No. 20S089-00

OMRON

Camera Link
Monochrome / Color CMOS Camera

STC-GPB250BPCL (25M / Monochrome)
STC-GPC250BPCL (25M / Color)

Product Specifications and User's Guide

OMRON SENTECH CO., LTD.

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Precautions for safe use

Please read carefully this “Precautions for safe use” before use the camera. Then the camera uses correctly with agreeing with below notes.

In this “Precautions for safe use”, notes divides into “Warning” and “Caution” to use the camera safety and prevent to harm and damage.

⚠ Warning	This shows, assumption for possibility of serious accident leading death or serious injury if ignore this note and camera uses incorrectly.
⚠ Caution	This shows, assumption for possibility of bear the damage or physical damage if ignore this note and camera uses incorrectly.

About Graphic symbols


This symbol shows general prohibition.


This symbol shows completion or instruction.

[Environment / condition]

⚠ Warning	
Do not use flammable or explosiveness atmospheres. This will cause of personal injury or fire.	Do not use for “safety for human body” related usage. This camera is designed for use “do not harm human body immediately” if by any chance the camera has malfunction.
⚠ Caution	
Use and store under specified environmental conditions (Vibration, shock, temperature, humidity) in the specifications for this camera. This will cause of fire or damage the camera.	

[Installation and cable wiring]

⚠ Warning	
Do not use with out of power voltage range that is specified in the specifications for this camera. This will cause of fire, electrification or malfunction.	Do not wrong wiring. This will cause of fire or malfunction.
⚠ Caution	
Do not grounding DC power (+) of all devices that are connect to the camera. The camera housing is connecting to 0 V line of camera inside circuit. There is a risk of short circuit between camera inside ciurcuit and frame ground. This will cause of malfunction.	It is necessary to wiring and mounting that is specified in the specifications for this camera. This will cause of fire or malfunction.
It is necessary to wiring with turn off the camera. This will cause of electrification or malfunction.	It is necessary to mounting the camera without stress for the cable. This will case of electrification or fire.
Do not use Camera Link un-supported cable and board. There is a risk of malfunction if the camera connects with wrong environment and turn on the camera.	

[Usage instruction]

⚠ Warning	
Do not touch the terminal and PCB board While turn on the camera. This will cause of electrification or accident caused by malfunction.	Do not put combustibles near the camera. This will cause of fire.
Do not use without usage that is specified in the specifications for this camera. This will cause of personal injury or malfunction.	Do not push metals including screw driver into radiation holes. This will cause of electrification or malfunction.
Do not touch the camera housing while or afterusing the camera. There is a risk of get burned.	
⚠ Caution	
Do not push contamination into opening of the camera. This will cause of electrification or malfunction.	Do not block the radiation holes. This will cause of fire due to increase the camera inside temperature.

[Maintenance]

⚠ Caution	
Do not disassemble or repair the camera. This will cause of fire, electrification or malfunction.	It is turn off the camera when maintaining or inspecting the camera. This will cause of electrification.

[Disposal]

⚠ Caution	
It is necessary to dispose of accordance with WEEE directive.	

1 Product Precautions

Do not give shock to the camera.
Do not haul or damage the camera cable.
Do not wrap the camera with any material while using the camera. This will cause the internal camera temperature to increase.
When the camera moving or using the place that temperature difference is extreme, countermeasure for dew condensation (heat removal / cold removal) is necessary.
While the camera is not using, keep the lens cap on the camera to prevent dust or contamination from getting in the sensor or filter and scratching or damaging it.
Do not keep the camera under the following conditions.
- In wet, moist, high humidity or dusty place
- Under direct sunlight
- In extreme high or low temperature place
- Near an object that releases a strong magnetic or electric filed
- Place with strong vibrations

Apply the power that satisfies the specified in specifications for the camera.
The defective pixels may appear due to the sensor characteristics.
Use below recommend materials (or equivalent materials) to clean the surface of glass.
- Air dust: Non Freon air duster (NAKABAYASHI Co., LTD.)
- Alcohol: Propan-2-ol (SAN'EI KAKO Co., LTD.)
- Non-woven: nikowipe clean room (NKB)

Use a soft cloth to clean the camera.

2 Warranty

■Warranty period

One year after delivery (However, the camera had malfunction with camera uses correctly)
In below case for a fee even within warranty period.

- The malfunction caused by incorrect usage, incorrect modify or repair.
- The malfunction caused by external shock including the camera dropping after delivery the camera.
- The malfunction caused by fire, earthquake, flood disaster, thunderbolt struck, other natural disaster or wrong voltage.

■Warranty coverage

Exchange or repair the malfunction camera if the malfunction is occurred by our responsibility.
"Warranty" mean is warranty for the delivered camera itself. Please accept the induction damage by the camera malfunction is not included.

3 Specifications

3.1 Electronic Specifications

Model Number		STC-GPB250BPCL	STC-GPC250BPCL
Image Sensor		1.1" 25M Progressive Monochrome CMOS (Gpixel: GMAX0505)	1.1" 25M Progressive Color CMOS (Gpixel: GMAX0505)
Shutter Type		Global shutter	
Effective Picture Resolution	10TAP / 8TAP / 4TAP / 2TAP Output	5,120 (H) x 5,120 (V)	
	3TAP Output	5,118 (H) x 5,120 (V)	
Cell Size		2.5 (H) x 2.5 (V) µm	
Scanning Mode		**Full scanning** / ROI	
Maximum Frame Rate (at full resolution) (*1)	10TAP	30.72 fps (84.857 MHz) / 24.40 fps (66 MHz) / 14.64 fps (39.6 MHz)	
	8TAP	**25.06 fps (84.857 MHz)** / 19.53 fps (66 MHz) / 11.75 fps (39.6 MHz)	
	4TAP	12.66 fps (84.857 MHz) / 9.84 fps (66 MHz)	
	3TAP	9.52 (84.857 MHz) / 7.39 fps (66 MHz) / 4.44 fps (39.6 MHz)	
	2TAP	6.35 fps (84.857 MHz)	
ADC Bits		10bits / 12bits	
Image Output		**8bits** / 10bits / 12bits	
Camera Link Data Output (*2)		Deca / Full / Medium / Base Configuration	
Camera Link TAP Configuration		10TAP / **8TAP** / 4TAP / 3TAP / 2TAP	
Camera Link Clock Speed (*3)		**84.857 MHz** / 66 MHz / 39.6 MHz	
Noise Level (Gain 0 dB) (*4)	8bits Output	Less than 4 digits	
	10bits Output	Less than 16 digits	
	12bits Output	Less than 64 digits	
Sensitivity (*5)		490 Lux	950 Lux
Exposure Time (All TAPs)		14 µseconds to 16.777 seconds (**Default: 39.279 µseconds**)	
Gain	Analog Gain	Fixed	
	Digital Gain	x1 to x5 (**Default: x1**)	
Black Level (*4)	8bits Output	0 to 63 digits	
	10bits Output	0 to 255 digits	
	12bits Output	0 to 1,008 digits	
White Balance Gain		N/A	Support

Default: **Bold**

Model Number			STC-GPB250BPCL	STC-GPC250BPCL
ROI	Size	Horizontal	10 TAP: 10 to 5,120 pixels (adjustable unit: 10 pixels) 8 TAP: 8 to 5,120 pixels (adjustable unit: 8 pixels) 4 TAP: 4 to 5,120 pixels (adjustable unit: 4 pixels) 3 TAP: 3 to 5,118 pixels (adjustable unit: 3 pixels) 2 TAP: 2 to 5,120 pixels (adjustable unit: 2 pixels) **(Default: 5,120)**	10 TAP: 10 to 5,120 pixels (adjustable unit: 10 pixels) 8 TAP: 8 to 5,120 pixels (adjustable unit: 8 pixels) 4 TAP: 4 to 5,120 pixels (adjustable unit: 4 pixels) 3 TAP: 6 to 5,118 pixels (adjustable unit: 6 pixels) 2 TAP: 2 to 5,120 pixels (adjustable unit: 2 pixels) **(Default: 5,120)**
		Vertical	1 to 5,120 lines (adjustable unit: 1 line) **(Default: 5,120)**	2 to 5,120 lines (adjustable unit: 2 lines) **(Default: 5,120)**
	Position	Horizontal	10 TAP: 0 to 5,110 pixels (adjustable unit: 1 pixel) 8 TAP: 0 to 5,112 pixels (adjustable unit: 1 pixel) 4TAP: 0 to 5,116 pixels (adjustable unit: 1 pixel) 3 TAP: 0 to 5,115 pixels (adjustable unit: 1 pixel) 2 TAP: 0 to 5,118 pixels (adjustable unit: 1 pixel)	10 TAP: 0 to 5,110 pixels (adjustable unit: 2 pixels) 8 TAP: 0 to 5,112 pixels (adjustable unit: 2 pixels) 4TAP: 0 to 5,116 pixels (adjustable unit: 2 pixels) 3 TAP: 0 to 5,112 pixels (adjustable unit: 2 pixels) 2 TAP: 0 to 5,118 pixels (adjustable unit: 2 pixels)
		Vertical	0 to 5,119 lines (adjustable unit: 1 line)	0 to 5,118 lines (adjustable unit: 2 lines)
Multi ROI (*6)			Eight regions One width applies to all eight regions. (Start position of each region can be configurable individually)	
Gamma			N/A	
Binning (*7)			2 x 2 / 4 x 4 / **Off**	N/A
Decimation (*8)			2 x 2 / 4 x 4 / **Off**	
FFC (Flat Field Correction) (*6)			32 x 32 block FFC	
Mirror Image			Horizontal / Vertical / Horizontal and Vertical / **Off**	
Pixel Defect Correction			Up to 2,046 points	
Auto Exposure			N/A	
Auto Gain			N/A	
Auto White Balance			N/A	
Operating Mode			Edge preset trigger / Pulse width trigger / **Free-run (continuous)**	
Save User Mode			Support	
I/O Ports			4 I/Os	
Power	Input Voltage		+12 Vdc +/- 10 % (PoCL Support)	
	Consumption		Maximum: 4.0 W, Typical: 3.5 W	

Default: **Bold**

Precautions

(*1) The selected image output bit does not make any influence for maximum frame rate.

(*2) Camera Link data output formats (TAP configuration and output bits) are in below table:

	10TAP	8TAP	4TAP	3TAP	2TAP
8bits	Support Deca	Support Full	Support Medium	Support Base	Support Base
10bits	N/A	Support Deca	Support Medium	N/A	Support Base
12bits	N/A	N/A	N/A	N/A	Support Base

(*3) Please select optimum Camera Link clock speed if long length Camera Link cable is required.
Please refer “The image data transferring speed” for more details.

(*4) The selected TAP configuration does not make any influence for noise level and black level.

(*5) The sensitivity is measured illumination of light source for 100% white under below conditions:

Camera Setting		Environment	
Parameter	Setting	Parameter	Setting
Gain	0 dB	Light Source	Light Box (White)
AGC	Off	Color temperature	5,100K
White Balance	Optimum	Lens	
Electrical Shutter	1/30 seconds	F on Lens	F5.6
Black Level	Optimum	Target Luminance	IM-600 (Topcon)
Gamma	Factory Setting		

(*6) Multi ROI and FFC function cannot use simultaneously.

(*7) The frame rate cannot change by binning function.

(*8) When using decimation,
when selecting 2x2 decimation, frame rate is about twice faster than when selecting decimation off.
when selecting 4x4 decimation, frame rate is about four times faster than when selecting decimation off.

