See the possibilities

User Manual

GO-2400M-PMCL

GO-2400C-PMCL

CMOS Digital Progressive Scan
Monochrome and Color Camera with Mini Camera Link Interface

Document Version: 2.5
GO-2400-PMCL_Manual_Ver.2.5_2023-06-19

Thank you for purchasing this product.

⚠Be sure to read this documentation before use.

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

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

Table of Contents

About Technical Note

Some additional technical information is provided on the JAI website as Technical Notes. In this manual, if a technical note is available for a particular topic, the above icon is shown. Please refer to the following URL for Technical notes.

https://www.jai.com/support-software/technical-notes

Notice/Warranty

Notice

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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-PMCL and GO-2400C-PMCL comply with the following provisions applying to their standards.

EN 61000-6-3 (Generic emission standard part 1)

EN 61000-6-2 (Generic immunity standard part 1)

FCC

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

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

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

Warning

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

KC

제조년월은 제품상자의 라벨을 참조하십시오.

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.

Applicable Model: GO-2400M-PMCL

重 要 注 意 事 项

有毒，有害物质或元素名称及含量表

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

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

○:表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572-2011规定的限量要求以下。

×:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572-2011规定的限量要求。

环保使用期限

电子信息产品中含有的有毒有害物质或元素在正常使用的条件下不会发生外 泄或突变、电子信息产品用户使用该电子信息产品不会对环境造成严重污染 或对其人身、财产造成严重损害的期限。

数字「15」为期限15年。

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.

Applicable Model: GO-2400C-PMCL

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

○:表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572-2011规定的限量要求以下。

×:表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572-2011规定的限量要求。

环保使用期限

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数字「15」为期限15年。

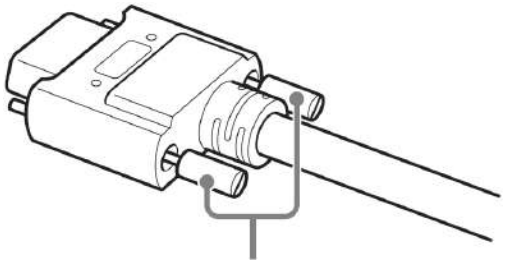
Usage Precautions

Notes on Cable Configurations

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

Notes on 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: 0.15 N·m or less)



Caution: Secure manually. Do not secure too tightly.

Notes on Attaching the Lens

Technical Notes How to Clean a Sensor

Avoiding Dust Particles

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

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

Phenomena Specific to CMOS Image Sensors

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

- **Aliasing**: When shooting straight lines, stripes, and similar patterns, vertical aliasing (zigzag distortion) may appear on the monitor.
- **Blooming**: When strong light enters the camera, some pixels on the CMOS image sensor may receive much more light than they are designed to hold, causing the accumulated signal charge to overflow into surrounding pixels. This “blooming” phenomenon can be seen in the image but does not affect the operation of the camera.
- **Fixed pattern noise**: When shooting dark objects in high-temperature conditions, fixed pattern noise may occur throughout the entire video monitor screen.
- **Defective pixels**: Defective pixels (white and black pixels) of the CMOS image sensor are minimized at the factory according to shipping standards. However, as this phenomenon can be affected by the ambient temperature, camera settings (e.g., high sensitivity and long exposure), and other factors, be sure to operate within the camera’s specified operating environment.

Notes on Exportation

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

Features

This camera is an industrial progressive scan camera equipped with a Type 1/1.2 global shutter CMOS image sensor with 2.35 effective megapixels (1936 × 1216). The unit is compact and lightweight in design and is equipped with Camera Link Ver. 2.0 compatible interface. The GO-2400M-PMCL produces monochrome output while the GO-2400C-PMCL produces color output.

Compact and lightweight

The unit's compact size (approx. 29 × 29 × 41.5 mm, excluding protrusions) 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 850M Bytes 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 color outputs.

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

High frame rate

This camera is capable of frame rates of up to 165.5 fps (8-bitformat) for full 2.35-megapixel output. Even faster frame rates can be achieved by using binning is (monochrome model only) or by specifying smaller scanning areas for the ROI (region of interest).

ALC (automatic level control) function

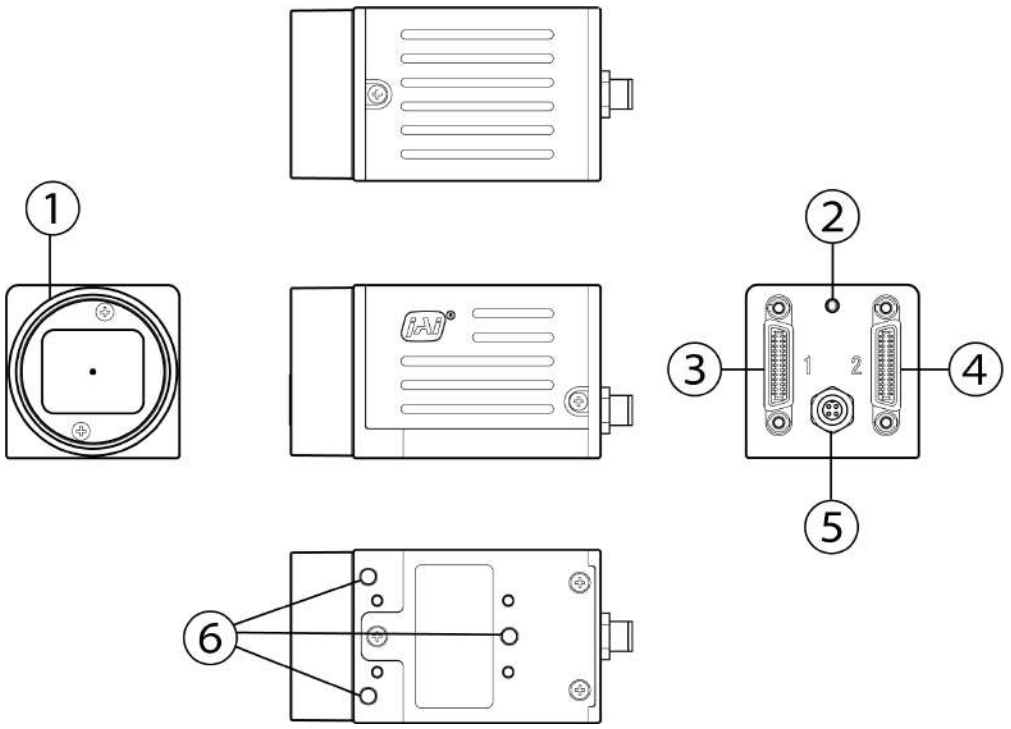
Combine the automatic gain control and automatic exposure control functions to allow handling of changes in various brightnesses.

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 (color model only): White balance

Parts Identification



① Lens Mount (C-Mount)
② POWER/TRIG LED
③ ④ Camera Link Connector 1 and 2
⑤ DC IN / Trigger IN Connector (4-pin Round)
⑥ Mounting Holes (M3, 3mm depth)

① Lens Mount (C-Mount)

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

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

② POWER/TRIG LED

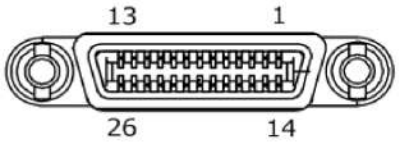
Indicates the power or trigger input status.

LED		Status
	Lit amber	Camera initializing. The light goes off after initiating
	Lit green	Camera in operation in Continuous mode
	Blinking green	During operation in trigger mode, trigger signals are being input. **Note:** The blinking interval is not related to the actual input interval of the external trigger.

③ ④ Camera Link Connector 1 and 2

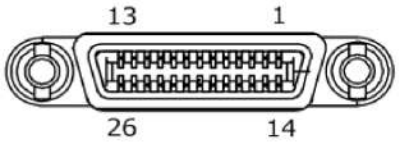
Connect a cable that is compatible with Mini Camera Link (SDR) connectors here.

Note: The cable length at which communication will be possible will be limited when using a cable that is not compatible with Camera Link, a small diameter type cable, or a high flex type cable.



Camera Link Connector 1

Pin	Input Output	Signal	Description
1, 26		Power	Power
2 (-), 15 (+)	Out	X_OUT0	Data out
3 (-), 16 (+)	Out	X_OUT1	Data out
4 (-), 17 (+)	Out	X_OUT2	Data out
5 (-), 18 (+)	Out	X_Clk	CL Clock
6 (-), 19 (+)	Out	X_OUT3	Data output
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	GND



Camera Link Connector 2

Pin	Input Output	Signal	Description
1, 26		Shield	GND
2 (-), 15 (+)	Out	Y_OUT0	Data out
3 (-), 16 (+)	Out	Y_OUT1	Data out
4 (-), 17 (+)	Out	Y_OUT2	Data out
5 (-), 18 (+)	Out	Y_Clk	CL Clock
6 (-), 19 (+)	Out	Y_OUT3	Data out
7, 20			Terminal (100Ω)
8 (-), 21 (+)	Out	Z_OUT0	Data out
9 (-), 22 (+)	Out	Z_OUT1	Data out
10 (-), 23 (+)	Out	Z_OUT2	Data out
11 (-), 24 (+)	Out	Z_Clk	CL Clock
12 (+), 25 (-)	Out	Z_OUT3	Data out
13, 14		Shield	GND

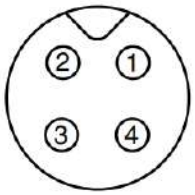
Connectors

Camera Side: HDR-EC26FYTG2-SL+ (HONDA)

Cable Side: SDR connector cable for PoCL

⑤ DC IN / Trigger IN Connector (4-pin Round)

Connect the cable 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 24V +/- 10%
2	In	TTL In	Line 4
3	Out	TTL Out	Line 1
4	Out	Power GND	COMMON GND

TTL Signal (Specifications)

TTL Out Signal (Typ.)	Output voltage: Low 0.0V, High 3.3V Input/output current: +/-24mA
TTL In Signal (Typ.)	Input voltage: Low 0.0 to 0.6V, High 2.0 to 5.5V

⑥ Mounting Holes (M3, 3mm 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.

> **Note:** The smaller holes (×4) are M2 with a depth of 3 mm.

Preparation

Read this section to learn how the camera connects to devices and accessories. The preparation process is described below.

1	**Step 1: Connect Devices** • Connect the lens, Camera Link cable, AC adapter, computer, and other devices.
2	**Step 2: Verify Camera Operation** • Verify whether the camera is turned on and ready for use.
3	**Step 3: Verify the Connection Between the Camera and PC** • Verify whether the camera is properly recognized via Control Tool.
4	**Step 4: Change the Camera Settings** • Refer to the procedure for changing the output format setting as an example and change various settings as necessary.
5	**Step 5: Adjust the Image Quality** • Refer to the procedures for adjusting the gain and black level as examples and adjust the image quality.
6	**Step 6: Configuring Various Other Settings** • Configure other settings as necessary.
7	**Step 7: Save the Settings** • Save the current setting configurations in user memory.

Short ASCII Commands

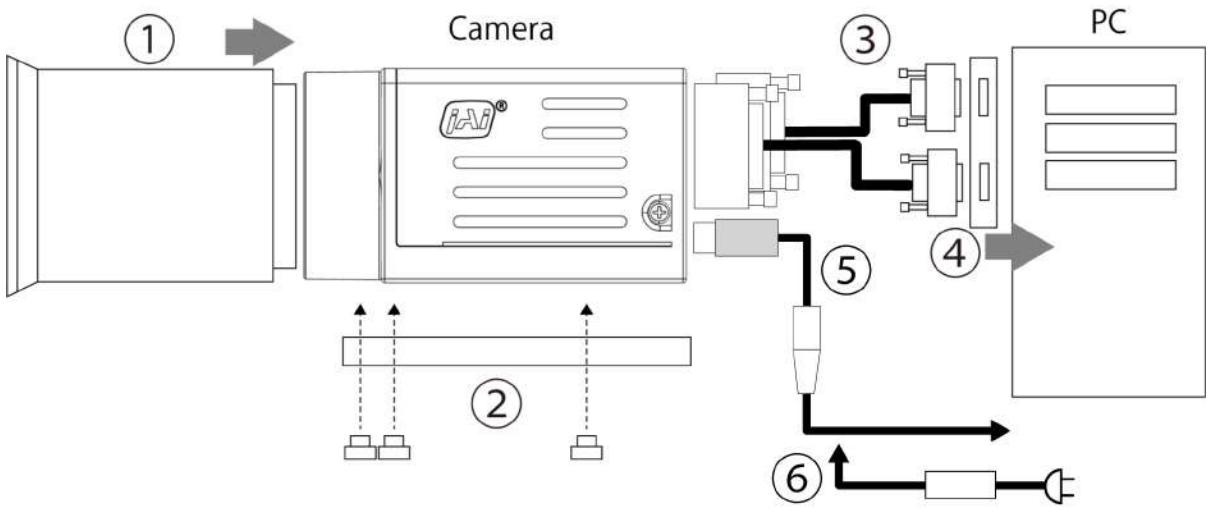
The most universal method for controlling a Camera Link camera such as this camera is by the use of short ASCII commands sent via serial communications. All Camera Link frame grabber boards support the use of these short ASCII commands. SDKs that utilize these ASCII commands for developing machine vision applications are typically available from the grabber manufacturer, as well as from third-party vendors.

This section describes how to configure various camera settings using serial communication and specific short ASCII commands. A complete list of all available ASCII commands for this camera is included in the Short ASCII Command List chapter.

Later sections of the manual refer to GenICam nomenclature for various features/functions and includes a complete list of all camera settings (Setting List (Feature Properties)).

This camera fully supports applications written using GenICam-based SDKs. The advantage of this is that programs written using GenICam names can be applied with little or no modification to control cameras with other GenICam-compliant interfaces and even GenICam compliant cameras from different vendors.

Step 1: Connect Devices



① Lens

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

③ Camera Link Cable

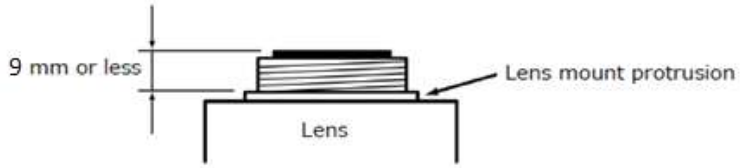
④ Frame Grabber Board

⑤ DC IN / Trigger IN Connection Cable

⑥ AC adapter (Power Supply, If Necessary)

① Lens

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



To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the image sensor size (Type 1/1.2, 11.3mm (H) x 7.13mm (V), 13.4mm diagonal).

Cautions:

- 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.

Notes:
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 (= 8.5mm)

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

When mounting the camera directly to a wall or other device, use screws that match the mounting 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 ③ ④ Camera Link Connector 1 and 2.

> **Caution:** Refer to Notes on Camera Link Cable Connections when connecting the cables to the connectors.

④ Frame Grabber Board

Refer to the operating instructions of the frame grabber board and configure settings on the computer as necessary. (Use a computer that meets the requirements of your frame grabber board).

⑤ DC IN / Trigger IN Connection Cable

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

⑥ AC adapter (Power Supply, If Necessary)

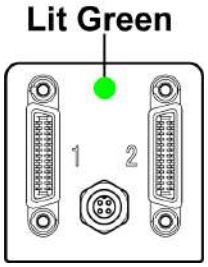
Connect the AC adapter and the round connector of the connection cable to the DC IN / trigger IN connector on the camera.

> **Note:** The AC adapter is not required when using PoCL.

Step 2: Verify Camera Operation

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

Verify whether power is being supplied to the camera by checking the rear LED. When properly turned on, the power LED is lit green.



> **Note:** For details on how to read the LEDs, see the ② POWER/TRIG LED section.

Step 3: Verify the Connection Between the Camera and PC

Use a short ASCII command to verify whether the camera is properly recognized in your setup.

1. Install terminal emulator software capable of serial communication to the PC connected to the camera via the frame grabber board.

   Set the following serial communication.

   - Baud Rate: 9600
   - Data Length: 8bit
   - Start Bit: 1bit
   - Stop Bit: 1 bit
   - Parity: None
   - Xon/Xoff Control: None

2. Enter the command **DVN? <CR><LF>** from the terminal emulator software.

   If correctly connected, response **DVN = JAI Corporation** will be displayed.

Item	Short ASCII Command	Description
DeviceVendorName	DVN	DVN? <CR><LF> Display the device vendor name: "JAI Corporation"

Step 4: Change the Camera Settings

> **Related Setting Items:** ImageFormatControl

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

Configure the Output Format

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

Factory Default Values

Item		Default Value
ImageFormatControl	Width	1936
	1216	1216
	OffsetX (horizontal position)	0
	OffsetY (vertical position)	0
	PixelFormat	Mono8 (Monochrome model) Bayer8 (Color model)

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

Example: Change the Width setting (ImageFormatControl)

1. To check the current Width setting, enter the command **WTC?<CR><LF>** from the terminal emulator software.
2. To change the Width setting to 1200, enter **WTC=1200<CR><LF>**.
3. To change other setting items, see Image Format Control (Short ASCII Command).

Example: Change the PixelFormat setting (ImageFormatControl)

1. To check the current PixelFormat setting, enter the command **BA?<CR><LF>** from the terminal emulator software.
2. To change the PixelFormat setting to Mono10, enter **BA=1<CR><LF>**.

Configure Exposure and External Trigger Settings

Related Setting Items: AcquisitionControl

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.

Note: For the details on the short ASCII commands required to configure the Exposure and Trigger settings, see Acquisition Control (Short ASCII Command).

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	8216 (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.

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

Note: *The actual exposure time will consist of the image sensor's offset duration (13.7 µs) added to the setting configured on the camera. When **ExposureMode** is set to **Timed** and the exposure time is set to 15 µs, the actual exposure time will be as follows.
15 µs + 13.7 µs (offset duration of image sensor) = 28.7 µs
When **ExposureMode** is set to **TriggerWidth**, the exposure is slightly longer than the width of the trigger signal. To achieve an exposure time of 28.7 µs and the exposure time offset is 13.7 µs, use 28.7 µs - 13.7 µs = 15 µs as the high or low time for the trigger signal.

1. Set **Exposure Mode** to **Timed**. (Timed is the default setting.)
2. Specify the exposure time in **ExposureTimeRaw**. The setting value for the exposure time can only be changed when Expos**ure Auto** is set to **Off**. If **Exposure Auto** is set to **Continuous**, temporarily set it to **Off** before changing the exposure time.
3. Set **FrameStartTriggerMode** to **On**.
4. 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 **FrameStartTriggerMode** to **On**.
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

Note: * The actual exposure time will consist of the image sensor's offset duration (13.7 µs) added to the setting configured on the camera. When **ExposureMode** is set to **Timed** and the exposure time is set to 15 µs, the actual exposure time will be as follows.
15 µs + 13.7 µs (offset duration of image sensor) = 28.7 µs
When **ExposureMode** is set to **TriggerWidth**, the exposure is slightly longer than the width of the trigger signal. To achieve an exposure time of 28.7 µs and the exposure time offset is 13.7 µs, use 28.7 µs - 13.7 µs = 15 µs as the high or low time for the trigger signal.

1. Set **Exposure Mode** to **Timed**. (Timed is the default setting.)
2. Specify the exposure time in **Exposure Time**. The setting value for the exposure time can only be changed when **Exposure Auto** is set to **Off**. If **Exposure Auto** is set to **Continuous**, temporarily set it to Off before changing the exposure time.
3. Set **FrameStartTriggerMode** to **Off**.
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: Adjust the Image Quality

> **Related Setting Items:** AnalogControl

Display the camera image and adjust the image quality.

Display the Image

Display the image captured by the camera. Please display the image with the viewer on the frame grabber board application.

Adjust the Gain

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

> **Notes:**
> - For details on gain control, see "Gain Control" in the Main Functions section.
> - For the details on the short ASCII commands required to configure the Gain settings, see Analog Control (Short ASCII Command).

Automatic Adjustment

1. Set **GainAuto** (AnalogControl) to **Continuous**.

Manual Adjustment

1. Set **GainAuto** to **Off**.
2. Configure the Gain value in Gain.
    - **GainRawAnalog All** (master gain) can be set to multiple (x1 to x16) of Analog Gain. The resolution is set in x0.1dB steps. Values are configured by multipliers.
    - For the color model, the **GainRawDigitalRedAll** (digital R gain) and **GainRawDigitalBlueAll** (digital B gain) can be set to a value from x0.447 to the Analog All (master gain) value.

Adjust the White Balance

> **Related Setting Items:** AnalogControl

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

> **Notes:**
> - This function is only supported on the color model.
> - For the details on the short ASCII commands required to configure the White Balance settings, see Analog Control (Short ASCII Command).

Manual white balance adjustment

1. Set **BalanceWhiteAuto** to **Off** . (Off is the default setting.)
2. Configure the R and B 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 **Continuous** or **Once** (**BalanceWhiteAuto**) depending on your intended application. The white balance is automatically adjusted.

Adjust the Black Level

> **Related Setting Items:** AnalogControl

> **Note:** For the details on the short ASCII commands required to configure the Black Level settings, see Analog Control (Short ASCII Command).

1. Select the black level you want to configure: BlackLevelRawAll, BlackLevelRawRed*, BlackLevelRawBlue*

   > **Note:** *Color model only.

2. Send the setting command(s).

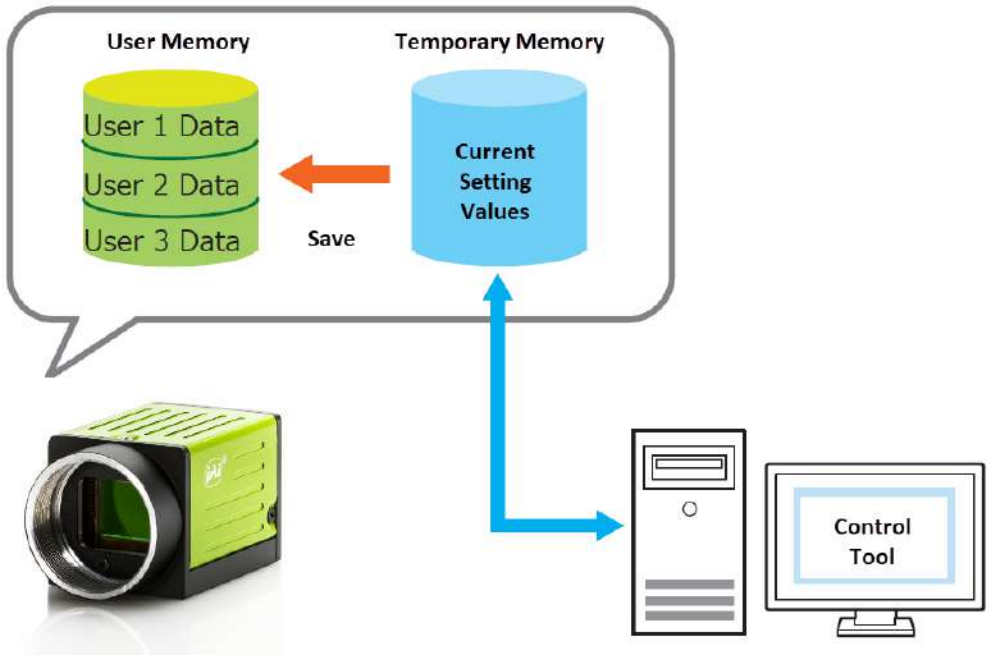
Step 6: Configuring Various Other Settings

See "Short ASCII Command List" and configure settings as necessary.

