VGA CMOS Monochrome / Color Camera Link Camera

STC-CMB33PCL (VGA, Monochrome)
STC-CMC33PCL (VGA, Color)

Product Specifications

OMRON SENTECH CO., LTD.

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Product Precautions

- Handle the camera with care. Do not abuse the camera. Avoid striking or shaking it. Improper handling or storage could damage the camera.
- Do not pull or damage the camera cable.
- During camera use, do not wrap the unit in any material. This will cause the internal temperature of the unit to increase.
- Do not expose the camera to moisture, or do not try to operate it in wet areas.
- Do not operate the camera beyond its temperature, humidity and power source ratings.
- While the camera is not being used, keep the lens or lens cap on the camera to prevent dust or contamination from getting in the Sensor or filter area and scratching or damaging this area.
- Do not keep the camera under the following conditions:
    - In wet, moist, and high humidity areas
    - Under hot direct sunlight
    - In high temperature areas
    - Near an object that releases a strong magnetic or electric field
    - Areas with strong vibrations
- Apply the power that satisfies the requirements specified in this document to the camera.
- Use a soft cloth to clean the camera. Use pressured air spray to clean the surface of the glass. DO not scratch the surface of the glass.
- The camera is a general-purpose electronic device; using the camera for the equipment that may threaten human life or cause dangers to human bodies directly in case of failure or malfunction of the camera is not guaranteed. Use the camera for special purposes at your own risk.

1 Introduction

This document describes the specifications and users guide of cameras as bellow.

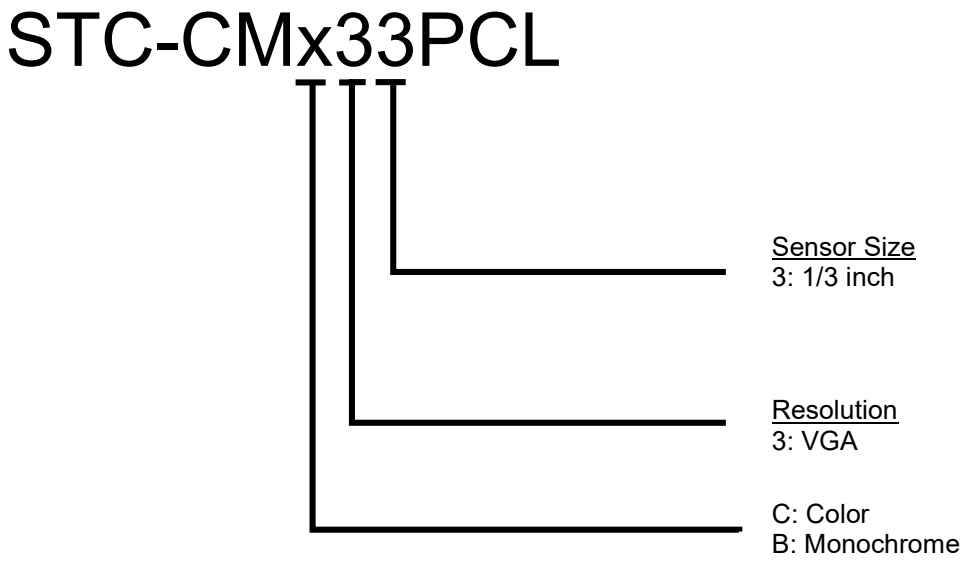
STC-CMB33PCL	(VGA Monochrome)
STC-CMC33PCL	(VGA Color)

1.1 Features

- CMOS Sensor(Global Shutter)
- Camera Link (Medium, Base Configuration)
- 3 / 2 TAP, 8 / 10 / 12bits
- PoCL

This model of cameras is Camera Link camera on COMS Sensor (Global Shutter). Medium.Base Configuration is available. The maximum allowed frame rate is 432 fps (8bits / 10bits / 12bits, 2TAP / 3TAP)

1.2 Naming Specification

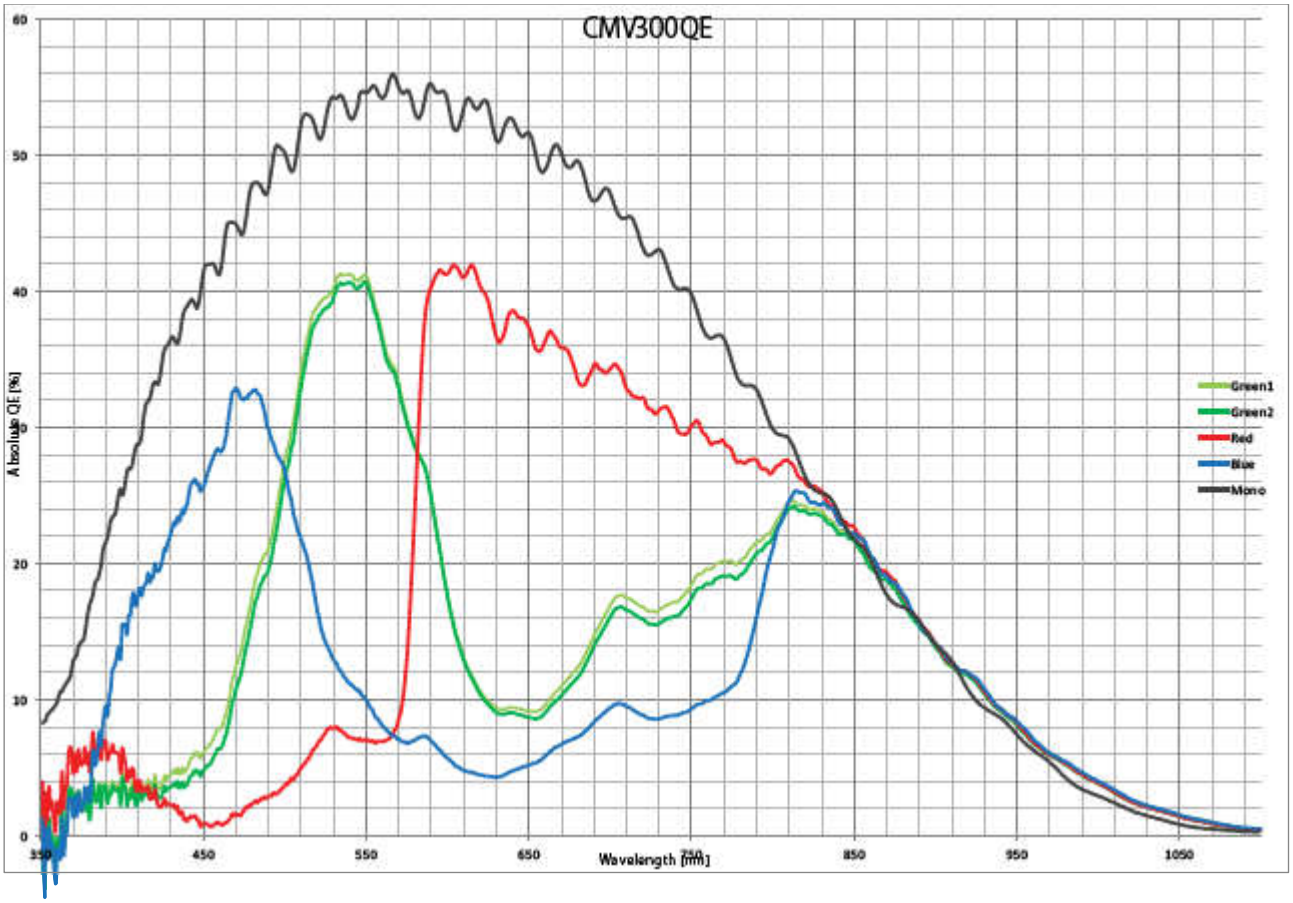


2 Specifications

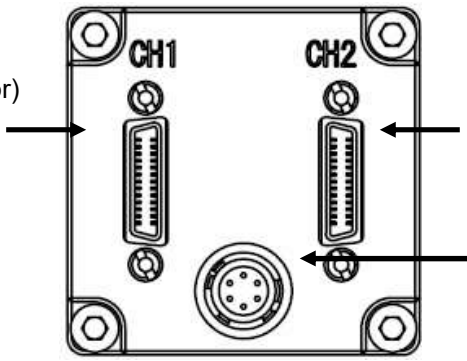
2.1 Electronic specifications / Mechanical specifications / Environmental specifications

Product			STC-CMC33PCL		STC-CMB33PCL
Electronic specifications	Imager		1/3" VGA color progressive CMOS (CMOSIS: CMV300)		1/3" VGA monochrome progressive CMOS (CMOSIS: CMV300)
	Active picture elements		642 (H) x 484 (V)		
	Cell size		7.4 (H) x 7.4 (V) µm		
	Scanning system		Progressive		
	Scanning method		Full scanning, Variable ROI		Full scanning, Variable ROI
	Frame rate Vertical frequency of Camera Link output		1X2-1Y 1X3-1Y	8bits / 10bits / 12bits 8bits / 10bits / 12bits	432 Hz
	Pixel frequency o Camera Link output		1X2-1Y 1X3-1Y	8bits / 10bits / 12bits 8bits / 10bits / 12bits	84 MHz 56 MHz
	Noise level (8bit output)		Less than 3 Digit (Gain 0 dB)		
	Sync. System		Internal		
	Video output	8bits / 10bits / 12bits	Medium configuration: 3TAP 10 / 12bits Base configuration: 2TAP 8 / 10 / 12bits / 3TAP 8bits		
	Shutter speed		20 µseconds to 16.777 seconds (in µseconds)		
	Digital gain		1x to 5x		
	Gamma		1.0		
	Power	Input voltage	12Vdc +/- 1.5V (PoCL or Power / IO connector)		
		Consumption	Less than 2.0 W		
	Operation mode		Free-run / Edge preset trigger (V-reset) / Pulse width trigger (V-reset)		
	Communication		RS232 via Camera Link connector		
Mechanical specifications	Dimensions		40 (W) x 40 (H) x 38 (D) mm (Excluding the connector)		
	Optical filter		No IR cut filter		
	Material		Aluminum alloy		
	Lens mount		C mount		
	Interface connector		Camera Link connector: SDR connector x 2 Power/IO connector: HR10A-7R-6PB (Hirose) or equivalent		
	Weight		Approximately 94 g		
Environmental	Operational temperature		-5 to 45 deg. C		
	Storage temperature		-30 to 65 deg. C		
	Vibration		20 Hz to 200Hz to 20Hz (5 min. / cycle), acceleration 10 G, XYZ 3 directions 30 min. each, 6 cycles		
	Shock		Acceleration 38 G, half amplitude 6 ms, XYZ 3 directions 3 times each		
	Standard compliancy		EMS: EN61000-6-2, EMI: EN55011 (Class A)		
	RoHS		RoHS compliance		

2.2 Spectral Sensitivity Characteristics



2.3 Connector Specifications



2.3.1 Camera Link connectors:

SDR (3M) equivalent x 2

(CAUTION)
This product is PoCL type.
When the frame grabber board and the cable are applicable for the PoCL, the frame grabber board supplies the power to the camera. In this case, please DO NOT supply the power from the Power / IO connector.

When the frame grabber board and the cable are NOT applicable for the PoCL, please input the power from the Power/IO connector.

When the camera uses as the Base configuration, please the Camera Link cable connects to the CH1 connector.
When the camera uses as the Medium configuration, please two Camera Link cables connect to the CH1 and CH2 connectors.

Pin assignment

CH1: 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

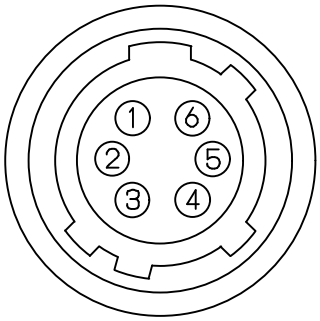
CH2: Medium Camera Link Connector

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

2.4 Power / IO connector: HR10A-7R-6PB (Hirose) or equivalent.
This connector is for 12Vdc power input and the input and output signals.
The trigger input and sync input /output signals can be assigned through the camera setting communication.
Please use HR10A-7P-6S (Hirose) or equivalent connector for the cable.

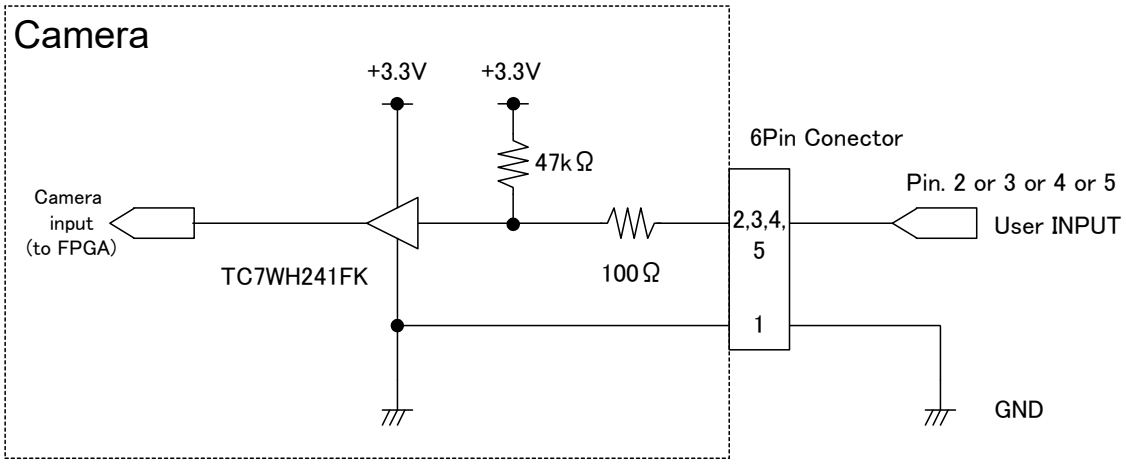
Pin assignment

Pin No.	Signal name	IN / OUT		Voltage	
				Low (Low)	High (High)
1	GND	IN		0V	
2	SP-4	IN / OUT	IN	0 to +0.99V	+2.3 to +5.0 V
			OUT	0V	+3.3V
3	SP-3	IN / OUT	IN	0 to +0.99V	+2.3 to +5.0 V
			OUT	0V	+3.3V
4	SP-2	IN / OUT	IN	0 to +0.99V	+2.3 to +5.0 V
			OUT	0V	+3.3V
5	SP-1	IN / OUT	IN	0 to +0.99V	+2.3 to +5.0 V
			OUT	0V	+3.3V
6	+12Vdc	IN		+12V	

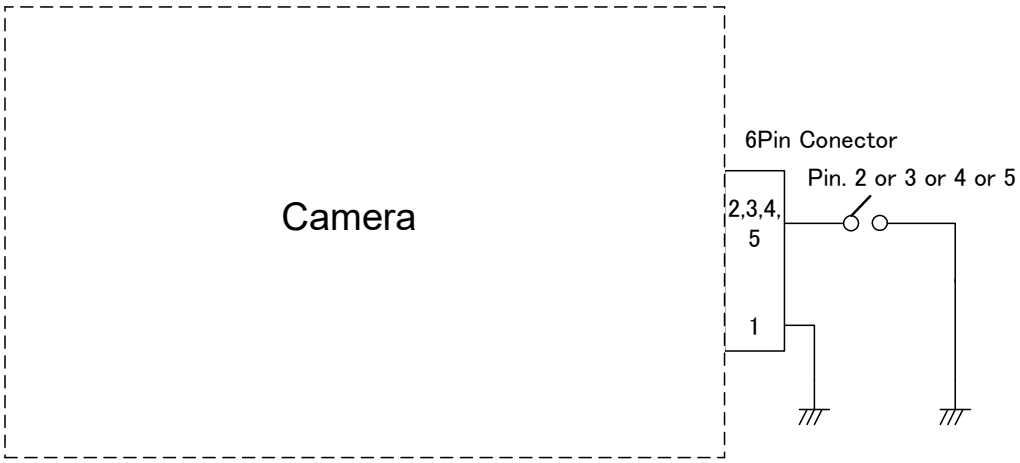


Trigger input signal can be assigned either on Camera Link connector (CC1) or on the No. 2 pin of the power / IO connector through the camera setting communication.

