See the possibilities

User Manual

GO-5101M-PMCL
GO-5101C-PMCL

5.1M Digital Progressive Scan Monochrome and Color Camera

Document Version: 1.0

GO-5101-PMCL_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-5101M-PMCL and GO-5101C-PMCL 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	×	○	○	○	○	○
.....	.....	.....	.....	.....	.....	.....	.....

○: 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。

Supplement

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电路板	×	○	○	○	○	○
螺丝	×	○	○	○	○	○
光学滤镜	×	○	×	○	○	○
.....	.....	.....	.....	.....	.....	.....

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。
×: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。
（企业可在此处、根据实际情况对上表中打 " × " 的技术原因进行进一步说明。）

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数字「15」为期限15年。

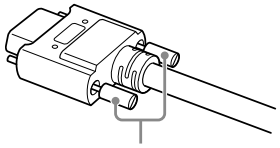
Usage Precautions

Notes on cable configurations

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

Notes on Camera Link cable connections

Secure the locking screws on the connector manually, and do not use a driver. Do not secure the screws too tightly. Doing so may wear down the screw threads on the camera. (Tightening torque: 0.291±0.049 N·m or less)



Secure manually.
Do not secure too tightly.

Notes on attaching the lens

Avoiding dust particles

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

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

Phenomena specific to CMOS image sensors

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

- Aliasing
  When shooting straight lines, stripes, and similar patterns, vertical aliasing (zigzag distortion) may appear on the monitor.
- Blooming
  When the camera is pointed at scenes containing very bright areas or strong light sources, some pixels on the CMOS image sensor may accumulate more than the maximum charge allowed, causing the excess charge to overflow into the surrounding pixels. While this "blooming" affects image quality, it does not affect the operation of the camera.
- Fixed pattern noise
  When shooting dark objects in high-temperature conditions, fixed pattern noise may occur throughout the entire video monitor screen.
- Defective pixels
  Defective pixels (white and black pixels) of the CMOS image sensor are minimized at the factory according to shipping standards. However, as this phenomenon can be affected by the ambient temperature, camera settings (e.g., high sensitivity and long exposure), and other factors, be sure to operate within the camera's specified operating environment.

Notes on exportation

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

Features

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

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

Compact and lightweight

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

Camera Link Ver. 2.0 compatible interface

- High-speed transfer at up to 850 MByte/s of uncompressed data, the ideal format for image processing.
- Maximum cable length of 10 m.
- Support for PoCL (Power over Camera Link) allowing you to supply power to the camera via the Camera Link cable.

Note

To power the camera via Camera Link, the frame grabber board you are using must support PoCL. You can also supply power via the 4-pin connector. A separate power supply and/or conversion cable (not supplied) is required.

Output formats

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

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

High frame rate

The GO-5101M-PMCL and GO-5101C-PMCL are both capable of frame rates of up to 35.6 fps (8-bit format) for full 5.1-megapixel output. Even faster frame rates can be achieved when binning is utilized (GO-5101M-PMCL only) or when a smaller ROI (region of interest) is specified.

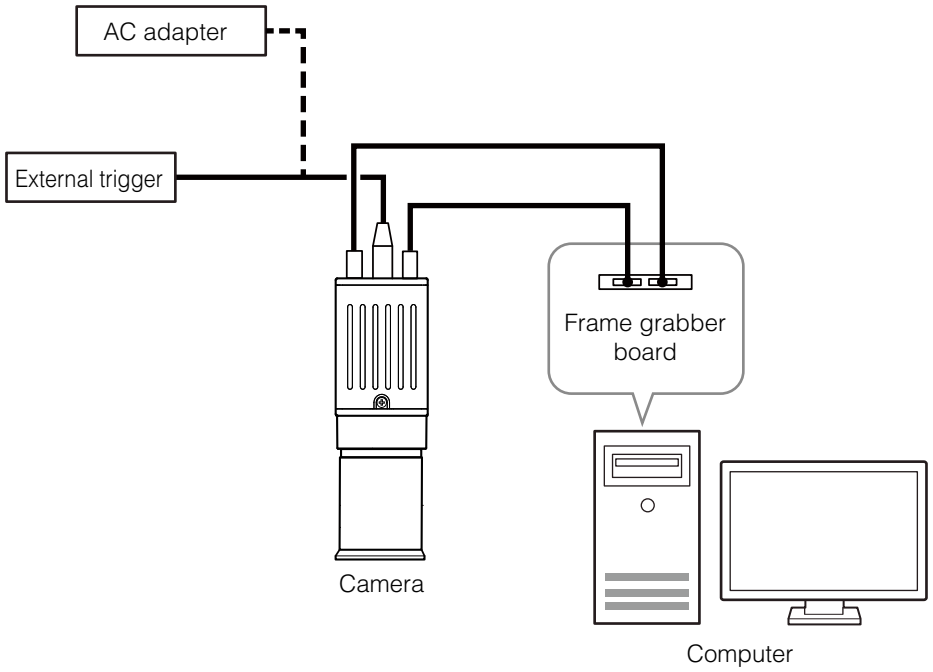
ALC (automatic level control) function

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

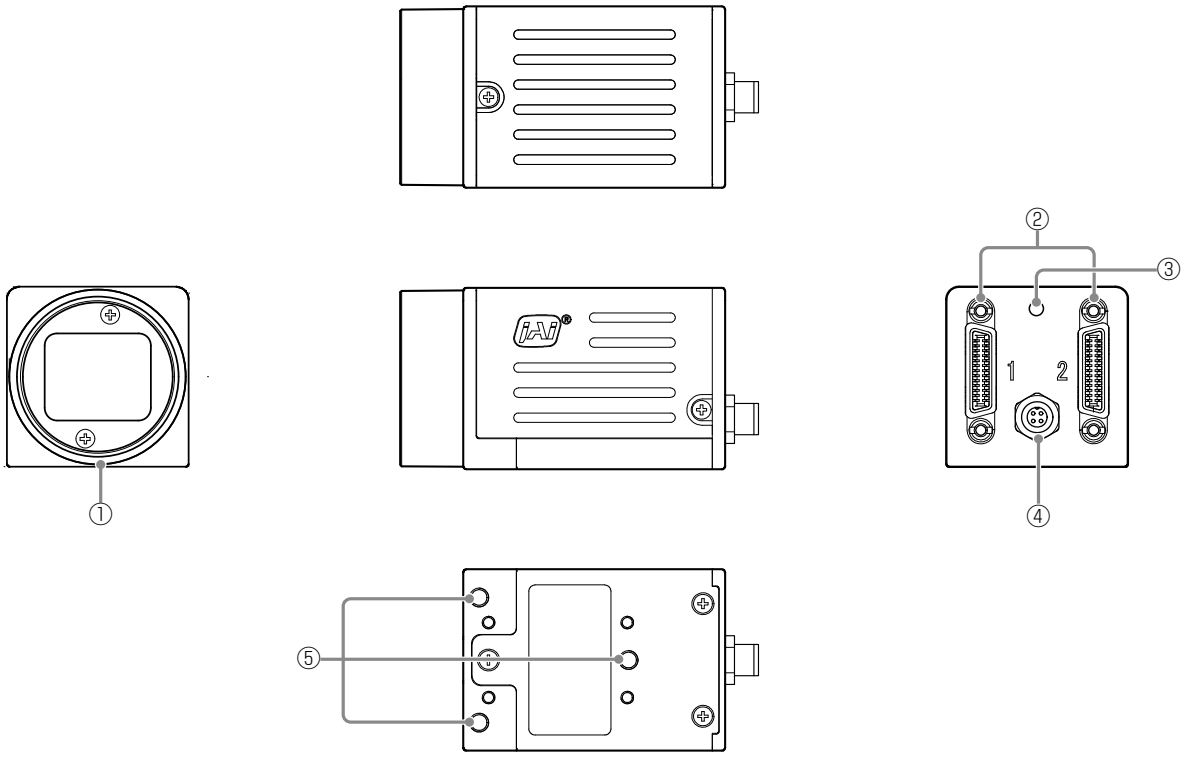
Variety of pre-process functions

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

Connection example:



Parts Identification



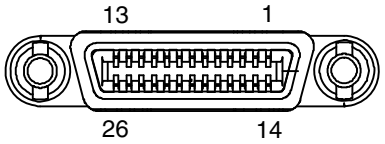
① Lens mount (C-mount)

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

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

② Mini Camera Link connector

Connect a cable that is compatible with Mini Camera Link (SDR) connectors here.



Camera side: HONDA HDR-EC26FYTG2-SL+

Port 1

Pin No.	Input/output	Signal	Description
1, 26		Power	Power
2(–), 15(+)	Out	X_OUT0	Data out
3(–), 16(+)	Out	X_OUT1	
4(–), 17(+)	Out	X_OUT2	
5(–), 18(+)	Out	X_Clk	CL Clock
6(–), 19(+)	Out	X_OUT3	Data out
7(+), 20(–)	In	SerTC (RxD)	LVDS Serial Control
8(–), 21(+)	Out	SerTFG (TxD)	
9(–), 22(+)	In	CC1 (Trigger)	JAI standard trigger
10(+), 23(–)	In	CC2 (Reserved)	
11, 24		N.C	
12, 25		N.C	
13, 14		Shield	Power Return

Port 2

Pin No.	Input/output	Signal	Description
1, 26		Power	Power
2(–), 15(+)	Out	Y_OUT0	Data out
3(–), 16(+)	Out	Y_OUT1	
4(–), 17(+)	Out	Y_OUT2	
5(–), 18(+)	Out	Y_Clk	CL Clock
6(–), 19(+)	Out	Y_OUT3	Data out
7(+), 20(–)		N.C	
8(–), 21(+)	Out	Z_OUT0	Data out
9(–), 22(+)	Out	Z_OUT1	
10(+), 23(–)	Out	Z_OUT2	
11(–), 24(+)	Out	Z_Clk	CL Clock
12(–), 25(+)	Out	Z_OUT3	Data out
13, 14		Shield	Power Return

③ Power/trigger LED

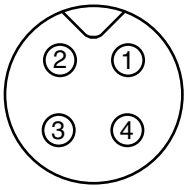
Indicates the power and trigger input status.

LED status and camera status

LED	Light	Status
Power / trigger LED	● Lit amber	Camera initializing.
	● Lit green	Operational and no triggers being input.
	✱ Blinking green	Operational and triggers being input. ❖ The blinking interval is not related to the actual input interval of the external trigger.

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

Connect the cable for a VA-044F or PD-4P-GO Power Supply (optional) or for DC IN /trigger IN here.



Compatible connectors

Camera side: 09-3111-81-04 (Binder)
Cable side: 79-3108-52-04 (Binder) AWG 26
or
79-3108-32-04 (Binder) AWG 24

Pin No.	Input/output	Signal	Description
1	Power In	DC (+12 V) In	DC 12 V to 24 V +/– 10%
2	In	TTL In	Line 4
3	Out	TTL Out	Line 1
4	Out	Power GND	COMMON GND

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.

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

Preparation

Preparation Process

Step 1	Installing the Software (first time only) Install the software for configuring and controlling the camera (JAI SDK) on the computer.
⬇	
Step 2	Connecting Devices Connect the lens, Camera Link cable, AC adapter, computer, and other devices.
⬇	
Step 3	Verifying the Camera's Connection Status Verify whether the camera is ready for use via the LEDs at the rear of the camera.
⬇	
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.

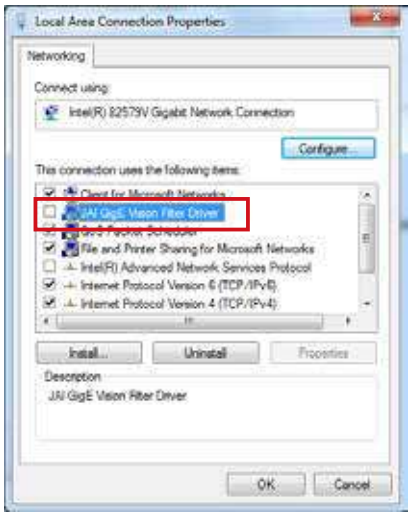
The computer will restart when installation is complete.

Note

When the JAI SDK is installed, a camera driver for the interface is also part of the default installation. This Vision Filter Driver is added to every NIC/port on the host computer. As the driver is also added to the NIC/port for Internet connection, it may, on some systems, affect Internet access speed. If you think your Internet speed is affected, configure the following settings to disable the filter driver on that port.

❶ Open [Control Panel] → [Network and Internet] → [Connect to a network], and right-click the port used for Internet connection to open the properties dialog box.

❷ Clear the [JAI Vision Filter Driver] checkbox, and save.



3 Verify the settings for using Camera Link.

The GO-5101-PMCL supports GenICam and Gen-CP. Check the following settings when controlling the camera via JAI SDK.

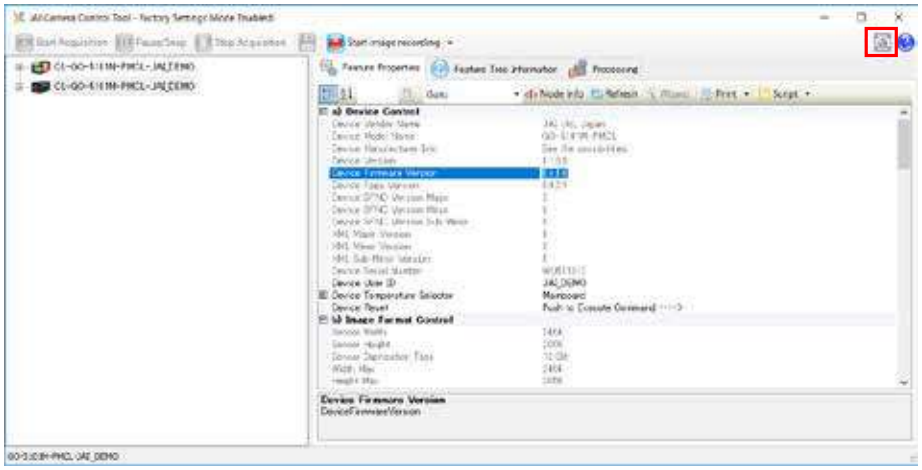
Checking the frame grabber board's settings

Settings must be configured on the frame grabber board to enable Gen-CP support.