Step 7: Save the Settings

> **Related Setting Items:** UserSetControl

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



> **Note:** For the details on the short ASCII commands required to configure the save/load settings, see User Set Control (Short ASCII Command).

Save the User Settings

1. Stop image acquisition. Settings can only be saved when image acquisition on the camera is stopped.
2. Specify the storage location (UserSet1 - UserSet3) using the **UserSetSave** command and save the current camera settings.

Load the User Settings

1. Stop image acquisition. User settings can only be loaded when image capture on the camera is stopped.
2. Specify the storage location (UserSet1 - UserSet3) using the **UserSetLoad** command and read the settings of the camera.

> **Note:** When selecting **Default**, the factory settings are loaded.

Main Functions

This chapter describes the camera's main functions.

Basic Function Matrix

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

Exposure Mode	Frame Start Trigger	Exposure Time	ROI	Balance White Auto*	Gain Auto	Exposure Auto	Video Send Mode		
							Sensor Multi ROI	Trigger Sequence Mode	Command Sequence Mode
Off	Off		✓	✓	✓		✓		
Timed	Off	✓	✓	✓	✓	✓	✓		✓
Timed (EPS)	On	✓	✓				✓	✓	✓
Trigger Width	On		✓				✓		

✓ : Supported
Empty: Not Supported

Notes: *Color model only.

GPIO (Digital Input/Output Settings)

Related Setting Items: DigitalIOControl

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.

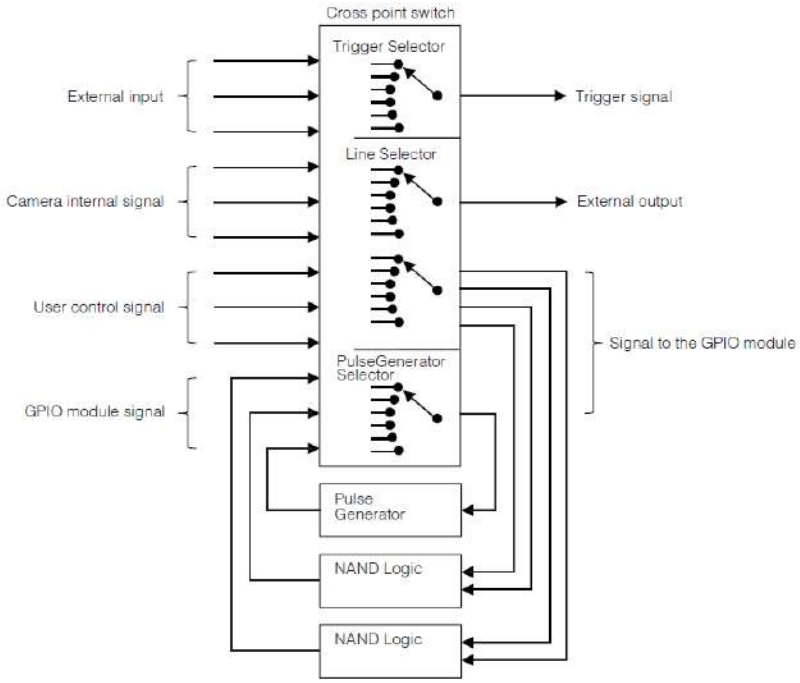
In addition, a pulse generator for generating custom pulses and a NAND module for performing logic operations are built into the camera. The two can be used together for a variety of purposes, such as noise removal for trigger signals and phase adjustment for pulse outputs.

Such functions are generally referred to as GPIO functions.

Select Signals

- 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.

Source signal (Cross point switch input) / Signals to use as output	Output Destination - Selector (Cross point switch output)											
	Trigger Selector				Line Selector							Pulse Generator Selector
	Acquisition Start	Acquisition Stop	Frame Start	Transfer Start	Line2 OPT Out 1	Line3 OPT Out 2	Time Stamp Reset	NAND 0 In 1	NAND 0 In 2	NAND 1 In 1	NAND 1 In 2	Pulse Generator 0
LOW	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
HIGH	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Line4 TTL In	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Line7 CC1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
NAND 0 Out	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
NAND 1 Out	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
Pulse Generator 0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
User Output 0	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
User Output 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Software Trigger	✓	✓	✓	✓			✓					
Action 1	✓	✓	✓	✓								✓
Action 2	✓	✓	✓	✓								✓
FVAL					✓	✓	✓	✓	✓	✓	✓	✓
LVAL					✓		✓	✓	✓	✓	✓	✓
Exposure Active					✓	✓	✓	✓	✓	✓	✓	✓
Frame Trigger Wait					✓	✓	✓	✓	✓	✓	✓	✓
Frame Active					✓	✓	✓	✓	✓	✓	✓	✓
Acquisition Trigger Wait					✓	✓	✓	✓	✓	✓	✓	✓
	Trigger Source				Line Source							Pulse Generator Clear Source
	Use											

	Indicates default values for each selector. "Configure Exposure and External Trigger Settings" shows the default values for Frame Start.
✓	Supported
	(Empty) Not Supported

Camera Output Format (Tap Geometry)

This camera 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 Mode "Off"	Video Process Bypass Mode "On"
1X1 - 1Y*	Base	bit: 8/10	bit : 8/10/12
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
1X8 - 1Y	Full	bit: 8	bit: 8
1X8 - 1Y	80 bit	bit: 10	bit: 10

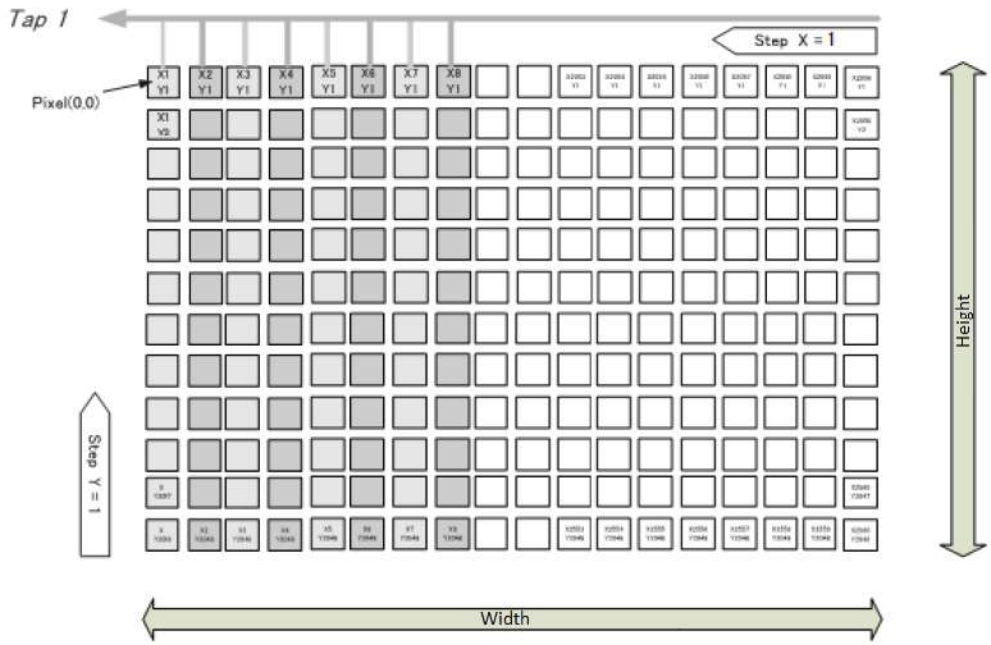
Note: *When the pixel format is RGB8, RGB10, or RGB12, the output format can only be configured when Tap Geometry is 1X1-1Y. Tap Geometry (1X1-1Y) cannot be used with pixel formats other than RGB8, RGB10, and RGB12.

1X1-1Y

1X1-1Y is a 1-tap output format as defined in GenICam tap geometry.

Notes:

- Width: 1936 pixels, 1936 pixels x 1 Taps
- Height: 1216 pixels

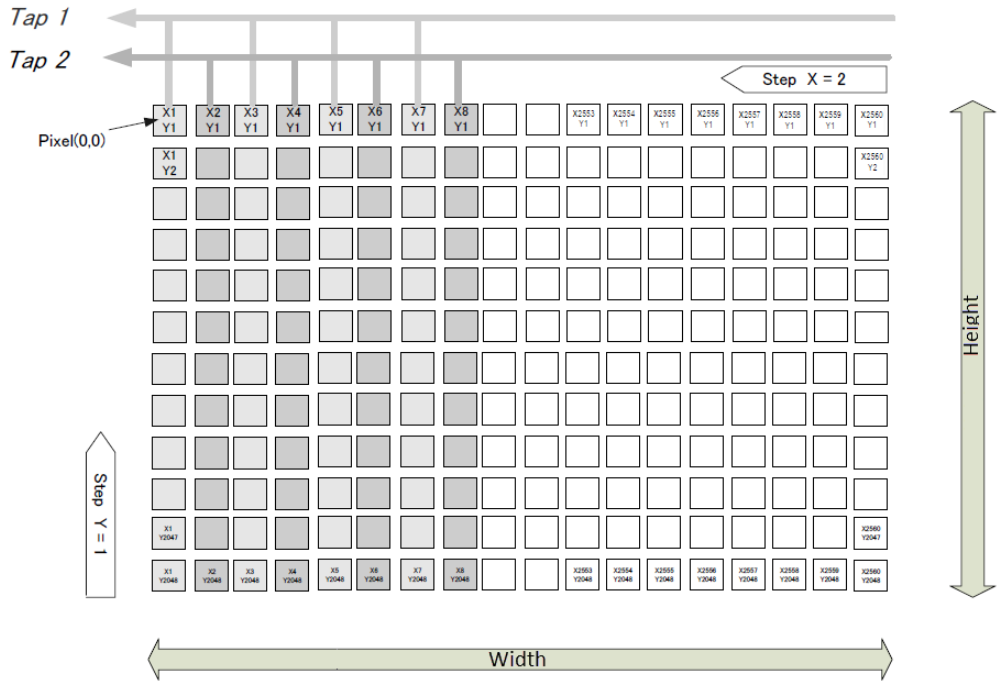


1X2–1Y

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

Notes:

- Width: 1936 pixels, 968 pixels x 2 Taps
- Height: 1216 pixels

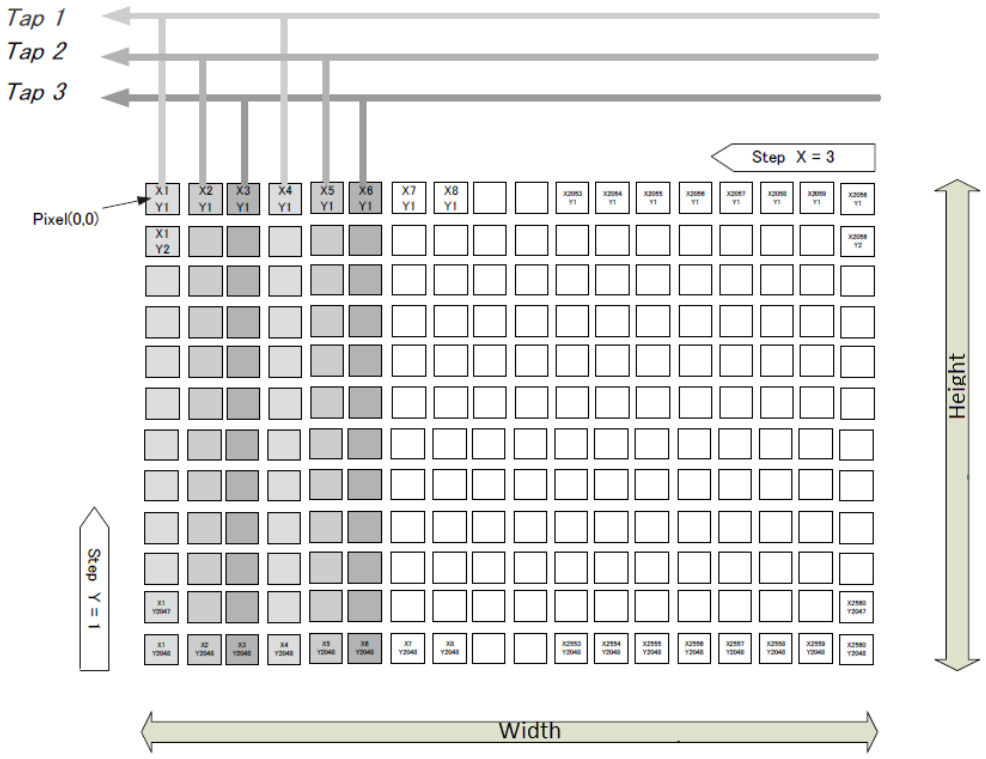


1X3-1Y

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

Notes:

- Width: 1932 pixels, 644 pixels x 3 Taps
- Height: 1216 pixels

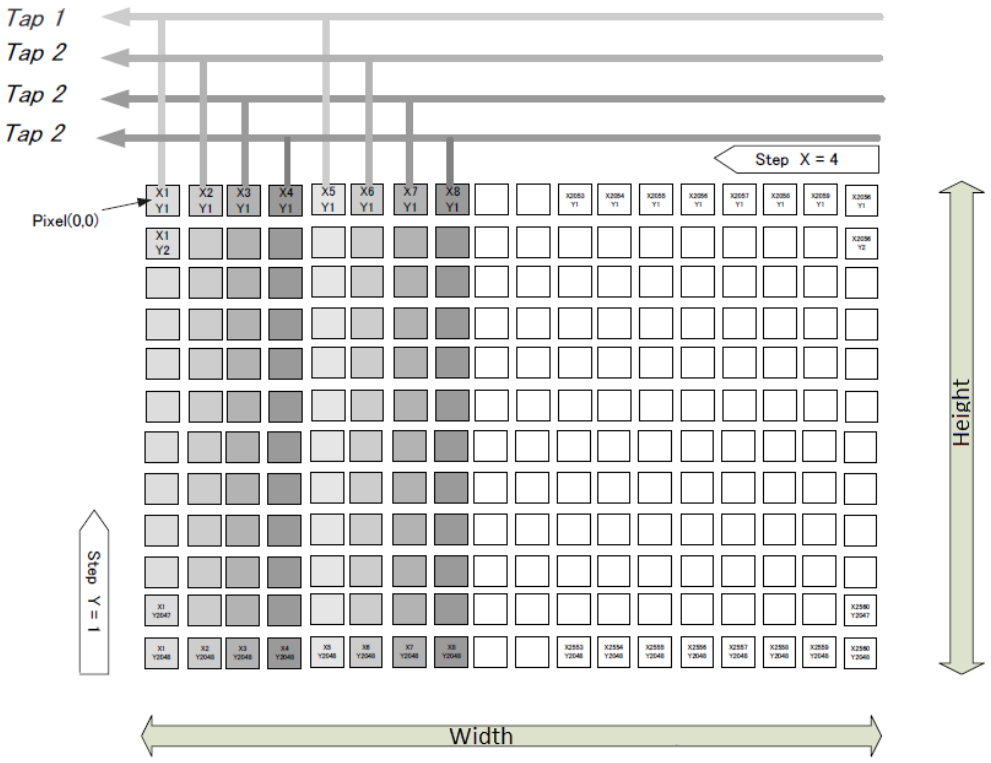


1X4–1Y

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

Notes:

- Width: 1936 pixels, 484 pixels x 4 Taps
- Height: 1216 pixels

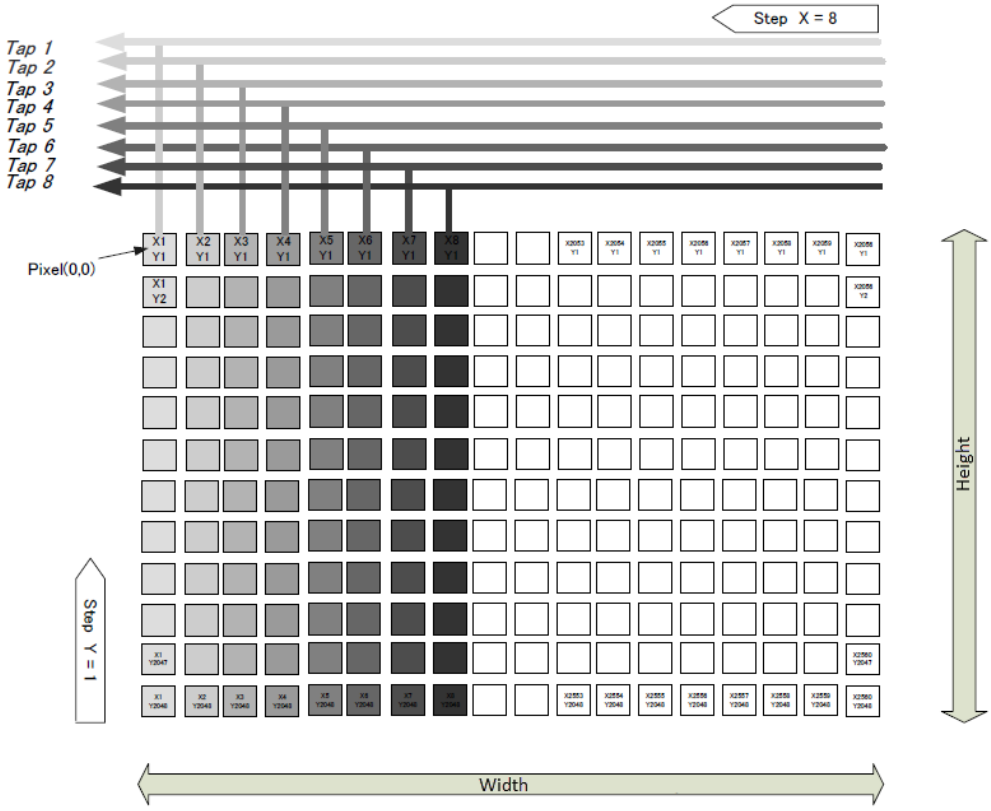


1X8–1Y (CL)

1X8-1Y (CL) is a 8-tap output format as defined in GenICam tap geometry

Notes:

- Width: 1936 pixels, 242 pixels x 8 Taps
- Height: 1216 pixels



Cable Length Reference

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

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

CL Pixel Clock MHz	CL Cable Length
37.125	10 m
74.25	7 m
84.85	3 m

Acquisition Control (Image Acquisition Controls)

Related Setting Items: AcquisitionControl

Perform operations and configure settings related to image capture in Acquisition Control. On this camera, 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.

Notes:

- The shortest frame period varies depending on the ROI and Pixel Format 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

Note: The Frame Rate Calculator, which calculates the maximum frame rate or trigger rate, is available for download from the product page on the JAI website (www.jai.com).

About the H_Period

H_Period(ms) : The value depends on TapGeometry, CL Pixel Clock and PixelFormat.

TapGeometry	CL Pixel Clock(MHz)	H_Period (ms)		
		8bit	10bit	12bit
1X2-1Y	37.125	26.29		
	74.25	13.15		
	84.85	12.45		
1X3-1Y	37.125	19.43	N/A	
	74.25	8.8		
	84.85	7.74		
1X4-1Y	37.125	13.26		
	74.25	6.63		
	84.85	6.23		

TapGeometry	CL Pixel Clock(MHz)	H_Period (ms)		
		8bit	10bit	12bit
1X8-1Y	37.125	6.74	6.74	N/A
	74.25	4.85	6.23	N/A
	84.85	4.81	6.23	N/A

Continuous Mode (Exposure Mode = Off)

Calculate the maximum frame rate using the following formula.

Maximum frame rate = 1000000 ÷ (H_Period × (Height + 40))

Exposure Mode = Timed, Trigger Overlap = Off

Calculate the maximum frame rate using the following formula.

Maximum frame rate = 1000000 ÷ (H_Period × (Height + 40) + ExposureTime)

Exposure Mode = Timed, Trigger Overlap = Readout

Calculate FR_Cont and MaxOverlapTime_TrOlrd using the following formulas.

FR_Cont = 1 ÷ (H_Period × (Height+40))

MaxOverlapTime_TrOlrd = (1 ÷ FR_Cont)-(14 × H_Period)

The formula for calculating the maximum frame rate differs depending on the values of ExposureTime and MaxOverlapTime_TrOlrd.

- Case.1 : (ExopureTime < MaxOvelapTime_TrOlrd)

  Maximum frame rate = 1000000 ÷ (H_Period × (Height + 40))

- Case.2 : (ExposureTime >= MaxOverlapTime_TrOlrd)

  Maximum frame rate = 1000000 ÷ (H_Period × (Height+40) + H_Period × ROUNDUP ((ExposureTime - MaxOverlapTime_TrOlrd) ÷ H_Period, 0))

Exposure Mode

Related Setting Items: AcquisitionControl

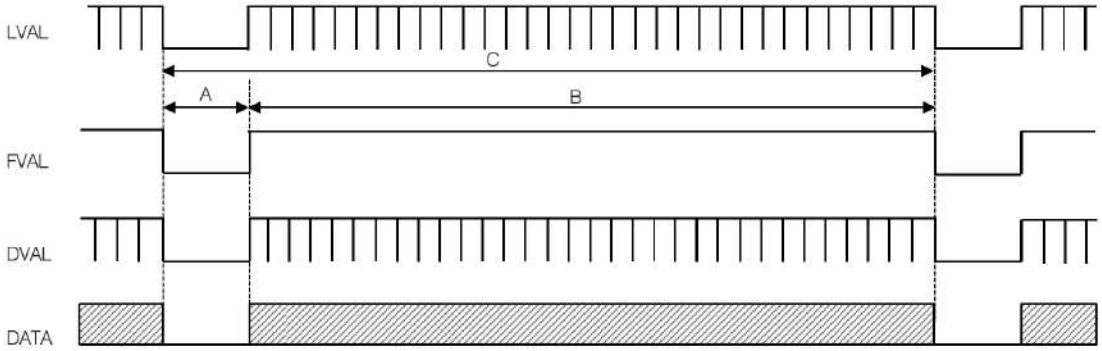
The following exposure modes are available on the camera.

Exposure Mode	Description
Off	Exposure control is not performed (free-running operation).
Timed	Mode in which exposure time is pre-set by the user. Images can be captured with the trigger off (free-running) or with trigger on (EPS).
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.

Note: The settings for exposure control and triggers are related to each other. Be sure to configure the settings described in "Configure Exposure and External Trigger Settings".

