Allied Vision

VIMBA VIEWER 2.3.0

Setting up your camera

Configuration Guide

V2.3.0

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May 2020

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Contact Allied Vision

Contact technical support, sales, general inquiries

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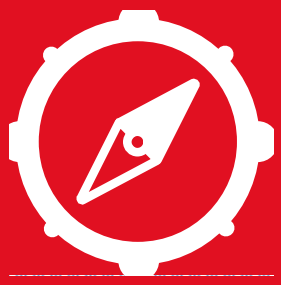
Document history and conventions



This chapter includes:

- Document history
- Conventions used in this manual

Document history

Version	Date	Remarks
V2.0.0	22 Feb 2016	New manual: Release status
V2.1.0	14 Feb 2017	Added Action Commands and saving images
V2.1.3	September 2017	Corrected some typos, Setting up your Goldeye CL camera on page 61: Added DeviceTapGeometry
V2.2.0	June 2019	Updated chapter Setting up your USB camera on page 50. Minor linguistic changes.
V2.2.1	October 2019	Minor corrections
V2.3.0	May 2020	Minor changes

Table 1: *Document history*

Conventions used in this manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

Styles

Style	Function	Example
Emphasis	Highlights important items and GUI elements	**Emphasis**
Names	Highlights proper names, features, and GUI non-interactive elements	*Names*
Reference	Links inside this document or to web pages	Link
Input	Input commands	`Command`

Table 2: *Styles*

Symbols and notes

Caution

Warning to prevent personal injuries

Notice

This symbol addresses important information to avoid material damage; however, is not related to physical injury.

Practical Tip

This symbol highlights a practical hint that helps to better understand the features and functions.

Safety-related instructions to avoid malfunctions

This symbol highlights instructions to avoid malfunctions.

Further information available online

This symbol highlights URLs for further information.

Overview

This chapter includes:

- Scope of this document
- Prerequisites
- Vimba Viewer tabs concept
- Starting and stopping image acquisition
- Loading and saving your settings
- Saving images

Overview

Scope of this document

This document guides you through the basic camera setup with the Vimba Viewer tabs. You will learn how to select, control, and save settings such as image size, exposure time, and color display.

Further information available online

For information on camera and driver installation and a detailed feature description, download the corresponding documents for your camera from:

https://www.alliedvision.com/en/support/technical-documentation.html

Feature availability depends on the camera model

Depending on the camera model, different features are available. The screenshots and examples in this document are generic.

Screenshots in this document

All screenshots in this document were made with Windows 7. If you use a different operating system, the user interface may look slightly different.

Prerequisites

This manual assumes you have already installed and configured the host adapter card or frame grabber and applicable drivers according to the instructions in the installation manual.

Vimba Viewer tabs concept

To select and configure settings, Vimba Viewer provides tabs with basic grouped camera features and the **All** tab, which contains a list both the basic features and advanced features.

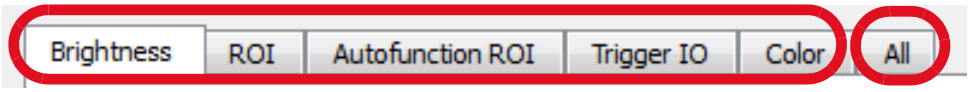


Figure 1: Basic features tabs and All tab

To quickly set up your camera, we recommend going through the tabs from left to right (except for Goldeye CL). The basic features can be adjusted either on the **All** tab or on the other tabs, whereas advanced features are available on the **All** tab only.

Example

You can adjust the exposure time either on the **Brightness** tab or on the **All** tab. If you set exposure time to 30 ms on the **Brightness** tab, the **All** tab automatically takes over this value and vice versa.

Finding features in the All tab

To quickly find features from the other tabs in the **All** tab, enter their first letters in the Search field.

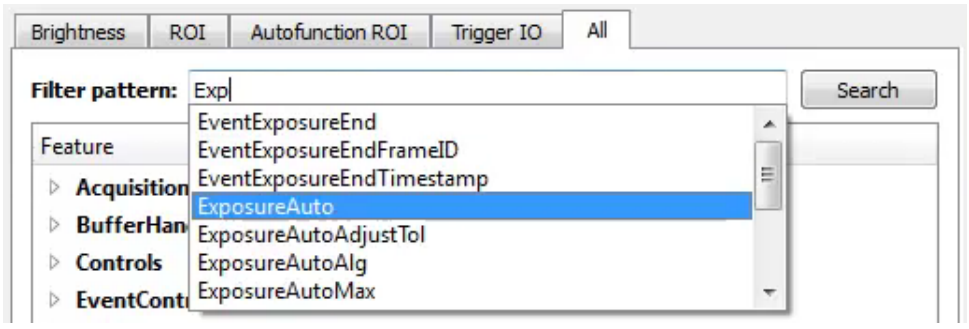


Figure 2: *Finding features*

Color tab

The **Color** tab is available for color cameras only.

Tooltips

The **All** tab provides tooltips and an optional feature description window. The description also lists which other features are affected by the selected feature.

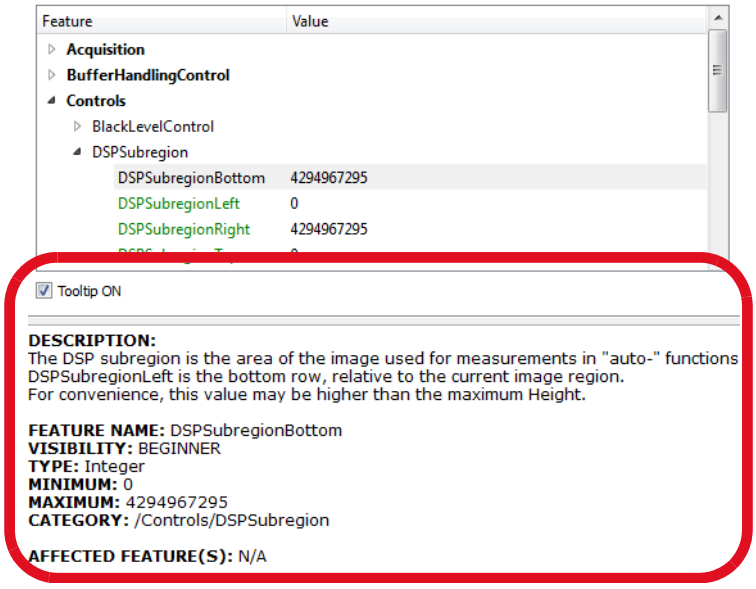


Figure 3: *Tooltips available in the All tab*

Starting and stopping image acquisition

To start and stop image acquisition, click the **Freerun** button.

Figure 4: Freerun button

Loading and saving your settings

Additionally to the user sets stored inside the cameras, you can save the feature values as an XML file to your host PC. You can load this camera settings XML file to a camera or use the XML file with Vimba API. To load or save a settings file, use the **Load** and **Save** buttons:

Figure 5: Load and Save buttons

Using saved settings files with Vimba API

To use a saved settings file with Vimba API:

1. Set up your camera with Vimba Viewer.
2. Save the settings.
3. Load the settings with the API (see the programming example and the API manuals).

Saving images

Saving one image

To save one image:

1. In the **File** menu, click **Save Image As...**

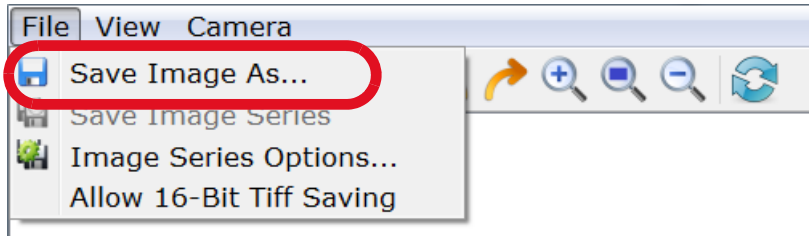


Figure 6: Saving one image

The Save Image window opens.

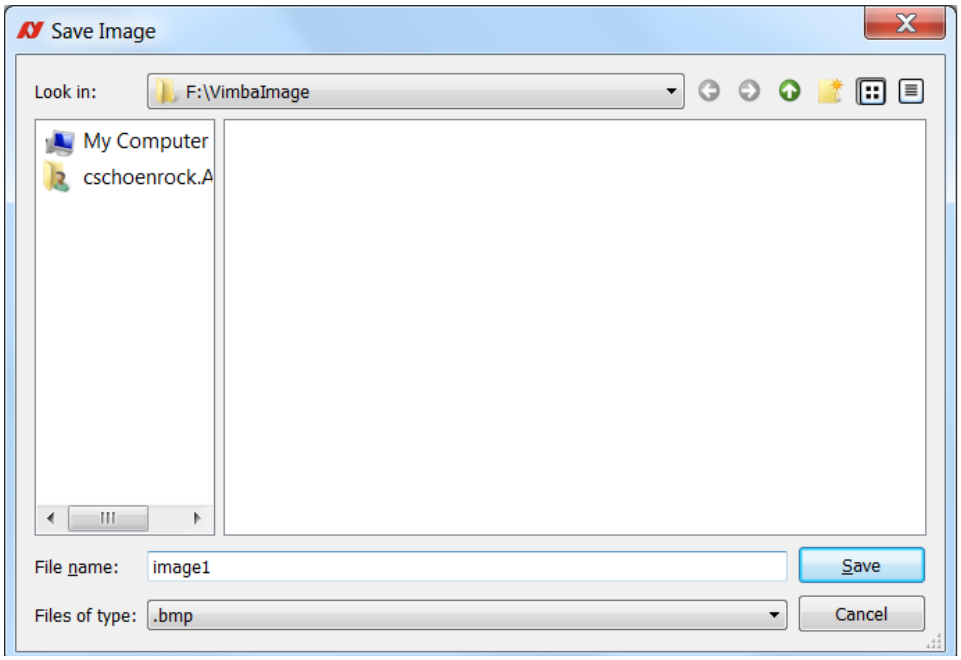


Figure 7: Save Image window

2. Select the save location, type a file name, select the file type, and click **Save**.

You can save the current image while the camera is running or you can save the current image displayed in Vimba Viewer while the camera is stopped.

Saving an image series

To save an image series:

1. If the camera is running, stop image acquisition.
2. In the **File menu**, click **Image Series Options...**

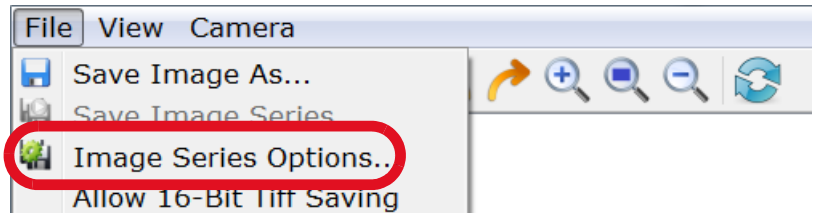


Figure 8: Image Series Options

The Saving Options window opens.

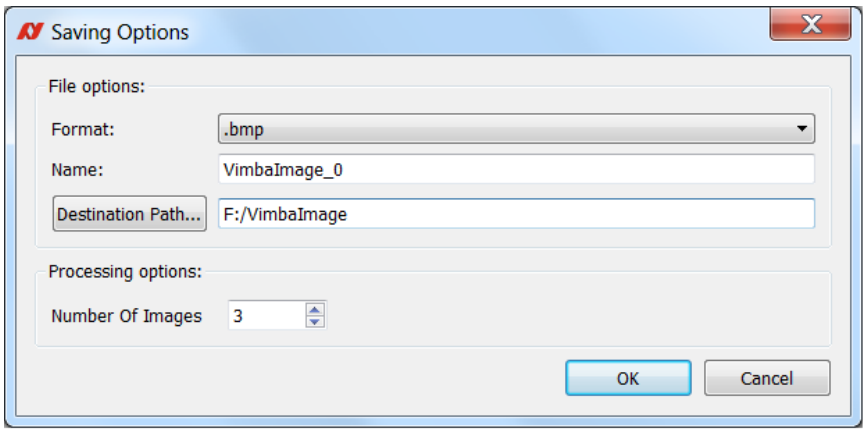


Figure 9: Saving Options

3. Make sure the *Number Of Images* is > 0, select the other options, and click **OK**.

Now **Save Image Series** is active. Clicking it triggers acquiring and saving the defined number of images.

