See the possibilities

User Manual

GO-5101M-PGE
GO-5101C-PGE

5.1M Digital Progressive Scan Monochrome and Color Camera

Document Version: 1.7

GO-5101-PGE_Ver.1.7_Mar.2021

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.

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 GO-5101M-PGE and GO-5101C-PGE comply with the following provisions applying to its standards.
EN 61000-6-3 (Generic emission standard part 1)
EN 61000-6-2 (Generic immunity standard part 1)

FCC

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

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

Warning

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

KC

제조년월은 제품상자의 라벨을 참조하십시요

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	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....	.....

○: 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。
（企业可在此处,根据实际情况对上表中打"×"的技术原因进行进一步说明。）

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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电路板	×	○	○	○	○	○
螺丝	×	○	○	○	○	○
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SJ/T11363-2006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SJ/T11363-2006规定的限量要求。
（企业可在此处、根据实际情况对上表中打 " × " 的技术原因进行进一步说明。）

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数字「15」为期限15年。

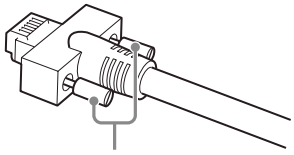
Usage Precautions

Notes on cable configurations

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

Notes on LAN cable connection

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



Secure manually.
Do not secure too tightly.

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 the camera is pointed at scenes containing very bright areas or strong light sources, some pixels on the CMOS image sensor may accumulate more than the maximum charge allowed, causing the excess charge to overflow into the surrounding pixels. While this "blooming" affects image quality, it 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

The GO-5101M-PGE/GO-5101C-PGE is an industrial progressive scan camera equipped with a 2/3-inch global shutter CMOS image sensor with 5.1 effective megapixels (2464 × 2056). The unit is compact and lightweight in design and is equipped with GigE Vision Ver.2.0 interface.

❖ The GO-5101M-PGE produces monochrome output while the GO-5101C-PGE produces Bayer output.

Compact and lightweight

The unit's compact size (approx. 29 × 29 × 41.5 mm, excluding lens mount) and lightweight design (approx. 46 g) allows for easy assembly and installation.

Gigabit Ethernet interface supporting GigE Vision Ver. 2.0

- High-speed transfer at up to 1 Gbps of uncompressed data, the ideal format for image processing.
- Connection of multiple cameras and computers supported through use of a switching hub, etc.
- Maximum cable length of 100 m.
- Support for IEEE802.af-compliant PoE (Power over Ethernet) allowing you to supply power to the camera via the LAN cable.

Note

Interface card or switching hub must support PoE. Alternatively, power can be supplied via the 6-pin connector using an optional +12 to +24V DC power supply.

Output formats

You can choose from 8-bit, 10-bit, and 12-bit* output for both monochrome and Bayer.

* As the color camera cannot perform white balance when using 12-bit output, perform white balance on the application.

High frame rate

The GO-5101M-PGE and GO-5101C-PGE are both capable of frame rates of up to 22.7 fps (8-bit format) for full 5.1-megapixel output. Even faster frame rates can be achieved when binning is utilized (GO-5101M-PGE only) or when a smaller ROI (region of interest) is specified.

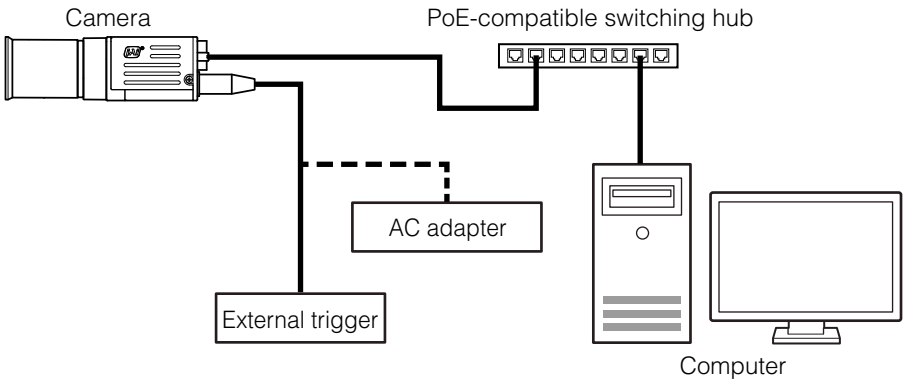
ALC (automatic level control) function

Combine the automatic gain control and automatic exposure control functions to allow handling of changes in various brightnesses.

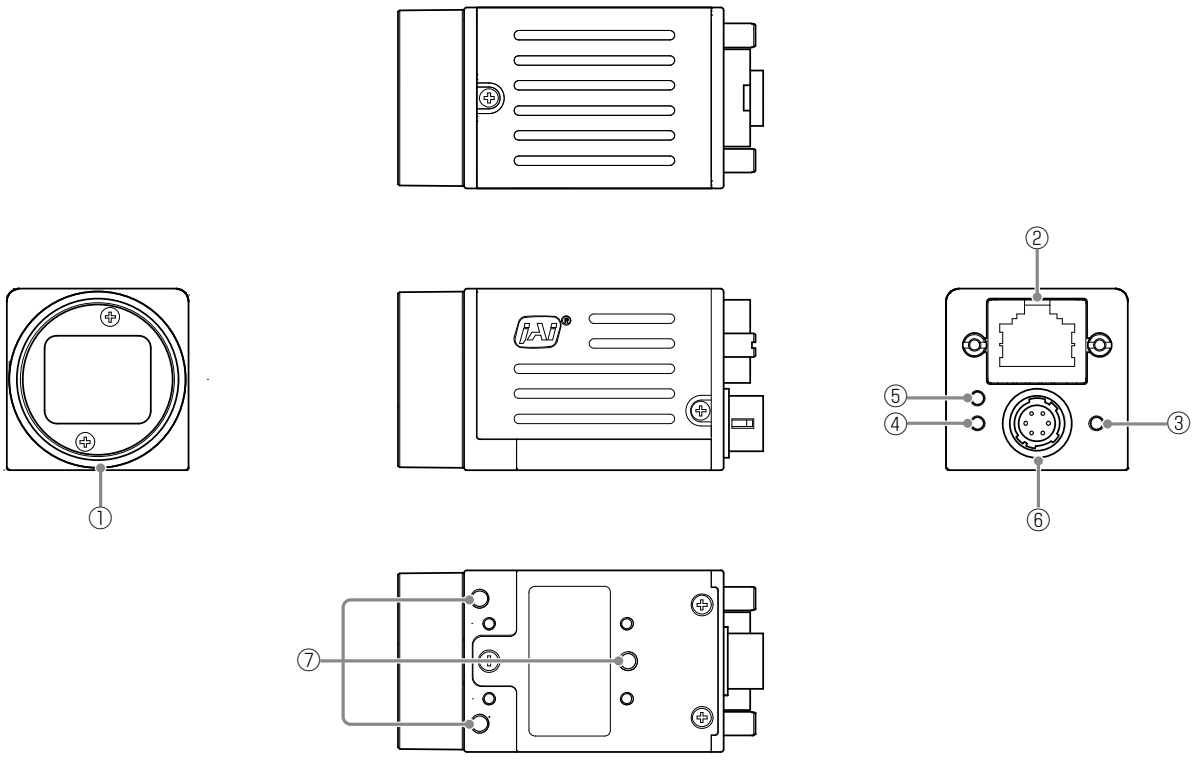
Variety of pre-process functions

- LUT (lookup table)
  For programmable control over gamma and contrast.
- Gamma correction
  Gamma can be set to 0.45, 0.60, or 1.0 (off).
- Shading correction (flat field and color shading)
  Non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment can be corrected.
- Bayer white balance (GO-5101C-PGE only)
  White balance can be automatically adjusted continuously. It can also be adjusted manually using R, and B gain.

Connection example:



Parts Identification



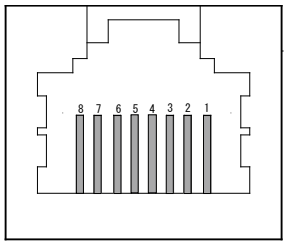
① Lens mount (C-mount)

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

❖ Before mounting a lens, be sure to refer to “Step 2: Connecting Devices” (page 13) and confirm the precautions for attaching a lens and the supported lens types.

② RJ-45 connector

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



Pin No.	Input/ output	Description
1	In/Out	MX1+ (DA+)
2	In/Out	MX1– (DA–)
3	In/Out	MX2+ (DB+)
4	In/Out	MX3+ (DC+)
5	In/Out	MX3– (DC–)
6	In/Out	MX2– (DB–)
7	In/Out	MX4+ (DD+)
8	In/Out	MX4– (DD–)

③ Power/trigger LED

Indicates the power and trigger input 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 ACT LED

Indicates the GigE network status.

LED	Light	Status
ACT LED	(Blinking amber)	Network communication in progress

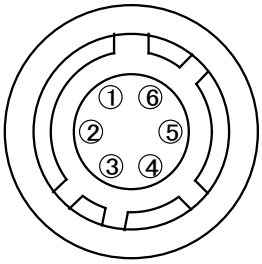
⑤ LINK LED

Indicates whether the GigE network connection is established or not.

LED	Light	Status
LINK LED	(Lit green)	1000BASE-T Link established

⑥ DC IN / trigger IN connector (6-pin round)

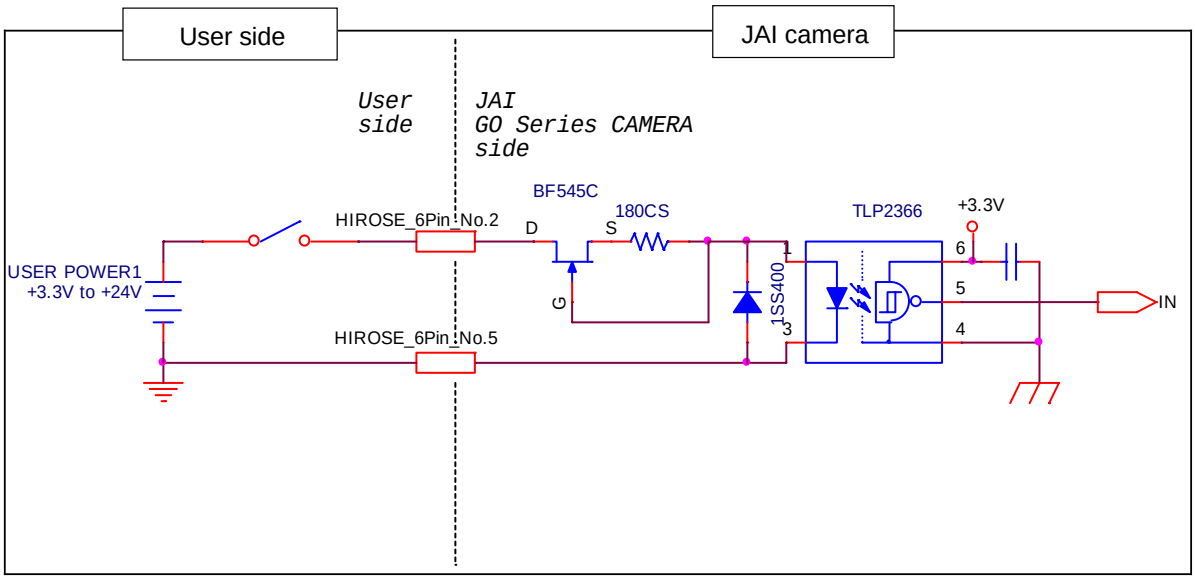
Connect the cable for a power supply (optional) or for DC IN / trigger IN here.



HR-10A-7R-6PB (73) (Hirose Electric or equivalent)

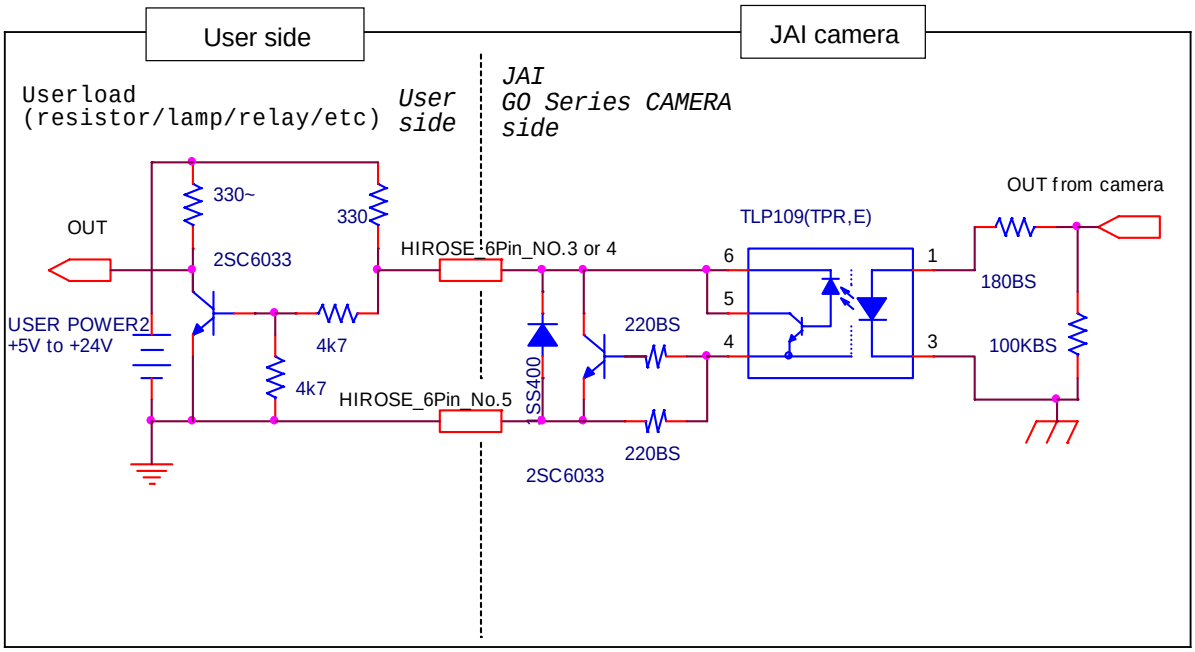
Pin No.	Input/ output	Signal	Description
1		DC IN	+12 to +24 V
2	In	Opto IN 1	GPIO 5
3	Out	Opto OUT 1	GPIO 1
4	Out	Opto OUT 2	GPIO 2
5		Opto Common	
6		GND	

Recommended external input circuit diagram (reference example)

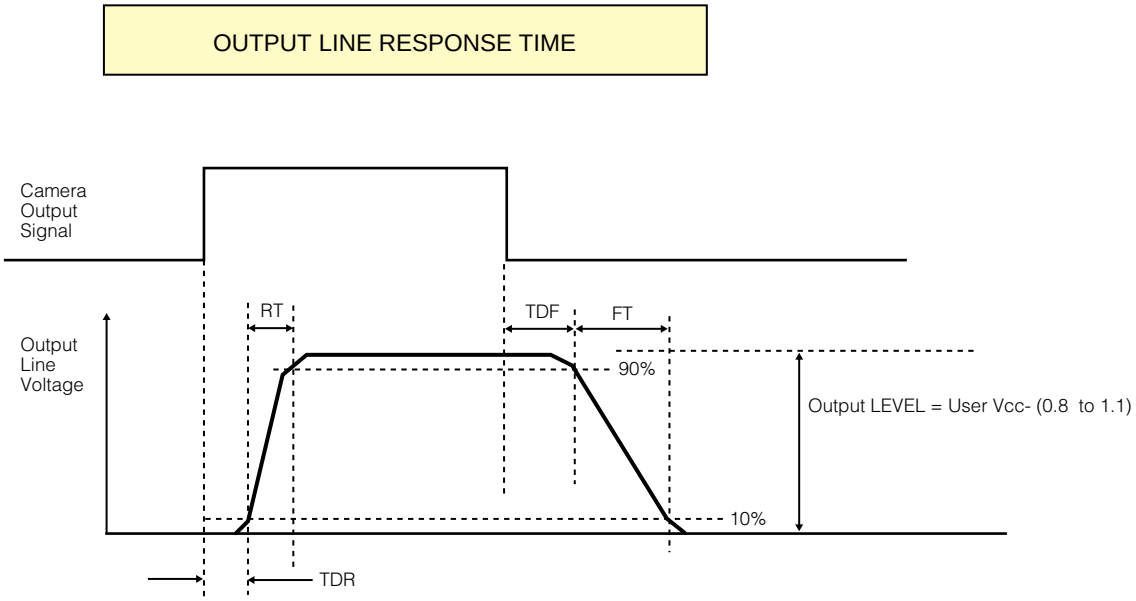


Recommended external output circuit diagram (reference example)

Standard circuit diagram example



Characteristics of the recommended circuits for Opto OUT



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

Use these holes when attaching an MP-43 tripod adapter plate (optional) or mounting the camera directly to a wall or other structural system.

❖ The smaller holes (×4) are M2 with a depth of 3 mm.

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, LAN cable, AC adapter, computer, and other devices.
Step 3	Verifying the Camera's Network Connection Status Verify whether the camera is ready for use via the LEDs at the rear of the camera.
Step 4	Verifying the Connection between the Camera and PC Verify whether the camera is properly recognized via eBUS Player for JAI.
Step 5	Changing the Camera Settings Refer to the procedure for changing the output format setting as an example, and Configuring Exposure and External Trigger Settings.
Step 6	Adjusting the Image Quality Refer to the procedures for adjusting the gain, white balance, and black level as examples.
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.

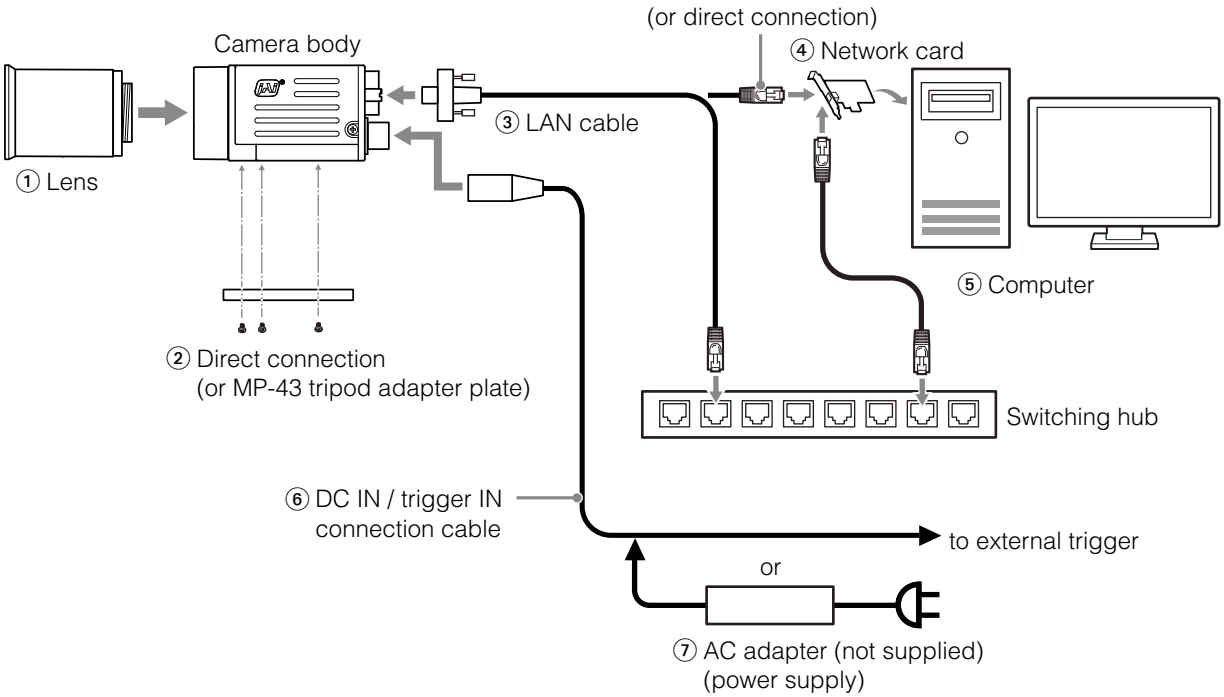
Caution

eBUS SDK for JAI was released in April 2018 and is the latest software for setting and controlling JAI cameras.

