See the possibilities

User Manual

GOX-2402M-PGE
GOX-3201M-PGE
GOX-5103M-PGE
GOX-8901M-PGE
GOX-12401M-PGE

GOX-2402C-PGE
GOX-3201C-PGE
GOX-5103C-PGE
GOX-8901C-PGE
GOX-12401C-PGE

CMOS Digital Progressive Scan
Monochrome and Color Camera with GigE Interface

Document Version: 1.5
Date: 2023-12-01

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

Notice/Warranty

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.

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

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 GOX-2402M-PGE, GOX-2402C-PGE, GOX-3201M-PGE, GOX-3201C-PGE, GOX-5103M-PGE, GOX-5103C-PGE, GOX-8901M-PGE, GOX-8901C-PGE, GOX-12401M-PGE, and GOX-12401C-PGE comply with the following provisions applying to their standards.

EN 55032:2015(CISPR32:2015)

EN 55035:2017(CISPR35:2016)

FCC

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

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Warning

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

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-2402M-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-2402C-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-3201M-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-3201C-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-5103M-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-5103C-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-8901M-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-8901C-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-12401M-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

상 호:	JAI Ltd. Japan
기자재명칭:	Industrial Camera
모 델 명:	GOX-12401C-PGE
제조자 및 제조국가:	JAI Ltd., Japan / JAPAN

R-R-JAi-GOX-12401C-PGE

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)
GOX-2402MC-PGE GOX-3201MC-PGE GOX-5103MC-PGE GOX-8901MC-PGE GOX-12401MC-PGE	×	○	○	○	○	○

○: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。

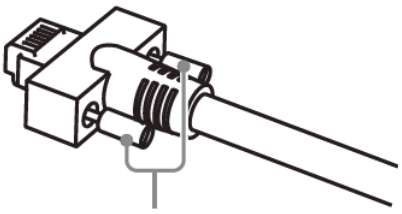
Usage Precautions

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.

Notes on Exportation

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

Features

Go-X Series GigE Vision interface cameras are industrial progressive scan cameras equipped with a global shutter CMOS image sensor. These provide an attractive combination of high resolution, high speed, and high image quality for machine vision applications.

These cameras are equipped with various functions required for machine vision including external trigger, exposure setting, image level control, look-up table, shading correction, blemish compensation, ROI, binning, etc.

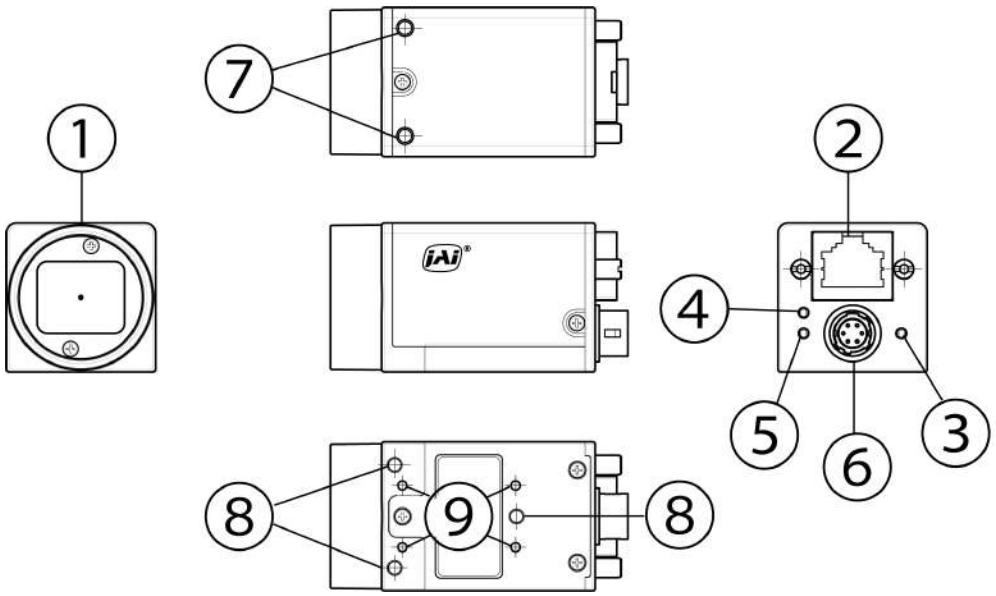
Model Name	Image Sensor		Active Pixels	Pixel Size	Max Frame Rate
GOX-2402M-PGE	Mono	Type 1/2.3	1920 x 1200	3.45 µm x 3.45 µm	49.9 fps
GOX-2402M-PGE-CS					
GOX-2402C-PGE	Color				
GOX-2402C-PGE-CS					
GOX-3201M-PGE	Mono	Type 1/1.8	2048 x 1536	3.45 µm x 3.45 µm	36.5 fps
GOX-3201M-PGE-CS					
GOX-3201C-PGE	Color				
GOX-3201C-PGE-CS					
GOX-5103M-PGE	Mono	Type 2/3	2448 x 2048	3.45 µm x 3.45 µm	22.9 fps
GOX-5103M-PGE-CS					
GOX-5103C-PGE	Color				
GOX-5103C-PGE-CS					
GOX-8901M-PGE	Mono	Type 1	4096 x 2160	3.45 µm x 3.45 µm	12.9 fps
GOX-8901C-PGE	Color				
GOX-12401M-PGE	Mono	Type 1.1	4096 x 3000	3.45 µm x 3.45 µm	9.3 fps
GOX-12401C-PGE	Color				

Note: In addition to the standard C-mount model, the CS-mount model (-CS) is also available.

Feature Overview

- Compliance with GigE Vision Ver.2.0 and GenICam standards
- Global Shutter high resolution CMOS sensor
- Lens mount: C-mount, CS-mount
- 8/10/12-bit output in choice of monochrome or raw Bayer color models.
- ROI settings for added flexibility
- Horizontal/vertical image flip function, plus blemish correction and shading compensation
- Sequencer function and Automatic Level Control (ALC) for dynamic lighting conditions

Parts Identification



Note: Above is an external view of the C-mount model; for an external view of the CS-mount model, see the CS-Mount Model page.

① Lens Mount (C-Mount / CS-Mount)

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

Note: Before mounting a lens, be sure to refer to ① Lens and confirm the precautions for attaching a lens and the supported lens types.

② RJ-45 Connector

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

③ POWER/TRIG LED

Indicates the power or trigger input status.

LED		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.

④ LINK LED

Indicates whether the GigE network connection is established or not.

LED		Status
	Off	The network link is not established (or in progress).
	Lit green	1000Base-T link is established.

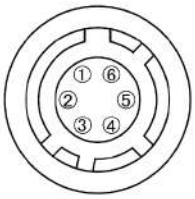
⑤ ACT LED

Indicates the GigE network status.

LED		Status
	Off	Communication is not active.
	Blinking Green	Communication is active. (TX)
	Blinking amber	Communication is active. (RX)

⑥ DC IN/TRIG Connector (6-Pin Round)

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



Camera Side: HR10A-7R-6PB (Hirose Electric or equivalent)

Cable Side: HR10A-7P-6S (Plug) (Hirose Electric or equivalent)

Pin No.	Input/Output	Signal	Description
1	Power In	DC In	DC in +10V ~ +25V
2	In	Opto In+	Line 5
3	In	Opto In-	
4	Out	Opto Out+	Line 2
5	Out	Opto Out-	
6	GND	GND	

Notes:

- See Recommended Circuit Diagram (Reference Examples) for the recommended Input/Output circuit diagrams.
- Refer to the GPIO (Digital Input/Output Settings) topic as well.

⑦ ⑧ ⑨ Mounting Holes

Use these holes when mounting the camera directly to a wall or other structural system.

⑦ Upper part of camera (x2): M3, 3mm depth, 21mm pitch

⑧ Lower part of camera (x3): M3, 3mm depth, 20mm pitch (lens side)

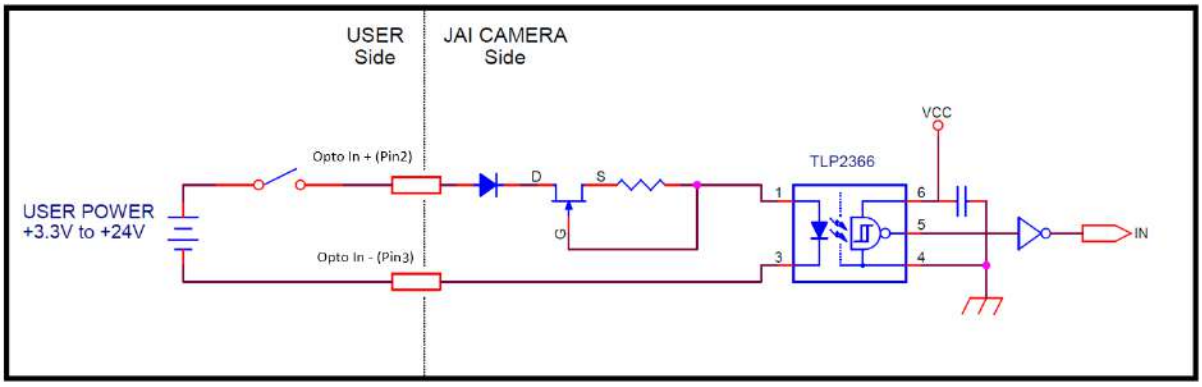
⑨ Lower part of camera (x4): M2, 3mm depth, 12mm pitch (lens side)

Recommended Circuit Diagram (Reference Examples)

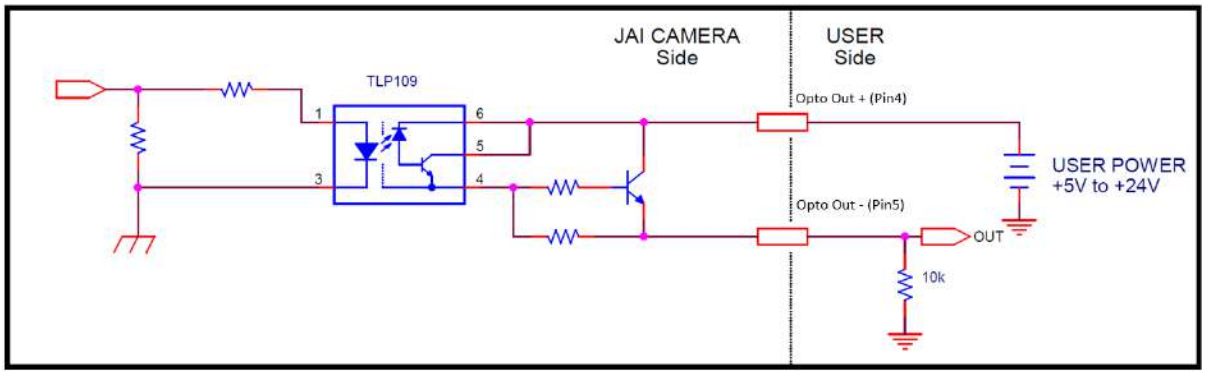
Related Setting Items: DigitalIOControl

Technical Notes OPTO-In Circuit Characteristics

Recommended External Input Circuit Diagram

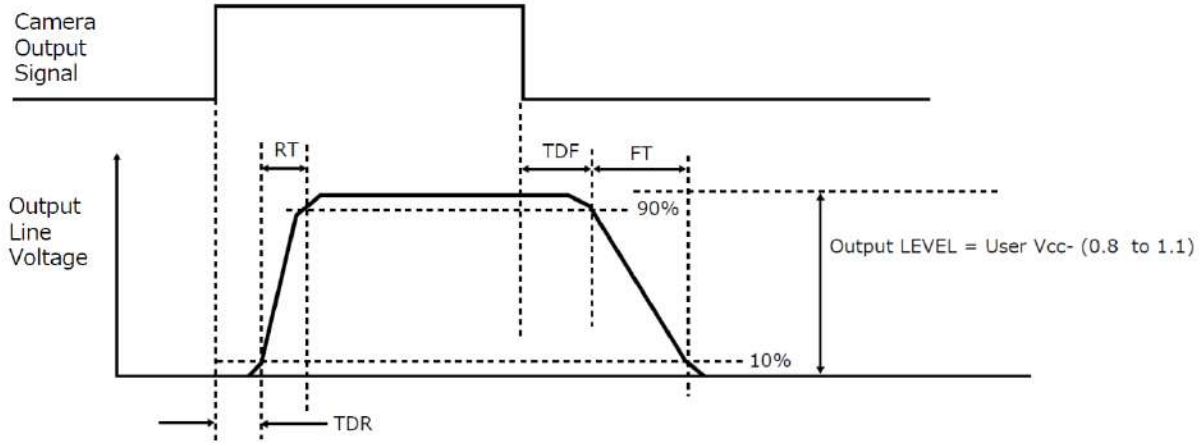


Recommended External Output Circuit Diagram (Reference Example)



Characteristics of the Recommended Circuits for Opto OUT

OUTPUT LINE RESPONSE TIME



For the operating conditions of applied voltage (User Power) +12V, load resistance 10kΩ, and cable length 1m, the timing is shown in the table below.

Item	Result (Typ)
TDR (Time Delay Rise)	0.48 (μs)
RT (Rise Time)	3.08 (μs)
TDF (Time Delay Fall)	3.16 (μs)
FT (Fall Time)	52.4 (μs)

Note: Since it varies depending on the applied voltage, load resistance, cable length, etc., check the actual environment before use.

Cautions:
Please note that the recommended load resistance of Opto output is 10 kΩ (rated 1/10 W) or more. The 270 Ω resistor shown in the circuit diagram is the MINIMUM resistance that should be used. The response speed from On (High) to Off (Low) depends on the voltage applied to Opto output and the value of the load resistance. Higher load resistance results in a slower response. If the response at 10 kΩ is slower than desired, you can try reducing the load resistance in order to increase the response speed but DO NOT go below the minimum 270 Ω value.

The load resistance loss can be calculated as follows.

load resistance loss ≒ (voltage applied to Opto output)^2 / (load resistance)

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** • Verify whether the camera is turned on and ready for use.
3	**Step 3: Verify Camera Operation** • Verify whether the camera is turned on and ready for use.
4	**Step 4: Verify the Connection between the Camera and PC** • Verify whether the camera is properly recognized via Control Tool.
5	**Step 5: Change the Camera Settings** • Refer to the procedure for changing the output format setting as an example and change various settings as necessary.
6	**Step 6: Adjust the Image Quality** • Refer to the procedures for adjusting the gain, white balance, and black level as examples, and adjust the image quality.
7	**Step 7: Save the Settings** • Save the current setting configurations in user memory.

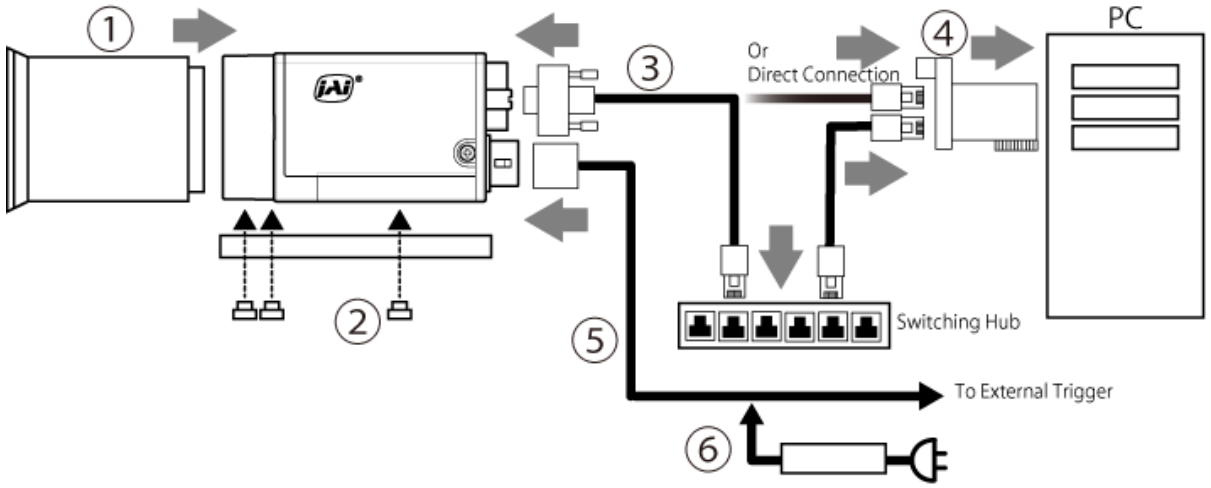
Step 1: Install the Software (First Time Only)

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

> **Note:** When you install eBUS SDK for JAI, eBUS Player for JAI will also be installed.

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



① Lens

② Mounting (or Use MP-43 Tripod Adapter Plate)

③ LAN Cable

④ Network Card

⑤ DC IN / Trigger IN Connection Cable

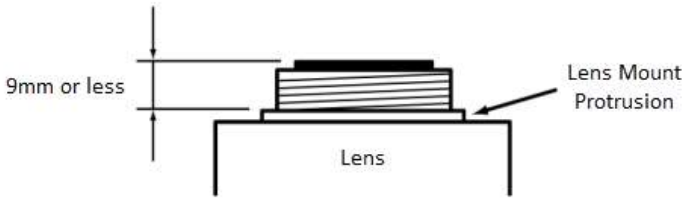
⑥ AC Adapter (Power Supply) (If Necessary)

① Lens

Technical Notes Lens Selection Guide

Standard Model (C-Mount Model)

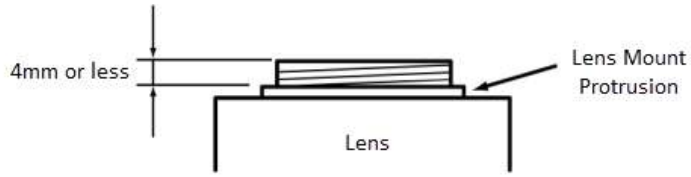
C-mount lenses with lens mount protrusions of 9 mm or less can be attached.



CS-Mount Model

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

> **Note:** If using a C-mount lens on the CS-mount model, use a 5mm lens adapter ring.



To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the image sensor size.

Model Name	Image Sensor		
GOX-2402M-PGE	Mono	Type1/2.3	6.62 mm x 4.14 mm (7.81 mm diagonal)
GOX-2402M-PGE-CS			
GOX-2402C-PGE	Color		
GOX-2402C-PGE-CS			
GOX-3201M-PGE	Mono	Type1/1.8	7.07 mm x 5.3 mm (8.83 mm diagonal)
GOX-3201M-PGE-CS			
GOX-3201C-PGE	Color		
GOX-3201C-PGE-CS			

Model Name	Image Sensor		
GOX-5103M-PGE	Mono	Type2/3	8.45 mm x 7.07 mm (11.01 mm diagonal)
GOX-5103M-PGE-CS			
GOX-5103C-PGE	Color		
GOX-5103C-PGE-CS			
GOX-8901M-PGE	Mono	Type1	14.13 mm x 7.45 mm (15.97 mm diagonal)
GOX-8901C-PGE	Color		
GOX-12401M-PGE	Mono	Type1.1	14.13 mm x 10.35 mm (17.52 mm diagonal)
GOX-12401C-PGE	Color		

Cautions:

- The maximum performance of the camera may not be realized depending on the lens.
- Attaching a lens with a protrusion longer than 9 mm for the C-mount (standard model) or 4 mm for the CS-mount 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

② Mounting (or Use MP-43 Tripod Adapter Plate)

When mounting the camera directly to a wall or other device, use screws that match the camera screw holes on the camera (see ⑦ ⑧ ⑨ Mounting Holes for more information).

Use the supplied screws to attach the tripod adapter plate (lower mounting holes).

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

③ LAN Cable

Connect a LAN cable to the RJ-45 connector.

- Use a LAN cable that is Category 5e or higher (Category 6 recommended).
- Use a LAN cable that is an STP cable.
- When supplying power via PoE, connect to a PoE-compatible switching hub or a PoE-compatible network card.

  > **Note:** JAI does not recommend using a PoE injector. If a PoE injector is used, the camera may not be able to transmit images properly.

- Refer to the specifications of the cable for details on its bend radius.

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

④ Network Card

Install this in 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.

⑤ DC IN / Trigger IN Connection Cable

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

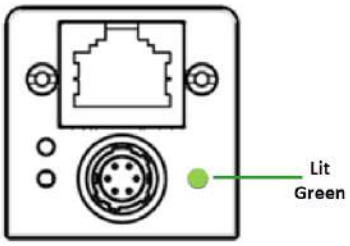
⑥ AC Adapter (Power Supply) (If Necessary)

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

Step 3: Verify 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.



For details on how to read the LEDs, see the ③ POWER/TRIG LED section.

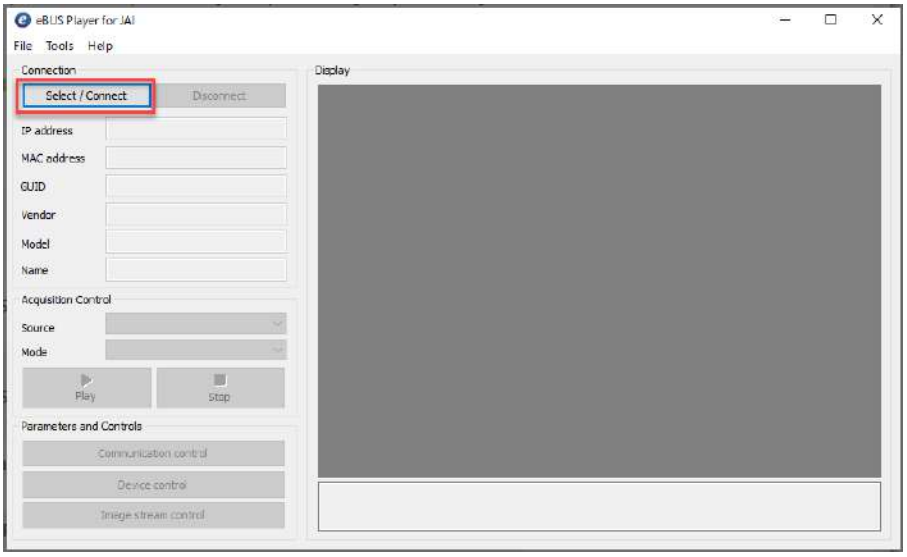
Step 4: Verify the Connection between the Camera and PC

Verify whether the camera is properly recognized via Control Tool.

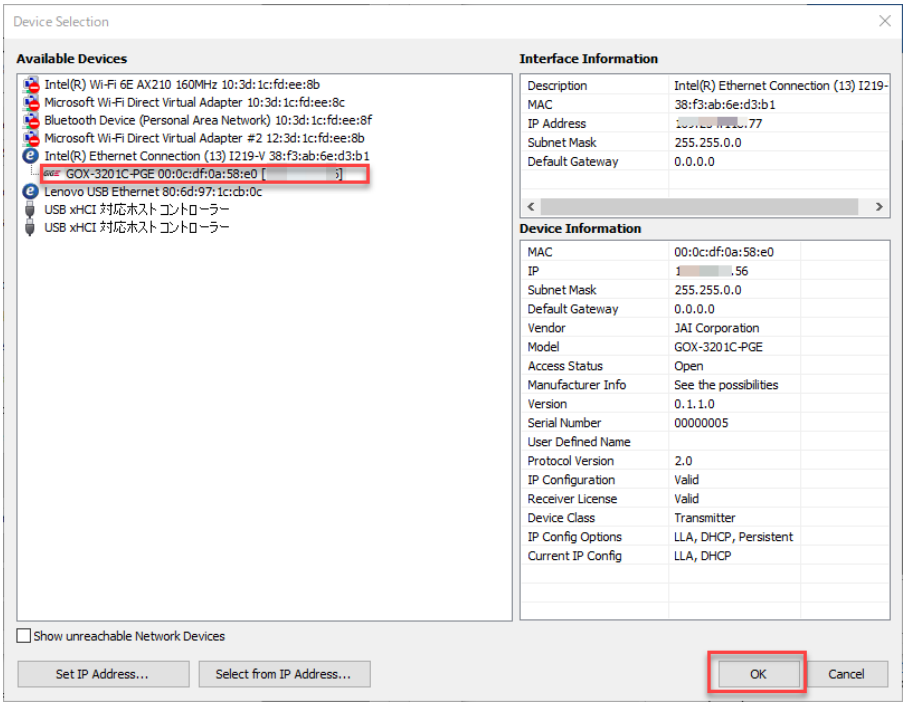
1. Launch eBUS Player for JAI

eBUS Player for JAI startup screen appears.

