See the possibilities

User Manual

GO-5000M-PMCL-UV

CMOS Digital Progressive Scan
Monochrome UV Camera
Document Version: 1.0
GO-5000M-PMCL-UV_Ver.1.0_Feb.2021

Thank you for purchasing this product.

⚠ Be sure to read this manual before use.

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

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

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Notice

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Company and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

Warranty

For information about the warranty, please contact your factory representative.

Certifications

CE compliance

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that GO-5000M-PMCL-UV 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 A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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

Warning

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

Supplement

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

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

重要注意事项

有毒，有害物质或元素名称及含量表

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

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

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572-2011规定的限量要求以下。
×: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572-2011规定的限量要求。
（企业可在此处,根据实际情况对上表中打“×”的技术原因进行进一步说明。）

环保使用期限

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

数字「15」为期限15年。

Usage Precautions

Notes on cable configurations

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

Notes on attaching the lens

Avoiding dust particles

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

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

Phenomena specific to CMOS image sensors

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

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

Notes on exportation

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

Features

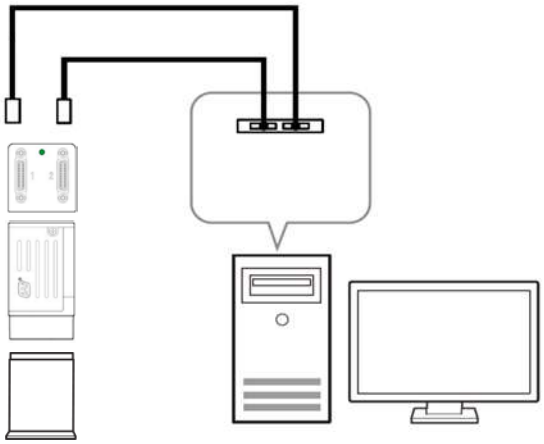
The GO-5000M-PMCL-UV is an industrial progressive scan camera equipped with a 1-inch global shutter CMOS image sensor with 5.2 effective megapixels (2560 × 2048). This CMOS image sensor has sensitivity in the UV region.
The unit is compact and lightweight in design and is equipped with Mini Camera Link interface Supporting a “Power over Camera Link” capability.

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

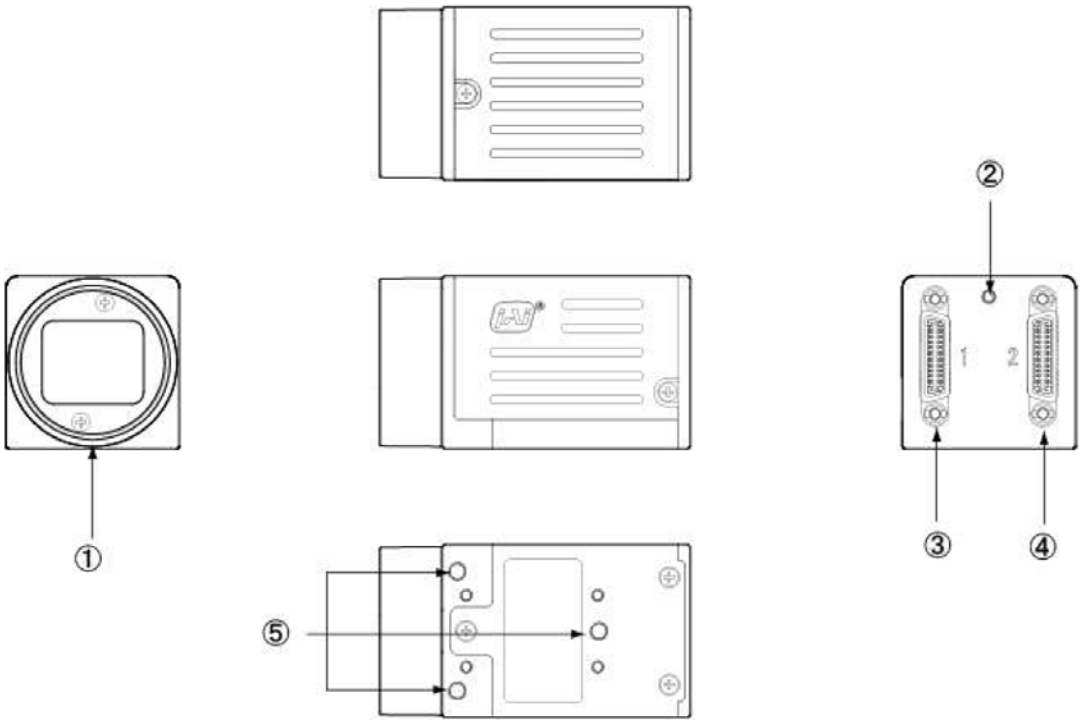
Feature overview

☐ New small-in-size 1-inch CMOS 5-megapixel progressive scan camera
☐ Utilizes two Mini Camera Link interfaces to support Base, Medium or Full configurations
☐ Aspect ratio 5:4, 2560 (H) x 2048 (V) - 5 million effective pixels
☐ 5 μm square pixels
☐ S/N 55dB (Dark compression is used, traditional measurement method)
☐ 8-bit, 10-bit or 12-bit output for monochrome and Bayer
☐ 107.2 frames/second with full resolution in continuous operation for 8-tap, 63.6 frames/second for 4-tap, 47.8 frames/second for 3-tap, and 31.9 fps for 2-tap readout
☐ Supports ROI (Region Of Interest) modes for faster frame rate
☐ 0dB to +24dB gain control
☐ 10 μs (1/100,000) to 8 seconds exposure control in 1 μs step
☐ Auto exposure control
☐ Timed and trigger width exposure control
☐ RCT trigger mode for specific applications
☐ ALC control with combined function of AGC and Auto Shutter
☐ Various pre-processing circuits are provided
  Programmable LUT
  Gamma correction (3 steps: 0.45, 0.6 and 1.0)
  Shading correction
  Blemish compensation
  HDR (High Dynamic Range) function
☐ C-mount for lens mount
☐ Accepts power over Mini Camera Link

Connection example:



Parts Identification



① Lens mount（C-mount）

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

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

② POWER/TRIG LED

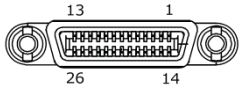
Indicates the power and trigger input status.

LED status and camera status

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

③ Camera Link Connector 1

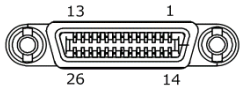
Connect a cable that is compatible with Mini Camera Link (SDR) connectors here.



Pin No.	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 out
7(+), 20(−)	In	SerTC (RxD)	LVDS Serial Control
8(−), 21(+)	Out	SerTFG (TxD)	
9(−), 22(+)	In	CC1 (Trigger)	JAI standard trigger
10(+), 23(−)	In	CC2 (Reserved)	
11,24		N.C.	
12,25		N.C.	
13,14		Shield	GND

④ Camera Link Connector 2

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



Pin No.	Input/Output	Signal	Description
1, 26		Power	Power
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
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

⑤ Camera locking screw 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.

Preparation

Preparation Process

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

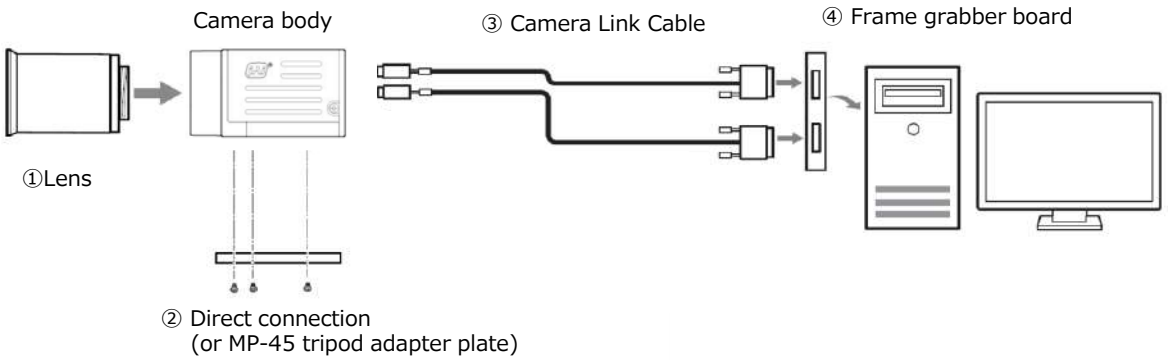
Short ASCII commands

The most universal method for controlling a Camera Link camera such as the GO-5000M-PMCL-UV 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 can be found at the end of this manual.

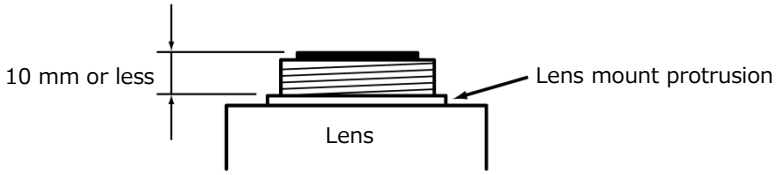
Later sections of the manual refer to GenICam nomenclature for various features/functions, and includes a complete list of all camera settings starting on Page 54. The GO-5000M-PMCL-UV fully supports applications written using GenICam-based SDKs. The advantage of this is that programs written using GenICam 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: Connecting Devices



① Lens

・C-mount lenses with lens mount protrusions of 10 mm or less can be attached.



・To prevent vignetting and to obtain the optimal resolution, use a lens that will cover the image sensor size.

Model name	Image Sensor		
GO-5000M-PMCL-UV	Mono	1 inch	12.8mm x 10.24mm (16.392mm diagonal)

Caution

・The maximum performance of the camera may not be realized depending on the lens.
・Attaching a lens with a mount protrusion of 10 mm or longer may damage the lens or camera.

Note

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

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

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

Caution

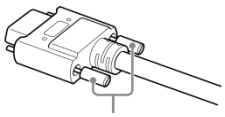
For heavy lenses, be sure to support the lens itself. Do not use configurations in which its weight is supported by the camera.

③ Camera Link cable

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

Caution

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



Secure manually.
Do not secure too tightly.

④ Frame grabber board

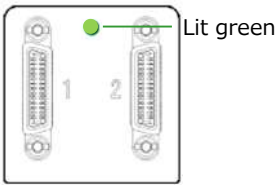
Refer to the operating instructions of the frame grabber board, and configure settings on the computer as necessary.

Step 2: Verifying Camera Operation

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

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

When properly turned on



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

Step 3: Verifying the Connection between the Camera and PC

Use a short ASCII command to verify whether the GO-5000M-PMCL-UV is properly recognized in your setup.

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

Then set the following serial communication.

Baud Rate	9600
Data Length	8bit
Start Bit	1bit
Stop Bit	1bit
Parity	Non
Xon/Xoff Control	Non

Please 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**	Display the device vendor name. "JAI Corporation"

Step 4: Changing the Camera Settings

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

Configuring the Output Format

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

Factory default values

Item		Default value
ImageFormatControl	Width	2560
	Height	2048
	OffsetX (horizontal position)	0
	OffsetY (vertical position)	0
	PixelFormat	Mono8

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

1 **Example of changing the [Width] setting of [ImageFormatControl].**

Use the Short ASCII command WTC.

You can check the current [Width] setting with **WTC? <CR> <LF>.**

To change the setting of [Width] to 2480, execute the following command.
WTC=2480<CR><LF>

To change the settings of other items, please use the Short ASCII command below.

Width	**WTC**	2～2560 2 pixels/step
Height	**HTL**	1～2048 1 lines/step
OffsetX	**OFC**	0～2558 2 pixels/step
OffsetY	**OFL**	0～2047 1 lines/step
PixelFormat	**BA**	0. Mono8 1. Mono10 2. Mono12

2 **Example of changing the [PixelFormat] setting of [ImageFormatControl] .**

Use the Short ASCII command BA.

You can check the current [PixelFormat] setting with **BA? <CR> <LF>.**

To change the setting of [PixelFormat] to Mono10, execute the following command.
BA=1<CR><LF>

Step 5: Adjusting the Image Quality

Display the camera image and adjust the image quality.

Displaying the Image

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

Adjusting the Gain

The gain control uses Analog Base Gain and Digital Gain.
Analog Base Gain can be set at 0dB, +6dB or +12dB.
The digital gain is used for the master gain setting.

For setting the gain,
1. Set analog gain (Select from 0dB, +6dB and +12dB)
2. Set digital gain
   The master gain (DigitalAll) can be set x1 (0dB) to x16 (+24dB) against the analog base gain. The resolution for gain setting is x0.01/step which is 0.05dB to 0.08dB, depending on the setting value.

Item	Short ASCII Command	Description
GainRawDigitalAll	**FGA**	It can be set in the range from 1 time to 16 times. Please specify with a value between 100 and 1600.
AnalogBaseGainAll	**ABALL**	It can be set in the range from 0 to 2. (0:0dB, 1:6dB, 2:12dB)
GainAuto	**AGC**	0:Off, 1:Continuous

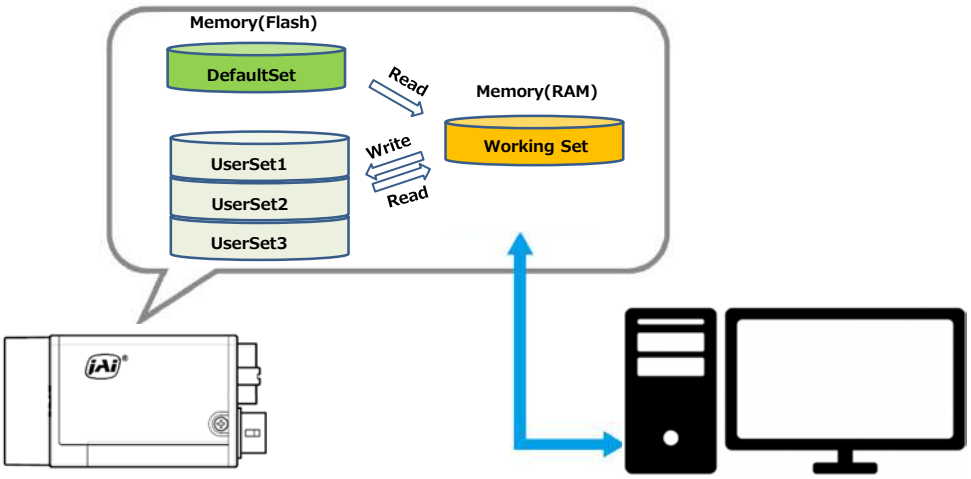
Adjusting the Black Level

The black level can be set in the following range.
GO-5000M-PMCL-UV: DigitalAll : -256～ +255

Item	Short ASCII Command	Description
BlackLevelRawAll	**BL**	It can be set in the range from -256 to 255.

Step 6: Saving the Settings

The setting values configured 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. (UserSet1 to UserSet3)



■ **To save user settings**

1 **Stop image acquisition.**

2 **Specify the storage location (UserSet1 - UserSet3) using the UserSetSave command and save the current camera settings.**

To save to UserSet1, execute the command **SA=1<CR><LF>**.

Note

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

Caution

Settings can only be saved when image acquisition on the camera is stopped.

Item	Short ASCII command	Description
UserSetLoad	**LD**	Set the specified user setting to the camera. 0: Default 1: UserSet1 2: UserSet2 3: UserSet3
UserSetSave	**SA**	Save the current camera settings in the specified user setting area. 1: UserSet1 2: UserSet2 3: UserSet3

■ **To load 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.**

To read the settings saved in UserSet 1, execute the command **LD=1<CR><LF>**.

Main Functions

Camera Link Interface

Port	Camera Link Configuration		Base	Base	Medium	Full	80bit
	Camera Link port/bit		2Tap / 12bit	3Tap/8bit	4Tap / 12bit	8 Tap / 8bit	8 Tap / 10bit
	GenICam Tap Geometry		1X2 - 1Y	1X3 - 1Y	1X4 - 1Y	1x8 - 1Y	1X8 - 1Y
Digital I/O-1	Port A0	TxIN 0	Tap1 D0	Tap 1 D0	Tap 1 D0	Tap 1 D0	Tap 1 D2
	Port A1	TxIN 1	Tap1 D1	Tap 1 D1	Tap 1 D1	Tap 1 D1	Tap 1 D3
	Port A2	TxIN 2	Tap1 D2	Tap 1 D2	Tap 1 D2	Tap 1 D2	Tap 1 D4
	Port A3	TxIN 3	Tap1 D3	Tap 1 D3	Tap 1 D3	Tap 1 D3	Tap 1 D5
	Port A4	TxIN 4	Tap1 D4	Tap 1 D4	Tap 1 D4	Tap 1 D4	Tap 1 D6
	Port A5	TxIN 6	Tap1 D5	Tap 1 D5	Tap 1 D5	Tap 1 D5	Tap 1 D7
	Port A6	TxIN 27	Tap1 D6	Tap 1 D6	Tap 1 D6	Tap 1 D6	Tap 1 D8
	Port A7	TxIN 5	Tap1 D7	Tap 1 D7	Tap 1 D7	Tap 1 D7	Tap 1 D9
	Port B0	TxIN 7	Tap1 D8	Tap 2 D0	Tap 1 D8	Tap 2 D0	Tap 2 D2
	Port B1	TxIN 8	Tap1 D9	Tap 2 D1	Tap 1 D9	Tap 2 D1	Tap 2 D3
	Port B2	TxIN 9	Tap1 D10	Tap 2 D2	Tap 1 D10	Tap 2 D2	Tap 2 D4
	Port B3	TxIN 12	Tap1 D11	Tap 2 D3	Tap 1 D11	Tap 2 D3	Tap 2 D5
	Port B4	TxIN 13	Tap2 D8	Tap 2 D4	Tap 2 D8	Tap 2 D4	Tap 2 D6
	Port B5	TxIN 14	Tap2 D9	Tap 2 D5	Tap 2 D9	Tap 2 D5	Tap 2 D7
	Port B6	TxIN 10	Tap2 D10	Tap 2 D6	Tap 2 D10	Tap 2 D6	Tap 2 D8
	Port B7	TxIN 11	Tap2 D11	Tap 2 D7	Tap 2 D11	Tap 2 D7	Tap 2 D9
	Port C0	TxIN 15	Tap2 D0	Tap 3 D0	Tap 2 D0	Tap 3 D0	Tap 3 D2
	Port C1	TxIN 18	Tap2 D1	Tap 3 D1	Tap 2 D1	Tap 3 D1	Tap 3 D3
	Port C2	TxIN 19	Tap2 D2	Tap 3 D2	Tap 2 D2	Tap 3 D2	Tap 3 D4
	Port C3	TxIN 20	Tap2 D3	Tap 3 D3	Tap 2 D3	Tap 3 D3	Tap 3 D5
	Port C4	TxIN 21	Tap2 D4	Tap 3 D4	Tap 2 D4	Tap 3 D4	Tap 3 D6
	Port C5	TxIN 22	Tap2 D5	Tap 3 D5	Tap 2 D5	Tap 3 D5	Tap 3 D7
	Port C6	TxIN 16	Tap2 D6	Tap 3 D6	Tap 2 D6	Tap 3 D6	Tap 3 D8
	Port C7	TxIN 17	Tap2 D7	Tap 3 D7	Tap 2 D7	Tap 3 D7	Tap 3 D9
	-	TxIN 24	LVAL	LVAL	LVAL	LVAL	LVAL
	-	TxIN 25	FVAL	FVAL	FVAL	FVAL	FVAL
	(Port I0)	TxIN 26	DVAL	DVAL	DVAL	DVAL	Tap 1 D0
	(Port I1)	TxIN 23	Exposure Active	Exposure Active	Exposure Active	Exposure Active	Tap 1 D1

Port	Camera Link Configuration		Base	Base	Medium	Full	80bit
	Camera Link port/bit		2Tap / 12bit	3Tap/8bit	4Tap / 12bit	8 Tap / 8bit	8 Tap / 10bit
	GenICam Tap Geometry		1X2 - 1Y	1X3 - 1Y	1X4 - 1Y	1x8 - 1Y	1X8 - 1Y
Digital I/O-2 (1/2)	Port D0	TxIN 0	–	–	Tap 4 D0	Tap 4 D0	Tap 4 D2
	Port D1	TxIN 1	–	–	Tap 4 D1	Tap 4 D1	Tap 4 D3
	Port D2	TxIN 2	–	–	Tap 4 D2	Tap 4 D2	Tap 4 D4
	Port D3	TxIN 3	–	–	Tap 4 D3	Tap 4 D3	Tap 4 D5
	Port D4	TxIN 4	–	–	Tap 4 D4	Tap 4 D4	Tap 4 D6
	Port D5	TxIN 6	–	–	Tap 4 D5	Tap 4 D5	Tap 4 D7
	Port D6	TxIN 27	–	–	Tap 4 D6	Tap 4 D6	Tap 4 D8
	Port D7	TxIN 5	–	–	Tap 4 D7	Tap 4 D7	Tap 4 D9
	Port E0	TxIN 7	–	–	Tap 3 D0	Tap 5 D0	Tap 5 D2
	Port E1	TxIN 8	–	–	Tap 3 D1	Tap 5 D1	Tap 5 D3
	Port E2	TxIN 9	–	–	Tap 3 D2	Tap 5 D2	Tap 5 D4
	Port E3	TxIN 12	–	–	Tap 3 D3	Tap 5 D3	Tap 5 D5
	Port E4	TxIN 13	–	–	Tap 3 D4	Tap 5 D4	Tap 5 D6
	Port E5	TxIN 14	–	–	Tap 3 D5	Tap 5 D5	Tap 5 D7
	Port E6	TxIN 10	–	–	Tap 3 D6	Tap 5 D6	Tap 5 D8
	Port E7	TxIN 11	–	–	Tap 3 D7	Tap 5 D7	Tap 5 D9
	Port F0	TxIN 15	–	–	Tap 3 D8	Tap6 D0	Tap 6 D2
	Port F1	TxIN 18	–	–	Tap 3 D9	Tap6 D1	Tap 6 D3
	Port F2	TxIN 19	–	–	Tap 3 D10	Tap6 D2	Tap 6 D4
	Port F3	TxIN 20	–	–	Tap 3 D11	Tap6 D3	Tap 6 D5
	Port F4	TxIN 21	–	–	Tap 4 D8	Tap6 D4	Tap 6 D6
	Port F5	TxIN 22	–	–	Tap 4 D9	Tap6 D5	Tap 6 D7
	Port F6	TxIN 16	–	–	Tap 4 D10	Tap6 D6	Tap 6 D8
	Port F7	TxIN 17	–	–	Tap 4 D11	Tap6 D7	Tap 6 D9
	-	TxIN 24	–	–	LVAL	LVAL	LVAL
	(Port I2)	TxIN 25	–	–	FVAL	FVAL	Tap 2 D0
	(Port I3)	TxIN 26	–	–	DVAL	DVAL	Tap 2 D1
	(Port I4)	TxIN 23	–	–	Exposure Active	Exposure Active	Tap 3 D0

Port	Camera Link Configuration		Base	Base	Medium	Full	80bit
	Camera Link port/bit		2Tap / 12bit	3Tap/8bit	4Tap / 12bit	8 Tap / 8bit	8 Tap / 10bit
	GenICam Tap Geometry		1X2 - 1Y	1X3 - 1Y	1X4 - 1Y	1x8 - 1Y	1X8 - 1Y
Digital I/O-2 (2/2)	Port G0	TxIN 0	–	–	–	Tap 7 D0	Tap 7 D2
	Port G1	TxIN 1	–	–	–	Tap 7 D1	Tap 7 D3
	Port G2	TxIN 2	–	–	–	Tap 7 D2	Tap 7 D4
	Port G3	TxIN 3	–	–	–	Tap 7 D3	Tap 7 D5
	Port G4	TxIN 4	–	–	–	Tap 7 D4	Tap 7 D6
	Port G5	TxIN 6	–	–	–	Tap 7 D5	Tap 7 D7
	Port G6	TxIN 27	–	–	–	Tap 7 D6	Tap 7 D8
	Port G7	TxIN 5	–	–	–	Tap 7 D7	Tap 7 D9
	Port H0	TxIN 7	–	–	–	Tap 8 D0	Tap 8 D2
	Port H1	TxIN 8	–	–	–	Tap 8 D1	Tap 8 D3
	Port H2	TxIN 9	–	–	–	Tap 8 D2	Tap 8 D4
	Port H3	TxIN 12	–	–	–	Tap 8 D3	Tap 8 D5
	Port H4	TxIN 13	–	–	–	Tap 8 D4	Tap 8 D6
	Port H5	TxIN 14	–	–	–	Tap 8 D5	Tap 8 D7
	Port H6	TxIN 10	–	–	–	Tap 8 D6	Tap 8 D8
	Port H7	TxIN 11	–	–	–	Tap 8 D7	Tap 8 D9
	(Port I5)	TxIN 15	–	–	–		Tap 3 D1
	(Port I6)	TxIN 18	–	–	–		Tap 4 D0
	(Port I7)	TxIN 19	–	–	–		Tap 4 D1
	(Port K0)	TxIN 20	–	–	–		Tap 5 D0
	(Port K1)	TxIN 21	–	–	–		Tap 5 D1
	(Port K2)	TxIN 22	–	–	–		Tap 6 D0
	(Port K3)	TxIN 16	–	–	–		Tap 6 D1
	(Port K4)	TxIN 17	–	–	–		Tap 7 D0
	-	TxIN 24	–	–	–	LVAL	LVAL
	(Port K5)	TxIN 25	–	–	–	FVAL	Tap 7 D1
	(Port K6)	TxIN 26	–	–	–	DVAL	Tap 8 D0
	(Port K7)	TxIN 23	–	–	–	Exposure Active	Tap 8 D1

Note

1. In this table, not all tap geometry items are described. For instance, 1X4–1Y shows only 12-bit. In case of 10-bit, upper 2 bits (D10 and D11) are not used and in case of 8-bit, upper 4 bits (D8 through D11) are not used.