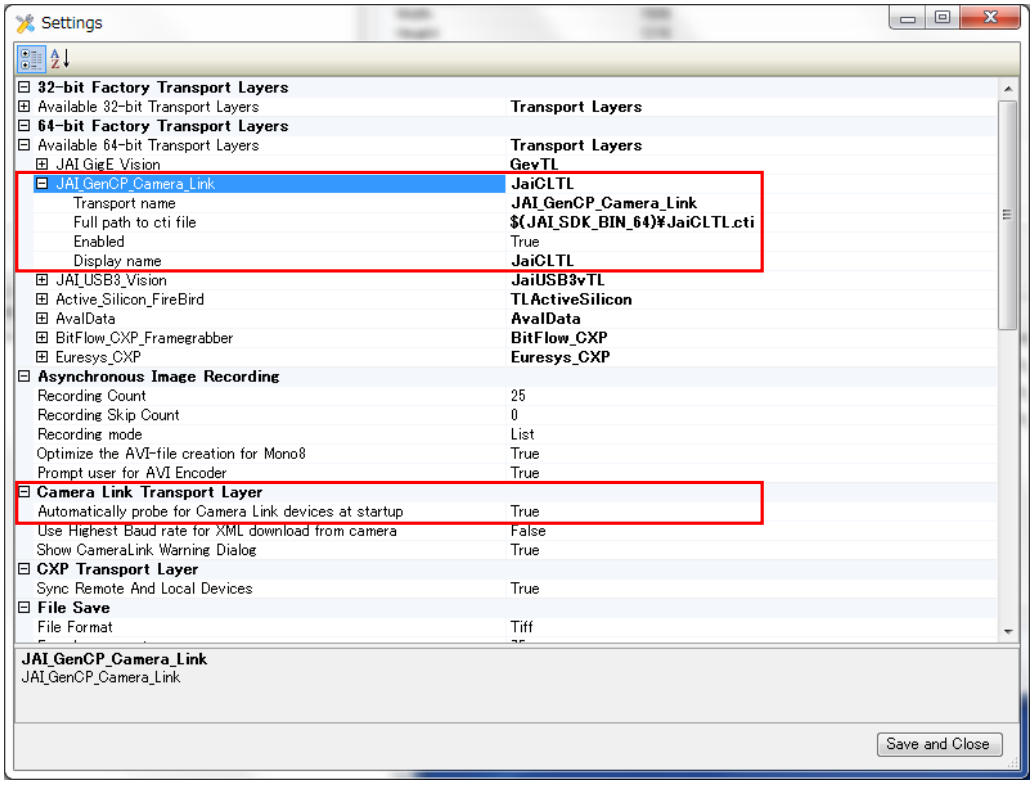
For details, refer to the operating instructions for each board.

Checking JAI SDK's settings

❶ Start JAI Control Tool, and click the  (Settings) icon at the top right.

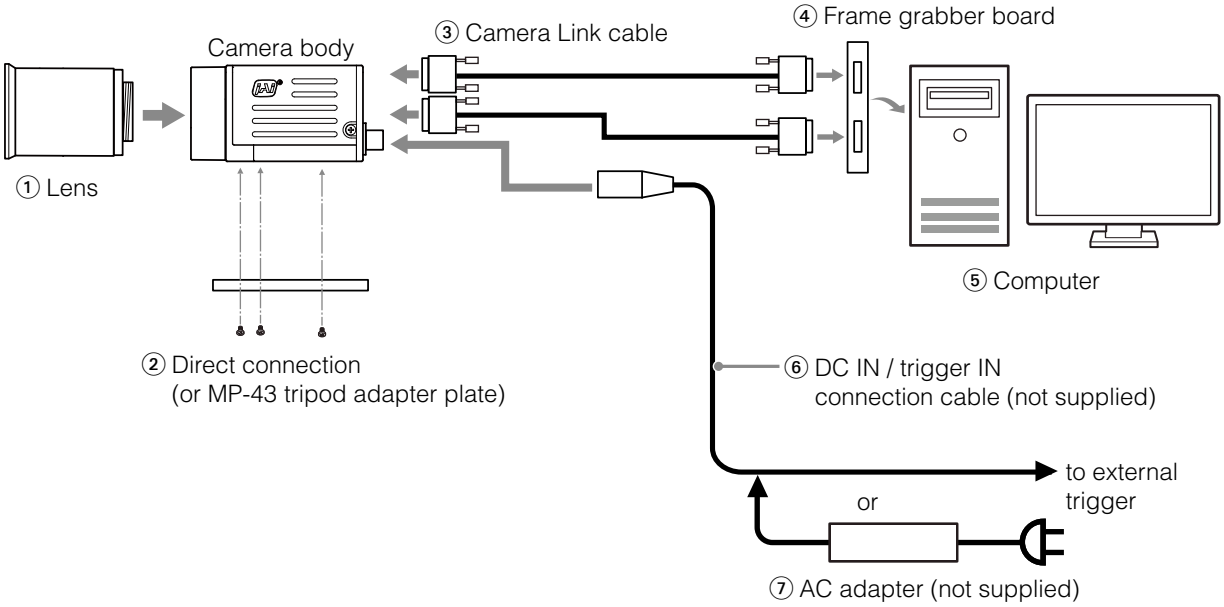


❷ Check that the [JAI_GenCP_Camera_Link] and [Camera Link Transport Layer] settings are configured as follows.



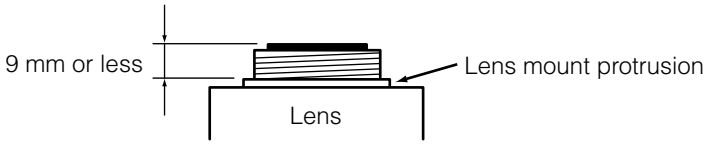
Step 2: Connecting Devices

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



① Lens

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



- The diagonal of the camera's CMOS image sensor is 11 mm, the size of standard 2/3-inch lenses.

To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the 11 mm diagonal. Some lens manufacturers offer lenses with an 11 mm format. If not, a 2/3-inch lens is recommended.

Caution

- The maximum performance of the camera may not be realized depending on the lens.
- Attaching a lens with a mount protrusion of 9.1 mm or longer may damage the lens or camera.

Note

The following formula can be used to estimate the focal length.

focal length = WD / (1 + W/w)

WD: Working distance (distance between lens and object)
W: Width of object
w: Width of sensor (sensor width is 8.5 mm on this camera)

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

When mounting the camera directly to a wall or other device, use screws that match the locking screw holes on the camera. (Large: M3, small: M2, depth: 3 mm)
Use the supplied screws to attach the tripod adapter plate.

Caution

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

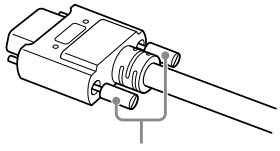
③ Camera Link cable

Connect the Camera Link cable to the Mini Camera Link connector.

- Use a cable that supports the Camera Link standard and is compatible with Mini Camera Link (SDR) connectors.
- Refer to the specifications of the cable for details on its bend radius.
- For details on the cable, see “2 Mini Camera Link connector” (page 9).

Caution

Secure the locking screws on the connector manually, and do not use a driver. Do not secure the screws too tightly. Doing so may wear down the screw threads on the camera. (Tightening torque: 0.291±0.049 N·m or less)



Secure manually.
Do not secure too tightly.

④ Frame grabber board

Refer to the operating instructions of the frame grabber board, and configure settings on the computer as necessary.

⑤ Computer

Use a computer that meets the following requirements.

Operating system (OS):
Microsoft Windows 7/8 32-bit/64-bit edition

CPU: Intel Core i3 or higher

Memory:
Windows 7/8 32-bit edition: DDR3, 4 GB or higher
Windows 7/8 64-bit edition: DDR3, 8 GB or higher

Graphics card: PCI-Express 3.0 or higher

⑥ DC IN / trigger IN connection cable

⑦ AC adapter (power supply) (if necessary)

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

connector on the camera.

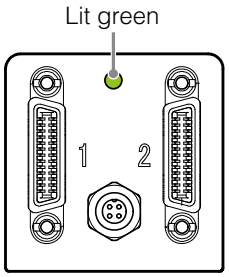
❖ The AC adapter is not required when using PoCL.

Step 3: Verifying the Camera's Connection Status

When the necessary devices are connected and power is supplied to the camera, 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 and whether the camera is operational by checking the rear LED.

During normal status



❖ For details on how to read the LEDs, see "LED status and camera status" (page 10) in the "Parts Identification" section.

Note

If the power / trigger LED does not switch to green within minutes of supplying power, check the Camera Link cable and other connections.

Step 4: Configuring Initial Settings for the Camera

Start Control Tool, connect the camera to the frame grabber board, and configure initial settings for the output format, exposure, external trigger, etc.

Connecting the Camera to the Control Tool

1 Start JAI Control Tool.

Cameras connected to the frame grabber board 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.

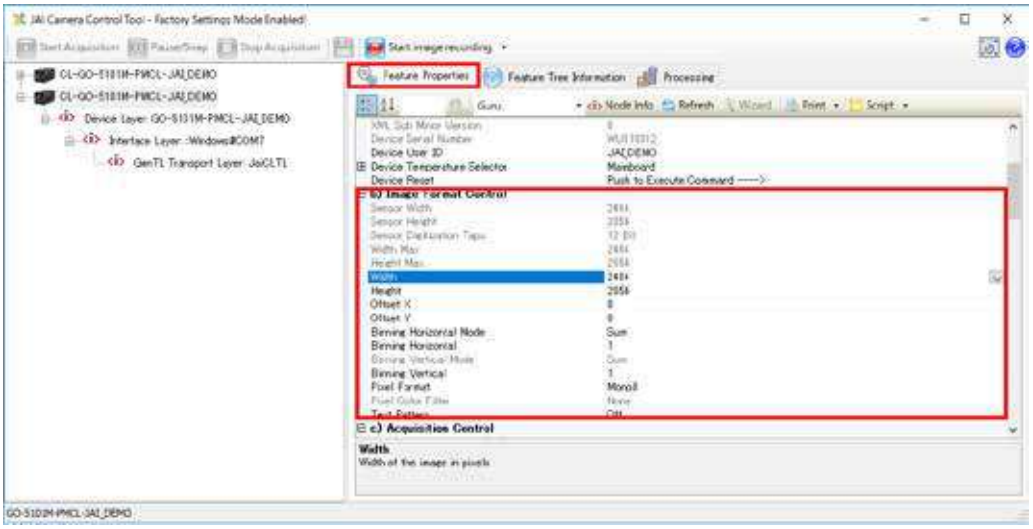
Factory default values

Item		Default value
Image Format Control	Width	2464 (pixels)
	Height	2056 (pixels)
	Offset X (horizontal position)	0 (pixels)
	Offset Y (vertical position)	0 (pixels)
	Pixel Format	GO-5101M-PMCL: Mono8 GO-5101C-PMCL: BayerRG8

❖ You can specify the image acquisition area. For details, see “ROI (Regional Scanning Function)” (page 38).

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

when a configurable item is selected.



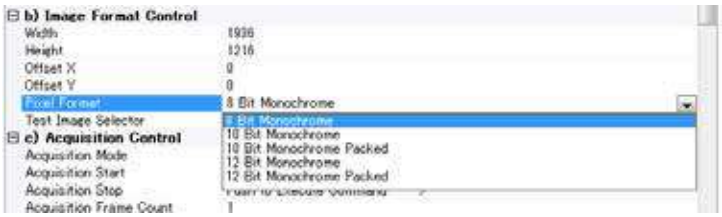
Note

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

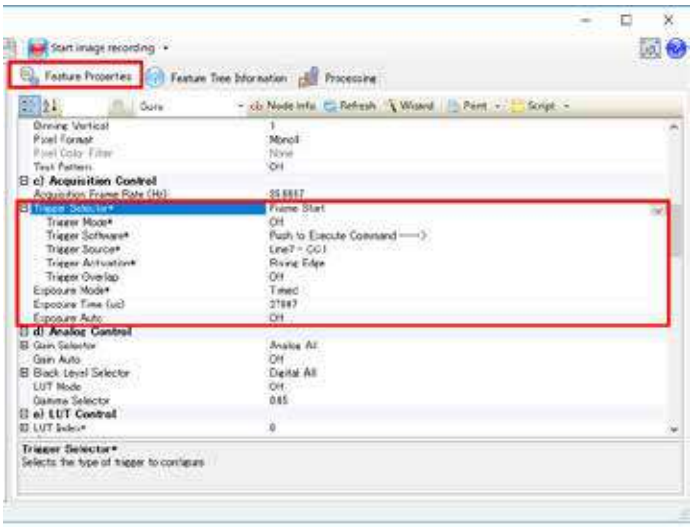
Item		Default value
Trigger Selector (trigger operation)		Frame Start
	Trigger Mode	Off
	Trigger Source (trigger signal source)	Line7-CC1
	Trigger Activation (trigger polarity)	Rising Edge (rising edge of input signal)
Exposure Mode		Timed (control via exposure time)
Exposure Time		27847 (µs)
Exposure 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.



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		Varies depending on the Tap Geometry and CL Pixel Clock settings.
Exposure Auto		Off, Continuous

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.

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	Varies depending on the Tap Geometry and CL Pixel Clock settings.
Exposure Auto	Off, Continuous

1 Set [Exposure Mode] to [Timed].

([Timed] is the default setting.)

2 Specify the exposure time in [Exposure Time].

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

3 Set [Trigger Mode] to [On].

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

When not Controlling the Exposure Time

Configure the settings as follows.

Item	Setting value / selectable range
Exposure Mode	Off

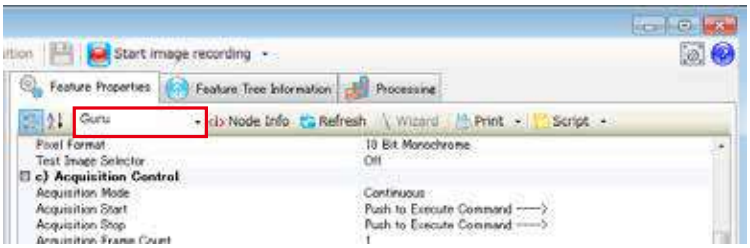
The exposure will be performed with an exposure time equal to 1 / frame rate.

Step 5: Adjusting the Image Quality

Adjust the image quality using the gain and white balance (GO-5101C-PMCL 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 33) in the “Main Functions” section.

■ Manual adjustment

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

([Off] is the default setting.)

2 Configure the gain.

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

- For the GO-5101M-PMCL, only [Analog All] (master gain) can be configured.
- For the GO-5101C-PMCL, [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 multiple (x1 to x16) of Analog Gain. 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 example, the values set for x1 and x16 are 100 and 1600 respectively.
- For the GO-5101C-PMCL, the [Digital Red] (digital R gain) and [Digital Blue] (digital B gain) can be set to a value from x0.45 to x5.62 (–7 dB to +15 dB) the [Digital All] (master gain) value. The resolution is set in x0.01 dB steps.

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

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

■ Manual white balance adjustment

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

([Off] is the default setting.)

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

■ Automatic white balance adjustment

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

White objects near the subject, such as a white cloth or wall, can also be used.

Be sure to prevent the high-intensity spot lights from entering the screen.

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

The white balance is automatically adjusted.

