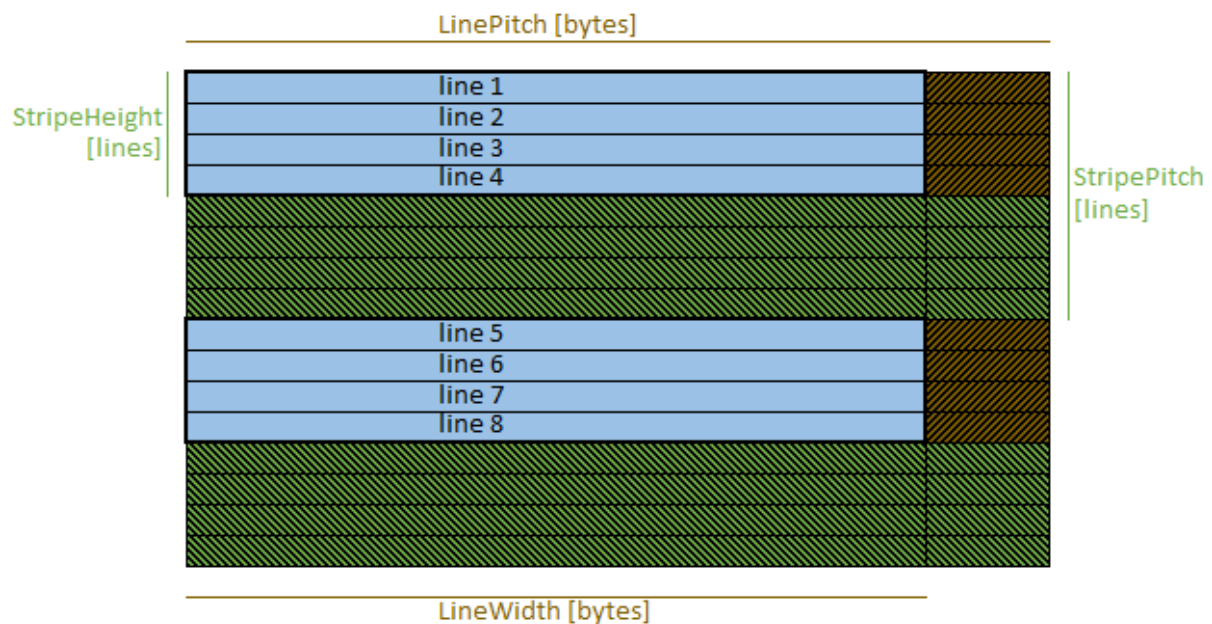


Image buffer padding model

Line Padding

The **LineWidth** and **LinePitch** features control the line padding.

When **LinePitch** > **LineWidth**, the line padding is enabled: the DMA engine inserts **LinePitch** - **LineWidth** bytes of padding at the end of each image line.

LinePitch can be set to 0 to disable padding after lines.

Stripe padding

Stripes are groups of adjacent lines. A stripe of height 1 is a line.

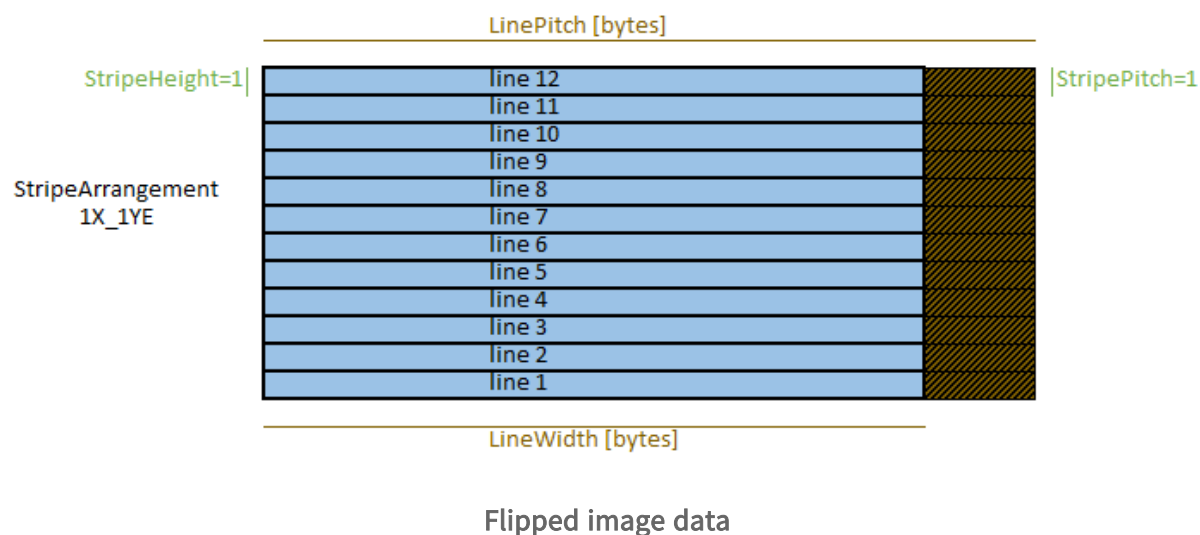
The **StripeHeight** and **StripePitch** features control the stripe padding.

When **StripePitch** > **StripeHeight**, the stripe padding is enabled: the DMA engine inserts **StripePitch** - **StripeHeight** lines of padding at the end of each stripe.

StripePitch can be set to **0** to disable padding after lines.

7.4. Vertical Image Flipping

The DMA engine provides the capability to flip the image vertically.



The vertical image flip is controlled by the **StripeArrangement** feature of the data Stream module.

By default, **StripeArrangement** is set to **1X_1Y**: the vertical image flip is disabled.

When **StripeArrangement** is set to **1X_1YE**, the driver determines the position of the first image line in the buffer by using this formula:

$$\text{BufferBase} + (\text{ImageHeight} - 1) * \text{LinePitch}$$

As a result:

- if the buffer is too small, it is the **top** part of the image (as given by the camera) that will be lost;
- lines will start at **BufferBase + n * LinePitch**;
- only complete lines are transferred;
- if the buffer size is not a multiple of **LinePitch** bytes, some bytes at the end of the buffer will be left unchanged.



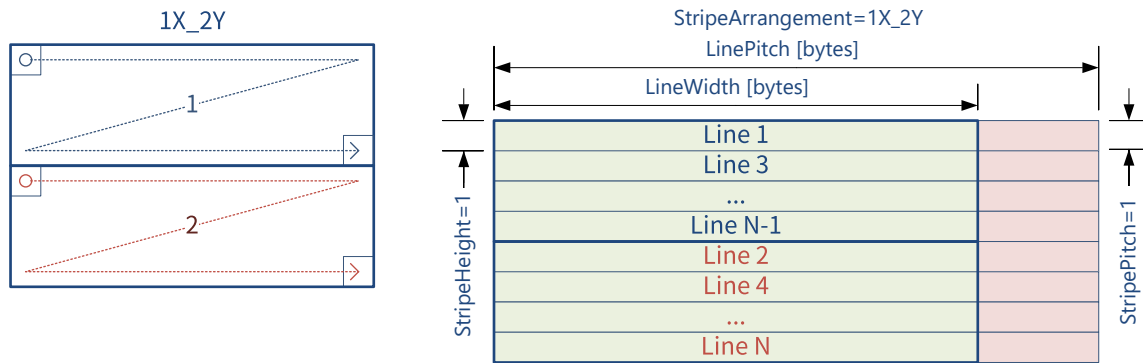
NOTE

When evaluating the above formula, if **LinePitch** is equal to **0**, **LineWidth** will be used instead. Similarly, if **StripeHeight** is **0**, **1** will be used instead.

7.5. Image Data Unscrambling

The DMA engine provides the capability to unscramble images having particular geometries along the Y-axis.

Unscrambling 1X_2Y images



When **StripeArrangement** is set to **Geometry_1X_2Y**, the driver determines the destination of the second line output by the camera (Line 2 in the above drawing) by using this formula:

$$\text{BufferBase} + (\text{BufferSize} + \text{LinePitch} - \text{LineWidth}) / (2 * \text{LinePitch}) * \text{LinePitch}$$

NOTE: this is the address of the first line in the second half of the buffer large enough to receive one complete line.

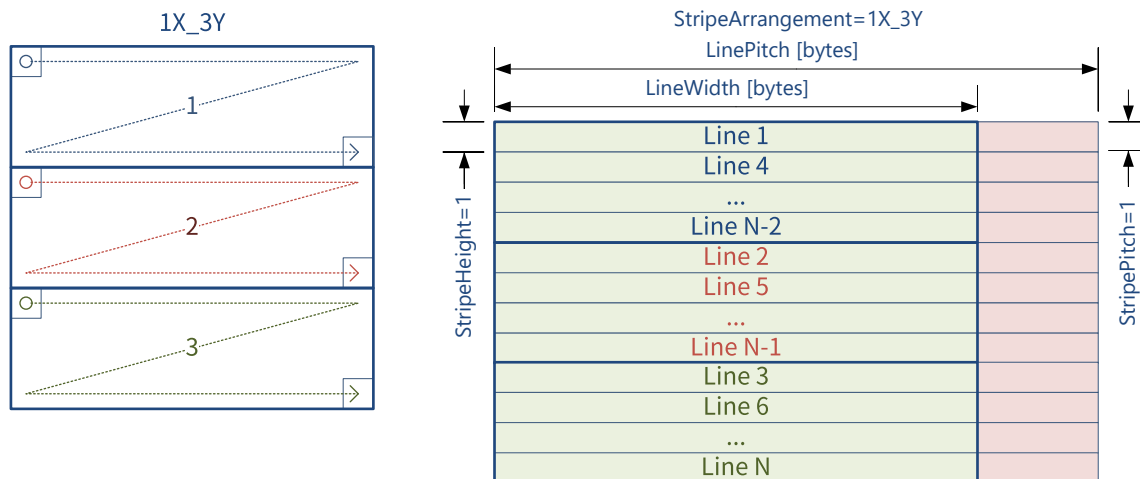
As a result:

- If the buffer is too small, the last lines output by the camera (i.e., the bottom part of each half of the image) will be lost; the application is responsible for avoiding this,
- Lines will start at

$$\text{BufferBase} + n * \text{LinePitch},$$

- Only complete lines are transferred. (When evaluating the above formula, if **LinePitch** is equal to **0**, **LineWidth** will be used instead. Similarly, if **StripeHeight** is **0**, **1** will be used instead.)
- **StripeHeight** and **StripePitch** cannot be set to values greater than **1**.

Unscrambling 1X_3Y images



When **StripeArrangement** is set to **Geometry_1X_3Y**, the driver determines the destination of the second line and third lines (Line 2 and Line 3 in the above drawing) by using these formulae:

$$\text{BufferBase} + (\text{BufferSize} + \text{LinePitch} - \text{LineWidth}) / (3 * \text{LinePitch}) * \text{LinePitch}$$

$$\text{BufferBase} + (\text{BufferSize} + \text{LinePitch} - \text{LineWidth}) / (3 * \text{LinePitch}) * \text{LinePitch} * 2$$

NOTE: these are the addresses of the first line in the second and third regions of the buffer large enough to receive one complete line.

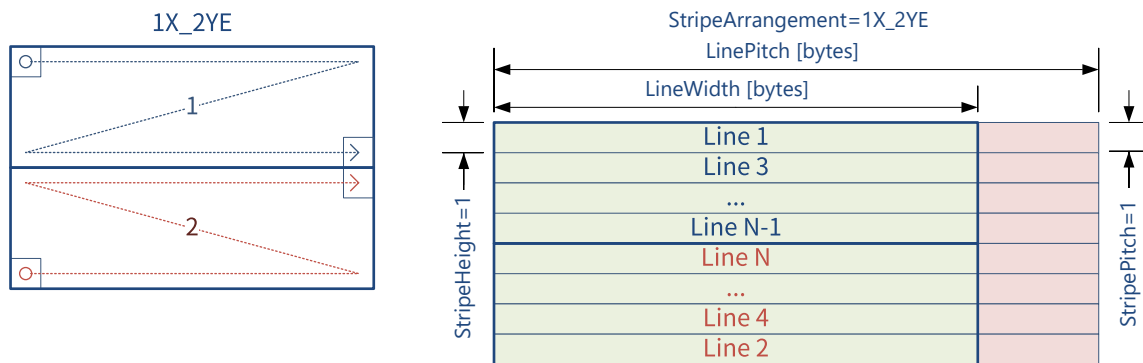
As a result:

- If the buffer is too small, the last lines output by the camera (i.e., the bottom part of each region of the image) will be lost; the application is responsible for avoiding this,
- Lines will start at

$$\text{BufferBase} + n * \text{LinePitch},$$

- Only complete lines are transferred. (When evaluating the above formula, if **LinePitch** is equal to **0**, **LineWidth** will be used instead. Similarly, if **StripeHeight** is **0**, **1** will be used instead.)
- **StripeHeight** and **StripePitch** cannot be set to values greater than **1**.

Unscrambling 1X_2YE images



When **StripeArrangement** is set to **Geometry_1X_2YE**, the driver determines the destination of the second line output by the camera (i.e., the position of last image line in the buffer) by using this formula:

$$\text{BufferBase} + (\text{ImageHeight} - 1) * \text{LinePitch}$$

As a result:

- If the buffer is too small, the last lines of the image will be lost; the application is responsible for avoiding this,
- Lines will start at

$$\text{BufferBase} + n * \text{LinePitch},$$

- Only complete lines are transferred. (When evaluating the above formula, if **LinePitch** is equal to **0**, **LineWidth** will be used instead. Similarly, if **StripeHeight** is **0**, **1** will be used instead.)
- **StripeHeight** and **StripePitch** cannot be set to values greater than **1**.

See also: "Transmission Methods of 1X_2YE Images (Coaxlink series)" on page 151

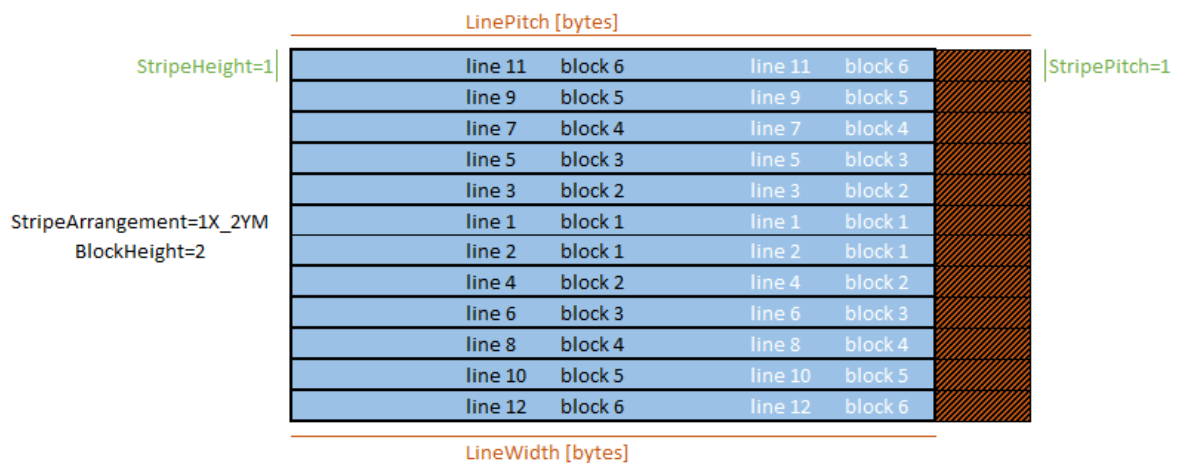
Unscrambling 1X_2YM images



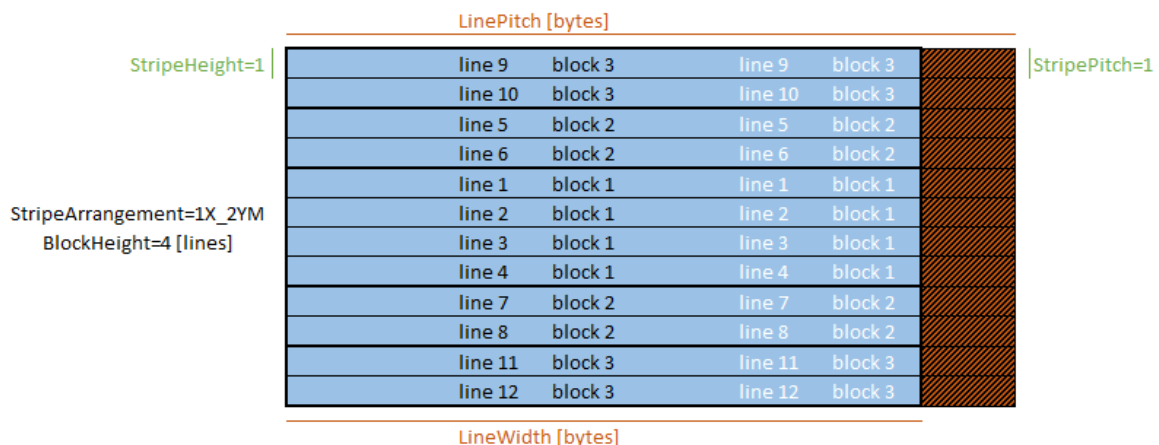
NOTE

- In the following figures, line numbers and block numbers sent by the *device* are in *white*, line numbers and block numbers received by the *host* are in *black*.
- The values of **StripePitch**, **StripeHeight** and **StripeOffset** must be multiple of **BlockHeight** value!

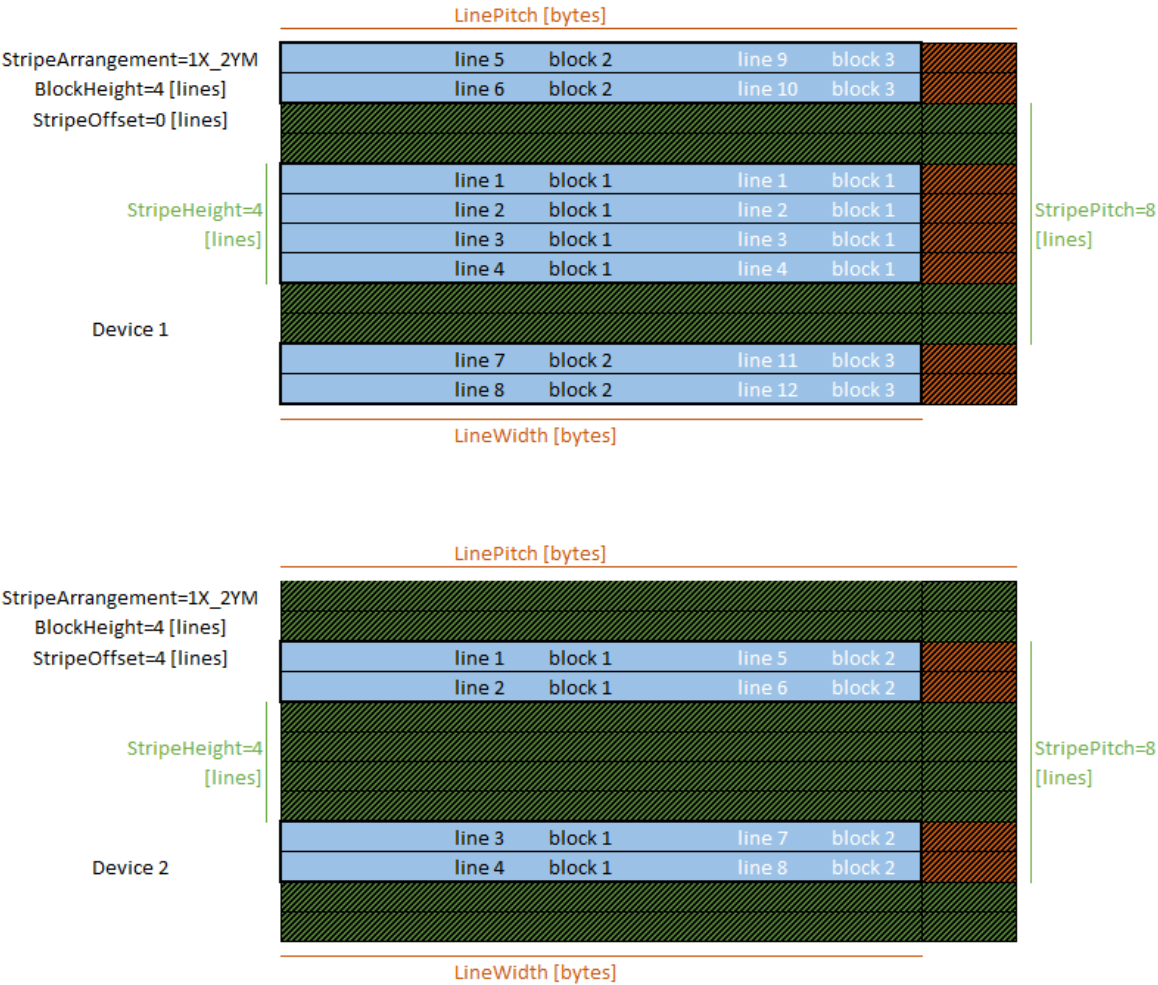
1X_2YM camera delivering lines by blocks of 2



1X_2YM camera delivering lines by blocks of 4

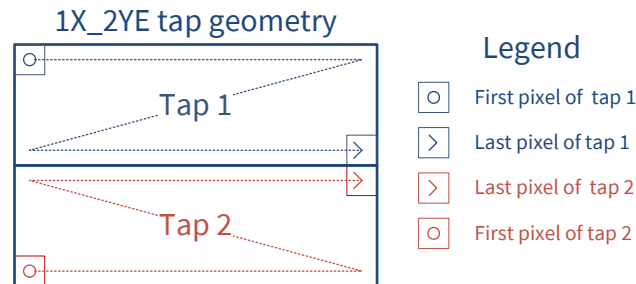


1X_2YM camera delivering lines by blocks of 4 to two hosts



7.6. Transmission Methods of 1X_2YE Images (Coaxlink series)

Geometry of 1X_2YE image sensors



An 1X_2YE image sensor has two taps:

- Tap 1 delivers the pixel data of the upper half of the image. It starts with the leftmost pixel of the top line and ends with the rightmost pixel of the bottom line of the upper half.
- Tap 2 delivers the pixel data of the lower half image lines. It starts with the leftmost pixel of the bottom line and ends with the rightmost pixel of the top line of the lower half.

Two methods are used by CoaXPress cameras to transmit images captured with 1X_2YE image sensors:

- ["Method 1 - Transmission using a single CoaXPress data stream" on page 152](#)
- ["Method 2 - Transmission using a dedicated CoaXPress data stream for each tap" on page 153.](#)

Method 1 - Transmission using a single CoaXPress data stream



NOTE

- This is NOT the method defined by the CoaXPress standard. However it is the most popular!
- The DMA engine of all area-scan firmware variants of all **Coaxlink frame grabbers** is capable to reorganize the lines and deliver an unscrambled image into the buffer.

The camera transmits the image data through a single CoaXPress data stream composed as follows:

Line 1 > Line H > Line 2 > Line H-1 > ... > Line H/2-1 > Line H/2 + 2 > Line H/2 > Line H/2 + 1

To deliver an unscrambled image into the buffer, configure the data stream as follows:

1. Keep default **DeviceTapGeometry** settings:
 - **DeviceTapGeometry=Geometry_1X_1Y**
2. Configure the DMA engine (as described in "[Unscrambling 1X_2YE images](#)" on page 148):
 - **StripeArrangement=Geometry_1X_2YE**
 - **LineWidth=<WIDTH>**
 - **LinePitch=<PITCH>** (only required when it is not equal to <WIDTH>)

Method 2 - Transmission using a dedicated CoaXPress data stream for each tap

Applies to the following firmware variants of PC3623-T Coaxlink Quad CXP-12 Value:

 Value12 (1-camera), (2-camera)



NOTE

- This is the method defined by the CoaXPress standard.
- Since this method requires more FPGA resources it is only supported by above-listed firmware variants.

The camera transmits the image data through two CoaXPress data streams:

Stream 1: Line 1 > Line 2 > ... > Line H/2 - 1 > Line H/2

Stream 2: Line H > Line H - 1 > ... > Line H/2 + 2 > Line H/2 + 1

To deliver an unscrambled image into the buffer, configure the data stream as follows:

1. Merge the 2 streams (as described in [Multi-tap CoaXPress Cameras](#)):
 - DeviceTapGeometry=Geometry_1X_2YE
 - Image1StreamID=... (depends on the camera, typically 0)
 - Image2StreamID=... (depends on the camera, typically 1)
2. Configure the DMA engine (as described in ["Unscrambling 1X_2YE images" on page 148](#)):
 - StripeArrangement=Geometry_1X_2YE
 - LineWidth=<WIDTH>
 - LinePitch=<PITCH> (only required when it is not equal to <WIDTH>)



NOTE

If an EGrabber object is created from EGrabberDiscovery::cameras, and, if a "1X_2YE (Method 2)" camera is detected, eGrabber automatically configures the data streams as described earlier. For instance, this is the case when, in **eGrabber Studio**, the user creates a grabber using the [Cameras](#) view.

In any other case, the configuration must be performed by the user.

See also: "Discovering grabbers and camera's" section in the [D204ET-eGrabber Programmer Guide-eGrabber-25.12.1.2209.pdf](#) document

7.7. Data Stream Statistics

The stream statistics tool monitors the image data stream at the card output and provides the application with averaged frame-, line- and data-rate.

Stream Statistics Sampling Methods

The `StatisticsSamplingSelector` determines the *averaging interval*. It can be any of the following:

- `LastSecond` or `LastTenSeconds`: The last completed *time* slot of 1 or 10 seconds.
- `Last2Buffers`, `Last10Buffers`, `Last100Buffers`, `Last1000Buffers`: The last 2, 10, 100, or 1000 *acquired buffers*
- `LastAcquisition`: The last acquisition activity period. Namely since the last `DSSStartAcquisition()` function call until now, if the acquisition is still active otherwise until the last `DSSStopAcquisition()` function call.
- `LastAcquisition`: Time interval between `StatisticsStartSampling` and `StatisticsStopSampling` commands.

The default sampling method is `LastSecond`.

Statistical Data

The statistical data is effectively computed when getting any of the following feature:

- `StatisticsFrameRate` reports the averaged frame rate expressed in frames/second (area-scan).
- `StatisticsLineRate` reports the average line rate expressed in lines/second (line-scan).
- `StatisticsDataRate` reports the average data rate expressed in megabytes/second

For every GenTL buffer filled during the averaging interval, the tool counts:

- The number of filled GenTL buffers and the corresponding number of frames (area-scan) or lines (line-scan)
- The number of transferred bytes of image data.

The related GenApi features are gathered into the Stream Statistics Category of the GenTL Data Stream Module.

7.8. Data Transfer Rate Test Program

Introduction

The *Data Transfer Rate Test Program* (DTR) can be used to measure the effective PCI Express data transfer rate in real conditions.

Host PC requirements

- The Host PC must be equipped with at least one **eGrabber**-driven frame grabber.
- Driver version 12.4 or higher must be installed on the Host PC.

Camera requirements

- The camera must be configured to deliver continuously image data.

Installation

The DTR is included in gentl.exe, a command-line tool that is delivered with the **eGrabber** driver. No further installation is required.

Measurement principle

The DTR measures the data transfer rate by completely filling the internal frame store and only then transferring images to the host computer:

1. All buffers are unqueued (the data stream cannot use them)
2. The data stream and remote device are started
3. When the frame store is full, the remote device is stopped
4. Current timestamp is retrieved (t0)
5. All buffers are queued to the data stream and transfers start
6. Buffers are popped from the data stream
7. When the frame store is empty and all buffers have been retrieved, the data stream is stopped

The DTR program computes the data transfer rate as follows:

```
- byte count = sum of each buffer's BUFFER_INFO_SIZE_FILLED  
- t1 = last buffer's BUFFER_INFO_CUSTOM_EVENT_TIMESTAMP  
- duration = t1 - t0  
- data transfer rate = byte count / duration
```

gentl --help

```
GenTL Explorer

gentl [COMMAND] ... [OPTIONS]

Commands:
    info      Show detailed information about the transport layer system
    report    Generate a GenTL report archive (for Euresys tech support)
    xml       Download GenApi files (XML register descriptions)
    play      Open a data stream and acquire images (no display)
    view      Open a data stream and display images
    grab      Grab N images
    genapi    Enter the GenApi command-line interface or perform a GenApi operation
    read      Read data from a GenTL port
    write     Write data to a GenTL port
    event     Wait for events and display information about them
    script    Execute script
    run       Run an action
    dtr       Measure PCIe data transfer rate
    ber       Measure bit error rate confidence level (a.k.a. link validation tool)

Common flags:
    --cti=LIBPATH      Path to GenTL producer library.
                       Default: use EURESYS_COAXLINK_GENTL64_CTI and
                       GENICAM_GENTL64_PATH environment variables to
                       locate the library.
    -j=N               Limit the number of CPU cores to use to N (default: 2)
    -h                 --help          Display help message
    -V                 --version       Print version information
                       --numeric-version Print just the version number
    -v                 --verbose       Loud verbosity
    -q                 --quiet         Quiet verbosity
```


gentl dtr --help

```

GenTL Explorer

gentl dtr [OPTIONS]

Flags:
    --if=ID                Interface ID
    --dev=ID               Device ID
    --ds=ID               Data stream ID
    --device-access=ACCESS Access flags used to open the device (GenTL standard
access flags:
                                DEVICE_ACCESS_READONLY, DEVICE_ACCESS_CONTROL,
                                DEVICE_ACCESS_EXCLUSIVE;
                                Coaxlink custom access flags:
                                DEVICE_ACCESS_CUSTOM_READONLY_DEVICE_READONLY_
STREAM) (default:
                                DEVICE_ACCESS_CONTROL)
    --ro                  Open the device as read-only (shorthand for
                                --device-access=DEVICE_ACCESS_READONLY)
    --buffers=INT         Buffer count (default: 4)
    --buffersize=INT      Buffer size
    --width=WIDTH         Buffer width
    --height=HEIGHT       Buffer height
    --pixelformat=ITEM     PFNC Pixel format
    --bayer=BAYERDECODINGMETHOD Bayer method (Legacy, Advanced) (default: Advanced)
    --set=SETTINGS        GenApi settings, such as Module.Feature=INT
    --setup=FILE           Path to script to execute before starting stream
    --run=FILE             Path to script to execute concurrently
    --timeout=INT         Acquisition timeout, in milliseconds (default:
infinite)
    --zero                Zero memory when queuing buffers (default: memory is
only zeroed when buffers
                                are allocated)
    --remotexml=FILE      Use FILE as register description (default: register
description is read from
                                remote device)
    -n --repeat[=N]       Measure data transfer rate N times (default: 1)
Common flags:
    --cti=LIBPATH         Path to GenTL producer library. Default: use
EURESYS_COAXLINK_GENTL64_CTI and
                                GENICAM_GENTL64_PATH environment variables to locate
the library.
    -j=N                 Limit the number of CPU cores to use to N (default:
2)
    -h --help            Display help message
    -V --version          Print version information
    --numeric-version     Print just the version number
    -v --verbose         Loud verbosity
    -q --quiet           Quiet verbosity

```



TIP

For a better measurement accuracy, use the `gentl dtr -n` option to execute multiple measurements repeatedly. The DTR program will average the results.

8. Camera and Illumination Control

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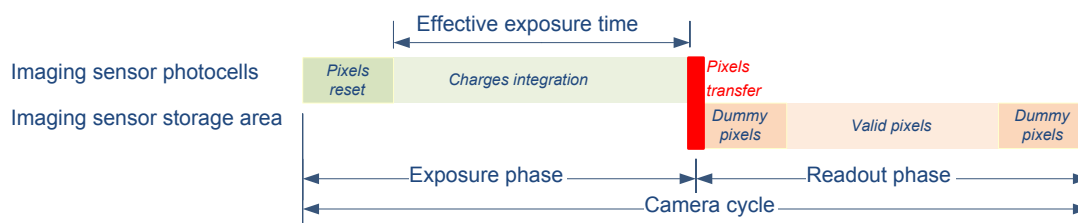
8.1. Camera Control Principles

Camera Cycle 160

Camera Cycle Concatenation Rules 161

Camera Cycle

A camera cycle is composed of two consecutive phases: the exposure phase and the readout phase.



Camera cycle

Exposure phase

The exposure phase is the period of time during which the photocells of the imaging sensor integrate electric charges induced by the incoming photons.

For cameras having an electronic shutter, the exposure phase begins with a pixel reset action that clears all the sensor photocells. For permanent exposure cameras, i.e. cameras having no (or not using) the electronic shutter, the exposure phase begins immediately after the completion of the previous exposure phase.

For all types of cameras, the exposure phase terminates with a “pixels transfer” action. The accumulated charges in the photocell are transferred to the storage area for further readout. This action clears the photocells and new charge integration begins immediately.

Cameras having an electronic shutter have the capability to reset the pixels asynchronously and initiate a new exposure on request. These cameras are named asynchronous reset cameras.

Having the capability of controlling the time of the start of exposure (pixel reset) and the time of the end of exposure (pixel transfer) gives full control on:

- The timing of each image capture
- The sensitivity of the imaging sensor by selecting the exposure time

Readout phase

The readout phase is the period of time during which the total amount of electrical charges accumulated by each pixel is measured and delivered to the imaging sensor output.

The readout phase is not controlled by the frame grabber:

- It is automatically initiated after each pixel transfer.
- Its duration is fixed; it is determined by the amount of pixel data to be transferred and by the readout structure of the sensor (one or more taps, tap output data rate).

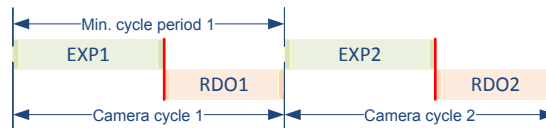
Some sensors provide the capability to select one or more region of interest (ROI) speeding up the readout since less data needs to be transferred.

Camera Cycle Concatenation Rules

This topic explains the rules that **MUST** be observed by the frame grabber to avoid *Camera Trigger* overrun when requesting successive camera cycles to an asynchronous reset camera.

Rule for cameras not allowing overlapping

The next camera cycle may NOT begin before the completion of the readout phase.



Shortest possible cycle period achievable by cameras NOT allowing the cycle overlapping

$$\text{Min. cycle period}_n = \text{EXP}_n + \text{RDO}_n$$

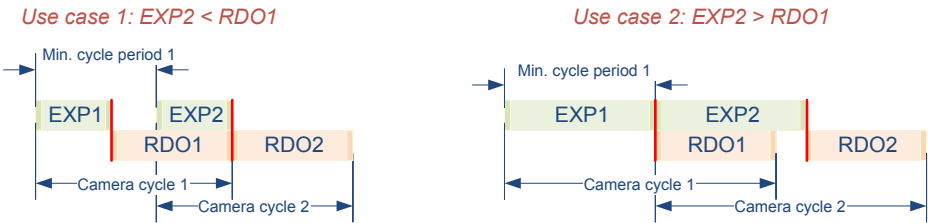


NOTE

Only a minority of industrial cameras are NOT allowing the cycle overlapping!

Rules for cameras allowing overlapping

- 1. The exposure phases of two consecutive camera cycles may NEVER overlap.
- 2. The readout phases of two consecutive camera cycles may NEVER overlap



Shortest possible cycle period achievable by cameras allowing the cycle overlapping

In the first case, the duration of the exposure phase of the second cycle is shorter than the duration of the readout phase of the first cycle. The next camera cycle may start ($EXP_{n+1} - RDO_n$) period of time after the completion of the exposure phase. The minimum cycle period is

$$Min. cycle period_n = EXP_n + RDO_n - EXP_{n+1}$$

In the second case, the duration of the exposure phase of the 2nd cycle is longer than the duration of the readout phase of the first cycle. The next camera cycle may start immediately after the completion of the exposure phase. The minimum cycle period is:

$$Min. cycle period_n = EXP_n$$



NOTE

The majority of asynchronous reset cameras used in the machine vision industry supports the overlapping of the camera cycles!

8.2. Illumination Control Principles

Illumination Devices 163

Aligning Camera and Illumination Cycles 164

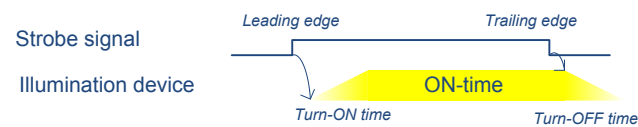
Illumination Devices

Two classes of illumination devices can be controlled by the illumination controller:

- Intermittent illumination devices
- Strobed illumination devices

Intermittent illumination devices

This illumination device class includes switched light sources where the turn-on and the turn-off time are controlled by the leading and the falling edges of the strobe signal.



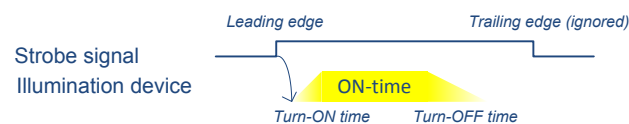
Timing diagram for intermittent illumination devices

The width of the strobe pulse determines the ON time duration of the light source

NOTE: The turn-on time and the turn-off time need to be considered when configuring the illumination controller!

Strobed illumination devices

This illumination device class includes switched light sources where only the turn-on time is controlled by the leading edge of the strobe signal.



Timing diagram for strobed illumination devices

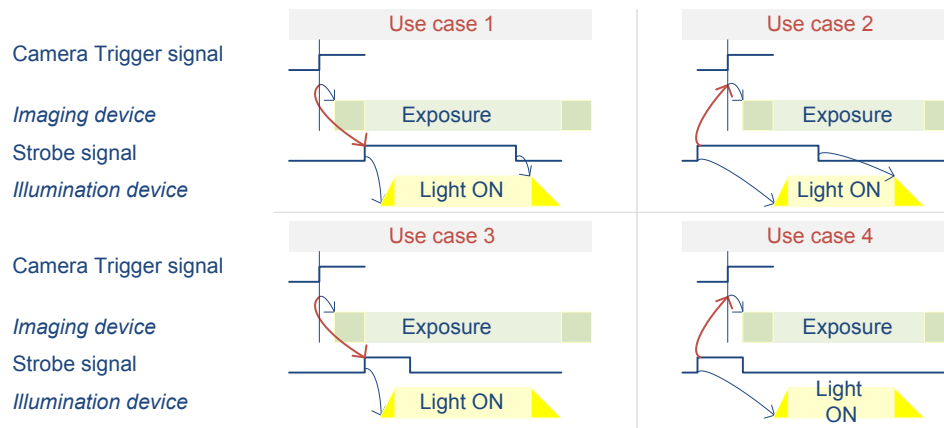
The on-time duration is either uncontrolled or controlled by the illumination device itself.

NOTE: The turn-on time and the ON time duration need to be considered when configuring the illumination controller.

Aligning Camera and Illumination Cycles

Obviously, the ON time of the light source must coincide with the exposure phase of the imaging sensor.

Therefore, the time relationship between the **Strobe** signal(s) and the **Camera Trigger** signal must be adequately controlled.



4 typical use cases of Camera Trigger vs. Strobe alignment

Intermittent light sources (Use cases 1 & 2)

The duration of the **Strobe** pulse must be adequately controlled in order to provide the right amount of light and get a correctly exposed image.

The sensor exposure should be adequately timed in order to terminate the sensor exposure after the light has turned off.

Strobed light sources (Use cases 3 & 4)

The sensor exposure should be adequately timed in order to terminate the sensor exposure after the light has turned off.

Late strobe (Use cases 1 & 3)

The leading edge (beginning) of the **Strobe** signal is delayed a little to ensure that the light is not turned on too early while the imaging device is resetting its pixels.

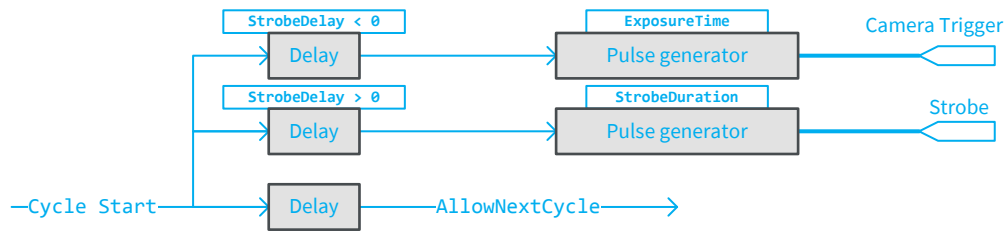
Early strobe (Use cases 2 & 4)

The leading edge of the **Camera Trigger** signal is delayed a little to ensure that the sensor exposure time is kept as short as possible and closely matches the on time.

8.3. Camera and Illumination Controller

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Cycle Timing Machine



CIC Cycle Timing Machine block diagram

The CIC timing machine is responsible for the generation of accurately timed events and signals structuring one camera and illumination controller cycle (CIC Cycle).

At every occurrence of a **Cycle Start** event, the timing machine generates:

- One single pulse on the **Camera Trigger** signal.
- One single pulse on the **Strobe** signal.
- One **AllowNextCycle** event.

Intra-cycle timing

Three GenApi features of the Device module are used to configure the timing of the output signals within a cycle:

- **ExposureTime** defines the duration of the **Camera Trigger** pulse.
- **StrobeDuration** defines the duration of the **Strobe** pulse.
- **StrobeDelay** defines the time offset from the leading edge of **Camera Trigger** up to the leading edge of **Strobe**.

See also: "Single Cycle" on page 175 for more explanations and timing diagrams

Cycle-to-cycle timing

The `AllowNextCycle` event is used by the Cycle Manager to determine when the next Cycle may start.

The position of the `AllowNextCycle` event is not directly set by the user. Instead, it is evaluated by the driver according to the following user settings:

- The `ExposureReadoutOverlap` feature of the Camera Model category defines if the camera supports or not the exposure/readout overlapping. If overlapping is allowed, the `AllowNextCycle` event is issued earlier and faster cycle rates are obtained.
- The `ExposureRecoveryTime` feature of the Camera Model category defines the minimum time gap required by the camera between two exposures. This feature is relevant when `ExposureReadoutOverlap = TRUE` and the duration of the exposure phase becomes larger than the duration of the readout phase.
- The `CycleMinimumPeriod` of the Cycle Control category defines the minimum cycle period. This value may not be smaller than the time required by the camera to perform the image readout!



NOTE

Some cameras have a data store in the image data path. This enables capturing bursts of images at a higher cycle-to-cycle rate than the camera-to-frame grabber data link can sustain. In that case, `CycleMinimumPeriod` declares the smallest cycle-to-cycle time that the image sensor can achieve!

See also: "Overlapping Cycles - Single timing" on page 177 for more explanations and timing diagrams.

Cycle Manager

The Cycle Manager is responsible for the generation of the **Cycle Start** event.

It prevents initiating a new cycle while the *cycle start conditions* listed hereafter are not satisfied:

Sequence Active Condition

The Sequence Manager must be in the ACTIVE state: the sequence has started and the sequence stop condition has not yet been reached.

This condition always applies.

Next Cycle Allowed Condition

The Cycle Timing Machine has already issued the **Allow Next Cycle** event of the previous cycle.

This condition always applies.

Free Memory Condition

There is enough free memory on board to acquire the image data of the next cycle.

This condition always applies.

Cycle Trigger Event Condition

A new Cycle Trigger event is required to initiate a new cycle.

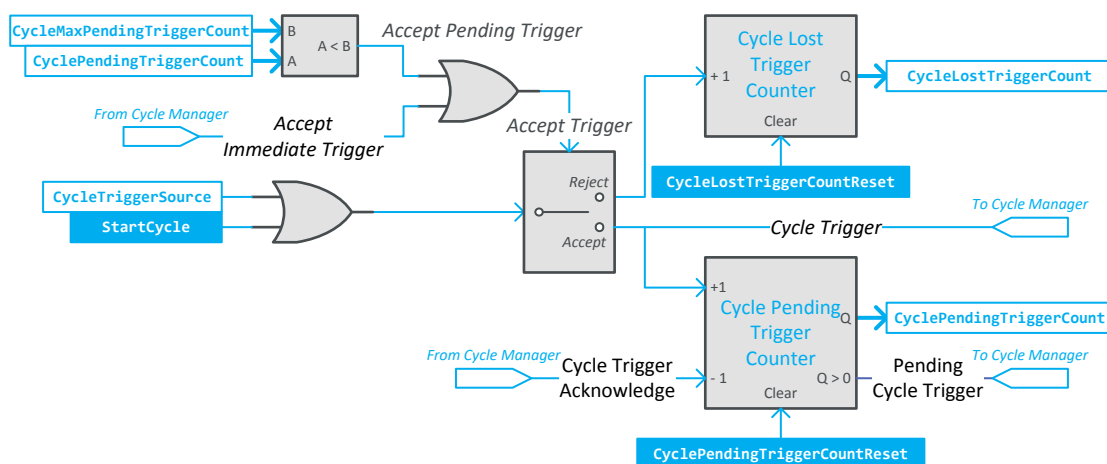
This condition applies only when **Cycle TriggerSource** $\neq$ **Immediate** AND **CycleMaxPendingTriggerCount** = 0.

Pending Trigger Condition

There is at least one pending trigger (possibly a new one) waiting for service.

This condition applies only when **Cycle TriggerSource** $\neq$ **Immediate** AND **CycleMaxPendingTriggerCount** > 0.

Cycle Trigger Manager



CIC Cycle Trigger Manager block diagram

The Cycle Trigger Manager is responsible, in collaboration with the Cycle Manager, to elaborate the effective *Cycle Trigger* event that initiates one cycle of the CIC timing machine.

Cycle Trigger Sources

The source of Cycle Trigger is defined by `CycleTriggerSource`.

When set to **Immediate**, the Cycle Trigger Manager is self-triggered. It generates a Cycle Trigger immediately after the start of the sequence and then repeatedly every `CycleMinimumPeriod` period.

When set to **StartCycle** or to *<any I/O toolbox event source>* the Cycle Trigger Manager doesn't start immediately after the start of the sequence, instead it waits for the execution of a **StartCycle** command or the occurrence of an event on the selected I/O toolbox event source.

A wide set of Cycle Trigger event sources is available. It includes all the I/O toolbox events, namely: LIN, QDC, MDV, DIV, DEL, EIN and User Events.

Cycle Trigger Latch Mechanism

The Cycle Manager is fitted with a trigger latch mechanism capable of latching cycle triggers that cannot be served immediately. Such triggers are named "pending triggers" since their execution is simply postponed until the corresponding CIC cycle is initiated.

The maximum number of pending triggers that can be recorded is defined by `CycleMaxPendingTriggerCount`. When `CycleMaxPendingTriggerCount = 0`, the trigger latching mechanism is disabled. This is the default value. To enable the trigger latching mechanism, set `CycleMaxPendingTriggerCount` to any integer value in range 1 to 7.

The number of pending triggers is reported by `CyclePendingTriggerCount`.

Cycle Trigger Events Sorting

When `CycleTriggerSource` is set to `StartCycle` or to *<any I/O toolbox event source>*, every Cycle Trigger event is evaluated against the *trigger acceptance criteria* and sorted according to the result.

The rejected Cycle Trigger events increment the *Cycle Lost Trigger Counter*.

The accepted Cycle Trigger events increment the *Cycle Pending Trigger Counter* if the pending trigger cannot be served immediately.

Trigger Acceptance Criteria

Cycle Trigger events are *accepted and executed immediately* when both conditions are satisfied:

- Cycle Sequence is active
- Cycle Manager is currently waiting for an immediate trigger event to start a new cycle (Accept Immediate Trigger)

Cycle Trigger events are *accepted and executed later* when following conditions are satisfied:

- Cycle Sequence is active.
- The number of pending triggers, `CycleMaxPendingTriggerCount`, is less than `CycleMaxPendingTriggerCount`.
- The Cycle Manager is not (yet) ready to initiate new cycle.

Sequence Manager

The *Sequence Manager* is the top-level manager of the CIC: It controls the Cycle Trigger Manager and the Cycle Manager.

It defines sequences of identical CIC cycles according to user-defined start sequence and stop sequence conditions.

Starting a Sequence

The conditions for starting a sequence are defined by `StartOfSequenceTriggerSource`.

When `StartOfSequenceTriggerSource` is set to `Immediate` (default setting), the Sequence Manager doesn't require any further action to allow the Cycle Manager and the Cycle Trigger Manager to proceed with the first cycle.

Depending on the `CycleTriggerSource` settings of the Cycle Manager the first cycle will be executed:

- Immediately when `CycleTriggerSource` is set to `Immediate`
- On execution of the `StartCycle` command when `CycleTriggerSource` is set to `StartCycle` or
- On execution of the `StartCycle` command or when an event occurs on the I/O toolbox event source designated by `CycleTriggerSource`.

When `StartOfSequenceTriggerSource` is set to `StartSequence`, the Sequence Manager waits for the execution of a `StartSequence` command before allowing the Cycle Manager and the Cycle Trigger Manager to proceed with the first cycle.

When `StartOfSequenceTriggerSource` is set to `<any-event-source>`, the Sequence Manager waits for the execution of a `StartSequence` command or the occurrence of an I/O toolbox event on the designated event source before allowing the Cycle Manager and the Cycle Trigger Manager to proceed with the first cycle.

Stopping a sequence

The conditions for stopping a sequence are defined by `EndOfSequenceTriggerSource`.

When `EndOfSequenceTriggerSource` is set to `StopSequence` (default setting), the Sequence Manager stops the sequence at the next cycle boundary after the execution of a `StopSequence` command.

When `EndOfSequenceTriggerSource` is set to `SequenceLength`, the Sequence Manager stops automatically the sequence after having executed a number of camera cycles specified by `SequenceLength`. The sequence can be stopped anticipatively on execution of the `StopSequence` command. The default `SequenceLength` value is 1; any value up to 16,777,215 is allowed.

When `EndOfSequenceTriggerSource` is set to `<any-event-source>`, the Sequence Manager waits for the execution of a `StopSequence` command or the occurrence of an I/O toolbox event on the designated event source before stopping the sequence at the next cycle boundary.

NOTE: Any combination of `StartOfSequenceTriggerSource` and `EndOfSequenceTriggerSource` settings is allowed.

Changing sequence length while camera is grabbing

Starting with release 10.5, if **SequenceLength** is changed between start-of-sequence and end-of-sequence events, the new value will be effective for the subsequent sequence.

NOTE: The value of **SequenceLength** is latched at the start-of-sequence event.

CIC Output Signals Routing

Camera Trigger signal

The frame grabber controls the camera cycle of an asynchronous reset camera by means of the **Camera Trigger** signal.

The signal can be transmitted from the frame grabber to the camera using one of the following media:

- The I/O channel of the CoaXPress link.
- A dedicated wiring driven by a TTL I/O

CoaXPress I/O channel

The **Camera Trigger** signal is transmitted to the camera as a high-priority Host to Device Trigger message on the CoaXPress I/O channel

See also: [CoaXPress Host To Device Trigger](#) for detailed information about the Host to Device Trigger transmitter (Coaxlink series only).

TTL I/O Line

Any TTL I/O line can be configured as a **Camera Trigger** output. The polarity control of the I/O control block provides an individual polarity control for each I/O port. The mode control of the I/O control block of TTLIO lines provides an individual output driver configuration.

Strobe signal

Every output capable I/O line can be configured as an Illumination **Strobe** output. The polarity control of the I/O control block provides an individual polarity control for each I/O port. The mode control of the I/O control block of TTLIO lines provides an individual output driver configuration for each I/O port used as strobe output.

8.4. CIC Timing Diagrams

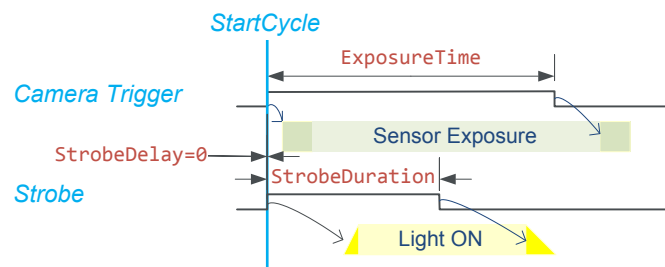
Single Cycle	175
Overlapping Cycles - Single timing	177
Cycle Sequence Timing Diagrams	182

Single Cycle

Timing diagrams of single CIC cycles

This topic shows timing diagrams of individual CIC cycles and illustrates the **ExposureTime**, **StrobeDuration** and **StrobeDelay** features for 3 use cases corresponding to positive, zero and negative values of **StrobeDelay**.

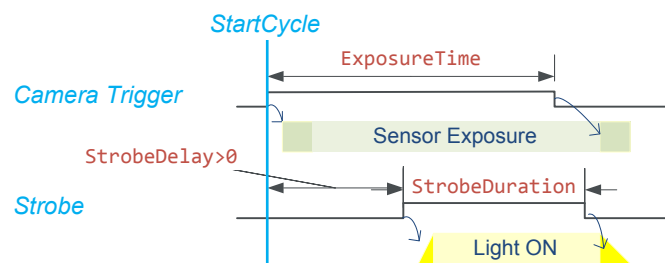
In-phase Strobe



In-phase Strobe signal

The **Camera Trigger** and the **Strobe** signals goes high immediately after the **StartCycle** event .

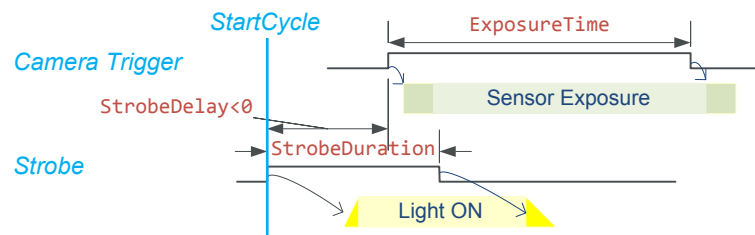
Late Strobe



Late Strobe signal

The **Camera Trigger** signal goes high immediately after the **StartCycle** event and the **Strobe** signal goes high after **StrobeDelay** microseconds.

Early Strobe



Early Strobe signal

The **Strobe** signal goes high immediately after the **StartCycle** event and the **Camera Trigger** signal goes high after a time delay equal to the opposite value of **StrobeDelay** microseconds.

Overlapping Cycles - Single timing

Timing diagrams of overlapping CIC cycles with identical cycle timing definition

This topic describes the behavior of the CIC when it is configured to generate one sequence of 4 cycles, each with identical timings settings.

In the following timing diagrams, user-defined values are shown in red:

- **c** is the minimum cycle period defined by **CycleMinimumPeriod**,
- **d** is the **Strobe** delay defined by **StrobeDelay**,
- **e** is the **Camera Trigger** pulse width defined by **ExposureTime**,
- **r** is the minimum time interval between consecutive exposure defined by **ExposureRecoveryTime**,
- **s** is the **Strobe** pulse width defined **StrobeDuration**.

In the following timing diagrams, values calculated by the driver are shown in blue:

- **a** is the CIC cycle duration,
- **f** is the time interval between consecutive **Camera Trigger** pulses,
 - the **Strobe** pulse width. This is the value of **StrobeDuration** set by the user.

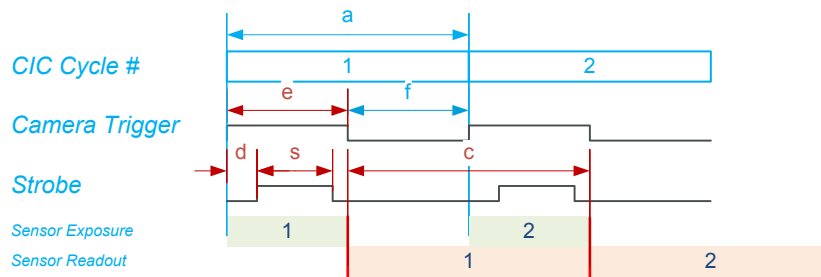
The driver calculates the duration of the CIC Cycle (**a** value) from the user-defined settings **ExposureTime**, **ExposureRecoveryTime** and **CycleMinimumPeriod** by searching the smallest value satisfying the following conditions:

- **Condition 1:** The time interval between consecutive **Camera Trigger** pulses (**f** value) must be greater than or equal to the **ExposureRecoveryTime** settings (**r** value). This ensures that the **Camera Trigger** properly flows through the trigger transmission link. It ensures also that a new exposure doesn't begin before the completion of the previous one.
- **Condition 2:** The CIC Cycle duration (**a** value) must be big enough to ensure that a new readout doesn't begin before the completion of the previous one.
- **Condition 3:** The CIC Cycle duration (**a** value) must be big enough to include both transitions of the **Camera Trigger** and the **Strobe** signal.

The "Readout-limited" use cases illustrate situations where the cycle period is equal to the duration of the readout phase.

The "Exposure-limited" use cases illustrate situations where the cycle period is equal to the duration of the exposure phase.

Case 1: Readout-limited - Late Strobe



The camera cycle rate is only limited by the camera readout time

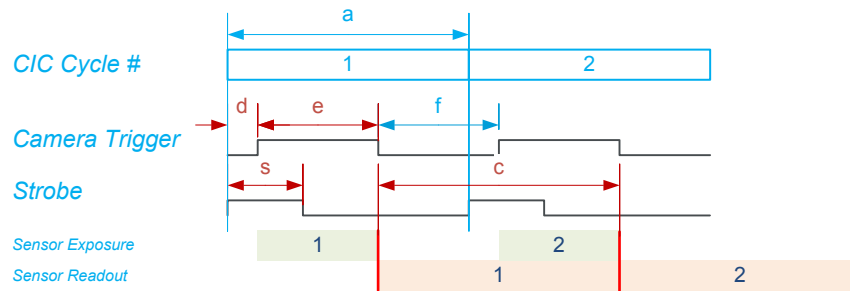
This situation occurs when the exposure time (**e** value) is significantly smaller than the readout duration (**c** value). In that situation:

- **f** is likely larger than **ExposureRecoveryTime**: *Condition 1* is fulfilled.
- The strobe pulse being "inside" the **Camera Trigger** pulse: *Condition 3* becomes irrelevant when *Condition 1* is fulfilled.
- The *Condition 2* is the only condition used by the driver to calculate the cycle duration.

The optimal duration of the CIC Cycle is equal to the effective duration of the sensor readout phase. This is obtained when the user sets **CycleMinimumPeriod** to a value corresponding to the readout duration.

NOTE: The readout duration can be derived from the maximum frame rate specification of the camera data sheet or experimentally.

Case 2: Readout-limited - Early Strobe



The camera cycle rate is only limited by the camera readout time (despite the early strobe)

This situation is similar to the case 1. It shows that despite an early strobe, it is possible to reach the maximum cycle rate of the camera.

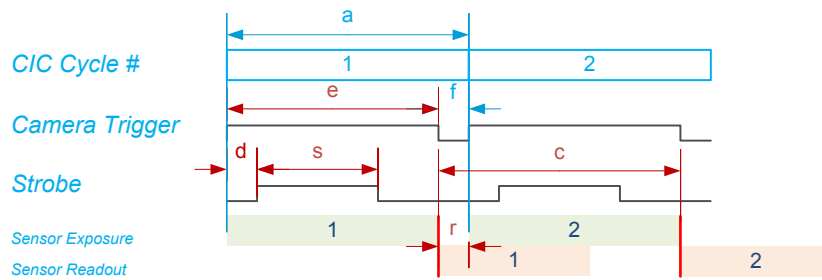
This situation occurs when the exposure time (**e** value) is significantly smaller than the readout duration (**c** value). In that situation:

- **f** is likely larger than **ExposureRecoveryTime**: *Condition 1* is fulfilled.
- The strobe pulse being terminating before the **Camera Trigger** pulse: *Condition 3* is fulfilled if **r** is greater than **d**. This is the case when $(d + e < c)$.
- The *Condition 2* is the only condition used by the driver to calculate the cycle duration.

The optimal duration of the CIC Cycle is equal to the effective duration of the sensor readout phase. This is obtained when the user sets **CycleMinimumPeriod** to a value corresponding to the readout duration.

NOTE: The readout duration can be derived from the maximum frame rate specification of the camera data sheet or experimentally.

Case 3: Exposure-limited - Late Strobe



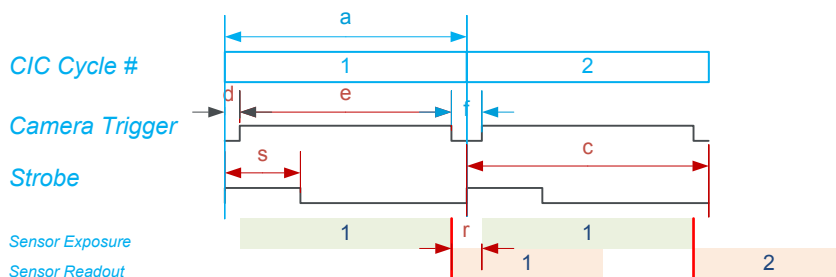
The camera cycle rate is limited by the exposure time settings

This situation occurs when the exposure time (**e** value) is significantly larger than the readout duration (**c** value). In that situation:

- All cycles being identical, having the readout duration smaller than the exposure duration, implies that *Condition 2* becomes irrelevant.
- The strobe pulse being "inside" the Camera Trigger pulse: *Condition 3* becomes irrelevant when *Condition 1* is fulfilled.
- The *Condition 1* is the only condition used by the driver to calculate the cycle duration .

The optimal duration of the Cycle is equal to the effective duration of the exposure phase. This is obtained when the user sets **ExposureRecoveryTime** to a value corresponding to the minimal time interval allowed by the camera between consecutive Camera Trigger pulses.

Case 4: Exposure-limited- Early Strobe



The camera cycle rate is limited by the exposure time settings (despite the early strobe)

This situation is similar to the case 3. It shows that despite an early strobe, it is possible to reach the same cycle rate in case of small negative **StrobeDelay** values.

This situation occurs when the exposure time (**e** value) is significantly larger than the readout duration (**c** value). In that situation:

- All cycles being identical, having the readout duration smaller than the exposure duration implies that *Condition 2* becomes irrelevant.
- The strobe pulse terminating before the **Camera Trigger** pulse: *Condition 3* becomes irrelevant when *Condition 1* is fulfilled and $d < r$.
- *Condition 3* and *Condition 1* are the only condition used by the driver to calculate the cycle duration.

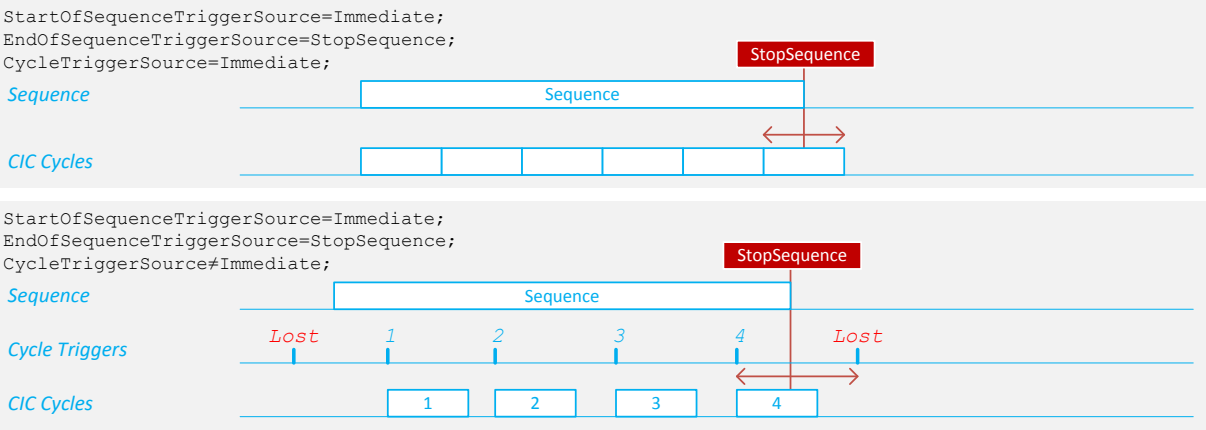
The user must set **ExposureRecoveryTime** to a value corresponding to the largest of the following two values:

- Minimal time interval allowed by the camera between consecutive **Camera Trigger** pulses.
- Opposite value of **StrobeDelay**.

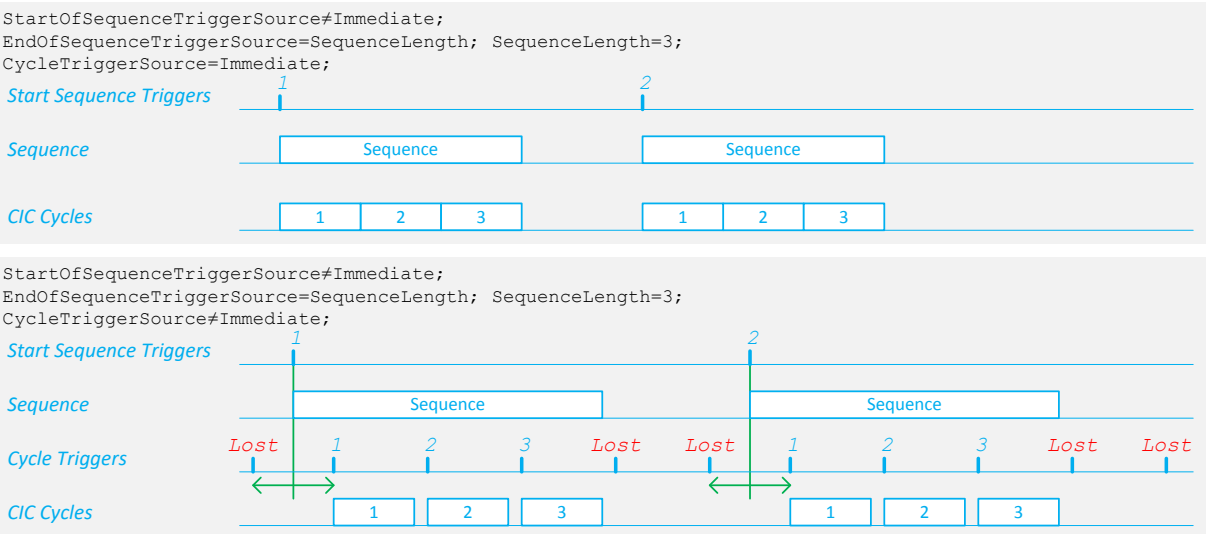
NOTE: When **CycleTriggerSource** = **Immediate**, the cycle rate can be lowered to the desired rate by assigning a greater value to **CycleMinimumPeriod**.

Cycle Sequence Timing Diagrams

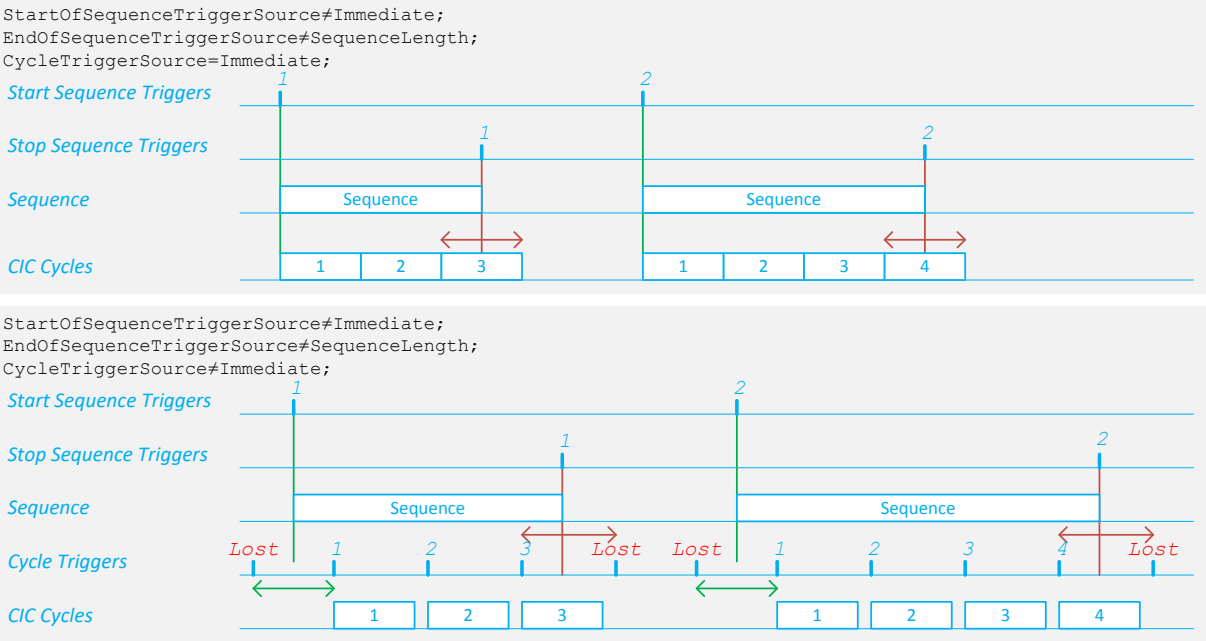
Timing diagrams of sequences of CIC cycles



Cycle sequences with immediate start



Cycle sequences with triggered start and fixed length



Cycle sequences with triggered start and triggered end

9. General Purpose I/O

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9.1. I/O Lines Overview

General Purpose I/O lines overview in eGrabber-driven frame grabbers

GPIO lines in GenApi

The **LineSelector** feature of the **eGrabber-driven frame grabbers** Interface Modules exposes:

- 2 **Standard I/O sets** of **10** I/O lines named **DIN****, **IIN****, **IOUT**** and **TTLIO****
- 1 **Module I/O set** of **40** I/O lines named **MIO****

Standard I/O set

Each *Standard I/O Set* is composed of 10 I/O lines:

I/O Line Type	I/O Line Names	Count
Isolated input	IINx1, IINx2, IINx3, IINx4	4
Isolated output	IOUTx1, IOUTx2	2
RS-422 input	DINx1, DINx2	2
TTL I/O	TTLIOx1, TTLIOx2	2
Total		10

NOTE: x is the instance number: **1** for the first instance; **2** for the second instance.

Module I/O set

I/O Line Type	I/O Line Names	Count
See note (1)	MIO1 ... MIO40	40



NOTE

(1) The mix of I/O line types is defined by the attached extension.

GPIO lines per product

The number of effectively available GPIO lines is defined by the frame grabber configuration:

- A frame grabber includes 0, 1 or 2 "**Standard I/O set**" on page 185.
- A selection of frame grabbers with less than 2 "**Standard I/O set**" on page 185 accepts one extension module with an additional Standard I/O set.
- Frame grabbers with an I/O extension connector may accept one I/O Extension module.

3610/3612 Module I/O set



WARNING

PC3610 HD26F I/O Extension Module - TTL-RS422 and PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422 have reached the "End Of Life" (EOL) stage in their life cycle. They are no longer sold.

Compatible with PC1628-T Grablink Duo, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.

