SILICONSOFTWARE GmbH

User Documentation

AcquisitionApplets Advanced

MediumLineRGB24

for microEnable IV AD4-CL/-PoCL

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User Documentation

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for microEnable IV AD4-CL/-PoCL

Applet Characteristics

Applet Name	MediumLineRGB24
Applet Version	2.1.0
Type of Applet	AcquisitionApplets Advanced
Frame Grabber	microEnable IV AD4-CL/-PoCL
No. of Cameras	1
Camera Interface	Camera Link MEDIUM Configuration
Sensor Type	Line Scan
Color	RGB
Processing Bit Depth	8 Bit per Color Component

Supplemental Information

1. Runtime Software Documentation: Is part of the Runtime Software Installation [InstDir]/doc
2. AcquisitionApplets Advanced Release Notes: Please refer to the Runtime Software Documentation, section *AcquisitionApplets Advanced - Release Notes*
3. Software Updates and Support (engl.): www.Silicon-Software.info/en/downloads.html
4. Software Updates and Support (dt.): www.Silicon-Software.info/de/downloads.html

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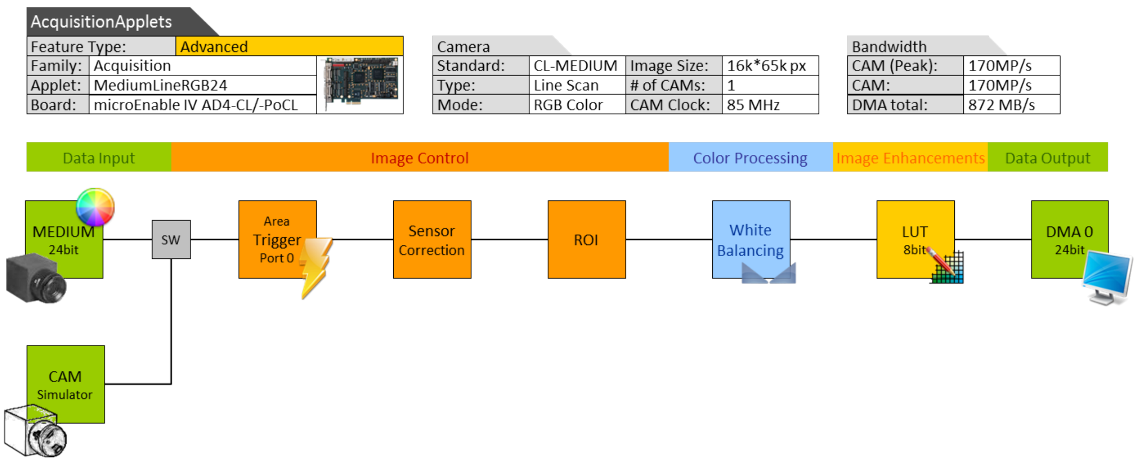
Chapter 1. Introduction

This document provides detailed information on the Silicon Software AcquisitionApplets Advanced "MediumLineRGB24" for microEnable IV AD4-CL/-PoCL frame grabbers. This document will outline the features and benefits of this AcquisitionApplets Advanced. Furthermore, the output formats and the software interface is explained. The main part of this document includes the detailed description of all applet modules and their parameters which make the AcquisitionApplets Advanced adaptable for numerous applications.

1.1. Features of Applet MediumLineRGB24

Figure 1.1. Block Diagram of AcquisitionApplets Advanced MediumLineRGB24



AcquisitionApplets Advanced "MediumLineRGB24" is a single camera applet. The Camera Link camera interface can be configured for Camera Link cameras in Medium-Configuration mode transferring RGB pixels at a bit depth of 24 bits. A multi-functional line trigger is included to control the camera or external devices using grabber generated, external or software generated trigger pulses. Line scan cameras up to a width of 16384 pixels can be processed. The trigger system will generate images of a maximum height of 65535 pixels. The applet is processing data at a bit depth of 8 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 grabbers and PCs. The applet includes a sensor correction which sorts the taps of subsensors. Acquired images are buffered in frame grabber memory. A ROI can be selected for further processing. The stepsize of the ROI width is 4 pixel and the ROI stepsize for the image height is 1 lines. A white balancing module for individual gain of each color component enhances image quality. The full resolution lookup table can either be configured by using a user defined table or by using a processor. The processor gives the opportunity to use pre-defined functions such as offset, gain, and gamma to enhance the image quality. The color components are processed individually.

Processed image data is output via a high speed DMA channel. The output pixel format is 24 bits per pixel in BGR color component order.

The applet can easily be included into user applications using the Silicon Software runtime.

Table 1.1. Feature Summary of MediumLineRGB24

Feature	Applet Property
Applet Name	MediumLineRGB24
Type of Applet	AcquisitionApplets Advanced
Board	microEnable IV AD4-CL/-PoCL
No. of Cameras	1
Camera Type	Camera Link Medium Configuration (24 Bit RGB only)
Sensor Type	Line Scan
Camera Format	RGB
Processing Bit Depth	8 Bit per color component
Sensor Correction / Tap Sorting	yes
Maximum Images Dimensions	16384 * 65535
ROI Stepsize	x: 4, y: 1
Mirroring	no
Image Selector	Yes
Noise Filter	No
Shading Correction	No
Dead Pixel Interpolation	No
Bayer Filter	No
Color White Balancing	Yes
Lookup Table	Full Resolution
DMA	High Speed (DMA900)
DMA Image Output Format	BGR 24 bits
Event Generation	yes
Overflow Control	yes

1.1.1. Parameterization Order

It is recommended to configure the functional blocks which are responsible for sensor correction first. This will be the camera settings, shading correction and dead pixel interpolation, if available. Afterwards, other image enhancement functional blocks can be configured, such as the white balancing, noise filter and lookup table.

1.2. Bandwidth

The maximum bandwidths of applet MediumLineRGB24 are listed in the following table.

Table 1.2. Bandwidth of MediumLineRGB24

Description	Bandwidth
Max. CamClk	85 MHz
Peak Bandwidth per Camera	170 MPixel/s
Mean Bandwidth per Camera	170 MPixel/s
DMA Bandwidth	872 MByte/s (depends on PC mainboard)

Max. CamClk refers to the maximum pixel clock frequency used by the the Camera Link camera. You can use any lower pixel clock frequency.

The peak bandwidth defines the maximum allowed bandwidth for each camera at the camera interface. When transferring data from the camera to the frame grabber at this bandwidth, the buffer on the frame grabber will fill up as the data can be buffered, but not being processed at that speed. The peak bandwidth is related to the Camera Link interface mode and pixel clock frequency. The product of the used Camera Link taps and the pixel frequency must not exceed the peak bandwidth.

The mean bandwidth per camera describes the maximum allowed mean bandwidth for each camera at the camera interface. It is the product of the framerate and the image pixels. For example, for a 1 Megapixel image and a framerate of 100 fps, the mean bandwidth will be 100 MPixel/s.

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 depends on the applet and the parameterization. 1 MByte is 1,000,000 Byte.

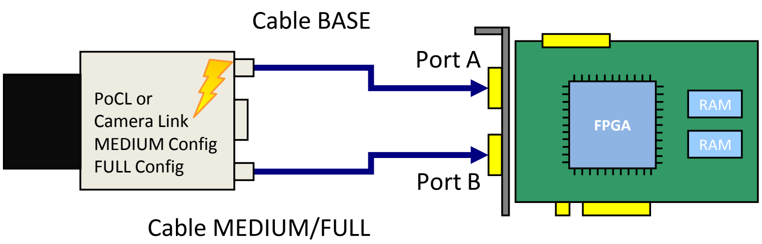
Bandwidth Varies

The exact maximum DMA bandwidth depends on the used PC system. The camera bandwidth depends on the image size. The given values might vary.

1.3. Camera Interface

AcquisitionApplets Advanced "MediumLineRGB24" supports one Camera Link camera in medium configuration mode. The frame grabber has two Camera Link connectors. Connect the camera to port 'A' with its base connector and to port 'B' with its medium connector.

Figure 1.2. Camera Interface and Camera Cable Setup



1.4. Image Transfer to PC Memory

Image transfer between the frame grabber and the PC is performed by DMA transfers. In this applet, only one DMA channel exists to transfer the image data. The DMA channel has index 0. The applet output format can be set with the parameters of the output format module. See Chapter 15, *Output Format*. All outputs are little endian coded.

DMA Image Tag

The applet does not generate a valid DMA image tag (*FG_IMAGE_TAG*). Check for lost or corrupted frames using the overflow module described in Chapter 10, *Overflow*.

Chapter 2. Software Interface

The software interface is fully compatible to the Silicon Software runtime. Please read the SDK manual of the Silicon Software runtime software to understand how to include the microEnable frame grabbers and their applets into own applications.

The runtime includes functional SDK examples which use the features of the runtime. Most of these examples can be used with this AcquisitionApplets Advanced. These examples are very useful to learn on how to acquire images, set parameters and use events.

This document is focused on the explanation of the functionality and parameterization of the applet. The next chapter will list all parameters of this applet. Keep in mind that for multi-camera applets, parameters are can be set for all cameras individually. The sample source codes in parameterize the processing components of the first camera. The index in the source code examples has to be changed for the other cameras.

Amongest others, parameters of the applet are set and read using functions

- int Fg_setParameter(Fg_Struct *Fg, const int Parameter, const void *Value, const unsigned int index)
- int Fg_setParameterWithType(Fg_Struct *Fg, const int Parameter, const void *Value, const unsigned int index, const enum FgParamTypes type)
- int Fg_getParameter(Fg_Struct *Fg, int Parameter, void *Value, const unsigned int index)
- int Fg_getParameterWithType(Fg_Struct *Fg, const int Parameter, void *Value, const unsigned int index, const enum FgParamTypes type)

The index is used to address a DMA channel a camera index or a processing logic index. It is important to understand the relations between cameras, processes, parameters and DMA channels. This AcquisitionApplets Advanced is a single camera applet and is using only one DMA channel. All parameterizations are made using index 0 only.

For applets having multiple DMA channels for each camera, the relation between the indices is more complex. Please check the respective documentation of these applets for more details.

Chapter 3. Camera Link

This AcquisitionApplets Advanced can be used with one line scan camera in Camera Link 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 grabber's camera interface to match with the individual camera properties. Most cameras support different operation modes. Please, consult the manual of your camera to obtain the necessary information, how to configure the camera to the desired data format.

Ensure that the lines transferred by the camera do not exceed the maximum allowed line length for this applet (16384).

3.1. FG_CAMERA_LINK_CAMTYPE

This parameter specifies the data format of the connected camera.

This camera interface can be configured to support the different data formats specified by the Camera Link standard. In this AcquisitionApplets Advanced,the processing data bit depth is 8 bit. The camera interface automatically performs a conversion to the 8 bit format using bit shifting independently from the selected camera format. If the Camera Link bit depth is greater than the processing bit depth, bits will be right shifted to meet the internal bit depth. If the Camera Link 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.

Table 3.1. Parameter properties of FG_CAMERA_LINK_CAMTYPE

Property	Value
Name	**FG_CAMERA_LINK_CAMTYPE**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_CL_MEDIUM_RGB_24** 24bit RGB Medium
Default value	**FG_CL_MEDIUM_RGB_24**

Example 3.1. Usage of FG_CAMERA_LINK_CAMTYPE

```
int result = 0;
unsigned int value = FG_CL_MEDIUM_RGB_24;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_CAMERA_LINK_CAMTYPE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_CAMERA_LINK_CAMTYPE, &value, 0, type)) < 0) {
    /* error handling */
}
```

3.2. FG_USEDVAL

With this parameter it is possible to support cameras that do not fully comply with the Camera Link specification. If **FG_YES** is selected, DVAL, LVAL and FVAL is used to decode valid pixels. If the parameter is set to **FG_NO**, only LVAL and FVAL is used to decode valid pixels. If you are not sure about the required setting, keep the parameter's value at **FG_YES**.