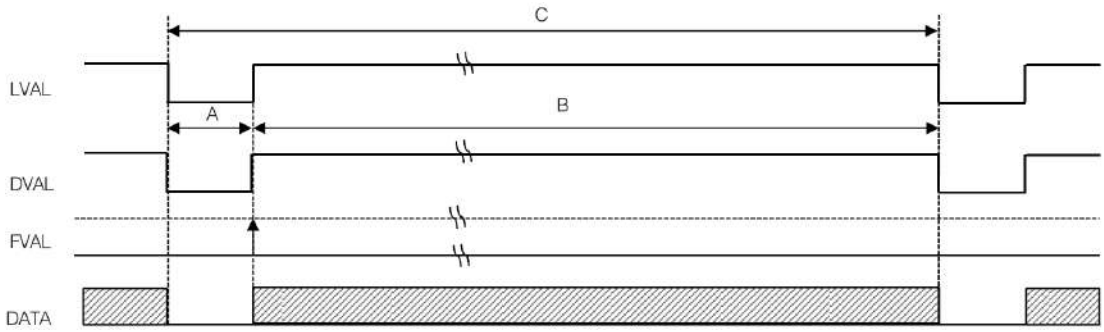
Image Output Timing

Vertical Timing



Tap Geometry	CL PixelClock [MHz]	H Frequency (KHz)	FVAL Blanking Line [A]	FVAL Valid Line [B]	Total FrameLine [C]	Total Frame Period (msec)	Frame Rate (Hz)
Vertical ROI	ALL	↓	40	Height	Height+40	(Height +40) / H Freq	H Freq*1000 / Height+40
1X2 - 1Y (Full)	37.125	38.038	40	1216	1256	33.020	30.28
	74.25	76.076	40	1216	1256	16.510	60.57
	84.85	80.357	40	1216	1256	15.630	63.98
1X3 - 1Y (Full)	37.125	51.491	40	1216	1256	24.393	41
	74.25	113.706	40	1216	1256	11.046	90.53
	84.85	129.355	40	1216	1256	9.710	102.99
1X4 - 1Y (Full)	37.125	75.457	40	1216	1256	16.645	60.08
	74.25	150.915	40	1216	1256	8.323	120.15
	84.85	160.714	40	1216	1256	7.815	127.96
1X8 - 1Y (Full)	37.125	148.5	40	1216	1256	8.458	118.23
	74.25_8	206.25	40	1216	1256	6.090	164.21
	74.25_10	160.714	40	1216	1256	7.815	127.96
	84.85_8	207.983	40	1216	1256	6.039	165.59
	84.85_10	160.714	40	1216	1256	7.815	127.96

Horizontal Timing



Tap Geometry	CL PixelClock [MHz]	Line Frequency (KHz)	LineValid clock [B	Total Line clock [C]	Total Line Period (usec) [C]	Line Rate (KHz) [C]
Horizontal ROI	ALL	(1936/ Tap)-Width+8	Width	↓	↓	↓
1X2 - 1Y (Full)	37.125	8	968	976	26.290	38.038
	74.25	8	968	976	13.145	76.076
	84.85	8	968	1056	12.444	80.357
1X3 - 1Y (Full)	37.125	76	645	721	19.421	51.491
	74.25	8	645	653	8.795	113.706
	84.85	11	645	656	7.731	129.355
1X4 - 1Y (Full)	37.125	8	484	492	13.253	75.457
	74.25	8	484	492	6.626	150.915
	84.85	44	484	528	6.222	160.714
1X8 - 1Y (Full)	37.125	8	242	250	6.734	148.500
	74.25_8	118	242	360	4.848	206.250
	74.25_10	220	242	462	6.222	160.714
	84.85_8	166	242	408	4.808	207.983
	84.85_10	286	242	528	6.222	160.714

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.

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

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.

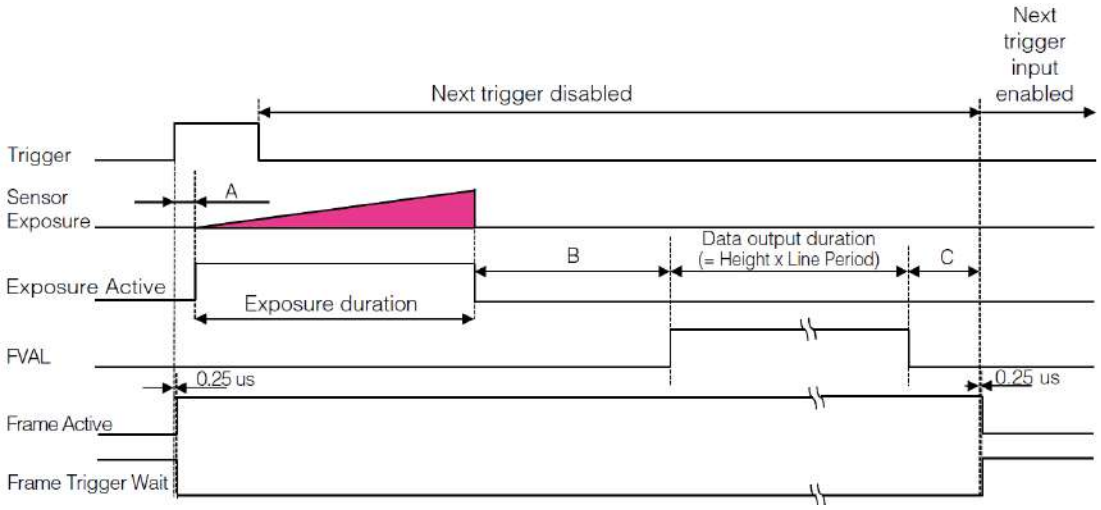
When Exposure Mode is Timed

Trigger Overlap: OFF

The below table indicates the shortest trigger periods for the shortest exposure times. By adding the value of the exposure time you are using to the values in the table, you can determine the shortest trigger periods under your own usage environment.

Example: When Trigger Source is set to Line7 CC1

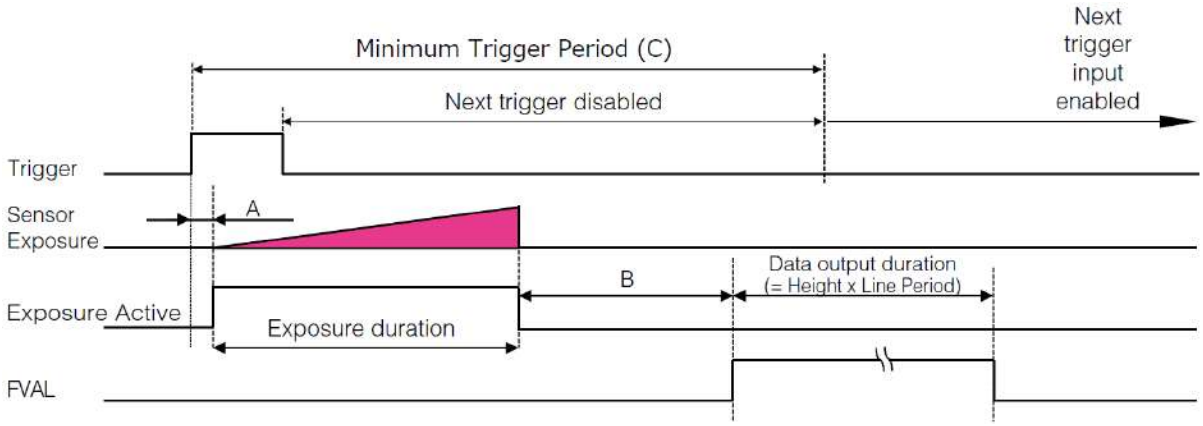
Scanning Range	Shortest period of trigger [µs], exposure condition: minimum exposure time			
	1X2-1Y	1X3-1Y	1X4-1Y	1X8-1Y
	84.85 MHz (8bit)	84.85 MHz (8bit)	84.85 MHz (8bit)	84.85 MHz (8bit)
Full	15670	9736	7836	6046
ROI 2/3 (Height=810)	10618	6597	5310	4094
ROI 1/2 (Height=608)	8104	5035	4053	3122
ROI 1/4 (Height=304)	4321	2685	2161	1661
ROI 1/8 (Height=152)	2429	1510	1216	930
Binning Vertical (968 × 608) (Mono model only)	15670	9736	7836	6046



Tap Geometry	CL Pixel Clock (MHz)	Period From Trigger start edge to Exposure start [A] (usec)	Period from Exposure endTo FVAL start [B] (usec)	Period FVAL end to next trigger start [C] (usec)	Max Exposure [msec]	Min Exposure [usec]
Horizontal ROI	ALL	↓	↓	↓	Framerate - 13/H Freq	3/H Freq + 22×0.013 + 13.7
1X2 - 1Y (Full)	37.125	80	884	≧ 89	7999.658	92.7
	74.25	40	452	≧ 37	7999.829	53.7
	84.85	38	428	≧ 34	7999.838	51.7
1X8 - 1Y (Full)	37.125	60	654	≧ 65	7999.748	72.7
	74.25	27	300	≧ 11	7999.886	40.7
	84.85	24	263	≧ 24	7999.900	37.7
1X4 - 1Y (Full)	37.125	41	454	≧ 37	7999.828	53.7
	74.25	21	228	≧ 18	7999.914	33.7
	84.85	20	214	≧ 17	7999.919	32.7
1X3 - 1Y (Full)	37.125	22	232	≧ 17	7999.912	34.7
	74.25_8	16	168	≧ 13	7999.937	28.7
	74.25_10	20	214	≧ 19	7999.919	32.7
	84.85_8	15	167	≧ 2.1	7999.937	28.7
	84.85_10	20	214	≧ 19	7999.919	32.7

Smallest input pulse width of trigger signal: 10 μS or more

Trigger Overlap: Readout



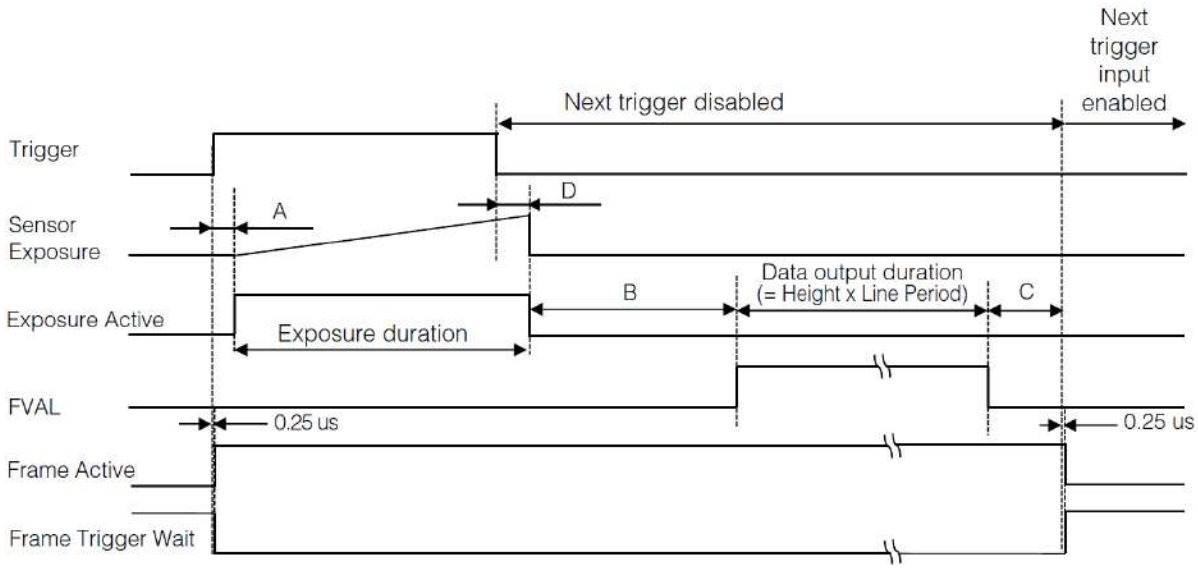
Tap Geometry	CL Pixel Clock (MHz)	Period From Trigger start edge to Exposure start [A](µsec)	Min Exposure (µsec)	Period from Exposure end to FVAL start [B] (µsec)	Minimum Trigger Period [C](µsec)
1X2 - 1Y (Full)	37.125	80	79	884	33021
	74.25	40	40	452	16511
	84.85	38	38	428	15630
1X3 - 1Y (Full)	37.125	60	59	654	24395
	74.25	27	27	300	11047
	84.85	24	24	263	9711
1X4 - 1Y (Full)	37.125	41	40	454	16646
	74.25	21	20	228	8323
	84.85	20	19	214	7815
1X8 - 1Y (Full)	37.125	22	21	232	8457
	74.25_8	16	15	168	7815
	74.25_10	20	19	214	6094
	84.85_8	15	15	167	6038
	84.85_10	20	19	214	7814

When Exposure Mode is Trigger Width

Trigger Overlap:Off

The below table indicates the shortest trigger periods for the shortest exposure times. By adding the value of the exposure time you are using to the values in the table, you can determine the shortest trigger periods under your own usage environment.

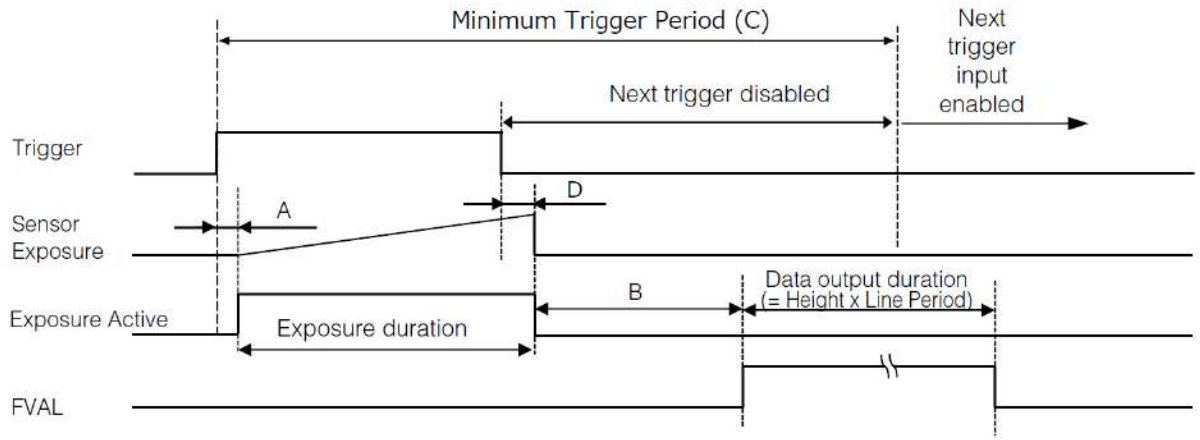
Scanning range	Shortest period of trigger [µs], exposure condition: minimum exposure time			
	1X2-1Y	1X3-1Y	1X4-1Y	1X8-1Y
	84.85 MHz (8bit)	84.85 MHz (8bit)	84.85 MHz (8bit)	84.85 MHz (8bit)
Full	15670	9736	7836	6046
ROI 2/3 (Height=810)	10618	6597	5310	4094
ROI 1/2 (Height=608)	8104	5035	4053	3122
ROI 1/4 (Height=304)	4321	2685	2161	1661
ROI 1/8 (Height=152)	2429	1510	1216	930
Binning Full (968 × 608) (Mono model only)	15670	9736	7836	6046



Tap Geometry	CL Pixel Clock (MHz)	Period From Trigger start edge to Exposure start [A] (usec)	Period from Exposure endTo FVAL start [B] (usec)	Period FVAL end to next trigger start [C] (usec)	Period From Trigger end edge to Exposure end [D] (usec)	Min Exposure [usec]
Horizontal ROI	ALL	↓	↓	↓	↓	3/H Freq + 22×0.013 + 13.7
1X2 - 1Y (Full)	37.125	80	885	≧ 88	80	92.7
	74.25	41	452	≧ 36	41	53.7
	84.85	39	428	≧ 33	39	51.7
1X3 - 1Y (Full)	37.125	60	654	≧ 64	60	72.7
	74.25	27	300	≧ 9.3	27.4	40.7
	84.85	24	264	≧ 23	25	37.7
1X4 - 1Y (Full)	37.125	41	452	≧ 36	41	53.7
	74.25	20	227	≧ 17	20.8	33.7
	84.85	19	214	≧ 16	19.6	32.7
1X8 - 1Y (Full)	37.125	21	231	≧ 17	21.2	34.7
	74.25_8	16	169	≧ 12	16	28.7
	74.25_10	20	215	≧ 18	20	32.7
	84.85_8	16	168	≧ 1.2	16	28.7
	84.85_10	20	214	≧ 19	20	32.7

Smallest input pulse width of trigger signal: minimum exposure time of each mode

Trigger Overlap: Readout



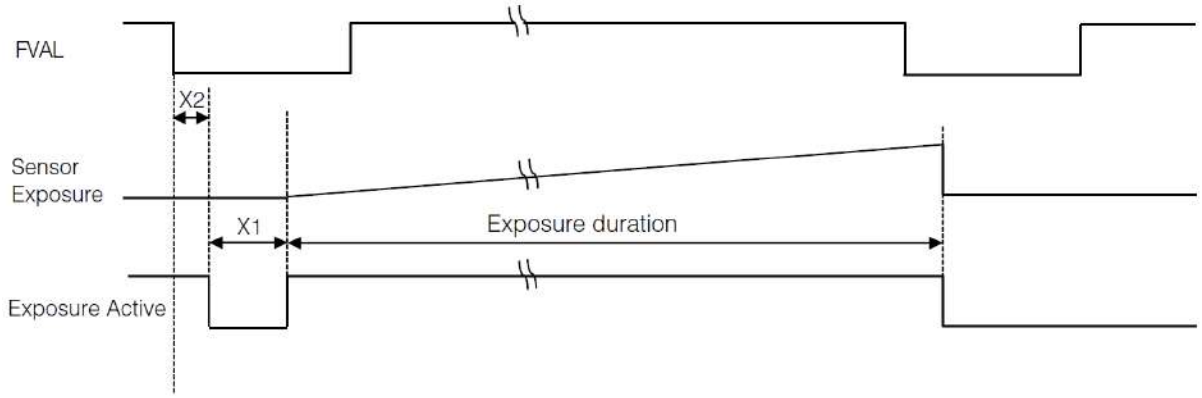
Tap Geometry	CL Pixel Clock (MHz)	Period From Trigger start edge to Exposure start [A](µsec)	Min Exposure (µsec)	Period from Exposure end to FVAL start [B] (µsec)	Minimum Trigger Period [C] (µsec)	Period from Trigger end to Exposure end[D](µsec)
1X2 - 1Y (Full)	37.125	80	26.2	885	33021	80
	74.25	41	13.12	452	16511	41
	84.85	39	12.5	428	15630	39
1X3 - 1Y (Full)	37.125	60	19.5	654	24395	60
	74.25	27	8.82	300	11047	27.4
	84.85	24	7.75	264	9711	25
1X4 - 1Y (Full)	37.125	41	13.28	452	16646	41
	74.25	20	6.64	227	8323	20.8
	84.85	19	6.24	214	7815	19.6
1X8 - 1Y (Full)	37.125	21	6.72	231	8457	21.2
	74.25_8	16	4.84	169	6089	16
	74.25_10	20	6.24	215	7814	20
	84.85_8	16	4.84	168	6040	16
	84.85_10	20	6.24	214	7814	20

During Normal Continuous Operation

When using an application that does not require external triggers, the following applies.

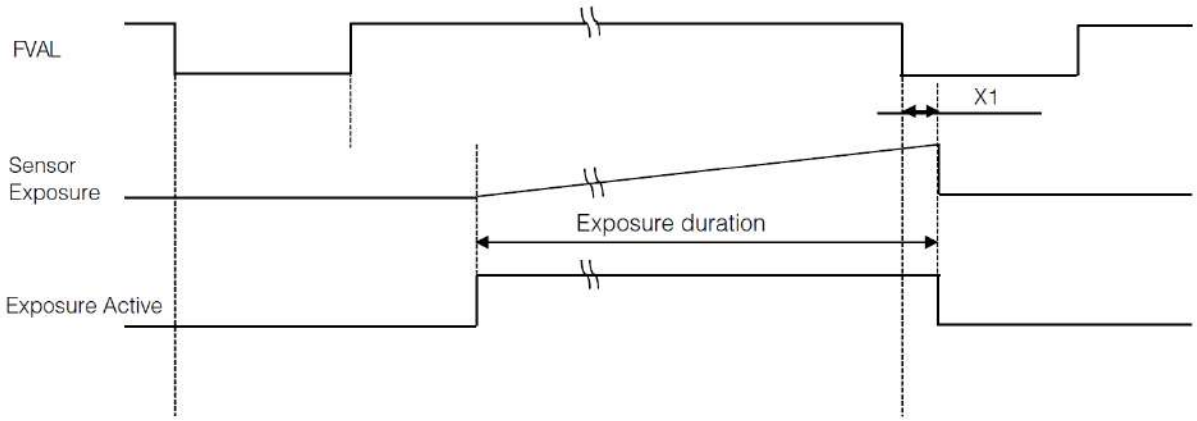
Scanning range	Shortest period [ms]			
	1X2-1Y	1X3-1Y	1X4-1Y	1X8-1Y
	84.85 MHz (8bit)	84.85 MHz (8bit)	84.85 MHz (8bit)	84.85 MHz (8bit)
Full	15.63	9.710	7.815	6.039
ROI 2/3 (Height=810)	10.578	6.571	5.289	4.087
ROI 1/2 (Height=608)	8.064	5.009	4.032	3.116
ROI 1/4 (Height=304)	4.281	2.659	2.140	1.654
ROI 1/8 (Height=152)	2.389	1.484	1.195	0.923
Binning Full (968 × 608) (Mono Only)	15.630	9.710	7.815	6.039

When Exposure Mode is set to Off



Tap Geometry	CL Pixel Clock (MHz)	Exposure stop period [X1] (usec)	Period From FVAL end to Exposure end [min] [X2] (usec)
Horizontal ROI	ALL	13/H Freq	↓
1X2 - 1Y (Full)	37.125	342	≧ 167
	74.25	171	≧ 75
	84.85	162	≧ 69
1X3 - 1Y (Full)	37.125	252	≧ 121
	74.25	114	≧ 35
	84.85	100	≧ 45
1X4 - 1Y (Full)	37.125	172	≧ 80
	74.25	86	≧ 36
	84.85	80	≧ 37
1X8 - 1Y (Full)	37.125	88	≧ 37
	74.25_8	63	≧ 26
	74.25_10	81	≧ 36
	84.85_8	63	≧ 8.9
	84.85_10	81	≧ 36

When Exposure Mode is set to Timed



Tap Geometry	CL Pixel Clock (MHz)	Period From FVAL end to Exposure end [X1] (usec)	Max Exposure [msec]	Min Exposure [usec]
Horizontal ROI	ALL	↓	Framerate - 13/H Freq	3H + 22 x 0.013 + 13.7
1X2 - 1Y (Full)	37.125	143 ~ 169	7999.658	92.7
	74.25	64 ~ 77	7999.829	53.7
	84.85	59 ~ 72	7999.838	51.7
1X3 - 1Y (Full)	37.125	104 ~ 124	7999.748	72.7
	74.25	29 ~ 39	7999.886	40.7
	84.85	40 ~ 48	7999.900	37.7
1X4 - 1Y (Full)	37.125	64 ~ 78	7999.828	53.7
	74.25	32 ~ 40	7999.914	33.7
	84.85	30 ~ 37	7999.919	32.7
1X8 - 1Y (Full)	37.125	32 ~ 40	7999.912	34.7
	74.25_8	24 ~ 29	7999.937	28.7
	74.25_10	32 ~ 39	7999.919	32.7
	84.85_8	7.3 ~ 12	7999.937	28.7
	84.85_10	33 ~ 39	7999.919	32.7

Gain Control

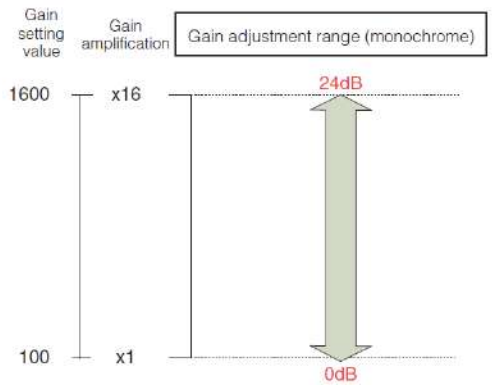
> **Related Setting Items:** AnalogControl

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 color model.