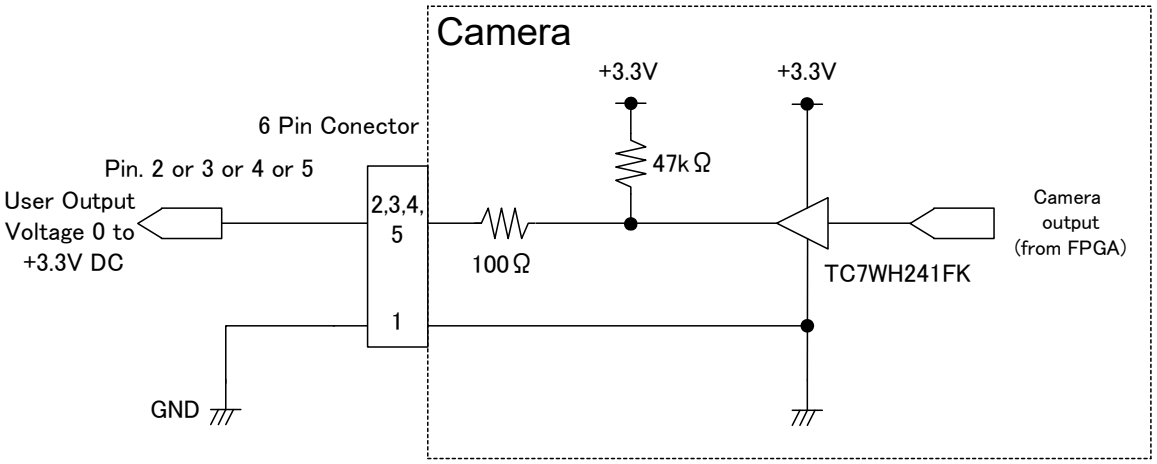
Input Signal Circuit



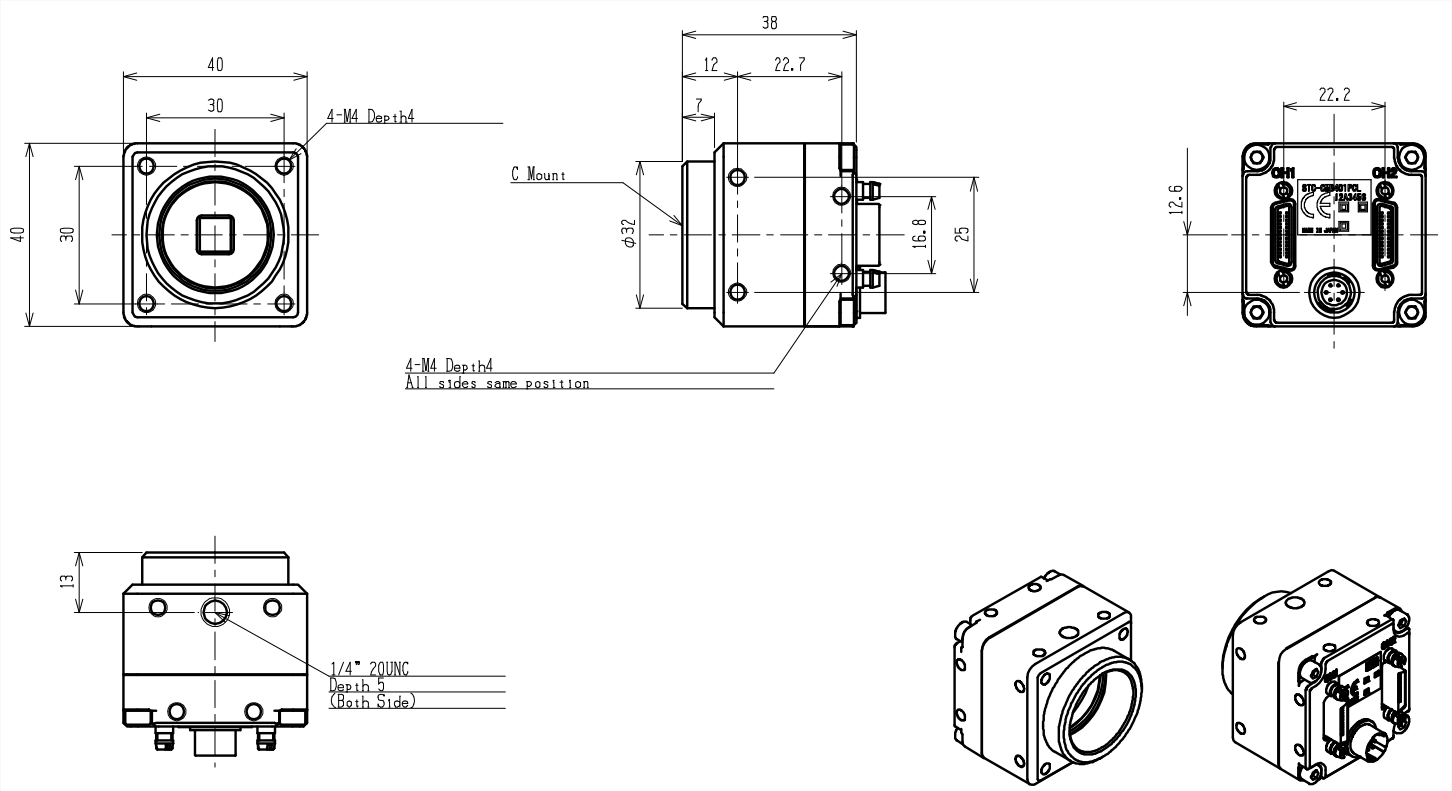
Input Signal Circuit Examples



Output Signal Circuit/ Examples



2.5 Dimensions



Unit: mm

3 Camera Installation

Below equipment are required to use the camera.

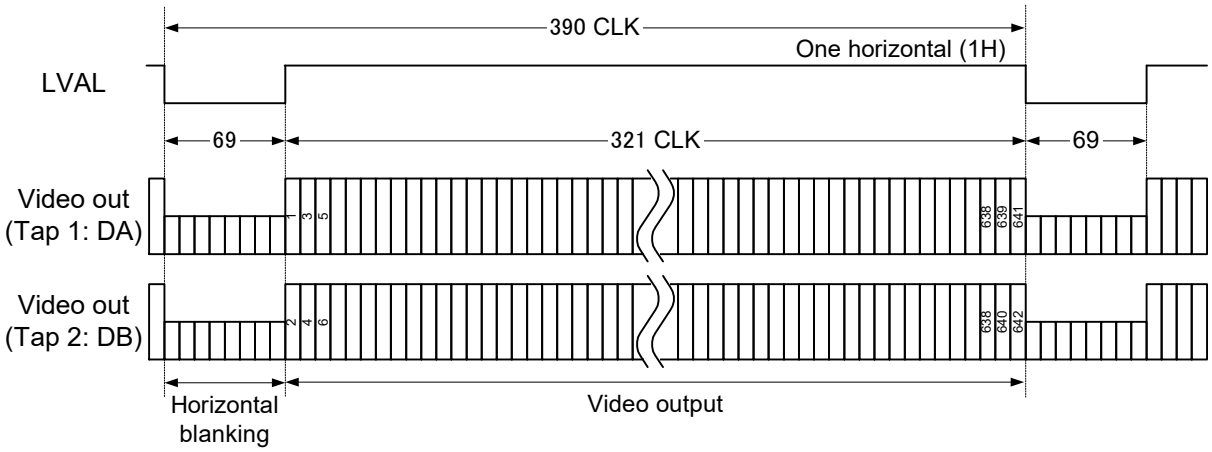
- The camera control software or the serial communication software, to access the camera registers (settings).
  Please refer “7 Control Software” for more details of the camera control software.
  Please refer “6 Communication Protocol Specifications” for more details of camera registers (settings).
- Camera Link Cable x 2 (SDR Connector : Camera side)
  When using on Full Configuration, please use the cable that has qualification.
- The Base or Medium configuration supported Camera Link frame grabber board is required.
  The Medium configuration supported Camera Link frame grabber board is required based on the camera operation mode.
  Please use the PoCL supported Camera Link frame grabber board when using the PoCL.

4 Camera Output Timing Charts

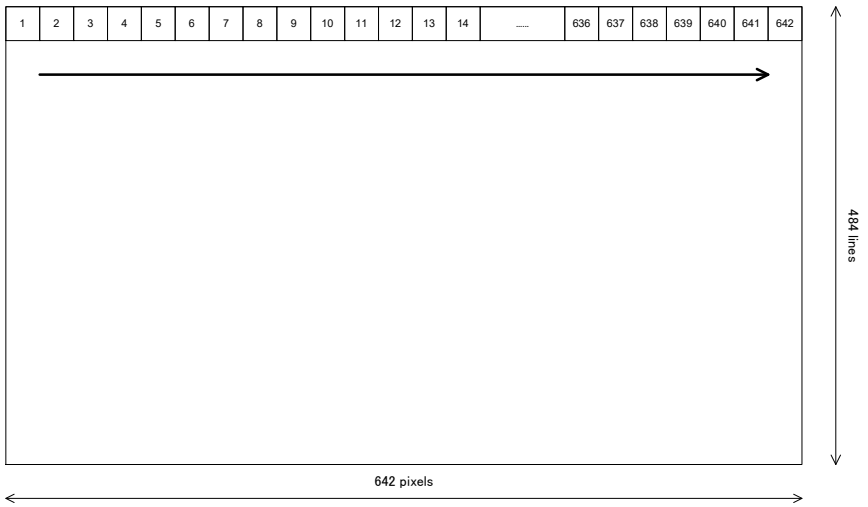
4.1 Horizontal timings

4.1.1 2 Taps (1X2-1Y) / Horizontal: 642 pixels

1CLK = 11.9 nsec.



The pixel order for the image



TAP1: DA output pixels

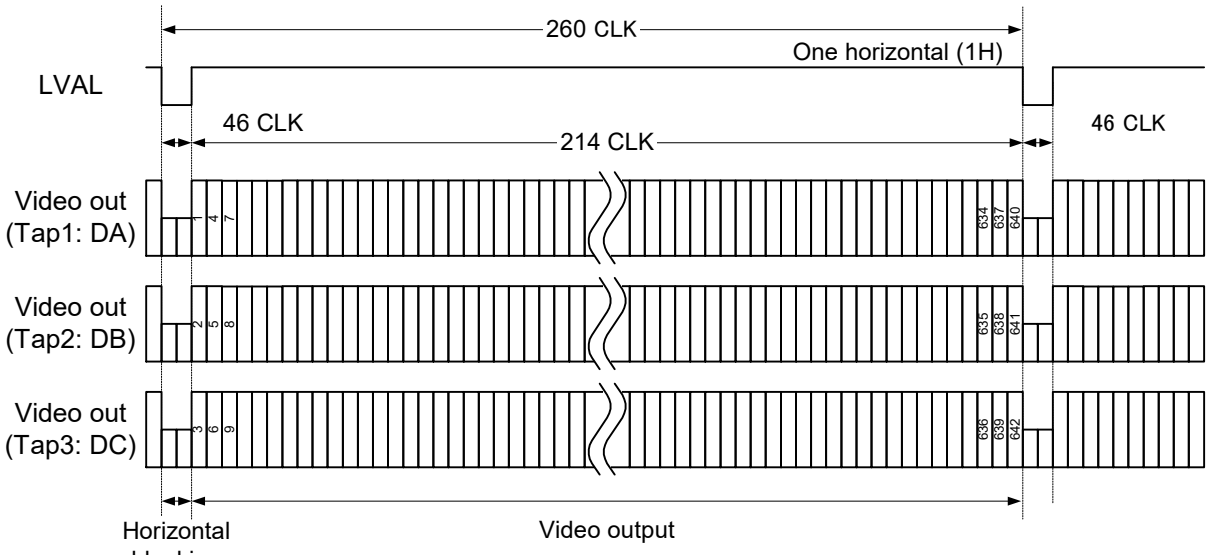
1	3	5	7	9	11	13	.....	629	631	633	635	637	639	641

TAP2: DB output pixels

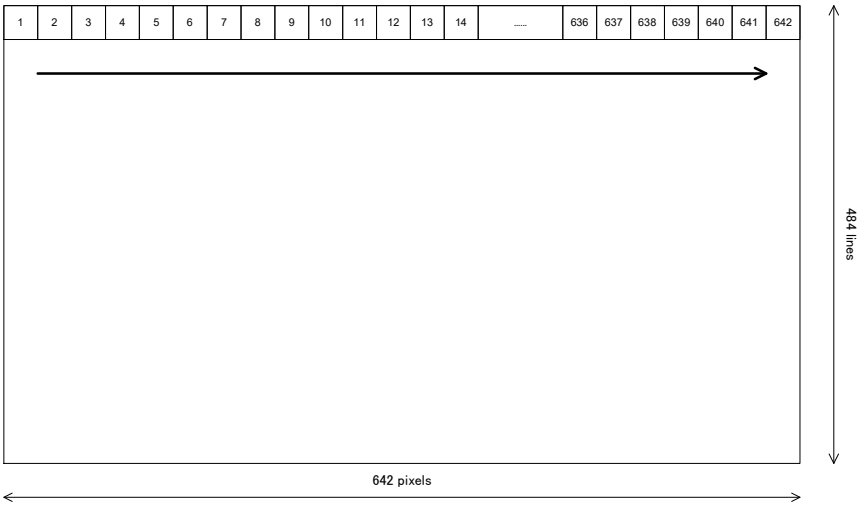
2	4	6	8	10	12	14	.....	630	632	634	636	638	640	642

4.1.2 3 Taps (1X3-1Y) / Horizontal: 642 pixels

1CLK = 17.857 nsec.

