See the possibilities

User Manual

GOX-2402M-USB / GOX-2402C-USB
GOX-3200M-USB / GOX-3200C-USB
GOX-3201M-USB / GOX-3201C-USB
GOX-5102M-USB / GOX-5102C-USB
GOX-5103M-USB / GOX-5103C-USB
GOX-8901M-USB / GOX-8901C-USB
GOX-12401M-USB / GOX-12401C-USB

CMOS Digital Progressive Scan
Monochrome and Color Camera
Document Version: 1.2
GO-X_Series_USB_Ver.1.2_June.2022

Thank you for purchasing this product.

⚠ Be sure to read this manual before use.

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

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

Contents

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-USB, GOX-2402C-USB, GOX-3200M-USB, GOX-3201C-USB, GOX-3201M-USB, GOX-3201C-USB, GOX-5102M-USB, GOX-5102C-USB, GOX-5103M-USB, GOX-5103C-USB, GOX-8901M-USB,GOX-8901C-USB, GOX-12401M-USB and GOX-12401C-USB 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.

Supplement

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『电子信息产品污染控制管理办法』，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)
电路板	×	○	○	○	○	○
螺丝	×	○	○	○	○	○
插座	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 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基人身、财产造成严重损害的期限。

数字「15」为期限15年。

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	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电路板	×	○	○	○	○	○
螺丝	×	○	○	○	○	○
插座	×	○	○	○	○	○
光学滤镜	×	○	×	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 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。

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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 attaching the lens

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 USB3 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.

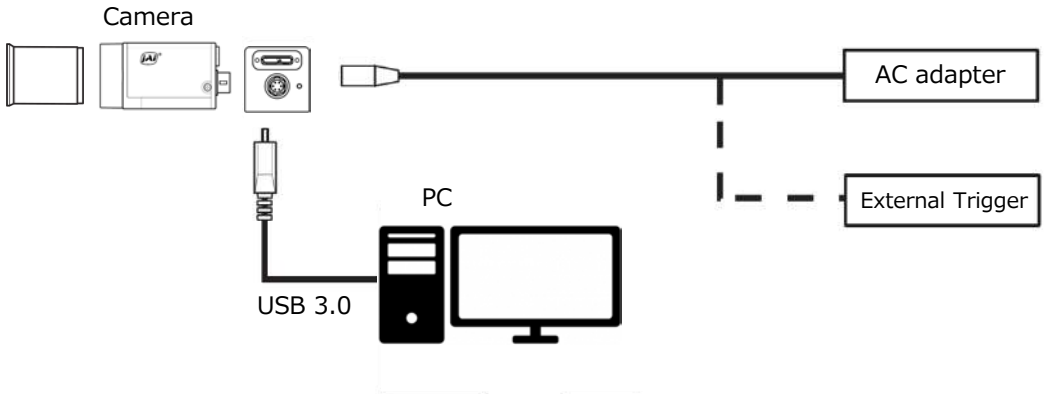
Model name	Image Sensor		Active Pixels	Pixel Size	Maximum framerate
GOX-2402M-USB	Mono	1/2.3 inch	1920 x 1200 (2.3 mega)	3.45µm x 3.45µm	162 fps
GOX-2402C-USB	Color				
GOX-3200M-USB	Mono	1/1.8 inch	2048 x 1536 (3.14 mega)	3.45µm x 3.45µm	119 fps
GOX-3200C-USB	Color				
GOX-3201M-USB	Mono				55 fps
GOX-3201C-USB	Color				
GOX-5102M-USB	Mono	2/3 inch	2448 x 2048 (5.01 mega)	3.45µm x 3.45µm	74 fps
GOX-5102C-USB	Color				
GOX-5103M-USB	Mono				35 fps
GOX-5103C-USB	Color				
GOX-8901M-USB	Mono	1 inch	4096 x 2160 (8.84 mega)	3.45µm x 3.45µm	32 fps
GOX-8901C-USB	Color				
GOX-12401M-USB	Mono	1.1 inch	4096 x 3000 (12.28 mega)	3.45µm x 3.45µm	23 fps
GOX-12401C-USB	Color				

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.

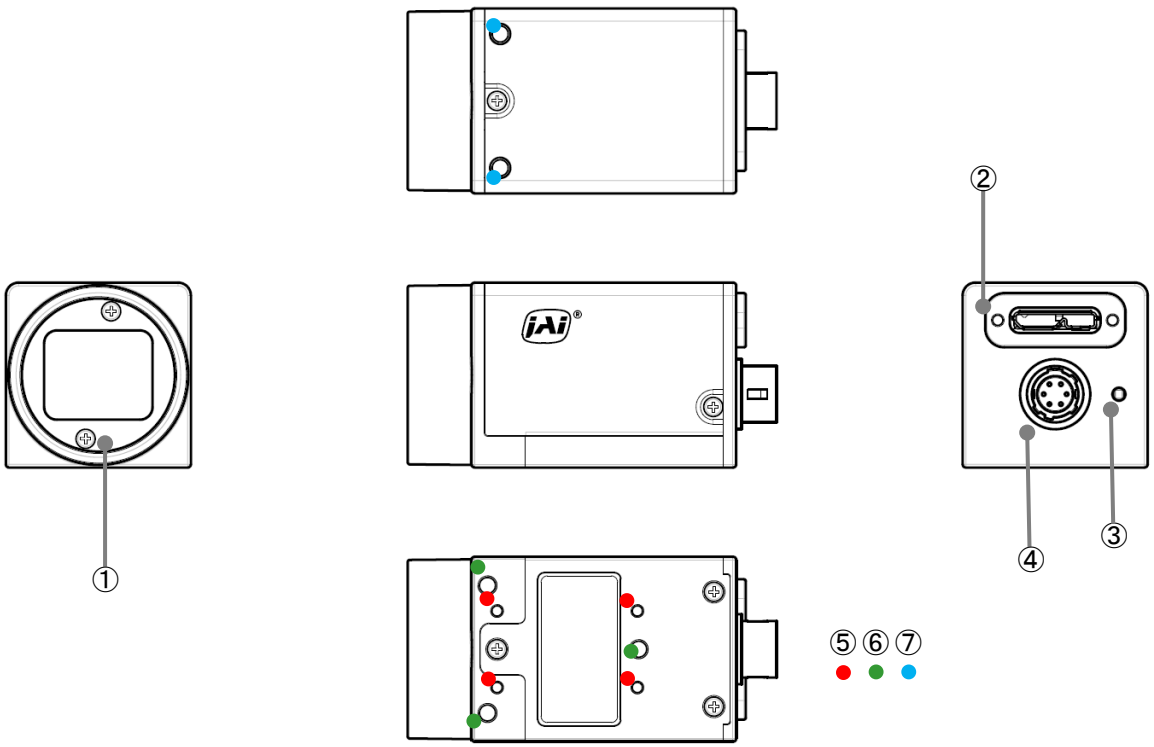
Feature overview

- Compliance with USB3 Vision and GenICam standards
- Global Shutter high resolution CMOS sensor
- Lens mount: C-mount (flange back: 17.526 mm)
- Various Video Output formats
  Monochrome models : Mono8, Mono10, Mono10p, Mono12, Mono12p
  Color models : BayerRG8, BayerRG10, BayerRG10p, BayerRG12, BayerRG12p
- Gamma correction circuit that uses lookup tables
- Internal test signal for settings configuration
- Compatible with free eBUS SDK for JAI

Connection example:



Parts Identification



① **Lens mount（C-mount)**
Mount a C-mount lens, microscope adapter, etc. here.
❖ Before mounting a lens, be sure to refer to “Step 2:Connecting Devices” and confirm the precautions for attaching a lens and the supported lens types.

② **USB 3.0 connector**
Use a USB 3.0 compatible cable to connect this to a USB port on the computer.

③ POWER/TRIG LED

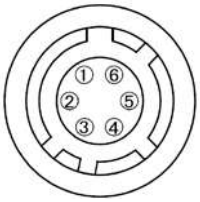
Indicates the power and trigger input status.

LED status and camera status

LED	Light	Status
POWER/ TRIG LED	(Lit amber)	Camera initializing.
	(Lit green)	Camera in operation.
	(Blinking green)	During operation in trigger mode, trigger signals are being input. ❖ The blinking interval is not related to the actual input interval of the external trigger.

④ DC IN/TRIG connector (6-pin round)

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

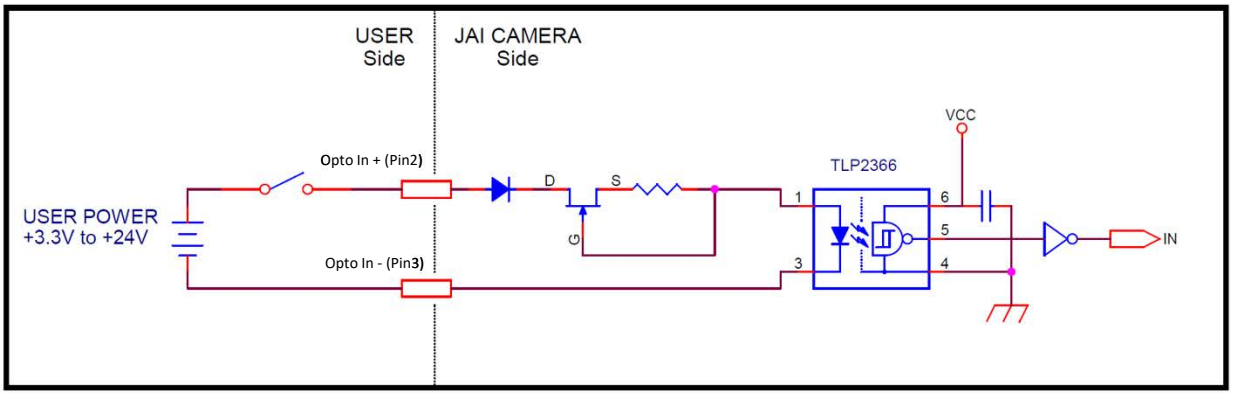


Compatible connectors

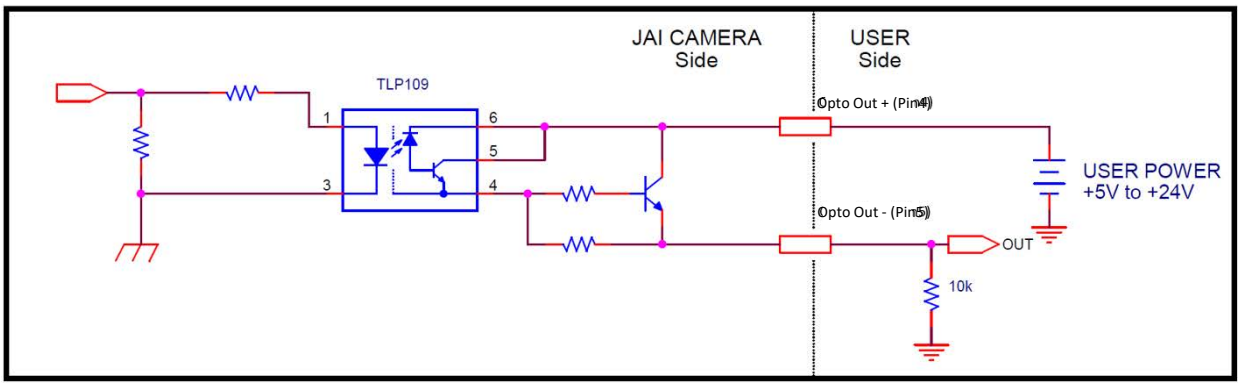
Camera side : HR10A-7R-6PB (73)　(Hirose Electric or equivalent)
Cable side : HR10A-7P-6S (plug) (Hirose Electric or equivalent)

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

■ Recommended external input circuit diagram (reference example)



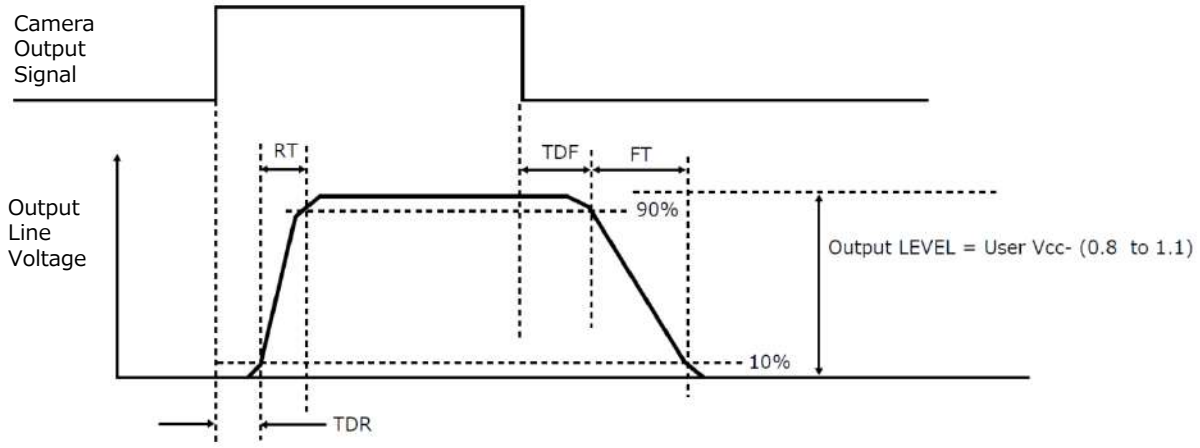
■ Recommended external output circuit diagram (reference example)



Technical notes OPTO-In circuit characteristics

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) (μs)	0.48
RT(Risc Time) (μs)	3.08
TDF(Time Delay Fall) (μs)	3.16
FT(Fall Time) (μs)	52.4

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

Caution

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 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)

⑤ Camera locking screw holes（M3, 3mm depth, 12mm pitch）

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

⑥ Camera locking screw holes（M2, 3mm depth, 20mm pitch）

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

⑦ Camera locking screw holes（M3, 3mm depth, 21mm pitch）

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

Preparation

Preparation Process

Step 1	**Installing the Software (first time only)** Install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.
⬇	
Step 2	**Connecting Devices** Connect the lens, USB3 cable, AC adapter, computer, and other devices.
⬇	
Step 3	**Verifying Camera Operation** Verify whether the camera is turned on and ready for use.
⬇	
Step 4	**Verifying the Connection between the Camera and PC** Verify whether the camera is properly recognized via Control Tool.
⬇	
Step 5	**Changing the Camera Settings** Refer to the procedure for changing the output format setting as an example, and change various settings as necessary.
⬇	
Step 6	**Adjusting the Image Quality** Refer to the procedures for adjusting the gain, white balance, and black level as examples, and adjust the image quality.
⬇	
Step 7	**Saving the Settings** Save the current setting configurations in user memory.

Step 1: Installing the Software (first time only)

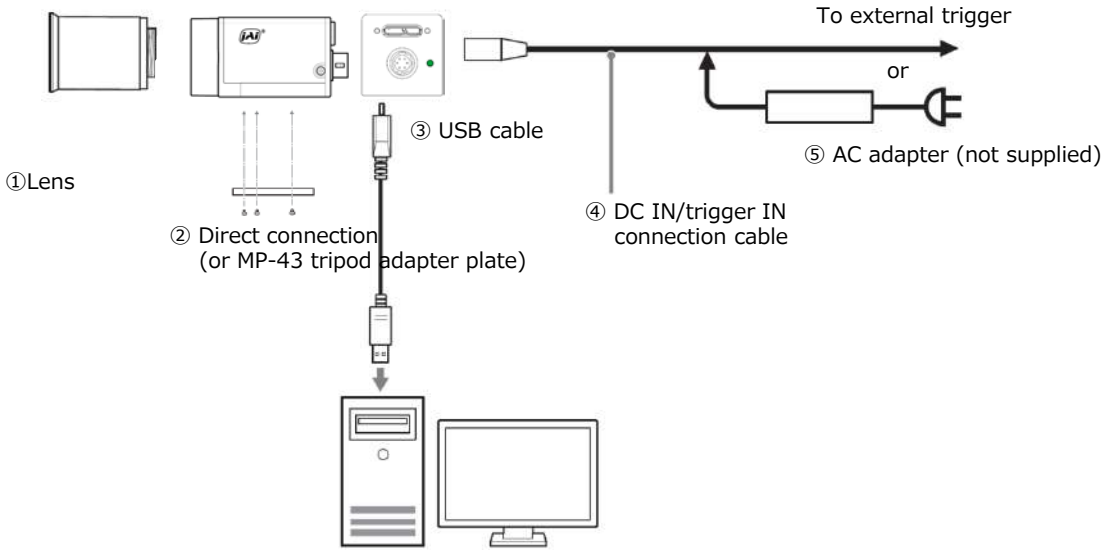
When using the camera for the first time, install the software for configuring and controlling the camera (eBUS SDK for JAI) on the computer.

❖ When you install eBUS SDK for JAI, eBUS SDK for JAI player will also be installed.

1 **Download the eBUS SDK for JAI from the JAI website.**
URL https://www.jai.com/support-software/jai-software

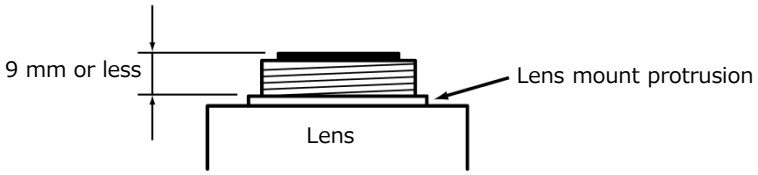
2 **Install eBUS SDK for JAI on the computer.**

Step 2: Connecting Devices



① Lens

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



・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-USB	Mono	1/2.3 inch	6.62mm x 4.14mm (7.81mm diagonal)
GOX-2402C-USB	Color		
GOX-3200M-USB	Mono	1/1.8 inch	7.07mm x 5.3mm (8.83mm diagonal)
GOX-3200C-USB	Color		
GOX-3201M-USB	Mono		
GOX-3201C-USB	Color		
GOX-5102M-USB	Mono	2/3 inch	8.45mm x 7.07mm (11.01mm diagonal)
GOX-5102C-USB	Color		
GOX-5103M-USB	Mono		
GOX-5103C-USB	Color		
GOX-8901M-USB	Mono	1 inch	14.13mm x 7.45mm (15.97mm diagonal)
GOX-8901C-USB	Color		
GOX-12401M-USB	Mono	1.1 inch	14.13mm x 10.35mm (17.52mm diagonal)
GOX-12401C-USB	Color		

Caution

・The maximum performance of the camera may not be realized depending on the lens.
・Attaching a lens with a mount protrusion of 9 mm or longer may damage the lens or camera.

Note

The following formula can be used to estimate the focal length.
Focal length = WD / (1 + W/w)
WD : Working distance (distance between lens and object)
W : Width of object
w : Width of sensor

② Direct connection (or MP-43 tripod adapter plate)

When mounting the camera directly to a wall or other device, use screws that match the camera locking screw holes on the camera (M3, depth: 3 mm). Use the supplied screws to attach the tripod adapter plate.

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 USB cable

Connect a USB cable to the USB 3.0 connector.

Caution

The camera is equipped with a USB 3.0 compatible Micro B connector. Although this connector includes USB 2.0 connectors, the camera does not support use of USB 2.0.

④ DC IN / trigger IN connection cable

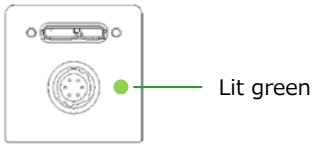
⑤ AC adapter (power supply) (if necessary)
Connect the AC adapter and the round connector of the connection cable to the DC IN / trigger IN connector on the camera.

Step 3: Verifying Camera Operation

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

Verify whether power is being supplied to the camera by checking the rear LED.

When properly turned on



* For details on how to read the LEDs, see “LED status and camera status” in the “Parts Identification” section.

Step 4: Verifying the Connection between the Camera and PC

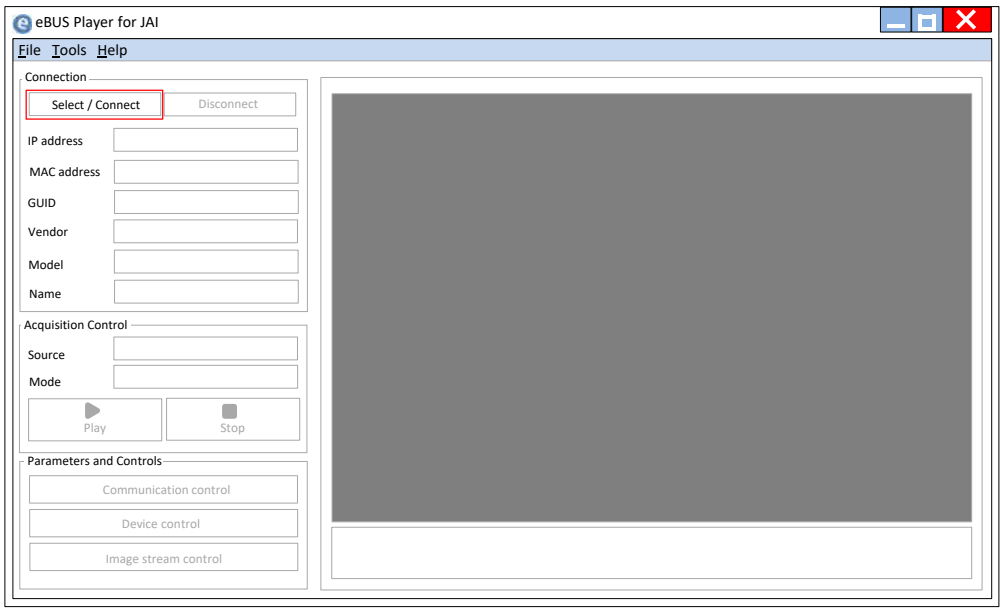
Verify whether the camera is properly recognized via Control Tool.

