See the possibilities

User Manual

Apex Series - 3 CMOS Prism-Based Camera

AP-5100T-5GE

CMOS Digital Progressive Scan Prism-Based RGB Camera

Document Version: 1.1

Date: 2026-05-07

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.

Table of Contents

About Technical Note

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

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.

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Warranty

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

Certifications

CE Compliance

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-5GE complies with the following provisions applying to their standards.

EMI: EN55032:2015 / A11:2020 Class B

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

FCC

This equipment has been tested and found to comply with the limits for a Class B 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

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

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-5GE	×	○	○	○	○	○

○: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。

×: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。

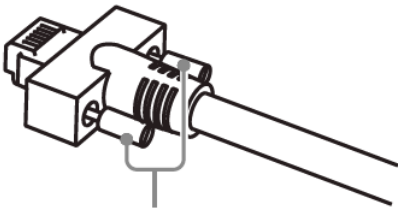
Usage Precautions

Notes on Cable Configurations

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 LAN Cable Connection

Secure the locking screws on the connector manually, and do not use a driver. Do not secure the screws too tightly. Doing so may wear down the screw threads on the camera. (Tightening torque: 0.147 Nm or less)



Caution: Secure manually. Do not secure too tightly.

Notes on Attaching the Lens

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

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

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

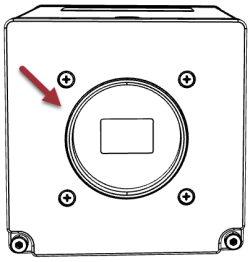
- Global shutter 1/1.8" 3 CMOS image sensor with backside illuminated pixel technology.
- Readout pixels: 2464 x 2056
- Pixel size: 2.74μm x 2.74μm
- Max frame rate (full ROI): 34 fps
- 8/10/12-bit output.
- Flexible ROI; rescaling function; traditional 1x2, 2x1, 2x2 binning; horizontal/vertical image 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.
- 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.

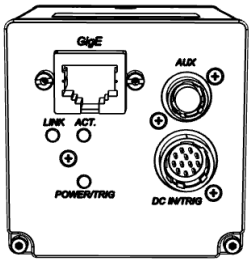


- Back flange distance: 17.526 mm
- Thread pitch: 0.79375mm (32TPI)

> **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

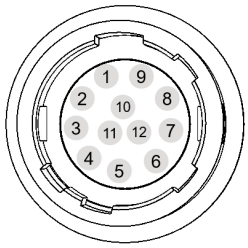
This section displays the pin assignments for each connector.



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.



Camera Side :
HR10A-10R-12PB (71)
(12-pin, Male)
Cable Side: HR10A-10P-12S

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:

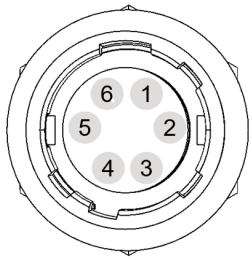
- The pin assignment of this camera is different from other JAI cameras.
- See Recommended Circuit Diagram (Reference Examples) for the recommended circuit diagram.

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.

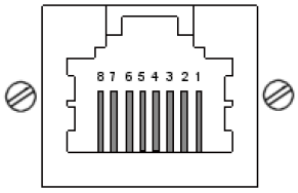


Camera side: HR10A-7R-6SB
(6-pin, Female)
Cable side: HR10A-7P-6P (77)

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	

RJ-45 Connector

Connect a Gigabit Ethernet compatible LAN cable (Category 5e or higher, Category 6 recommended) here.

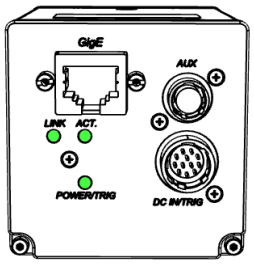


GigE Vision Interface

Pin	8	7	6	5	4	3	2	1
Signal	TRD-(3)	TRD+(3)	TRD-(1)	TRD-(2)	TRD+(2)	TRD+(1)	TRD-(0)	TRD+(0)

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. **Note:** 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).
	Blinking green (slow)	1000BASE-T link is established. (Interval 1sec)
	Blinking green (fast)	2.5GBASE-T or 5GBASE-T link is established. (Interval 200ms)

ACT

Light		Status
	Off	Communication is not active.
	Blinking amber	Communication is active.

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

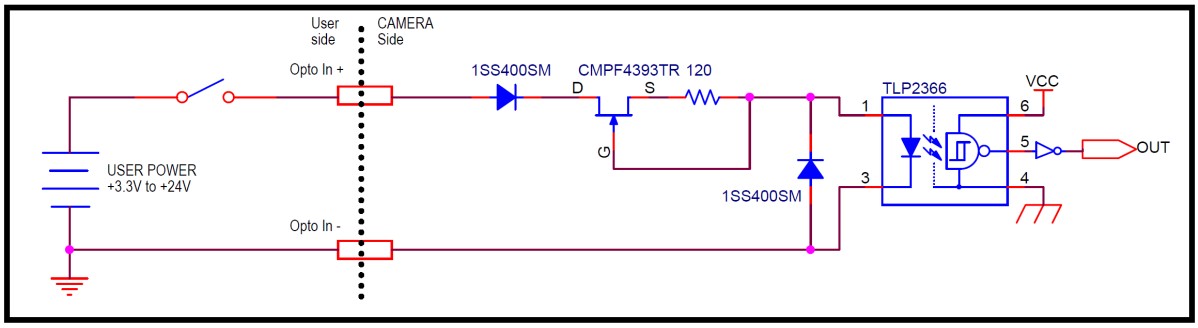
> **Note:** For the position of the mounting holes, see “Dimensions”.

Recommended Circuit Diagram (Reference Examples)

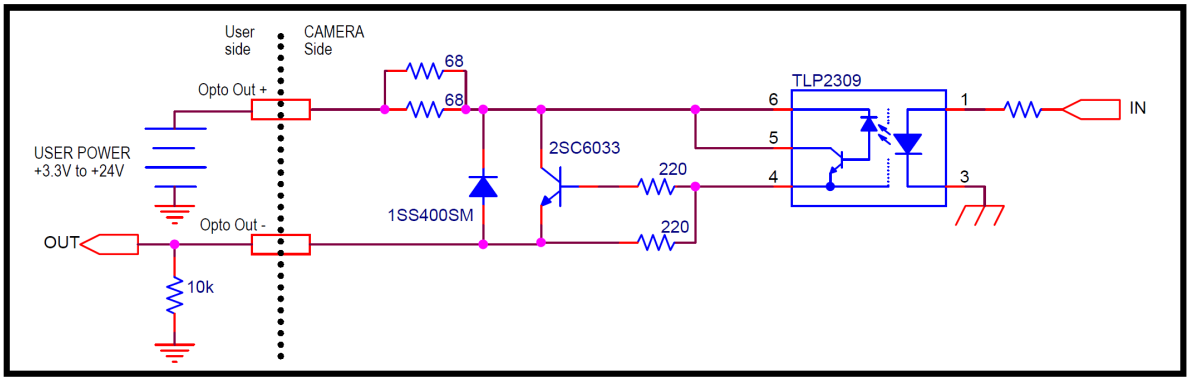
Related Setting Items: DigitalIOControl

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.

1	**Step 1: Install the Software (First Time Only)** Install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.
2	**Step 2: Connect Devices** Connect the lens, cables, computer, and other devices.
3	**Step 3: Verifying Camera Operation** Verify whether the camera is turned on and ready for use.
4	**Step 4: Verifying the Connection between the Camera and PC** Verify whether the camera is properly recognized via Control Tool.
5	**Step 5: Configure Trigger, Exposure, and Frame Rate Settings** Refer to the setting examples to configure the trigger, exposure, and line rate settings.
6	**Step 6: Adjusting the Image Quality** Refer to the procedures for adjusting image quality.
7	**Step 7: Saving the Settings** Save the current setting configurations in user memory.

Step 1: Install the Software (First Time Only)

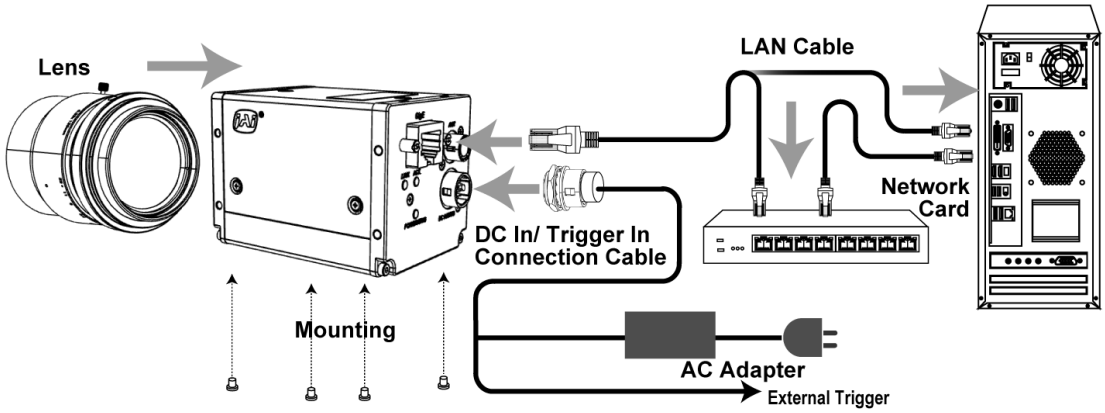
When using the camera for the first time, install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.

Notes:

- When you install eBUS SDK for JAI, eBUS Player for JAI will also be installed.
- For the operating system (OS) requirements for eBUS SDK for JAI, see the JAI Camera Software page (https://www.jai.com/support-software/jai-software) or eBUS Player User Guide.

1. Download the eBUS SDK for JAI from the JAI website (https://www.jai.com/support-software/jai-software).
2. Install eBUS SDK for JAI on the computer.

Step 2: Connect Devices



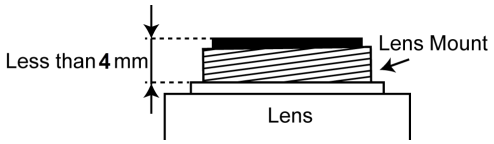
Lens
Mounting
DC IN / Trigger IN Connection Cable
AC Adapter (Power Supply)
LAN Cable
Network Card

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)

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

LAN Cable

Connect a LAN cable to the RJ-45 connector.

> **Note:** The AP-5100T-5GE model does not support the PoE function.

> **Caution:** See the Notes on LAN Cable Connection topic as well.

The camera supports the following Ethernet standards: 1000BASE-T, 2.5GBASE-T, 5GBASE-T.

- Use a LAN cable that is Category 5e or higher (Category 6 recommended).
- Refer to the specifications of the cable for details on its bend radius.

- LAN cable types, Ethernet standards, and maximum cable lengths are listed in the table below.

	Cat5e	Cat6 / Cat6e	Cat6A	Cat7
1000Base-T	100m	100m	100m	100m
2.5GBase-T	100m	100m	100m	100m
5GBase-T	100m	100m	100m	100m

Network Card

Install this on the computer that will be used to configure and operate the camera. As the camera supports PoE, you can also use PoE-compatible network cards. Refer to the instruction manual of the network card and configure settings on the computer as necessary.

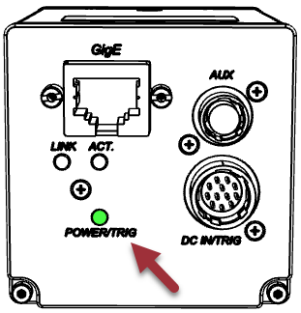
Cautions: If the network adapter driver settings are not optimized, packet delays or loss may occur, resulting in unstable communication. Modify the network adapter driver settings as shown below. The following example shows the settings for the ASUS XG-C100; similar setting items are available for network adapters from other manufacturers.

- Interrupt Moderation Rate: **Extreme**
- Jumbo Packet: **16348 Bytes**
- Receive Buffers: **4096**
- Transmit Buffers: **8184**

Step 3: 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.

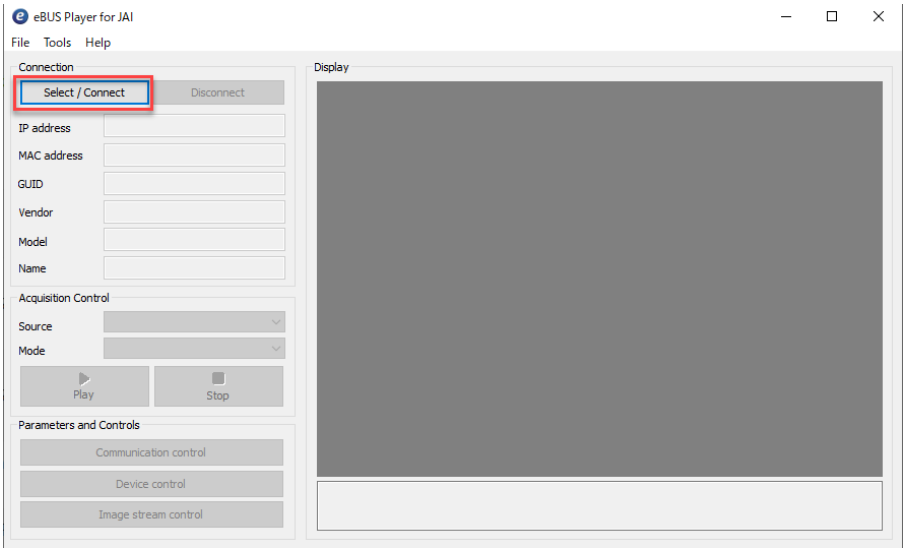
Step 4: Verifying the Connection between the Camera and PC

Verify whether the camera is properly recognized eBUS Player for JAI.

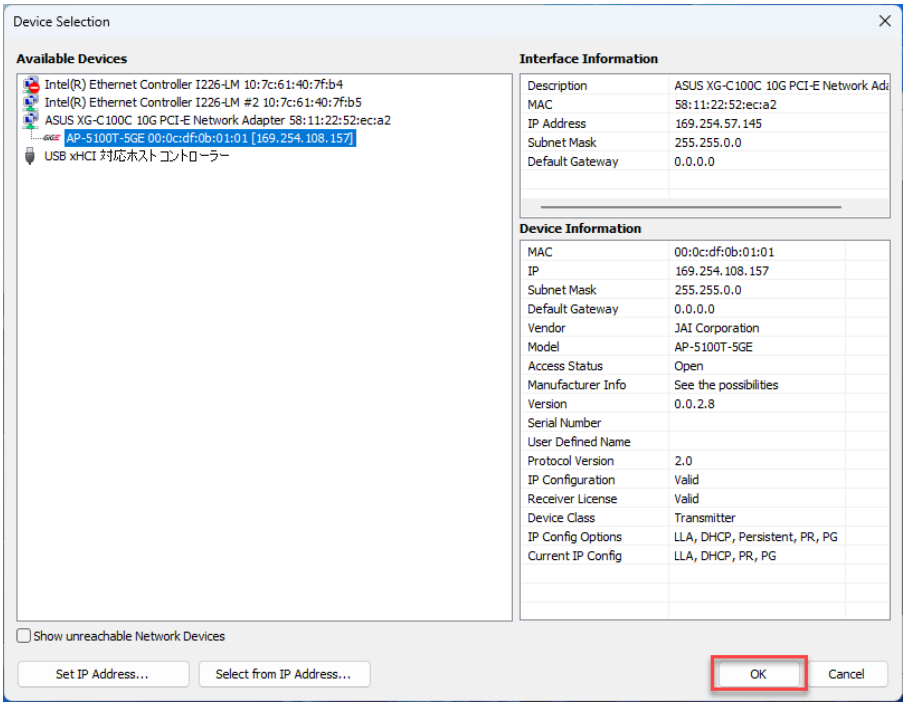
1. Launch eBUS Player for JAI.

   eBUS Player for JAI startup screen appears.

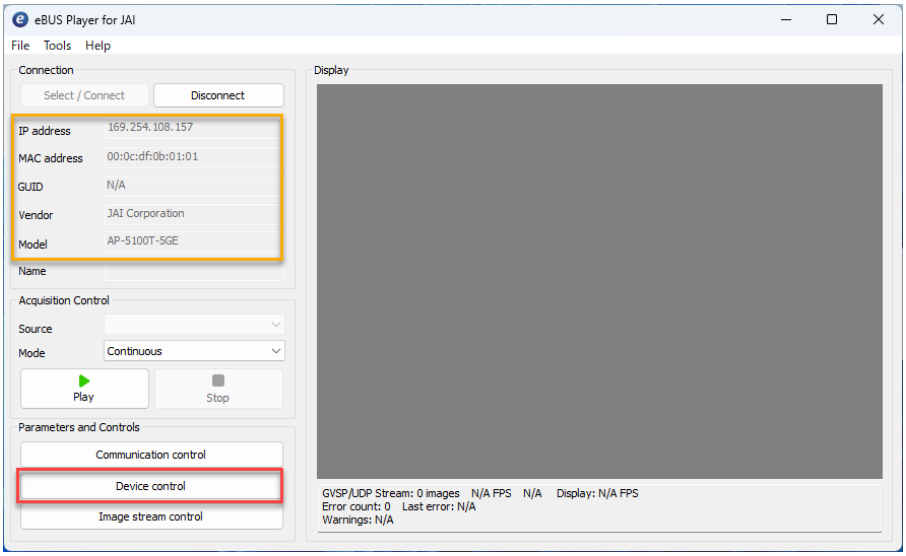
2. Click the **Select / Connect** button.



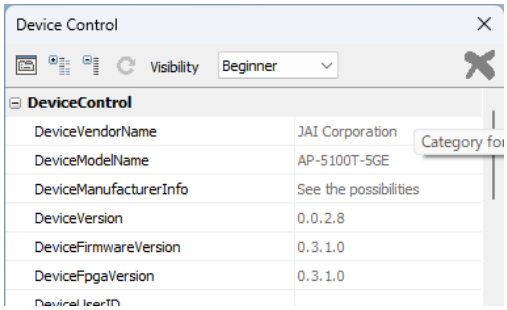
3. The connected camera is listed. Please select one camera and click **OK**.



4. Check that the settings of the selected camera are displayed.



5. Click the **Device control** button. The DeviceControl window will be displayed. In this window, you can adjust various settings of the camera.



6. This completes the procedure for verifying whether the camera is properly recognized and whether control and settings configuration are possible.