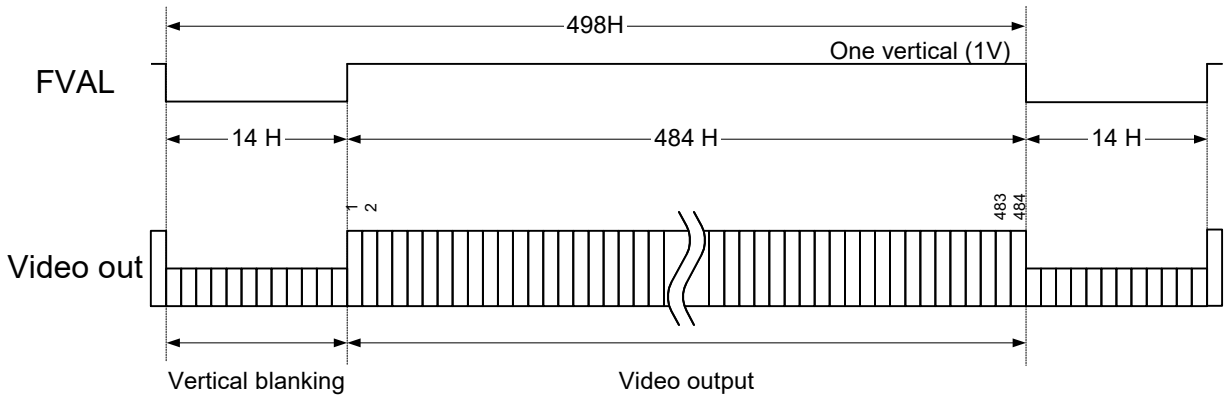


The pixel order for the image



TAP1: DA output pixels	1	4	7	10	13	16	19	.....	622	625	628	631	634	637	640
TAP2: DB output pixels	2	5	8	11	14	17	20	.....	623	626	629	632	635	638	641
TAP3: DC output pixels	3	6	9	12	15	18	21	.....	624	627	630	633	636	639	642

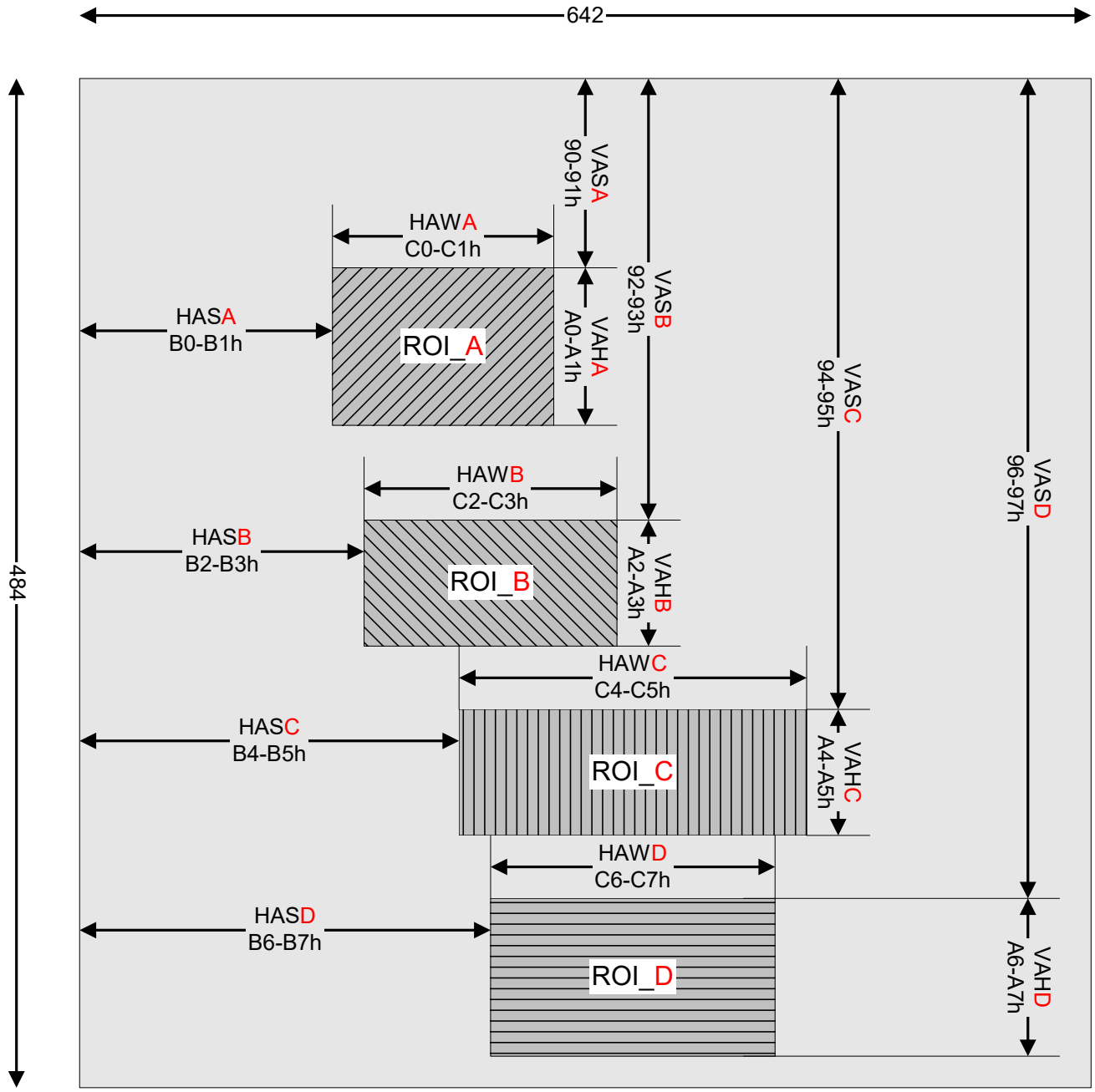
4.2 Vertical timings



Mode (EEH)	Tap Number	Configuration	CameraLink Output PixelClock Frequency(MHz)	Horizontal Pixel (Pixel)	FPS	Camera Link Output Bit
0	2	Base	84.0	648	432	8/10/12
1	3	Base / Medium	56.0	648	432	8/10/12

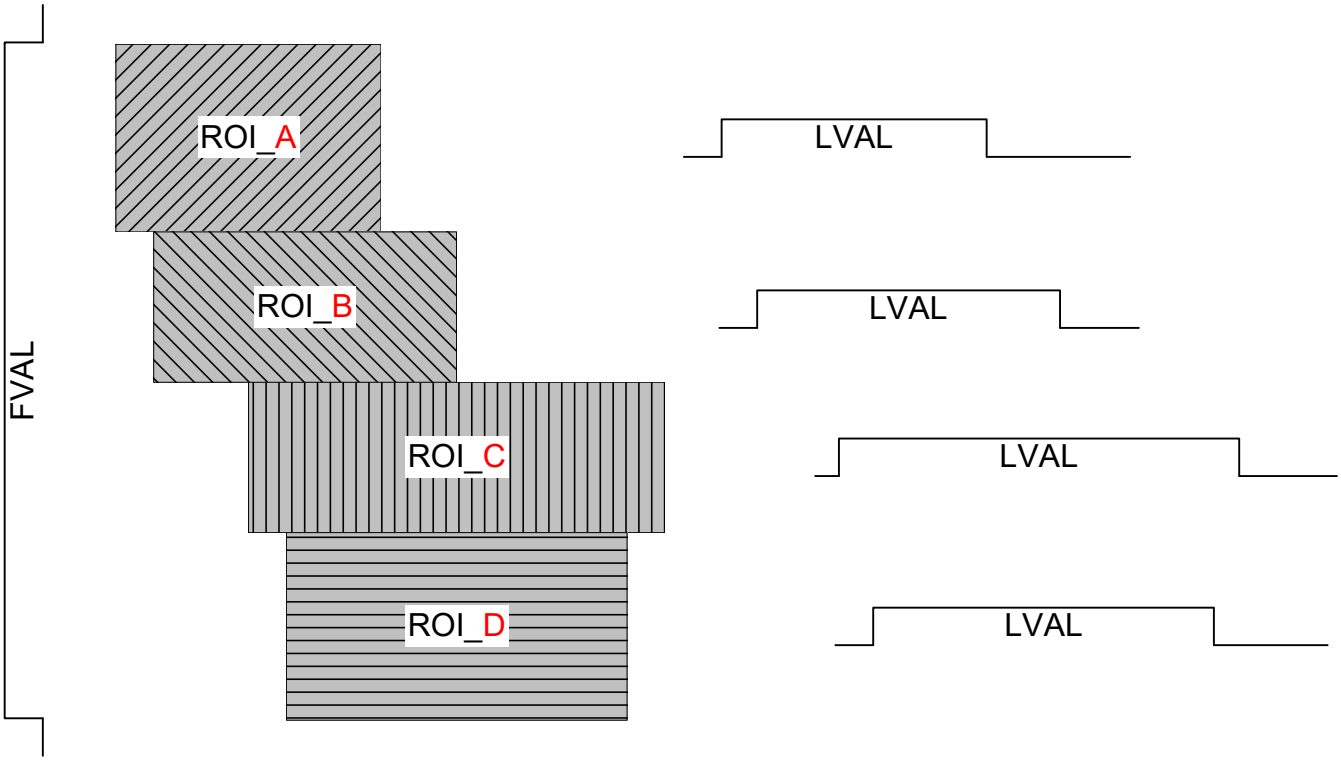
4.3 ROI Output Timing

The maximum 7 ROI regions are configurable for this camera.



This is example for 4 ROI regions configuration.
The vertical start line and the vertical effective lines are selectable for the individual ROI region.
Please refer “6 Communication Protocol Specifications” for more details.

The Camera Link output image for the multiple ROI configuration.



This is example for 4 ROI regions configuration. The configured ROI regions are output continuously.

The configured ROI regions are output continuously.
The horizontal pixels are changeable by width setting.

Normally, the horizontal width of LVAL and DVAL is same.
The horizontal width of LVAL can be fixable.

ROI configuration for the color model.
The vertical start line (VAS*) and the vertical effective lines (VAH*) are changeable in 2 lines.
The horizontal start pixel (HAS*) and the horizontal effective pixels (HAW*) are changeable in 2 pixels.

4.4 Camera Link bit assignment

Base Configuration

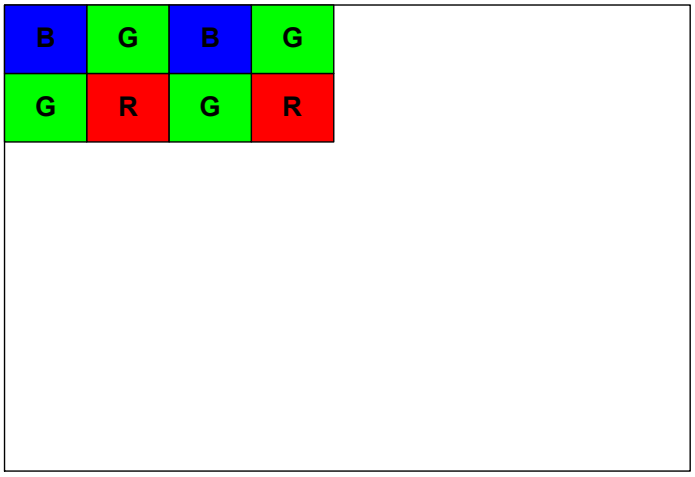
		xTAP Number		
	Port/bit	8bit x2～3	10bit x2	12bit x2
Connector1	Port A0	A0	A0	A0
	Port A1	A1	A1	A1
	Port A2	A2	A2	A2
	Port A3	A3	A3	A3
	Port A4	A4	A4	A4
	Port A5	A5	A5	A5
	Port A6	A6	A6	A6
	Port A7	A7	A7	A7
	Port B0	B0	A8	A8
	Port B1	B1	A9	A9
	Port B2	B2	nc	A10
	Port B3	B3	nc	A11
	Port B4	B4	B8	B8
	Port B5	B5	B9	B9
	Port B6	B6	nc	B10
	Port B7	B7	nc	B11
	Port C0	C0	B0	B0
	Port C1	C1	B1	B1
	Port C2	C2	B2	B2
	Port C3	C3	B3	B3
	Port C4	C4	B4	B4
	Port C5	C5	B5	B5
	Port C6	C6	B6	B6
	Port C7	C7	B7	B7

Medium Configuration

		xTAP Number	
	Port/bit	10bit x3	12bit x3
Connector1	Port A0	A0	A0
	Port A1	A1	A1
	Port A2	A2	A2
	Port A3	A3	A3
	Port A4	A4	A4
	Port A5	A5	A5
	Port A6	A6	A6
	Port A7	A7	A7
	Port B0	A8	A8
	Port B1	A9	A9
	Port B2	nc	A10
	Port B3	nc	A11
	Port B4	B8	B8
	Port B5	B9	B9
	Port B6	nc	B10
	Port B7	nc	B11
	Port C0	B0	B0
	Port C1	B1	B1
	Port C2	B2	B2
	Port C3	B3	B3
	Port C4	B4	B4
	Port C5	B5	B5
	Port C6	B6	B6
	Port C7	B7	B7

	Port/bit	10bit x3～4	12bit x3～4
Connector2	Port D0	D0	D0
	Port D1	D1	D1
	Port D2	D2	D2
	Port D3	D3	D3
	Port D4	D4	D4
	Port D5	D5	D5
	Port D6	D6	D6
	Port D7	D7	D7
	Port E0	C0	C0
	Port E1	C1	C1
	Port E2	C2	C2
	Port E3	C3	C3
	Port E4	C4	C4
	Port E5	C5	C5
	Port E6	C6	C6
	Port E7	C7	C7
	Port F0	C8	C8
	Port F1	C9	C9
	Port F2	nc	C10
	Port F3	nc	C11
	Port F4	D8	D8
	Port F5	D9	D9
	Port F6	nc	D10
	Port F7	nc	D11

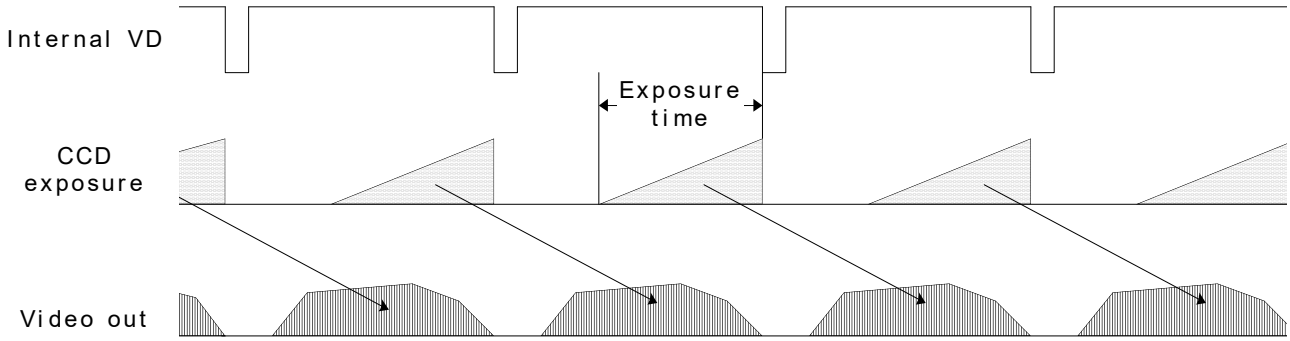
4.5 Bayer pattern for color model (Only STC-CMC33PCL)



5 Camera Function Modes

5.1 Normal mode

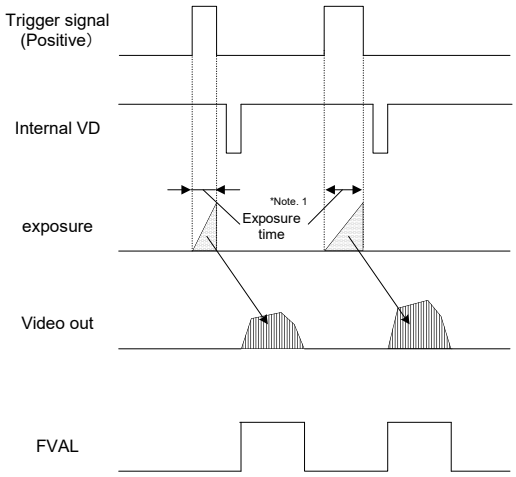
5.1.1 Normal mode (Electronic shutter)



5.2 Pulse width trigger mode

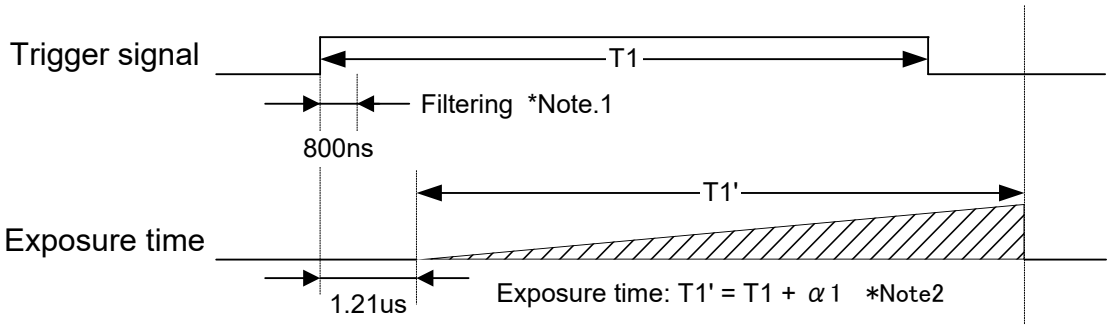
In this trigger mode with positive polarity, the camera exposure starts at the rising edge of the trigger pulse and stops at the falling edge of the trigger pulse. Therefore, In the case of the exposure positive polarity is selected, the exposure periods are the high states of the trigger pulse.

5.2.1 Pulse width trigger mode (V-Reset)



Note.1: The exposure time sets by the pulse width of the trigger signal.

