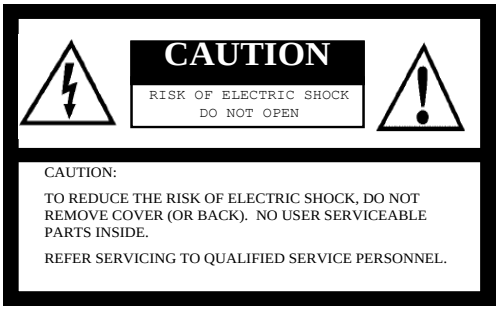
SENTECH

STC-POGE33A
STC-POGEC33A
User Guide

VGA Color/Monochrome CCD
GigE Vision Camera

Safety Precautions



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

For U.S.A.

Warning:

This equipment generates and uses radio frequency energy and if not installed and used properly, I.e., in strict accordance with the instruction manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

For Canada

Warning:

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

WARNING:

TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

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 he 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 CCD 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
- 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.

Copyright & Disclaimer

Sensor Technologies America, Inc. (DBA Sentech America) believes the contents and specifications of its website, catalog, documentation and ads are correct; however, Sentech America provides no representation or warranty regarding such information or product(s) contained therein. It is requested that Sentech America be given appropriate acknowledgement in any subsequent use of such work by a third party.

While every effort has been made to ensure that the details contained in Sentech America's website and all documentation are correct and up-to-date, Sentech America assumes no liability, legal or otherwise for any errors in listings, specifications, part numbers, process, software or model applications. Sentech America reserves the right to change specifications, product descriptions, product quality, pricing and application at any time without prior written or oral notice. Any party using such information assumes all risk for any and all damaged caused to themselves, a third party and/or property by virtue of incorrect information and/or failure of these products. By installing and/or using a Sentech America software development kit or other similar product and/or information obtained from Sentech America's website, catalog, documentation or ads, you hereby accept and understand these stated terms and conditions.

Contents

I. The Connector Specifications

A. RJ45 connector

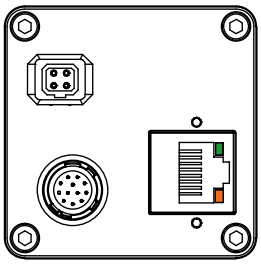
Caution: This product is a PoE type. Only apply power (+10.8 to +26.4 V) through the power/IO connector whenever PoE is not supported.

Pin assignment

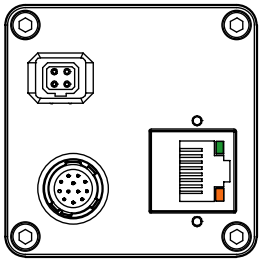
Pin No.	Signal name
1	TA+
2	TA-
3	TB+
4	TC+
5	TC-
6	TB-
7	TD+
8	TD-

LED information

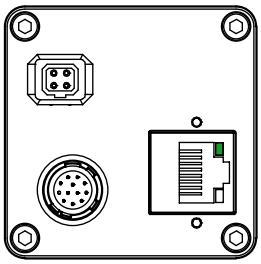
Yellow LED	Green LED	Status
Orange light ON	Green light ON	Power ON
Orange light ON	Green light blinking	1Gb transfering
Light OFF	Green light blinking	100Mb transfering



Power ON the camera



Yellow LED: Blinking
1Gb transferring



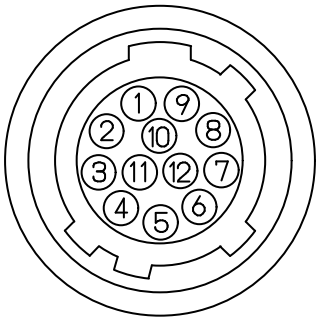
Yellow LED: OFF
Green LED: Blinking
100Mb transferring

Please use a 1Gb supported NIC, HUB and LAN cable. Check that the NIC and HUB being used is “1Gb transferring”.
Damaging or mishandling the CAT5e cable may cause the transferring speed to change from 1Gb to 100Mb. If this happens, please replace the CAT5e cable.