Step 5: Configure Trigger, Exposure, and Frame Rate Settings

> **Related Setting Items:** AcquisitionControl

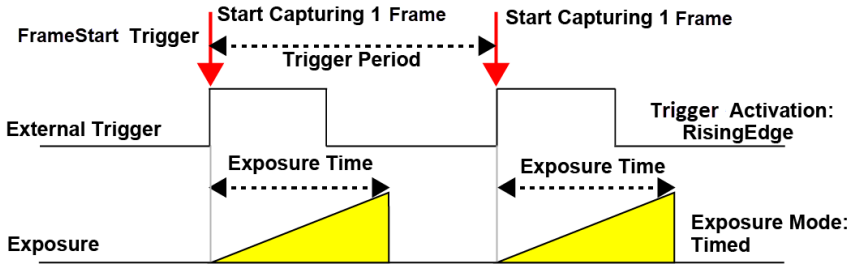
This section describes scenarios for controlling the trigger, exposure, and frame rate.

> **Note:** This section is intended to explain the basic relationship between the trigger, exposure, and frame rate.

Trigger Mode	Exposure Mode	Setting Example
On	Timed	Control via External Triggers with the Specified Exposure Time
	TriggerWidth	Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal
Off	Timed	Control without External Triggers with the Specified Exposure Time
	Off	Control without External Triggers without Specifying the Exposure Time

Control via External Triggers with the Specified Exposure Time

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



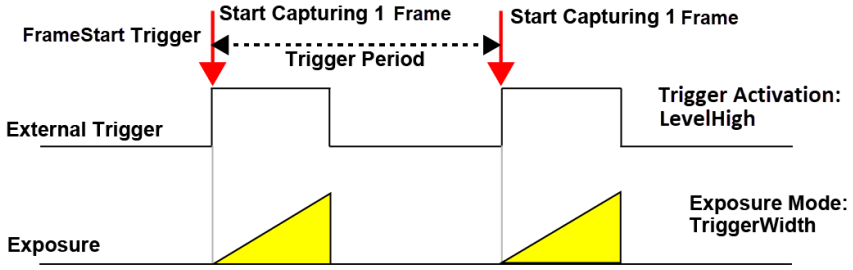
Notes:

- 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**.

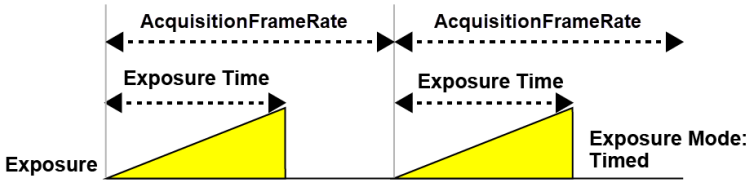


Notes:

- 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

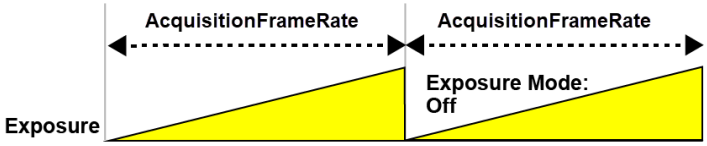


Notes:

- 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 6: Adjusting the Image Quality

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.

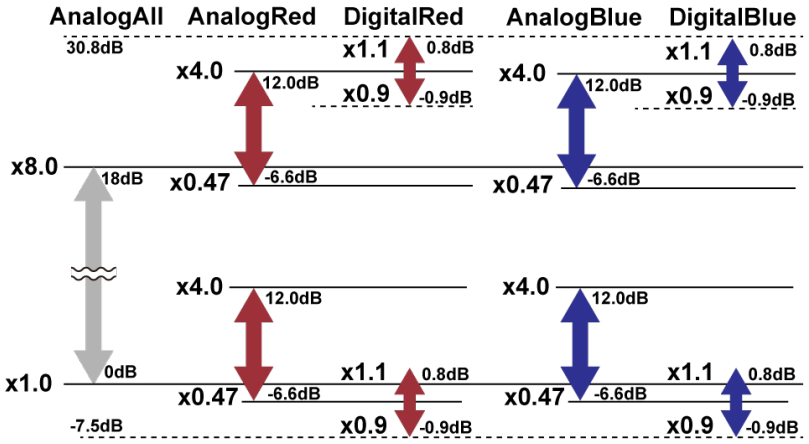
There are two gain control modes: **Master Mode (IndividualGainMode = Off)**, where you adjust the master gain and fine-tune with R and B, and **Individual Mode (IndividualGainMode = On)**, which allows separate gain adjustment for each RGB channel.

> **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 "GainAuto" and "ALC (Automatic Level Control) Function" topics.

Master Mode (IndividualGainMode = Off)

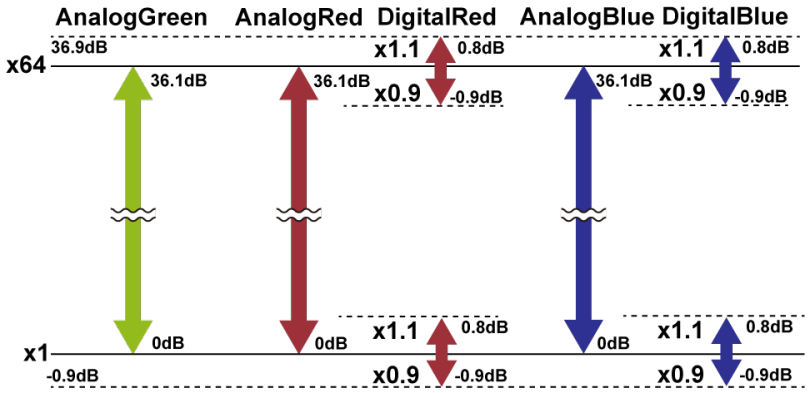
1. Set **IndividualGainMode** to **Off**.
2. Select the **Gain** to configure from **GainSelector**. First, perform the overall gain adjustment using **AnalogAll**. Then, fine-tune the gain by adjusting the **AnalogRed**, **DigitalRed**, **AnalogBlue** and **DigitalBlue** settings.

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.

     > **Note:** This item is enabled only when **ExposureTimeMode** is set to **Individual**.

   - **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.

     > **Note:** This item is enabled only when **ExposureTimeMode** is set to **Individual**.

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. **BalanceWhiteAuto** returns to **Off**.
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 (AcquisitionControl) not executed. - TestPattern (ImageFormatControl) set to a value other than Off. - No valid metering area ([AWBAreaSelector]) - AcquisitionMode (AcquisitionControl) set to Single / MultiFrame - Sequencer Mode active (SequencerControl) - MultiROI Modeactive (MultiROIControl) - IndividualGainMode (AnalogControl) 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:

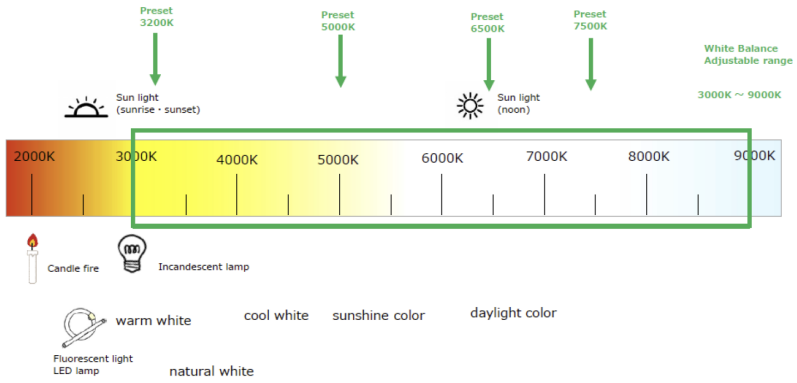
- When **Continuous** or **ExposureContinuous** is selected, automatic adjustment will not execute under the following conditions. However, the adjustment will not be terminated, and automatic adjustment will start or resume once the condition is cleared.

  - 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.

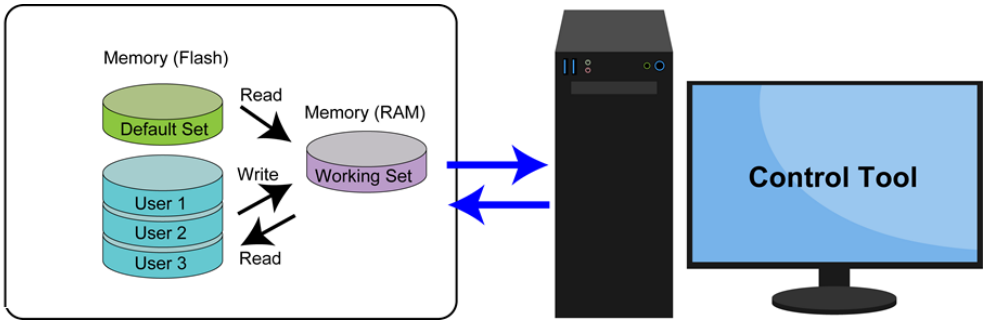
1. Select the black level you want to configure in **BlackLevelSelector**. **All** (master black), **Red**, and **Blue** can be configured.
2. Specify the adjustment value in BlackLevel (Default: 0). The available setting range for each option is as follows.

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

Step 7: 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

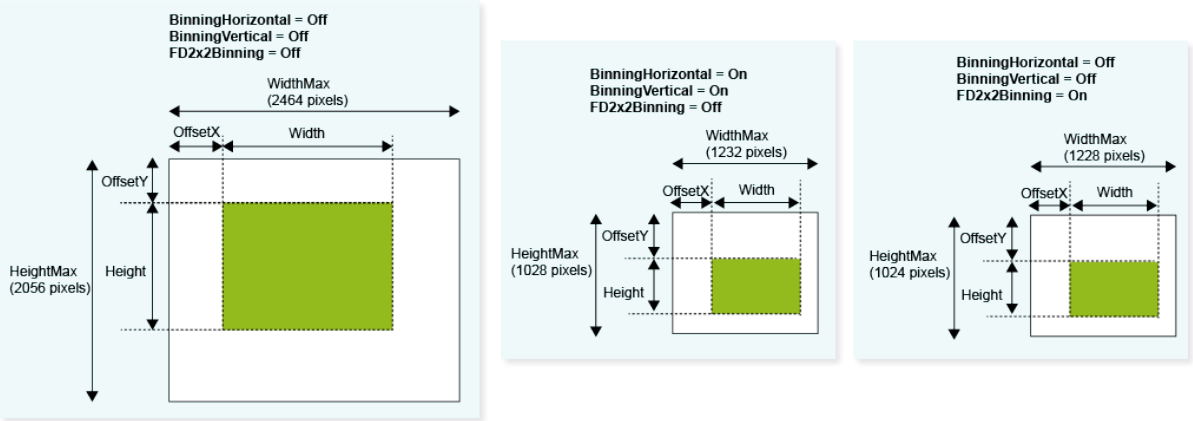
The ROI (region of interest) function allows you to output images by specifying the areas to scan. Specify the area to scan by specifying width, height, and horizontal/vertical offset values under ImageFormatControl. You can increase the frame rate by specifying a lower height, as the number of lines 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.
> - When using this function with FD2x2BinningMode (Binning Function), the **Width** and **Height** settings must be set to their maximum values (WidthMax, HeightMax). Then, configure the ROI settings as needed.
> - Refer to Functions That Cannot Be Used Together for usage restrictions.
> - Use "Multi ROI Function" when outputting image by specifying multiple areas.

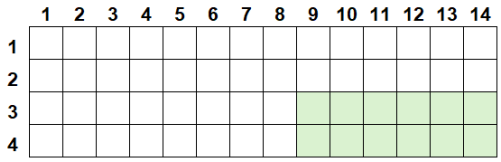
The setting ranges for the ROI function's readable area based on the Binning setting (BinningHorizontal, BinningVertical, FD2x2BinningMode) are as follows.

	HorizontalBinning = 1 VerticalBinning = 1 FD2x2Binning = Off	**HorizontalBinning = 2 VerticalBinning = 2 FD2x2Binning = Off**	**HorizontalBinning = 1 VerticalBinning = 1 FD2x2Binning = On**
Width	96 ~ 2464, step: 8	48 ~ 1232, step: 4	96 ~ 1228, step: 4
Height	8 ~ 2056, step: 2	4 ~ 1028, step: 1	8 ~ 1024, step: 1
OffsetX	0 ~ 2368, step: 8	0 ~ 1184, step: 4	0 ~ 1180, step: 4
OffsetY	0 ~ 2048, step: 2	0 ~ 1024, step: 1	0 ~ 1020, step: 1
BinningHorizontal / BinningVertical and FD2x2BinningMode cannot be used together.			

Examples



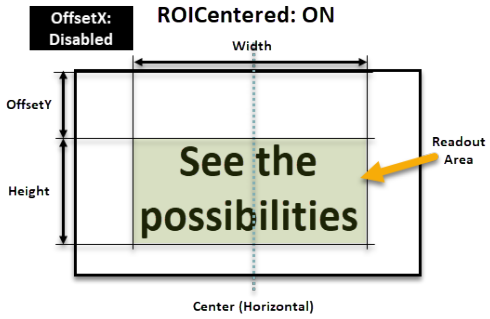
For example, when **OffsetX** is set to **8** and **OffsetY** is set to **2**, the first readout pixel is the ninth pixel on line 3.



ROICentered

> **Related Setting Items:** ImageFormatControl

When **ROICentered** 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: 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.

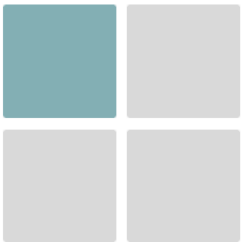
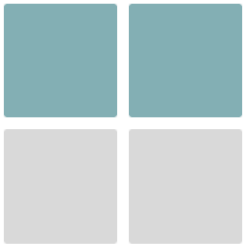
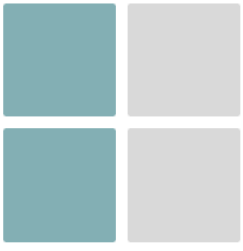
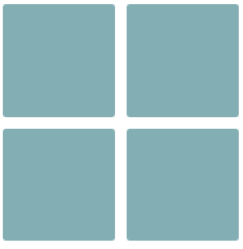
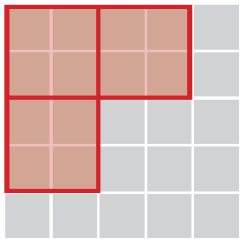
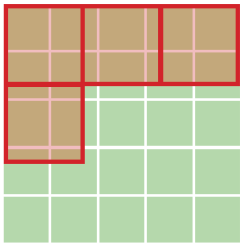
	Binning off	2 x 1	1 x 2	2 x 2
				
FD2x2BinningMode	OFF	N/A	N/A	ON
BinningHorizontal	1	2	1	2
Binning Vertical	1	1	2	2

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

1. 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 ÷ 3.45 = 0.79).

2. 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 ÷ 0.79 = 1843. Since ROI Width has a step of 8, the setting value becomes "1840."
Height	1376	1088 ÷ 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 ÷ 1840 = 0.791304
ImageScalingVertical	0.790697	1088 ÷ 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.

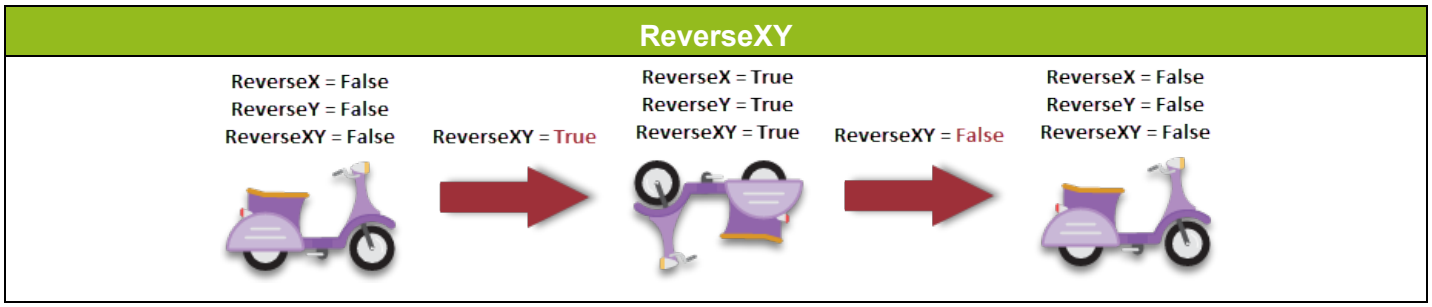
ReverseX	ReverseY
	

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, RGB10V1Packed, RGB10p32, RGB12V1Packed

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:

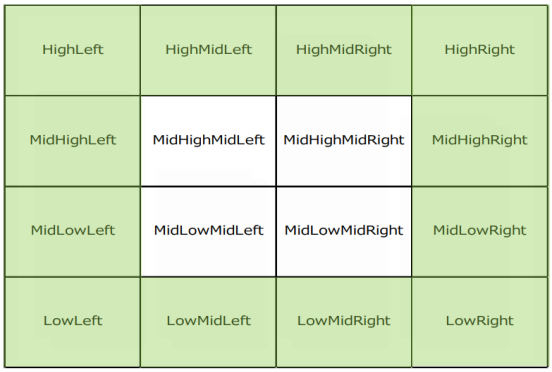
- To set Overlay Mode to **MultRoiAreaMode**, MultiRoiMode (MultiROIControl) must be set to **Off** in advance.
- In the following scenario, OverlayMode = MultiRoiMode will be disabled (you can still set to ALCAreaMode or AWBAreaMode): ImageScalingMode = On, BinningHorizontal = 2, BinningVertical = 2,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



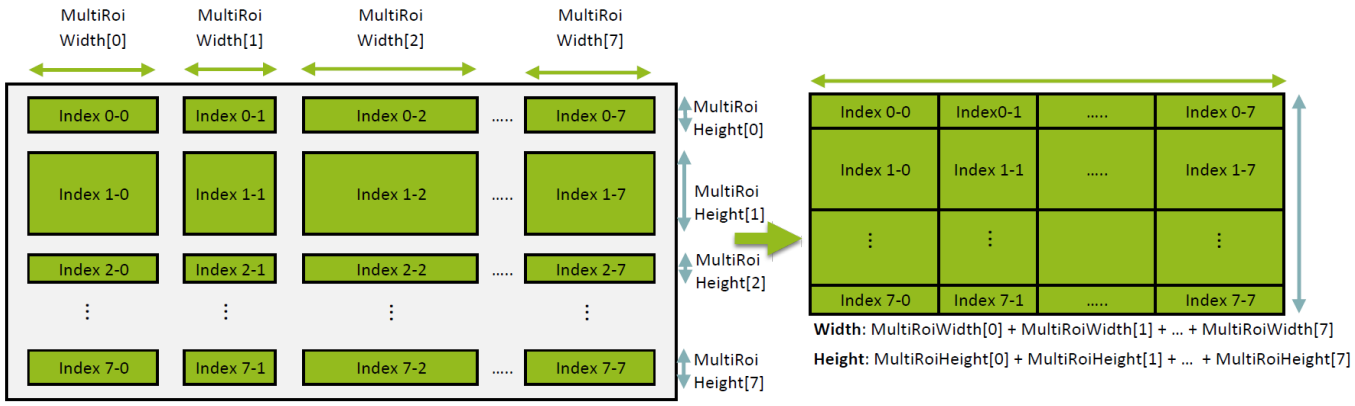
Multi ROI Function

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.