Table 3.2. Parameter properties of FG_USEDVAL

Property	Value
Name	**FG_USEDVAL**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_YES** Yes **FG_NO** No
Default value	**FG_YES**

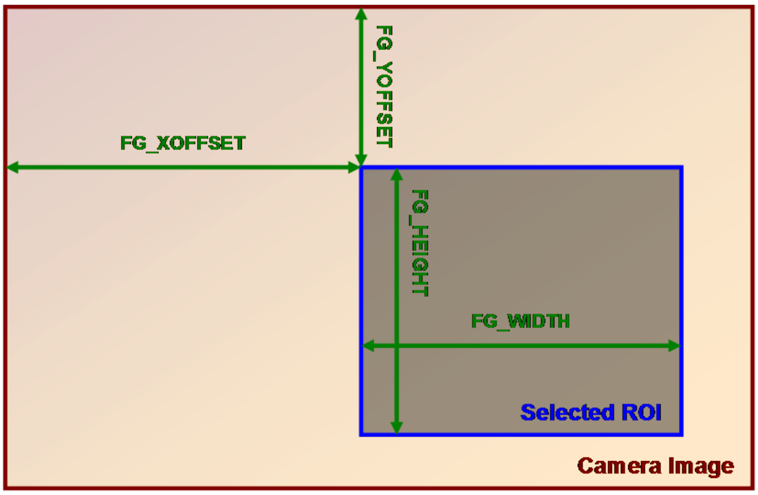
Example 3.2. Usage of FG_USEDVAL

```
int result = 0;
unsigned int value = FG_YES;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_USEDVAL, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_USEDVAL, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 4. ROI

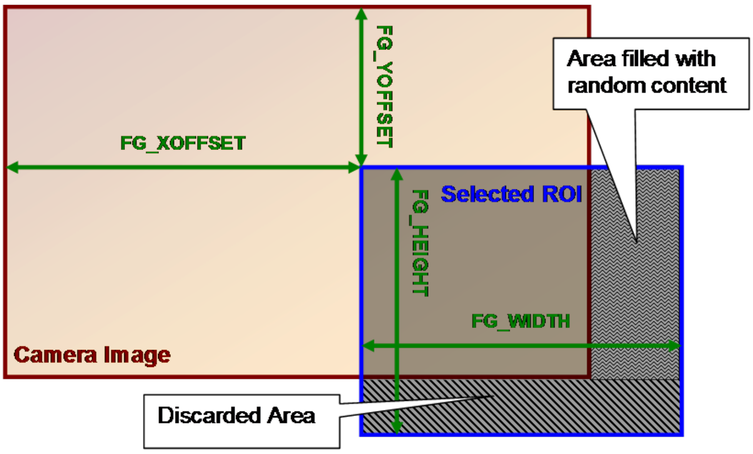
This module allows the definition of a region of interest (ROI), also called area of interest (AOI). A ROI allows the selection of a smaller subset pixel area from the input image. It is defined by using parameters *FG_XOFFSET*, *FG_WIDTH*, *FG_YOFFSET* and *FG_HEIGTH*. The following figure illustrates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

Figure 4.1. 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 grater 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 4.2. Region of Interest Selection Outside the Input Image Dimensions



Furthermore, mind that the image send by the camera must not exceed the maximum allowed image dimensions. This applet allows a maximum image width of 16384 pixels and a maximum image height of 65535 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 4 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.

Camera ROI

Most cameras allow the setting of a ROI inside the camera. The ROI settings described in this section are independent from the camera settings.

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.

4.1. FG_WIDTH

The parameter specifies the width of the ROI. The values of parameters *FG_WIDTH* + *FG_XOFFSET* must not exceed the maximum image width of 16384 pixels.

Table 4.1. Parameter properties of FG_WIDTH

Property	Value
Name	FG_WIDTH
Type	Unsigned Integer
Access policy	Read/Write
Storage policy	Persistent
Allowed values	Minimum 8 Maximum 16384 Stepsize 4
Default value	1024
Unit of measure	pixel

Example 4.1. Usage of FG_WIDTH

```
int result = 0;
unsigned int value = 1024;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_WIDTH, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_WIDTH, &value, 0, type)) < 0) {
    /* error handling */
}
```

4.2. FG_HEIGHT

The parameter specifies the height of the ROI. The values of parameters *FG_HEIGHT* + *FG_YOFFSET* must not exceed the maximum image height of 65535 pixels.

Table 4.2. Parameter properties of FG_HEIGHT

Property	Value
Name	**FG_HEIGHT**
Type	**Unsigned Integer**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**Minimum 8** **Maximum 65535** **Stepsize 1**
Default value	**1024**
Unit of measure	**pixel**

Example 4.2. Usage of FG_HEIGHT

```
int result = 0;
unsigned int value = 1024;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_HEIGHT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_HEIGHT, &value, 0, type)) < 0) {
    /* error handling */
}
```

4.3. FG_XOFFSET

The x-offset is defined by this parameter.

Table 4.3. Parameter properties of FG_XOFFSET

Property	Value
Name	**FG_XOFFSET**
Type	**Unsigned Integer**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 16376** **Stepsize 4**
Default value	**0**
Unit of measure	**pixel**

Example 4.3. Usage of FG_XOFFSET

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_XOFFSET, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_XOFFSET, &value, 0, type)) < 0) {
    /* error handling */
}
```

4.4. FG_YOFFSET

The y-offset is defined by this parameter.

Table 4.4. Parameter properties of FG_YOFFSET

Property	Value
Name	**FG_YOFFSET**
Type	**Unsigned Integer**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 65534** **Stepsize 1**
Default value	**0**
Unit of measure	**pixel**

Example 4.4. Usage of FG_YOFFSET

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_YOFFSET, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_YOFFSET, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 5. Sensor Correction

Most camera sensors are read out sequentially in the so called raster scan format (line by line from top-left to bottom-right). However, to speed up the data transfer, some sensors can be configured to read out several pixels in parallel. As a result, succeeding pixels which are transferred via the Camera Link cable are not necessarily neighboring pixels. The sensor readout correction can re-order the pixels on board of the frame grabber and transform the grabbed image in the usual raster-scan fashion. All common readout strategies are supported to save computational power of the host system.

The sensor correction module in this AcquisitionApplets Advanced is configured by a set of parameters to perform the desired correction. Namely, the parameters are **FG_SC_SENSORLENGTH**, **FG_SC_SUBSENSORCOUNT**, **FG_SC_TAPCOUNT**, **FG_SC_ROTATEDSENSOR**, **FG_SC_READOUTDIRECTION** and **FG_SC_PIXELORDER**.

Use preset parameter FG_SENSORREADOUT

Instead of using the parameters described above, one of the presets defined by *FG_SENSORREADOUT* can be used.

- **FG_SC_SENSORLENGTH**:

  This parameter has to be set to the actual sensor length of the camera without any ROI or offset considerations defined in the applet. In the current version of this AcquisitionApplets Advanced, this parameter has no influence on the functionality and is included for compatibility reasons for future releases only.

- **FG_SC_SUBSENSORCOUNT**:

  The sensor of the camera is assumed to be divided into several subsensors. The number of these subsensors is set by this parameter. For this AcquisitionApplets Advanced this can either be 1 or 2 subsensors.

- **FG_SC_TAPCOUNT**:

  The number of taps, the camera uses to transfer the pixels is defined by this parameter. For this AcquisitionApplets Advanced this can either be 1 or 2 subsensors.

  These taps are not related to the taps known from Camera Link transfers but the numer is equal in many cases.

- **FG_SC_ROTATEDSENSOR**:

  It is assumed that the subsensors of the camera will be read in a linear fashion e.g. first subsensor 0, next subsensor 1, next subsensor 2 and finally subsensor 3. It is not possible to read subsensors in a shuffled order such as 0, 2, 1, 3 for example. For some cameras, the sensor is read out in rotated order i.e. 3, 2, 1, 0. This can be defined by this parameter.

- **FG_SC_READOUTDIRECTION**:

  The read out direction defines the order to read out pixels out of a subsensor i.e. in forward = 0 or backward = 1 direction. This is a field parameter, where a value can be set for every subsensor.

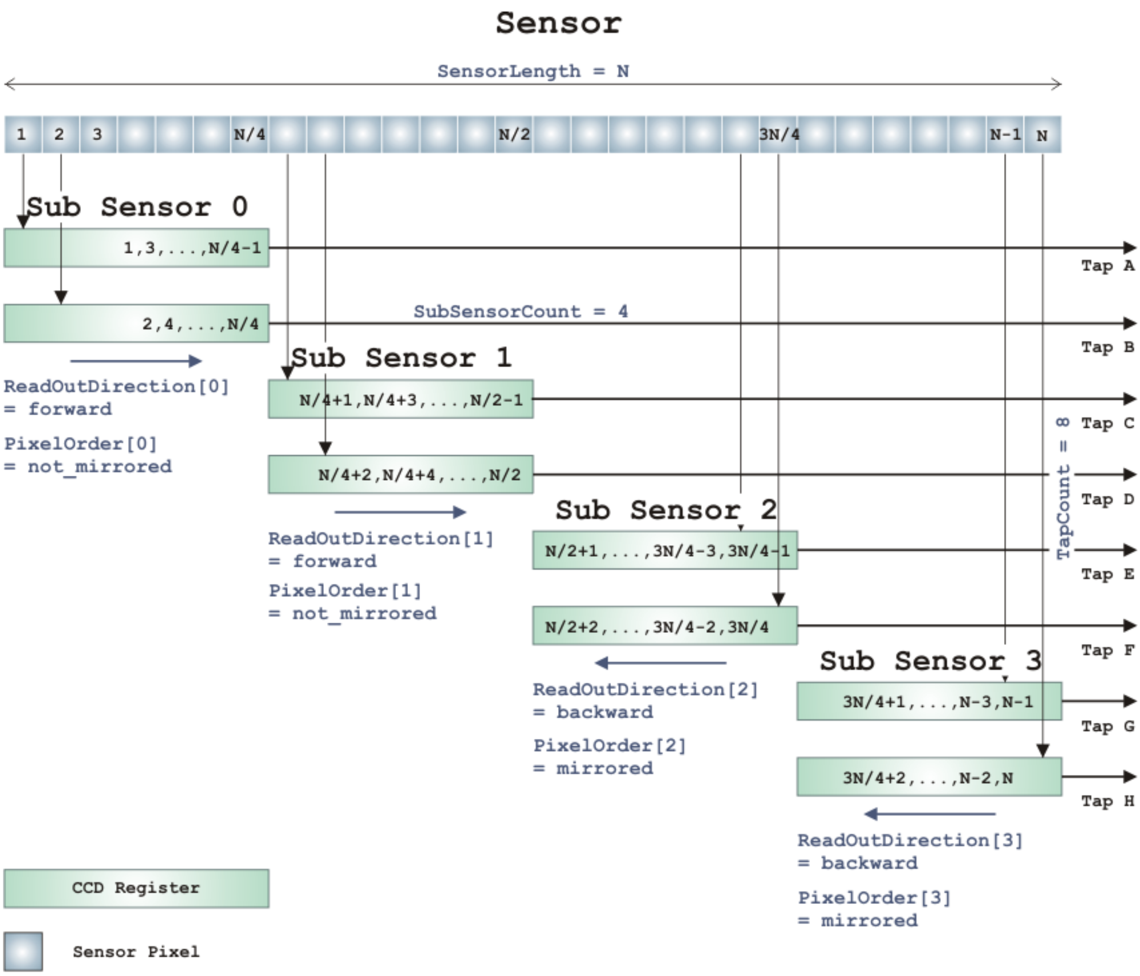
- **FG_SC_PIXELORDER**:

  The pixel order defines the read out order of a pixel in a subsensor. This parameter only has effect if more than one tap is used to transfer the pixels of a subsensor. This is a field parameter, where a value can be set for every subsensor.

The following image will illustrate the functionality of the sensor correction parameters. In this example, the camera sensor has 4 subsensors and transfers data via Camera Link using 8 taps. As can be seen from the figure, the subsensors are read in linear order and start with subsensor 0 i.e. the whole sensor is not rotated. Subsensors 0 and 1 are read in forward direction and are not mirrored. However, subsensors 2 and 3 are read in backward direction. Furthermore, the pixel order is mirrored as subsensor 2 transfers the first i.e. even numbered pixels via tap "F' and the second i.e. odd numbered pixels via tap "E".

Note that the figure is an example only. This applet might have other configuration options.

Figure 5.1. Illustration of Sensor Correction Parameters and Functionality. Example only. This applet might differ.



Please consult the user manual of the camera manufacturer to get information about the camera specific sensor read out.

The current implementation of this AcquisitionApplets Advanced does not allow any permutation of the parameters described above. The following table lists all allowed combinations.

FG_SC_SUBSENSORCOUNT no. of subsensors	FG_SC_TAPCOUNT no. of taps	FG_SC_ROTATEDSENSOR rotated sensor	FG_SC_READOUTDIRECTION readout direction	FG_SC_PIXELORDER pixel order	old SC notation
1	1	no	forward	don't care	|-> |
1	1	false	backward	don't care	| <-|
1	1	true	forward	don't care	| <-|
2	2	false	forward, forward	don't care, don't care	|1> 2> |
2	2	true	forward, forward	don't care, don't care	| <2 <1|
2	2	false	forward, backward	don't care, don't care	|1> <2|

After all settings have been made, the configuration is enabled by writing to parameter **FG_SC_UPDATESCHEME**. If the parameter settings are not correct or if they do not match with one of the sensor correction modes described in the tables, writing to this parameter will return an error code.

5.1. FG_SENSORREADOUT

Select one of the presets to configure the sensor correction. The selected preset will directly overwrite the other parameters which define the sensor correction. Writing to parameter *FG_SC_UPDATESCHEME* it not required when a preset is used.