B. Power/IO connector
Connector: HR10A-10R-12PB (Hirose) or equivalent.
This connector is for DC power input and the input and output signals.

Pin assignment

No.	Signal type	IO direction	Spec.	Initial signal
1	POWER IN GND	-	GND	-
2	POWER IN	-	+10.8 to 26.4Vdc	-
3	OUT0_AUX_OP	OUT	Opt. Isolated	FrametriggerWait out
4	OUT1_AUX_OP	OUT	Opt. Isolated	ExposureActive out
5	OUT2_AUX_OP	OUT	Opt. Isolated	Open
6	OUT3_AUX_OP	OUT	Opt. Isolated	Open
7	OUT4_AUX_OP	OUT	Opt. Isolated	Open
8	IN0_AUX_OP	IN	Opt. Isolated	TRG In
9	IN1_AUX_OP	IN	Opt. Isolated	Open
10	IN2_AUX_OP	IN	Opt. Isolated	Open
11	IO VCC IN	-	IO VCC +3 to +26.4Vdc	-
12	IO GND	-	IO GND Refer Fig. 3	-



Notes:
- All I/Os (Pin number 3 through 10) are user assignable.
- Do NOT connect or disconnect the power/IO connector while the power is being input through PoE.

1. Input Signal

TRG IN: Input the trigger signal
High: Voltage of the “IO VCC IN”
Low: Smaller than 0.4V

2. Output Signals
Set the output signals from the power/IO connector.
The following six output signals are selectable with the software or communication:

a. FrameTriggerWait
With the FrameTriggerWait signal, the user can check the camera conditions of the camera exposure and the image output processing by the trigger signal.

1) High status (Voltage of the “IO VCC IN”): No processing by the trigger signal. The camera accepts the trigger signal
2) Low status (0V): The camera exposes and the image output processing by the trigger signal

The camera’s default setting is that the input trigger signal is INVALID during the low status for this signal.

In order to start the exposure while the image is being output by the next trigger signal, please change the camera settings (Device code: 001, Command: 13H) to accept the trigger signal while the image is being output.

Noise may appear on the image when the exposure is initiated while the image is being output. In this case, please change the “H reset” of the exposure start mode (Device code: 00H, Command: 12H) in order to change the exposure start point to next HD timing.

b. UserOutput
The status of this UserOutput signal can be changed with the “UserOutputValue”.

c. ExposureActive
The user can check the exposure time with the ExposureActive signal.

1) High status (Voltage of the “IO VCC IN"): The camera is exposing
2) Low status (0V): The camera is not exposed

d. TriggerAuxiliary
This TriggerAuxiliary signal is the trigger signal.

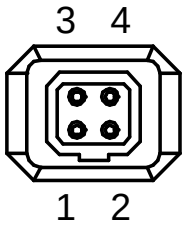
e. TriggerInternal
This TrigerInternal signal is the trigger signal for the trigger delay time.

f. SensorReadOut
SensorReadOut signal is the FVAL signal (the image output period of the time).