When JAI SDK and eBUS SDK for JAI are installed on the same machine, conflicts can occur. Therefore, JAI strongly recommends that JAI SDK is uninstalled before installing eBUS SDK for JAI.

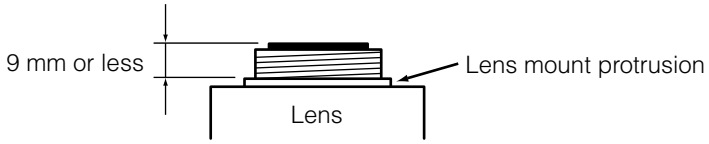
Step 2: Connecting Devices

Connect the lens, LAN cable, AC adapter, and other devices.
Attach the lens in a clean environment to prevent dust from adhering to the unit.



① Lens

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



- The diagonal of the camera's CMOS image sensor is 11 mm, the size of standard 2/3-inch lenses. To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the 11 mm diagonal. Some lens manufacturers offer lenses with an 11 mm format. If not, a 2/3-inch lens is recommended.

Caution

- The maximum performance of the camera may not be realized depending on the lens.
- Attaching a lens with a mount protrusion of 9.1 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 (sensor width is 8.5 mm on this camera)

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 locking screw holes on the camera. (Large: M3, small: M2, 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 LAN cable
Connect a LAN cable to the RJ-45 connector.
- Use a LAN cable that is Category 5e or higher (Category 6 recommended).
- When supplying power via PoE, connect to a PoE-compatible switching hub or a PoE-compatible network card.
- Refer to the specifications of the cable for details on its bend radius.

④ Network card
Install this in the computer that will be used to configure and operate the camera.
As the GO-5101-PGE supports PoE, you can also use PoE-compatible network cards.
Refer to the instruction manual of the network card, and configure settings on the computer as necessary.

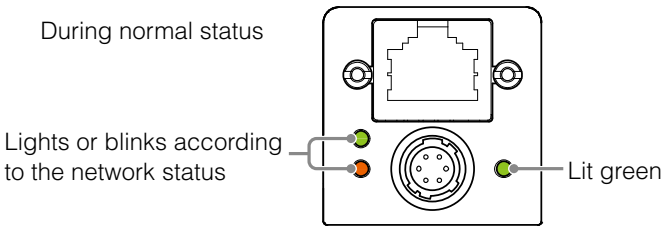
⑤ Computer
Use a computer that meets the following requirements.
Operating system (OS): Microsoft Windows 7/8 32-bit/64-bit edition
CPU: Intel Core i3 or higher
Memory: Windows 7/8 32-bit edition: DDR3, 4 GB or higher
Windows 7/8 64-bit edition: DDR3, 8 GB or higher
Graphics card: PCI-Express 3.0 or higher
Network card: We recommend using a network card that uses an Intel chip.

⑥ DC IN / trigger IN connection cable

⑦ 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.
❖ The AC adapter is not required when using PoE.

Step 3: Verifying the Camera's Network Connection Status

When power is supplied to the camera while the necessary equipment is connected, the power / trigger LED and ACT LED at the rear of the camera light amber, and initialization of the camera starts. When initialization is complete, the power / trigger LED lights green. The ACT LED and LINK LED will light or blink according to the network status.
Verify whether power is being supplied to the camera and whether the camera is connected to the network by checking the rear LEDs.



❖ For details on how to read the LEDs, see “LED status and camera status” (page 9) in the “Parts Identification” section.

Note

Initialization of the camera will not complete unless it is connected to the network. If the power / trigger LED does not switch to green within minutes of supplying power, check the LAN cable and other connections. After initialization is completed once, the power / trigger LED will remain green, even if the network is disconnected.

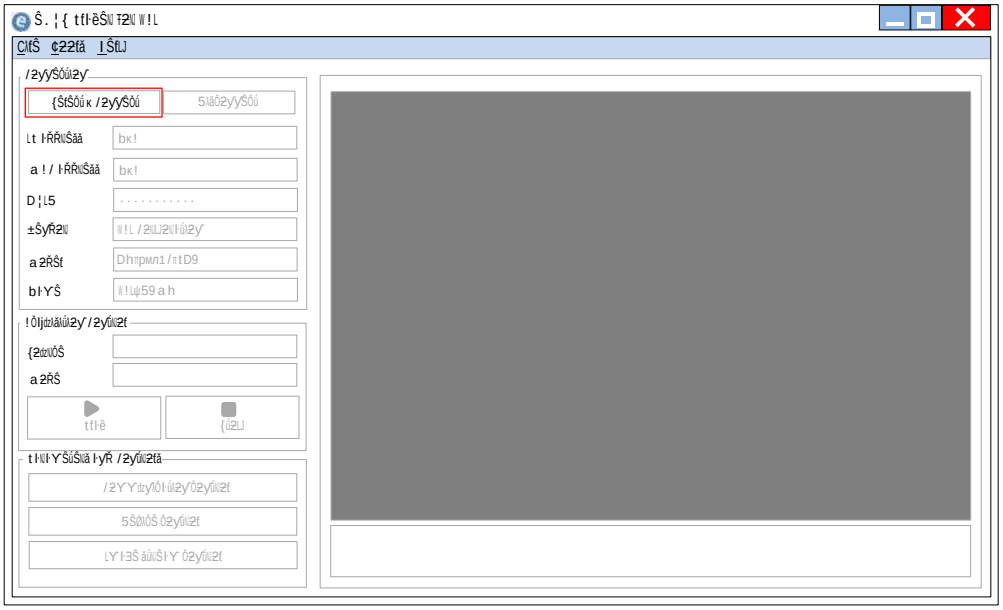
Step 4: Verifying the Connection between the Camera and PC

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

Connecting the Camera to eBUS Player for JAI.

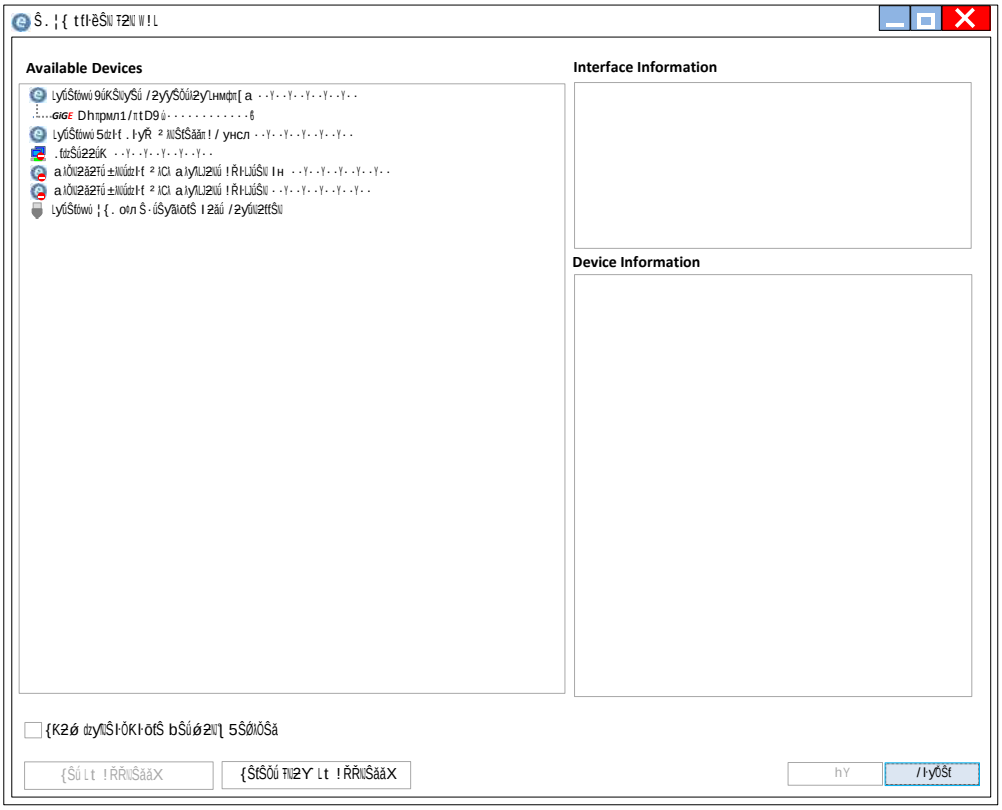
1 Startup eBUS Player for JAI

eBUS Player for JAI startup screen appears.



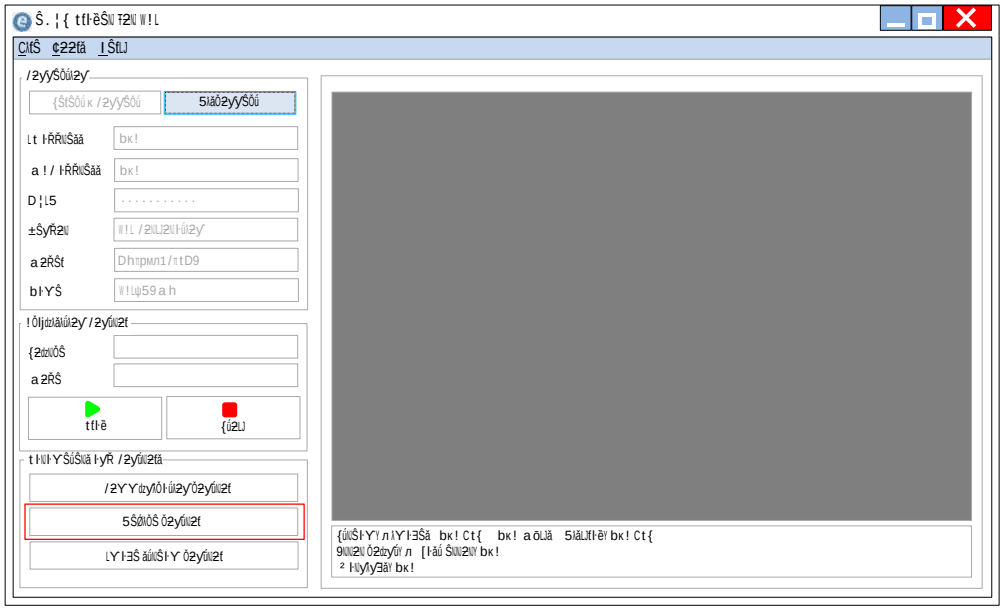
2 Select the camera you want to configure.

Push Select / Connect button

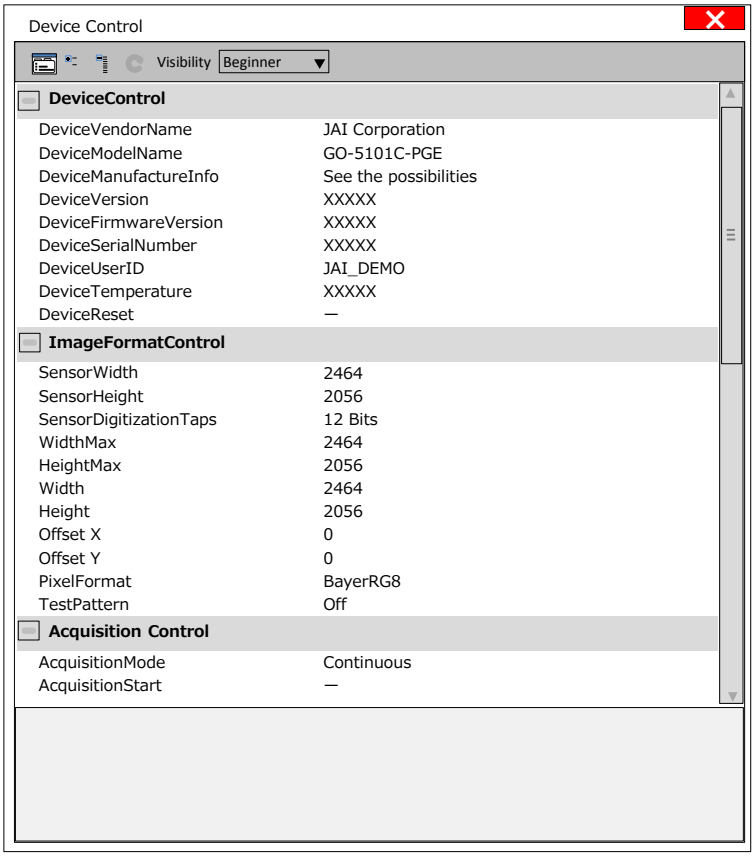


The connected camera is listed. Please select one camera.

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.

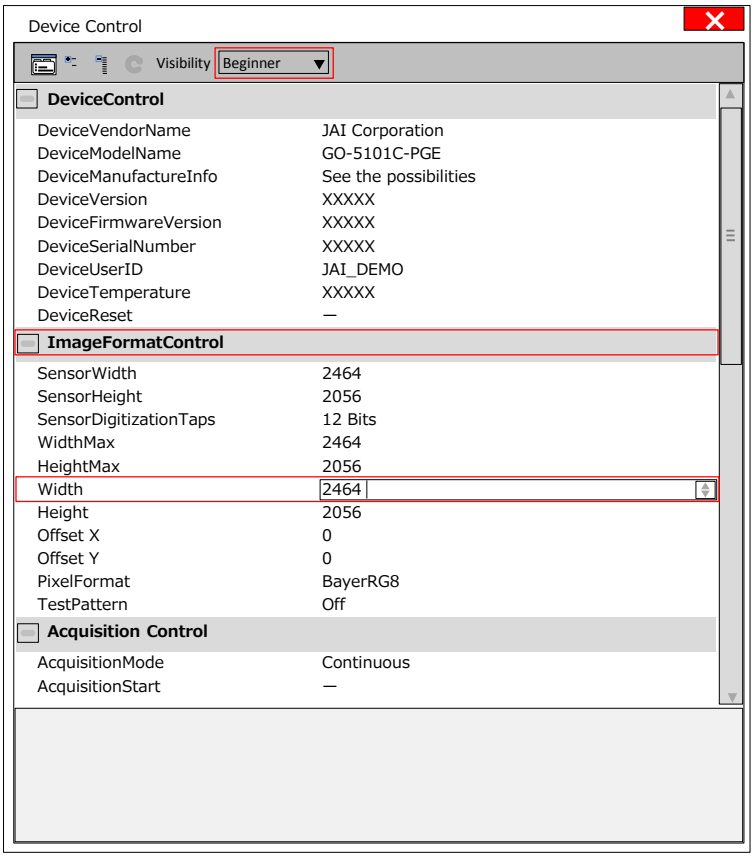
Factory default values

Item		Default value
ImageFormatControl	Width	2464
	Height	2056
	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.

Configuring Exposure and External Trigger Settings

Configure settings related to exposure control methods and trigger control.
The factory settings are as follows. Change settings as necessary, according to the intended purpose or application.

Factory default values

Item		Default value
Trigger Selector (trigger operation)		Frame Start
	Trigger Mode	Off
	Trigger Source (trigger signal source)	Line 5 - Optical In 1
	Trigger Activation (trigger polarity)	Rising Edge (rising edge of input signal)
Exposure Mode		Timed (control via exposure time)
Exposure Time		43864 (µs)
Exposure Auto*		Off

* This item is only enabled when [Exposure Mode] is set to [Timed].

Caution

When [Exposure Mode] is set to [Off], [Trigger Mode] cannot be set to [On]. Other settings may also be restricted depending on the exposure mode, so be sure to set the exposure mode before configuring the trigger settings.
Adjusting Packet Size: With [Trigger Mode] set to [Off] and [Exposure Mode] set to [Continuous], clicking the (Start Acquisition) button should produce a live image. If, however, you can only see a black screen, it may be the result of the packet size setting in the camera being larger than the packet size setting in the GigE NIC or switch. To correct the problem, you can either reduce the [Packet Size] setting to a value less than 1500 in the JAI Control Tool (under [Transport Layer Control] / [Stream Channel Selector], or set your NIC or switch to support "Jumbo Frames." This setting is typically found in the Advanced Adapter Settings for the NIC or switch which can be accessed through the Device Manager on your PC.

■ Control via External Triggers

When Controlling the Exposure Time Using Specified Exposure Times

Configure the settings as follows.

Item		Setting value / selectable range
Trigger Selector (trigger operation)		Frame Start
	Trigger Mode	On
	Trigger Source (trigger signal source)	Any
	Trigger Activation (trigger polarity)	Rising Edge (rising edge of input signal), Falling Edge (falling edge of input signal)
Exposure Mode		Timed (control via exposure time)
Exposure Time		8 bit: 1 to 7999810 (µs)*1 10-/12-bit: 1 to 7999630 (µs)*1
Exposure Auto		Off, Continuous

* 1 The maximum value for [Exposure Time] varies depending on the value configured for the [Acquisition Frame Rate] setting and the [Pixel Format] setting.
The minimum value will differ depending on the [Pixel Format] setting value.

❖ The actual exposure time will consist of the image sensor's offset duration (13.7 µs) added to the setting configured on the camera.
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.

1 Set [Exposure Mode] to [Timed].

([Timed] is the default setting.)

2 Specify the exposure time in [Exposure Time].

The setting value for the exposure time can only be changed when [Exposure Auto] is set to [Off]. If [Exposure Auto] is set to [Continuous], temporarily set it to [Off] before changing the exposure time.

3 Set [Trigger Selector] to [Frame Start].

([Frame Start] is the default setting.)

4 Set [Trigger Mode] to [On].

5 If necessary, change the [Trigger Source], [Trigger Activation], and [Exposure Auto] settings.

When Controlling the Exposure Time using the Pulse Width of the Trigger Input Signal

Configure the settings as follows.