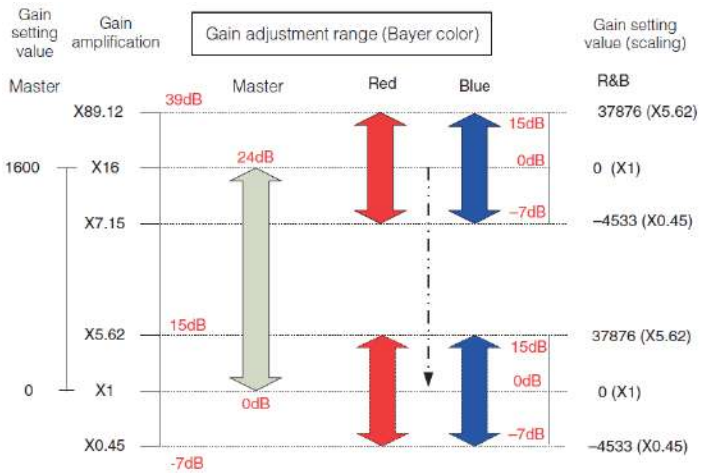
> **Note:** For details on how to configure the settings, see "Adjust the Gain".

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



Color



LUT (Lookup Table)

Related Setting Items: LUT Control

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 256 setting points (indexes).

To use the LUT function

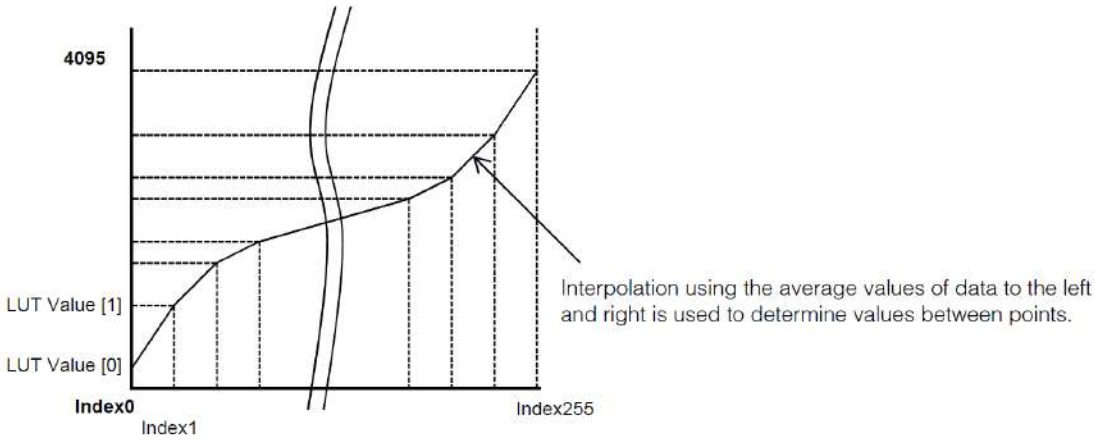
Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
JAI LUT Mode	LUT	Use LUT.
LUT Selector	Red, Green, Blue (Color model only)	Select the LUT channel to control.
LUT Index	0 ~ 255	Select the LUT index to configure. Indexes represent the setting points, and values from the lowest point (Index 0) to the highest point (Index 15) are represented. On the monochrome model, for example, Index 0 is full black and Index 255 is full white.
LUT Value	0 ~ 4095	Set the LUT output value for the selected index.

Note: For the color model, the same characteristic curve is configured for R, G, and B.

LUT values

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

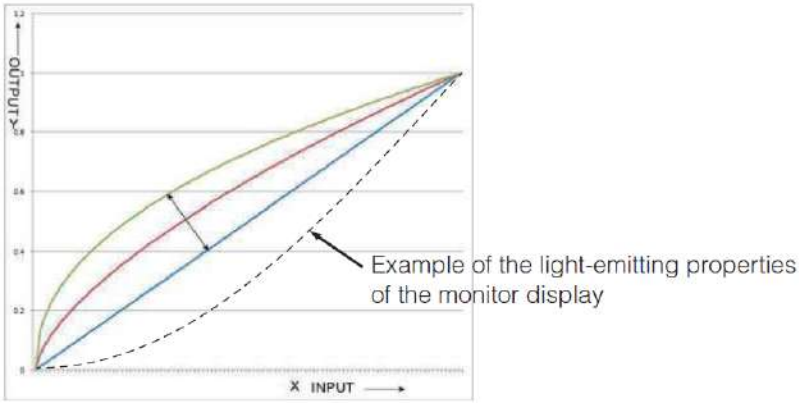


Gamma Function

> **Note:** AnalogControl

The gamma function corrects the output signals from the camera beforehand (reverse correction), taking into consideration the light-emitting properties of the monitor display. As the light-emitting properties of the monitor are not linear, the entire image may be darker or the gradation in the dark areas may be less noticeable when camera outputs are displayed without processing.

The gamma function can be used to correct the camera signals with an opposite-direction curve and produce a display that is close to linear.



To use the gamma function

Configure the settings as follows.

Item	Setting Value / Selectable Range	Description
Gamma	0.45, 0.60, 1.0 (Off)	Select the gamma correction value.
JAI LUT Mode	Gamma	Use gamma.

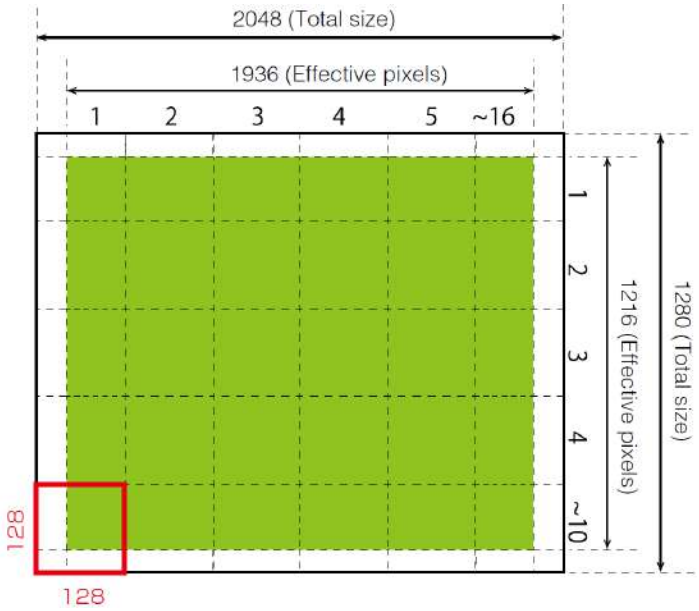
> **Note:** You can use the LUT function to configure a curve with more detailed points. For details, see “LUT (Lookup Table)”.

Shading Correction

Related Setting Items: JAICustomControl

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).

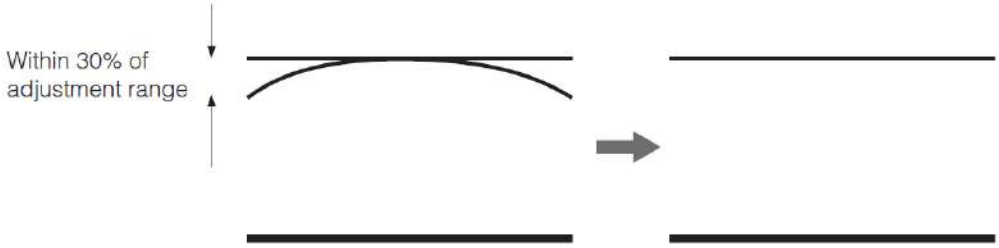
The size of the correction block is 16 (H) × 10 (V) blocks and calculation errors in the correction data are minimized due to the small interpolation block. Each block is 128 × 128 pixels. The total size of the blocks is 2048 (H) × 1216 (V), but the actual number of effective pixels for the camera is 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

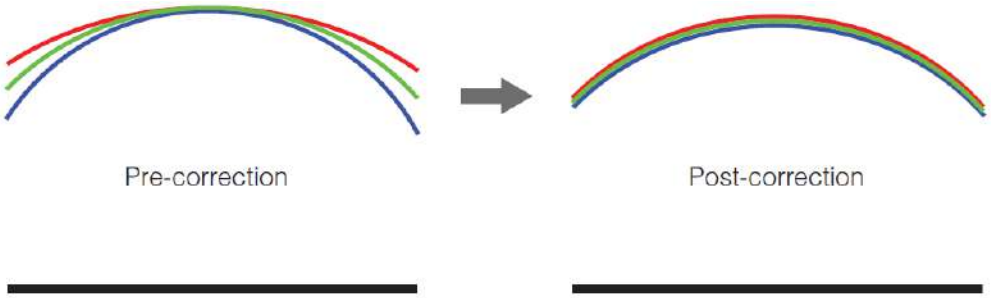
Flat Shading

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 (Color model only)

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



Cautions:
The PerformShadingCalibration command cannot be executed 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).
- If the ROI (Regional Scanning Function) is configured.
- If the Binning Function is enabled (mono model only).

To Use the Shading Correction Function

Configure the settings as follows.

Item	Setting Value	Description
Shading Correction Mode	Monochrome: Flat Shading (Fixed) Color: Flat Shading, Color Shading	Select the shading correction mode.
Shading Mode	User 1, User 2, User 3	Select the user area to which to save the shading correction value.

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

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

Binning Function

Related Setting Items: ImageFormatControl

Note: This function is supported only on the monochrome model.

The binning function 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.

This camera performs vertical binning on the sensor, reducing the total number of lines that must be read out, thereby resulting in a faster frame rate.

Caution: Binning function cannot be used in video process bypass mode.

ROI (Regional Scanning Function)

Related Setting Items: ImageFormatControl

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

ROI Settings

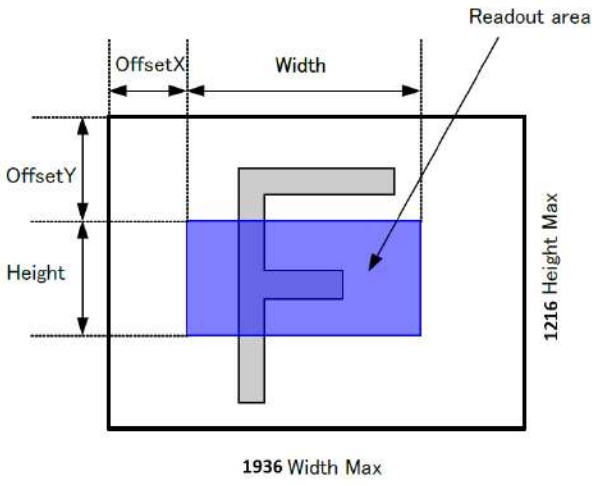
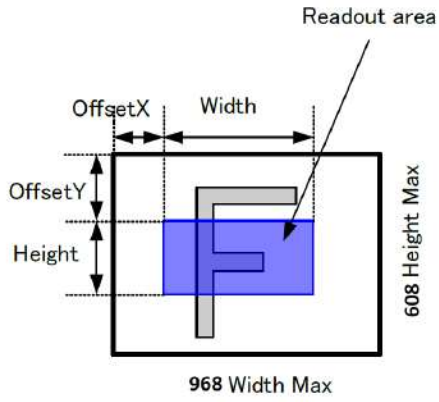
Specify the area to scan by specifying width, height, and horizontal/vertical offset values under ImageFormatControl .

Note: For details on the frame rates for common ROI sizes, see "Frame Rate Reference".

The minimum area is as follows.

	Minimum width value (pixels)	Minimum height value (pixels)
GO-2400M-PMCL	Binning Off: 96 Binning On: 48	2
GO-2400C-PMCL	96	2

Note: The minimum value for the monochrome model varies depending on the Binning setting.

Setting Example: 1	**Setting Example: 2* (Mono model only)**
Binning Horizontal = 1 Binning Vertical = 1	Binning Horizontal = 2 Binning Vertical = 2
	

Video Send Mode

Switch the video send mode to configure and operate Sequence Trigger and other JAI Custom Control functions.

Select the video send mode in **Video Send Mode Selector**.

Video Send Mode Selector Option	Description
Normal Mode	Normal camera operation.
Trigger Sequence Mode	Sequence Trigger mode. Sequence Trigger mode that executes presets in a predefined order based on **Sequence Roi Frame Count** and **Sequence Roi Next Index**. Starts at Index #1.
Command Sequence Mode	Sequence Command mode. Sequence Trigger mode that executes the preset listed in **Command Sequence Index** each time a trigger is received. Can jump to new preset by sending a new index value to Command Sequence Index.

Sequence Mode

> **Related Setting Items:** JAICustomControl

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.

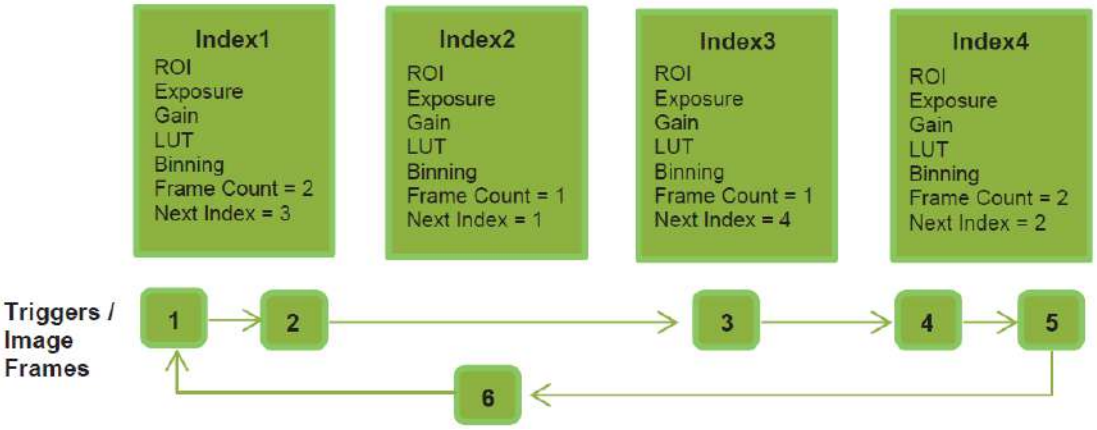
Reset Sequencer Reset causes the index selector to be reset to Index 1. Thus, the sequencer pattern will start over at the next trigger.

In Trigger Sequence mode, patterns always begin with Index1. Subsequent triggers follow the user-defined values in Sequence Index Frame Count and Sequence ROI Next Index.

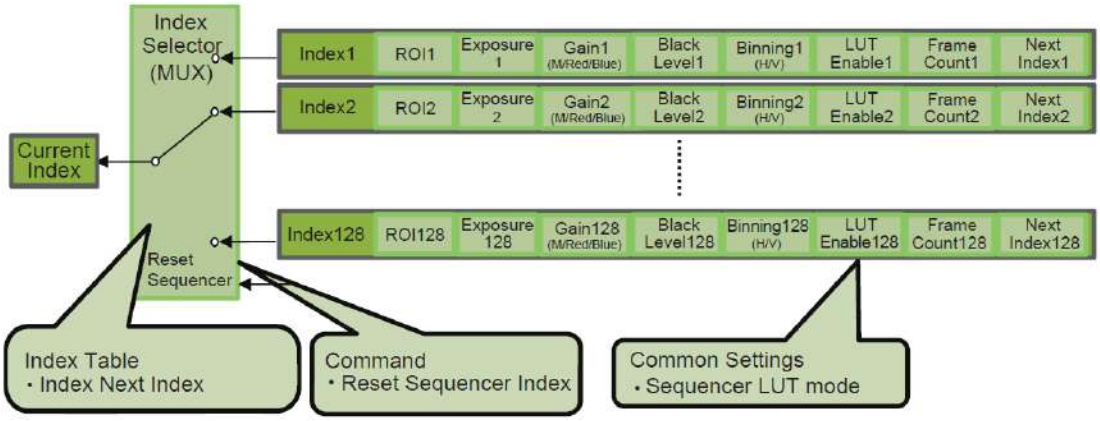
Assigning a Next Index value of “1” to an index creates a loop back to the start of the sequencer pattern.

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.

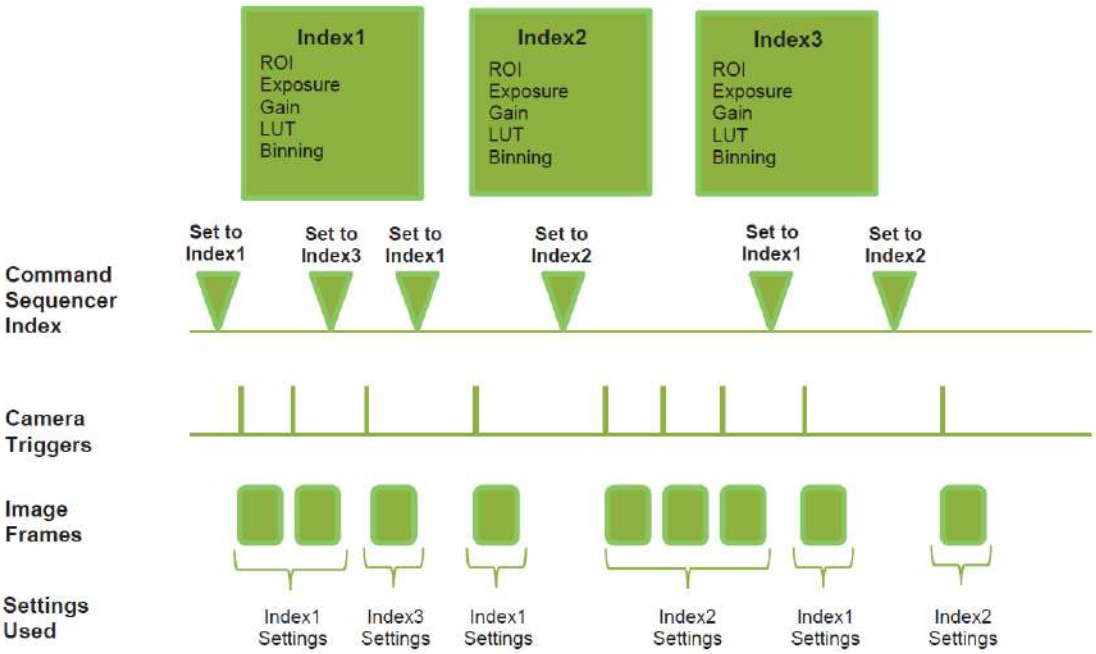
Changing the value of Command Sequencer Index to one of the other predefined indexes causes that index to be executed in response to subsequent triggers. This mode of operation enables users to develop applications that continually send new values to Command Sequencer Index in response to external factors 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.

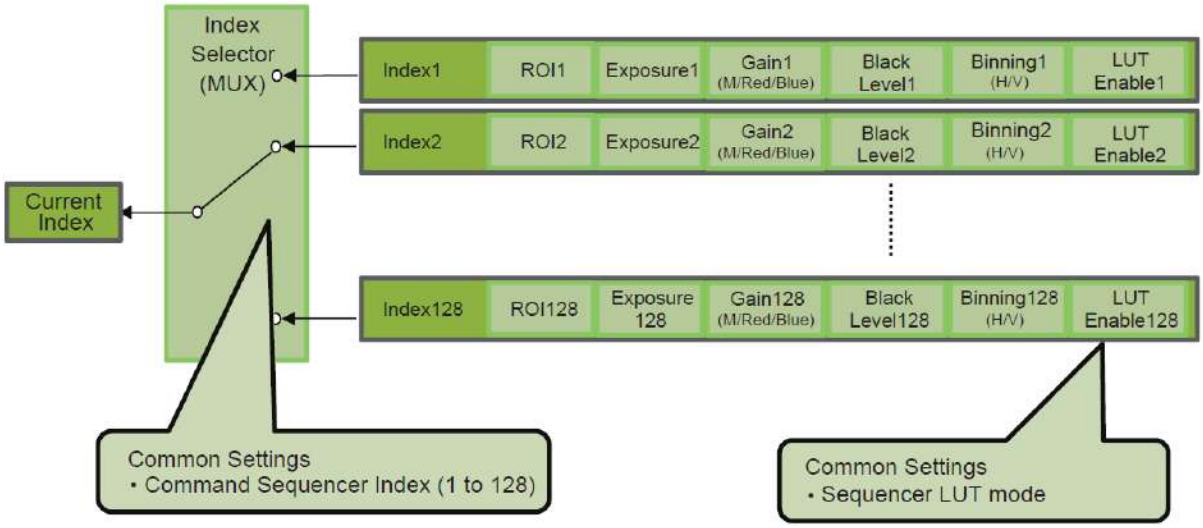
Sequencer Index Frame Count, Sequencer ROI Next Index , and Reset Sequencer Index are not used in Command Sequencer mode and entered values are ignored.