5.2.2 Pulse width trigger mode (Exposure timing)



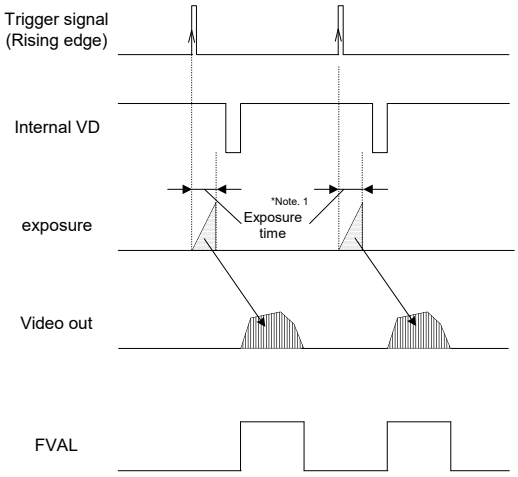
Note.1: The trigger signal is removed by the filtering if the pulse width of the input trigger signal is less than 800ns. Please input the trigger signal has more than 800ns pulse width.

Note.2: A1(Exposure time offset) is 12 [us]

5.3 Edge preset trigger mode

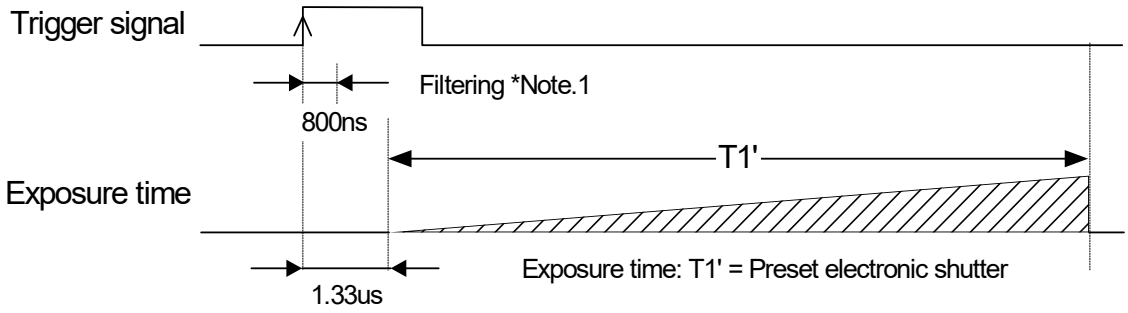
In this trigger mode, the camera exposure starts at the rising edge of the trigger pulse or negative edge when setting is “Trigger Polarity::Negative”, the camera exposure starts at the falling edge of the trigger pulse. Exposure duration time is preset by the “Electrical Shutter” settings.
.

5.3.1 Edge preset trigger mode (V-Reset)



Note.1: The exposure time sets by the preset electronic shutter speed.

5.3.2 Edge preset trigger mode (Exposure timing)



Note.1: The trigger signal is removed by the filtering if the pulse width of the input trigger signal is less than 800ns. Please input the trigger signal has more than 800ns pulse width.

6 Communication Protocol Specifications

This camera has the communication function that enables external devises like PC control the camera functions. Please use “CLCtrl2” communication software or use following the communication protocol to communicate to the camera.

6.1 The communication method

UART (RS232C), Binary communication

6.2 The communication settings

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

6.3 The communication format

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

a. Send the read command

SOF (8bit)	Device code (6bit)	Read (1bit)	Page selection (1bit)	Command code (8bit)	Data length (8bit)	Data (1byte)	EOF (8bit)

b. Send the write command

SOF (8bit)	Device code (6bit)	Write (1bit)	Page selection (1bit)	Command code (8bit)	Data length (8bit)	Data (Data length byte)	EOF (8bit)

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

a. After sent the read command

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

b. After sent the write command

SOF (8bit)	Data length (8bit) "00"	Receiving code (8bit)	EOF (8bit)

C. Descriptions of the format

Name	Descriptions
SOF	**S**tart **o**f the **f**rame Sets (or gets) the value is as “02H” always.
Device code	Sets the device code of the camera is as “000000”.
Read / Write	Sets (or gets) “0” when send read command. Sets (or gets) “1” when send write command.
Page selection	Sets “0” when access to the command register of the camera Gets current data from the command register when sent read command. The data of the command register is replaced by the sent data when sent write command. **The data of the EEPROM is not replaced.** Sets “1” when access to the EEPROM of the camera The camera works with the data of the EEPROM when the power on the camera. Gets the data from the EEPROM when sent read. The data of the EEPROM is replaced by sent data when sent write command. The camera sends the receiving coce as "01H" to the PC after the data of the EEPROM is replaced. The camera rejects other commands while the data of the EEPROM is being replaced (approximately 5 msec. / byte).
Command code	**Please refer from the following page.**
Data length	Data length (Unit: byte) Receiving data The data length is depending on the command after sent read command. The data length is “00H” after sent write command. Sending data The data length is 1 byte when send read command. The data length is depending on the command when send write command.
Data	The value of the data is depending on the command
EOF	**E**nd **o**f the **f**rame Sets (or gets) the value is as “03H” always
Receiving code	Result of the sending command 01H: OK (ACK), 10H: Receiving problem (NAC), 11H: Communication problem

D. Example command

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

6.4 The camera control commands

6.4.1 The camera commands list (Device Code: 00H)

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

Command No.	R/W	EEPROM	Function	Default	Data Range
00 - 0FH			Reserved	-	-
10H	R/W	X	Camera function mode1 (8bits: D[7..0])	1	
11H	R/W	X	Camera function mode2 (8bits: D[7..0])	08H	
12H	R/W	X	Camera function mode3 (8bits: D[7..0])	50H	
13H			Reserved	-	-
14H	R/W	X	Communication mode (8bits: D[7..0])	1	
15 - 1FH			Reserved	-	-
20H	R/W	X	Exposure time of electronic shutter (24bits: D[7..0])	0	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 - 27H			Reserved	-	-
28H	R/W	X	Delay time for the trigger (8bits: D[7..0])	0	0 to 255
29 – 2FH			Reserved	-	-
30H	R/W	X	CMOS ADC gain (8bits: D[7..0])	111	0 to 255
31H	R/W	X	Digital gain (8bits: D[7..0])	Factory adjusted	-
32 - 37H			Reserved	-	-
38H	R/W	X	Clamp level (8bits: D[7..0])	40	0 to 255
39H			Reserved	-	-
3AH	R/W	X	White balance R gain_L (15bits: D[7..0])	0	0 to 255
3BH	R/W	X	White balance B gain_L (15bits: D[7..0])	0	0 to 255
3CH	R/W	X	White balance GR gain_L (15bits: D[7..0])	0	0 to 255
3DH	R/W	X	White balance GB gain_L (15bits: D[7..0])	0	0 to 255
3EH	R/W	X	Test signal level (10bits: D[9..8])	341	0 to 1023
3FH	R/W	X	Test signal level (10bits: D[7..0])		
40 - 46H			Reserved	-	-
47H	R/W	X	HDR slope (8bits: D[7..0])	0	
48 - 4AH			Reserved	-	-
4BH	R/W	X	PGA gain (8bits: D[7..0])	C0H	-
4C - 55H			Reserved	-	-
56H	R/W	X	Knee1 parameter (8bits: D[7..0])	0	
57H	R/W	X	Knee2 parameter (8bits: D[7..0])	0	
58 - 5AH			Reserved	-	-
5BH	R/W	X	Vlow2 voltage (8bits: D[7..0])	64	0 to 255
5CH	R/W	X	Vlow3 voltage (8bits: D[7..0])	64	0 to 255
5D - 67H			Reserved	-	-
68H	R/W	X	Image flip mode (8bits: D[7..0])	0	

Command No.	R/W	EEPROM	Function	Default	Data Range
69 - 77H			Reserved	-	-
78H	R/W	X	Test pattern selection (8bits: D[7..0])	0	
79 - 7FH			Reserved	-	
80H	R/W		EEPROM control (8bits: D[7..0])	0	0 or 1
81 - 8FH			Reserved	-	-
90H	R/W	X	Vertical ROI Start Line ROI_A (16bits: D[7..0])	0	0 to 483
91H	R/W	X	Vertical ROI Start Line ROI_A (16bits: D[15..8])		
92H	R/W	X	Vertical ROI Start Line ROI_B (16bits: D[7..0])	0	0 to 483
93H	R/W	X	Vertical ROI Start Line ROI_B (16bits: D[15..8])		
94H	R/W	X	Vertical ROI Start Line ROI_C (16bits: D[7..0])	0	0 to 483
95H	R/W	X	Vertical ROI Start Line ROI_C (16bits: D[15..8])		
96H	R/W	X	Vertical ROI Start Line ROI_D (16bits: D[7..0])	0	0 to 483
97H	R/W	X	Vertical ROI Start Line ROI_D (16bits: D[15..8])		
98H	R/W	X	Vertical ROI Start Line ROI_E (16bits: D[7..0])	0	0 to 483
99H	R/W	X	Vertical ROI Start Line ROI_E (16bits: D[15..8])		
9AH	R/W	X	Vertical ROI Start Line ROI_F (16bits: D[7..0])	0	0 to 483
9BH	R/W	X	Vertical ROI Start Line ROI_F (16bits: D[15..8])		
9CH	R/W	X	Vertical ROI Start Line ROI_G (16bits: D[7..0])	0	0 to 483
9DH	R/W	X	Vertical ROI Start Line ROI_G (16bits: D[15..8])		
9E - 9FH			Reserved	-	-
A0H	R/W	X	Vertical ROI Effective Line ROI_A (16bit：D[7..0])	484	4 to 484
A1H	R/W	X	Vertical ROI Effective Line ROI_A (16bit：D[15..8])		
A2H	R/W	X	Vertical ROI Effective Line ROI_B (16bit：D[7..0])	0	4 to 484
A3H	R/W	X	Vertical ROI Effective Line ROI_B (16bit：D[15..8])		
A4H	R/W	X	Vertical ROI Effective Line ROI_C (16bits: D[7..0])	0	4 to 484
A5H	R/W	X	Vertical ROI Effective Line ROI_C (16bits: D[15..8])		
A6H	R/W	X	Vertical ROI Effective Line ROI_D (16bits: D[7..0])	0	4 to 484
A7H	R/W	X	Vertical ROI Effective Line ROI_D (16bits: D[15..8])		
A8H	R/W	X	Vertical ROI Effective Line ROI_E (16bits: D[7..0])	0	4 to 484
A9H	R/W	X	Vertical ROI Effective Line ROI_E (16bits: D[15..8])		
AAH	R/W	X	Vertical ROI Effective Line ROI_F (16bits: D[7..0])	0	4 to 484
ABH	R/W	X	Vertical ROI Effective Line ROI_F (16bits: D[15..8])		
ACH	R/W	X	Vertical ROI Effective Line ROI_G (16bits: D[7..0])	0	4 to 484
ADH	R/W	X	Vertical ROI Effective Line ROI_G (16bits: D[15..8])		
AE - AFH			Reserved	-	-

Command No.	R/W	EEPROM	Function	Default	Data Range
B0H	R/W	X	Horizontal ROI Start Pixel ROI_A (16bits: D[7..0])	0	0 to 641
B1H	R/W	X	Horizontal ROI Start Pixel ROI_A (16bits: D[15..8])		
B2H	R/W	X	Horizontal ROI Start Pixel ROI_B (16bits: D[7..0])	0	0 to 641
B3H	R/W	X	Horizontal ROI Start Pixel ROI_B (16bits: D[15..8])		
B4H	R/W	X	Horizontal ROI Start Pixel ROI_C (16bits: D[7..0])	0	0 to 641
B5H	R/W	X	Horizontal ROI Start Pixel ROI_C (16bits: D[15..8])		
B6H	R/W	X	Horizontal ROI Start Pixel ROI_D (16bits: D[7..0])	0	0 to 641
B7H	R/W	X	Horizontal ROI Start Pixel ROI_D (16bits: D[15..8])		
B8H	R/W	X	Horizontal ROI Start Pixel ROI_E (16bits: D[7..0])	0	0 to 641
B9H	R/W	X	Horizontal ROI Start Pixel ROI_E (16bits: D[15..8])		
BAH	R/W	X	Horizontal ROI Start Pixel ROI_F (16bits: D[7..0])	0	0 to 641
BBH	R/W	X	Horizontal ROI Start Pixel ROI_F (16bits: D[15..8])		
BCH	R/W	X	Horizontal ROI Start Pixel ROI_G (16bits: D[7..0])	0	0 to 641
BDH	R/W	X	Horizontal ROI Start Pixel ROI_G (16bits: D[15..8])		
BE - BFH			Reserved	-	-
C0H	R/W	X	Horizontal ROI Effective Pixel ROI_A (16bits: D[7..0])	642	0 to 642
C1H	R/W	X	Horizontal ROI Effective Pixel ROI_A (16bits: D[15..8])		
C2H	R/W	X	Horizontal ROI Effective Pixel ROI_B (16bits: D[7..0])	0	0 to 642
C3H	R/W	X	Horizontal ROI Effective Pixel ROI_B (16bits: D[15..8])		
C4H	R/W	X	Horizontal ROI Effective Pixel ROI_C (16bits: D[7..0])	0	0 to 642
C5H	R/W	X	Horizontal ROI Effective Pixel ROI_C (16bits: D[15..8])		
C6H	R/W	X	Horizontal ROI Effective Pixel ROI_D (16bits: D[7..0])	0	0 to 642
C7H	R/W	X	Horizontal ROI Effective Pixel ROI_D (16bits: D[15..8])		
C8H	R/W	X	Horizontal ROI Effective Pixel ROI_E (16bits: D[7..0])	0	0 to 642
C9H	R/W	X	Horizontal ROI Effective Pixel ROI_E (16bits: D[15..8])		
CAH	R/W	X	Horizontal ROI Effective Pixel ROI_F (16bits: D[7..0])	0	0 to 642
CBH	R/W	X	Horizontal ROI Effective Pixel ROI_F (16bits: D[15..8])		
CCH	R/W	X	Horizontal ROI Effective Pixel ROI_G (16bits: D[7..0])	0	0 to 642
CDH	R/W	X	Horizontal ROI Effective Pixel ROI_G (16bits:D[15..8])		
CE - DDH			Reserved	-	-
DEH	R/W	X	Pixel defect correction mode (8bits: D[7..0])	1	
DF – E9H			Reserved	-	-
EAH	R/W	X	White balance R gain_H (15bits: D[14..8])	16	0 to 127
EBH	R/W	X	White balance B gain_H (15bits: D[14..8])	16	0 to 127
ECH	R/W	X	White balance GR gain_H (15bits: D[14..8])	16	0 to 127
EDH	R/W	X	White balance GB gain_H (15bits: D[14..8])	16	0 to 127
EEH	R/W	X	The camera function mode6 (8bits: D[7..0])	2	
EF - FFH			Reserved	-	-

6.4.2 Description of the camera control commands

The underline settings are the 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: MOD1[7..0] = 01H
Sets the camera function mode.
D[7..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>No Function</td><td colspan="2">Always set 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: Plus Width</td></tr>
<tr><td>D4 to D1:</td><td>No Function</td><td colspan="2">Always set as “0000”</td></tr>
<tr><td>D0:</td><td>Exposure time unit</td><td>0: in lines</td><td>1: in µsecond</td></tr>
</table></td></tr>
<tr><td>11H:
MOD2[7..0]</td><td>[Camera function mode 2] Default: MOD2[7..0] = 08H
Sets the camera function mode.
D[7..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 to D4:</td><td>No Function</td><td colspan="2">Always set as “00000”</td></tr>
<tr><td>D3:</td><td>Trigger Mode</td><td>0: Tigger</td><td>1: Free run</td></tr>
<tr><td>D2 o D0:</td><td>No Function</td><td colspan="2">Always set as “000”</td></tr>
</table>
Note: While the camera is in the Trigger Mode, the video will not output without the trigger signal input.</td></tr>
<tr><td>12H:
MOD3[7..0]</td><td>[Camera function mode 3] Default: MOD3[7..0] = 50H
Sets the camera function mode.
D[7..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 rowspan="3">D7 to D6:</td><td rowspan="3">Video out</td><td>00: 10bit</td><td>01: 8bit</td></tr>
<tr><td>10: 12bit</td><td>11: No function</td></tr>
<tr><td colspan="2">(Prohibited setting. Do not set these values)</td></tr>
<tr><td>D5:</td><td>Trigger Source</td><td>0: Camera Link (CC1)</td><td>1: Power / IO connector</td></tr>
<tr><td>D4:</td><td>No function</td><td colspan="2">Always set as “1”</td></tr>
<tr><td>D3 to D0:</td><td>No function</td><td colspan="2">Always set as "0000"</td></tr>
</table></td></tr>
<tr><td>14H:
UART[7..0]</td><td>[Communication mode] Default: UART[7..0] = 01H
Sets the communication mode.
D[7..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 to D2:</td><td>No function</td><td colspan="2">Always set as “000000”</td></tr>
<tr><td rowspan="2">D1 to D0:</td><td rowspan="2">Communication mode</td><td>00: 38,400bps</td><td>01: 9,600bps</td></tr>
<tr><td>10: 57,600bps</td><td>11: 115,200bps</td></tr>
</table></td></tr>
</table>