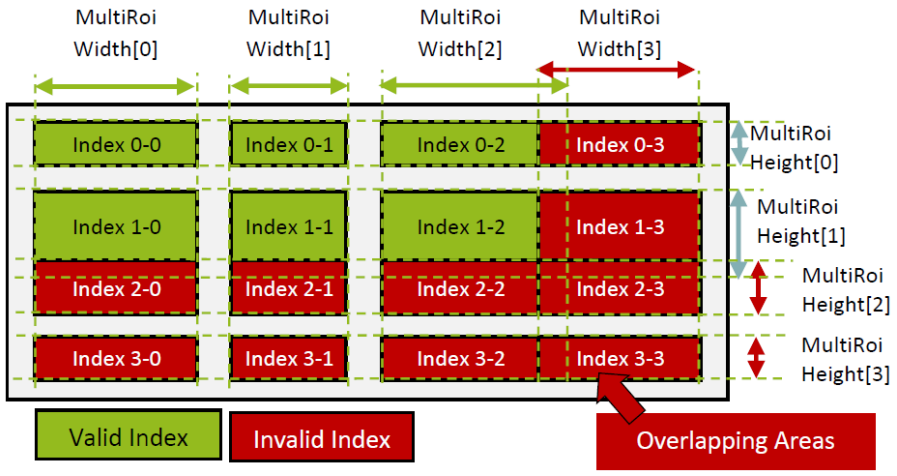
In Multi ROI mode, you can specify up to 64 scanning areas for a single-frame image. By skipping areas that are not specified as regions of interest when scanning a frame, the ROI function outputs the specified regions in a combined state. You can increase the frame rate due to the reduced scanning time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



How to Configure

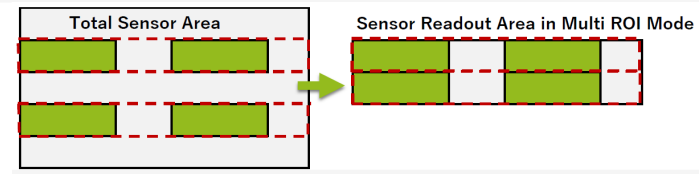
1. Set **MultiRoiMode (MultiROIControl)** to **On**.
2. Select from the eight indexes in MultiRoiIndex then set **MultiRoiWidth**, **MultiRoiHeight, MultiRoiOffsetX**, and **MultiRoiOffsetY**.
3. Set the maximum index number to be enabled to **MultiRoiVerticalEnableNumber** and **MultiRoiHorizontalEnableNumber**.

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.

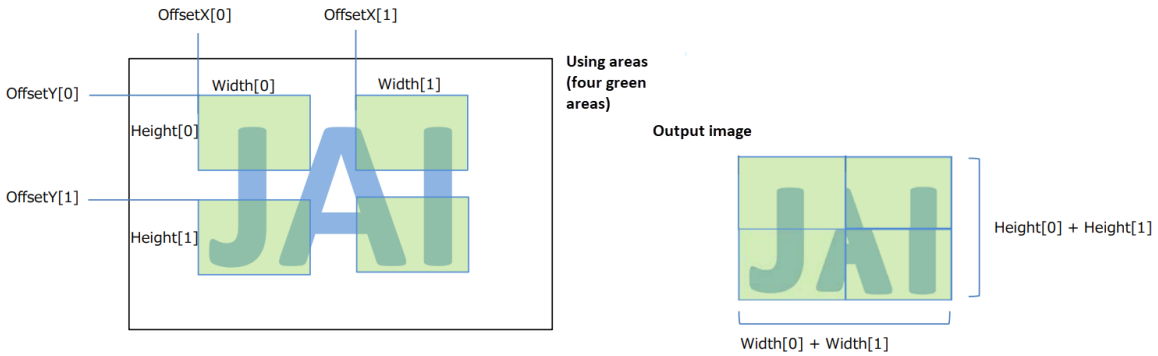


- In the horizontal direction, the configuration for the second and subsequent rows will be identical. In the vertical direction, the configuration for the second and subsequent columns will be identical.

Configuration Example

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

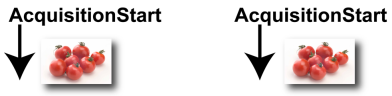
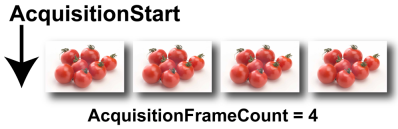
1. Set MultiROIControl-**>MultiRoiMode On**.
2. Select “0” in MultiRoiIndex. Set MultiRoiWidth, MultiRoiHeight, MultiRoiOffsetX and MultiRoiOffsetY.
3. Select “1” in MultiRoiIndex. Set MultiRoiWidth, MultiRoiHeight, MultiRoiOffsetX and MultiRoiOffsetY.
4. Set 2 to MultiRoiVerticalEnableNumber.
5. Set 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 **AcquisitionStart** command is executed, one frame of image is captured.	
MultiFrame	When the **AcquisitionStart** command is executed, the number of frames set in AcquisitonFrameCount are acquired as images.	
Continuous	When the **AcquisitionStart** 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	Control without External Triggers without Specifying the Exposure Time
Off	Off	Control without External Triggers with the Specified Exposure Time

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. GevSCPD = 0 (default)
  2. DeviceLinkSpeed = 625000000 (5Gbps)
  3. GevGVSPExtendedIDMode = Off (default)
- 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. In addition to frame-rate calculations, the Frame Rate Calculator for this model also provides approximate maximum frame rates when the camera is connected using 2.5GBASE-T or 1000BASE-T link speeds.

1. Calculate the H Period

The H Period value can be calculated from the LineTime[clk] value, which is calculated using the IF_LINETIME, SENSOR_LINETIME, and VIDEO_LINETIME values.

IF_LINETIME, SENSOR_LINETIME, VIDEO_LINETIME

A. **IF_LINETIME**

First calculate SendTime from the Payload, PacketNum and Overhead values, then calculate IF_Hperiod from SendTime, and finally calculate IF_LINETIME from IF_Hperiod.

1. Calculate **Payload[Byte]**.

   Payload[Byte] = Width(*1) x Height(*1) x (PixelSize / 8)

   Width (*1) and Height (*1): When using a Binning Function (FD2x2BinningMode, BinningHorizontal/Vertical) or Image Scaling Mode (Xscale), enter the Width and Height values **"after"** configuring the settings.

PixelSize value: Select the value from below based on your Pixel Format setting.

- RGB8: **24**
- RGB10V1Packed, RGB10p32: **32**
- RGB12V1Packet: **36**

2. Calculate **PacketNum** from the Payload value.

   PacketNum = Roundup(Payload[Byte] / (GevSCPSPacketSize - 36), 0)

3. Calculate **Overhead[Byte]** from the PacketNum value.

   Overhead[Byte] = 44 + (74 x (PacketNum + 2))

4. Calculate **SendTime[us]** from the Payload, PacketNum, and Overhead values.

   SendTime[us] = Rounddown((((Payload[Byte] + Overhead[Byte]) x 1000 / 575[MB]) + (PacketNum x 32)) / 1000, 0)

5. Calculate **IF_Hperiod[us]** from the SendTime value.

   IF_Hperiod[us] = SendTime[us] / (Height(*1) + 1)

   Height(*1): Enter the following value when using the Binning Function or Image Scaling Mode (Xscale).

   - When **BinningVertical** is set to **2** or **ImageScalingMode** is set to **On**, enter the Height value **"before"** configuring the Binning or Image Scaling Mode settings.
   - When **FD2x2BinningMode** is turned **On**, enter the Height value **"after"** configuring the FD2x2Binning or Decimation Mode settings.

6. Calculate IF_LINETIME[clk] from the **IF_Hperiod** value.

   IF_LINETIME[clk] = Rounddown(IF_Hperiod[us] x 74.25[MHz] + 1, 0)

B. **SENSOR_LINETIME[clk]**

SENSOR_LINETIME[clk] = HMAX

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

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

C. **VIDEO_LINETIME[clk]**

Width(*1): Enter the following value when using a Binning Function or Image Scaling Mode (Xscale).

- When **BinningHorizontal** is set to **2** or **ImageScalingMode** is set to **On**.

  VIDEO_LINETIME[clk] = Ceiling(((Width(*1) / 2) + 8) / 250.0 x 74.25, 1)

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

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

  VIDEO_LINETIME[clk] = Ceiling(((Width(*1) / 2) + 4) / 250.0 x 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.

LineTime[clk] = MAX(IF_LINETIME, SENSOR_LINETIME, VIDEO_LINETIME)

H Period

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

H Period[µs] = LineTime[clk] / 74.25[MHz]

2. Calculate the Minimum Frame Period

Next, calculate the Minimum Frame Period.

Minimum Frame Period[µs] = H Period[µs] x (Height(*2) + 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)

Maximum Acquisition Frame Rate[Hz] = 1000000 / Minimum Frame Period[µs]

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

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

   MaxOverlapTime_TrOIrd[µs]
   = Minimum Frame Period[µs] - (Non-ExposurePeriod[H] x H Period[µs])

   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 ≦ MaxOverlapTime_TrOIrd[µs]**

   Maximum Trigger Rate[Hz] = Maximum Acquisition Frame Rate[Hz]

   B. **When ExposureTime > MaxOverlapTime_TrOIrd[µs]**

      1. First, calculate the Non-OverlapExposureTime_TrOIrd[µs] value.

         Non-OverlapExposureTime_TrOIrd[µs]
         = ExposureTime - MaxOverlapTime_TrOIrd[µs]

      2. Finally, calculate the Maximum Trigger Rate.

         Maximum Trigger Rate[Hz]
         = 1000000 / (Minimum Frame Period[µs] + Non-OverlapExposureTime_TrOIrd[µs])

Trigger Control

> **Related Setting Items:** AcquisitionControl

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

<table>
<tr><th>TriggerSelector</th><th>Description</th></tr>
<tr><td>AcquisitionStart</td><td>Start image acquisition in response to the external trigger signal input.</td></tr>
<tr><td>AcquisitionEnd</td><td>Stop image acquisition in response to the external trigger signal input.</td></tr>
<tr><td>FrameStart</td><td>Start capturing a one-frame image in response to the external trigger signal input.

Notes:
• The FrameStart Trigger can only be used when the Exposure Mode setting is set to Timed or TriggerWidth.
• For more information, see "FrameStart Trigger".</td></tr>
<tr><td>AcquisitionTransferStart</td><td>Output acquired images at a specified timing in response to an external trigger signal input. For more information, see "FrameStart Trigger and AcquisitionTransferStart Trigger".

Note: There is a limit to the number of image frames that can be stored internally.

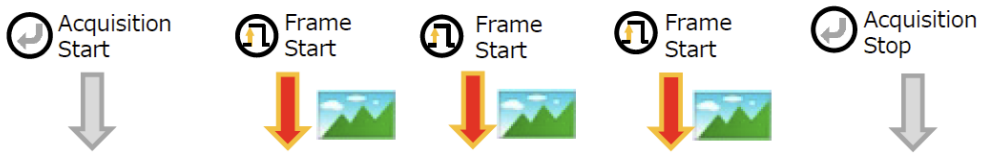
<table><tr><th>PixelFormat</th><th>Number of Frames That Can Be Acquired</th></tr><tr><td>RGB8</td><td>8</td></tr><tr><td>RGB10p32</td><td>6</td></tr><tr><td>RGB10V1Packed</td><td>6</td></tr><tr><td>RGB12V1Packed</td><td>5</td></tr></table></td></tr>
</table>

Notes:

- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in Step 5: 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

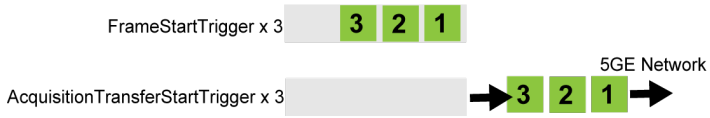
When **AcquisitionStart** has been executed, a single frame is captured each time a **FrameStart trigger** is received, until the **AcquisitionStop** command is executed.



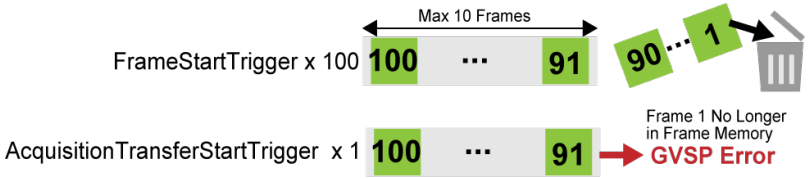
> **Note:** For the configurable source signals of the trigger, refer to **TriggerSource** (AcquisitionControl).

FrameStart Trigger and AcquisitionTransferStart Trigger

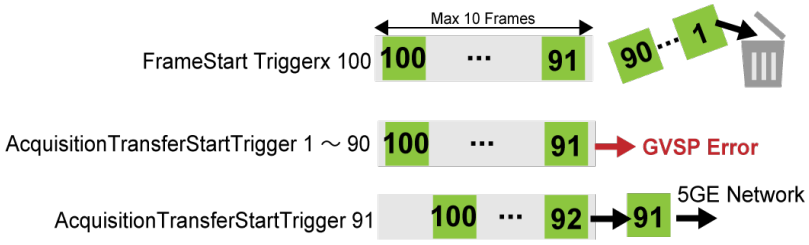
On this camera, when **AcquisitionTransferStart** is **On**, the camera expects that the number of **AcquisitionTransferStart** trigger inputs is the same as the number of **FrameStart** trigger inputs. Otherwise, a GVSP error may occur.



For example, if the FrameStart trigger is issued 100 times but the AcquisitionTransferStart trigger is issued only once, the camera attempts to send the first frame, but a GVSP Error will be sent instead because the first frame is already discarded. The below shows an example of when the camera can hold up to 10 frames in the frame memory.



To output an image, the AcquisitionTransferStart trigger must be issued continuously until it reaches the number of frames in the frame memory. For example, if 10 frames remain in the frame memory, the AcquisitionTransferStart trigger must be issued 90 more times to output the image.



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.	Control without External Triggers without Specifying the Exposure Time
Timed	Mode in which control is performed using ExposureTime. Acquire images using an exposure time configured beforehand on an external trigger.	Control via External Triggers with the Specified Exposure Time
		Control without External Triggers with the Specified Exposure Time
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.	Control via External Triggers with Exposure Time Controlled by the Pulse Width of the Trigger Input Signal

Notes:

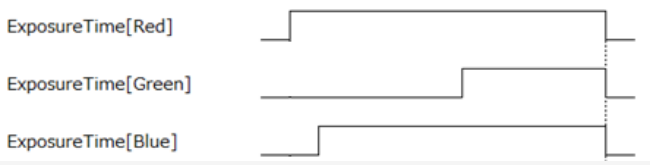
- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in Step 5: Configure Trigger, Exposure, and Frame Rate Settings.
- When exposed to strong light, the accumulation time may appear to shift due to PLS (Parasitic Light Sensitivity) and other effects.
- When set to Timed or TriggerWidth, the actual exposure time is the set exposure time plus the exposure offset time (2.47µs). For more information, see "Actual Exposure Time".

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	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. **Note**: 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). 

Actual Exposure Time

> **Related Setting Items:** AcquisitionControl

The actual exposure time will consist of the image sensor's offset duration (2.47µs) 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 0.1µs, and the maximum Exposure setting depends on other settings (see Exposure Mode on "Specifications").

ExposureMode = Timed

When **ExposureTime** is set to **1µs**, the actual exposure time will be as follows.

- 1µ+ 2.47µs (Image sensor's offset duration) = 3.47µs

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 3.47µs, set the width of the Trigger Signal to the camera to 1µ (= 3.47 - 1µs).

> **Note:** On this camera, the pulse width of the ExposureActive Signal includes the Exposure offset duration (2.47µs). Therefore, "ExposureActive signal's pulse width = *ExposureTime* value (µs) + 2.47µs."

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.

ExposureAuto

This function allows the exposure to be adjusted automatically.

Option	Description
Off	Exposure is not adjusted automatically. Refer to "Exposure Mode" and configure the Exposure settings manually.
Once	Performs automatic exposure adjustment once. After the adjustment is completed, the ExposureAuto setting returns to **Off**.
Continuous	Performs continuous automatic exposure adjustment. In addition, the ALC (Automatic Level Control) Function can be used to fine-tune the automatic adjustment settings.

> **Note**: Under the following conditions, automatic adjustment will not operate (an error message "**Error1 - could not processing**" is displayed in **AutoControlStatus** (AutoLevelControl). Operation will resume once the conditions are cleared.
>
> - When no image is being output
> - When **AcquisitionMode** is set to anything other than **Continuous** (AcquisitionControl)
> - Continuous only: When **TestPattern** is set to anything other than **Off** (ImageFormatControl)
> - Continuous only: When **OverlayMode** is set to **MultiRoiAreaMode** (ImageFormatControl)
> - Continuous only: During SequencerMode (SequencerControl)
> - During MultiRoiMode (MultiROIControl)
> - Continuous only: When **ExposureMode** = **Off** and **TriggerWidth** is enabled

Timing Chart

> **Related Setting Items:** AcquisitionControl

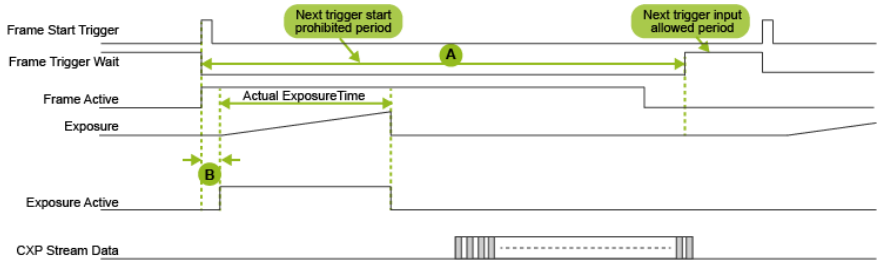
This section shows the timing charts under the following conditions on each model when FrameStartTriger is set to **On**.

