



*See the possibilities*

## *User Manual*

# ***GO-5000M-PMCL*** ***GO-5000C-PMCL***

*5M CMOS Digital Progressive Scan  
Monochrome and Color Camera*

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### **Warranty**

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

### **Certifications**

#### **CE compliance**

As defined by the Directive 2004/108/EC of the European Parliament and of the Council, EMC (Electromagnetic compatibility), JAI Ltd., Japan declares that GO-5000M-PMCL and GO-5000C-PMCL comply with the following provisions applying to its standards.

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

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

#### **FCC**

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


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

#### **Warning**

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

Supplement

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

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

重要注意事项

有毒，有害物质或元素名称及含量表

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


| 部件名称   | 有毒有害物质或元素   |             |             |                   |                 |                   |
|--|-------------|-------------|-------------|-------------------|-----------------|-------------------|
|  | 铅<br>( Pb ) | 汞<br>( Hg ) | 镉<br>( Cd ) | 六价铬<br>( Cr(VI) ) | 多溴联苯<br>( PPB ) | 多溴二苯醚<br>( PBDE ) |
| 螺丝固定座  | ×           | ○           | ○           | ○                 | ○               | ○                 |
| 连接插头   | ×           | ○           | ○           | ○                 | ○               | ○                 |
| 电路板  | ×           | ○           | ○           | ○                 | ○               | ○                 |
| .....  | .....       | .....       | .....       | .....             | .....           | .....             |
| <p>○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。<br/>×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。<br/>( 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。 )</p> |             |             |             |                   |                 |                   |



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数字「15」为期限15年。

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| 部件名称   | 有毒有害物质或元素   |             |             |                   |                 |                   |
|--|-------------|-------------|-------------|-------------------|-----------------|-------------------|
|  | 铅<br>( Pb ) | 汞<br>( Hg ) | 镉<br>( Cd ) | 六价铬<br>( Cr(VI) ) | 多溴联苯<br>( PPB ) | 多溴二苯醚<br>( PBDE ) |
| 螺丝固定座  | ×           | ○           | ○           | ○                 | ○               | ○                 |
| 光学滤色镜  | ×           | ○           | ×           | ○                 | ○               | ○                 |
| 连接插头   | ×           | ○           | ○           | ○                 | ○               | ○                 |
| 电路板  | ×           | ○           | ○           | ○                 | ○               | ○                 |
| .....  | .....       | .....       | .....       | .....             | .....           | .....             |
| <p>○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T11363-2006规定的限量要求以下。<br/>×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T11363-2006规定的限量要求。<br/>(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。)</p> |             |             |             |                   |                 |                   |



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数字「15」为期限15年。

## - Contents -

|   |               |
|---|---------------|
| <b>Before using this camera .....</b>                   | <b>- 6 -</b>  |
| <b>1. General .....</b>                                 | <b>- 7 -</b>  |
| <b>2. Camera composition .....</b>                      | <b>- 7 -</b>  |
| <b>3. Key features .....</b>                            | <b>- 8 -</b>  |
| <b>4. Installation and preparation .....</b>            | <b>- 9 -</b>  |
| <b>5. Parts locations and their functions .....</b>     | <b>- 12 -</b> |
| 5.1 Parts locations and their functions .....           | - 12 -        |
| 5.2 Rear Panel .....                                    | - 13 -        |
| <b>6. Input and output .....</b>                        | <b>- 14 -</b> |
| 6.1 Connector and its pin configuration .....           | - 14 -        |
| 6.1.1 Camera Link Connector .....                       | - 14 -        |
| 6.1.1.1 Figure .....                                    | - 14 -        |
| 6.1.1.2 Pin assignment .....                            | - 14 -        |
| 6.2 Camera Link interface .....                         | - 15 -        |
| 6.2.1 Camera Link Interface .....                       | - 15 -        |
| 6.2.2 Camera Link pixel clock frequency .....           | - 17 -        |
| 6.3 Digital IN/OUT interface .....                      | - 18 -        |
| 6.3.1 Line Selector .....                               | - 18 -        |
| 6.3.2 Line Source .....                                 | - 18 -        |
| 6.3.3 Line Mode .....                                   | - 18 -        |
| 6.3.4 Line Inverter .....                               | - 18 -        |
| 6.3.5 Line Status .....                                 | - 18 -        |
| 6.3.6 Line Format .....                                 | - 18 -        |
| 6.3.7 GPIO .....  | - 19 -        |
| 6.3.7.1 Basic block diagram .....                       | - 19 -        |
| 6.3.7.2 Input and output matrix table .....             | - 20 -        |
| 6.4 Pulse Generator .....                               | - 20 -        |
| 6.4.1 Clock Pre-scaler .....                            | - 21 -        |
| 6.4.2 Pulse Generator Selector .....                    | - 21 -        |
| 6.4.3 Pulse Generator Length .....                      | - 21 -        |
| 6.4.4 Pulse Generator Start Point .....                 | - 21 -        |
| 6.4.5 Pulse Generator End Point .....                   | - 21 -        |
| 6.4.6 Pulse Generator Repeat Count .....                | - 22 -        |
| 6.4.7 Pulse Generator Clear Activation .....            | - 22 -        |
| 6.4.8 Pulse Generator Clear Sync Mode .....             | - 22 -        |
| 6.4.9 Pulse Generator Clear Source .....                | - 23 -        |
| 6.4.10 Pulse Generator Inverter .....                   | - 23 -        |
| 6.4.11 Pulse Generator Setting table .....              | - 23 -        |
| <b>7. Sensor layout, output format and timing .....</b> | <b>- 24 -</b> |
| 7.1 Sensor layout .....                                 | - 24 -        |
| 7.1.1 Monochrome sensor .....                           | - 24 -        |
| 7.1.2 Bayer sensor .....                                | - 24 -        |
| 7.2 Camera output format (Tap Geometry) .....           | - 25 -        |
| 7.2.1 1X2-1Y .....                                      | - 25 -        |
| 7.2.2 1X3-1Y .....                                      | - 25 -        |
| 7.2.3 1X4-1Y .....                                      | - 26 -        |
| 7.2.4 1X8-1Y .....                                      | - 26 -        |
| 7.3 Output timing and output image .....                | - 27 -        |
| 7.3.1 Horizontal timing .....                           | - 27 -        |
| 7.3.2 Vertical timing .....                             | - 35 -        |
| 7.3.3 ROI (Region Of Interest) setting .....            | - 39 -        |
| 7.4 Digital output bit allocation .....                 | - 40 -        |

|  |               |
|--|---------------|
| <b>8. Operating modes</b>  | <b>- 41 -</b> |
| 8.1. Acquisition control (change the frame rate).....                        | - 41 -        |
| 8.1.1 Acquisition control .....  | - 41 -        |
| 8.1.2 Calculation of the frame rate.....                                     | - 41 -        |
| 8.2. Exposure setting .....  | - 42 -        |
| 8.2.1 Exposure Mode .....  | - 42 -        |
| 8.2.2 ExposureTime .....   | - 43 -        |
| 8.2.3 ExposureAuto.....  | - 43 -        |
| 8.3. Trigger control .....   | - 44 -        |
| 8.3.1 Trigger Selector.....  | - 44 -        |
| 8.3.2 Trigger Mode .....   | - 44 -        |
| 8.3.3 Trigger Source.....  | - 45 -        |
| 8.3.4 TriggerActivation .....  | - 45 -        |
| 8.4. Normal continuous operation (Timed Exposure Mode/Trigger Mode OFF)..... | - 45 -        |
| 8.5. Timed mode (EPS operation) .....  | - 46 -        |
| 8.6. Trigger width mode (PWC) .....  | - 47 -        |
| 8.7. RCT mode .....  | - 48 -        |
| 8.7.1 RCT mode .....   | - 48 -        |
| 8.7.2 RCT mode together with ALC function.....                               | - 48 -        |
| 8.8. Sequence Mode.....  | - 49 -        |
| 8.8.1 Sequence mode setting.....   | - 49 -        |
| 8.8.2 Trigger Sequence mode timing.....                                      | - 50 -        |
| 8.8.3 Setting command .....  | - 50 -        |
| 8.8.3.1 Default setting .....  | - 50 -        |
| 8.8.3.2 Sequence mode setting Command .....                                  | - 51 -        |
| 8.9. Multi ROI function .....  | - 52 -        |
| 8.9.1 Multi ROI setting command .....  | - 52 -        |
| 8.10. Operation and function matrix.....                                     | - 54 -        |
| Exposure .....   | - 54 -        |
| <b>9. Other functions</b>  | <b>- 55 -</b> |
| 9.1. Black level control.....  | - 55 -        |
| 9.1.1 Black Level Selector.....  | - 55 -        |
| 9.1.2 Black Level.....   | - 55 -        |
| 9.2. Gain control.....   | - 55 -        |
| 9.2.1 Analog base gain .....   | - 55 -        |
| 9.2.2 Gain .....   | - 55 -        |
| 9.2.3 Gain Selector .....  | - 56 -        |
| 9.2.4 Gain .....   | - 56 -        |
| 9.2.5 Gain Raw .....   | - 56 -        |
| 9.2.4 Gain Auto .....  | - 56 -        |
| 9.2.4 Balance white auto.....  | - 57 -        |
| 9.3. LUT .....   | - 57 -        |
| 9.3.1 LUT Mode .....   | - 57 -        |
| 9.3.2 LUT Index .....  | - 58 -        |
| 9.3.3 LUT Value .....  | - 58 -        |
| 9.4. Gamma.....  | - 58 -        |
| 9.4.1 Linear and Dark Compression.....                                       | - 58 -        |
| 9.5. Shading Correction .....  | - 59 -        |
| 9.6. Blemish compensation .....  | - 60 -        |
| 9.7. ALC .....   | - 61 -        |
| 9.8. HDR (High Dynamic Range) (GO-5000M-PMCL only).....                      | - 62 -        |
| <b>10. Camera Settings</b>   | <b>- 63 -</b> |
| <b>11. External appearance and dimensions</b>                                | <b>- 64 -</b> |
| <b>12. Specifications</b>  | <b>- 65 -</b> |
| 12.1. Camera spectral response .....   | - 65 -        |

|  |               |
|--|---------------|
| 12.2. Specification table .....                                    | - 66 -        |
| <b>Appendix 1 Short ASCII Command Communication Protocol .....</b> | <b>- 69 -</b> |
| <b>1 Communication setting.....</b>                                | <b>- 69 -</b> |
| <b>2 Protocol (Short ASCII Command) .....</b>                      | <b>- 69 -</b> |
| 2.1 Transmit the setting command to camera .....                   | - 69 -        |
| 2.2 Transmit the request command to camera .....                   | - 69 -        |
| 2.3 Switching baud rate between PC and camera .....                | - 69 -        |
| 2.4 Command list (Short ASCII command).....                        | - 70 -        |
| 2.4.1 GenCP Bootstrap Register .....                               | - 70 -        |
| 2.4.2 Technology Specific Bootstrap Register .....                 | - 70 -        |
| 2.4.3 Device Control .....   | - 71 -        |
| 2.4.4 Image Format Control.....                                    | - 71 -        |
| 2.4.5 Acquisition Control .....                                    | - 72 -        |
| 2.4.6 Digital I/O Control.....                                     | - 73 -        |
| 2.4.7 Analogue Control .....                                       | - 74 -        |
| 2.4.8 LUT Control .....  | - 74 -        |
| 2.4.9 Transport Layer Control .....                                | - 75 -        |
| 2.4.10 User Set Control .....                                      | - 75 -        |
| 2.4.11 JAI-Custom .....  | - 75 -        |
| <b>0: Flat Shading 1: Color Shading*.....</b>                      | <b>- 75 -</b> |
| <b>Appendix 2 .....</b>  | <b>- 90 -</b> |
| 1. Precautions .....   | - 90 -        |
| 2. Typical Sensor Characteristics.....                             | - 90 -        |
| 3. Caution when mounting a lens on the camera .....                | - 90 -        |
| 4. Caution when mounting the camera .....                          | - 90 -        |
| 5. Exportation .....   | - 91 -        |
| 6. References .....  | - 91 -        |
| <b>Manual change history .....</b>                                 | <b>- 92 -</b> |
| <b>User's Record .....</b>   | <b>- 93 -</b> |

### **Before using this camera**

#### **EMVA 1288**

With regard to signal to noise ratio in this manual, specifications measured by EMVA 1288 are used together with specifications by a traditional measurement method.

EMVA 1288 is a more complete measurement that considers multiple noise sources, including random noise, pattern noise, and shading. Additionally, EMVA 1288 incorporates temporal variances in pixel output by capturing 100 frames of data and computing the RMS variations over the captured frames. Because of the comprehensive nature of the noise analysis and the additional consideration for RMS variances over time, EMVA 1288 SNR measurements are inherently lower than the traditional SNR measurements given by manufacturers. However, the comprehensive nature combined with rigid test parameters, means that all manufacturers' are measuring their products equally and EMVA 1288 tested parameters can be compared among different manufacturers' products.

In order to learn more about EMVA 1288, please visit <http://www.emva.org>



## 1. General

The GO-5000M-PMCL and GO-5000C-PMCL are new small-in-size cameras providing both high resolution and a high frame rate with excellent image quality for machine vision applications. The GO-5000M-PMCL is a monochrome progressive scan COMS camera and the GO-5000C-PMCL is the equivalent Bayer mosaic progressive scan CMOS camera. Both are equipped with CMOS sensors offering a 1-inch image format, a resolution of 5 million pixels, and a 5:4 aspect ratio. They provide a maximum of 107.2 frames per second for continuous scanning with 2560 x 2048 full pixel resolution in 1x8-1Y, 8-bit output format.

8-bit, 10-bit or 12-bit output can be selected for both monochrome and raw Bayer formats. The new cameras feature a Mini Camera Link interface supporting a "Power over Camera Link" capability. A full pixel readout or partial scan readout mode can be selected depending on applications. The readout format is available for 8-tap, 4-tap, 3-tap or 2-tap output.

The GO-5000M-PMCL and GO-5000C-PMCL have various comprehensive functions needed for automated optical inspection applications, such as solid state device inspection or material surface inspection. They incorporate video processing functions such as a look-up table, flat field shading compensation and blemish compensation in addition to fundamental functions such as trigger, exposure setting and video level control.

The latest version of this manual can be downloaded from: [www.jai.com](http://www.jai.com)

The latest version of the JAI SDK for the GO-5000M-PMCL and GO-5000C-PMCL can be downloaded from: [www.jai.com](http://www.jai.com)

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

## 2. Camera composition

The standard camera composition is as follows.

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

The following optional accessories are available.

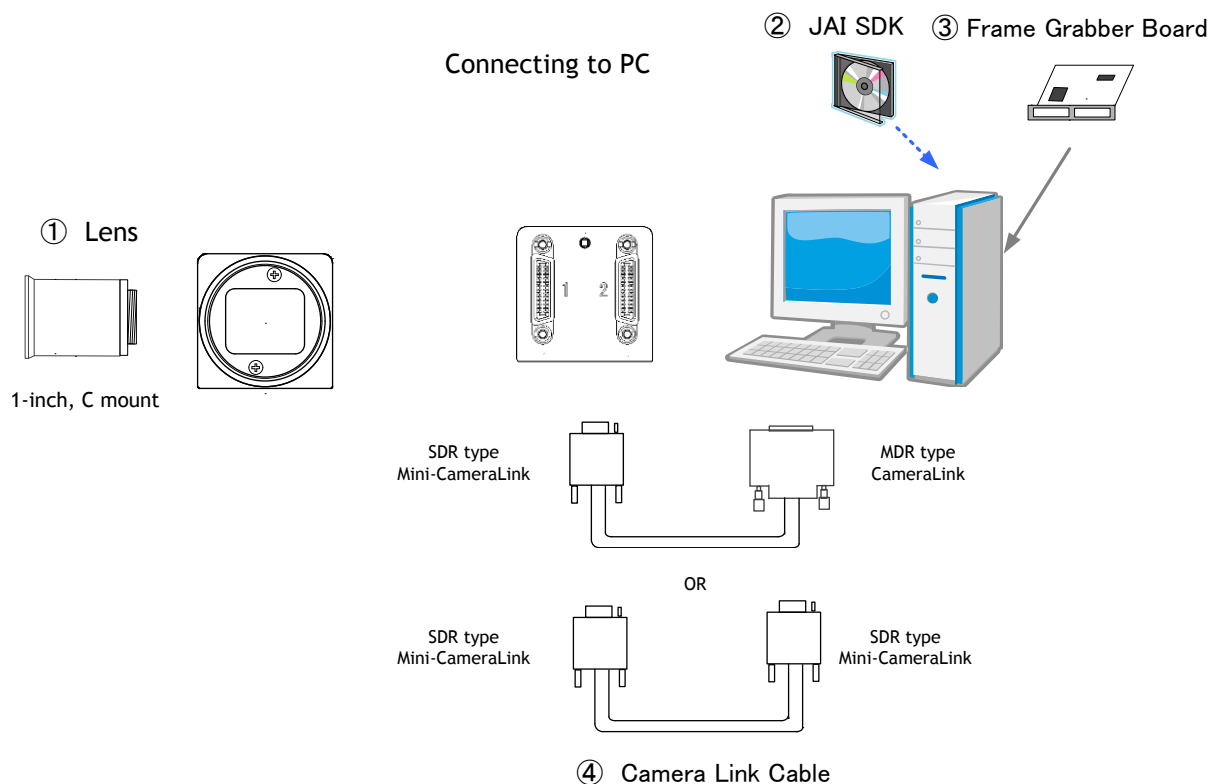
|             |       |
|-------------|-------|
| Tripod base | MP-43 |
|-------------|-------|

### **3. Key features**

- 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  $\mu\text{m}$  square pixels
- S/N 55dB for monochrome and 50dB for color (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 for both GO-5000M-PMCL and GO-5000C-PMCL
- 10  $\mu\text{s}$  (1/100,000) to 8 seconds exposure control in 1  $\mu\text{s}$  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 from 0.45, 0.6 and 1.0
  - Shading correction
  - Bayer white balance with manual or one-push auto (GO-5000C-PMCL only)
  - Blemish compensation
  - HDR (High Dynamic Range) function (GO-5000M-PMCL only)
- C-mount for lens mount
- Accepts power over Mini Camera Link
- Setup by Windows XP/Vista/7/8 via serial communication

## 4. Installation and preparation

Before starting operation, check to make sure that all equipment is appropriate and is connected in the right manner.



### 1. Lens used

The GO-5000-PMCL employs a 1-inch CMOS imager. It is necessary to select a 1-inch C mount lens if the full resolution of the camera is to be utilized. The imager used in the GO-5000-PMCL measures 16.392 mm diagonally, which is slightly larger than the standard 16 mm diagonal of the 1-inch format. Please consult with your lens provider to select a 1-inch lens able to cover 16.392 mm, otherwise the image captured may show vignetting.

It is possible to use C mount lenses with an optical format smaller than 1-inch, provided a less-than full-resolution ROI is going to be used. For example, a centered ROI of 1920 x 1080 pixels (HD format) will fit inside the image circle of most standard 2/3-inch C mount lenses. Likewise, a centered VGA ROI (640 x 480 pixels) can be accommodated by a standard 1/3-inch C mount lens.

The rear protrusion on any lens used must be less than 10 mm.

The focal length of lens used is estimated by the following formula.

$$\text{Focal length} = WD / (1 + W/w)$$

Here, WD: Working distance (the distance between lens and object)  
 W: Width of object  
 w: Width of sensor (the GO-5000-PMCL is 12.8 mm)

### 2. JAI SDK and Control Tool software

The GO-5000M-PMCL and GO-5000C-PMCL are designed to use the JAI SDK and Control Tool software to control camera functions. All controllable functions are stored in the camera's XML file. The JAI SDK can be downloaded from [www.jai.com](http://www.jai.com). Third-party software can also be used with the camera provided it is compliant with the GenICam® standard. See section 10 for important notes regarding the use of third-party software.

A camera control tool for using the Short ASCII command protocol is not available on the JAI website. Please contact your local JAI representative if this is required. A list of ASCII commands is shown at the end of this manual.

### 3. Frame grabber board

The GO-5000M-PMCL complies with "Power over Camera Link" which utilizes power supplied to the camera through the Camera Link cabling. Please be sure that the frame grabber board you are using also complies with this specification.

The GO-5000-PMCL employs output formats which comply with the GenICam® standard. They are 1X8-1Y (8-Tap output), 1X4-1Y (4-Tap output), 1X3-1Y (3-Tap output) and 1X2-1Y (2-Tap output). 1X8-1Y is available for 8-bit and 10-bit output, and 1X4-1Y and 1X2-1Y are available for 8-bit, 10-bit and 12-bit output. 1X3-1Y is only available for 8-bit output. Please check if the frame grabber used in the system complies with the mentioned formats.

The GO-5000-PMCL has two Camera Link connectors. Connector #1 is used for the Camera Link Base configuration, as well as in Medium and Full configurations. Power is supplied through this connector. Connector #2 is used for Medium and Full configurations.

### 4. Camera Link Cable

Please confirm that the Camera Link cable is securely connected to both the camera and the Camera Link interface board. A cable with a Mini-Camera Link connector (SDR) on one end is required to connect to the camera. A Standard Camera Link connector (MDR) or Mini (SDR) can be used on the other end of the cable, depending on the connector used in the Camera Link frame grabber board.

The length between the camera and frame grabber board is described in chapter 6.2.2.

### 5. Caution when certain commands are executed

When the following commands are executed, the video output may be interrupted instantaneously.

1. Base Gain
2. HDR\* mode (ON/OFF)
3. Setting HDR\* SLOPE when HDR\* mode is ON
  - \* GO-5000M-PMCL only.

When this occurs, it is necessary to disable the frame grabber board.

### 6. Camera Default Settings

When the camera is connected to a PC and JAI SDK 2.0 is started up, an XML file which stores default settings of the camera is downloaded to the JAI\_SDK camera control tool.

The default settings of the GO-5000-PMCL are as follows.

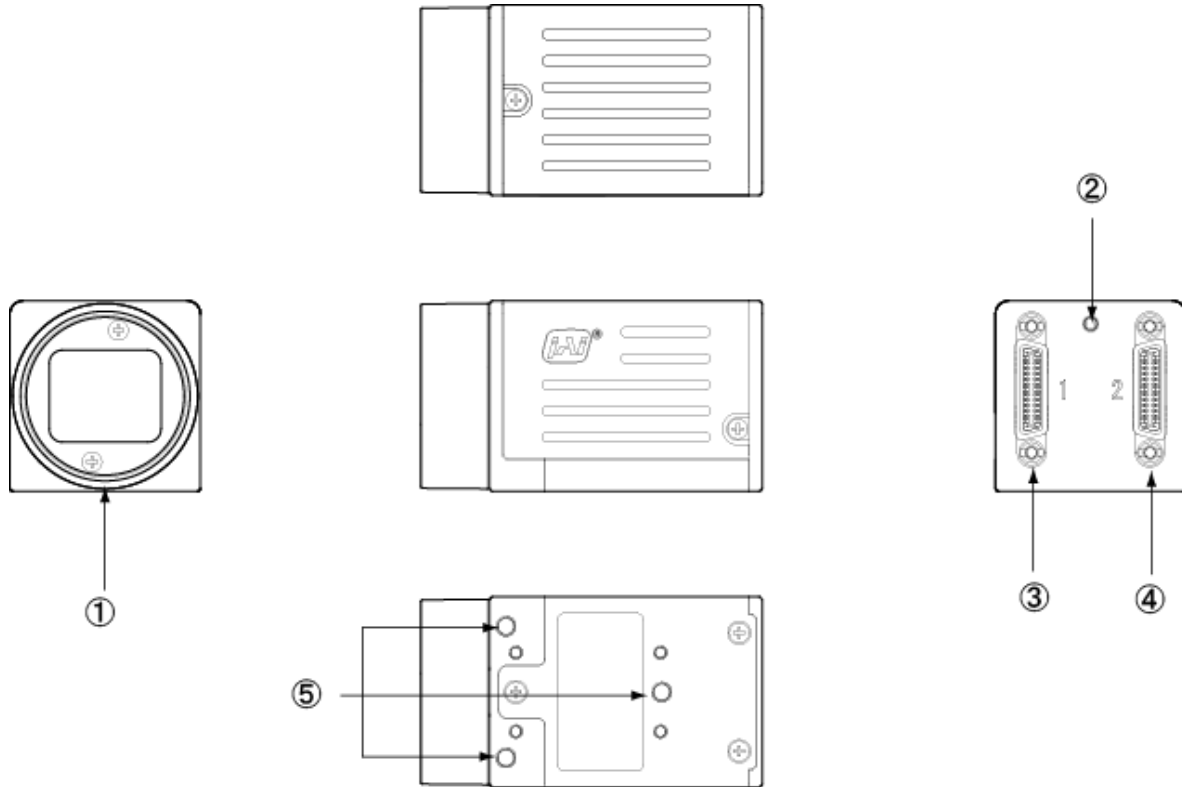
Table - 1 Default settings

|                   |                           |           |
|-------------------|---------------------------|-----------|
| Image Format      | Bit allocation            | 8-bit     |
|                   | Height                    | 2048      |
|                   | Device Tap Geometry       | 1x8_1Y    |
|                   | Binning Horizontal *      | OFF       |
|                   | Binning Vertical *        | OFF       |
| Trigger Operation | Trigger Mode              | OFF       |
|                   | Trigger Source            | CL_CC1_In |
| Exposure Control  | Exposure Mode             | OFF       |
| Gain              | Gain Auto                 | OFF       |
|                   | Manual      Gain all      | 0         |
|                   | Manual      Fine Gain all | 0         |
|                   | Analogue Base Gain        | 0dB       |

\* GO-5000M-PMCL only.