Adjusting the Black Level

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

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

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

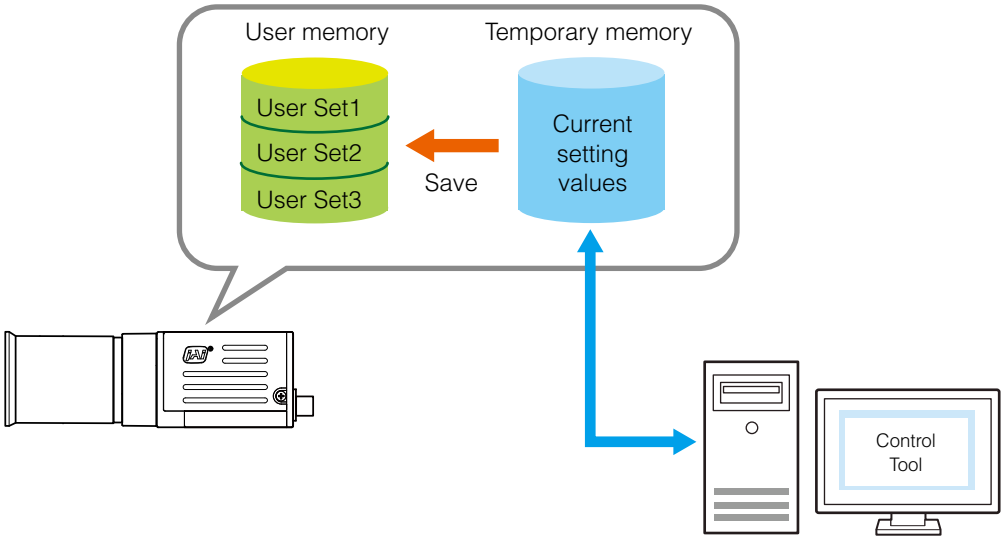
2 Specify the adjustment value in [Black Level].

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.



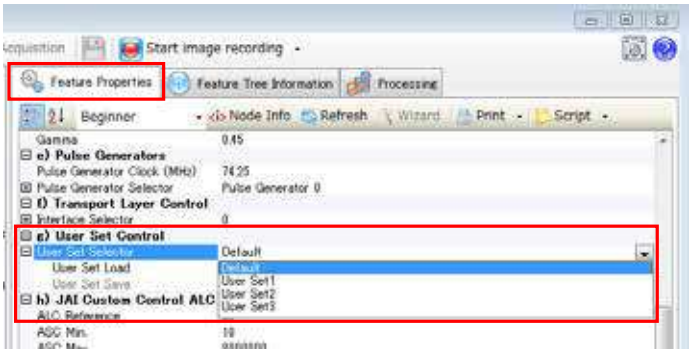
Note

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

■ To save user settings

1 Stop image acquisition.

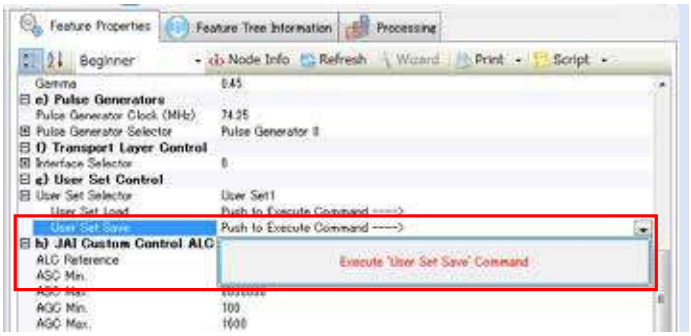
2 Expand [User Set Control], and select the save destination ([User Set1] to [User Set3]) in [User Set Selector].



Note

The factory default setting values are stored in [Default] and cannot be overwritten.

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 Select the settings to load (User Set1 to User Set3) in [User Set Selector].

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

The selected user settings are loaded.

Basic Function Matrix

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

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

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

Main Functions

GPIO (Digital Input/Output Settings)

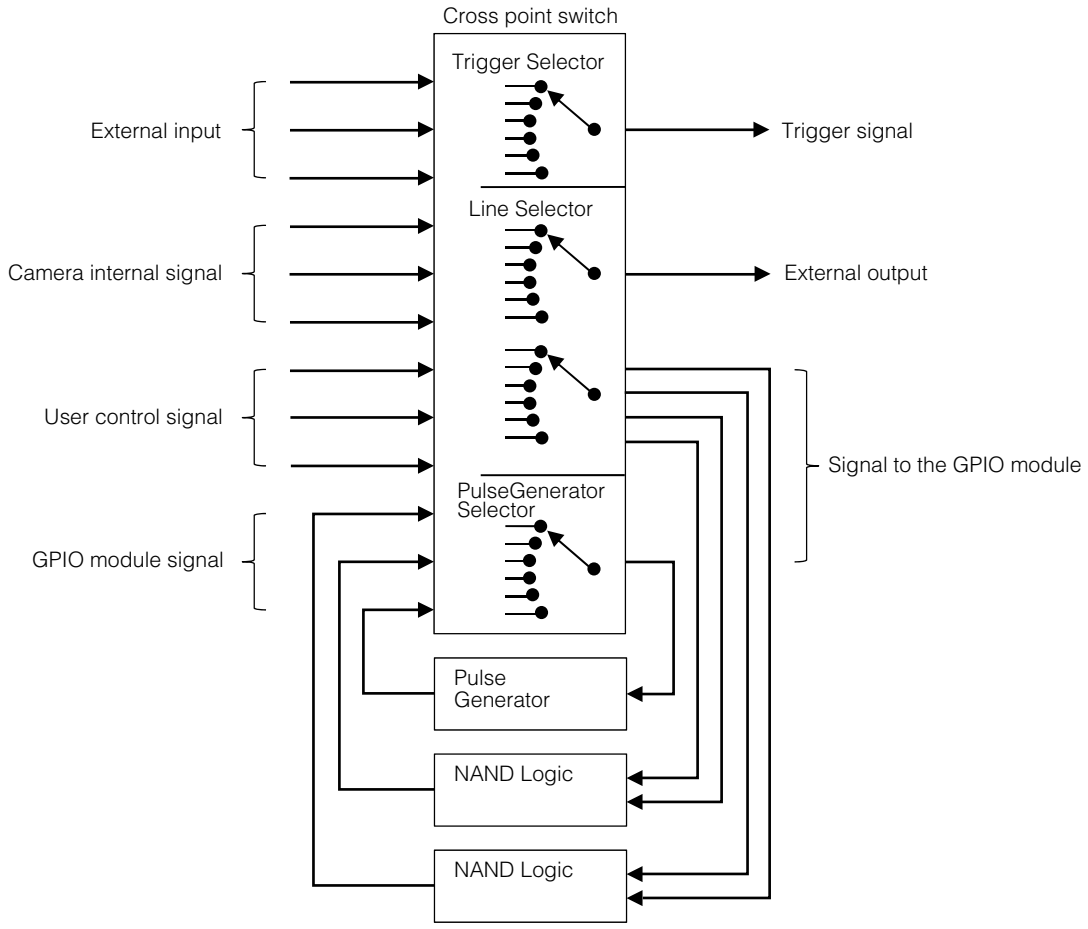
The unit can input/output the following signals to and from external input/output connectors.

External output	TTL Out (Line1)	DC IN / trigger IN connector (4-pin round)
External input	TTL IN (Line4)	DC IN / trigger IN connector (4-pin round)
	CC1 (Line7)	Camera Link cable

These signals can be used as triggers and other necessary signals within the camera or as signals output from the camera to the system, such as those used for lighting equipment control.
In addition, a pulse generator for generating custom pulses and a NAND module for performing logic operations are built into the camera. The two can be used together for a variety of purposes, such as noise removal for trigger signals and phase adjustment for pulse outputs.
Such functions are generally referred to as GPIO functions.

Signals are selected as follows.
- When using external signals or the signals of each GPIO module as trigger signals:
  Select in [Trigger Selector] > [Trigger Source].
- When selecting the signals to use for external outputs:
  Select in [Line Selector] > [Line Source].
- When selecting the input signal for the NAND logic line:
  Select in [Line Selector] > [Line Source].
- When selecting the clear signal for [Pulse Generator]:
  Select in [Pulse Generator Selector] > [Pulse Generator Clear source].

GPIO block diagram



Valid Input/Output Combinations

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

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

Selector (Cross point switch output) / Source signal (Cross point switch input)		Output destination						
		Trigger Selector	Line Selector					Pulse Generator Selector
		Frame Start	Line1 Output Source	Nand Gate 0 In 1	Nand Gate 0 In 2	Nand Gate 1 In 1	Nand Gate 1 In 2	Pulse Generator Clear Source
Signals to use as output	LOW	○	○	○	○	○	○	○
	HIGH	○	○	○	○	○	○	○
	Software	○	×	×	×	×	×	×
	Line 4 TTL In	○	○	○	○	○	○	○
	Line 7 CC1	○	○	○	○	○	○	○
	Pulse Generator 0	○	○	○	○	○	○	×
	User Output 0	○	○	○	○	○	○	○
	User Output 1	○	○	○	○	○	○	○
	NAND 0 Out	○	○	×	×	○	○	○
	NAND 1 Out	○	○	○	○	×	×	○
	Exposure Active	×	○	○	○	○	○	○
	Frame Active	×	○	○	○	○	○	○
	Frame Trigger Wait	×	○	○	○	○	○	○
	FVAL	×	○	○	○	○	○	○
	LVAL	×	×	×	×	×	×	○
		Trigger Source	Line Source					Pulse Generator Clear Source
		Use						

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

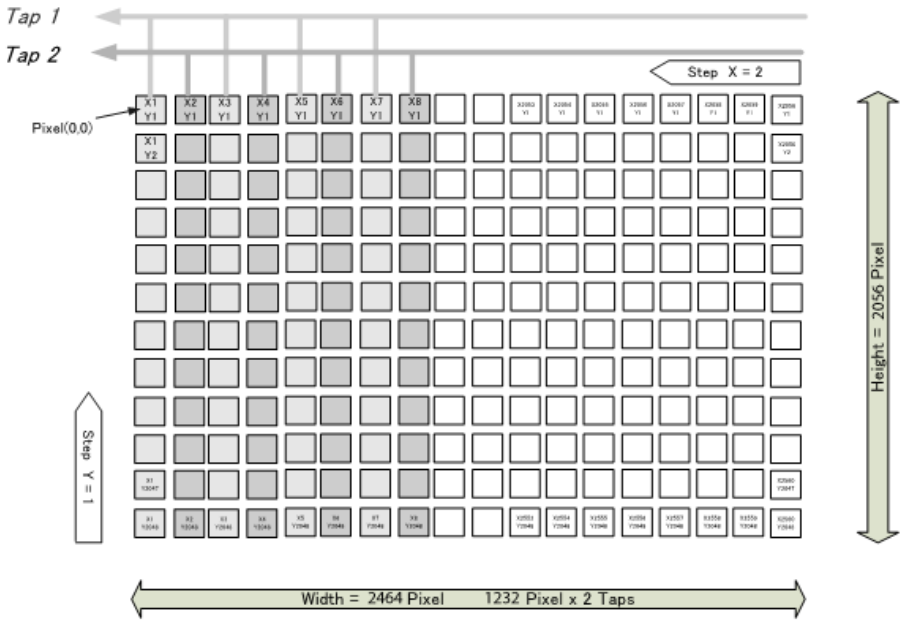
Camera Output Formats

The GO-5101-PMCL supports a variety of output formats.
The following tap geometries are supported.
The settings on the frame grabber board must be configured to match the tap geometry setting on the camera. For details configuring frame grabber board settings, refer to the operating instructions for each board.

Tap Geometry	CL Configuration	Video Process Bypass Off	Video Process Bypass On
1X2-1Y	Base	bit: 8/10	bit: 8/10/12
1X3-1Y	Base	bit: 8	bit: 8
1X3-1Y	Medium	bit: 10	bit: 10/12
1X4-1Y	Medium	bit: 8/10	bit: 8/10/12

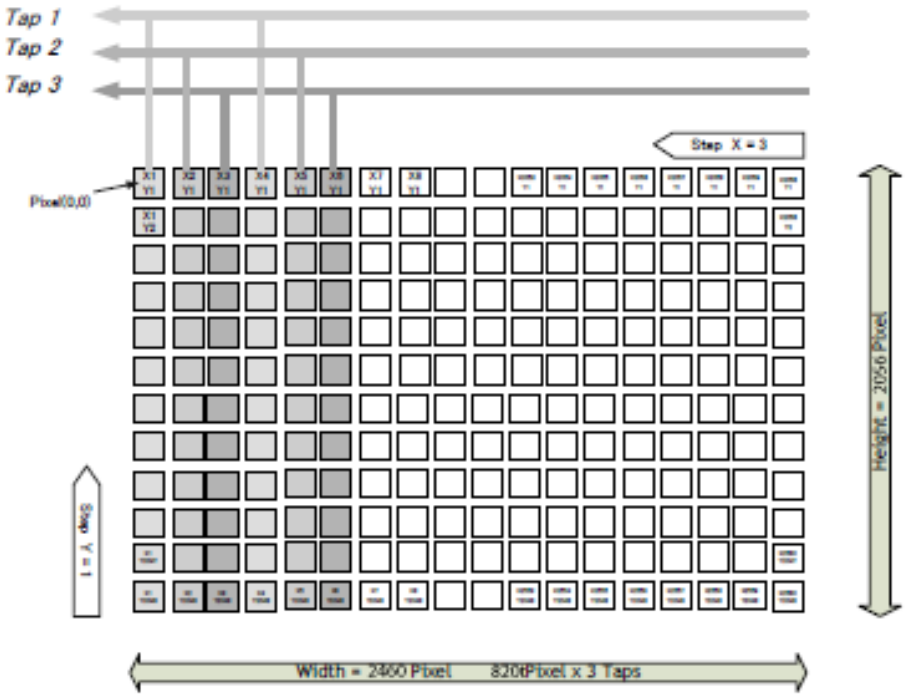
■ 1X2-1Y

1X2-1Y is a 2-tap output format as defined in GenICam tap geometry.



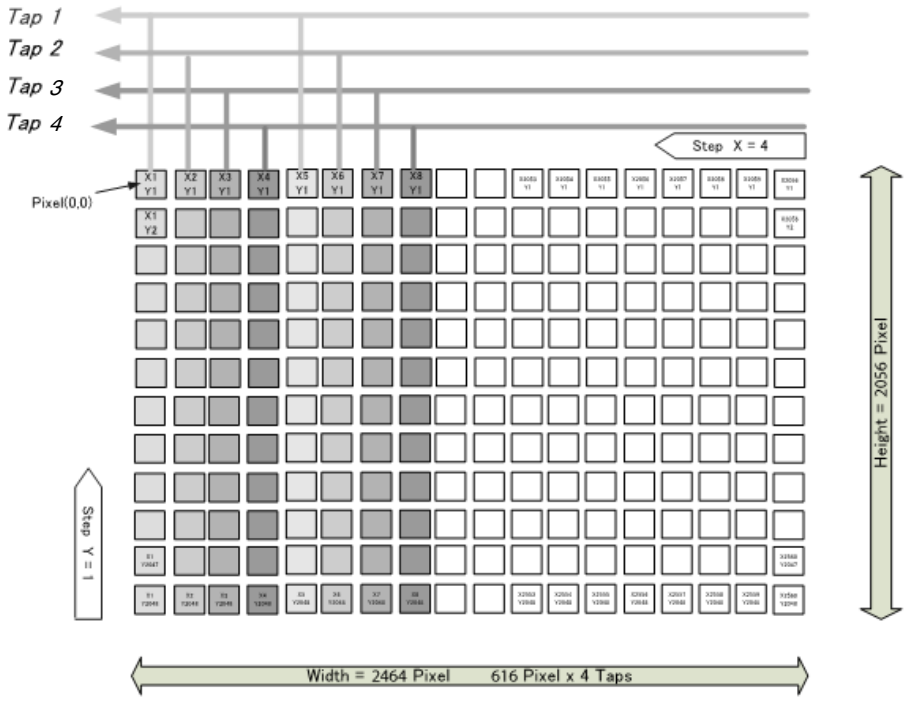
■ 1X3-1Y

1X3-1Y is a 3-tap output format as defined in GenICam tap geometry.