- 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).

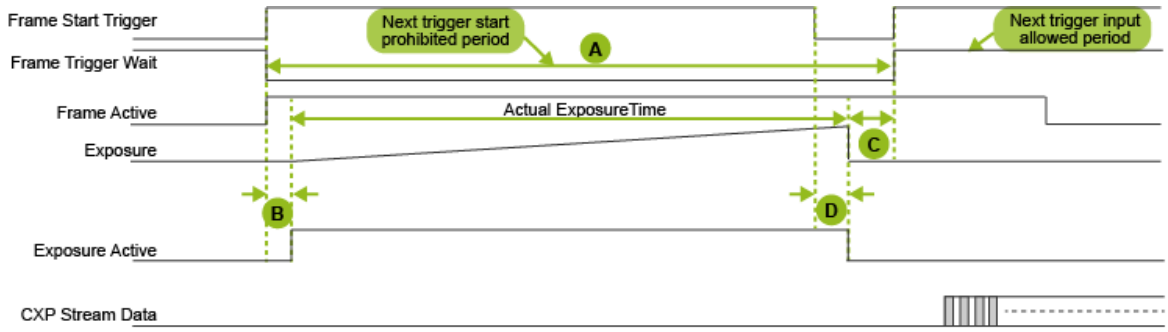


Frame Start Trigger = On

Pixel format	(A) Frame Period (usec)	(B) Period From Trigger start edge to Exposure start (usec)	MAX Frame Rate (Hz)
Full (Max Frame Rate)			
RGB8	28986	143.9	34.5
RGB10V1Packed, RGB10p32	38462	191.6	26.0
RGB12V1Packed	43290	215.4	23.1
Binning Horizontal (Max Frame rate)			
RGB8	22222	110.6	45.0
RGB10V1Packed, RGB10p32	22124	110.5	45.2
RGB12V1Packed	22124	110.5	45.2
Binning Vertical (Max Frame rate)			
RGB8	28902	143.7	34.6
RGB10V1Packed, RGB10p32	38462	191.4	26.0
RGB12V1Packed	43290	215.3	23.1
Binning Horizontal & Vertical (Max Frame rate)			
RGB8	22222	110.6	45.0
RGB10V1Packed, RGB10p32	22124	110.6	45.2
RGB12V1Packed	22124	110.6	45.2

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).



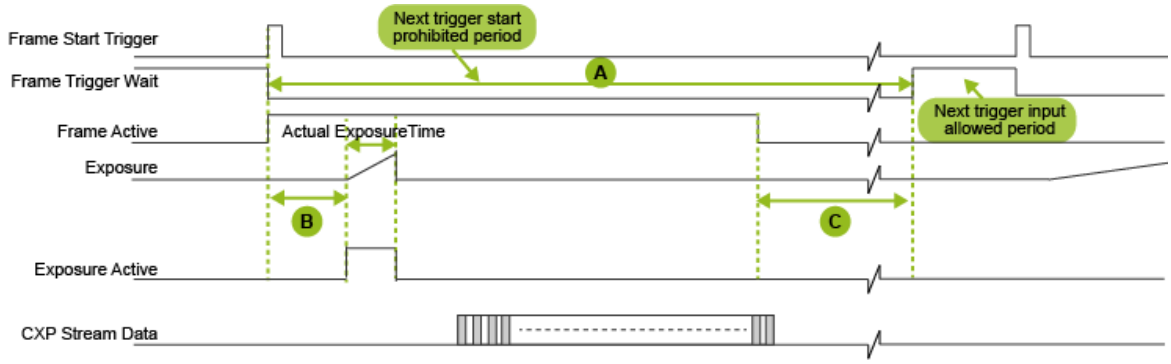
Frame Start Trigger = On

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)
Full (Max Exposure Time in Max Frame rate)				
RGB8	28572	143.9	521.0	35.0
RGB10V1Packed, RGB10p32	38023	191.6	625.0	26.3
RGB12V1Packed	42735	215.4	704.2	23.4
Binning Horizontal (Max Exposure Time in Max Frame rate)				
RGB8	21930	110.5	397.0	45.6
RGB10V1Packed, RGB10p32	21882	110.5	357.1	45.7
RGB12V1Packed	21882	110.5	356.7	45.7
Binning Vertical (Max Exposure Time in Max Frame rate)				
RGB8	28572	143.7	521.0	35.0
RGB10V1Packed, RGB10p32	38023	191.4	625.3	26.3
RGB12V1Packed	42735	215.3	704.2	23.4
Binning Horizontal & Vertical (Max Exposure Time in Max Frame rate)				
RGB8	21930	110.5	397.0	45.6
RGB10V1Packed, RGB10p32	21882	110.5	357.1	45.7
RGB12V1Packed	21882	110.5	356.7	45.7

Note: D: Period From Trigger End to Exposure End (µsec) (= B + 2.47 µsec)

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).



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)
Full (Max Frame Rate, Exposure Time Minimum)			
RGB8	104167	3233	72594
RGB10V1Packed, RGB10p32	104167	3281	63165
RGB12V1Packed	105264	3305	59521
Binning Horizontal (Max Frame Rate, Exposure Time Minimum)			
RGB8	104167	3200	79166
RGB10V1Packed, RGB10p32	104167	3200	79205
RGB12V1Packed	104167	3200	79205
Binning Vertical (Max Frame Rate, Exposure Time Minimum)			
RGB8	104167	3233	72589
RGB10V1Packed, RGB10p32	104167	3281	63190
RGB12V1Packed	105264	3305	59546
Binning Horizontal & Vertical (Max Frame Rate, Exposure Time Minimum)			
RGB8	104167	3200	79161
RGB10V1Packed, RGB10p32	104167	3200	79200
RGB12V1Packed	104167	3200	79200

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
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	O	O	O	O	O	O	OFF
High	O	O	O	O	O	O	---
Line5-OptIn1	O	O	O	O	O	O	O
Line4 -TTLIN1	O	O	O	O	O	O	O
Line6 -OptIn2	O	O	O	O	O	O	O
Line10 -TTLIN2	O	O	O	O	O	O	O
UserOutput 0-3	O	O	O	O	O	O	O
PulseGenerator0	O	O	O	O	O	O	O
PulseGenerator1	O	O	O	O	O	O	O
PulseGenerator2	O	O	O	O	O	O	O
PulseGenerator3	O	O	O	O	O	O	O
Nand0Out	O	O	O	O	---	O	O
Nand1Out	O	O	O	O	O	---	O
Action 0 -3	O	O	O	O	O	O	O
ExposureActive	O	O	O	O	O	O	---
AcquisitionActive	O	O	O	O	O	O	---
AcquisitionTriggerWait	O	O	O	O	O	O	---
FrameTriggerWait	O	O	O	O	O	O	---
FrameActive	O	O	O	O	O	O	---
FVAL	O	O	O	O	O	O	---

Pulse Generator Clear Source

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

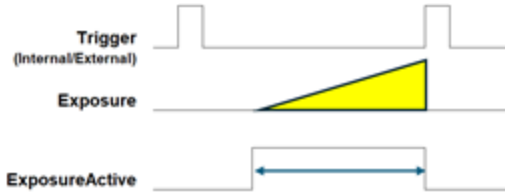
LineSource Items

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

LineSource	Description
Off	This item is available only when LineSelector is set to **TimeStampReset**. To enable TimeStampReset, set to the option other than Off.
AcquisitionActive	From AcquisitionStart to AcquisitionStop. See "Acquisition Control" for reference.
FrameActive	A frame is being captured, active from the start of the frame's exposure until the end of FVAL.
ExposureActive	Camera is doing the exposure. See "ExposureActive Signal" 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: https://www.jai.com/uploads/documents/Technical-notes/English/TNE-0005-2015XII11-000-TechNote-PulseGenerator-tips.pdf
UserOutput0 ~ 3	Allows you to toggle UserOutput's On / Off on the software. Select the **User Output 0 ~ 3** you want to use from **UserOutputSelector**, and then set the **UserOutputValue** (**High** or **Low**).
Line4 TTL In1	TTL In1
Line5 Opt In1	Opt In1
Line6 Opt In2	Opt In2
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

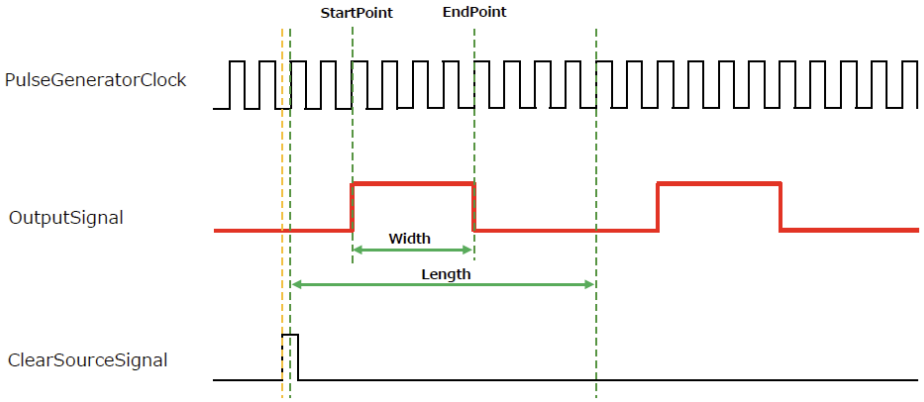
Technical Notes Tips for using the Pulse Generator

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.

GainAuto

This function allows the gain to be adjusted automatically.

Option	Description
Off	Gain is not adjusted automatically. Refer to "Adjust the Gain" and configure the Gain settings manually.
Once	Performs automatic gain adjustment once. After the adjustment is completed, the setting returns to **Off**.
Continuous	Performs continuous automatic gain adjustment. In addition, the ALC (Automatic Level Control) Function can be used to fine-tune the automatic adjustment settings.

Note: Under the following conditions, automatic adjustment will not operate (an error message "**Error1 - could not processing**" is displayed in **AutoControlStatus** (AutoLevelControl). Operation will resume once the conditions are cleared.

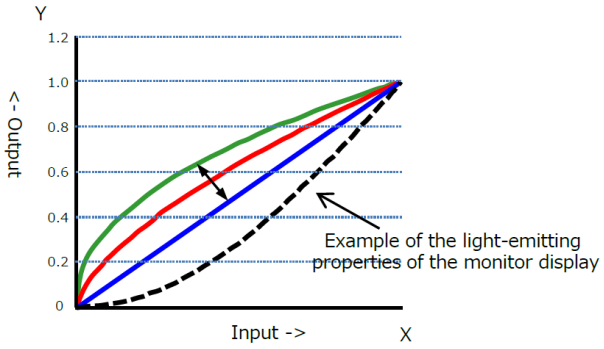
- When no image is being output
- When **AcquisitionMode** is set to anything other than **Continuous** (AcquisitionControl)
- When **TestPattern** is set to anything other than **Off** (ImageFormatControl)
- Continuous only: When **OverlayMode** is set to **MultiRoiAreaMode** (ImageFormatControl)
- During SequencerMode (SequencerControl)
- During MultiRoiMode (MultiROIControl)

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

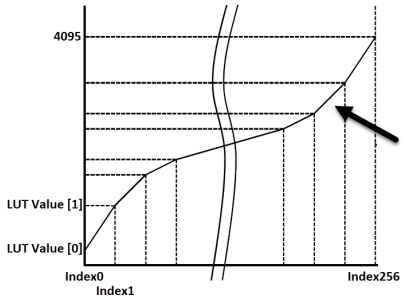
The LUT function is used to generate a non-linear mapping between signal values captured on the sensor and those that are output from the camera. You can specify the output curve using 257 setting points (indexes).

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.



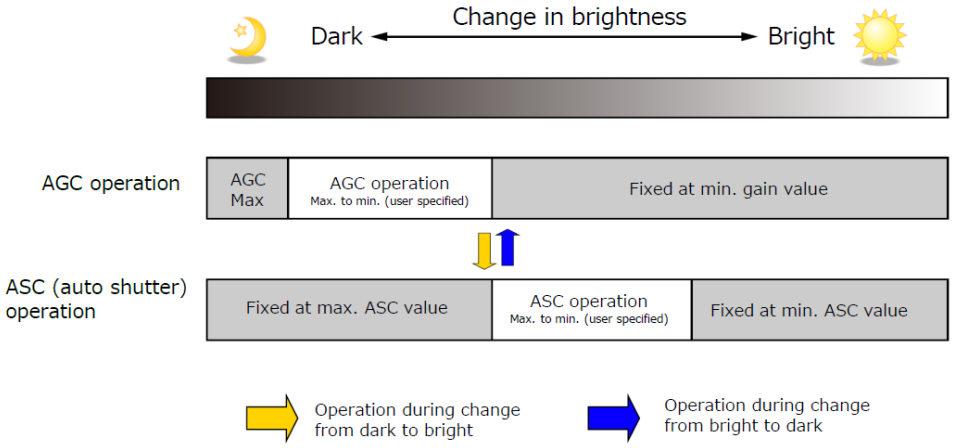
Interpolation using the average values of data to the left and right is used to determine values between points.

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.

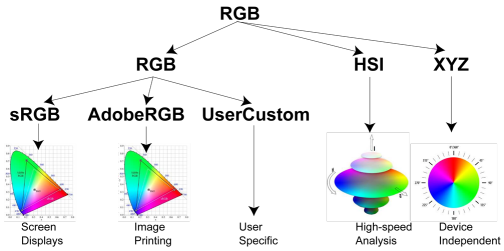
7. Use **AutoControlStatus** to check the operating status of ALC. The following will be displayed in AutoControlStatus:

- Idle
- Processing - ExposureTime
- Processing - Gain
- Converging - Exposure Time
- Converging - Gain
- Error1 - could not processing (For more information, see "GainAuto" and "ExposureAuto)
- Error2 - timeout

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.



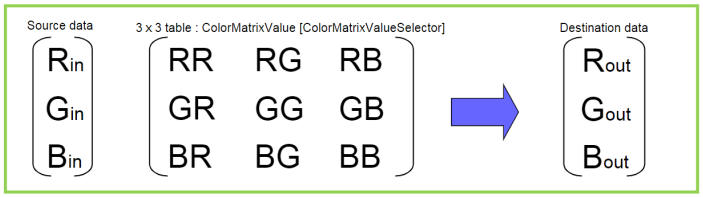
> **Note:** This function is only supported on the color model.

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, eBUS Player for JAI 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° to 360° can be specified for 8bit, 10bit and 12bit output as follows.

Output	Description
8bit	Can be specified in 2° increments - 0°(00000000) ~ 360°(10110100)
10bit	Can be specified in 0.5°increments- 0°(0000000000) ~ 360°(1011010000)
12bit	Can be specified in 0.5°increments- 0°(000000000000) ~ 360°(101101000000)

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

Output	Description
8bit	0%(00000000) ~ 100%(11111111)
10bit	0%(00000000) ~ 100%(1111111111)
12bit	0%(00000000) ~ 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".

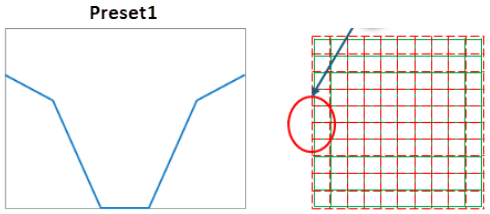
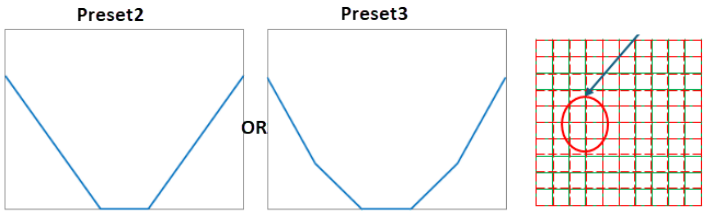
Chromatic Aberration Correction

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

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)

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

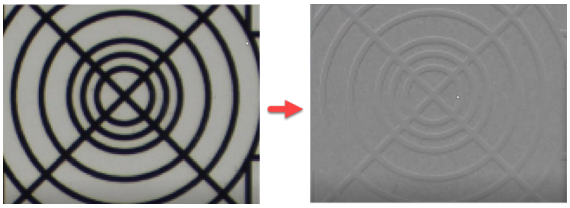
Using the target image, adjust the R and B channels so they align with the G channel. In this example, **PixelShiftCheckMode** is used to switch the image output to the difference image between the Red/Blue and Green channels for easier visual confirmation.

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**.

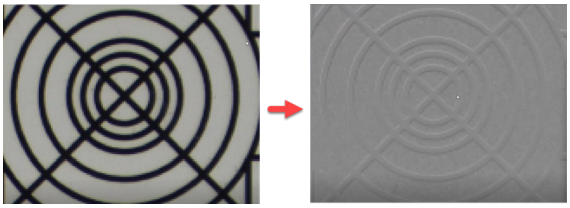
> **Notes:**
> - If alignment is difficult using the target image, use the waveform for fine adjustments.
> - If set **PixelShiftAlignmentMode** to **Off**, the PixelShiftAlignment is disabled and the image before the correction is displayed.

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 **ChromaticAberrationCorrectionCoeffI** 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**

  The following functions are disabled regardless of their current settings (they are reset to their default values).

Category	Disabled Items
ImageFormatControl	BinningHorizontalMode, BinningVerticalMode, ImageScalingSumMode
AnalogControl	Gain[DigitalRed][DigitalBlue], BlackLevel[All][Red][Blue], LUTMode
ShadingControl	ShadingMode
SequencerControl	SequencerBlackLevelAll, SequencerLutEnable

- **VideoProcessBypassMode = OFF (Default)**

  All image processing functions remain enabled.

