Allied Vision

APPLICATION NOTE

Multiple Regions of Interest for Goldeye and Goldeye Pro

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Scope

A region of interest (ROI) is used to reduce the image resolution when only a section of the sensor image is needed and to increase maximum frame rates.

Goldeye and Goldeye Pro cameras support `MultipleRegions` features for multiple ROIs that are non-overlapping. This document explains how to use the these features.

Required firmware version		Supported camera models	Supported number of ROIs
Goldeye Pro G5	**Goldeye G/CL**		
-	≥ V04.04.x	-008 SWIR models	Maximum 32
-	≥ V02.26.x	-030 VSWIR TEC1	Maximum 8
-	≥ V03.06.x	-034 SWIR models	Maximum 32
≥ V00.03.00.361abc93	≥ V02.26.x	-130 VSWIR TEC1	Maximum 8
≥ V00.03.00.361abc93	-	-320, 530 VSWIR TEC1	Maximum 8

Table 1: Supported camera models, number of ROIs and required firmware version

Single ROI

With ROI features, you can configure a single ROI by `Height`, `Width`, `OffsetX`, and `OffsetY`:

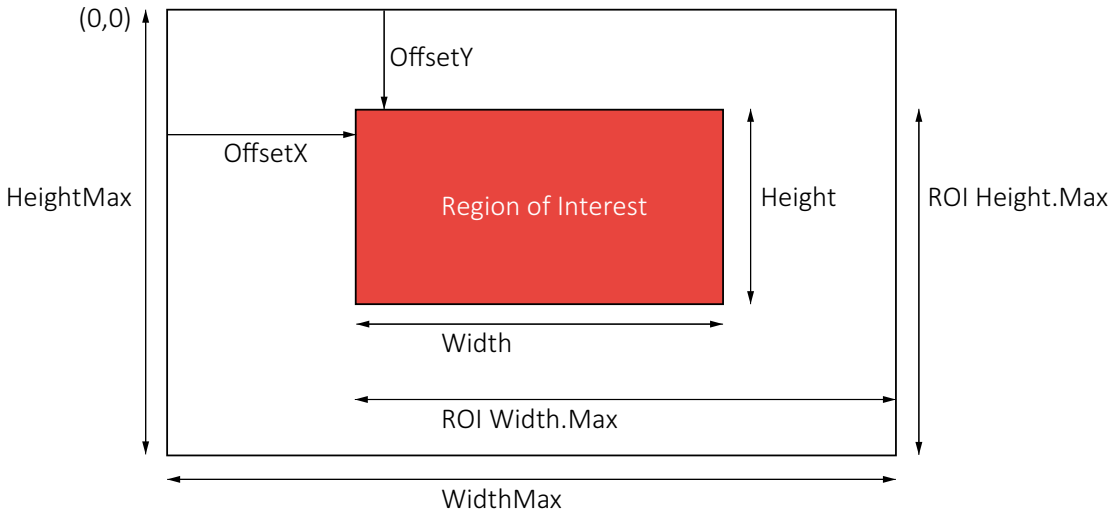


Figure 1: Features to configure a single ROI

Multiple ROIs

Note: With Goldeye Pro cameras, Multiple ROIs cannot be used along with binning.

Multiple ROIs merged to a common image

With Multiple ROI, you can configure several ROIs, named subregions. The maximum number of supported subregions depends on the camera model. Figure 2 shows an example with 3 ROIs.

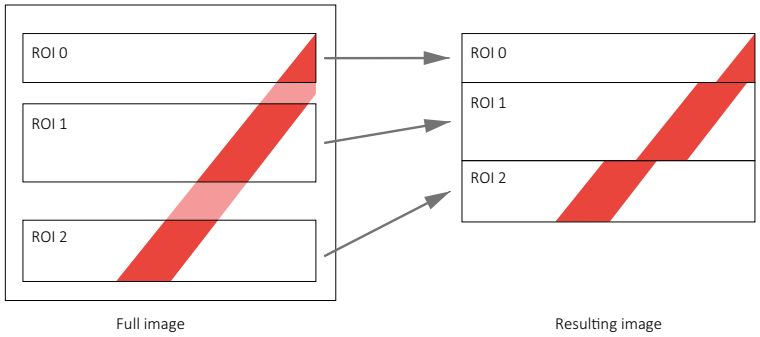


Figure 2: Mutiple ROIs merged to a common image

All active ROIs are transmitted in a single frame. For each ROI, you can configure `Height` and `OffsetY`. In contrast, `Width` and the `OffsetX` are common for all regions, as shown in Figure 3.

