See the possibilities

User Manual

GO-2400M-USB
GO-2400C-USB

2.35M Digital Progressive Scan Monochrome and Color Camera

Document Version: 1.0

GO-2400-USB_Ver.1.0_Mar.2017

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-2400M-USB and GO-2400C-USB 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.

Supplement

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

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

重要注意事项

有毒，有害物质或元素名称及含量表

根据中华人民共和国信息产业部『电子信息产品污染控制管理办法』，本产品《 有毒，有害物质或元素名称及含量表 》如下.

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
电路板	×	○	○	○	○	○
螺丝	×	○	○	○	○	○
插座	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在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。）

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	×	○	○	○	○	○
插座	×	○	○	○	○	○
光学滤镜	×	○	×	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。
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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 attaching the lens

Avoiding dust particles

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

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

Phenomena specific to CMOS image sensors

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

- Aliasing
  When shooting straight lines, stripes, and similar patterns, vertical aliasing (zigzag distortion) may appear on the monitor.
- Blooming
  When strong light enters, more than the allowable amount of charge of the sensor element in the CMOS image sensor (pixel) and the charge is overflowing, enters into the surrounding pixels, and blooming may occur. However, this does not affect actual operation.
- 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-2400M-USB/GO-2400C-USB is an industrial progressive scan camera equipped with a 1/1.2-inch global shutter CMOS image sensor with 2.35 effective megapixels (1936 × 1216). The unit is compact and lightweight in design and is equipped with USB 3.0 interface.

❖ The GO-2400M-USB produces monochrome output while the GO-2400C-USB produces Bayer output.

Compact and lightweight

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

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-2400M-USB and GO-2400C-USB are both capable of frame rates of up to 159 fps (8-bit format) for full 2.35-megapixel output. Even faster frame rates can be achieved when a smaller ROI (region of interest) is specified.

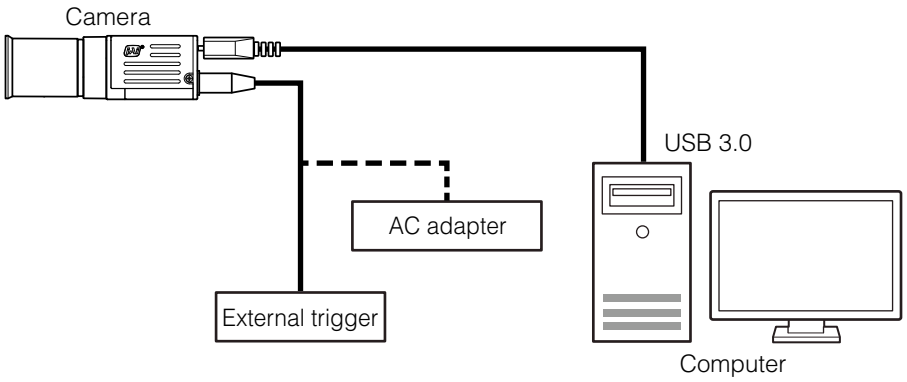
ALC (automatic level control) function

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

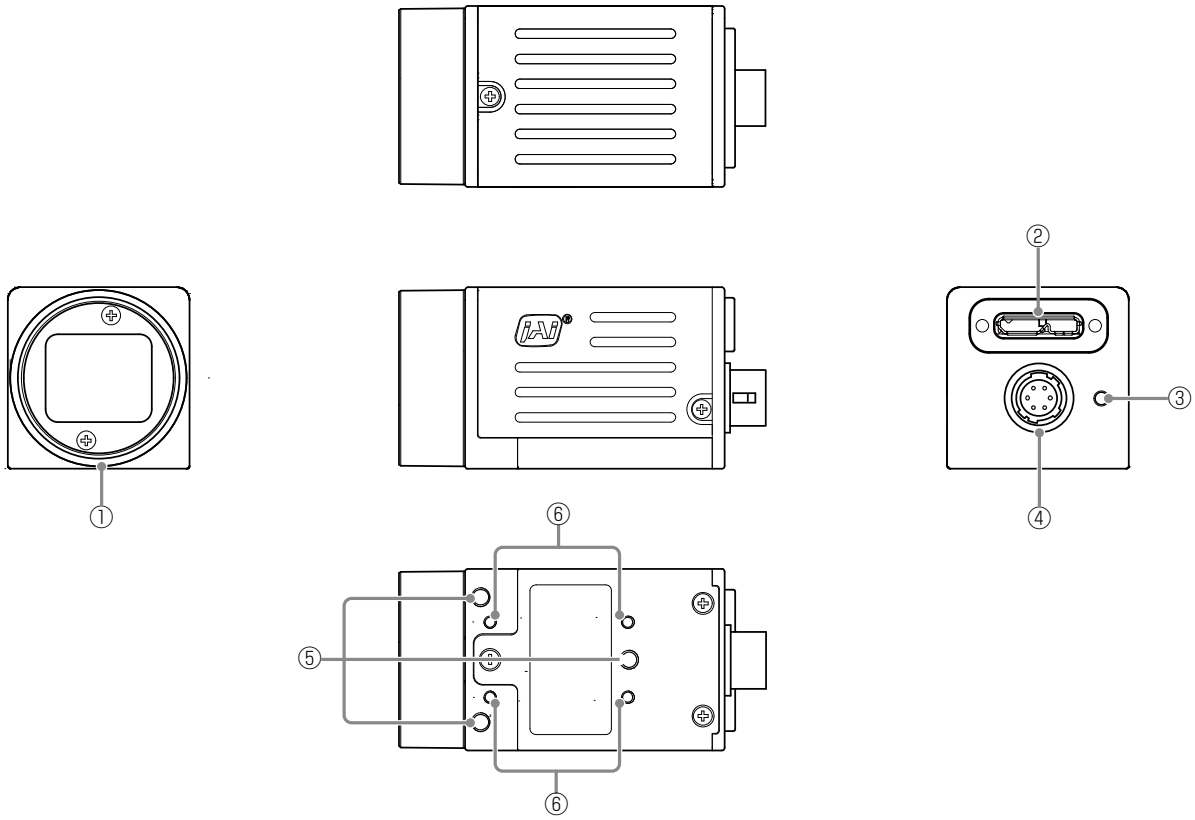
Variety of pre-process functions

- 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-2400C-USB 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 12) and confirm the precautions for attaching a lens and the supported lens types.

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

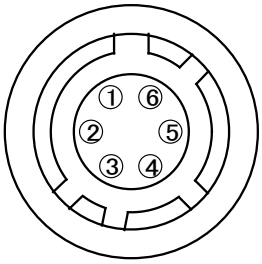
③ Power/trigger LED
Indicates the power and trigger input status.

LED status and camera status

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

④ DC IN / trigger IN connector (6-pin round)

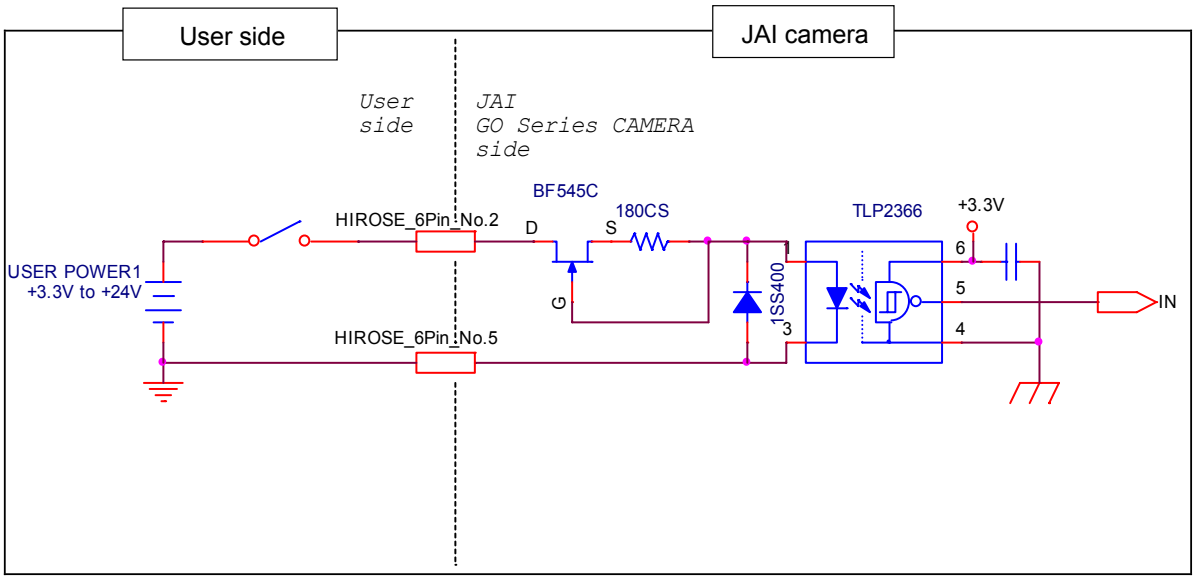
Connect the cable for a power supply (optional) or for DC IN / trigger IN here.



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

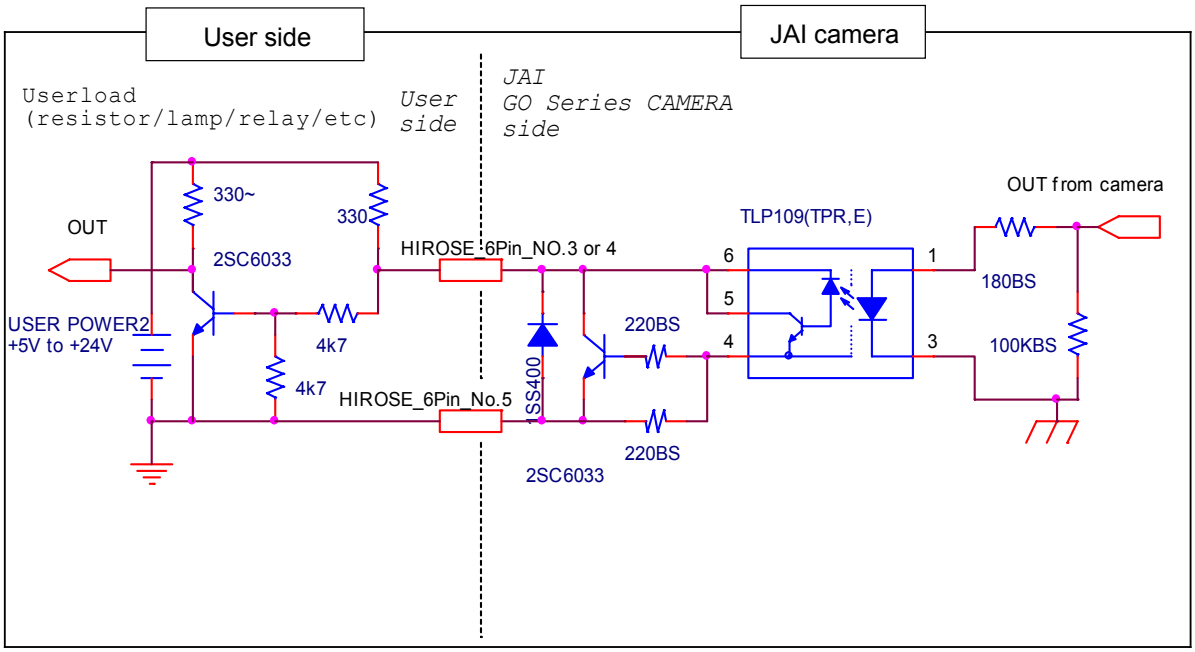
Pin No.	Input/ output	Signal	Description
1		DC IN	+12 to +24 V±10%
2	In	Opto IN 1	Line 5
3	Out	Opto OUT 1	Line 2
4	Out	Opto OUT 2	Line 3
5		Opto Common	
6		GND	

Recommended external input circuit diagram (reference example)



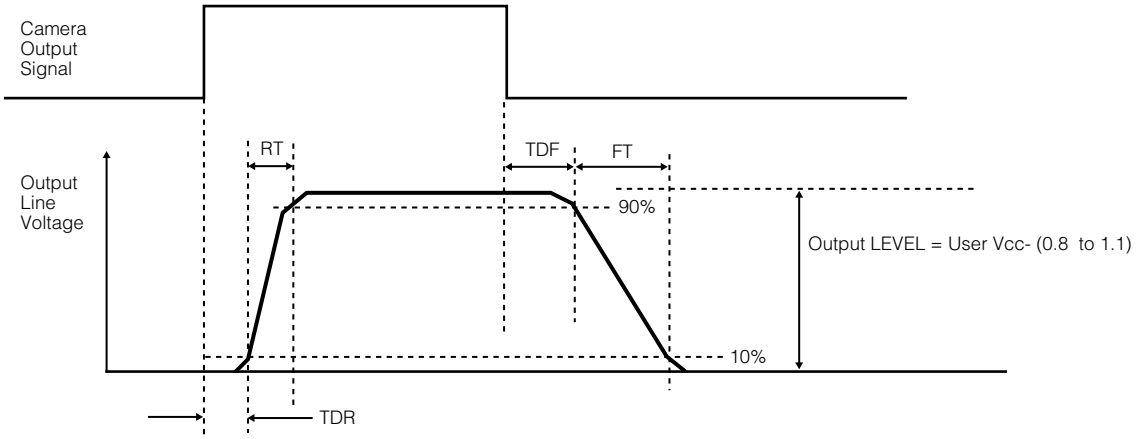
Recommended external output circuit diagram (reference example)

Standard circuit diagram example



Characteristics of the recommended circuits for Opto OUT

OUTPUT LINE RESPONSE TIME



⑤ 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.

⑥ Camera locking screws (M3, 3 mm depth)
Use these when mounting the camera directly to a wall or other structural system.