Connecting the Camera to Control Tool

1 Startup eBUS Player for JAI

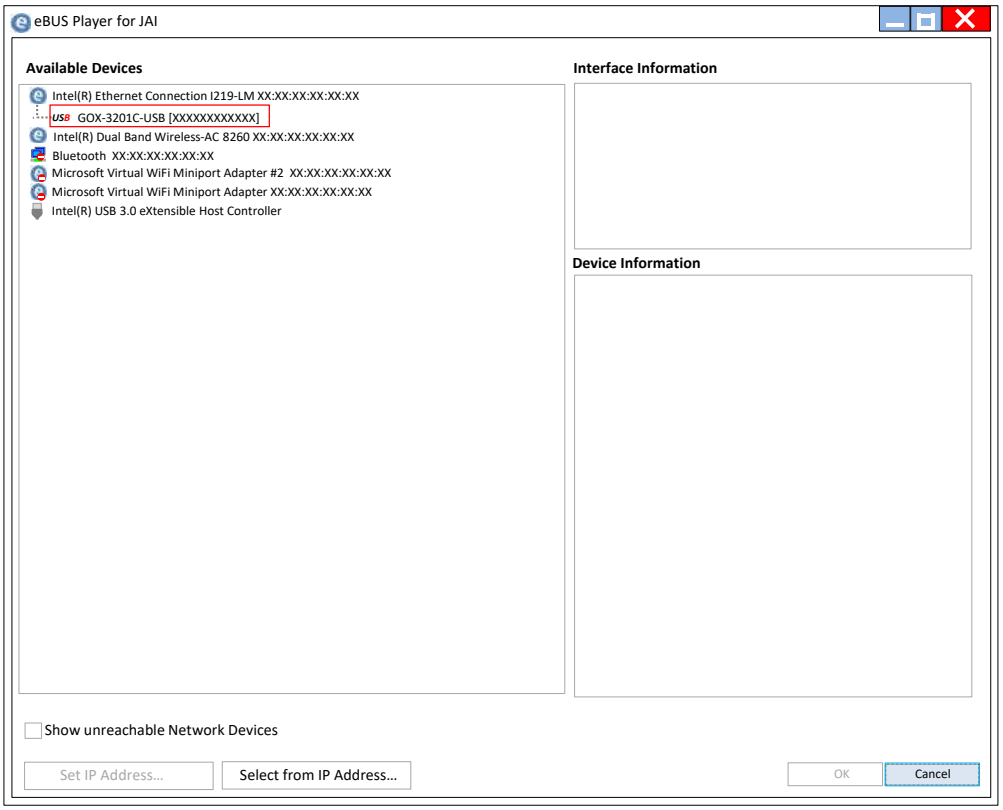
eBUS Player for JAI

eBUS Player for JAI startup screen appears.



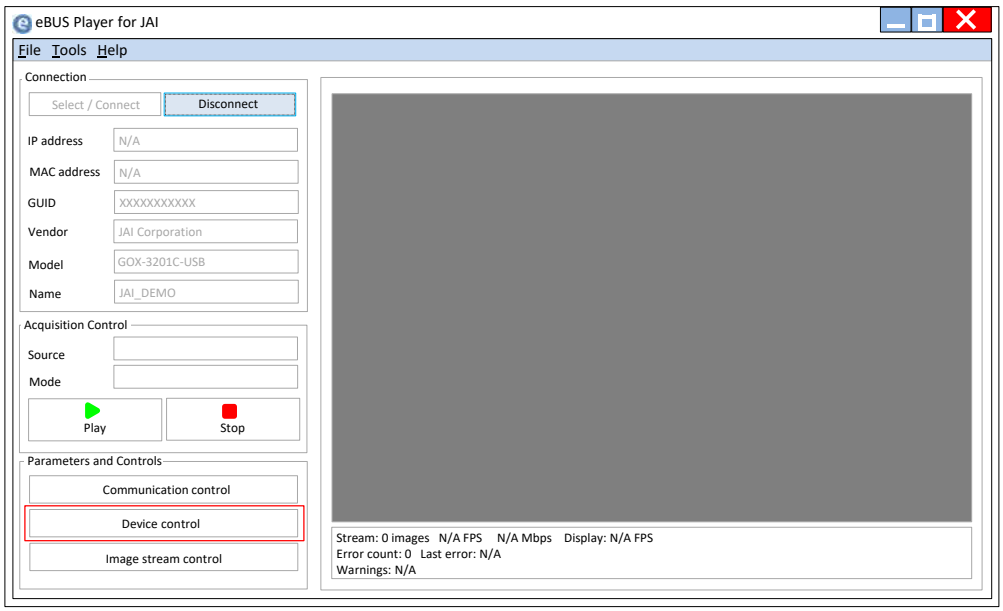
2 Select the camera you want to configure.

Push Select / Connect button

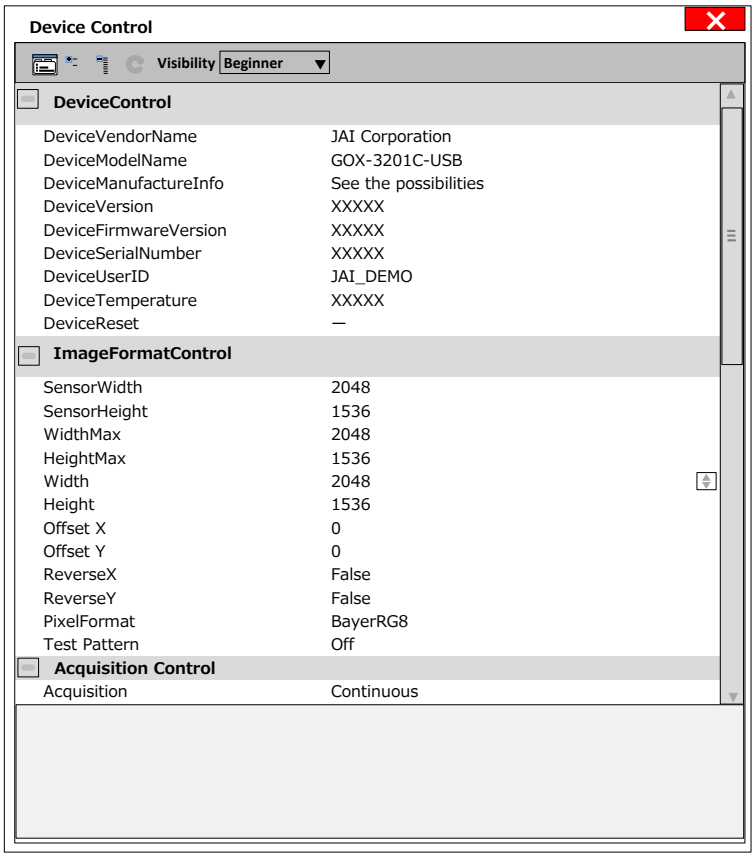


The connected camera is listed.
Please select one camera.

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



Push 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: Changing the Camera Settings

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

Configuring 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.

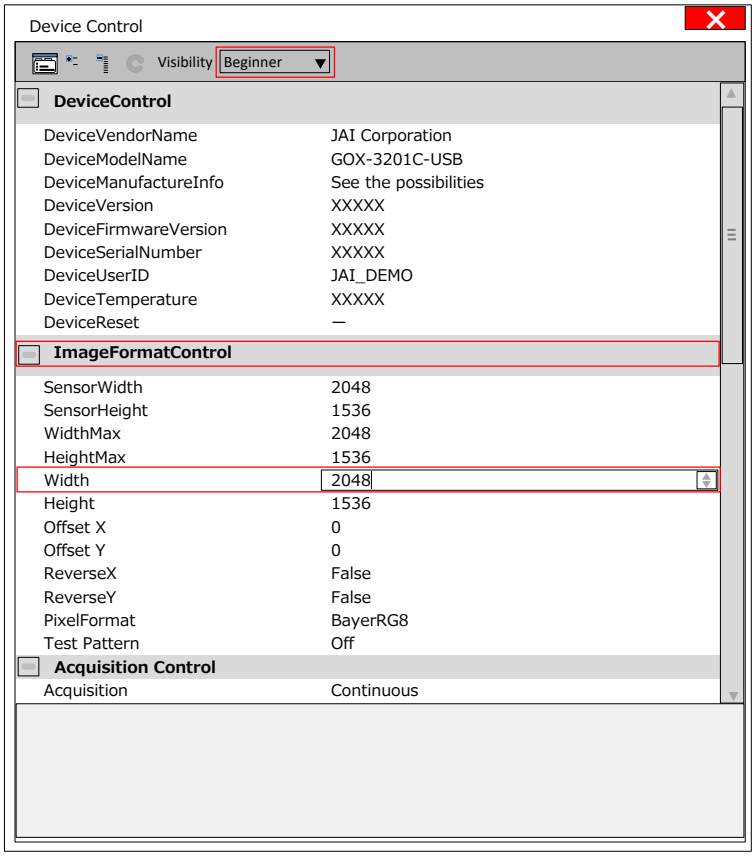
Factory default values (GOX-3201C-USB)

Item		Default value
ImageFormatControl	Width	2048
	Height	1536
	OffsetX (horizontal position)	0
	OffsetY (vertical position)	0
	PixelFormat	BayerRG8

* You can specify the image acquisition area. For details, see “ROI (Regional Scanning Function)”.

1 Configuring the [Width] of [ImageFormatControl]

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



Note

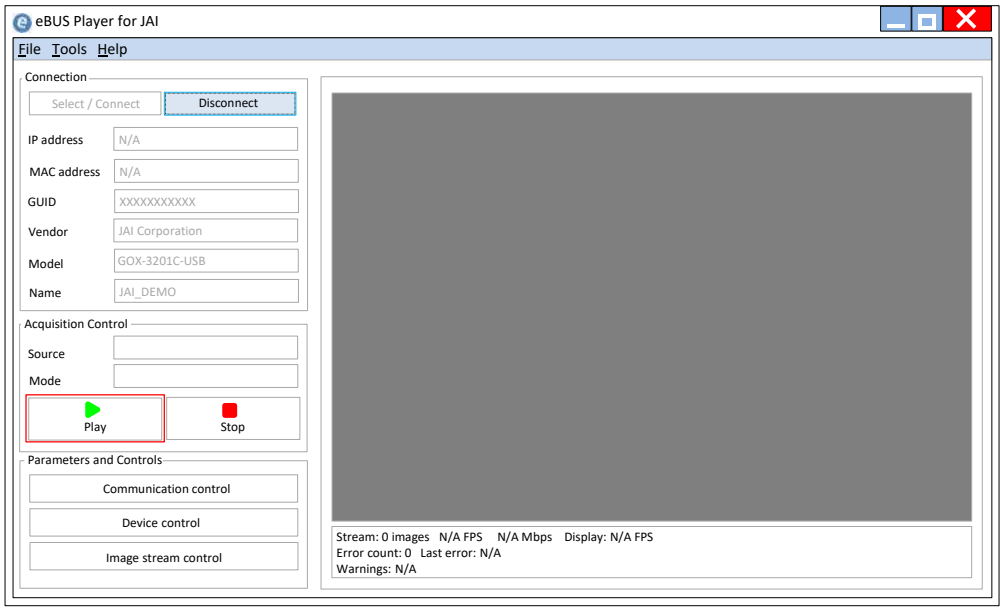
Depending on the setting item, you need to change visibility.
Please switch visibility (Beginner / Expert / Guru) as necessary.

Step 6: Adjusting the Image Quality

Display the camera image and adjust the image quality.

Displaying the Image

Display the image captured by the camera.
When you push [Play] button, the camera image appears in right area.



Adjusting the Gain

Adjust the image quality using the gain and white balance* functions.
*) Color model only

To adjust the image quality

The Visibility must be changed from [Beginner] to [Guru].

Adjust the sensitivity via the analog gain (i.e., master gain).
For details on gain control, see “Gain Control” in the “Main Functions” section.

■ **Manual adjustment**

1 **Expand [AnalogControl], and set [GainAuto] to [Off].**

([Off] is default setting.)

2 **Configure the gain.**

❶ Expand [AnalogControl], and select the gain you want to configure in [GainSelector]. [AnalogAll] (master gain), [DigitalRed]* (digital R gain), and [DigitalBlue]* (digital B gain) can be configured.

❷ Configure the gain value in [Gain].
- [AnalogAll] (master gain) can be set to a value from x1 to x126 the analog gain value. The resolution is set in 0.1 dB 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 the [AnalogAll] (master gain) value.

Adjusting the White Balance*

Adjust the white balance using the automatic adjustment function.
*) Color model only

■ **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 spot lights from entering the screen.

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

The white balance is automatically adjusted.

Adjusting the Black Level

1 **Expand [AnalogControl], and select the black level you want to configure in [BlackLevelSelector].**

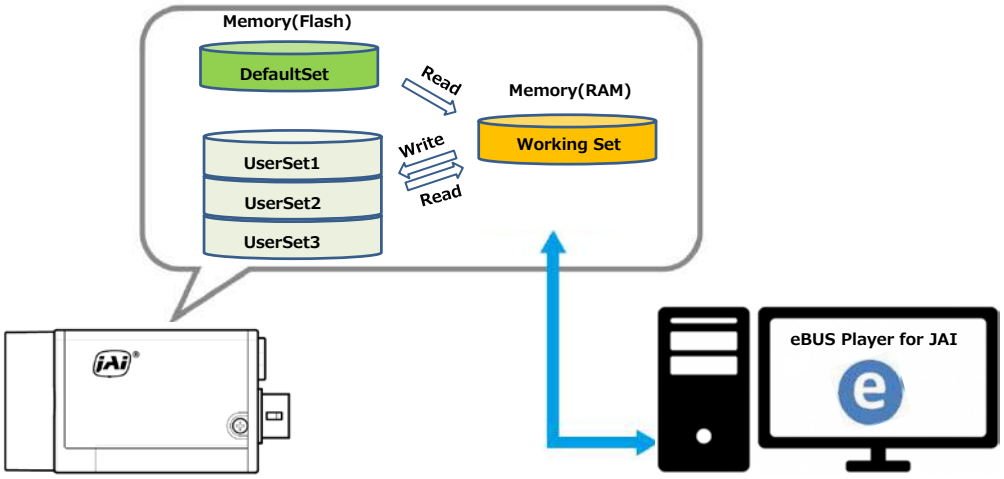
[DigitalAll] (master black), [DigitalRed]* (digital R), and [DigitalBlue]* (digital B) can be configured.

2 **Specify the adjustment value in [BlackLevel].**

*) Color model only

Step 7: Saving the Settings

The setting values configured in the player (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)



Note

Changes to settings are not saved to the computer (eBUS SDK for JAI).

■ **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 [Execute 'UserSetSave' Command].**

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 [Execute 'UserSetLoad' Command].**

The selected user settings are loaded.

Main Functions

Acquisition Control

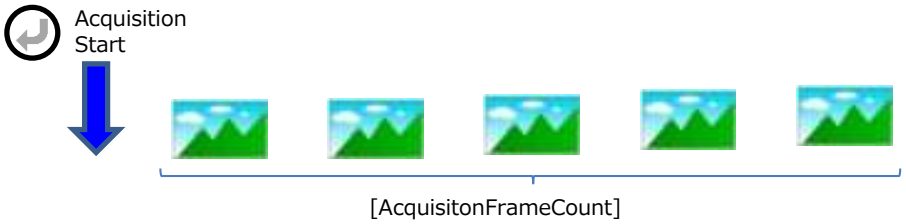
This camera has three Acquisition modes (SingleFrame, MultFrame, Continuous).
Use [AcquisitionControl] settings to perform operations and settings for image capture.

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].

Note

- 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

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

ExposureMode = Off

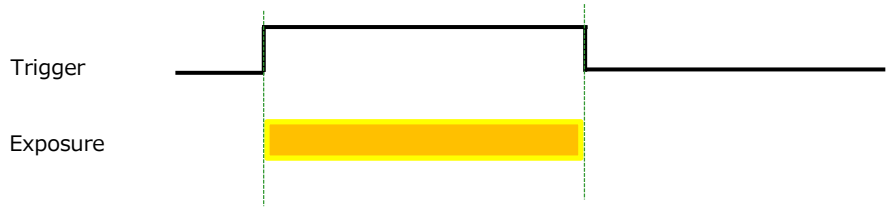
Exposure control is not performed (free-running operation).
The exposure time is the longest possible time within the operating conditions such as the frame rate.

ExposureMode = Timed

Mode in which control is performed using exposure time. 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 Brightness 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.



- The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in “Trigger Control”.

Actual Exposure Times

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-USB)
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.

Model name	Image sensor's offset
GOX-2402M-USB	13.73µs
GOX-2402C-USB	
GOX-3200M-USB	
GOX-3200C-USB	
GOX-3201M-USB	
GOX-3201C-USB	
GOX-5102M-USB	
GOX-5102C-USB	
GOX-5103M-USB	
GOX-5103C-USB	
GOX-8901M-USB	14.26µs
GOX-8901C-USB	
GOX-12401M-USB	
GOX-12401C-USB	

The offset time varies depending on the model as shown in the table on the left.

RCT mode

RCT mode can be used when [Exposure Mode] is Timed and [Frame Start Trigger] is enabled. In RCT mode, the image is not output from the camera until FrameStartTrigger is input, but internally the imaging operation is continued and the automatic gain control (AGC) function and the automatic shutter control (ASC) function can be continued.

Trigger Control

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 exposure in response to the external trigger signal input. Select this to perform exposure control using external triggers.
AcquisitionTransferStart	Start output of acquired image data in response to external trigger signal input (delayed readout).

・The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in “ExposureMode” .

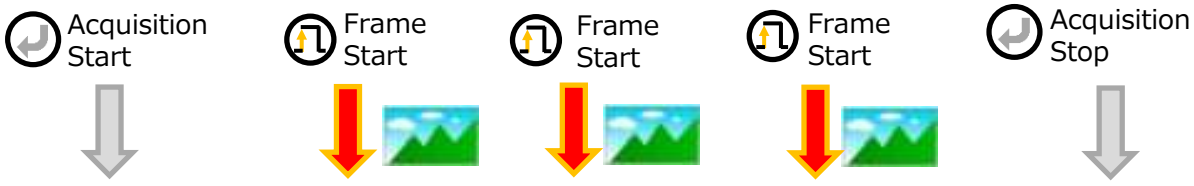
・ You can delay when exposure actually starts after a trigger is received by a specific amount of time by configuring [TriggerDelay].

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, UserOutput1, UserOutput2, UserOutput3, Software*, Line5, Nand0Out, Nand1Out
* 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 FrameStart trigger

If [AcquisitionStart] is executed and the [AcquisitionStop] command is not executed, if a FrameStart trigger is received, one frame is acquired.



The source signals that can be set for the trigger are as follows.

	Off	AcquisitionActive	FrameActive	ExposureActive	FVAL	LVAL	Software	PulseGenerator0	UserOutput0	UserOutput1	UserOutput2	UserOutput3	Line5 Opt In	Nand0Out	Nand1Out	Low	High	AcquisitionTriggerWait	FrameTriggerWait
AcquisitionStart							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
AcquisitionEnd							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
FrameStart							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
AcquisitionTransferStart							✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

Pixel Format

Selectable PixelFormat is as follows.
Color model : BayerRG8, BayerRG10, BayerRG10p, BayerRG12, BayerRG12p
Monochrome model : Mono8, Mono10, Mono10p, Mono12, Mono12p

Note

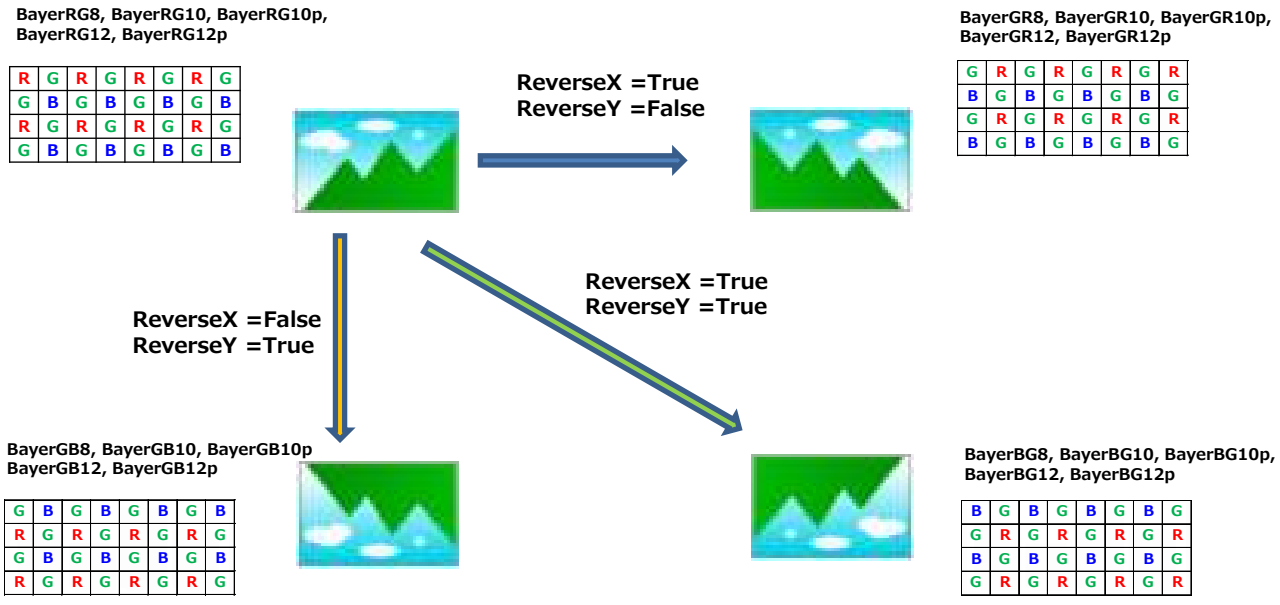
In color model, the Bayer array is changed by the image flip function.
ReverseX : 0 (False) ReverseY : 0 (False) -> BayerRG
ReverseX : 0 (False) ReverseY : 1 (True) -> BayerGB
ReverseX : 1 (True) ReverseY : 0 (False) -> BayerGR
ReverseX : 1 (True) ReverseY : 1 (True) -> BayerBG

Image flip function

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

In [ImageFormatControl] settings,
To reverse the image horizontally, set [ReverseX] to True.
To reverse the image vertically, set [ReverseY] to True.