Command No.	Command Description
20H: SVR[7..0] 21H: SVR[15..8] 22H: SVR[23..16]	[The exposure time of the electronic shutter] Default: SVR[23..0] = 0, data range: 0 to 16,777,215 Sets the preset shutter speed for the electronic shutter. When 10H.0 = 1 (Exposure time unit: in µseconds) Exposure time (shutter speed) = SVR[23..0] x 325 pixels x (1 cycle interval) µseconds When 10H.0 = 0 (Exposure time unit: in lines) Exposure time (shutter speed) = SVR[23..0] x 1 µseconds
28H: DLY[7..0]	[The delay time for the trigger] Default: DLY[7..0] = 0, data range: 0 to 255 Sets the delay time that is from the trigger signal input to start exposure. Delay time = 2 x DLY[7..0] (µsecond)
30H: [7..0]	[CMOS ADC gain] Default: 111, data range: 0 to 255
31H: DGB[7..0]	[The digital gain] Default: DGB[7..0] = The factory adjusted value (The value of the address 0EH) Video level = (Input video level - CLAMP[7..0]) x (1 + DGB[7..0] / 64) + CLAMP[7..0] CLAMP[7..0]: The clamp level (The value of the address 38H)
38H: CLAMP[7..0]	[The clamp level] Default: CLAMP[7..0] = 40, data range: 0 to 255 Sets the clamp level (The clamp level of the black signal). This value is on 10bit video output/ when 8bit output, 1/4 from setting value output as the clamp level.
3AH: WBR[7..0]	[White Balance R Gain] Default: WBR[14..0] = 4,096, data range: 0 to 255 Set the Red gain on Bayer Video level = (Input video level - CLAMP[7..0]) x WBR[14..0] / 4,096 + CLAMP[7..0] WBR [14..0] = 4,096: x1 gain, WBR [14..0] = 8,192: x2 gain, WBR [14..0] = 12,288: x3 gain, WBR [14..0] = 16,384: x4 gain, WBR [14..0] = 20,480: x5 gain, WBR [14..0] = 24,576: x6 gain, WBR [14..0] = 28,672: x7 gain, WBR [14..0] = 32,768: x8 gain *WBR[14:8]: EAH
3BH: WBB[7..0]	[White Balance GR Gain] Default: WBB[14..0] = 4,096, data range: 0 to 255 Set the Green gain on Bayer GR line Video level = (Input video level - CLAMP[7..0]) x WBB[14..0] / 4,096 + CLAMP[7..0] WBB [14..0] = 4,096: x1 gain, WBB [14..0] = 8,192: x2 gain, WBB [14..0] = 12,288: x3 gain, WBB [14..0] = 16,384: x4 gain, WBB [14..0] = 20,480: x5 gain, WBB45+ [14..0] = 24,576: x6 gain, WBB [14..0] = 28,672: x7 gain, WBB [14..0] = 32,768: x8 gain *WBB[14:8]: EBH
3CH: WBGR[7..0]	[White Balance GR Gain] Default: WBGR[7..0] = 4,096, data range: 0 to 255 Set the Green gain on Bayer GR line Video level = (Input video level – CLAMP[7..0]) x WBGR[7..0] / 4,096 + CLAMP[7..0] WBGR [14..0] = 4,096: x1 gain, WBGR [14..0] = 8,192: x2 gain, WBGR [14..0] = 12,288: x3 gain, WBGR [14..0] = 16,384: x4 gain, WBGR [14..0] = 20,480: x5 gain, WBGR [14..0] = 24,576: x6 gain, WBGR [14..0] = 28,672: x7 gain, WBGR [14..0] = 32,768: x8 gain *WBGR[14:8]: ECH
3DH: WBGB[7..0]	[White Balance GB Gain] Default: WBGB[14..0] = 4,096, data range: 0 to 255 Set the Green gain on Bayer GB line Video level = (Input video level – CLAMP[7..0]) x WBGB [14..0] / 4,096 + CLAMP[7..0] WBGB [14..0] = 4,096: x1 gain, WBGB [14..0] = 8,192: x2 gain, WBGB [14..0] = 12,288: x3 gain, WBGB [14..0] = 16,384: x4 gain, WBGB [14..0] = 20,480: x5 gain, WBGB [14..0] = 24,576: x6 gain, WBGB [14..0] = 28,672: x7 gain, WBGB [14..0] = 32,768: x8 gain *WBGB[14:8]: EDH
3EH: W[9..8] 3FH: W[7..0]	[Test signal level] Default: W[9..0] = 341, data range: 0 to 1023

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>47H:
HDR[7..0]</td><td>[HDR slope] Default: HDR[7..0] = 0
Sets the slope mode (HDR mode) and number of the slope.
D[7..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 to D6:</td><td>HDR mode</td><td><u>00: Normal</u></td><td>01: Enable</td></tr>
<tr><td></td><td></td><td colspan="2">others: No Function</td></tr>
<tr><td>D5 to D2:</td><td>No function</td><td colspan="2">Always set as "0000"</td></tr>
<tr><td>D1 to D0:</td><td>Number of the slope</td><td>0: No Function</td><td><u>1: No Function</u></td></tr>
<tr><td></td><td></td><td>2: Two Slopes</td><td>3: Three Slopes</td></tr>
</table></td></tr>
<tr><td>48H:
PGA[7..0]</td><td>[PGA gain] Default: PGA[7..0] = C0H
Sets the PGA gain.
<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>PGA gain</td><td>000: x1.0</td><td>001: x1.25</td></tr>
<tr><td></td><td></td><td>010: x1.5</td><td>011: x1.75</td></tr>
<tr><td></td><td></td><td>100: x2.0</td><td>101: x2.5</td></tr>
<tr><td></td><td></td><td><u>110: x3.0</u></td><td>111: x3.5</td></tr>
<tr><td>D4 to D0:</td><td>No function</td><td colspan="2">Always set as “00000”</td></tr>
</table></td></tr>
<tr><td>56H:
KN1P[7..0]</td><td>[Knee1 parameter] Default: KN1P[7..0] = 0, data range: 0 to 255
Sets the exposure time for the electronic shutter for the knee1 point, as for the exposure time.
Knee1 exposure = EXPTA[23..0] x KN1P[7..0] / 256
EXPTA[23..0]: 22H to 20H</td></tr>
<tr><td>57H:
KN2P[7..0]</td><td>[Knee2 parameter] Default: KN2P[7..0] = 0, data range: 0 to 255
Sets the exposure time for the electronic shutter for the knee2 point, as for the exposure time.
Knee1 exposure = EXPTA[23..0] x KN2P[7..0] / 256
EXPTA[23..0]: 22H to 20H</td></tr>
<tr><td>5BH:
Vlow2[7..0]</td><td>[Vlow2 voltage] Default: 64, data range: 0 to 255
Sets the Vlow2 voltage for the HDR saturation level voltage.</td></tr>
<tr><td>5FH:
Vlow3[7..0]</td><td>[Vlow3 voltage] Default: 64, data range: 0 to 255
Sets the Vlow3 voltage for the HDR saturation level voltage.</td></tr>
<tr><td>68H:
[7..0]</td><td>[Reverse mode] Default: 0
Sets the image flip function.
D[7..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 to D6:</td><td>No Function</td><td colspan="2">Always set as “00”</td></tr>
<tr><td>D5:</td><td>Vertical flip image</td><td><u>0: Normal image</u></td><td>1: Vertical flipped image</td></tr>
<tr><td>D4:</td><td>Horizontal flip image</td><td><u>0: Normal image</u></td><td>1:Horizontal flipped image</td></tr>
<tr><td>D3 to D0:</td><td>No Function</td><td colspan="2">Always set as “0000”</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>78H:
TESTP[7..0]</td><td>[Test Pattern] Default: TESTP [7..0] = 00H
Sets the test pattern video output.
D[7..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 to D4:</td><td>No function</td><td colspan="2">Always set as “0000”</td></tr>
<tr><td rowspan="4">D3 to D0:</td><td rowspan="4">Test Pattern</td><td>0: Normal Video Image</td><td>1: Gray Scale</td></tr>
<tr><td>2: Ramp</td><td>3: 100% White</td></tr>
<tr><td>4: White Clip</td><td>6: Color Bar</td></tr>
<tr><td colspan="2">Others: Black</td></tr>
</table></td></tr>
<tr><td>80H:
E2P[7..0]</td><td>[EEPROM control] Default: E2P[7..0] = 00H
D[7..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 to D1:</td><td>No function</td><td colspan="2">Always set as “0000000”</td></tr>
<tr><td>D0:</td><td>Write control to the EEPROM</td><td>0: Prohibited</td><td>1: Accept</td></tr>
</table>
Note: This bit is cleared to “0” automatically by the internal processes after the execution of the command.</td></tr>
</table>

Command No.	Command Description
90H: VASA[7..0] 91H: VASA[15..8]	[Vertical ROI Start Line ROI_A] Default: ROI_A[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_A. The actual start line of the ROI_A = this value + 1
92H: VASB[7..0] 93H: VASB[15..8]	[Vertical ROI Start Line ROI_B] Default: ROI_B[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_B. The actual start line of the ROI_B = this value + 1
94H: VASC[7..0] 95H: VASC[15..8]	[Vertical ROI Start Line ROI_C] Default: ROI_C[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_C. The actual start line of the ROI_C = this value + 1
96H: VASD[7..0] 97H: VASD[15..8]	[Vertical ROI Start Line ROI_D] Default: ROI_D[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_D. The actual start line of the ROI_D = this value + 1
98H: VASE[7..0] 99H: VASE[15..8]	[Vertical ROI Start Line ROI_E] Default: ROI_E[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_E. The actual start line of the ROI_E = this value + 1
9AH: VASF[7..0] 9BH: VASF[15..8]	[Vertical ROI Start Line ROI_F] Default: ROI_F[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_F. The actual start line of the ROI_F = this value + 1
9CH: VASG[7..0] 9DH: VASG[15..8]	[Vertical ROI Start Line ROI_G] Default: ROI_G[15..0] = 0, data range: 0 to 483 Sets Vertical ROI Start Line ROI_G. The actual start line of the ROI_G = this value + 1
A0H: VAHA[7..0] A1H: VAHA[15..8]	[Vertical ROI Effective Line ROI_A] Default: VAHA [15..0] = 484, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_A.
A2H: VAHB[7..0] A3H: VAHB[15..8]	[Vertical ROI Effective Line ROI_B] Default: VAHB [15..0] = 0, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_B.
A4H: VAHC[7..0] A5H: VAHC[15..8]	[Vertical ROI Effective Line ROI_C] Default: VAHC [15..0] = 0, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_C.
A6H: VAHD[7..0] A7H: VAHD[15..8]	[Vertical ROI Effective Line ROI_D] Default: VAHD [15..0] = 0, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_D.
A8H: VAHE[7..0] A9H: VAHE[15..8]	[Vertical ROI Effective Line ROI_E] Default: VAHE [15..0] = 0, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_E.
AAH: VAHF[7..0] ABH: VAHF[15..8]	[Vertical ROI Effective Line ROI_F] Default: VAHF [15..0] = 0, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_F.
ACH: VAHG[7..0] ADH: VAHG[15..8]	[Vertical ROI Effective Line ROI_G] Default: VAHG [15..0] = 0, data range: 4 to 484 Sets the number of the effective lines (image height) of the ROI_G.

Command No.	Command Description
B0H: HASA[7..0] B1H: HASA[15..8]	[Horizontal ROI Start Pixel ROI_A] Default: HASA [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_A. The actual start pixel of the ROI_A = this value + 1
B2H: HASB[7..0] B3H: HASB[15..8]	[Horizontal ROI Start Pixel ROI_B] Default: HASB [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_B. The actual start pixel of the ROI_B = this value + 1
B4H: HASC[7..0] B5H: HASC[15..8]	[Horizontal ROI Start Pixel ROI_C] Default: HASC [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_C. The actual start pixel of the ROI_C = this value + 1
B6H: HASD[7..0] B7H: HASD[15..8]	[Horizontal ROI Start Pixel ROI_D] Default: HASD [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_D The actual start pixel of the ROI_D = this value + 1
B8H: HASE[7..0] B9H: HASE[15..8]	[Horizontal ROI Start Pixel ROI_E] Default: HASE [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_E. The actual start pixel of the ROI_E = this value + 1
BAH: HASF[7..0] BBH: HASF [15..8]	[Horizontal ROI Start Pixel ROI_F] Default: HASF [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_F. The actual start pixel of the ROI_F = this value + 1
BCH: HASG[7..0] BDH: HASG[15..8]	[Horizontal ROI Start Pixel ROI_G] Default: HASG [15..0] = 0, data range: 0 to 641 Sets Horizontal ROI Start Pixel ROI_G. The actual start pixel of the ROI_G = this value + 1
C0H: HAWA[7..0] C1H: HAWA[15..8]	[Horizontal ROI Effective Pixel ROI_A] Default: HAWA [15..0] = 642, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels
C2H: HAWB[7..0] C3H: HAWB[15..8]	[Horizontal ROI Effective Pixel ROI_B] Default: HAWB [15..0] = 0, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels
C4H: HAWC[7..0] C5H: HAWC[15..8]	[Horizontal ROI Effective Pixel ROI_C] Default: HAWC [15..0] = 0, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels
C6H: HAWD[7..0] C7H: HAWD[15..8]	[Horizontal ROI Effective Pixel ROI_D] Default: HAWD [15..0] = 0, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels
C8H: HAWE[7..0] C9H: HAWE[15..8]	[Horizontal ROI Effective Pixel ROI_E] Default: HAWE [15..0] = 0, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels
CAH: HAWF[7..0] CBH: HAWF[15..8]	[Horizontal ROI Effective Pixel ROI_F] Default: HAWF [15..0] = 0, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels
CCH: VAWG[7..0] CDH: VAWG[15..8]	[Horizontal ROI Effective Pixel ROI_G] Default: HAWG [15..0] = 0, data range: 0 to 642 Sets the number of effective pixels (image width). The effective pixels are same as DVAL that depends on Tap number of the Camera Link. When the effective pixels (image width) is 0 or larger than the horizontal pixels, Effective pixels (image width) = Horizontal pixels