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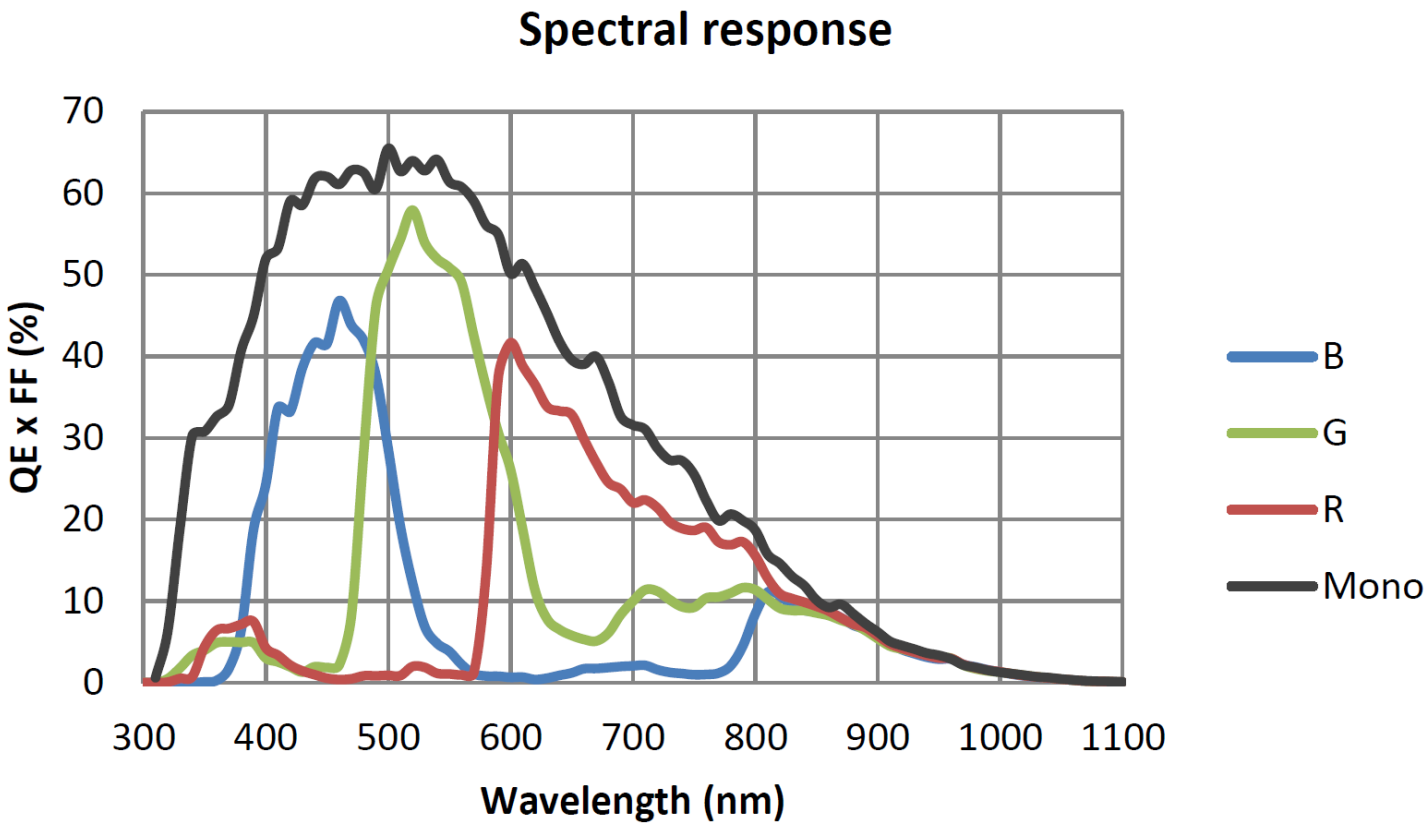
3.2 Spectral Sensitivity Characteristics



3.3 Mechanical specifications

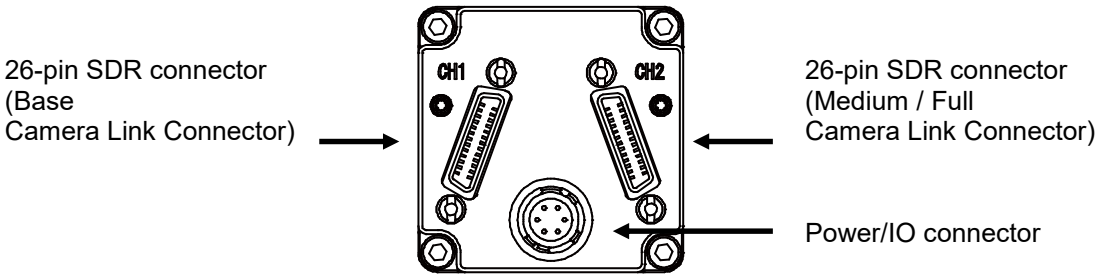
Model Number	STC-GPB250BPCL	STC-GPC250BPCL
Dimensions	35 (W) x 35 (H) x 42.2 (D) mm (*1)	
Optical Filter	No Optical Filter	
Optical Center Accuracy	Positional accuracy in Horizontal and Vertical directions: +/- 0.3 mm Rotational accuracy in Horizontal and Vertical directions: +/- 1.5 deg.	
Material	Aluminum alloy	
Lens Mount	C Mount	
Interface Connectors	Camera Link connector: SDR connector x 2 Power/IO connector: HR10A-7R-6PB (Hirose) or equivalent x 1	
Camera Mounting	M4 screws holes (Four on top, bottom, three on both side plates)	
Weight	Approximately 77 g	

(*1) Excluding the connectors

3.4 Environmental specifications

Model Number	STC-GPB250BPCL	STC-GPC250BPCL
Operational Temperature / Humidity	Environmental temperature: 0 to +42 deg. C Environmental humidity: 20 to 85 %RH (No condensation)	
Storage Temperature / Humidity	Environmental temperature: -25 to +75 deg. C Environmental humidity: 20 to 85 %RH (No condensation)	
Vibration	20 Hz to 200 Hz to 20 Hz (5 min. / cycle), acceleration 10 G, XYZ 3 directions 30 min. each	
Shock	Acceleration 38 G, half amplitude 6 msec., XYZ 3 directions 3 times each	
Standard Compliancy	EMS: EN61000-6-2, EMI: EN61000-6-4	
RoHS	RoHS compliance	

3.5 Connector specifications



3.5.1 Camera Link connector

SDR (3M) or equivalent connector x 2

This camera is PoCL supported Camera Link camera.
The Camera Link frame grabber board is supplied power to camera through Camera Link cable if frame grabber board and cable are applicable for PoCL.

Please supply the power (+12 Vdc) from Power/IO connector if frame grabber board is not applicable for PoCL.

Camera Link connector pin assignment

Base Camera Link Connector

Pin No.	Signal Name	Pin No.	Signal Name
1	+12V	14	GND
2	X0-	15	X0+
3	X1-	16	X1+
4	X2-	17	X2+
5	Xclk-	18	Xclk+
6	X3-	19	X3+
7	SerTC+	20	SerTC-
8	SerTFG-	21	SerTFG+
9	CC1- (TRG)	22	CC1+ (TRG)
10	CC2+	23	CC2-
11	CC3-	24	CC3+
12	CC4+	25	CC4-
13	GND	26	+12V

Medium / Full Camera Link Connector

Pin No.	Signal Name	Pin No.	Signal Name
1	+12V	14	GND
2	Y0-	15	Y0+
3	Y1-	16	Y1+
4	Y2-	17	Y2+
5	Yclk-	18	Yclk+
6	Y3-	19	Y3+
7	100Ω	20	100Ω
8	Z0-	21	Z0+
9	Z1-	22	Z1+
10	Z2-	23	Z2+
11	Zclk-	24	Zclk+
12	Z3-	25	Z3+
13	GND	26	+12V

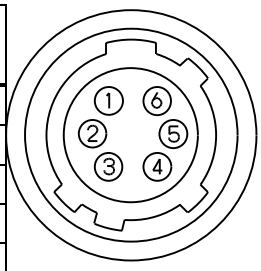
3.5.2 Power/IO Connector

HR10A-7R-6PB (Hirose) or equivalent connector x 1

This connector is for DC12V power input and input and output signals.
Please use HR10A-7P-6S (Hirose) or equivalent connector for connecting cable.

Power/IO connector pin assignment

Pin No.	Signal Name	IN / OUT	Voltage		Consumption
			Low voltage	High voltage	
1	GND	IN	0 V		
2	Trigger	IN	0 to +0.99 V	+2.3 to +3.6V	5 μA (typ.) (*1)
	FVAL	OUT	0 V	+3.3 V	10 mA (Max.) (*2)
3	LVAL	OUT	0 V	+3.3 V	10 mA (Max.) (*2)
4	Exposure	OUT	0 V	+3.3 V	10 mA (Max.) (*2)
5	Trigger Filter	OUT	0 V	+3.3 V	10 mA (Max.) (*2)
6	12 Vdc	IN	+12 V		



The trigger signal input connector is selectable from below two connectors by camera control command (12H).

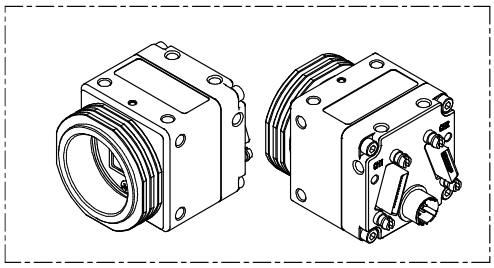
Camera Link connector: CC1
Power/IO connector: Pin No. 2

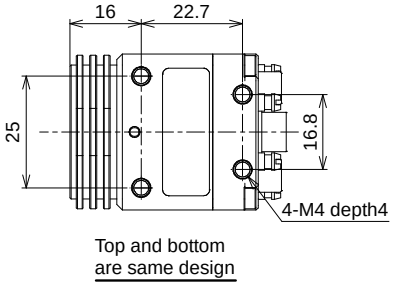
When selecting “Pin No.2” for trigger input connector, input and output signals are below:
No.2: Trigger signal input, No.3: LVAL signal out, No.4: Exposure signal out (active low)

When not selecting “Pin No.2” for trigger input connector, input and output signals are below:
No.2: FVAL signal out, No.3: LVAL signal out, No.4: Exposure signal out (active low)

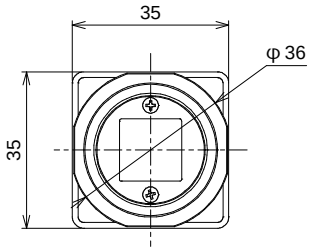
(*1) The power consumption when high voltage trigger signal input to input port.
(*2) The power consumption for output port has to be managed less than 10 mA.

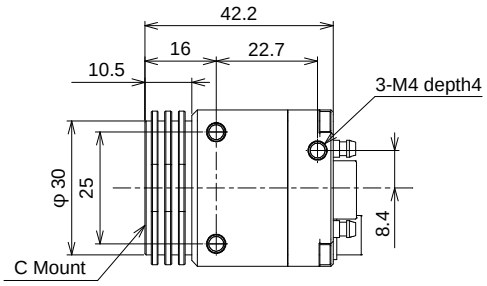
4 Dimensions



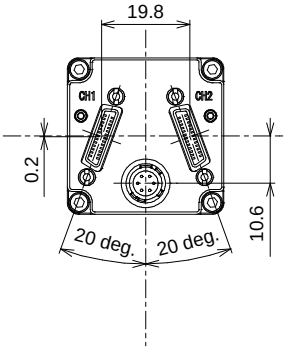


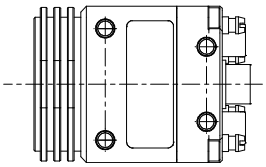
Top and bottom
are same design





Right and left
are same design



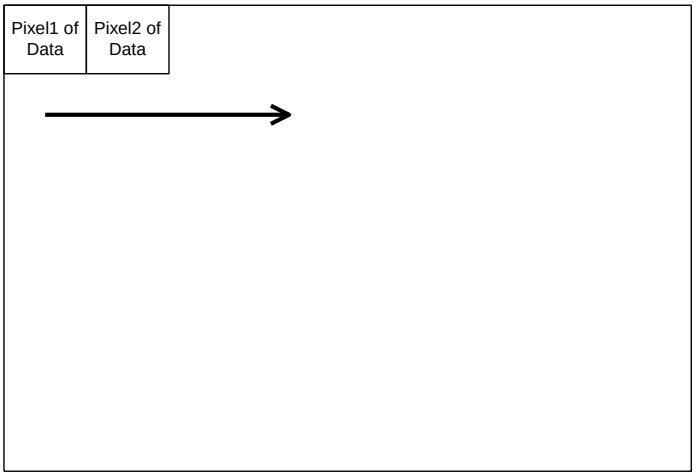


Unit: mm

5 Sensor Information

5.1 Pixel Transferring Imager

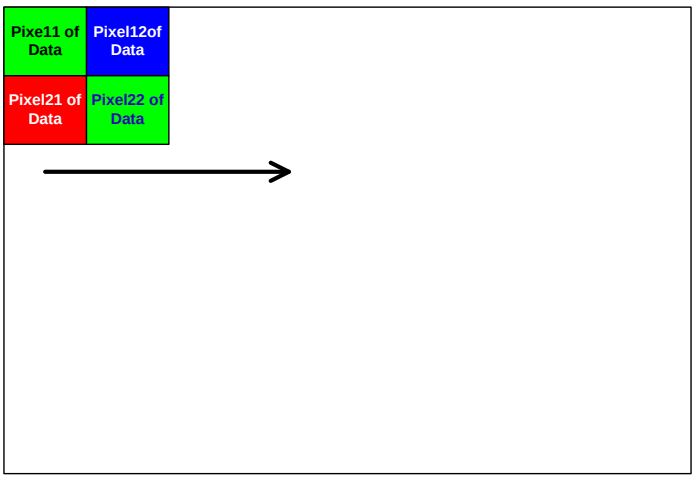
STC-GPB250BPCL (Monochrome model)



Pixel (n) of Data: nth pixel being transferred

STC-GPC250BPCL (Color model)

The Bayer pattern array on sensor

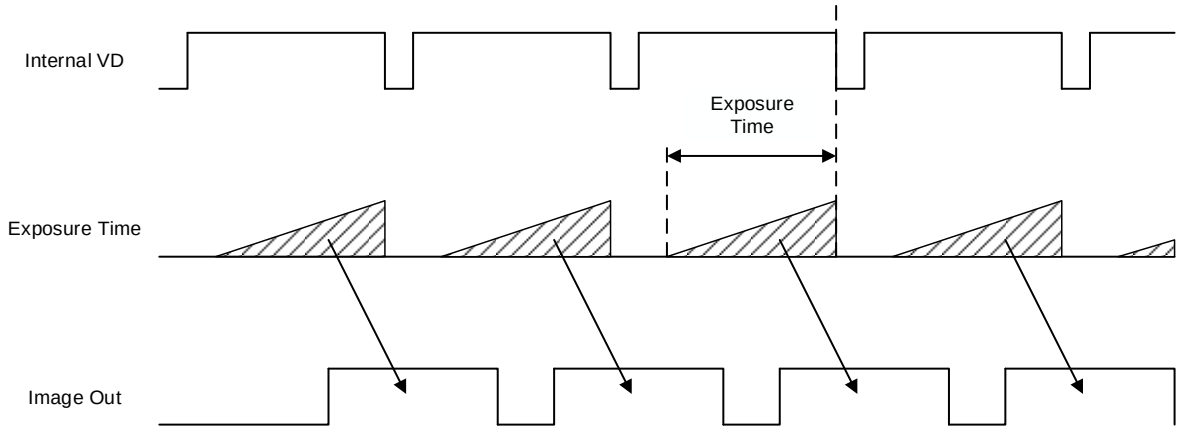


Pixel (m, n) of Data: nth pixel of mth line being transferred

6 Camera Function Modes

6.1 Free-run / Continuous mode

This mode can be outputted camera image signal continuously.