Preparation

Preparation Process

Step 1	Installing the Software (first time only) Install the software for configuring and controlling the camera (JAI SDK) on the computer.
⬇	
Step 2	Connecting Devices Connect the lens, USB cable, AC adapter, computer, and other devices.
⬇	
Step 3	Verifying Whether the Camera is Running Verify whether the camera is ready for use.
⬇	
Step 4	Configuring Initial Settings for the Camera • Configure the output format. • Configure settings related to the exposure and external trigger.
⬇	
Step 5	Adjusting the Image Quality • Adjust the gain and white balance. • Adjust the exposure (shutter).
⬇	
Step 6	Configuring Various Other Settings Configure various other settings as necessary.
⬇	
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 (JAI SDK) on the computer.

❖ When you install JAI SDK, JAI Camera Control Tool will also be installed.

1 Download the “JAI - Getting Started Guide” and JAI SDK from the JAI website.

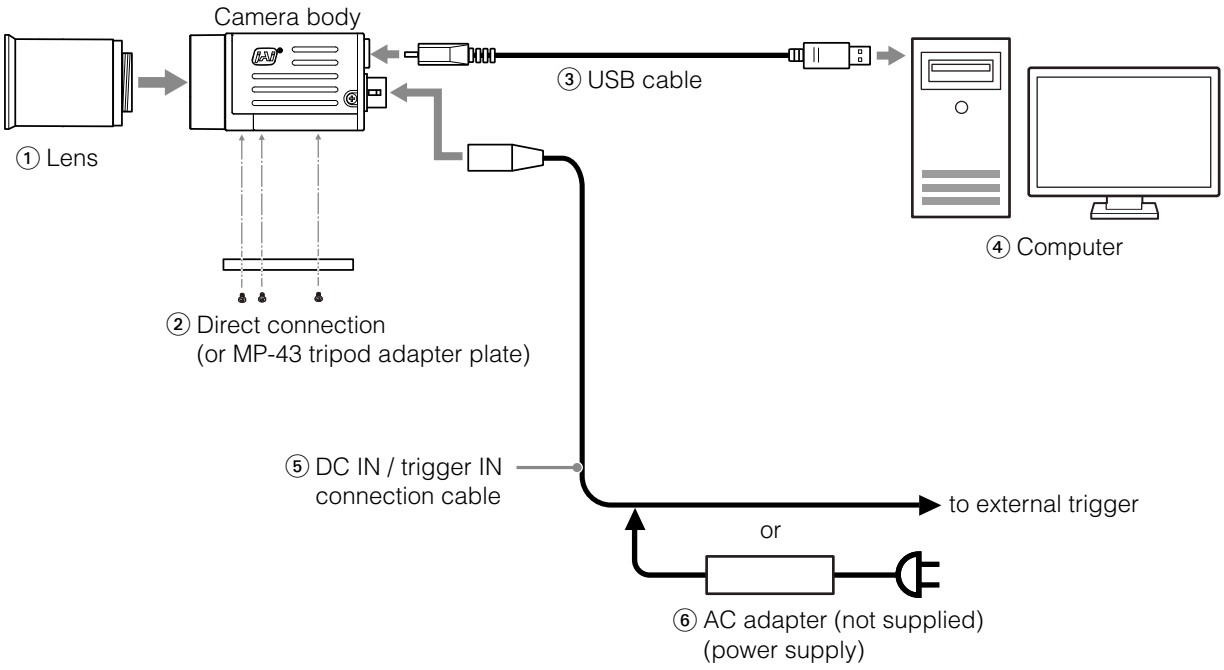
URL: http://www.jai.com/en/support/download-jai-software

2 Refer to the “JAI - Getting Started Guide,” and install JAI SDK on the computer.

The computer will restart when installation is complete.

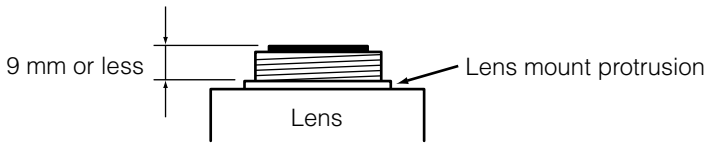
Step 2: Connecting Devices

Connect the lens, USB 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 13.4 mm, which is larger than the 11 mm size of standard 2/3-inch lenses. To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the 13.4 mm diagonal. Some lens manufacturers offer lenses with a 13.4 mm format. If not, a 1-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 (11.3 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 camera 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 USB cable

Connect a USB cable to the USB 3.0 connector.

Caution

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

④ 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

Interface: USB 3.0 compatible connector

⑤ DC IN / trigger IN connection cable

⑥ AC adapter (power supply) (if necessary)

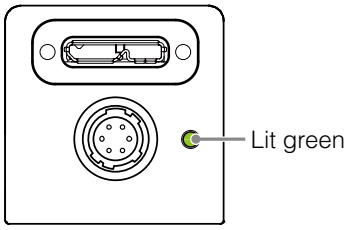
Connect the AC adapter and the round connector of the connection cable to the DC IN / trigger IN connector on the camera.

Step 3: Verifying the Camera's Network Connection Status

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

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

During normal status



❖ For details on how to read the LEDs, see "LED status and camera status" (page 8) in the "Parts Identification" section.

Step 4: Configuring Initial Settings for the Camera

Start Control Tool, configure initial settings for the output format, exposure, external trigger, etc.

Connecting to the Camera to Control Tool

1 Start JAI Control Tool.

Cameras connected to the computer's USB 3.0 connectors are detected, and a window appears. If they do not appear, right-click inside the window and select [Search for Cameras].

2 Select the camera you want to configure.

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

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.

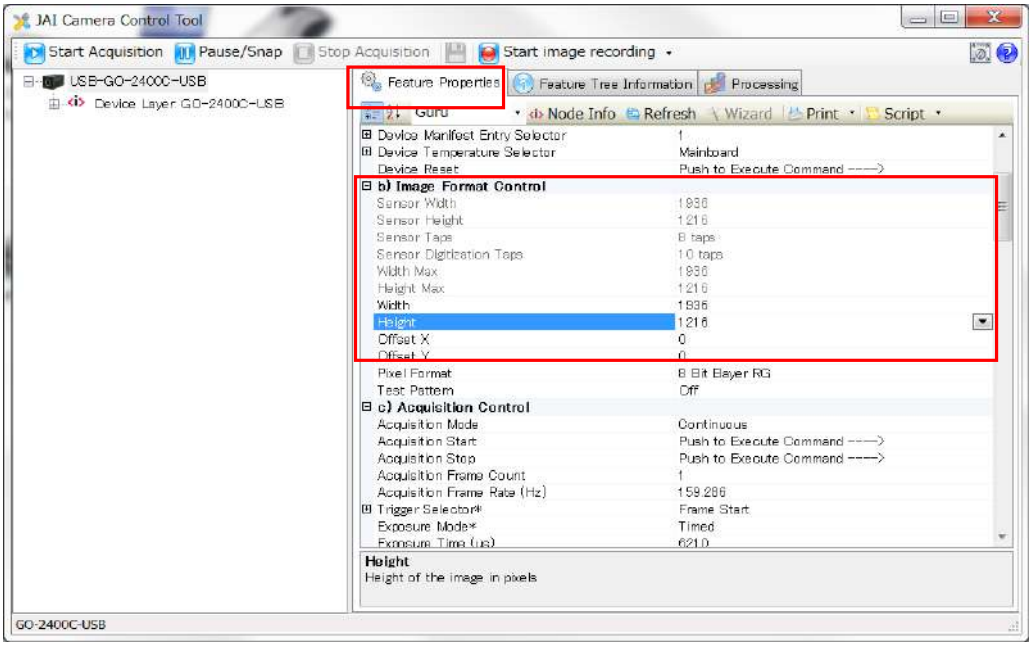
Factory default values

Item		Default value
Image Format Control	Width	1936 (pixels)
	Height	1216 (pixels)
	Offset X (horizontal position)	0 (pixels)
	Offset Y (vertical position)	0 (pixels)
	Pixel Format	GO-2400M-USB: 8 Bit Monochrome GO-2400C-USB: 8 Bit Bayer RG

❖ You can specify the image acquisition area. For details, see “ROI (Regional Scanning Function)” (page 34).

1 Select the [Feature Properties] tab, and select the item you want to configure under [Image Format Control].

 when a configurable item is selected.

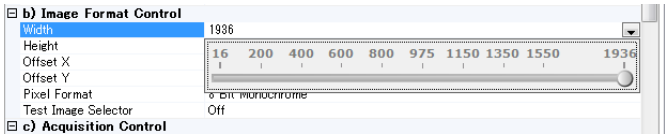


Note

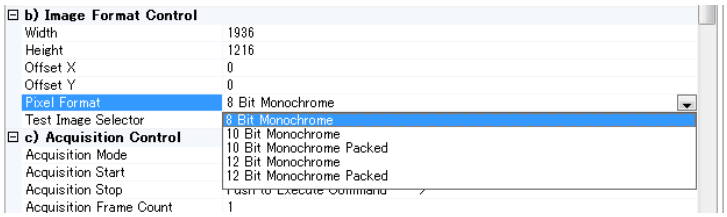
Settings can only be changed when image acquisition on the camera is stopped. If an item is grayed out and  does not appear even when you select it, click  (Stop Acquisition) to stop image acquisition.

2 Click  and change the setting value.

Example: When changing [Width]



Example: When changing [Pixel Format]



Note

Direct entry of numerical and text values is possible for some setting items.

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

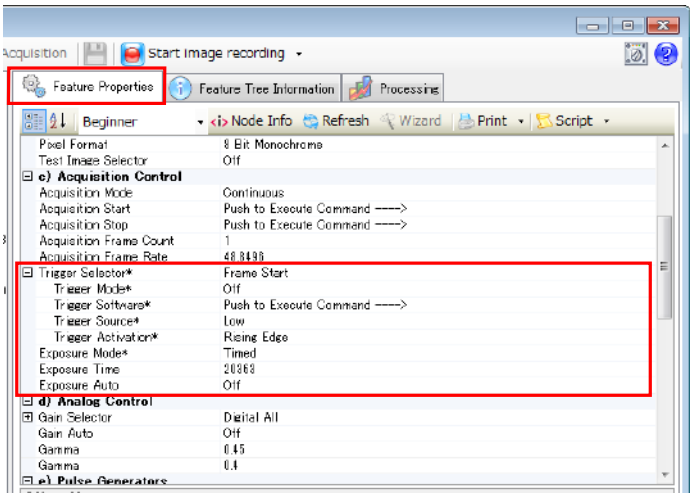
Item		Default value
Trigger Selector (trigger operation)		Frame Start
	Trigger Mode	Off
	Trigger Source (trigger signal source)	Line 5 - Optical In 1
	Trigger Activation (trigger polarity)	Rising Edge (rising edge of input signal)
Exposure Mode		Timed (control via exposure time)
Exposure Time		6210 (µs)
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.

Configure the settings by expanding [Acquisition Control] and configuring the following items.



Caution

Settings can only be configured when image acquisition on the camera is stopped. If an item is grayed out and the setting cannot be changed, stop image acquisition beforehand.

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		6 to 7999892 (µs) (1 µs/step)*1
Exposure Auto		Off, Continuous

* 1 The minimum value will differ depending on the [Pixel Format] setting value.

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 8 frames for 8-bit, and up to 4 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	The exposure time will differ depending on the [Pixel Format] and [Acquisition Frame Rate] setting values. (1 µs/step)*1
Exposure Auto	Off, Continuous

*1 The maximum value for [Exposure Time] varies depending on the value configured for the [Acquisition Frame Rate Raw] setting.
Max. value for [Exposure Time] = [Acquisition Frame Rate Raw] value - 14H (8 bit: 14×4.85 = 67.9, 10/12 bit: 14×6.22 = 87.1)

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.

Note

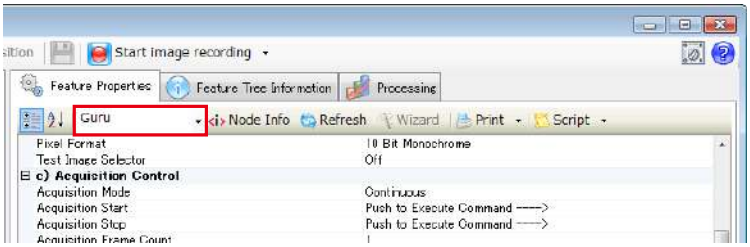
- [Exposure Time] will be disabled.
- [Exposure Auto] cannot be used.

Step 5: Adjusting the Image Quality

Adjust the image quality using the gain and white balance (GO-2400C-USB only) functions.

To adjust the image quality

The display level must be changed from [Beginner] to [Guru].



Adjusting the Gain

Adjust the sensitivity via the analog gain (i.e., master gain).

❖ For details on gain control, see “Gain Control” (page 29) 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-2400M-USB, only [Analog All] (master gain) can be configured.
- For the GO-2400C-USB, [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].

- [Analog All] (master gain) can be set to a value from x1 to x16 (0 dB to +24 dB). The resolution is set in x0.01 steps (0.005 dB to 0.08 dB depending on the setting value). Values are configured by multipliers.
- For the GO-2400C-USB, 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 [Analog All] (master gain) value. The resolution is set in x0.01 steps.

Adjusting the White Balance (GO-2400C-USB 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-2400M-USB, only [Digital All] (master black) can be configured.

For the GO-2400C-USB, [Digital All] (master black), [Digital Red] (digital R), and [Digital Blue] (digital B) can be configured individually.