Table 5.1. Parameter properties of FG_SENSORREADOUT

Property	Value	
Name	**FG_SENSORREADOUT**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**SMODE_UNCHANGED** **SMODE_REVERSE** **SMODE_TAB2_0** **SMODE_TAB2_1** **SMODE_TAB2_2**	SMODE_UNCHANGED|-> | SMODE_REVERSE | <-| SMODE_TAB2_0 |1> 2> | SMODE_TAB2_1 | <2 <1| SMODE_TAB2_2 |1> <2|
Default value	**SMODE_UNCHANGED**	

Example 5.1. Usage of FG_SENSORREADOUT

```
int result = 0;
unsigned int value = SMODE_UNCHANGED;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SENSORREADOUT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SENSORREADOUT, &value, 0, type)) < 0) {
    /* error handling */
}
```

5.2. FG_SC_SUBSENSORCOUNT

Specify the number of subsensors by use of this parameter. Don't forget to update any modifications to the applet using parameter *FG_SC_UPDATESCHEME*.

Table 5.2. Parameter properties of FG_SC_SUBSENSORCOUNT

Property	Value
Name	`FG_SC_SUBSENSORCOUNT`
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 1** **Maximum 2** **Stepsize 1**
Default value	**1**

Example 5.2. Usage of FG_SC_SUBSENSORCOUNT

```
int result = 0;
unsigned int value = 1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SC_SUBSENSORCOUNT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SC_SUBSENSORCOUNT, &value, 0, type)) < 0) {
    /* error handling */
}
```

5.3. FG_SC_SENSORLENGTH

This parameter is used for compatibility reasons and has no functionality in the current release of this AcquisitionApplets Advanced. Future versions will have extended sensor correction functionalities using this parameter.

Table 5.3. Parameter properties of FG_SC_SENSORLENGTH

Property	Value
Name	`FG_SC_SENSORLENGTH`
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 8** **Maximum 16384** **Stepsize 1**
Default value	**1024**

Example 5.3. Usage of FG_SC_SENSORLENGTH

```
int result = 0;
unsigned int value = 1024;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SC_SENSORLENGTH, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SC_SENSORLENGTH, &value, 0, type)) < 0) {
    /* error handling */
}
```

5.4. FG_SC_TAPCOUNT

The number of taps is defined by this parameter. Don't forget to update any modifications to the applet using parameter *FG_SC_UPDATESCHEME*.

Table 5.4. Parameter properties of FG_SC_TAPCOUNT

Property	Value
Name	**FG_SC_TAPCOUNT**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum** 1 **Maximum** 2 **Stepsize** 1
Default value	**1**

Example 5.4. Usage of FG_SC_TAPCOUNT

```
int result = 0;
unsigned int value = 1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SC_TAPCOUNT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SC_TAPCOUNT, &value, 0, type)) < 0) {
    /* error handling */
}
```

5.5. FG_SC_ROTATEDSENSOR

Set this parameter to **FG_TRUE** if the camera has a rotated sensor. Don't forget to update any modifications to the applet using parameter *FG_SC_UPDATESCHEME*.

Table 5.5. Parameter properties of FG_SC_ROTATEDSENSOR

Property	Value
Name	**FG_SC_ROTATEDSENSOR**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_FALSE** False **FG_TRUE** True
Default value	**FG_FALSE**

Example 5.5. Usage of FG_SC_ROTATEDSENSOR

```
int result = 0;
unsigned int value = FG_FALSE;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SC_ROTATEDSENSOR, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SC_ROTATEDSENSOR, &value, 0, type)) < 0) {
    /* error handling */
}
```

5.6. FG_SC_READOUTDIRECTION

This field parameter is used to set the readout direction for each subsensor. Value 0 represents option "forward" and value 1 represents option "backward". Index 0 corresponds to subsensor 0. Index 1 corresponds to subsensor 1 etc. Don't forget to update any modifications to the applet using parameter *FG_SC_UPDATESCHEME*.

Table 5.6. Parameter properties of FG_SC_READOUTDIRECTION

Property	Value
Name	**FG_SC_READOUTDIRECTION**
Type	**Unsigned Integer Field**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Default value	**0**

Example 5.6. Usage of FG_SC_READOUTDIRECTION

```
int result = 0;

FieldParameterInt access;
const enum FgParamTypes type = FG_PARAM_TYPE_STRUCT_FIELDPARAMINT;

for (unsigned int i = 0; i < 2; ++i)
{
    access.index = i;
    access.value = 0;

    if ((result = Fg_setParameterWithType(FG_SC_READOUTDIRECTION, &access, 0, type)) < 0) {
        /* error handling */
    }

    if ((result = Fg_getParameterWithType(FG_SC_READOUTDIRECTION, &access, 0, type)) < 0) {
        /* error handling */
    }
}
```

5.7. FG_SC_PIXELORDER

The pixel order defines whether the camera's sub sensors are read in forward or in reverse direction. Set the parameter to 0 for forward direction and 1 for reverse direction. Don't forget to update any modifications to the applet using parameter *FG_SC_UPDATESCHEME*.

Table 5.7. Parameter properties of FG_SC_PIXELORDER

Property	Value
Name	**FG_SC_PIXELORDER**
Type	**Unsigned Integer Field**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Default value	**0**

Example 5.7. Usage of FG_SC_PIXELORDER

```
int result = 0;

FieldParameterInt access;
const enum FgParamTypes type = FG_PARAM_TYPE_STRUCT_FIELDPARAMINT;

for (unsigned int i = 0; i < 2; ++i)
{
    access.index = i;
    access.value = 0;

    if ((result = Fg_setParameterWithType(FG_SC_PIXELORDER, &access, 0, type)) < 0) {
        /* error handling */
    }

    if ((result = Fg_getParameterWithType(FG_SC_PIXELORDER, &access, 0, type)) < 0) {
        /* error handling */
    }
}
```

5.8. FG_SC_UPDATESCHEME

After the sensor correction has been configured using the parameters described above, the actual configuration can be enabled in the frame grabber. Use this parameter to start verification of the settings made and transfer to the grabber. The parameter may only be changed while no acquisition is started.

If the parameter settings are not correct or if they do not match with one of the sensor correction modes described in the tables above, writing to this parameter will return an error code.

Table 5.8. Parameter properties of FG_SC_UPDATESCHEME

Property	Value
Name	**FG_SC_UPDATESCHEME**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Allowed values	**FG_APPLY** Apply
Default value	**FG_APPLY**

Example 5.8. Usage of FG_SC_UPDATESCHEME

```
int result = 0;
unsigned int value = FG_APPLY;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SC_UPDATESCHEME, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SC_UPDATESCHEME, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 6. CC Signal Mapping

The CameraLink interface specifies four camera input signals, i.e. CC1, CC2, CC3 and CC4. Usually the camera will use one particular CC-signal to trigger the data acquisition and define the exposure time. Please consult the vendor's manual of your camera to identify the required signals and their mapping to the CC1-CC4 signals.

This AcquisitionApplets Advanced provides eight different methods to map five source signals to any of the four CC-signal lines:

- **CC_EXSYNC**

  The ExSync signal is used to trigger the line acquisition of the camera. It can be generated periodically, or triggered by one of the eight trigger input signals. When generated periodically by the frame grabber (grabber controlled), it determines the framerate. Depending on the operation mode of the camera, its active-time can determine the exposure time. For details refer to the trigger section of this document.

- **CC_NOT_EXSYNC**

  The inverted signal to **CC_EXSYNC**.

- **CC_EXSYNC2**

  A delayed copy of line trigger ExSync is provided by ExSync2

- **CC_NOT_EXSYNC2**

  The inverted signal to ExSync2.

- **CC_STROBEPULSE**

  A delayed copy of the image trigger is provided by the flash. It has as separate delay and is usually used to control external flashes. For details refer to the Image Trigger System.

- **CC_NOT_STROBEPULSE**

  The inverted signal to **CC_STROBEPULSE**.

- **CC_GND**

  Ground

- **CC_VCC**

  V_{CC}

6.1. FG_CCSEL0

Select one of the options described above.

Table 6.1. Parameter properties of FG_CCSEL0

Property	Value	
Name	**FG_CCSEL0**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**CC_EXSYNC**	Exsync
	CC_NOT_EXSYNC	!Exsync
	CC_EXSYNC2	Exsync2
	CC_NOT_EXSYNC2	!Exsync2
	CC_STROBEPULSE	Flash
	CC_NOT_STROBEPULSE	!Flash
	CC_GND	Gnd
	CC_VCC	Vcc
Default value	**CC_EXSYNC**	

Example 6.1. Usage of FG_CCSEL0

```
int result = 0;
unsigned int value = CC_EXSYNC;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_CCSEL0, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_CCSEL0, &value, 0, type)) < 0) {
    /* error handling */
}
```

6.2. FG_CCSEL1

Select one of the options described above.

Table 6.2. Parameter properties of FG_CCSEL1

Property	Value	
Name	**FG_CCSEL1**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**CC_EXSYNC**	Exsync
	CC_NOT_EXSYNC	!Exsync
	CC_EXSYNC2	Exsync2
	CC_NOT_EXSYNC2	!Exsync2
	CC_STROBEPULSE	Flash
	CC_NOT_STROBEPULSE	!Flash
	CC_GND	Gnd
	CC_VCC	Vcc
Default value	**CC_VCC**	

Example 6.2. Usage of FG_CCSEL1

```
int result = 0;
unsigned int value = CC_VCC;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_CCSEL1, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_CCSEL1, &value, 0, type)) < 0) {
    /* error handling */
}
```

6.3. FG_CCSEL2

Select one of the options described above.

Table 6.3. Parameter properties of FG_CCSEL2

Property	Value	
Name	**FG_CCSEL2**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**CC_EXSYNC**	Exsync
	CC_NOT_EXSYNC	!Exsync
	CC_EXSYNC2	Exsync2
	CC_NOT_EXSYNC2	!Exsync2
	CC_STROBEPULSE	Flash
	CC_NOT_STROBEPULSE	!Flash
	CC_GND	Gnd
	CC_VCC	Vcc
Default value	**CC_VCC**	

Example 6.3. Usage of FG_CCSEL2

```
int result = 0;
unsigned int value = CC_VCC;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_CCSEL2, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_CCSEL2, &value, 0, type)) < 0) {
    /* error handling */
}
```

6.4. FG_CCSEL3

Select one of the options described above.

Table 6.4. Parameter properties of FG_CCSEL3

Property	Value	
Name	**FG_CCSEL3**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**CC_EXSYNC**	Exsync
	CC_NOT_EXSYNC	!Exsync
	CC_EXSYNC2	Exsync2
	CC_NOT_EXSYNC2	!Exsync2
	CC_STROBEPULSE	Flash
	CC_NOT_STROBEPULSE	!Flash
	CC_GND	Gnd
	CC_VCC	Vcc
Default value	**CC_VCC**	

Example 6.4. Usage of FG_CCSEL3

```
int result = 0;
unsigned int value = CC_VCC;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_CCSEL3, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_CCSEL3, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 7. Line Trigger / Exsync

The line trigger generates the Exsync and Exsync2 signals that are used to trigger the line acquisition of the specific camera. With the help of these signals it is possible to define the line frequency and exposure time. Since ExSync2 is just a copy of the Exsync with a user selectable delay, the following description will refer to "ExSync" only.

To use the ExSync signals for the application specific camera it is necessary to configure the camera accordingly. Furthermore the camera might expect the ExSync at a particular CC signal. Please consult the camera's manual for details.

Basically two different generation modes for the ExSync signals are available, a simple periodical and an externally triggered generation. Additionally, two variants 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.

Image gate 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. Again, the ExSync is active for exposure time to define 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.

7.1. FG_LINETRIGGERMODE

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

Table 7.1. Parameter properties of FG_LINETRIGGERMODE

Property	Value	
Name	**FG_LINETRIGGERMODE**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**GRABBER_CONTROLLED** **ASYNC_TRIGGER** **GRABBER_CONTROLLED_GATED** **ASYNC_GATED**	Grabber controlled Async External Trigger Gated, Grabber controlled Gated, External Triggered
Default value	**GRABBER_CONTROLLED**	

Example 7.1. Usage of FG_LINETRIGGERMODE

```
int result = 0;
unsigned int value = GRABBER_CONTROLLED;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_LINETRIGGERMODE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINETRIGGERMODE, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.2. FG_EXSYNCON

The ExSync generation can be enabled by using this parameter.

Please remember to first start the acquisition before setting the ExSyncOn parameter to On (**FG_ON**). The signal will be sent as soon as the ExSync has been started. Please make sure to set the ExSync parameter within the time that is set to the timeout parameter.

Table 7.2. Parameter properties of FG_EXSYNCON

Property	Value
Name	**FG_EXSYNCON**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_ON**

Example 7.2. Usage of FG_EXSYNCON

```
int result = 0;
unsigned int value = FG_ON;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_EXSYNCON, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_EXSYNCON, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.3. Line Trigger Input

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.