* Note: The exposure time sets by preset exposure time.
When setting shorter than 14 µseconds for exposure time, 14 µseconds set to exposure time automatically.

6.2 Overlap mode

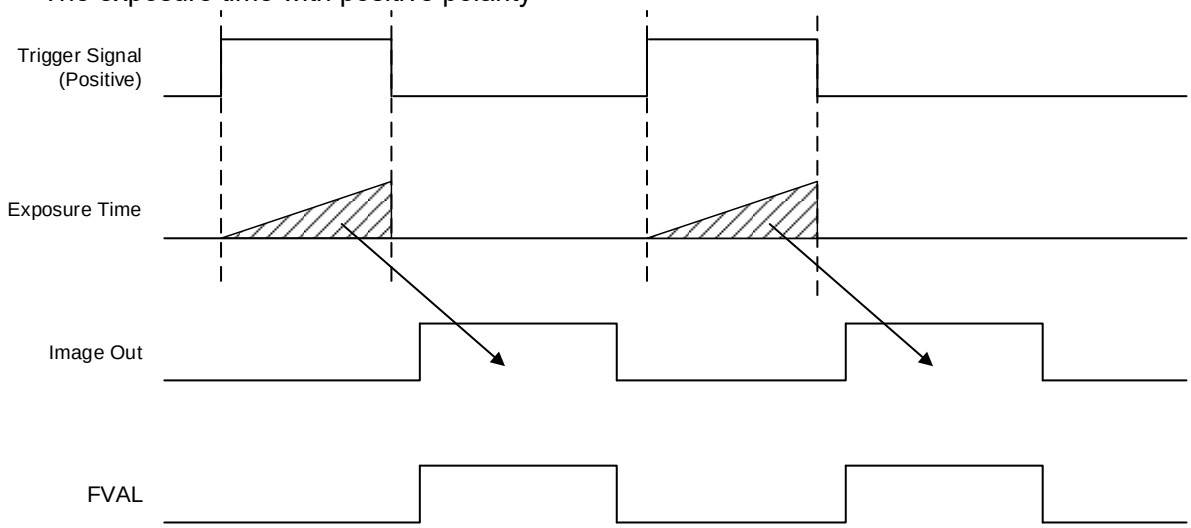
The overlap mode off is recommending setting.
In this mode, the exposing timing is overlapping to period of image output.

The exposure time could be change due to timing of image output and start exposing timing when trigger signal inputting while image is output with overlap mode.

6.3 Pulse width trigger mode

The camera exposure starts by trigger signal.
In this trigger mode with positive trigger polarity, camera exposure starts at rising edge of trigger signal and stops at falling edge of trigger signal. The exposure time is active pulse duration (high state) of trigger signal.
In this trigger mode with negative trigger polarity, camera exposure starts at falling edge of trigger signal and stops at rising edge of trigger signal. The exposure time is active pulse duration (low state) of trigger signal.
The exposure start will be delay about 1 µseconds by filtering system on camera.

6.3.1 The exposure time with positive polarity



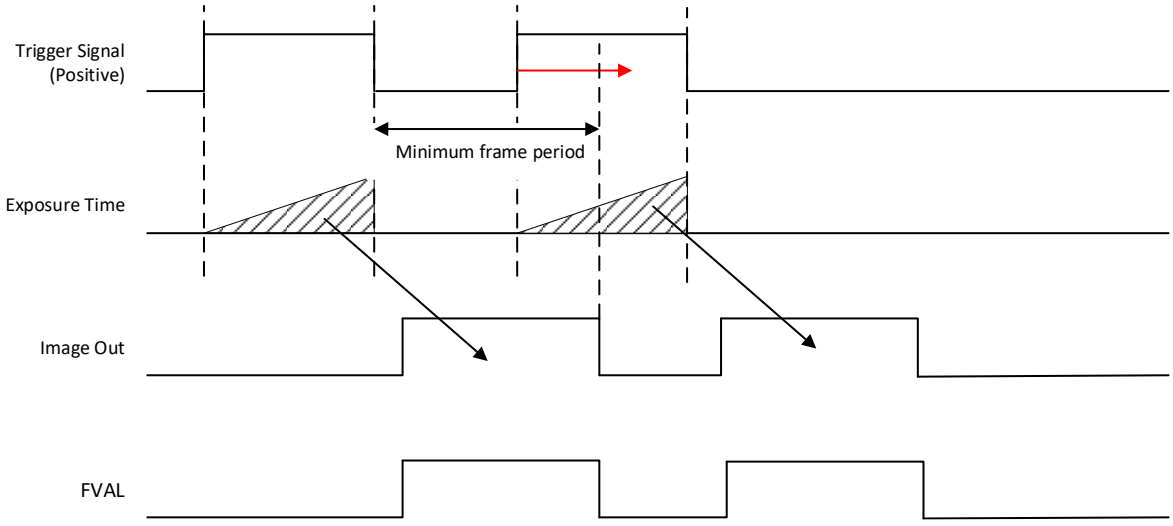
* Note.1: The exposure time sets by active pulse duration of trigger signal.
There is no FVAL output without exposing by trigger signal.

* Note.2: When active pulse duration of trigger signal is shorter than 0.8 µseconds, trigger signal is discard by filtering system on camera.
It is necessary to supply more than 0.8 µseconds active pulse duration of trigger signal to camera.

* Note.3: The trigger signal is discard when trigger signal supplies shorter than below minimum frame interval time from previous supplied trigger signal.
Minimum frame interval:

10TAP, 84.857 MHz:	81.5 µseconds,	10TAP, 66 MHz:	102.5 µseconds,
10TAP, 66 MHz:	170.8 µseconds,	8TAP, 85.857 MHz:	99.8 µseconds,
8TAP, 66 MHz:	128.1 µseconds,	8TAP, 39.6 MHz:	212.8 µseconds,
4TAP, 84.857 MHz:	197.7 µseconds,	4TAP, 66 MHz:	254.1 µseconds,
3TAP, 84.857 MHz:	252.7 µseconds,	3TAP, 66 MHz:	338.2 µseconds,
3TAP, 39.6 MHz:	562.7 µseconds,	2TAP, 84.857 MHz, 8bit:	394.0 µseconds
2TAP, 84.857 MHz, 10bit:	394.0 µseconds,	2TAP, 84.857 MHz, 12bit:	121.3 µseconds

* Note.4: When the overlap mode is OFF, the signal becomes invalid if the trigger is input within the period less than the minimum frame period from the previous trigger signal input. When the overlap mode is ON, set the trigger signal so that it exceeds the minimum frame period from the fall of the previous trigger signal.



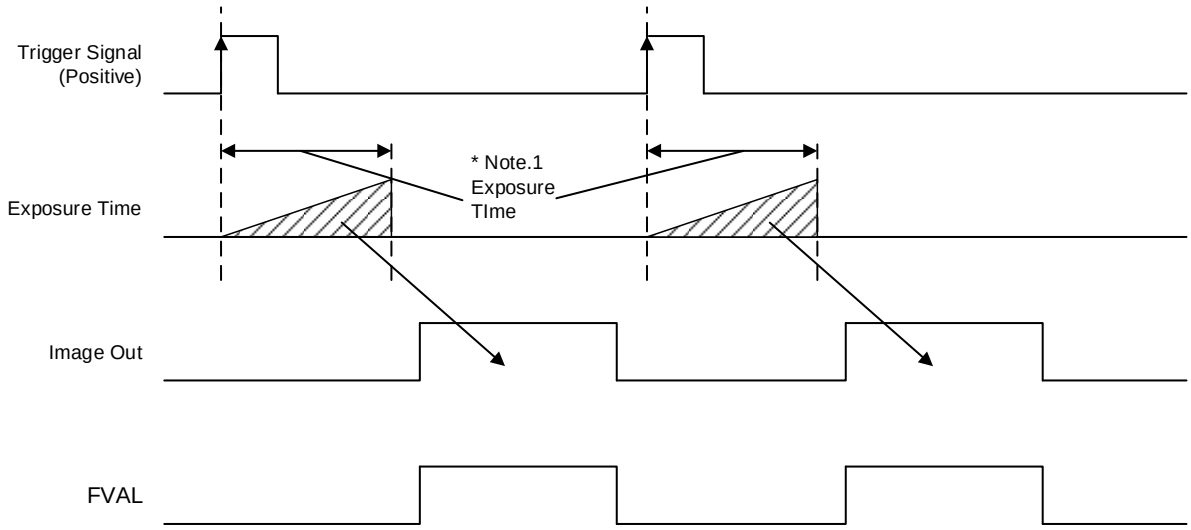
Minimum frame period:

10TAP, 84.857 MHz: 32.55 mseconds,	10TAP, 66.11 MHz: 40.98 mseconds,
10TAP, 39.6 MHz: 68.31 mseconds,	8TAP, 84.857 MHz: 39.90 mseconds,
8TAP, 66 MHz: 51.20 mseconds,	8TAP, 39.6 MHz: 85.11 mseconds,
4TAP, 84.857 MHz: 78.99 mseconds,	4TAP, 66 MHz: 101.63 mseconds,
3TAP, 84.857 MHz: 105.04 mseconds,	3TAP, 66 MHz: 135.32 mseconds,
3TAP, 39.6 MHz: 225.23 mseconds,	2TAP, 84.857 MHz: 157.23 mseconds,

6.4 Edge preset trigger mode

The camera exposure starts by trigger signal.
In this trigger mode with positive trigger polarity, camera exposure starts at rising edge of trigger signal.
The exposure time sets by preset exposure time.
In this trigger mode with negative trigger polarity, camera exposure starts at falling edge of trigger signal.
The exposure time sets by preset exposure time.
The exposure start will be delay about 1 µseconds by filtering system on camera.

6.4.1 The exposure timing with positive polarity



* Note.1: The exposure time sets by preset exposure time.
When setting shorter than 14 µseconds for exposure time, 14 µseconds set to exposure time automatically.

* Note.2: When active pulse duration of trigger signal is shorter than 0.8 µseconds, trigger signal is discard by filtering system on camera.
It is necessary to supply more than 0.8 µseconds active pulse duration of trigger signal to camera.

* Note.3: The trigger signal is discard when trigger signal supplies shorter than below minimum frame interval time from previous supplied trigger signal.
Minimum frame interval:

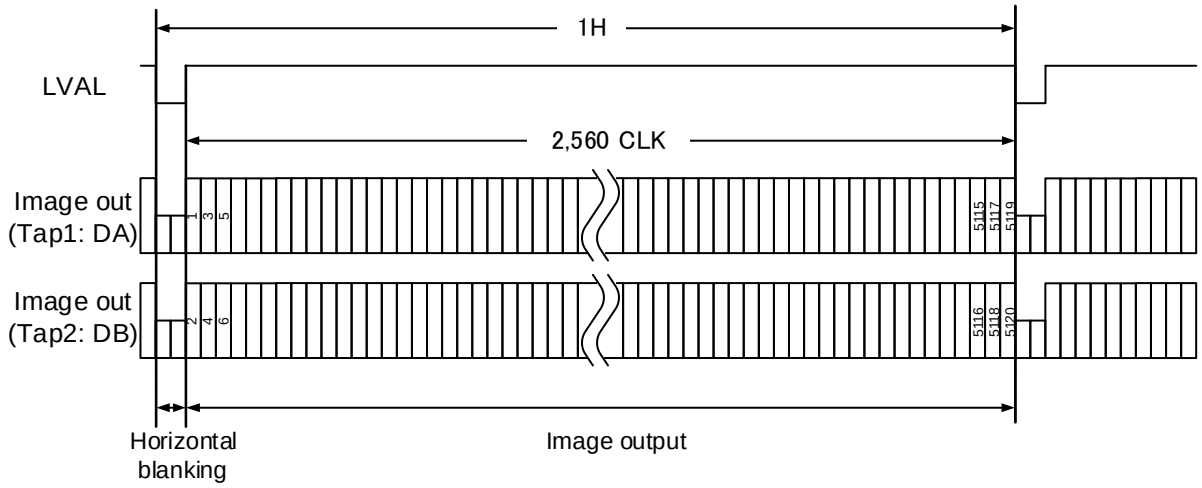
10TAP, 84.857 MHz: 32.55 mseconds,	10TAP, 66 MHz: 40.98 mseconds,
10TAP, 66 MHz: 68.31 mseconds,	8TAP, 85.857 MHz: 39.90 mseconds,
8TAP, 66 MHz: 51.20 mseconds,	8TAP, 39.6 MHz: 85.11 mseconds,
4TAP, 84.857 MHz: 78.99 mseconds,	4TAP, 66 MHz: 101.83 mseconds,
3TAP, 84.857 MHz: 105.04 mseconds,	3TAP, 66 MHz: 135.32 mseconds,
3TAP, 39.6 MHz: 225.23 mseconds,	2TAP, 84.857 MHz: 157.23 mseconds

However, when detecting signal state change from low to high (for positive polarity) at minimum frame interval passed from previous trigger signal, exposing by trigger signal starts.