Item		Setting value / selectable range
Trigger Selector (trigger operation)		Frame Start
	Trigger Mode	On
	Trigger Source (trigger signal source)	Any
	Trigger Activation (trigger polarity)	Level High (high-level duration), Level Low (low-level duration)
Exposure Mode		Trigger Width (control via trigger width)

1 Set [Exposure Mode] to [Trigger Width] .

When you select [Trigger Width], [Trigger Mode] will automatically be set to [On].

2 Set [Trigger Selector] to [Frame Start].

([Frame Start] is the default setting.)

3 If necessary, change the [Trigger Source] and [Trigger Activation] settings.

Other controls

In addition to exposure time, the following can also be controlled by external triggers. Select these control operations in [Trigger Selector].

[Trigger Selector] setting	Description
Acquisition Start	Start image acquisition.
Acquisition End	Stop image acquisition.
Acquisition Transfer Start	Output acquired images at a specified timing. (Up to 7 frames for 8-bit, and up to 3 frames for 10-/12-bit.)

■ Control Without External Triggers

When Controlling the Exposure Time Using Specified Exposure Times

Configure the settings as follows.

Item	Setting value / selectable range
Trigger Selector (trigger operation)	Frame Start
Trigger Mode	Off
Exposure Mode	Timed (control via exposure time)
Exposure Time	8 bit: 1 to 7999810 (µs)*1 10-/12-bit: 1 to 7999630 (µs)*1
Exposure Auto	Off, Continuous

* 1 The maximum value for [Exposure Time] varies depending on the value configured for the [Acquisition Frame Rate] setting and the [Pixel Format] setting.
The minimum value will differ depending on the [Pixel Format] setting value.

❖ The actual exposure time will consist of the image sensor's offset duration (13.7 µs) added to the setting configured on the camera.
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.

1 Set [Exposure Mode] to [Timed].
([Timed] is the default setting.)

2 Specify the exposure time in [Exposure Time].
The setting value for the exposure time can only be changed when [Exposure Auto] is set to [Off]. If [Exposure Auto] is set to [Continuous], temporarily set it to [Off] before changing the exposure time.

3 Set [Trigger Mode] to [On].

4 If necessary, change the [Exposure Auto] setting.

When not Controlling the Exposure Time

Configure the settings as follows.

Item	Setting value / selectable range
Exposure Mode	Off

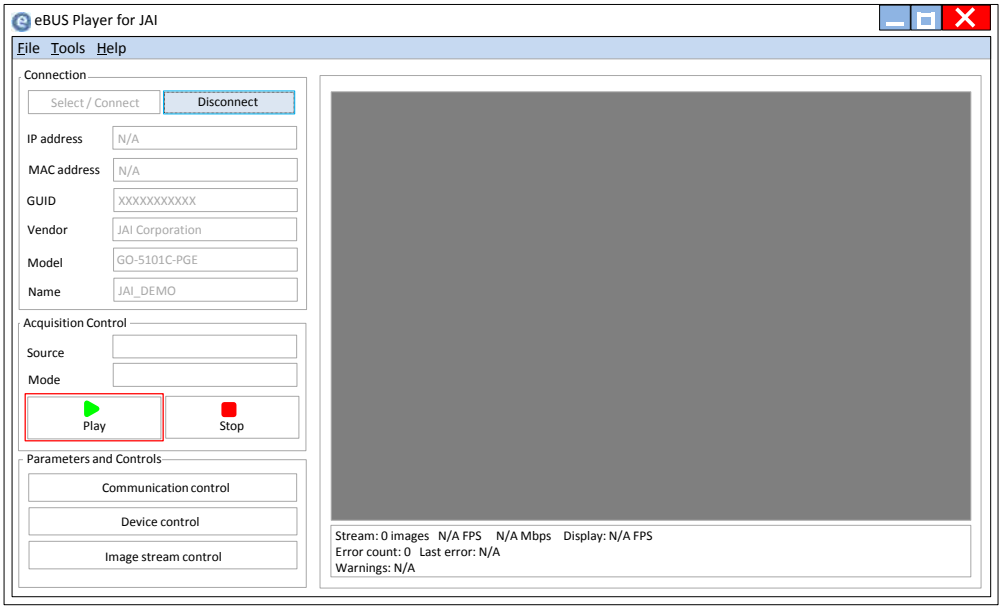
The exposure will be performed with an exposure time equal to 1 / frame rate.

Step 5: 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 sensitivity via the analog gain (i.e., master gain).

❖ For details on gain control, see “Gain Control” (page 32) in the “Main Functions” section.

■ Manual adjustment

1 Expand [Analog Control], and set [Gain Auto] to [Off].

([Off] is the default setting.)

2 Configure the gain.

❶ Expand [Analog Control], and select the gain you want to configure in [Gain Selector].

- For the GO-5101M-PGE, only [Analog All] (master gain) can be configured.
- For the GO-5101C-PGE, [Analog All] (master gain), [Digital Red] (digital R gain), and [Digital Blue] (digital B gain) can be configured individually.

❷ Configure the gain value in [Gain].

- [Digital All] (master gain) can be set to a value from x1 to x16 (0 dB to +24 dB) the analog gain value. The resolution is set in x0.01 steps (0.05 dB to 0.08 dB depending on the setting value). Values are configured by multipliers. For example, the values set for x1 and x16 are 100 and 1600 respectively.
- For the GO-5101C-PGE, the [Digital Red] (digital R gain) and [Digital Blue] (digital B gain) can be set to a value from x0.45 to x5.62 (–7 dB to +15 dB) the [Digital All] (master gain) value. The resolution is set in 0.1 dB steps. Specify 0 for 0 dB, negative values for settings below 0, and positive values for settings above 0.

Adjusting the White Balance (GO-5101C-PGE only)

Adjust the white balance using R and B gain. The white balance can also be adjusted automatically.

■ Manual white balance adjustment

1 Expand [Analog Control], and set [Balance White Auto] to [Off].

([Off] is the default setting.)

2 Select the gain to configure in [Gain Selector], and set the gain value in [Gain].

■ 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 [Balance White Auto] tab, and click [Continuous] or [Once] depending on your intended application.

The white balance is automatically adjusted.

Adjusting the Black Level

1 Expand [Analog Control], and select the black level you want to configure in [Black Level Selector].

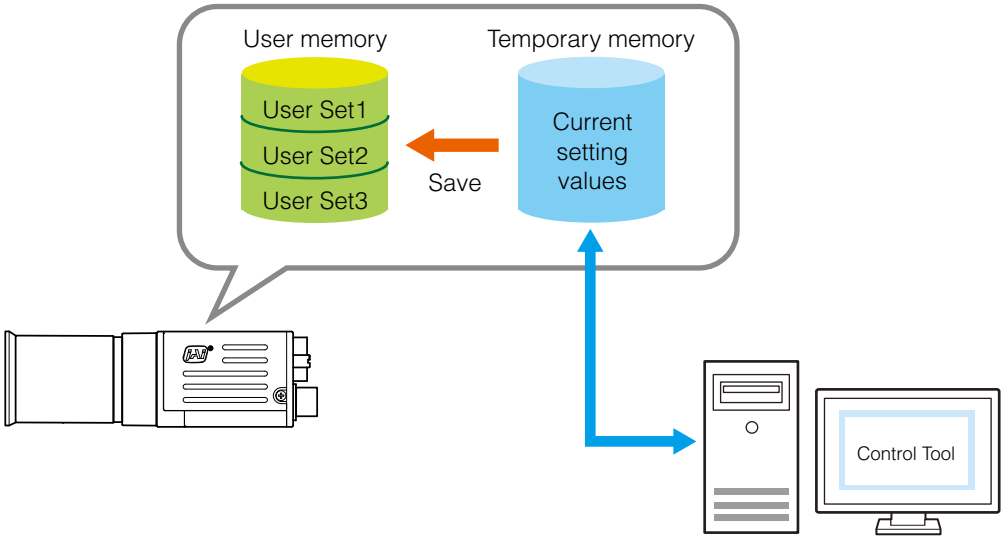
For the GO-5101M-PGE, only [Digital All] (master black) can be configured.

For the GO-5101C-PGE, [Digital All] (master black), [Digital Red] (digital R), and [Digital Blue] (digital B) can be configured individually.

2 Specify the adjustment value in [Black Level].

Step 7: Saving the Settings

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



Note

Changes to settings are not saved to the computer (Control Tool).

■ To save user settings

1 Stop image acquisition.

2 Expand [User Set Control], and select the save destination ([User Set1] to [User Set3]) in [User Set Selector].

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 [User Set Save], and click [Execute 'User Set Save' 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 (User Set1 to User Set3) in [User Set Selector].

3 Select [User Set Load], and click [Execute 'User Set Load' Command].

The selected user settings are loaded.

Basic Function Matrix

The combinations of settings for the basic functions that can be used together are as follows.

Exposure Mode	Frame Start Trigger	Binning Vertical*1	Binning Horizontal*1	Exposure Time	ROI	Balance White Auto*2	Gain Auto	Exposure Auto	Sequencer	
									Trigger Sequencer Mode	Command Sequencer Mode
Off	Off	1 × 1 (Off)		×	○	○	○	×	×	×
		1 × 2		×	○	—	○	×	×	×
		2 × 1		×	○	—	○	×	×	×
		2 × 2		×	○	—	○	×	×	×
Timed	Off	1 × 1 (Off)		○	○	○	○	○	×	○
		1 × 2		○	○	—	○	○	×	○
		2 × 1		○	○	—	○	○	×	○
		2 × 2		○	○	—	○	○	×	○
Timed (EPS)	On	1 × 1 (Off)		○	○	○	○	○	○	○
		1 × 2		○	○	—	○	○	○	○
		2 × 1		○	○	—	○	○	○	○
		2 × 2		○	○	—	○	○	○	○
Trigger Width	On	1 × 1 (Off)		×	○	○	○	×	×	×
		1 × 2		×	○	—	○	×	×	×
		2 × 1		×	○	—	○	×	×	×
		2 × 2		×	○	—	○	×	×	×

*1 Operates only on the GO-5101M-PGE
*2 Operates only on the GO-5101C-PGE

Main Functions

GPIO (Digital Input/Output Settings)

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

Valid Input/Output Combinations

The following signals can be used as sources for each output destination (Trigger Selector, Line Selector, Pulse Generator Selector).
You can also connect two different sources to NAND paths in the GPIO and reuse the signal generated there as a source for a different selector.

The combinations of source signals and output destinations are indicated in the following.

Selector (Cross point switch output) / Source signal (Cross point switch input)		Output destination											
		Trigger Selector				Line Selector							Pulse Generator Selector
		Acquisition Start	Acquisition Stop	Frame Start	Transfer Start	Line2 OPT Out 1 (GPIO 1)	Line3 OPT Out 2 (GPIO 2)	Time Stamp Reset	NAND 0 In 1	NAND 0 In 2	NAND 1 In 1	NAND 1 In 2	Pulse Generator 0
Signals to use as output	LOW	○	○	○	○	○	○	○	○	○	○	○	○
	HIGH	○	○	○	○	○	○	○	○	○	○	○	○
	Line5 OPT 1 In	○	○	○	○	○	○	○	○	○	○	○	○
	NAND 0 Out	○	○	○	○	○	○	○	×	×	○	○	○
	NAND 1 Out	○	○	○	○	○	○	○	○	○	×	×	○
	Pulse Generator 0	○	○	○	○	○	○	○	○	○	○	○	×
	User Output 0	○	○	○	○	○	○	○	○	○	○	○	○
	User Output 1	○	○	○	○	○	○	○	○	○	○	○	○
	Software Trigger	○	○	○	○	×	×	○	×	×	×	×	×
	Action 1	○	○	○	○	×	×	×	×	×	×	×	○
	Action 2	○	○	○	○	×	×	×	×	×	×	×	○
	FVAL	×	×	×	×	○	○	○	○	○	○	○	○
	LVAL	×	×	×	×	×	×	○	×	×	×	×	○
	Exposure Active	×	×	×	×	○	○	○	○	○	○	○	○
	Frame Trigger Wait	×	×	×	×	○	○	○	○	○	○	○	○
	Frame Active	×	×	×	×	○	○	○	○	○	○	○	○
	Acquisition Trigger Wait	×	×	×	×	○	○	○	○	○	○	○	○
		Trigger Source				Line Source							Pulse Generator Clear Source
		Use											

: Indicates default values for each selector. “Factory default values” (page 17) shows the default values for [Frame Start].

Acquisition Control (Image Acquisition Controls)

Perform operations and configure settings related to image acquisition in [Acquisition Control].

The following acquisition modes are available on the camera.

Acquisition Mode	Description
Single Frame	Acquire a single frame when the [Acquisition Start] command is executed.
Multi Frame	Acquire the number of frames specified in [Acquisition Frame Count] when the [Acquisition Start] command is executed.
Continuous	Acquire images continuously until the [Acquisition Stop] command is executed.

Changing the Frame Rate

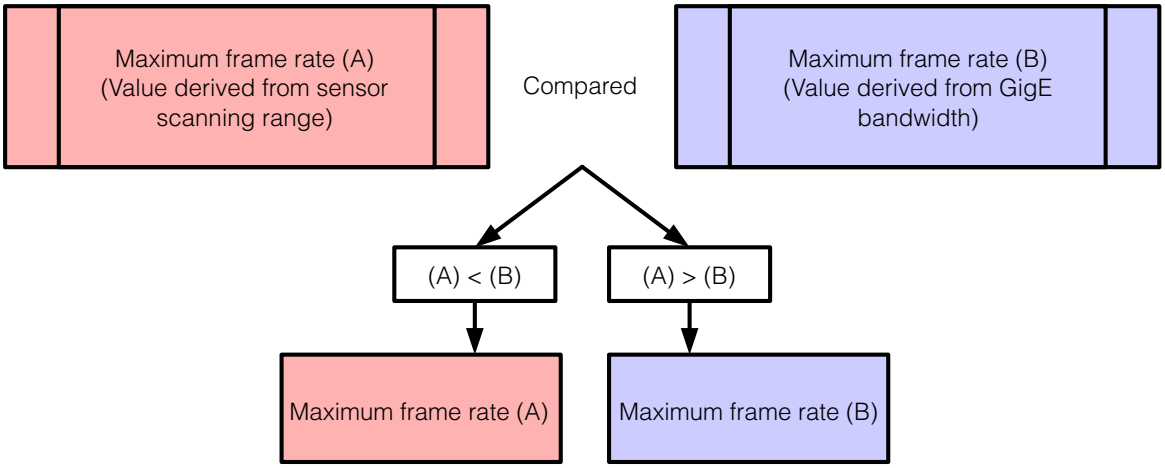
When [Trigger Mode] is disabled, you can change the frame rate in [Acquisition Frame Rate].

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 [Trigger Mode] is enabled, the [Acquisition Frame Rate] setting is disabled.

Maximum Frame Rate

The maximum frame rate is as follows depending on the sensor's scanning range and the GigE bandwidth.



■ Maximum frame rate period formula

During continuous operation ([Frame Start] trigger is [Off] or [Exposure Mode] is [Off])

- Maximum frame rate of sensor
  Sensor FR = 1 / {H Period × (Height + 34)}
- Maximum frame rate by interface
  Interface FR = 920 × 1000000 / (Height × Width × Pack value)
- Maximum frame rate
  FR_Cont = Min (Sensor FR, Interface FR)

When the exposure time is longer than the frame interval

- Maximum exposure time at maximum frame rate
  MaxExposureTime_TrOlrd = (1 / FR_Cont) - (14 × H Period)
- Exposure time outside of frame interval
  NonOverlapExposureTime = ExposureTime - MaxExposureTime_TrOlrd
  However, NonOverlapExposureTime calculation results that are 0 or below will be considered as 0.
- Maximum frame rate
  FR_ContLongExposure = 1/{(1/FR_Cont) + NonOverlapExposureTime}

When [Frame Start] trigger is [On] and [Trigger OverLap] is [Off]

- Maximum frame rate of sensor
  Sensor FR = 1 / {H Period × (Height + 34)}
- Maximum frame rate by interface
  Interface FR = 920 × 1000000 / (Height × Width × Pack value)
- Maximum frame rate
  FR_TrOloff = Min (Sensor FR, Interface FR)

- Exposure time possible within frames
  MaxOverlapTime_TrOloff = (1 / FR_TrOloff) - (1 / Sensor FR)
- Exposure time outside of frame interval
  NonOverlapExposureTime_TrOloff = ExposureTime - MaxOverlapTime_TrOloff
  However, NonOverlapExposureTime_TrOloff calculation results that are 0 or below will be considered as 0.
  For TriggerWidth, the trigger pulse is equivalent to ExposureTime.
- Maximum frame rate
  FR_TrOloff = 1 / {(1 / FR_TrOloff) + NonOverlapExposureTime_TrOloff}

When [Frame Start] trigger is [On] and [Trigger OverLap] is [Readout]

- Maximum frame rate of sensor
  Sensor FR = 1 / {H Period × (Height + 34)}
- Maximum frame rate by interface
  Interface FR = 920 × 1000000 / (Height × Width × Pack value)
- Maximum frame rate
  FR_TrOloff = Min (Sensor FR, Interface FR)

- Exposure time possible within frames
  MaxOverlapTime_TrOlrd = (1 / FR_TrOloff) - (14 × H Period)
- Exposure time outside of frame interval
  NonOverlapExposureTime_TrOlrd = ExposureTime - MaxOverlapTime_TrOlrd
  However, NonOverlapExposureTime_TrOlrd calculation results that are 0 or below will be considered as 0.
  For TriggerWidth, the trigger pulse is equivalent to ExposureTime.
- Maximum frame rate
  FR_TrOlrd = 1 / {(1 / FR_Cont) + NonOverlapExposureTime_TrOlrd}

Pixel Format	Binning settings	Output area		H period	Pack value	Frame rate (fps)
		Height	Width			
8-bit	B.V&B.H 1	2056	2464	13.414 µs	8	22.7
	BV 2/BH 1 (Mono)	1028	2464			45.4
	BV 1/BH 2 (Mono)	2056	1232			35.6
	B.V & B.H 2 (Mono)	1028	1232			69.8
10-/12-bit *1	B.V&B.H 1	2056	2464	26.343 µs	16	11.3
	BV 2/BH 1 (Mono)	1028	2464			18.1
	BV 1/BH 2 (Mono)	2056	1232			35.6
	B.V & B.H 2 (Mono)	1028	1232			35.5
10-/12-bit packed *1	B.V&B.H 1	2056	2464	26.343 µs	12	15.1
	BV 2/BH 1 (Mono)	1028	2464			30.2
	BV 1/BH 2 (Mono)	2056	1232			18.1
	B.V & B.H 2 (Mono)	1028	1232			35.5

* The values during [Continuous]

*1) 12-bit binning is not supported.

Caution

Although the maximum frame rate value is determined by the GigE bandwidth range, when ROI is configured, the frame rate cannot exceed the sensor output's allowable frame rate value.