7.3.1. FG_LINETRIGGERINSRC

This parameter specifies the signal source, which is used to trigger the Exsync signal generator. If a shaft encoder is used, configure source B, too. Please check the hardware documentation of the microEnable board to find out the pins of the connector corresponding to the selection made.

Table 7.3. Parameter properties of FG_LINETRIGGERINSRC

Property	Value
Name	**FG_LINETRIGGERINSRC**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**TRGINSRC_0** Trigger Source 0 **TRGINSRC_1** Trigger Source 1 **TRGINSRC_2** Trigger Source 2 **TRGINSRC_3** Trigger Source 3 **TRGINSRC_4** Trigger Source 4 **TRGINSRC_5** Trigger Source 5 **TRGINSRC_6** Trigger Source 6 **TRGINSRC_7** Trigger Source 7
Default value	**TRGINSRC_1**

Example 7.3. Usage of FG_LINETRIGGERINSRC

```
int result = 0;
unsigned int value = TRGINSRC_1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_LINETRIGGERINSRC, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINETRIGGERINSRC, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.3.2. FG_LINETRIGGERINPOLARITY

The parameter defines the polarity of the external input trigger signal Source A and Source B. When set to low, the Exsync generator starts on a falling edge of the input signal. Otherwise, the Exsync generation starts on a rising edge.

Table 7.4. Parameter properties of FG_LINETRIGGERINPOLARITY

Property	Value
Name	**FG_LINETRIGGERINPOLARITY**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ONE** Low Active **FG_ZERO** High Active
Default value	**FG_ZERO**

Example 7.4. Usage of FG_LINETRIGGERINPOLARITY

```
int result = 0;
unsigned int value = FG_ZERO;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_LINETRIGGERINPOLARITY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINETRIGGERINPOLARITY, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.3.3. Downscale

7.3.3.1. FG_LINE_DOWNSCALE

Sets the value of how often the frequency of the input trigger signal has to be divided. For example, a value of 16 creates an ExSync pulse at each 16th input trigger signal.

Table 7.5. Parameter properties of FG_LINE_DOWNSCALE

Property	Value
Name	**FG_LINE_DOWNSCALE**
Type	**Unsigned Integer**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**Minimum 1** **Maximum 255** **Stepsize 1**
Default value	**1**
Unit of measure	**pulses**

Example 7.5. Usage of FG_LINE_DOWNSCALE

```
int result = 0;
unsigned int value = 1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_LINE_DOWNSCALE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINE_DOWNSCALE, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.3.3.2. FG_LINE_DOWNSCALEINIT

In addition to the downscale value this parameter sets a phase position. To turn the phase position to about 90°, a value of 4 has to be chosen. In this case (take a look at "Downscale") the ExSync signals will be created at each 16 * n + 4 trigger signal.

Table 7.6. Parameter properties of FG_LINE_DOWNSCALEINIT

Property	Value
Name	**FG_LINE_DOWNSCALEINIT**
Type	**Unsigned Integer**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**Minimum 1** **Maximum 255** **Stepsize 1**
Default value	**1**
Unit of measure	**pulses**

Example 7.6. Usage of FG_LINE_DOWNSCALEINIT

```
int result = 0;
unsigned int value = 1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_LINE_DOWNSCALEINIT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINE_DOWNSCALEINIT, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.4. Shaft Encoder A/B Filter

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. FG_SHAFTENCODERON

Switch the shaft encoder filter on or off. By enabling the shaft encoder, a reset of the encoder compensation is performed. Therefore, disable and enable the shaft encoder to reset the reverse compensation.

Table 7.7. Parameter properties of FG_SHAFTENCODERON

Property	Value
Name	**FG_SHAFTENCODERON**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_OFF**

Example 7.7. Usage of FG_SHAFTENCODERON

```
int result = 0;
unsigned int value = FG_OFF;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SHAFTENCODERON, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SHAFTENCODERON, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.4.2. FG_SHAFTENCODERMODE

The shaft encoder filter can be run in three operation modes. Please choose the according operation mode which compatible to the connected shaft encoder. 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 edge of Source A and a rising edge of Source B.

- 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.

Table 7.8. Parameter properties of FG_SHAFTENCODERMODE

Property	Value
Name	**FG_SHAFTENCODERMODE**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FILTER_X1** Filter x1 **FILTER_X2** Filter x2 **FILTER_X4** Filter x4
Default value	**FILTER_X1**

Example 7.8. Usage of FG_SHAFTENCODERMODE

```
int result = 0;
unsigned int value = FILTER_X1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SHAFTENCODERMODE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SHAFTENCODERMODE, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.4.3. FG_SHAFTENCODERINSRC

Specifies the input signal source B of the shaft encoder filter. Please check the hardware documentation of the microEnable board to find out the pins of the connector corresponding to the selection made.

Table 7.9. Parameter properties of FG_SHAFTENCODERINSRC

Property	Value
Name	**FG_SHAFTENCODERINSRC**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**TRGINSRC_0** Trigger Source 0 **TRGINSRC_1** Trigger Source 1 **TRGINSRC_2** Trigger Source 2 **TRGINSRC_3** Trigger Source 3 **TRGINSRC_4** Trigger Source 4 **TRGINSRC_5** Trigger Source 5 **TRGINSRC_6** Trigger Source 6 **TRGINSRC_7** Trigger Source 7
Default value	**TRGINSRC_2**

Example 7.9. Usage of FG_SHAFTENCODERINSRC

```
int result = 0;
unsigned int value = TRGINSRC_2;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SHAFTENCODERINSRC, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SHAFTENCODERINSRC, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.4.4. FG_SHAFTENCODERLEADING

This parameter defines the leading signal (=direction) of the shaft encoder filter.

Table 7.10. Parameter properties of FG_SHAFTENCODERLEADING

Property	Value
Name	**FG_SHAFTENCODERLEADING**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**SOURCE_A** Source A **SOURCE_B** Source B
Default value	**SOURCE_A**

Example 7.10. Usage of FG_SHAFTENCODERLEADING

```
int result = 0;
unsigned int value = SOURCE_A;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SHAFTENCODERLEADING, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SHAFTENCODERLEADING, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.5. Exsync Output

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

7.5.1. FG_LINEPERIODE

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.

Table 7.11. Parameter properties of FG_LINEPERIODE

Property	Value
Name	FG_LINEPERIODE
Type	Double
Access policy	Read/Write/Change
Storage policy	Persistent
Allowed values	Minimum 1.024 Maximum 4194.288 Stepsize 0.016
Default value	200.0
Unit of measure	µs

Example 7.11. Usage of FG_LINEPERIODE

```
int result = 0;
double value = 200.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_LINEPERIODE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINEPERIODE, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.5.2. FG_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.

Table 7.12. Parameter properties of FG_LINEEXPOSURE

Property	Value
Name	**FG_LINEEXPOSURE**
Type	**Double**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum** **1.024** **Maximum** **2097.136** **Stepsize** **0.016**
Default value	**19.0**
Unit of measure	**µs**

Example 7.12. Usage of FG_LINEEXPOSURE

```
int result = 0;
double value = 19.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_LINEEXPOSURE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINEEXPOSURE, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.5.3. FG_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.

Table 7.13. Parameter properties of FG_EXSYNCPOLARITY

Property	Value
Name	**FG_EXSYNCPOLARITY**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ZERO** Low Active **FG_ONE** High Active
Default value	**FG_ONE**

Example 7.13. Usage of FG_EXSYNCPOLARITY

```
int result = 0;
unsigned int value = FG_ONE;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_EXSYNCPOLARITY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_EXSYNCPOLARITY, &value, 0, type)) < 0) {
    /* error handling */
}
```

7.5.4. FG_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).

Table 7.14. Parameter properties of FG_LINETRIGGERDELAY

Property	Value
Name	**FG_LINETRIGGERDELAY**
Type	**Double**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum** **0.0** **Maximum** **2097.136** **Stepsize** **0.016**
Default value	**0.0**
Unit of measure	**µs**

Example 7.14. Usage of FG_LINETRIGGERDELAY

```
int result = 0;
double value = 0.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_LINETRIGGERDELAY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LINETRIGGERDELAY, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 8. Image Trigger / Flash

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 Advanced 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 *FG_HEIGHT* of the display module. Also, offsets defined by *FG_YOFFSET* 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 *FG_HEIGHT* + *FG_YOFFSET* 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 **`Async Trigger`** mode, the gate is open for *FG_IMGTRIGGER_ASYNC_HEIGHT* lines while this image is split into smaller chunks of *FG_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 *FG_YOFFSET* 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 *FG_HEIGHT* + *FG_YOFFSET* 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 *FG_HEIGHT* + *FG_YOFFSET* 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 *FG_HEIGHT* lines. It will cut the image after *FG_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 *FG_HEIGHT*.

All images of a generated sequence will have a height of *FG_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 *FG_YOFFSET* is not considered if the 'Gated Multi Buffer Trigger' mode is used. An YOffset cannot be set in the applet.

8.1. FG_IMGTRIGGERMODE

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 FG_IMGTRIGGERMODE

Property	Value	
Name	**FG_IMGTRIGGERMODE**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**FREE_RUN**	Free Run
	ASYNC_TRIGGER	Async External Trigger
	ASYNC_TRIGGER_MULTIFRAME	Async Multi Buffer External Trigger
	ASYNC_GATED	Gated, External Triggered
	ASYNC_GATED_MULTIFRAME	Gated Multi Buffer, External Triggered
Default value	**FREE_RUN**	

Example 8.1. Usage of FG_IMGTRIGGERMODE

```
int result = 0;
unsigned int value = FREE_RUN;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGERMODE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGERMODE, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.2. FG_IMGTRIGGERON

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 FG_IMGTRIGGERON

Property	Value
Name	**FG_IMGTRIGGERON**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_ON**

Example 8.2. Usage of FG_IMGTRIGGERON

```
int result = 0;
unsigned int value = FG_ON;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGERON, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGERON, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.3. FG_FLASHON

To enable the flash output use this parameter.

Table 8.3. Parameter properties of FG_FLASHON

Property	Value
Name	**FG_FLASHON**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_ON**

Example 8.3. Usage of FG_FLASHON

```
int result = 0;
unsigned int value = FG_ON;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_FLASHON, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_FLASHON, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.4. FG_IMGTRIGGER_ASYNC_HEIGHT

This parameter only has influcence in the image trigger mode *FG_IMGTRIGGERMODE* Async Trigger Multi Frame **ASYNC_TRIGGER_MULTIFRAME**. The value is used to define the image height of the frame after the trigger pulse. Whereas parameter *FG_HEIGHT* defines the chunk height.

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

Table 8.4. Parameter properties of FG_IMGTRIGGER_ASYNC_HEIGHT

Property	Value
Name	**FG_IMGTRIGGER_ASYNC_HEIGHT**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 8** **Maximum 16777216** **Stepsize 1**
Default value	**1024**
Unit of measure	**lines**

Example 8.4. Usage of FG_IMGTRIGGER_ASYNC_HEIGHT

```
int result = 0;
unsigned int value = 1024;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGER_ASYNC_HEIGHT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGER_ASYNC_HEIGHT, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.5. FG_IMGTRIGGER_IS_BUSY

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 FG_IMGTRIGGER_IS_BUSY

Property	Value
Name	**FG_IMGTRIGGER_IS_BUSY**
Type	**Enumeration**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**IS_BUSY** Busy Flag is set **IS_NOT_BUSY** Busy Flag is not set

Example 8.5. Usage of FG_IMGTRIGGER_IS_BUSY

```
int result = 0;
unsigned int value = IS_NOT_BUSY;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_IMGTRIGGER_IS_BUSY, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6. Image Trigger Input

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. FG_IMGTRIGGERINSRC

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 **TRG_IN_SOURCE_SOFTWARE**.