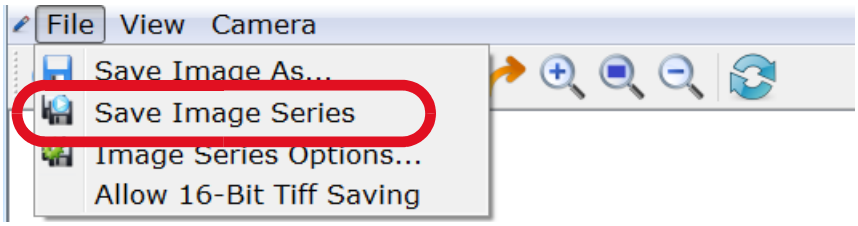


Figure 10: Trigger acquiring and saving an image series - File menu

You can also use the icon in the menu bar.

Figure 11: Trigger acquiring and saving an image series - icon bar

If the icon is grayed out, make sure that image acquisition is stopped and the selected number of images is > 0.

Saving 16-bit images

By default, Vimba Viewer saves 8-bit images, regardless of the selected pixel format or file format. Optionally, all images with mono or Bayer pixel formats > 8-bit per channel (e.g., Mono10, BayerRG12Packed, Mono14) can be saved as 16-bit TIFF. To enable this option, select *Allow 16-Bit TIFF Saving*.

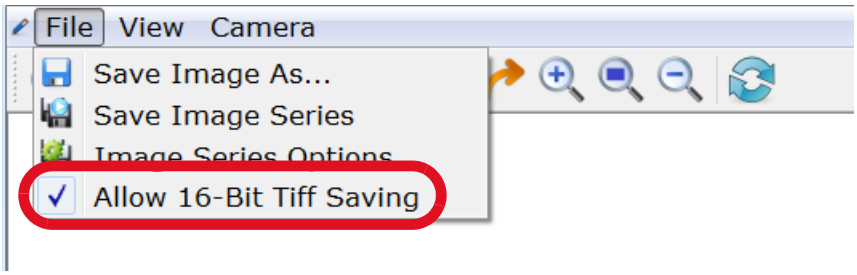


Figure 12: Allow 16-Bit TIFF Saving

Saving 16-bit image files and performance

The option for saving 16-bit image files is not optimized for performance. Therefore, it is deselected by default when a camera is opened. We recommend selecting it on demand.

16-bit image files are saved if these conditions are true:

- *Allow 16-Bit TIFF Saving* is checked.
- TIFF or TIF is the selected file format for image (series) saving.
- The camera's current pixel format is a mono or Bayer format > 8 bits per channel.

Supported pixel formats

- Mono10, Mono10p
- Mono12, Mono12p, Mono12Packed
- Mono14, Mono16
- BayerGR10, BayerRG10, BayerGB10, BayerBG10, BayerGR10p, BayerRG10p, BayerGB10p, BayerBG10p
- BayerGR12, BayerRG12, BayerGB12, BayerBG12, BayerGR12Packed, BayerRG12Packed, BayerGB12Packed, BayerBG12Packed, BayerGR12p, BayerRG12p, BayerGB12p, BayerBG12p
- BayerGR16, BayerRG16, BayerGB16, BayerBG16

Setting up your GigE camera

This chapter includes:

- Brightness tab
- ROI tab
- Autofunction ROI tab
- Trigger IO tab
- Color tab

Camera model dependence

Available features and appearance of screenshots vary depending on the camera model.

Brightness tab

The **Brightness** tab contains features for controlling exposure, gain, and the black level.

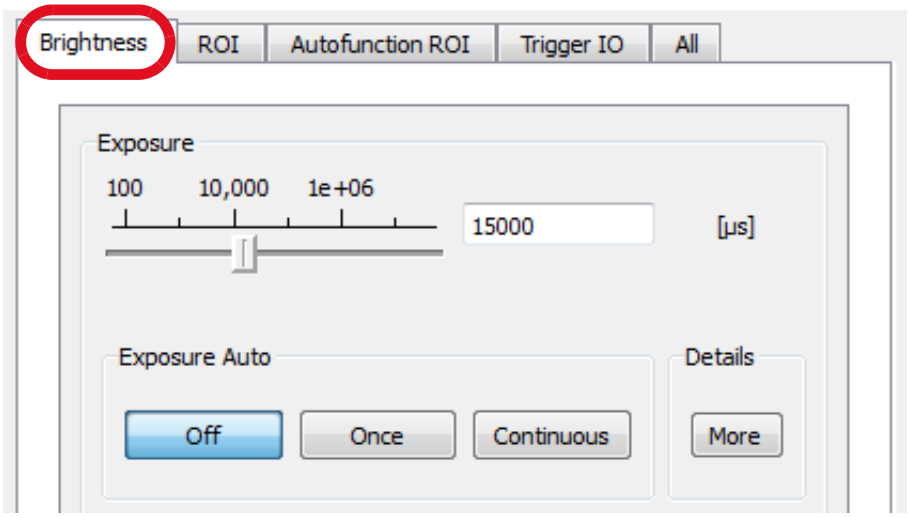


Figure 1: Brightness tab

Exposure and Gain

To change the exposure time, either move the **Exposure** slider or enter a value and press the ENTER key. To enter exposure times in s, ms, and µs, click **More**.

Exposure time and maximum frame rate

If your camera does not reach the maximum frame rate, check if the exposure time is short enough. Example: If the exposure time is 100 ms, the camera cannot acquire more than approximately 10 fps.

To change the gain value, either move the **Gain** slider or enter a value and press the ENTER key. Your entry is automatically rounded up or down to the next possible value.

Using auto exposure and auto gain

The purpose of auto functions is to automatically compensate for changes of the lighting intensity. They use information from the camera's current image and apply the optimized settings to the next image. Therefore, they can control values only if the camera is running. Large changes in scene lighting may require several frames for the algorithm to stabilize.

The auto functions can be applied either once or continuously.

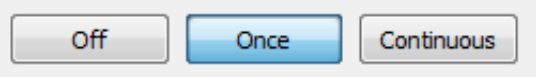


Figure 2: Auto functions - modes

Best practice

In most cases, you reach the best possible image quality by setting gain to the lowest possible value and increasing the exposure time as needed. The reason is that gain amplifies all image contents including noise.

Using Exposure Auto and Gain Auto simultaneously

If both auto features are used simultaneously, *Exposure Auto* has priority until *ExposureAutoMax* is reached. Then *Gain Auto* takes over priority.

Exposure Auto Target

Exposure Auto Target defines the desired mean gray scale value in percent. Increase or decrease it if you want *Exposure Auto* to produce a brighter or darker image.

Black Level

If dark objects are indistinguishable and appear black or if the image lacks contrast because black objects in the camera image appear gray, adjust the **BlackLevel** slider.

Best practice

Before adjusting black level, make sure your display is properly calibrated. Then adjust black level with a test chart.

ROI tab

Selecting an ROI (region of interest) enables working with a reduced image resolution to save bandwidth, achieve a higher frame rate (depending on the sensor), or crop the image according to your needs. Moreover, some cameras support binning.

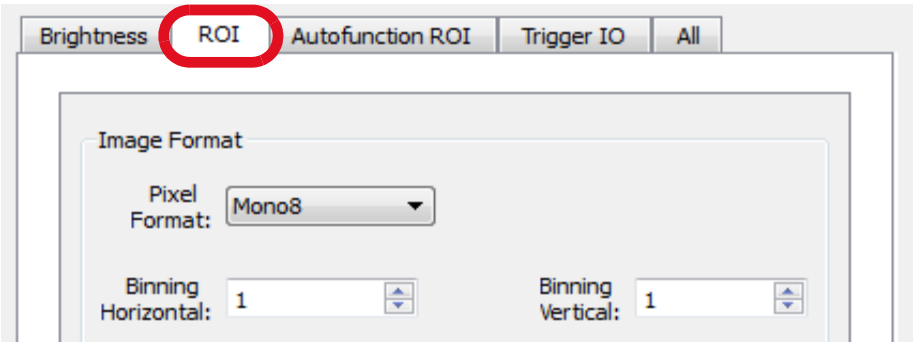


Figure 3: ROI tab

Setting up ROI and binning

To set up the basic image format:

1. Select a pixel format.
   a. Optionally (and if your camera supports it), activate binning by selecting a value greater than 1 (binning = 1 does not affect the image).
   Binning combines neighboring pixels into one pixel. This decreases resolution and increases light sensitivity. Depending on the camera model, binning may increase the frame rate.
2. Select an ROI. To do this, either click in the blue ROI area and scale or move it with the mouse or enter values into the **ROI** fields.

The buttons **Full**, **1/4**, and **1/16** evoke a centered ROI of the full or partial image.

Figure 4: Full - 1/4 - 1/16 buttons

Further reading

For the maximum frame rate as a function of ROI, see the technical manual of your camera, chapter *Specifications*.

For a feature description, see the GigE Features Reference.

Autofunction ROI tab

Autofunction ROI means that the auto functions react to lighting changes only within the selected image section.

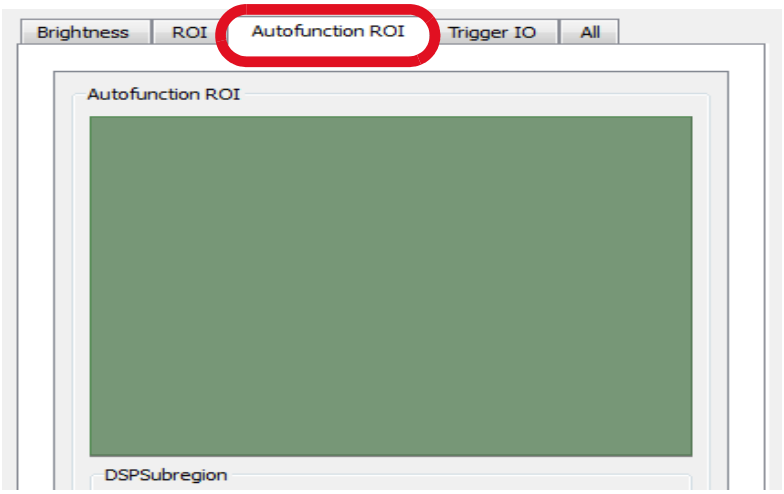


Figure 5: Autofunction ROI tab

With GigE cameras, Autofunction ROI (the *DSPSubregion* feature) is active as soon as auto exposure or auto gain are switched on. You cannot switch off *DSPSubregion*. Therefore, click the **Full** button if you want to apply auto gain and auto exposure to the whole image.

To change Autofunction ROI, either click in the green ROI area and drag it or enter values.

The buttons **Full**, **1/4**, and **1/16** evoke a centered ROI of the full, half, or quarter image.

Figure 6: Full - 1/4 - 1/16 buttons

Exposure Auto

Exposure Auto controls the minimum and maximum exposure time values in µs. If you want to reach a minimum frame rate, limit the exposure time accordingly.

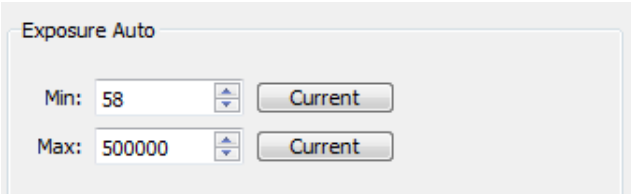


Figure 7: Exposure Auto

Trigger IO tab

Observe safety when using electrical connections.

Unsuitable connections may damage the camera or cause electrical shock.

Before connecting external devices, read the instructions in the technical manual of your camera, especially chapter *Camera interfaces*, section *Camera I/O connector pin assignment* and following.

Optionally, image acquisition can be started and stopped by a trigger signal from an external device or as a Vimba software command. Moreover, control signals can be transferred to external devices or additional cameras.

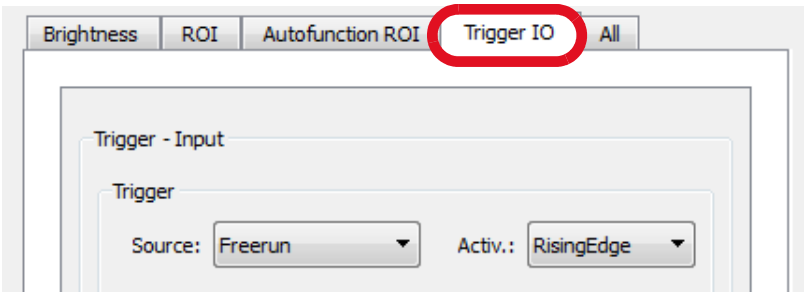


Figure 8: Trigger IO tab

Quick settings

Allied Vision cameras offer numerous options for triggering and I/O configuration. The quick settings cover typical machine vision scenarios. You can use the quick settings as a start and modify all features according to your needs.