Exposure Mode

The following exposure modes are available on the camera.

Exposure Mode	Description
Off	Exposure control is not performed (free-running operation).
Timed	Mode in which control is performed using exposure time. Acquire images using an exposure time configured beforehand on an external trigger.
Trigger Width	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. This allows long exposure.

❖ The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in “Configuring Exposure and External Trigger Settings” (page 17).

Trigger Control

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

Trigger Selector	Description
Frame Start	Start exposure in response to the external trigger signal input. Select this to perform exposure control using external triggers.
Acquisition Start	Start image acquisition in response to the external trigger signal input.
Acquisition End	Stop image acquisition in response to the external trigger signal input.
Acquisition Transfer Start	Output acquired images at a specified timing in response to an external trigger signal input. (Up to 7 frames for 8-bit, and up to 3 frames for 10-/12-bit.)

❖ The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in “Configuring Exposure and External Trigger Settings” (page 17).

Shortest Repetition Period for Triggers

The reciprocal of the maximum frame rate is the time required to output one frame. The shortest repetition periods for triggers cannot be lower than that value.

Scanning range	Shortest period		
	8-bit (at 14 µs)	10-bit packed (at 27 µs)	10-bit (at 27 µs)
Full	44.05 ms	66.08 ms	88.10 ms
ROI 2/3 (Height = 1370)	19.56 ms	37.14 ms	39.12 ms
ROI 1/2 (Height = 1028)	14.32 ms	28.13 ms	28.13 ms
ROI 1/4 (Height = 514)	7.43 ms	14.59 ms	14.59 ms
ROI 1/8 (Height = 257)	3.98 ms	7.82 ms	7.82 ms
Binning Vertical 2*	22.03 ms	33.04 ms	44.05 ms

The values in parentheses indicate exposure time.

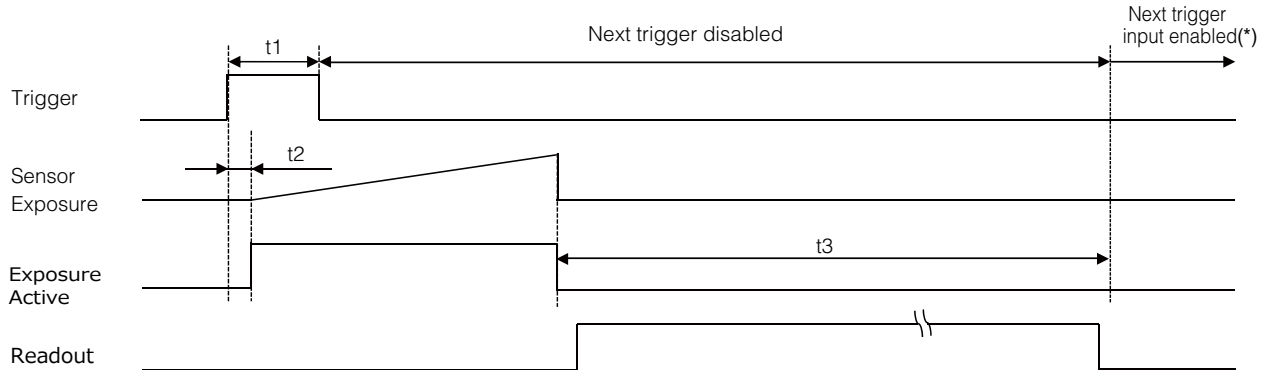
* GO-5101M-PGE only

The shortest periods of trigger in the table above are values for when the trigger overlap is set to “Readout.” When the trigger overlap is set to “Off,” the exposure time will be added to the periods.

■ When [Exposure Mode] is [Timed]

Example: When [Trigger Source] is set to [Line 5 - Optical In 1] and [OptIn Filter Selector] is set to [10 µs]

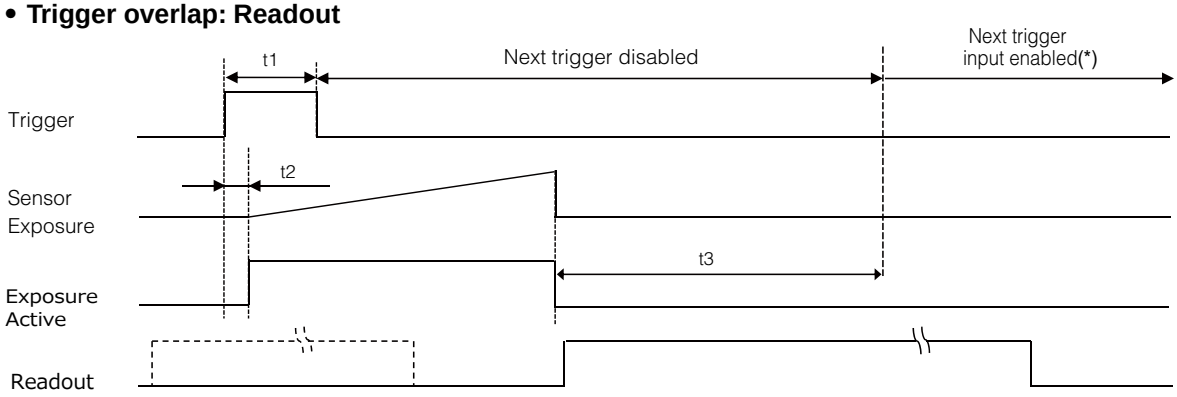
- **Trigger overlap: Off**



	t1	t2	t3 (Minimum)
8 bit	10 µs (Minimum)	40 µs	28 ms
10 bit packed		79 µs	55 ms
10 bit			

* If the exposure time is longer than (input trigger cycle - t3), the next trigger input can not be accepted.

• **Trigger overlap: Readout**



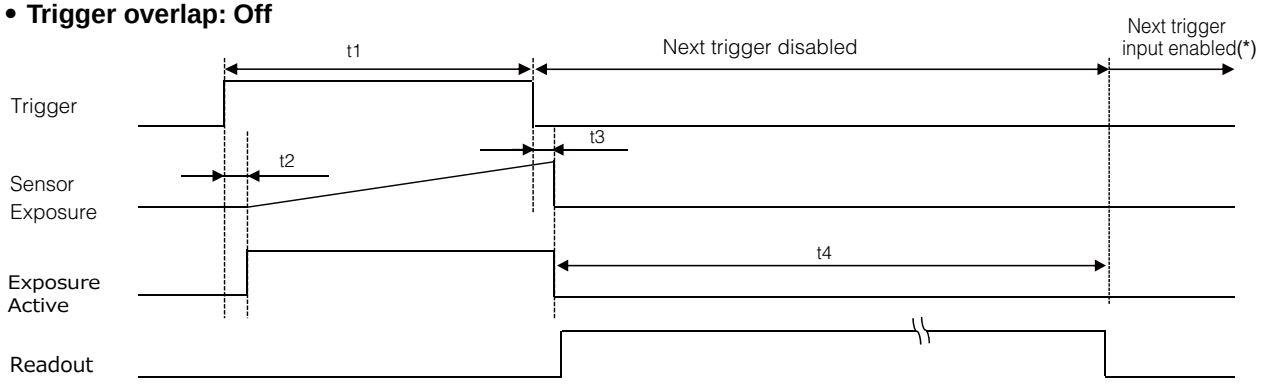
	t1	t2	t3 (Minimum)
8 bit	10 μs (Minimum)	40 μs	173 μs
10 bit packed		79 μs	328 μs
10 bit			

* If the exposure time is longer than (input trigger cycle - t3), the next trigger input can not be accepted.

■ When [Exposure Mode] is [Trigger Width]

Example: When [Trigger Source] is set to [Line 5 - Optical In 1] and [OptIn Filter Selector] is set to [10 µs]

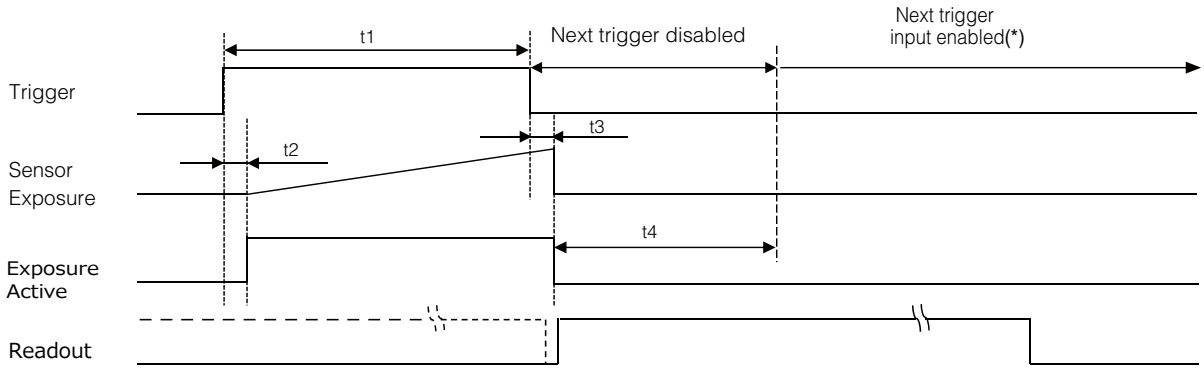
• **Trigger overlap: Off**



	t1	t2	t3	t4 (Minimum)
8 bit	10 μs (Minimum)	40 μs	40 μs	28 ms
10 bit packed		79 μs	79 μs	55 ms
10 bit				

* If the exposure time is longer than (input trigger cycle - t4), the next trigger input can not be accepted.

• **Trigger overlap: Readout**



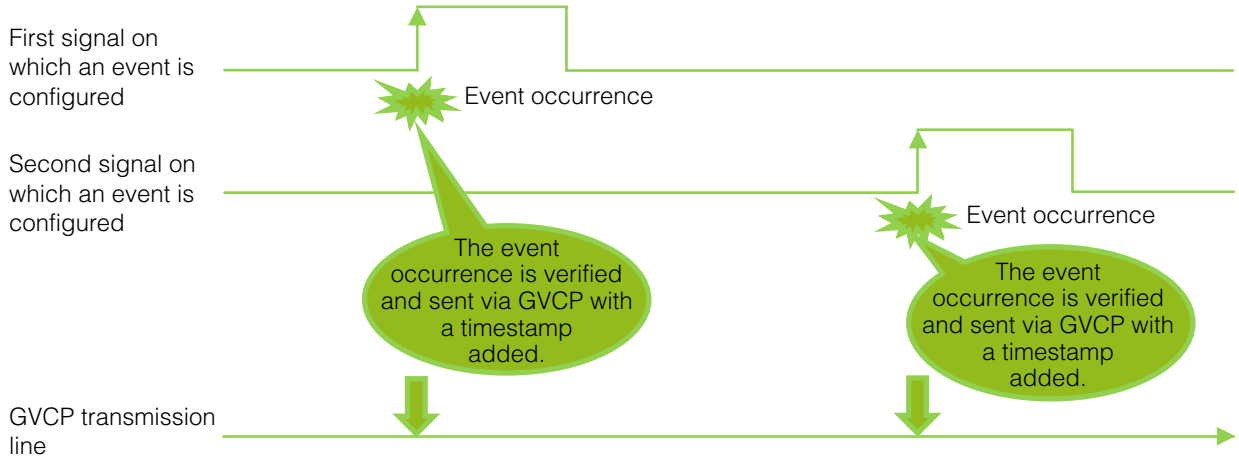
	t1	t2	t3	t4 (Minimum)
8 bit	10 μs (Minimum)	40 μs	40 μs	173 μs
10 bit packed		79 μs	79 μs	328 μs
10 bit				

* If the exposure time is longer than (input trigger cycle - t3), the next trigger input can not be accepted.

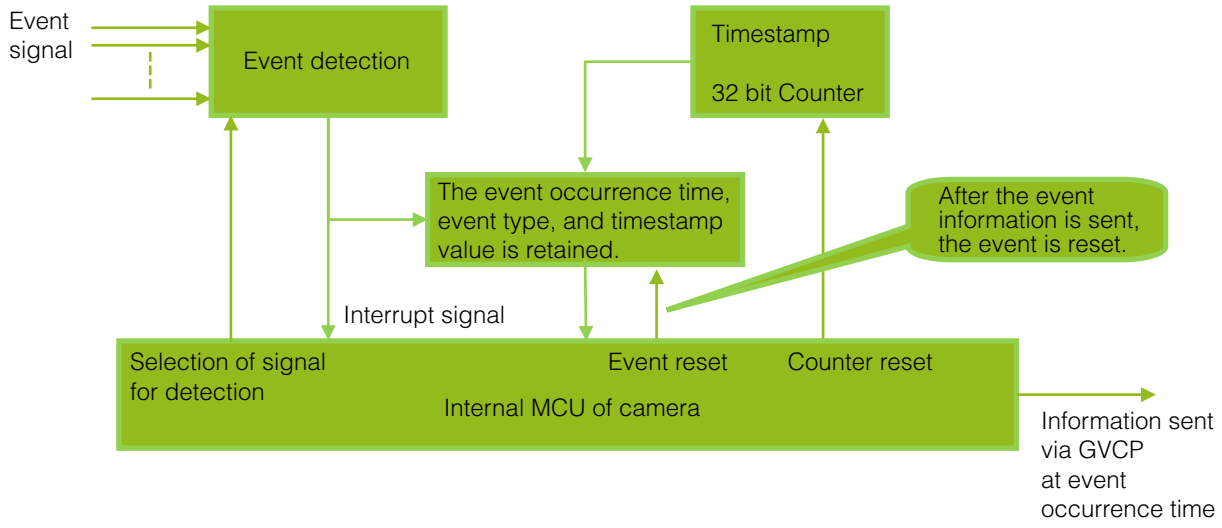
Event Control

"Event control" is a function that uses GVCP (GigE Vision Control Protocol) to output points of change in the camera's internal signal as event occurrence information or "event messages." When this information is output, the camera's internal timestamp counter value is added.

■ Event message occurrence diagram



■ Internal camera blocks



■ To use the event control function

Configure the settings as follows.

Item	Setting value / selectable range	Description
Event Selector	AcquisitionTrigger, FrameStart, FrameEnd, FVAL Start, FVAL End, ExposureStart, ExposureEnd, Line2RisingEdge, Line2FallingEdge, Line3RisingEdge, Line3FallingEdge, Line5RisingEdge, Line5FallingEdge	Select the event for which to send notifications.
Event Notification	On	Output event messages.

Note

[Event Notification] is set to [Off] and event messages will not be output under factory default settings.

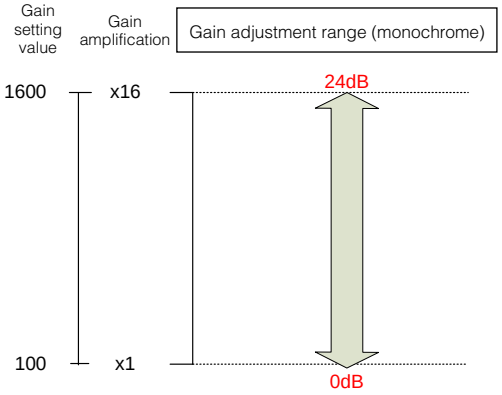
Gain Control

[Analog All] can be used for gain control for both the monochrome and color camera. [Analog All] (master gain) uses the sensor's internal gain function and consists of analog gain + digital gain. Analog gain is used for lower gain, and analog gain + digital gain is used when the gain becomes high. R and B can be configured individually as digital gain on the GO-5101C-PGE.

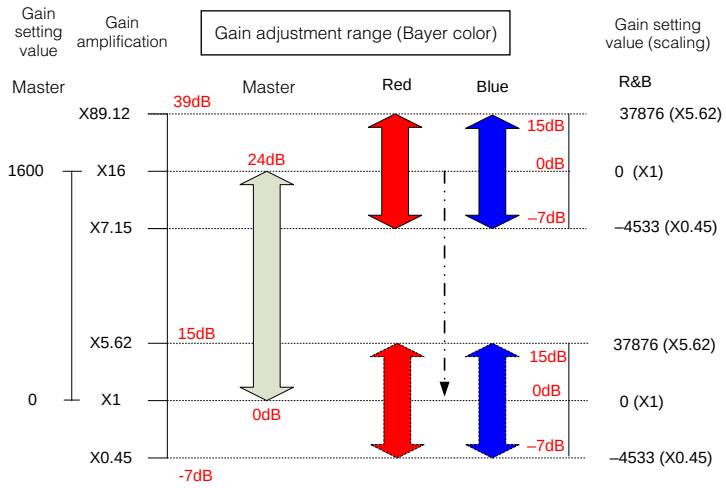
❖ For details on how to configure the settings, see “Adjusting the Gain” (page 21).

The relationship between the gain setting value, gain amplification, and dB value is as follows. For example, a gain amplification of x5.62 will be 15 dB.

Monochrome



Bayer color



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
JAI LUT Mode	LUT	Use LUT.
LUT Selector*	GO-5101M-PGE: Mono GO-5101C-PGE: Red, Gree, Blue	Select the LUT channel to control.
LUT Index	GO-5101M-PGE: 0 to 256 GO-5101C-PGE: 0 to 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 255 represents a full white pixel.
LUT Value	0 to 4095	Set the LUT output value for the selected index.

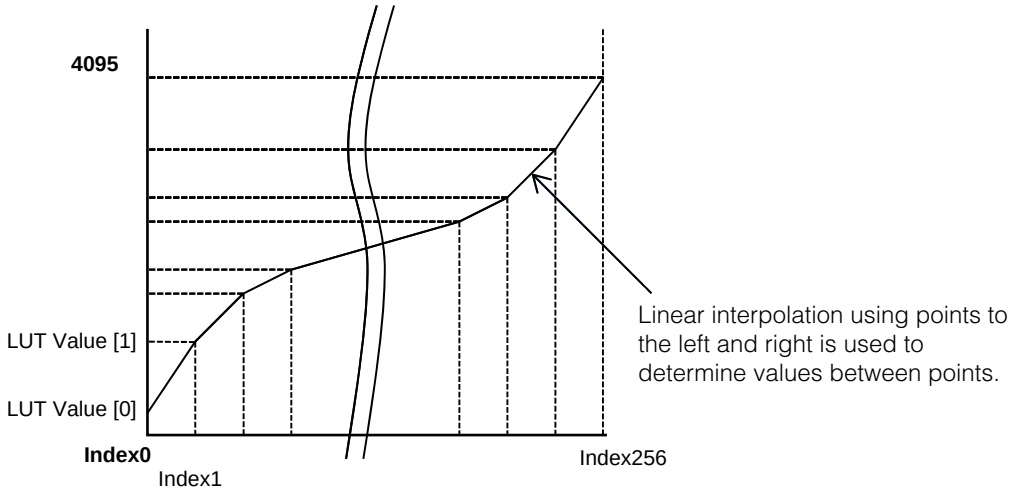
* GO-5101C-PGE only

Note

For the GO-5101C-PGE, the same characteristic curve is configured for R, G, and B.