## 5. Parts locations and their functions

### 5.1 Parts locations and their functions



- |                           |   |
|---------------------------|---|
| ① Lens mount              | C-mount (Note *1)   |
| ② LED                     | Indication for power and trigger input  |
| ③ Camera Link Connector 1 | Digital video output (Base, Medium and Full config.) (Note *2)                          |
| ④ Camera Link Connector 2 | Digital video output (Medium and Full configuration) (Note *2)                          |
| ⑤ Mounting holes          | M3 depth 3 mm for fixing the camera to the tripod base or direct installation (Note *3) |

\*1) Note: Rear protrusion on C-mount lens must be less than 10.0 mm.

\*2) Note: When a Camera Link cable is connected to the camera, please do not excessively tighten screws by using a driver. The Camera Link receptacle on the camera might be damaged. For security, the strength to tighten screws is less than 0.147 Newton meter (Nm). Tightening by hand is sufficient in order to achieve this.

\*3) Note: The part number for the tripod adapter plate (with 1/4"-20 thread) is MP-43 (option). For MP-43, three M3x3 pan head screws must be used.

Fig. 1 Locations

## 5.2 Rear Panel

The rear panel mounted LED provides the following information:

- Amber: Power connected - initiating  
This light goes OFF after initiating.
- Steady green: Camera is operating in Continuous mode
- ✱ Flashing green: The camera is receiving external triggering

Note: The interval of flashing does not correspond with external trigger duration.

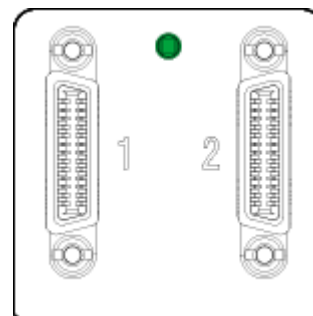


Fig. 2 Rear panel

## 6. Input and output

### 6.1 Connector and its pin configuration

#### 6.1.1 Camera Link Connector

##### 6.1.1.1 Figure

Type: 26-pin Mini Camera Link connector (Honda HDR-EC26FYTG2-SL+). The camera has two connectors. Power over Camera Link (PoCL) must be provided over Connector #1.

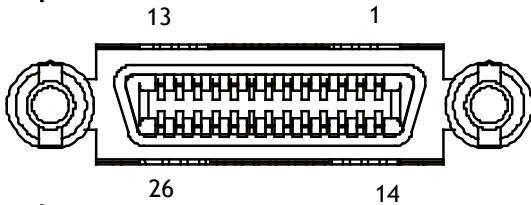


Fig.3 Camera Link connector

##### 6.1.1.2 Pin assignment

Table-2 Camera link pin configuration - connector 1

| Pin No      | In/Out | Name           | Note                |
|-------------|--------|----------------|---------------------|
| 1,26        |        | Power          | Power               |
| 2(-),15(+)  | O      | X_OUT0         | Data output         |
| 3(-),16(+)  | O      | X_OUT1         |                     |
| 4(-),17(+)  | O      | X_OUT2         |                     |
| 5(-),18(+)  | O      | X_Clk          | Clock for CL        |
| 6(-),19(+)  | O      | X_OUT3         | Data output         |
| 7(+),20(-)  | I      | SerTC (RxD)    | LVDS serial control |
| 8(-),21(+)  | O      | SerTFG (TxD)   |                     |
| 9(-),22(+)  | I      | CC1 (Trigger)  | Trigger input       |
| 10(+),23(-) | I      | CC1 (Reserved) |                     |
| 11,24       |        | N.C            |                     |
| 12,25       |        | N.C            |                     |
| 13,14       |        | Shield         | Power Return        |

Camera Link connector 2

| Pin No      | In/Out | Name   | Note                                |
|-------------|--------|--------|-------------------------------------|
| 1,26        |        | Power  | Connector #1 must be used for Power |
| 2(-),15(+)  | O      | Y_OUT0 | Data output                         |
| 3(-),16(+)  | O      | Y_OUT1 |                                     |
| 4(-),17(+)  | O      | Y_OUT2 |                                     |
| 5(-),18(+)  | O      | Y_Clk  | Clock for CL                        |
| 6(-),19(+)  | O      | Y_OUT3 | Data output                         |
| 7(+),20(-)  |        | N.C    |                                     |
| 8(-),21(+)  | O      | Z_OUT0 | Data output                         |
| 9(-),22(+)  | O      | Z_OUT1 |                                     |
| 10(+),23(-) | O      | Z_OUT2 |                                     |
| 11,24       | O      | Z_Clk  | Clock for CL                        |
| 12,25       | O      | Z_OUT3 | Data output                         |
| 13,14       |        | Shield | Power Return                        |



## 6.2 Camera Link interface

### 6.2.1 Camera Link Interface

Table-3 Camera Link interface

| GO-5000M/C-PMCL   |                           |         |                 |                 |                 |                 |               |
|---|---------------------------|---------|-----------------|-----------------|-----------------|-----------------|---------------|
| 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      |
| D<br>i<br>g<br>i<br>t<br>a<br>l<br><br>/<br>O<br><br>-<br><br>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      |

# GO-5000M-PMCL / GO-5000C-PMCL

| GO-5000-PMCL   |                           |         |              |           |                 |                 |               |
|--|---------------------------|---------|--------------|-----------|-----------------|-----------------|---------------|
| 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      |
| D<br>i<br>g<br>i<br>t<br>a<br>l<br><br>/<br>O<br><br>-<br><br>2<br><br>(<br>1<br>/<br>2<br>) | 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        | Tap 6 D0        | Tap 6 D2      |
|  | Port F1                   | TxIN 18 | —            | —         | Tap 3 D9        | Tap 6 D1        | Tap 6 D3      |
|  | Port F2                   | TxIN 19 | —            | —         | Tap 3 D10       | Tap 6 D2        | Tap 6 D4      |
|  | Port F3                   | TxIN 20 | —            | —         | Tap 3 D11       | Tap 6 D3        | Tap 6 D5      |
|  | Port F4                   | TxIN 21 | —            | —         | Tap 4 D8        | Tap 6 D4        | Tap 6 D6      |
|  | Port F5                   | TxIN 22 | —            | —         | Tap 4 D9        | Tap 6 D5        | Tap 6 D7      |
|  | Port F6                   | TxIN 16 | —            | —         | Tap 4 D10       | Tap 6 D6        | Tap 6 D8      |
|  | Port F7                   | TxIN 17 | —            | —         | Tap 4 D11       | Tap 6 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      |

| GO-5000M/C-PMCL   |                           |  |              |           |              |              |               |
|---|---------------------------|--|--------------|-----------|--------------|--------------|---------------|
| 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<br>Analogue<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><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|                           |  |              |           |              |              |               |

**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.

**6.2.2 Camera Link pixel clock frequency**

In the GO-5000M-PMCL and GO-5000C-PMCL, 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.

Table - 4 Camera link pixel clock, cable length, and frame rates

| 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.

## 6.3 Digital IN/OUT interface

In the GO-5000M-PMCL and GO-5000C-PMCL, the software control tool can assign the necessary signals used in the system to digital inputs and outputs (see Section 5.3.7.1 for block diagram).

### 6.3.1 Line Selector

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

Table-5 Line selector

| 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 |

### 6.3.2 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.

Table-6 Line Source

| Line Source item  | Description   |
|---|---|
| Low   | Connect Low Level signal to line item selected in Line Selector, <b>Default setting</b> |
| 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]<br>As for LVAL, some line items cannot be connected. Refer to “5.3.7.2 GPIO matrix table” |   |

### 6.3.3 Line Mode

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

### 6.3.4 Line Inverter

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

### 6.3.5 Line Status

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

### 6.3.6 Line Format

Indicates the interface information of the input and output lines.

Not connected, TTL, LVDS or Opto-coupled

Note: In the GO-5000-PMCL, Opto-coupled interface is not available.

### 6.3.7 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.

#### 6.3.7.1 Basic block diagram

The basic block diagram is as follows.

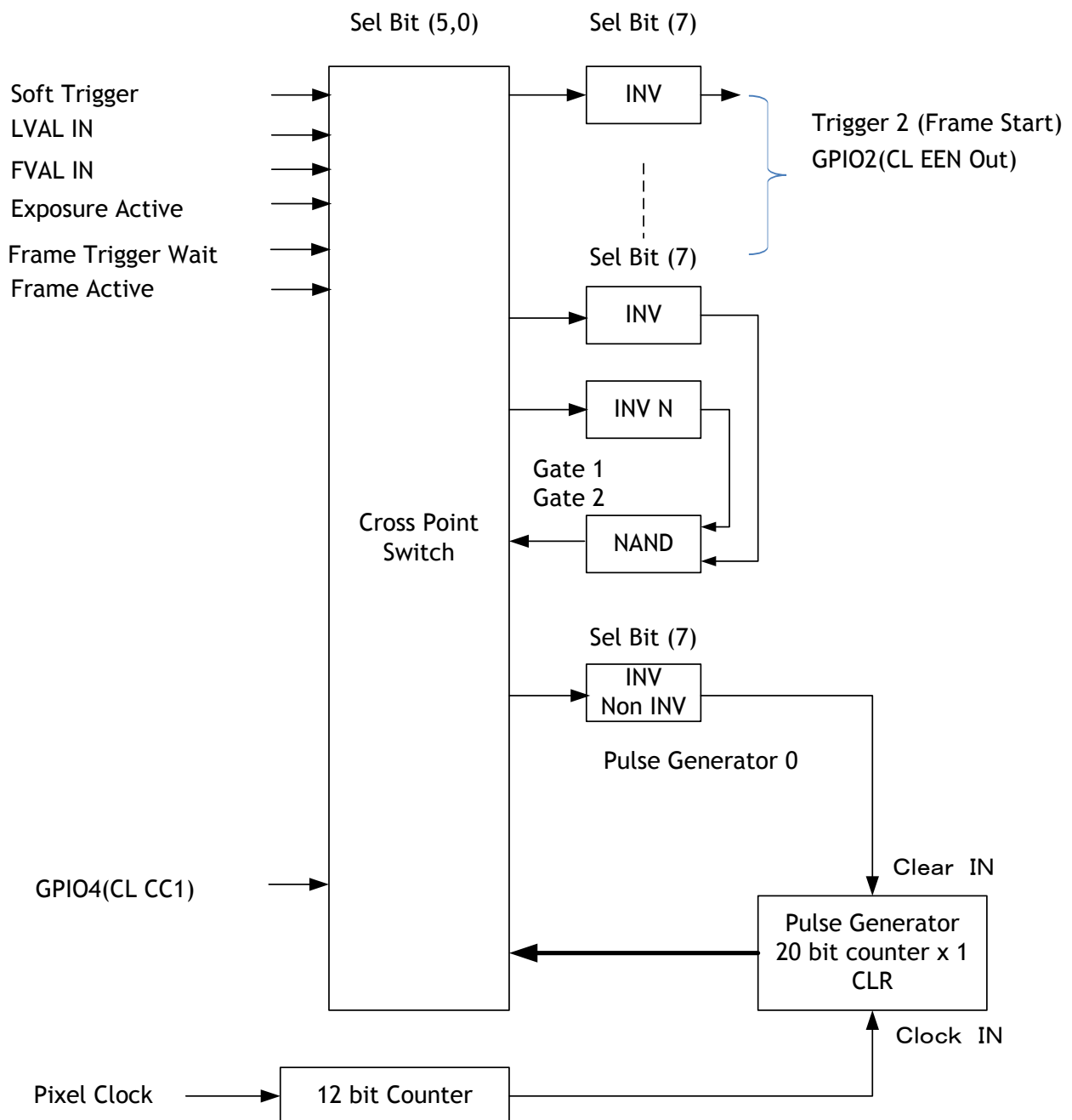


Fig.4 GPIO interface

### 6.3.7.2 Input and output matrix table

The relationship between input and output is as follows.

Table-7 GPIO matrix table

| Selector (Cross<br>point switch output)<br><br>Source signal<br>(Cross point switch input) | Trigger Selector                 | Line Selector |             |             |             | Pulse Generator<br>Selector     |
|--|----------------------------------|---------------|-------------|-------------|-------------|---------------------------------|
|  | Trigger Source<br>(Frame Start ) | NAND 1 In 1   | NAND 1 In 2 | NAND 2 In 1 | NAND 2 In 2 | Pulse Generator 0               |
| Low  | O                                | O             | O           | O           | O           | O                               |
| High   | O                                | O             | O           | O           | O           | O                               |
| Soft Trigger   | O                                | x             | x           | x           | x           | x                               |
| Exposure Active  | x                                | O             | O           | O           | O           | O                               |
| Frame Trigger Wait   | x                                | O             | O           | O           | O           | O                               |
| Frame Active   | x                                | O             | O           | O           | O           | O                               |
| FVAL   | x                                | O             | O           | O           | O           | O                               |
| LVAL   | x                                | x             | x           | x           | x           | O                               |
| Pulse Generator 0  | O                                | O             | O           | O           | O           | x                               |
| CL CC1 in  | O                                | O             | O           | O           | O           | O                               |
| NAND 0 Out   | O                                | x             | x           | O           | O           | O                               |
| NAND 1 Out 1   | O                                | O             | O           | x           | x           | O                               |
|  | Trigger Source                   |               |             |             |             | Pulse Generator<br>Clear Source |

## 6.4 Pulse Generator

The GO-5000-PMCL 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-5000-PMCL, the sensor pixel clock is 36 MHz for 8-bit, 28.8MHZ for 10-bit and 24 MHZ for 12-bit.

Table - 8 Pulse Generator default settings

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

#### 6.4.1 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.

#### 6.4.2 Pulse Generator Selector

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

Table - 9 Pulse Generator setting

| Trigger item      | Selector | 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. |

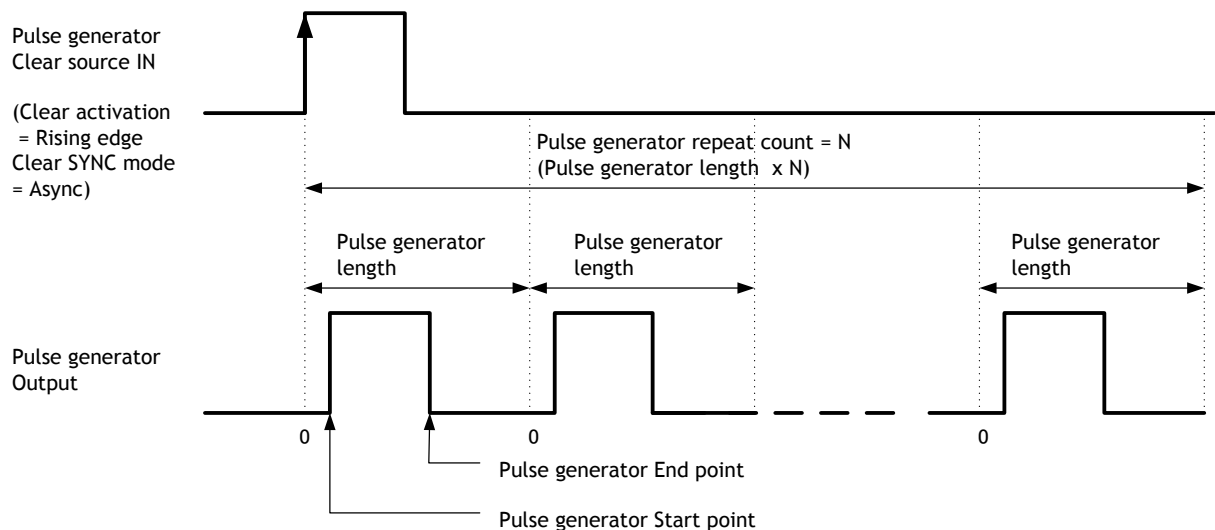


Fig.5 Pulse Generator pulse construction

#### 6.4.3 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.

#### 6.4.4 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.

#### 6.4.5 Pulse Generator End Point

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

#### 6.4.6 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.

#### 6.4.7 Pulse Generator Clear Activation

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

#### 6.4.8 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.

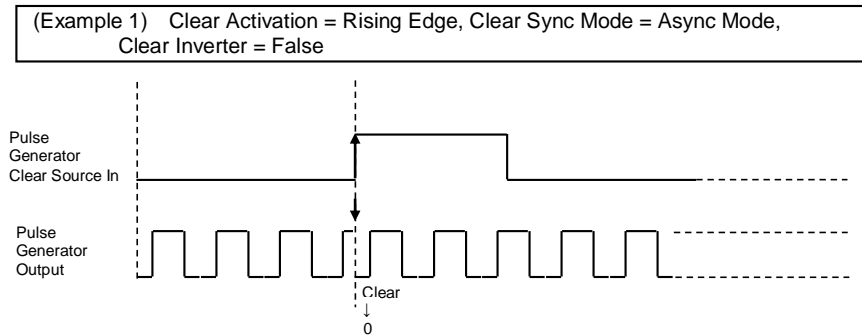


Fig.6 Counter clear in Async mode

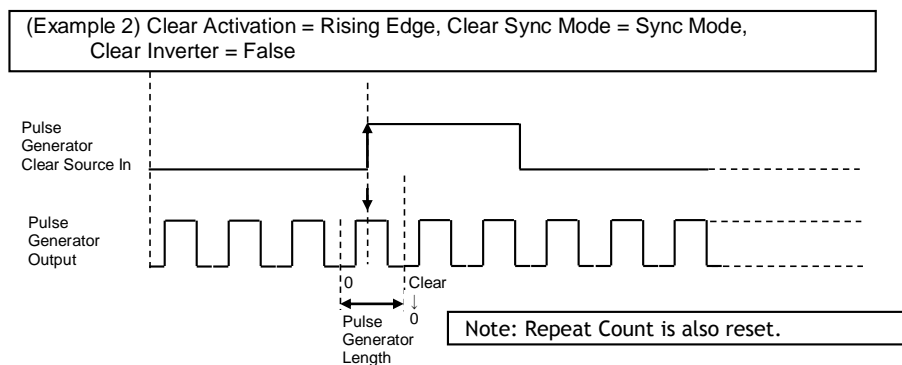


Fig.7 Counter clear in Sync mode



#### 6.4.9 Pulse Generator Clear Source

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

Table - 10 Pulse generator clear source

| Pulse Generator Clear Source item | Description   |
|-----------------------------------|---|
| Low                               | Connect Low level signal to Clear Source for the pulse generator.<br><b>Default setting</b> |
| 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.                       |

#### 6.4.10 Pulse Generator Inverter

Clear Source Signal can be have polarity inverted.

#### 6.4.11 Pulse Generator Setting table

Table - 11 Pulse Generator setting parameters

| 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)   | $([\text{Clock Source}] \div [\text{Clock Pre-scaler}])^{-1} \times [\text{Pulse Generator Length}]$      |
| - Pulse Generator Frequency (Hz)  | $[ \text{Pulse Generator Length (ms)} ]^{-1}$   |
| - Pulse Generator Start Point   | 0 to 1048574  |
| - Pulse Generator Start Point (ms)  | $([\text{Clock Source}] \div [\text{Clock Pre-scaler}])^{-1} \times [\text{Pulse Generator Start Point}]$ |
| - Pulse Generator End Point   | 1 to 1048575  |
| - Pulse Generator End Point (ms)  | $([\text{Clock Source}] \div [\text{Clock Pre-scaler}])^{-1} \times [\text{Pulse Generator End Point}]$   |
| - Pulse Generator pulse-width (ms)  | $[ \text{Pulse Generator End Point (ms)} ] - [ \text{Pulse Generator Start Point (ms)} ]$                 |
| - Pulse Generator Repeat Count  | 0 to 255  |
| - Pulse Generator Clear Activation<br>Clear Mode for the Pulse Generators | - Off   |
|   | - High Level  |
|   | - Low level   |
|   | - Rising Edge   |
|   | - Falling Edge  |
| - Pulse Generator Clear Sync Mode   | - Async mode<br>- 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)<br>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.

## 7. Sensor layout, output format and timing

### 7.1 Sensor layout

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

#### 7.1.1 Monochrome sensor

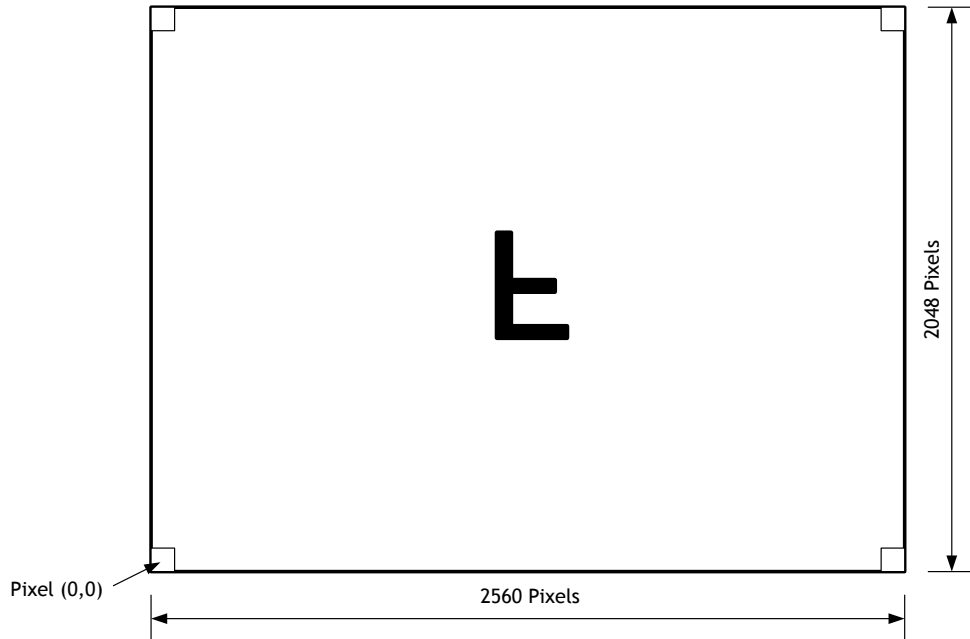


Fig. 8 Monochrome sensor layout

#### 7.1.2 Bayer sensor

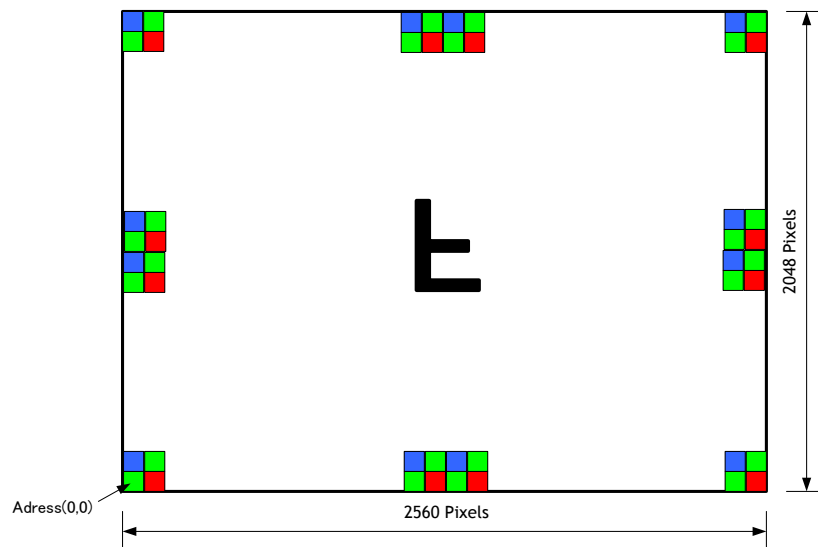


Fig. 9 Color sensor layout

## 7.2 Camera output format (Tap Geometry)

Table - 12 Output format

| 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.