2. Please check whether the frame grabber complies with those formats if you use 80-bit (8-tap/10-bit) camera configuration.

3. If you use 80-bit (8-tap/10-bit) camera configuration, DVAL and Exposure Active (JAI custom) are not output through the Camera Link interface. FVAL is only output via Digital I/O-1 connector.

Camera Link pixel clock frequency

In the GO-5000M-PMCL-UV, the Camera Link pixel clock can be selected from 84.99 MHz, 72.85 MHz, 58.28 MHz, and 48.57 MHz. If the 48.57MHz clock is used, the transfer length through the camera link cable will be extended to 10m for all tap geometries. On the other hand, the frame rate will be reduced (see table). The default setting is 72.85 MHz.

Camera Link Pixel Clock	Maximum length	1X2-1Y	1X3-1Y	1X4-1Y	1X8-1Y	
		8/10/12bit	8bit	8/10/12bit	8bit	10bit
High (84.99MHz)	5m	31.9	47.8	63.6	-	-
Mid (72.85 MHz)	5m	27.4	41.0	54.7	-	-
High (72.85 MHz)	10m	-	-	-	107.2	-
Mid (58.28 MHz)	10m	-	-	-	-	84.9
Low (48.57 MHz)	10m	18.3	27.4	36.4	70.8	70.8

Note: The maximum lengths shown in the above table are guidelines. Operating at these lengths may generate bit noise, depending on the cable used.

Digital IN/OUT interface

In the GO-5000M-PMCL-UV, the software control tool can assign the necessary signals used in the system to digital inputs and outputs.

Line Selector

In the Line Selector, the following input and output signals can be assigned.

Line Selector item	Description
NAND 0 IN 1	No. 1 input to the first NAND gate
NAND 0 IN 2	No. 2 input to the first NAND gate
NAND 1 IN 1	No. 1 input to the second NAND gate
NAND 1 IN 2	No. 2 input to the second NAND gate

Line Source

Line source signal can be selected from the following table to connect it to the line item which is selected in the line selector.

Line Source item	Description
Low	Connect Low Level signal to line item selected in Line Selector, **Default setting**
High	Connect High Level signal to line item selected in Line Selector
Frame Trigger Wait	Connect Frame Trigger Wait signal to line item selected in Line Selector
Frame Active	Connect Frame Active signal to line item selected in Line Selector
Exposure Active	Connect Exposure Active signal to line item selected in Line Selector
FVAL	Connect FVAL signal to line item selected in Line Selector
LVAL	Connect LVAL signal to line item selected in Line Selector
Pulse Generator 0 Out	Connect Pulse Generator 0 signal to line item selected in Line Selector
CL CC1 In	Connect CL CC1 IN signal to line item selected in Line Selector
NAND 0 Out	Connect NAND 0 signal to line item selected in Line Selector
NAND 1 Out	Connect NAND 1 signal to line item selected in Line Selector

Note)
As for LVAL, some line items cannot be connected. Refer to “GPIO matrix table”.

Line Mode

Indicates the status of the item selected in Line Selector. (INPUT or OUTPUT)

Line Inverter

Inverts the signal polarity for the item selected in Line Selector. (False=Positive, True=Negative)

Line Status

Indicates the status of the selected signal (input or output) (True=High, False=Low)

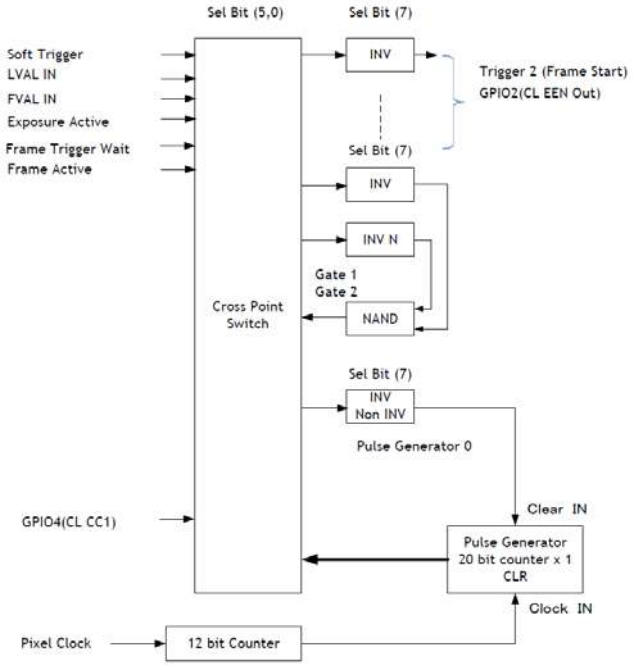
Line Format

Indicates the interface information of the input and output lines.
Not connected, TTL, LVDS or Opto-coupled
Note: In the GO-5000M-PMCL-UV, Opto-coupled interface is not available.

GPIO

GPIO is a general interface for input and output which controls the I/O for trigger signals and other valid signals and pulse generators. By using this interface you can control an external light source, make a delay function for an external trigger signal, or make a precise exposure setting together with a PWC trigger.

Basic block diagram



GPIO IN/OUT Matrix

Selector (Cross point switch output) / Source signal (Cross point switch input)	Trigger Selector	Line Selector				Pulse Generator Selector
	Trigger Source (Frame Start)	NAND 1 In 1	NAND 1 In 2	NAND 2 In 1	NAND 2 In 2	Pulse Generator 0
Low	○	○	○	○	○	○
High	○	○	○	○	○	○
Soft Trigger	○	×	×	×	×	×
Exposure Active	×	○	○	○	○	○
Frame Trigger Wait	×	○	○	○	○	○
Frame Active	×	○	○	○	○	○
FVAL	×	○	○	○	○	○
LVAL	×	×	×	×	×	○
Pulse Generator 0	○	○	○	○	○	×
CL CC1 in	○	○	○	○	○	○
NAND 0 Out	○	×	×	○	○	○
NAND 1 Out 1	○	○	○	×	×	○
	Trigger Source					Pulse Generator Clear Source

Pulse Generator

The GO-5000M-PMCL-UV has a frequency divider using the sensor clock as the basic clock and one pulse generator. In the Pulse Generator, various Clear settings are connected to GPIO. The following shows the Pulse Generator default settings. In the GO-5000M-PMCL-UV, the sensor pixel clock is 36 MHz for 8-bit, 28.8MHZ for 10-bit and 24 MHZ for 12-bit.

Pulse Generator default settings

Display Name	Value							
Clock Pre-scaler	1							
Pulse Generator Selector	Pulse Generator							
	Length	Start Point	End Point	Repeat Count	Clear Source	Clear Inverter	Clear Activation	Clear Sync Mode
- Pulse Generator 0	1	0	1	0	Off	True	Off	Async Mode

Note:]
When Pulse Generator Repeat Count is set to "0", the camera is operating in free-running mode. However, based on the above default settings, Length=1, Start Point=0 and End Point=1, Pulse Generator stops at High output. Therefore, if Start Point=0 and End Point=1 are configured, Length should be "2" as the minimum active width.

Clock Pre-scaler

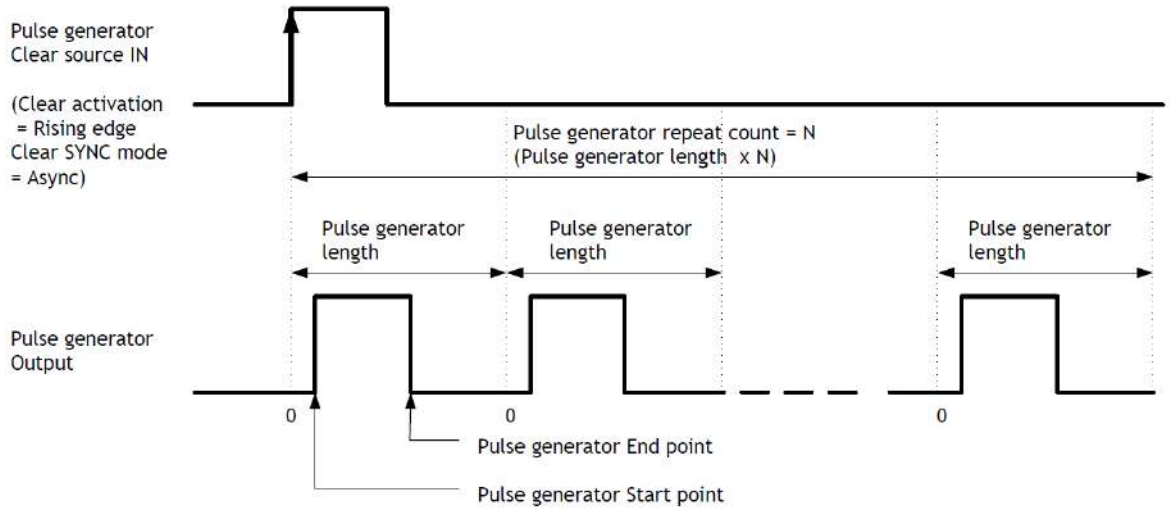
Clock pre-scaler (Divide Value) can set the dividing value of the frequency divider (12-bit length) and the sensor clock is used for this. Four built-in pulse generators work by the same clock.

Pulse Generator Selector

The GO-5000M-PMCL-UV has only one pulse generator. Therefore, it is fixed.

Pulse Generator setting / Pulse Generator pulse construction

Trigger Selector item	Description
Pulse Generator 0	If Pulse Generator 0 is selected, Length Start Point, End Point, Repeat Count, Clear Source, Clear Inverter Clear Activation and Clear Sync Mode of pulse generator 0 are displayed under the selector.



Pulse Generator Length

Set the counter up value for the pulse generator. If Repeat Count value is “0” and if Pulse Generator Clear signal is not input, the pulse generator generates the pulse repeatedly until reaching this counter up value.

Pulse Generator Start Point

Set the active output start count value for the pulse generator. However, please note that a maximum 1 clock jitter for the clock which is divided in the clock pre-scaler can occur.

Pulse Generator End Point

Set the active output ending count value for the pulse generator.

Pulse Generator Repeat Count

Set the repeating number of the pulse for the pulse generator. After Trigger Clear signal is input, the pulse generator starts the count set in Repeat Count. Accordingly, an active pulse which has a start point and end point can be output repeatedly. However, if Repeat Count is set to“0”, it works as a free-running counter.

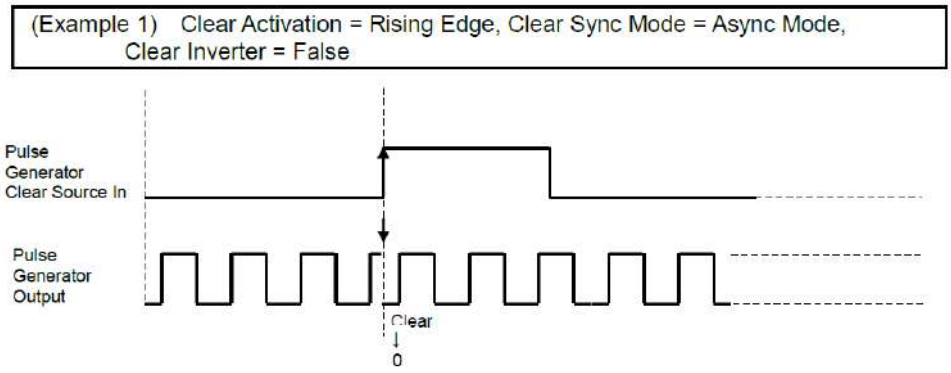
Pulse Generator Clear Activation

Set the clear conditions of clear count pulse for the pulse generator.

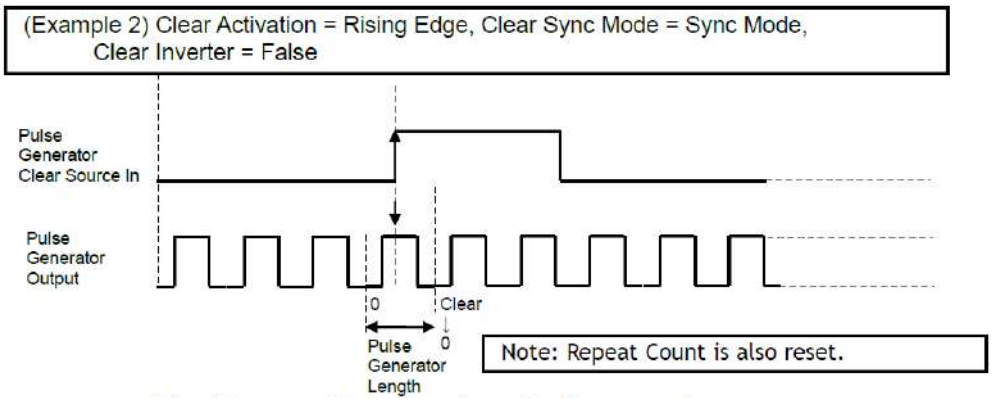
Pulse Generator Clear Sync Mode

Set the count clear method for the pulse generator. In case of Async Mode, if the clear signal is input during the length setting value, the counter will stop counting according to the clear signal input. In case of Sync Mode, if the clear signal is input during the length setting value, the counter will continue to count until the end of the length setting value and then clear the count. Both modes clear the repeat count when the counter is cleared.

Counter clear in Async mode



Counter clear in Sync mode



Pulse Generator Clear Source

The following clear source can be selected as the pulse generator clear signal.

Pulse Generator Clear Source item	Description
Low	Connect Low level signal to Clear Source for the pulse generator. **Default setting**
High	Connect High level signal to Clear Source for the pulse generator.
Frame Trigger Wait	Connect Frame Trigger Wait signal to Clear Source for the pulse generator.
Frame Active	Connect Frame Active signal to Clear Source for the pulse generator.
Exposure Active	Connect Exposure Active signal to Clear Source for the pulse generator.
FVAL	Connect FVAL signal to Clear Source for the pulse generator.
LVAL	Connect LVAL signal to Clear Source for the pulse generator.
CL CC1 In	Connect CL CC1 IN signal to Clear Source for the pulse generator.
Nand0 Out	Connect NAND 0 output signal to Clear Source for the pulse generator.
Nand1 Out	Connect NAND 1 output signal to Clear Source for the pulse generator.

Pulse Generator Inverter

Clear Source Signal can have polarity inverted.

Pulse Generator Setting table

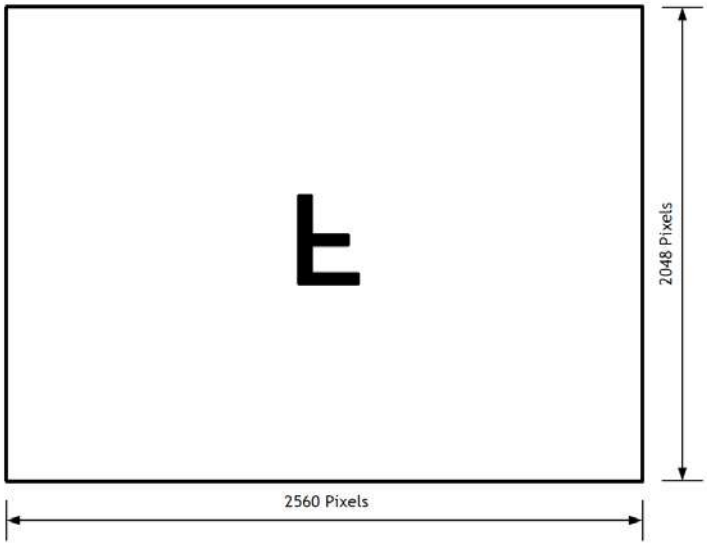
Display Name	Value
Clock Pre-scaler	1 to 4096
Pulse Generator Clock (MHZ)	[Pixel Clock:36MHz/28.8MHz/24MHz]÷[Clock Pre-scaler]
Pulse Generator Selector	- Pulse Generator 0
- Pulse Generator Length	1 to 1048575
- Pulse Generator Length (ms)	([Clock Source]÷[Clock Pre-scaler]) $^{-1}$ x [Pulse Generator Length]
- Pulse Generator Frequency (Hz)	[Pulse Generator Length (ms)] $^{-1}$
- Pulse Generator Start Point	0 to 1048574
- Pulse Generator Start Point (ms)	([Clock Source]÷[Clock Pre-scaler]) $^{-1}$ x [Pulse Generator Start Point]
- Pulse Generator End Point	1 to 1048575
- Pulse Generator End Point (ms)	([Clock Source]÷[Clock Pre-scaler]) $^{-1}$ x [Pulse Generator End Point]
- Pulse Generator pulse-width (ms)	[Pulse Generator End Point (ms)]－[Pulse Generator Start Point (ms)]
- Pulse Generator Repeat Count	0 to 255
- Pulse Generator Clear Activation Clear Mode for the Pulse Generators	- Off
	- High Level
	- Low level
	- Rising Edge
	- Falling Edge
- Pulse Generator Clear Sync Mode	- Async mode
	- Sync mode
- Pulse Generator Clear Source	- Low
	- High
	- Frame Trigger Wait
	- Frame Active
	- Exposure Active
	- Fval
	- Lval
	- CL_CC1_In
	- Nand0 Out
	- Nand1 Out
- Pulse Generator Inverter(Polarity) Pulse Generator Clear Inverter	- False
	- True

Note:

1. If Pulse Generator Repeat Count is set to “0”, the pulse generator works in free-running mode.
2. The output of the same pulse generator cannot be connected to Clear input.

Sensor layout

The CMOS sensors used in the GO-5000M-PMCL-UV have the following tap and pixel layout.



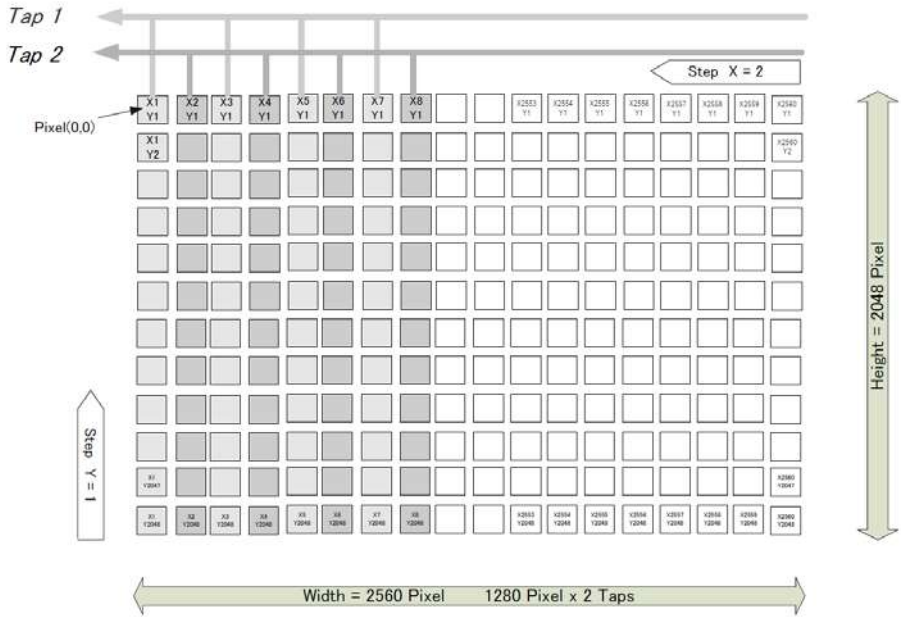
Camera output format (Tap Geometry)

Camera output format	Bit assignment	Refer to drawing
1X2-1Y	8-bit, 10-bit, 12-bit	7.2.1
1X3-1Y	8-bit	7.2.2
1X4-1Y	8-bit, 10-bit, 12-bit	7.2.3
1X8-1Y	8-bit, 10-bit	7.2.4

Note: The camera output description is based on GenICam SFNC Ver.1.5.1.