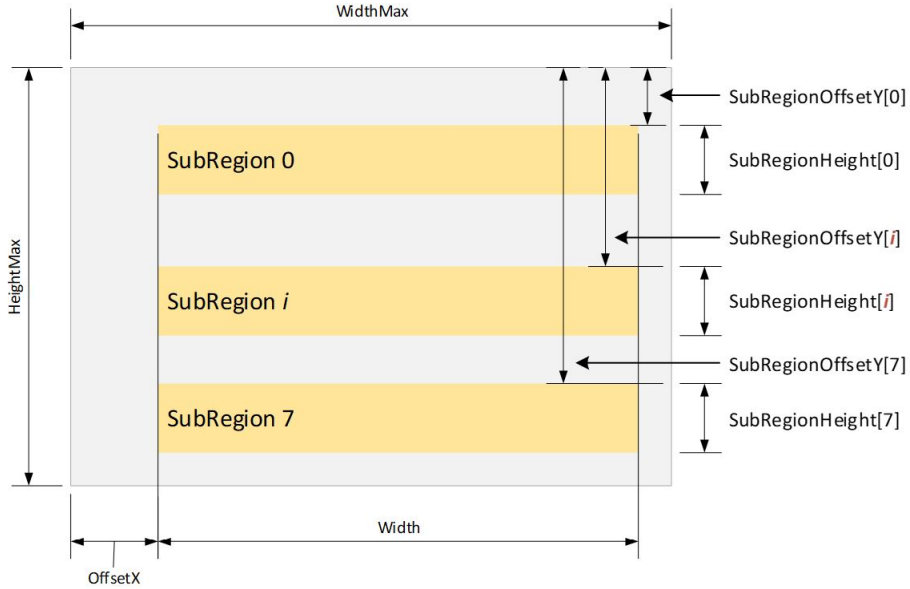


Figure 3: Subregion parameters and ROI order

Rules for configuring subregions

- ROIs must not overlap.
- Keep the order for ROIs as defined in Equation 1 on page 3 and Equation 2 on page 3.
- NUC (non uniformity correction) and DPC (defect pixel correction) are disabled for multiple ROIs.

The `SubRegionHeight` and `SubRegionOffsetY` parameters must meet the conditions shown in Equation 1 and Equation 2 (see Figure 3 on page 2 for reference).

$$SubRegionOffsetY[i+1] \geq SubRegionOffsetY[i] + SubRegionHeight[i]$$

with i as `SubRegionSelector`

Equation 1: Rule 1 for the start position of the next subregion

$$SubRegionOffsetY[i] + SubRegionOffsetHeight[i] \leq HeightMax$$

with i as `SubRegionSelector`

Equation 2: Rule 2 for the maximum height of the next subregion

Therefore, **SubRegion 1** must start after **SubRegion 0**, **SubRegion 2** after **SubRegion 1**, and so on.

Table 2 gives examples of valid and invalid settings for subregions.

Note: With Goldeye Pro cameras, **SubRegion 0** must always be active.

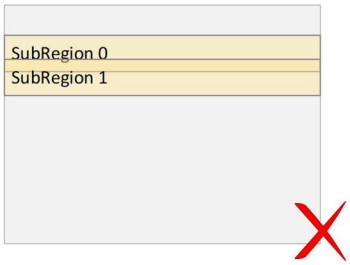
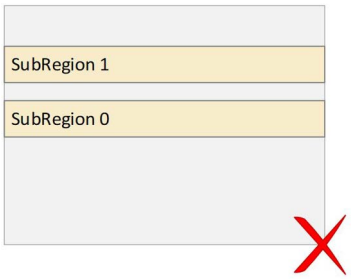
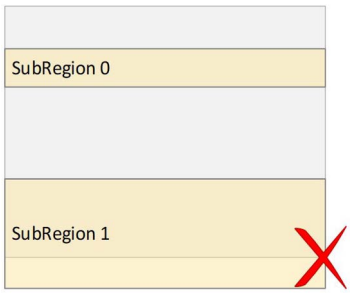
Example	Description
	Subregions are overlapping.
	Wrong order of subregions. Subregion indices must be increasing.
	**SubRegion 1** exceeds the maximum height. See Equation 2.

Table 2: Valid and invalid conditions for subregions (sheet 1 of 2)

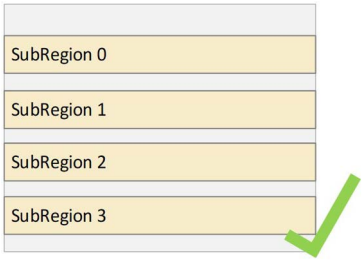
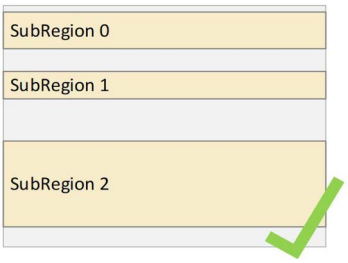
Example	Description
	Correct order of subregions
	Subregions may be omitted as long as the indices are increasing.
	Subregions may have different height values.