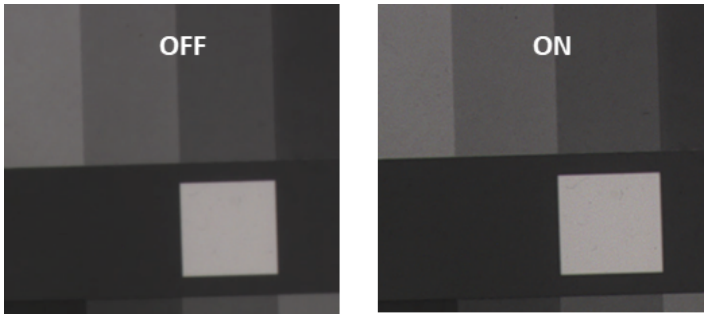
Edge Enhancer, Color Enhancer

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

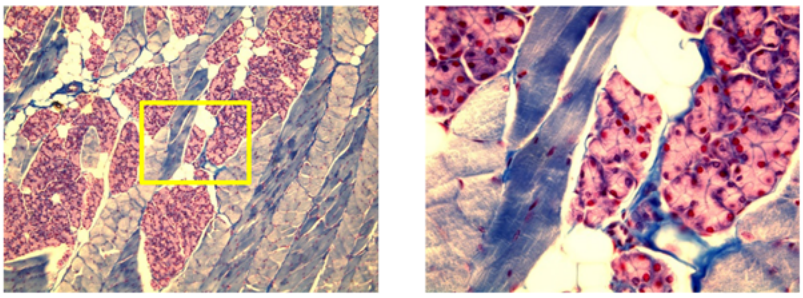
The Edge Enhancer function is enabled when EdgeEnhancerEnable is set to On. Four enhancement levels are available: Low, Middle, High, and Strong.



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

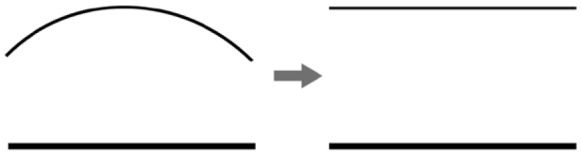
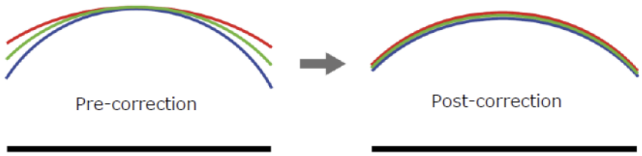
> **Related Setting Items:** ShadingControl

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
	
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.	R-channel and B-channel properties are adjusted to using the G-channel shading properties as a reference.

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

> **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 (ImageFormatControl
> - OverlayMode is set to other than Off (ImageFormatControl)
> - In MultiRoi mode (Multi ROI Function)
> - BalanceWhiteAuto is set to Continuous (AnalogControl)
> - ExposureAuto is set to Continuous (AcquisitionControl)
> - ReverseX is set to True or ReverseY is Set to True (ImageFormatControl)
> - Width/Height is not set to WidthMax or HeightMax (ImageFormatControl)
> - In Sequencer Mode (Sequencer 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
ImageFormatControl	BinningHorizontalMode, BinningVerticalMode
AcquisitionControl	AcqusitionFramerate, TriggerMode, ExposureMode, ExposureTime, ExposureAuto
AnalogControl	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 / SequencerHeght, 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.

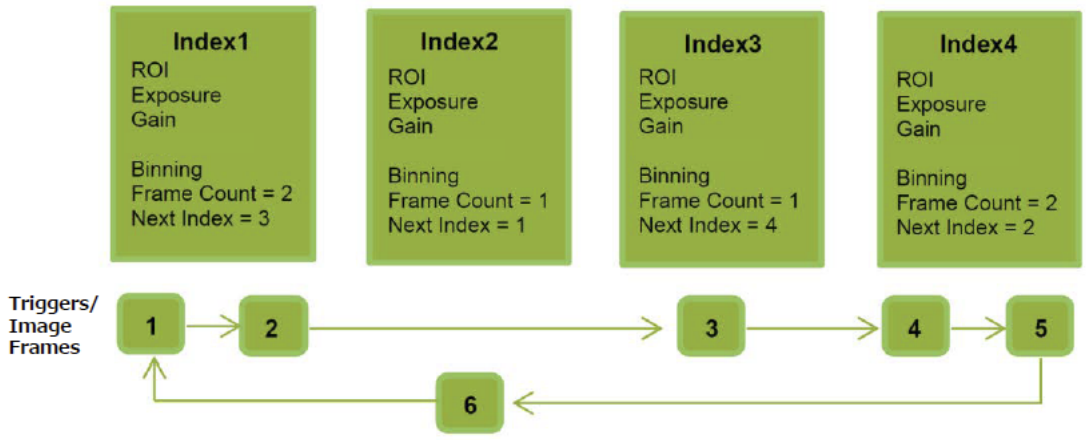
SequencerReset: During TriggerSequencer mode operation, this switches the index number to be executed to that specified in SequencerSetStart.

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.

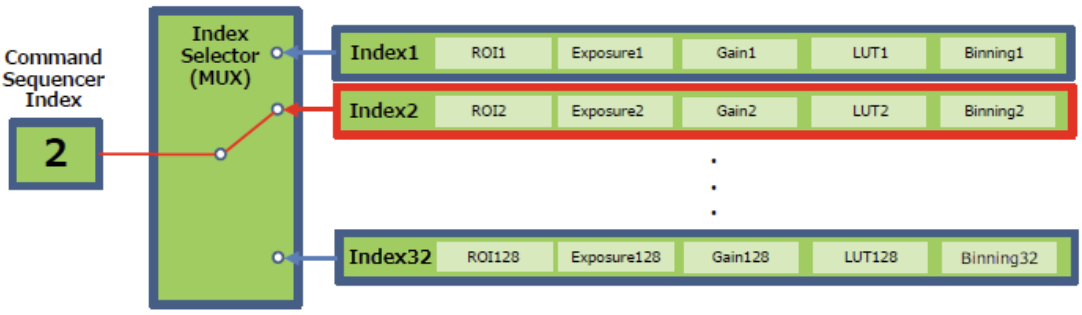
> **Note:** In addition to repeating multiple conditions as in the above example, you can specify "0" (which indicates the end of TriggerSequencer mode) in SequencerSetNext of index 2 and specify the number of repetitions in SequencerRepetition.

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.

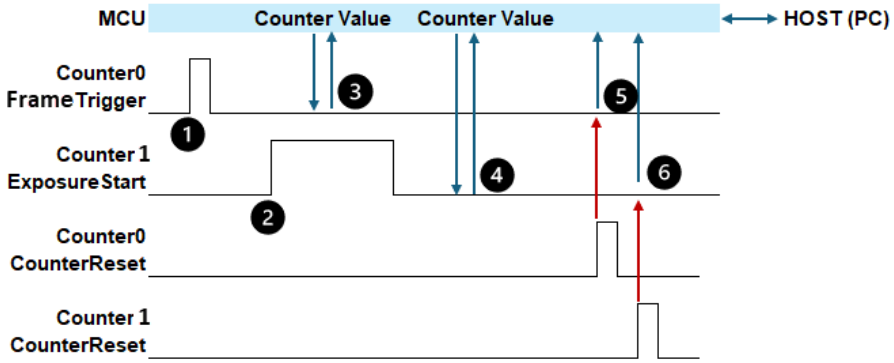
The following counters are available on this camera, and the functions that can be counted are fixed for each counter.

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 **ConterEventSource** (Defaut = 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.

Action Control Function

Related Setting Items: ActionControl

Technical Notes How to use GigE Vision Action Commands

Note: This function is supported only on the AP-5100T-5GE model.

The Action Control Function is a function that executes the pre-configured action when the camera receives action commands. Action commands can send both unicast and broadcast messages and give instructions for actions to multiple cameras simultaneously by broadcasting them. A camera that has this function can even give instructions for actions to different types of multiple cameras. Although this function includes jitter and delays, it is useful for controlling multiple cameras simultaneously.

Note: When the PTP (Precision Time Protocol) function is turned on, **Scheduled Action Command** (Action Control function) becomes available, which allows you to send Action Commands to multiple cameras synchronized with PTP at the same time. For more information, see the How to use GigEVision Action Commands technical note.

Actions are performed when the following three conditions are met.

1. ActionDeviceKey set to the camera and ActionDeviceKey in the action command match.
2. ActionGroupKey set to the camera and ActionGroupKey in the action command match.
3. ActionGroupMask set to the camera and GroupMask in the action command perform AND operation, and the result is not 0.

How to Configure

1. Specify ActionDeviceKey.
2. Then, specify two actions that can be configured on the camera.

Action 1	1. Select **1** in **ActionSelector**. 2. Specify **ActionGroupMask [ActionSelector]**. 3. Specify **ActionGroupKey [ActionSelector]**.
Action 2	1. Select **2** in **ActionSelector**. 2. Specify **ActionGroupMask [ActionSelector]**. 3. Specify **ActionGroupKey [ActionSelector]**.

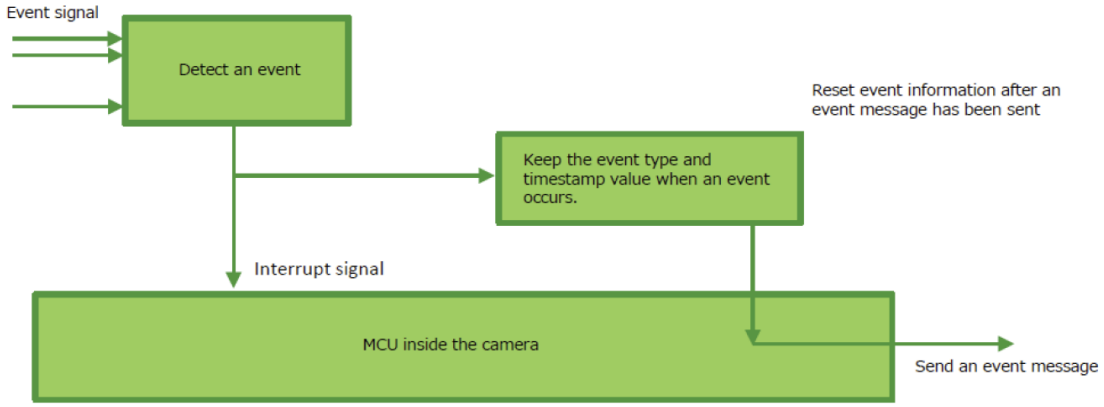
3. Set triggers (AcquisitionStart, AcquisitionEnd, FrameStart, AcquisitionTransferStart) to Action1 and Action2.

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: **EvenID**, **EventTimeStamp**, **EventFrameID**.

   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.
EventAcquisitionStartFrameID	Display the FrameID value when the enabled Event occurs.

Chunk Data Function

> **Related Setting Items:** ChunkDataControl

The Chunk Data function adds camera configuration information to the image data that is output from the camera. In addition, when images are acquired with a single camera in sequence under multiple setting conditions, you can search for images by their setting conditions.

> **Note:** This function is supported only on the AP-5100T-5GE model.

Configuring Chunk Data

1. Set **ChunkModeActive** to **True**. (Default = False)

> **Caution:** The Chunk Data function settings cannot be changed during image output. To change the settings, stop Acquisition.

PTP (Precision Time Protocol)

Related Setting Items: TransportLayerControl

The camera can work as the slave for Precision Time Protocol defined in IEEE 1588. When the IEEE 1588 master clock exists in the network where the camera is connected, this function synchronizes the camera to the time of the master clock.

- Transport to be used: Multicast UDP datagram (224.0.1.129); however, Delay Resp is a unicast UDP datagram.
- Destination port number:
  - 319 : Sync, Delay Req, Pdelay Req, Pdelay Resp
  - 320 : Announce, Follow Up, Delay Resp, Pdelay Resp, Management, Signaling
- Items for synchronization: Time synchronization is performed. Frequency tuning is not performed.
- PTP time data: 80 bit (elapsed time in 1 ns, with 00:00:00, January 1 1970 set as the origin)
- Timestamp (this camera): 64 bit* (PTP synchronization: LSB64bit* of PTP time data)
- Supported PTP messages: Announce message (receive only), Sync message (receive only), Follow Up message (receive only), Delay Req message (send only), Delay Resp message (receive only)

Cautions:
- The Timestamp Tick Frequency register value is fixed at 1,000,000,000 (1 GHz).
- When PTP synchronization is being performed, the Timestamp Reset function is disabled.
- Because GenICam treats the timestamp (64 bit) as a 64 bit signed integer, 63 bit is actually timestamp data without the sign bit.

How To Configure

1. Set **GevIEEE1588** (TransportLayerControl) to **True**.
2. After several statuses from Disable, when a Sync Message is received from the PTP server, **Slave** is Displayed in **GevIEEE1588 Status**.

Note: When the PTP function is **On**, you can use Scheduled Action Command (ActionControl), which allows you to send action commands to multiple cameras synchronized with PTP at the same time.

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	ROICentered	FD2x2Binning	BinningHorizontal = 2	BinningVertical = 2	ImageScalingMode	ReverseX/Y/XY	Overlay Mode: ALCAreaMode / AWBAreaMode	Overlay Mode: MultiROIAreaMode	MultiRoiMode	SequencerMode
Single ROI (Weight, Height, OffsetX, OffsetY)		1	2			3					⊖
ROICentered	1		⊖	⊖		⊖				⊖	⊖
FD2x2Binning	2			⊖	⊖	3			⊖	⊖	⊖
BinningHorizontal = 2		⊖	⊖			⊖			⊖	⊖	⊖
BinningVertical = 2			⊖			⊖			⊖	⊖	⊖
ImageScalingMode	3	⊖	3	⊖	⊖				⊖	⊖	⊖
ReverseX/Y/XY											⊖
OverlayMode: ALCAreaMode / AWBAreaMode											⊖
OverlayMode: MultiRoiAreaMode			⊖	⊖	⊖	⊖				4	⊖
MultiRoiMode		⊖	⊖	⊖	⊖	⊖			4		⊖
SequencerMode		⊖	⊖			⊖	⊖	⊖	⊖	⊖	

Empty	Can be used together
⊖	Cannot be used together
1	When ROICentered is set to **On**, OffsetX will be disabled.
2	When the Single ROI Function and FD2x2BinningMode (Binning Function) are used together, the **Width** and **Height** settings must be set to their maximum values (WidthMax, HeightMax). Then, configure the ROI settings as needed.
3	When using Image Scaling Mode (Xscale) together with the Single ROI Function and/or FD2x2Binning, first, set the Width, Height, OffsetX, OffsetY and/or FD2x2Binning settings, and then configure the Image Scaling Mode settings.
4	To set Overlay Mode to **MultRoiAreaMode**, MultiRoiMode (MultiROIControl) must be set to **Off** 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 (IInteger), a real type (IFloat), an element enumeration type (IEnumeration), a character string (IString), a logical type (IBoolean), and a category type (ICategory) or a command type (ICommand) 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 (IEnumeration) or an integer type (IInteger). 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-5GE"		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 (IInteger)	-	2	Display the SFNC Major version.
DeviceSFNCVersionMinor (IInteger)	-	7	Display the SFNC Minor version.
DeviceSFNCVersionSubMinor (IInteger)	-	1	Display the SFNC Sub Minor version.
DeviceManifestEntrySelector (IInteger)	1	1	Selects the manifest entry to reference. (Fixed to XML1)
DeviceManifestXML MajorVersion (IInteger)	0 ~ 9	-	Indicates the major version number of the XML file of the selected manifest entry.
DeviceManifestXML MinorVersion (IInteger)	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 (IInteger)	-	1	Indicates the major version number of the schema file of the selected manifest entry.
DeviceManifestSchema MinorVersion (IInteger)	-	1	Indicates the minor version number of the schema file of the selected manifest entry.
DeviceManifestPrimaryURL (IString)	-	-	Display the PrimaryURL.

Device Control Item	Setting Range	Default	Description
DeviceManifestSecondaryURL (IString)	-	-	Display the SecondaryURL.
DeviceTLType (IEnum)	0: GigEVision		Display the Transport Layer type of the device.
DeviceTLVersionMajor (IInteger)	2 (Fixed)	-	Display the major version number of the Transport Layer type.
DeviceTLVersionMinor (IInteger)	0 (Fixed)	-	Display the minor version number of the Transport Layer type.
DeviceTLVersionSubMinor (IInteger)	-	-	Display the sub minor version number of the Transport Layer type.
DeviceLinkSelector (IInteger)	0		Select which Link of the device to control.
DeviceLinkSpeed (Bps) (IInteger)		125000000	Display the negotiated transmission rate.
DeviceLinkHeartbeatMode (IEnum)	0: Off 1: On	1: On	Display whether Heartbeat mode is enabled/disabled.
DeviceLinkHeartbeatTimeout (µs) (IFloat)	500000 ~ 120000000, step: 1000	3000000	Configure the timeout value for Heartbeat (unit: µs).
DeviceStreamChannelCount (IInteger)	-	-	Display the number of supported stream channels.
DeviceEventChannelCount (IInteger)	-	-	Display the number of supported message channels.
DeviceReset (ICommand)	-	-	Reset the device.
DeviceTemperatureSelector (IEnum)	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 (IFloat)	-55 ~ 125	-	Display the internal temperature (˚C) of the camera.
Timestamp (ns) (IInteger)	0 ~ 64bit max	0	Display the timestamp value (ns). Resets to 0 when the signed maximum 64-bit value is exceeded.
TimestampReset (ICommand)	-	-	Forcibly sets the timestamp's count value to 0.
TimestampLatch (ICommand)	-	-	Sets the timestamp's count value to TimestampLatchValue.
TimestampLatchValue (ns) (IInteger)	0 ~ 64bit max	0	Returns the latched value of the timestamp counter.

Device Control Item	Setting Range	Default	Description
UserDefinedValueSelector (IEnum)	0: Value1 1: Value2 2: Value3 3: Value4 4: Value5	0: Value1	32bit data x 5 can be set and saved.
UserDefinedValue (IInteger)	-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 (IInteger)	48 ~ 67109240	12288	Display the payload size information.
GigEVision (ICategory)			
GevPhysicalLinkConfiguration (IEnum)	-	SingleLink (Fixed)	Display the LinkConfiguration status.
GevSupportedOption Selector (IEnum)	Select the supported options for GigEVision. The selections are as follows: Link Configuration: SingleLink, MultiLink, StaticLAG, DynamicLAG nif Configuration: PAUSEFrameReception, PAUSEFrameGeneration, IPConfigurationLLA, IPConfigurationDHCP, IPConfigurationPersistentIP GVCP: MessageChannelSourceSocket, CommandsConcatenation, WriteMem, PacketResend, Event, EventData, PendingAck, IEEE1588, Action, UnconditionalAction, ScheduledAction, PrimaryApplicationSwitchover, ExtendedStatusCodes, ExtendedStatusCodesVersion2_0, DiscoveryAckDelay, DiscoveryAckDelayWritable, TestData,ManifestTable, CCPApplicationSocket, LinkSpeed, HeartbeatDisable, SerialNumber, UserDefinedName GVSP: StreamChannelSourceSocket, StandardIDMode, StreamChannelBigAndLittleEndian, StreamChannelIPReassembly, StreamChannelMultiZone, StreamChannelPacketResendDestination, StreamChannelAllInTransmission, StreamChannelUnconditionalStreaming, StreamChannelExtendedChunkData		
GevSupportedOption (IBoolean)	False True	-	Displays whether the function selected by GevSupportOptionSelector is supported or not.
GevInterfaceSelector (IInteger)	-	0 (Fixed)	Selects which logical link to control.