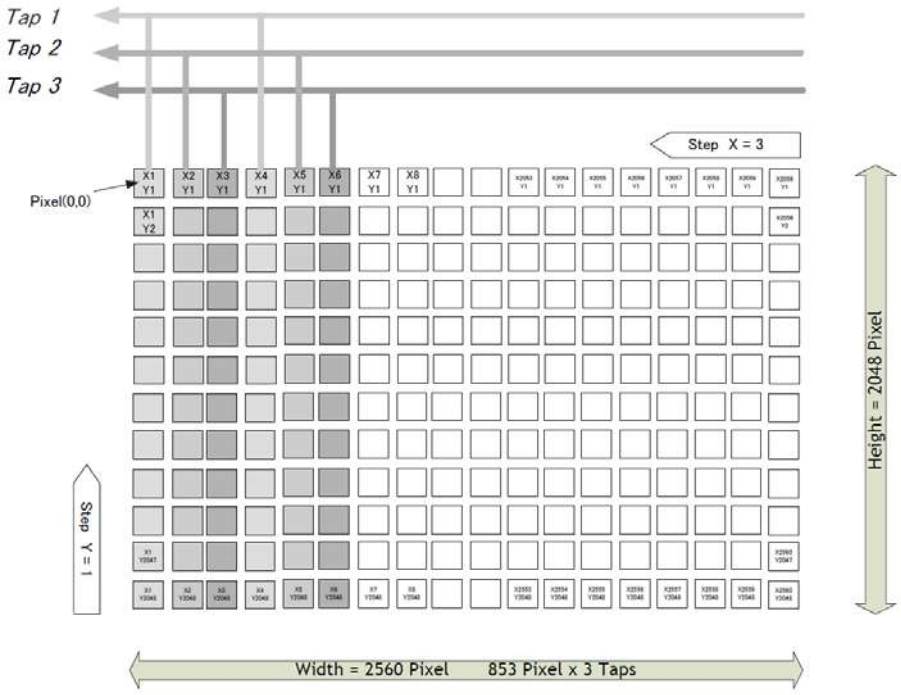
1X2–1Y

1X2–1Y is a 2-tap readout system specified in GenICam Tap Geometry and it outputs as the following.



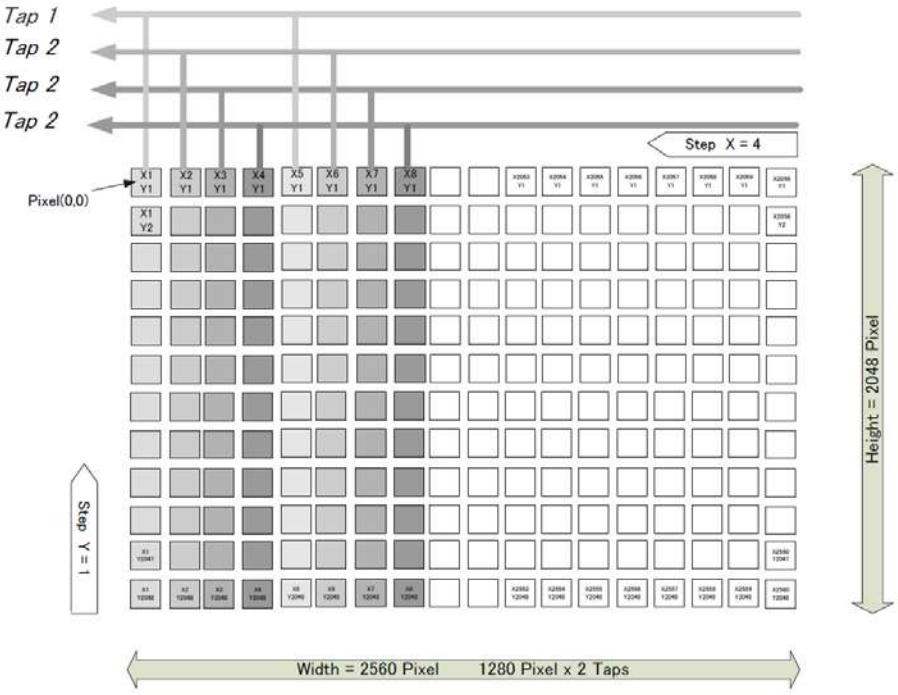
1X3–1Y

1X3–1Y is a 3-tap readout system specified in GenICam Tap Geometry.



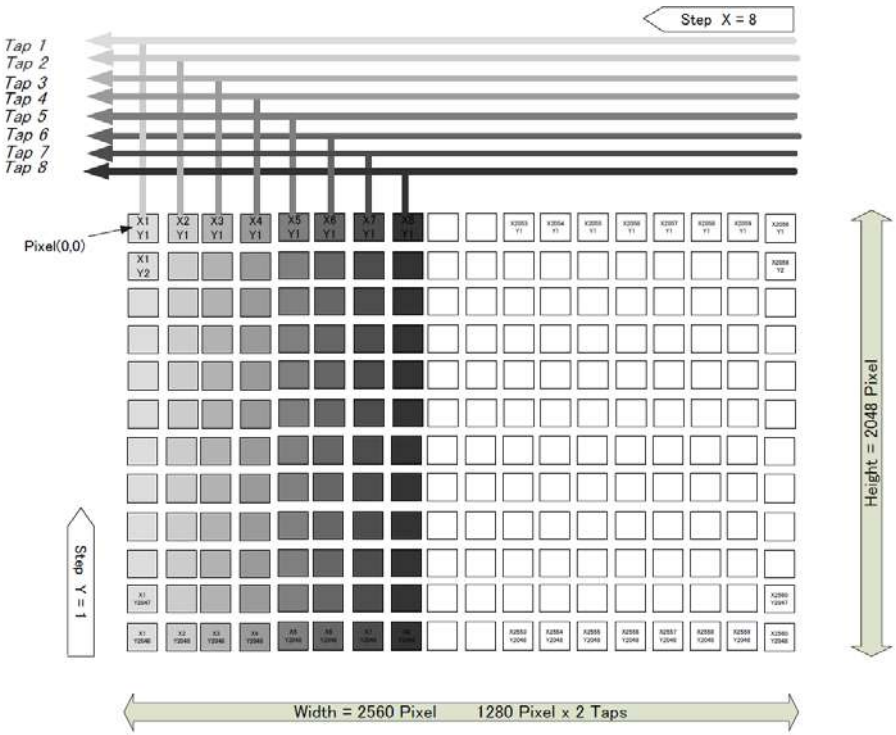
1X4–1Y

1X4–1Y is a 4-tap readout system specified in GenICam Tap Geometry.



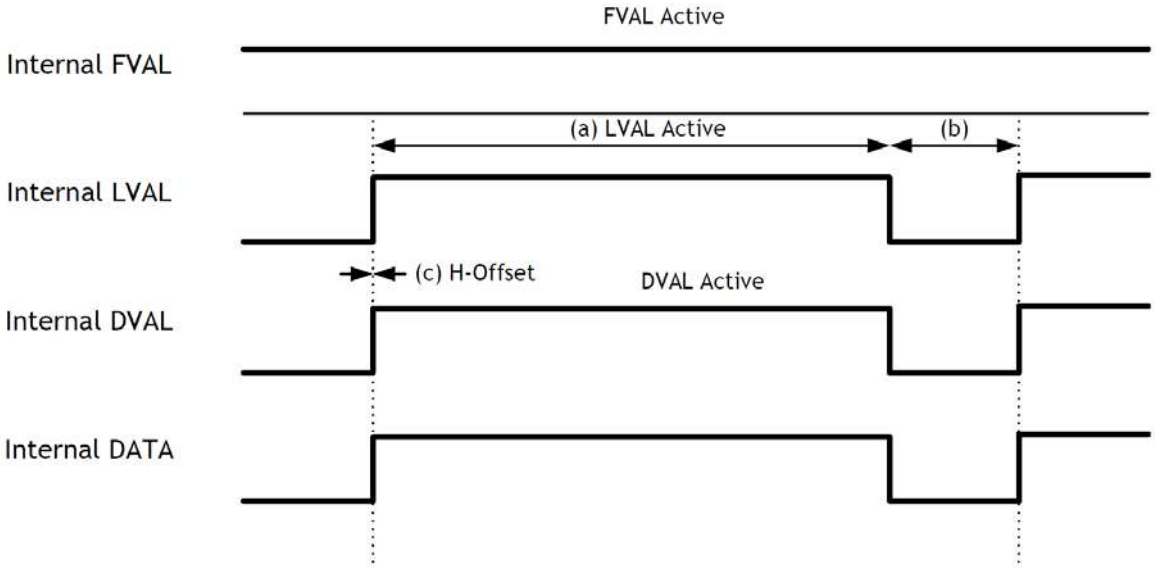
1X8–1Y

1X8–1Y is an 8-tap readout system and outputs as follows.



Output timing(Horizontal)

The horizontal frequency is changed by setting the Tap Geometry.



Camera Settings								(a)	(b)	(c)
Tap Geometry	Camera Link Pixel Clock	ROI				Bining		LVAL Active	LVAL Non Active	H Total
		Width	Offset X	Height	Offset Y	Horizontal	Vertical	(Unit: clock)	(Unit: clock)	(Unit: clock)
1X8 - 1Y 8-bit	72.85 MHz	2560	0	2048	0	Off	Off	320	10	330
		1280	0	2048	0	x2	Off	160	170	330
		640	0	2048	0	x4	Off	80	250	330
		2560	0	1024	0	Off	x2	320	10	330
		1280	0	1024	0	x2	x2	160	170	330
		640	0	1024	0	x4	x2	80	250	330
		2560	0	512	0	Off	Off	320	10	330
		1280	0	512	0	x2	x4	160	170	330
		640	0	512	0	x4	x4	80	250	330
	48.57 MHz	2560	0	2048	0	Off	Off	320	14	334
		1280	0	2048	0	x2	Off	160	170	330
		640	0	2048	0	x4	Off	80	250	330
		2560	0	1024	0	Off	x2	320	14	334
		1280	0	1024	0	x2	x2	160	170	330
		640	0	1024	0	x4	x2	80	250	330
		2560	0	512	0	Off	Off	320	14	334
		1280	0	512	0	x2	x4	160	170	330
		640	0	512	0	x4	x4	80	250	330
1X8 - 1Y 10-bit	58.28 MHz	2560	0	2048	0	Off	Off	320	14	334
		1280	0	2048	0	x2	Off	160	170	330
		640	0	2048	0	x4	Off	80	250	330
		2560	0	1024	0	Off	x2	320	14	334
		1280	0	1024	0	x2	x2	160	170	330
		640	0	1024	0	x4	x2	80	250	330
		2560	0	512	0	Off	Off	320	14	334
		1280	0	512	0	x2	x4	160	170	330
		640	0	512	0	x4	x4	80	250	330

Camera Settings								(a)	(b)	(c)
Tap Geometry	Camera Link Pixel Clock	ROI				Bining		LVAL Active	LVAL Non Active	H Total
		Width	Offset X	Height	Offset Y	Horizontal	Vertical	(Unit: clock)	(Unit: clock)	(Unit: clock)
1X4 - 1Y	84.99 MHZ	2560	0	2048	0	Off	Off	640	14	654
		1280	0	2048	0	x2	Off	320	253	573
		640	0	2048	0	x4	Off	160	413	573
		2560	0	1024	0	Off	x2	640	14	654
		1280	0	1024	0	x2	x2	320	253	573
		640	0	1024	0	x4	x2	160	413	573
		2560	0	512	0	Off	Off	640	14	654
		1280	0	512	0	x2	x4	320	253	573
		640	0	512	0	x4	x4	160	413	573
	72.85 MHz	2560	0	2048	0	Off	Off	640	12	652
		1280	0	2048	0	x2	Off	320	179	499
		640	0	2048	0	x4	Off	160	339	499
		2560	0	1024	0	Off	x2	640	12	652
		1280	0	1024	0	x2	x2	320	179	499
		640	0	1024	0	x4	x2	160	339	499
		2560	0	512	0	Off	Off	640	12	652
		1280	0	512	0	x2	x4	320	179	499
		640	0	512	0	x4	x4	160	339	499
	48.57 MHz	2560	0	2048	0	Off	Off	640	12	652
		1280	0	2048	0	x2	Off	320	173	493
		640	0	2048	0	x4	Off	160	333	493
		2560	0	1024	0	Off	x2	640	12	652
		1280	0	1024	0	x2	x2	320	173	493
		640	0	1024	0	x4	x2	160	333	493
		2560	0	512	0	Off	Off	640	12	652
		1280	0	512	0	x2	x4	320	173	493
		640	0	512	0	x4	x4	160	333	493
1X3 - 1Y	84.99 MHZ	2559	0	2048	0	Off	Off	853	12	865
		1278	0	2048	0	x2	Off	426	149	575
		639	0	2048	0	x4	Off	213	365	578
		2559	0	1024	0	Off	x2	853	12	865
		1280	0	1024	0	x2	x2	426	149	575
		639	0	1024	0	x4	x2	213	365	578
		2559	0	512	0	Off	Off	853	12	865
		1278	0	512	0	x2	x4	426	149	575
		639	0	512	0	x4	x4	213	365	578
1X2 - 1Y	84.99 MHz	2560	0	2048	0	Off	Off	1280	14	1294
		1280	0	2048	0	x2	Off	640	17	657
		640	0	2048	0	x4	Off	320	155	575
		2560	0	1024	0	Off	x2	1280	14	1294
		1280	0	1024	0	x2	x2	640	17	657
		640	0	1024	0	x4	x2	320	155	575
		2560	0	512	0	Off	Off	1280	14	1294
		1280	0	512	0	x2	x4	640	17	657
		640	0	512	0	x4	x4	320	155	575
	72.85 MHz	2560	0	2048	0	Off	Off	1280	14	1294
		1280	0	2048	0	x2	Off	640	13	653
		640	0	2048	0	x4	Off	320	173	493
		2560	0	1024	0	Off	x2	1280	14	1294
		1280	0	1024	0	x2	x2	640	13	653
		640	0	1024	0	x4	x2	320	173	493
		2560	0	512	0	Off	Off	1280	14	1294
		1280	0	512	0	x2	x4	640	13	653
		640	0	512	0	x4	x4	320	173	493
	48.57 MHz	2560	0	2048	0	Off	Off	1280	16	1296
		1280	0	2048	0	x2	Off	640	21	651
		640	0	2048	0	x4	Off	320	15	335
		2560	0	1024	0	Off	x2	1280	16	1296
		1280	0	1024	0	x2	x2	640	21	651
		640	0	1024	0	x4	x2	320	15	335
		2560	0	512	0	Off	Off	1280	16	1296
		1280	0	512	0	x2	x4	640	21	651
		640	0	512	0	x4	x4	320	15	335

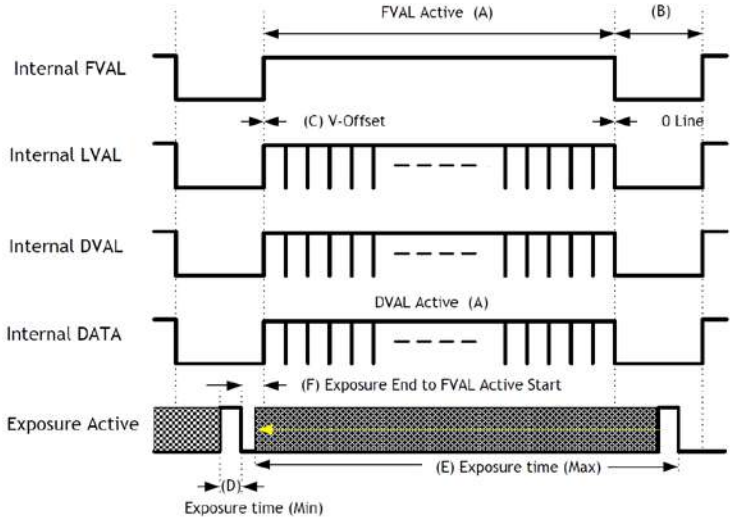
Camera Settings								A: Operation value, B:Calculation value			
Tap Geometry	Camera Link Pixel Clock	ROI				Bining			1 line Total clock	Horizontal Frequency	Horizontal Period
		Width	Offset X	Height	Offset Y	Horizontal	Vertical		(Unit: clock)	(Unit: kHz)	(Unit: µs)
1X8 - 1Y 8-bit	72.85 MHz	2560	0	2048	0	Off	Off	A	330	220.751	4.53
								B	330	220.779	4.529
		1280	0	2048	0	x2	Off	A	330	220.751	4.53
								B	330	220.779	4.529
		640	0	2048	0	x4	Off	A	330	220.751	4.53
								B	330	220.779	4.529
		2560	0	1024	0	Off	x2	A	330	220.751	4.53
								B	330	220.779	4.529
		1280	0	1024	0	x2	x2	A	330	220.751	4.53
								B	330	220.779	4.529
		640	0	1024	0	x4	x2	A	330	220.751	4.53
								B	330	220.779	4.529
		2560	0	512	0	Off	x4	A	330	220.751	4.53
								B	330	220.779	4.529
		1280	0	512	0	x2	x4	A	330	220.751	4.53
								B	330	220.779	4.529
		640	0	512	0	x4	x4	A	330	220.751	4.53
								B	330	220.779	4.529
	48.57 MHz	2560	0	2048	0	Off	Off	A	333.7	145.56	6.87
								B	334	145.423	6.876
		1280	0	2048	0	x2	Off	A	329.3	147.493	6.78
								B	330	147.186	6.794
		640	0	2048	0	x4	Off	A	329.3	147.493	6.78
								B	330	147.186	6.794
		2560	0	1024	0	Off	x2	A	333.7	145.56	6.87
								B	334	145.423	6.876
		1280	0	1024	0	x2	x2	A	329.3	147.493	6.78
								B	330	147.186	6.794
		640	0	1024	0	x4	x2	A	329.3	147.493	6.78
								B	330	147.186	6.794
		2560	0	512	0	Off	x4	A	333.7	145.56	6.87
								B	334	145.423	6.876
		1280	0	512	0	x2	x4	A	329.3	147.493	6.78
								B	330	147.186	6.794
		640	0	512	0	x4	x4	A	329.3	147.493	6.78
								B	330	147.186	6.794
1X-8 - 1Y 10bit	58.28 MHz	2560	0	2048	0	Off	Off	A	333.4	174.825	5.72
								B	334	174.508	5.73
		1280	0	2048	0	x2	Off	A	329.9	176.687	5.66
								B	330	176.623	5.662
		640	0	2048	0	x4	Off	A	329.9	176.687	5.66
								B	330	176.623	5.662
		2560	0	1024	0	Off	x2	A	333.4	174.825	5.72
								B	334	174.508	5.73
		1280	0	1024	0	x2	x2	A	329.9	176.687	5.66
								B	330	176.623	5.662
		640	0	1024	0	x4	x2	A	329.9	176.687	5.66
								B	330	176.623	5.662
		2560	0	512	0	Off	x4	A	333.4	174.825	5.72
								B	334	174.508	5.73
		1280	0	512	0	x2	x4	A	329.9	176.687	5.66
								B	330	176.623	5.662
		640	0	512	0	x4	x4	A	329.9	176.687	5.66
								B	330	176.623	5.662
	48.57 MHz	2560	0	2048	0	Off	Off	A	333.7	145.56	6.87
								B	334	145.423	6.876
		1280	0	2048	0	x2	Off	A	329.3	147.493	6.78
								B	330	147.186	6.794
		640	0	2048	0	x4	Off	A	329.3	147.493	6.78
								B	330	147.186	6.794
		2560	0	1024	0	Off	x2	A	333.7	145.56	6.87
								B	334	145.423	6.876
		1280	0	1024	0	x2	x2	A	329.3	147.493	6.78
								B	330	147.186	6.794
		640	0	1024	0	x4	x2	A	329.3	147.493	6.78
								B	330	147.186	6.794
		2560	0	512	0	Off	x4	A	333.7	145.56	6.87
								B	334	145.423	6.876
		1280	0	512	0	x2	x4	A	329.3	147.493	6.78
								B	330	147.186	6.794
		640	0	512	0	x4	x4	A	329.3	147.493	6.78
								B	330	147.186	6.794

Camera Settings								A: Operation value, B:Calculation value			
Tap Geometry	Camera Link Pixel Clock	ROI				Bining			1 line Total clock	Horizontal Frequency	Horizontal Period
		Width	Offset X	Height	Offset Y	Horizontal	Vertical		(Unit: clock)	(Unit: kHz)	(Unit: µs)
1X4 -1Y	84.99 MHz	2560	0	2048	0	Off	Off	A	653.6	130.039	7.69
								B	654	129.969	7.694
		1280	0	2048	0	x2	Off	A	572.9	148.368	6.74
								B	573	148.342	6.741
		640	0	2048	0	x4	Off	A	572.9	148.368	6.74
								B	573	148.342	6.741
		2560	0	1024	0	Off	x2	A	653.6	130.039	7.69
								B	654	129.969	7.694
		1280	0	1024	0	x2	x2	A	572.9	148.368	6.74
								B	573	148.342	6.741
		640	0	1024	0	x4	x2	A	572.9	148.368	6.74
								B	573	148.342	6.741
		2560	0	512	0	Off	x4	A	653.6	130.039	7.69
								B	654	129.969	7.694
		1280	0	512	0	x2	x4	A	572.9	148.368	6.74
								B	573	148.342	6.741
		640	0	512	0	x4	x4	A	572.9	148.368	6.74
								B	573	148.342	6.741
	72.85 MHz	2560	0	2048	0	Off	Off	A	651.3	111.857	8.94
								B	652	111.916	8.935
		1280	0	2048	0	x2	Off	A	498.3	146.199	6.84
								B	499	146.006	6.849
		640	0	2048	0	x4	Off	A	492.5	147.929	6.76
								B	493	147.059	6.767
		2560	0	1024	0	Off	x2	A	651.3	111.857	8.94
								B	652	111.916	8.935
		1280	0	1024	0	x2	x2	A	498.3	146.199	6.84
								B	499	146.006	6.849
		640	0	1024	0	x4	x2	A	492.5	147.929	6.76
								B	493	147.059	6.767
		2560	0	512	0	Off	x4	A	651.3	111.857	8.94
								B	652	111.916	8.935
		1280	0	512	0	x2	x4	A	498.3	146.199	6.84
								B	499	146.006	6.849
		640	0	512	0	x4	x4	A	492.5	147.929	6.76
								B	493	147.059	6.767
	48.57 MHz	2560	0	2048	0	Off	Off	A	651.3	74.571	13.41
								B	652	75.421	13.259
		1280	0	2048	0	x2	Off	A	334.2	154.349	6.88
								B	335	144.989	6.897
		640	0	2048	0	x4	Off	A	329.3	147.493	6.78
								B	330	147.186	6.794
		2560	0	1024	0	Off	x2	A	651.3	74.571	13.41
								B	652	75.421	13.259
		1280	0	1024	0	x2	x2	A	334.2	154.349	6.88
								B	335	144.989	6.897
		640	0	1024	0	x4	x2	A	651.3	74.571	13.41
								B	652	75.421	13.259
		2560	0	512	0	Off	x4	A	334.2	154.349	6.88
								B	335	144.989	6.897
		1280	0	512	0	x2	x4	A	651.3	74.571	13.41
								B	652	75.421	13.259
		640	0	512	0	x4	x4	A	334.2	154.349	6.88
								B	335	144.989	6.897
1X3 - 1Y	84.99 MHz	2560	0	2048	0	Off	Off	A	864.4	98.328	10.17
								B	865	98.266	10.176
		1280	0	2048	0	x2	Off	A	578	147.059	6.8
								B	578	147.059	6.8
		640	0	2048	0	x4	Off	A	578	147.059	6.8
								B	578	147.059	6.8
		2560	0	1024	0	Off	x2	A	864.4	98.328	10.17
								B	865	98.266	10.176
		1280	0	1024	0	x2	x2	A	578	147.059	6.8
								B	578	147.059	6.8
		640	0	1024	0	x4	x2	A	578	147.059	6.8
								B	578	147.059	6.8
		2560	0	512	0	Off	x4	A	864.4	98.328	10.17
								B	865	98.266	10.176
		1280	0	512	0	x2	x4	A	578	147.059	6.8
								B	578	147.059	6.8
		640	0	512	0	x4	x4	A	578	147.059	6.8
								B	578	147.059	6.8

