



See the possibilities

# User Manual

*Apex Series - 3 CMOS Prism-Based Camera*

## AP-5100T-CXPA



**CMOS Digital Progressive Scan Prism-Based RGB Camera**

**Document Version: 1.1**

**Date: 2026-02-19**

Thank you for purchasing this product.

 Be sure to read this documentation before use.

This documentation includes important safety precautions and instructions on how to operate the unit. Be sure to read this documentation to ensure proper operation.

The contents of this documentation are subject to change without notice for the purpose of improvement.

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## About Technical Note

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Some additional technical information is provided on the JAI website as Technical Notes. In this manual, if a technical note is available for a particular topic, the above icon is shown. Please refer to the following URL for Technical notes.

<https://www.jai.com/support-software/technical-notes>

# Regulations

## Notice

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The material contained in this manual consists of information that is proprietary to JAI Ltd., Japan, and may only be used by the purchasers of the product. JAI Ltd., Japan makes no warranty for the use of its product and assumes no responsibility for any errors which may appear or for damages resulting from the use of the information contained herein. JAI Ltd., Japan reserves the right to make changes without notice.

Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

## Warranty

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For information about the warranty, please contact your factory representative.

## Certifications

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### CE Compliance

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As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that AP-5100T-CXPA complies with the following provisions applying to their standards.

EMI: EN55032:2015/A11:2020 Class A

EMS: EN55035:2017(CISPR35:2016) Class A

### FCC

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This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

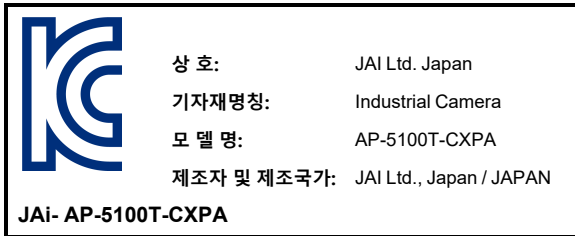
## Warning

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Changes or modifications to this unit not expressly approved by the party responsible for FCC compliance could void the user's authority to operate the equipment.

## KC

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제조년월은 제품상자의 라벨을 참조하십시오.

## China RoHS

The following statement is related to the regulation on “Measures for the Administration of the Control of Pollution by Electronic Information Products”, known as “China RoHS”. The table shows contained Hazardous Substances in this camera.

 mark shows that the environment-friendly use period of contained Hazardous Substances is 15 years.

### 重要注意事项

#### 有毒有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电器电子产品有害物质限制使用管理办法』，本产品《有毒有害物质或元素名称及含量表》如下。

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
AP-5100T-CXPA	x	○	○	○	○	○

○:表示该有毒有害物质在该部件所有均质材料中的含量均在 GB/T 26572-2011规定的限量要求以下。  
x:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572-2011规定的限量要求。

#### 环保使用期限



电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染 或对其人身、财产造成严重损害的期限。

数字「15」为期限15年。

# Usage Precautions

## Notes on Cable Configurations

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The presence of lighting equipment and television receivers nearby may result in video noise. In such cases, change the cable configurations or placement.

## Notes on Attaching the Lens

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### Technical Notes

How to Clean a Sensor

### Avoiding Dust Particles

When attaching the lens to the camera, stray dust and other particles may adhere to the sensor surface and rear surface of the lens. Be careful of the following when attaching the lens.

- Work in a clean environment.
- Do not remove the caps from the camera and lens until immediately before you attach the lens.
- To prevent dust from adhering to surfaces, point the camera and lens downward and do not allow the lens surface to come into contact with your hands or other objects.
- Always use a blower brush to remove any dust that adheres.
- Never use your hands or cloth, blow with your mouth, or use other methods to remove dust.

## Phenomena Specific to CMOS Image Sensors

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The following phenomena are known to occur on cameras equipped with CMOS image sensors. These do not indicate malfunctions.

- **Aliasing:** When shooting straight lines, stripes, and similar patterns, vertical aliasing (zigzag distortion) may appear on the monitor.
- **Blooming:** When strong light enters the camera, some pixels on the CMOS image sensor may receive much more light than they are designed to hold, causing the accumulated signal charge to overflow into surrounding pixels. This “blooming” phenomenon can be seen in the image but does not affect the operation of the camera.
- **Fixed pattern noise:** When shooting dark objects in high-temperature conditions, fixed pattern noise may occur throughout the entire video monitor screen.
- **Defective pixels:** Defective pixels (white and black pixels) of the CMOS image sensor are minimized at the factory according to shipping standards. However, as this phenomenon can be affected by the

ambient temperature, camera settings (e.g., high sensitivity and long exposure), and other factors, be sure to operate within the camera's specified operating environment.

- **Vertical stripes:** Due to the design characteristics of the sensor used, vertical stripes may appear in the image when using the camera under the following condition(s), especially a combination of these circumstances:
  - A shallow incident angle, a large aperture, a short exposure time, and/or the use of long-waveband lighting (especially infrared)

You may be able to improve the vertical stripes in the image by changing the above condition(s) (e.g., smaller aperture, longer shutter speed).

## Notes on Exportation

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When exporting this product, please follow the export regulations of your country or region.

# Features

This camera is an industrial progressive scan camera that uses three global shutter CMOS image sensors.

Enhanced color reproduction is achieved via the compact-designed 3CMOS C-mount prism optical system in addition to the internal color matrix circuit. Even higher definition imaging is made possible by the shading correction and gamma correction circuits.

The ROI and binning functions allow for even faster readout speeds. The gain and exposure time can be configured individually for each CMOS sensor. A color space conversion function is also supported.

## Feature Overview

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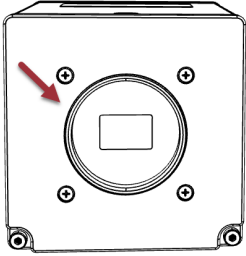
- Global shutter 1/1.8" 3 CMOS image sensor with backside illuminated pixel technology.
- Readout pixels: 2464 x 2056
- Pixel size: 2.74 $\mu$ m x 2.74 $\mu$ m
- Max frame rate (full ROI): 75 fps
- 8/10/12-bit output.
- Flexible ROI; rescaling function; traditional 1x2, 2x1, 2x2 binning; horizontal/vertical image flip function; chromatic aberration correction, blemish correction; shading compensation; sequencer function; and Automatic Level Control (ALC) for dynamic lighting conditions. (See the [Main Functions](#) chapter for details).
- Compact size with excellent shock and vibration resistance.
- Supports power over CoaXPress interface
- Lens mount: C-mount

## Parts Identification

Read this section to learn the camera's parts, such as lens mount, connectors, and LEDs.

### Lens Mount (C-Mount)

Mount a C-mount lens, microscope adapter, etc. here.

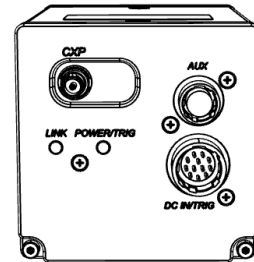


- Back flange distance: 17.526 mm
- Thread pitch: 0.79375mm (32TPI)

**Note:** Before mounting a lens, be sure to refer to [Lens](#) and confirm the precautions for attaching a lens and the supported lens types.

### Connectors

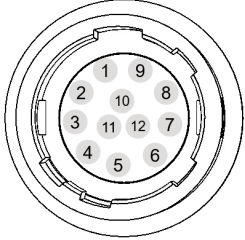
This section displays the pin assignments for each connector.



## DC IN/TRIG Connector (12-Pin Round)

Related Setting Items: [DigitalIOControl](#)

Connect the cable for a power supply (optional) or for DC IN / trigger IN here.

 <p>Camera Side : HR10A-10R-12PB (71) (12-pin, Male) Cable Side: HR10A-10P-12S</p>	Pin No.	I/O	Signal	Description
	1	GND	GND	
	2	Power In	DC In (+12V)	DC10.8 ~ 26.4V
	3	In	Opt In 2 (-)	Line 6
	4	In	Opt In 2 (+)	
	5	In	Opt In 1(-)	Line 5
	6	In	Opt In 1(+)	
	7	Out	Opt Out 1(-)	Line 2
	8	Out	Opt Out 1(+)	
	9	Out	TTL Out 1	Line 1
	10	In	TTL In 1	Line 4
	11	Power In	DC In (+12V)	DC10.8 ~ 26.4V
12	GND	GND		

### Notes:

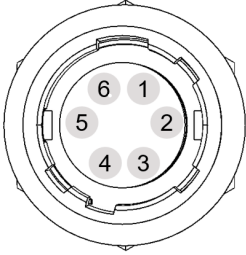
- The pin assignment of this camera is different from other JAI cameras.
- See [Recommended Circuit Diagram \(Reference Examples\)](#) for the recommended circuit diagram.

### TTL Signal Specification

TTL out signal specification (Typ.)	Output voltage: Low 0.0V, High 5.0V
TTL in signal specification (Typ.)	Input voltage: Low 0.0 ~ 0.7V, High 2.0 ~ 5.5V

## AUX Connector (6-Pin Round)

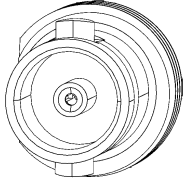
Performs external input/output such as trigger input.

 <p>Camera side: HR10A-7R-6SB (6-pin, Female) Cable side: HR10A-7P-6P (77)</p>	Pin No.	I/O	Signal	Description
	1		NC	
	2	Out	TTL Out 2	Line 8
	3	In	TTL In 2	Line 10
	4	Out	Opt Out 2 (-)	Line 3
	5	Out	Opt Out 2 (+)	
	6	GND	GND	

## CXP (CoaXPress) Connector

Connect the coaxial cable for digital video output.

**Note:** The AP-5100T-CXPA model supports the PoCXP function.

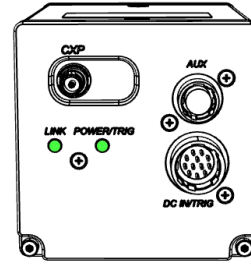


- **Connector:** Micro-BNC
- **CxpLinkConfiguration:** CXP12\_X1, CXP6\_X1, CXP3\_X1 (Default)




**Note:** You can check the current CXP version in CxpVersion Used ( [TransportLayerControl](#)). Even if you are using a CoaXPress frame grabber board that supports CXP 2.0, if [CxpVersionUsed] is CXP 1.1, you may need to make settings on the frame grabber board side. For the specific setting method, refer to the instruction manual of the frame grabber board to be used.

## LED






The table below shows the LED light and camera status.







### POWER TRIG

Light		Status
	Lit amber	Camera initializing.
	Lit green	Camera in operation.
	Blinking green	During operation in trigger mode, trigger signals are being input. <b>Note:</b> The blinking interval is not related to the actual input interval of the external trigger.

### LINK

Light		Status
	Off	The network link is not established (or is in progress).
	Lit amber	System is powering up.
	Red pulse - slow	No connection. <b>Note:</b> Not applicable when using PoCXP.
	Alternating between green and amber - rapid	<b>When using PoCXP:</b> Detecting link. <b>Note:</b> Blinks for 1 second even when detected immediately.
	Blinking amber - rapid	<b>When not using PoCXP:</b> Detecting link. <b>Note:</b> Blinks for 1 second even when detected immediately.

Light		Status
	Lit green	Connection between device and host is established, but there is no data being transmitted.
	Blinking amber - slow	Established connection between camera and frame grabber. Waiting for an event (trigger, exposure pulse, etc.)
	Blinking green - rapid	Established connection between camera and frame grabber. Data is being transmitted.
	Alternating between green and amber - slow	Sending connection test packet.

## Mounting Holes

Use these holes to mount the camera directly to a structural system.

Location	Available Mounting Holes
Top	M3, Depth 3mm x 4
Side	M3, Depth 3mm x 4
Bottom	M3, Depth 3mm x 4

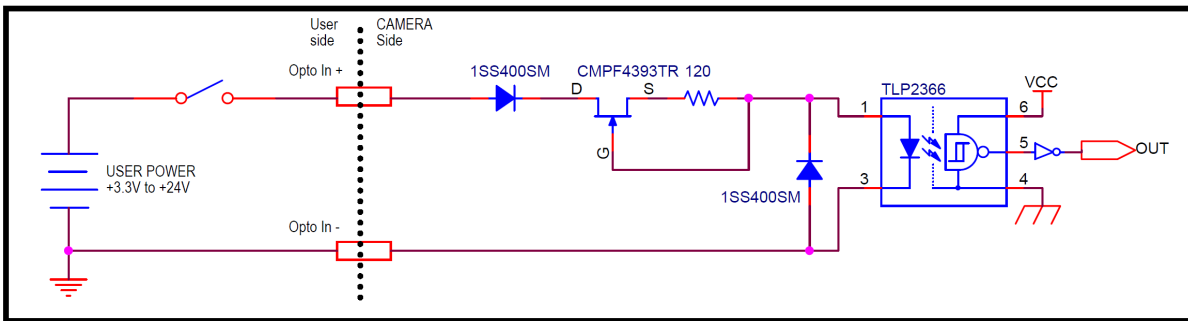
**Note:** For the position of the mounting holes, see "[Dimensions](#)".

## Recommended Circuit Diagram (Reference Examples)

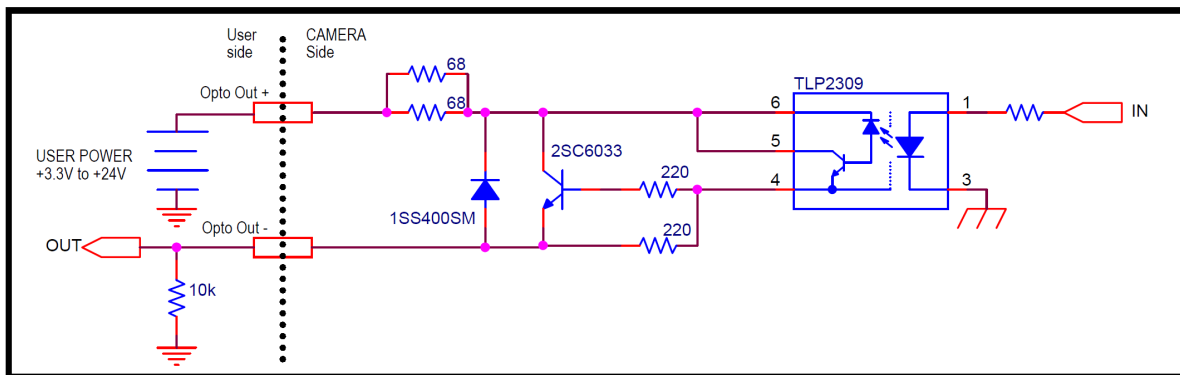
Related Setting Items: [DigitalIOControl](#)

### Technical Notes OPTO-In Circuit Characteristics

#### Recommended External Input Circuit Diagram



#### Recommended External Output Circuit Diagram (Reference Example)



**Caution:** Check the recommended external input circuit diagram (reference example) and connect correctly.

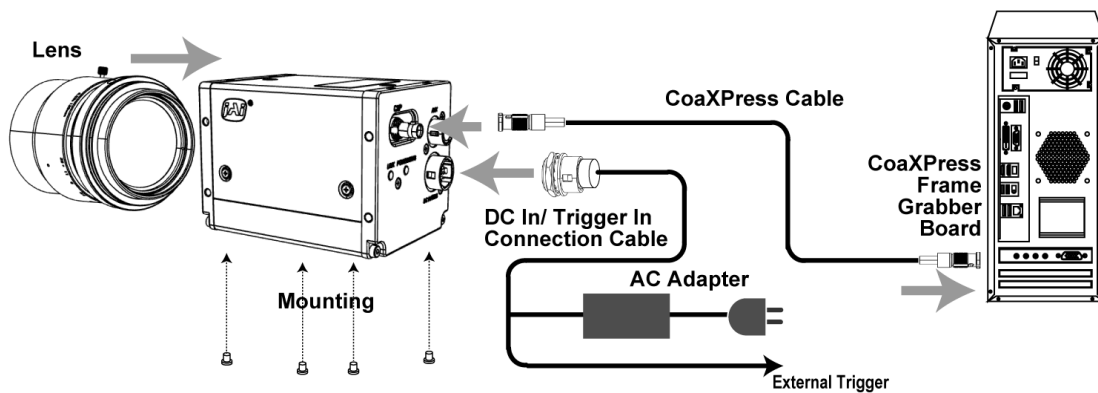
**Note:** Parts may be replaced with equivalent products.

# Preparation

Read this section to learn how the camera connects to devices and accessories. The preparation process is described below.

<b>1</b>	<b><u>Step 1: Connect Devices</u></b> Connect the lens, cables, computer, and other devices.
<b>2</b>	<b><u>Step 2: Verifying Camera Operation</u></b> Verify whether the camera is turned on and ready for use.
<b>3</b>	<b><u>Step 3: Verifying the Connection between the Camera and PC</u></b> Verify whether the camera is properly recognized via Control Tool.
<b>4</b>	<b><u>Step 4: Configure Trigger, Exposure, and Frame Rate Settings</u></b> Refer to the setting examples to configure the trigger, exposure, and line rate settings.
<b>5</b>	<b><u>Step 5: Adjusting the Image Quality</u></b> Refer to the procedures for adjusting image quality.
<b>6</b>	<b><u>Step 6: Saving the Settings</u></b> Save the current setting configurations in user memory.

## Step 1: Connect Devices



Lens

DC IN / Trigger IN Connection Cable

CoaXPress Cable

Mounting

AC Adapter (Power Supply) - Optional

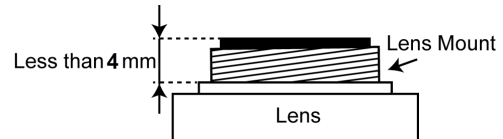
CXP Frame Grabber Board

## Lens

### Technical Notes Lens Selection Guide

C-mount lenses with lens mount protrusions of 4 mm or less can be attached.

- Back flange distance: 17.526 mm
- Thread pitch: 0.79375mm (32TPI)



#### Notes:

- Use a lens designed for three-sensor cameras. Using a lens for single-sensor cameras may hinder full performance of the camera.
- The camera's CMOS sensor is 1/1.8", and image size (effective image) is 6.77mm (H)×5.66mm(V), 8.82mm (diagonal). To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the image sensor size.

#### Cautions:

- The maximum performance of the camera may not be realized depending on the lens.
- Attaching a lens with a mount protrusion of 4 mm or longer may damage the lens or camera.

**Note:** The following formula can be used to estimate the focal length.

- Focal length =  $WD / (1 + W/w)$
- WD: Working distance (distance between lens and object)
- W: Width of object
- w: Width of sensor

## Mounting

When mounting the camera directly to a device, use screws that match the mounting holes on the camera. For more information on the mounting holes, see "[Mounting Holes](#)".

When using the tripod adapter plate (MP-44), attach it to the mounting holes on the bottom of the camera using the supplied screws.

**Caution:** For heavy lenses, be sure to support the lens itself. Do not use configurations in which its weight is supported by the camera.

## DC IN / Trigger IN Connection Cable

Performs external I/O such as power supply and trigger input.

## AC Adapter (Power Supply) - Optional

Connect the AC adapter and the round connector of the connection cable to the DC IN / trigger IN connector on the camera.

## CoaXPress Cable

Connect the CXP cable to the CXP connector on the camera and frame grabber board. Refer to the specifications of the cable for details on its bend radius.

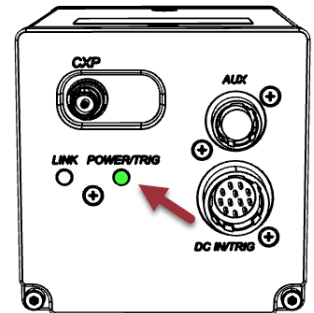
## CXP Frame Grabber Board

Refer to the operating instructions of the frame grabber board and configure settings on the computer as necessary.

## Step 2: Verifying Camera Operation

When power is supplied to the camera while the necessary equipment is connected, the POWER/TRIG LED at the rear of the camera lights amber, and initialization of the camera starts. When initialization is complete, the POWER/TRIG LED lights green.

Verify whether power is being supplied to the camera by checking the rear LED. When properly turned on, the power LED is lit green.



**Note:** For details on how to read the LEDs, see the [LED](#) section.

## Step 3: Verifying the Connection between the Camera and PC

Use an appropriate software tool associated with your frame grabber to set up the camera and display captured images. Refer to the operation manual of the selected software tool for specific instructions.

**Note:** This camera does not support eBUS Player for JAI.

## Step 4: Configure Trigger, Exposure, and Frame Rate Settings

**Related Setting Items:** [AcquisitionControl](#)

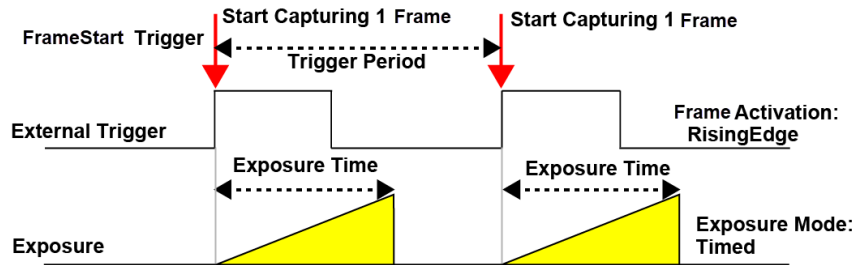
This section describes scenarios for controlling the trigger, exposure, and frame rate.

**Note:** This section is intended to explain the basic relationship between the trigger, exposure, and frame rate. For the detailed timings, see "[Timing Chart](#)".

Trigger Mode	Exposure Mode	Setting Example
On	Timed	<a href="#">Control via External Triggers with the Specified Exposure Time</a>
	TriggerWidth	<a href="#">Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal</a>
Off	Timed	<a href="#">Control without External Triggers with the Specified Exposure Time</a>
	Off	<a href="#">Control without External Triggers without Specifying the Exposure Time</a>

## Control via External Triggers with the Specified Exposure Time

In the example below, **TriggerSelector** is set to **FrameStart**.



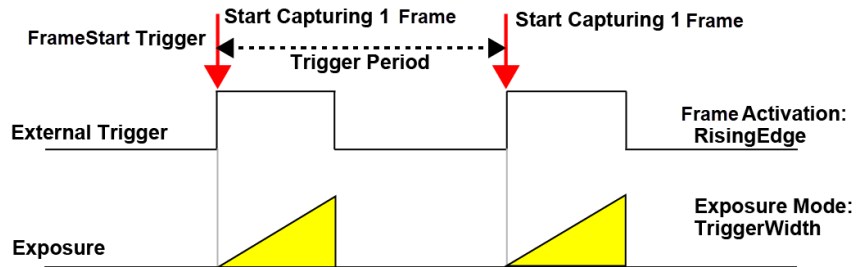
### Notes:

- When using external triggers, the frame rate is determined by the trigger period.
- The ExposureTime value cannot be longer than the trigger period.

Item	Setting
Trigger Mode	On
Trigger Selector	Frame Start
Trigger Source	Any
Trigger Activation	RisingEdge (rising edge of input signal) or FallingEdge (falling edge of input signal)
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.

## Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal

In the example below, **TriggerSelector** is set to **FrameStart**.

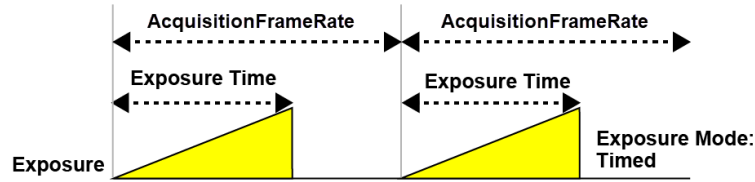


**Notes:**

- When using external triggers, the frame rate is determined by the trigger period.

Item	Setting
Trigger Mode	On
Trigger Selector	Frame Start
Trigger Source	Any
Trigger Activation	LevelHigh (high-level duration) or LevelLow (low-level duration)
Exposure Mode	TriggerWidth (control via trigger width)

## Control without External Triggers with the Specified Exposure Time

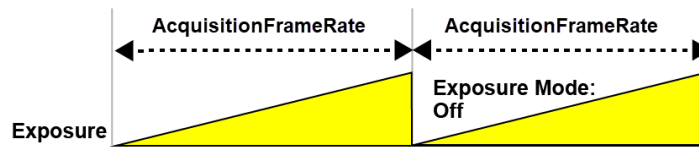


**Notes:**

- ExposureTime can be set up to 1 frame cycle to lengthen the accumulation time to increase sensitivity.
- The ExposureTime value cannot be longer than the frame period.

Item	Setting
Trigger Mode	Off
Exposure Mode	Timed (control via exposure time)
Exposure Time	Varies depending on settings.
Acquisition Frame Rate	The maximum value varies depending on PixelFormat, ROI, Link Speed, etc.

## Control without External Triggers without Specifying the Exposure Time



**Notes:**

- The frame rate can be set up to 1 frame cycle toto increase sensitivity.
- The exposure time will be the longest possible duration given the operating conditions, such as the frame period.

Item	Setting
Trigger Mode	Off
Exposure Mode	Off
Acquisition Frame Rate	The maximum value varies depending on PixelFormat, ROI, Link Speed, etc.

## Step 5: Adjusting the Image Quality

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Display the camera image and adjust the image quality.

### Adjust the Gain

**Related Setting Items:** [AnalogControl](#)

This topic explains how to manually adjust the gain.

There are two gain control modes: **Master Mode (IndividualGainMode = Off)**, where you adjust the master gain and fine-tune with R and B, and **Individual Mode (IndividualGainMode = On)**, which allows separate gain adjustment for each RGB channel.