Table 8.6. Parameter properties of FG_IMGTRIGGERINSRC

Property	Value	
Name	**FG_IMGTRIGGERINSRC**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**TRGINSRC_0**	Trigger Source 0
	TRGINSRC_1	Trigger Source 1
	TRGINSRC_2	Trigger Source 2
	TRGINSRC_3	Trigger Source 3
	TRGINSRC_4	Trigger Source 4
	TRGINSRC_5	Trigger Source 5
	TRGINSRC_6	Trigger Source 6
	TRGINSRC_7	Trigger Source 7
	TRGINSOFTWARE	Software Trigger
Default value	**TRGINSRC_0**	

Example 8.6. Usage of FG_IMGTRIGGERINSRC

```
int result = 0;
unsigned int value = TRGINSRC_0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGERINSRC, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGERINSRC, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6.2. FG_IMGTRIGGERINPOLARITY

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

Table 8.7. Parameter properties of FG_IMGTRIGGERINPOLARITY

Property	Value
Name	**FG_IMGTRIGGERINPOLARITY**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ONE** Low Active **FG_ZERO** High Active
Default value	**FG_ZERO**

Example 8.7. Usage of FG_IMGTRIGGERINPOLARITY

```
int result = 0;
unsigned int value = FG_ZERO;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGERINPOLARITY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGERINPOLARITY, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6.3. FG_IMGTRIGGERGATEDELAY

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 FG_IMGTRIGGERGATEDELAY

Property	Value
Name	**FG_IMGTRIGGERGATEDELAY**
Type	**Unsigned Integer**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 4095** **Stepsize 1**
Default value	**0**
Unit of measure	**lines**

Example 8.8. Usage of FG_IMGTRIGGERGATEDELAY

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGERGATEDELAY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGERGATEDELAY, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6.4. FG_IMGTRIGGERDEBOUNCING

This parameter specifies the debouncing time 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 FG_IMGTRIGGERDEBOUNCING

Property	Value
Name	`FG_IMGTRIGGERDEBOUNCING`
Type	`Double`
Access policy	`Read/Write/Change`
Storage policy	`Persistent`
Allowed values	`Minimum` **0.016** `Maximum` **30.0** `Stepsize` **0.016**
Default value	`0.112`
Unit of measure	**µs**

Example 8.9. Usage of FG_IMGTRIGGERDEBOUNCING

```
int result = 0;
double value = 0.112;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_IMGTRIGGERDEBOUNCING, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMGTRIGGERDEBOUNCING, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6.5. FG_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 FG_STROBEPULSEDELAY

Property	Value
Name	`FG_STROBEPULSEDELAY`
Type	`Unsigned Integer`
Access policy	`Read/Write`
Storage policy	`Persistent`
Allowed values	`Minimum` **0** `Maximum` **4095** `Stepsize` **1**
Default value	`0`
Unit of measure	`lines`

Example 8.10. Usage of FG_STROBEPULSEDELAY

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_STROBEPULSEDELAY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_STROBEPULSEDELAY, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6.6. Software Trigger

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.

8.6.6.1. FG_SENDSOFTWARETRIGGER

A software trigger pulse can be sent by use of this parameter.

Table 8.11. Parameter properties of FG_SENDSOFTWARETRIGGER

Property	Value
Name	**FG_SENDSOFTWARETRIGGER**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Allowed values	**FG_APPLY** Apply
Default value	**FG_APPLY**

Example 8.11. Usage of FG_SENDSOFTWARETRIGGER

```
int result = 0;
unsigned int value = FG_APPLY;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SENDSOFTWARETRIGGER, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SENDSOFTWARETRIGGER, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.6.6.2. FG_SETSOFTWARETRIGGER

The software trigger state can be set to zero = low or one = high.

Table 8.12. Parameter properties of FG_SETSOFTWARETRIGGER

Property	Value
Name	**FG_SETSOFTWARETRIGGER**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ZERO** Low Active **FG_ONE** High Active
Default value	**FG_ZERO**

Example 8.12. Usage of FG_SETSOFTWARETRIGGER

```
int result = 0;
unsigned int value = FG_ZERO;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_SETSOFTWARETRIGGER, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SETSOFTWARETRIGGER, &value, 0, type)) < 0) {
    /* error handling */
}
```

8.7. Flash

8.7.1. FG_FLASH_POLARITY

The polarity of the generated flash signal can be changed with this parameter.

Table 8.13. Parameter properties of FG_FLASH_POLARITY

Property	Value
Name	**FG_FLASH_POLARITY**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ZERO** Low Active **FG_ONE** High Active
Default value	**FG_ONE**

Example 8.13. Usage of FG_FLASH_POLARITY

```
int result = 0;
unsigned int value = FG_ONE;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_FLASH_POLARITY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_FLASH_POLARITY, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 9. Digital I/O

The frame grabber provides eight digital input and digital outputs. The current state of the digital inputs can be obtained using parameter *FG_DIGIO_INPUT*. The outputs are used by the trigger module. See the corresponding sections. However, outputs 3 and 7 can be arbitrarily set 0 or 1 using parameter *FG_DIGIO_OUTPUT*.

Besides reading the current state by parameters, events can be used for notification on changes.

9.1. FG_DIGIO_OUTPUT

Set the output value of outputs 3 and 7 using this parameter. Bit 0 of the parameter refers to the value at output 3, while bit 1 refers to output 7.

Table 9.1. Parameter properties of FG_DIGIO_OUTPUT

Property	Value
Name	**FG_DIGIO_OUTPUT**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 3** **Stepsize 1**
Default value	**3**
Unit of measure	

Example 9.1. Usage of FG_DIGIO_OUTPUT

```
int result = 0;
unsigned int value = 3;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_DIGIO_OUTPUT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_DIGIO_OUTPUT, &value, 0, type)) < 0) {
    /* error handling */
}
```

9.2. FG_DIGIO_INPUT

Parameter *FG_DIGIO_INPUT* is used to monitor the digital inputs of the frame grabber. This AcquisitionApplets Advanced has eight digital inputs. You can read the current state of these inputs using parameter *FG_DIGIO_INPUT*. 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 it's digital inputs 0, 2 and 5.

Table 9.2. Parameter properties of FG_DIGIO_INPUT

Property	Value
Name	**FG_DIGIO_INPUT**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 255** **Stepsize 1**
Unit of measure	

Example 9.2. Usage of FG_DIGIO_INPUT

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_DIGIO_INPUT, &value, 0, type)) < 0) {
    /* error handling */
}
```

9.3. Events

9.3.1. FG_TRIGGER_INPUT0_RISING et al.

Note

This description applies also to the following events: FG_TRIGGER_INPUT1_RISING, FG_TRIGGER_INPUT2_RISING, FG_TRIGGER_INPUT3_RISING, FG_TRIGGER_INPUT4_RISING, FG_TRIGGER_INPUT5_RISING, FG_TRIGGER_INPUT6_RISING, FG_TRIGGER_INPUT7_RISING

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.

9.3.2. FG_TRIGGER_INPUT0_FALLING et al.

Note

This description applies also to the following events: FG_TRIGGER_INPUT1_FALLING, FG_TRIGGER_INPUT2_FALLING, FG_TRIGGER_INPUT3_FALLING, FG_TRIGGER_INPUT4_FALLING, FG_TRIGGER_INPUT5_FALLING, FG_TRIGGER_INPUT6_FALLING, FG_TRIGGER_INPUT7_FALLING

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.

Chapter 10. Overflow

The applet processes image data as fast as possible. Any image data sent by the camera is immediately processed and send 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. 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. This buffer can store up to 32,000 image lines. The fill level of the buffer can be obtained by reading from parameter *FG_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.

- 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.

A way to detect the overflows is to read parameter *FG_OVERFLOW* or check for event *FG_OVERFLOW_CAM0*. 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. FG_FILLLEVEL

The fill-level of the frame grabber buffers used in this AcquisitionApplets Advanced 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 FG_FILLLEVEL

Property	Value
Name	**FG_FILLLEVEL**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**Minimum 0** **Maximum 100** **Stepsize 1**
Unit of measure	**%**

Example 10.1. Usage of FG_FILLLEVEL

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_FILLLEVEL, &value, 0, type)) < 0) {
    /* error handling */
}
```

10.2. FG_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 the loose of images. To avoid overflows reduce the mean input bandwidth.

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

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

Table 10.2. Parameter properties of FG_OVERFLOW

Property	Value
Name	**FG_OVERFLOW**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

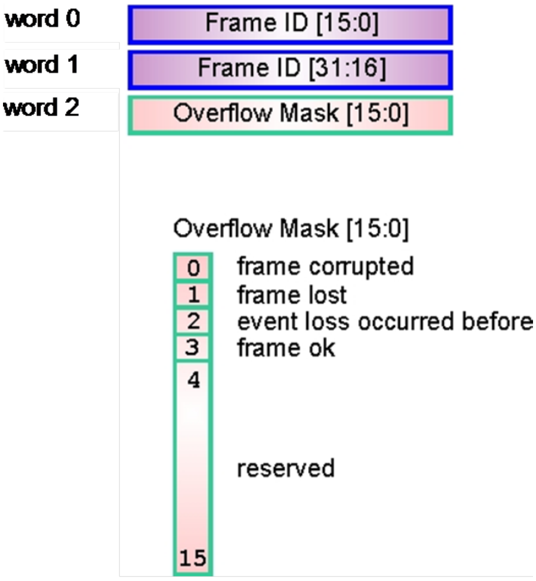
Example 10.2. Usage of FG_OVERFLOW

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_OVERFLOW, &value, 0, type)) < 0) {
    /* error handling */
}
```

10.3. FG_OVERFLOW_CAM0

Overflow events are generated for each corrupted or lost frame. In contrast to the other events presented in this document, the overflow event transports data, namely the type of overflow, the image number and the timestamp. The following figure illustrates the event data. Data is included in a 64 Bit data packet. The first 32 Bit include the frame number. Bits 32 to 47 include an overflow mask.

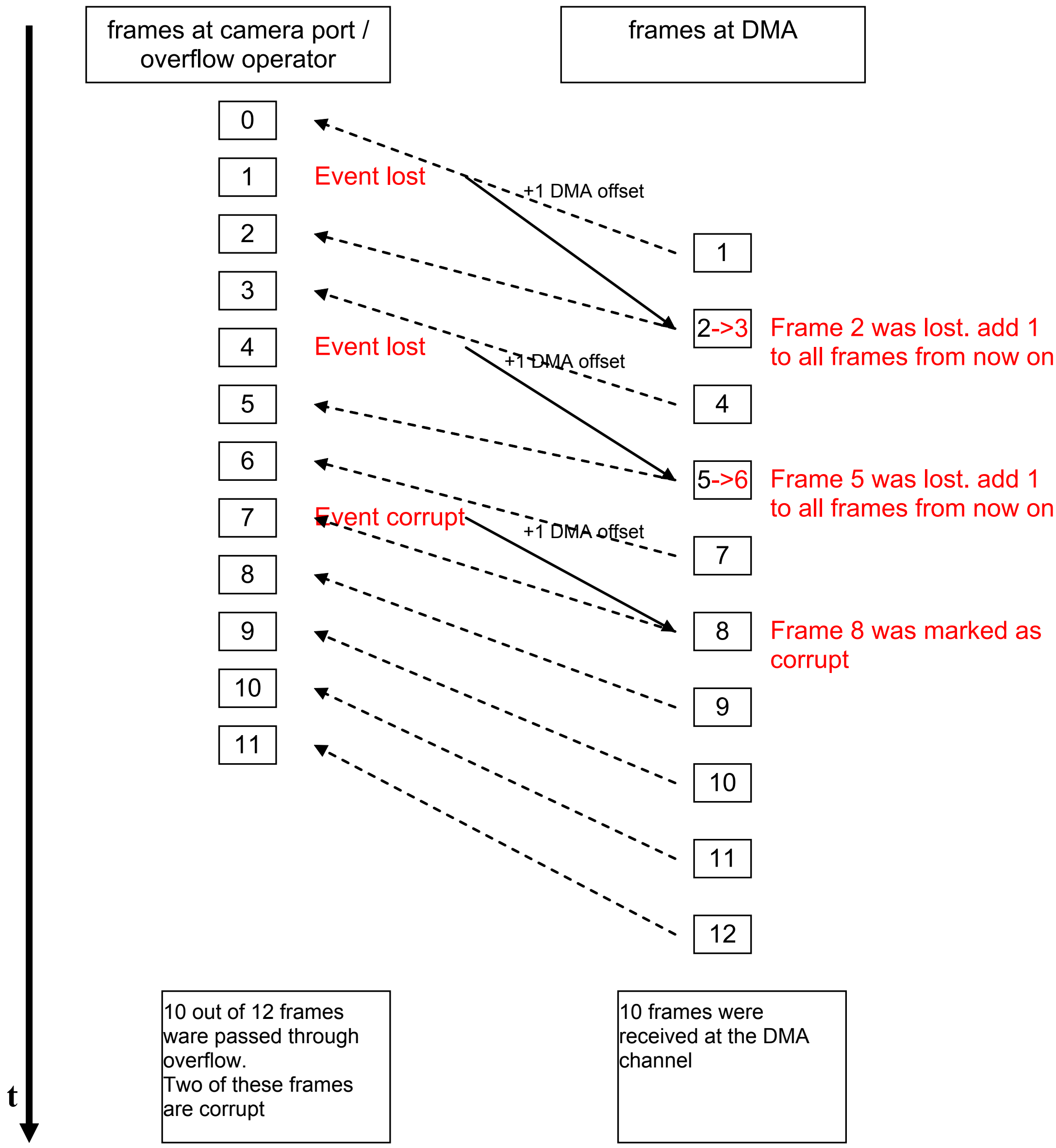
Figure 10.1. Illustration of Overflow Data Packet



Note that the frame number is reset on acquisition start. Also note that the first frame will have frame number zero, while a DMA transfer starts with frame number one. The frame number is a 32 Bit value. If it's maximum is reached, it will start from zero again. Keep in mind that on a 64 Bit runtime, the DMA transfer number will be a 64 Bit value. If the frame corrupted flag is set, the frame with the frame number in the event is corrupted i.e. it will not have it's full length but is still transfered via DMA channel. If the frame lost flag is set, the frame with the frame number in the event was fully discarded. No DMA transfer will exist for this frame. The corrupted frame flag and the frame lost flag will never occur for the same event. The flag "event loss occured before" is an additional security mechanism. It means that an event has been lost. This can only happen at very high event rates and should not happen under normal conditions.