Camera Settings								A: Operation value, B:Calculation value			
Tap Geometry	Camera Link Pixel Clock	ROI				Bining			1 line Total clock	Horizontal Frequency	Horizontal Period
		Width	Offset X	Height	Offset Y	Horizontal	Vertical		(Unit: clock)	(Unit: kHz)	(Unit: µs)
1X2 - 1Y	84.99 MHz	2560	0	2048	0	Off	Off	A	1293.7	65.703	15.22
								B	1294	65.668	15.224
		1280	0	2048	0	x2	Off	A	656.2	129.534	7.72
								B	657	129.376	7.729
		640	0	2048	0	x4	Off	A	574.6	147.929	6.76
								B	575	147.826	6.765
		2560	0	1024	0	Off	x2	A	1293.7	65.703	15.22
								B	1294	65.668	15.224
		1280	0	1024	0	x2	x2	A	656.2	129.534	7.72
								B	657	129.376	7.729
		640	0	1024	0	x4	x2	A	574.6	147.929	6.76
								B	575	147.826	6.765
		2560	0	512	0	Off	x4	A	1293.7	65.703	15.22
								B	1294	65.668	15.224
		1280	0	512	0	x2	x4	A	656.2	129.534	7.72
								B	657	129.376	7.729
		640	0	512	0	x4	x4	A	574.6	147.929	6.76
								B	575	147.826	6.765
	72.85 MHz	2560	0	2048	0	Off	Off	A	1293.2	56.338	17.75
								B	1294	56.304	17.761
		1280	0	2048	0	x2	Off	A	652.8	111.607	8.96
								B	653	111.573	8.963
		640	0	2048	0	x4	Off	A	492.5	147.929	6.76
								B	493	147.783	6.767
		2560	0	1024	0	Off	x2	A	1293.2	56.338	17.75
								B	1294	56.304	17.761
		1280	0	1024	0	x2	x2	A	652.8	111.607	8.96
								B	653	111.573	8.963
		640	0	1024	0	x4	x2	A	492.5	147.929	6.76
								B	493	147.783	6.767
		2560	0	512	0	Off	x4	A	1293.2	56.338	17.75
								B	1294	56.304	17.761
		1280	0	512	0	x2	x4	A	652.8	111.607	8.96
								B	653	111.573	8.963
		640	0	512	0	x4	x4	A	492.5	147.929	6.76
								B	493	147.783	6.767
	48.57 MHz	2560	0	2048	0	Off	Off	A	1294.9	37.509	26.66
								B	1296	37.478	26.682
		1280	0	2048	0	x2	Off	A	650.9	74.627	13.4
								B	651	74.61	13.403
		640	0	2048	0	x4	Off	A	334.2	145.349	6.88
								B	335	144.989	6.897
		2560	0	1024	0	Off	x2	A	1294.9	37.509	26.66
								B	1296	37.478	26.682
		1280	0	1024	0	x2	x2	A	650.9	74.627	13.4
								B	651	74.61	13.403
		640	0	1024	0	x4	x2	A	334.2	145.349	6.88
								B	335	144.989	6.897
		2560	0	512	0	Off	x4	A	1294.9	37.509	26.66
								B	1296	37.478	26.682
		1280	0	512	0	x2	x4	A	650.9	74.627	13.4
								B	651	74.61	13.403
		640	0	512	0	x4	x4	A	334.2	145.349	6.88
								B	335	144.989	6.897

Output timing(Vertical)

The below figure shows the vertical timing of Camera Link output during continuous trigger operation. However, with 1X8-1Y 10-bit geometry, which is 80-bit configuration, DVAL and Exposure Active, which are normally output to Camera Link spare bits, are not output through the Camera Link interface as data bits are applied to those bits.



Camera Settings									(A)	(B)	(C)	(D)
Tap Geometry	Pixel Clock	Frame Period (Typ)	ROI				Binning		FVAL & DVAL Active	FVAL Non Active	V-Offset	Exposure Time (min)
			Width	Offset X	Height	Offset Y	Horizontal	Vertical	(Unit:line)	(Unit:line)	(Unit:line)	(Unit:μs)
1X8 - 1Y 8-bit	72.85 MHz	9328 us	2560	0	2048	0	Off	Off	2048	10	0	10
			2560	0	1024	0	Off	x2	1024	10		
			2560	0	512	0	Off	x4	512	10		
			1280	0	2048	0	x2	Off	2048	10		
			1280	0	1024	0	x2	x2	1024	10		
			1280	0	512	0	x2	x4	512	10		
			512	0	2048	0	x4	Off	2048	10		
			512	0	1024	0	x4	x2	1024	10		
			512	0	512	0	x4	x4	512	10		
	48.57 MHz	14117 us	2560	0	2048	0	Off	Off	2048	14	0	10
			2560	0	1024	0	Off	x2	1024	14		
			2560	0	512	0	Off	x4	512	14		
			1280	0	2048	0	x2	Off	2048	14		
			1280	0	1024	0	x2	x2	1024	14		
			1280	0	512	0	x2	x4	512	14		
			512	0	2048	0	x4	Off	2048	14		
			512	0	1024	0	x4	x2	1024	14		
			512	0	512	0	x4	x4	512	14		
1X8 - 1Y 10-bit	58.28 MHz	11765 us	2560	0	2048	0	Off	Off	2048	14	0	10
			2560	0	1024	0	Off	x2	1024	14		
			2560	0	512	0	Off	x4	512	14		
			1280	0	2048	0	x2	Off	2048	14		
			1280	0	1024	0	x2	x2	1024	14		
			1280	0	512	0	x2	x4	512	14		
			512	0	2048	0	x4	Off	2048	14		
			512	0	1024	0	x4	x2	1024	14		
			512	0	512	0	x4	x4	512	14		
1X4 - 1Y	84.99 MHz	15719 us	2560	0	2048	0	Off	Off	2048	14	0	10
			2560	0	1024	0	Off	x2	1024	14		
			2560	0	512	0	Off	x4	512	14		
			1280	0	2048	0	x2	Off	2048	14		
			1280	0	1024	0	x2	x2	1024	14		
			1280	0	512	0	x2	x4	512	14		
			512	0	2048	0	x4	Off	2048	14		
			512	0	1024	0	x4	x2	1024	14		
			512	0	512	0	x4	x4	512	14		
	72.85 MHz	18288 us	2560	0	2048	0	Off	Off	2048	12	0	10
			2560	0	1024	0	Off	x2	1024	12		
			2560	0	512	0	Off	x4	512	12		
			1280	0	2048	0	x2	Off	2048	12		
			1280	0	1024	0	x2	x2	1024	12		
			1280	0	512	0	x2	x4	512	12		
			512	0	2048	0	x4	Off	2048	12		
			512	0	1024	0	x4	x2	1024	12		
			512	0	512	0	x4	x4	512	12		
	48.57 MHz	27778 us	2560	0	2048	0	Off	Off	2048	12	0	10
			2560	0	1024	0	Off	x2	1024	12		
			2560	0	512	0	Off	x4	512	12		
			1280	0	2048	0	x2	Off	2048	12		
			1280	0	1024	0	x2	x2	1024	12		
			1280	0	512	0	x2	x4	512	12		
			512	0	2048	0	x4	Off	2048	12		
			512	0	1024	0	x4	x2	1024	12		
			512	0	512	0	x4	x4	512	12		
1X3 - 1Y 8-bit	84.99 MHz	20796 us	2559	0	2048	0	Off	Off	2048	14	0	10
			2559	0	1024	0	Off	x2	1024	14		
			2559	0	512	0	Off	x4	512	14		
			1278	0	2048	0	x2	Off	2048	14		
			1278	0	1024	0	x2	x2	1024	14		
			1278	0	512	0	x2	x4	512	14		
			510	0	2048	0	x4	Off	2048	14		
			510	0	1024	0	x4	x2	1024	14		
			510	0	512	0	x4	x4	512	14		

Camera Settings									(A)	(B)	(C)	(D)
Tap Geometry	Pixel Clock	Frame Period (Typ)	ROI				Binning		FVAL & DVAL Active	FVAL Non Active	V-Offset	Exposure Time (min)
			Width	Offset X	Height	Offset Y	Horizontal	Vertical	(Unit:line)	(Unit:line)	(Unit:line)	(Unit:µs)
1X2 - 1Y	84.99 MHz	31268 us	2560	0	2048	0	Off	Off	2048	14	0	10
			2560	0	1024	0	Off	x2	1024	14		
			2560	0	512	0	Off	x4	512	14		
			1280	0	2048	0	x2	Off	2048	14		
			1280	0	1024	0	x2	x2	1024	14		
			1280	0	512	0	x2	x4	512	14		
			512	0	2048	0	x4	Off	2048	14		
			512	0	1024	0	x4	x2	1024	14		
			512	0	512	0	x4	x4	512	14		
	72.85 MHz	36388 us	2560	0	2048	0	Off	Off	2048	14	0	10
			2560	0	1024	0	Off	x2	1024	14		
			2560	0	512	0	Off	x4	512	14		
			1280	0	2048	0	x2	Off	2048	14		
			1280	0	1024	0	x2	x2	1024	14		
			1280	0	512	0	x2	x4	512	14		
			512	0	2048	0	x4	Off	2048	14		
			512	0	1024	0	x4	x2	1024	14		
			512	0	512	0	x4	x4	512	14		
	48.57 MHz	55129 us	2560	0	2048	0	Off	Off	2048	16	0	10
			2560	0	1024	0	Off	x2	1024	16		
			2560	0	512	0	Off	x4	512	16		
			1280	0	2048	0	x2	Off	2048	16		
			1280	0	1024	0	x2	x2	1024	16		
			1280	0	512	0	x2	x4	512	16		
			512	0	2048	0	x4	Off	2048	16		
			512	0	1024	0	x4	x2	1024	16		
			512	0	512	0	x4	x4	512	16		

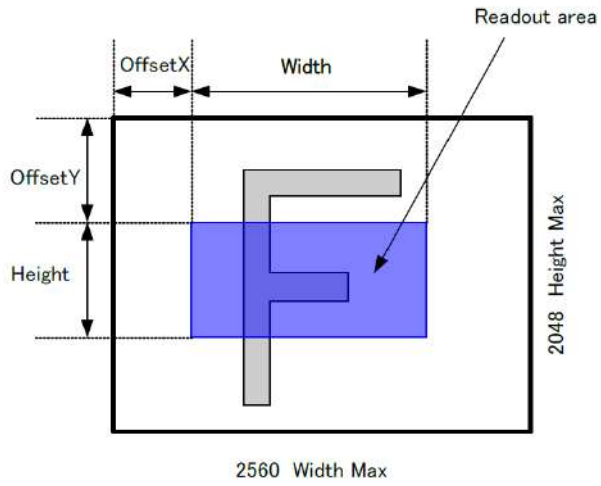
Camera Settings										(E)	(F)
Tap Geometry	Pixel Clock	Frame Period (Typ)	ROI				Binning		Frame Period (min)	Exposure Time (max)	Exposure End to FVAL Active Start
			Width	Offset X	Height	Offset Y	Horizontal	Vertical	(Unit:us)	(Unit:us)	(Unit:us)
1X8 - 1Y 8-bit	72.85 MHz	9328 us	2560	0	2048	0	Off	Off	9328	9222	29.6
			2560	0	1024	0	Off	x2	4709	4657	
			2560	0	512	0	Off	x4	2367	2317	
			1280	0	2048	0	x2	Off	9272	9228	
			1280	0	1024	0	x2	x2	4681	4628	
			1280	0	512	0	x2	x4	2383	2302	
			512	0	2048	0	x4	Off	9272	9280	
			512	0	1024	0	x4	x2	4681	4628	
			512	0	512	0	x4	x4	2383	2302	
	48.57 MHz	14117 us	2560	0	2048	0	Off	Off	14117	14184	40.4
			2560	0	1024	0	Off	x2	7127	7102	
			2560	0	512	0	Off	x4	3627	3560	
			1280	0	2048	0	x2	Off	13947	14012	
			1280	0	1024	0	x2	x2	7041	7015	
			1280	0	512	0	x2	x4	3584	3516	
			512	0	2048	0	x4	Off	13947	14012	
			512	0	1024	0	x4	x2	7041	7015	
			512	0	512	0	x4	x4	3584	3516	
1X8 - 1Y 10-bit	58.28 MHz	11785 us	2560	0	2048	0	Off	Off	11785	11803	35.2
			2560	0	1024	0	Off	x2	5938	5900	
			2560	0	512	0	Off	x4	3023	2949	
			1280	0	2048	0	x2	Off	11822	11859	
			1280	0	1024	0	x2	x2	5867	5828	
			1280	0	512	0	x2	x4	2986	2913	
			512	0	2048	0	x4	Off	11822	11859	
			512	0	1024	0	x4	x2	5867	5828	
			512	0	512	0	x4	x4	2988	2913	
1X4 - 1Y	84.99 MHz	15719 us	2560	0	2048	0	Off	Off	15719	15804	41.6
			2560	0	1024	0	Off	x2	7927	7911	
			2560	0	512	0	Off	x4	4028	3964	
			1280	0	2048	0	x2	Off	13934	13998	
			1280	0	1024	0	x2	x2	7027	7001	
			1280	0	512	0	x2	x4	3570	3502	
			512	0	2048	0	x4	Off	13934	13998	
			512	0	1024	0	x4	x2	7027	7001	
			512	0	512	0	x4	x4	3570	3502	
	72.85 MHz	18268 us	2560	0	2048	0	Off	Off	18288	18384	43.2
			2560	0	1024	0	Off	x2	9213	9211	
			2560	0	512	0	Off	x4	4681	4624	
			1280	0	2048	0	x2	Off	13934	13998	
			1280	0	1024	0	x2	x2	7027	7001	
			1280	0	512	0	x2	x4	3570	3502	
			512	0	2048	0	x4	Off	13934	13998	
			512	0	1024	0	x4	x2	7027	7001	
			512	0	512	0	x4	x4	3570	3502	
	48.57 MHz	27444 us	2560	0	2048	0	Off	Off	27444	27672	52.4
			2560	0	1024	0	Off	x2	13841	13891	
			2560	0	512	0	Off	x4	7033	7000	
			1280	0	2048	0	x2	Off	14019	14084	
			1280	0	1024	0	x2	x2	7070	7044	
			1280	0	512	0	x2	x4	3592	3524	
			512	0	2048	0	x4	Off	13934	13998	
			512	0	1024	0	x4	x2	7027	7001	
			512	0	512	0	x4	x4	3608	3502	
1X3 - 1Y 8-bit	84.99 MHz	20796 us	2559	0	2048	0	Off	Off	20881	20944	46
			2559	0	1024	0	Off	x2	10521	10491	
			2559	0	512	0	Off	x4	5336	5264	
			1278	0	2048	0	x2	Off	13920	13985	
			1278	0	1024	0	x2	x2	7013	6987	
			1278	0	512	0	x2	x4	3557	3489	
			510	0	2048	0	x4	Off	13920	13985	
			510	0	1024	0	x4	x2	7013	6987	
			510	0	512	0	x4	x4	3557	3489	

Camera Settings										(E)	(F)
Tap Geometry	Pixel Clock	Frame Period (Typ)	ROI				Binning		Frame Period (min) (Unit:us)	Exposure Time (max) (Unit:us)	Expsoure End to FVAL Active Start (Unit:us)
			Width	Offset X	Height	Offset Y	Horizontal	Vertical			
1X2 - 1Y	84.99 MHz	31288 us	2560	0	2048	0	Off	Off	31268	31542	58
			2560	0	1024	0	Off	x2	15770	15841	
			2560	0	512	0	Off	x4	8013	7990	
			1280	0	2048	0	x2	Off	15889	15976	
			1280	0	1024	0	x2	x2	8013	7998	
			1280	0	512	0	x2	x4	4071	4008	
			512	0	2048	0	x4	Off	13934	13998	
			512	0	1024	0	x4	x2	7027	7001	
			512	0	512	0	x4	x4	3570	3502	
	72.85 MHz	36366 us	2560	0	2048	0	Off	Off	36366	36702	70
			2560	0	1024	0	Off	x2	18341	18441	
			2560	0	512	0	Off	x4	9319	9310	
			1280	0	2048	0	x2	Off	18438	18556	
			1280	0	1024	0	x2	x2	9299	9298	
			1280	0	512	0	x2	x4	4725	4668	
			512	0	2048	0	x4	Off	13934	13998	
			512	0	1024	0	x4	x2	7027	7001	
			512	0	512	0	x4	x4	3570	3502	
	48.57 MHz	55126 us	2560	0	2048	0	Off	Off	54464	55020	82.8
			2560	0	1024	0	Off	x2	27469	27671	
			2560	0	512	0	Off	x4	13958	13998	
			1280	0	2048	0	x2	Off	27614	27844	
			1280	0	1024	0	x2	x2	13926	13978	
			1280	0	512	0	x2	x4	7077	7044	
			512	0	2048	0	x4	Off	14189	14258	
			512	0	1024	0	x4	x2	7156	7131	
			512	0	512	0	x4	x4	3635	3568	

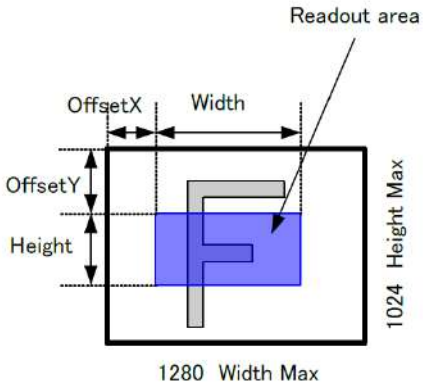
ROI (Region Of Interest) setting

In the GO-5000M-PMCL-UV, a subset of the image can be output by setting Width, Height, Offset-X, and Offset-Y. If the height is decreased, the number of lines read out is decreased and as the result, the frame rate is increased. However, in the horizontal direction, the horizontal frequency is not changed if the width is decreased. In the GO-5000M-PMCL-UV, the minimum width is “8” and minimum height is “1”.

Setting example (1)
Binning Horizontal = 1
Binning Vertical = 1

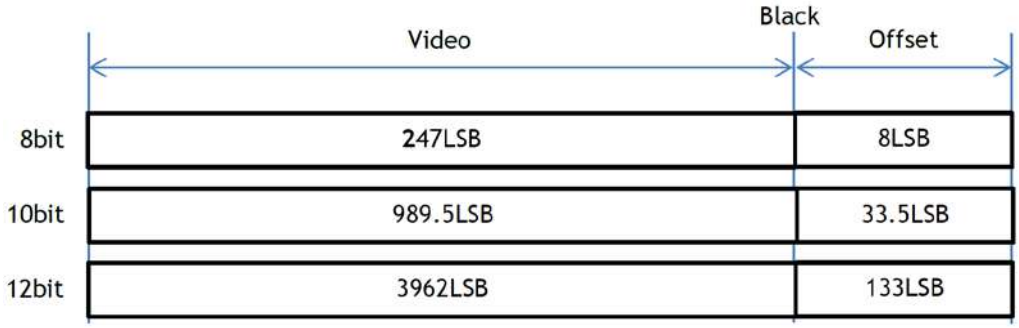


Setting example (2)
Binning Horizontal = 2
Binning Vertical = 2



Digital output Bit allocation

Below figures on the above drawing are the average values of 100 pixels x 100 pixels in the center of the image.



Acquisition control

With Trigger OFF (free running mode), the default frame rate of the camera is based on the specified ROI. The smaller the ROI, the faster the default frame rate. However, it is possible to specify a free-running frame rate (i.e., no trigger needed) that is slower than the default rate. This can be useful when a longer exposure time is needed for a specific ROI.

Modification of the frame rate is done by entering a value in the AcquisitionFrameRate control corresponding to the frame frequency (Hz). Allowed values range from the shortest frame rate to 0.125Hz (fps), however if the value entered is less than the time required for the default frame rate, the setting is ignored and the default frame rate is used.

The setting range in Acquisition Frame Rate is:

Shortest	to	Longest
Inverse number of time required to drive all pixels in the area set by ROI command	to	0.125 Hz (fps) = 8 seconds

Calculation of the frame rate

The frame rate depends on the tap geometry and is calculated in the following formula.

Maximum Frame Rate (fps) = 1/(Rounddown*3([Trow]x16/C) x ([H]+E) x 0.988*4) x 1000000

Where,
[Trow]=Roundup*1((Roundup*1(2560 /A*2) x [W] /2560 + B) x A*2) x C /(Dx16)
If the result of the calculation is equal or less to 164, [Trow] is fixed to 164.

Binning OFF: [W] = [Width*5], [H] = [Height*6]
Binning ON: [W] = [Width*5] + 1, [H] = [Height*6]

Figures for A to E by the tap geometry.

Tap Geometry	CL Clock Frequency(MHz)	A	B	C	D	E	Max. Frame Rate(fps)*7
1X2-1Y	84.99(High)	2	20	384	169.9999	16	31.9
	72.85(Mid)		18		145.7142		27.4
	48.57(Low)		16		97.1428		18.3
1X3-1Y	84.99(High)	3	15		254.99985	14	47.8
	72.85(Mid)		16		218.5713		41.0
	48.57(Low)		14		145.7142		27.4
1X4-1Y	84.99(High)	4	12		339.9998	16	63.6
	72.85(Mid)				291.4284		54.7
	48.57(Low)				194.2856		36.4
1X8-1Y (8bit)	72.85(High)	8	12	577.6	582.8568	18	107.1
	48.57(Low)		14	384	388.5712		70.8
1X8-1Y (10bit)	58.28(Mid)			460.8	466.28544		84.9
	48.57(Low)			384	388.5712		70.8

The following table shows Width and Height in the binning modes.