In color model, the Bayer array is changed by the image flip function.



GPIO (Digital Input/Output Settings)

The unit 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)
External input	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.

Use the [Digital I/O Control] 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].

LineSelector	**LineMode**	**LineFormat**	**LineInverter**	**LineStatusAll**	
Line2	Output	OptoCoupled	True/False	bit1	DC IN / TRIG IN connector (6-pin round)
Line5	Input	OptoCoupled	False (fixed)	bit4	DC IN / TRIG IN connector (6-pin round)
Nand0In1	Input	InternalSignal	True/False		
Nand0In2	Input	InternalSignal	True/False		
Nand1In1	Input	InternalSignal	True/False		
Nand1In2	Input	InternalSignal	True/False		
TimestampReset	Internal Connection	InternalSignal	False (fixed)		

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	Line5 Opt In	Nand0Out	Nand1Out	Low	High	AcquisitionTriggerWait	FrameTriggerWait
Line2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Line5																		
Nand0In1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Nand0In2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
Nand1In1		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Nand1In2		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
TimestampReset	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

VideoProcessBypassMode

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.
12-bit outputs can only be performed in bypass mode.

■ Functions available in VideoProcessBypassMode

The following functions can be used in video process bypass mode.
Gain[AnalogGain], BlemishCompensation

Calculate the maximum frame rate (approximate)

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 USB bandwidth.

■ **The maximum frame rate (USB bandwidth)**

Interface_FR[Hz] = 3000000000 ÷ (Width* x Height* x PixelSize*)

*) When using the Binning function, specify the number of pixels and number of lines after Binning for the Width and Height values.

*) Please refer to table below for PixelSize.

Pixelformat	PixelSize
Mono8	8
Bayer8	
Mono10p	10
Bayer10p	
Mono12p	12
Bayer12p	
Mono10	16
Mono12	
Bayer10	
Bayer12	

■ **The maximum frame rate (Sensor's scanning rate)**

Sensor_FR[Hz] = 1000000 ÷ (H_Period x (VerticalLineNumber* + InvalidLine))

H_Period = HMAX ÷ 74.25

*) Please refer to table below for VerticalLineNumber.

Model name	Binning		
	H=2, V=1	H=1, V=2	H=2, V=2
GOX-2402M-USB	Height value before Binning.		Height value after Binning.
GOX-3200M-USB	Height value before Binning.	Height value after Binning.	
GOX-3201M-USB	Height value before Binning.		
GOX-5102M-USB	Height value before Binning.	Height value after Binning.	
GOX-5103M-USB	Height value before Binning.		
GOX-8901M-USB			
GOX-12401M-USB			

*) Please refer to table below for HMAX and InvalidLine.

Model name	Mono8/Bayer8		Mono10/12/10p/12p Bayer10/12/10p/12p	
	HMAX	InvalidLine	HMAX	InvalidLine
GOX-2402MC-USB	355	38	441	34
GOX-3200MC-USB	380	40	444	40
GOX-3201MC-USB	846	34	846	34
GOX-5102MC-USB	440	40	519	40
GOX-5103MC-USB	996	34	996	34
GOX-8901MC-USB	1041	36	1041	36
GOX-12401MC-USB	1041	36	1041	36

*) In GOX-2402M-USB, When the pixel format is Mono8 or Bayer8, HMAX = 290 and InvalidLine = 40.

■ **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])**

First, calculate the maximum OverlapTime value for the shortest trigger cycle.

MaxOverlapTime_TrOlrd[us] = (1000000/FR_Cont) - (Non-ExposurePeriod[H] x H_period)

*) Please refer to table below for Non-ExposurePeriod[H] .

Model name	Non-ExposurePeriod[H]
GOX-2402MC-USB	14
GOX-3200MC-USB	16
GOX-3201MC-USB	14
GOX-5102MC-USB	16
GOX-5103MC-USB	14
GOX-8901MC-USB	14
GOX-12401MC-USB	14

*) In GOX-2402M-USB, When using Binning(2x2) and PixelFormat is Mono8 or Bayer8, Non-ExposurePeriod[H] = 16.

・When ExposureTime ≦ MaxOverlapTime_TrOlrd

FR_TrOlrd[Hz] = FR_Cont (Same as during Continuous operation)

・When ExposureTime > MaxOverlapTime_TrOlrd

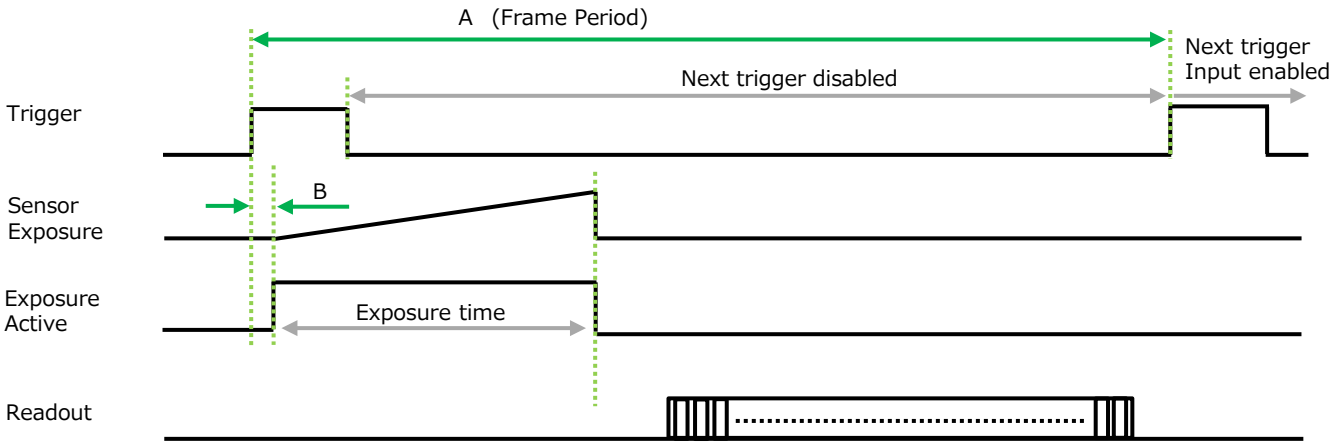
Non-OverlapExposureTime_TrOlrd = ExposureTime - MaxOverlapTime_TrOlrd

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

Timing chart

■ When [ExposureMode] is [Timed]

• FrameStartTrigger On



GOX-2402MC-USB

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	6146	15.4
Mono10/Mono12	12300	18.8
Mono10p	7686	18.9
Mono12p	9225	18.9
Bayer8	6146	15.4
Bayer10/Bayer12	12300	18.8
Bayer10p	7686	18.9
Bayer12p	9225	18.9
Horizontal Binning On		
Mono8	5924	15.4
Mono10	7348	18.9
Mono10p	7348	18.9
Vertical Binning On		
Mono8	5924	15.4
Mono10	7348	18.9
Mono10p	7348	18.9
Horizontal Binning On & Vertical Binning On		
Mono8	2504	12.8
Mono10	3782	18.9
Mono10p	3782	18.9

GOX-3200MC-USB

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	8396	16.4
Mono10/Mono12	16807	19
Mono10p	10493	19
Mono12p	12595	19
Bayer8	8396	16.4
Bayer10/Bayer12	16807	19
Bayer10p	10493	19
Bayer12p	12595	19
Horizontal Binning On		
Mono8	8071	16.4
Mono10	9434	19
Mono10p	9434	19
Vertical Binning On		
Mono8	4200	16.4
Mono10/Mono12	8396	19
Mono10p	5247	19
Mono12p	6293	19
Horizontal Binning On & Vertical Binning On		
Mono8	4137	16.4
Mono10	4836	19
Mono10p	4833	19

GOX-3201MC-USB

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	17921	35.3
Mono10/Mono12	17921	35.3
Mono10p	17921	35.3
Mono12p	17921	35.3
Bayer8	17921	35.3
Bayer10/Bayer12	17921	35.3
Bayer10p	17921	35.3
Bayer12p	17921	35.3
Horizontal Binning On		
Mono8	17921	35.3
Mono10	17921	35.3
Mono10p	17921	35.3
Vertical Binning On		
Mono8	17921	35.3
Mono10	17921	35.3
Mono10p	17921	35.3
Horizontal Binning On & Vertical Binning On		
Mono8	17921	35.3
Mono10	17921	35.3
Mono10p	17921	35.3

GOX-5102MC-USB

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	13387	18.8
Mono10/Mono12	26810	22
Mono10p	16723	22
Mono12p	20081	22
Bayer8	13387	18.8
Bayer10/Bayer12	26810	22
Bayer10p	16723	22
Bayer12p	20081	22
Horizontal Binning On		
Mono8	12376	18.8
Mono10	14599	22
Mono10p	14599	22
Vertical Binning On		
Mono8	6689	18.8
Mono10/Mono12	13387	22
Mono10p	8368	22
Mono12p	10040	22
Horizontal Binning On & Vertical Binning On		
Mono8	6309	18.9
Mono10	7441	22
Mono10p	7441	22

GOX-5103MC-USB

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	27933	41.3
Mono10/Mono12	27933	41.3
Mono10p	27933	41.3
Mono12p	27933	41.3
Bayer8	27933	41.3
Bayer10/Bayer12	27933	41.3
Bayer10p	27933	41.3
Bayer12p	27933	41.3
Horizontal Binning On		
Mono8	27933	41.3
Mono10	27933	41.3
Mono10p	27933	41.3
Vertical Binning On		
Mono8	27933	41.3
Mono10	27933	41.3
Mono10p	27933	41.3
Horizontal Binning On & Vertical Binning On		
Mono8	27933	41.3
Mono10	27933	41.3
Mono10p	27933	41.3

GOX-8901MC-USB

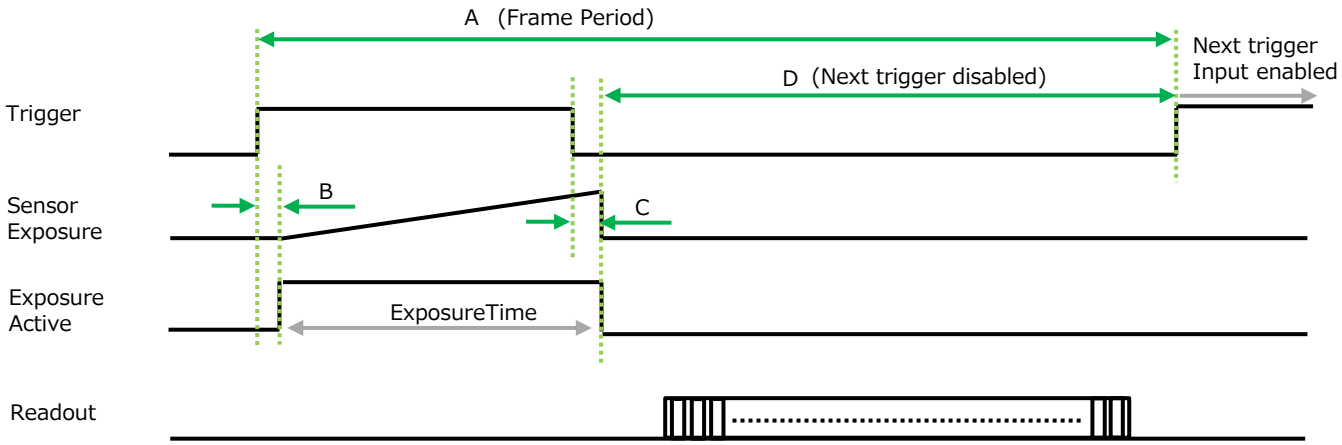
PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	30864	43.1
Mono10/Mono12	47394	43.1
Mono10p	30864	43.1
Mono12p	35461	43.1
Bayer8	30864	43.1
Bayer10/Bayer12	47394	43.1
Bayer10p	30864	43.1
Bayer12p	35461	43.1
Horizontal Binning On		
Mono8	30865	43.1
Mono10	30864	43.1
Mono10p	30864	43.1
Vertical Binning On		
Mono8	30864	43.1
Mono10	30865	43.1
Mono10p	30865	43.1
Horizontal Binning On & Vertical Binning On		
Mono8	30865	43.1
Mono10	30864	43.1
Mono10p	30864	43.1

GOX-12401MC-USB

PixelFormat	Frame Period [A] (usec)	Period From Trigger start edge to Exposure start [B] (usec)
Binning Off		
Mono8	42735	43.1
Mono10/Mono12	65790	43
Mono10p	42735	43.1
Mono12p	49261	43.1
Bayer8	42735	43.1
Bayer10/Bayer12	65790	43
Bayer10p	42735	43.1
Bayer12p	49261	43.1
Horizontal Binning On		
Mono8	42735	43.1
Mono10	42735	43.1
Mono10p	42735	43.1
Vertical Binning On		
Mono8	42735	43.1
Mono10	42735	43.1
Mono10p	42735	43.1
Horizontal Binning On & Vertical Binning On		
Mono8	42735	43.1
Mono10	42735	43.1
Mono10p	42735	43.1

■ When [ExposureMode] is [TriggerWidth]

• FrameStartTrigger On



GOX-2402MC-USB

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	5907	15.4	15.4	54.9
Mono10/Mono12	7326	18.8	18.8	67.6
Mono10p	7326	18.8	18.8	67.6
Mono12p	7326	18.8	18.8	67.6
Bayer8	5907	15.4	15.4	54.9
Bayer10/Bayer12	7326	18.8	18.8	67.6
Bayer10p	7326	18.8	18.8	67.6
Bayer12p	7326	18.8	18.8	67.6
Horizontal Binning On				
Mono8	5907	15.4	15.4	54.9
Mono10	7326	18.8	18.8	67.6
Mono10p	7326	18.8	18.8	67.6
Vertical Binning On				
Mono8	5907	15.4	15.4	54.9
Mono10	7326	18.8	18.8	67.6
Mono10p	7326	18.8	18.8	67.6
Horizontal Binning On & Vertical Binning On				
Mono8	2479	12.7	12.7	52.6
Mono10	3759	18.8	18.8	67.6
Mono10p	3759	18.8	18.8	67.6

GOX-3200MC-USB

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	8052	16.4	16.4	69
Mono10/Mono12	9407	18.9	18.9	81
Mono10p	9407	18.9	18.9	81
Mono12p	9407	18.9	18.9	81
Bayer8	8052	16.4	16.4	69
Bayer10/Bayer12	9407	18.9	18.9	81
Bayer10p	9407	18.9	18.9	81
Bayer12p	9407	18.9	18.9	81
Horizontal Binning On				
Mono8	8052	16.4	16.4	69
Mono10	9407	18.9	18.9	81
Mono10p	9407	18.9	18.9	81
Vertical Binning On				
Mono8	4119	16.4	16.4	69
Mono10/Mono12	4812	19	19	81
Mono10p	4812	19	19	81
Mono12p	4812	19	19	81
Horizontal Binning On & Vertical Binning On				
Mono8	4119	16.4	16.4	69
Mono10	4812	19	19	81
Mono10p	4812	19	19	81

GOX-3201MC-USB

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	17857	35.2	35.2	35.3
Mono10p	17857	35.2	35.2	35.3
Mono12p	17857	35.2	35.2	35.3
Bayer8	17857	35.2	35.2	35.3
Bayer10/Bayer12	17857	35.2	35.2	35.3
Bayer10p	17857	35.2	35.2	35.3
Bayer12p	17857	35.2	35.2	35.3
Horizontal Binning On				
Mono8	17857	35.2	35.2	35.3
Mono10	17857	35.2	35.2	35.3
Mono10p	17857	35.2	35.2	35.3
Vertical Binning On				
Mono8	17857	35.2	35.2	35.3
Mono10	17857	35.2	35.2	35.3
Mono10p	17857	35.2	35.2	35.3
Horizontal Binning On & Vertical Binning On				
Mono8	17857	35.2	35.2	35.3
Mono10	17857	35.2	35.2	35.3
Mono10p	17857	35.2	35.2	35.3

GOX-5102MC-USB

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	12361	18.8	18.8	127.7
Mono10/Mono12	14577	22	22	127.7
Mono10p	14577	22	22	127.7
Mono12p	14577	22	22	127.7
Bayer8	12361	18.8	18.8	127.7
Bayer10/Bayer12	14577	22	22	127.7
Bayer10p	14577	22	22	127.7
Bayer12p	14577	22	22	127.7
Horizontal Binning On				
Mono8	12361	18.8	18.8	127.7
Mono10	14577	22	22	127.7
Mono10p	14577	22	22	127.7
Vertical Binning On				
Mono8	6289	18.8	18.8	127.7
Mono10/Mono12	7413	22	22	127.7
Mono10p	7413	22	22	127.7
Mono12p	7413	22	22	127.7
Horizontal Binning On & Vertical Binning On				
Mono8	6289	18.8	18.8	127.7
Mono10	7413	22	22	127.7
Mono10p	7413	22	22	127.7

GOX-5103MC-USB

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	41.1	41.1	149.8
Mono10/Mono12	27855	41.1	41.1	149.8
Mono10p	27855	41.1	41.1	149.8
Mono12p	27855	41.1	41.1	149.8
Bayer8	27855	41.1	41.1	149.8
Bayer10/Bayer12	27855	41.1	41.1	149.8
Bayer10p	27855	41.1	41.1	149.8
Bayer12p	27855	41.1	41.1	149.8
Horizontal Binning On				
Mono8	27855	41.2	41.2	149.8
Mono10	27855	41.2	41.2	149.8
Mono10p	27855	41.2	41.2	149.8
Vertical Binning On				
Mono8	27855	41.2	41.2	149.8
Mono10	27855	41.2	41.2	149.8
Mono10p	27855	41.2	41.2	149.8
Horizontal Binning On & Vertical Binning On				
Mono8	27855	41.1	41.1	149.8
Mono10	27855	41.1	41.1	149.8
Mono10p	27855	41.1	41.1	149.8

GOX-8901MC-USB

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	30770	43	43	157.1
Mono10/Mono12	30770	43	43	157.1
Mono10p	30770	43	43	157.1
Mono12p	30770	43	43	157.1
Bayer8	30770	43	43	157.1
Bayer10/Bayer12	30770	43	43	157.1
Bayer10p	30770	43	43	157.1
Bayer12p	30770	43	43	157.1
Horizontal Binning On				
Mono8	30769	43	43	157.1
Mono10	30769	43	43	157.1
Mono10p	30769	43	43	157.1
Vertical Binning On				
Mono8	30770	43	43	157.1
Mono10	30770	43	43	157.1
Mono10p	30770	43	43	157.1
Horizontal Binning On & Vertical Binning On				
Mono8	30770	43	43	157.1
Mono10	30770	43	43	157.1
Mono10p	30770	43	43	157.1

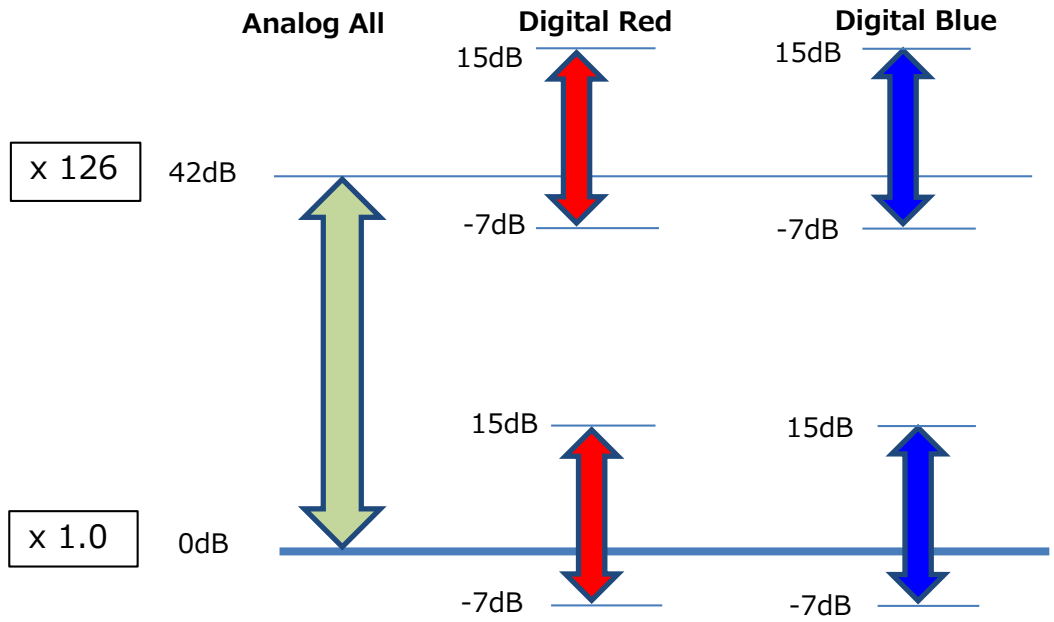
GOX-12401MC-USB

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	42554	43	43	156.6
Mono10/Mono12	42554	43	43	156.6
Mono10p	42554	43	43	156.6
Mono12p	42554	43	43	156.6
Bayer8	42554	43	43	156.6
Bayer10/Bayer12	42554	43	43	156.6
Bayer10p	42554	43	43	156.6
Bayer12p	42554	43	43	156.6
Horizontal Binning On				
Mono8	42554	43	43	156.6
Mono10	42554	43	43	156.6
Mono10p	42554	43	43	156.6
Vertical Binning On				
Mono8	42554	43	43	156.6
Mono10	42554	43	43	156.6
Mono10p	42554	43	43	156.6
Horizontal Binning On & Vertical Binning On				
Mono8	42554	43	43	156.6
Mono10	42554	43	43	156.6
Mono10p	42554	43	43	156.6

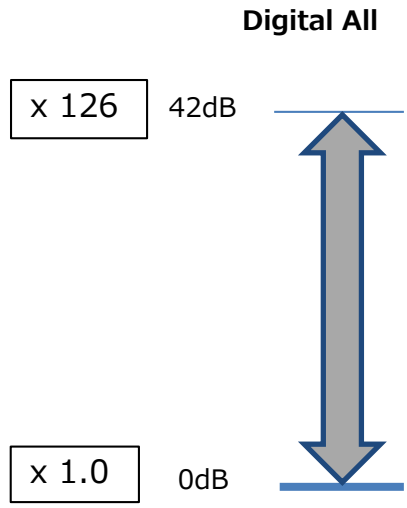
Gain Control

Adjust the [AnalogAll] (master gain) setting first, and then adjust the [DigitalRed], [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], automatic adjustment will be performed continuously.
When [GainAuto] is set to [Once], automatic adjustment will be performed only once.