Duo	Octo	Mono12LH	Duo12	Value12

PC3610 HD26F I/O Extension Module - TTL-RS422 and PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422 provide the "3610/3612 Module" I/O set:

I/O Line Type	I/O Line Names	Count
RS-422 input	MIO1, MIO3...MIO19	0 to 10
RS-422 output	MIO1, MIO3...MIO19	0 to 10
TTL input	MIO1, MIO2...MIO20	0 to 20
TTL output (3610) CMOS output (3612)	MIO1, MIO2...MIO20	0 to 20
Total		10 RS-422 0 TTL/CMOS
		... 0 RS-422 20 TTL/CMOS

9.2. I/O Lines Usage

Input lines

The input-capable I/O lines (DIN, TTLIO, IN, MIO) can be used as:

- General purpose input: An input signal whose state can be read or monitored by the host application.
- Motion encoder input: A pair of input signals delivered by a quadrature motion encoder and used for triggering the acquisition from the camera.
- Trigger input: An input signal used to trigger the acquisition from the camera.

Output lines

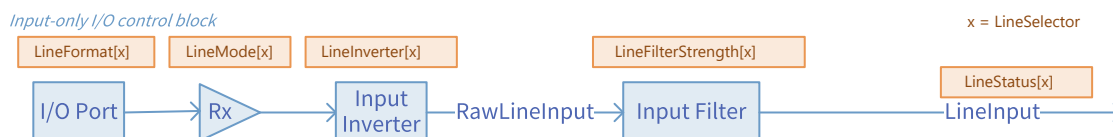
The output-capable I/O lines (TTLIO, IOOUT, MIO) can be used as:

- General purpose output: An output signal whose state can be set by the host application.
- Strobe output: An output signal usually used to control a strobe light, in synchronization with the camera.
- Camera trigger output (only available on TTLIO): An output signal generated by the frame grabber and used to trigger the camera.

9.3. I/O Control Blocks

Every I/O line is controlled through an I/O control block. There are 3 types of control blocks:

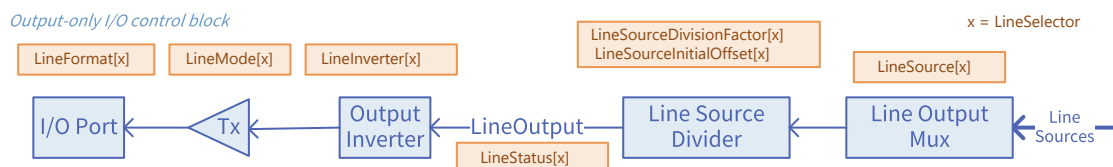
Input-only I/O control block



Input-only I/O control blocks and "Bidirectional I/O control block" on page 189 share a common *input path structure* composed with:

- The *I/O port* and *Rx* blocks represent the I/O pin on the [GPIO connector](#) and the line receiver circuit. The electrical style is defined by **LineFormat**: **ISO**, **DIFF** or **TTL**. The direction is defined by **LineMode**=**Input**. For details, refer to "[Line Format and Line Mode Controls](#)" on page 190.
- The *Input Inverter* block represents the user-configurable logic inverter. The inverter is controlled by **LineInverter**. For details, refer to "[Line Polarity Control](#)" on page 193.
- The *Input Filter* block represents the user-configurable glitch-removal filter. The filter is controlled by **LineFilterStrength**. For details, refer to "[Line Filter Control](#)" on page 194.
- **LineStatus** reports the logical state of the **LineInput** signal.

Output-only I/O control block

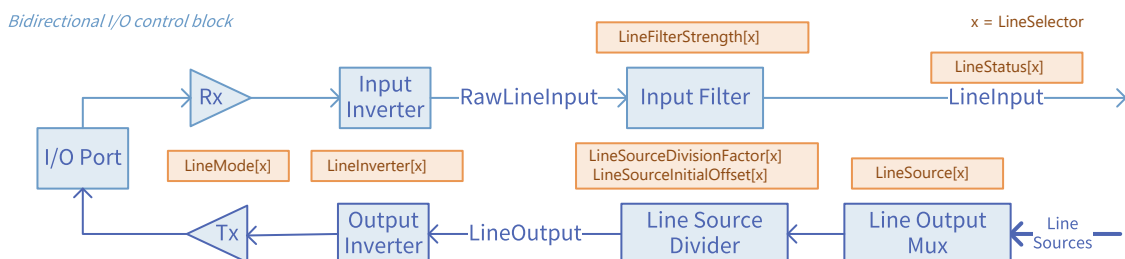


Output-only I/O control blocks and "Bidirectional I/O control block" on page 189 share a common *output path structure* including:

- The *I/O port* and *Tx* blocks represent the I/O pin on the [GPIO connector](#) and the line driver circuit. The electrical style is defined by **LineFormat**: **ISO**, **DIFF** or **TTL**. The direction and the driver configuration (if any) is defined by **LineMode**. For details, refer to "[Line Format and Line Mode Controls](#)" on page 190.
- The *Output Inverter* block represents the user-configurable logic inverter. The inverter is controlled by **LineInverter**. For details, refer to "[Line Polarity Control](#)" on page 193.
- The *Line Source Divider* block represents the user-configurable pulse train divider. The division is controlled by **LineSourceInitialOffset** and **LineSourceDivisionFactor**. For details, refer to "[Line Source Divider](#)" on page 196.

- The *Line Output Mux* block represents the user-configurable line source multiplexer. The multiplexer is controlled by **LineSource**. For details, refer to "[Line Source Selection](#)" on page 195.
- **LineStatus** reports the logical state of the **LineOutput** signal.

Bidirectional I/O control block



Bidirectional I/O control blocks implement both an input and an output paths. The input path structure is common with the "[Input-only I/O control block](#)" on page 188 and the output path structure is common with the "[Output-only I/O control block](#)" on page 188.

However, take care of the following facts:

- The **LineStatus** value reports the logical state of the **LineInput** signal. It is not possible to read back the logical state of the **LineOutput** signal!
- The **LineInverter** settings applies equally to the signal input path and the signal output path. It is not possible to have different polarity settings!

Legend

In the above figures:

- A thin blue line represents one individual electrical signal path
- A thick blue line represents a collection of electrical signal paths
- The blue arrowhead shows the propagation direction of the electrical signal(s)
- A blue shape represents a functional element of the I/O control block
- An orange (rectangular) shape represents a GenApi feature; the text inside being the feature name
- An [x] appended to the feature name indicates that the feature is associated with a selector feature (in this case: **LineSelector**)

9.4. Line Format and Line Mode Controls

Introduction

The following tables summarize the details of the I/O Control blocks of each I/O line:

- The first column indicates the **LineSelector** value
- The second column indicates the bit position in the integer value reported by **LineStatusAll**
- The third column indicates the value reported by **LineFormat**
- The fourth column indicates the values that can be assigned to **LineMode**

Standard I/O sets

Standard I/O set #1

LineSelector	Bit#	LineFormat	LineMode
DIN11	0	DIFF	Input
DIN12	1	DIFF	Input
IIN11	4	ISO	Input
IIN12	5	ISO	Input
IIN13	6	ISO	Input
IIN14	7	ISO	Input
IOUT11	12	ISO	Output
IOUT12	13	ISO	Output
TTLIO11	16	TTL	Input, Output, DriveLow or DriveHigh
TTLIO12	17	TTL	Input, Output, DriveLow or DriveHigh

Standard I/O set #2

LineSelector	Bit#	LineFormat	LineMode
DIN21	1	DIFF	Input
DIN22	3	DIFF	Input
IIN21	8	ISO	Input
IIN22	9	ISO	Input
IIN23	1	ISO	Input
IIN24	11	ISO	Input
IOUT21	14	ISO	Output
IOUT22	15	ISO	Output
TTLIO21	18	TTL	Input, Output, DriveLow or DriveHigh
TTLIO22	19	TTL	Input, Output, DriveLow or DriveHigh

TTLIO ports mode control

The **LineMode** feature controls the direction and the line driver mode of each individual TTLIO port. Four modes can be selected at any time:

- **Input**: input only, totem-pole driver disabled (default power-up settings),
- **Output**: totem-pole driver capable of driving low and high,
- **DriveLow**: open-collector driver capable of driving low only,
- **Drivehigh**: open-emitter driver capable of driving high only.



NOTE

The two latest configurations allow wired-AND configurations. The line state can be read back through the input port.

I/O modules

3610/3612 I/O Extension modules

LineSelector	Bit#	LineFormat	LineMode
MIO1	20	TTL or DIFF	Input or Output
MIO2	21	TTL	Input or Output
:	:	:	:
MIO19	38	TTL or DIFF	Input or Output
MIO20	39	TTL	Input or Output

MIO format and mode controls

The **LineFormat** feature controls the electrical style of the MIO ports. Possible values:

- **TTL**: single-ended (TTL or CMOS)
- **DIFF**: differential (RS422)

The **LineMode** feature controls the direction of the MIO ports. Possible values::

- **Input**: input only,
- **Output**: totem-pole driver capable of driving low an high.



NOTE

The controls can only be changed during the module configuration .

See also: "PC3610 HD26F I/O Extension Module - TTL-RS422 and PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422" on page 338 for an extensive description of the configuration.

9.5. Line Polarity Control

All the I/O lines are fitted with a polarity control. For bidirectional I/O lines, a single control affects equally both paths.

The line polarity is user-configurable through the **LineInverter** control.



NOTE

The user is invited to set the polarity control according to the polarity of the external signal in such a way that the *Line Input* signals of the input path and the *LineSources* signals of the output path are always using positive logic.

9.6. Line Filter Control

All the I/O input lines are fitted with a glitch-removal filter.

The filter strength is user-configurable through the **LineFilterStrength** control:

- When set to **Custom**, the filter time constant is configurable by setting **LineFilterDelay** to the desired value.
- When set to another value (**Lowest**, ... **Highest**):
 - the filter time constant is preset according to the selected strength and the I/O input line type (as shown hereafter)
 - the actual filter time constant is reported by **LineFilterDelay**

The default settings is **Lowest**.

LineFilterStrength	Differential inputs (DIN)	TTL inputs (TTLIO)	Isolated Inputs (IIN)
Lowest	50 ns	50 ns	500 ns
Low	100 ns	100 ns	1 µs
Medium	200 ns	200 ns	2 µs
High	500 ns	500 ns	5 µs
Highest	1 µs	1 µs	10 µs



TIP

The user is invited to set the filter strength according to the quality of the external signal. Select a filter strength such that its time constant is:

- Greater than the longest glitch duration
- Greater than the 10%~90% rise/fall time of the signal
- At least 2 times smaller than the smallest signal pulse duration



NOTE

The glitch removal filter introduces a latency into the input signal path. The latency is equal to the filter time constant when the incoming signal has clean transitions. The latency may increase significantly in case of bad quality signals.

9.7. Line Source Selection

Any output-capable I/O lines is fitted with a source signal multiplexer.

The source signal multiplexers implement a fully-populated signal routing matrix allowing a selection of internal signals to be routed to any output lines.

Selecting a line source

To select an internal signal to feed the line driver of an output capable I/O line:

1. Select an I/O line by assigning the appropriate value to the **LineSelector** feature
2. Assign the appropriate value to the **LineSource** feature:

LineSource feature value	Source signal
UserOutput<0:7>	Any bit of the User Output register
Device<0:7>Strobe	Strobe output of any device
Device<0:7>CameraTrigger	Camera trigger of any device
Device<0:7>Stream<0:7>StartOfCameraReadout	StartOfCameraReadout event* ¹ on any stream of any device
CustomLogicOutput<0:31>	Any bit of the custom_logic_output_ctrl register* ² (CustomLogic General Purpose I/O Interface)
Low	Steady low
High	Steady high



NOTE

1. The StartOfCameraReadout event corresponds to a pulse of 344 ns.
2. The custom_logic_output_ctrl register is only available in CustomLogic variants.

9.8. Line Source Divider

Output ports pulse train divider

The signal output path of "Output-only I/O control block" on page 188 and "Bidirectional I/O control block" on page 189 includes a *Line Source Divider* block.

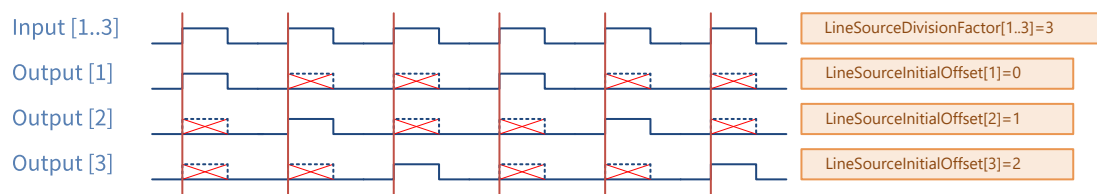
The *Line Source Divider* decimates the incoming pulse train, keeping only 1 pulse every N pulses. N is user-configurable by setting **LineSourceDivisionFactor** to any value in the [1..8] range. The default value is 1 (no decimation).

The decimation happens on the rising edge of the incoming pulse. This is not configurable.

The decimation can be offset by up to 7 pulses by setting **LineSourceInitialOffset** to any value in the [0..7] range. The default value is 0 (no offset).

Typical use case

The *Line Source Divider* of 3 outputs is configured to decimate the same input signal by 3 with respective offsets of 0, 1 and 2.



Decimation by 3 with respective offsets of 0, 1 and 2

GenApi settings example

The pulse train of the **Strobe** signal of Device0 is routed to 3 outputs: TTLIO11, TTLIO12 and TTLIO21 and, then, decimated by 3 with respective offsets of 0, 1 and 2.

```
LineMode[TTLIO11] = Output
LineSource[TTLIO11] = Device0Strobe0
LineSourceDivisionFactor[TTLIO11] = 3
LineSourceInitialOffset[TTLIO11] = 0
```

```
LineMode[TTLIO21] = Output
LineSource[TTLIO21] = Device0Strobe0
LineSourceDivisionFactor[TTLIO21] = 3
LineSourceInitialOffset[TTLIO21] = 2
```

```
LineMode[TTLIO12] = Output
LineSource[TTLIO12] = Device0Strobe0
LineSourceDivisionFactor[TTLIO12] = 3
LineSourceInitialOffset[TTLIO12] = 1
```


9.9. Logical I/O Line State

Logical I/O line state

The (logical) state of an I/O line is the logical state of an electrical signal of the I/O control block:

- For input-capable I/O lines: the *LineInput* signal: a point in the input path of the I/O control block that is located after the Input Inverter.
- For output-only I/O lines: the *LineOutput* signal, a point in the output path of the I/O control block that is located before the Output Inverter.

Getting the state of a single I/O line

1. *Step 1:* Select an I/O line by assigning the appropriate value to the **LineSelector** feature
2. *Step 2:* Obtain directly the line status by getting the value of the **LineStatus** feature

Getting the state of all I/O lines in a single operation

Get the value of the **LineStatusAll** feature.

Each bit of the integer corresponds to an I/O line. A bit at one corresponds to a line logical state being high.

9.10. Physical I/O Line State

The physical state of the I/O line state does not only depend on the value reported when reading LineStatus but also on the following I/O block settings: LineFormat, LineMode, and LineInverter

LineFormat	LineMode	LineInverter/LineStatus	Physical I/O line state
DIFF	Input	False/False or True/True	$(VIN+ - VIN-) < VThreshold$
		False/True or True/False	$(VIN+ - VIN-) > VThreshold$ or unconnected I/O line
ISO	Input	False/False or True/True	Opto coupler is OFF. The line current is < 1 mA. <i>Line may be left unconnected or connected with the wrong polarity.</i>
		False/True or True/False	Opto coupler is ON. The line current is > 1 mA.
ISO	Output	False/False or True/True	Opto coupler is OFF
		False/True or True/False	Opto coupler is ON
TTL	Input	False/False or True/True	The line voltage is < 0.8 Volt.
		False/True or True/False	The line voltage is > 2.0 Volt.
TTL	Output	False/False or True/True	The line is driven LOW.
		False/True or True/False	The line is driven HIGH.
TTL	DriveLow	False/False or True/True	The line is driven LOW.
		False/True or True/False	The line voltage is > 2.0 Volt.
TTL	DriveHigh	False/False or True/True	The line voltage is < 0.8 Volt.
		False/True or True/False	The line is driven HIGH.

9.11. Line Driver Physical Output States

The line driver output state depends not only on the logical level of the selected Line Output signal but also on the following I/O block settings: LineFormat, LineMode, and LineInverter.

LineFormat	LineMode	LineInverter / LineOutput logical level	Line driver output state
ISO	Output	False / low or True / high	The opto-coupler switch is turned OFF.
		False / high or True / low	The opto-coupler switch is turned ON.
TTL CMOS	Output	False / low or True / high	The I/O line is driven LOW.
		False / high or True / low	The I/O line is driven HIGH.
TTL	DriveLow	False / low or True / high	The I/O line is driven LOW.
		False / high or True / low	The I/O line is not driven.
TTL	DriveHigh	False / low or True / high	The I/O line is not driven.
		False / high or True / low	The I/O line is driven HIGH.

9.12. Initial States

At power-on, the I/O lines are in the following state:

Differential Inputs

- LineInverter = **False**,
- LineFilterStrength = **Low**.

TTL Inputs/outputs

- LineMode = **Input** (The line is not driven),
- LineInverter = **False**,
- LineFilterStrength = **Low**.

Isolated Inputs

- LineInverter = **False**,
- LineFilterStrength = **Low**.

Isolated Outputs

- LineInverter = **False**,
- LineFilterStrength = **Low**,
- The opto-coupler is **OFF**.

10. I/O Toolbox

- 10.1. Introducing the I/O Toolbox 202
- 10.2. I/O Toolbox Composition Tables 204
- 10.3. Line Input Tool 207
- 10.4. Quadrature Decoder Tool 208
- 10.5. User Actions Tool 211
- 10.6. C2C-Link Synchronization Tool 216
- 10.7. Delay Tool 218
- 10.8. Divider Tool 220
- 10.9. Multiplier/Divider Tool 221

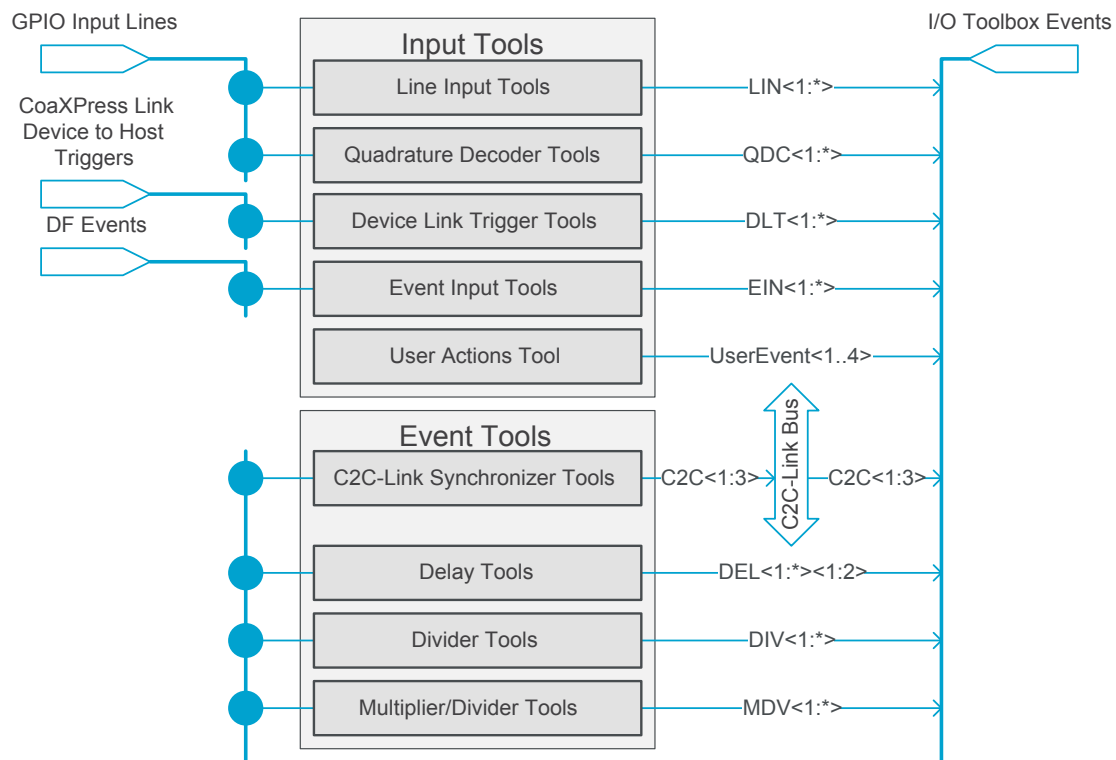
10.1. Introducing the I/O Toolbox

The *I/O Toolbox* is a configurable array of interconnected tools belonging to the GenTL Interface module.

Each tool generates one (or more) event stream. The stream name is composed of a prefix designating the tool (LIN, QDC, DLT...) followed by a 1-based index.

The *I/O Toolbox Events stream* are shared by various consumers on the card:

- The Camera and Illumination controller of any device belonging to the card for camera cycle triggering
- The Acquisition controller of any device belonging to the card for starting or stopping line-scan acquisition sequences
- Event counters



I/O Toolbox structure diagram

I/O Toolbox input tools

The *Input Tools* generate event streams from external sources.

1. The "[Line Input Tool](#)" on [page 207](#) for use with sensors and detectors attached to a single GPIO input line.
2. The "[Quadrature Decoder Tool](#)" on [page 208](#) for use with quadrature motion encoders attached to a pair of GPIO input lines.
3. The [Device Link Trigger Tool](#) for use with triggers issued by CoaXPress 2.0 cameras.
4. The [Event Input Tool](#) for use in line-scan data-forwarding applications.
5. The "[User Actions Tool](#)" on [page 211](#) for use by the application software to generate user events.

A fully populated interconnection matrix allows:

- any *Line Input Tool* to be fed by any GPIO input line.
- any *Quadrature Decoder Tool* to be fed by a selection of GPIO input line pairs.
- any *Device Link Trigger Tool* to be fed by any CoaXPress Link Device to Host Trigger of any camera attached to the card.

I/O Toolbox event tools

The *Event Tools* process internal events generated by any *I/O Toolbox* tool

1. The "[C2C-Link Synchronization Tool](#)" on [page 216](#) delivers one event stream to the C2C-Link Bus driver.
2. The "[Delay Tool](#)" on [page 218](#) delays the events of one (or two) stream(s) by a configurable number of clock tick events.
3. The "[Divider Tool](#)" on [page 220](#) divides the event rate by an integer factor D.
4. The "[Multiplier/Divider Tool](#)" on [page 221](#) converts the event rate by a rational factor M/D.

A fully populated interconnection matrix allows any *Event Tool* to be fed by any *I/O Toolbox* event stream

I/O Toolbox tools cascading

Tools can be cascaded to form a tool chain:

- A tool chain always begins with an Input Tool.
- A tool may drive 0, 1 or several Event Tools.

10.2. I/O Toolbox Composition Tables

Introduction

Each of the following tables show the composition of the I/O toolbox for all variants of the designated product.

Column Name	Description
Input Tools	I/O Toolbox input tools: - #LIN: Number of line input tools - #QDC: Number of quadrature decoder tools - #DLT: Number of device link trigger tools - #EIN: Number of event input tools - #UAS: Number of user actions scheduler tools
Event Tools	I/O Toolbox event tools: - #DEL: Number of delay tools - #DIV: Number of divider tools - #MDV: Number of multiplier/divider tools - #C2C: Number of C2C-Link synchronization tools



NOTE

An empty cell indicates that the corresponding tool type is not available.

PC1628-T Grablink Duo

Firmware Variant	Input tools					Event tools			
	#LIN	#QDC	#DLT	#EIN	#UAS	#DEL	#DIV	#MDV	#C2C
1-camera	8	1			1	2	1	1	2
1-camera, line-scan	8	1			1	2	1	1	3
2-camera	8	2			1	2	2	2	2
2-camera, line-scan	8	2			1	2	2	2	3

PC1633-T Coaxlink Quad G3

Firmware Variant	Input tools					Event tools			
	#LIN	#QDC	#DLT	#EIN	#UAS	#DEL	#DIV	#MDV	#C2C
1-camera	8	1			1	2	1	1	2
1-camera, 4-data-stream	8	1			1	2	1	1	2
1-camera, line-scan	8	1			1	2	1	1	3
1-slm-camera	8	1			1	2	1	1	2
1-sls-camera	8	1			1	2	1	1	3
2-camera	8	2			1	2	2	2	2
2-camera, bayer	8	1			1				
2-camera, line-scan	8	2			1	2	2	2	3
3-camera	8	2			1	2	2	2	2
4-camera	8	4			1	4	4	4	2
4-camera, line-scan	8	4			1	4	4	4	3

PC3602-T Coaxlink Octo

Firmware Variant	Input tools					Event tools			
	#LIN	#QDC	#DLT	#EIN	#UAS	#DEL	#DIV	#MDV	#C2C
1-camera	8	1	2		1	2	1	1	2
1-camera, custom-logic	8	1	2		1	2	1	1	2
1-camera, line-scan	8	1	2		1	2	1	1	3
2-camera	8	1	4		1	2	1	1	2
2-camera, line-scan	8	2	4		2	2	2	2	3
2-camera, line-scan, custom-logic	8	2	4		1	2	2	2	3
3-camera	8	1	6		1	2	1	1	2
4-camera	8	1	8		1	2	1	1	2
4-camera, line-scan	8	4	8		1	4	4	4	3
5-camera	8	1	10		1	2	1	1	2
5-camera, 5D22211	8	1	10		1	2	1	1	2
6-camera	8	1	12		1	2	1	1	2
8-camera	8	1	16		1	2	1	1	2
8-camera, line-scan	8	4	16		1	4	4	4	3

PC3621-LH-T Coaxlink Mono CXP-12-LH

Firmware Variant	Input tools					Event tools			
	#LIN	#QDC	#DLT	#EIN	#UAS	#DEL	#DIV	#MDV	#C2C
1-camera	8	1	2		1	2	1	1	2
1-camera, line-scan	8	1	2		1	2	1	1	3

PC3622-T Coaxlink Duo CXP-12

Firmware Variant	Input tools					Event tools			
	#LIN	#QDC	#DLT	#EIN	#UAS	#DEL	#DIV	#MDV	#C2C
1-camera	8	1	2		1	2	1	1	2
1-camera, line-scan	8	1	2		1	2	1	1	3
2-camera	8	2	4		1	2	2	2	2
2-camera, line-scan	8	2	4		1	2	2	2	3

PC3623-T Coaxlink Quad CXP-12 Value

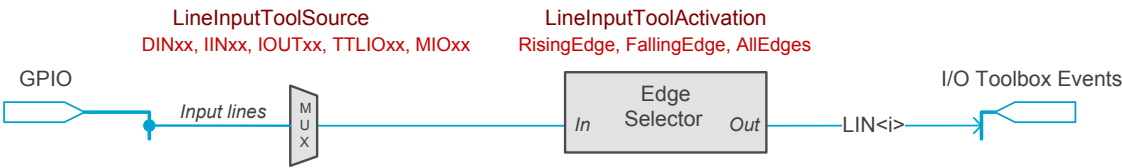
Firmware Variant	Input tools					Event tools			
	#LIN	#QDC	#DLT	#EIN	#UAS	#DEL	#DIV	#MDV	#C2C
1-camera	8	1	2		1	2	1	1	2
1-camera, line-scan	8	1	2		1	2	1	1	3
2-camera	8	2	4		1	2	2	2	2
2-camera, line-scan	8	2	4		1	2	2	2	3
3-camera	8	3	6		1	3	3	3	2
4-camera	8	4	8		1	4	4	4	2
4-camera, line-scan	8	4	8		1	4	4	4	3

10.3. Line Input Tool

Applies to all firmware variants of eGrabber-driven frame grabbers

Tool Name	Short Name	Inputs Count/Type	Outputs Count/Type/Name
Line Input Tool	LIN	1 GPIO input line	1 event stream: LIN<i></i>

Diagram



LIN tool functional and wiring diagram

Any input-capable GPIO line can be selected as the input source.

The tool feeds one I/O Toolbox event stream named LIN<i></i>.

Operation

The Line Input tool detects the rising or the falling edge of the LineInput signal delivered by the I/O Control block selected by LineInputToolSource.

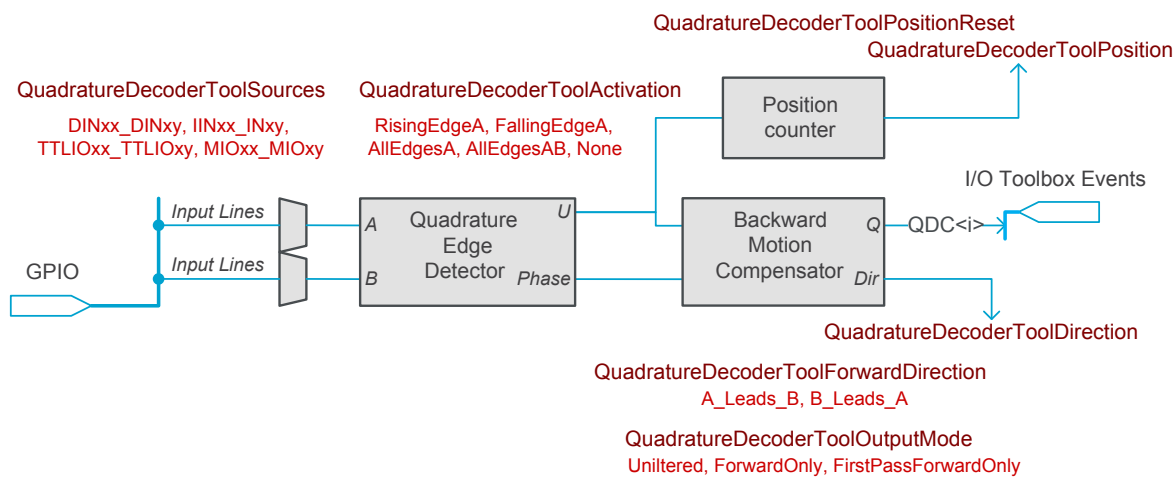
The Line Input tool delivers one event at every rising or falling edge or both according to the LineInputToolActivation settings.

10.4. Quadrature Decoder Tool

Applies to all firmware variants of eGrabber-driven frame grabbers

Tool Name	Short Name	Inputs Count/Type	Outputs Count/Type/Name
Quadrature Decoder Tool	QDC	2 paired I/O input lines	1 event stream: QDC<i> 1 status bit: QDC<i>Direction 1 status word: QDC<i>Position

Diagram



QDC tool functional and wiring diagram

The quadrature edge detector is fed by a pair of signals named A and B delivered by a *phase-quadrature motion encoder* device.

The source selectors allows selected pairs of adjacent input-capable GPIO input lines to be selected as A/B input sources.

See also: "QuadratureDecoderToolSources" on page 1

The tool includes the following function blocks:

- A quadrature edge detector
- A backward motion compensator
- A position counter

The tool delivers:

- One I/O Toolbox event stream named QDC<i>.
- A *direction* status bit indicating the direction of the motion.
- A *position* status word indicating the position offset.

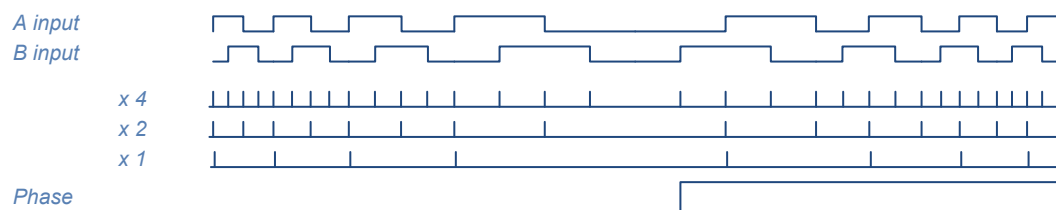
Operation

The Quadrature Decoder Tool decodes the A/B signals and delivers 1, 2, or 4 events every A/B cycle, possibly filtered by the backward motion compensator.

Quadrature edge detector

The *quadrature edge detector* analyzes the transitions on the A/B lines. It delivers:

- An event stream, named U, having 1, 2, or 4 events every A/B cycle according to the **QuadratureDecoderToolActivation** settings
- An identification of the phase between A and B (A leads B or vice-versa)



Quadrature edge detector waveforms

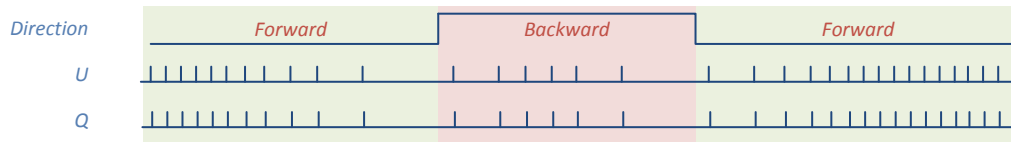
The U stream may be filtered by the backward motion compensator before being delivered to the QDC output.

The phase indication may be inverted according to the **QuadratureDecoderToolForwardDirection** settings before being delivered to the *Direction* output.

Backward motion compensator

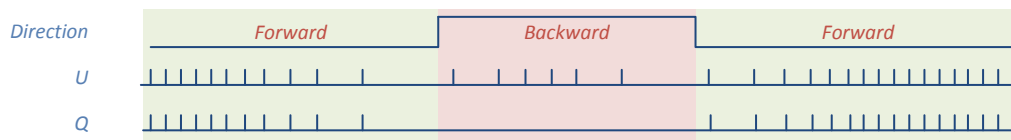
The *backward motion compensator* (BMC) filters the U stream according to the `QuadratureDecoderToolOutputMode` setting.

When set to **Unfiltered**, all the events of the U stream are delivered to the QDC<i> output:



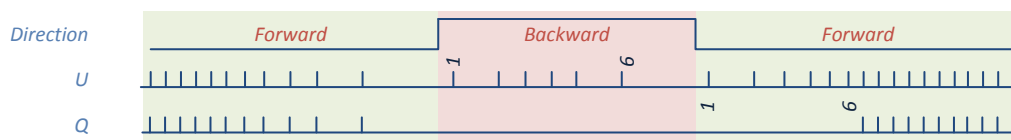
BMC waveforms - Unfiltered

When set to **ForwardOnly**, only the events corresponding to the forward direction are delivered to the QDC<i> output:



BMC waveforms - Forward Only

When set to **FirstPassForwardOnly**, only the events corresponding to the first pass in the forward direction are delivered to the QDC<i> output:



BMC waveforms - First Pass Forward Only

Position Counter

The *position counter* increments by 1 for any U event corresponding to the forward direction and decrements by 1 for the backward direction.

The counter can be reset using the `QuadratureDecoderToolPositionReset` command.

10.5. User Actions Tool

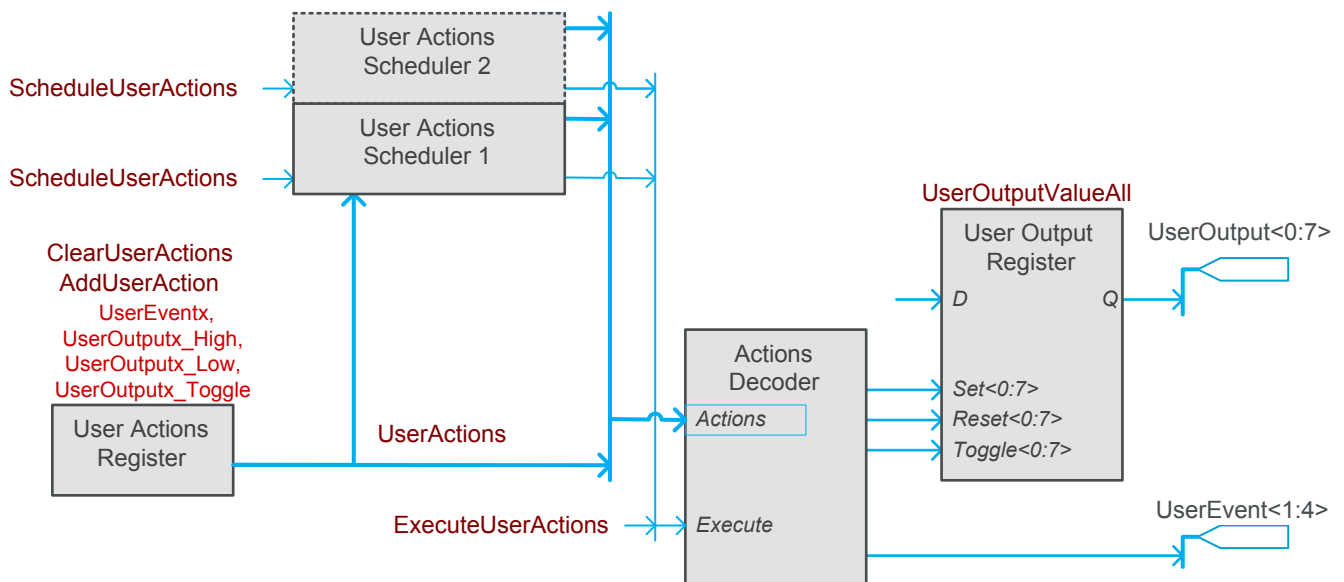
Applies to all firmware variants of **eGrabber-driven frame grabbers**

The *User Actions Tool* allow the application software to perform the following *User Actions*:

- Setting high, setting low or toggling any bit of the [UserOutputRegister](#),
- Generate any one or more [UserEvent](#).

To generate actions, the user application has to proceed in two steps:

1. Define a set of one or more User Actions in the [UserActionsRegister](#).
2. Schedule the execution:
 - a. For an *Immediate* execution, use the [ExecuteUserActions](#) GenApi feature.
 - b. For a *Deferred* execution, use the [ScheduleUserActions](#) GenApi feature of any available [UserActionsScheduler](#).



User Actions Tool functional block diagram

User output register

eGrabber-driven frame grabbers provide an 8-bit¹ *User Output Register* where bits are named UserOutput0 ... UserOutput7.

Any *User Output Register* bit can drive any one or more output-capable GPIO lines.

The user application has two options to define the state of the *User Output Register* bits :

- The User Actions option allows to change the state of each bit individually.
- Setting a value to the **UserOutputValueAll** to define the state of all bits.

Getting the value of **UserOutputValueAll** allows the user application to get the state of all *User Output Register* bits.

User events

eGrabber-driven frame grabbers provide a generator for 4 user-defined events named UserEvent1 ... UserEvent4.

User-defined events can be used by various consumers:

- To trigger a camera cycle using **CycleTriggerSource** feature
- To trigger the start or the end of an acquisition sequence using **StartOfSequenceTriggerSource** and **EndOfSequenceTriggerSource** features
- To trigger the start or the end of a line-scan acquisition using **StartOfScanTriggerSource** and **EndOfScanTriggerSource** features
- As an event source for the Divider, Multiplier/Divider and the Delay tool using **DividerToolSource**, **DelayToolSource<1:2>** and **MultiplierDividerToolSource** features
- As trigger source on the C2C-Link using the **C2CLinkSynchronizationToolSource** feature
- As notification context using **EventNotificationContext<1:3>** features

User actions register

The User Actions Register is a 32-bit register that defines a set of User Actions that will be executed simultaneously.

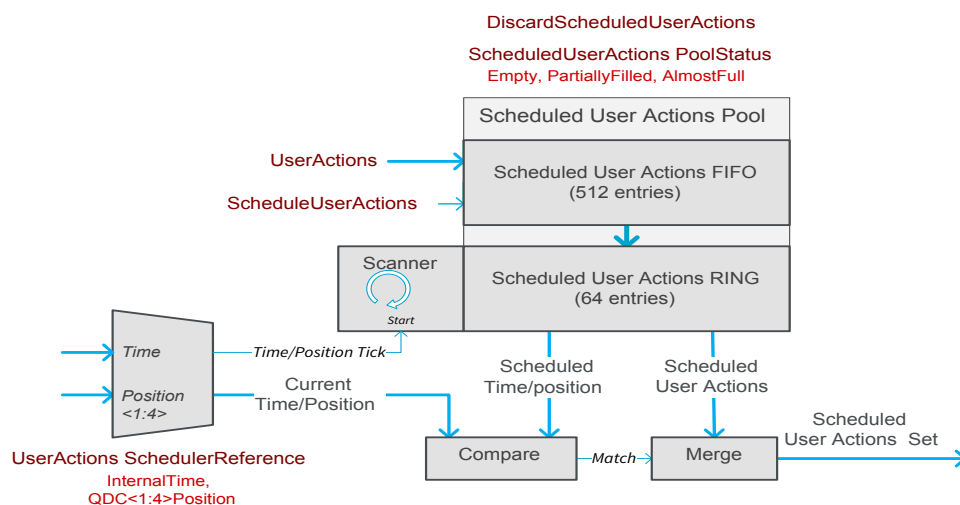
The **ClearUserActions** feature allows to clear the register.

The **AddUserActions** feature allows the application to compose the actions set one by one:

- Assert a user event using the **UserEvent<1:4>** values
- Set any user output bit high using **UserOutput<0:7>_High**
- Set any user output bit low using **UserOutput<0:7>_Low**
- Toggle user output bit high using **UserOutput<0:7>_Toggle**

¹ **PC1630 Coaxlink Mono** implements only the 4 lowest bits!

User actions scheduler



User actions scheduler functional diagram

The *User Actions Scheduler* (UAS) function block allows an application software to postpone the execution of the actions at predefined time or position.

Prior to schedule any user actions, the user application has to setup the UAS:

1. Define the [SchedulerReference](#)
2. Initialize the [ScheduledActionsPool](#)

Scheduler reference

The scheduler reference is a 32-bit value that can be a *time* or a *position*. It is defined by setting **UserActionsSchedulerReference** as follows:

- **InternalTime** selects the *frame grabber local time*: a monotonic time base that increments by 1 every 1 microsecond and wraps around after about 71 minutes when it reaches the maximum value of 4,294,967,295.
- **QDC<1:4>Position** select the *Position Counter* of the Quadrature Decoder tools QDC<1:4> respectively. In that case,



NOTE

For correct operation of the UAS with a position reference:

- The position counter must increment monotonically and not faster than every microsecond.
- To ensure monotonic increments of the QDC position counter:
 - set properly **QuadratureDecoderToolForwardDirection** such that the counter increments when the object moves in the forward direction.
 - If it exists any backward motion, prevent the position counter to decrement by setting the **QuadratureDecoderToolOutputMode** to **ForwardOnly** or to **FirstPassForwardOnly**.

Scheduled user actions pool

The *Scheduled User Actions Pool* is a memory area where the *Scheduled User Actions Sets* are stored by the user application.

The pool is sub-divided into two sections:

1. A 512-locations FIFO
2. A 64-locations RING

FIFO operation

New Scheduled User Actions are first written to the FIFO before being automatically transferred to the RING when it contains at least one free location.

The first (oldest) entry is transferred first. The entries are not reordered!

The **ScheduledUserActionsPoolStatus** reports an **AlmostFull** value when the FIFO is almost full and is unable to accept a new entry.

Adding new Scheduled User Actions

To add a new Scheduled User Actions to the Pool, the user application must:

1. Ensure that there is at least one free location by getting the value of the **ScheduledUserActionsPoolStatus** GenApi feature,
2. Define a User Actions Set,
3. Determines the time/position 32-bit value when the actions are to be executed,
4. Set this value to **ScheduledUserActions** GenApi feature.

Removing Scheduled User Actions

Scheduled User Actions are removed from the pool when they are executed.

The pool can be cleared at any time by executing the **DiscardScheduledUserActions** GenICam command.

NOTE: It is not possible to remove a specific entry!

RING operation

At every increment of the 32-bit (time or position) reference counter, the Scanner reads all the locations and compares the scheduled reference time/position with the current time/position count value.

When the values are identical, the Scheduled User Actions Set is elected for execution at the end of the scan and removed from the pool.

When multiple sets are elected for execution, their actions are merged.



NOTE

Merging a set low and a set high action on the same User Output Register bit results into a toggle action.

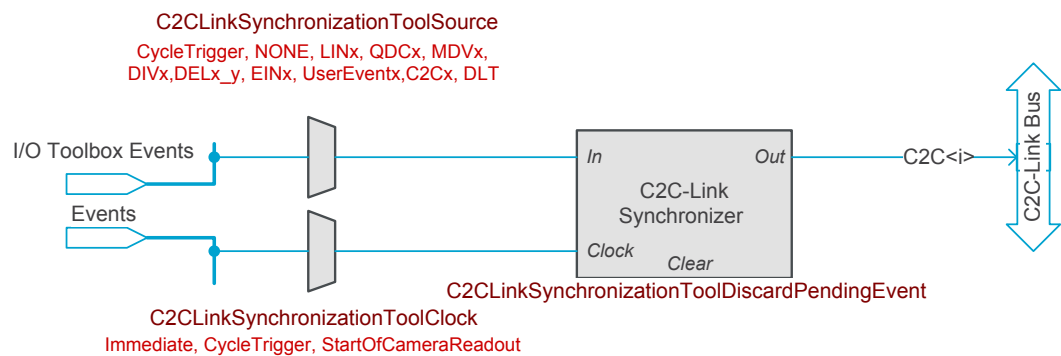
At the end of the scan, the merged elected actions are executed simultaneously. The time delay from the reference tick up to the execution of the elected actions is very small (sub-microsecond) and constant.

10.6. C2C-Link Synchronization Tool

Applies to all firmware variants of eGrabber-driven frame grabbers

Tool Name	Short Name	Inputs Count/Type	Outputs Count/Type/Name
C2C-Link Synchronization Tool	C2C	1 or 2 event streams	1 event stream: C2C<i>

Diagram



C2C tool functional and wiring diagram

The C2C-Link Synchronization tool (C2C) tool delivers one event stream to the C2C-Link Bus driver. It includes the following blocks:

- A source selector
- A clock source selector
- An event synchronizer with clear control

Operation

Source selector

The source selector selects the event stream applied to the tool input (In). It provides following options:

- On C2C1 instance only: `Cycle Trigger` event stream driven by the Camera and Illumination controller.
- On C2C2 and C2C3 instances only: any I/O toolbox event.

Synchronizer control

The clock source selector controls the event stream synchronization:

- When `C2CLinkSynchronizationToolClock` is set to `Immediate`, the event stream applied to the input (In) is sent immediately to the output.
- On C2C2 and C2C3 instances only: when `C2CLinkSynchronizationToolClock` is set to `CycleTrigger`, the event is latched and delayed until the following `Cycle Trigger` event.
- On C2C2 and C2C3 instances only: when `C2CLinkSynchronizationToolClock` is set to `StartOfCameraReadout`, the event is latched and delayed until the following `Start of Camera Readout` event.

The `C2CLinkSynchronizationToolDiscardPendingEvent` command discards an event that has been received but that has not been forwarded.



NOTE

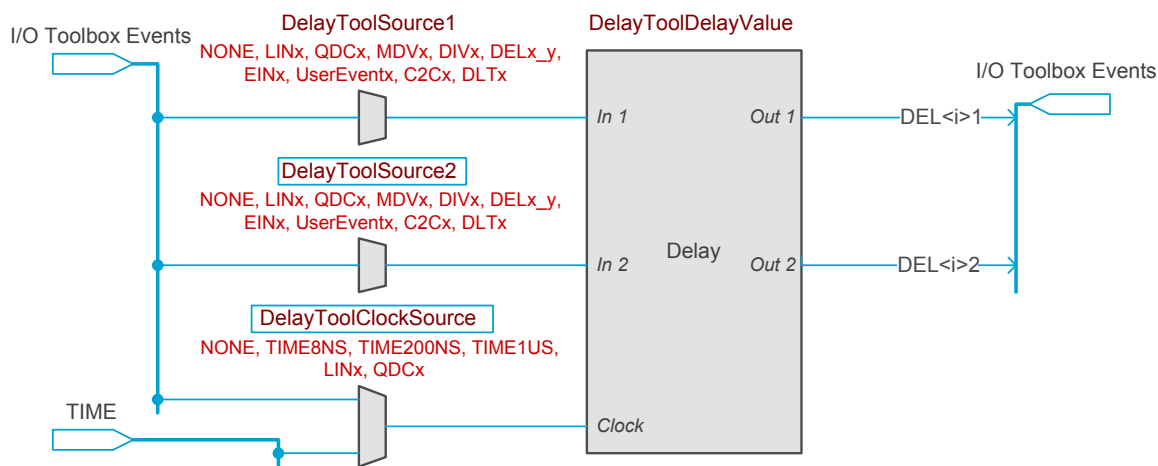
Area-scan firmware variants provide 2 instances of the C2C tool; line-scan firmware variants provide 3 instances!

10.7. Delay Tool

Applies to all firmware variants of eGrabber-driven frame grabbers

Tool Name	Short Name	Inputs Count/Type	Outputs Count/Type/Name
Delay Tool	DEL	2 Toolbox event streams 1 clock signal	2 Toolbox event stream: DEL<i>1, DEL<i>2

Diagram



DEL tool functional and wiring diagram

Any I/O Toolbox event stream can be selected as the input 1 source.
Any I/O Toolbox event stream can be selected as the input 2 source.
The tool feeds two I/O Toolbox event streams. The outputs of the tool instance <i> are named DEL<i>1 and DEL<i>2.

Operation

The event streams applied on either inputs (**In1** and **In2**) are replicated on the corresponding output (**Out1** and **Out2**) after a configurable number of clock tick events.

The sources are selected by **DelayToolSource1** and **DelayToolSource2** respectively.

The same delay applies to both channels. The common delay is defined by **DelayToolDelayValue**.

The same clock source applies to both channels. The clock source is defined by **DelayToolClockSource**. It can be a *time base*, a *Line Tool event stream*, or a *Quadrature Decoder Tool event stream*.

Selecting a *time base* implements a time delay function. The available time bases are:

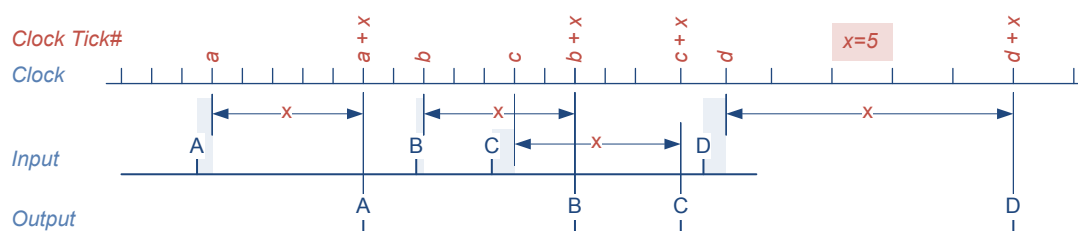
- **8NS**: A 125 MHz high accuracy regular time base allowing delays from *40 nanoseconds* up to *134 milliseconds* by steps of 8 nanoseconds
- **200NS**: A 5 MHz high accuracy regular time base allowing delays from *200 nanoseconds* up to *3.35 seconds* by steps of 200 nanoseconds
- **1US**: A 1 MHz high accuracy regular time base allowing delays from *1 microsecond* up to *16.7 seconds* by steps of 1 microsecond

Selecting a *line tool event stream* implements a position offset function when the line tool is fed by a motion encoder device. Any available Line Input tool or Quadrature Decoder tool can be used as delay clock source. The delay range is *1* up to *16,777,215 events*.



NOTE

The Delay tool operates as a delay line. The tool may accept a new event while the previous one is not yet delivered! The Delay tool is capable of recording, globally for all channels, up to 16 distinct events.



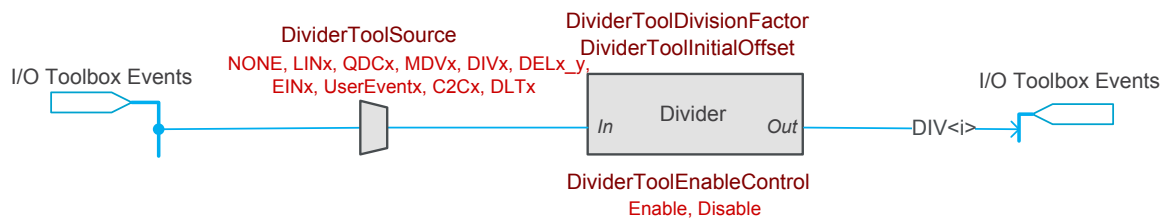
DEL tool waveforms

10.8. Divider Tool

Applies to all firmware variants of eGrabber-driven frame grabbers

Tool Name	Short Name	Inputs Count/Type	Outputs Count/Type/Name
Divider Tool	DIV	1 Toolbox event stream	1 event stream: DIV<i>

Diagram

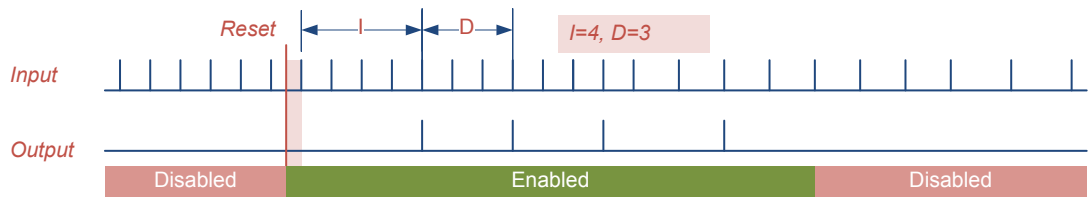


DIV tool functional and wiring diagram

Any I/O Toolbox event stream can be selected as the input source.

The tool feeds one I/O Toolbox event stream named DIV<i>.

Operation



DIV tool waveforms

Once enabled, the Divider tool skips the first – I – input events before delivering an event every D input events.

The division factor – D – is defined by **DividerToolDivisionFactor**. The default value is 2 and the value range is 1 ∙ 65535.

The initial offset – I – is defined by **DividerToolInitialOffset**. The default value is 0 and the value range is 0 ∙ 65535.

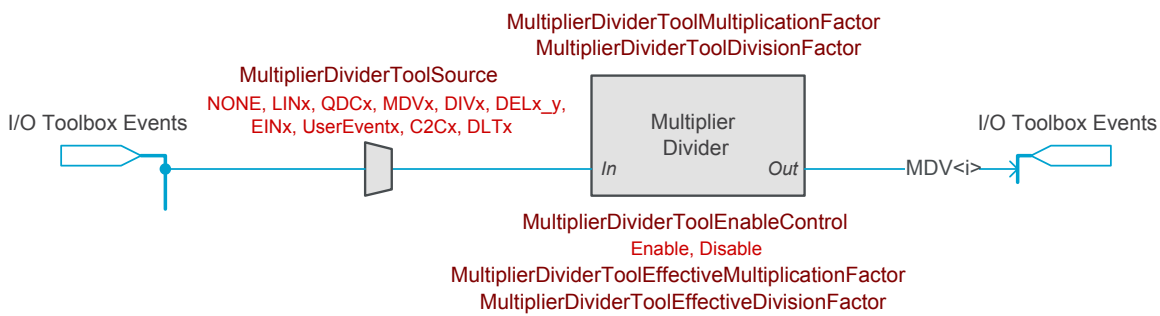
The operation state is defined by **DividerToolEnableControl**. The default value is **Disable**.

10.9. Multiplier/Divider Tool

Applies to all firmware variants of eGrabber-driven frame grabbers

Tool Name	Short Name	Inputs Count/Type	Outputs Count/Type/Name
Multiplier/Divider Tool	MDV	1 Toolbox event stream	1 Toolbox event stream: MDV<i>

Diagram



MDV tool functional and wiring diagram

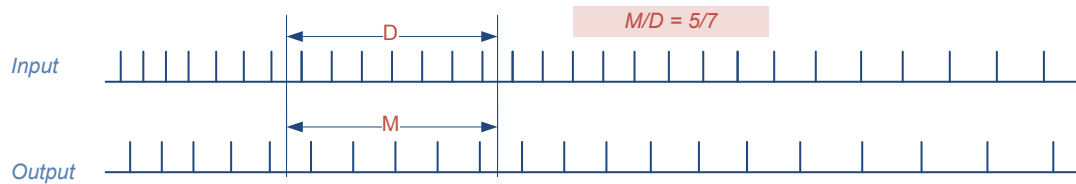
Any I/O Toolbox event stream can be selected as the input source.
The tool feeds one I/O Toolbox event stream named MDV<i>.

Multiplier/Divider Tool Operation

The Multiplier/Divider tool multiplies and/or divides the input rate by any rate conversion ratio – RCR – value in the range 0.001 to 1000.0.

The Multiplier/Divider tool measures the time interval between every consecutive input events and adapts the output rate accordingly.

The Multiplier/Divider is *frequency accurate*. The output frequency is strictly proportional to the input frequency provided that the input frequency is stable (or varies slowly). In such conditions, the Multiplier/Divider delivers M events for every D input events.



MDV tool waveforms

The Rate Conversion Ratio is configured as the ratio of two float numbers:

- The *M* value is defined by `MultiplierDividerToolMultiplicationFactor`. The default value is **1.0** and the value range is **0.001** to **1000.0**.
- The *D* value is defined by `MultiplierDividerToolDivisionFactor`. The default value is **1.0** and the value range is **0.001** to **1000.0**.

The effective multiplication and division factors are respectively reported by `MultiplierDividerToolMultiplicationFactor` and `MultiplierDividerToolDivisionFactor`.



NOTE

The effective values may slightly differ from the specified values. However, the RCR relative error remains negligible (less than 1/1000).

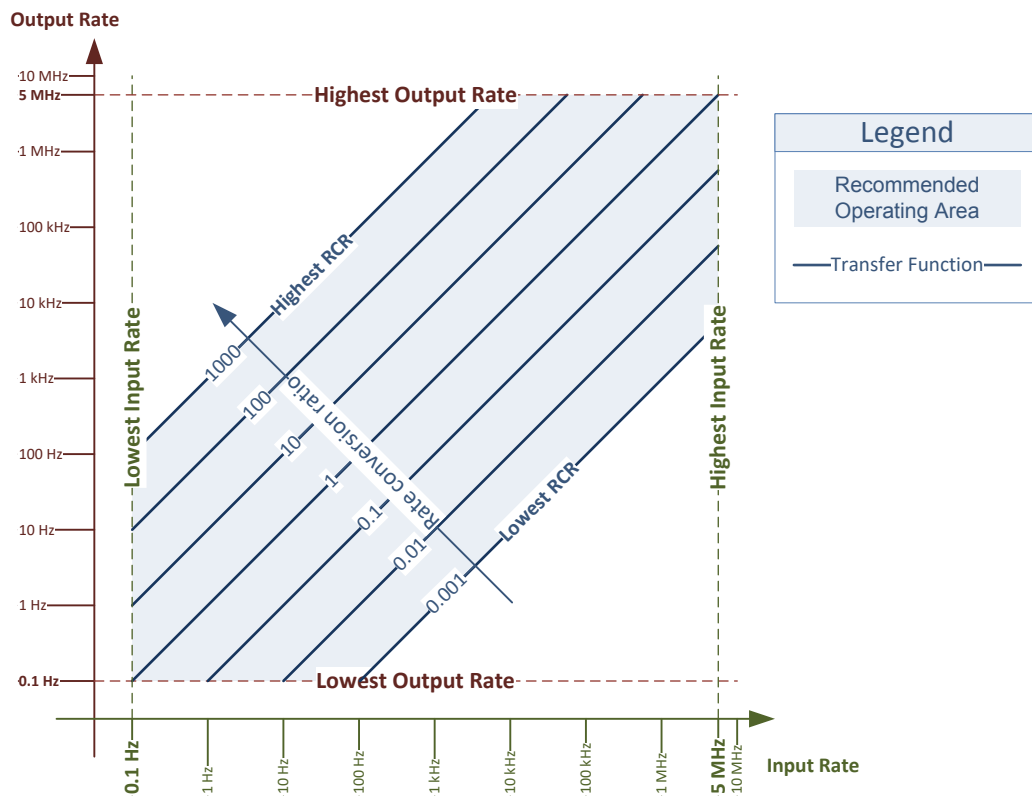


NOTE

Frequency variations of the input event stream are reported to the output event stream with a latency of 1 period of the input event stream. Such a latency induces some phase errors in the output event stream. The accumulated phase error increases when the input frequency increases. It decreases when the input frequency decreases.
The Multiplier/Divider is *not phase accurate*.

Operating Limits

Characteristic	Symbol	Min	Max
Rate Conversion Ratio	RCR	0.001	1000
Input Rate	f_{IN}	0.1 Hz	5 MHz
Output Rate	f_{OUT}	0.1 Hz	5 MHz



MDV tool operating limits diagram

11. Event Signaling And Counting

Extensive user-configurable event-reporting and event-counting mechanism

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11.1. Introduction

Short description

eGrabber-driven frame grabbers feature a powerful event management that allows the application to be notified of the occurrence of various events.

In addition to the GenTL EVENT_NEW_BUFFER and EVENT_REMOTE_DEVICE standard event types, the Coaxlink, Grablink and Gigelink GenTL producers provide a wide set of custom event sources.

The event sources are grouped by types according to the function block and the GenTL module they belong to.

Each custom event source is associated with a counter that counts the number of occurrences.

For each notified custom event, the following event context data is recorded and made available to the application:

- Identifier of the event source
- Time stamp (expressed in microseconds)
- 3 user-defined context data

Each individual event source is configurable:

- The event notification can enabled or disabled.
- The content of each user-defined context data.

Event data are temporarily stored in the Event Queue Buffer. The Coaxlink GenTL producer is notified, using an interruption mechanism, of the availability of one or more event entries in the Event Queue Buffer.

The Coaxlink, Grablink and Gigelink GenTL producers implements the GenTL signaling mechanism for reporting the occurrence of asynchronous events to the application software.

The EGrabber API provides 3 callback threading models:

- *CallbackOnDemand*: This is the simplest model which gives complete control over when and how callbacks are invoked. Events are processed on demand.
- *CallbackSingleThread*: This model delivers events to callbacks in their chronological order, sequentially, in a dedicated thread context. Events are processed automatically as soon as they are available.
- *CallbackMultiThread*: This model delivers events to callbacks in separate threads (one thread per event DATA type). Events are processed automatically as soon as they are available.

Event types

GenTL identifies the events according to their Type and their relevant object Module.

Standard event types

The Coaxlink, Grablink and Gigelink GenTL producers implement the following standard event type for registration by the GenTL Consumer application:

GenTL Standard Event Type	GenTL Module	Description
EVENT_NEW_BUFFER	Data Stream	Notification on newly filled buffers.
EVENT_REMOTE_DEVICE	Device	Notification if the GenTL Producer library wants to manually set a feature in the GenICam GenApi instance using the module.

Custom event types

Beside the *standard event types*, the GenTL specification provides room for *custom event types*. Custom event types are specific to the GenTL Producer implementation.

The Coaxlink GenTL producer implements the following custom event types for registration by the GenTL Consumer application:

Event Type	Module	Description
EVENT_CUSTOM_CIC	Device	Notification of Camera and Illumination Control events
EVENT_CUSTOM_CXP_DEVICE	Device	Notification of CoaXPress device events
EVENT_CUSTOM_CXP_INTERFACE	Interface (Device)	Notification of CoaXPress Host Interface events
EVENT_CUSTOM_DATASTREAM	Data Stream	Notification of CoaXPress data stream events
EVENT_CUSTOM_DEVICE_ERROR	Device	Notification of device error events
EVENT_CUSTOM_IO_TOOLBOX	Interface (Device)	Notification of I/O Toolbox events



NOTE

The [EVENT_CUSTOM_IO_TOOLBOX](#) and the [EVENT_CUSTOM_CXP_INTERFACE](#) event types can also be registered on a Device Module.



NOTE

The custom event types are generic; each one gathers multiple event sources.

See also: "Custom Event Sources" on page 228 for an exhaustive list.

Custom events counter

A 32-bit counter is associated with every custom event source.

The counter cannot be disabled. When it reaches its maximum value, 4 294 967 295 ($2^{32} - 1$), it wraps around to 0.

At any time, the user application can:

- Read the count value of a selected event source.
- Reset the counter of a selected event source.
- Reset the counters of all the event sources of the module.

The count-value can also be used as user-defined context data by any event source.

Custom events configuration

The event source is configurable.

At any time, the user application can:

- Enable or disable the notification of a selected event source.
- Enable or disable the notification of all the event sources of the module.
- Define the content of each user-defined context data of a selected event source.

Notification

By default, all notifications are disabled.

The application software must configure the event notification filter according the application needs.

The configuration of the notification filter configuration can be modified at any time without interfering with the event counting function.

Context data

The last 3 32-bit context data words of the event context data can be configured as follows:

- Event-specific data.
- State of I/O lines sampled at the event occurrence time
- Count value of any event counter.
- Count value of any Quadrature Decoder (QDC) position counter.

Some event sources provide additional options.

See also: "Event Specific Context Data" on page 234

11.2. Custom Event Sources

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EVENT_CUSTOM_CIC

Camera and Illumination Controller custom event sources (Device module)

Coaxlink GenTL Producer

Event Source	Description
_CAMERA_TRIGGER_RISING_EDGE	Rising edge of the Camera Trigger output signal (Start of Exposure in RC and RG camera control methods)
_CAMERA_TRIGGER_FALLING_EDGE	Falling edge of the Camera Trigger output signal (End of Exposure in RG camera control method)
_STROBE_RISING_EDGE	Rising edge of the Strobe output signal
_STROBE_FALLING_EDGE	Falling edge of the Strobe output signal
_ALLOW_NEXT_CYCLE	A new camera cycle is allowed to start immediately.
_DISCARDED_CIC_TRIGGER	A CIC cycle trigger is discarded.
_PENDING_CIC_TRIGGER	A CIC cycle trigger is recorded, but its execution is delayed until CIC is ready.
_CXP_TRIGGER_ACK	A positive acknowledgment is received in response to a CoaXPress Host to Device Trigger Message.
_CXP_TRIGGER_RESEND	A resent of the CoaXPress Host to Device Trigger Message is executed.
_TRIGGER	CIC trigger



NOTE

There is one Camera and Illumination Controller instance per GenTL Device Module. The number of GenTL Device Modules per frame grabber is defined by the firmware-variant.

EVENT_CUSTOM_DATASTREAM

Data Stream custom event sources (Data Stream Module)

Coaxlink and Grablink GenTL Producers

Event Source	Description
_START_OF_CAMERA_READOUT	The first pixel data of an image frame is written into the on-board FIFO Buffer. Applies to area-scan firmware variants only.
_END_OF_CAMERA_READOUT	The last pixel data of an image frame is written into the on-board FIFO Buffer. Applies to area-scan firmware variants only.
_START_OF_SCAN	The first pixel data of an image scan is written into the on-board FIFO Buffer. Applies to line-scan firmware variants only.
_END_OF_SCAN	The last pixel data of an image scan is written into the on-board FIFO Buffer. Applies to line-scan firmware variants only.
_REJECTED_FRAME	An image frame is rejected (On-board FIFO Buffer is full). Applies to area-scan firmware variants only.
_REJECTED_SCAN	An image scan is rejected (On-board FIFO Buffer is full). Applies to line-scan firmware variants only.
_TRIGGER_TO_CAMERA_READOUT_TIMEOUT	Trigger to camera readout timeout.
_CAMERA_READOUT_TIMEOUT	Camera readout timeout.
_BROKEN_FRAME	Broken frame due to frame store overflow. Applies to area-scan firmware variants only.

EVENT_CUSTOM_DEVICE_ERROR

Device Error custom event sources (Device Module)

Coaxlink GenTL Producer

Event Source	Description
_STREAM_PACKET_SIZE_ERROR	Stream packet size error
_STREAM_PACKET_FIFO_OVERFLOW	Stream packet FIFO overflow
_CAMERA_TRIGGER_OVERRUN	New trigger sent to remote device even though readout of previous frame has not started yet
_DID_NOT_RECEIVE_TRIGGER_ACK	Trigger ignored because ACK to previous trigger has not been received yet
_TRIGGER_PACKET_RETRY_ERROR	Trigger packet resend not successful
_INPUT_STREAM_FIFO_HALF_FULL	Input stream FIFO half full
_INPUT_STREAM_FIFO_FULL	Input stream FIFO full
_IMAGE_HEADER_ERROR	Image header error
_MIG_AXI_WRITE_ERROR	MIG AXI write error
_MIG_AXI_READ_ERROR	MIG AXI read error
_PACKET_WITH_UNEXPECTED_TAG	Received a CXP packet with unexpected tag
_FILL_LEVEL_ABOVE_IL_SOS_REJECTED	Start of scan skipped (caused by internal exception: frame store almost full)
_FILL_LEVEL_ABOVE_AF_EARLY_EOS	End of scan (caused by internal exception: frame store almost full)
_EXTERNAL_TRIGGER_REQS_TOO_CLOSE	External trigger requests too close together

EVENT_CUSTOM_IO_TOOLBOX

I/O Toolbox custom event sources (Interface module)

Coaxlink GenTL Producer

Event Source	Description
_LIN1	Line Input Tool 1 – Event output
_LIN2	Line Input Tool 2 – Event output
_LIN3	Line Input Tool 3 – Event output
_LIN4	Line Input Tool 4 – Event output
_LIN5	Line Input Tool 5 – Event output
_LIN6	Line Input Tool 6 – Event output
_LIN7	Line Input Tool 7 – Event output
_LIN8	Line Input Tool 8 – Event output
_QDC1	Quadrature Decoder Tool 1 – Event output
_QDC1_DIR	Quadrature Decoder Tool 1 – Changed direction
_QDC2	Quadrature Decoder Tool 2 – Event output
_QDC2_DIR	Quadrature Decoder Tool 2 – Changed Direction
_QDC3	Quadrature Decoder Tool 3 – Event output
_QDC3_DIR	Quadrature Decoder Tool 3 – Changed direction
_QDC4	Quadrature Decoder Tool 4 – Event output
_QDC4_DIR	Quadrature Decoder Tool 4 – Changed direction
_DIV1	Divider Tool 1 – Event output
_DIV2	Divider Tool 2 – Event output
_DIV3	Divider Tool 3 – Event output
_DIV4	Divider Tool 4 – Event output
_MDV1	Multiplier/Divider Tool 1 – Event output
_MDV2	Multiplier/Divider Tool 2 – Event output
_MDV3	Multiplier/Divider Tool 3 – Event output
_MDV4	Multiplier/Divider Tool 4 – Event output
_DEL1_1	Delay Tool 1 Output 1 – Event output
_DEL1_2	Delay Tool 1 Output 2 – Event output
_DEL2_1	Delay Tool 2 Output 1 – Event output
_DEL2_2	Delay Tool 2 Output 2 – Event output
_DEL3_1	Delay Tool 3 Output 1 – Event output
_DEL3_2	Delay Tool 3 Output 2 – Event output

Event Source	Description
_DEL4_1	Delay Tool 4 Output 1 – Event output
_DEL4_2	Delay Tool 4 Output 2 – Event output
_USER_EVENT_1	User Event 1
_USER_EVENT_2	User Event 2
_USER_EVENT_3	User Event 3
_USER_EVENT_4	User Event 4
_C2C1	C2C Synchronization Tool Output 1 – Event output
_C2C2	C2C Synchronization Tool Output 2 – Event output
_C2C3	C2C Synchronization Tool Output 3 – Event output
_EIN1	Event Input Tool 1 – Event output
_EIN2	Event Input Tool 2 – Event output
_DLT1	Device Link Trigger Tool 1 – Event output
_DLT2	Device Link Trigger Tool 2 – Event output
_DLT3	Device Link Trigger Tool 3 – Event output
_DLT4	Device Link Trigger Tool 4 – Event output
_DLT5	Device Link Trigger Tool 5 – Event output
_DLT6	Device Link Trigger Tool 6 – Event output
_DLT7	Device Link Trigger Tool 7 – Event output
_DLT8	Device Link Trigger Tool 8 – Event output
_DLT9	Device Link Trigger Tool 9 – Event output
_DLT10	Device Link Trigger Tool 10 – Event output
_DLT11	Device Link Trigger Tool 11 – Event output
_DLT12	Device Link Trigger Tool 12 – Event output
_DLT13	Device Link Trigger Tool 13 – Event output
_DLT14	Device Link Trigger Tool 14 – Event output
_DLT15	Device Link Trigger Tool 15 – Event output
_DLT16	Device Link Trigger Tool 16 – Event output



NOTE

Check the "[I/O Toolbox Composition Tables](#)" on [page 204](#) for applicable values

11.3. Event Specific Context Data

EVENT_DATA_NUMID_CIC_DISCARDED_CIC_TRIGGER

Value of *EventSpecific* for EVENT_DATA_NUMID_CIC_DISCARDED_CIC_TRIGGER is a bitfield that can be interpreted according to the following definitions:

Bit#	Description
0	Cause: frame store is full.
1	Cause: camera cycle not complete.
2	Cause: maximum number of pending triggers already reached.
3	Cause: data stream is not active

EVENT_DATA_NUMID_CIC_PENDING_CIC_TRIGGER

Value of *EventSpecific* for EVENT_DATA_NUMID_CIC_PENDING_CIC_TRIGGER is a bitfield that can be interpreted according to the following definitions:

Bit#	Description
0	Cause: frame store is full.
1	Cause: camera cycle not complete

EVENT_DATA_NUMID_DATASTREAM_START_OF_SCAN

Value of *EventSpecific* for EVENT_DATA_NUMID_DATASTREAM_START_OF_SCAN is a bitfield that can be interpreted according to the following definitions:

Bit#	Description
1	Cause: software trigger.
2	Cause: hardware trigger
3	Cause: DSStartAcquisition or end of previous scan

EVENT_DATA_NUMID_DATASTREAM_END_OF_SCAN

Value of *EventSpecific* for EVENT_DATA_NUMID_DATASTREAM_END_OF_SCAN is a bitfield that can be interpreted according to the following definitions:

Bit#	Description
1	Cause: software trigger.
2	Cause: hardware trigger
3	Cause: reached scan length
4	Cause: DSStopAcquisition
5	Cause: internal exception (frame store almost full)

EVENT_DATA_NUMID_DATASTREAM_REJECTED_FRAME

Value of *EventSpecific* for EVENT_DATA_NUMID_DATASTREAM_REJECTED_FRAME is a bitfield that can be interpreted according to the following definitions:

Bit#	Description
0	Cause: frame store is full.
1	Cause: data stream is not active
2	Cause: frame store underwent overflow

EVENT_DATA_NUMID_CXP_DEVICE_LINK_TRIGGER

Value of *EventSpecific* for GenTL::EuresysCustomGenTL::EVENT_DATA_NUMID_CXP_DEVICE_LINK_TRIGGER is a bitfield that can be interpreted according to the following definition:

Bit#	Description
7:0	LinkTriggerN (Word 2 of the CoaXPress 2.0 high speed connection trigger packet)
15:8	Delay (Word 1 of the CoaXPress 2.0 high speed connection trigger packet)
31:16	Reserved



WARNING

Undocumented bits must be ignored.