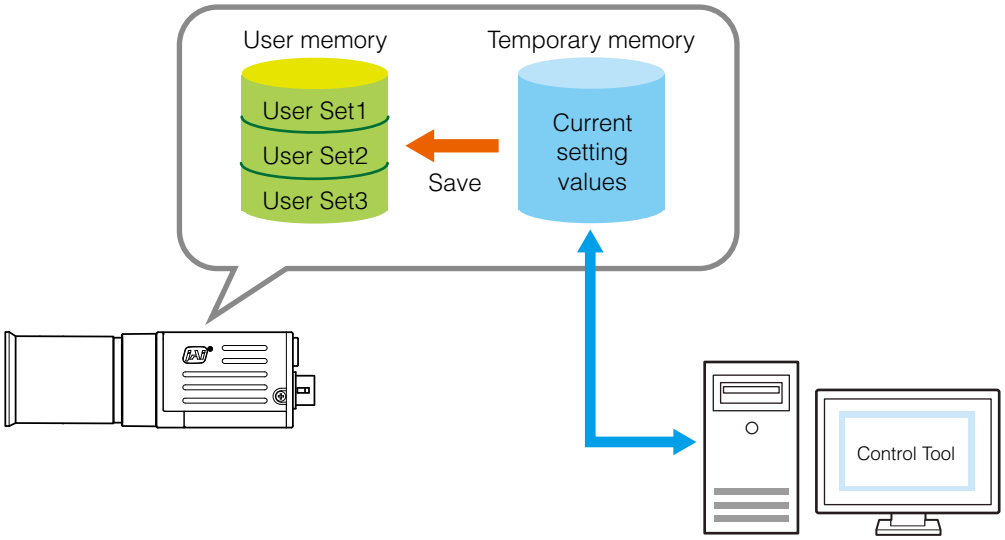
2 Specify the adjustment value in [Black Level].

Step 6: Configuring Various Other Settings

See “Settings List” (page 46) and configure settings as necessary.

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.



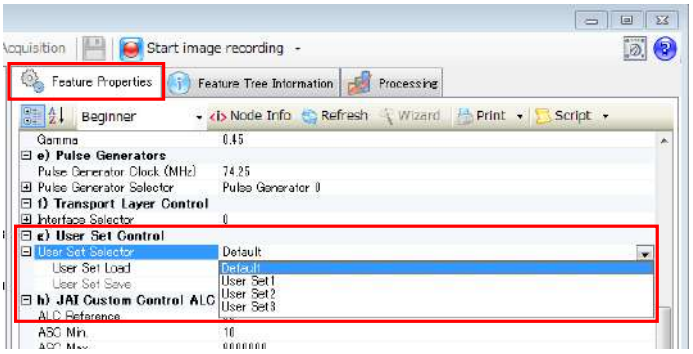
Note

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].



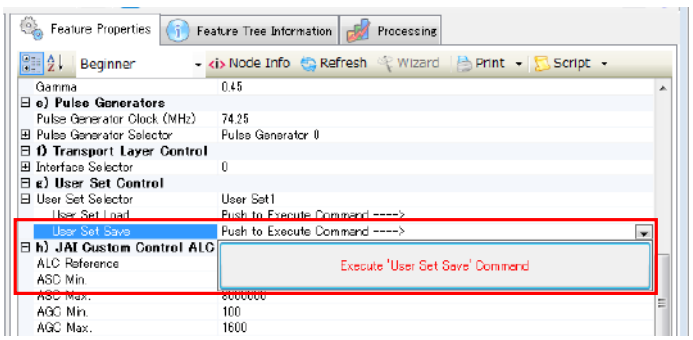
Note

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 Multi ROI	Sensor Multi ROI	Sensor: Trigger Sequencer Mode	Sensor: 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-2400M-USB
*2 Operates only on the GO-2400C-USB

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					
		Acquisition Start	Acquisition End	Frame Start	Transfer Start	Line2 OPT Out 1	Line3 OPT Out 2	PG Clear	Time Stamp Reset	Nand Gate 0 In	Nand Gate 1 In
Signals to use as output	LOW	○	○	○	○	○	○	○	○	○	○
	HIGH	○	○	○	○	○	○	○	○	○	○
	User Output 0	○	○	○	○	○	○	○	○	○	○
	User Output 1	○	○	○	○	○	○	○	○	○	○
	Software	○	○	○	○	×	×	×	×	×	×
	Pulse Generator 0	○	○	○	○	○	○	×	○	○	○
	NAND 0 Out	○	○	○	○	○	○	○	○	×	○
	NAND 1 Out	○	○	○	○	○	○	○	○	○	×
	Line5-Optical In 1	○	○	○	○	○	○	○	○	○	○
	FVAL	×	×	×	×	○	○	○	○	○	○
	LVAL	×	×	×	×	×	×	○	○	○	○
	Acquisition Trigger Wait	×	×	×	×	○	○	○	○	○	○
	Frame Trigger Wait	×	×	×	×	○	○	○	○	○	○
	Frame Active	×	×	×	×	○	○	○	○	○	○
	Exposure Active	×	×	×	×	○	○	○	○	○	○
		Trigger Source				Line Source					
		Use									

: Indicates default values for each selector. “Factory default values” (page 16) 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

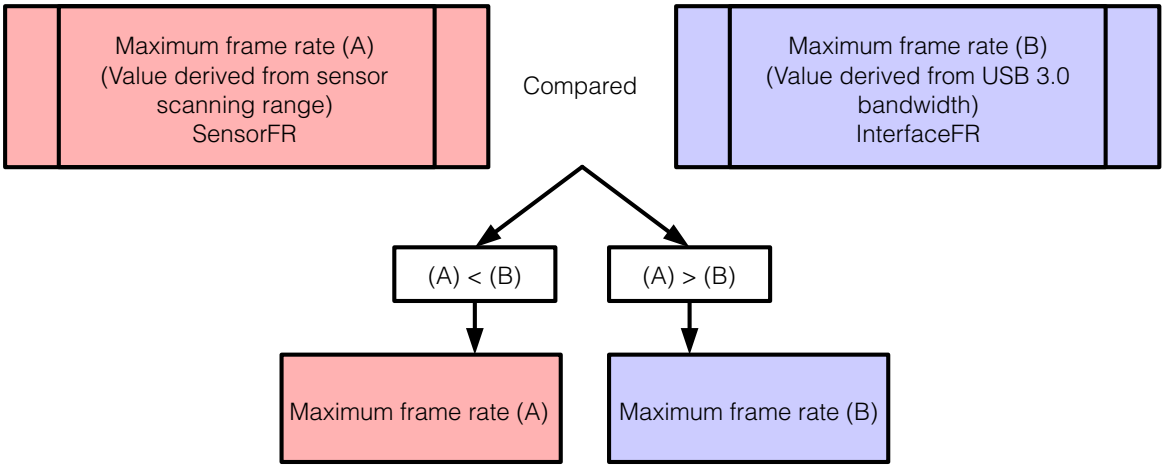
When [Trigger Mode] is disabled, you can change the frame rate in [Acquisition Frame Rate].

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 USB 3.0 bandwidth.



■ Maximum frame rate period formula

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

- Maximum frame rate of sensor output
  SensorFR = 1 / ((Height_s + 40) × Hperiod)
- Maximum frame rate of USB 3.0 output bandwidth
  InterfaceFR = 3000 × 1000000 / (Height_g × Width_g × Pack value)
- Maximum frame rate
  FR_Cont = Min (<SensorFR>, <InterfaceFR>)

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 output
  Sensor FR = 1 / {H Period × (Height + 40)}
- Maximum frame rate by interface
  Interface FR = 3000 × 1000000 / (Height × Width × Pack value)
- Maximum frame rate
  FR_Cont = Min (Sensor FR, Interface FR)

- Exposure time possible within frames
  MaxOverlapTime_TrOloff = (1 / FR_Cont) - (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_Cont) + NonOverlapExposureTime_TrOloff}

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

- Maximum frame rate of sensor
  Sensor FR = 1 / {H Period × (Height + 40)}
- Maximum frame rate by interface
  Interface FR = 3000 × 1000000 / (Height × Width × Pack value)
- Maximum frame rate
  FR_Cont = Min (Sensor FR, Interface FR)

- Exposure time possible within frames
  MaxOverlapTime_TrOlrd = (1 / FR_Cont) - (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	H Period (µs)	Pack Value
8 bit	4.8485	8
10 bit packed	6.2222	10
12 bit packed	6.2222	12
10 bit/12 bit	6.2222	16

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 16).

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 8 frames for 8-bit, and up to 4 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 16).

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 of trigger		
	8 bit	10 bit Packed	10 bit
Full	6.289 ms	7.874 ms	12.658 ms
ROI 2/3 (Height = 810)	4.193 ms	5.249 ms	8.439 ms
ROI 1/2 (Height = 608)	3.145 ms	3.937 ms	6.329 ms
ROI 1/4 (Height = 304)	1.572 ms	1.969 ms	3.165 ms
ROI 1/8 (Height = 152)	0.786 ms	0.984 ms	1.582 ms
Binning Vertical 2*	3.145 ms	5.249 ms	8.439 ms

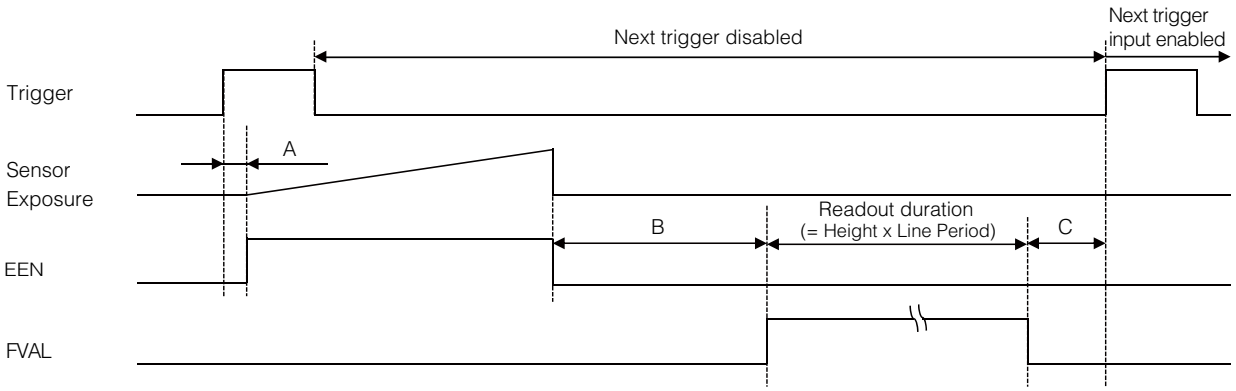
* GO-2400M-USB only

The above table indicates the shortest trigger periods for when [Trigger OverLap] is set to [Readout]. When [Trigger OverLap] is set to [Off], the exposure time is added to the period.

■ When [Exposure Mode] is [Timed]

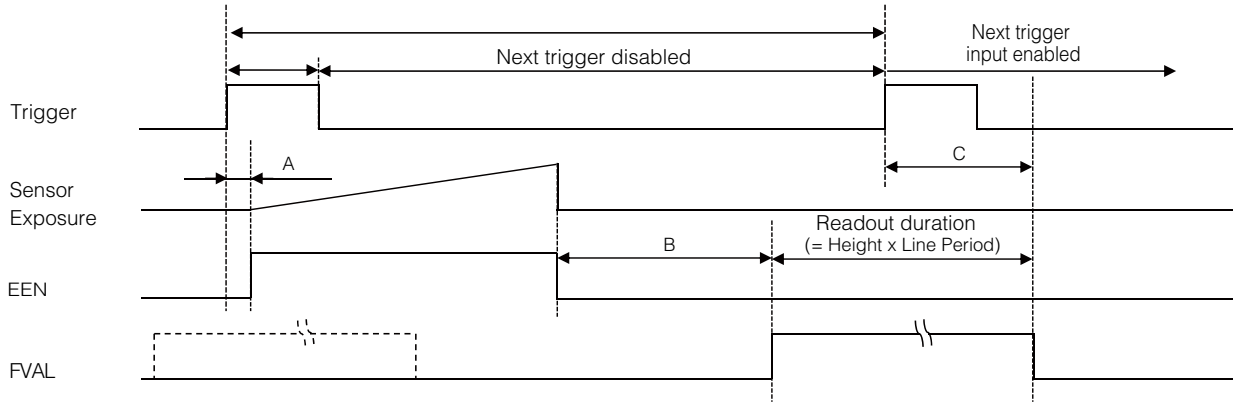
Example: When [Trigger Source] is set to [Line 5 - Optical In 1] and [OptIn Filter Selector] is set to [10 µs]

- **Trigger overlap: Off**



Pixel format	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B] (usec)	Period FVAL end to next trigger start[C] (usec)
8 bit	422	165	355
10 bit packed	26	212	41
10 bit	26	212	4749

- **Trigger overlap: Readout**

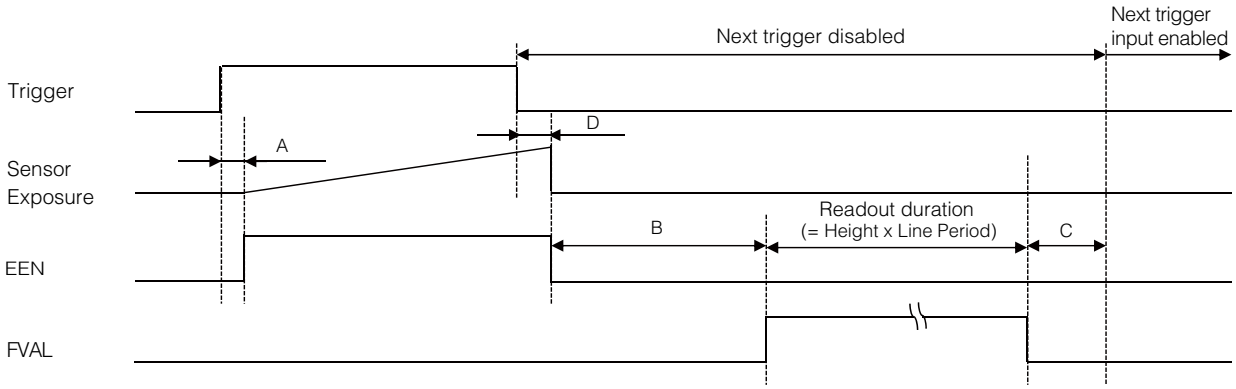


Pixel format	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B] (usec)	Period FVAL end to next trigger start[C] (usec)
8 bit	422	165	6277-ExposureTime
10 bit packed	26	212	7848-ExposureTime
10 bit	26	212	12556-ExposureTime