White Balance

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.

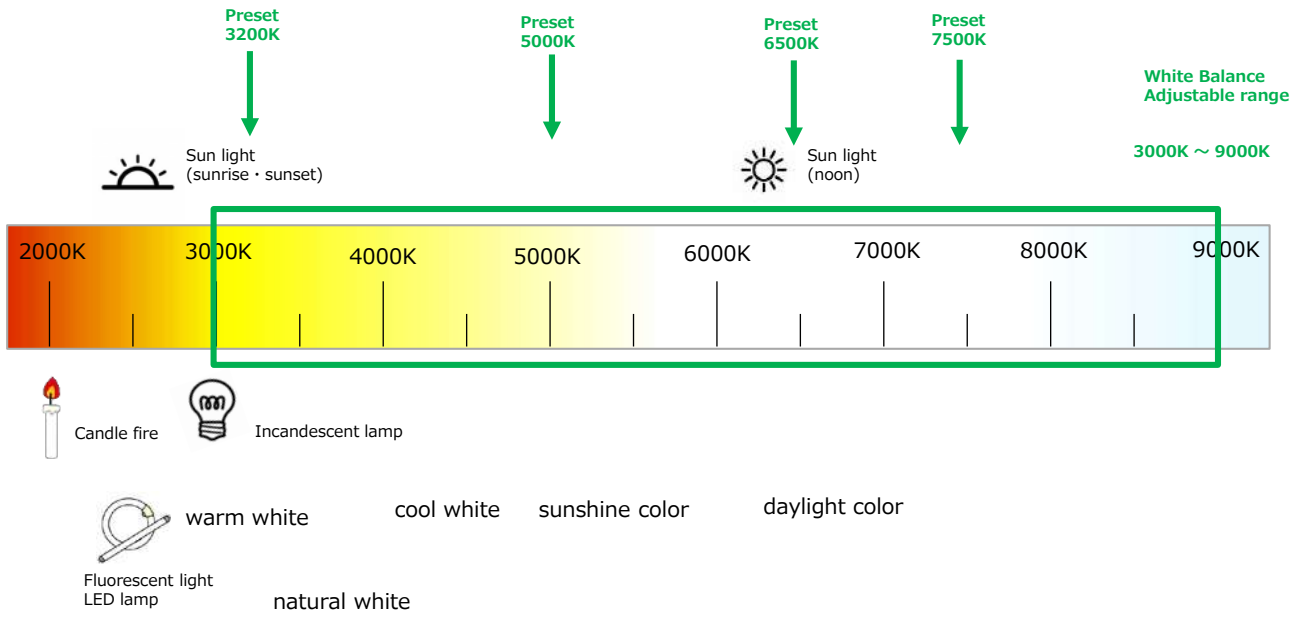
■ 16 areas

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

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

Color temperature

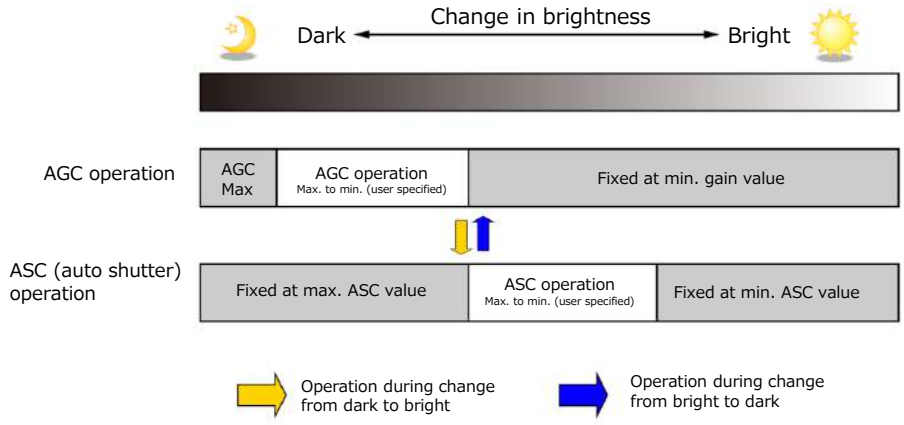
The adjustable range of white balance for this camera is 3000K to 9000K.
Please refer to the figure below for an overview of the relationship between various lighting types and color temperature.



ALC (Automatic Level Control) Function

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 under [JAICustomControlALC]. 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]

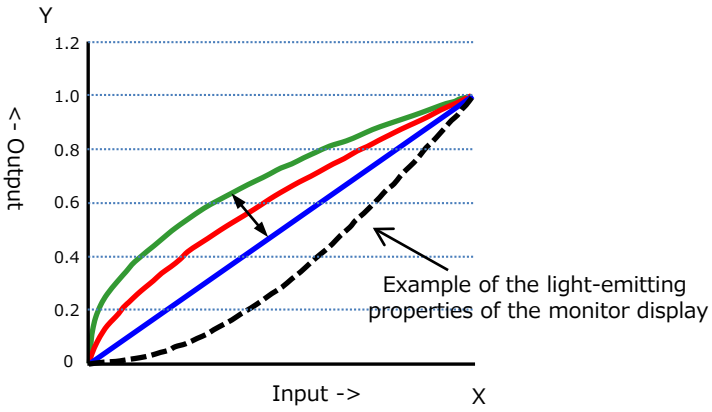
The speed of ALC control can be set from 1 to 100(fastest) in [ALC Control Ratio].

* 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

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 “Lookup Table (LUT)”.

LUT (Lookup Table)

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

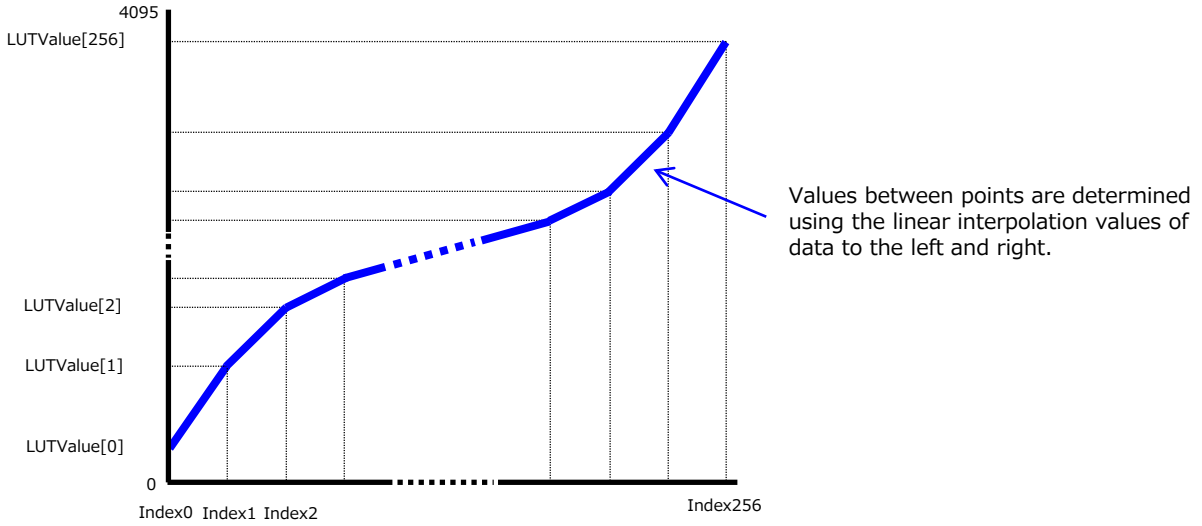
Configure the settings as follows.

Item	Setting value / selectable range	Description
LUTMode	LUT	Use LUT.
LUTSelector*	Red, Green, Blue	Select the LUT channel to control.
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.

*) Color model only

■ 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

Multiple defective pixels that are not adjacent to each other can occur on conventional 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.**

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.

■ 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.**

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.

Note

BlemishCompensationDataClear[BlemishCompensationIndex], you can return a specific pixel correction setting to the default value (storage not required).

3 **Execute [BlemishStore].**

Blemish compensation data will be stored.

4 **Set [BlemishEnable] to [True], and execute interpolation.**

If it is set to [False] , Blemish compensation is not effective.

Shading Correction

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. In such cases, the correction area is included in the image area configured by the ROI.

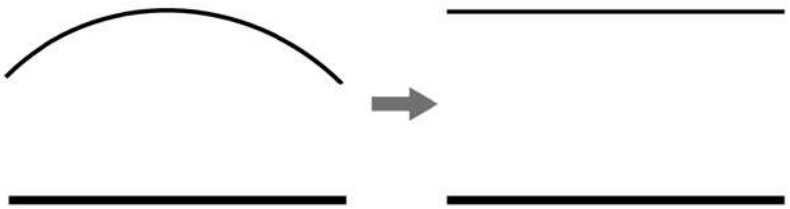
Block size is 256 x 256 pixels.

When using ROI, the number of blocks and the number of pixels that comprise each block differ from a full image.

The following shading correction modes are available on the camera.

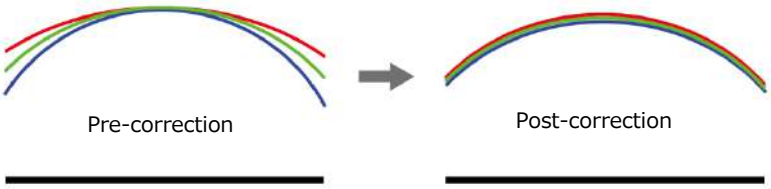
■ **FlatShading (Monochrome model, Color model)**

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 model only)**

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



Caution

- 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].

Note

After shading correction is executed, the shading correction value is automatically saved to the user area selected in [ShadingMode].

Binning Function

Monochrome model only

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 lower pixel resolution and higher sensitivity.

Model name	Horizontal binning	Vertical Binning
GOX-2402M-USB*	digital addition or averaging processing	digital addition or averaging processing
GOX-3200M-USB	digital addition or averaging processing	digital addition in image sensor
GOX-3201M-USB	digital addition or averaging processing	digital addition or averaging processing
GOX-5102M-USB	digital addition or averaging processing	digital addition in image sensor
GOX-5103M-USB	digital addition or averaging processing	digital addition or averaging processing
GOX-8901M-USB	digital addition or averaging processing	digital addition or averaging processing
GOX-12401M-USB	digital addition or averaging processing	digital addition or averaging processing

* In GOX-2402M-USB, 2x2 binning is processed in the image sensor.

Note

・If Binning function is active, [BlemishDetect] does not work.

Decimation mode

Decimation mode performs 2X downsampling of the image horizontally, vertically, or both. This reduces the file size for processing or storage while maintaining the full field of view of the image.
Please set [DecimationHorizontal], [DecimationVertical] in [PixelFormatControl].

Note

・Decimation mode can not be used with Binning or ROI.
・If Decimation mode is active, [BlemishDetect] does not work.

ROI Function (Single ROI)

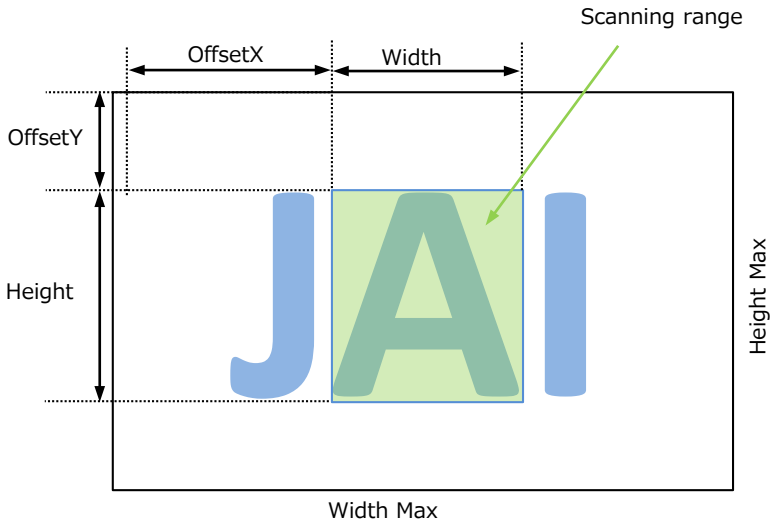
The ROI (region of interest) function allows you to output images by specifying the areas to scan. Specify the area to scan by specifying width, height, and horizontal/vertical offset values under [ImageFormatControl].

For details on how to configure the settings, see “Configuring the Output Format”.
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.

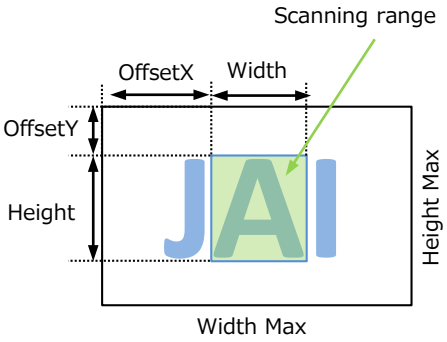
Width (pixels)	Height (lines)
H Binning Off : 96 to (*A) step 16	V Binning Off : 8 to (*C) step 2
H Binning On : 48 to (*B) step 8	V Binning On : 4 to (*D) step 1
(*A): GOX-2402MC-USB 1920	(*C): GOX-2402MC-USB 1200
GOX-3200MC-USB 2048	GOX-3200MC-USB 1536
GOX-3201MC-USB 2048	GOX-3201MC-USB 1536
GOX-5102MC-USB 2448	GOX-5102MC-USB 2048
GOX-5103MC-USB 2448	GOX-5103MC-USB 2048
GOX-8901MC-USB 4096	GOX-8901MC-USB 2160
GOX-12401MC-USB 4096	GOX-12401MC-USB 3000
(*B): GOX-2402M-USB 960	(*D): GOX-2402M-USB 600
GOX-3200M-USB 1024	GOX-3200M-USB 768
GOX-3201M-USB 1024	GOX-3201M-USB 768
GOX-5102M-USB 1224	GOX-5102M-USB 1024
GOX-5103M-USB 1224	GOX-5103M-USB 1024
GOX-8901M-USB 2048	GOX-8901M-USB 1080
GOX-12401M-USB 2048	GOX-12401M-USB 1500

Offset X (pixels)	Offset Y (lines)
H Binning Off : 0 to (*E) step 16	V Binning Off : 0 to (*G) step 2
H Binning On : 0 to (*F) step 8	V Binning On : 0 to (*H) step 1
(*E): GOX-2402MC-USB 1824	(*G): GOX-2402MC-USB 1192
GOX-3200MC-USB 1952	GOX-3200MC-USB 1524
GOX-3201MC-USB 1952	GOX-3201MC-USB 1524
GOX-5102MC-USB 2352	GOX-5102MC-USB 2040
GOX-5103MC-USB 2352	GOX-5103MC-USB 2040
GOX-8901MC-USB 4000	GOX-8901MC-USB 2152
GOX-12401MC-USB 4000	GOX-12401MC-USB 2992
(*F): GOX-2402M-USB 912	(*H): GOX-2402M-USB 596
GOX-3200M-USB 976	GOX-3200M-USB 762
GOX-3201M-USB 976	GOX-3201M-USB 762
GOX-5102M-USB 1176	GOX-5102M-USB 1020
GOX-5103M-USB 1176	GOX-5103M-USB 1020
GOX-8901M-USB 2000	GOX-8901M-USB 1076
GOX-12401M-USB 2000	GOX-12401M-USB 1496

■ **Without Binning**
[BinningHorizontal] : 1
[BinningVertical] : 1



■ **With Binning**
[BinningHorizontal] : 2
[BinningVertical] : 2



Note

・If ROI function is active, [BlemishDetect] does not work.

ROI Function (Multi ROI)

In the Multi ROI mode, you can specify up to 64 scanning areas for a single-frame image. The areas cannot overlap.

This function is supported in GOX-3200MC-USB, GOX-5102MC-USB only.

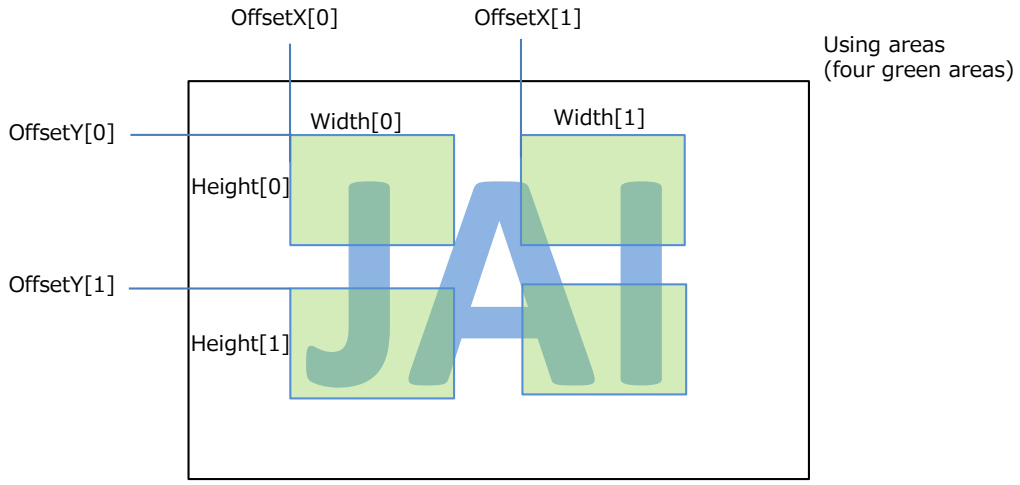
The Multi ROI mode can be used only when both the Sequencer mode and the Shading mode are off.

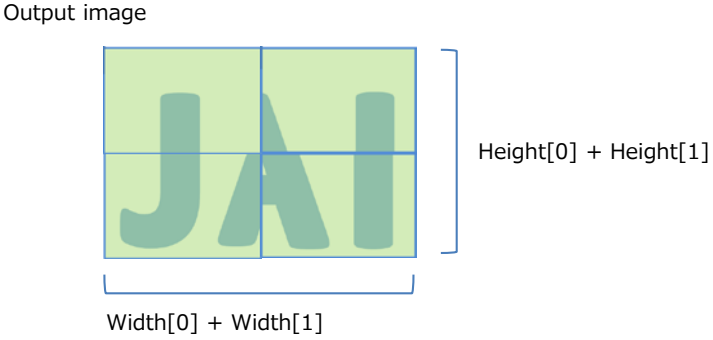
Set [MultiROIControl]->[MultiRoiMode] On. Select from the eight indexes in [MultiRoiIndex] then set [MultiRoiWidth], [MultiRoiHeight], [MultiRoiOffsetX] and [MultiRoiOffsetY].
And set the index number to be enabled to [MultiRoiVerticalEnable] and [MultiRoiHorizontalEnable].