11.4. About GenTL Signaling

The **eGrabber** driver implements the Signaling mechanism of a GenTL Producer.

This mechanism is briefly described hereafter.

See also: section 4.2 starting on page 34 of the [GenICam GenTL Standard Version 1.4](#) for an extensive description.

Event Registration

Source: GenTL specification

Before the GenTL Consumer can be informed about an event, the event object must be registered. After a module instance has been created in the enumeration process an event object can be created with the `GCRegisterEvent()` function. This function returns a unique `EVENT_HANDLE` which identifies the registered event object. To get information about a registered event the `EventGetInfo()` function can be used.



WARNING

There must be only one event registered per module and event type!

(...)

After an `EVENT_HANDLE` is obtained the GenTL Consumer can wait for the event object to be signaled by calling the `EventGetData()` function. Upon delivery of an event, the event object carries data. This data is copied into a GenTL Consumer provided buffer when the call to `EventGetData()` was successful.

Notification and Data Retrieval

Source: GenTL specification

If the event object is signaled, data was put into the event data queue at some point in time. The `EventGetData()` function can be called to retrieve the actual data.

(...)

When data is read with this function the data is removed from the queue. Afterwards the GenTL Producer implementation checks whether the event data queue is empty or not. If there is more data available the event object stays signaled and next the call to `EventGetData()` will deliver the next queue entry. Otherwise the event object is reset to not signaled state.

(...)

The exact type of data is dependent on the event type and the GenTL Producer implementation. The data is copied into a user buffer allocated by the GenTL Consumer. The content of the event data can be queried with the `EventGetDataInfo()` function. The maximum size of the buffer to be filled is defined by the event type and can be queried using `EVENT_INFO_DATA_SIZE_MAX` after the buffer is delivered. This information can be queried using the `EventGetInfo()` function.

12. Advanced Features

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12.1. C2C-Link

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C2C-Link Interconnections

The C2C-Link is a hardware communication medium allowing a single *C2C-Link master device* to reliably share trigger events with multiple *C2C-Link slave devices*.

In area-scan applications, the C2C-Link Interconnect:

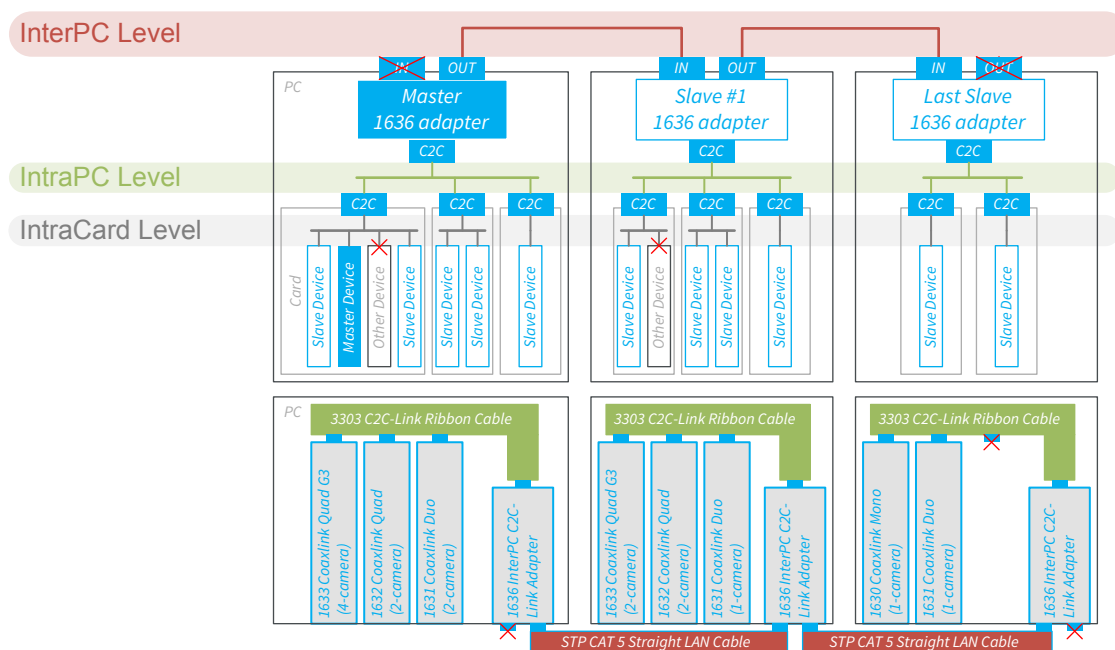
- allows to share up to 2 triggers: a CIC Cycle Trigger (mandatory) and one I/O Toolbox event (optional).
- allows any C2C-Link device to indicate to the C2C-Link master device that it is not able to accept a trigger.

In line-scan applications, the C2C-Link Interconnect allows to share up to 3 triggers: a CIC Cycle Trigger (mandatory) and two I/O Toolbox events (optional).

The C2C-Link is scalable: it may interconnect devices belonging to the same frame grabber, or to different cards in the same PC or to different cards in different PCs.

A C2C-Link interconnection may combine up to three interconnection levels:

- The *IntraCard Level* interconnects 2 or more C2C-Link devices belonging to the same card using FPGA internal resources.
- The *IntraPC Level* interconnects C2C-Link devices across two or more cards of the same PC. It requires one accessory cable such as the **PC3303 C2C-Link Ribbon Cable** or a custom-made C2C-Link cable for each PC.
- The *InterPC Level* interconnects C2C-Link devices across two or more PCs. It requires one **PC1636 InterPC C2C-Link Adapter** for each PC and one RJ 45 CAT 5 STP straight LAN cable for each adapter but the last one.



C2C-Link configuration example using InterPC, IntraPC and IntraCard levels

C2C-Link Electrical Specification

Definitions

Trigger delay

Propagation delay of the trigger signal from the master device to a slave device. This delay is composed of the propagation delay inside electronic devices (FPGA, adapter...) and interconnection cables.

For cables, the delay is proportional to the cable length, typically: 5 ns/m.

Trigger delay skew

Dispersion of the trigger delay values across all the devices belonging to a C2C-Link.

Trigger delay jitter

Variation of the trigger delay depending on external factors such as temperature, signal noise...

Trigger rate

Rate of occurrence of repetitive trigger events. The reciprocal value (1/Trigger rate) is the minimum time interval required between consecutive triggers.

IntraCard C2C-Link Interconnection Level

Parameter	Min.	Typ.	Max.	Units
Trigger delay jitter			5	ns
Trigger rate	0		2.5	MHz

IntraPC C2C-Link Interconnection Level

Parameter	Min.	Typ.	Max.	Units
Cable connectors count (including 1636 adapter if any)	2		8	-
Cable length	-		1.2	m
Trigger delay jitter	5		10	ns
Trigger rate	0		2.5	MHz

InterPC C2C-Link Interconnection Level

The following specification targets applications where the *highest trigger rate* is required:

Parameter	Min.	Typ.	Max.	Units
1636 adapters count	2		10	-
Adapter-to-adapter LAN cable length	0.3		100	m
Cumulated adapter-to-adapter LAN cable length	0.3		100	m
Trigger delay jitter	10	20	40	ns
Trigger rate	0		2.5	MHz

The following specification targets applications where the *longest reachable distance* is required:

Parameter	Min.	Typ.	Max.	Units
1636 adapters count	2		32	-
Adapter-to-adapter cable length	0.3		1200	m
Cumulated adapter-to-adapter cable length	0.3		1200	m
Trigger delay jitter			1	μs
Trigger rate	0		200	kHz



NOTE

The maximum trigger rate specification can be extrapolated for intermediate distances between 100 m and 1200 m assuming that the *length x frequency* product is constant: in this case 250 [m. MHz].

Trigger Propagation Delays

The propagation delay of the Trigger signals from the master device to a slave device can be roughly estimated by adding the typical delays encountered in each segment of the signal path.

Typical Delay values per C2C-Link segment

Delay Element	Min.	Typ.	Max.	Units
(1) IntraPC interconnection (Whole IntraPC C2C-Link interconnect including FPGA I/O and IntraPC cable)	0	5	10	ns
(2) PC1636 InterPC C2C-Link Adapter – IntraPC-to-InterPC delay		15		ns
(3) PC1636 InterPC C2C-Link Adapter – InterPC-to-IntraPC delay		20		ns
(4) PC1636 InterPC C2C-Link Adapter – InterPC-to-InterPC delay		0		ns
(5) InterPC LAN cable		5		ns/m

Example 1 – IntraPC Configuration

For an IntraPC only configuration there is only one delay element to consider: (1)

Parameter	Min.	Typ.	Max.	Units
(1) IntraPC interconnection	0	5	10	ns
Total Trigger Delay	0	5	10	ns

Example 2 – 3-adapter InterPC Configuration; 20 m+20 m LAN cable

This configuration is composed of 3 Intra-PC segments. For devices belonging to the same IntraPC segment as the Master device, there is only one element to consider.

Parameter	Min.	Typ.	Max.	Units
(1) IntraPC interconnection	0	5	10	ns
Total Trigger Delay for devices of the Master InterPC segment	0	5	10	ns

For devices belonging to the same IntraPC segment as the Slave1 adapter, there are 5 delay elements to consider:

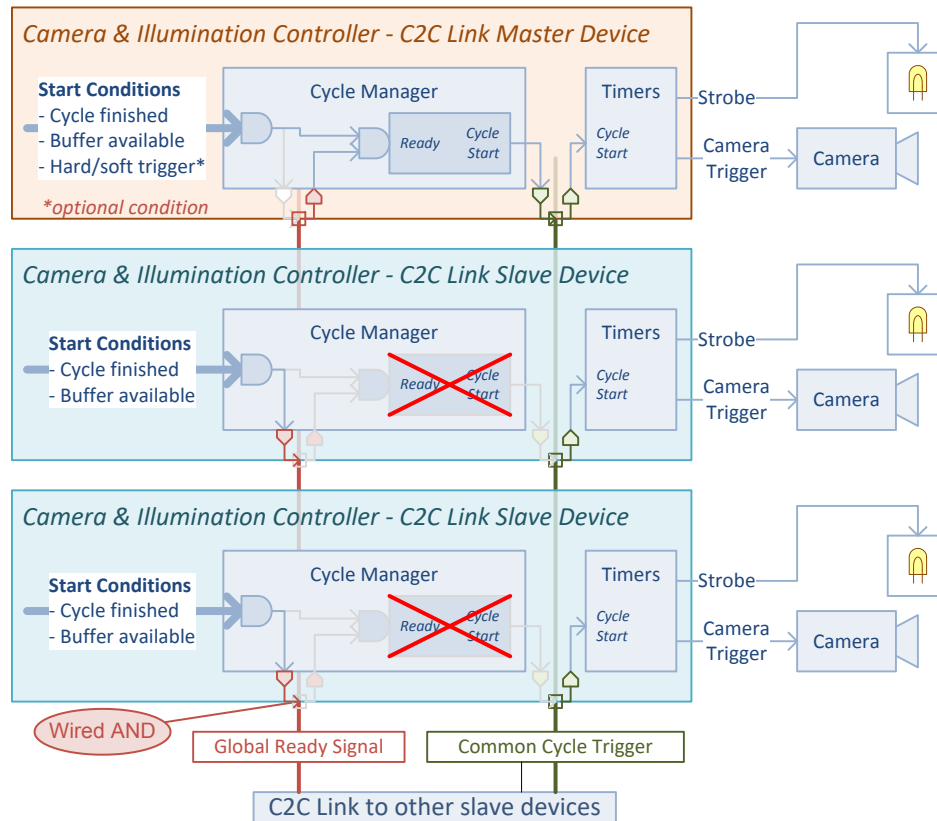
Parameter	Min.	Typ.	Max.	Units
(1) Master IntraPC interconnection	0	5	10	ns
(2) Master PC1636 InterPC C2C-Link Adapter – IntraPC-to-InterPC delay		15		ns
(5) Master to slave1 InterPC LAN cable – 20 m		100		ns
(3) Slave1 PC1636 InterPC C2C-Link Adapter – InterPC-to-IntraPC delay		20		ns
(1) Slave1 IntraPC interconnection	0	5	10	ns
Total Trigger Delay for devices of the Slave1 InterPC segment		145		ns

For devices belonging to the same IntraPC segment as the Slave2 adapter, there are 7 delay elements to consider:

Parameter	Min.	Typ.	Max.	Units
(1) Master IntraPC interconnection	0	5	10	ns
(2) Master PC1636 InterPC C2C-Link Adapter – IntraPC-to-InterPC delay		15		ns
(5) Master to slave1 InterPC LAN cable – 20 m		100		ns
(4) Slave1 PC1636 InterPC C2C-Link Adapter – InterPC-to-InterPC delay		0		ns
(5) Slave1 to slave2 InterPC LAN cable – 20 m		100		ns
(3) Slave2 PC1636 InterPC C2C-Link Adapter – InterPC-to-IntraPC delay		20		ns
(1) Slave2 IntraPC interconnection	0	5	10	ns
Total Trigger Delay for devices of the Slave2 InterPC segment		245		ns

Cycle Trigger Synchronization

Principle



One C2C-Link master and two C2C-Link slave devices (With Global Ready)

Common cycle trigger

The CIC synchronization is achieved by sharing a common **Cycle Trigger** event between all involved CIC 's using the C2C-Link interconnections. The C2C-Link interconnects two or more devices. One device is named **C2C-Link Master Device**, the others are named **C2C-Link Slave Device**.

The **Cycle Trigger** is generated by the Cycle Manager of the "C2C-Link Master Device" and broadcasted on the C2C-Link via the "**C2C-Link Synchronization Tool**" on page 216 of the I/O toolbox. All the participating C2C-Link devices (1 Master and one or more slaves) uses the shared C2C1 event stream as event source for the camera cycle trigger.

The CIC Cycles of all participating devices start simultaneously. However, the Cycle Timing parameters (exposure time, strobe pulse width and strobe delay) can be configured individually.

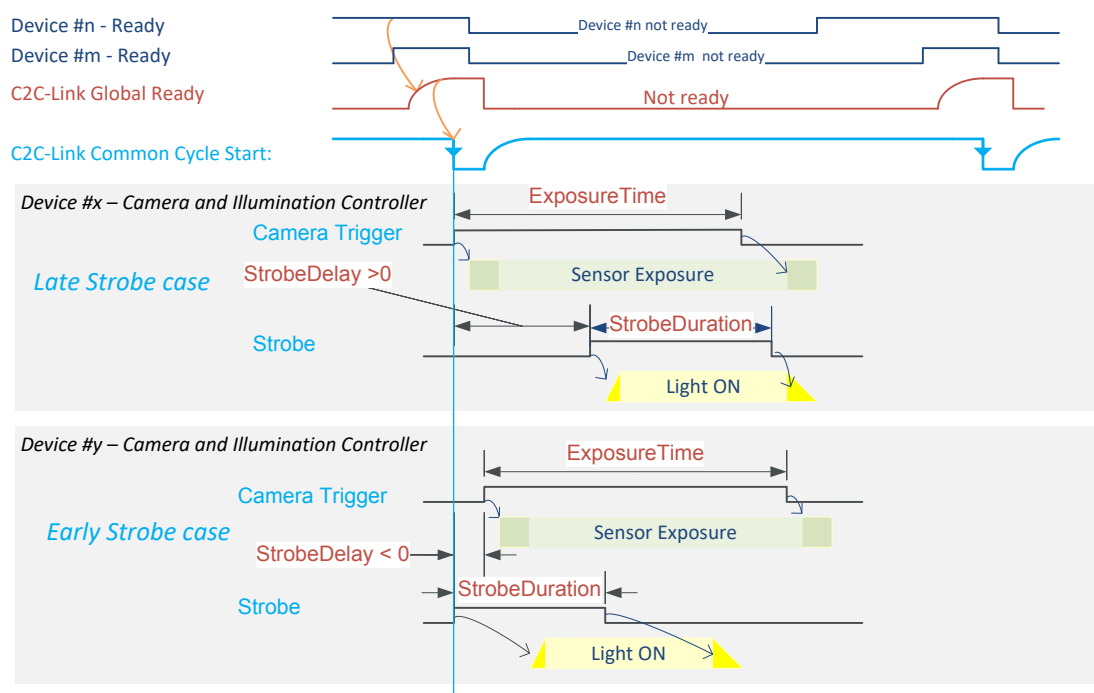
Global Ready signal

Global Ready applies only to area-scan firmware variants!

The Global Ready signal is elaborated by all C2C-Link slaves using a wired AND connection logic. A C2C-Link Slave forces the Global Ready signal to 'false' until its start conditions are all satisfied.

The C2C-Link Master device further delays the assertion a Cycle Trigger event while the Global Ready signal is false.

Timing Diagram



CIC Synchronization through C2C-Link timing diagram (With Global Ready)

The above diagram shows the timing diagram of two consecutive common CycleTrigger events with Global Ready :

The C2C-Link Global Ready signal is held low until the Ready of all participating devices is true preventing the C2C-Link Master to issue a start event. When released by all participating devices, it ramps up rapidly with a rise time of maximum 100 ns.

As soon as the C2C-Link Global Ready signal is confirmed to be high, the master device asserts an abrupt going low transition on the Common Cycle Start signal; this edge is propagated to all the Start inputs of the timers of all participating devices.

As soon as the cycle has started, every CIC forces the ready low as long as all the local conditions to initiate the next cycle are not satisfied.

The timers of each device issue a **Camera Trigger** and a **Strobe**, with their respective delay and duration settings. Usually, the settings are identical for all participating devices; but the application is allowed to apply different ones, if needed.

The shortest **Cycle Start** period allowed by the C2C-Link is 400 ns; allowing a theoretical frequency limit of 2.5 MHz.

C2C-Link Setup Procedure

Hardware setup

This step is specific to each C2C-Link Configuration:

IntraCard C2C-Link configuration

This configuration exclusively uses FPGA internal resources to build the C2C-Link interconnect; it doesn't require any additional hardware!

IntraPC C2C-Link configuration

This configuration requires one accessory cable such as the **PC3303 C2C-Link Ribbon Cable** or a custom-made C2C-Link cable for each PC.

Insert a C2C-Link female connector of the C2C-Link cable into the C2C-Link pin header connector of each participating frame grabber.

InterPC C2C-Link configuration

This configuration requires one **PC1636 InterPC C2C-Link Adapter** for each PC and one RJ 45 CAT 5 STP straight LAN cable for each adapter but the last one.

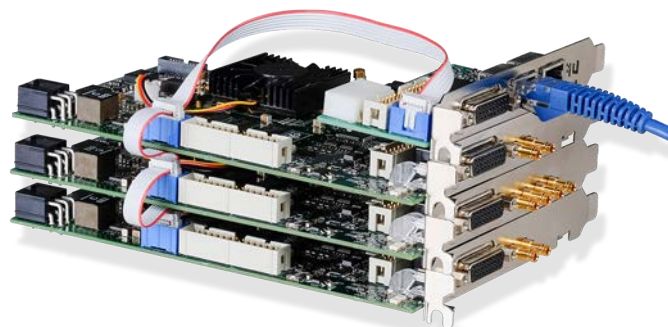
In each participating PC:

1. Install **PC1636 InterPC C2C-Link Adapter** into a free slot and secure the bracket.
2. Connect the adapter to a power source.

See also: "Adapter Powering" topic in the 1636 section of the hardware manual.

3. Using one **PC3303 C2C-Link Ribbon Cable**, bind together the C2C-Link connectors of all the participating cards together with the C2C-Link of the adapter card.
4. Using LAN Cables, interconnect the adapters.

See also: "InterPC Interconnect" topic in the 1636 section of the hardware manual.



IntraPC segment of an InterPC configuration

GenApi setup

Master C2C-Link device

- Assign value **Master** to **C2CLinkConfiguration** of the GenTL Device module
- Configure the I/O Toolbox C2C1 tool of the GenTL Interface module to share Cycle Trigger:
 - Assign value **CycleTrigger** to **C2CLinkSynchronizationToolSource**
 - Assign value **Immediate** to **C2CLinkSynchronizationToolClock**
- Optional, configure the I/O Toolbox C2C2 and C2C3 tools of the GenTL Interface module according to the application requirements

Slave C2C-Link devices

Assign value **Slave** to **C2CLinkConfiguration** of the GenTL Device module

12.2. OEM Safety Key

Introducing OEM Safety Key	250
Using OEMSafetyKey	251

Introducing OEM Safety Key

The OEM Safety Key capability allows the application to:

- Program an "OEM safety key" in the non-volatile memory of the frame grabber.
- Retrieve the encrypted version of the OEM safety key just programmed.
- Check a key against the programmed OEM safety key or its encrypted version.

OEM Safety Key

The OEM Safety Key is an application-defined string of characters. Any character except the null character is allowed. The string length is unlimited.

Key Programming

When the application sets the **ProgramOemSafetyKey** GenApi feature with the OEM Safety Key value, the **eGrabber** driver computes an encrypted version of the OEM Safety Key and stores it in the non-volatile memory of the frame grabber.

The encrypted value can be retrieved by getting the value of **EncryptedOemSafetyKey** immediately after having set **ProgramOemSafetyKey**.



WARNING

Only the same application process having set **ProgramOemSafetyKey** is allowed to retrieve the encrypted value. This is only allowed until any other GenApi feature is set.

Key Checking

The application has to select one **OemSafetyKeyVerification** value of the

In order to verify the OEM Safety Key of a frame grabber, the application sets a "challenge" value to the **CheckOemSafetyKey[selector]** feature.

When the [selector] argument is set to **EncryptedKey**, the set action terminates normally only when the challenge string is identical to the encrypted OEM Safety Key string.

When the [selector] argument is set to **ProgrammingKey**, the set action terminates normally only when the challenge string is identical to the programming OEM Safety Key string.

When the [selector] argument is set to **ProgrammingKeyOrEncryptedKey**, or omitted, the set action terminates normally only when the challenge string is identical to the original OEM Safety Key string or to the encrypted OEM Safety Key string.

AV recommends using the **EncryptedKey** selector. This improves the security level since the programming key doesn't need to appear anywhere in the end user application. Having only the encrypted key, the end user cannot retrieve the original programming key.

Using OEMSafetyKey

Programming Step – Option A

Using **GenICam Browser (Deprecated)**:

- Go to the GenApi tab of the interface module.
- Write a secret key to **ProgramOemSafetyKey**
- Copy the value of **EncryptedOemSafetyKey** and paste it somewhere appropriate.



NOTE

There is a direct relationship between the *programming key* and the *encrypted key*. A given *programming key* will always lead to the same *encrypted key*, even on different computers or with different frame grabbers. This makes it possible to read the *encrypted key* once and hard-code this value in the application that must be protected by the OEM safety key.

Programming Step – Option B

Using a custom application:

1. Program the OEM safety key of the frame grabber by writing a secret key to **ProgramOemSafetyKey**.
2. Read back the encrypted key by reading **EncryptedOemSafetyKey**. Write this value somewhere appropriate.

```
grabber.set<InterfacePort>("ProgramOemSafetyKey", "plain-text key"); // 1  
std::string encryptedKey = grabber.get<InterfacePort>("EncryptedOemSafetyKey"); // 2
```

Verification Step

In the application that must be protected by the OEM key:

```
InterfacePort>("CheckOemSafetyKey[EncryptedKey]", "encrypted key retrieved in the programming step");
```



NOTE

Even if the *encrypted key* is discovered and an attacker uses it to reprogram cards, the above verification will fail.

PART II

HARDWARE MANUAL

1. Mechanical Specification

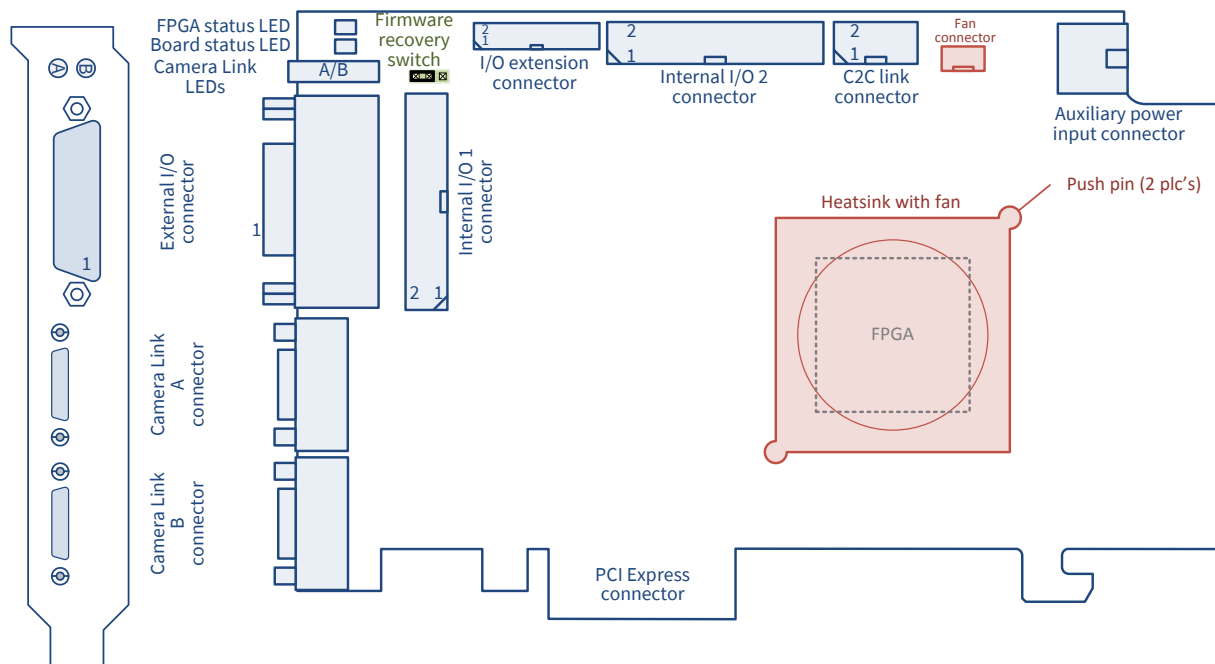
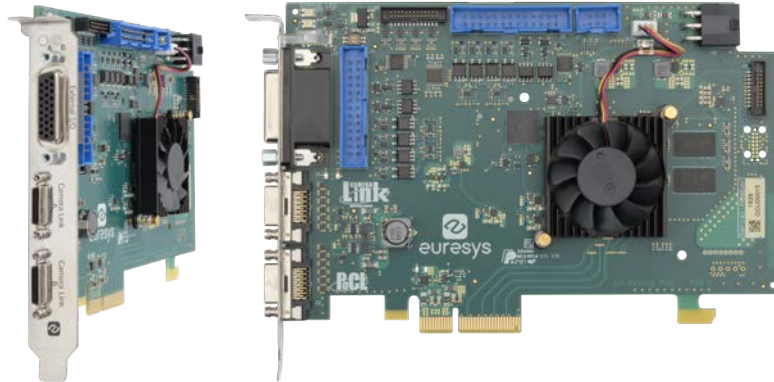
Mechanical specifications of the product(s) including: product pictures, physical dimensions, connectors description and pin assignments, LEDs description, switches description, etc.

- 1.1. Product Layouts 254
- 1.2. Camera and Data Output Connectors 257
- 1.3. GPIO Connectors 263
- 1.4. Other Connectors 280
- 1.5. LEDs and Switches 285

1.1. Product Layouts

PC1628 Grablink Duo 255

PC1628 Grablink Duo



Connectors

- "Auxiliary Power Input Connector for PoCL and I/O" on page 284
- "C2C-Link Connector" on page 283
- "Camera Link A Connector" on page 258
- "Camera Link B Connector" on page 260
- "External I/O Connector" on page 264
- "I/O Extension Connector" on page 281
- "Internal I/O 1 Connector" on page 272
- "Internal I/O 2 Connector" on page 274

Lamps and switches

- Camera Link LED lamps
- "Board Status LED" on page 286
- "FPGA Status LED" on page 287
- "Firmware Recovery Switch" on page 288

Printed circuit board dimensions and assembly weight

Product	Length	Width	Weight
PC1628 Grablink Duo	167.65 mm	111.15 mm	150 g
	6.6 in	4.38 in	5,29 oz

1.2. Camera and Data Output Connectors

Camera Link A Connector 258

Camera Link B Connector 260

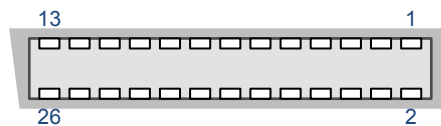
Camera Link A Connector

Applies to **PC1628-T Grablink Duo**.

Duo

Connector description

Property	Value
Name, Label	A
Type	26-position Shrunk Delta Ribbon (SDR) socket with M2 jack socket screws
Location	Card bracket
Usage	Camera Link camera A input, PoCL output



Pin assignments

Base configuration

Pin	Signal	Usage
1	PoCL	PoCL +12 V Power output
2	CC4-	Camera Control 4 - Negative pole
3	CC3+	Camera Control 3 - Positive pole
4	CC2-	Camera Control 2 - Negative pole
5	CC1+	Camera Control 1 - Positive pole
6	SERTFG+	Serial COM to Frame Grabber - Positive pole
7	SERTC-	Serial COM to Camera - Negative pole
8	X3+	Channel Link X - Pair 3 - Positive pole
9	XCLK+	Channel Link X - Clock - Positive pole
10	X2+	Channel Link X - Pair 2 - Positive pole
11	X1+	Channel Link X - Pair 1 - Positive pole
12	X0+	Channel Link X - Pair 0 - Positive pole
13	GND	Ground
14	GND	Ground
15	CC4+	Camera Control 4 - Positive pole

Pin	Signal	Usage
16	CC3-	Camera Control 3 - Negative pole
17	CC2+	Camera Control 2 - Positive pole
18	CC1-	Camera Control 1 - Negative pole
19	SERTFG-	Serial COM to Frame Grabber - Negative pole
20	SERTC+	Serial COM to Camera - Positive pole
21	X3-	Channel Link X - Pair 3 - Negative pole
22	XCLK-	Channel Link X - Clock - Negative pole
23	X2-	Channel Link X - Pair 2 - Negative pole
24	X1-	Channel Link X - Pair 1 - Negative pole
25	X0-	Channel Link X - Pair 0 - Negative pole
26	PoCL	PoCL +12 V Power output

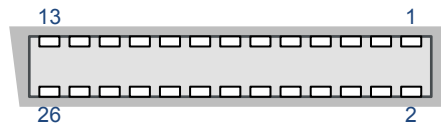
Camera Link B Connector

Applies to **PC1628-T Grablink Duo**.

Duo

Connector description

Property	Value
Name, Label	B
Type	26-position Shrunk Delta Ribbon (SDR) socket with M2 jack socket screws
Location	Card bracket
Usage	Camera Link camera B input or camera A second cable input, PoCL output



Pin assignments

Base configuration

Pin	Signal	Usage
1	PoCL	PoCL +12 V Power output
2	CC4-	Camera Control 4 - Negative pole
3	CC3+	Camera Control 3 - Positive pole
4	CC2-	Camera Control 2 - Negative pole
5	CC1+	Camera Control 1 - Positive pole
6	SERTFG+	Serial COM to Frame Grabber - Positive pole
7	SERTC-	Serial COM to Camera - Negative pole
8	X3+	Channel Link X - Pair 3 - Positive pole
9	XCLK+	Channel Link X - Clock - Positive pole
10	X2+	Channel Link X - Pair 2 - Positive pole
11	X1+	Channel Link X - Pair 1 - Positive pole
12	X0+	Channel Link X - Pair 0 - Positive pole
13	GND	Ground
14	GND	Ground
15	CC4+	Camera Control 4 - Positive pole

Pin	Signal	Usage
16	CC3-	Camera Control 3 - Negative pole
17	CC2+	Camera Control 2 - Positive pole
18	CC1-	Camera Control 1 - Negative pole
19	SERTFG-	Serial COM to Frame Grabber - Negative pole
20	SERTC+	Serial COM to Camera - Positive pole
21	X3-	Channel Link X - Pair 3 - Negative pole
22	XCLK-	Channel Link X - Clock - Negative pole
23	X2-	Channel Link X - Pair 2 - Negative pole
24	X1-	Channel Link X - Pair 1 - Negative pole
25	X0-	Channel Link X - Pair 0 - Negative pole
26	PoCL	PoCL +12 V Power output

Medium/72-bit/Full/80-bit configuration

Pin	Signal	Usage
1	PoCL	PoCL +12 V Power output
2	Z3+	Channel Link Z - Pair 3 - Positive pole
3	ZCLK+	Channel Link Z - Clock - Positive pole
4	Z2+	Channel Link Z - Pair 2 - Positive pole
5	Z1+	Channel Link Z - Pair 1 - Positive pole
6	Z0+	Channel Link Z - Pair 0 - Positive pole
7	TERM-	Unused but terminated pair
8	Y3+	Channel Link Y - Pair 3 - Positive pole
9	YCLK+	Channel Link Y - Clock - Positive pole
10	Y2+	Channel Link Y - Pair 2 - Positive pole
11	Y1+	Channel Link Y - Pair 1 - Positive pole
12	Y0+	Channel Link Y - Pair 0 - Positive pole
13	GND	Ground
14	GND	Ground
15	Z3-	Channel Link Z - Pair 3 - Negative pole
16	ZCLK-	Channel Link Z - Clock - Negative pole
17	Z2-	Channel Link Z - Pair 2 - Negative pole
18	Z1-	Channel Link Z - Pair 1 - Negative pole
19	Z0-	Channel Link Z - Pair 0 - Negative pole
20	TERM+	Unused but terminated pair
21	Y3-	Channel Link Y - Pair 3 - Negative pole
22	YCLK-	Channel Link Y - Clock - Negative pole
23	Y2-	Channel Link Y - Pair 2 - Negative pole

Pin	Signal	Usage
24	Y1-	Channel Link Y - Pair 1 - Negative pole
25	Y0-	Channel Link Y - Pair 0 - Negative pole
26	PoCL	PoCL +12 V Power output

1.3. GPIO Connectors

External I/O Connector	264
External I/O Connector for PC1625	266
External I/O Connector for PC3304	268
External I/O Connector for PC3610/PC3612	270
Internal I/O 1 Connector	272
Internal I/O 2 Connector	274
Internal I/O Connector for PC3610/PC3612	276
Internal I/O 2 Connector for PC3614/PC3618	278

External I/O Connector

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3 and PC3623-T Coaxlink Quad CXP-12 Value.



Connector description

Property	Value
Name, Label	External I/O
Type	26-pin 3-row high-density D-Sub female socket with UNC4-40 jack socket screws
Location	Card bracket
Usage	I/O lines and I/O power output



Pin assignments

Standard I/O set #1

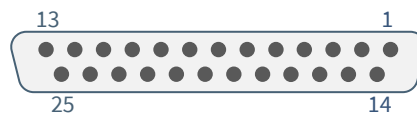
Pin	Signal	Usage
1	GND	Ground
2	DIN12+	High-speed differential input #12 – Positive pole
3	IIN11+	Isolated input #11 – Positive pole
4	IIN13-	Isolated input #13 – Negative pole
5	IIN14-	Isolated input #14 – Negative pole
6	IOUT12-	Isolated contact output #12 – Negative pole
7	GND	Ground
8		Not connected
9	GND	Ground
10	GND	Ground
11	DIN12-	High-speed differential input #12 – Negative pole
12	IIN11-	Isolated input #11 – Negative pole
13	IIN12+	Isolated input #12 – Positive pole
14	IIN13+	Isolated input #13 – Positive pole
15	IIN14+	Isolated input #14 – Positive pole
16	IOUT12+	Isolated contact output #12 – Positive pole

Pin	Signal	Usage
17	TTLIO12	TTL input/output #12
18	GND	Ground
19	DIN11-	High-speed differential input #11 – Negative pole
20	DIN11+	High-speed differential input #11 – Positive pole
21	IIN12-	Isolated input #12 – Negative pole
22	IOUT11-	Isolated contact output #11 – Negative pole
23	IOUT11+	Isolated contact output #11 – Positive pole
24	GND	Ground
25	TTLIO11	TTL input/output #11
26	+12V	+12 V Power output

External I/O Connector for PC1625

Connector description

Property	Value
Name, Label	External I/O
Type	25-pin 2-row D-Sub female socket with UNC4-40 jack socket screws
Location	Card bracket
Usage	I/O lines and I/O power output



Pin assignments

Standard I/O set #1

Pin	Signal	Usage
1	GND	Ground
2	DIN11+	High-speed differential input #11 – Positive pole
3	DIN11-	High-speed differential input #11 – Negative pole
4	DIN12+	High-speed differential input #12 – Positive pole
5	DIN12-	High-speed differential input #12 – Negative pole
6	IIN11+	Isolated input #11 – Positive pole
7	IIN11-	Isolated input #11 – Negative pole
8	IIN12+	Isolated input #12 – Positive pole
9	IIN12-	Isolated input #12 – Negative pole
10	IIN13+	Isolated input #13 – Positive pole
11	IIN13-	Isolated input #13 – Negative pole
12	IIN14+	Isolated input #14 – Positive pole
13	IIN14-	Isolated input #14 – Negative pole
14	IOUT11+	Isolated contact output #11 – Positive pole
15	IOUT11-	Isolated contact output #11 – Negative pole
16	IOUT12+	Isolated contact output #12 – Positive pole
17	IOUT12-	Isolated contact output #12 – Negative pole

Pin	Signal	Usage
18	TTLIO11	TTL input/output #11
19	GND	Ground
20	TTLIO12	TTL input/output #12
21	GND	Ground
22		Not connected
23	GND	Ground
24	+12V	+12 V Power output
25	+12V_RTN	Ground

Standard I/O set #2

Pin	Signal	Usage
1	GND	Ground
2	DIN21+	High-speed differential input #21 – Positive pole
3	DIN21-	High-speed differential input #21 – Negative pole
4	DIN22+	High-speed differential input #22 – Positive pole
5	DIN22-	High-speed differential input #22 – Negative pole
6	IIN21+	Isolated input #21 – Positive pole
7	IIN21-	Isolated input #21 – Negative pole
8	IIN22+	Isolated input #22 – Positive pole
9	IIN22-	Isolated input #22 – Negative pole
10	IIN23+	Isolated input #23 – Positive pole
11	IIN23-	Isolated input #23 – Negative pole
12	IIN24+	Isolated input #24 – Positive pole
13	IIN24-	Isolated input #24 – Negative pole
14	IOUT21+	Isolated contact output #21 – Positive pole
15	IOUT21-	Isolated contact output #21 – Negative pole
16	IOUT22+	Isolated contact output #22 – Positive pole
17	IOUT22-	Isolated contact output #22 – Negative pole
18	TTLIO21	TTL input/output #21
19	GND	Ground
20	TTLIO22	TTL input/output #22
21	GND	Ground
22		Not connected
23	GND	Ground
24	+12V	+12 V Power output
25	+12V_RTN	Ground

External I/O Connector for PC3304

Connector description

Property	Value
Name, Label	External I/O
Type	26-pin 3-row high-density D-Sub female socket with UNC4-40 jack socket screws
Location	Card bracket
Usage	I/O lines and I/O power output



Pin assignments

Standard I/O set #1

Pin	Signal	Usage
1	GND	Ground
2	DIN12+	High-speed differential input #12 – Positive pole
3	IIN11+	Isolated input #11 – Positive pole
4	IIN13-	Isolated input #13 – Negative pole
5	IIN14-	Isolated input #14 – Negative pole
6	IOOUT12-	Isolated contact output #12 – Negative pole
7	GND	Ground
8		Not connected
9	GND	Ground
10	GND	Ground
11	DIN12-	High-speed differential input #12 – Negative pole
12	IIN11-	Isolated input #11 – Negative pole
13	IIN12+	Isolated input #12 – Positive pole
14	IIN13+	Isolated input #13 – Positive pole
15	IIN14+	Isolated input #14 – Positive pole
16	IOOUT12+	Isolated contact output #12 – Positive pole
17	TTLIO12	TTL input/output #12
18	GND	Ground

Pin	Signal	Usage
19	DIN11-	High-speed differential input #11 – Negative pole
20	DIN11+	High-speed differential input #11 – Positive pole
21	IIN12-	Isolated input #12 – Negative pole
22	IOUT11-	Isolated contact output #11 – Negative pole
23	IOUT11+	Isolated contact output #11 – Positive pole
24	GND	Ground
25	TTLIO11	TTL input/output #11
26	+12V	+12 V Power output

Standard I/O set #2

Pin	Signal	Usage
1	GND	Ground
2	DIN22+	High-speed differential input #22 – Positive pole
3	IIN21+	Isolated input #21 – Positive pole
4	IIN23-	Isolated input #23 – Negative pole
5	IIN24-	Isolated input #24 – Negative pole
6	IOUT22-	Isolated contact output #22 – Negative pole
7	GND	Ground
8		Not connected
9	GND	Ground
10	GND	Ground
11	DIN22-	High-speed differential input #22 – Negative pole
12	IIN21-	Isolated input #21 – Negative pole
13	IIN22+	Isolated input #22 – Positive pole
14	IIN23+	Isolated input #23 – Positive pole
15	IIN24+	Isolated input #24 – Positive pole
16	IOUT22+	Isolated contact output #22 – Positive pole
17	TTLIO22	TTL input/output #22
18	GND	Ground
19	DIN21-	High-speed differential input #21 – Negative pole
20	DIN21+	High-speed differential input #21 – Positive pole
21	IIN22-	Isolated input #22 – Negative pole
22	IOUT21-	Isolated contact output #21 – Negative pole
23	IOUT21+	Isolated contact output #21 – Positive pole
24	GND	Ground
25	TTLIO21	TTL input/output #21
26	+12V	+12 V Power output

External I/O Connector for PC3610/PC3612

Connector description

Property	Value
Name, Label	External I/O
Type	26-pin 3-row high-density D-Sub female socket with UNC4-40 jack socket screws
Location	Card bracket
Usage	I/O lines and I/O power output



Pin assignments

Pin	Signal	Usage
1	GND	Ground
2	MIO03	Single-ended I/O #3 or differential I/O #3 positive pole
3	MIO05	Single-ended I/O #5 or differential I/O #5 positive pole
4	GND	Ground
5	MIO10-	Single-ended I/O #10 or differential I/O #9 negative pole
6	MIO14	Single-ended I/O #14 or differential I/O #13 negative pole
7	MIO18	Single-ended I/O #18 or differential I/O #17 negative pole
8	GND	Ground
9	MIO19	Single-ended I/O #19 or differential I/O #19 positive pole
10	GND	Ground
11	MIO04	Single-ended I/O #4 or differential I/O #3 negative pole
12	MIO06-	Single-ended I/O #6 or differential I/O #5 negative pole
13	MIO07	Single-ended I/O #7 or differential I/O #7 positive pole
14	GND	Ground
15	MIO09	Single-ended I/O #9 or differential I/O #9 positive pole
16	MIO13	Single-ended I/O #13 or differential I/O #13 positive pole
17	MIO17	Single-ended I/O #17 or differential I/O #17 positive pole
18	MIO20	Single-ended I/O #20 or differential I/O #19 negative pole
19	MIO02	Single-ended I/O #2 or differential I/O #1 negative pole
20	MIO01	Single-ended I/O #1 or differential I/O #1 positive pole

Pin	Signal	Usage
21	MIO08	Single-ended I/O #8 or differential I/O #7 negative pole
22	MIO12	Single-ended I/O #12 or differential I/O #11 negative pole
23	MIO11	Single-ended I/O #11 or differential I/O #11 positive pole
24	MIO16	Single-ended I/O #16 or differential I/O #15 negative pole
25	MIO15	Single-ended I/O #15 or differential I/O #15 positive pole
26	+12V	+12 V Power output

Internal I/O 1 Connector

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Connector description

Property	Value
Name, Label	Internal I/O 1
Type	26-pin 2-row 0.1" pitch pin header with shrouding
Location	Printed circuit board
Usage	I/O lines and I/O power output



Pin assignments

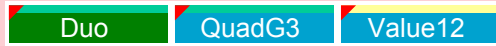
Standard I/O set #1

Pin	Signal	Usage
1	GND	Ground
2	GND	Ground
3	DIN11+	High-speed differential input #11 – Positive pole
4	DIN11-	High-speed differential input #11 – Negative pole
5	DIN12+	High-speed differential input #12 – Positive pole
6	DIN12-	High-speed differential input #12 – Negative pole
7	IIN11+	Isolated input #11 – Positive pole
8	IIN11-	Isolated input #11 – Negative pole
9	IIN12+	Isolated input #12 – Positive pole
10	IIN12-	Isolated input #12 – Negative pole
11	IIN13+	Isolated input #13 – Positive pole
12	IIN13-	Isolated input #13 – Negative pole
13	IIN14+	Isolated input #14 – Positive pole
14	IIN14-	Isolated input #14 – Negative pole

Pin	Signal	Usage
15	IOUT11+	Isolated contact output #11 – Positive pole
16	IOUT11-	Isolated contact output #11 – Negative pole
17	IOUT12+	Isolated contact output #12 – Positive pole
18	IOUT12-	Isolated contact output #12 – Negative pole
19	TTLIO11	TTL input/output #11
20	GND	Ground
21	TTLIO12	TTL input/output #12
22	GND	Ground
23		Not connected
24	GND	Ground
25	+12V	+12 V Power output
26	+12V_RTN	Ground

Internal I/O 2 Connector

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3 and PC3623-T Coaxlink Quad CXP-12 Value.



Connector description

Property	Value
Name, Label	Internal I/O 2
Type	26-pin 2-row 0.1" pitch pin header with shrouding
Location	Printed circuit board
Usage	I/O lines and I/O power output



Pin assignments

Standard I/O set #2

Pin	Signal	Usage
1	GND	Ground
2	GND	Ground
3	DIN21+	High-speed differential input #21 – Positive pole
4	DIN21-	High-speed differential input #21 – Negative pole
5	DIN22+	High-speed differential input #22 – Positive pole
6	DIN22-	High-speed differential input #22 – Negative pole
7	IIN21+	Isolated input #21 – Positive pole
8	IIN21-	Isolated input #21 – Negative pole
9	IIN22+	Isolated input #22 – Positive pole
10	IIN22-	Isolated input #22 – Negative pole
11	IIN23+	Isolated input #23 – Positive pole
12	IIN23-	Isolated input #23 – Negative pole
13	IIN24+	Isolated input #24 – Positive pole
14	IIN24-	Isolated input #24 – Negative pole
15	IOU21+	Isolated contact output #21 – Positive pole
16	IOU21-	Isolated contact output #21 – Negative pole

Pin	Signal	Usage
17	IOUT22+	Isolated contact output #22 – Positive pole
18	IOUT22-	Isolated contact output #22 – Negative pole
19	TTLIO21	TTL input/output #21
20	GND	Ground
21	TTLIO22	TTL input/output #22
22	GND	Ground
23		Not connected
24	GND	Ground
25	+12V	+12 V Power output
26	+12V_RTN	Ground

Internal I/O Connector for PC3610/PC3612

Connector description

Property	Value
Name, Label	Internal I/O
Type	26-pin 2-row 0.1" pitch pin header with shrouding
Location	Printed circuit board
Usage	I/O lines and I/O power output



Pin assignments

Pin	Signal	Usage
1	GND	Ground
2	GND	Ground
3	MIO01	Single-ended I/O #1 or differential I/O #1 positive pole
4	MIO02	Single-ended I/O #2 or differential I/O #1 negative pole
5	MIO03	Single-ended I/O #3 or differential I/O #3 positive pole
6	MIO04	Single-ended I/O #4 or differential I/O #3 negative pole
7	MIO05	Single-ended I/O #5 or differential I/O #5 positive pole
8	MIO06	Single-ended I/O #6 or differential I/O #5 negative pole
9	MIO07	Single-ended I/O #7 or differential I/O #7 positive pole
10	MIO08	Single-ended I/O #8 or differential I/O #7 negative pole
11	GND	Ground
12	GND	Ground
13	MIO09	Single-ended I/O #9 or differential I/O #9 positive pole
14	MIO10	Single-ended I/O #10 or differential I/O #9 negative pole
15	MIO11	Single-ended I/O #11 or differential I/O #11 positive pole
16	MIO12	Single-ended I/O #12 or differential I/O #11 negative pole
17	MIO13	Single-ended I/O #13 or differential I/O #13 positive pole
18	MIO14	Single-ended I/O #14 or differential I/O #13 negative pole
19	MIO15	Single-ended I/O #15 or differential I/O #15 positive pole
20	MIO16	Single-ended I/O #16 or differential I/O #15 negative pole

Pin	Signal	Usage
21	MIO17	Single-ended I/O #17 or differential I/O #17 positive pole
22	MIO18	Single-ended I/O #18 or differential I/O #17 negative pole
23	MIO19	Single-ended I/O #19 or differential I/O #19 positive pole
24	MIO20	Single-ended I/O #20 or differential I/O #19 negative pole
25	+12V	+12 V Power output
26	+12V_RTN	Ground

Internal I/O 2 Connector for PC3614/PC3618

Connector description

Property	Value
Name, Label	Internal I/O 2
Type	26-pin 2-row 0.1" pitch pin header with shrouding
Location	Printed circuit board
Usage	I/O lines and I/O power output



Pin assignments

Standard I/O set #2

Pin	Signal	Usage
1	GND	Ground
2	GND	Ground
3	DIN21+	High-speed differential input #21 – Positive pole
4	DIN21-	High-speed differential input #21 – Negative pole
5	DIN22+	High-speed differential input #22 – Positive pole
6	DIN22-	High-speed differential input #22 – Negative pole
7	IIN21+	Isolated input #21 – Positive pole
8	IIN21-	Isolated input #21 – Negative pole
9	IIN22+	Isolated input #22 – Positive pole
10	IIN22-	Isolated input #22 – Negative pole
11	IIN23+	Isolated input #23 – Positive pole
12	IIN23-	Isolated input #23 – Negative pole
13	IIN24+	Isolated input #24 – Positive pole
14	IIN24-	Isolated input #24 – Negative pole
15	IOUT21+	Isolated contact output #21 – Positive pole
16	IOUT21-	Isolated contact output #21 – Negative pole
17	IOUT22+	Isolated contact output #22 – Positive pole
18	IOUT22-	Isolated contact output #22 – Negative pole

Pin	Signal	Usage
19	TTLIO21	TTL input/output #21
20	GND	Ground
21	TTLIO22	TTL input/output #22
22	GND	Ground
23		Not connected
24	GND	Ground
25	+12V	+12 V Power output
26	+12V_RTN	Ground

1.4. Other Connectors

I/O Extension Connector	281
C2C-Link Connector	283
Auxiliary Power Input Connector for PoCL and I/O	284

I/O Extension Connector

Applies to PC1628-T Grablink Duo, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Connector description

Property	Value
Name, Label	I/O Extension
Type	26-pin 2-row 0.05" pitch pin header with shrouding
Location	Printed circuit board
Usage	I/O extension cable socket



Pin assignments

Pin	Signal	Usage
1	IOEXT1WIRE	1-wire serial I/O
2	GND	Ground
3	IOEXT01	I/O Extension #1
4	+3V3	+3.3 V Power
5	IOEXT02	I/O Extension #2
6	GND	Ground
7	IOEXT03	I/O Extension #3
8	+3V3	+3.3 V Power
9	IOEXT04	I/O Extension #4
10	GND	Ground
11	IOEXT05	I/O Extension #5
12	+3V3	+3.3 V Power
13	IOEXT06	I/O Extension #6
14	GND	Ground
15	IOEXT07	I/O Extension #7
16	+3V3	+3.3 V Power
17	IOEXT08	I/O Extension #8

Pin	Signal	Usage
18	GND	Ground
19	IOEXT09	I/O Extension #9
20	12V	12 V Power
21	IOEXT10	I/O Extension #10
22	GND	Ground
23	IOEXT11	I/O Extension #11
24	12V	12 V Power
25	IOEXT12	I/O Extension #12
26	GND	Ground

C2C-Link Connector

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Connector description

Property	Value
Name, Label	C2C-Link
Type	6-pin 2-row 0.1" pitch pin header with shrouding
Location	Printed circuit board
Usage	Card-to-card link



Pin assignments

Pin	Signal	Usage
1	GND	Ground
2	CSync1	Card-to-card synchronization bus – Signal 1
3	GND	Ground
4	CSync2	Card-to-card synchronization bus – Signal 2
5	GND	Ground
6	CSync3	Card-to-card synchronization bus – Signal 3

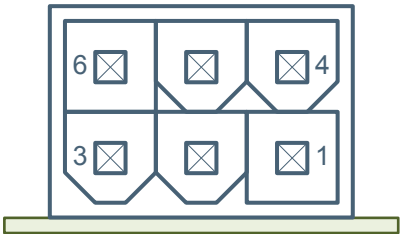
Auxiliary Power Input Connector for PoCL and I/O

Applies to PC1628-T Grablink Duo.



Connector description

Property	Value
Name, Label	Auxiliary Power Input
Type	6-pin PEG power socket
Location	Printed circuit board
Usage	12 V DC power input for PoCL and I/O power output



Pin assignments

Pin	Signal	Usage
1	+12VIN	Auxiliary +12 V input
2	+12VIN	Auxiliary +12 V input
3	+12VIN	Auxiliary +12 V input
4	GND	Ground
5	SenseIN	Power source presence detection
6	GND	Ground

1.5. LEDs and Switches

Board Status LED	286
FPGA Status LED	287
Firmware Recovery Switch	288

Board Status LED

Board status LED indicator states

LED state	Symbol	Meaning
Off		No power. The board is not powered or the power distribution network is not functional.
		FPGA NOK. The FPGA start-up procedure is not completed. <i>The normal completion time is around 100 milliseconds.</i>
Solid green		Board status OK. The main power distribution network is operational and the FPGA start-up procedure has successfully completed.
Solid red		Board status NOK. Possible causes are: • There is no power delivered on the +12 V rail of the PCI Express connector slot • At least one power converter of the main power distribution network is unable to operate properly. <i>This might be caused by excessive temperature due to inadequate board cooling, accidental short-circuits having blown one (or more) protection fuses, inappropriate supply voltages, etc.</i>

FPGA Status LED

FPGA status LED indicator states

LED state	Symbol	Meaning
Solid green		FPGA status OK. All the FPGA clock networks and the DDR memory are operating normally.
Solid red		FPGA status NOK. Possible causes: • At least one FPGA clock network is not operating normally. <i>This might be caused by excessive jitter on external clock signals of the CoaXPress or the PCI Express interfaces.</i> • The DDR memory controller has not been able to successfully perform the calibration procedure.
Solid orange		FPGA status NOK. Possible causes: • The DDR memory controller has not been able to successfully perform the calibration procedure. • The eGrabber package doesn't have the second part of the FPGA binary file. <i>A firmware update of the frame grabber is required.</i>¹

¹ Only for boards using Tandem PCIe FPGA configuration: **PC3623 Coaxlink Quad CXP-12 Value**, **PC3624 Coaxlink Quad CXP-12 DF** and **PC3633 Coaxlink Quad CXP-12 3D-LLE**

Firmware Recovery Switch

Switch types and location

The *firmware recovery switch* is implemented with one of the following components:

- 3-pin header and a jumper
- 2-way DIP switch

See also: "Product Layouts" on page 254 in the Handbook to locate the firmware recovery switch. .

Switch positions

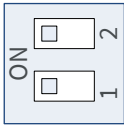
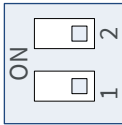
The *firmware recovery switch* has two positions:

Normal position (factory default)

At the next power ON, the latest firmware successfully written into the Flash EEPROM is used to program the FPGA. After FPGA startup completion, the card exhibits the *standard PCI ID* and the driver allows normal operation.

Recovery position

At the next power ON, the last but one firmware successfully written into the Flash EEPROM is used to program the FPGA. After FPGA startup completion, the card exhibits the *recovery PCI ID* and the driver inhibits image acquisition.

Switch type	Normal position	Recovery position
3-pin header and a jumper		
2-way DIP switch		

2. Electrical Specification

Electrical specification of the product(s) including: electrical characteristics of all the input/output ports, description of the power distribution, power requirements, etc.

2.1. 4-lane Rev 2.0 PCIe end-point	290
2.2. Power	291
Power Distribution	292
Main Power Input Requirements	294
Auxiliary Power Input	295
I/O Power Output	296
2.3. I/O Interfaces	298
Differential Input (Version 1)	299
Differential Input/Output	301
TTL Input/Output (Version 2)	303
TTL Input/5 V CMOS Output	306
Isolated Input (Version 2)	308
Isolated Output	311

2.1. 4-lane Rev 2.0 PCIe end-point

Applies to **PC1628-T Grablink Duo**.

Duo

The PCI Express Interface implements a *PCIe end-point* interface and provides *electrical power* to the on-board circuits.

The 4-lane Rev 2.0 PCIe end-point:

- complies with Revision 2.0 of the PCI Express Card Electromechanical specification,
- supports 1-lane, 2-lane, and 4-lane link width,
- supports PCIe Rev 2.0 link speed (5.0 GT/s with 8b/10b coding),
- supports PCIe Rev 1.0 link speed (2.5 GT/s with 8b/10b coding),
- supports payload size up to 512 bytes,
- offers the optimal performance when it is configured for 4-lane PCIe Rev 2.0 link speed (5 GT/s).

4-lane Rev 2.0 PCIe end-point to PC memory data transfer performance

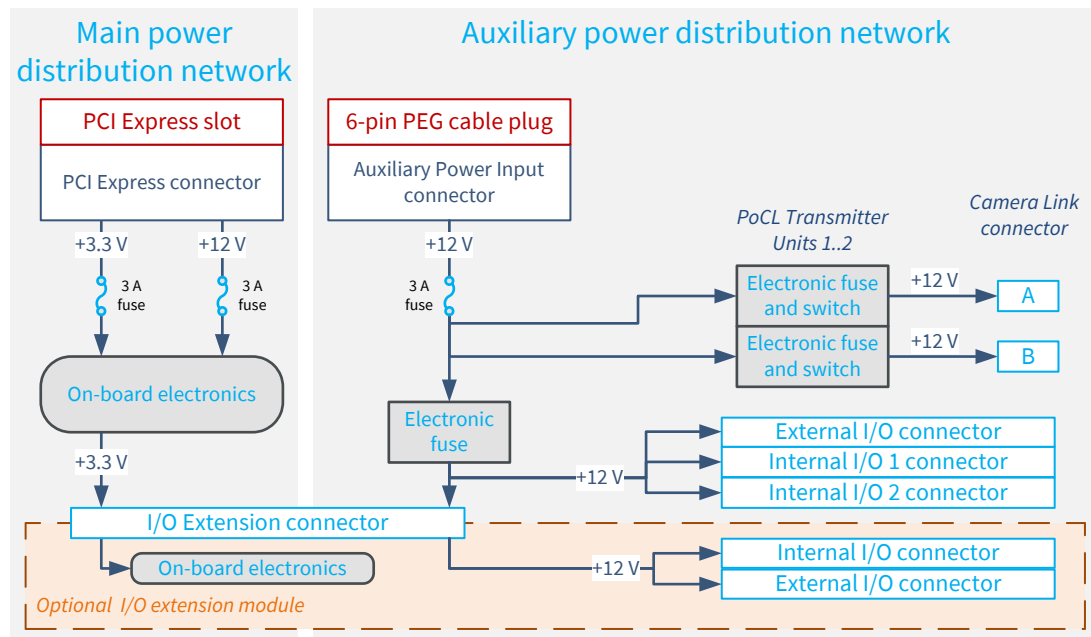
Parameter	Conditions	Min.	Typ.	Max.	Unit
Sustainable output data rate	4-lane @ 5 GT/s (PCIe Rev 2.0)		1,700		MB/s
	4-lane @ 2.5 GT/s (PCIe Rev 1.0)		800		MB/s
	2-lane @ 5 GT/s (PCIe Rev 2.0)		800		MB/s

2.2. Power

Power requirements and specifications

Power Distribution	292
Main Power Input Requirements	294
Auxiliary Power Input	295
I/O Power Output	296

Power Distribution



Main power distribution network

The main power distribution network delivers power to *all the on-board electronic devices* including FPGA, memory chips, I/O drivers and receivers.

The network is fed by the Host PC motherboard through the +3.3 V and the +12 V power rails of the PCI Express slot connector. Protection fuses inserted at the input side of each power rail prevent potential fire hazards.

The *board status LED* reflects the global status of all the power converters of the main distribution network.

See also: "Main Power Input Requirements" on page 294

Auxiliary power distribution network

The auxiliary power distribution network delivers power to the external devices including:

- Camera Link cameras using the PoCL capability available on all Camera Link Host connectors
- System devices using the +12 V power output available on all I/O connectors

See also: "Auxiliary Power Input" on page 295, "I/O Power Output" on page 296 and



WARNING

- The fuses are not serviceable! When blown, the card must be returned to the factory.
- PTCs and electronic fuses are self-resettable fuses.

The card can be operated without applying power to the auxiliary power distribution network.



TIP

The card can be operated without applying power to the auxiliary power distribution network.

Main Power Input Requirements

Typical PCI Express power consumption

The following table provides the *typical PCI Express power consumption* for each product when it operates under the following conditions:

- Acquiring image data using all CoaXPress Host Interface connections operating at their maximum speed
- Delivering image data on the PCI Express configured for the largest link width and the highest link speed
- Operating @25°C [77 °F] ambient temperature and nominal supply voltages

Product	+12 V	+3.3 V	Total	Units
PC1628-T Grablink Duo	4.4	2.7	7.1	W



WARNING

The above table provides typical power consumption to help the system integrator with the sizing of the Host PC power supply.

Voltage requirements

Parameter	Min.	Typ.	Max.	Units
+3.3 V voltage	3.0	3.3	3.6	V
+12 V voltage	11.0	12.0	13.0	V

Auxiliary Power Input

Auxiliary power input requirements

The following table provides the 'worst case' auxiliary power consumption for each product:

- The *I/O power* column specifies the maximum required input power dedicated to external I/O powering.
- The *Camera power* column specifies the maximum required input power dedicated to camera powering. This number takes care of the power conversion efficiency.

Product	Connector	Nominal voltage [V]	I/O power [W]	Camera power [W]	Total power [W]
PC1628 Grablink Duo	PEG	12	12	2 x 4	20

Requirements for PEG connector

The network is fed by a 12 V external power supply attached to the auxiliary power input connector using a power cable terminated by a 6-pin PEG plug connector. A protection fuse inserted at the input side prevents potential fire hazards.

Parameter	Min.	Typ.	Max.	Units
Voltage	11.0	12.0	13.0	V



WARNING

On the card side of the power cable, check carefully the voltage on each pin of the 6-pin PEG connector plug before insertion!

See also: ["Avoid Mixing Power Supply Cables" on page 364](#)

Monitoring the auxiliary power input

The `AuxiliaryPower12VInput` GenApi feature of the Interface module reports the status of the "12V Auxiliary Power Input" measured after the input fuse.

The `AuxiliaryPowerInput` GenApi feature of the Interface module reports the status of the auxiliary power input cable connection.



NOTE

The *SenseIN* input of the PEG connector is used for power source cable presence detection. It should be grounded at the power supply level.

I/O Power Output

I/O Power Output (Version 1)

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH and PC3622-T Coaxlink Duo CXP-12.

Duo	QuadG3	Octo	Mono12LH	Duo12

Description

A non-isolated +12 V power output is available on every I/O connector.

The power originates from an external 12 V power supply plugged into the Auxiliary Power Input connector. It is distributed from a common electronic fuse to all the I/O connectors.

The electronic fuse provides the following protections:

- Limits the inrush current during power on sequence
- Protects the frame grabber and the power source against overload
- Protects the frame grabber and the power source against short-circuits.

The sum of the load currents drawn from all the 12 V outputs of the I/O connectors must be lower or equal to the specified maximum output current.

Specification

Parameter	Conditions	Min.	Typ.	Max.	Units
Aggregated output current	Operating temperature range			1.0	A
Voltage drop across the electronic fuse	Max. output current			0.2	V

NOTE: The above specification applies over the whole operating temperature range of the frame grabber.

I/O Power Output (Version 2)

Applies to PC3623-T Coaxlink Quad CXP-12 Value.

Value12

A non-isolated +12 V power output is available on every I/O connector.

The power originates from an external 12 V power supply plugged into the Auxiliary Power Input connector. It is distributed from a common resettable fuse to all the I/O connectors.

The resettable fuse provides the following protections:

- Limits the inrush current during power on sequence
- Protects the frame grabber and the power source against overload
- Protects the frame grabber and the power source against short-circuits.
- The resettable fuse is a positive temperature coefficient device 1.85 A PTC.

The sum of the load currents drawn from all the 12 V outputs of the I/O connectors must be lower or equal to the specified maximum output current.

Specification

Parameter	Conditions	Min.	Typ.	Max.	Units
Aggregated output current	Operating temperature range			1.0	A
Voltage drop across the electronic fuse	Max. output current			0.2	V

NOTE: The above specification applies over the whole operating temperature range of the frame grabber.

2.3. I/O Interfaces

Electrical specification of the I/O interfaces

Differential Input (Version 1)	299
Differential Input/Output	301
TTL Input/Output (Version 2)	303
TTL Input/5 V CMOS Output	306
Isolated Input (Version 2)	308
Isolated Output	311

Differential Input (Version 1)

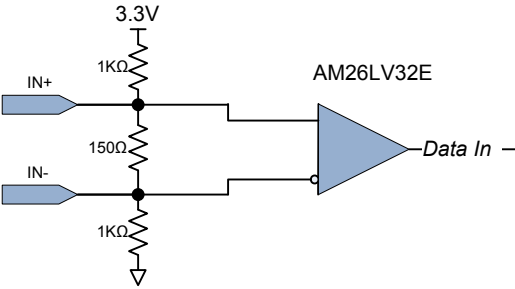
Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo and PC3623-T Coaxlink Quad CXP-12 Value.

Duo

QuadG3

Octo

Value12



Differential Input Simplified Schematic

The receiver complies with the ANSI/TIA/EIA-422B specification.

DC Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Common mode voltage		-7		+7	V
Differential sensitivity				200	mV
Input impedance			120		Ohm
ESD protection	Human Body Model (HBM)	15			kV
	Contact discharge	8			kV
	Air gap discharge	15			kV

AC characteristics

Parameter	Min.	Typ.	Max.	Units
Pulse width	100			ns
Pulse rate	0		5	MHz
10%-90% rise/fall time			1	µs

Logical map

The state of the port is reported as follows:

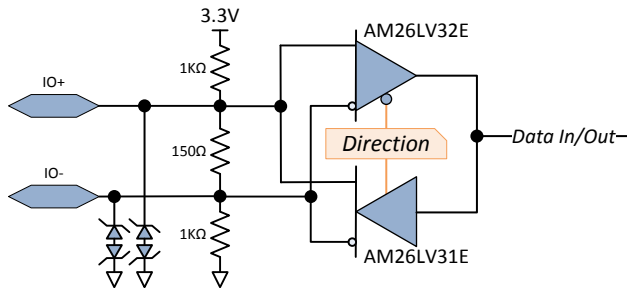
Relative V+/V- voltage	Logical State
V+ > V-	HIGH
V+ < V-	LOW
Unconnected input	HIGH

Compatible drivers

The following drivers are compatible with the high-speed differential input ports:

- RS-422/RS-485 differential line drivers
- Complementary TTL drivers

Differential Input/Output



Differential Input/Output Simplified Schematic

The driver and the receiver complies with the ANSI/TIA/EIA-422B specification.

