imaFlex 2 Dual 100

Applet Feature Reference Manual for

Acq_SingleCoF25Line

Functional Description
For pylon or GenTL Usage

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Supplemental Information

Acquisition Card Documentation:
https://docs.baslerweb.com/acquisition-cards
Frame Grabber Documentation:
https://docs.baslerweb.com/frame-grabbers
Framegrabber SDK Documentation:
https://docs.baslerweb.com/frame-grabbers/framegrabber-sdk-overview.html

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Chapter 1. Introduction

This document provides detailed information about the "Acq_SingleCoF25Line" applet for imaFlex 2 Dual 100 frame grabber.

For detailed information about your hardware and the software tools with which you can configure your frame grabber, see the frame grabber documentation [https://docs.baslerweb.com/frame-grabbers/].

In the following, you will find a full description of the applet's functionality and features.

All applet-specific parameters described in this document are as represented in the GenTL interface.

For a general explanation of the GenTL interface, see the Basler GenTL interface documentation (https://docs.baslerweb.com/frame-grabbers/using-the-gen-tl-interface).

For information about camera features, see your camera documentation https://docs.baslerweb.com/cameras.

For information about Basler pylon features and for API documentation, see the pylon documentation https://docs.baslerweb.com/software.

1.1. Features of the Acq_SingleCoF25Line Applet

"Acq_SingleCoF25Line" is an applet for one camera (single-camera applet). You can configure the CoaXPress over Fiber (CoF) camera interface (CXP Standard version 3.0), transferring grayscale (monochrome) or color pixels. Allowed pixel formats are Gray (Mono8, Mono10, Mono12, Mono14, Mono16), Color (RGB8, RGB10, RGB12, RGB14, RGB16), and YCbCr422_8. With this applet, you can use a camera with a CoaXPress link aggregation of 4. The maximum link speed is CXP-25. A multi-functional line trigger is included in the applet. This allows you to control the camera or external devices using frame grabber generated, external or software generated trigger pulses. Line scan cameras up to a width of 32768 pixels can be processed. The trigger system will generate images of a maximum height of 16777216 pixels. The applet is processing data at a bit depth of 16 bits. An image selector at the camera port facilitates the selection of one image out of a parameterizable sequence of images. This enables the distribution of the images to multiple frame grabber and PCs. For reverse operation, you can mirror the image in x-direction and y-direction before cutting the ROI. Acquired images are buffered in frame grabber memory. You can select a region of interest (ROI) for further processing. The stepsize of the ROI width is 32 pixel. The ROI stepsize for the image height is 1 line. A color converter automatically converts the input pixel formats to the output formats. In this applet conversions from monochrome, RGB to monochrome and RGB can be performed. You can configure the 14 bit full resolution lookup table either by using a user defined table, or by using a processor. The processor gives you the opportunity to use pre-defined functions such as offset, gain, invert to enhance the image quality. The color components are processed individually. A gamma correction is possible.

Processed image data are output by the applet via a high speed DMA channel. You can select the pixel format of the output. The pixel format can either be 8 bit, 10 bit packed, 12 bit packed, 14 bit packed, or 16 bits per pixel (or per pixel component if you work with a color format).

Table 1.1. Feature Summary of Acq_SingleCoF25Line

Feature	Applet Property
Applet Name	 Acq_SingleCoF25Line
Type of Applet	AcquisitionApplets
Board	imaFlex 2 Dual 100
No. of Cameras	1
Camera Type	CoaXPress, link aggregation max. 4, maximum speed CXP-25,
Sensor Type	Line Scan
Camera Format	Monochrome or RGB
Pixel Format	Gray (Mono8, Mono10, Mono12, Mono14, Mono16), Color (RGB8, RGB10, RGB12, RGB14, RGB16), and YCbCr422_8.
Processing Bit Depth	16 Bit per color component
Sensor Correction / Tap Sorting	no
Maximum Images Dimensions	32768 * 16777216
ROI Stepsize	x: 32, y: 1
Tap Geometry Sorting	1X-1Y only
Mirroring	Yes, horizontal and vertical (set the parameter *VantagePoint*)
Image Selector	Yes
Noise Filter	No
Shading Correction	No
Dead Pixel Interpolation	No
Color White Balancing	Yes
Color Converter	yes, Mono, RGB to Mono or RGB
Lookup Table	Full Resolution Input bits = 14, Output bits = 16 Lookup table can be disabled.
DMA	Full Speed
DMA Image Output Format	All grayscale and color formats. See description above.
Event Generation	yes
Overflow Control	yes

1.1.1. Parameterization Order

We recommend to configure the functional blocks which are responsible for sensor setup/correction first. This will be the camera settings, shading correction, and dead pixel interpolation (if available). Afterwards, you can

configure other image enhancement functional blocks such as white balancing, noise filter, and lookup table. By default, all presets are configured for receiving images directly.

1.2. Bandwidth

The maximum bandwidths of applet Acq_SingleCoF25Line are listed in the following table.

Table 1.2. Bandwidth of Acq_SingleCoF25Line

Description	Bandwidth
Max. CXP Speed	CXP-25
Peak Bandwidth per Camera	12800 MPixel/s
Mean Bandwidth per Camera	12800 MPixel/s
DMA Bandwidth	12800 MByte/s (depends on PC mainboard)

The peak bandwidth defines the maximum allowed bandwidth for each camera at the camera interface. If the camera's peak bandwidth is higher than the mean bandwidth, the frame grabber on-board buffer will fill up as the data can be buffered, but not be processed at that speed.

The mean bandwidth per camera describes the maximally allowed mean bandwidth for each camera at the camera interface. It is the product of the framerate and the image pixels. For example, with 1-megapixel images at a framerate of 100 frames per second, the mean bandwidth will be 100 MPixel/s. In case of 8bit per pixel as output format, this would be equal to 100 MB per second.

The required output bandwidth of an applet can differ from the input bandwidth. A region of interest (ROI) and the output format can change the required output bandwidth and the maximum mean bandwidth.

Regard the relation between MPixel/s and MByte/s: The MByte/s depend on the applet and its parameterization concerning the pixel format. It is possible to acquire more than 8 bit per pixel or to convert from one bit depth to another. 1 MByte is 1,000,000 Byte.

Bandwidth Varies

The exact maximum DMA bandwidth depends on the used PC system and its chipset. The camera bandwidth depends on the image size and the selected frame rate. The given values of 12800 MByte/s for the possible DMA bandwidth might be lower due to the chipset and its configuration. Additionally, some PCIe slots do not support the required number of lanes to transfer the requested or expected bandwidth. In these cases, have a look at the mainboard specification. A behaviour like multiplexing between several PCIe slots can be seen in rare cases. Some mainboard manufacturers provide a BIOS feature where you can select the PCIe payload size: Always try to set this to its maximum value or simply to automatic. This can help in specific cases.

1.3. Requirements

In the following, the requirements on software, hardware and frame grabber license are listed.

1.3.1. Software Requirements

To run this applet, a supporting runtime environment is required. This can be either Basler pylon, or the Basler Framegrabber SDK providing the GenTL interface.

1.3.2. Hardware Requirements

To run applet "Acq_SingleCoF25Line", a Basler imaFlex 2 Dual 100 frame grabber is required.

For PC system requirements, check the frame grabber hardware documentation. The applet itself does not require any additional PC system requirements.

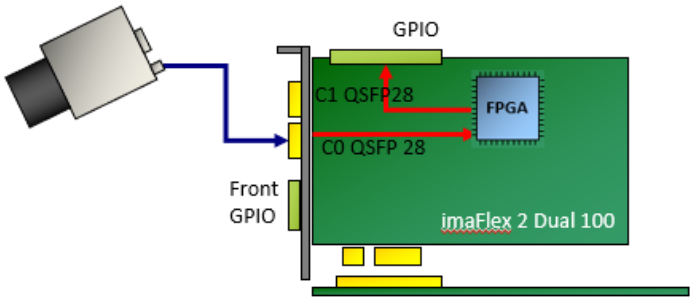
1.3.3. License

This applet is of type AcquisitionApplets. For applets of this type, no license is required. All compatible frame grabbers can run the applet using the Basler Framegrabber SDK.

1.4. Camera Interface

The "Acq_SingleCoF25Line" applet supports 1 CXP over Fiber camera. The frame grabber has 2 fiber connectors (C1 and C0), but the applet only supports the camera connection on port 0 (C0 connector).

Figure 1.1. Camera Interface and Camera Cable Setup



1.5. Frame ID

For CoaXPress linescan cameras the CXP Source Tag is not used as it is constand throughout the acquisition. Instead an internal counter is used to represent frame IDs. This applet will output each frame to the host PC attached with this frame ID. Moreover, overflow events will also include this frame ID. By this, the exact mapping of a given frame in the host PC to the frame the frame grabber's image trigger is possible.

Check chapter Chapter 10, '*BufferStatus*' for more information about overflow conditions and the overflow event data structure including the frame ID.

The frame ID is processed together with the images in the host PC. Check the Basler GenTL documentation to learn on how to extract the frame ID from the buffer.

1.6. Image Transfer to PC Memory

The image transfer between frame grabber and PC is performed via DMA transfers. In this applet, only one DMA channel exists for transferring image data. The DMA channel has index 0. The applet output format can be set via the parameters of the output format module. See Chapter 16, '*OutputFormat*'. All outputs are little-endian coded.

Chapter 2. CoaXPress

This applet can be used with one line scan camera. To receive correct image data from your camera, it is crucial that the camera output format matches the selected frame grabber input format. The following parameters configure the frame grabber's camera interface to match with the individual camera pixel format. Most cameras support different operation modes. Consult the manual of your camera to obtain the necessary information how to configure the camera to the desired pixel format.

Ensure that the lines transferred by the camera do not exceed the maximum allowed line length for this applet (32768).

With the following parameters you can define the way trigger packets are sent from the frame grabber to the camera on the CXP link.

2.1. CxpStreamPacketCount

This parameter indicates the number of received stream packets:

- **Bits [29:0]** indicate the actual packet count.
- **Bit [30]** indicates overflow.
- **Range**: 0 to 2 147 483 647 (31 bits)

Table 2.1. Parameter properties of CxpStreamPacketCount

Property	Value
Name	**CxpStreamPacketCount**
Display Name	**CXP Stream Packet Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 2.1. Usage of CxpStreamPacketCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpStreamPacketCountSelector = i;
    value_ = CxpStreamPacketCount;
}
```

2.2. PixelFormat

This parameter specifies the data format of the connected camera.

The formats defined in the following list can be selected. Choose the pixel format which best matches with your camera.

In this applet, the processing data bit depth is 16 bit. The camera interface automatically performs a conversion to the 16 bit format using bit shifting independently from the selected camera format. If the camera bit depth is greater than the processing bit depth, bits will be right shifted to meet the internal bit depth. If the camera bit depth is less than the processing bit depth, bits will be left shifted to meet the internal bit depth. In this case, the lower bits are fixed to zero.

GenTL Controls the Pixel Format

The GenTL interface has a built in automatic adaptation of the pixel format to the camera settings. Changing the applet pixel format might be overwritten by the GenTL on acquisition start. You can only set the pixel format if the automatic setting is disabled. See the GenTL documentation parameter **`AutomaticFormatControl`** for more details.

Table 2.2. Parameter properties of PixelFormat

Property	Value	
Name	**`PixelFormat`**	
Display Name	**`Pixel Format`**	
Interface	**`IEnumeration`**	
Access policy	**`Read/Write/Change`**	
Visibility	**`Beginner`**	
Allowed values	**`Mono8`**	Mono 8
	`Mono10p`	Mono 10p
	`Mono12p`	Mono 12p
	`Mono14p`	Mono 14p
	`Mono16`	Mono 16p
	`RGB8`	RGB 8
	`RGB10p`	RGB 10p
	`RGB12p`	RGB 12p
	`RGB14p`	RGB 14p
	`RGB16`	RGB 16
	`YCbCr422_8`	YCbCr422_8
Default value	**`Mono8`**	

Example 2.2. Usage of PixelFormat

```
/* Set */ PixelFormat = Mono8;
/* Get */ value_ = PixelFormat;
```

2.3. SystemmonitorUsedCxpConnections

The currently used number of CXP ports used in this process.

Table 2.3. Parameter properties of SystemmonitorUsedCxpConnections

Property	Value
Name	**`SystemmonitorUsedCxpConnections`**
Display Name	**`System Monitor Used Cxp Connections`**
Interface	**`IInteger`**
Access policy	**`Read-Only`**
Visibility	**`Beginner`**
Allowed values	**`Minimum 1`** **`Maximum 4`** **`Stepsize 1`**

Example 2.3. Usage of SystemmonitorUsedCxpConnections

```
/* Get */ value_ = SystemmonitorUsedCxpConnections;
```

2.4. SystemmonitorCxpImageLineMode

The received image header indicates whether the stream is intended for an area scan or a line scan application. This parameter shows the most recently received stream image header information.

- **0** = Area scan
- **1** = Line scan

Table 2.4. Parameter properties of SystemmonitorCxpImageLineMode

Property	Value
Name	**SystemmonitorCxpImageLineMode**
Display Name	**System Monitor Cxp Image Line Mode**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum** 0 **Maximum** 1 **Stepsize** 1

Example 2.4. Usage of SystemmonitorCxpImageLineMode

```
/* Get */ value_ = SystemmonitorCxpImageLineMode;
```

2.5. CxpCameraMaxPacketSize

This parameter defines the maximum stream packet size for the connected camera in bytes, as specified by the CXP standard. The camera will send stream packets that are equal to or smaller than this limit.

The parameter influences Block RAM usage in the FPGA: the smaller the value, the fewer Block RAM resources will be used.

Example (CoFCamera operator in 4-lane configuration):

- Value 16384 uses 64 Block RAM resources.
- Value 8192 uses 32 Block RAM resources.

Range: 8192 (_8192), 16384 (_16384).

Table 2.5. Parameter properties of CxpCameraMaxPacketSize

Property	Value
Name	**CxpCameraMaxPacketSize**
Display Name	**CXP Camera Maximum Packet Size**
Interface	**IEnumeration**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**CamPacketSize8192** _8192 **CamPacketSize16384** _16384

Example 2.5. Usage of CxpCameraMaxPacketSize

```
/* Get */ value_ = CxpCameraMaxPacketSize;
```

Chapter 3. Camera

This applet Acq_SingleCoF25Line for the imaFlex 2 Dual 100 acquires the sensor data of a line scan camera. When this is performed some sensor dimension depending information can be used to register an event based callback function.

3.1. CameraEvents

In programming or runtime environments, a callback function is a piece of executable code that is passed as an argument, which is expected to call back (execute) exactly that time an event is triggered. This applet can generate some software callback events based on applet-events as explained in the following section. These events are not related to a special camera functionality. Other event sources are described in additional sections of this document.

The Basler Framegrabber SDK enables an application to get these event notifications about certain state changes at the data flow from camera to RAM and the image and trigger processing as well. Please consult the Basler Framegrabber SDK documentation for more details concerning the implementation of this functionality.

3.1.1. FrameTransferStart

The applet generates frames from linescan cameras unsing the image trigger module. The event is generated with the first pixel of the generated frame which is simultaneously to the arrival of a camera line. Keep in mind that a high framerate can cause high interrupt rates which might slow down the overall PC system. This event can only occur if the acquisition is running.

3.1.2. FrameTransferEnd

The applet generates frames from linescan cameras unsing the image trigger module. The event is generated when the last pixel passes through the image trigger module. Note that this might not be at the same time as the pixel arrives from the camera at the framegrabber as the image trigger module needs to delay the data to wait for closing gates. Keep in mind that a high framerate can cause high interrupt rates which might slow down the overall PC system. This event can only occur if the acquisition is running.

3.1.3. LineTransferStart

This event is generated when the first pixel of camera line arrives at the framegrabber. Keep in mind that a high linerate can cause a critical high interrupt rate which might slow down the overall PC system. Even if the trigger setup will not use this line for a generated frame output this event will occour. This event can only occur if the acquisition is running.

3.1.4. LineTransferEnd

This event is generated when the last pixel of camera line has arrives at the framegrabber. Keep in mind that a high linerate can cause a critical high interrupt rate which might slow down the overall PC system. This event can only occur if the acquisition is running.

Chapter 4. SensorGeometry

Some operations, for example mirroring or tap sorting, require knowledge on the sensor dimension and orientation of the camera. The following parameters supply this kind of information.

4.1. VantagePoint

This parameter defines the vantage point. Use this parameter to mirror the image. Note that when using this parameter for mirroring, the received sensor image is mirrored and not the selected ROI in the frame grabber. Therefore, to mirror the ROI in the frame grabber, ensure to set the correct offsets in the frame grabber.

If a horizontal mirroring is active, the parameter *SensorWidth* limits the maximum width. The parameter dependency will then be *OffsetX* + *Width* <= *SensorWidth*.

If a vertical mirroring is active , the parameter *SensorHeight* limits the maximum height. The parameter dependency will then be *OffsetY* + *Height* <= *SensorHeight*.

Table 4.1. Parameter properties of VantagePoint

Property	Value	
Name	**VantagePoint**	
Display Name	**Vantage Point**	
Interface	**IEnumeration**	
Access policy	**Read/Write**	
Visibility	**Beginner**	
Allowed values	**TopLeft**	Top Left
	TopRight	Top Right
	BottomLeft	Bottom Left
	BottomRight	Bottom Right
Default value	**TopLeft**	

Example 4.1. Usage of VantagePoint

```
/* Set */ VantagePoint = TopLeft;
/* Get */ value_ = VantagePoint;
```

4.2. SensorWidth

To mirror the incoming data correctly, the parameter *SensorWidth* is required. The value of *SensorWidth* is ignored, if *VantagePoint* = Top-**Left** or Bottom-**Left**. If also a vertical mirroring is used, the available DRAM and sensor height limit the maximum sensor width. This is so, because the sensor image needs to fit twice into the DRAM, because double buffering is used.

If No Mirroring Is Active, the Value of *SensorWidth* Is Not Used

If no mirroring is active, the value of the parameter *SensorWidth* is not used. Instead, the sum of *OffsetX* and *Width* is used. This makes the use of the module easier as an extra configuration is avoided, if defaults are used.

Table 4.2. Parameter properties of SensorWidth

Property	Value
Name	**SensorWidth**
Display Name	**Sensor Width**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum 64** **Maximum 32768** **Stepsize 32**
Default value	**1024**
Unit of measure	**pixel**

Example 4.2. Usage of SensorWidth

```
/* Set */ SensorWidth = 1024;
/* Get */ value_ = SensorWidth;
```

4.3. SensorHeight

For vertical mirroring or tap geometry sorting in vertical direction, the applet needs to be parameterized with the exact height transferred from the camera to the frame grabber. If you have set a region of interest in the camera, the parameter *SensorHeight* needs to be set to the ROI size, otherwise use the sensor height.

If Only One Y-Zone Is Used and No Vertical Mirroring Is Active, the Value of *SensorHeight* Is Not Used

If no vertical mirroring is configured the value of the parameter *SensorHeight* is not used. Instead, the sum of *OffsetY* and *Height* is used. This makes the use of the module easier as an extra configuration is avoided, if defaults are used.

Table 4.3. Parameter properties of SensorHeight

Property	Value
Name	**SensorHeight**
Display Name	**Sensor Height**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum 1** **Maximum 16777216** **Stepsize 1**
Default value	**1024**
Unit of measure	**pixel**

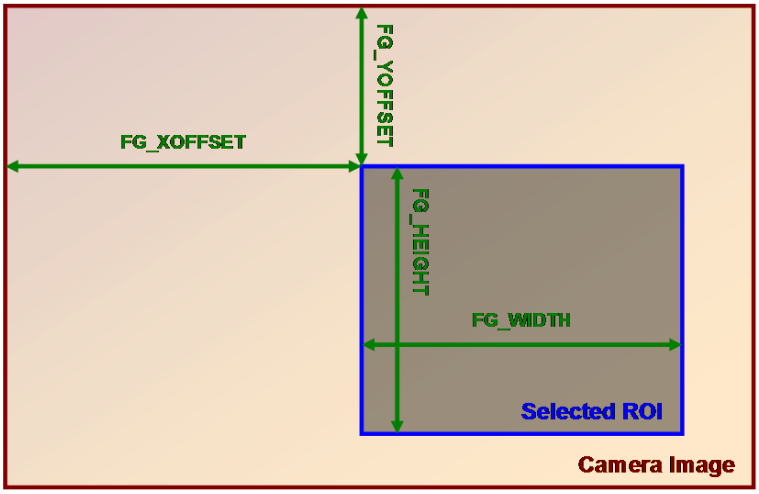
Example 4.3. Usage of SensorHeight

```
/* Set */ SensorHeight = 1024;
/* Get */ value_ = SensorHeight;
```

Chapter 5. ROI

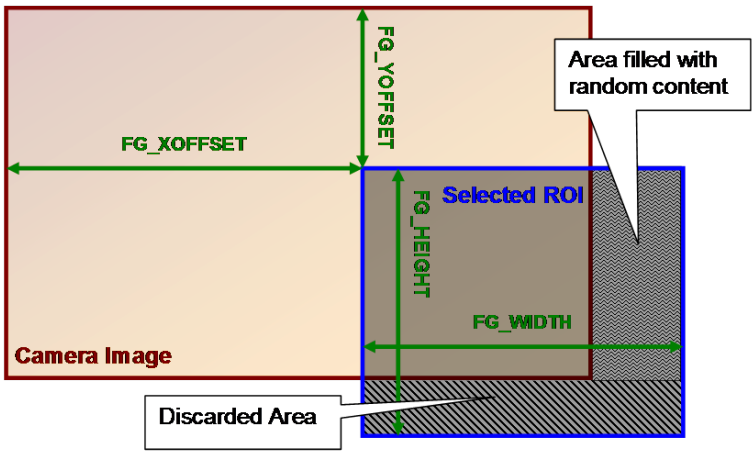
This module allows the definition of a region of interest (ROI), also called area of interest (AOI). A ROI allows the selection of a smaller subset pixel area from the input image. It is defined by using parameters *OffsetX*, *Width*, *OffsetY* and *Height*. The following figure illustrates the parameters.

Figure 5.1. Region of Interest



As can be seen, the region of interest lies within the input image dimensions. Thus, if the image dimension provided by the camera is greater or equal to the specified ROI parameters, the applet will fully cut-out the ROI subset pixel area. However, if the image provided by the camera is smaller than the specified ROI, lines will be filled with random pixel content and the image height might be cut or filled with random image lines as illustrated in the following.

Figure 5.2. Region of Interest Selection Outside the Input Image Dimensions



Furthermore, mind that the image sent by the camera must not exceed the maximum allowed image dimensions. This applet allows a maximum image width of 32768 pixels and a maximum image height of 16777216 lines. The chosen ROI settings can have a direct influence on the maximum bandwidth of the applet as they define the image size and thus, define the amount of data.

The parameters have dynamic value ranges. For example an x-offset cannot be set if the sum of the offset and the image width will exceed the maximum image width. To set a high x-offset, the image width has to be reduced, first. Hence, the order of setting the parameters for this module is important. The return values of the function calls in the SDK should always be evaluated to check if changes were accepted.

Mind the minimum step size of the parameters. This applet has a minimum step size of 32 pixel for the width and the x-offset, while the step size for the height and the y-offset is 1.

The settings made in this module will define the display size and buffer size if the applet is used in microDisplay. If you use the applet in your own programs, ensure to define a sufficient buffer size for the DMA transfers in your PC memory.

All ROI parameters can only be changed if the acquisition is not started i.e. stopped.

Automatic Adaptation to Camera Width and Height with the GenTL Adaptor

The GenTL adaptor can automatically copy the image width and height from the camera to the applet settings so that the user does not have to set these values. Changing the *Width* and *Height* of the applet might get overwritten by the Gen TL on acquisition start. You can only set the width and height if this automatic adaptation is disabled. See the GenTL documentation parameter **`AutomaticROIControl`** for more details.

ROI Setting Defines GenTL Buffer Info

The parameters define the DMA output size and therefore the GenTL buffer info values to inform the consumer about the used output image width and height of the interface. See the GenTL documentation parameter **`AutomaticROIControl`** for more details.

Influence on Bandwidth

A ROI might cause a strong reduction of the required bandwidth. If possible, the camera frame dimension should be reduced directly in the camera to the desired size instead of reducing the size in the applet. This will reduce the required bandwidth between the camera and the frame grabber.

5.1. Width

The parameter specifies the width of the ROI. The values of parameters *Width* + *OffsetX* must not exceed the maximum image width of 32768 pixels. If a horizontal mirroring is active the sensor width limits the maximum width (Width + XOffset). If furthermore vertical mirroring is active the maximum width is limited by the DRAM and sensor height (the sensor dimension needs to fit into the DRAM).

Table 5.1. Parameter properties of Width

Property	Value
Name	**`Width`**
Display Name	**`Width`**
Interface	**`IInteger`**
Access policy	**`Read/Write`**
Visibility	**`Expert`**
Allowed values	**`Minimum 64`** **`Maximum 32768`** **`Stepsize 32`**
Default value	**`1024`**
Unit of measure	**`pixel`**

Example 5.1. Usage of Width

```
/* Set */ Width = 1024;
/* Get */ value_ = Width;
```

5.2. Height

The parameter specifies the height of the ROI. The values of parameters *Height* + *OffsetY* must not exceed the maximum image height of 16777216 pixels. If a vertical mirroring is active the sensor height limits the maximum height (Height + YOffset). Furthermore he maximum height is limited by the DRAM and the sensor width (the sensor dimension needs to fit into the DRAM).

Table 5.2. Parameter properties of Height

Property	Value
Name	**Height**
Display Name	**Height**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Expert**
Allowed values	**Minimum 1** **Maximum 16777216** **Stepsize 1**
Default value	**1024**
Unit of measure	**pixel**

Example 5.2. Usage of Height

```
/* Set */ Height = 1024;
/* Get */ value_ = Height;
```

5.3. OffsetX

The x-offset is defined by this parameter. If a horizontal mirroring is active the sensor width limits the maximum width (Width + XOffset). If furthermore vertical mirroring is active the maximum width is limited by the DRAM and the sensor height (the sensor dimension needs to fit into the DRAM).

Table 5.3. Parameter properties of OffsetX

Property	Value
Name	**OffsetX**
Display Name	**Offset X**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 32704** **Stepsize 32**
Default value	**0**
Unit of measure	**pixel**

Example 5.3. Usage of OffsetX

```
/* Set */ OffsetX = 0;
/* Get */ value_ = OffsetX;
```

5.4. OffsetY

The y-offset is defined by this parameter. If a vertical mirroring is active the sensor height limits the maximum height (Height + YOffset). Furthermore the maximum height is limited by the DRAM and the sensor width (the sensor dimension needs to fit into the DRAM).

Table 5.4. Parameter properties of OffsetY

Property	Value
Name	**OffsetY**
Display Name	**Offset Y**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Expert**
Allowed values	**Minimum** 0 **Maximum** 16777215 **Stepsize** 1
Default value	**0**
Unit of measure	**pixel**

Example 5.4. Usage of OffsetY

```
/* Set */ OffsetY = 0;
/* Get */ value_ = OffsetY;
```

Chapter 6. DigitalIO

The frame grabber provides digital inputs and digital outputs for triggering, light synchronization, hardware control etc. This imaFlex 2 Dual 100 frame grabber has

- 8 general purpose digital inputs (GPIs) using the extension board connector of the frame grabber.
- 8 digital outputs on the GPO connector
- 8 front general purpose digital inputs (Front GPIs) using the SUB-D connector on the frame grabber slot bracket.
- 8 digital outputs on the Front GPO connector
- trigger over CXP cable function

This AcquisitionApplets allows an arbitrary mapping of the inputs to the trigger processing modules of the frame grabber. The same applies for the outputs: Any signal source from the trigger modules or digital inputs can be selected.

- **GND**: Value set to GND, zero. For digital outputs check for possibly inverted outputs.
- **VCC**: Value set to VCC, one. For digital outputs check for possibly inverted outputs.
- **SignalExsync**: The Exsync signal. Usually the line trigger signal used to trigger the camera. Check Chapter 7, '*LineTriggerExSync*' for more information.
- **SignalExsync2**: The Exsync 2 signal a delayed exsync signal. Check *LineTriggerDelay* for more information.
- **SignalFlash**: The flash signal. It is generated once at the start of each frame generated by the trigger module. Check Chapter 8, '*ImageTriggerFlash*' for more information.
- **SignalLineValid**: The line valid signal of the received camera or simulator image data. The signal is high for the duration of the line data transfer.
- **SignalFrameValid**: The frame valid signal after the trigger module. The signal is high for the duration of the frame data transfer. Depending on the image trigger mode, the image dimension and timing the signal can vary. See Chapter 8, '*ImageTriggerFlash*' for more information.
- **SignalGPI0** to **SignalGPI7**: Direct mapping of the digital input signal after debouncing.
- **SignalFrontGPI0** to **SignalFrontGPI7**: Direct mapping of the digital input signal after debouncing.
- **SignalLineStart**: Line start pulse. Use for events and signal analyzer.
- **SignalLineEnd**: Line end pulse. Use for events and signal analyzer.
- **SignalFrameStart**: Frame start pulse. Use for events and signal analyzer.
- **SignalFrameEnd**: Frame end pulse. Use for events and signal analyzer.

6.1. CameraTriggerSource

For CoaXPress triggering, packets are sent to the camera instead of signals. A trigger signal usually consists of a pulse of a certain pulse length defining, for example, the duration time of the exposure. The start of the pulse, i.e. the rising edge, defines the start of the exposure. For most cameras the moment of this rising edge of the pulse is used to send a CXP trigger on CXP LinkTigger0. At the time of the falling edge, the CXP LinkTrigger1 is used by many cameras to end the exposure in a trigger controlled mode.

Thus, you need to select the source signals for the CXP link triggers and define whether you want to use the rising or falling edge. You can do this with the following parameter. Note that the camera must match with these settings.

6.1.1. CxpLinkTrigger0Source

Table 6.1. Parameter properties of CxpLinkTrigger0Source

Property	Value	
Name	**CxpLinkTrigger0Source**	
Display Name	**CXP Link Trigger 0 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalExsync**	

Example 6.1. Usage of CxpLinkTrigger0Source