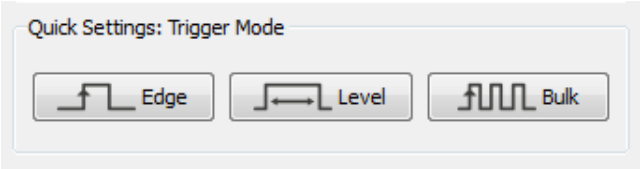


Figure 9: Quick settings

Trigger scenarios

Scenario A: Master/subordinate mode

If you want one camera to serve as master and a second camera as subordinate, connect the trigger device with the master camera's input and connect the subordinate camera with the master camera's output (for I/O pin assignments, see technical manual).

To configure master/subordinate functionality, open both cameras in Vimba Viewer:

Master camera

1. Click the **Edge** button.
2. Select *Source*: Select the chosen input, for example, **Line 1**
3. In the *Output* section, go to *SyncOut* and select **Exposing**.
4. Click the **Freerun** button.

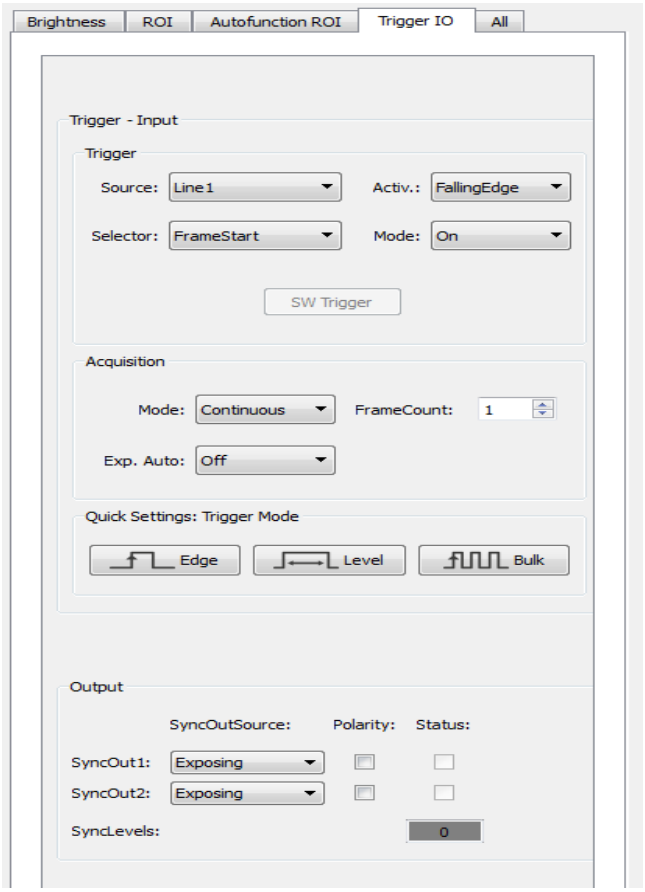


Figure 10: *Master camera*

Subordinate camera

1. Click the **Edge** button. Make sure that *Source* is switched to your selected input.
2. Click the **Freerun** button.

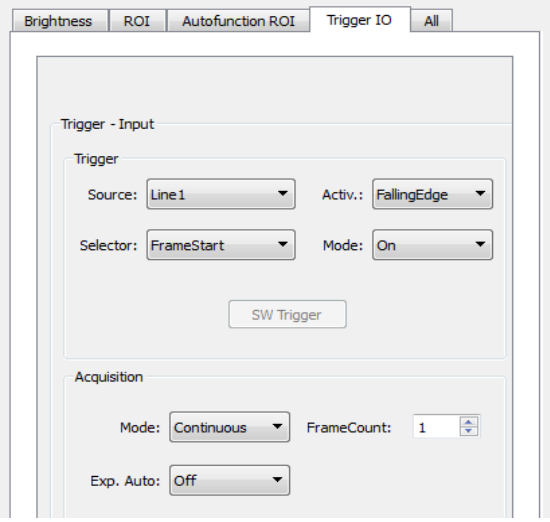


Figure 11: *Subordinate camera*

Now both cameras start acquiring images when the trigger signal edge is falling.

Scenario B: Controlling exposure externally

To control the exposure time with an external device, connect the trigger device with the master camera's input:

1. Click the **Level** button.
2. Click the **Freerun** button.

Now the camera exposes as long as the signal level from the trigger device is high or low (select **Activ.:** *LevelHigh* or *LevelLow)*.

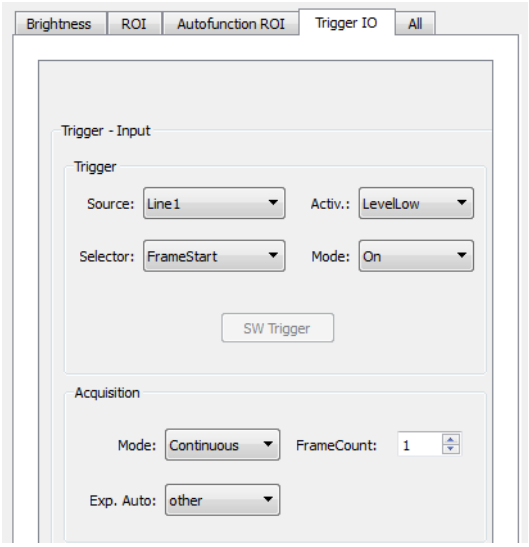


Figure 12: *Level Mode*

Scenario C: Acquiring an image series

To acquire n frames with a single trigger signal:

1. Click the **Bulk** button.
2. Click the **Freerun** button.

Now the camera acquires an image series when it receives a trigger signal.

To select the desired number of frames, enter the number in the *FrameCount* box. By default, the frames triggered with **Bulk** mode are acquired with the maximum possible frame rate. To acquire the image series with a frame rate of your choice:

1. Go to the **All** tab.
2. Select *AcquisitionFrameRateAbs.*
3. Enter the desired frame rate.

Scenario D: Software trigger

Software trigger and latency

The camera does not react immediately on a software trigger because a computer needs some time (latency) to process it. Since the CPU load varies all the time, the latency varies as well. If your application requires triggering with high precision, use a hardware device.

To trigger the camera by clicking the **SW Trigger** button:

1. Select *Source: Software.*(If *Software* is unavailable, click the Edge button.)
2. Checkmark *Mode: On/Off*.
3. Click the **Freerun** button.

Now the camera starts acquiring images when you click the **SW Trigger** button.

Scenario E: Trigger over Ethernet - Action Commands

Action Command support

Action Commands are supported by selected Allied Vision GigE camera models with the latest firmware.

Ethernet routers

If you use an Ethernet router, make sure all cameras are in the same subnet. Using a switch does not affect Action Commands.

Using Action Commands requires configuring them first on the camera and then on the host PC.

Configuring Action Commands on the camera

1. On the **Trigger IO** tab, select *Source: Action0* or *Action1* and *Mode: On.*

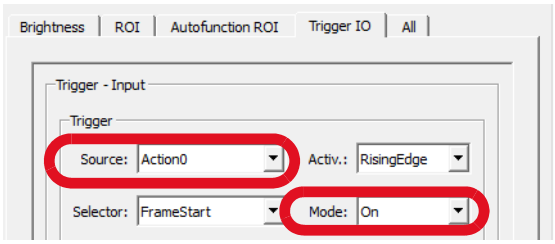


Figure 13: *Select an Action and switch on trigger*

2. Adjust the other trigger parameters as required by your use case.
3. On the **All** tab, open *ActionControl* and enter your desired values.

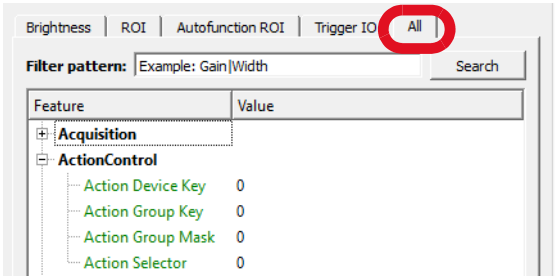


Figure 14: *Enter ActionControl values*

4. Click the **Freerun** button.

Configuring Action Commands on the host PC

1. While the main window remains open, go to the Camera Selector window and click the **Action Commands** icon.

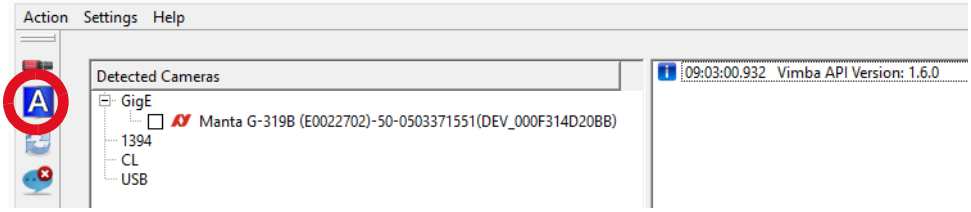


Figure 15: *Action Commands icon*

The Trigger over Ethernet- Action Commands window opens.

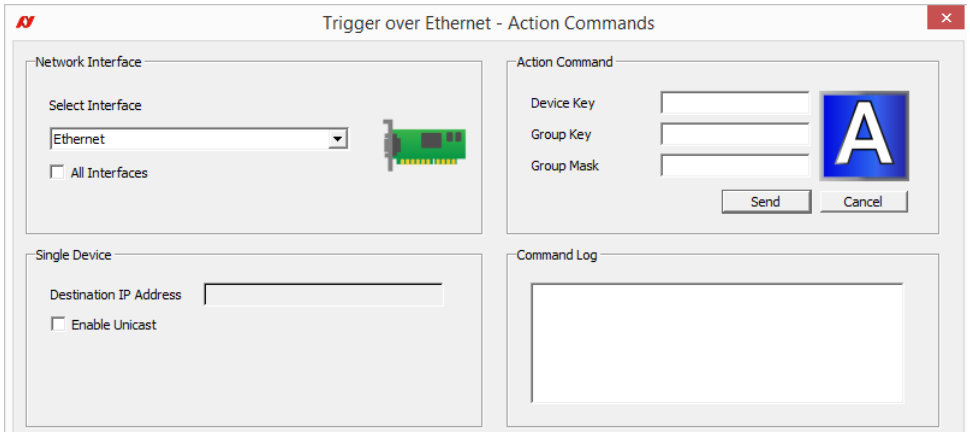


Figure 16: *Trigger over Ethernet - Action Commands window*

2. Select the host adapter your cameras are connected to or select *All interfaces.*

Listed host adapters

All Gigabit Ethernet adapters with a connected device are shown, even if the device does not support Action Commands.

No reload

The Send Action Command window does not reload when you plug in or out a camera. If you plug in a GigE cameras while the Send Action Command is open, close the Send Action Command window, wait until the device is detected, an then reopen the Send Action Command window.

3. Select the desired interface. To trigger a single device, check *Enable Unicast* and enter the device's IP address.
4. Copy the values for Device Key, Group Key, and Group Mask from the camera settings into the empty fields to configure them on the host PC.

5. To execute an Action Command, click the *Send* button. The Command log shows successfully sent Action Commands.

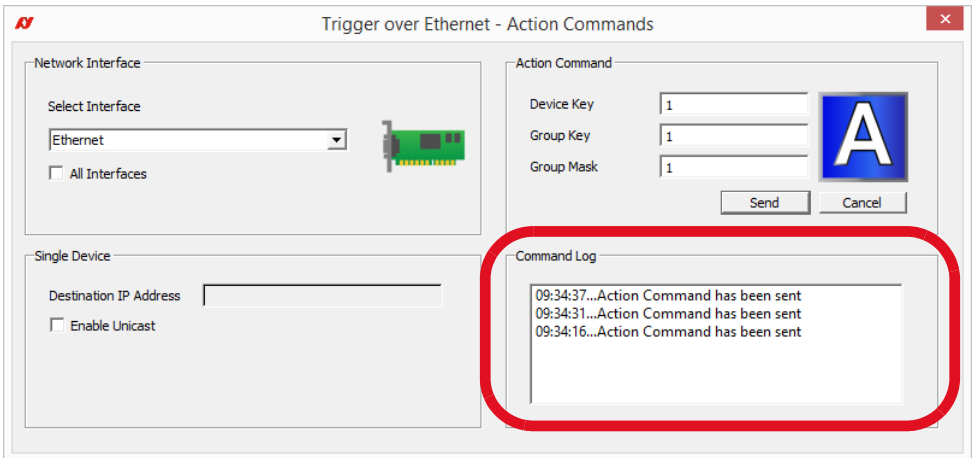


Figure 17: *Command Log*

Set Action Device Key

Action Device Key must be set each time a camera was opened.