■ Example

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

1. Set [MultiROIControl]->[MultiRoiMode] On.
2. Select “0” in [MultiRoiIndex].
   Set [MultiRoiWidth], [MultiRoiHeight], [MultiRoiOffsetX] and [MultiRoiOffsetY].
3. Select “1” in [MultiRoiIndex].
   Set [MultiRoiWidth], [MultiRoiHeight], [MultiRoiOffsetX] and [MultiRoiOffsetY].
4. Set True to [MultiRoiVerticalEnable[Index2]].
5. Set True to [MultiRoiHorizontalEnable[Index2]].



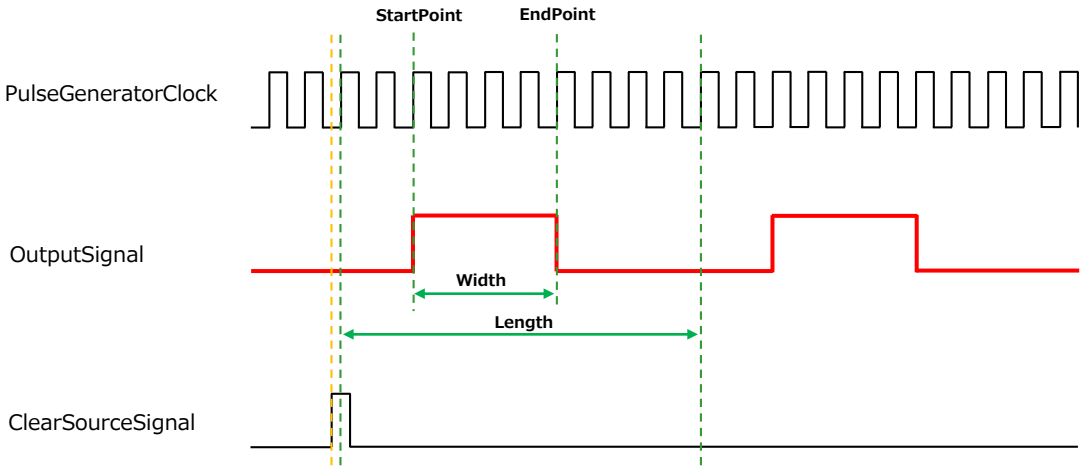


Pulse Generator

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 table below shows the PulseGeneratorClearSource signals that can be set.

LineSelector	Off	AcquisitionActive	FrameActive	ExposureActive	FVAL	LVAL	PulseGenerator0	UserOutput0	UserOutput1	UserOutput2	UserOutput3	Line5 Opt In	Nand0Out	Nand1Out	Low	High	AcquisitionTriggerWait	FrameTriggerWait
PulseGenerator0		✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Technical notes The Pulse Generator function – what it is and how to use it

Sequencer Function

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.

Caution

If the values of [ImageFormatControl] Width and Height are smaller than [SequencerControl] 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.

About indexes (imaging conditions)

Up to 32 indexes can be configured.The following settings can be configured for each index. However, SequencerFrameNumber and SequencerSetNext can only be configured in TriggerSequencer mode.

Trigger Sequencer mode

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

[SequencerSetActive]
This allows you to confirm the index number displayed on next trigger reception.

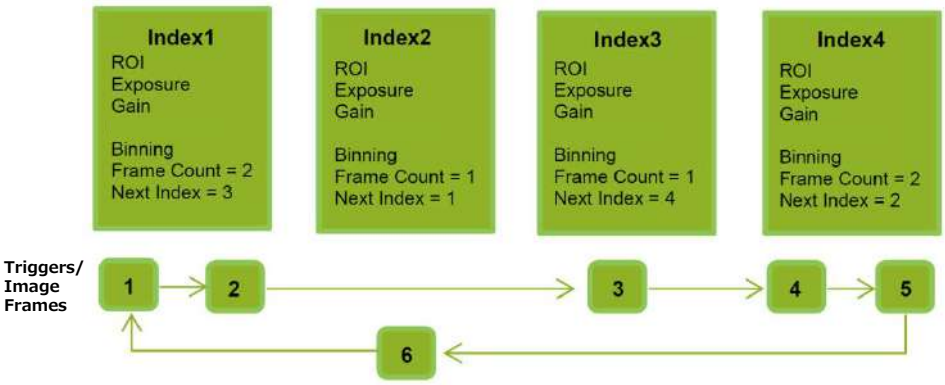
[SequencerSetStart]
This configures the index number to execute at the start of TriggerSequencer mode.

[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 **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 (number of triggers) specified in [SequencerFrameNumber].**

Proceed to sequence from index 4 to index 2 to index 1.

Note

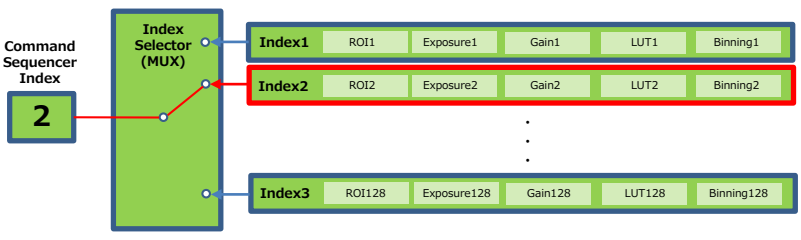
In addition to repeating multiple conditions as in the above example, you can specify "0" (which indicates the end of TriggerSequencer mode) in [SequencerSetNext] of index 2, and specify the number of repetitions in [SequencerRepetition].

Command Sequencer mode

As with TriggerSequencer mode, you can define up to 32 indexes beforehand in this mode. Set [SequencerCommandIndex] to point to one of your pre-configured 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.

Note

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



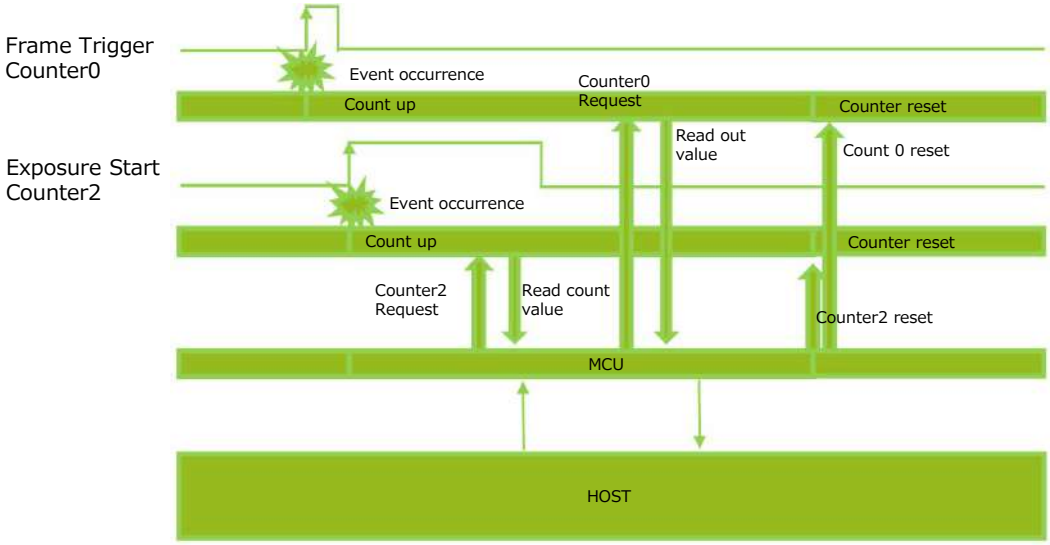
Counter And Timer Control Function

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.

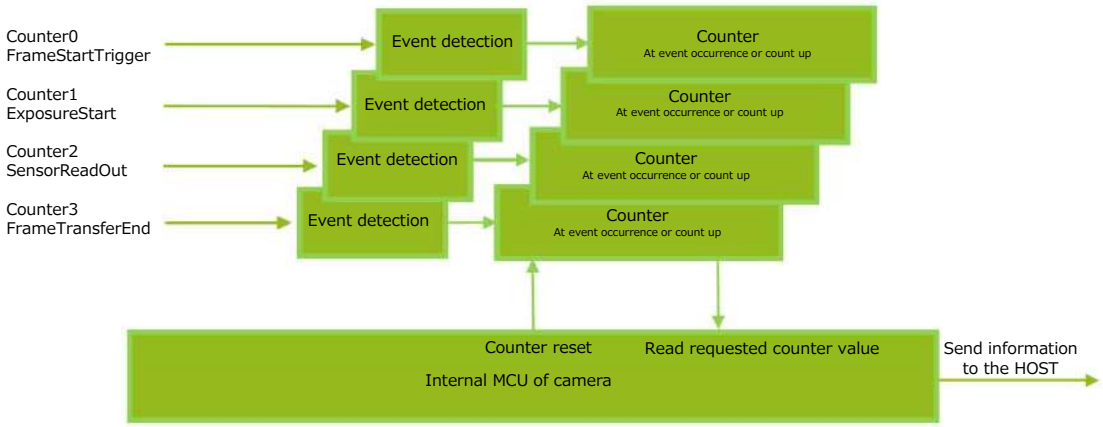
■ Counter occurrence diagram



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, FrameStartTrigger 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	Rising Edge, Falling Edge	Specify timing at which to count. Counter0 Rising Edge Counter1 Rising Edge Counter2 Rising Edge Counter3 Falling Edge

Chunk Data Function

The Chunk Data function adds camera configuration information to the image data that is output from the camera. Embedding camera configuration information in the image data allows you to use the serial number of the camera as a search key and find specific image data from among large volumes of image data. 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.

Non-Volatile Flash Memory

The camera has non-volatile memory for users to store data.
Refer to the technical note “Storing Data in On-Camera Flash Memory” for more information.

Note

JAI strongly recommends saving images to the PC or other storage location because the non-volatile flash memory may not have enough memory size to store large data.

Technical notes Storing Data in On-Camera Flash Memory

Setting List

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.

Each setting item is given permission to view and set. There are three types of authority: Beginner, Expert, and Guru.
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]
When the analog gain can be changed for each of the red, green, and blue channels in a color camera.
Analog gain is a function that has multiple instances, and red, green, and blue are the indexes.

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 gain given as an example of an instance, the description is as follows.
Gain[AnalogAll] = 1.0
Gain[DigitalRed] = 1.1
Gain[DigitalBlue] = 1.2

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

Feature Properties

Item	Setting range	Default value	Description
a) DeviceControl			Display/configure information related to the device.
DeviceVendorName	—	"JAI Corporation"	Display the manufacturer name.
DeviceModelName	—	—	Display the model name.
DeviceManufacturerInfo	—	See the possibilities	Display the manufacturer information.
DeviceVersion	—	—	Display the hardware 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.
DeviceTLType	4:USB3Vision		
DeviceTLVersionMajor	1		
DeviceTLVersionMinor	0		
DeviceTLVersionSubMinor	1		
DeviceGenCPVersionMajor	1		
DeviceGenCPVersionMinor	0		
DeviceCharacterSet	1:UTF8	1:UTF8	
DeviceReset			
DeviceRegistersEndianness	0:Little	0:Little	
DeviceTemperatureSelector	0:Mainboard	0:Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading. (Fixed Mainboard)
DeviceTemperature(C)	—	—	Display the internal temperature (°C) of the camera.
Timestamp (ns)	—	0~922337203685477580 7 (maximum value of signed 64-bit)	Display the timestamp value. 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 (ns)	0~9223372036854775807 (maximum value of signed 64-bit)	0	
DeviceReset	—	—	Reset the device. (After the camera receives this command, it returns an ACK response. Then, execute reset.)
UserDefinedValueSelector	0:Value1, 1:Value2 2:Value3, 3:Value4 4:Value5		
UserDefinedValue			
j) TransportLayerControl			Display information on transport layer control.
PayloadSize	48 ~ 67109240	12288	Display the payload size. (Include ChunkData) (unit: bytes)

Item	Setting range	Default value	Description
c) ImageFormatControl			Configure image format settings.
SensorWidth	—	—	Display the maximum image width. [Setting range] GOX-2402MC-USB : 1936 GOX-3200MC-USB : 2064 GOX-3201MC-USB : 2064 GOX-5102MC-USB : 2464 GOX-5103MC-USB : 2464 GOX-8901MC-USB : 4112 GOX-12401MC-USB : 4112
SensorHeight	—	—	Display the maximum image height. [Setting range] GOX-2402MC-USB : 1216 GOX-3200MC-USB : 1544 GOX-3201MC-USB : 1544 GOX-5102MC-USB : 2056 GOX-5103MC-USB : 2056 GOX-8901MC-USB : 2176 GOX-12401MC-USB : 3008
SensorDigitizationBits	10: 10 Bits, 12: 12 Bits	—	Display the number of bits at which the sensor is operating.
WidthMax	—	—	Display the maximum image width. (Monochrome model : This value will vary depending on the HorizontalBinning setting.) [Setting range] BinningHorizontal 1: GOX-2402MC-USB : 1920 GOX-3200MC-USB : 2048 GOX-3201MC-USB : 2048 GOX-5102MC-USB : 2448 GOX-5103MC-USB : 2448 GOX-8901MC-USB : 4096 GOX-12401MC-USB : 4096 BinningHorizontal 2: GOX-2402MC-USB : 960 GOX-3200M-USB : 1024 GOX-3201M-USB : 1024 GOX-5102M-USB : 1224 GOX-5103M-USB : 1224 GOX-8901MC-USB : 2048 GOX-12401MC-USB : 2048
HeightMax	—	—	Display the maximum image height. (Monochrome model : This value will vary depending on the VerticalBinning setting.) [Setting range] BinningVertical 1: GOX-2402MC-USB : 1200 GOX-3200MC-USB : 1536 GOX-3201MC-USB : 1536 GOX-5102MC-USB : 2048 GOX-5103MC-USB : 2048 GOX-8901MC-USB : 2160 GOX-12401MC-USB : 3000 BinningVertical 2: GOX-2402MC-USB : 600 GOX-3200MC-USB : 768 GOX-3201MC-USB : 768 GOX-5102MC-USB : 1024 GOX-5103MC-USB : 1024 GOX-8901MC-USB : 1080 GOX-12401MC-USB : 1500
Width	—	—	Set the image width. [Setting range] BinningHorizontal 1: GOX-2402MC-USB : 96～1920 step 16 GOX-3200MC-USB : 96～2048 step 16 GOX-3201MC-USB : 96～2048 step 16 GOX-5102MC-USB : 96～2448 step 16 GOX-5103MC-USB : 96～2448 step 16 GOX-8901MC-USB : 96～4096 step 16 GOX-12401MC-USB : 96～4096 step 16 BinningHorizontal 2: GOX-2402M-USB : 48～960 step 8 GOX-3200M-USB : 48～1024 step 8 GOX-3201M-USB : 48～1024 step 8 GOX-5102M-USB : 48～1224 step 8 GOX-5103M-USB : 48～1224 step 8 GOX-8901M-USB : 48～2048 step 8 GOX-12401M-USB : 48～2048 step 8
Height	—	—	Set the image height. [Setting range] BinningVertical 1: GOX-2402MC-USB : 8～1200 step 2 GOX-3200MC-USB : 8～1536 step 2 GOX-3201MC-USB : 8～1536 step 2 GOX-5102MC-USB : 8～2048 step 2 GOX-5103MC-USB : 8～2048 step 2 GOX-8901MC-USB : 8～2160 step 2 GOX-12401MC-USB : 8～3000 step 2 BinningVertical 2: GOX-24021M-USB : 4～600 step 1 GOX-3200M-USB : 4～768 step 1 GOX-3201M-USB : 4～768 step 1 GOX-5102M-USB : 4～1024 step 1 GOX-5103M-USB : 4～1024 step 1 GOX-8901M-USB : 4～1080 step 1 GOX-12401M-USB : 4～1500 step 1

OffsetX	—	0	Set the horizontal offset. [Setting range] BinningHorizontal 1: GOX-2402MC-USB : 0～1824 step 16 GOX-3200MC-USB : 0～1952 step 16 GOX-3201MC-USB : 0～1952 step 16 GOX-5102MC-USB : 0～2352 step 16 GOX-5103MC-USB : 0～2352 step 16 GOX-8901MC-USB : 0～4000 step 16 GOX-12401MC-USB : 0～4000 step 16 BinningHorizontal 2: GOX-2402M-USB : 0～912 step 8 GOX-3200M-USB : 0～976 step 8 GOX-3201M-USB : 0～976 step 8 GOX-5102M-USB : 0～1176 step 8 GOX-5103M-USB : 0～1176 step 8 GOX-8901M-USB : 0～2000 step 8 GOX-12401M-USB : 0～2000 step 8
OffsetY	—	0	Set the vertical offset. [Setting range] BinningVertical 1: GOX-2402MC-USB : 0～1192 step 2 GOX-3200MC-USB : 0～1524 step 2 GOX-3201MC-USB : 0～1524 step 2 GOX-5102MC-USB : 0～2040 step 2 GOX-5103MC-USB : 0～2040 step 2 GOX-8901MC-USB : 0～2152 step 2 GOX-12401MC-USB : 0～2992 step 2 BinningVertical 2: GOX-2402M-USB : 0～596 step 1 GOX-3201M-USB : 0～762 step 1 GOX-5103M-USB : 0～1020 step 1 GOX-8901M-USB : 0～1076 step 1 GOX-12401M-USB : 0～1496 step 1
BinningHorizontalMode	1:Average, 0:Sum	0:Sum	Set the addition process to be used during horizontal binning. (Monochrome model only) With GOX-2402M-USB, only 0:Sum can be set during 2x2 binning.
BinningHorizontal	1,2	1	Set the number of pixels in the horizontal direction for which to perform binning.(Monochrome model only)
BinningVerticalMode	1:Average, 0:Sum	1:Sum	Set the addition process to be used during vertical binning. (Monochrome model only) With GOX-2402M-USB, only 0:Sum can be set during 2x2 binning.
BinningVertical	1,2	1	Set the number of pixels in the vertical direction for which to perform binning. (Monochrome model only)
DecimationHorizontalMode	0:Discard (Fixed)	0:Discard	Set DecimationHorizontal mode.
DecimationHorizontal	1:none, 2:pixels are thinned out horizontally	2:pixels are thinned out horizontally	If set to 2, Pixels(50%) are thinned out horizontally. BinningHorizontal=2: this function is not available.
DecimationVerticalMode	0:Discard (Fixed)	0:Discard	Set DecimationVertical mode.
DecimationVertical	1:none, 2:pixels are thinned out Vertically	2:pixels are thinned out Vertically	If set to 2, Pixels(50%) are thinned out Vertically. BinningVertical=2: this function is not available.
ReverseX	True, False	False	Reverse pixels horizontally.
ReverseY	True, False	False	Reverse pixels vertically.
PixelFormat	—	monochrome model 0x01080001:Mono8 color model 0x01080009:BayerRG8	Set the pixel format. (Bayer models) 0x01080009:BayerRG8, 0x0110000D:BayerRG10, 0x010A0058:BayerRG10p 0x01100011:BayerRG12, 0x010C0059:BayerRG12p (Mono models) 0x01080001:Mono8, 0x01100003:Mono10, 0x010A0046:Mono10p 0x01100005:Mono12, 0x010C0047:Mono12p
TestPattern	0:Off 1:GreyHorizontalRamp 4:HorizontalColorBar (color model only)	Off	Select the test image.

Item	Setting range	Default value	Description
d) MultiRoiControl			Configure setings for sensor Multi ROI
MultiRoiMode	Off, On	Off	Enable/disable Multi Roi. (This function only works in GOX-3200MC-USB and GOX-5102MC-USB)
MultiRoiIndex	—	—	Select the index for the Multi Roi mode. [Setting range] 0:Index1, 1:Index2, 2:Index3, 3:Index4 4:Index5, 5:Index6, 6:Index7, 7:Index8
MultiRoiWidth	—	—	Set the width for the selected Multi Roi index. [Setting range] BinningHorizontal 1: GOX-3200MC-USB : 96～2048 step 16 GOX-5102MC-USB : 96～2448 step 16 BinningHorizontal 2: GOX-3200M-USB : 48～1024 step 8 GOX-5102M-USB : 48～1224 step 8
MultiRoiHeight	—	—	Set the height for the selected Multi Roi index. [Setting range] BinningVertical 1: GOX-3200MC-USB : 8～1536 step 2 GOX-5102MC-USB : 8～2048 step 2 BinningVertical 2: GOX-3200M-USB : 4～768 step 1 GOX-5102M-USB : 4～1024 step 1
MultiRoiOffsetX	—	—	Set the horizontal offset for the selected Multi Roi index. [Setting range] BinningHorizontal 1: GOX-3200MC-USB : 0～1952 step 16 GOX-5102MC-USB : 0～2352 step 16 BinningHorizontal 2: GOX-3200M-USB : 0～976 step 8 GOX-5102M-USB : 0～1176 step 8
MultiRoiOffsetY	—	—	Set the vertical offset for the selected Multi Roi index. [Setting range] BinningVertical 1: GOX-3200MC-USB : 0～1524 step 2 GOX-5102MC-USB : 0～2040 step 2 BinningVertical 2: GOX-3200M-USB : 0～762 step 1 GOX-5102M-USB : 0～1020 step 1
MultiRoiHorizonalEnable	True, False	—	Set the maximum number of valid horizontal index numbers.
MultiRoiVerticalEnable	True, False	—	Set the maximum number of valid vertical index numbers.