```
/* Set */ CxpLinkTrigger0Source = SignalExsync;
/* Get */ value_ = CxpLinkTrigger0Source;
```

6.1.2. CxpLinkTrigger0SourceEdge

Table 6.2. Parameter properties of CxpLinkTrigger0SourceEdge

Property	Value	
Name	**CxpLinkTrigger0SourceEdge**	
Display Name	**CXP Link Trigger 0 Source Edge**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**RisingEdge**	Rising Edge
	FallingEdge	Falling Edge
Default value	**RisingEdge**	

Example 6.2. Usage of CxpLinkTrigger0SourceEdge

```
/* Set */ CxpLinkTrigger0SourceEdge = RisingEdge;
/* Get */ value_ = CxpLinkTrigger0SourceEdge;
```

6.1.3. CxpLinkTrigger1Source

Table 6.3. Parameter properties of CxpLinkTrigger1Source

Property	Value	
Name	**CxpLinkTrigger1Source**	
Display Name	**CXP Link Trigger 1 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalExsync**	

Example 6.3. Usage of CxpLinkTrigger1Source

```
/* Set */ CxpLinkTrigger1Source = SignalExsync;
/* Get */ value_ = CxpLinkTrigger1Source;
```

6.1.4. CxpLinkTrigger1SourceEdge

Table 6.4. Parameter properties of CxpLinkTrigger1SourceEdge

Property	Value
Name	**CxpLinkTrigger1SourceEdge**
Display Name	**CXP Link Trigger 1 Source Edge**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**RisingEdge** Rising Edge **FallingEdge** Falling Edge
Default value	**FallingEdge**

Example 6.4. Usage of CxpLinkTrigger1SourceEdge

```
/* Set */ CxpLinkTrigger1SourceEdge = FallingEdge;
/* Get */ value_ = CxpLinkTrigger1SourceEdge;
```

6.1.5. CxpLinkTrigger2Source

Table 6.5. Parameter properties of CxpLinkTrigger2Source

Property	Value
Name	**CxpLinkTrigger2Source**
Display Name	**CXP Link Trigger 2 Source**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**GND** GND **VCC** VCC **SignalExsync** Signal Exsync **SignalExsync2** Signal Exsync2 **SignalFlash** Signal Flash **SignalGPI0** Signal GPI 0 **SignalGPI1** Signal GPI 1 **SignalGPI2** Signal GPI 2 **SignalGPI3** Signal GPI 3 **SignalGPI4** Signal GPI 4 **SignalGPI5** Signal GPI 5 **SignalGPI6** Signal GPI 6 **SignalGPI7** Signal GPI 7 **SignalFrontGPI0** Signal Front GPI 0 **SignalFrontGPI1** Signal Front GPI 1 **SignalFrontGPI2** Signal Front GPI 2 **SignalFrontGPI3** Signal Front GPI 3 **SignalFrontGPI4** Signal Front GPI 4 **SignalFrontGPI5** Signal Front GPI 5 **SignalFrontGPI6** Signal Front GPI 6 **SignalFrontGPI7** Signal Front GPI 7
Default value	**GND**

Example 6.5. Usage of CxpLinkTrigger2Source

```
/* Set */ CxpLinkTrigger2Source = GND;
/* Get */ value_ = CxpLinkTrigger2Source;
```

6.1.6. CxpLinkTrigger2SourceEdge

Table 6.6. Parameter properties of CxpLinkTrigger2SourceEdge

Property	Value
Name	**CxpLinkTrigger2SourceEdge**
Display Name	**CXP Link Trigger 2 Source Edge**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**RisingEdge** Rising Edge **FallingEdge** Falling Edge
Default value	**RisingEdge**

Example 6.6. Usage of CxpLinkTrigger2SourceEdge

```
/* Set */ CxpLinkTrigger2SourceEdge = RisingEdge;
/* Get */ value_ = CxpLinkTrigger2SourceEdge;
```

6.1.7. CxpLinkTrigger3Source

Table 6.7. Parameter properties of CxpLinkTrigger3Source

Property	Value
Name	**CxpLinkTrigger3Source**
Display Name	**CXP Link Trigger 3 Source**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**GND** GND **VCC** VCC **SignalExsync** Signal Exsync **SignalExsync2** Signal Exsync2 **SignalFlash** Signal Flash **SignalGPI0** Signal GPI 0 **SignalGPI1** Signal GPI 1 **SignalGPI2** Signal GPI 2 **SignalGPI3** Signal GPI 3 **SignalGPI4** Signal GPI 4 **SignalGPI5** Signal GPI 5 **SignalGPI6** Signal GPI 6 **SignalGPI7** Signal GPI 7 **SignalFrontGPI0** Signal Front GPI 0 **SignalFrontGPI1** Signal Front GPI 1 **SignalFrontGPI2** Signal Front GPI 2 **SignalFrontGPI3** Signal Front GPI 3 **SignalFrontGPI4** Signal Front GPI 4 **SignalFrontGPI5** Signal Front GPI 5 **SignalFrontGPI6** Signal Front GPI 6 **SignalFrontGPI7** Signal Front GPI 7
Default value	**GND**

Example 6.7. Usage of CxpLinkTrigger3Source

```
/* Set */ CxpLinkTrigger3Source = GND;
/* Get */ value_ = CxpLinkTrigger3Source;
```

6.1.8. CxpLinkTrigger3SourceEdge

Table 6.8. Parameter properties of CxpLinkTrigger3SourceEdge

Property	Value
Name	**CxpLinkTrigger3SourceEdge**
Display Name	**CXP Link Trigger 3 Source Edge**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**RisingEdge** Rising Edge **FallingEdge** Falling Edge
Default value	**RisingEdge**

Example 6.8. Usage of CxpLinkTrigger3SourceEdge

```
/* Set */ CxpLinkTrigger3SourceEdge = RisingEdge;
/* Get */ value_ = CxpLinkTrigger3SourceEdge;
```

6.2. GPO

6.2.1. TriggerOutGPO0Source et al.

Note

This description applies also to the following parameters: TriggerOutGPO1Source, TriggerOutGPO2Source, TriggerOutGPO3Source, TriggerOutGPO4Source, TriggerOutGPO5Source, TriggerOutGPO6Source, TriggerOutGPO7Source

Select the signal source of the General Purpose Output (GPO). For further explanation of the available sources see Chapter 6, '*DigitalIO*'.

You can change the polarity using parameter *TriggerOutGPO0Polarity*.

Table 6.9. Parameter properties of TriggerOutGPO0Source

Property	Value	
Name	**TriggerOutGPO0Source**	
Display Name	**Trigger Out GPO 0 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalLineValid	Signal Line Valid
	SignalFrameValid	Signal Frame Valid
	SignalLineStart	Signal Line Start
	SignalLineEnd	Signal Line End
	SignalFrameStart	Signal Frame Start
	SignalFrameEnd	Signal Frame End
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalFlash**	

Example 6.9. Usage of TriggerOutGPO0Source

```
/* Set */ TriggerOutGPO0Source = SignalFlash;
/* Get */ value_ = TriggerOutGPO0Source;
```

6.2.2. TriggerOutGPO0Polarity et al.

Note

This description applies also to the following parameters: TriggerOutGPO1Polarity, TriggerOutGPO2Polarity, TriggerOutGPO3Polarity, TriggerOutGPO4Polarity, TriggerOutGPO5Polarity, TriggerOutGPO6Polarity, TriggerOutGPO7Polarity

Select the output polarity the General Purpose Output (GPO). For further explanation of the available sources see Chapter 6, '*DigitalIO*'.

Table 6.10. Parameter properties of TriggerOutGPO0Polarity

Property	Value
Name	**TriggerOutGPO0Polarity**
Display Name	**Trigger Out GPO 0 Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 6.10. Usage of TriggerOutGPO0Polarity

```
/* Set */ TriggerOutGPO0Polarity = HighActive;
/* Get */ value_ = TriggerOutGPO0Polarity;
```

6.2.3. TriggerOutFrontGPO0Source et al.

Note

This description applies also to the following parameters: TriggerOutFrontGPO1Source, TriggerOutFrontGPO2Source, TriggerOutFrontGPO3Source, TriggerOutFrontGPO4Source, TriggerOutFrontGPO5Source, TriggerOutFrontGPO6Source, TriggerOutFrontGPO7Source

Select the signal source of the Front General Purpose Output (Front GPO). For further explanation of the available sources see Chapter 6, '*DigitalIO*'.

You can change the polarity using parameter *TriggerFrontOutGPO0Polarity*.

Table 6.11. Parameter properties of TriggerOutFrontGPO0Source

Property	Value	
Name	**TriggerOutFrontGPO0Source**	
Display Name	**Trigger Out Front GPO 0 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalLineValid	Signal Line Valid
	SignalFrameValid	Signal Frame Valid
	SignalLineStart	Signal Line Start
	SignalLineEnd	Signal Line End
	SignalFrameStart	Signal Frame Start
	SignalFrameEnd	Signal Frame End
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalFlash**	

Example 6.11. Usage of TriggerOutFrontGPO0Source

```
/* Set */ TriggerOutFrontGPO0Source = SignalFlash;
/* Get */ value_ = TriggerOutFrontGPO0Source;
```

6.2.4. TriggerFrontOutGPO0Polarity et al.

Note

This description applies also to the following parameters: TriggerFrontOutGPO1Polarity, TriggerFrontOutGPO2Polarity, TriggerFrontOutGPO3Polarity, TriggerFrontOutGPO4Polarity, TriggerFrontOutGPO5Polarity, TriggerFrontOutGPO6Polarity, TriggerFrontOutGPO7Polarity

Select the output polarity the Front General Purpose Output (Front GPO). For further explanation of the available sources see Chapter 6, '*DigitalIO*'.

Table 6.12. Parameter properties of TriggerFrontOutGPO0Polarity

Property	Value
Name	**TriggerFrontOutGPO0Polarity**
Display Name	**Trigger Front Out GPO 0 Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 6.12. Usage of TriggerFrontOutGPO0Polarity

```
/* Set */ TriggerFrontOutGPO0Polarity = HighActive;
/* Get */ value_ = TriggerFrontOutGPO0Polarity;
```

6.3. GPIState

6.3.1. DigitalInput

Parameter *DigitalInput* is used to monitor the digital inputs of the frame grabber. This AcquisitionApplets has 16 digital inputs. You can read the current state of these inputs using parameter *DigitalInput*. Bit 0 of the read value represents input 0, bit 1 represents input 1 and so on. For example, if you obtain the value 37 or hexadecimal 0x25, the frame grabber will have high level on its digital inputs 0, 2 and 5.

Table 6.13. Parameter properties of DigitalInput

Property	Value
Name	**DigitalInput**
Display Name	**Digital Input**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum** **0** **Maximum** **65535** **Stepsize** **1**
Unit of measure	

Example 6.13. Usage of DigitalInput

```
/* Get */ value_ = DigitalInput;
```

6.4. EventSource

6.4.1. CustomSignalEvent0Source

Select the source for the custom signal event.

Table 6.14. Parameter properties of CustomSignalEvent0Source

Property	Value	
Name	**CustomSignalEvent0Source**	
Display Name	**Custom Signal Event 0 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalLineValid	Signal Line Valid
	SignalFrameValid	Signal Frame Valid
	SignalLineStart	Signal Line Start
	SignalLineEnd	Signal Line End
	SignalFrameStart	Signal Frame Start
	SignalFrameEnd	Signal Frame End
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalExsync**	

Example 6.14. Usage of CustomSignalEvent0Source

```
/* Set */ CustomSignalEvent0Source = SignalExsync;
/* Get */ value_ = CustomSignalEvent0Source;
```

6.4.2. CustomSignalEvent0Polarity

Select the polarity for the custom signal event.

Table 6.15. Parameter properties of CustomSignalEvent0Polarity

Property	Value
Name	**CustomSignalEvent0Polarity**
Display Name	**Custom Signal Event 0 Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 6.15. Usage of CustomSignalEvent0Polarity

```
/* Set */ CustomSignalEvent0Polarity = HighActive;
/* Get */ value_ = CustomSignalEvent0Polarity;
```

6.4.3. CustomSignalEvent1Source

Select the source for the custom signal event.

Table 6.16. Parameter properties of CustomSignalEvent1Source

Property	Value	
Name	**CustomSignalEvent1Source**	
Display Name	**Custom Signal Event 1 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalLineValid	Signal Line Valid
	SignalFrameValid	Signal Frame Valid
	SignalLineStart	Signal Line Start
	SignalLineEnd	Signal Line End
	SignalFrameStart	Signal Frame Start
	SignalFrameEnd	Signal Frame End
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalFlash**	

Example 6.16. Usage of CustomSignalEvent1Source

```
/* Set */ CustomSignalEvent1Source = SignalFlash;
/* Get */ value_ = CustomSignalEvent1Source;
```

6.4.4. CustomSignalEvent1Polarity

Select the polarity for the custom signal event.

Table 6.17. Parameter properties of CustomSignalEvent1Polarity

Property	Value
Name	**CustomSignalEvent1Polarity**
Display Name	**Custom Signal Event 1 Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 6.17. Usage of CustomSignalEvent1Polarity

```
/* Set */ CustomSignalEvent1Polarity = HighActive;
/* Get */ value_ = CustomSignalEvent1Polarity;
```

6.5. Events

In programming or runtime environments, a callback function is a piece of executable code that is passed as an argument, which is expected to call back (execute) exactly that time an event is triggered. This applet can generate some software callback events based on trigger inputs as explained in the following section. These events are not related to a special camera functionality. Other event sources are described in additional sections of this document.

Basler Framegrabber SDK enables an application to get these event notifications about certain state changes at the data flow from camera to RAM and the image and trigger processing as well. Please consult the Basler Framegrabber SDK documentation for more details concerning the implementation of this functionality.

6.5.1. Line0RisingEdge

This event is generated for each rising signal edge at trigger input 0. Except for the timestamp, the event has no additional data included. Keep in mind that fast changes of the input signal can cause high interrupt rates which might slow down the system. This event can occur independent of the acquisition status.

6.5.2. Line0FallingEdge

This event is generated for each falling signal edge at trigger input 0. Except for the timestamp, the event has no additional data included. Keep in mind that fast changes of the input signal can cause high interrupt rates which might slow down the system. This event can occur independent of the acquisition status.

6.5.3. CustomSignalEvent0

The event defined by *CustomSignalEvent0Source* and *CustomSignalEvent0Polarity*.

6.5.4. CustomSignalEvent1

The event defined by *CustomSignalEvent1Source* and *CustomSignalEvent1Polarity*.

6.6. Debouncing

This category provides debouncing paramters for the Digital I/Os.

6.6.1. DebouncingGPI

The parameters in this category control the debouncing of electrical signals applied to the GPIs.

6.6.1.1. Gpi0Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.18. Parameter properties of Gpi0Debounce

Property	Value
Name	**Gpi0Debounce**
Display Name	**GPI0 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.18. Usage of Gpi0Debounce

```
/* Set */ Gpi0Debounce = 0.112;
/* Get */ value_ = Gpi0Debounce;
```

6.6.1.2. Gpi1Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.19. Parameter properties of Gpi1Debounce

Property	Value
Name	**Gpi1Debounce**
Display Name	**GPI1 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.19. Usage of Gpi1Debounce

```
/* Set */ Gpi1Debounce = 0.112;
/* Get */ value_ = Gpi1Debounce;
```

6.6.1.3. Gpi2Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.20. Parameter properties of Gpi2Debounce

Property	Value
Name	**Gpi2Debounce**
Display Name	**GPI2 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.20. Usage of Gpi2Debounce

```
/* Set */ Gpi2Debounce = 0.112;
/* Get */ value_ = Gpi2Debounce;
```

6.6.1.4. Gpi3Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.21. Parameter properties of Gpi3Debounce

Property	Value
Name	**Gpi3Debounce**
Display Name	**GPI3 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.21. Usage of Gpi3Debounce

```
/* Set */ Gpi3Debounce = 0.112;
```

```
/* Get */ value_ = Gpi3Debounce;
```

6.6.1.5. Gpi4Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.22. Parameter properties of Gpi4Debounce

Property	Value
Name	**Gpi4Debounce**
Display Name	**GPI4 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.22. Usage of Gpi4Debounce

```
/* Set */ Gpi4Debounce = 0.112;
/* Get */ value_ = Gpi4Debounce;
```

6.6.1.6. Gpi5Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.23. Parameter properties of Gpi5Debounce

Property	Value
Name	**Gpi5Debounce**
Display Name	**GPI5 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.23. Usage of Gpi5Debounce

```
/* Set */ Gpi5Debounce = 0.112;
/* Get */ value_ = Gpi5Debounce;
```

6.6.1.7. Gpi6Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.24. Parameter properties of Gpi6Debounce

Property	Value
Name	**Gpi6Debounce**
Display Name	**GPI6 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.24. Usage of Gpi6Debounce

```
/* Set */ Gpi6Debounce = 0.112;
/* Get */ value_ = Gpi6Debounce;
```

6.6.1.8. Gpi7Debounce

This parameter sets the debounce time for the corresponding GPI. The debounce time is given in microseconds.

Table 6.25. Parameter properties of Gpi7Debounce

Property	Value
Name	**Gpi7Debounce**
Display Name	**GPI7 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.25. Usage of Gpi7Debounce

```
/* Set */ Gpi7Debounce = 0.112;
/* Get */ value_ = Gpi7Debounce;
```

6.6.2. DebouncingFrontGPI

The parameters in this category control the debouncing of electrical signals applied to the `FrontGPIs`.

6.6.2.1. FrontGpi0Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.26. Parameter properties of FrontGpi0Debounce

Property	Value
Name	**`FrontGpi0Debounce`**
Display Name	**`FrontGPI0 Debouncing`**
Interface	**`IFloat`**
Access policy	**`Read/Write/Change`**
Visibility	**`Beginner`**
Allowed values	**`Minimum 0.0025`** **`Maximum 20.3125`** **`Stepsize 0.0025`**
Default value	**`0.112`**
Unit of measure	**`µs`**

Example 6.26. Usage of FrontGpi0Debounce

```
/* Set */ FrontGpi0Debounce = 0.112;
/* Get */ value_ = FrontGpi0Debounce;
```

6.6.2.2. FrontGpi1Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.27. Parameter properties of FrontGpi1Debounce

Property	Value
Name	**`FrontGpi1Debounce`**
Display Name	**`FrontGPI1 Debouncing`**
Interface	**`IFloat`**
Access policy	**`Read/Write/Change`**
Visibility	**`Beginner`**
Allowed values	**`Minimum 0.0025`** **`Maximum 20.3125`** **`Stepsize 0.0025`**
Default value	**`0.112`**
Unit of measure	**`µs`**

Example 6.27. Usage of FrontGpi1Debounce

```
/* Set */ FrontGpi1Debounce = 0.112;
/* Get */ value_ = FrontGpi1Debounce;
```

6.6.2.3. FrontGpi2Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.28. Parameter properties of FrontGpi2Debounce

Property	Value
Name	**`FrontGpi2Debounce`**
Display Name	**`FrontGPI2 Debouncing`**
Interface	**`IFloat`**
Access policy	**`Read/Write/Change`**
Visibility	**`Beginner`**
Allowed values	**`Minimum 0.0025`** **`Maximum 20.3125`** **`Stepsize 0.0025`**
Default value	**`0.112`**
Unit of measure	**`µs`**

Example 6.28. Usage of FrontGpi2Debounce

```
/* Set */ FrontGpi2Debounce = 0.112;
/* Get */ value_ = FrontGpi2Debounce;
```

6.6.2.4. FrontGpi3Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.29. Parameter properties of FrontGpi3Debounce

Property	Value
Name	**`FrontGpi3Debounce`**
Display Name	**`FrontGPI3 Debouncing`**
Interface	**`IFloat`**
Access policy	**`Read/Write/Change`**
Visibility	**`Beginner`**
Allowed values	**`Minimum 0.0025`** **`Maximum 20.3125`** **`Stepsize 0.0025`**
Default value	**`0.112`**
Unit of measure	**`µs`**

Example 6.29. Usage of FrontGpi3Debounce

```
/* Set */ FrontGpi3Debounce = 0.112;
/* Get */ value_ = FrontGpi3Debounce;
```

6.6.2.5. FrontGpi4Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.30. Parameter properties of FrontGpi4Debounce

Property	Value
Name	**FrontGpi4Debounce**
Display Name	**FrontGPI4 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.30. Usage of FrontGpi4Debounce

```
/* Set */ FrontGpi4Debounce = 0.112;
/* Get */ value_ = FrontGpi4Debounce;
```

6.6.2.6. FrontGpi5Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.31. Parameter properties of FrontGpi5Debounce

Property	Value
Name	**FrontGpi5Debounce**
Display Name	**FrontGPI5 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.31. Usage of FrontGpi5Debounce

```
/* Set */ FrontGpi5Debounce = 0.112;
/* Get */ value_ = FrontGpi5Debounce;
```

6.6.2.7. FrontGpi6Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.32. Parameter properties of FrontGpi6Debounce

Property	Value
Name	**FrontGpi6Debounce**
Display Name	**FrontGPI6 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.32. Usage of FrontGpi6Debounce

```
/* Set */ FrontGpi6Debounce = 0.112;
/* Get */ value_ = FrontGpi6Debounce;
```

6.6.2.8. FrontGpi7Debounce

This parameter sets the debounce time for the corresponding `FrontGPI`. The debounce time is given in microseconds.

Table 6.33. Parameter properties of FrontGpi7Debounce

Property	Value
Name	**FrontGpi7Debounce**
Display Name	**FrontGPI7 Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 6.33. Usage of FrontGpi7Debounce

```
/* Set */ FrontGpi7Debounce = 0.112;
/* Get */ value_ = FrontGpi7Debounce;
```

Chapter 7. LineTriggerExSync

The line trigger function block uses signals to control the line scan acquisition of the specific camera. A external synchronization signal or internal generated puls with fixed frequency being sent to the line scan camera is called ExSync. With the help of this signal it is possible to control the exposure of the connected camera.

The camera needs to be configured accordingly to use the ExSync as control signal. Furthermore the camera might expect the ExSync at a particular CC signal and/or polarity.

For CoaXPress the the exposure control is sent in two independent packets. A single start- and a single end-packet. The time in between is interpreted as pulse width. The timing of these is very precise.

An sensor exposure control based on pulse length/duration is very common. Please make sure that the exposure time is less than the period of the expected maximum line frequency. Consult the camera's manual for more details because these are device specific. More details concerning ExSync can be found in the parameter description of *ExSyncOn*.

Basically two different generation modes for the ExSync signals are available,

- a simple periodical and
- an externally triggered generation.

Additionally, two variants of these are available,

- the first is independent from the image gate,
- and the second is gated by the image gate, which creates ExSync signals only during the actual acquisition.

All details can be found in the parameter description of *LineTriggerMode*.

For the mapping of the ExSync signals to the digital outputs check Chapter 6, '*DigitalIO*'.

7.1. LineTriggerMode

Please choose one of the line trigger modes described here. Make sure that the operation modes of the frame grabber and the camera are the same.

Image independent ExSync modes:

- **Grabber Controlled**

  For the grabber controlled line trigger, the ExSync signal is a simple periodical signal. Its period defines the line frequency and its active time is used by many cameras to define the exposure time.

- **External Trigger**

  The external trigger mode for ExSync generates a single ExSync pulse when the external trigger source becomes active. The ExSync defines the exposure time for the camera. During the exposure time is not possible to re-trigger the ExSync. If the camera needs an additional setup time, it is possible to extend the deadtime of the trigger - the time where no re-trigger is possible - beyond the exposure time. If you want to trigger fewer lines than pulses available at the trigger input, it is possible to downscale the trigger input, e.g. a downscaler of 2 will generate an ExSync every 2nd input pulse, a downscaler of 3 only every third of the input pulses, and so on.

Image gate dependent ExSync modes:

- **Grabber Controlled Gated**

For the grabber controlled gated line trigger, the ExSync signal is generated the very same way as for the grabber controlled mode described above. However, the generator for the ExSync is starting the rising image gate and stops with the image gate becoming inactive. This gives a smaller jitter for the time from the start of the image gate and the generation of the first ExSync, especially for very long ExSync periods.

- **External Trigger Gated**

  For the external trigger gated controlled line trigger, the ExSync signal is generated the very same way as for the external trigger mode described above. However, the generator for the ExSync is starting the rising image gate and stops with the image gate becoming inactive. For this mode two downscalers are available. The first is the downscaler from the beginning of the image gate to the first ExSync, it is called phase. The second is downscaling all succeeding input triggers and is the same as the downscaler used in external trigger mode described above. The options downscale and phase allow further adjustment of the camera trigger with respect to its external source, the trigger input. The value downscale determines the divisor of the input frequency, e.g. a downscale of 16 will produce an ExSync every 16 * n of the input trigger. Furthermore, the phase gives the possibility to shift the camera trigger. A phase shift of 90° is achieved when setting phase to 4, which produces a camera trigger at times 16 * n + 4 of the input trigger signal.

Table 7.1. Parameter properties of LineTriggerMode

Property	Value	
Name	**`LineTriggerMode`**	
Display Name	**`Line Trigger Mode`**	
Interface	**`IEnumeration`**	
Access policy	**`Read/Write`**	
Visibility	**`Beginner`**	
Allowed values	**`GrabberControlled`**	Grabber Controlled
	`AsyncExternalTrigger`	Async External Trigger
	`GrabberControlledGated`	Grabber Controlled Gated
	`AsyncGatedTrigger`	Async Gated Trigger
Default value	**`GrabberControlled`**	

Example 7.1. Usage of LineTriggerMode

```
/* Set */ LineTriggerMode = GrabberControlled;
/* Get */ value_ = LineTriggerMode;
```

7.2. ExSyncOn

This parameter enables the transmission of ExSync signals to the camera.

Please take care to first start the acquisition before setting this ExSyncOn parameter to On (**On**) if you want to acquire all lines being generated by the camera. The signal will be sent as soon as the ExSync has been started. As soon as the acquisition is started the used timeout parameter becomes valid independent of the ExSyncOn parameter being On (**On**) or Off (**Off**). By switching this parameter On (**On**) and Off (**Off**) during an acquisition you can check if the camera is configured to use this external signal for exposure start.

Whether the ExSync is really used by the camera is based on the settings of the camera. Consult the camera's manual for more details because these are device specific.

Table 7.2. Parameter properties of ExSyncOn

Property	Value
Name	**ExSyncOn**
Display Name	**Ex Sync On**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**On** On **Off** Off
Default value	**On**

Example 7.2. Usage of ExSyncOn