	Width *5		Height *6	
	Mono	Color	Mono	Color
Binning OFF 1	8 ~ 2560		1 ~ 2048	2 ~ 2048
Binning ON 2	4 ~ 1280	-	1 ~ 1024	-
Binning ON 4	2 ~ 640	-	1 ~ 512	-

*1 Roundup after the decimal point
*2 Number of TAP
*3 Round down after the decimal point
*4 Compensation coefficient
*5 Refer to the width value on the above table.
*6 Refer to the height value on the above table.
*7 Maximum frame rate at the full image size

Exposure setting

This section describes how to set the exposure settings.

Command name	Parameter	Description
Exposure Mode	Off	Shutter control is not available. The exposure time depends on the frame rate.
	Timed	The exposure is set by ExposureTime.
	Trigger Width	The exposure is controlled by the input trigger pulse width.
Exposure Time	10～Max. Exposure time[us]	Exposure time(float)
Exposure Time Raw	10～Max. exposure time[us]	Exposure time(integer)
Exposure Auto	Off	Disable the exposure auto
	Continuous	Enable the exposure auto

Exposure Mode

The exposure mode set the way of the exposure. There are three ways.

Exposure Mode setting	Exposure operation
OFF	No exposure control (free-running operation)
Timed	Exposure operation at the value set in Exposure Time. Setting value is usec unit. ・If Trigger Mode setting is OFF, the camera is in free-running operation. ・If Trigger Mode setting is ON, the exposure operation depends on the setting of Trigger Option.
Trigger Width	The exposure is controlled by the pulse width of the external trigger. ・Trigger Mode is forced to ON.

If Exposure Mode is set at Timed, the exposure operation can be selected as follows by setting Trigger Option.

Trigger Option setting	Exposure operation
OFF	Timed (EPS) mode
RCT	RCT mode

If the trigger is used, it uses “Frame Start”.
The procedure is;

1. Select “Frame Start” in “Trigger Selector”
   Note: In the GO-5000M-PMCL-UV, only “Frame Start” is available.
2. Select “Timed” or “Trigger Width” in “Exposure Mode”.
3. Set “ON” in “Trigger Mode”.

Important note:

For trigger operation, Exposure Mode must first be set to something other than OFF and then Trigger Mode of Frame Start must be ON.
If the exposure mode is set to OFF, the trigger mode cannot be set.

Operational mode by the combination of the exposure mode and the trigger control.

TriggerControl / ExposureMode	Frame Start Trigger mode (ON/OFF)	Exposure control
OFF	OFF	Not available
Timed (EPS, RCT)	OFF or ON	Preset exposure time
Trigger Width	OFF	Not available
	ON	The pulse width of the input trigger pulse

Frame Start Trigger: The start of image capturing of a frame is controlled by the external trigger.
Trigger Mode ON: Start the exposure by the selected signal for the frame start
Trigger OFF: The camera is in free-running mode

ExposureTime

This command is effective only when Exposure Mode is set to Timed. It is for setting exposure time. The setting step for exposure time is 1 µsec per step.

Minimum: 10 µsec
Maximum: 8 seconds (Note – noise may make image unusable after 1 second)

ExposureAuto

This is a function to control the exposure automatically. It is effective only for Timed. JAI ALC Reference controls the brightness.
There are two modes, OFF and Continuous.

OFF: No exposure control
Continuous: Exposure continues to be adjusted automatically

In this mode, the following settings are available.
ALC Speed: Rate of adjustment can be set

ASC Max: The maximum value for the exposure time to be controlled can be set.
ASC Min: The minimum value for the exposure time to be controlled can be set.
ALC Reference: The reference level of the exposure control can be set
ALC Channel Area: This can Enable or Disable the area selected by ALC Custom Area Selector

ALC Area Type

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

Trigger control

The following 5 types of Trigger Control are available by the combination of Trigger Selector, Trigger Mode, Exposure Mode and Trigger Option.

Camera Settings				JAI Custom Trigger Mode Name	Description
Trigger Selector	Trigger Mode	Exposure Mode	Trigger Option		
Frame Start	Off	Off	Off	Continuous Trigger	Free-running operation with the maximum exposure time per the frame rate
	Off	Timed	Off	Continuous Trigger	Free-running operation with a user-set exposure time.
	On	Timed	Off	EPS Trigger	Externally triggered operation with a user-set exposure time
	On	Timed	RCT	RCT Trigger	Externally triggered operation for RCT
	On	Trigger Width	Off	PWC Trigger	Externally triggered operation with a pulse width exposure time

Trigger Selector

Selects the trigger operation. In the GO-5000M-PMCL-UV, only Frame Start is available.

Trigger Mode

Selects the trigger operation. In the GO-5000M-PMCL-UV, only Frame Start is available.

Important note:
For trigger operation, Exposure Mode must first be set to something other than OFF and the Trigger Mode of Frame Start must be ON.
If the exposure mode is set to OFF, the trigger mode cannot be set.

Trigger Source

Select the trigger source to be used for trigger operation (Frame Start) from the following:

Trigger Source item	Description
Low	Connect LOW level signal to the selected trigger operation **Default setting**
High	Connect HIGH level signal to the selected trigger operation
Soft Trigger	Connect Soft Trigger signal to the selected trigger operation Trigger can be input manually by the execution of the software trigger Trigger software is available on each trigger source.
PulseGenerator0 Out	Connect Pulse generator 0 signal to the selected trigger operation
Line 7 - CC1	Connect Trigger In signal through CC1 in Camera Link Interface to the selected trigger operation
NAND 0 Out	Connect NAND 0 OUT signal to the selected trigger operation
NAND 1 Out	Connect NAND 1 OUT signal to the selected trigger operation

Trigger Activation

This command can select how to activate the trigger.

Rising edge: At the rising edge of the pulse, the trigger is activated.
Falling edge: At the falling edge of the pulse, the trigger is activated.
Level High: During the high level of trigger, the accumulation is activated
Level Low: During the low level of trigger, the accumulation is activated

If Exposure Mode is set to Trigger Width, Level High or Level Low must be used.

	Trigger Activation Setting			
Exposure Mode	Rising Edge	Falling Edge	Level High	Level Low
Timed	○	○	×	×
Trigger width	×	×	○	○
Timed RCT	○	○	×	×

Normal continuous operation

This is used for applications which do not require triggering.

Minimum interval (1X8–1Y, 8-bit, CL Clock =72.85MHz)

Trigger Mode	Readout Mode	Time(Min. frame period)
Timed Exposure Mode Trigger Mode OFF (Note 1)	Full	9435us
	AOI Center 2/3	6281us
	AOI Center 1/2	4740us
	AOI Center 1/4	2393us
	AOI Center 1/8	1219us
	V Binning ON (Full)	4740us

Note1: Readout setting in Trigger Overlap is not available

Timed mode

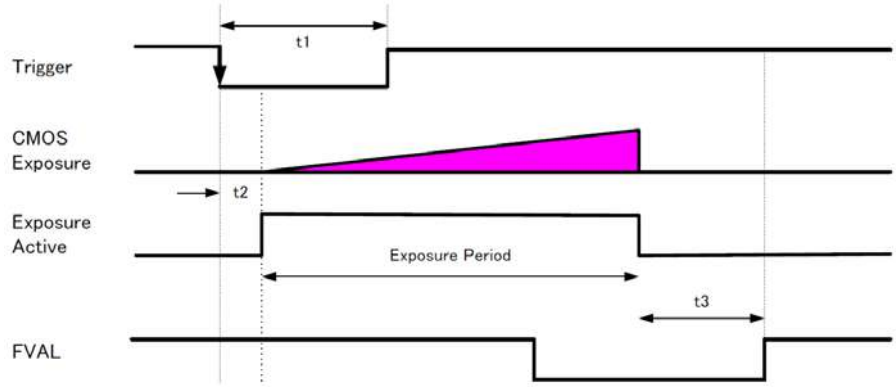
This mode captures image(s) with a preset exposure time by using the external trigger. An additional setting determines if the trigger pulse can be accepted during the exposure period.

Primary settings to use this mode

Acquisition Mode = Single frame, Multi-frame or Continuous
Trigger Mode = ON
Exposure Mode = Timed

Trigger minimum interval (Trigger Overlap = Readout) (1X8–1Y, 8-bit, CL Clock=72.85 MHz)

Trigger Mode	Readout Mode	Time (Min. Trigger Period)
Timed Exposure Mode Trigger Mode ON	Full	9435 us + 8.01 µs
	AOI Center 2/3	6281 us + 8.01 µs
	AOI Center 1/2	4740 us + 8.01 µs
	AOI Center 1/4	2393 us + 8.01 µs
	AOI Center 1/8	1219 us + 8.01 µs
	V Binning ON (Full)	4740 us + 8.01 µs



t1	t2	t3
10µ(Min.)	18µ	6L to 7L

Trigger width mode

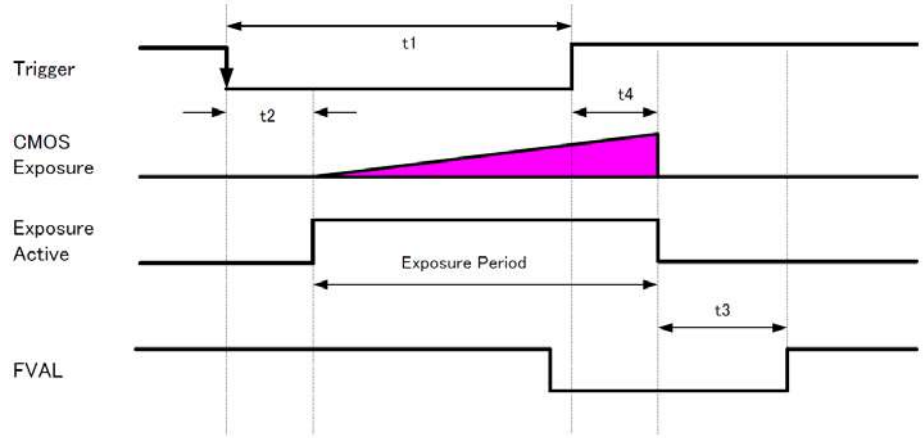
In this mode, the exposure time is equal to the trigger pulse width. Accordingly, longer exposure times are supported. Additional settings determine if the trigger pulse can be accepted during the exposure period.

Primary settings to use this mode

Trigger Mode = ON
Exposure Mode = Trigger Width

Minimum trigger interval (Trigger Overlap = Readout) (1X8–1Y, 8-bit, CL Clock=72.85 MHz)

Trigger Mode	Readout Mode	Time (Min. Trigger Period)
Trigger Width Exposure Mode	Full	9435 us + 8.01 µs
	AOI Center 2/3	6281 us + 8.01 µs
	AOI Center 1/2	4740 us + 8.01 µs
	AOI Center 1/4	2393 us + 8.01 µs
	AOI Center 1/8	1219 us + 8.01 µs
	V Binning ON (Full) (Note1)	4740 us + 8.01 µs



t1	t2	t3	t4
10 µs (Min)	18 µs	6L ～7L	14.2 µs

RCT mode

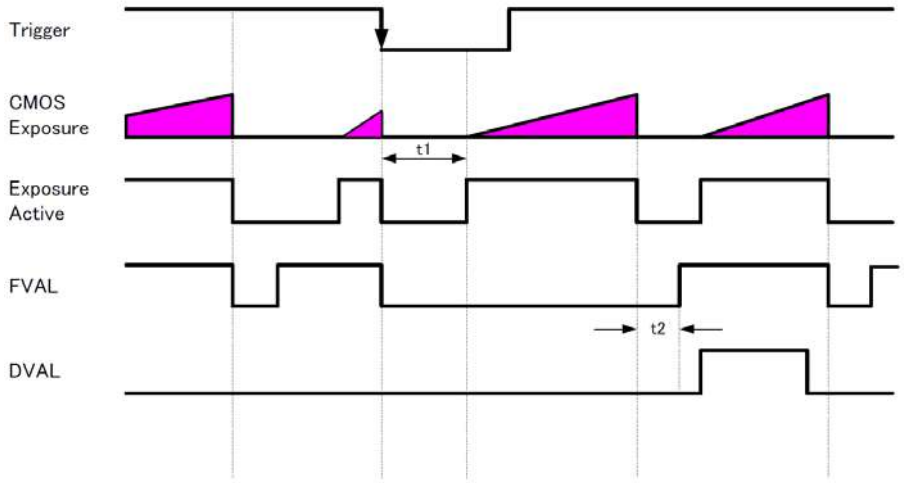
Until the trigger is input, the camera operates continuously and can use auto-gain, if necessary, to control the exposure setting. During this time, FVAL and LVAL are output but DVAL is not output. When the trigger is input, the fast dump is activated to read out the electronic charge very quickly, after which the accumulation and the readout are performed. When the accumulated signal against the trigger is read out, FVAL, LVAL and DVAL are output too.

Primary settings to use this mode

Trigger Mode = ON
Exposure Mode = Timed
Trigger Option = RC

Minimum trigger interval (1X8–1Y)

Trigger Mode	Readout Mode	Time (Min. Trigger Period)
Reset Continuous Trigger Mode (Note2)	Full	9435 us + Exposure time + 1.562 ms
	AOI Center 2/3	6281 us + Exposure time + 1.562 ms
	AOI Center 1/2	4740 us+ Exposure time + 1.562 ms
	AOI Center 1/4	2393 us + Exposure time + 1.562 ms
	AOI Center 1/8	1219 us + Exposure time + 1.562 ms
	V Binning ON (Full) (Note1)	4740 us + Exposure time + 1.562 ms



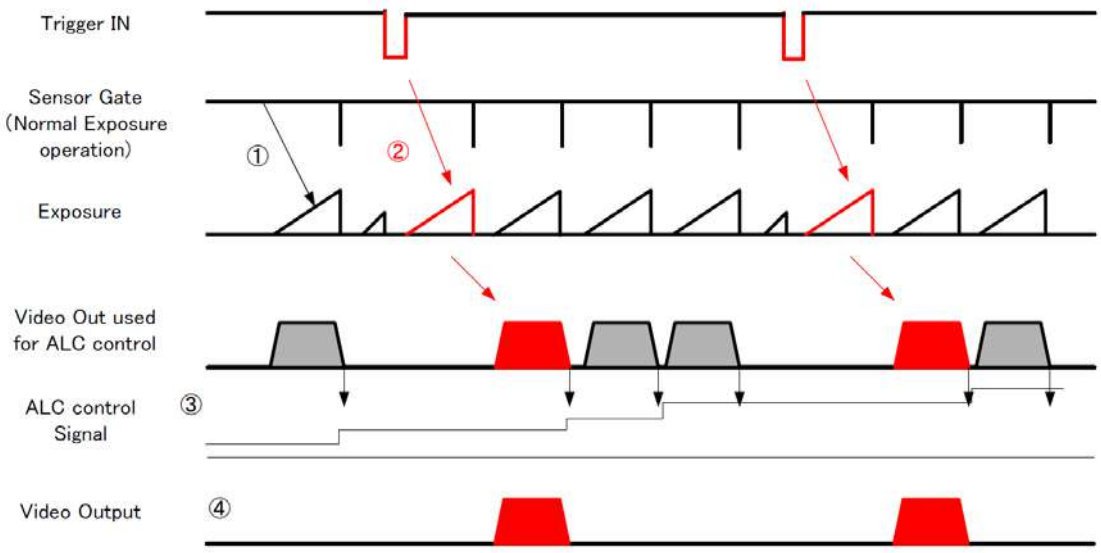
t1	t2
28L	9L ～10L

RCT mode together with ALC function

RCT mode can use ALC control to ensure that the proper exposure is set when the trigger pulse is input. In this case, the following settings are additionally required to RCT mode settings.

1. Exposure Auto: Continuous
2. Gain Auto: Continuous

In the following drawing, the steps to achieve this combination are explained.
① The exposure control is the same as in continuous mode.
② When the trigger signal is input, the charge that has already been accumulated during the current exposure period is read out very quickly and a new exposure period starts. The exposure continues as in continuous mode.
③ All video level data from every exposure is transferred to ALC control.
④ The video output sent to the GigE interface is only the signal after the trigger is input.



Sequence Mode

This is a function to capture images in sequence based on preset ROI, Exposure Time, Gain and other parameters in the sequence index table. To use sequence mode, Video Send Mode must be set to “Command Sequence.” In the GO-5000M-PMCL-UV, this is the only sequence mode available.

Video Send Mode	How to select Index
Command Sequence	Select the index directly by setting the index number with the Command Sequence Index command.

Basic setting to use this function

Trigger Mode: ON
Exposure mode : Timed
Video Send Mode: Command Sequence

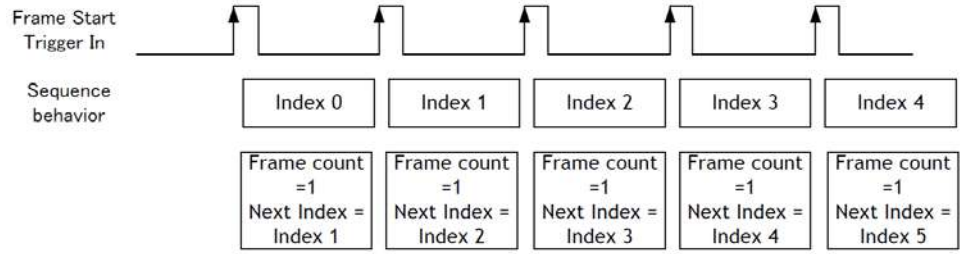
Minimum trigger interval (1x8–1Y)

Trigger Mode	Readout Mode	Time (Min. Trigger Period)
Sequence mode	Full	9435 us + Exposure time + 8.01μs
	ROI Center 2/3	6281 us + Exposure time + 8.01μs
	ROI Center 1/2	4740 us + Exposure time + 8.01μs
	ROI Center 1/4	2393 us + Exposure time + 8.01μs
	ROI Center 1/8	1219 us + Exposure time + 8.01μs
	V Binning ON (Full)	4740 us + Exposure time + 8.01μs

Note 2: The minimum trigger interval assumes that the exposure time is the same for each index in the sequence. If the exposure time is different, the difference in period should be added to the interval calculation.
Note 3: If it is necessary to use different exposure times, it is recommended to arrange the exposure times from the shortest to the longest.
Note 4: In sequence mode, the exposure should be adjusted so that the operation is not in LVAL sync accumulation.

Trigger Sequence mode timing

The following drawing shows the sequence mode timing concept.



In this mode, it is not possible to overlap the next exposure while the previous trigger operation (Indextable) is in progress.

Default setting

Sequence ROI Index	Sequence ROI													
	Width	Height	Offset		Gain Selector			Exposure Time	Black Level	Binning		LUT Enable	Frame Count	Next Index
			X	Y	Gain (ALL)	Red	Blue			Horizontal	Vertical			
- Index 1	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 2	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 3	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 4	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 5	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 6	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 7	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 8	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
- Index 9	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0
-Index 10	2560	2048	0	0	100	0	0	18000	0	1 (Off)	1 (Off)	Off	1	Index 0

Sequence mode setting Command

Command	Parameter	Description
Sequence ROI Index	Index 1～10	Select an index to be set
Sequence ROI Frame Count	1～255	<Set to each Index> Set fame number for display per a frame
Sequence ROI Width	16～2560 (Note 1)	<Set to each Index> Set the width value
Sequence ROI Height	1～2048 (Note 1) 2～2048	<Set to each Index> Set the height value
Sequence ROI Offset X	0～2560 (Note 1)- [Sequence ROI Width]	<Set to each Index> Set the offset X value.
Sequence ROI Offset Y	0 ～ 2048(Note1) - [Sequence ROI Height]	<Set to each Index> Set the offset Y.
Sequence ROI Gain All	100～1600	<Set to each index> Set the gain value.
Sequence ROI Exposure Time	10～8000000	<Set to each Index> Set the exposure time value.
Sequence ROI Black Level	-256～255	<Set to each index> Set the black level value.
Sequence ROI LUT enable	0 (Disable) 1 (Enable)	<Set to each Index> Set the disable or enable of LUT. If it is set to enable, the function is selected in the Sequence LUT mode.
Sequence ROI H Binning	1, 2, 4 (3 is disable)	<Set to each Index> Set the H Binning value.
Sequence ROI V Binning	1, 2, 4 (3 is disable)	<Set to each Index> Set the V Binning value.
Sequence Repetition	1～255	<For Trigger Sequence Mode> Set the repeat number of the sequence.
Command Sequence Index	Index 1～10	<For Command Sequence Mode> Set the performed index.
Current Sequence Index	Index 1～10	<READ only> Refer to the current Sequence Index.
Sequence LUT Mode	Gamma LUT	Set the function if Sequence ROI LUT is set to enable. Set the value on Gamma or LUT control.
Reset Sequence Index	No (EXE command)	Reset the Sequence Index to 0. At the same time, the Frame Count is also initialized.

Note1: In the binning mode, the maximum value is changed.

Multi ROI function

This function divides one frame image into a maximum of 5 images vertically and reads out all areas in one frame. In this function, width is the same for all 5 images. In the GO-5000M-PMCL-UV, image overlapping is not possible.