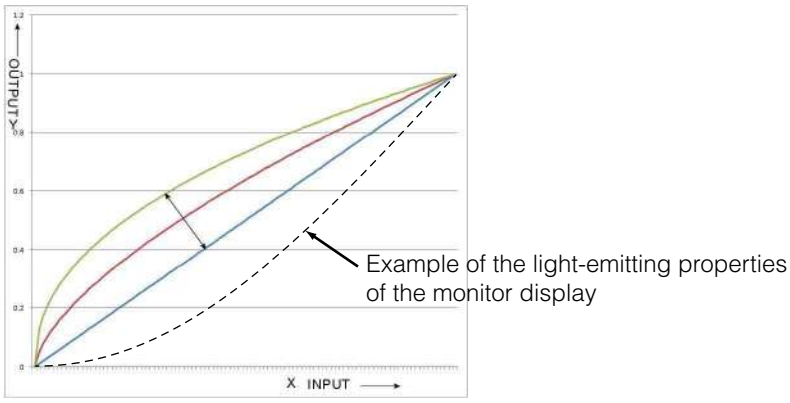
■ LUT values

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



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, 0.60, 1.0 (Off)	Select the gamma correction value.
JAI LUT Mode	Gamma	Use gamma.

Note

You can use the LUT function to configure a curve with more detailed points. For details, see “LUT (Lookup Table)” (page 33).

Line Status

The line status function allows you to verify the status of external input/output signals.
You can verify the status of the following signals.

- Opt Out 1, Opt Out 2, Opt In 1
- Time Stamp Reset
- NAND Gate 0 In 1, NAND Gate 0 In 2, NAND Gate 1 In 1, NAND Gate 1 In 2

Defective Pixel Correction Function

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 511 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.

Specify the threshold value for the blemishes to be detected using the [JAI Custom Control Blemish] - [Blemish Detect Threshold] setting.

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 [Blemish Detect] 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 [Blemish Detect Position Index].

You can select from 0 to 511. 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 [Blemish Detect Position X] and [Blemish Detect Position Y] settings.

Each point is saved to the camera's internal memory as you configure them.

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.

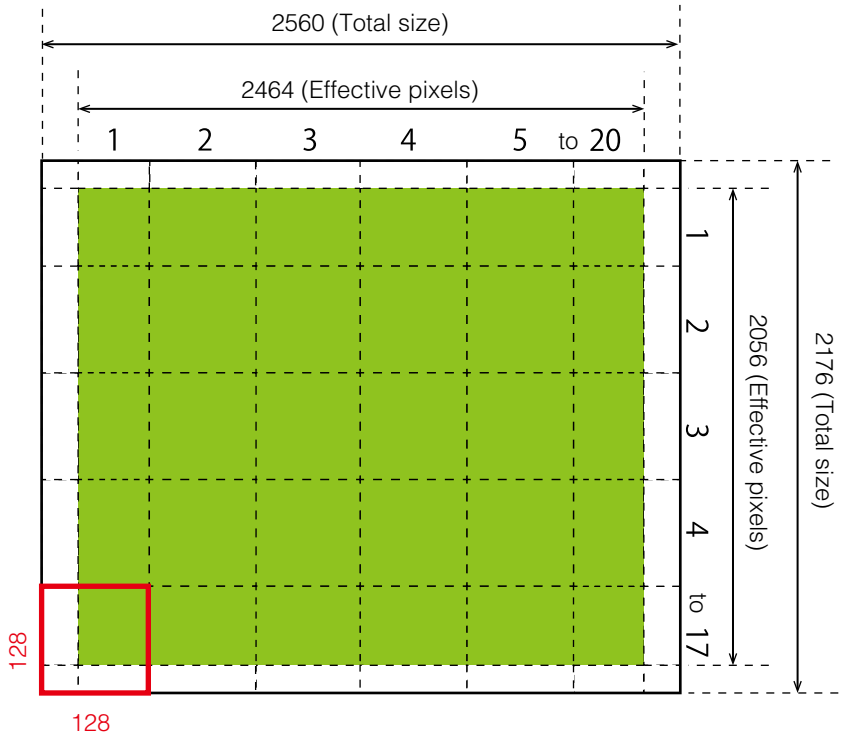
3 Set [Blemish Enable] to [True], and execute interpolation.

If [False] is specified, defective pixel interpolation is disabled.

Shading Correction

The shading correction is a function that 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).

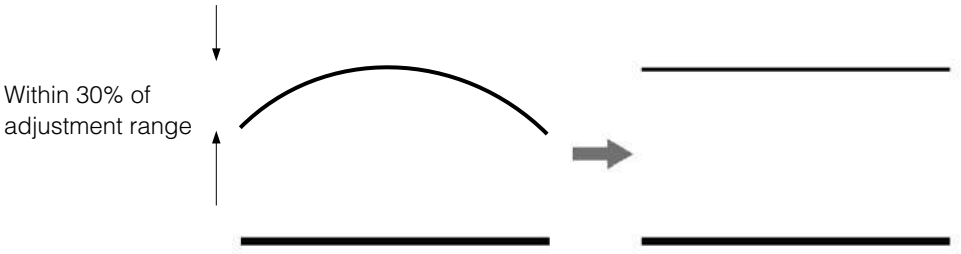
The size of the correction block is 20 (H) × 17 (V) blocks and calculation errors in the correction data are minimized due to the small interpolation block. Each block is 128 × 128 pixels.
The total size of the blocks is 2560 (H) × 2176 (V), but the actual number of effective pixels for the camera is 2464 (H) × 2056 (V). The ineffective peripheral areas will be deleted internally on the camera automatically.



The following shading correction modes are available on the camera.

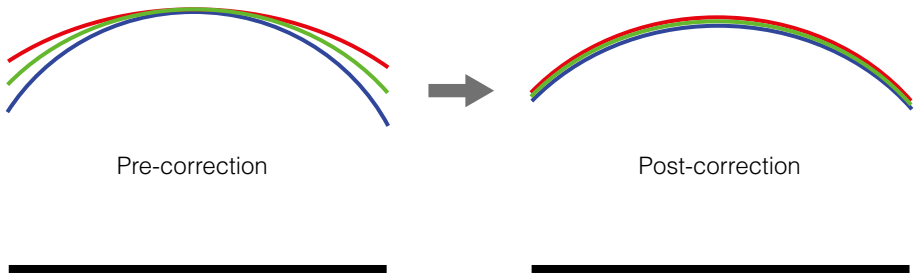
■ Flat Shading

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.



■ Color Shading (GO-5101C-PGE only)

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



Caution

Proper correction is not possible under the following conditions.

- If an area with a brightness level that is more than 30% less than the reference level exists within the screen
- If the brightness level is saturated in parts or all of the screen
- If the area in the screen with the highest brightness level is 300 LSB or less (during 10-bit video output)

■ To use the shading correction function

Configure the settings as follows.

Item	Setting value	Description
Shading Correction Mode	GO-5101M-PGE: Flat Shading (fixed) GO-5101C-PGE: Flat Shading, Color Shading	Select the shading correction mode.
Shading Mode	User 1, User 2, User 3	Select the user area to which to save the shading correction value.

Display a white chart under a uniform light, and execute [Perform Shading Calibration].

Note

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

Binning Function

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.
The GO-5101 performs vertical binning via internal addition processing on the sensor, and horizontal binning via digital addition or averaging processing.
Pixels are added together during vertical binning, allowing for increased frame rates.

Note

Binning function cannot be used in video process bypass mode.

ROI (Regional Scanning Function)

The ROI (region of interest) function allows you to output images by specifying the areas to scan.

ROI Settings

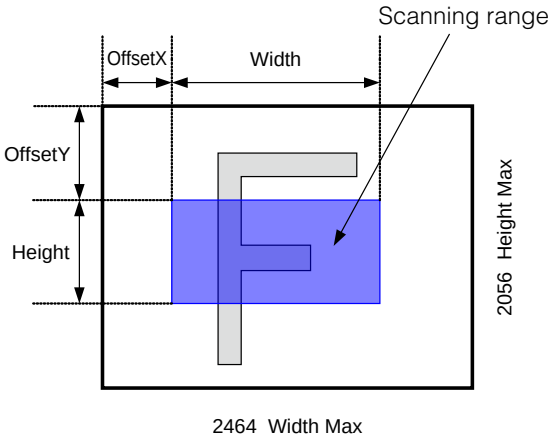
Specify the area to scan by specifying width, height, and horizontal/vertical offset values under [Image Format Control].

❖ For details on how to configure the settings, see “Configuring the Output Format” (page 16).

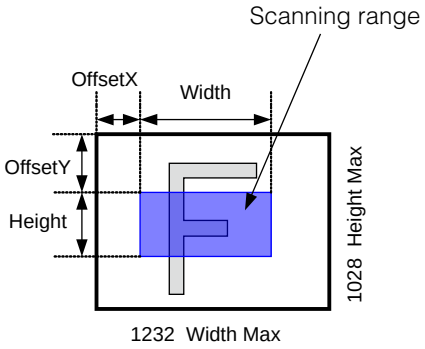
You can increase the frame rate by specifying a lower height, as the number of lines scanned decreases.
The minimum area is as follows.

	Width (pixels)	Height (pixels)
GO-5101M-PGE	Binning Off: 16 Binning On: 8 ❖ The minimum value for Monochrome varies depending on the [Binning] setting.	4
GO-5101C-PGE	16	4

Example 1: Without binning
[Binning Horizontal] *: 1
[Binning Vertical] *: 1



Example 2: With binning
[Binning Horizontal] *: 2
[Binning Vertical] *: 2



* GO-5101M-PGE only

❖ For details on the frame rates for common ROI sizes, see “Frame Rate Reference” (page 60).

Sequencer Function

The Sequencer function lets you define up to 128 preset 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. The order of execution and the repetition of particular presets are based on user-defined parameters configured in [Sequencer Control].

Two operation modes (Trigger Sequencer mode and Command Sequencer mode) are available for the Sequencer function.

Trigger Sequencer mode

With this mode, the Sequencer Trigger “pattern” is predetermined by the user. The user defines up to 128 different “indexes.” Each index represents a combination of the following parameters:

- ROI (width, height, offset X, and offset Y)
- Exposure Time
- Gain Level (R/B Gain can also be configured on the color model)
- Black Level
- Binning Mode (monochrome only)
- LUT Enable (whether or not to enable the use of LUT for this index)
- Frame Count (the number of times to repeat this index before moving to the next)
- Next Index to execute in the predetermined pattern

In addition to these individual index parameters, two other parameters are applied to the entire sequence:

[Sequencer LUT Mode] defines whether Gamma or LUT is to be applied to the sequence. If Gamma is selected, the Gamma setting defined in the camera’s Analog Control section will be applied to all exposures in the sequence. If LUT is selected, the LUT characteristics defined in Analog Control will be applied to any index where [Sequencer LUT enable] has been set to ON.

[Reset Sequencer Reset] causes the index selector to be reset to Index 1. Thus, the sequencer pattern will start over at the next trigger.

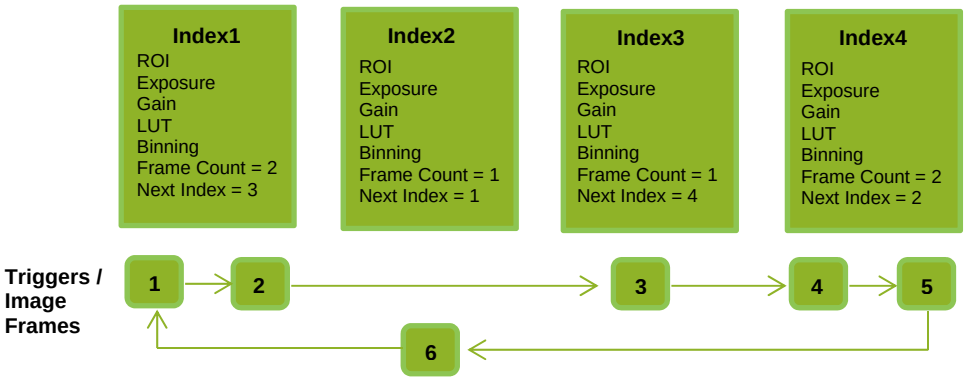
In Trigger Sequencer mode, patterns begin with the index of [Sequencer Set Start]. Subsequent triggers follow the user-defined values in [Sequencer Index Frame Count] and [Sequencer ROI Next Index].
Assigning a Next Index value of “1” to an index creates a loop back to the start of the sequencer pattern. Setting a Next Index value to “OFF” causes the value of [Sequencer Repetition] to be applied as described below.

[Sequencer Repetition]

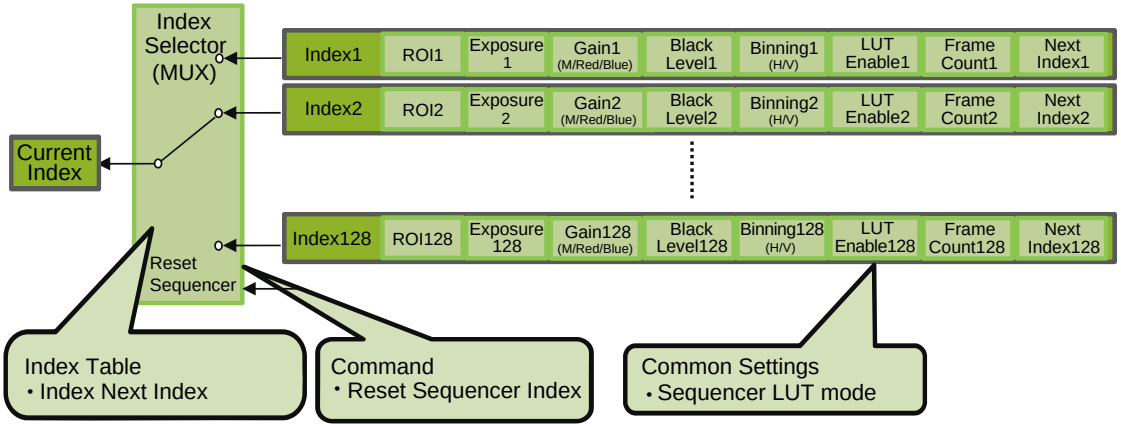
This parameter applies to Trigger Sequencer patterns which include an index whose [Sequencer ROI Next Index] is set to OFF.
When the index whose [Sequencer ROI Next Index] is set to OFF is finished executing, the value of Sequencer Repetition (range = 1-255) is decremented internally. If the result of the decrement is not zero, the Trigger Sequencer pattern starts over from Index1. If the result of the decrement is zero, the status changes to Acquisition Stop and external triggers are not accepted.

Trigger Sequencer example

User-defined Indexes (up to 128)



Index structure for Trigger Sequencer



Command Sequencer mode

This mode allows the user to vary the “pattern” of the sequence in response to external factors. Changes in the sequence can be initiated manually or in a programmatic fashion as the result of data from sensors/controllers or from the analysis of previous images.

In this mode, the user can define up to 128 different “indexes” each incorporating a combination of:

- ROI (width, height, offset X, and offset Y)
- Exposure Time
- Gain Level (R/B Gain can also be configured on the color model)
- Black Level
- Binning Mode (monochrome only)
- LUT Enable (whether or not to enable the use of LUT for this index)

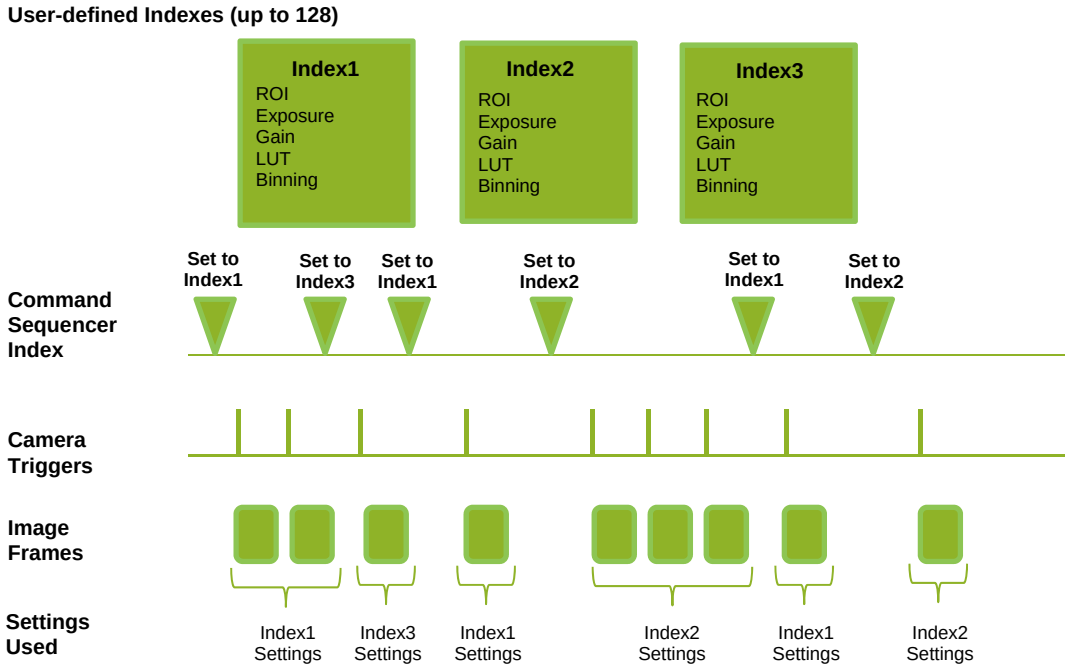
The user must also enter a value from 1 to 128 in [Command Sequencer Index]. This indicates which index to execute each time a trigger is received. The same index will continue to be executed for all subsequent triggers as long as the value of [Command Sequencer Index] remains unchanged.

Changing the value of [Command Sequencer Index] to one of the other predefined indexes causes that index to be executed in response to subsequent triggers. This mode of operation enables users to develop applications that continually send new values to [Command Sequencer Index] in response to external factors such as changing light conditions, different types or sizes of objects being inspected, or other factors. This allows applications to change ROI, exposure, gain, etc., without being restricted to a predefined pattern.