Item	Setting range	Default value	Description
e) AcquisitionControl			Configure image capture settings.
AcquisitionMode	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(Hz)	0.125～		Set the frame rate as a frequency. (unit: Hz) The maximum value varies depending on the PixelFormat and ROI settings.
TriggerSelector	0:AcquisitionStart 1:AcquisitionEnd 3:FrameStart 4:AcquisitionTransferStart	0:AcquisitionStart	Select the trigger operation.
TriggerMode	Off, On	Off	Select the trigger mode.
TriggerSoftware			Execute a software trigger.
TriggerSource	0: Low 1: High 2: Software 10: PulseGenerator0 14-17: UserOutput0-3 21: Line5 Opt In1 26: Nand0 Out 27: Nand1 Out	—	Select the trigger signal source.
TriggerActivation	1:Rising Edge, 2:Falling Edge, 3:Level High, 4:Level Low	1:RisingEdge	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. TriggerOverlap[AcquisitionStart] = Off (Fixed) TriggerOverlap[AcquisitionEnd] = Off (Fixed) TriggerOverlap[FrameStart] = ReadOut (Fixed) TriggerOverlap[AcquisitionTransferStart] = Off (Fixed)
TriggerDelay (us)	0～500000	0	Set the time of exposure start from trigger input. (unit: μs)
ExposureMode	0:Off 1:Timed 2:TriggerWidth	0:Off	Select the exposure mode.
ExposureTime (us)	1μs ～	—	Set the exposure time. The specifiable range varies depending on the [StartTriggerMode] and [PixelFormat] setting.
ExposureAuto	0:Off 1:Once 2:Continuous	Off	Set whether to enable auto exposure.
ExposureModeOption	0:Off 1:RCT	Off	Set whether to enable RCT mode.

Item	Setting range	Default value	Description
f) DigitalIOcontrol			Configure settings for digital input/output.
LineSelector	21:Line2 24:Line5 60:Nand0 In1 61:Nand0 In2 62:Nand1 In1 63:Nand1 In2 255:TimestampReset	21:Line2	Select the input/output to configure.
LineMode	0:Input, 1:Output, 2:InternalConnection	—	Display the LineMode status (whether it is input, output or internalConnection).
LineInverter	True, False	False	Enable/disable polarity inversion for the selected input signal or output signal.
LineStatus	True, False	—	Display the status of the input signal or output signal (True: High, False: Low).
LineSource	—	—	Select the line source signal for the item selected in [LineSelector]. 0:Off (LineSelector=TimestampReset only) 1:AcquisitionActive, 2:FrameActive, 4:ExposureActive, 5:FVAL, 43:AcquisitionTriggerWait 44:FrameTriggerWait , 7:PulseGenerator0, 11:UserOutput0, 12:UserOutput1, 13:UserOutput2, 14:UserOutput3, 24:Line5, 36:Nand0 Out, 37:Nand1 Out 41:Low, 42:High
LineFormat	5:OptoCoupled 7:Internal Signal	—	Display the signal format.
LineStatusAll	—	—	Display the input/output signal status. The state is shown with 16 bits. Bit assignments are as follows. [0] unused [1] Line2 [2], [3] unused [4] Line5 [5] , [6], [7], [8], [9], [10] unused [11] Time Stamp Reset [12] NAND Gate 0 In 1 [13] NAND Gate 0 In 2 [14] NAND Gate 1 In 1 [15] NAND Gate 1 In 2
OptInFilterSelector	—	Off	Remove noise from the OptIn input signal of Digital I/O. [Setting range] 0:Off, 1:10us, 2:100us, 3:500us 4:1ms, 5:3m, 6:5ms, 7:7ms, 8:10ms, 9:15ms, 10:20ms 11:25ms, 12:30ms, 13:35ms, 14:40ms
UserOutputSelector	0:UserOutput0, 1:UserOutput1 2:UserOutput2, 3:UserOutput3	0:UserOutput0	Set the UserOutput signal.
UserOutputValue	True, False	False	Set the value for the UserOutput selected in [UserOutputSelector].

Item	Setting range	Default value	Description
g) PulseGenerator			Configure pulse generator settings.
ClockPreScaler	1～4096	4	Set the division value for the prescaler (12 bit) using PixelClock as the base clock.
PulseGeneratorClock (MHz)	0.0181274～74.25	0.45	Set the clock used for the pulse generator. This value is calculated using the [ClockPreScaler] value as a base.
PulseGeneratorSelector	PulseGenerator0	PulseGenerator0	Select the pulse generator.
PulseGeneratorLength	1～1048575	618750	Set the maximum count-up value as a clock count.
PulseGeneratorLengthMs (ms)	1 / PulseGeneratorClock (MHz) ～1048575 / PulseGeneratorClock (MHz)	33.3333	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.
PulseGeneratorFrequency (Hz)	PulseGeneratorClock (MHz) ÷ 1048575 x 1000000 ～ PulseGeneratorClock (MHz) x 1000000	30	Set the maximum count-up value as a frequency. This value is calculated using the [PulseGeneratorLength] value as a base.
PulseGeneratorStartPoint	0 ～ 1048574	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 ～ 1048575 / PulseGeneratorClock (MHz)	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.
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)	1/ PulseGeneratorClock (MHz) ～ 1048575 / PulseGeneratorClock (MHz)	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.
PulseGeneratorPulseWidth (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.
PulseGeneratorRepeatCount	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.
PulseGeneratorClearActivation	0:Off 1:Rising Edge 2:Falling Edge 3:Level High 4:Level Low	Off	Set the clear signal condition for the count clear input of the pulse generator.
PulseGeneratorClearSource	—	Low	Select the count clear input signal source. [Setting range] 0:Low, 1:High, 3:AcquisitionTriggerWait, 4:AcquisitionActive 5:FrameTriggerWait, 6:FrameActive, 7:ExposureActive, 8 : FVAL 14:UserOutput0, 15:UserOutput1, 16:UserOutput2, 17:UserOutput3, 21:Line5, 26:Nand0 Out, 27:Nand1 Out
PulseGeneratorClearSyncMode	0:Async Mode 1:Sync Mode	0:Async Mode	Select the sync mode for the count clear input signal.

Item	Setting range	Default value	Description
h) AnalogControl			Configure analog control settings.
GainSelector	0:AnalogAll, 1:DigitalRed, 2:DigitalBlue	0:AnalogAll	Select the gain to configure. (DigitalRed and DigitalBlue are color model only)
Gain	AnalogAll x1.0 ～ x126.0 DigitalRed x0.447～x5.624 DigitalBlue x0.447～x5.624	AnalogAll, x1.0 DigitalRed, x1.0 DigitalBlue, x1.0	Set the gain value for the gain setting selected in [GainSelector]. (DigitalRed and DigitalBlue are 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.
BalanceWhiteAuto	—	0:Off	Enable/disable auto white balance. [Setting range] 0:Off, 1:Once, 2:Continuous, 5:Preset 3200K, 6:Preset 5000K, 7:Preset 6500K, 8:Preset 7500K,
AWBAreaSelector	—	0:Low Right	Select the area for which to configure [AWBAreaEnable]. [Setting range] 0:Low Right, 1:Low Mid-Right, 2:Low Mid-Left, 3:Low Left 4:Mid-Low Right, 5:Mid-Low Mid-Right, 6:Mid-Low Mid-Left, 7:Mid-Low Left 8:Mid-High Right, 9:Mid-High Mid-Right, 10:Mid-High Mid-Left, 11:Mid-High Left 12:High Right, 13:High Mid-Right, 14:High Mid-Left, 15:High Left
AWBAreaEnable	True, False	True	Enable/disable the photometry area selected in [AWBAreaSelector].
AWBAreaEnableAll	True, False	True	True: Operate AWB with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [AWBAreaSelector]. False: Operate AWB according to the individual enabled/disabled photometry area states configured in [AWBAreaSelector].
AWBControlSpeed	1 ～ 8	4	Set the response speed for AWB adjustment. (8 is the fastest.)
AWBControlStatus	—	Idle	Displays the operation status of the AWB. [Operation status] Complete, TooBright, TooDark, Timeout, Executing, TriggerError, Convergent, ConditionError, Idle
BlackLevelSelector	0:DigitalAll, 1:DigitalRed, 3:DigitalBlue	0:DigitalAll	Select the black level to configure. (DigitalRed and DigitalBlue are color model only)
BlackLevel	DigitalAll, -133～255 DigitalRed, -64～ 64 DigitalBlue -64～ 64	DigitalAll, 0 DigitalRed, 0 DigitalBlue 0	Set the black level value.
Gamma	0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0	0.45	Set the gamma value.
LUTMode	Off, Gamma, LUT	Off	Select the LUT mode.
i) LUTControl			Configure LUT settings.
LUTSelector	Red, Green, Blue	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.

Item	Setting range	Default value	Description
j) AutoLevelControl			Configure Auto Level Control settings.
ALCControlReference	0: Peak Channel, 1: Selected Channel	1: Selected Channel	
ALCControlChannel	0:Red, 1:Green, 2:Blue	1: Green	
ALCReference	30～95	50	Set the target level for ALC. (unit: %)
ALCAreaSelector	—	Low Right	Select the area for which to configure [ALCAreaEnable]. [Setting range] 0:Low Right, 1:Low Mid-Right, 2:Low Mid-Left, 3:Low Left 4:Mid-Low Right, 5:Mid-Low Mid-Right, 6:Mid-Low Mid-Left, 7:Mid-Low Left 8:Mid-High Right, 9:Mid-High Mid-Right, 10:Mid-High Mid-Left, 11:Mid-High Left 12:High Right, 13:High Mid-Right, 14:High Mid-Left, 15:High Left
ALCAreaEnable	True, False	True	Enable/disable the photometry area selected in [ALCAreaSelector].
ALCAreaEnableAll	True, False	True	True: Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [ALCAreaSelector]. False: Operate ALC according to the individual enabled/disabled photometry area states configured in [ALCAreaSelector].
ALCControlRatio	1～100	90	Set the response speed. (100 is the fastest.)
AutoShutterControlExposureMin	100 ～	100	Set the minimum value for the ExposureAuto(ASC) control range.
AutoShutterControlExposureMax	—	—	Set the maximum value for the ExposureAuto(ASC) control range.
AutoGainControlGainRawMin	100 ～	100	Set the minimum value for the GainAuto(ASC) control range.
AutoGainControlGainRawMax	～ 12600	12600	Set the maximum value for the GainAuto(ASC) control range.
ALCStatus	0: Off, 2: ASC, 3: AGC	0:Off	Allows confirmation of the current operation area during ALC operation.
AutoControlStatus	—	Idle	Allows confirmation of the AGC, ASC, and AWB convergence status. [Status] 1:ExecutingASC, 2:ExecutingAGC, 3:ExecutingASCandAGC, 4:ExecutingAWB 5:ExecutingASCandAWB, 6:ExecutingAGCandAWB, 7:ExecutingASCandAGCandAWB, 8:Convergent, 9:ConditionError, 255:Idle
k) ImagingControl			Configure settings for other JAI functions.
VideoProcessBypassMode	Off, On	Off	Enable/disable VideoProcessBypass mode.
l) ShadingConrol			Configure shading correction settings.
ShadingCorrectionMode	0:Flat Shading 1:Color Shading	0:Flat Shading	Select the shading correction method.
ShadingMode	0:Off, 2:User1 3:User2, 4:User3	0:Off	Set the area to which to save shading correction data. When this is set to [Off], shading correction data is not saved.
PerformShadingCalibration	—	—	Execute shading correction. This command can not be executed under the following conditions. ・When no image is output ・Outputting TestPattern ・In Sequencer mode ・When the ROI setting is under the following conditions (Width or Height is less than 128) ・In Decimation mode ・In Binning mode
ShadingDetectResult	—	—	Display the shading correction results. [results] 0: Condition Error, 1: TooDark, 2: TooBright, 3: Correction Limit, 4: Complete

項目	設定範囲	初期値	説明
m) BlemishControl			Configure blemish compensation settings.
BlemishEnable	True, False	True	Enable/disable blemish correction.
BlemishDetect	—	—	Execute blemish detection. This command can not be executed under the following conditions. ・When no image is output ・Outputting TestPattern ・In Sequencer mode ・In Overlap MultiRoi mode ・In single ROI mode ・In Decimation mode ・In Binning mode ・In multi ROI mode
BlemishDetectionResult	—	—	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.
BlemishDetectThreshold	1 ～ 100	10	Set the blemish detection threshold.
BlemishCompensationIndex	1 ～ 256	1	Select the index for the target blemish coordinates (BlemishDataPosition X/Y).
BlemishCompensationPositionX	—	-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. [Setting range] GOX-2402MC-USB: -1～1919 GOX-3200MC-USB: -1～2047 GOX-3201MC-USB: -1～2047 GOX-5102MC-USB: -1～2447 GOX-5103MC-USB: -1～2447 GOX-8901MC-USB: -1～4095 GOX-12401MC-USB: -1～4095
BlemishCompensationPositionY	—	-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. [Setting range] GOX-2402MC-USB: -1～1119 GOX-3200MC-USB: -1～1535 GOX-3201MC-USB: -1～1535 GOX-5102MC-USB: -1～2047 GOX-5103MC-USB: -1～2047 GOX-8901MC-USB: -1～2159 GOX-12401MC-USB: -1～2999
BlemishCompensationDataClear	—	—	Delete detected or specified blemish information selected in [BlemishCompensationIndex].
BlemishCompensationNumber	0 ～ 256	0	Display the number of target blemishes.
n) SequencerControl			Configure sequencer settings.
SequencerMode	0:Off, 1:On	Off	Enable/disable [SequencerMode].
SequencerModeSelect	0:TriggerSequencerMode, 1:CommandSequencerMode	TriggerSequencerMode	Select the sequencer mode.
SequencerSetSelector	1～32	1	Select the index number to configure.
SequencerWidth	—	—	Set the width of the selected SequencerIndex.
SequencerHeight	—	—	Set the height of the selected SequencerIndex.
SequencerOffsetX	—	—	Set the horizontal offset value for the selected SequencerIndex.
SequencerOffsetY	—	—	Set the vertical offset value for the selected SequencerIndex.
SequencerFrameCount	—	—	Set the FrameCount value for the selected SequencerIndex.
SequencerExposureTime	1μs ～	—	Set the exposure time for the selected SequencerIndex.
SequencerGainAnalogAll	x1.0 ～ x126.0	x1.0	Set the GainAnalogAll value for the selected SequencerIndex.
SequencerGainDigitalRed	x0.447～x5.624	x1.0	Set the DigitalRed Gain value for the selected SequencerIndex.
SequencerGainDigitalBlue	x0.447～x5.624	x1.0	Set the DigitalBlue Gain value for the selected SequencerIndex.
SequencerLutEnable	True, False	False	Set the LutEnable value for 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 Sequencer is stopped.
SequencerRepetition	1～255	1	Set the repeat count for the sequencer.
SequencerSetActive	1～32	1	Displays the sequencer set 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].

Item	Setting range	Default value	Description
o) CounterAndTimerControl			Configure counter settings. (This camera only supports counter functions.)
CounterSelector	0:Counter0, 1:Counter1, 2:Counter2, 3:Counter3	—	Select the counter.
CounterEventSource	—	Off	Assign the counter event signal for which you want to read the count value to a dedicated counter, and read the value. Counter0 0:Off, 1:FrameTrigger Counter1 0:Off, 3:SensorReadOut Counter2 0:Off, 2:ExposureStart Counter3 0:Off, 4:FrameTransferEnd
CounterEventActivation	—	—	Set the count timing. The setting value is fixed with the following data. Counter0:RisingEdge, Counter1:RisingEdge, Counter2:RisingEdge, Counter3:FallingEdge
CounterReset	—	—	Reset the counter.
CounterRefresh	0～65535	0	Update the count value.
CounterValue	0～65535	0	Display the count value.
CounterStatus	—	—	Display the counter status. 0:CounterIdle: Idle 2:CounterActive: Counting 4:CounterOverflow: Count value exceeded the mazimum value
p) ChunkDataControl			Configure chunk control settings.
ChunkModeActive	True, False	False	Set whether to enable ChunkData.
ChunkOffsetX	—	—	The value of OffsetX (ChunkID 2000h : DataType Integer)
ChunkOffsetY	—	—	The value of OffsetY (ChunkID 2001h : DataType Integer)
ChunkWidth	—	—	The value of Width (ChunkID 2002h : DataType Integer)
ChunkHeight	—	—	The value of Height (ChunkID 2003h : DataType Integer)
ChunkLineStatusAll	—	—	The value of LineStatusAll (ChunkID 2013h : DataType Integer)
ChunkExposureTime			The value of ExposureTime (ChunkID 2004h : DataType Integer)
ChunkGainAnalogAll	—	—	The value of AnalogGainAll (ChunkID 201Fh : DataType Float)
ChunkGainDigitalRed	—	—	The value of DigitalGainRed (ChunkID 2006h : DataType Float)
ChunkGainAnalogBlue	—	—	The value of AnalogGainBlue (ChunkID 2007h : DataType Float)
ChunkFrameTriggerCounter	—	—	The value of FrameTriggerのCounter (ChunkID 200Eh : DataType Integer)
ChunkSequencerSetActive	—	—	The value of SequencerSetActive (ChunkID 200Ch : DataType Integer)
q) TestControl			
TestPendingAck (ms)	0～10000	0	PendingAck function test command. The camera waits for TestPendingAck (ms) time and returns an Ack response.
r) UserSetControl			Configure user settings.
UserSetSelector	Default, UserSet1, UserSet2, UserSet3	Default	Select the user settings.
UserSetLoad	0(default), 1, 2, 3	—	Load user settings. (If 0 is specified, the factory default setting is read.)
UserSetSave	1,2,3	—	Save the current setting values as user settings.

Miscellaneous

Troubleshooting

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

■ **Power supply and connections**

The POWER/TRIG LED remains lit amber and does not turn green, even after power is supplied to the camera.	Camera initialization may not be complete due to lack of a power. Check the 6-pin power cable connection. Or GigE connection may be not established, check ethernet cable connection.

■ **Image display**

Problem	Cause and solution
Gradation in dark areas is not noticeable.	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**

Problem	Cause and solution
Settings cannot be saved to user memory.	You cannot save to user memory while images are being acquired by the camera. Stop image acquisition before performing the save operation.
I want to restore the factory default settings.	Load [Default] under [User Set Selector] in the [Feature Properties] tab to restore the factory default settings.

Specifications

Item	Monochrome	Color
Scanning system	Progressive scan, 1 tap	
Synchronization	Internal	
Interface	1000BASE-T Ethernet (GigE Vision 2.0), IEEE 802.3af	
Image Sensor	Monochrome CMOS	Bayer color CMOS
Dark SN (0dB@10bit)	>60dB@10bit	>60 dB@10bit (Gch)
	GOX-2402M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 130.20 fps GOX-2402C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 130.20 fps GOX-3200M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 95.36 fps GOX-3200C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 95.36 fps GOX-3201M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 55.90 fps GOX-3201C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 55.90 fps GOX-5102M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 59.83 fps GOX-5102C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 59.83 fps GOX-5103M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 35.80 fps GOX-5103C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 35.80 fps GOX-8901M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 32.47 fps GOX-8901C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 32.47 fps GOX-12401M-USB AnalogGainAll:x1.0,Shutter:OFF, Mono10, Frame Rate 23.49 fps GOX-12401C-USB AnalogGainAll:x1.0,Shutter:OFF, Bayer10, Frame Rate 23.49 fps	
Bright SN (0dB/890LSB@10bit)	>38 dB	>36 dB (Gch)
image size (effective image)	GOX-2402MC-USB: 1/2.3-inch 6.62mm(H) x 4.14mm(V) : 7.81mm(diagonal) GOX-3200MC-USB: 1/1.8-inch 7.07mm(H) x 5.3mm(V) : 8.83mm(diagonal) GOX-3201MC-USB: 1/1.8-inch 7.07mm(H) x 5.3mm(V) : 8.83mm(diagonal) GOX-5102MC-USB: 2/3-inch 8.45mm(H) x 7.07mm(V) : 11.01mm(diagonal) GOX-5103MC-USB: 2/3-inch 8.45mm(H) x 7.07mm(V) : 11.01mm(diagonal) GOX-8901MC-USB: 1-inch 14.13mm(H) x 7.45mm(V) : 15.97mm(diagonal) GOX-12401MC-USB: 1/1.1-inch 14.13mm(H) x 10.35mm(V) : 17.52mm(diagonal)	
Pixel size	3.45 µm (H) x 3.45µm(V)	
Effective image pixel	GOX-2402MC-USB: 1920(H) x 1200(V) GOX-3200MC-USB: 2048(H) x 1536(V) GOX-3201MC-USB: 2048(H) x 1536(V) GOX-5102MC-USB: 2448(H) x 2048(V) GOX-5103MC-USB: 2448(H) x 2048(V) GOX-8901MC-USB: 4096(H) x 2160(V) GOX-12401MC-USB: 4096(H) x 3000(V)	

*) Refer to Exposure Mode section for details.