■ 1X4-1Y

1X4-1Y is a 4-tap output format as defined in GenICam tap geometry.



■ Cable length reference

The following is a reference for the length of cable you can use based on the Camera Link clock*1.

CL Pixel Clock [MHz]	CL cable length
37.125	10 m
74.25	7 m
84.85	3 m

*1 The length of cable you can use will also vary depending on type and maker.

Acquisition Control (Image Acquisition Controls)

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

On the GO-5101-PMCL, acquisition control always operates in [Continuous] mode.

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 period formula

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

- Maximum frame rate of sensor
  FR_Cont = 1 / {H Period × (Height + 34)}

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
  FR_Cont = 1 / {H Period × (Height + 34)}
- Maximum frame rate
  FR_TrOloff = 1/{1/FR_Cont) + ExposureTime}

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

- Maximum frame rate of sensor
  FR_Cont = 1 / {H Period × (Height + 34)}

- 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}

Full size - Vertical Binning =1(OFF)

Tap Geometry	CL Pixel Clock (MHz)	H Period [usec]	Frame Rate (fps)
1X2-1Y	37.125	33.293	14.3
1X2-1Y	74.25	16.646	28.7
1X2-1Y	84.85	14.613	32.7
1X3-1Y	37.125	22.249	21.5
1X3-1Y	74.25	13.414	35.6
1X4-1Y	37.125	16.700	28.6
1X4-1Y	74.25	13.414	35.6

Exposure Mode

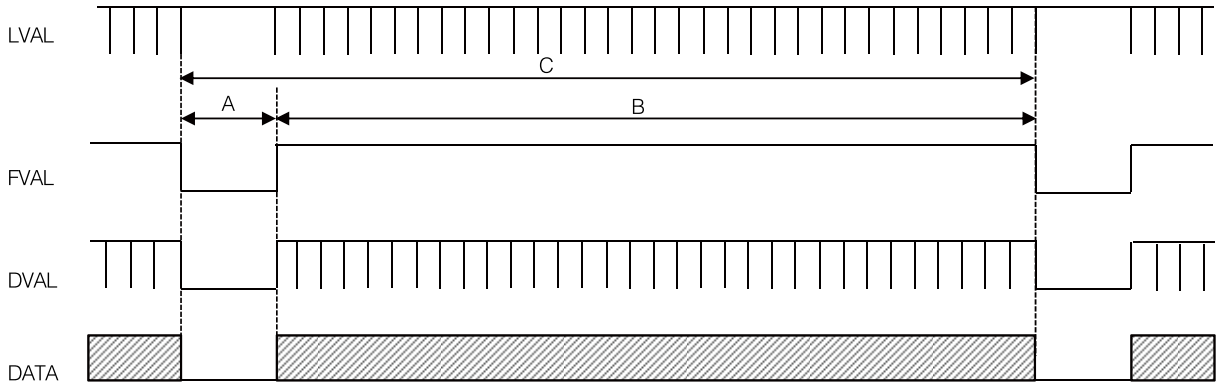
The following exposure modes are available on the camera.

Exposure Mode	Description
Off	Exposure control is not performed (free-running operation).
Timed	Mode in which control is performed using exposure time. Acquire images using an exposure time configured beforehand on an external trigger.
Trigger Width	Mode in which control of the exposure time is performed using the pulse width of the trigger input signal. The exposure time will be the same as the pulse width of the trigger input signal. This allows long exposure.

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

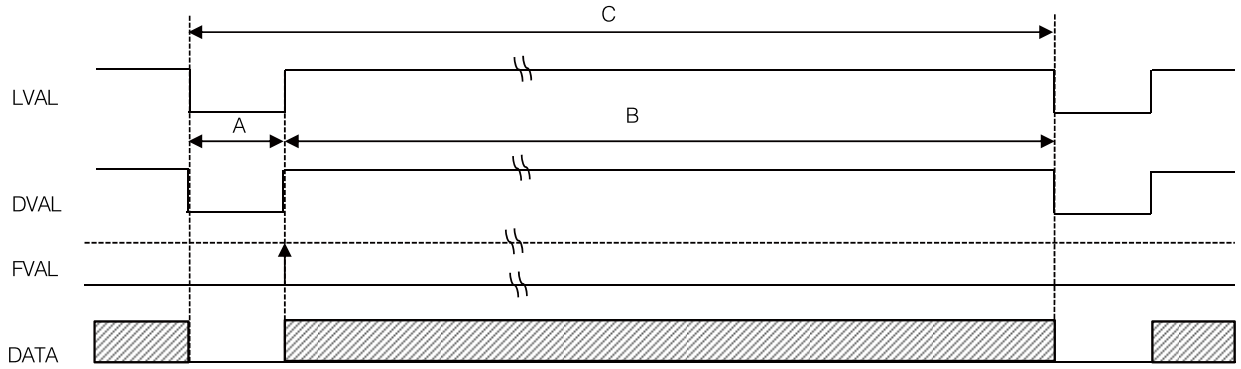
Image Output Timing

■ Vertical timing



Tap Geometry	CL PixelClock [MHz]	H Frequency (KHz)	FVAL BlankingLine [A]	FVALValid Line [B]	Total FrameLine [C]	Total Frame Period (msec)	Frame Rate (Hz)
1X2-1Y (Full)	37.125	30.036	34	2056	2090	69.6	14.37
	74.25	60.073	34	2056	2090	34.8	28.74
	84.85	68.433	34	2056	2090	30.5	32.74
1X3-1Y (Full)	37.125	44.946	34	2056	2090	46.5	21.51
	74.25	74.548	34	2056	2090	28.0	35.67
1X4-1Y (Full)	37.125	59.879	34	2056	2090	34.9	28.65
	74.25	74.548	34	2056	2090	28.0	35.67

■ Horizontal timing



Tap Geometry	CL Pixel Clock (MHz)	Line BlankingClock [A]	LineValid clock [B]	Total Line clock [C]	Total Line Period (usec) [C]	Line Rate (KHz) [C]
1X2-1Y (Full)	37.125	4	1232	1236	33.293	30.036
	74.25	4	1232	1236	16.646	60.073
	84.85	8	1232	1240	14.613	68.433
1X3-1Y (Full)	37.125	6	820	826	22.249	44.946
	74.25	176	820	996	13.414	74.548
1X4-1Y (Full)	37.125	4	616	620	16.700	59.879
	74.25	380	616	996	13.414	74.548

Trigger Control

The camera allows Frame Start trigger controls to be performed via external trigger signals.
The Frame Start trigger allows exposure control via the trigger signal inputs.

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

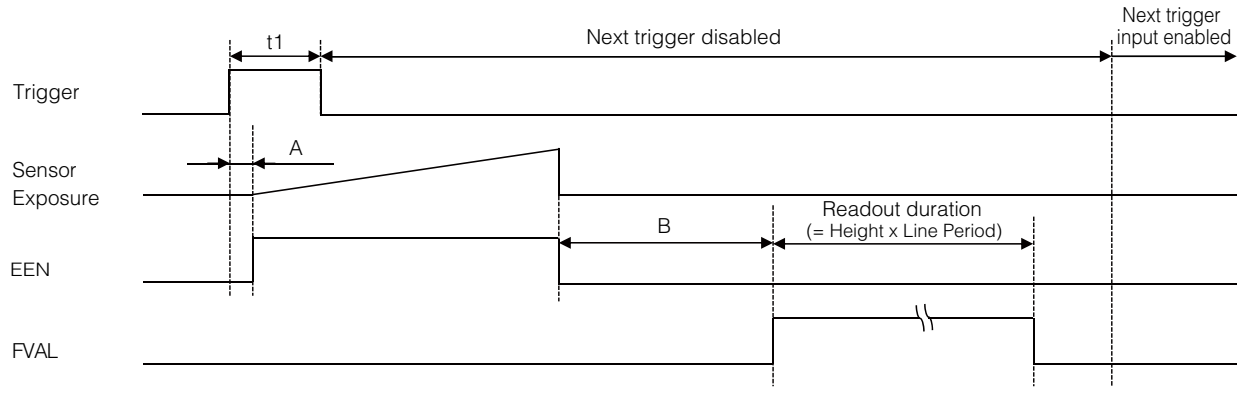
Shortest Repetition Period for Triggers

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

■ When [Exposure Mode] is [Timed]

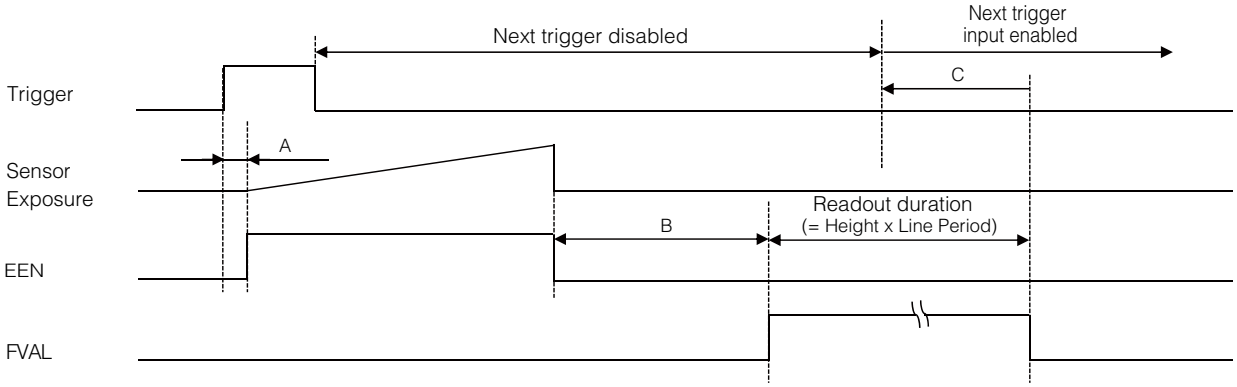
Example: When [Trigger Source] is set to [Line 7 - CC1]

• Trigger overlap: Off



Tap Geometry	CL Pixel Clock (MHz)	Period from Trigger start edge to Exposure start[A] (usec)	Period from Exposure end to FVAL start[B] (usec)	Max Exposure [msec]	Min Exposure [usec]
1X2-1Y	37.125	101	851	69.116	34
1X2-1Y	74.25	51	435	34.558	17
1X2-1Y	84.85	45	384	30.336	15
1X3-1Y	37.125	68	573	46.189	23
1X3-1Y	74.25	42	354	27.847	14
1X4-1Y	37.125	51	436	34.669	17
1X4-1Y	74.25	42	314	27.847	14

- **Trigger overlap: Readout**

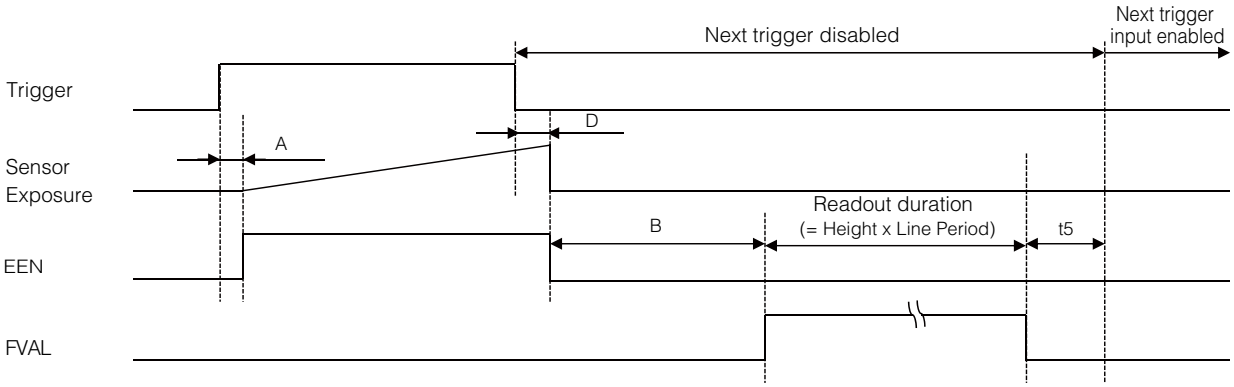


Tap Geometry	CL Pixel Clock (MHz)	Period from Trigger start edge to Exposure start[A](usec)	Period from Exposure end to FVAL start[B](usec)	Period FVAL end to next trigger start[C] (usec)	Max Exposure [msec]	Min Exposure [usec]
1X2-1Y	37.125	101	851	851 – Expo (Current) + Expo (Next)	69.116	34
1X2-1Y	74.25	51	435	934 – Expo (Current) + Expo (Next)	34.558	17
1X2-1Y	84.85	45	384	939 – Expo (Current) + Expo (Next)	30.336	15
1X3-1Y	37.125	68	573	906 – Expo (Current) + Expo (Next)	46.189	23
1X3-1Y	74.25	42	354	942 – Expo (Current) + Expo (Next)	27.847	14
1X4-1Y	37.125	51	436	937 – Expo (Current) + Expo (Next)	34.669	17
1X4-1Y	74.25	42	314	952 – Expo (Current) + Expo (Next)	27.847	14

■ When [Exposure Mode] is [Trigger Width]

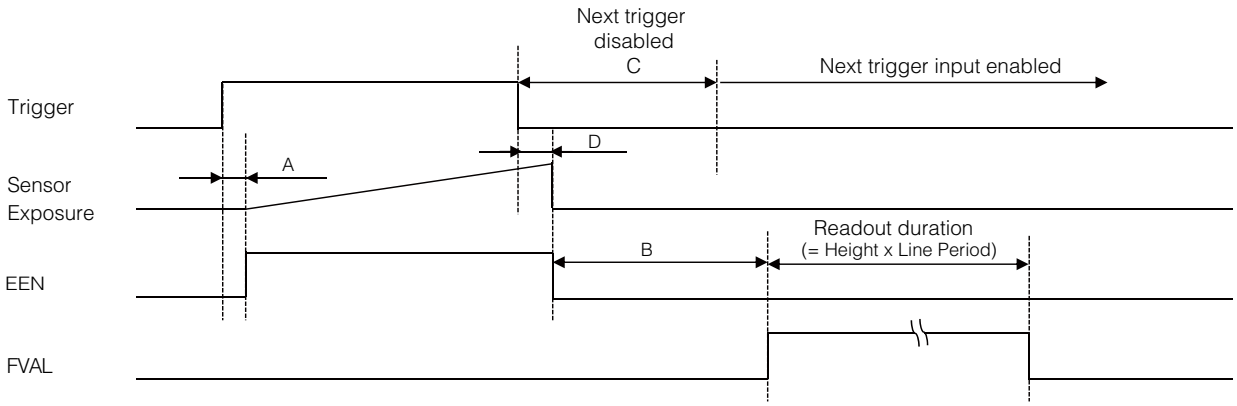
Example: When [Trigger Source] is set to [Line 7 - CC1]