The analysis of the overflow events depends on the user requirements. In the following, an example is shown on how to ensure the integrity if the DMA data by analyzing the events and DMA transfers.

Figure 10.2. Analysis of Overflow Data



In the example, two frames got lost and one is marked as corrupted. As the events are not synchronous with the DMA transfers, for analysis a software queue (push and pull) is required to allocate the events to the DMA transfers.

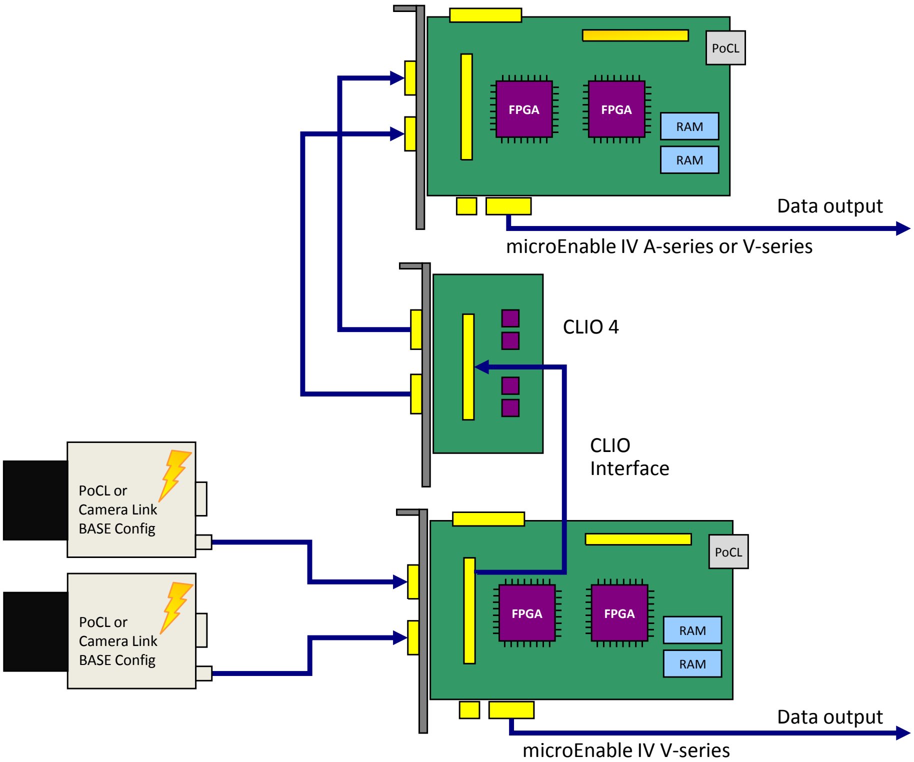
Chapter 11. Image Selector

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.

A typical setup to use this module would be the following: 2 frame grabbers and 1 CameraLink IO board (CLIO) in one PC or two PCs.

The CLIO module distributes the camera output to *p* frame grabbers by copying the image data. The image selector at each frame grabber is programmed to accept only one of *p* images, which decreases the processing frame rate in the grabber and thus, the frame rate at the PCI Express interface. This can be useful if a PC cannot compute the full data rate or if different pre-processing is required to be performed in the frame grabbers.

Figure 11.1. CameraLink IO Board Setup



The following example will explain the settings of *p* and *n* which represent the frame grabber parameters *FG_IMG_SELECT_PERIOD* and *FG_IMG_SELECT*. Suppose two frame grabbers which are connected via a CLIO board to one camera. 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:

   - *FG_IMG_SELECT_PERIOD* = 2

     FG_IMG_SELECT = 0

2. Grabber 1:

   - *FG_IMG_SELECT_PERIOD* = 2

FG_IMG_SELECT = 1

Ensure that both grabbers are synchronously used. 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. FG_IMG_SELECT_PERIOD

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 *FG_IMG_SELECT*.

Table 11.1. Parameter properties of FG_IMG_SELECT_PERIOD

Property	Value
Name	**FG_IMG_SELECT_PERIOD**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 1** **Maximum 256** **Stepsize 1**
Default value	**1**
Unit of measure	**image**

Example 11.1. Usage of FG_IMG_SELECT_PERIOD

```
int result = 0;
unsigned int value = 1;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMG_SELECT_PERIOD, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMG_SELECT_PERIOD, &value, 0, type)) < 0) {
    /* error handling */
}
```

11.2. FG_IMG_SELECT

The parameter *FG_IMG_SELECT* specifies a particular image from the image set defined by *FG_IMG_SELECT_PERIOD*. 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 *FG_IMG_SELECT_PERIOD*.

Table 11.2. Parameter properties of FG_IMG_SELECT

Property	Value
Name	**FG_IMG_SELECT**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 255** **Stepsize 1**
Default value	**0**
Unit of measure	**image**

Example 11.2. Usage of FG_IMG_SELECT

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_IMG_SELECT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_IMG_SELECT, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 12. White Balance

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.

White Balancing using the Shading Correction or Lookup Table

Please note, that an individual white balancing for each pixel value can be realized with a shading correction. The shading correction also enables an automatic white balancing. If a shading calibration is used, perform the calibration before changing the white balancing parameters. Also, the lookup table can be used for corrections.

12.1. FG_SCALINGFACTOR_RED

Table 12.1. Parameter properties of FG_SCALINGFACTOR_RED

Property	Value
Name	FG_SCALINGFACTOR_RED
Type	Double
Access policy	Read/Write/Change
Storage policy	Persistent
Allowed values	Minimum 0.0 Maximum 3.9990234375 Stepsize 9.765625E-4
Default value	1.0

Example 12.1. Usage of FG_SCALINGFACTOR_RED

```
int result = 0;
double value = 1.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_SCALINGFACTOR_RED, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SCALINGFACTOR_RED, &value, 0, type)) < 0) {
    /* error handling */
}
```

12.2. FG_SCALINGFACTOR_BLUE

Table 12.2. Parameter properties of FG_SCALINGFACTOR_BLUE

Property	Value
Name	FG_SCALINGFACTOR_BLUE
Type	Double
Access policy	Read/Write/Change
Storage policy	Persistent
Allowed values	Minimum 0.0 Maximum 3.9990234375 Stepsize 9.765625E-4
Default value	1.0

Example 12.2. Usage of FG_SCALINGFACTOR_BLUE

```
int result = 0;
double value = 1.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_SCALINGFACTOR_BLUE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SCALINGFACTOR_BLUE, &value, 0, type)) < 0) {
    /* error handling */
}
```

12.3. FG_SCALINGFACTOR_GREEN

Table 12.3. Parameter properties of FG_SCALINGFACTOR_GREEN

Property	Value
Name	FG_SCALINGFACTOR_GREEN
Type	Double
Access policy	Read/Write/Change
Storage policy	Persistent
Allowed values	Minimum 0.0 Maximum 3.9990234375 Stepsize 9.765625E-4
Default value	1.0

Example 12.3. Usage of FG_SCALINGFACTOR_GREEN

```
int result = 0;
double value = 1.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_SCALINGFACTOR_GREEN, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_SCALINGFACTOR_GREEN, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 13. Lookup Table

This AcquisitionApplets Advanced 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 14). The lookup table can also be loaded with custom values. Application areas are: custom image enhancements or pixel classifications.

This applet is processing data with a resolution of 8 bits. Thus, the lookup table has 8 input bits i.e. pixel values can be in the range [0, 255]. For each of these 256 elements, a table entry exists containing a new output value. The new values are in the range from 0 to 256. All color components are treated separately.

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

13.1. FG_LUT_TYPE

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 14, *Processing* for more detailed documentation. Set this parameter to `LUT_TYPE_PROCESSING` 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 `LUT_TYPE_CUSTOM` 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 *FG_LUT_VALUE_RED*, *FG_LUT_VALUE_GREEN* and *FG_LUT_VALUE_BLUE*. 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 13.1. Parameter properties of FG_LUT_TYPE

Property	Value	
Name	**FG_LUT_TYPE**	
Type	**Enumeration**	
Access policy	**Read/Write/Change**	
Storage policy	**Persistent**	
Allowed values	**LUT_TYPE_PROCESSING**	Processor
	LUT_TYPE_CUSTOM	User file
Default value	**LUT_TYPE_PROCESSING**	

Example 13.1. Usage of FG_LUT_TYPE

```
int result = 0;
unsigned int value = LUT_TYPE_PROCESSING;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_LUT_TYPE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LUT_TYPE, &value, 0, type)) < 0) {
    /* error handling */
}
```

13.2. FG_LUT_VALUE_RED

Table 13.2. Parameter properties of FG_LUT_VALUE_RED

Property	Value
Name	**FG_LUT_VALUE_RED**
Type	**Unsigned Integer Field**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Default value	**0**

Example 13.2. Usage of FG_LUT_VALUE_RED

```
int result = 0;

FieldParameterInt access;
const enum FgParamTypes type = FG_PARAM_TYPE_STRUCT_FIELDPARAMINT;

for (unsigned int i = 0; i < 256; ++i)
{
    access.index = i;
    access.value = 0;

    if ((result = Fg_setParameterWithType(FG_LUT_VALUE_RED, &access, 0, type)) < 0) {
        /* error handling */
    }

    if ((result = Fg_getParameterWithType(FG_LUT_VALUE_RED, &access, 0, type)) < 0) {
        /* error handling */
    }
}
```

13.3. FG_LUT_VALUE_GREEN

Table 13.3. Parameter properties of FG_LUT_VALUE_GREEN

Property	Value
Name	**FG_LUT_VALUE_GREEN**
Type	**Unsigned Integer Field**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Default value	**0**

Example 13.3. Usage of FG_LUT_VALUE_GREEN

```
int result = 0;

FieldParameterInt access;
const enum FgParamTypes type = FG_PARAM_TYPE_STRUCT_FIELDPARAMINT;

for (unsigned int i = 0; i < 256; ++i)
{
    access.index = i;
    access.value = 0;

    if ((result = Fg_setParameterWithType(FG_LUT_VALUE_GREEN, &access, 0, type)) < 0) {
        /* error handling */
    }

    if ((result = Fg_getParameterWithType(FG_LUT_VALUE_GREEN, &access, 0, type)) < 0) {
        /* error handling */
    }
}
```

13.4. FG_LUT_VALUE_BLUE

Table 13.4. Parameter properties of FG_LUT_VALUE_BLUE

Property	Value
Name	`FG_LUT_VALUE_BLUE`
Type	`Unsigned Integer Field`
Access policy	`Read/Write/Change`
Storage policy	`Transient`
Default value	`0`

Example 13.4. Usage of FG_LUT_VALUE_BLUE

```
int result = 0;

FieldParameterInt access;
const enum FgParamTypes type = FG_PARAM_TYPE_STRUCT_FIELDPARAMINT;

for (unsigned int i = 0; i < 256; ++i)
{
    access.index = i;
    access.value = 0;

    if ((result = Fg_setParameterWithType(FG_LUT_VALUE_BLUE, &access, 0, type)) < 0) {
        /* error handling */
    }

    if ((result = Fg_getParameterWithType(FG_LUT_VALUE_BLUE, &access, 0, type)) < 0) {
        /* error handling */
    }
}
```

13.5. FG_LUT_CUSTOM_FILE

If parameter *FG_LUT_TYPE* is set to `LUT_TYPE_CUSTOM`, 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 *FG_LUT_SAVE_FILE*.

Please make sure to activate the Type of LUT *FG_LUT_TYPE* to "UserFile"/ `LUT_TYPE_CUSTOM` 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;
…
4096,4096;
```

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 pairs of Keys / values. Key and value are separated by "=". The value has to be followed by a semicolon (0x3B)
- Format 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 runtime SDK manual.

Table 13.5. Parameter properties of FG_LUT_CUSTOM_FILE

Property	Value
Name	**FG_LUT_CUSTOM_FILE**
Type	**String**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Default value	**""**

Example 13.5. Usage of FG_LUT_CUSTOM_FILE

```
int result = 0;
char* value = "";
const enum FgParamTypes type = FG_PARAM_TYPE_CHAR_PTR;

if ((result = Fg_setParameterWithType(FG_LUT_CUSTOM_FILE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LUT_CUSTOM_FILE, &value, 0, type)) < 0) {
    /* error handling */
}
```

13.6. FG_LUT_SAVE_FILE

To save the current lookup table configuration to 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 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 *FG_LUT_CUSTOM_FILE*.