7 Camera Output Timing Charts

7.1 Horizontal timing: Full scanning

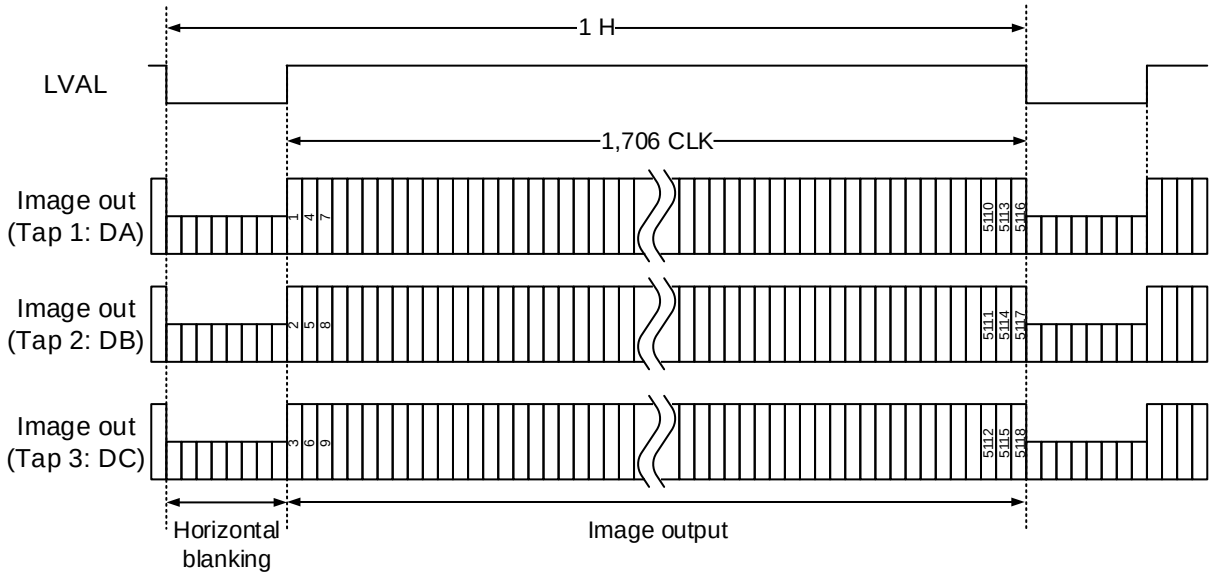
7.1.1 2TAP (1X2-1Y) / Horizontal: 5,120 pixels



Camera settings		Horizontal period (μsecond)	Horizontal Blanking period (CLK)
Camera Link Clock (MHz)	Camera Link output format		
84.857	8 / 10 / 12	30.309	12

* The horizontal blanking period (CLK) could be plus 1 CLK of above CLK due to influence of camera internal sync circuit.

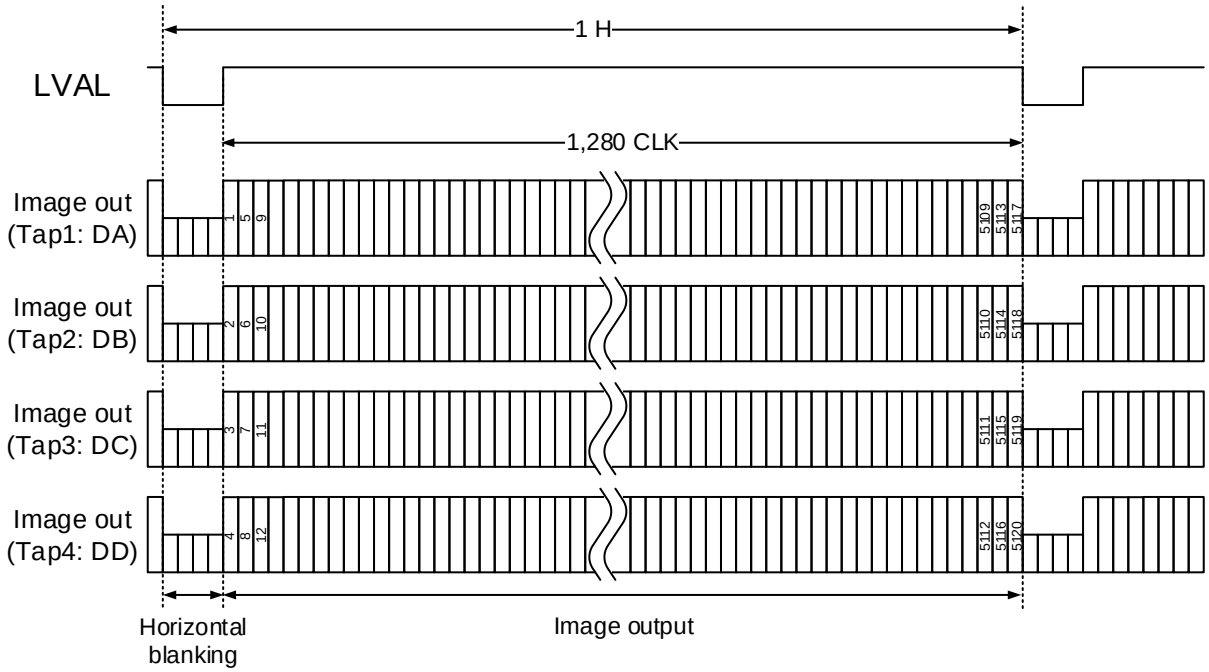
7.1.2 3TAP (1X3-1Y) / Horizontal: 5,118 pixels



Camera settings		Horizontal period (µsecond)	Horizontal Blanking period (CLK)
Camera Link Clock (MHz)	Camera Link output format		
84.857	8	20.202	8
66	8	26.014	11
39.6	8	43.282	8

* The horizontal blanking period (CLK) could be plus 1 CLK of above CLK due to influence of camera internal sync circuit.

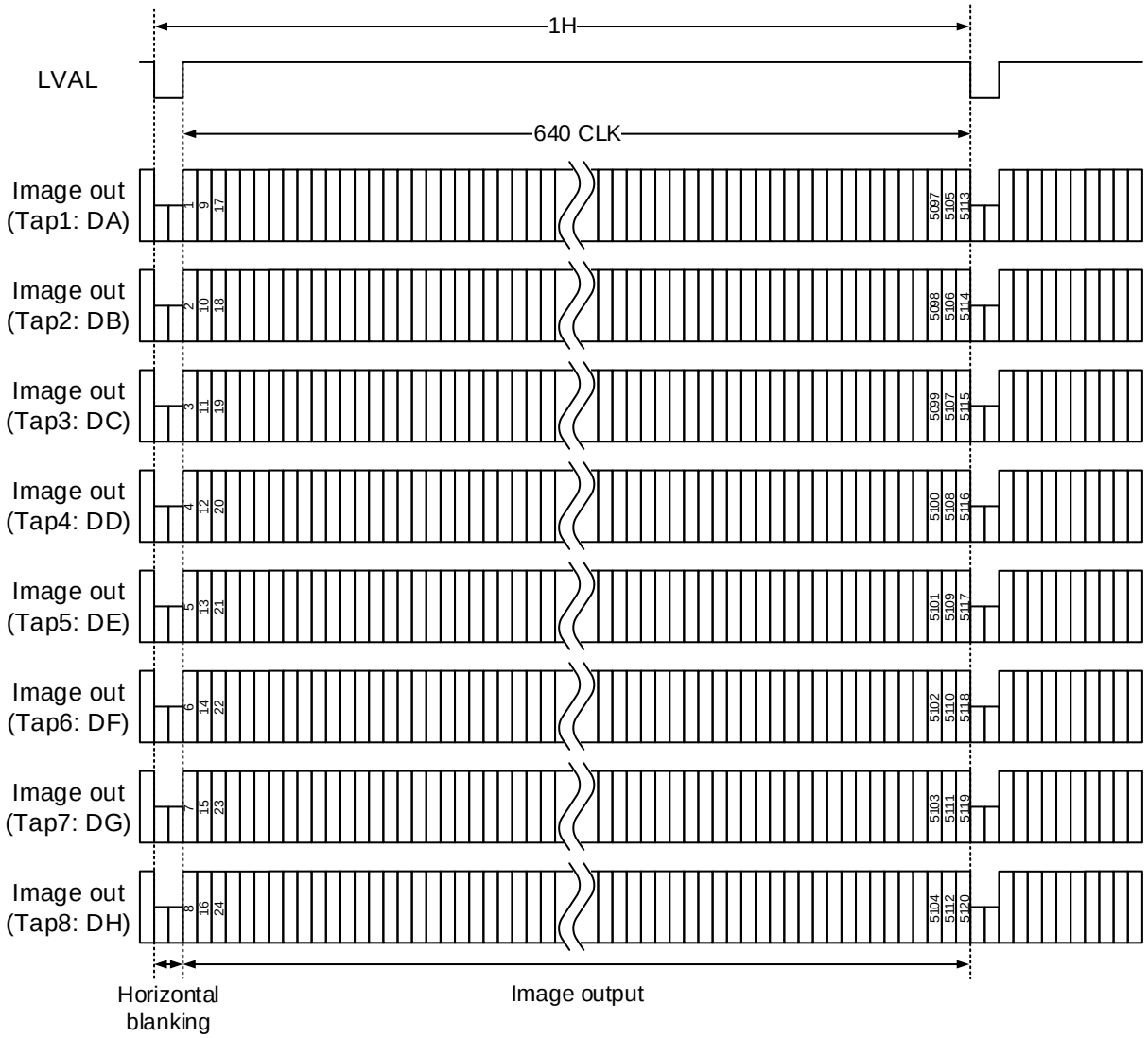
7.1.3 4TAP (1X4-1Y) / Horizontal: 5,120 pixels



Camera settings		Horizontal period (µsecond)	Horizontal Blanking period (CLK)
Camera Link Clock (MHz)	Camera Link output format		
84.857	8 / 10	15.201	10
66	8 / 10	19.545	10

* The horizontal blanking period (CLK) could be plus 1 CLK of above CLK due to influence of camera internal sync circuit.

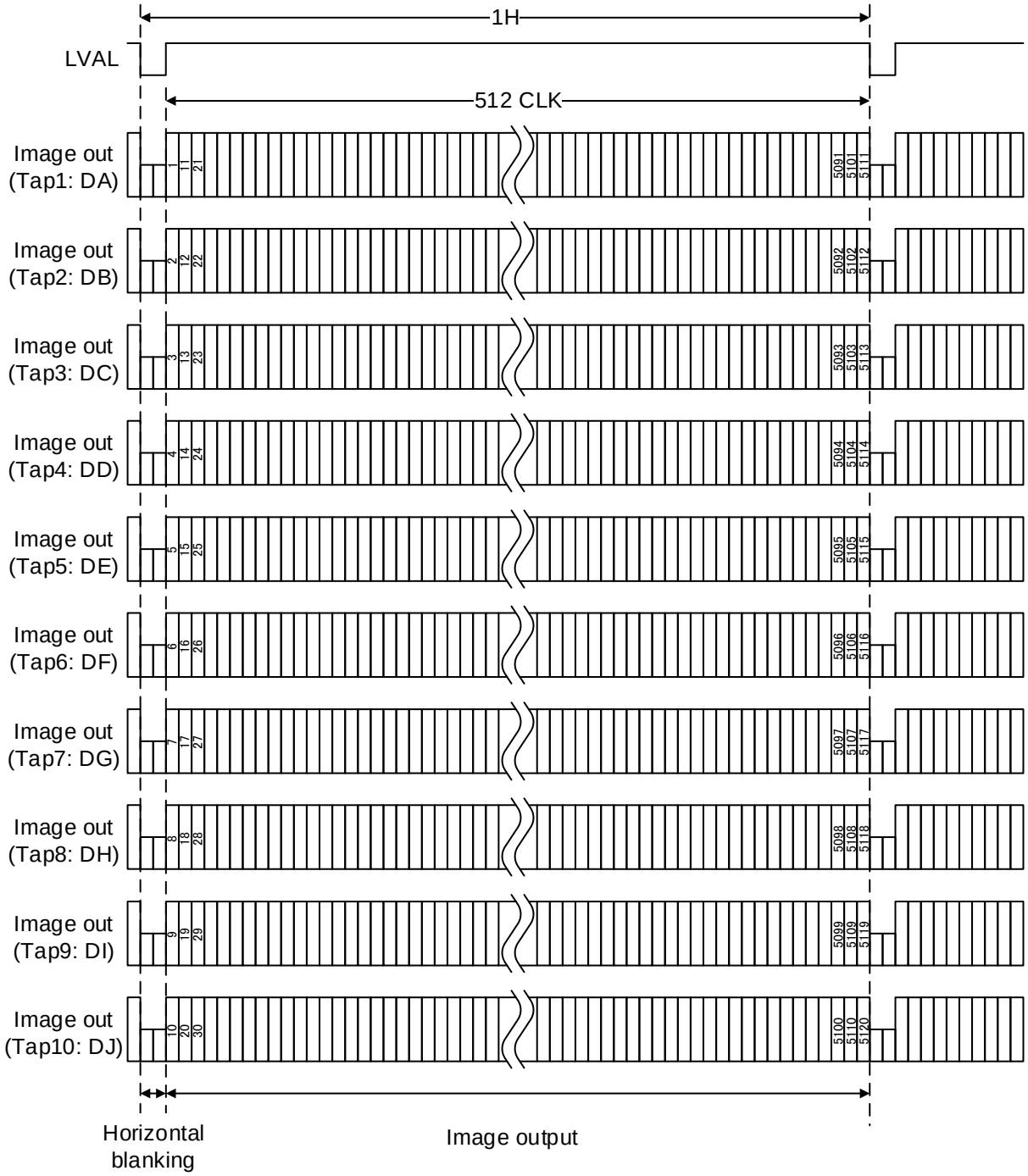
7.1.4 8TAP (1X8-1Y) / Horizontal: 5,120 pixels



Camera settings		Horizontal period (μsecond)	Horizontal Blanking period (CLK)
Camera Link Clock (MHz)	Camera Link output format		
84.857	8 / 10	7.683	12
66	8 / 10	9.848	10
39.8	8 / 10	16.363	8

* The horizontal blanking period (CLK) could be plus 1 CLK of above CLK due to influence of camera internal sync circuit.