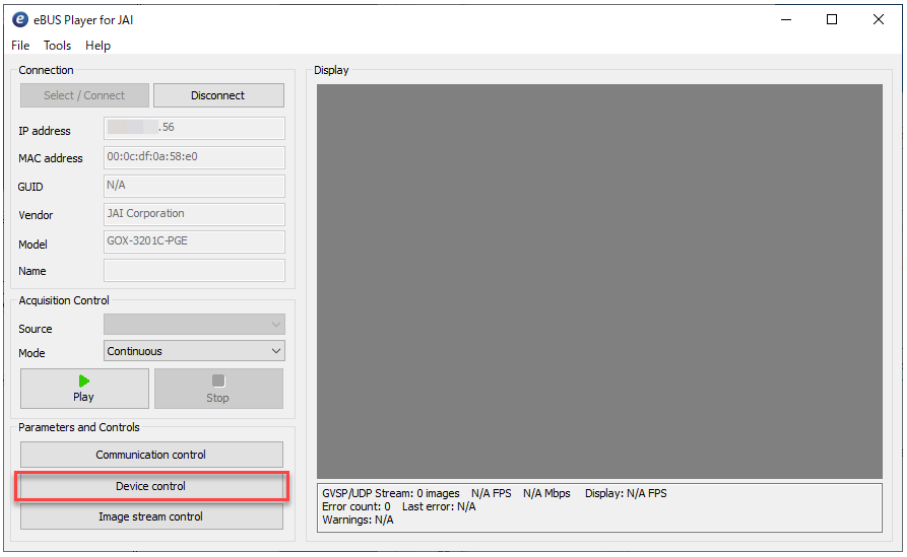
2. Select the camera you want to configure. Click the **Select / Connect** button.



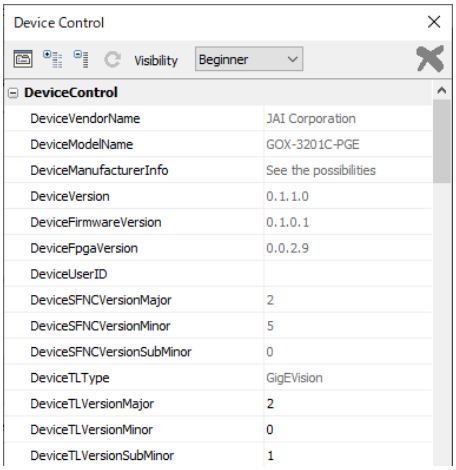
3. The connected camera is listed. Please select one camera and click **OK**.



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



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



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

Step 5: Change the Camera Settings

This section explains how to change settings by describing the procedure for changing the output format as an example.

Configure the Output Format

Configure the size, position, and pixel format of the images to be acquired. The factory settings are as follows. Change the settings as necessary.

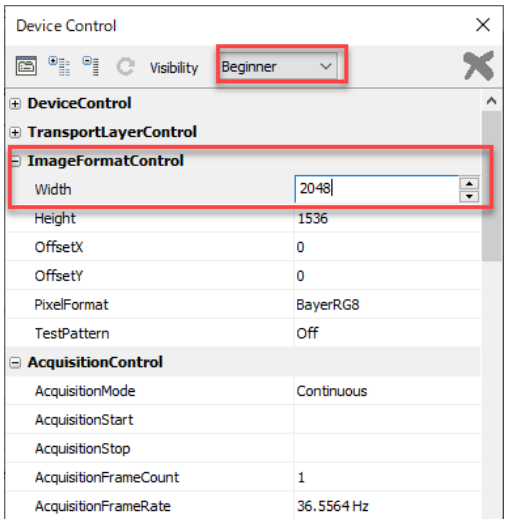
Factory default values (GOX-3201C-PGE)

Item		Default Value
ImageFormatControl	Width	2048
	Height	1536
	OffsetX	0
	OffsetY	0
	PixelFormat	BayerRG8

Note: You can specify the image acquisition area. For details, see "ROI Function (Single ROI)".

Example: Configure the Width of ImageFormatControl

1. By selecting the item of Width, you can change the value as shown below.



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

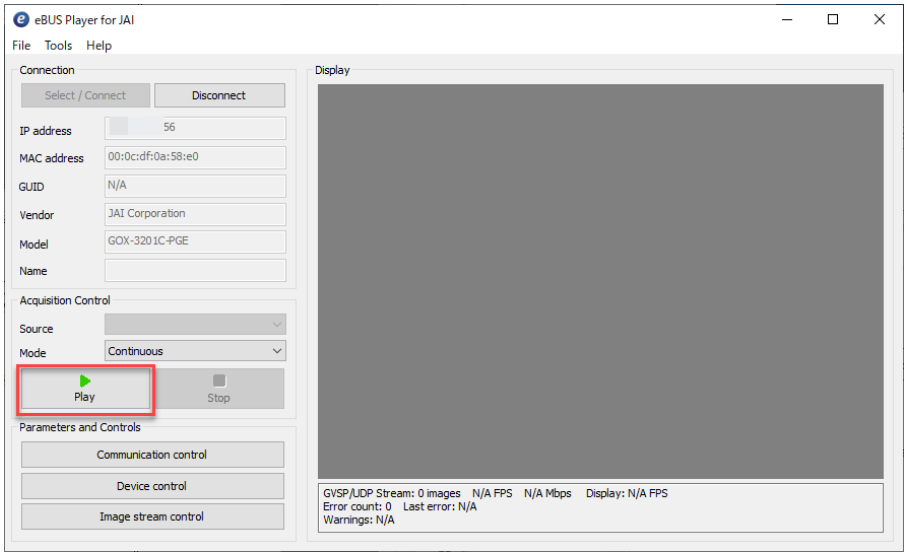
Step 6: Adjust the Image Quality

> **Related Setting Items:** AnalogControl

Display the camera image and adjust the image quality.

Display the Image

Display the image captured by the camera. When you click the **Play** button, the camera image appears in the right area.



> **Note:** It is recommended to set **GevGVCPPendingAck** in TransportLayerControl to **True**. When a time-consuming process such as white balance is performed, this camera returns an Ack response when the process is completed. In this case, some camera control software may cause a timeout error without waiting for an Ack response from the camera. When the GevGVCPPendingAck setting is enabled, if a time-consuming process is performed, the camera immediately returns a Pending Ack response and returns an Ack response when the processing is completed. The Timeout errors are prevented.

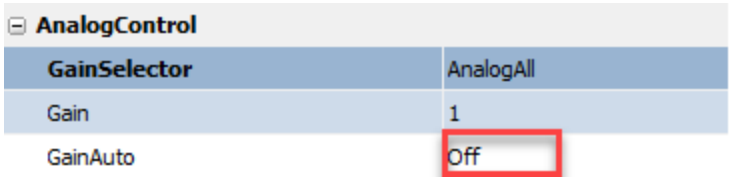
Adjust the Gain

Adjust the image quality using the gain and white balance functions. The Visibility must be changed from Beginner to **Guru**.

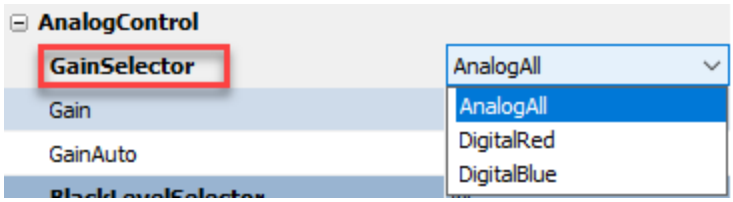
> **Note:** For details on the Gain control, see Gain Control in the Main Functions chapter.

Manual Adjustment

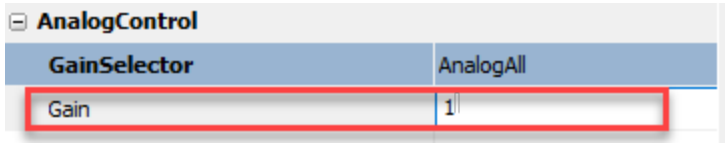
1. Expand **AnalogControl** and set GainAuto to **Off** (Default = Off).



2. Select the gain you want to configure in GainSelector. AnalogAll (master gain), DigitalRed* (digital R gain), and DigitalBlue* (digital B gain) can be configured.



3. Configure the Gain.



   - DigitalAll (master gain) can be set to a value from x1 to x126 the analog gain value. The resolution is set in about 0.1dB steps. Values are configured by multipliers.
   - The DigitalRed* (digital R gain) and DigitalBlue* (digital B gain) can be set to a value from x0.447 to x5.624. Values are configured by multipliers.

> **Note:** *Color models only.

Adjust the White Balance

Adjust the white balance using the automatic adjustment function.

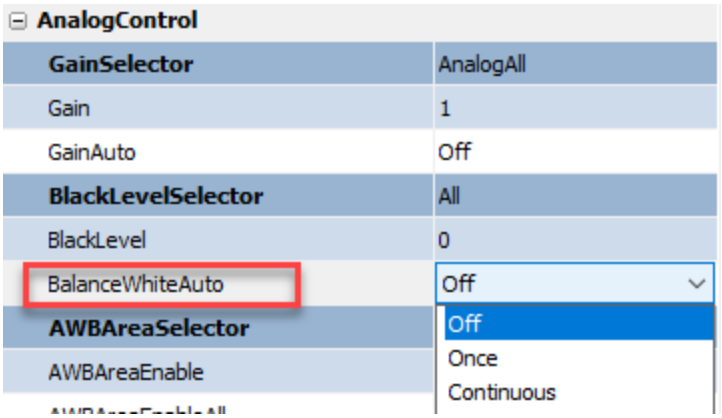
> **Note:** The white balance is only supported on color models.

Automatic White Balance Adjustment

1. Place a white sheet of paper or similar object under the same lighting conditions as the intended subject and zoom in to capture the white.

   White objects near the subject, such as a white cloth or wall, can also be used. Be sure to prevent the high-intensity spotlights from entering the screen.

2. Select the **BalanceWhiteAuto** tab and select **Continuous** or **Once** for the adjustment method.



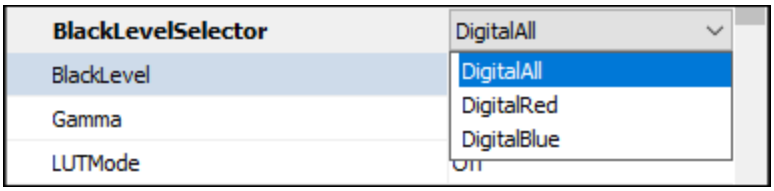
   The white balance is automatically adjusted.

> **Note:** For Continuous and Once, white balance is adjusted using R/B Gain.

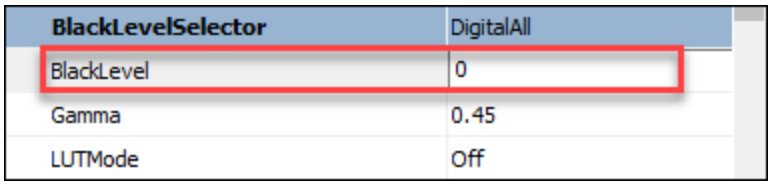
Adjust the Black Level

1. Expand **AnalogControl**, and select the black level you want to configure in **BlackLevelSelector**. All (master black), Red* (digital R), and Blue* (digital B) can be configured.

   > **Note:** *Color models only.



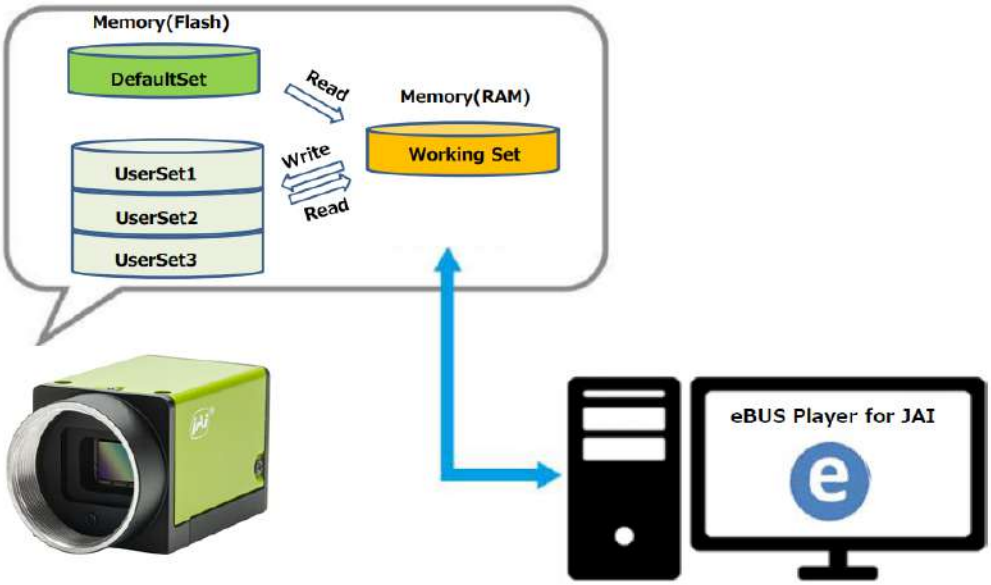
2. Specify the adjustment value in BlackLevel.



Step 7: Save the Settings

Related Setting Items: UserSetControl

The setting values configured in eBUS SDK for JAI 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)

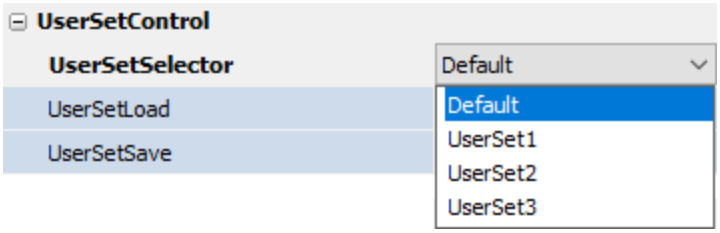


Notes:

- Changes to settings are not saved to the computer (eBUS SDK for JAI).
- The camera has non-volatile flash memory for users to store data; however, images should be saved to a PC or other storage location using eBUS Player for JAI (Image and Video Saving Options).

To Save User Settings

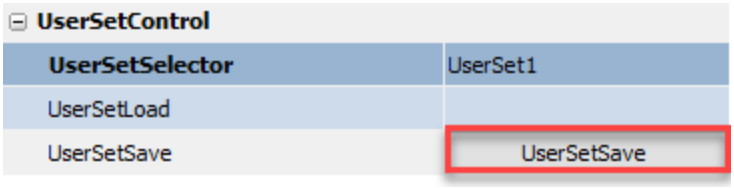
1. Stop image acquisition.
2. Expand **UserSetControl** and select the save destination (UserSet1 to UserSet3) in UserSetSelector.



> **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.

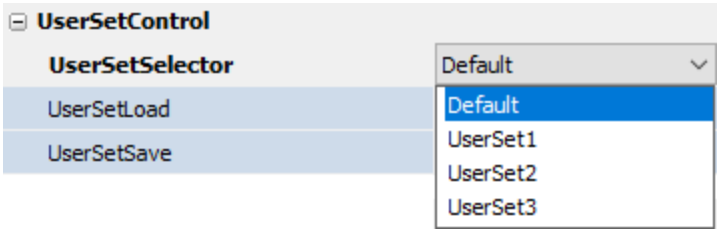
3. Select **UserSetSave** and click the **UserSetSave** button.



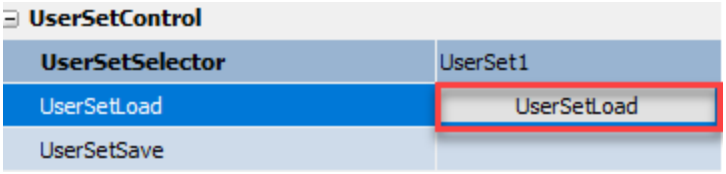
4. The current setting values are saved as user settings.

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.

Acquisition Control

> **Related Setting Items:** AcquisitionControl

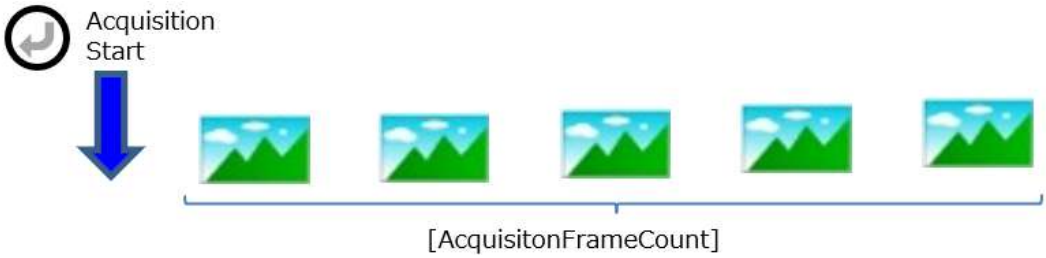
This camera has three Acquisition modes (SingleFrame, MultiFrame, Continuous). Use the AcquisitionControl settings to perform operations and settings for image capture.

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.

Changing the Frame Rate

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

> **Notes:**
> - The shortest frame period varies depending on the ROI, pixel format, and binning mode selected. The longest frame period is 0.125 Hz (8 sec.).
> - When TriggerMode[FrameStart] is enabled, the AcquisitionFrameRate setting is disabled.

Exposure Mode

> **Related Setting Items:** AcquisitionControl

This camera has three Exposure modes (Off, Timed, TriggerWidth). Use the AcquisitionControl settings to perform operations and settings for exposure.

ExposureMode = 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.

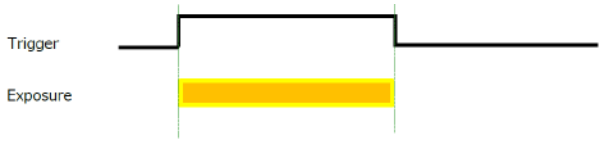
ExposureMode = Timed

Mode in which control is performed using ExposureTime. Acquire images using an exposure time configured beforehand on an external trigger.

In this mode, the exposure time can be adjusted automatically by setting ExposureAuto. For details, refer to ALC (Automatic Level Control) Function.

ExposureMode = 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.



> **Note:** The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in Trigger Control.

Actual Exposure Time

> **Related Setting Items:** AcquisitionControl

The actual exposure time will consist of the image sensor's offset duration (refer to the table below) added to the setting configured on the camera.

Example for GOX-3201M-PGE

- When **ExposureMode** is set to **Timed** and the exposure time is set to 1 µs, the actual exposure time will be as follows: 1 µs + 13.7 µs (offset duration of image sensor) = 14.7 µs
- When **ExposureMode** is set to **TriggerWidth**, the exposure is slightly longer than the width of the trigger signal. To achieve an exposure time of 14.7 µs and the exposure time offset is 13.7 µs, use "14.7 µs - 13.7 µs = 1 µs" as the high or low time for the trigger signal.

The offset time varies depending on the model.

Model Name	Image Sensor's Offset
GOX-2402MC-PGE	13.73µs
GOX-2402MC-PGE-CS	
GOX-3201MC-PGE	
GOX-3201MC-PGE-CS	
GOX-5103MC-PGE	
GOX-5103MC-PGE-CS	
GOX-8901MC-PGE	14.26µs
GOX-12401MC-PGE	

RCT Mode

> **Related Setting Items:** AcquisitionControl

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.

You can use RCT mode when:

- **ExposureMode** is set to **Timed**, and **FrameStartTrigger** is set to **On**.
- Sequencer Function = **Off**

Trigger Control

> **Related Setting Items:** AcquisitionControl

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

TriggerSelector	Description
AcquisitionStart	Start image acquisition in response to the external trigger signal input.
AcquisitionEnd	Stop image acquisition in response to the external trigger signal input.
FrameStart	Start capturing a one-frame image in response to the external trigger signal input. Select this to perform exposure control using external triggers. **Note:** The FrameStart Trigger can only be used when the Exposure Mode setting is set to **Timed** or **TriggerWidth**.
AcquisitionTransferStart	Start output of acquired image data in response to external trigger signal input (delayed readout). **Note:** The number of frames that can be acquired on this camera is 4 frames (in Monoxx or Bayerxx Pixel Format).

Notes:

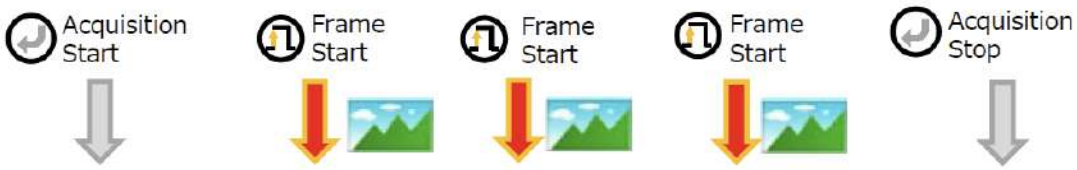
- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in Exposure Mode.
- You can delay when exposure actually starts after a trigger is received for a specific amount of time by configuring **TriggerDelay**.

Select the trigger type with TriggerSelector and set the following items for each trigger.

TriggerMode	Switch enable or disable.
TriggerSource	Select the source signal (PulseGenerator0, UserOutput0-3, Software, Line5 Opt In, Nand0 Out, Nand1 Out). **Note:** Trigger can be executed by **TriggerSoftware**[TriggerSelector] command only when **Software** is set.
TriggerActivation	Sets the polarity of the trigger signal.
TriggerDelay	You can specify a delay after receiving the trigger signal until the trigger is enabled.

When Using the FrameStart Trigger

When AcquisitionStart is executed and a FrameStart trigger is received before the AcquisitionStop command is executed, one frame is acquired.



The source signals that can be set for the AcquisitionStart, AcquisitionEnd, FrameStart, and AcquisitionTransferStart triggers are as follows:

- Software, PulseGenerator 0, UserOutput 0 ~ 3, Action 1 ~ 2, Line5 Opt In 1, NAND0 Out, and NAND1 Out, Low, High

Pixel Format

Related Setting Items: ImageFormatControl

Technical Notes Pixel Format Alignments for GigE Vision

Selectable PixelFormat is as follows.

Color models	BayerRG8 (default), BayerRG10, BayerRG10Packed, BayerRG12, BayerRG12Packed, BayerGR8*, BayerGR10*, BayerGR10Packed*, BayerGR12*, BayerGR12Packed*, BayerGB8*, BayerGB10*, BayerGB10Packed*, BayerGB12*, BayerGB12Packed*, BayerBG8*, BayerBG10*, BayerBG10Packed*, BayerBG12*, BayerBG12Packed* **Note:** *When using ReverseX, ReverseY.
Mono models	Mono8 (default), Mono10, Mono10Packed, Mono12, Mono12Packed

Notes:

- On color models, the Bayer array is changed by the Image Flip Function.

  - ReverseX : 0 (False), ReverseY : 0 (False) -> BayerRG
  - ReverseX : 0 (False), ReverseY : 1 (True) -> BayerGB
  - ReverseX : 1 (True), ReverseY : 0 (False) -> BayerGR
  - ReverseX : 1 (True), ReverseY : 1 (True) -> BayerBG

- When in 12-bit pixel format, VideoProcessBypassMode is forced to On.