Table 2: Valid and invalid conditions for subregions (sheet 2 of 2)

Application workflow

We recommend you to configure the Multiple region features as follows:

1. Stop the acquisition.
2. Set `MultipleRegionsEnable` to *`True`* to enable multiple regions. (If this feature is set to *`False`*, only a single region is active that can be configured as usual by `Width`, `Height`, `OffsetX`, and `OffsetY`.)
3. Select a subregion through `SubRegionSelector`.
4. Set `SubRegionMode` to *`On`* to activate the selected subregion.
5. Set the subregion's height by `SubRegionHeight`.
6. Set the subregions's vertical offset by `SubRegionOffsetY`.
7. Check the subregion's status by `SubRegionStatus`. The feature must be shown as *`Valid`*. Otherwise continue the configuration from Step 5 again.
8. Continue with Step 3 to set up further subregions.
9. Adjust width and horizontal offset for all subregions by `Width` and `OffsetX` features if desired.
10. Start the acquisition.

Result: The frames are merged from the subregions.

Multiple region features

Features References

This is an excerpt of the Goldeye and Goldeye Pro feature descriptions.

- Goldeye G/CL Features Reference: www.alliedvision.com/en/support/technical-documentation/goldeye-gcl-documentation.
- Goldeye Pro Features Reference: www.alliedvision.com/en/support/technical-documentation/goldeye-pro-documentation.

Descriptions for Goldeye and Goldeye Pro

The following descriptions apply to Goldeye **and** Goldeye Pro cameras, unless otherwise stated. Differences are marked red.

Goldeye | MultipleRegions (subcategory)

This subcategory holds the features to configure and control the multiple regions of the camera.

Notes

- Features in the `NonUniformityCorrection` and `DefectPixelCorrection` subcatogries are not supported when `MultipleRegionsEnable` is set *`True`*.
- Enabling `NonUniformityCorrection` and `DefectPixelCorrection` features disables `MultipleRegions` features and vice versa.

Goldeye G/CL	-008 SWIR, -030 VSWIR TEC1, -034 SWIR, -130 VSWIR TEC1
Display name	MultipleRegions
Origin of feature	Camera
Feature type	(Subcategory)
Category	/ImageFormatControl

Goldeye Pro | MultipleRegionControl (subcategory)

This subcategory holds the features to configure and control the multiple regions of the camera.

Notes

- Features in the `NonUniformityCorrection` and `DefectPixelCorrection` subcatogries are not supported when `MultipleRegionEnable` is set *`True`*.
- Enabling `NonUniformityCorrection` and `DefectPixelCorrection` features disables `MultipleRegionControl` features and vice versa.

Goldeye Pro G5	-130 VSWIR TEC1, -320 VSWIR TEC1, -530 VSWIR TEC1
Display name	MultipleRegions
Origin of feature	Camera
Feature type	(Subcategory)
Category	/ImageFormatControl

Goldeye | MultipleRegionsEnable

Selects between single region and multiple regions mode. The number of subregions to be configured depends on the camera model.

Note: The height and Y-offset for each active subregion can be configured individually, but the horizontal dimensions are commonly set by `Width` and `OffsetX` for all subregions.

Display name	MultipleRegionsEnable
Origin of feature	Camera
Feature type	Boolean
Access	R/W
Affected features	`Height`, `OffsetY`
Category Goldeye	/ImageFormatControl/MultipleRegions

Values	Description
`False`	Single region mode is enabled, subregions mode is disabled (**default**). `Height` and `OffsetY` can be used as usual.
`True`	Subregions mode is enabled. `Height` and `OffsetY` features are locked and are automatically aligned with the values set for subregions.

Goldeye Pro | MultipleRegionEnable

Selects between single region and multiple regions mode. The number of subregions to be configured depends on the camera model.

Note: The height and Y-offset for each active subregion can be configured individually, but the horizontal dimensions are commonly set by `Width` and `OffsetX` for all subregions.

Display name	MultipleRegionEnable
Origin of feature	Camera
Feature type	Boolean
Access	R/W
Affected features	`Height`, `OffsetY`
Category Goldeye Pro	/ImageFormatControl/MultipleRegionControl

Values	Description
`False`	Single region mode is enabled, subregions mode is disabled (**default**). `Height` and `OffsetY` can be used as usual.
`True`	Subregions mode is enabled. `Height` and `OffsetY` features are locked and are automatically aligned with the values set for subregions.