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>DEH:
DEF_M[7..0]</td><td>[Pixel defect correction mode] Default: DEF_M [7..0] = 01H
Sets the pixel defect correction. As for the x-y coordinate of defect pixel.
D[7..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>
When the Highlight the corrected pixel is Enabled, the corrected pixel appeared with highlight.
Highlight does not work with subsampling.
<table>
<tr><td>D7 to D2:</td><td>No Function</td><td colspan="2">Always set 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>Pixel defect correction</td><td>0: Disable</td><td>1: Enable</td></tr>
</table></td></tr>
<tr><td>EAH:
WBR[14..8]</td><td>[White Balance R Gain] Default: WBR[14..0] = 4,096, data range: 0 to 127
Set the Red gain on Bayer
Video level = (Input video level - CLAMP[7..0]) x WBR[14..0] / 4096 + CLAMP[7..0]
WBR [14..0] = 4,096: x1 gain, WBR [14..0] = 8,192: x2 gain, WBR [14..0] = 12,288: x3 gain,
WBR [14..0] = 16,384: x4 gain, WBR [14..0] = 20,480: x5 gain, WBR [14..0] = 24,576: x6 gain,
WBR [14..0] = 28,672: x7 gain, WBR [14..0] = 32,768: x8 gain
*WBR[7:0]: 3AH</td></tr>
<tr><td>EBH:
WBB[14..8]</td><td>[White Balance GR Gain] Default: WBB[14..0] = 4,096, data range: 0 to 127
Set the Green gain on Bayer GR line
Video level = (Input video level - CLAMP[7..0]) x WBB[14..0] / 4,096 + CLAMP[7..0]
WBB [14..0] = 4,096: x1 gain, WBB [14..0] = 8,192: x2 gain, WBB [14..0] = 12,288: x3 gain,
WBB [14..0] = 16,384: x4 gain, WBB [14..0] = 20,480: x5 gain, WBB [14..0] = 24,576: x6 gain,
WBB [14..0] = 28,672: x7 gain, WBB [14..0] = 32,768: x8 gain
*WBB[7:0]: 3BH</td></tr>
<tr><td>ECH:
WBGR[14..8]</td><td>[White Balance GR Gain] Default: WBGR[14..0] = 4,096, data range: 0 to 127
Set the Green gain on Bayer GR line
Video level = (Input video level - CLAMP[7..0]) x WBGR[7..0] / 4,096 + CLAMP[7..0]
WBGR [14..0] = 4,096: x1 gain, WBGR [14..0] = 8,192: x2 gain, WBGR [14..0] = 12,288: x3 gain,
WBGR [14..0] = 16,384: x4 gain, WBGR [14..0] = 20,480: x5 gain, WBGR [14..0] = 24,576: x6 gain,
WBGR [14..0] = 28,672: x7 gain, WBGR [14..0] = 32,768: x8 gain
*WBGR[7:0]: 3CH</td></tr>
<tr><td>EDH:
WBGB[14..8]</td><td>[White Balance GB Gain] Default: WBGB[14..0] = 4,096, data range: 0 to 127
Set the Green gain on Bayer GB line
Video level = (Input video level - CLAMP[7..0]) x WBGB [14..0] / 4,096 + CLAMP[7..0]
WBGB [14..0] = 4,096: x1 gain, WBGB [14..0] = 8,192: x2 gain, WBGB [14..0] = 12,288: x3 gain,
WBGB [14..0] = 16,384: x4 gain, WBGB [14..0] = 20,480: x5 gain, WBGB [14..0] = 24,576: x6 gain,
WBGB [14..0] = 28,672: x7 gain, WBGB [14..0] = 32,768: x8 gain
*WBGB[7:0]: 3DH</td></tr>
<tr><td>EEH:
MOD6[7..0]</td><td>[The camera function mode 6] Default: MOD6 [7..0] = 02H, data range: 1 to 2
Sets the camera TAP number for each setting.
D[7..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 rowspan="2">D7 to D0</td><td rowspan="2">TAP configuration</td><td>1: 2TAP</td><td>2: 3TAP</td></tr>
<tr><td colspan="2">Others: 2TAP</td></tr>
</table></td></tr>
</table>

6.4.3 The camera commands list (Device Code: 3AH)
Note. 1: The data unit of the each command is 1byte (8bits).
Note. 2: The data can be saved to the EEPROM if “x” in the “Save to EEPROM” column in the list.
Note. 3: The camera is operating with the data of the EEPROM when the power on the camera.

Pixel Defect Correction

Maximum 64points can be corrected.
When defect pixels were found in the factory, these defect pixels were corrected before shipping.

This function can be control through Pixel defect correction mode (DEH, DFH).

Command No.	R/W	EEPROM	Function	Default	Data range
00H	R/W	X	Pixel defect correction horizontal coordinate 1 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
01H	R/W	X	Pixel defect correction horizontal coordinate 1 (16bits: D[15..8])		
02H	R/W	X	Pixel defect correction vertical coordinate 1 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
03H	R/W	X	Pixel defect correction vertical coordinate 1 (16bits: D[15..8])		
04H	R/W	X	Pixel defect correction horizontal coordinate 2 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
05H	R/W	X	Pixel defect correction horizontal coordinate 2 (16bits: D[15..8])		
06H	R/W	X	Pixel defect correction vertical coordinate 2 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
07H	R/W	X	Pixel defect correction vertical coordinate 2 (16bits: D[15..8])		
08H	R/W	X	Pixel defect correction horizontal coordinate 3 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
09H	R/W	X	Pixel defect correction horizontal coordinate 3 (16bits: D[15..8])		
0AH	R/W	X	Pixel defect correction vertical coordinate 3 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
0BH	R/W	X	Pixel defect correction vertical coordinate 3 (16bits: D[15..8])		
0CH	R/W	X	Pixel defect correction horizontal coordinate 4 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
0DH	R/W	X	Pixel defect correction horizontal coordinate 4 (16bits: D[15..8])		
0EH	R/W	X	Pixel defect correction vertical coordinate 4 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
0FH	R/W	X	Pixel defect correction vertical coordinate 4 (16bits: D[15..8])		
10H	R/W	X	Pixel defect correction horizontal coordinate 5 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
11H	R/W	X	Pixel defect correction horizontal coordinate 5 (16bits: D[15..8])		
12H	R/W	X	Pixel defect correction vertical coordinate 5 (16bits: D[7..0])	FFFFh Function: Off	0 ～ 483
13H	R/W	X	Pixel defect correction vertical coordinate 5 (16bits: D[15..8])		
14H	R/W	X	Pixel defect correction horizontal coordinate 6 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
15H	R/W	X	Pixel defect correction horizontal coordinate 6 (16bits: D[15..8])		
16H	R/W	X	Pixel defect correction vertical coordinate 6 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
17H	R/W	X	Pixel defect correction vertical coordinate 6 (16bits: D[15..8])		
18H	R/W	X	Pixel defect correction horizontal coordinate 7 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
19H	R/W	X	Pixel defect correction horizontal coordinate 7 (16bits: D[15..8])		
1AH	R/W	X	Pixel defect correction vertical coordinate 7 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
1BH	R/W	X	Pixel defect correction vertical coordinate 7 (16bits: D[15..8])		
1CH	R/W	X	Pixel defect correction horizontal coordinate 8 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
1DH	R/W	X	Pixel defect correction horizontal coordinate 8 (16bits: D[15..8])		
1EH	R/W	X	Pixel defect correction vertical coordinate 8 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
1FH	R/W	X	Pixel defect correction vertical coordinate 8 (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default	Data range
20H	R/W	X	Pixel defect correction horizontal coordinate 9 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
21H	R/W	X	Pixel defect correction horizontal coordinate 9 (16bits: D[15..8])		
22H	R/W	X	Pixel defect correction vertical coordinate 9 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
23H	R/W	X	Pixel defect correction vertical coordinate 9 (16bits: D[15..8])		
24H	R/W	X	Pixel defect correction horizontal coordinate 10 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
25H	R/W	X	Pixel defect correction horizontal coordinate 10 (16bits: D[15..8])		
26H	R/W	X	Pixel defect correction vertical coordinate 10 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
27H	R/W	X	Pixel defect correction vertical coordinate 10 (16bits: D[15..8])		
28H	R/W	X	Pixel defect correction horizontal coordinate 11 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
29H	R/W	X	Pixel defect correction horizontal coordinate 11 (16bits: D[15..8])		
2AH	R/W	X	Pixel defect correction vertical coordinate 11 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
2BH	R/W	X	Pixel defect correction vertical coordinate 11 (16bits: D[15..8])		
2CH	R/W	X	Pixel defect correction horizontal coordinate 12 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
2DH	R/W	X	Pixel defect correction horizontal coordinate 12 (16bits: D[15..8])		
2EH	R/W	X	Pixel defect correction vertical coordinate 12 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
2FH	R/W	X	Pixel defect correction vertical coordinate 12 (16bits: D[15..8])		
30H	R/W	X	Pixel defect correction horizontal coordinate 13 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
31H	R/W	X	Pixel defect correction horizontal coordinate 13 (16bits: D[15..8])		
32H	R/W	X	Pixel defect correction vertical coordinate 13 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
33H	R/W	X	Pixel defect correction vertical coordinate 13 (16bits: D[15..8])		
34H	R/W	X	Pixel defect correction horizontal coordinate 14 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
35H	R/W	X	Pixel defect correction horizontal coordinate 14 (16bits: D[15..8])		
36H	R/W	X	Pixel defect correction vertical coordinate 14 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
37H	R/W	X	Pixel defect correction vertical coordinate 14 (16bits: D[15..8])		
38H	R/W	X	Pixel defect correction horizontal coordinate 15 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
39H	R/W	X	Pixel defect correction horizontal coordinate 15 (16bits: D[15..8])		
3AH	R/W	X	Pixel defect correction vertical coordinate 15 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
3BH	R/W	X	Pixel defect correction vertical coordinate 15 (16bits: D[15..8])		
3CH	R/W	X	Pixel defect correction horizontal coordinate 16 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
3DH	R/W	X	Pixel defect correction horizontal coordinate 16 (16bits: D[15..8])		
3EH	R/W	X	Pixel defect correction vertical coordinate 16 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
3FH	R/W	X	Pixel defect correction vertical coordinate 16 (16bits: D[15..8])		
40H	R/W	X	Pixel defect correction horizontal coordinate 17 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
41H	R/W	X	Pixel defect correction horizontal coordinate 17 (16bits: D[15..8])		
42H	R/W	X	Pixel defect correction vertical coordinate 17 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
43H	R/W	X	Pixel defect correction vertical coordinate 17 (16bits: D[15..8])		
44H	R/W	X	Pixel defect correction horizontal coordinate 18 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
45H	R/W	X	Pixel defect correction horizontal coordinate 18 (16bits: D[15..8])		
46H	R/W	X	Pixel defect correction vertical coordinate 18 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
47H	R/W	X	Pixel defect correction vertical coordinate 18 (16bits: D[15..8])		
48H	R/W	X	Pixel defect correction horizontal coordinate 19 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
49H	R/W	X	Pixel defect correction horizontal coordinate 19 (16bits: D[15..8])		
4AH	R/W	X	Pixel defect correction vertical coordinate 19 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
4BH	R/W	X	Pixel defect correction vertical coordinate 19 (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default	Data range
4CH	R/W	X	Pixel defect correction horizontal coordinate 20 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
4DH	R/W	X	Pixel defect correction horizontal coordinate 20 (16bits: D[15..8])		
4EH	R/W	X	Pixel defect correction vertical coordinate 20 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
4FH	R/W	X	Pixel defect correction vertical coordinate 20 (16bits: D[15..8])		
50H	R/W	X	Pixel defect correction horizontal coordinate 21 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
51H	R/W	X	Pixel defect correction horizontal coordinate 21 (16bits: D[15..8])		
52H	R/W	X	Pixel defect correction vertical coordinate 21 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
53H	R/W	X	Pixel defect correction vertical coordinate 21 (16bits: D[15..8])		
54H	R/W	X	Pixel defect correction horizontal coordinate 22 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
55H	R/W	X	Pixel defect correction horizontal coordinate 22 (16bits: D[15..8])		
56H	R/W	X	Pixel defect correction vertical coordinate 22 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
57H	R/W	X	Pixel defect correction vertical coordinate 22 (16bits: D[15..8])		
58H	R/W	X	Pixel defect correction horizontal coordinate 23 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
59H	R/W	X	Pixel defect correction horizontal coordinate 23 (16bits: D[15..8])		
5AH	R/W	X	Pixel defect correction vertical coordinate 23 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
5BH	R/W	X	Pixel defect correction vertical coordinate 23 (16bits: D[15..8])		
5CH	R/W	X	Pixel defect correction horizontal coordinate 24 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
5DH	R/W	X	Pixel defect correction horizontal coordinate 24 (16bits: D[15..8])		
5EH	R/W	X	Pixel defect correction vertical coordinate 24 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
5FH	R/W	X	Pixel defect correction vertical coordinate 24 (16bits: D[15..8])		
60H	R/W	X	Pixel defect correction horizontal coordinate 25 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
61H	R/W	X	Pixel defect correction horizontal coordinate 25 (16bits: D[15..8])		
62H	R/W	X	Pixel defect correction vertical coordinate 25 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
63H	R/W	X	Pixel defect correction vertical coordinate 25 (16bits: D[15..8])		
64H	R/W	X	Pixel defect correction horizontal coordinate 26 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
65H	R/W	X	Pixel defect correction horizontal coordinate 26 (16bits: D[15..8])		
66H	R/W	X	Pixel defect correction vertical coordinate 26 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
67H	R/W	X	Pixel defect correction vertical coordinate 26 (16bits: D[15..8])		
68H	R/W	X	Pixel defect correction horizontal coordinate 27 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
69H	R/W	X	Pixel defect correction horizontal coordinate 27 (16bits: D[15..8])		
6AH	R/W	X	Pixel defect correction vertical coordinate 27 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
6BH	R/W	X	Pixel defect correction vertical coordinate 27 (16bits: D[15..8])		
6CH	R/W	X	Pixel defect correction horizontal coordinate 28 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
6DH	R/W	X	Pixel defect correction horizontal coordinate 28 (16bits: D[15..8])		
6EH	R/W	X	Pixel defect correction vertical coordinate 28 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
6FH	R/W	X	Pixel defect correction vertical coordinate 28 (16bits: D[15..8])		
70H	R/W	X	Pixel defect correction horizontal coordinate 29 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
71H	R/W	X	Pixel defect correction horizontal coordinate 29 (16bits: D[15..8])		
72H	R/W	X	Pixel defect correction vertical coordinate 29 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
73H	R/W	X	Pixel defect correction vertical coordinate 29 (16bits: D[15..8])		
74H	R/W	X	Pixel defect correction horizontal coordinate 30 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
75H	R/W	X	Pixel defect correction horizontal coordinate 30 (16bits: D[15..8])		
76H	R/W	X	Pixel defect correction vertical coordinate 30 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
77H	R/W	X	Pixel defect correction vertical coordinate 30 (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default	Data range
78H	R/W	X	Pixel defect correction horizontal coordinate 31 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
79H	R/W	X	Pixel defect correction horizontal coordinate 31 (16bits: D[15..8])		
7AH	R/W	X	Pixel defect correction vertical coordinate 31 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
7BH	R/W	X	Pixel defect correction vertical coordinate 31 (16bits: D[15..8])		
7CH	R/W	X	Pixel defect correction horizontal coordinate 32 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
7DH	R/W	X	Pixel defect correction horizontal coordinate 32 (16bits: D[15..8])		
7EH	R/W	X	Pixel defect correction vertical coordinate 32 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
7FH	R/W	X	Pixel defect correction vertical coordinate 32 (16bits: D[15..8])		
80H	R/W	X	Pixel defect correction horizontal coordinate 33 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
81H	R/W	X	Pixel defect correction horizontal coordinate 33 (16bits: D[15..8])		
82H	R/W	X	Pixel defect correction vertical coordinate 33 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
83H	R/W	X	Pixel defect correction vertical coordinate 33 (16bits: D[15..8])		
84H	R/W	X	Pixel defect correction horizontal coordinate 34 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
85H	R/W	X	Pixel defect correction horizontal coordinate 34 (16bits: D[15..8])		
86H	R/W	X	Pixel defect correction vertical coordinate 34 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
87H	R/W	X	Pixel defect correction vertical coordinate 34 (16bits: D[15..8])		
88H	R/W	X	Pixel defect correction horizontal coordinate 35 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
89H	R/W	X	Pixel defect correction horizontal coordinate 35 (16bits: D[15..8])		
8AH	R/W	X	Pixel defect correction vertical coordinate 35 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
8BH	R/W	X	Pixel defect correction vertical coordinate 35 (16bits: D[15..8])		
8CH	R/W	X	Pixel defect correction horizontal coordinate 36 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
8DH	R/W	X	Pixel defect correction horizontal coordinate 36 (16bits: D[15..8])		
8EH	R/W	X	Pixel defect correction vertical coordinate 36 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
8FH	R/W	X	Pixel defect correction vertical coordinate 36 (16bits: D[15..8])		
90H	R/W	X	Pixel defect correction horizontal coordinate 37 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
91H	R/W	X	Pixel defect correction horizontal coordinate 37 (16bits: D[15..8])		
92H	R/W	X	Pixel defect correction vertical coordinate 37 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
93H	R/W	X	Pixel defect correction vertical coordinate 37 (16bits: D[15..8])		
94H	R/W	X	Pixel defect correction horizontal coordinate 38 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
95H	R/W	X	Pixel defect correction horizontal coordinate 38 (16bits: D[15..8])		
96H	R/W	X	Pixel defect correction vertical coordinate 38 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
97H	R/W	X	Pixel defect correction vertical coordinate 38 (16bits: D[15..8])		
98H	R/W	X	Pixel defect correction horizontal coordinate 39 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
99H	R/W	X	Pixel defect correction horizontal coordinate 39 (16bits: D[15..8])		
9AH	R/W	X	Pixel defect correction vertical coordinate 36 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
9BH	R/W	X	Pixel defect correction vertical coordinate 39 (16bits: D[15..8])		
9CH	R/W	X	Pixel defect correction horizontal coordinate 40 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
9DH	R/W	X	Pixel defect correction horizontal coordinate 40 (16bits: D[15..8])		
9EH	R/W	X	Pixel defect correction vertical coordinate 40 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
9FH	R/W	X	Pixel defect correction vertical coordinate 40 (16bits: D[15..8])		
A0H	R/W	X	Pixel defect correction horizontal coordinate 41 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
A1H	R/W	X	Pixel defect correction horizontal coordinate 41 (16bits: D[15..8])		
A2H	R/W	X	Pixel defect correction vertical coordinate 41 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
A3H	R/W	X	Pixel defect correction vertical coordinate 41 (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default	Data range
A4H	R/W	X	Pixel defect correction horizontal coordinate 42 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
A5H	R/W	X	Pixel defect correction horizontal coordinate 42 (16bits: D[15..8])		
A6H	R/W	X	Pixel defect correction vertical coordinate 42 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
A7H	R/W	X	Pixel defect correction vertical coordinate 42 (16bits: D[15..8])		
A8H	R/W	X	Pixel defect correction horizontal coordinate 43 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
A9H	R/W	X	Pixel defect correction horizontal coordinate 43 (16bits: D[15..8])		
AAH	R/W	X	Pixel defect correction vertical coordinate 43 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
ABH	R/W	X	Pixel defect correction vertical coordinate 43 (16bits: D[15..8])		
ACH	R/W	X	Pixel defect correction horizontal coordinate 44 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
ADH	R/W	X	Pixel defect correction horizontal coordinate 44 (16bits: D[15..8])		
AEH	R/W	X	Pixel defect correction vertical coordinate 44 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
AFH	R/W	X	Pixel defect correction vertical coordinate 44 (16bits: D[15..8])		
B0H	R/W	X	Pixel defect correction horizontal coordinate 45 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
B1H	R/W	X	Pixel defect correction horizontal coordinate 45 (16bits: D[15..8])		
B2H	R/W	X	Pixel defect correction vertical coordinate 45 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
B3H	R/W	X	Pixel defect correction vertical coordinate 45 (16bits: D[15..8])		
B4H	R/W	X	Pixel defect correction horizontal coordinate 46 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
B5H	R/W	X	Pixel defect correction horizontal coordinate 46 (16bits: D[15..8])		
B6H	R/W	X	Pixel defect correction vertical coordinate 46 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
B7H	R/W	X	Pixel defect correction vertical coordinate 46 (16bits: D[15..8])		
B8H	R/W	X	Pixel defect correction horizontal coordinate 47 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
B9H	R/W	X	Pixel defect correction horizontal coordinate 47 (16bits: D[15..8])		
BAH	R/W	X	Pixel defect correction vertical coordinate 47 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
BBH	R/W	X	Pixel defect correction vertical coordinate 47 (16bits: D[15..8])		
BCH	R/W	X	Pixel defect correction horizontal coordinate 48 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
BDH	R/W	X	Pixel defect correction horizontal coordinate 48 (16bits: D[15..8])		
BEH	R/W	X	Pixel defect correction vertical coordinate 48 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
BFH	R/W	X	Pixel defect correction vertical coordinate 48 (16bits: D[15..8])		
C0H	R/W	X	Pixel defect correction horizontal coordinate 49 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
C1H	R/W	X	Pixel defect correction horizontal coordinate 49 (16bits: D[15..8])		
C2H	R/W	X	Pixel defect correction vertical coordinate 49 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
C3H	R/W	X	Pixel defect correction vertical coordinate 49 (16bits: D[15..8])		
C4H	R/W	X	Pixel defect correction horizontal coordinate 50 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
C5H	R/W	X	Pixel defect correction horizontal coordinate 50 (16bits: D[15..8])		
C6H	R/W	X	Pixel defect correction vertical coordinate 50 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
C7H	R/W	X	Pixel defect correction vertical coordinate 50 (16bits: D[15..8])		
C8H	R/W	X	Pixel defect correction horizontal coordinate 51 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
C9H	R/W	X	Pixel defect correction horizontal coordinate 51 (16bits: D[15..8])		
CAH	R/W	X	Pixel defect correction vertical coordinate 51 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
CBH	R/W	X	Pixel defect correction vertical coordinate 51 (16bits: D[15..8])		
CCH	R/W	X	Pixel defect correction horizontal coordinate 52 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
CDH	R/W	X	Pixel defect correction horizontal coordinate 52 (16bits: D[15..8])		
CEH	R/W	X	Pixel defect correction vertical coordinate 52 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
CFH	R/W	X	Pixel defect correction vertical coordinate 52 (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default	Data range
D0H	R/W	X	Pixel defect correction horizontal coordinate 53 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
D1H	R/W	X	Pixel defect correction horizontal coordinate 53 (16bits: D[15..8])		
D2H	R/W	X	Pixel defect correction vertical coordinate 53 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
D3H	R/W	X	Pixel defect correction vertical coordinate 53 (16bits: D[15..8])		
D4H	R/W	X	Pixel defect correction horizontal coordinate 54 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
D5H	R/W	X	Pixel defect correction horizontal coordinate 54 (16bits: D[15..8])		
D6H	R/W	X	Pixel defect correction vertical coordinate 54 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
D7H	R/W	X	Pixel defect correction vertical coordinate 54 (16bits: D[15..8])		
D8H	R/W	X	Pixel defect correction horizontal coordinate 55 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
D9H	R/W	X	Pixel defect correction horizontal coordinate 55 (16bits: D[15..8])		
DAH	R/W	X	Pixel defect correction vertical coordinate 55 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
DBH	R/W	X	Pixel defect correction vertical coordinate 55 (16bits: D[15..8])		
DCH	R/W	X	Pixel defect correction horizontal coordinate 56 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
DDH	R/W	X	Pixel defect correction horizontal coordinate 56 (16bits: D[15..8])		
DEH	R/W	X	Pixel defect correction vertical coordinate 56 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
DFH	R/W	X	Pixel defect correction vertical coordinate 56 (16bits: D[15..8])		
E0H	R/W	X	Pixel defect correction horizontal coordinate 57 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
E1H	R/W	X	Pixel defect correction horizontal coordinate 57 (16bits: D[15..8])		
E2H	R/W	X	Pixel defect correction vertical coordinate 57 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
E3H	R/W	X	Pixel defect correction vertical coordinate 57 (16bits: D[15..8])		
E4H	R/W	X	Pixel defect correction horizontal coordinate 58 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
E5H	R/W	X	Pixel defect correction horizontal coordinate 58 (16bits: D[15..8])		
E6H	R/W	X	Pixel defect correction vertical coordinate 58 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
E7H	R/W	X	Pixel defect correction vertical coordinate 58 (16bits: D[15..8])		
E8H	R/W	X	Pixel defect correction horizontal coordinate 59 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
E9H	R/W	X	Pixel defect correction horizontal coordinate 59 (16bits: D[15..8])		
EAH	R/W	X	Pixel defect correction vertical coordinate 59 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
EBH	R/W	X	Pixel defect correction vertical coordinate 59 (16bits: D[15..8])		
ECH	R/W	X	Pixel defect correction horizontal coordinate 60 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
EDH	R/W	X	Pixel defect correction horizontal coordinate 60 (16bits: D[15..8])		
EEH	R/W	X	Pixel defect correction vertical coordinate 60 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
EFH	R/W	X	Pixel defect correction vertical coordinate 60 (16bits: D[15..8])		
F0H	R/W	X	Pixel defect correction horizontal coordinate 61 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
F1H	R/W	X	Pixel defect correction horizontal coordinate 61 (16bits: D[15..8])		
F2H	R/W	X	Pixel defect correction vertical coordinate 61 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
F3H	R/W	X	Pixel defect correction vertical coordinate 61 (16bits: D[15..8])		
F4H	R/W	X	Pixel defect correction horizontal coordinate 62 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
F5H	R/W	X	Pixel defect correction horizontal coordinate 62 (16bits: D[15..8])		
F6H	R/W	X	Pixel defect correction vertical coordinate 62 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
F7H	R/W	X	Pixel defect correction vertical coordinate 62 (16bits: D[15..8])		
F8H	R/W	X	Pixel defect correction horizontal coordinate 63 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
F9H	R/W	X	Pixel defect correction horizontal coordinate 63 (16bits: D[15..8])		
FAH	R/W	X	Pixel defect correction vertical coordinate 63 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
FBH	R/W	X	Pixel defect correction vertical coordinate 63 (16bits: D[15..8])		