DC Characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Common mode voltage		-7		+7	V
Input impedance			120		Ohm
ESD protection	Human Body Model (HBM)	15			kV
	Contact discharge	8			kV
	Air gap discharge	15			kV

Driver

Parameter	Conditions	Min.	Typ.	Max.	Units
Low-level output current			30		mA
Low-level output voltage	20 mA	0.2	0.4		V
High-level output current			-30		mA
High-level output voltage	-20 mA	2.4	3		V
Differential output voltage	0 mA	2		4	V

Receiver

Parameter	Conditions	Min.	Typ.	Max.	Units
Differential amplitude		200			mV

AC characteristics

Driver

Parameter	Min.	Typ.	Max.	Units
Pulse width	50			ns
Pulse rate	0		10	MHz
10%-90% rise/fall time		TBD		μs

Receiver

Parameter	Min.	Typ.	Max.	Units
Pulse width	50			ns
Pulse rate	0		10	MHz
10%-90% rise/fall time		TBD		μs

Logical map

The state of the port is as follows:

Relative V+/V- voltage Logical State

V+ > V-	HIGH
V+ < V-	LOW

Compatible sources

Sources with the following drivers are compatible:

- RS-422 differential line drivers
- Complementary TTL drivers

Compatible loads

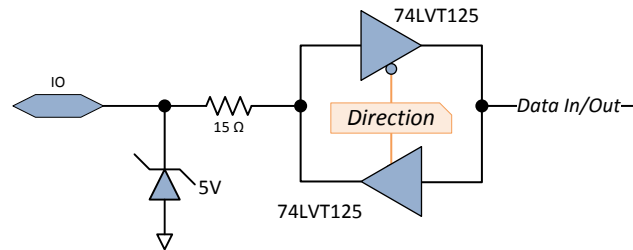
Loads with the following receivers are compatible:

- RS-422 differential line receivers

TTL Input/Output (Version 2)

Applies to PC1628-T Grablink Duo, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.

Duo	Octo	Mono12LH	Duo12	Value12



TTL Input/Output Simplified schematic

The port implements a 3.3 V LVTTTL driver and a 5 V-compliant 3.3 V LVTTTL receiver.

DC characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
ESD protection	Human Body Model (HBM)	2			kV



NOTE

The I/O port includes a latch-up protection.

Driver

Parameter	Conditions	Min.	Typ.	Max.	Units
Low-level output current				64	mA
	@ 8 mA		0.34	0.36	V
	@ 16 mA		0.48	0.55	V
Low-level output voltage	@ 32 mA		0.78	0.81	V
	@ 64 mA		1.34	1.36	V
High-level output current				-32	mA
	@-8 mA; (1)	2.60	3.00		V
High-level output voltage	@-16 mA; (1)	2.20	2.70		V
	@-32 mA; (1)	1.75	2.20		V
ESD protection	Human Body Model (HBM)	2			kV

Condition (1): 300 Ohms line termination resistor to GND.

Receiver

Parameter	Conditions	Min.	Typ.	Max.	Units
Absolute maximum voltage rating		0		5	V

AC characteristics

Driver

Parameter	Conditions	Min.	Typ.	Max.	Units
Pulse width		100			ns
Pulse rate		0		5	MHz
10%-90% rise time			8		ns
10%-90% fall time			7.5		ns

Receiver

Parameter	Conditions	Min.	Typ.	Max.	Units
Pulse width		100			ns
Pulse rate		0		5	MHz

Logical Map

The state of the port is reported as follows:

Input voltage	Logical State
VIN > 2.0 V	HIGH
VIN < 0.8 V	LOW
Unconnected input port	<i>Undetermined</i>

Compatible sources

Sources with the following drivers are compatible:

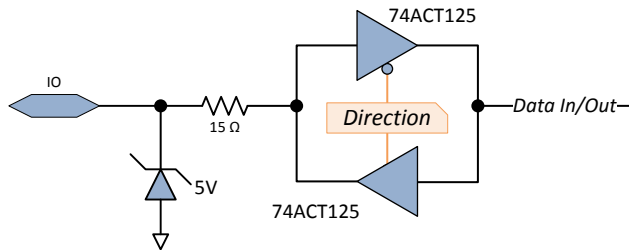
- ❑ LVTTTL (3.3 V low-voltage TTL)
- ❑ TTL (5 V TTL)
- ❑ CMOS (5 V CMOS)

Compatible loads

Loads with the following receivers are compatible:

- ❑ LVTTTL (3.3 V low-voltage TTL)
- ❑ TTL (5 V TTL)

TTL Input/5 V CMOS Output



TTL Input/5 V CMOS Output Simplified schematic

The port implements a 5 V CMOS driver and a TTL-compliant receiver.

DC characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
ESD protection	Human Body Model (HBM)	2			kV



NOTE
The I/O port includes a latch-up protection.

Driver

Parameter	Conditions	Min.	Typ.	Max.	Units
Absolute maximum voltage rating		0		5	V
Low-level output current				24	mA
Low-level output voltage	@50µA		0.001	0.1	V
	@ 24 mA			0.81	V
High-level output current				-24	mA
High-level output voltage	@-50 µA; (1)	4.9	4.99		V
	@-24 mA; (1)	3.89			V

Condition (1): 300 Ohms line termination resistor to GND.

Receiver

Parameter	Conditions	Min.	Typ.	Max.	Units
Absolute maximum voltage rating		0		5	V

AC characteristics

Driver

Parameter	Conditions	Min.	Typ.	Max.	Units
Pulse width		500			ns
Pulse rate		0		1	MHz
10%-90% rise/fall time			TBD		ns

Receiver

Parameter	Conditions	Min.	Typ.	Max.	Units
Pulse width		500			ns
Pulse rate		0		1	MHz
10%-90% rise/fall time			TBD		ns

Logical Map

The state of the port is reported as follows:

Input voltage	Logical State
VIN > 2.0 V	HIGH
VIN < 0.8 V	LOW
Unconnected input port	<i>Undetermined</i>

Compatible sources

Sources with the following drivers are compatible:

- LVTTTL (3.3 V low-voltage TTL)
- CMOS (5 V CMOS)
- LVCMOS (3.3 V CMOS)

Compatible loads

Loads with the following receivers are compatible:

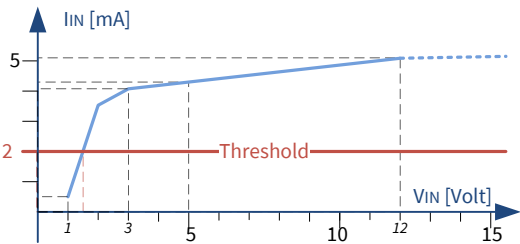
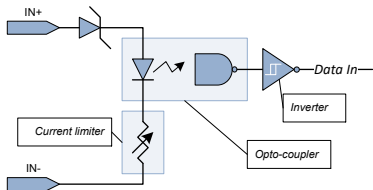
- TTL (5 V TTL)
- CMOS (5 V CMOS)

Isolated Input (Version 2)

Applies to **PC1628-T Grablink Duo** and **PC3623-T Coaxlink Quad CXP-12 Value**.



Isolated current-sense input with wide voltage input range up to 30V, compatible with totem-pole (push-pull) HTL drivers, 5V TTL/RS-422 differential line drivers, 5V CMOS drivers, potential free contacts, solid-state relays and opto-couplers



Simplified schematic

Input Current vs. Input Voltage Characteristics

DC characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Differential voltage		-30		+30	V
Input current threshold			2	3	mA
Differential voltage	@3 mA		2.2		V
Input current	@(VIN+ - VIN-) < 1 V		0.5		mA
	@(VIN+ - VIN-) = 3 V		4.1		mA
	@(VIN+ - VIN-) = 5 V		4.4		mA
	@(VIN+ - VIN-) = 12 V		5.1		mA
	@(VIN+ - VIN-) = 30 V		6.8		mA

AC characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Positive pulse width		2.5			μs
Negative pulse width		2.5			μs
Pulse rate		0		200	kHz
Turn-ON delay ¹	25 °C; 100 kHz; 5 V square signal		800		ns
Turn-OFF delay ²	LineFilterStrength = Lowest (LineFilterDelay = 500 ns)		1350		ns



NOTE

1. The "Turn-ON" delay is defined as the time difference between a transition of state at the input that turns ON the opto-coupler and the subsequent transition in the FPGA.
2. The "Turn-OFF" delay is defined as the time difference between a transition of state at the input that turns OFF the opto-coupler and the subsequent transition in the FPGA.
3. The response of the Isolated I/Os vary in function of the activation frequency. It appears that the variation is caused by a variation on temperature: Higher is the frequency, higher is the temperature, witch increases the propagation delay.

These delays include the delay introduced by the digital line filter controlled by the LineFilterStrength GenApi feature!

Isolation characteristics

Parameter	Value
Isolation grade	Functional
Max. DC voltage	250 V
Max. AC voltage	170 V _{RMS}



NOTE

The functional isolation is only for the circuit technical protection. It does not provide an isolation that can protect a human being from electrical shock!

Logical map

The state of the port is reported as follows:

Input current	Logical State
$I_{IN} \geq 3 \text{ mA}$	HIGH
$I_{IN} < 0.5 \text{ mA}$	LOW

Input current	Logical State
Unconnected input port	LOW

Compatible drivers

The following drivers are compatible with this version of the isolated current-sense inputs:

- Totem-pole (push-pull) HTL drivers, 5V TTL/RS-422 differential line drivers, 5 V CMOS drivers
- Potential free contact, solid-state relay, or opto-isolators
- 12 V and 24 V signaling voltages are also accepted



NOTE

- The +12 V power supply on the I/O connector(s) can be used for powering drivers requiring a power supply.
- No external resistors are required. However, to obtain a *higher switching threshold* with 12 V and 24 V signaling, it is recommended to insert a series resistor in the circuit. The recommended resistor values¹ are:
 - 2k Ohms for 12 V signaling
 - 4.7k Ohms for 24 V signaling

See also: "Using Isolated Inputs" on page 349

¹ These resistor values are specific for this version of isolated inputs.

Isolated Output

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.

Duo

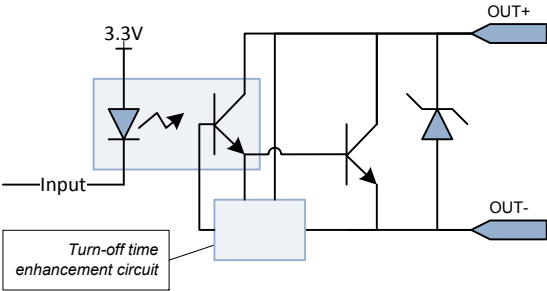
QuadG3

Octo

Mono12LH

Duo12

Value12



Isolated Output Simplified schematic

The output port implements an isolated contact output.

DC characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Current				100	mA
	Open state	-30		30	V
Differential voltage	Closed state @ 1 mA			0.4	V
	Closed state @ 100 mA			1.0	V



NOTE

- The output port in the closed state has no current limiter, the user circuit must be designed to avoid excessive currents that could destroy the output port.
- The output port remains in the OFF-state until it is under control of the application.

AC characteristics

Parameter	Conditions	Min.	Typ.	Max.	Units
Pulse rate		0		100	kHz
Turn-on time	See "Test conditions" below			5	µs
Turn-off time				5	µs

Test conditions

- LVTTTL signaling (0.4V-2.4V) at IOUT output. Tr/Tf is measured between 0.4V & 2.4V.
- Signal span of 5V. The receiver is supposed to be TTL 5V Compliant (like, for instance, our TTLIO). The span of 5V is achieved by a pull-up/pull-down ratio of about 1.2 (for instance 220R/180R or 470R/390R) supplied by 12VIO.
- R-R divider must be strong enough to maintain good fall time (Rdown must be low enough). A R-R divider current of 10 mA is the minimum to get good results.

Performance above 70 kHz

Inter-symbol Interface (ISI) appears for pulse rates higher than 70 KHz.

The ISI adds an extra delay (i.e. jitter) of about 0.5 µsec at 100kHz.

NOTE: This jitter on the IOUT output delay parameter can be limiting in some applications.

Typical switching performance @ 25°C

Current [mA]	Turn ON time [µs]	Turn OFF time [µs]
0.5	2.0	4.8
1.0	2.0	3.9
4.0	2.2	3.3
10	2.3	2.7
40	2.3	2.7
100	2.3	2.7

Isolation characteristics

Parameter	Value
Isolation grade	Functional
Max. DC voltage	250 V
Max. AC voltage	170 V _{RMS}



NOTE

The functional isolation is only for the circuit technical protection. It does not provide an isolation that can protect a human being from electrical shock!

Logical map

The state of the output port is determined as follows:

Logical State	Output port state
HIGH	The contact switch is closed (ON)
LOW	The contact switch is open (OFF)

Compatible loads

The following loads are compatible with the isolated contact output ports:

- Any load within the 30 V / 100 mA envelope is accepted. The power originates from an external power source or alternatively from the power delivered through the 12 V and GND pins of the I/O connectors.

3. Environmental Specification

Environmental specification of the product(s) including: climatic requirements, electromagnetic standards compliance statements, safety standards compliance statements, etc.

- 3.1. Storage Conditions 315
- 3.2. Operating Conditions 316
- 3.3. Temperature Monitor 317
- 3.4. Thermal Design Data 320
- 3.5. Compliance Statements 321

3.1. Storage Conditions

Standard (-20°C/+70°C) storage range

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.

Duo	QuadG3	Octo	Mono12LH	Duo12	Value12

Parameter	Conditions	Min	Max	Units
Ambient air temperature		-20 [-4]	70 [158]	°C [°F]
Ambient air humidity	Non-condensing	10	90	% RH

3.2. Operating Conditions

3.3. Temperature Monitor

Monitoring the FPGA temperature

Temperature sensor

All FPGA based products embed a temperature sensor located inside the FPGA, on the die.

To read the FPGA die temperature expressed in °C, the application must :

1. Set the **TemperatureSensorSelector** feature of the Interface Module to **Grabber**, and then ...
2. Get the **Temperature** feature value of the Interface Module.



WARNING

The user application is invited to check regularly the FPGA die temperature to ensure that the board operates within the specified operating limits.

Dual-threshold (85°C/100°C) temperature detection with automatic acquisition stop

Applies to **PC3621-LH-T Coaxlink Mono CXP-12-LH** and **PC3622-T Coaxlink Duo CXP-12**.

Mono12LH

Duo12

The above listed frame grabbers implement a dual-threshold excessive FPGA die temperature detection and an automatic acquisition stopping service.

Warning threshold (85 °C) - Notify

When the measured FPGA die temperature reaches 87°C, the frame grabber posts a **FPGA temperature is too high** Memento message.

The message is sent repeatedly every second until the measured temperature decreases below 83°C or increases above 103°C.



WARNING

- Operation is still possible but is not recommended!
- When such event occurs, the user is invited to check and, possibly, improve the card cooling in the host PC!

Error threshold (100 °C) - Notify - Stop acquisition

When the measured FPGA die temperature reaches 103°C, the frame grabber stops image acquisition and posts a **FPGA temperature is too high; operation may stop to prevent damaging the card** Memento message.

The message is sent repeatedly every second until the measured temperature decreases below 97°C.



TIP

Stopping the acquisition reduces significantly the heat production of the FPGA. This action is aimed to reduce the die temperature, to prevent the application against unexpected FPGA behavior and to prevent damaging the card.



WARNING

- Random errors could occur in the FPGA if its core temperature becomes excessive!
- When such event occurs, the user must immediately shut down the system and revise the card cooling in the host PC before restarting!

Dual-threshold (85°C/100°C) temperature detection

Applies to **PC3623-T Coaxlink Quad CXP-12 Value.**

Value12

The above listed frame grabbers implement a dual-threshold excessive FPGA die temperature detection.

Warning threshold (85 °C) - Notify

When the measured FPGA die temperature reaches 87°C, the frame grabber posts a **FPGA temperature is too high** Memento message.

The message is sent repeatedly every second until the measured temperature decreases below 83°C or increases above 103°C.



WARNING

- Operation is still possible but is not recommended!
- When such event occurs, the user is invited to check and, possibly, improve the card cooling in the host PC!

Error threshold (100 °C) - Notify

When the measured FPGA die temperature reaches 103°C, the frame grabber posts a **FPGA temperature is too high; operation may stop to prevent damaging the card** Memento message.

The message is sent repeatedly every second until the measured temperature decreases below 97°C.



TIP

Stopping the acquisition reduces significantly the heat production of the FPGA. This action is aimed to reduce the die temperature, to prevent the application against unexpected FPGA behavior and to prevent damaging the card.



WARNING

- Random errors could occur in the FPGA if its core temperature becomes excessive!
- When such event occurs, the user must immediately shut down the system and revise the card cooling in the host PC before restarting!

3.4. Thermal Design Data

Main contributors

Generated heat power estimation and cooling method

Requirements for air-cooled products with fan

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.

Duo

QuadG3

Octo

Duo12

Value12

The heat is dissipated into the ambient air inside the Host PC. The heat exchange is facilitated by a heat sink and a fan mounted on the FPGA (the component having the largest heat source).

The thermal design must ensure sufficient air flow along both sides to keep the FPGA die temperature below the upper limit of the allowed temperature range. The application is responsible for regularly checking the temperature and for taking the appropriate action in case of excessive temperature.

The heat is dissipated into the ambient air surrounding the appliance. The heat exchange is facilitated by a heat sink and a fan mounted on the FPGA (the component having the largest heat source).

The thermal design must ensure sufficient air flow to keep the FPGA die temperature below the upper limit of the allowed temperature range. The application is responsible for regularly checking the temperature and for taking the appropriate action in case of excessive temperature.

3.5. Compliance Statements

EMC compliance statements for Europe and Great Britain



Notice for Europe

This product is in conformity with the Council Directive 2014/30/EU



Notice for Great Britain

This product is in conformity with Electromagnetic Compatibility Regulations 2016

EMC compliance statement for USA



Notice for USA

Compliance Information Statement (Declaration of Conformity Procedure) DoC FCC 47 Part 15B

EMC Compliance statement for Korea

Applies to PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Notice for Korea

Registered products under the Clause 3, Article 58-2 of Radio Waves Act:

Product	Registration Number
PC1628-T Grablink Duo	R-R-EUr-PC1628

RoHS compliance statement



This product is in conformity with the European Union 2015/863 (ROHS3) directive, that stands for "the restriction of the use of certain hazardous substances in electrical and electronic equipment".

REACH statement



This product is in conformity with the European Union 1907/2006 (REACH) regulation.

WEEE statement



According the European Union 2012/19/EU directive, the product must be disposed of separately from normal household waste. It must be recycled according to the local regulations.

4. Accessories

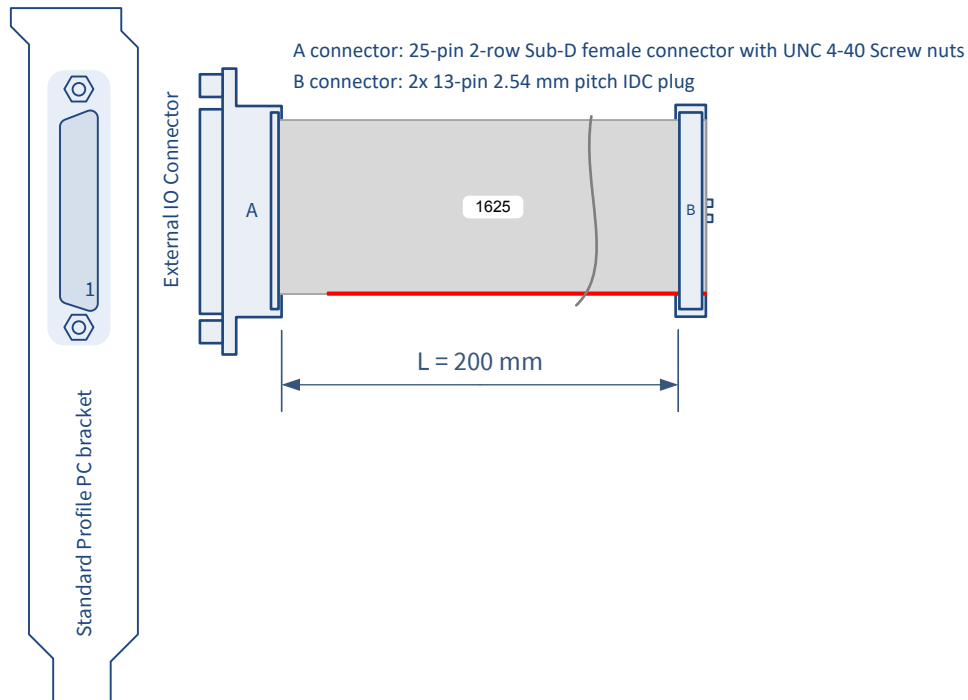
4.1. PC1625 DB25F I/O Adapter Cable	323
4.2. PC1636 InterPC C2C-Link Adapter	326
Using PC1636 as C2C-Link Extender	328
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4.6. Custom C2C-Link Ribbon Cable Assembly	346

4.1. PC1625 DB25F I/O Adapter Cable

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



1625 DB25F I/O Adapter Cable



PC1625 DB25F I/O Adapter Cable

The **PC1625 DB25F I/O Adapter Cable** connects all the pins (but the pin 1) 1 of a 26-pin dual-row 0.1" pitch connector to a 25-pin female SubD connector fitted into a standard-profile PC bracket.

Usage with Internal IO2 connector

The adapter brings the second set of I/O lines and the +12 V power output to a bracket-mount SubD connector. The pins are assigned as follows:

Wire #	IDC Pin #	SubD Pin #	Signal Name	Signal Description
1	1		GND	Ground
2	2	1	GND	Ground
3	3	14	DIN21+	High-speed differential input #21 – Positive pole
4	4	2	DIN21-	High-speed differential input #21 – Negative pole
5	5	15	DIN22+	High-speed differential input #22 – Positive pole
6	6	3	DIN22-	High-speed differential input #22 – Negative pole
7	7	16	IIN21+	Isolated input #21 – Positive pole
8	8	4	IIN21-	Isolated input #21 – Negative pole
9	9	17	IIN22+	Isolated input #22 – Positive pole
10	10	5	IIN22-	Isolated input #22 – Negative pole
11	11	18	IIN23+	Isolated input #23 – Positive pole
12	12	6	IIN23-	Isolated input #23 – Negative pole
13	13	19	IIN24+	Isolated input #24 – Positive pole
14	14	7	IIN24-	Isolated input #24 – Negative pole
15	15	20	IOU21+	Isolated contact output #21 – Positive pole
16	16	8	IOU21-	Isolated contact output #21 – Negative pole
17	17	21	IOU22+	Isolated contact output #22 – Positive pole
18	18	9	IOU22-	Isolated contact output #22 – Negative pole
19	19	22	TTLIO21	TTL input/output #21
20	20	10	GND	Ground (TTLIO21 return)
21	21	23	TTLIO22	TTL input/output #22
22	22	11	GND	Ground (TTLIO22 return)
23	23	24	-	Not used
24	24	12	GND	Ground
25	25	25	+12V	+12 V Power output
26	26	13	GND	Ground (+12 V return)

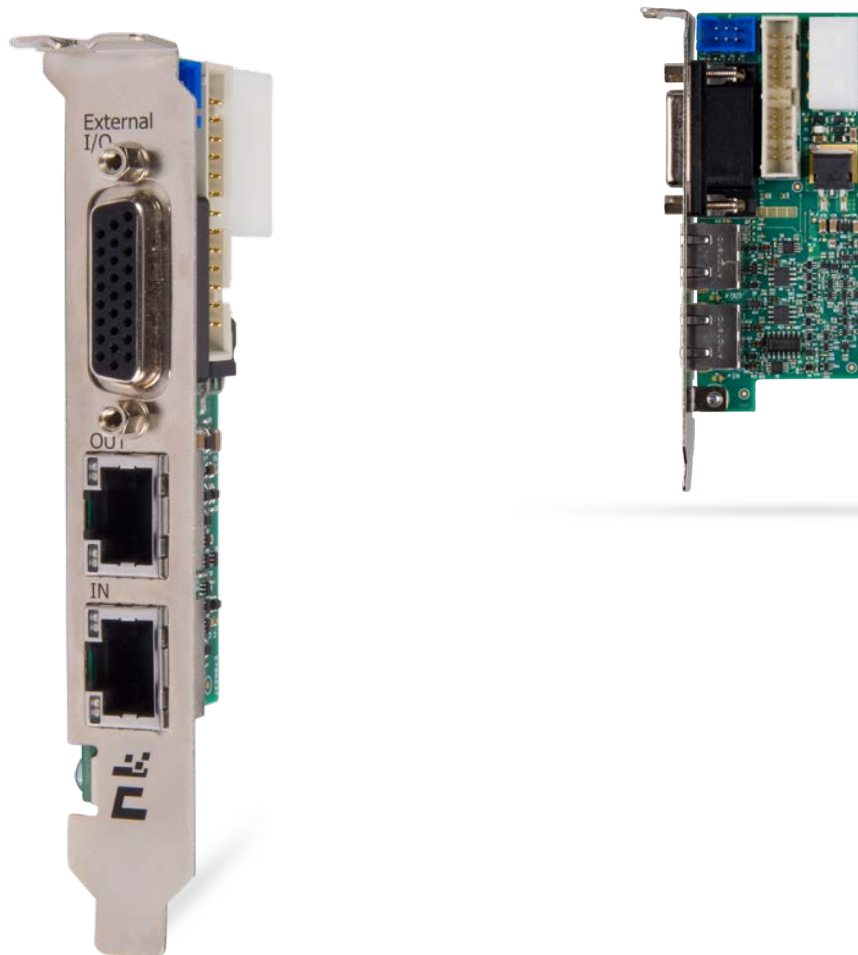
Usage with Internal IO1 connector

The adapter brings the second set of I/O lines and the +12 V power output to a bracket-mount SubD connector. The pins are assigned as follows:

Wire #	IDC Pin #	SubD Pin #	Signal Name	Signal Description
1	1		GND	Ground
2	2	1	GND	Ground
3	3	14	DIN11+	High-speed differential input #11 – Positive pole
4	4	2	DIN11-	High-speed differential input #11 – Negative pole
5	5	15	DIN12+	High-speed differential input #12 – Positive pole
6	6	3	DIN12-	High-speed differential input #12 – Negative pole
7	7	16	IIN11+	Isolated input #11 – Positive pole
8	8	4	IIN11-	Isolated input #11 – Negative pole
9	9	17	IIN12+	Isolated input #12 – Positive pole
10	10	5	IIN12-	Isolated input #12 – Negative pole
11	11	18	IIN13+	Isolated input #13 – Positive pole
12	12	6	IIN13-	Isolated input #13 – Negative pole
13	13	19	IIN14+	Isolated input #14 – Positive pole
14	14	7	IIN14-	Isolated input #14 – Negative pole
15	15	20	IOUT11+	Isolated contact output #11 – Positive pole
16	16	8	IOUT11-	Isolated contact output #11 – Negative pole
17	17	21	IOUT12+	Isolated contact output #12 – Positive pole
18	18	9	IOUT12-	Isolated contact output #12 – Negative pole
19	19	22	TTLIO11	TTL input/output #11
20	20	10	GND	Ground (TTLIO11 return)
21	21	23	TTLIO12	TTL input/output #12
22	22	11	GND	Ground (TTLIO12 return)
23	23	24	-	Not used
24	24	12	GND	Ground
25	25	25	+12V	+12 V Power output
26	26	13	GND	Ground (+12 V return)

4.2. PC1636 InterPC C2C-Link Adapter

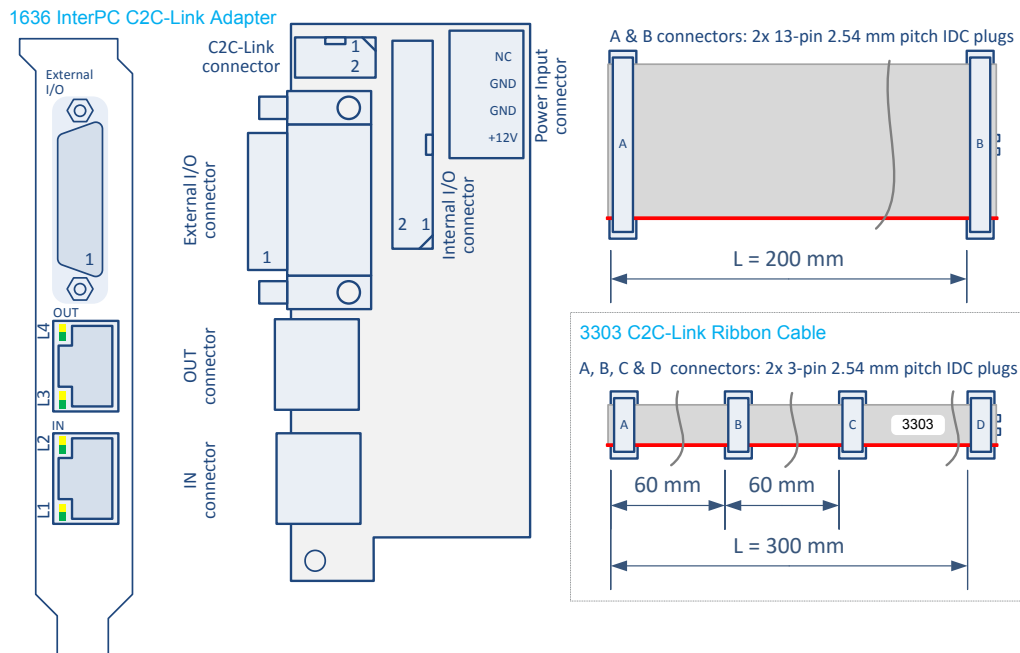
Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Pictures of PC1636 InterPC C2C-Link Adapter

The **PC1636 InterPC C2C-Link Adapter** is an accessory product for use as an [InterPC C2C-Link extender](#) and/or as a [HD26F I/O adapter](#).

Layout



PC1636 InterPC C2C-Link Adapter

The **PC1636 InterPC C2C-Link Adapter** product accessory is composed of:

- A printed circuit board assembly fitted with a standard-profile PC bracket.
- A 200-mm 26-way ribbon cable.
- A **PC3303 C2C-Link Ribbon Cable**.

Connectors

The **External I/O connector** is a HD26F – 26-pin 3-row high-density female – Sub-D connector fitted on the bracket with UNC 4-40 screws.

The **IN connector** and the **OUT connector** are RJ-45 8-pin sockets fitted on the bracket.

The **Internal I/O connector** is a 26-pin dual-row 0.1" pitch pin header with shrouding.

The **C2C-Link connector** is a 6-pin dual-row 0.1" pitch pin header with shrouding.

The **Internal I/O connector** is a 26-pin dual-row 0.1" pitch pin header with shrouding.

The **Power Input connector** is a 0.2" pitch right-angled Disk Drive Power connector.

LEDs

The **IN connector** and the **OUT connector** are each equipped with 2 green/yellow LEDs named respectively **L1, L2, L3** and **L4**.

Using PC1636 as C2C-Link Extender

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Adapter Powering



WARNING

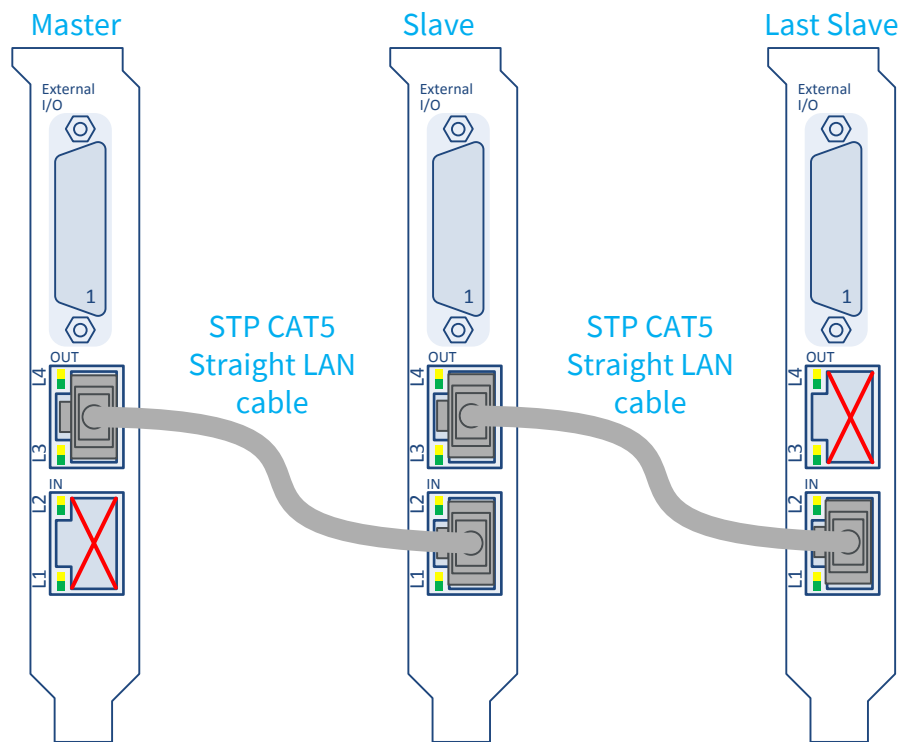
The **PC1636 InterPC C2C-Link Adapter** must be powered when it is used as a C2C-Link extender.

The user has two options to supply power to the adapter:

- From the compatible frame grabber +12 V power output through the 26-way ribbon cable attached to the **Internal I/O** connector.
- From the Host PC power supply through a Disk Drive Power connector cable plugged into the **Power Input** connector.

Parameter	Min.	Typ.	Max.	Units
+12 V DC Input voltage	11.0	12.0	13.0	V
+12 V Input power		1.8		W

InterPC Interconnect



External wiring of a C2C-Link across 3 adapters.

The external wiring of the C2C-Link is made with RJ 45 CAT 5 STP straight LAN cables. N-1 cables are required to interconnect N adapters in a daisy-chain scheme.

The daisy-chain begins on the OUT connector of the Master adapter and ends at the IN connector of the Last Slave adapter.

The IN connector of the Master adapter and the OUT connector of the Last Slave adapter are unused.



NOTE

The adapter disables the signal drivers of the IN and OUT connectors to avoid electrical damages when it detects a bad or a missing connection.

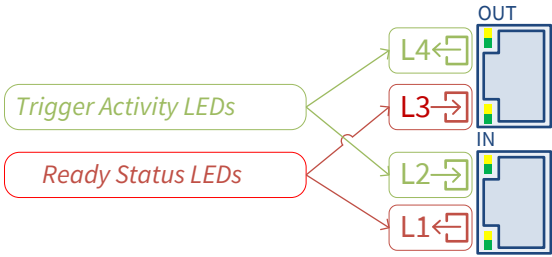
The InterPC cable drivers and receivers are not electrically isolated.



WARNING

To avoid damages, the interconnected PCs must have a common ground reference.

LEDs



PC1636 InterPC C2C-Link Adapter LEDs

Trigger Activity LEDs

The L2 and L4 LEDs indicate the trigger activity on the LAN cable. L2 shows the activity on the received trigger signals; L4 shows the activity on the transmitted trigger signals.

LED State	Indication
Off	The LAN cable is unplugged or the adapter is not powered.
Green	No trigger activity. <i>No trigger events in the past 10 milliseconds.</i>
Yellow	Trigger activity. <i>One or more trigger events in the past 10 milliseconds.</i>

Ready Status LEDs

The L1 and L3 LEDs indicate the state of the ready signal on the LAN cable. L1 shows the state of the transmitted ready signal; L3 shows the state of the received ready signal.

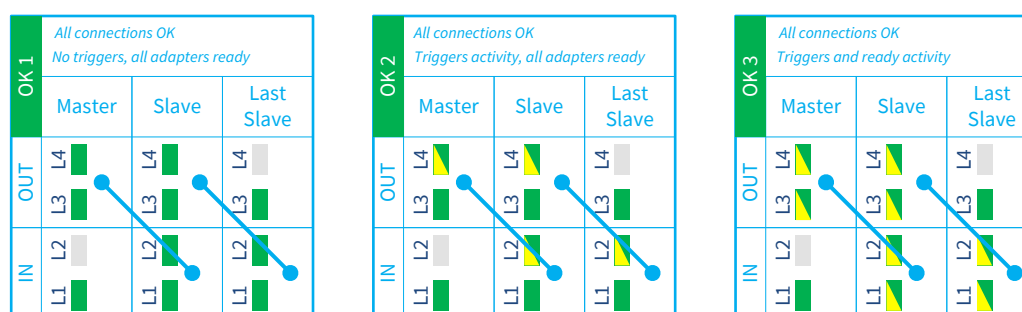
LED State	Indication
Off	The adapter is not powered.
Green	Ready true. <i>For L1: all the C2C-Link devices attached to this adapter and the downwards adapters (if any) are ready.</i> <i>For L3: all the C2C-Link devices attached to the downwards adapters (if any) are ready.</i>
Yellow	Ready false. <i>For L1: one or more C2C-Link devices attached to this adapter and the downwards adapters (if any) are not ready.</i> <i>For L3: one or more C2C-Link devices attached to the downwards adapters (if any) are not ready.</i>



NOTE

Unlike the trigger activity LEDs, the ready signals are not enlarged. Short-duration not-ready states are hardly visible!

Adapters Array LED States – Normal Situations



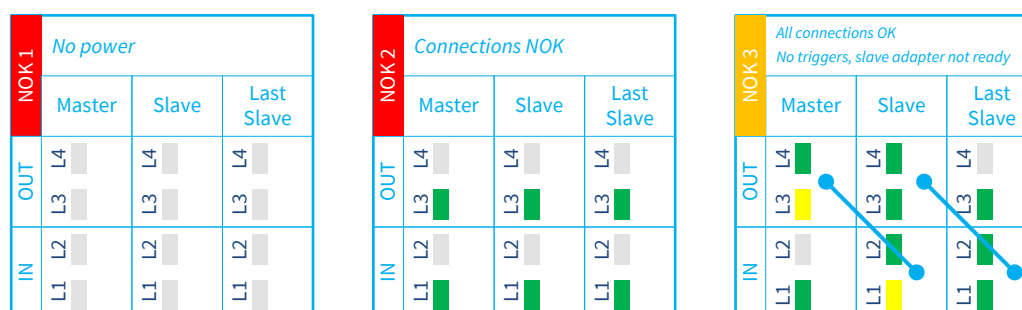
The above drawings show the LEDs states of 3 daisy-chained adapters for 3 normal situations.

In the OK 1 situation, all adapters are ready to accept triggers but no triggers are sent by the master.

In the OK 2 situation, the master adapter sends triggers and the ready signal of all adapters is permanently high. The yellow/green toggling L2 and L4 LEDs indicate the trigger activity. The steady green L1 and L3 LEDs indicate that all adapters are permanently ready to receive triggers.

In the OK 3 situation, the master adapter sends triggers and the ready signal of all adapters is cycling. The yellow/green toggling L2 and L4 LEDs indicate the trigger activity. The yellow/green toggling L1 and L3 LEDs indicate that all adapters are not ready to receive triggers for a significant duration.

Adapters Array LED States – Abnormal Situations



The above drawings show the LEDs states of 3 daisy-chained adapters for 3 abnormal situations.

In the NOK 1 situation, no adapters are powered. All LEDs are Off.

In the NOK 2 situation, all adapters are powered but all connections are missing or incorrect.

In the NOK 3 situation, all adapters are powered and all connections are OK, but the second adapter is not ready preventing the master to send new triggers. This situation is considered as abnormal when it persists.

Troubleshooting Guide

LEDs state	Indication and possible causes	Action
All LEDs Off	The adapter is not powered.	Apply power to the adapter
L2 Off L1 Green	The external connection to the IN connector is missing or incorrect.	For the master adapter, this is OK: nothing to do!

LEDs state	Indication and possible causes	Action
		For the other adapters: check and correct the connection to the OUT connector of the previous adapter in the daisy-chain.
L4 Off L3 Green	The external connection to the OUT connector is missing or incorrect.	For the last slave adapter of the daisy-chain, this is OK: nothing to do! For the other adapters: check and correct the connection to the IN connector of the next adapter in the daisy-chain.

Using PC1636 as HD26F I/O Adapter

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo and PC3623-T Coaxlink Quad CXP-12 Value.



- Plug the A-connector of the supplied 200-mm 26-way ribbon cable to the **Internal I/O** connector of the **PC1636 InterPC C2C-Link Adapter**
- Plug the B-connector to the **Internal I/O** connector of the target card.

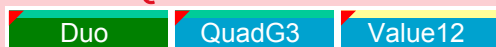
Target cards where the PC1636 InterPC C2C-Link Adapter can be used for the standard I/O set #1

Compatible with PC3602-T Coaxlink Octo.



Target cards where the PC1636 InterPC C2C-Link Adapter can be used for the standard I/O set #2

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3 and PC3623-T Coaxlink Quad CXP-12 Value.



NOTE

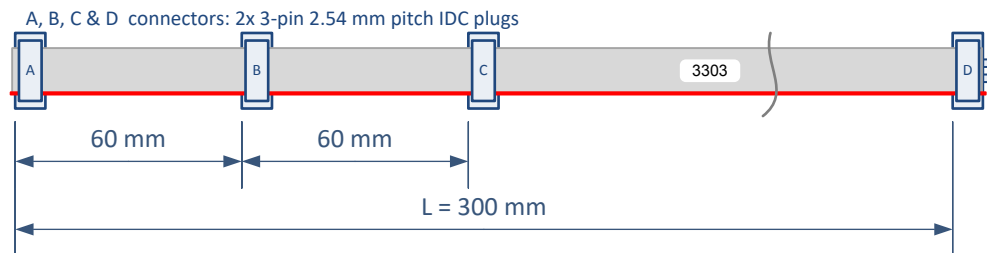
No power supply connection is required when using the **PC1636 InterPC C2C-Link Adapter** as an HD26F I/O adapter only.

4.3. PC3303 C2C-Link Ribbon Cable

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



3303 C2C-Link Ribbon Cable



PC3303 C2C-Link Ribbon Cable assembly

The **PC3303 C2C-Link Ribbon Cable** is a 6-conductor 0.05-in pitch ribbon fitted with 4 6-pin female ribbon cable connectors.

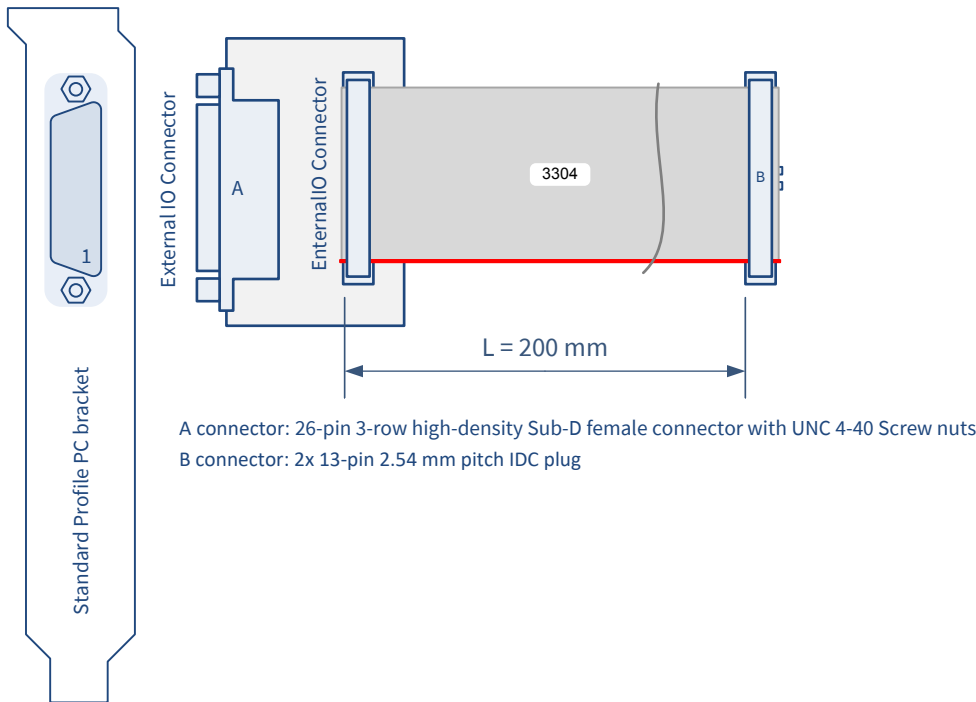
This cable is used for interconnecting the C2C-Link connectors of up to 4 cards located in the same PC.

4.4. PC3304 HD26F I/O Adapter Cable

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



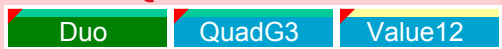
3304 HD26F I/O Adapter Cable



The **PC3304 HD26F I/O Adapter Cable** interconnects a 26-pin dual-row 0.1" pitch connector to a 26-pin 3-row female High-density SubD connector fitted into a standard-profile PC bracket.

Usage with Internal IO2 connector

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3 and PC3623-T Coaxlink Quad CXP-12 Value.



The adapter brings the second set of I/O lines and the +12 V power output to a bracket-mount SubD connector. The pins are assigned as follows:

Wire #	IDC Pin #	SubD Pin #	Signal Name	Signal Description
1	1	1	GND	Ground
2	2	10	GND	Ground

Wire #	IDC Pin #	SubD Pin #	Signal Name	Signal Description
3	3	20	DIN21+	High-speed differential input #21 – Positive pole
4	4	19	DIN21-	High-speed differential input #21 – Negative pole
5	5	2	DIN22+	High-speed differential input #22 – Positive pole
6	6	11	DIN22-	High-speed differential input #22 – Negative pole
7	7	3	IIN21+	Isolated input #21 – Positive pole
8	8	12	IIN21-	Isolated input #21 – Negative pole
9	9	13	IIN22+	Isolated input #22 – Positive pole
10	10	21	IIN22-	Isolated input #22 – Negative pole
11	11	14	IIN23+	Isolated input #23 – Positive pole
12	12	4	IIN23-	Isolated input #23 – Negative pole
13	13	15	IIN24+	Isolated input #24 – Positive pole
14	14	5	IIN24-	Isolated input #24 – Negative pole
15	15	23	IOUT21+	Isolated contact output #21 – Positive pole
16	16	22	IOUT21-	Isolated contact output #21 – Negative pole
17	17	16	IOUT22+	Isolated contact output #22 – Positive pole
18	18	6	IOUT22-	Isolated contact output #22 – Negative pole
19	19	25	TTLIO21	TTL input/output #21
20	20	24	GND	Ground (TTLIO21 return)
21	21	17	TTLIO22	TTL input/output #22
22	22	7	GND	Ground (TTLIO22 return)
23	23	8	-	Reserved
24	24	9	GND	Ground
25	25	26	+12V	+12 V Power output
26	26	18	GND	Ground (+12 V return)

Usage with Internal IO1 connector

Compatible with PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH and PC3622-T Coaxlink Duo CXP-12.



Wire #	IDC Pin #	SubD Pin #	Signal Name	Signal Description
1	1	1	GND	Ground
2	2	10	GND	Ground
3	3	20	DIN11+	High-speed differential input #11 – Positive pole
4	4	19	DIN11-	High-speed differential input #11 – Negative pole
5	5	2	DIN12+	High-speed differential input #12 – Positive pole

Wire #	IDC Pin #	SubD Pin #	Signal Name	Signal Description
6	6	11	DIN12-	High-speed differential input #12 – Negative pole
7	7	3	IIN11+	Isolated input #11 – Positive pole
8	8	12	IIN11-	Isolated input #11 – Negative pole
9	9	13	IIN12+	Isolated input #12 – Positive pole
10	10	21	IIN12-	Isolated input #12 – Negative pole
11	11	14	IIN13+	Isolated input #13 – Positive pole
12	12	4	IIN13-	Isolated input #13 – Negative pole
13	13	15	IIN14+	Isolated input #14 – Positive pole
14	14	5	IIN14-	Isolated input #14 – Negative pole
15	15	23	IOUT11+	Isolated contact output #11 – Positive pole
16	16	22	IOUT11-	Isolated contact output #11 – Negative pole
17	17	16	IOUT12+	Isolated contact output #12 – Positive pole
18	18	6	IOUT12-	Isolated contact output #12 – Negative pole
19	19	25	TTLIO11	TTL input/output #11
20	20	24	GND	Ground (TTLIO11 return)
21	21	17	TTLIO12	TTL input/output #12
22	22	7	GND	Ground (TTLIO12 return)
23	23	8	-	Reserved
24	24	9	GND	Ground
25	25	26	+12V	+12 V Power output
26	26	18	GND	Ground (+12 V return)

4.5. PC3610 HD26F I/O Extension Module - TTL-RS422 and PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422



WARNING

PC3610 HD26F I/O Extension Module - TTL-RS422 and PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422 have reached the "End Of Life" (EOL) stage in their life cycle. They are no longer sold.

Compatible with **PC1628-T Grablink Duo**, **PC3602-T Coaxlink Octo**, **PC3621-LH-T Coaxlink Mono CXP-12-LH**, **PC3622-T Coaxlink Duo CXP-12** and **PC3623-T Coaxlink Quad CXP-12 Value**.

Duo

Octo

Mono12LH

Duo12

Value12

The **PC3610 HD26F I/O Extension Module - TTL-RS422** and the **PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422** accessories are *I/O extension modules* to be used with frame grabber cards having an I/O extension connector.

These modules extend the I/O capabilities of the frame grabber with a configurable mix of 4 types of I/O ports:

- ☐ single-ended 5 V compliant TTL input
- ☐ single-ended 3.3 V LVTTTL (3610 only) or 5 V CMOS (3612 only) output
- ☐ differential RS-422 input
- ☐ differential RS-422 output



NOTE

The 3610 and the 3612 I/O extension modules are almost identical! They differ only by the electrical specification of the single-ended outputs: low-voltage 3.3 V TTL for 3610, 5 V CMOS for 3612.

These modules:

- ☐ are powered by the frame grabber through the I/O EXTENSION cable.
- ☐ are software configurable. There are no jumpers.
- ☐ provide a persistent configuration. The last configuration is automatically restored at power-up.



WARNING

Hot plugging is not allowed!

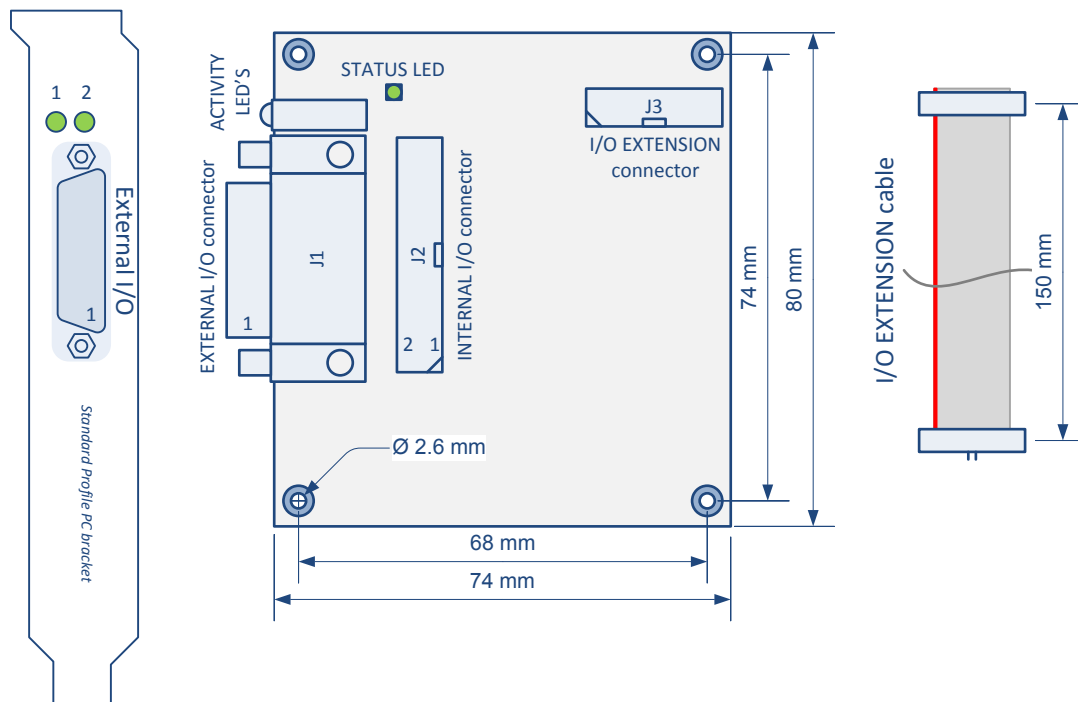


PC3610 HD26F I/O Extension Module - TTL-RS422



PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422

Module layout



Connectors

- "External I/O Connector for PC3610/PC3612" on page 270
- "I/O Extension Connector" on page 281
- "Internal I/O Connector for PC3610/PC3612" on page 276
- EXTERNAL I/O connector
 - Robust 26-pin high-density Sub-D
 - Compatible pin layout with *External I/O* connectors of **eGrabber-driven frame grabbers** for 12 V/GND and signals pairs
- INTERNAL I/O connector
 - Standard pitch 26-pin flat cable header
 - Compatible pin layout with *Internal I/O* connectors of **eGrabber-driven frame grabbers** for 12 V/GND and signals pairs
- I/O EXTENSION connector
 - Fine pitch 26-pin flat cable header fitted with the *I/O EXTENSION cable*: a 150 mm length flat cable for direct connection to the *I/O Extension* connector of compatible frame grabbers

Activity LED #1 on bracket

The ACTIVITY LED #1 is dedicated to the activity of input ports

LED State	Meaning
Green	Normal mode - Flashing indicates activity on at least one input.
Orange	Configuration mode
Red	Error - The I/O module is not (yet) controlled by the frame grabber
Off	The I/O module is not powered

Activity LED #2 on bracket

The ACTIVITY LED #2 is dedicated to the activity of output ports

LED State	Meaning
Green	Normal mode - Flashing indicates activity on at least one output.
Orange	Configuration mode
Red	Error - The I/O module is not (yet) controlled by the frame grabber
Off	The I/O module is not powered

Status LED on board

The STATUS LED is dedicated to the activity of the I/O extension bus

LED State	Meaning
Solid green	Normal mode - No activity on the bus.
Flashing green	Normal mode - Activity on the I/O extension bus.
Flashing orange	Configuration mode - Activity on the I/O extension bus.
Flashing red	Configuration mode - No activity on the I/O extension bus
Off	The I/O module is not powered

Electrical specifications

Specification Item	Product	
	PC3610 HD26F I/O Extension Module - TTL-RS422	PC3612 HD26F I/O Extension Module - TTL-CMOS5V-RS422
Differential I/O	"Differential Input/Output" on page 301	
Single-ended I/O	"TTL Input/Output (Version 2)" on page 303	"TTL Input/5 V CMOS Output" on page 306
Power output	"I/O Power Output" on page 296	
Power consumption	< 5 W	

I/O configuration capabilities and constraints

Group	Single-ended I/O			Differential		
	I/O#	Input	Output	I/O#	Input	Output
Group #1	MIO1	2 x TTL in	2 x TTL out	MIO1	4 x RS-422 in	4 x RS-422 out
	MIO2					
	MIO3	2 x TTL in	2 x TTL out	MIO3		
	MIO4					
	MIO5	2 x TTL in	2 x TTL out	MIO5		
	MIO6					
	MIO7	2 x TTL in	2 x TTL out	MIO7		
	MIO8					
Group #2	MIO9	2 x TTL in	2 x TTL out	MIO9	4 x RS-422 in	4 x RS-422 out
	MIO10					
	MIO11	2 x TTL in	2 x TTL out	MIO11		
	MIO12					
	MIO13	2 x TTL in	2 x TTL out	MIO13		
	MIO14					
	MIO15	2 x TTL in	2 x TTL out	MIO15		
	MIO16					
Group #3	MIO17	2 x TTL in	2 x TTL out	MIO17	2 x RS-422 in	2 x RS-422 out
	MIO18					
	MIO19	2 x TTL in	2 x TTL out	MIO19		
	MIO20					

The 20 I/O ports are configurable by group. There are 3 groups:

- The group #1 contains **8 single-ended I/O ports** named MIO1 to MIO8 *OR* **4 differential I/O ports** MIO1, MIO3, MIO5, MIO7.
- The group #2 contains **8 single-ended I/O ports** named MIO9 to MIO16 *OR* **4 differential I/O ports** MIO9, MIO11, MIO13, MIO15.
- The group #3 contains **4 single-ended I/O ports** named MIO17 to MIO20 *OR* **2 differential I/O ports** MIO17 and MIO19.

Within a group, it is allowed to set *all* the I/O ports:

- for **differential input** operation *OR* ...
- for **differential output** operation *OR* ...
- for **single-ended** operation.

When the group is set for **single-ended** operation, it is allowed to set **each pair** of single-ended I/O:

- for input operation *OR* ...
- for output operation.



TIP

The configuration is saved into a non-volatile memory on the I/O module.
The configuration is automatically restored after applying power.

Software configuration

The **IOExtensionModule** category of the Interface module provides a set of features to configure the 3610/3612 I/O extension modules:

- **IOExtensionModuleConfiguration** to enter/leave configuration mode
- **IOExtensionModuleLineSelector** to select a MIO to configure
- **IOExtensionModuleLineFormat**, **IOExtensionModuleLineMode** and **IOExtensionModuleLineStatus** to configure the selected MIO
- **IOExtensionModuleLineToRepair** and **IOExtensionModuleErrorCount** to help troubleshoot an invalid current configuration.

Configuration procedure

1. Select an Interface module
2. Enter the configuration mode: set **IOExtensionModuleConfiguration** to **Begin**
3. Select the I/O line to configure: set **IOExtensionModuleLineSelector** to the desired value (**MIO1** to **MIO20**)
4. Select the single-ended or differential I/O line format
 - For a single-ended I/O, set **IOExtensionModuleLineFormat** to **TTL**
 - For a differential I/O, set **IOExtensionModuleLineFormat** to **DIFF**
5. Select the input or output I/O line mode:
 - For an input, set **IOExtensionModuleLineMode** to **Input**
 - For an output, set **IOExtensionModuleLineMode** to **Output**
6. Repeat from steps 3 for all I/O's to configure
7. Verify the validity of the configuration
 - Get the value of **IOExtensionModuleErrorCount**
 - If 0, the configuration is OK, proceed to next step
 - If greater than 0, the configuration is NOK, proceed to step 9
8. Record the configuration
 - Set **IOExtensionModuleConfiguration** to **Commit**
 - The procedure is complete!
9. Repair the configuration
 - Get the value of **IOExtensionModuleLineToRepair**
 - Read "[I/O configuration capabilities and constraints](#)" on page 342 to determine why the indicated MIO doesn't satisfy the configuration constraints.
 - Adapt the configuration of one (or more) I/O's accordingly by proceeding from step 3 .

GenApi Features

The `IOExtensionModuleInformation` category of the Interface module provides information details.

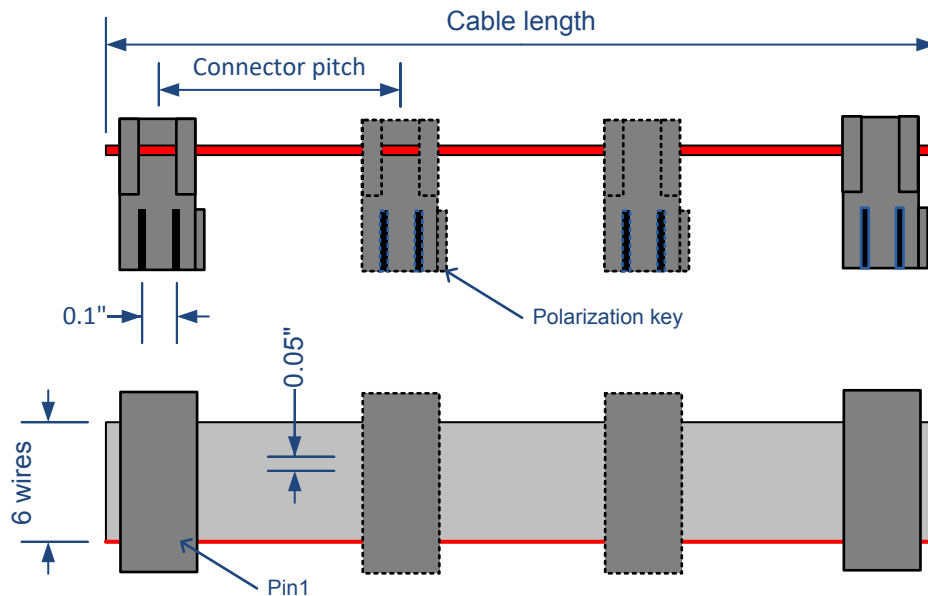
- `IOExtensionModuleSerialNumber`
- `IOExtensionModulePartNumber`
- `OExtensionModuleProductCode`
- `IOExtensionModuleRevision`
- `IOExtensionModuleVariant`

4.6. Custom C2C-Link Ribbon Cable Assembly

Compatible with PC1628-T Grablink Duo, PC1633-T Coaxlink Quad G3, PC3602-T Coaxlink Octo, PC3621-LH-T Coaxlink Mono CXP-12-LH, PC3622-T Coaxlink Duo CXP-12 and PC3623-T Coaxlink Quad CXP-12 Value.



Assembly instructions of a custom-made IntraPC C2C-Link interconnection.



Custom C2C-Link Ribbon Cable Assembly

The cable assembly is composed with:

- A piece of a 6-conductor 0.05-in pitch ribbon cable. For instance: *Belden's (9L280XX Series)*.
- Two or more pieces of a 2 x 3-pin female ribbon cable connectors. For instance: *TE connectivity 1-1658528-1*.

The cable assembly has:

- A maximum of **8** connectors allowing up to **8** cards to share the same C2C-Link.
- A maximum length of **120 cm**.



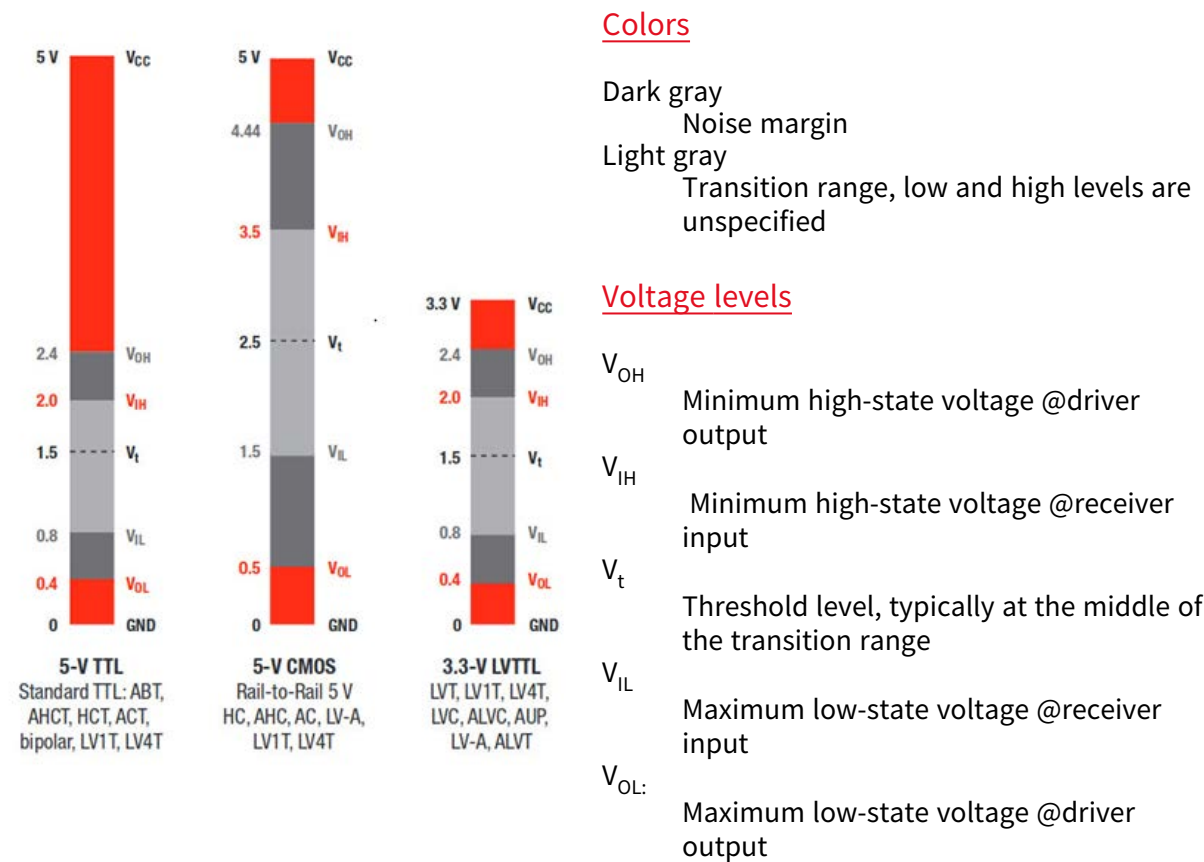
NOTE

The connector pitch(es) must be determined according to the actual card to card spacing in the Host PC.

5. Appendix

- 5.1. TTL, 5 V CMOS and LVTTTL Levels 348
- 5.2. Using Isolated Inputs 349
- 5.3. Connecting TTL Devices to Isolated I/O Ports 353
 - TTL And LVTTTL Voltage Levels 354
 - Connecting TTL Devices to Isolated Input Ports 356
 - Connecting TTL Devices to Isolated Output Ports 358
- 5.4. Avoid Mixing Power Supply Cables 364

5.1. TTL, 5 V CMOS and LVTTL Levels



5.2. Using Isolated Inputs

Unless specified explicitly, this application note applies to all versions of isolated inputs:

- [Isolated Input \(Version 1\)](#) a.k.a 50 kHz
- ["Isolated Input \(Version 2\)" on page 308](#) a.k.a 200 kHz
- [Isolated Input \(Version 3\)](#) a.k.a 400 kHz
- [Isolated Input \(Version 4\)](#) a.k.a 50 kHz

Compatible drivers

The following drivers are compatible with isolated inputs:

- Totem-pole LVTTTL, TTL, 5 V CMOS drivers (Versions 1 and 4)
- Totem-pole (push-pull) HTL drivers, 5 V CMOS drivers (Versions 2 and 3)
- RS-422 Differential line drivers
- Potential free contact, solid-state relay, or opto-isolators
- 12 V and 24 V signaling voltages are also accepted



NOTE

- The +12 V power supply on the I/O connector(s) can be used for powering drivers requiring a power supply.
- No external resistors are required. However, to obtain a *higher switching threshold* with 12 V and 24 V signaling, it is recommended to insert a series resistor in the circuit.

The recommended resistor values for versions 1, 3 and 4 are:

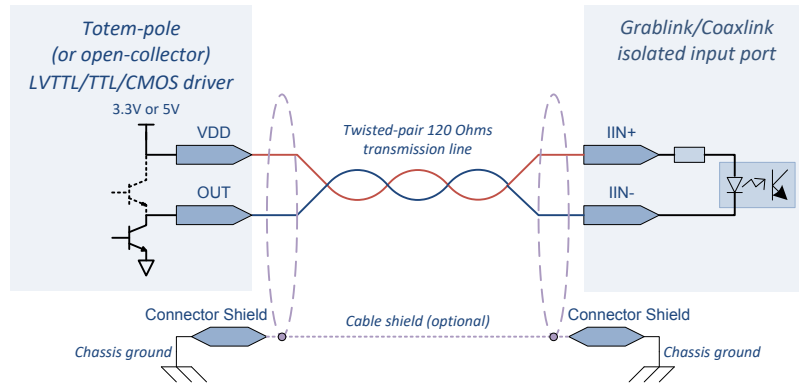
- 4.7k Ohms for 12 V signaling
- 10k Ohms for 24 V signaling

The recommended resistor values for version 2 are:

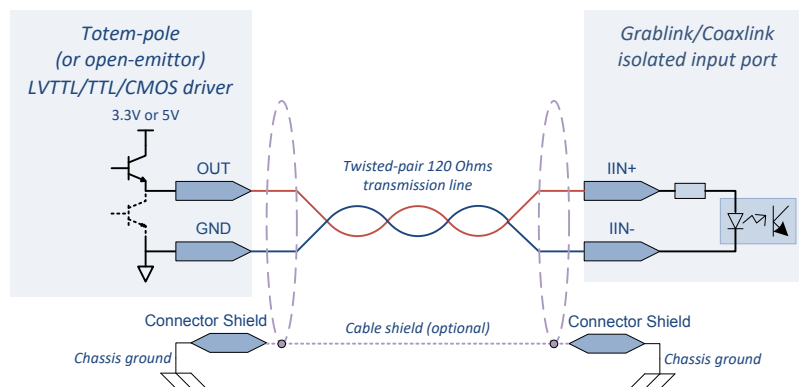
- 2k Ohms for 12 V signaling
- 4.7k Ohms for 24 V signaling

Electrical circuit examples for 3.3V or 5V logic drivers

The following figure shows the wiring diagram for a system device using *totem-pole (or open-collector)* 3.3V low-voltage TTL, 5V TTL, or 5V CMOS drivers. With this circuit diagram, the highest transistor of the totem-pole driver is useless.

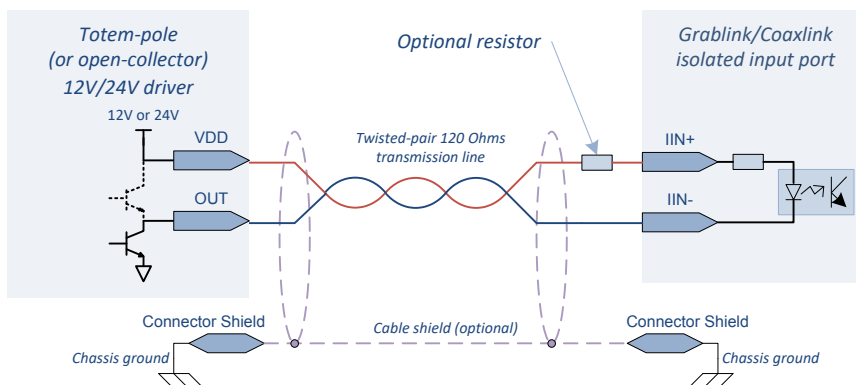


The following figure shows the wiring diagram for a system device using *totem-pole (or open-emitter)* 3.3V low-voltage TTL, 5V TTL, or 5V CMOS drivers. With this circuit diagram, the lowest transistor of the totem-pole driver is useless.