```
/* Set */ ExSyncOn = On;
/* Get */ value_ = ExSyncOn;
```

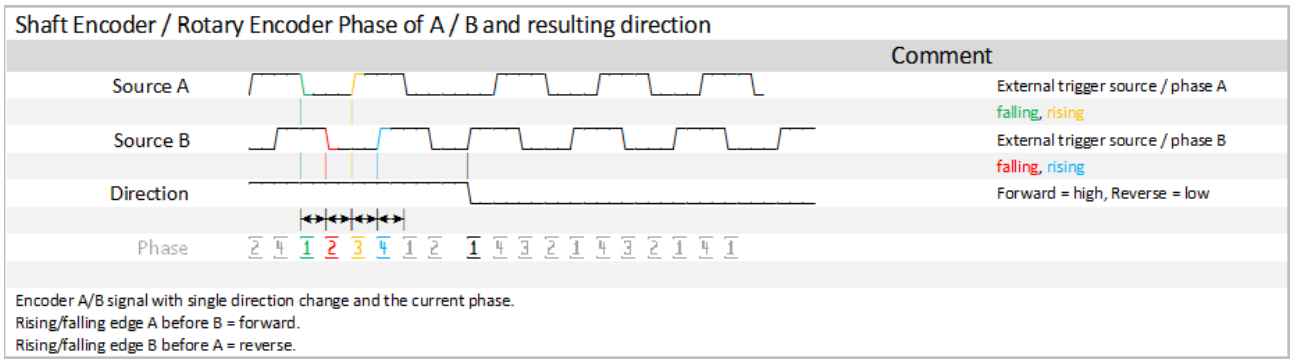
7.3. LineTriggerInput

In the line trigger input category of the line trigger module, the applet is configured for a possible external line trigger input. Here, debouncing times, downscales, polarities and a shaft encoder input are configured.

The external peripheral line trigger source will be in most cases a shaft encoder, also called a rotary encoder. These devices convert the objects movement over an angular motion into relative incremental pulses. The angular motion is taken from the motor axis or a wheel being connected to the translational motion of the scanned object. For most line scan applications it is relevant to get exact feedback of the relative motion between camera and object. By this a certain number of incremental pulses per distance is given to the frame grabber trigger input interface. Depending on the used incremental shaft encoders a certain number (500, 1000, ...) of incremental pulses per rotation is produced.

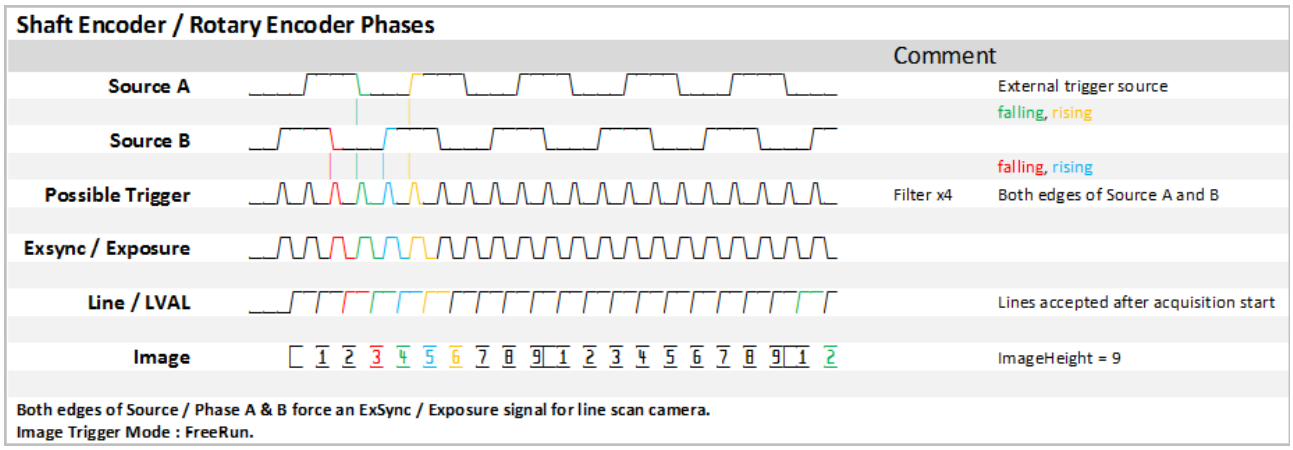
Most incremental shaft encoders provide 2 signals that are called A & B. By using these two signals the relative increments can be seen at the edges of these signals and a direction. In one direction the A-phase high state rises before the B-phase in the other direction, i.e. vice versa. If we do not need a direction for our application, only the A-phase is necessary. A combination of A & B may provide a higher resolution. Please see *ShaftEncoderMode* and *ShaftEncoderOn* for this.

Figure 7.1. Shaft Encoder, A & B phase, direction



During an acquisition the shaft encoder signals trigger the ExSync signals and force the sensor to perform an exposure. After the sensor exposure the line is read-out and transfered. The time between exposure and transfer is for most line scan cameras very short.

Figure 7.2. Shaft Encoder, A & B signal, acquisition



The different phases are defined as seen in the following table. A positive phase increment is forward direction, a negative means reverse. This induces rising/falling edge A before B equals forward direction and rising/falling edge B before A means reverse.

Table 7.3. Phases of an A/B Shaft Encoder

Phase	A-state	B-state
1	low	high
2	low	low
3	high	low
4	high	high

Some shaft encoders provide a third signal that is pulsed for each full rotation which is called Z or index. This signal Z could become interesting for an image trigger mode. For more details see Chapter 8, '*ImageTriggerFlash*'.

For most applications and several camera or line scan sensor types it is necessary to have the same resolution in X and Y direction of an image. Due to this the number of pixels per mm in sensor- and motion-direction needs to be the same. In case of an 1024 pixel line scan sensor looking at 10 cm we have 10.24 pixel per mm orthogonal to the web direction. In order to reach an 1:1 scaling we need 10.24 ExSync signals per mm. If a perfectly round object is scanned with an 1:1 scaling then it is exactly round in the image too. When the result becomes elliptic, the scaling is not perfect and some line scan sensor architectures (Bi/Tri-Linear, Dual-Line, ...) will show some additional artefacts.

7.3.1. LineTriggerInSource

This parameter specifies the digital signal source for phase A, which is used to trigger the ExSync signal. If an A/B shaft encoder is used, configure source B at *ShaftEncoderInputSource*, too. For more details consult the Framegrabber SDK manual.

It is possible to use the shaft encoder A phase only if the direction of scanning is not of interest in the target application. Concerning more details to the shaft encoder please consider the introduction of Section 7.3, 'LineTriggerInput'.

Table 7.4. Parameter properties of LineTriggerInSource

Property	Value	
Name	**LineTriggerInSource**	
Display Name	**Line Trigger In Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GPITriggerSource0**	GPI Trigger Source 0
	GPITriggerSource1	GPI Trigger Source 1
	GPITriggerSource2	GPI Trigger Source 2
	GPITriggerSource3	GPI Trigger Source 3
	GPITriggerSource4	GPI Trigger Source 4
	GPITriggerSource5	GPI Trigger Source 5
	GPITriggerSource6	GPI Trigger Source 6
	GPITriggerSource7	GPI Trigger Source 7
	TriggerInSourceFrontGPI0	Trigger In Source Front GPI 0
	TriggerInSourceFrontGPI1	Trigger In Source Front GPI 1
	TriggerInSourceFrontGPI2	Trigger In Source Front GPI 2
	TriggerInSourceFrontGPI3	Trigger In Source Front GPI 3
	TriggerInSourceFrontGPI4	Trigger In Source Front GPI 4
	TriggerInSourceFrontGPI5	Trigger In Source Front GPI 5
	TriggerInSourceFrontGPI6	Trigger In Source Front GPI 6
	TriggerInSourceFrontGPI7	Trigger In Source Front GPI 7
Default value	**GPITriggerSource1**	

Example 7.3. Usage of LineTriggerInSource

```
/* Set */ LineTriggerInSource = GPITriggerSource1;
/* Get */ value_ = LineTriggerInSource;
```

7.3.2. LineTriggerInPolarity

The parameter defines the polarity of the external input trigger signal encoder source A and source B. When set to LowActive, the ExSync generator starts on a falling edge of the signal specified by the parameter *LineTriggerInSource*. Otherwise, the ExSync generation starts on a rising edge. This is only relevant if the *LineTriggerMode* is set to an external trigger.

Table 7.5. Parameter properties of LineTriggerInPolarity

Property	Value	
Name	**LineTriggerInPolarity**	
Display Name	**Line Trigger In Polarity**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**LowActive**	Low Active
	HighActive	High Active
Default value	**HighActive**	

Example 7.4. Usage of LineTriggerInPolarity

```
/* Set */ LineTriggerInPolarity = HighActive;
```

```
/* Get */ value_ = LineTriggerInPolarity;
```

7.3.3. LineTriggerDebouncing

This parameter specifies the debouncing time. This is the time for which the input line trigger signals must keep the same value to be detected as such. Fast signal changes within the debouncing time will be filtered out.

Table 7.6. Parameter properties of LineTriggerDebouncing

Property	Value
Name	**LineTriggerDebouncing**
Display Name	**Line Trigger Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 7.5. Usage of LineTriggerDebouncing

```
/* Set */ LineTriggerDebouncing = 0.112;
/* Get */ value_ = LineTriggerDebouncing;
```

7.3.4. Downscale

7.3.4.1. LineDownscale

Sets the value after how many pulses of the input trigger signal a single one is passed through as ExSync. For example, a value of 2 creates an ExSync pulse at each 2nd input trigger signal. This is only relevant if the *LineTriggerMode* is set to an external trigger mode. The parameter *LineDownscaleInit* selects an initial delay of incoming pulses.

Figure 7.3. Downscale and Init phase behaviour

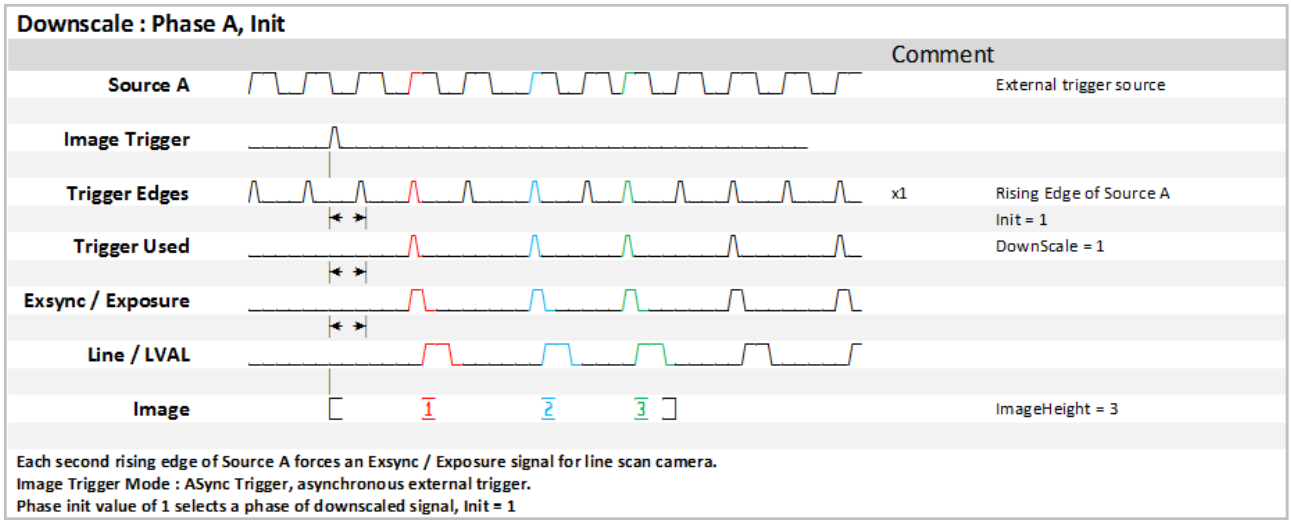


Table 7.7. Parameter properties of LineDownscale

Property	Value
Name	**LineDownscale**
Display Name	**Line Downscale**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum 1** **Maximum 255** **Stepsize 1**
Default value	**1**
Unit of measure	**pulses**

Example 7.6. Usage of LineDownscale

```
/* Set */ LineDownscale = 1;
/* Get */ value_ = LineDownscale;
```

7.3.4.2. LineDownscaleInit

In addition to the downscale value this parameter sets a phase position. This parameter specifies the number of external input trigger signals, which are needed to generate the first ExSync of a frame. This is only relevant if the *LineTriggerMode* is set to an image gate dependent ExSync mode. This value is applied after the image start pulse. The parameter *LineDownscale* represents the number of possible steps and an explaining figure is found in its description (Init=1).

Table 7.8. Parameter properties of LineDownscaleInit

Property	Value
Name	**LineDownscaleInit**
Display Name	**Line Downscale Init**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum 1** **Maximum 255** **Stepsize 1**
Default value	**1**
Unit of measure	**pulses**

Example 7.7. Usage of LineDownscaleInit

```
/* Set */ LineDownscaleInit = 1;
/* Get */ value_ = LineDownscaleInit;
```

7.4. ShaftEncoderABFilter

With the support of signal A/B for shaft encoders it is possible to detect the rotary direction of an attached encoder and filter the encoder signals accordingly. Also a compensation is performed for up to 16,777,216 reverse encoder signals. A brief description about this feature is found in the shaft encoder documentation.

7.4.1. ShaftEncoderOn

Switch the shaft encoder filter On or Off. This is only relevant if the *LineTriggerMode* is set to an external trigger mode. The functionalities of *ShaftEncoderMode*, *ShaftEncoderInputSource*, *ShaftEncoderLeading*, *ShaftEncoderCompensationEnable*, *ShaftEncoderCompensationCount* become relevant in the case this parameter is set to On = **On**. When enabling the shaft encoder, a reset of the encoder compensation is performed. If this filter is switched on an correct A & B encoder signal is expected and necessary for correct functionality. Please be aware that the input signal at *ShaftEncoderInputSource* is interpreted as phase B and the input signal at *LineTriggerInSource* as phase A. A sketch of the signal can be found in the description of parameter *LineTriggerInSource*.

Table 7.9. Parameter properties of ShaftEncoderOn

Property	Value
Name	**ShaftEncoderOn**
Display Name	**Shaft Encoder On**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**On** On **Off** Off
Default value	**Off**

Example 7.8. Usage of ShaftEncoderOn

```
/* Set */ ShaftEncoderOn = Off;
/* Get */ value_ = ShaftEncoderOn;
```

7.4.2. ShaftEncoderMode

The shaft encoder mode can be run in three operation modes. Please choose the according operation mode for your application. This feature can be used if *ShaftEncoderOn* is switched on. It enables you to adjust the number of increments per rotation of the shaft encoder. Together with the parameter *LineDownscale* you can adjust the increment re-scaling.

The following modes are available:

- Filter x1

  ExSync is generated for a forward rotation of the shaft encoder in single resolution, i.e. a trigger pulse for rising edge of Source A.

- Filter x2

  ExSync is generated for a forward rotation of the shaft encoder in double resolution, i.e. a trigger pulse for a rising and falling edge of Source A, edges of Source B are not used.

- Filter x4

  ExSync is generated for a forward rotation of the shaft encoder in quad resolution, i.e. a trigger pulse for a rising and falling edge of Source A and a rising and falling edge of Source B.

Figure 7.4. Shaft Encoder Mode : Filter x4, x2, x1

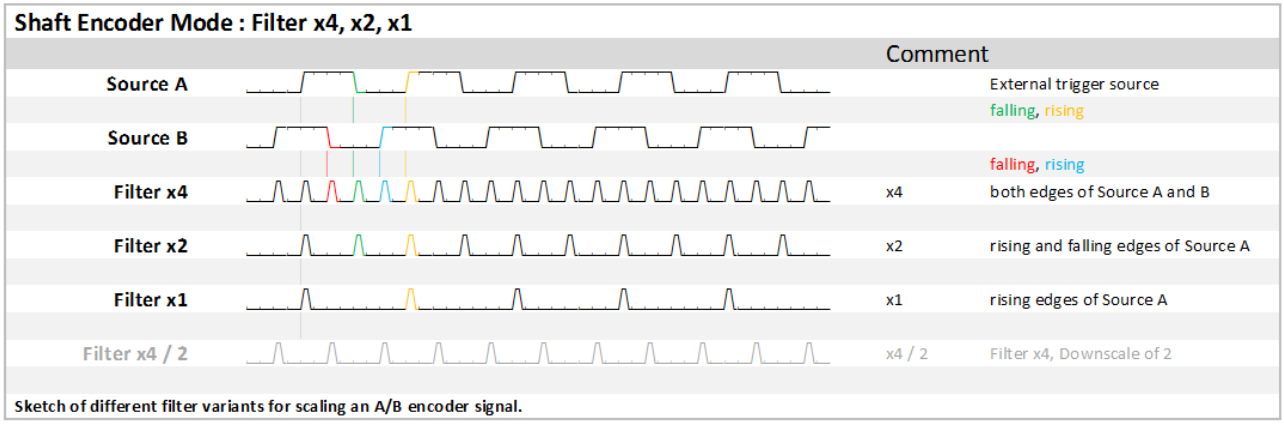


Table 7.10. Parameter properties of ShaftEncoderMode

Property	Value
Name	**ShaftEncoderMode**
Display Name	**Shaft Encoder Mode**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**FilterX1** Filter X1 **FilterX2** Filter X2 **FilterX4** Filter X4
Default value	**FilterX1**

Example 7.9. Usage of ShaftEncoderMode

```
/* Set */ ShaftEncoderMode = FilterX1;
/* Get */ value_ = ShaftEncoderMode;
```

7.4.3. ShaftEncoderInputSource

Specifies the input signal source / phase B for the shaft encoder filter. Signal source B of the shaft encoder is 90 degree phase shifted to source / phase A. In this document you can get more explanations regarding the input pins in the context of parameter *LineTriggerInSource* and concerning the shaft encoder in the introduction of Section 7.3, 'LineTriggerInput'. Check the hardware documentation of the microEnable trigger board and the Framegrabber SDK manual for more details.

Table 7.11. Parameter properties of ShaftEncoderInputSource

Property	Value	
Name	**ShaftEncoderInputSource**	
Display Name	**Shaft Encoder Input Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GPITriggerSource0**	GPI Trigger Source 0
	GPITriggerSource1	GPI Trigger Source 1
	GPITriggerSource2	GPI Trigger Source 2
	GPITriggerSource3	GPI Trigger Source 3
	GPITriggerSource4	GPI Trigger Source 4
	GPITriggerSource5	GPI Trigger Source 5
	GPITriggerSource6	GPI Trigger Source 6
	GPITriggerSource7	GPI Trigger Source 7
	TriggerInSourceFrontGPI0	Trigger In Source Front GPI 0
	TriggerInSourceFrontGPI1	Trigger In Source Front GPI 1
	TriggerInSourceFrontGPI2	Trigger In Source Front GPI 2
	TriggerInSourceFrontGPI3	Trigger In Source Front GPI 3
	TriggerInSourceFrontGPI4	Trigger In Source Front GPI 4
	TriggerInSourceFrontGPI5	Trigger In Source Front GPI 5
	TriggerInSourceFrontGPI6	Trigger In Source Front GPI 6
	TriggerInSourceFrontGPI7	Trigger In Source Front GPI 7
Default value	**GPITriggerSource2**	

Example 7.10. Usage of ShaftEncoderInputSource

```
/* Set */ ShaftEncoderInputSource = GPITriggerSource2;
/* Get */ value_ = ShaftEncoderInputSource;
```

7.4.4. ShaftEncoderLeading

This parameter defines the leading signal (= direction) of the shaft encoder filter. This induces rising/falling edge A before B equals forward direction and rising/falling edge B before A means reverse. The default setting is A as the leading signal. Flipping the input pins or their polarity will have the same effect as changing this to B as the leading signal. It simply defines the valid direction of the scan. An explanation of the direction detection based on an encoder A / B signal is found in Section 7.3, 'LineTriggerInput'.

Table 7.12. Parameter properties of ShaftEncoderLeading

Property	Value	
Name	**ShaftEncoderLeading**	
Display Name	**Shaft Encoder Leading**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**SourceA**	Source A
	SourceB	Source B
Default value	**SourceA**	

Example 7.11. Usage of ShaftEncoderLeading

```
/* Set */ ShaftEncoderLeading = SourceA;
```

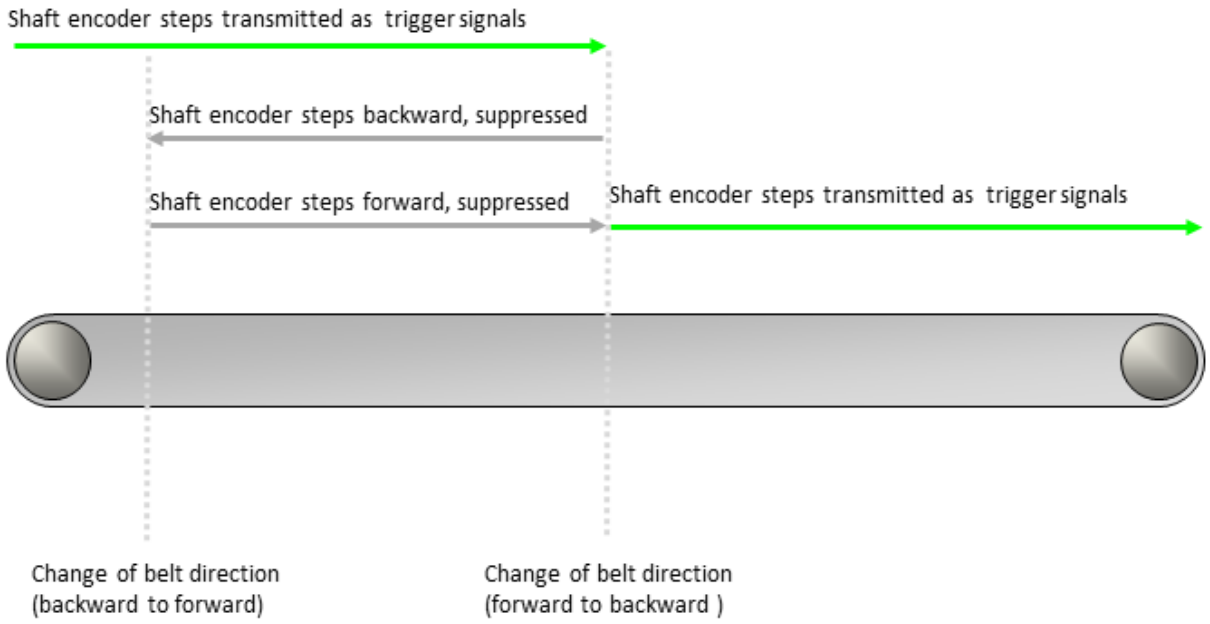
```
/* Get */ value_ = ShaftEncoderLeading;
```

7.4.5. ShaftEncoderCompensationEnable

The shaft encoder analyzer includes a rollback compensation. In case the rollback compensation is enabled, the module will compensate the reverse movement so that no object is scanned twice. The module will count the number of reverse pulses and will suppress all reverse and forward pulses until position of maximum progress is reached again. If switched to ON, in case of shaft encoder backward movement, the operator counts how many shaft encoder steps the shaft encoder moves backwards. When the shaft encoder moves forwards again, this number of shaft encoder steps (now forward direction) is not transmitted as external trigger signals. Only after the transportation belt is back to the place where the backward movement started, the shaft encoder steps (forward direction) are transmitted as external trigger signals again.

Parameter *ShaftEncoderCompensationEnable* switched ON:

Figure 7.5. Shaft Encoder Compensation Enable = ON



In case the rollback compensation is disabled, the shaft encoder analyzer will only suppress reverse pulses but use all forward pulses. If switched to OFF, the operator simply doesn't transmit any trigger signals as long as the transportation belt moves backwards. As soon as the transport belt starts to move forwards again, the operator transmits the shaft encoder steps (forward direction) as trigger signals.

Parameter *ShaftEncoderCompensationEnable* switched OFF:

Figure 7.6. Shaft Encoder Compensation Enable = OFF

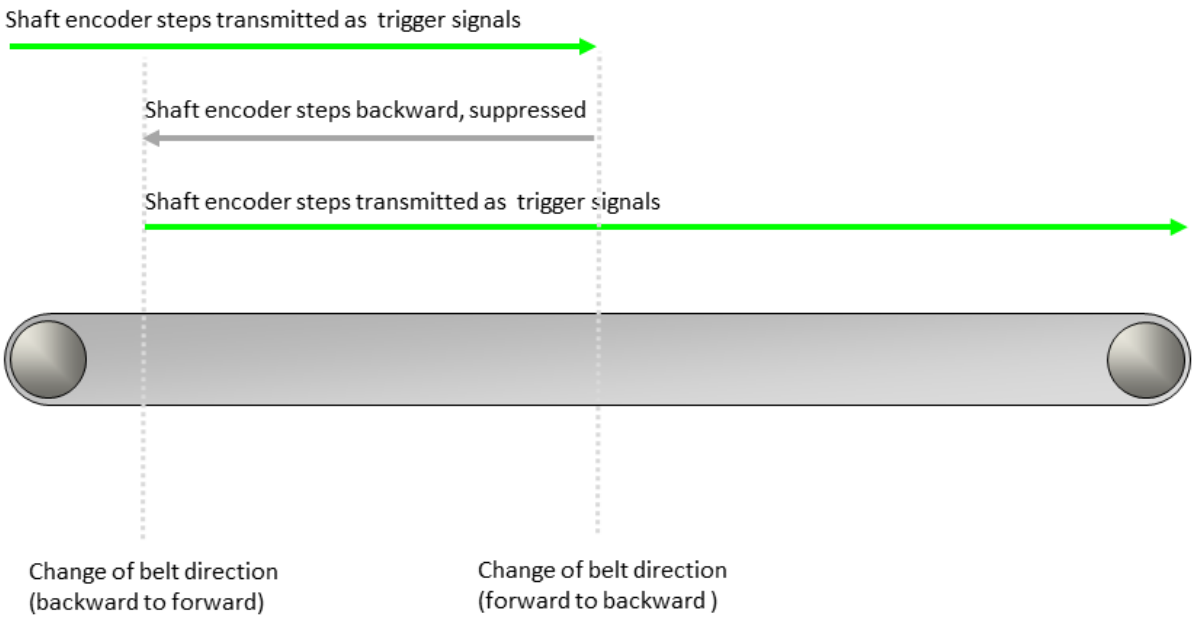


Table 7.13. Parameter properties of ShaftEncoderCompensationEnable

Property	Value
Name	**ShaftEncoderCompensationEnable**
Display Name	**Shaft Encoder Compensation Enable**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**On** On **Off** Off
Default value	**On**

Example 7.12. Usage of ShaftEncoderCompensationEnable