Advanced trigger and I/O settings

In addition to the *Quick Settings*, the **Trigger IO** tab provides advanced settings. More information is provided in the following documents:

Further reading

For a feature description, see the GigE Features Reference. See also the technical manual of your GigE camera, chapter *Camera interfaces*.

For advanced information on triggering, download the application note: Triggering Concept for Allied Vision GigE Cameras, available at:

https://www.alliedvision.com/en/support/technical-documentation.html

Color tab

Color cameras only

The Color tab is available for color cameras only.

The **Color** tab contains features for controlling white balance, hue, and saturation as well as a color transformation matrix.

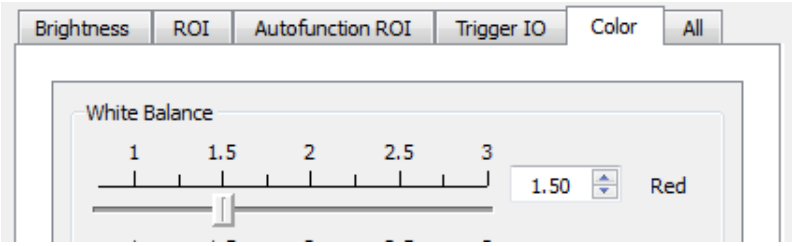


Figure 18: Color tab

Bayer pixel formats

Hue, Saturation, and Color Transformation have no effect if you select any Bayer pixel format on the **ROI** tab.

Auto white balance

Auto white balance automatically compensates for changes of the lighting source spectrum, for example, if artificial illumination is switched on and off additionally to daylight.

Auto white balance uses information from the camera's current image and applies the optimized settings to the next image. Therefore, it can control values only if the camera is running. Large changes in scene lighting may require several frames for the algorithm to stabilize.

Auto white balance can be applied either once or continuously.

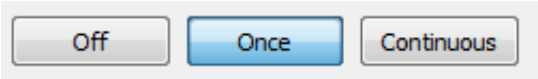


Figure 19: Auto functions - modes

To adapt white balance, either move the **White Balance** slider or enter a value and press the ENTER key.

Hue and Saturation

In the color circle, hue is represented by the outer ring and saturation by the inner ring.

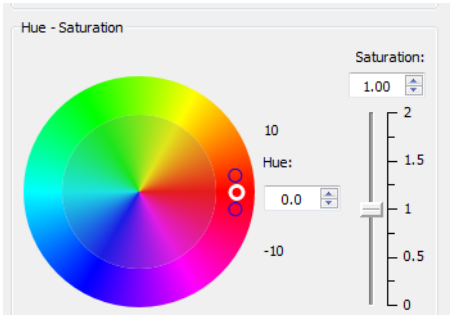


Figure 20: *Hue and Saturation*

To change hue, click between the two small circles in the outer ring of the color circle (white circle: valid value, black circle: invalid value) or use the **Hue** box.
To change saturation, click in the inner ring of the color circle or use the **Saturation** box or slider.

Using the color transformation matrix

The color transformation matrix enables you to adapt the color reproduction.

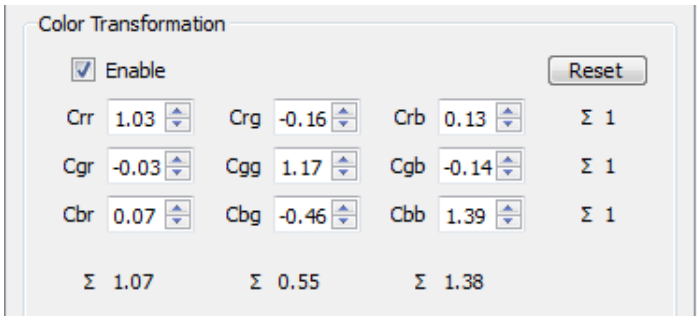


Figure 21: *Color transformation*

Color correction

Color correction compensates the overlap in the color channels. For example, a certain amount of blue light is “seen” not only by the blue pixels, but also by the red and green pixels. Depending on the spectrum of the light source and the sensor’s spectral response, different values are required to adjust the overlap and thus achieve the desired color reproduction.

In the color transformation matrix, Crr, Cgg, and Cbb represent the primary colors red (of the red pixel), green (of the green pixel), and blue (of the blue pixel).

Example

Crr represents red color of the red pixel. Increasing or decreasing Crr amplifies or attenuates red image components.

Values with two colors mean that the first color is mapped to the pixel of the second color. For example, Cgr means that green is mapped to the red pixel.

To better understand values affecting two colors, have a look at the *Hue - Saturation* circle.

Example

Cgr maps green light to the red color channel. Therefore, increasing Cgr amplifies green image components and shifts red image components towards green, resulting in a more orange red. Decreasing Cgr has the opposite effect: It attenuates green image components and shifts red image components towards magenta (the distance from red to green is larger).

Natural color reproduction

For natural color reproduction (depending on the sensor’s capabilities), make sure all row sums are 1. Values that deviate from 1 may result in tinted images.

Best practice

In machine vision, color correction is often used to emphasize a color of interest, to enhance the difference between two similar colors, or to reduce the image complexity.

Default values

To reset the matrix to its default values, click the **Reset** button.

Setting up your FireWire camera

This chapter includes:

- Brightness tab
- AOI tab
- Autofunction AOI tab
- Trigger IO tab
- Color tab

Camera model dependence

Available features and appearance of screenshots vary depending on the camera model.

Brightness tab

The **Brightness** tab contains features for controlling exposure, gain, and the black level.

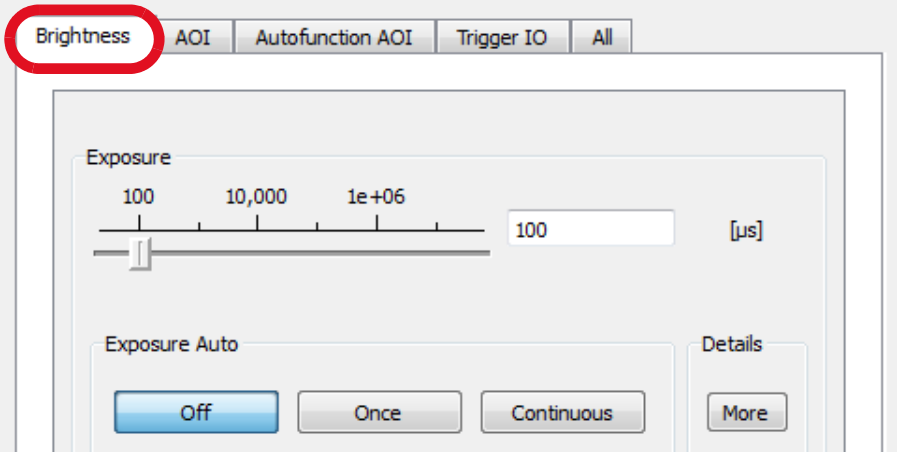


Figure 1: Brightness tab

Exposure and Gain

To change the exposure time, either move the **Exposure** slider or enter a value and press the ENTER key. To enter exposure times in s, ms, and µs, click **More**.

Exposure time and maximum frame rate

If your camera does not reach the maximum frame rate, check if the exposure time is short enough. Example: If the exposure time is 100 ms, the camera cannot acquire more than approximately 10 fps.

To change the gain value, either move the **Gain** slider or enter a value and press the ENTER key. Your entry is automatically rounded up or down to the next possible value.

Using auto exposure and auto gain

The purpose of auto functions is to automatically compensate for changes of the lighting intensity. They use information from the camera's current image and apply the optimized settings to the next image. Therefore, they can control values only if the camera is running. Large changes in scene lighting may require several frames for the algorithm to stabilize.

The auto functions can be applied either once or continuously.

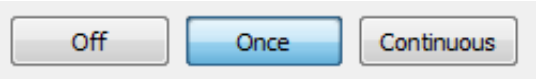


Figure 2: Auto functions - modes

Best practice

In most cases, you achieve the best possible image quality by setting gain to the lowest possible value and increasing the exposure time as needed. The reason is that gain amplifies all image contents including noise.

Using Exposure Auto and Gain Auto simultaneously

If both auto features are used simultaneously, *Exposure Auto* has priority until *ExposureAutoMax* is reached. Then *Gain Auto* takes over priority.

Exposure Auto Target

Exposure Auto Target defines the desired mean gray scale value in percent. Increase or decrease it if you want *Exposure Auto* to produce a brighter or darker image.

Black Level

If dark objects are indistinguishable and appear black or if the image lacks contrast because black objects in the camera image appear gray, adjust **BlackLevel**.

Best practice

Before adjusting **BlackLevel**, make sure your display is properly calibrated. Then adjust **BlackLevel** with a test chart.

AOI tab

Selecting a AOI (area of interest, also called: ROI, region of interest) enables working with a reduced image resolution to save bandwidth, achieve a higher frame rate (depending on the sensor), or crop the image according to your needs. Moreover, some cameras support binning.

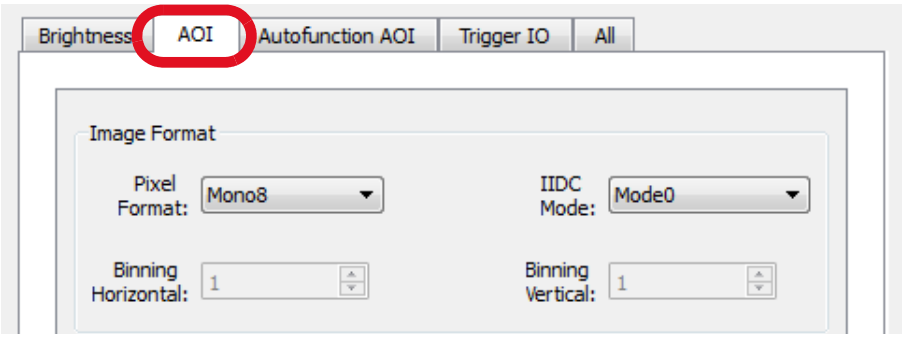


Figure 3: AOI tab

Change values while the camera is running

Change all values on the AOI tab while the camera is running.

Setting up AOI and IIDC Mode

To set up the basic image format:

1. Select a pixel format.
   a. Optionally, select an IIDC Mode with smaller resolution and binning. Binning combines neighboring pixels into one pixel. This decreases resolution and increases light sensitivity. Depending on the camera model, binning may increase the frame rate.
2. Select a AOI. To do this, either click in the blue AOI area and scale or move it with the mouse or enter values into the **AOI** fields.

The buttons **Full**, **1/4**, and **1/16** evoke a centered AOI of the full or partial image.

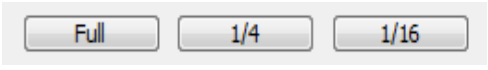


Figure 4: Full - 1/4 - 1/16 buttons

Advanced binning settings

To apply advanced binning settings, access the camera register and follow the instructions in the technical manual.

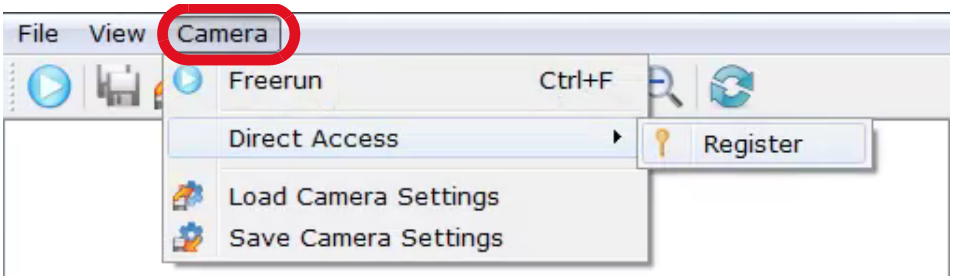


Figure 5: *Register access*

Further reading

For the maximum frame rate depending on AOI, see the technical manual of your camera, chapter *Video formats, modes and bandwidth*.

For more information about binning, see the technical manual of your camera, section *Binning.* Advanced binning settings are described in section *Binning and subsampling access.*

Autofunction AOI tab

Autofunction AOI means that the auto functions react to lighting changes only within the selected image section.