Image Flip Function

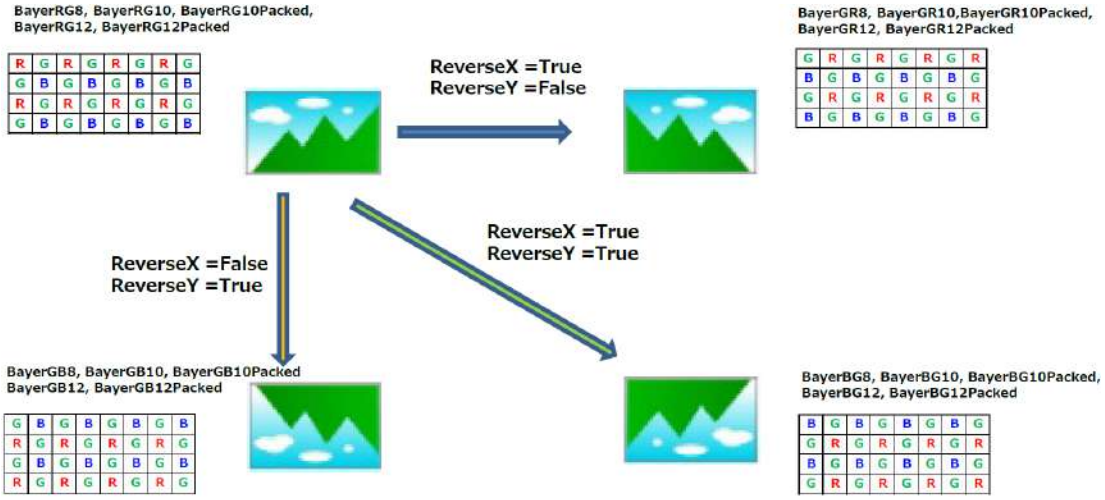
> **Related Setting Items:** ImageFormatControl

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

In the ImageFormatControl settings,

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

On color models, the Bayer array is changed by the Image Flip function.



GPIO (Digital Input/Output Settings)

> **Related Setting Items:** DigitalIOControl

The camera can input/output the following signals to and from external input/output connectors.

External Output	Line2 : Opt Out	DC IN / TRIG IN Connector (6-pin round)
Internal Output	Line5 : Opt In	DC IN / TRIG IN Connector (6-pin round)

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.

Use the DigitalIOControl to set the digital input/output. Select input or output in LineSelector, you can check LineMode, LineFormat, and set LineInverter. You can also check the status of each digital I/O as shown in the table below with LineStatusAll.

<table>
<tr><th>LineSelector</th><th>LineMode</th><th>LineFormat</th><th>LineInverter</th><th>LineStatusAll</th><th>LineSource</th><th></th></tr>
<tr><td>Line2 (Opt Output1)</td><td>Output</td><td>OptCoupled</td><td>True/False</td><td>bit1</td><td>Available (Default = PulseGenerator0)</td><td>DC IN / TRG IN connector</td></tr>
<tr><td>Line5 (Opt In 2)</td><td>Input</td><td>OptCoupled</td><td>False (fixed)</td><td>bit4</td><td>Invalid (Not Available)</td><td>DC IN / TRG IN connector</td></tr>
<tr><td>Nand0In1</td><td>Input</td><td>InternalSignal</td><td>True/False</td><td>bit12</td><td rowspan="4">Available (Default = Low)</td><td></td></tr>
<tr><td>Nand0In2</td><td>Input</td><td>InternalSignal</td><td>True/False</td><td>bit13</td><td></td></tr>
<tr><td>Nand1In1</td><td>Input</td><td>InternalSignal</td><td>True/False</td><td>bit14</td><td></td></tr>
<tr><td>Nand1In2</td><td>Input</td><td>InternalSignal</td><td>True/False</td><td>bit15</td><td></td></tr>
<tr><td>Timestamp Reset</td><td>Internal Connection</td><td>InternalSignal</td><td>False (fixed)</td><td></td><td>Available (Default = Off)</td><td></td></tr>
</table>

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.

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

LineSelector	Off	AcquisitionActive	FrameActive	ExposureActive	FVAL	LVAL	PulseGenerator0	UserOutput0	UserOutput1	UserOutput2	UserOutput3	Action1	Action2	Line5 Opt In1	NAND0 Out	NAND1 Out	Low	High	AcquisitionTriggerWait	FrameTriggerWait
Line2		✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
Line5																				
Nand0In1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓
Nand0In2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓
Nand1In1		✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓
Nand1In2		✓	✓	✓	✓		✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓
TimestampReset	✓						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				

VideoProcessBypassMode

> **Related Setting Items:** ImagingControl

The video process bypass mode is a function that bypasses internal video processing on the camera. When bypass is enabled, the sensor output and camera output data can be set to the same bit depth.

When in 12-bit Pixel Format, VideoProcessBypassMode is forced to On.

Functions Available in VideoProcessBypassMode

- Gain[AnalogAll], BlemishCompensation
- GOX-2402M-PGE: BinningHorizontal/BinningVertical. For more information, see Binning Function.

Calculate the Maximum Frame Rate (Approximate)

Related Setting Items: AcquisitionControl

Note: 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 (www.jai.com).

This section describes how to calculate the maximum frame rate (approximate). The maximum frame rate is as follows depending on the sensor's scanning range and the GigE bandwidth.

The Maximum Frame Rate (GigE Bandwidth)

```
Interface_FR[Hz] = BandwidthPerPixelFormat x 1000000 ÷ (Width x Height)
```

Note: When using the Binning Function, specify the number of pixels and number of lines after Binning for the Width and Height values.

The Maximum Frame Rate (Sensor's Scanning Rate)

```
Sensor_FR[Hz] = 1000000 ÷ (H_Period x (Height-S + InvalidLine) )

     H_Period = MAX(HMAX_Period, HMAX_Width)

     HMAX_Width = (PixelSizeCount / 111375) x Width-S
```

Notes:

- For the values of Width-S and Height-S, specify the number of pixels read from the sensor and the number of lines. (Number of pixels and number of lines before Binning).
- In GOX-2402M-PGE, 2x2 binning is processed on the image sensor. Therefore, the maximum sensor frame rate can be increased. In this case, for the values of Width-S and Height-S, specify the number of pixels and the number of lines after Binning.

Please refer to tables below for PixelSizeCount, BandwidthPerPixelFormat, HMAX_Period and InvalidLine.

PixelFormat	PixelSizeCount	BandwidthPerPixelFormat
Mono8, Bayer8	594	115
Mono10Packed, Mono12Packed, Bayer10Packed, Bayer12Packed	891	76.6
Mono10, Mono12, Bayer10, Bayer12	1188	57.5

Model Name	HMAX_Period	InvalidLine
GOX-2402MC-PGE (including CS-mount model)	10.586*	22
GOX-3201MC-PGE (including CS-mount model)	11.394	34
GOX-5103MC-PGE (including CS-mount model)	13.415	34
GOX-8901MC-PGE	21.738	36
GOX-12401MC-PGE	21.738	36

Note: *In GOX-2402M-PGE, 2x2 binning is processed on the image sensor. Therefore, the maximum sensor frame rate can be increased. When the 2x2 binning is used, the value of HMAX_Period is 5.98 instead of 10.586.

During Continuous operation (Frame Start trigger is Off)

```
FR_Cont[Hz] = MIN(Interface_FR, Sensor_FR)
```

When TriggerMode is On (Frame Start trigger is On)

```
MaxOverlapTime_TrOlrd[us] = (1000000/FR_Cont) - (14 x H_period)
```

ExposureTime ≦ MaxOverlapTime_TrOlrd (Same As During Continuous Operation)

```
FR_TrOlrd[Hz] = FR_Cont
```

ExposureTime > MaxOverlapTime_TrOlrd

```
Non-OverlapExposureTime_TrOlrd = ExposureTime - MaxOverlapTime_TrOlrd

FR_TrOlrd[Hz] = 1000000/{ (1000000/FR_Cont) + Non-OverlapExposureTime_TrOlrd }
```

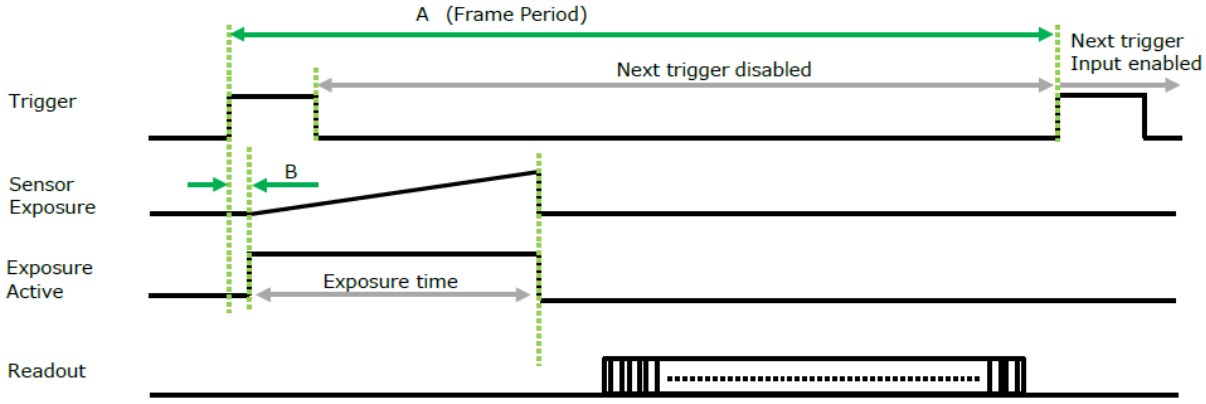
Timing Chart

> **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

This section shows the timing charts when FrameStartTrigger is set to **On**.



A	Frame Period [A] (usec)
B	Period From Trigger start edge to Exposure start [B] (usec)

GOX-2402MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	20080	32.8
Mono10/Mono12	40161	62.4
Mono10Packed/Mono12Packed	30121	62.4
Bayer8	20080	32.8
Bayer10/Bayer12	40161	62.4
Bayer10Packed/Bayer12Packed	30121	62.4
Horizontal Binning On		
Mono8	13038	32.78
Mono10	25189	62.5
Mono10Packed	25189	62.5
Vertical Binning On		
Mono8	13038	32.8
Mono10	25189	62.5
Mono10Packed	25189	62.5
Horizontal Binning On & Vertical Binning On		
Mono8	5015	19
Mono10	10030	31.8
Mono10Packed	7519	31.8

GOX-3201MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	27397	35.2
Mono10/Mono12	54945	66.5
Mono10Packed/Mono12Packed	41153	66.6
Bayer8	27397	35.2
Bayer10/Bayer12	54945	66.5
Bayer10Packed/Bayer12Packed	41153	66.6
Horizontal Binning On		
Mono8	17921	35.3
Mono10	34365	66.6
Mono10Packed	34365	66.6
Vertical Binning On		
Mono8	17921	35.2
Mono10	34365	66.6
Mono10Packed	34365	66.6
Horizontal Binning On & Vertical Binning On		
Mono8	17921	35.3
Mono10	34365	66.6
Mono10Packed	34365	66.6

GOX-5103MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	43669	41.2
Mono10/Mono12	87720	79.2
Mono10Packed/Mono12Packed	65790	79.4
Bayer8	43669	41.2
Bayer10/Bayer12	87720	79.2
Bayer10Packed/Bayer12Packed	65790	79.4
Horizontal Binning On		
Mono8	27933	41.3
Mono10	54054	78.9
Mono10Packed	54054	78.9
Vertical Binning On		
Mono8	27933	41.3
Mono10	54348	79.4
Mono10Packed	54348	79.4
Horizontal Binning On & Vertical Binning On		
Mono8	27933	41.3
Mono10	54054	78.9
Mono10Packed	54054	78.9

GOX-8901MC-PGE

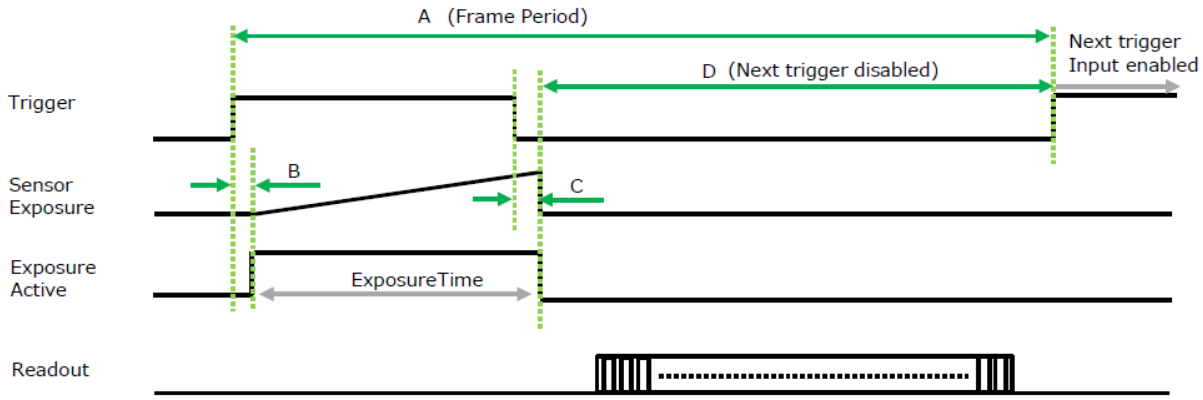
PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	77520	66.2
Mono10/Mono12	156251	132
Mono10Packed/Mono12Packed	116280	132.1
Bayer8	77520	66.2
Bayer10/Bayer12	156251	132
Bayer10Packed/Bayer12Packed	116280	132.1
Horizontal Binning On		
Mono8	47847	66.3
Mono10	96154	132.1
Mono10Packed	96154	132.1
Vertical Binning On		
Mono8	47847	66.3
Mono10	96154	132.1
Mono10Packed	96155	132.1
Horizontal Binning On & Vertical Binning On		
Mono8	47847	66.3
Mono10	96155	132.1
Mono10Packed	96155	132.1

GOX-12401MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	107528	66.1
Mono10/Mono12	217393	132
Mono10Packed/Mono12Packed	161.291	132
Bayer8	107528	66.1
Bayer10/Bayer12	217393	132
Bayer10Packed/Bayer12Packed	161.291	132
Horizontal Binning On		
Mono8	66226	66.3
Mono10	133334	132.1
Mono10Packed	133334	132.1
Vertical Binning On		
Mono8	66226	66.3
Mono10	133334	132.1
Mono10Packed	133334	132.1
Horizontal Binning On & Vertical Binning On		
Mono8	66226	66.3
Mono10	133334	132.1
Mono10Packed	133334	132.1

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).



A	Frame Period [A] (usec)
B	Period From Trigger start edge to Exposure start [B] (usec)
C	Period From Trigger end to Exposure end [C] (usec)
D	Period From Exposure end to next Trigger start [D] (usec)

GOX-2402MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)	Period From Trigger end to Exposure end [C] (usec)	Period From Exposure end to next Trigger start [D] (usec)
Binning Off				
Mono8	12987	32.8	32.8	77.1
Mono10 Mono12	25126	62.3	62.3	146.5
Mono10Packed Mono12Packed	25126	62.3	62.3	146.5
Bayer8	12987	32.8	32.8	77.1
Bayer10 Bayer12	25126	62.3	62.3	146.5
Bayer10Packed Bayer12Packed	25126	62.3	62.3	146.5
Horizontal Binning On				
Mono8	12987	32.8	32.8	77.1
Mono10	25126	62.3	62.3	146.5
Mono10Packed	25126	62.4	62.4	146.5
Vertical Binning On				
Mono8	12987	32.8	41.2	77.1
Mono10	25126	62.4	79.3	146.5
Mono10Packed	25126	62.4	79.4	146.5
Horizontal Binning On & Vertical Binning On				
Mono8	3748	19	19	68.6
Mono10	6419	31.7	31.7	115
Mono10Packed	6419	31.7	31.7	115

GOX-3201MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)	Period From Trigger end to Exposure end [C] (usec)	Period From Exposure end to next Trigger start [D] (usec)
Binning Off				
Mono8	17857	35.2	35.2	35.3
Mono10 Mono12	34247	66.5	66.5	66.7
Mono10Packed Mono12Packed	34247	66.5	66.5	66.7
Bayer8	17857	35.2	35.2	35.3
Bayer10 Bayer12	34247	66.5	66.5	66.7
Bayer10Packed Bayer12Packed	34247	66.5	66.5	66.7
Horizontal Binning On				
Mono8	17857	35.2	35.2	35.4
Mono10	34247	66.5	66.5	66.7
Mono10Packed	34247	66.5	66.5	66.7
Vertical Binning On				
Mono8	17857	35.2	35.2	35.3
Mono10	34247	66.5	66.5	66.8
Mono10Packed	34247	66.5	66.5	66.8
Horizontal Binning On & Vertical Binning On				
Mono8	17857	35.2	35.2	35.3
Mono10	34247	66.5	66.5	66.7
Mono10Packed	34247	66.5	66.5	66.8

GOX-5103MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)	Period From Trigger end to Exposure end [C] (usec)	Period From Exposure end to next Trigger start [D] (usec)
Binning Off				
Mono8	27855	41.2	41.2	150
Mono10 Mono12	54348	79.3	79.3	290
Mono10Packed Mono12Packed	54348	79.3	79.3	290
Bayer8	27855	41.2	41.2	150
Bayer10 Bayer12	54348	79.3	79.3	290
Bayer10Packed Bayer12Packed	54348	79.3	79.3	290
Horizontal Binning On				
Mono8	27855	41.2	41.2	150
Mono10	54348	79.3	79.3	290
Mono10Packed	54348	79.4	79.4	290
Vertical Binning On				
Mono8	27855	41.2	41.2	150
Mono10	54348	79.3	79.3	290
Mono10Packed	54348	79.4	79.4	290
Horizontal Binning On & Vertical Binning On				
Mono8	27855	41.2	41.2	150
Mono10	54054	78.9	78.9	290
Mono10Packed	54054	78.9	78.9	290

GOX-8901MC-PGE

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)	Period From Trigger end to Exposure end [C] (usec)	Period From Exposure end to next Trigger start [D] (usec)
Binning Off				
Mono8	47619	66	66	240
Mono10 Mono12	96154	132.1	132.1	484
Mono10Packed Mono12Packed	96154	132.1	132.1	484
Bayer8	47619	66	66	240
Bayer10 Bayer12	96154	132.1	132.1	484
Bayer10Packed Bayer12Packed	96154	132.1	132.1	484
Horizontal Binning On				
Mono8	47619	66	66	240
Mono10	96154	132.1	132.1	484
Mono10Packed	96154	132.1	132.1	484
Vertical Binning On				
Mono8	47619	66	66	240
Mono10	96155	132.1	132.1	484
Mono10Packed	96155	132.1	132.1	484
Horizontal Binning On & Vertical Binning On				
Mono8	47619	66.2	66.2	240
Mono10	96154	132.1	132.1	484
Mono10Packed	96154	132.1	132.1	484

GOX-12401MC-PGE

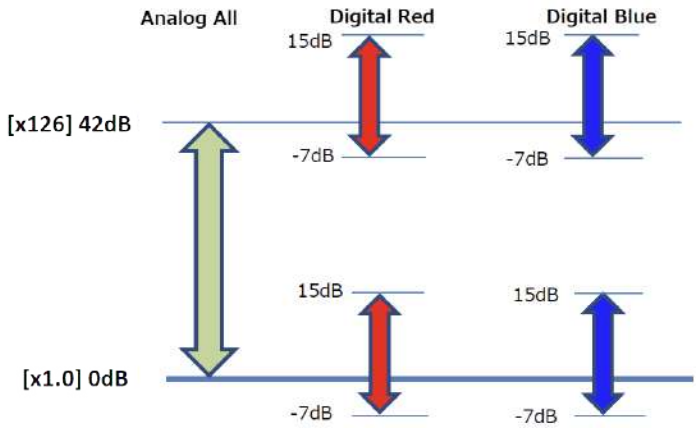
PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)	Period From Trigger end to Exposure end [C] (usec)	Period From Exposure end to next Trigger start [D] (usec)
Binning Off				
Mono8	66226	66.2	66.2	240.6
Mono10 Mono12	133334	132.1	132.1	482.8
Mono10Packed Mono12Packed	133334	132.1	132.1	482.8
Bayer8	66226	66.2	66.2	240.6
Bayer10 Bayer12	133334	132.1	132.1	482.8
Bayer10Packed Bayer12Packed	133334	132.1	132.1	482.8
Horizontal Binning On				
Mono8	66226	66.3	66.3	240.6
Mono10	133334	132.1	132.1	482.8
Mono10Packed	133334	132.1	132.1	482.8
Vertical Binning On				
Mono8	66226	66.2	66.2	240.6
Mono10	133334	132.1	132.1	482.8
Mono10Packed	133334	132.1	132.1	482.8
Horizontal Binning On & Vertical Binning On				
Mono8	66226	66.2	66.2	240.6
Mono10	133334	132.1	132.1	482.8
Mono10Packed	133334	132.1	132.1	482.8

Gain Control

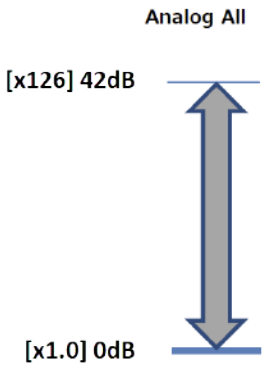
> **Related Setting Items:** AnalogControl

Adjust the overall gain with AnalogAll (master gain) and adjust the white balance by changing DigitalRed and DigitalBlue.

Color Model



Monochrome Model



Automatic Gain Level Control

Set GainAuto to **Continuous** to control the gain level automatically.

When GainAuto is set to **Continuous**, you can configure the conditions for automatic adjustment in detail.

- When GainAuto is set to **Continuous**, the automatic adjustment will be performed continuously.
- When GainAuto is set to **Once**, the automatic adjustment will be performed only once.

White Balance

> **Related Setting Items:** AnalogControl

To adjust the white balance automatically, set BalanceWhiteAuto to **Once** (automatic adjustment only once) or **Continuous** (automatic adjustment always).

The metering area can be limited for automatic adjustment. To limit the metering area, specify each of the 16 areas with AWBAreaSelector and set AWBAreaEnable to True or False.