• Trigger overlap: Off



Tap Geometry	CL Pixel Clock (MHz)	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)	Max Exposure [msec]	Min Exposure [usec]
1X2-1Y	37.125	101	851	851 – Expo (Current) + Expo (Next)	69.116	34
1X2-1Y	74.25	51	435	934 – Expo (Current) + Expo (Next)	34.558	17
1X2-1Y	84.85	45	384	939 – Expo (Current) + Expo (Next)	30.336	15
1X3-1Y	37.125	68	573	906 – Expo (Current) + Expo (Next)	46.189	23
1X3-1Y	74.25	42	354	942 – Expo (Current) + Expo (Next)	27.847	14
1X4-1Y	37.125	51	436	937 – Expo (Current) + Expo (Next)	34.669	17
1X4-1Y	74.25	42	314	952 – Expo (Current) + Expo (Next)	27.847	14

• Trigger overlap: Readout



Tap Geometry	CL Pixel Clock (MHz)	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)	Min Exposure [usec]
1X2-1Y	37.125	101	851	466	128	34
1X2-1Y	74.25	51	435	233	61	17
1X2-1Y	84.85	45	384	205	53	15
1X3-1Y	37.125	68	573	311	83	23
1X3-1Y	74.25	42	354	188	48	14
1X4-1Y	37.125	51	436	234	61	17
1X4-1Y	74.25	42	314	188	48	14

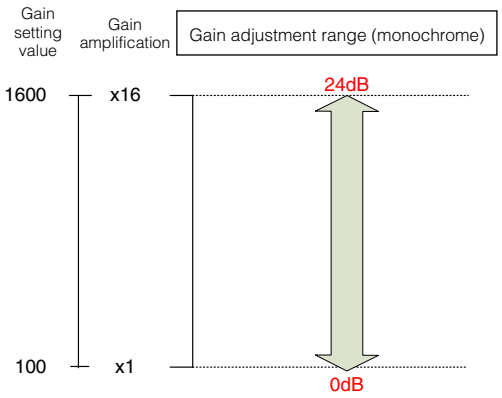
Gain Control

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

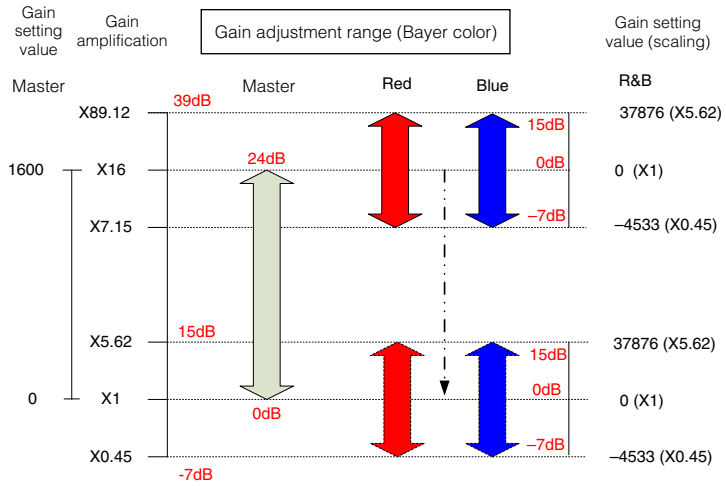
❖ For details on how to configure the settings, see “Adjusting the Gain” (page 20).

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

Monochrome



Bayer color



LUT (Lookup Table)

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

■ To use the LUT function

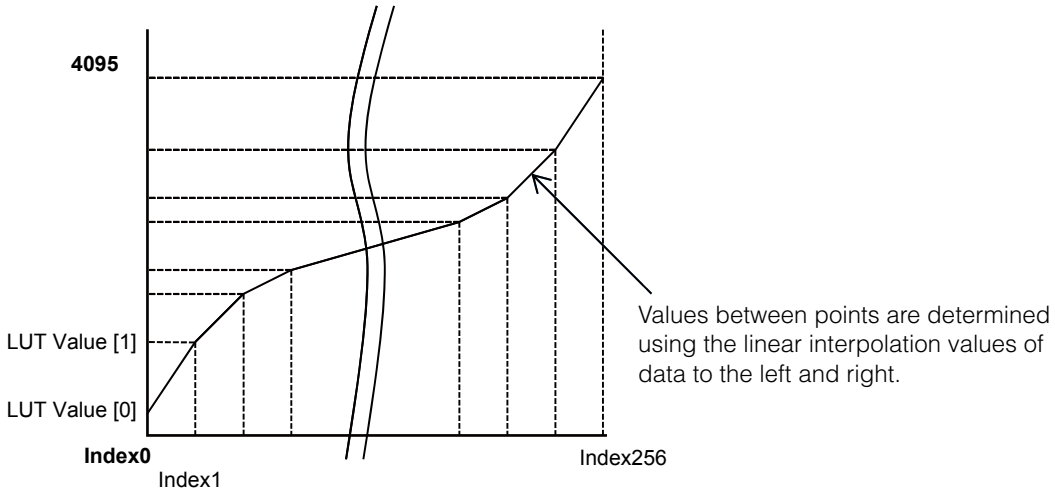
Configure the settings as follows.

Item	Setting value / selectable range	Description
JAI LUT Mode	LUT	Use LUT.
LUT Selector*	GO-5101M-PMCL: Mono GO-5101C-PMCL: Red, Green, Blue	Select the LUT channel to control.
LUT Index	GO-5101M-PMCL: 0 to 256 GO-5101C-PMCL: 0 to 256	Select the LUT index to configure. Indexes represent the possible pixel values captured on the sensor, from the lowest value (Index 0) to the highest (Index 256). For example, Index 0 represents a full black pixel and Index 255 represents a full white pixel.
LUT Value	0 to 4095	Set the LUT output value for the selected index.

* GO-5101C-PMCL only

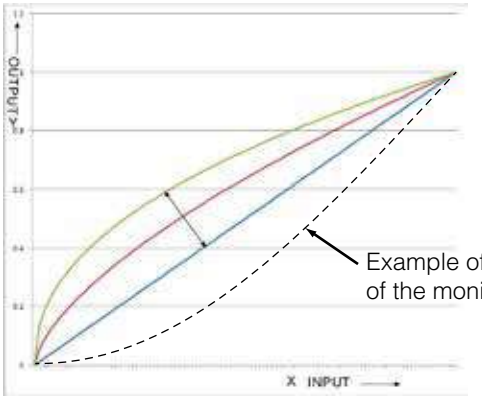
■ LUT values

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 34).

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

■ Automatic detection

Automatic detection can only detect lit defective pixels (i.e., white blemishes).

1 Shield the camera sensor.

If a lens is attached, use the lens cap as a shield, for example.

2 Configure the threshold level for defective pixel detection.

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

The threshold value is specified as a percentage.

The default setting is "10" with 10% of the full scale (100%) specified as the threshold value.

3 Execute [Blemish Detect] to start automatic detection.

After detection, the interpolation data is saved to the camera's internal memory.

To check the number of interpolated pixels after automatic detection

You can check the number of pixels interpolated via automatic detection by loading the BlemishNum data.

■ Manual configuration

1 Select the index in [Blemish Detect Position Index].

You can select from 0 to 511. However, configure the indexes in order starting with the smallest index. If you skip indexes while configuring settings, interpolation may not be performed.

2 Specify the pixel points for interpolation using the [Blemish Detect Position X] and [Blemish Detect Position Y] settings.

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

You can configure values that are within the total effective pixel area. Specify pixels for which interpolation is not necessary as -1. If 0 is specified, the first line or first pixel will be interpolated.

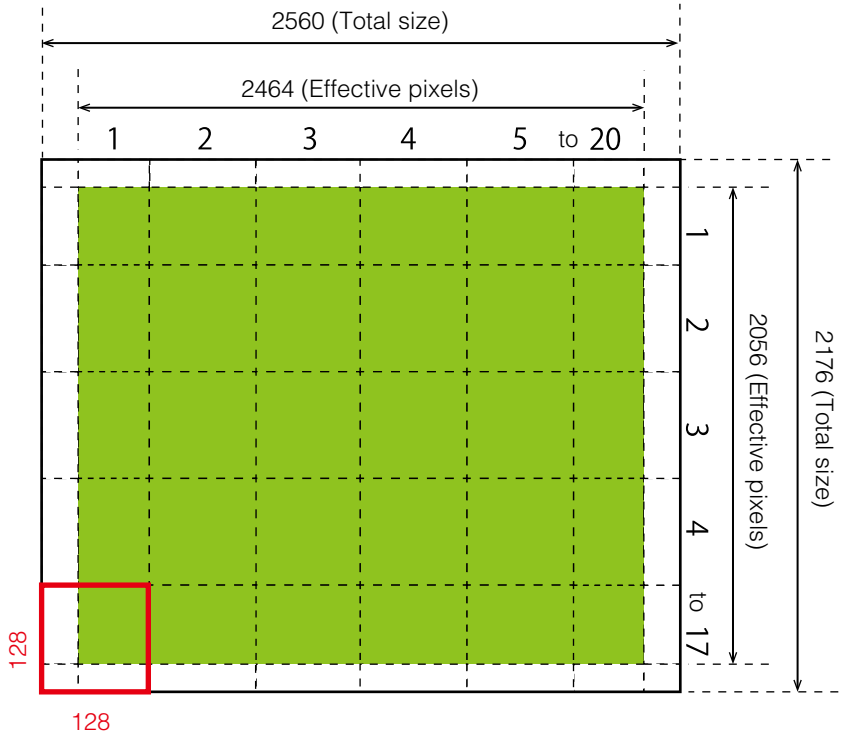
3 Set [Blemish Enable] to [True], and execute interpolation.

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

Shading Correction

The shading correction is a function that corrects non-uniformity (i.e., shading) in the amount of light generated by the lens and lighting equipment. Using this function allows correction even if top, bottom, left, and right shading is not symmetrical in relation to the center of the screen (H, V).

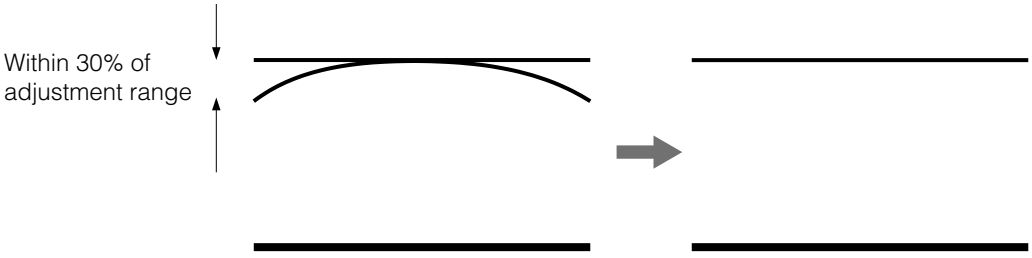
The size of the correction block is 20 (H) × 17 (V) blocks and calculation errors in the correction data are minimized due to the small interpolation block. Each block is 128 × 128 pixels.
The total size of the blocks is 2560 (H) × 2176 (V), but the actual number of effective pixels for the camera is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



The following shading correction modes are available on the camera.

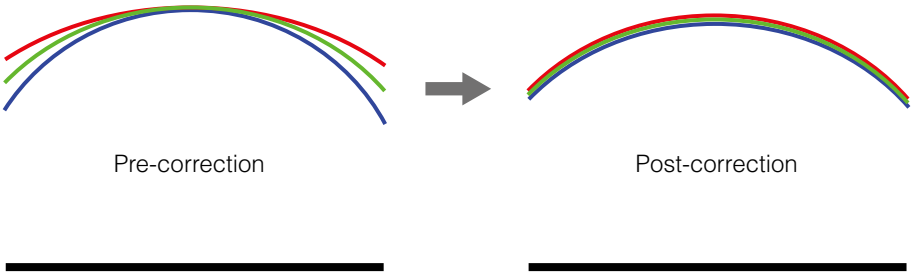
■ Flat Shading

Correction is performed using the area of the screen with the highest brightness level as the reference, and adjusting the brightness levels of the other areas to match this level.



■ Color Shading (GO-5101C-PMCL only)

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



Caution

Proper correction is not possible under the following conditions.

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

■ To use the shading correction function

Configure the settings as follows.

Item	Setting value	Description
Shading Correction Mode	GO-5101M-PMCL: Flat Shading (fixed) GO-5101C-PMCL: 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-5101M-PMCL only) allows you to combine the signal values of adjacent pixels in the vertical or horizontal direction (1 x 2 or 2 x 1), or in both directions simultaneously (2 x 2 binning).

Applying binning to a specific field of view results in greater pixel sensitivity with reduced resolution in the direction(s) that binning has been applied.

The GO-5101M-PMCL performs vertical binning on the sensor, reducing the total number of lines that must be read out, thereby resulting in a faster frame rate.

ROI (Regional Scanning Function)

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

ROI Settings

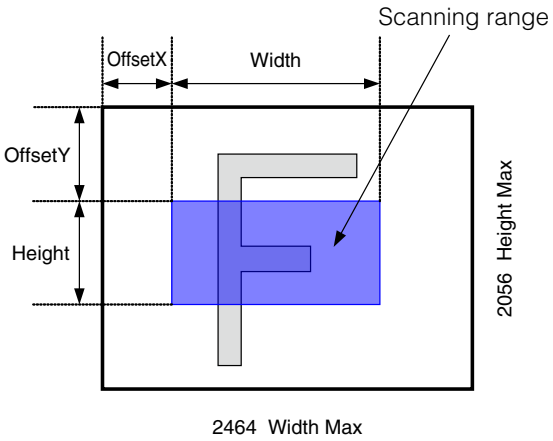
Specify the area to scan by specifying width, height, and horizontal/vertical offset values under [Image Format Control].

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

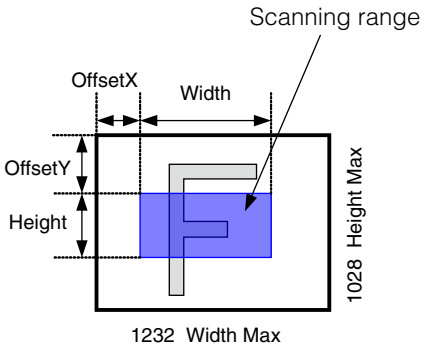
You can increase the frame rate by specifying a lower height, as the number of lines scanned decreases.
The minimum area is as follows.

	Width (pixels)	Height (pixels)
GO-5101M-PMCL	96	2
GO-5101C-PMCL	96	2

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



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



* GO-5101M-PMCL only

❖ For details on the frame rates for common ROI sizes, see “Frame Rate Reference” (page 56).

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.
Use [Sequencer Mode] and [Sequencer Mode Select] to enable the Sequencer and select a mode of operation.