### 7.2.1 1X2-1Y

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

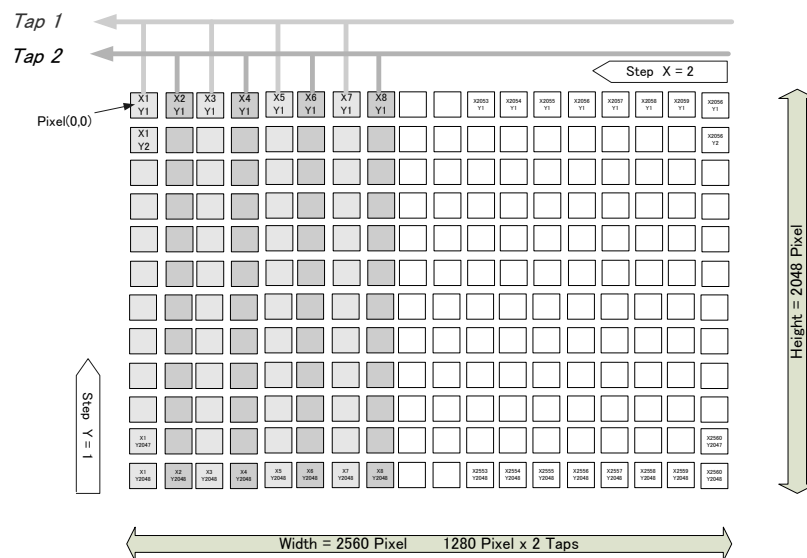
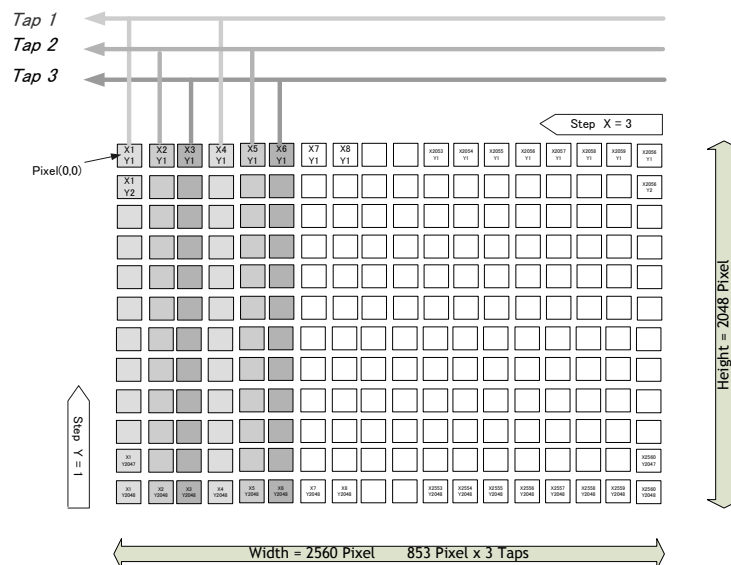


Fig.10 1X2-1Y output format

### 7.2.2 1X3-1Y

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



### 7.2.3 1X4-1Y

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

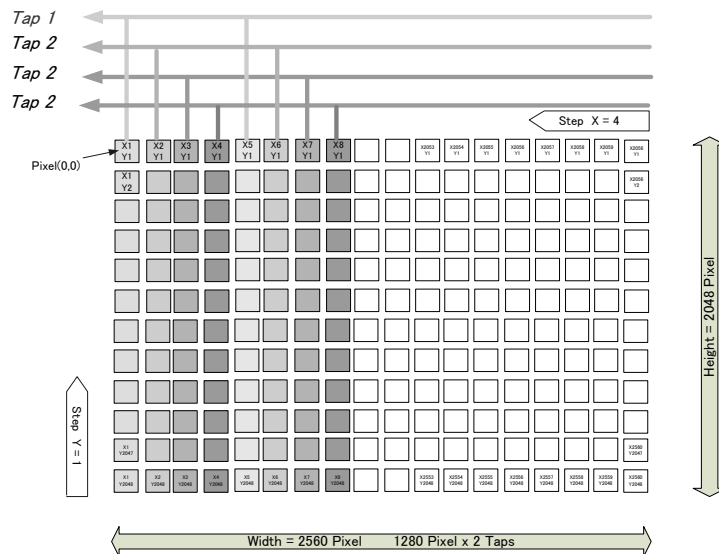


Fig. 11 1X4-1Y output format

#### 7.2.4 1X8-1Y

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

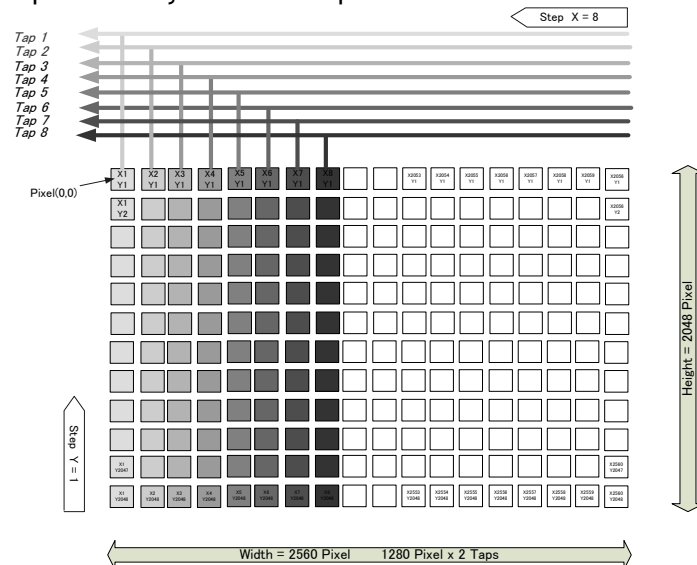


Fig. 12 1X8-1Y output format

## 7.3 Output timing and output image

### 7.3.1 Horizontal timing

The horizontal frequency is changed by setting the Tap Geometry.  
H-binning function is available on GO-5000M-PMCL only.

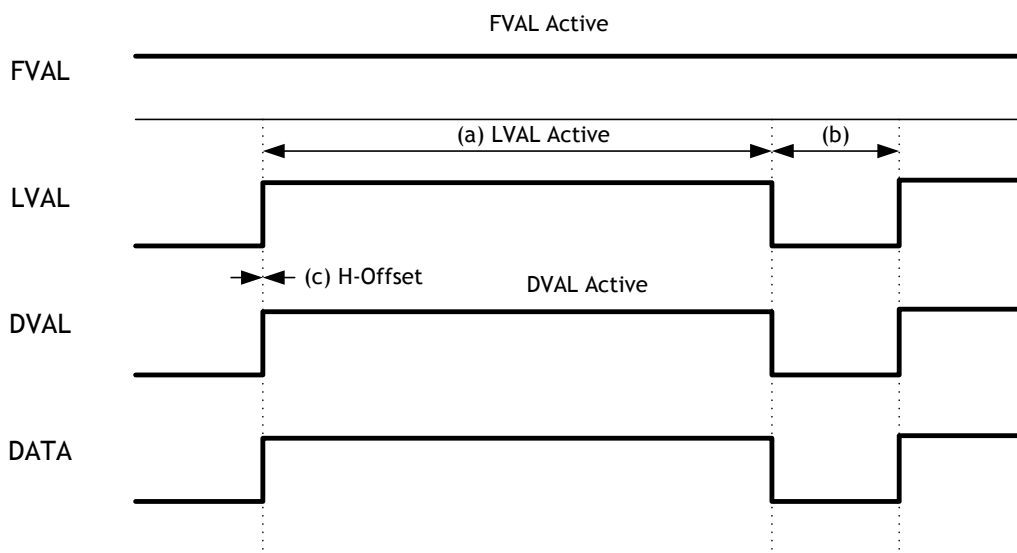


Fig. 13 Horizontal timing per 1 tap in Camera Link output

Table -13 Horizontal timing parameters in continuous trigger mode (1/2)

| Camera Settings   |                         |       |          |        |          |            |          | (a)                          | (b)                              | (c)                      |
|-------------------|-------------------------|-------|----------|--------|----------|------------|----------|------------------------------|----------------------------------|--------------------------|
| Tap Geometry      | Camera Link Pixel Clock | ROI   |          |        |          | Bining     |          | LVAL Active<br>(Unit: clock) | LVAL Non Active<br>(Unit: clock) | H Total<br>(Unit: clock) |
|                   |                         | Width | Offset X | Height | Offset Y | Horizontal | Vertical |                              |                                  |                          |
| 1X8 - 1Y<br>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                      |
|                   | 48.57 MHz               | 640   | 0        | 512    | 0        | x4         | x4       | 80                           | 250                              | 330                      |
|                   |                         | 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                      |

## GO-5000M-PMCL / GO-5000C-PMCL

| 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<br>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           |
|                 | 72.85 MHz               | 640   | 0        | 512    | 0        | x4         | x4       | 160           | 413             | 573           |
|                 |                         | 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           |
|                 | 48.57 MHz               | 1280  | 0        | 512    | 0        | x2         | x4       | 320           | 179             | 499           |
|                 |                         | 640   | 0        | 512    | 0        | x4         | x4       | 160           | 339             | 499           |
|                 |                         | 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           |

| 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) |
| 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           |

| 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) |
| 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           |
|                 | 72.85 MHz               | 640   | 0        | 512    | 0        | x4         | x4       | 320           | 155             | 575           |
|                 |                         | 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          |
|                 | 48.57 MHz               | 1280  | 0        | 512    | 0        | x2         | x4       | 640           | 13              | 653           |
|                 |                         | 640   | 0        | 512    | 0        | x4         | x4       | 320           | 173             | 493           |
|                 |                         | 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           |

## GO-5000M-PMCL / GO-5000C-PMCL

Table - 14 Horizontal timing parameters in continuous trigger mode (2/2)

Note: A is Operation value and B is calculation value

| 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: clock)        | (Unit: clock)     |
| 1X8 - 1Y<br>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             |



| 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: clock)        | (Unit: clock)     |
| 1X-8 - 1Y<br>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             |

# GO-5000M-PMCL / GO-5000C-PMCL

| 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: clock)        | (Unit: clock)     |
| 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             |
|                 | 72.85 MHz               | 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             |
|                 |                         | 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             |
|                 | 48.57 MHz               | 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             |
|                 |                         | 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             |

| 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: clock)        | (Unit: clock)     |
| 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               |

# GO-5000M-PMCL / GO-5000C-PMCL

| 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: clock)        | (Unit: clock)     |
| 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             |
|                 | 72.85 MHz               | 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             |
|                 |                         | 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             |
|                 | 48.57 MHz               | 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             |
|                 |                         | 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             |
|                 |                         |       |          |        |          |            |          | A  | 1294.9             | 37.509               | 26.66             |
|                 |                         |       |          |        |          |            |          | B  | 1296               | 37.478               | 26.682            |

### 7.3.2 Vertical timing

Figure 17 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. V-Binning function is available in GO-5000M-PMCL only.

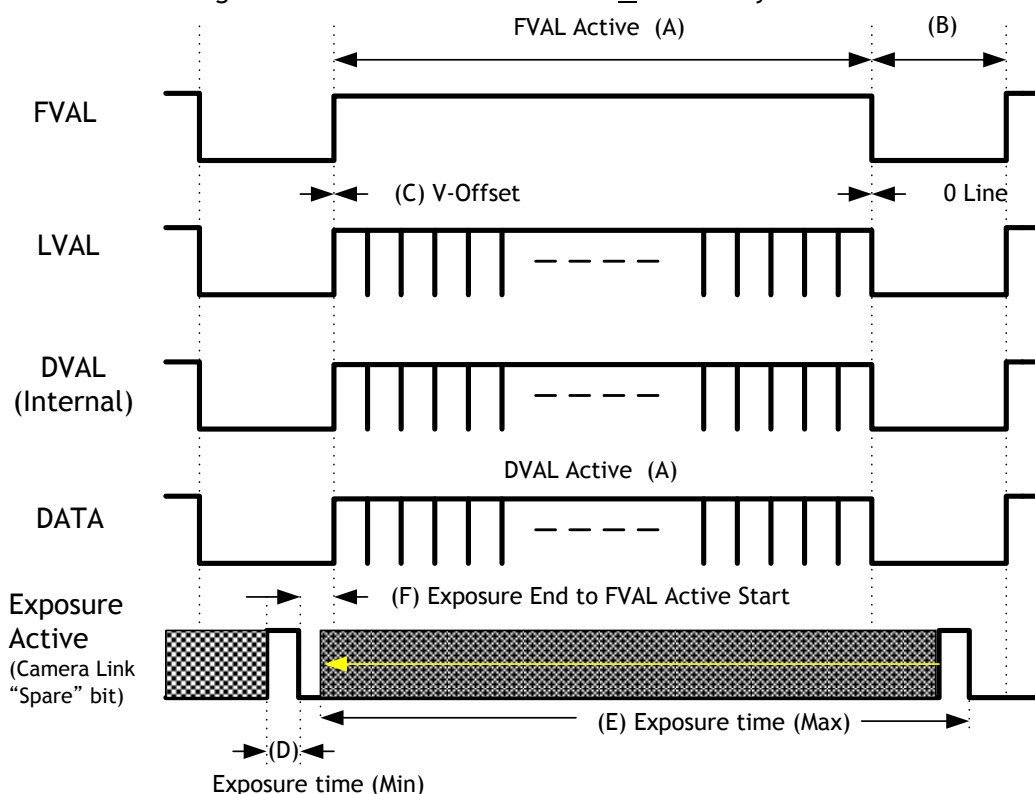


Fig. 14 Vertical timing

Table - 15 Vertical format (in Continuous trigger mode) (1/2)

| Camera Settings |             |                    |       |          |        |          |            |          | (A)                 | (B)                 | (C)          | (D)              |
|-----------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|---------------------|---------------------|--------------|------------------|
| Tap Geometry    | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | FVAL & DVAL         | FVAL Non Active     | V-Offset     | Exposure Time    |
|                 |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical | Active (Unit: line) | Active (Unit: line) | (Unit: line) | (min) (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                  |              |                  |
|                 | 48.57 MHz   | 14117 us           | 512   | 0        | 512    | 0        | x4         | x4       | 512                 | 10                  | 0            | 10               |
|                 |             |                    | 2560  | 0        | 2048   | 0        | Off        | Off      | 2048                | 14                  |              |                  |
|                 |             |                    | 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                  |              |                  |

## GO-5000M-PMCL / GO-5000C-PMCL

| Camera Settings    |             |                    |       |          |        |          |            |          | (A)                 | (B)                 | (C)          | (D)                 |
|--------------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|---------------------|---------------------|--------------|---------------------|
| Tap Geometry       | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | FVAL & DVAL         | FVAL Non Active     | V-Offset     | Exposure Time (min) |
|                    |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical | Active (Unit: line) | Active (Unit: line) | (Unit: line) | (Unit: μs)          |
| 1X8 - 1Y<br>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                  |              |                     |

| Camera Settings |             |                    |       |          |        |          |            |          | (A)                 | (B)                 | (C)          | (D)                 |
|-----------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|---------------------|---------------------|--------------|---------------------|
| Tap Geometry    | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | FVAL & DVAL         | FVAL Non Active     | V-Offset     | Exposure Time (min) |
|                 |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical | Active (Unit: line) | Active (Unit: line) | (Unit: line) | (Unit: μs)          |
| 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   | 18268 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                  |              |                     |

| Camera Settings   |             |                    |       |          |        |          |            |          | (A)                 | (B)                 | (C)          | (D)                 |
|-------------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|---------------------|---------------------|--------------|---------------------|
| Tap Geometry      | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | FVAL & DVAL         | FVAL Non Active     | V-Offset     | Exposure Time (min) |
|                   |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical | Active (Unit: line) | Active (Unit: line) | (Unit: line) | (Unit: μs)          |
| 1X3 - 1Y<br>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 (Unit: line) | FVAL Non Active (Unit: line) | V-Offset (Unit: line) | Exposure Time (min) (Unit: $\mu$ s) |
|                 |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical |                                 |                              |                       |                                     |
| 1X2 - 1Y        | 84.99 MHz   | 31268 $\mu$ s      | 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                           |                       |                                     |
|                 | 72.85 MHz   | 36366 $\mu$ s      | 512   | 0        | 512    | 0        | x4         | x4       | 512                             | 14                           | 0                     | 10                                  |
|                 |             |                    | 2560  | 0        | 2048   | 0        | Off        | Off      | 2048                            | 14                           |                       |                                     |
|                 |             |                    | 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                           |                       |                                     |
|                 | 48.57 MHz   | 55126 $\mu$ s      | 512   | 0        | 1024   | 0        | x4         | x2       | 1024                            | 14                           | 0                     | 10                                  |
|                 |             |                    | 512   | 0        | 512    | 0        | x4         | x4       | 512                             | 14                           |                       |                                     |
|                 |             |                    | 2560  | 0        | 2048   | 0        | Off        | Off      | 2048                            | 16                           |                       |                                     |
|                 |             |                    | 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                           |                       |                                     |

Table - 15 Vertical format (in Continuous trigger mode) (2/2)

| Camera Settings |             |                    |       |          |        |          |            |          |                                    | (E)                                 | (F)   |
|-----------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|------------------------------------|-------------------------------------|---|
| Tap Geometry    | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | Frame Period (min) (Unit: $\mu$ s) | Exposure Time (max) (Unit: $\mu$ s) | Exposure End to FVAL Active Start (Unit: $\mu$ s) |
|                 |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical |                                    |                                     |   |
| 1X8 - 1Y 8-bit  | 72.85 MHz   | 9328 $\mu$ s       | 2560  | 0        | 2048   | 0        | Off        | Off      | 9328                               | 9222                                | 29.6  |
|                 |             |                    | 2560  | 0        | 1024   | 0        | Off        | x2       | 4709                               | 4657                                |   |
|                 |             |                    | 2560  | 0        | 512    | 0        | Off        | x4       | 2397                               | 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                                |   |
|                 | 48.57 MHz   | 14117 $\mu$ s      | 512   | 0        | 512    | 0        | x4         | x4       | 2383                               | 2302                                | 40.4  |
|                 |             |                    | 2560  | 0        | 2048   | 0        | Off        | Off      | 14117                              | 14184                               |   |
|                 |             |                    | 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                                |   |

# GO-5000M-PMCL / GO-5000C-PMCL

| Camera Settings    |             |                    |       |          |        |          |            |          |                              | (E)                           | (F)   |
|--------------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|------------------------------|-------------------------------|---|
| Tap Geometry       | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | Frame Period (min) (Unit:us) | Exposure Time (max) (Unit:us) | Exposure End to FVAL Active Start (Unit:us) |
|                    |             |                    |       |          |        |          |            |          |                              |                               |   |
|                    |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical |                              |                               |   |
| 1X8 - 1Y<br>10-bit | 58.28 MHz   | 11765 us           | 2560  | 0        | 2048   | 0        | Off        | Off      | 11765                        | 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      | 11622                        | 11659                         |   |
|                    |             |                    | 1280  | 0        | 1024   | 0        | x2         | x2       | 5867                         | 5828                          |   |
|                    |             |                    | 1280  | 0        | 512    | 0        | x2         | x4       | 2986                         | 2913                          |   |
|                    |             |                    | 512   | 0        | 2048   | 0        | x4         | Off      | 11622                        | 11659                         |   |
|                    |             |                    | 512   | 0        | 1024   | 0        | x4         | x2       | 5867                         | 5828                          |   |
|                    |             |                    | 512   | 0        | 512    | 0        | x4         | x4       | 2986                         | 2913                          |   |

| Camera Settings |             |                    |       |          |        |          |            |          |                              | (E)                           | (F)   |
|-----------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|------------------------------|-------------------------------|---|
| Tap Geometry    | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | Frame Period (min) (Unit:us) | Exposure Time (max) (Unit:us) | Exposure End to FVAL Active Start (Unit:us) |
|                 |             |                    |       |          |        |          |            |          |                              |                               |   |
|                 |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical |                              |                               |   |
| 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                          |   |
|                 | 72.85 MHz   | 18268 us           | 512   | 0        | 512    | 0        | x4         | x4       | 3570                         | 3502                          | 43.2  |
|                 |             |                    | 2560  | 0        | 2048   | 0        | Off        | Off      | 18268                        | 18384                         |   |
|                 |             |                    | 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                         |   |
|                 | 48.57 MHz   | 27444 us           | 512   | 0        | 1024   | 0        | x4         | x2       | 7027                         | 7001                          | 52.4  |
|                 |             |                    | 512   | 0        | 512    | 0        | x4         | x4       | 3570                         | 3502                          |   |
|                 |             |                    | 2560  | 0        | 2048   | 0        | Off        | Off      | 27444                        | 27672                         |   |
|                 |             |                    | 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                          |   |

| Camera Settings   |             |                    |       |          |        |          |            |          |                              | (E)                           | (F)   |
|-------------------|-------------|--------------------|-------|----------|--------|----------|------------|----------|------------------------------|-------------------------------|---|
| Tap Geometry      | Pixel Clock | Frame Period (Typ) | ROI   |          |        |          | Binning    |          | Frame Period (min) (Unit:us) | Exposure Time (max) (Unit:us) | Exposure End to FVAL Active Start (Unit:us) |
|                   |             |                    |       |          |        |          |            |          |                              |                               |   |
|                   |             |                    | Width | Offset X | Height | Offset Y | Horizontal | Vertical |                              |                               |   |
| 1X3 - 1Y<br>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   | 31268 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     | 70                           |                               |   |
|                 | 2560        | 0                  | 2048  | 0        | Off    | Off      | 36366      | 36702    |                              |                               |   |
|                 | 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     | 82.8                         |                               |   |
|                 | 512         | 0                  | 512   | 0        | x4     | x4       | 3570       | 3502     |                              |                               |   |
|                 | 2560        | 0                  | 2048  | 0        | Off    | Off      | 54464      | 55020    |                              |                               |   |
|                 | 2560        | 0                  | 1024  | 0        | Off    | x2       | 27469      | 27671    |                              |                               |   |
|                 | 2560        | 0                  | 512   | 0        | Off    | x4       | 13958      | 13996    |                              |                               |   |
|                 | 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      | 14256    |                              |                               |   |
|                 | 512         | 0                  | 1024  | 0        | x4     | x2       | 7156       | 7131     |                              |                               |   |
|                 | 512         | 0                  | 512   | 0        | x4     | x4       | 3635       | 3568     |                              |                               |   |

### 7.3.3 ROI (Region Of Interest) setting

In the GO-5000-PMCL, 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, the minimum width is "8" and minimum height is "1". In the GO-5000C-PMCL, the minimum width is the same as GO-5000-PMCL but minimum height is "2".