Acquisition Frame Rate (max)	8bit		Mono8 GOX-2402M-USB: 162 fps GOX-3200M-USB: 119 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 74 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 32 fps GOX-12401M-USB: 23 fps	BayerRG8 GOX-2402M-USB: 162 fps GOX-3200M-USB: 119 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 74 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 32 fps GOX-12401M-USB: 23 fps
	10bit Packed		Mono10p GOX-2402M-USB: 130 fps GOX-3200M-USB: 95 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 59 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 32 fps GOX-12401M-USB: 23 fps	BayerRG10p GOX-2402M-USB: 130 fps GOX-3200M-USB: 95 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 59 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 32 fps GOX-12401M-USB: 23 fps
	12bit Packed		Mono12p GOX-2402M-USB: 108 fps GOX-3200M-USB: 79 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 49 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 28 fps GOX-12401M-USB: 20 fps	BayerRG12p GOX-2402M-USB: 108 fps GOX-3200M-USB: 79 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 49 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 28 fps GOX-12401M-USB: 20 fps
	10/12bit UnPacked		Mono10, Mono12 GOX-2402M-USB: 81 fps GOX-3200M-USB: 59 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 37 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 21 fps GOX-12401M-USB: 15 fps	BayerRG10, BayerRG12 GOX-2402M-USB: 81 fps GOX-3200M-USB: 59 fps GOX-3201M-USB: 55 fps GOX-5102M-USB: 37 fps GOX-5103M-USB: 35 fps GOX-8901M-USB: 21 fps GOX-12401M-USB: 15 fps
Digital image output format	Full		GOX-2402MC-USB: 1920(H) x 1200(V) GOX-3200MC-USB: 2048(H) x 1536(V) GOX-3201MC-USB: 2048(H) x 1536(V) GOX-5102MC-USB: 2448(H) x 2048(V) GOX-5103MC-USB: 2448(H) x 2048(V) GOX-8901MC-USB: 4096(H) x 2160(V) GOX-12401MC-USB: 4096(H) x 3000(V)	
	ROI	Width	GOX-2402MC-USB： 96 to 1920 step 16 GOX-3200MC-USB： 96 to 2048 step 16 GOX-3201MC-USB： 96 to 2048 step 16 GOX-5102MC-USB： 96 to 2448 step 16 GOX-5103MC-USB： 96 to 2448 step 16 GOX-8901MC-USB： 96 to 4096 step 16 GOX-12401MC-USB： 96 to 4096 step 16	
		Offset X	GOX-2402MC-USB： 0～1824 step 16 GOX-3200MC-USB： 0～1952 step 16 GOX-3201MC-USB： 0～1952 step 16 GOX-5102MC-USB： 0～2352 step 16 GOX-5103MC-USB： 0～2352 step 16 GOX-8901MC-USB： 0～4000 step 16 GOX-12401MC-USB： 0～4000 step 16	
		Height	GOX-2402MC-USB： 8～1200 step 2 GOX-3200MC-USB： 8～1536 step 2 GOX-3201MC-USB： 8～1536 step 2 GOX-5102MC-USB： 8～2048 step 2 GOX-5103MC-USB： 8～2048 step 2 GOX-8901MC-USB： 8～2160 step 2 GOX-12401MC-USB： 8～3000 step 2	
		Offset Y	GOX-2402MC-USB： 0～1192 step 2 GOX-3200MC-USB： 0～1524 step 2 GOX-3201MC-USB： 0～1524 step 2 GOX-5102MC-USB： 0～2040 step 2 GOX-5103MC-USB： 0～2040 step 2 GOX-8901MC-USB： 0～2152 step 2 GOX-12401MC-USB： 0～2992 step 2	

Digital image output format	Binning (H)	1	GOX-2402MC-USB : 1920 GOX-3200MC-USB : 2048 GOX-3201MC-USB : 2048 GOX-5102MC-USB : 2448 GOX-5103MC-USB : 2448 GOX-8901MC-USB : 4096 GOX-12401MC-USB : 4096	-
		2	GOX-2402M-USB : 960 GOX-3200M-USB : 1024 GOX-3201M-USB : 1024 GOX-5102M-USB : 1224 GOX-5103M-USB : 1224 GOX-8901M-USB : 2048 GOX-12401M-USB : 2048	-
	Binning (V)	1	GOX-2402MC-USB : 1200 GOX-3200MC-USB : 1536 GOX-3201MC-USB : 1536 GOX-5102MC-USB : 2048 GOX-5103MC-USB : 2048 GOX-8901MC-USB : 2160 GOX-12401MC-USB : 3000	-
		2	GOX-2402M-USB : 600 GOX-3200M-USB : 768 GOX-3201M-USB : 768 GOX-5102M-USB : 1024 GOX-5103M-USB : 1024 GOX-8901M-USB : 1080 GOX-12401M-USB : 1500	-
	Pixel Format		Mono8,Mono10, Mono10p, Mono12,Mono12p	BayerRG8, BayerRG10, BayerRG10p, BayerRG12, BayerRG12p
Acquisition Mode			Continuous / SingleFrame / MultiFrame（1 ～ 65535）	
Trigger Selector	Acquisition		AcquisitionStart / AcquisitionEnd	
	Exposure		FrameStart	
	Transfer		AcquisitionTransferStart（Delayed readout）	
Opto filter			Off(Default), 10μs, 100μs, 500μs, 1ms, 3ms, 5ms, 7ms, 10ms, 15ms, 20ms, 25ms, 30ms, 35ms, 40ms	
Trigger overlap			Off / Read out	
Trigger input signals			Low, High, Software, PulseGenerator0, UserOutput0-3, Line5, NAND 0 Out, NAND 1 Out	
Exposure Mode	Timed		GOX-2402MC-USB / GOX-3200MC-USB / GOX-3201MC-USB / GOX-5102MC-USB / GOX-5103MC-USB 14.73 μs*（min） ～ 8 s（max） GOX-8901MC-USB / GOX-12401MC-USB 15.26 μs*（min） ～ 8 s（max） ❖ Performance verified for up to 1 second.	
	Trigger Witdh		GOX-2402MC-USB / GOX-3200MC-USB / GOX-3201MC-USB / GOX-5102MC-USB / GOX-5103MC-USB 14.73 μs*（min） ～ ∞ s（max） GOX-8901MC-USB / GOX-12401MC-USB 15.26 μs*（min） ～ ∞ s（max） ❖ Performance verified for up to 1 second.	
Auto Exposure (Exposure Auto)			Off / Continuous / Once	
Auto exposure response speed （ALCControlRatio）			1 ～ 100	
Digital I/O			LineSelector（6P） : GPIO IN / GPIO OUT	

Black Level adjustment	Default level		8LSB@8bit
	Video level adjustment range		DigitalAll : -133 ~ +255 LSB @12bit DigitalRed : -64 ~ +64 LSB @12bit DigitalBlue : -64 ~ +64 LSB @12bit
	Resolution adjustment		1LSB@12bit
Gain adjustment	Manual adjustment range		AnalogAll : 0dB ～ 42dB DigitalRed : -7dB ～ 15dB DigitalBlue : -7dB ～ 15dB
	adjustment Auto gain		Off, Continuous, Once
White balance	WhiteBalanceGain		DigitalRed, DigitalBlue : -7dB ～ 15dB
	BalanceWhiteAuto		Off, Continuous, Once, Preset3200K, Preset5000K, Preset6500K, Preset7500K
	Photometry area		16 (4 x 4) Area
	Adjustment range		3000K ～ 9000K
Blemish correction	Detection		Detect white blemishes using threshhold values (100 steps available) (black blemish correction performed only at factory)
	Correction		Interpolation using adjacent pixels (continuous blemishes not corrected)
	Correctable pixels		256 pixels
ALC			Video level adjusted automatically using AGC and ASC
Gamma			0.45, 0.5, 0.55, 0.6, 0.65, 0.75, 0.8, 0.9, 1.0 (9 steps available)
LUT			OFF : γ= 1.0、ON = 257 points can be set
Vibration resistance			10G（20 Hz ～ 200 Hz X-Y-Z direction)
Impact resistance			80G
Power supply	6-pin Connector	Input range	DC + 10 V ～+ 25 V （Via input terminal)
		Consumption	4.3 W（typ.）(at 12 V input, default setting, 25 ℃ environment) 4.9 W（max.）
	USB BUS Power	Input range	9
		Consumption	4.2 W（typ.）(default setting, 25 ℃ environment) 4.7. W（max.）
Lens mount			C-mount Lens mount protrusion length of 9 mm or less is supported
Flange back			17.526, tolerance: 0 mm to -0.05 mm
Optical filter			IR cut filter (color model only)
Verified performance temperature / humidity			− 5℃～+ 45℃ / 20%～ 80% (non-condensing) (* It may change depending on the installation environment. Please refer to the Caution.)
Storage temperature / humidity			− 25℃～+ 60℃ / 20%～ 80% (non-condensing)
Regulations			CE(EN 55032:2015 and EN 55035:2017), FCC class A part 15,
Dimensions (housing)			29 × 29 × 41.5 mm (WHD) (excluding mount protrusions)
Weight			62 g

Package contentsCamera body (1)
Sensor protection cap (1)
Dear Customer (sheet) (1)

Optional accessories (not supplied) MP-43 tripod mount

Design and specifications are subject to change without notice.

Approximately 30 minutes of warm-up are required to achieve these specifications.

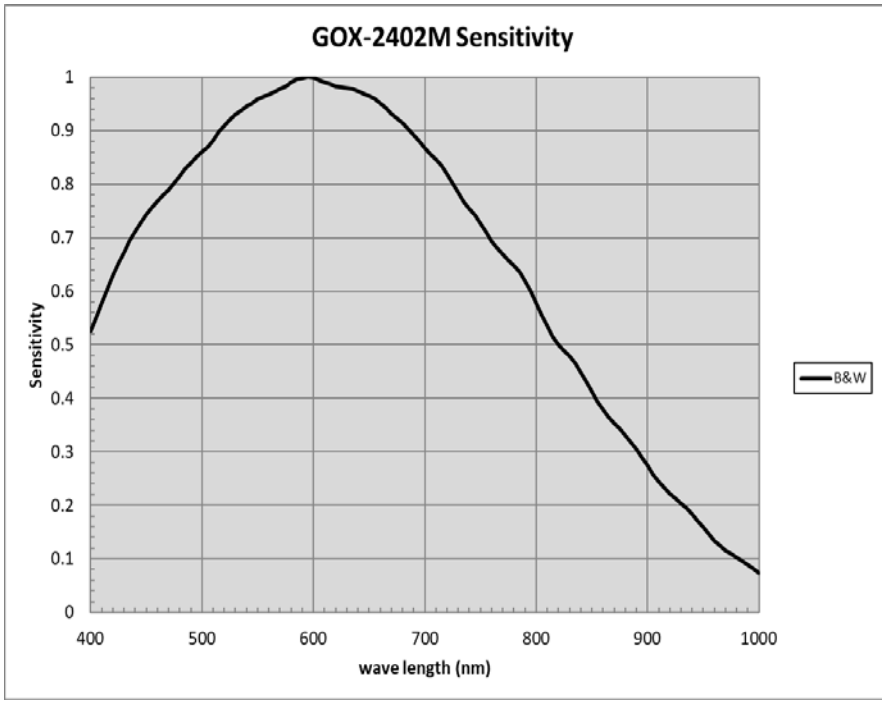
Caution

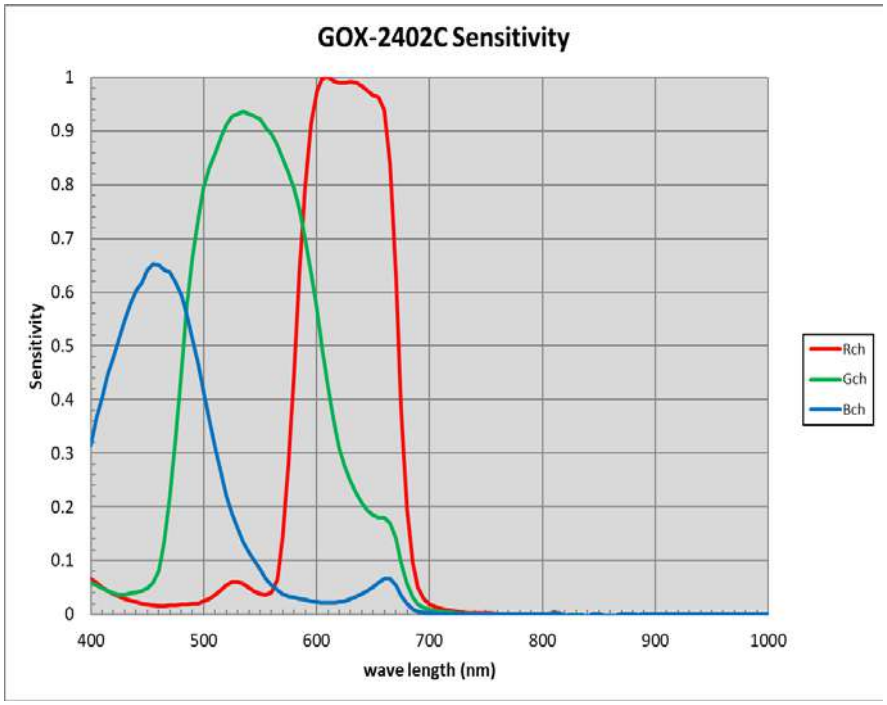
About the verified performance temperatureMake sure the following temperature conditions is met when operating the unit.

1) The camera's internal temperature sensor detects temperatures of 77 °C or less during operation.

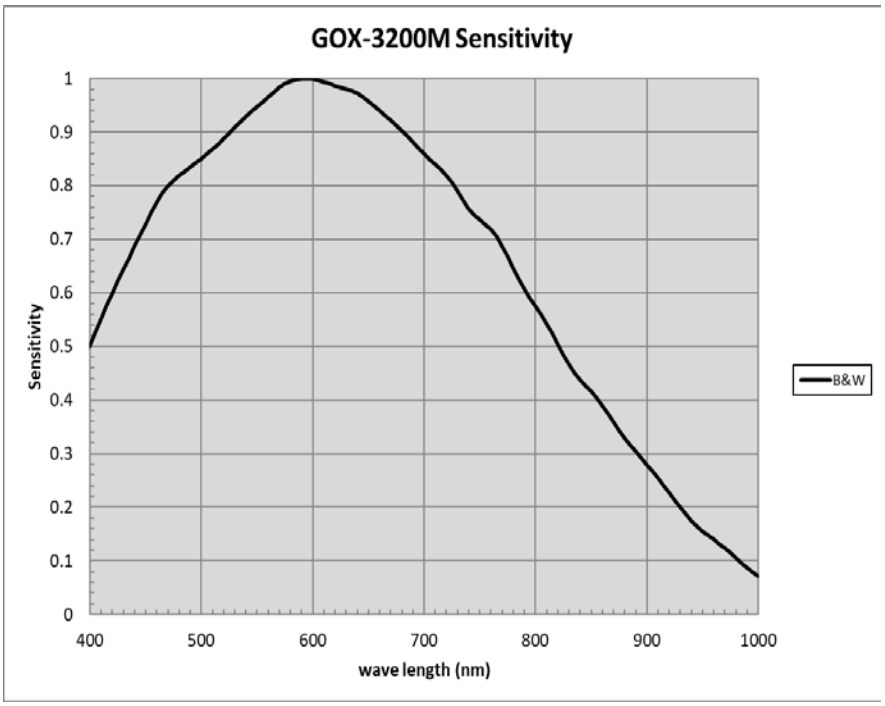
If the above temperature conditions are exceeded, take measures to dissipate heat according to your installation environment and conditions.

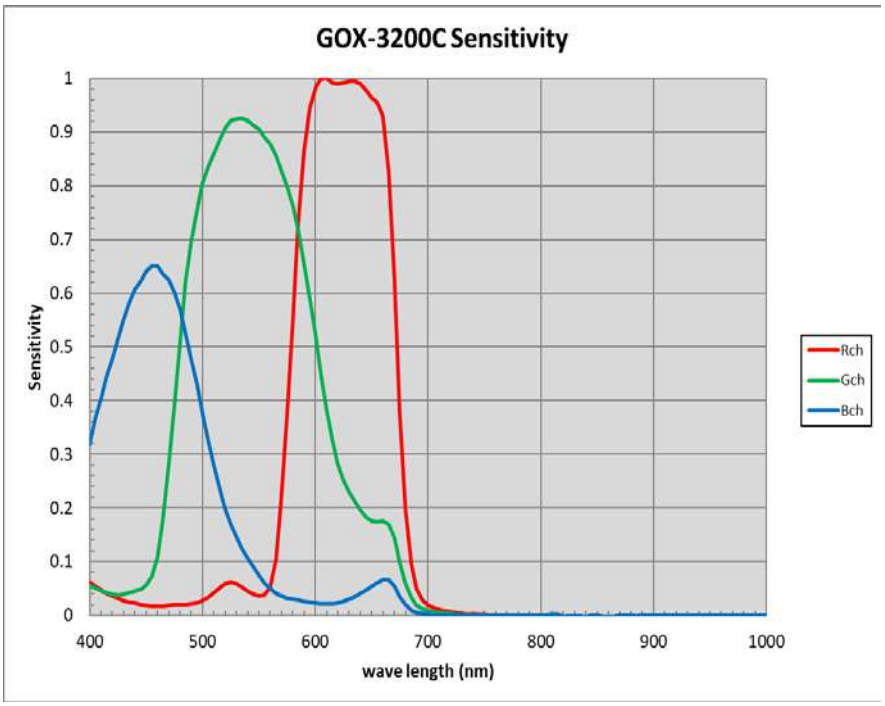
Spectral Response (GOX-2402MC-USB)



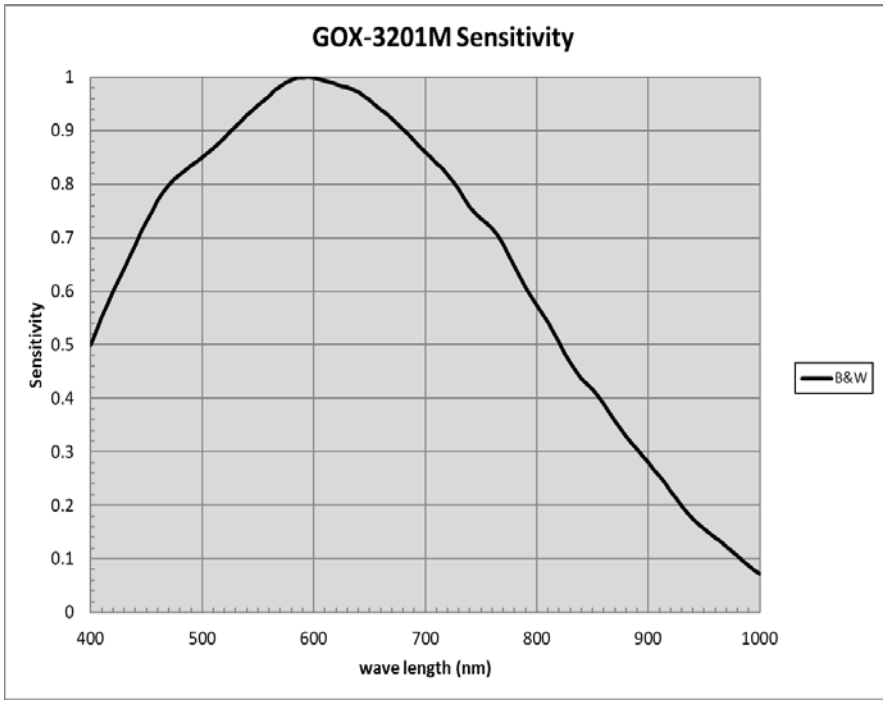


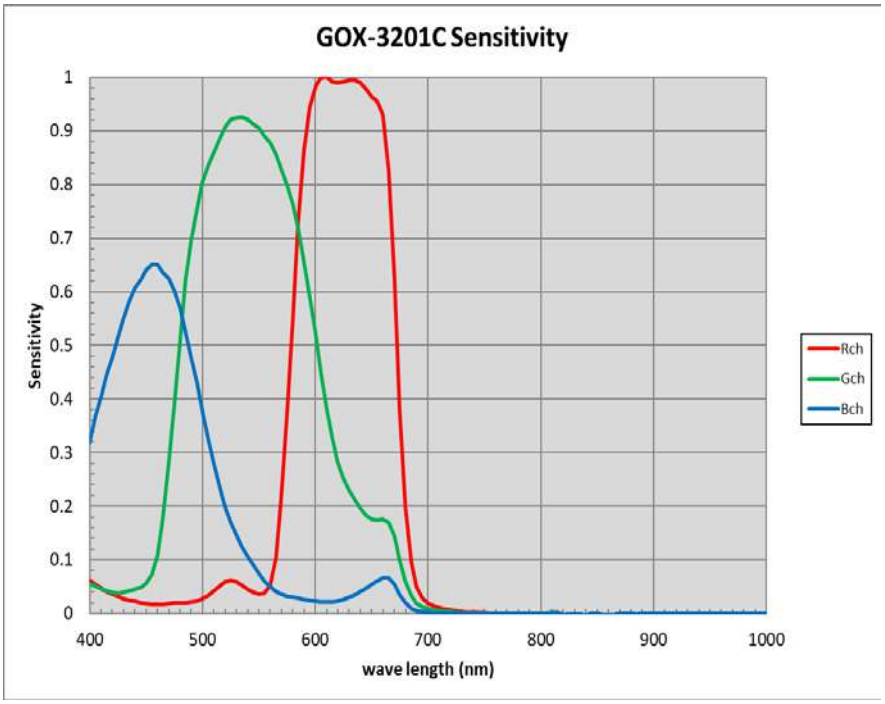
Spectral Response (GOX-3200MC-USB)