■ When [Exposure Mode] is [Trigger Width]

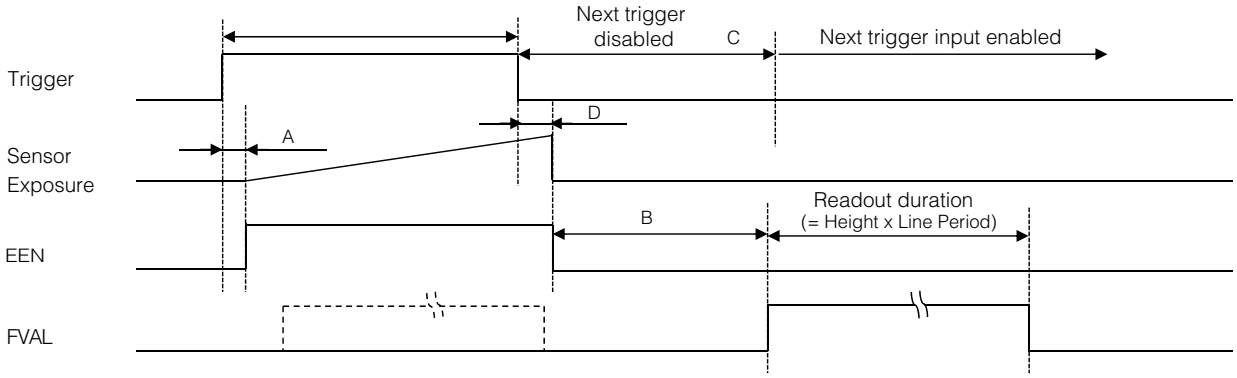
Example: When [Trigger Source] is set to [Line 5 - Optical In 1] and [OptIn Filter Selector] is set to [10 µs]

- **Trigger overlap: Off**



Pixel format	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B] (usec)	Period FVAL end to next trigger start[C](usec)	Period from Trigger end edge to Exposure end[D](usec)
8 bit	422	165	355	22
10 bit packed	26	212	41	26
10 bit	26	212	4749	26

- **Trigger overlap: Off**



Pixel format	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B] (usec)	Next trigger start prohibited period[C](usec)	Period from Trigger end edge to Exposure end[D](usec)
8 bit	422	165	67.879 (14*Line Period)	22
10 bit packed	26	212	87.1108 (14*Line Period)	26
10 bit	26	212	87.1108 (14*Line Period)	26

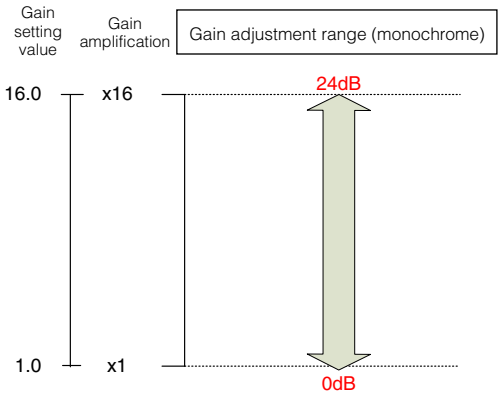
Gain Control

[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-2400C-USB.

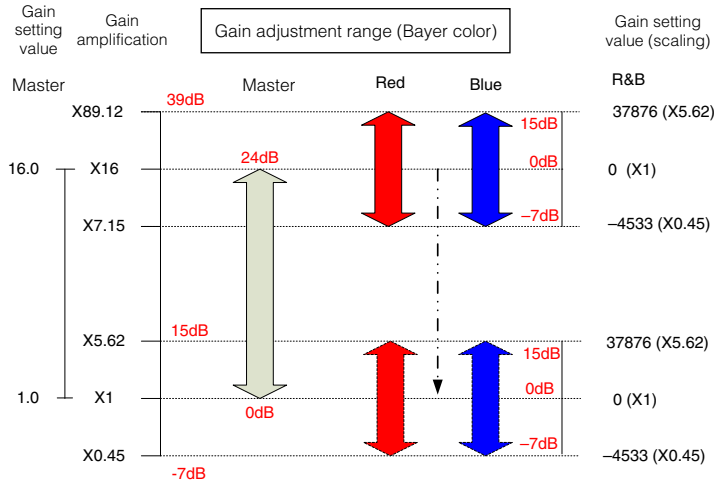
❖ For details on how to configure the settings, see “Adjusting the Gain” (page 19).

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

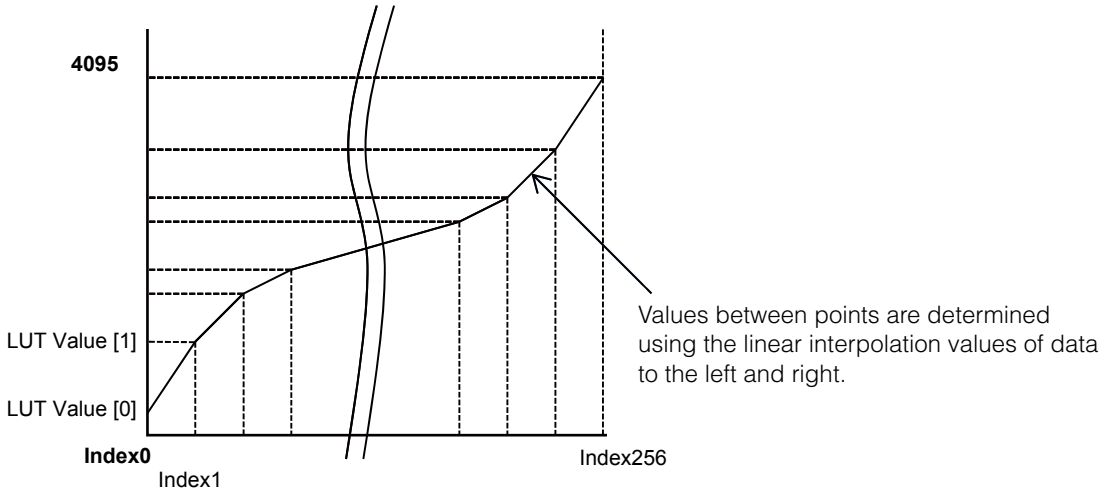
Configure the settings as follows.

Item	Setting value / selectable range	Description
JAI LUT Mode	LUT	Use LUT.
LUT Selector*	R, G, B	Select the LUT channel to control.
LUT Index	GO-2400M-USB: 0 to 256 GO-2400C-USB: 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 256 represents a full white pixel.
LUT Value	0 to 4095	Set the LUT output value for the selected index.

* GO-2400C-USB only

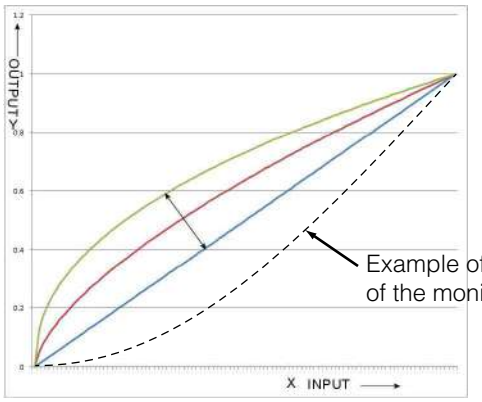
■ LUT values

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 30).

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 256 pixels can be corrected.

Line Status

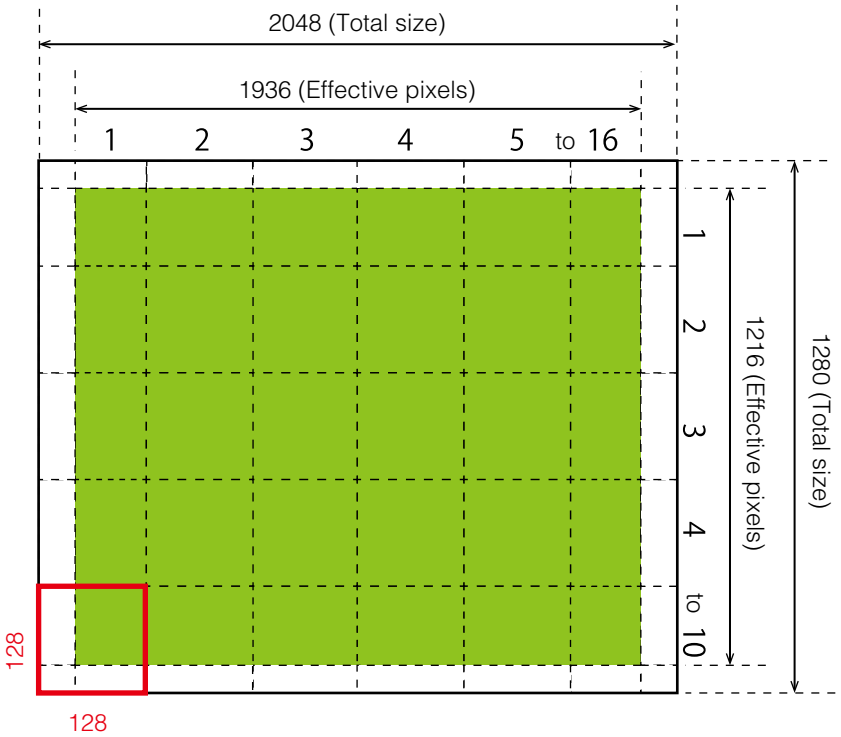
The line status function allows you to verify the status of external input/output signals.
You can verify the status of the following signals.

- 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

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).

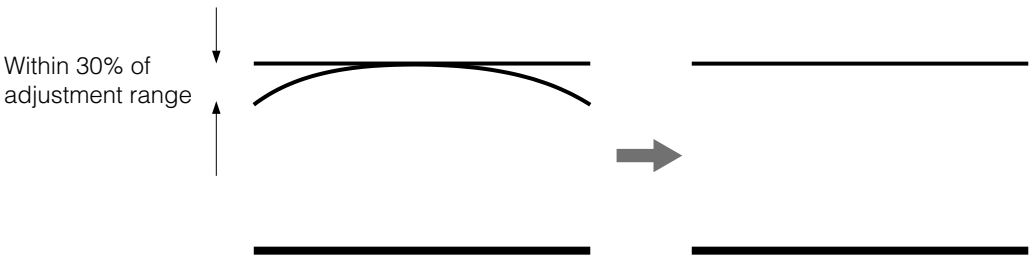
The size of the correction block is 16 (H) × 10 (V) blocks and calculation errors in the correction data are minimized due to the small interpolation block. Each block is 128 × 128 pixels.
The total size of the blocks is 2048 (H) × 1280 (V), but the actual number of effective pixels for the camera is 1936 (H) × 1216 (V). The ineffective peripheral areas will be deleted internally on the camera automatically.



The following shading correction modes are available on the camera. However, as proper interpolation is not performed when ROI settings are configured, execute shading correction at full size before configuring the ROI settings.

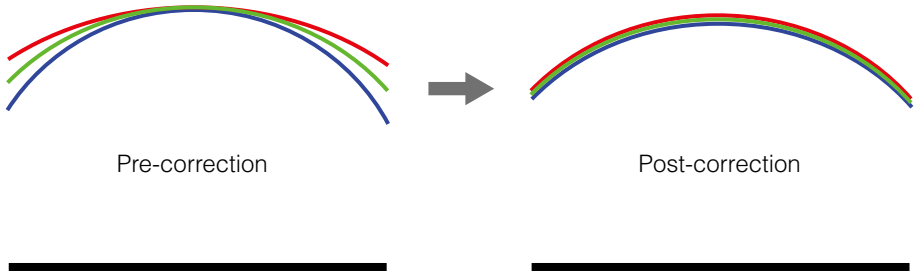
■ Flat Shading

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-2400C-USB only)

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



Pre-correction　　Post-correction

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-2400M-USB: Flat Shading (fixed) GO-2400C-USB: Flat Shading, Color Shading	Select the shading correction mode.
Shading Mode	User 1, User 2, User 3, Off	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 (GO-2400M-USB Only) allows you to combine the signal values of clusters of adjacent pixels on the sensor to create improved virtual pixels. Using the function results in images with lower pixel resolution and higher sensitivity.
Common methods of binning include “horizontal binning” where two horizontally adjacent pixels are combined, and “vertical binning” where two vertically adjacent pixels are combined. By combining the horizontal and vertical methods to create a group of four pixels (2×2 binning), you can create images with x4 sensitivity.

ROI (Regional Scanning Function)

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

ROI Settings

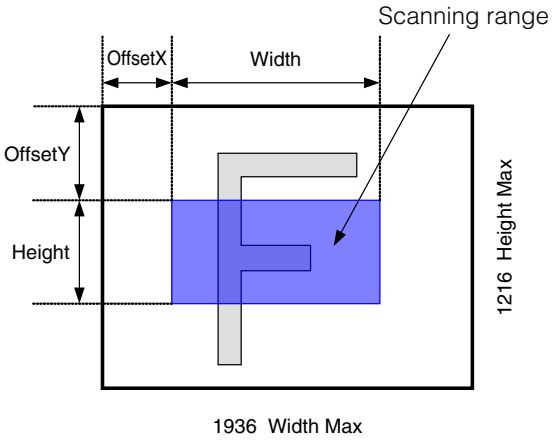
Specify the area to scan by specifying width, height, and horizontal/vertical offset values under [Image Format Control].

❖ For details on how to configure the settings, see “Configuring the Output Format” (page 15).

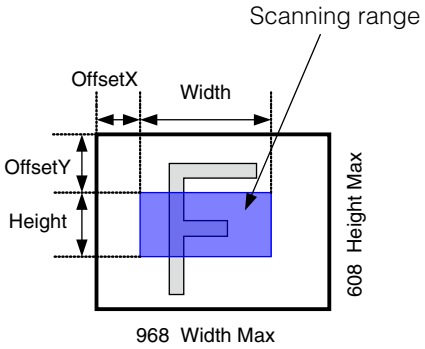
You can increase the frame rate by specifying a lower height, as the number of lines scanned decreases.
The minimum area is as follows.