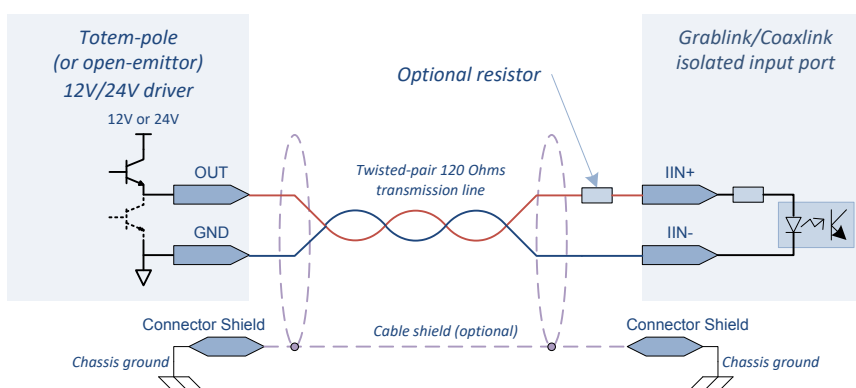


Electrical circuit examples for 12V or 24V logic drivers

The following figure shows the wiring diagram for a system device using *totem-pole (or open-collector)* 12V, or 24V CMOS drivers. With this circuit diagram, the highest transistor of the totem-pole driver is useless.



The following figure shows the wiring diagram for a system device using *totem-pole (or open-emitter)* 12V, or 24V CMOS drivers. With this circuit diagram, the lowest transistor of the totem-pole driver is useless.



NOTE

For the two above circuits:

No external resistors are required. However, to obtain a *higher switching threshold* with 12 V and 24 V signaling, it is recommended to insert a series resistor in the circuit.

The recommended resistor values for versions 1, 3 and 4 are:

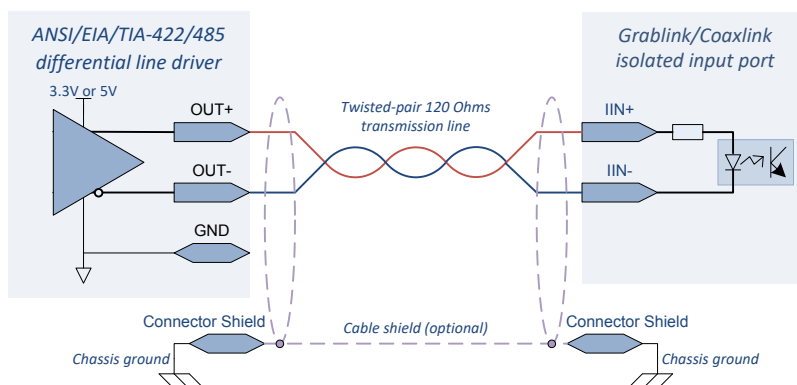
- 4.7k Ohms for 12 V signaling
- 10k Ohms for 24 V signaling

The recommended resistor values for version 2 are:

- 2k Ohms for 12 V signaling
- 4.7k Ohms for 24 V signaling

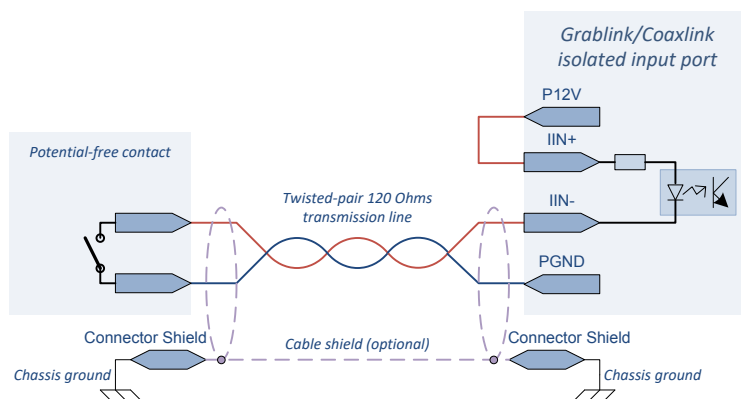
Electrical circuit example for RS-422 differential logic drivers

The following figure shows an alternate wiring diagram for a system device using *RS-422 differential drivers*. This alternate solution has to be used when no more high-speed differential input ports are available and when the pulse width of the transmitted signals exceeds or equal 5 microseconds.



Electrical circuit example for potential-free contact

The following figure shows the wiring diagram for a system device using potential-free contacts. In this circuit, the current is supplied by the board.

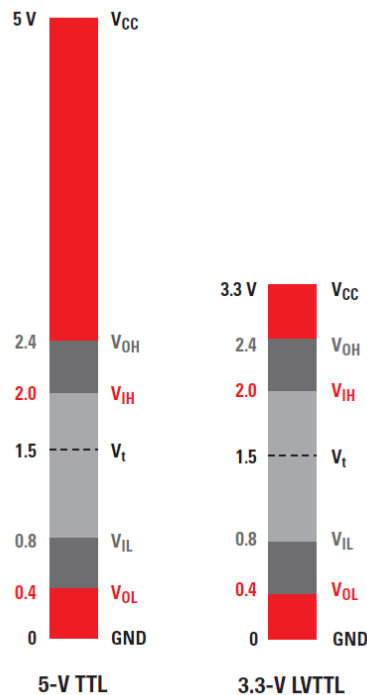


5.3. Connecting TTL Devices to Isolated I/O Ports

This application note explains how to connect TTL devices to the isolated inputs and isolated outputs.

TTL And LVTTTL Voltage Levels	354
Connecting TTL Devices to Isolated Input Ports	356
Connecting TTL Devices to Isolated Output Ports	358

TTL And LVTTL Voltage Levels



The figure above shows the respective voltage levels of a TTL and a LVTTL signaling interfaces using colored bars.

Driver output

At the *low logic level*, the driver guarantees an output voltage within the *bottom red window*.

- The maximum driver output voltage, namely V_{OL} is 0.4 V for both TTL and LVTTL.
- The minimum driver output voltage is GND

At the *high logic level*, the driver output voltage is within the *upper red window*.

- The minimum driver output voltage, namely V_{OH} is 2.4 V for both TTL and LVTTL.
- The maximum driver output voltage is V_{CC} : 5 V for TTL and 3.3 V for LVTTL

Receiver input

The receiver guarantees to see a *low logic level* when the input signal voltage is within the *bottom red and dark gray windows*.

- The maximum receiver input voltage, namely V_{IL} is 0.8 V for both TTL and LVTTL.
- The minimum receiver input voltage is GND

The receiver guarantees to see a *high logic level* when the input signal voltage is within the *upper red and dark gray windows*.

- The minimum receiver input voltage, namely V_{IH} is 2.0 V for both TTL and LVTTL.

- The maximum receiver input voltage is VCC: 5 V for TTL and 3.3 V for LVTTTL



NOTE

The dark gray window is a 0.4 V noise margin between the driver output and the receiver input.



WARNING

The light gray window is an area where the receiver cannot guarantee the logic level.

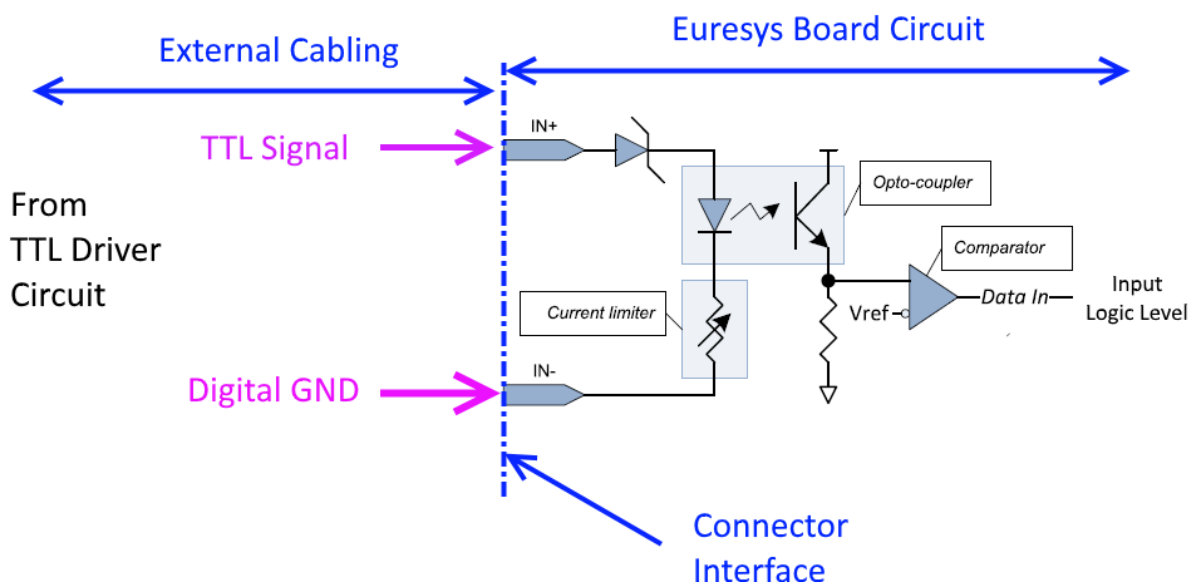
Typically the actual transition V_t between logic level low and high will occur at around 1.5 V but the actual V_t level may change a lot according to specimens or process (P) variations, actual Vcc supply voltage (V), and temperature (T). Only V_{IL} and V_{IH} are guaranteed over P,V,T variations.

Connecting TTL Devices to Isolated Input Ports

Interfacing a device with a TTL or LVTTTL output driver using an isolated input port

The isolated input ports of Coaxlink and Grablink 3G products are, by design, compatible with TTL and LVTTTL levels. No additional adapter is required to interconnect a (LV)TTL driver and an isolated input. The following section describes in detail how to connect them, what are the static voltage margins and what are the dynamic limitations.

Wiring diagram



Connecting an (LV)TTL driver to an isolated input

1. Connect TTL Signal to IN+
2. Connect TTL Circuit Ground (Digital GND) to IN-



TIP

As good practice, it is recommended to shield the whole set of wires, using a shielded cable. Shielding improve EMI protection against external interferences (immunity) and avoid unwanted EM emissions. The shield should be connected to the devices (PC, cameras, and systems components) chassis and should be separated from the digital GND line.

Static levels compatibility

(LV)TTL Driver Logic Level	(LV)TTL Driver Voltage Level	Isolated-Input Voltage Level	Voltage Margin	Isolated Input Logic Level
Low	0.4 V max	1.5 V max	1.1 V	Low
High	2.4 V min	1.9 V min	0.5 V	High

The above table shows that the voltage levels are well compatible and that they remains acceptable voltage margins for both TTL and LVTTTL applications.



NOTE

Note the circuit does not perform logic level inversion.



NOTE

The isolated input needs about 1 mA of current at high logic level. This is compatible with the current drive capabilities of (LV)TTL drivers at, as most (LV)TTL drivers provides +/-16 mA. Even old TTL technologies provides 4 mA min in any case.

Dynamic limitations

Isolated inputs requires a minimum pulse high of 10 μ s. The highest achievable pulse rate is 50 KHz.

Isolated inputs adds an extra delay of typically 5 μ s (10 μ s maximum).



NOTE

The delay can be sometimes ignored and sometimes not, according to the application.

For probably all the area-scan applications, such delay can be ignored, as is it very short compared to the camera cycle. For instance, such delay represents only 0.5 % of the cycle time of a super-fast 1,000 fps camera. For line-scan applications, the delay becomes significant since the camera cycle rate is much higher.

Connecting TTL Devices to Isolated Output Ports

Interfacing a device with a TTL or LVTTTL receiver using an isolated output port

Power must be provided to the opto-coupler transistor in order to operate the circuit.

Two cases are considered:

See also: "Using External Power" on page 358 when an external 5 V or 3.3 V power supply line is available and can be carried to the opto-coupler(s) V_{out+} pin(s).

See also: "Using Local 12 V Power" on page 361 when the power is taken from the board itself, namely through the +12 V power line connector pin.

Using External Power

The power supply voltage is not taken from the board but comes from the "external" system. A 3.3 V or also 5 V power supply can be considered, as most LVTTTL input receiver circuits support 5 V levels at their inputs. The power supply line must be carried through the cable up to the OUT+ pin of the opto-coupler.

In this case the voltage rail is called V_{CC} , as the voltage could be the same as the TTL receiver V_{CC} pin.

This circuit needs only one pull-down resistor as show in the next figure. A resistor of 180 ohm 1/8 W is suggested as best compromise but the circuit can also work within a large range of resistor values from 50 ohm 1/2 W to 10K ohm 1/16 W (1).

If an existing pull-down resistor is already available at the TTL receiver side it can be used as R resistor to operate the circuit, avoiding the need of adding an extra resistor somewhere in the cabling.

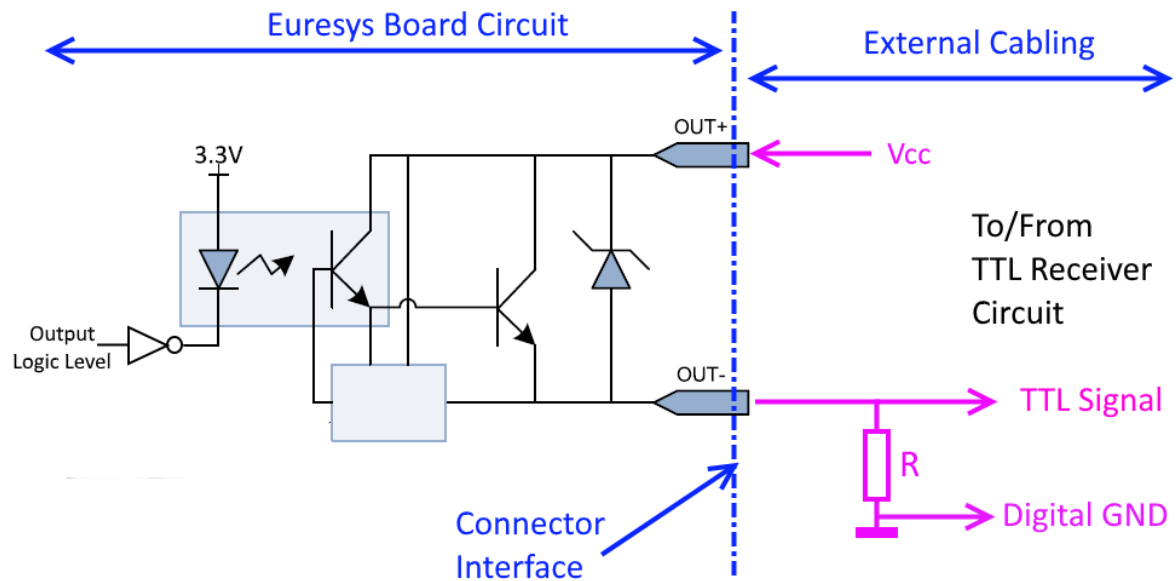
The circuit does not perform logic level inversion.



TIP

The resistor value can be also changed to match special "Static levels compatibility" on page 359 or "Dynamic limitations" on page 360 performance requirements. This topic is covered in the coming paragraphs.

Wiring diagram



Connecting an isolated output to a TTL receiver using the receiver's V_{CC} supply

See also: "GPIO Connectors" on page 263 in the hardware manual for I/O connectors pin assignments.

1. Connect OUT+ to TTL V_{CC} . Nominally, V_{CC} should be 3.3 V or 5 V.
2. Connect OUT- to the TTL input.
3. Pull-down OUT- with a resistor (R) of 180 ohm 1/8 W (or another resistor value that suits the circuit requirements).



TIP

As good practice, it is recommended to shield the whole set of wires, using a shielded cable. Shielding improve EMI protection against external interferences (immunity) and avoid unwanted EM emissions. The shield should be connected to the devices (PC, cameras, and systems components) chassis and should be separated from the digital GND line.

Static levels compatibility

The following tables show that the voltage levels are well compatible and that they remains acceptable voltage margins for both TTL and LVTTTL applications.

Voltage levels and margins in a TTL (5 V) system, $R = 180 \text{ ohm}$

Isolated Output Logic Level	Isolated Output State	Isolated Output Voltage Level	TTL Input Voltage Level	Voltage Margin	TTL Input Logic Level
High	Close	4.1 V max ⁽²⁾	2.0 V min	2.1 V	High
Low	Open	0.36 V max ⁽¹⁾	0.8 V max	0.44 V	Low

Voltage levels and margins in a LVTTTL (3.3 V) system, $R = 180 \text{ ohm}$

Isolated Output Logic Level	Isolated Output State	Isolated Output Voltage Level	TTL Input Voltage Level	Voltage Margin	TTL Input Logic Level
High	Close	2.4 V min ⁽²⁾	2.0 V min	0.4 V	High
Low	Open	0.36 V max ⁽¹⁾	0.8 V max	0.44 V	Low

See also: "Isolated Output" on page 311 for voltage levels of isolated outputs.



NOTE

(1) 0.36 V is obtained considering a worst-case external (pull-up) load of 2 mA ($180 \text{ ohm} \times 2 \text{ mA} = 0.36 \text{ V}$), which means that the circuit can support the presence of an external pull-up resistor up to a (minimum) value of 1K5 ohm (in 3.3 V) or 2K4 ohm (in 5 V). If needed, an other R value can be chosen according to the actual pull-up load within the circuit.



NOTE

(2) In any case, the voltage drop across the opto-coupler pins ($V_{\text{OUT}}^+ - V_{\text{OUT}}^-$) is lower than 0.9 V. Which gives the following results: $3.3 \text{ V} - 0.9 \text{ V} = 2.4 \text{ V}$; $5 \text{ V} - 0.9 \text{ V} = 4.1 \text{ V}$.

Dynamic limitations

The maximum pulse width of isolated outputs is about 5 μs and the maximum pulse rate is 100 KHz,

Isolated outputs add an extra delay of about 5 μs in the signal propagation.

The resistor value of $R = 180 \text{ ohm}$ has good dynamic results for a usual capacitive loads as 1 or 2 meters of cable. As example, a 2m cable will add 100 pF of load (50pF/m) which give a rise time of about $18 \text{ }\mu\text{s}$ at 180 ohm ($R \times C = 180 \text{ ohm} \times 100 \text{ pF} = 18 \text{ }\mu\text{s}$). If needed, the R value can be adapted to match special requirements in terms of rise time and/or capacitive load.

If maximizing the opto-coupler switching time is a concern, it is not recommended to not increase too much the value of the resistor. The opto-coupler circuit behaves better (switching times) with a load of about 10 mA or higher. $R = 180 \text{ ohm}$ loads the opto-coupler at 13 mA (3.3 V) and 23 mA (5 V).

Using Local 12 V Power

The power supply voltage is taken from the I/O connector itself, using the power supply pin “+12V”.

This circuit needs two resistors, named R and R_{POL} .

A resistor of 180 ohm 1/8 W is suggested for R, as best compromise but the circuit can also work within a large range of resistor values from 50 ohm 1/2 W to 10K ohm 1/16 W (1).

A resistor of 560 ohm 1/4 W is suggested for R_{POL} , as best companion of $R = 180 \text{ ohm}$ but the value of R_{POL} can be adapted to match accordingly others R values.

If an existing pull-down resistor is already available at the TTL receiver side it can be used as R resistor to operate the circuit, avoiding the need of adding an extra resistor somewhere in the cabling.

The circuit does not perform logic level inversion.



TIP

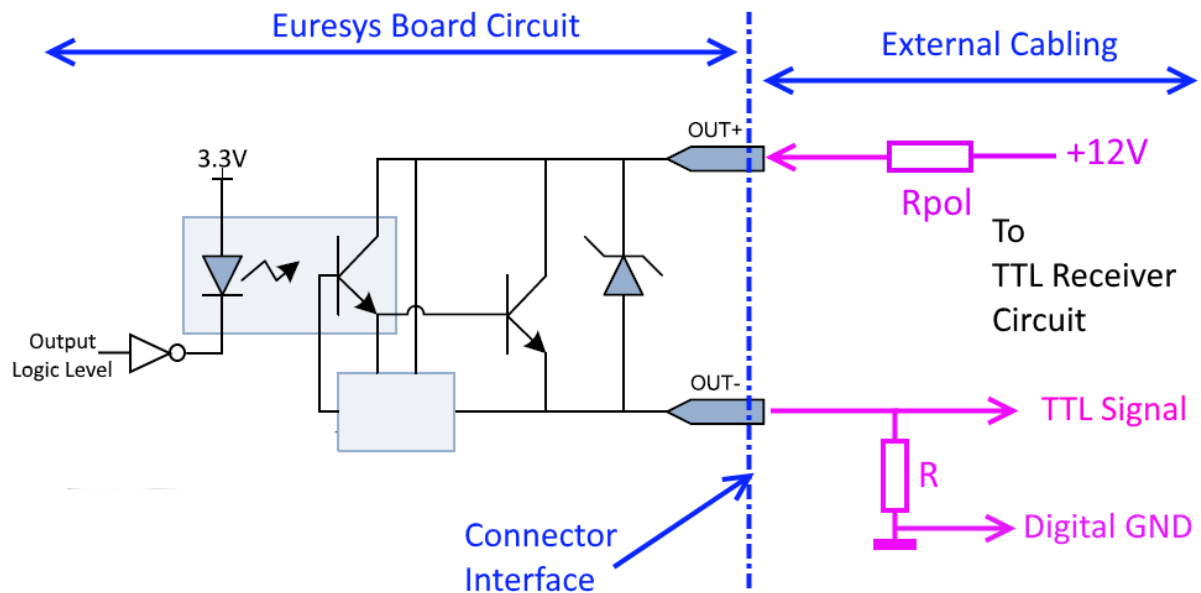
The resistor value can be also changed to match special static or dynamic performance requirements.



NOTE

The circuit does not perform logic level inversion.

Wiring diagram



See also: "GPIO Connectors" on page 263 in the hardware manual for I/O connectors pin assignments.

1. Connect "OUT+" to "+12V" through a resistor (R_{POL}) of 560 ohm 1/4 W (or another resistor value that suits the circuit requirements).
2. Connect "OUT-" to the TTL input.
3. Pull-down "OUT-" with a resistor (R) of 180 ohm 1/8 W (or another resistor value that suits the circuit requirements).

Static levels compatibility

The following table shows that the voltage levels are well compatible and that they remains acceptable voltage margins for both TTL and LVTTTL applications.

Voltage levels and margins, $R_{pol} = 560$ ohm 1/4 W, $R = 180$ ohm 1/8 W.

Isolated Output Logic Level	Isolated Output State	Isolated Output Voltage Level	TTL Input Voltage Level	Voltage Margin	TTL Input Logic Level
High	Close	2.7 V max ⁽²⁾	2.0 V min	0.7 V	High
Low	Open	0.36 V max ⁽¹⁾	0.8 V max	0.44 V	Low

See also: "Isolated Output" on page 311 for voltage levels of isolated outputs.



NOTE

(1) 0.36 V is obtained considering a worst-case external (pull-up) load of 2 mA ($180 \text{ ohm} \times 2 \text{ mA} = 0.36 \text{ V}$), which means that the circuit can support the presence of an external pull-up resistor up to a (minimum) value of 1K5 ohm (in 3.3 V) or 2K4 ohm (in 5 V). If needed, an other R value can be chosen according to the actual pull-up load within the circuit.



NOTE

(2) R_{POL} limits the Voh voltage to about 2.7 V in order to match TTL and LVTTTL levels.

2.7 V is obtained considering the R_{POL} -R 560 ohm-180 ohm divider and taking into account that the voltage drop across the opto-coupler pins ($V_{OUT}^{+} - V_{OUT}^{-}$) is about 0.9 V.

Dynamic limitations

The maximum pulse width of isolated outputs is about 5 μs and the maximum pulse rate is 100 KHz,

Isolated outputs add an extra delay of about 5 μs in the signal propagation.

The resistor value of $R = 180 \text{ ohm}$ has good dynamic results for a usual capacitive loads as 1 or 2 meters of cable. As example, a 2m cable will add 100 pF of load (50pF/m) which give a rise time of about 18 μs at 180 ohm ($R \times C = 180 \text{ ohm} \times 100 \text{ pF} = 18 \mu\text{s}$). If needed, the R value can be adapted to match special requirements in terms of rise time and/or capacitive load.

If maximizing the opto-coupler switching time is a concern, it is not recommended to not increase too much the value of the resistor. The opto-coupler circuit behaves better (switching times) with a load of about 10 mA or higher. $R = 180 \text{ ohm}$ loads the opto-coupler at 13 mA (3.3 V) and 23 mA (5 V).

5.4. Avoid Mixing Power Supply Cables



WARNING

Don't mix PSU cables between PSU models!

Modular power supply units — PSU

Nowadays, power supply units are modular or semi-modular: all or some-of the power cables are removable for cleaner cable management. Additionally, all cables become black!



Example of a semi modular PSU and some removable cables

Power connectors pin layout

Power connectors are standardized on the device side (ATX mother board, PCIe Graphic Connector (PEG), SATA memory drives, "Molex", etc.).



WARNING

Unfortunately, power connectors are NOT standardized on the power supply unit side!

PART III

GENAPI FEATURES

1. Grablink System Module Register Description

Categorized features list of System module version 25_12_1

- 1.1. Root Category 367
- 1.2. SystemInformation Category 371
- 1.3. InterfaceEnumeration Category 381
- 1.4. ConfigurationFile Category 385
- 1.5. GenApi Category 389
- 1.6. System Category 391

1.1. Root Category

SystemInformation	368
InterfaceEnumeration	369
ConfigurationFile	370

SystemInformation

Feature Info

Module	Category Path	Type	Access
System	Root	Category	

Category Members

See also: ["SystemInformation Category" on page 371](#)

InterfaceEnumeration

Feature Info

Module	Category Path	Type	Access
System	Root	Category	

Category Members

See also: ["InterfaceEnumeration Category" on page 381](#)

ConfigurationFile

Feature Info

Module	Category Path	Type	Access
System	Root	Category	

Category Members

See also: ["ConfigurationFile Category" on page 385](#)

1.2. SystemInformation Category

TLVendorName	372
TLModelName	373
TLID	374
TLVersion	375
TLPath	376
TLType	377
GenTLVersionMajor	378
GenTLVersionMinor	379
LicenseStatus	380

TLVendorName

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	String	Imposed: RO

Short Description

Name of the GenTL Producer vendor.

TLModelName

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	String	Imposed: RO

Short Description

Name of the GenTL Producer.

TLID

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	String	Imposed: RO

Short Description

Unique identifier of the GenTL.

TLVersion

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	String	Imposed: RO

Short Description

Vendor specific version string.

TLPath

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	String	Imposed: RO

Short Description

Full path to the GenTL Producer driver including name and extension.

TLType

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	Enumeration	Imposed: RO

Short Description

Identifies the transport layer technology of the GenTL Producer implementation.

Enumeration Values

- **CL**: This enumeration value indicates Camera Link transport layer technology.

GenTLVersionMajor

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	IntReg	RO

Register Port: TLPort

Short Description

Major version number of the GenTL specification the GenTL Producer implementation complies with.

GenTLVersionMinor

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	IntReg	RO

Register Port: TLPort

Short Description

Minor version number of the GenTL specification the GenTL Producer implementation complies with.

LicenseStatus

Feature Info

Module	Category Path	Type	Access
System	Root → SystemInformation	Enumeration	Imposed: RO

Short Description

Grablink License Status.

Enumeration Values

- **OK**: Grablink license is OK.
- **NotOK**: Grablink license is not OK.
- **Unknown**: Grablink license status is unknown.

1.3. InterfaceEnumeration Category

InterfaceUpdateList	382
InterfaceSelector	383
InterfaceID	384

InterfaceUpdateList

Feature Info

Module	Category Path	Type	Access
System	Root → InterfaceEnumeration	Command	Imposed: WO

Short Description

Updates the internal interface list.

InterfaceSelector

Feature Info

Module	Category Path	Type	Access
System	Root → InterfaceEnumeration	Integer	

Value Info

Minimum value: 0

Short Description

Selector for the different GenTL Producer interfaces.

Selected Features

- ["InterfaceID" on page 384](#)

InterfaceID

Feature Info

Module	Category Path	Type	Access
System	Root → InterfaceEnumeration	String	Imposed: RO

Short Description

GenTL Producer wide unique identifier of the selected interface.

1.4. ConfigurationFile Category

ConfigurationFilePath	386
GenApi	387
System	388

ConfigurationFilePath

Feature Info

Module	Category Path	Type	Access
System	Root → ConfigurationFile	String	Imposed: RO

Short Description

Path to the .ini configuration file.

GenApi

Feature Info

Module	Category Path	Type	Access
System	Root → ConfigurationFile	Category	

Category Members

See also: ["GenApi Category" on page 389](#)

System

Feature Info

Module	Category Path	Type	Access
System	Root → ConfigurationFile	Category	

Category Members

See also: ["System Category" on page 391](#)

1.5. GenApi Category

GenApiMathParserMode 390

GenApiMathParserMode

Feature Info

Module	Category Path	Type	Access
System	Root → ConfigurationFile → GenApi	String	Imposed: RO

Short Description

Behavior of GenApi SwissKnife parser ([Genapi]/MathParserMode).

1.6. System Category

SystemInterfaceOrder 392

SystemInterfaceOrder

Feature Info

Module	Category Path	Type	Access
System	Root → ConfigurationFile → System	String	Imposed: RO

Short Description

Ordering used to list interfaces ([System]/InterfaceOrder).

2. Grablink Interface Module Register Description

Categorized features list of Interface module version 25_12_1

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2.2. InterfaceInformation Category	409
2.3. DeviceEnumeration Category	420
2.4. DigitalIOControl Category	431
2.5. IOExtensionModule Category	448
2.6. IOExtensionModuleInformation Category	459
2.7. UserOutputRegister Category	465
2.8. IOToolbox Category	478
2.9. PCIExpress Category	485
2.10. InterfaceControl Category	506
2.11. InterfaceDetails Category	523
2.12. CameraLink Category	535
2.13. LineInputTool Category	542
2.14. MultiplierDividerTool Category	548
2.15. QuadratureDecoderTool Category	558
2.16. DividerTool Category	567
2.17. DelayTool Category	575
2.18. C2CLinkSynchronizationTool Category	585
2.19. EventControl Category	592
2.20. OemSafetyKey Category	610
2.21. CustomLogic Category	616
2.22. OnboardMemory Category	619

2.1. Root Category

InterfaceInformation	395
DeviceEnumeration	396
CameraLink	397
DigitalIOControl	398
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UserOutputRegister	400
IOToolbox	401
PCIExpress	402
InterfaceControl	403
InterfaceDetails	404
EventControl	405
OemSafetyKey	406
CustomLogic	407
OnboardMemory	408

InterfaceInformation

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["InterfaceInformation Category"](#) on page 409

DeviceEnumeration

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["DeviceEnumeration Category" on page 420](#)

CameraLink

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["CameraLink Category" on page 535](#)

DigitalIOControl

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["DigitalIOControl Category" on page 431](#)

IOExtensionModule

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["IOExtensionModule Category" on page 448](#)

UserOutputRegister

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["UserOutputRegister Category" on page 465](#)

IOToolbox

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["IOToolbox Category" on page 478](#)

PCIExpress

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["PCIExpress Category" on page 485](#)

InterfaceControl

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["InterfaceControl Category" on page 506](#)

InterfaceDetails

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["InterfaceDetails Category" on page 523](#)

EventControl

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["EventControl Category" on page 592](#)

OemSafetyKey

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["OemSafetyKey Category" on page 610](#)

CustomLogic

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["CustomLogic Category" on page 616](#)

OnboardMemory

Feature Info

Module	Category Path	Type	Access
Interface	Root	Category	

Category Members

See also: ["OnboardMemory Category" on page 619](#)

2.2. InterfaceInformation Category

InterfaceID	410
InterfaceType	411
ProductCode	412
SerialNumber	413
PartNumber	414
FirmwareRevision	415
CustomFirmwareProjectID	416
FirmwareVariant	417
FirmwareStatus	418
FirmwareRecoverySwitch	419

InterfaceID

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	String	Imposed: RO

Short Description

GenTL Producer wide unique identifier of the selected interface.

InterfaceType

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	Enumeration	Imposed: RO

Short Description

Identifies the transport layer technology of the interface.

Enumeration Values

- **CL**: This enumeration value indicates Camera Link transport layer technology.

ProductCode

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	String	Imposed: RO

Short Description

Product Code.

SerialNumber

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	String	Imposed: RO

Short Description

Serial Number.

PartNumber

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	String	Imposed: RO

Short Description

Part Number.

FirmwareRevision

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	IntReg	RO

Register Port: InterfacePort

Short Description

Firmware Revision.

CustomFirmwareProjectID

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	IntSwissKnife	

Short Description

Custom Firmware Project ID.

FirmwareVariant

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	IntReg	RO

Register Port: InterfacePort

Short Description

Firmware Variant.

FirmwareStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	Enumeration	RO

Short Description

Firmware Status.

Enumeration Values

- **OK**: OK.
- **TooRecent**: Firmware is too recent.
- **TooOld**: Firmware is too old.
- **RecoveryMode**: Firmware is in recovery mode.
- **PCleGen1NotSupported**: PCIe gen 1 not supported.
- **UpdateRequired**: Firmware update is required.
- **PCleSlotPowerInsufficient**: PCIe slot power is insufficient.
- **VariantObsolete**: Firmware variant is obsolete.

FirmwareRecoverySwitch

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceInformation	Boolean	

Short Description

Position of the firmware recovery switch.

2.3. DeviceEnumeration Category

DeviceUpdateList	421
DeviceSelector	422
DeviceID	423
DeviceVendorName	424
DeviceModelName	425
DeviceAccessStatus	426
DeviceLicenseStatus	427
DeviceControlProtocol	428
GenCPSerialBaudRate	429
GenCPSerialBaudRateMaximize	430

DeviceUpdateList

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Command	Imposed: WO

Short Description

Updates the internal device list.

DeviceSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Integer	

Value Info

Minimum value: 0

Short Description

Selector for the different devices on this interface.

Selected Features

- "DeviceID" on page 423
- "DeviceVendorName" on page 424
- "DeviceModelName" on page 425
- "DeviceAccessStatus" on page 426
- "DeviceLicenseStatus" on page 427
- "DeviceControlProtocol" on page 428
- "GenCPSerialBaudRate" on page 429
- "GenCPSerialBaudRateMaximize" on page 430

DeviceID

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	String	Imposed: RO

Short Description

Interface wide unique identifier of the selected device.

DeviceVendorName

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	String	Imposed: RO

Short Description

Name of the device vendor.

DeviceModelName

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	String	Imposed: RO

Short Description

Name of the device model.

DeviceAccessStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Enumeration	Imposed: RO

Short Description

Gives the device's access status at the moment of the last execution of DeviceUpdateList.

Enumeration Values

- **Unknown**: Unknown access.
- **ReadWrite**: Available to be opened with full access.
- **ReadOnly**: Available to be opened with read-only access.
- **NoAccess**: Not reachable.
- **Busy**: Already opened by another entity.
- **OpenReadWrite**: Opened with read-write access.
- **OpenReadOnly**: Opened with read-only access.

DeviceLicenseStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Enumeration	Imposed: RO

Short Description

Device License Status.

Enumeration Values

- **OK**: Device license is OK.
- **NotOK**: Device license is not OK.
- **Unknown**: Device license status is unknown.

DeviceControlProtocol

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Enumeration	RW

Short Description

Protocol used to control the remote device upon next IFUpdateDeviceList.

Enumeration Values

- **Default:** Virtual remote device.
- **GenCP:**

GenCPSerialBaudRate

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Enumeration	RW

Short Description

Baud rate used to initialize communication with the GenCP remote device.

Enumeration Values

- **Detect:** Automatically detect baud rate of the GenCP remote device.
- **Baud9600:**
- **Baud19200:**
- **Baud38400:**
- **Baud57600:**
- **Baud115200:**
- **Baud230400:**

GenCPSerialBaudRateMaximize

Feature Info

Module	Category Path	Type	Access
Interface	Root → DeviceEnumeration	Boolean	RW

Short Description

Configure maximum baud rate supported by both the grabber and the GenCP remote device.

2.4. DigitalIOControl Category

LineSelector	432
LineFormat	435
LineMode	436
LineInverter	437
LineFilterStrength	438
LineFilterDelay	439
LineStatus	440
LineStatusAll	441
LineSource	442
LineSourceInitialOffset	446
LineSourceDivisionFactor	447

LineSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Enumeration	

Description

Selects one physical GPIO line.

Default value: **DIN11**.

Selected Features

- ["LineFormat" on page 435](#)
- ["LineMode" on page 436](#)
- ["LineInverter" on page 437](#)
- ["LineFilterStrength" on page 438](#)
- ["LineFilterDelay" on page 439](#)
- ["LineStatus" on page 440](#)
- ["LineSource" on page 442](#)
- ["LineSourceInitialOffset" on page 446](#)
- ["LineSourceDivisionFactor" on page 447](#)

Enumeration Values

- **DIN11**: Differential input 1 of Internal I/O connector 1.
- **DIN12**: Differential input 2 of Internal I/O connector 1.
- **DIN21**: Differential input 1 of Internal I/O connector 2.
- **DIN22**: Differential input 2 of Internal I/O connector 2.
- **IIN11**: Isolated input 1 of Internal I/O connector 1.
- **IIN12**: Isolated input 2 of Internal I/O connector 1.
- **IIN13**: Isolated input 3 of Internal I/O connector 1.
- **IIN14**: Isolated input 4 of Internal I/O connector 1.
- **IIN21**: Isolated input 1 of Internal I/O connector 2.
- **IIN22**: Isolated input 2 of Internal I/O connector 2.
- **IIN23**: Isolated input 3 of Internal I/O connector 2.
- **IIN24**: Isolated input 4 of Internal I/O connector 2.

- **IOUT11**: Isolated output 1 of Internal I/O connector 1.
- **IOUT12**: Isolated output 2 of Internal I/O connector 1.
- **IOUT21**: Isolated output 1 of Internal I/O connector 2.
- **IOUT22**: Isolated output 2 of Internal I/O connector 2.
- **TTLIO11**: TTL input/output 1 of Internal I/O connector 1.
- **TTLIO12**: TTL input/output 2 of Internal I/O connector 1.
- **TTLIO21**: TTL input/output 1 of Internal I/O connector 2.
- **TTLIO22**: TTL input/output 2 of Internal I/O connector 2.
- **MIO1**: Input/output 1 of I/O extension module.
- **MIO2**: Input/output 2 of I/O extension module.
- **MIO3**: Input/output 3 of I/O extension module.
- **MIO4**: Input/output 4 of I/O extension module.
- **MIO5**: Input/output 5 of I/O extension module.
- **MIO6**: Input/output 6 of I/O extension module.
- **MIO7**: Input/output 7 of I/O extension module.
- **MIO8**: Input/output 8 of I/O extension module.
- **MIO9**: Input/output 9 of I/O extension module.
- **MIO10**: Input/output 10 of I/O extension module.
- **MIO11**: Input/output 11 of I/O extension module.
- **MIO12**: Input/output 12 of I/O extension module.
- **MIO13**: Input/output 13 of I/O extension module.
- **MIO14**: Input/output 14 of I/O extension module.
- **MIO15**: Input/output 15 of I/O extension module.
- **MIO16**: Input/output 16 of I/O extension module.
- **MIO17**: Input/output 17 of I/O extension module.
- **MIO18**: Input/output 18 of I/O extension module.
- **MIO19**: Input/output 19 of I/O extension module.
- **MIO20**: Input/output 20 of I/O extension module.
- **MIO21**: Input/output 21 of I/O extension module.
- **MIO22**: Input/output 22 of I/O extension module.
- **MIO23**: Input/output 23 of I/O extension module.
- **MIO24**: Input/output 24 of I/O extension module.
- **MIO25**: Input/output 25 of I/O extension module.
- **MIO26**: Input/output 26 of I/O extension module.
- **MIO27**: Input/output 27 of I/O extension module.
- **MIO28**: Input/output 28 of I/O extension module.

- **MIO29:** Input/output 29 of I/O extension module.
- **MIO30:** Input/output 30 of I/O extension module.
- **MIO31:** Input/output 31 of I/O extension module.
- **MIO32:** Input/output 32 of I/O extension module.
- **MIO33:** Input/output 33 of I/O extension module.
- **MIO34:** Input/output 34 of I/O extension module.
- **MIO35:** Input/output 35 of I/O extension module.
- **MIO36:** Input/output 36 of I/O extension module.
- **MIO37:** Input/output 37 of I/O extension module.
- **MIO38:** Input/output 38 of I/O extension module.
- **MIO39:** Input/output 39 of I/O extension module.
- **MIO40:** Input/output 40 of I/O extension module.

LineFormat

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Enumeration	Imposed: RO

Description

Returns the electrical style of the selected physical GPIO line.

Enumeration Values

- **ISO**: The I/O line is opto-coupled.
- **DIFF**: The differential I/O line is RS-422 compliant.
- **TTL**: The singled-ended I/O line is TTL compliant.

LineMode

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Enumeration	

Description

Direction and line driver mode of the selected physical GPIO line.

Default value: **Input** for the input-capable GPIO lines; **Output** for the output-only GPIO lines.

Enumeration Values

- **Input:** Input line.
- **Output:** Output line.
- **DriveLow:** Open-collector driver capable of driving low only.
- **DriveHigh:** Open-emitter driver capable of driving high only.

LineInverter

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Boolean	RW

Description

Signal inversion of the selected input or output line.

When set to **False**, the line signal is not inverted.

When set to **True**, the line signal is inverted.



NOTE

For bidirectional GPIO lines such as the TTL input/output lines, the settings applies equally to the signal input path and the signal output path!

Default value: **False**.

LineFilterStrength

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Enumeration	RW

Description

Strength of the glitch removal filter of the selected physical GPIO line.



NOTE

This feature is only available for input-capable GPIO lines.

Default value: **Low**.

Enumeration Values

- **Lowest:** Lowest filter strength.
- **Low:** Low filter strength.
- **Medium:** Medium filter strength.
- **High:** High filter strength.
- **Highest:** Highest filter strength.
- **Custom:** Custom filter strength.

LineFilterDelay

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Float	

Value Info

Maximum value: 2097

Unit: us (microsecond)

Description

Returns the latency delay, expressed in microseconds, introduced by the glitch removal filter of the selected physical GPIO line.



NOTE

This feature is only available for input-capable GPIO lines.

LineStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Boolean	

Description

Returns the current status of the selected physical GPIO line.

When **False**, the logical state of the selected physical GPIO line is low.

When **True**, The logical state of the selected physical GPIO line is high.



NOTE

For input-capable I/O lines, the reported value is the logical state of the LineInput signal: a node in the input path of the I/O control block that is located after the Input Inverter.



NOTE

For output-only I/O lines, the reported value is the logical state of the LineOutput signal, a node in the output path of the I/O control block that is located before the Output Inverter.

LineStatusAll

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Integer	RO

Description

Returns the current state of all available GPIO line signals at time of polling in a single bit field.

Bit values:

- **0:** The logical state of the corresponding GPIO line is low.
- **1:** The logical state of the corresponding GPIO line is high.

Bit assignments:

- Bit 0: DIN11 GPIO line.
- Bit 1: DIN12 GPIO line.
- Bit 2: DIN21 GPIO line.
- Bit 3: DIN22 GPIO line.
- Bit 4: IIN11 GPIO line.
- Bit 5: IIN12 GPIO line.
- Bit 6: IIN13 GPIO line.
- Bit 7: IIN14 GPIO line.
- Bit 8: IIN21 GPIO line.
- Bit 9: IIN22 GPIO line.
- Bit 10: IIN23GPIO line.
- Bit 11: IIN24 GPIO line.
- Bit 12: IOUT11 GPIO line.
- Bit 13: IOUT12 GPIO line.
- Bit 14: IOUT21 GPIO line.
- Bit 15: IOUT22 GPIO line.
- Bit 16: TTLIO11 GPIO line.
- Bit 17: TTLIO12 GPIO line.
- Bit 18: TTLIO21 GPIO line.
- Bit 19: TTLIO22 GPIO line.
- Bit 20 ... Bit 59 : MIO1 ... MIO40 GPIO lines.

LineSource

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Enumeration	

Description

Select the internal signal sourcing the output of the selected physical GPIO line.



NOTE

This feature is only available for output-capable GPIO lines.

Enumeration Values

- **UserOutput0**: Bit 0 of user output register.
- **UserOutput1**: Bit 1 of user output register.
- **UserOutput2**: Bit 2 of user output register.
- **UserOutput3**: Bit 3 of user output register.
- **UserOutput4**: Bit 4 of user output register.
- **UserOutput5**: Bit 5 of user output register.
- **UserOutput6**: Bit 6 of user output register.
- **UserOutput7**: Bit 7 of user output register.
- **Device0Strobe**: Strobe output of device 0.
- **Device1Strobe**: Strobe output of device 1.
- **Device2Strobe**: Strobe output of device 2.
- **Device3Strobe**: Strobe output of device 3.
- **Device4Strobe**: Strobe output of device 4.
- **Device5Strobe**: Strobe output of device 5.
- **Device6Strobe**: Strobe output of device 6.
- **Device7Strobe**: Strobe output of device 7.
- **Device0CameraTrigger**: Camera trigger output of device 0.
- **Device1CameraTrigger**: Camera trigger output of device 1.
- **Device2CameraTrigger**: Camera trigger output of device 2.
- **Device3CameraTrigger**: Camera trigger output of device 3.
- **Device4CameraTrigger**: Camera trigger output of device 4.

- **Device5CameraTrigger**: Camera trigger output of device 5.
- **Device6CameraTrigger**: Camera trigger output of device 6.
- **Device7CameraTrigger**: Camera trigger output of device 7.
- **Device0Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 0.
- **Device0Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 0.
- **Device0Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 0.
- **Device0Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 0.
- **Device0Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 0.
- **Device0Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 0.
- **Device0Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 0.
- **Device0Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 0.
- **Device1Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 1.
- **Device1Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 1.
- **Device1Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 1.
- **Device1Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 1.
- **Device1Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 1.
- **Device1Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 1.
- **Device1Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 1.
- **Device1Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 1.
- **Device2Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 2.
- **Device2Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 2.
- **Device2Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 2.
- **Device2Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 2.
- **Device2Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 2.
- **Device2Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 2.
- **Device2Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 2.
- **Device2Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 2.
- **Device3Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 3.
- **Device3Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 3.
- **Device3Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 3.
- **Device3Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 3.
- **Device3Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 3.
- **Device3Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 3.
- **Device3Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 3.
- **Device3Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 3.
- **Device4Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 4.

- **Device4Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 4.
- **Device4Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 4.
- **Device4Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 4.
- **Device4Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 4.
- **Device4Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 4.
- **Device4Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 4.
- **Device4Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 4.
- **Device5Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 5.
- **Device5Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 5.
- **Device5Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 5.
- **Device5Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 5.
- **Device5Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 5.
- **Device5Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 5.
- **Device5Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 5.
- **Device5Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 5.
- **Device6Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 6.
- **Device6Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 6.
- **Device6Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 6.
- **Device6Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 6.
- **Device6Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 6.
- **Device6Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 6.
- **Device6Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 6.
- **Device6Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 6.
- **Device7Stream0StartOfCameraReadout**: Start of camera readout on stream 0 of device 7.
- **Device7Stream1StartOfCameraReadout**: Start of camera readout on stream 1 of device 7.
- **Device7Stream2StartOfCameraReadout**: Start of camera readout on stream 2 of device 7.
- **Device7Stream3StartOfCameraReadout**: Start of camera readout on stream 3 of device 7.
- **Device7Stream4StartOfCameraReadout**: Start of camera readout on stream 4 of device 7.
- **Device7Stream5StartOfCameraReadout**: Start of camera readout on stream 5 of device 7.
- **Device7Stream6StartOfCameraReadout**: Start of camera readout on stream 6 of device 7.
- **Device7Stream7StartOfCameraReadout**: Start of camera readout on stream 7 of device 7.
- **Device0ChannelXFval**: Camera Link FVAL signal from channel link X of device 0.
- **Device0ChannelXLval**: Camera Link LVAL signal from channel link X of device 0.
- **Device0ChannelXDval**: Camera Link DVAL signal from channel link X of device 0.
- **Device1ChannelXFval**: Camera Link FVAL signal from channel link X of device 1.
- **Device1ChannelXLval**: Camera Link LVAL signal from channel link X of device 1.

- **Device1ChannelXDval**: Camera Link DVAL signal from channel link X of device 1.
- **Low**: Low.
- **High**: high.

LineSourceInitialOffset

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Integer	

Value Info

Minimum value: 0

Maximum value: 7

Short Description

Offset of the first pulse to drive the selected output line.

LineSourceDivisionFactor

Feature Info

Module	Category Path	Type	Access
Interface	Root → DigitalIOControl	Integer	

Value Info

Minimum value: 1

Maximum value: 8

Short Description

Interval between each pulse sent on the selected output line. This factor should be equal to the number of output lines over which pulses are distributed.

2.5. IOExtensionModule Category

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IOExtensionModuleConfiguration

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Enumeration	Imposed: WO

Description

This feature selects the I/O extension module configuration action.



NOTE

Committing a new configuration is only possible when no conflict is detected in the current configuration (i.e. when `IOExtensionModuleErrorCount = 0`)

Enumeration Values

- **Begin**: Enter configuration mode.
- **Commit**: Commit current configuration.
- **Abort**: Cancel current configuration.

IOExtensionModuleLineSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Enumeration	

Short Description

Selects an extension module I/O line to configure.

Selected Features

- ["IOExtensionModuleLineFormat" on page 452](#)
- ["IOExtensionModuleLineMode" on page 453](#)
- ["IOExtensionModuleLineStatus" on page 454](#)

Enumeration Values

- **MIO1**: Input/output 1 of I/O extension module.
- **MIO2**: Input/output 2 of I/O extension module.
- **MIO3**: Input/output 3 of I/O extension module.
- **MIO4**: Input/output 4 of I/O extension module.
- **MIO5**: Input/output 5 of I/O extension module.
- **MIO6**: Input/output 6 of I/O extension module.
- **MIO7**: Input/output 7 of I/O extension module.
- **MIO8**: Input/output 8 of I/O extension module.
- **MIO9**: Input/output 9 of I/O extension module.
- **MIO10**: Input/output 10 of I/O extension module.
- **MIO11**: Input/output 11 of I/O extension module.
- **MIO12**: Input/output 12 of I/O extension module.
- **MIO13**: Input/output 13 of I/O extension module.
- **MIO14**: Input/output 14 of I/O extension module.
- **MIO15**: Input/output 15 of I/O extension module.
- **MIO16**: Input/output 16 of I/O extension module.
- **MIO17**: Input/output 17 of I/O extension module.
- **MIO18**: Input/output 18 of I/O extension module.
- **MIO19**: Input/output 19 of I/O extension module.

- **MIO20:** Input/output 20 of I/O extension module.
- **MIO21:** Input/output 21 of I/O extension module.
- **MIO22:** Input/output 22 of I/O extension module.
- **MIO23:** Input/output 23 of I/O extension module.
- **MIO24:** Input/output 24 of I/O extension module.
- **MIO25:** Input/output 25 of I/O extension module.
- **MIO26:** Input/output 26 of I/O extension module.
- **MIO27:** Input/output 27 of I/O extension module.
- **MIO28:** Input/output 28 of I/O extension module.
- **MIO29:** Input/output 29 of I/O extension module.
- **MIO30:** Input/output 30 of I/O extension module.
- **MIO31:** Input/output 31 of I/O extension module.
- **MIO32:** Input/output 32 of I/O extension module.
- **MIO33:** Input/output 33 of I/O extension module.
- **MIO34:** Input/output 34 of I/O extension module.
- **MIO35:** Input/output 35 of I/O extension module.
- **MIO36:** Input/output 36 of I/O extension module.
- **MIO37:** Input/output 37 of I/O extension module.
- **MIO38:** Input/output 38 of I/O extension module.
- **MIO39:** Input/output 39 of I/O extension module.
- **MIO40:** Input/output 40 of I/O extension module.

IOExtensionModuleLineFormat

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Enumeration	RW

Short Description

Electrical style of the selected I/O line.

Enumeration Values

- **DIFF**: RS-422 compliant.
- **TTL**: TTL compliant.

IOExtensionModuleLineMode

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Enumeration	RW

Short Description

Direction of the selected I/O line.

Enumeration Values

- **Input:** Input line.
- **Output:** Output line.

IOExtensionModuleLineStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Boolean	RW

Short Description

Default status of the selected output line at power up (or after leaving the configuration mode).

IOExtensionModuleLineToRepair

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Enumeration	RO

Description

This feature helps the user to solve a I/O module configuration conflict by indicating the first I/O line requiring attention.



NOTE

This feature is not available unless configuration conflicts are detected in the current configuration (i.e. when IOExtensionModuleErrorCount > 0)

Enumeration Values

- **MIO1**: Input/output 1 of I/O extension module.
- **MIO2**: Input/output 2 of I/O extension module.
- **MIO3**: Input/output 3 of I/O extension module.
- **MIO4**: Input/output 4 of I/O extension module.
- **MIO5**: Input/output 5 of I/O extension module.
- **MIO6**: Input/output 6 of I/O extension module.
- **MIO7**: Input/output 7 of I/O extension module.
- **MIO8**: Input/output 8 of I/O extension module.
- **MIO9**: Input/output 9 of I/O extension module.
- **MIO10**: Input/output 10 of I/O extension module.
- **MIO11**: Input/output 11 of I/O extension module.
- **MIO12**: Input/output 12 of I/O extension module.
- **MIO13**: Input/output 13 of I/O extension module.
- **MIO14**: Input/output 14 of I/O extension module.
- **MIO15**: Input/output 15 of I/O extension module.
- **MIO16**: Input/output 16 of I/O extension module.
- **MIO17**: Input/output 17 of I/O extension module.
- **MIO18**: Input/output 18 of I/O extension module.
- **MIO19**: Input/output 19 of I/O extension module.
- **MIO20**: Input/output 20 of I/O extension module.

- **MIO21:** Input/output 21 of I/O extension module.
- **MIO22:** Input/output 22 of I/O extension module.
- **MIO23:** Input/output 23 of I/O extension module.
- **MIO24:** Input/output 24 of I/O extension module.
- **MIO25:** Input/output 25 of I/O extension module.
- **MIO26:** Input/output 26 of I/O extension module.
- **MIO27:** Input/output 27 of I/O extension module.
- **MIO28:** Input/output 28 of I/O extension module.
- **MIO29:** Input/output 29 of I/O extension module.
- **MIO30:** Input/output 30 of I/O extension module.
- **MIO31:** Input/output 31 of I/O extension module.
- **MIO32:** Input/output 32 of I/O extension module.
- **MIO33:** Input/output 33 of I/O extension module.
- **MIO34:** Input/output 34 of I/O extension module.
- **MIO35:** Input/output 35 of I/O extension module.
- **MIO36:** Input/output 36 of I/O extension module.
- **MIO37:** Input/output 37 of I/O extension module.
- **MIO38:** Input/output 38 of I/O extension module.
- **MIO39:** Input/output 39 of I/O extension module.
- **MIO40:** Input/output 40 of I/O extension module.

IOExtensionModuleErrorCount

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Integer	Imposed: RO

Short Description

Number of I/O line configuration errors.

IOExtensionModuleInformation

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule	Category	

Category Members

See also: ["IOExtensionModuleInformation Category" on page 459](#)

2.6. IOExtensionModuleInformation Category

IOExtensionModuleProductCode	460
IOExtensionModuleSerialNumber	461
IOExtensionModulePartNumber	462
IOExtensionModuleRevision	463
IOExtensionModuleVariant	464

IOExtensionModuleProductCode

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule → IOExtensionModuleInformation	String	Imposed: RO

Short Description

I/O Extension Module Product Code.

IOExtensionModuleSerialNumber

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule → IOExtensionModuleInformation	String	Imposed: RO

Short Description

I/O Extension Module Serial Number.

IOExtensionModulePartNumber

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule → IOExtensionModuleInformation	String	Imposed: RO

Short Description

I/O Extension Module Part Number.

IOExtensionModuleRevision

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule → IOExtensionModuleInformation	IntReg	RO

Register Port: InterfacePort

Short Description

I/O Extension Module Revision.

IOExtensionModuleVariant

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOExtensionModule → IOExtensionModuleInformation	IntReg	RO

Register Port: InterfacePort

Short Description

I/O Extension Module Variant.

2.7. UserOutputRegister Category

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UserOutputValueAll

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Integer	

Value Info

Minimum value: 0

Maximum value: 255

Description

Value of all User Output Register bits as a bit-field in a single data word.

Bit values:

- 0: The value of the corresponding User Output Register bit is low.
- 1: The value of the corresponding User Output Register bit is high.

Bit assignments:

- Bit 0: Value for bit 0 of the user output register.
- Bit 1: Value for bit 1 of the user output register.
- Bit 2: Value for bit 2 of the user output register.
- Bit 3: Value for bit 3 of the user output register.
- Bit 4: Value for bit 4 of the user output register.
- Bit 5: Value for bit 5 of the user output register.
- Bit 6: Value for bit 6 of the user output register.
- Bit 7: Value for bit 7 of the user output register.

UserActions

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Integer	

Value Info

Minimum value: 0

Maximum value: 2147483647

Description

Current set of user actions (built with [AddUserAction](#)) that can be executed immediately (c.f. [ExecuteUserActions](#)) or scheduled for execution at a specific time/position (c.f. [ScheduleUserActions](#)).

AddUserAction

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Enumeration	Imposed: WO

Description

Add an action to the current set of user actions ([UserActions](#)).

Enumeration Values

- [UserEvent1](#): User Event 1.
- [UserEvent2](#): User Event 2.
- [UserEvent3](#): User Event 3.
- [UserEvent4](#): User Event 4.
- [UserOutput0_High](#): Set User Output Register bit 0 high.
- [UserOutput0_Low](#): Set User Output Register bit 0 low.
- [UserOutput0_Toggle](#): Toggle User Output Register bit 0.
- [UserOutput1_High](#): Set User Output Register bit 1 high.
- [UserOutput1_Low](#): Set User Output Register bit 1 low.
- [UserOutput1_Toggle](#): Toggle User Output Register bit 1.
- [UserOutput2_High](#): Set User Output Register bit 2 high.
- [UserOutput2_Low](#): Set User Output Register bit 2 low.
- [UserOutput2_Toggle](#): Toggle User Output Register bit 2.
- [UserOutput3_High](#): Set User Output Register bit 3 high.
- [UserOutput3_Low](#): Set User Output Register bit 3 low.
- [UserOutput3_Toggle](#): Toggle User Output Register bit 3.
- [UserOutput4_High](#): Set User Output Register bit 4 high.
- [UserOutput4_Low](#): Set User Output Register bit 4 low.
- [UserOutput4_Toggle](#): Toggle User Output Register bit 4.
- [UserOutput5_High](#): Set User Output Register bit 5 high.
- [UserOutput5_Low](#): Set User Output Register bit 5 low.
- [UserOutput5_Toggle](#): Toggle User Output Register bit 5.
- [UserOutput6_High](#): Set User Output Register bit 6 high.
- [UserOutput6_Low](#): Set User Output Register bit 6 low.

- **UserOutput6_Toggle**: Toggle User Output Register bit 6.
- **UserOutput7_High**: Set User Output Register bit 7 high.
- **UserOutput7_Low**: Set User Output Register bit 7 low.
- **UserOutput7_Toggle**: Toggle User Output Register bit 7.

ClearUserActions

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Command	Imposed: WO

Description

Clear the current set of user actions (**UserActions**).

ExecuteUserActions

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Command	Imposed: WO

Description

Immediately execute the current set of user actions (**UserActions**).

InternalTime

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	IntReg	RO

Register Port: InterfacePort

Short Description

Reports the Grablink card internal time.

UserActionsSchedulerToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Enumeration	

Short Description

Selects a User Action Scheduler Tool.

Selected Features

- ["UserActionsSchedulerReference" on page 474](#)
- ["ScheduledUserActionsPoolStatus" on page 475](#)
- ["ScheduleUserActions" on page 476](#)
- ["DiscardScheduledUserActions" on page 477](#)

Enumeration Values

- **UAS1**: User Action Scheduler Tool 1.
- **UAS2**: User Action Scheduler Tool 2.

UserActionsSchedulerReference

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Enumeration	

Description

Defines the reference used by the user action scheduler; can only be changed when `ScheduledUserActionsPoolStatus` is **Empty**.

Enumeration Values

- **InternalTime**: Grablink card internal time.
- **QDC1Position**: Quadrature Decoder Tool 1 Position.
- **QDC2Position**: Quadrature Decoder Tool 2 Position.
- **QDC3Position**: Quadrature Decoder Tool 3 Position.
- **QDC4Position**: Quadrature Decoder Tool 4 Position.

ScheduledUserActionsPoolStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Enumeration	

Description

Reports the status of the pool of scheduled user actions.

Enumeration Values

- **Empty**: The pool of scheduled user actions is empty.
- **PartiallyFilled**: The pool of scheduled user actions is partially filled.
- **AlmostFull**: The pool of scheduled user actions is almost full.

ScheduleUserActions

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Integer	Imposed: WO

Value Info

Minimum value: 0

Maximum value: 4294967295

Description

Schedule the current set of user actions ([UserActions](#)) for execution at given time/position.

DiscardScheduledUserActions

Feature Info

Module	Category Path	Type	Access
Interface	Root → UserOutputRegister	Command	Imposed: WO

Short Description

Discard all scheduled user actions.

2.8. IOToolbox Category

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LineInputTool

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox	Category	

Category Members

See also: ["LineInputTool Category" on page 542](#)

MultiplierDividerTool

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox	Category	

Category Members

See also: ["MultiplierDividerTool Category" on page 548](#)

QuadratureDecoderTool

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox	Category	

Category Members

See also: ["QuadratureDecoderTool Category" on page 558](#)

DividerTool

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox	Category	

Category Members

See also: ["DividerTool Category" on page 567](#)

DelayTool

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox	Category	

Category Members

See also: ["DelayTool Category" on page 575](#)

C2CLinkSynchronizationTool

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox	Category	

Category Members

See also: "C2CLinkSynchronizationTool Category" on page 585

2.9. PCIeExpress Category

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PCIeLinkSpeed64000MTpsSupported	500
PCIeSlotPowerLimit	501
PCIBus	502
PCIDevice	503
PCIFunction	504
PCISlot	505

PCleMaxPayloadSizeSupported

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntReg	RO

Register Port: InterfacePort

Description

Maximum payload size of PCIe TLPs (Transaction Layer Packets) that this interface can support (cf. PCIe Capability Structure offset 04h (Device Capabilities) bits 2:0).



NOTE

PCleMaxPayloadSizeSupported is the max packet payload size supported by Coaxlink for data in the direction frame grabber to PC memory.

PCleMaxPayloadSize

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntReg	RO

Register Port: InterfacePort

Description

Maximum payload size of PCIe TLPs (Transaction Layer Packets) that this interface is allowed to generate (cf. PCIe Capability Structure offset 08h (Device Control) bits 7:5).



NOTE

PCleMaxPayloadSize is the max packet payload size supported by the PC for data in the direction frame grabber to PC memory.

PCleMaxReadRequestSize

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIeExpress	IntReg	RO

Register Port: InterfacePort

Description

Maximum size of PCIe read requests that this interface is allowed to generate (cf. PCIe Capability Structure offset 08h (Device Control) bits 14:12).

PCleCapturedSlotPowerLimitValue

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntReg	RO

Register Port: InterfacePort

Short Description

Captured slot power limit value (cf. PCIe Capability Structure offset 04h (Device Capabilities) bits 25:18).

PCleCapturedSlotPowerLimitScale

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntReg	RO

Register Port: InterfacePort

Short Description

Captured slot power limit scale (cf. PCIe Capability Structure offset 04h (Device Capabilities) bits 27:26).

PCleMaxLinkSpeed

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIeExpress	Enumeration	Imposed: RO

Short Description

Maximum PCIe transfer rate supported by this interface (cf. PCIe Capability Structure offset 0Ch (Link Capabilities) bits 3:0).

Enumeration Values

- **NotAvailable**: Not available.
- **PCleLinkSpeed2500MTps**: 2.5 GT/s (PCIe Gen 1).
- **PCleLinkSpeed5000MTps**: 5.0 GT/s (PCIe Gen 2).
- **PCleLinkSpeed8000MTps**: 8.0 GT/s (PCIe Gen 3).
- **PCleLinkSpeed16000MTps**: 16.0 GT/s (PCIe Gen 4).
- **PCleLinkSpeed32000MTps**: 32.0 GT/s (PCIe Gen 5).
- **PCleLinkSpeed64000MTps**: 64.0 GT/s (PCIe Gen 6).

PCleCurrentLinkSpeed

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIeExpress	Enumeration	Imposed: RO

Short Description

Negotiated PCIe transfer rate (cf. PCIe Capability Structure offset 12h (Link Status) bits 3:0).

Enumeration Values

- **NotAvailable**: Not available.
- **PCleLinkSpeed2500MTps**: 2.5 GT/s (PCIe Gen 1).
- **PCleLinkSpeed5000MTps**: 5.0 GT/s (PCIe Gen 2).
- **PCleLinkSpeed8000MTps**: 8.0 GT/s (PCIe Gen 3).
- **PCleLinkSpeed16000MTps**: 16.0 GT/s (PCIe Gen 4).
- **PCleLinkSpeed32000MTps**: 32.0 GT/s (PCIe Gen 5).
- **PCleLinkSpeed64000MTps**: 64.0 GT/s (PCIe Gen 6).

PCleMaximumLinkWidth

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	Enumeration	Imposed: RO

Short Description

Maximum PCIe link width supported by this interface (cf. PCIe Capability Structure offset 0Ch (Link Capabilities) bits 9:4).

Enumeration Values

- **NotAvailable**: Not available.
- **x1**: 1 Lane.
- **x2**: 2 Lanes.
- **x4**: 4 Lanes.
- **x8**: 8 Lanes.
- **x12**: 12 Lanes.
- **x16**: 16 Lanes.
- **x32**: 32 Lanes.

PCleNegotiatedLinkWidth

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	Enumeration	Imposed: RO

Short Description

Negotiated PCIe link width (cf. PCIe Capability Structure offset 12h (Link Status) bits 9:4).

Enumeration Values

- **NotAvailable**: Not available.
- **x1**: 1 Lane.
- **x2**: 2 Lanes.
- **x4**: 4 Lanes.
- **x8**: 8 Lanes.
- **x12**: 12 Lanes.
- **x16**: 16 Lanes.
- **x32**: 32 Lanes.

PCleLinkSpeed2500MTpsSupported

Feature Info

Module	Category	Path	Type	Access
Interface	Root	→ PCIeExpress	Boolean	

Short Description

Reports whether this interface supports PCIe Gen 1 transfer rate (2.5 GT/s).

PCleLinkSpeed5000MTpsSupported

Feature Info

Module	Category	Path	Type	Access
Interface	Root	→ PCIeExpress	Boolean	

Short Description

Reports whether this interface supports PCIe Gen 2 transfer rate (5.0 GT/s).

PCleLinkSpeed8000MTpsSupported

Feature Info

Module	Category	Path	Type	Access
Interface	Root	→ PCIeExpress	Boolean	

Short Description

Reports whether this interface supports PCIe Gen 3 transfer rate (8.0 GT/s).

PCleLinkSpeed16000MTpsSupported

Feature Info

Module	Category	Path	Type	Access
Interface	Root	→ PCIeExpress	Boolean	

Short Description

Reports whether this interface supports PCIe Gen 4 transfer rate (16.0 GT/s).

PCleLinkSpeed32000MTpsSupported

Feature Info

Module	Category	Path	Type	Access
Interface	Root	→ PCIeExpress	Boolean	

Short Description

Reports whether this interface supports PCIe Gen 5 transfer rate (32.0 GT/s).

PCleLinkSpeed64000MTpsSupported

Feature Info

Module	Category	Path	Type	Access
Interface	Root	→ PCIeExpress	Boolean	

Short Description

Reports whether this interface supports PCIe Gen 6 transfer rate (64.0 GT/s).

PCleSlotPowerLimit

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	SwissKnife	Imposed: RO

Short Description

PCIe slot power limit in Watt.

PCIBus

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntSwissKnife	Imposed: RO

Short Description

PCI bus number.

PCIDevice

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntSwissKnife	Imposed: RO

Short Description

PCI device number.

PCIFunction

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntSwissKnife	Imposed: RO

Short Description

PCI function number.

PCISlot

Feature Info

Module	Category Path	Type	Access
Interface	Root → PCIExpress	IntSwissKnife	Imposed: RO

Short Description

PCI slot identification.

2.10. InterfaceControl Category

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FanStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Enumeration	Imposed: RO

Short Description

Fan Status.

Enumeration Values

- **OK**: Fan speed is OK.
- **NotOK**: Fan speed is not OK.

TemperatureSensorSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Enumeration	

Short Description

Temperature Sensor Selector.

Selected Features

- ["Temperature" on page 509](#)

Enumeration Values

- **Grabber**: Grabber Temperature Sensor.

Temperature

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	SwissKnife	

Description

Returns the temperature, expressed in °C measured by the selected temperature sensor.

AuxiliaryPowerInput

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Enumeration	Imposed: RO

Description

Auxiliary power input cable connection status.



NOTE

This status is valid only if a PEG-compliant power supply is attached to the Coaxlink auxiliary power input connector through a PEG-compliant power cable.

Enumeration Values

- **Unconnected:** There is no PEG-compliant power cable connected to the auxiliary power input.
- **Connected:** A PEG-compliant power cable is connected to the auxiliary power input.

AuxiliaryPower12VInput

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Enumeration	Imposed: RO

Short Description

Return the status of the 12 V Auxiliary Power Input.

Enumeration Values

- **NotOK:** The 12 V auxiliary power input is NOK.
- **OK:** The 12 V auxiliary power input is OK.

LampMode

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Enumeration	RW

Short Description

Selects the lamp mode.

Enumeration Values

- **Standard**: Default bracket lamps behavior.
- **Dark**: All bracket lamps are turned off.
- **Error**: All bracket lamps are turned off unless error conditions are detected.
- **Custom**: Bracket lamps are controlled by LampCustomValue (bitfield), each lamp can be individually switched on (orange) or off.

LampCustomValue

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Integer	

Value Info

Minimum value: 0

Maximum value: 255

Short Description

Controls the bracket lamps with a bitfield value
(LedA=0x01,LedB=0x02,LedC=0x04,LedD=0x08,LedE=0x10,LedF=0x20,LedG=0x40,LedH=0x80).

LampCustomLedA

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led A.

LampCustomLedB

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led B.

LampCustomLedC

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led C.

LampCustomLedD

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led D.

LampCustomLedE

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led E.

LampCustomLedF

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led F.

LampCustomLedG

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led G.

LampCustomLedH

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Boolean	

Short Description

Lamp Custom Led H.

InterfaceReset

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceControl	Command	Imposed: WO

Short Description

Interface Reset.

2.11. InterfaceDetails Category

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BoardCapabilities

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	StringReg	RO

Short Description

Board Capabilities.

FirmwareBoardID

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntReg	RO

Register Port: InterfacePort

Short Description

Firmware Board ID.

CPLDRevision

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	Integer	RO

Short Description

CPLD Revision.

PreviousBootBank

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntSwissKnife	

Short Description

Flash bank used during the previous power on.

NextBootBank

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntSwissKnife	

Short Description

Flash bank that will be used during the next power on.