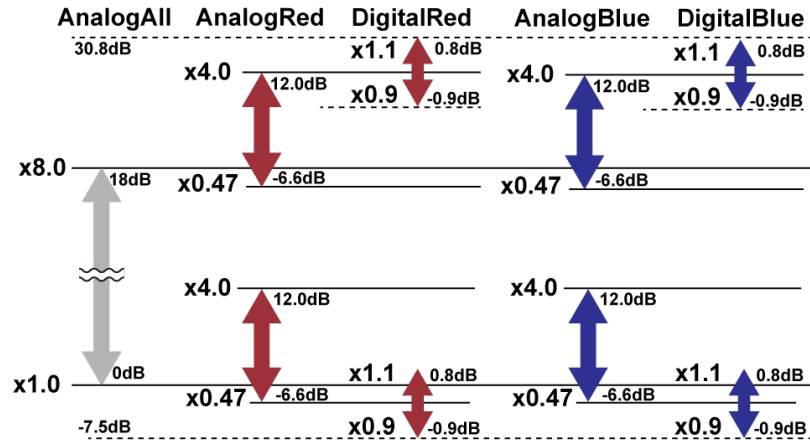
#### Notes:

- **Visibility** must be changed from **Beginner** to **Guru**.
- The Gain setting is configured in multipliers. See "[Comparison of the Decibel Display and Multiplier Display](#) when configuring the Gain settings"
- The Analog Gain's resolution is set in about 0.1dB steps.
- When **SequencerMode** ([Sequencer Function](#)) is set to **On**, the **IndividualGainMode** setting cannot be changed.
- You can also automatically adjust the gain. For details, refer to the "[ALC \(Automatic Level Control\) Function](#)".

#### ■ Master Mode (IndividualGainMode = Off)

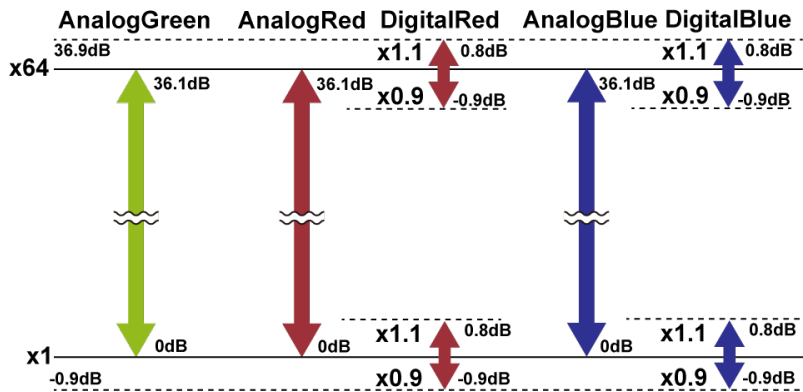
1. Set **IndividualGainMode** to **Off**.
2. Select the **Gain** to configure from **GainSelector**. First, perform the overall gain adjustment using **AnalogAll**. Then, fine-tune the gain by adjusting the **AnalogRed**, **DigitalRed**, **AnalogBlue** and **DigitalBlue** settings.

3. Refer to the table below for the setting range of each gain.



### Individual Mode (IndividualGainMode = On)

1. Set **IndividualGainMode** to **On**.
2. Select the **Gain** to configure from **GainSelector**. You can individually adjust the red, green, and blue by adjusting the **AnalogGreen**, **AnalogRed**, **DigitalRed**, **AnalogBlue**, and **DigitalBlue** settings.
3. Refer to the table below for the setting range of each gain.



### Setting Ranges

GainSelector	IndividualGainMode = Off	IndividualGainMode = On
AnalogAll*	0.0dB ~ 18.1dB (x1.0 ~ x8.0)	0db (x1.0) (Fixed)
AnalogRed*	-6.6dB ~ 12.0dB (x0.47 ~ x4.0)	0dB ~ 36.1dB (x1.0 ~ x64.0)
AnalogBlue*	-6.6dB ~ 12.0dB (x0.47 ~ x4.0)	0dB ~ 36.1dB (x1.0 ~ x64.0)
AnalogGreen*	0db (x1.0) (Fixed)	0dB ~ 36.1dB (x1.0 ~ x64.0)
DigitalRed	-0.9dB ~ 0.8dB (x0.9 ~ x1.1)	
DigitalBlue	-0.9dB ~ 0.8dB (x0.9 ~ x1.1)	

\*The resolution is set in about 0.1dB steps.

## Adjusting the White Balance

Related Setting Items: [AnalogControl](#)

Adjust the white balance using the automatic adjustment function.

### Automatic Adjustment: Once, Continuous, ExposureOnce, ExposureContinuous

1. Place a white/gray White Balance target in front of the camera, at the same position as the inspected object. Ensure that the White Balance target fills the whole image or the area(s) specified with **AWBAreaSelector**.
2. If you want to restrict the metering area for automatic adjustment, configure each of the 16 areas with **AWBAreaSelector** to enable or disable metering.

15: High Left	14: High Mid-Left	13: High Mid-Right	12: High Right
11: Mid-High Left	10: Mid-High Mid-Left	9: Mid-High Mid-Right	8: Mid-High Right
7: Mid-Low Left	6: Mid-Low Mid-Left	5: Mid-Low Mid-Right	4: Mid-Low Right
3: Low Left	2: Low Mid-Left	1: Low Mid-Right	0: Low Right (Default)

3. From **BalanceWhiteAuto**, select the adjustment method according to your application:
  - **Once**: Performs white balance adjustment once and then keeps the fixed value. The correction is carried out by automatically adjusting the gain for each channel. This setting is useful when the lighting environment is constant and stable.
  - **Continuous**: Continuously analyzes the image during acquisition and automatically updates the white balance according to changes in ambient light or the object. The correction is carried out by automatically adjusting the gain for each channel. When this option is selected, you can set the control speed of white balance adjustment with **AWBControlSpeed**. This setting is useful when lighting conditions change or when the subject has different color characteristics.
  - **ExposureOnce**: Performs white balance adjustment once and then keeps the fixed value. The correction is carried out by changing the exposure time of the Red / Blue channels. This setting is useful when the lighting environment is constant and stable.
  - **ExposureContinuous**: Continuously analyzes the image during capture and automatically updates the white balance according to changes in ambient light or the object. The correction is carried out by changing the exposure time of the Red / Blue channels. When this option is selected, you can set the control speed of white balance adjustment with **AWBControlSpeed**. This setting is useful when lighting conditions change or when the subject has different color characteristics.
4. White balance is adjusted automatically.

When **Once** or **ExposureOnce** is selected, **BalanceWhiteAuto** returns to **Off** after the automatic adjustment.

5. BalanceWhiteAutoResult displays the result of the white balance adjustment (for **Once / ExposureOnce**) or the control status (for **Continuous / ExposureContinuous**).

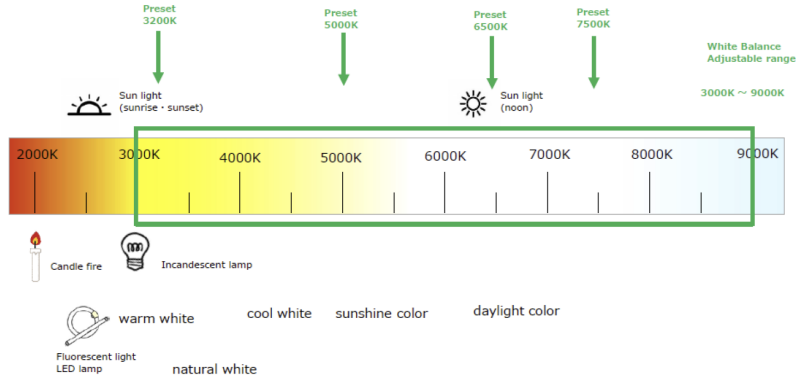
BalanceWhiteAutoResult	BalanceWhiteAuto	Description
Processing	Any	White balance adjustment in progress.
Converging	Continuous, Exposure Continuous	White balance adjustment success conditions met. (Automatic adjustment does not stop and continues.)
Succeeded	Once, Exposure Once	Automatic adjustment successful. <b>BalanceWhiteAuto</b> returns to <b>Off</b> .
Error1 - G Image was too bright	Once, Exposure Once	Adjustment failed. G value is too high.
Error2 - G Image was too dark	Once, Exposure Once	Adjustment failed. G value is too low.
Error3 - Timeout	Once, Exposure Once	Adjustment failed: Success conditions were not met after repeating adjustment for 10 seconds.
Error4 - Could not processing	Once, Exposure Once	Adjustment terminated due to the following reasons: - AcquisitionStart ( <a href="#">AcquisitionControl</a> ) not executed. - TestPattern ( <a href="#">ImageFormatControl</a> ) set to a value other than Off. - No valid metering area ([AWBAreaSelector]) - AcquisitionMode ( <a href="#">AcquisitionControl</a> ) set to Single / MultiFrame - Sequencer Mode active ( <a href="#">SequencerControl</a> ) - MultiROI Modeactive ( <a href="#">MultiROIControl</a> ) - IndividualGainMode ( <a href="#">AnalogControl</a> ) set to On
Error5 - R or B image was out of range	Once, Exposure Once	Adjustment failed. R or G channel signal exceeded control range.

**Notes:**

- When **Continuous** or **ExposureContinuous** is selected, automatic adjustment will not execute under the following conditions. However, the adjustment will not be terminated, and automatic adjustment will start or resume once the condition is cleared.
  - AcquisitionStart ([AcquisitionControl](#)) not executed.
  - TestPattern ([ImageFormatControl](#)) set to a value other than Off.
  - No valid metering area ([AWBAreaSelector])
  - Sequencer Mode active ([SequencerControl](#))
  - MultiROI Modeactive ([MultiROIControl](#))
  - IndividualGainMode ([AnalogControl](#)) set to On
- When **Continuous** or **ExposureContinuous** is selected and the success conditions for white balance adjustment are not met, the adjustment will not be terminated and automatic adjustment continues. In this case, **BalanceWhiteAutoResult** displays **Processing**.

## Automatic Adjustment: Preset3200K, Preset5000K, Preset6500K, Preset7500K

In addition to the automatic adjustment functions described above, this camera allows you to fix the white balance to a specified color temperature (**Preset5000K, Preset6500K, Preset7500K**). When the preset option is used, set **IndividualGainMode** [[AnalogControl](#)] to **Off**.



**Note:** When a Preset setting is selected, **BalanceWhiteAutoResult** displays **Idle**.

## Adjusting the Black Level

**Related Setting Items:** [AnalogControl](#)

Black level adjustment aligns the baseline of dark areas to suppress noise and color cast, ensuring accurate and stable images. **All** applies the same correction value to all channels, useful when simply aligning the overall black reference. **Red** and **Blue** apply corrections to individual color channels, and are used when only the red or blue channel black level is shifted. This helps reduce color cast or unevenness in dark areas, improving stable color reproduction and inspection accuracy.

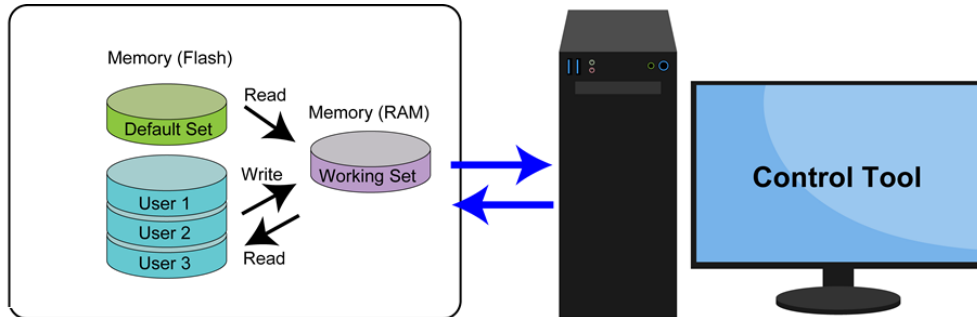
1. Select the black level you want to configure in **BlackLevelSelector**. **All** (master black), **Red**, and **Blue** can be configured.
2. Specify the adjustment value in BlackLevel (Default: 0). The available setting range for each option is as follows.

BlackLevelSelector	Setting Range
All	-133 ~ 255
Red	-64 to +64
Blue	-64 to +64

## Step 6: Saving the Settings

Related Setting Items: [UserSetControl](#)

The setting values configured in the tool will be deleted when the camera is turned off. By saving current setting values to user memory, you can load and recall them whenever necessary. You can save up to three sets of user settings in the camera. (User Set1 to 3)



### To Save User Settings

1. Stop image acquisition.
2. Expand **UserSetControl** and select the save destination (UserSet1 to UserSet3) in UserSetSelector.

**Note:** The factory default setting values are stored in Default and cannot be overwritten.

**Caution:** Settings can only be saved when image acquisition on the camera is stopped.

3. Select **UserSetSave** and click the **UserSetSave** button.
4. The current setting values are saved as user settings.

### To Load User Settings

1. Stop image acquisition. User settings can only be loaded when image capture on the camera is stopped.
2. Select the settings to load (UserSet1 to UserSet3) in UserSetSelector.
3. Select **UserSetLoad** and click the **UserSetLoad** button.
4. The selected user settings are loaded.

**Note:** When selecting **Default** for UserSetSelector, the factory settings are loaded.

# Main Functions

This chapter describes the camera's main functions.

## Single ROI Function

**Related Setting Items:** [ImageFormatControl](#)

The ROI (region of interest) function allows you to output images by specifying the areas to scan. Specify the area to scan by specifying width, height, and horizontal/vertical offset values under ImageFormatControl. You can increase the frame rate by specifying a lower height, as the number of lines scanned decreases.

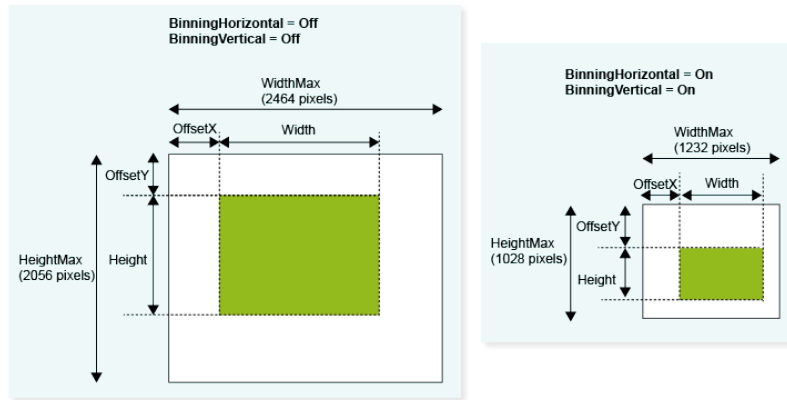
### Notes:

- When using this function with [Image Scaling Mode \(Xscale\)](#), first, set the Width, Height, OffsetX, and OffsetY settings, and then configure the Image Scaling Mode settings.
- The "[Single ROI Function](#)" and [FD2x2BinningMode \(Binning Function\)](#) cannot be used together on this model. Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.
- Use "[Multi ROI Function](#)" when outputting image by specifying multiple areas.

The setting ranges for the ROI function's readable area based on the Binning setting (BinningHorizontal, BinningVertical, FD2x2BinningMode) are as follows.

	HorizontalBinning = 1 VerticalBinning = 1	HorizontalBinning = 2 VerticalBinning = 2
Width	96 ~ 2464, step: 8	48 ~ 1232, step: 4
Height	8 ~ 2056, step: 2	4 ~ 1028, step: 1
OffsetX	0 ~ 2368, step: 8	0 ~ 1184, step: 4
OffsetY	0 ~ 2048, step: 2	0 ~ 1024, step: 1

## Examples



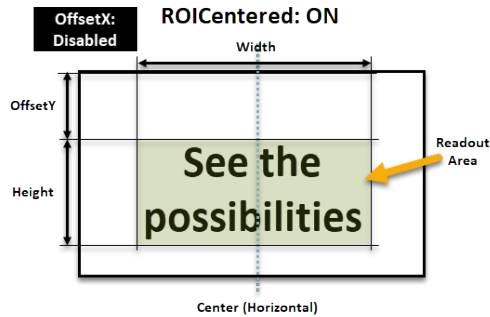
For example, when **OffsetX** is set to **8** and **OffsetY** is set to **2**, the first readout pixel is the ninth pixel on line 3.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1														
2														
3														
4														

## ROI Centered

Related Setting Items: [ImageFormatControl](#)

When **ROI Centered** is set to **ON** while using the [Single ROI Function](#), **OffsetX** is disabled and the image output position in the X direction is always forced to be centered.



### Notes:

- Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.
- When switching this function back to **Off**, the **OffsetX** value will be 0.

# Binning Function

**Related Setting Items:** [ImageFormatControl](#)

The Binning function allows you to combine the signal values of clusters of adjacent pixels to create improved virtual pixels. Using the function results in images with a lower pixel resolution and higher sensitivity in summing mode or reduced noise in averaging mode.

This camera model supports the following binning modes:

- **FD2x2BinningMode** (Floating diffusion binning): Performs Horizontal x2 and Vertical x2 analog binning (Sum) on the sensor.

**Note:** The "[Single ROI Function](#)" and FD2x2BinningMode ([Binning Function](#)) cannot be used together on this model. To set FD2x2BinningMode to On, the **Width** and **Height** settings must be set to their maximum values (WidthMax, HeightMax). When FD2x2BinningMode is set to On, the image size is 1228 (H) x 1024 (V).

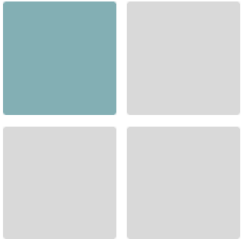
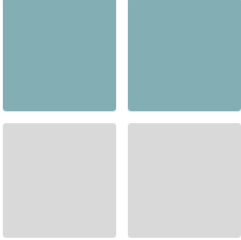

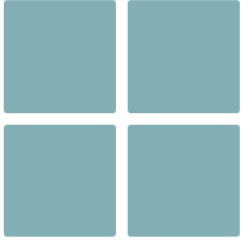
- **BinningHorizontal, BinningVertical:** Performs Horizontal x2 and/or Vertical x2 digital binning (Sum or Average) on the FPGA.

**Note:** Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.

## How to Configure

When configuring **FD2x2BinningMode**, set the setting to **On**. When configuring **BinningHorizontal/ BinningVertical**, set the setting to **2**.

**Note:** **FD2x2BinningMode** and **BinningHorizontal/ BinningVertical** cannot be used together.

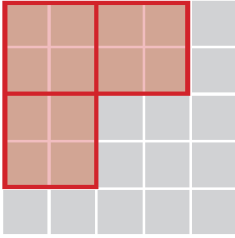
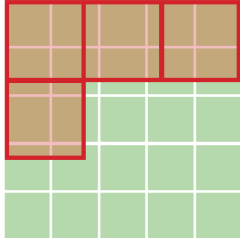
	Binning off	2 x 1	1 x 2	2 x 2
				
<b>FD2x2BinningMode</b>	OFF	N/A	N/A	ON
<b>BinningHorizontal</b>	1	2	1	2
<b>Binning Vertical</b>	1	1	2	2

## Image Scaling Mode (Xscale)

**Related Setting Items:** [ImageFormatControl](#)

JAI's Xscale algorithm digitally reduces the sensor's pixel resolution by specifying the vertical and horizontal scaling ratio. This function can also be used for color models and allows finer adjustment of resolution than the conventional [Binning Function](#).

The output image types are Average or Sum.

Traditional Binning (2 x 2)	ImageScaling Mode (1.666 x 1.666)
	

### Notes:

- When using [Image Scaling Mode \(Xscale\)](#) together with the [Single ROI Function](#) or [FD2x2Binning \(Binning Function\)](#), first, set the Width, Height, OffsetX, OffsetY or [FD2x2Binning](#) settings, and then configure the Image Scaling Mode settings.
- Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.
- For more information, see the JAI news "[Xscale](#)".

### How To Configure

1. If necessary, configure the [Single ROI Function](#) settings or the [FD2x2Binning \(Binning Function\)](#) setting.
2. Set **ImageScalingMode** (ImageFormatControl) to **On**.
3. Use **ImageScalingSumMode** to specify the output image mode. The options are "**Average** (Off)" or "**Sum** (On)." Depending on the mode, the output image's brightness will be different.

**Average Mode:** The average brightness of the sensor image is equal to the average brightness of the reduced output image.

**Sum Mode:** The sum of the brightness of all pixels in the sensor image and the sum of the brightness of all pixels in the reduced output image is equal, thus increasing the brightness of the output image.

4. Use **ImageScalingHorizontal** and **ImageScalingVertical** to specify the horizontal and vertical scaling ratio.

## Specifying the Scaling Ratio

Specify the scaling ratio in decimal point (maximum six decimal places) for ImageScalingHorizontal and ImageScalingVertical. The setting range is 0.0625 to 1. If "1" is specified, the image will not be scaled.

**Caution:** Xscale automatically rounds down the width to the nearest value that is a multiple of 8 and rounds down the height to the nearest value that is a multiple of 2.

Before rounding down, width and height calculations are first rounded (up or down) to seven significant digits. If the subsequent rounding down to the nearest multiple of 8 (or 2) results in a value that is beyond Xscale's maximum 16X scaling limit, the value is rounded up to the nearest multiple of 8 (or 2) and the corresponding ImageScalingHorizontal/Vertical value is adjusted accordingly.

**Note:** When using Xscale, the horizontal and vertical scaling factors determine the size of the virtual pixels in the scaled image. This information, plus any ROI that has been preset by the user, determines the maximum number of whole virtual pixels possible in the output image.

### Settings Example When Replacing a Camera

When you are replacing your camera with a new one, but the new camera has a different pixel size and resolution, you can reproduce the current camera's pixel size and output image size on the replacement camera, using the [Single ROI Function](#) and/or FD2x2Binning ([Binning Function](#)) and ImageScalingMode functions.

This example shows how to configure the ROI and ImageScalingMode settings when replacing the AP-1600T camera with the AP-5100T camera.

	Pixel Size	Full Resolution (Width x Height)
Current Camera: AP-1600T	3.45 μm x 3.45 μm	1456 x 1088
New Camera: AP-5100T	2.74 μm x 2.74 μm	2464 x 2056

- First, find the scaling ratio for the ROI. This value can be obtained by dividing the "pixel size of the replacement camera" by the "pixel size of the camera currently in use."  
In this example, the scaling ratio is **0.79** ( $2.74 \div 3.45 = 0.79$ ).
- The setting values can be obtained by dividing the "Width and Height of the camera currently in use" by the "ROI scaling ratio." However, the calculated values must be adjusted to match the step size of the replacement camera.

The Width and Height settings in this example are as follows:

Setting Item	Setting Value	Calculation
Width	1840	$1456 \div 0.79 = 1843$ . Since ROI Width has a step of 8, the setting value becomes "1840."
Height	1376	$1088 \div 0.79 = 1377$ . Since ROI Width has a step of 2, the setting value becomes "1376."

3. Set the new camera's **ImageScalingMode** to **On**.
4. Set **ImageScalingHorizontal** and **ImageScalingVertical**. The setting values can be obtained by dividing the “Width or Height value of the camera currently in use” by the corresponding “Width or Height value of the replacement camera” calculated in step 2.

Setting Item	Setting Value	Calculation
ImageScalingHorizontal	0.791304	$1456 \div 1840 = 0.791304$
ImageScalingVertical	0.790697	$1088 \div 1376 = 0.790697$

5. Now, the virtual pixel size of the replacement camera (AP-5100T) becomes 3.45 μm x 3.45 μm, and the output image size becomes 1456 x 1088.

## Image Flip Function

**Related Setting Items:** [ImageFormatControl](#)

Using this function, you can output the image by inverting it horizontally and/or vertically.

### ReverseX, ReverseY

- To reverse the image horizontally, set **ReverseX** to True.
- To reverse the image vertically, set **ReverseY** to True.

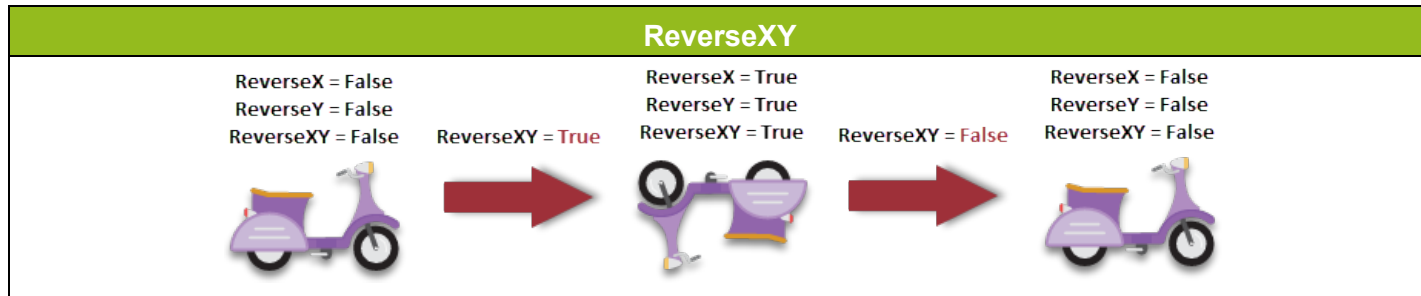


## ReverseXY

ReverseXY inverts the current **ReverseX** and **ReverseY** settings.

**Note:** The ReverseXY setting can be changed during the acquisition; however, the frame rate will temporarily slow down while the setting is changed.

For example, if ReverseX, ReverseY, and ReverseXY are all set to **False**, changing ReverseXY to **True** will change ReverseX and ReverseY to **True**. If ReverseXY is changed back to **False**, ReverseX and ReverseY are also changed back to **False**. (ReverseXY acts as a toggle).



## Pixel Format

**Related Setting Items:** [ImageFormatControl](#)

Selectable PixelFormat is as follows.

- RGB8, RGB10, RGB12

# Overlay Mode

Related Setting Items: [ImageFormatControl](#)

**Notes:**

- This function cannot be used with the [Sequencer Function](#).
- This function is always Off when the camera is powered up and when **AcquisitionStop** is executed.