#### Setting example (1)

Binning\* Horizontal = 1  
Binning\* Vertical = 1

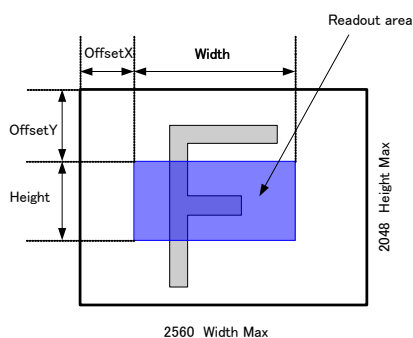


Fig. 15 Setting example ( No binning)

#### Setting example (2)

Binning\* Horizontal = 2  
Binning\* Vertical = 2

\* Binning: GO-5000M-PMCL only.

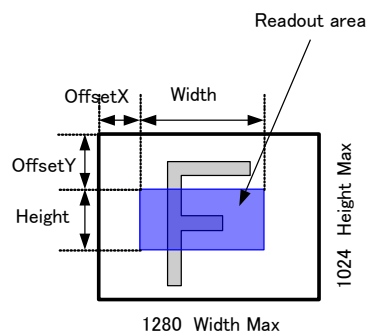


Fig.16 Setting example (Binning)

## 7.4 Digital output bit allocation

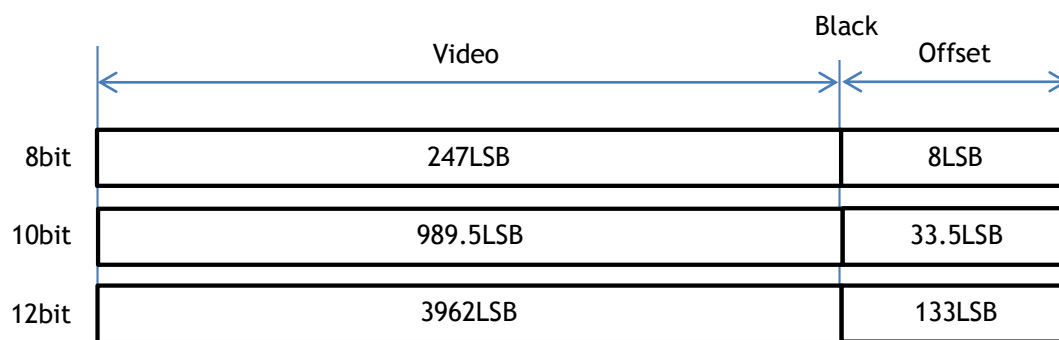


Fig. 17 Bit allocation

## 8. Operating modes

### 8.1. Acquisition control (change the frame rate)

#### 8.1.1 Acquisition control

With Trigger OFF (free running mode - see section 7.2.1), 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 0.125 Hz (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 |

#### 8.1.2 Calculation of the frame rate

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

$$\text{Maximum Frame Rate (fps)} = 1 / (\text{Rounddown}^3([\text{Trow}] \times 16 / C) \times ([H] + E) \times 0.988^4) \times 1000000$$

Where,

$$[\text{Trow}] = \text{Roundup}^1((\text{Roundup}^1(2560 / A^2) \times [W] / 2560 + B) \times A^2) \times C / (D \times 16)$$

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]

Table-16 Figures for A to E by the tap geometry.

| Tap Geometry      | CL Clock Frequency(MHz) | A | B  | C     | D         | E         | Max. Frame Rate(fps) <sup>7</sup> |
|-------------------|-------------------------|---|----|-------|-----------|-----------|-----------------------------------|
| 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<br>(8bit)  | 72.85(High)             | 8 | 12 | 577.6 | 18        | 107.1     |                                   |
|                   | 48.57(Low)              |   | 14 | 384   |           | 388.5712  | 70.8                              |
| 1X8-1Y<br>(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 <sup>*5</sup> |       | Height <sup>*6</sup> |          |
|---------------|---------------------|-------|----------------------|----------|
|               | 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              | -        |

Note: Binning ON is available for only GO-5000M-PMCL.

\*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

## 8.2. Exposure setting

This section describes how to set the exposure settings.

Table-17 Exposure setting

| Command name      | Parameter                 | Description   |
|-------------------|---------------------------|---|
| Exposure Mode     | Off                       | Shutter control is not available.<br>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  |

### 8.2.1 Exposure Mode

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

Table - 18 Exposure mode

| 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.<br><ul style="list-style-type: none"> <li>If Trigger Mode setting is OFF, the camera is in free-running operation.</li> <li>If Trigger Mode setting is ON, the exposure operation depends on the setting of Trigger Option.</li> </ul> |
| Trigger Width         | The exposure is controlled by the pulse width of the external trigger.<br><ul style="list-style-type: none"> <li>Trigger Mode is forced to ON.</li> </ul>  |

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

Table - 19 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-5000-PMCL, 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.**

Table - 20 Operational mode by the combination of the exposure mode and the trigger control

| ExposureMode \ TriggerControl | Frame Start<br>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

### 8.2.2 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  $\mu$ sec per step.

Minimum: 10  $\mu$ sec

Maximum: 8 seconds (Note - noise may make image unusable after 1 second)

### 8.2.3 ExposureAuto

This is a function to control the exposure automatically. It is effective only for Timed. JAI ALC Reference controls the brightness.

There are three 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

|                  |                      |                       |                      |
|------------------|----------------------|-----------------------|----------------------|
| High<br>Left     | High<br>Mid-left     | High<br>Mid-right     | High<br>Right        |
| Mid-High<br>Left | Mid-High<br>Mid-left | Mid-High<br>Mid-right | Mid-High<br>Right    |
| Mid-Low<br>Left  | Mid-Low<br>Mid-left  | Mid-Low<br>Mid-right  | Mid-<br>Low<br>Right |
| Low<br>Left      | Low<br>Mid-left      | Low<br>Mid-right      | Low<br>Right         |

Fig.18 ALC Area Type

### 8.3. Trigger control

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

Table - 21 Trigger control

| Camera Settings     |                 |                  |                   | JAI Custom<br>Trigger Mode<br>Name | Description  |
|---------------------|-----------------|------------------|-------------------|------------------------------------|--|
| Trigger<br>Selector | Trigger<br>Mode | Exposure<br>Mode | Trigger<br>Option |                                    |  |
| Frame<br>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<br>Width | Off               | PWC Trigger                        | Externally triggered operation with a pulse width exposure time          |

#### 8.3.1 Trigger Selector

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

Table - 22 Trigger selector

| Trigger Selector Item | Description         |
|-----------------------|---------------------|
| Frame Start           | Frame Start Trigger |

#### 8.3.2 Trigger Mode

Select either free-running operation or external trigger operation.

OFF: Free-running operation

ON: External trigger operation

- **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.**

### 8.3.3 Trigger Source

Select the trigger source to be used for trigger operation (Frame Start for the GO-5000-PMCL) from the following:

Table - 23 Trigger Source

| Trigger Source item | Description  |
|---------------------|--|
| Low                 | Connect LOW level signal to the selected trigger operation<br><b>Default setting</b>   |
| High                | Connect HIGH level signal to the selected trigger operation  |
| Soft Trigger        | Connect Soft Trigger signal to the selected trigger operation<br>Trigger can be input manually by the execution of the software trigger<br>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  |

### 8.3.4 TriggerActivation

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.

Table - 24 Trigger Activation

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

## 8.4. Normal continuous operation (Timed Exposure Mode/Trigger Mode OFF)

This is used for applications which do not require triggering.

Table - 25 Minimum interval (1X8-1Y, 8-bit, CL Clock =72.85MHz)

| Trigger Mode   | Readout Mode                | Time (Min. trigger period ) |
|--|-----------------------------|-----------------------------|
| Timed Exposure Mode<br>Trigger Mode OFF<br>(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) (Note2) | 4740us                      |

Note 1 : Readout setting in Trigger Overlap is not available

Note 2: GO-5000M-PMCL only

## 8.5. Timed mode (EPS operation)

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

Table - 26 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<br>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) (Note 1) | 4740 us + 8.01 μs          |

Note1 : GO-5000M-PMCL only

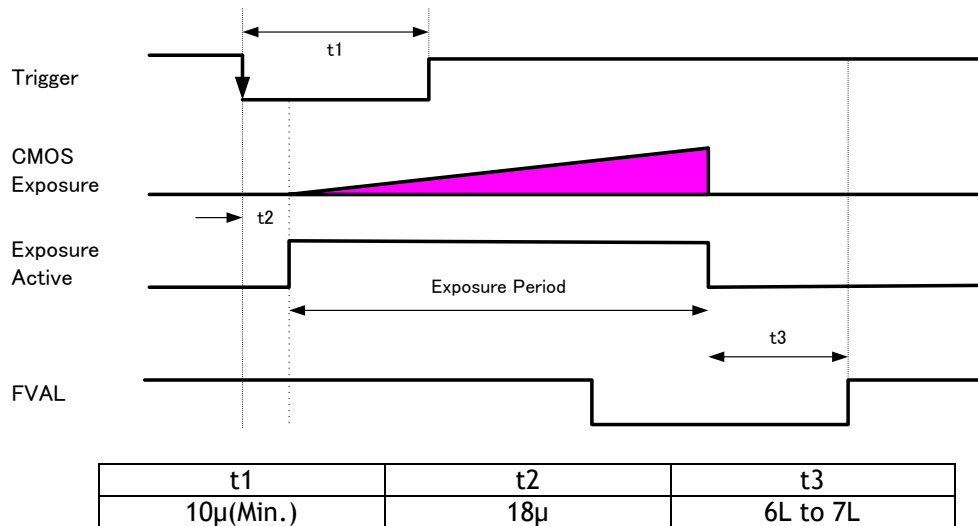


Fig. 19 Times timing



## 8.6 Trigger width mode (PWC)

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

Table - 27 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 $\mu$ s + 8.01 $\mu$ s |
|                             | AOI Center 2/3              | 6281 $\mu$ s + 8.01 $\mu$ s |
|                             | AOI Center 1/2              | 4740 $\mu$ s + 8.01 $\mu$ s |
|                             | AOI Center 1/4              | 2393 $\mu$ s + 8.01 $\mu$ s |
|                             | AOI Center 1/8              | 1219 $\mu$ s + 8.01 $\mu$ s |
|                             | V Binning ON (Full) (Note1) | 4740 $\mu$ s + 8.01 $\mu$ s |

Note1 : GO-5000M-PMCL only

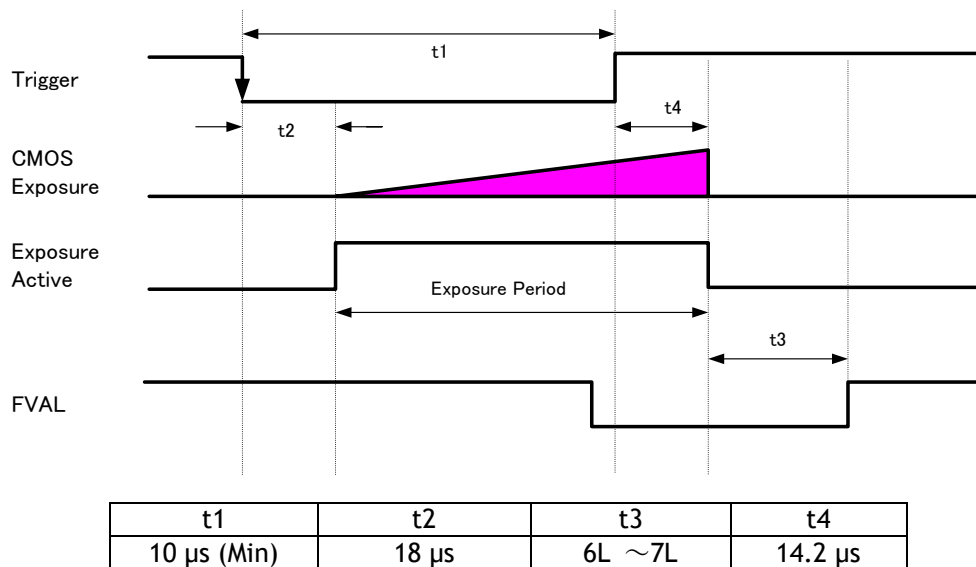


Fig. 20 Trigger Width timing

## 8.7. RCT mode

### 8.7.1 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

Table - 28 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 |

Note1 : GO-5000M-PMCL only

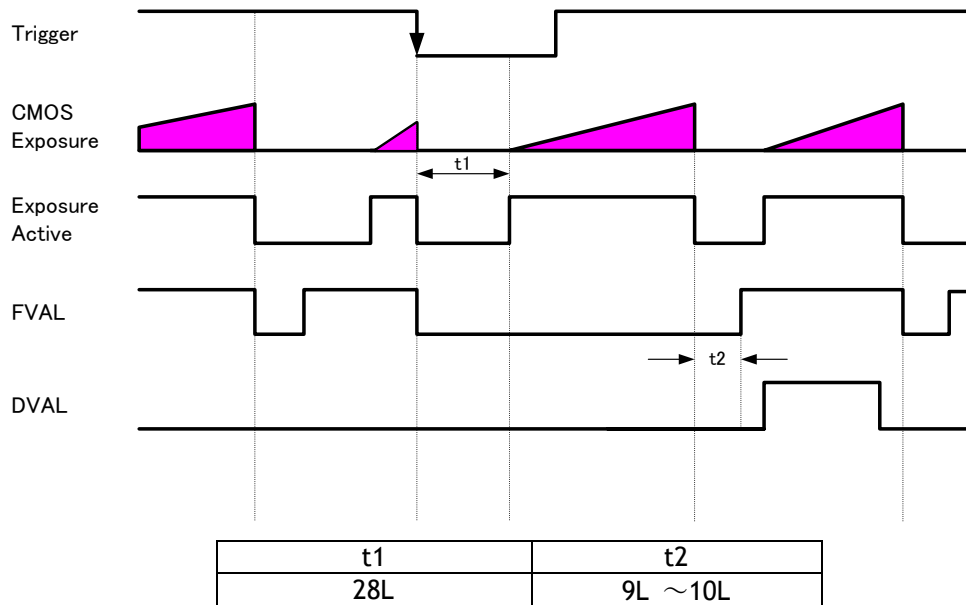


Fig.21 RCT mode timing

### 8.7.2 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.

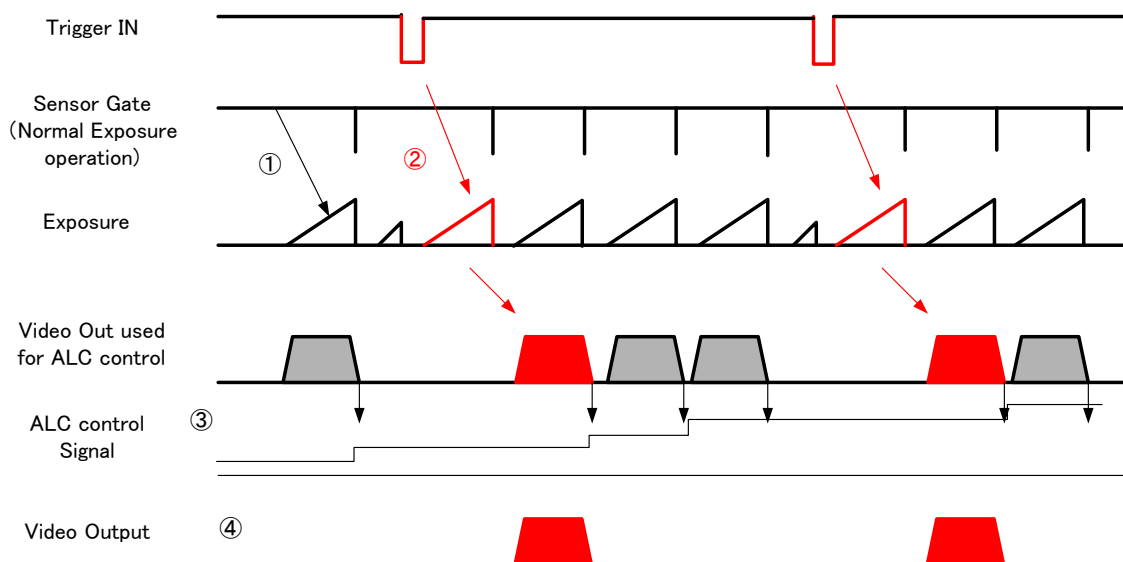


Fig.22 RCT mode timing for ALC operation (Example)

## 8.8 Sequence Mode

### 8.8.1 Sequence mode setting

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-5000-PMCL, 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

Table - 29 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)<br>(Note 1) | 4740 us + Exposure time + 8.01μs |

Note 1: GO-5000M-PMCL only

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.

### 8.8.2 Trigger Sequence mode timing

The following drawing shows the sequence mode timing concept.

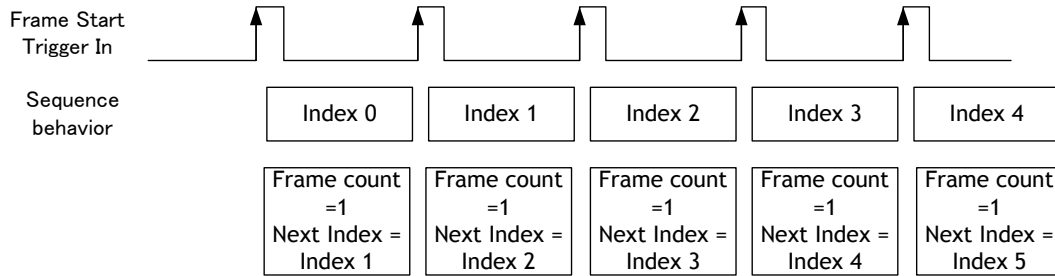


Fig. 23 Behavior of Sequence trigger

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

### 8.8.3 Setting command

#### 8.8.3.1 Default setting

Table 30. Sequence mode: Sequence Index default value

| Sequence ROI Index | Sequence ROI |        |        |   |               |     |      |               |             |                  |          |            |             |            |
|--------------------|--------------|--------|--------|---|---------------|-----|------|---------------|-------------|------------------|----------|------------|-------------|------------|
|                    | Width        | Height | Offset |   | Gain Selector |     |      | Exposure Time | Black Level | Binning (Note 1) |          | 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    |

(Note 1) GO-5000M-PMCL only.

## 8.8.3.2 Sequence mode setting Command

Table – 31 Command list

| 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><br>Set frame number for display per a frame  |
| Sequence ROI Next Index       | Index 1~10<br>Off                         | This is not used for GO-5000-PMCL  |
| Sequence ROI Width            | 16~2560 (Note 1)                          | <Set to each Index><br>Set the width value   |
| Sequence ROI Height           | 1~2048 (Note 1, Note3)<br>2~2048 (Note 2) | <Set to each Index><br>Set the height value  |
| Sequence ROI Offset X         | 0~2560 (Note 1)- [Sequence ROI Width]     | <Set to each Index><br>Set the offset X value.   |
| Sequence ROI Offset Y         | 0 ~ 2048(Note1) - [Sequence ROI Height]   | <Set to each Index><br>Set the offset Y.   |
| Sequence ROI Gain All         | 100~1600                                  | <Set to each index><br>Set the gain value.   |
| Sequence ROI Gain Red(Note2)  | -4533~28000                               | <Set to each Index><br>Set the Gain Red value.   |
| Sequence ROI Gain Blue(Note2) | -4533~28000                               | <Set to each Index><br>Set the Gain Blue value.  |
| Sequence ROI Exposure Time    | 10~8000000                                | <Set to each Index><br>Set the exposure time value.  |
| Sequence ROI Black Level      | -256~255                                  | <Set to each index><br>Set the black level value.  |
| Sequence ROI LUT enable       | 0 (Disable)<br>1 (Enable)                 | <Set to each Index><br>Set the disable or enable of LUT.<br>If it is set to enable, the function is selected in the Sequence LUT mode. |
| Sequence ROI H Binning(Note3) | 1, 2, 4 (3 is disable)                    | <Set to each Index><br>Set the H Binning value.  |
| Sequence ROI V Binning(Note3) | 1, 2, 4 (3 is disable)                    | <Set to each Index><br>Set the V Binning value.  |
| Sequence Repetition           | 1~255                                     | <For Trigger Sequence Mode><br>Set the repeat number of the sequence.  |
| Command Sequence Index        | Index 1~10                                | <For Command Sequence Mode><br>Set the performed index.  |
| Current Sequence Index        | Index 1~10                                | <READ only><br>Refer to the current Sequence Index.  |
| Sequence LUT Mode             | Gamma<br>LUT                              | Set the function if Sequence ROI LUT is set to enable.<br>Set the value on Gamma or LUT control.                                       |
| Reset Sequence Index          | No (EXE command)                          | Reset the Sequence Index to 0.<br>At the same time, the Frame Count is also initialized.   |

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

Note2: Only for GO-5000C-PMCL

Note3: Only for GO-5000M-PMCL

## 8.9 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-5000-PMCL, image overlapping is not possible.

### Multi ROI setting

Video Send Mode: Set to Multi ROI

Table - 32 Multi ROI Index table default values

|                          |           |        |   |
|--------------------------|-----------|--------|---|
| Multi ROI Index Max      | 1         |        |   |
| Multi ROI Width          | 2560      |        |   |
| Multi ROI Index Selector | Multi ROI |        |   |
|                          | Height    | Offset |   |
|                          |           | X      | 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 |

### 8.9.1 Multi ROI setting command

Table - 33 Command list

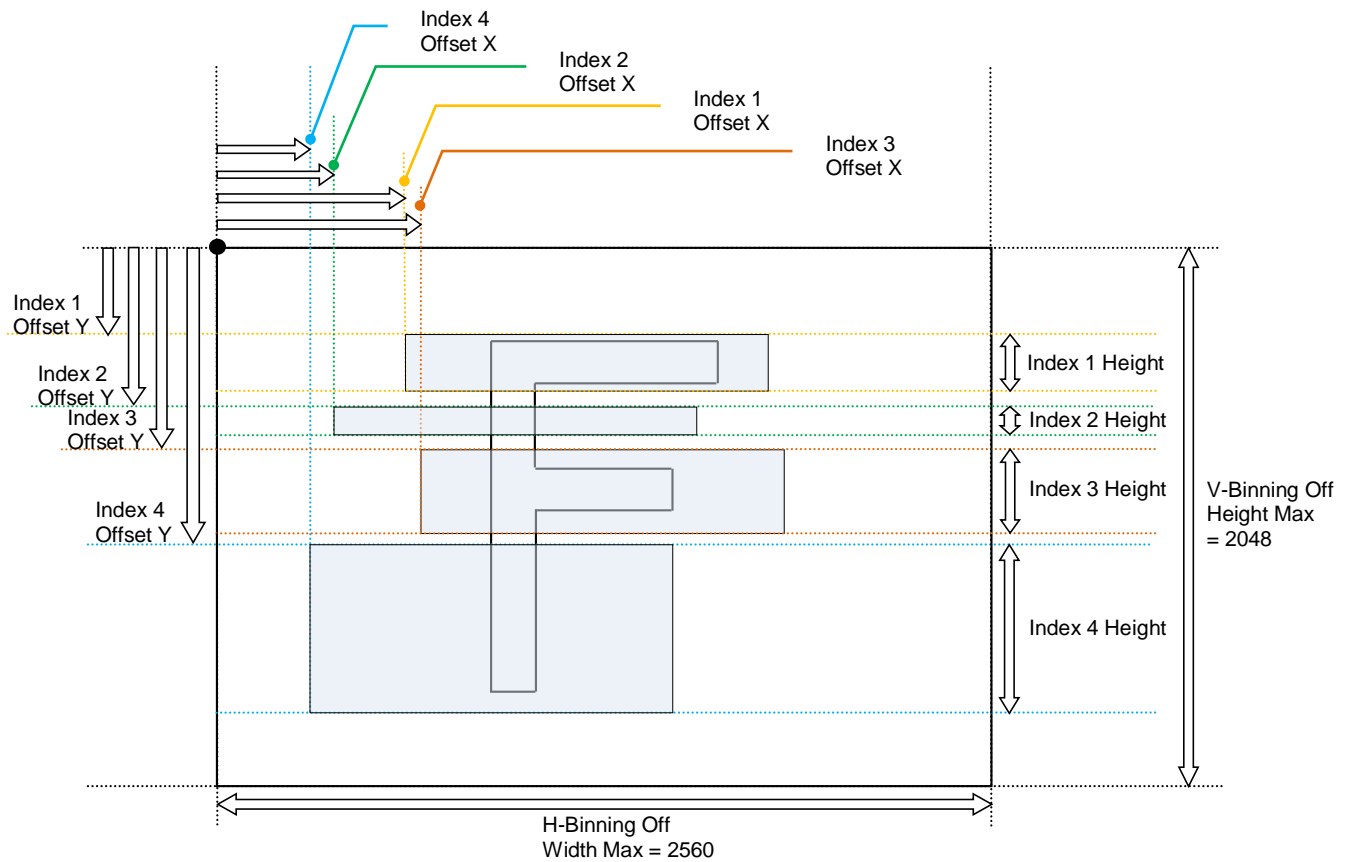
| Command             | Parameter                              | Description  |
|---------------------|--|--|
| Multi ROI Index     | Index 1~5                              | Select index table to be set   |
| Multi ROI Width     | 8~2560 (Note1)                         | <Common for all indexes><br>Set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

Note2: For GO-5000M-PMCL

Note3: For GO-5000C-PMCL

## ROI setting explanation if Multi ROI Index Max is set to 4



## Video output of Multi ROI

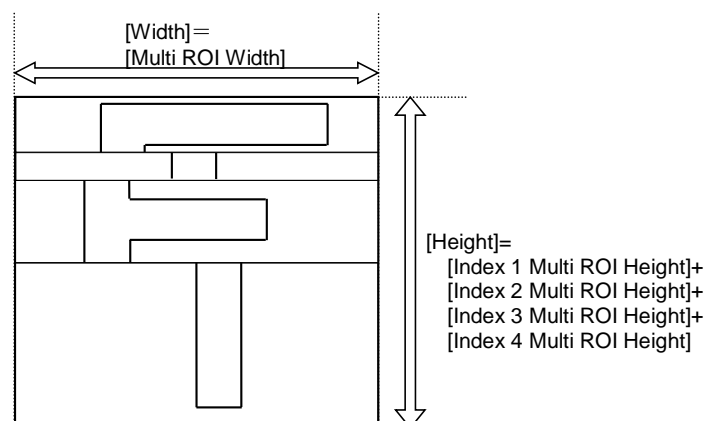


Fig. 24 Multi ROI settings and output image

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.