	Minimum width value (pixels)	Minimum height value (pixels)
GO-2400M-USB	16	1
GO-2400C-USB	16	2

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



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



* GO-2400M-USB only

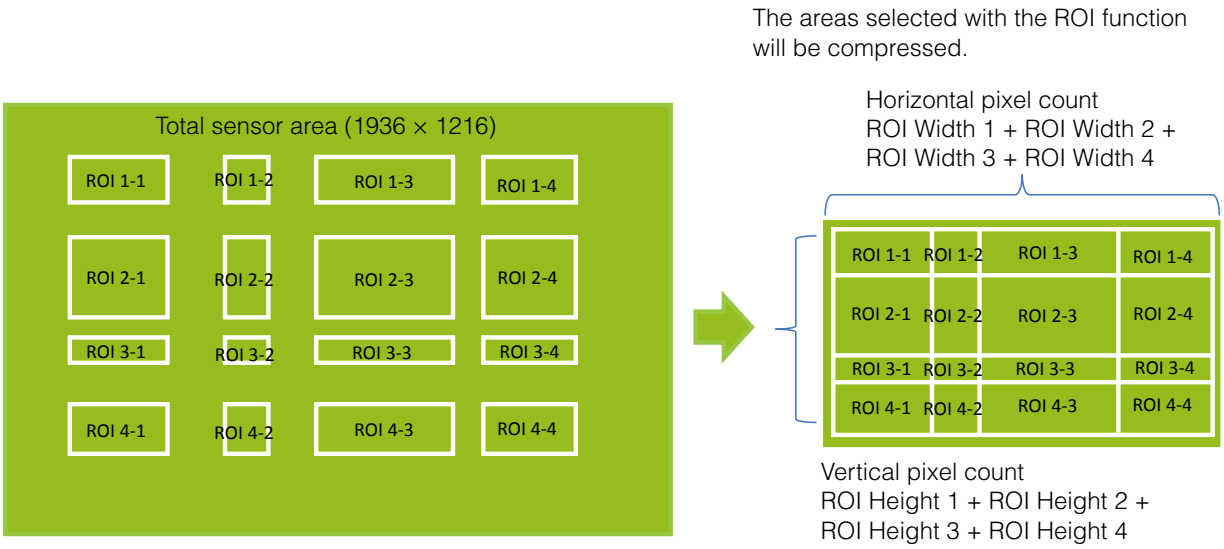
❖ For details on the frame rates for common ROI sizes, see “Frame Rate Reference” (page 57).

Sensor Multi ROI Function

Sensor Multi ROI is an ROI function that is configured and functions inside the sensor.
You can configure up to 16 scanning regions (4 horizontal and 4 vertical).
By skipping areas that are not specified as regions of interest when scanning a frame, the sensor's ROI function outputs the specified regions in a compressed state. You can increase the frame rate due to the reduced scanning time for the compressed areas. However, you cannot make the line frequency faster by compressing in the horizontal direction.

Note

Sensor Multi ROI cannot be used together with Sequencer function (Page 37).



Restrictions

- The specified areas cannot overlap.
- The frame rate can be increased in relation to size of the area specified in the vertical direction, but not in relation to the horizontal direction.
- In the horizontal direction, the configuration for the second and subsequent row will be identical. In the vertical direction, the configuration for the second and subsequent column will be identical.

Configuration

Configure each area so that they do not overlap.
Both the horizontal and vertical settings must be configured as even values.

Horizontal ROI conditions

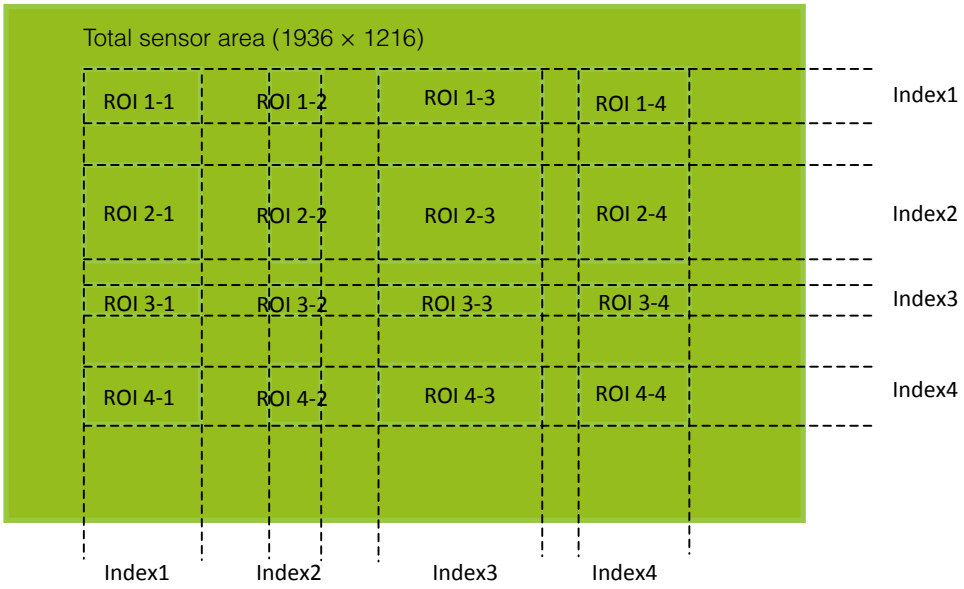
ROI Offset H1 + ROI Width 1 < ROI Offset H2
ROI Offset H2 + ROI Width 2 < ROI Offset H3
ROI Offset H3 + ROI Width 3 < ROI Offset H4
ROI Offset H4 + ROI Width 4 < 1936

Vertical ROI conditions

ROI Offset V1 + ROI Height 1 < ROI Offset V2
ROI Offset V2 + ROI Height 2 < ROI Offset V3
ROI Offset V3 + ROI Height 3 < ROI Offset V4
ROI Offset V4 + ROI Height 4 < 1216

Configure the four index settings (Index 1 to 4). The [OffsetH], [Width], [OffsetV], [Height], [Horizontal Enable], and [Vertical Enable] settings can be configured for each index.

When you configure the [OffsetH], [Width], [OffsetV], and [Height] settings for an index and set [Horizontal Enable] or [Vertical Enable] to [True] for that index, the corresponding area is configured. When [False] is specified, the settings within the index are disabled.
OffsetH, Width: 16 pixels/step
OffsetV, Height: 2 lines/step



Reference: Areas corresponding to the [Horizontal Enable] and [Vertical Enable] settings of each setting

Index 1		Index 2		Index 3		Index 4		Number of Enabled ROI	Enabled area
Hori	Vert	Hori	Vert	Hori	Vert	Hori	Vert		
True	True	False	False	False	False	False	False	1	ROI 1-1
True	True	True	True	False	False	False	False	4	ROI 1-1, ROI 1-2, ROI 2-1, ROI 2-2
True	True	True	False	False	False	False	False	2	ROI 1-1, ROI 1-2
True	True	True	True	True	True	False	False	9	ROI 1-1, ROI 1-2, ROI 1-3 ROI 2-1, ROI 2-2, ROI 2-3 ROI 3-1, ROI 3-2, ROI 3-3
True	True	True	True	True	True	True	False	12	ROI 1-1, ROI 1-2, ROI 1-3, ROI 1-4 ROI 2-1, ROI 2-2, ROI 2-3, ROI 2-4 ROI 3-1, ROI 3-2, ROI 3-3, ROI 3-4
True	True	True	True	True	True	True	True	16	ROI 1-1, ROI 1-2, ROI 1-3, ROI 1-4 ROI 2-1, ROI 2-2, ROI 2-3, ROI 2-4 ROI 3-1, ROI 3-2, ROI 3-3, ROI 3-4 ROI 4-1, ROI 4-2, ROI 4-3, ROI 4-4

Frame rate calculation formula

FR = line frequency ÷ (ROI Height 1 + ROI Height 2 + ROI Height 3 + ROI Height 4 + vertical invalid line)

There are two types of line frequencies.
SensorReadout 10 bit, camera output 8 bit: 12.4445 KHz
SensorReadout 12 bit, camera output 10 bit: 24.2425 KHz
Vertical invalid line: 40 (fixed)

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.

Note

Sequencer function cannot be used together with Sensor Multi ROI function (Page 35).

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.

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

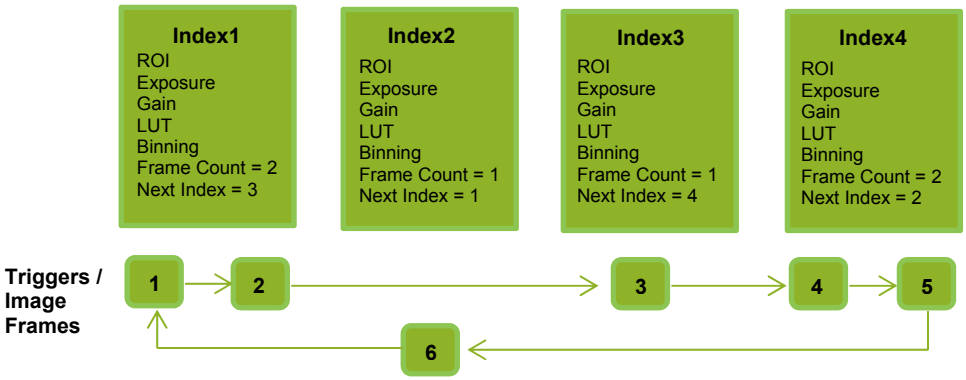
In Trigger Sequencer mode, patterns begin with the index of [Sequencer Set Start]. Subsequent triggers follow the user-defined values in [Sequencer Index Frame Count] and [Sequencer ROI Next Index].
Assigning a Next Index value of “1” to an index creates a loop back to the start of the sequencer pattern.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

[Sequencer Repetition]

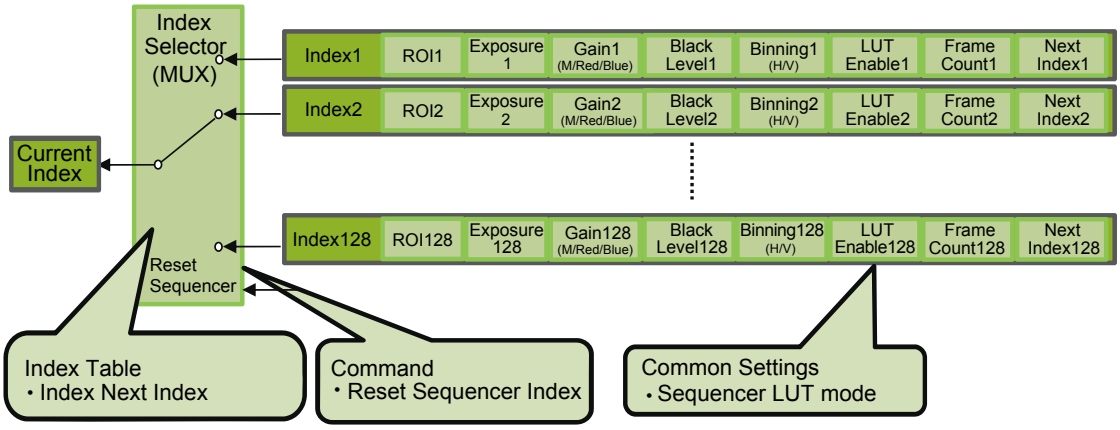
This parameter applies to Trigger Sequencer patterns which include an index whose [Sequencer ROI Next Index] is set to OFF.
When the index whose [Sequencer ROI Next Index] is set to OFF is finished executing, the value of Sequencer Repetition (range = 1-255) is decremented internally. If the result of 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)

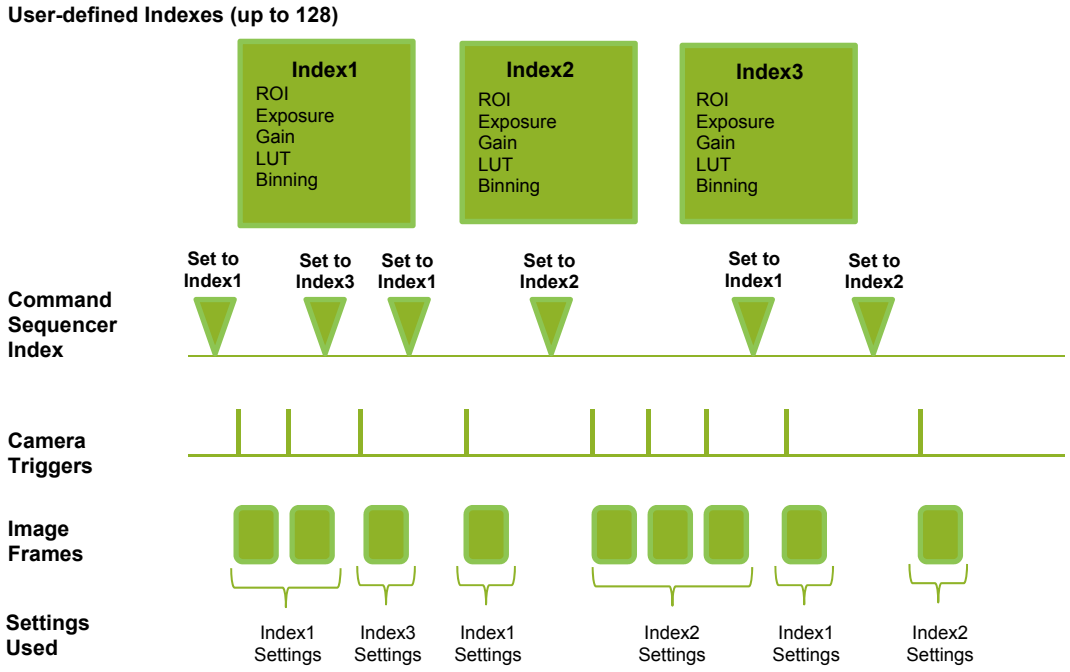
The user must also enter a value from 1 to 128 in [Command Sequencer Index]. This indicates which index to execute each time a trigger is received. The same index will continue to be executed for all subsequent triggers as long as the value of [Command Sequencer Index] remains unchanged.