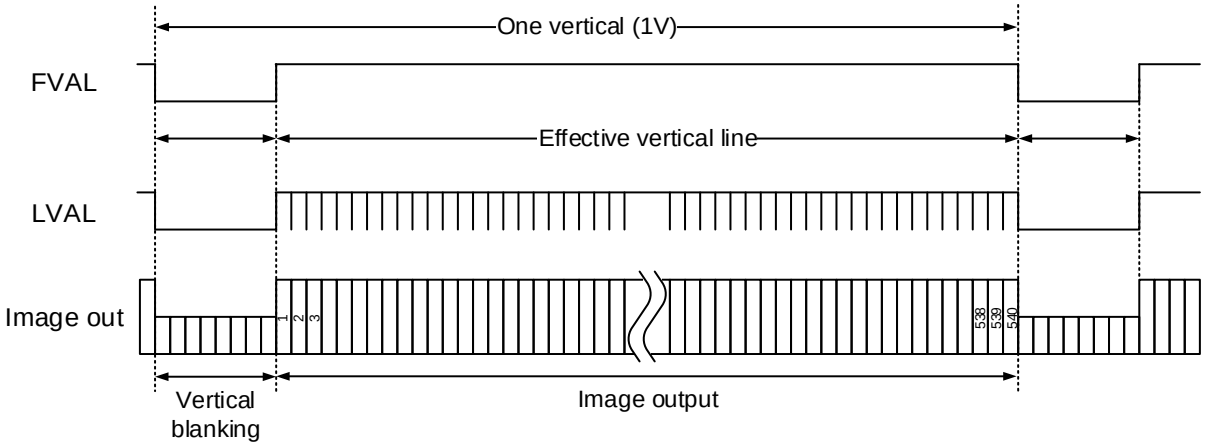
7.1.5 10TAP (1X10-1Y) / Horizontal: 5,120 pixels



Camera settings		Horizontal period (μsecond)	Horizontal Blanking period (CLK)
Camera Link Clock (MHz)	Camera Link output format		
84.857	8	6.268	20
66	8	7.878	8
39.8	8	13.130	8

* The horizontal blanking period (CLK) could be plus 1 CLK of above CLK due to influence of camera internal sync circuit.

7.2 Vertical timing



The table of vertical effective lines and vertical blanking (Free-run / continuous operation)

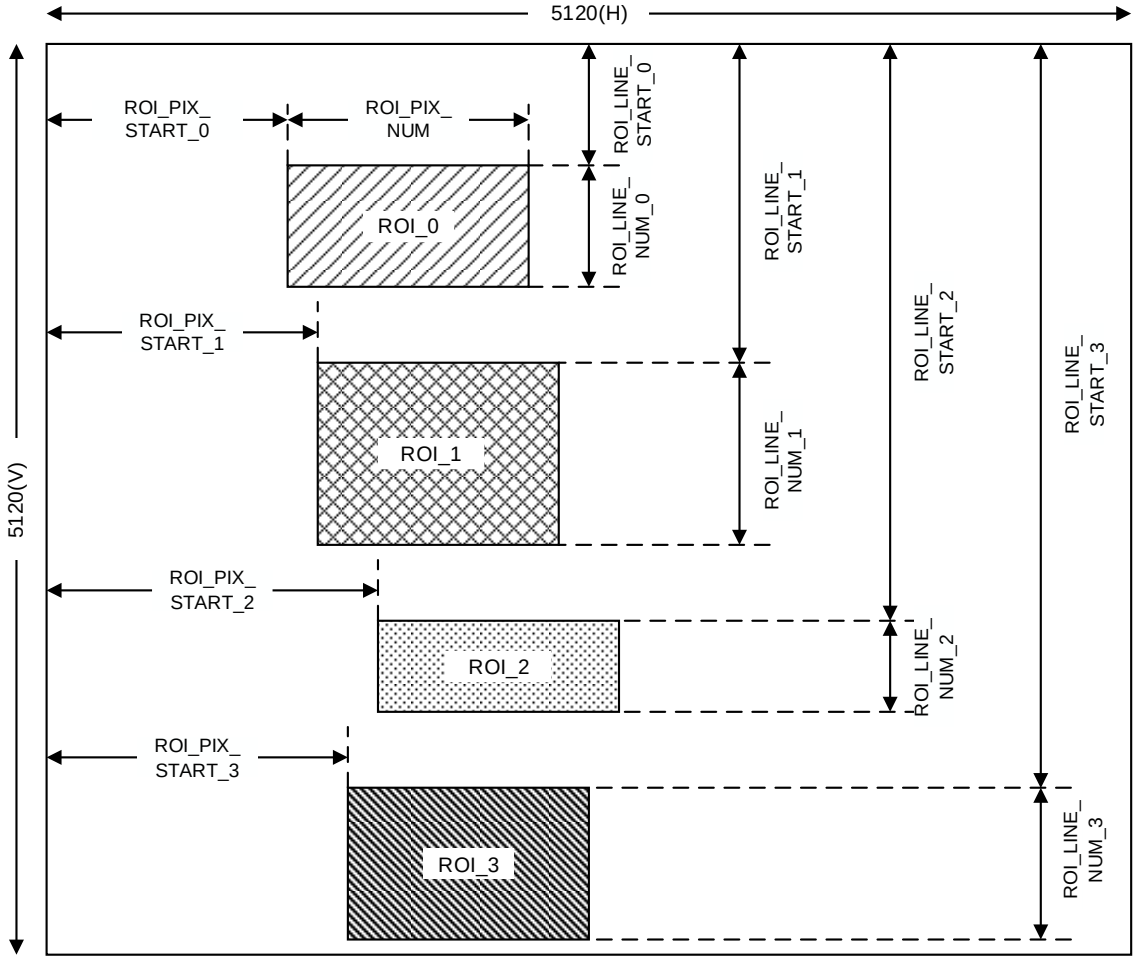
Camera Link output TAP number	Camera Link output bit number	Camera Link CLK (MHz)	Full scanning		
			Vertical blanking (µs)	Vertical effective lines (H)	Frame rate (fps)
2	8	84.857	1,970	5,120	6.35
	10	84.857	1,970		6.35
	12	84.857	1,697		6.36
3	8	84.857	1,313	5,118	9.52
		66	1,643		7.39
		39.6	2,761		4.44
4	8	84.857	935.6	5,120	12.66
		66	1,253		9.84
	10	84.857	935.6		12.66
		66	1,253		9.84
8	8	84.857	499	5,120	25.06
		66	622.7		19.53
		39.8	1,064		11.75
	10	84.857	499		25.06
		66	622.7		19.53
		39.8	1,064		11.75
10	8	84.857	407	5,120	30.72
		66	512.1		24.40
		39.8	853.6		14.64

8 Scanning Mode

8.1 ROI Output Timing

The maximum eight regions of ROI is configurable.
The horizontal start pixel (ROI_PIX_START_x), vertical start line (ROI_LINE_START_x) and vertical effective lines (ROI_LINE_NUM_x) are configurable for individual ROI region.
The horizontal effective pixels is common setting for all ROI regions.
The position of ROI region cannot overlap.
* Multi ROI and FFC function cannot use simultaneously.

e.g. Settings for four ROI regions



- The vertical settings for ROI region
  The region has more than 5,120 vertical start line (ROI_LINE_START_x) is invalid region.
  It is necessary to set vertical effective lines (ROI_LINE_NUM_x) and vertical start line (ROI_LINE_START_x) do not overlap other regions.
  When overlapping regions or total vertical effective lines becomes more than 5,120 lines, subsequent regions are invalid

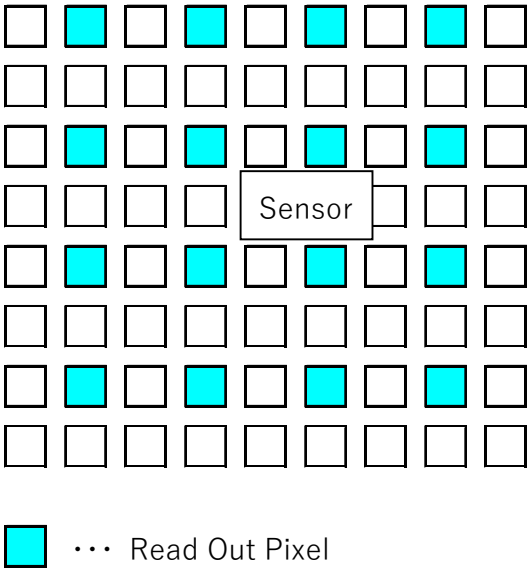
- The horizontal setting for ROI region
  The horizontal effective pixels (ROI_PIX_NUM) is common setting for all regions.

- The frame rate on ROI
  The frame rate could be increasing with total vertical effective lines (ROI_LINE_NUM_x) of active ROI regions.
  The horizontal effective pixels (ROI_PIX_NUM) does not influence frame rate.

8.2 Decimation

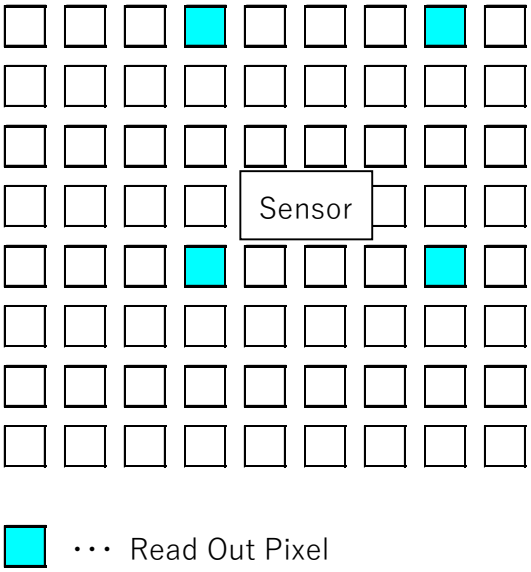
The horizontal and vertical thinning image is output.
The resolution of image becomes 1/4 (when selecting 2x2 decimation) or 1/16 (when selecting 4x4 decimation) based on setting of 8AH command.
The frame rate becomes twice faster when selecting 2x2 decimation, four times faster when selecting 4x4 decimaation.
* Decimation function cannot use with binning function.