## 8.10. Operation and function matrix

Table - 30 Operation and function matrix

| Exposure operation | Trigger Mode | Trigger Option | Binning Vertical (Note 1) | Binning Horizontal (Note 1) | Exposure Time | ROI | Auto White Balance (Note2) | Auto Gain | Auto Exposure | Overlap | Vide Send Mode |               |
|--------------------|--------------|----------------|---------------------------|-----------------------------|---------------|-----|----------------------------|-----------|---------------|---------|----------------|---------------|
|                    |              |                |                           |                             |               |     |                            |           |               |         | Multi ROI      | Sequenc e 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                           | ×             | ×   | ×                          | ×         | ×             | ×       | ×              | ×             |

(Note1) GO-5000M-PMCL only

(Note2) GO-5000C-PMCL only



## 9. Other functions

### 9.1 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                         |

#### 9.1.1 Black Level Selector

The following items can be adjusted.

Monochrome: Black Level All  
 Color: Black Level All/ Black Level Red/ Black Level Blue

#### 9.1.2 Black Level

The black level can be adjusted in the following range.

Monochrome: Black Level All : -256 ~+255  
 Color: Black Level All : -256 ~+255  
 Black Level Red/Blue: -512 ~+511

## 9.2 Gain control

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

#### 9.2.1 Analog base gain

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

In the GO-5000C-PMCL, R, G, B or All can be selected in AnaloBaseGainSelector command.

| Command                   | Parameter | Description   |
|---------------------------|-----------|---|
| Analog Base Gain Selector | All       | Red, Green, Blue can be controlled under the same Analog Base Gain. If this is selected, pre-set Red, Green or Blue Analog Base Gain is disabled. |
|                           | Red       | Analog Base Gain of Red can be set. If this is selected, the value set in All is disabled. So, Green and Blue must be set.                        |
|                           | Green     | Analog Base Gain of Green can be set. If this is selected, the value set in All is disabled. So, Red and Blue must be set.                        |
|                           | Blue      | Analog Base Gain of Blue can be set. If this is selected, the value set in All is disabled. So, Green and Red must be set.                        |
| Analog Base Gain          | 0dB       | Set for All, Red, Green or Blue. If Red, Green or Blue is selected, other two channels must be set at the same time.                              |
|                           | 6dB       |   |
|                           | 12dB      |   |

#### 9.2.2 Gain

The master gain (DigitalAll) for both monochrome and color 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.

In the GO-5000C-PMCL, blue and red gain can be set from x0.45 to x5.62 against the master gain setting and its resolution is x0.01/step.

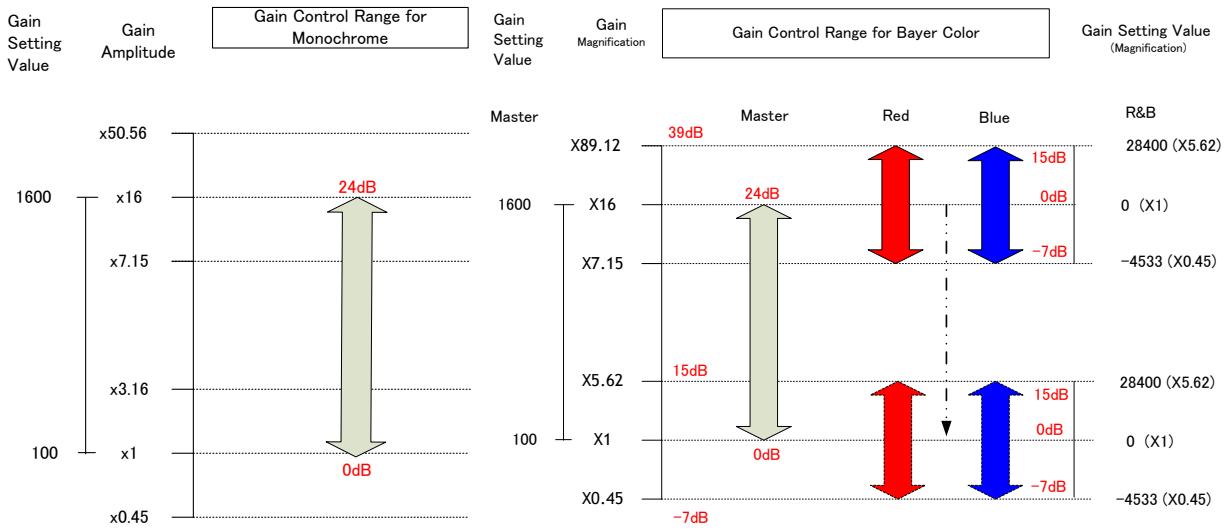


Fig.2.25 Gain control

## 9.2.3 Gain Selector

The following parameters can be set.

Monochrome: Digital All  
Color: Digital All/Digital Red/ Digital Blue

## 9.2.4 Gain

The range for adjustment is as follows.

Monochrome: Digital All: 1 ~ 16 (x1 (0dB) ~ x16 (+24dB))  
Color: Digital All: 1 ~ 16 (x1 (0dB) ~ x16 (+24dB))  
Digital Red: -0.4467 ~ 5.6235 (-7dB ~ +15dB)  
Digital Blue: 0.4467 ~ 5.6235 (-7dB ~ +15dB)

## 9.2.5 Gain Raw

The range for adjustment is as follows.

Mono: Gain Raw Digital All : 100 ~ 1600 (0dB~24dB)  
Color: Gain Raw Digital All : 100 ~ 1600 (0dB~24dB)  
Gain Raw Digital Red / Gain Raw Digital Blue : -4533~28400

## 9.2.4 Gain Auto

This provides automatic control of the gain level.

This is controlled by the command JAI ALC Reference.

There are three 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.

|               |                   |                    |                |
|---------------|-------------------|--------------------|----------------|
| 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      |

Fig.26 ALC channel area

#### 9.2.4 Balance white auto

This is to adjust the white balance by controlling R and B gain level.

OFF: Auto white balance is disabled. Manually adjusted.

Once: The white balance is controlled at one time when it is activated.

Continuous: The white balance is continuously adjusted.

Preset 4600K: R and B gain is preset so that the color temperature is 4600K.

Preset 5600K: R and B gain is preset so that the color temperature is 5600K.

Preset 6500K: R and B gain is preset so that the color temperature is 6500K.

For the details setting,

AWB Area Selector: The measurement area of AWB control can be set.

AWB Area Enable: Determine the use of selected AWB area.

This can enable its use area by area. If AWB Area Selector is set to ALL and AWB Area Enable is set to “True”, all areas are enabled. In this case, setting area by area is disabled.

### 9.3. 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 the monochrome model (GO-5000M-PMCL) and 16 points for setup in the color model (GO-5000C-PMCL). The output level is created by applying gain to the input level to achieve the specified output level.

#### 9.3.1 LUT Mode

Can be set to OFF, gamma (see section 9.4), or Lookup Table. If Lookup Table is selected, the dark compression is forced to be OFF.

## 9.3.2 LUT Index

This represents the “starting” or “input” pixel value to be modified by the Lookup Table. The GO-5000M-PMCL has a 32-point Lookup Table and GO-5000C-PMCL has a 16-point table. Thus, in the GO-5000M-PMCL, an index value of 0 represents a full black pixel and a value of 31 represents a full white pixel. For the GO-5000C-PMCL, the corresponding index values range from 0 to 15. The index point values are automatically scaled to fit the internal pixel format of the camera. This is common for all output configurations.

## 9.3.3 LUT Value

This is the “adjusted” or “output” pixel value for a given LUT index. It has 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).

Note: 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.

## 9.4 Gamma

This command is used set gamma. Gamma 0.45, 0.6 and 1.0 (OFF) can be selected. The gamma value is an approximate value.

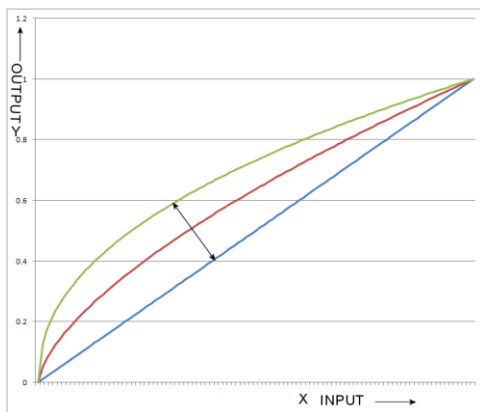


Fig.27 Gamma correction

### 9.4.1 Linear and Dark Compression

GO-5000-PMCL 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.

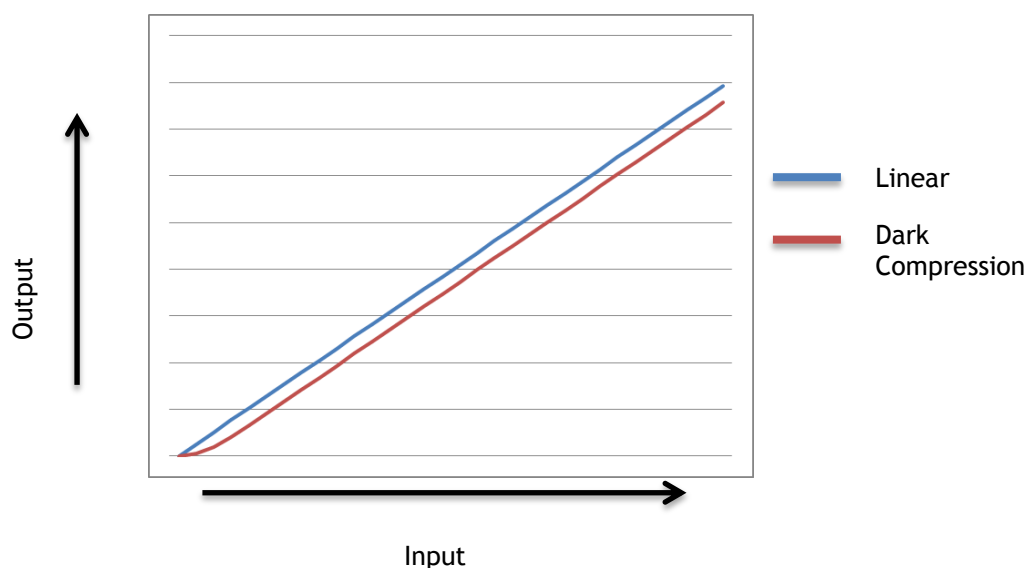


Fig.28 Characteristics

## 9.5 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.

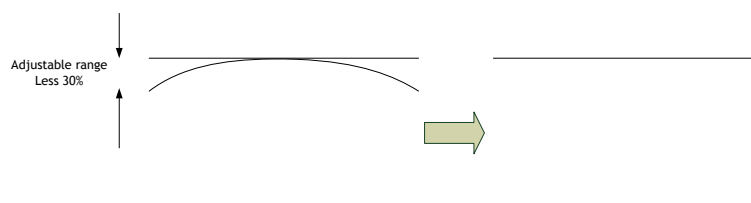


Fig.29 Concept drawing of flat shading correction

### Color shading correction (For GO-5000C-PMCL only):

In this case, R channel and B channel are adjusted to match with G channel characteristics. 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.

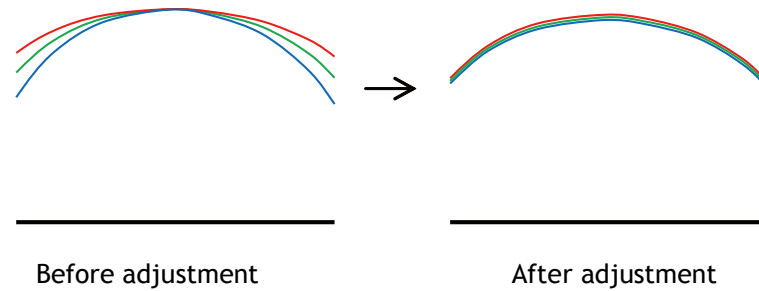


Fig. 30 Concept drawing of color shading correction

Note: Under the following conditions, the shading correction circuit may not work properly.

- If there is some area in the image with a video level less than 70%
- If part of the image or the entire image is saturated
- If the highest video level in the image is less than 300LSB (at 10-bit output)

## 9.6 Blemish compensation

The GO-5000-PMCL 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 and, in the case of the GO-5000C-PMCL, the defective pixels can be compensated by averaging the data from the same Bayer color pixel in left adjacent column. The number of pixels that can be compensated is up to 512 pixels.

GO-5000-PMCL 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.

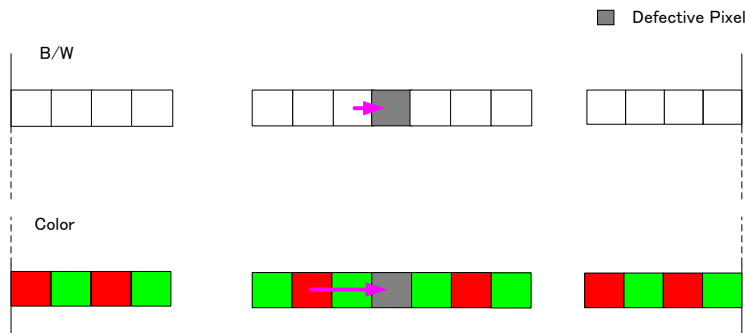


Fig. 31 Blemish compensation

## 9.7 ALC

In the GO-5000-PMCL, 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

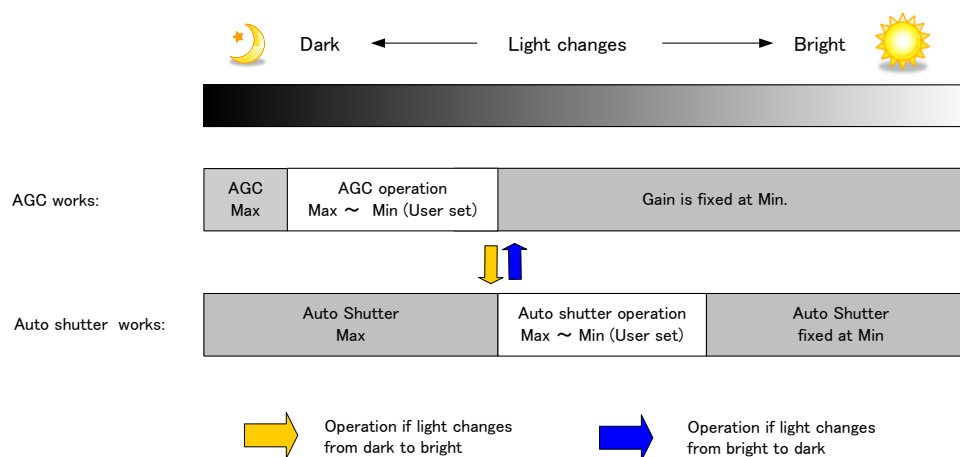


Fig.32 ALC function concept

## 9.8 HDR (High Dynamic Range) (GO-5000M-PMCL only)

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 the 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, the HDR\* Mode can be set to ON again.
5. In this mode, Exposure Auto function is disabled.

\*\* GO-5000M-PMCL only

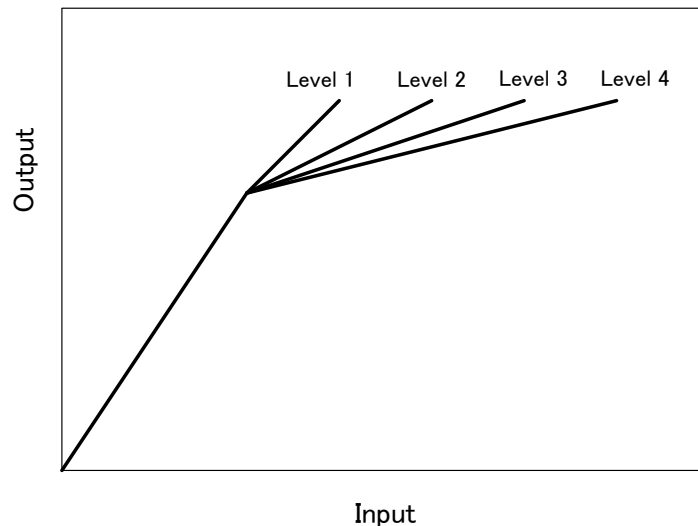


Fig. 33 HDR characteristics

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



## 10. Camera Settings

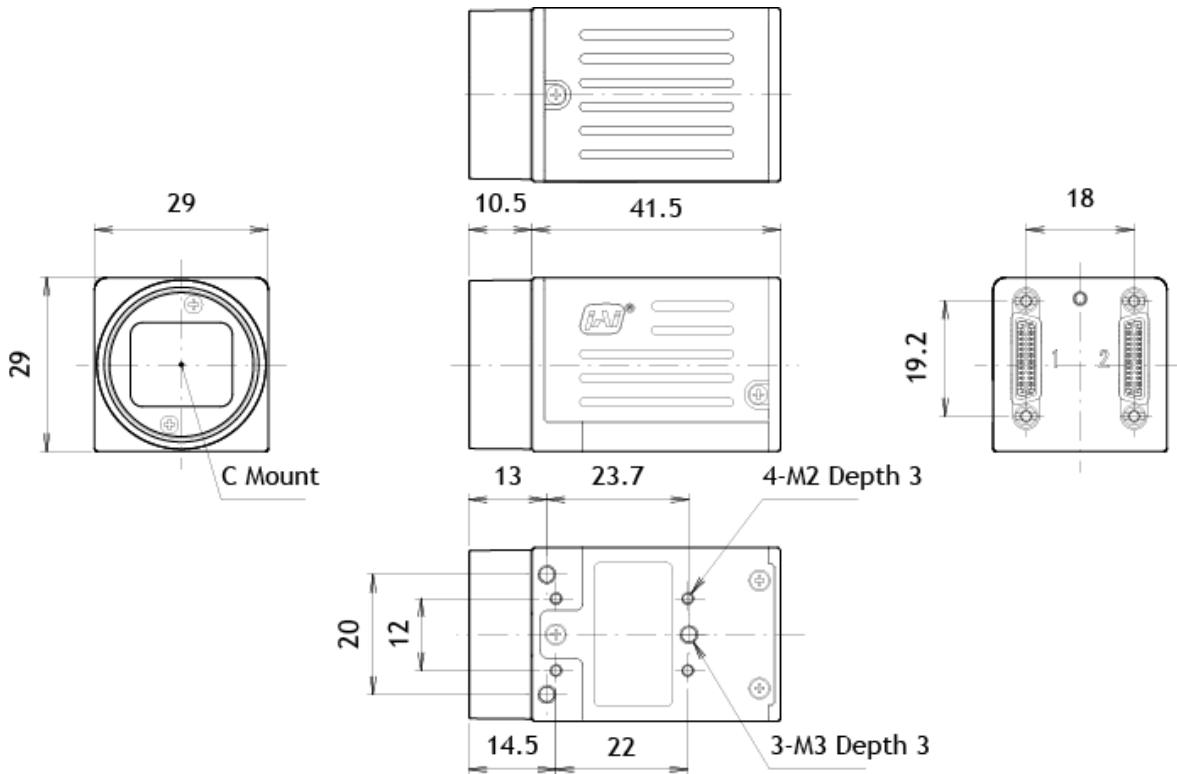
In the GO-5000-PMCL, control of all camera functions is done by the JAI SDK and Control Tool software. All controllable camera functions are stored in an XML file inside of the camera. The JAI SDK and Control Tool software can be downloaded from [www.jai.com](http://www.jai.com).

If you need to use the Short ASCII communication protocol and associated control tool, please contact your local JAI representative.

### **Specific notes regarding Control Tool use:**

1. For GO-5000-PMCL, the JAI SDK and Control Tool 2.0 can be used to control the camera, provided the PC on which the JAI software is installed is connected to the camera via a GenCP-compliant Camera Link frame grabber. Many frame grabber vendors also provide their own GenlCam control tool software, as do a number of third-party software companies. Software conflicts can occur between these GenlCam tools and the JAI SDK and Control Tool causing one or both tools to function improperly. Therefore, if you intend to use the JAI SDK and Control Tool you should A) not install any other GenlCam software on your host PC, or B) install the JAI SDK and Control Tool last, after installing any other software. This will, in most cases, ensure that the JAI SDK and Control Tool functions properly. If not, please contact the frame grabber manufacturer or JAI to determine other ways to eliminate any software conflict.
2. The frame grabber used must be compliant with Camera Link Specification v1.1 or greater in order to communicate with the JAI SDK and Control Tool. If it is not, the JAI SDK and Control Tool cannot be used, and the Short ASCII communication protocol and associated control tool should be used instead.