16 Areas

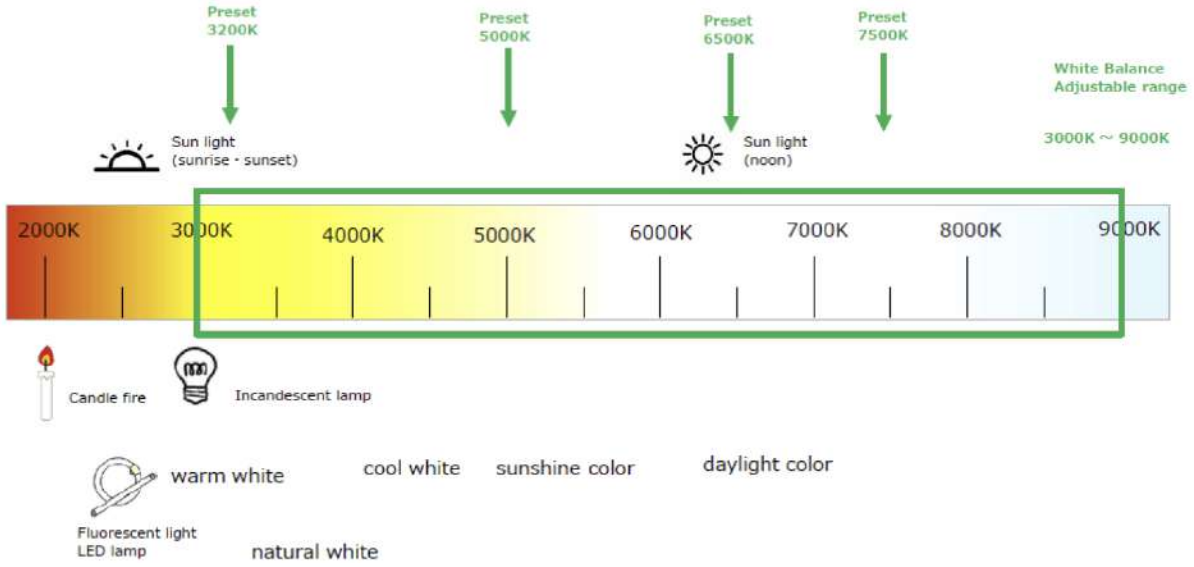
HighLeft	High MidLeft	High MidRight	HighRight
MidHigh Left	MidHigh MidLeft	MidHigh MidRight	MidHigh Right
MidLow Left	MidLow MidLeft	MidLow MidRight	MidLow Right
LowLeft	Low MidLeft	Low MidRight	LowRight

In addition, the white balance has been adjusted in advance for specific color temperature lighting. It is possible to select from the following four presets. (Color temperature for preset : 3200K, 5000K, 6500K, 7500K)

Color Temperature

The adjustable range of white balance for this camera is 3000K to 9000K.

Please refer to the figure below for an overview of the relationship between various lighting types and color temperature.



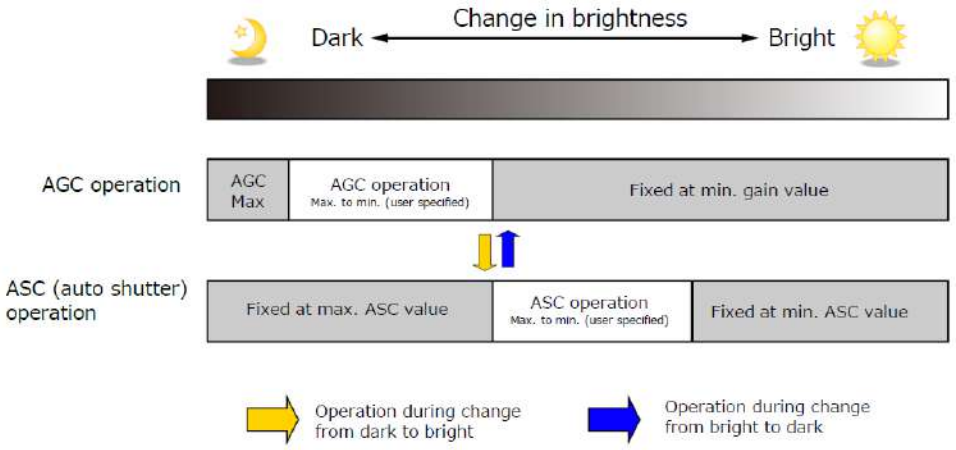
ALC (Automatic Level Control) Function

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

Set GainAuto or ExposureAuto or both to **Continuous** mode. Configure the minimum value, maximum value, etc. for AGC and ASC in AutoLevelControl.

The target video levels for AGC and ASC are configured in ALCReference. For example, when ALCReference is set to 95%, video levels will be maintained at 95% using AGC and ASC.

In color models, the channel to be used as the reference for ALC control can be set.

- **ALCControlReference**: Set whether to specify the SelectedChannel refer to channel (R, G, B) or PeakChannel refer to the channel with the highest average image level.
- If ALCControlReference= SelectedChannel, set ALCControlChannel to **Red**, **Green** or **Blue**.

The speed of ALC control can be set from 1 to 100 (fastest) in ALCControlRatio.

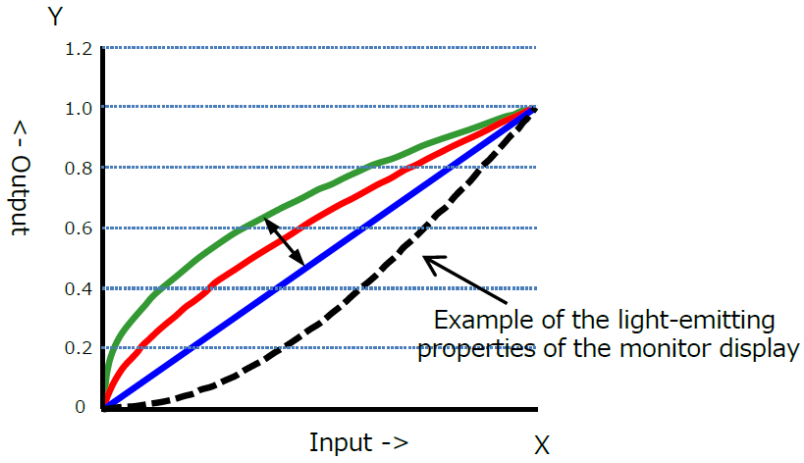
Note: If the ALCControlRatio setting is large, the ALC operation may cause hunting depending on the AcquisitionFrameRate setting. In this case, lower the value of AcquisitionFrameRate or ALCControlRatio.

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.



To Use the Gamma Function

Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
Gamma	0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0	Select the Gamma correction value.
LUTMode	Gamma	Use Gamma.

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).

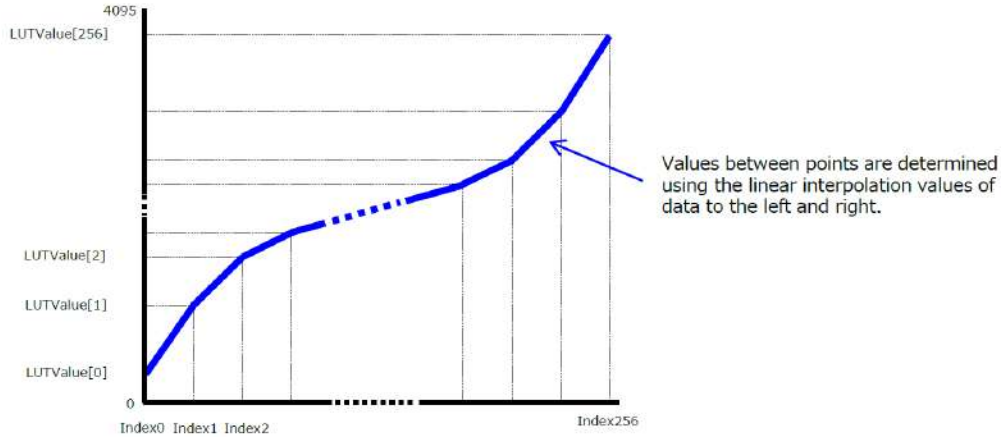
To Use the LUT Function

Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
LUTSelector	Red, Green, Blue	Select the LUT channel to control (Color models only).
LUTIndex	0 ~ 256	Select the LUT index to configure. 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.
LUTValue	0 ~ 4095	Set the LUT output value for the selected index.

LUT Value

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.



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 256 pixels can be corrected. Pixel interpolation can be performed via automatic detection or point-by-point manual settings.

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 with **BlemishDetectThreshold**.
    - Up to 256 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.
> - TestPattern is being output
> - In Sequencer Mode (Sequencer Function)
> - The image is not full ROI size (ROI Function (Single ROI))
> - In Reverse mode (Image Flip Function)
> - When an image is not displayed within the specified time in Acquisition Start status (Acquisition Control)
> - Not in lens cap state

Manual Configuration

1. Select the **index** in **BlemishCompensationIndex**. You can select from 1 to 256. 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.
   > - 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). If set to **Disable user detection**, the factory-set interpolation data remains valid, and only the interpolation data registered in **BlemishCompensationIndex** is disabled.

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).

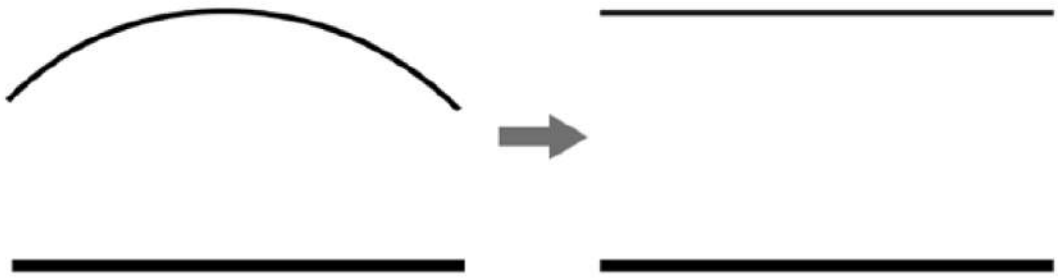
This function can be used even when the effective image area is limited (an area with both Width and Height set to more than 128 must be configured) by the ROI Function (Single ROI). In such cases, the correction area is included in the image area configured by the ROI.

Block size is 256 × 256 pixels.

The following shading correction modes are available on the camera.

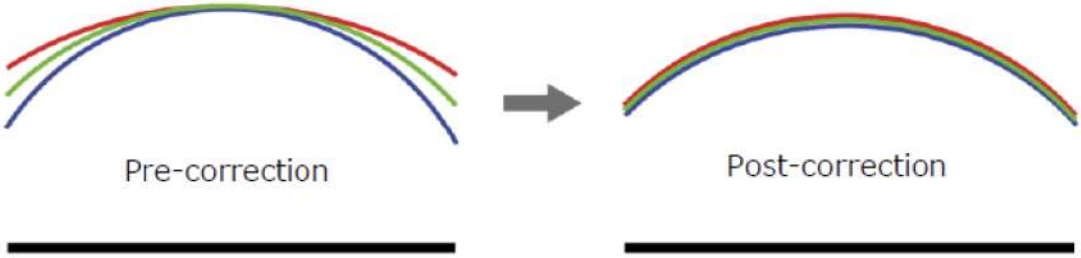
FlatShading (Monochrome model, Color model)

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.



ColorShading (Color models only)

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.

Item	Setting Value	Description
ShadingCorrectionMode	FlatShading, ColorShading	Select the shading correction mode.
ShadingMode	User1, User2, User3, Off	Select the user area to which to save the shading correction value.

Display a white chart under a uniform light, and execute **PerformShadingCalibration**.

Notes:

- After shading correction is executed, the shading correction value is automatically saved to the user area selected in ShadingMode.
- 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.
  - When ExposureAuto is set to Continuous (AcquisitionControl)
  - When in SequencerMode (Sequencer Function)
  - When GainAuto is set to Continuous (AnalogControl)

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.

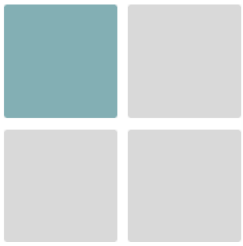
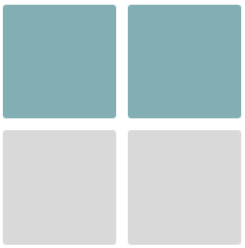
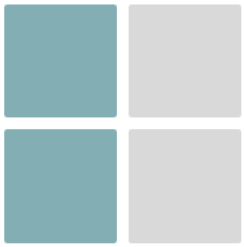
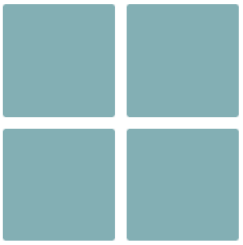
> **Note:** This function is supported only on monochrome models.

This camera supports the following Binning mode.

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

  > **Note:** GOX-2402M-PGE processes 2x2 binning in the image sensor and is fixed to Sum mode.

How to Configure

	Binning off	2 x 1	1 x 2	2 x 2
				
BinningHorizontal	1	2	1	2
BinningVertical	1	1	2	2

> **Notes:**
> - This function cannot be used together with Decimation Mode.
> - When this function is used, you cannot execute **BlemishDetect** (BlemishCompensation).

VideoProcessBypassMode

- This function cannot be used when VideoProcessBypassMode is On, except GOX-2402M-PGE.
- When using GOX-2402M-PGE, this function can be used with VideoProcessBypassMode but BinningHorizontal and BinningVertical cannot be set individually. If VideoProcessBypassMode is changed from On to Off, the BinningHorizontal and BinningVertical settings will not be restored.

Decimation Mode

> **Related Setting Items:** ImageFormatControl

Decimation mode performs 2X downsampling of the image in both the horizontal and vertical direction. This reduces the file size for processing or storage while maintaining the full field of view of the image. Please set DecimationHorizontal, DecimationVertical in ImageFormatControl.

> **Notes:**
> - This function cannot be used together with the Binning Function or ROI Function (Single ROI). (This function can be set only when the ROI size is full).
> - When this function is used, you cannot execute **BlemishDetect** (BlemishCompensation).
> - DecimationHorizontal and DecimationVertical cannot be set separately. For example, changing DecimationHorizontal to 2 will automatically change DecimationVertical to 2.

ROI Function (Single ROI)

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

Notes:

- The Binning Function can only be used for monochrome camera models.
- This function cannot be used together with Decimation Mode

Width/OffsetX (Pixels)

Width OffsetX	BinningHorizontal = 1 (OFF)	BinningHorizontal = 2 (ON)	*A,B = WidthMax
Width (pixels)	96 to [(*A) - OffsetX], step 16	48 to [(*B) - OffsetX], step 8	
Offset X (pixels)	0 to [(*A) - Width], step 16	0 to [(*B) - Width], step 8	

	A	B
GOX-2402MC-PGE	1920	960
GOX-3201MC-PGE	2048	1024
GOX-5103MC-PGE	2448	1224
GOX-8901MC-PGE	4096	2048
GOX-12401MC-PGE	4096	2048

Height/OffsetY (Lines)

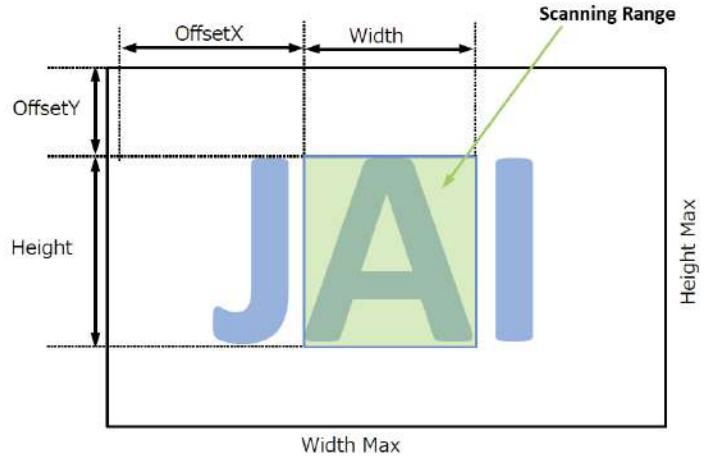
Height OffsetY	BinningVertical = 1 (OFF)	BinningVertical = 2 (ON)	*C, D = HeightMax
Height (lines)	8 to [(*C) - OffsetY], step 2	4 to [(*D) - OffsetY], step 1	
OffsetY (lines)	0 to [(*C) - Height], step 2	0 to [(*D) - Height], step 1	

	C	D
GOX-2402MC-PGE	1200	600
GOX-3201MC-PGE	1536	768
GOX-5103MC-PGE	2048	1024
GOX-8901MC-PGE	2160	1080
GOX-12401MC-PGE	3000	1500

Single ROI - Example

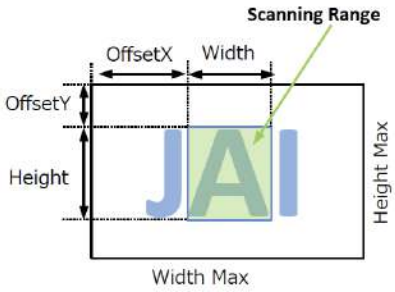
Binning Off

[BinningHorizontal]: 1, [BinningVertical] : 1



Binning On

[BinningHorizontal]: 2, [BinningVertical] : 2



Pulse Generator

Related Setting Items: PulseGenerator

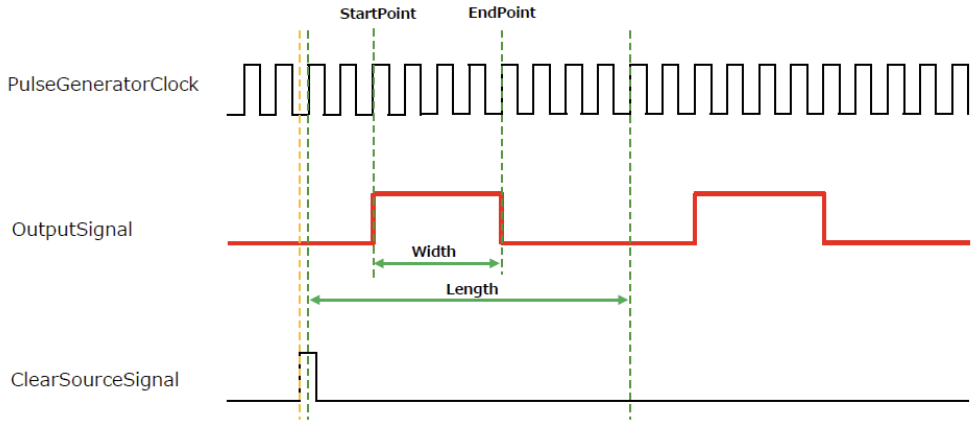
Technical Notes Tips for using the Pulse Generator

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



The configurable PulseGeneratorClearSource signals are as follows.

- Low, High, AcqusitionTriggerWait, Acquisition Active, FrameTriggerWait, FrameActive, ExosureActive, FVAL, UserOutput0 ~ 3, Action1 ~ 2, Line5 Opt In, Nan0Out, and Nan1Out.

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:

- Up to 32 indexes can be configured. Refer to "SequencerControl" for the configurable items for each index.
- When **SequencerMode** is changed from Off to **On**, the **Width**, [**Height**], [**OffsetX**], and [**OffsetY**] (ImageFormatControl) settings are automatically set to the default settings (full size). Also, **Width**, **Height**, **OffsetX**, and **OffsetY** cannot be changed when [SequencerMode] is On.
- When **SequencerMode** is changed from Off to **On**, **ExposureModeOption** (AcquisitionControl) is forced to be **Off**.
- When **FrameStart** (Trigger Control) is set to Off in Trigger Sequencer Mode, **SequencerMode** is forced to be **On**. When SequencerMode is set from On to Off, FrameStart remains On.
- When **TriggerMode** is set to **Off** in Command Sequencer Mode, if **SequencerMode** is **On**, **AcquisitionFrameRate** cannot be configured during acquisition.
- When **ExposureMode** is set to **TriggerWidth** in Command Sequencer Mode, if **SequencerMode** is set from Off to **On**, **ExposureMode** is forced to be **Timed**.
- When **SequencerMode** is set to **On** in Command Sequencer Mode, **ExposureMode** is forced to be **Timed**.

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.

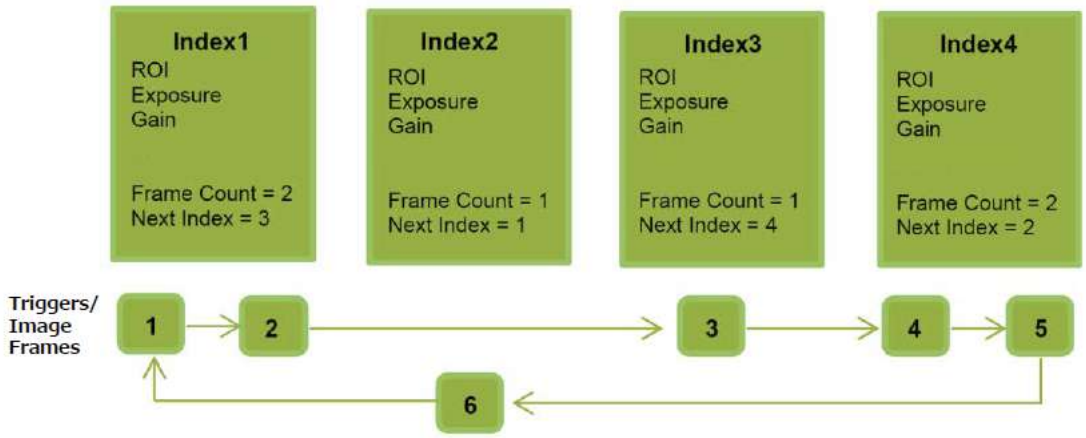
SequencerReset: During TriggerSequencer mode operation, this switches the index number to be executed to that specified in SequencerSetStart.

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.

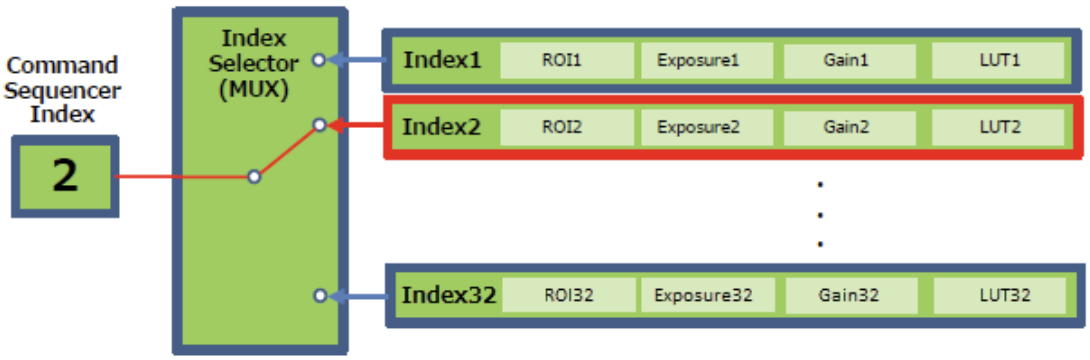
CommandSequencer Mode

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.

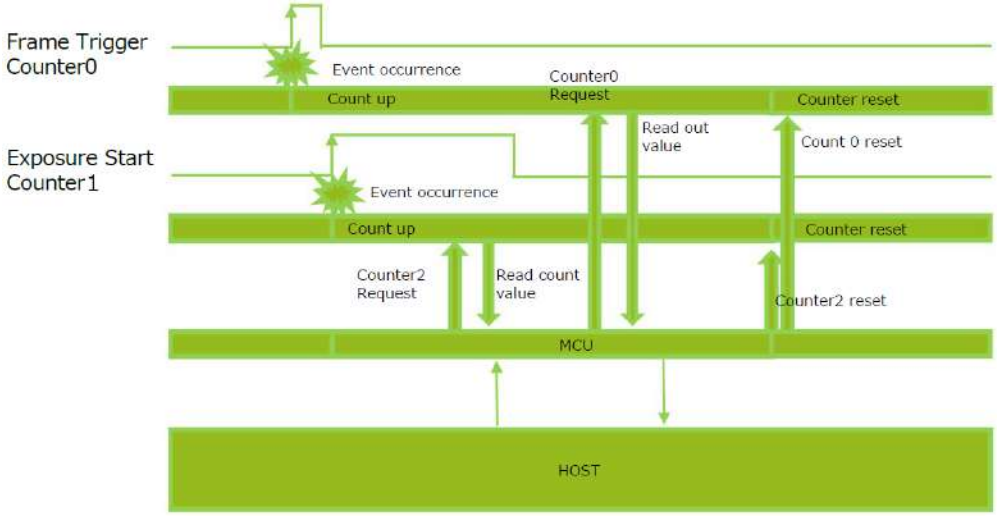
The counter function counts up change points in the camera's internal signals using the camera's internal counter and reads that information from the host side. This function is useful for verifying error conditions via the count value using internal camera operations.

Four counters are available on the camera; Counter0, Counter1, Counter2, and Counter3. The functions that can be counted are fixed for each counter.