Command No.	R/W	EEPROM	Function	Default	Data range
FCH	R/W	X	Pixel defect correction horizontal coordinate 64 (16bits: D[7..0])	FFFFh Function: Off	0 to 641
FDH	R/W	X	Pixel defect correction horizontal coordinate 64 (16bits: D[15..8])		
FEH	R/W	X	Pixel defect correction vertical coordinate 64 (16bits: D[7..0])	FFFFh Function: Off	0 to 483
FFH	R/W	X	Pixel defect correction vertical coordinate 64 (16bits: D[15..8])		

6.4.4 Sequence for the command saves to the EEPROM

Please use below sequence for the command saves to the EEPROM

1) Set “1” to the 80H.0 for the accept “write control to the EEPROM”.

2) Send the command and the save data with the EEPROM access command, which is set “1” for the page selection.

3) The camera send back the one of the below receiving code after write EEPROM.
   01H: OK
   10H: EEPROM write error

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

Note.1) DO NOT saves to the EEPROM when 80H.0 is “0”.

Note.2) When save the multiple sequence command to the EEPROM, all data save to the EEPROM by one operation from 1) to 4).
Example of the multiple sequence command: “10H, 11H, 12H and 13H” or “22H, 23H and 24H”.

Note.3) When save the multiple command data, which is not sequence command, to the EEPROM, it is necessary to operate the number of times from 1) to 4).
Example of the multiple command: “10H, 13H, 19H and 1BH” or “20H, 23H and 25H”.

h

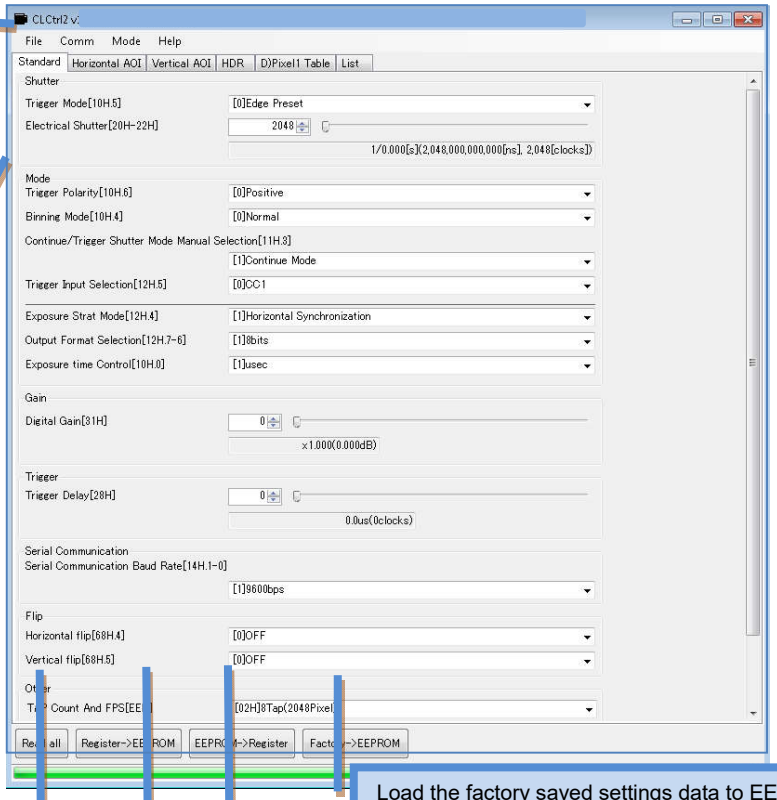
7 Control Software

7.1 Summary

After installing the control software and launch the CLCtrl2.exe, main window appears as below.

Menu
As for the detail, please refer to the next page.

Camera Setting Parameters
As for the detail, please refer to the next chapter Software Function (Standard).



Load the factory saved settings data to EERPOM .
As for the detail, please refer to the next chapter Comm.

Load the previously saved settings data from EERPOM to Register.
As for the detail, please refer to the next chapter Comm.

Save the camera setting data on the register to EEPROM.
As for the detail, please refer to the next chapter Comm.

Read the camera setting data from Register.
As for the detail, please refer to the next chapter Comm.

7.1.1 File

Open[From File to Register]

Open the camera setting file (.i2c).

Save as[From Register to File]

Save the current camera setting data on the register to the PC as i2c file.

Open[From File to EEPROM]

Open the camera setting file (.i2c) that is read at power on.

Save as[From EEPROM to File]

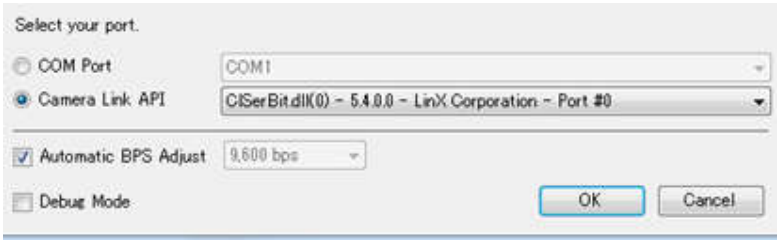
Save the camera setting data on EEPROM to the PC as i2c file.

Quit

Exit the control software.

7.1.2 Comm

Port Setting



[Select your port]

COM port When the Graber Board supprot COM port, Please select this comand.

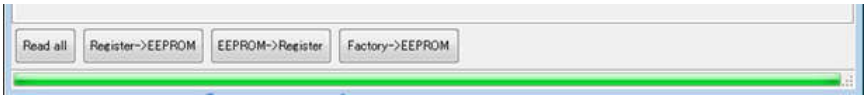
Camera Link API When the Graber Board supprots Camera Link API, Please select this comand.

[Automatic BPS Adjust]

Select the serial comunication speed automatically. When un-checked the box, comunication speed can be selected.

[Debug Mode]

Basically un-checked the box, when checked the box, transfer data can be monitored through 3rd party software.



Read all

Read the setting of all data from camera register. This setting data on the register cannot be saved without saving the EEPROM (**Register -> EEPROM)**.

Register -> EEPROM

Save the register data into the EEPROM on the camera. When camera turns off, data remain on the EEPROM.

EEPROM -> Register

Read the EEPROM data into the register. When saved data wants to be used again, this can be done.

Factory -> EEPROM
Restore the factory setting data from EEPROM to the register.