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.

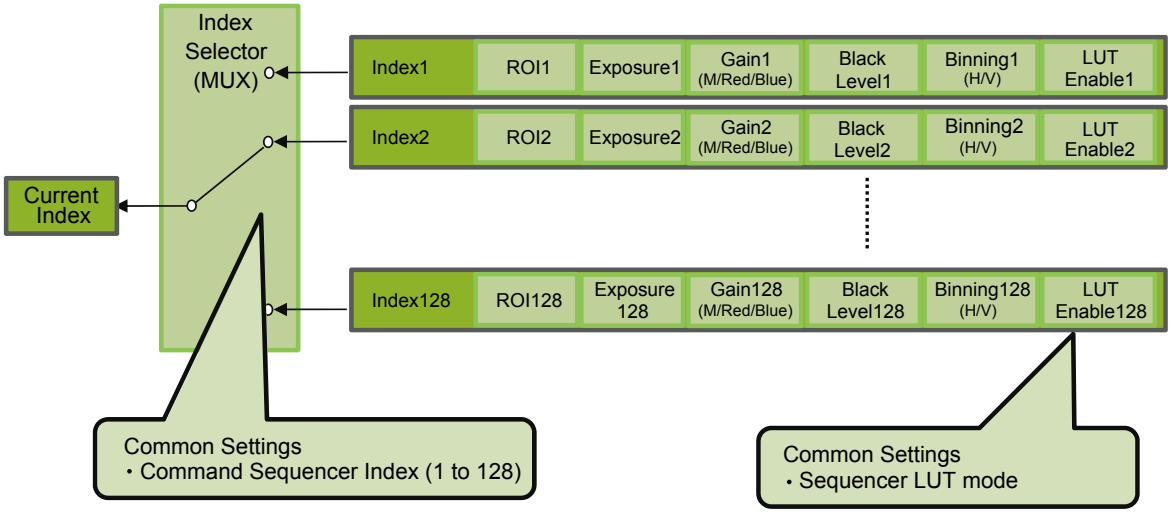
As with Trigger Sequencer, [Sequencer LUT Mode] defines whether Gamma or LUT is to be applied to the sequence. If Gamma is selected, the Gamma setting defined in the camera's Analog Control section will be applied to all exposures in the sequence. If LUT is selected, the LUT characteristics defined in 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]

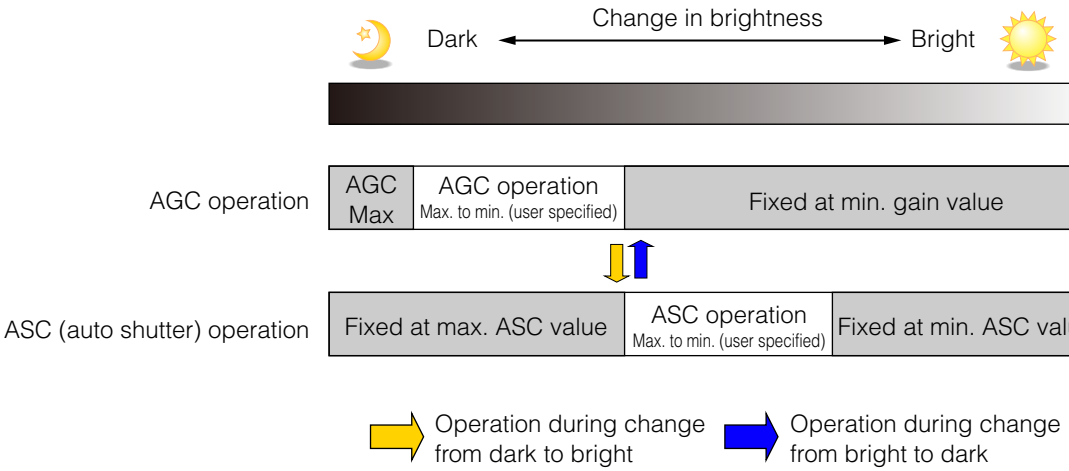
Delayed readout enables images captured by a Frame Start trigger command to be stored inside the camera and read out on demand at a later time using Acquisition Transfer Start trigger. This can be especially useful when multiple cameras need to be triggered at the same time, but simultaneous readout of all images would overwhelm the available network bandwidth. The delayed readout buffer can hold up to 8 frames in 8-bit mode or 4 frames in 10-bit or 12-bit modes.

❖ For details, see “Trigger Control” (page 26).

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.)

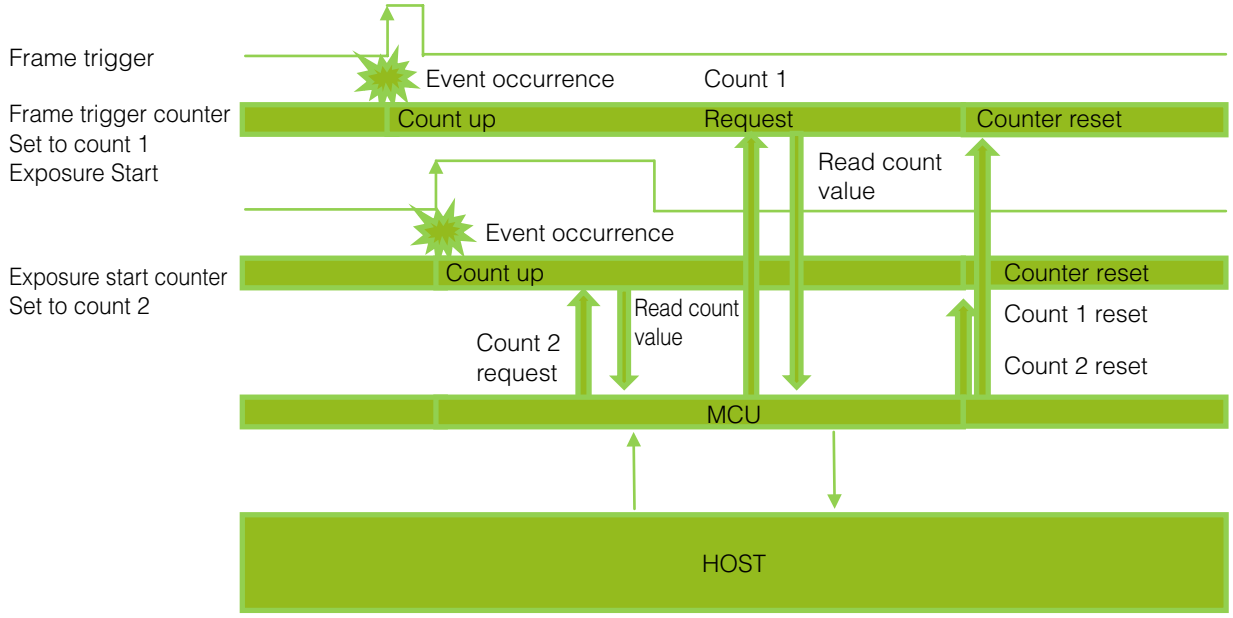
Auto gain metering areas (16 areas)

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

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.

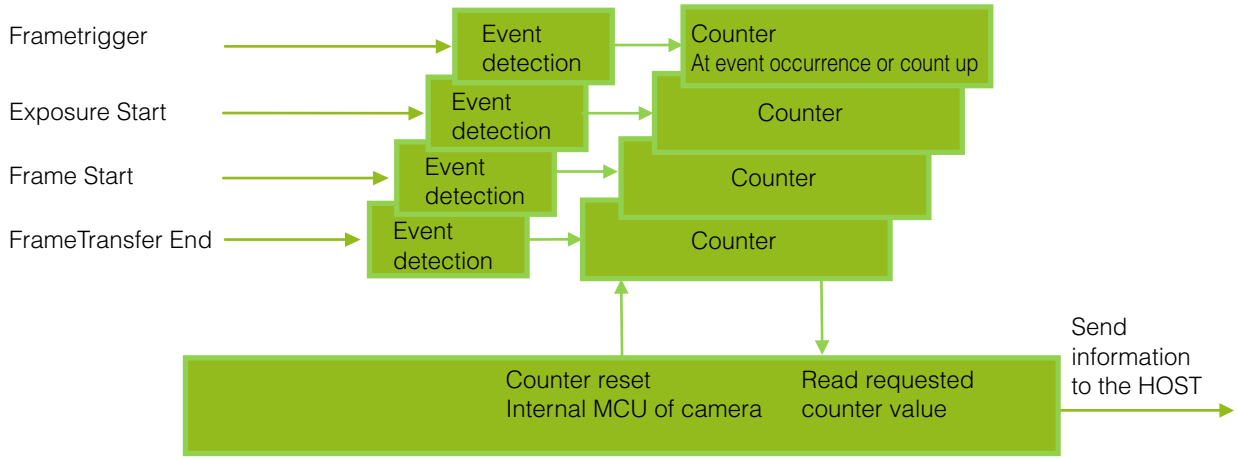
■ Counter occurrence diagram



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, Exposure 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 three counter event signals are always counted up internally on the camera.

Video Process Bypass Mode

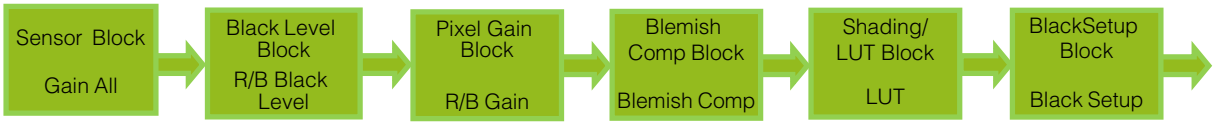
The video process bypass mode is a function that bypasses internal video processing on the camera. When bypass is enabled, the sensor output and camera output data can be set to the same bit width. Operation using 12-bit outputs must be performed in bypass mode.

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

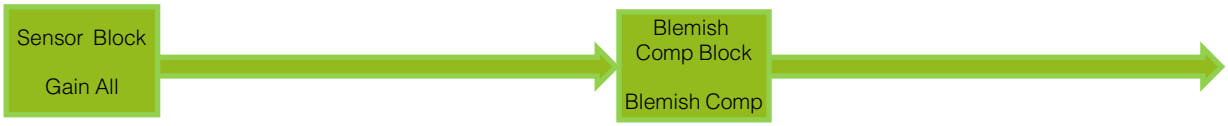
When video process bypass mode is disabled

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.



■ To enable video process bypass mode

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

Chunk Data Function

The Chunk Data function adds camera configuration information to the image data that is output from the camera.
Embedding camera configuration information in the image data allows you to use the serial number of the camera as a search key and find specific image data from among large volumes of image data. In addition, when images are shot with a single camera in sequence under multiple setting conditions, you can search for images by their setting conditions.

The following information can be added to image data as chunk data.

Genicam Name	Chunk ID	Data type	Description
Chunk Image	1000h	IRegister	Image data (Image data is also handled as a piece of chunk data.)
Chunk Offset X	2000h	IInteger	Offset X value
Chunk Offset Y	2001h	IInteger	Offset Y value
Chunk Width	2002h	IInteger	Width value
Chunk Height	2003h	IInteger	Height value
Chunk Pixel Format	2012h	IEnumeration	Pixel Format value
Chunk Timestamp	2014h	IInteger	Timestamp value
Chunk Line Status All	2013h	IInteger	[0]: Line1 - TTL Out 1 [1]: Line2 - Opt Out 1 [2]: Line3 - Opt Out 2 [3]: Line4 - TTL In 1 [4]: Line5 - Opt In 1 [5]: Line6 - Opt In 2 [6]: Line7 - CC1/CXP In [7]: Line8 - TTL Out 2 (Option) [8]: Line9 - TTL Out 3 (Option) [9]: Line10 - TTL In 2 (Option) [10]: Line11 - LVDS In (Option) [11]: TimeStampReset [12]: Nand0_In_1 [13]: Nand0_In_2 [14]: Nand1_In_1 [15]: Nand1_In_2
Chunk Exposure Time (us)	2004h	IFloat	ExposureTime value for when Exposure Mode is set to Timed
Chunk Gain All	2005h	IFloat	Gain All value
Chunk Gain Red	2006h	IFloat	Gain Red value*
Chunk Gain Blue	2007h	IFloat	Gain Blue value*
Chunk Black Level All	2008h	IFloat	Black Level Alll value
Chunk Sequencer Set Active	200Ch	IInteger	Value indicating the Sequencer status
Chunk Frametrigger Counter	200Eh	IInteger	Counter value for FrameTtrigger
Chunk Exposure Start Counter	200Fh	IInteger	Counter value for ExposureStart
Chunk Frame Start Counter	2010h	IInteger	Counter value for FrameStart
Chunk Frame Transfer End Counter	2011h	IInteger	Counter value for FrameTransferEnd
Chunk Line Status All On FVAL Start	2016h	IInteger	The line status is added when FVAL is established. The content of the data is identical to [ChunkLineStatusAll].
Chunk Device Temperature	2019h	IFloat	Device Temperature value
Chunk Device Serial Number	2017h	IString	Device Serial Number value
Chunk Device User ID	2018h	IString	Decice User ID value

* GO-2400C-USB only

■ Configuring Chunk Data

1 Set [Chunk Mode Active] to [True].

2 Select the items of information you want added to image data with [Chunk Selector], and set [Chunk Enable] from [False] to [True].

Note

When [Chunk Mode Active] is set to [True], [Chunk Image] is automatically set to [True].