2 x 2 decimation



··· Read Out Pixel

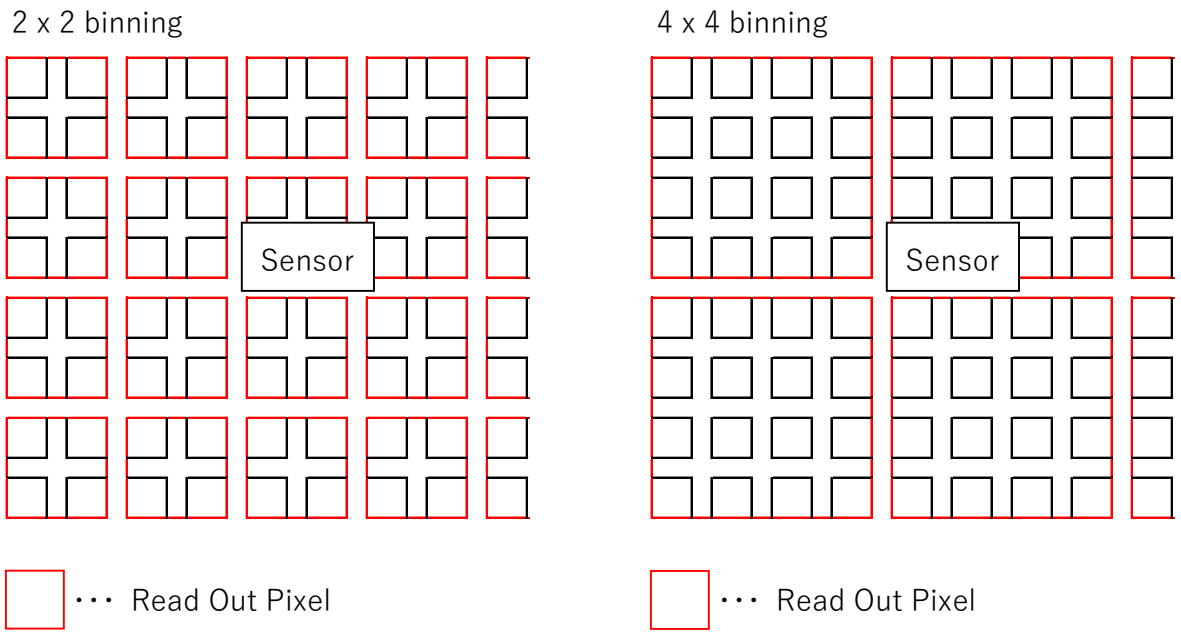
4 x 4 decimation



··· Read Out Pixel

8.3 Binning

The sensitivity is improving when using summing binning. The noise characteristics is improving when using averaging binning.
By using binning function, twice brighter, half resolution and twice faster frame rate image can be obtained.
The resolution of image becomes 1/4 (when selecting 2x2 decimation) or 1/16 (when selecting 4x4 decimation) based on setting of 89H command.
* Binning function is only available for monochrome camera.
* Binning function cannot use with decimation function.



8.4 Flat Field Correction Control (FFC function)

Flat Flied Correction (FFC) function is correcting shading on image that caused by characteristics of lens (amount of through light difference at center and edge of lens) and characteristics of light (uneven brightness level).

The FFC control tool (SendFFCCorrect) is required to proceed this.

9 Communication Protocol specifications

This camera has a communication function that enables external devises such as a PC, to change camera settings. Please use “CLCtrl2 (ver. 1.26 Beta8 or later)” communication software or use following communication protocol to communicate to the camera.

9.1 Communication method

UART (RS232C standard compliant), Binary communication

9.2 Communication settings

Baud rate	**9,600bps** / 38,400bps / 57,600bps / 115,200bps
Data bit	8bits
Parity	None
Stop bit	1bit
Flow control	None

9.3 Communication format

A. The sending data format from PC to camera is as follows:

SOF (8bits)	Device code (6bits)	Read / write (1bit)	Page selection (1bit)	Command code (8bits)	Data length (8bits)	Data (Write: Data length) (Read: 1 byte)	EOF (8bits)

B. The receiving data format from camera is as follows:

a. After sent the read command

SOF (8bits)	Data length (8bits)	Data (Data length byte)	EOF (8bits)

b. After sent the write command

SOF (8bits)	Data length (00H) (8bits)	Receiving code (8bits)	EOF (8bits)

C. Descriptions of the format

SOF	Start of the frame. Sets (or obtains) the value is as “02H” always.
Device code	Sets the device code of camera. Sets the value is as “000000” always.
Read / Write	Sets “0” when sending read command. Sets “1” when sending write command.
Page selection	Sets “0” when accessing to register of camera. Obtains the current data from register when sending read command. Replaces the data in register by sending data when sending write command. **The data in EEPROM does not replace.** Sets “1” when accessing to EEPROM of camera. Obtains the data from EEPROM when sending read command. Replaces the data in EEPROM by sending data when sending write command. The camera uses data in EEPROM when power on camera. The camera sends receiving code as “01H” to PC after data in EEPROM is replaced. The camera rejects any commands while data in EEPROM is replacing. (Approximately 5 mseconds / byte)
Command code	Sets the command code. Please refer “The camera control commands” for more details.
Data length	Sets (or obtains) the data length. (unit: byte) For receiving data: The data length is based on command after sent read command. The data length is “00H” after sent write command. For sending data: The data length is 1 byte when sending read command. The data length is based on command when sending write command.
Data	Sets (or obtains) the data based on command.
EOF	End of the frame Sets (or obtains) the value is as “03H” always.
Receiving code	Obtains the result of sending command. 01H: The command proceeded correctly (ACK) 10H: The command could not process correctly (NAC) 11H: The communication issue 14H: Timeout error

D. Command example

Send the read command to read 00H address data of register

02, 00, 00, 01, 00, 03

SOF, (Device code / Read / Register), Command code, Data length, Data, EOF

The return command

02, 01, 00, 03

9.4 Camera control commands

9.4.1 Camera commands list

Note. 1: The data unit of each command is 1 byte (8bits).
Note. 2: The data can be saved to EEPROM if “X” in “EEPROM” column in list.
Note. 3: The camera is operating with data of EEPROM when power on camera.

Command No.	R/W	EEPROM	Function	Default Data	Data Range
00 - 0FH			Reserved	-	-
10H	R/W	X	Camera function mode 1 (8bits: D[7..0])	00H	
11H	R/W	X	Camera function mode 2 (8bits: D[7..0])	08H	
12H	R/W	X	Camera function mode 3 (8bits: D[7..0])	40H	
13H	R/W	X	FFC enable (8bits: D[7..0])	00H	-
14H	R/W	X	Communication mode (8bits: D[7..0])	01H	
15 - 1FH			Reserved	-	-
20H	R/W	X	Exposure time of electronic shutter (24bits: D[7..0])	1,000	0 to 16,777,215
21H	R/W	X	Exposure time of electronic shutter (24bits: D[15..8])		
22H	R/W	X	Exposure time of electronic shutter (24bits: D[23..16])		
23 - 25H			Reserved	-	-
26H	R/W	X	Number of frames for bust trigger (16bits: D[7..0])	0	0 to 65,535
27H	R/W	X	Number of frames for bust trigger (16bits: D[15..8])		
28H	R/W	X	Delay time for trigger signal (8bits: D[7..0])	0	0 to 255
29H	R		Camera inside temperature (8bits: D[7..0])	Variable	-
29 - 30H			Reserved	-	-
31H	R/W	X	Digital gain (8bits: D[7..0])	0	0 to 255
32 - 37H			Reserved	-	-
38H	R/W	X	Clamp level (8bits: D[7..0])	10	0 to 63
39H			Reserved	-	-
3AH	R/W	X	White Balance R gain (8bits: D[7..0]) (*1)	64	0 to 255
3BH	R/W	X	White Balance B gain (8bits: D[7..0]) (*1)	64	0 to 255
3CH	R/W	X	White Balance GR gain (8bits: D[7..0]) (*1)	64	0 to 255
3DH	R/W	X	White Balance GB gain (8bits: D[7..0]) (*1)	64	0 to 255
3E - 3FH			Reserved	-	-
40H	R		CMOS temperature (8bits D[7..0])	Variable	
41 - 77H			Reserved	-	-

(*1) Only available for color model

Command No.	R/W	EEPROM	Function	Default Data	Data Range
78H	R/W	X	Test Pattern (1bit: D[0])	0	0 to 17
79 - 7FH			Reserved	-	-
80H	R/W	X	EEPROM control (1bit: D[0])	00H	-
81 - 88H			Reserved	-	-
89H	R/W	X	Binning control (2bit: D[1..0])	00H	-
8AH	R/W	X	Decimation control (1bit: D[0])	00H	-
8B - 8FH			Reserved	-	-
90H	R/W	X	Vertical ROI_A Start line (16bits: D[7..0])	0	0 to 5,118
91H	R/W	X	Vertical ROI_A Start line (16bits: D[15..8])		
90H	R/W	X	Vertical ROI_0 Start line (16bits: D[7..0])	0	0 to 5,118
91H	R/W	X	Vertical ROI_0 Start line (16bits: D[15..8])		
92H	R/W	X	Vertical ROI_1 Start line (16bits: D[7..0])	0	0 to 5,118
93H	R/W	X	Vertical ROI_1 Start line (16bits: D[15..8])		
94H	R/W	X	Vertical ROI_2 Start line (16bits: D[7..0])	0	0 to 5,118
95J	R/W	X	Vertical ROI_2 Start line (16bits: D[15..8])		
96H	R/W	X	Vertical ROI_3 Start line (16bits: D[7..0])	0	0 to 5,118
97H	R/W	X	Vertical ROI_3 Start line (16bits: D[15..8])		
98H	R/W	X	Vertical ROI_4 Start line (16bits: D[7..0])	0	0 to 5,118
99H	R/W	X	Vertical ROI_4 Start line (16bits: D[15..8])		
9AH	R/W	X	Vertical ROI_5 Start line (16bits: D[7..0])	0	0 to 5,118
9BH	R/W	X	Vertical ROI_5 Start line (16bits: D[15..8])		
9CH	R/W	X	Vertical ROI_6 Start line (16bits: D[7..0])	0	0 to 5,118
9DH	R/W	X	Vertical ROI_6 Start line (16bits: D[15..8])		
9EH	R/W	X	Vertical ROI_7 Start line (16bits: D[7..0])	0	0 to 5,118
9FH	R/W	X	Vertical ROI_7 Start line (16bits: D[15..8])		
A0H	R/W	X	Vertical ROI_0 Effective lines (16bits: D[7..0])	5,120	1 to 5,120 (*2) 2 to 5,120 (*3)
A1H	R/W	X	Vertical ROI_0 Effective lines (16bits: D[15..8])		
A2H	R/W	X	Vertical ROI_1 Effective lines (16bits: D[7..0])	0	0 to 5,120
A3H	R/W	X	Vertical ROI_1 Effective lines (16bits: D[15..8])		
A4H	R/W	X	Vertical ROI_2 Effective lines (16bits: D[7..0])	0	0 to 5,120
A5H	R/W	X	Vertical ROI_2 Effective lines (16bits: D[15..8])		
A6H	R/W	X	Vertical ROI_3 Effective lines (16bits: D[7..0])	0	0 to 5,120
A7H	R/W	X	Vertical ROI_3 Effective lines (16bits: D[15..8])		
A8H	R/W	X	Vertical ROI_4 Effective lines (16bits: D[7..0])	0	0 to 5,120
A9H	R/W	X	Vertical ROI_4 Effective lines (16bits: D[15..8])		
AAH	R/W	X	Vertical ROI_5 Effective lines (16bits: D[7..0])	0	0 to 5,120
ABH	R/W	X	Vertical ROI_5 Effective lines (16bits: D[15..8])		
ACH	R/W	X	Vertical ROI_6 Effective lines (16bits: D[7..0])	0	0 to 5,120
ADH	R/W	X	Vertical ROI_6 Effective lines (16bits: D[15..8])		
AEH	R/W	X	Vertical ROI_7 Effective lines (16bits: D[7..0])	0	0 to 5,120
AFH	R/W	X	Vertical ROI_7 Effective lines (16bits: D[15..8])		

(*2) Only available for monochrome model
(*3) Only available for color model

Command No.	R/W	EEPROM	Function	Default Data	Data Range
B0H	R/W	X	Horizontal ROI_0 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
B1H	R/W	X	Horizontal ROI_0 Start pixel (16bits: D[15..8])		
B2H	R/W	X	Horizontal ROI_1 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
B3H	R/W	X	Horizontal ROI_1 Start pixel (16bits: D[15..8])		
B4H	R/W	X	Horizontal ROI_2 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
B5H	R/W	X	Horizontal ROI_2 Start pixel (16bits: D[15..8])		
B6H	R/W	X	Horizontal ROI_3 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
B7H	R/W	X	Horizontal ROI_3 Start pixel (16bits: D[15..8])		
B8H	R/W	X	Horizontal ROI_4 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
B9H	R/W	X	Horizontal ROI_4 Start pixel (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default Data	Data Range
BAH	R/W	X	Horizontal ROI_5 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
BBH	R/W	X	Horizontal ROI_5 Start pixel (16bits: D[15..8])		
BCH	R/W	X	Horizontal ROI_6 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
BDH	R/W	X	Horizontal ROI_6 Start pixel (16bits: D[15..8])		
BEH	R/W	X	Horizontal ROI_7 Start pixel (16bits: D[7..0])	0	2TAP: 0 to 5,118 3TAP (Mono): 0 to 5,115 3TAP (Color) 0 to 5,112 4TAP: 0 to 5,116 8TAP: 0 to 5,112 10TAP: 0 to 5,110
BFH	R/W	X	Horizontal ROI_7 Start pixel (16bits: D[15..8])		
C0H	R/W	X	Horizontal ROI Effective pixels (16bits: D[7..0])	5,120	2TAP: 2 to 5,120 3TAP (mono): 3 to 5,118 3TAP (color): 6 to 5,118 4TAP: 4 to 5,120 8TAP: 8 to 5,120 10TAP: 10 to 5,120
C1H	R/W	X	Horizontal ROI Effective pixels (16bits: D[15..8])		
C2 - CFH			Reserved	-	-
D0H	R/W	X	Defective pixel correction control (8bits: D[7..0])	0	
D1H	R/W	X	Defective pixel correction coordinate number (16bits: D[7..0])	0	0 to 2,045
D2H	R/W	X	Defective pixel correction coordinate number (16bits: D[15..8])		
D3H	R/W	X	Defective pixel X position (Set) (16bits: D[7..0])	0	0 to 5,119
D4H	R/W	X	Defective pixel X position (Set) (16bits: D[15..8])		
D5H	R/W	X	Defective pixel Y position (Set) (16bits: D[7..0])	0	0 to 5,119
D6H	R/W	X	Defective pixel Y position (Set) (16bits: D[15..8])		
D7H	R/W	X	Defective pixel X position (Read) (16bits: D[7..0])	0	-
D8H	R/W	X	Defective pixel X position (Read) (16bits: D[15..8])		
D9H	R/W	X	Defective pixel Y position (Read) (16bits: D[7..0])	0	-
DAH	R/W	X	Defective pixel Y position (Read) (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default Data	Data Range
DB - DDH			Reserved	-	-
DEH	R/W	X	Defective pixel correction mode (2bits: D[1..0])	01H	
DF - EDH			Reserved	-	-
EEH	R/W	X	Camera function mode 6 (8bits: D[7..0])	07H	
EFH			Reserved	-	-
F0H	R/W	X	Signal selection for 6pin connector (8bits: D[7..0]	00H	
F1H	R/W	X	Signal setting/status for 6pin connector (8bits: D[7..0]	8XH	
F2 - FFH			Reserved	-	-