Command Sequencer Example

User-defined Indexes (up to 128)

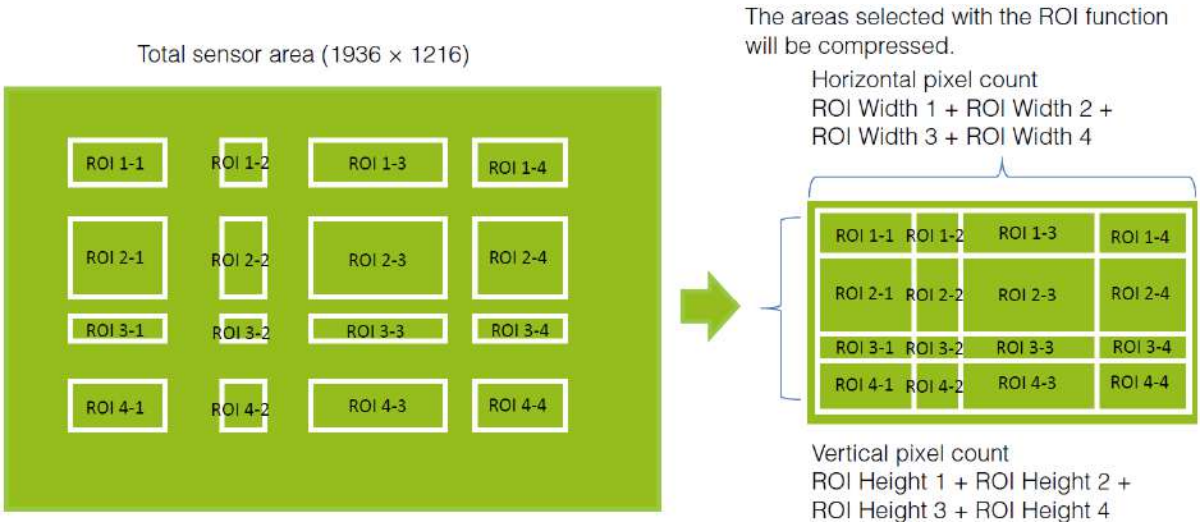


Index Structure for Command Sequencer



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.



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 Width1 < ROI Offset H2
- ROI Offset H2 + ROI Width2 < ROI Offset H3
- ROI Offset H3 + ROI Width3 < ROI Offset H4
- ROI Offset H4 + ROI Width4 < 1936

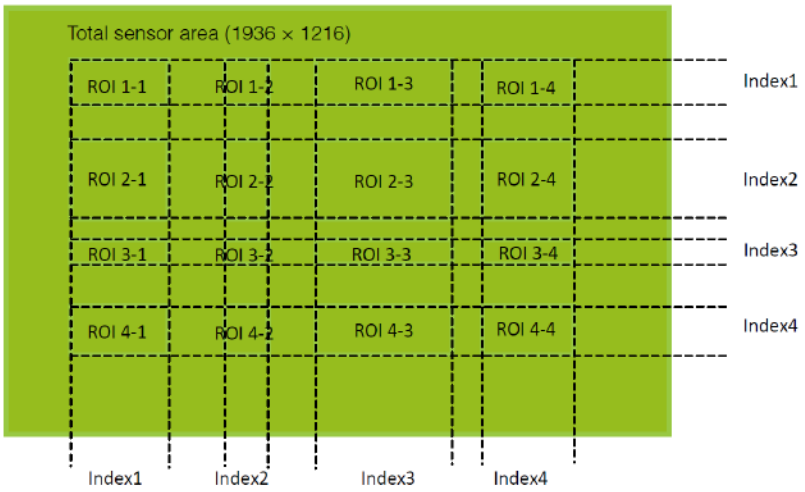
Vertical ROI conditions

- ROI Offset V1 + ROI Height1 < ROI Offset V2
- ROI Offset V2 + ROI Height2 < ROI Offset V3
- ROI Offset V3 + ROI Height3 < ROI Offset V4
- ROI Offset V4 + ROI Height4 < 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		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 Rate ÷ (ROI Height 1 + ROI Height 2 + ROI Height 3 + ROI Height 4 +vertical invalid lines)

- Invalid vertical lines = 40 (constant)
- The value of Line Rate depends on tap geometry and Camera Link pixel clock frequency as shown in the following table.

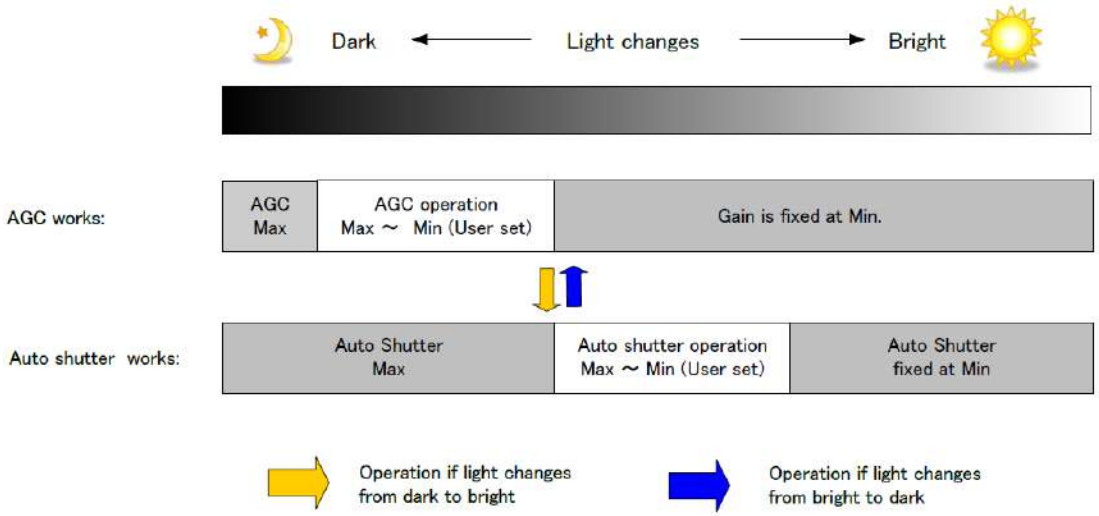
Tap Geometry	CL Pixel Clock (MHz)	Line Rate (KHz)
1X2-1Y (Full)	37.125	38.038
	74.25	76.076
	84.85	80.357
1X3-1Y (Full)	37.125	51.491
	74.25	113.706
	84.85	129.355
1X4-1Y (Full)	37.125	75.457
	74.25	150.915
	84.85	160.714
1X8-1Y (Full)	37.125	148.500
	74.25_8	206.250
	74.25_10	160.714
	84.85_8	207.983
	84.85_10	160.714

ALC (Automatic Level Control)

Related Setting Items: JAICustomControl

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 JAICustomControl .

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	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

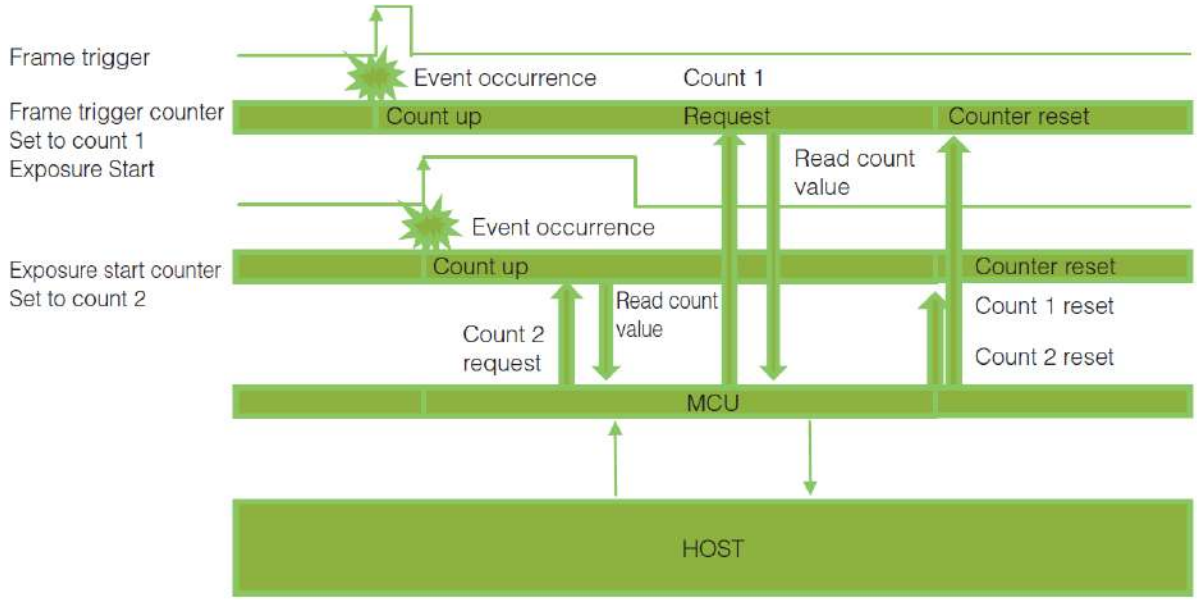
Related Setting Items: Counter and Timer Control

Note: This camera supports the Counter function 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.

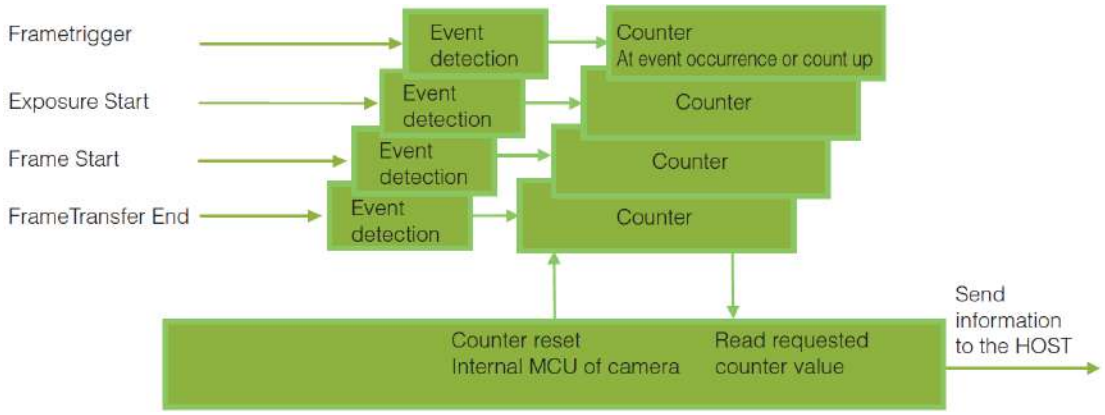
Counting is performed at frame trigger, frame start, exposure start, and exposure transfer end, and by comparing these values, you can determine the internal camera state at which missed triggers will occur.

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 ~ 2	Counter 0 ~ 2	Select the counter.
- Counter 0 ~ 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 ~ 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

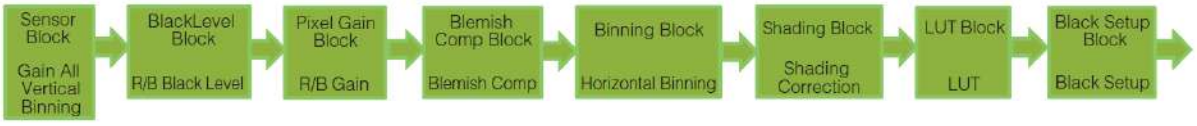
Related Setting Items: JAICustomControl

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.

Caution: The Binning function cannot be used in video process bypass mode.

To Enable Video Process Bypass Mode

Item	Setting Value / Selectable Range	Description
Video Process Bypass Mode	On	Enables Video Process Bypass Mode.

Setting List (Feature Properties)

DeviceControl

Display/configure information related to the device.

DeviceControl Item	Setting Range	Default	Description
Device Vendor Name	-	“JAI Ltd., Japan”	Display the manufacturer name.
Device Model Name	-	-	Display the model name.
Device Manufacturer Info	-	"See the possibilities"	Display manufacturer information.
Device Version	-	-	Display the software version.
Device Firmware Version	-	-	Display the firmware version.
Device Fpga Version	-	FPGA Ver. No.	Display the FPGA version.
Device SFNC Version Major	-	SFNCMajorVersion	Display the SFNC version.
Device SFNC Version Minor	-	SFNCMinorVersion	Display the SFNC version.
Device SFNC Version SubMinor	-	SFNCSubMinorVersion	Display the SFNC version.
XML Major Version	-	XMLMajorVersion	Display the XML version.
XML Minor Version	-	XMLMinorVersion	Display the XML version.
XML Sub Minor Version	-	XMLSubMinorVersion	Display the XML version.
Device Serial Number	-	-	Display the device ID.
Device User ID		-	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.

ImageFormatControl

Configure image format settings.

<table>
<tr><th>Image Format Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>Sensor Width</td><td>1936</td><td>1936</td><td>Display the maximum image width.</td></tr>
<tr><td>Sensor Height</td><td>1216</td><td>1216</td><td>Display the maximum image height.</td></tr>
<tr><td>Sensor Digitization Taps</td><td>Ten [10 Bit]
Twelve [12 Bit]</td><td>12 Bit</td><td>Displays the digital tones output from the sensor.</td></tr>
<tr><td>Width Max</td><td>1936</td><td>1936</td><td>Display the maximum image width.</td></tr>
<tr><td>Height Max</td><td>1216</td><td>1216</td><td>Display the maximum image height.</td></tr>
<tr><td>Width

Related Topic: ROI (Regional Scanning Function)</td><td>-</td><td>96</td><td>Set the image width.

<table><tr><th>Tap Geometry</th><th>Min</th><th>Max</th><th>Step</th></tr><tr><td>1x1-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>2 (1)pixels</td></tr><tr><td>1x2-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>2 (1)pixels</td></tr><tr><td>1x3-1Y</td><td>96 (48)</td><td>1932 (966)</td><td>6 (3) pixels</td></tr><tr><td>1x4-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>4 (2) pixels</td></tr><tr><td>1x8-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>8 (4) pixels</td></tr></table>
For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
<tr><td>Height</td><td>-</td><td>1216</td><td>Set the image height.

<table><tr><th>Model</th><th>Min</th><th>Height Max</th><th>Step</th></tr><tr><td>Mono</td><td>2 (1)</td><td>1216 (608)</td><td>2 (1)pixels</td></tr><tr><td>Color</td><td>2</td><td>1216</td><td>2 pixels</td></tr></table>
For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
<tr><td>Offset X</td><td>-</td><td>0</td><td>Set the horizontal offset.

<table><tr><th>Tap Geometry</th><th>Min</th><th>Max</th><th>Step</th></tr><tr><td>1x2-1Y</td><td>0</td><td>1840 (920)</td><td>2 (1) pixels</td></tr><tr><td>1x3-1Y</td><td>0</td><td>1836 (918)</td><td>6 (3) pixels</td></tr><tr><td>1x4-1Y</td><td>0</td><td>1840 (920)</td><td>4 (2) pixels</td></tr><tr><td>1x8-1Y</td><td>0</td><td>1840 (920)</td><td>8 (4) pixels</td></tr></table>
For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
</table>

<table>
<tr><th>Image Format Control Item</th><th>Setting Range</th><th>Default</th><th>Description</th></tr>
<tr><td>Offset Y</td><td>-</td><td>0</td><td>Set the vertical offset.<table><tr><th>Model</th><th>Min</th><th>Height Max</th><th>Step</th></tr><tr><td>Mono</td><td>0</td><td>1214 (607)</td><td>2 (1)pixels</td></tr><tr><td>Color</td><td>0</td><td>1214</td><td>2 pixels</td></tr></table>For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
<tr><td>Binning Horizontal

Related Topic:
Binning Function</td><td>1: Off
2: x2</td><td>1: Off</td><td>Set the number of pixels in the horizontal direction for which to perform binning. (Mono only)</td></tr>
<tr><td>Binning Vertical</td><td>1: Off
2: x2</td><td>1: Off</td><td>Set the number of pixels in theoertical direction for which to perform binning. (Mono only)</td></tr>
<tr><td>Pixel Format</td><td>Monochrome Model
Mono8
Mono10
Mono12
Color Model
BayerRG8
BayerRG10
BayerRG12
RGB8
RGB10
RGB12</td><td>Mono8
BayerRG8</td><td>Set the pixel format. Mono12, BayerRG12 and RGB12 are available when Video Process Bypass Mode is set to On.</td></tr>
<tr><td>PixelColorFilter</td><td>Monochrome Model
None
Color Model
BayerRG</td><td>-</td><td>Display the color filter type that will be applied to the image.</td></tr>
<tr><td>Bayer Algorithm</td><td>Monochrome Model
None
Color Model
Standard Extended</td><td>-</td><td>Set the pixel interpolation method.</td></tr>
<tr><td>Test Pattern</td><td>Off
GreyHorizontalRamp
GreyVerticalRamp
GreyHorizontalRamp Moving
HorizontalColorBar*
VerticalColorBar*
MovingColorBar*

*Color model only</td><td>0: Off</td><td>Select the test image.</td></tr>
</table>

AcquisitionControl

Related Topic: Acquisition Control (Image Acquisition Controls), Exposure Mode, Trigger Control

Configure image capture settings.

Acquisition Control Item	Setting Range	Default	Description
Acquisition Frame Rate (Hz)	0.125 ~ 127.975	120.163	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	Enables/Disables 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. Line4 TTL In is available on Standard Model.
Trigger Activation	Rising Edge Falling Edge LevelHigh LevelLow	Rising Edge	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.
Trigger Option	Off	Off	Fixed to OFF on this camera.
Exposure Mode	Off Timed Trigger Width	Timed(control via exposure time)	Select the exposure mode.
Exposure Time (us)	Sensor Digitization Taps: 10Bit 15~8000000 Sensor Digitization Taps: 12Bit 19~8000000	8216	Set the exposure time. The minimum value varies depending on the TapGeometry.
Exposure Auto	Off Continuous	Off	Set whether to enable auto exposure.

DigitalIOControl

Related Topic: GPIO (Digital Input/Output Settings)

Configure settings for digital input/output.

Digital IO Control Item	Setting Range	Default	Description
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	6: Line7 - CC1	Select the input/ output to configure. Line1 TTL Out and Line4 TTL In are available on Standard Model.
Line Mode	Input Output	Input	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	0	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 LVAL 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. Line4 TTL In is available on Standard Model.
Line Format	NoConnect InternalSignal TTL LVDS OptoCoupled	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 User Output value selected in User Output Selector.

AnalogControl

Related Topic: Gain Control, Gamma Function

Configure analog control settings.

Analog Control Item	Setting Range	Default	Description
Gain Selector	Analog All Digital Red All* Digital Blue All* *Color Model Only	Analog All (Master Gain)	Select the gain to configure.
Gain	Analog All: 1 ~ 16 Digital Red All, Digital Blue All: 0.4467 ~ 5.6235	AnalogAll: 1 DigitalRedAll / DigitalBLueAll: 1	Set the gain value for the gain item selected with the GainSelector setting.
Gain Auto	Off Continuous	Off	Enable/disable gain auto adjustment.
Black Level Selector	Digital All Digital Red* Digital Blue* *Color Model Only	Digital All (Master Black)	Select the black level to configure.
Black Level	-133 ~ 255	0	Set the black level value.
Balance White Auto	Off Once Continuous Preset 4600K Preset 5600K Preset 6500K	Off	Enable/disable auto white balance.
LUT Mode	Off Gamma LUT	Off	Select the JAI LUT mode.
Gamma Selector	Gamma_0_45: 0.45 Gamma_0_6: 0.60 Gamma_1_0: 1.0	0.45	Set the gamma value.

PulseGenerators

Related Topic: GPIO (Digital Input/Output Settings)

Configure pulse generator settings.

Pulse Generators Item	Setting Range	Default	Description
Clock Pre-scaler	1~ 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 ~ 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.
Pulse GeneratorLength	1 ~ 1048575	30000	Set the maximum count up value using clock value.
Pulse Generator Length (ms)	0.002222~2330.166666	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)	0.429154~450000	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 ~ 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 ~ 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 ~ 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)	0.002222~2330.166666	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)	0 ~ 14.1222	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 ~ 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 Generators Item	Setting Range	Default	Description
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 Frame Trigger Wait Frame Active Exposure Active FVAL LVAL User Output 0 User Output 1 Line4 - TTL In Line7 - CC1 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	0: 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.

LUT Control

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

Configure LUT settings.

LUT Control Item	Setting Range	Default	Description
LUT Selector *Color Model Only	Red Green Blue	Green	Select the LUT channel to control.
LUT Index	0 ~ 255	0	Set the LUT index table number.
LUT Value	0 ~ 4095	0	Set the LUT index table number.

Transport Layer Control

> **Related Topic:** Camera Output Format (Tap Geometry)

Configure Camera Link Transport Layer settings.

Transport Layer Control Item	Setting Range	Default	Description
Device Tap Geometry	Geometry_1X1_1Y Geometry_1X2_1Y Geometry_1X3_1Y Geometry_1X4_1Y Geometry_1X8_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.

UserSetControl

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

Load factory default settings or save/load user settings for camera settings.

User Set Control Item	Setting Range	Default	Description
User Set Selector	Default User Set1 ~ 3	0: 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.

JAICustomControl

Configure settings for functions that are unique to JAI cameras and not specified by SFNC.

JAI Custom Control Item	Setting Range	Default	Description
Video Process Bypass Mode **Related Topic:** Video Process Bypass Mode	Off On	Off	Enable/ disable video process bypass mode.
Binning Gain Enable	Off On	Off	Set whether to apply gain to the image during binning mode (Mono model only).
Blemish Reduction Enable	True False	True	Enable/disable blemish correction.
Perform White Blemish Reduction Calibration	-	-	Execute blemish detection.
Blemish Detect Threshold	0 ~ 100	10	Set the blemish detection threshold.
Blemish Data Index	0 ~ 255	0	Select the correction blemish coordinate (Blemish Data Position X/Y) index.
Blemish Data Position X Value	- 1 ~ 1935	-	Display the x coordinate (horizontal pixel position) of the correction blemish selected in [Blemish Data Index]. You can also manually enter the x coordinate of the blemish you want to correct.
Blemish Data Position Y Value	- 1 ~ 1215	-	Display the y coordinate (vertical pixel position) of the correction blemish selected in [Blemish Data Index]. You can also manually enter the y coordinate of the blemish you want to correct.
Blemish Compensation Number	-	-	Display the number of correction blemishes.
Shading Correction Mode **Related Topic:** Shading Correction	FlatShading ColorShading (Color model only)	FlatShading	Select the shading correction mode. This is fixed at **Flat Shading** on the mono model. You can select from **Flat Shading** or **Color Shading** on the color model.
Shading Mode	Off User1 User2 User3	Off	Set the storage area for the shading correction data. When this is set to [Off], the shading correction data is not saved.
Perform Shading Calibration	-	-	Execute shading correction.
Shading Detect Result	-	0	Display the shading correction results.

JAI Custom Control Item	Setting Range	Default	Description
ALC Reference **Related Topic:** ALC (Automatic Level Control)	10 ~ 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	Off On	Off	Enable/disable the photometry area selected in ALC Area Selector.
ALC Area Enable All	Off On	On	**On**: Specify all photometry areas for ALC, regardless of the enabled/disabled statuses configured individually for each photometry area with [ALC Area Selector]. **Off**: Specify areas for ALC, based on the enabled/disabled statuses configured individually for each photometry area with ALC Area Selector.
ASC Min.	100 ~ 7999999	100	Set the minimum value for the Exposure Auto (ASC) control range.
ASC Max.	101 ~ 8000000	8216	Set the maximum value for the Exposure Auto (ASC) control range.
AGC Min.	100 ~ 1599	100	Set the minimum value for the Gain Auto (AGC) control range.
AGC Max.	101 ~ 1600	1600	Set the maximum value for the Gain Auto (AGC) control range.
AGC/ASC Control Speed	1 (slow) ~ 8 (fast)	4	Set the control speed for AGC and ASC (8 is the fastest).
ALC Status	Off AIC ASC AGC	-	Display whether ASC or AGC is being controlled during ALC.