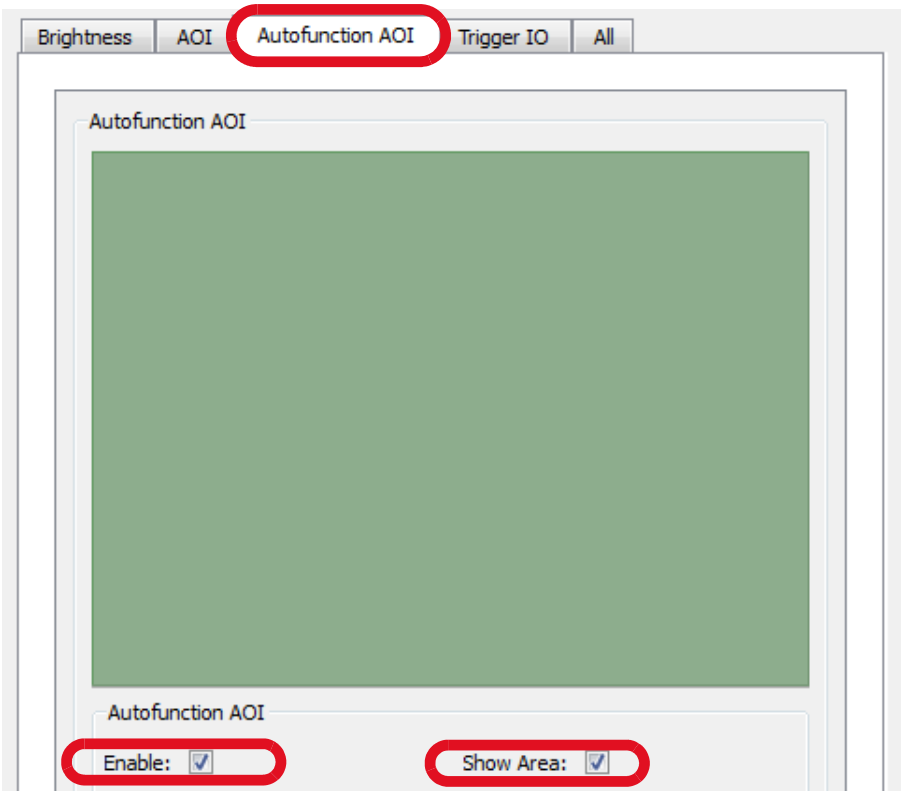


Figure 6: Autofunction AOI tab

To activate the autofunction AOI, checkmark **Enable**. To change the autofunction AOI, either click in the green area and drag it or enter values. **Show Area** highlights the autofunction AOI in the camera image.

The buttons **Full**, **1/4**, and **1/16** evoke a centered AOI of the full, half, or quarter image.

Figure 7: Full - 1/4 - 1/16 buttons

Exposure Auto

Exposure Auto controls the minimum and maximum exposure time values in µs. If you want to reach a minimum frame rate, limit the exposure time accordingly.

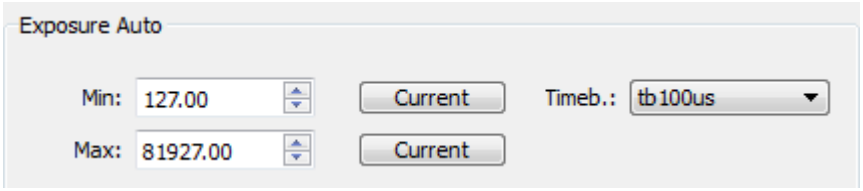


Figure 8: Exposure Auto

Timebase

Timebase values determine the possible range of exposure time values. To work within a range of short exposure times, select a small timebase value. For long exposure times, select a large timebase value.

Further reading

For more information, see the technical manual of your FireWire camera.

Trigger IO tab

Observe safety when using electrical connections.

Unsuitable connections may damage the camera or cause electrical shock.

Before connecting external devices, read the instructions in the 1394 Installation Manual, chapter *Camera interfaces*.

Optionally, image acquisition can be started and stopped by a trigger signal from an external device or as a Vimba software command. Moreover, control signals can be transferred to external devices or additional cameras.

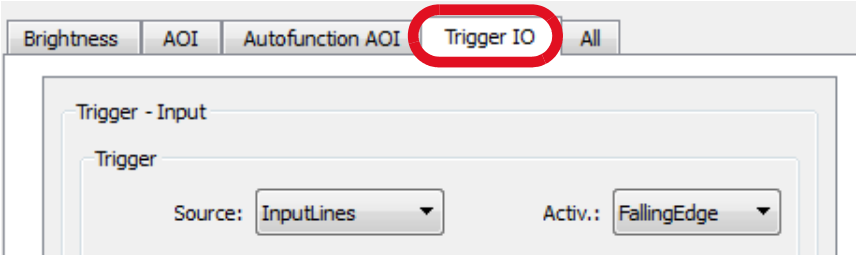


Figure 9: Trigger IO tab

Quick settings

Allied Vision cameras offer numerous options for triggering and I/O configuration. The quick settings cover typical machine vision scenarios. You can use the quick settings as a start and modify all features according to your needs.

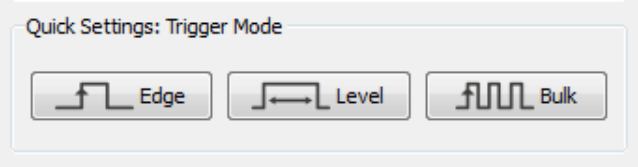


Figure 10: Quick settings

Trigger scenarios

Scenario A: Master/subordinate mode

If you want one camera to serve as master and a second camera as subordinate, connect the trigger device with the master camera's input (GPIn1 in the technical manual is shown as Line0 in Vimba) and connect the subordinate camera with the master camera's output (With FireWire cameras, GPOut1 in the technical manual is shown as Line4 in Vimba).

To configure master/subordinate functionality, open both cameras in Vimba Viewer:

Master camera

1. Click the **Edge** button.
2. In the *Trigger Input section*, use *Line Sel*. to select the input.
3. In the *Output* section, go to *Line* (select the output line used) and select **ExposureActive**.
4. Click the **Freerun** button.

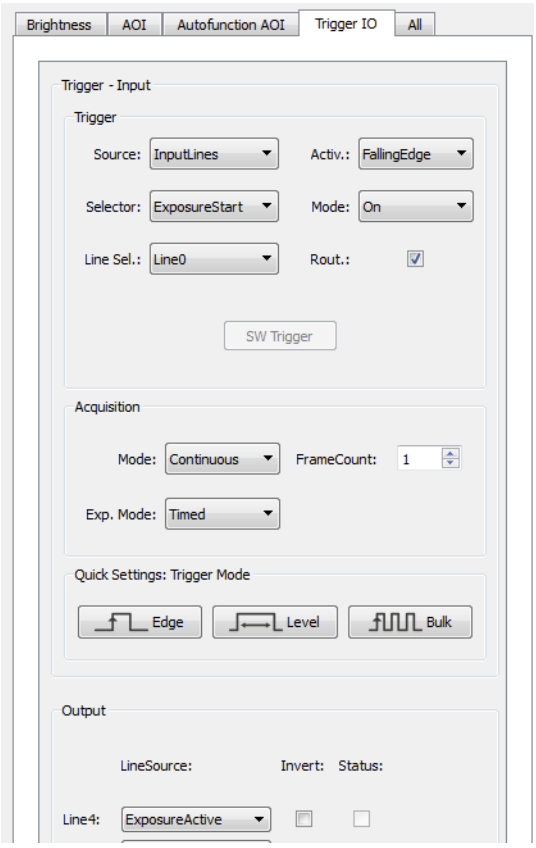


Figure 11: *Master camera*

Subordinate camera

1. Click the **Edge** button and make sure *Line Sel:* activates the input line used.
2. Click the **Freerun** button.

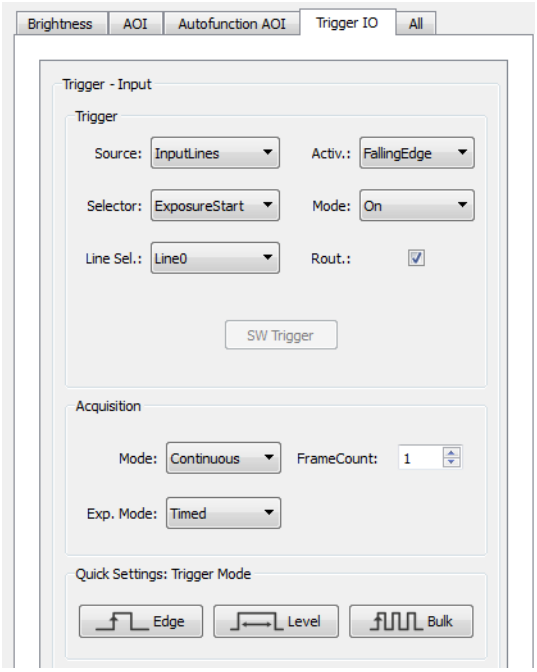


Figure 12: *Subordinate camera*

Now both cameras start acquiring images when the trigger signal edge is falling.

Scenario B: Controlling exposure externally

To control the exposure time with an external device, connect the trigger device with the master camera's input (GPIn1 in the technical manual is shown as Line0 in Vimba) and:

1. Click the **Level** button.
2. Click the **Freerun** button.

Now the camera exposes as long as the signal level from the trigger device is high or low (select **Activ.:** *LevelHigh* or *LevelLow)*.

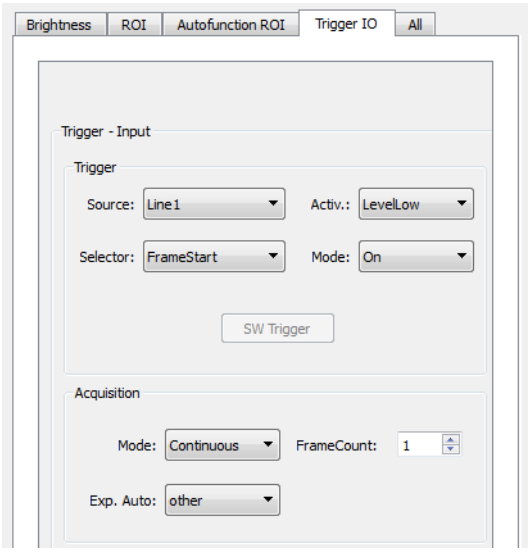


Figure 13: *Level Mode*

Scenario C: Acquiring an image series

To acquire n frames with a single trigger signal:

1. Click the **Bulk** button.
2. Click the **Freerun** button.

Now the camera acquires an image series when it receives a trigger signal.

To select the desired number of frames, enter the number in the *FrameCount* box. By default, the frames triggered with Bulk mode are acquired with the maximum possible frame rate. To acquire the image series with a frame rate of your choice:

1. Go to the **All** tab.
2. Select *AcquisitionFrameRateAbs.*
3. Enter the desired frame rate.

Scenario D: Software trigger

Software trigger and latency

The camera does not react immediately on a software trigger because a computer needs some time (latency) to process it. Since the CPU load varies all the time, the latency varies as well. If your application requires triggering with high precision, use a hardware device.

To trigger the camera by clicking the **SW Trigger** button:

1. Select *Source: Software.*
2. Checkmark *Mode: On/Off*.
3. Click the **Freerun** button.

Now the camera starts acquiring images when you click the **SW Trigger** button.

Advanced trigger and I/O settings

In addition to the *Quick Settings*, the **Trigger IO** tab provides advanced settings. More information is provided in the following documents:

Further reading

Technical manual and Installation guide, chapter *Camera interfaces*, technical manual, chapter *Controlling image capture.*

Color tab

Color cameras only

The Color tab is available for color cameras only.

The **Color** tab contains features for controlling white balance, hue, and saturation as well as a color transformation matrix.

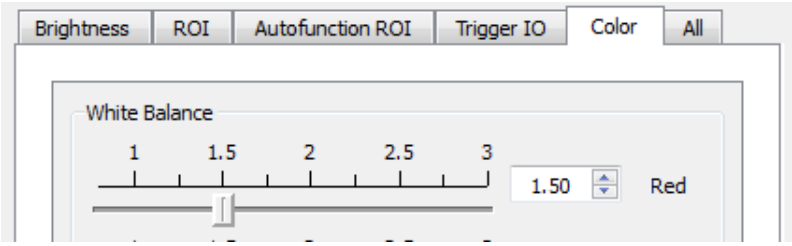


Figure 14: Color tab

Bayer pixel formats

Hue, Saturation, and Color Transformation have no effect if you select any Bayer pixel format on the **AOI** tab.