Transport Layer Control Item	Setting Range	Default	Description
GevMacAddress (IInteger)	-	-	Display the MAC address.
GevPAUSEFrameReception (IBoolean)	False True	True	Controls whether incoming PAUSE Frames are handled on the given logical link.
GevPAUSEFrameTransmission (IBoolean)	False True	True	Controls whether PAUSE Frames can be generated on the given logical link.
GevCurrentIPConfiguration LLA (IBoolean)	-	-	Display whether the current IP configuration is calibrated by LLA (link-local address).
GevCurrentIPConfiguration DHCP (IBoolean)	False True	True	Select whether to set the IP configuration to DHCP.
GevCurrentIPConfiguration PersistentIP (IBoolean)	False True	False	Select whether to set the IP configuration to Persistent IP.
GevCurrentIPAddress (IInteger)	-	-	Display the IP address.
GevCurrentSubnetMask (IInteger)	-	-	Display the subnet.
GevCurrentDefaultGateway (IInteger)	-	-	Display the default gateway.
GevIPConfigurationStatus (IEnum)	0: None 1: PersistantIP 2: DHCP (Default) 3: LLA 4: ForceIP		Display the current IP configuration status.
GevPersistentIPAddress (IInteger)	-	192.168.0.100	Set the persistent IP address.
GevCurrentSubnetMask (IInteger)	-	255.255.255.0	Set the persistent subnet mask.
GevPersistentDefaultGateway (IInteger)	-	0.0.0.0	Set the persistent default gateway.
GevIEEE1588 (IBoolean) **Related Topic:** PTP (Precision Time Protocol)	False True	False	True : Enables PTP False: Disables PTP

Transport Layer Control Item	Setting Range	Default	Description
GevIEEE1588ClockAccuracy (IEnum)	0 ~ 20	Unknown	Indicates clock accuracy. 0:Within25ns, 1:Within100ns, 2:Within250ns, 3:Within1us, 4:Within2p5us, 5:Within10us, 6:Within25us, 7:Within100us, 8:Within250us, 9:Within1ms. 10:Within2p5ms, 11:Within10ms, 12:Within25ms, 13:Within100ms, 14:Within250ms, 15:Within1s, 16:Within10s, 17:GreaterThan10s, 18:AlternatePTPProfile, 19:Unknown, 20:Reserved
GevIEEE1588Status (IEnum)	-	Disabled	Display the IEEE 1588 Status. 1: Initializing, 2: Faulty, 3: Disabled, 4: Listening, 5: PreMaster, 6: Master, 7: Passive, 8: Uncalibrated, 9: Slave
GevGVCPExtendedStatus CodesSelector (IEnum)	0:Version1_1 1:Version2_0	Version1_1	Select the GevGVCPExtendedStatusCodes.
GevGVCPExtended StatusCodes (IBoolean)	False True	False	Enables the generation of extended status codes.
GevGVCPPendingAck (IBoolean)	False True	False	Enables/disables the PENDING_ACK.
GevGVSPExtendedIDMode (IEnum)	0: Off 1: On	On	Enables/disables Extended ID Mode.
GevCCP (IEnum)	0: OpenAccess 1: ExclusiveAccess 2: ControlAccess	0: OpenAccess	Control access rights. **0: OpenAccess** - Access rights have not been obtained by the application. **1: ExclusiveAccess** - Once the application has made this setting, no other applications can control or reference the camera. **2: ControlAccess** - Access rights have been obtained by the application. Other applications cannot control the camera, but can refer to it.
GevPrimaryApplicationSocket (IInteger)	-	-	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress (IInteger)	-	-	Returns the address of the primary application.
GevMCPHostPort (IInteger)	-	-	Controls the port to which the device must send messages. Setting this value to 0 closes the message channel.
GevMCDA (IInteger)	-	-	Controls the destination IP address for the message channel.

Transport Layer Control Item	Setting Range	Default	Description
GevMCSP (IInteger)	-	-	This feature indicates the source port for the message channel.
GevStreamChannelSelector (IInteger)	-	0 (Fixed)	Selects the stream channel to control.
GevSCPHostPort (IInteger)	-	-	Controls the port to which the device must send messages.
GevSCPSFireTestPacket (IBoolean)	False True	True	Sends a test packet.
GevSCPSDoNotFragment (IBoolean)	False True	True	The state of this feature is copied into the "do not fragment" bit of IP header of each stream packet. It can be used by the application to prevent IP fragmentation of packets on the stream channel.
GevSCPSPacketSize (byte) (IInteger)	1476 ~ 8192	1476	This GigE Vision specific feature corresponds to DeviceStreamChannelPacketSize and should be kept in sync with it. It specifies the stream packet size, in bytes, to send on the selected channel for a GVSP transmitter or specifies the maximum packet size supported by a GVSP receiver.
GevSCPD (IInteger)	0 ~	0	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel. The maximum value varies depending on the settings.
GevSCDA (IInteger)	-	-	Controls the destination IP address of the selected stream channel to which a GVSP transmitter must send data stream or the destination IP address from which a GVSP receiver may receive data stream.
GevSCSP (IInteger)	-	-	Indicates the source port of the stream channel.
NetworkStatistics (ICategory)			Category containing statistics about the different modules of the GigE Vision transport layer.
oMACControlFunctionEntity (ICategory)			Category containing statistics related to the device's MAC control PAUSE function.
aPAUSEMACCtrlFrames Received (IInteger)	-	-	Displays the number of Pause frames received.

ImageFormatControl

Configure image format settings.

> **Note:** Refer to Functions That Cannot Be Used Together for usage restrictions.

<table>
<tr><th>Image Format Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>SensorWidth (IInteger)</td><td colspan="2">2472</td><td>Display the sensor's maximum image width.</td></tr>
<tr><td>SensorHeight (IInteger)</td><td colspan="2">2064</td><td>Display the sensor's maximum image height.</td></tr>
<tr><td>SensorDigitizationBits (IEnum)</td><td colspan="2">8: 8 Bits
10: 10 Bits (Default)
12: 12 Bits</td><td>Display the number of bits at which the sensor is operating.</td></tr>
<tr><td>WidthMax (IInteger)</td><td colspan="3">Display the maximum image width.
<table>
<tr><th>Binning Horizontal</th><th>FD2x2 BinningMode</th><th>WidthMax</th></tr>
<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>
<tr><td colspan="3">BinningHorizontal and FD2x2BinningMode cannot be used together.</td></tr>
</table></td></tr>
<tr><td>HeightMax (IInteger)</td><td colspan="3">Display the maximum image height.
<table>
<tr><th>Binning Vertical</th><th>FD2x2 BinningMode</th><th>HeightMax</th></tr>
<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>
<tr><td colspan="3">BinningVertical and FD2x2BinningMode cannot be used together.</td></tr>
</table></td></tr>
<tr><td>Width (IInteger)

Related Topic: Single ROI Function</td><td>-</td><td>WidthMax</td><td>Set the image width.
Setting Range: 96 (48)* ~ [WidthMax - OffsetX] , Step 8(4)*
*When BinningHorizontal = 2, the value in parentheses is applicable.</td></tr>
<tr><td>Height (IInteger)</td><td>-</td><td>HeightMax</td><td>Set the image height.
Setting Range: 8 (4)* ~ [HeightMax - OffsetY], Step 2(1)*
*When BinningVertical = 2, the value in parentheses is applicable.</td></tr>
<tr><td>OffsetX (IInteger)</td><td>-</td><td>0</td><td>Set the horizontal offset.
Setting Range: 0 ~ [WidthtMax - Width], Step 8(4)*
*When BinningHorizontal = 2, the value in parentheses is applicable.</td></tr>
</table>

Image Format Control Item	Setting Range	Default	Description
OffsetY (IInteger)	-	0	Set the vertical offset. Setting Range: 0 ~ [HeightMax - Height], Step 2(1)* *When BinningVertical = 2, the value in parentheses is applicable.
ROICentered (IEnum) **Related Topic:** Single ROI Function	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 (IEnum) **Related Topic:** Binning Function	0: Off 1: On	0: Off	Performs 2x2 analog binning (Sum processing). When On, the Width and Height are 1228 x 1024. **Note:** To set this function On, the **Width** and **Height** settings must be set to their maximum values (WidthMax, HeightMax).
BinningHorizontalMode (IEnum) **Related Topic:** Binning Function	0: Sum 1: Average	0: Sum	Set the processing method for horizontal binning.
BinningHorizontal (IInteger)	0: Off 1: On	1: Off	Set the number of pixels in the horizontal direction for which to perform binning.
BinningVerticalMode (IEnum)	0: Sum 1: Average	0: Sum	Set the processing method for vertical binning.
BinningVertical (IInteger)	0: Off 1: On	1: Off	Set the number of pixels in the vertical direction for which to perform binning.
ImageScalingMode (IEnum) **Related Topic:** Image Scaling Mode (Xscale)	0: Off 1: On	0: Off	Enable ImageScalingMode.
ImageScalingSumMode (IEnum)	0: Off (Ave) (Default) 1: On (Sum)		Selects whether to use Sum or Average mode when ImageScalingMode is On.
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 (IInteger)	256 ~ 4096	-	Indicates the horizontal scaling ratio as an integer value (rounded down to the nearest whole number). The formula is: ImageScalingHorizontal X 4096.

Image Format Control Item	Setting Range	Default	Description
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 (IInteger)	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 (IInteger)	4096 (Fixed)		The base value for ImageScaling (Fixed to 4096)
ReverseX (IBoolean) **Related Topic:** Image Flip Function	0: Off 1: On	0	Reverse pixels horizontally.
ReverseY (IBoolean)	0: Off 1: On	0	Reverse pixels vertically.
ReverseXY (IBoolean)	0: Off 1: On	0: Off	Reverse the current ReverseX and ReverseY settings.
PixelFormat (IEnum) **Related Topic:** Pixel Format	-	RGB8	Set the pixel format. 0x02180014: RGB8 0x0220001C: RGB10V1Packed 0x0220001D: RGB10p32 0x02240034: RGB12V1Packed
TestPattern (IEnum)	0: Off (Default) 1: GreyHorizontalRamp 2: GreyVerticalRamp 3: GreyHorizontalRampMoving 4: HorizontalColorBar 5: VerticalColorBar 6: HorizontalColorBarMoving		Select the test image. **Note:** This item cannot be changed when **ExposureAuto** (AcquisitionControl) is set to other than **Off**.
OverlayMode (IEnum) **Related Topic:** Overlay Mode	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.		You can check the target area by reducing the brightness of the non-target area to 50%.

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 (IInteger)	0 ~ 7	0	Select the index for the Multi Roi mode.
MultiRoiWidth (IInteger)	-	256	Set the width for the selected Multi Roi index. Step 16 (8)
MultiRoiHeight (IInteger)	-	192	Set the height for the selected Multi Roi index. Step: 4 (2)
MultiRoiOffsetX (IInteger)	-	-	Set the horizontal offset for the selected Multi Roi index. **Min**: The minimum value of the range where each Index does not overlap. **Max**: The maximum value of the range where each Index does not overlap. **Step**: 16 (8) **Default**: 0 (Index1) / 256 (Index2) / 512 (Index3) / 768 (Index4) / 1024 (Index5) / 1280 (Index6) / 1536 (Index7) / 1792 (Index8)
MultiRoiOffsetY (IInteger)	-	-	Set the vertical offset for the selected Multi Roi index. **Min**: The minimum value of the range where each Index does not overlap. **Max**: The maximum value of the range where each Index does not overlap. **Step**: 16 (8) **Default**: 0 (Index1) / 192 (Index2) / 384 (Index3) / 576 (Index4) / 768 (Index5) / 960 (Index6) / 1152 (Index7) / 1344 (Index8)
MultiRoiHorizontalEnableNumber (IInteger)	1 ~ 8	1	Set the maximum number of valid horizontal index numbers.
MultiRoiVerticalEnableNumber (IInteger)	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) **Related Topic:** Acquisition Control	0: SingleFrame 1: MultiFrame 2: Continuous (Default)		Select the image capture mode.
AcquisitionStart (ICommand)	-	-	Start image capture.
AcquisitionStop (ICommand)	-	-	Stop image capture.
AcquisitionFrameCount (IInteger)	1 ~ 65535	1	In MultiFrame mode, set the number of frames to capture.
AcquisitionFrameRate (Hz) (IFloat)	0.125 ~	-	Set the AcquisitionFrameRate in Hz. See "Specifications" for the maximum acquisition rate value under different settings.
TriggerSelector (IEnum) **Related Topic:** Trigger Control	0: AcquisitionStart (Default) 1: AcquisitionEnd 3: FrameStart 4: AcquisitionTransferStart		Select the trigger operation.
TriggerMode (IEnum)	0: Off 1: On	0: Off	Enables/Disables the Trigger mode.
TriggerSoftware (ICommand)	-	-	Execute a software trigger.
TriggerSource (IEnum)	7 - 10: PulseGenerator0 - 3 11 - 14: UserOutput0 - 3 15 - 18: Action0 - 3 19: Software 23: Line4 TTL In1 (Default) 24: Line5 Opt In1 25: Line6 Opt In2 29: Line10 TTL In2 36: Nand0 Out 37: Nand1 Out		Select the trigger signal source.

<table>
<tr><th>Acquisition Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>TriggerActivation (IEnum)</td><td colspan="2">1: Rising Edge (Default)
2: Falling Edge
3: Level High
4: Level Low</td><td>Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied). The options vary depending on the TriggerSelector setting.<table><tr><th>TriggerSelector</th><th>TriggerActivation</th></tr><tr><td>AcquisitionStart</td><td rowspan="3">RisingEdge or FallingEdge</td></tr><tr><td>AcquisitionEnd</td></tr><tr><td>Acquisition TransferStart</td></tr><tr><td>FrameStart</td><td>Depends on ExposureMode.
Timed: RisingEdge or FallingEdge
TriggerWidth: LevelHigh or LevelLow</td></tr></table></td></tr>
<tr><td>TriggerOverlap (IEnum)</td><td>0: Off
1: ReadOut</td><td>-</td><td>Display the trigger overlap operation. The below table shows the default values.<table><tr><th>TriggerSelector</th><th>TriggerOverlap</th></tr><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></table></td></tr>
<tr><td>TriggerDelay (µs) (IFloat)</td><td>0 - 500000</td><td>0</td><td>Set the time of exposure start from trigger input (in µs). This item can be configured only when TriggerSelector is set to FrameStart.</td></tr>
<tr><td>ExposureMode (IEnum)
Related Topic: Exposure Mode</td><td colspan="2">0: Off
1: Timed (Default)
2: TriggerWidth</td><td>Select the exposure mode.</td></tr>
<tr><td>ExposureTimeMode (IEnum)</td><td colspan="2">0: Common (Default)
1: Individual</td><td>When set to Individual, ExposureTime can be adjusted for RGB individually.</td></tr>
<tr><td>ExposureTimeSelector (IEnum)</td><td colspan="2">0: Common (Default)
1: Red
2: Green
3: Blue</td><td>Selects which exposure time is controlled by the ExposureTime feature.</td></tr>
<tr><td>ExposureTime (µs) (IFloat)</td><td>1 ~ ExposureTime Max*</td><td>ExposureTime Max*</td><td>Set the exposure time for the item selected in ExposureTimeSelector.
Note: *ExposureTimeMax: The maximum exposure time value under the current setting conditions.</td></tr>
</table>

Acquisition Control Item	Setting Range	Default	Description
ExposureTimeMax (µs) (IFloat)	1 ~		Displays the maximum exposure time value under the current settings. (1/AcquisitionFrameRateMax) – Next Trigger Inhibit Period
ExposureAuto (IEnum) **Related Topic:** ExposureAuto	0: Off (Default) 1: Once 2: Continuous		Set whether to enable auto exposure. **Once** automatically changes to **Off** when the signal level converges.
ExposureModeOption (IEnum) **Related Topic:** RCT Mode	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)	Select the input / output to configure.		

LineSelector	LineMode	LineFormat
20: Line1 TTL Out1 (Default)	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
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.

Digital IO Control Item	Setting Range	Default	
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).
LineStatusAll (IInteger)		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 Bit7: Line8 TTL Out2 Bit8: Unused (fixed 0) Bit9: Line10 TTL In2 Bit10-31: Unused (fixed 0)
LineFormat (IEnum)	2: TTL 5: OptoCoupled 7: Internal Signal		The signal format for the item selected in **LineSelector** is displayed. For the displayed values, please refer to the LineSelector's description.
LineSource (IEnum)	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 29: Line10 TTL In2 36: Nand0 Out 37: Nand1 Out 41: Low (Not selectable when LineMode = InternalConnection) 42: High (Not selectable when LineMode = InternalConnection)		Select the line source signal for the item selected in Line Selector. **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) (IInteger)	0 ~ 40000000	0	Select the period for filtering mask of the Opt-In signal.
UserOutputSelector (IEnum)	0: User Output 0 (Default) 1: User Output 1 2: User Output 2 3: User Output 3		Set the user output signal.
UserOutputValue (IBoolean)	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 (IInteger)	1 ~ 4096	100	Set the division value for the prescaler (12-bit) using the pixel clock as the base clock.
PulseGeneratorClock (MHz) (IFloat)	-	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 (IEnum)	0: PulseGenerator0 (Default) 1: PulseGenerator1 2: PulseGenerator2 3: PulseGenerator3		Select the pulse generator.
PulseGeneratorLength (IInteger)	1 ~ 1048575	22275	Set the maximum count up value using clock value.
PulseGeneratorLengthMs (ms) (IFloat)	-	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) (IFloat)	-	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 (IInteger)	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 (IInteger)	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	Select the count clear input signal source. 1: AcquisitionActive 2: FrameActive 4: ExposureActive 43: AcquisitionTriggerWait 44: FrameTriggerWait 7-10: PulseGenerator0-3 (※) 11-14: UserOutput0-3 23: Line4 TTL In1 (Default) 24: Line5 Opt In1 25: Line6 Opt In2 29: Line10 TTL In2 36: Nand0 Out 37: Nand1 Out **Note:** (※) The PulseGenerator currently selected in PulseGeneratorSelector is disabled.
PulseGeneratorClear SyncMode (IEnum)	0: Async Mode (Default) 1: Sync Mode		Select the count clear input signal source.

