

## Sequencer: Realization of a “moving” Region of Interest (ROI)

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### Description

This document describes the general approach of using the sequencer with Baumer industrial cameras. It explores the realization of a “moving” region of interest (ROI).

### Products

Baumer VCXG cameras

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## 1 Sequencer basics

### 1.1 Introduction

The sequencer enables the possibility of image series recording including automated re-parameterization of the camera based on different events and signals. Therefore the desired camera settings for each step are stored in so-called sequencer sets. Stringing together a number of these sequencer sets results in a sequence. The connection of sequences is done by using different paths. Alongside the camera features the path related features are also part of a sequencer set.

### 1.2 Sequencer sets

Sequencer sets combine camera features – comparable with a user set – and sequencer (set and path) related parameters.

Settings for several camera features such as

- exposure time
- gain
- partial scan
- user output
- counter

...can be controlled by the sequencer and thus stored to a sequencer set as well as information for the set switch-over via four different paths.

Each path involves

- the destination for the set switch-over that is mapped by the 'SequencerSetNext' feature
- the signal, whose change of state is used for triggering the set switch-over and that is mapped as 'SequencerTriggerSource'
- the change of state triggering the set switch-over and that is mapped as 'SequencerTriggerActivation'

As with user sets the camera's current settings are overwritten once a sequencer set is loaded and the sequencer is activated.

### 1.3 Sequencer configuration

In order to avoid overwriting current camera settings while configuring a sequencer, the camera needs to be set to the sequencer configuration mode.

Once the camera is set to the sequencer configuration mode, the individual sequencer sets can be selected via the SequencerSetSelector, configured and saved by executing SequencerSetSave.

Starting the configured sequence requires to switch the sequencer configuration mode off and to enable the sequencer mode.