CurrentBankSelect

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntSwissKnife	

Short Description

Current Bank Select.

CurrentBankSelectReadback

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntSwissKnife	

Short Description

Current Bank Select Readback.

NextBankSelect

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntSwissKnife	

Short Description

Next Bank Select.

SpiBankStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntReg	RO

Register Port: InterfacePort

Short Description

Spi Bank Status.

PotBankStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	IntReg	RO

Register Port: InterfacePort

Short Description

Pot Bank Status.

DriverVersion

Feature Info

Module	Category Path	Type	Access
Interface	Root → InterfaceDetails	String	RO

Short Description

Driver Version.

2.12. CameraLink Category

CIPOCIHostConnectionSelector	536
CIPOCIAuto	537
CIPOCITurnOff	538
CIPOCIConfigurationStatus	539
CIPOCIStatus	540
CIPOCIPowerInputStatus	541

ClPoClHostConnectionSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → CameraLink	Enumeration	

Short Description

Selects the Camera Link physical connection for PoCL control.

Selected Features

- ["ClPoClAuto" on page 537](#)
- ["ClPoClTurnOff" on page 538](#)
- ["ClPoClConfigurationStatus" on page 539](#)
- ["ClPoClStatus" on page 540](#)

Enumeration Values

- **All**: All Camera Link physical host connections.
- **A**: Camera Link physical host connection A.
- **B**: Camera Link physical host connection B.

ClPoClAuto

Feature Info

Module	Category Path	Type	Access
Interface	Root → CameraLink	Command	Imposed: WO

Short Description

Activate automatic control of the Power over Camera Link (PoCL).

ClPoClTurnOff

Feature Info

Module	Category Path	Type	Access
Interface	Root → CameraLink	Command	Imposed: WO

Short Description

Disable Power over Camera Link (PoCL).

ClPoClConfigurationStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → CameraLink	Enumeration	Imposed: RO

Short Description

Return Power over Camera Link (PoCL) configuration.

Enumeration Values

- **Off**: PoCL is forced off.
- **Auto**: Normal automatic PoCL operation.
- **Unknown**: PoCL configuration is unknown.
- **Compound**: PoCL configuration is compound.

ClPoClStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → CameraLink	Enumeration	Imposed: RO

Short Description

Return Power over Camera Link (PoCL) status.

Enumeration Values

- **NoCamera**: No camera detected.
- **PoClCamera**: PoCL camera detected.
- **ConventionalCamera**: Conventional non-PoCL camera detected.
- **Compound**: PoCL status is compound.

ClPoClPowerInputStatus

Feature Info

Module	Category Path	Type	Access
Interface	Root → CameraLink	Enumeration	Imposed: RO

Short Description

Return Camera Link Power Input Status.

Enumeration Values

- **NotOK:** The 12 V Power Supply is not OK.
- **OK:** The 12 V Power Supply is OK.

2.13. LineInputTool Category

LineInputToolSelector	543
LineInputToolSource	544
LineInputToolActivation	547

LineInputToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → LineInputTool	Enumeration	

Short Description

Selects a Line Input Tool.

Selected Features

- ["LineInputToolSource" on page 544](#)
- ["LineInputToolActivation" on page 547](#)

Enumeration Values

- **LIN1**: Line Input Tool 1.
- **LIN2**: Line Input Tool 2.
- **LIN3**: Line Input Tool 3.
- **LIN4**: Line Input Tool 4.
- **LIN5**: Line Input Tool 5.
- **LIN6**: Line Input Tool 6.
- **LIN7**: Line Input Tool 7.
- **LIN8**: Line Input Tool 8.

LineInputToolSource

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → LineInputTool	Enumeration	RW

Description

Physical GPIO line used as input for the selected Line Input Tool.

Default value: DIN11.

Enumeration Values

- **DIN11:** Differential input 1 of Internal I/O connector 1.
- **DIN12:** Differential input 2 of Internal I/O connector 1.
- **DIN21:** Differential input 1 of Internal I/O connector 2.
- **DIN22:** Differential input 2 of Internal I/O connector 2.
- **IIN11:** Isolated input 1 of Internal I/O connector 1.
- **IIN12:** Isolated input 2 of Internal I/O connector 1.
- **IIN13:** Isolated input 3 of Internal I/O connector 1.
- **IIN14:** Isolated input 4 of Internal I/O connector 1.
- **IIN21:** Isolated input 1 of Internal I/O connector 2.
- **IIN22:** Isolated input 2 of Internal I/O connector 2.
- **IIN23:** Isolated input 3 of Internal I/O connector 2.
- **IIN24:** Isolated input 4 of Internal I/O connector 2.
- **IOUT11:** Isolated output 1 of Internal I/O connector 1.
- **IOUT12:** Isolated output 2 of Internal I/O connector 1.
- **IOUT21:** Isolated output 1 of Internal I/O connector 2.
- **IOUT22:** Isolated output 2 of Internal I/O connector 2.
- **TTLIO11:** TTL input/output 1 of Internal I/O connector 1.
- **TTLIO12:** TTL input/output 2 of Internal I/O connector 1.
- **TTLIO21:** TTL input/output 1 of Internal I/O connector 2.
- **TTLIO22:** TTL input/output 2 of Internal I/O connector 2.
- **MIO1:** Input/output 1 of I/O extension module.
- **MIO2:** Input/output 2 of I/O extension module.
- **MIO3:** Input/output 3 of I/O extension module.

- **MIO4:** Input/output 4 of I/O extension module.
- **MIO5:** Input/output 5 of I/O extension module.
- **MIO6:** Input/output 6 of I/O extension module.
- **MIO7:** Input/output 7 of I/O extension module.
- **MIO8:** Input/output 8 of I/O extension module.
- **MIO9:** Input/output 9 of I/O extension module.
- **MIO10:** Input/output 10 of I/O extension module.
- **MIO11:** Input/output 11 of I/O extension module.
- **MIO12:** Input/output 12 of I/O extension module.
- **MIO13:** Input/output 13 of I/O extension module.
- **MIO14:** Input/output 14 of I/O extension module.
- **MIO15:** Input/output 15 of I/O extension module.
- **MIO16:** Input/output 16 of I/O extension module.
- **MIO17:** Input/output 17 of I/O extension module.
- **MIO18:** Input/output 18 of I/O extension module.
- **MIO19:** Input/output 19 of I/O extension module.
- **MIO20:** Input/output 20 of I/O extension module.
- **MIO21:** Input/output 21 of I/O extension module.
- **MIO22:** Input/output 22 of I/O extension module.
- **MIO23:** Input/output 23 of I/O extension module.
- **MIO24:** Input/output 24 of I/O extension module.
- **MIO25:** Input/output 25 of I/O extension module.
- **MIO26:** Input/output 26 of I/O extension module.
- **MIO27:** Input/output 27 of I/O extension module.
- **MIO28:** Input/output 28 of I/O extension module.
- **MIO29:** Input/output 29 of I/O extension module.
- **MIO30:** Input/output 30 of I/O extension module.
- **MIO31:** Input/output 31 of I/O extension module.
- **MIO32:** Input/output 32 of I/O extension module.
- **MIO33:** Input/output 33 of I/O extension module.
- **MIO34:** Input/output 34 of I/O extension module.
- **MIO35:** Input/output 35 of I/O extension module.
- **MIO36:** Input/output 36 of I/O extension module.
- **MIO37:** Input/output 37 of I/O extension module.
- **MIO38:** Input/output 38 of I/O extension module.
- **MIO39:** Input/output 39 of I/O extension module.

- **MIO40:** Input/output 40 of I/O extension module.

LineInputToolActivation

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → LineInputTool	Enumeration	RW

Short Description

Edge activating the output of the selected Line Input Tool.

Enumeration Values

- **RisingEdge**: Activate the output on the rising edge only.
- **FallingEdge**: Activate the output on the falling edge only.
- **AllEdges**: Activate the output on all edges.

2.14. MultiplierDividerTool Category

MultiplierDividerToolSelector	549
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MultiplierDividerToolEffectiveDivisionFactor	557

MultiplierDividerToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Enumeration	

Short Description

Selects a Multiplier/Divider Tool.

Selected Features

- ["MultiplierDividerToolSource" on page 550](#)
- ["MultiplierDividerToolOutputControl" on page 553](#)
- ["MultiplierDividerToolMultiplicationFactor" on page 554](#)
- ["MultiplierDividerToolDivisionFactor" on page 555](#)
- ["MultiplierDividerToolEffectiveMultiplicationFactor" on page 556](#)
- ["MultiplierDividerToolEffectiveDivisionFactor" on page 557](#)

Enumeration Values

- **MDV1**: Multiplier/Divider Tool 1.
- **MDV2**: Multiplier/Divider Tool 2.
- **MDV3**: Multiplier/Divider Tool 3.
- **MDV4**: Multiplier/Divider Tool 4.

MultiplierDividerToolSource

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Enumeration	

Short Description

I/O Toolbox event stream used as input for the selected Multiplier/Divider Tool.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.

- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.
- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.
- **CFW6**: When an event occurs on Custom Firmware Tool 6.

- CFW7: When an event occurs on Custom Firmware Tool 7.
- CFW8: When an event occurs on Custom Firmware Tool 8.
- CFW9: When an event occurs on Custom Firmware Tool 9.
- CFW10: When an event occurs on Custom Firmware Tool 10.
- CFW11: When an event occurs on Custom Firmware Tool 11.
- CFW12: When an event occurs on Custom Firmware Tool 12.
- CFW13: When an event occurs on Custom Firmware Tool 13.
- CFW14: When an event occurs on Custom Firmware Tool 14.
- CFW15: When an event occurs on Custom Firmware Tool 15.
- CFW16: When an event occurs on Custom Firmware Tool 16.

MultiplierDividerToolOutputControl

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Enumeration	

Short Description

Output control of the selected Multiplier/Divider Tool.

Enumeration Values

- **Enable**: Output enabled.
- **Disable**: Output disabled.

MultiplierDividerToolMultiplicationFactor

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Float	RW

Value Info

Minimum value: 0.001

Maximum value: 1000

Description

Multiplication factor of the selected Multiplier/Divider Tool.

This feature is the **numerator** of the fraction defining the Rate Conversion Ratio (RCR) of the Multiplier/Divider Tool.

$RCR = M/D$ where:

- $M = \text{MultiplierDividerToolMultiplicationFactor}$
- $D = \text{MultiplierDividerToolDivisionFactor}$

The Multiplier/Divider Tools allows defining any RCR values in the range 0.001 to 1000.0.



NOTE

The user may define RCR using any of the following methods:

- A ratio of 2 integer numbers by assigning integer values to both the numerator and the denominator.
- A single non-integer number greater or smaller than 1 assigned to the numerator leaving the denominator to the default value (1.0).
- A single non-integer number greater or smaller than 1 assigned to the denominator leaving the numerator to the default value (1.0).

Default value: 1.0.

MultiplierDividerToolDivisionFactor

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Float	RW

Value Info

Minimum value: 0.001

Maximum value: 1000

Description

Division factor of the selected Multiplier/Divider Tool.

This feature is the **denominator** of the fraction defining the Rate Conversion Ratio (RCR) of the Multiplier/Divider Tool.

$RCR = M/D$ where:

- M = MultiplierDividerToolMultiplicationFactor
- D = MultiplierDividerToolDivisionFactor

The Multiplier/Divider Tools allows defining any RCR values in the range 0.001 to 1000.0.



NOTE

The user may define RCR using any of the following methods:

- A ratio of 2 integer numbers by assigning integer values to both the numerator and the denominator.
- A single non-integer number greater or smaller than 1 assigned to the numerator leaving the denominator to the default value (1.0).
- A single non-integer number greater or smaller than 1 assigned to the denominator leaving the numerator to the default value (1.0).

Default value: 1.0.

MultiplierDividerToolEffectiveMultiplicationFactor

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Integer	RO

Description

Effective multiplication factor of the selected Multiplier/Divider Tool.

This feature is the **numerator** of the fraction defining the Effective Rate Conversion Ratio (Effective RCR) of the Multiplier/Divider Tool.

Effective RCR = Effective M/Effective D where:

- Effective M = **MultiplierDividerToolEffectiveMultiplicationFactor**
- Effective D = **MultiplierDividerToolEffectiveDivisionFactor**

MultiplierDividerToolEffectiveDivisionFactor

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → MultiplierDividerTool	Integer	RO

Description

Effective division factor of the selected Multiplier/Divider Tool.

This feature is the **denominator** of the fraction defining the Effective Rate Conversion Ratio (Effective RCR) of the Multiplier/Divider Tool.

Effective RCR = Effective M/Effective D where:

- Effective M = **MultiplierDividerToolEffectiveMultiplicationFactor**
- Effective D = **MultiplierDividerToolEffectiveDivisionFactor**

2.15. QuadratureDecoderTool Category

QuadratureDecoderToolSelector	559
QuadratureDecoderToolSources	560
QuadratureDecoderToolActivation	561
QuadratureDecoderToolForwardDirection	562
QuadratureDecoderToolOutputMode	563
QuadratureDecoderToolPosition	564
QuadratureDecoderToolDirection	565
QuadratureDecoderToolPositionReset	566

QuadratureDecoderToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Enumeration	

Short Description

Selects a Quadrature Decoder Tool.

Selected Features

- ["QuadratureDecoderToolSources" on page 560](#)
- ["QuadratureDecoderToolActivation" on page 561](#)
- ["QuadratureDecoderToolForwardDirection" on page 562](#)
- ["QuadratureDecoderToolOutputMode" on page 563](#)
- ["QuadratureDecoderToolPosition" on page 564](#)
- ["QuadratureDecoderToolDirection" on page 565](#)
- ["QuadratureDecoderToolPositionReset" on page 566](#)

Enumeration Values

- **QDC1**: Quadrature Decoder Tool 1.
- **QDC2**: Quadrature Decoder Tool 2.
- **QDC3**: Quadrature Decoder Tool 3.
- **QDC4**: Quadrature Decoder Tool 4.

QuadratureDecoderToolSources

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Enumeration	

Description

Selects the pair of physical GPIO lines used as A/B inputs for the selected Quadrature Decoder Tool.

Enumeration Values

- **DIN11_DIN12**: Differential inputs 1 and 2 of Internal I/O connector 1.
- **DIN21_DIN22**: Differential inputs 1 and 2 of Internal I/O connector 2.
- **IIN11_IIN12**: Isolated inputs 1 and 2 of Internal I/O connector 1.
- **IIN13_IIN14**: Isolated inputs 3 and 4 of Internal I/O connector 1.
- **IIN21_IIN22**: Isolated inputs 1 and 2 of Internal I/O connector 2.
- **IIN23_IIN24**: Isolated inputs 3 and 4 of Internal I/O connector 2.
- **TTLIO11_TTLIO12**: TTL inputs 1 and 2 of Internal I/O connector 1.
- **TTLIO21_TTLIO22**: TTL inputs 1 and 2 of Internal I/O connector 2.
- **MIO1_MIO3**: Inputs 1 and 3 of I/O extension module.
- **MIO5_MIO7**: Inputs 5 and 7 of I/O extension module.
- **MIO9_MIO11**: Inputs 9 and 11 of I/O extension module.
- **MIO13_MIO15**: Inputs 13 and 15 of I/O extension module.
- **MIO17_MIO19**: Inputs 17 and 19 of I/O extension module.
- **MIO21_MIO23**: Inputs 21 and 23 of I/O extension module.
- **MIO25_MIO27**: Inputs 25 and 27 of I/O extension module.
- **MIO29_MIO31**: Inputs 29 and 31 of I/O extension module.
- **MIO33_MIO35**: Inputs 33 and 35 of I/O extension module.
- **MIO37_MIO39**: Inputs 37 and 39 of I/O extension module.

QuadratureDecoderToolActivation

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Enumeration	

Description

Edge activating the output of the selected Quadrature Decoder Tool.



NOTE

The A output of the quadrature encoder device connects to the first physical GPIO line of the designated pair, e.g. DIN11.



NOTE

The B output of the quadrature encoder device connects to the second physical GPIO line of the designated pair, e.g. DIN12.

Enumeration Values

- **RisingEdgeA**: The event is activated on the rising edge of the A signal.
- **FallingEdgeA**: The event is activated on the falling edge of the A signal.
- **AllEdgesA**: The event is activated on both edges of the A signal.
- **AllEdgesAB**: The event is activated on both edges of all signals.
- **None**: The event is not activated.

QuadratureDecoderToolForwardDirection

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Enumeration	

Short Description

Selects the A/B phase relationship corresponding to the forward direction.

Enumeration Values

- **A_Leads_B**: A leads B.
- **B_Leads_A**: B leads A.

QuadratureDecoderToolOutputMode

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Enumeration	

Short Description

Selects the filtering mode of the backward motion compensator.

Enumeration Values

- **Unfiltered**: All the quadrature decoder events are delivered.
- **ForwardOnly**: Only the events corresponding to the forward motion are delivered.
- **FirstPassForwardOnly**: Only the events corresponding to the first pass in the forward direction are delivered.

QuadratureDecoderToolPosition

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	IntReg	RO

Register Port: InterfacePort

Description

Position counter value of the selected Quadrature Decoder Tool.

The position counter is a 32-bit up/down counter that increments by 1 for any event corresponding to the forward direction and decrements by 1 for the backward direction.

Unit: encoder events as defined by [QuadratureDecoderToolActivation](#).

Value range: from -2,147,483,648 up to 2,147,483,647.

QuadratureDecoderToolDirection

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Enumeration	

Short Description

Current direction of the selected Quadrature Decoder Tool.

Enumeration Values

- **Forward**: Forward.
- **Backward**: Backward.

QuadratureDecoderToolPositionReset

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → QuadratureDecoderTool	Command	Imposed: WO

Short Description

Reset Position counter of the selected Quadrature Decoder Tool.

2.16. DividerTool Category

DividerToolSelector	568
DividerToolSource	569
DividerToolEnableControl	572
DividerToolDivisionFactor	573
DividerToolInitialOffset	574

DividerToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DividerTool	Enumeration	

Short Description

Selects a Divider Tool.

Selected Features

- "DividerToolSource" on page 569
- "DividerToolEnableControl" on page 572
- "DividerToolDivisionFactor" on page 573
- "DividerToolInitialOffset" on page 574

Enumeration Values

- **DIV1**: Divider Tool 1.
- **DIV2**: Divider Tool 2.
- **DIV3**: Divider Tool 3.
- **DIV4**: Divider Tool 4.

DividerToolSource

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DividerTool	Enumeration	

Short Description

I/O Toolbox event stream used as input for the selected Divider Tool.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.

- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.
- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.
- **CFW6**: When an event occurs on Custom Firmware Tool 6.

- CFW7: When an event occurs on Custom Firmware Tool 7.
- CFW8: When an event occurs on Custom Firmware Tool 8.
- CFW9: When an event occurs on Custom Firmware Tool 9.
- CFW10: When an event occurs on Custom Firmware Tool 10.
- CFW11: When an event occurs on Custom Firmware Tool 11.
- CFW12: When an event occurs on Custom Firmware Tool 12.
- CFW13: When an event occurs on Custom Firmware Tool 13.
- CFW14: When an event occurs on Custom Firmware Tool 14.
- CFW15: When an event occurs on Custom Firmware Tool 15.
- CFW16: When an event occurs on Custom Firmware Tool 16.

DividerToolEnableControl

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DividerTool	Enumeration	

Short Description

Output control of the selected Divider Tool.

Enumeration Values

- **Enable**: Output enabled.
- **Disable**: Output disabled.

DividerToolDivisionFactor

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DividerTool	Integer	

Value Info

Minimum value: 1

Maximum value: 65535

Default value: 2

Description

Division factor of the selected Divider Tool.

This feature is the **denominator** of the fraction defining the Rate Conversion Ratio (RCR) of the Divider Tool.

RCR = 1/D where:

- D = DividerToolDivisionFactor

DividerToolInitialOffset

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DividerTool	Integer	

Value Info

Minimum value: 0

Maximum value: 65535

Description

Initial offset of the selected Divider Tool.

This feature defines the number of skipped input events after enabling the Divider tool.

2.17. DelayTool Category

DelayToolSelector	576
DelayToolSource1	577
DelayToolSource2	580
DelayToolClockSource	583
DelayToolDelayValue	584

DelayToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DelayTool	Enumeration	

Short Description

Selects a Delay Tool.

Selected Features

- "DelayToolSource1" on page 577
- "DelayToolSource2" on page 580
- "DelayToolClockSource" on page 583
- "DelayToolDelayValue" on page 584

Enumeration Values

- **DEL1**: Delay Tool 1.
- **DEL2**: Delay Tool 2.
- **DEL3**: Delay Tool 3.
- **DEL4**: Delay Tool 4.

DelayToolSource1

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DelayTool	Enumeration	

Short Description

I/O Toolbox event stream used as input 1 for the selected Delay Tool.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.

- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.
- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.
- **CFW6**: When an event occurs on Custom Firmware Tool 6.

- CFW7: When an event occurs on Custom Firmware Tool 7.
- CFW8: When an event occurs on Custom Firmware Tool 8.
- CFW9: When an event occurs on Custom Firmware Tool 9.
- CFW10: When an event occurs on Custom Firmware Tool 10.
- CFW11: When an event occurs on Custom Firmware Tool 11.
- CFW12: When an event occurs on Custom Firmware Tool 12.
- CFW13: When an event occurs on Custom Firmware Tool 13.
- CFW14: When an event occurs on Custom Firmware Tool 14.
- CFW15: When an event occurs on Custom Firmware Tool 15.
- CFW16: When an event occurs on Custom Firmware Tool 16.

DelayToolSource2

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DelayTool	Enumeration	

Short Description

I/O Toolbox event stream used as input 2 for the selected Delay Tool.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.

- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.
- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.
- **CFW6**: When an event occurs on Custom Firmware Tool 6.

- CFW7: When an event occurs on Custom Firmware Tool 7.
- CFW8: When an event occurs on Custom Firmware Tool 8.
- CFW9: When an event occurs on Custom Firmware Tool 9.
- CFW10: When an event occurs on Custom Firmware Tool 10.
- CFW11: When an event occurs on Custom Firmware Tool 11.
- CFW12: When an event occurs on Custom Firmware Tool 12.
- CFW13: When an event occurs on Custom Firmware Tool 13.
- CFW14: When an event occurs on Custom Firmware Tool 14.
- CFW15: When an event occurs on Custom Firmware Tool 15.
- CFW16: When an event occurs on Custom Firmware Tool 16.

DelayToolClockSource

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DelayTool	Enumeration	

Short Description

I/O Toolbox event stream used as clock.

Enumeration Values

- **NONE**: No event stream.
- **TIME8NS**: Clock input 8 nanoseconds time base.
- **TIME200NS**: Clock input 200 nanoseconds time base.
- **TIME1US**: Clock input 1 microsecond time base.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.

DelayToolDelayValue

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → DelayTool	Integer	

Value Info

Maximum value: 16777215

Description

Delay value of the selected Delay Tool.

Minimum value:

- 5 when DelayToolClockSource is TIME8NS
- 1 in other cases

Unit: time or event according to DelayToolClockSource.

2.18. C2CLinkSynchronizationTool Category

C2CLinkSynchronizationToolSelector	586
C2CLinkSynchronizationToolSource	587
C2CLinkSynchronizationToolClock	590
C2CLinkSynchronizationToolDiscardPendingEvent	591

C2CLinkSynchronizationToolSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → C2CLinkSynchronizationTool	Enumeration	

Short Description

Selects a C2C-Link Synchronization Tool.

Selected Features

- ["C2CLinkSynchronizationToolSource" on page 587](#)
- ["C2CLinkSynchronizationToolClock" on page 590](#)
- ["C2CLinkSynchronizationToolDiscardPendingEvent" on page 591](#)

Enumeration Values

- **C2C1**: C2C-Link Synchronization Tool 1.
- **C2C2**: C2C-Link Synchronization Tool 2.
- **C2C3**: C2C-Link Synchronization Tool 3.

C2CLinkSynchronizationToolSource

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → C2CLinkSynchronizationTool	Enumeration	

Short Description

I/O Toolbox event stream used as input for the selected C2C-Link Synchronization Tool.

Enumeration Values

- **CycleTrigger**: C2C-Link cycle trigger.
- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.

- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.
- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.

- CFW6: When an event occurs on Custom Firmware Tool 6.
- CFW7: When an event occurs on Custom Firmware Tool 7.
- CFW8: When an event occurs on Custom Firmware Tool 8.
- CFW9: When an event occurs on Custom Firmware Tool 9.
- CFW10: When an event occurs on Custom Firmware Tool 10.
- CFW11: When an event occurs on Custom Firmware Tool 11.
- CFW12: When an event occurs on Custom Firmware Tool 12.
- CFW13: When an event occurs on Custom Firmware Tool 13.
- CFW14: When an event occurs on Custom Firmware Tool 14.
- CFW15: When an event occurs on Custom Firmware Tool 15.
- CFW16: When an event occurs on Custom Firmware Tool 16.

C2CLinkSynchronizationToolClock

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → C2CLinkSynchronizationTool	Enumeration	

Short Description

Event used as clock for the selected C2C-Link Synchronization Tool.

Enumeration Values

- **Immediate**: Event is forwarded on the selected C2C-Link Synchronization Tool immediately.
- **CycleTrigger**: Event is forwarded on the selected C2C-Link Synchronization Tool upon the following C2C-Link cycle trigger event.
- **StartOfCameraReadout**: Event is forwarded on the selected C2C-Link Synchronization Tool upon the following start of camera readout event.

C2CLinkSynchronizationToolDiscardPendingEvent

Feature Info

Module	Category Path	Type	Access
Interface	Root → IOToolbox → C2CLinkSynchronizationTool	Command	Imposed: WO

Short Description

Discard an event that has been received but that has not been forwarded yet on the selected C2C-Link Synchronization Tool. This can be useful when C2CLinkSynchronizationToolClock is not set to Immediate.

2.19. EventControl Category

EventSelector	593
EventNotification	596
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EventNotificationAll	608
EventCountResetAll	609

EventSelector

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Enumeration	

Short Description

Select an event.

Selected Features

- ["EventNotification" on page 596](#)
- ["EventNotificationContext1" on page 597](#)
- ["EventNotificationContext2" on page 600](#)
- ["EventNotificationContext3" on page 603](#)
- ["EventCount" on page 606](#)
- ["EventCountReset" on page 607](#)

Enumeration Values

- **LIN1**: Line Input Tool 1.
- **LIN2**: Line Input Tool 2.
- **LIN3**: Line Input Tool 3.
- **LIN4**: Line Input Tool 4.
- **LIN5**: Line Input Tool 5.
- **LIN6**: Line Input Tool 6.
- **LIN7**: Line Input Tool 7.
- **LIN8**: Line Input Tool 8.
- **QDC1**: Quadrature Decoder Tool 1.
- **QDC1Dir**: Quadrature Decoder Tool 1 Changed Direction.
- **QDC2**: Quadrature Decoder Tool 2.
- **QDC2Dir**: Quadrature Decoder Tool 2 Changed Direction.
- **QDC3**: Quadrature Decoder Tool 3.
- **QDC3Dir**: Quadrature Decoder Tool 3 Changed Direction.
- **QDC4**: Quadrature Decoder Tool 4.
- **QDC4Dir**: Quadrature Decoder Tool 4 Changed Direction.

- **DIV1**: Divider Tool 1.
- **DIV2**: Divider Tool 2.
- **DIV3**: Divider Tool 3.
- **DIV4**: Divider Tool 4.
- **MDV1**: Multiplier/Divider Tool 1.
- **MDV2**: Multiplier/Divider Tool 2.
- **MDV3**: Multiplier/Divider Tool 3.
- **MDV4**: Multiplier/Divider Tool 4.
- **DEL11**: Delay Tool 1 Output 1.
- **DEL12**: Delay Tool 1 Output 2.
- **DEL21**: Delay Tool 2 Output 1.
- **DEL22**: Delay Tool 2 Output 2.
- **DEL31**: Delay Tool 3 Output 1.
- **DEL32**: Delay Tool 3 Output 2.
- **DEL41**: Delay Tool 4 Output 1.
- **DEL42**: Delay Tool 4 Output 2.
- **UserEvent1**: User Event 1.
- **UserEvent2**: User Event 2.
- **UserEvent3**: User Event 3.
- **UserEvent4**: User Event 4.
- **C2C1**: C2C-Link Synchronization Tool 1.
- **C2C2**: C2C-Link Synchronization Tool 2.
- **C2C3**: C2C-Link Synchronization Tool 3.
- **CFW1**: Custom Firmware Tool 1.
- **CFW2**: Custom Firmware Tool 2.
- **CFW3**: Custom Firmware Tool 3.
- **CFW4**: Custom Firmware Tool 4.
- **CFW5**: Custom Firmware Tool 5.
- **CFW6**: Custom Firmware Tool 6.
- **CFW7**: Custom Firmware Tool 7.
- **CFW8**: Custom Firmware Tool 8.
- **CFW9**: Custom Firmware Tool 9.
- **CFW10**: Custom Firmware Tool 10.
- **CFW11**: Custom Firmware Tool 11.
- **CFW12**: Custom Firmware Tool 12.
- **CFW13**: Custom Firmware Tool 13.

- CFW14: Custom Firmware Tool 14.
- CFW15: Custom Firmware Tool 15.
- CFW16: Custom Firmware Tool 16.

EventNotification

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Boolean	RW

Short Description

Activate or deactivate the notification to the host application of the occurrence of the selected event.

EventNotificationContext1

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_1.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.
- **DIV1EventCount**: Number of DIV1 events.

- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.
- **CFW14EventCount**: Number of CFW14 events.

- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.

EventNotificationContext2

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_2.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.
- **DIV1EventCount**: Number of DIV1 events.

- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.
- **CFW14EventCount**: Number of CFW14 events.

- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.

EventNotificationContext3

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_3.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.
- **DIV1EventCount**: Number of DIV1 events.

- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.
- **CFW14EventCount**: Number of CFW14 events.

- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.

EventCount

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	IntReg	RO

Register Port: InterfacePort

Short Description

Number of occurrences of the selected event (32-bit counter).

EventCountReset

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Command	Imposed: WO

Short Description

Reset the selected EventCount.

EventNotificationAll

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Boolean	Imposed: WO

Short Description

Activate or deactivate the notification of all events.

EventCountResetAll

Feature Info

Module	Category Path	Type	Access
Interface	Root → EventControl	Command	Imposed: WO

Short Description

Reset all EventCount.

2.20. OemSafetyKey Category

OemSafetyKeyVerification	611
CheckOemSafetyKey	612
ProgramOemSafetyKey	613
EncryptedOemSafetyKey	614
MaximumOemKeyLength	615

OemSafetyKeyVerification

Feature Info

Module	Category Path	Type	Access
Interface	Root → OemSafetyKey	Enumeration	RW

Description

Defines which key can be compared with the programmed OEM safety key.

Acts as a selector for [CheckOemSafetyKey](#).

Recommended value: [EncryptedKey](#).

Default value: [ProgrammingKeyOrEncryptedKey](#).

Selected Features

- ["CheckOemSafetyKey" on page 612](#)

Enumeration Values

- [ProgrammingKey](#): Only the key written to ProgramOemSafetyKey can be used to verify the OEM safety key.
- [EncryptedKey](#): Only the key read from EncryptedOemSafetyKey can be used to verify the OEM safety key (recommended).
- [ProgrammingKeyOrEncryptedKey](#): Both the key written to ProgramOemSafetyKey and the key read from EncryptedOemSafetyKey can be used to verify the OEM safety key.

CheckOemSafetyKey

Feature Info

Module	Category Path	Type	Access
Interface	Root → OemSafetyKey	String	Imposed: WO

Description

Write-only string to use for comparing a key (the key written to **ProgramOemSafetyKey** or the key read from **EncryptedOemSafetyKey**) and the programmed OEM safety key.

ProgramOemSafetyKey

Feature Info

Module	Category Path	Type	Access
Interface	Root → OemSafetyKey	String	Imposed: WO

Short Description

Write-only string to use for programming the non-volatile OEM safety key.

EncryptedOemSafetyKey

Feature Info

Module	Category Path	Type	Access
Interface	Root → OemSafetyKey	String	Imposed: RO

Description

Read-only string that contains the encrypted version of the OEM safety key just programmed with **ProgramOemSafetyKey**.

MaximumOemKeyLength

Feature Info

Module	Category Path	Type	Access
Interface	Root → OemSafetyKey	Integer	

Value Info

Minimum value: 40

Maximum value: 2147483647

Description

The length of `ProgramOemSafetyKey` and `CheckOemSafetyKey` is limited by `MaximumOemKeyLength`.

Default value: 4096.

2.21. CustomLogic Category

CustomLogicControlAddress	617
CustomLogicControlData	618

CustomLogicControlAddress

Feature Info

Module	Category Path	Type	Access
Interface	Root → CustomLogic	Integer	RW

Value Info

Minimum value: 0

Maximum value: 65535

Short Description

Custom Logic Control Address.

Selected Features

- "CustomLogicControlData" on page 618

CustomLogicControlData

Feature Info

Module	Category Path	Type	Access
Interface	Root → CustomLogic	Integer	RW

Value Info

Minimum value: 0

Maximum value: 4294967295

Short Description

Custom Logic Control Data.

2.22. OnboardMemory Category

OnboardMemoryBase	620
OnboardMemorySize	621

OnboardMemoryBase

Feature Info

Module	Category Path	Type	Access
Interface	Root → OnboardMemory	Integer	Imposed: RO

Short Description

Base address of the onboard memory.

OnboardMemorySize

Feature Info

Module	Category Path	Type	Access
Interface	Root → OnboardMemory	IntReg	RO

Register Port: InterfacePort

Short Description

Available size in bytes of the onboard memory.

3. Grablink Device Module Register Description

Categorized features list of Device module version 25_12_1

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3.1. Root Category

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DeviceInformation

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: ["DeviceInformation Category" on page 632](#)

StreamEnumeration

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: ["StreamEnumeration Category" on page 641](#)

CameraAndIlluminationControl

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Description

Set of features related to the Camera and Illumination Controller (CIC).

Category Members

See also: ["CameraAndIlluminationControl Category" on page 673](#)

CameraLink

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: ["CameraLink Category" on page 644](#)

GenCP

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: "GenCP Category" on page 664

GenCPAdvanced

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: ["GenCPAdvanced Category" on page 670](#)

EventControl

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: ["EventControl Category" on page 730](#)

Errors

Feature Info

Module	Category Path	Type	Access
Device	Root	Category	

Category Members

See also: ["Errors Category" on page 746](#)

3.2. DeviceInformation Category

DeviceID	633
DeviceVendorName	634
DeviceModelName	635
DeviceAccessStatus	636
DeviceLicenseStatus	637
DeviceType	638
DeviceDescription	639
DeviceControlProtocol	640

DeviceID

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	String	Imposed: RO

Short Description

Interface wide unique identifier of this device.

DeviceVendorName

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	String	Imposed: RO

Short Description

Name of the device vendor.

DeviceModelName

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	String	Imposed: RO

Short Description

Name of the device model.

DeviceAccessStatus

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	Enumeration	Imposed: RO

Short Description

Gives the device's access status at the moment of the last execution of DeviceUpdateList.

Enumeration Values

- **Unknown**: Unknown access.
- **ReadWrite**: Available to be opened with full access.
- **ReadOnly**: Available to be opened with read-only access.
- **NoAccess**: Not reachable.
- **Busy**: Already opened by another entity.
- **OpenReadWrite**: Opened with read-write access.
- **OpenReadOnly**: Opened with read-only access.

DeviceLicenseStatus

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	Enumeration	Imposed: RO

Short Description

Device License Status.

Enumeration Values

- **OK**: Device license is OK.
- **NotOK**: Device license is not OK.
- **Unknown**: Device license status is unknown.

DeviceType

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	Enumeration	Imposed: RO

Short Description

Identifies the transport layer technology of the interface.

Enumeration Values

- **CL**: This enumeration value indicates Camera Link transport layer technology.

DeviceDescription

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	String	Imposed: RO

Short Description

Description of the device.

DeviceControlProtocol

Feature Info

Module	Category Path	Type	Access
Device	Root → DeviceInformation	Enumeration	Imposed: RO

Short Description

Protocol used to control the remote device.

Enumeration Values

- **Default:** Virtual remote device.
- **GenCP:**

3.3. StreamEnumeration Category

StreamSelector	642
StreamID	643

StreamSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → StreamEnumeration	Integer	

Value Info

Minimum value: 0

Short Description

Selector for the different stream channels.

Selected Features

- "StreamID" on page 643

StreamID

Feature Info

Module	Category Path	Type	Access
Device	Root → StreamEnumeration	String	Imposed: RO

Short Description

Device unique ID for the stream.

3.4. CameraLink Category

CameraControlLineSelector	645
CameraControlLineSource	646
CameraControlLineInverter	647
ClTriggerDuration	648
EnableSignals	649
AntiGlitchFilters	650
RemoteDeviceClockSelector	651
RemoteDeviceClockFrequency	652
SerialAccessControl	653

CameraControlLineSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Enumeration	

Short Description

Selects a camera control line.

Selected Features

- ["CameraControlLineSource" on page 646](#)
- ["CameraControlLineInverter" on page 647](#)

Enumeration Values

- **CC1**: Camera control output 1.
- **CC2**: Camera control output 2.
- **CC3**: Camera control output 3.
- **CC4**: Camera control output 4.

CameraControlLineSource

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Enumeration	RW

Short Description

Camera Control Line Source.

Enumeration Values

- **CameraTrigger**: The camera trigger pulse is sent on the selected camera control line.
- **LIN1Source**: The line source of IO Toolbox LIN1 is sent on the selected camera control line.
- **LIN2Source**: The line source of IO Toolbox LIN2 is sent on the selected camera control line.
- **LIN3Source**: The line source of IO Toolbox LIN3 is sent on the selected camera control line.
- **LIN4Source**: The line source of IO Toolbox LIN4 is sent on the selected camera control line.
- **LIN5Source**: The line source of IO Toolbox LIN5 is sent on the selected camera control line.
- **LIN6Source**: The line source of IO Toolbox LIN6 is sent on the selected camera control line.
- **LIN7Source**: The line source of IO Toolbox LIN7 is sent on the selected camera control line.
- **LIN8Source**: The line source of IO Toolbox LIN8 is sent on the selected camera control line.
- **Low**: The selected camera control line is driven to the Low state.
- **High**: The selected camera control line is driven to the High state.

CameraControlLineInverter

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Boolean	RW

Short Description

Inversion of the selected camera control line.

ClTriggerDuration

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Float	RW

Value Info

Minimum value: 0.096

Maximum value: 5.6295e+11

Short Description

Cl Trigger Duration.

EnableSignals

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Category	

Category Members

See also: "EnableSignals Category" on page 654

AntiGlitchFilters

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Category	

Category Members

See also: ["AntiGlitchFilters Category" on page 657](#)

RemoteDeviceClockSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Enumeration	

Short Description

Selects the clock frequency to access from the remote device.

Selected Features

- ["RemoteDeviceClockFrequency" on page 652](#)

Enumeration Values

- **CameraLink**: Camera Link clock from channel link X.
- **CameraLinkChannelX**: Camera Link clock from channel link X.
- **CameraLinkChannelY**: Camera Link clock from channel link Y.
- **CameraLinkChannelZ**: Camera Link clock from channel link Z.

RemoteDeviceClockFrequency

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Integer	RO

Short Description

Remote Device Clock Frequency.

SerialAccessControl

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink	Category	

Category Members

See also: ["SerialAccessControl Category" on page 717](#)

3.5. EnableSignals Category

FvalLvalMode	655
DvalMode	656

FvalLvalMode

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → EnableSignals	Enumeration	RW

Short Description

Specifies the usage of the FVAL and LVAL downstream signals.

Enumeration Values

- **AreaScan**: The rising edge of the FVAL signal is used as a StartOfFrame (the falling edge is ignored); the rising edge of the LVAL signal is used as a StartOfLine (the falling edge is ignored).
- **FrameCover**: Start/stop recording on FVAL rising/falling edges; the rising edge of the LVAL signal is used as a StartOfLine (the falling edge is ignored).
- **LineScan**: The FVAL signal is ignored; the rising edge of the LVAL signal is used as a StartOfLine (the falling edge is ignored).

DvalMode

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → EnableSignals	Enumeration	RW

Short Description

Specifies the usage of the DVAL downstream signal.

Enumeration Values

- **Ignore:** The DVAL signal is ignored.
- **Gating:** The DVAL signal is used as a clock qualifier.

3.6. AntiGlitchFilters Category

AntiGlitchFilterSelector	658
AntiGlitchFilterEnable	659
ChannelXGlitchCount	660
ChannelYGlitchCount	661
ChannelZGlitchCount	662
ChannelXYZGlitchCountReset	663

AntiGlitchFilterSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → AntiGlitchFilters	Enumeration	

Short Description

Selects the Camera Link signal on which the anti-glitch filter applies.

Selected Features

- "AntiGlitchFilterEnable" on page 659
- "ChannelXGlitchCount" on page 660
- "ChannelYGlitchCount" on page 661
- "ChannelZGlitchCount" on page 662
- "ChannelXYZGlitchCountReset" on page 663

Enumeration Values

- LVAL:
- FVAL:

AntiGlitchFilterEnable

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → AntiGlitchFilters	Boolean	RW

Short Description

When enabled on LVAL, filters out LVAL high/low pulses narrower than 2 clock periods. When enabled on FVAL, filters out FVAL high/low pulses narrower than 3 clock periods.

ChannelXGlitchCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → AntiGlitchFilters	Integer	RO

Short Description

Count of glitches that have been filtered on channel link X of the selected Camera Link signal.

ChannelYGlitchCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → AntiGlitchFilters	Integer	RO

Short Description

Count of glitches that have been filtered on channel link Y of the selected Camera Link signal.

ChannelZGlitchCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → AntiGlitchFilters	Integer	RO

Short Description

Count of glitches that have been filtered on channel link Z of the selected Camera Link signal.

ChannelXYZGlitchCountReset

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → AntiGlitchFilters	Command	Imposed: WO

Short Description

Resets the glitch counters of the selected Camera Link signal.

3.7. GenCP Category

GenCPConnectionStatus	665
GenCPSerialBaudRate	666
GenCPSerialBaudRateDetect	667
GenCPSerialBaudRateMaximize	668
ShowGenCPAdvancedFeatures	669

GenCPConnectionStatus

Feature Info

Module	Category Path	Type	Access
Device	Root → GenCP	Enumeration	RO

Short Description

Gen CP Connection Status.

Enumeration Values

- OK:
- NotOK:

GenCPSerialBaudRate

Feature Info

Module	Category Path	Type	Access
Device	Root → GenCP	Enumeration	RW

Short Description

Baud rate used to communicate with the GenCP remote device.

Enumeration Values

- Baud9600:
- Baud19200:
- Baud38400:
- Baud57600:
- Baud115200:
- Baud230400:

GenCPSerialBaudRateDetect

Feature Info

Module	Category	Path	Type	Access
Device	Root → GenCP	Command	Imposed: WO	

Short Description

Automatically detect baud rate of the GenCP remote device.

GenCPSerialBaudRateMaximize

Feature Info

Module	Category	Path	Type	Access
Device	Root	→ GenCP	Command	Imposed: WO

Short Description

Configure maximum baud rate supported by both the grabber and the GenCP remote device.

ShowGenCPAdvancedFeatures

Feature Info

Module	Category Path	Type	Access
Device	Root → GenCP	Boolean	

Short Description

Show GenCP advanced features.

3.8. GenCPAdvanced Category

GenCPMaxPacketSize	671
GenCPIgnoreLengthWrittenField	672

GenCPMaxPacketSize

Feature Info

Module	Category Path	Type	Access
Device	Root → GenCPAdvanced	Integer	RW

Value Info

Minimum value: 64

Maximum value: 1024

Short Description

Maximum packet size used to communicate with the GenCP remote device.

GenCPIgnoreLengthWrittenField

Feature Info

Module	Category Path	Type	Access
Device	Root → GenCPAdvanced	Boolean	RW

Short Description

Ignore the `length_written` field in the SCD section of a WriteMem Acknowledge command if the value is unexpected.

3.9. CameraAndIlluminationControl Category

CameraModel	674
CycleTiming	675
CycleControl	676
SequenceControl	677
DeviceReset	678
CameraAndIlluminationControllerStream	679

CameraModel

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl	Category	

Description

Set of features describing the behavioral model of a grabber-controlled camera.



NOTE

These features defines the operating limits of the camera and are used to configure the trigger-overrun protection mechanism of the CIC.



NOTE

An incorrectly set behavioral model may prevent reaching the highest achievable camera cycle rate or, reversely, allow the grabber to assert triggers too quickly.

Category Members

See also: "CameraModel Category" on page 680

CycleTiming

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl	Category	

Description

Set of features describing the CIC Cycle timing properties.

Category Members

See also: "CycleTiming Category" on page 688

CycleControl

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl	Category	

Description

Set of features describing the CIC cycle control properties.

Category Members

See also: "CycleControl Category" on page 694

SequenceControl

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl	Category	

Description

Set of features describing the CIC cycle sequence control properties.

Default value: **True**.

Category Members

See also: ["SequenceControl Category" on page 704](#)

DeviceReset

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl	Command	Imposed: WO

Description

Reset the CIC.

CameraAndIlluminationControllerStream

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl	Enumeration	RW

Short Description

Defines which data stream the CIC uses to check whether a new cycle can be started.

Enumeration Values

- **Stream0**: CIC uses camera readout and frame buffer status from Stream0.
- **Stream1**: CIC uses camera readout and frame buffer status from Stream1.
- **Stream2**: CIC uses camera readout and frame buffer status from Stream2.
- **Stream3**: CIC uses camera readout and frame buffer status from Stream3.

3.10. CameraModel Category

CameraControlMethod	681
C2CLinkConfiguration	682
ExposureReadoutOverlap	683
ExposureRecoveryTime	684
ExposureTimeMin	685
ExposureTimeMax	686
CycleMinimumPeriod	687

CameraControlMethod

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Enumeration	RW

Description

Camera control method.

The **NC** camera control method is intended for use with free-run or asynchronous reset cameras not controlled by the frame grabber.

The **RC** camera control method is intended for use with asynchronous reset cameras having the camera cycle start controlled by the grabber CIC and the exposure time controlled by the camera.

The **RG** camera control method is intended for use with asynchronous reset cameras having the camera cycle start and the exposure duration controlled by the grabber CIC.

The **EXTERNAL** camera control method is intended for use with asynchronous reset cameras having the camera cycle start and the exposure duration controlled by a hardware signal applied by an external controller to any GPIO input port of the grabber.

The **INTERNAL** camera control method is intended for use with asynchronous reset cameras having the camera cycle start and the exposure duration controlled by I/O Toolbox events mapped to CoaXPress LinkTrigger messages.



NOTE

The **NC**, **INTERNAL** and **EXTERNAL** camera control methods do not utilize the CIC.

Enumeration Values

- **NC**: Not Controlled.
- **RC**: Grabber-controlled cycle start, Camera-controlled exposure time.
- **RG**: Grabber-controlled cycle start and exposure time.

C2CLinkConfiguration

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Enumeration	RW

Description

Sets/gets the C2C-Link configuration.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Default value: **Disconnected**.

Enumeration Values

- **Disconnected**: Disconnected from the C2C-Link.
- **Master**: Connected to the C2C-Link as the C2C-Link Master Device.
- **Slave**: Connected to the C2C-Link as a C2C-Link Slave Device.

ExposureReadoutOverlap

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Boolean	RW

Description

Declares the exposure overlapping capability of the camera.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

When set to true, it indicates that the camera allows overlapping. The exposure phase of a new camera cycle is allowed to begin during the readout phase.

When set to false, it indicates that the camera doesn't allow overlapping. The exposure phase of a new camera cycle is not allowed to begin before the completion of the readout phase.

ExposureRecoveryTime

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Float	RW

Value Info

Minimum value: 0

Maximum value: 1.71799e+07

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Minimum time interval between two consecutive exposure phases.

When **CameraControlMethod** is **RG**, the CIC ensure that the time interval between two consecutive camera trigger pulses is not lower than the specified value in case of large exposure time (exposure time > readout time).

Directive

Only when **CameraControlMethod** is **RG**, set this value to the minimum time interval allowed by the camera.



WARNING

A too small value may cause missed triggers.



WARNING

An excessive value prevents reaching the highest achievable camera cycle rate.

ExposureTimeMin

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Float	RW

Value Info

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Minimum exposure time.

When **CameraControlMethod** is **RG**, the CIC ensure that the camera trigger pulse width is not lower than the specified value.

Directive

Only when **CameraControlMethod** is **RG**, set this value to the minimum exposure time allowed by the camera.



WARNING

A too small value may cause missed triggers.

ExposureTimeMax

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Float	RW

Value Info

Maximum value: 5.6295e+11

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Maximum exposure time.

When **CameraControlMethod** is **RG**, the CIC ensure that the camera trigger pulse width is not larger than the specified value.

Directive

Only when **CameraControlMethod** is **RG**, set this value to the maximum exposure time allowed by the camera.



WARNING

An excessive value may cause missed triggers.

CycleMinimumPeriod

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CameraModel	Float	RW

Value Info

Maximum value: 5.6295e+11

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Minimum camera cycle period.

When **CameraControlMethod** is **RC** or **RG**, the CIC ensure that the camera cycle period is not smaller than the specified value.



NOTE

was named **CycleTargetPeriod** in Coaxlink driver versions prior to 9.4



NOTE

was named **CyclePeriodTarget** in Coaxlink driver versions prior to 4.1

Directive

Only when **CameraControlMethod** is **RC** or **RG**, set this value to the minimum cycle period allowed by the camera.



WARNING

A too small value may cause missed triggers.

3.11. CycleTiming Category

CycleTimingSelector	689
CycleTimingCount	690
ExposureTime	691
StrobeDelay	692
StrobeDuration	693

CycleTimingSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleTiming	Integer	

Value Info

Minimum value: 0

Short Description

Selector for the different cycle timings.

Selected Features

- ["ExposureTime" on page 691](#)
- ["StrobeDelay" on page 692](#)
- ["StrobeDuration" on page 693](#)

CycleTimingCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleTiming	Integer	RW

Value Info

Minimum value: 1

Short Description

A timing represents a set of values in the CycleTiming category.

ExposureTime

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleTiming	Float	RW

Value Info

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Sets/gets the exposure time.

Applies only when **CameraControlMethod** is **RG**.



NOTE

Avoid using exposure time settings outside the exposure time range of the camera.



NOTE

The upper limit is very high: > 150 hours!

Default value: **1,000.0** (1 millisecond).

StrobeDelay

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleTiming	Float	RW

Value Info

Minimum value: -8.58993e+06

Maximum value: 8.58993e+06

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Sets/gets the strobe pulse delay.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Default value: 0.

StrobeDuration

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleTiming	Float	RW

Value Info

Minimum value: 0

Maximum value: 5.6295e+11

Dimension: Time

Unit: μs

Increment: 0.008 μs (8 ns)

Description

Sets/gets the strobe pulse duration.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).



NOTE

The upper limit is very high: > 150 hours!

Default value: 1,000.0 (1 millisecond).

3.12. CycleControl Category

CycleTriggerSource	695
StartCycle	699
CycleMaxPendingTriggerCount	700
CyclePendingTriggerCount	701
CycleLostTriggerCount	702
CycleLostTriggerCountReset	703

CycleTriggerSource

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleControl	Enumeration	

Description

Sets/gets the start-of-camera-cycle trigger conditions and selects a hardware or software trigger source.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Default value: **Immediate**.

Enumeration Values

- **Immediate**: Immediately after the start of the sequence and then repeatedly every **CycleMinimumPeriod** period.
- **StartCycle**: On execution of the **StartCycle** command.
- **C2C**: Synchronized with the C2C-Link master device. This value is enforced when **C2CLinkConfiguration** = **Slave**.
- **LIN1**: When an event occurs on Line Input Tool 1 or on execution of the **StartCycle** command.
- **LIN2**: When an event occurs on Line Input Tool 2 or on execution of the **StartCycle** command.
- **LIN3**: When an event occurs on Line Input Tool 3 or on execution of the **StartCycle** command.
- **LIN4**: When an event occurs on Line Input Tool 4 or on execution of the **StartCycle** command.
- **LIN5**: When an event occurs on Line Input Tool 5 or on execution of the **StartCycle** command.
- **LIN6**: When an event occurs on Line Input Tool 6 or on execution of the **StartCycle** command.
- **LIN7**: When an event occurs on Line Input Tool 7 or on execution of the **StartCycle** command.
- **LIN8**: When an event occurs on Line Input Tool 8 or on execution of the **StartCycle** command.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1 or on execution of the **StartCycle** command.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2 or on execution of the **StartCycle** command.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3 or on execution of the **StartCycle** command.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4 or on execution of the **StartCycle** command.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1 or on execution of the **StartCycle** command.

- **MDV2**: When an event occurs on Multiplier/Divider Tool 2 or on execution of the StartCycle command.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3 or on execution of the StartCycle command.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4 or on execution of the StartCycle command.
- **DIV1**: When an event occurs on Divider Tool 1 or on execution of the StartCycle command.
- **DIV2**: When an event occurs on Divider Tool 2 or on execution of the StartCycle command.
- **DIV3**: When an event occurs on Divider Tool 3 or on execution of the StartCycle command.
- **DIV4**: When an event occurs on Divider Tool 4 or on execution of the StartCycle command.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1 or on execution of the StartCycle command.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2 or on execution of the StartCycle command.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1 or on execution of the StartCycle command.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2 or on execution of the StartCycle command.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1 or on execution of the StartCycle command.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2 or on execution of the StartCycle command.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1 or on execution of the StartCycle command.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2 or on execution of the StartCycle command.
- **EIN1**: When an event occurs on Event Input Tool 1 or on execution of the StartCycle command.
- **EIN2**: When an event occurs on Event Input Tool 2 or on execution of the StartCycle command.
- **UserEvent1**: When an event occurs on User Event 1 or on execution of the StartCycle command.
- **UserEvent2**: When an event occurs on User Event 2 or on execution of the StartCycle command.
- **UserEvent3**: When an event occurs on User Event 3 or on execution of the StartCycle command.
- **UserEvent4**: When an event occurs on User Event 4 or on execution of the StartCycle command.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1 or on execution of the StartCycle command.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2 or on execution of the StartCycle command.

- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3 or on execution of the StartCycle command.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1 or on execution of the StartCycle command.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2 or on execution of the StartCycle command.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3 or on execution of the StartCycle command.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4 or on execution of the StartCycle command.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5 or on execution of the StartCycle command.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6 or on execution of the StartCycle command.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7 or on execution of the StartCycle command.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8 or on execution of the StartCycle command.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9 or on execution of the StartCycle command.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10 or on execution of the StartCycle command.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11 or on execution of the StartCycle command.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12 or on execution of the StartCycle command.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13 or on execution of the StartCycle command.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14 or on execution of the StartCycle command.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15 or on execution of the StartCycle command.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16 or on execution of the StartCycle command.
- **CFW1**: When an event occurs on Custom Firmware Tool 1 or on execution of the StartCycle command.
- **CFW2**: When an event occurs on Custom Firmware Tool 2 or on execution of the StartCycle command.
- **CFW3**: When an event occurs on Custom Firmware Tool 3 or on execution of the StartCycle command.
- **CFW4**: When an event occurs on Custom Firmware Tool 4 or on execution of the StartCycle command.

- **CFW5:** When an event occurs on Custom Firmware Tool 5 or on execution of the StartCycle command.
- **CFW6:** When an event occurs on Custom Firmware Tool 6 or on execution of the StartCycle command.
- **CFW7:** When an event occurs on Custom Firmware Tool 7 or on execution of the StartCycle command.
- **CFW8:** When an event occurs on Custom Firmware Tool 8 or on execution of the StartCycle command.
- **CFW9:** When an event occurs on Custom Firmware Tool 9 or on execution of the StartCycle command.
- **CFW10:** When an event occurs on Custom Firmware Tool 10 or on execution of the StartCycle command.
- **CFW11:** When an event occurs on Custom Firmware Tool 11 or on execution of the StartCycle command.
- **CFW12:** When an event occurs on Custom Firmware Tool 12 or on execution of the StartCycle command.
- **CFW13:** When an event occurs on Custom Firmware Tool 13 or on execution of the StartCycle command.
- **CFW14:** When an event occurs on Custom Firmware Tool 14 or on execution of the StartCycle command.
- **CFW15:** When an event occurs on Custom Firmware Tool 15 or on execution of the StartCycle command.
- **CFW16:** When an event occurs on Custom Firmware Tool 16 or on execution of the StartCycle command.

StartCycle

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleControl	Command	Imposed: WO

Description

Starts a camera cycle.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).



NOTE

was named **CycleSoftwareTrigger** in Coaxlink driver versions prior to 4.1.

CycleMaxPendingTriggerCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleControl	Integer	RW

Value Info

Minimum value: 0

Maximum value: 7

Description

The Camera and Illumination Controller is fitted with a trigger latching mechanism capable of recording triggers that cannot be served immediately and postponing their execution.

This feature determines the capacity of the latch :

- When 0, the trigger latch mechanism is disabled. Any cycle trigger that cannot be served immediately is rejected and increments **CycleLostTriggerCount**.
- When set to any value ranging from 1 to 7, the trigger latch mechanism is enabled. Providing that **CyclePendingTriggerCount** is below **CycleMaxPendingTriggerCount**, any cycle trigger that cannot be served immediately is latched and increments **CyclePendingTriggerCount**.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Default value: 0 (Disabled)

CyclePendingTriggerCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleControl	IntReg	RO

Register Port: DevicePort

Description

Returns the count of pending CIC cycle trigger events.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

CycleLostTriggerCount

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleControl	IntReg	RO

Register Port: DevicePort

Description

Returns the count of lost CIC cycle trigger events.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Value range: from 0 up to 4,294,967,295.

CycleLostTriggerCountReset

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → CycleControl	Command	Imposed: WO

Description

Resets the count of lost CIC cycle trigger events.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

3.13. SequenceControl Category

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StartOfSequenceTriggerSource

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → SequenceControl	Enumeration	

Description

Sets/gets the start-of-sequence trigger conditions and selects a hardware or software trigger source.

- When set to **Immediate**, the sequence starts immediately.
- When set to **StartSequence**, the sequence starts only on execution of the StartSequence command.
- When set to <any-event-source>, the sequence starts on the next occurrence of an event on the specified event source or on execution of the StartSequence command. Possible event sources include any available LIN*, QDC*, MDV*, DIV*, DEL*, EIN*, User Event* event source.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Enumeration Values

- **Immediate**: Immediate.
- **StartSequence**: StartSequence command.
- **LIN1**: When an event occurs on Line Input Tool 1 or on execution of the StartSequence command.
- **LIN2**: When an event occurs on Line Input Tool 2 or on execution of the StartSequence command.
- **LIN3**: When an event occurs on Line Input Tool 3 or on execution of the StartSequence command.
- **LIN4**: When an event occurs on Line Input Tool 4 or on execution of the StartSequence command.
- **LIN5**: When an event occurs on Line Input Tool 5 or on execution of the StartSequence command.
- **LIN6**: When an event occurs on Line Input Tool 6 or on execution of the StartSequence command.
- **LIN7**: When an event occurs on Line Input Tool 7 or on execution of the StartSequence command.
- **LIN8**: When an event occurs on Line Input Tool 8 or on execution of the StartSequence command.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1 or on execution of the StartSequence command.

- **QDC2**: When an event occurs on Quadrature Decoder Tool 2 or on execution of the StartSequence command.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3 or on execution of the StartSequence command.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4 or on execution of the StartSequence command.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1 or on execution of the StartSequence command.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2 or on execution of the StartSequence command.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3 or on execution of the StartSequence command.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4 or on execution of the StartSequence command.
- **DIV1**: When an event occurs on Divider Tool 1 or on execution of the StartSequence command.
- **DIV2**: When an event occurs on Divider Tool 2 or on execution of the StartSequence command.
- **DIV3**: When an event occurs on Divider Tool 3 or on execution of the StartSequence command.
- **DIV4**: When an event occurs on Divider Tool 4 or on execution of the StartSequence command.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1 or on execution of the StartSequence command.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2 or on execution of the StartSequence command.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1 or on execution of the StartSequence command.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2 or on execution of the StartSequence command.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1 or on execution of the StartSequence command.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2 or on execution of the StartSequence command.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1 or on execution of the StartSequence command.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2 or on execution of the StartSequence command.
- **EIN1**: When an event occurs on Event Input Tool 1 or on execution of the StartSequence command.
- **EIN2**: When an event occurs on Event Input Tool 2 or on execution of the StartSequence command.

- **UserEvent1**: When an event occurs on User Event 1 or on execution of the StartSequence command.
- **UserEvent2**: When an event occurs on User Event 2 or on execution of the StartSequence command.
- **UserEvent3**: When an event occurs on User Event 3 or on execution of the StartSequence command.
- **UserEvent4**: When an event occurs on User Event 4 or on execution of the StartSequence command.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1 or on execution of the StartSequence command.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2 or on execution of the StartSequence command.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3 or on execution of the StartSequence command.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1 or on execution of the StartSequence command.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2 or on execution of the StartSequence command.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3 or on execution of the StartSequence command.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4 or on execution of the StartSequence command.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5 or on execution of the StartSequence command.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6 or on execution of the StartSequence command.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7 or on execution of the StartSequence command.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8 or on execution of the StartSequence command.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9 or on execution of the StartSequence command.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10 or on execution of the StartSequence command.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11 or on execution of the StartSequence command.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12 or on execution of the StartSequence command.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13 or on execution of the StartSequence command.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14 or on execution of the StartSequence command.

- **DLT15:** When an event occurs on DeviceLinkTrigger Tool 15 or on execution of the StartSequence command.
- **DLT16:** When an event occurs on DeviceLinkTrigger Tool 16 or on execution of the StartSequence command.
- **CFW1:** When an event occurs on Custom Firmware Tool 1 or on execution of the StartSequence command.
- **CFW2:** When an event occurs on Custom Firmware Tool 2 or on execution of the StartSequence command.
- **CFW3:** When an event occurs on Custom Firmware Tool 3 or on execution of the StartSequence command.
- **CFW4:** When an event occurs on Custom Firmware Tool 4 or on execution of the StartSequence command.
- **CFW5:** When an event occurs on Custom Firmware Tool 5 or on execution of the StartSequence command.
- **CFW6:** When an event occurs on Custom Firmware Tool 6 or on execution of the StartSequence command.
- **CFW7:** When an event occurs on Custom Firmware Tool 7 or on execution of the StartSequence command.
- **CFW8:** When an event occurs on Custom Firmware Tool 8 or on execution of the StartSequence command.
- **CFW9:** When an event occurs on Custom Firmware Tool 9 or on execution of the StartSequence command.
- **CFW10:** When an event occurs on Custom Firmware Tool 10 or on execution of the StartSequence command.
- **CFW11:** When an event occurs on Custom Firmware Tool 11 or on execution of the StartSequence command.
- **CFW12:** When an event occurs on Custom Firmware Tool 12 or on execution of the StartSequence command.
- **CFW13:** When an event occurs on Custom Firmware Tool 13 or on execution of the StartSequence command.
- **CFW14:** When an event occurs on Custom Firmware Tool 14 or on execution of the StartSequence command.
- **CFW15:** When an event occurs on Custom Firmware Tool 15 or on execution of the StartSequence command.
- **CFW16:** When an event occurs on Custom Firmware Tool 16 or on execution of the StartSequence command.

EndOfSequenceTriggerSource

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → SequenceControl	Enumeration	

Description

Sets/gets the end-of-sequence trigger conditions and selects a hardware or software trigger source.

- When set to **SequenceLength**, the sequence stops automatically after having executed a number of camera cycles specified by **SequenceLength**. The sequence can be stopped anticipatively on execution of the **StopSequence** command.
- When set to **StopSequence**, the sequence stops only on execution of the **StopSequence** command.
- When set to <any-event-source>, the sequence stops on the next occurrence of an event on the specified event source or on execution of the **StopSequence** command. Possible event sources include any available LIN*, QDC*, MDV*, DIV*, DEL*, EIN*, User Event* event source.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

Enumeration Values

- **SequenceLength**: SequenceLength.
- **StopSequence**: StopSequence command.
- **LIN1**: When an event occurs on Line Input Tool 1 or on execution of the StopSequence command.
- **LIN2**: When an event occurs on Line Input Tool 2 or on execution of the StopSequence command.
- **LIN3**: When an event occurs on Line Input Tool 3 or on execution of the StopSequence command.
- **LIN4**: When an event occurs on Line Input Tool 4 or on execution of the StopSequence command.
- **LIN5**: When an event occurs on Line Input Tool 5 or on execution of the StopSequence command.
- **LIN6**: When an event occurs on Line Input Tool 6 or on execution of the StopSequence command.
- **LIN7**: When an event occurs on Line Input Tool 7 or on execution of the StopSequence command.
- **LIN8**: When an event occurs on Line Input Tool 8 or on execution of the StopSequence command.

- **QDC1**: When an event occurs on Quadrature Decoder Tool 1 or on execution of the StopSequence command.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2 or on execution of the StopSequence command.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3 or on execution of the StopSequence command.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4 or on execution of the StopSequence command.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1 or on execution of the StopSequence command.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2 or on execution of the StopSequence command.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3 or on execution of the StopSequence command.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4 or on execution of the StopSequence command.
- **DIV1**: When an event occurs on Divider Tool 1 or on execution of the StopSequence command.
- **DIV2**: When an event occurs on Divider Tool 2 or on execution of the StopSequence command.
- **DIV3**: When an event occurs on Divider Tool 3 or on execution of the StopSequence command.
- **DIV4**: When an event occurs on Divider Tool 4 or on execution of the StopSequence command.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1 or on execution of the StopSequence command.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2 or on execution of the StopSequence command.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1 or on execution of the StopSequence command.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2 or on execution of the StopSequence command.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1 or on execution of the StopSequence command.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2 or on execution of the StopSequence command.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1 or on execution of the StopSequence command.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2 or on execution of the StopSequence command.
- **EIN1**: When an event occurs on Event Input Tool 1 or on execution of the StopSequence command.

- **EIN2**: When an event occurs on Event Input Tool 2 or on execution of the StopSequence command.
- **UserEvent1**: When an event occurs on User Event 1 or on execution of the StopSequence command.
- **UserEvent2**: When an event occurs on User Event 2 or on execution of the StopSequence command.
- **UserEvent3**: When an event occurs on User Event 3 or on execution of the StopSequence command.
- **UserEvent4**: When an event occurs on User Event 4 or on execution of the StopSequence command.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1 or on execution of the StopSequence command.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2 or on execution of the StopSequence command.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3 or on execution of the StopSequence command.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1 or on execution of the StopSequence command.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2 or on execution of the StopSequence command.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3 or on execution of the StopSequence command.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4 or on execution of the StopSequence command.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5 or on execution of the StopSequence command.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6 or on execution of the StopSequence command.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7 or on execution of the StopSequence command.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8 or on execution of the StopSequence command.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9 or on execution of the StopSequence command.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10 or on execution of the StopSequence command.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11 or on execution of the StopSequence command.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12 or on execution of the StopSequence command.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13 or on execution of the StopSequence command.

- **DLT14:** When an event occurs on DeviceLinkTrigger Tool 14 or on execution of the StopSequence command.
- **DLT15:** When an event occurs on DeviceLinkTrigger Tool 15 or on execution of the StopSequence command.
- **DLT16:** When an event occurs on DeviceLinkTrigger Tool 16 or on execution of the StopSequence command.
- **CFW1:** When an event occurs on Custom Firmware Tool 1 or on execution of the StopSequence command.
- **CFW2:** When an event occurs on Custom Firmware Tool 2 or on execution of the StopSequence command.
- **CFW3:** When an event occurs on Custom Firmware Tool 3 or on execution of the StopSequence command.
- **CFW4:** When an event occurs on Custom Firmware Tool 4 or on execution of the StopSequence command.
- **CFW5:** When an event occurs on Custom Firmware Tool 5 or on execution of the StopSequence command.
- **CFW6:** When an event occurs on Custom Firmware Tool 6 or on execution of the StopSequence command.
- **CFW7:** When an event occurs on Custom Firmware Tool 7 or on execution of the StopSequence command.
- **CFW8:** When an event occurs on Custom Firmware Tool 8 or on execution of the StopSequence command.
- **CFW9:** When an event occurs on Custom Firmware Tool 9 or on execution of the StopSequence command.
- **CFW10:** When an event occurs on Custom Firmware Tool 10 or on execution of the StopSequence command.
- **CFW11:** When an event occurs on Custom Firmware Tool 11 or on execution of the StopSequence command.
- **CFW12:** When an event occurs on Custom Firmware Tool 12 or on execution of the StopSequence command.
- **CFW13:** When an event occurs on Custom Firmware Tool 13 or on execution of the StopSequence command.
- **CFW14:** When an event occurs on Custom Firmware Tool 14 or on execution of the StopSequence command.
- **CFW15:** When an event occurs on Custom Firmware Tool 15 or on execution of the StopSequence command.
- **CFW16:** When an event occurs on Custom Firmware Tool 16 or on execution of the StopSequence command.

SequenceLength

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → SequenceControl	Integer	RW

Value Info

Minimum value: 1

Maximum value: 16777215

Short Description

Sequence Length.

StartSequence

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → SequenceControl	Command	Imposed: WO

Description

Starts a CIC sequence.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**) and **StartOfSequenceTriggerSource** is not set to **Immediate**.

StopSequence

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → SequenceControl	Command	Imposed: WO

Description

Stops a CIC sequence.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**).

AbortSequence

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraAndIlluminationControl → SequenceControl	Command	Imposed: WO

Description

Abort a CIC sequence.

Applies only when the CIC is used (i.e., when **CameraControlMethod** is **RC** or **RG**) and **StartOfSequenceTriggerSource** is not set to **Immediate**.

3.14. SerialAccessControl Category

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SerialTimeout	727
SerialReadQueueSize	728
SerialWriteQueueSize	729

SerialOperationSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Enumeration	RW

Short Description

Serial Operation Selector.

Selected Features

- ["SerialOperationExecute" on page 719](#)
- ["SerialOperationStatus" on page 720](#)
- ["SerialOperationResult" on page 721](#)

Enumeration Values

- Open:
- Close:
- Read:
- Write:
- Flush:
- Drain:

SerialOperationExecute

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Command	WO

Short Description

Serial Operation Execute.

SerialOperationStatus

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Enumeration	Imposed: RO

Short Description

Serial Operation Status.

Enumeration Values

- Success:
- Failure:
- Timeout:

SerialOperationResult

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	IntReg	RO

Register Port: DevicePort

Short Description

Serial Operation Result.

SerialAccessBuffer

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Register	RW

Short Description

Serial Access Buffer.

SerialAccessBufferString

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	StringReg	RW

Short Description

Serial Access Buffer String.