Multi ROI setting

Video Send Mode: Set to Multi ROI

Multi ROI Index table default values

Multi ROI Index Max	1		
Multi ROI Width	2560		
Multi ROI Index Selector	Multi ROI Height	Offset X	Offset Y
- Index 1	2048	0	0
- Index 2	2	0	0
- Index 3	2	0	0
- Index 4	2	0	0
- Index 5	2	0	0

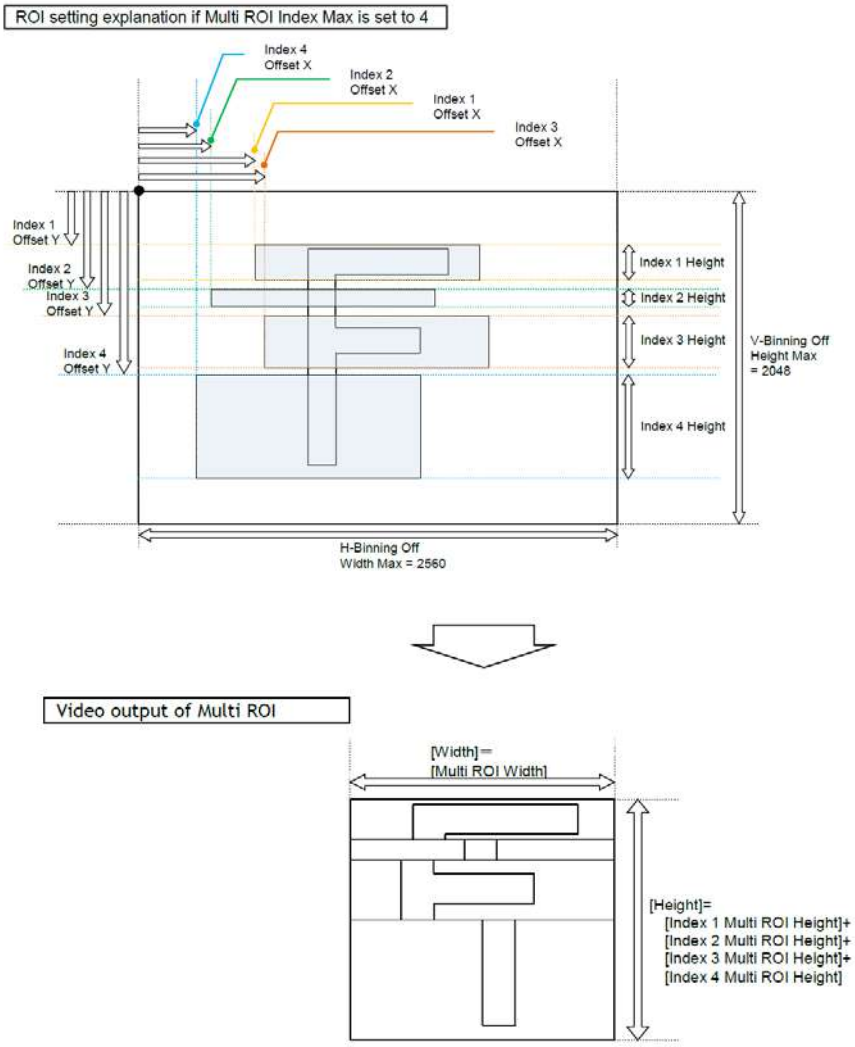
Multi ROI setting command

Command list

Command	Parameter	Description
Multi ROI Index	Index 1～5	Select index table to be set
Multi ROI Width	8～2560 Note1)	<Common for all indexes> Set the width value to be used in Multi ROI Mode
Multi ROI Height	1～2048(Note1) (Note2) 2～2048(Note3)	<Set to each Index> Set the height value
Multi ROI Offset X	0～2560(Note1) - [Sequence ROI Width]	<Set to each Index> Set the offset X value.
Multi ROI Offset Y	0～2048(Note1) - [Sequence ROI Height]	<Set to each Index> Set the offset Y value.
Multi ROI Index Max	1～5	Set the index number to be used.

Note1: In the binning mode, the maximum value is changed.

Multi ROI settings and output image



Note: In this mode, the frame grabber board must set its horizontal pixel number to Multi ROI Width and its vertical pixels to Multi ROI Max and the sum of Multi ROI Height.

Operation and function matrix

Exposure operation	Trigger Mode	Trigger Option	Binning Vertical	Binning Horizontal	Exposure Time	ROI	Auto Gain	Auto Exposure	Over lap	Vide Send Mode	
										Multi ROI	Sequence ROI
OFF	OFF	OFF	1	1	×	○	○	×	×	○	×
			2	2	×	○	○	×	×	○	×
Timed	OFF	OFF	1	1	○	○	○	○	×	○	×
			2	2	○	○	○	○	×	○	×
Timed	ON	OFF	1	1	○	○	○	○	○	○	○
			2	2	○	○	○	○	○	○	○
Trigger Width	ON	OFF	1	1	×	○	○	×	○	○	×
			2	2	×	○	○	×	○	○	×
RCT	ON	RCT	1	1	○	○	○	○	×	○	×
			2	2	×	×	×	×	×	×	×

Black level control

This function adjusts the setup level.

Reference level	33.5LSB (Average of 100 x 100 pixels)
Video level variable range	0～apprx.100 LSB
Variable range	-256～255 (Default: 0)
Resolution	1STEP=0.25LSB

Black Level Selector

The following items can be adjusted.
GO-5000M-PMCL-UV: Black Level All

Black Level

The black level can be adjusted in the following range.
GO-5000M-PMCL-UV: Black Level All : -256 ～+255

Gain control

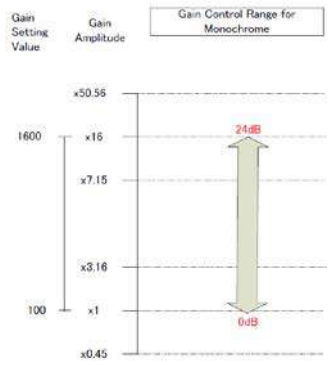
In the GO-5000M-PMCL-UV, the gain control uses Analog Base Gain and Digital Gain. Analog Base Gain can be set at 0dB, +6dB or +12dB. The digital gain is used for the master gain setting.

Analog base gain

Analog base gain can be selected from 0dB, 6dB and 12dB.

Gain

The master gain (DigitalAll) can be set x1 (0dB) to x16 (+24dB) against the analog base gain.
The resolution for gain setting is 0.01%/step which is 0.05dB to 0.08dB, depending on the setting value.



Gain Selector

The following parameters can be set.
GO-5000M-PMCL-UV: Digital All

Gain

The range for adjustment : Digital All: 1 ～ 16 (x1 (0dB) ～x16 (+24dB))

Gain Raw

The range for adjustment : Gain Raw Digital All : 100 ～ 1600 (0dB～24dB)

Gain Auto

This provides automatic control of the gain level.
This is controlled by the command JAI ALC Reference.
There are two modes.
OFF: Adjust manually.
Continuous: Operate the auto gain continuously

The following detailed settings are also available.
ALC Speed: The rate of adjustment of GainAuto can be set
(common with Exposure Auto)
Gain Auto Max: The maximum value of GainAuto control range can be set
Gain Auto Min: The minimum value of GainAuto control range can be set
ALC Reference: The reference level of Gain Auto control can be set
(common with Exposure Auto)
ALC Area Selector: The measurement area of GainAuto control can be set.
(Common with Exposure Auto)
ALC Area Enable: Determine the use of selected ALC area.
This can enable its use area by area. If ALC Area Enable All is set to “True”, all areas are enabled. In this case, the setting area by area is disabled.

ALC channel area

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

LUT

This function can be used to convert the input to the desired output characteristics. The Lookup Table (LUT) has 32 points for setup in GO-5000M-PMCL-UV. The output level is created by applying gain to the input level to achieve the specified output level.

LUT Mode

Can be set to OFF, gamma, or Lookup Table. If Lookup Table is selected, the dark compression is forced to be OFF.

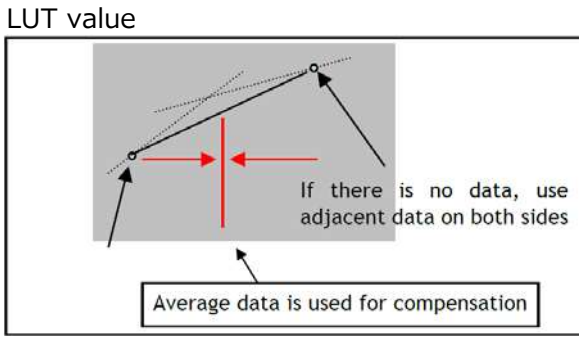
LUT Index

This represents the “starting” or “input” pixel value to be modified by the Lookup Table. The GO-5000M-PMCL-UV has a 32-point Lookup Table. Thus, in the GO-5000M-PMCL-UV, an index value of 0 represents a full black pixel and a value of 31 represents a full white pixel. The index point values are automatically scaled to fit the internal pixel format of the camera. This is common for all output configurations.

LUT value

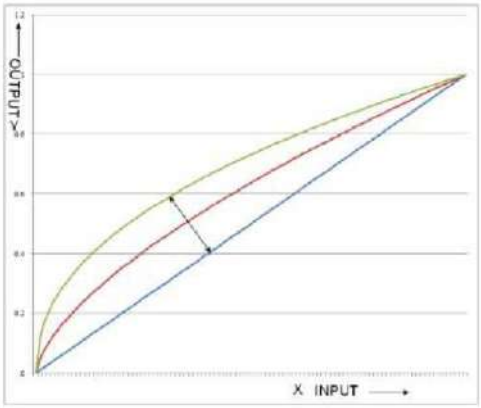
This is the "adjusted" or "output" pixel value for a given LUT index. It has a range of 0 to 4095 (12 bits) and is automatically scaled to the bit depth of the current output mode (8-bit, 10 bit, or 12-bit). Linear interpolation is used to calculate LUT values between index points. In the color model, the LUT function works the same regardless of the color of the pixel.

*Note: The LUT must have a positive slope, i.e., the value for each index must be greater than th previous index. If the value for an index is set ≤ one or more previous indexes, those indexes will be automatically adjusted to maintain a positive slope.



Gamma

This command is used to set gamma 0.45, gamma 0.6 and gamma 1.0 (OFF) in 3 steps.
The gamma value is an approximate value.

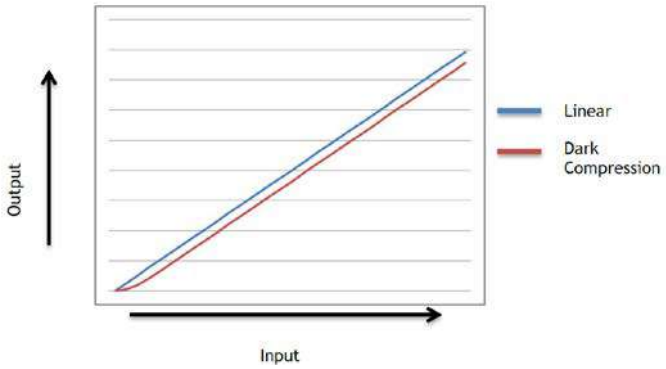


Linear and Dark Compression

GO-5000M-PMCL-UV has a dark compression circuit to improve the signal-to-noise ratio in the dark portion of the image.

Dark Compression	Function
Linear(Factory default)	No compression, Gamma=1.0
Dark Compression	Compress the signal level in the dark portion. It can improve the signal to noise ratio, but on the other hand, the linearity will be deteriorated.

The following drawing is characteristics of linear and dark compression.

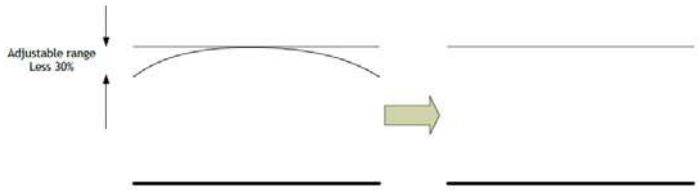


Shading Correction

This function compensates for shading (non-uniformity) caused by the lens or the light source used. This compensation can be performed even if shading issues are not symmetrical in horizontal and/or vertical directions. There are two methods of correction.

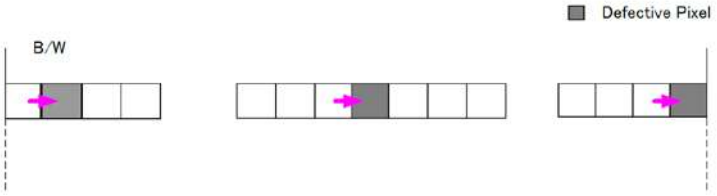
Flat shading correction:

The method to compensate the shading is to measure the highest luminance level in the image and use that data as the reference. Luminance levels of other areas are then adjusted so that the level of the entire area is equal. The block grid for compensation is 20 (H) x 16(V) and each block contains 128 x 128 pixels. The complementary process is applied to produce the compensation data with less error.



Blemish compensation

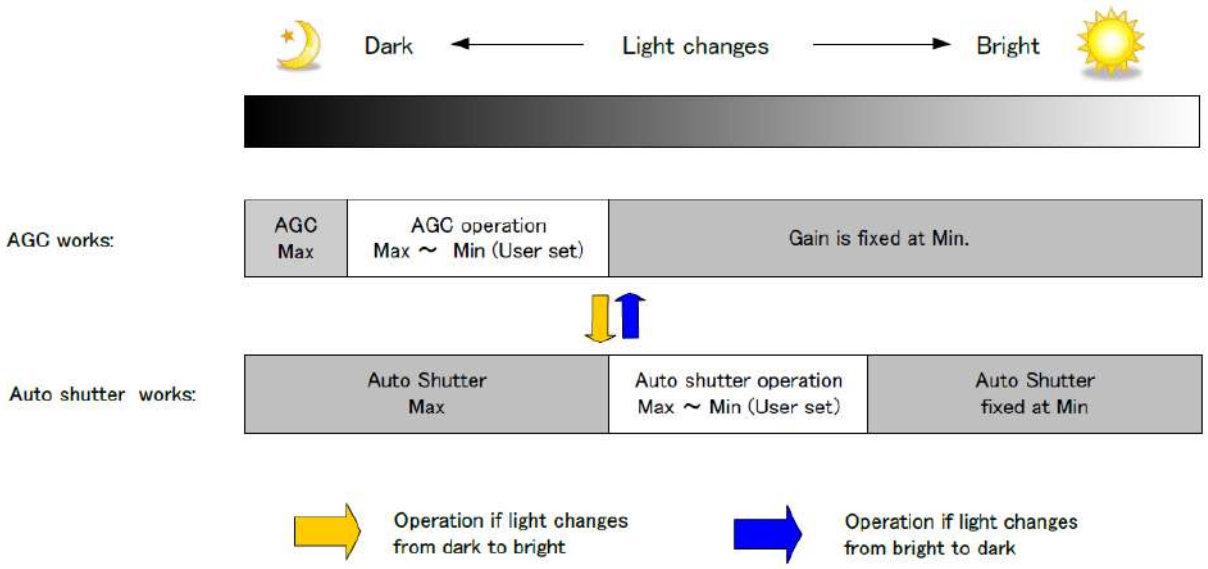
The GO-5000M-PMCL-UV has a blemish compensation circuit. This function compensates blemishes on the CMOS sensor (typically pixels with extremely high response or extremely low response). This applies to both monochrome and color versions. Pixels that fulfill the blemish criteria can be compensated by averaging the data from the pixel in the left adjacent column.
The GO-5000M-PMCL-UV has automatic blemish detection function. After setting the threshold, and then the blemish compensation is executed, blemishes are automatically detected and stored in the memory inside the camera. If the blemish compensation is set to ON, the stored data is loaded.
The customer can adjust white blemishes but not black blemishes.



ALC

In the GO-5000M-PMCL-UV, auto gain and auto exposure can be combined to provide a wide ranging automatic exposure control from dark to bright or vice versa.
The functions are applied in the sequence shown below and if one function is disabled, the remaining function will work independently.

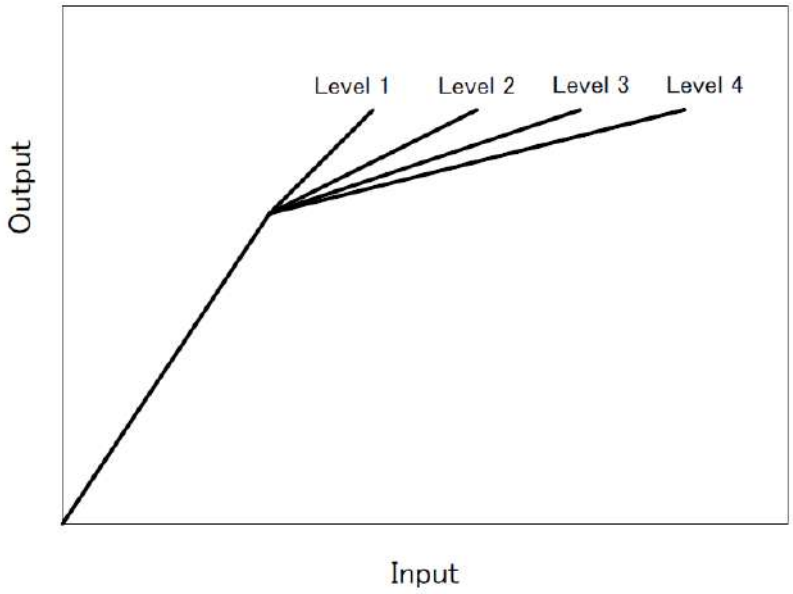
If the lighting condition is changed from bright to dark ASC — AGC
If the lighting condition is changed from dark to bright AGC — ASC



HDR (High Dynamic Range)

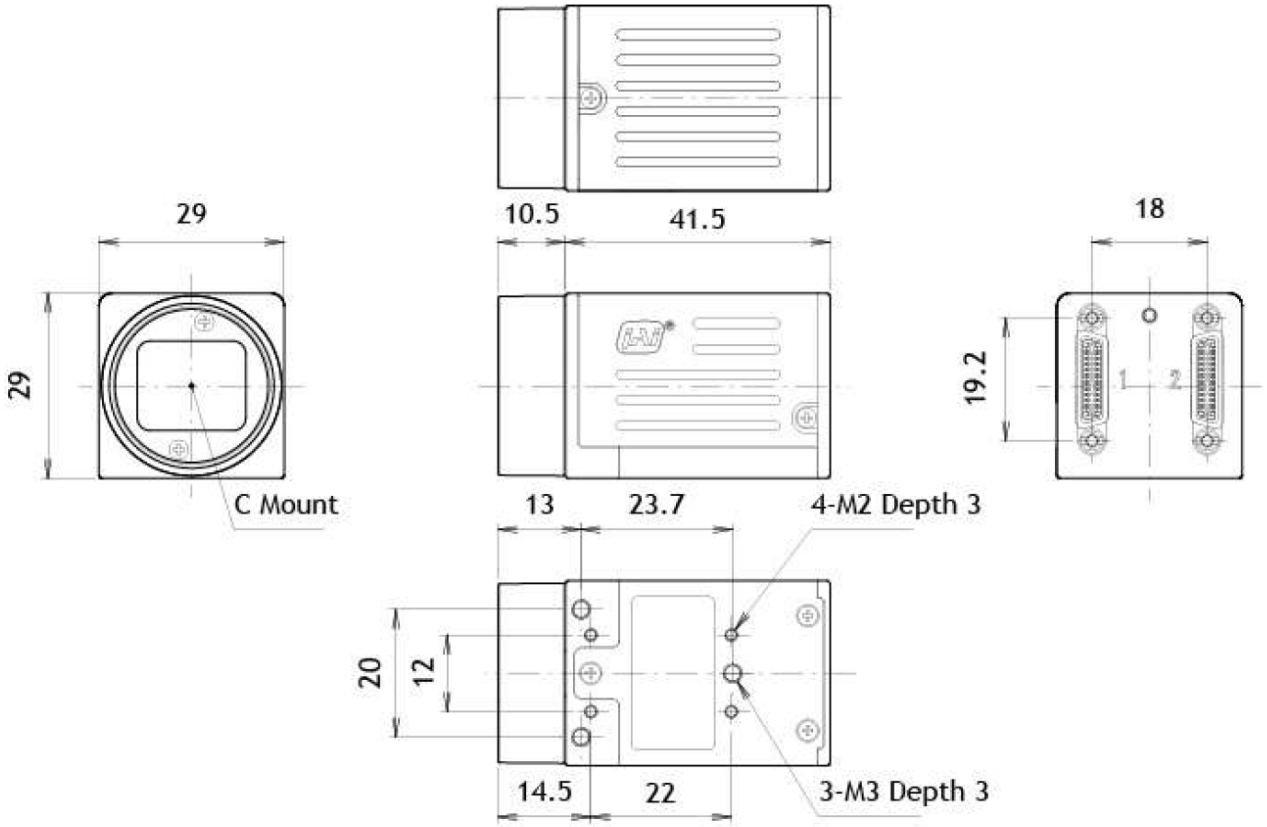
HDR sensing mode can be set when HDR Mode is set to ON while Exposure Mode is Timed.
The parameters to configure dynamic range are HDR_SLOPE Level 1, Level 2, Level 3 and Level 4.
The user can select any one of those parameters as required for their application.
In this mode, the timed exposure is used as the reference and the value selected in HDR_SLOPE will compensate to get an appropriate dynamic range by changing the exposure time.

Notes:
1. If the exposure mode is OFF and the HDR mode is set to ON, the exposure mode is automatically changed to Timed.
2. If horizontal binning and/or vertical binning are set to ON, the HDR mode cannot be set. In this case, the HDR mode must be set first before H-Binning and/or V-Binning are set.
3. In this mode, exposure overlapped behavior is not available and the frame rate is slower than normal operation.
4. The exposure time value is fixed at the value when HDR Mode is activated. When the exposure time is changed, HDR Mode should be off. Once the exposure time is changed, HDR Mode can be set to ON again.
5. In this mode, Exposure Auto function is disabled.