## OverlayMode = MultiRoiAreaMode

In this mode, you can check the readout area when using the [Multi ROI Function](#). The area that is not readout is displayed with the brightness reduced to half. This makes it possible to set and adjust the readout area while checking the target area on the screen.

**Notes:**

- To set Overlay Mode to **MultiRoiAreaMode**, MultiRoiMode ([MultiROIControl](#)) must be set to **Off** in advance.
- In the following scenario, OverlayMode = MultiRoiMode will be disabled (you can still set to **ALCAreaMode** or **AWBAreaMode**): ImageScalingMode = On, BinningHorizontal = 2, BinningVertical = 2, FD2x2BinningMode = On

## OverlayMode = AWBAreaMode or ALCAreaMode

When Overlay Mode is set to **AWBAreaMode** or **ALCAreaMode**, you can check the photometry areas of WhiteBalance and ALC. In the non-target area as shown below, the brightness is reduced to half.

**MultiRoiAreaMode**



**AWBAreaMode or ALCAreaMode**

HighLeft	HighMidLeft	HighMidRight	HighRight
MidHighLeft	MidHighMidLeft	MidHighMidRight	MidHighRight
MidLowLeft	MidLowMidLeft	MidLowMidRight	MidLowRight
LowLeft	LowMidLeft	LowMidRight	LowRight

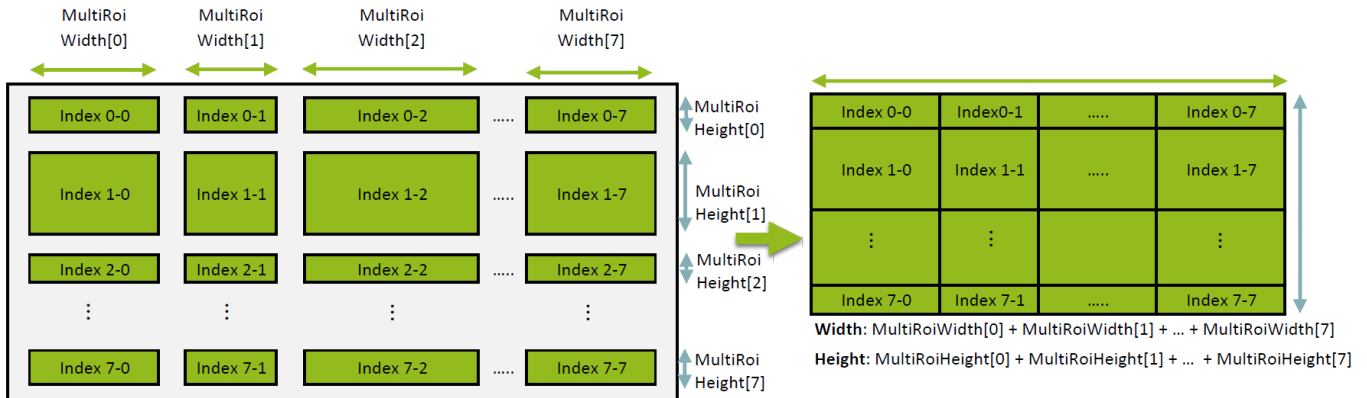
# Multi ROI Function

Related Setting Items: [MultiROIControl](#)

**Notes:**

- Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.
- If this function is turned on while [Shading Correction](#) is set to On, Shading Correction will be forced to Off.

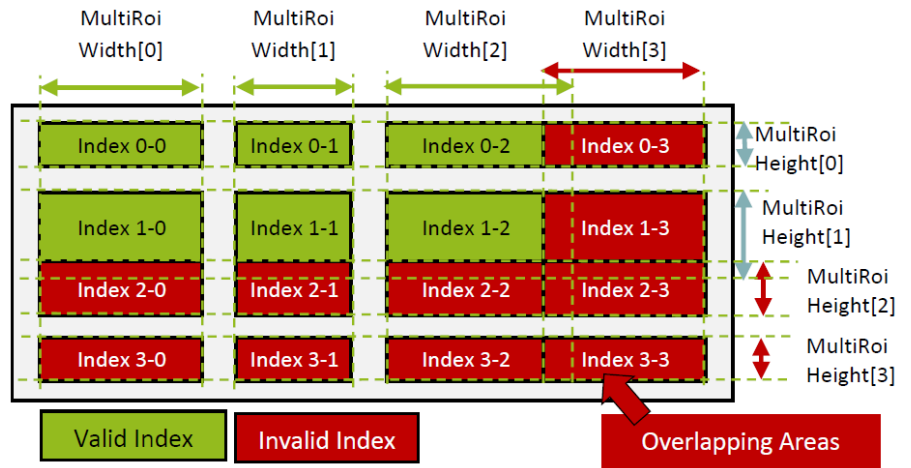
In Multi ROI mode, you can specify up to 64 scanning areas for a single-frame image. By skipping areas that are not specified as regions of interest when scanning a frame, the ROI function outputs the specified regions in a combined state. You can increase the frame rate due to the reduced scanning time for the combined areas. However, you cannot increase the frame rate by compressing in the horizontal direction.



## How to Configure

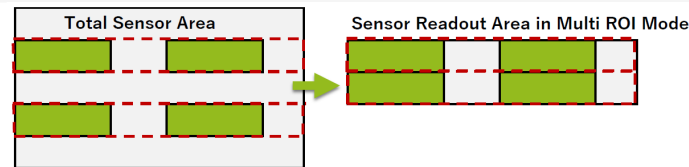
1. Set **MultiRoiMode (MultiROIControl)** to **On**.
2. Select from the eight indexes in **MultiRoiIndex** then set **MultiRoiWidth**, **MultiRoiHeight**, **MultiRoiOffsetX**, and **MultiRoiOffsetY**.
3. Set the maximum index number to be enabled to **MultiRoiVerticalEnableNumber** and **MultiRoiHorizontalEnableNumber**.

**Caution:** The specified areas cannot overlap. If the areas overlap, all indexes after the overlapping areas become unconfigurable.



### Notes:

- The frame rate can be increased in relation to the size of the area specified in the vertical direction, but not in relation to the horizontal direction.

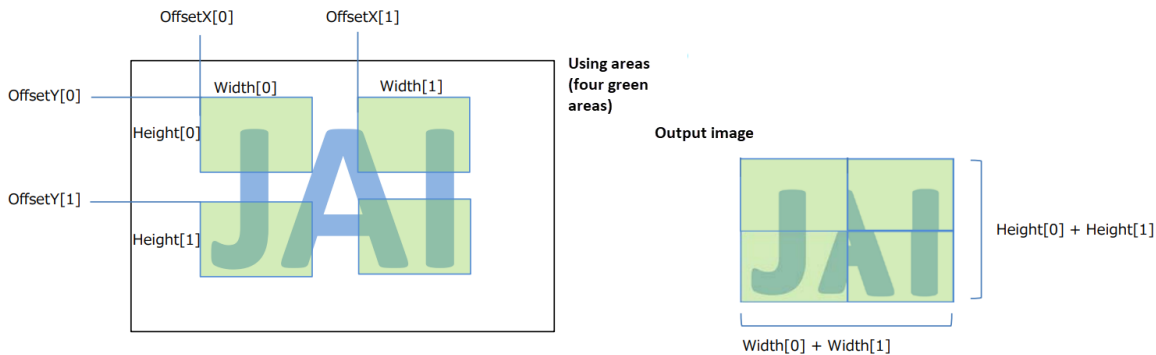


- In the horizontal direction, the configuration for the second and subsequent rows will be identical. In the vertical direction, the configuration for the second and subsequent columns will be identical.

## Configuration Example

To use four areas as shown below, refer to the following.

1. Set MultiROIControl->**MultiRoiMode On**.
2. Select "0" in MultiRoiIndex. Set MultiRoiWidth, MultiRoiHeight, MultiRoiOffsetX and MultiRoiOffsetY.
3. Select "1" in MultiRoiIndex. Set MultiRoiWidth, MultiRoiHeight, MultiRoiOffsetX and MultiRoiOffsetY.
4. Set 2 to MultiRoiVerticalEnableNumber.
5. Set 2 to MultiRoiHorizontalEnableNumber.



## Acquisition Control

Related Setting Items: [AcquisitionControl](#)

This camera has three Acquisition modes (SingleFrame, MultiFrame, Continuous). Use the AcquisitionControl settings to perform operations and settings for image capture.

AcquisitionMode	Description	
SingleFrame	When the <b>AcquisitionStart</b> command is executed, one frame of image is captured.	
MultiFrame	When the <b>AcquisitionStart</b> command is executed, the number of frames set in AcquisitionFrameCount are acquired as images.	
Continuous	When the <b>AcquisitionStart</b> command is executed, images will continue to be acquired until the AcquisitionStop command is executed.	

**Note:** After changing various settings, the black level may not be stable for several frames immediately after AcquisitionStart.

## Changing the Frame Rate

Related Setting Items: [AcquisitionControl](#)

When **TriggerMode** is disabled, you can change the frame rate in **AcquisitionFrameRate**.

The shortest frame period depends on various settings. The longest frame period is 0.125 Hz (8 sec.).

### Available Operation Mode

TriggerMode	ExposureMode	例
Off	Timed	<u>Control without External Triggers without Specifying the Exposure Time</u>
Off	Off	<u>Control without External Triggers with the Specified Exposure Time</u>

**Note:** When TriggerMode[FrameStart] is enabled, the AcquisitionFrameRate setting is disabled.

## Calculate the Maximum Frame or Trigger Rate (Approximate)

Related Setting Items: [AcquisitionControl](#)

This section describes how to calculate the maximum frame rate or the maximum trigger rate (approximate). First, calculate the H Period, then calculate the minimum frame period based on the H Period value, and finally calculate the maximum frame rate (when in Continuous mode) or maximum trigger rate (when in Trigger mode).

### Notes:

- The formulas described in this section are simplified versions and may have a certain margin of error.
- The following conditions are applied:
  1. PacketSize = 8192 (the max value)
  2. DeviceLinkThroughputLimitMode = Off (No bandwidth limitations)
- The Frame Rate Calculator, which calculates the maximum frame rate or trigger rate, is available for download from the product page on the JAI website.

## 1. Calculate the H Period

First, Calculate the **IF\_LINETIME**, **SENSOR\_LINETIME**, and **VIDEO\_LINETIME** values, then calculate the **LineTime[clk]** value and finally calculate the **H Period** value.

### IF\_LINETIME, SENSOR\_LINETIME, VIDEO\_LINETIME

#### A. IF\_LINETIME

$$\text{IF\_LINETIME[clk]} = \text{Roundup}(\text{Width}(*1) \times a + b / 10000, 0) \times 3$$

1. **Width(\*1)**: When setting **BinningHorizontal** to **2**, or **FD2x2BinningMode** to **ON**, or **ImageScalingMode** to **ON**, enter the Width value "after" configuring the setting.

2. For the "a" and "b" values, select the values from the table below based on the CxpLinkConfiguration ([TransportLayerControl](#)) and [Pixel Format](#) settings.

	CxpLinkConfiguration	PixelFormat		
		RGB8	RGB10	RGB12
a	CXP12_X1	600	750	900
	CXP6_X1	1205	1504	1807
	CXP3_X1	2410	3013	3613
b	CXP12_X1	0	0	0
	CXP6_X1	-3333	7857	-714
	CXP3_X1	6608	6422	14021

B. **SENSOR\_LINETIME[clk]**

$$\text{SENSOR\_LINETIME[clk]} = \text{HMAX}$$

Select the **HMAX** value from the table below.

FD2x2BinningMode	PixelFormat	
	8bit / 10bit	12bit
Off	359	400
On	180	209

C. **VIDEO\_LINETIME[clk]**

The calculation formula varies based on the settings of the Binning Horizontal, Binning Vertical ([Binning Function](#)), and Image Scaling Mode ([Image Scaling Mode \(Xscale\)](#)).

- When **BinningHorizontal = 2**, or **BinningVertical = 2**, or **ImageScalingMode = On**

$$\text{VIDEO\_LINETIME[clk]} = \text{Ceiling}((\text{Width}(*1) / 2) + 8) / 250.0 \times 74.25, 1)$$

**Note:** Width(\*1): Enter the Width value "before" configuring the settings.

- When **BinningHorizontal = 1**, and **BinningVertical = 1**, and **ImageScalingMode = Off**

$$\text{VIDEO\_LINETIME[clk]} = \text{Ceiling}((\text{Width}(*1) / 2) + 4) / 250.0 \times 74.25, 1)$$

**Note:** Width(\*1): Enter the Width value "after" configuring the settings.

### ■ LineTime[clk]

Next, calculate the LineTime[clk] value using the IF\_LINETIME, SENSOR\_LINETIME, and VIDEO\_LINETIME values.

$$\text{LineTime[clk]} = \text{MAX}( \text{IF\_LINETIME}, \text{SENSOR\_LINETIME}, \text{VIDEO\_LINETIME} )$$

### ■ H Period

Calculate the H Period based on the above LineTime[clk] value.

$$\text{H Period}[\mu\text{s}] = \text{LineTime[clk]} / 74.25[\text{MHz}]$$

## 2. Calculate the Minimum Frame Period

Next, calculate the Minimum Frame Period.

$$\text{Minimum Frame Period}[\mu\text{s}] = \text{H Period}[\mu\text{s}] \times (\text{Height}(*2) + \text{VBlanking} + 2)$$

1. For the Height(\*2), enter the following value when using the [Binning Function](#) or in [Image Scaling Mode \(Xscale\)](#).
  - When setting **BinningVertical** to **2** or **ImageScalingMode** is set to **On**, enter the Height value "**before**" configuring the settings.
  - When setting **FD2x2BinningMode** to **On**, enter the Height value "**after**" configuring the setting.
2. Select the **VBlanking** value from the table.

FD2x2BinningMode	PixelFormat	
	8bit / 10bit	12bit
Off	150	144
On	214	198

### 3. Calculate the Maximum Frame Rate or Maximum Trigger Rate

Finally, calculate the maximum acquisition frame rate (Continuous Mode) or maximum trigger rate (Trigger Mode).

#### Maximum Acquisition Frame Rate (When in Continuous Mode: Frame Start Trigger = Off)

$$\text{Maximum Acquisition Frame Rate[Hz]} = 1000000 / \text{Minimum Frame Period}[\mu\text{s}]$$

#### Maximum Trigger Rate (When in Trigger Mode: Frame Start Trigger = On)

1. First, calculate the Maximum Overlap Time value for the shortest trigger period.

$$\begin{aligned} \text{MaxOverlapTime\_TrOIRD}[\mu\text{s}] \\ = \text{Minimum Frame Period}[\mu\text{s}] - (\text{Non-ExposurePeriod}[\text{H}] \times \text{H Period}[\mu\text{s}]) \end{aligned}$$

Select the **Non-ExposurePeriod[H]** value from the table below.

FD2x2BinningMode	PixelFormat	
	8bit / 10bit	12bit
Off	54	50
On	100	88

2. Next, calculate the Maximum Trigger Rate. The formula depends on whether the Exposure Time value is longer or shorter than the MaxOverlapTime\_TrOIRD value.

##### A. When ExposureTime $\leq$ MaxOverlapTime\_TrOIRD[ $\mu\text{s}$ ]

$$\text{Maximum Trigger Rate[Hz]} = \text{Maximum Acquisition Frame Rate[Hz]}$$

##### B. When ExposureTime > MaxOverlapTime\_TrOIRD[ $\mu\text{s}$ ]

1. First, calculate the Non-OverlapExposureTime\_TrOIRD[ $\mu\text{s}$ ] value.

$$\begin{aligned} \text{Non-OverlapExposureTime\_TrOIRD}[\mu\text{s}] \\ = \text{ExposureTime} - \text{MaxOverlapTime\_TrOIRD}[\mu\text{s}] \end{aligned}$$

2. Finally, calculate the Maximum Trigger Rate.

$$\begin{aligned} \text{Maximum Trigger Rate[Hz]} \\ = 1000000 / (\text{Minimum Frame Period}[\mu\text{s}] + \text{Non-OverlapExposureTime\_TrOIRD}[\mu\text{s}]) \end{aligned}$$

# Trigger Control

**Related Setting Items:** [AcquisitionControl](#)

The camera allows the following controls to be performed via external trigger signals.

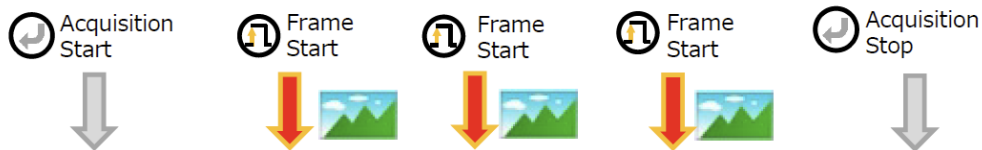
TriggerSelector	Description
AcquisitionStart	Start image acquisition in response to the external trigger signal input.
AcquisitionEnd	Stop image acquisition in response to the external trigger signal input.
FrameStart	<p>Start capturing a one-frame image in response to the external trigger signal input.</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>The FrameStart Trigger can only be used when the <a href="#">Exposure Mode</a> setting is set to <b>Timed</b> or <b>TriggerWidth</b>.</li> <li>For more information, see "<a href="#">FrameStart Trigger</a>".</li> </ul>

**Notes:**

- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in [Step 4: Configure Trigger, Exposure, and Frame Rate Settings](#).
- You can delay when exposure actually starts after a trigger is received for a specific amount of time by configuring **TriggerDelay**.

## FrameStart Trigger

When **AcquisitionStart** has been executed, a single frame is captured each time a **FrameStart** trigger is received, until the **AcquisitionStop** command is executed.



**Note:** For the configurable source signals of the trigger, refer to **TriggerSource** ([AcquisitionControl](#)).

## Exposure Mode

**Related Setting Items:** [AcquisitionControl](#)

This camera supports the following Exposure modes:

Exposure Mode	Description	Example
Off	Exposure control is not performed (free-running operation). The exposure time is the longest possible time within the operating conditions such as the frame rate.	<a href="#">Control without External Triggers without Specifying the Exposure Time</a>
Timed	Mode in which control is performed using ExposureTime. Acquire images using an exposure time configured beforehand on an external trigger.	<a href="#">Control via External Triggers with the Specified Exposure Time</a>
		<a href="#">Control without External Triggers with the Specified Exposure Time</a>
TriggerWidth	Mode in which control of the exposure time is performed using the pulse width of the trigger input signal. The exposure time will be the same as the pulse width of the trigger input signal.	<a href="#">Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal</a>

### Notes:

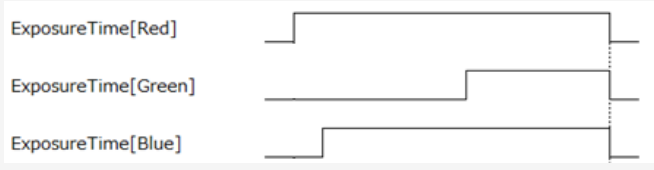
- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in [Step 4: Configure Trigger, Exposure, and Frame Rate Settings](#).
- When exposed to strong light, the accumulation time may appear to shift due to PLS (Parasitic Light Sensitivity) and other effects.
- When set to Timed or TriggerWidth, the actual exposure time is the set exposure time plus the exposure offset time (2.47 $\mu$ s).

## ExposureTimeMode

When ExposureMode is set to Timed, you can select the following Exposure Time Mode.

**Notes:**

- **ExposureTimeMode** can only be configured only when **ExposureMode** is set to **Timed**.
- When **SequencerMode** is On ([Sequencer Function](#)), **ExposureTimeMode** cannot be changed.

ExposureTimeMode	Description
Common	Set the common exposure time for Red, Green, and Blue (the RGB channels will have the same exposure time).
Individual	<p>Set the exposure times for Red, Green, and Blue individually. To set the exposure time individually for Red, set ExposureTimeSelector to Red, and configure the exposure time for Red in ExposureTime. Similarly, configure the exposure times individually for Green and Blue.</p> <p><b>Note:</b> The actual exposure time starts with the channel with the longest exposure time and ends with the channel with the shortest exposure time, so that the exposures end at the same time (see image below).</p> 

## Actual Exposure Time

**Related Setting Items:** [AcquisitionControl](#)

The actual exposure time will consist of the image sensor's offset duration (2.47 $\mu$ s) added to the ExposureTime setting (when ExposureMode = Timed) or the Width of the trigger signal to the camera (when ExposureMode = TriggerWidth).

The minimum ExposureTime setting is 0.1 $\mu$ s, and the maximum Exposure setting depends on other settings (see Exposure Mode on "[Specifications](#)").

### ExposureMode = Timed

When **ExposureTime** is set to **1 $\mu$ s**, the actual exposure time will be as follows.

- $1\mu + 2.47\mu$  (Image sensor's offset duration) = 3.47 $\mu$ s

### ExposureMode = TriggerWidth

The actual exposure time will consist of the image sensor's offset duration added to the Width of the trigger signal to the camera.

- If the exposure time needs to be 3.47 $\mu$ s, set the width of the Trigger Signal to the camera to 1 $\mu$  (= 3.47 - 1 $\mu$ s).

**Note:** On this camera, the pulse width of the [ExposureActive Signal](#) includes the Exposure offset duration (2.47 $\mu$ s). Therefore, "ExposureActive signal's pulse width = *ExposureTime* value ( $\mu$ s) + 2.47 $\mu$ s."

## RCT Mode

**Related Setting Items:** [AcquisitionControl](#)

RCT mode (**ExposureModeOption** = RCT) can be used when **Exposure Mode** is **Timed**, and **Frame Start Trigger** is enabled.

In RCT mode, the image is not output from the camera until FrameStartTrigger is input, but internally the imaging operation is continued and the automatic gain control (AGC) function, the automatic shutter control (ASC) function and the automatic white balance (AWB) function can be continued.

**Note:** This function and the "[Sequencer Function](#)" cannot be used together.

# Timing Chart

**Related Setting Items:** [AcquisitionControl](#)

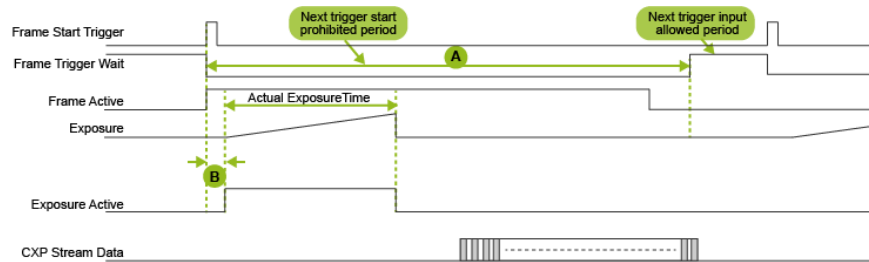
This section shows the timing charts under the following conditions on each model when FrameStartTrigger is set to **On**.

- [Exposure Mode = Timed \(Overlap Readout\)](#)
- [Exposure Mode = TriggerWidth \(Overlap Readout\)](#)
- [Exposure Mode = Timed \(RCT Mode\)](#)

**Note:** On this camera, the ExposureActive signal's pulse width includes the Exposure offset duration (2.47μs). Therefore, "ExposureActive signal's pulse width = ExposureTime value (μs) + 2.47μs," or in the case of TriggerWidth operation "ExposureActive signal's pulse width = Trigger Signal's Effective Pulse Width (μs) + 2.47μs."

## Exposure Mode = Timed (Overlap Readout)

This section shows the timing charts when FrameStartTrigger is set to **On**, and ExposureMode is set to **Timed** (Overlap Readout).



<b>A</b>	Frame Period (μsec)
<b>B</b>	Period From Trigger Start Edge to Exposure Start (μsec)

**CXP12-1 (ExposureMode = Timed; Overlap Readout)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	MAX Frame Rate (Hz)
<b>Full (Max Frame Rate)</b>			
RGB8	13287	66.5	75.3
RGB10	16639	83.3	60.1
RGB12	19881	99.4	50.3
<b>Binning Horizontal (Max Frame rate)</b>			
RGB8	11136	55.8	89.8
RGB10	11919	59.9	83.9
RGB12	11919	59.9	83.9
<b>Binning Vertical (Max Frame rate)</b>			
RGB8	13298	66.5	75.2
RGB10	16639	83.3	60.1
RGB12	19881	99.5	50.3
<b>Binning Horizontal &amp; Vertical (Max Frame rate)</b>			
RGB8	11136	55.8	89.8
RGB10	11919	59.9	83.9
RGB12	11919	59.9	83.9

**CXP6-1 (ExposureMode = Timed; Overlap Readout)****■ Frame Start Trigger = On**

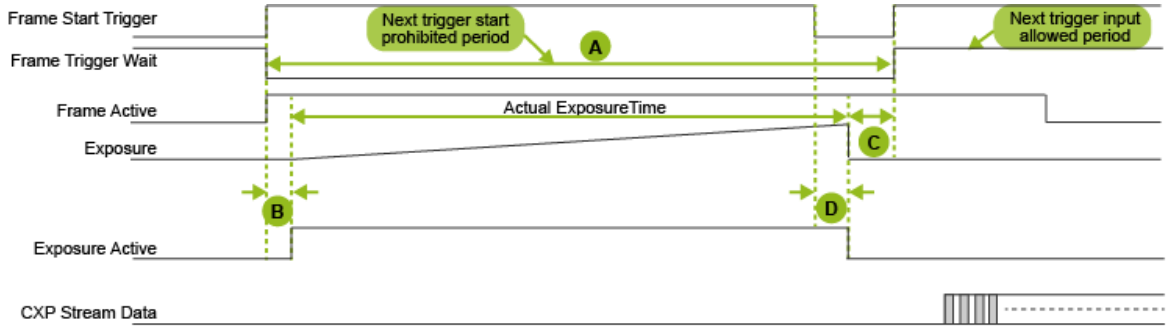
Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	MAX Frame Rate (Hz)
<b>Full (Max Frame Rate)</b>			
RGB8	26667	132.7	37.5
RGB10	33334	166.5	30.0
RGB12	40000	199	25.0
<b>Binning Horizontal (Max Frame rate)</b>			
RGB8	13387	66.9	74.7
RGB10	16807	84.2	59.5
RGB12	19960	99.9	50.1
<b>Binning Vertical (Max Frame rate)</b>			
RGB8	26667	132.6	37.5
RGB10	33334	166.4	30.0
RGB12	40000	199.0	25.0
<b>Binning Horizontal &amp; Vertical (Max Frame rate)</b>			
RGB8	13387	66.9	74.7
RGB10	16807	84.2	59.5
RGB12	19960	99.9	50.1

**CXP3-1 (ExposureMode = Timed; Overlap Readout)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	MAX Frame Rate (Hz)
<b>Full (Max Frame Rate)</b>			
RGB8	53476	265.1	18.7
RGB10	66667	331.7	15.0
RGB12	80001	397.2	12.5
<b>Binning Horizontal (Max Frame rate)</b>			
RGB8	26810	133.1	37.3
RGB10	33334	166.5	30.0
RGB12	40000	199.5	25.0
<b>Binning Vertical (Max Frame rate)</b>			
RGB8	53476	265.1	18.7
RGB10	66667	331.7	15.0
RGB12	80001	397.2	12.5
<b>Binning Horizontal &amp; Vertical (Max Frame rate)</b>			
RGB8	26810	133.1	37.3
RGB10	33334	166.5	30.0
RGB12	40000	199.5	25.0

## Exposure Mode = TriggerWidth (Overlap Readout)

This section shows the timing charts when FrameStartTrigger is set to **On**, and ExposureMode is set to **TriggerWidth** (Overlap Readout).