Table 13.6. Parameter properties of FG_LUT_SAVE_FILE

Property	Value
Name	**FG_LUT_SAVE_FILE**
Type	**String**
Access policy	**Read/Write/Change**
Storage policy	**Transient**
Default value	**""**

Example 13.6. Usage of FG_LUT_SAVE_FILE

```
int result = 0;
char* value = "";
const enum FgParamTypes type = FG_PARAM_TYPE_CHAR_PTR;

if ((result = Fg_setParameterWithType(FG_LUT_SAVE_FILE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_LUT_SAVE_FILE, &value, 0, type)) < 0) {
    /* error handling */
}
```

13.7. Applet Properties

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

13.7.1. FG_LUT_IMPLEMENTATION_TYPE

In this applet, a full lookup table is implemented.

Table 13.7. Parameter properties of FG_LUT_IMPLEMENTATION_TYPE

Property	Value
Name	**FG_LUT_IMPLEMENTATION_TYPE**
Type	**Enumeration**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**LUT_IMPLEMENTATION_FULL_LUT** Full LUT **LUT_IMPLEMENTATION_KNEELUT** KneeLUT

Example 13.7. Usage of FG_LUT_IMPLEMENTATION_TYPE

```
int result = 0;
unsigned int value = LUT_IMPLEMENTATION_FULL_LUT;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_LUT_IMPLEMENTATION_TYPE, &value, 0, type)) < 0) {
    /* error handling */
}
```

13.7.2. FG_LUT_IN_BITS

This applet is using 8 lookup table input bits.

Table 13.8. Parameter properties of FG_LUT_IN_BITS

Property	Value
Name	**FG_LUT_IN_BITS**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Unit of measure	**bit**

Example 13.8. Usage of FG_LUT_IN_BITS

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_LUT_IN_BITS, &value, 0, type)) < 0) {
    /* error handling */
}
```

13.7.3. FG_LUT_OUT_BITS

This applet is using 8 lookup table output bits.

Table 13.9. Parameter properties of FG_LUT_OUT_BITS

Property	Value
Name	**FG_LUT_OUT_BITS**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Unit of measure	**bit**

Example 13.9. Usage of FG_LUT_OUT_BITS

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_LUT_OUT_BITS, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 14. 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 *FG_LUT_TYPE* of category Lookup Table to `LUT_TYPE_PROCESSING` . 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, 2^8[, 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 = 8 input bits and n = 8 outputs bits is used to perform the corrections. Values are determined by

Equation 14.1. LUT Processor without Inversion

$$Output(x) = \left[\left[gain * \left(\frac{x}{2^8 - 1} + offset \right) \right]^{\frac{1}{gamma}} \right] * (2^8 - 1)$$

If the inversion is used, output values are determined by

Equation 14.2. LUT Processor with Inversion

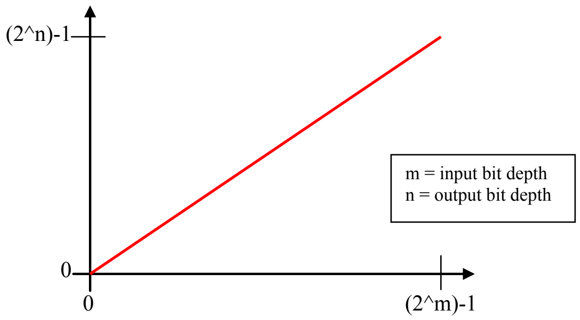
$$Output(x) = 2^8 - 1 - \left[\left[gain * \left(\frac{x}{2^8 - 1} + offset \right) \right]^{\frac{1}{gamma}} \right] * (2^8 - 1)$$

where x represents the input pixel value i.e. is in the range from 0 to 2^8 - 1. If the determined output value is less than 0, it will be set to 0. If the determined output value is greater than 2^8 - 1 it is set to 2^8 - 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 following figure. In the following, you will find detailed explanations for all processing parameters.

Figure 14.1. Lookup Table Processing: Identity



14.1. FG_PROCESSING_OFFSET

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 The following figure shows an example of an offset. Identity = 0.0

Figure 14.2. Lookup Table Processing: Offset

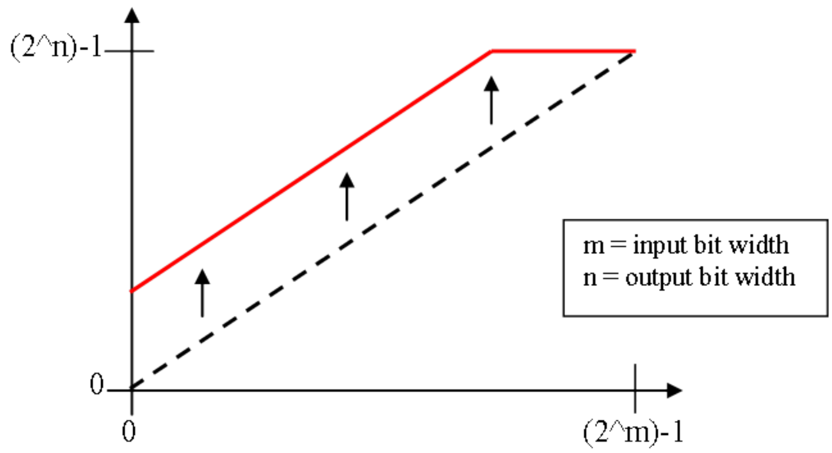


Table 14.1. Parameter properties of FG_PROCESSING_OFFSET

Property	Value
Name	`FG_PROCESSING_OFFSET`
Type	**Double**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum -1.0** **Maximum 1.0** **Stepsize 2.220446049250313E-16**
Default value	**0.0**

Example 14.1. Usage of FG_PROCESSING_OFFSET

```
int result = 0;
double value = 0.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_PROCESSING_OFFSET, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_PROCESSING_OFFSET, &value, 0, type)) < 0) {
    /* error handling */
}
```

14.2. FG_PROCESSING_GAIN

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 14.3. Lookup Table Processing: Gain

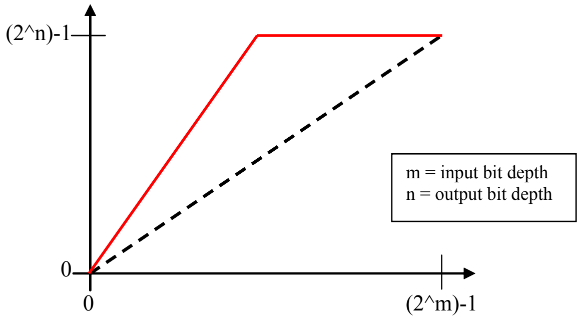


Table 14.2. Parameter properties of FG_PROCESSING_GAIN

Property	Value
Name	**FG_PROCESSING_GAIN**
Type	**Double**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0.0** **Maximum 256.0** **Stepsize 2.220446049250313E-16**
Default value	**1.0**

Example 14.2. Usage of FG_PROCESSING_GAIN

```
int result = 0;
double value = 1.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_PROCESSING_GAIN, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_PROCESSING_GAIN, &value, 0, type)) < 0) {
    /* error handling */
}
```

14.3. FG_PROCESSING_GAMMA

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

Figure 14.4. Lookup Table Processing: Gamma

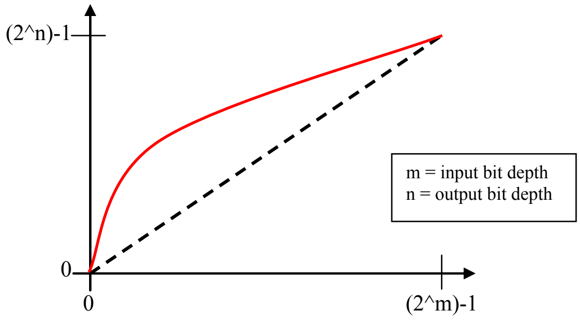


Table 14.3. Parameter properties of FG_PROCESSING_GAMMA

Property	Value
Name	**FG_PROCESSING_GAMMA**
Type	**Double**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum** **-1000.0** **Maximum** **1000.0** **Stepsize** **2.220446049250313E-16**
Default value	**1.0**

Example 14.3. Usage of FG_PROCESSING_GAMMA

```
int result = 0;
double value = 1.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_PROCESSING_GAMMA, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_PROCESSING_GAMMA, &value, 0, type)) < 0) {
    /* error handling */
}
```

14.4. FG_PROCESSING_INVERT

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

Figure 14.5. Lookup Table Processing: Invert

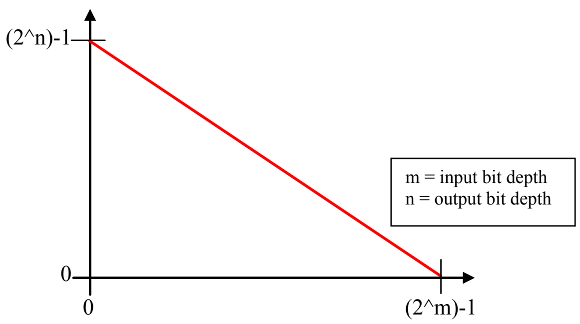


Table 14.4. Parameter properties of FG_PROCESSING_INVERT

Property	Value
Name	**FG_PROCESSING_INVERT**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_OFF**

Example 14.4. Usage of FG_PROCESSING_INVERT

```
int result = 0;
unsigned int value = FG_OFF;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_PROCESSING_INVERT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_PROCESSING_INVERT, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 15. Output Format

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

15.1. FG_FORMAT

Parameter *FG_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. A possibly differing applet processing bit depth from the output format is compensated by adaption to the output format bit depth.

This applet supports the following output formats:

- **FG_COL24**: 24 bit RGB color format with 8 bit/pixel.

Note that the color components are written to the PC buffer in the common blue, green, red (BGR) order. This means, that the blue component is at the lower memory address, while red is at the highest memory address of the components triple.

Table 15.1. Parameter properties of FG_FORMAT

Property	Value
Name	**FG_FORMAT**
Type	**Enumeration**
Access policy	**Read/Write**
Storage policy	**Persistent**
Allowed values	**FG_COL24** Color 24bit
Default value	**FG_COL24**

Example 15.1. Usage of FG_FORMAT

```
int result = 0;
unsigned int value = FG_COL24;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_FORMAT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_FORMAT, &value, 0, type)) < 0) {
    /* error handling */
}
```

15.2. FG_BITALIGNMENT

The bit alignment is used to map the pixel bits of the internal processing bit depth (8 for the this respective AcquisitionApplets Advanced) to the DMA output bit depth. If the output bit depth is greater than the internal processing bit depth, the bits can either be left- or right-aligned in the output. For example, an internal processing bit depth of 12 bit has to be mapped into a 16 bit output. If the parameter is set to **FG_LEFT_ALIGNED**, the output bits 4 to 11 will transport the pixel data, while bits 0 to 3 are set to zero. If the parameter is set to **FG_RIGHT_ALIGNED**, the output bits 0 to 11 will transport the pixel data. Now, the upper four bits are set to zero.

If the output bit depth is less than the internal processing bit depth, the parameter has no effect as the pixel are automatically left shifted.

If the DMA output bit depth is less than the internal bit depth, values will be rounded. For example the 12 bit value 3785 has to be mapped into an 8-bit output. The value will be divided by 16 (= 236.5625) and rounded to value 237.

Table 15.2. Parameter properties of FG_BITALIGNMENT

Property	Value
Name	**FG_BITALIGNMENT**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_LEFT_ALIGNED** Left Aligned **FG_RIGHT_ALIGNED** Right Aligned
Default value	**FG_LEFT_ALIGNED**

Example 15.2. Usage of FG_BITALIGNMENT

```
int result = 0;
unsigned int value = FG_LEFT_ALIGNED;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_BITALIGNMENT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_BITALIGNMENT, &value, 0, type)) < 0) {
    /* error handling */
}
```

15.3. FG_PIXELDEPTH

The pixel depth read-only parameter is used to determine the number of bits used to process a pixel in the applet. For example, a 12 bit applet will transfer its image data in 16 bit DMA packages. Hence, only 12 bits of the 16 bits data are used.

Table 15.3. Parameter properties of FG_PIXELDEPTH

Property	Value
Name	**FG_PIXELDEPTH**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**Minimum 0** **Maximum 128** **Stepsize 1**
Unit of measure	**bit**

Example 15.3. Usage of FG_PIXELDEPTH

```
int result = 0;
unsigned int value = 8;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_PIXELDEPTH, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 16. Camera Simulator

The camera simulator is a convenient way to simulate cameras for first time applet tests. If the simulator is enabled it generates pattern frames of specified size and frequency. The image data is replaced at the position of the camera i.e. all applet processing functionalities are applied to the generated images. Note that camera specific settings of the applet will not have any functionality. The generated patterns will use the full bit depth available for the applet i.e. they will have a bit depth of 8Bit for this applet.

The generated images are diagonal grayscale patterns, such as the one shown in the following figure.

Figure 16.1. Generator Pattern

No Sub-Sensor sorting in Generated Images

The camera simulator will generate a simple grayscale pattern. If the camera or this applet uses sub sensor pixel sorting (sensor correction), the simulator will not generate images which represent the camera sensor.

16.1. FG_GEN_ENABLE

The generator is enabled with this parameter. Note that an activated generator will have effect on parameter *FG_CAMSTATUS*.

Table 16.1. Parameter properties of FG_GEN_ENABLE

Property	Value
Name	**FG_GEN_ENABLE**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_CAMPORT** Camera **FG_GENERATOR** Generator
Default value	**FG_CAMPORT**

Example 16.1. Usage of FG_GEN_ENABLE

```
int result = 0;
unsigned int value = FG_CAMPORT;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_ENABLE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_ENABLE, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.2. FG_GEN_START

This will enable or disable the generation of image data.