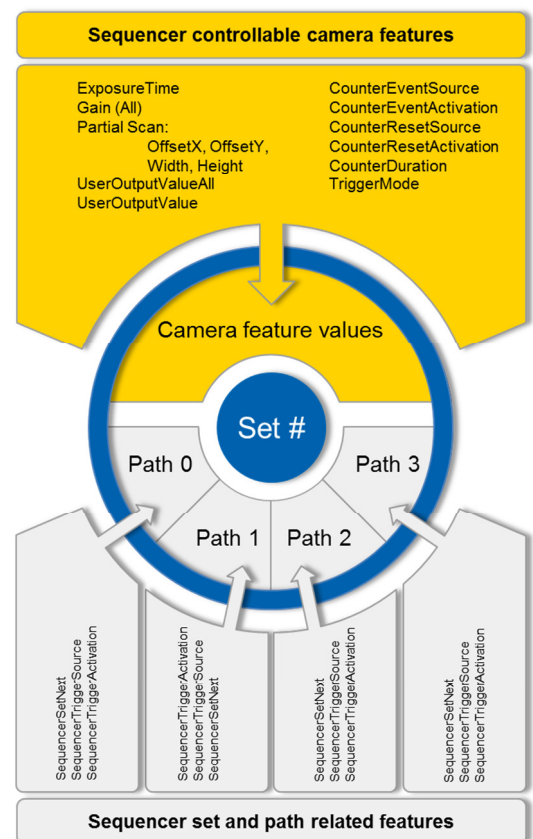


Figure 1: Structure of a sequencer set

## 1.4 Sequencer command overview

Features	Values	Description
<b>SequencerMode</b>	On/Off	Enables / disables the sequencer mechanism  To use this feature, the SequencerConfigurationMode must be off.
<b>SequencerConfigurationMode</b>	On/Off	Enables / disables the sequencer configuration mode  Here the sequencer configuration can take place but there is no image acquisition.  To use this feature, the SequencerMode must be off.
<b>SequencerFeatureSelector</b>	ExposureTime Gain (All) OffsetX OffsetY Width Height UserOutputValueAll UserOutputValue CounterEventSource CounterEventActivation CounterResetSource CounterResetActivation CounterDuration TriggerMode	Selects the camera features that are controlled by the sequencer.
<b>SequencerFeatureEnable</b>	true/false [RO]	Enables / disables the selected feature.
<b>SequencerSetSelector</b>	0...127	Selects the sequencer set that contains the feature settings coming afterward.
<b>SequencerSetSave</b>		Stores the current device settings to the selected sequencer set.
<b>SequencerSetLoad</b>		Loads the currently selected sequencer set.
<b>SequencerSetActive</b>	0...127 [RO]	Displays the currently active sequencer set.
<b>SequencerSetStart</b>	0...127	Defines the initial sequencer set.
<b>SequencerPathSelector</b>	0...3	Selects the path that contains the settings coming afterward.
<b>SequencerSetNext</b>	0...127	Defines the Set, that will be next
<b>SequencerTriggerSource</b>	Counter1End Counter2End ExposureActive Line0 ReadoutActive Timer1End Off	Defines the internal or external event that is used as trigger source for the sequencer.
<b>SequencerTriggerActivation</b>	RisingEdge FallingEdge AnyEdge	Defines the signals edge that triggers the sequencer.

The blue marked features are only available in the sequencer configuration mode.

## 2 ROI movement

The sequencer enables the possibility of ROI position changing from one image acquisition to the next. This for example allows the “tracking” and “extraction” of moving objects within a larger field of view.

Figure 2 shows the example of a vial that is moved thru the scene by a conveyer belt. The application aims for the inspection of the vial itself and thus all other image information is useless. In order to extract the vial, the ROI has to move from one image to the next.

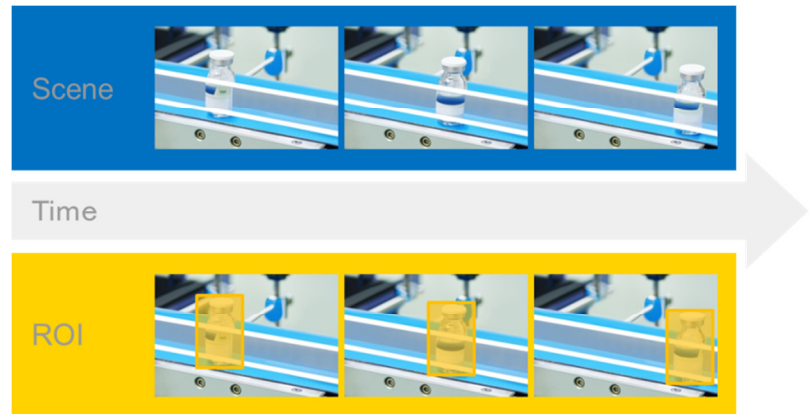


Figure 2: Example for moving ROI

### 2.1 Desired camera behavior

The theoretical approach is to set the camera to trigger mode and for each incoming trigger signal an image with specific, pre-configured partial scan settings is recorded.

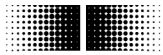
### 2.2 Concept for the sequencer procedure

Taking the sequencer basics into consideration makes the parameterization of the sequencer a little bit more complex than originally expected:

- Since every image features its own partial scan parameterization, they all need to be included in separate sequencer sets.
- Besides the exposure time configuration each set contains the desired partial scan configuration including ROI height, ROI width, Offset x and Offset y as well as sequencer set and path related information.



Figure 3: Concept of the "Moving" ROI



## 2.3 Implementation

Since any image shall be recorded in response to an incoming trigger, the **TriggerMode** needs to be turned ON and a **TriggerSource** needs to be defined. For this example this is **Line0** where the hardware trigger is attached to.

### 2.3.1 Sequencer sets

For this example, the sequencer sets differ regarding ROI configuration and **SequencerSetNext** settings.

- **SequencerPathSelector = 0** Defines the path for switching to the next sequencer set. Here it is **Path0**.
- **ExposureTime = t** Defines the exposure time for the recorded image.
- **SequencerTriggerSource = ExposureActive** Defines the internal or external signal that is used as sequencer trigger source. In this case it's the internal signal **ExposureActive**.
- **SequencerTriggerActivation = RisingEdge** Defines the signal's status change that triggers the sequencer set change. Here **RisingEdge** was selected.
- **SequencerSetNext** Defines the sequencer set that will be next when this path is used.  
Set0 → SequencerSetNext = 1  
Set1 → SequencerSetNext = 2  
Set2 → SequencerSetNext = 0