- Counter0: Counts the number of FrameTrigger.
- Counter1: Counts the number of ExposureStart.
- Counter2: Counts the number of SensorReadOut.
- Counter3: Counts the number of FrameTransferEnd.

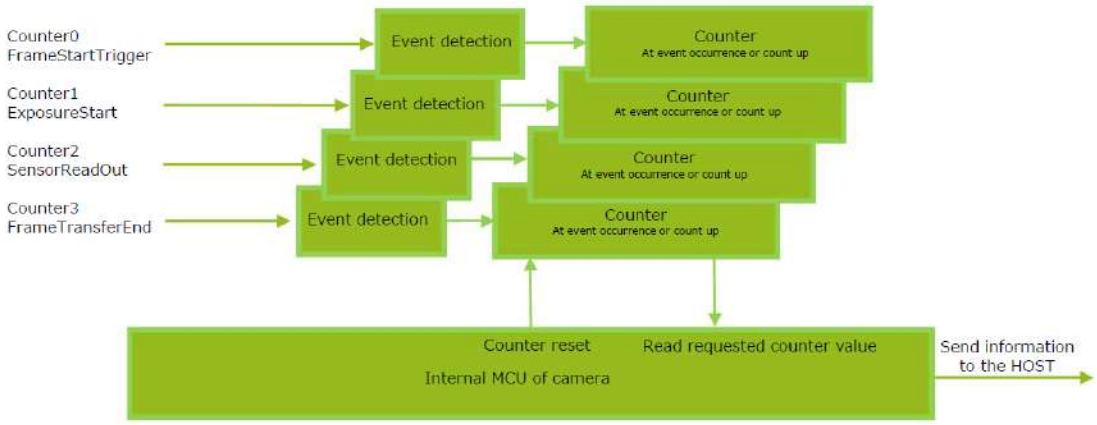
When a problem occurs in a system that includes this camera, comparing the values from multiple counters allows you to verify the extent of normal operability and can be useful when investigating the cause of the problem.

Counter Occurrence Diagram



Note: You can reset a specific counter's count value by executing CounterReset[Counter0, Counter1, Counter2, Counter3].

Internal Camera Blocks



To Use the Counter Function

Configure the settings as follows.

Four counters are available. Specify a counter (Counter0 to Counter3), and configure the settings.

Item	Setting Value Selectable Range	Description
Counter 0 ~ 3	Counter 0 ~ 3	Select the counter.
CounterEventSource	Counter0: Off, Frame Trigger Counter1: Off, ExposureStart Counter2: Off, SensorReadOut Counter3: Off, FrameTransferEnd	Select the Counter Event signal for which to read the count value. When set to Off, the counter operation will stop (but will not be reset).
CounterEventActivation	When the Counter function is enabled: Counter0, Counter1, Counter2 = RisingEdge (Fixed) Counter3 = FallingEdge (Fixed)	Specify timing at which to count.

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 shot with a single camera in sequence under multiple setting conditions, you can search for images by their setting conditions.

Configuring Chunk Data

1. Set **ChunkModeActive** to **True**.

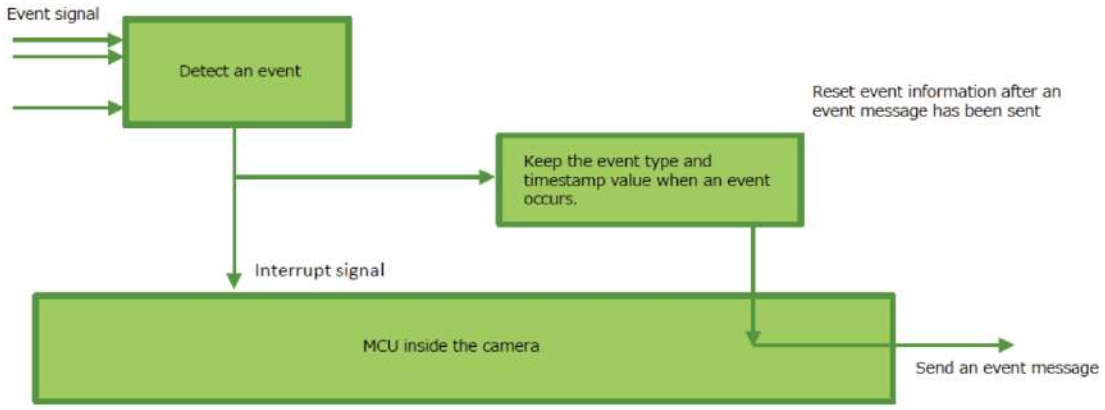
> **Caution:** The Chunk Data function settings cannot be changed during image output. To change the settings, stop Acquisition.

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



Events That Can Use the Event Control Function

Events that can use the Event Control function are as follows. You can specify whether or not to send an event message when an event occurs at each event.

Supported Events:

- AcquisitionTrigger, FrameStart, FrameEnd, ExposureStart, ExposureEnd

Action Control Function

Related Setting Items: ActionControl

Technical Notes How to use GigE Vision Action Commands

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.

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.

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.
    a. Action1
        1. Select 1 in ActionSelector.
        2. Specify ActionGroupMask [ActionSelector].
        3. Specify ActionGroupKey [ActionSelector].
    b. Action2
        1. Select 2 in ActionSelector.
        2. Specify ActionGroupMask [ActionSelector].
        3. Specify ActionGroupKey [ActionSelector].
3. Set triggers (AcquisitionStart, AcquisitionEnd, FrameStart, AcquisitionTransferStart) to Action1 and Action2.

Action Control Example

Assume that the following settings have been pre-configured on the camera.

- ActionDeviceKey : 0x00001001
- ActionGroupMask[1] : 0x00000011
- ActionGroupKey[1] : 0x00000001
- ActionGroupMask[2] : 0x00000111
- ActionGroupKey[2] : 0x00000002

When the camera receives action commands (ActionDeviceKey:0x00001001, ActionGroupMask:0x00000011, ActionGroupKey: 0x00000002), Action2 is executed.

When the camera receives action commands (ActionDeviceKey:0x00001001, ActionGroupMask:0x00000011, ActionGroupKey: 0x00000001), ActionDevice and ActionGroupKey [1] match. However, the result of AND operation performed by ActionGroupMask is 0. Therefore, in this case, neither Action1 nor Action2 is executed.

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.

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.

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 Items	Setting Range	Default	Description
DeviceVendorName	-	"JAI Corporation"	Display the manufacturer name.
DeviceModelName	-	-	Display the model name.
DeviceManufacturerInfo	-	See the possibilities	Display the manufacturer information.
DeviceVersion	-	-	Display the Device Version.
DeviceFirmwareVersion	-	-	Display the firmware version.
DeviceFpgaVersion			Display the FPGA version.
DeviceSerialNumber	-	-	Display the device ID.
DeviceUserID	Any	-	Set the user ID (16bytes) for the camera.
DeviceSFNCVersionMajor	-	2	Display the SFNC Major version.
DeviceSFNCVersionMinor	-	5	Display the SFNC Minor version.
DeviceSFNCVersionSubMinor	-	0	Display the SFNC Sub-Minor version.
DeviceManifestEntrySelector	1	1	Display the valid XML file information.
DeviceManifestXML MajorVersion	0 ~ 32bit max	0	Display XML file's major version number.
DeviceManifestXML MinorVersion	0 ~ 32bit max	0	Display XML file's minor version number.
DeviceManifestXML SubMinorVersion	0 ~ 32bit max	1	Display XML file's sub-minor version number.
DeviceManifestSchema MajorVersion	0 ~ 32bit max	1	Display schema file's major version number.
DeviceManifestSchema MinorVersion	0 ~ 32bit max	1	Display schema file's minor version number.
DeviceManifestPrimaryURL	-	-	Display the Primary URL.
DeviceManifestSecondaryURL	-	-	Display the Secondary URL.
DeviceTLType	0:GigEVision (Fixed)	-	Transport Layer type of the device.
DeviceTLVersionMajor	2 (Fixed)	-	Indicates the major version number of the device's Transport Layer.

Device Control Items	Setting Range	Default	Description
DeviceTLVersionMinor	0 (Fixed)	-	Indicates the minor version number of the device's Transport Layer.
DeviceTLVersionSubMinor	1 (Fixed)	-	Indicates the sub minor version number of the device's Transport Layer.
DeviceLinkSelector	0 (Fixed)	0	Select Link.
DeviceLinkSpeed	-	125000000 Bps	Displays the negotiated transmission rate.
DeviceLinkHeartbeatMode	1:On (Fixed)	-	Display whether Heartbeat mode is enabled/disabled.
DeviceLinkHeartbeatTimeout	500000 ~ 120000000	3000000	Configure the timeout value for Heartbeat (unit: μs). Step: 1000
DeviceStreamChannelCount	-	1 (Fixed)	Display the number of supported stream channels.
DeviceEventChannelCount	-	1 (Fixed)	Display the number of supported message channels.
DeviceCharacterSet		1: UTF8 (Fixed)	Display the character encoding.
DeviceReset	-	-	Reset the device.(After the camera receives this command, it returns an ACK response and executes the reset.)
DeviceRegistersEndianness		1:big-endian (Fixed)	Display the register's endianness.
DeviceTemperatureSelector	0: Main board (Fixed)	-	Select the area of the camera's interior for which to display the temperature sensor's reading.
DeviceTemperature	-55 ~ 125	0	Display the internal temperature (°C) of the device specified by DeviceTemperatureSelector.
Timestamp	0 ~ 64bit max	0	Display the timestamp value (ns). Resets to 0 when the signed maximum 64-bit value is exceeded.
TimestampReset	-	-	Forcibly sets the timestamp's count value to 0.
TimestampLatch	-	-	Sets the timestamp's count value to TimestampLatchValue.
TimestampLatchValue	0 ~ 64bit max	0	Maximum value Signed 64-bit max value.
UserDefinedValueSelector	0: Value1 1: Value2 2: Value3 3: Value4 4: Value5	0: Value1	Five 32bit data can be set and saved.
UserDefinedValue	-2147483648 ~ 2147483647	0	Selects one of the 32bit data (Value1 to Value5) set in UserDefinedValueSelector, and reads and sets the value in UserDefinedValue.

TransportLayerControl

Display information on transport layer control.

TransportLayerControl Items	Setting Range	Default	Description
PayloadSize	48 ~ 67109240	12288	Display the payload size. (Include ChunkData) (unit: bytes)
GigEVision			
GevPhysicalLinkConfiguration	-	0:Single Link (Fixed)	Display the LinkConfiguration status.
GevSupportedOptionSelector		-	Select the supported options for GigEVision. **Note:** See the "GevSupportedOptionSelector Options" note below this table.
GevSupportedOption	-	-	Displays whether the function selected by GevSupportOptionSelector is supported or not.
GevInterfaceSelector		0: (Fixed)	Select the logical link to control.
GevMACAddress	-	-	Display the MAC address.
GevPAUSEFrameReception		1: False (Fixed)	Controls whether incoming PAUSE Frames are handled on the given logical link.
GevPAUSEFrameTransmission	-	1: False (Fixed)	Controls whether PAUSE Frames can be generated on the given logical link.
GevCurrentIPConfigurationLLA	-	1: TRUE (Fixed)	Display whether the current IP configuration is calibrated by LLA (link-local address).
GevCurrentIPConfigurationDHCP	0: False 1: True	1: TRUE	Select whether to set the IP configuration to DHCP.
GevCurrentIPConfiguration PersistentIP	0: False 1: True	0: FALSE	Select whether to set the IP configuration to Persistent IP.
GevCurrentIPAddress	-	-	Display the IP address for the given logical link.
GevCurrentSubnetMask	-	-	Display the subnet mask of the given logical link.
GevCurrentDefaultGateway	-	-	Display the default gateway IP address to be used on the given logical link.

TransportLayerControl Items	Setting Range	Default	Description
GevIPConfigurationStatus	0:None 1:PersistentIP 2:DHCP 3:LLA 4:ForceIP	2:DHCP	Display the current IP configuration status.
GevPersistentIPAddress	-	192.168.0.100	Set the persistent IP address.
GevPersistentSubnetMask	-	255.255.255.0	Set the persistent subnet mask.
GevPersistentDefaultGateway	-	0.0.0.0	Set the persistent default gateway.
GevIEEE1588 **Related Topic:** PTP (Precision Time Protocol)	0: False 1: True	0: FALSE	True: Enable the IEEE 1588 Precision Time Control. False: Disable the IEEE 1588 Precision Time Control.
GevIEEE1588ClockAccuracy	0 -20	19:Unknown	Indicates the expected accuracy of the device clock. **Setting Range**: 0:Within25ns, 1:Within100ns, 2:Within250ns, 3:Within1us, 4:Within2p5u, 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	-	-	Display the status of the IEEE 1588 clock. 1:initializing, 2:faulty, 3:disabled, 4:listening, 5:preMaster, 6:master, 7:passive, 8:uncalibrated, 9:slave
GevGVCPExtendedStatus CodesSelector	0:Version1_1 1:Version2_0	0:Version1_1	Selects the GigE Vision version to control extended status codes for.
GevGVCPExtended StatusCodes	0: False 1: True	0: False	Enables the generation of extended status codes.
GevGVCPPendingAck **Related Topic:** Step 6: Adjust the Image Quality	0: False 1: True	0: False	Enables the generation of PENDING_ACK.
GevGVSPExtendedIDMode	0: Off 1: On	0: Off	Enables the extended IDs mode.

TransportLayerControl Items	Setting Range	Default	Description
GevCCP	0: Open Access 1: Exclusive Access 2:Control Access 3: Control Access Switchover Active	0: Open Access	Controls the device access privilege of an application. **0: Open Access**: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: Control Access**Access rights have been obtained by the application. Other applications cannot control the camera, but can refer to it. **3: Control Access Switchover Active**: Can only be set if the camera supports the primary application switchover capability. The application sets this mode when it allows other applications to request ExclusiveAccess or ControlAccess to the camera.
GevPrimaryApplicationSocket	-	-	Returns the UDP source port of the primary application.
GevPrimaryApplicationIPAddress	-	-	Returns the address of the primary application.
GevMCPHostPort	-	-	Controls the port to which the device must send messages.
GevMCDA	-	-	Controls the destination IP address for the message channel.
GevMCSP	-	-	Indicates the source port for the message channel.
GevStreamChannelSelector	0 (Fixed)	0	Selects the stream channel to control.
GevSCCFGPacket ResendDestination	0: False 1: True	0: FALSE	Enables the alternate IP destination for stream packets resent due to a packet resend request.
GevSCCFGAllInTransmission	0: False 1: True	0: FALSE	Enables the selected GVSP transmitter to use the single packet per data block All-in Transmission mode.
GevSCCFGUnconditional Streaming	0: False 1: True	0: FALSE	Enables the camera to continue to stream, for this stream channel, if its control channel is closed or regardless of the reception of any ICMP messages (such as destination unreachable messages).
GevSCCFGExtended ChunkData	0: False 1: True	0: FALSE	Enables cameras to use the extended chunk data payload type for this stream channel.
GevSCPInterfaceIndex	0 (Fixed)	0	Index of the logical link to use.
GevSCPHostPort	-	-	Controls the port to which the device must send messages.
GevSCPSFireTestPacket	0: False 1: True	1: TRUE	Sends a test packet.

TransportLayerControl Items	Setting Range	Default	Description
GevSCPSDoNotFragment	0: False 1: True	1: 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)	1476 ~ 12036 (step 4)	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	0 ~ 4000000 (step 8)	0	Controls the delay (in GEV timestamp counter unit) to insert between each packet for this stream channel. This can be used as a crude flow-control mechanism if the application or the network infrastructure cannot keep up with the packets coming from the device.
GevSCDA	-	-	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	-	-	Indicates the source port of the stream channel.

GevSupportedOptionSelector Options:

SingleLink, MultiLink, StaticLAG, DynamicLAG, PAUSEFrameReception, PAUSEFrameGeneration, IPConfigurationLLA, IPConfigurationDHCP, IPConfigurationPersistentIP, StreamChannelSourceSocket, StandardIDMode, MessageChannelSourceSocket, CommandsConcatenation, WriteMem, PacketResend, Event, EventData, PendingAck, IEEE1588, Action, UnconditionalAction, ScheduledAction, PrimaryApplicationSwitchover, ExtendedStatusCodes, ExtendedStatusCodesVersion2_0, DiscoveryAckDelay, DiscoveryAckDelayWritable, TestData, ManifestTable, CCPApplicationSocket, LinkSpeed, HeartbeatDisable, SerialNumber, UserDefinedName, StreamChannel0BigAndLittleEndian, StreamChannel0MultiZone, StreamChannel0PacketResendDestination, StreamChannel0AllInTransmission, StreamChannel0UnconditionalStreaming, StreamChannel0ExtendedChunkData, pGevSupportedOptionSelectorValue

ImageFormatControl

Configure image format settings.

Image Format Control Items	Setting Range	Default	Description
SensorWidth	Display the maximum image width. GOX-2402MC-PGE: 1936 GOX-3201MC-PGE: 2064 GOX-5103MC-PGE: 2464 GOX-8901MC-PGE: 4112 GOX-12401MC-PGE: 4112		
SensorHeight	Display the maximum image height. GOX-2402MC-PGE: 1216 GOX-3201MC-PGE: 1544 GOX-5103MC-PGE: 2056 GOX-8901MC-PGE: 2176 GOX-12401MC-PGE: 3008		
SensorDigitizationBits	12 Bits (Fixed)		Display the number of bits at which the sensor is operating.
WidthMax	Display the maximum image width. GOX-2402MC-PGE: 1920 (960) GOX-3201MC-PGE: 2048 (1024) GOX-5103MC-PGE: 2448 (1224) GOX-8901MC-PGE: 4096 (2048) GOX-12401MC-PGE: 4096 (2048) **Note:** The value in parentheses applies when BinningHorizontal = 2 (mono model only) or DecimationVertical = 2.		
HeightMax	Display the maximum image height. GOX-2402MC-PGE: 1200 (600) GOX-3201MC-PGE: 1536 (768) GOX-5103MC-PGE: 2048 (1024) GOX-8901MC-PGE: 2160 (1080) GOX-12401MC-PGE: 3000 (1500) **Note:** The value in parentheses applies when BinningVertical = 2 (mono model only) or DecimationVertical = 2.		

Image Format Control Items	Setting Range	Default	Description
Width **Related Topic:** ROI Function (Single ROI)	96 (48)* ~ [WidthMax - OffsetX] , Step 16 (8)*	WidthMax	Set the image width. *The value in parentheses applies when BinningHorizontal = 2 (mono model only) Disabled when DecimationHorizontal / DecimationVertical = 2.
Height	8 (4)* ~ [HeightMax - OffsetY], Step 2 (1)*	HeightMax	Set the image height. *The value in parentheses applies when BinningVertical = 2 (mono model only) Disabled when DecimationHorizontal / DecimationVertical = 2.
OffsetX	0 ~ [WidthtMax - Width] , Step 16 (8)*	0	Set the horizontal offset. *The value in parentheses applies when BinningHorizontal = 2 (mono model only) Disabled when DecimationHorizontal / DecimationVertical = 2.
OffsetY	0 ~ [HeightMax - Height], Step 2(1)*	0	Set the vertical offset. *The value in parentheses applies when BinningVertical = 2 (mono model only) Disabled when DecimationHorizontal / DecimationVertical = 2.
BinningHorizontalMode **Related Topic:** Binning Function	0:Sum 1:Average	0:Sum	Set the processing method for horizontal binning. Monochrome models only. **Note:** GOX-2402M-PGE processes 2x2 binning in the image sensor and is fixed to Sum mode.
BinningHorizontal	1 ~ 2	1	Set the number of pixels in the horizontal direction for which to perform binning. Monochrome models only.
BinningVerticalMode	0:Sum 1:Average	0:Sum	Set the processing method for vertical binning. Monochrome models only. **Note:** GOX-2402M-PGE processes 2x2 binning in the image sensor and is fixed to Sum mode.
BinningVertical	1 ~ 2	1	Set the number of pixels in the vertical direction for which to perform binning. Monochrome models only.
DecimationHorizontalMode	-	0: Discard (Fixed)	Set Decimation Horizontal mode.

Image Format Control Items	Setting Range	Default	Description
DecimationHorizontal **Related Topic:** Decimation Mode	1: None 2: Pixels are thinned out horizontally	1: None	If set to 2, Pixels (50%) are thinned out horizontally. **Note:** DecimationHorizontal and DecimationVertical cannot be set separately. For example, changing DecimationHorizontal to 2 will automatically change DecimationVertical to 2.
DecimationVerticalMode	-	0: Discard (Fixed)	Set Decimation Vertical mode.
DecimationVertical	1: None 2: Pixels are thinned out horizontally	1: None	If set to 2, Pixels (50%) are thinned out horizontally. **Note:** DecimationHorizontal and DecimationVertical cannot be set separately. For example, changing DecimationHorizontal to 2 will automatically change DecimationVertical to 2.
ReverseX **Related Topic:** Image Flip Function	0:Off 1:On	0:Off	Reverse pixels horizontally.
ReverseY	0:Off 1:On	0:Off	Reverse pixels vertically.

<table>
<tr><th>Image Format Control Items</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>PixelFormat

Related Topic: Pixel Format</td><td colspan="3">Set the pixel format.

Mono Model
0x01080001: Mono8 (Default)
0x01100003: Mono10
0x010C0004: Mono10Packed
0x01100005: Mono12
0x010C0006:Mono12Packed

Color Model
0x01080009: BayerRG8 (Default)
0x0110000D: BayerRG10
0x010C0027: BayerRG10Packed
0x01100011: BayerRG12
0x010C002B: BayerRG12Packed
0x01080008: BayerGR8*
0x0110000C: BayerGR10*
0x010C0026:BayerGR10Packed*
0x01100010: BayerGR12*
0x010C002A: BayerGR12Packed*
0x0108000A: BayerGB8*
0x0110000E: BayerGB10*
0x10C0028: BayerGB10Packed*
0x01100012: BayerGB12*
0x010C002C: BayerGB12Packed*
0x0108000B: BayerBG8*
0x0110000F: BayerBG10*
0x010C0029: BayerBG10Packed*
0x01100013: BayerBG12*
0x010C002D: BayerBG12Packed*

Notes:
• *When using the Image Flip Function.
• When in 12-bit pixel format, VideoProcessBypassMode is forced to On.</td></tr>
<tr><td>TestPattern</td><td>-</td><td>0: Off</td><td>Select the test image.

0: Off (Default)
1: GreyHorizontalRamp
4: HorizontalColorBar (Color only)</td></tr>
</table>

AcquisitionControl

Configure image capture settings.

Acquisition Control Items	Setting Range	Default	Description
AcquisitionMode **Related Topic:** Acquisition Control	0:SingleFrame 1:MultiFrame 2:Continuous	2:Continuous	Select the image capture mode.
AcquisitionStart	-	-	Start image capture.
AcquisitionStop	-	-	Stop image capture.
AcquisitionFrameCount	1 ~ 65535	1	In MultiFrame mode, set the number of frames to capture.
AcquisitionFrameRate **Related Topic:** Changing the Frame Rate	0.125 ~	-	Display the frame rate as a frequency (unit: Hz). The maximum value varies depending on the PixelFormat, ROI settings. **Default** GOX-2402MC-PGE: 49.9 fps GOX-3201MC-PGE: 36.5 fps GOX-5103MC-PGE: 22.9 fps GOX-8901MC-PGE: 12.9 fps GOX-12401MC-PGE: 9.3 fps
TriggerSelector **Related Topic:** Trigger Control	0:AcquisitionStart 1:AcquisitionEnd 2:FrameStart 3:Acquisition TransferStart	0:AcquisitionStart	Select the trigger operation.
TriggerMode	0:Off 1:On	0:Off	Select the trigger mode.
TriggerSoftware	-	-	Execute a software trigger.