9.4.2 The Description of camera control commands
(The underline settings are factory default settings)

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>10H:
MOD1 [7..0]</td><td>[Camera function mode 1] Default data: MOD1 [7..0] = 00H
Sets the camera function mode.
<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>
<table>
<tr><td>D7</td><td>No Function</td><td colspan="2">Always sets as “0”</td></tr>
<tr><td>D6</td><td>Trigger Polarity</td><td>0: Positive</td><td>1: Negative</td></tr>
<tr><td>D5</td><td>Trigger Mode</td><td>0: Edge Preset</td><td>1: Pulse Width</td></tr>
<tr><td>D4</td><td>Binning Mode</td><td>0: Binning Off</td><td>1: Binning On</td></tr>
<tr><td>D3</td><td>Scanning Mode</td><td>0: Decimation Off</td><td>1: Decimation On</td></tr>
<tr><td>D2 to D0</td><td>No Function</td><td colspan="2">Always sets as “000”</td></tr>
</table></td></tr>
<tr><td>11H:
MOD2 [7..0]</td><td>[Camera function mode 2] Default data: MOD2 [7..0] = 08H
Sets the camera function mode.
<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>
<table>
<tr><td>D7 to D4</td><td>No Function</td><td colspan="2">Always sets as “0”</td></tr>
<tr><td rowspan="2">D6 to D5</td><td rowspan="2">Clock Speed</td><td>00: 84.857 MHz</td><td>01: 66 MHz</td></tr>
<tr><td>10: 39.6 MHz</td><td>11: No function</td></tr>
<tr><td>D4</td><td>No Function</td><td colspan="2">Always sets as “0”</td></tr>
<tr><td>D3</td><td>Operation Mode</td><td>0: Trigger</td><td>1: Free-run / Continuous</td></tr>
<tr><td>D2 to D0</td><td>No Function</td><td colspan="2">Always sets as “000”</td></tr>
</table>
* Note: While the camera is in trigger mode, image will not output without trigger signal input.</td></tr>
<tr><td>12H:
MOD3 [7..0]</td><td>[Camera function mode 3] Default data: MOD3 [7..0] = 40H
Sets the camera function mode.
<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>
<table>
<tr><td rowspan="2">D7 to D6</td><td rowspan="2">Output Format</td><td>00: 10bits</td><td>01: 8bits</td></tr>
<tr><td>10: 12bits</td><td>11: No Function</td></tr>
<tr><td>D5</td><td>Trigger Input Selection</td><td>0: CC1 on Camera Link</td><td>1: 2pin on Power/IO</td></tr>
<tr><td>D4</td><td>Overlap mode</td><td>0: Off</td><td>1: On</td></tr>
<tr><td>D3</td><td>No Function</td><td colspan="2">Always sets as "0"</td></tr>
<tr><td>D2</td><td>Vertical Image Flip</td><td>0: Off</td><td>1: Vertical Flip</td></tr>
<tr><td>D1</td><td>Horizontal Image Flip</td><td>0: Off</td><td>1: Horizontal Flip</td></tr>
<tr><td>D0</td><td>No Function</td><td colspan="2">Always sets as “0”</td></tr>
</table></td></tr>
<tr><td>13H:
FFC_EN [0]</td><td>[FFC enable] Default data: FFC_EN [7..0] = 00H
Sets the FFC mode.
<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>
<table>
<tr><td>D7 to D1</td><td>No Function</td><td colspan="2">Always sets as "0000000"</td></tr>
<tr><td>D0</td><td>FFC Mode</td><td>0: Off</td><td>1: On</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>14H:
UART [7..0]</td><td>[Communication mode] Default data: UART [7..0] = 01H
Sets the communication mode.
<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>
<table>
<tr><td>D7 to D5</td><td>No Function</td><td colspan="2">Always sets as "000"</td></tr>
<tr><td rowspan="3">D4 to D0</td><td rowspan="3">Communication Mode</td><td>00000: 38,400 bps</td><td>00001: 9,600 bps</td></tr>
<tr><td>00010: 57,600 bps</td><td>00011: 115,200 bps</td></tr>
<tr><td colspan="2">Other: No function</td></tr>
</table></td></tr>
<tr><td>20H: EXPOS [7:0]
21H: EXPOS [15:8]
22H:
EXPOS [23:16]</td><td>[Exposure time of electronic shutter] Default data: EXPOS [23..0] = 0, Data range: 0 to 16,777,215
Sets the preset shutter speed (exposure time) for electronic shutter.
When sets “0”, the maximum exposure time at maximum fps.

Exposure time (shutter speed) = 1 * EXPOS[23..0] (μseconds)</td></tr>
<tr><td>26H:
FRAME_NUM[7..0]
27H:
FRAME_NUM
[15..8]</td><td>[Number of frames for bust trigger] Default: FRAME_NUM[15..0] = 0, Data range: 0 to 65,535
Sets the number of frames acquiring by one trigger signal input.

When sets “0”, camera operates as “1”.</td></tr>
<tr><td>28H:
TRG_DELAY_NUM
[7:0]</td><td>[Delay time for trigger signal] Default data: TRG_DELAY_NUM[7..0] = 0, Data range: 0 to 255
Sets the delay time from trigger signal input to start exposure.
Delay time = 2 * TRG_DELAY_NUM[7..0] (μseconds)</td></tr>
<tr><td>29H:
TMP_SENSOR
[7..0]</td><td>[Camera inside temperature] Default: TMP_SENSOR[7..0] = Variable
Obtains the temperature (-128 to +127 deg.C) of inside of camera (temperature sensor on FPGA board)
<table>
<tr><th>Temperature [deg. C]</th><th>Value (Binary)</th><th>Value (Decimal)</th></tr>
<tr><td>100</td><td>0110 0100</td><td>100</td></tr>
<tr><td>5</td><td>0000 0101</td><td>5</td></tr>
<tr><td>0</td><td>0000 0000</td><td>0</td></tr>
<tr><td>-1</td><td>1111 11111</td><td>128</td></tr>
<tr><td>-5</td><td>1111 11011</td><td>123</td></tr>
</table></td></tr>
<tr><td>31H:
DIGITAL_GAIN
[7..0]</td><td>[Digital gain] Default: DIGITAL_GAIN[7..0] = 0, Data range: 0 to 255

Image output level = (Image input level - CLAMP[7..0]) x (1 + DIGIAL_GAIN[7..0] / 64) + CLAMP[7..0]

CLAMP[7..0]: Clamp level</td></tr>
<tr><td>38H:
CLAMP [7:0]</td><td>[Clamp level] Default data: CLAMP [7..0] = 10, Data range: 0 to 255
Sets the 8bits clamp level of black signal.</td></tr>
<tr><td>3AH:
WBR [7:0]</td><td>[White Balance R gain] Default data: WBR [7..0] = 0, Data range (WBR [7..0]): 0 to 255
Sets the Red gain on Bayer

Image level = (Input image level - CLAMP [7..0]) * WBR [7..0] / 64 + CLAMP [7..0]</td></tr>
<tr><td>3BH:
WBB [7:0]</td><td>[White Balance B gain] Default data: WBB [7..0] = 0, Data range (WBB [7..0]): 0 to 255
Sets the Blue gain on Bayer

Image level = (Input image level - CLAMP [7..0]) * WBB [7..0] / 64 + CLAMP [7..0]</td></tr>
<tr><td>3CH:
WBGR [7:0]</td><td>[White Balance GR gain] Default data: WBGR [7..0] = 0, Data range (WBGR [7..0]): 0 to 255
Sets the Green gain on Bayer GR line

Image level = (Input image level - CLAMP [7..0]) * WBGR [7..0] / 64 + CLAMP [7..0]</td></tr>
</table>

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>3DH:
WBGB [7:0]</td><td>[White Balance GB gain] Default data: WBGB [7..0] = 0, Data range (WBGB [7..0]): 0 to 255
Set the Green gain on Bayer GB line

Image level = (Input image level - CLAMP [7..0]) * WBGB [7..0] / 64 + CLAMP [7..0]</td></tr>
<tr><td>40H:
TMP_SENSOR _
PCB1 [7..0]</td><td>[Camera inside temperature] Default: TMP_SENSOR_PCB1[7..0] = Variable
Obtains the temperature (-128 to +127 deg.C) of inside of camera (temperature sensor on CMOS image sensor board)

<table>
<tr><th>Temperature [deg. C]</th><th>Value (Binary)</th><th>Value (Decimal)</th></tr>
<tr><td>100</td><td>0110 0100</td><td>100</td></tr>
<tr><td>5</td><td>0000 0101</td><td>5</td></tr>
<tr><td>0</td><td>0000 0000</td><td>0</td></tr>
<tr><td>-1</td><td>1111 11111</td><td>128</td></tr>
<tr><td>-5</td><td>1111 11011</td><td>123</td></tr>
</table>
</td></tr>
<tr><td>78H:
TESTP [7:0]</td><td>[Test Pattern] Default data: TESTP [7..0] = 00H
Sets the output test pattern.

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D1</td><td>No Function</td><td colspan="2">Always sets as “00000”</td></tr>
<tr><td>D0</td><td>Test Pattern</td><td>0: Off (image output)</td><td>1: Test patter output</td></tr>
</table>
</td></tr>
<tr><td>80H:
E2P [0]</td><td>[EEPROM control] Default data: E2P[0] = 00H
Controls the data writing to EEPROM.

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D1</td><td>No Function</td><td colspan="2">Always sets as “0000000”</td></tr>
<tr><td>D0</td><td>Data writes to EEPROM</td><td>0: Prohibited</td><td>1: Accept</td></tr>
</table>
Note: This bit is cleared to “0” automatically after data writes into EEPROM.</td></tr>
<tr><td>89H:
BINNING_CTL
[1..0]</td><td>[Binning control] Default data: BINNING_CTL [1..0] = 00H
Sets operational mode of binning

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D2</td><td>No Function</td><td colspan="2">Always sets as “000000”</td></tr>
<tr><td>D1</td><td>Binning mode</td><td>0: Summing</td><td>1: Averaging</td></tr>
<tr><td>D0</td><td>Binning setting</td><td>0: 2x2</td><td>1: 4x4</td></tr>
</table>
</td></tr>
<tr><td>8AH:
DECIMATION_CTL
[0]</td><td>[Decimation control] Default data: DECIMATION_CTL [0] = 00H
Sets operational mode of decimation.

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D1</td><td>No Function</td><td colspan="2">Always sets as “0000000”</td></tr>
<tr><td>D0</td><td>Decimation setting</td><td>0: 2x2</td><td>1: 4x4</td></tr>
</table>
</td></tr>
</table>

Command No.	Command Description
90H: ROI_LINE_START_0_L [7..0] 91H: ROI_LINE_START_0_H [15..8]	[Vertical ROI_0 Start line] Default data: ROI_LINE_START_0 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1
92H: ROI_LINE_START_1_L [7..0] 93H: ROI_LINE_START_1_H [15..8]	[Vertical ROI_1 Start line] Default data: ROI_LINE_START_1 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height of ROI_0 and ROI_1 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.
94H: ROI_LINE_START_2_L [7..0] 95H: ROI_LINE_START_2_H [15..8]	[Vertical ROI_2 Start line] Default data: ROI_LINE_START_2 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height from ROI_0 to ROI_2 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.
96H: ROI_LINE_START_3_L [7..0] 97H: ROI_LINE_START_3_H [15..8]	[Vertical ROI_3 Start line] Default data: ROI_LINE_START_3 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height from ROI_0 to ROI_3 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.
98H: ROI_LINE_START_4_L [7..0] 99H: ROI_LINE_START_4_H [15..8]	[Vertical ROI_4 Start line] Default data: ROI_LINE_START_4 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height from ROI_0 to ROI_4 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.
9AH: ROI_LINE_START_5_L [7..0] 9BH: ROI_LINE_START_5_H [15..8]	[Vertical ROI_5 Start line] Default data: ROI_LINE_START_5 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height from ROI_0 to ROI_5 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.
9CH: ROI_LINE_START_6_L [7..0] 9DH: ROI_LINE_START_6_H [15..8]	[Vertical ROI_6 Start line] Default data: ROI_LINE_START_6 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height from ROI_0 to ROI_6 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.