```
/* Set */ ShaftEncoderCompensationEnable = On;
/* Get */ value_ = ShaftEncoderCompensationEnable;
```

7.4.6. ShaftEncoderCompensationCount

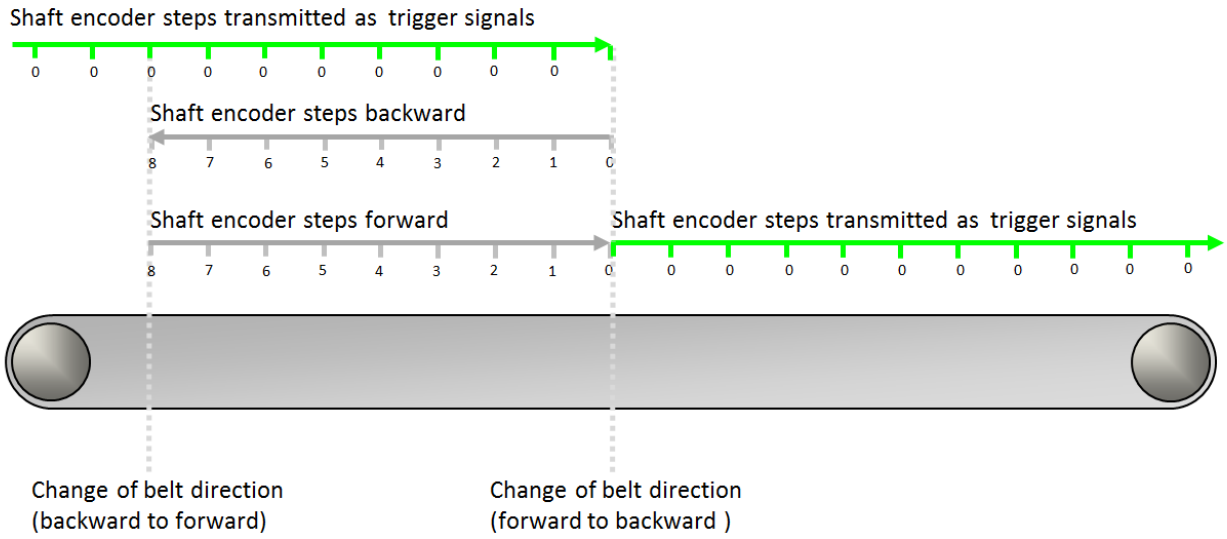
Using this parameter you can read and write the current shaft encoder rollback compensation counter. A compensation value zero indicates that currently no compensation is made. Therefore, you can reset the compensation by writing value zero to this parameter. Any other value will set a new compensation value. By knowing the distance / resolution for every encoder pulse, the compensation distance can be set. Concerning the shaft encoder find some more details in the introduction of Section 7.3, 'LineTriggerInput'.

It is based on a 20bit counter enabling a backward movement of up to 1048575 encoder pulses. An overflow of this value will not occur since it will skip all additional pulses for a compensation state of more than 1048575. By this the count of the rollback compensation is limited by 2 to the power of 20 pulses, what is enough for most applications in practice. As an example we could use a pretty high resolution of 20 pulses per mm, what is already sufficient for a maximum rollback distance of more than 50 meters.

Basic Conditions

If parameter *ShaftEncoderCompensationEnable* is set to ON, an internal counter counts the shaft encoder steps the transportation belt moves backwards. This is necessary to be able to compensate the exact number of shaft encoder steps when the transportation belt starts moving forwards again:

Figure 7.7. Shaft Encoder Compensation Enable = ON



The internal counter counts forwards as long as the transportation belt moves backwards. (In figure 7.7, from 0 to 8.)

The internal counter counts backwards while the transportation belt moves forwards. (In figure 7.7, from 8 to 0.)

When the internal counter holds the value 0, the shaft encoder steps are transmitted as trigger signals.

The value the internal counter holds at a given moment is the value of parameter *ShaftEncoderCompensationCount*. Only if this value is 0, encoder steps are transmitted as trigger signals. If the value of parameter *ShaftEncoderCompensationCount* is not 0, the shaft encoder steps are not transmitted as trigger signals and the value keeps changing with every encoder step until it reaches the value 0 again.

Reading the Parameter

The parameter *ShaftEncoderCompensationCount* is a read/write parameter. Therefore, at any given moment, you can always read out the value the counter holds at a given moment.

Defining an Offset

On the other hand, you can always modify the parameter value since you have write access during acquisition. If you need to define an offset to the standard encoder compensation, you can use this parameter to enter the number of steps you need the offset to be.

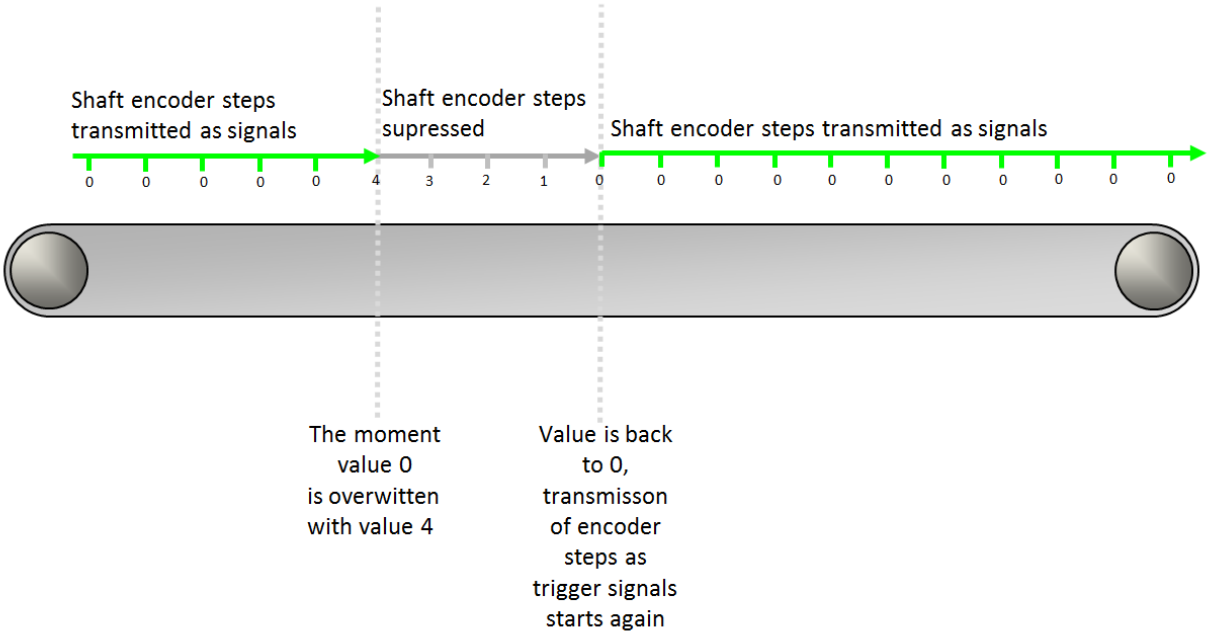
As soon as you enter a value for *ShaftEncoderCompensationCount*, this value overwrites the value the parameter holds before.

In the following let's look at some examples for overwriting the current value of *ShaftEncoderCompensationCount*:

Example 1:

The transportation belt is moving forward, the shaft encoder steps are transmitted as trigger signals, and the value of *ShaftEncoderCompensationCount* is 0. Then, the value 0 of *ShaftEncoderCompensationCount* is overwritten by value 4. Result: 4 shaft encoder steps are not transmitted as trigger signals.

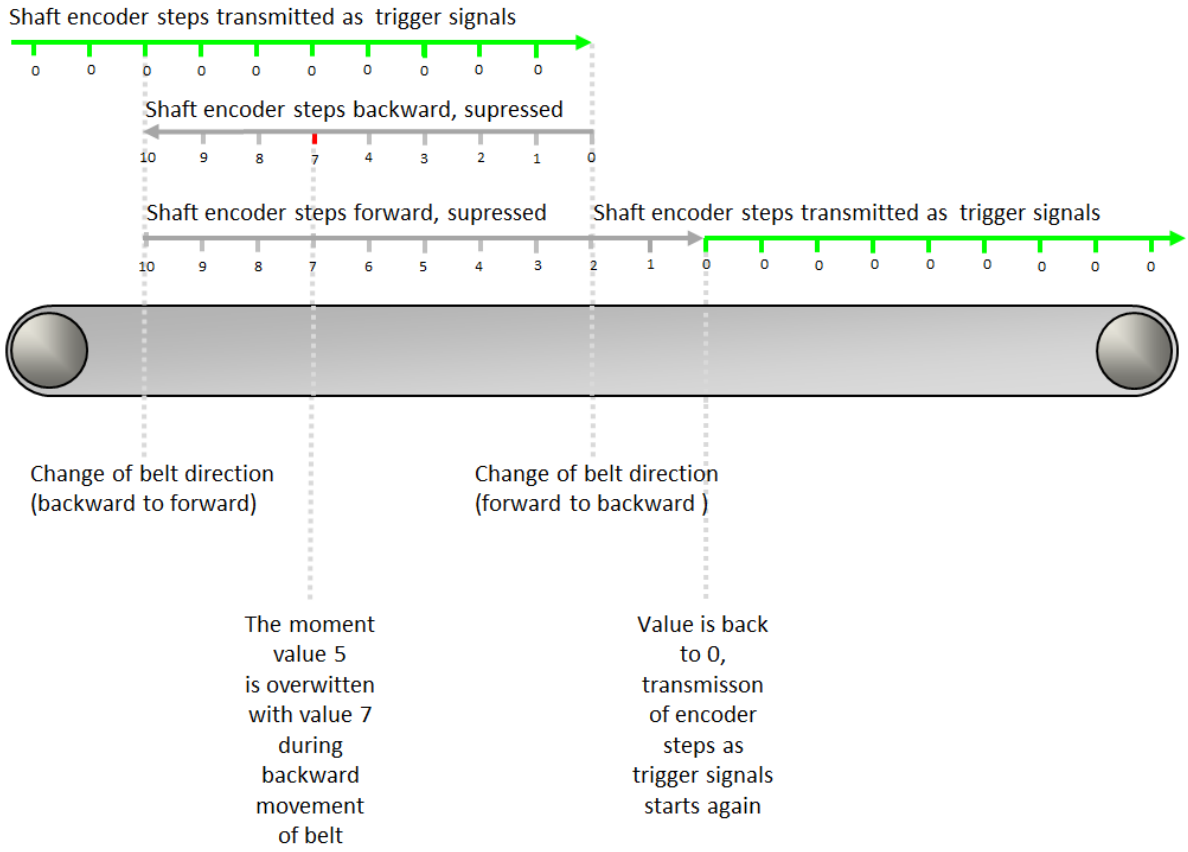
Figure 7.8. Shaft Encoder Compensation Count Example 1



Example 2:

The transportation belt is moving backward, the (backward) shaft encoder steps are suppressed, and the value of *ShaftEncoderCompensationCount* is not 0. Then, during backward movement of the transportation belt, the value 5 of *ShaftEncoderCompensationCount* is overwritten by value 7. Result: Offset of 2 shaft encoder steps.

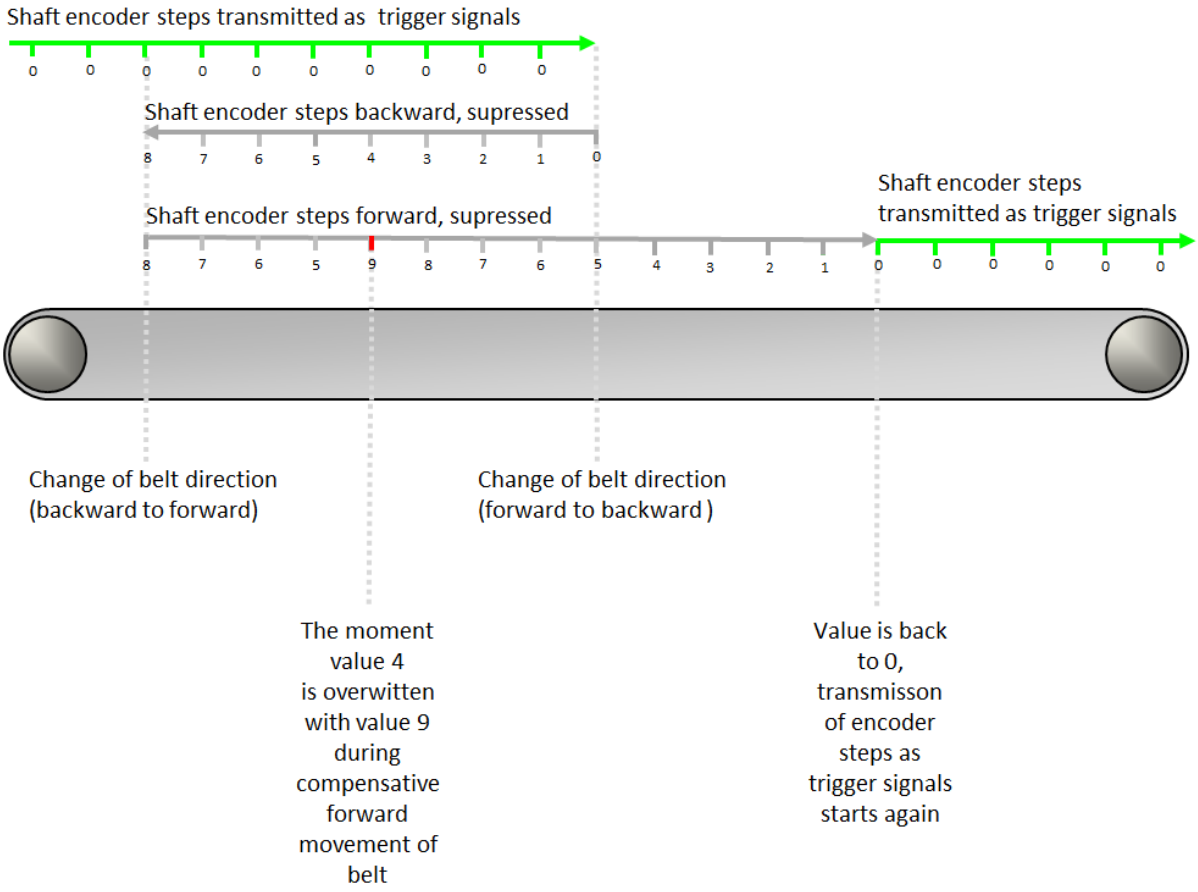
Figure 7.9. Shaft Encoder Compensation Count Example 2



Example 3:

The transportation belt is moving forward during compensation, the (forward) shaft encoder steps are suppressed, and the value of *ShaftEncoderCompensationCount* is not 0. Then, during compensative forward movement of the transportation belt, the value 4 of *ShaftEncoderCompensationCount* is overwritten with value 9. Result: Offset of 5 shaft encoder steps.

Figure 7.10. Shaft Encoder Compensation Count Example 3



Example 4:

The transportation belt is moving forward during compensation, the (forward) shaft encoder steps are suppressed, and the value of *ShaftEncoderCompensationCount* is not 0. Then, during compensative forward movement of the transportation belt, the value 4 of *ShaftEncoderCompensationCount* is overwritten with a smaller value, in our case with value 3. Result: Negative offset of -1 shaft encoder step.

Figure 7.11. Shaft Encoder Compensation Count Example 4

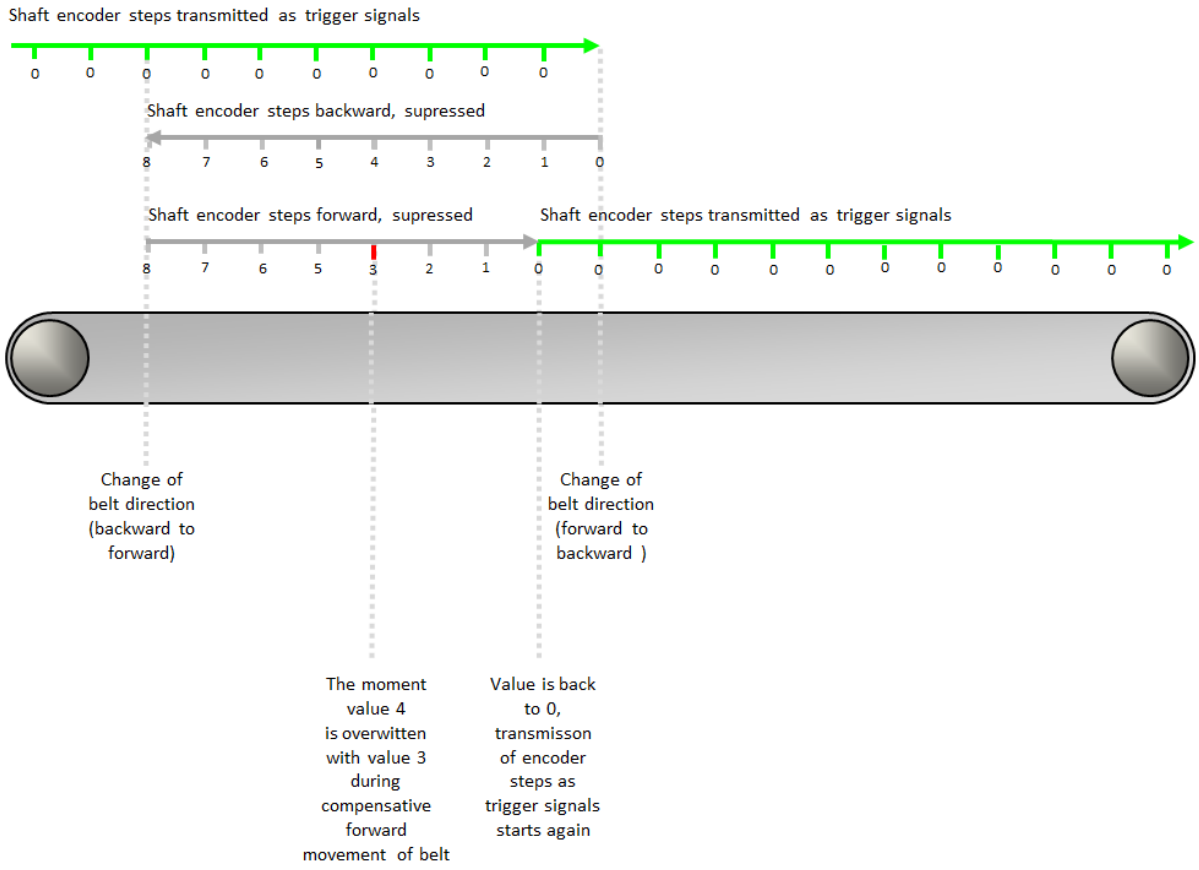


Table 7.14. Parameter properties of ShaftEncoderCompensationCount

Property	Value
Name	**ShaftEncoderCompensationCount**
Display Name	**Shaft Encoder Compensation Count**
Interface	**IInteger**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1048575** **Stepsize 1**
Default value	**0**
Unit of measure	**pulses**

Example 7.13. Usage of ShaftEncoderCompensationCount

```
/* Set */ ShaftEncoderCompensationCount = 0;
/* Get */ value_ = ShaftEncoderCompensationCount;
```

7.5. ExSyncOutput

This category includes parameters to specify and parameterize the generated ExSync output signals.

7.5.1. LinePeriod

This parameter specifies the period of the ExSync signal. Therefore, it defines the line frequency when using the grabber controlled mode to trigger the connected camera. This period is of interest if a grabber controlled line trigger mode is used; more details for this can be found at *LineTriggerMode*. The line period is not allowed to be shorter than the minimum period - maximum line frequency - being supported by the camera, or in other words:

Please do not try to trigger the camera at a higher frequency than possible.

This maximum frequency is limited by the exposure time and the line scan sensor maximum speed. Please consider the camera manual for more details.

The following equations are mentioned in order to support the setup process if no period for *LinePeriod* is mentioned:

- **Frequency**

  The period **T** is the duration of time of one cycle in a repeating event, so the period is the reciprocal of the frequency **f**.

  Equation 7.1. Frequency to Period

$$T = \frac{1}{f}$$

  Equation 7.2. Example: 17.6 kHz to Period

$$\begin{aligned} T &= \frac{1}{F} = \frac{1}{17.6kHz} = \frac{1}{17600Hz} \\ T &= 0.0000568s = 0.0568ms = 56.8\mu s \end{aligned}$$

- **Velocity and Pixel / mm**

  The period **T** is the duration of time of one cycle in a repeating event. At a velocity **v** and a given number **n** of pixels / mm together with the number **n** of pixels / mm being based on the resolution count **r** of the line scan sensor pixels and the width of view **w** in mm the following equations are valid.

  Equation 7.3. Velocity and Resolution to Period

$$\begin{aligned} n &= \frac{r}{w} \\ v &= \frac{distance}{time} \\ f &= v * n \\ T &= \frac{1}{f} \end{aligned}$$

  Equation 7.4. Example: v = 53.4 m/min, r = 4096 pixels, w = 19.2 cm Wide Web to Period

$$\begin{aligned} n &= \frac{r}{w} = \frac{4096}{19.2cm} = \frac{4096}{192mm} = \frac{21.33}{mm} \\ v &= \frac{distance}{time} = \frac{53.4m}{min} = \frac{53.4m}{60s} = 0.89\frac{m}{s} \\ f &= v * n = 0.89\frac{m}{s} * \frac{21.33}{mm} = 890\frac{mm}{s} * \frac{21.33}{mm} \\ &= \frac{890 * 21.33}{s} = \frac{18983.7}{s} = 18983.7Hz = 18.9837kHz \\ T &= \frac{1}{f} \\ &= \frac{1}{18983.7Hz} = 52.68\mu s \end{aligned}$$

Table 7.15. Parameter properties of LinePeriod

Property	Value
Name	**LinePeriod**
Display Name	**Line Period**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.16** **Maximum 655.3575** **Stepsize 0.0025**
Default value	**200.0**
Unit of measure	**µs**

Example 7.14. Usage of LinePeriod

```
/* Set */ LinePeriod = 200.0;
/* Get */ value_ = LinePeriod;
```

7.5.2. LineExposure

This parameter specifies the pulse width of the ExSync signal, which can be used by many cameras to specify the exposure time. It is possible to adjust the exposure time via software, even while grabbing. The value is set in microseconds and may not exceed the period time of the ExSync *LinePeriod*. In order to check the polarity simply increase this value and the resulting frame should become brighter. If this behaves in an opposite way check the polarity using *ExSyncPolarity*.

Table 7.16. Parameter properties of LineExposure

Property	Value
Name	**LineExposure**
Display Name	**Line Exposure**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.16** **Maximum 327.6775** **Stepsize 0.0025**
Default value	**19.0**
Unit of measure	**µs**

Example 7.15. Usage of LineExposure

```
/* Set */ LineExposure = 19.0;
/* Get */ value_ = LineExposure;
```

7.5.3. ExSyncPolarity

The parameter adjusts the polarity of the ExSync signal generator. Use Low Active, if the camera opens the shutter on a falling edge, otherwise use High Active. For the mapping of the ExSync signals to the digital outputs check Chapter 6, '*DigitalIO*'.

Table 7.17. Parameter properties of ExSyncPolarity

Property	Value
Name	**ExSyncPolarity**
Display Name	**Ex Sync Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 7.16. Usage of ExSyncPolarity

```
/* Set */ ExSyncPolarity = HighActive;
/* Get */ value_ = ExSyncPolarity;
```

7.5.4. LineTriggerDelay

This parameter specifies the delay between the generated ExSync and ExSync2 signals with respect to an external trigger input. Therefore, the ExSync2 signal is a delayed clone of the ExSync (polarity, period, etc. are the same as for ExSync). For the mapping of the ExSync signals to the digital outputs check Chapter 6, '*DigitalIO*'.

Please note that the line trigger delay needs to be less than the line trigger period. You might need to increase the line period first before increasing the line delay. This constraint also applies for external line trigger modes.

Table 7.18. Parameter properties of LineTriggerDelay

Property	Value
Name	**LineTriggerDelay**
Display Name	**Line Trigger Delay**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum** **0.0** **Maximum** **327.6775** **Stepsize** **0.0025**
Default value	**0.0**
Unit of measure	**µs**

Example 7.17. Usage of LineTriggerDelay

```
/* Set */ LineTriggerDelay = 0.0;
/* Get */ value_ = LineTriggerDelay;
```

Chapter 8. ImageTriggerFlash

The image trigger for line-scan cameras is in charge to generate an internal signal called image gate. Lines sent by the camera are only accepted if this image gate is active = open. Therefore, with help of the Image Gate it is possible to define frames by grouping all lines that belong to the same image gate into one frame.

This AcquisitionApplets supports three distinct operation modes of the image trigger:

- Free run

  In free run mode the image gate basically remains active all time. Therefore, all lines sent by the camera are grabbed. Moreover, it cuts the input lines into frames of the height specified by parameter *Height* of the display module. Also, offsets defined by *OffsetY* are covered and removed from the camera transfers for each image.

- Async Trigger

  For the external trigger mode of the image trigger, the image gate is inactive = closed until an external trigger signal activates the image gate for *Height* + *OffsetY* lines. Therefore, for each external trigger event, the frame grabber records a frame of the specified height.

- Async Trigger Multi Buffer

  For the external trigger mode of the image trigger, the image gate is inactive = closed until an external trigger signal activates the image gate. In contrast to the **AsyncExternalTrigger** mode, the gate is open for *ImageTriggerAsyncHeight* lines while this image is split into smaller chunks of *Height* lines. Therefore, for each external trigger event, the frame grabber records a frame of a large specified height and split the large image into smaller chunks. The purpose of the mode is to start processing in PC while the image is still recorded.

  The parameter value of *OffsetY* is without influence in this mode.

- Gated, Trigger

  For the external gated mode of the image trigger, the image gate is active as long as the external trigger source is active, but is becoming inactive when *Height* + *OffsetY* lines have been grabbed. Therefore, during an external trigger phase the frame grabber records a frame with a height depending on the duration of active time of the external trigger signal, but is not exceeding an image height of *Height* + *OffsetY* lines.

- Gated Multi Buffer, Triggered

  Equal to the 'Gated Trigger' mode, for the 'Gated Multi Buffer Trigger' the image gate is active as long as the external trigger source is active. In contrast, it does not limit the height to *Height* lines. It will cut the image after *Height* lines and start a new frame. Thus, for each gate, multiple frames are generated when a gate is active for more lines than defined by *Height*.

  All images of a generated sequence will have a height of *Height* lines. However, the last image of each sequence might have a lower number of lines in the image.

  To detect the last image of a sequence in your software. Parameter **FG_IMAGE_TAG** can be used. This parameter is of type unsigned 32 bit integer. The most significant bit i.e. bit 31 includes a flag which is set to one if the respective image is the last image of a multi buffer sequence.

```
uint32_t imageTag = 0;
int returnCode = Fg_getParameterEx(fg, FG_IMAGE_TAG, &imageTag, 0, pmem0, imageNumber);
bool isLastImageOfSequence = imageTagRAW >> 31;
```

  All other bits of parameter **FG_IMAGE_TAG** are fixed to value 0. The image tag parameter does not output the image number as available for older AcquisitionApplets.

Note that the value of parameter *OffsetY* is not considered if the 'Gated Multi Buffer Trigger' mode is used. An y-offset cannot be set in the applet.

8.1. ImageTriggerMode

Choose one of the image trigger modes described above. Please make sure that the operation mode of frame grabber and camera is the same.

Table 8.1. Parameter properties of ImageTriggerMode

Property	Value	
Name	**ImageTriggerMode**	
Display Name	**Image Trigger Mode**	
Interface	**IEnumeration**	
Access policy	**Read/Write**	
Visibility	**Beginner**	
Allowed values	**freeRun**	Free Run
	AsyncExternalTrigger	Async External Trigger
	AsyncExternalTriggerMultiframe	Async External Trigger Multiframe
	AsyncGatedTrigger	Async Gated Trigger
	AsyncGatedTriggerMultiframe	Async Gated Trigger Multiframe
Default value	**freeRun**	

Example 8.1. Usage of ImageTriggerMode

```
/* Set */ ImageTriggerMode = freeRun;
/* Get */ value_ = ImageTriggerMode;
```

8.2. ImageTriggerOn

The generation of image triggers can be switched on or off by use of this parameter. When the image trigger is disabled and the image trigger is not running in free-run mode, the image acquisition is terminated. If the image trigger is enabled, the acquisition will start immediately.

Table 8.2. Parameter properties of ImageTriggerOn

Property	Value	
Name	**ImageTriggerOn**	
Display Name	**Image Trigger On**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**On**	On
	Off	Off
Default value	**On**	

Example 8.2. Usage of ImageTriggerOn

```
/* Set */ ImageTriggerOn = On;
/* Get */ value_ = ImageTriggerOn;
```

8.3. FlashOn

To enable the flash output use this parameter.

For the mapping of the flash signal to the digital IO check Chapter 6, '*DigitalIO*'.

Table 8.3. Parameter properties of FlashOn

Property	Value
Name	**FlashOn**
Display Name	**Flash On**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**On** On **Off** Off
Default value	**On**

Example 8.3. Usage of FlashOn

```
/* Set */ FlashOn = On;
/* Get */ value_ = FlashOn;
```

8.4. ImageTriggerAsyncHeight

This parameter only has influence in the image trigger mode *ImageTriggerMode* Async Trigger Multi Frame **AsyncExternalTriggerMultiframe**. The value is used to define the image height of the frame after the trigger pulse. Whereas parameter *Height* defines the chunk height.

If the value of *ImageTriggerAsyncHeight* is less than *Height*, the frame is not split into multiple frames an will result in a smaller output frame.

Table 8.4. Parameter properties of ImageTriggerAsyncHeight

Property	Value
Name	**ImageTriggerAsyncHeight**
Display Name	**Image Trigger Async Height**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum** 1 **Maximum** 16777216 **Stepsize** 1
Default value	**1024**
Unit of measure	**lines**

Example 8.4. Usage of ImageTriggerAsyncHeight

```
/* Set */ ImageTriggerAsyncHeight = 1024;
/* Get */ value_ = ImageTriggerAsyncHeight;
```

8.5. ImageTriggerIsBusy

The image trigger is busy if the current requested frame from the camera has not been completely transferred to the grabber. This parameter can be used to check if the camera can accept a new software trigger pulse.

Table 8.5. Parameter properties of ImageTriggerIsBusy

Property	Value	
Name	**ImageTriggerIsBusy**	
Display Name	**Image Trigger is Busy**	
Interface	**IEnumeration**	
Access policy	**Read-Only**	
Visibility	**Beginner**	
Allowed values	**Busy** **NotBusy**	Busy Not Busy

Example 8.5. Usage of ImageTriggerIsBusy

```
/* Get */ value_ = ImageTriggerIsBusy;
```

8.6. ImageTriggerInput

This category includes parameters to specify and control the image trigger inputs. The input can either be input pins of the frame grabber's trigger connector or trigger pulses generated by software register accesses.

8.6.1. ImageTriggerInputSource

This parameter specifies the signal source, which is used to trigger the image acquisition gate. If a software image trigger has to be used select option **SoftwareTrigger**.

Table 8.6. Parameter properties of ImageTriggerInputSource

Property	Value	
Name	**ImageTriggerInputSource**	
Display Name	**Image Trigger Input Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GPITriggerSource0** **GPITriggerSource1** **GPITriggerSource2** **GPITriggerSource3** **GPITriggerSource4** **GPITriggerSource5** **GPITriggerSource6** **GPITriggerSource7** **TriggerInSourceFrontGPI0** **TriggerInSourceFrontGPI1** **TriggerInSourceFrontGPI2** **TriggerInSourceFrontGPI3** **TriggerInSourceFrontGPI4** **TriggerInSourceFrontGPI5** **TriggerInSourceFrontGPI6** **TriggerInSourceFrontGPI7** **SoftwareTrigger**	GPI Trigger Source 0 GPI Trigger Source 1 GPI Trigger Source 2 GPI Trigger Source 3 GPI Trigger Source 4 GPI Trigger Source 5 GPI Trigger Source 6 GPI Trigger Source 7 Trigger In Source Front GPI 0 Trigger In Source Front GPI 1 Trigger In Source Front GPI 2 Trigger In Source Front GPI 3 Trigger In Source Front GPI 4 Trigger In Source Front GPI 5 Trigger In Source Front GPI 6 Trigger In Source Front GPI 7 Software Trigger
Default value	**GPITriggerSource0**	

Example 8.6. Usage of ImageTriggerInputSource