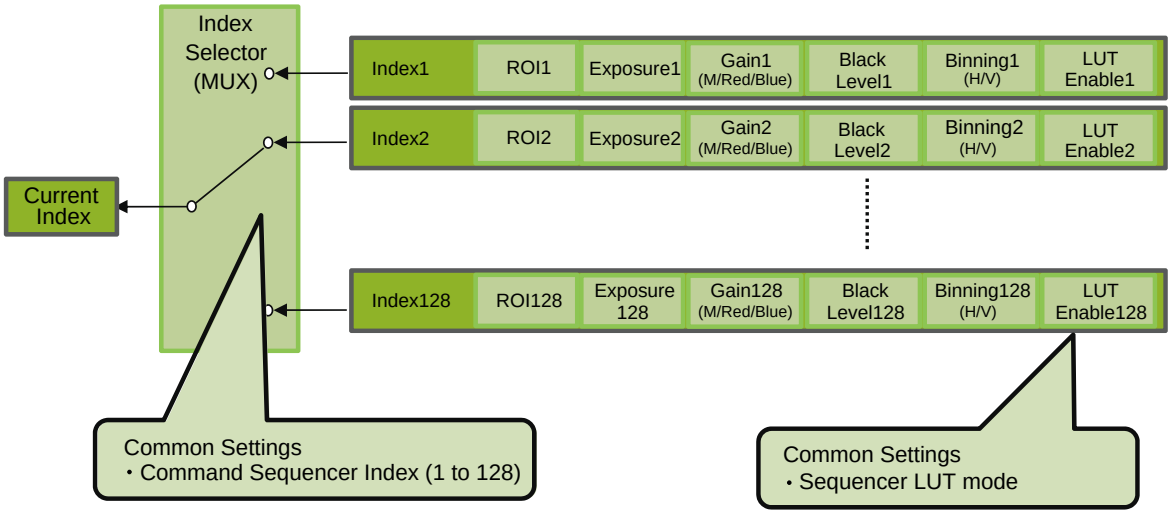
As with Trigger Sequencer, [Sequencer LUT Mode] defines whether Gamma or LUT is to be applied to the sequence. If Gamma is selected, the Gamma setting defined in the camera’s Analog Control section will be applied to all exposures in the sequence. If LUT is selected, the LUT characteristics defined in Analog Control will be applied to any index where [Sequencer LUT enable] has been set to ON.

[Sequencer Index Frame Count], [Sequencer ROI Next Index], and [Reset Sequencer Index] are not used in Command Sequencer mode and entered values are ignored.

Command Sequencer Example



Index structure for Command Sequencer



Delayed Readout [Acquisition Transfer Start]

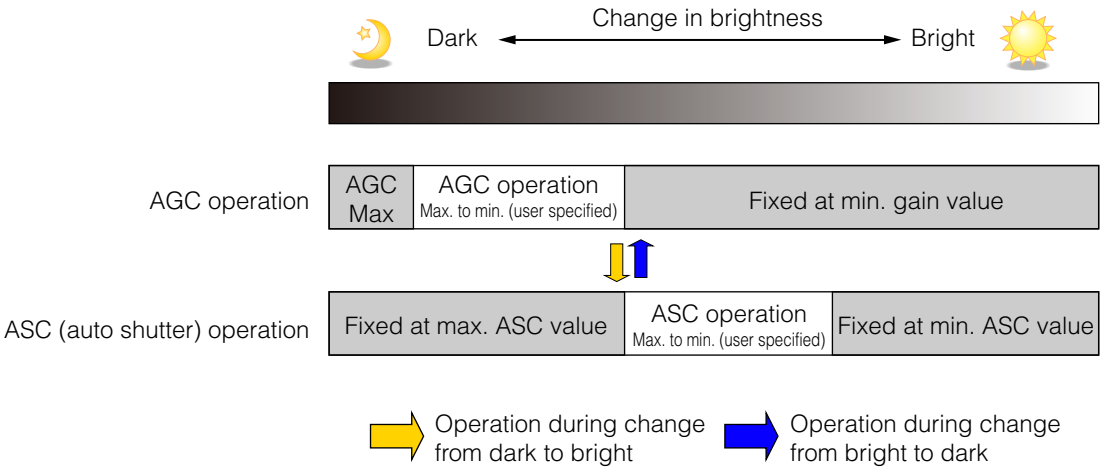
Delayed readout enables images captured by a Frame Start trigger command to be stored inside the camera and read out on demand at a later time using Acquisition Transfer Start trigger. This can be especially useful when multiple cameras need to be triggered at the same time, but simultaneous readout of all images would overwhelm the available network bandwidth. The delayed readout buffer can hold up to 7 frames in 8-bit mode or 3 frames in 10-bit or 12-bit modes.

❖ For details, see “Trigger Control” (page 28).

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 [Gain Auto] or [Exposure Auto] or both to [Continuous] mode. Configure the minimum value, maximum value, etc. for AGC and ASC under [JAI Custom Control ALC].
The target video levels for AGC and ASC are configured in [ALC Reference]. For example, when [ALC Reference] is set to 100%, video levels will be maintained at 100% for AGC and ASC.

■ Automatic gain level control

Set [Gain] to [Continuous].

Detailed Settings for Gain Auto (Automatic Gain Level Control)

When [Gain Auto] is set to [Continuous], you can configure the conditions for automatic adjustment in detail.

Item	Description
ALC Reference	Specify the target level for automatic gain control. (This setting is also used for automatic exposure control.)
ALC Area Enable All	Select whether to specify all areas as auto gain metering areas or whether to specify the areas individually. [0]: Specify areas as auto gain metering areas (16 areas) individually. [1]: Specify all areas as auto gain metering areas.
ALC Area Selector	Individually select any of 16 areas for automatic gain metering. (This setting is also used for automatic exposure control.)
ALC Area Enable	Select [True] to enable the metering area selected in [ALC Area Selector], or select [False] to disable it.
AGC Max.	Specify the maximum value for the automatic gain control range.
AGC Min.	Specify the minimum value for the automatic gain control range.
AGC/ASC Control Speed	Specify the reaction speed for automatic gain control. (This setting is also used for automatic exposure control.)

Auto gain metering areas (16 areas)

High Left	High Mid-left	High Mid-right	High Right
Mid-High Left	Mid-High Mid-left	Mid-High Mid-right	Mid-High Right
Mid-Low Left	Mid-Low Mid-left	Mid-Low Mid-right	Mid-Low Right
Low Left	Low Mid-left	Low Mid-right	Low Right

PTP (Precision Time Protocol) Function

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

・Transport to be used
Multicast UDP datagram (224.0.1.129)
(However, Delay_Resp is a unicast UDP datagram.)
・Destination port number
319 : Sync, Delay_Req, Pdelay_Req, Pdelay_Resp
320 : Announce, Follow_Up, Delay_Resp, Pdelay_Resp, Management, Signaling
・Items for synchronization
Time synchronization is performed. Frequency tuning is not performed.
・PTP time data
80 bit (elapsed time in 1 ns, with 00:00:00, January 1 1970 set as the origin)
・Timestamp (this camera)
64 bit* (PTP synchronization: LSB64bit* of PTP time data)
・Supported PTP messages
Announce message (receive only), Sync message (receive only),
Follow_Up message (receive only), Delay_Req mesasge (send only),
Delay_Resp message (receive only)

Cautions

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

Edge enhancer Function

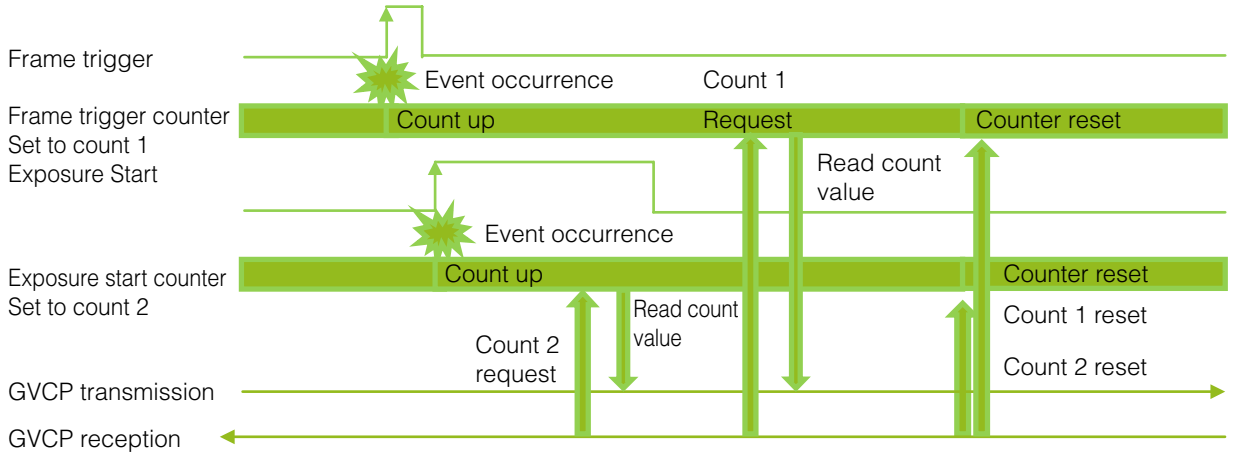
This camera is equipped with an edge enhancer function for enhancing the contrast of lines or edges within images.
(GO-5101M-PGE only)

Edge enhancer function
The edge enhancer function is enabled when EnhancerEnable is set to True.
Four enhancement levels are available: Low, Middle, High, and Strong.

Counter and Timer Control Function (counter support only)

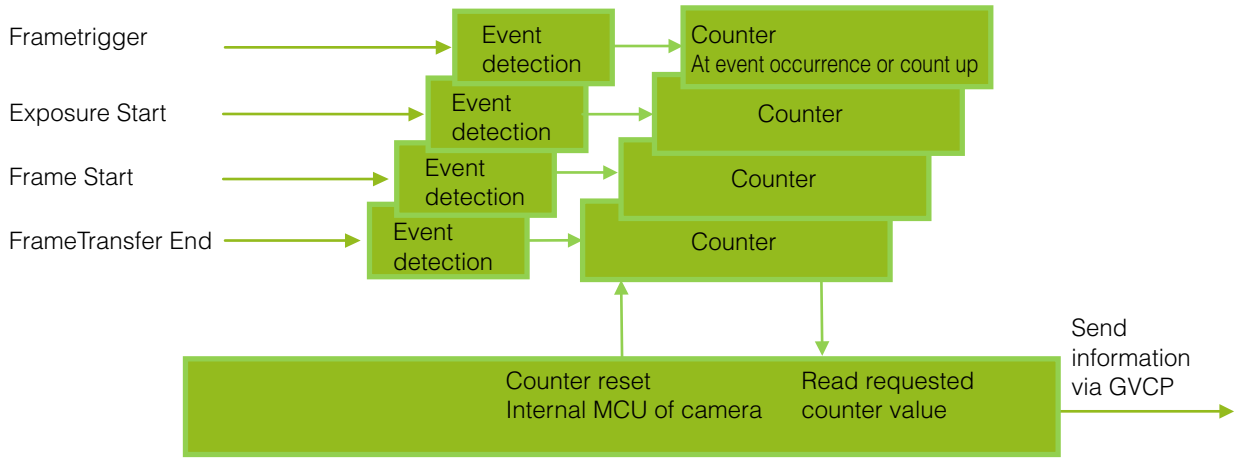
The counter function counts up change points in the camera's internal signals using the camera's internal counter, and reads that information from the host side. This function is useful for verifying error conditions via the count value using internal camera operations.
Counting is performed at frame trigger, frame start, exposure start, and exposure transfer end, and by comparing these values, you can determine the internal camera state at which missed triggers will occur.

■ Counter occurrence diagram



Note To reset the counter itself, execute [Counter Reset] or enter "1" in [Counter Reset].

■ Internal camera blocks



■ To use the counter function

Configure the settings as follows.
Three counters can be configured (Counter 0 to 2).

Item		Setting value / selectable range	Description
Counter 0 to 2		Counter 0 to 2	Select the counter.
	Counter 0 to 2 Event Source	Off, Frame Trigger, Frame Start, Exposure Start, Frame Transfer End	Select the counter event signal for which to read the count value.
	Counter 0 to 2 Event Activation	Rising Edge (fixed) or Falling Edge	Specify the timing at which to count.

Note The four counter event signals are always counted up internally on the camera.

Video Process Bypass Mode

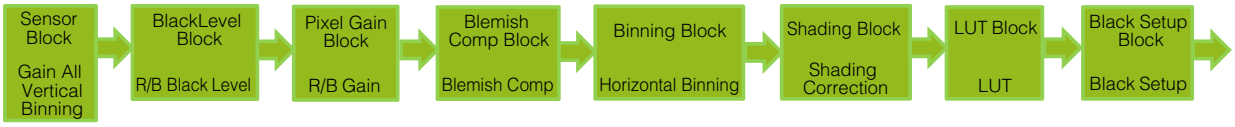
The video process bypass mode is a function that bypasses internal video processing on the camera. When bypass is enabled, the sensor output and camera output data can be set to the same bit width. Operation using 12-bit outputs must be performed in bypass mode.

Video process bypass mode	On	Off
Camera operation	All video processes except Gain all (excluding R/B Gain) and Blemish Compensation are disabled.	All video processes are enabled.
Camera output	8-/10-/12-bit	8-/10-bit

■ Differences in camera operation

When video process bypass mode is disabled

All video processes are enabled.



When video process bypass mode is enabled

All video processes except Gain all (excluding R/B Gain) and Blemish Compensation are disabled.

Note

Binning function cannot be used in video process bypass mode.

■ To enable video process bypass mode

Item	Setting value / selectable range	Description
Video Process Bypass Mode	On	Enable video process bypass mode.

Settings List

Feature Properties

: Settings that can only be configured when image acquisition on the camera is stopped.

Item	Setting range	Default value	Description
a) Device Control			Display/configure information related to the device.
Device Vendor Name	—	"JAI Ltd., Japan"	Display the manufacturer name.
Device Model Name	—	GO-5101M-PGE GO-5101C-PGE	Display the model name.
Device Manufacturer Info	—	—	Display the manufacturer information.
Device Version	—	—	Display the hardware version.
Device Firmware Version	—	—	Display the firmware version.
Device Serial Number	—	—	Display the device ID.
Device User ID	Any	—	Set the user ID for the camera.
Device Temperature in degrees Celsius	—	—	Display the internal temperature (°C) of the camera.
Device Reset	—	—	Reset the device.
b) Image Format Control			Configure image format settings.
Sensor Width	2464	2464	Display the maximum image width.
Sensor Height	2056	2056	Display the maximum image height.
Sensor Digitization Taps	12 Bit	12 Bit	Displays the digital tones output from the sensor.
Width Max	2464	2464	Display the maximum image width.
Height Max	2056	2056	Display the maximum image height.
Width	Binning Horizontal 1: 16 to 2464 Binning Horizontal 2: 8 to 1232 ❖ The minimum value for Monochrome varies depending on the [Binning Horizontal] setting.	2464	Set the image width.
Height	GO-5101M-PGE: Binning Vertical 1: 4 to 2056 Binning Vertical 2: 4 to 1028 GO-5101C-PGE: 4 to 2056 ❖ The minimum value for Monochrome varies depending on the [Binning Vertical] setting.	2056	Set the image height.
Offset X	Binning Horizontal 1: 0 to 2448 Binning Horizontal 2: 0 to 1224	0	Set the horizontal offset.
Offset Y	GO-5101M-PGE: Binning Vertical 1: 0 to 2052 Binning Vertical 2: 0 to 1024 GO-5101C-PGE: 0 to 2052	0	Set the vertical offset.
Binning Horizontal Mode (GO-5101M-PGE only)	Sum, Average	Sum	Set the addition process to be used during horizontal binning.
Binning Horizontal (GO-5101M-PGE only)	1, 2	1	Set the number of pixels in the horizontal direction for which to perform binning.
Binning Vertical Mode (GO-5101M-PGE only)	Sum	Sum	Display the addition process to be used during vertical binning.
Binning Vertical (GO-5101M-PGE only)	1, 2	1	Set the number of pixels in the vertical direction for which to perform binning.

Item	Setting range	Default value	Description
Pixel Format	GO-5101M-PGE: Mono8, Mono10, Mono10 Packed, Mono12, Mono12 Packed GO-5101C-PGE: BayerRG8, BayerRG10, BayerRG10 Packed, BayerRG12, BayerRG12 Packed	GO-5101M-PGE: Mono8 GO-5101C-PGE: BayerRG8	Set the pixel format. [Mono12] and [BayerRG12] are enabled when [Video Process Bypass] is set to [On].
Test Image Selector	GO-5101M-PGE: Off, GreyHorizontalRamp, GreyVerticalRamp, GreyHorizontalRamp Moving GO-5101C-PGE: Off, GreyHorizontalRamp, GreyVerticalRamp, GreyHorizontalRamp Moving, HorizontalColorBar, VerticalColorBar, MovingColorBar	Off	Select the test image.
c) Acquisition Control			Configure image acquisition settings.
Acquisition Mode	Single Frame, Multi Frame, Continuous	Continuous	Select the image acquisition mode.
Acquisition Start	—	—	Start image acquisition.
Acquisition Stop	—	—	Stop image acquisition.
Acquisition Frame Count	1 to 255	1	In [Multi Frame] mode, set the number of frames to acquire.
Acquisition Frame Rate (Hz)	0.125 to 22.7004 (Full)	22.7004	Set the frame rate as a frequency. (unit: Hz) The maximum value varies depending on the TapGeometory and ROI settings.
Trigger Selector	Acquisition Start, Acquisition End, Frame Start, Acquisition Transfer Start	Frame Start	Select the trigger operation.
Trigger Mode	Off, On	Off	Select the trigger mode.
Trigger Software	—	—	Execute a software trigger.
Trigger Source	Low, High, Software, Pulse Generator 0, User Output 0, User Output 1, Action 1, Action 2, Line 5 - Optical In 1, NAND0 Out , NAND1 Out	Line 5 - Optical In 1	Select the trigger signal source.
Trigger Activation	Rising Edge, Falling Edge, Level High, Level Low	Rising Edge (rising edge of input signal)	Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied).
Trigger OverLap	Off Readout	Off	Select the trigger overlap operation.
Exposure Mode	Off, Timed, Trigger Width	Timed (control via exposure time)	Select the exposure mode.
Exposure Time	8-bit: 1 to 7999810 10-/12-bit: 1 to 7999630	43864	Set the exposure time. Maximum depends on Acquisition Frame Rate and Pixel Format.
Exposure Auto	Off, Continuous	Off	Set whether to enable auto exposure.