Acquisition Control Items	Setting Range	Default	Description
TriggerSource	0: Low 1: High 2: Software 10: PulseGenerator0 14-17: UserOutput0-3 18-19: Action0-1 21: Line5 Opt In1 26: Nand0 Out 27: Nand1 Out	21: Line5 Opt In	Select the trigger signal source.
TriggerActivation	1:Rising Edge 2:Falling Edge 3:Level High 4:Level Low	1:Rising Edge	Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied).
TriggerOverlap	0: Off 1: ReadOut	-	Select the trigger overlap operation. TriggerSelector = AcquisitionStart / AcquisitionEnd / AcquisitionTransferStart 0:Off (Fixed) TriggerSelector=FrameStart: 1:ReadOut (Fixed)
TriggerDelay	0 - 500000	0	Set the time of exposure start from trigger input. (unit: µs)
ExposureMode **Related Topic:** Exposure Mode	0: Off 1: Timed 2: TriggerWidth	1: Timed	Select the exposure mode.
ExposureTime (us) **Related Topic:** Actual Exposure Time	1 ~	-	Set the exposure time (us). The maximum exposure time varies depending on the AcquisitionFrameRate setting. **Note:** The actual exposure time will consist of the image sensor's offset duration added to the ExposureTime setting. See Actual Exposure Time for each camera model's offset duration. **Default:** GOX-2402MC-PGE: 19929 GOX-3201MC-PGE: 27195 GOX-5103MC-PGE: 43408 GOX-8901MC-PGE: 76629 GOX-12401MC-PGE: 106548

Acquisition Control Items	Setting Range	Default	Description
ExposureAuto	0: Off 1:Once 2:Continuous	0: Off	Set whether to enable auto exposure. When set to Once, the automatic adjustment will be performed only once, and then automatically switched to Off.
ExposureModeOption **Related Topic:** RCT Mode	0: Off 1: RCT	0: Off	Enables RCT mode.

DigitalIOControl

Configure settings for digital input/output.

Related Topic: GPIO (Digital Input/Output Settings)

Digital IO Control Items	Setting Range	Default	Description
LineSelector	21: Line2 Opt Out1 24: Line5 Opt In1 60: Nand0 In1 61: Nand0 In2 62: Nand1 In1 63: Nand1 In2 255: TimestampReset	21: Line2 Opt Out1	Select the input/output to configure.
LineSource	0: Off 1: AcquisitionActive 2: FrameActive 4: ExposureActive 5: FVAL 7: PulseGenerator0 11-14: UserOutput0-3 24: Line5 Opt In1 36: Nand0 Out 37: Nand1 Out 40: - 41: Low 42: High 43: AcquisitionTriggerWait 44: FrameTriggerWait	-	Select the line source signal for the item selected in LineSelector. Line5 Opt In1: Fixed to "-" 0: Off: Only when LineSelector=TimestampReset 40: - : Not selectable for Output **Default** LineSelector =TimestampReset: Off(0) LineSelector = Line2 Opt Out1: ExposureActive(4) LineSelector = Other than above: Low(41)

Digital IO Control Items	Setting Range	Default	Description
LineInverter	0: False 1: True	0: False	Enable/disable polarity inversion for the selected input signal or output signal. **Note:** Line5 Opt In1 is fixed to "0".
LineStatus	0: False (Low) 1: True (High)	0: False	Display the status of the input signal or output signal (True: High, False: Low).
LineMode	-	-	Display the input/output status (whether it is input or output). 0: Input (LineSelector = Line5 Opt In1, Nand0 In1, Nand0 In2, Nand1 In1, Nand1 In2) 1: Output (Line2 Opt Out1) 2: InternalConnection (TimestampReset)
LineFormat	5: OptoCoupled 7: Internal Signal	-	Display the signal format. **Default** LineSelector = Line2 Opt Out1,Line5 Opt In1: OptoCoupled LineSelector= TimestampReset: Internal Signal
LineStatusAll	bit0:Unused (Fixed to 0) bit1: Line2 (Opt Out1) bit2 - 3: Unused (Fixed to 0) bit4: Line5 (Opt In1) bit5 - 11:Unused (Fixed to 0) bit12: Nand0 In1 bit13: Nand0 In2 bit14: Nand1 In1 bit15: Nand1 In2	-	Display the input/output signal status. The state is shown with 16 bits.

Digital IO Control Items	Setting Range	Default	Description
OptInFilterSelector	0: Off 1: 10us 2: 100us 3: 500us 4: 1ms 5: 3ms 6: 5ms 7: 7ms 8: 10ms 9: 15ms 10: 20ms 11: 25ms 12: 30ms 13: 35ms 14: 40ms	0: Off	Remove noise from the OptIn input signal of Digital I/O.
UserOutputSelector	0: User Output 0 1: User Output 1 2: User Output 2 3: User Output 3	0: User Output 0	Set the UserOutput signal.
UserOutputValue	0: False 1: True	0: False	Set the value for the UserOutput selected in UserOutputSelector.

PulseGenerator

Configure pulse generator settings.

> **Related Topic:** Pulse Generator

Pulse Generator Items	Setting Range	Default	Description
ClockPreScaler	1 ~ 4096	4	Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorClock (MHz)	-	18.5625	Set the clock used for the pulse generator. This value is calculated using the ClockPreScaler value as a base. PulseGeneratorClock = 74.25 / ClockPreScaler
PulseGeneratorSelector	0:PulseGenerator0	0:PulseGenerator0	Select the pulse generator.
PulseGeneratorLength	1 ~ 1048575	618750	Set the maximum count-up value as a clock count.
PulseGeneratorLengthMs (ms)	-	33.333333	Set the maximum count-up value in milliseconds. This value is calculated using the PulseGeneratorLength value as a base. The setting range varies depending on the ClockPreScaler value. PulseGeneratorLength = (1/(PulseGeneratorClock * 1000)) * PulseGeneratorLength
PulseGeneratorFrequency (Hz)	-	30	Set the maximum count-up value as a frequency. This value is calculated using the PulseGeneratorLength value as a base. PulseGeneratorFrequency = 1sec / PulseGeneratorLengthMs
PulseGeneratorStartPoint	0 ~ 1048575	0	Set the start point of the High interval as a clock count. When the counter reaches this value, the output will be 1.
PulseGeneratorStartPointMs (ms)	-	0	Set the start point of the High interval in milliseconds. When the counter reaches this value, the output will be 1. The setting range varies depending on the ClockPreScaler value. PulseGeneratorStartPointMs = 1/PulseGeneratorClock * PulseGeneratorStartPoint

Pulse Generator Items	Setting Range	Default	Description
PulseGeneratorEndPoint	1 ~ 1048575	464063	Set the start point of the Low interval as a clock count. When the counter reaches this value, the output will be 0.
PulseGeneratorEndPointMs (ms)	-	25	Set the start point of the Low interval in milliseconds. When the counter reaches this value, the output will be 0. The setting range varies depending on the ClockPreScaler value. PulseGeneratorEndPoint = (1/(PulseGeneratorClock * 1000)) * PulseGeneratorEndPoint
PulseGeneratorPulse Width (ms)	-	25	Display the High interval width of the pulse in milliseconds. The duration between the Start Point and End Point is calculated. The setting range varies depending on the ClockPreScaler value. PulseGeneratorPulseWidth = (1/ (PulseGeneratorClock * 1000)) * (PulseGeneratorEndPoint - PulseGeneratorStartPoint)
PulseGeneratorRepeat Count	0 ~ 255	0	Set the repeat count for the counter. When this is set to 0, a free counter is enabled with no repeat limit.
PulseGeneratorClear Activation	0: Off 1: Rising Edge 2: Falling Edge 3: Level High 4 :Level Low	0: Off	Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClear Source	0: Low 1: High 3: Acquisition Trigger Wait 4: Acquisition Active 5: Frame Trigger Wait 6: Frame Active 7: Exposur eActive 8: FVAL 14-17: User Output 0-3 18: Action1 19: Action2 21: Line5 Opt In1 26: Nand0 Out 27: Nand1 Out	0: Off	Select the count clear input signal source.

Pulse Generator Items	Setting Range	Default	Description
PulseGeneratorClear SyncMode	0:Async Mode 1:Sync Mode	0:Async Mode	Select the sync mode for the count clear input signal.

AnalogControl

Configure analog control settings.

Analog Control Items	Setting Range	Default	Description
GainSelector **Related Topic:** Gain Control	0: Analog All 1: Digital Red 2: Digital Blue	0:Analog All	Select the gain to configure. **Note:** DigitalRed, DigitalBlue: Color model only.
Gain	**AnalogAll**: x1.0 ~ x126.0 **DigitalRed / DigitalBlue**: x0.447 ~ x5.624	x1.0	Set the Gain value for the Gain setting selected in GainSelector. **Note:** DigitalRed, DigitalBlue: Color model only.
GainAuto	0: Off 1: Once 2: Continuous	0: Off	Enable/disable gain auto adjustment. [Once] automatically changes to [Off] when the signal level converges once.
BlackLevelSelector	0: DigitalAll 1: DigitalRed 3: DigitalBlue	0: All	Select the black level to configure. **Note:** DigitalRed and DigitalBlue: color model only
BlackLevel	**DigitalAll**: -133 ~ +255 **DigitalRed** / **DigitalBlue**: - 64 ~ + 64	0	Set the black level value. **Note:** DigitalRed and DigitalBlue: color model only
BalanceWhiteAuto **Related Topic:** White Balance	0: Off 1: Once 2: Continuous 5: Preset 3200K 6: Preset 5000K 7: Preset 6500K 8: Preset 7500K	0: Off	Enable/disable auto white balance. **Once** automatically changes to **Off** when the signal level converges once. **Note:** Supported only on the color models.

<table>
<tr><th>Analog Control Items</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>AWBAreaSelector</td><td>-</td><td>0: Low Right</td><td>Select the area for which to configure AWBAreaEnable.
<table>
<tr><td>15: HighLeft</td><td>14: High MidLeft</td><td>13: High MidRight</td><td>12: HighRight</td></tr>
<tr><td>11: MidHigh Left</td><td>10: MidHigh MidLeft</td><td>9: MidHigh MidRight</td><td>8: MidHigh Right</td></tr>
<tr><td>7: MidLow Left</td><td>6: MidLow MidLeft</td><td>5: MidLow MidRight</td><td>4: MidLow Right</td></tr>
<tr><td>3: LowLeft</td><td>2: Low MidLeft</td><td>1: Low MidRight</td><td>0: LowRight</td></tr>
</table></td></tr>
<tr><td>AWBAreaEnable</td><td>0: False
1: True</td><td>1: True</td><td>Enable/disable the photometry area selected in AWBAreaSelector.</td></tr>
<tr><td>AWBAreaEnableAll</td><td>0: False
1: True</td><td>1: True</td><td>
<table>
<tr><td>True</td><td>Operate AWB with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in AWBAreaSelector.</td></tr>
<tr><td>False</td><td>Operate AWB according to the individual enabled/disabled photometry area states configured in AWBAreaSelector.</td></tr>
</table></td></tr>
<tr><td>AWBControlSpeed</td><td>1 ~ 8</td><td>4</td><td>Set the response speed for AWB adjustment. (8 is the fastest.)</td></tr>
<tr><td>AWBControlStatus</td><td>0: Complete
1: TooBright
2: TooDark
3: Timeout
4: Executing
6: TriggerError
8: Convergent
9: Condition Error
255: Idle</td><td>255: Idle</td><td>Displays the operation status of the AWB.</td></tr>
<tr><td>Gamma
Related Topic:
Gamma Function</td><td>0.45
0.50
0.55
0.60
0.65
0.75
0.80
0.90
1.00</td><td>0.45</td><td>Set the gamma value.</td></tr>
</table>

Analog Control Items	Setting Range	Default	Description
LUTMode	0: Off 1: Gamma 2: LUT	0:Off	Select the LUT mode.

LUTControl

Configure LUT settings.

> **Related Topic:** LUT (Lookup Table)

LUT Control Items	Setting Range	Default	Description
LUTSelector	0: Red 1: Green 2: Blue	0: Red	Select the LUT channel to control. (Color model only)
LUTIndex	0 ~ 256	0	Set the LUT index table number.
LUTValue	0 ~ 4095	Gamma≒ 1.0	Set the LUT value.

AutoLevelControl

Configure AutoLevelControl.

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

Auto Level Control Items	Setting Range	Default	Description
ALCControlReference	0: Peak Channel 1: Selected Channel	1: Selected Channel	Sets the channel to be used for ALC control reference.
ALCControlChannel	0: Red 1: Green 2: Blue	1: Green	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. **Note:** Color models only.
ALCReference	30 ~ 95	50	Set the target level for ALC. (unit: %)

<table>
<tr><th>Auto Level Control Items</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>ALCAreaSelector</td><td>-</td><td>0: Low Right</td><td>Select the area for which to configure ALCAreaEnable.
<table>
<tr><td>15: HighLeft</td><td>14: High MidLeft</td><td>13: High MidRight</td><td>12: HighRight</td></tr>
<tr><td>11: MidHigh Left</td><td>10: MidHigh MidLeft</td><td>9: MidHigh MidRight</td><td>8: MidHigh Right</td></tr>
<tr><td>7: MidLow Left</td><td>6: MidLow MidLeft</td><td>5: MidLow MidRight</td><td>4: MidLow Right</td></tr>
<tr><td>3: LowLeft</td><td>2: Low MidLeft</td><td>1: Low MidRight</td><td>0: LowRight</td></tr>
</table></td></tr>
<tr><td>ALCAreaEnable</td><td>0: False
1: True</td><td>1: True</td><td>Enable/disable the photometry area selected in ALCAreaSelector.</td></tr>
<tr><td>ALCAreaEnableAll</td><td>0: False
1: True</td><td>1: True</td><td><table>
<tr><td>True</td><td>Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in AWBAreaSelector.</td></tr>
<tr><td>False</td><td>Operate ALC according to the individual enabled/disabled photometry area states configured in AWBAreaSelector.</td></tr>
</table></td></tr>
<tr><td>ALCControlRatio</td><td>1 ~ 100</td><td>90</td><td>Set the response speed (%). (100 is the fastest.)</td></tr>
<tr><td>AutoControlStatus</td><td>-</td><td>255: Idle</td><td>Allows confirmation of the AGC, ASC, and AWB convergence status.

1: ExecutingASC
2: ExecutingAGC
3: ExecutingASCandAGC
4: ExecutingAWB
5: ExecutingASCandAWB
6: ExecutingAGCandAWB
7: ExecutingASCandAGCandAWB
8: Convergent
9: ConditionError
255: Idle</td></tr>
<tr><td>ALCStatus</td><td>0: Off
2: ASC
3: AGC</td><td>0: Off</td><td>Allows confirmation of the current operation area during ALC operation.</td></tr>
<tr><td>AutoShutterControl ExposureMin</td><td>-</td><td>100</td><td>Set the minimum value for the ExposureAuto (ASC) control range.

Min: 100
Max: (AutoShutterControlExposureMax - 1)</td></tr>
</table>

Auto Level Control Items	Setting Range	Default	Description
AutoShutterControl ExposureMax	-	-	Set the maximum value for the ExposureAuto (ASC) control range. Min: (AutoShutterControlExposureMin + 1) Max: ExposureTimeMax(04-29) のInteger型 値 Default GOX-2402MC-PGE: 19929 GOX-3201MC-PGE: 27195 GOX-5103MC-PGE: 43408 GOX-8901MC-PGE: 76629 GOX-12401MC-PGE: 106548
AutoGainControl GainRawMin	-	100	Set the minimum value for the GainAuto(ASC) control range. Min: 1 Max: (GainAutoControlMax - 1)
AutoGainControl GainRawMax	-	12600	Set the maximum value for the GainAuto(ASC) control range. Min: GainAutoControlMin +1 Max: 12600

ImagingControl

Configure other JAI functions.

Imaging Control Items	Setting Range	Default	Description
VideoProcessBypassMode **Related Topic:** VideoProcessBypassMode	0: Off 1: On	0: Off	Enable/disable VideoProcessBypass mode.

ShadingControl

Configure shading correction settings.

> **Related Topic:** Shading Correction

Shading Control Items	Setting Range	Default	Description
ShadingCorrectionMode	0: Flat Shading 1: Color Shading*	0: Flat Shading	Select the shading correction method. **Notes:** *Color model only
ShadingMode	0: Off 1: User1 2: User2 3: User3	0: Off	Set the area to which to save shading correction data. When this is set to Off, PerformShadingCalibration will not be executed.
PerformShadingCalibration	-	-	Execute shading correction. This command can not be executed under the following conditions. - When outputting no image. - When outputting TestPattern. - When ExposureAuto is set to Continuous (AcquisitionControl) - When in SequencerMode (Sequencer Function) - When GainAuto is set to Continuous (AnalogControl)
ShadingDetectResult	-	0: Idle	Display the shading correction results. 0: Condition Error 1: TooDark 2: TooBright 3: Correction Limit 4: Complete

BlemishControl

Configure settings for JAI white blemish correction.

> **Related Topic:** BlemishCompensation

Blemish Control Items	Setting Range	Default	Description
BlemishEnable	0: False 1: True	1: Enable	Enable/disable blemish correction.
BlemishDetect	-	-	Execute blemish detection. This command cannot be executed under the following conditions. - No image is being output. - TestPattern is being output - In Sequencer Mode (Sequencer Function) - The image is not full ROI size (ROI Function (Single ROI)) - In Reverse mode (Image Flip Function) - When an image is not displayed within the specified time in Acquisition Start status (Acquisition Control) - Not in lens cap state
BlemishDetectionResult	-	0: Idle	Display the blemish detection results. 0: Idle 1: Succeeded 3: Error2 - exceeded max compensation number 4: Error3 - could not detected 5: Error4 - timeout
BlemishStore	-	-	Save the location information of detected blemishes, manually specified by BlemishiCompensationPositionX and BlemishCompensasionPositionY.
BlemishDetectThreshold	1 ~ 100 (%)	10	Set the blemish detection threshold.
BlemishCompensation Index	1 ~ 256	1	Select the index for the target blemish coordinates.
BlemishCompensation PositionX	-1 ~ (WidthMax -1)	-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.
BlemishCompensation PositionY	-1 ~ (HeightMax - 1)	-1	Display the Y coordinate (vertical pixel position) of the target blemish selected in BlemishCompensationIndex. You can also manually enter the Y coordinate of the blemish you want to correct.

Blemish Control Items	Setting Range	Default	Description
BlemishCompensation DataClear	-	-	Delete detected or specified blemish information selected in BlemishCompensationIndex.
BlemishCompensationNumber	0 ~ 256	0	Display the number of target blemishes.

SequencerControl

Configure sequencer settings.

> **Related Topic:** Sequencer Function

Sequencer Control Items	Setting Range	Default	Description
SequencerMode	0: Off 1: On	0: Off	Enable/disable SequencerMode.
SequencerModeSelect	0: Trigger Sequencer Mode 1: Command Sequencer Mode	0: Trigger Sequencer Mode	Select the sequencer mode.
SequencerSetSelector	1 ~ 32	1	Select the index number to configure.
SequencerWidth	-	WidthMax	Set the width of the selected SequencerIndex. **Note:** The setting range is the same as the Width (ImageFormatControl).
SequencerHeight	-	HeightMax	Set the height of the selected SequencerIndex. **Note:** The setting range is the same as the Height (ImageFormatControl).
SequencerOffsetX	-	0	Set the OffsetX of the selected SequencerIndex. **Note:** The setting range is the same as the OffsetX (ImageFormatControl).
SequencerOffsetY	-	0	Set the OffsetY of the selected SequencerIndex. **Note:** The setting range is the same as the OffsetY (ImageFormatControl).

Sequencer Control Items	Setting Range	Default	Description
SequencerFrameCount	1 ~ 255	1	Set the FrameCount of the selected SequencerIndex.
SequencerExposureTime	1 ~	-	Set the ExposureTime of the selected SequencerIndex. **Note:** The setting range and the default value are the same as the ExposureTime (AcquisitionControl).
SequencerGainAnalogAll	-	1	Set the Gain[AnalogAll] of the selected SequencerIndex. **Note:** The setting range is the same as the Gain[AnalogAll] (AnalogControl).
SequencerGainDigitalRed	-	1	Set the Gain[DigitalRed] of the selected SequencerIndex. **Note:** The setting range is the same as the Gain[DigitalRed] (AnalogControl).(Color model only)
SequencerGainDigitalBlue	-	1	Set the Gain[DigitalBlue] of the selected SequencerIndex. **Note:** The setting range is the same as the Gain[DigitalBlue] (AnalogControl).(Color model only)
SequencerLUTEnable	0: False 1: True	0: False	Set LUTEnable of the selected SequencerIndex.
SequencerSetNext	0 ~ 32	-	Set the next index to be displayed for the selected SequencerIndex. (Enabled only for TriggerSequencer.) If 0 is specified, the operation of the Sequencer is stopped. Default: SequencerSetSelector = 1 ~ 31: SequencerSetSelector+1 SequencerSetSelector = 32: 1
SequencerRepetition	1 ~ 255	1	Set the repeat count for the sequencer.
SequencerSetActive	1 ~ 32	1	Displays the active index number.
SequencerSetStart	1 ~ 32	1	Specify the first index number to switch to when starting TriggerSequencerMode.
SequencerCommandIndex	1 ~ 32	1	Set this to change the SequencerIndex. (Enabled only for CommandSequencer.)
SequencerReset	-	-	In TriggerSequencerMode, reset the current index number to the number configured in SequencerSetStart.

CounterAndTimerControl

Configure counter settings.

This camera only supports the counter functions.

> **Related Topic:** Counter and Timer Control Function

Counter And Timer Control Items	Setting Range	Default	Description
CounterSelector	0: Counter0 1: Counter1 2: Counter2 3: Counter3	0: Counter0	Select the counter.
CounterEventSource	0: Off 1: FrameTrigger (Counter0) 2: Exposure Start (Counter1) 3: Sensor Readout (Counter2) 4: FrameTransferEnd (Counter3)	0: Off	Assign the Counter Event signal for which you want to read the count value to a dedicated counter, and read the value.
CounterEventActivation	1:Rising Edge 2:Falling Edge	-	Set the count timing. The setting value is fixed with the following data. Default: CounterSelector=0, 1, 2:Rising Edge CounterSelector=3:Falling Edge
CounterReset	-	-	Reset the counter.
CounterValue	0 - 32bit max	0	Display the count value.
CounterStatus	-	0: CounterIdle	Display the counter status. 0: CounterIdle 1: CounterTriggerWait 2: CounterActive 3: CounterCompleted 4: CounterOverflow

ActionControl

Configures action control settings.

> **Related Topic:** Action Control Function

Action Control Items	Setting Range	Default	Description
ActionDeviceKey	0x00000000 ~ 0xFFFFFFFF	0x00000000	An action command is executed if this ActionDeviceKey matches the DeviceKey contained in the action command message.
ActionQueueSize	-	-	Displays the queue size of ScheduledActionCommand. This value represents the maximum number of ScheduledActionCommands that can be pending at the time a ScheduledActionCommand is given in time.
ActionSelector	1 ~ 2	1	Select the ActionSelector.
ActionGroupMask	0x00000000 ~ 0xFFFFFFFF	0x00000000	An action command is executed if the result of an AND operation of GroupMask contained in this ActionGroupMask and an action command message is not 0.
ActionGroupKey	0x00000000 ~ 0xFFFFFFFF	0x00000000	An action command is executed if this ActionGroupKey matches the GroupKey contained in the action command message.

EventControl

Configure settings for event control.