JAI Custom Control Item	Setting Range	Default	Description
AWB 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 AWB Area Enable.
AWB Area Enable	Off On	Off	Enable/disable the photometry area selected in AWB Area Selector.
AWB Area Enable All	Off On	On	**On**: Specify all photometry areas for AWB, regardless of the enabled/disabled statuses configured individually for each photometry area with AWB Area Selector. **Off**: Specify areas for AWB based on the enabled/disabled statuses configured individually for each photometry area with AWB Area Selector.
AWB Control Speed	1 (slow) ~ 8 (fast)	4	Set the control speed for Balance White Auto (AWB) (8 is the fastest).
Video Send Mode Selector **Related Topic:** Video Send Mode	NormalMode TriggerSequenceMode CommandSequenceMode	NormalMode	Set the video send mode.
Sequence Roi Index **Related Topic:** Sequence Mode	1 ~ 128	1	Select the index for Trigger Sequence Mode and Command Sequence Mode.
Sequence Roi Frame Count	1 ~ 255	1	Set the display frame count of the selected Sequence Roi Index. (Only enabled during 4Trigger Sequence Mode.)
Sequence Roi Next Index	1 ~ 128	1	Set the index to be displayed after the selected Sequence Roi Index. (Only enabled during Trigger Sequence Mode.)
Sequence Roi Width	96 ~ 1936	1936	Set the width of the selected Sequence Roi Index.
Sequence Roi Height	2 ~ 1216	1216	Set the height of the selected Sequence Roi Index.
Sequence Roi Offset X	0 ~ 1840	0	Set the Offset X of the selected Sequence Roi Index.

JAI Custom Control Item	Setting Range	Default	Description
Sequence Roi Offset Y	0 ~ 1214	0	Set the Offset Y of the selected Sequence Roi Index.
Sequence Roi V Binning	1 ~ 2	1	Set the Horizontal Binning of the selected Sequence Roi Index. (Mono only)
Sequence Roi Black Level	1 ~ 2	1	Set the Vertical Binning of the selected Sequence Roi Index. (Mono only)
Sequence Roi Exposure Time	15* ~ 8000000 *) The minimum value varies depending on the TapGeometry setting.	8000	Set the exposure time of the selected Sequence Roi Index.
Sequence Roi Gain	100 ~ 1600	100	Set the gain of the selected Sequence Roi Index.
Sequence Roi Gain Red	- 4533 ~ + 37876	37876	Set the red gain of the selected Sequence Roi Index.
Sequence Roi Gain Blue	- 4533 ~ + 37876	37876	Set the blue gain of the selected Sequence Roi Index.
Sequence Roi H Binning	- 133 ~ + 255	0	Set the black level of the selected Sequence Roi Index.
Sequence Lut enable	True False	FALSE	Enable/disable the LUT setting for the selected Sequence Roi Index.
Sequence LUT Mode	Gamma LUT	Gamma	Select the LUT mode to use during Trigger Sequence Mode and Command Sequence Mode. (This setting is applied when Sequence Roi Lut Enable is set to "True.")
Command Sequence Index	1 ~ 128	0	Set the index displayed during Command Sequence Mode.
Current Sequence Index	-	-	Display the index number of the currently displayed image.
Reset Sequence Index	-	-	Reset the current index number for Trigger Sequence Mode and Command Sequence Mode to "Index 1."
Sensor Multi Roi Index **Note:** Sensor Multi ROI Function	Index 1 ~ 4	Index 1	Select the index for Sensor Multi Roi Mode.
Sensor Multi Roi Width	96 ~ 1936	1936	Set the width of the selected Sensor Multi Roi Index.
Sensor Multi Roi Height	2 ~ 1216	1216	Set the height of the selected Sensor Multi Roi Index.
Sensor Multi Roi Offset X	0 ~ 1840	0	Set the Offset X of the selected Sensor Multi Roi Index.
Sensor Multi Roi Offset Y	0 ~ 1214	0	Set the Offset Y of the selected Sensor Multi Roi Index.
Horizontal Enable	Off On	Off	Enable/disable the Width/Offset X for the selected Sequence Multi Roi Index.
Vertical Enable	Off On	Off	Enable/disable the Height/Offset Y for the selected Sequence Multi Roi Index.

Counter and Timer Control

Related Topic: Counter and Timer Control

Configure counter settings. (This camera only supports counter functions.)

Counter and Timer Control Item	Setting Range	Default	Description
Counter 0	Counter [Counter 0]	-	Select the counter.
Counter0 Event Source	Off [Off] FrameTrigger [Frame Trigger] FrameStart [Frame Start] ExposureStart [Exposure Start] FrameTransferEnd [Frame Transfer End]	Off	Select the counter event signal for which to read the count value.
Counter0 Event Activation	RisingEdge [Rising Edge] FallingEdge [Falling Edge]	-	Display the timing at which to count.
Counter0 Reset	-	-	Reset the counter.
Counter0 Refresh	-	-	Update the count value.
Counter0 Value	-	-	Display the count value.
Counter0 Status	CounterActive [Counter Active]	Counter Active	Display the counter status.
Counter 1	Counter [Counter 1]	-	Select the counter.
Counter1 Event Source	Off [Off] FrameTrigger [Frame Trigger] FrameStart [Frame Start] ExposureStart [Exposure Start] FrameTransferEnd [Frame Transfer End]	Off	Select the counter event signal for which to read the count value.
Counter1 Event Activation	RisingEdge [Rising Edge] FallingEdge [Falling Edge]	-	Display the timing at which to count.
Counter1 Reset	-	-	Reset the counter.
Counter1 Refresh	-	-	Update the count value.
Counter1 Value	-	-	Display the count value.
Counter1 Status	CounterActive [Counter Active]	Counter Active	Display the counter status.
Counter 2	Counter [Counter 2]	-	Select the counter.
Counter2 Event Source	Off [Off] FrameTrigger [Frame Trigger] FrameStart [Frame Start] ExposureStart [Exposure Start] FrameTransferEnd [Frame Transfer End]	Off	Select the counter event signal for which to read the count value.

Counter and Timer Control Item	Setting Range	Default	Description
Counter2 Event Activation	RisingEdge [Rising Edge] FallingEdge [Falling Edge]	-	Display the timing at which to count.
Counter2 Reset	-	-	Reset the counter.
Counter2 Refresh	-	-	Update the count value.
Counter2 Value	-	-	Display the count value.
Counter2 Status	CounterActive [Counter Active]	Counter Active	Display the counter status.

Short ASCII Command List

All configuration of the camera is done via the RS-232C port. The camera can be set up from a PC running terminal emulator software.

Below is the description of the ASCII based short command protocol.

Communication Setting

Baud Rate	9600 (Default)
Data Length	8bit
Start Bit	1bit
Stop Bit	1 bit
Parity	None
Xon/Xoff Control	None

Protocol (Short ASCII Command)

Transmit the Setting Command to Camera

NN is any kind of the command.

NN=[Param.]<CR><LF>

Send to camera: GA=0 <CR><LF>

Camera response: COMPLETE<CR><LF>

When camera receives a valid command, camera will return 'COMPLETE'. If camera receives an invalid command, camera will return following:

Send to camera: GAX=0 <CR><LF>

Camera response: 01 Unknown Command!!<CR><LF>

Send to camera: GA=10000 <CR><LF>

Camera response: 02 Bad Parameters!!<CR><LF>

Transmit the Request Command to Camera

The status of camera's settings can be queried by transmitting NN?<CR><LF>, where NN is any valid command.

The camera will return the current setting data.

Send to camera: GA? <CR><LF>

Camera response: GA=0<CR><LF>

Switching baud rate between PC and camera

Camera always starts up with 9600bps. This can be switched to higher baud rates after a communication has been established. When switching to other baud rate the procedure is as follows.

e.g. Change baud rate to 115200bps

1. Confirm baud rates camera supported
   Send to camera: SBDRT? <CR><LF>
   Camera response: SBDRT=31(0x1F)<CR><LF>
2. Request new baud rate 115200bps
   Send to camera: CBDRT=16(0x10) <CR><LF>
   Camera response: COMPLETE<CR><LF>
3. Rewrite new baud rate again with new baud rate (Confirmation command)
   Send to camera: CBDRT=16(0x10) <CR><LF>
   Camera response: COMPLETE<CR><LF>

In case the camera does not receive the confirming command with new baud rate within 250ms after sending the acknowledge it falls back to the original baud rate (9600bps).

GenCP Bootstrap Register (Short ASCII Command)

Name	Access	Short ASCII	Values	Default	Description
DeviceVendorName	R/O	DVN	"JAI Ltd., Japan"	-	DVN?<CR><LF> Display the manufacture name.
DeviceModelName	R/O	MD	GO-2400C-PMCL GO-2400M-PMCL	-	MD?<CR><LF> Display the model name.
DeviceVersion	R/O	DV	Indicate device version (e.g. “0.1.0.0”)	-	DV?<CR><LF> Display the camera version.
DeviceID	R/O	ID	Serial Number	-	ID?<CR><LF> Display the device ID.
DeviceUserID	R/W	UD	User can save and load free text. (64 or less characters)	-	UD=[Param.]<CR><LF > UD?<CR><LF> Set the user ID for the camera

Technology Specific Bootstrap Register (Short ASCII Command)

Name	Access	Short ASCII	Values	MIN	MAX	Default	Description
SupportedBaud rates	R/O	SBDRT	Indicate Support/Non-support status for each baud rate bit0: 9600bps bit1: 19200bps bit2: 38400bps bit3: 57600bps bit4: 115200bps	0x01	0xFF	0x1F	SBDRT?<CR><LF> Display the supported transmission baud rate as bit fields This camera supports 9600bps, 19200bps, 38400bps,57600bps, and 115200bps.
CurrentBaudrate	R/W	CBDRT	**READ**: Indicate current baud rate. **WRITE**: Set any bit of baud rate. bit0: 9600bps bit1: 19200bps bit2: 38400bps bit3: 57600bps bit4: 115200bps	0x01	0x80	1 (9600bps)	CBDRT=[Param.]<CR><LF> CBDRT?<CR><LF> In case of WRITE execution (change baud rate), it needs to control in the proper sequence between Host and Camera. Display the currently configured transmission baud rate. To change the transmission baud rate, use this command (configuration steps).

Device Control (Short ASCII Command)

Name	Interface Access	Short ASCII	Values	Default	Description
DeviceFirmware Version	R/O	VN	Firm Ver. No.	-	VN?<CR><LF> Display the firmware version.
DeviceReset	W/O	CRS00	1	-	CRS00=1<CR><LF> Reset the device.

Image Format Control (Short ASCII Command)

<table>
<tr><th>Name</th><th>Access</th><th>Short ASCII</th><th>Values</th><th>DEFAULT</th><th>Description</th></tr>
<tr><td>Height</td><td>R/W</td><td>HTL</td><td>Min ~ (Max - OffsetY)</td><td>1216</td><td>HTL=[Param.]<CR><LF>
HTL?<CR><LF>
(2 line/ Step)

Set the image height. (The value will be set in configuration steps)

<table>
<tr><th>Model</th><th>Min</th><th>Height Max</th><th>Step</th></tr>
<tr><td>Mono</td><td>2 (1)</td><td>1216 (608)</td><td>2 (1)pixels</td></tr>
<tr><td>Color</td><td>2</td><td>1216</td><td>2 pixels</td></tr>
</table>

For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
<tr><td>Width</td><td>R/W</td><td>WTC</td><td>Min ~ (Max - OffsetX)*

(*) Varies depending on the Tap Geometry setting.</td><td>1936</td><td>WTC=[Param.]<CR><LF>
WTC?<CR><LF>

Set the image width. (The value will be set in configuration steps)

<table>
<tr><th>Tap Geometry</th><th>Min</th><th>Max</th><th>Step</th></tr>
<tr><td>1x1-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>2 (1) pixels</td></tr>
<tr><td>1x2-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>2 (1) pixels</td></tr>
<tr><td>1x3-1Y</td><td>96 (48)</td><td>1932 (966)</td><td>6 (3) pixels</td></tr>
<tr><td>1x4-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>4 (2) pixels</td></tr>
<tr><td>1x8-1Y</td><td>96 (48)</td><td>1936 (968)</td><td>8 (4) pixels</td></tr>
</table>

For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
</table>

<table>
<tr><th>Name</th><th>Access</th><th>Short ASCII</th><th>Values</th><th>DEFAULT</th><th>Description</th></tr>
<tr><td>OffsetY</td><td>R/W</td><td>OFL</td><td>Min ~ (Max – Height)</td><td>0</td><td>OFL=[Param.]<CR><LF>
OFL?<CR><LF>
(2 line/ Step)

Set the vertical offset. (The value will be set in configuration steps)

<table><tr><th>Model</th><th>Min</th><th>Height Max</th><th>Step</th></tr><tr><td>Mono</td><td>0</td><td>1214 (607)</td><td>2 (1)pixels</td></tr><tr><td>Color</td><td>0</td><td>1214</td><td>2 pixels</td></tr></table>
For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
<tr><td>OffsetX</td><td>R/W</td><td>OFC</td><td>Min ~ (Max – Width)</td><td>0</td><td>OFC=[Param.]<CR><LF>
OFC?<CR><LF>

Set the horizontal offset. (The value will be set in configuration steps)

<table><tr><th>Tap Geometry</th><th>Min</th><th>Max</th><th>Step</th></tr><tr><td>1x2-1Y</td><td>0</td><td>1840 (920)</td><td>2 (1) pixels</td></tr><tr><td>1x3-1Y</td><td>0</td><td>1836 (918)</td><td>6 (3) pixels</td></tr><tr><td>1x4-1Y</td><td>0</td><td>1840 (920)</td><td>4 (2) pixels</td></tr><tr><td>1x8-1Y</td><td>0</td><td>1840 (920)</td><td>8 (4) pixels</td></tr></table>
For the monochrome model, the parenthesis value applies when BinningHorizontal is set to 2.</td></tr>
<tr><td>BinningHorizontal</td><td>R/W</td><td>HB</td><td>1: Binning Off
2: Binning 2 mode*

*Mono model only.</td><td>1</td><td>HB=[Param.]<CR><LF>
HB?<CR><LF>

Set the number of pixels in the horizontal direction for which to perform binning.</td></tr>
<tr><td>BinningVertical</td><td>R/W</td><td>VB</td><td>1: Binning Off
2: Binning 2 mode*

*Mono model only.</td><td>1</td><td>VB=[Param.]<CR><LF>
VB?<CR><LF>

Set the number of pixels in the vertical direction for which to perform binning.</td></tr>
</table>

Name	Access	Short ASCII	Values	DEFAULT	Description
PixelFormat	R/(W)	BA	**Monochrome Model** 0: Mono8 1: Mono10 2: Mono12* **Color Model** 0: BayerRG8 1: BayerRG10 2: BayerRG12* 3: RGB8 4: RGB10 5: RGB12*	0	BA=[Param.]<CR><LF> BA?<CR><LF> Set the pixel format. Mono12, BayerRG12 and RGB12 can be used only when **VideoProcessBypassMode** is set to On.
TestImageSelector	R/W	TPN	0: Off 1: GreyHorizontalRamp 2: GreyVerticalRamp 3: GreyHorizontal RampMoving 4: Horizontal Colorbar* 5: Vertical Colorbar* 6: Moving Colorbar*	0	TPN=[Param.]<CR><LF> TPN?<CR><LF> Select the test image.* Color model only
SensorDigitization Taps	R/W	SDT	1: 10bit 2: 12bit	2	SDT=[Param.]<CR><LF> SDT?<CR><LF> Displays the digital tones output from the sensor.
BayerAlgorithm	R/W	BYRA	0: Standard 1: Extended	0	BYRA=[Param.]<CR><LF> BYRA?<CR><LF> Select the pixel interpolation method.

Acquisition Control (Short ASCII Command)

Name	Access	Short ASCII	Values	DEFAULT	Description
FrameStartTrigMode	R/W	TM	Off On	0	TM=[Param.]<CR><LF> TM?<CR><LF> Display the Trigger mode.
TriggerSoftware	(R)/W	STRG	0	-	STRG=0<CR><LF> Execute a software trigger.

Name	Access	Short ASCII	Values	DEFAULT	Description
FrameStartTrigSource	R/W	TI	0: Low 1: High 2: SoftTrigger 8: PulseGenerator0 10:UserOutput0 11:UserOutput1 12: TTL_In1 (Std Only) 13: CL_CC1_In 14: Nand0 15: Nand1	13	TI=[Param.]<CR><LF> TI?<CR><LF> Select the trigger signal source.
FrameStartTrigActivation	R/W	TA	0: RisingEdge 1: FallingEdge 2: LevelHigh 3: LevelLow	0	TA=[Param.]<CR><LF> TA?<CR><LF> Select the polarity of the trigger signal (i.e., location of signal at which trigger is applied).
ExposureMode	R/W	EM	0: Off 1: Timed 2: TriggerWidth	1	EM=[Param.]<CR><LF> EM?<CR><LF> Select the exposure mode.
ExposureTimeRaw	R/W	PE	15* ~ 8000000[us]	18000	PE=[Param.]<CR><LF> PE?<CR><LF> Set the exposure time. **Note:** The maximum value varies depending on the Acquisition Frame Rate Raw value.
ExposureAuto	R/W	ASC	0: Off 1: Continuous	0	ASC=[Param.]<CR><LF> ASC?<CR><LF> Set whether to enable auto exposure.
TriggerOverlap	R/W	TO	0:Off 1:Read Out	0	TO=[Param.]<CR><LF> TO?<CR><LF> Set whether to enable ”Trigger Overlap”.

Digital IO Control (Short ASCII Command)

Name	Access	Short ASCII	Values	DEFAULT	Description
LineInverter_TTLOut	R/W	LI0	0: False 1: True	0	LI0=[Param.]<CR><LF> LI0?<CR><LF> Enable/disable polarity inversion for the TTL output.
LineInverter_ Nand0In1	R/W	ND0INV1	0: False 1: True	0	ND0INV1=[Param.]<CR><LF> ND0INV1?<CR><LF> Enable/disable polarity inversion for the NAND0 In1 input.
LineInverter_ Nand0In2	R/W	ND0INV2	0: False 1: True	0	ND0INV2=[Param.]<CR><LF> ND0INV2?<CR><LF> Enable/disable polarity inversion for the NAND0 In2 input.
LineInverter_ Nand1In1	R/W	ND1INV1	0: False 1: True	0	ND1INV1=[Param.]<CR><LF> ND1INV1?<CR><LF> Enable/disable polarity inversion for the NAND1 In1 input.
LineInverter_ Nand1In2	R/W	ND1INV2	0: False 1: True	0	ND1INV2=[Param.]<CR><LF> ND1INV2?<CR><LF> Enable/disable polarity inversion for the NAND1 In2 input.
LineSource_Line1	R/W	LS0	0: Low 1: High 3: FrameTrigger Wait 4: FrameActive 5: ExposureActive 6: Fval 7: Lval 8: PulseGenerator0 10:UserOutput0 11:UserOutput1 12: TTL_In1 (Std Only) 13: CL_CC1_In 14: Nand0 15: Nand1	0	LS0=[Param.]<CR><LF> LS0?<CR><LF> Select the line source signal for Line 1(12-pin TTL output)

Name	Access	Short ASCII	Values	DEFAULT	Description
UserOutput0	R/W	USC0	0: False 1: True	0	USC0=[Param.]<CR><LF> USC0?<CR><LF> Set the User Output0 value.
UserOutput1	R/W	USC1	0: False 1: True	0	USC1=[Param.]<CR><LF> USC1?<CR><LF> Set the User Output1 value.

Analog Control (Short ASCII Command)

Name	Access	Short ASCII	Values	DEFAULT	Description
GainRawAnalogAll	R/W	FGA	100 ~ 1600	100	FGA=[Param.]<CR><LF> FGA?<CR><LF> Set the gain value.
GainRawDigitalRedAll	R/W	PGR	-4533 ~ 0 ~ 28400	0	PGR=[Param.]<CR><LF> PGR?<CR><LF> Set the red gain value for white balance control. Color model only.
GainRawDigitalBlueAll	R/W	PGB	-4533 ~ 0 ~ 28400	0	PGB=[Param.]<CR><LF> PGB?<CR><LF> Set the blue gain value for white balance control. Color model only.
GainAuto	R/W	AGC	0: Off 1: Continuous	0	AGC=[Param.]<CR><LF> AGC?<CR><LF> Enable/disable gain auto adjustment.
BlackLevelRawAll	R/W	BL	-133 ~ 0 ~ 255	0	BL=[Param.]<CR><LF> BL?<CR><LF> Set the black level value.
BlackLevelRawRed	R/W	BLR1	-133 ~ 0 ~ 255	0	BLR1=[Param.]<CR><LF> BLR1?<CR><LF> Set the red gain value for black balance control. Color model only.
BlackLevelRawBlue	R/W	BLB1	-133 ~ 0 ~ 255	0	BLB1=[Param.]<CR><LF> BLB1?<CR><LF> Set the blue gain value for black balance control. Color model only.

Name	Access	Short ASCII	Values	DEFAULT	Description
BalanceWhiteAuto	R/W	AWB	0: Off 1: Once 2: Continuous 3: 4600K 4: 5600K 5: 6500K Else : Off	0	AWB=[Param.]<CR><LF> AWB?<CR><LF> Set the auto white balance mode. Color model only.

LUT Control (Short ASCII Command)

Name	Access	Short ASCII	Values	DEFAULT	Description
LUTValueRed	R/W	LUTR	Param 1: LUT index (0 ~ 255) Param 2:LUTdata (0 ~ 4095)	γ=1 equivalent value	LUTR=[Param1],[Param2]<CR><LF> LUTR?[Param1]<CR><LF> Set the LUT value for the red output signal. Color model only.
LUTValueGreen (Mono)	R/W	LUTG	Param 1: LUT index (0 ~ 255) Param 2:LUTdata (0 ~ 4095)	γ=1 equivalent value	LUTG=[Param1],[Param2]<CR><LF> LUTG?[Param1]<CR><LF> **Color model**: Set the LUT value for the green output signal. **Mono model**: Set the LUT value for the image output signal.
LUTValueBlue	R/W	LUTB	Param 1: LUT index (0 ~ 255) Param 2:LUTdata (0 ~ 4095)	γ=1 equivalent value	LUTB=[Param1],[Param2]<CR><LF> LUTB?[Param1]<CR><LF> Set the LUT value for the red output signal. Color model only.