Command No.	Command Description
9EH: ROI_LINE_START_7_L [7..0] 9FH: ROI_LINE_START_7_H [15..8]	[Vertical ROI_7 Start line] Default data: ROI_LINE_START_7 [15..0] = 0, Data range: 0 to 5,118 Adjustable unit: 1 (monochrome), 2 (color) Sets the start line (vertical) of ROI. The actual start line of ROI = this value (ROI_LINE_START) + 1 * Total vertical height from ROI_0 to ROI_7 becomes more than 5,120 lines, this ROI region becomes invalid and not displaying.
A0H: ROI_LINE_NUM_0_L [7..0] A1H: ROI_LINE_NUM_0_H [15..8]	[Vertical ROI_0 Effective lines] Default data: ROI_LINE_NUM_0 [15..0] = 5,120, Data range: 1 to 5,120 (monochrome), 2 to 5,120 (color) Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI.
A2H: ROI_LINE_NUM_1_L [7..0] A3H: ROI_LINE_NUM_1_H [15..8]	[Vertical ROI_1 Effective lines] Default data: ROI_LINE_NUM_1 [15..0] = 0, Data range: 0 to 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.
A4H: ROI_LINE_NUM_2_L [7..0] A5H: ROI_LINE_NUM_2_H [15..8]	[Vertical ROI_2 Effective lines] Default data: ROI_LINE_NUM_2 [15..0] = 0, Data range: 0 to 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.
A6H: ROI_LINE_NUM_3_L [7..0] A7H: ROI_LINE_NUM_3_H [15..8]	[Vertical ROI_3 Effective lines] Default data: ROI_LINE_NUM_3 [15..0] = 0, Data range: 0 to 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.
A8H: ROI_LINE_NUM_4_L [7..0] A9H: ROI_LINE_NUM_4_H [15..8]	[Vertical ROI_4 Effective lines] Default data: ROI_LINE_NUM_4 [15..0] = 0, Data range: 0 to 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.
AAH: ROI_LINE_NUM_5_L [7..0] ABH: ROI_LINE_NUM_5_H [15..8]	[Vertical ROI_5 Effective lines] Default data: ROI_LINE_NUM_5 [15..0] = 0, Data range: 0to 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.
ACH: ROI_LINE_NUM_6_L [7..0] ADH: ROI_LINE_NUM_6_H [15..8]	[Vertical ROI_6 Effective lines] Default data: ROI_LINE_NUM_6 [15..0] = 0, Data range: 0to 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.
AEH: ROI_LINE_NUM_7_L [7..0] AFH: ROI_LINE_NUM_7_H [15..8]	[Vertical ROI_7 Effective lines] Default data: ROI_LINE_NUM_7 [15..0] = 0, Data range: 0 o 5,120 Adjustable unit: 1 (monochrome), 2 (color) Sets the effective lines (image height) of ROI. * When sets “0”, this and following other ROIs becomes invalid.

Command No.	Command Description
B0H: ROI_PIX_START_0_L [7..0] B1H: ROI_PIX_START_0_H [15..8]	[Horizontal ROI_0 Start pixel] Default data: ROI_PIX_START_0 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
B2H: ROI_PIX_START_1_L [7..0] B3H: ROI_PIX_START_1_H [15..8]	[Horizontal ROI_1 Start pixel] Default data: ROI_PIX_START_1 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,111 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
B4H: ROI_PIX_START_2_L [7..0] B5H: ROI_PIX_START_2_H [15..8]	[Horizontal ROI_2 Start pixel] Default data: ROI_PIX_START_2 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
B6H: ROI_PIX_START_3_L [7..0] B7H: ROI_PIX_START_3_H [15..8]	[Horizontal ROI_3 Start pixel] Default data: ROI_PIX_START_3 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
B8H: ROI_PIX_START_4_L [7..0] B9H: ROI_PIX_START_4_H [15..8]	[Horizontal ROI_4 Start pixel] Default data: ROI_PIX_START_4 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
BAH: ROI_PIX_START_5_L [7..0] BBH: ROI_PIX_START_5_H [15..8]	[Horizontal ROI_5 Start pixel] Default data: ROI_PIX_START_5 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
BCH: ROI_PIX_START_6_L [7..0] BDH: ROI_PIX_START_6_H [15..8]	[Horizontal ROI_6 Start pixel] Default data: ROI_PIX_START_6 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
BEH: ROI_PIX_START_7_L [7..0] BFH: ROI_PIX_START_7_H [15..8]	[Horizontal ROI_7 Start pixel] Default data: ROI_PIX_START_7 [15..0] = 0, Data range: 0 to 5,188 (2TAP), 0 to 5,115 (3TAP monochrome), 0 to 5,112 (3TAP color), 0 to 5,116 (4TAP), 0 to 5,112 (8TAP), 0 to 5,110 (10TAP) Adjustable unit: 1 (monochrome), 2 (color) Sets the start pixel (horizontal) of ROI.
C0H: ROI_PIX_NUM_L [7..0] C1H: ROI_PIX_NUM_H [15..8]	[Horizontal ROI Effective pixels] Default data: ROI_PIX_NUM [15..0] = 5,120, Data range: 2 to 5,120 (2TAP), 3 to 5,118 (3TAP monochrome), 6 to 5,118 (3TAP color), 4 to 5,120 (4TAP), 8 to 5,120 (8TAP), 10 to 5,120 (10TAP) Adjustable unit: 2 (2TAP), 3 (3TAP monochrome), 6 (3TAP color), 4 (4TAP), 8 (8TAP), 10 (10TAP) Sets the effective pixels (image width, DVAL, LVAL) of ROI.

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>D0H:
DEF_M[7..0]</td><td>[Defective pixel correction control] Default data: PDC0 [7..0] = 0

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7</td><td>Set coordinate of defective pixel position</td><td>0 to 1: Set the coordinate of defective pixel position
Sets the correspond positions in D2H to D5H registers to defective pixel coordinate number is assigned in D1H register.
(This bit is cleared to “0” automatically after sets coordinate of defective pixel position)</td></tr>
<tr><td>D6</td><td>Load coordinate of defective pixel position</td><td>0 to 1: Read the coordinate of defective pixel position
Reads the defective pixel coordinate number is assigned in D1H register corresponding position to D6H to D9H register.
(This bit is cleared to “0” automatically after reads coordinate of defective pixel position)</td></tr>
<tr><td>D5</td><td>Save coordinate of defective pixel position into EEPROM</td><td>0 to 1: Save the coordinate of defective pixel positions into EEPROM
All 512 coordinate numbers of defective pixel position information are saved into EEPROM.
(This bit is cleared to “0” automatically after saves coordinate of defective pixel positions)</td></tr>
<tr><td>D4 to D0</td><td>No Function</td><td>Always sets as "00000"</td></tr>
</table>
</td></tr>
<tr><td>D1H:
PDC1[7..0]
D2H:
PDC1[15..8]</td><td>[Defective pixel correction coordinate number] Default data: PDC1 [15..0] = 0
Sets the coordinate number of defective pixel correction.

<table>
<tr><td>D15</td><td>D14</td><td>D13</td><td>D12</td><td>D11</td><td>D10</td><td>D9</td><td>D8</td><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D15 to D0</td><td>Defective pixel correction coordinate number</td><td>0 to 2,045</td></tr>
</table>
</td></tr>
<tr><td>D3H:
PDC_WX [7..0]
D4H:
PDC_WX [15..8]</td><td>[Defective pixel X position (Set)] Default data: PDC_WX [15..0] = 0, Data range: 0 to 5,119
Sets the X (horizontal) coordinate position of defective pixel for set position.</td></tr>
<tr><td>D5H:
PDC_WY [7..0]
D6H:
PDC_WY [15..8]</td><td>[Defective pixel Y position (Set)] Default data: PDC_WY [15..0] = 0, Data range: 0 to 5,119
Sets the Y (vertical) coordinate position of defective pixel for set position.</td></tr>
<tr><td>D7H:
PDC_RX [7..0]
D8H:
PDC_RX [15..8]</td><td>[Defective pixel X position (Read)] Default data: PDC_RX [15..0] = 0
Sets the X (horizontal) coordinate position of defective pixel for read position.</td></tr>
<tr><td>D9H:
PDC_RY [7..0]
DAH:
PDC_RY [15..8]</td><td>[Pixel defect Y position (Read)] Default data: PDC_RY [15..0] = 0
Sets the Y (vertical) coordinate position of defective pixel for read position.</td></tr>
<tr><td>DEH:
DEF_M [7..0]</td><td>[Defective pixel correction mode] Default data: DEF_M [7..0] = 1

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D2</td><td>No Function</td><td colspan="2">Always sets as “0000000”</td></tr>
<tr><td>D1</td><td>Highlight corrected pixel</td><td>0: Disable</td><td>1: Enable</td></tr>
<tr><td>D0</td><td>Defective pixel correction</td><td>0: Disable</td><td>1: Enable</td></tr>
</table>
The corrected pixel is appeared with highlight when “Highlight corrected pixel” is enabled.</td></tr>
</table>

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<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>EEH:
MOD6 [7..0]</td><td>[The camera function mode] Default data: MOD6 [7..0] = 07H
Sets the camera TAP number for each setting.

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D3</td><td>No Function</td><td colspan="2">Always sets as “00000”</td></tr>
<tr><td rowspan="3">D2 to D0</td><td rowspan="3">TAP Configuration</td><td>1: 2TAP</td><td>2: 3TAP</td></tr>
<tr><td>3: 4TAP</td><td>7: 8TAP</td></tr>
<tr><td>9: 10TAP</td><td>Others: No Function</td></tr>
</table>
</td></tr>
<tr><td>F0H:
SP_CONT_L
[7..0]</td><td>[Signal assignment for 6pin connector] Default: SP_CONT_L [7..0] = 00H

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>6pin connector</td><td>No. 5</td><td>No. 4</td><td>Nol. 3</td><td>No. 2</td></tr>
<tr><td>Addr = F0H</td><td>SP1</td><td>SP2</td><td>SP3</td><td>SP4</td></tr>
<tr><td>0</td><td>Trigger after filtering output</td><td>Exposing signal</td><td>LVAL output</td><td>Trigger input / FVAL output</td></tr>
<tr><td>1</td><td>F1h.0</td><td>F1h.1</td><td>F1h.2</td><td>F1h.3</td></tr>
<tr><td>2</td><td>Trigger after filtering output</td><td>Exposing (HIGH) output</td><td>Exposing (LOW) output</td><td>Trigger input</td></tr>
<tr><td>3</td><td>Trigger after filtering output</td><td>LVAL output</td><td>FVAL output</td><td>Trigger input</td></tr>
<tr><td>7</td><td>LVAL output</td><td>CC1 output</td><td>Exposing (HIGHT) output</td><td>FVAL output</td></tr>
<tr><td>10</td><td>Trigger after filtering output (inverted)</td><td>LVAL output</td><td>FVAL output</td><td>Trigger input</td></tr>
<tr><td>Others</td><td colspan="4">No Function</td></tr>
</table>
</td></tr>
<tr><td>F1H:
SP_CONT_H
[7..0]</td><td>[Input / output setting / status of 6pin connector] Default: SP_CONT_H [7..0] = 8XH (* X is variable)

<table>
<tr><td>D7</td><td>D6</td><td>D5</td><td>D4</td><td>D3</td><td>D2</td><td>D1</td><td>D0</td></tr>
</table>

<table>
<tr><td>D7 to D4</td><td>SP4 Input / Output setting</td><td>0: Output</td><td>1: Input</td></tr>
<tr><td>D6</td><td>SP3 Input / Output setting</td><td>0: Output</td><td>1: Input</td></tr>
<tr><td>D5</td><td>SP2 Input / Output setting</td><td>0: Output</td><td>1: Input</td></tr>
<tr><td>D4</td><td>SP1 Input / Output setting</td><td>0: Output</td><td>1: Input</td></tr>
<tr><td>D3 to D0</td><td>Status of SP4 to SP1</td><td colspan="2">Display Input / Output status of SP4 to SP1</td></tr>
</table>
</td></tr>
</table>

9.4.3 Command sequence for data saves to EEPROM

Please follow the command sequence in below for data saves to EEPROM.

1) Sets “1” to command 80H.0 to accept “write control to EEPROM”.

2) Sends the EEPROM write command with data, which sets “1” for page selection.

3) The camera sends back one of below receiving code after EEPROM write command is proceed.
   01H: Data saves to EEPROM correctly
   10H: EEPROM write error

4) Command 80H.0 is changed to “0” automatically after EEPROM write command is proceed.

Note.1) The data does not save into EEPROM when command 80H.0 is “0”.

Note.2) The data of multiple continuous commands can save to EEPROM by one sets of above sequence (1) to 4)).
   e.g. Multiple continuous command: “10H, 11H, 12H and 13H” or “22H, 23H and 24H”.

Note.3) When save the data of multiple commands, which is not continuous commands, to EEPROM, it is necessary to operate multiple sets of above sequence (1) to 4)).
   e.g. Multiple commands: “10H, 13H, 19H and 1BH” or “20H, 23H and 25H”.

10 Revision History

Rev	Date	Changes	Note
00	2021/01/28	New Document	

Note: Product specifications would be changed without notification.

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