```
/* Set */ ImageTriggerInputSource = GPITriggerSource0;
/* Get */ value_ = ImageTriggerInputSource;
```

8.6.2. ImageTriggerInputPolarity

The parameter defines the polarity of the external input trigger signal.

Table 8.7. Parameter properties of ImageTriggerInputPolarity

Property	Value
Name	**ImageTriggerInputPolarity**
Display Name	**Image Trigger Input Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 8.7. Usage of ImageTriggerInputPolarity

```
/* Set */ ImageTriggerInputPolarity = HighActive;
/* Get */ value_ = ImageTriggerInputPolarity;
```

8.6.3. ImageTriggerGateDelay

With this parameter, a delay of lines can be configured before the activation of the image gate. This delays the start of the image acquisition. The parameter y-offest (as in free run mode) rejects the first lines from the camera. Delay and y-offset seem to have the same effect, however the difference is, that y-offset doesn't affect the image gate, which is relevant while using the gated line trigger mode.

Table 8.8. Parameter properties of ImageTriggerGateDelay

Property	Value
Name	**ImageTriggerGateDelay**
Display Name	**Image Trigger Gate Delay**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum** 0 **Maximum** 65535 **Stepsize** 1
Default value	**0**
Unit of measure	**lines**

Example 8.8. Usage of ImageTriggerGateDelay

```
/* Set */ ImageTriggerGateDelay = 0;
/* Get */ value_ = ImageTriggerGateDelay;
```

8.6.4. ImageTriggerDebouncing

This parameter specifies the debouncing time. This is the time for which the input image trigger signal must keep the same value to be detected as such. Fast signal changes within the debounce time will be filtered out.

Table 8.9. Parameter properties of ImageTriggerDebouncing

Property	Value
Name	**ImageTriggerDebouncing**
Display Name	**Image Trigger Debouncing**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 20.3125** **Stepsize 0.0025**
Default value	**0.112**
Unit of measure	**µs**

Example 8.9. Usage of ImageTriggerDebouncing

```
/* Set */ ImageTriggerDebouncing = 0.112;
/* Get */ value_ = ImageTriggerDebouncing;
```

8.6.5. StrobePulseDelay

This parameter specifies the delay of the generated flash signal with respect to an external trigger input. Therefore, it is possible to synchronize the flash to the external trigger input. The delay is set in image line ticks.

Table 8.10. Parameter properties of StrobePulseDelay

Property	Value
Name	**StrobePulseDelay**
Display Name	**Strobe Pulse Delay**
Interface	**IInteger**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 65535** **Stepsize 1**
Default value	**0**
Unit of measure	**lines**

Example 8.10. Usage of StrobePulseDelay

```
/* Set */ StrobePulseDelay = 0;
/* Get */ value_ = StrobePulseDelay;
```

8.6.6. Flash

8.6.6.1. FlashPolarity

The polarity of the generated flash signal can be changed with this parameter. For the mapping of the flash signal to the digital outputs check Chapter 6, '*DigitalIO*'.

Table 8.11. Parameter properties of FlashPolarity

Property	Value
Name	**FlashPolarity**
Display Name	**Flash Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 8.11. Usage of FlashPolarity

```
/* Set */ FlashPolarity = HighActive;
/* Get */ value_ = FlashPolarity;
```

8.6.7. SoftwareTrigger

For the image trigger it is possible to use a software generated trigger signal to replace the external trigger input.

The software trigger control modules allows the to either generate a software trigger pulse or allows to set the state of the software trigger signal to generate a gate i.e. for gated image trigger mode.

To enable the software trigger set parameter *ImageTriggerInputSource* to software trigger.

8.6.7.1. SendSoftwareTrigger

A software trigger pulse can be sent by use of this parameter. Ensure to enable the software trigger by *ImageTriggerInputSource*.

Table 8.12. Parameter properties of SendSoftwareTrigger

Property	Value
Name	**SendSoftwareTrigger**
Display Name	**Send Software Trigger**
Interface	**ICommand**
Access policy	**Write/Change**
Visibility	**Beginner**

Example 8.12. Usage of SendSoftwareTrigger

```
/* Set */ SendSoftwareTrigger();
```

8.6.7.2. SetSoftwareTrigger

The software trigger state can be set to zero = inactive = low or one = active = high. Ensure to enable the software trigger by *ImageTriggerInputSource*.

Table 8.13. Parameter properties of SetSoftwareTrigger

Property	Value
Name	**SetSoftwareTrigger**
Display Name	**Set Software Trigger**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	

Example 8.13. Usage of SetSoftwareTrigger

```
/* Set */ SetSoftwareTrigger = ;
/* Get */ value_ = SetSoftwareTrigger;
```

Chapter 9. SignalAnalyzer

The signal analyzer module computes some information on a signal source. These are

- Pulse Count
- Period (current, min, max)
- Difference between two pulse counters

The module is used to detect unexpected behaviors of the trigger system. For example a bouncing encode signal resulting in overtriggering of the camera. Another example is the detection of trigger lost signals or corrupted camera data which can result in extra lines.

Simply select the analyzer source signal and polarity. The measurement values can be obtained using read-only parameters. All measurements can be cleared synchronously.

Note that the module is available only once for the applet. All cameras share the same module. The camera/DMA index in the setParameter and getParameter functions has no influence.

9.1. SignalAnalyzer0Source et al.

Note

This description applies also to the following parameters: SignalAnalyzer1Source

Select the source signal for the trigger analyzer. For further explanation of the available sources see Chapter 6, '*DigitalIO*'. In addition, the line/frame start/end pulses can be used as signal sources, too.

Table 9.1. Parameter properties of SignalAnalyzer0Source

Property	Value	
Name	**SignalAnalyzer0Source**	
Display Name	**Signal Analyzer 0 Source**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**GND**	GND
	VCC	VCC
	SignalExsync	Signal Exsync
	SignalExsync2	Signal Exsync2
	SignalFlash	Signal Flash
	SignalLineValid	Signal Line Valid
	SignalFrameValid	Signal Frame Valid
	SignalLineStart	Signal Line Start
	SignalLineEnd	Signal Line End
	SignalFrameStart	Signal Frame Start
	SignalFrameEnd	Signal Frame End
	SignalGPI0	Signal GPI 0
	SignalGPI1	Signal GPI 1
	SignalGPI2	Signal GPI 2
	SignalGPI3	Signal GPI 3
	SignalGPI4	Signal GPI 4
	SignalGPI5	Signal GPI 5
	SignalGPI6	Signal GPI 6
	SignalGPI7	Signal GPI 7
	SignalFrontGPI0	Signal Front GPI 0
	SignalFrontGPI1	Signal Front GPI 1
	SignalFrontGPI2	Signal Front GPI 2
	SignalFrontGPI3	Signal Front GPI 3
	SignalFrontGPI4	Signal Front GPI 4
	SignalFrontGPI5	Signal Front GPI 5
	SignalFrontGPI6	Signal Front GPI 6
	SignalFrontGPI7	Signal Front GPI 7
Default value	**SignalExsync**	

Example 9.1. Usage of SignalAnalyzer0Source

```
/* Set */ SignalAnalyzer0Source = SignalExsync;
/* Get */ value_ = SignalAnalyzer0Source;
```

9.2. SignalAnalyzer0Polarity et al.

Note

This description applies also to the following parameters: SignalAnalyzer1Polarity

Select the polarity for the signal analyzer of the selected source. With this parameter you can invert the signal. The signal analyzer module will only measure on rising edges.

Table 9.2. Parameter properties of SignalAnalyzer0Polarity

Property	Value
Name	**SignalAnalyzer0Polarity**
Display Name	**Signal Analyzer 0 Polarity**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LowActive** Low Active **HighActive** High Active
Default value	**HighActive**

Example 9.2. Usage of SignalAnalyzer0Polarity

```
/* Set */ SignalAnalyzer0Polarity = HighActive;
/* Get */ value_ = SignalAnalyzer0Polarity;
```

9.3. SignalAnalyzer0CurrentPeriod et al.

Note

This description applies also to the following parameters: SignalAnalyzer1CurrentPeriod

This read-only parameter returns the last measured period of the selected signal source. Keep in mind that the module requires two rising edges to obtain a measurement result. Selecting a new source or changing the acquisition states can result in very long periods.

Table 9.3. Parameter properties of SignalAnalyzer0CurrentPeriod

Property	Value
Name	**SignalAnalyzer0CurrentPeriod**
Display Name	**Signal Analyzer 0 Current Period**
Interface	**IFloat**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum** 0.0 **Maximum** 1.07374182375E7 **Stepsize** 0.0025
Unit of measure	**ns**

Example 9.3. Usage of SignalAnalyzer0CurrentPeriod

```
/* Get */ value_ = SignalAnalyzer0CurrentPeriod;
```

9.4. SignalAnalyzer0MaxPeriod et al.

Note

This description applies also to the following parameters: SignalAnalyzer1MaxPeriod

This read-only parameter returns the maximum measured period after the last reset. Keep in mind that selecting a new source or changing the acquisition states can result in very long periods.

Table 9.4. Parameter properties of SignalAnalyzer0MaxPeriod

Property	Value
Name	**SignalAnalyzer0MaxPeriod**
Display Name	**Signal Analyzer 0 Max Period**
Interface	**IFloat**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0.0** **Maximum 1.07374182375E7** **Stepsize 0.0025**
Unit of measure	**ns**

Example 9.4. Usage of SignalAnalyzer0MaxPeriod

```
/* Get */ value_ = SignalAnalyzer0MaxPeriod;
```

9.5. SignalAnalyzer0MinPeriod et al.

Note

This description applies also to the following parameters: SignalAnalyzer1MinPeriod

This read-only parameter returns the minimum measured period after the last reset.

Table 9.5. Parameter properties of SignalAnalyzer0MinPeriod

Property	Value
Name	**SignalAnalyzer0MinPeriod**
Display Name	**Signal Analyzer 0 Min Period**
Interface	**IFloat**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0.0025** **Maximum 1.07374182375E7** **Stepsize 0.0025**
Unit of measure	**ns**

Example 9.5. Usage of SignalAnalyzer0MinPeriod

```
/* Get */ value_ = SignalAnalyzer0MinPeriod;
```

9.6. SignalAnalyzer0PulseCount et al.

Note

This description applies also to the following parameters: SignalAnalyzer1PulseCount

Returns the counter value of the selected source. For each rising edge the counter is increased. This, after the first pulse, the counter value will be one. On counter overflow, it will start from 0 again.

Table 9.6. Parameter properties of SignalAnalyzer0PulseCount

Property	Value
Name	**SignalAnalyzer0PulseCount**
Display Name	**Signal Analyzer 0 Pulse Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 4294967295** **Stepsize 1**
Unit of measure	**pulses**

Example 9.6. Usage of SignalAnalyzer0PulseCount

```
/* Get */ value_ = SignalAnalyzer0PulseCount;
```

9.7. SignalAnalyzerPulseCountDifference

Use this read only parameter to check the difference of the signal analyzer 0 and 1 pulse counter values (Analyzer 0 - Analyzer 1 value). This can be used to check for trigger lost signals if analyzer 0 will count the exsyc pulses and analyzer 1 the returned camera lines. In this case the difference is between 0 and 1 for single line cameras with no extra delay. If the difference exceeds 1, the camera did not return a line for all trigger pulses i.e. a trigger is lost or ignored due to overtriggering. If the difference is less than 0 an additional camera line was generated and received by the frame grabber. The reason for this can be a noisy trigger cable which added extra spikes or a corrupted data transfer which split the data into several parts.

Table 9.7. Parameter properties of SignalAnalyzerPulseCountDifference

Property	Value
Name	**SignalAnalyzerPulseCountDifference**
Display Name	**Signal Analyzer Pulse Count Difference**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum -4294967296** **Maximum 4294967295** **Stepsize 1**
Unit of measure	**pulses**

Example 9.7. Usage of SignalAnalyzerPulseCountDifference

```
/* Get */ value_ = SignalAnalyzerPulseCountDifference;
```

9.8. SignalAnalyzerClear

To clear all signal analyzer measurement results and counters use this parameter. All counters will be reset synchronously and are ready to restart immediately.

Table 9.8. Parameter properties of SignalAnalyzerClear

Property	Value
Name	**SignalAnalyzerClear**
Display Name	**Signal Analyzer Clear**
Interface	**ICommand**
Access policy	**Write/Change**
Visibility	**Beginner**

Example 9.8. Usage of SignalAnalyzerClear

```
/* Set */ SignalAnalyzerClear();
```

Chapter 10. BufferStatus

The applet processes image data as fast as possible. Any image data sent by the camera is immediately processed and sent to the PC. The latency is minimal. In general, only one concurrent image line is stored and processed in the frame grabber. However, the transfer bandwidth to the PC via DMA channel can vary caused by interrupts, other hardware and the current CPU load. Furthermore, if operated in **selective mode**, it is possible to queue buffer slower than the camera offers new images and therefore generate an overflow condition on the frame grabber. Also, the camera frame rate can vary due to an fluctuating trigger. For these cases, the applet is equipped with a memory to buffer the input frames. The fill level of the buffer can be obtained by reading from parameter *FillLevel*.

In normal operation conditions the buffer will always remain almost empty. For fluctuating camera bandwidths or for short and fast acquisitions, the buffer can easily fill up quickly. Of course, the input bandwidth must not exceed the maximum bandwidth of the applet. Check Section 1.2, 'Bandwidth' for more information.

If the buffer's fill level reaches 100%, the applet is in overflow condition, as no more data can be buffered and camera data will be discarded. This can result in two different behaviors:

- Corrupted Frames:

  The transfer of a current frame is interrupted by an overflow. This means, the first pixels or lines of the frame were transfered into the buffer, but not the full frame. The output of the applet i.e. the DMA transfer will be shorter. The output image will not have it's full height. These images will be marked incomplete. Check the Basler GenTL documentation to learn on how to identify incompleted buffers (https://www.baslerweb.com/en/sales-support/downloads/document-downloads/cxp-gentl-producer-feature-documentation/).

- Lost Frames:

  A full camera frame was discarded due to a full buffer memory. No DMA transfer will exist for the discarded frame. This means the number of applet output images can differ from the number of applet input images.

The buffer overflow threshold *OverflowOnThreshold* and *OverflowSyncOnThreshold* default ensures that under normal conditions frames can be completed or will be fully dropped so that corrupted frames are avoide

A way to detect the overflows is to read parameter *Overflow* or check for event *Overflow*. Reading from the parameter will provide information about an overflow condition. As soon as the parameter is read, it will reset. Using the parameter an overflow condition can be detect, but it is not possible to obtain the exact image number and the moment. For this, the overflow event can be used.

10.1. FillLevel

The fill-level of the frame grabber buffers used in this applet can be read-out by use of this parameter. The value allows to check if the mean input bandwidth of the camera is to high to be processed with the applet.

Table 10.1. Parameter properties of FillLevel

Property	Value
Name	**FillLevel**
Display Name	**Fill Level**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 100** **Stepsize 1**
Unit of measure	**%**

Example 10.1. Usage of FillLevel

```
/* Get */ value_ = FillLevel;
```

10.2. Overflow

If the applet runs into overflow, a value "1" can be read by the use of this parameter. Note that an overflow results in loss of images. To avoid overflows reduce the mean input bandwidth.

The parameter is reset at each readout cycle. The program microDisplayX will continuously poll the value, thus the occurrence of an overflow might not be visible in microDisplayX.

A more effective and robust way is to detect overflows is the use of the event system.

Table 10.2. Parameter properties of Overflow

Property	Value
Name	**Overflow**
Display Name	**Buffer overflow**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 10.2. Usage of Overflow

```
/* Get */ value_ = Overflow;
```

10.3. OverflowOffThreshold

The Overflow state will be deactivated once the buffer Fillevel (*FillLevel*) will fall below this value. As long as the applet remains in overflow state all images arriving will be discarded. This will result in Overflow events with a set "lost" flag.

Table 10.3. Parameter properties of OverflowOffThreshold

Property	Value
Name	**OverflowOffThreshold**
Display Name	**Overflow Off Threshold**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0** **Maximum 100.0** **Stepsize 0.5**
Default value	**50.0**

Example 10.3. Usage of OverflowOffThreshold

```
/* Set */ OverflowOffThreshold = 50.0;
/* Get */ value_ = OverflowOffThreshold;
```

10.4. OverflowOnThreshold

The applet will enter Overflow state once the buffer Fillevel exceeds this filllevel (*FillLevel*). If the overflow state is active images will be stopped imidiately. This may lead to an incomplete frame. Incomplete frames are marked incomplete in the image Tag and an overflow event can be generated.

Table 10.4. Parameter properties of OverflowOnThreshold

Property	Value
Name	**OverflowOnThreshold**
Display Name	**Overflow On Threshold**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0** **Maximum 100.0** **Stepsize 0.5**
Default value	**99.5**

Example 10.4. Usage of OverflowOnThreshold

```
/* Set */ OverflowOnThreshold = 99.5;
/* Get */ value_ = OverflowOnThreshold;
```

10.5. OverflowSyncOnThreshold

The applet will enter Overflow state once the buffer fillevel (*FillLevel*) exceeds this filllevel and the currently arriving frame is stored to the buffer. If the applet remains in overflow state frames might be droped. If the buffer falls below this fillevel frames are accepted again. There is no hysteresis for this threshold.

Table 10.5. Parameter properties of OverflowSyncOnThreshold

Property	Value
Name	**OverflowSyncOnThreshold**
Display Name	**Overflow Sync On Threshold**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0.0** **Maximum 100.0** **Stepsize 0.5**
Default value	**80.0**

Example 10.5. Usage of OverflowSyncOnThreshold

```
/* Set */ OverflowSyncOnThreshold = 80.0;
/* Get */ value_ = OverflowSyncOnThreshold;
```

10.6. OverflowEventSelect

The *Overflow* Event. Allows to generate events if one of the following conditions is meet.

Table 10.6. Event select for *Overflow*

Value	Description
Incomplete	Each incomplete frame will generate an Event containing the information that the frame is incomplete and the frameID
Lost	Each lost frame will generate an Event containing the information that the frame is lost and the frameID
IncompleteLost	Each lost or incomplete frame will generate an Event containing the information that the frame is lost/ incomplete and the frameID
OK	Each correct frame will generate an Event containing the information that the frame is transfered correct and the frameID of the frame
IncompleteOK	Each incomplete or correct frame will generate an Event containing the information that the frame is correct or incomplete and the frameID
LostOK	Each lost or correct frame will generate an Event containing the information that the frame is correct or lost and the frameID
All	Each frame will generate an Event containing the status(lost, incomplete or correct) of the frame and the frameID

Table 10.7. Parameter properties of OverflowEventSelect

Property	Value	
Name	**`OverflowEventSelect`**	
Display Name	**`Overflow Event Select`**	
Interface	**`IEnumeration`**	
Access policy	**`Read/Write/Change`**	
Visibility	**`Beginner`**	
Allowed values	**`Incomplete`**	Incomplete
	`Lost`	Lost
	`IncompleteLost`	Incomplete Lost
	`OK`	OK
	`IncompleteOK`	Incomplete OK
	`LostOK`	Lost OK
	`All`	All
Default value	**`IncompleteLost`**	

Example 10.6. Usage of OverflowEventSelect

```
/* Set */ OverflowEventSelect = IncompleteLost;
/* Get */ value_ = OverflowEventSelect;
```

10.7. OverflowEvents

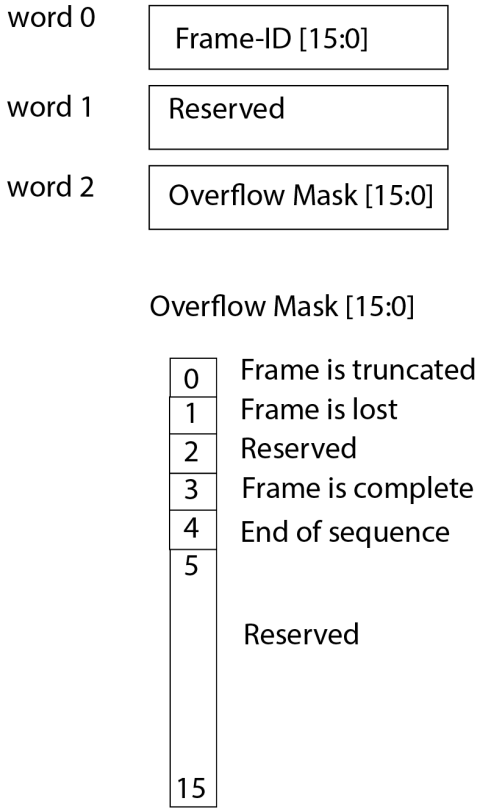
In programming or runtime environments, a callback function is a piece of executable code that is passed as an argument, which is expected to call back (execute) exactly that time an event is triggered. This applet can generate some software callback events based on the memory overflow condition as explained in the following section. These events are not related to a special camera functionality. Other event sources are described in additional sections of this document.

The Basler Framegrabber SDK and pylon SDK via GenTL enables an application to get these event notifications about certain state changes at the data flow from camera to RAM and the image and trigger processing as well. Please consult the Basler Framegrabber SDK, pylon SDK or GenTL documentation for more details concerning the implementation of this functionality.

10.7.1. Overflow

Overflow events are generated for each truncated, lost or complete frame. The selection can be done using *OverflowEventSelect*. The overflow event contains data, namely the type of overflow, the image number and the timestamp. The following figure illustrates the event data. Data is contained in a 64-bit data packet. The first 16 bits contain the frame-ID from the camera. Bits 32 to 47 provide an overflow mask.

Figure 10.1. Illustration of Overflow Data Packet



Note that the frame-ID is taken from the camera stream. See Section 1.5, 'Frame ID' for more information. The frame-ID is a 16-bit value. If its maximum is reached, the frame-ID starts at zero again. If the **frame truncated** flag is set, the frame with the frame-ID in the event is truncated i.e. it doesn't have its full length but is still transferred via DMA channel. If the **frame lost** flag is set, the frame with the frame-ID in the event was fully discarded. No DMA transfer exists for this frame. The **truncated frame** flag and the **frame lost** flag never occur for the same event.

Table 10.8. Event parameters of Overflow

Name	Interface	Description
EventOverflowFrameID	IInteger	Camera frame-ID for area scan applets or grabber frame-ID for line scan applets.
EventOverflowIsTru	IBoolean	Frame is truncated.
EventOverflowIsLostI	IBoolean	Frame is lost.
EventOverflowIsCor	IBoolean	Frame is complete.
EventOverflowIsEndOfSequence	IBoolean	Marks the end of a sequence.

Chapter 11. ImageSelector

The Image Selector allows the user to cut out a period of *p* images from the image stream and select a particular image *n* from it.

The following example will explain the settings of *p* and *n* which represent the frame grabber parameters *ImageSelectPeriod* and *ImageSelect*. Suppose two frame grabbers being connected to a camera signal multiplexer, providing all camera images to both devices. Grabber 0 is required to process all even frames, while grabber 1 is required to process all odd frames. The settings will then be:

1. Grabber 0:
   - *ImageSelectPeriod* = 2

     ImageSelect = 0
2. Grabber 1:
   - *ImageSelectPeriod* = 2

     ImageSelect = 1

Ensure that both grabbers are used synchronously. This is possible with a triggered camera. To do so, initialize and configure both frame grabbers. Configure the camera for external trigger and the trigger system of master grabber which is directly connected to the camera.

11.1. ImageSelectPeriod

This parameter specifies the period length *p*. The parameter can be changed at any time. However, changing during acquisition can result in an asynchronous switching which will result in the loss of a synchronous grabbing. It is recommended to change the parameter only when the acquisition is stopped.

The parameter's value has to be greater than *ImageSelect*.

Table 11.1. Parameter properties of ImageSelectPeriod

Property	Value
Name	**ImageSelectPeriod**
Display Name	**Image Select Period**
Interface	**IInteger**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 1** **Maximum 256** **Stepsize 1**
Default value	**1**
Unit of measure	**image**

Example 11.1. Usage of ImageSelectPeriod

```
/* Set */ ImageSelectPeriod = 1;
/* Get */ value_ = ImageSelectPeriod;
```

11.2. ImageSelect

The parameter *ImageSelect* specifies a particular image from the image set defined by *ImageSelectPeriod*. This parameter can be changed at any time. However, changing during acquisition can result in an asynchronous switching which will result in the loss of a synchronous grabbing. It is recommended to change the parameter only when the acquisition is stopped.

The parameter's value has to be less than *ImageSelectPeriod*.

Table 11.2. Parameter properties of ImageSelect

Property	Value
Name	**ImageSelect**
Display Name	**Image Select**
Interface	**IInteger**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 255** **Stepsize 1**
Default value	**0**
Unit of measure	**image**

Example 11.2. Usage of ImageSelect

```
/* Set */ ImageSelect = 0;
/* Get */ value_ = ImageSelect;
```

Chapter 12. WhiteBalance

The applet enables a spectral adaptation of the image to the lighting situation of the application. The color values for the red, green and blue components can be individually enhanced or reduced by a scaling factor to adjust the spectral sensibility of the camera sensor.

12.1. ScalingFactorRed

Table 12.1. Parameter properties of ScalingFactorRed

Property	Value
Name	**ScalingFactorRed**
Display Name	**Scaling Factor Red**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum** 0.0 **Maximum** 3.9990234375 **Stepsize** 9.765625E-4
Default value	**1.0**

Example 12.1. Usage of ScalingFactorRed

```
/* Set */ ScalingFactorRed = 1.0;
/* Get */ value_ = ScalingFactorRed;
```

12.2. ScalingFactorBlue

Table 12.2. Parameter properties of ScalingFactorBlue

Property	Value
Name	**ScalingFactorBlue**
Display Name	**Scaling Factor Blue**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum** 0.0 **Maximum** 3.9990234375 **Stepsize** 9.765625E-4
Default value	**1.0**

Example 12.2. Usage of ScalingFactorBlue

```
/* Set */ ScalingFactorBlue = 1.0;
/* Get */ value_ = ScalingFactorBlue;
```

12.3. ScalingFactorGreen

Table 12.3. Parameter properties of ScalingFactorGreen

Property	Value
Name	**ScalingFactorGreen**
Display Name	**Scaling Factor Green**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum** 0.0 **Maximum** 3.9990234375 **Stepsize** 9.765625E-4
Default value	**1.0**

Example 12.3. Usage of ScalingFactorGreen

```
/* Set */ ScalingFactorGreen = 1.0;
/* Get */ value_ = ScalingFactorGreen;
```

Chapter 13. ColorConverter

The color converter module is used to convert the input pixel format to an output pixel format. The conversion is performed post to the Bayer de-mosicing and just before the lookup table.

This applet can perform the following conversions.

Table 13.1. Color Conversion

Input Format	Mono	RGB		YCbCr
Output Format				
Mono	yes	yes	yes	N/A
RGB	yes	yes	yes	N/A
	N/A	N/A	yes	N/A
YCbCr	N/A	N/A	N/A	yes

By setting the input and output format the conversion is automatically applied if a conversion is possible. Otherwise the applet will output unchanged values. See *PixelFormat* and *Format*.

Chapter 14. LookupTable

This Acquisition Applet includes a full resolution lookup table (LUT) for each of the three color components. Settings are applied to the acquired images just before transferring them to the host PC. Thus, it is the last pre-processing step on the frame grabber.

A lookup table includes one entry for every allowed input pixel value. The pixel value will be replaced by the value of the lookup table element. In other words, a new value is assigned to each pixel value. This can be used for image quality enhancements such as an added offset, a gain factor or gamma correction which can be performed by use of the processing module of this applet in a convenient way (see Module Chapter 15, '*Processing*'). The lookup table can also be loaded with custom values. Application areas are custom image enhancements or correct pixel classifications.

This applet is processing data with an internal resolution of 16 bits. But the lookup table has 14 input bits i.e. pixel values can be in the range [0, 16383]. For each of these 16383 elements, a table entry exists containing a new output value. The new values are in the range from 0 to 65536. All color components are treated separately. Since this applet uses 16 bit internally, consider that all values need to represent this value range. This LUT is applied to all pixel values before *Format* is applied. The input values for the LUT are aligned to the most significant bit (MSB).

In the following the parameters to use the lookup table are explained. Parameter *LutType* is important to be set correctly as it defines the lookup table operation mode.

14.1. LutEnable

It is possible to disable the functionality of this lookup table. The intenal processor enables a convenient way to improve the image quality using parameters such as offset, gain and gamma. By disabling the lookup table the processing functions are not available anymore. See category Chapter 15, '*Processing*' for a more detailed documentation concerning this. Set this parameter to **On** to use the look up table. By default it is set to **Off** disabling the lookup table functionality itself and the related processing functions.

Table 14.1. Parameter properties of LutEnable

Property	Value
Name	**`LutEnable`**
Display Name	**`Enabled`**
Interface	**`IEnumeration`**
Access policy	**`Read/Write/Change`**
Visibility	**`Beginner`**
Allowed values	**`On`** On **`Off`** Off
Default value	**`Off`**

Example 14.1. Usage of LutEnable