## 11. External appearance and dimensions



Dimensions tolerance:  $\pm 0.3\text{mm}$  Unit: mm

Fig. 34 Appearance and Dimensions

## 12. Specifications

### 12.1. Camera spectral response

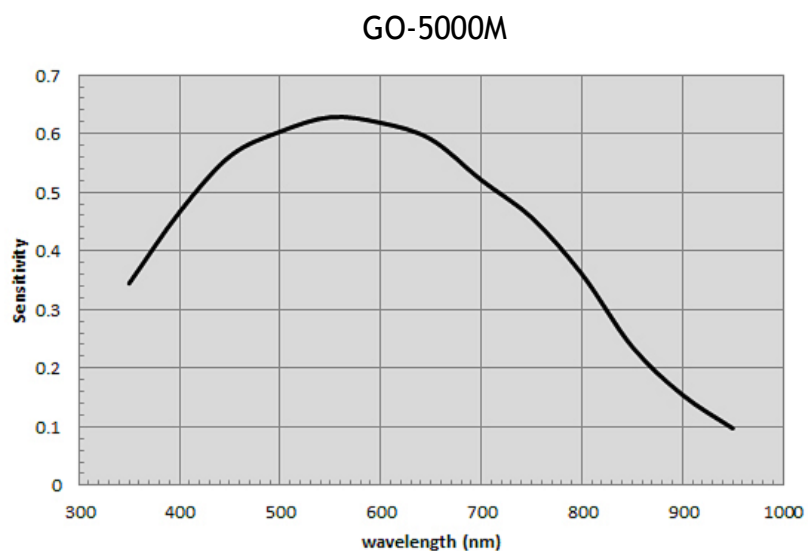


Fig.35 GO-5000M-PMCL Spectral response

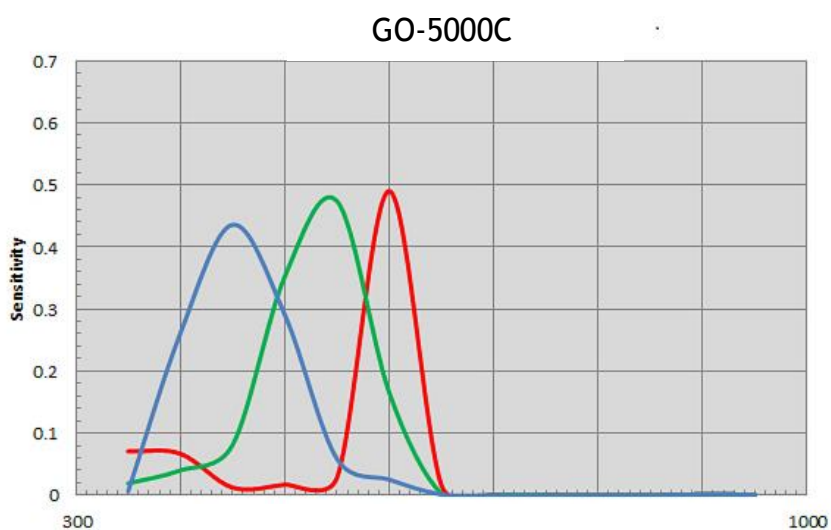


Fig.36 GO-5000C-PMCL Spectral response (With IR Cut Filter)

## GO-5000M-PMCL / GO-5000C-PMCL

### 12.2. Specification table

Table - 31 Specification table

| Specifications                                 |         |        | GO-5000M-PMCL   | GO-5000C-PMCL           |
|--|---------|--------|---|-------------------------|
| Scanning system                                |         |        | Progressive scan  |                         |
| Synchronization                                |         |        | Internal  |                         |
| Interface                                      |         |        | CameraLink Specifications (V.2.0 RC2), Conforming with PoCL specifications  |                         |
| Image sensor                                   |         |        | 1 inch Monochrome CMOS  | 1 inch Bayer color CMOS |
| Aspect ratio                                   |         |        | 5:4   |                         |
| Effective image size                           |         |        | 12.8 (h) x 10.24 (v) mm 16.39 mm diagonal   |                         |
| Cell size                                      |         |        | 5.0 (h) x 5.0 (v) $\mu\text{m}$   |                         |
| Active pixels                                  |         |        | 2560 (h) x 2048 (v)   |                         |
| Sensor Pixel clock                             |         |        | 8-bit: 36MHz, 10-bit: 28.8MHz, 12-bit: 24MHz  |                         |
| Camera Link clock                              |         |        | 48.57 MHz/8 Pixels (Camera Link Clock = Low)<br>58.28 MHz/8 Pixels (Camera Link Clock = Mid, only for X8-1Y-10bit)<br>72.85 MHz/8 Pixels (Camera Link Clock = Mid, High for 1X8-1Y-8bit)<br>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<br>8/10/<br>12-bit<br>CL clock:<br>HIGH | H1, V1  |        | 31.9fps   | 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 | 124.7fps  | —                       |
|  |         | H4, V2 | 245.6fps  | —                       |
|  |         | H4, V4 | 280.1fps  | —                       |
| 1X3-1Y<br>8-bit<br>CL clock:<br>HIGH           | H1, V1  |        | 47.8fps   | 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<br>8/10/<br>12-bit<br>CL clock:<br>HIGH | H1, V1  |        | 63.6fps   | 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<br>8-bit<br>CL Clock:<br>HIGH           | H1, V1  |        | 107.2fps  | 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<br>10-bit<br>CL Clock:<br>MID                        | H1, V1        |                     | 84.9fps   | 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  | —  |
| EMVA 1288 Parameters<br>Absolute sensitivity<br>Maximum SNR |               |                     | At 10-bit output<br>20.17 p (λ = 525 nm)<br>41.3 dB                                   | At 10-bit output<br>51.25 p (λ = 525 nm)<br>38.12 dB                                       |
| SN ratio (Traditional)                                      |               |                     | Dark Compression:55dB (Typical)<br>Linear:49dB (Typical)<br>(0dB gain, Black))        | Dark Compression:53dB (Typical)<br>Linear: 44dB (Typical)<br>(0dB gain, Green Pixel Black) |
| Image<br>Output<br>Format<br>Digital                        | Full image    |                     | 2560 (h) x 2048 (v)   | 2560 (h) x 2048 (v)  |
|   | ROI           | Height              | 1 ~2048 lines, 1 line / step  | 2 ~2048 lines, 2 lines / step  |
|   |               | OFFSET Y            | 0 ~2047 lines, 1 line / step  | 0 ~2046 lines, 2 lines / step  |
|   |               | Width               | 8 ~2560 pixels, 8 pixels/step(1X2-1Y)   | 8 ~2560 pixels, 8 pixels/step(1X2-1Y)  |
|   |               |                     | 8 ~2560 pixels, 8 pixels/step(1X3-1Y)   | 8 ~2560 pixels, 8 pixels/step(1X3-1Y)  |
|   |               |                     | 8 ~2560 pixels, 8 pixels/step(1X4-1Y)   | 8 ~2560 pixels, 8 pixels/step(1X4-1Y)  |
|   |               |                     | 8 ~2560 pixels, 8 pixels/step(1X8-1Y)   | 8 ~2560 pixels, 8 pixels/step(1X8-1Y)  |
|   |               | OFFSET X            | 0 ~2552 pixels, 8 pixels/step(1X2-1Y)   | 0 ~2552 pixels, 8 pixels/step(1X2-1Y)  |
|   |               |                     | 0 ~2552 pixels, 8 pixels/step<br>(1X3-1Y)(Note1)                                      | 0 ~2552 pixels, 8 pixels/step<br>(1X3-1Y)(Note1)   |
|   |               |                     | 0 ~2552 pixels, 8 pixels/step(1X4-1Y)   | 0 ~2552 pixels, 8 pixels/step(1X4-1Y)  |
|   |               |                     | 0 ~2552 pixels, 8 pixels/step(1X8-1Y)   | 0 ~2552 pixels, 8 pixels/step(1X8-1Y)  |
|   | H<br>Binning  | H1                  | 2560 pixels   | 2560 pixels  |
|   |               | H2                  | 1280 pixels   | —  |
|   |               | H4                  | 640 pixels  | —  |
|   | V<br>Binning  | V1                  | 2048 lines  | 2048 lines   |
|   |               | V2                  | 1024 lines  | —  |
| V4  |               | 512 lines           | —   |  |
| Pixel Format  |               | Mono8,Mono10,Mono12 | BayerGR8, BayerGR10, BayerGR12  |  |
| 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,<br>NAND0 (out), NAND1 (out) |  |
| Exposure<br>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  |  |
| Exposure Auto response speed                                |               |                     | 1 ~8  |  |

## GO-5000M-PMCL / GO-5000C-PMCL

|   |                   |  |   |
|---|-------------------|--|---|
| Video Send Mode   |                   | Normal, Multi ROI, Command Sequence  |   |
| Digital I/O   |                   | Line Selector (Camera Link): EEN out/CC1 in  |   |
| Black level adjust  | Reference         | 33.5LSB 10-bit (Average of 100*100)  |   |
|   | Adj. range        | -256 ~ +255LSB 10-bit  |   |
|   | Resolution        | 1 STEP = 0.25LSB   |   |
| Analog Base Gain  |                   | x1 (0dB), x2 (+6dB), x4 (+12dB)  | x1 (0dB), x2 (+6dB), x4 (+12dB)<br>R,G,B can be adjustable individually |
| Gain Adjust   | Manual adj. range | 0dB ~ +24dB, 1%/step (Note3)   | 0dB ~ +24dB, 1%/step (Note3)  |
|   | WB gain           | —  | R / B : -7dB to +15dB, 1% / step  |
|   | WB area           | —  | 4 x 4   |
|   | WB range          | —  | 3000K ~ 9000K   |
|   | White balance     | —  | OFF, Once, Continuous,<br>Preset 4600K/5600K/6500K                      |
| Blemish comp.   | Detection         | Detect white blemish above the threshold value<br>(Black blemish is detected only by factory ) |   |
|   | Compensation      | Complement by adjacent pixels (Continuous blemishes are not compensated)                       |   |
|   | Correct Numbers   | Up to 512 pixels   |   |
| ALC   |                   | AGC and Auto Shutter can be combined and automatically controlled                              |   |
| Gamma   |                   | $\gamma=0.45, 0.6, 1.0$ (3 steps are available)  |   |
| LUT   |                   | OFF: $\gamma=1.0$ , ON=32 points can be set  |   |
| Shading compensation(Note1)                                   |                   | Flat field<br>Block based (20 x 16 blocks))  | Flat field, Color shading<br>Block based (20 x 16 blocks)               |
| HDR   |                   | Level 1, 2, 3 and 4 based on the exposure time setting   | —   |
| Power supply  | Power input       | DC+12V $\pm$ 1V (Complies with PoCL Standards)   |   |
|   | Current           | 250mA $\pm$ 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   |                   | C mount : 17.526 mm, Tolerance 0 to -0.05 mm   |   |
| Optical filter  |                   | Protection glass : Not provided  | IR cut filter (Half value is 670 nm)                                    |
| Performance Guaranteed<br>Operating temperature<br>/ Humidity |                   | -5°C to +45°C / 20% - 80% (non-condensing)   |   |
| Storage Temp. / Humidity                                      |                   | -25°C to +60°C / 20% - 80% (non-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) (including lens mount)   |   |
| Weight  |                   | 46 g   |   |

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 Short ASCII Command Communication Protocol

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

### 1 Communication setting

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

### 2 Protocol (Short ASCII Command)

#### 2.1 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>

#### 2.2 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>

#### 2.3 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: CBDR=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).

## 2.4 Command list (Short ASCII command)

### 2.4.1 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          | Revision+Order-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><br>><br>UD?<CR><LF> |

### 2.4.2 Technology Specific Bootstrap Register

| Name               | Interface | Access | Short ASCII | Values   | MIN  | MAX  | DEFAULT     | Description   |
|--------------------|-----------|--------|-------------|--|------|------|-------------|---|
| SupportedBaudrates | I Integer | R/O    | SBDR T      | Indicate Support/Non-support status for each baud rate<br>bit0: 9600bps<br>bit1: 19200bps<br>bit2: 38400bps<br>bit3: 57600bps<br>bit4: 115200bps<br>bit5: 230400bps<br>bit6: 460800bps<br>bit7: 921600bps              | 0x01 | 0xFF | 0x1F        | SBDRT?<CR><LF><br><br>This camera supports 9600bps, 19200bps, 38400bps, 57600bps, and 115200bps.  |
| CurrentBaudrate    | I Integer | R/W    | CBDR T      | READ: Indicate current baud rate<br>WRITE: Set any bit of baud rate<br>bit0: 9600bps<br>bit1: 19200bps<br>bit2: 38400bps<br>bit3: 57600bps<br>bit4: 115200bps<br>bit5: 230400bps<br>bit6: 460800bps<br>bit7: 921600bps | 0x01 | 0x80 | 1 (9600bps) | CBDR=[Param.]<CR><LF><br>CBDR?<CR><LF><br><br>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) |



## 2.4.3 Device Control

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

## 2.4.4 Image Format Control

| Name                           | Interface     | Access | Short ASCII | Values   | MIN                                 | MAX                         | DEFAULT | Description                          |
|--------------------------------|---------------|--------|-------------|--|-------------------------------------|-----------------------------|---------|--------------------------------------|
| Height                         | I Integer     | R/W    | HTL         | Min ~ (Max - OffsetY)  | 1(Mono)<br>2(Bayer)                 | 2048                        | 2048    | HTL=[Param.]<CR><LF><br>HTL?<CR><LF> |
| Width                          | I Integer     | R/W    | WTC         | Min ~ (Max - OffsetX)  | 2(1X2-1y)<br>4(1X4-1Y)<br>8(1X8-1Y) | 2560                        | 2560    | WTC=[Param.]<CR><LF><br>WTC?<CR><LF> |
| Width                          | I Integer     | R/W    | WTC         | Min ~ (Max - OffsetX)  | (1X3-1Y)                            | 2559                        | 2559    | WTC=[Param.]<CR><LF><br>WTC?<CR><LF> |
| Offset Y                       | I Integer     | R/W    | OFL         | Min~(Max - Height)   | 0                                   | 2047 (Mono)<br>2046 (Bayer) | 0       | OFL=[Param.]<CR><LF><br>OFL?<CR><LF> |
| Offset X                       | I Integer     | R/W    | OFC         | Min~(Max - Width)  | 0                                   | 2544                        | 0       | OFC=[Param.]<CR><LF><br>OFC?<CR><LF> |
| Binning Horizontal (Mono only) | I Integer     | R/W    | HB          | 1: Normal / 2: Binning mode  | 1                                   | 2                           | 1       | HB=[Param.]<CR><LF><br>HB?<CR><LF>   |
| Binning Vertical (Mono only)   | I Integer     | R/W    | VB          | 1: Normal / 2: Binning mode  | 1                                   | 2                           | 1       | VB=[Param.]<CR><LF><br>VB?<CR><LF>   |
| PixelFormat                    | I Enumeration | R/(W)  | BA          | Mono model:<br>0: Mono8<br>1: Mono10<br>2: Mono12<br>Bayer model:<br>0: BayerGR8<br>1: BayerGR10<br>2: BayerGR12 | 0                                   | 2                           | 0       | BA=[Param.]<CR><LF><br>BA?<CR><LF>   |

## GO-5000M-PMCL / GO-5000C-PMCL

|                   |             |     |     |   |   |   |   |                                      |
|-------------------|-------------|-----|-----|---|---|---|---|--------------------------------------|
| TestImageSelector | Enumeration | R/W | TPN | 0: Off<br>1: GreyHorizontalRamp<br>2: GreyVerticalRamp<br>3: GreyHorizontalRampMoving | 0 | 6 | 0 | TPN=[Param.]<CR><LF><br>TPN?<CR><LF> |
|-------------------|-------------|-----|-----|---|---|---|---|--------------------------------------|

### 2.4.5 Acquisition Control

| Name                     | Interface   | Access | Short ASCII | Values   | MIN | MAX    | DEFAULT | Description                          |
|--------------------------|-------------|--------|-------------|--|-----|--------|---------|--------------------------------------|
| FrameStartTrigMode       | Enumeration | R/W    | TM          | Off/On   | 0   | 1      | 0       | TM=[Param.]<CR><LF><br>TM?<CR><LF>   |
| TrigSoftware             | Command     | (R)/W  | STRG        | 0  | —   | —      | —       | STRG=0<CR><LF>                       |
| FrameStartTrigSource     | Enumeration | R/W    | TI          | 0: Low<br>1: High<br>2: SoftTrigger<br>8: PulseGenerator0<br>13: CL_CC1_In<br>14: Nand0<br>15: Nand1 | 0   | 17     | 0       | TI=[Param.]<CR><LF><br>TI?<CR><LF>   |
| FrameStartTrigActivation | Enumeration | R/W    | TA          | 0: RisingEdge<br>1: FallingEdge<br>2: LevelHigh<br>3: LevelLow                                       | 0   | 3      | 0       | TA=[Param.]<CR><LF><br>TA?<CR><LF>   |
| FrameStartTrigOverlap    | Enumeration | R/W    | TO          | 0: Off / 1: ReadOut  | 0   | 1      | 0       | TO=[Param.]<CR><LF><br>TO?<CR><LF>   |
| ExposureMode             | Enumeration | R/W    | EM          | 0: Off<br>1: Timed<br>2: TriggerWidth  | 0   | 2      | 0       | EM=[Param.]<CR><LF><br>EM?<CR><LF>   |
| ExposureTimeRaw          | Integer     | R/W    | PE          | Min~Max[us]  | 10  | 800000 | 18000   | PE=[Param.]<CR><LF><br>PE?<CR><LF>   |
| ExposureAuto             | Enumeration | R/W    | ASC         | 0: Off<br>1: Continuous  | 0   | 1      | 0       | ASC=[Param.]<CR><LF><br>ASC?<CR><LF> |

## 2.4.6 Digital I/O Control

| Name                  | Interface     | Access | Short ASCII | Values   | MIN | MAX | DEFAULT | Description   |
|-----------------------|---------------|--------|-------------|--|-----|-----|---------|---|
| LineInverter_Line1    | I Boolean     | R/W    | LI0         | False/True   | 0   | 1   | 0       | LI0=[Param.]<CR><LF><br>LI0?<CR><LF>                      |
| LineInverter_Nand0In1 | I Boolean     | R/W    | ND0INV1     | False/True   | 0   | 1   | 0       | ND0INV1=[Param.]<CR><LF><br>ND0INV1?<CR><LF>              |
| LineInverter_Nand0In2 | I Boolean     | R/W    | ND0INV2     | False/True   | 0   | 1   | 0       | ND0INV2=[Param.]<CR><LF><br>ND0INV2?<CR><LF>              |
| LineInverter_Nand1In1 | I Boolean     | R/W    | ND1INV1     | False/True   | 0   | 1   | 0       | ND1INV1=[Param.]<CR><LF><br>ND0INV1?<CR><LF>              |
| LineInverter_Nand1In2 | I Boolean     | R/W    | ND1INV2     | False/True   | 0   | 1   | 0       | ND1INV2=[Param.]<CR><LF><br>ND0INV2?<CR><LF>              |
| LineSource_Line1      | I Enumeration | R/W    | LS0         | 0: Low<br>1: High<br>3: Frame TriggerWait<br>4: Frame Active<br>5: Exposure Active<br>6: Fval<br>7: Lval<br>8: Pulse Generator0<br>13: CL_CC1_In<br>14: Nand0<br>15: Nand1 | 0   | 17  | 0       | LS0=[Param.]<CR><LF><br>LS0?<CR><LF><br>For 12pin TTL out |
| LineSource_Nand0In1   | I Enumeration | R/W    | ND0IN1      | Same as for Line1  | 0   | 17  | 0       | ND0IN1=[Param.]<CR><LF><br>ND0IN1?<CR><LF>                |
| LineSource_Nand0In2   | I Enumeration | R/W    | ND0IN2      | Same as for Line1  | 0   | 17  | 0       | ND0IN2=[Param.]<CR><LF><br>ND0IN2?<CR><LF>                |
| LineSource_Nand1In1   | I Enumeration | R/W    | ND1IN1      | Same as for Line1  | 0   | 17  | 0       | ND1IN1=[Param.]<CR><LF><br>ND1IN1?<CR><LF>                |
| LineSource_Nand1In2   | I Enumeration | R/W    | ND1IN2      | Same as for Line1  | 0   | 17  | 0       | ND1IN2=[Param.]<CR><LF><br>ND1IN2?<CR><LF>                |

## GO-5000M-PMCL / GO-5000C-PMCL

### 2.4.7 Analogue 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><LF><br>FGA?<CR><LF>                         |
| GainRawDigitalRedAll   | I Integer     | R/W    | PGR         | min~0~max               | -4533 | 28400 | 0       | PGR=[Param.]<CR><LF><br>PGR?<CR><LF>                         |
| GainRawDigitalBlueAll  | I Integer     | R/W    | PGB         | min~0~max               | -4533 | 28400 | 0       | PGB=[Param.]<CR><LF><br>PGB?<CR><LF>                         |
| AnalogBaseColorGainAll | I Integer     | R/W    | ABALL       | 0:0dB, 1:6dB, 2:12dB    | 0     | 2     | 0       | ABALL=[Param.]<CR><LF><br>ABALL?<CR><LF>                     |
| AnalogBaseColorGainR   | I Integer     | R/W    | ABR         | 0:0dB, 1:6dB, 2:12dB    | 0     | 2     | 0       | ABR=[Param.]<CR><LF><br>ABR?<CR><LF>                         |
| AnalogBaseColorGainG   | I Integer     | R/W    | ABG         | 0:0dB, 1:6dB, 2:12dB    | 0     | 2     | 0       | ABG=[Param.]<CR><LF><br>ABG?<CR><LF>                         |
| AnalogBaseColorGainB   | I Integer     | R/W    | ABB         | 0:0dB, 1:6dB, 2:12dB    | 0     | 2     | 0       | ABB=[Param.]<CR><LF><br>ABB?<CR><LF>                         |
| GainAuto               | I Enumeration | R/W    | AGC         | 0: Off<br>1: Continuous | 0     | 1     | 0       | AGC=[Param.]<CR><LF><br>AGC?<CR><LF>                         |
| BlackLevelRawAll       | I Integer     | R/W    | BL          | min~0~max               | 0     | 2047  | 0       | BL=[Param.]<CR><LF><br>BL?<CR><LF>                           |
| BlackLevelRawRed       | I Integer     | R/W    | BLR         | min~0~max               | 0     | 2047  | 0       | BLR1=[Param.]<CR><LF><br>BLR1?<CR><LF><br>(Bayer model only) |
| BlackLevelRawBlue      | I Integer     | R/W    | BLB         | min~0~max               | 0     | 2047  | 0       | BLB1=[Param.]<CR><LF><br>BLB1?<CR><LF><br>(Bayer model only) |

### 2.4.8 LUT Control

| Name                 | Interface     | Access | Short ASCII | Values   | MIN | MAX                    | DEFAULT               | Description   |
|----------------------|---------------|--------|-------------|--|-----|------------------------|-----------------------|---|
| LUTValueRed          | I Integer     | R/W    | LUTR        | Param 1: LUT index<br>Param 2:LUTdata(Min~Max) | 0   | 32 (Mono)<br>16(Bayer) | $\gamma=1$ equivalent | LUTR=[Param1],[Param2]<CR><LF><br>LUTR?[Param1]<CR><LF> |
| LUTValueGreen (Mono) | I Integer     | R/W    | LUTG        | Param 1: LUT index<br>Param 2:LUTdata(Min~Max) | 0   | 32 (Mono)<br>16(Bayer) | $\gamma=1$ equivalent | LUTG=[Param1],[Param2]<CR><LF><br>LUTG?[Param1]<CR><LF> |
| LUTValueBlue         | I Integer     | R/W    | LUTB        | Param 1: LUT index<br>Param 2:LUTdata(Min~Max) | 0   | 32 (Mono)<br>16(Bayer) | $\gamma=1$ equivalent | LUTB=[Param1],[Param2]<CR><LF><br>LUTB?[Param1]<CR><LF> |
| Dark Compression     | I Enumeration | R/O    | SBS         | 0: Dark Compression<br>1: Linear               | 0   | 1                      | 1                     | SBS=[Param.]<CR><LF>                                    |

## 2.4.9 Transport Layer Control

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

## 2.4.10 User Set Control

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

## 2.4.11 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><br>AR?<CR><LF><br>Maximum value is calculated depending on Height and Offset Y settings |
| BlemishWhiteEnable           | I Boolean     | R/W    | BMW         | 0: False<br>1: True                                      | 0   | 1      | 0       | BMW=[Param.]<CR><LF><br>BMW?<CR><LF>  |
| BlemishWhiteDetect           | I Command     | W/O    | BMRCW       | 0  | 0   | 0      | 0       | BMRCW=0<CR><LF>   |
| BlemishWhiteDetect Threshold | I Integer     | R/W    | BMTHW       | 0  | 0   | 100    | 10      | BMTHW=[Param.]<CR><LF><br>BMTHW?<CR><LF>  |
| BlemishWhiteDetect PositionX | I Integer     | R/W    | BMPXW       | Param 1: Blemish index<br>Param 2: X position (Min~Max)  | 0   | 2559   | 0       | BMPXW=[Param1],[Param2]<CR><LF><br>BMPXW? [Param1]<CR><LF>  |
| BlemishWhiteDetect PositionY | I Integer     | R/W    | BMPYW       | Param 1: Blemish index<br>Param 2: Y position (Min~Max)  | 0   | 2047   | 0       | BMPYW=[Param1],[Param2]<CR><LF><br>BMPYW? [Param1]<CR><LF>  |
| ShadingCorrection Mode       | I Enumeration | R/W    | SDCM        | 0: Flat Shading<br>1: Color Shading* (*Bayer model only) | 0   | 1      | 0       | SDCM=[Param.]<CR><LF><br>SDCM?<CR><LF>  |
| ShadingCorrect               | I Command     | W/O    | RS          |  | 0   | 0      | 0       | RS=0<CR><LF>  |