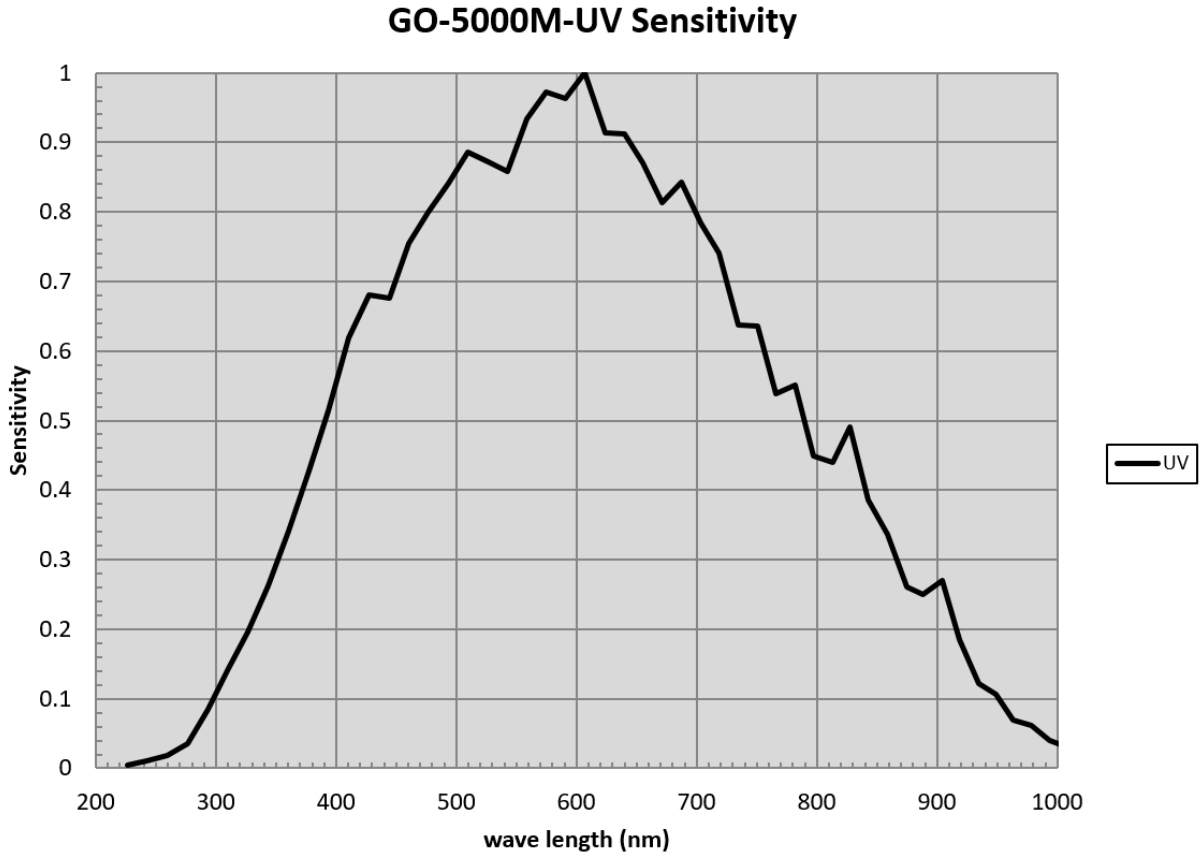
Knee Slope	Dynamic Range [%]
1	(200)
2	(400)
3	(800)
4	(1600)

External appearance and dimensions



Dimensions tolerance: ±0.3mm Unit: mm

Spectral response



Specifications table

Specifications			GO-5000M-PMCL-UV
Scanning system			Progressive scan
Synchronization			Internal
Interface			CameraLink Specifications (V.2.0 RC2), Conforming with PoCL specifications
Image sensor			1-inch Monochrome CMOS
Aspect Ratio			5:4
Image size(Effective Image)			12.8 (h) x 10.24 (v) mm, 16.39 mm diagonal
Pixel size			5 (h) x 5 (v) µm
Effective Image output Pixels			2560 (h) x 2048 (v)
Sensor Pixel clock			8-bit: 36MHz, 10-bit: 2 8.8MHz, 12-bit: 24MHz
Camera Link clock			48.57 MHz/8 Pixels (Camera Link Clock = Low) 58.28 MHz/8 Pixels (Camera Link Clock = Mid, only for X8-1Y-10bit) 72.85 MHz/8 Pixels (Camera Link Clock = Mid, High for 1X8-1Y-8bit) 84.99 MHz/8 Pixels (Camera Link Clock = High)
Acquisition Frame Rate			Maximum frame rate shown. Minimum is 0.125fps in all instances.
1X2–1Y 8/10/12-bit CL clock: HIGH	H1, V1		31.9fps
	Binning	H1, V2	63.4fps
		H1, V4	124.7fps
		H2, V1	62.9fps
		H2, V2	124.7fps
		H2, V4	245.6fps
		H4, V1	71.8fps
		H4, V2	245.6fps
		H4, V4	280.1fps
1X3–1Y 8-bit CL clock: HIGH	H1, V1		47.8fps
	Binning	H1, V2	95.0fps
		H1, V4	187.4fps
		H2, V1	71.8fps
		H2, V2	142.5fps
		H2, V4	281.1fps
		H4, V1	71.8fps
		H4, V2	142.5fps
		H4, V4	281.1fps
1X4–1Y 8/10/12-bit CL clock: HIGH	H1, V1		63.6fps
	Binning	H1, V2	126.1fps
		H1, V4	248.2fps
		H2, V1	71.7fps
		H2, V2	142.3fps
		H2, V4	280.1fps
		H4, V1	71.7fps
		H4, V2	142.3fps
		H4, V4	280.1fps
1x8–1Y 8-bit CL Clock: HIGH	H1, V1		107.2fps
	Binning	H1, V2	212.3fps
		H1, V4	417.1fps
		H2, V1	107.1fps
		H2, V2	213.6fps
		H2, V4	417.0fps
		H4, V1	107.8fps
		H4, V2	213.6fps
		H4, V4	419.6fps
1x8–1Y 10-bit CL Clock: MID	H1, V1		84.9fps
	Binning	H1, V2	168.4fps
		H1, V4	330.7fps
		H2, V1	86.0fps
		H2, V2	170.4fps
		H2, V4	334.8fps
		H4, V1	86.0fps
		H4, V2	170.4fps
		H4, V4	334.8fps
SN ratio (traditional method)			Dark Compression:55dB (Typical) Linear:49dB (Typical) (0dB gain, Black))

Image Output format Digital	Full pixels			2560 (h) x 2048 (v)
	ROI	Width		8 ～2560 pixels, 8 pixels/step(1X2-1Y) 8 ～2560 pixels, 8 pixels/step(1X3-1Y) 8 ～2560 pixels, 8 pixels/step(1X4-1Y) 8 ～2560 pixels, 8 pixels/step(1X8-1Y)
		OFFSET X		0 ～2552 pixels, 8 pixels/step(1X2-1Y) 0 ～2552 pixels, 8 pixels/step(1X3-1Y)(Note1) 0 ～2552 pixels, 8 pixels/step(1X4-1Y) 0 ～2552 pixels, 8 pixels/step(1X8-1Y)
		Height		1 ～2047 lines,1 line/step
		OFFSET Y		0 ～2047 lines, 1 line/step
	Binning	H	1	2560(H)
			2	1280(H)
			4	640(H)
		V	1	2048(V)
			2	1024(V)
			4	512(V)
	Pixel Format			Mono8,Mono10,Mono12
Acquisition mode				Continuous
Trigger selector				Frame Start
Trigger mode				Continuous, Timed (EPS), Trigger Width,
Trigger option				JAI_RCT with ALC
Trigger Overlap				Fixed to Readout
Trigger Input Signal				Line7 (Camera link CC1), Pulse Generator 0, Soft Trigger, NAND0 (out), NAND1 (out)
Exposure Mode	Timed			Auto Exposure OFF: 10 µs (Min) ～ 8 sec. (Max)(Note2), Step: 1µs
	Trigger Width			10 µs (Min) ～ ∞ (Max)(Note2)
Auto exposure				OFF / Continuous
Auto Exposure Response Speed				1 ～ 8
Video Send mode				Normal, Multi ROI, Command Sequence
Digital I/O				Line Selector (Camera Link): EEN out/CC1 in
Black Level Adjust.	Ref. level			33.5LSB 10-bit (Average value of 100*100)
	Video level adj. range			0 ～ approx. 100LSB
	Adj. range			-256 ～ +255LSB 10-bit
	Resolution			1 STEP = 0.25LSB
Analog Base Gain (For manual)				x1 (0dB), x2 (+6dB), x4 (+12dB)
Gain Control	Manual Adj. range			0dB ～+24dB, 1%/step (Note3)
Blemish Comp.	Detection			Detect white blemish above the threshold value (Black blemish is detected only by factory)
	Compensation			Complement by adjacent pixels (Continuous blemishes are not compensated)
	Numbers			Up to 512 pixels
ALC				AGC and Auto Shutter can be combined and automatically controlled
Gamma				γ=0.45, 0.6, 1.0 (3 steps are available)
LUT				OFF: γ=1.0, ON=32 points can be set
Shading compensation(Note1)				Flat field Block based (20 x 16 blocks))
HDR				4 settings, Level 1, 2, 3 and 4
Power supply		Input range		DC+12V ± 1V (Complies with PoCL Standards)
		Current		250mA ± 20mA (12V input, full image)
		Power Consumption		3.0W (12V input, full image)
Lens mount				C mount, Rear protrusion of the lens is less than 10 mm.
Flange back				17.526 mm, Tolerance: 0 to -0.05 mm
Optical filter				Protection glass: Not provided
Operating temperature/Humidity Performance guaranteed				-5℃to +45℃ / 20 to 80% (No-condensing)
Storage Temp. / Humidity				-25℃ to +60℃ / 20 to 80% (No-condensing)
Regulation				CE (EN61000-6-2 and EN61000-6-3), FCC part 15 class B, RoHS, WEEE
Housing Dimensions				29 x 29 x 52 mm (W x H x D) (excluding protrusion)
Weight				46g

Note1) In 1X3-1Y type, if the width is set not to the multiple of 24, 1 or 2 pixels may not contain video data.
Note 2) Performance guarantee is up to 1 second.
Note 3) Gaps in histogram may occur if more than +12dB of gain is applied.
Note 4) Approximately 5 minutes pre-heating is required to achieve these specifications.
Note 5) The above specifications are subject to change without notice.

Appendix

1. Precautions

Personnel not trained in dealing with similar electronic devices should not service this camera.
The camera contains components sensitive to electrostatic discharge. The handling of these devices should follow the requirements of electrostatic sensitive components.
Do not attempt to disassemble this camera.
Do not expose this camera to rain or moisture.
Do not face this camera towards the sun, extreme bright light or light reflecting objects.
When this camera is not in use, put the supplied lens cap on the lens mount.
Handle this camera with the maximum care.
Operate this camera only from the type of power source indicated on the camera.
Power off the camera during any modification such as changes of jumper and switch setting.

2. Typical Sensor Characteristics

The following effects may be observed on the video monitor screen. They do not indicate any fault of the camera, but are associated with typical sensor characteristics.

V. Aliasing
When the CMOS camera captures stripes, straight lines or similar sharp patterns, jagged edges may appear on the monitor.

Blemishes
All cameras are shipped without visible image sensor blemishes.
Over time some pixel defects can occur. This does not have a practical effect on the operation of the camera. These will show up as white spots (blemishes).
Exposure to cosmic rays can cause blemishes to appear on the image sensor. Please take care to avoid exposure to cosmic rays during transportation and storage. It is recommended using sea shipment instead of air flight in order to limit the influence of cosmic rays on the camera.
Pixel defects/blemishes also may emerge due to prolonged operation at elevated ambient temperature, due to high gain setting, or during long time exposure. It is therefore recommended to operate the camera within its specifications.

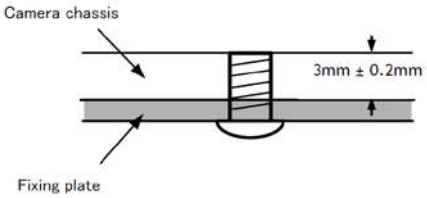
Patterned Noise
When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear on the video monitor screen.

3. Caution when mounting a lens on the camera

When mounting a lens on the camera dust particles in the air may settle on the surface of the lens or the image sensor of the camera. It is therefore important to keep the protective caps on the lens and on the camera until the lens is mounted. Point the lens mount of the camera downward to prevent dust particles from landing on the optical surfaces of the camera. This work should be done in a dust free environment. Do not touch any of the optical surfaces of the camera or the lens.

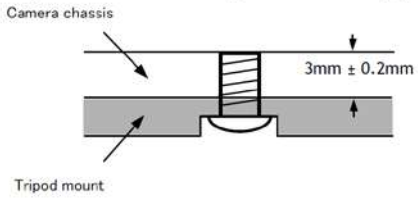
4. Caution when mounting the camera

When you mount the camera on your system, please make sure to use screws of the recommended length described in the following drawing. Longer screws may cause serious damage to the PCB inside the camera.



Mounting the camera to fixing plate

If you mount the tripod mounting plate, please use the provided screws.



5. Exportation

When exporting this product, please follow the export regulation of your own country.

6. References

1. This manual can and datasheet for GO-5000M-PMCL-UV can be downloaded from www.jai.com
2. Camera control software can be downloaded from www.jai.com

5. Short ASCII Command Communication Protocol

This chapter described the communication control protocol based on the short ASCII command as the reference.

Communication setting

Baud Rate	9600
Data Length	8bit
Start Bit	1bit
Stop Bit	1bit
Parity	Non
Xon/Xoff Control	Non

Protocol (Short ASCII Command)

Transmit the setting command to camera

NN is any kind of command.
NN=[Param.]<CR><LF>
e.g.
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 improper command, camera will return one of the following:
e.g.
Send to camera: GAX=0 <CR><LF>
Camera response: 01 Unknown Command!!<CR><LF>
e.g.
Send to camera: GA=1000 <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.
e.g.
Send to camera: GA? <CR><LF>
Camera response: GA=0<CR><LF>

Switching baud rate between PC and camera

Camera always starts up with 9600 bps. This can be switched to higher baud rates after communication has been established. When switching to other baud rates the procedure is as follows.
e.g. Change baud rate to 115200 bps

1. Confirm baud rates camera supported
   Send to camera: SBDRT? <CR><LF>
   Camera response: SBDRT=31(0x1F)<CR><LF>
2. Request new baud rate
   Send to camera: CBDRT=16(0x10) <CR><LF>
   Camera response: COMPLETE<CR><LF>
   (Change baud rate to 115200 bps)
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 250 ms after sending the acknowledgement it falls back to the original baud rate (9600 bps).

5. Command list (Short ASCII command)

GenCP Bootstrap Register

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
DeviceVendorName	I String	R/O	DVN	"JAI Ltd., Japan"	—	—	—	DVN?<CR><LF>
DeviceModelName	I String	R/O	MD		—	—	—	MD?<CR><LF>
DeviceVersion	I String	R/O	DV	Indicate device version (e.g. "0.1.0.0")	—	—	—	DV?<CR><LF>
DeviceID	I String	R/O	ID	Serial Number	—	—	—	ID?<CR><LF>
DeviceUserID	I String	R/W	UD	User can save and load free text. (12 or less characters)				UD=[Param.]<CR><LF > UD?<CR><LF>

Technology Specific Bootstrap Register

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
SupportedBaudrates	I Integer	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>
CurrentBaudrate	I Integer	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. (Refer to the section 3.3)

Device Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
DeviceFirmware Version	I String	R/O	VN	Firm Ver. No.	—	—	—	VN?<CR><LF>
DeviceReset	I Command	W/O	CRS00	1	—	—	—	CRS00=1<CR><LF>

Image Format Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
Height	I Integer	R/W	HTL	Min ~ (Max - OffsetY)	1(Mono) 2(Bayer)	2048	2048	HTL=[Param.]<CR>< LF> HTL?<CR><LF>
Width	I Integer	R/W	WTC	Min ~ (Max - OffsetX)	8	2560	2560	WTC=[Param.]<CR><LF> WTC?<CR><LF>
Offset Y	I Integer	R/W	OFL	Min~(Max - Height)	0	2047 (Mono) 2046 (Bayer)	0	OFL=[Param.]<CR><LF> OFL?<CR><LF>
Offset X	I Integer	R/W	OFC	Min~(Max - Width)	0	2544	0	OFC=[Param.]<CR><LF> OFC?<CR><LF>

Binning Horizontal	I Integer	R/W	HB	1: Normal 2: Binning 2 mode 4: Binning 4 mode	1	4	1	HB=[Param.]<CR><LF> HB?<CR><LF> only Mono
Binning Vertical	I Integer	R/W	VB	1: Normal 2: Binning 2 mode 4: Binning 4 mode	1	4	1	VB=[Param.]<CR><LF> VB?<CR><LF> only Mono
PixelFormat	I Enumeration	R/(W)	BA	Mono model: 0: Mono8 1: Mono10 2: Mono12 Bayer model: 0: BayerGR8 1: BayerGR10 2: BayerGR12	0	2	0	BA=[Param.]<CR><LF > BA?<CR><LF>
TestImage Selector	I Enumeration	R/W	TPN	0: Off 1: GreyHorizontalRamp 2: GreyVerticalRamp 3: GreyHorizontalRampMoving 4: Horizontal Colorbar* 5: Vertical Colorbar* 6: Moving Colorbar* (* Bayer model only)	0	6	0	TPN=[Param.]<CR><LF> TPN?<CR><LF>

Acquisition Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
FrameStartTrigMode	I Enumeration	R/W	TM	Off/On	0	1	0	TM=[Param.]<CR><LF> TM?<CR><LF>
TriggerSoftware	I Command	(R)/W	STRG	0, 1	—	—	—	STRG=0<CR><LF>
FrameStartTrigSource	I Enumeration	R/W	TI	0: Low 1: High 2: SoftTrigger 8: PulseGenerator0 13: CL_CC1_In 14: Nand0 15: Nand1	0	15	0	TI=[Param.]<CR><LF> TI?<CR><LF>
FrameStartTrigActivation	I Enumeration	R/W	TA	0: RisingEdge 1: FallingEdge 2: LevelHigh 3: LevelLow	0	3	0	TA=[Param.]<CR><LF> TA?<CR><LF>
ExposureMode	I Enumeration	R/W	EM	0: Off 1: Timed 2: TriggerWidth	0	2	0	EM=[Param.]<CR><LF> EM?<CR><LF>
ExposureTimeRaw	I Integer	R/W	PE	Min～Max[us]	10	8000000	18000	PE=[Param.]<CR><LF> PE?<CR><LF>
ExposureAuto	I Enumeration	R/W	ASC	0: Off 1: Continuous	0	1	0	ASC=[Param.]<CR><LF> ASC?<CR><LF>

Digital I/O Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
LineInverter_Nand0In1	I Boolean	R/W	ND0INV1	False/True	0	1	0	ND0INV1=[Param.]<CR><LF> ND0INV1?<CR><LF>
LineInverter_Nand0In2	I Boolean	R/W	ND0INV2	False/True	0	1	0	ND0INV2=[Param.]<CR><LF> ND0INV2?<CR><LF>
LineInverter_Nand1In1	I Boolean	R/W	ND1INV1	False/True	0	1	0	ND1INV1=[Param.]<CR><LF> ND0INV1?<CR><LF>
LineInverter_Nand1In2	I Boolean	R/W	ND1INV2	False/True	0	1	0	ND1INV2=[Param.]<CR><LF> ND0INV2?<CR><LF>
LineSource_Line1	I Enumeration	R/W	LS0	0: Low 1: High 3: Frame TriggerWait 4: Frame Active 5: Exposure Active 6: Fval 7: Lval 8: Pulse Generator0 13: CL_CC1_In 14: Nand0 15: Nand1	0	15	0	LS0=[Param.]<CR><LF> LS0?<CR><LF> For 12pin TTL out
LineSource_Nand0In1	I Enumeration	R/W	ND0IN1	Same as for Line1	0	15	0	ND0IN1=[Param.]<CR><LF> ND0IN1?<CR><LF>
LineSource_Nand0In2	I Enumeration	R/W	ND0IN2	Same as for Line1	0	15	0	ND0IN2=[Param.]<CR><LF> ND0IN2?<CR><LF>
LineSource_Nand1In1	I Enumeration	R/W	ND1IN1	Same as for Line1	0	15	0	ND1IN1=[Param.]<CR><LF> ND1IN1?<CR><LF>
LineSource_Nand1In2	I Enumeration	R/W	ND1IN2	Same as for Line1	0	15	0	ND1IN2=[Param.]<CR><LF> ND1IN2?<CR><LF>

Analog Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
GainRawDigitalAll	I Integer	R/W	FGA	min～0～max	100	1600	100	FGA=[Param.]<CR><L F> FGA?<CR><LF>
AnalogBaseGainAll	I Integer	R/W	ABALL	0:0dB, 1:6dB, 2:12dB	0	2	0	ABALL=[Param.]<CR><LF> ABALL?<CR><LF>
GainAuto	I Enumeration	R/W	AGC	0: Off 1: Continuous	0	1	0	AGC=[Param.]<CR><L F> AGC?<CR><LF>
BlackLevelRawAll	I Integer	R/W	BL	min～0～max	-256	255	0	BL=[Param.]<CR><L F> BL?<CR><LF>

LUT Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
LUTValueGreen (Mono)	I Integer	R/W	LUTG	Param 1: LUT index Param 2: LUTdata (Min～Max)	0	32 (Mono)	γ=1 相当値	LUTG=[Param1],[Para m2]<CR><LF> LUTG?[Param1]<CR>< LF>

Transport Layer Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
DeviceTapGeometry	I Enumeration	R/(W)	TAGM	1: Geometry_1X2_1Y 3: Geometry_1X4_1Y 5: Geometry_1X8_1Y 7: Geometry_1X3_1Y	1	7	5	TAGM=[Param.]<CR><LF> TAGM?<CR><LF>

User Set Control

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
UserSetLoad	I Command	(R)/W	LD	0: Default 1: UserSet1 2: UserSet2 3: UserSet3	0	3	0	LD=[Param.]<CR><LF> LD?<CR><LF>
UserSetSave	I Command	(R)/W	SA	1: UserSet1 2: UserSet2 3: UserSet3	1	3	1	SA=[Param.]<CR><LF> SA?<CR><LF>

JAI Custom

Name	Interface	Access	Short ASCII	Values	MIN	MAX	DEFAULT	Description
AcquisitionFramePeriod	I Integer	R/W	AR	Min～Max[us]	1	325786	11961	AR=[Param.]<CR><LF> AR?<CR><LF> Maximum value is calcurated depending on Height and Offset Y settings
BlemishWhiteEnable	I Boolean	R/W	BMW	0: False 1: True	0	1	0	BMW=[Param.]<CR><LF> BMW?<CR><LF>
BlemishWhiteDetect	I Command	W/O	BMRCW	1	1	1	-	BMRCW=1<CR><LF>
BlemishWhiteDetectThreshold	I Integer	R/W	BMTHW	Min ～ Max [%]	0	100	10	BMTHW=[Param.]<CR><LF> BMTHW?<CR><LF>
BlemishWhiteDetectPositionX	I Integer	R/W	BMPXW	Param 1: Blemish index Param 2: X position (Min～Max)	0	2559	0	BMPXW=[Param1], [Param2] <CR><LF> BMPXW? [Param1] <CR><LF>
BlemishWhiteDetectPositionY	I Integer	R/W	BMPYW	Param 1: Blemish index Param 2: Y position (Min～Max)	0	2047	0	BMPYW=[Param1], [Param2] <CR><LF> BMPYW? [Param1]<CR><LF>
ShadingCorrectionMode	I Enumeration	R/W	SDCM	0: Flat Shading	0	1	0	SDCM=[Param.]<CR><LF> SDCM?<CR><LF>
ShadingCorrect	I Command	W/O	RS		0	0	0	RS=0<CR><LF>
RequestShadingDetectResult	I Enumeration	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.	0	6	0	SDRS?<CR><LF>
ShadingMode	I Enumeration	R/W	SDM	0: OFF 1: User 1 2: User 2 3: User 3	0	3	0	SDM=[Param.]<CR>< LF> SDM?<CR><LF>
VideoSendMode	I Enumeration	R/W	VSM	0: Normal 1: Trigger Sequence 2: Command Sequence 3: Multi Roi Mode	0	3	0	VSM=[Param.]<CR><LF> VSM?<CR><LF>
SequenceModeFrameCount0	I Integer	R/W	SQF1	Min～Max	1	255	1	SQF1=[Param.]<CR><LF> SQI1?<CR><LF>
SequenceModeFrameCount1	I Integer	R/W	SQF2	Min～Max	1	255	1	SQF2=[Param.]<CR><LF> SQI2?<CR><LF>
SequenceModeFrameCount2	I Integer	R/W	SQF3	Min～Max	1	255	1	SQF3=[Param.]<CR><LF> SQI3?<CR><LF>
SequenceModeFrameCount(n-1)	I Integer	R/W	SQF(n)	Min～Max	1	255	1	SQF(n)=[Param.]<CR><LF> SQI(n)?<CR><LF>
SequenceModeFrameCount127	I Integer	R/W	SQF128	Min～Max	1	255	1	SQF128=[Param.]<CR><LF> SQI128?<CR><LF>