Trigger Sequencer mode

With this mode, the Sequencer Trigger “pattern” is predetermined by the user. The user defines up to 128 different “indexes.” Each index represents a combination of the following parameters:
- ROI (width, height, offset X, and offset Y)
- Exposure Time
- Gain Level (R/B Gain can also be configured on the color model)
- Black Level
- Binning Mode (monochrome only)
- LUT Enable (whether or not to enable the use of LUT for this index)
- Frame Count (the number of times to repeat this index before moving to the next)
- Next Index to execute in the predetermined pattern

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

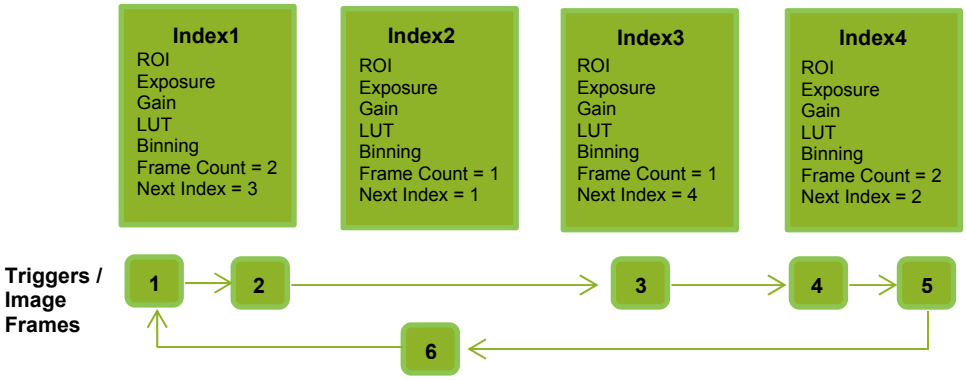
[Sequencer LUT Mode] defines whether Gamma or LUT is to be applied to the sequence. If Gamma is selected, the Gamma setting defined in the camera’s Analog Control section will be applied to all exposures in the sequence. If LUT is selected, the LUT characteristics defined in Analog Control will be applied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

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

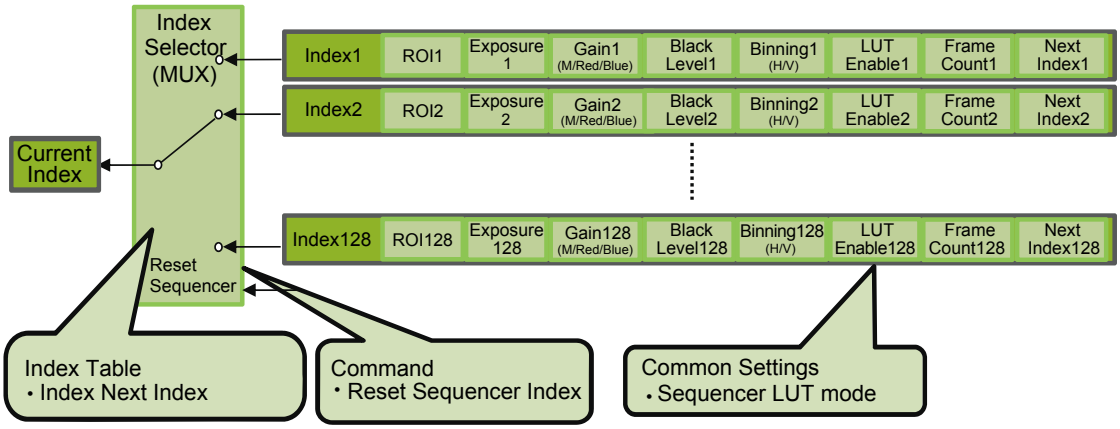
In Trigger Sequencer mode, patterns begin with the index of [Sequencer Set Start]. Subsequent triggers follow the user-defined values in [Sequencer Index Frame Count] and [Sequencer ROI Next Index].
Assigning a Next Index value of “1” to an index creates a loop back to the start of the sequencer pattern.

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)

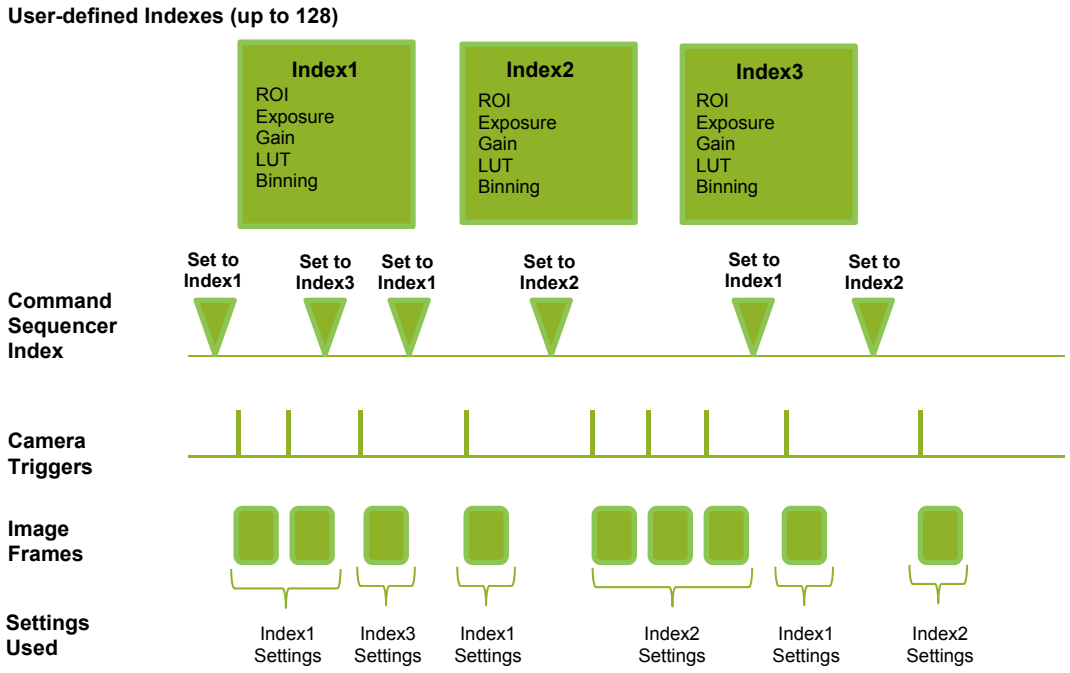
The user must also enter a value from 1 to 128 in [Command Sequencer Index]. This indicates which index to execute each time a trigger is received. The same index will continue to be executed for all subsequent triggers as long as the value of [Command Sequencer Index] remains unchanged.

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.

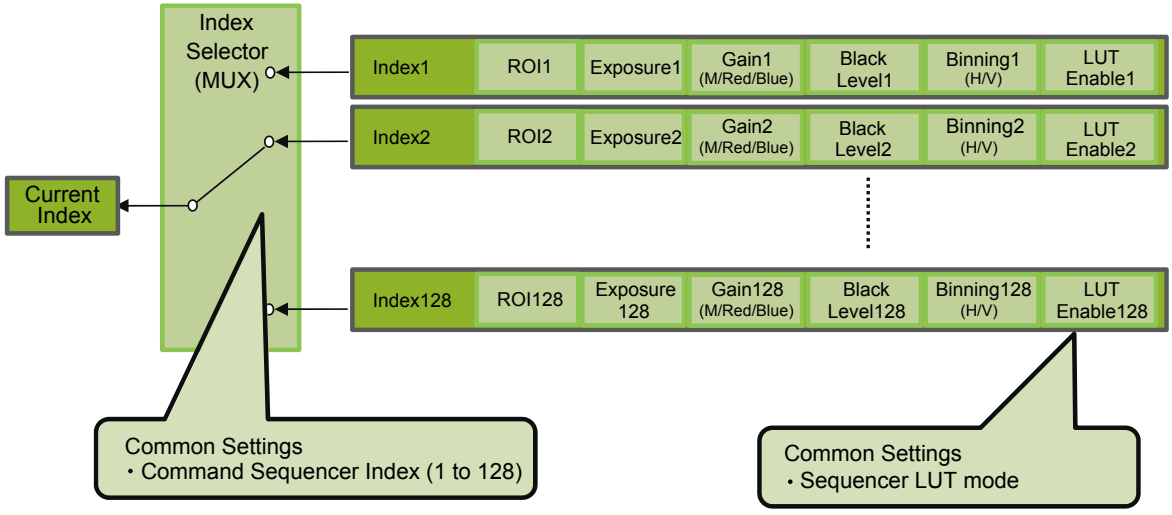
As with Trigger Sequencer, [Sequencer LUT Mode] defines whether Gamma or LUT is to be applied to the sequence. If Gamma is selected, the Gamma setting defined in the camera's Analog Control section will be applied to all exposures in the sequence. If LUT is selected, the LUT characteristics defined in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



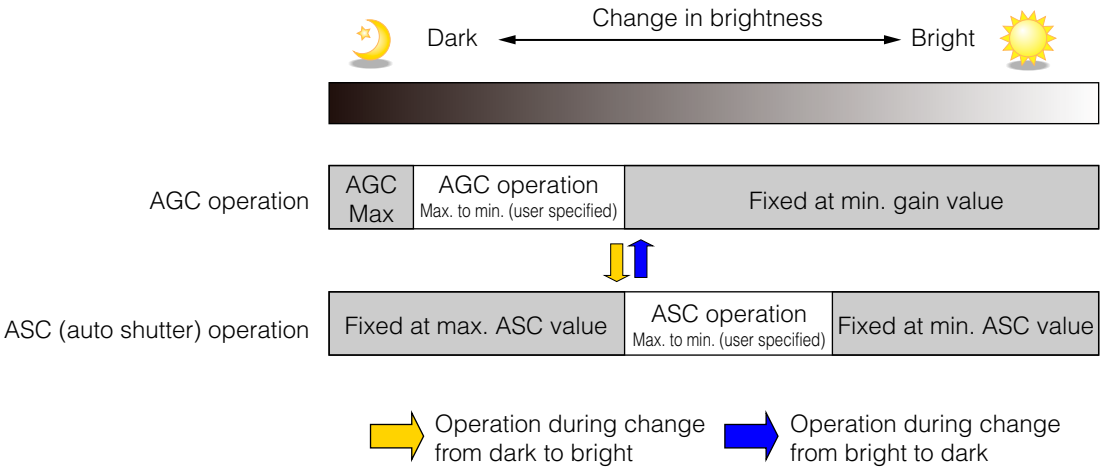
Index structure for Command Sequencer



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.)

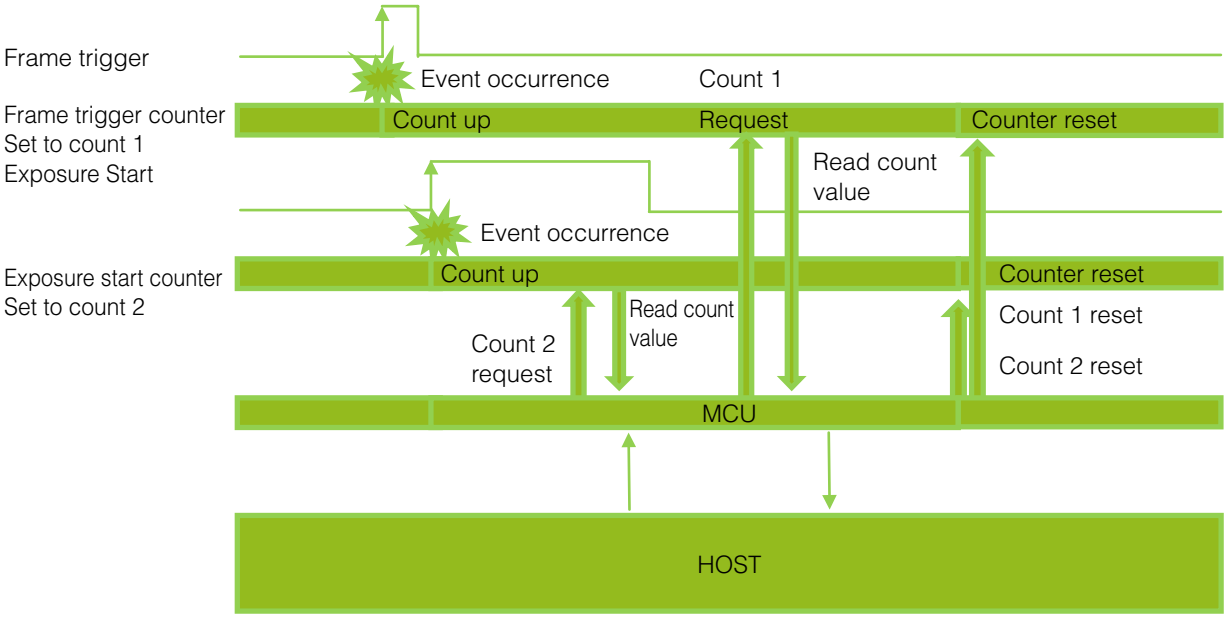
Auto gain metering areas (16 areas)

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.

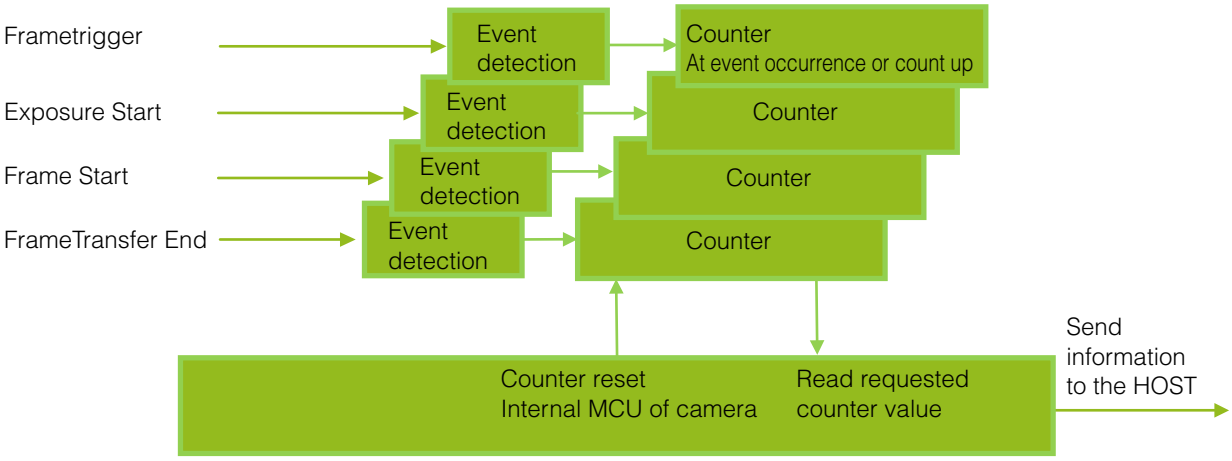
■ Counter occurrence diagram



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, Frame Transfer End	Select the counter event signal for which to read the count value.
	Counter 0 to 2 Event Activation	Rising Edge (fixed) or Falling Edge	Specify the timing at which to count.