<b>A</b>	Frame Period ( $\mu\text{sec}$ )
<b>B</b>	Period From Trigger Start Edge to Exposure Start ( $\mu\text{sec}$ )
<b>C</b>	Period From Exposure End to Next Trigger Start ( $\mu\text{sec}$ )
<b>D</b>	Period From Trigger End to Exposure End ( $\mu\text{sec}$ ) (= $B + 2.47 \mu\text{sec}$ )

**CXP12-1 (ExposureMode = TriggerWidth; Overlap Readout)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	(C) Period From Exposure end to next Trigger Start(usec)	MAX Frame Rate (Hz)
<b>Full (Max Exposure Time in Max Frame rate)</b>				
RGB8	13106	66.5	237.5	76.3
RGB10	16448	83.3	268.4	60.8
RGB12	19685	99.4	321.2	50.8
<b>Binning Horizontal (Max Exposure Time in Max Frame rate)</b>				
RGB8	11001	55.8	197.9	90.9
RGB10	11793	59.9	191.6	84.8
RGB12	11793	59.9	191.6	84.8
<b>Binning Vertical (Max Exposure Time in Max Frame rate)</b>				
RGB8	13106	66.4	247.9	76.3
RGB10	16448	83.3	268.4	60.8
RGB12	19685	99.5	268.4	50.8
<b>Binning Horizontal &amp; Vertical (Max Exposure Time in Max Frame rate)</b>				
RGB8	11001	55.8	197.9	90.9
RGB10	11793	59.9	191.6	84.8
RGB12	11793	59.9	191.6	84.8

**CXP6-1 (ExposureMode = TriggerWidth; Overlap Readout)****■ Frame Start Trigger = On**

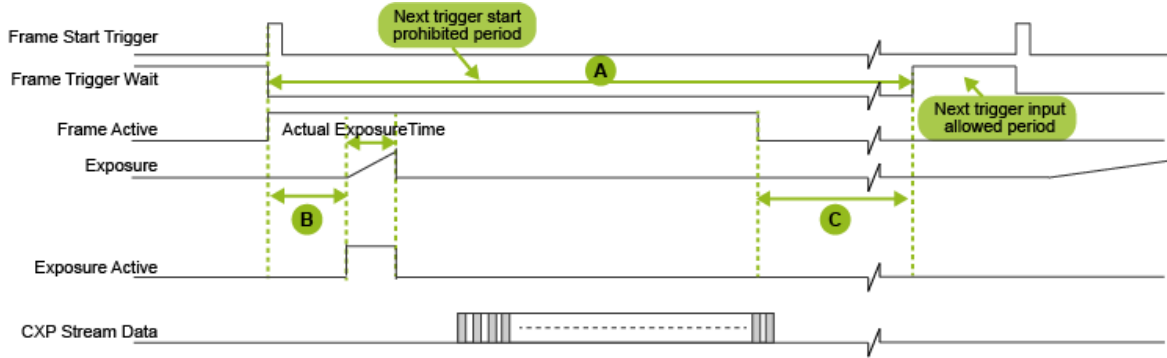
Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	(C) Period From Exposure end to next Trigger Start(usec)	MAX Frame Rate (Hz)
<b>Full (Max Exposure Time in Max Frame rate)</b>				
RGB8	26316	132.7	477.9	38.0
RGB10	33004	166.4	539.6	30.3
RGB12	39526	199.0	646.5	25.3
<b>Binning Horizontal (Max Exposure Time in Max Frame rate)</b>				
RGB8	13193	66.9	238.6	75.8
RGB10	16639	84.2	271.3	60.1
RGB12	19763	99.9	322.7	50.6
<b>Binning Vertical (Max Exposure Time in Max Frame rate)</b>				
RGB8	26316	132.6	477.9	38.0
RGB10	33004	166.4	539.6	30.3
RGB12	39526	199.0	646.5	25.3
<b>Binning Horizontal &amp; Vertical (Max Exposure Time in Max Frame rate)</b>				
RGB8	13193	66.9	238.6	75.8
RGB10	16639	84.2	271.3	60.1
RGB12	19763	99.9	322.7	50.6

**CXP3-1 (ExposureMode = TriggerWidth; Overlap Readout)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	(C) Period From Exposure end to next Trigger Start(usec)	MAX Frame Rate (Hz)
<b>Full (Max Exposure Time in Max Frame rate)</b>				
RGB8	52911	265.1	989.5	18.9
RGB10	66226	331.8	1.1	15.1
RGB12	79366	397.3	1.3	12.6
<b>Binning Horizontal (Max Exposure Time in Max Frame rate)</b>				
RGB8	26385	133.1	479.5	37.9
RGB10	33004	166.4	539.9	30.3
RGB12	39526	199.4	647.6	25.3
<b>Binning Vertical (Max Exposure Time in Max Frame rate)</b>				
RGB8	52910	265.1	989.5	18.9
RGB10	66226	331.8	1.1	15.1
RGB12	79366	397.2	1.3	12.6
<b>Binning Horizontal &amp; Vertical (Max Exposure Time in Max Frame rate)</b>				
RGB8	26385	133.1	479.5	37.9
RGB10	33004	166.4	539.9	30.3
RGB12	39526	199.4	647.6	25.3

## Exposure Mode = Timed (RCT Mode)

This section shows the timing charts when FrameStartTrigger is set to **On**, and ExposureMode is set to **Timed** (RCT Mode).



A	Frame Period ( $\mu\text{sec}$ )
B	Period From Trigger Start Edge to Exposure Start ( $\mu\text{sec}$ )
C	Data Invalid Period ( $\mu\text{sec}$ )

**CXP12-1 (ExposureMode = Timed; RCT Mode)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	(C) Data Invalid Period (usec)
<b>Full (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103471	3156	87265
RGB10	103552	3173	84012
RGB12	103638	3189	80890
<b>Binning Horizontal (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103471	3145	89371
RGB10	103425	3149	88533
RGB12	103419	3149	88527
<b>Binning Vertical (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103473	3156	87261
RGB10	103544	3173	84000
RGB12	103620	3189	80867
<b>Binning Horizontal &amp; Vertical (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103416	3145	89311
RGB10	103425	3149	88527
RGB12	103416	3149	88518

**CXP6-1 (ExposureMode = Timed; RCT Mode)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	(C) Data Invalid Period (usec)
<b>Full (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103845	3852	73824
RGB10	103983	3886	67297
RGB12	104150	3918	60987
<b>Binning Horizontal (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103481	3786	86551
RGB10	103559	3804	83208
RGB12	103632	3819	80160
<b>Binning Vertical (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103858	3852	73832
RGB10	103979	3886	67288
RGB12	104161	3918	60993
<b>Binning Horizontal &amp; Vertical (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103473	3786	86538
RGB10	103537	3804	83181
RGB12	103626	3819	80149

**CXP3-1 (ExposureMode = Timed; RCT Mode)****■ Frame Start Trigger = On**

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	(C) Data Invalid Period (usec)
<b>Full (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	104585	3984	48196
RGB10	104842	4051	35299
RGB12	105196	4117	22641
<b>Binning Horizontal (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103895	3852	73781
RGB10	104049	3886	67358
RGB12	104258	3919	61002
<b>Binning Vertical (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	104597	3984	48203
RGB10	104851	4051	35303
RGB12	105358	4117	22798
<b>Binning Horizontal &amp; Vertical (Max Frame Rate, Exposure Time Minimum)</b>			
RGB8	103842	3852	73723
RGB10	103979	3886	67283
RGB12	104178	3919	60917

## GPIO (Digital Input/Output Settings)

**Related Setting Items:** [DigitalIOControl](#)

The camera is equipped with GPIO (general-purpose input/output) functions for generating and using combinations of triggers and other necessary signals within the camera and of signals output from the camera to the system such as those used for lighting equipment control.

These signals can be used as triggers and other necessary signals within the camera or as signals output from the camera to the system, such as those used for lighting equipment control.

**Note:** See "[Recommended Circuit Diagram \(Reference Examples\)](#)" for recommended external circuit examples.

You can check the status of each digital I/O as shown in the table below with LineStatusAll.

LineSelector	LineMode	LineFormat	LineInverter	LineStatusAll	Line Source	Connector
20: Line1 TTL Out1	Output	TTL	True/False	Bit0	user-configured	12-pin
21: Line2 Opt Out1	Output	OptoCoupled	True/False	Bit1	user-configured	12-pin
22: Line3 Opt Out2	Output	OptoCoupled	True/False	Bit2	user-configured	6-pin
23: Line4 TTL In1	Input	TTL	False (fixed)	Bit3	-	12-pin
24: Line5 Opt In1	Input	OptoCoupled	False (fixed)	Bit4	-	12-pin
25: Line6 Opt In2	Input	OptoCoupled	False (fixed)	Bit5	-	12-pin
26: Line7 CXP In	Input	TTL	False (fixed)	Bit6	-	CXP
27: Line8 TTL Out2	Output	TTL	True/False	Bit7	user-configured	6-pin
29: Line10 TTL In2	Input	TTL	False (fixed)	Bit9	-	6-pin
53: Nand0 In1	Input	Internal Signal	True/False	-	user-configured	-
54: Nand0 In2	Input	Internal Signal	True/False	-	user-configured	-
55: Nand1 In1	Input	Internal Signal	True/False	-	user-configured	-
56: Nand1 In2	Input	Internal Signal	True/False	-	user-configured	-
255: TimestampReset	Internal Connection	Internal Signal	False (fixed)	-	user-configured	-

For digital output, set the output source signal using LineSource. Set the source signal in the same way for NAND Logic (Nand0In1, Nand0In2, Nand1In1, NandIn2) and TimestampReset.

## Selectable Source Signals

The table below shows the source signals that can be set.

### Line Selector

Line Source signal	Line2- OptOut1	Line1- TTLOut1	Line3- OptOut2	Line8- TTLOUT2	NANDGate0In1 NANDGate0In2	NANDGate1In1 NANDGate1In2	Timestamp
Low	○	○	○	○	○	○	OFF
High	○	○	○	○	○	○	---
Line5-OptIn1	○	○	○	○	○	○	○
Line4 -TTLIN1	○	○	○	○	○	○	○
Line6 -OptIn2	○	○	○	○	○	○	○
Line10 -TTLIN2	○	○	○	○	○	○	○
UserOutput 0-3	○	○	○	○	○	○	○
PulseGenerator0	○	○	○	○	○	○	○
PulseGenerator1	○	○	○	○	○	○	○
PulseGenerator2	○	○	○	○	○	○	○
PulseGenerator3	○	○	○	○	○	○	○
Nand0Out	○	○	○	○	---	○	○
Nand1Out	○	○	○	○	○	---	○
Line7-Cxpln	○	○	○	○	○	○	○
ExposureActive	○	○	○	○	○	○	---
AcquisitionActive	○	○	○	○	○	○	---
AcquisitionTriggerWait	○	○	○	○	○	○	---
FrameTriggerWait	○	○	○	○	○	○	---
FrameActive	○	○	○	○	○	○	---
FVAL	○	○	○	○	○	○	---

**Pulse Generator Clear Source**

Line Source signal	Pulse Generator0	Pulse Generator1	Pulse Generator2	Pulse Generator3
Low	○	○	○	○
High	○	○	○	○
Line5-OptIn1	○	○	○	○
Line4 -TTLIN1	○	○	○	○
Line6 -OptIn2	○	○	○	○
Line10 -TTLIN2	○	○	○	○
UserOutput 0-3	○	○	○	○
PulseGenerator0	---	○	○	○
PulseGenerator1	○	---	○	○
PulseGenerator2	○	○	---	○
PulseGenerator3	○	○	○	---
Nand0Out	○	○	○	○
Nand1Out	○	○	○	○
Line7-Cxpln	○	○	○	○
ExposureActive	○	○	○	○
AcquisitionActive	○	○	○	○
AcquisitionTriggerWait	○	○	○	○
FrameTriggerWait	○	○	○	○
FrameActive	○	○	○	○
FVAL	○	○	○	○

## LineSource Items

This section describes each item that can be selected in **LineSource**.

LineSource	Description
Off	This item is available only when LineSelector is set to <b>TimeStampReset</b> . To enable TimeStampReset, set to the option other than Off.
AcquisitionActive	From AcquisitionStart to AcquisitionStop. See " <a href="#">Acquisition Control</a> " for reference.
ExposureActive	Camera is doing the exposure. See " <a href="#">ExposureActive Signal</a> " for reference.
FVAL	The valid data period of one frame, active from the start of the frame's exposure until the end of FVAL.
AcquisitionTriggerWait	The state in which the camera has received AcquisitionStart but is waiting before actual acquisition begins.
FrameTriggerWait	The period during frame acquisition when the camera is waiting for a FrameTrigger.
PulseGenerator0 ~ 3	PulseGenerator output. For more information, see the following technical note: <a href="https://www.jai.com/uploads/documents/Technical-notes/English/TNE-0005-2015XII11-000-TechNote-PulseGenerator-tips.pdf">https://www.jai.com/uploads/documents/Technical-notes/English/TNE-0005-2015XII11-000-TechNote-PulseGenerator-tips.pdf</a>
UserOutput0 ~ 3	Allows you to toggle UserOutput's On / Off on the software. Select the <b>User Output 0 ~ 3</b> you want to use from <b>UserOutputSelector</b> , and then set the <b>UserOutputValue (High or Low)</b> .
Line4 TTL In1	TTL In1
Line5 Opt In1	Opt In1
Line6 Opt In2	Opt In2
Line7 Cxp In	CXP In
Line10 TTL In2	TTL In2
Nand0 Out	Logic NAND output signal 0
Nand1 Out	Logic NAND output signal 1
Low	The Low signal. (Not available when LineMode = InternalConnection)
High	The High signal. (Not available when LineMode = InternalConnection)

## ExposureActive Signal

Perform external output for the timing at which video is accumulated to the sensor. The signal is output to the DC IN / TRIG IN connector (12-pin round) or AUX connector (6-pin round).

**Note:** ExposureActive includes the exposure offset time.



## Pulse Generator

Related Setting Items: [PulseGenerator](#)



### Technical Notes

Tips for using the Pulse Generator

By using this function, any signal can be generated inside the camera.

The following is an example of signal generation.

### Settings

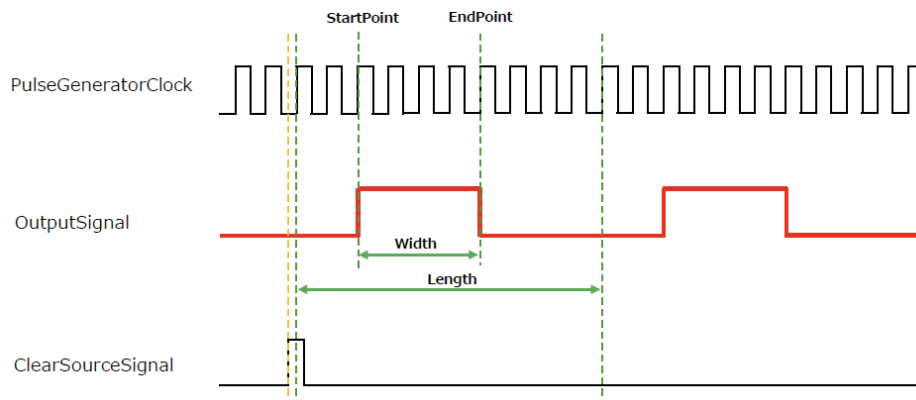
PulseGeneratorStartPoint = 2

PulseGeneratorEndPoint = 6

PulseGeneratorLength = 10

PulseGeneratorPulseWidth = 4

PulseGeneratorClearSyncMode = AsyncMode



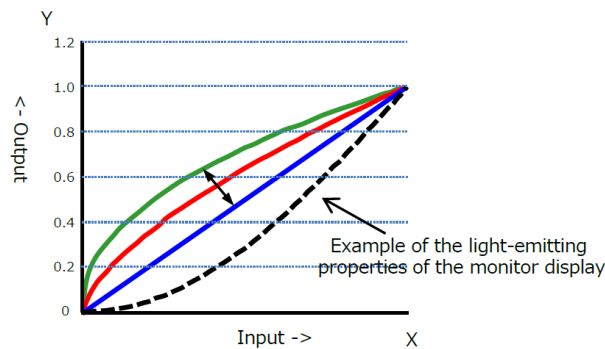
**Note:** See "PulseGeneratorClearSource ([Selectable Source Signals](#))" for the available PulseGeneratorSource signals.

# Gamma Function

Related Setting Items: [AnalogControl](#)

The Gamma function corrects the output signals from the camera beforehand (reverse correction), taking into consideration the light-emitting properties of the monitor display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing.

The Gamma function can be used to correct the camera signals with an opposite-direction curve and produce a display that is close to linear.



## How to Configure

1. Select the correction value from **Gamma**. The selectable values are as follows: 0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0
2. Select **Gamma** from **LUTMode**.

**Note:** You can use the LUT function to configure a curve with more detailed points. For details, see "[LUT \(Lookup Table\)](#)".

## LUT (Lookup Table)

Related Setting Items: [LUTControl](#)

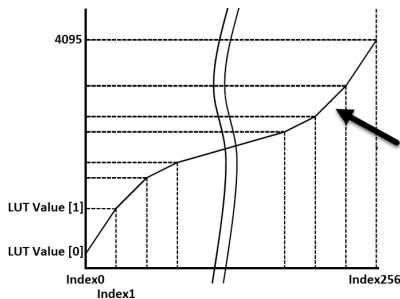
The LUT function is used to generate a non-linear mapping between signal values captured on the sensor and those that are output from the camera. You can specify the output curve using 257 setting points (indexes).

### To Use the LUT function

1. Select **LUT** from **LUTMode** ([AnalogControl](#)).
2. Select the LUT channel you want to control from **LUTSelector** ([LUTControl](#)). (Red, Green, or Blue)
3. Select the LUT Index from **LUTIndex** (0 ~ 256). Indexes represent the possible pixel values captured on the sensor, from the lowest value (Index 0) to the highest (Index 256). For example, Index 0 represents a full black pixel and Index 256 represents a full white pixel.
4. Set the LUT output value for the selected index in **LUTValue** (0 ~ 4095).

### LUT values

LUT values range from 0 at the lowest to 4095 at the highest. Linear interpolation is used to calculate LUT values between the index points.



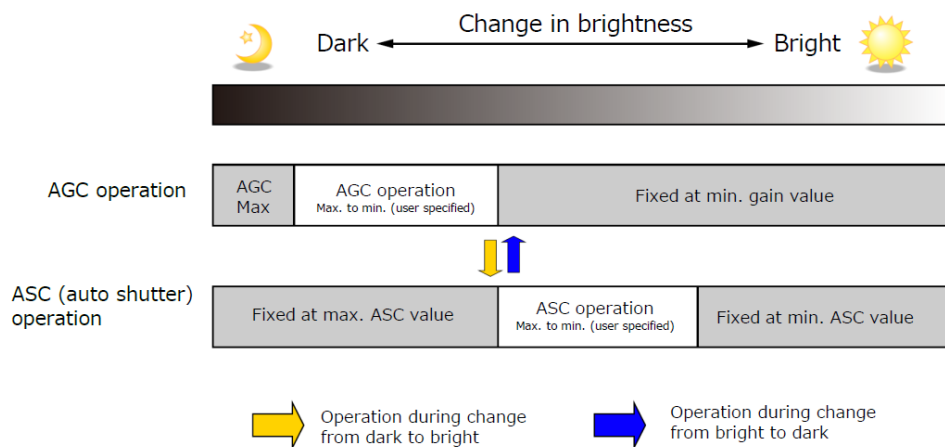
Interpolation using the average values of data to the left and right is used to determine values between points.

## ALC (Automatic Level Control) Function

Related Setting Items: [AutoLevelControl](#)

The ALC (automatic level control) function combines the automatic gain control (AGC/Auto Gain Control) and automatic exposure control (ASC/Auto Shutter Control) functions and is capable of handling various changes in brightness. The function operates as follows in response to changes in brightness.

- Change from bright to dark: ASC → AGC
- Change from dark to bright: AGC → ASC



### To Use the ALC Function

1. Set either **GainAuto** ([AnalogControl](#)), **ExposureAuto** ([AcquisitionControl](#)), or both to **Continuous** mode.
2. Use **ALCControlReference** to specify the channel used as the reference for ALC control.
  - a. **PeakChannel**: Uses the channel with the highest average image level among the RGB channels as the reference.
  - b. **SelectedChannel**: Specify which RGB channel signal is used for ALC control. When this option is selected, choose either **Red**, **Green**, or **Blue** with **ALCControlChannel**.
3. Set the target image level for AGC and ASC with **ALCReference**. For example, if **ALCReference** is set to **95%**, AGC and ASC operate to maintain an image level of 95%.
4. If necessary, you can specify the metering area. Select the metering area with **ALCAreaSelector** and set **ALCAreaEnable** to **True**.
5. Set the minimum and maximum values for AGC and ASC. (**AutoShutterControlExposureMin/Max**, **AutoGainControlGainRawMin/Max**)

6. Specify the convergence speed of ALC with **ALCControlRatio** (1 to 8).

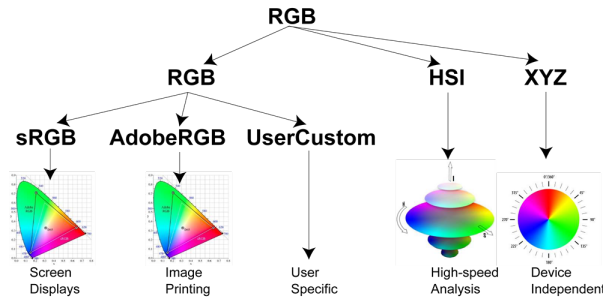
**Note:** If **ALCControlRatio** is set to a large value, ALC operation may cause hunting depending on the AcquisitionFrameRate setting. In such cases, reduce the AcquisitionFrameRate value or decrease the ALCControlRatio value.

7. Use AutoControlStatus to check the operating status of ALC.

## Color Space Conversion (ColorTransformationControl)

**Related Setting Items:** [ColorTransformationControl](#)

This camera allows you to convert the standard color space (RGB) that is used to produce colors into other color spaces.



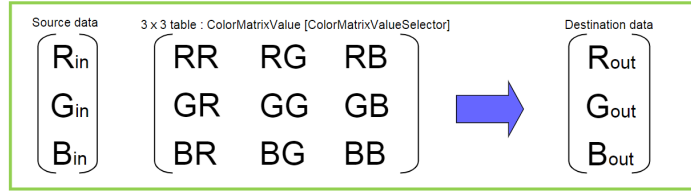
**Note:** This function is only supported on the color model.

### How to Configure

1. Select the color space (RGB, HSI, XYZ) you want to use from **ColorTransformationMode** ([ColorTransformationControl](#)).
2. When **RGB** is selected, select the details (sRGB, AdobeRGB, UserCustom) from **ColorTransformationRGBMode**.

**Note:** If you select other than RGB, **ColorTransformationRGBMode** is fixed to **Off**.

3. When **UserCustom** is selected,
  - i. Select the item you want to configure in **ColorMatrixValueSelector**.
  - ii. Configure the value (-2 to +2) in **ColorMatrixValue**.



**Caution:** If you set the color space to XYZ or HSI, Control Tool will not display the images captured by the camera properly. To display them properly, XYZ- or HSI-compatible image processing must be performed on the computer side.

### About Color Space HSI

- Hue Value :  $0^\circ$  to  $360^\circ$  can be specified for 8bit, 10bit and 12bit output as follows.

Output	Description
8bit	Can be specified in $2^\circ$ increments - $0^\circ(00000000) \sim 360^\circ(10110100)$
10bit	Can be specified in $0.5^\circ$ increments- $0^\circ(0000000000) \sim 360^\circ(1011010000)$
12bit	Can be specified in $0.5^\circ$ increments- $0^\circ(000000000000) \sim 360^\circ(101101000000)$

- Saturation value, Intensity value:  $0 \sim 100\%$  can be specified for 8bit, 10bit and 12bit output as follows.

Output	Description
8bit	$0\%(00000000) \sim 100\%(11111111)$
10bit	$0\%(00000000) \sim 100\%(1111111111)$
12bit	$0\%(00000000) \sim 100\%(111111111111)$

## Pixel Shift Alignment

**Related Setting Items:** [ImagingControl](#)

In this camera, the incoming light is split into the R, G, and B wavelengths and captured individually by three precisely aligned CMOS sensors. During this process, pixel positions may become misaligned between channels. When such misalignment occurs, each wavelength is aligned to the G channel with subpixel precision so that the same pixel corresponds to the same spatial point across all channels.