SequenceMode Next Index0	I Enumeration	R/W	SQNI1	Same as SequenceRoiIndex	0	9	0	SQNI1=[Param.]<CR><LF> SQNI1?<CR><LF>
SequenceMode NextIndex1	I Enumeration	R/W	SQNI2	Same as SequenceRoiIndex	0	9	0	SQNI2=[Param.]<CR><LF> SQNI2?<CR><LF>
SequenceMode NextIndex2	I Enumeration	R/W	SQNI3	Same as SequenceRoiIndex	0	9	0	SQNI3=[Param.]<CR><LF> SQNI3?<CR><LF>
SequenceMode NextIndex(n-1)	I Enumeration	R/W	SQNI(n)	Same as SequenceRoiIndex	0	9	0	SQNI(n)=[Param.]<CR><LF> SQNI(n)?<CR><LF>
SequenceMode NextIndex127	I Enumeration	R/W	SQNI128	Same as SequenceRoiIndex	0	9	0	SQNI128=[Param.]<CR> <LF> SQNI128?<CR><LF>
SequenceMode Height0	I Integer	R/W	SQH1	Min~Max	1(Mono) 2(Bayer)	2048	2048	SQH1=[Param.]<CR><LF> SQH1?<CR><LF>
SequenceMode Height1	I Integer	R/W	SQH2	Min~Max	1(Mono) 2(Bayer)	2048	2048	SQH2=[Param.]<CR><LF> SQH2?<CR><LF>
SequenceMode Height2	I Integer	R/W	SQH3	Min~Max	1(Mono) 2(Bayer)	2048	2048	SQH3=[Param.]<CR><LF> SQH3?<CR><LF>
SequenceMode Height(n-1)	I Integer	R/W	SQH(n)	Min~Max	1(Mono) 2(Bayer)	2048	2048	SQH(n)=[Param.]<CR> <LF> SQH(n)?<CR><LF>
SequenceMode Height127	I Integer	R/W	SQH128	Min~Max	1(Mono) 2(Bayer)	2048	2048	SQH128=[Param.]<CR> <LF> SQH128?<CR><LF>
SequenceMode OffsetY0	I Integer	R/W	SQOY1	Min~Max	0	2047 (Mono) 2046 (Bayer)	0	SQOY1=[Param.]<CR><LF> SQOY1?<CR><LF>
SequenceMode OffsetY1	I Integer	R/W	SQOY2	Min~Max	0	2047 (Mono) 2046 (Bayer)	0	SQOY2=[Param.]<CR><LF> SQOY2?<CR><LF>
SequenceMode OffsetY2	I Integer	R/W	SQOY3	Min~Max	0	2047 (Mono) 2046 (Bayer)	0	SQOY3=[Param.]<CR><LF> SQOY3?<CR><LF>
SequenceMode OffsetY(n-1)	I Integer	R/W	SQOY(n)	Min~Max	0	2047 (Mono) 2046 (Bayer)	0	SQOY(n)=[Param.]<CR> <LF> SQOY(n)?<CR><LF>
SequenceMode OffsetY127	I Integer	R/W	SQOY128	Min~Max	0	2047 (Mono) 2046 (Bayer)	0	SQOY128=[Param.]<CR > <LF> SQOY128?<CR><LF>
SequenceMode Gain0	I Integer	R/W	SQGA1	Min~Max	100	1600	0	SQGA1=[Param.]<CR><LF> SQGA1?<CR><LF>
SequenceMode Gain1	I Integer	R/W	SQGA2	Min~Max	100	1600	0	SQGA2=[Param.]<CR><LF> SQGA2?<CR><LF>
SequenceMode Gain2	I Integer	R/W	SQGA3	Min~Max	100	1600	0	SQGA3=[Param.]<CR><LF> SQGA3?<CR><LF>
SequenceMode Gain(n-1)	I Integer	R/W	SQGA(n)	Min~Max	100	1600	0	SQGA(n)=[Param.]<CR> <LF> SQGA(n)?<CR><LF>
SequenceMode Gain127	I Integer	R/W	SQGA128	Min~Max	100	1600	0	SQGA128=[Param.]<CR> <LF> SQGA128?<CR><LF>
SequenceMode ExposureTime0	I Integer	R/W	SQPE1	Min~Max	10	8000000	18000	SQPE1=[Param.]<CR><LF> SQPE1?<CR><LF>
SequenceMode ExposureTime1	I Integer	R/W	SQPE2	Min~Max	10	8000000	18000	SQPE2=[Param.]<CR><LF> SQPE2?<CR><LF>
SequenceMode ExposureTime2	I Integer	R/W	SQPE3	Min~Max	10	8000000	18000	SQPE3=[Param.]<CR><LF> SQPE3?<CR><LF>
SequenceMode ExposureTime(n-1)	I Integer	R/W	SQPE(n)	Min~Max	10	8000000	18000	SQPE(n)=[Param.]<CR> <LF> SQPE(n)?<CR><LF>
SequenceMode ExposureTime127	I Integer	R/W	SQPE128	Min~Max	10	8000000	18000	SQPE128=[Param.]<CR > <LF> SQPE128?<CR><LF>

SequenceMode Hbinning0	I Enumeration	R/W	SQHB1	1: Hbinning = OFF 2: Hbinning = x2 4: Hbinning = x4	1	4	1	SQHB1=[Param.]<CR><LF> SQHB1?<CR><LF> (Mono model only)
SequenceMode Hbinning1	I Enumeration	R/W	SQHB2	1: Hbinning = OFF 2: Hbinning = x2 4: Hbinning = x4	1	4	1	SQHB2=[Param.]<CR><LF> SQHB2?<CR><LF> (Mono model only)
SequenceMode Hbinning2	I Enumeration	R/W	SQHB3	1: Hbinning = OFF 2: Hbinning = x2 4: Hbinning = x4	1	4	1	SQHB3=[Param.]<CR><LF> SQHB3?<CR><LF> (Mono model only)
SequenceMode Hbinning(n-1)	I Enumeration	R/W	SQHB(n)	1: Hbinning = OFF 2: Hbinning = x2 4: Hbinning = x4	1	4	1	SQHB(n)=[Param.]<CR><LF> SQHB(n)?<CR><LF> (Mono model only)
SequenceMode Hbinning127	I Enumeration	R/W	SQHB128	1: Hbinning = OFF 2: Hbinning = x2 4: Hbinning = x4	1	4	1	SQHB128=[Param.]<CR><LF> SQHB128?<CR><LF> (Mono model only)
SequenceMode Vbinning0	I Enumeration	R/W	SQVB1	1: Vbinning = OFF 2: Vbinning = x2 4: Vbinning = x4	1	4	1	SQVB1=[Param.]<CR><LF> SQVB1?<CR><LF> (Mono model only)
SequenceMode Vbinning1	I Enumeration	R/W	SQVB2	1: Vbinning = OFF 2: Vbinning = x2 4: Vbinning = x4	1	4	1	SQVB2=[Param.]<CR><LF> SQVB2?<CR><LF> (Mono model only)
SequenceMode Vbinning2	I Enumeration	R/W	SQVB3	1: Vbinning = OFF 2: Vbinning = x2 4: Vbinning = x4	1	4	1	SQVB3=[Param.]<CR><LF> SQVB3?<CR><LF> (Mono model only)
SequenceMode Vbinning(n-1)	I Enumeration	R/W	SQVB(n)	1: Vbinning = OFF 2: Vbinning = x2 4: Vbinning = x4	1	4	1	SQVB(n)=[Param.]<CR><LF> SQVB(n)?<CR><LF> (Mono model only)
SequenceMode Vbinning127	I Enumeration	R/W	SQVB128	1: Vbinning = OFF 2: Vbinning = x2 4: Vbinning = x4	1	4	1	SQVB128=[Param.]<CR><LF> SQVB128?<CR><LF> (Mono model only)
SequenceMode LutEnable0	I Enumeration	R/W	SQLUT1	Off/On	0	1	0	SQLUT1=[Param.]<CR><LF> SQLUT1?<CR><LF>
SequenceMode LutEnable1	I Enumeration	R/W	SQLUT2	Off/On	0	1	0	SQLUT2=[Param.]<CR><LF> SQLUT2?<CR><LF>
SequenceMode LutEnable2	I Enumeration	R/W	SQLUT3	Off/On	0	1	0	SQLUT3=[Param.]<CR><LF> SQLUT3?<CR><LF>
SequenceMode LutEnable(n-1)	I Enumeration	R/W	SQLUT(n)	Off/On	0	1	0	SQLUT(n)=[Param.]<CR><LF> SQLUT(n)?<CR><LF>
SequenceMode LutEnable127	I Enumeration	R/W	SQLUT128	Off/On	0	1	0	SQLUT128=[Param.]<CR><LF> SQLUT128?<CR><LF>
SequenceMode BlackLevel0	I Integer	R/W	SQBL1	Min～Max	-256	255	0	SQBL1=[Param.]<CR><LF> SQBL1?<CR><LF>
SequenceMode BlackLevel1	I Integer	R/W	SQBL2	Min～Max	-256	255	0	SQBL2=[Param.]<CR><LF> SQBL2?<CR><LF>
SequenceMode BlackLevel2	I Integer	R/W	SQBL3	Min～Max	-256	255	0	SQBL3=[Param.]<CR><LF> SQBL3?<CR><LF>
SequenceMode BlackLevel(n-1)	I Integer	R/W	SQBL(n)	Min～Max	-256	255	0	SQBL(n)=[Param.]<CR><LF> SQBL(n)?<CR><LF>
SequenceMode BlackLevel127	I Integer	R/W	SQBL128	Min～Max	-256	255	0	SQBL128=[Param.]<CR><LF> SQBL128?<CR><LF>

CommnadSequence Index	I Enumeration	R/W	CSQI	Same as SequenceModeIndex	0	9	0	CSQI=[Param.]<CR><LF> CSQI?<CR><LF>
CurrentSequence Index	I Enumeration	R/O	SQIDX	Same as SequenceModeIndex	0	9	0	SQIDX?<CR><LF>
SequenceReset	I Enumeration	W/O	SQRST	0	0	0	0	SQRST=[Param.]<CR><LF>
SequenceLutMode	I Enumeration	R/W	SQLUT	0: Gamma 1: LUT	0	1	0	SQLUT=[Param.]<CR><LF> SQLUT?<CR><LF>
MultiRoiIndexMax	I Integer	R/W	MRIM	Min~Max	1	5	1	MRIM=[Param.]<CR><LF> MRIM?<CR><LF>
MultiRoiWidth	I Integer	R/W	MRW	Min~Max	8	2560	2560	MRW=[Param.]<CR><LF> MRW?<CR><LF>
MultiRoiHeight1	I Integer	R/W	MRH1	Min~Max	0	2048	2048	MRH1=[Param.]<CR><LF> MRH1?<CR><LF>
MultiRoiHeight2	I Integer	R/W	MRH2	Min~Max	0	2048	2	MRH2=[Param.]<CR><LF> MRH2?<CR><LF>
MultiRoiHeight3	I Integer	R/W	MRH3	Min~Max	0	2048	2	MRH3=[Param.]<CR><LF> MRH3?<CR><LF>
MultiRoiHeight4	I Integer	R/W	MRH4	Min~Max	0	2048	2	MRH4=[Param.]<CR><LF> MRH4?<CR><LF>
MultiRoiHeight5	I Integer	R/W	MRH5	Min~Max	0	2048	2	MRH5=[Param.]<CR><LF> MRH5?<CR><LF>
MultiRoiOffsetX1	I Integer	R/W	MROX1	Min~Max	0	2559	0	MROX1=[Param.]<CR><LF> MROX1?<CR><LF>
MultiRoiOffsetX2	I Integer	R/W	MROX2	Min~Max	0	2559	0	MROX2=[Param.]<CR><LF> MROX2?<CR><LF>
MultiRoiOffsetX3	I Integer	R/W	MROX3	Min~Max	0	2559	0	MROX3=[Param.]<CR><LF> MROX3?<CR><LF>
MultiRoiOffsetX4	I Integer	R/W	MROX4	Min~Max	0	2559	0	MROX4=[Param.]<CR><LF> MROX4?<CR><LF>
MultiRoiOffsetX5	I Integer	R/W	MROX5	Min~Max	0	2559	0	MROX5=[Param.]<CR><LF> MROX5?<CR><LF>
MultiRoiOffsetY1	I Integer	R/W	MROY1	Min~Max	0	2047	0	MROY1=[Param.]<CR><LF> MROY1?<CR><LF>
MultiRoiOffsetY2	I Integer	R/W	MROY2	Min~Max	0	2047	0	MROY2=[Param.]<CR><LF> MROY2?<CR><LF>
MultiRoiOffsetY3	I Integer	R/W	MROY3	Min~Max	0	2047	0	MROY3=[Param.]<CR><LF> MROY3?<CR><LF>
MultiRoiOffsetY4	I Integer	R/W	MROY4	Min~Max	0	2047	0	MROY4=[Param.]<CR><LF> MROY4?<CR><LF>
MultiRoiOffsetY5	I Integer	R/W	MROY5	Min~Max	0	2047	0	MROY5=[Param.]<CR><LF> MROY5?<CR><LF>
LUTMode	I Enumeration	R/W	LUTC	0: Off 1: Gamma 2: LUT	0	2	0	LUTC=[Param.]<CR><LF> LUTC?<CR><LF>
AlcSpeed	I Integer	R/W	ALCS	Min~Max	1	8	4	ALCS=[Param.]<CR><LF> ALCS?<CR><LF> for AGC and ASC
AwbSpeed	I Integer	R/W	AWBS	Min~Max	1	8	4	AWBS=[Param.]<CR><LF> AWBS?<CR><LF> for AWB

ExposureAutoMax	I Integer	R/W	ASCEA	Min～Max[us]	101	8000000	18000	ASCEA=[Param.]<CR><LF> ASCEA?<CR><LF> Maximum value is varied depending on frame rate.
ExposureAutoMin	I Integer	R/W	ASCEI	Min～Max	100	7999999	100	ASCEI=[Param.]<CR>< LF> ASCEI?<CR><LF> Maximum value is varied depending on frame rate.
RequestExposureAutoResult	I Enumeration	R/O	ASRS	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6=Trig is not set as Normal.	0	6	0	ASRS?<CR><LF>
TriggerOption	I Enumeration	R/W	TRGOP	0: Off 1: RCT	0	1	0	TRGOP=[Param.]<CR><LF> TRGOP?<CR><LF>
AlcReference	I Integer	R/W	AGCF	Min～Max[%]	1	100	50	AGCF=[Param.]<CR><LF> AGCF?<CR><LF>
GainAutoMax	I Integer	R/W	AGCGA	Min～Max	101	1600	1600	AGCGA=[Param.]<CR><LF> AGCGA?<CR><LF>
GainAutoMin	I Integer	R/W	AGCGI	Min～Max	100	1599	100	AGCGI=[Param.]<CR>< LF> AGCGI?<CR><LF>
RequestGainAutoResult	I Enumeration	R/O	AGRS	0=Complete. 1=Too Bright. 2=Too dark. 3=Timeout Error. 4=Busy. 5=Limit. 6= Trig is not set as Normal.	0	6	0	AGRS?<CR><LF>
ALCChannelAreaAll	I Enumeration	R/W	ALCA	0: Off / 1: On	0	1	0	ALCA=[Param.]<CR><LF> ALCA?<CR><LF>
ALCChannelAreaLowRight	I Enumeration	R/W	ALCLR	0: Off / 1: On	0	1	1	ALC**=[Param.]<CR><LF> ALC**?<CR><LF>
ALCChannelAreaLowMidRight	I Enumeration	R/W	ALCLMR	0: Off / 1: On	0	1	1	
ALCChannelAreaLowMidLeft	I Enumeration	R/W	ALCLML	0: Off / 1: On	0	1	1	
ALCChannelAreaLowLeft	I Enumeration	R/W	ALCLL	0: Off / 1: On	0	1	1	
ALCChannelAreaMidLowRight	I Enumeration	R/W	ALCMLR	0: Off / 1: On	0	1	1	
ALCChannelAreaMidLowMidRight	I Enumeration	R/W	ALCMLMR	0: Off / 1: On	0	1	1	
ALCChannelAreaMidLowMidLeft	I Enumeration	R/W	ALCMLML	0: Off / 1: On	0	1	1	
ALCChannelAreaMidLowLeft	I Enumeration	R/W	ALCMLL	0: Off / 1: On	0	1	1	
ALCChannelAreaMidHighRight	I Enumeration	R/W	ALCMHR	0: Off / 1: On	0	1	1	
ALCChannelAreaMidHighMidRight	I Enumeration	R/W	ALCMHMR	0: Off / 1: On	0	1	1	
ALCChannelAreaMidHighMidLeft	I Enumeration	R/W	ALCMHML	0: Off / 1: On	0	1	1	
ALCChannelAreaMidHighLeft	I Enumeration	R/W	ALCMHL	0: Off / 1: On	0	1	1	

ALCChannelArea HighRight	I Enumeration	R/W	ALCHR	0: Off / 1: On	0	1	1	
ALCChannelArea HighMidRight	I Enumeration	R/W	ALCHMR	0: Off / 1: On	0	1	1	
ALCChannelArea HighMidLeft	I Enumeration	R/W	ALCHML	0: Off / 1: On	0	1	1	
ALCChannelArea HighLeft	I Enumeration	R/W	ALCHL	0: Off / 1: On	0	1	1	
CurrentAreaNo Request	I Integer	R/O	EA	0: Factory area 1: User 1 area 2: User 2 area 3: User 3 area	0	3	0	EA?<CR><LF> The camera return the latest used DATA AREA.
GammaSelector	I Integer	R/W	GMA	0(γ=0.45) 1(γ=0.6) 2(γ=1)	0	2	0	GMA=[Param.]<CR><LF> GMA?<CR><LF>
Temperature	I Integer	R/O	TMP0	value	—	—	—	TMP0?<CR><LF> (Value÷128)= Temperature[℃]
GpioPulseGen DivideValue	I Integer	R/W	PGDEV	Min～Max	1	4096	1	PGDEV=[Param.]<CR><LF> PGDEV?<CR><LF>
GpioPulseGen Length0	I Integer	R/W	PGL	Min～Max	1	1048575	1	PGL=[Param.]<CR><LF> PGL?<CR><LF>
GpioPulseGen StartPoint0	I Integer	R/W	PGST	Min～Max	0	1048574	0	PGST=[Param.]<CR><LF> PGST?<CR><LF>
GpioPulseGen EndPoint0	I Integer	R/W	PGEN	Min～Max	1	1048575	1	PGEN=[Param.]<CR><LF> PGEN?<CR><LF>
GpioPulseGen RepeatCount0	I Integer	R/W	PGRPT	Min～Max	0	255	0	PGRPT=[Param.]<CR><LF> PGRPT?<CR><LF>
GpioPulseGen ClearMode0	I Enumeration	R/W	PGCM	0: Free Run 1: Level High 2: Level Low 3: Rising Edge 4: Falling Edge	0	4	0	PGCM=[Param.]<CR><LF> PGCM?<CR><LF>
GpioPulseGen SyncMode0	I Enumeration	R/W	PGSM	0: Async Mode 1: Sync Mode	0	1	0	PGSM=[Param.]<CR><LF> PGSM?<CR><LF>

GpioPulseGenInput0	I Enumeration	R/W	PGIN	0:Low 1:High 2:Soft 3:AcquisitionTriggerWait 4:FrameTriggerWait 5:FrameActive 6:ExposureActive 7:FVAL 8:LVAL 15:nand0 16:nand1	0	16	0	PGIN=[Param.]<CR><LF> PGIN?<CR><LF>
GpioPulseGenInvert0	I Enumeration	R/W	PGINV	0:Non-Inv 1:Inv	0	1	0	PGINV=[Param.]<CR><LF> PGINV?<CR><LF>
GpioNand0InputSource1	I Enumeration	R/W	IND0IN1	0: Low 1: High 2: FrameTriggerWait 3: FramActive 4: ExposureActive 5: Fval 6: PulseGenerator0	0	6	0	IND0N1=[Param.]<CR><LF> IND0IN1?<CR><LF>
GpioNand1InputSource1	I Enumeration	R/W	IND1IN1	Same as above.	0	6	0	IND1N1=[Param.]<CR><LF> IND1IN1?<CR><LF>
GpioNand0InputSource2	I Enumeration	R/W	IND0IN2	: Low 1: High 2: FrameTriggerWait 3: FramActive 4: ExposureActive 5: Fval 6: PulseGenerator0	0	6	0	IND0N2=[Param.]<CR><LF> IND0IN2?<CR><LF>
GpioNand1InputSource2	I Enumeration	R/W	IND1IN2	Same as above.	0	6	0	IND1N2=[Param.]<CR><LF> IND1IN2?<CR><LF>
GpioNand0InputInvert1	I Enumeration	R/W	IND0INV1	0: Non-Inv 1: Inv	0	1	0	IND0INV1=[Param.]<CR><LF> IND0INV1?<CR><LF>
GpioNand1InputInvert1	I Enumeration	R/W	IND1INV1	Same as above.	0	1	0	IND1INV1=[Param.]<CR><LF> IND1INV1?<CR><LF>
GpioNand0InputInvert2	I Enumeration	R/W	IND0INV2	0: Non-Inv 1: Inv	0	1	0	IND0INV2=[Param.]<CR><LF> IND0INV2?<CR><LF>
GpioNand1InputInvert2	I Enumeration	R/W	IND1INV2	Same as above.	0	1	0	IND1INV2=[Param.]<CR><LF> IND1INV2?<CR><LF>
BlemishNum	I Integer	R/O	BNUM	Min~Max	0	512	0	BNUM?<CR><LF>
CameraLinkClockFrequency	I Enumeration	R/W	CLCF	0= 72.9MHz 1= 48.6MHz 2= 84.9MHz 3= 58.3MHz	0	3	0	CLCF=[Param.]<CR><LF> CLCF?<CR><LF>
DarkCompression	I Enumeration	R/O	SBS	0: Linear 1: DarkCompression	0	1	0	SBS=[Param.]<CR><LF> SBS?<CR><LF>
BINNING_GAIN_EN	I Enumeration	R/W	BGOE	0: Off / 1: On	0	1	0	BGOE =[Param.]<CR><LF> BGOE?<CR><LF>
HighDynamicRangeMode	I Enumeration	R/W	HES	0: Off / 1: On	0	1	0	HES=[Param.]<CR><LF > HES?<CR><LF>
HighDynamicRangeSlope	I Enumeration	R/W	HKS	0: Level1 1: Level2 2: Level3 3: Level4	0	3	0	HKS=[Param.]<CR><LF > HKS?<CR><LF>

User's Record

Camera type: GO-5000M-PMCL-UV

Model name: ……

Revision: ……

Serial No: ……

Firmware version: ……

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

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Revision history

Revision	Date	Changes
1.0	Feb. 2021	1st Draft