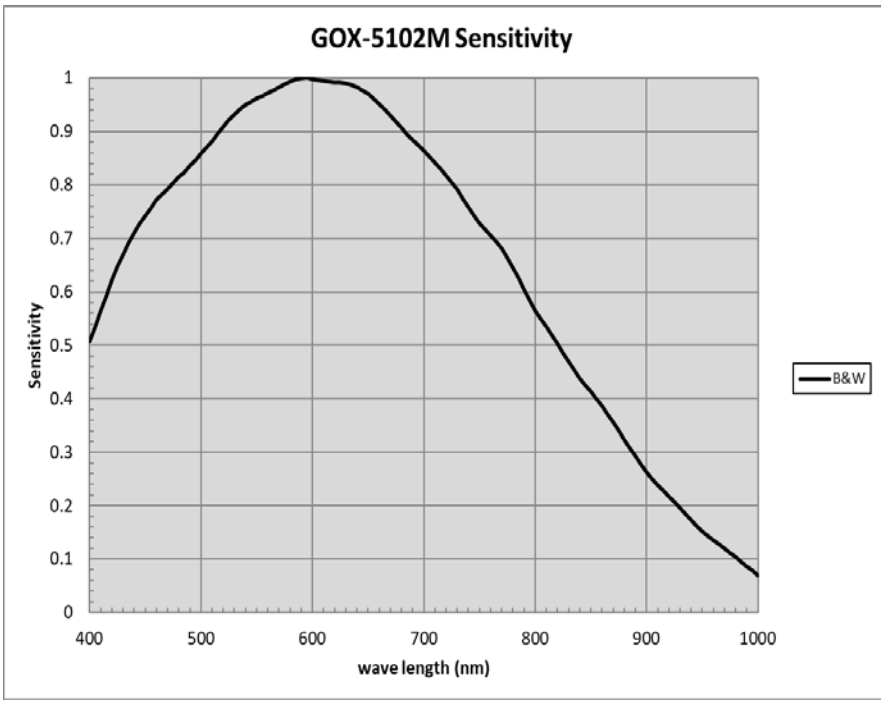


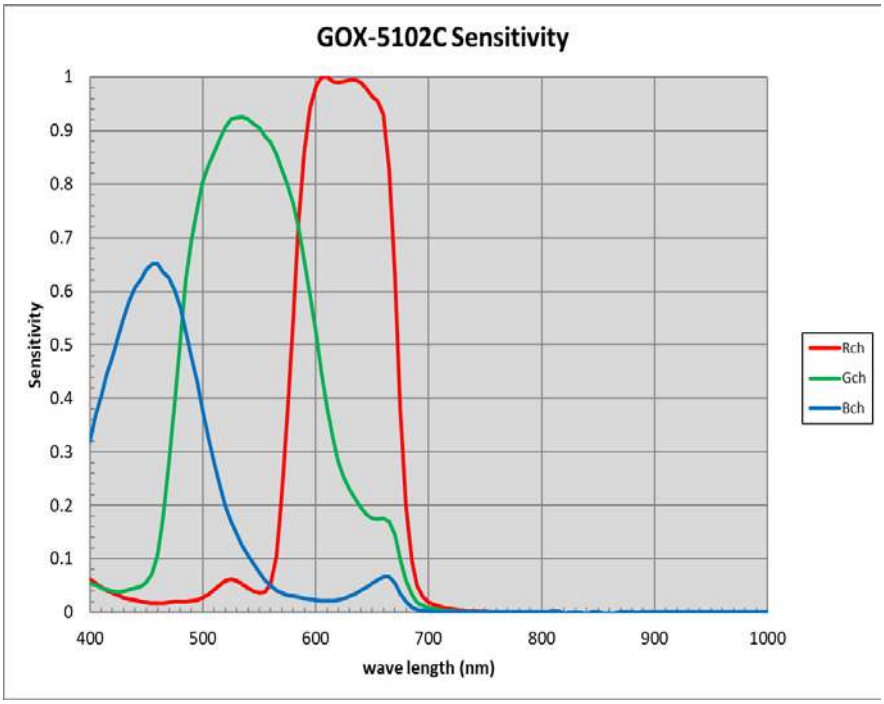
Spectral Response (GOX-3201MC-USB)



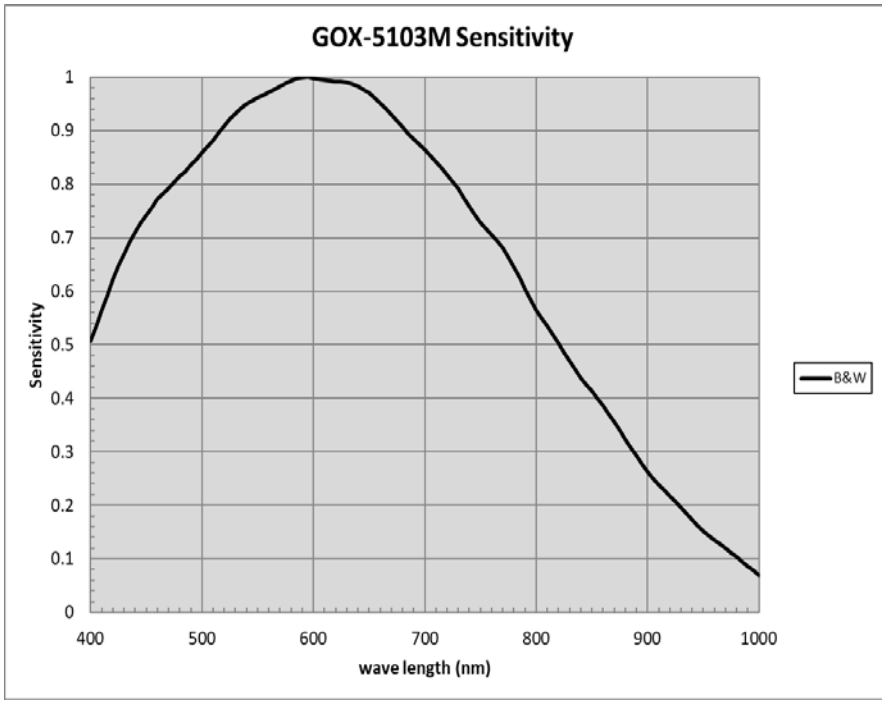


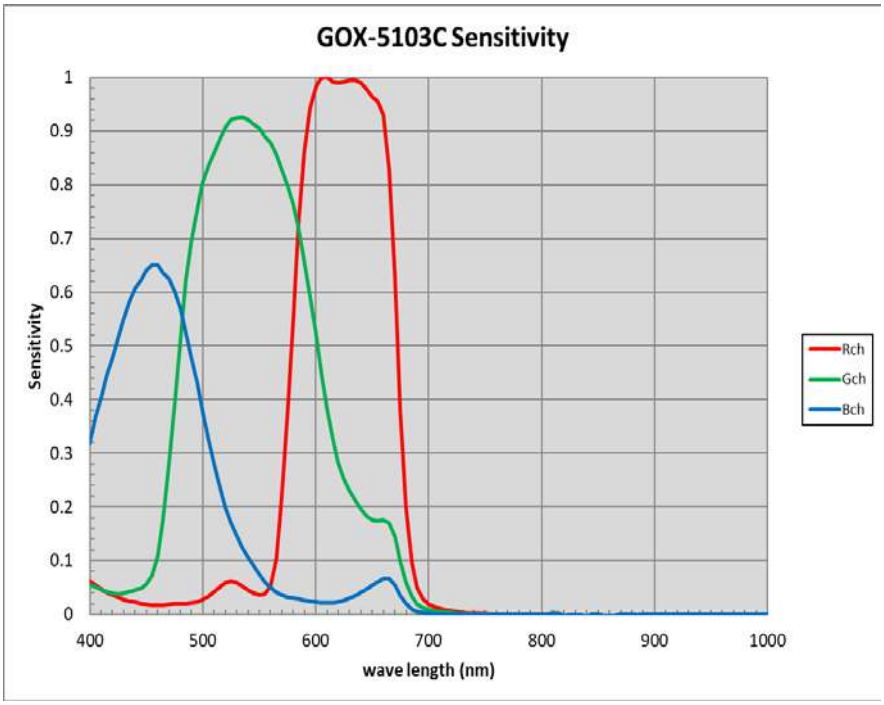
Spectral Response (GOX-5102MC-USB)



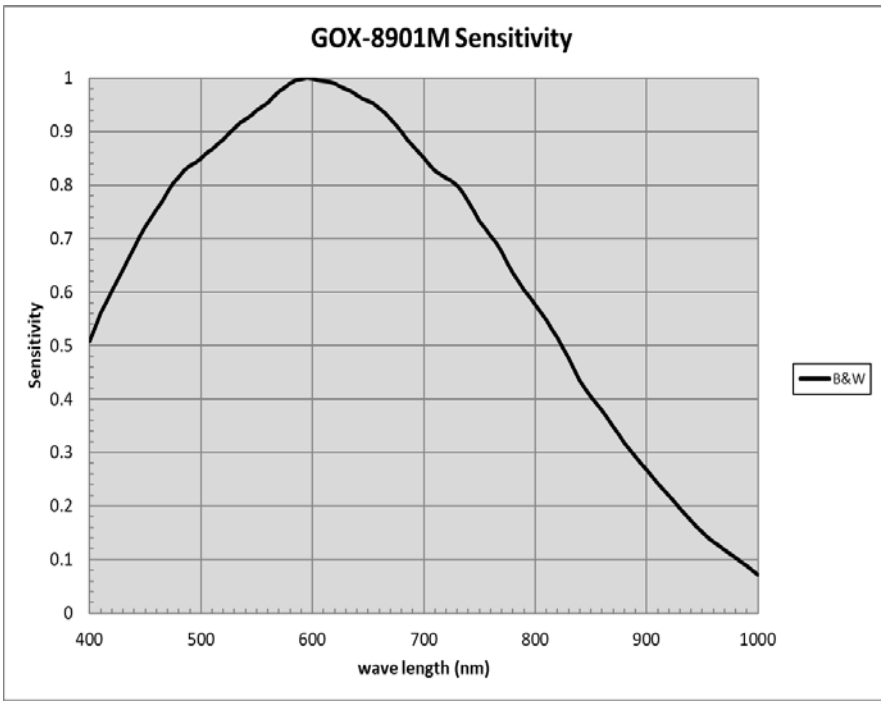


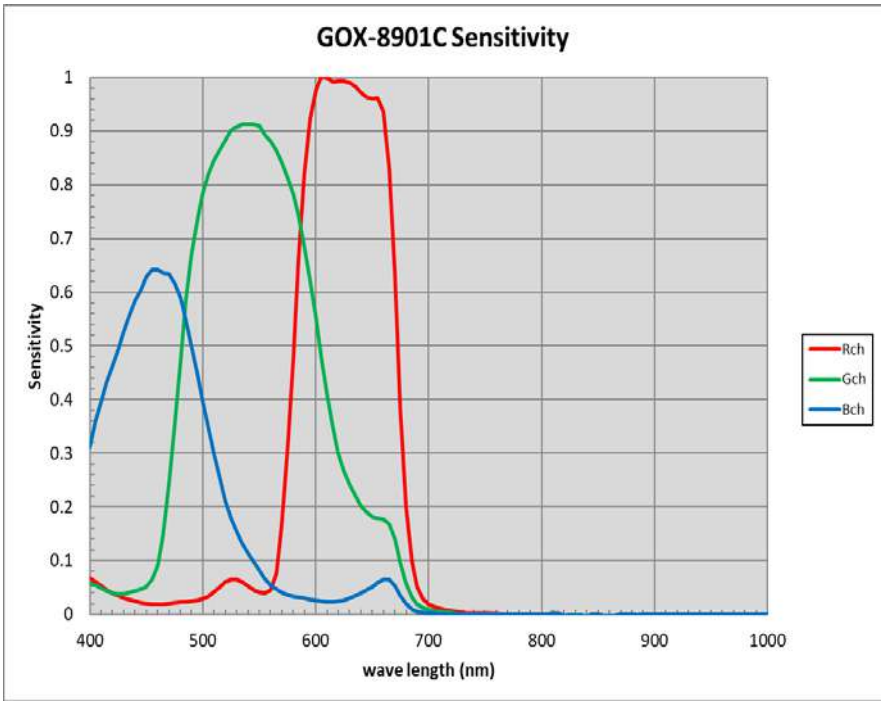
Spectral Response (GOX-5103MC-USB)



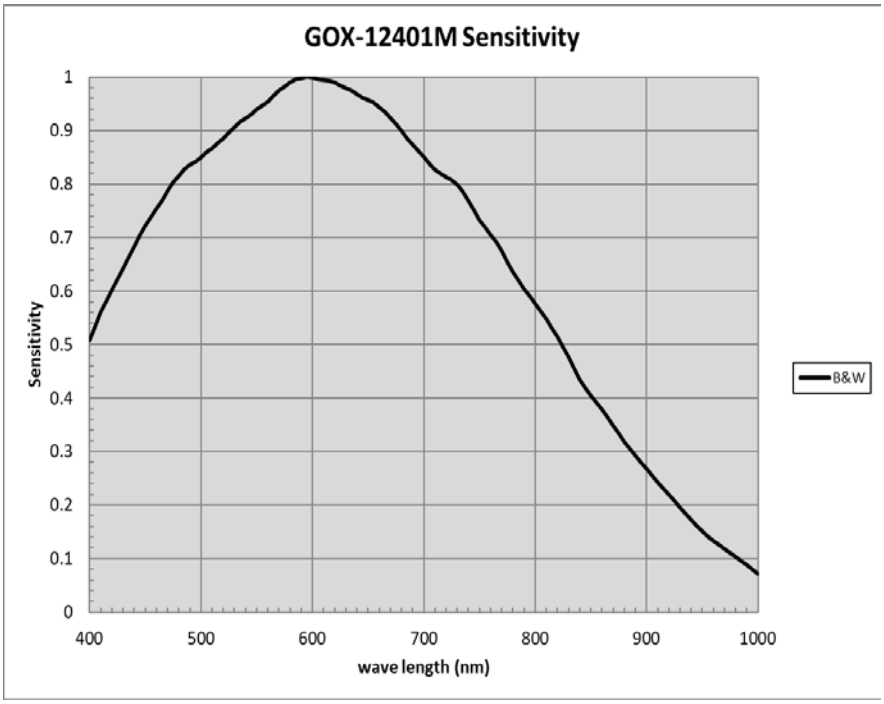


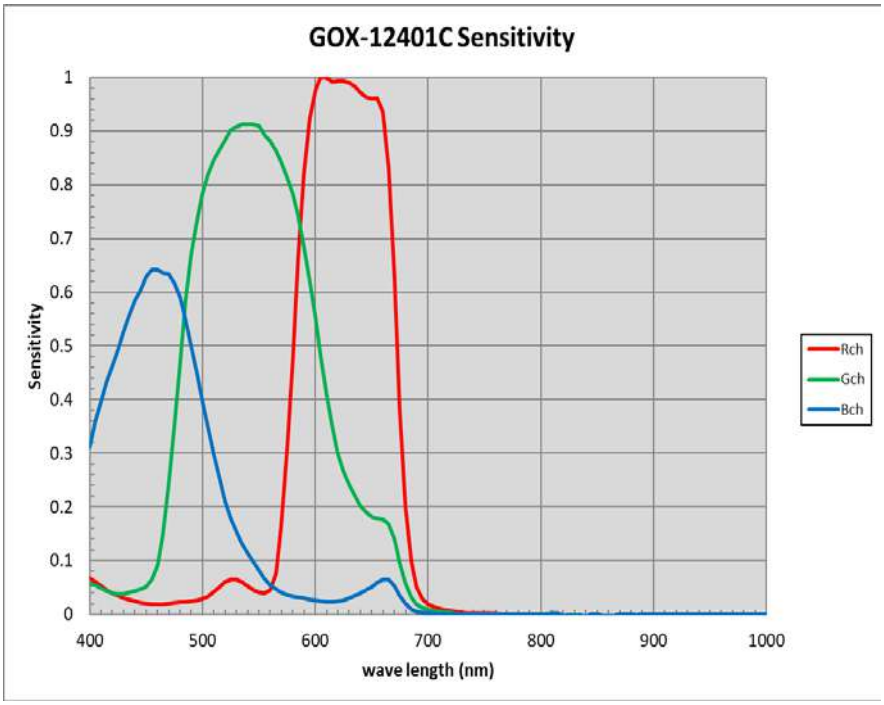
Spectral Response (GOX-8901MC-USB)



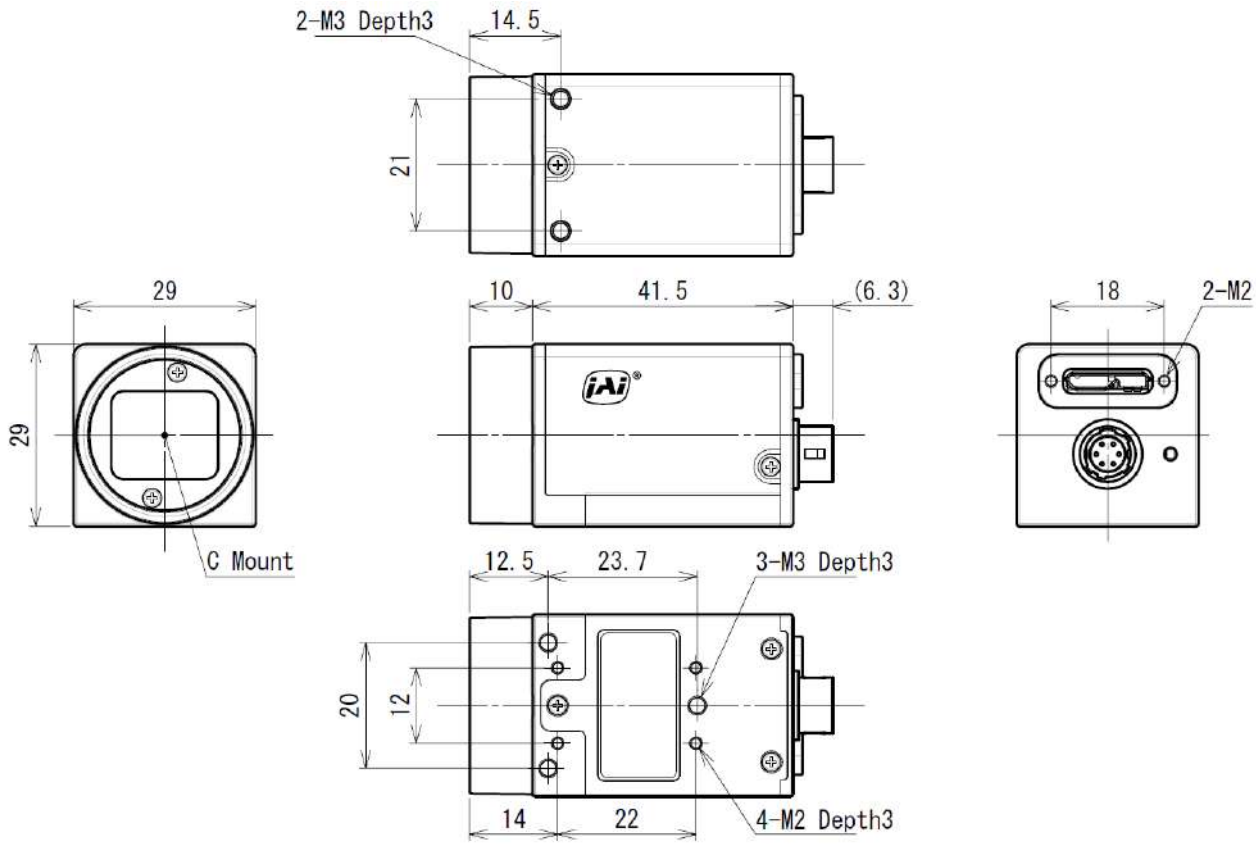


Spectral Response (GOX-12401MC-USB)





Dimensions



Dimenstional 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	
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 USB3 Vision interface

Model name: ·····

Revision: ·····

Serial No: ·····

Firmware version: ·····

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

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Revision history

Revision	Date	Changes
1.2	June 2022	Updated China RoHS. Corrected the external input/output circuit diagrams.
1.1	Oct. 2021	Added the Non-Volatile Flash Memory topic.
1.0	July 2021	First Release.