**Note:** For detailed steps to configure this function, see "[Alignment Correction](#)".

# Chromatic Aberration Correction

**Related Setting Items:** [ImagingControl](#)

Lateral Chromatic Aberration is a common lens imperfection where different wavelengths of light (colors) do not focus at the same point. This results in slightly different image magnifications for the red, green, and blue channels, causing visible color fringing, especially toward the image edges. The camera includes a chromatic aberration correction function that digitally compensates for this effect by rescaling the color channels to align them more precisely.

- The correction is performed with the center of the image sensor as the reference point. The correction amount increases toward the edges of the image and reaches its maximum at the outermost areas.
- The G channel is used as the reference, and correction is applied to the R and B channels.
- The correction uses predefined correction patterns (correction pattern curves). First, use **Preset1** and adjust the correction coefficient to correct misalignment at the upper, lower, left, and right edges of the image.

If misalignment remains in the mid-range area after applying Preset1, switch to **Preset2** or **Preset3**, which apply correction patterns optimized for the intermediate region.

Preset1	Preset2, Preset3
Correct misalignment at the edges of the image.	Correct misalignment in the mid-range area.

- If the lens is not perfectly aligned with the sensor, the center position of the correction can be adjusted.

**Notes:**

- For detailed steps to configure this function, see "[Alignment Correction](#)".
- If Chromatic Aberration correction is required, always perform [Pixel Shift Alignment](#) first, and then execute this function.

## Alignment Correction

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The camera provides the [Pixel Shift Alignment](#) and [Chromatic Aberration Correction](#) functions to accurately adjust the RGB channel alignment.

Perform the corrections in the order shown below. If Chromatic Aberration is not present or is negligible in your environment, performing Pixel Shift Alignment only is sufficient.

### 1. Perform ColorShading Correction ([ShadingControl](#))

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1. Perform **ColorShading** ([Shading Correction](#)) to adjust the sensitivity characteristics of the R, G, and B channels.

**Note:** For detailed steps to configure this function, see "[To Use the Shading Correction Function](#)".

### 2. Perform [Pixel Shift Alignment](#)

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Using the target image, adjust the R and B channels so they align with the G channel. In this example, **PixelShiftCheckMode** is used to switch the image output to the difference image between the Red/Blue and Green channels for easier visual confirmation.

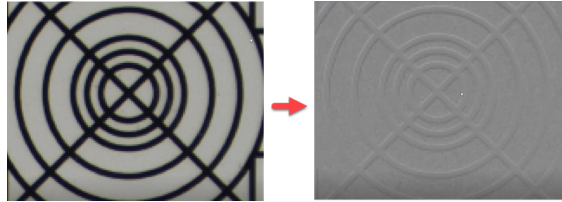
1. Acquire the target image.

**Note:** For best alignment accuracy, use a target image that meet the following conditions. A resolution test chart or grid chart is generally the most suitable choice.

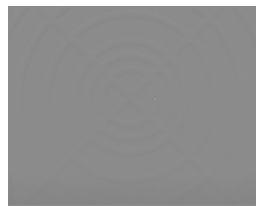
- High contrast
- Clear and well-defined edges
- Patterns distributed uniformly across the entire image
- Low noise and high sharpness
- Images acquired under stable lighting with the camera firmly mounted

2. Set **PixelShiftAlignmentMode** to **On**.
3. First, adjust the **Red channel**:

- Set **PixelShiftAlignmentChannelSelector** to **Red**.
- Set **PixelShiftCheckMode** to **R-G**. The camera output switches to the difference image between the R and G channels, and areas with misalignment appear as embossed, 3-dimensional edges.



- Adjust **PixelShiftAlignmentHorizontal** and **PixelShiftAlignmentVertical** until the embossed edges appear flat (setting range: -128 to +127).



4. Next, adjust the **Blue channel**:

- Set **PixelShiftAlignmentChannelSelector** to **Blue**.
- Set **PixelShiftCheckMode** to **B-G**. The camera output switches to the difference image between the R and G channels, and areas with misalignment appear as embossed, 3-dimensional edges.
- Adjust **PixelShiftAlignmentHorizontal** and **PixelShiftAlignmentVertical** until the embossed edges appear flat (setting range: -64 to +64).

5. After completing both Red and Blue corrections, set **PixelShiftCheckMode** to **Off**.

#### Notes:

- If alignment is difficult using the target image, use the waveform for fine adjustments.
- If set **PixelShiftAlignmentMode** to **Off**, the PixelShiftAlignment is disabled and the image before the correction is displayed.

### 3. Perform Chromatic Aberration Correction

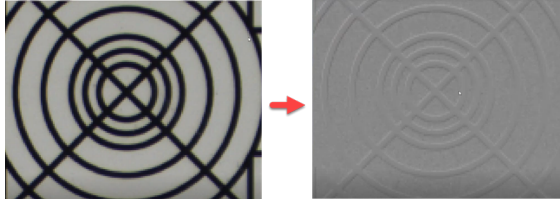
Using the target image, corrects the magnification differences between the color channels which is caused by the chromatic aberration of the lens. In this example, **PixelShiftCheckMode** is used to switch the image output to the difference image between the Red/Blue and Green channels for easier visual confirmation.

**Note:** If chromatic aberration is negligible, this correction is not required.

1. Set **ChromaticAberrationCorrectionMode** to **On**.

2. First, adjust the **Red channel**:

- Set **ChromaticAberrationCorrectionChannelSelector** to **Red**.
- Set **PixelShiftCheckMode** to **R-G**. The camera output switches to the difference image between the R and G channels, and areas with misalignment appear as embossed, 3-dimensional edges.



3. Adjust misalignment at the top, bottom, left, and right edges of the image:

- Select **Preset1** from **ChromaticAberrationCorrectionPreset**.
- Adjust **ChromaticAberrationCorrectionCoeffl** until the embossed edges appear flat (setting range: -256 to +256)



4. If necessary, adjust the chromatic aberration center position (if needed). Because chromatic aberration correction is symmetric around the image center, misalignment may not be corrected properly if the optical center is offset.

In this case, use **ChromaticAberrationCenterOffsetHorizontal** and **ChromaticAberrationCenterOffsetVertical** to adjust the image center. The origin of correction is the center of the image.

5. If necessary, adjust chromatic aberration of the mid-range area. If the edges are corrected using Preset1 but misalignment remains in the intermediate region, select **Preset2** or **Preset3**, which are optimized for mid-range correction.

6. Next, adjust the **Blue channel**:

- Set **ChromaticAberrationCorrectionChannelSelector** to **Blue**.
- Set **PixelShiftCheckMode** to **B-G**. The camera output switches to the difference image between the R and G channels, and areas with misalignment appear as embossed, 3-dimensional edges.

7. Repeat Steps 3 to 5 to adjust the blue channel.

8. After completing both Red and Blue corrections, set **PixelShiftCheckMode** to **Off**.

**Caution:** After completing the alignment adjustments, save the settings using **UserSetSave** (see “[To Save User Settings](#)”). If the settings are not saved, they will be cleared when the camera is powered off.

**Notes:**

- If alignment is difficult using the target image, use the waveform for fine adjustments.
- If set **ChromaticAberrationCorrectionMode** to **Off**, ChromaticAberrationCorrectionMode is disabled and the image before the correction is displayed.

## VideoProcessBypassMode

**Related Setting Items:** [ImagingControl](#)

The video process bypass mode is a function that bypasses internal video processing on the camera. To use this function, **VideoProcessBypassMode** must be set to **On**.

	VideoProcessBypassMode = ON	OFF
Operation	When On, the following functions are disabled regardless of their settings: <ul style="list-style-type: none"> <li>• BinningHorizontal</li> <li>• Gain[DigitalRed][DigitalBlue], BlackLevel[All][Red][Blue], LUTMode</li> <li>• ShadingMode</li> <li>• SequencerBinnigHorizontal, SequencerBlackLevelAll, SequencerLutEnable</li> </ul>	All image processing enabled.

### Functions Available in VideoProcessBypassMode

- Gain[AnalogAll], Gain[AnalogRed], Gain[AnalogGreen], Gain[AnalogBlue]
- AutoShutterControl (ASC)
- AutoWhiteBalance
- SequencerMode
- BlemishCompensation

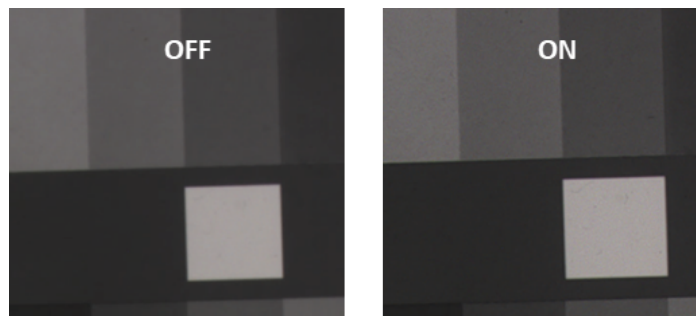
## Edge Enhancer, Color Enhancer

Related Setting Items: [ImagingControl](#)

This camera is equipped with an Edge Enhancer function for enhancing the contrast of lines or edges within images and a Color Enhancer function for enhancing specified colors.

### Edge Enhancer Function

The Edge Enhancer function is enabled when EdgeEnhancerEnable is set to On. Four enhancement levels are available: Low, Middle, High, and Strong.



### Color Enhancer Function

The Color Enhancer function is enabled when ColorEnhancerEnable is set to On. Set a value from 0 to 1.0 (0.1 steps) for ColorEnhancerValue to configure the enhancement level: 0 = no enhancement, 1.0 = approx. x2 the color level of the original data.

Six colors can be specified in ColorEnhancerSelector: Red, Cyan, Green, Magenta, Blue, and Yellow.



# Shading Correction

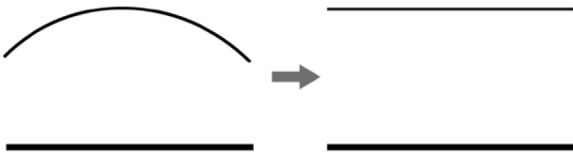
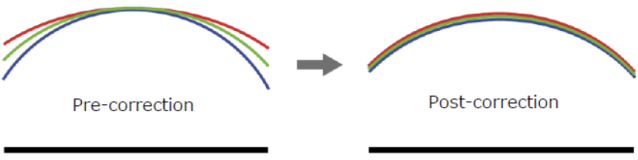
**Related Setting Items:** [ShadingControl](#)

The ShadingCorrection function corrects non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment. Using this function allows correction even if top, bottom, left, and right shading is not symmetrical in relation to the center of the screen (H, V).

This function can be used even when the effective image area is limited (an area with both Width and Height set to more than 512 must be configured) by the [Single ROI Function](#). In such cases, the correction area is included in the image area configured by the ROI.

**Note:** Block size is 128 × 128 pixels.

The following shading correction modes are available on the camera.

FlatShading	ColorShading
	
<p>Correction is performed using the area of the screen with the highest brightness level as the reference and adjusting the brightness levels of the other areas to match this level.</p>	<p>R-channel and B-channel properties are adjusted to using the G-channel shading properties as a reference.</p>

**Cautions:**

- For FlatShading and ColorShading, the maximum amount of correction gain for all pixels is limited to 8 times the amount of gain before correction. (The amount of gain cannot be increased to more than 8 times the amount of gain from before correction.)
- If the area in the screen with the highest brightness level is 175 LSB or less (during 10-bit video output), proper correction is not possible.

## To Use the Shading Correction Function

Configure the settings as follows.

1. To specify the area used for calculating shading correction values, set the **Width / OffsetX** and **Height / OffsetY** values of the target area. For details on how to configure this, refer to [Single ROI Function](#).
2. Select the shading correction mode with **ShadingCorrectionMode** (**Flat Shading** (Default) or **Color Shading**).
3. Select the user area (**User1 ~ User3**) in **ShadingMode** where the shading correction values will be stored.
4. Display a white chart under a uniform light and execute **CalibrateShadingCorrection**.
5. After shading correction is completed, the correction values are automatically saved to the user area selected in ShadingMode.
6. When calibration is successful, "Succeeded" is displayed in **ShadingDetectResult**.

**Note:** The **PerformShadingCalibration** command cannot be executed under the following conditions. (An error also occurs when ShadingMode is set to Off).

- When outputting no image.
- When outputting TestPattern.
- Width and/or Height are less than 512 ([Single ROI Function](#))
- In FD2x2Binning mode ([Binning Function](#))
- In ImageScaling mode ([Image Scaling Mode \(Xscale\)](#))
- When BalanceWhiteAuto = Continuous
- When GainAuto = Continuous
- In Sequencer mode ([Sequencer Function](#))
- In MultiRoi mode ([Multi ROI Function](#))
- In Reverse mode ([Image Flip Function](#))
- In ALC mode ([ALC \(Automatic Level Control\) Function](#))

## BlemishCompensation

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**Related Setting Items:** [BlemishControl](#)

Multiple defective pixels that are not adjacent to each other can occur on CMOS sensor cameras. This camera features a function that interpolates defective pixels using the surrounding pixels. Up to 300 pixels can be corrected. Pixel interpolation can be performed via automatic detection or point-by-point manual settings.

**Note:** When you want to manually enter blemish coordinates while in the **PixelShiftAlignment mode** ([Pixel Shift Alignment](#)) or **ChromaticAberrationCorrection mode** ([Chromatic Aberration Correction](#)), first set these functions to **Off**, then enter the correction coordinates, and afterward set the functions to **On** again. (Automatic detection using **BlemishDetect** is always available.)

### Automatic Detection

Automatic detection can only detect lit defective pixels (i.e., white blemishes).

1. Shield the camera sensor. If a lens is attached, use the lens cap as a shield, for example.
2. Configure the threshold level for defective pixel detection.
  - Up to 300 pixels can be corrected.
  - The threshold value is specified as a percentage.
  - The default setting is "10" with 10% of the full scale (100%) specified as the threshold value.
3. Execute **BlemishDetect** to start automatic detection. After detection, the interpolation data is saved to the camera's internal memory.

## ■ To check the number of interpolated pixels after automatic detection

You can check the number of pixels interpolated via automatic detection by loading the BlemishNum data.

### Notes:

Automatic detection will not be executed when:

- No image is being output.
- When AcquisitionMode is set to Single or MultiFrame.
- TestPattern is being output
- In Sequencer Mode ([Sequencer Function](#))
- In MultiRoi mode ([Multi ROI Function](#))
- The image is not full ROI size ([Single ROI Function](#))
- Not in lens cap state

## Manual Configuration

1. Select the **index** in BlemishCompensationIndex. You can select from 1 to 300. However, configure the indexes in order starting with the smallest index. If you skip indexes while configuring settings, interpolation may not be performed.
2. Specify the pixel points for interpolation using the **BlemishCompensationPositionX** and **BlemishCompensationPositionY** settings.

### Notes:

- You can configure values that are within the total effective pixel area. Specify pixels for which interpolation is not necessary as -1. If 0 is specified, the first line or first pixel will be interpolated.
- If -1 is entered for either BlemishCompensationPositionX or BlemishCompensationPositionY, the corresponding blemish data for the same BlemishCompensationIndex becomes invalid, even if the other position value is not set to -1.
- To delete the configured pixel points, execute **BlemishCompensationDataClear** with the corresponding index selected.

3. Execute **BlemishStore**. Blemish compensation data will be stored.
4. Set BlemishEnable to **Enable** and execute interpolation. If it is set to **Disable all**, all interpolation for defective pixels will be disabled (including the factory-set interpolation data).

## Sequencer Function

**Related Setting Items:** [SequencerControl](#)

The Sequencer function lets you define up to 32 index combinations of exposure time, gain, ROI, and other settings which can be stepped through each time a trigger is received. This is particularly useful for quickly capturing multiple exposures of objects under inspection to adjust for areas or components with significantly different levels of reflectance. You can specify the next index in the stepping sequence and the order in which indexes are executed. Multiple indexes can also be executed repeatedly.

Two operation modes (TriggerSequencer mode and CommandSequencer mode) are available for the Sequencer function.

### Notes:

- Refer to [Functions That Cannot Be Used Together](#) for usage restrictions. In addition, "[RCT Mode](#)" (ExposureModeOption [[AcquisitionControl](#)]) cannot be used together with this function.
- This function can be configured only when **ExposureMode** [[AcquisitionControl](#)] is set to **Timed**.
- Up to 32 indexes can be configured. For details on the items that can be set for each index, see [SequencerControl](#).
- When **SequencerMode** is set to **On**, the settings of the following functions cannot be changed:

Category	Functions
<a href="#">ImageFormatControl</a>	BinningHorizontalMode, BinningVerticalMode
<a href="#">AcquisitionControl</a>	AcquisitionFramerate, TriggerMode, ExposureMode, ExposureTime, ExposureAuto
<a href="#">AnalogControl</a>	Gain, GainAuto, BlackLevel, BalanceWhiteAuto, LUTMode

### Cautions:

- If the values of [ImageFormatControl](#)'s Width and Height are smaller than SequencerControl's SequencerWidth and SequencerHeight, the image may not be output correctly.
- When using SequencerWidth / SequencerHeight, set the Width and Height to the default values in advance.

## TriggerSequencer Mode

With this mode, the Sequencer Trigger “pattern” is predetermined by the user. The user defines up to 32 different “indexes.” Different camera settings can be configured for each index. The operation of this mode is controlled using the following five commands.

**Caution:** In TriggerSequencer mode, the TriggerOverlap function of the FrameStart trigger is disabled and the operation is always Off.

**SequencerSetActive:** This allows you to confirm the index number displayed on the next trigger reception.

**SequencerSetStart:** This configures the index number to execute at the start of TriggerSequencer mode.

**SequencerFrameCount:** This configures the number of frame acquisitions for the selected SequencerIndex.

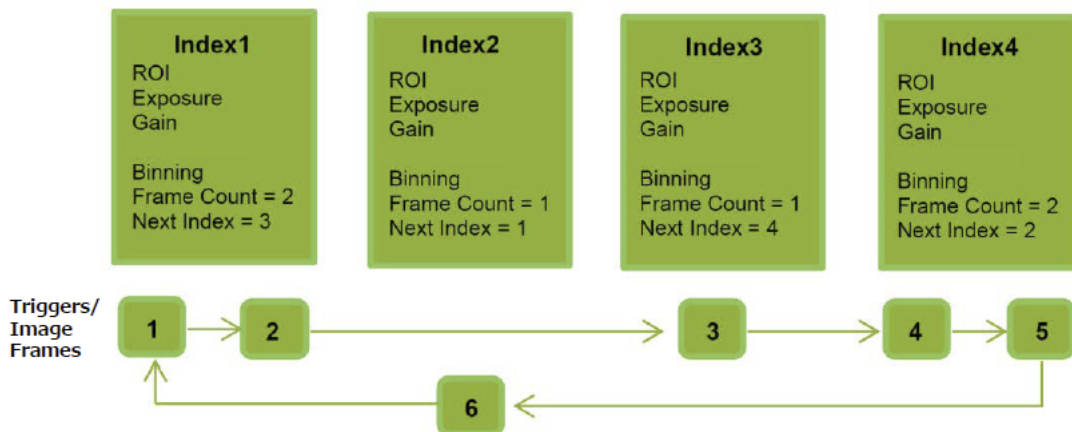
**SequencerReset:** During TriggerSequencer mode operation, this switches the index number to be executed to that specified in SequencerSetStart.

**SequencerRepetition:** This parameter applies to TriggerSequencer patterns which include an index whose SequencerROINextIndex is set to 0 (OFF).

When the index whose SequencerROINextIndex is set to 0 (OFF) is finished executing, the value of Sequencer Repetition (range = 1 ~ 255) is decremented internally. If the result of the decrement is not zero, the TriggerSequencer pattern starts over from the index specified in SequencerSetStart. If the result of the decrement is zero, the status changes to Acquisition Stop and external triggers are not accepted.

## Sample TriggerSequencer Mode Operation

User-Defined Indexes (Up to 32)



1. Specify "1" in SequencerSetStart and start TriggerSequencer mode with index 1.
2. Based on the SequencerFrameCount setting (= 2), capture a 2-frame image with the first and second triggers.

3. For the next index, configure index 3 specified in SequencerSetNext, and capture an image with the number of frames (the number of triggers) specified in SequencerFrameCount (=1).
4. Proceed to sequence from index 4 to index 2 to index 1.

**Note:** In addition to repeating multiple conditions as in the above example, you can specify "0" (which indicates the end of TriggerSequencer mode) in SequencerSetNext of index 2 and specify the number of repetitions in SequencerRepetition.

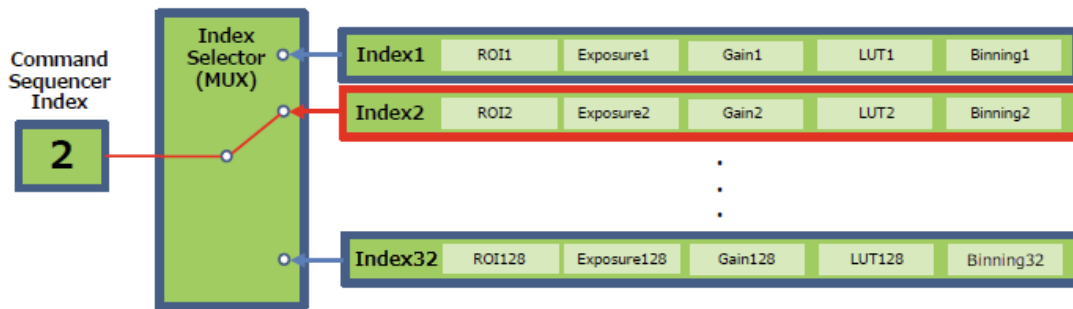
## CommandSequencer Mode

As with TriggerSequencer mode, you can define up to 32 indexes beforehand in this mode. Set SequencerCommandIndex to point to one of your preconfigured indexes. This index will be executed on each trigger, until it is changed to point to a different index, typically by your vision application.

In this way, Command Sequencer mode allows you to programmatically adjust your sequence in response to image analysis or input from other sensors.

**Notes:**

- The same index table will be executed for subsequent triggers unless the CommandSequencerIndex value is changed.
- SequencerFrameCount, SequencerSetNext and SequencerRepetition cannot be used in CommandSequencer mode.



## Counter and Timer Control Function

**Related Setting Items:** [CounterAndTimerControl](#)

**Note:** This camera supports only the counter function.

The counter function counts up change points in the camera's internal signals using the camera's internal counter and reads that information from the host side. This function is useful for verifying error conditions via the count value using internal camera operations.

When a problem occurs in a system that includes this camera, comparing the values from multiple counters allows you to verify the extent of normal operability and can be useful when investigating the cause of the problem.

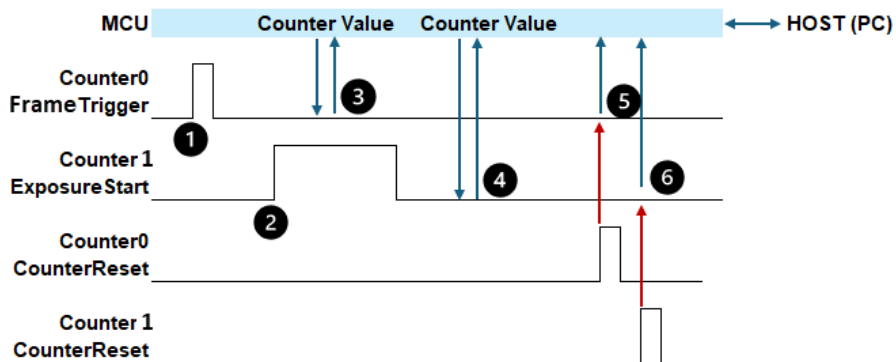
The following counters are available on this camera, and the functions that can be counted are fixed for each counter.

Counter Selector	Counter Event Source (Fixed)	Counter Event Activation
Counter0	Counts the number of FrameTrigger.	Rising Edge (Fixed)
Counter1	Counts the number of ExposureStart.	Rising Edge (Fixed)
Counter2	Counts the number of SensorReadOut.	Rising Edge (Fixed)
Counter3	Counts the number of FrameTransferEnd.	Falling Edge (Fixed)

### How to Configure

1. Select the counter you want to use from **CounterSelector**.
2. Enable the counter by selecting the event source in **CounterEventSource** (Default = Off).
3. **CounterEventActivation** displays the timing for counting for the selected counter.
4. You can reset and refresh the selected counter's counter value by executing **CounterReset** and **CounterRefresh**, respectively. The selected counter's value and status are displayed in **CounterValue** and **CounterStatus**, respectively.

**Counter Occurrence Diagram (Example)**



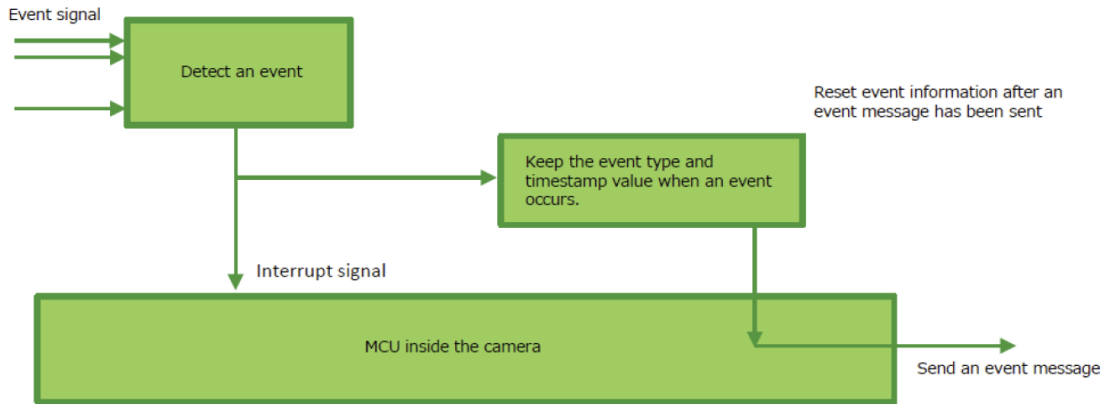
1. A Frame Trigger Event occurs. Counter0 counts up.
2. An Exposure Start Event occurs. Counter 1 counts up.
3. The camera's internal MCU requests and reads the Counter0's counter value.
4. The camera's internal MCU requests and reads the Counter1's counter value.
5. Reset the Counter0's counter value to 0 by a CounterReset command or a CounterResetSource signal.
6. Reset the Counter1's counter value to 0 by a CounterReset command or a CounterResetSource signal.