## GO-5000M-PMCL / GO-5000C-PMCL

|                            |             |     |       |  |   |     |   |  |
|----------------------------|-------------|-----|-------|--|---|-----|---|--|
| RequestShadingDetectResult | Enumeration | R/O | SDRS  | 0=Complete.<br>1=Too Bright.<br>2=Too dark.<br>3=Timeout Error.<br>4=Busy.<br>5=Limit.<br>6= Trig is not set as Normal.        | 0 | 6   | 0 | <b>SDRS?</b> <CR><LF>                                    |
| ShadingMode                | Enumeration | R/W | SDM   | 0: OFF<br>1: User 1<br>2: User 2<br>3: User 3  | 0 | 3   | 0 | <b>SDM</b> =[Param.]<CR><LF><br><b>SDM?</b> <CR><LF>     |
| VideoSendMode              | Enumeration | R/W | VSM   | 0: Normal<br>1: Trigger Sequence Command<br>2: Sequence<br>3: Multi Roi Mode   | 0 | 3   | 0 | <b>VSM</b> =[Param.]<CR><LF><br><b>VSM?</b> <CR><LF>     |
| SequenceModelIndex         | Enumeration | R/W | SQI   | 0: Index0<br>1: Index1<br>2: Index2<br>3: Index3<br>4: Index4<br>5: Index5<br>6: Index6<br>7: Index7<br>8: Index8<br>9: Index9 | 0 | 9   | 0 | <b>SQI</b> =[Param.]<CR><LF><br><b>SQI?</b> <CR><LF>     |
| SequenceModeFrameCount0    | Integer     | R/W | SQF1  | Min~Max  | 1 | 255 | 1 | <b>SQF1</b> =[Param.]<CR><LF><br><b>SQI1?</b> <CR><LF>   |
| SequenceModeFrameCount1    | Integer     | R/W | SQF2  | Min~Max  | 1 | 255 | 1 | <b>SQF2</b> =[Param.]<CR><LF><br><b>SQI2?</b> <CR><LF>   |
| SequenceModeFrameCount2    | Integer     | R/W | SQF3  | Min~Max  | 1 | 255 | 1 | <b>SQF3</b> =[Param.]<CR><LF><br><b>SQI3?</b> <CR><LF>   |
| SequenceModeFrameCount3    | Integer     | R/W | SQF4  | Min~Max  | 1 | 255 | 1 | <b>SQF4</b> =[Param.]<CR><LF><br><b>SQI4?</b> <CR><LF>   |
| SequenceModeFrameCount4    | Integer     | R/W | SQF5  | Min~Max  | 1 | 255 | 1 | <b>SQF5</b> =[Param.]<CR><LF><br><b>SQI5?</b> <CR><LF>   |
| SequenceModeFrameCount5    | Integer     | R/W | SQF6  | Min~Max  | 1 | 255 | 1 | <b>SQF6</b> =[Param.]<CR><LF><br><b>SQI6?</b> <CR><LF>   |
| SequenceModeFrameCount6    | Integer     | R/W | SQF7  | Min~Max  | 1 | 255 | 1 | <b>SQF7</b> =[Param.]<CR><LF><br><b>SQI7?</b> <CR><LF>   |
| SequenceModeFrameCount7    | Integer     | R/W | SQF8  | Min~Max  | 1 | 255 | 1 | <b>SQF8</b> =[Param.]<CR><LF><br><b>SQI8?</b> <CR><LF>   |
| SequenceModeFrameCount8    | Integer     | R/W | SQF9  | Min~Max  | 1 | 255 | 1 | <b>SQF9</b> =[Param.]<CR><LF><br><b>SQI9?</b> <CR><LF>   |
| SequenceModeFrameCount9    | Integer     | R/W | SQF10 | Min~Max  | 1 | 255 | 1 | <b>SQF10</b> =[Param.]<CR><LF><br><b>SQI10?</b> <CR><LF> |
| SequenceModeNextIndex0     | Enumeration | R/W | SQNI1 | Same as SequenceRoiIndex   | 0 | 9   | 0 | <b>SQNI1</b> =[Param.]<CR><LF><br><b>SQNI1?</b> <CR><LF> |

|                                |                      |     |        |                              |                               |      |      |  |
|--------------------------------|----------------------|-----|--------|------------------------------|-------------------------------|------|------|--|
| SequenceModeN<br>ext<br>Index1 | I<br>Enumera<br>tion | R/W | SQNI2  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI2=[Param.]<CR><LF><br>SQNI2?<CR><LF>   |
| SequenceModeN<br>ext<br>Index2 | I<br>Enumera<br>tion | R/W | SQNI3  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI3=[Param.]<CR><LF><br>SQNI3?<CR><LF>   |
| SequenceModeN<br>ext<br>Index3 | I<br>Enumera<br>tion | R/W | SQNI4  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI4=[Param.]<CR><LF><br>SQNI4?<CR><LF>   |
| SequenceModeN<br>ext<br>Index4 | I<br>Enumera<br>tion | R/W | SQNI5  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI5=[Param.]<CR><LF><br>SQNI5?<CR><LF>   |
| SequenceModeN<br>ext<br>Index5 | I<br>Enumera<br>tion | R/W | SQNI6  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI6=[Param.]<CR><LF><br>SQNI6?<CR><LF>   |
| SequenceModeN<br>ext<br>Index6 | I<br>Enumera<br>tion | R/W | SQNI7  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI7=[Param.]<CR><LF><br>SQNI7?<CR><LF>   |
| SequenceModeN<br>ext<br>Index7 | I<br>Enumera<br>tion | R/W | SQNI8  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI8=[Param.]<CR><LF><br>SQNI8?<CR><LF>   |
| SequenceModeN<br>ext<br>Index8 | I<br>Enumera<br>tion | R/W | SQNI9  | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI9=[Param.]<CR><LF><br>SQNI9?<CR><LF>   |
| SequenceModeN<br>ext<br>Index9 | I<br>Enumera<br>tion | R/W | SQNI10 | Same<br>SequenceRoilIndex as | 0                             | 9    | 0    | SQNI10=[Param.]<CR><LF><br>SQNI10?<CR><LF> |
| SequenceMode<br>Height0        | I Integer            | R/W | SQH1   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH1=[Param.]<CR><LF><br>SQH1?<CR><LF>     |
| SequenceMode<br>Height1        | I Integer            | R/W | SQH2   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH2=[Param.]<CR><LF><br>SQH2?<CR><LF>     |
| SequenceMode<br>Height2        | I Integer            | R/W | SQH3   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH3=[Param.]<CR><LF><br>SQH3?<CR><LF>     |
| SequenceMode<br>Height3        | I Integer            | R/W | SQH4   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH4=[Param.]<CR><LF><br>SQH4?<CR><LF>     |
| SequenceMode<br>Height4        | I Integer            | R/W | SQH5   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH5=[Param.]<CR><LF><br>SQH5?<CR><LF>     |
| SequenceMode<br>Height5        | I Integer            | R/W | SQH6   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH6=[Param.]<CR><LF><br>SQH6?<CR><LF>     |
| SequenceMode<br>Height6        | I Integer            | R/W | SQH7   | Min~Max                      | 1 (Mon<br>o)<br>2 (Bay<br>er) | 2048 | 2048 | SQH7=[Param.]<CR><LF><br>SQH7?<CR><LF>     |

# GO-5000M-PMCL / GO-5000C-PMCL

|                       |           |     |        |         |                     |                            |      |  |
|-----------------------|-----------|-----|--------|---------|---------------------|----------------------------|------|--|
| SequenceMode Height7  | I Integer | R/W | SQH8   | Min~Max | 1(Mono)<br>2(Bayer) | 2048                       | 2048 | SQH8=[Param.]<CR><LF><br>SQH8?<CR><LF>     |
| SequenceMode Height8  | I Integer | R/W | SQH9   | Min~Max | 1(Mono)<br>2(Bayer) | 2048                       | 2048 | SQH9=[Param.]<CR><LF><br>SQH9?<CR><LF>     |
| SequenceMode Height9  | I Integer | R/W | SQH10  | Min~Max | 1(Mono)<br>2(Bayer) | 2048                       | 2048 | SQH10=[Param.]<CR><LF><br>SQH10?<CR><LF>   |
| SequenceMode OffsetY0 | I Integer | R/W | SQOY1  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY1=[Param.]<CR><LF><br>SQOY1?<CR><LF>   |
| SequenceMode OffsetY1 | I Integer | R/W | SQOY2  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY2=[Param.]<CR><LF><br>SQOY2?<CR><LF>   |
| SequenceMode OffsetY2 | I Integer | R/W | SQOY3  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY3=[Param.]<CR><LF><br>SQOY3?<CR><LF>   |
| SequenceMode OffsetY3 | I Integer | R/W | SQOY4  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY4=[Param.]<CR><LF><br>SQOY4?<CR><LF>   |
| SequenceMode OffsetY4 | I Integer | R/W | SQOY5  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY5=[Param.]<CR><LF><br>SQOY5?<CR><LF>   |
| SequenceMode OffsetY5 | I Integer | R/W | SQOY6  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY6=[Param.]<CR><LF><br>SQOY6?<CR><LF>   |
| SequenceMode OffsetY6 | I Integer | R/W | SQOY7  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY7=[Param.]<CR><LF><br>SQOY7?<CR><LF>   |
| SequenceMode OffsetY7 | I Integer | R/W | SQOY8  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY8=[Param.]<CR><LF><br>SQOY8?<CR><LF>   |
| SequenceMode OffsetY8 | I Integer | R/W | SQOY9  | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY9=[Param.]<CR><LF><br>SQOY9?<CR><LF>   |
| SequenceMode OffsetY9 | I Integer | R/W | SQOY10 | Min~Max | 0                   | 2047 (Mno)<br>2046 (Bayer) | 0    | SQOY10=[Param.]<CR><LF><br>SQOY10?<CR><LF> |



|                            |           |     |        |         |     |             |       |  |
|----------------------------|-----------|-----|--------|---------|-----|-------------|-------|--|
|                            |           |     |        |         |     | r)          |       |  |
| SequenceMode Gain0         | I Integer | R/W | SQGA1  | Min~Max | 100 | 1600        | 0     | SQGA1=[Param.]<CR><LF><br>SQGA1?<CR><LF>   |
| SequenceMode Gain1         | I Integer | R/W | SQGA2  | Min~Max | 100 | 1600        | 0     | SQGA2=[Param.]<CR><LF><br>SQGA2?<CR><LF>   |
| SequenceMode Gain2         | I Integer | R/W | SQGA3  | Min~Max | 100 | 1600        | 0     | SQGA3=[Param.]<CR><LF><br>SQGA3?<CR><LF>   |
| SequenceMode Gain3         | I Integer | R/W | SQGA4  | Min~Max | 100 | 1600        | 0     | SQGA4=[Param.]<CR><LF><br>SQGA4?<CR><LF>   |
| SequenceMode Gain4         | I Integer | R/W | SQGA5  | Min~Max | 100 | 1600        | 0     | SQGA5=[Param.]<CR><LF><br>SQGA5?<CR><LF>   |
| SequenceMode Gain5         | I Integer | R/W | SQGA6  | Min~Max | 100 | 1600        | 0     | SQGA6=[Param.]<CR><LF><br>SQGA6?<CR><LF>   |
| SequenceMode Gain6         | I Integer | R/W | SQGA7  | Min~Max | 100 | 1600        | 0     | SQGA7=[Param.]<CR><LF><br>SQGA7?<CR><LF>   |
| SequenceMode Gain7         | I Integer | R/W | SQGA8  | Min~Max | 100 | 1600        | 0     | SQGA8=[Param.]<CR><LF><br>SQGA8?<CR><LF>   |
| SequenceMode Gain8         | I Integer | R/W | SQGA9  | Min~Max | 100 | 1600        | 0     | SQGA9=[Param.]<CR><LF><br>SQGA9?<CR><LF>   |
| SequenceMode Gain9         | I Integer | R/W | SQGA10 | Min~Max | 100 | 1600        | 0     | SQGA10=[Param.]<CR><LF><br>SQGA10?<CR><LF> |
| SequenceMode ExposureTime0 | I Integer | R/W | SQPE1  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE1=[Param.]<CR><LF><br>SQPE1?<CR><LF>   |
| SequenceMode ExposureTime1 | I Integer | R/W | SQPE2  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE2=[Param.]<CR><LF><br>SQPE2?<CR><LF>   |
| SequenceMode ExposureTime2 | I Integer | R/W | SQPE3  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE3=[Param.]<CR><LF><br>SQPE3?<CR><LF>   |
| SequenceMode ExposureTime3 | I Integer | R/W | SQPE4  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE4=[Param.]<CR><LF><br>SQPE4?<CR><LF>   |
| SequenceMode ExposureTime4 | I Integer | R/W | SQPE5  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE5=[Param.]<CR><LF><br>SQPE5?<CR><LF>   |
| SequenceMode ExposureTime5 | I Integer | R/W | SQPE6  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE6=[Param.]<CR><LF><br>SQPE6?<CR><LF>   |
| SequenceMode ExposureTime6 | I Integer | R/W | SQPE7  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE7=[Param.]<CR><LF><br>SQPE7?<CR><LF>   |
| SequenceMode ExposureTime7 | I Integer | R/W | SQPE8  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE8=[Param.]<CR><LF><br>SQPE8?<CR><LF>   |
| SequenceMode ExposureTime8 | I Integer | R/W | SQPE9  | Min~Max | 10  | 80000<br>00 | 18000 | SQPE9=[Param.]<CR><LF><br>SQPE9?<CR><LF>   |
| SequenceMode ExposureTime9 | I Integer | R/W | SQPE10 | Min~Max | 10  | 80000<br>00 | 18000 | SQPE10=[Param.]<CR><LF><br>SQPE10?<CR><LF> |

# GO-5000M-PMCL / GO-5000C-PMCL

|                           |                      |     |            |                                       |   |   |   |   |
|---------------------------|----------------------|-----|------------|---------------------------------------|---|---|---|---|
| SequenceMode<br>Hbinning0 | I<br>Enumera<br>tion | R/W | SQHB1      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB1=[Param.]<CR><<br>LF><br>SQHB1?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning1 | I<br>Enumera<br>tion | R/W | SQHB2      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB2=[Param.]<CR><<br>LF><br>SQHB2?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning2 | I<br>Enumera<br>tion | R/W | SQHB3      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB3=[Param.]<CR><<br>LF><br>SQHB3?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning3 | I<br>Enumera<br>tion | R/W | SQHB4      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB4=[Param.]<CR><<br>LF><br>SQHB4?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning4 | I<br>Enumera<br>tion | R/W | SQHB5      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB5=[Param.]<CR><<br>LF><br>SQHB5?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning5 | I<br>Enumera<br>tion | R/W | SQHB6      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB6=[Param.]<CR><<br>LF><br>SQHB6?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning6 | I<br>Enumera<br>tion | R/W | SQHB7      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB7=[Param.]<CR><<br>LF><br>SQHB7?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning7 | I<br>Enumera<br>tion | R/W | SQHB8      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB8=[Param.]<CR><<br>LF><br>SQHB8?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning8 | I<br>Enumera<br>tion | R/W | SQHB9      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB9=[Param.]<CR><<br>LF><br>SQHB9?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Hbinning9 | I<br>Enumera<br>tion | R/W | SQHB1<br>0 | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQHB10=[Param.]<CR><br><LF><br>SQHB10?<CR><LF><br>(Mono model only) |
| SequenceMode<br>Vbinning0 | I<br>Enumera<br>tion | R/W | SQVB1      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQVB1=[Param.]<CR><<br>LF><br>SQVB1?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning1 | I<br>Enumera<br>tion | R/W | SQVB2      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQVB2=[Param.]<CR><<br>LF><br>SQVB2?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning2 | I<br>Enumera<br>tion | R/W | SQVB3      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQVB3=[Param.]<CR><<br>LF><br>SQVB3?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning3 | I<br>Enumera<br>tion | R/W | SQVB4      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQVB4=[Param.]<CR><<br>LF><br>SQVB4?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning4 | I<br>Enumera<br>tion | R/W | SQVB5      | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2 | 1 | SQVB5=[Param.]<CR><<br>LF><br>SQVB5?<CR><LF><br>(Mono model only)   |
| SequenceMode              | I                    | R/W | SQVB6      | 1: Hbinning = OFF                     | 1 | 2 | 1 | SQVB6=[Param.]<CR><   |

|                             |             |     |         |                                       |   |      |   |   |
|-----------------------------|-------------|-----|---------|---------------------------------------|---|------|---|---|
| Vbinning5                   | Enumeration |     |         | 2: Hbinning = ON                      |   |      |   | LF><br>SQVB6?<CR><LF><br>(Mono model only)                      |
| SequenceMode<br>Vbinning6   | Enumeration | R/W | SQVB7   | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2    | 1 | SQVB7=[Param.]<CR><LF><br>SQVB7?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning7   | Enumeration | R/W | SQVB8   | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2    | 1 | SQVB8=[Param.]<CR><LF><br>SQVB8?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning8   | Enumeration | R/W | SQVB9   | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2    | 1 | SQVB9=[Param.]<CR><LF><br>SQVB9?<CR><LF><br>(Mono model only)   |
| SequenceMode<br>Vbinning9   | Enumeration | R/W | SQVB10  | 1: Hbinning = OFF<br>2: Hbinning = ON | 1 | 2    | 1 | SQVB10=[Param.]<CR><LF><br>SQVB10?<CR><LF><br>(Mono model only) |
| SequenceMode<br>LutEnable0  | Enumeration | R/W | SQLUT1  | Off/On                                | 0 | 1    | 0 | SQLUT1=[Param.]<CR><LF><br>SQLUT1?<CR><LF>                      |
| SequenceMode<br>LutEnable1  | Enumeration | R/W | SQLUT2  | Off/On                                | 0 | 1    | 0 | SQLUT2=[Param.]<CR><LF><br>SQLUT2?<CR><LF>                      |
| SequenceMode<br>LutEnable2  | Enumeration | R/W | SQLUT3  | Off/On                                | 0 | 1    | 0 | SQLUT3=[Param.]<CR><LF><br>SQLUT3?<CR><LF>                      |
| SequenceMode<br>LutEnable3  | Enumeration | R/W | SQLUT4  | Off/On                                | 0 | 1    | 0 | SQLUT4=[Param.]<CR><LF><br>SQLUT4?<CR><LF>                      |
| SequenceMode<br>LutEnable4  | Enumeration | R/W | SQLUT5  | Off/On                                | 0 | 1    | 0 | SQLUT5=[Param.]<CR><LF><br>SQLUT5?<CR><LF>                      |
| SequenceMode<br>LutEnable5  | Enumeration | R/W | SQLUT6  | Off/On                                | 0 | 1    | 0 | SQLUT6=[Param.]<CR><LF><br>SQLUT6?<CR><LF>                      |
| SequenceMode<br>LutEnable6  | Enumeration | R/W | SQLUT7  | Off/On                                | 0 | 1    | 0 | SQLUT7=[Param.]<CR><LF><br>SQLUT7?<CR><LF>                      |
| SequenceMode<br>LutEnable7  | Enumeration | R/W | SQLUT8  | Off/On                                | 0 | 1    | 0 | SQLUT8=[Param.]<CR><LF><br>SQLUT8?<CR><LF>                      |
| SequenceMode<br>LutEnable8  | Enumeration | R/W | SQLUT9  | Off/On                                | 0 | 1    | 0 | SQLUT9=[Param.]<CR><LF><br>SQLUT9?<CR><LF>                      |
| SequenceMode<br>LutEnable9  | Enumeration | R/W | SQLUT10 | Off/On                                | 0 | 1    | 0 | SQLUT10=[Param.]<CR><LF><br>SQLUT10?<CR><LF>                    |
| SequenceMode<br>BlackLevel0 | Integer     | R/W | SQBL1   | Min~Max                               | 0 | 2047 | 0 | SQBL1=[Param.]<CR><LF><br>SQBL1?<CR><LF>                        |
| SequenceMode<br>BlackLevel1 | Integer     | R/W | SQBL2   | Min~Max                               | 0 | 2047 | 0 | SQBL2=[Param.]<CR><LF><br>SQBL2?<CR><LF>                        |
| SequenceMode<br>BlackLevel2 | Integer     | R/W | SQBL3   | Min~Max                               | 0 | 2047 | 0 | SQBL3=[Param.]<CR><LF><br>SQBL3?<CR><LF>                        |
| SequenceMode<br>BlackLevel3 | Integer     | R/W | SQBL4   | Min~Max                               | 0 | 2047 | 0 | SQBL4=[Param.]<CR><LF><br>SQBL4?<CR><LF>                        |