```
/* Set */ LutEnable = Off;
/* Get */ value_ = LutEnable;
```

14.2. LutType

There exist two basic possibilities to use and configure the lookup table. One possibility is to use the internal processor which allows a convenient way to improve the image quality using parameters such as offset, gain

and gamma. Check category Chapter 15, '*Processing*' for more detailed documentation. Set this parameter to **LutTypeProcessing** to use the processor.

The second possibility to use the lookup table is to load a file containing custom values to the lookup table. Set the parameter to **UserFile** to enable the possibility to load a custom file with lookup table entries.

Beside these two possibilities it is always possible to directly write to the lookup table entries using the field parameters *LutValueRed*, *LutValueGreen* and *LutValueBlue*. The use of these parameters will overwrite the settings made with the processor or the custom input file. Vice versa, changing a processing parameter or loading a custom lookup table file, will overwrite the settings made by the field parameters.

Table 14.2. Parameter properties of LutType

Property	Value	
Name	**LutType**	
Display Name	**Type**	
Interface	**IEnumeration**	
Access policy	**Read/Write/Change**	
Visibility	**Beginner**	
Allowed values	**LutTypeProcessing** **UserFile**	Processor User File
Default value	**LutTypeProcessing**	

Example 14.2. Usage of LutType

```
/* Set */ LutType = LutTypeProcessing;
/* Get */ value_ = LutType;
```

14.3. LutValue

Table 14.3. Parameter properties of LutValue

Property	Value
Name	**LutValue**
Display Name	**LUT Values**
Interface	**IInteger (Field)**
Field Size	**16384**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Default value	**0**

Example 14.3. Usage of LutValue

```
/* Set */ for (i = 0; i < 16384; ++i)
{
    LutValueSelector = i;
    LutValue = 0;
}
/* Get */ for (i = 0; i < 16384; ++i)
{
    LutValueSelector = i;
    value_ = LutValue;
}
```

14.4. LutValueRed

Table 14.4. Parameter properties of LutValueRed

Property	Value
Name	**LutValueRed**
Display Name	**Red LUT Values**
Interface	**IInteger (Field)**
Field Size	**16384**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Default value	**0**

Example 14.4. Usage of LutValueRed

```
/* Set */ for (i = 0; i < 16384; ++i)
{
    LutValueRedSelector = i;
    LutValueRed = 0;
}
/* Get */ for (i = 0; i < 16384; ++i)
{
    LutValueRedSelector = i;
    value_ = LutValueRed;
}
```

14.5. LutValueGreen

Table 14.5. Parameter properties of LutValueGreen

Property	Value
Name	**LutValueGreen**
Display Name	**Green LUT Values**
Interface	**IInteger (Field)**
Field Size	**16384**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Default value	**0**

Example 14.5. Usage of LutValueGreen

```
/* Set */ for (i = 0; i < 16384; ++i)
{
    LutValueGreenSelector = i;
    LutValueGreen = 0;
}
/* Get */ for (i = 0; i < 16384; ++i)
{
    LutValueGreenSelector = i;
    value_ = LutValueGreen;
}
```

14.6. LutValueBlue

Table 14.6. Parameter properties of LutValueBlue

Property	Value
Name	**LutValueBlue**
Display Name	**Blue LUT Values**
Interface	**IInteger (Field)**
Field Size	**16384**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Default value	**0**

Example 14.6. Usage of LutValueBlue

```
/* Set */ for (i = 0; i < 16384; ++i)
{
    LutValueBlueSelector = i;
    LutValueBlue = 0;
}
/* Get */ for (i = 0; i < 16384; ++i)
{
    LutValueBlueSelector = i;
    value_ = LutValueBlue;
}
```

14.7. LutCustomFile

If parameter *LutType* is set to **UserFile**, the according path and filename to the file containing the custom lookup table entries can be set here. If the file is valid, the file values will be loaded to the lookup table. If the file is invalid, the call to this parameter will return an error.

A convenient way of getting a draft file, is to save the current lookup table settings to file using parameter *LutSaveFile*.

Please make sure to activate the Type of LUT *LutType* to "UserFile"/**UserFile** in order to make the changes and file names taking effect.

This section describes the file formats which are in use to fill the so called look-up tables (LUT). The purpose of a LUT is a transformation of pixel values from a input (source) image to the pixel values of an output image. This transformation is done by a kind of table, which contains the assignment between these pixel values (input pixel values - output pixel values). Basically the LUT is defined for gray format and color formats as well. When defining a LUT for color formats, the definition of tables has to be done for each color component. The LUT file format consists of 2 parts:

- Header section containing control and description information.
- Main section containing the assignment table for transforming pixel values form a source (input) image to a destination (output) image.

The following example shows how a grey scale lookup table description could look like:

```
# Lut data file v1.1
id=3;
nrOfElements=4096;
format=0;
number=0;
0,0;
1,1;
2,2;
3,3;
```

```
4,4;
5,5;
6,6;
…
4095,4095;
```

General Properties:

- File format extension should be ".lut"
- LUT file format is an ASCII file format consisting of multiple lines of data.
- Lines are defined by a line separator a <CR> <LF> line feed (0x3D 0x0D 0x0A).
- Lines consist of key / value pairs. Key and value are separated by "=". The value has to be followed by a semicolon ; (0x3B)
- Formats consist of header data, containing control information and the assignment table for a specific color component (gray / red, green, blue).
- Basically the LUT file color format follows the same rules as the gray image format. In addition, due to the fact, that each color component can has its own transformation, the definitions are repeated for each color component.

The following example shows how a color scale lookup table description could look like:

```
# Lut data file v1.1
[red]
id=0;
nrOfElements=256;
format=0;
number=0;
0,0;
1,1;
..
255,255;
[green]
id=1;
nrOfElements=256;
format=0;
number=0;
0,0;
1,1;
..
255,255;
[blue]
id=2;
nrOfElements=256;
format=0;
number=0;
0,0;
1,1;
..
255,255;
```

A more detailed explanation of the lookup table file format can be found in the Basler Framegrabber API manual.

Table 14.7. Parameter properties of LutCustomFile

Property	Value
Name	**LutCustomFile**
Display Name	**Load File**
Interface	**IString**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Default value	**""**

Example 14.7. Usage of LutCustomFile

14.8. LutSaveFile

To save the current lookup table configuration to a file, write the according output filename to this parameter. Keep in mind that you need to have full write access to the specified path.

Writing the current lookup table settings to a file is also a convenient way to exploit the settings made by the processor. Moreover, you will get a draft version of the lookup table file format. The values in the output file can directly be used to be loaded to the lookup table again using parameter *LutCustomFile*.

Table 14.8. Parameter properties of LutSaveFile

Property	Value
Name	**LutSaveFile**
Display Name	**Save File**
Interface	**IString**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Default value	**""**

Example 14.8. Usage of LutSaveFile

14.9. AppletProperties

In the following, some properties of the lookup table implementation are listed.

14.9.1. LutImplementationType

In this applet, a full lookup table is implemented and can be setup in a custom way. By default a linear representation is performed.

Table 14.9. Parameter properties of LutImplementationType

Property	Value
Name	**LutImplementationType**
Display Name	**LUT Implementation Type**
Interface	**IEnumeration**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**FullLUT** Full LUT **KneeLUT** Knee LUT

Example 14.9. Usage of LutImplementationType

```
/* Get */ value_ = LutImplementationType;
```

14.9.2. LutInputPixelBitDepth

This applet is using 14 lookup table input bits.

Table 14.10. Parameter properties of LutInputPixelBitDepth

Property	Value
Name	**LutInputPixelBitDepth**
Display Name	**LUT Input Pixel Bit Depth**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 16** **Stepsize 1**
Unit of measure	**bit**

Example 14.10. Usage of LutInputPixelBitDepth

```
/* Get */ value_ = LutInputPixelBitDepth;
```

14.9.3. LutOutputPixelBitDepth

This applet is using 16 lookup table output bits.

Table 14.11. Parameter properties of LutOutputPixelBitDepth

Property	Value
Name	**LutOutputPixelBitDepth**
Display Name	**LUT Output Pixel Bit Depth**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 16** **Stepsize 1**
Unit of measure	**bit**

Example 14.11. Usage of LutOutputPixelBitDepth

```
/* Get */ value_ = LutOutputPixelBitDepth;
```

Chapter 15. Processing

A convenient way to improve the image quality are the processing parameters. Using these parameters an offset, gain and gamma correction can be performed. Moreover, the image can be inverted.

Processor Activation

The processing parameters use the lookup table for determination of the correction values. For activation of the processing parameters, set *LutType* of category lookup table to **LutTypeProcessing** . Otherwise, parameter changes will have no effect.

All transformations apply in the following order:

1. Offset Correction, range [-1.0, +1.0], identity = 0
2. Gain Correction, range [0, 2^14[, identity = 1.0
3. Gamma Correction, range]0, inf], identity = 1.0
4. Invert, identity = 'off'

In this applet, a full lookup table with m = 14 input bits and n = 16 outputs bits is used to perform the corrections. Values are determined by

Equation 15.1. LUT Processor without Inversion

$$Output(x) = \left[\left[gain * \left(\frac{x}{2^{14}-1} + offset\right)\right]^{\frac{1}{gamma}}\right] * \left(2^{16}-1\right).$$

If the inversion is used, output values are determined by

Equation 15.2. LUT Processor with Inversion

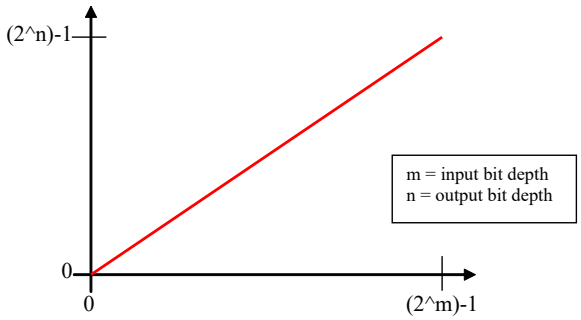
$$Output(x) = 2^{16} - 1 - \left[\left[gain * \left(\frac{x}{2^{14}-1} + offset\right)\right]^{\frac{1}{gamma}}\right] * \left(2^{16}-1\right),$$

where x represents the input pixel value i.e. is in the range from 0 to 2^14 - 1. If the determined output value is less than 0, it will be set to 0. If the determined output value is greater than 2^16 - 1 it is set to 2^16 - 1.

This applet processes each color component separately using the same processing parameters for each component.

If no parameters are changed, i.e. they are set to identity, the output values will be equal to the input values as shown in the figure below. In the following, you will find detailed explanations for all processing parameters.

Figure 15.1. Lookup Table Processing: Identity



15.1. ProcessingOffset

The offset is a relative value added to each pixel, which leads to a behavior similar to a brightness controller. A relative offset means, that e. g. 0.5 adds half of the total brightness to each pixel. In absolute numbers when using 8 bit/pixel, 128 is added to each pixel (0.5 x 255 = 127.5). If you rather want to add an absolute value to each pixel do the following calculation: e. g. add -51 to an 8 bit/pixel offset = -51 / 255 = -0.2.Figure 15.2 shows an example of an offset.

Figure 15.2. Lookup Table Processing: Offset

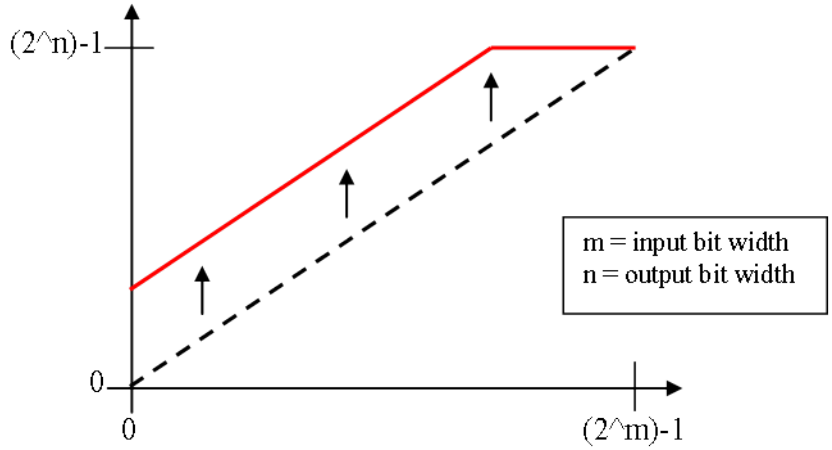


Table 15.1. Parameter properties of ProcessingOffset

Property	Value
Name	**ProcessingOffset**
Display Name	**Offset**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum -1.0** **Maximum 1.0** **Stepsize 2.220446049250313E-16**
Default value	**0.0**

Example 15.1. Usage of ProcessingOffset

```
/* Set */ ProcessingOffset = 0.0;
/* Get */ value_ = ProcessingOffset;
```

15.2. ProcessingGain

The gain is a multiplicative coefficient applied to each pixel, which leads to a behavior similar to a contrast controller. Each pixel value will be multiplied with the given value. For identity select value 1.0.

Figure 15.3. Lookup Table Processing: Gain

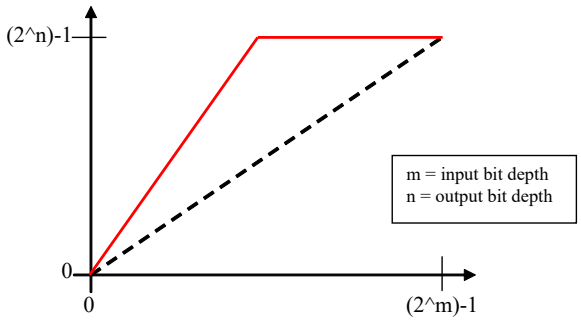


Table 15.2. Parameter properties of ProcessingGain

Property	Value
Name	**ProcessingGain**
Display Name	**Gain**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum** 0.0 **Maximum** 16384.0 **Stepsize** 2.220446049250313E-16
Default value	**1.0**

Example 15.2. Usage of ProcessingGain

```
/* Set */ ProcessingGain = 1.0;
/* Get */ value_ = ProcessingGain;
```

15.3. ProcessingGamma

The gamma correction is a power-law transformation applied to each pixel. Normalized pixel values p ranging [0, 1.0] transform like $p' = p^{1/gamma}$.

Figure 15.4. Lookup Table Processing: Gamma

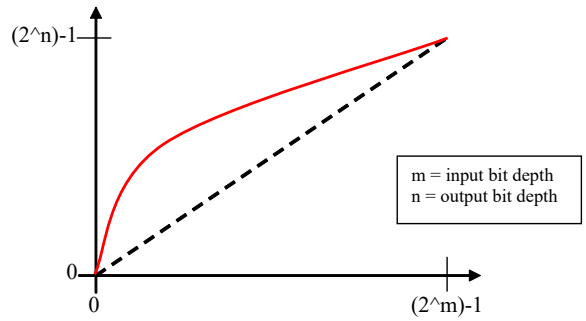


Table 15.3. Parameter properties of ProcessingGamma

Property	Value
Name	**ProcessingGamma**
Display Name	**Gamma**
Interface	**IFloat**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum** -1000.0 **Maximum** 1000.0 **Stepsize** 2.220446049250313E-16
Default value	**1.0**

Example 15.3. Usage of ProcessingGamma

```
/* Set */ ProcessingGamma = 1.0;
/* Get */ value_ = ProcessingGamma;
```

15.4. ProcessingInvert

When *ProcessingInvert* is set to **On**, the output is the negative of the input. Normalized pixel values p ranging [0, 1.0] transform to $p' = 1 - p$.

Figure 15.5. Lookup Table Processing: Invert

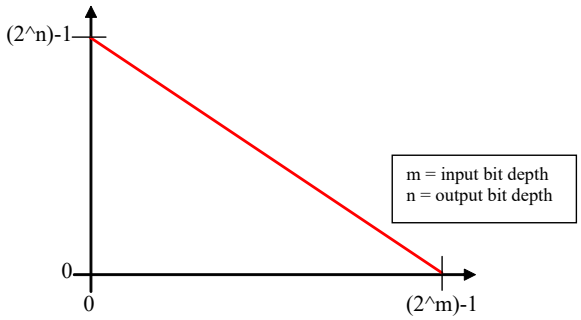


Table 15.4. Parameter properties of ProcessingInvert

Property	Value
Name	**ProcessingInvert**
Display Name	**Invert**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**On** On **Off** Off
Default value	**Off**

Example 15.4. Usage of ProcessingInvert

```
/* Set */ ProcessingInvert = Off;
/* Get */ value_ = ProcessingInvert;
```

Chapter 16. OutputFormat

The following parameter can be used to configure the applet's image output format i.e. the format and bit alignment.

Automatic Adaptation of the Output Format by the GenTL Adaptor

The GenTL adaptor can automatically set the output format based on the camera settings and a given mapping table. Changing the output format of the applet might get overwritten by the GenTL adaptor on acquisition start. You can only set the output format if this automatic adaptation is disabled. See the GenTL documentation parameter **`AutomaticFormatControl`** for more details.

The automatic adaptation applies for parameters *PixelFormat*, *Format*, *BitAlignment* and *CustomBitShiftRight*.

Depending on the setting of GenTL interface parameter **`OutputPackedFormats`** the automatic adaptation will either use the same pixel format as coming from the camera or an unpacked PC output format. Changing the output format of the applet might get overwritten by the GenTL on acquisition start. You can only set the output format if this automatic adaptation is disabled. See the GenTL documentation parameter **`AutomaticFormatControl`** for more details.

Output Format Setting Defines GenTL Buffer Info

The parameters define the DMA output format and therefore the GenTL buffer info values to inform the consumer about the used output pixel format of the interface.

16.1. Format

Parameter *Format* is used to set and determine the output formats of the DMA channels. An output format value specifies the number of bits and the color format of the output.

This applet has an internal processing bit width of 16 bits. Any selected camera pixel format is mapped to this internal bit width. Check the camera parameter section to learn about the mapping of the camera bits to the internal bit width. For a definition on how to map the internal bits to the output bits, check parameter *BitAlignment*.

Moreover, the color converter of this applet can convert between different color formats of the input and output. Check Chapter 13, '*ColorConverter*' for more information.

This applet supports the following output formats:

- **BGR8** and **RGB8**: 24 bit BGR/RGB color format with 8 bit/component.
- **BGRa8** and **RGBa8**: Color format with 8 bit/component. Component "a" has value zero.
- **BGR10p** and **RGB10p**: 30 bit BGR/RGB color format with 10 bit/component.

30 Bit Output Format

Note that in the 30 bit output format 1 pixel and its 3 color components are distributed over multiple bytes. Also, two successive pixel might share one byte. The pixel are directly aligned in memory. Thus 8 successive color components are stored in 10 byte. The DMA transfer might be filled with random content for the last bytes.

- **BGR12p** and **RGB12p**: 36 bit BGR/RGB color format with 12 bit/component.

36 Bit Output Format

Note that in the 36 bit output format 1 pixel and its 3 color components are distributed over multiple bytes. Also, two successive pixel might share one byte. The pixel are directly aligned in memory. Thus 2 successive color components are stored in 3 byte or two pixel in 9 Byte. The DMA transfer might be filled with random content for the last bytes.

- **BGR14p** and **RGB14p**: 42 bit BGR/RGB color format with 14 bit/component.

42 Bit Output Format

Note that in the 42 bit output format 1 pixel and its 3 color components are distributed over multiple bytes. Also, two successive pixel might share one byte. The pixel are directly aligned in memory. Thus 4 successive color components are stored in 7 byte or four pixel in 21 Byte. The DMA transfer might be filled with random content for the last bytes.

- **BGR16** and **RGB16**: 48 bit BGR/RGB color format with 16 bit/component.

BGR vs. RGB Memory Alignement

Note that the color components are either written to the PC buffer in the common blue, green, red (BGR) or red, green, blue order. So either the blue or red color component is at the lower memory address.

- **Mono8**: 8 bit grayscale format
- **Mono10p**: 10 bit grayscale format

10 Bit Output Format

Note that in the 10 bit output format 1 pixel is distributed over more than one byte. Also, two successive pixel share one byte. The pixel are directly aligned in memory. Thus 8 successive pixel are stored in 10 byte. The DMA transfer might be filled with random content for the last bytes.

- **Mono12p**: 12 bit grayscale format

12 Bit Output Format

Note that in the 12 bit output format 1 pixel is distributed over more than one byte. Also, two successive pixel share the same byte. The pixel are directly aligned in memory. Thus 2 successive pixel are stored in 3 byte. The DMA transfer might be filled with random content for the last bytes.

- **Mono14p**: 14 bit grayscale format

14 Bit Output Format

Note that in the 14 bit output format 1 pixel is distributed over more than one byte. Also, two successive pixel share the same byte. The pixel are directly aligned in memory. Thus 12 successive pixel are stored in 21 byte. The DMA transfer might be filled with random content for the last bytes.

- **Mono16**: 16 bit grayscale format

DMA Bandwidth

Keep in mind that for the 16 bit output mode, the DMA bandwidth might not be sufficient to process the camera input data. Check Section 1.2, 'Bandwidth' for more information.

- **BayerGR8**, **BayerRG8**, **BayerGB8** and **BayerBG8**: 8 bit Bayer format Green-followed-by-Red, Red-followed-by-Green, Green-followed-by-Blue and Blue-followed-by-Green.

- **BayerGR10p**, **BayerRG10p**, **BayerGB10p** and **BayerBG10p**: 10 bit Bayer format Green-followed-by-Red, Red-followed-by-Green, Green-followed-by-Blue and Blue-followed-by-Green.

10 Bit Output Format

Note that in the 10 bit output format 1 pixel is distributed over more than one byte. Also, two successive pixel share one byte. The pixel are directly aligned in memory. Thus 8 successive pixel are stored in 10 byte. The DMA transfer might be filled with random content for the last bytes.

- **BayerGR12p**, **BayerRG12p**, **BayerGB12p** and **BayerBG12p**: 12 bit Bayer format Green-followed-by-Red, Red-followed-by-Green, Green-followed-by-Blue and Blue-followed-by-Green.

12 Bit Output Format

Note that in the 12 bit output format 1 pixel is distributed over more than one byte. Also, two successive pixel share the same byte. The pixel are directly aligned in memory. Thus 2 successive pixel are stored in 3 byte. The DMA transfer might be filled with random content for the last bytes.

- **BayerGR14p**, **BayerRG14p**, **BayerGB14p** and **BayerBG14p**: 14 bit Bayer format Green-followed-by-Red, Red-followed-by-Green, Green-followed-by-Blue and Blue-followed-by-Green.

14 Bit Output Format

Note that in the 14 bit output format 1 pixel is distributed over more than one byte. Also, two successive pixel share the same byte. The pixel are directly aligned in memory. Thus 12 successive pixel are stored in 21 byte. The DMA transfer might be filled with random content for the last bytes.

- **BayerGR16**, **BayerRG16**, **BayerGB16** and **BayerBG16**: 16 bit Bayer format Green-followed-by-Red, Red-followed-by-Green, Green-followed-by-Blue and Blue-followed-by-Green.

DMA Bandwidth

Keep in mind that for the 16 bit output mode, the DMA bandwidth might not be sufficient to process the camera input data. Check Section 1.2, 'Bandwidth' for more information.

- **YCbCr422_8**: YUV 422 output in 8 bit per component.

Table 16.1. Parameter properties of Format

Property	Value
Name	**Format**
Display Name	**Output Format**
Interface	**IEnumeration**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**Mono8** Mono 8 **Mono10p** Mono 10p **Mono12p** Mono 12p **Mono14p** Mono 14p **Mono16** Mono 16 **BGR8** BGR 8bit **BGR10p** BGR 10bit **BGR12p** BGR 12bit **BGR14p** BGR 14p **BGR16** BGR 16bit **RGB8** RGB 8 **RGB10p** RGB 10p **RGB12p** RGB 12p **RGB14p** RGB 14p **RGB16** RGB 16 **BGRa8** BGRA 8 **RGBa8** RGBA 8 **YCbCr422_8** YCbCr422_8
Default value	**Mono8**

Example 16.1. Usage of Format

```
/* Set */ Format = Mono8;
/* Get */ value_ = Format;
```

16.2. BitAlignment

The bit alignment is used to map the pixel bits of the internal processing with a depth of 16 bit to the configured DMA output bit depth defined by parameter *Format*.

You can select three different modes: Left aligned, right aligned and a custom shift mode. If you select left aligned, the applet will map the upper bits of the internal processing bit width to the available output bits. If you select right aligned, the applet will map the lower bits of the internal processing bit width to the available output bits. If you want to define a custom bit shift, you'll need to set the parameter to CustomBitShift and use parameter *CustomBitShiftRight* to define the bit shift.

Keep in mind that the internal processing bit width has nothing to do with the camera pixel format. Check the camera parameter section to learn about the mapping of the camera bits to the internal bit width.

Table 16.2. Parameter properties of BitAlignment

Property	Value
Name	**BitAlignment**
Display Name	**Bit Alignment**
Interface	**IEnumeration**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**LeftAligned** Left Aligned **RightAligned** Right Aligned **CustomBitShift** Custom Bit Shift
Default value	**LeftAligned**

Example 16.2. Usage of BitAlignment

```
/* Set */ BitAlignment = LeftAligned;
/* Get */ value_ = BitAlignment;
```

16.3. PixelDepth

The pixel depth read-only parameter is used to determine the number of bits used to process a pixel in the applet. It represents the internal bit width.

Table 16.3. Parameter properties of PixelDepth

Property	Value
Name	**PixelDepth**
Display Name	**Pixel Depth**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum** 0 **Maximum** 128 **Stepsize** 1
Unit of measure	**bit**

Example 16.3. Usage of PixelDepth

```
/* Get */ value_ = PixelDepth;
```

16.4. CustomBitShiftRight

This parameter can only be used if parameter *BitAlignment* is set to **CustomBitShift**. If it is enabled, you can define a custom right bit shift value for the DMA output of the frame grabber. A shift of 0 means that the most significant bits (MSB) of the internal processing bit width are mapped to the output MSB. For example, if the applet has an internal processing bit width of 12 bit and you select a 10 bit output, the upper 10 bits are mapped to the output. If you select however a bit width of two, the lower 10 bits are mapped to the output. Note that this applet has an internal bit width of 16 bits.

Table 16.4. Parameter properties of CustomBitShiftRight

Property	Value
Name	**CustomBitShiftRight**
Display Name	**Bit Shift Right**
Interface	**IInteger**
Access policy	**Read/Write/Change**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 15** **Stepsize 1**
Default value	**0**
Unit of measure	**bit**

Example 16.4. Usage of CustomBitShiftRight

```
/* Set */ CustomBitShiftRight = 0;
/* Get */ value_ = CustomBitShiftRight;
```

Chapter 17. Miscellaneous

This category summarizes other read and write parameters such as the camera status, buffer fill levels, DMA transfer lengths, and time stamps.

17.1. HardwareRevision

This parameter reads the hardware revision of the board, which is hard-coded during the board production process.

Table 17.1. Parameter properties of HardwareRevision

Property	Value
Name	**HardwareRevision**
Display Name	**Hardware Revision**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 7** **Stepsize 1**

Example 17.1. Usage of HardwareRevision

```
/* Get */ value_ = HardwareRevision;
```

17.2. Version

The category provides version information.

17.2.1. AppletVersion

This parameter indicates the version number of the applet. Report this value when contacting the Basler support.

Table 17.2. Parameter properties of AppletVersion

Property	Value
Name	**AppletVersion**
Display Name	**Applet Version**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 256** **Stepsize 1**

Example 17.2. Usage of AppletVersion

```
/* Get */ value_ = AppletVersion;
```

17.2.2. AppletRevision

This parameter indicates the revision number of the applet. Report this value when contacting the Basler support.

Table 17.3. Parameter properties of AppletRevision

Property	Value
Name	**AppletRevision**
Display Name	**Applet Revision**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum** 0 **Maximum** 256 **Stepsize** 1

Example 17.3. Usage of AppletRevision

```
/* Get */ value_ = AppletRevision;
```

17.3. GpioConfiguration

17.3.1. FrontGPIPullControl03

This parameter controls the pull-up and pull-down resistors (20 kOhm) for the front slot GPI signals, regardless of whether they are configured as differential or single-ended. You can set the GPI to either `PullUp` or `PullDown` state.

The pull resistors define the voltage level on the GPI pin when it is not driven externally or when the external driver powers up later than the frame grabber. If an external driver is connected, it must be strong enough to override the 20 kOhm pull resistors.

The `03` parameter controls the behavior for GPI group channel-A (GPI pins 0–3), while the `47` parameter controls the behavior for GPI group channel-B (GPI pins 4–7).

For the pull resistors to function correctly, the external GPIO power must be connected to the appropriate connector pins (group channel-A or channel-B GPI voltage IN and GPI ground IN).

Table 17.4. Parameter properties of FrontGPIPullControl03

Property	Value
Name	**FrontGPIPullControl03**
Display Name	**Front GPI Pull Control 0 to 3**
Interface	**IEnumeration**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**FrontGPIPullDown** Pull-down **FrontGPIPullUp** Pull-up
Default value	**FrontGPIPullUp**

Example 17.4. Usage of FrontGPIPullControl03