Caution

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

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	—	—	Display the manufacturer name.
Device Model Name	—	—	Display the model name.
Device Manufacturer Info	—	See the possibilities	Display the device 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 Selector	Mainboard	Mainboard	Select the area of the camera's interior for which to display the temperature sensor's reading.
Device Temperature (C)	—	—	Display the internal temperature (˚C) of the camera.
Device Reset	—	—	Reset the device.
b) Image Format Control			Configure image format settings.
Sensor Width	1936	1936	Display the maximum image width.
Sensor Height	1216	1216	Display the maximum image height.
Width Max	—	1936	Display the maximum image width.
Height Max	—	1216	Display the maximum image height.
Width	Binning Off: 16 to 1936 Binning 2 On: 16 to 968 ❖ The minimum value for Monochrome varies depending on the [Binning] setting.	1936	Set the image width.
Height	GO-2400M-USB: Binning Off: 1 to 1216 Binning 2 On: 1 to 608 GO-2400C-USB: 2 to 1216 ❖ The minimum value for Monochrome varies depending on the [Binning] setting.	1216	Set the image height.
Offset X	0 to (1936 to Width)	0	Set the horizontal position.
Offset Y	0 to (1216 to Height)1	0	Set the vertical position.
Binning Horizontal Mode (GO-2400M-USB only)	Sum, Average	Sum	Set the addition process to be used during horizontal binning.
Binning Horizontal (GO-2400M-USB only)	1, 2	1	Set the number of pixels in the horizontal direction for which to perform binning.
Binning Vertical (GO-2400M-USB only)	1, 2	1	Set the number of pixels in the vertical direction for which to perform binning.
Binning Vertical Mode (GO-2400M-USB only)	Sum, Average	Sum	Display the addition process to be used during vertical binning.

Item	Setting range	Default value	Description
Pixel Format	GO-2400M-USB: 8 Bit Monochrome, 10 Bit Monochrome, 10 Bit Monochrome Packed, 12 Bit Monochrome, 12 Bit Monochrome Packed GO-2400C-USB: 8 Bit Bayer RG, 10 Bit Bayer RG (Unpacked), 10 Bit Bayer RG Packed, 12 Bit Bayer RG (Unpacked), 12 Bit Bayer RG Packed	GO-2400M-USB: 8 Bit Monochrome GO-2400C-USB: 8 Bit Bayer RG	Set the pixel format.
Test Pattern	GO-2400M-USB: Off, GreyHorizontal Ramp, GreyVertical Ramp, GreyHorizontalRamp Moving GO-2400C-USB: 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)* * Max. frequency/min. frame period depends on ROI, pixel format, and binning mode selected.	0.125 to 159.286	159.286	Set the frame rate as a frequency. (unit: Hz)
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, 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	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, Read Out (Frame Start only)	Off	Select the trigger overlap operation.
Exposure Mode	Off, Timed, Trigger Width	Timed (control via exposure time)	Select the exposure mode.
Exposure Time	6 to 6210 (µs)	6210 (µs)	Set the exposure time.
Exposure Auto	Off, Continuous	Off	Set whether to enable auto exposure.
d) Analog Control			Configure analog control settings.

Item	Setting range	Default value	Description
Gain Selector	GO-2400M-USB: Analog All GO-2400C-USB: Analog All, Digital Red, Digital Blue	Analog All (master gain)	Select the gain to configure.
Gain	Analog All: 1 to 16 Digital Red & Blue: 0.447 to 5.624 (color only)	Master gain: 1 R, B: 1	Set the gain value.
Black Level Selector	GO-2400M-USB: Digital All GO-2400C-USB: Digital All, Digital Red, Digital Blue	Digital All (master black)	Select the black level to configure.
Black Level	Digital All: –133 to 255 Digital Red & Blue: –133 to 255 (color only)	0	Set the black level value.
Gain Auto	Off, Continuous	Off	Enable/disable gain auto adjustment.
Gamma	0.45, 0.60, 1.0	0.45	Set the gamma value.
JAI LUT Mode	Off, Gamma, LUT	Off	Select the JAI LUT mode.
e) LUT Control			Configure LUT settings.
LUT Selector (GO-2400C-USB only)	R, G, B	R	Select the LUT channel to control.
LUT Index	GO-2400M-USB: 0 to 256 GO-2400C-USB: 0 to 256	0	Set the LUT index table number.
LUT Value	0 to 4095	0	Set the LUT value.
f) 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	—	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	—	False	Display the status of the input signal or output signal (True: High, False: Low).
LineSource	Low, High, Acquisition Trigger Wait, Frame Trigger Wait, Frame Active, Exposure Active, FVAL, 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.
Line Status All	—	0x00	Display the status of the input signal and output signal.
User Output Selector	User Output 0, User Output 1	User Output 0	Set the user output signal.
User Output Value	True, False	False	
g) Counter And Timer Control			Configure counter settings. (This camera only supports counter functions.)
Counter 0 to 2	Counter 0 to 2	—	Display the counter.

Item	Setting range	Default value	Description
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 (fixed)	Rising Edge	Specify 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 to 2	Display the count value.
Counter 0 to 2 Status	—	Counter Active	Display the counter status.
h) User Set Control			Configure user settings.
User Set Selector	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.
i) Sequencer Control			Configure sequencer settings.
Sequencer Mode	On, Off	Off	Enable/disable [Sequencer Mode].
Sequencer Mode Select	Trigger Sequencer, Command Sequencer	Trigger Sequencer	Select the sequencer mode.
Sequencer Configuration Mode	On, Off	On	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	0 (Off), 1 to 128	1	Set the next index to be displayed for the selected Sequencer Index. (Enabled only for Trigger Sequencer.)
Sequencer Width	GO-2400M-USB: 16 to 1216 GO-2400C-USB: 16 to 1936	1936	Set the width of the selected Sequencer Index.
Sequencer Height	2 to 1216	1216	Set the height of the selected Sequencer Index.
Sequencer Offset X	0 to (1936 - Width)	0	Set the horizontal offset value for the selected Sequencer Index.
Sequencer Offset Y	0 to (1218 - Height)	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 Exposure Time (US)	6 to 8000000	6210	Set the exposure time for the selected Sequencer Index.
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-2400M-USB only)	1 to 2	1	Set the horizontal binning for the selected Sequencer Index.
Sequencer V Binning (GO-2400M-USB only)	1 to 2	1	Set the vertical binning for the selected Sequencer Index.
Sequencer Repetition	1 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	1 to 128	1	Set this to change the Sequencer Index. (Enabled only for Command Sequencer.)
Sequencer Set Start	1 to 128	1	Set the index number that is used when executing [Sequencer Reset] in [Trigger Sequencer] mode.
Sequencer Reset	—	—	Reset the current index number to the number configured in [Sequencer Set Start].
j) Chunk Data Control			Configure Chunk Data function settings.
Chunk Mode Active	True, False	False	Enable/disable the Chunk Data function.

Item	Setting range	Default value	Description
Chunk Selector	Chunk Image, Chunk Offset X, Chunk Offset Y, Chunk Width, Chunk Height, Chunk Pixel Format, Chunk Timestamp, Chunk Line Status All, Chunk Exposure rtime (us), Chunk Gain All, Chunk Gain Red,* Chunk Gain Blue,* Chunk Black Level All, Chunk Sequencer Set Active, Chunk Frame Trigger Counter, Chunk Exposure Start Counter, Chunk Frame Start Counter, Chunk Frame Transfer End Counter, Chunk Line Status All On FVAL Start, Chunk Device Temperature, Chunk Device Serial Number, Chunk Device User ID	Image	Select the information you want added to the image data. * GO-2400C-USB only
Chunk Enable	True, False	—	Select whether to add the information to the image data. Default value: [Chunk Image] only "True"
k) Transport Layer Control			Display information on transport layer control.
Payload Size (B)	—	2354176	Display the payload size.
Device Tap Geometry	Geometry_1X1_1Y	Geometry_1X1_1Y	Set the transmission method for each time images are transmitted from the device (TAP structure).
l) JAI Custom Control Pulse Generators			Configure pulse generator settings.
Clock Pre-scaler	1 to 4096	165	Set the division value for the prescaler (12-bit) using the pixel clock as the base clock.
Pulse Generator Clock (MHz)	0.018127 to 74.25	0.45	Set the clock used for the pulse generator. This value is calculated based on the Clock Pre-Scaler value.
Pulse Generator Selector	Pulse Generator 0	Pulse Generator 0	Select the pulse generator.

Item	Setting range	Default value	Description
Pulse Generator Length	1 to 1048575	30000	Set the maximum count up value using clock value.
Pulse Generator Length (ms)	0.002222 to 2330.166666	66.6667	Set the maximum count up value using ms. This value is calculated based on the Pulse Generator Length value. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator Frequency (Hz)	0.429154 to 450000	15	Set the maximum count up value using frequency. This value is calculated based on the Pulse Generator Length value.
Pulse Generator Start Point	0 to 1048574	0	Set the start point for the High interval using clock value. When the counter reaches this value, the output becomes 1.
Pulse Generator Start Point (ms)	0 to 2330.164444	0	Set the start point for the High interval using ms. When the counter reaches this value, the output becomes 1. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator End Point	1 to 1048575	15000	Set the start point for the Low interval using clock value. When the counter reaches this value, the output becomes 0.
Pulse Generator End Point (ms)	0.000013468 to 14.1222	33.3333	Set the start point for the Low interval using ms. When the counter reaches this value, the output becomes 0. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator Pulse-Width (ms)	-	33.3333	Display High interval width for the pulse in ms. This is a calculation of the time between the Start Point and End Point. The setting range varies depending on the Clock Pre-Scaler value.
Pulse Generator Repeat Count	0 to 255	0	Set the repeat count for the counter. When this is set to 0, the counter will be free-running with limitless repeating.
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, High, Acquisition Trigger Wait, Frame Trigger Wait, Frame Active, Exposure Active, FVAL, LVAL, User Output 0, User Output 1, Action 1, Action 2, Line 5 - Opt In 1, Nand0 Out, Nand1 Out	0: Low	Select the count clear input signal source. Line4 TTL In is available on 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.
m) 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: %)
ALC Area Selector	Low Right to High Left	Low Right	Select an ALC metering area.
ALC Area Enable	True, False	False	Enable/disable the metering area where selected metering area.

Item	Setting range	Default value	Description
ALC Area Enable All	True, False	True	Set whether to enable ALC for all areas.
ASC Min.	100 to 6209	100	Set the minimum value for the ASC range.
ASC Max.	101 to 6210	6210	Set the maximum value for the ASC range.
AGC Min.	100 to 1599	100	Set the minimum value for the AGC range.
AGC Max.	101 to 1600	1600	Set the maximum value for the AGC range.
AGC/ASC Control Speed	1 to 8	4	Set the reaction speed for AGC/ASC. These settings are also used for auto exposure control.
ALC Status	—	Idle	Display the status of the ALC.
n) JAI Custom Control Blemish			Configure settings for JAI white blemish correction.
Blemish Enable	True, False	True	Set whether to enable white blemish correction.
Blemish Detect	—	—	Detect white blemishes.
Blemish Detect Threshold	0 to 100	10	Set the white blemish detection threshold.
Blemish Detect Position Index	0 to 511	0	Select the index table for the white blemish detection position.
Blemish Detect Position X	–1 to 1935	–1	Set the horizontal position.
Blemish Detect Position Y	–1 to 1215	–1	Set the vertical position.
Blemish Compensation Number	—	0	Display the number of correction blemishes.
o) JAI Custom Control Shading			Configure shading correction settings.
Shading Correction Mode	GO-2400M-USB: Flat Shading (fixed) GO-2400C-USB: Flat Shading, Color Shading	Flat Shading	Select the shading correction mode.
Shading Mode	Off, User 1, User 2, User 3	Off	Select whether to use shading correction. When using the function, select the user area to which to save the shading correction value.
Perform Shading Calibration	—	—	Execute shading correction. After execution, the shading correction value is automatically saved to the selected user area.
Shading Detect Result	—	—	Display the shading detection results.
p) JAI Custom Control Sensor MultiROI			Configure settings for JAI sensor multi ROI.
Sensor Multi Roi Enable	True, False	False	Enable/disable sensor multi ROI.
Sensor Multi Roi Index	Index 1 to 4	Index 1	Select the sensor multi ROI index table.
Sensor Multi Roi Width	16 to 1936/16 steps	256	Set the width. When binning is enabled on the GO-2400M-USB, the maximum value will change.
Sensor Multi Roi Height	2 to 1216/2 steps	160	Set the height. When binning is enabled on the GO-2400M-USB, the maximum value will change.
Sensor Multi Roi Offset X	0 to 1680/16 steps ❖ maximum value = 1936 - width value	0	Set the horizontal position. When binning is enabled on the GO-2400M-USB, the maximum value will change.
Sensor Multi Roi Offset Y	0 to 1056/2 step ❖ maximum value = 1216 - height value	0	Set the vertical position. When binning is enabled on the GO-2400M-USB, the maximum value will change.
Horizontal Enable	True, False	False	Enable/disable horizontal offset.
Vertical Enable	True, False	False	Enable/disable vertical offset.

Item		Setting range	Default value	Description
q) JAI Custom control Misc.				Configure settings for other JAI functions.
	Video Process Bypass Mode	On, Off	Off	Enable / disable video process bypass mode.
	Trigger Option	Off	Off	—
	OptIn Filter Selector	10 us, 100 us, 500 us, 1 ms, 5 ms, 10 ms	10 us	Select the surge protection filter.
	Video Send Mode	Normal Mode, Trigger Sequence Mode, Command Sequence Mode	Normal	Display the video send mode status.
	Sensor LVDS Ch Num	8	8	Display the number of sensor output LVDS channels.
	Sensor Digitization Bits	10,12	12	Display the resolution per pixel of sensor output.

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 USB 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 31).