> **Related Topic:** Event Control Function

Event Control Items	Setting Range	Default	Description
EventSelector	0: Acquisition Trigger 1: Frame Start 2: Frame End 5: Exposure Start 6: Exposure End	0: Acquisition Trigger	Select the event to send the event message.
EventNotification	0: Off 1: On	0: Off	Sets whether or not to send an event message when an event selected by EventSelector occurs.
EventAcquisitionTriggerData	-	-	When the event AcquisitionTrigger occurs, the following three data can be checked.
EventAcquisitionTrigger	-	0x9002	Displays the EventID (0x9002).
EventAcquisitionTriggerTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs.

Event Control Items	Setting Range	Default	Description
EventAcquisitionTriggerFrameID	-	0 (Fixed)	Displays the FrameID value when an event occurs.
EventFrameStartData	-	-	When the event AEventFrameStartData occurs, the following three data can be checked.
EventFrameStart	-	0x9300	Displays the EventID (0x9300).
EventFrameStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs.
EventFrameStartFrameID	-	0 (Fixed)	Displays the FrameID value when an event occurs.
EventFrameEndData	-	-	When the event FrameEndData occurs, the following three data can be checked.
EventFrameEnd	-	0x9301	Displays the EventID (0x9301).
EventFrameEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs.
EventFrameEndFrameID	-	0 (Fixed)	Displays the FrameID value when an event occurs.
EventExposureStartData	-	-	When the event ExposureStartData occurs, the following three data can be checked.
EventExposureStart	-	0x9003	Displays the EventID (0x9003).
EventExposureStartTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs.
EventExposureStartFrameID	-	0 (Fixed)	Displays the FrameID value when an event occurs.
EventExposureEndData	-	-	When the event ExposureEndDataoccurs, the following three data can be checked.
EventExposureEnd	-	0x9004	Displays the EventID (x9004).
EventExposureEndTimestamp	0 ~ 64bit max	0	Displays the Timestamp value when an event occurs.
EventExposureEndFrameID	-	0 (Fixed)	Displays the FrameID value when an event occurs.

ChunkDataControl

Configure Chunk Control settings.

> **Related Topic:** Chunk Data Function

Chunk Data Control Items	Setting Range	Default	Description
ChunkModeActive	0: Off 1: On	0: Off	Set whether to enable ChunkData.
ChunkOffsetX	-	-	Dispaly the OffsetX value (ImageFormatControl). ChunkID: 0x00002000
ChunkOffsetY	-	-	Dispaly the OffsetY value (ImageFormatControl). ChunkID: 0x00002001
ChunkWidth	-	-	Dispaly the Width value (ImageFormatControl). ChunkID: 0x00002002
ChunkHeight	-	-	Dispaly the Height value (ImageFormatControl). ChunkID: 0x00002003
ChunkLineStatusAll	-	-	Display the LineStatusAll (DigitalIOControl) value. ChunkID: 0x00002013
ChunkFrameTriggerCounter	-	-	Display the LineStatusAll (DigitalIOControl) value. Data acquisition timing is FrameStart. ChunkID: 0x0000200E
ChunkExposureTime	-	-	Display the ExposureTime value (unit: us). ChunkID: 0x00002004 **Note:** The value displayed in ChunkExposureTime includes the exposure offset value. See "Actual Exposure Time" for the offset value.
ChunkGainAnalog All	-	-	Display the AnalogAll[Gain] (AnalogControl) value. (ChunkID: 0x0000201F)
ChunkGainDigitalRed	-	-	Display the DigitalRed[Gain] (AnalogControl) value. (ChunkID: 0x00002006)
ChunkGainDigitalBlue	-	-	Display the DigitalBlue[Gain] (AnalogControl) value. (ChunkID: 0x00002007)

Chunk Data Control Items	Setting Range	Default	Description
ChunkSequencerSetActive	-	-	Displays the SequencerSet number currently set in TriggerSequenceMode or CommandSequencerMode. (1 is displayed in Normal Mode.) (SequencerControl) ChunkID: 0x0000200C

TestControl

Configure the test control setting.

Test Control Items	Setting Range	Default	Description
TestPendingAck	0 ~ 10000	0	PendingAck function test command. The camera waits for TestPendingAck (ms) time and returns an Ack response.

UserSetControl

Configure user settings.

> **Related Topic:** Step 7: Save the Settings

User Set Control Items	Setting Range	Default	Description
UserSetSelector	0: Default* 1: User1 2: User2 3: User3	0: Default	Select the user settings. **Note:** *Default - Invalid when executing UserSetSave.
UserSetLoad	-	-	Read the user settings specified in UserSetSelector. When selecting **Default** for UserSetSelector, the factory settings are loaded.
UserSetSave	-	-	Overwrite the current setting values with the user settings specified in UserSetSelector. Invalid when UserSetSelector is set to **Default**.

Miscellaneous

Troubleshooting

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

Power Supply and Connections

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

Cause and Solution:

- Camera initialization may not be complete due to a lack of power. Check the 6-pin power cable connection.

  Or the GigE connection may be not established. Check the ethernet cable connection.

Image Display

Issue: Gradation in dark areas is not noticeable.

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

Settings and Operations

Issue: Settings cannot be saved to user memory.

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

Issue: I want to restore the factory default settings.

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

Specifications

> **Note:** GOX-2402MC-PGE, GOX-3201MC-PGE, and GOX-5103MC-PGE include the CS-Mount models.

<table>
<tr><th>Item</th><th>Description</th></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>1000BASE-T Ethernet (GigE Vision 2.0), IEEE 802.3af</td></tr>
<tr><td>Image Sensor</td><td>Monochrome: Monochrome CMOS
Color: Bayer color CMOS</td></tr>
<tr><td>Dark SN
(0dB@10bit)</td><td>Monochrome: >60 dB@10bit
Color: >60 dB@10bit (Gch)
<table>
<tr><td>GOX-2402MC-PGE</td><td>AnalogGainAll:x1.0,Shutter:OFF, Mono10/Bayer10, Frame Rate: 33.27fps</td></tr>
<tr><td>GOX-3201MC-PGE</td><td>AnalogGainAll:x1.0,Shutter:OFF, Mono10/Bayer10, Frame Rate: 24.37fps</td></tr>
<tr><td>GOX-5103MC-PGE</td><td>AnalogGainAll:x1.0,Shutter:OFF, Mono10/Bayer10, Frame Rate: 15.29fps</td></tr>
<tr><td>GOX-8901MC-PGE</td><td>AnalogGainAll:x1.0,Shutter:OFF, Mono10/Bayer10, Frame Rate: 8.66fps</td></tr>
<tr><td>GOX-12401MC-PGE</td><td>AnalogGainAll:x1.0,Shutter:OFF, Mono10/Bayer10, Frame Rate: 6.23fps</td></tr>
</table></td></tr>
<tr><td>Bright SN
(0db/890LSB@10bit)</td><td>Monochrome: >38 dB
Color: >36 dB (Gch)</td></tr>
<tr><td>Image Size
(Effective Image)</td><td>
<table>
<tr><td>GOX-2402MC-PGE</td><td>Type 1/2.3</td><td>6.62 mm x 4.14 mm (7.81 mm diagonal)</td></tr>
<tr><td>GOX-3201MC-PGE</td><td>Type 1/1.8</td><td>7.07 mm x 5.3 mm (8.83 mm diagonal)</td></tr>
<tr><td>GOX-5103MC-PGE</td><td>Type 2/3</td><td>8.45 mm x 7.07 mm (11.01 mm diagonal)</td></tr>
<tr><td>GOX-8901MC-PGE</td><td>Type 1</td><td>14.13 mm x 7.45 mm (15.97 mm diagonal)</td></tr>
<tr><td>GOX-12401MC-PGE</td><td>Type 1.1</td><td>14.13 mm x 10.35 mm (17.52 mm diagonal)</td></tr>
</table></td></tr>
<tr><td>Pixel Size</td><td>3.45 µm x 3.45 µm</td></tr>
<tr><td>Effective image pixel</td><td>GOX-2402MC-PGE: 1920 x 1200
GOX-3201MC-PGE: 2048 x 1536
GOX-5103MC-PGE: 2448 x 2048
GOX-8901MC-PGE: 4096 x 2160
GOX-12401MC-PGE: 4096 x 3000</td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Max Acquisition Frame Rate</td><td>
<table>
<tr><th>Model Name</th><th>8-bit</th><th>10/12-bit Packed</th><th>10/12-bit Unpacked</th></tr>
<tr><td>GOX-2402MC-PGE</td><td>49.9 fps</td><td>33.2 fps</td><td>24.9 fps</td></tr>
<tr><td>GOX-3201MC-PGE</td><td>36.5 fps</td><td>24.3 fps</td><td>18.2 fps</td></tr>
<tr><td>GOX-5103MC-PGE</td><td>22.9 fps</td><td>15.2 fps</td><td>11.4 fps</td></tr>
<tr><td>GOX-8901MC-PGE</td><td>12.9 fps</td><td>8.6 fps</td><td>6.4 fps</td></tr>
<tr><td>GOX-12401MC-PGE</td><td>9.3 fps</td><td>6.2 fps</td><td>4.6 fps</td></tr>
</table>
</td></tr>
<tr><td>Digital image output format
Full</td><td>GOX-2402MC-PGE: 1920 x 1200
GOX-3201MC-PGE: 2048 x 1536
GOX-5103MC-PGE: 2448 x 2048
GOX-8901MC-PGE: 4096 x 2160
GOX-12401MC-PGE: 4096 x 3000</td></tr>
<tr><td>Digital image output format
ROI Width</td><td>GOX-2402MC-PGE: 96(48) to 1920(960), step 16(8)
GOX-3201MC-PGE: 96(48) to 2048(1024), step 16(8)
GOX-5103MC-PGE:96(48) to 2448 step(1224), 16(8)
GOX-8901MC-PGE: 96(48) to 4096(2048), step 16(8)
GOX-12401MC-PGE: 96(48) to 4096(2048), step 16(8)

Note: The value in parentheses applies when BinningHorizontal = 2 (monochrome model only).</td></tr>
<tr><td>Digital image output format
ROI OffsetX</td><td>GOX-2402MC-PGE : 0 ~ 1824(912), step 16(8)
GOX-3201MC-PGE: 0 ~ 1952(976), step 16(8)
GOX-5103MC-PGE: 0 ~ 2352(1176), step 16(8)
GOX-8901MC-PGE: 0 ~ 4000 step(2000), 16(8)
GOX-12401MC-PGE: 0 ~ 4000(2000), step 16(8)

Note: The value in parentheses applies when BinningHorizontal = 2 (monochrome model only).</td></tr>
<tr><td>Digital image output format
ROI Height</td><td>GOX-2402MC-PGE :8(4) ~ 1200(600), step 2(1)
GOX-3201MC-PGE:8(4) ~ 1536(768), step 2(1)
GOX-5103MC-PGE: 8(4) ~ 2048(1024). step 2(1)
GOX-8901MC-PGE: 8(4) ~ 2160(1080), step 2(1)
GOX-12401MC-PGE: 8(4) ~ 3000(1500), step 2(1)

Note: The value in parentheses applies when BinningVertical = 2 (monochrome model only).</td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Digital image output format
ROI OffsetY</td><td>GOX-2402MC-PGE:0 ~ 1192(596), step 2(1)
GOX-3201MC-PGE: 0 ~ 1528(764), step 2(1)
GOX-5103MC-PGE:0 ~ 2040(1020), step 2(1)
GOX-8901MC-PGE: 0 ~ 2152(1076), step 2(1)
GOX-12401MC-PGE:0 ~ 2992(1496), 2 step 2(1)

Note: The value in parentheses applies when BinningVertical = 2 (monochrome model only).</td></tr>
<tr><td>Pixel Format</td><td><table><tr><td>Mono</td><td>Mono8 (default), Mono10, Mono10Packed, Mono12, Mono12Packed</td></tr><tr><td>Color</td><td>BayerRG8 (default), BayerRG10, BayerRG10Packed, BayerRG12, BayerRG12Packed, BayerGR8*, BayerGR10*, BayerGR10Packed*, BayerGR12*, BayerGR12Packed*, BayerGB8*, BayerGB10*, BayerGB10Packed*, BayerGB12*, BayerGB12Packed*, BayerBG8*, BayerBG10*, BayerBG10Packed*, BayerBG12*, BayerBG12Packed*
* When using Image Flip Function</td></tr></table></td></tr>
<tr><td>Acquisition Mode</td><td>Continuous / SingleFrame / MultiFrame (1 ~ 65535)</td></tr>
<tr><td>Trigger Selector</td><td>Acquisition: AcquisitionStart / AcquisitionEnd
Exposure: FrameStart
Transfer: AcquisitionTransferStart (Delayed Readout)</td></tr>
<tr><td>Opto Filter</td><td>Off(Default), 10µs, 100µs, 500µs, 1ms, 3ms, 5ms, 7ms, 10ms, 15ms, 20ms, 25ms, 30ms, 35ms, 40ms</td></tr>
<tr><td>Trigger Overlap</td><td>Off / Read out</td></tr>
<tr><td>Trigger Input Signals</td><td>Low, High, Software, PulseGenerator0, Action1, Action2, UserOutput0-3, Line5, NAND 0 Out, NAND 1 Out</td></tr>
<tr><td>Exposure Mode</td><td><table><tr><th></th><th>Timed</th><th>TriggerWidth</th></tr><tr><td>GOX-2402MC-PGE</td><td rowspan="3">14.73 µs* (Min) ~ 8sec. (Max)</td><td rowspan="3">14.73 µs* (Min) ~ ∞ sec. (Max)</td></tr><tr><td>GOX-3201MC-PGE</td></tr><tr><td>GOX-5103MC-PGE</td></tr><tr><td>GOX-8901MC-PGE</td><td rowspan="2">15.26 µs* (Min) ~ 8sec. (Max)</td><td rowspan="2">15.26 µs* (Min) ~ ∞ sec. (Max)</td></tr><tr><td>GOX-12401MC-PGE</td></tr></table>
Note: *Includes the exposure offset time. Performance verified for up to 1 second.</td></tr>
<tr><td>Exposure Auto</td><td>Off / Continuous / Once</td></tr>
<tr><td>ALCControlRatio</td><td>(Auto Exposure Response Speed): 1 ~ 100%</td></tr>
<tr><td>Digital I/O</td><td>LineSelector (6P): GPIO IN / GPIO OUT</td></tr>
</table>

<table>
<tr><th>Item</th><th>Description</th></tr>
<tr><td>Black Level Adjustment</td><td>Default Level: 8LSB@8bit
DigitalAll (Mono/Color): -133 ~ +255 LSB @12bit
DigitalRed (Color): -64 ~ +64 LSB @12bit
DigitalBlue (Color): -64 ~ +64 LSB @12bit
Resolution Adjustment: 1LSB@12bit</td></tr>
<tr><td>Gain Adjustment</td><td>Manual Adjustment Range
AnalogAll (Mono/Color): 0db ~ 42dB
DigitalRed (Color): -7dB ~ 15dB
DigitalBlue (Color): -7dB ~ 15dB
Auto Gain: Off, Continuous, Once</td></tr>
<tr><td>White Balance</td><td>WhiteBalanceGain: DigitalRed, DigitalBlue : -7dB ~ 15dB
BalanceWhiteAuto: Off, Continuous, Once, Preset3200K, Preset5000K, Preset6500K, Preset7500K
Photometry Area: 16 (4 x 4) Area
Adjustment Range: 3000K ~ 9000K</td></tr>
<tr><td>Blemish Correction</td><td>Detection: Detect white blemishes using threshold values (100 steps available) (black blemish correction performed only at factory)
Correction: Interpolation using adjacent pixels (continuous blemishes not corrected)
Correctable Pixels: 256 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>Vibration Resistance</td><td>10G (20 Hz ~ 200 Hz X-Y-Z direction)</td></tr>
<tr><td>Shock Resistance</td><td>80G</td></tr>
<tr><td>Power Supply</td><td><table>
<tr><td rowspan="2">PoE</td><td>Input Range: DC +36 ~ +57V</td></tr>
<tr><td>Consumption: 3.7W typical (Default Setting/ 25°C Environment), 4.7 W (Max)</td></tr>
<tr><td rowspan="2">6-pin Connector</td><td>Input Range: DC +10V ~ +25V</td></tr>
<tr><td>Consumption: 2.7 W typical (Default Setting/ 25 °C Environment), 3.4W (Max)</td></tr>
</table></td></tr>
<tr><td>Lens Mount</td><td>C-mount: Lens mount protrusion length of 9 mm or less is supported
CS-mount: Lens mount protrusion length of 4mm or less is supported.</td></tr>
<tr><td>Flange Back</td><td>C-mount: 17.526mm, CS-mount: 12.5mm, tolerance: 0 mm to -0.05 mm</td></tr>
<tr><td>Optical Filter</td><td>IR cut filter (color model only)</td></tr>
</table>

Item	Description
Verified Performance Temperature / Humidity	5°C ~ + 45°C / 20% ~ 80% (non-condensing) **Note:** It may change depending on the installation environment. Please refer to the Caution (Package Contents).
Storage Temperature / Humidity	-25°C ~ +60°C (20 to 80%, non-condensing)
Regulations	CE(EN 55032:2015 and EN 55035:2017), FCC Class A part 15, EU RoHS/WEEE, China RoHS, KC
Dimensions (Housing)	29mm x 29mm x 41.5mm (Excluding Mount Protrusions)
Weight	C-Mount: 65g CS-Mount: 64g

Package Contents

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

Optional Accessories (Sold Separately)

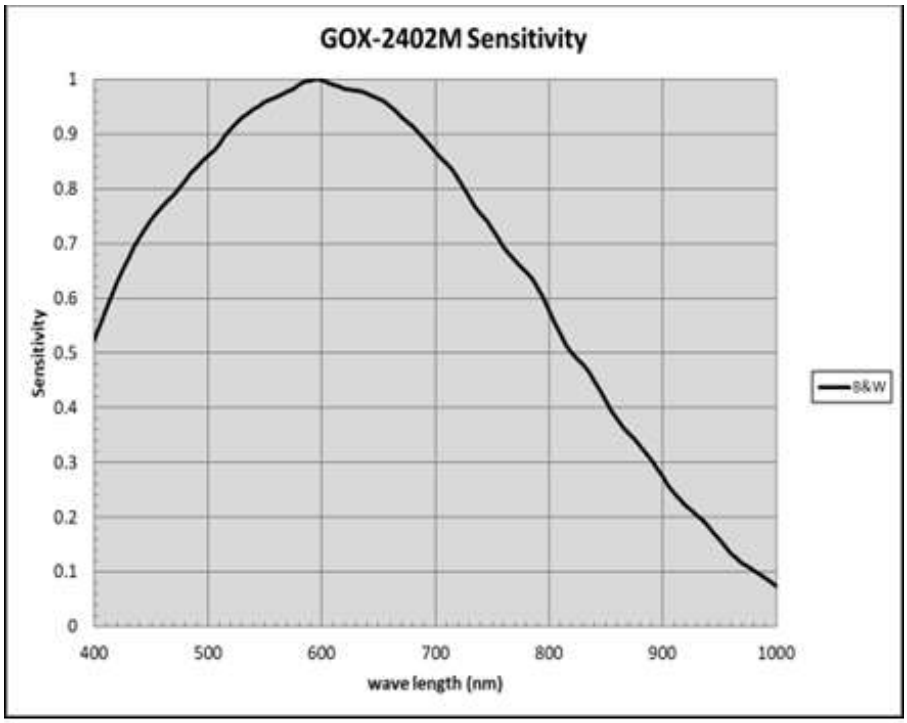
- MP-43 Tripod Adapter Plate

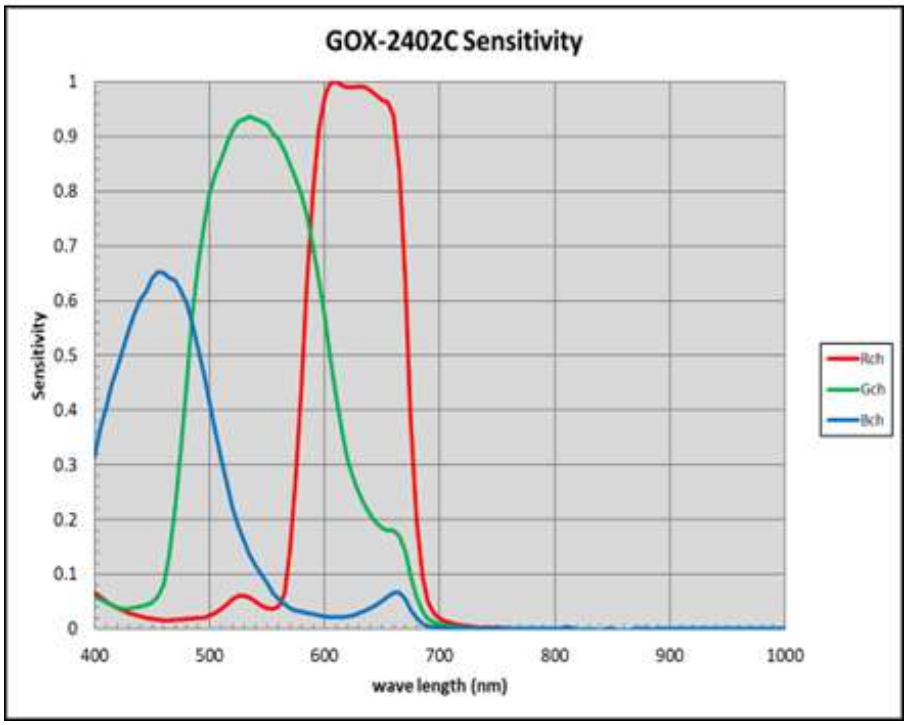
> **Notes:**
> - Design and specifications are subject to change without notice.
> - Approximately 30 minutes of warm-up are required to achieve these specifications.

> **Cautions:**
> The performance specifications given for this camera have been verified for the Operating Temperature range shown in the Specifications table. The camera may be able to perform outside of the specified temperature range, but such performance has not been verified and is therefore not guaranteed.
>
> - The camera's internal temperature should not exceed 72 °C during operation.
>
> If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

Spectral Response: GOX-2402M-PGE, GOX-2402C-PGE

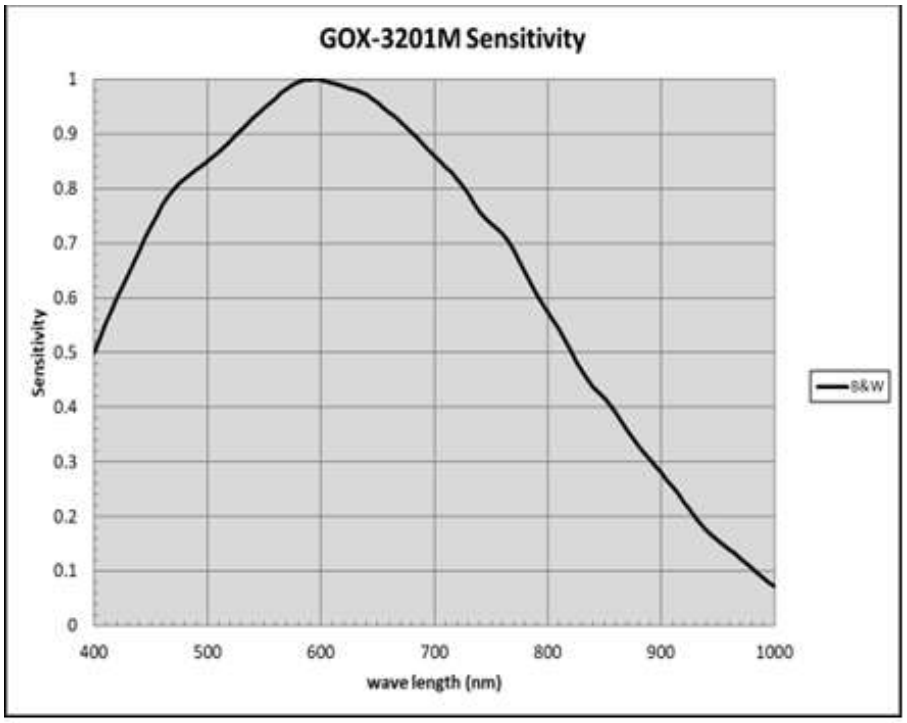
> **Note:** Including CS-mount models.