Auto white balance

Auto white balance automatically compensates for changes of the lighting source, for example, if artificial illumination is switched on and off additionally to daylight.

Auto white balance uses information from the camera's current image and applies the optimized settings to the next image. Therefore, it can control values only if the camera is running. Large changes in scene lighting may require several frames for the algorithm to stabilize.

Auto white balance can be applied either once or continuously.

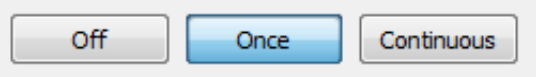


Figure 15: Auto functions - modes

Auto functions: Once

If you select **Once**, consider that the algorithm may need several images to find the optimal values, especially if the lighting conditions changed considerably since the last image was taken. In this case, activate **Once** several times.

To adapt white balance, either move the **White Balance** slider or enter a value and press the ENTER key.

Hue and Saturation

In the color circle, hue is represented by the outer ring and saturation by the inner ring.

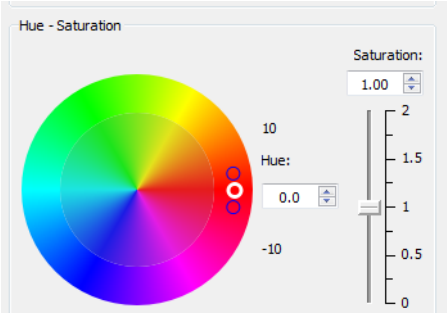


***Figure 16:** Hue and Saturation*

To change hue, click between the two small circles in the outer ring of the color circle (white circle: valid value, black circle: invalid value) or use the **Hue** box.

To change saturation, click in the inner ring of the color circle or use the **Saturation** box or slider.

Using the color transformation matrix

The color transformation matrix enables you to adapt the color reproduction.

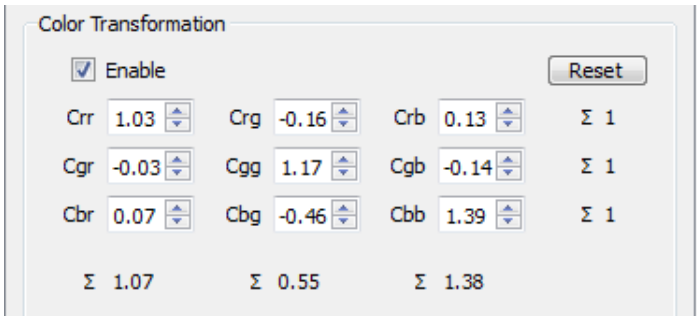


Figure 17: *Color transformation*

Color correction

Color correction compensates the overlap in the color channels. For example, a certain amount of blue light is “seen” not only by the blue pixels, but also by the red and green pixels. Depending on the spectrum of the light source and the sensor’s spectral response, different values are required to adjust the overlap and thus achieve the desired color reproduction.

In the color transformation matrix, Crr, Cgg, and Cbb represent the primary colors red (of the red pixel), green (of the green pixel), and blue (of the blue pixel).

Example

Crr represents red color of the red pixel. Increasing or decreasing Crr amplifies or attenuates red image components.

Values with two colors mean that the first color is mapped to the pixel of the second color. For example, Cgr means that green is mapped to the red pixel.

To better understand values affecting two colors, have a look at the *Hue - Saturation* circle.

Example

Cgr maps green light to the red color channel. Therefore, increasing Cgr amplifies green image components and shifts red image components towards green, resulting in a more orange red. Decreasing Cgr has the opposite effect: It attenuates green image components and shifts red image components towards magenta (the distance from red to green is larger).

Natural color reproduction

For natural color reproduction (depending on the sensor’s capabilities), make sure all row sums are 1. Values that deviate from 1 may result in tinted images.

Best practice

In machine vision, color correction is often used to emphasize a color of interest, to enhance the difference between two similar colors, or to reduce the image complexity.

Default values

To reset the matrix to its default values, click the **Reset** button.

Setting up your USB camera

This chapter includes:

- Brightness tab
- ROI tab
- Autofunction ROI tab
- Trigger IO tab
- Color tab

Camera model dependence

Available features and appearance of screenshots vary depending on the camera model.

Brightness tab

The **Brightness** tab contains features such as exposure, gain, the black level, and gamma.

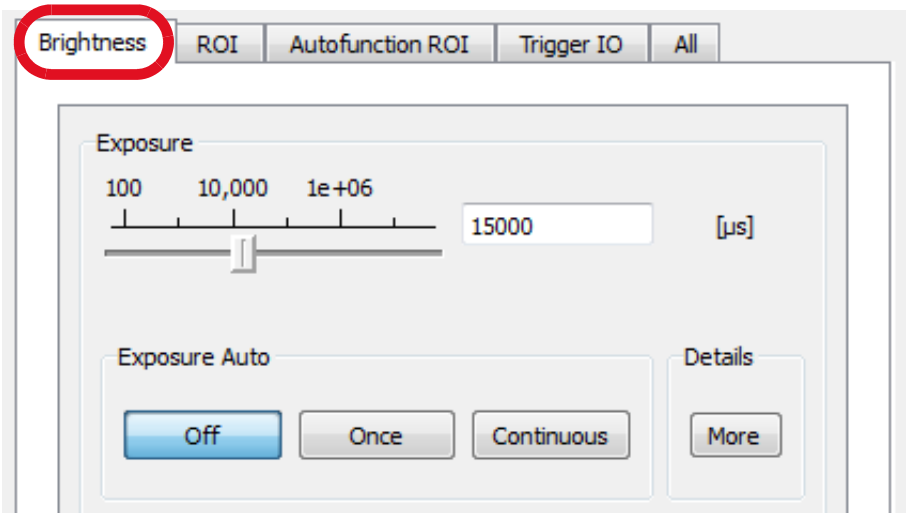


Figure 1: Brightness tab

Exposure and Gain

To change the exposure time, either move the **Exposure** slider or enter a value and press the ENTER key. To enter exposure times in s, ms, and µs, click **More**.

Exposure time and maximum frame rate

If your camera does not reach the maximum frame rate, check if the exposure time is short enough. Example: If the exposure time is 100 ms, the camera cannot acquire more than approximately 10 fps.

To change the gain value, either move the **Gain** slider or enter a value and press the ENTER key. Your entry is automatically rounded up or down to the next possible value.

Using auto exposure and auto gain

The purpose of auto functions is to automatically compensate for changes of the lighting intensity. They use information from the camera's current image and apply the optimized settings to the next image. Therefore, they can control values only if the camera is running. Large changes in scene lighting may require several frames for the algorithm to stabilize.

The auto functions can be applied either once or continuously.

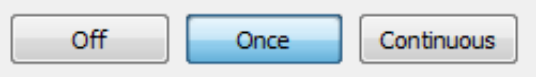


Figure 2: Auto functions - modes

Best practice

In most cases, you reach the best possible image quality by setting gain to the lowest possible value and increasing the exposure time as needed. The reason is that gain amplifies all image contents including noise.

Using Exposure Auto and Gain Auto simultaneously

If both auto features are used simultaneously, Exposure Auto has priority until ExposureAutoMax is reached.

Intensity Controller Target

Intensity Auto Target (Exposure Auto Target with Mako U cameras) defines the desired mean gray scale value in percent. Increase or decrease it if you want *Exposure Auto* or *Gain Auto* to produce a brighter or darker image.

Black Level

If dark objects are indistinguishable and appear black or if the image lacks contrast because black objects in the camera image appear gray, adjust the **BlackLevel** slider.

Best practice

Before adjusting black level, make sure your display is properly calibrated. Then adjust black level with a test chart.

ROI tab

Selecting an ROI (region of interest) enables working with a reduced image resolution to save bandwidth, achieve a higher frame rate (depending on the sensor), or crop the image according to your needs.

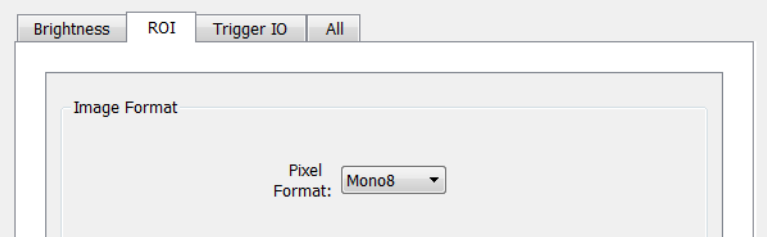


Figure 3: ROI tab

Setting up ROI

To set up the basic image format:

1. Select a pixel format.
2. Select an ROI. To do this, either click in the blue ROI area and scale or move it with the mouse or enter values into the **ROI** fields.

The buttons **Full**, **1/4**, and **1/16** evoke a centered ROI of the full or partial image.

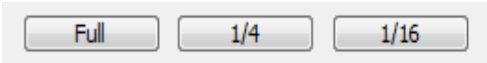


Figure 4: Full - 1/4 - 1/16 buttons

Further reading

For the maximum frame depending on ROI, see the technical manual or user guide of your camera, chapter *Specifications*.

For a feature description, see the Features Reference document.

Autofunction ROI tab

Autofunction ROI means that the auto functions react to lighting changes only within the selected image section.

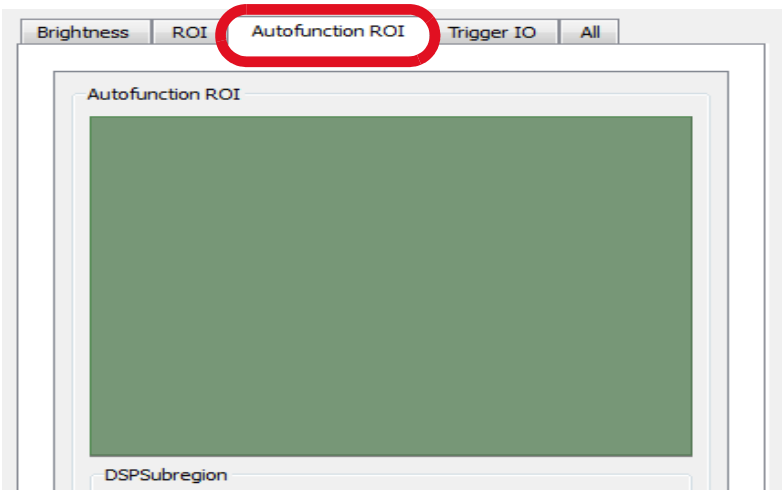


Figure 5: Autofunction ROI tab

Autofunction ROI (the *DSPSubregion* feature) is active as soon as auto exposure or auto gain are switched on.

To change Autofunction ROI, either click in the colored ROI area and drag it or enter values.

The buttons **Full**, **1/4**, and **1/16** evoke a centered ROI of the full, half, or quarter image.

Figure 6: Full - 1/4 - 1/16 buttons

Exposure Auto

Exposure Auto controls the minimum and maximum exposure time values in µs. If you want to reach a minimum frame rate, limit the exposure time accordingly.

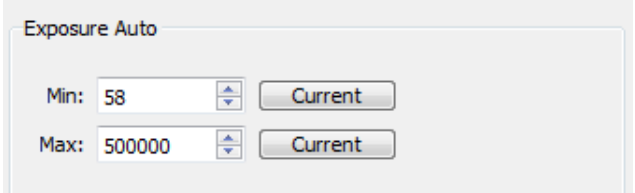


Figure 7: Exposure Auto

Trigger IO tab

Observe safety when using electrical connections.

Unsuitable connections may damage the camera or cause electrical shock.

Before connecting external devices, read the instructions in the technical manual or user guide of your camera, especially chapter *Camera interfaces*, section *Camera I/O connector pin assignment* and following.

Optionally, image acquisition can be started and stopped by a trigger signal from an external device or as a Vimba software command. Moreover, control signals can be transferred to external devices or additional cameras.

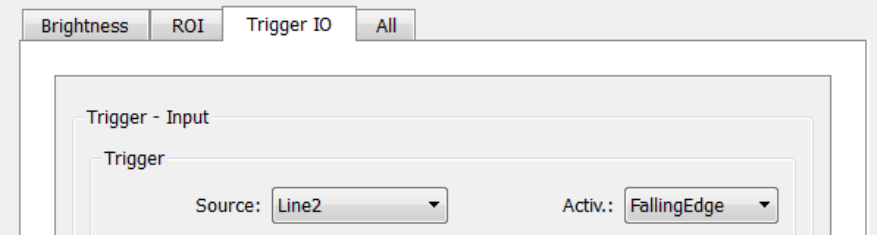


Figure 8: Trigger IO tab

Quick settings

Allied Vision cameras offer numerous options for triggering and I/O configuration. The quick settings cover typical machine vision scenarios. You can use the quick settings as a start and modify all features according to your needs.