Item	Setting range	Default value	Description
d) Event Control			Configure event control settings.
Event Selector	Acquisition Trigger, Frame Start, Frame End, Jai FVAL Start, Jai FVAL End, Exposure Start, Exposure End, OptOut1 Rising Edge, Line2 Rising Edge, OptOut2 Rising Edge, Line3 Rising Edge, OptIn1 Rising Edge, Line5 Rising Edge, OptOut1 Falling Edge, Line2 Falling Edge, OptOut2 Falling Edge, Line3 Fallinig Edge, OptIn1 Falling Edge, Line5 Falling Edge	AcquisitionTrigger	Select the event for which to send notifications.
Event Notification	Off, On	Off	Select whether to output event messages.
e) Analog Control			Configure analog control settings.
Gain Selector	GO-5101M-PGE: Analog All GO-5101C-PGE: Analog All, Digital Red All, Digital Blue All	Analog All	Select the gain to configure.
Gain	Analog All: 1 to 16 Digital Red All and Digital Blue All: 0.4467 to 5.6235	Master gain: 1 R, B: 1	Set the gain value for the gain setting selected in [Gain Selector].
Black Level Selector	GO-5101M-PGE: Digital All GO-5101C-PGE: Digital All, Digital Red, Digital Blue	Digital All	Select the black level to configure.
Black Level	–133 to 255	0	Set the black level value.
Gain Auto	Off, Continuous	Off	Enable/disable gain auto adjustment.
Balance White Auto (GO-5101C-PGE only)	Off, Once, Continuous	Off	Enable/disable auto white balance.
Gamma	G045(0.45), G060(0.60), G100(1.0)	G100(1.0)	Set the gamma value.
JAI LUT Mode	Off, Gamma, LUT	Off	Select the JAI LUT mode.
f) LUT Control			Configure LUT settings.
LUT Selector	GO-5101M-PGE: Mono GO-5101C-PGE: Red, Green, Blue	GO-5101M-PGE: Mono GO-5101C-PGE: Green	Select the LUT channel to control.
LUT Index	0 to 256	0	Set the LUT index table number.
LUT Value	0 to 4095	0	Set the LUT value.
g) Sequencer Control			Configure sequencer settings.
Sequencer Mode	On, Off	Off	Enable/disable [Sequencer Mode].
Sequencer Mode Select	Trigger Sequencer Mode, Command Sequencer Mode	Trigger Sequencer Mode	Select the sequencer mode.
Sequencer Configuration Mode	On, Off	Off	Select [On] to change the settings within the index.
Sequencer Set Selector	1 to 128	1	Select the [Trigger Sequencer] mode and [Command Sequencer] mode index.
Sequencer Frame Number	1 to 255	1	Set the number of frames to display for the selected Sequencer Index. (Enabled only for Trigger Sequencer.)
Sequencer Set Next	1 to 128	1	Set the next index to be displayed for the selected Sequencer Index. (Enabled only for Trigger Sequencer.)
Sequencer Width	16 to 2464	2464	Set the width of the selected Sequencer Index.
Sequencer Height	4 to 2056	2056	Set the height of the selected Sequencer Index.
Sequencer Offset X	0 to 2448	0	Set the horizontal offset value for the selected Sequencer Index.

Item	Setting range	Default value	Description
Sequencer Offset Y	0 to 2052	0	Set the vertical offset value for the selected Sequencer Index.
Sequencer Gain	100 to 1600	100	Set the gain for the selected Sequencer Index.
Sequencer Gain Red	-4533 to 37876	0	Set the red gain for the selected Sequencer Index.
Sequencer Gain Blue	-4533 to 37876	0	Set the blue gain for the selected Sequencer Index.
Sequencer Exposure Time	8-bit: 1 to 7999810 10-/12-bit: 1 to 7999630	18000	Set the exposure time for the selected Sequencer Index. Maximum depends on Acquisition Frame Rate and Pixel Format.
Sequencer Black Level	-133 to 255	0	Set the black level for the selected Sequencer Index.
Sequencer LUT Enable	True, False	False	Enable/disable the LUT setting for the selected Sequencer Index.
Sequencer H Binning (GO-5101M-PGE only)	1 to 2	1	Set the horizontal binning for the selected Sequencer Index.
Sequencer V Binning (GO-5101M-PGE only)	1 to 2	1	Set the vertical binning for the selected Sequencer Index.
Sequencer Repetition	0 to 255	1	Set the repeat count for the sequencer.
Sequencer LUT Mode	Gamma, LUT	Gamma	Set the sequencer LUT mode.
Sequencer Set Active	—	—	Displays the active LUT number.
Sequencer Command Index	—	0	Set this to change the Sequencer Index. (Enabled only for Command Sequencer.)
Sequencer Set Start	—	1	Set the index number that is used when executing [Sequencer Reset] in [Trigger Sequencer] mode or [Command Sequencer] mode.
Sequencer Reset	—	—	Reset the current index number to the number configured in [Sequencer Set Start].
h) Digital IO Control			Configure settings for digital input/output.
Line Selector	Line2 - Opt Out 1, Line3 - Opt Out 2, Line5 - Opt In 1, Time Stamp Reset, NAND Gate 0 In 1, NAND Gate 0 In 2, NAND Gate 1 In 1, NAND Gate 1 In 2	Line2 - Opt Out 1	Select the input/output to configure.
Line Mode	Input, Output	Output	Display the input/output status (whether it is input or output).
Line Inverter	True, False	False	Enable/disable polarity inversion for the selected input signal or output signal.
Line Status	True, False	True	Display the status of the input signal or output signal (True: High, False: Low).
LineSource	Low, High, Acquisition Trigger Wait, Acquisition Active, Frame Trigger Wait, Frame Active, Exposure Active, FVAL, LVAL, User Output 0, User Output 1, Line 5 - Opt In 1, Pulse Generator 0, Nand 0 Out, Nand 1 Out,	Low	Select the line source signal for the item selected in [Line Selector].
Line Format	—	Opto Coupled	Display the current I/F type.
User Output Selector	User Output 0, User Output 1	0: User Output 0	Set the user output signal.
User Output Value	True, False	False	Set the value for the User Output selected in [User Output Selector].
i) Pulse Generators			Configure pulse generator settings.
Clock Pre-scaler	1 to 4096	165	Set the division value for the prescaler (128-bit length) using the pixel clock as the base clock.

Item	Setting range	Default value	Description
Pulse Generator Clock (MHz)	0.018127 to 74.25	0.45	Set the clock used for the pulse generator. This value is calculated using the [Clock Pre-scaler] value as a base.
Pulse Generator Selector	Pulse Generator 0	Pulse Generator 0	Select the pulse generator.
Pulse Generator Length	1 to 1048575	30000	Set the maximum count-up value as a clock count.
Pulse Generator Length (ms)	0.000013468 to 14.1222	66.6667	Set the maximum count-up value in milliseconds. This value is calculated using the [Pulse Generator Length] value as a base. The setting range varies depending on the [Clock Pre-scaler] value.
Pulse Generator Frequency (Hz)	70.810386 to 74250000	15	Set the maximum count-up value as a frequency. This value is calculated using the [Pulse Generator Length] value as a base.
Pulse Generator Start Point	0 to 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.
Pulse Generator Start Point (ms)	0 to 14.1222	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 [Clock Pre-scaler] value.
Pulse Generator End Point	1 to 1048575	15000	Set the start point of the Low interval as a clock count. When the counter reaches this value, the output will be 0.
Pulse Generator End Point (ms)	0.000013468 to 14.1222	33.3333	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 [Clock Pre-scaler] value.
Pulse Generator pulse-width (ms)	0 to 14.1222	33.3333	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 [Clock Pre-scaler] value.
Pulse Generator Repeat Count	0 to 255	0	Set the repeat count for the counter. When this is set to [0], a free counter is enabled with no repeat limit.
Pulse Generator Clear Activation	Off, High Level, Low Level, Rising Edge, Falling Edge	0: Off	Set the clear signal condition for the count clear input of the pulse generator.
Pulse Generator Clear Source	Low, Hight, Acquisition Trigger Wait, Frame Trigger Wait, Frame Active, Exposure Active, FVAL, LVAL, User Output 0, User Output 1, Action 1, Action 2, Line5 - Opt In 1, Nand0 Out, Nand1 Out	0: Low	Select the count clear input signal source. [Line4 TTL In] can be used on the Standard Model.
Pulse Generator Clear Inverter	True, False	False	Select whether to invert the polarity of the count clear input signal.
Pulse Generator Clear Sync Mode	Async Mode, Sync Mode	Async Mode	Select the sync mode for the count clear input signal.
j) Transport Layer Control			Display information on transport layer control.
Payload Size	—	5065984	Display the payload size.

Item	Setting range	Default value	Description
GigE Vision Major Version	—	2	Display the GigE version.
GigE Vision Minor Version	—	0	
Is Big Endian	—	True	Display the endianness.
Character Set	—	UTF8	Display the character set.
Interface Selector	—	0	Set the interface.
Mac Address	—	XX-XX-XX-XX-XX-XX	Display the MAC address.
Current IP Configuration LLA	True, False	True	Display whether the current IP configuration is calibrated by LLA (link-local address).
Current IP Configuration DHCP	True, False	True	Select whether to set the IP configuration to DHCP.
Current IP Configuration Persistent IP	True, False	False	Select whether to set the IP configuration to persistent IP.
Current IP Address	—	XXX.XXX.XXX.XXX	Display the IP address.
Current Subnet Mask	000.000.000.000 to 255.255.255.255	255.255.0.0	Display the subnet.
Current Default Gateway	000.000.000.000 to 255.255.255.255	0.0.0.0	Display the default gateway.
Persistent IP Address	000.000.000.000 to 255.255.255.255	0.0.0.0	Set the persistent IP address.
Persistent Subnet Mask	000.000.000.000 to 255.255.255.255	0.0.0.0	Set the persistent subnet mask.
Persistent Default Gateway	000.000.000.000 to 255.255.255.255	0.0.0.0	Set the persistent default gateway.
GigE Vision Supported Option Selector	Link Local Address configuration, DHCP configuration, Persistent IP configuration, Stream Channel Source Socket, Message Channel Source Socket, Command Concatenation, Write Mem, Packet Resend, Event, Event Data, Pending Ack, Action, Extended Status Codes, Discovery Ack Delay, Discovery Ack Delay Writable, Test Data, Manifest Table, CCP Application Socket, Link Speed, Heartbeat Disable, Serial Number	Link Local Address configuration	Select the supported options for GigE Vision.
Supported Option	True, False	True	Enable/disable the supported options.
First URL	—	Local:XXXXXX	Display the first URL.
Second URL	—		Display the second URL.
Number Of Interfaces	—	1	Display the number of interfaces.
Message Channel Count	—	1	Display the message channel count.
Stream Channel Count	—	1	Display the stream channel count.
Heartbeat Timeout	500 to 2147483647	3000	Set the timeout value for heartbeat.
Timestamp Tick Frequency	—	1000000000	Display the timestamp frequency.
Timestamp Control Latch	—	—	Latch the timestamp value.
Timestamp Control Reset	—	—	Reset the timestamp value.
Timestamp Tick Value	—	0	Display the timestamp value.
Control Channel Privilege	—	ControlAccess	Display the control channel privilege.
Message Channel Port	—	XXXXX	Set the port number for the message channel.
Message Channel Destination Address	000.000.000.000 to 255.255.255.255	XXX.XXX.XXX.XXX	Set the destination IP address for the message channel.

Item	Setting range	Default value	Description
Message Channel Transmission Timeout (ms)	0 to 4294967295	300	Set the transmission timeout for the message channel. (unit: ms)
Message Channel Retry Count	0 to 4294967295	2	Set the retry count for the message channel.
Message Channel Source Port	—	XXXXX	Display the port number of the message channel source.
Stream Channel Selector	—	0	Select the stream channel.
Stream Channel Port	0 to 4294967295	0	Set the port number for the stream channel.
Do Not Fragment	True, False	True	Enable/disable “Do Not Fragment.”
Packet Size	0 to 4000000	1476	Set the packet size.
Packet Delay		0	Set the packet delay.
Stream Channel Destination Address	000.000.000.000 to 255.255.255.255	0.0.0.0	Set the destination IP address for the stream channel.
Stream Channel Source Port	—	0	Display the port number of the stream channel source.
IEEE 1588 Status	PTP Stopped, PTP Initializing, PTP Faulty, PTP Disabled, PTP Listenning, PTP PreMaster, PTP Passive, PTP Uncalibrated, PTP Slave	PTP Disabled	
k) Action Control			Configure action control settings.
Action Device Key	—	0x00	Set the action device key.
Action Selector	1, 2	1	Select the action.
Action Group Key	—	0x00	Set the key that executes action 1.
Action Group Mask	—	0x00	Set the mask value that creates the action 0 group,
Action Queue Size	—	255	Set the queue size.
l) User Set Control			Configure user settings.
User Set Selector	0: Default, User Set1 to User Set3	Default (factory default values)	Select the user settings.
User Set Load	—	—	Load user settings.
User Set Save	—	—	Save the current setting values as user settings.
m) Chunk Data Control			Configure chunk control settings.
Chunk Mode Active	Off, On	Off	Set whether to enable the Chunk Data.
Chunk Selector	Image, OffsetX, OffsetY, Width, Height, Pixel Format, TimeStamp, LineStatusAll, ExposureTime, GainAll, GainRed, GainBlue, BlackLevelAll, SequencerSetActive, FrametriggerCounter, ExposureStartCounter, FrameStartCounter, FrameTransferEndCounter, LineStatusAllOnFVALStart, DeviceTemperature, DeviceSerialNumber, DeviceUserID	Image	Select the Chunk Data to be added.
Chunk Enable	True, False	False	Select whether to output Chunk Data.
n) JAI Custom Control ALC			Configure JAI ALC settings. These settings are also used for AGC (auto gain control).
ALC Reference	10 to 95	50	Set the target level for ALC. (unit: %)

Item	Setting range	Default value	Description
ALC Area Selector	Low Right, Low Mid-Right, Low Mid-Left, Low Left, Mid-Low Right, Mid-Low Mid-Right, Mid-Low Mid-Left, Mid-Low Left, Mid-High Right, Mid-High Mid-Right, Mid-High Mid-Left, Mid-High Left, High Right, High Mid-Right, High Mid-Left, High Left	Low Right	Select the area for which to configure [ALC Area Enable].
ALC Area Enable	True, False	False	Enable/disable the photometry area selected in [ALC Area Selector].
ALC Area Enable All	True, False	True	On: Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [ALC Area Selector]. Off: Operate ALC according to the individual enabled/disabled photometry area states configured in [ALC Area Selector].
ASC Min.	100 to 7999811	100	Set the minimum value for the Exposure Auto (ASC) control range.
ASC Max.	101 to 7999812	8216	Set the maximum value for the Exposure Auto (ASC) control range.
AGC Min.	100 to 1599	100	Set the minimum value for the Gain Auto (ASC) control range.
AGC Max.	101 to 1600	1600	Set the maximum value for the Gain Auto (ASC) control range.
AGC/ASC Control Speed	1 (slow) to 8 (fast)	4	Set the reaction speed for AGC/ASC. (8 is the fastest.)
ALC Status	Executing ASC, Executing AGC, Executing ASC and AGC Executing AWB, Executing ASC and AWB, Executing AGC and AWB, Executing ASC and AGC and AWB Convergent, Idle	Idle	Display the ALC status.
o) JAI Custom Control Blemish			Configure settings for JAI white blemish correction.
Blemish Enable	True, False	True	Enable/disable blemish correction.
Blemish Detect	—	—	Execute blemish detection.
Blemish Detect Threshold	0 to 100	10	Set the blemish detection threshold.
Blemish Detect Position Index	0 to 255	0	Select the index for the target blemish coordinates (Blemish Data Position X/Y).
Blemish Detect Position X	–1 to 2463	Varies depending on camera	Display the X coordinate (horizontal pixel position) of the target blemish selected in [Blemish Detect Position Index]. You can also manually enter the X coordinate of the blemish you want to correct.
Blemish Detect Position Y	–1 to 2055	Varies depending on camera	Display the Y coordinate (vertical pixel position) of the target blemish selected in [Blemish Detect Position Index]. You can also manually enter the Y coordinate of the blemish you want to correct.
Blemish Compensation Number	—	Varies depending on camera	Display the number of target blemishes.
p) JAI Custom Control Shading			Configure shading correction settings.
Shading Correction Mode	GO-5101M-PGE: Flat Shading (fixed) GO-5101C-PGE: Flat Shading, Color Shading	Flat Shading	Select the shading correction method.
Shading Mode	Off, User 1, User 2, User 3	Off	Set the area to which to save shading correction data. When this is set to [Off], shading correction data is not saved.
Perform Shading Calibration	—	—	Execute shading correction.

Item	Setting range	Default value	Description
Shading Detect Result	—	—	Display the shading correction results.
q) CounterAndTimer Control			Configure counter settings. (This camera only supports counter functions.)
Counter 0 to 2	Counter 0 to 2	—	Select the counter.
Counter 0 to 2 Event Source	Off, Frame Trigger, Frame Start, Exposure Start, Exposure Transfer End	Off	Select the counter event signal for which to read the count value.
Counter 0 to 2 Event Activation	Rising Edge Falling Edge	—	Display the timing at which to count.
Counter 0 to 2 Reset	—	—	Reset the counter.
Counter 0 to 2 Refresh	—	—	Update the count value.
Counter 0 to 2 Value	—	0	Display the count value.
Counter 0 to 2 Status	Counter Active	Counter Active	Display the counter status.
r) JAI Custom control AWB			Configure settings for AWB function.
AWB Area Selector (GO-5101C-PGE only)	Low Right Low Mid-Right Low Mid-Left Low Left Mid-Low Right Mid-Low Mid-Right Mid-Low Mid-Left Mid-Low Left Mid-High Right Mid-High Mid-Right Mid-High Mid-Left Mid-High Left High Right High Mid-Right High Mid-Left High Left	Low Right	Select the area for which to configure [AWB Area Enable].
AWB Area Enable	Off, On	Off	Enable/disable the photometry area selected in [AWB Area Selector].
AWB Area Enable All	Off, On	Off	On: Operate AWB with all areas designated as photometry areas, regardless of the individual enabled/disabled states configured in [AWB Area Selector]. Off: Operate AWB according to the individual enabled/disabled photometry area states configured in [AWB Area Selector].
AWB Control Speed	1 (slow) to 8 (fast)	4	Set the AWB control speed. (8 is the fastest.)
AWB Status	Complete, Too Bright, Too Dark, Timeout, Executing, Trigger Error, Convergent, Idle	Idle	Display the AWB status.
s) JAI Custom control feature Misc.			Configure settings for other JAI functions.
Video Process Bypass Mode	On, Off	Off	Enable/disable VideoProcessBypss mode.
Enhancer Enable	True, False	False	Enable/disable Enhancer function.
Enhancer Level (GO-5101M-PGE only)	Low, Middle, High, Strong	Middle	Set the Level for EdgeEnhancer.
Trigger Option	Off	Off	
OptIn Filter Selector	10 µs, 100 µs, 500 µs, 1 ms, 5 ms, 10 ms	10 µs	Select the surge protection filter.
Video Send Mode	Normal Mode, Trigger Sequencer Mode, Command Sequencer Mode	Normal Mode	Display the [Video Send Mode].