## GO-5000M-PMCL / GO-5000C-PMCL

|                             |           |     |             |         |       |       |   |  |
|-----------------------------|-----------|-----|-------------|---------|-------|-------|---|--|
| SequenceMode<br>BlackLevel4 | I Integer | R/W | SQBL5       | Min~Max | 0     | 2047  | 0 | SQBL5=[Param.]<CR><LF><br>SQBL5?<CR><LF>                           |
| SequenceMode<br>BlackLevel5 | I Integer | R/W | SQBL6       | Min~Max | 0     | 2047  | 0 | SQBL6=[Param.]<CR><LF><br>SQBL6?<CR><LF>                           |
| SequenceMode<br>BlackLevel6 | I Integer | R/W | SQBL7       | Min~Max | 0     | 2047  | 0 | SQBL7=[Param.]<CR><LF><br>SQBL7?<CR><LF>                           |
| SequenceMode<br>BlackLevel7 | I Integer | R/W | SQBL8       | Min~Max | 0     | 2047  | 0 | SQBL8=[Param.]<CR><LF><br>SQBL8?<CR><LF>                           |
| SequenceMode<br>BlackLevel8 | I Integer | R/W | SQBL9       | Min~Max | 0     | 2047  | 0 | SQBL9=[Param.]<CR><LF><br>SQBL9?<CR><LF>                           |
| SequenceMode<br>BlackLevel9 | I Integer | R/W | SQBL10      | Min~Max | 0     | 2047  | 0 | SQBL10=[Param.]<CR><LF><br>SQBL10?<CR><LF>                         |
| SequenceMode<br>GainRed0    | I Integer | R/W | SQPGR<br>1  | Min~Max | -4533 | 17713 | 0 | SQPGR1=[Param.]<CR><LF><br>SQPGR1?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed1    | I Integer | R/W | SQPGR<br>2  | Min~Max | -4533 | 17713 | 0 | SQPGR2=[Param.]<CR><LF><br>SQPGR2?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed2    | I Integer | R/W | SQPGR<br>3  | Min~Max | -4533 | 17713 | 0 | SQPGR3=[Param.]<CR><LF><br>SQPGR3?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed3    | I Integer | R/W | SQPGR<br>4  | Min~Max | -4533 | 17713 | 0 | SQPGR4=[Param.]<CR><LF><br>SQPGR4?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed4    | I Integer | R/W | SQPGR<br>5  | Min~Max | -4533 | 17713 | 0 | SQPGR5=[Param.]<CR><LF><br>SQPGR5?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed5    | I Integer | R/W | SQPGR<br>6  | Min~Max | -4533 | 17713 | 0 | SQPGR6=[Param.]<CR><LF><br>SQPGR6?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed6    | I Integer | R/W | SQPGR<br>7  | Min~Max | -4533 | 17713 | 0 | SQPGR7=[Param.]<CR><LF><br>SQPGR7?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed7    | I Integer | R/W | SQPGR<br>8  | Min~Max | -4533 | 17713 | 0 | SQPGR8=[Param.]<CR><LF><br>SQPGR8?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed8    | I Integer | R/W | SQPGR<br>9  | Min~Max | -4533 | 17713 | 0 | SQPGR9=[Param.]<CR><LF><br>SQPGR9?<CR><LF><br>(Bayer model only)   |
| SequenceMode<br>GainRed9    | I Integer | R/W | SQPGR<br>10 | Min~Max | -4533 | 17713 | 0 | SQPGR10=[Param.]<CR><LF><br>SQPGR10?<CR><LF><br>(Bayer model only) |
| SequenceMode<br>GainBlue0   | I Integer | R/W | SQPGB<br>1  | Min~Max | -4533 | 17713 | 0 | SQPGB1=[Param.]<CR><LF><br>SQPGB1?<CR><LF><br>(Bayer model only)   |

|                        |               |     |        |                           |       |       |   |  |
|------------------------|---------------|-----|--------|---------------------------|-------|-------|---|--|
| SequenceMode GainBlue1 | I Integer     | R/W | SQPG2  | Min~Max                   | -4533 | 17713 | 0 | SQPG2=[Param.]<CR><LF><br>SQPG2?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue2 | I Integer     | R/W | SQPG3  | Min~Max                   | -4533 | 17713 | 0 | SQPG3=[Param.]<CR><LF><br>SQPG3?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue3 | I Integer     | R/W | SQPG4  | Min~Max                   | -4533 | 17713 | 0 | SQPG4=[Param.]<CR><LF><br>SQPG4?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue4 | I Integer     | R/W | SQPG5  | Min~Max                   | -4533 | 17713 | 0 | SQPG5=[Param.]<CR><LF><br>SQPG5?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue5 | I Integer     | R/W | SQPG6  | Min~Max                   | -4533 | 17713 | 0 | SQPG6=[Param.]<CR><LF><br>SQPG6?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue6 | I Integer     | R/W | SQPG7  | Min~Max                   | -4533 | 17713 | 0 | SQPG7=[Param.]<CR><LF><br>SQPG7?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue7 | I Integer     | R/W | SQPG8  | Min~Max                   | -4533 | 17713 | 0 | SQPG8=[Param.]<CR><LF><br>SQPG8?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue8 | I Integer     | R/W | SQPG9  | Min~Max                   | -4533 | 17713 | 0 | SQPG9=[Param.]<CR><LF><br>SQPG9?<CR><LF><br>(Bayer model only)   |
| SequenceMode GainBlue9 | I Integer     | R/W | SQPG10 | Min~Max                   | -4533 | 17713 | 0 | SQPG10=[Param.]<CR><LF><br>SQPG10?<CR><LF><br>(Bayer model only) |
| CommnadSequence Index  | I Enumeration | R/W | SQI    | Same as SequenceModeIndex | 0     | 9     | 0 | CSQI=[Param.]<CR><LF><br>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<br>1: LUT        | 0     | 1     | 0 | SQLUT=[Param.]<CR><LF><br>SQLUT?<CR><LF>                         |
| MultiRoiIndexMax       | I Integer     | R/W | MRIM   | Min~Max                   | 1     | 8     | 1 | MRIM=[Param.]<CR><LF><br>MRIM?<CR><LF>                           |
| MultiRoiWidth          | I Integer     | R/W | MRW    | Min~Max                   | 8     | 2560  | 8 | MRW=[Param.]<CR><LF><br>MRW?<CR><LF>                             |
| MultiRoiHeight1        | I Integer     | R/W | MRH1   | Min~Max                   | 0     | 2048  | 1 | MRH1=[Param.]<CR><LF><br>MRH1?<CR><LF>                           |

## GO-5000M-PMCL / GO-5000C-PMCL

|                  |               |     |       |                              |     |        |       |  |
|------------------|---------------|-----|-------|------------------------------|-----|--------|-------|--|
| MultiRoiHeight2  | I Integer     | R/W | MRH2  | Min~Max                      | 0   | 2048   | 1     | MRH2=[Param.]<CR><LF><br>MRH2?<CR><LF>   |
| MultiRoiHeight3  | I Integer     | R/W | MRH3  | Min~Max                      | 0   | 2048   | 1     | MRH3=[Param.]<CR><LF><br>MRH3?<CR><LF>   |
| MultiRoiHeight4  | I Integer     | R/W | MRH4  | Min~Max                      | 0   | 2048   | 1     | MRH4=[Param.]<CR><LF><br>MRH4?<CR><LF>   |
| MultiRoiHeight5  | I Integer     | R/W | MRH5  | Min~Max                      | 0   | 2048   | 1     | MRH5=[Param.]<CR><LF><br>MRH5?<CR><LF>   |
| MultiRoiOffsetX1 | I Integer     | R/W | MROX1 | Min~Max                      | 0   | 5118   | 0     | MROX1=[Param.]<CR><LF><br>MROX1?<CR><LF>   |
| MultiRoiOffsetX2 | I Integer     | R/W | MROX2 | Min~Max                      | 0   | 5118   | 0     | MROX2=[Param.]<CR><LF><br>MROX2?<CR><LF>   |
| MultiRoiOffsetX3 | I Integer     | R/W | MROX3 | Min~Max                      | 0   | 5118   | 0     | MROX3=[Param.]<CR><LF><br>MROX3?<CR><LF>   |
| MultiRoiOffsetX4 | I Integer     | R/W | MROX4 | Min~Max                      | 0   | 5118   | 0     | MROX4=[Param.]<CR><LF><br>MROX4?<CR><LF>   |
| MultiRoiOffsetX5 | I Integer     | R/W | MROX5 | Min~Max                      | 0   | 5118   | 0     | MROX5=[Param.]<CR><LF><br>MROX5?<CR><LF>   |
| MultiRoiOffsetY1 | I Integer     | R/W | MROY1 | Min~Max                      | 0   | 3839   | 0     | MROY1=[Param.]<CR><LF><br>MROY1?<CR><LF>   |
| MultiRoiOffsetY2 | I Integer     | R/W | MROY2 | Min~Max                      | 0   | 3839   | 0     | MROY2=[Param.]<CR><LF><br>MROY2?<CR><LF>   |
| MultiRoiOffsetY3 | I Integer     | R/W | MROY3 | Min~Max                      | 0   | 3839   | 0     | MROY3=[Param.]<CR><LF><br>MROY3?<CR><LF>   |
| MultiRoiOffsetY4 | I Integer     | R/W | MROY4 | Min~Max                      | 0   | 3839   | 0     | MROY4=[Param.]<CR><LF><br>MROY4?<CR><LF>   |
| MultiRoiOffsetY5 | I Integer     | R/W | MROY5 | Min~Max                      | 0   | 3839   | 0     | MROY5=[Param.]<CR><LF><br>MROY5?<CR><LF>   |
| LUTMode          | I Enumeration | R/W | LUTC  | 0: Off<br>1: Gamma<br>2: LUT | 0   | 2      | 0     | LUTC=[Param.]<CR><LF><br>LUTC?<CR><LF>   |
| AlcSpeed         | I Integer     | R/W | ALCS  | Min~Max                      | 1   | 8      | 4     | ALCS=[Param.]<CR><LF><br>ALCS?<CR><LF><br>for AGC and ASC                                    |
| AwbSpeed         | I Integer     | R/W | AWBS  | Min~Max                      | 1   | 8      | 4     | AWBS=[Param.]<CR><LF><br>AWBS?<CR><LF><br>for AWB  |
| ExposureAutoMax  | I Integer     | R/W | ASCEA | Min~Max[us]                  | 101 | 800000 | 18000 | ASCEA=[Param.]<CR><LF><br>ASCEA?<CR><LF><br>Maximum value is varied depending on frame rate. |
| ExposureAutoMin  | I Integer     | R/W | ASCEI | Min~Max                      | 100 | 79999  | 100   | ASCEI=[Param.]<CR><LF>   |

|                              |             |     |         |   |     |      |      |   |
|------------------------------|-------------|-----|---------|---|-----|------|------|---|
| n                            |             |     |         |   |     | 99   |      | LF><br>ASCEI?<CR><LF><br>Maximum value is<br>varied depending on<br>frame rate. |
| RequestExposureAutoResult    | Enumeration | R/O | ASRS    | 0=Complete.<br>1=Too Bright.<br>2=Too dark.<br>3=Timeout Error.<br>4=Busy.<br>5=Limit.<br>6= Trig is not set as Normal. | 0   | 6    | 0    | ASRS?<CR><LF>   |
| TriggerOption                | Enumeration | R/W | TRGOP   | 0: Off<br>1: RCT<br>3: Smear-less<br>4: RCT Continuous  | 0   | 4    | 0    | TRGOP=[Param.]<CR><LF><br>TRGOP?<CR><LF>  |
| AlcReference                 | Integer     | R/W | AGCF    | Min~Max[%]  | 1   | 100  | 50   | AGCF=[Param.]<CR><LF><br>AGCF?<CR><LF>  |
| GainAutoMax                  | Integer     | R/W | AGCGA   | Min~Max   | 101 | 1600 | 1600 | AGCGA=[Param.]<CR><LF><br>AGCGA?<CR><LF>  |
| GainAutoMin                  | Integer     | R/W | AGCGI   | Min~Max   | 100 | 1599 | 100  | AGCGI=[Param.]<CR><LF><br>AGCGI?<CR><LF>  |
| RequestGainAutoResult        | Enumeration | R/O | AGRS    | 0=Complete.<br>1=Too Bright.<br>2=Too dark.<br>3=Timeout Error.<br>4=Busy.<br>5=Limit.<br>6= Trig is not set as Normal. | 0   | 6    | 0    | AGRS?<CR><LF>   |
| ALCChannelAreaAll            | Enumeration | R/W | ALCA    | 0: Off / 1: On  | 0   | 1    | 0    | ALCA=[Param.]<CR><LF><br>ALCA?<CR><LF>  |
| ALCChannelAreaLowRight       | Enumeration | R/W | ALCLR   | 0: Off / 1: On  | 0   | 1    | 1    | ALC**=[Param.]<CR><LF><br>ALC**?<CR><LF>  |
| ALCChannelAreaLowMidRight    | Enumeration | R/W | ALCLMR  | 0: Off / 1: On  | 0   | 1    | 1    |   |
| ALCChannelAreaLowMidLeft     | Enumeration | R/W | ALCLML  | 0: Off / 1: On  | 0   | 1    | 1    |   |
| ALCChannelAreaLowLeft        | Enumeration | R/W | ALCLL   | 0: Off / 1: On  | 0   | 1    | 1    |   |
| ALCChannelAreaMidLowRight    | Enumeration | R/W | ALCMLR  | 0: Off / 1: On  | 0   | 1    | 1    |   |
| ALCChannelAreaMidLowMidRight | Enumeration | R/W | ALCMLMR | 0: Off / 1: On  | 0   | 1    | 1    |   |
| ALCChannelAreaMidLowMidLeft  | Enumeration | R/W | ALCMLML | 0: Off / 1: On  | 0   | 1    | 1    |   |
| ALCChannelAreaMidLowLeft     | Enumeration | R/W | ALCMLL  | 0: Off / 1: On  | 0   | 1    | 1    |   |



## GO-5000M-PMCL / GO-5000C-PMCL

|                               |             |     |         |                |   |   |   |  |
|-------------------------------|-------------|-----|---------|----------------|---|---|---|--|
| ALCChannelAreaMidHighRight    | Enumeration | R/W | ALCMHR  | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaMidHighMidRight | Enumeration | R/W | ALCMHMR | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaMidHighMidLeft  | Enumeration | R/W | ALCMHML | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaMidHighLeft     | Enumeration | R/W | ALCMHL  | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaHighRight       | Enumeration | R/W | ALCHR   | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaHighMidRight    | Enumeration | R/W | ALCHMR  | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaHighMidLeft     | Enumeration | R/W | ALCHML  | 0: Off / 1: On | 0 | 1 | 1 |  |
| ALCChannelAreaHighLeft        | Enumeration | R/W | ALCHL   | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaAll             | Enumeration | R/W | AWBA    | 0: Off / 1: On | 0 | 1 | 0 | AWBA=[Param.]<CR><LF><br>AWBA?<CR><LF>   |
| AWBChannelAreaLowRight        | Enumeration | R/W | AWBLR   | 0: Off / 1: On | 0 | 1 | 1 | AWB**=[Param.]<CR><LF><br>AWB**?<CR><LF> |
| AWBChannelAreaLowMidRight     | Enumeration | R/W | AWBLMR  | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaLowMidLeft      | Enumeration | R/W | AWBLML  | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaLowLeft         | Enumeration | R/W | AWBLL   | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaMidLowRight     | Enumeration | R/W | AWBMLR  | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaMidLowMidRight  | Enumeration | R/W | AWBMLMR | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaMidLowMidLeft   | Enumeration | R/W | AWBMLML | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaMidLowLeft      | Enumeration | R/W | AWBMLL  | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaMidHighRight    | Enumeration | R/W | AWBMR   | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelAreaMidHighMidRight | Enumeration | R/W | AWBMHR  | 0: Off / 1: On | 0 | 1 | 1 |  |
| AWBChannelArea                |             | R/W | AWBM    | 0: Off / 1: On | 0 | 1 | 1 |  |



|                                    |                      |     |            |   |   |             |     |   |
|------------------------------------|----------------------|-----|------------|---|---|-------------|-----|---|
| a<br>MidHighMidLeft                | Enumera<br>tion      |     | HML        |   |   |             |     |   |
| AWBChannelAre<br>a<br>MidHighLeft  | I<br>Enumera<br>tion | R/W | AWBM<br>HL | 0: Off / 1: On  | 0 | 1           | 1   |   |
| AWBChannelAre<br>a<br>HighRight    | I<br>Enumera<br>tion | R/W | AWBHR      | 0: Off / 1: On  | 0 | 1           | 1   |   |
| AWBChannelAre<br>a<br>HighMidRight | I<br>Enumera<br>tion | R/W | AWBH<br>MR | 0: Off / 1: On  | 0 | 1           | 1   |   |
| AWBChannelAre<br>a<br>HighMidLeft  | I<br>Enumera<br>tion | R/W | AWBH<br>ML | 0: Off / 1: On  | 0 | 1           | 1   |   |
| AWBChannelAre<br>a<br>HighLeft     | I<br>Enumera<br>tion | R/W | AWBHL      | 0: Off / 1: On  | 0 | 1           | 1   |   |
| CurrentAreaNoR<br>equest           | I Integer            | R/O | EA         | 0: Factory area<br>1: User 1 area<br>2: User 2 area<br>3: User 3 area             | 0 | 3           | 0   | EA?<CR><LF><br>The camera return the<br>latest used DATA<br>AREA.   |
| AcquisitionFram<br>eRateLine       | I Integer            | R/W | AR         | Min~Max   | 1 | 32578<br>6  | 774 | ART=[Param.]<CR><LF><br>><br>ART?<CR><LF><br>Maximum value is<br>calculated depending<br>on Height and Offset Y<br>settings |
| GammaSelector                      | I Integer            | R/W | GMA        | 0( $\gamma=0.45$ )<br>1( $\gamma=0.6$ )<br>2( $\gamma=1$ )                        | 0 | 2           | 0   | GMA=[Param.]<CR><L<br>F><br>GMA?<CR><LF>  |
| Temperature                        | I Integer            | R/O | TMP0       | value   | — | —           | —   | TMP0?<CR><LF><br>(Value÷128) =<br>Temperature[°C]   |
| GpioPulseGenDi<br>vide Value       | I Integer            | R/W | PGDEV      | Min~Max   | 1 | 4096        | 1   | PGDEV=[Param.]<CR><br><LF><br>PGDEV?<CR><LF>  |
| GpioPulseGenLe<br>ngth0            | I Integer            | R/W | PGL0       | Min~Max   | 1 | 10485<br>75 | 1   | PGL0=[Param.]<CR><L<br>F><br>PGL0?<CR><LF>  |
| GpioPulseGenSt<br>art Point0       | I Integer            | R/W | PGST0      | Min~Max   | 0 | 10485<br>74 | 0   | PGST0=[Param.]<CR><<br>LF><br>PGST0?<CR><LF>  |
| GpioPulseGenEn<br>d Point0         | I Integer            | R/W | PGEN0      | Min~Max   | 1 | 10485<br>75 | 1   | PGEN0=[Param.]<CR><<br>LF><br>PGEN0?<CR><LF>  |
| GpioPulseGenR<br>epeat Count0      | I Integer            | R/W | PGRPT<br>0 | Min~Max   | 0 | 255         | 0   | PGRPT0=[Param.]<CR<br>><LF><br>PGRPT0?<CR><LF>  |
| GpioPulseGenCl<br>ear Mode0        | I<br>Enumera<br>tion | R/W | PGCM0      | 0: Free Run<br>1: Level High<br>2: Level Low<br>3: Rising Edge<br>4: Falling Edge | 0 | 4           | 0   | PGCM0=[Param.]<CR><br><LF><br>PGCM0?<CR><LF>  |
| GpioPulseGenSy<br>nc Mode0         | I<br>Enumera<br>tion | R/W | PGSM0      | 0: Async Mode<br>1: Sync Mode   | 0 | 1           | 0   | PGSM0=[Param.]<CR><br><LF><br>PGSM0?<CR><LF>  |

# GO-5000M-PMCL / GO-5000C-PMCL

|                       |             |     |         |   |   |    |   |  |
|-----------------------|-------------|-----|---------|---|---|----|---|--|
| GpioPulseGenInput0    | Enumeration | R/W | PGIN0   | 0:Low<br>1:High<br>2:Soft<br>3:AcquisitionTriggerWait<br>4:FrameTriggerWait<br>5:FrameActive<br>6:ExposureActive<br>7:FVAL<br>8:LVAL<br>9:PG0<br>10:PG1<br>14:CL CC1 in<br>15:nand0<br>16:nand1 | 0 | 18 | 0 | PGIN0=[Param.]<CR><LF><br>PGIN0?<CR><LF>     |
| GpioPulseGenInvert0   | Enumeration | R/W | PGINV0  | 0:Non-Inv<br>1:Inv  | 0 | 1  | 0 | PGIN0=[Param.]<CR><LF><br>PGIN0?<CR><LF>     |
| GpioNand0InputSource1 | Enumeration | R/W | ND0IN1  | 0: Low<br>1: High<br>2: FrameTriggerWait<br>3: FramActive<br>4: ExposureActive<br>5: Fval<br>6: PulseGenerator0<br>11: CL_CC1_In  | 0 | 11 | 0 | ND0N1=[Param.]<CR><LF><br>ND0IN1?<CR><LF>    |
| GpioNand1InputSource1 | Enumeration | R/W | ND1IN1  | Same as above.  | 0 | 11 | 0 | ND1N1=[Param.]<CR><LF><br>ND1IN1?<CR><LF>    |
| GpioNand0InputSource2 | Enumeration | R/W | ND0IN2  | 0: Low<br>1: High<br>2: FrameTriggerWait<br>3: FramActive<br>4: ExposureActive<br>5: Fval<br>6: PulseGenerator0<br>11: CL_CC1_In  | 0 | 11 | 0 | ND0N2=[Param.]<CR><LF><br>ND0IN2?<CR><LF>    |
| GpioNand1InputSource2 | Enumeration | R/W | ND1IN2  | Same as above.  | 0 | 11 | 0 | ND1N2=[Param.]<CR><LF><br>ND1IN2?<CR><LF>    |
| GpioNand0InputInvert1 | Enumeration | R/W | ND0INV1 | 0: Non-Inv<br>1: Inv  | 0 | 1  | 0 | ND0INV1=[Param.]<CR><LF><br>ND0INV1?<CR><LF> |
| GpioNand1InputInvert1 | Enumeration | R/W | ND1INV1 | Same as above.  | 0 | 1  | 0 | ND1INV1=[Param.]<CR><LF><br>ND1INV1?<CR><LF> |
| GpioNand0InputInvert2 | Enumeration | R/W | ND0INV2 | 0: Non-Inv<br>1: Inv  | 0 | 1  | 0 | ND0INV2=[Param.]<CR><LF><br>ND0INV2?<CR><LF> |
| GpioNand1InputInvert2 | Enumeration | R/W | ND1INV2 | Same as above.  | 0 | 1  | 0 | ND1INV2=[Param.]<CR><LF><br>ND1INV2?<CR><LF> |
| LUTSequenceR          | Enumeration | R/W | LUTSR   | Min~Max   | 0 | 32 | 0 | LUTSR=[Param.]<CR><LF><br>LUTSR?<CR><LF>     |
| LUTSequenceG          | Enumeration | R/W | LUTSG   | Min~Max   | 0 | 32 | 0 | LUTSG=[Param.]<CR><LF><br>LUTSG?<CR><LF>     |
| LUTSequenceB          | Enumeration | R/W | LUTSB   | Min~Max   | 0 | 32 | 0 | LUTSB=[Param.]<CR><LF><br>LUTSB?<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<br>1= 48.6MHz<br>2= 84.9MHz<br>3= 58.3MHz | 0 | 3   | 0 | CLCF=[Param.]<CR><LF><br>CLCF?<CR><LF>     |
| DarkCompression                | I Enumeration | R/O | SBS  | 0: Off / 1: On                                       | 0 | 1   | 0 | SBS<br>=[Param.]<CR><LF><br>SBS?<CR><LF>   |
| BINNING_GAIN_EN<br>(Mono only) | I Enumeration | R/W | BGOE | 0: Off / 1: On                                       | 0 | 1   | 0 | BGOE<br>=[Param.]<CR><LF><br>BGOE?<CR><LF> |
| HighDynamicRange<br>Mode       | I Enumeration | R/W | HES  | 0: Off / 1: On                                       | 0 | 1   | 0 | HES=[Param.]<CR><LF><br>HES?<CR><LF>       |
| HighDynamicRange<br>Slope      | I Enumeration | R/W | HKS  | 0: Level1<br>1: Level2<br>2: Level3<br>3: Level4     | 0 | 3   | 0 | HKS=[Param.]<CR><LF><br>HKS?<CR><LF>       |

## **Appendix 2**

### **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**

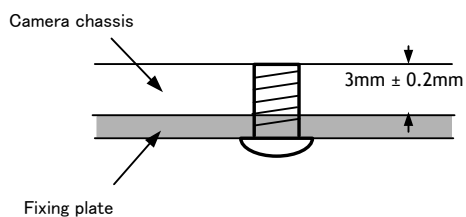
When the sensor captures a dark object at high temperature or is used for long time integration, fixed pattern noise may appear on the video monitor screen.

### **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.

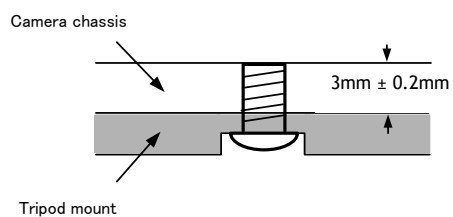
### **4. Caution when mounting the camera**

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.



Attaching the tripod mount

## 5. Exportation

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

## 6. References

1. This manual and a datasheet for GO-5000M-PMCL / GO-5000C-PMCL can be downloaded from [www.jai.com](http://www.jai.com)
2. Camera control software can be downloaded from [www.jai.com](http://www.jai.com)

## Manual change history

[illegible]

## User's Record

Camera type: GO-5000M-PMCL / GO-5000C-PMCL

Revision: .....

Serial No. ....

Firmware version. ....

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

## User's Mode Settings.

## User's Modifications.

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### ***Europe, Middle East & Africa***

*Phone +45 4457 8888  
Fax +45 4491 3252*

### ***Asia Pacific***

*Phone +81 45 440 0154  
Fax +81 45 440 0166*

### ***Americas***

*Phone (toll-free) +1 800 445 5444  
Phone +1 408 383 0300*

***Visit our web site at [www.jai.com](http://www.jai.com)***