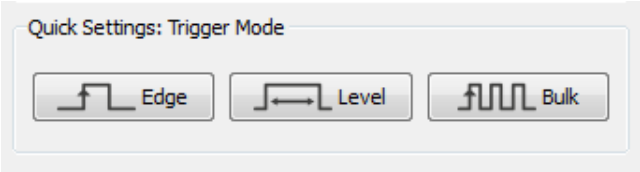


Figure 9: Quick settings

Trigger scenarios

Scenario A: Master/subordinate mode

If you want one camera to serve as master and a second camera as subordinate, connect the trigger device with the master camera's input and connect the subordinate camera with the master camera's output (for pin assignments, see technical manual or user guide). To configure master/subordinate functionality, open both cameras in Vimba Viewer:

Master camera

1. Click the **Edge** button.
2. Select *Source*: Select the chosen input line, for example, **Line 2.**
3. In the *Output* section, go to the selected output line and select **Exposing**.
4. Click the **Freerun** button.

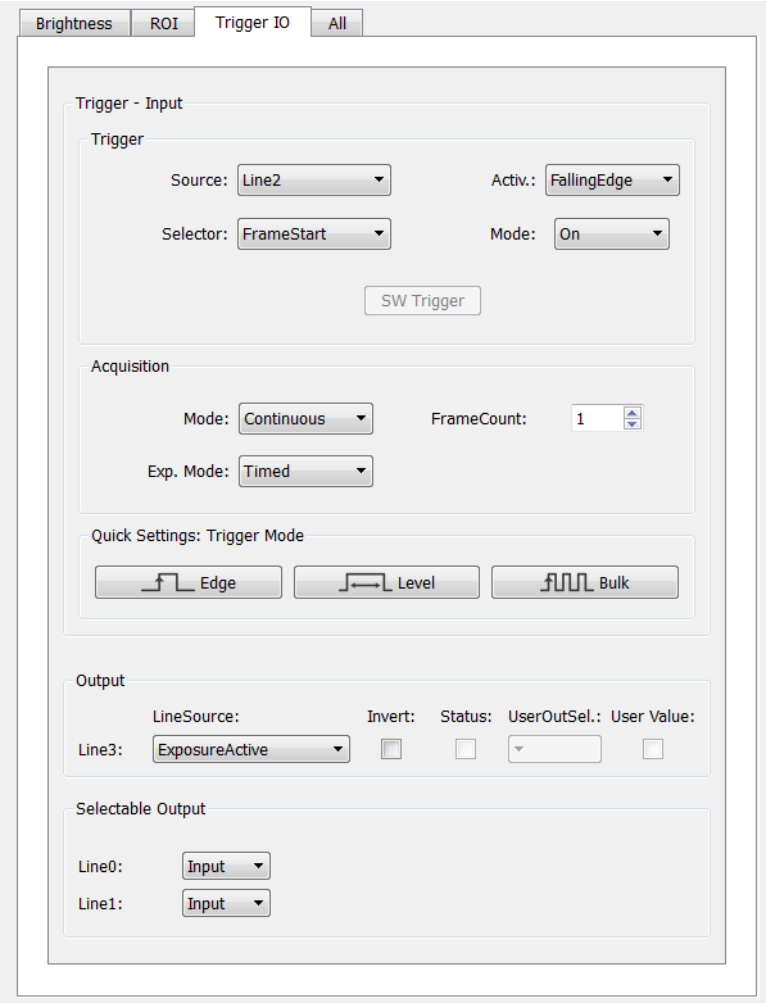


Figure 10: *Master camera*

Subordinate camera

1. Click the **Edge** button. Make sure that *Source* is switched to your selected input.
2. Click the **Freerun** button.

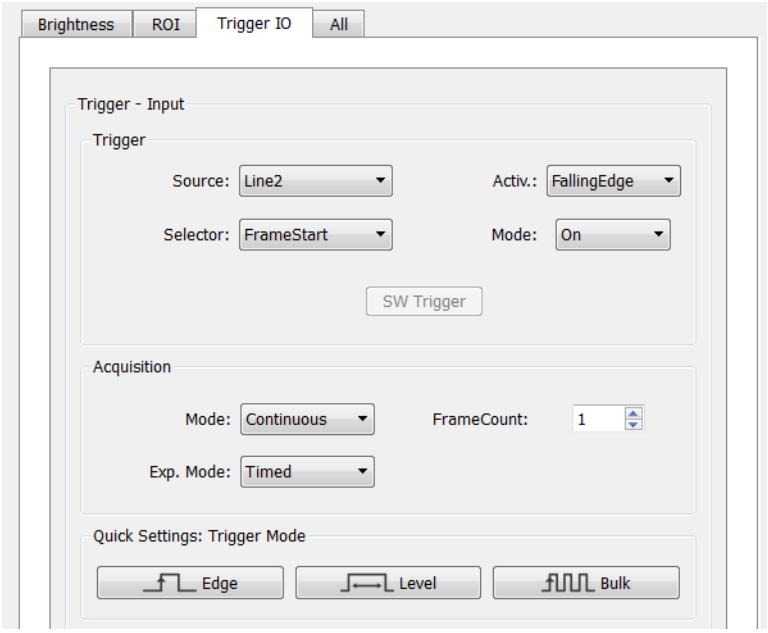


Figure 11: *Subordinate camera*

Now both cameras start acquiring images when the trigger signal edge is falling.

Scenario B: Controlling exposure externally

To control the exposure time with an external device, connect the trigger device with the master camera's input line:

1. Click the **Level** button.
2. Click the **Freerun** button.

Now the camera exposes as long as the signal level from the trigger device is high or low (select **Activ.:** *LevelHigh* or *LevelLow, if available on your camera model)*.

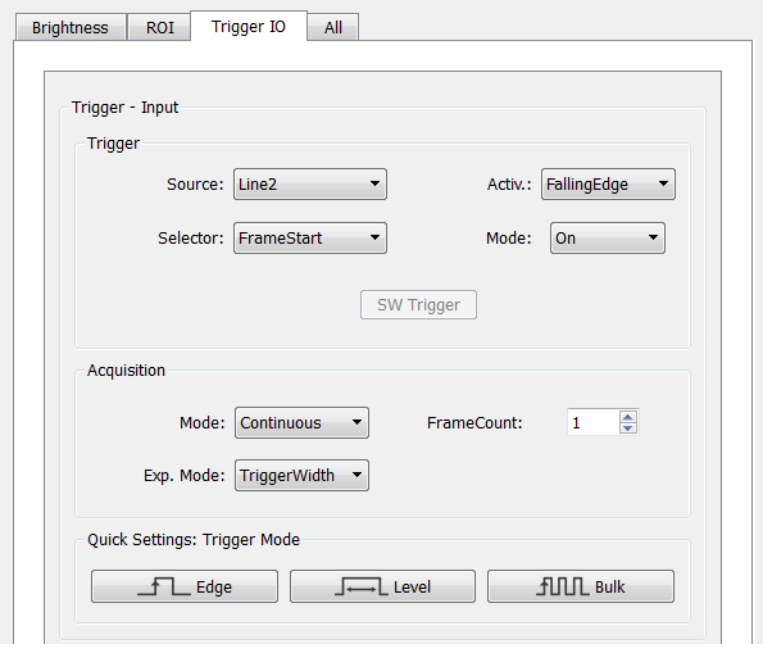


Figure 12: *Level Mode*

Scenario C: Acquiring an image series

To acquire n frames with a single trigger signal:

1. Click the **Bulk** button.
2. Click the **Freerun** button.

Now the camera acquires an image series when it receives a trigger signal.

To select the desired number of frames, enter the number in the *FrameCount* box. By default, the frames triggered with **Bulk** mode are acquired with the maximum possible frame rate. To acquire the image series with a frame rate of your choice:

1. Go to the **All** tab.
2. Select *AcquisitionFrameRateAbs.*
3. Enter the desired frame rate.

Scenario D: Software trigger

Software trigger and latency

The camera does not react immediately on a software trigger because a computer needs some time (latency) to process it. Since the CPU load varies all the time, the latency varies as well. If your application requires triggering with high precision, use a hardware device.

To trigger the camera by clicking the **SW Trigger** button:

1. Select *Source: Software.*(If *Software* is unavailable, click the Edge button.)
2. Checkmark *Mode: On/Off*.
3. Click the **Freerun** button.

Now the camera starts acquiring images when you click the **SW Trigger** button.

Advanced trigger and I/O settings

In addition to the *Quick Settings*, the **Trigger IO** tab provides advanced settings. More information is provided in the following documents:

Further reading

For a feature description, see the Features Reference of your USB camera. See also the technical manual or user guide of your USB camera, chapters *Camera interfaces* and *Triggering*.

Color tab

Color cameras only

The Color tab is available for color cameras only.

The **Color** tab contatins white balance.

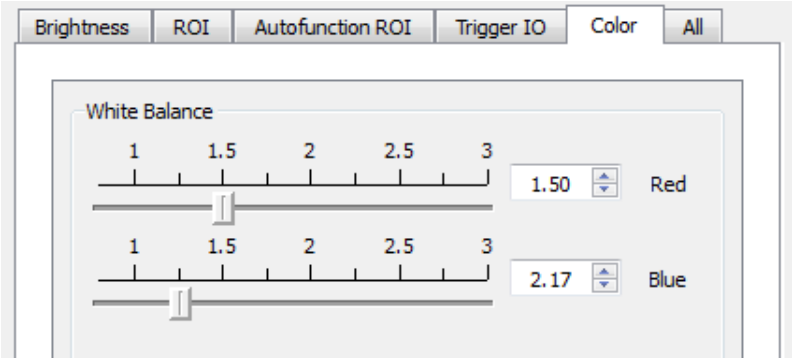


Figure 13: Color tab

Auto white balance

Auto white balance automatically compensates for changes of the lighting source spectrum, for example, if artificial illumination is switched on and off additionally to daylight.

Auto white balance uses information from the camera's current image and applies the optimized settings to the next image. Therefore, it can control values only if the camera is running. Large changes in scene lighting may require several frames for the algorithm to stabilize.

Auto white balance can be applied either once or continuously.

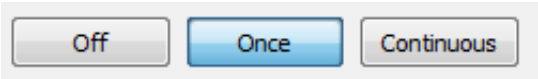


Figure 14: Auto functions - modes

To adapt white balance, either move the **White Balance** slider or enter a value and press the ENTER key.

Setting up your Goldeye CL camera

This chapter includes:

- ROI tab and tap settings
- Brightness tab
- Trigger IO tab

ROI tab and tap settings

Identical settings in Vimba and frame grabber software

The settings on the ROI tab and for DeviceTapGeometry (All tab) must be identical with the corresponding settings in the frame grabber software.

Selecting an ROI (region of interest) enables working with a reduced image resolution to save bandwidth, achieve a higher frame rate, or crop the image according to your needs. Moreover, Goldeye CL cameras support binning and 1-tap or 2-tap configuration.

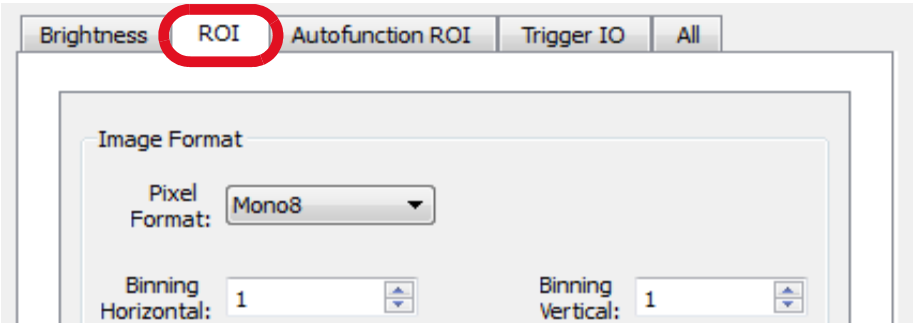


Figure 1: ROI tab

ROI, binning, and tap configuration

To set up the image format:

1. On the ROI tab, select a pixel format.
   a. Optionally, activate binning by selecting a value greater than 1 (binning = 1 does not affect the image).
   Binning combines neighboring pixels into one pixel. This decreases resolution and increases light sensitivity.
2. Select an ROI. To do this, either click in the blue ROI area and scale or move it with the mouse or enter values into the **ROI** fields.