```
/* Set */ FrontGPIPullControl03 = FrontGPIPullUp;
/* Get */ value_ = FrontGPIPullControl03;
```

17.3.2. FrontGPIPullControl47

This parameter controls the pull-up and pull-down resistors (20 kOhm) for the front slot GPI signals, regardless of whether they are configured as differential or single-ended. You can set the GPI to either `PullUp` or `PullDown` state.

The pull resistors define the voltage level on the GPI pin when it is not driven externally or when the external driver powers up later than the frame grabber. If an external driver is connected, it must be strong enough to override the 20 kOhm pull resistors.

The `03` parameter controls the behavior for GPI group channel-A (GPI pins 0–3), while the `47` parameter controls the behavior for GPI group channel-B (GPI pins 4–7).

For the pull resistors to function correctly, the external GPIO power must be connected to the appropriate connector pins (group channel-A or channel-B GPI voltage IN and GPI ground IN).

Table 17.5. Parameter properties of FrontGPIPullControl47

Property	Value
Name	**FrontGPIPullControl47**
Display Name	**Front GPI Pull Control 4 to 7**
Interface	**IEnumeration**
Access policy	**Read/Write**
Visibility	**Beginner**
Allowed values	**FrontGPIPullDown** Pull-down **FrontGPIPullUp** Pull-up
Default value	**FrontGPIPullUp**

Example 17.5. Usage of FrontGPIPullControl47

```
/* Set */ FrontGPIPullControl47 = FrontGPIPullUp;
/* Get */ value_ = FrontGPIPullControl47;
```

17.3.3. FrontGPISignalType03

This parameter controls whether the GPI pins operate in differential or single-ended mode. The `03` parameter manages group channel-A (GPI pins 0–3), and the `47` parameter manages group channel-B (GPI pins 4–7).

In **SingleEnded** mode, each GPI pin is passed unchanged into VisualApplets, allowing all four pins in the group to be used independently.

In **Differential** mode, the even-numbered GPI pin and the next odd-numbered pin are combined to form a differential channel in VisualApplets. In VisualApplets, there are 4 GPIs for each of the 2 group channels-A/B. When differential mode is active, even pins carry the differential signal, while odd pins only represent the negative pair state and can be ignored. In single-ended mode all 4 group GPI pins are valid and can be used independently.

Table 17.6. Parameter properties of FrontGPISignalType03

Property	Value	
Name	**FrontGPISignalType03**	
Display Name	**Front GPI Signal Type 0 to 3**	
Interface	**IEnumeration**	
Access policy	**Read/Write**	
Visibility	**Beginner**	
Allowed values	**FrontGPISingleEnded** **FrontGPIDifferential**	Single-ended Differential
Default value	**FrontGPISingleEnded**	

Example 17.6. Usage of FrontGPISignalType03

```
/* Set */ FrontGPISignalType03 = FrontGPISingleEnded;
/* Get */ value_ = FrontGPISignalType03;
```

17.3.4. FrontGPISignalType47

This parameter controls whether the GPI pins operate in differential or single-ended mode. The `03` parameter manages group channel-A (GPI pins 0–3), and the `47` parameter manages group channel-B (GPI pins 4–7).

In **SingleEnded** mode, each GPI pin is passed unchanged into VisualApplets, allowing all four pins in the group to be used independently.

In **Differential** mode, the even-numbered GPI pin and the next odd-numbered pin are combined to form a differential channel in VisualApplets. In VisualApplets, there are 4 GPIs for each of the 2 group channels-A/B. When differential mode is active, even pins carry the differential signal, while odd pins only represent the negative pair state and can be ignored. In single-ended mode all 4 group GPI pins are valid and can be used independently.

Table 17.7. Parameter properties of FrontGPISignalType47

Property	Value	
Name	**FrontGPISignalType47**	
Display Name	**Front GPI Signal Type 4 to 7**	
Interface	**IEnumeration**	
Access policy	**Read/Write**	
Visibility	**Beginner**	
Allowed values	**FrontGPISingleEnded** **FrontGPIDifferential**	Single-ended Differential
Default value	**FrontGPISingleEnded**	

Example 17.7. Usage of FrontGPISignalType47

```
/* Set */ FrontGPISignalType47 = FrontGPISingleEnded;
/* Get */ value_ = FrontGPISignalType47;
```

Chapter 18. BoardStatus

This category gives information about the current framegrabber board status. For example, the number of used PCIe lanes, or the mapping of the physical and logical CXP ports. For imaWorx and imaFLex, it also shows if a trigger board is connected.

18.1. SystemmonitorCurrentLinkSpeed

Returns the current link width of the frame grabber representing the number of PCIe lanes that are used for data transfer. This is a value that should correspond to the number of hardware lanes the frame grabber is requiring, otherwise the possible maximum of DMA bandwidth can be reduced drastically.

Table 18.1. Parameter properties of SystemmonitorCurrentLinkSpeed

Property	Value
Name	**SystemmonitorCurrentLinkSpeed**
Display Name	**System Monitor Current Link Speed**
Interface	**IFloat**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0.0** **Maximum 1000.0** **Stepsize 0.5**
Unit of measure	**Gb/s**

Example 18.1. Usage of SystemmonitorCurrentLinkSpeed

```
/* Get */ value_ = SystemmonitorCurrentLinkSpeed;
```

18.2. SystemmonitorPcieTrainedPayloadSize

Returns the PCIe packet size that was evaluated during the training period at boot-time.

Table 18.2. Parameter properties of SystemmonitorPcieTrainedPayloadSize

Property	Value
Name	**SystemmonitorPcieTrainedPayloadSize**
Display Name	**System Monitor PCIe Trained Payload Size**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 1024** **Stepsize 1**
Unit of measure	**byte**

Example 18.2. Usage of SystemmonitorPcieTrainedPayloadSize

```
/* Get */ value_ = SystemmonitorPcieTrainedPayloadSize;
```

18.3. SystemmonitorPcieTrainedRequestSize

Returns the size (in bytes) of the PCIe packets payload that are used for the data transmission between the frame grabber and the PCIe bridge.

Table 18.3. Parameter properties of SystemmonitorPcieTrainedRequestSize

Property	Value
Name	**SystemmonitorPcieTrainedRequestSize**
Display Name	**System Monitor PCIe Trained Request Size**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum** 0 **Maximum** 4096 **Stepsize** 1
Unit of measure	**byte**

Example 18.3. Usage of SystemmonitorPcieTrainedRequestSize

```
/* Get */ value_ = SystemmonitorPcieTrainedRequestSize;
```

18.4. SystemmonitorFrontGpioPower

This parameter indicates the power state of the front GPIO's isolated 5 V regulator, which supplies power to pin 9 (VCC 5V OUT) on the front GPIO connector.

- GOOD: The 5 V supply is active, and the power circuitry is functioning correctly.
- NO_POWER: The 5 V isolated supply couldn't be generated because of a fault in the power path. This may be caused by a hardware damage.

Table 18.4. Parameter properties of SystemmonitorFrontGpioPower

Property	Value
Name	**SystemmonitorFrontGpioPower**
Display Name	**System Monitor FrontGPIO Power Good**
Interface	**IEnumeration**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**PowerGood** Good **NoPower** No Power

Example 18.4. Usage of SystemmonitorFrontGpioPower

```
/* Get */ value_ = SystemmonitorFrontGpioPower;
```

18.5. SystemmonitorExtensionGpioPower

This parameter indicates the power state of the extension GPIO board's 3.3 V power circuitry, which supplies power to connector pins 2 (+3.3 VDC), 4 (+3.3 VDC), 32 (VCCIO: +2.5 VDC / 3.3 VDC), and 34 (VCCIO: +2.5 VDC / 3.3 VDC).

- GOOD: The 3.3 V supply is active, and the power circuitry is functioning correctly.
- NO_POWER: The 3.3 V isolated supply couldn't be generated because of a fault in the power path. This may be caused by a hardware damage.

Table 18.5. Parameter properties of SystemmonitorExtensionGpioPower

Property	Value
Name	**SystemmonitorExtensionGpioPower**
Display Name	**System Monitor ExtensionGPIO Power Good**
Interface	**IEnumeration**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**PowerGood** Good **NoPower** No Power

Example 18.5. Usage of SystemmonitorExtensionGpioPower

```
/* Get */ value_ = SystemmonitorExtensionGpioPower;
```

18.6. SystemmonitorFiberPortPowerEnable0

These parameters mirror the runtime software power settings for the fiber QSFP28 ports 0 and 1.

- NO: Port power has been disabled by the software to save energy.
- YES: Port is powered and used for the application.

Table 18.6. Parameter properties of SystemmonitorFiberPortPowerEnable0

Property	Value
Name	**SystemmonitorFiberPortPowerEnable0**
Display Name	**System Monitor Fiber Port 0 Power Enable**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum** 0 **Maximum** 1 **Stepsize** 1

Example 18.6. Usage of SystemmonitorFiberPortPowerEnable0

```
/* Get */ value_ = SystemmonitorFiberPortPowerEnable0;
```

18.7. SystemmonitorFiberPortPowerGood0

These parameters indicate the power supply circuitry state of the dedicated QSFP28 ports 0 and 1.

- GOOD: Port is successfully powered. GOOD does not mean the communication is running and module is present. It can be shown also when the QSFP28 module is not plugged in. For the module detection circuitry to work, the powering of the port is required. So GOOD means that after the runtime software enables the power, the power supply circuitry of the port is booted successfully.

- NO_POWER: The port is not powered, either because it was disabled by software or due to a fault in the power circuitry.

Table 18.7. Parameter properties of SystemmonitorFiberPortPowerGood0

Property	Value
Name	**SystemmonitorFiberPortPowerGood0**
Display Name	**System Monitor Fiber Port 0 Power Good**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.7. Usage of SystemmonitorFiberPortPowerGood0

```
/* Get */ value_ = SystemmonitorFiberPortPowerGood0;
```

18.8. SystemmonitorFiberPortModulePresent0

These parameters indicate the physical state of the module detection on QSFP28 ports 0 and 1. Detection works only when the port is powered.

- NO: QSFP28 module is not plugged in or port is not powered. The module detection is not possible
- YES: QSFP28 module is plugged in.

Table 18.8. Parameter properties of SystemmonitorFiberPortModulePresent0

Property	Value
Name	**SystemmonitorFiberPortModulePresent0**
Display Name	**System Monitor Fiber Port 0 Module Present**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.8. Usage of SystemmonitorFiberPortModulePresent0

```
/* Get */ value_ = SystemmonitorFiberPortModulePresent0;
```

18.9. SystemmonitorFiberPortInitReady0

These parameters indicate the hardware initialization state for QSFP28 ports 0 and 1.

- YES: Port is powered and module plugged in, initialization can start.
- NO: Port isn't ready for initialization. Either the port is not powered or the QSFP28 module is not detected yet.

Table 18.9. Parameter properties of SystemmonitorFiberPortInitReady0

Property	Value
Name	**SystemmonitorFiberPortInitReady0**
Display Name	**System Monitor Fiber Port 0 Module Ready**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.9. Usage of SystemmonitorFiberPortInitReady0

```
/* Get */ value_ = SystemmonitorFiberPortInitReady0;
```

18.10. SystemmonitorFiberPortPowerEnable1

These parameters mirror the runtime software power settings for the fiber QSFP28 ports 0 and 1.

- NO: Port power has been disabled by the software to save energy.
- YES: Port is powered and used for the application.

Table 18.10. Parameter properties of SystemmonitorFiberPortPowerEnable1

Property	Value
Name	**SystemmonitorFiberPortPowerEnable1**
Display Name	**System Monitor Fiber Port 1 Power Enable**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.10. Usage of SystemmonitorFiberPortPowerEnable1

```
/* Get */ value_ = SystemmonitorFiberPortPowerEnable1;
```

18.11. SystemmonitorFiberPortPowerGood1

These parameters indicate the power supply circuitry state of the dedicated QSFP28 ports 0 and 1.

- GOOD: Port is successfully powered. GOOD does not mean the communication is running and module is present. It can be shown also when the QSFP28 module is not plugged in. For the module detection circuitry to work, the powering of the port is required. So GOOD means that after the runtime software enables the power, the power supply circuitry of the port is booted successfully.
- NO_POWER: The port is not powered, either because it was disabled by software or due to a fault in the power circuitry.

Table 18.11. Parameter properties of SystemmonitorFiberPortPowerGood1

Property	Value
Name	**SystemmonitorFiberPortPowerGood1**
Display Name	**System Monitor Fiber Port 1 Power Good**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.11. Usage of SystemmonitorFiberPortPowerGood1

```
/* Get */ value_ = SystemmonitorFiberPortPowerGood1;
```

18.12. SystemmonitorFiberPortModulePresent1

These parameters indicate the physical state of the module detection on QSFP28 ports 0 and 1. Detection works only when the port is powered.

- NO: QSFP28 module is not plugged in or port is not powered. The module detection is not possible
- YES: QSFP28 module is plugged in.

Table 18.12. Parameter properties of SystemmonitorFiberPortModulePresent1

Property	Value
Name	**SystemmonitorFiberPortModulePresent1**
Display Name	**System Monitor Fiber Port 1 Module Present**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.12. Usage of SystemmonitorFiberPortModulePresent1

```
/* Get */ value_ = SystemmonitorFiberPortModulePresent1;
```

18.13. SystemmonitorFiberPortInitReady1

These parameters indicate the hardware initialization state for QSFP28 ports 0 and 1.

- YES: Port is powered and module plugged in, initialization can start.
- NO: Port isn't ready for initialization. Either the port is not powered or the QSFP28 module is not detected yet.

Table 18.13. Parameter properties of SystemmonitorFiberPortInitReady1

Property	Value
Name	**SystemmonitorFiberPortInitReady1**
Display Name	**System Monitor Fiber Port 1 Module Ready**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 18.13. Usage of SystemmonitorFiberPortInitReady1

```
/* Get */ value_ = SystemmonitorFiberPortInitReady1;
```

18.14. SystemmonitorFanSpeed

This parameter measures the fan rotation speed in revolution per minute (RPM) units. The maximum RPM depends on the assembled fan and can vary between different hardware revisions and product customizations.

Table 18.14. Parameter properties of SystemmonitorFanSpeed

Property	Value
Name	**SystemmonitorFanSpeed**
Display Name	**System Monitor Fan Speed**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Minimum 0** **Maximum 16383** **Stepsize 1**
Unit of measure	**RPM**

Example 18.14. Usage of SystemmonitorFanSpeed

```
/* Get */ value_ = SystemmonitorFanSpeed;
```

18.15. SystemmonitorExtensionGpioBoardPresent

This parameter monitors the status of the GPIO Extension board:

- YES: GPIO extension board is detected to be plugged in on the imaFlex 2 Dual 100 / imaFlex CXP-12 Quad / imaFlex CXP-12 Penta board.
- NO: GPIO extension board is not plugged in and/or is not detected.

Table 18.15. Parameter properties of SystemmonitorExtensionGpioBoardPresent

Property	Value
Name	**SystemmonitorExtensionGpioBoardPresent**
Display Name	**Extension GPIO Board Present**
Interface	**IEnumeration**
Access policy	**Read-Only**
Visibility	**Beginner**
Allowed values	**Yes** Yes **No** No

Example 18.15. Usage of SystemmonitorExtensionGpioBoardPresent

```
/* Get */ value_ = SystemmonitorExtensionGpioBoardPresent;
```

18.16. FiberStatistics

This category provides information about the fiber connection quality, i.e., fiber connection statistics.

18.16.1. SystemmonitorFiberReceivedPacketCount00

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.16. Parameter properties of SystemmonitorFiberReceivedPacketCount00

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount00**
Display Name	**Fiber Received Packet Count0 0**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum** **0** **Maximum** **9223372036854775807** **Stepsize** **1**

Example 18.16. Usage of SystemmonitorFiberReceivedPacketCount00

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount00;
```

18.16.2. SystemmonitorFiberReceivedPacketCount01

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.17. Parameter properties of SystemmonitorFiberReceivedPacketCount01

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount01**
Display Name	**Fiber Received Packet Count0 1**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.17. Usage of SystemmonitorFiberReceivedPacketCount01

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount01;
```

18.16.3. SystemmonitorFiberReceivedPacketCount02

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.18. Parameter properties of SystemmonitorFiberReceivedPacketCount02

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount02**
Display Name	**Fiber Received Packet Count0 2**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.18. Usage of SystemmonitorFiberReceivedPacketCount02

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount02;
```

18.16.4. SystemmonitorFiberReceivedPacketCount03

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.19. Parameter properties of SystemmonitorFiberReceivedPacketCount03

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount03**
Display Name	**Fiber Received Packet Count0 3**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.19. Usage of SystemmonitorFiberReceivedPacketCount03

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount03;
```

18.16.5. SystemmonitorFiberReceivedPacketCount10

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.20. Parameter properties of SystemmonitorFiberReceivedPacketCount10

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount10**
Display Name	**Fiber Received Packet Count1 0**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.20. Usage of SystemmonitorFiberReceivedPacketCount10

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount10;
```

18.16.6. SystemmonitorFiberReceivedPacketCount11

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.21. Parameter properties of SystemmonitorFiberReceivedPacketCount11

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount11**
Display Name	**Fiber Received Packet Count1 1**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.21. Usage of SystemmonitorFiberReceivedPacketCount11

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount11;
```

18.16.7. SystemmonitorFiberReceivedPacketCount12

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.22. Parameter properties of SystemmonitorFiberReceivedPacketCount12

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount12**
Display Name	**Fiber Received Packet Count1 2**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.22. Usage of SystemmonitorFiberReceivedPacketCount12

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount12;
```

18.16.8. SystemmonitorFiberReceivedPacketCount13

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3).

Range: 0 to 18446744073709551615 (64-bit).

Note: A fiber packet is a raw data block over fiber.

Table 18.23. Parameter properties of SystemmonitorFiberReceivedPacketCount13

Property	Value
Name	**SystemmonitorFiberReceivedPacketCount13**
Display Name	**Fiber Received Packet Count1 3**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 9223372036854775807** **Stepsize 1**

Example 18.23. Usage of SystemmonitorFiberReceivedPacketCount13

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketCount13;
```

18.16.9. SystemmonitorFiberReceivedPacketErrorCount00

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.24. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount00

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount00**
Display Name	**Fiber Received Packet Error Count0 0**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.24. Usage of SystemmonitorFiberReceivedPacketErrorCount00

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount00;
```

18.16.10. SystemmonitorFiberReceivedPacketErrorCount01

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.25. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount01

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount01**
Display Name	**Fiber Received Packet Error Count0 1**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.25. Usage of SystemmonitorFiberReceivedPacketErrorCount01

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount01;
```

18.16.11. SystemmonitorFiberReceivedPacketErrorCount02

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.26. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount02

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount02**
Display Name	**Fiber Received Packet Error Count0 2**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.26. Usage of SystemmonitorFiberReceivedPacketErrorCount02

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount02;
```

18.16.12. SystemmonitorFiberReceivedPacketErrorCount03

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.27. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount03

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount03**
Display Name	**Fiber Received Packet Error Count0 3**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.27. Usage of SystemmonitorFiberReceivedPacketErrorCount03

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount03;
```

18.16.13. SystemmonitorFiberReceivedPacketErrorCount10

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.28. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount10

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount10**
Display Name	**Fiber Received Packet Error Count1 0**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.28. Usage of SystemmonitorFiberReceivedPacketErrorCount10

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount10;
```

18.16.14. SystemmonitorFiberReceivedPacketErrorCount11

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.29. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount11

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount11**
Display Name	**Fiber Received Packet Error Count1 1**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.29. Usage of SystemmonitorFiberReceivedPacketErrorCount11

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount11;
```

18.16.15. SystemmonitorFiberReceivedPacketErrorCount12

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.30. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount12

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount12**
Display Name	**Fiber Received Packet Error Count1 2**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.30. Usage of SystemmonitorFiberReceivedPacketErrorCount12

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount12;
```

18.16.16. SystemmonitorFiberReceivedPacketErrorCount13

This parameter indicates the number of received fiber packets over the QSFP28 port[P] lane[L] (ports 0 and 1, lanes 0 to 3), which are corrupted. Packet corruption can occur when the QSFP28 module is damaged, or the fiber connector exceeds the allowed plug limits, or due to electrical or optical damage of the fiber connection.

Range: 0 to 281474976710655 (48-bit).

This parameter together with the corresponding `FiberReceivedPacketCount` can be used to judge the quality of the optical connection and to compute the connection error rate.

Table 18.31. Parameter properties of SystemmonitorFiberReceivedPacketErrorCount13

Property	Value
Name	**SystemmonitorFiberReceivedPacketErrorCount13**
Display Name	**Fiber Received Packet Error Count1 3**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.31. Usage of SystemmonitorFiberReceivedPacketErrorCount13

```
/* Get */ value_ = SystemmonitorFiberReceivedPacketErrorCount13;
```

18.16.17. SystemmonitorReserved00

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.32. Parameter properties of SystemmonitorReserved00

Property	Value
Name	**SystemmonitorReserved00**
Display Name	**Reserved0 0**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.32. Usage of SystemmonitorReserved00

```
/* Get */ value_ = SystemmonitorReserved00;
```

18.16.18. SystemmonitorReserved01

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.33. Parameter properties of SystemmonitorReserved01

Property	Value
Name	**SystemmonitorReserved01**
Display Name	**Reserved0 1**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.33. Usage of SystemmonitorReserved01

```
/* Get */ value_ = SystemmonitorReserved01;
```

18.16.19. SystemmonitorReserved02

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.34. Parameter properties of SystemmonitorReserved02

Property	Value
Name	**SystemmonitorReserved02**
Display Name	**Reserved0 2**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.34. Usage of SystemmonitorReserved02

```
/* Get */ value_ = SystemmonitorReserved02;
```

18.16.20. SystemmonitorReserved03

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.35. Parameter properties of SystemmonitorReserved03

Property	Value
Name	**SystemmonitorReserved03**
Display Name	**Reserved0 3**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.35. Usage of SystemmonitorReserved03

```
/* Get */ value_ = SystemmonitorReserved03;
```

18.16.21. SystemmonitorReserved10

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.36. Parameter properties of SystemmonitorReserved10

Property	Value
Name	**SystemmonitorReserved10**
Display Name	**Reserved1 0**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.36. Usage of SystemmonitorReserved10

```
/* Get */ value_ = SystemmonitorReserved10;
```

18.16.22. SystemmonitorReserved11

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.37. Parameter properties of SystemmonitorReserved11

Property	Value
Name	**SystemmonitorReserved11**
Display Name	**Reserved1 1**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.37. Usage of SystemmonitorReserved11

```
/* Get */ value_ = SystemmonitorReserved11;
```

18.16.23. SystemmonitorReserved12

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.38. Parameter properties of SystemmonitorReserved12

Property	Value
Name	**SystemmonitorReserved12**
Display Name	**Reserved1 2**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.38. Usage of SystemmonitorReserved12

```
/* Get */ value_ = SystemmonitorReserved12;
```

18.16.24. SystemmonitorReserved13

This parameter is reserved for future implementations. Treat the indicated value as don’t care and don't evaluate it.

Table 18.39. Parameter properties of SystemmonitorReserved13

Property	Value
Name	**SystemmonitorReserved13**
Display Name	**Reserved1 3**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 281474976710655** **Stepsize 1**

Example 18.39. Usage of SystemmonitorReserved13

```
/* Get */ value_ = SystemmonitorReserved13;
```

Chapter 19. Errors

This category gives information about the current error status. It shows error counters for different error types, such as packet errors, missing connection, undefined data or overtriggering. Additionally, it reports warning type errors, like the number of both corrected and uncorrected packets.

19.1. SystemmonitorRxStreamIncompleteCount

This parameter counts how many received stream packets are incorrectly formatted, for example, when the end-of-packet indicator is missing:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.1. Parameter properties of SystemmonitorRxStreamIncompleteCount

Property	Value
Name	**SystemmonitorRxStreamIncompleteCount**
Display Name	**System Monitor Rx Stream Incomplete Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.1. Usage of SystemmonitorRxStreamIncompleteCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    SystemmonitorRxStreamIncompleteCountSelector = i;
    value_ = SystemmonitorRxStreamIncompleteCount;
}
```

19.2. SystemmonitorRxUnknownDataReceivedCount

This parameter counts instances where unknown packet data is received which is not part of the CXP standard.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.2. Parameter properties of SystemmonitorRxUnknownDataReceivedCount

Property	Value
Name	**SystemmonitorRxUnknownDataReceivedCount**
Display Name	**System Monitor Rx Unknown Data Received Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.2. Usage of SystemmonitorRxUnknownDataReceivedCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    SystemmonitorRxUnknownDataReceivedCountSelector = i;
    value_ = SystemmonitorRxUnknownDataReceivedCount;
}
```

19.3. CxpOvertriggerRequestPulseCount

This parameter counts how many trigger requests were skipped, because the transmitter was still busy sending the previous trigger packet:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.3. Parameter properties of CxpOvertriggerRequestPulseCount

Property	Value
Name	**CxpOvertriggerRequestPulseCount**
Display Name	**CXP Overtrigger Request Pulse Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.3. Usage of CxpOvertriggerRequestPulseCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpOvertriggerRequestPulseCountSelector = i;
    value_ = CxpOvertriggerRequestPulseCount;
}
```

19.4. CxpTriggerAckMissingCount

The parameter counts instances where a trigger packet was sent but no acknowledgment packet was received before the CXP-defined timeout of 480 ns elapsed.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.4. Parameter properties of CxpTriggerAckMissingCount

Property	Value
Name	**CxpTriggerAckMissingCount**
Display Name	**CXP Lost Trigger ACK Missing Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.4. Usage of CxpTriggerAckMissingCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpTriggerAckMissingCountSelector = i;
    value_ = CxpTriggerAckMissingCount;
}
```

19.5. CxpControlAckLostCount

This parameter counts how many control packets were sent without receiving an acknowledgment within the CXP-defined timeout (200 ms):

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.5. Parameter properties of CxpControlAckLostCount

Property	Value
Name	**CxpControlAckLostCount**
Display Name	**CXP Control ACK Lost Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.5. Usage of CxpControlAckLostCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpControlAckLostCountSelector = i;
    value_ = CxpControlAckLostCount;
}
```

19.6. CxpControlTagErrorCount

This parameter counts how many acknowledgments for control packets were received with a tag that doesn't match the expected tag sent in the corresponding request control packet:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.6. Parameter properties of CxpControlTagErrorCount

Property	Value
Name	**CxpControlTagErrorCount**
Display Name	**CXP Control Tag Error Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.6. Usage of CxpControlTagErrorCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpControlTagErrorCountSelector = i;
    value_ = CxpControlTagErrorCount;
}
```

19.7. CxpControlAckIncompleteCount

This parameter counts how many incorrectly formatted acknowledgement packets were received, for example with a missing end-of-packet indicator:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits)

Table 19.7. Parameter properties of CxpControlAckIncompleteCount

Property	Value
Name	**CxpControlAckIncompleteCount**
Display Name	**CXP Control ACK Incomplete Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.7. Usage of CxpControlAckIncompleteCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpControlAckIncompleteCountSelector = i;
    value_ = CxpControlAckIncompleteCount;
}
```

19.8. CxpHeartbeatIncompleteCount

This parameter counts how many incomplete heartbeat packets were received, for example heartbeat packets with a missing end-of-packet indicator:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.8. Parameter properties of CxpHeartbeatIncompleteCount

Property	Value
Name	**CxpHeartbeatIncompleteCount**
Display Name	**CXP Heartbeat Incomplete Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.8. Usage of CxpHeartbeatIncompleteCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpHeartbeatIncompleteCountSelector = i;
    value_ = CxpHeartbeatIncompleteCount;
}
```

19.9. CxpHeartbeatMaxPeriodViolationCount

In the CXP 2.0 standard, the heartbeat period is defined as maximum 100 ms. This means that during this time at least one heartbeat packet needs to be sent by the camera. This parameter counts how often this condition is **not** met:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.9. Parameter properties of CxpHeartbeatMaxPeriodViolationCount

Property	Value
Name	**CxpHeartbeatMaxPeriodViolationCount**
Display Name	**CXP Hearbeat Max Period Violation Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.9. Usage of CxpHeartbeatMaxPeriodViolationCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpHeartbeatMaxPeriodViolationCountSelector = i;
    value_ = CxpHeartbeatMaxPeriodViolationCount;
}
```

19.10. CxpTriggerAckErrorCount

The parameter counts instances where the receiver detects an error in a trigger acknowledgment packet.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.10. Parameter properties of CxpTriggerAckErrorCount

Property	Value
Name	**CxpTriggerAckErrorCount**
Display Name	**CXP Trigger Ack Error Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.10. Usage of CxpTriggerAckErrorCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpTriggerAckErrorCountSelector = i;
    value_ = CxpTriggerAckErrorCount;
}
```

19.11. CxpRxBridgeErrorCount

This parameter counts cases where the receiver bridge module detects protocol violations in the received data:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.11. Parameter properties of CxpRxBridgeErrorCount

Property	Value
Name	**CxpRxBridgeErrorCount**
Display Name	**CXP Rx Bridge Error Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.11. Usage of CxpRxBridgeErrorCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxBridgeErrorCountSelector = i;
    value_ = CxpRxBridgeErrorCount;
}
```

19.12. CxpRxTriggerOverRequestCount

This parameter counts received trigger packets for which no acknowledgment could be sent because the acknowledgment for the previous trigger was still in progress.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.12. Parameter properties of CxpRxTriggerOverRequestCount

Property	Value
Name	**CxpRxTriggerOverRequestCount**
Display Name	**CXP Rx Trigger Over Request Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.12. Usage of CxpRxTriggerOverRequestCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxTriggerOverRequestCountSelector = i;
    value_ = CxpRxTriggerOverRequestCount;
}
```

19.13. CxpRxTriggerLostCount

The parameter counts instances where a received trigger packet is lost due to defective or not correctable trigger content.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.13. Parameter properties of CxpRxTriggerLostCount

Property	Value
Name	**CxpRxTriggerLostCount**
Display Name	**CXP Rx Trigger Lost Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.13. Usage of CxpRxTriggerLostCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxTriggerLostCountSelector = i;
    value_ = CxpRxTriggerLostCount;
}
```

19.14. CxpRxEventTagErrorCount

The parameter counts tag errors in received event packets, which happens when the event packet tag gets a gap.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.14. Parameter properties of CxpRxEventTagErrorCount

Property	Value
Name	**CxpRxEventTagErrorCount**
Display Name	**CXP Rx Event Packet Tag Error Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.14. Usage of CxpRxEventTagErrorCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventTagErrorCountSelector = i;
    value_ = CxpRxEventTagErrorCount;
}
```

19.15. CxpRxEventOverAckCount

The parameter counts instances where another event packet is received, but the corresponding acknowledgment cannot be sent because the transmitter is still sending a previous event acknowledgment.