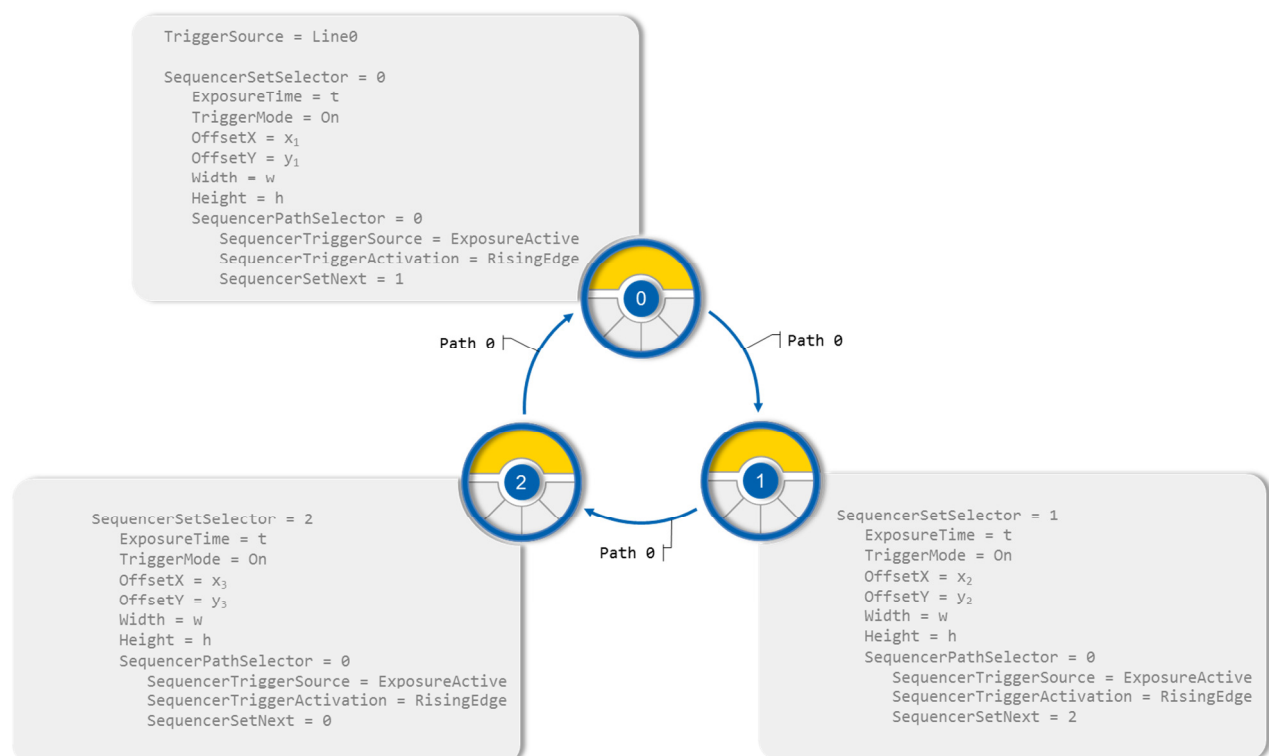


Figure 4: Implementation of the "moving" ROI

## 2.4 Result

The figure below shows the resulting images of the described sequence. The vial is virtually cut out within the camera by moving the ROI over the image.



Figure 5: Images resulting from the "moving" ROI

### 3 Related Topics

Sequencer:     Realization of a double shutter  
                 Multiple acquisitions on one incoming trigger

### 4 Support

In the case of any questions or for troubleshooting please contact our support team.

#### **Worldwide**

#### **Baumer Optronic GmbH**

Badstrasse 30 · DE-01454 Radeberg  
Deutschland

Phone +49 3528 4386 845  
[support.cameras@baumer.com](mailto:support.cameras@baumer.com)

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**Baumer Optronic GmbH**

Badstrasse 30 · DE-01454 Radeberg  
Phone +49 3528 4386 0 · Fax +49 3528 4386 86  
[sales@baumeroptronic.com](mailto:sales@baumeroptronic.com) · [www.baumer.com](http://www.baumer.com)