Note

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

Video Process Bypass Mode

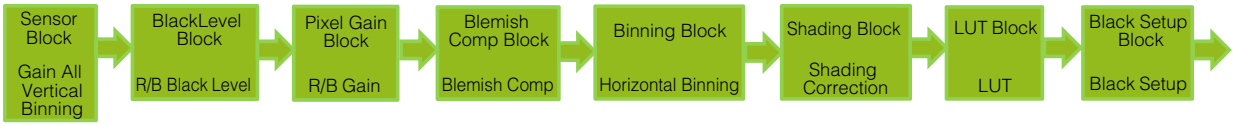
The video process bypass mode is a function that bypasses internal video processing on the camera. When bypass is enabled, the sensor output and camera output data can be set to the same bit width. Operation using 12-bit outputs must be performed in bypass mode.

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

■ Differences in camera operation

When video process bypass mode is disabled

All video processes are enabled.



When video process bypass mode is enabled

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

■ To enable video process bypass mode

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

Settings List

Feature Properties

Item	Setting range	Default value	Description
a) Device Control			Display/configure information related to the device.
Device Vendor Name	—	"JAI Ltd., Japan"	Display the manufacturer name.
Device Model Name	—	GO-5101M-PMCL GO-5101C-PMCL	Display the model name.
Device Manufacturer Info	—	See the possibilities	Display the manufacturer information.
Device Version	—	—	Display the hardware version.
Device Firmware Version	—	—	Display the firmware version.
Device Serial Number	—	—	Display the device ID.
Device User ID	Any	—	Set the user ID for the camera.
Device Temperature 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	2464	2464	Display the maximum image width.
Sensor Height	2056	2056	Display the maximum image height.
Sensor Digitization Taps	12 Bit	12 Bit	Displays the pixel depth output from the sensor.
Width Max	2464	2464	Display the maximum image width.
Height Max	2056	2056	Display the maximum image height.
Width	Binning Horizontal 1: 96 to 2464 Binning Horizontal 2: 96 to 1232	2464	Set the image width.
Height	GO-5101M-PMCL: Binning Vertical 1: 2 to 2056 Binning Vertical 2: 2 to 1028 GO-5101C-PMCL: 2 to 2056	2056	Set the image height.
Offset X	Binning Horizontal 1: 0 to 2448 Binning Horizontal 2: 0 to 1224	0	Set the horizontal offset.
Offset Y	GO-5101M-PMCL: Binning Vertical 1: 0 to 2054 Binning Vertical 2: 0 to 1027 GO-5101C-PMCL: 0 to 2054	0	Set the vertical offset.
Binning Horizontal Mode (GO-5101M-PMCL only)	Sum, Average	Sum	Set the addition process to be used during horizontal binning.
Binning Horizontal (GO-5101M-PMCL only)	1, 2	1	Set the number of pixels in the horizontal direction for which to perform binning.
Binning Vertical Mode (GO-5101M-PMCL only)	Sum	Sum	Display the addition process to be used during vertical binning.
Binning Vertical (GO-5101M-PMCL only)	1, 2	1	Set the number of pixels in the vertical direction for which to perform binning.

Item	Setting range	Default value	Description
Pixel Format	GO-5101M-PMCL: Mono8, Mono10, Mono12 GO-5101C-PMCL: BayerRG8, BayerRG10, BayerRG12	GO-5101M-PMCL: Mono8 GO-5101C-PMCL: BayerRG8	Set the pixel format. [Mono12] and [BayerRG12] are enabled when [Video Process Bypass] is set to [On].
Test Pattern	GO-5101M-PMCL: Off, GreyHorizontalRamp, GreyVerticalRamp, GreyHorizontalRamp Moving GO-5101C-PMCL: Off, GreyHorizontalRamp, GreyVerticalRamp, GreyHorizontalRamp Moving, HorizontalColorBar, VerticalColorBar, MovingColorBar	Off	Select the test image.
c) Acquisition Control			Configure image acquisition settings.
Acquisition Frame Rate (Hz)	0.125 to 35.6697 (Full)	35.6697	Set the frame rate as a frequency. (unit: Hz) The maximum value varies depending on the TapGeometory and ROI settings.
Trigger Selector	Frame 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, Line4 - TTL In, Line7 - CC1, NAND0 Out, NAND1 Out	Line7 - CC1	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 Readout	Off	Select the trigger overlap operation.
Exposure Mode	Off, Timed, Trigger Width	Timed (control via exposure time)	Select the exposure mode.
Exposure Time	8-bit: 14 to 7999812 10-/12-bit: 14 to 7999631	27847	Set the exposure time. The maximum value when [Trigger Mode] is set to [Off] varies depending on the [Acquisition Frame Rate Raw] value. The minimum value varies depending on the [Pixel Format] setting.
Exposure Auto	Off, Continuous	Off	Set whether to enable auto exposure.
d) Analog Control			Configure analog control settings.
Gain Selector	GO-5101M-PMCL: Analog All GO-5101C-PMCL: Analog All, Digital Red All, Digital Blue All	Analog All	Select the gain to configure.
Gain	Analog All: 1 to 16 Digital Red All and Digital Blue All: 0.4467 to 5.6235	Master gain: 1 R, B: 1	Set the gain value for the gain setting selected in [Gain Selector].

Item	Setting range	Default value	Description
Black Level Selector	GO-5101M-PMCL: Digital All GO-5101C-PMCL: Digital All, Digital Red, Digital Blue	Digital All	Select the black level to configure.
Black Level	–133 to 255	0	Set the black level value.
Balance White Auto	Off, Once, Countinuos, Preset 4600K, Preset 5600K, Preset 6500K	Off	Set the auto white balance.
LUT Mode	Off, Gamma, LUT	Off	Select the LUT mode.
Gamma Selector	0.45, 0.60, 1.0	0.45	Set the gamma value.
e) LUT Control			Configure LUT settings.
LUT Selector	Red, Green, Blue	Green	Select the LUT channel to control.
LUT Index	0 to 256	0	Set the LUT index table number.
LUT Value	0 to 4095	0	Set the LUT value.
f) Sequencer Control			Configure sequencer settings.
Sequencer Mode	On, Off	Off	Enable/disable [Sequencer Mode].
Sequencer Mode Select	Trigger Sequencer Mode, Command Sequencer Mode	Trigger Sequencer Mode	Select the sequencer mode.
Sequencer Configuration Mode	On, Off	Off	Select [On] to change the settings within the index.
Sequencer Set Selector	1 to 128	1	Select the [Trigger Sequencer] mode and [Command Sequencer] mode index.
Sequencer Frame Number	1 to 255	1	Set the number of frames to display for the selected Sequencer Index. (Enabled only for Trigger Sequencer.)
Sequencer Set Next	1 to 128	1	Set the next index to be displayed for the selected Sequencer Index. (Enabled only for Trigger Sequencer.)
Sequencer Width	96 to 2464	2464	Set the width of the selected Sequencer Index.
Sequencer Height	2 to 2056	2056	Set the height of the selected Sequencer Index.
Sequencer Offset X	0 to 2448	0	Set the horizontal offset value for the selected Sequencer Index.
Sequencer Offset Y	0 to 2054	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 GainR	-4533 to 37876	1024	Set the red gain for the selected Sequencer Index.
Sequencer GainB	-4533 to 37876	1024	Set the blue gain for the selected Sequencer Index.
Sequencer Exposure Time	27 to 8000000	27847	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-5101M-PMCL only)	1 to 2	1	Set the horizontal binning for the selected Sequencer Index.
Sequencer V Binning (GO-5101M-PMCL only)	1 to 2	1	Set the vertical binning for the selected Sequencer Index.
Sequencer Command Index	—	1	Set this to change the Sequencer Index. (Enabled only for Command Sequencer.)
Sequencer Set Active	—	—	Displays the active LUT number.
Sequencer LUT Mode	Gamma, LUT	Gamma	Set the sequencer LUT mode.
Sequencer Set Start	—	1	Set the index number that is used when executing [Sequencer Reset] in [Trigger Sequencer] mode or [Command Sequencer] mode.

Item	Setting range	Default value	Description
Sequencer Reset	—	—	Reset the current index number to the number configured in [Sequencer Set Start].
g) Digital IO Control			Configure settings for digital input/output.
Line Selector	Line1 - TTL Out, Line4 - TTL In, Line7 - CC1, NAND Gate 0 In 1, NAND Gate 0 In 2, NAND Gate 1 In 1, NAND Gate 1 In 2	Line1 - TTL Out	Select the input/output to configure.
Line Mode	Input, Output	Output	Display the input/output status (whether it is input or output).
Line Inverter	True, False	False	Enable/disable polarity inversion for the selected input signal or output signal.
Line Status	True, False	False	Display the status of the input signal or output signal (True: High, False: Low).
LineSource	Low, High, Frame Trigger Wait, Frame Active, Exposure Active, FVAL, Pulse Generator 0, User Output 0, User Output 1, Line4 - TTL In, Line7 - CC1, Nand 0 Out, Nand 1 Out	Low	Select the line source signal for the item selected in [Line Selector].
Line Format	—	TTL	Display the current I/F type.
User Output Selector	User Output 0, User Output 1	0: User Output 0	Set the user output signal.
User Output Value	True, False	False	Set the value for the User Output selected in [User Output Selector].
h) Pulse Generators			Configure pulse generator settings.
Clock Pre-scaler	1 to 4096	165	Set the division value for the prescaler (128-bit length) using the pixel clock as the base clock.
Pulse Generator Clock (MHz)	0.018127 to 74.25	0.45	Set the clock used for the pulse generator. This value is calculated using the [Clock Pre-scaler] value as a base.
Pulse Generator Selector	Pulse Generator 0	Pulse Generator 0	Select the pulse generator.

Item	Setting range	Default value	Description
Pulse Generator Length	1 to 1048575	30000	Set the maximum count-up value as a clock count.
Pulse Generator Length (ms)	0.002222 to 2330.166666	66.6667	Set the maximum count-up value in milliseconds. This value is calculated using the [Pulse Generator Length] value as a base. The setting range varies depending on the [Clock Pre-scaler] value.
Pulse Generator Frequency (Hz)	0.429154 to 450000	15	Set the maximum count-up value as a frequency. This value is calculated using the [Pulse Generator Length] value as a base.
Pulse Generator Start Point	0 to 1048574	0	Set the start point of the High interval as a clock count. When the counter reaches this value, the output will be 1.
Pulse Generator Start Point (ms)	0 to 2330.164444	0	Set the start point of the High interval in milliseconds. When the counter reaches this value, the output will be 1. The setting range varies depending on the [Clock Pre-scaler] value.
Pulse Generator End Point	1 to 1048575	15000	Set the end point of the High interval as a clock count.
Pulse Generator End Point (ms)	0.002222 to 2330.166666	33.3333	Set the end point of the High interval in milliseconds.
Pulse Generator pulse-width (ms)	0 to 14.1222	33.3333	Display the High interval width of the pulse in milliseconds. The duration between the Start Point and End Point is calculated. The setting range varies depending on the [Clock Pre-scaler] value.
Pulse Generator Repeat Count	0 to 255	0	Set the repeat count for the counter. When this is set to [0], a free counter is enabled with no repeat limit.
Pulse Generator Clear Activation	Off, High Level, Low Level, Rising Edge, Falling Edge	Off	Set the clear signal condition for the count clear input of the pulse generator.
Pulse Generator Clear Source	Low, High, Frame Trigger Wait, Frame Active, Exposure Active, FVAL, LVAL, User Output 0, User Output 1, Line4 - TTL In, Line7 - CC1, Nand0 Out, Nand1 Out	Low	Select the count clear input signal source. [Line4 TTL In] can be used on the Standard Model.
Pulse Generator Clear Inverter	True, False	False	Select whether to invert the polarity of the count clear input signal.
Pulse Generator Clear Sync Mode	Async Mode, Sync Mode	Async Mode	Select the sync mode for the count clear input signal.
i) Transport Layer Control			Display information on transport layer control.
Device Tap Geometry	Geometry_1X2_1Y, Geometry_1X3_1Y, Geometry_1X4_1Y	Geometry_1X4_1Y	Set the transmission method for each time images are transmitted from the device (TAP structure).
Camera Link Clock Frequency	37.1MHz, 74.3MHz, 84.9MHz	74.3MHz	Set the Camera Link clock.
j) User Set Control			Configure user settings.
User Set Selector	0: Default, User Set1 to User Set3	Default (factory default values)	Select the user settings.

Item	Setting range	Default value	Description
User Set Load	—	—	Load user settings.
User Set Save	—	—	Save the current setting values as user settings.
k) 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, Low Mid-Right, Low Mid-Left, Low Left, Mid-Low Right, Mid-Low Mid-Right, Mid-Low Mid-Left, Mid-Low Left, Mid-High Right, Mid-High Mid-Right, Mid-High Mid-Left, Mid-High Left, High Right, High Mid-Right, High Mid-Left, High Left	Low Right	Select the area for which to configure [ALC Area Enable].
ALC Area Enable	True, False	False	Enable/disable the photometry area selected in [ALC Area Selector].
ALC Area Enable All	**True**, **False**	**True**	**True**: Operate ALC with all areas designated as photometry areas, regardless of the individual enabled/disabled photometry area states configured in [ALC Area Selector]. **False**: Operate ALC according to the individual enabled/disabled photometry area states configured in [ALC Area Selector].
ASC Min.	100 to 7999999	100	Set the minimum value for the Exposure Auto (ASC) control range.
ASC Max.	101 to 8000000	8216	Set the maximum value for the Exposure Auto (ASC) control range.
AGC Min.	100 to 1599	100	Set the minimum value for the Gain Auto (ASC) control range.
AGC Max.	101 to 1600	1600	Set the maximum value for the Gain Auto (ASC) control range.
AGC/ASC Control Speed	1 (slow) to 8 (fast)	4	Set the reaction speed for AGC/ASC. (8 is the fastest.)
ALC Status			Display the counter ALC.
l) JAI Custom Control AWB			Configure settings for JAI AWB.
AWB Area Selector	Low Right to High Left	Low Right	Select from the 16 metering areas for AWB individually.
AWB Area Enable	True, False	False	Enable / disable the selected AWB metering area.
AWB Area Enable All	True, False	True	Enable / disable all AWB metering area.
AWB Control Speed	1 to 8	4	Select the AWB reaction speed. (for continuous)
AWB Status	—	Idle	Display the counter AWB.
m) JAI Custom Control Blemish			Configure settings for JAI white blemish correction.
Blemish Enable	True, False	True	Enable/disable blemish correction.
Blemish Detect Threshold	0 to 100	10	Set the blemish detection threshold.
Blemish Detect Position Index	0 to 511	0	Select the index for the target blemish coordinates (Blemish Data Position X/Y).