The buttons **Full**, **1/4**, and **1/16** evoke a centered ROI of the full or partial image.

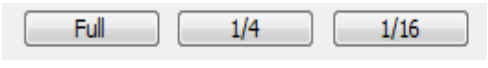


Figure 2: Full - 1/4 - 1/16 buttons

3. On the All tab, select the desired DeviceTapGeometry.

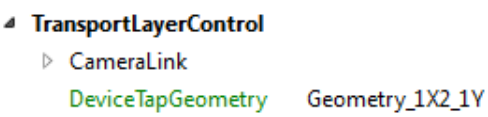


Figure 3: DeviceTapGeometry

Brightness tab

The **Brightness** tab contains features for controlling exposure

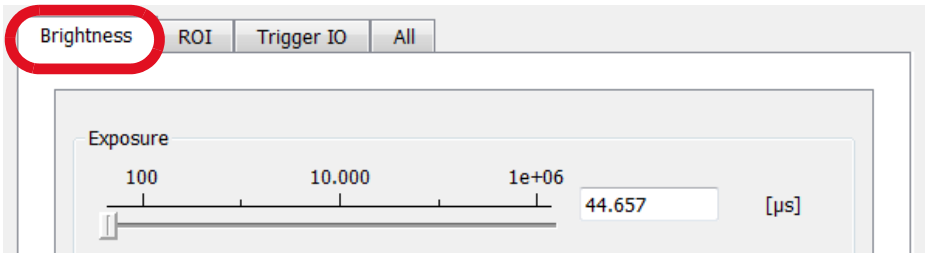


Figure 4: Brightness tab

Exposure

To change the exposure time, either move the **Exposure** slider or enter a value and press the ENTER key. To enter exposure times in s, ms, and µs, click **More**.

Exposure time and maximum frame rate

If your camera does not reach the maximum frame rate, check if the exposure time is short enough. Example: If the exposure time is 100 ms, the camera cannot acquire more than approximately 10 fps.

Further reading

For the maximum frame rate as a function of ROI, see the technical manual.
For a feature description, see the Goldeye G/CL Features Reference.

Trigger IO tab

Observe safety when using electrical connections.

Unsuitable connections may damage the camera or cause electrical shock.

Before connecting external devices, read the instructions in the technical manual of your camera, especially chapter *Camera interfaces*, section *Camera I/O connector pin assignment* and following.

Optionally, image acquisition can be started and stopped by a trigger signal from an external device or as a Vimba software command. Moreover, control signals can be transferred to external devices or additional cameras.

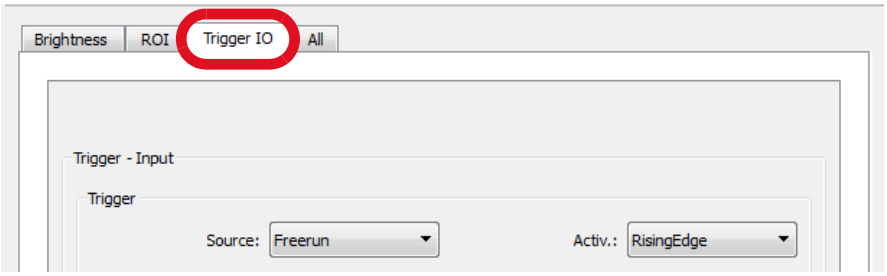


Figure 5: Trigger IO tab

Quick settings

Allied Vision cameras offer numerous options for triggering and I/O configuration. The quick settings cover typical machine vision scenarios. You can use the quick settings as a start and modify all features according to your needs.

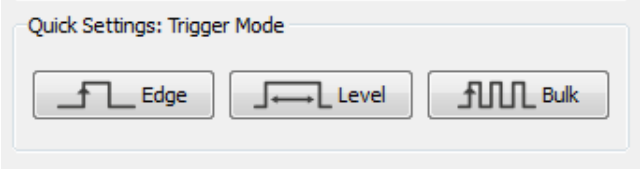


Figure 6: Quick settings

Trigger scenarios

Scenario A: Master/subordinate mode

If you want one camera to serve as master and a second camera as subordinate, connect the trigger device with the master camera's input line 1 (LineIn1) and connect the subordinate camera with the master camera's output 1 line (LineOut1).

To configure master/subordinate functionality, open both cameras in Vimba Viewer:

Master camera

1. Click the **Edge** button.
2. In the *Output* section, go to *SyncOut1* and select **Exposing**.
3. Click the **Freerun** button.

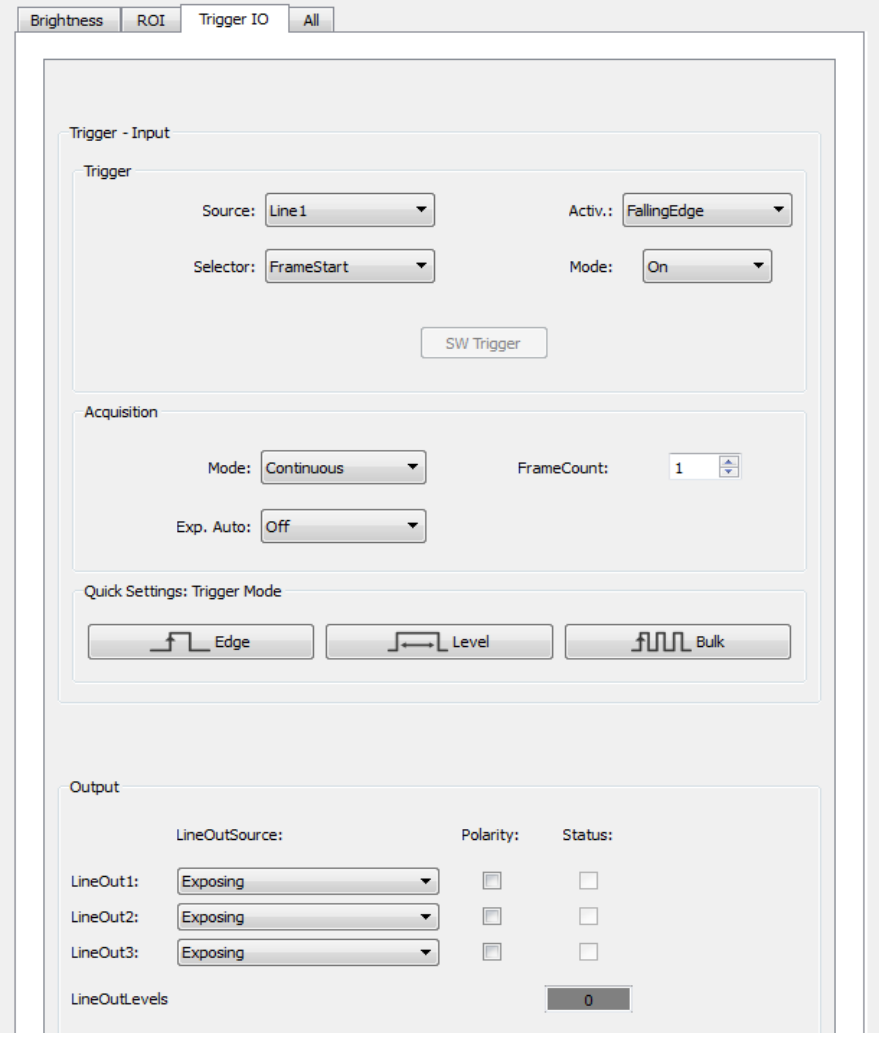


Figure 7: *Master camera*

Subordinate camera

1. Click the **Edge** button and make sure *Source:* **Line1** is selected.
2. Click the **Freerun** button.

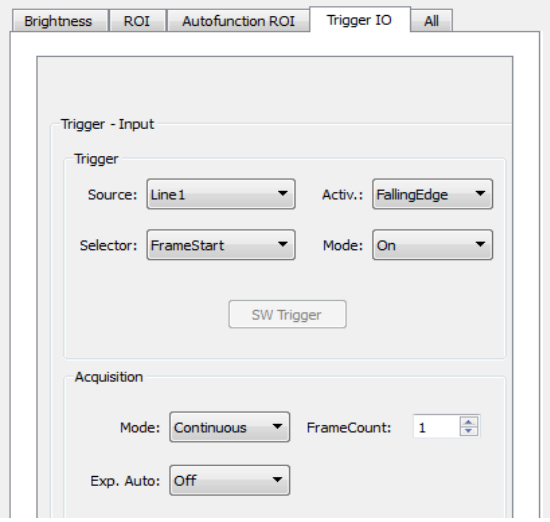


Figure 8: *Subordinate camera*

Now both cameras start acquiring images when the trigger signal edge is falling.

Scenario B: Controlling exposure externally

To control the exposure time with an external device, connect the trigger device with the master camera's input line 1 (LineIn1) and:

1. Click the **Level** button.
2. Click the **Freerun** button.

Now the camera exposes as long as the signal level from the trigger device is high or low (select **Activ.:** *LevelHigh* or *LevelLow)*.

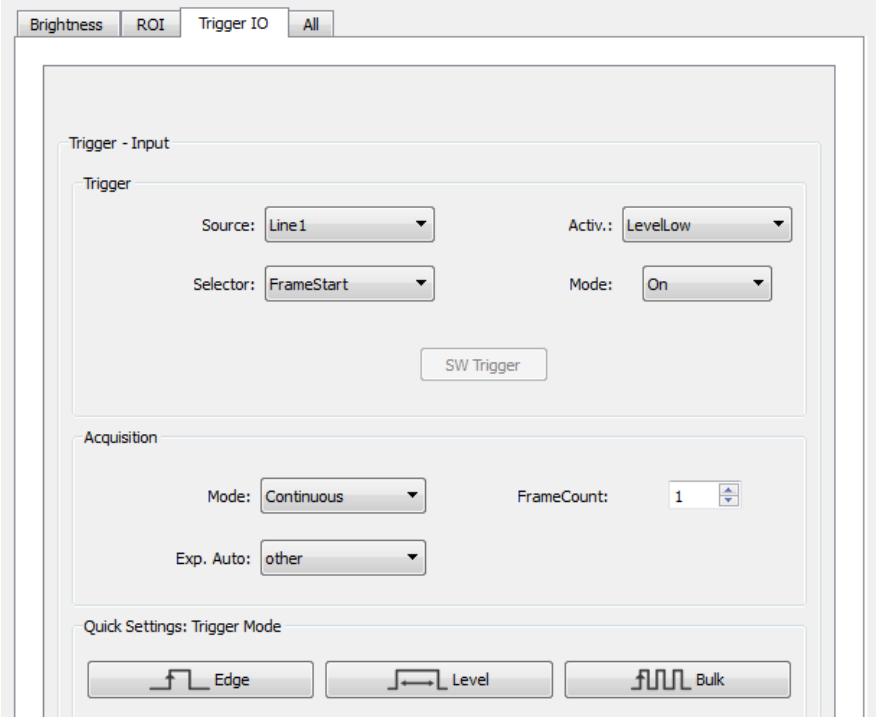


Figure 9: *Level Mode*

Scenario C: Acquiring an image series

To acquire n frames with a single trigger signal:

1. Click the **Bulk** button.
2. Click the **Freerun** button.

Now the camera acquires an image series when it receives a trigger signal.

To select the desired number of frames, enter the number in the *FrameCount* box. By default, the frames triggered with Bulk mode are acquired with the maximum possible frame rate. To acquire the image series with a specific frame rate:

1. Go to the **All** tab.
2. Select *AcquisitionFrameRateAbs.*
3. Enter the desired frame rate.

Scenario D: Software trigger

Software trigger and latency

The camera does not react immediately on a software trigger because a computer needs some time (latency) to process it. Since the CPU load varies all the time, the latency varies as well. If your application requires triggering with high precision, use a hardware trigger.

To trigger the camera by clicking the **SW Trigger** button:

1. Select *Source: Software.*
2. Checkmark *Mode: On/Off*.
3. Click the **Freerun** button.

Now the camera starts acquiring images when you click the **SW Trigger** button.

Advanced trigger and I/O settings

In addition to the *Quick Settings*, the **Trigger IO** tab provides advanced settings. More information is provided in the following documents:

Further reading

For a general feature description, see the Goldeye G/CL Features Reference. See also the technical manual.