SerialAccessBufferLength

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Integer	RW

Value Info

Minimum value: 4096

Maximum value: 16777216

Short Description

Serial Access Buffer Length.

SerialAccessLength

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Serial Access Length.

SerialBaudRate

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Enumeration	RW

Short Description

Serial Baud Rate.

Enumeration Values

- Baud9600:
- Baud19200:
- Baud38400:
- Baud57600:
- Baud115200:
- Baud230400:

SerialTimeout

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	Integer	RW

Value Info

Minimum value: 0

Maximum value: 10000

Short Description

Serial Timeout.

SerialReadQueueSize

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	IntReg	RO

Register Port: DevicePort

Short Description

Serial Read Queue Size.

SerialWriteQueueSize

Feature Info

Module	Category Path	Type	Access
Device	Root → CameraLink → SerialAccessControl	IntReg	RO

Register Port: DevicePort

Short Description

Serial Write Queue Size.

3.15. EventControl Category

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EventSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Enumeration	

Short Description

Select an event.

Selected Features

- ["EventNotification" on page 732](#)
- ["EventNotificationContext1" on page 733](#)
- ["EventNotificationContext2" on page 736](#)
- ["EventNotificationContext3" on page 739](#)
- ["EventCount" on page 742](#)
- ["EventCountReset" on page 743](#)

Enumeration Values

- **CameraTriggerRisingEdge**: Start of camera trigger.
- **CameraTriggerFallingEdge**: End of camera trigger.
- **StrobeRisingEdge**: Start of light strobe.
- **StrobeFallingEdge**: End of light strobe.
- **AllowNextCycle**: CIC is ready for next camera cycle.
- **DiscardedCicTrigger**: Ignored CIC trigger because CIC is not ready for next camera cycle.
- **PendingCicTrigger**: Delayed CIC trigger until CIC is ready for next camera cycle.
- **Trigger**: CIC trigger.
- **CameraTriggerOverrun**: New trigger sent to remote device even though readout of previous frame has not started yet.
- **MigAxiWriteError**: MIG AXI write error.
- **MigAxiReadError**: MIG AXI read error.
- **FillLevelAboveHwRejected**: Start of scan skipped (caused by internal exception: frame store almost full).
- **FillLevelAboveHwEarlyEos**: End of scan (caused by internal exception: frame store almost full).
- **ExternalTriggerReqsTooClose**: External trigger requests too close together.

EventNotification

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Boolean	RW

Description

Activate or deactivate the notification to the host application of the occurrence of the selected event.

When true, activate the notification.

When false, deactivate the notification.

Default value: **False.**

EventNotificationContext1

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_1.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **PendingCicTriggerCount**: Number of currently pending CIC triggers.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.

- **DIV1EventCount**: Number of DIV1 events.
- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.

- **CFW14EventCount**: Number of CFW14 events.
- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.
- **CameraTriggerRisingEdgeEventCount**: Number of CameraTriggerRisingEdge events.
- **CameraTriggerFallingEdgeEventCount**: Number of CameraTriggerFallingEdge events.
- **StrobeRisingEdgeEventCount**: Number of StrobeRisingEdge events.
- **StrobeFallingEdgeEventCount**: Number of StrobeFallingEdge events.
- **AllowNextCycleEventCount**: Number of AllowNextCycle events.
- **DiscardedCicTriggerEventCount**: Number of DiscardedCicTrigger events.
- **PendingCicTriggerEventCount**: Number of PendingCicTrigger events.
- **TriggerEventCount**: Number of Trigger events.
- **CameraTriggerOverrunEventCount**: Number of CameraTriggerOverrun events.
- **MigAxiWriteErrorEventCount**: Number of MigAxiWriteError events.
- **MigAxiReadErrorEventCount**: Number of MigAxiReadError events.
- **FillLevelAboveIISosRejectedEventCount**: Number of FillLevelAboveIISosRejected events.
- **FillLevelAboveAfEarlyEosEventCount**: Number of FillLevelAboveAfEarlyEos events.
- **ExternalTriggerReqsTooCloseEventCount**: Number of ExternalTriggerReqsTooClose events.

EventNotificationContext2

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_2.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **PendingCicTriggerCount**: Number of currently pending CIC triggers.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.

- **DIV1EventCount**: Number of DIV1 events.
- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.

- **CFW14EventCount**: Number of CFW14 events.
- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.
- **CameraTriggerRisingEdgeEventCount**: Number of CameraTriggerRisingEdge events.
- **CameraTriggerFallingEdgeEventCount**: Number of CameraTriggerFallingEdge events.
- **StrobeRisingEdgeEventCount**: Number of StrobeRisingEdge events.
- **StrobeFallingEdgeEventCount**: Number of StrobeFallingEdge events.
- **AllowNextCycleEventCount**: Number of AllowNextCycle events.
- **DiscardedCicTriggerEventCount**: Number of DiscardedCicTrigger events.
- **PendingCicTriggerEventCount**: Number of PendingCicTrigger events.
- **TriggerEventCount**: Number of Trigger events.
- **CameraTriggerOverrunEventCount**: Number of CameraTriggerOverrun events.
- **MigAxiWriteErrorEventCount**: Number of MigAxiWriteError events.
- **MigAxiReadErrorEventCount**: Number of MigAxiReadError events.
- **FillLevelAboveIISosRejectedEventCount**: Number of FillLevelAboveIISosRejected events.
- **FillLevelAboveAfEarlyEosEventCount**: Number of FillLevelAboveAfEarlyEos events.
- **ExternalTriggerReqsTooCloseEventCount**: Number of ExternalTriggerReqsTooClose events.

EventNotificationContext3

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_3.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **PendingCicTriggerCount**: Number of currently pending CIC triggers.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.

- **DIV1EventCount**: Number of DIV1 events.
- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.

- **CFW14EventCount**: Number of CFW14 events.
- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.
- **CameraTriggerRisingEdgeEventCount**: Number of CameraTriggerRisingEdge events.
- **CameraTriggerFallingEdgeEventCount**: Number of CameraTriggerFallingEdge events.
- **StrobeRisingEdgeEventCount**: Number of StrobeRisingEdge events.
- **StrobeFallingEdgeEventCount**: Number of StrobeFallingEdge events.
- **AllowNextCycleEventCount**: Number of AllowNextCycle events.
- **DiscardedCicTriggerEventCount**: Number of DiscardedCicTrigger events.
- **PendingCicTriggerEventCount**: Number of PendingCicTrigger events.
- **TriggerEventCount**: Number of Trigger events.
- **CameraTriggerOverrunEventCount**: Number of CameraTriggerOverrun events.
- **MigAxiWriteErrorEventCount**: Number of MigAxiWriteError events.
- **MigAxiReadErrorEventCount**: Number of MigAxiReadError events.
- **FillLevelAboveIISosRejectedEventCount**: Number of FillLevelAboveIISosRejected events.
- **FillLevelAboveAfEarlyEosEventCount**: Number of FillLevelAboveAfEarlyEos events.
- **ExternalTriggerReqsTooCloseEventCount**: Number of ExternalTriggerReqsTooClose events.

EventCount

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	IntReg	RO

Register Port: DevicePort

Short Description

Number of occurrences of the selected event (32-bit counter).

EventCountReset

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Command	Imposed: WO

Short Description

Reset the selected EventCount.

EventNotificationAll

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Boolean	Imposed: WO

Short Description

Activate or deactivate the notification of all events.

EventCountResetAll

Feature Info

Module	Category Path	Type	Access
Device	Root → EventControl	Command	Imposed: WO

Short Description

Reset all EventCount.

3.16. Errors Category

ErrorSelector	747
ErrorCount	748
ErrorCountReset	749

ErrorSelector

Feature Info

Module	Category Path	Type	Access
Device	Root → Errors	Enumeration	

Short Description

Error Selector.

Selected Features

- "ErrorCount" on page 748
- "ErrorCountReset" on page 749

Enumeration Values

- **All**: All errors.
- **CameraTriggerOverrun**: New trigger sent to remote device even though readout of previous frame has not started yet.
- **MigAxiWriteError**: MIG AXI write error.
- **MigAxiReadError**: MIG AXI read error.
- **StartOfScanSkipped**: Start of scan skipped (caused by internal exception: frame store almost full).
- **PrematureEndOfScan**: End of scan (caused by internal exception: frame store almost full).
- **ExternalTriggerReqsTooClose**: Trigger requests too close together.
- **Unknown**: Unknown errors.

ErrorCount

Feature Info

Module	Category Path	Type	Access
Device	Root → Errors	IntReg	RO

Register Port: DevicePort

Short Description

Error Count.

ErrorCountReset

Feature Info

Module	Category Path	Type	Access
Device	Root → Errors	Command	Imposed: WO

Short Description

Reset the selected ErrorCount.

4. Grablink Data Stream Module Register Description

Categorized features list of Data Stream module version 25_12_1

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4.1. Root Category

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StreamInformation

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["StreamInformation Category" on page 769](#)

ImageFormatControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["ImageFormatControl Category" on page 775](#)

TransportLayerControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["TransportLayerControl Category" on page 806](#)

BufferHandlingControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["BufferHandlingControl Category" on page 811](#)

PixelProcessing

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["PixelProcessing Category" on page 826](#)

LineScanAcquisitionControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["LineScanAcquisitionControl Category" on page 832](#)

StreamControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["StreamControl Category" on page 846](#)

Errors

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["Errors Category" on page 897](#)

LUTControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: "LUTControl Category" on page 901

LinearFilter

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["LinearFilter Category" on page 910](#)

Threshold

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["Threshold Category" on page 915](#)

LaserLineExtractor

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["LaserLineExtractor Category" on page 918](#)

Bayer

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["Bayer Category" on page 922](#)

FlatFieldCorrection

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["FlatFieldCorrection Category" on page 924](#)

MetadataInsertion

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: "MetadataInsertion Category" on page 930

EventControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["EventControl Category" on page 951](#)

StreamStatistics

Feature Info

Module	Category Path	Type	Access
Data Stream	Root	Category	

Category Members

See also: ["StreamStatistics Category" on page 967](#)

4.2. StreamInformation Category

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StreamID

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamInformation	String	Imposed: RO

Short Description

Device unique ID for the data stream.

StreamType

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamInformation	Enumeration	Imposed: RO

Short Description

Identifies the transport layer technology of the interface.

Enumeration Values

- **CL**: This enumeration value indicates Camera Link transport layer technology.

StreamDescription

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamInformation	String	Imposed: RO

Short Description

Description of the stream.

StreamConfigurationStatus

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamInformation	Enumeration	Imposed: RO

Short Description

Stream Configuration Status.

Enumeration Values

- OK:
- UnknownError:
- BayerDecoderAndUnpackingModeMsbNotAllowed:
- BayerDecoderAndUnpackingModeOffNotAllowed:
- BinningAndFormatNotAllowed:
- BinningAndUnpackingModeNotAllowed:
- BinningConfigAndFormatDepthNotAllowed:
- LleAndFormatNotAllowed:
- LutAndBayerFormatNotAllowed:
- LutAndLleNotAllowed:
- LutAndMultiComponentFormatNotAllowed:
- LutAndPackedFormatNotAllowed:
- LutAndUnpackingModeOffNotAllowed:
- LutConfigAndFormatDepthDontMatch:
- WidthNotAligned:
- CameraWidthNotAlignedToBinningWindow:
- CameraHeightNotAlignedToBinningWindow:
- UnpackingModeOffAnd16bitFormatNotAllowed:
- UnpackingModeOffAndFormatNotAllowed:
- ReverseXAndFormatNotAllowed:
- ReverseXAndUnpackingModeNotAllowed:
- CameraWidthTooLargeForReverseX:
- PixelFormatNotSupportedForPlanarRgb:
- CameraWidthTooLargeForPlanarRgb:

- CameraWidthGenapiFeatureError:
- CameraHeightGenapiFeatureError:
- CameraPixelFormatGenapiFeatureError:
- CameraPixelFormatNotSupported:
- CameraDeviceTapGeometryGenapiFeatureError:
- CameraDeviceTapGeometryNotSupported:

4.3. ImageFormatControl Category

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ReverseX	803
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ImageFormatSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Enumeration	

Short Description

Image Format Selector.

Selected Features

- ["PixelFormat" on page 777](#)
- ["PixelFormatNamespace" on page 788](#)
- ["Width" on page 791](#)
- ["Height" on page 792](#)
- ["Pitch" on page 793](#)
- ["PixelSize" on page 789](#)
- ["PixelComponentCount" on page 790](#)
- [WidthInc](#)
- ["PayloadSize" on page 807](#)

Enumeration Values

- **DataStream**: Format of buffers filled by the data stream.
- **PixelProcessor**: Format of images produced by the image data pixel processor.
- **RemoteDevice**: Format of images expected from the camera.

PixelFormat

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Enumeration	Imposed: RO

Short Description

Pixel format of the image.

Enumeration Values

- **B10**: Blue 10-bit.
- **B10_Deprecated**: Deprecated because size field is wrong.
- **B12**: Blue 12-bit.
- **B12_Deprecated**: Deprecated because size field is wrong.
- **B16**: Blue 16-bit.
- **B8**: Blue 8-bit.
- **BGR10**: Blue-Green-Red 10-bit unpacked.
- **BGR10_HorizontalPlanar**: BGR10_HorizontalPlanar.
- **BGR10p**: Blue-Green-Red 10-bit packed.
- **BGR12**: Blue-Green-Red 12-bit unpacked.
- **BGR12_HorizontalPlanar**: BGR12_HorizontalPlanar.
- **BGR12p**: Blue-Green-Red 12-bit packed.
- **BGR14**: Blue-Green-Red 14-bit unpacked.
- **BGR14_HorizontalPlanar**: BGR14_HorizontalPlanar.
- **BGR16**: Blue-Green-Red 16-bit.
- **BGR16_HorizontalPlanar**: BGR16_HorizontalPlanar.
- **BGR565p**: Blue-Green-Red 5/6/5-bit packed.
- **BGR8**: Blue-Green-Red 8-bit.
- **BGR8_HorizontalPlanar**: BGR8_HorizontalPlanar.
- **BGR8a32**: BGR8a32.
- **BGRa10**: Blue-Green-Red-alpha 10-bit unpacked.
- **BGRa10p**: Blue-Green-Red-alpha 10-bit packed.
- **BGRa12**: Blue-Green-Red-alpha 12-bit unpacked.
- **BGRa12p**: Blue-Green-Red-alpha 12-bit packed.

- **BGRa14**: Blue-Green-Red-alpha 14-bit unpacked.
- **BGRa16**: Blue-Green-Red-alpha 16-bit.
- **BGRa8**: Blue-Green-Red-alpha 8-bit.
- **BayerBG10**: Bayer Blue-Green 10-bit unpacked.
- **BayerBG10Packed**: Bayer Blue-Green 10-bit packed.
- **BayerBG10p**: Bayer Blue-Green 10-bit packed.
- **BayerBG10pmsb**: BayerBG10pmsb.
- **BayerBG12**: Bayer Blue-Green 12-bit unpacked.
- **BayerBG12Packed**: Bayer Blue-Green 12-bit packed.
- **BayerBG12p**: Bayer Blue-Green 12-bit packed.
- **BayerBG12pmsb**: BayerBG12pmsb.
- **BayerBG14**: Bayer Blue-Green 14-bit.
- **BayerBG14p**: Bayer Blue-Green 14-bit packed.
- **BayerBG14pmsb**: BayerBG14pmsb.
- **BayerBG16**: Bayer Blue-Green 16-bit.
- **BayerBG4p**: Bayer Blue-Green 4-bit packed.
- **BayerBG8**: Bayer Blue-Green 8-bit.
- **BayerGB10**: Bayer Green-Blue 10-bit unpacked.
- **BayerGB10Packed**: Bayer Green-Blue 10-bit packed.
- **BayerGB10p**: Bayer Green-Blue 10-bit packed.
- **BayerGB10pmsb**: BayerGB10pmsb.
- **BayerGB12**: Bayer Green-Blue 12-bit unpacked.
- **BayerGB12Packed**: Bayer Green-Blue 12-bit packed.
- **BayerGB12p**: Bayer Green-Blue 12-bit packed.
- **BayerGB12pmsb**: BayerGB12pmsb.
- **BayerGB14**: Bayer Green-Blue 14-bit.
- **BayerGB14p**: Bayer Green-Blue 14-bit packed.
- **BayerGB14pmsb**: BayerGB14pmsb.
- **BayerGB16**: Bayer Green-Blue 16-bit.
- **BayerGB4p**: Bayer Green-Blue 4-bit packed.
- **BayerGB8**: Bayer Green-Blue 8-bit.
- **BayerGR10**: Bayer Green-Red 10-bit unpacked.
- **BayerGR10Packed**: Bayer Green-Red 10-bit packed.
- **BayerGR10p**: Bayer Green-Red 10-bit packed.
- **BayerGR10pmsb**: BayerGR10pmsb.
- **BayerGR12**: Bayer Green-Red 12-bit unpacked.

- **BayerGR12Packed**: Bayer Green-Red 12-bit packed.
- **BayerGR12p**: Bayer Green-Red 12-bit packed.
- **BayerGR12pmsb**: BayerGR12pmsb.
- **BayerGR14**: Bayer Green-Red 14-bit.
- **BayerGR14p**: Bayer Green-Red 14-bit packed.
- **BayerGR14pmsb**: BayerGR14pmsb.
- **BayerGR16**: Bayer Green-Red 16-bit.
- **BayerGR4p**: Bayer Green-Red 4-bit packed.
- **BayerGR8**: Bayer Green-Red 8-bit.
- **BayerRG10**: Bayer Red-Green 10-bit unpacked.
- **BayerRG10Packed**: Bayer Red-Green 10-bit packed.
- **BayerRG10p**: Bayer Red-Green 10-bit packed.
- **BayerRG10pmsb**: BayerRG10pmsb.
- **BayerRG12**: Bayer Red-Green 12-bit unpacked.
- **BayerRG12Packed**: Bayer Red-Green 12-bit packed.
- **BayerRG12p**: Bayer Red-Green 12-bit packed.
- **BayerRG12pmsb**: BayerRG12pmsb.
- **BayerRG14**: Bayer Red-Green 14-bit.
- **BayerRG14p**: Bayer Red-Green 14-bit packed.
- **BayerRG14pmsb**: BayerRG14pmsb.
- **BayerRG16**: Bayer Red-Green 16-bit.
- **BayerRG4p**: Bayer Red-Green 4-bit packed.
- **BayerRG8**: Bayer Red-Green 8-bit.
- **BiColorBGRG10**: Bi-color Blue/Green - Red/Green 10-bit unpacked.
- **BiColorBGRG10p**: Bi-color Blue/Green - Red/Green 10-bit packed.
- **BiColorBGRG10pmsb**: BiColorBGRG10pmsb.
- **BiColorBGRG12**: Bi-color Blue/Green - Red/Green 12-bit unpacked.
- **BiColorBGRG12p**: Bi-color Blue/Green - Red/Green 12-bit packed.
- **BiColorBGRG12pmsb**: BiColorBGRG12pmsb.
- **BiColorBGRG16**: BiColorBGRG16.
- **BiColorBGRG8**: Bi-color Blue/Green - Red/Green 8-bit.
- **BiColorRGBG10**: Bi-color Red/Green - Blue/Green 10-bit unpacked.
- **BiColorRGBG10p**: Bi-color Red/Green - Blue/Green 10-bit packed.
- **BiColorRGBG10pmsb**: BiColorRGBG10pmsb.
- **BiColorRGBG12**: Bi-color Red/Green - Blue/Green 12-bit unpacked.
- **BiColorRGBG12p**: Bi-color Red/Green - Blue/Green 12-bit packed.

- **BiColorRGBG12pmsb**: BiColorRGBG12pmsb.
- **BiColorRGBG16**: BiColorRGBG16.
- **BiColorRGBG8**: Bi-color Red/Green - Blue/Green 8-bit.
- **Confidence1**: Confidence 1-bit unpacked.
- **Confidence16**: Confidence 16-bit.
- **Confidence1p**: Confidence 1-bit packed.
- **Confidence32f**: Confidence 32-bit floating point.
- **Confidence8**: Confidence 8-bit.
- **Coord3D_A10p**: 3D coordinate A 10-bit packed.
- **Coord3D_A12p**: 3D coordinate A 12-bit packed.
- **Coord3D_A16**: 3D coordinate A 16-bit.
- **Coord3D_A32f**: 3D coordinate A 32-bit floating point.
- **Coord3D_A64f**: 3D coordinate A 64-bit floating point.
- **Coord3D_A8**: 3D coordinate A 8-bit.
- **Coord3D_ABC10p**: 3D coordinate A-B-C 10-bit packed.
- **Coord3D_ABC10p_Planar**: 3D coordinate A-B-C 10-bit packed planar.
- **Coord3D_ABC12p**: 3D coordinate A-B-C 12-bit packed.
- **Coord3D_ABC12p_Planar**: 3D coordinate A-B-C 12-bit packed planar.
- **Coord3D_ABC16**: 3D coordinate A-B-C 16-bit.
- **Coord3D_ABC16_Planar**: 3D coordinate A-B-C 16-bit planar.
- **Coord3D_ABC32f**: 3D coordinate A-B-C 32-bit floating point.
- **Coord3D_ABC32f_Planar**: 3D coordinate A-B-C 32-bit floating point planar.
- **Coord3D_ABC64f**: 3D coordinate A-B-C 64-bit floating point.
- **Coord3D_ABC64f_Planar**: 3D coordinate A-B-C 64-bit floating point planar.
- **Coord3D_ABC8**: 3D coordinate A-B-C 8-bit.
- **Coord3D_ABC8_Planar**: 3D coordinate A-B-C 8-bit planar.
- **Coord3D_AC10p**: 3D coordinate A-C 10-bit packed.
- **Coord3D_AC10p_Planar**: 3D coordinate A-C 10-bit packed planar.
- **Coord3D_AC12p**: 3D coordinate A-C 12-bit packed.
- **Coord3D_AC12p_Planar**: 3D coordinate A-C 12-bit packed planar.
- **Coord3D_AC16**: 3D coordinate A-C 16-bit.
- **Coord3D_AC16_Planar**: 3D coordinate A-C 16-bit planar.
- **Coord3D_AC32f**: 3D coordinate A-C 32-bit floating point.
- **Coord3D_AC32f_Planar**: 3D coordinate A-C 32-bit floating point planar.
- **Coord3D_AC64f**: 3D coordinate A-C 64-bit floating point.
- **Coord3D_AC64f_Planar**: 3D coordinate A-C 64-bit floating point planar.

- **Coord3D_AC8**: 3D coordinate A-C 8-bit.
- **Coord3D_AC8_Planar**: 3D coordinate A-C 8-bit planar.
- **Coord3D_B10p**: 3D coordinate B 10-bit packed.
- **Coord3D_B12p**: 3D coordinate B 12-bit packed.
- **Coord3D_B16**: 3D coordinate B 16-bit.
- **Coord3D_B32f**: 3D coordinate B 32-bit floating point.
- **Coord3D_B64f**: 3D coordinate B 64-bit floating point.
- **Coord3D_B8**: 3D coordinate B 8-bit.
- **Coord3D_C10p**: 3D coordinate C 10-bit packed.
- **Coord3D_C12p**: 3D coordinate C 12-bit packed.
- **Coord3D_C16**: 3D coordinate C 16-bit.
- **Coord3D_C32f**: 3D coordinate C 32-bit floating point.
- **Coord3D_C64f**: 3D coordinate C 64-bit floating point.
- **Coord3D_C8**: 3D coordinate C 8-bit.
- **CustomJFIF**: CustomJFIF.
- **Data16**: Data 16-bit.
- **Data16s**: Data 16-bit signed.
- **Data32**: Data 32-bit.
- **Data32f**: Data 32-bit floating point.
- **Data32s**: Data 32-bit signed.
- **Data64**: Data 64-bit.
- **Data64f**: Data 64-bit floating point.
- **Data64s**: Data 64-bit signed.
- **Data8**: Data 8-bit.
- **Data8s**: Data 8-bit signed.
- **G10**: Green 10-bit.
- **G10_Deprecated**: Deprecated because size field is wrong.
- **G12**: Green 12-bit.
- **G12_Deprecated**: Deprecated because size field is wrong.
- **G16**: Green 16-bit.
- **G8**: Green 8-bit.
- **Mono10**: Monochrome 10-bit unpacked.
- **Mono10Packed**: Monochrome 10-bit packed.
- **Mono10p**: Monochrome 10-bit packed.
- **Mono10pmsb**: Mono10pmsb.
- **Mono12**: Monochrome 12-bit unpacked.

- **Mono12Packed**: Monochrome 12-bit packed.
- **Mono12p**: Monochrome 12-bit packed.
- **Mono12pmsb**: Mono12pmsb.
- **Mono14**: Monochrome 14-bit unpacked.
- **Mono14p**: Monochrome 14-bit packed.
- **Mono14pmsb**: Mono14pmsb.
- **Mono16**: Monochrome 16-bit.
- **Mono1p**: Monochrome 1-bit packed.
- **Mono2p**: Monochrome 2-bit packed.
- **Mono32**: Monochrome 32-bit.
- **Mono4p**: Monochrome 4-bit packed.
- **Mono8**: Monochrome 8-bit.
- **Mono8s**: Monochrome 8-bit signed.
- **R10**: Red 10-bit.
- **R10_Deprecated**: Deprecated because size field is wrong.
- **R12**: Red 12-bit.
- **R12_Deprecated**: Deprecated because size field is wrong.
- **R16**: Red 16-bit.
- **R8**: Red 8-bit.
- **RGB10**: Red-Green-Blue 10-bit unpacked.
- **RGB10V1Packed**: Red-Green-Blue 10-bit packed - variant 1.
- **RGB10_HorizontalPlanar**: RGB10_HorizontalPlanar.
- **RGB10_Planar**: Red-Green-Blue 10-bit unpacked planar.
- **RGB10p**: Red-Green-Blue 10-bit packed.
- **RGB10p32**: Red-Green-Blue 10-bit packed into 32-bit.
- **RGB10pmsb**: RGB10pmsb.
- **RGB12**: Red-Green-Blue 12-bit unpacked.
- **RGB12V1Packed**: Red-Green-Blue 12-bit packed - variant 1.
- **RGB12_HorizontalPlanar**: RGB12_HorizontalPlanar.
- **RGB12_Planar**: Red-Green-Blue 12-bit unpacked planar.
- **RGB12p**: Red-Green-Blue 12-bit packed.
- **RGB12pmsb**: RGB12pmsb.
- **RGB14**: Red-Green-Blue 14-bit unpacked.
- **RGB14_HorizontalPlanar**: RGB14_HorizontalPlanar.
- **RGB14pmsb**: RGB14pmsb.
- **RGB16**: Red-Green-Blue 16-bit.

- **RGB16_HorizontalPlanar**: RGB16_HorizontalPlanar.
- **RGB16_Planar**: Red-Green-Blue 16-bit planar.
- **RGB565p**: Red-Green-Blue 5/6/5-bit packed.
- **RGB8**: Red-Green-Blue 8-bit.
- **RGB8_HorizontalPlanar**: RGB8_HorizontalPlanar.
- **RGB8_Planar**: Red-Green-Blue 8-bit planar.
- **RGB8a32**: RGB8a32.
- **RGBa10**: Red-Green-Blue-alpha 10-bit unpacked.
- **RGBa10p**: Red-Green-Blue-alpha 10-bit packed.
- **RGBa10pmsb**: RGBa10pmsb.
- **RGBa12**: Red-Green-Blue-alpha 12-bit unpacked.
- **RGBa12p**: Red-Green-Blue-alpha 12-bit packed.
- **RGBa12pmsb**: RGBa12pmsb.
- **RGBa14**: Red-Green-Blue-alpha 14-bit unpacked.
- **RGBa14pmsb**: RGBa14pmsb.
- **RGBa16**: Red-Green-Blue-alpha 16-bit.
- **RGBa8**: Red-Green-Blue-alpha 8-bit.
- **SCF1WBWG10**: Sparse Color Filter #1 White-Blue-White-Green 10-bit unpacked.
- **SCF1WBWG10p**: Sparse Color Filter #1 White-Blue-White-Green 10-bit packed.
- **SCF1WBWG12**: Sparse Color Filter #1 White-Blue-White-Green 12-bit unpacked.
- **SCF1WBWG12p**: Sparse Color Filter #1 White-Blue-White-Green 12-bit packed.
- **SCF1WBWG14**: Sparse Color Filter #1 White-Blue-White-Green 14-bit unpacked.
- **SCF1WBWG16**: Sparse Color Filter #1 White-Blue-White-Green 16-bit unpacked.
- **SCF1WBWG8**: Sparse Color Filter #1 White-Blue-White-Green 8-bit.
- **SCF1WGWB10**: Sparse Color Filter #1 White-Green-White-Blue 10-bit unpacked.
- **SCF1WGWB10p**: Sparse Color Filter #1 White-Green-White-Blue 10-bit packed.
- **SCF1WGWB12**: Sparse Color Filter #1 White-Green-White-Blue 12-bit unpacked.
- **SCF1WGWB12p**: Sparse Color Filter #1 White-Green-White-Blue 12-bit packed.
- **SCF1WGWB14**: Sparse Color Filter #1 White-Green-White-Blue 14-bit unpacked.
- **SCF1WGWB16**: Sparse Color Filter #1 White-Green-White-Blue 16-bit.
- **SCF1WGWB8**: Sparse Color Filter #1 White-Green-White-Blue 8-bit.
- **SCF1WGWR10**: Sparse Color Filter #1 White-Green-White-Red 10-bit unpacked.
- **SCF1WGWR10p**: Sparse Color Filter #1 White-Green-White-Red 10-bit packed.
- **SCF1WGWR12**: Sparse Color Filter #1 White-Green-White-Red 12-bit unpacked.
- **SCF1WGWR12p**: Sparse Color Filter #1 White-Green-White-Red 12-bit packed.
- **SCF1WGWR14**: Sparse Color Filter #1 White-Green-White-Red 14-bit unpacked.

- SCF1WGW16: Sparse Color Filter #1 White-Green-White-Red 16-bit.
- SCF1WGW8: Sparse Color Filter #1 White-Green-White-Red 8-bit.
- SCF1WRWG10: Sparse Color Filter #1 White-Red-White-Green 10-bit unpacked.
- SCF1WRWG10p: Sparse Color Filter #1 White-Red-White-Green 10-bit packed.
- SCF1WRWG12: Sparse Color Filter #1 White-Red-White-Green 12-bit unpacked.
- SCF1WRWG12p: Sparse Color Filter #1 White-Red-White-Green 12-bit packed.
- SCF1WRWG14: Sparse Color Filter #1 White-Red-White-Green 14-bit unpacked.
- SCF1WRWG16: Sparse Color Filter #1 White-Red-White-Green 16-bit.
- SCF1WRWG8: Sparse Color Filter #1 White-Red-White-Green 8-bit.
- YCbCr10_CbYCr: YCbCr 4:4:4 10-bit unpacked.
- YCbCr10p_CbYCr: YCbCr 4:4:4 10-bit packed.
- YCbCr12_CbYCr: YCbCr 4:4:4 12-bit unpacked.
- YCbCr12p_CbYCr: YCbCr 4:4:4 12-bit packed.
- YCbCr2020_10_CbYCr: YCbCr 4:4:4 10-bit unpacked BT.2020.
- YCbCr2020_10p_CbYCr: YCbCr 4:4:4 10-bit packed BT.2020.
- YCbCr2020_12_CbYCr: YCbCr 4:4:4 12-bit unpacked BT.2020.
- YCbCr2020_12p_CbYCr: YCbCr 4:4:4 12-bit packed BT.2020.
- YCbCr2020_411_8_CbYYCrYY: YCbCr 4:1:1 8-bit BT.2020.
- YCbCr2020_422_10: YCbCr 4:2:2 10-bit unpacked BT.2020.
- YCbCr2020_422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked BT.2020.
- YCbCr2020_422_10p: YCbCr 4:2:2 10-bit packed BT.2020.
- YCbCr2020_422_10p_CbYCrY: YCbCr 4:2:2 10-bit packed BT.2020.
- YCbCr2020_422_12: YCbCr 4:2:2 12-bit unpacked BT.2020.
- YCbCr2020_422_12_CbYCrY: YCbCr 4:2:2 12-bit unpacked BT.2020.
- YCbCr2020_422_12p: YCbCr 4:2:2 12-bit packed BT.2020.
- YCbCr2020_422_12p_CbYCrY: YCbCr 4:2:2 12-bit packed BT.2020.
- YCbCr2020_422_8: YCbCr 4:2:2 8-bit BT.2020.
- YCbCr2020_422_8_CbYCrY: YCbCr 4:2:2 8-bit BT.2020.
- YCbCr2020_8_CbYCr: YCbCr 4:4:4 8-bit BT.2020.
- YCbCr411_8: YCbCr 4:1:1 8-bit.
- YCbCr411_8_CbYYCrYY: YCbCr 4:1:1 8-bit.
- YCbCr420_8_YY_CbCr_Semiplanar: YCbCr 4:2:0 8-bit YY/CbCr Semiplanar.
- YCbCr420_8_YY_CrCb_Semiplanar: YCbCr 4:2:0 8-bit YY/CrCb Semiplanar.
- YCbCr422_10: YCbCr 4:2:2 10-bit unpacked.
- YCbCr422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked.
- YCbCr422_10p: YCbCr 4:2:2 10-bit packed.

- YCbCr422_10p_CbYCrY: YCbCr 4:2:2 10-bit packed.
- YCbCr422_12: YCbCr 4:2:2 12-bit unpacked.
- YCbCr422_12_CbYCrY: YCbCr 4:2:2 12-bit unpacked.
- YCbCr422_12p: YCbCr 4:2:2 12-bit packed.
- YCbCr422_12p_CbYCrY: YCbCr 4:2:2 12-bit packed.
- YCbCr422_8: YCbCr 4:2:2 8-bit.
- YCbCr422_8_CbYCrY: YCbCr 4:2:2 8-bit.
- YCbCr422_8_YY_CbCr_Semiplanar: YCbCr 4:2:2 8-bit YY/CbCr Semiplanar.
- YCbCr422_8_YY_CrCb_Semiplanar: YCbCr 4:2:2 8-bit YY/CrCb Semiplanar.
- YCbCr601_10_CbYCr: YCbCr 4:4:4 10-bit unpacked BT.601.
- YCbCr601_10p_CbYCr: YCbCr 4:4:4 10-bit packed BT.601.
- YCbCr601_10pmsb: YCbCr601_10pmsb.
- YCbCr601_12_CbYCr: YCbCr 4:4:4 12-bit unpacked BT.601.
- YCbCr601_12p_CbYCr: YCbCr 4:4:4 12-bit packed BT.601.
- YCbCr601_12pmsb: YCbCr601_12pmsb.
- YCbCr601_14pmsb: YCbCr601_14pmsb.
- YCbCr601_16: YCbCr601_16.
- YCbCr601_411_10pmsb: YCbCr601_411_10pmsb.
- YCbCr601_411_12pmsb: YCbCr601_411_12pmsb.
- YCbCr601_411_14pmsb: YCbCr601_411_14pmsb.
- YCbCr601_411_16: YCbCr601_411_16.
- YCbCr601_411_8: YCbCr601_411_8.
- YCbCr601_411_8_CbYYCrYY: YCbCr 4:1:1 8-bit BT.601.
- YCbCr601_422_10: YCbCr 4:2:2 10-bit unpacked BT.601.
- YCbCr601_422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked BT.601.
- YCbCr601_422_10p: YCbCr 4:2:2 10-bit packed BT.601.
- YCbCr601_422_10p_CbYCrY: YCbCr 4:2:2 10-bit packed BT.601.
- YCbCr601_422_10pmsb: YCbCr601_422_10pmsb.
- YCbCr601_422_12: YCbCr 4:2:2 12-bit unpacked BT.601.
- YCbCr601_422_12_CbYCrY: YCbCr 4:2:2 12-bit unpacked BT.601.
- YCbCr601_422_12p: YCbCr 4:2:2 12-bit packed BT.601.
- YCbCr601_422_12p_CbYCrY: YCbCr 4:2:2 12-bit packed BT.601.
- YCbCr601_422_12pmsb: YCbCr601_422_12pmsb.
- YCbCr601_422_14pmsb: YCbCr601_422_14pmsb.
- YCbCr601_422_16: YCbCr601_422_16.
- YCbCr601_422_8: YCbCr 4:2:2 8-bit BT.601.

- YCbCr601_422_8_CbYCrY: YCbCr 4:2:2 8-bit BT.601.
- YCbCr601_8: YCbCr601_8.
- YCbCr601_8_CbYCr: YCbCr 4:4:4 8-bit BT.601.
- YCbCr709_10_CbYCr: YCbCr 4:4:4 10-bit unpacked BT.709.
- YCbCr709_10p_CbYCr: YCbCr 4:4:4 10-bit packed BT.709.
- YCbCr709_10pmsb: YCbCr709_10pmsb.
- YCbCr709_12_CbYCr: YCbCr 4:4:4 12-bit unpacked BT.709.
- YCbCr709_12p_CbYCr: YCbCr 4:4:4 12-bit packed BT.709.
- YCbCr709_12pmsb: YCbCr709_12pmsb.
- YCbCr709_14pmsb: YCbCr709_14pmsb.
- YCbCr709_16: YCbCr709_16.
- YCbCr709_411_10pmsb: YCbCr709_411_10pmsb.
- YCbCr709_411_12pmsb: YCbCr709_411_12pmsb.
- YCbCr709_411_14pmsb: YCbCr709_411_14pmsb.
- YCbCr709_411_16: YCbCr709_411_16.
- YCbCr709_411_8: YCbCr709_411_8.
- YCbCr709_411_8_CbYYCrYY: YCbCr 4:1:1 8-bit BT.709.
- YCbCr709_422_10: YCbCr 4:2:2 10-bit unpacked BT.709.
- YCbCr709_422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked BT.709.
- YCbCr709_422_10p: YCbCr 4:2:2 10-bit packed BT.709.
- YCbCr709_422_10p_CbYCrY: YCbCr 4:2:2 10-bit packed BT.709.
- YCbCr709_422_10pmsb: YCbCr709_422_10pmsb.
- YCbCr709_422_12: YCbCr 4:2:2 12-bit unpacked BT.709.
- YCbCr709_422_12_CbYCrY: YCbCr 4:2:2 12-bit unpacked BT.709.
- YCbCr709_422_12p: YCbCr 4:2:2 12-bit packed BT.709.
- YCbCr709_422_12p_CbYCrY: YCbCr 4:2:2 12-bit packed BT.709.
- YCbCr709_422_12pmsb: YCbCr709_422_12pmsb.
- YCbCr709_422_14pmsb: YCbCr709_422_14pmsb.
- YCbCr709_422_16: YCbCr709_422_16.
- YCbCr709_422_8: YCbCr 4:2:2 8-bit BT.709.
- YCbCr709_422_8_CbYCrY: YCbCr 4:2:2 8-bit BT.709.
- YCbCr709_8: YCbCr709_8.
- YCbCr709_8_CbYCr: YCbCr 4:4:4 8-bit BT.709.
- YCbCr8: YCbCr 4:4:4 8-bit.
- YCbCr8_CbYCr: YCbCr 4:4:4 8-bit.
- YUV10pmsb: YUV10pmsb.

- **YUV12pmsb**: YUV12pmsb.
- **YUV14pmsb**: YUV14pmsb.
- **YUV16**: YUV16.
- **YUV411_10pmsb**: YUV411_10pmsb.
- **YUV411_12pmsb**: YUV411_12pmsb.
- **YUV411_14pmsb**: YUV411_14pmsb.
- **YUV411_16**: YUV411_16.
- **YUV411_8**: YUV411_8.
- **YUV411_8_UYVYY**: YUV 4:1:1 8-bit.
- **YUV422Packed**: YUV422Packed.
- **YUV422_10pmsb**: YUV422_10pmsb.
- **YUV422_12pmsb**: YUV422_12pmsb.
- **YUV422_14pmsb**: YUV422_14pmsb.
- **YUV422_16**: YUV422_16.
- **YUV422_8**: YUV 4:2:2 8-bit.
- **YUV422_8_UYVY**: YUV 4:2:2 8-bit.
- **YUV8**: YUV8.
- **YUV8_UYV**: YUV 4:4:4 8-bit.

PixelFormatNamespace

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Enumeration	Imposed: RO

Short Description

Namespace of the pixel format.

Enumeration Values

- **Unknown**: Unknown.
- **GEV**: GEV.
- **IIDC**: IIDC.
- **PFNC_16BIT**: PFNC 16-bit.
- **PFNC_32BIT**: PFNC 32-bit.

PixelSize

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	IntReg	RO

Register Port: StreamPort

Short Description

Pixel size in bits.

PixelComponentCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	IntReg	RO

Register Port: StreamPort

Short Description

Number of components per pixel.

Width

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	Imposed: RO

Short Description

Width of the image.

Height

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	Imposed: RO

Short Description

Height of the image.

Pitch

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	

Short Description

Pitch of the image (in bytes).

MinimumPitch

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	Imposed: RO

Short Description

Minimum pitch of the buffer (in bytes).

UserDefinedPitch

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	RW

Value Info

Minimum value: 0

Short Description

Pitch of the buffer (in bytes) defined by the user, or 0 to use MinimumPitch. Values smaller than MinimumPitch are ignored. Buffers should be reallocated after changing this.

ImageFormatSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Enumeration	RW

Short Description

ImageFormatSource defines how the data stream determines the format of images that will be sent by the camera.

Enumeration Values

- **RemoteDevice**: The data stream relies on the remote device PixelFormat, Width, and Height.
- **DataStream**: The data stream relies on RemotePixelFormat, RemoteWidth, and RemoteHeight.

RemotePixelFormat

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Enumeration	RW

Short Description

Pixel format of the remote device image.

Enumeration Values

- Mono8:
- Mono10:
- Mono12:
- Mono14:
- Mono16:
- RGB8:
- RGB10:
- RGB12:
- RGB14:
- RGB16:
- RGBa8:
- RGBa10:
- RGBa12:
- RGBa14:
- RGBa16:
- BayerBG8:
- BayerBG10:
- BayerBG12:
- BayerBG14:
- BayerBG16:
- BayerGB8:
- BayerGB10:
- BayerGB12:
- BayerGB14:

- BayerGB16:
- BayerRG8:
- BayerRG10:
- BayerRG12:
- BayerRG14:
- BayerRG16:
- BayerGR8:
- BayerGR10:
- BayerGR12:
- BayerGR14:
- BayerGR16:

RemoteWidth

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Width of the remote device image.

RemoteHeight

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Height of the remote device image.

InterleavedHorizontalStriping

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Category	

Category Members

See also: ["InterleavedHorizontalStriping Category" on page 858](#)

VerticalStriping

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Category	

Category Members

See also: ["VerticalStriping Category" on page 863](#)

ReverseX

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Boolean	

Short Description

Horizontally flip the image sent by the camera.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

ReverseY

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Boolean	RW

Short Description

Vertically flip the image sent by the camera. Buffers should be reannounced after changing this.

PlanarRGB

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl	Enumeration	

Short Description

Splits each line into three parts. Each part corresponds to a single component.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable.
- **Enable**: Enable.

4.4. TransportLayerControl Category

PayloadSize	807
DeviceTapGeometrySource	808
RemoteDeviceTapGeometry	809

PayloadSize

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → TransportLayerControl	Integer	Imposed: RO

Short Description

Expected size of buffers for the data stream. This depends on the camera resolution, onboard pixel processing (e.g., UnpackingMode, BayerMethod), padding (Pitch[DataStream], StripePitch). Also depends on BufferPartCount (area-scan firmware variants) and BufferHeight (line-scan firmware variants).

DeviceTapGeometrySource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → TransportLayerControl	Enumeration	RW

Short Description

Source of remote device tap geometry.

Enumeration Values

- **RemoteDevice**: Remote device (DeviceTapGeometry).
- **DataStream**: Data stream (RemoteDeviceTapGeometry).

RemoteDeviceTapGeometry

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → TransportLayerControl	Enumeration	RW

Short Description

Device tap geometry of the remote device.

Enumeration Values

- Geometry_1X_1Y:
- Geometry_1X2_1Y:
- Geometry_1X3_1Y:
- Geometry_1X4_1Y:
- Geometry_1X5_1Y:
- Geometry_1X6_1Y:
- Geometry_1X7_1Y:
- Geometry_1X8_1Y:
- Geometry_1X10_1Y:
- Geometry_2X_1Y:
- Geometry_2XE_1Y:
- Geometry_2XM_1Y:
- Geometry_2XR_1Y:
- Geometry_2X2_1Y:
- Geometry_2X2E_1Y:
- Geometry_2X2M_1Y:
- Geometry_2X3_1Y:
- Geometry_2X4_1Y:
- Geometry_3X_1Y:
- Geometry_3X2_1Y:
- Geometry_4X_1Y:
- Geometry_4XE_1Y:
- Geometry_4XR_1Y:
- Geometry_4X2_1Y:

- Geometry_4X2E_1Y:
- Geometry_5X_1Y:
- Geometry_6X_1Y:
- Geometry_7X_1Y:
- Geometry_8X_1Y:
- Geometry_8XR_1Y:
- Geometry_10X_1Y:

4.5. BufferHandlingControl Category

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StreamAnnouncedBufferCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Integer	Imposed: RO

Short Description

Number of announced buffers on the stream.

StreamBufferHandlingMode

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	

Short Description

Available buffer handling modes of this Stream.

Enumeration Values

- **Default:** Default Buffer Handling Mode.

StreamAnnounceBufferMinimum

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Integer	Imposed: RO

Short Description

Minimal number of buffers to announce to enable selected buffer handling mode.

StreamAcquisitionModeSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	

Short Description

Available buffer handling modes of this Stream. Deprecated.

Enumeration Values

- **Default:** Default Buffer Handling Mode.

BufferAllocationAlignmentControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	RW

Short Description

Buffer Allocation Alignment Control.

Enumeration Values

- **Disable**: Disable aligned buffer allocation.
- **Enable**: Enable aligned buffer allocation.

BufferAllocationAlignment

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Alignment of buffers allocated by DSAllocAndAnnounceBuffer, should be a power of 2.

MemoryType

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	

Short Description

Memory type (cf. MEMORY_TYPE in GenTL_EuresysCustom.h).

Selected Features

- ["MemoryTypeSupported" on page 819](#)

Enumeration Values

- **Default:** Default host memory.
- **BusAddress:** Bus address (already mapped and translated).
- **NvidiaRDMA:** Device memory allocated for RDMA on a NVIDIA card.

MemoryTypeSupported

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Boolean	Imposed: RO

Short Description

Indicates whether the selected MemoryType can be used in EuresysDSAnnounceDeviceBuffer.

BufferFilledRule

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	RW

Short Description

Rule for handling remaining data when a buffer is full.

Enumeration Values

- **DiscardRemainingData**: Discard remaining acquired data.
- **ContinueInNextBuffer**: Continue acquisition in next buffer.

BufferInfoSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	RW

Short Description

BufferInfoSource defines how the data stream determines the format of images sent by the camera.

Enumeration Values

- **ImageHeader**: The data stream relies on the remote device PixelFormat, Width, and Height.
- **DataStream**: The data stream relies on BufferInfoPixelFormat, BufferInfoWidth, and BufferInfoHeight.

BufferInfoWidth

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Imposed width.

BufferInfoHeight

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Integer	RW

Value Info

Minimum value: 0

Short Description

Imposed height.

BufferInfoPixelFormat

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → BufferHandlingControl	Enumeration	RW

Short Description

Imposed pixel format.

Enumeration Values

- **BayerBG10pmsb**: BayerBG10pmsb.
- **BayerBG12pmsb**: BayerBG12pmsb.
- **BayerBG14pmsb**: BayerBG14pmsb.
- **BayerBG16**: BayerBG16.
- **BayerBG8**: BayerBG8.
- **BayerGB10pmsb**: BayerGB10pmsb.
- **BayerGB12pmsb**: BayerGB12pmsb.
- **BayerGB14pmsb**: BayerGB14pmsb.
- **BayerGB16**: BayerGB16.
- **BayerGB8**: BayerGB8.
- **BayerGR10pmsb**: BayerGR10pmsb.
- **BayerGR12pmsb**: BayerGR12pmsb.
- **BayerGR14pmsb**: BayerGR14pmsb.
- **BayerGR16**: BayerGR16.
- **BayerGR8**: BayerGR8.
- **BayerRG10pmsb**: BayerRG10pmsb.
- **BayerRG12pmsb**: BayerRG12pmsb.
- **BayerRG14pmsb**: BayerRG14pmsb.
- **BayerRG16**: BayerRG16.
- **BayerRG8**: BayerRG8.
- **BiColorBGRG10pmsb**: BiColorBGRG10pmsb.
- **BiColorBGRG12pmsb**: BiColorBGRG12pmsb.
- **BiColorBGRG8**: BiColorBGRG8.
- **BiColorRGBG10pmsb**: BiColorRGBG10pmsb.

- **BiColorRGBG12pmsb**: BiColorRGBG12pmsb.
- **BiColorRGBG8**: BiColorRGBG8.
- **Mono10pmsb**: Mono10pmsb.
- **Mono12pmsb**: Mono12pmsb.
- **Mono14pmsb**: Mono14pmsb.
- **Mono16**: Mono16.
- **Mono8**: Mono8.
- **RGB10pmsb**: RGB10pmsb.
- **RGB12pmsb**: RGB12pmsb.
- **RGB14pmsb**: RGB14pmsb.
- **RGB16**: RGB16.
- **RGB8**: RGB8.
- **RGBa10pmsb**: RGBa10pmsb.
- **RGBa12pmsb**: RGBa12pmsb.
- **RGBa14pmsb**: RGBa14pmsb.
- **RGBa16**: RGBa16.
- **RGBa8**: RGBa8.
- **YCbCr601_422_10pmsb**: YCbCr601_422_10pmsb.
- **YCbCr601_422_12pmsb**: YCbCr601_422_12pmsb.
- **YCbCr601_422_14pmsb**: YCbCr601_422_14pmsb.
- **YCbCr601_422_16**: YCbCr601_422_16.
- **YCbCr601_422_8**: YCbCr601_422_8.
- **YCbCr709_422_10pmsb**: YCbCr709_422_10pmsb.
- **YCbCr709_422_12pmsb**: YCbCr709_422_12pmsb.
- **YCbCr709_422_14pmsb**: YCbCr709_422_14pmsb.
- **YCbCr709_422_16**: YCbCr709_422_16.
- **YCbCr709_422_8**: YCbCr709_422_8.
- **YUV422_10pmsb**: YUV422_10pmsb.
- **YUV422_12pmsb**: YUV422_12pmsb.
- **YUV422_14pmsb**: YUV422_14pmsb.
- **YUV422_16**: YUV422_16.
- **YUV422_8**: YUV422_8.

4.6. PixelProcessing Category

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UnpackingMode

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → PixelProcessing	Enumeration	RW

Description

Unpacking Mode of multi-byte pixel components.

When set to Lsb, each pixel component is unpacked to the least significant bit. Padding '0' bits are put as necessary in the most significant bits to reach the next 8-bit boundary. 16-bit data are delivered using the little-endian convention.

When set to Msb, each pixel component is unpacked to the most significant bit. Padding '0' bits are put as necessary in the least significant bits to reach the next 8-bit boundary. 16-bit data are delivered using the little-endian convention.

When set to Off, the pixel components are not unpacked. The pixel data stream is left unchanged.

Default value: Lsb.



NOTE

The default value was Msb for Coaxlink driver versions prior to 4.3.

Enumeration Values

- **Lsb**: Unpacking to lsb.
- **Msb**: Unpacking to msb.
- **Off**: No unpacking.

RedBlueSwap

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → PixelProcessing	Boolean	RW

Description

Red-Blue component swapping.

When true, the first (Red) and the last (Blue) color components of an RGB packed pixel are swapped before being delivered.

When false, the pixel component order remains unchanged.

Default value: **False.**

ImageScaling

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → PixelProcessing	Enumeration	RW

Short Description

Image scaling.

Enumeration Values

- **Off**: No image scaling.
- **Scaling_1_8**: 1:8 image down-scaling.

JpegQuality

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → PixelProcessing	Integer	RW

Value Info

Minimum value: 1

Maximum value: 100

Short Description

JPEG quality.

BinningMethod

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → PixelProcessing	Enumeration	RW

Short Description

Binning method and window.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable.
- **Sum_2x2**: Binning 2x2 Sum.
- **Mean_2x2**: Binning 2x2 Mean.
- **Sum_4x4**: Binning 4x4 Sum.
- **Mean_4x4**: Binning 4x4 Mean.

4.7. LineScanAcquisitionControl Category

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StartOfScanTriggerSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Enumeration	

Description

Start-of-scan trigger conditions and trigger source.

Default value: **Immediate**.

Enumeration Values

- **Immediate**: Immediate.
- **StartScan**: StartScan command.
- **LIN1**: When an event occurs on Line Input Tool 1 or on execution of the StartScan command.
- **LIN2**: When an event occurs on Line Input Tool 2 or on execution of the StartScan command.
- **LIN3**: When an event occurs on Line Input Tool 3 or on execution of the StartScan command.
- **LIN4**: When an event occurs on Line Input Tool 4 or on execution of the StartScan command.
- **LIN5**: When an event occurs on Line Input Tool 5 or on execution of the StartScan command.
- **LIN6**: When an event occurs on Line Input Tool 6 or on execution of the StartScan command.
- **LIN7**: When an event occurs on Line Input Tool 7 or on execution of the StartScan command.
- **LIN8**: When an event occurs on Line Input Tool 8 or on execution of the StartScan command.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1 or on execution of the StartScan command.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2 or on execution of the StartScan command.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3 or on execution of the StartScan command.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4 or on execution of the StartScan command.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1 or on execution of the StartScan command.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2 or on execution of the StartScan command.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3 or on execution of the StartScan command.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4 or on execution of the StartScan command.

- **DIV1**: When an event occurs on Divider Tool 1 or on execution of the StartScan command.
- **DIV2**: When an event occurs on Divider Tool 2 or on execution of the StartScan command.
- **DIV3**: When an event occurs on Divider Tool 3 or on execution of the StartScan command.
- **DIV4**: When an event occurs on Divider Tool 4 or on execution of the StartScan command.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1 or on execution of the StartScan command.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2 or on execution of the StartScan command.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1 or on execution of the StartScan command.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2 or on execution of the StartScan command.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1 or on execution of the StartScan command.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2 or on execution of the StartScan command.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1 or on execution of the StartScan command.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2 or on execution of the StartScan command.
- **EIN1**: When an event occurs on Event Input Tool 1 or on execution of the StartScan command.
- **EIN2**: When an event occurs on Event Input Tool 2 or on execution of the StartScan command.
- **UserEvent1**: When an event occurs on User Event 1 or on execution of the StartScan command.
- **UserEvent2**: When an event occurs on User Event 2 or on execution of the StartScan command.
- **UserEvent3**: When an event occurs on User Event 3 or on execution of the StartScan command.
- **UserEvent4**: When an event occurs on User Event 4 or on execution of the StartScan command.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1 or on execution of the StartScan command.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2 or on execution of the StartScan command.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3 or on execution of the StartScan command.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1 or on execution of the StartScan command.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2 or on execution of the StartScan command.

- **DLT3:** When an event occurs on DeviceLinkTrigger Tool 3 or on execution of the StartScan command.
- **DLT4:** When an event occurs on DeviceLinkTrigger Tool 4 or on execution of the StartScan command.
- **DLT5:** When an event occurs on DeviceLinkTrigger Tool 5 or on execution of the StartScan command.
- **DLT6:** When an event occurs on DeviceLinkTrigger Tool 6 or on execution of the StartScan command.
- **DLT7:** When an event occurs on DeviceLinkTrigger Tool 7 or on execution of the StartScan command.
- **DLT8:** When an event occurs on DeviceLinkTrigger Tool 8 or on execution of the StartScan command.
- **DLT9:** When an event occurs on DeviceLinkTrigger Tool 9 or on execution of the StartScan command.
- **DLT10:** When an event occurs on DeviceLinkTrigger Tool 10 or on execution of the StartScan command.
- **DLT11:** When an event occurs on DeviceLinkTrigger Tool 11 or on execution of the StartScan command.
- **DLT12:** When an event occurs on DeviceLinkTrigger Tool 12 or on execution of the StartScan command.
- **DLT13:** When an event occurs on DeviceLinkTrigger Tool 13 or on execution of the StartScan command.
- **DLT14:** When an event occurs on DeviceLinkTrigger Tool 14 or on execution of the StartScan command.
- **DLT15:** When an event occurs on DeviceLinkTrigger Tool 15 or on execution of the StartScan command.
- **DLT16:** When an event occurs on DeviceLinkTrigger Tool 16 or on execution of the StartScan command.
- **CFW1:** When an event occurs on Custom Firmware Tool 1 or on execution of the StartScan command.
- **CFW2:** When an event occurs on Custom Firmware Tool 2 or on execution of the StartScan command.
- **CFW3:** When an event occurs on Custom Firmware Tool 3 or on execution of the StartScan command.
- **CFW4:** When an event occurs on Custom Firmware Tool 4 or on execution of the StartScan command.
- **CFW5:** When an event occurs on Custom Firmware Tool 5 or on execution of the StartScan command.
- **CFW6:** When an event occurs on Custom Firmware Tool 6 or on execution of the StartScan command.
- **CFW7:** When an event occurs on Custom Firmware Tool 7 or on execution of the StartScan command.

- **CFW8:** When an event occurs on Custom Firmware Tool 8 or on execution of the StartScan command.
- **CFW9:** When an event occurs on Custom Firmware Tool 9 or on execution of the StartScan command.
- **CFW10:** When an event occurs on Custom Firmware Tool 10 or on execution of the StartScan command.
- **CFW11:** When an event occurs on Custom Firmware Tool 11 or on execution of the StartScan command.
- **CFW12:** When an event occurs on Custom Firmware Tool 12 or on execution of the StartScan command.
- **CFW13:** When an event occurs on Custom Firmware Tool 13 or on execution of the StartScan command.
- **CFW14:** When an event occurs on Custom Firmware Tool 14 or on execution of the StartScan command.
- **CFW15:** When an event occurs on Custom Firmware Tool 15 or on execution of the StartScan command.
- **CFW16:** When an event occurs on Custom Firmware Tool 16 or on execution of the StartScan command.

EndOfScanTriggerSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Enumeration	

Description

End-of-scan trigger conditions and trigger source.

Default value: `ScanLength`.

Enumeration Values

- `ScanLength`: `ScanLength`.
- `StopScan`: `StopScan` command.
- `LIN1`: When an event occurs on Line Input Tool 1 or on execution of the `StopScan` command.
- `LIN2`: When an event occurs on Line Input Tool 2 or on execution of the `StopScan` command.
- `LIN3`: When an event occurs on Line Input Tool 3 or on execution of the `StopScan` command.
- `LIN4`: When an event occurs on Line Input Tool 4 or on execution of the `StopScan` command.
- `LIN5`: When an event occurs on Line Input Tool 5 or on execution of the `StopScan` command.
- `LIN6`: When an event occurs on Line Input Tool 6 or on execution of the `StopScan` command.
- `LIN7`: When an event occurs on Line Input Tool 7 or on execution of the `StopScan` command.
- `LIN8`: When an event occurs on Line Input Tool 8 or on execution of the `StopScan` command.
- `QDC1`: When an event occurs on Quadrature Decoder Tool 1 or on execution of the `StopScan` command.
- `QDC2`: When an event occurs on Quadrature Decoder Tool 2 or on execution of the `StopScan` command.
- `QDC3`: When an event occurs on Quadrature Decoder Tool 3 or on execution of the `StopScan` command.
- `QDC4`: When an event occurs on Quadrature Decoder Tool 4 or on execution of the `StopScan` command.
- `MDV1`: When an event occurs on Multiplier/Divider Tool 1 or on execution of the `StopScan` command.
- `MDV2`: When an event occurs on Multiplier/Divider Tool 2 or on execution of the `StopScan` command.
- `MDV3`: When an event occurs on Multiplier/Divider Tool 3 or on execution of the `StopScan` command.
- `MDV4`: When an event occurs on Multiplier/Divider Tool 4 or on execution of the `StopScan` command.

- **DIV1**: When an event occurs on Divider Tool 1 or on execution of the StopScan command.
- **DIV2**: When an event occurs on Divider Tool 2 or on execution of the StopScan command.
- **DIV3**: When an event occurs on Divider Tool 3 or on execution of the StopScan command.
- **DIV4**: When an event occurs on Divider Tool 4 or on execution of the StopScan command.
- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1 or on execution of the StopScan command.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2 or on execution of the StopScan command.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1 or on execution of the StopScan command.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2 or on execution of the StopScan command.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1 or on execution of the StopScan command.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2 or on execution of the StopScan command.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1 or on execution of the StopScan command.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2 or on execution of the StopScan command.
- **EIN1**: When an event occurs on Event Input Tool 1 or on execution of the StopScan command.
- **EIN2**: When an event occurs on Event Input Tool 2 or on execution of the StopScan command.
- **UserEvent1**: When an event occurs on User Event 1 or on execution of the StopScan command.
- **UserEvent2**: When an event occurs on User Event 2 or on execution of the StopScan command.
- **UserEvent3**: When an event occurs on User Event 3 or on execution of the StopScan command.
- **UserEvent4**: When an event occurs on User Event 4 or on execution of the StopScan command.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1 or on execution of the StopScan command.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2 or on execution of the StopScan command.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3 or on execution of the StopScan command.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1 or on execution of the StopScan command.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2 or on execution of the StopScan command.

- **DLT3:** When an event occurs on DeviceLinkTrigger Tool 3 or on execution of the StopScan command.
- **DLT4:** When an event occurs on DeviceLinkTrigger Tool 4 or on execution of the StopScan command.
- **DLT5:** When an event occurs on DeviceLinkTrigger Tool 5 or on execution of the StopScan command.
- **DLT6:** When an event occurs on DeviceLinkTrigger Tool 6 or on execution of the StopScan command.
- **DLT7:** When an event occurs on DeviceLinkTrigger Tool 7 or on execution of the StopScan command.
- **DLT8:** When an event occurs on DeviceLinkTrigger Tool 8 or on execution of the StopScan command.
- **DLT9:** When an event occurs on DeviceLinkTrigger Tool 9 or on execution of the StopScan command.
- **DLT10:** When an event occurs on DeviceLinkTrigger Tool 10 or on execution of the StopScan command.
- **DLT11:** When an event occurs on DeviceLinkTrigger Tool 11 or on execution of the StopScan command.
- **DLT12:** When an event occurs on DeviceLinkTrigger Tool 12 or on execution of the StopScan command.
- **DLT13:** When an event occurs on DeviceLinkTrigger Tool 13 or on execution of the StopScan command.
- **DLT14:** When an event occurs on DeviceLinkTrigger Tool 14 or on execution of the StopScan command.
- **DLT15:** When an event occurs on DeviceLinkTrigger Tool 15 or on execution of the StopScan command.
- **DLT16:** When an event occurs on DeviceLinkTrigger Tool 16 or on execution of the StopScan command.
- **CFW1:** When an event occurs on Custom Firmware Tool 1 or on execution of the StopScan command.
- **CFW2:** When an event occurs on Custom Firmware Tool 2 or on execution of the StopScan command.
- **CFW3:** When an event occurs on Custom Firmware Tool 3 or on execution of the StopScan command.
- **CFW4:** When an event occurs on Custom Firmware Tool 4 or on execution of the StopScan command.
- **CFW5:** When an event occurs on Custom Firmware Tool 5 or on execution of the StopScan command.
- **CFW6:** When an event occurs on Custom Firmware Tool 6 or on execution of the StopScan command.
- **CFW7:** When an event occurs on Custom Firmware Tool 7 or on execution of the StopScan command.

- **CFW8:** When an event occurs on Custom Firmware Tool 8 or on execution of the StopScan command.
- **CFW9:** When an event occurs on Custom Firmware Tool 9 or on execution of the StopScan command.
- **CFW10:** When an event occurs on Custom Firmware Tool 10 or on execution of the StopScan command.
- **CFW11:** When an event occurs on Custom Firmware Tool 11 or on execution of the StopScan command.
- **CFW12:** When an event occurs on Custom Firmware Tool 12 or on execution of the StopScan command.
- **CFW13:** When an event occurs on Custom Firmware Tool 13 or on execution of the StopScan command.
- **CFW14:** When an event occurs on Custom Firmware Tool 14 or on execution of the StopScan command.
- **CFW15:** When an event occurs on Custom Firmware Tool 15 or on execution of the StopScan command.
- **CFW16:** When an event occurs on Custom Firmware Tool 16 or on execution of the StopScan command.

ScanLength

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Integer	RW

Value Info

Minimum value: 1

Maximum value: 16777215

Unit: lines

Default value: 512

Description

Sets/gets the number of captured lines before stopping the scanning.



NOTE

Applies only when `EndOfScanTriggerSource = ScanLength`.

BufferHeight

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Integer	RW

Value Info

Unit: lines

Short Description

Height of the image in line-scan mode. This feature is only used in line-scan acquisition scenarios to compute PayloadSize. Buffers should be reallocated after changing this.

StartScan

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Command	Imposed: WO

Short Description

Starts a scan.

StopScan

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Command	Imposed: WO

Short Description

Stops a scan.

TriggerToLineLatencyCompensation

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LineScanAcquisitionControl	Enumeration	RW

Short Description

Enable or disable the trigger to line latency compensation for StartOfScan and/or EndOfScan events. Can be enabled if the Camera and Illumination Controller is used (i.e., CameraControlMethod set to either RG or RC) and at least one of BufferMetadataInsertionEnable and LineMetadataInsertionEnable is set to True.

Enumeration Values

- **Disable**: Disable latency compensation.
- **Enable**: Enable latency compensation for StartOfScan and EndOfScan events.
- **EnableForStartOfScanOnly**: Enable latency compensation for StartOfScan events only.
- **EnableForEndOfScanOnly**: Enable latency compensation for EndOfScan events only.

4.8. StreamControl Category

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StreamReset

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Command	Imposed: WO

Short Description

Stream Reset.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

DmaEngineOptimization

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Enumeration	RW

Short Description

Dma Engine Optimization.

Enumeration Values

- **Default:** DMA operations are optimized for low latency and maximum PCIe throughput.
- **LowMemoryUsage:** DMA operations are optimized for low memory usage; this may lead to higher latency and reduced PCIe throughput.

DmaEngineMaxQueueSize

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Integer	RW

Value Info

Minimum value: 1

Maximum value: 10000

Short Description

Maximum number of pending buffers (i.e., buffers queued for DMA operations). Pending buffers are removed from the input queue and placed in an internal pending buffer queue. When a pending buffer is filled, it is removed from the pending buffer queue and placed in the output buffer queue. Higher values of DmaEngineMaxQueueSize lead to lower latency and higher PCIe throughput. DmaEngineMaxQueueSize is ignored when DmaEngineOptimization is set to LowMemoryUsage.

TriggerToCameraReadoutTimeout

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Integer	RW

Value Info

Minimum value: 0

Maximum value: 134217728

Short Description

Trigger To Camera Readout Timeout.

CameraReadoutTimeout

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Integer	RW

Value Info

Minimum value: 0

Maximum value: 134217728

Short Description

Camera Readout Timeout.

StripeArrangement

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Enumeration	RW

Short Description

The stripe arrangement defines how image data is arranged in user buffers. Buffers should be reannounced after changing this.

Enumeration Values

- **Geometry_1X_1Y**: Regular (top-down) image.
- **Geometry_1X_1YE**: Deprecated; please use ReverseY instead.
- **Geometry_1X_2Y**: 2 taps arranged top-down.
- **Geometry_1X_2YE**: 2 taps arranged top-down and bottom-up.
- **Geometry_1X_2YM**: 2 taps arranged middle-up and middle-down.
- **Geometry_1X_3Y**: 3 taps arranged top-down.
- **DmaProgram1**: Custom DMA program 1.
- **DmaProgram2**: Custom DMA program 2.
- **DmaProgram3**: Custom DMA program 3.

BufferPartCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Number of images to put in one buffer (default: 1). Using larger values is recommended for high frame rate applications. Note that the value of BufferPartCount is only used when the buffer is announced. Buffers should be reallocated after changing this.

DmaProgram

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Category	

Category Members

See also: ["DmaProgram Category" on page 867](#)

SyncMarker

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Category	

Category Members

See also: ["SyncMarker Category" on page 893](#)

ActivateCic

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Command	Imposed: WO

Short Description

Activate the Camera and Illumination Controller if the data stream was started with ACQ_START_FLAGS_CUSTOM_DO_NOT_ACTIVATE_SEQUENCER.

DeactivateCic

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl	Command	Imposed: WO

Short Description

Deactivate the Camera and Illumination Controller.

4.9. InterleavedHorizontalStriping Category

StripeHeight	859
StripePitch	860
StripeOffset	861
BlockHeight	862

StripeHeight

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → InterleavedHorizontalStriping	Integer	RW

Value Info

Minimum value: 0

Short Description

Stripe height in lines. This is only useful for a few multi-bank cameras. Buffers should be reallocated after changing this.

StripePitch

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → InterleavedHorizontalStriping	Integer	RW

Value Info

Minimum value: 0

Short Description

Stripe pitch in lines. This is only useful for a few multi-bank cameras. Buffers should be reallocated after changing this.

StripeOffset

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → InterleavedHorizontalStriping	Integer	RW

Value Info

Minimum value: 0

Short Description

Stripe offset in lines. This is only useful for a few multi-bank cameras. Buffers should be reannounced after changing this.

BlockHeight

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → InterleavedHorizontalStriping	Integer	RW

Value Info

Minimum value: 0

Short Description

Block height in lines; ignored if StripeArrangement is not Geometry_1X_2YM. This is only useful for a few multi-bank cameras. Buffers should be reannounced after changing this.

4.10. VerticalStriping Category

VerticalStripeCount	864
VerticalStripeIndex	865
VerticalStripeOverlap	866

VerticalStripeCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → VerticalStriping	Integer	RW

Value Info

Minimum value: 0

Short Description

Number of vertical stripes delivered by the camera. 0 means that vertical striping is not used. This is only useful for multi-bank cameras. Buffers should be reallocated after changing this.

VerticalStripeIndex

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → VerticalStriping	Integer	RW

Value Info

Minimum value: 0

Short Description

Index of the vertical stripe received on this data stream. This is only useful for multi-bank cameras. Buffers should be reannounced after changing this.

VerticalStripeOverlap

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → ImageFormatControl → VerticalStriping	Integer	Imposed: RO

Short Description

Overlap between vertical stripes is not supported.

4.11. DmaProgram Category

DmaSegmentSize	868
DmaSegmentOffset	869
DmaSegmentOffsetIncrement	870
DmaSegmentsActiveCount	871
DmaSegmentsCycleCount	872
DmaSegmentsRepeatCount	873
DmaProgramSelector	874
DmaAddSegment	875
DmaAddSequence	876
DmaCompleteProgram	877
DmaResetProgram	878
DmaProgramPixelFormat	879
DmaProgramWidth	890
DmaProgramHeight	891
DmaProgramPitch	892

DmaSegmentSize

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Value Info

Minimum value: 0

Short Description

Segment size in bytes defines the transfer size.