# Event Control Function

Related Setting Items: [EventControl](#)

The Event Control function is a function that outputs a signal change point inside the camera as information indicative of an event occurrence (event message).

## Flow from Detecting an Event to Sending an Event Message



## How to Configure

1. Select the even you want to configure from **EventSelector**.
2. Set **EventNotification** to **On**.
3. When an enabled Event occurs, the following Event data will be sent: **EventID**, **EventTimeStamp**

For example, when **AcquisitionStart** is selected from **EventSelector** and **EventNotification** is set to **On**, the following message will be sent when an Acquisition Start trigger occurs.

EventAcquisitionStartData	Display the following data when the enabled Event occurs.
EventAcquisitionStart	Display EventID 0x9011.
EventAcquisitionStartTimestamp	Display the time stamp value when the enabled Event occurs.

## Functions That Cannot Be Used Together

The table below shows functions that cannot be used with [ImageFormatControl](#), [MultiROIControl](#) and [SequencerControl](#) setting items.

**Note:** For functions that are not in this table, refer to the relevant function topic or setting item topic.

	Single ROI	ROI Centered	FD2x2Binning	BinningHorizontal = 2	BinningVertical = 2	ImageScalingMode	ReverseX/Y/XY	ALCAreaMode / AWBAreaMode	Overlay Mode: MultiRoiAreaMode	MultiRoiMode	SequencerMode
Single ROI (Weight, Height, OffsetX, OffsetY)		1	⊘			2					⊘
ROI Centered	1		⊘	⊘		⊘				⊘	⊘
FD2x2Binning	⊘			⊘	⊘	2			1	⊘	⊘
BinningHorizontal = 2		⊘	⊘			⊘			⊘	⊘	⊘
BinningVertical = 2			⊘			⊘			⊘	⊘	⊘
ImageScalingMode	2	⊘	2	⊘	⊘				⊘	⊘	⊘
ReverseX/Y/XY											⊘
OverlayMode: ALCAreaMode / AWBAreaMode											⊘
OverlayMode: MultiRoiAreaMode			⊘	⊘	⊘	⊘				3	⊘
MultiRoiMode		⊘	⊘	⊘	⊘	⊘			3		⊘
SequencerMode		⊘	⊘			⊘	⊘	⊘	⊘	⊘	

Empty	Can be used together
⊘	Cannot be used together
1	When <a href="#">ROI Centered</a> is set to <b>On</b> , OffsetX will be disabled.
2	When using <a href="#">Image Scaling Mode (Xscale)</a> together with the <a href="#">Single ROI Function</a> and/or <a href="#">FD2x2Binning</a> , first, set the Width, Height, OffsetX, OffsetY and/or <a href="#">FD2x2Binning</a> settings, and then configure the Image Scaling Mode settings.
3	To set Overlay Mode to <b>MultiRoiAreaMode</b> , MultiRoiMode ( <a href="#">MultiROIControl</a> ) must be set to <b>Off</b> in advance.

## Setting List (Feature Properties)

This camera complies with GenICam. Each setting item name conforms to GenICam SFNC (Standard Features Naming Convention). (There are some JAI-specific setting items).

Each setting item is an integer type (Integer), a real type (Float), an element enumeration type (Enumeration), a character string (String), a logical type (Boolean), and a category type (Category) or a command type (Command) for executing the function.

**Beginner:** For beginner users.

**Expert:** For users with deep knowledge of camera functions.

**Guru:** For advanced users who make settings, including advanced features that can cause the camera to malfunction if not set correctly.

**Note:** Depending on the setting item, you may need to change visibility. Please switch visibility (Beginner / Expert / Guru) as necessary.

## Selector

A Selector is used to index which instance of the feature is accessed in situations where multiple instances of a feature exist.

### Instance Example:

Each Line-related item (LineSource, LineInverter, etc.) has LineSelector-LineX instances, which can be set or referenced as an index.

Selectors are a feature of element enumeration type (Enumeration) or an integer type (Integer). However, unlike normal configuration items, it is only used to select the instance in the following configuration item.

It does not change the behavior of the camera by changing the value of the selector. Also, the selector may have only one selectable value. In this case, use the selector function only for information purposes. In this document, it is described as SelectedFeature[Selector] according to the description method of GenICam.

In the case of Line Selector with a specific I/O line selected, the description could be as follows.

LineSource[LineSelector-LineX] = High

LineInverter[LineSelector-LineX] = False

LineMode[LineSelector-LineX] = Input

LineFormat[LineSelector-LineX] = TTL

Generally, selectors only apply to a single category of features. (Example: TriggerSelector only applies to trigger related functions.)

## DeviceControl

Display/configure information related to the device.

Device Control Item	Setting Range	Default	Description
DeviceScanType (IEnum)	0: Areascan		Display the device's scan type.
DeviceVendorName (IString)	"JAI Corporation"		Display the manufacturer name.
DeviceModelName (IString)	"AP-5100T-CXPA"		Display the model name.
DeviceManufacturerInfo (IString)	"See the possibilities"		Display manufacturer information.
DeviceVersion (IString)	-	-	Display the software version.
DeviceFirmwareVersion (IString)	-	-	Display the firmware version.
DeviceFpgaVersion (IString)	-	-	Display the FPGA version.
DeviceSerialNumber (IString)	-	-	Display the device serial number.
DeviceUserID (IString)	Any	-	Set the user ID for the camera.
DeviceSFNCVersionMajor (IIInteger)	-	2	Display the SFNC Major version.
DeviceSFNCVersionMinor (IIInteger)	-	7	Display the SFNC Minor version.
DeviceSFNCVersionSubMinor (IIInteger)	-	1	Display the SFNC Sub Minor version.
DeviceManifestEntrySelector (IIInteger)	1	1	Selects the manifest entry to reference. (Fixed to XML1)
DeviceManifestXML MajorVersion (IIInteger)	0 ~ 9	-	Indicates the major version number of the XML file of the selected manifest entry.
DeviceManifestXML MinorVersion (IIInteger)	0 ~ 9	-	Indicates the minor version number of the XML file of the selected manifest entry.
DeviceManifestXML SubMinorVersion	0 ~ 9	-	Indicates the sub minor version number of the XML file of the selected manifest entry.
DeviceManifestSchema MajorVersion (IIInteger)	-	1	Indicates the major version number of the schema file of the selected manifest entry.
DeviceManifestSchema MinorVersion (IIInteger)	-	1	Indicates the minor version number of the schema file of the selected manifest entry.
DeviceManifestPrimaryURL (IString)	-	-	Display the PrimaryURL.
DeviceTLType (IEnum)	3: CoaXPress		Display the Transport Layer type of the device.

Device Control Item	Setting Range	Default	Description								
DeviceTLVersionMajor (Integer)	2 (Fixed)	-	Display the major version number of the Transport Layer type.								
DeviceTLVersionMinor (Integer)	0 (Fixed)	-	Display the minor version number of the Transport Layer type.								
DeviceTLVersionSubMinor (Integer)	-	-	Display the sub minor version number of the Transport Layer type.								
DeviceMaxThroughput (Integer)	390625000 ~	-	<p>Maximum bandwidth of the data that can be streamed out of the device. The maximum value depends on the CxpLinkConfiguration setting.</p> <table border="1"> <thead> <tr> <th></th> <th>Max (Bytes/sec)</th> </tr> </thead> <tbody> <tr> <td>CXP-12</td> <td>1562500000 (Default)</td> </tr> <tr> <td>CXP6-1</td> <td>781250000</td> </tr> <tr> <td>CXP3-1</td> <td>390625000</td> </tr> </tbody> </table>		Max (Bytes/sec)	CXP-12	1562500000 (Default)	CXP6-1	781250000	CXP3-1	390625000
	Max (Bytes/sec)										
CXP-12	1562500000 (Default)										
CXP6-1	781250000										
CXP3-1	390625000										
DeviceLinkThroughputLimitMode (Enum)	0: Off 1: On	0: Off	<p><b>Off:</b> No CXP bandwidth limit. Stream packets are transmitted without gaps.</p> <p><b>On:</b> CXP bandwidth is limited. Stream packets are transmitted with packet gaps calculated based on the CXP bandwidth value specified by DeviceLinkThroughputLimit.</p>								
DeviceLinkThroughputLimit (Integer)	195312500 ~ 781250000	-	Enabled when DeviceLinkThroughputLimitMode = On. Limits the maximum bandwidth of the data that will be streamed out by the device.								
DeviceStreamChannelCount (Integer)	-	-	Display the number of supported stream channels.								
DeviceStreamChannelPacketSize (Integer)	0 ~ 8192 (step: 4)	-	Specifies the stream packet size, in bytes.								
DeviceReset (Command)	-	-	Reset the device.								
DeviceTemperatureSelector (Enum)	0: Main board (Default) 1: Sensor 2: FPGA		Select the area of the camera's interior for which to display the temperature sensor's reading.								
DeviceTemperature (Float)	-55 ~ 125	-	Display the internal temperature (°C) of the camera.								
Timestamp (ns) (Integer)	0 ~ 64bit max	0	Display the timestamp value (ns). Resets to 0 when the signed maximum 64-bit value is exceeded.								
TimestampReset (Command)	-	-	Forcibly sets the timestamp's count value to 0.								
TimestampLatch (Command)	-	-	Sets the timestamp's count value to TimestampLatchValue.								

Device Control Item	Setting Range	Default	Description
TimestampLatchValue (ns) (Integer)	0 ~ 64bit max	0	Returns the latched value of the timestamp counter.
UserDefinedValueSelector (Enum)	0: Value1 1: Value2 2: Value3 3: Value4 4: Value5	0: Value1	32bit data x 5 can be set and saved.
UserDefinedValue (Integer)	-2147483648 ~ 2147483647	0	Read and set the value for the 32-bit data (Value 1 to Value5) selected in UserDefinedValueSelector.

# TransportLayerControl

Configure Transport Layer settings.

Transport Layer Control Item	Setting Range	Default	Description
PayloadSize (Integer)	48 ~ 22796928	15197952	Display the payload size information.
DeviceTapGeometry (IEnum)	0: Geometry_1X_1Y (Fixed)		The method of transferring images from the device at one time (TAP configuration).
CoaXPress (ICategory)			
CxpLinkConfigurationPreferred (IEnum)	Displays the link structure that allows the camera to operate in default mode.		
	<b>Configuration</b>		<b>Speed</b>
	CXP12_X1		CXP-12 (12.50 Gbps)
	CXP6_X1		CXP-6 (6.25 Gbps)
	CXP3_X1		CXP-3 (3.125 Gbps)
* CXP12 can only be used when VersionUsed = 2.0 or later			
CxpLinkConfiguration (IEnum)	-	-	Set the CoaXPress Link Configuration.
JAI CxpLinkConfigurationPreferred (IEnum)	0x00010038: CXP3_X1 (Default) 0x00010048: CXP6_X1 0x00010058: CXP12_X1		Custom command to change and save the CxpLinkConfigurationPreferred configuration value.
CxpConnectionSelector (Integer)	-	-	Select the CoaXPress physical connection you want to control.
CxpConnectionTestMode (IEnum)	0: Off (Fixed)	-	Display the test mode. On this camera it is fixed to Off (=Normal Mode).
CxpConnectionTestErrorCount (Integer)	-	-	Reports the current connection error count for the test packet.
CxpConnectionTestPacketCount (Integer)	-	-	Reports the current count of test packets.
CxpVersionUsed (IEnum)	2: CXP1.1 (Default) 3: CXP2.0		Display the current CXP version. When the frame grabber supports CXP2.0, "3: CXP2.0" is displayed.

# ImageFormatControl

Configure image format settings.

**Note:** Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.

Image Format Control Item	Setting Range	Default	Description												
SensorWidth (Integer)	2472		Display the sensor's maximum image width.												
SensorHeight (Integer)	2064		Display the sensor's maximum image height.												
SensorDigitizationBits (Enum)	8: 8 Bits 10: 10 Bits (Default) 12: 12 Bits		Display the number of bits at which the sensor is operating.												
WidthMax (Integer)	-	-	Display the maximum image width.												
			<table border="1"> <thead> <tr> <th>Binning Horizontal</th> <th>FD2x2 BinningMode</th> <th>WidthMax</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Off</td> <td>2464</td> </tr> <tr> <td>2</td> <td>Off</td> <td>1232</td> </tr> <tr> <td>1</td> <td>On</td> <td>1228</td> </tr> </tbody> </table>	Binning Horizontal	FD2x2 BinningMode	WidthMax	1	Off	2464	2	Off	1232	1	On	1228
			Binning Horizontal	FD2x2 BinningMode	WidthMax										
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HeightMax (Integer)	-	-	Display the maximum image height.												
			<table border="1"> <thead> <tr> <th>Binning Vertical</th> <th>FD2x2 BinningMode</th> <th>HeightMax</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Off</td> <td>2056</td> </tr> <tr> <td>2</td> <td>Off</td> <td>1028</td> </tr> <tr> <td>1</td> <td>On</td> <td>1024</td> </tr> </tbody> </table>	Binning Vertical	FD2x2 BinningMode	HeightMax	1	Off	2056	2	Off	1028	1	On	1024
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BinningHorizontal and FD2x2BinningMode cannot be used together.															
BinningHorizontal and FD2x2BinningMode cannot be used together.															
Width (Integer)	-	WidthMax	Set the image width. Setting Range: 96 (48)* ~ [WidthMax - OffsetX], Step 8(4)* *When BinningHorizontal = 2, the value in parentheses is applicable.												
Height (Integer)	-	HeightMax	Set the image height. Setting Range: 8 (4)* ~ [HeightMax - OffsetY], Step 2(1)* *When BinningVertical = 2, the value in parentheses is applicable.												

Image Format Control Item	Setting Range	Default	Description
OffsetX (Integer)	-	0	Set the horizontal offset. Setting Range: 0 ~ [WidthMax - Width], Step 8(4)* *When BinningHorizontal = 2, the value in parentheses is applicable.
OffsetY (Integer)	-	0	Set the vertical offset. Setting Range: 0 ~ [HeightMax - Height], Step 2(1)* *When BinningVertical = 2, the value in parentheses is applicable.
ROICentered (Enum)  <b>Related Topic:</b> <a href="#">Single ROI Function</a>	0: Off 1: On	0: Off	When set to On, the image output position in the X direction is always forced to be centered and OffsetX is disabled.
FD2x2BinningMode (Enum)  <b>Related Topic:</b> <a href="#">Binning Function</a>	0: Off 1: On	0: Off	Performs 2x2 analog binning (Sum processing). When On, the Width and Height are 1228 x 1024.  <b>Note:</b> The " <a href="#">Single ROI Function</a> " and <a href="#">FD2x2BinningMode (Binning Function)</a> cannot be used together on this model.
BinningHorizontalMode (Enum)  <b>Related Topic:</b> <a href="#">Binning Function</a>	0: Sum 1: Average	0: Sum	Set the processing method for horizontal binning.
BinningHorizontal (Integer)	1 ~ 2	1	Set the number of pixels in the horizontal direction for which to perform binning.
BinningVerticalMode (Enum)	0: Sum 1: Average	0: Sum	Set the processing method for vertical binning.
BinningVertical (Integer)	1 ~ 2	1	Set the number of pixels in the vertical direction for which to perform binning.
ImageScalingMode (Enum)  <b>Related Topic:</b> <a href="#">Image Scaling Mode (Xscale)</a>	0: Off 1: On	0: Off	Enable ImageScalingMode.
ImageScalingSumMode (Enum)	0: Off (Ave) (Default) 1: On (Sum)		Selects whether to use Sum or Average mode when ImageScalingMode is On.

Image Format Control Item	Setting Range	Default	Description
ImageScalingHorizontal (IFloat)	0.0625 ~ 1	1	Specifies the horizontal scaling ratio in decimal units. For example, if you want to scale the image by 50% in the horizontal direction, specify "0.5".
ImageScalingHorizontalAbs (Integer)	256 ~ 4096	-	Indicates the horizontal scaling ratio as an integer value (rounded down to the nearest whole number). The formula is: ImageScalingHorizontal X 4096.
ImageScalingVertical (IFloat)	0.0625 ~ 1	1	Specifies the vertical scaling ratio in decimal units. For example, if you want to scale the image by 50% in the vertical direction, specify "0.5".
ImageScalingVerticalAbs (Integer)	256 ~ 4096	-	Indicates the vertical scaling ratio as an integer value (rounded down to the nearest whole number). The formula is: ImageScalingVertical X 4096.
ImageScalingBaseAbs (Integer)	4096 (Fixed)		
ReverseX (Boolean)  <b>Related Topic:</b> <a href="#">Image Flip Function</a>	0 ~ 1	0	Reverse pixels horizontally.
ReverseY (Boolean)	0 ~ 1	0	Reverse pixels vertically.
ReverseXY (Boolean)	0: Off 1: On	0: Off	Reverse the current ReverseX and ReverseY settings.
PixelFormat (Enum)  <b>Related Topic:</b> <a href="#">Pixel Format</a>	-	RGB8	Set the pixel format. 0x02180014: RGB8 0x02300018: RGB10 0x0230001A: RGB12
TestPattern (Enum)	-	0: Off	Select the test image. 0: Off (Default) 1: GreyHorizontalRamp 2: GreyVerticalRamp 3: GreyHorizontalRampMoving 4: HorizontalColorBar 5: VerticalColorBar 6: HorizontalColorBarMoving  <b>Note:</b> This item cannot be changed when <b>ExposureAuto</b> ( <a href="#">AcquisitionControl</a> ) is set to other than <b>Off</b> .

Image Format Control Item	Setting Range	Default	Description
OverlayMode (IEnum) <b>Related Topic:</b> <a href="#">Overlay Mode</a>	-	0: Off	You can check the target area by reducing the brightness of the non-target area to 50%. 0: Off (Default) 1: MultiRoiAreaMode - Check the active area on MultiROI. 2: ALCAreaMode - Check the photometry area on ALC. 3: AWBAreaMode - Check the photometry area on AWB.

## MultiROIControl

Configure settings for Multi ROI.

**Related Topic:** [Multi ROI Function](#)

**Note:** Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.

Multi ROI Item	Setting Range	Default	Description
MultiRoiMode (IEnum)	0: Off (Default) 1: On		Enable/disable Multi Roi.
MultiRoiIndex (Integer)	0 ~ 7	0	Select the index for the Multi Roi mode.
MultiRoiWidth (Integer)	-	256	Set the width for the selected Multi Roi index. Step 16 (8)
MultiRoiHeight (Integer)	-	192	Set the height for the selected Multi Roi index. Step: 4 (2)
MultiRoiOffsetX (Integer)	-	-	Set the horizontal offset for the selected Multi Roi index. <b>Min:</b> The minimum value of the range where each Index does not overlap. <b>Max:</b> The maximum value of the range where each Index does not overlap. <b>Step:</b> 16 (8) <b>Default:</b> 0 (Index1) / 256 (Index2) / 512 (Index3) / 768 (Index4) / 1024 (Index5) / 1280 (Index6) / 1536 (Index7) / 1792 (Index8)
MultiRoiOffsetY (Integer)	-	-	Set the vertical offset for the selected Multi Roi index. <b>Min:</b> The minimum value of the range where each Index does not overlap. <b>Max:</b> The maximum value of the range where each Index does not overlap. <b>Step:</b> 16 (8) <b>Default:</b> 0 (Index1) / 192 (Index2) / 384 (Index3) / 576 (Index4) / 768 (Index5) / 960 (Index6) / 1152 (Index7) / 1344 (Index8)

Multi ROI Item	Setting Range	Default	Description
MultiRoiHorizontalEnableNumber (Integer)	1 ~ 8	1	Set the maximum number of valid horizontal index numbers.
MultiRoiVerticalEnableNumber (Integer)	1 ~ 8	1	Set the maximum number of valid vertical index numbers.

## AcquisitionControl

Configure image capture settings.

Acquisition Control Item	Setting Range	Default	Description
AcquisitionMode (IEnum) <b>Related Topic:</b> <a href="#">Acquisition Control</a>	0: SingleFrame 1: MultiFrame 2: Continuous (Default)		Select the image capture mode.
AcquisitionStart (ICommand)	-	-	Start image capture.
AcquisitionStop (ICommand)	-	-	Stop image capture.
AcquisitionFrameCount (Integer)	1 ~ 65535	1	In MultiFrame mode, set the number of frames to capture.
AcquisitionFrameRate (Hz) (IFloat)	0.125 ~	-	Set the AcquisitionFrameRate in Hz. See " <a href="#">Specifications</a> " for the maximum acquisition rate value under different settings.
TriggerSelector (IEnum) <b>Related Topic:</b> <a href="#">Trigger Control</a>	0: AcquisitionStart (Default) 1: AcquisitionEnd 3: FrameStart		Select the trigger operation.
TriggerMode (IEnum)	0: Off 1: On	0: Off	Enables/Disables the Trigger mode.
TriggerSoftware (ICommand)	-	-	Execute a software trigger.

Acquisition Control Item	Setting Range	Default	Description								
TriggerSource (IEnum)	-	Line4 TTL In1	Select the trigger signal source. 7 - 10: PulseGenerator0 - 3 11 - 14: UserOutput0 - 3 19: Software 23: Line4 TTL In1 (Default) 24: Line5 Opt In1 25: Line6 Opt In2 26: Line7 CXP In 29: Line10 TTL In2 36: Nand0 Out 37: Nand1 Out								
TriggerActivation (IEnum)	1: Rising Edge (Default) 2: Falling Edge 3: Level High 4: Level Low		Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied). The options vary depending on the <b>TriggerSelector</b> setting. <table border="1"> <thead> <tr> <th>TriggerSelector</th> <th>TriggerActivation</th> </tr> </thead> <tbody> <tr> <td>AcquisitionStart</td> <td rowspan="3">RisingEdge or FallingEdge</td> </tr> <tr> <td>AcquisitionEnd</td> </tr> <tr> <td>AcquisitionTransferStart</td> </tr> <tr> <td>FrameStart</td> <td>Any</td> </tr> </tbody> </table>	TriggerSelector	TriggerActivation	AcquisitionStart	RisingEdge or FallingEdge	AcquisitionEnd	AcquisitionTransferStart	FrameStart	Any
TriggerSelector	TriggerActivation										
AcquisitionStart	RisingEdge or FallingEdge										
AcquisitionEnd											
AcquisitionTransferStart											
FrameStart	Any										
TriggerOverlap (IEnum)	0: Off 1: ReadOut	-	Display the trigger overlap operation. The below table shows the default values. <table border="1"> <thead> <tr> <th>TriggerSelector</th> <th>TriggerOverlap</th> </tr> </thead> <tbody> <tr> <td>AcquisitionStart</td> <td rowspan="3">Off (Fixed)</td> </tr> <tr> <td>AcquisitionEnd</td> </tr> <tr> <td>AcquisitionTransferStart</td> </tr> <tr> <td>FrameStart</td> <td>ReadOut (Fixed)</td> </tr> </tbody> </table>	TriggerSelector	TriggerOverlap	AcquisitionStart	Off (Fixed)	AcquisitionEnd	AcquisitionTransferStart	FrameStart	ReadOut (Fixed)
TriggerSelector	TriggerOverlap										
AcquisitionStart	Off (Fixed)										
AcquisitionEnd											
AcquisitionTransferStart											
FrameStart	ReadOut (Fixed)										
TriggerDelay (µs) (IFloat)	0 - 500000	0	Set the time of exposure start from trigger input (in µs).								
ExposureMode (IEnum)  <b>Related Topic:</b> <a href="#">Exposure Mode</a>	0: Off 1: Timed (Default) 2: TriggerWidth		Select the exposure mode.								
ExposureTimeMode (IEnum)	0: Common (Default) 1: Individual		When set to Individual, <b>ExposureTime</b> can be adjusted for RGB individually.								
ExposureTimeSelector (IEnum)	0: Common (Default) 1: Red 2: Green 3: Blue		Selects which exposure time is controlled by the ExposureTime feature.								

Acquisition Control Item	Setting Range	Default	Description
ExposureTime (μs) (IFloat)	1 ~ ExposureTime Max*	ExposureTime Max*	Set the exposure time for the item selected in ExposureTimeSelector.  <b>Note:</b> *ExposureTimeMax: The maximum exposure time value under the current setting conditions.
ExposureTimeMax (μs) (IFloat)	1 ~		Displays the maximum exposure time value under the current settings. (1/AcquisitionFrameRateMax) – Next Trigger Inhibit Period
ExposureAuto (IEnum)	0: Off (Default) 1: Once 2: Continuous		Set whether to enable auto exposure. <b>Once</b> automatically changes to <b>Off</b> when the signal level converges.
ExposureModeOption (IEnum)  <b>Related Topic:</b> <a href="#">RCT Mode</a>	0: Off (Default) 1: RCT		Enable RCT mode.

# DigitalIOControl

Configure settings for digital input/output.