Transport Layer Control (Short ASCII Command)

Name	Access	Short ASCII	Values	DEFAULT	Description
DeviceTapGeometry	R/W	TAGM	0: Geometry_1X1_1Y 1: Geometry_1X2_1Y 3: Geometry_1X4_1Y 5: Geometry_1X8_1Y 7: Geometry_1X3_1Y	3	TAGM=[Param.]<CR><LF> TAGM?<CR><LF> Set the transmission method for each time images are transmitted from the device(TAP structure).

User Set Control (Short ASCII Command)

Name	Access	Short ASCII	Values	Default	Description
UserSetLoad	(R)/W	LD	0: Default 1: UserSet1 2: UserSet2 3: UserSet3	0	LD=[Param.]<CR><LF> LD?<CR><LF> Load user settings.
UserSetSave	(R)/W	SA	1: UserSet1 2: UserSet2 3: UserSet3	1	SA=[Param.]<CR><LF> SA?<CR><LF> Save the current setting values as user settings.

Counter and Timer Control (Short ASCII Command)

Name	Access	Short ASCII	Values	Default	Description
Counter0EventSource	R/W	CE0	0:Off 1:FrameTrigger 2:FrameStart 3:ExposuerStart 4:FrameTransferEnd	0	CE0=[Param.]<CR><LF> CE0?<CR><LF> Select the counter event signal for which to read the count value(for Counter0).
Counter1EventSource	R/W	CE1	0:Off 1:FrameTrigger 2:FrameStart 3:ExposuerStart 4:FrameTransferEnd	0	CE1=[Param.]<CR><LF> CE1?<CR><LF> Select the counter event signal for which to read the count value(for Counter1).
Counter2EventSource	R/W	CE2	0:Off 1:FrameTrigger 2:FrameStart 3:ExposuerStart 4:FrameTransferEnd	0	CE2=[Param.]<CR><LF> CE2?<CR><LF> Select the counter event signal for which to read the count value(for Counter2).
Counter0Reset	(R)/W	CR0	1	-	CR0=1<CR><LF> Reset Counter 0.
Counter1Reset	(R)/W	CR1	1	-	CR1=1<CR><LF> Reset Counter 1.
Counter2Reset	(R)/W	CR2	1	-	CR2=1<CR><LF> Reset Counter 2.
Counter0Value	R/O	CV0	0 ~ 65535	0	CV0?<CR><LF> Display the Counter0 value.

Name	Access	Short ASCII	Values	Default	Description
Counter1Value	R/O	CV1	0 ~ 65535	0	CV1?<CR><LF> Display the Counter1 value.
Counter2Value	R/O	CV2	0 ~ 65535	0	CV2?<CR><LF> Display the Counter2 value.

JAI Custom (Short ASCII Command)

Name	Access	Short ASCII	Values	Default	
AcquisitionFramePeriod	R/W	AR	32764 ~ 8000000[us]	11961	AR=[Param.]<CR><LF> AR?<CR><LF> Maximum value is calculated depending on Height and Offset Y settings. Set the frame rate as a frame interval[us].
BlemishWhiteEnable	R/W	BMW	0: False 1: True	1	BMW=[Param.]<CR><LF> BMW?<CR><LF> Enable/disable blemish correction.
BlemishWhiteDetect	W/O	BMRCW	1	-	BMRCW=1<CR><LF> Execute blemish detection.
BlemishWhiteDetect Threshold	R/W	BMTHW	0 ~ 100	10	BMTHW=[Param.]<CR><LF> BMTHW?<CR><LF> Set the blemish detection threshold.
BlemishWhiteDetect PositionX	R/W	BMPXW	Param 1: Blemish index (0 ~ 255) Param 2: X position(-1 ~ 1935)	-1	BMPXW=[Param1], [Param2]<CR><LF> BMPXW? [Param1]<CR><LF> Display the X coordinate (horizontal pixel position) of the blemish selected in Blemish Data Index. You can also manually enter the X coordinate of the blemish you want to correct.

Name	Access	Short ASCII	Values	Default	
BlemishWhiteDetect PositionY	R/W	BMPYW	Param 1: Blemish index (0 ~ 255) Param 2: X position(-1 ~ 1935)	-1	BMPYW=[Param1], [Param2]<CR><LF> BMPYW? [Param1]<CR><LF> Display the Y coordinate (vertical pixel position) of the blemish selected in Blemish Data Index. You can also manually enter the Y coordinate of the blemish you want to correct.
VideoSendMode	R/W	VSM	0: Normal 1: Trigger Sequence 2: Command Sequence	0	VSM=[Param.]<CR><LF> VSM?<CR><LF> Configure Video Send Mode.
ShadingCorrection Mode	R/W	SDCM	0: Flat Shading 1: Color Shading*	0	SDCM=[Param.]<CR><LF> SDCM?<CR><LF> Select the shading correction mode. *Color only / fixed at Flat Shading for Mono)
ShadingCorrect	W/O	RS	-	-	RS=0<CR><LF> Execute shading correction.
RequestShadingDetect Result	R/O	SDRS	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6= Trig is not set as Normal.	-	SDRS?<CR><LF> Display the shading correction results.
ShadingMode	R/W	SDM	0: OFF 1: User 1 2: User 2 3: User 3	0	SDM=[Param.]<CR><LF> SDM?<CR><LF> Set the storage area for the shading correction data. When this is set to **Off**, the shading correction data is not saved.
SequenceModeFrame Count *n* *n* = 1 ~ 128	R/W	SQF *n*	1 ~ 255	1	SQF *n*=[Param.]<CR><LF> SQF *n*?<CR><LF> Set the frame count of Sequence Roi Index *n*. (Only enabled during Trigger Sequence Mode.)

Name	Access	Short ASCII	Values	Default	
SequenceModeNext Index *n* *n* = 1 ~ 128	R/W	SQNI*n*	1 ~ 128	1	SQNI *n*=[Param.]<CR><LF> SQNI *n*?<CR><LF> Set the index to be executed after Sequence Roi Index *n*. (Only enabled during Trigger Sequence Mode.)
SequenceMode Width *n* *n* = 1 ~ 128	R/W	SQW*n*	96 ~1936	1936	SQW *n*=[Param.]<CR><LF> SQW *n*?<CR><LF> Set the width of Sequence Roi Index *n*. See Width in Image Format Control (Short ASCII Command).
SequenceMode OffsetX *n* *n* = 1 ~ 128	R/W	SQOX*n*	0 ~ 1840	0	SQOX *n*=[Param.]<CR><LF> SQOX *n*?<CR><LF> Set the Offset X of Sequence Roi Index *n*.
SequenceMode Height*n* *n* = 1 ~ 128	R/W	SQH*n*	2 ~ 1216	1216	SQH *n*=[Param.]<CR><LF> SQH *n*?<CR><LF> Set the height of Sequence Roi Index *n*.
SequenceMode OffsetY*n* *n* = 1 ~ 128	R/W	SQOY*n*	0 ~ 1214	0	SQOY *n*=[Param.]<CR><LF> SQOY *n*?<CR><LF> Set the Offset Y of Sequence Roi Index *n*.
SequenceMode Gain*n* *n* = 1 ~ 128	R/W	SQGA*n*	100 ~ 1600	100	SQGA *n*=[Param.]<CR><LF> SQGA *n*?<CR><LF> Set the gain of Sequence Roi Index *n*.
SequenceMode ExposureTime*n* *n* = 1 ~ 128	R/W	SQPE*n*	15 ~ 8000000	18000	SQPE *n*=[Param.]<CR><LF> SQPE *n*?<CR><LF> Set the exposure time of Sequence Roi Index *n*. The minimum value varies depending on the TapGeometry.
SequenceMode Hbinning*n* *n* = 1 ~ 128	R/W	SQHB*n*	1: Hbinning = OFF 2: Hbinning = x2*	1	SQHB *n*=[Param.]<CR><LF> SQHB *n*?<CR><LF> Set the horizontal binning of Sequence Roi Index *n*. *Mono model only.

Name	Access	Short ASCII	Values	Default	
SequenceMode Vbinning*n* n = 1 ~ 128	R/W	SQVB*n*	1: Vbinning = OFF 2: Vbinning = x2*	1	SQVB *n*=[Param.]<CR><LF> SQVB *n*?<CR><LF> Set the vertical binning of Sequence Roi Index *n*. *Mono model only.
SequenceMode LutEnable*n* *n* = 1 ~ 128	R/W	SQLUT*n*	Off/On	0	SQLUT *n*=[Param.]<CR><LF> SQLUT *n*?<CR><LF> Enable/disable the LUT setting for Sequence Roi Index *n*.
SequenceMode BlackLevel*n* *n* = 1 ~ 128	R/W	SQBL*n*	-133 ~ 255	0	SQBL *n*=[Param.]<CR><LF> SQBL *n*?<CR><LF> Set the black level of Sequence Roi Index *n*.
SequenceMode GainRed*n* *n* = 1 ~ 128	R/W	SQPGR*n*	-4533 ~ 17713	0	SQPGR *n*=[Param.]<CR><LF> SQPGR *n*?<CR><LF> Set the red gain of Sequence Roi Index *n*. Color model only.
SequenceMode GainBlue*n* *n* = 1 ~ 128	R/W	SQPGB*n*	-4533 ~ 17713	0	SQPGB *n*=[Param.]<CR><LF> SQPGB *n*?<CR><LF> Set the blue gain of Sequence Roi Index *n*. Color model only.
CommandSequence Index	R/W	CSQI	1 ~ 128	0	CSQI=[Param.]<CR><LF> CSQI?<CR><LF> Set the inidex to execute during Command Sequence Mode.
CurrentSequence Index	R/O	SQIDX	1 ~ 128	0	SQIDX?<CR><LF> Dispaly the index number of the current Command Sequence Index.
SequenceReset	W/O	SQRST	0	0	SQRST=[Param.]<CR><LF> Reset the current index number for Trigger Sequence Mode and Command Sequence Mode to ”Index 1”.

Name	Access	Short ASCII	Values	Default	
SequenceLutMode	R/W	SQLUT	0: Gamma 1: LUT	0	SQLUT=[Param.]<CR><LF> SQLUT?<CR><LF> Select the LUT mode to use during Trigger Sequence Mode and Command Sequence Mode. (This setting is applied when Sequence Roi Lut Enable is set to ”True”.)
SensorMultiRoiEnable	R/W	SMRE	0: False 1: True	0	SMRE=[Param.]<CR><LF> SMRE?<CR><LF> Enable/disable the MultiRoi function
SensorMultiRoiWidth*n* *n* = 1 ~ 4	R/W	SMRW*n*	16 ~1936	1936	SMRW*n*=[Param.]<CR><LF> SMRW*n*?<CR><LF> Set the width of Sensor Multi Roi Index*n*.
SensorMultiRoiHeight*n* *n* = 1 ~ 4	R/W	SMRH*n*	2 ~ 1216	1216	SMRH*n*=[Param.]<CR><LF> SMRH*n*?<CR><LF> Set the height of Sensor Multi Roi Index*n*.
SensorMultiRoiOffsetX*n* *n* = 1 ~ 4	R/W	SMROX*n*	0 ~ 1920	0	SMROX*n*=[Param.]<CR><LF> SMROX*n*?<CR><LF> Set the Offset X of Sensor Multi Roi Index*n*.
SensorMultiRoiOffsetY*n* n = 1 ~ 4	R/W	SMROY*n*	0 ~ 1214	0	SMROX*n*=[Param.]<CR><LF> SMROX*n*?<CR><LF> Set the Offset Y of Sensor Multi Roi Index*2*.
SensorMultiRoi HorizontalEnable*n* *n* = 1 ~ 4	R/W	SMROH*n*	0: OFF 1: ON	0	SMROH*n*=[Param.]<CR><LF> SMROH*n*?<CR><LF> Enable/disable Sensor Multi Roi horizontal Index*n* (Row *n*).
SensorMultiRoi VerticalEnable*n* *n* = 1 ~ 4	R/W	SMROV*n*	0: OFF 1: ON	0	SMROV*n*=[Param.]<CR><LF> SMROV*n*?<CR><LF> Enable/disable Sensor Multi Roi vertical Index*n* (Column *n*).
LUTMode	R/W	LUTC	0: Off 1: Gamma 2: LUT	0	LUTC=[Param.]<CR><LF> LUTC?<CR><LF> Select the JAI LUT mode.

Name	Access	Short ASCII	Values	Default	
AlcSpeed	R/W	ALCS	1 ~ 8	4	ALCS=[Param.]<CR><LF> ALCS?<CR><LF> Set the control speed for AGC and ASC. (8 is the fastest.)
AwbSpeed	R/W	AWBSU	1 ~ 8	4	AWBSU=[Param.]<CR><LF> AWBSU?<CR><LF> Set the control speed for Balance White Auto (AWB). (8 is fastest.)
ExposureAutoMax	R/W	ASCEA	101 ~ 8000000[us]	18000	ASCEA=[Param.]<CR><LF> ASCEA?<CR><LF> Set the maximum value for the Exposure Auto (ASC) control range. Maximum value is varied depending on frame rate.
ExposureAutoMin	R/W	ASCEI	100 ~ 7999999	100	ASCEI=[Param.]<CR><LF> ASCEI?<CR><LF> Set the minimum value for the Exposure Auto (ASC) control range. Maximum value is varied depending on frame rate.
AlcReference	R/W	AGCF	10 ~ 100[%]	50	AGCF=[Param.]<CR><LF> AGCF?<CR><LF> Set the target level for ALC. (unit: %)
GainAutoMax	R/W	AGCGA	101 ~ 1600	1600	AGCGA=[Param.]<CR><LF> AGCGA?<CR><LF> Set the maximum value for the Gain Auto (AGC) control range.
GainAutoMin	R/W	AGCGI	100 ~ 1599	100	AGCGI=[Param.]<CR><LF> AGCGI?<CR><LF> Set the minimum value for the Gain Auto (AGC) control range.

<table>
<tr><th>Name</th><th>Access</th><th>Short ASCII</th><th>Values</th><th>Default</th><th></th></tr>
<tr><td>ALCChannelAreaAll</td><td>R/W</td><td>ALCA</td><td>0: OFF
1: ON</td><td>1</td><td>ALCA=[Param.]<CR><LF>
ALCA?<CR><LF>

On: Specify all photometry areas for ALC, regardless of the enabled/disabled statuses configured individually for each photometry area with [ALC Area Selector].

Off: Specify areas for ALC based on the enabled/disabled statuses configured individually for each photometry area with [ALC Area Selector].</td></tr>
<tr><td>ALCChannelArea</td><td>R/W</td><td>ALCLR
ALCLMR
ALCLML
ALCLL
ALCMLR
ALCMLMR
ALCMLML
ALMLL
ALCMHR
ALCMHMR
ALCMHML
ALMHL
ALCHR
ALCHMR
ALCHML
ALCHL</td><td>0: Off
1: On

Default: 0</td><td colspan="2">ALC***=[Param.]<CR><LF>
ALC***?<CR><LF>

Enable/disable the specified photometry area.

16 Photometry Areas and Short ASCII Commands.

<table><tr><td>ALCHL
(High Left)</td><td>ALCHML
(Hight Mid-Left)</td><td>ALCHMR
(High Mid-Right)</td><td>ALCHR
(High Right)</td></tr><tr><td>ALCMHL
(Mid-High Left)</td><td>ALCMHML
(Mid-Hight Mid-Left)</td><td>ALCMHMR
(Mid-High Mid-Right)</td><td>ALCMHR
(Mid-High Right)</td></tr><tr><td>ALCMLL
(Mid-Low Left)</td><td>ALCMLML
(Mid-Low Mid-Left)</td><td>ALCMLMR
(Mid-Low Mid-Right)</td><td>ALCMLR
(Mid-Low Right)</td></tr><tr><td>ALCLL
(Low Left)</td><td>ALCLML
(Low Mid-Left)</td><td>ALCLMR
(Low Mid-Right)</td><td>ALCLR
(Low Right)</td></tr></table></td></tr>
<tr><td>RequestBalanceWhite AutoResult</td><td>R/O</td><td>AWRS</td><td>0=Complete.
1=Too Bright.
2=Too dark.
3=Timeout Error.
4=Busy.
5=Limit.
6= Trig is not set as Normal.</td><td>0</td><td>AWRS?<CR><LF>

Display the AWB Once results.
Color model only.</td></tr>
</table>

<table>
<tr><th>Name</th><th>Access</th><th>Short ASCII</th><th>Values</th><th>Default</th><th></th></tr>
<tr><td>AWBChannelAreaAll</td><td>R/W</td><td>AWBA</td><td>0: OFF
1: ON

Color model only.</td><td>1</td><td>AWBA=[Param.]<CR><LF>
AWBA?<CR><LF>

On: Specify all photometry areas for AWB, regardless of the enabled/disabled statuses configured individually for each photometry area with [AWB Area Selector].

Off: Specify areas for AWB based on the enabled/disabled statuses configured individually for each photometry area with [AWB Area Selector]</td></tr>
<tr><td>AWBChannelArea</td><td>R/W</td><td>AWBLR
AWBLMR
AWBLML
AWBLL
AWBMLR
AWBMLMR
AWBMLML
ALMLL
AWBMHR
AWBMHMR
AWBMHML
ALMHL
AWBHR
AWBHMR
AWBHML
AWBHL</td><td>0: Off
1: On

Default: 0</td><td colspan="2">AWB***=[Param.]<CR><LF>
AWB***?<CR><LF>

Enable/disable the specified photometry area. (Color model only)

16 Photometry Areas and Short ASCII Commands.
<table>
<tr><td>AWBHL
(High Left)</td><td>AWBHML
(Hight Mid-Left)</td><td>AWBHMR
(High Mid-Right)</td><td>AWBHR
(High Right)</td></tr>
<tr><td>AWBLMHL
(Mid-High Left)</td><td>AWBMHML
(Mid-Hight Mid-Left)</td><td>AWBMHMR
(Mid-High Mid-Right)</td><td>AWBMHR
(Mid-High Right)</td></tr>
<tr><td>AWBLMLL
(Mid-Low Left)</td><td>AWBMLML
(Mid-Low Mid-Left)</td><td>AWBMLMR
(Mid-Low Mid-Right)</td><td>AWBMLR
(Mid-Low Right)</td></tr>
<tr><td>AWBLL
(Low Left)</td><td>AWBLML
(Low Mid-Left)</td><td>AWBLMR
(Low Mid-Right)</td><td>AWBLR
(Low Right)</td></tr>
</table></td></tr>
<tr><td>CurrentAreaNoRequest</td><td>R/O</td><td>EA</td><td>0: Factory area
1: User 1 area
2: User 2 area
3: User 3 area</td><td>0</td><td>EA?<CR><LF>

Display the currently configured Use Set Selector status. (Start up with the state saved to this area.)

The camera returns the latest used DATA AREA.</td></tr>
</table>

Name	Access	Short ASCII	Values	Default	
AcquisitionFrameLine	R/W	AR	1 ~ 325786	774	AR=[Param.]<CR><LF> AR?<CR><LF> Not required. Acquisition Frame Period exists. Maximum value is calculated depending on Height and Offset Y settings
GammaSelector	R/W	GMA	0(γ=0.45)/1(γ=0.60)/2(γ=1.0) 0(γ=0.45) 1(γ=0.60) 2(γ=1.0)	0	GMA=[Param.]<CR><LF> GMA?<CR><LF> Set the gamma value.
Temperature	R/O	TMP0	value	-	TMP0?<CR><LF> (Value÷128) = Temperature (C°) Display the internal temperature (C°) of the camera as a x128 value.
GpioPulseGenDivide Value	R/W	PGDEV	1 ~ 4096	1	PGDEV=[Param.]<CR><LF> PGDEV?<CR><LF> Set the division value for the prescaler (12-bit) using the pixel clock as the base clock.
GpioPulseGenLength0	R/W	PGL0	1 ~ 1048575	1	PGL0=[Param.]<CR><LF> PGL0?<CR><LF> Set the maximum count up value using clock value.
GpioPulseGen StartPoint0	R/W	PGST0	0 ~ 1048575	0	PGST0=[Param.]<CR><LF> PGST0?<CR><LF> Set the start point for the High interval using clock value. When the counter reaches this value, the output becomes 1.
GpioPulseGen EndPoint0	R/W	PGEN0	1 ~ 1048575	1	PGEN0=[Param.]<CR><LF> PGEN0?<CR><LF> Set the start point for the Low interval using clock value. When the counter reaches this value, the output becomes 0.

Name	Access	Short ASCII	Values	Default	
GpioPulseGen RepeatCount0	R/W	PGRPT0	0 ~ 255	0	PGRPT0=[Param.]<CR><LF> PGRPT0?<CR><LF> Set the repeat count for the counter. When this is set to 0, the counter will be free-running with limitless repeating.
GpioPulseGen ClearMode0	R/W	PGCM0	0: Free Run 1: Level High 2: Level Low 3: Rising Edge 4: Falling Edge	0	PGCM0=[Param.]<CR><LF> PGCM0?<CR><LF> Set the clear signal condition for the count clear input of the pulse generator.
GpioPulseGen SyncMode0	R/W	PGSM0	0: Async Mode 1: Sync Mode	0	PGSM0=[Param.]<CR><LF> PGSM0?<CR><LF> Select the sync mode for the count clear input signal.
GpioPulseGen Input0	R/W	PGIN0	0:Low 1:High 2:n/a 3:n/a 4:FrameTriggerWait 5:FrameActive 6:ExposureActive 7:FVAL 8:LVAL 10:UserOutput0 11:UserOutput1 12: TTL_In1 (Std Only) 13: CL_CC1_In 15:nand0 16:nand1	0	PGIN0=[Param.]<CR><LF> PGIN0?<CR><LF> Select the count clear input signal source.
GpioPulseGen Invert0	R/W	PGINV0	0:Non-Inv 1:Inv	0	PGINV0=[Param.]<CR><LF> PGINV0?<CR><LF> Select whether to invert the polarity of the count clear input signal.

Name	Access	Short ASCII	Values	Default	
GpioNand0 InputSource1	R/W	ND0IN1	0:Low 1:High 3: FrameTriggerWait 4: FrameActive 5: ExposureActive 6: Fval 7:LVAL 8: PulseGenerator0 10:UserOutput0 11:UserOutput1 12: TTL_In1 (Std Only) 13: CL_CC1_In 14: Nand1	0	ND0IN1=[Param.]<CR><LF> ND0IN1?<CR><LF> Select the input source signal for NAND0 In1.
GpioNand0 InputSource2	R/W	ND0IN2	Same as above	0	ND0IN2=[Param.]<CR><LF> ND0IN2?<CR><LF> Select the input source signal for NAND0 In2.
GpioNand1 InputSource1	R/W	ND1IN1	0:Low 1:High 3: FrameTriggerWait 4: FrameActive 5: ExposureActive 6: Fval 7:LVAL 8: PulseGenerator0 10:UserOutput0 11:UserOutput1 12: TTL_In1 (Std Only) 13: CL_CC1_In 15: Nand0	0	ND1IN1=[Param.]<CR><LF> ND1IN1?<CR><LF> Select the input source signal for NAND1 In1.
GpioNand1 InputSource2	R/W	ND1IN2	Same as above.	0	ND1IN2=[Param.]<CR><LF> ND1IN2?<CR><LF> Select the input source signal for NAND1 In2.
GpioNand0 InputInvert1	R/W	ND0INV1	0: Non-Inv 1: Inv	0	ND0INV1=[Param.]<CR><LF> ND0INV1?<CR><LF> Not required. LineInverter_ Nand0In1 exists.