■ 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-2400M-USB	GO-2400C-USB
Scanning system				Progressive scan, 1 tap	
Synchronization				Internal	
Interface				USB 3.0 Vision (Specification V1.0 RC4.02) compatible	
Image sensor				1/1.2-inch monochrome CMOS	1/1.2-inch Bayer color CMOS
Image size (effective image)				11.3 (H) × 7.13 (V), 13.4 mm diagonal	
Pixel size				5.86 (H) × 5.86 (V) µm	
Effective image pixel output				1936 (H) × 1216 (V)	1936 (H) × 1216 (V)
Acquisition Frame Rate (max) ❖ The minimum value is 0.125 fps for all.	8-bit	H1, V1		159 fps	159 fps
		Binning	H1, V2	164 fps	—
			H2, V1	164 fps	—
			H2, V2	164 fps	—
	10-bit packed / 12-bit packed	H1, V1		127 fps	127 fps
		Binning	H1, V2	127 fps	—
			H2, V1	127 fps	—
			H2, V2	127 fps	—
	10-bit / 12-bit	H1, V1		79 fps	79 fps
		Binning	H1, V2	127 fps	—
			H2, V1	127 fps	—
			H2, V2	127 fps	—
EMVA 1288 parameters Absolute sensitivity Maximum SN ratio				At 12-bit output 9.44p (λ = 525 nm) 45.16 dB	At 12-bit output 10.86p (λ = 525 nm) 45.23 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			1936 (H) × 1216 (V)	Bayer 1936 (H) × 1216 (V)
	ROI	Width		16 to 1936, 16 pixels/step	16 to 1936, 16 pixels/step
		Offset X		0 to 1920, 16 pixels/step	0 to 1920, 16 pixels/step
		Height		1 to 1216, 1 line/step	2 to 1216, 2 lines/step
		Offset Y		0 to 1215, 1 line/step	0 to 1214, 2 lines/step
	Binning	H	1	1936 (H)	1936 (H)
			2	968 (H)	—
		V	1	1216 (V)	1216 (V)
			2	968 (V)	—
	Pixel Format			Mono8, Mono10, Mono10 Packed, Mono12, Mono12 Packed	BayerGR8, BayerGR10, BayerGR10 Packed, BayerGR12, BayerGR12 Packed
Trigger selector	Exposure			Frame Start	
Exposure modes				Off, Timed (EPS), Trigger Width (PWC)	
Trigger overlap				Off	
Trigger input signals				Line 5 (Opt In), Software, PG0, NAND Out 0/1	
Exposure modes	Timed			6 µs (8-bit), 7 µs (10-bit) (min) to 8 s (max), variable unit: 1 µs ❖ Performance verified for up to 1 second.	
	Trigger Width			6 µs (8-bit), 7 µs (10-bit) (min) to 8 s (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 modes				Normal Mode, Trigger Sequencer Mode, Command Sequencer Mode, Multi Mode	
Digital I/O				Line Selector (6P): GPIO IN / GPIO OUT	
Black level adjustment	Default level			33LSB (during 10-bit output)	
	Video level adjustment range			R/B: 20 to 60 (during 10-bit output)	
	Adjustment range			–33LSB to +64LSB against reference level (during 10-bit output)	
	Resolution adjustment			1 STEP = 0.25LSB	

Item			GO-2400M-USB	GO-2400C-USB
Gain adjustment	Manual adjustment range		0 dB to +24 dB	0 dB to +24 dB
	Auto gain		Off, Continuous	Off, Continuous
	WB gain		—	R / B: –7 dB to +15 dB, 1 step = 0.1 dB
	WB Preset		—	4600K, 5600K, 6500K
	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		256 pixels	
ALC			Can be adjusted automatically together with AGC and auto exposure	
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)	
		Power consumption	4.08 W (at 12 V input, full pixel) (Typical)	
	USB bus power	Input range	DC 5 V ± 10%	
		Power consumption	4.1 W (at 5 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			Protective glass: Not provided	IR cut filter (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.

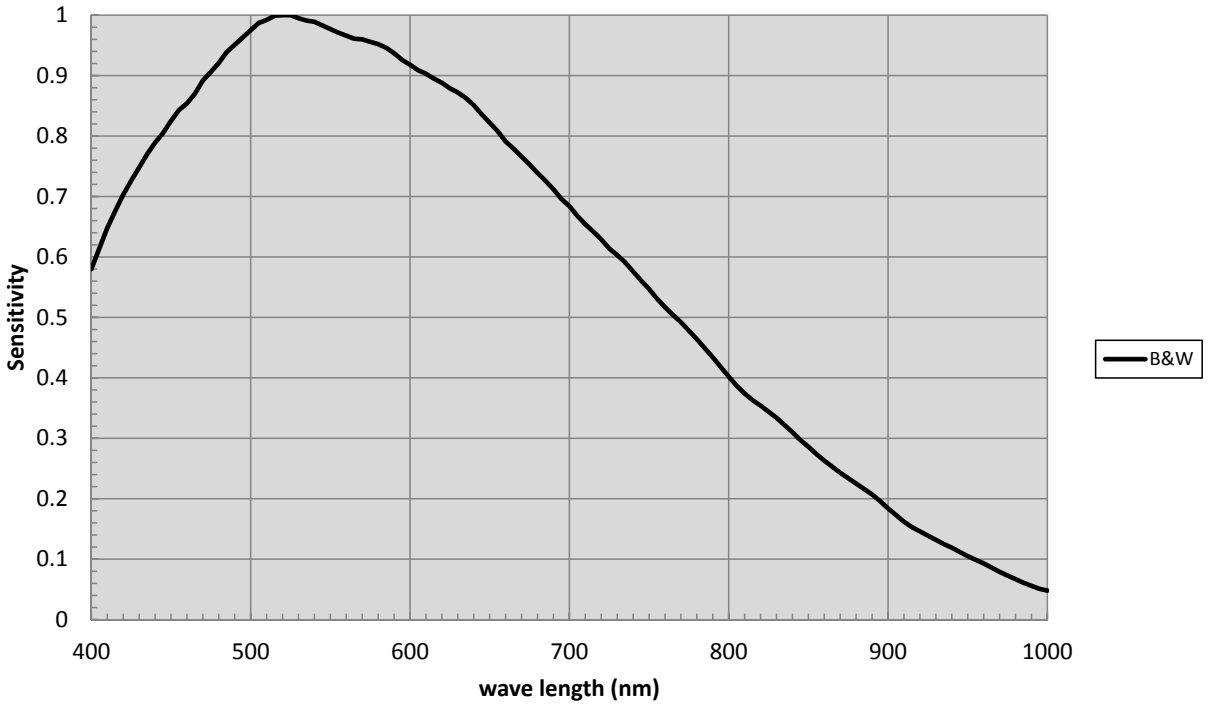
Frame Rate Reference

(Theoretical value: decimal values are dropped)

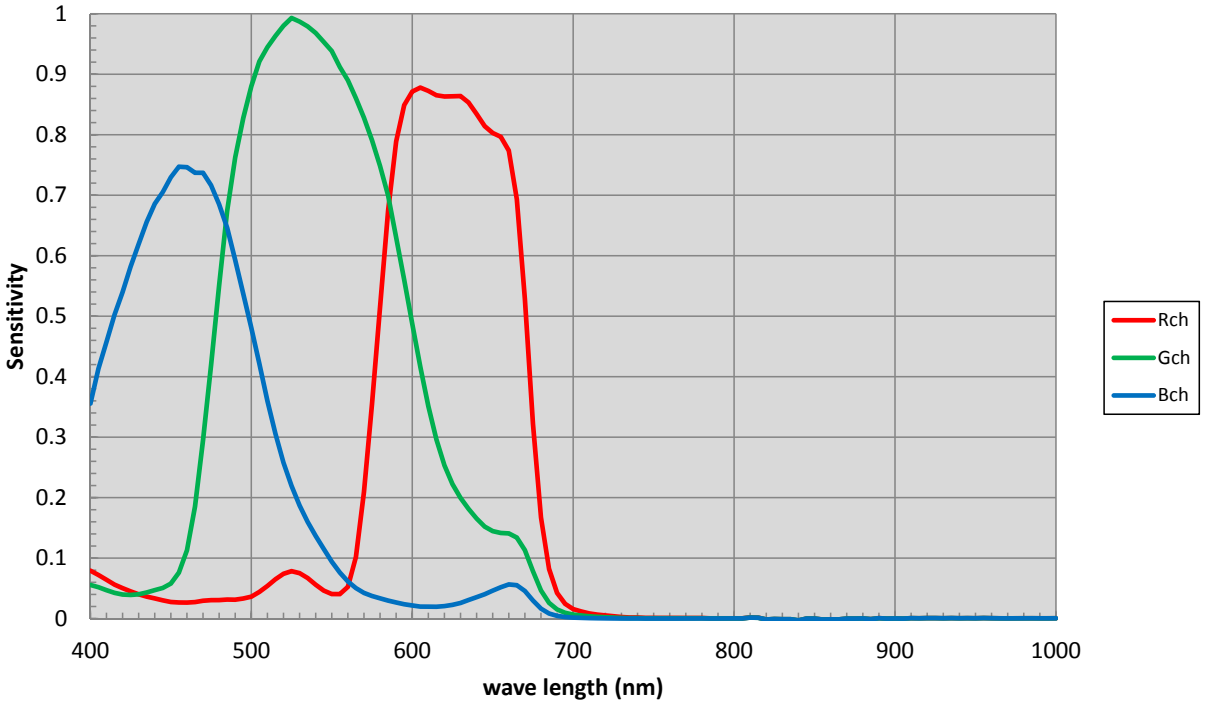
Pixel count	Resolution (screen size)	ROI/Binning	Pixel size(μm)	Image size	Frame rate 8 / 10 / 12 bit
2.35 MP	1936 × 1216	Full pixel	5.86 × 5.86	1/1.2" (13.40 mm)	159 fps (@8 bit)
2 MP	1920 × 1080	ROI	5.86 × 5.86	1/1.2" (12.91 mm)	180 fps (@8 bit)
1.4 MP	1392 × 1050	ROI	5.86 × 5.86	1/1.6" (10.26 mm)	189 fps (@8 bit)
1.3 MP	1280 × 1024	ROI	5.86 × 5.86	1/1.7" (9.61 mm)	193 fps (@8 bit)
0.5 MP	800 × 600	ROI	5.86 × 5.86	1/2.7" (5.86 mm)	322 fps (@8 bit)
0.3 MP	640 × 480	ROI	5.86 × 5.86	1/3.4" (4.69 mm)	396 fps (@8 bit)

Spectral Response

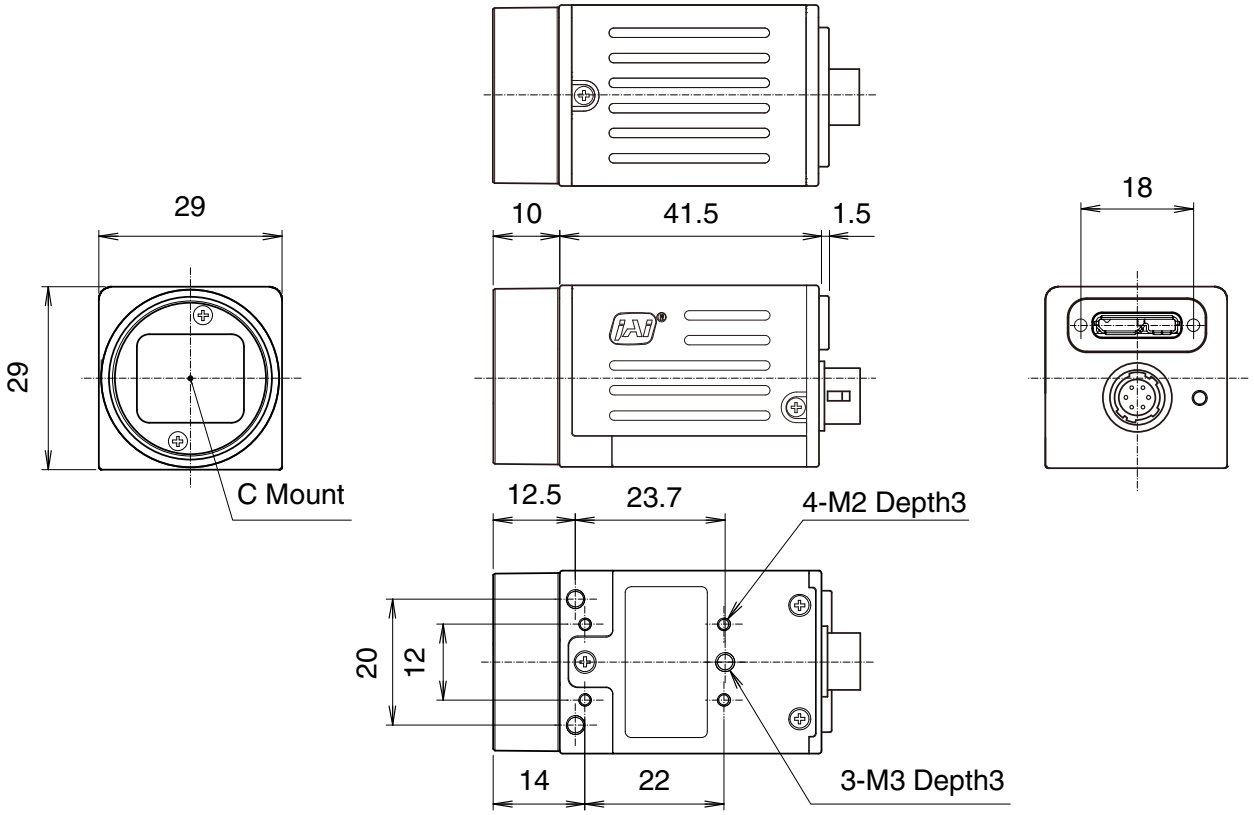
GO-2400M-USB



GO-2400C-USB



Dimensions



Dimensional tolerance: ±0.3 mm
Unit: mm

User's Record

Camera type: GO-2400M-USB / GO-2400C-USB

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	Mar 2017	First draft