**Related Topic:** [GPIO \(Digital Input/Output Settings\)](#)

Digital IO Control Item	Setting Range	Default			
LineSelector (IEnum)	-	Line1 TTL Out1	Select the input / output to configure.		
			<b>LineSelector</b>	<b>LineMode</b>	<b>LineFormat</b>
			20: Line1 TTL Out1	Output	TTL
			21: Line2 Opt Out1	Output	OptoCoupled
			22: Line3 Opt Out2	Output	OptoCoupled
			23: Line4 TTL In1	Input	TTL
			24: Line5 Opt In1	Input	OptoCoupled
			25: Line6 Opt In2	Input	OptoCoupled
			26: Line7 CXP In	Input	TTL
			27: Line8 TTL Out2	Output	TTL
			29: Line10 TTL In2	Input	TTL
			53: Nand0 In1	Input	Internal Signal
			54: Nand0 In2	Input	Internal Signal
			55: Nand1 In1	Input	Internal Signal
56: Nand1 In2	Input	Internal Signal			
255: TimestampReset	Internal Connection	Internal Signal			
LineMode (IEnum)	0: Input 1: Output 2: InternalConnection		Display the input/ output status (whether it is input or output).Please see the LineSelector's descriptions for the values displayed on this item.		
LineInverter (IBoolean)	False (Default) True		Enable/disable polarity inversion for the selected input signal or output signal. When LineMode is Output, this parameter can be configured. When Input, configuration is not possible (fixed to False).		
LineStatus (IBoolean)	False (Default) True		Display the status of the input signal or output signal (True: High, False: Low).		

Digital IO Control Item	Setting Range	Default	
LineStatusAll (Integer)		0	Display the input/output signal status. Bit0: Line1 TTL Out1 Bit1: Line2 Opt Out1 Bit2: Line3 Opt Out2 Bit3: Line4 TTL In1 Bit4: Line5 Opt In1 Bit5: Line6 Opt In2 Bit6: Line7 CC1 Bit7: Line8 TTL Out2 Bit8: Unused (fixed 0) Bit9: Line10 TTL In2 Bit10-31: Unused (fixed 0)
LineFormat (Enum)	2: TTL 5: OptoCoupled 7: Internal Signal		The signal format for the item selected in <b>LineSelector</b> is displayed. For the displayed values, please refer to the LineSelector's description.
LineSource (Enum)	-	-	Select the line source signal for the item selected in Line Selector. 0: Off (LineSelector=TimestampReset) 1: AcquisitionActive 2: FrameActive 4: ExposureActive 5: FVAL 43: AcquisitionTriggerWait 44: FrameTriggerWait 7-10: PulseGenerator0-3 11-14: UserOutput0-3 23: Line4 TTL In1 24: Line5 Opt In1 25: Line6 Opt In2 26: Line7 CXP In 29: Line10 TTL In2 36: Nand0 Out 37: Nand1 Out 41: Low (Not selectable when LineMode = InternalConnection) 42: High (Not selectable when LineMode = InternalConnection)

**Note:** The following is fixed to "-": LineSelector = 23: Line4 TTL In1, 24: Line5 Opt In1, 25: Line6 Opt In2, 29: Line10 TTL In2

**Default**  
 LineSelector = TimestampReset: Off (0)  
 LineSelector = Other than TimestampReset: Line4 TTL In1(23)

Digital IO Control Item	Setting Range	Default	
OptInFilter (ns) (Integer)	0 ~ 40000000	0	Select the period for filtering mask of the Opt-In signal.
UserOutputSelector (Enum)	0: User Output 0 (Default) 1: User Output 1 2: User Output 2 3: User Output 3		Set the user output signal.
UserOutputValue (Boolean)	False True	False	Set the User Output value selected in User Output Selector.

## PulseGenerator

Configure pulse generator settings.

**Related Topic:** [Pulse Generator](#)

Pulse Generator Setting Item	Setting Range	Default	Description
ClockPreScaler (Integer)	1 ~ 4096	100	Set the division value for the prescaler (12-bit) using the pixel clock as the base clock.
PulseGeneratorClock (MHz) (Float)	-	0.7425	Set the clock used for the pulse generator. This value is calculated based on the Clock Pre-Scaler value. PulseGeneratorClock = Source frequency / ClockPreScaler Source frequency: 74.25 MHz
PulseGeneratorSelector (Enum)	0: PulseGenerator0 (Default) 1: PulseGenerator1 2: PulseGenerator2 3: PulseGenerator3		Select the pulse generator.
PulseGeneratorLength (Integer)	1 ~ 1048575	22275	Set the maximum count up value using clock value.
PulseGeneratorLengthMs (ms) (Float)	-	30	Set the maximum count up value using ms. This value is calculated based on the Pulse Generator Length value. The setting range varies depending on the Clock Pre-Scaler value. PulseGeneratorLengthMs = 1/PulseGeneratorClock * PulseGeneratorLength
PulseGeneratorFrequency (Hz) (Float)	-	33.3333	Set the maximum count up value using frequency. This value is calculated based on the Pulse Generator Length value. PulseGeneratorFrequency = 1sec / PulseGeneratorLengthMs

Pulse Generator Setting Item	Setting Range	Default	Description
PulseGeneratorStartPoint (IFloat)	0~1048575	0	Set the start point for the High interval using clock value. When the counter reaches this value, the output becomes 1.
PulseGeneratorStartPointMs (ms) (IFloat)	-	0	Set the start point for the High interval using ms. When the counter reaches this value, the output becomes 1. The setting range varies depending on the Clock Pre-Scaler value. PulseGeneratorStartPointMs = 1/PulseGeneratorClock * PulseGeneratorStartPointValue
PulseGeneratorEndPoint (Integer)	1~1048575	11138	Set the start point for the Low interval using clock value. When the counter reaches this value, the output becomes 0.
PulseGeneratorEndPointMs (ms) (IFloat)	-	15.0007	Set the start point for the Low interval using ms. When the counter reaches this value, the output becomes 0. The setting range varies depending on the Clock Pre-Scaler value. PulseGeneratorEndPoint = 1/PulseGeneratorClock * PulseGeneratorEndPointValue
PulseGeneratorPulseWidth (ms) (IFloat)	-	15.0007	Display High interval width for the pulse in ms. This is a calculation of the time between the Start Point and End Point. The setting range varies depending on the Clock Pre-Scaler value. PulseGeneratorPulseWidth = 1/PulseGeneratorClock * (PulseGeneratorEndPoint - PulseGeneratorStartPoint)
PulseGeneratorRepeatCount (Integer)	0 ~ 255	0	Set the repeat count for the counter. When this is set to 0, the counter will be free-running with limitless repeating.
PulseGeneratorClear Activation (IEnum)	0: Off (Default) 1: Rising Edge 2: Falling Edge 3: Level High 4: Level Low		Set the clear signal condition for the count clear input of the pulse generator.

Pulse Generator Setting Item	Setting Range	Default	Description
PulseGeneratorClearSource (IEnum)	-	Line4 TTL In1	<p>Select the count clear input signal source.</p> <ul style="list-style-type: none"> <li>1: AcquisitionActive</li> <li>2: FrameActive</li> <li>4: ExposureActive</li> <li>43: AcquisitionTriggerWait</li> <li>44: FrameTriggerWait</li> <li>7-10: PulseGenerator0-3 (*)</li> <li>11-14: UserOutput0-3</li> <li>23: Line4 TTL In1</li> <li>24: Line5 Opt In1</li> <li>25: Line6 Opt In2</li> <li>26: Line7 CXP In</li> <li>29: Line10 TTL In2</li> <li>36: Nand0 Out</li> <li>37: Nand1 Out</li> </ul> <p><b>Note:</b> (*) The PulseGenerator currently selected in PulseGeneratorSelector is disabled.</p>
PulseGeneratorClear SyncMode (IEnum)	0: Async Mode (Default) 1: Sync Mode		Select the count clear input signal source.

## AnalogControl

Configure analog control settings.

Analog Control Item	Setting Range	Default	Description
IndividualGainMode (IEnum)	0: Off 1: On	Off	When <b>On</b> , RGB can be configured individually for the entire gain adjustment range of the sensor.
GainSelector (IEnum)	0: Analog All (Default) 1: Analog Red 2: Analog Green 3: Analog Blue 4: Digital Red 5: Digital Blue		Select the gain to configure.

**Related Topic:** [Adjust the Gain](#)

Analog Control Item	Setting Range	Default	Description	
Gain (IFloat)	Set the gain value for the gain item selected with the GainSelector setting. The Gain setting is configured in multipliers. (Unit: times, step: equivalent to 0.1db, default = x1.00).			
	<b>GainSelector</b>	<b>IndividualGainMode = Off</b>	<b>IndividualGainMode = On</b>	
	AnalogAll*	0.0dB ~ 18.1dB (x1.0 ~ x8.0)	0db (x1.0) (Fixed)	
	AnalogRed*	-6.6dB ~ 12.0dB (x0.47 ~ x4.0)	0dB ~ 36.1dB (x1.0 ~ x64.0)	
	AnalogBlue*	-6.6dB ~ 12.0dB (x0.47 ~ x4.0)	0dB ~ 36.1dB (x1.0 ~ x64.0)	
	AnalogGreen*	0db (x1.0) (Fixed)	0dB ~ 36.1dB (x1.0 ~ x64.0)	
	DigitalRed	-0.9dB ~ 0.8dB (x0.9 ~ x1.1)		
	DigitalBlue	-0.9dB ~ 0.8dB (x0.9 ~ x1.1)		
*The resolution is set in about 0.1dB steps.				
GainAuto (IEnum)	0: Off (Default) 1: Once 2: Continuous		Enable/disable gain auto adjustment. <b>Once</b> automatically changes to <b>Off</b> when the signal level converges.	
BlackLevelSelector (IEnum)	0: All (Default) 1: Red 3: Blue		Select the black level to configure.	
BlackLevel (IFloat)	<b>BlackLevelSelector</b>	<b>Setting Range</b>	Set the black level value. (Default: 0)	
	All	-133 ~ 255		
	Red	-64 to +64		
	Blue	-64 to +64		
BalanceWhiteAuto (IEnum)	0: Off (Default) 1: Once 2: Continuous 3: Exposure Once 4: Exposure Continuous 5: Preset 3200K 6: Preset 5000K 7: Preset 6500K 8: Preset 7500K		Enable/disable auto white balance.	
AWBAreaSelector (IEnum)	Select the area for which to configure AWBAreaEnable.			
	15: High Left	14: High Mid-Left	13: High Mid-Right	12: High Right
	11: Mid-High Left	10: Mid-High Mid-Left	9: Mid-High Mid-Right	8: Mid-High Right
	7: Mid-Low Left	6: Mid-Low Mid-Left	5: Mid-Low Mid-Right	4: Mid-Low Right
	3: Low Left	2: Low Mid-Left	1: Low Mid-Right	0: Low Right (Default)
AWBAreaEnable (IBoolean)	False True (Default)		Enable/disable the photometry area selected in AWBAreaSelector.	

Analog Control Item	Setting Range	Default	Description
AWBAreaEnableAll (IBoolean)	False True (Default)		<p><b>True:</b> Operate BalanceWhiteAuto with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in AWBAreaSelector.</p> <p><b>False:</b> Operate BalanceWhiteAuto according to the individual enabled/disabled photometry area states configured in AWBAreaSelector.</p>
AWBControlSpeed (IInteger)	1~ 8	4	Set the response speed for BalanceWhiteAuto. (8 is the fastest)
BalanceWhiteAutoResult (IEnum)	-	0: Idle	<p>Display the results of BalanceWhiteAuto. See "<a href="#">Adjusting the White Balance</a>" for more information on each error.</p> <p>0: Idle (Default)            1: Processing            2: Converging            3: Succeeded            4: Error1 - G image was too bright            5: Error2 - G image was too dark            6: Error3 - Timeout            7: Error4 - could not processing            8: Error5 - R or B image was out of range</p>
Gamma (IFloat)  <b>Related Topic:</b> <a href="#">Gamma Function</a>	0.45~ 1	0.45	<p>Set the gamma value.</p> <p>Setting Range: 0.45, 0.50, 0.55, 0.60, 0.65, 0.75, 0.80, 0.90, 1.00</p>
LUTMode (IEnum)  <b>Related Topic:</b> <a href="#">LUT (Lookup Table)</a>	0: Off (Default) 1: Gamma 2: LUT		Select the LUT mode.

## LUTControl

Configure LUT settings.

**Related Topic:** [LUT \(Lookup Table\)](#)

LUT Control Item	Setting Range	Default	Description
LUTSelector (IEnum)	0: Red (Default) 1: Green 2: Blue		Select the LUT channel to control.
LUTIndex (Integer)	0 ~ 256	0	Set the LUT index table number.
LUTValue (Integer)	0 ~ 4095	Gamma= 1.0	Set the LUT value.

## AutoLevelControl

Configure AutoLevelControl.

**Related Topic:** [ALC \(Automatic Level Control\) Function](#)

Auto Level Control Item	Setting Range	Default	Description	
ALCControlReference (IEnum)	0: Peak Channel 1: Selected Channel (Default)		Sets the channel to be used for ALC control reference.	
ALCControlChannel (IEnum)	0: Red 1: Green (Default) 2: Blue		When <b>ALCControlReference</b> is set to <b>SelectedChannel</b> , this setting determines which RGB channel signal is used for ALC control. When <b>ALCControlReference</b> is set to <b>PeakChannel</b> , this setting is disabled.	
ALCReference (Integer)	30 ~ 95	50	Set the target level for ALC. (unit: %)	
ALCAreaSelector (IEnum)	Select the area for which to configure <b>ALCAreaEnable</b> .			
	15: High Left	14: High Mid-Left	13: High Mid-Right	12: High Right
	11: Mid-High Left	10: Mid-High Mid-Left	9: Mid-High Mid-Right	8: Mid-High Right
	7: Mid-Low Left	6: Mid-Low Mid-Left	5: Mid-Low Mid-Right	4: Mid-Low Right
	3: Low Left	2: Low Mid-Left	1: Low Mid-Right	0: Low Right (Default)
ALCAreaEnable (Boolean)	False True	True	Enable/disable the photometry area selected in <b>ALCAreaSelector</b> .	

Auto Level Control Item	Setting Range	Default	Description
ALCAreaEnableAll (IBoolean)	False True	True	<b>True:</b> Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in ALCAreaSelector. <b>False:</b> Operate ALC according to the individual enabled/disabled photometry area states configured in ALCAreaSelector.
ALCControlRatio (IInteger)	1 ~ 100	90	Set the response speed (%). (100 is the fastest.)
AutoControlStatus (IEnum)	0: Idle (Default) 1: Processing - Exposure Time 2: Processing - Gain 3: Converging - Exposure Time 4: Converging - Gain 5: Error1 - Could not processing 6: Error2 - Timeout		Allows confirmation of the AGC, ASC, and AWB convergence status.
ExposureAutoControlMin (IFloat)	-	100	Set the minimum value for the ExposureTime control range. (μs) <b>Min:</b> 100 <b>Max:</b> ExposureAutoControlMax - 1
ExposureAutoControlMax (IFloat)	-	ExposureTimeMax*	Set the maximum value for the ExposureTime control range. (μs) <b>Min:</b> ExposureAutoControlMin + 1 <b>Max:</b> ExposureTimeMax*
GainAutoControlMin	-	1	Set the minimum value for the GainAuto control range. <b>Min:</b> 1 <b>Max:</b> (GainAutoControlMax - 1)
GainAutoControlMax (IFloat)	-	8	Set the maximum value for the GainAuto control range. <b>Min:</b> GainAutoControlMin+1 <b>Max:</b> 8

**Note:** \*ExposureTimeMax: The maximum exposure time value under the current setting conditions.

# ColorTransformationControl

Configure color transformation settings.

**Related Topic:** [Color Space Conversion \(ColorTransformationControl\)](#)

Color Transformation Control Item	Setting Range	Default	Description						
ColorTransformationMode (IEnum)	0: RGB (Default) 1: HSI 2: XYZ		Set the output image format.						
ColorTransformationRGBMode (IEnum)	0: OFF (Default) 1: sRGB 2: AdobeRGB 3: UserCustom		Set the detailed mode when RGB is selected for the color space.						
ColorMatrixValueSelector (IEnum)	0: R-R (Default) 1: R-G 2: R-B 3: G-R 4: G-G 5: G-B 6: B-R 7: B-G 8: B-B		Select the ColorMatrix setting component.						
ColorMatrixValue (IFloat)	-2 ~ 2	-	Set the Color Matrix value. (Step = 0.1)						
			<table border="1"> <thead> <tr> <th>ColorMatrixValueSelector</th> <th>Default</th> </tr> </thead> <tbody> <tr> <td>R-R, G-G, B-B</td> <td>1.0</td> </tr> <tr> <td>Other than above</td> <td>0.0</td> </tr> </tbody> </table>	ColorMatrixValueSelector	Default	R-R, G-G, B-B	1.0	Other than above	0.0
ColorMatrixValueSelector	Default								
R-R, G-G, B-B	1.0								
Other than above	0.0								

# ImagingControl

Configure other JAI functions.

Imaging Control Item	Setting Range	Default	Description
PixelShiftAlignmentMode (IEnum)  <b>Related Topic:</b> <a href="#">Pixel Shift Alignment</a>	0: Off 1: On	0: Off	Enable/Disable PixelShiftAlignment, which corrects the sensor's registration misalignment.
PixelShiftAlignmentChannelSelector (IEnum)	0: Red (Default) 2: Blue		Select the channel to perform the sensor alignment.
PixelShiftAlignmentHorizontal (pixel) (Integer)	-64 to +64	0	Set the correction value for horizontal sensor alignment.
PixelShiftAlignmentVertical (pixel) (Integer)	-64 to +64	0	Set the correction value for vertical sensor alignment.
ChromaticAberrationCorrectionMode (IEnum)  <b>Related Topic:</b> <a href="#">Chromatic Aberration Correction</a>	0: Off 1: On	Off	Enable / Disable Chromatic Aberration Correction.
ChromaticAberrationCorrectionChannelSelector (IEnum)	0: Red (Default) 2: Blue		Select the color of the Chromatic Aberration Correction values.
ChromaticAberrationCorrectionPreset (IEnum)	1: Preset1 (Default) 2: Preset2 3: Preset3		Select the correction pattern of the Chromatic Aberration Correction. Preset1 corrects misalignment at the upper, lower, left, and right edges of the image. Preset2 and Preset3 corrects misalignment in the mid-range area.
ChromaticAberrationCorrectionCoeff (Integer)	-256 to +256	0	Set the coefficient value for the selected preset.
ChromaticAberrationCenterOffsetHorizontal (Integer)	-128 to +127	0	Set the correction value for the horizontal position of chromatic aberration. The correction is performed with the image center as the origin.
ChromaticAberrationCenterOffsetVertical (Integer)	-128 to +127	0	Set the correction value for the vertical position of chromatic aberration. The correction is performed with the image center as the origin.

Imaging Control Item	Setting Range	Default	Description
PixelShiftCheckMode (IEnum)	0: Off (Default) 1: R-G 2: B-G		Switches the camera's output image to the image that shows the difference between the G channel's image data.
<b>Related Topic:</b> <a href="#">VideoProcessBypassMode</a>	0: Off 1: On	0: Off	Enable/disable VideoProcessBypass mode.
<b>Related Topic:</b> <a href="#">Edge Enhancer</a> , <a href="#">Color Enhancer</a>	0: Off 1: On	0: Off	Enable/disable EdgeEnhancer.
EdgeEnhancerLevel (IEnum)	0: Low 1: Middle (Default) 2: High 3: Strong		Set the Level for EdgeEnhancer.
ColorEnhancerEnable (IBoolean)	0: Off 1: On	0: Off	Enable/disable ColorEnhancer.
ColorEnhancerSelector (IEnum)	0: Red (Default) 1: Cyan 2: Green 3: Magenta 4: Blue 5: Yellow		Index for configuring detailed settings of ColorEnhancer.
ColorEnhancerValue (IFloat)	0~ 1.0	0	Set the enhancement to one of ten levels for each color element. (Step = 0.1) 0: No enhancement

# ShadingControl

Configure shading correction settings.

**Related Topic:** [Shading Correction](#)

Shading Control Item	Setting Range	Default	Description
ShadingCorrectionMode (IEnum)	0: Flat Shading (Default) 1: Color Shading		Select the shading correction method.
ShadingMode (IEnum)	0: Off (Default) 1: User1 2: User2 3: User3		Set the area to which to save shading correction data. When this is set to Off, PerformShadingCalibration will not be executed.
PerformShadingCalibration (ICommand)	Execute shading correction. This command cannot be executed under the following conditions. (Could not calibrated error is displayed) <ul style="list-style-type: none"> <li>- When outputting no image.</li> <li>- When outputting TestPattern.</li> <li>- Width and/or Height are less than 512 (<a href="#">Single ROI Function</a>)</li> <li>- In FD2x2Binning mode (<a href="#">Binning Function</a>)</li> <li>- In ImageScaling mode (<a href="#">Image Scaling Mode (Xscale)</a>)</li> <li>- When BalanceWhiteAuto = Continuous</li> <li>- When GainAuto = Continuous</li> <li>- In Sequencer mode (<a href="#">Sequencer Function</a>)</li> <li>- In MultiRoi mode (<a href="#">Multi ROI Function</a>)</li> <li>- In Reverse mode (<a href="#">Image Flip Function</a>)</li> <li>- In ALC mode (<a href="#">ALC (Automatic Level Control) Function</a>)</li> </ul>		
ShadingDetectResult (IEnum)	0: Idle (Default) 1: Succeeded 2: Error1 - image was too bright 3: Error2 - image was too dark 4: Error3 - Could not calibrated 5: Error4 - Correction limit		Display the shading correction results.

## BlemishControl

Configure settings for JAI white blemish correction.

**Related Topic:** [BlemishCompensation](#)

Blemish Control Item	Setting Range	Default	Description
BlemishEnable (IBoolean)	False True	True	Enable/disable blemish correction.
BlemishDetect (ICommand)	-	-	Execute blemish detection. This command cannot be executed under the following conditions. <ul style="list-style-type: none"> <li>- No image is being output.</li> <li>- When AcquisitionMode is set to Single or MultiFrame.</li> <li>- TestPattern is being output</li> <li>- In Sequencer Mode (<a href="#">Sequencer Function</a>)</li> <li>- In MultiRoi mode (<a href="#">Multi ROI Function</a>)</li> <li>- The image is not full ROI size (<a href="#">Single ROI Function</a>)</li> <li>- Not in lens cap state</li> </ul>
BlemishDetectionResult (IEnum)	-	Idle	Display the blemish detection results. <ul style="list-style-type: none"> <li>0: Idle</li> <li>1: Succeeded</li> <li>2: Error1 - image was too bright</li> <li>5: Error4 - detect blemishes too many</li> <li>6: Error5 - could not detected</li> <li>7: Error6 - timeout</li> </ul>
BlemishStore (ICommand)	-	-	Save the location information of detected blemishes, manually specified by BlemishiCompensationPositionX and BlemishCompensationPositionY.
BlemishCompensation ChannelSelector (IEnum)	0 ~ 2	0	Selects the channel of the blemish data to be referenced.
BlemishDetectThreshold (IInteger)	1 ~ 100	10	Set the blemish detection threshold.
BlemishCompensationIndex (IInteger)	1 ~ 300	1	Select the index for the target blemish coordinates.

Blemish Control Item	Setting Range	Default	Description
BlemishCompensation PositionX (Integer)	-	-1	Display the X coordinate (horizontal pixel position) of the target blemish selected in BlemishCompensationIndex. You can also manually enter the X coordinate of the blemish you want to correct. <b>Min:</b> -1 <b>Max:</b> WidthMax - 1
BlemishCompensation PositionY (Integer)	-	-1	Display the Y coordinate (horizontal pixel position) of the target blemish selected in BlemishCompensationIndex. You can also manually enter the Y coordinate of the blemish you want to correct. <b>Min:</b> -1 <b>Max:</b> HeightMax - 1
BlemishCompensation DataClear (Command)	-	-	Delete detected or specified blemish information selected in BlemishCompensationIndex.
BlemishCompensationNumber (Integer)	0 ~ 300	0	Display the number of target blemishes.

## SequencerControl

Configure sequencer settings.

**Related Topic:** [Sequencer Function](#)

**Note:** Refer to [Functions That Cannot Be Used Together](#) for usage restrictions.

Sequencer Control Item	Setting Range	Default	Description
SequencerMode (Enum)	0: Off 1: On	0: Off	Enable / disable SequencerMode.
SequencerModeSelect (Enum)	0: Trigger Sequencer Mode (Default) 1: Command Sequencer Mode		Select the sequencer mode.
SequencerSetSelector (Integer)	1 ~ 32	1	Select the index number to configure.
SequencerWidth (Integer)	-	WidthMax	Set the Width of the selected SequencerIndex. The setting range is the same as Width <a href="#">[ImageFormatControl]</a> .