Settings

❖ For details on the setting items, refer to the JAI Control Tool User's Guide

Item	Setting range	Default value
32-bit Factory Transport Layers		
Available 32-bit Transport Layers	—	
JAI_GigE_Vision	—	
Transport name	—	JAI_GigE_Vision
Full path to cti file	—	$(JAI_SDK_BIN)\ JaiGevTL.cti
Enabled	True, False	True
Display name	—	GevTL
64-bit Factory Transport Layers	—	
Available 64-bit Transport Layers	—	
JAI_GigE_Vision	—	
Transport name	—	JAI_GigE_Vision
Full path to cti file	—	$(JAI_SDK_BIN_64)\ JaiGenTL.cti
Enabled	True, False	True
Display name	—	GenTL
Asynchronous Image Recording		
Recording Count	—	25
Recording Skip Count	—	0
Recording mode	List, CyclicBuffer	List
Optimize the AVI-file creation for Mono8	True, False	True
Prompt user for AVI Encoder	True, False	True
Camera Link Transport Layer		
Automatically probe for CameraLink devices at startup	True, False	True
Use Highest Baud rate for XML download from camera	True, False	False
Show CameraLink Warning Dialog	True, False	True
CXP Transport Layer		
Sync Remote And Local Devices	True, False	True
File Save		
File Format	Tiff, Jpeg, Bmp, Jai, RAW	Tiff
Encoder parameter	—	75
GigE Transport Layer		
Preferred Drive Type	FilterDriver, SocketDriver	FilterDriver
Preferred Device Access Mode	None, ReadOnly, Control	Control
Enable Automatic Force IP	True, False	True
Enable Subnet Conflict Warning?	True, False	True
Look-and-feel		
Visibility Level	Beginner, Expert, Guru	Beginner
HEX display	True, False	False
Display ToolTips	True, False	True
Floating-Point Display Notation	Automatic, Fixed, Scientific	Automatic
Floating-Point Display Precision	—	5
Display the Remote device layer at the top of the tree (transport at the bottom)	True, False	True
Refresh Property Grid After Editing	True, False	False
Override TrackBar Floating-point display precision settings	True, False	False
Make the control tool appear on top of images	True, False	False
Timestamp display format	Ticks, MSec, PTP	Ticks
Plugins		
Search path for plugin DLLs	—	.\plugins
Enable the plug-in button on the menu tab	True, False	False
Support		
Open settings file after save	True, False	True

Item	Setting range	Default value
Support EMail Address	—	camerasupport@jai.com
Logging Properties		
Enable logging	True, False	False
Use custom properties file	True, False	False
Custom logging properties file path		
Output log file path		
Enable GenApi logging	True, False	False
Enable GenTL logging	True, False	False
Enable CIProtocol logging	True, False	False
Enable USB logging	True, False	False
Log Level	FATAL, ALERT, CRIT, ERROR, WARN, NOTICE, INFO, DEBUG, NOTEST	INFO
Format string	—	LOG %d %x: %c : %m%n
Append To Log file	True, False	False
Video Display		
Stretch Live Video	True, False	True
Restore Live Video Window	True, False	True
Skip image display when busy	True, False	True
Enable Color Interpolation	True, False	True
Color Interpolation	BayerStandard, BayerStandardMultiprocessor, BayerExtended, BayerExtendedMultiprocessor, BayerSimple, BayerSimpleMultiprocessor, BayerFast, BayerFastMultiprocessor	BayerStandard
Show Zoom Navigation window	True, False	True
Show Cursor Information window	True, False	False
Enable Mouse Zoom	True, False	True
Enable Mouse Cursor Display	True, False	False

Miscellaneous

Troubleshooting

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

■ Power supply and connections

Problem	Cause and solution
The power / trigger 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 network connection. Check the LAN cable conection.

■ 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” (page 34).

■ 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				GO-5101M-PGE	GO-5101C-PGE
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
Image size (effective image)				8.5 (H) × 7.09 (V), 11.1 mm diagonal	
Pixel size				3.45 (H) × 3.45 (V) µm	
Effective image pixel output				2464 (H) × 2056 (V)	2464 (H) × 2056 (V)
Acquisition Frame Rate (max) ❖ The minimum value is 0.125 fps for all.	8-bit	H1, V1		22.7 fps	22.7 fps
		Binning	H1, V2	45.4 fps	—
			H2, V1	35.6 fps	—
			H2, V2	69.8 fps	—
	10-bit packed / 12-bit packed *1	H1, V1		15.1 fps	15.1 fps
		Binning	H1, V2	30.3 fps	—
			H2, V1	18.1 fps	—
			H2, V2	35.5 fps	—
	10-bit / 12-bit *1	H1, V1		11.4 fps	11.4 fps
		Binning	H1, V2	18.1 fps	—
			H2, V1	35.6 fps	—
			H2, V2	35.5 fps	—
EMVA 1288 parameters Absolute sensitivity Maximum SN ratio				At 12-bit output 3.54p (λ = 525 nm) 40.26 dB	At 12-bit output 3.94p (λ = 525 nm) 40.26 dB
SN ratio (traditional method)				60 dB or more (typical) (0 dB gain, Black)	60 dB or more (typical) Dark compression ON: 50 dB (typical) (0 dB gain, Green Black)
Digital image output format	Full pixel			2464 (H) × 2056 (V)	Bayer 2464 (H) × 2056 (V)
	ROI	Width		16 to 2464, 16 pixels/step	16 to 2464, 16 pixels/step
		Offset X		0 to 2448, 16 pixels/step	0 to 2448, 16 pixels/step
		Height		4 to 2056, 2 line/step	4 to 2056, 2 lines/step
		Offset Y		0 to 2052, 2 lines/step	0 to 2052, 2 lines/step
	Binning	H	1	2464 (H)	2464 (H)
			2	1232 (H)	—
		V	1	2056 (V)	2056(V)
			2	1028 (V)	—
	Pixel Format			Mono8, Mono10, Mono10 Packed, Mono12, Mono12 Packed	BayerGR8, BayerGR10, BayerGR10 Packed, BayerGR12, BayerGR12 Packed
Acquisition modes				Continuous, Single Frame, Multi Frame (1 to 255)	
Trigger selector	Acquisition			Acquisition Start, Acquisition Stop	
	Exposure			Frame Start	
	Transfer			Acquisition Transfer Start	
Exposure modes				Off, Timed (EPS), Trigger Width (PWC)	
Trigger overlap				Off/Readout	
Trigger input signals				Line 5 (Opt In), Software, PG0, NAND Out 0/1, Action 1/2	
OptIn filter (for trigger noise)				5 steps (10 µs (Typ), 100 µs, 500 µs, 1ms, 5ms, 10ms)	
Exposure modes	Timed			14.7 µs*2(min) to 8 s (max), variable unit: 1 µs ❖ Performance verified for up to 1 second.	
	Trigger Width			14.7 µs*2 (min) to ∞ (max) ❖ Performance verified for up to 1 second.	
Auto exposure (Exposure Auto)				Off, Continuous	
Auto exposure response speed (AGC/ASC Control Speed)				1 to 8	
Video Send Mode Selector				Normal ROI, Multi ROI (1 to 5), Trigger Sequencer, Command Sequencer, Delayed Readout	
Digital I/O				Line Selector (6P): GPIO IN / GPIO OUT	

*1) 12-bit binning is not supported.

*2) The actual exposure time will be consist of the image sensor's offset duration (13.7 µs) added to the setting configured on the camera.

Item			GO-5101M-PGE	GO-5101C-PGE
Black level adjustment	Default level		33LSB (during 10-bit output)	
	Video level adjustment range		0 to 100 (during 10-bit output)	
	Adjustment range		–33LSB to +64LSB against reference level (during 10-bit output)	
	Resolution adjustment		1 STEP = 0.25LSB	
Gain adjustment	Manual adjustment range		0 dB to +24 dB 1 step = x0.01 (0.005 dB to 0.08 dB) (varies by setting value)	0 dB to +24 dB 1 step = x0.01 (0.005 dB to 0.08 dB) (varies by setting value)
	Auto gain		Off, Continuous	Off, Continuous
	WB gain		—	R / B: –7 dB to +15 dB, 1 step = 0.1 dB
	WB area		—	16 (4 × 4) Area
	WB range		—	3000 K to 9000 K
	White balance		—	Off, Continuous, Once
Blemish correction	Detection		Detect white blemishes using threshold values (black blemish correction performed only at factory)	
	Correction		Interpolation using adjacent pixels (continuous blemishes not corrected)	
	Correctable pixels		512 pixels	
ALC			Adjusts exposure automatically using combination of AGC and auto shutter	
Gamma			0.45, 0.6 an, 1.0 (OFF) (3 steps available)	
LUT			OFF: γ = 1.0, ON = 257 points can be set	
Power supply	6-pin connector	Input range	DC +12 V to +24 V ±10% (via input terminal)	
		Current	275 mA ±20 mA (at 12 V input, full pixel) (Typical)	
		Current	3.3 W (at 12 V input, full pixel) (Typical)	
	PoE	Input range	DC 36 V to 57 V	
		Current	83 mA ±6 mA (at 48 V input, full pixel) (Typical)	
		Current	3.99 W (at 48 V input, full pixel) (Typical)	
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 m	
Optical filter (IR cut filter)			Not provided	Half value of 670 nm
Verified performance temperature / humidity			–5°C to +45°C / 20% to 80% (non-condensing)	
Storage temperature / humidity			–25°C to +60°C / 20% to 80% (non-condensing)	
Regulations			CE (EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS, WEEE	
Dimensions (housing)			29 × 29 × 41.5 mm (WHD) (excluding mount protrutions)	
Weight			46 g	

Approximately 5 minutes of warm-up are required to achieve these specifications.

Package contents

Camera body (1)
Sensor protection cap (1)
Dear Customer (sheet) (1)

Optional accessories (not supplied)

MP-43 tripod mount
AC adapter

Design and specifications are subject to change without notice.

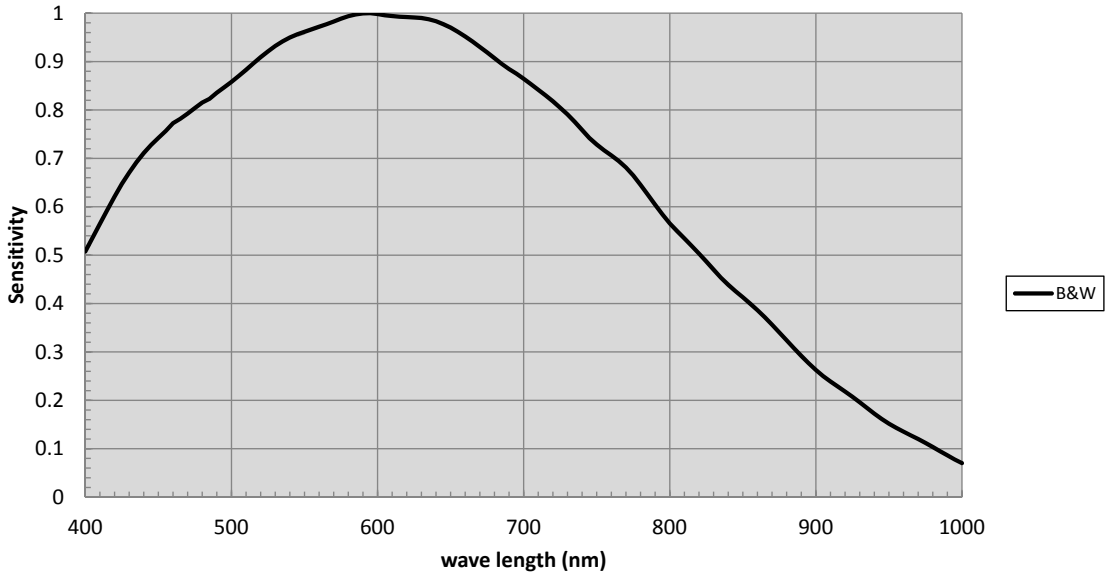
Frame Rate Reference

(Theoretical value: decimal values are dropped, during Unpacked)

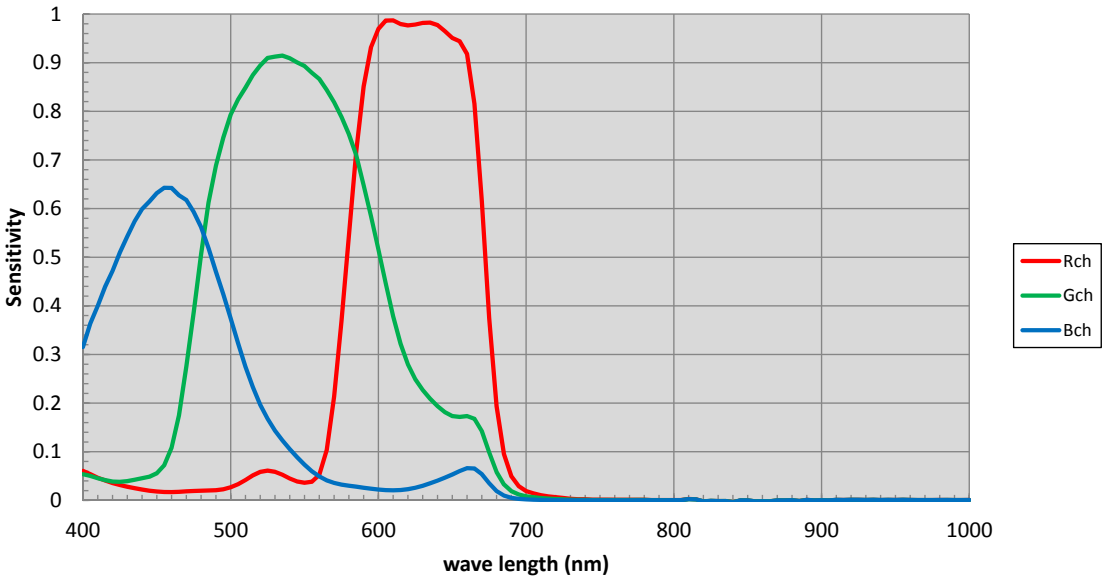
Pixel count	Resolution (screen size)	ROI/Binning	Pixel size(μm)	Image size	Frame rate 8 / 10 / 12 bit
5.1 MP	2464 × 2056	Full pixel	3.45 × 3.45	2/3"	22.7 fps (@8-bit)
2 MP	1920 × 1080	ROI	3.45 × 3.45	1/2" (7.6 mm)	55.5 fps (@8-bit)
1.4 MP	1408 × 1050	ROI	3.45 × 3.45	1/2.6" (6.04 mm)	68.4 fps (@8-bit)
1.3 MP	1280 × 1024	ROI	3.45 × 3.45	1/2.8" (5.66 mm)	70.1 fps (@8-bit)
0.5 MP	800 × 600	ROI	3.45 × 3.45	1/4.6" (3.45 mm)	116.5 fps (@8-bit)
0.5 MP	800 × 600 (Mono only)	ROI + 2×2 Binning	6.9 × 6.9	1/2.3" (6.90 mm)	116.5 fps (@8-bit)
0.3 MP	640 × 480	ROI	3.45 × 3.45	1/5.75" (2.76 mm)	143.4 fps (@8-bit)
0.3 MP	640 × 480 (Mono only)	ROI + 2×2 Binning	6.9 × 6.9	1/2.9" (5.52 mm)	143.4 fps (@8-bit)

Spectral Response

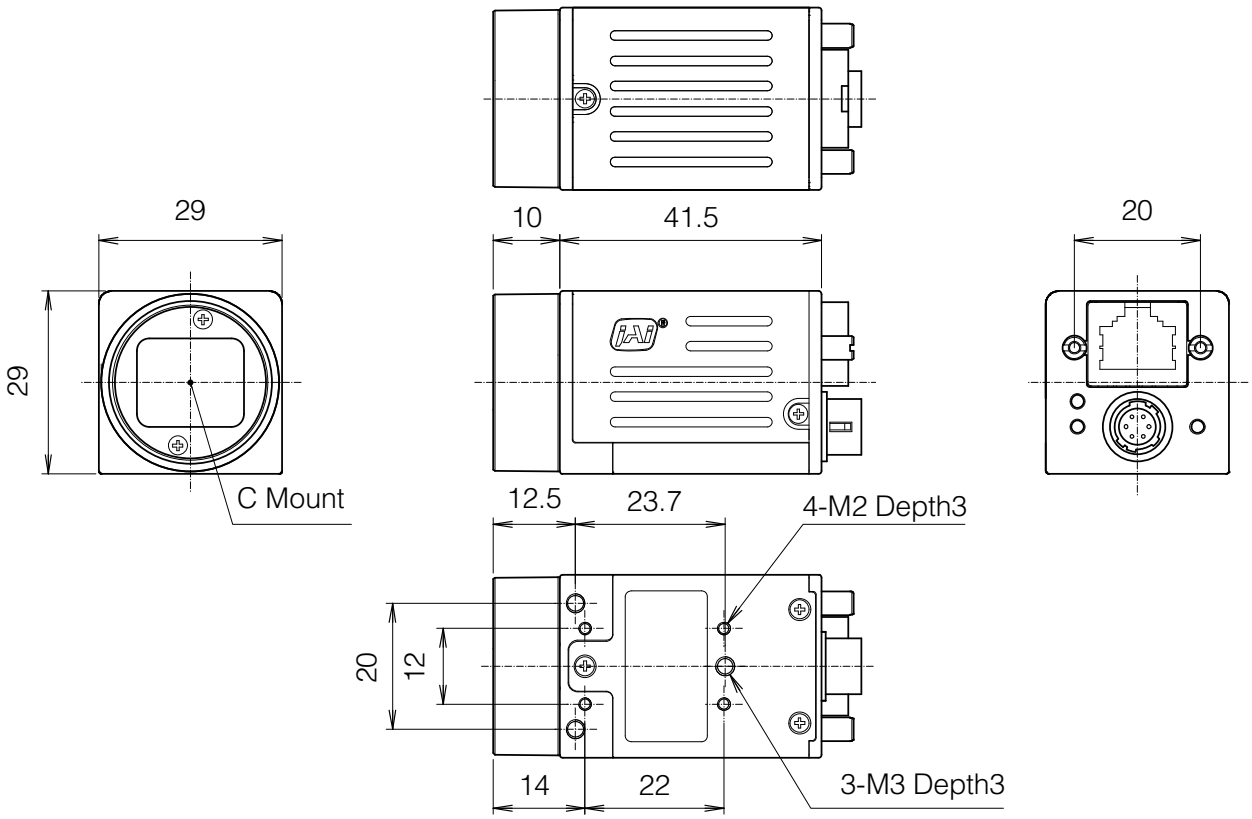
GO-5101M-PGE



GO-5101C-PGE



Dimensions



Dimensional tolerance: ±0.3 mm
Unit: mm

User's Record

Camera type: GO-5101M-PGE / GO-5101C-PGE

Revision: ……..

Serial No. ……..

Firmware version. ……..

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

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Index

Revision history

Revision	Date	Changes
1.0	July 2016	First draft
1.1	Aug. 2016	LUT index revised, China RoHs certificate updated
1.2	Sep. 2016	Maximum frame rate period formula changed
1.4	Mar. 2019	Add KC, actual exposure time
1.5	Jul. 2019	eBUS SDK for JAI and others.
1.6	Feb. 2020	Add Note, binning mode cannot be used in video process bypass mode.
1.7	Mar. 2021	China RoHS.