SubRegionMode

[SubRegionSelector]

Enables or disables the selected subregion.

Display name	SubRegionMode
Origin of feature	Camera
Feature type	Boolean
Access	R/W
Affected features	`Height`, `OffsetY`, `SubRegionStatus`
Category Goldeye	/ImageFormatControl/MultipleRegions
Category Goldeye Pro	/ImageFormatControl/MultipleRegionControl

Values	Description
On	The selected subregion is enabled.
Off	The selected subregion is disabled.

SubRegionHeight

[SubRegionSelector]

Height of the selected subregion.

Goldeye G/CL-030/130 VSWIR TEC1, Goldeye Pro G5-130/320/530 VSWIR TEC1:
If values are entered that are not dividable by 8, `SubRegionHeight` is increased automatically to the next higher available value. For example, if *9* is entered, the value is increased to *16*.

Goldeye G/CL-008 SWIR, G/CL-034 SWIR and XSWIR:
The total sum of all active SubRegionsHeights must be >= 4.

Display name	SubRegionHeight
Origin of feature	Camera
Feature type	Integer
Access	R/W
Unit	Pixels
Affected features	`Height`, `SubRegionStatus`
Category Goldeye	/ImageFormatControl/MultipleRegions
Category Goldeye Pro	/ImageFormatControl/MultipleRegionControl

Values	Description
8 ; *1*	Minimum
(Height max)	Maximum, depending on the height of other subregions
8 ; *1*	Increment

SubRegionOffsetY

[SubRegionSelector]

Y-offset of the selected subregion.

Goldeye G/CL-030/130 VSWIR TEC1, Goldeye Pro G5-130/320/530 VSWIR TEC1: If values are entered that are not dividable by 8, `SubRegionOffsetY` is increased automatically to the next higher available value. For example, if *9* is entered, the value is increased to *16*.

Display name	SubRegionOffsetY
Origin of feature	Camera
Feature type	Integer
Access	R/W
Unit	Pixels
Affected features	`OffsetY`, `SubRegionStatus`
Category Goldeye	/ImageFormatControl/MultipleRegions
Category Goldeye Pro	/ImageFormatControl/MultipleRegionControl

Values	Description
8 ; *1*	Minimum
(Height max)	Maximum, depending on the height of other subregions
8 ; *1*	Increment

Goldeye | SubRegionSelector

Selects the subregion in a range from *0* to *n*, where *0* is the index of the first subregion and *n* is the index of the last one.

Display name	SubRegionSelector
Origin of feature	Camera
Feature type	Enumeration
Access	R/W
Affected features	`SubRegionHeight`, `SubRegionMode`, `SubRegionOffsetY`, `SubRegionStatus`
Category Goldeye	/ImageFormatControl/MultipleRegions

Values	Description
0 ; *0*	Minimum
7 ; *31*	Maximum

Goldeye Pro | SubRegionSelector

Selects the subregion in a range from ***Region0*** to ***RegionN***, where ***Region0*** is the index of the first subregion and ***RegionN*** is the index of the last one.

Display name	SubRegionSelector
Origin of feature	Camera
Feature type	Enumeration
Access	R/W
Affected features	`SubRegionHeight`, `SubRegionMode`, `SubRegionOffsetY`, `SubRegionStatus`
Category Goldeye Pro	/ImageFormatControl/MultipleRegionControl

Values	Description
Region0	Minimum
Region7	Maximum

SubRegionStatus

[SubRegionSelector]

Displays the status of the selected subregion.

Note: The `SubRegionStatus` is updated only if `MultipleRegionsEnable` (Goldeye) or if `MultipleRegionEnable` (Goldeye Pro) is *True* and the corresponding `SubRegionMode` is set to *On*.

Display name	SubRegionStatus
Origin of feature	Camera
Feature type	Enumeration
Access	R
Affected features	(None)
Category Goldeye	/ImageFormatControl/MultipleRegions
Category Goldeye Pro	/ImageFormatControl/MultipleRegionControl

Values	Description
Disabled	The selected subregion is disabled.
Valid	The selected subregion is enabled, it has a valid configuration.
OverlapError[1]	The selected subregion is enabled, but it has an invalid configuration.
[1] Invalid subregions are excluded automatically from the resulting frame.	

Additional features for Goldeye Pro

In addition to the features described above, Goldeye Pro cameras support

- `MultipleRegionArrangement`: *Vertical* (only value)
- `SubRegionOffsetX`: Displays the status, cannot be configured.
- `SubRegionWidth`: Displays the status, cannot be configured.

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