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.15. Parameter properties of CxpRxEventOverAckCount

Property	Value
Name	**CxpRxEventOverAckCount**
Display Name	**CXP Rx Event Over Acknowledge Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.15. Usage of CxpRxEventOverAckCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventOverAckCountSelector = i;
    value_ = CxpRxEventOverAckCount;
}
```

19.16. CxpRxEventIncompleteCount

This parameter counts how many incomplete event packets were received, for example event packets with a missing end-of-packet indicator:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.16. Parameter properties of CxpRxEventIncompleteCount

Property	Value
Name	**CxpRxEventIncompleteCount**
Display Name	**CXP Rx Event Incomplete Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.16. Usage of CxpRxEventIncompleteCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventIncompleteCountSelector = i;
    value_ = CxpRxEventIncompleteCount;
}
```

19.17. PacketTagErrorCount

This parameter shows how many received packets have a tag that is not compliant with the expected tag according to the CXP standard. The counter increments when gaps are observed in the sequence of stream packet tag enumerations.

Details:

- The parameter is 12 bits wide.
- Bits [10:0] represent the actual counter value (maximum value: 2,047).
- Bit [11] indicates counter overflow. When this bit is set, the counter value should be ignored because more than 2,047 error situations occurred.

Range: 0 to 4,095 (12-bit representation).

Table 19.17. Parameter properties of PacketTagErrorCount

Property	Value
Name	**PacketTagErrorCount**
Display Name	**Packet Tag Error Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 4095** **Stepsize 1**

Example 19.17. Usage of PacketTagErrorCount

```
/* Get */ value_ = PacketTagErrorCount;
```

19.18. SystemmonitorPacketbufferOverflowCount

This parameter monitors overflow situations in the channel bonding packet buffer. Such overflow conditions can only occur in configurations using more than one fiber lane due to the CXP protocol.

Details:

- The parameter is 12 bits wide.
- Bits [10:0] represent the actual counter value (maximum value: 2047).
- Bit [11] indicates counter overflow. When this bit is set, the counter value should be ignored because more than 2,047 error situations occurred.

Range: 0 to 4095 (12-bit representation).

Table 19.18. Parameter properties of SystemmonitorPacketbufferOverflowCount

Property	Value
Name	**SystemmonitorPacketbufferOverflowCount**
Display Name	**Systemmonitor Packetbuffer Overflow Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 4095** **Stepsize 1**

Example 19.18. Usage of SystemmonitorPacketbufferOverflowCount

```
/* Get */ value_ = SystemmonitorPacketbufferOverflowCount;
```

19.19. SystemmonitorPacketbufferOverflowSource

The parameter implements a bit mask to query in which of the potential 4 CXP channels (fiber lanes) the packet buffer overflow occurred. The order is: LSB = lowest CXP channel number, MSB = highest CXP channel number allocated by the operator. Range: 0x0 to 0xF (4 bits).

Table 19.19. Parameter properties of SystemmonitorPacketbufferOverflowSource

Property	Value
Name	**SystemmonitorPacketbufferOverflowSource**
Display Name	**Systemmonitor Packetbuffer Overflow Source**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 15** **Stepsize 1**

Example 19.19. Usage of SystemmonitorPacketbufferOverflowSource

```
/* Get */ value_ = SystemmonitorPacketbufferOverflowSource;
```

19.20. CxpImageTagErrorCount

This parameter counts the number of mismatches between the image header tag, the expected tag according to the CXP standard, and the received tag.

Details:

- The parameter is **12 bits wide**.
- **Bits [10:0]** represent the actual counter value (maximum value: 2,047).
- **Bit [11]** indicates **counter overflow**. When this bit is set, the counter value should be ignored because more than 2,047 error situations occurred.

Range: 0 to 4,095 (12-bit representation).

Table 19.20. Parameter properties of CxpImageTagErrorCount

Property	Value
Name	**CxpImageTagErrorCount**
Display Name	**CXP Image Tag Error Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 8191** **Stepsize 1**

Example 19.20. Usage of CxpImageTagErrorCount

```
/* Get */ value_ = CxpImageTagErrorCount;
```

19.21. CxpCameraFrameCorruptCount

This parameter counts the number of corrupted frames during acquisition. Corrupted frames are frames containing erroneous pixels that were sent to the VisualApplets pipeline.

Details:

- The parameter is **12 bits wide**.
- **Bits [10:0]** represent the actual counter value (maximum value: 2,047).
- **Bit [11]** indicates **counter overflow**. When this bit is set, the counter value should be ignored because more than 2,047 error situations occurred.

Range: 0 to 4,095 (12-bit representation).

Table 19.21. Parameter properties of CxpCameraFrameCorruptCount

Property	Value
Name	**CxpCameraFrameCorruptCount**
Display Name	**CXP Camera Frame Corrupt Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 33554431** **Stepsize 1**

Example 19.21. Usage of CxpCameraFrameCorruptCount

```
/* Get */ value_ = CxpCameraFrameCorruptCount;
```

19.22. CxpCameraUnexpectedStartupDataCount

This parameter detects an error situation where the first data value after an operator reset was unexpected because no image header was received beforehand. It contains the number of unexpected bytes at the beginning of processing.

Details:

- The parameter is 12 bits wide.
- Bits [10:0] represent the actual counter value (maximum value: 2,047).
- Bit [11] indicates counter overflow. When this bit is set, the counter value should be ignored because more than 2,047 error situations occurred.

Possible Causes:

- Error in the implementation of the camera or frame grabber firmware
- Incorrect software control of the discovery procedure
- Hardware defect in the camera, fiber modules, or fiber cable

Range: 0 to 4,095 (12-bit representation).

Table 19.22. Parameter properties of CxpCameraUnexpectedStartupDataCount

Property	Value
Name	**CxpCameraUnexpectedStartupDataCount**
Display Name	**CXP Camera Unexpected Startup Data Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 4095** **Stepsize 1**

Example 19.22. Usage of CxpCameraUnexpectedStartupDataCount

```
/* Get */ value_ = CxpCameraUnexpectedStartupDataCount;
```

19.23. CxpCameraFrameOversizedCount

The parameter counts the oversized frames during acquisition. Oversized frames are received frames with too many lines or pixels in comparison to the received image header specification. This type of the error condition can occur due to transmission errors caused by hardware defects or due to a firmware bug in the camera implementation. The parameter is 12 bits wide, where the bits [10:0] represent the actual counter value and the bit [11] stands for the counter overflow. When the overflow bit is set, the counter value shall be treated as don't care, i.e. more than 2047 error situations occurred. Range: 0 to 4095 (12 bit).

Table 19.23. Parameter properties of CxpCameraFrameOversizedCount

Property	Value
Name	**CxpCameraFrameOversizedCount**
Display Name	**CXP Camera Frame Oversized Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 4095** **Stepsize 1**

Example 19.23. Usage of CxpCameraFrameOversizedCount

```
/* Get */ value_ = CxpCameraFrameOversizedCount;
```

19.24. CrcErrors

This category gives information about packet CRC errors detected for stream packets and control packets.

19.24.1. SystemmonitorRxPacketCrcErrorCount

This parameter counts occurrences of CRC errors in received packets:

- **Bits [11:0]** represent the number of errors.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.24. Parameter properties of SystemmonitorRxPacketCrcErrorCount

Property	Value
Name	**SystemmonitorRxPacketCrcErrorCount**
Display Name	**System Monitor Rx Packet CRC Error Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.24. Usage of SystemmonitorRxPacketCrcErrorCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    SystemmonitorRxPacketCrcErrorCountSelector = i;
    value_ = SystemmonitorRxPacketCrcErrorCount;
}
```

19.24.2. CxpStreamPacketCrcError

This parameter returns information whether there were CRC errors in received stream packets. Range: 0 (NO) to 1 (YES).

Table 19.25. Parameter properties of CxpStreamPacketCrcError

Property	Value
Name	**CxpStreamPacketCrcError**
Display Name	**CXP Stream Packet CRC Error**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.25. Usage of CxpStreamPacketCrcError

```
/* Get */ for (i = 0; i < 4; ++i)
```

```
{
    CxpStreamPacketCrcErrorSelector = i;
    value_ = CxpStreamPacketCrcError;
}
```

19.24.3. CxpControlAckPacketCrcError

This parameter returns information whether there were CRC errors in received control acknowledgement packets. Range: 0 (NO) to 1 (YES).

Table 19.26. Parameter properties of CxpControlAckPacketCrcError

Property	Value
Name	**CxpControlAckPacketCrcError**
Display Name	**CXP Control ACK Packet CRC Error**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.26. Usage of CxpControlAckPacketCrcError

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpControlAckPacketCrcErrorSelector = i;
    value_ = CxpControlAckPacketCrcError;
}
```

19.24.4. CxpRxEventPacketCrcError

This parameter indicates whether CRC errors occurred in the received event packets.

Range: 0 (NO) to 1 (YES).

Table 19.27. Parameter properties of CxpRxEventPacketCrcError

Property	Value
Name	**CxpRxEventPacketCrcError**
Display Name	**CXP Rx Event Packet CRC Error**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.27. Usage of CxpRxEventPacketCrcError

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventPacketCrcErrorSelector = i;
    value_ = CxpRxEventPacketCrcError;
}
```

19.25. LengthErrors

This category gives information about packet length mismatches for different types of packets.

19.25.1. SystemmonitorRxLengthErrorCount

This parameter counts cases where the actual packet length differs from the length specified in the packet header:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.28. Parameter properties of SystemmonitorRxLengthErrorCount

Property	Value
Name	**SystemmonitorRxLengthErrorCount**
Display Name	**System Monitor Rx Length Error Count**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.28. Usage of SystemmonitorRxLengthErrorCount

```
/* Get */ for (i = 0; i < 4; ++i)
{
    SystemmonitorRxLengthErrorCountSelector = i;
    value_ = SystemmonitorRxLengthErrorCount;
}
```

19.25.2. CxpStreamPacketLengthError

Theis parameter indicates whether length errors occurred in the received stream packets.

Range: 0 (NO) to 1 (YES).

Table 19.29. Parameter properties of CxpStreamPacketLengthError

Property	Value
Name	**CxpStreamPacketLengthError**
Display Name	**CXP Stream Packet Length Error**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.29. Usage of CxpStreamPacketLengthError

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpStreamPacketLengthErrorSelector = i;
    value_ = CxpStreamPacketLengthError;
}
```

19.25.3. CxpRxEventPacketLengthError

This parameter indicates whether length errors occurred in the received event packets.

Range: 0 (NO) to 1 (YES).

Table 19.30. Parameter properties of CxpRxEventPacketLengthError

Property	Value
Name	**CxpRxEventPacketLengthError**
Display Name	**CXP Rx Event Packet Length Error**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.30. Usage of CxpRxEventPacketLengthError

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventPacketLengthErrorSelector = i;
    value_ = CxpRxEventPacketLengthError;
}
```

19.26. ReceivedPacketsCorrected

This category gives information about errors which occurred in received packets which have been corrected.

19.26.1. CxpErrorCorrected

This parameter counts errors received in packet headers and trailers that were corrected:

- **Bits [11:0]** represent the number of violations.
- **Bit [12]** indicates overflow.
- **Range**: 0 to 8191 (13 bits).

Table 19.31. Parameter properties of CxpErrorCorrected

Property	Value
Name	**CxpErrorCorrected**
Display Name	**CXP Error Corrected**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.31. Usage of CxpErrorCorrected

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorCorrectedSelector = i;
```

```
    value_ = CxpErrorCorrected;
}
```

19.26.2. CxpErrorCorrectedTrigger

This parameter returns the information whether errors were corrected in received trigger packets. Range: 0 (NO) to 1 (YES).

Table 19.32. Parameter properties of CxpErrorCorrectedTrigger

Property	Value
Name	**CxpErrorCorrectedTrigger**
Display Name	**CXP Error Corrected Trigger**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.32. Usage of CxpErrorCorrectedTrigger

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorCorrectedTriggerSelector = i;
    value_ = CxpErrorCorrectedTrigger;
}
```

19.26.3. CxpErrorCorrectedTriggerAck

This parameter returns the information whether errors were corrected in received trigger acknowledge packets. Range: 0 (NO) to 1 (YES).

Table 19.33. Parameter properties of CxpErrorCorrectedTriggerAck

Property	Value
Name	**CxpErrorCorrectedTriggerAck**
Display Name	**CXP Error Corrected Trigger ACK**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.33. Usage of CxpErrorCorrectedTriggerAck

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorCorrectedTriggerAckSelector = i;
    value_ = CxpErrorCorrectedTriggerAck;
}
```

19.26.4. CxpErrorCorrectedStream

This parameter returns the information whether errors were corrected in received stream packets. Range: 0 (NO) to 1 (YES).

Table 19.34. Parameter properties of CxpErrorCorrectedStream

Property	Value
Name	**CxpErrorCorrectedStream**
Display Name	**CXP Error Corrected Stream**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.34. Usage of CxpErrorCorrectedStream

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorCorrectedStreamSelector = i;
    value_ = CxpErrorCorrectedStream;
}
```

19.26.5. CxpErrorCorrectedControlAck

This parameter returns the information whether errors were corrected in received stream acknowledge packets. Range: 0 (NO) to 1 (YES).

Table 19.35. Parameter properties of CxpErrorCorrectedControlAck

Property	Value
Name	**CxpErrorCorrectedControlAck**
Display Name	**CXP Error Corrected Control ACK**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.35. Usage of CxpErrorCorrectedControlAck

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorCorrectedControlAckSelector = i;
    value_ = CxpErrorCorrectedControlAck;
}
```

19.26.6. CxpErrorCorrectedHeartbeat

This parameter returns the information whether errors were corrected in received heartbeat packets. Range: 0 (NO) to 1 (YES).

Table 19.36. Parameter properties of CxpErrorCorrectedHeartbeat

Property	Value
Name	**CxpErrorCorrectedHeartbeat**
Display Name	**CXP Error Corrected Heartbeat**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.36. Usage of CxpErrorCorrectedHeartbeat

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorCorrectedHeartbeatSelector = i;
    value_ = CxpErrorCorrectedHeartbeat;
}
```

19.26.7. CxpRxBridgeErrorsCorrected

This parameter indicates whether any errors in the received bridge data were corrected.

Range: 0 (NO) to 1 (YES).

Table 19.37. Parameter properties of CxpRxBridgeErrorsCorrected

Property	Value
Name	**CxpRxBridgeErrorsCorrected**
Display Name	**CXP Rx Bridge Errors Corrected**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.37. Usage of CxpRxBridgeErrorsCorrected

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxBridgeErrorsCorrectedSelector = i;
    value_ = CxpRxBridgeErrorsCorrected;
}
```

19.26.8. CxpRxEventPacketCorrected

This parameter indicates whether errors were corrected in received event packets.

Range: 0 (NO) to 1 (YES).

Table 19.38. Parameter properties of CxpRxEventPacketCorrected

Property	Value
Name	**CxpRxEventPacketCorrected**
Display Name	**CXP Rx Event Packet Corrected**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.38. Usage of CxpRxEventPacketCorrected

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventPacketCorrectedSelector = i;
    value_ = CxpRxEventPacketCorrected;
}
```

19.26.9. CameraCorrectedErrorCount

The parameter counts the number of single-byte error corrections in CXP stream packets.

Table 19.39. Parameter properties of CameraCorrectedErrorCount

Property	Value
Name	**CameraCorrectedErrorCount**
Display Name	**Corrected Error Count**
Interface	**IInteger**
Access policy	**Read-Only**
Visibility	**Expert**
Allowed values	**Minimum 0** **Maximum 4095** **Stepsize 1**

Example 19.39. Usage of CameraCorrectedErrorCount

```
/* Get */ value_ = CameraCorrectedErrorCount;
```

19.27. ReceivedPacketsUncorrected

This category gives information about errors which occurred in received packets and which could not be corrected.

19.27.1. CxpErrorUncorrected

The parameter counts errors received in packet headers and trailers which could not be corrected. Bits [11:0] count the number of violations. Bit [12] indicates the counter overflow. Range: 0 to 8191 (13 bit).

Table 19.40. Parameter properties of CxpErrorUncorrected

Property	Value
Name	**CxpErrorUncorrected**
Display Name	**CXP Error Uncorrected**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.40. Usage of CxpErrorUncorrected

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorUncorrectedSelector = i;
    value_ = CxpErrorUncorrected;
}
```

19.27.2. CxpErrorUncorrectedTrigger

The parameter notifies whether there were errors in received trigger packets which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.41. Parameter properties of CxpErrorUncorrectedTrigger

Property	Value
Name	**CxpErrorUncorrectedTrigger**
Display Name	**CXP Error Uncorrected Trigger**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.41. Usage of CxpErrorUncorrectedTrigger

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorUncorrectedTriggerSelector = i;
    value_ = CxpErrorUncorrectedTrigger;
}
```

19.27.3. CxpErrorUncorrectedTriggerAck

The parameter notifies whether there were errors in received trigger acknowledgement packets which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.42. Parameter properties of CxpErrorUncorrectedTriggerAck

Property	Value
Name	**CxpErrorUncorrectedTriggerAck**
Display Name	**CXP Error Uncorrected Trigger ACK**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.42. Usage of CxpErrorUncorrectedTriggerAck

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorUncorrectedTriggerAckSelector = i;
    value_ = CxpErrorUncorrectedTriggerAck;
}
```

19.27.4. CxpErrorUncorrectedStream

The parameter notifies whether there were errors in received stream packets which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.43. Parameter properties of CxpErrorUncorrectedStream

Property	Value
Name	**CxpErrorUncorrectedStream**
Display Name	**CXP Error Uncorrected Stream**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.43. Usage of CxpErrorUncorrectedStream

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorUncorrectedStreamSelector = i;
    value_ = CxpErrorUncorrectedStream;
}
```

19.27.5. CxpErrorUncorrectedControlAck

This parameter notifies whether there were errors in received control acknowledgement packets which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.44. Parameter properties of CxpErrorUncorrectedControlAck

Property	Value
Name	**CxpErrorUncorrectedControlAck**
Display Name	**CXP Error Uncorrected Control ACK**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.44. Usage of CxpErrorUncorrectedControlAck

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorUncorrectedControlAckSelector = i;
    value_ = CxpErrorUncorrectedControlAck;
}
```

19.27.6. CxpErrorUncorrectedHeartbeat

The parameter notifies whether there were errors in received heartbeat packets which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.45. Parameter properties of CxpErrorUncorrectedHeartbeat

Property	Value
Name	**CxpErrorUncorrectedHeartbeat**
Display Name	**CXP Error Uncorrected Heartbeat**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.45. Usage of CxpErrorUncorrectedHeartbeat

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpErrorUncorrectedHeartbeatSelector = i;
    value_ = CxpErrorUncorrectedHeartbeat;
}
```

19.27.7. CxpRxBridgeErrorsUncorrected

The parameter notifies whether there were errors in received bridge data which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.46. Parameter properties of CxpRxBridgeErrorsUncorrected

Property	Value
Name	**CxpRxBridgeErrorsUncorrected**
Display Name	**CXP Rx Bridge Errors Uncorrected**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.46. Usage of CxpRxBridgeErrorsUncorrected

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxBridgeErrorsUncorrectedSelector = i;
    value_ = CxpRxBridgeErrorsUncorrected;
}
```

19.27.8. CxpRxEventPacketUncorrected

The parameter notifies whether there were errors in received event packets which could not be corrected. Range: 0 (NO) to 1 (YES).

Table 19.47. Parameter properties of CxpRxEventPacketUncorrected

Property	Value
Name	**CxpRxEventPacketUncorrected**
Display Name	**CXP Rx Event Packet Uncorrected**
Interface	**IInteger (Field)**
Field Size	**4**
Access policy	**Read-Only**
Visibility	**Expert**

Example 19.47. Usage of CxpRxEventPacketUncorrected

```
/* Get */ for (i = 0; i < 4; ++i)
{
    CxpRxEventPacketUncorrectedSelector = i;
    value_ = CxpRxEventPacketUncorrected;
}
```

Chapter 20. Revision History

Revision history of acquisition applet releases.

Applet Version	Release Date	Change Log	Delivered with
1.0.1.0	30 Jan 2026	Initial version of this applet.	Framegrabber SDK 5.11.50
1.1.2.0	02 Feb 2026	Applet rebuilt with maximum CXP-packet size of 8 kB.	Framegrabber SDK 5.11.50
1.2.3.0	09 Feb 2026	• Fixed an issue regarding the Signal Analyzer. • Added fiber statistics parameters.	Framegrabber SDK 5.11.51
1.2.4.0	12 Feb 2026	• Added missing trigger events for `FrontGPI2` and `FrontGPI3`. • Added debounce parameters for `GPI` and `FrontGPI`.	Framegrabber SDK 5.11.52
1.2.5.0	23 Feb 2026	• Fixed an issue that occurred when loading the GPIO control settings `FG_FRONT_GPI_PULL_CONTROL_03`, `FG_FRONT_GPI_PULL_CONTROL_47`, `FG_FRONT_GPI_TYPE_03`, and `FG_FRONT_GPI_TYPE_47` from an MCF file. • Removed the error message “Failed in saving field parameter...” that appeared when saving the configuration to an MCF file.	Framegrabber SDK 5.11.53

20.1. Changes and Fixed Issues

20.1.1. Changes in Version 1.2.5.0

- Before fixing this issue, the GPIO control settings `FG_FRONT_GPI_PULL_CONTROL_03`, `FG_FRONT_GPI_PULL_CONTROL_47`, `FG_FRONT_GPI_TYPE_03`, and `FG_FRONT_GPI_TYPE_47` weren't loaded from the MCF file. This issue has been fixed.
- Before fixing this issue, a misleading error message appeared in the log file when saving a configuration to an MCF file. This issue has been fixed.

20.1.2. Changes in Version 1.2.4.0

- The trigger events for `FrontGPI2` and `FrontGPI3` were missing and have been added.
- Debounce parameters for `GPI` and `FrontGPI` have been added to the category `Digital I/O`.

20.1.3. Changes in Version 1.2.3.0

- For the Signal Analyzer, the source signals `LineStart`, `LineEnd`, `FrameStart`, and `FrameEnd` didn't work correctly. This issue has been fixed.
- Fiber statistics parameters have been added to the category `BoardStatus`.

20.1.4. Changes in Version 1.1.2.0

- The maximum CXP-packet size changed from 16384 bytes to 8192 bytes (see section "Known Issues").

20.2. Known Issues

- The applet supports only a maximum CXP-packet size of 8192 bytes.
- The newly added debounce parameters for Digital I/O interfer with the line trigger debounce settings as they map to the same applet parameters.

Glossary

Area of Interest (AOI)	See Region of Interest.
Board	A Basler hardware. Usually, a board is represented by a frame grabber. Boards might comprise multiple devices.
Board ID Number	An identification number of a Basler board in a PC system. The number is not fixed to a specific hardware but has to be unique in a PC system.
Camera Index	The index of a camera connected to a frame grabber. The first camera will have index zero. Mind the difference between the camera index and the frame grabber camera port. See also Camera Port.
Camera Port	The Basler frame grabber connectors for cameras are called camera ports. They are numbered {0, 1, 2, ...} or enumerated {A, B, C, ... }. Depending on the interface one camera could be connected to multiple camera ports. Also, multiple cameras could be connected to one camera port.
Camera Tap	See Tap.
Device	A board can consist of multiple devices. Devices are numbered. The first device usually has number one.
Direct Memory Access (DMA)	A DMA transfer allows hardware subsystems within the computer to access the system memory independently of the central processing unit (CPU). Basler uses DMAs for data transfer such as image data between a board e.g. a frame grabber and a PC. Data transfers can be established in multiple directions i.e. from a frame grabber to the PC (download) and from the PC to a frame grabber (upload). Multiple DMA channels may exist for one board. Control and configuration data usually do not use DMA channels.
DMA Channel	See DMA Index.
DMA Index	The index of a DMA transfer channel. See also Direct Memory Access.
Event	In programming or runtime environments, a callback function is a piece of executable code that is passed as an argument, which is expected to call back (execute) exactly that time an event is triggered. These events are not related to a special camera functionality and based on frame grabber internal functionality. Basler uses hardware interrupts for the event transfer and processing is absolutely optimized for low latency. These interrupts are only produced by the frame grabber if an event is registered and activated by software. If an event is fired at a very high frequency this may influence the system performance. For example these events can be used to check the reliability between a frame trigger input and the resulting and expected camera frame. The Basler Framegrabber SDK enables an application to get these event notifications about certain state changes at the data flow from camera to RAM and the image and trigger processing as well. Please consult the Basler Framegrabber SDK documentation for more details concerning the implementation of this functionality. Some events are enabled to produce additional data, which is described for the event itself.

Frame Grabber	Usually a PC hardware using PCI express to interface the camera and grab camera images. The frame grabber will grab, buffer, pre-process and forward the images to the PC memory. Moreover, the frame grabber performs the trigger signal processing to trigger the camera, external lights and controllers. On V-series frame grabber custom processing can be implemented using VisualApplets. See also Direct Memory Access, Interface Card, VisualApplets.
GenICam	Generic Interface for Cameras is a generic programming interface for machine vision (industrial) cameras.
GenTL	GenICam Transport Layer. This is the transport layer interface for enumerating cameras, grabbing images from the camera, and moving them to the user application.
Interface Card	Usually a PC hardware using PCI express to interface the camera and grab camera images. The interface card will grab, buffer and forward the images to the PC memory. Moreover, the interface card performs the trigger signal processing to trigger the camera, external lights and controllers. See also Direct Memory Access, Frame Grabber.
Port	See Camera Port.
Process	An image or signal data processing block. A process can include one or more cameras, one or more DMA channels and modules.
Region of Interest (ROI)	Represents a part of a frame. Mostly rectangular and within the original image boundaries. Defined by source coordinates and its dimension. The frame grabber cuts the region of interest from the camera image. A region of interest might reduce or increase the required bandwidth and the corresponding image dimension.
Sensor Tap	See Tap.
Software Callback	See Event.
Tap	Some cameras have multiple taps. This means, they can acquire or transfer more than one pixel at a time which increses the camera's acquisition speed. The camera sensor tap readout order varies. Some cameras read the pixels interlaced using multiple taps, while some cameras read the pixel simultaneously from different locations on the sensor. The reconstruction of the frame is called sensor readout correction. The Camera Link interface is also using multiple taps for image transfer to increase the bandwidth. These taps are independent from the sensor taps.
Trigger	In machine vision and image processing, a trigger is an event which causes an action. This can be for example the initiation of a new line or frame acquisition, the control of external hardware such as flash lights or actions by a software applications. Trigger events can be initiated by external sources, an internal frequency generator (timer) or software applications. The event itself is mostly based on a rising or falling edge of a electrical signal.
Trigger Input	A logic input of a trigger IO. The first input has index 0. Check mapping of input pins to logic inputs in the hardware documentation.
Trigger Output	A logic output of a trigger IO. The first output has index 1. Please check the mapping of output pins to logic outputs in the hardware documentation. The electrical characteristics and specification can be found related to the selected or used trigger board/connector.
Trigger Reliability	See Event.

User Interrupt	See Event.
VisualApplets	Simple programming of FPGA-based image processing devices. VisualApplets enables access to the FPGA processors in the image processing hardware, such as frame grabbers, industrial cameras and image processing devices, to implement individual image processing applications.

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