Item	Setting range	Default value	Description
Blemish Detect Position X	–1 to 2463	—	Display the X coordinate (horizontal pixel position) of the target blemish selected in [Blemish Detect Position Index]. You can also manually enter the X coordinate of the blemish you want to correct.
Blemish Detect Position Y	–1 to 2055	—	Display the Y coordinate (vertical pixel position) of the target blemish selected in [Blemish Detect Position Index]. You can also manually enter the Y coordinate of the blemish you want to correct.
Blemish Compensation Number	—	0	Display the number of target blemishes.
n) JAI Custom Control Shading			Configure shading correction settings.
Shading Correction Mode	GO-5101M-PMCL: Flat Shading (fixed) GO-5101C-PMCL: Flat Shading, Color Shading	Flat Shading	Select the shading correction method.
Shading Mode	Off, User 1, User 2, User 3	Off	Set the area to which to save shading correction data. When this is set to [Off], shading correction data is not saved.
Perform Shading Calibration	—	—	Execute shading correction.
Shading Detect Result	—	—	Display the shading correction results.
o) JAI Custom Control Counter And Timer Control			Configure counter settings. (This camera only supports counter functions.)
Counter 0 to 2	Counter 0 to 2	—	Select the counter.
Counter 0 to 2 Event Source	Off, Frame Trigger, Frame Start, Exposure Start, Exposure Transfer End	Off	Select the counter event signal for which to read the count value.
Counter 0 to 2 Event Activation	Rising Edge Falling Edge	Rising Edge	Display the timing at which to count.
Counter 0 to 2 Reset	—	—	Reset the counter.
Counter 0 to 2 Refresh	—	—	Update the count value.
Counter 0 to 2 Value	—	0	Display the count value.
Counter 0 to 2 Status	Counter Active	Counter Active	Display the counter status.
p) 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	—
Video Send Mode	Normal Mode, Trigger Sequencer Mode, Command Sequencer Mode	Normal Mode	Display the video send mode status.

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. Check the Camera Link 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 35).

■ Settings and operations

Problem	Cause and solution
I want to restore the factory default settings.	Load [Default] under [User Set Selector] in the [Feature Properties] tab to restore the factory default settings.

Specifications

Item				GO-5101M-PMCL	GO-5101C-PMCL
Scanning system				Progressive scan, 1 tap	
Synchronization				Internal	
Interface				CameraLink (Version 2.0)	
Image sensor				Monochrome CMOS	Bayer color CMOS
Image size (effective image)				8.5 (H) × 7.09 (V), 11.1 mm diagonal	
Pixel size				3.45 (H) × 3.45 (V) µm	
Effective image pixel output				2464 (H) × 2056 (V)	2464 (H) × 2056 (V)
Frame Rate (max.)	Tap Geometry		CL Pixel Clock [MHz]	—	—
	Base	1X2-1Y	37.125	14.3 fps	14.3 fps
			74.25	28.7 fps	28.7 fps
			84.85	32.7 fps	32.7 fps
		1X3-1Y	37.125	21.5 fps	21.5 fps
			74.25	35.6 fps	35.6 fps
	Medium	1X4-1Y	37.125	28.6 fps	28.6 fps
			74.25	35.6 fps	35.6 fps
EMVA 1288 parameters Absolute sensitivity Maximum SN ratio				At 10-bit output 3.54p (λ = 525 nm) 40.26 dB	At 10-bit output 3.94p (λ = 525 nm) 40.26 dB
SN ratio (traditional method)				60 dB or more (typical) (0 dB gain, Black)	60 dB or more (typical) Dark compression ON: 50 dB (typical) (0 dB gain, Green Black)
Digital image output format	Full pixel			2464 (H) × 2056 (V)	Bayer 2464 (H) × 2056 (V)
	ROI	Width		96 to 2464, 16 pixels/step	96 to 2464, 16 pixels/step
		Offset X		0 to 2448, 16 pixels/step	0 to 2448, 16 pixels/step
		Height		2 to 2056, 2 line/step	2 to 2056, 2 lines/step
		Offset Y		0 to 2054, 2 lines/step	0 to 2054, 2 lines/step
	Binning	H	1	2464 (H)	2464 (H)
			2	1232 (H)	—
		V	1	2056 (V)	2056(V)
			2	1028 (V)	—
	Pixel Format			Mono8, Mono10, Mono12	BayerRG8, BayerRG10, BayerRG12
Trigger selector	Exposure			Frame Start	
Exposure modes				Off, Timed (EPS), Trigger Width (PWC)	
Trigger overlap				Off/Readout	
Trigger input signals				Line4 - TTL In, Line7 - CC1, Software, PG0, NAND Out 0/1, Low, High, User Output 0/1	
Exposure modes	Timed			14 µs (min) to 8 s (max), variable unit: 1 µs	
	Trigger Width			14 µs (min) to 8 s (max)	
Auto exposure (Exposure Auto)				Off, Continuous	
Auto exposure response speed (AGC/ASC Control Speed)				1 to 8	
Video Send Mode Selector				Normal ROI, Trigger Sequencer, Command Sequencer	
Digital I/O				Line Selector (4P): GPIO IN / GPIO OUT	
Black level adjustment	Default level			33LSB (during 10-bit output)	
	Video level adjustment range			0 to 100 (during 10-bit output)	
	Adjustment range			–33LSB to +64LSB against reference level (during 10-bit output)	
	Resolution adjustment			1 STEP = 0.25LSB	

Item			GO-5101M-PMCL	GO-5101C-PMCL
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		512 pixels	
ALC			Adjusts exposure automatically using combination of AGC and auto shutter	
Gamma			0.45, 0.6 an, 1.0 (OFF) (3 steps available)	
LUT			OFF: γ = 1.0, ON = 257 points can be set	
Power supply	4-pin connector	Input range	DC +12 V to +24 V ±10% (via input terminal)	
		Power consumption	3.12 W (Typ) 12 V input	
	PoCL	Input range	DC 12 V ±10%	
		Power consumption	3.12 W (Typ) 12 V input	
Lens mount			C-mount Lens mount protrusion length of 9 mm or less is supported	
Flange back			17.526, tolerance: 0 mm to –0.05 m	
Optical filter (IR cut filter)			Not provided	Half value of 670 nm
Verified performance temperature / humidity			–5°C to +45°C / 20% to 80% (non-condensing)	
Storage temperature / humidity			–25°C to +60°C / 20% to 80% (non-condensing)	
Regulations			CE (EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS, WEEE	
Dimensions (housing)			29 × 29 × 41.5 mm (WHD) (excluding mount protrutions)	
Weight			46 g	

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

Package contents

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

Optional accessories (not supplied)

MP-43 tripod mount
AC adapter

Design and specifications are subject to change without notice.

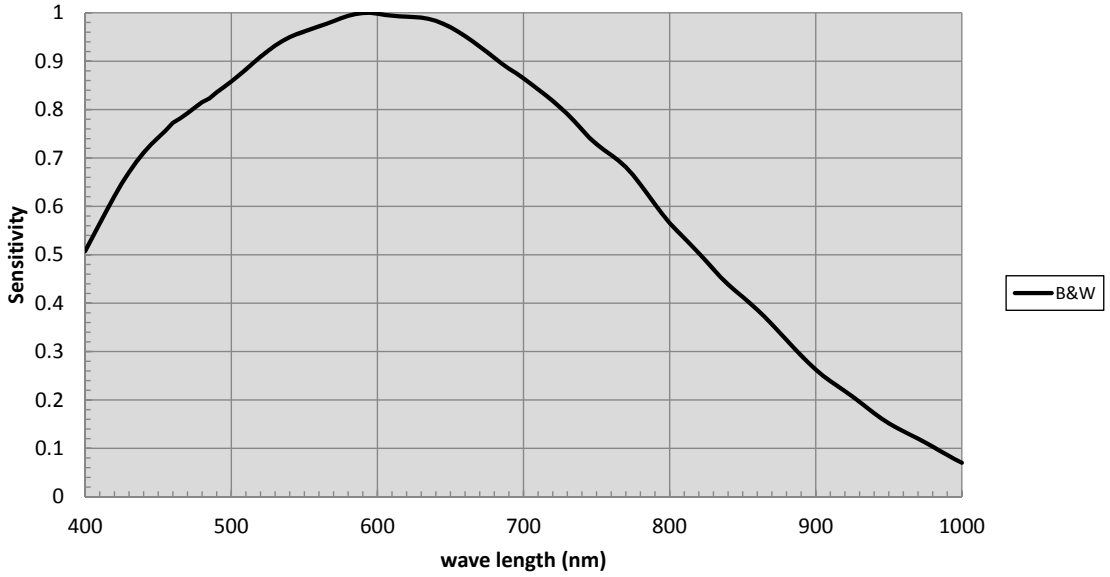
Frame Rate Reference

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

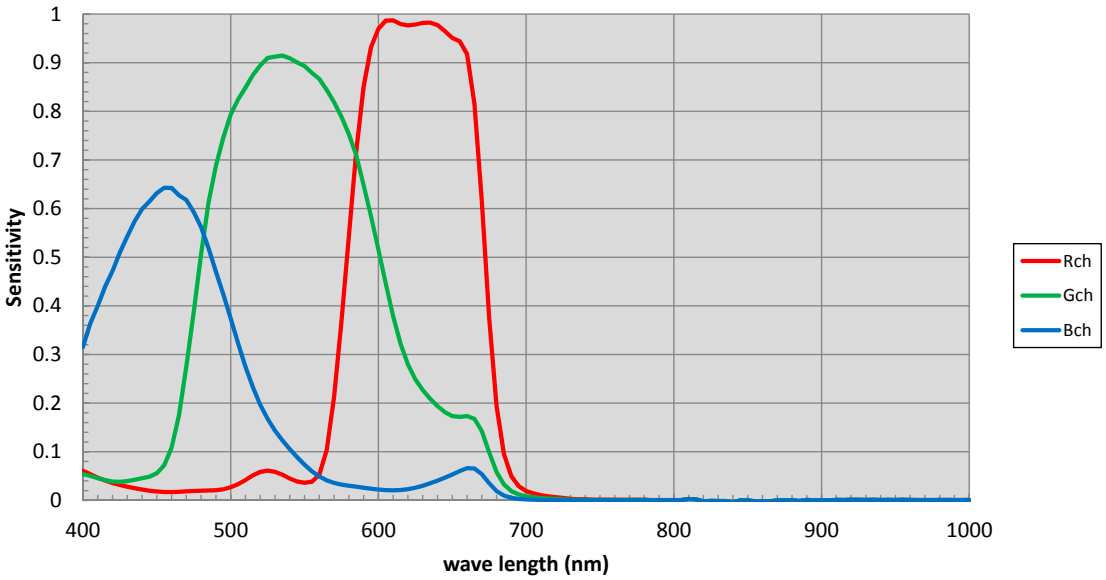
Pixel count	Resolution (screen size)	ROI/Binning	Pixel size(μm)	Image size	Frame rate 8 / 10 / 12 bit
5.1 MP	2464 × 2056	Full pixel	3.45 × 3.45	2/3"	35.6 fps
2 MP	1920 × 1080	ROI	3.45 × 3.45	1/2" (7.6 mm)	66.9 fps
1.4 MP	1408 × 1050	ROI	3.45 × 3.45	1/2.6" (6.04 mm)	68.7 fps
1.3 MP	1280 × 1024	ROI	3.45 × 3.45	1/2.8" (5.66 mm)	70.4 fps
0.5 MP	800 × 600	ROI	3.45 × 3.45	1/4.6" (3.45 mm)	117.5 fps
0.5 MP	800 × 600 (Mono only)	ROI + 2×2 Binning	6.9 × 6.9	1/2.3" (6.90 mm)	117.5 fps
0.3 MP	640 × 480	ROI	3.45 × 3.45	1/5.75" (2.76 mm)	145.0 fps
0.3 MP	640 × 480 (Mono only)	ROI + 2×2 Binning	6.9 × 6.9	1/2.9" (5.52 mm)	145.0 fps

Spectral Response

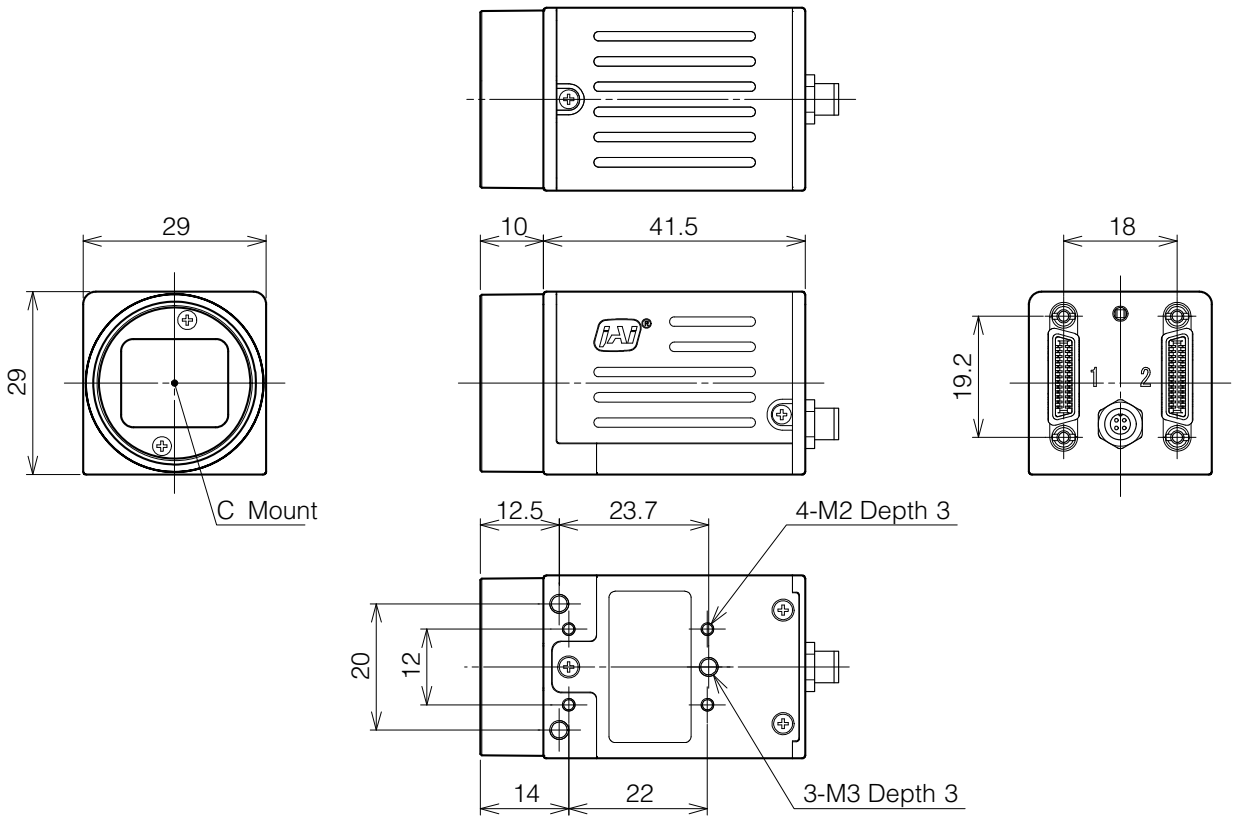
GO-5101M-PMCL



GO-5101C-PMCL



Dimensions



Dimensional tolerance: ±0.3 mm
Unit: mm

User's Record

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

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