Sequencer Control Item	Setting Range	Default	Description
SequencerHeight (Integer)	-	HeightMax	Set the Height of the selected SequencerIndex. The setting range is the same as Height <a href="#">[ImageFormatControl]</a> .
SequencerOffsetX (Integer)	-	0	Set the OffsetX of the selected SequencerIndex. The setting range is the same as OffsetX <a href="#">[ImageFormatControl]</a> .
SequencerOffsetY (Integer)	-	0	Set the OffsetY of the selected SequencerIndex. The setting range is the same as OffsetY <a href="#">[ImageFormatControl]</a> .
SequencerBinningHorizontal (Integer)	-	1	Set the BinningHorizontal of the selected SequencerIndex. The setting range is the same as BinningHorizontal <a href="#">[ImageFormatControl]</a> .
SequencerBinningVertical (Integer)	-	1	Set the BinningVertical of the selected SequencerIndex. The setting range is the same as BinningVertical <a href="#">[ImageFormatControl]</a> .
SequencerFrameCount (Integer)	1 ~ 255	1	Set the FrameCount value for the selected SequencerIndex.
SequencerExposureTime Common (Float)	-	-	Set the ExposureTimeCommon of the selected SequencerIndex. The setting range is the same as ExposureTimeCommon <a href="#">[AcquisitionControl]</a> .
SequencerExposureTime Red (Float)	-	-	Set the ExposureTimeRed of the selected SequencerIndex. The setting range is the same as ExposureTimeRed <a href="#">[AcquisitionControl]</a> .
SequencerExposureTime Green (Float)	-	-	Set the ExposureTimeGreen of the selected SequencerIndex. The setting range is the same as ExposureTimeGreen <a href="#">[AcquisitionControl]</a> .
SequencerExposureTime Blue (Float)	-	-	Set the ExposureTimeBlue of the selected SequencerIndex. The setting range is the same as ExposureTimeBlue <a href="#">[AcquisitionControl]</a> .
SequencerGainAnalogAll (Float)	-	-	Set the Gain[AnalogAll] of the selected SequencerIndex. The setting range is the same as Gain[AnalogAll] <a href="#">[AnalogControl]</a> .
SequencerGainAnalogRed (Float)	-	-	Set the Gain[AnalogRed] of the selected SequencerIndex. The setting range is the same as Gain [AnalogRed] <a href="#">[AnalogControl]</a> .

Sequencer Control Item	Setting Range	Default	Description
SequencerGainAnalogGreen (IFloat)	-	-	Set the Gain[AnalogGreen] of the selected SequencerIndex. The setting range is the same as Gain [AnalogGreen] [AnalogControl].
SequencerGainAnalogBlue (IFloat)	-	-	Set the Gain[AnalogBlue] of the selected SequencerIndex. The setting range is the same as Gain [AnalogBlue] [AnalogControl].
SequencerBlackLevelAll (IFloat)	-	-	Set the BlackLevelAll of the selected SequencerIndex. The setting range is the same as BlackLevelAll [AnalogControl].
SequencerLUTEnable (IBoolean)	False True	False	Set the LUTEnable of the selected SequencerIndex.
SequencerSetNext (IInteger)	Set the next index to be displayed for the selected SequencerIndex. (Enabled only for TriggerSequencer.)		
	Setting Range:	0* ~ 32	
	Default:	SequencerSetSelector = 1 ~ 31: SequencerSetSelector value + 1	
		SequencerSetSelector = 32: 0	
*If 0 is specified, the operation of the Sequencer is stopped.			
SequencerRepetition (IInteger)	1 ~ 255	1	Set the repeat count for the sequencer.
SequencerSetActive (IInteger)	1 ~ 32	1	Displays the active index number.
SequencerSetStart (IInteger)	1 ~ 32	1	Specify the first index number to switch to when starting TriggerSequencerMode.
SequencerCommandIndex (IInteger)	1 ~ 32	1	Set this to change the SequencerIndex. (Enabled only for CommandSequencer.)
SequencerReset (ICommand)	-	-	In TriggerSequencerMode, reset the current index number to the number configured in SequencerSetStart.

# CounterAndTimerControl

Configure counter settings.

**Note:** This camera only supports the counter functions.

**Related Topic:** [CounterAndTimerControl](#)

Count And Time Control	Setting Range	Default	Description						
CounterSelector (IEnum)	0: Counter0 (Default) 1: Counter1 2: Counter2 3: Counter3		Select the counter.						
CounterEventSource (IEnum)	-	0: Off	Assign the Counter Event signal for which you want to read the count value to a dedicated counter, and read the value. 0: Off (Default) 1: FrameTrigger(Counter0 only) 2: Exposure Start(Counter1 only) 3: Sensor Readout(Counter2 only) 4: FrameTransferEnd(Counter3 only)						
CounterEventActivation (IEnum)	1: Rising Edge 2: Falling Edge		Set the count timing. The setting value is fixed with the following data. <table border="1" data-bbox="922 1228 1528 1360"> <thead> <tr> <th>Counter Selector</th> <th>CounterEventActivation</th> </tr> </thead> <tbody> <tr> <td>Counter0, 1, 2</td> <td>Rising Edge</td> </tr> <tr> <td>Counter3</td> <td>Falling Edge</td> </tr> </tbody> </table>	Counter Selector	CounterEventActivation	Counter0, 1, 2	Rising Edge	Counter3	Falling Edge
Counter Selector	CounterEventActivation								
Counter0, 1, 2	Rising Edge								
Counter3	Falling Edge								
CounterReset (ICommand)	-	-	Reset the counter.						
CounterValue (ICommand)	0 - 32bit max	0	Display the count value.						
CounterStatus (IEnum)	-	CounterIdle	Display the counter status. 0: CounterIdle 1: CounterTriggerWait 2: CounterActive 3: CounterCompleted 4: CounterOverflow						



Event Control Item	Setting Range	Default	Description
EventExposureRedStartData (ICategory)			Display the following data when the Event occurs.
EventExposureRedStart (Integer)	-	0x0130	Display the EventID.
EventExposureRedStart Timestamp (Integer)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureRedEndData (ICategory)			Display the following data when the Event occurs.
Event ExposureRedEnd (Integer)	-	0x0131	Display the EventID.
EventExposureRedEnd Timestamp (Integer)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureGreenStartData (ICategory)			Display the following data when the Event occurs.
EventExposureGreenStart (Integer)	-	0x0132	Display the EventID.
EventExposureGreenStart Timestamp (Integer)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureGreenEndData (ICategory)			Display the following data when the Event occurs.
EventExposureGreenEnd (Integer)	-	0x0133	Display the EventID.
EventExposureGreenEnd Timestamp (Integer)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureBlueStartData (ICategory)			Display the following data when the Event occurs.
Event ExposureBlueStart (Integer)	-	0x0134	Display the EventID.
Event ExposureBlueStart Timestamp (Integer)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureBlueEndData (ICategory)			Display the following data when the Event occurs.
EventExposureBlueEnd (Integer)	-	0x0135	Display the EventID.
EventExposureBlueEnd Timestamp (Integer)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.

## UserSetControl

---

Load factory default settings or save/load user settings for camera settings.

**Related Topic:** [Step 6: Saving the Settings](#)

User Set Control Item	Setting Range	Default	Description
UserSetSelector (IEnum)	0: Default (Default) 1: User1 2: User2 3: User3		Select the user settings.  <b>Note:</b> The factory default setting values are stored in Default and cannot be overwritten.
UserSetLoad (ICommand)	-	-	Load user settings. When selecting Default, the factory settings are loaded.
UserSetSave (ICommand)	-	-	Save the current setting values as user settings. This item is disabled when UserSetSelector is set to Default.

# Miscellaneous

## Troubleshooting

---

Check the following before requesting help. If the problem persists, contact your local JAI distributor.

### Power Supply and Connections

**Issue:** The POWER/TRIG LED remains lit amber and does not turn green, even after power is supplied to the camera.

**Cause and Solution:** Camera initialization may not be complete due to lack of power. Check the 12-pin power cable connection.

### Image Display

**Issue:** Gradation in dark areas is not noticeable.

**Cause and Solution:** Use the gamma function to correct the display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing. Using the gamma function performs correction to produce a display that is close to linear. For details, see [Gamma Function](#).

### Settings and Operations

**Issue:** Settings cannot be saved to user memory.

**Cause and Solution:** You cannot save to user memory while images are being acquired by the camera. Stop image acquisition before performing the save operation.

**Issue:** I want to restore the factory default settings.

**Cause and Solution:** Load Default under User Set Selector in the Feature Properties tab to restore the factory default settings.

# Specifications

Item	Specifications																
Image Sensor	5.1 megapixel 3CMOS global shutter prism camera Image Sensor: Type 1/1.8 Readout Pixels (Full ROI): 3x 2464 (H) x 2056 (V) pixels Active Pixels: 3x 2472 (H) x 2064 (V) pixels Pixel Size: 2.74 μm x 2.74 μm Image Size (Effective Image): 6.77mm(H)×5.66mm(V), 8.82mm (diagonal)																
Scanning System	Progressive scan, 1 tap																
Synchronization	Internal																
Interface	CoaxPress v2.0/v1.1 (CXP-12_X1, CXP6_X1, CXP3_X1)																
Max Frame Rate	<table border="1"> <thead> <tr> <th>CxpLinkConfiguration</th> <th>RGB8</th> <th>RGB10</th> <th>RGB12</th> </tr> </thead> <tbody> <tr> <td>CXP12_X1</td> <td>75 fps</td> <td>60 fps</td> <td>50 fps</td> </tr> <tr> <td>CXP6_X1</td> <td>37 fps</td> <td>30 fps</td> <td>25 fps</td> </tr> <tr> <td>CXP3_X1 (Default)</td> <td>18 fps</td> <td>15 fps</td> <td>12 fps</td> </tr> </tbody> </table>	CxpLinkConfiguration	RGB8	RGB10	RGB12	CXP12_X1	75 fps	60 fps	50 fps	CXP6_X1	37 fps	30 fps	25 fps	CXP3_X1 (Default)	18 fps	15 fps	12 fps
	CxpLinkConfiguration	RGB8	RGB10	RGB12													
	CXP12_X1	75 fps	60 fps	50 fps													
	CXP6_X1	37 fps	30 fps	25 fps													
CXP3_X1 (Default)	18 fps	15 fps	12 fps														
Dark SN (DR) DarkLevel @ 10bit	<table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">IndividualGainMode</th> </tr> <tr> <th>Off</th> <th>On</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>56dB (Typ)</td> <td>&gt;60dB (Typ)</td> </tr> <tr> <td>G</td> <td>60dB (Typ)</td> <td>&gt;60dB (Typ)</td> </tr> <tr> <td>B</td> <td>60dB (Typ)</td> <td>&gt;60dB (Typ)</td> </tr> </tbody> </table>		IndividualGainMode		Off	On	R	56dB (Typ)	>60dB (Typ)	G	60dB (Typ)	>60dB (Typ)	B	60dB (Typ)	>60dB (Typ)		
			IndividualGainMode														
		Off	On														
	R	56dB (Typ)	>60dB (Typ)														
	G	60dB (Typ)	>60dB (Typ)														
	B	60dB (Typ)	>60dB (Typ)														
Individual Gain Green/Red/Blue : x1.0 (0dB)																	
GainAnalogAll : AcquisitionFrameRate 12 fps, ExposureMode:OFF, Pixelformat RGB8																	
Bright SN 890LBS @ 10bit	<table border="1"> <thead> <tr> <th rowspan="2"></th> <th colspan="2">IndividualGainMode</th> </tr> <tr> <th>Off</th> <th>On</th> </tr> </thead> <tbody> <tr> <td>R</td> <td>33dB (Typ)</td> <td>39dB (Typ)</td> </tr> <tr> <td>G</td> <td>35dB (Typ)</td> <td>39dB (Typ)</td> </tr> <tr> <td>B</td> <td>34dB (Typ)</td> <td>39dB (Typ)</td> </tr> </tbody> </table>		IndividualGainMode		Off	On	R	33dB (Typ)	39dB (Typ)	G	35dB (Typ)	39dB (Typ)	B	34dB (Typ)	39dB (Typ)		
			IndividualGainMode														
		Off	On														
	R	33dB (Typ)	39dB (Typ)														
	G	35dB (Typ)	39dB (Typ)														
	B	34dB (Typ)	39dB (Typ)														
Individual Gain Green/Red/Blue : x1.0(0dB)																	
GainAnalogAll : AcquisitionFrameRate 12 fps, ExposureMode:OFF, Pixelformat RGB8																	

Item	Specifications			
Digital Image Output		<b>HorizontalBinning = 1 VerticalBinning = 1 FD2x2Binning = Off</b>	<b>HorizontalBinning = 2 VerticalBinning = 2 FD2x2Binning = Off</b>	<b>HorizontalBinning = 1 VerticalBinning = 1 FD2x2Binning = On</b>
	Width	96 ~ 2464, step: 8	48 ~ 1232, step: 4	1228 (Fixed)
	Height	8 ~ 2056, step: 2	4 ~ 1028, step: 1	1024 (Fixed)
	OffsetX	0 ~ 2368, step: 8	0 ~ 1184, step: 4	0 (Fixed)
	OffsetY	0 ~ 2048, step: 2	0 ~ 1024, step: 1	0 (Fixed)
Pixel Format	RGB8, RGB10, RGB12			
ImageScalingMode (Xscale)	Independent, sub-pixel rescaling of H and/or V resolution (1/16 Max)			
Acquisition Mode	SingleFrame, MultiFrame (AcquisitionFrameCount 1 ~ 65535), Continuous			
Trigger Selector	AcquisitionStart, AcquisitionEnd, FrameStart			
ExposureMode / Time	<b>ExposureMode</b>		<b>ExposureTime (μs)</b>	
	Timed (FrameStartTrigger Off)		1μs ~ 7998701μs	
	Timed (FrameStartTrigger On)		1μs ~ 7998701μs	
	TriggerWidth		1μs ~ ∞	
<b>Note:</b> Does not include the exposure offset duration (2.47μs).				
ExposureModeOption	Off / RCT			
OptInFilter	0 ~ 40 ms (step: 100ns)			
TriggerOverlap	Off, Readout			
Trigger Input Signals	TTL In x2, Opto In x2, CXP In, Software, Pulse Generator x 4, User Output x 4, NAND 0 Out, NAND 1 Out			
Exposure Auto	Off, Once, Continuous			
ALCControlRatio	1 ~ 100%			
Digital IO	LineSelector (12-pin, 6-pin): GPIO IN / OUT			
Gain Adjustment (Manual)	<b>GainSelector</b>	<b>IndividualGainMode = Off</b>		<b>IndividualGainMode = On</b>
	AnalogAll*	0.0dB ~ 18.1dB (x1.0 ~ x8.0)		0db (x1.0) (Fixed)
	AnalogRed*	-6.6dB ~ 12.0dB (x0.47 ~ x4.0)		0dB ~ 36.1dB (x1.0 ~ x64.0)
	AnalogBlue*	-6.6dB ~ 12.0dB (x0.47 ~ x4.0)		0dB ~ 36.1dB (x1.0 ~ x64.0)
	AnalogGreen*	0db (x1.0) (Fixed)		0dB ~ 36.1dB (x1.0 ~ x64.0)
	DigitalRed	-0.9dB ~ 0.8dB (x0.9 ~ x1.1)		
	DigitalBlue	-0.9dB ~ 0.8dB (x0.9 ~ x1.1)		
*The resolution is set in about 0.1dB steps.				

Item	Specifications												
Gain Adjustment (Automatic)	Off, Once, Continuous												
Black Level Adjustment	All: -133 ~ +255; Red/Blue: -64 ~ +64												
White Balance	Manual: WB Gain: AnalogRed, AnalogBlue (0.47 ~ 4.0, 1step = 0.1dB) Auto: BalanceWhiteAuto: Once, Continuous, Exposure Once, Exposure Continuous, 3200K, 5000K, 6500K, 7500K WB Area : 16 (4x4) WB Range: 3000K~9000K												
Blemish Compensation	<p><b>Detection:</b> Detect white blemishes using threshold values (100 steps available) (black blemish correction performed only at the factory)</p> <p><b>Correction:</b> Interpolation using adjacent pixels. Continuous blemishes can be corrected up to 3 horizontal pixels</p> <p><b>Correctable pixels:</b> 300 pixels</p>												
ALC	Video level adjusted automatically using AGC and ASC												
Gamma	0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0 (9 steps available)												
LUT	OFF: $\gamma = 1.0$ . ON = 257 points can be set												
Power	<table border="1" data-bbox="391 1010 1528 1184"> <tbody> <tr> <td data-bbox="391 1010 651 1087">12-pin</td> <td data-bbox="651 1010 1003 1052">Input Range</td> <td data-bbox="1003 1010 1528 1052">DC10.8 to 26.4 V</td> </tr> <tr> <td data-bbox="391 1052 651 1087"></td> <td data-bbox="651 1052 1003 1087">Consumption*</td> <td data-bbox="1003 1052 1528 1087">8.0W (typ), Max 9.8W</td> </tr> <tr> <td data-bbox="391 1087 651 1129">PoCXP</td> <td data-bbox="651 1087 1003 1129">Consumption*</td> <td data-bbox="1003 1087 1528 1129">8.0W (typ), Max 9.8W</td> </tr> <tr> <td colspan="3" data-bbox="391 1129 1528 1184">*Default Setting/25°C Environment)</td> </tr> </tbody> </table>	12-pin	Input Range	DC10.8 to 26.4 V		Consumption*	8.0W (typ), Max 9.8W	PoCXP	Consumption*	8.0W (typ), Max 9.8W	*Default Setting/25°C Environment)		
12-pin	Input Range	DC10.8 to 26.4 V											
	Consumption*	8.0W (typ), Max 9.8W											
PoCXP	Consumption*	8.0W (typ), Max 9.8W											
*Default Setting/25°C Environment)													
Lens Mount	C-mount												
Back flange distance	17.526mm												
Optical Filter	IR cut filter												
Verified Performance Temperature/Humidity	-5°C ~ +45°C (20 to 80%, non-condensing) <p><b>Note:</b> It may change depending on the installation environment. Please refer to the Caution in this section.</p>												
Storage Temperature/Humidity	-25°C ~ +60°C (20 to 80%, non-condensing)												
Vibration Resistance	3G (20 Hz ~ 200 Hz X-Y-Z direction)												
Shock Resistance	50G												
Regulations	EN55032:2015/A11:2020 Class A, EN55035:2017(CISPR35:2016) Class A, FCC Part15 Subpart B Class A, EU RoHS/WEEE, China RoHS, KC												

Item	Specifications
Dimensions	54mm x 54 mm x 74 mm(Excluding lens mount protrusions and connectors)
Weight	210g

**Notes:**

- Design and specifications are subject to change without notice.
- Approximately 30 minutes of warm-up are required to achieve these specifications.

**Cautions:**

The performance specifications given for this camera have been verified for the Operating Temperature range shown in the Specifications table. The camera may be able to perform outside of the specified temperature range, but such performance has not been verified and is therefore not guaranteed.

- The camera's internal temperature should not exceed 72°C during operation.

If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

**Package Contents**

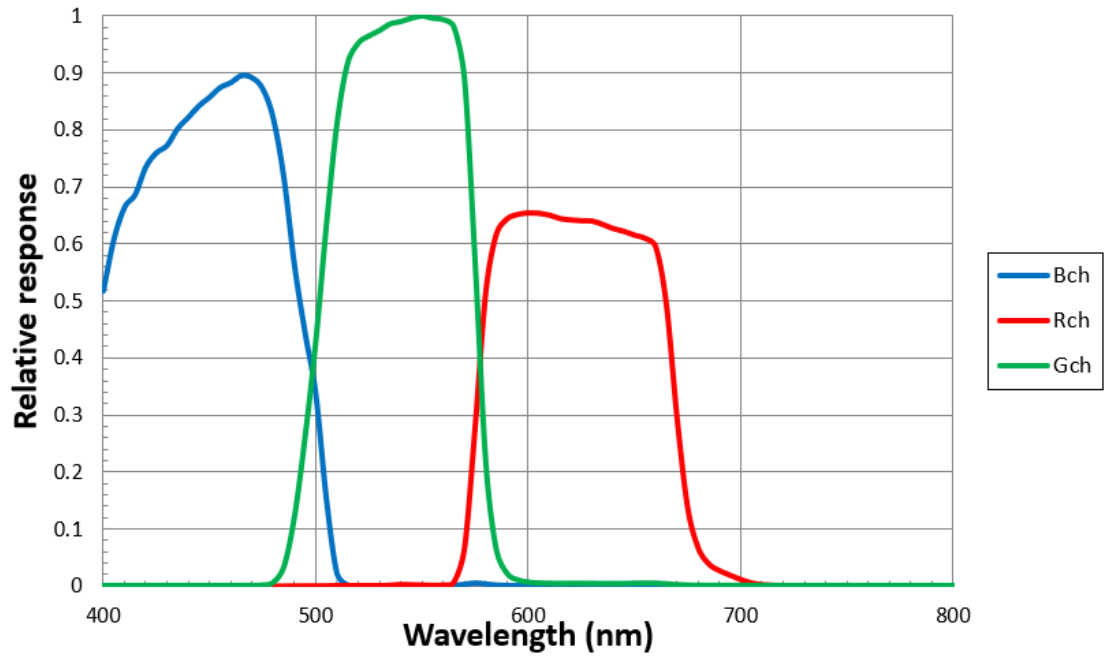
- Camera (1)
- Sensor protection cap (1)
- Dear customer (sheet) (1)

**Optional Accessories (Sold Separately)**

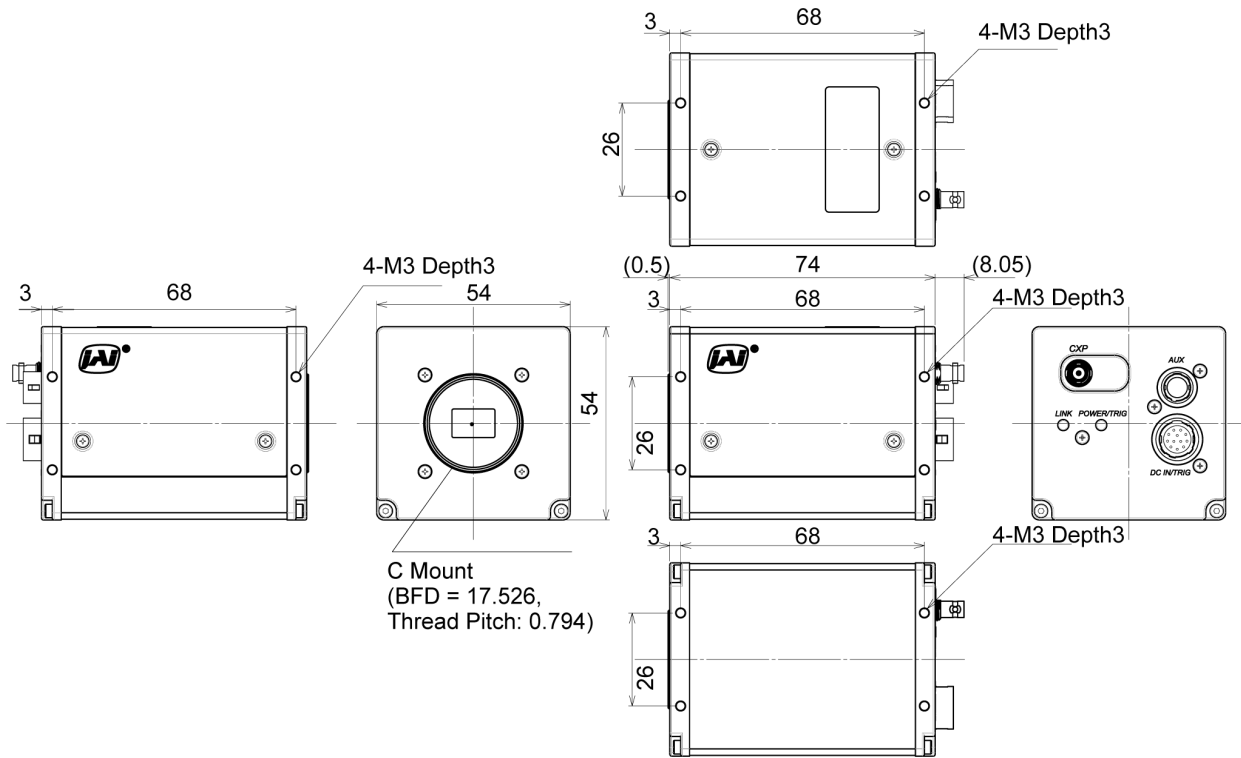
- MP-44 Tripod Adapter Plate

## Spectral Response

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# Dimensions



## Notes:

- Dimensional tolerance:  $\pm 0.3\text{mm}$
- Unit: mm
- BFD = Back flange distance

## Comparison of the Decibel Display and Multiplier Display

Decibels [dB]	Multipliers [X]	Remarks
-6	0.501	
-5	0.562	
-4	0.631	
-3	0.708	
-2	0.794	
-1	0.891	
0	1	
1	1.122	
2	1.259	
3	1.413	
4	1.585	
5	1.778	
6	1.995	
7	2.239	
8	2.512	
9	2.818	
10	3.162	
11	3.548	
12	3.981	
13	4.467	
14	5.012	
15	5.623	
16	6.31	
17	7.079	
18	7.943	
19	8.913	
20	10	
21	11.22	
22	12.589	
23	14.125	
24	15.849	
25	17.783	
26	19.953	
27	22.387	
28	25.119	
29	28.184	
30	31.623	
31	35.481	

Decibels [dB]	Multipliers [X]	Remarks
32	39.811	
33	44.668	
34	50.119	
35	56.234	
36	63.096	
37	70.795	
38	79.433	
39	89.125	
40	100	
41	112.202	
42	125.893	

## User's Record

---

Model name: .....

Revision: .....

Serial No: .....

Firmware version: .....

For camera revision history, please contact your local JAI distributor.

# Appendix

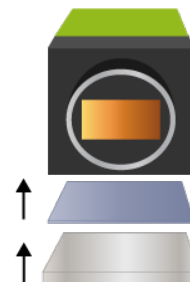
This section provides information about the thermal management of this camera.

## Recommended Passive Cooling Method

If the camera's internal temperature exceeds the allowed maximum temperature (72 °C), JAI recommends attaching a thermal pad to the camera and placing a metal plate beneath it to improve heat dissipation.

### Notes:

- Depending on the installation environment, the thermal pad and metal plate may be attached to the top, bottom, or side of the camera. However, for this camera, attaching them to the bottom surface provides the most effective heat dissipation.
- You can monitor the camera's internal temperature by DeviceTemperature ([DeviceControl](#)).



# Revision History

Revision	Date	Device Version	Changes
1.1	2026/02/19	DV0100	Corrected " <u>1. Calculate the H Period</u> ".
1.0	2026/02/09	DV0100	First release

## Trademarks

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*See the possibilities*