Table 16.2. Parameter properties of FG_GEN_START

Property	Value
Name	**FG_GEN_START**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_ON**

Example 16.2. Usage of FG_GEN_START

```
int result = 0;
unsigned int value = FG_ON;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_START, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_START, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.3. FG_GEN_WIDTH

The width of the generated frame is set with this parameter.

Table 16.3. Parameter properties of FG_GEN_WIDTH

Property	Value
Name	**FG_GEN_WIDTH**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 65535** **Stepsize 1**
Default value	**1024**
Unit of measure	**pixel**

Example 16.3. Usage of FG_GEN_WIDTH

```
int result = 0;
unsigned int value = 1024;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_WIDTH, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_WIDTH, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.4. FG_GEN_HEIGHT

The height of the generated frame is set with this parameter. This parameter has no effect on line scan camera applets.

Table 16.4. Parameter properties of FG_GEN_HEIGHT

Property	Value
Name	**FG_GEN_HEIGHT**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 65535** **Stepsize 1**
Default value	**1024**
Unit of measure	**pixel**

Example 16.4. Usage of FG_GEN_HEIGHT

```
int result = 0;
unsigned int value = 1024;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_HEIGHT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_HEIGHT, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.5. FG_GEN_LINE_GAP

The line gap can be specified with this parameter. A high value reduces the line rate of the camera simulator.

Table 16.5. Parameter properties of FG_GEN_LINE_GAP

Property	Value
Name	**FG_GEN_LINE_GAP**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 65535** **Stepsize 1**
Default value	**4**
Unit of measure	**pixel**

Example 16.5. Usage of FG_GEN_LINE_GAP

```
int result = 0;
unsigned int value = 4;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_LINE_GAP, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_LINE_GAP, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.6. FG_GEN_FREQ

This parameter sets the pixel frequency. Note that the generator only simulates cameras. It is made for a first time use of the applet and user SDK verification. The camera simulator cannot reflect the exact timings and frequencies of cameras.

Using the pixel frequency, the resulting frame rate (fps) can be obtained.

Equation 16.1. Shading Correction

$$fps = \frac{FG\_GEN\_FREQ}{(FG\_GEN\_WIDTH + FG\_GEN\_LINE\_GAP) * FG\_GEN\_HEIGHT}$$

Table 16.6. Parameter properties of FG_GEN_FREQ

Property	Value
Name	**FG_GEN_FREQ**
Type	**Double**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 3.0** **Maximum 125.0** **Stepsize 1.0**
Default value	**40.0**
Unit of measure	**MHz**

Example 16.6. Usage of FG_GEN_FREQ

```
int result = 0;
double value = 40.0;
const enum FgParamTypes type = FG_PARAM_TYPE_DOUBLE;

if ((result = Fg_setParameterWithType(FG_GEN_FREQ, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_FREQ, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.7. FG_GEN_ACCURACY

The accuracy enhances the allowed frequency range, but downgrades the accuracy itself.

Table 16.7. Parameter properties of FG_GEN_ACCURACY

Property	Value
Name	**FG_GEN_ACCURACY**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 1** **Maximum 65535** **Stepsize 1**
Default value	**25**

Example 16.7. Usage of FG_GEN_ACCURACY

```
int result = 0;
unsigned int value = 25;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_ACCURACY, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_ACCURACY, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.8. FG_GEN_TAP1 et al.

Note

This description applies also to the following parameters: FG_GEN_TAP2, FG_GEN_TAP3, FG_GEN_TAP4

If a tap is disabled, it will output black pixels instead of the generated pattern.

Table 16.8. Parameter properties of FG_GEN_TAP1

Property	Value
Name	**FG_GEN_TAP1**
Type	**Enumeration**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**FG_ON** On **FG_OFF** Off
Default value	**FG_ON**

Example 16.8. Usage of FG_GEN_TAP1

```
int result = 0;
unsigned int value = FG_ON;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_TAP1, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_TAP1, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.9. FG_GEN_ROLL

The generated pattern can be 'rolled'. The speed is controlled by this parameter.

Table 16.9. Parameter properties of FG_GEN_ROLL

Property	Value
Name	**FG_GEN_ROLL**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 0** **Maximum 255** **Stepsize 1**
Default value	**0**

Example 16.9. Usage of FG_GEN_ROLL

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_GEN_ROLL, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_GEN_ROLL, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.10. FG_GEN_ACTIVE

Table 16.10. Parameter properties of FG_GEN_ACTIVE

Property	Value
Name	FG_GEN_ACTIVE
Type	Unsigned Integer
Access policy	Read-Only
Storage policy	Transient
Allowed values	Minimum 0 Maximum 65535 Stepsize 1

Example 16.10. Usage of FG_GEN_ACTIVE

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_GEN_ACTIVE, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.11. FG_GEN_PASSIVE

Table 16.11. Parameter properties of FG_GEN_PASSIVE

Property	Value
Name	FG_GEN_PASSIVE
Type	Unsigned Integer
Access policy	Read-Only
Storage policy	Transient
Allowed values	Minimum 0 Maximum 65535 Stepsize 1

Example 16.11. Usage of FG_GEN_PASSIVE

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_GEN_PASSIVE, &value, 0, type)) < 0) {
    /* error handling */
}
```

16.12. FG_GEN_LINE_WIDTH

Table 16.12. Parameter properties of FG_GEN_LINE_WIDTH

Property	Value
Name	**FG_GEN_LINE_WIDTH**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**Minimum 0** **Maximum 65535** **Stepsize 1**
Unit of measure	**pixel**

Example 16.12. Usage of FG_GEN_LINE_WIDTH

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_GEN_LINE_WIDTH, &value, 0, type)) < 0) {
    /* error handling */
}
```

Chapter 17. Miscellaneous

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

17.1. FG_TIMEOUT

This parameter is used to set a timeout for DMA transfers. After a timeout the acquisition is stopped.

Table 17.1. Parameter properties of FG_TIMEOUT

Property	Value
Name	**FG_TIMEOUT**
Type	**Unsigned Integer**
Access policy	**Read/Write/Change**
Storage policy	**Persistent**
Allowed values	**Minimum 2** **Maximum 2147483646** **Stepsize 1**
Default value	**1000000**
Unit of measure	**seconds**

Example 17.1. Usage of FG_TIMEOUT

```
int result = 0;
unsigned int value = 1000000;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_TIMEOUT, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_TIMEOUT, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.2. FG_TURBO_DMA_MODE

This applet is equipped with a high speed DMA frame grabber to PC image transfer. For most scenarios, the speed of the DMA is sufficient. In some cases an even higher DMA bandwidth is required. Using this parameter, a DMA turbo mode can be activated for further increase of the bandwidth. Set the parameter to value one for activation of the turbo mode.

PC Mainboard Dependent

Some mainboards cannot handle the increased data rates. These mainboards might significantly decrease the bandwith when the DMA turbo mode is activated. Test your mainboard for compatibility of the DMA turbo mode.

Global Setting of the Turbo Mode

The default value of the parameter is overwritten if a global setting for the DMA turbo mode is set in the used Silicon Software runtime. Check the runtime documentation for further information. If an MCF file is used, the global setting is overwritten by the value in the configuration file.

Table 17.2. Parameter properties of FG_TURBO_DMA_MODE

Property	Value
Name	`FG_TURBO_DMA_MODE`
Type	`Unsigned Integer`
Access policy	`Read/Write`
Storage policy	`Persistent`

Allowed values	`Minimum 0`
	`Maximum 1`
	`Stepsize 1`

Default value	`0`

Example 17.2. Usage of FG_TURBO_DMA_MODE

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_setParameterWithType(FG_TURBO_DMA_MODE, &value, 0, type)) < 0) {
    /* error handling */
}

if ((result = Fg_getParameterWithType(FG_TURBO_DMA_MODE, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.3. FG_APPLET_VERSION

This parameter represents the version number of the AcquisitionApplets Advanced. Please report this value for any support of the applet.

Table 17.3. Parameter properties of FG_APPLET_VERSION

Property	Value
Name	`FG_APPLET_VERSION`
Type	`Unsigned Integer`
Access policy	`Read-Only`
Storage policy	`Transient`

Example 17.3. Usage of FG_APPLET_VERSION

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_APPLET_VERSION, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.4. FG_APPLET_REVISION

This parameter represents the revision number of the AcquisitionApplets Advanced. Please report this value for any support case with the applet.

Table 17.4. Parameter properties of FG_APPLET_REVISION

Property	Value
Name	`FG_APPLET_REVISION`
Type	`Unsigned Integer`
Access policy	`Read-Only`
Storage policy	`Transient`

Example 17.4. Usage of FG_APPLET_REVISION

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_APPLET_REVISION, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.5. FG_APPLET_ID

This value is for internal use only.

Table 17.5. Parameter properties of FG_APPLET_ID

Property	Value
Name	`FG_APPLET_ID`
Type	`Unsigned Integer`
Access policy	`Read-Only`
Storage policy	`Transient`

Example 17.5. Usage of FG_APPLET_ID

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_APPLET_ID, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.6. FG_HAP_FILE

Please report this read-only string parameter for any support case of the AcquisitionApplets Advanced.

Table 17.6. Parameter properties of FG_HAP_FILE

Property	Value
Name	`FG_HAP_FILE`
Type	`String`
Access policy	`Read-Only`
Storage policy	`Transient`

Example 17.6. Usage of FG_HAP_FILE

```
int result = 0;
char* value = "";
const enum FgParamTypes type = FG_PARAM_TYPE_CHAR_PTR;

if ((result = Fg_getParameterWithType(FG_HAP_FILE, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.7. FG_DMASTATUS

Using this parameter the status of a DMA channel can be obtained. Value "1" represents a started DMA i.e. a started acquisition. Value "0" represents a stopped acquisition.

Table 17.7. Parameter properties of FG_DMASTATUS

Property	Value
Name	**FG_DMASTATUS**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**

Example 17.7. Usage of FG_DMASTATUS

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_DMASTATUS, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.8. FG_CAMSTATUS

The camera status shows whether the camera clock signal can be recognized by frame grabber or not. If value "1" is determined from this read parameter, the grabber recognized a camera clock signal.

Table 17.8. Parameter properties of FG_CAMSTATUS

Property	Value
Name	**FG_CAMSTATUS**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**Minimum 0** **Maximum 1** **Stepsize 1**

Example 17.8. Usage of FG_CAMSTATUS

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_CAMSTATUS, &value, 0, type)) < 0) {
    /* error handling */
}
```

17.9. FG_CAMSTATUS_EXTENDED

This parameter provides extended information on the pixel clock from the camera, LVAL and FVAL, as well as the camera trigger signals, external trigger signals, buffer overflow status and buffer status. Each bit of the eight bit output word represents one parameter listed in the following:

- 0 = CameraClk
- 1 = CameraLval
- 2 = CameraFval
- 3 = Camera CC1 Signal
- 4 = ExTrg
- 5 = BufferOverflow
- 6 = BufStatus
- 7 = BufStatus

Table 17.9. Parameter properties of FG_CAMSTATUS_EXTENDED

Property	Value
Name	**FG_CAMSTATUS_EXTENDED**
Type	**Unsigned Integer**
Access policy	**Read-Only**
Storage policy	**Transient**
Allowed values	**Minimum 0** **Maximum 255** **Stepsize 1**

Example 17.9. Usage of FG_CAMSTATUS_EXTENDED

```
int result = 0;
unsigned int value = 0;
const enum FgParamTypes type = FG_PARAM_TYPE_UINT32_T;

if ((result = Fg_getParameterWithType(FG_CAMSTATUS_EXTENDED, &value, 0, type)) < 0) {
    /* error handling */
}
```

Glossary

Area of Interest (AOI)	See Region of Interest.
Board	A Silicon Software hardware. Usually, a board is represented by a frame grabber. Boards might comprise multiple devices.
Board ID Number	An identification number of a Silicon Software 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 Silicon Software 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). SiliconSoftware 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.
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)	A part a frame. Mostly rectengular and within the original image boundaries. Defined by coordinates. The frame grabber cuts the region of interest from the camera

	image. A region of interest might reduce or increase the required bandwidth.
Sensor Tap	See Tap.
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 simulatiously 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 tranfer 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.
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 triger IO. The first output has index 1. Check mapping of output pins to logic outputs in the harware documentation.

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