AnalogControl

Configure analog control settings.

<table>
<tr><th>Analog Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>IndividualGainMode (IEnum)</td><td>0: Off
1: On</td><td>Off</td><td>When On, RGB can be configured individually for the entire gain adjustment range of the sensor.</td></tr>
<tr><td>GainSelector (IEnum)

Related Topic:
Adjust the Gain</td><td colspan="2">0: Analog All (Default)
1: Analog Red
2: Analog Green
3: Analog Blue
4: Digital Red
5: Digital Blue</td><td>Select the gain to configure.</td></tr>
<tr><td>Gain (IFloat)</td><td colspan="3">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).
<table>
<tr><th>GainSelector</th><th>IndividualGainMode = Off</th><th>IndividualGainMode = On</th></tr>
<tr><td>AnalogAll*</td><td>0.0dB ~ 18.1dB (x1.0 ~ x8.0)</td><td>0db (x1.0) (Fixed)</td></tr>
<tr><td>AnalogRed*</td><td>-6.6dB ~ 12.0dB (x0.47 ~ x4.0)</td><td>0dB ~ 36.1dB (x1.0 ~ x64.0)</td></tr>
<tr><td>AnalogBlue*</td><td>-6.6dB ~ 12.0dB (x0.47 ~ x4.0)</td><td>0dB ~ 36.1dB (x1.0 ~ x64.0)</td></tr>
<tr><td>AnalogGreen*</td><td>0db (x1.0) (Fixed)</td><td>0dB ~ 36.1dB (x1.0 ~ x64.0)</td></tr>
<tr><td>DigitalRed</td><td colspan="2">-0.9dB ~ 0.8dB (x0.9 ~ x1.1)</td></tr>
<tr><td>DigitalBlue</td><td colspan="2">-0.9dB ~ 0.8dB (x0.9 ~ x1.1)</td></tr>
<tr><td colspan="3">*The resolution is set in about 0.1dB steps.</td></tr>
</table></td></tr>
<tr><td>GainAuto (IEnum)</td><td colspan="2">0: Off (Default)
1: Once
2: Continuous</td><td>Enable/disable gain auto adjustment. Once automatically changes to Off when the signal level converges.</td></tr>
<tr><td>BlackLevelSelector (IEnum)

Related Topic:
Adjusting the Black Level</td><td colspan="2">0: All (Default)
1: Red
3: Blue</td><td>Select the black level to configure.</td></tr>
<tr><td>BlackLevel (IFloat)</td><td colspan="2"><table>
<tr><th>BlackLevelSelector</th><th>Setting Range</th></tr>
<tr><td>All</td><td>-133 to +255</td></tr>
<tr><td>Red</td><td>-64 to +64</td></tr>
<tr><td>Blue</td><td>-64 to +64</td></tr>
</table></td><td>Set the black level value. (Default: 0)</td></tr>
</table>

<table>
<tr><th>Analog Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>BalanceWhiteAuto (IEnum)

Related Topic:
Adjusting the White Balance</td><td colspan="2">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</td><td>Enable/disable auto white balance.</td></tr>
<tr><td>AWBAreaSelector (IEnum)</td><td colspan="3">Select the area for which to configure AWBAreaEnable.<table><tr><td>15: High Left</td><td>14: High Mid-Left</td><td>13: High Mid-Right</td><td>12: High Right</td></tr><tr><td>11: Mid-High Left</td><td>10: Mid-High Mid-Left</td><td>9: Mid-High Mid-Right</td><td>8: Mid-High Right</td></tr><tr><td>7: Mid-Low Left</td><td>6: Mid-Low Mid-Left</td><td>5: Mid-Low Mid-Right</td><td>4: Mid-Low Right</td></tr><tr><td>3: Low Left</td><td>2: Low Mid-Left</td><td>1: Low Mid-Right</td><td>0: Low Right (Default)</td></tr></table></td></tr>
<tr><td>AWBAreaEnable (IBoolean)</td><td colspan="2">False
True (Default)</td><td>Enable/disable the photometry area selected in AWBAreaSelector.</td></tr>
<tr><td>AWBAreaEnableAll (IBoolean)</td><td colspan="2">False
True (Default)</td><td>True: Operate BalanceWhiteAuto with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in AWBAreaSelector.
False: Operate BalanceWhiteAuto according to the individual enabled/disabled photometry area states configured in AWBAreaSelector.</td></tr>
<tr><td>AWBControlSpeed (IInteger)</td><td>1~ 8</td><td>4</td><td>Set the response speed for BalanceWhiteAuto. (8 is the fastest)</td></tr>
<tr><td>BalanceWhiteAutoResult (IEnum)</td><td colspan="2">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</td><td>Display the results of BalanceWhiteAuto. See "Adjusting the White Balance" for more information on each error.</td></tr>
<tr><td>Gamma (IFloat)

Related Topic:
Gamma Function</td><td>0.45~ 1</td><td>0.45</td><td>Set the gamma value.

Setting Range: 0.45, 0.50, 0.55, 0.60, 0.65, 0.75, 0.80, 0.90, 1.00</td></tr>
</table>

Analog Control Item	Setting Range	Default	Description
LUTMode (IEnum) **Related Topic:** LUT (Lookup Table)	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 (IInteger)	0 ~ 256	0	Set the LUT index table number.
LUTValue (IInteger)	0 ~ 4095	Gamma≒ 1.0	Set the LUT value.

AutoLevelControl

Configure AutoLevelControl.

> **Related Topic:** ALC (Automatic Level Control) Function

<table>
<tr><th>Auto Level Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>ALCControlReference (IEnum)</td><td colspan="2">0: Peak Channel
1: Selected Channel (Default)</td><td>Sets the channel to be used for ALC control reference.</td></tr>
<tr><td>ALCControlChannel (IEnum)</td><td colspan="2">0: Red
1: Green (Default)
2: Blue</td><td>When ALCControlReference is set to SelectedChannel, this setting determines which RGB channel signal is used for ALC control. When ALCControlReferenc is set to PeakChannel, this setting is disabled.</td></tr>
<tr><td>ALCReference (IInteger)</td><td>30 ~ 95</td><td>50</td><td>Set the target level for ALC. (unit: %)</td></tr>
<tr><td>ALCAreaSelector (IEnum)</td><td colspan="3">Select the area for which to configure ALCAreaEnable.
<table>
<tr><td>15: High Left</td><td>14: High Mid-Left</td><td>13: High Mid-Right</td><td>12: High Right</td></tr>
<tr><td>11: Mid-High Left</td><td>10: Mid-High Mid-Left</td><td>9: Mid-High Mid-Right</td><td>8: Mid-High Right</td></tr>
<tr><td>7: Mid-Low Left</td><td>6: Mid-Low Mid-Left</td><td>5: Mid-Low Mid-Right</td><td>4: Mid-Low Right</td></tr>
<tr><td>3: Low Left</td><td>2: Low Mid-Left</td><td>1: Low Mid-Right</td><td>0: Low Right (Default)</td></tr>
</table></td></tr>
<tr><td>ALCAreaEnable (IBoolean)</td><td>False
True</td><td>True</td><td>Enable/disable the photometry area selected in ALCAreaSelector.</td></tr>
<tr><td>ALCAreaEnableAll (IBoolean)</td><td>False
True</td><td>True</td><td>True: Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in ALCAreaSelector.
False: Operate ALC according to the individual enabled/disabled photometry area states configured in ALCAreaSelector.</td></tr>
<tr><td>ALCControlRatio (IInteger)</td><td>1 ~ 100</td><td>90</td><td>Set the response speed (%). (100 is the fastest.)</td></tr>
<tr><td>AutoControlStatus (IEnum)</td><td colspan="2">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</td><td>Allows confirmation of the AGC, ASC, and AWB convergence status.</td></tr>
<tr><td>ExposureAuto ControlMin (IFloat)</td><td>-</td><td>100</td><td>Set the minimum value for the ExposureTime control range. (µs)
Min: 100
Max: ExposureAutoControlMax - 1</td></tr>
</table>

Auto Level Control Item	Setting Range	Default	Description
ExposureAuto ControlMax (IFloat)	-	ExposureTimeMax*	Set the maximum value for the ExposureTime control range. (μs) **Min**: ExposureAutoControlMin + 1 **Max**: ExposureTimeMax*
GainAutoControlMin	-	1	Set the minimum value for the GainAuto control range. **Min**: 1 **Max**: (GainAutoControlMax - 1)
GainAutoControlMax (IFloat)	-	8	Set the maximum value for the GainAuto control range. **Min**: GainAutoControlMin+1 **Max**: 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)	-20 to +20	-	Set the Color Matrix value. (Step = 0.1) **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) **Related Topic:** Pixel Shift Alignment	0: Off 1: On	0: Off	Enable/Disable PixelShiftAllignment, which corrects the sensor's registration misalignment.
PixelShiftAlignment ChannelSelector (IEnum)	0: Red (Default) 2: Blue		Select the channel to perform the sensor alignment.
PixelShiftAlignmentHorizontal (pixel) (IInteger)	-64 to +64	0	Set the correction value for horizontal sensor alignment.
PixelShiftAlignmentVertical (pixel) (IInteger)	-64 to +64	0	Set the correction value for vertical sensor alignment.
ChromaticAberrationCorrectionMode (IEnum) **Related Topic:** Chromatic Aberration Correction	0: Off 1: On	Off	Enable / Disable Chromatic Aberration Correction.
ChromaticAberrationCorrection ChannelSelector (IEnum)	0: Red (Default) 2: Blue		Select the color of the Chromatic Aberration Correction values.
ChromaticAberrationCorrection Preset (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 Preset 3 corrects misalignment in the mid-range area.
ChromaticAberrationCorrection Coeff (IInteger)	-256 to +256	0	Set the coefficient value for the selected preset.
ChromaticAberration CenterOffsetHorizontal (IInteger)	-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.
ChromaticAberration CenterOffsetVertical (IInteger)	-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.
VideoProcessBypassMode (IEnum) **Related Topic:** VideoProcessBypassMode	0: Off 1: On	0: Off	Enable/disable VideoProcessBypass mode.
EdgeEnhancerEnable (IBoolean) **Related Topic:** Edge Enhancer, Color Enhancer	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) - 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)		
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. - No image is being output. - When AcquisitionMode is set to Single or MultiFrame. - TestPattern is being output (ImageFormatControl - OverlayMode is set to other than Off (ImageFormatControl) - In MultiRoi mode (Multi ROI Function) - BalanceWhiteAuto is set to Continuous (AnalogControl) - ExposureAuto is set to Continuous (AcquisitionControl) - ReverseX is set to True or ReverseY is Set to True (ImageFormatControl) - Width/Height is not set to WidthMax or HeightMax (ImageFormatControl) - In Sequencer Mode (Sequencer Function) - Not in lens cap state		
BlemishDetectionResult (IEnum)	0: Idle (Default) 1: Succeeded 2: Error1 - image was too bright 5: Error4 - detect blemishes too many 6: Error5 - could not detected 7: Error6 - timeout		Display the blemish detection results.
BlemishStore (ICommand)	-	-	Save the location information of detected blemishes, manually specified by BlemishiCompensationPositionX and BlemishCompensasionPositionY.
BlemishCompensation ChannnelSelector (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 (IInteger)	-	-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. **Min**: -1 **Max**: WidthMax - 1
BlemishCompensation PositionY (IInteger)	-	-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. **Min**: -1 **Max**: HeightMax - 1
BlemishCompensation DataClear (ICommand)	-	-	Delete detected or specified blemish information selected in BlemishCompensationIndex.
BlemishCompensationNumber (IInteger)	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 (IEnum)	0: Off 1: On	0: Off	Enable / disable SequencerMode.
SequencerModeSelect (IEnum)	0: Trigger Sequencer Mode (Default) 1: Command Sequencer Mode		Select the sequencer mode.
SequencerSetSelector (IInteger)	1 ~ 32	1	Select the index number to configure.
SequencerWidth (IInteger)	-	WidthMax	Set the Width of the selected SequencerIndex. The setting range is the same as Width [ImageFormatControl].

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

<table>
<tr><th>Sequencer Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>SequencerLUTEnable (IBoolean)</td><td>False
True</td><td>False</td><td>Set the LUTEnable of the selected SequencerIndex.</td></tr>
<tr><td>SequencerSetNext (IInteger)</td><td>0 ~ 32</td><td>-</td><td>Set the next index to be displayed for the selected SequencerIndex. (Enabled only for TriggerSequencer.)<table><tr><th>SequencerSelector</th><th>Default:</th></tr><tr><td>0~ 31</td><td>SequencerSetSelector value+1</td></tr><tr><td>32</td><td>0</td></tr></table></td></tr>
<tr><td>SequencerRepetition (IInteger)</td><td>1 ~ 255</td><td>1</td><td>Set the repeat count for the sequencer.</td></tr>
<tr><td>SequencerSetActive (IInteger)</td><td>1 ~ 32</td><td>1</td><td>Displays the active index number.</td></tr>
<tr><td>SequencerSetStart (IInteger)</td><td>1 ~ 32</td><td>1</td><td>Specify the first index number to switch to when starting TriggerSequencerMode.</td></tr>
<tr><td>SequencerCommandIndex (IInteger)</td><td>1 ~ 32</td><td>1</td><td>Set this to change the SequencerIndex. (Enabled only for CommandSequencer.)</td></tr>
<tr><td>SequencerReset (ICommand)</td><td>-</td><td>-</td><td>In TriggerSequencerMode, reset the current index number to the number configured in SequencerSetStart.</td></tr>
</table>

CounterAndTimerControl

Configure counter settings.

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

> **Related Topic:** CounterAndTimerControl

<table>
<tr><th>Count And Time Control</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>CounterSelector (IEnum)</td><td colspan="2">0: Counter0 (Default)
1: Counter1
2: Counter2
3: Counter3</td><td>Select the counter.</td></tr>
<tr><td>CounterEventSource (IEnum)</td><td>-</td><td>0: Off</td><td>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)</td></tr>
<tr><td>CounterEventActivation (IEnum)</td><td colspan="2">1: Rising Edge
2: Falling Edge</td><td>Set the count timing. The setting value is fixed with the following data.<table><tr><th>Counter Selector</th><th>CounterEventActivation</th></tr><tr><td>Counter0, 1, 2</td><td>Rising Edge</td></tr><tr><td>Counter3</td><td>Falling Edge</td></tr></table></td></tr>
<tr><td>CounterReset (ICommand)</td><td>-</td><td>-</td><td>Reset the counter.</td></tr>
<tr><td>CounterValue (ICommand)</td><td>0 - 32bit max</td><td>0</td><td>Display the count value.</td></tr>
<tr><td>CounterStatus (IEnum)</td><td>-</td><td>CounterIdle</td><td>Display the counter status.
0: CounterIdle
1: CounterTriggerWait
2: CounterActive
3: CounterCompleted
4: CounterOverflow</td></tr>
</table>

ActionControl

> **Related Topic:** Action Control Function

Configure action control settings.

> **Note:** This function is supported only on the AP-5100T-5GE model.

Action Control Item	Setting Range	Default	Description
Action Device Key (IInteger)	0x0 ~ 0xFFFFFFFF	0x00	Set the action device key.
Action Queue Size (IInteger)	0 ~ 32bit max	256	Set the size of action queue.
Action Selector (IInteger)	0 ~ 3	0	Select the action.
Action Group Mask (IInteger)	0x0 ~ 0xFFFFFFFF	0x00	Set the mask value that creates the action 0 group,
Action Group Key (IInteger)	0x0 ~ 0xFFFFFFFF	0x00	Set the key that executes action 1.

EventControl

Related Topic: Event Control Function

Configure event control settings.

Event Control Item	Setting Range	Default	Description
EventSelector (IEnum)	Select the event for which to send notifications. 42: FrameStart 44: FrameEnd 6: ExposureRedStart 7: ExposureRedEnd 8: ExposureGreenStart 9: ExposureGreenEnd 10: ExposureBlueStart 11: ExposureBlueEnd		
EventNotification (IEnum)	0: Off (Default) 1: On		Select whether to output the Event message selected by **EventSelector**. When set to **On**, the following data will be displayed each time the specified Event occurs.
EventAcquisitionStartData (ICategory)			Display the following data when the Event occurs.
EventAcquisitionStart (IInteger)	-	0x9011	Display the EventID.
EventAcquisitionStart Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when an Event occurred.
EventAcquisitionStartFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventAcquisitionEndData (ICategory)			Display the following data when the Event occurs.
EventAcquisitionEnd (IInteger)	-	0x9012	Display the EventID.
EventAcquisitionEnd Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventAcquisitionEndFrameID			Displays the FrameID value when an event occurs.
EventFrameStartData (ICategory)			Display the following data when the Event occurs.
EventFrameStart (IInteger)	-	0x9300	Display the EventID.
EventFrameStartTimestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when an Event occurred.
EventFrameStartFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventFrameEndData (IInteger)			Display the following data when the Event occurs.
EventFrameEnd (IInteger)	-	0x9301	Display the EventID.

Event Control Item	Setting Range	Default	Description
EventFrameEnd Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EvenFrameEndFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventExposureRedStartData (ICategory)			Display the following data when the Event occurs.
EventExposureRedStart (IInteger)	-	0x9302	Display the EventID.
EventExposureRedStart Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureRedStartFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventExposureRedEndData (ICategory)			Display the following data when the Event occurs.
Event ExposureRedEnd (IInteger)	-	0x9303	Display the EventID.
EventExposureRedEnd Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureRedEndFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventExposureGreenStartData (ICategory)			Display the following data when the Event occurs.
EventExposureGreenStart (IInteger)	-	0x9304	Display the EventID.
EventExposureGreenStart Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureGreenStartFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventExposureGreenEndData (ICategory)			Display the following data when the Event occurs.
EventExposureGreenEnd (IInteger)	-	0x9305	Display the EventID.
EventExposureGreenEnd Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureGreenEndFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventExposureBlueStartData (ICategory)			Display the following data when the Event occurs.
Event ExposureBlueStart (IInteger)	-	0x9306	Display the EventID.

Event Control Item	Setting Range	Default	Description
Event ExposureBlueStart Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureBlueStartFrameID (IInteger)			Displays the FrameID value when an event occurs.
EventExposureBlueEndData (ICategory)			Display the following data when the Event occurs.
EventExposureBlueEnd (IInteger)	-	0x9307	Display the EventID.
EventExposureBlueEnd Timestamp (IInteger)	0 ~ 64bit max	0	Display the Timestamp value when the Event occurred.
EventExposureBlueEndtFrameID (IInteger)			Displays the FrameID value when an event occurs.