DmaSegmentOffset

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Value Info

Minimum value: -1

Short Description

Segment offset in bytes defines the transfer destination offset from the base address of the announced buffer or part (-1 to discard the data). The program keeps track of the transfer destination offset of each segment individually in the sequence.

DmaSegmentOffsetIncrement

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Short Description

Segment offset increment in bytes defines the signed transfer destination offset automatic increment (ignored when DmaSegmentOffset is -1). The program keeps track of each segment transfer destination offset incremented by DmaSegmentOffsetIncrement.

DmaSegmentsActiveCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Value Info

Minimum value: 1

Maximum value: 65535

Short Description

DmaSegmentsActiveCount defines the count of active steps (that is allowed to transfer data) in a cycle of DmaSegmentsCycleCount steps. DmaSegmentsActiveCount=1 with DmaSegmentsCycleCount=1 means that all segments are active but DmaSegmentsActiveCount=1 with DmaSegmentsCycleCount=2 means that only one out of two segments is active. An internal cycle step counter is used to decide when a segment is active or not, this counter is incremented on every segment and it is not reset when the sequence of segments is repeated but only after the repeat count (DmaSegmentsRepeatCount).

DmaSegmentsCycleCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Value Info

Minimum value: 1

Maximum value: 65535

Short Description

DmaSegmentsCycleCount defines the total count of steps defining a cycle. This feature is used with DmaSegmentsActiveCount. DmaSegmentsActiveCount=1 with DmaSegmentsCycleCount=1 means that all segments are active but DmaSegmentsActiveCount=1 with DmaSegmentsCycleCount=2 means that only one out of two segments is active. An internal cycle step counter is used to decide when a segment is active or not, this counter is incremented on every segment and it is not reset when the sequence of segments is repeated but only after the repeat count (DmaSegmentsRepeatCount).

DmaSegmentsRepeatCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Value Info

Minimum value: 1

Maximum value: 1000000

Short Description

DmaSegmentsRepeatCount defines the number of times the sequence of segments is executed. The cycle step counter is only reset after DmaSegmentsRepeatCount executions.

DmaProgramSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Enumeration	RW

Short Description

Select a Custom DMA program.

Selected Features

- ["DmaAddSegment" on page 875](#)
- ["DmaAddSequence" on page 876](#)
- ["DmaCompleteProgram" on page 877](#)
- ["DmaResetProgram" on page 878](#)
- ["DmaProgramPixelFormat" on page 879](#)
- ["DmaProgramWidth" on page 890](#)
- ["DmaProgramHeight" on page 891](#)
- ["DmaProgramPitch" on page 892](#)

Enumeration Values

- **DmaProgram1**: Custom DMA program 1.
- **DmaProgram2**: Custom DMA program 2.
- **DmaProgram3**: Custom DMA program 3.

DmaAddSegment

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Command	Imposed: WO

Short Description

Add a new segment defined by DmaSegmentSize, DmaSegmentOffset and DmaSegmentOffsetIncrement to the selected program.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

DmaAddSequence

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Command	Imposed: WO

Short Description

Add a new sequence of segments defined by DmaSegmentsRepeatCount, DmaSegmentsActiveCount and DmaSegmentsCycleCount to the selected program.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

DmaCompleteProgram

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Command	Imposed: WO

Short Description

Complete the selected program and make it available in StripeArrangement (the program cannot be further modified unless it is reset with DmaResetProgram). DmaProgramPixelFormat, DmaProgramWidth, DmaProgramHeight, and DmaProgramPitch must be defined before executing DmaCompleteProgram.

DmaResetProgram

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Command	Imposed: WO

Short Description

Clear the selected program.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

DmaProgramPixelFormat

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Enumeration	RW

Short Description

Pixel format of the images resulting from the selected program.

Enumeration Values

- **B10**: Blue 10-bit.
- **B10_Deprecated**: Deprecated because size field is wrong.
- **B12**: Blue 12-bit.
- **B12_Deprecated**: Deprecated because size field is wrong.
- **B16**: Blue 16-bit.
- **B8**: Blue 8-bit.
- **BGR10**: Blue-Green-Red 10-bit unpacked.
- **BGR10_HorizontalPlanar**: BGR10_HorizontalPlanar.
- **BGR10p**: Blue-Green-Red 10-bit packed.
- **BGR12**: Blue-Green-Red 12-bit unpacked.
- **BGR12_HorizontalPlanar**: BGR12_HorizontalPlanar.
- **BGR12p**: Blue-Green-Red 12-bit packed.
- **BGR14**: Blue-Green-Red 14-bit unpacked.
- **BGR14_HorizontalPlanar**: BGR14_HorizontalPlanar.
- **BGR16**: Blue-Green-Red 16-bit.
- **BGR16_HorizontalPlanar**: BGR16_HorizontalPlanar.
- **BGR565p**: Blue-Green-Red 5/6/5-bit packed.
- **BGR8**: Blue-Green-Red 8-bit.
- **BGR8_HorizontalPlanar**: BGR8_HorizontalPlanar.
- **BGR8a32**: BGR8a32.
- **BGRa10**: Blue-Green-Red-alpha 10-bit unpacked.
- **BGRa10p**: Blue-Green-Red-alpha 10-bit packed.
- **BGRa12**: Blue-Green-Red-alpha 12-bit unpacked.
- **BGRa12p**: Blue-Green-Red-alpha 12-bit packed.

- **BGRa14**: Blue-Green-Red-alpha 14-bit unpacked.
- **BGRa16**: Blue-Green-Red-alpha 16-bit.
- **BGRa8**: Blue-Green-Red-alpha 8-bit.
- **BayerBG10**: Bayer Blue-Green 10-bit unpacked.
- **BayerBG10Packed**: Bayer Blue-Green 10-bit packed.
- **BayerBG10p**: Bayer Blue-Green 10-bit packed.
- **BayerBG10pmsb**: BayerBG10pmsb.
- **BayerBG12**: Bayer Blue-Green 12-bit unpacked.
- **BayerBG12Packed**: Bayer Blue-Green 12-bit packed.
- **BayerBG12p**: Bayer Blue-Green 12-bit packed.
- **BayerBG12pmsb**: BayerBG12pmsb.
- **BayerBG14**: Bayer Blue-Green 14-bit.
- **BayerBG14p**: Bayer Blue-Green 14-bit packed.
- **BayerBG14pmsb**: BayerBG14pmsb.
- **BayerBG16**: Bayer Blue-Green 16-bit.
- **BayerBG4p**: Bayer Blue-Green 4-bit packed.
- **BayerBG8**: Bayer Blue-Green 8-bit.
- **BayerGB10**: Bayer Green-Blue 10-bit unpacked.
- **BayerGB10Packed**: Bayer Green-Blue 10-bit packed.
- **BayerGB10p**: Bayer Green-Blue 10-bit packed.
- **BayerGB10pmsb**: BayerGB10pmsb.
- **BayerGB12**: Bayer Green-Blue 12-bit unpacked.
- **BayerGB12Packed**: Bayer Green-Blue 12-bit packed.
- **BayerGB12p**: Bayer Green-Blue 12-bit packed.
- **BayerGB12pmsb**: BayerGB12pmsb.
- **BayerGB14**: Bayer Green-Blue 14-bit.
- **BayerGB14p**: Bayer Green-Blue 14-bit packed.
- **BayerGB14pmsb**: BayerGB14pmsb.
- **BayerGB16**: Bayer Green-Blue 16-bit.
- **BayerGB4p**: Bayer Green-Blue 4-bit packed.
- **BayerGB8**: Bayer Green-Blue 8-bit.
- **BayerGR10**: Bayer Green-Red 10-bit unpacked.
- **BayerGR10Packed**: Bayer Green-Red 10-bit packed.
- **BayerGR10p**: Bayer Green-Red 10-bit packed.
- **BayerGR10pmsb**: BayerGR10pmsb.
- **BayerGR12**: Bayer Green-Red 12-bit unpacked.

- **BayerGR12Packed**: Bayer Green-Red 12-bit packed.
- **BayerGR12p**: Bayer Green-Red 12-bit packed.
- **BayerGR12pmsb**: BayerGR12pmsb.
- **BayerGR14**: Bayer Green-Red 14-bit.
- **BayerGR14p**: Bayer Green-Red 14-bit packed.
- **BayerGR14pmsb**: BayerGR14pmsb.
- **BayerGR16**: Bayer Green-Red 16-bit.
- **BayerGR4p**: Bayer Green-Red 4-bit packed.
- **BayerGR8**: Bayer Green-Red 8-bit.
- **BayerRG10**: Bayer Red-Green 10-bit unpacked.
- **BayerRG10Packed**: Bayer Red-Green 10-bit packed.
- **BayerRG10p**: Bayer Red-Green 10-bit packed.
- **BayerRG10pmsb**: BayerRG10pmsb.
- **BayerRG12**: Bayer Red-Green 12-bit unpacked.
- **BayerRG12Packed**: Bayer Red-Green 12-bit packed.
- **BayerRG12p**: Bayer Red-Green 12-bit packed.
- **BayerRG12pmsb**: BayerRG12pmsb.
- **BayerRG14**: Bayer Red-Green 14-bit.
- **BayerRG14p**: Bayer Red-Green 14-bit packed.
- **BayerRG14pmsb**: BayerRG14pmsb.
- **BayerRG16**: Bayer Red-Green 16-bit.
- **BayerRG4p**: Bayer Red-Green 4-bit packed.
- **BayerRG8**: Bayer Red-Green 8-bit.
- **BiColorBGRG10**: Bi-color Blue/Green - Red/Green 10-bit unpacked.
- **BiColorBGRG10p**: Bi-color Blue/Green - Red/Green 10-bit packed.
- **BiColorBGRG10pmsb**: BiColorBGRG10pmsb.
- **BiColorBGRG12**: Bi-color Blue/Green - Red/Green 12-bit unpacked.
- **BiColorBGRG12p**: Bi-color Blue/Green - Red/Green 12-bit packed.
- **BiColorBGRG12pmsb**: BiColorBGRG12pmsb.
- **BiColorBGRG16**: BiColorBGRG16.
- **BiColorBGRG8**: Bi-color Blue/Green - Red/Green 8-bit.
- **BiColorRGBG10**: Bi-color Red/Green - Blue/Green 10-bit unpacked.
- **BiColorRGBG10p**: Bi-color Red/Green - Blue/Green 10-bit packed.
- **BiColorRGBG10pmsb**: BiColorRGBG10pmsb.
- **BiColorRGBG12**: Bi-color Red/Green - Blue/Green 12-bit unpacked.
- **BiColorRGBG12p**: Bi-color Red/Green - Blue/Green 12-bit packed.

- **BiColorRGBG12pmsb**: BiColorRGBG12pmsb.
- **BiColorRGBG16**: BiColorRGBG16.
- **BiColorRGBG8**: Bi-color Red/Green - Blue/Green 8-bit.
- **Confidence1**: Confidence 1-bit unpacked.
- **Confidence16**: Confidence 16-bit.
- **Confidence1p**: Confidence 1-bit packed.
- **Confidence32f**: Confidence 32-bit floating point.
- **Confidence8**: Confidence 8-bit.
- **Coord3D_A10p**: 3D coordinate A 10-bit packed.
- **Coord3D_A12p**: 3D coordinate A 12-bit packed.
- **Coord3D_A16**: 3D coordinate A 16-bit.
- **Coord3D_A32f**: 3D coordinate A 32-bit floating point.
- **Coord3D_A64f**: 3D coordinate A 64-bit floating point.
- **Coord3D_A8**: 3D coordinate A 8-bit.
- **Coord3D_ABC10p**: 3D coordinate A-B-C 10-bit packed.
- **Coord3D_ABC10p_Planar**: 3D coordinate A-B-C 10-bit packed planar.
- **Coord3D_ABC12p**: 3D coordinate A-B-C 12-bit packed.
- **Coord3D_ABC12p_Planar**: 3D coordinate A-B-C 12-bit packed planar.
- **Coord3D_ABC16**: 3D coordinate A-B-C 16-bit.
- **Coord3D_ABC16_Planar**: 3D coordinate A-B-C 16-bit planar.
- **Coord3D_ABC32f**: 3D coordinate A-B-C 32-bit floating point.
- **Coord3D_ABC32f_Planar**: 3D coordinate A-B-C 32-bit floating point planar.
- **Coord3D_ABC64f**: 3D coordinate A-B-C 64-bit floating point.
- **Coord3D_ABC64f_Planar**: 3D coordinate A-B-C 64-bit floating point planar.
- **Coord3D_ABC8**: 3D coordinate A-B-C 8-bit.
- **Coord3D_ABC8_Planar**: 3D coordinate A-B-C 8-bit planar.
- **Coord3D_AC10p**: 3D coordinate A-C 10-bit packed.
- **Coord3D_AC10p_Planar**: 3D coordinate A-C 10-bit packed planar.
- **Coord3D_AC12p**: 3D coordinate A-C 12-bit packed.
- **Coord3D_AC12p_Planar**: 3D coordinate A-C 12-bit packed planar.
- **Coord3D_AC16**: 3D coordinate A-C 16-bit.
- **Coord3D_AC16_Planar**: 3D coordinate A-C 16-bit planar.
- **Coord3D_AC32f**: 3D coordinate A-C 32-bit floating point.
- **Coord3D_AC32f_Planar**: 3D coordinate A-C 32-bit floating point planar.
- **Coord3D_AC64f**: 3D coordinate A-C 64-bit floating point.
- **Coord3D_AC64f_Planar**: 3D coordinate A-C 64-bit floating point planar.

- **Coord3D_AC8**: 3D coordinate A-C 8-bit.
- **Coord3D_AC8_Planar**: 3D coordinate A-C 8-bit planar.
- **Coord3D_B10p**: 3D coordinate B 10-bit packed.
- **Coord3D_B12p**: 3D coordinate B 12-bit packed.
- **Coord3D_B16**: 3D coordinate B 16-bit.
- **Coord3D_B32f**: 3D coordinate B 32-bit floating point.
- **Coord3D_B64f**: 3D coordinate B 64-bit floating point.
- **Coord3D_B8**: 3D coordinate B 8-bit.
- **Coord3D_C10p**: 3D coordinate C 10-bit packed.
- **Coord3D_C12p**: 3D coordinate C 12-bit packed.
- **Coord3D_C16**: 3D coordinate C 16-bit.
- **Coord3D_C32f**: 3D coordinate C 32-bit floating point.
- **Coord3D_C64f**: 3D coordinate C 64-bit floating point.
- **Coord3D_C8**: 3D coordinate C 8-bit.
- **CustomJFIF**: CustomJFIF.
- **Data16**: Data 16-bit.
- **Data16s**: Data 16-bit signed.
- **Data32**: Data 32-bit.
- **Data32f**: Data 32-bit floating point.
- **Data32s**: Data 32-bit signed.
- **Data64**: Data 64-bit.
- **Data64f**: Data 64-bit floating point.
- **Data64s**: Data 64-bit signed.
- **Data8**: Data 8-bit.
- **Data8s**: Data 8-bit signed.
- **G10**: Green 10-bit.
- **G10_Deprecated**: Deprecated because size field is wrong.
- **G12**: Green 12-bit.
- **G12_Deprecated**: Deprecated because size field is wrong.
- **G16**: Green 16-bit.
- **G8**: Green 8-bit.
- **Mono10**: Monochrome 10-bit unpacked.
- **Mono10Packed**: Monochrome 10-bit packed.
- **Mono10p**: Monochrome 10-bit packed.
- **Mono10pmsb**: Mono10pmsb.
- **Mono12**: Monochrome 12-bit unpacked.

- **Mono12Packed**: Monochrome 12-bit packed.
- **Mono12p**: Monochrome 12-bit packed.
- **Mono12pmsb**: Mono12pmsb.
- **Mono14**: Monochrome 14-bit unpacked.
- **Mono14p**: Monochrome 14-bit packed.
- **Mono14pmsb**: Mono14pmsb.
- **Mono16**: Monochrome 16-bit.
- **Mono1p**: Monochrome 1-bit packed.
- **Mono2p**: Monochrome 2-bit packed.
- **Mono32**: Monochrome 32-bit.
- **Mono4p**: Monochrome 4-bit packed.
- **Mono8**: Monochrome 8-bit.
- **Mono8s**: Monochrome 8-bit signed.
- **R10**: Red 10-bit.
- **R10_Deprecated**: Deprecated because size field is wrong.
- **R12**: Red 12-bit.
- **R12_Deprecated**: Deprecated because size field is wrong.
- **R16**: Red 16-bit.
- **R8**: Red 8-bit.
- **RGB10**: Red-Green-Blue 10-bit unpacked.
- **RGB10V1Packed**: Red-Green-Blue 10-bit packed - variant 1.
- **RGB10_HorizontalPlanar**: RGB10_HorizontalPlanar.
- **RGB10_Planar**: Red-Green-Blue 10-bit unpacked planar.
- **RGB10p**: Red-Green-Blue 10-bit packed.
- **RGB10p32**: Red-Green-Blue 10-bit packed into 32-bit.
- **RGB10pmsb**: RGB10pmsb.
- **RGB12**: Red-Green-Blue 12-bit unpacked.
- **RGB12V1Packed**: Red-Green-Blue 12-bit packed - variant 1.
- **RGB12_HorizontalPlanar**: RGB12_HorizontalPlanar.
- **RGB12_Planar**: Red-Green-Blue 12-bit unpacked planar.
- **RGB12p**: Red-Green-Blue 12-bit packed.
- **RGB12pmsb**: RGB12pmsb.
- **RGB14**: Red-Green-Blue 14-bit unpacked.
- **RGB14_HorizontalPlanar**: RGB14_HorizontalPlanar.
- **RGB14pmsb**: RGB14pmsb.
- **RGB16**: Red-Green-Blue 16-bit.

- **RGB16_HorizontalPlanar**: RGB16_HorizontalPlanar.
- **RGB16_Planar**: Red-Green-Blue 16-bit planar.
- **RGB565p**: Red-Green-Blue 5/6/5-bit packed.
- **RGB8**: Red-Green-Blue 8-bit.
- **RGB8_HorizontalPlanar**: RGB8_HorizontalPlanar.
- **RGB8_Planar**: Red-Green-Blue 8-bit planar.
- **RGB8a32**: RGB8a32.
- **RGBa10**: Red-Green-Blue-alpha 10-bit unpacked.
- **RGBa10p**: Red-Green-Blue-alpha 10-bit packed.
- **RGBa10pmsb**: RGBa10pmsb.
- **RGBa12**: Red-Green-Blue-alpha 12-bit unpacked.
- **RGBa12p**: Red-Green-Blue-alpha 12-bit packed.
- **RGBa12pmsb**: RGBa12pmsb.
- **RGBa14**: Red-Green-Blue-alpha 14-bit unpacked.
- **RGBa14pmsb**: RGBa14pmsb.
- **RGBa16**: Red-Green-Blue-alpha 16-bit.
- **RGBa8**: Red-Green-Blue-alpha 8-bit.
- **SCF1WBWG10**: Sparse Color Filter #1 White-Blue-White-Green 10-bit unpacked.
- **SCF1WBWG10p**: Sparse Color Filter #1 White-Blue-White-Green 10-bit packed.
- **SCF1WBWG12**: Sparse Color Filter #1 White-Blue-White-Green 12-bit unpacked.
- **SCF1WBWG12p**: Sparse Color Filter #1 White-Blue-White-Green 12-bit packed.
- **SCF1WBWG14**: Sparse Color Filter #1 White-Blue-White-Green 14-bit unpacked.
- **SCF1WBWG16**: Sparse Color Filter #1 White-Blue-White-Green 16-bit unpacked.
- **SCF1WBWG8**: Sparse Color Filter #1 White-Blue-White-Green 8-bit.
- **SCF1WGWB10**: Sparse Color Filter #1 White-Green-White-Blue 10-bit unpacked.
- **SCF1WGWB10p**: Sparse Color Filter #1 White-Green-White-Blue 10-bit packed.
- **SCF1WGWB12**: Sparse Color Filter #1 White-Green-White-Blue 12-bit unpacked.
- **SCF1WGWB12p**: Sparse Color Filter #1 White-Green-White-Blue 12-bit packed.
- **SCF1WGWB14**: Sparse Color Filter #1 White-Green-White-Blue 14-bit unpacked.
- **SCF1WGWB16**: Sparse Color Filter #1 White-Green-White-Blue 16-bit.
- **SCF1WGWB8**: Sparse Color Filter #1 White-Green-White-Blue 8-bit.
- **SCF1WGWR10**: Sparse Color Filter #1 White-Green-White-Red 10-bit unpacked.
- **SCF1WGWR10p**: Sparse Color Filter #1 White-Green-White-Red 10-bit packed.
- **SCF1WGWR12**: Sparse Color Filter #1 White-Green-White-Red 12-bit unpacked.
- **SCF1WGWR12p**: Sparse Color Filter #1 White-Green-White-Red 12-bit packed.
- **SCF1WGWR14**: Sparse Color Filter #1 White-Green-White-Red 14-bit unpacked.

- SCF1WGW16: Sparse Color Filter #1 White-Green-White-Red 16-bit.
- SCF1WGW8: Sparse Color Filter #1 White-Green-White-Red 8-bit.
- SCF1WRWG10: Sparse Color Filter #1 White-Red-White-Green 10-bit unpacked.
- SCF1WRWG10p: Sparse Color Filter #1 White-Red-White-Green 10-bit packed.
- SCF1WRWG12: Sparse Color Filter #1 White-Red-White-Green 12-bit unpacked.
- SCF1WRWG12p: Sparse Color Filter #1 White-Red-White-Green 12-bit packed.
- SCF1WRWG14: Sparse Color Filter #1 White-Red-White-Green 14-bit unpacked.
- SCF1WRWG16: Sparse Color Filter #1 White-Red-White-Green 16-bit.
- SCF1WRWG8: Sparse Color Filter #1 White-Red-White-Green 8-bit.
- YCbCr10_CbYCr: YCbCr 4:4:4 10-bit unpacked.
- YCbCr10p_CbYCr: YCbCr 4:4:4 10-bit packed.
- YCbCr12_CbYCr: YCbCr 4:4:4 12-bit unpacked.
- YCbCr12p_CbYCr: YCbCr 4:4:4 12-bit packed.
- YCbCr2020_10_CbYCr: YCbCr 4:4:4 10-bit unpacked BT.2020.
- YCbCr2020_10p_CbYCr: YCbCr 4:4:4 10-bit packed BT.2020.
- YCbCr2020_12_CbYCr: YCbCr 4:4:4 12-bit unpacked BT.2020.
- YCbCr2020_12p_CbYCr: YCbCr 4:4:4 12-bit packed BT.2020.
- YCbCr2020_411_8_CbYYCrYY: YCbCr 4:1:1 8-bit BT.2020.
- YCbCr2020_422_10: YCbCr 4:2:2 10-bit unpacked BT.2020.
- YCbCr2020_422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked BT.2020.
- YCbCr2020_422_10p: YCbCr 4:2:2 10-bit packed BT.2020.
- YCbCr2020_422_10p_CbYCrY: YCbCr 4:2:2 10-bit packed BT.2020.
- YCbCr2020_422_12: YCbCr 4:2:2 12-bit unpacked BT.2020.
- YCbCr2020_422_12_CbYCrY: YCbCr 4:2:2 12-bit unpacked BT.2020.
- YCbCr2020_422_12p: YCbCr 4:2:2 12-bit packed BT.2020.
- YCbCr2020_422_12p_CbYCrY: YCbCr 4:2:2 12-bit packed BT.2020.
- YCbCr2020_422_8: YCbCr 4:2:2 8-bit BT.2020.
- YCbCr2020_422_8_CbYCrY: YCbCr 4:2:2 8-bit BT.2020.
- YCbCr2020_8_CbYCr: YCbCr 4:4:4 8-bit BT.2020.
- YCbCr411_8: YCbCr 4:1:1 8-bit.
- YCbCr411_8_CbYYCrYY: YCbCr 4:1:1 8-bit.
- YCbCr420_8_YY_CbCr_Semiplanar: YCbCr 4:2:0 8-bit YY/CbCr Semiplanar.
- YCbCr420_8_YY_CrCb_Semiplanar: YCbCr 4:2:0 8-bit YY/CrCb Semiplanar.
- YCbCr422_10: YCbCr 4:2:2 10-bit unpacked.
- YCbCr422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked.
- YCbCr422_10p: YCbCr 4:2:2 10-bit packed.

- **YCbCr422_10p_CbYCrY**: YCbCr 4:2:2 10-bit packed.
- **YCbCr422_12**: YCbCr 4:2:2 12-bit unpacked.
- **YCbCr422_12_CbYCrY**: YCbCr 4:2:2 12-bit unpacked.
- **YCbCr422_12p**: YCbCr 4:2:2 12-bit packed.
- **YCbCr422_12p_CbYCrY**: YCbCr 4:2:2 12-bit packed.
- **YCbCr422_8**: YCbCr 4:2:2 8-bit.
- **YCbCr422_8_CbYCrY**: YCbCr 4:2:2 8-bit.
- **YCbCr422_8_YY_CbCr_Semiplanar**: YCbCr 4:2:2 8-bit YY/CbCr Semiplanar.
- **YCbCr422_8_YY_CrCb_Semiplanar**: YCbCr 4:2:2 8-bit YY/CrCb Semiplanar.
- **YCbCr601_10_CbYCr**: YCbCr 4:4:4 10-bit unpacked BT.601.
- **YCbCr601_10p_CbYCr**: YCbCr 4:4:4 10-bit packed BT.601.
- **YCbCr601_10pmsb**: YCbCr601_10pmsb.
- **YCbCr601_12_CbYCr**: YCbCr 4:4:4 12-bit unpacked BT.601.
- **YCbCr601_12p_CbYCr**: YCbCr 4:4:4 12-bit packed BT.601.
- **YCbCr601_12pmsb**: YCbCr601_12pmsb.
- **YCbCr601_14pmsb**: YCbCr601_14pmsb.
- **YCbCr601_16**: YCbCr601_16.
- **YCbCr601_411_10pmsb**: YCbCr601_411_10pmsb.
- **YCbCr601_411_12pmsb**: YCbCr601_411_12pmsb.
- **YCbCr601_411_14pmsb**: YCbCr601_411_14pmsb.
- **YCbCr601_411_16**: YCbCr601_411_16.
- **YCbCr601_411_8**: YCbCr601_411_8.
- **YCbCr601_411_8_CbYYCrYY**: YCbCr 4:1:1 8-bit BT.601.
- **YCbCr601_422_10**: YCbCr 4:2:2 10-bit unpacked BT.601.
- **YCbCr601_422_10_CbYCrY**: YCbCr 4:2:2 10-bit unpacked BT.601.
- **YCbCr601_422_10p**: YCbCr 4:2:2 10-bit packed BT.601.
- **YCbCr601_422_10p_CbYCrY**: YCbCr 4:2:2 10-bit packed BT.601.
- **YCbCr601_422_10pmsb**: YCbCr601_422_10pmsb.
- **YCbCr601_422_12**: YCbCr 4:2:2 12-bit unpacked BT.601.
- **YCbCr601_422_12_CbYCrY**: YCbCr 4:2:2 12-bit unpacked BT.601.
- **YCbCr601_422_12p**: YCbCr 4:2:2 12-bit packed BT.601.
- **YCbCr601_422_12p_CbYCrY**: YCbCr 4:2:2 12-bit packed BT.601.
- **YCbCr601_422_12pmsb**: YCbCr601_422_12pmsb.
- **YCbCr601_422_14pmsb**: YCbCr601_422_14pmsb.
- **YCbCr601_422_16**: YCbCr601_422_16.
- **YCbCr601_422_8**: YCbCr 4:2:2 8-bit BT.601.

- YCbCr601_422_8_CbYCrY: YCbCr 4:2:2 8-bit BT.601.
- YCbCr601_8: YCbCr601_8.
- YCbCr601_8_CbYCr: YCbCr 4:4:4 8-bit BT.601.
- YCbCr709_10_CbYCr: YCbCr 4:4:4 10-bit unpacked BT.709.
- YCbCr709_10p_CbYCr: YCbCr 4:4:4 10-bit packed BT.709.
- YCbCr709_10pmsb: YCbCr709_10pmsb.
- YCbCr709_12_CbYCr: YCbCr 4:4:4 12-bit unpacked BT.709.
- YCbCr709_12p_CbYCr: YCbCr 4:4:4 12-bit packed BT.709.
- YCbCr709_12pmsb: YCbCr709_12pmsb.
- YCbCr709_14pmsb: YCbCr709_14pmsb.
- YCbCr709_16: YCbCr709_16.
- YCbCr709_411_10pmsb: YCbCr709_411_10pmsb.
- YCbCr709_411_12pmsb: YCbCr709_411_12pmsb.
- YCbCr709_411_14pmsb: YCbCr709_411_14pmsb.
- YCbCr709_411_16: YCbCr709_411_16.
- YCbCr709_411_8: YCbCr709_411_8.
- YCbCr709_411_8_CbYYCrYY: YCbCr 4:1:1 8-bit BT.709.
- YCbCr709_422_10: YCbCr 4:2:2 10-bit unpacked BT.709.
- YCbCr709_422_10_CbYCrY: YCbCr 4:2:2 10-bit unpacked BT.709.
- YCbCr709_422_10p: YCbCr 4:2:2 10-bit packed BT.709.
- YCbCr709_422_10p_CbYCrY: YCbCr 4:2:2 10-bit packed BT.709.
- YCbCr709_422_10pmsb: YCbCr709_422_10pmsb.
- YCbCr709_422_12: YCbCr 4:2:2 12-bit unpacked BT.709.
- YCbCr709_422_12_CbYCrY: YCbCr 4:2:2 12-bit unpacked BT.709.
- YCbCr709_422_12p: YCbCr 4:2:2 12-bit packed BT.709.
- YCbCr709_422_12p_CbYCrY: YCbCr 4:2:2 12-bit packed BT.709.
- YCbCr709_422_12pmsb: YCbCr709_422_12pmsb.
- YCbCr709_422_14pmsb: YCbCr709_422_14pmsb.
- YCbCr709_422_16: YCbCr709_422_16.
- YCbCr709_422_8: YCbCr 4:2:2 8-bit BT.709.
- YCbCr709_422_8_CbYCrY: YCbCr 4:2:2 8-bit BT.709.
- YCbCr709_8: YCbCr709_8.
- YCbCr709_8_CbYCr: YCbCr 4:4:4 8-bit BT.709.
- YCbCr8: YCbCr 4:4:4 8-bit.
- YCbCr8_CbYCr: YCbCr 4:4:4 8-bit.
- YUV10pmsb: YUV10pmsb.

- **YUV12pmsb**: YUV12pmsb.
- **YUV14pmsb**: YUV14pmsb.
- **YUV16**: YUV16.
- **YUV411_10pmsb**: YUV411_10pmsb.
- **YUV411_12pmsb**: YUV411_12pmsb.
- **YUV411_14pmsb**: YUV411_14pmsb.
- **YUV411_16**: YUV411_16.
- **YUV411_8**: YUV411_8.
- **YUV411_8_UYVYY**: YUV 4:1:1 8-bit.
- **YUV422Packed**: YUV422Packed.
- **YUV422_10pmsb**: YUV422_10pmsb.
- **YUV422_12pmsb**: YUV422_12pmsb.
- **YUV422_14pmsb**: YUV422_14pmsb.
- **YUV422_16**: YUV422_16.
- **YUV422_8**: YUV 4:2:2 8-bit.
- **YUV422_8_UYVY**: YUV 4:2:2 8-bit.
- **YUV8**: YUV8.
- **YUV8_UYV**: YUV 4:4:4 8-bit.

DmaProgramWidth

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Short Description

Width of the images resulting from the selected program.

DmaProgramHeight

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Short Description

Height of the images resulting from the selected program.

DmaProgramPitch

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → DmaProgram	Integer	RW

Short Description

Pitch of the images resulting from the selected program.

4.12. SyncMarker Category

SyncMarkerBusAddress	894
SyncMarkerValue	895
SyncMarkerValueIncrement	896

SyncMarkerBusAddress

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → SyncMarker	Integer	RW

Short Description

When a buffer is announced (with one of DSAnnounceBuffer, DSAllocAndAnnounceBuffer, or EuresysDSAnnounceBusBuffer), if SyncMarkerBusAddress is non-zero, the driver will setup DMA operations so that a 4-byte synchronization marker (value SyncMarkerValue) is written to PCIe address SyncMarkerBusAddress as soon as the DMA transfer is complete. Note that the value of SyncMarkerBusAddress is only used when the buffer is announced, while the value of SyncMarkerValue is used (and adjusted by SyncMarkerValueIncrement) each time the buffer is queued.

SyncMarkerValue

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → SyncMarker	Integer	RW

Value Info

Minimum value: 0

Maximum value: 4294967295

Short Description

32-bit value of sync marker that will be written upon DMA transfer completion.

SyncMarkerValueIncrement

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamControl → SyncMarker	Integer	RW

Value Info

Minimum value: 0

Maximum value: 4294967295

Short Description

32-bit value that will be added to SyncMarkerValue each time a buffer is queued.

4.13. Errors Category

ErrorSelector	898
ErrorCount	899
ErrorCountReset	900

ErrorSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → Errors	Enumeration	

Short Description

Error Selector.

Selected Features

- "ErrorCount" on page 899
- "ErrorCountReset" on page 900

Enumeration Values

- **All**: All errors.
- **CameraTriggerOverrun**: New trigger sent to remote device even though readout of previous frame has not started yet.
- **MigAxiWriteError**: MIG AXI write error.
- **MigAxiReadError**: MIG AXI read error.
- **StartOfScanSkipped**: Start of scan skipped (caused by internal exception: frame store almost full).
- **PrematureEndOfScan**: End of scan (caused by internal exception: frame store almost full).
- **ExternalTriggerReqsTooClose**: Trigger requests too close together.
- **Unknown**: Unknown errors.

ErrorCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → Errors	IntReg	RO

Register Port: StreamPort

Short Description

Error Count.

ErrorCountReset

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → Errors	Command	Imposed: WO

Short Description

Reset the selected ErrorCount.

4.14. LUTControl Category

LUTConfiguration	902
LUTLength	903
LUTMaxValue	904
LUTSet	905
LUTIndex	906
LUTValue	907
LUTReadBlockLength	908
LUTEnable	909

LUTConfiguration

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	Enumeration	RW

Short Description

Configuration of the LUT processor.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **M_8x8**: Monochrome 8-bit to 8-bit.
- **M_10x8**: Monochrome 10-bit to 8-bit.
- **M_10x10**: Monochrome 10-bit to 10-bit.
- **M_10x16**: Monochrome 10-bit to 16-bit.
- **M_12x8**: Monochrome 12-bit to 8-bit.
- **M_12x12**: Monochrome 12-bit to 12-bit.
- **M_12x16**: Monochrome 12-bit to 16-bit.

LUTLength

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	IntReg	RO

Register Port: StreamPort

Short Description

Number of table entries in a LUT device.

LUTMaxValue

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	IntReg	RO

Register Port: StreamPort

Short Description

Highest value of a table entry.

LUTSet

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	Enumeration	RW

Short Description

LUT set to access.

Selected Features

- ["LUTValue" on page 907](#)

Enumeration Values

- **Set1**: Select LUT set 1 for access.
- **Set2**: Select LUT set 2 for access.
- **Set3**: Select LUT set 3 for access.
- **Set4**: Select LUT set 4 for access.
- **Set5**: Select LUT set 5 for access.
- **Set6**: Select LUT set 6 for access.
- **Set7**: Select LUT set 7 for access.
- **Set8**: Select LUT set 8 for access.
- **Set9**: Select LUT set 9 for access.
- **Set10**: Select LUT set 10 for access.
- **Set11**: Select LUT set 11 for access.
- **Set12**: Select LUT set 12 for access.
- **Set13**: Select LUT set 13 for access.
- **Set14**: Select LUT set 14 for access.
- **Set15**: Select LUT set 15 for access.
- **Set16**: Select LUT set 16 for access.

LUTIndex

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	Integer	RW

Value Info

Minimum value: 0

Short Description

Index of the first entry to access.

Selected Features

- ["LUTValue" on page 907](#)

LUTValue

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	StringReg	RW

Short Description

String of value(s) to read from- or to write to- the accessed LUT at location LUTIndex.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

LUTReadBlockLength

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	Integer	RW

Value Info

Minimum value: 1

Short Description

Number of consecutive table entries to read.

LUTEnable

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LUTControl	Enumeration	RW

Short Description

Enables the LUT processor with a specific LUT set..



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- Off:
- **Set1**: Enables the LUT processor with LUT set 1.
- **Set2**: Enables the LUT processor with LUT set 2.
- **Set3**: Enables the LUT processor with LUT set 3.
- **Set4**: Enables the LUT processor with LUT set 4.
- **Set5**: Enables the LUT processor with LUT set 5.
- **Set6**: Enables the LUT processor with LUT set 6.
- **Set7**: Enables the LUT processor with LUT set 7.
- **Set8**: Enables the LUT processor with LUT set 8.
- **Set9**: Enables the LUT processor with LUT set 9.
- **Set10**: Enables the LUT processor with LUT set 10.
- **Set11**: Enables the LUT processor with LUT set 11.
- **Set12**: Enables the LUT processor with LUT set 12.
- **Set13**: Enables the LUT processor with LUT set 13.
- **Set14**: Enables the LUT processor with LUT set 14.
- **Set15**: Enables the LUT processor with LUT set 15.
- **Set16**: Enables the LUT processor with LUT set 16.

4.15. LinearFilter Category

LinearFilterControl	911
LinearFilterCoefficientA	912
LinearFilterCoefficientB	913
LinearFilterCoefficientC	914

LinearFilterControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LinearFilter	Enumeration	RW

Short Description

Linear Filter Control.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable.
- **Enable**: Enable.

LinearFilterCoefficientA

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LinearFilter	Integer	RW

Value Info

Minimum value: 0

Maximum value: 512

Short Description

Linear filter coefficient A.

LinearFilterCoefficientB

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LinearFilter	Integer	RW

Value Info

Minimum value: 0

Maximum value: 512

Short Description

Linear filter coefficient B.

LinearFilterCoefficientC

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LinearFilter	Integer	RW

Value Info

Minimum value: 0

Maximum value: 512

Short Description

Linear filter coefficient C.

4.16. Threshold Category

ThresholdControl	916
ThresholdLevel	917

ThresholdControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → Threshold	Enumeration	RW

Short Description

Threshold Control.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable.
- **Enable**: Enable.

ThresholdLevel

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → Threshold	Integer	RW

Value Info

Minimum value: 0

Maximum value: 255

Short Description

Threshold level.

4.17. LaserLineExtractor Category

Scan3dExtractionMethod	919
Scan3dOutputMode	920
Scan3dSecondLineROIOffsetY	921

Scan3dExtractionMethod

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LaserLineExtractor	Enumeration	RW

Short Description

Scan3d Extraction Method.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable extraction.
- **MaxDetection_8**: Maximum detection, 8-bit integer coordinates.
- **MaxDetection_16**: Maximum detection, 16-bit integer coordinates.
- **PeakDetection_11_5**: Peak detection, UQ11.5 fixed-point coordinates (fx11.16).
- **PeakDetection_8_8**: Peak detection, UQ8.8 fixed-point coordinates (fx8.16).
- **CenterOfGravity_11_5**: Center of gravity, UQ11.5 fixed-point coordinates (fx11.16).
- **CenterOfGravity_8_8**: Center of gravity, UQ8.8 fixed-point coordinates (fx8.16).

Scan3dOutputMode

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LaserLineExtractor	Enumeration	

Short Description

Scan3d Output Mode.

Enumeration Values

- **UncalibratedC**: Uncalibrated 2.5D Depth map.

Scan3dSecondLineROIOffsetY

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → LaserLineExtractor	Integer	RW

Value Info

Minimum value: 0

Maximum value: 65535

Short Description

Scan3d Second Line ROI Offset Y.

4.18. Bayer Category

BayerMethod 923

BayerMethod

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → Bayer	Enumeration	RW

Short Description

Bayer Decoder method.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable.
- **Legacy**: 3x3 interpolation, a.k.a. method 1.
- **Advanced**: 3x3 median-based interpolation, a.k.a. method 2.
- **Method3**: 5x5 gradient-based interpolation.
- **Method5**: 2x2 average-based interpolation.

4.19. FlatFieldCorrection Category

FfcCoefficientPartitionBase	925
FfcCoefficientPartitionSize	926
FfcControl	927
FfcBypass	928
FfcCoefficientsValid	929

FfcCoefficientPartitionBase

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → FlatFieldCorrection	Integer	Imposed: RO

Short Description

Base address of the flat field correction coefficient partition.

FfcCoefficientPartitionSize

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → FlatFieldCorrection	IntReg	RO

Register Port: StreamPort

Short Description

Flat field correction coefficient partition size in bytes.

FfcControl

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → FlatFieldCorrection	Enumeration	RW

Short Description

Ffc Control.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **Disable**: Disable.
- **Enable**: Enable.

FfcBypass

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → FlatFieldCorrection	Enumeration	RW

Short Description

Ffc Bypass.

Enumeration Values

- **Disable**: Disable.
- **Enable**: Enable.

FfcCoefficientsValid

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → FlatFieldCorrection	Boolean	Imposed: RO

Short Description

Flat field correction coefficients are valid.

4.20. MetadataInsertion Category

BufferMetadataInsertionEnable	931
LineMetadataInsertionEnable	932
LineMetadataSize	933
MetadataContent0	934
MetadataContent1	935
MetadataContent2	936
MetadataContent3	937
GeneralPurposeCounter	938

BufferMetadataInsertionEnable

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Boolean	RW

Short Description

The buffer metadata are sampled on the first CycleStart. The buffer metadata can be retrieved with the info commands BUFFER_INFO_CUSTOM_BUFFER_METADATA_<N>.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

LineMetadataInsertionEnable

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Boolean	RW

Short Description

The line metadata are sampled on each CycleStart. The base address of the line metadata can be retrieved with the info command BUFFER_INFO_CUSTOM_LINE_METADATA_BASE. Buffers should be reallocated after changing this.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

LineMetadataSize

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Integer	Imposed: RO

Short Description

Number of bytes of metadata inserted at the end of each image line.

MetadataContent0

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Enumeration	RW

Short Description

Content of the 32-bit metadata at offset 0.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **GPC1Value**: Value of General Purpose Counter 1.
- **GPC1LatchedValue**: Latched value of General Purpose Counter 1.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.

MetadataContent1

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Enumeration	RW

Short Description

Content of the 32-bit metadata at offset 1.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **GPC2Value**: Value of General Purpose Counter 2.
- **GPC2LatchedValue**: Latched value of General Purpose Counter 2.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.

MetadataContent2

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Enumeration	RW

Short Description

Content of the 32-bit metadata at offset 2.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **GPC3Value**: Value of General Purpose Counter 3.
- **GPC3LatchedValue**: Latched value of General Purpose Counter 3.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.

MetadataContent3

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Enumeration	RW

Short Description

Content of the 32-bit metadata at offset 3.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **GPC4Value**: Value of General Purpose Counter 4.
- **GPC4LatchedValue**: Latched value of General Purpose Counter 4.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.

GeneralPurposeCounter

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion	Category	

Category Members

See also: ["GeneralPurposeCounter Category" on page 939](#)

4.21. GeneralPurposeCounter Category

GeneralPurposeCounterSelector	940
GeneralPurposeCounterEnable	941
GeneralPurposeCounterIncrementSource	942
GeneralPurposeCounterDecrementSource	945
GeneralPurposeCounterLatchAndResetSource	948

GeneralPurposeCounterSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion → GeneralPurposeCounter	Enumeration	

Short Description

Select a General Purpose Counter.

Selected Features

- ["GeneralPurposeCounterEnable" on page 941](#)
- ["GeneralPurposeCounterIncrementSource" on page 942](#)
- ["GeneralPurposeCounterDecrementSource" on page 945](#)
- ["GeneralPurposeCounterLatchAndResetSource" on page 948](#)

Enumeration Values

- **GPC1:** General Purpose Counter 1.
- **GPC2:** General Purpose Counter 2.
- **GPC3:** General Purpose Counter 3.
- **GPC4:** General Purpose Counter 4.

GeneralPurposeCounterEnable

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion → GeneralPurposeCounter	Boolean	RW

Short Description

The selected General Purpose Counter is reset when disabled.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

GeneralPurposeCounterIncrementSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion → GeneralPurposeCounter	Enumeration	

Short Description

Event stream used as trigger to increment the selected General Purpose Counter.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.

- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.

- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.
- **CFW6**: When an event occurs on Custom Firmware Tool 6.
- **CFW7**: When an event occurs on Custom Firmware Tool 7.
- **CFW8**: When an event occurs on Custom Firmware Tool 8.
- **CFW9**: When an event occurs on Custom Firmware Tool 9.
- **CFW10**: When an event occurs on Custom Firmware Tool 10.
- **CFW11**: When an event occurs on Custom Firmware Tool 11.
- **CFW12**: When an event occurs on Custom Firmware Tool 12.
- **CFW13**: When an event occurs on Custom Firmware Tool 13.
- **CFW14**: When an event occurs on Custom Firmware Tool 14.
- **CFW15**: When an event occurs on Custom Firmware Tool 15.
- **CFW16**: When an event occurs on Custom Firmware Tool 16.
- **CycleStart**:
- **StartOfLine**:
- **TIME16NS**: Clock input 16 nanoseconds time base.
- **CycleLostTrigger**:

GeneralPurposeCounterDecrementSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion → GeneralPurposeCounter	Enumeration	

Short Description

Event stream used as trigger to decrement the selected General Purpose Counter.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.

- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.

- **CFW4**: When an event occurs on Custom Firmware Tool 4.
- **CFW5**: When an event occurs on Custom Firmware Tool 5.
- **CFW6**: When an event occurs on Custom Firmware Tool 6.
- **CFW7**: When an event occurs on Custom Firmware Tool 7.
- **CFW8**: When an event occurs on Custom Firmware Tool 8.
- **CFW9**: When an event occurs on Custom Firmware Tool 9.
- **CFW10**: When an event occurs on Custom Firmware Tool 10.
- **CFW11**: When an event occurs on Custom Firmware Tool 11.
- **CFW12**: When an event occurs on Custom Firmware Tool 12.
- **CFW13**: When an event occurs on Custom Firmware Tool 13.
- **CFW14**: When an event occurs on Custom Firmware Tool 14.
- **CFW15**: When an event occurs on Custom Firmware Tool 15.
- **CFW16**: When an event occurs on Custom Firmware Tool 16.
- **CycleStart**:
- **StartOfLine**:
- **TIME16NS**: Clock input 16 nanoseconds time base.

GeneralPurposeCounterLatchAndResetSource

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → MetadataInsertion → GeneralPurposeCounter	Enumeration	

Short Description

Event stream used as trigger to latch and reset the selected General Purpose Counter.



WARNING

This feature can only be activated or de-activated when the data-stream is inactive.

Enumeration Values

- **NONE**: No event stream.
- **LIN1**: When an event occurs on Line Input Tool 1.
- **LIN2**: When an event occurs on Line Input Tool 2.
- **LIN3**: When an event occurs on Line Input Tool 3.
- **LIN4**: When an event occurs on Line Input Tool 4.
- **LIN5**: When an event occurs on Line Input Tool 5.
- **LIN6**: When an event occurs on Line Input Tool 6.
- **LIN7**: When an event occurs on Line Input Tool 7.
- **LIN8**: When an event occurs on Line Input Tool 8.
- **QDC1**: When an event occurs on Quadrature Decoder Tool 1.
- **QDC2**: When an event occurs on Quadrature Decoder Tool 2.
- **QDC3**: When an event occurs on Quadrature Decoder Tool 3.
- **QDC4**: When an event occurs on Quadrature Decoder Tool 4.
- **MDV1**: When an event occurs on Multiplier/Divider Tool 1.
- **MDV2**: When an event occurs on Multiplier/Divider Tool 2.
- **MDV3**: When an event occurs on Multiplier/Divider Tool 3.
- **MDV4**: When an event occurs on Multiplier/Divider Tool 4.
- **DIV1**: When an event occurs on Divider Tool 1.
- **DIV2**: When an event occurs on Divider Tool 2.
- **DIV3**: When an event occurs on Divider Tool 3.
- **DIV4**: When an event occurs on Divider Tool 4.

- **DEL1_1**: When an event occurs on Delay Tool 1 Output 1.
- **DEL1_2**: When an event occurs on Delay Tool 1 Output 2.
- **DEL2_1**: When an event occurs on Delay Tool 2 Output 1.
- **DEL2_2**: When an event occurs on Delay Tool 2 Output 2.
- **DEL3_1**: When an event occurs on Delay Tool 3 Output 1.
- **DEL3_2**: When an event occurs on Delay Tool 3 Output 2.
- **DEL4_1**: When an event occurs on Delay Tool 4 Output 1.
- **DEL4_2**: When an event occurs on Delay Tool 4 Output 2.
- **EIN1**: When an event occurs on Event Input Tool 1.
- **EIN2**: When an event occurs on Event Input Tool 2.
- **UserEvent1**: When an event occurs on User Event 1.
- **UserEvent2**: When an event occurs on User Event 2.
- **UserEvent3**: When an event occurs on User Event 3.
- **UserEvent4**: When an event occurs on User Event 4.
- **C2C1**: When an event occurs on C2C-Link Synchronization Tool 1.
- **C2C2**: When an event occurs on C2C-Link Synchronization Tool 2.
- **C2C3**: When an event occurs on C2C-Link Synchronization Tool 3.
- **DLT1**: When an event occurs on DeviceLinkTrigger Tool 1.
- **DLT2**: When an event occurs on DeviceLinkTrigger Tool 2.
- **DLT3**: When an event occurs on DeviceLinkTrigger Tool 3.
- **DLT4**: When an event occurs on DeviceLinkTrigger Tool 4.
- **DLT5**: When an event occurs on DeviceLinkTrigger Tool 5.
- **DLT6**: When an event occurs on DeviceLinkTrigger Tool 6.
- **DLT7**: When an event occurs on DeviceLinkTrigger Tool 7.
- **DLT8**: When an event occurs on DeviceLinkTrigger Tool 8.
- **DLT9**: When an event occurs on DeviceLinkTrigger Tool 9.
- **DLT10**: When an event occurs on DeviceLinkTrigger Tool 10.
- **DLT11**: When an event occurs on DeviceLinkTrigger Tool 11.
- **DLT12**: When an event occurs on DeviceLinkTrigger Tool 12.
- **DLT13**: When an event occurs on DeviceLinkTrigger Tool 13.
- **DLT14**: When an event occurs on DeviceLinkTrigger Tool 14.
- **DLT15**: When an event occurs on DeviceLinkTrigger Tool 15.
- **DLT16**: When an event occurs on DeviceLinkTrigger Tool 16.
- **CFW1**: When an event occurs on Custom Firmware Tool 1.
- **CFW2**: When an event occurs on Custom Firmware Tool 2.
- **CFW3**: When an event occurs on Custom Firmware Tool 3.

- **CFW4:** When an event occurs on Custom Firmware Tool 4.
- **CFW5:** When an event occurs on Custom Firmware Tool 5.
- **CFW6:** When an event occurs on Custom Firmware Tool 6.
- **CFW7:** When an event occurs on Custom Firmware Tool 7.
- **CFW8:** When an event occurs on Custom Firmware Tool 8.
- **CFW9:** When an event occurs on Custom Firmware Tool 9.
- **CFW10:** When an event occurs on Custom Firmware Tool 10.
- **CFW11:** When an event occurs on Custom Firmware Tool 11.
- **CFW12:** When an event occurs on Custom Firmware Tool 12.
- **CFW13:** When an event occurs on Custom Firmware Tool 13.
- **CFW14:** When an event occurs on Custom Firmware Tool 14.
- **CFW15:** When an event occurs on Custom Firmware Tool 15.
- **CFW16:** When an event occurs on Custom Firmware Tool 16.
- **CycleStart:**
- **StartOfLine:**

4.22. EventControl Category

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EventSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Enumeration	

Short Description

Select an event.

Selected Features

- ["EventNotification" on page 953](#)
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Enumeration Values

- **StartOfCameraReadout**: Starts acquiring data of a new image frame (area-scan only).
- **EndOfCameraReadout**: Stops acquiring data of an image frame (area-scan only).
- **StartOfScan**: Starts acquiring data of a new image scan (line-scan only).
- **EndOfScan**: Stops acquiring data of an image scan (line-scan only).
- **RejectedFrame**: Dropped image frame data (area-scan only).
- **RejectedScan**: Dropped image scan data (line-scan only).
- **TriggerToCameraReadoutTimeout**: Trigger to camera readout timeout.
- **CameraReadoutTimeout**: Camera readout timeout.
- **BrokenFrame**: Broken frame due to frame store overflow (area-scan only).
- **RejectedLine**: Dropped line data (line-scan only).

EventNotification

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Boolean	RW

Description

Activate or deactivate the notification to the host application of the occurrence of the selected event.

Default value: **True**.

EventNotificationContext1

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Enumeration	RW

Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_1 (context information value is latched when the event occurs).

Default value: **EventSpecific**.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **PendingCicTriggerCount**: Number of currently pending CIC triggers.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.

- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.
- **DIV1EventCount**: Number of DIV1 events.
- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.

- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.
- **CFW14EventCount**: Number of CFW14 events.
- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.
- **CameraTriggerRisingEdgeEventCount**: Number of CameraTriggerRisingEdge events.
- **CameraTriggerFallingEdgeEventCount**: Number of CameraTriggerFallingEdge events.
- **StrobeRisingEdgeEventCount**: Number of StrobeRisingEdge events.
- **StrobeFallingEdgeEventCount**: Number of StrobeFallingEdge events.
- **AllowNextCycleEventCount**: Number of AllowNextCycle events.
- **DiscardedCicTriggerEventCount**: Number of DiscardedCicTrigger events.
- **PendingCicTriggerEventCount**: Number of PendingCicTrigger events.
- **TriggerEventCount**: Number of Trigger events.
- **StartOfCameraReadoutEventCount**: Number of StartOfCameraReadout events.
- **EndOfCameraReadoutEventCount**: Number of EndOfCameraReadout events.
- **StartOfScanEventCount**: Number of StartOfScan events.
- **EndOfScanEventCount**: Number of EndOfScan events.
- **RejectedFrameEventCount**: Number of RejectedFrame events.
- **RejectedScanEventCount**: Number of RejectedScan events.
- **TriggerToCameraReadoutTimeoutEventCount**: Number of TriggerToCameraReadoutTimeout events.
- **CameraReadoutTimeoutEventCount**: Number of CameraReadoutTimeout events.
- **BrokenFrameEventCount**: Number of BrokenFrame events.
- **RejectedLineEventCount**: Number of RejectedLine events.

EventNotificationContext2

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_2.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **PendingCicTriggerCount**: Number of currently pending CIC triggers.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.

- **DIV1EventCount**: Number of DIV1 events.
- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.

- **CFW14EventCount**: Number of CFW14 events.
- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.
- **CameraTriggerRisingEdgeEventCount**: Number of CameraTriggerRisingEdge events.
- **CameraTriggerFallingEdgeEventCount**: Number of CameraTriggerFallingEdge events.
- **StrobeRisingEdgeEventCount**: Number of StrobeRisingEdge events.
- **StrobeFallingEdgeEventCount**: Number of StrobeFallingEdge events.
- **AllowNextCycleEventCount**: Number of AllowNextCycle events.
- **DiscardedCicTriggerEventCount**: Number of DiscardedCicTrigger events.
- **PendingCicTriggerEventCount**: Number of PendingCicTrigger events.
- **TriggerEventCount**: Number of Trigger events.
- **StartOfCameraReadoutEventCount**: Number of StartOfCameraReadout events.
- **EndOfCameraReadoutEventCount**: Number of EndOfCameraReadout events.
- **StartOfScanEventCount**: Number of StartOfScan events.
- **EndOfScanEventCount**: Number of EndOfScan events.
- **RejectedFrameEventCount**: Number of RejectedFrame events.
- **RejectedScanEventCount**: Number of RejectedScan events.
- **TriggerToCameraReadoutTimeoutEventCount**: Number of TriggerToCameraReadoutTimeout events.
- **CameraReadoutTimeoutEventCount**: Number of CameraReadoutTimeout events.
- **BrokenFrameEventCount**: Number of BrokenFrame events.
- **RejectedLineEventCount**: Number of RejectedLine events.

EventNotificationContext3

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Enumeration	RW

Short Description

Select context information reported in EVENT_DATA_CUSTOM_CONTEXT_3.

Enumeration Values

- **EventSpecific**: Event-specific context information.
- **LineStatusAll**: Low 32-bit part of LineStatusAll.
- **LineStatusAllHi**: High 32-bit part of LineStatusAll.
- **QDC1Position**: Position of Quadrature Decoder Tool 1.
- **QDC2Position**: Position of Quadrature Decoder Tool 2.
- **QDC3Position**: Position of Quadrature Decoder Tool 3.
- **QDC4Position**: Position of Quadrature Decoder Tool 4.
- **PendingCicTriggerCount**: Number of currently pending CIC triggers.
- **LIN1EventCount**: Number of LIN1 events.
- **LIN2EventCount**: Number of LIN2 events.
- **LIN3EventCount**: Number of LIN3 events.
- **LIN4EventCount**: Number of LIN4 events.
- **LIN5EventCount**: Number of LIN5 events.
- **LIN6EventCount**: Number of LIN6 events.
- **LIN7EventCount**: Number of LIN7 events.
- **LIN8EventCount**: Number of LIN8 events.
- **QDC1EventCount**: Number of QDC1 events.
- **QDC1DirEventCount**: Number of QDC1Dir events.
- **QDC2EventCount**: Number of QDC2 events.
- **QDC2DirEventCount**: Number of QDC2Dir events.
- **QDC3EventCount**: Number of QDC3 events.
- **QDC3DirEventCount**: Number of QDC3Dir events.
- **QDC4EventCount**: Number of QDC4 events.
- **QDC4DirEventCount**: Number of QDC4Dir events.

- **DIV1EventCount**: Number of DIV1 events.
- **DIV2EventCount**: Number of DIV2 events.
- **DIV3EventCount**: Number of DIV3 events.
- **DIV4EventCount**: Number of DIV4 events.
- **MDV1EventCount**: Number of MDV1 events.
- **MDV2EventCount**: Number of MDV2 events.
- **MDV3EventCount**: Number of MDV3 events.
- **MDV4EventCount**: Number of MDV4 events.
- **DEL11EventCount**: Number of DEL11 events.
- **DEL12EventCount**: Number of DEL12 events.
- **DEL21EventCount**: Number of DEL21 events.
- **DEL22EventCount**: Number of DEL22 events.
- **DEL31EventCount**: Number of DEL31 events.
- **DEL32EventCount**: Number of DEL32 events.
- **DEL41EventCount**: Number of DEL41 events.
- **DEL42EventCount**: Number of DEL42 events.
- **UserEvent1EventCount**: Number of UserEvent1 events.
- **UserEvent2EventCount**: Number of UserEvent2 events.
- **UserEvent3EventCount**: Number of UserEvent3 events.
- **UserEvent4EventCount**: Number of UserEvent4 events.
- **C2C1EventCount**: Number of C2C1 events.
- **C2C2EventCount**: Number of C2C2 events.
- **C2C3EventCount**: Number of C2C3 events.
- **CFW1EventCount**: Number of CFW1 events.
- **CFW2EventCount**: Number of CFW2 events.
- **CFW3EventCount**: Number of CFW3 events.
- **CFW4EventCount**: Number of CFW4 events.
- **CFW5EventCount**: Number of CFW5 events.
- **CFW6EventCount**: Number of CFW6 events.
- **CFW7EventCount**: Number of CFW7 events.
- **CFW8EventCount**: Number of CFW8 events.
- **CFW9EventCount**: Number of CFW9 events.
- **CFW10EventCount**: Number of CFW10 events.
- **CFW11EventCount**: Number of CFW11 events.
- **CFW12EventCount**: Number of CFW12 events.
- **CFW13EventCount**: Number of CFW13 events.

- **CFW14EventCount**: Number of CFW14 events.
- **CFW15EventCount**: Number of CFW15 events.
- **CFW16EventCount**: Number of CFW16 events.
- **CameraTriggerRisingEdgeEventCount**: Number of CameraTriggerRisingEdge events.
- **CameraTriggerFallingEdgeEventCount**: Number of CameraTriggerFallingEdge events.
- **StrobeRisingEdgeEventCount**: Number of StrobeRisingEdge events.
- **StrobeFallingEdgeEventCount**: Number of StrobeFallingEdge events.
- **AllowNextCycleEventCount**: Number of AllowNextCycle events.
- **DiscardedCicTriggerEventCount**: Number of DiscardedCicTrigger events.
- **PendingCicTriggerEventCount**: Number of PendingCicTrigger events.
- **TriggerEventCount**: Number of Trigger events.
- **StartOfCameraReadoutEventCount**: Number of StartOfCameraReadout events.
- **EndOfCameraReadoutEventCount**: Number of EndOfCameraReadout events.
- **StartOfScanEventCount**: Number of StartOfScan events.
- **EndOfScanEventCount**: Number of EndOfScan events.
- **RejectedFrameEventCount**: Number of RejectedFrame events.
- **RejectedScanEventCount**: Number of RejectedScan events.
- **TriggerToCameraReadoutTimeoutEventCount**: Number of TriggerToCameraReadoutTimeout events.
- **CameraReadoutTimeoutEventCount**: Number of CameraReadoutTimeout events.
- **BrokenFrameEventCount**: Number of BrokenFrame events.
- **RejectedLineEventCount**: Number of RejectedLine events.

EventCount

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	IntReg	RO

Register Port: StreamPort

Short Description

Number of occurrences of the selected event (32-bit counter).

EventCountReset

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Command	Imposed: WO

Short Description

Reset the selected EventCount.

EventNotificationAll

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Boolean	Imposed: WO

Short Description

Activate or deactivate the notification of all events.

EventCountResetAll

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → EventControl	Command	Imposed: WO

Short Description

Reset all EventCount.

4.23. StreamStatistics Category

StatisticsSamplingSelector	968
StatisticsFrameRate	969
StatisticsLineRate	970
StatisticsDataRate	971
StatisticsStartSampling	972
StatisticsStopSampling	973

StatisticsSamplingSelector

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamStatistics	Enumeration	

Description

Selects the stream statistics sampling method.

Default value: `LastSecond`.

Selected Features

- ["StatisticsFrameRate" on page 969](#)
- ["StatisticsLineRate" on page 970](#)
- ["StatisticsDataRate" on page 971](#)

Enumeration Values

- `LastSecond`: During the last second.
- `LastTenSeconds`: During the last 10 seconds.
- `Last2Buffers`: For the last 2 buffers.
- `Last10Buffers`: For the last 10 buffers.
- `Last100Buffers`: For the last 100 buffers.
- `Last1000Buffers`: For the last 1000 buffers.
- `LastAcquisition`: During the last acquisition activity period. Namely since the last `DSStartAcquisition()` function call until now, if the acquisition is still active otherwise until the last `DStopAcquisition()` function call.
- `Custom`: Custom sampling using `StatisticsStartSampling` and `StatisticsStopSampling` commands.

StatisticsFrameRate

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamStatistics	FloatReg	RO

Register Port: StreamPort

Value Info

Unit: Fps (Frames per second)

Description

Average frame delivery rate using the selected sampling method.



NOTE

This feature is only available for area-scan firmware variants.



NOTE

The statistics measures the frame rate at the level of the PCI Express interface, NOT at the level of the CoaXPress interface!

StatisticsLineRate

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamStatistics	FloatReg	RO

Register Port: StreamPort

Value Info

Unit: Lps (Lines per second)

Description

Average line delivery rate using the selected sampling method.



NOTE

This feature is only available for line-scan firmware variants.



NOTE

The statistics measures the line rate at the level of the PCI Express interface, NOT at the level of the CoaXPress interface!

StatisticsDataRate

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamStatistics	FloatReg	RO

Register Port: StreamPort

Value Info

Unit: MBps (Megabytes per second)

Short Description

Get the average PCI data delivery rate using the selected sampling method.

StatisticsStartSampling

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamStatistics	Command	Imposed: WO

Short Description

Start sampling the stream data. Applies only when StatisticsSamplingSelector = Custom.

StatisticsStopSampling

Feature Info

Module	Category Path	Type	Access
Data Stream	Root → StreamStatistics	Command	Imposed: WO

Short Description

Stop sampling the stream data. Applies only when StatisticsSamplingSelector = Custom.

5. Grablink Fake Camera Link Device Register Description

Categorized features list of Camera module version 25_12_1

- 5.1. Root Category 975
- 5.2. DeviceEnumeration Category 981
- 5.3. ImageFormatControl Category 984
- 5.4. TransportLayerControl Category 990
- 5.5. AcquisitionControl Category 994
- 5.6. DeviceControl Category 998

5.1. Root Category

DeviceControl	976
DeviceEnumeration	977
ImageFormatControl	978
TransportLayerControl	979
AcquisitionControl	980

DeviceControl

Feature Info

Module	Category Path	Type	Access
Camera	Root	Category	

Category Members

See also: ["DeviceControl Category" on page 998](#)

DeviceEnumeration

Feature Info

Module	Category Path	Type	Access
Camera	Root	Category	

Category Members

See also: ["DeviceEnumeration Category" on page 981](#)

ImageFormatControl

Feature Info

Module	Category Path	Type	Access
Camera	Root	Category	

Category Members

See also: ["ImageFormatControl Category" on page 984](#)

TransportLayerControl

Feature Info

Module	Category Path	Type	Access
Camera	Root	Category	

Category Members

See also: ["TransportLayerControl Category" on page 990](#)

AcquisitionControl

Feature Info

Module	Category Path	Type	Access
Camera	Root	Category	

Category Members

See also: ["AcquisitionControl Category" on page 994](#)

5.2. DeviceEnumeration Category

DeviceVendorName	982
DeviceModelName	983

DeviceVendorName

Feature Info

Module	Category Path	Type	Access
Camera	Root → DeviceEnumeration	StringReg	RO

Short Description

Device Vendor Name.

DeviceModelName

Feature Info

Module	Category Path	Type	Access
Camera	Root → DeviceEnumeration	StringReg	RO

Short Description

Device Model Name.

5.3. ImageFormatControl Category

Width	985
Height	986
PixelFormat	987
PixelSize	989

Width

Feature Info

Module	Category Path	Type	Access
Camera	Root → ImageFormatControl	Integer	RW

Short Description

Width.

Height

Feature Info

Module	Category Path	Type	Access
Camera	Root → ImageFormatControl	Integer	RW

Short Description

Height.

PixelFormat

Feature Info

Module	Category Path	Type	Access
Camera	Root → ImageFormatControl	Enumeration	RW

Short Description

Pixel Format.

Enumeration Values

- Mono8:
- Mono10:
- Mono12:
- Mono14:
- Mono16:
- RGB8:
- RGB10:
- RGB12:
- RGB14:
- RGB16:
- RGBa8:
- RGBa10:
- RGBa12:
- RGBa14:
- RGBa16:
- BayerBG8:
- BayerBG10:
- BayerBG12:
- BayerBG14:
- BayerBG16:
- BayerGB8:
- BayerGB10:
- BayerGB12:
- BayerGB14:

- BayerGB16:
- BayerRG8:
- BayerRG10:
- BayerRG12:
- BayerRG14:
- BayerRG16:
- BayerGR8:
- BayerGR10:
- BayerGR12:
- BayerGR14:
- BayerGR16:

PixelSize

Feature Info

Module	Category Path	Type	Access
Camera	Root → ImageFormatControl	Integer	RW

Short Description

Pixel Size.

5.4. TransportLayerControl Category

PayloadSize	991
DeviceTapGeometry	992

PayloadSize

Feature Info

Module	Category Path	Type	Access
Camera	Root → TransportLayerControl	IntSwissKnife	

Short Description

Payload Size.

DeviceTapGeometry

Feature Info

Module	Category Path	Type	Access
Camera	Root → TransportLayerControl	Enumeration	RW

Short Description

Device Tap Geometry.

Enumeration Values

- Geometry_1X_1Y:
- Geometry_1X2_1Y:
- Geometry_1X3_1Y:
- Geometry_1X4_1Y:
- Geometry_1X5_1Y:
- Geometry_1X6_1Y:
- Geometry_1X7_1Y:
- Geometry_1X8_1Y:
- Geometry_1X10_1Y:
- Geometry_2X_1Y:
- Geometry_2XE_1Y:
- Geometry_2XM_1Y:
- Geometry_2XR_1Y:
- Geometry_2X2_1Y:
- Geometry_2X2E_1Y:
- Geometry_2X2M_1Y:
- Geometry_2X3_1Y:
- Geometry_2X4_1Y:
- Geometry_3X_1Y:
- Geometry_3X2_1Y:
- Geometry_4X_1Y:
- Geometry_4XE_1Y:
- Geometry_4XR_1Y:
- Geometry_4X2_1Y:

- Geometry_4X2E_1Y:
- Geometry_5X_1Y:
- Geometry_6X_1Y:
- Geometry_7X_1Y:
- Geometry_8X_1Y:
- Geometry_8XR_1Y:
- Geometry_10X_1Y:

5.5. AcquisitionControl Category

AcquisitionMode	995
AcquisitionStart	996
AcquisitionStop	997

AcquisitionMode

Feature Info

Module	Category Path	Type	Access
Camera	Root → AcquisitionControl	Enumeration	

Short Description

Acquisition Mode.

Enumeration Values

- Continuous:

AcquisitionStart

Feature Info

Module	Category Path	Type	Access
Camera	Root → AcquisitionControl	Command	Imposed: WO

Short Description

Acquisition Start.

AcquisitionStop

Feature Info

Module	Category Path	Type	Access
Camera	Root → AcquisitionControl	Command	Imposed: WO

Short Description

Acquisition Stop.

5.6. DeviceControl Category

DeviceClockSelector	999
DeviceClockFrequency	1000

DeviceClockSelector

Feature Info

Module	Category Path	Type	Access
Camera	Root → DeviceControl	Enumeration	

Short Description

Selects the clock frequency to access from the device.

Selected Features

- ["DeviceClockFrequency" on page 1000](#)

Enumeration Values

- **CameraLink**: Camera Link clock from channel link X.
- **CameraLinkChannelX**: Camera Link clock from channel link X.
- **CameraLinkChannelY**: Camera Link clock from channel link Y.
- **CameraLinkChannelZ**: Camera Link clock from channel link Z.

DeviceClockFrequency

Feature Info

Module	Category Path	Type	Access
Camera	Root → DeviceControl	Integer	RO

Short Description

Device Clock Frequency.