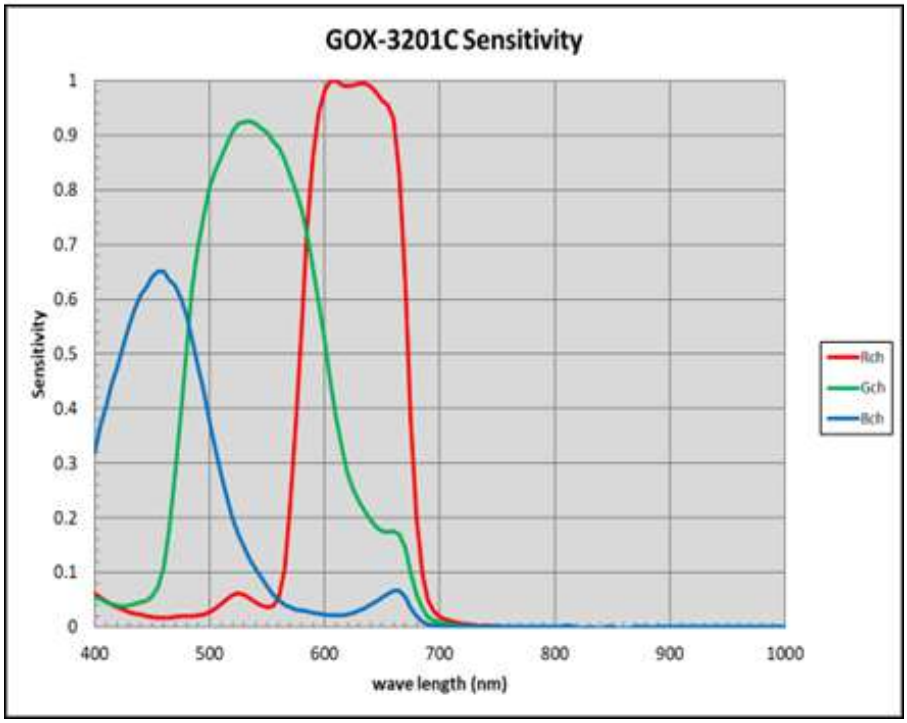




Spectral Response: GOX-3201M-PGE, GOX-3201C-PGE

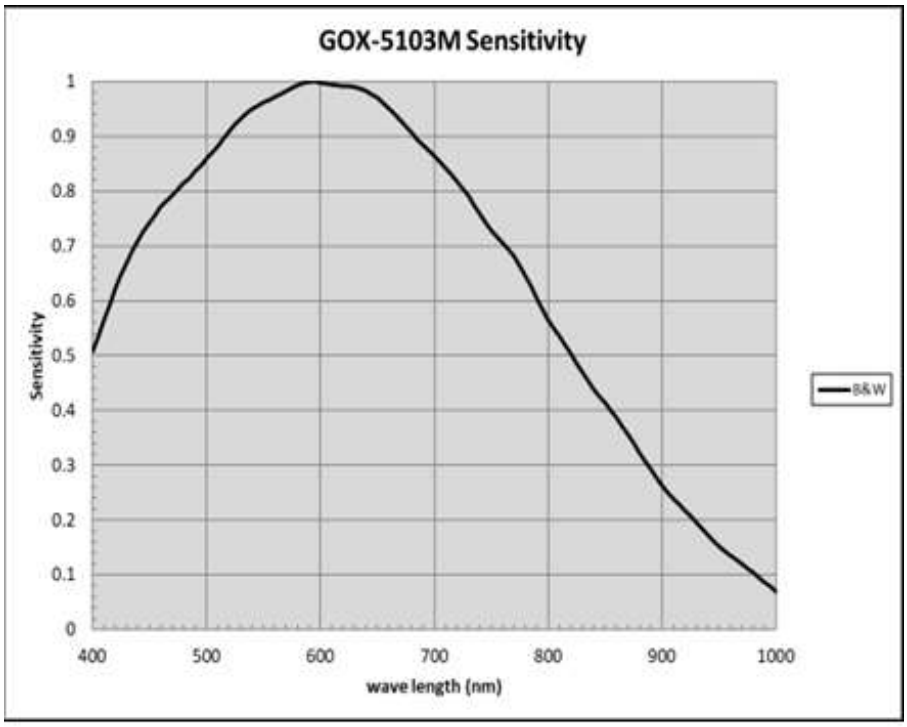
> **Note:** Including CS-mount models.

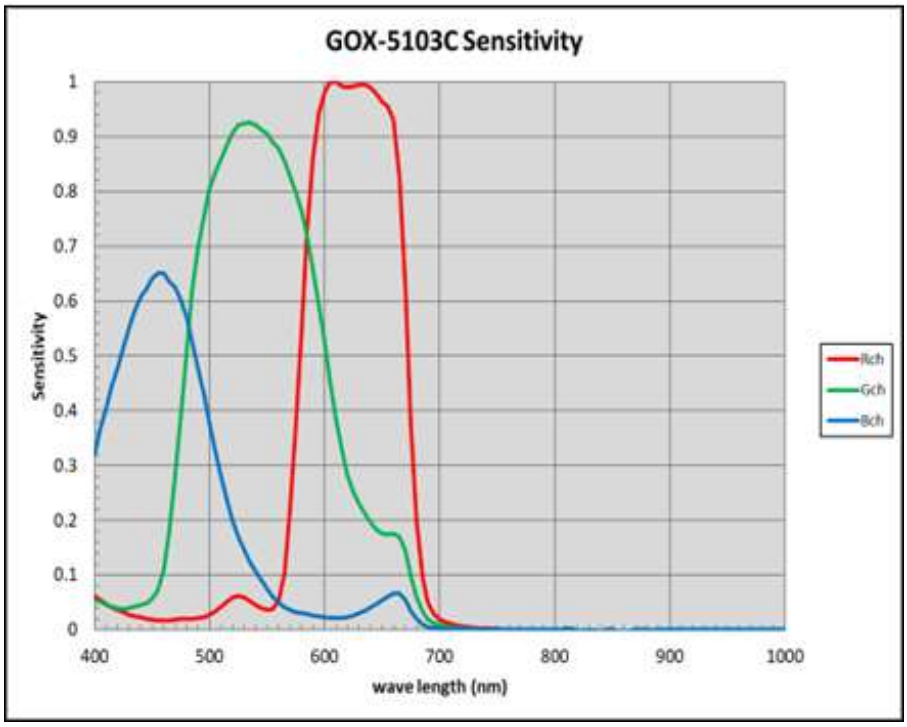




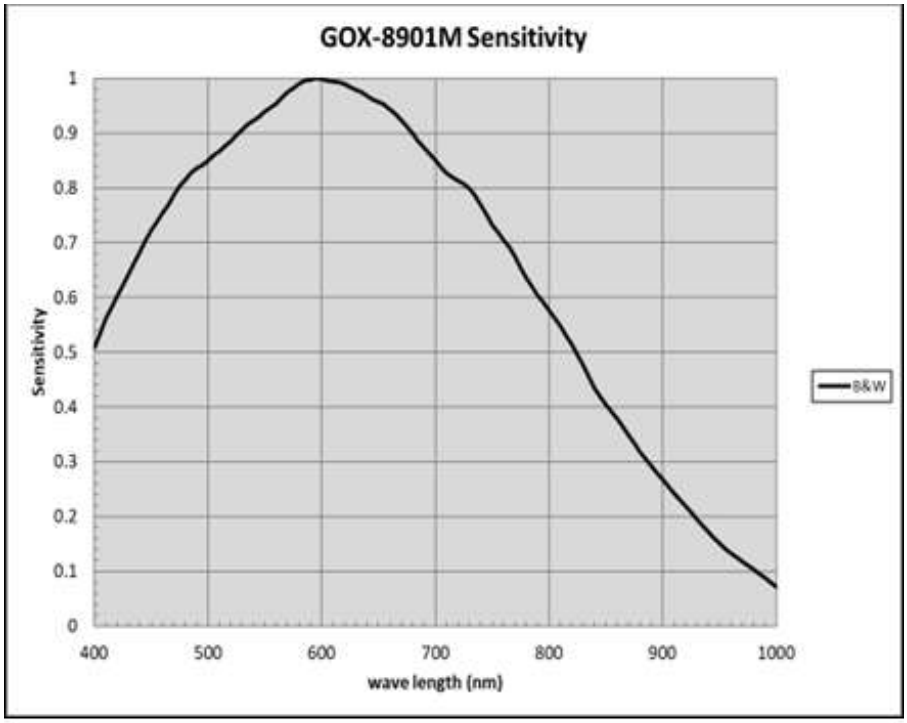
Spectral Response: GOX-5103M-PGE, GOX-5103C-PGE

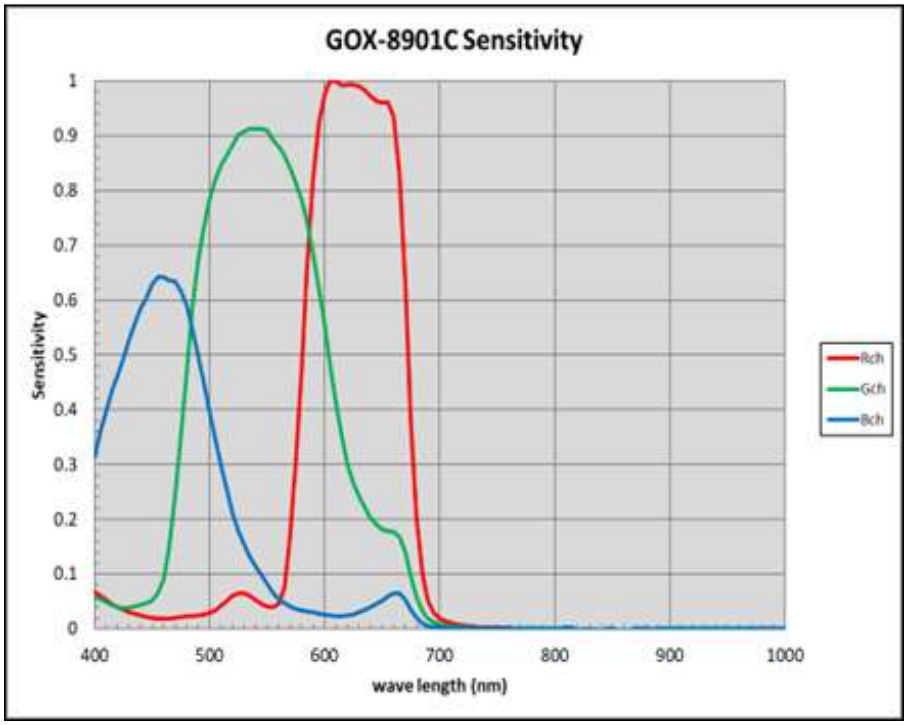
> **Note:** Including CS-mount models.



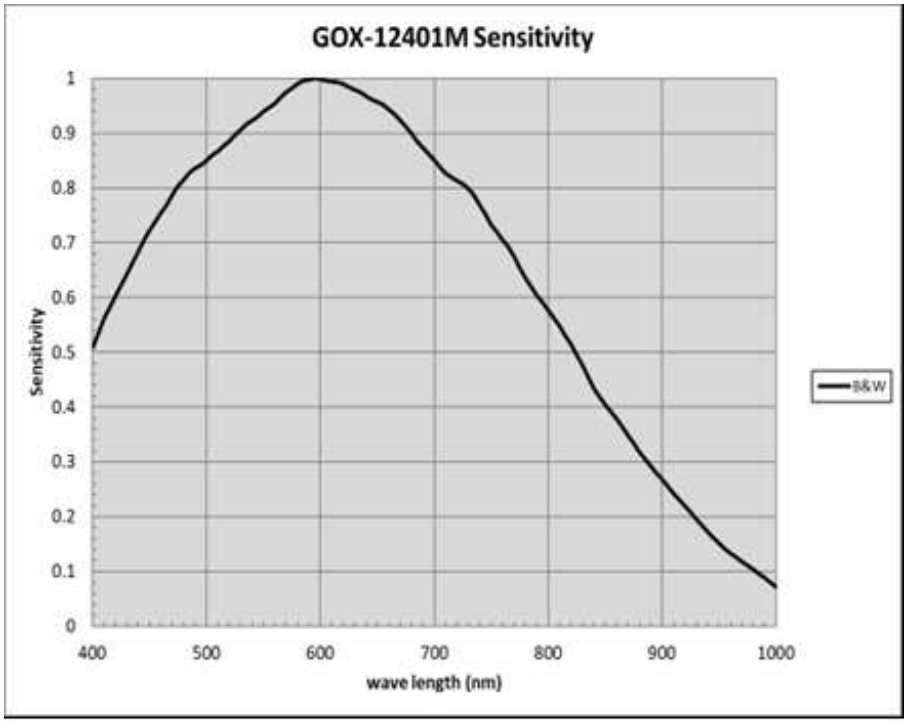


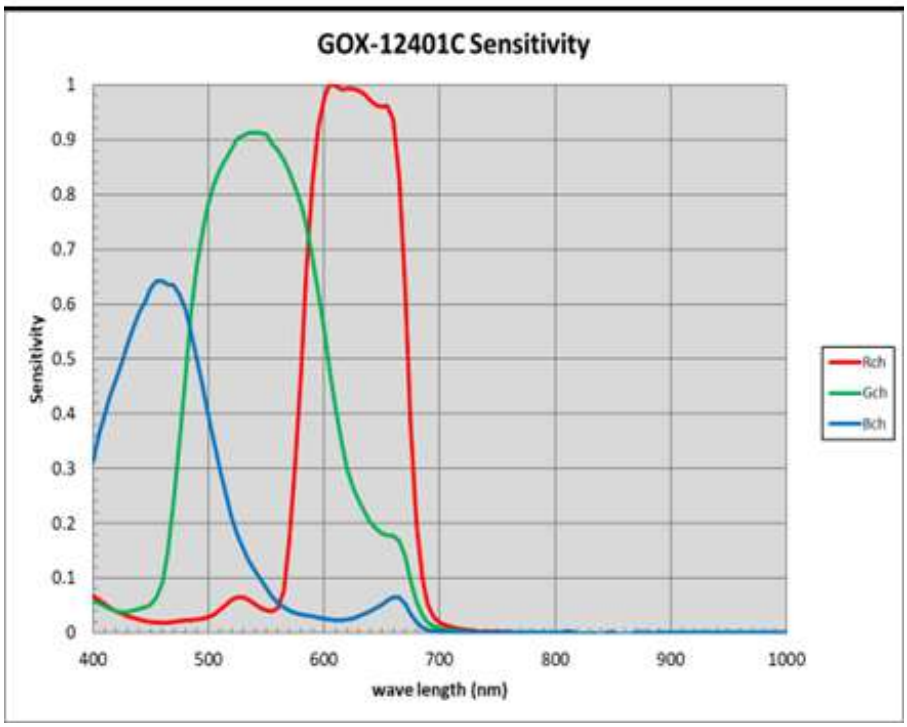
Spectral Response: GOX-8901M-PGE, GOX-8901C-PGE





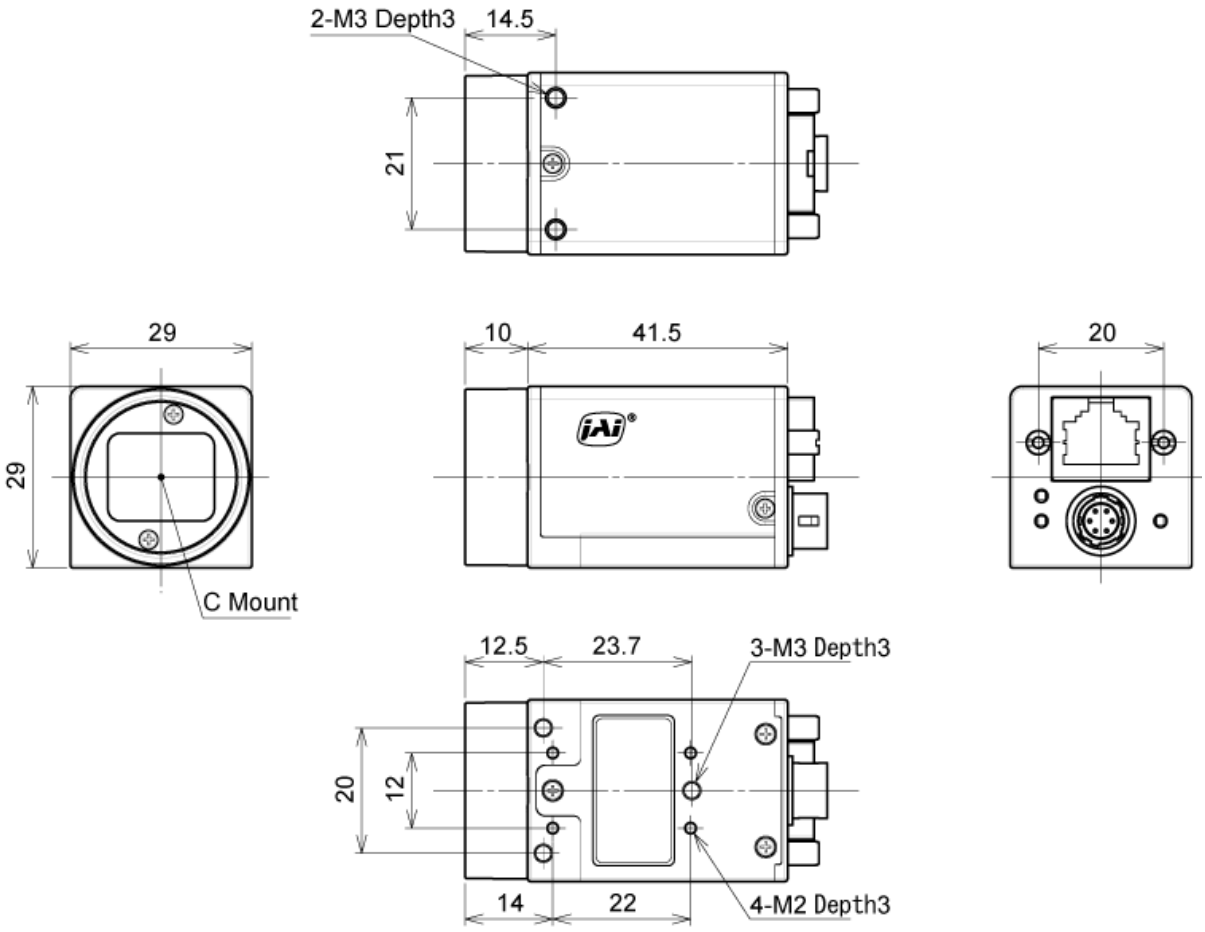
Spectral Response: GOX-12401M-PGE, GOX-12401C-PGE





Dimensions

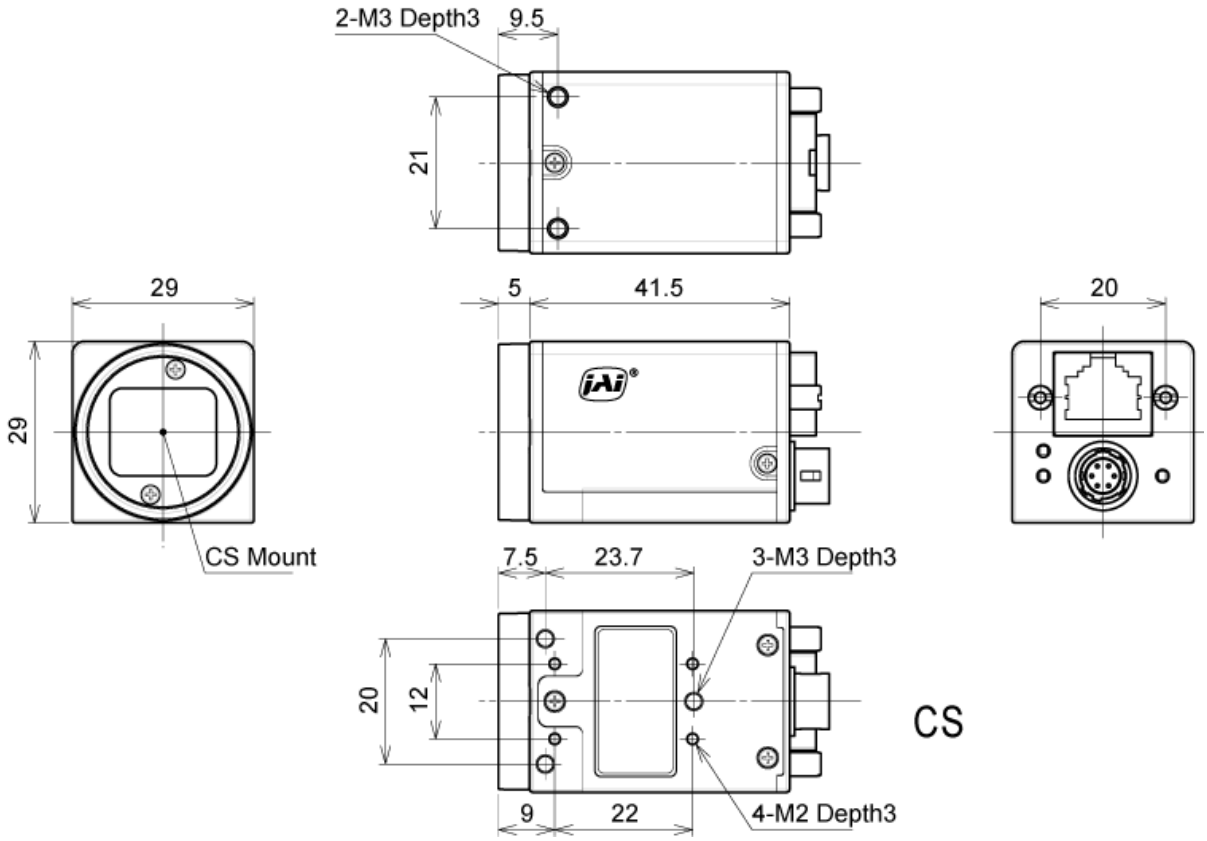
Standard Model (C-Mount)



Notes:

- Dimensional tolerance: ± 0.3mm
- Unit: mm

CS-Mount Model



Notes:

- Dimensional tolerance: ± 0.3mm
- Unit: mm

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

Camera type: Go-X Series Global Shutter GigE interface

Model name: ……

Revision: ……

Serial No: ……

Firmware version: ……

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

Revision History

Revision	Date	Device Version	Changes
1.5	2023/12/01	DV0110	Changed the layout of the manual, and corrected errors. Added the KC certification information. Updated topics including the China RoHS, Trigger Control, Binning Function, Sequencer Function.
1.4	May 2023	DV0110	Added the CS-mount models.
1.3	Nov. 2022	DV0110	Changed the AnalogAll max value to x126.0 (42dB). Changed the AutoGainControlGainRawMax default and max values to 12600. Changed the SequencerGainAnalogAll max value to x126.0. Modified the Comparison of the Decibel Display and Multiplier Display table to include up to 42dB.
1.2	June 2022	DV0110	Updated China RoHS. Corrected the external input/output circuit diagrams.
1.1	Oct. 2021	DV0100	Added the Non-Volatile Flash Memory topic.
1.0	March 2021	DV0100	First Release