ChunkDataControl

Related Topic: Chunk Data Function

Configure Chunk Control settings.

Chunk Data Control Items	Setting Range	Default	Description
ChunkModeActive (IBoolean)	False True	False	Set whether to enable ChunkData.
ChunkLineStatusAll OnExposureStart (IInteger)	-	-	Display the LineStatusAll (DigitalIOControl) value. The data acquisition timing is at theExposureStart, and the displayed value is the value determined by the Line Inverter setting. ChunkID: 0x00002015
ChunkExposureTimeSelector (IEnum)	0: Common (Default) 1: Red 2: Green 3: Blue		Select the ExposureTime to display.
ChunkExposureTime (IFloat) (µs)	-	-	Display the ExposureTime (AcquisitionControl) value. The data acquisition timing is on the first line's ExposureTime.

ChunkID	Item
0x00002004	ChunkExposureTimeCommon
0x00002004	ChunkExposureTimeGreen
0x0000201C	ChunkExposureTimeRed
0x0000201D	ChunkExposureTimeBlue

<table>
<tr><th>Chunk Data Control Items</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>ChunkGainSelector (IEnum)</td><td colspan="2">0: Analog All (Default)
1: Analog Red
2: Analog Green
3: Analog Blue</td><td>Select the Gain to display.</td></tr>
<tr><td>ChunkGain (IFloat)</td><td>-</td><td>-</td><td>Display the Gain value (AnalogControl).<table><tr><th>ChunkID</th><th>Item</th></tr><tr><td>0x0000201F</td><td>ChunkGainAnalogAll</td></tr><tr><td>0x0000201F</td><td>ChunkGainAnalogGreen</td></tr><tr><td>0x00002020</td><td>ChunkGainAnalogRed</td></tr><tr><td>0x00002021</td><td>ChunkGainAnalogBlue</td></tr></table></td></tr>
<tr><td>ChunkFrameTriggerCounter (IInteger)</td><td></td><td></td><td>Display the CounterValue[Counter0] (CounterAndTimerControl) value. Data acquisition timing is FrameStart.
ChunkID: 0x0000200E</td></tr>
</table>

UserSetControl

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

> **Related Topic:** Step 7: 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. **Note:** 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.

TestControl

Tests the PendingAck function.

Test Control Item	Setting Range	Default	Description
TestPendingAck (ms) (IInteger)	-	-	After the time specified by TestPendingAck has elapsed, a WriteRegAck is issued. If the specified time period exceeds the maximum device response time defined by DeviceLinkCommandTimeout, a PendingAck is issued instead. When read, the current Value is returned immediately without any waiting period.

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.

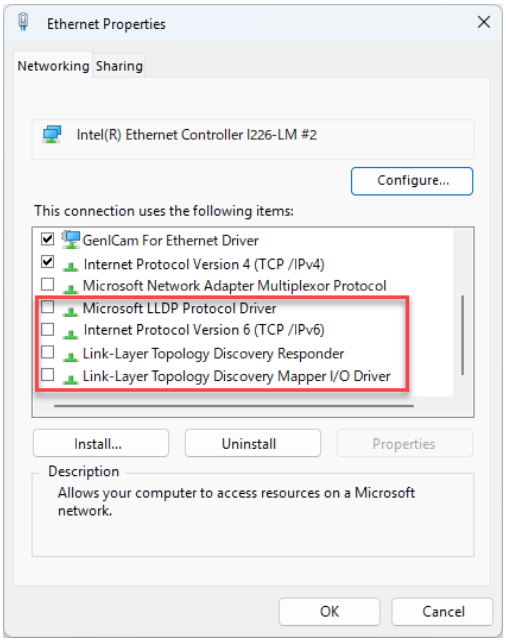
Issue: I want to restore the factory default settings.

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

When a Network Error Occurs

Issue: A network error occurs between the camera and the PC.

Cause and Solution: Depending on the network adapter settings, unnecessary protocols or features may interfere with communication and cause errors. Open the **Ethernet Properties** dialog, go to the **Networking** tab, and uncheck the unnecessary items within the red rectangle in the screenshot below.



Specifications

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Image Sensor</td><td>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)</td></tr>
<tr><td>Scanning System</td><td>Progressive scan, 1 tap</td></tr>
<tr><td>Synchronization</td><td>Internal</td></tr>
<tr><td>Interface</td><td>5GBASE-T Ethernet (GigE Vision 2.0)</td></tr>
<tr><td>Max Frame Rate:</td><td>
<table>
<tr><th>RGB8</th><th>RGB10V1Packed, RGB10p32</th><th>RGB12V1Packed</th></tr>
<tr><td>34 fps</td><td>26 fps</td><td>23 fps</td></tr>
</table>
</td></tr>
<tr><td>Dark SN (DR)
DarkLevel @ 10bit</td><td>
<table>
<tr><th rowspan="2"></th><th colspan="2">IndividualGainMode</th></tr>
<tr><th>Off</th><th>On</th></tr>
<tr><td>R</td><td>56dB (Typ)</td><td>>60dB (Typ)</td></tr>
<tr><td>G</td><td>60dB (Typ)</td><td>>60dB (Typ)</td></tr>
<tr><td>B</td><td>60dB (Typ)</td><td>>60dB (Typ)</td></tr>
<tr><td colspan="3">Individual Gain Green/Red/Blue : x1.0 (0dB)
GainAnalogAll : AcquisitionFrameRate 12 fps, ExposureMode:Off, Pixelformat RGB8</td></tr>
</table>
</td></tr>
<tr><td>Bright SN
890LBS @ 10bit</td><td>
<table>
<tr><th rowspan="2"></th><th colspan="2">IndividualGainMode</th></tr>
<tr><th>Off</th><th>On</th></tr>
<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>
<tr><td colspan="3">Individual Gain Green/Red/Blue : x1.0(0dB)
GainAnalogAll : AcquisitionFrameRate 12 fps, ExposureMode:Off, Pixelformat RGB8</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Digital Image Output</td><td>
<table>
<tr><th></th><th>HorizontalBinning = 1
VerticalBinning = 1
FD2x2Binning = Off</th><th>HorizontalBinning = 2
VerticalBinning = 2
FD2x2Binning = Off</th><th>HorizontalBinning = 1
VerticalBinning = 1
FD2x2Binning = On</th></tr>
<tr><td>Width</td><td>96 ~ 2464, step: 8</td><td>48 ~ 1232, step: 4</td><td>96 ~ 1228, step: 4</td></tr>
<tr><td>Height</td><td>8 ~ 2056, step: 2</td><td>4 ~ 1028, step: 1</td><td>8 ~ 1024, step: 1</td></tr>
<tr><td>OffsetX</td><td>0 ~ 2368, step: 8</td><td>0 ~ 1184, step: 4</td><td>0 ~ 1180, step: 4</td></tr>
<tr><td>OffsetY</td><td>0 ~ 2048, step: 2</td><td>0 ~ 1024, step: 1</td><td>0 ~ 1020, step: 1</td></tr>
<tr><td colspan="4">BinningHorizontal / BinningVertical and FD2x2BinningMode cannot be used together.</td></tr>
</table>
</td></tr>
<tr><td>Pixel Format</td><td>RGB8, RGB10V1Packed, RGB10p32, RGB12V1Packed</td></tr>
<tr><td>ImageScalingMode (Xscale)</td><td>Independent, sub-pixel rescaling of H and/or V resolution (1/16 Max)</td></tr>
<tr><td>Acquisition Mode</td><td>SingleFrame, MultiFrame (AcquisitionFrameCount 1 ~ 65535), Continuous</td></tr>
<tr><td>Trigger Selector</td><td>AcquisitionStart, AcquisitionEnd, FrameStart, AcquisitionTransferStart</td></tr>
<tr><td>ExposureMode / Time</td><td>
<table>
<tr><th>ExposureMode</th><th>ExposureTime (µs)</th></tr>
<tr><td>Timed (FrameStartTrigger Off)</td><td>1µs ~ 7998701µs</td></tr>
<tr><td>Timed (FrameStartTrigger On)</td><td>1µs ~ 7998701µs</td></tr>
<tr><td>TriggerWidth</td><td>1µs ~ ∞</td></tr>
</table>
Note: The setting values. Does not include the exposure offset duration (2.47µsµs).
</td></tr>
<tr><td>ExposureModeOption</td><td>Off / RCT</td></tr>
<tr><td>OptInFilter</td><td>0 ~ 40 ms (step: 100ns)</td></tr>
<tr><td>TriggerOverlap</td><td>Off, Readout</td></tr>
<tr><td>Trigger Input Signals</td><td>TTL In x2, Opto In x2, Software, Pulse Generator x 4, User Output x 4, Action x4, NAND 0 Out, NAND 1 Out</td></tr>
<tr><td>Exposure Auto</td><td>Off, Once, Continuous</td></tr>
<tr><td>ALCControlRatio</td><td>1 ~ 100%</td></tr>
<tr><td>Digital IO</td><td>LineSelector (12-pin, 6-pin): GPIO IN / OUT</td></tr>
</table>

<table>
<tr><th>Item</th><th>Specifications</th></tr>
<tr><td>Gain Adjustment (Manual)</td><td>
<table>
<tr><th>GainSelector</th><th>IndividualGainMode = Off</th><th>IndividualGainMode = On</th></tr>
<tr><td>AnalogAll*</td><td>0.0dB ~ 18.1dB (x1.0 ~ x8.0)</td><td>0db (x1.0) (Fixed)</td></tr>
<tr><td>AnalogRed*</td><td>-6.6dB ~ 12.0dB (x0.47 ~ x4.0)</td><td>0dB ~ 36.1dB (x1.0 ~ x64.0)</td></tr>
<tr><td>AnalogBlue*</td><td>-6.6dB ~ 12.0dB (x0.47 ~ x4.0)</td><td>0dB ~ 36.1dB (x1.0 ~ x64.0)</td></tr>
<tr><td>AnalogGreen*</td><td>0db (x1.0) (Fixed)</td><td>0dB ~ 36.1dB (x1.0 ~ x64.0)</td></tr>
<tr><td>DigitalRed</td><td colspan="2">-0.9dB ~ 0.8dB (x0.9 ~ x1.1)</td></tr>
<tr><td>DigitalBlue</td><td colspan="2">-0.9dB ~ 0.8dB (x0.9 ~ x1.1)</td></tr>
<tr><td colspan="3">*The resolution is set in about 0.1dB steps.</td></tr>
</table>
</td></tr>
<tr><td>Gain Adjustment (Automatic)</td><td>Off, Once, Continuous</td></tr>
<tr><td>Black Level Adjustment</td><td>All: -133 ~ +255; Red/Blue: -64 ~ +64</td></tr>
<tr><td>White Balance</td><td>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</td></tr>
<tr><td>Blemish Compensation</td><td>Detection: Detect white blemishes using threshold values (100 steps available) (black blemish correction performed only at the factory)
Correction: Interpolation using adjacent pixels. Continuous blemishes can be corrected up to 3 horizontal pixels
Correctable pixels: 300 pixels</td></tr>
<tr><td>ALC</td><td>Video level adjusted automatically using AGC and ASC</td></tr>
<tr><td>Gamma</td><td>0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9,1.0 (9 steps available)</td></tr>
<tr><td>LUT</td><td>Off: γ = 1.0、ON = 257 points can be set</td></tr>
<tr><td>Power</td><td>
<table>
<tr><td rowspan="2">12-pin</td><td>Input Range</td><td>DC10.8 to 26.4 V</td></tr>
<tr><td>Consumption*</td><td>8.2W (typ), Max 9.8W</td></tr>
<tr><td colspan="3">*Default Setting/25°C (Environment)</td></tr>
</table>

Note: PoE is not supported.
</td></tr>
<tr><td>Lens Mount</td><td>C-mount</td></tr>
<tr><td>Back flange distance</td><td>17.526mm</td></tr>
<tr><td>Optical Filter</td><td>IR cut filter</td></tr>
</table>

Item	Specifications
Verified Performance Temperature/Humidity	-5°C ~ +45°C (20 to 80%, non-condensing) **Note:** It may change depending on the installation environment. Please refer to the Caution in this section.
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 B, EN55035:2017(CISPR35:2016) Class B, FCC Part15 Subpart B Class B, EU RoHS/WEEE, China RoHS, KC
Dimensions	54mm x 54 mm x 74 mm(Excluding lens mount protrusions and connectors)
Weight	215g

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 66°C during operation.

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

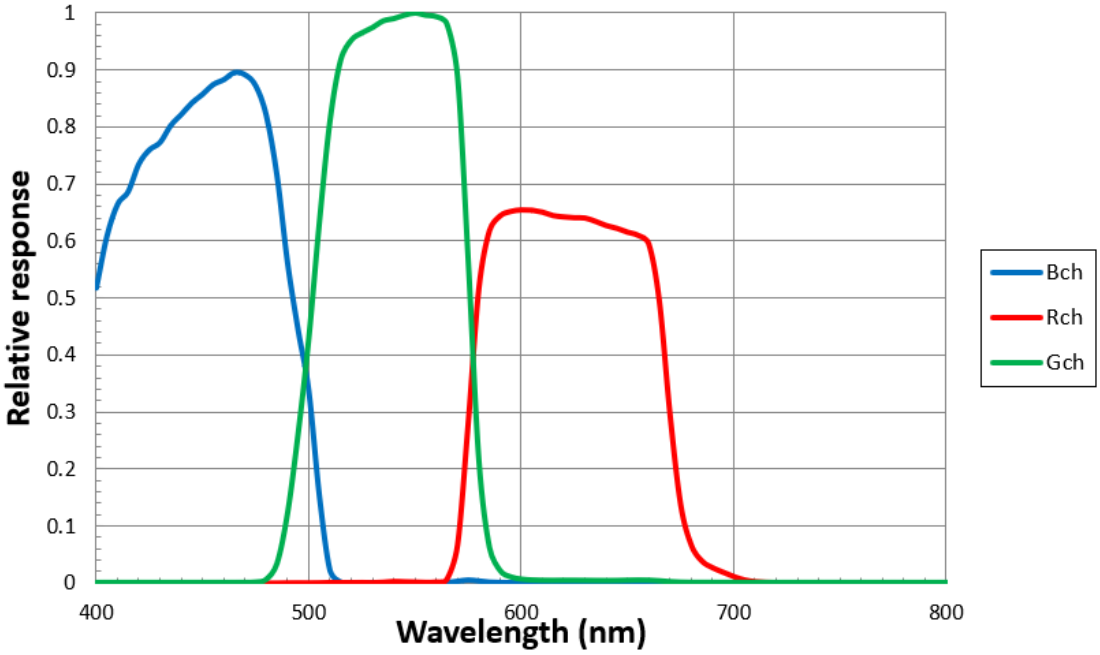
Package Contents

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

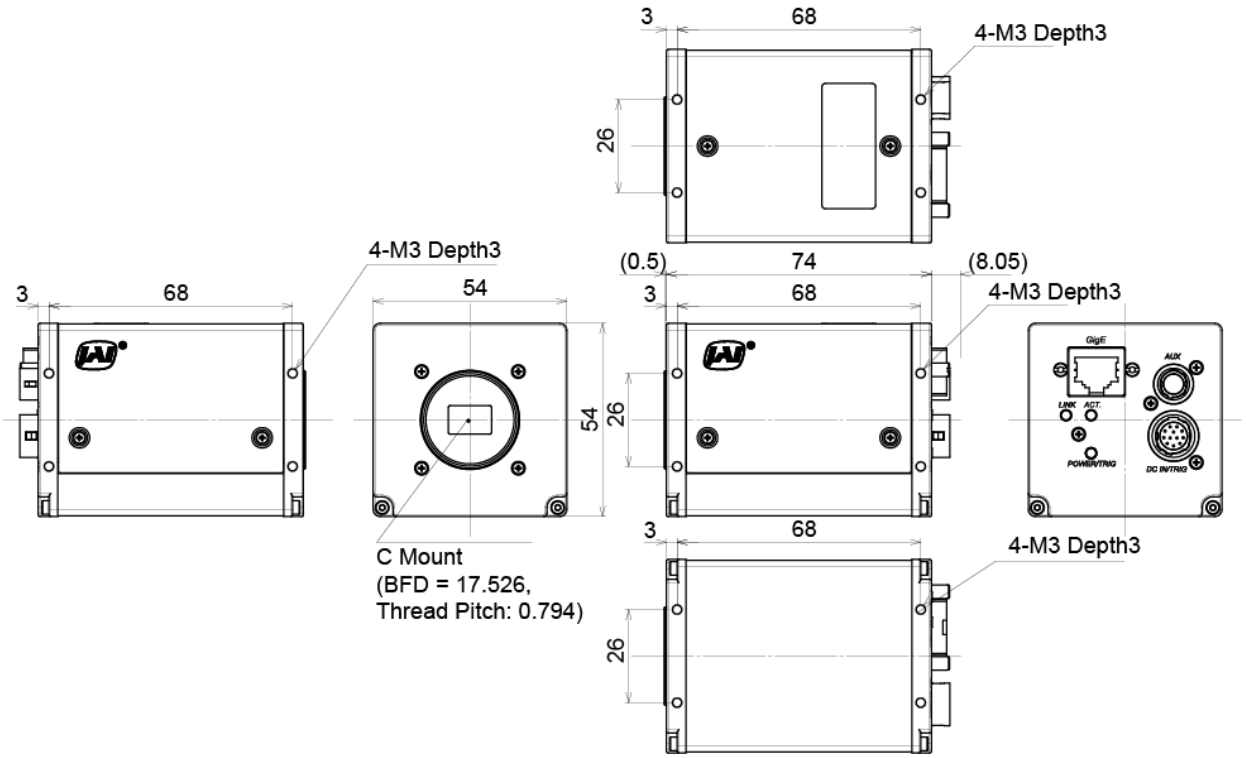
Optional Accessories (Sold Separately)

- MP-44 Tripod Adapter Plate

Spectral Response



Dimensions



Notes:

- Dimensional tolerance: ± 0.3mm
- 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: ……

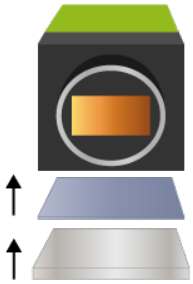
For camera revision history, please contact your local JAI distributor.

Appendix

This section provides additional information about this camera.

Recommended Passive Cooling Method

If the camera's internal temperature exceeds the allowed maximum temperature (66°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	2026/05/07	DV0100	Added "Calculate the Maximum Frame or Trigger Rate (Approximate)" and "Timing Chart".
1.0	2026/04/23	DV0100	First release