7.1.3 Mode

Language
Select the language from English, Japanese.

7.1.4 Help

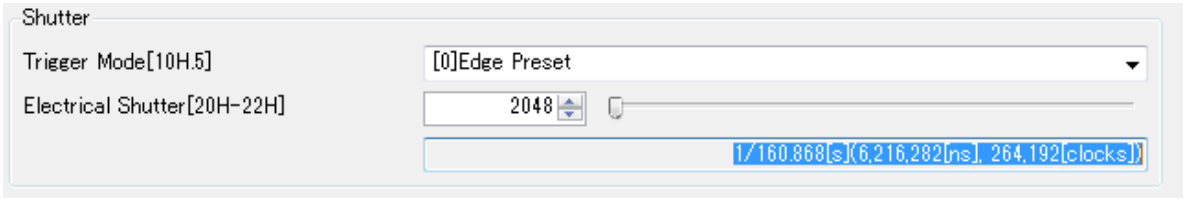
Advanced Operation
When password (sentechcamera) is input, additional functions appear for power user. SP Pin tab can be used.

Version Information
Software information window appear.

7.2 Software Function (Standard)

This tab has basic camera function. The number (like [10H.5]) beside of the function is register address. When direct register access is needed. Please refer to “6. Communication Protocol Specifications”.

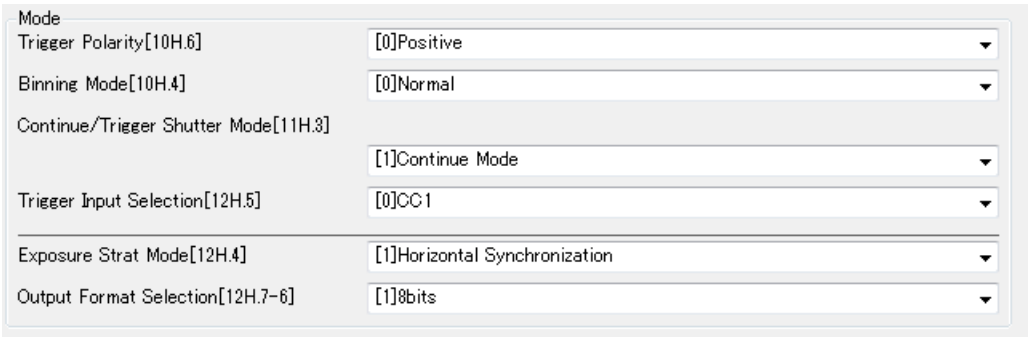
7.2.1 Shutter



Trigger Mode
Edge Preset The camera exposure starts at the rising (or falling) edge of the trigger pulse. Exposure duration time is preset.
Pulse Width The camera exposure starts at the rising (or falling) edge of the trigger pulse and stops at the falling(or rising) edge of the trigger pulse.
As for the detail of Trigger Mode, please refer to “5. Camera function modes”.

Electrical Shutter
Effectrical shutter setting can be set through the slide ba or set through the actrual register value. Actual exposure time appears on the bottom of the slide bar.
As for the detail of exposure time setting, please refer to “6. Communication Protocol Specifications”.

7.2.2 Mode



Trigger Polarity
Positive Positive signal is availabe as Trigger
Negative Negative signal is availabe as Trigger

Binning Mode
Normal Binning function is Off
Binning Binning function is On.
Please refere “6. Communication Protocol Specification, Binning[2AH.5-4] and Sub[2AH.1-0] for more details.

Contiune/Trigger Shutter Mode
Continue Mode Obtaing the image from the camera automatically.The trigger is gerated inside of the camera continuously.
Trigger Shutter Mode Obtaing the image from the external trigger timing. When this mode is selected.Edge Preset, Pulse Width on the [Trigger Mode] are available.
As for the detail of Continue Mode, Trigger Shutter Mode, please refer to “5. Camera function modes”.

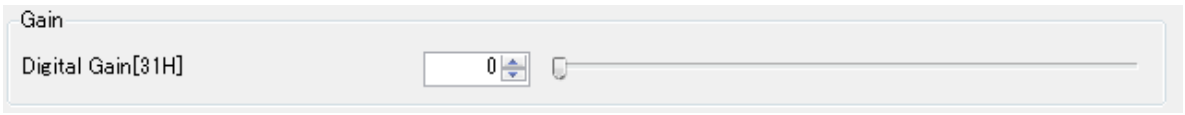
Trigger Input Selection
CC1: Trigger signal input from camera link conector on pin CC1.
SP4: Trigger singnal input from I/Oport. As for the detail, please refer to “8.1 Using the Trigger Signal through 6pin”.

Exposure Start Mode
Normal Exposure is going to start after trigger input. The exposure can start during the video out from the camera with horizontal noises.

Horizontal Synchronization The exposure can start during the video out from the camera without horizontal noises. The maximum delay to start exposure from the trigger inputs in 1H.

Output Format Selection
Video output bit can be selected from 8/10/12 bit. Video output bit is different for each mode. As for the relation of mode to video output, please refer to “4.2 The Vertical timings”.

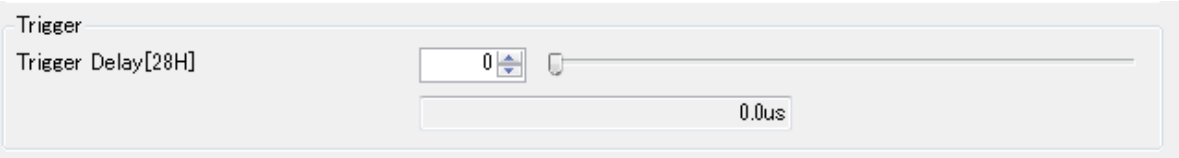
7.2.3 Gain



Digital Gain

The value of digital gain.As for the detail of gain calucuration, please refer to “6. Communication Protorol Specifications 31H”.

Trigger

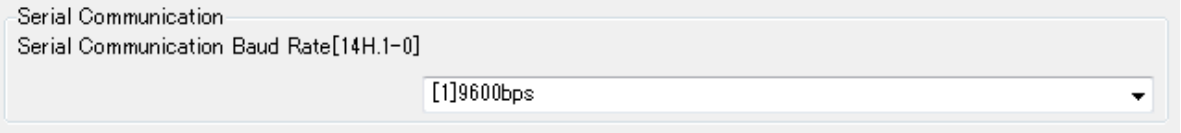


Trigger

Delay

The delay time for the trigger. As for the detail of delay time calculation, please refer to “6. Communication Protocol Specifications 28H.

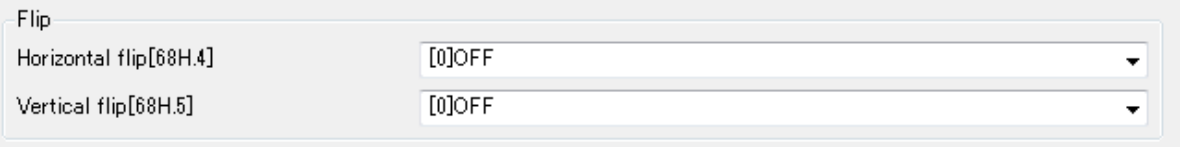
7.2.4 Serial Communication



Serial Communication Baud Rate

Baud rate can be selected.

7.2.5 Flip



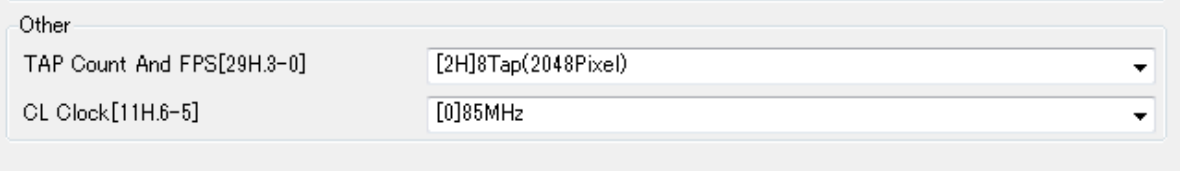
Horizontal flip

OFF Normal image
ON Horizontal flipped image

Vertical flip

OFF Normal image
ON Vertical flipped image

7.2.6 Other



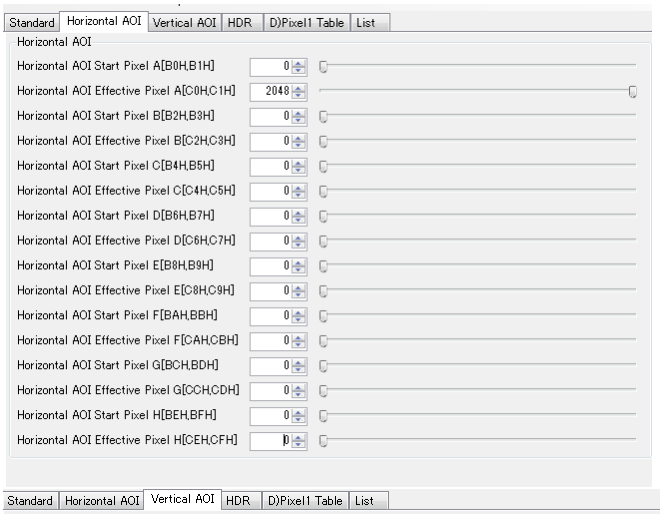
TAP Count And FPS

TAP number can be selected by frame rate, Camera Link Output Bit, Video mode. As for the detail, please refer to “4.2 The Vertical timings”.

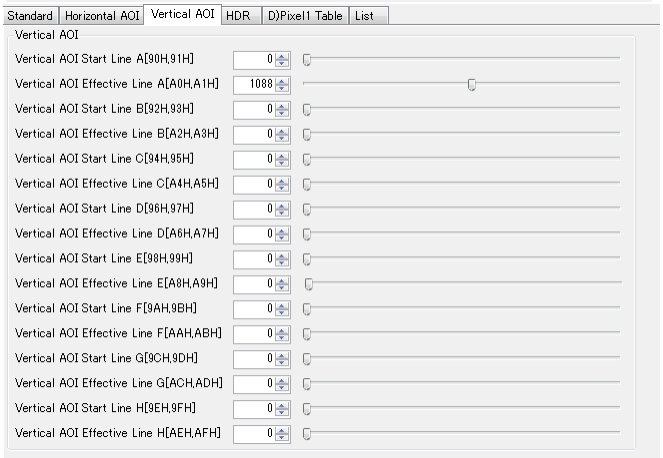
CL Clock

Camera Link Output Pixel Clock Frequency (MHz) support High speed mode and Low speed mode. Clock speed can be selected by frame rate, Camera Link Output Bit and Video mode. As for the detail, please refer to “4.2 Vertical timings”.

7.3 Software Function (RO)



Horizontal ROI
Horizontal scan can be set.



Vertical ROI
Vertical scan can be set.

7.4 Software Function (HDR)

This tab uses for the power user to control the Gamma deeply. Do not use the color model.

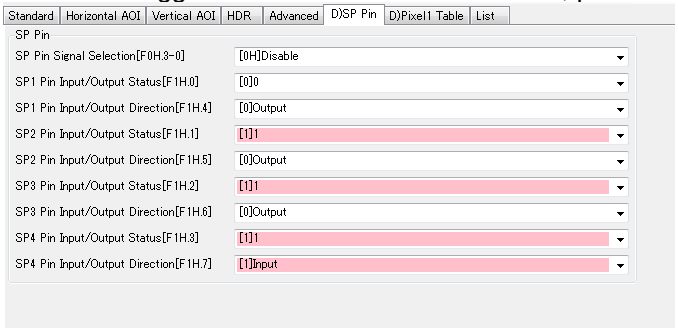
After entered ”sentechcamera” on Advanced Operation on Help Menu. Use can control these function as below.

7.5 Software Function (Advanced)

This tab is used for factory setting. Please do not use this tab.

7.6 Software Function (SP Pin)

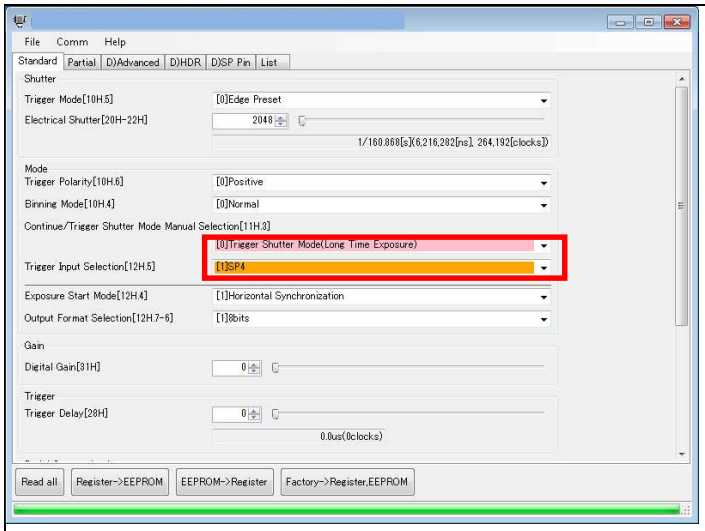
External trigger can be used. As for the detail, please refer to “8.1 Using the Trigger Signal through 6pin”.

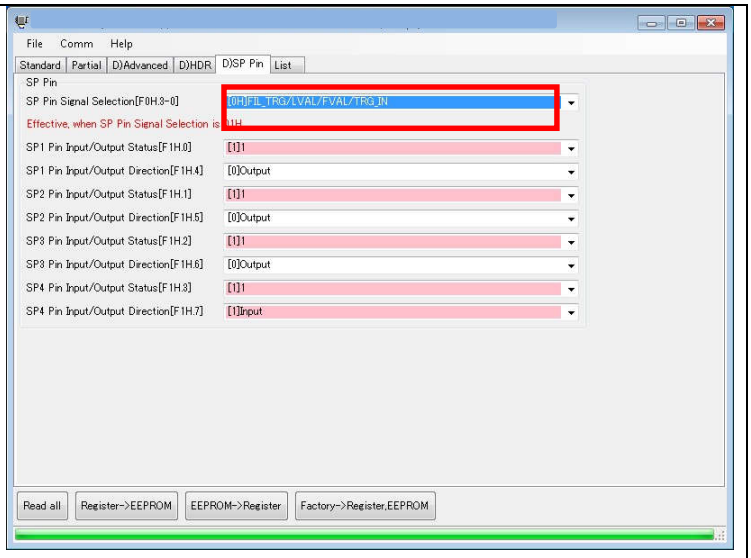


8 Actual Camera Setting & Technical Notes

8.1 Using the Trigger Signal through 6pin

1.Select the “[0]Trigger Shutter Mode(Long Exposure)” on Contiue/Trigger Shutter Mode Selection at Standard tab through the control software(CLCtrl2).
2. Select the ”[0H] FIL_TRG/LVAL/FVAL_TRG_IN” on SP Pin Signal Selection at SP_Pin tab.
3. Input the trigger signal through Pin2. As for using the software, please refer to the **0. Control** Software.





SP Pin Signal Selection Table

Pin No	5	4	3	2
Addr=F0	SP1	SP2	SP3	SP4
0	AfterTrigger FILTER	LVAL	FVAL	**Trigger Input**
1	F1h.0	F1h.1	F1h.2	F1h.3
2	CC1	T_EXP1	FRAME_REQ	HIGH in Exposure
3	CC1	T_EXP1	FRAME_REQ	FVAL
4 ～15	Reserved			

9 Revisions

Rev	Date	Changes	Note
00	2015/05/01	New document	
01	2015/05/22	Revised: Frame rate, EMI	
02	2015/06/12	Revised: 45 degree on Operation Temperature From 8 to 7th area support on ROI Trigger delay timing	
03	2015/08/21	Revised: Bayer pattern for color model (Only STC-CMC33PCL) GB -> GR	
04	2015/11/25	Revised Power Consumption	
05	2016/02/18	Revised Register information on 12H	
06	2016/11/04	Revised Input Signal Circuit Examples	
07	2017/05/12	Revised The maximum frame rate specification is changed.	
08	2017/07/03	Revised Change the name of company	

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