Name	Access	Short ASCII	Values	Default	
GpioNand1 InputInvert1	R/W	ND1INV1	0: Non-Inv 1: Inv	0	ND1INV1=[Param.]<CR><LF> ND1INV1?<CR><LF> Not required. LineInverter_ Nand1In1 exists.
GpioNand0 InputInvert2	R/W	ND0INV2	0: Non-Inv 1: Inv	0	ND0INV2=[Param.]<CR><LF> ND0INV2?<CR><LF> Not required. LineInverter_ Nand1In1 exists.
GpioNand1 InputInvert2	R/W	ND1INV2	0: Non-Inv 1: Inv	0	ND1INV2=[Param.]<CR><LF> ND1INV2?<CR><LF> Not required. LineInverter_ Nand1In1 exists.
LUTSequenceR	R/W	LUTSR	0 ~ 4095 Color model only.	0	LUTSR =[Param.]<CR><LF> LUTSR?<CR><LF> When 256 commands are sent in succession, the LUT curve is updated (during WRITE) or the LUT curve is loaded sequentially (during READ). (Red signal)
LUTSequenceG	R/W	LUTSG	0 ~ 4095 Color model only.	0	LUTSG =[Param.]<CR><LF> LUTSG?<CR><LF> When 256 commands are sent in succession, the LUT curve is updated (during WRITE) or the LUT curve is loaded sequentially (during READ). (Green signal)
LUTSequenceB	R/W	LUTSB	0 ~ 4095 Color model only.	0	LUTSG =[Param.]<CR><LF> LUTSG?<CR><LF> When 256 commands are sent in succession, the LUT curve is updated (during WRITE) or the LUT curve is loaded sequentially (during READ). (Blue signal)
BlemishNum	R/O	BNUM	0 ~ 255	0	BNUM?<CR><LF> . Display the number of correction blemishes.
CameraLinkClock Frequency	R/W	CLCF	0= 84.85MHz 1= 74.25MHz 2= 37.12MHz	1	CLCF =[Param.]<CR><LF> CLCF?<CR><LF> Set eh Camera Link clock.

Name	Access	Short ASCII	Values	Default	
BINNING_GAIN_EN	R/W	BGOE	0: OFF 1: ON Mono model only	0	BGOE =[Param.]<CR><LF> BGOE?<CR><LF> Set whether to apply gain to the image during horizontal binning mode.
AlcStatus	R/O	ALCST	0: Off 1: Alc (P-Iris Model Only) 2: ASC 3: AGC	0	ALCST =[Param.]<CR><LF> ALCST?<CR><LF> Display whether Alc(exposure time) or Alc(gain) or Alc(white balance) or convergent is currently being used for control when using ALC.
VideoProcessBypass	R/W	VPB	0: OFF 1: ON	0	VPB =[Param.]<CR><LF> VPB?<CR><LF> Enable/disable video process bypass mode.
Frame rate min limit	R/O	ARMIN	6029 ~ 32764	6080	ARMIN?<CR><LF> Display the fastest value for the frame rate under the current configurations as a frame interval [us].
Exposure min limit	R/O	PEMIN	15 ~ 79	20	PEMIN?<CR><LF> Display the minimum value[us] for exposure time under the current configurations.
Exposure max limit	R/O	PEMAX	5976 ~ 8000000	8236	PEMAX?<CR><LF> Display the maximum value [us] for exposure time under the current configurations.

Miscellaneous

Troubleshooting

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

Power Supply and Connections

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

Cause and Solution: Camera initialization may not be complete. Check the Camera Link cable connection.

Image Display

Issue: Gradation in dark areas is not noticeable.

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

Settings and Operations

Issue: Settings cannot be saved to user memory.

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

Issue: I want to restore the factory default settings.

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

Specifications

<table>
<tr><th>Item</th><th colspan="5">GO-2400M-PMCL</th><th colspan="5">GO-2400C-PMCL</th></tr>
<tr><td>Scanning system</td><td colspan="10">Progressive scan</td></tr>
<tr><td>Synchronization</td><td colspan="10">Internal</td></tr>
<tr><td>Interface</td><td colspan="10">CameraLink (Version 2.0)</td></tr>
<tr><td>Image sensor</td><td colspan="5">1/1.2-inch monochrome CMOS</td><td colspan="5">1/1.2-inch Bayer color CMOS</td></tr>
<tr><td>Image size (effective image)</td><td colspan="10">11.3mm x 7.13mm (13.4mm diagonal)</td></tr>
<tr><td>Pixel size</td><td colspan="10">5.86 µm x 5.86 µm</td></tr>
<tr><td>Effective image pixel output</td><td colspan="10">1936 × 1216</td></tr>
<tr><td rowspan="2">Acquisition Frame Rate (max.)
The minimum value is 0.125 fps for all.</td><td colspan="10"><table>
<tr><td rowspan="5">8bit</td><td colspan="2">H1, V1</td><td colspan="2"></td><td>165.5 fps*</td></tr>
<tr><td rowspan="3">Binning
(Mono model only)</td><td colspan="2"></td><td>H1, V2</td><td>165.5 fps</td></tr>
<tr><td colspan="2"></td><td>H2, V1</td><td>165.5 fps</td></tr>
<tr><td colspan="2"></td><td>H2, V2</td><td>165.5 fps</td></tr>
<tr><td rowspan="5">10bit</td><td colspan="2">H1, V1</td><td colspan="2"></td><td>127.9 fps</td></tr>
<tr><td rowspan="3">Binning
(Mono model only)</td><td colspan="2"></td><td>H1, V2</td><td>127.9 fps</td></tr>
<tr><td colspan="2"></td><td>H2, V1</td><td>127.9 fps</td></tr>
<tr><td colspan="2"></td><td>H2, V2</td><td>127.9 fps</td></tr>
</table></td></tr>
<tr><td colspan="10">*When pixel format is RGB8, Acquisition Frame Rate (max) is 34.8fps.</td></tr>
<tr><td>EMVA 1288 parameters
Absolute sensitivity
Maximum SNR</td><td colspan="5">10bit output
6.82p (λ= 525 nm)
45.29 dB</td><td colspan="5">10bit output
6.94p (λ= 525 nm)
45.15 dB</td></tr>
<tr><td>SN ratio (traditional method)</td><td colspan="5">60 dB or more (standard)
(0 dB gain, Black)</td><td colspan="5">60 dB or more (standard)
(0 dB gain, Green Black)</td></tr>
<tr><td>Digital image output format</td><td colspan="10"><table>
<tr><td colspan="2">Full pixel</td><td>1936 (H) × 1216 (V)</td></tr>
<tr><td rowspan="4">ROI</td><td>Width</td><td>96 to 1936, 12 or 16 pixels/step</td></tr>
<tr><td>OffsetX</td><td>0 to 1920, 2 to 8 pixels/step</td></tr>
<tr><td>Height</td><td>2 to 1216, 2 line/step</td></tr>
<tr><td>OffsetY</td><td>0 to 1214, 2 lines/step</td></tr>
<tr><td rowspan="4">Binning</td><td>H (1)</td><td>1936 (H)</td></tr>
<tr><td>H (2)*</td><td>968 (H)</td></tr>
<tr><td>V (1)</td><td>1216 (V)</td></tr>
<tr><td>V (2)*</td><td>608 (V)</td></tr>
<tr><td colspan="2">Pixel Format</td><td>Mono model: Mono8、Mono10、Mono12
Color model: BayerRG8、BayerRG10、BayerRG12、RGB8、RGB10、RGB12</td></tr>
<tr><td colspan="3">*Mono model only</td></tr>
</table></td></tr>
<tr><td>Trigger Selector (Exposure)</td><td colspan="10">Frame Start</td></tr>
<tr><td>Exposure Mode</td><td colspan="10">Off, Timed (EPS) , Trigger Width (PWC)</td></tr>
</table>

<table>
<tr><th>Item</th><th colspan="3">GO-2400M-PMCL</th><th>GO-2400C-PMCL</th></tr>
<tr><td>Trigger Overlap</td><td colspan="4">Off / Read out</td></tr>
<tr><td>Trigger Input Signals</td><td colspan="4">Line4 - TTL In、Software、PG0、NAND Out0/1</td></tr>
<tr><td rowspan="3">Exposure Mode</td><td colspan="4">Timed: 28.7 µs (8-bit), 32.7 µs (10-bit) (min)*2 to 8 s (max), variable unit: 1 µs</td></tr>
<tr><td colspan="4">TriggerWidth: 28.7 µs (8-bit), 32.7 µs (10-bit) (min)*2 to ∞ (max)</td></tr>
<tr><td colspan="4">*Performance verified for up to 1 second. Min. value varies depending on Tap Geometry setting.
*The minimum exposure time consists of the image sensor's offset duration (13.7 µs) added to the setting configured on the camera.</td></tr>
<tr><td>Exposure Auto</td><td colspan="4">Off / Continuous</td></tr>
<tr><td>AGC/ASC Control Speed (Auto Exposure Response Speed)</td><td colspan="4">1 ~ 8</td></tr>
<tr><td>Video Send Mode Selector</td><td colspan="4">Normal ROI, Trigger Sequencer, Command Sequencer</td></tr>
<tr><td>Digital I/O</td><td colspan="4">Line Selector (4P) : GPIO IN / GPIO OUT</td></tr>
<tr><td>Black level adjustment</td><td colspan="4"><table>
<tr><td>Default Level</td><td>33LSB (10bit output)</td></tr>
<tr><td>Video level adjustment range</td><td>0 ~ 100 (10bit output)</td></tr>
<tr><td>Adjustment range</td><td>-33LSB to +64LSB against reference level (during 10-bit output)</td></tr>
<tr><td>Resolution adjustment</td><td>1 STEP = 0.25LSB</td></tr>
</table></td></tr>
<tr><td>Gain adjustment</td><td colspan="4"><table>
<tr><td>Manual adjustment range</td><td>0 dB ~ + 24 d, 1 step = x0.01 (0.005 dB to 0.08 dB) (varies by setting value)</td></tr>
<tr><td>Auto gain</td><td>Off / Continuous</td></tr>
<tr><td>WB gain*</td><td>R / B: -7 dB to +15 dB, 1 step = 0.1 dB</td></tr>
<tr><td>WB Preset*</td><td>4600K, 5600K, 6500K</td></tr>
<tr><td>WB area*</td><td>16 (4 × 4) Area</td></tr>
<tr><td>WB range*</td><td>3000 K to 9000 K</td></tr>
<tr><td>White balance*</td><td>Off, Continuous, Once</td></tr>
<tr><td colspan="2">*Color Model Only</td></tr>
</table></td></tr>
<tr><td>Blemish correction</td><td colspan="4"><table>
<tr><td>Detection</td><td>Detect white blemishes using threshold values (black blemish correction performed only at factory)</td></tr>
<tr><td>Correction</td><td>Interpolation using adjacent pixels (continuous blemishes not corrected)</td></tr>
<tr><td>Correctable pixels</td><td>256 pixels</td></tr>
</table></td></tr>
<tr><td>ALC</td><td colspan="4">Adjusts exposure automatically using combination of AGC and auto exposure</td></tr>
<tr><td>Gamma</td><td colspan="4">0.45, 0.6, 1.0 (OFF) (3 steps available)</td></tr>
<tr><td>LUT</td><td colspan="4">OFF: γ = 1.0, ON = 256 points can be set</td></tr>
<tr><td>Power Supply</td><td colspan="4"><table>
<tr><td rowspan="3">4-pin connector</td><td>Input range</td><td>DC +12 V to +24 V ±10% (via input terminal)</td></tr>
<tr><td>Current</td><td>230 mA ±20 mA (at 12 V input, full pixel) (Typical)</td></tr>
<tr><td>Power consumption</td><td>2.76 W at 12 V input, full pixel (Typical)</td></tr>
<tr><td rowspan="3">PoCL</td><td>Input range</td><td>DC 12 V ± 10%</td></tr>
<tr><td>Current</td><td>230 mA ±20 mA (at 12 V input, full pixel) (Typical)</td></tr>
<tr><td>Power consumption</td><td>2.76 W at 12 V input, full pixel (Typical)</td></tr>
</table></td></tr>
</table>

Item	GO-2400M-PMCL	GO-2400C-PMCL
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 ~ + 45°C / 20% ~ 80% (non-condensing)	
Storage temperature / humidity	- 25°C ~ + 60°C / 20% ~ 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 protrusions)	
Weight	46 g	

Notes:

- Approximately 5 minutes of warm-up are required to achieve these specifications.
- Design and specifications are subject to change without notice.

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

Optional accessories (not supplied)

- MP-43 tripod mount

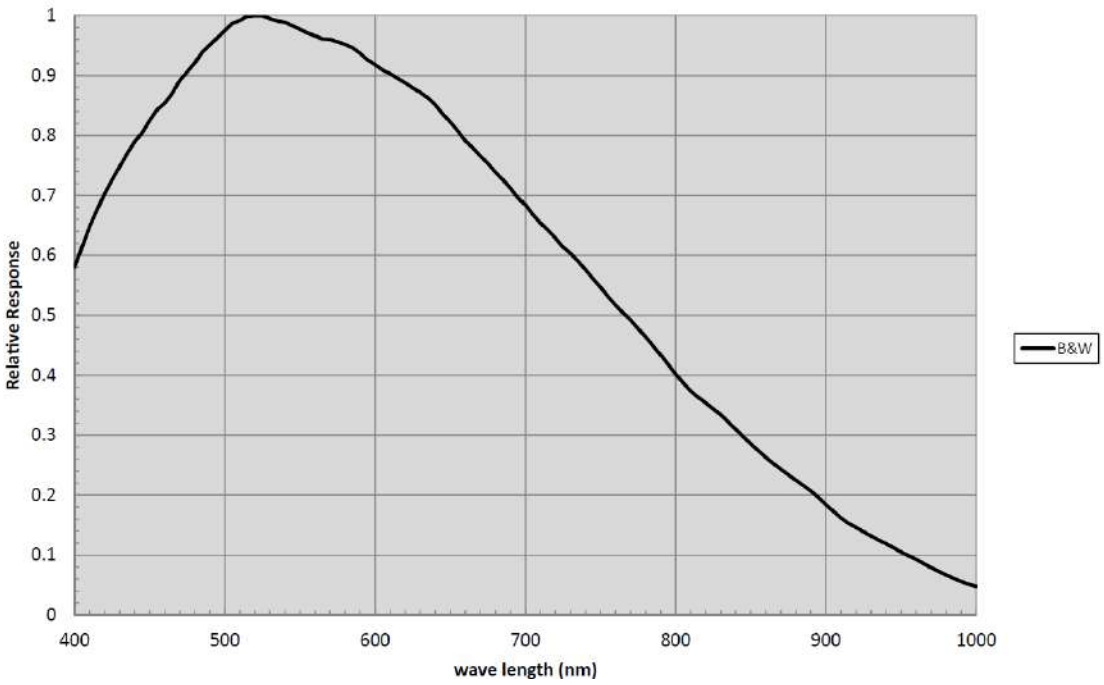
Frame Rate Reference

Theoretical value: decimal values are dropped, during Unpacked

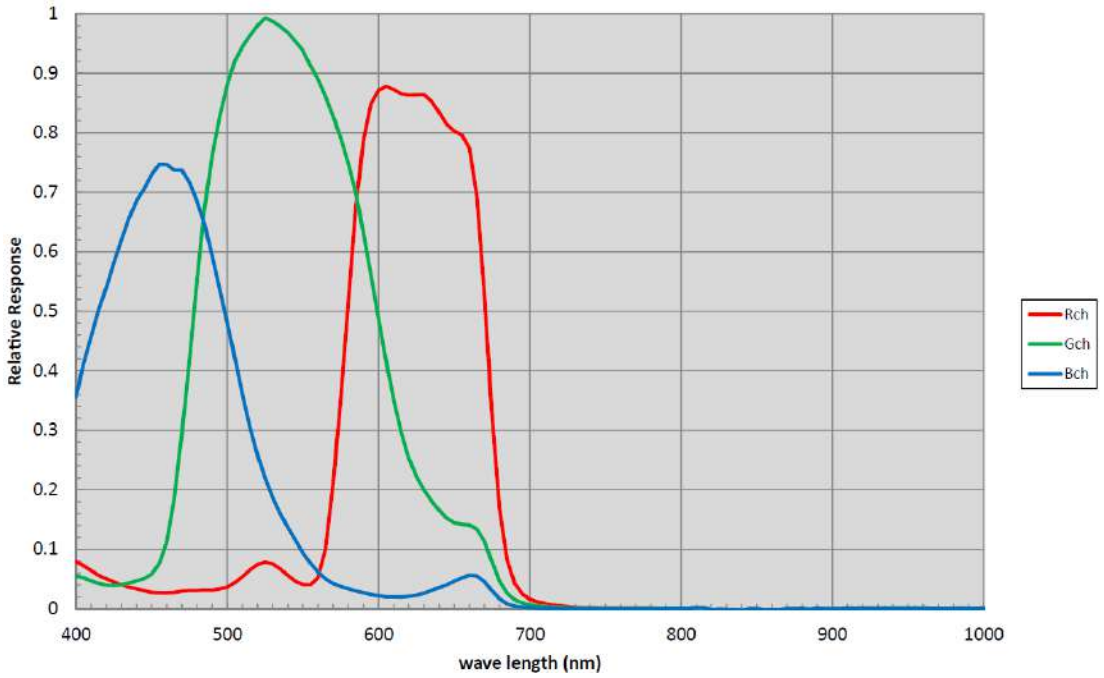
Pixel Count	Resolution (Screen Size)	ROI/Binning	Pixel Size (μm)	Image Size	Frame Rate 8 / 10 / 12 bit
2.35 MP	1936 × 1216	Full pixel	5.86 × 5.86	1/1.2" (13.40 mm)	165 fps (@ 8 bit)
2 MP	1920 × 1080	ROI	5.86 × 5.86	1/1.2" (12.91 mm)	185 fps (@ 8 bit)
1.4 MP	1400 × 1050	ROI	5.86 × 5.86	1/1.6" (10.26 mm)	190 fps (@ 8 bit)
1.3 MP	1280 × 1024	ROI	5.86 × 5.86	1/1.7" (9.61 mm)	195 fps (@ 8 bit)
0.5 MP	800 × 600	ROI	5.86 × 5.86	1/2.7" (5.86 mm)	324 fps (@ 8 bit)
0.3 MP	640 × 480	ROI	5.86 × 5.86	1/3.4" (4.69 mm)	400 fps (@ 8 bit)

Spectral Response

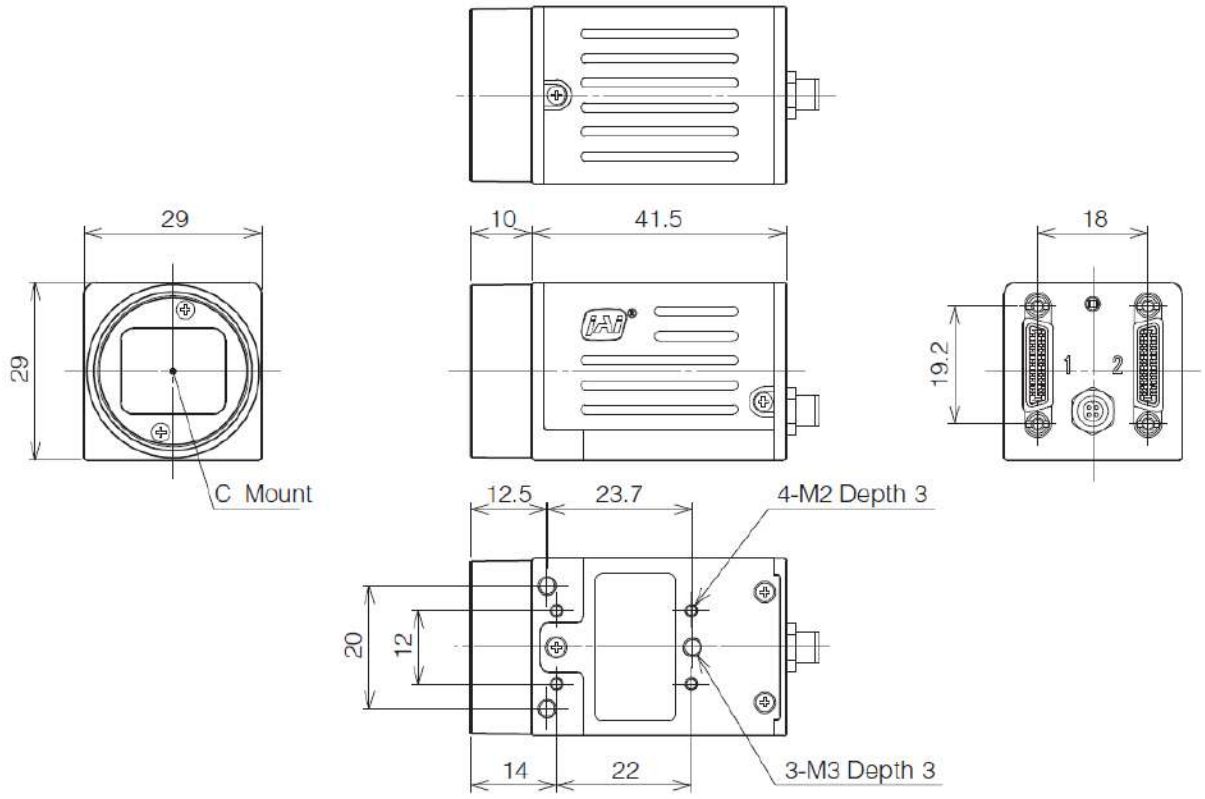
GO-2400M-PMCL



GO-2400C-PMCL



Dimensions



Notes:

- Dimensional tolerance: ± 0.3mm
- Unit: mm

User's Record

Model name: ……

Revision: ……

Serial No: ……

Firmware version: ……

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

Revision History

Revision	Date	Device Version	Changes
2.5	2023/06/19	DV0119	Redesigned the user manual and corrected/updated topics.
2.4	Nov. 2020	-	Fixed TriggerOverlap and others.
2.3	Feb. 2020	-	Add Note, binning mode cannot be used in video process bypass mode.
2.2	Mar. 2019	-	Add KC, actual exposure time

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