C. DC IRIS lens connector
Connector: M1951 (EMUDEN) or equivalent.

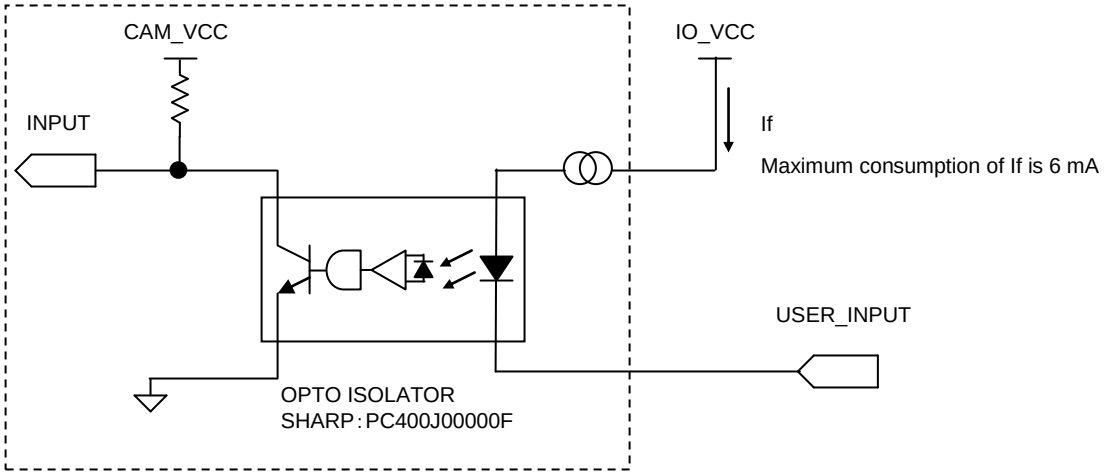
Pin Assignment:

Pin No.	Signal name
1	DAMP-
2	DAMP+
3	DRIVE+
4	DRIVE-

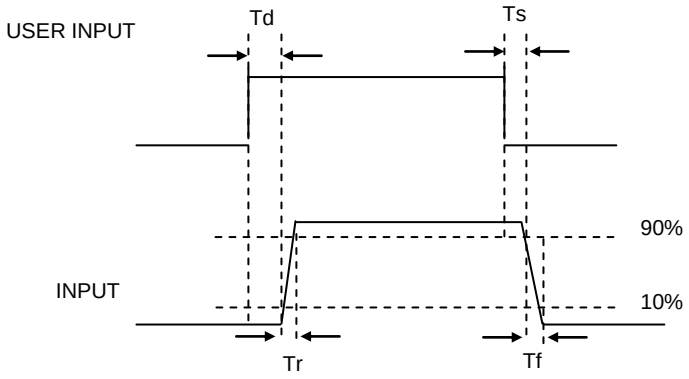


II. I/O Circuits

A. Input Circuit

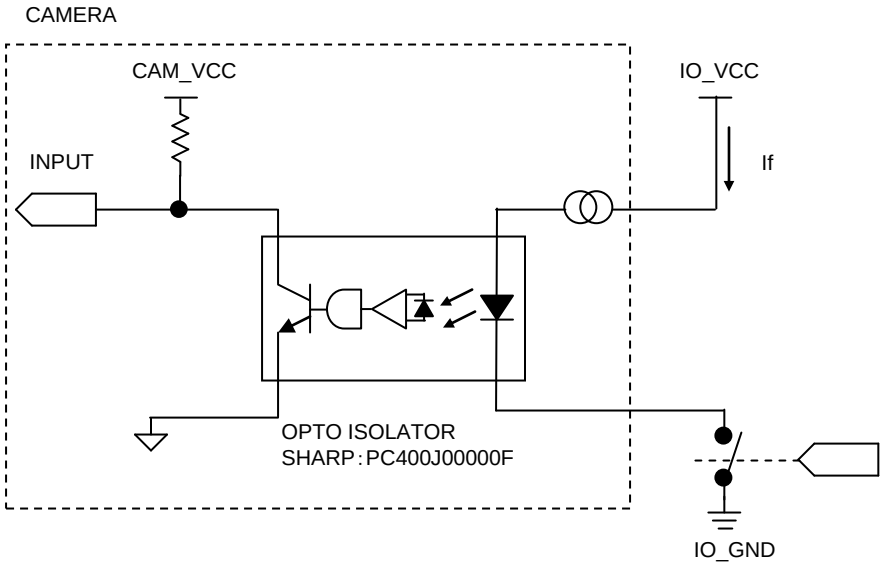


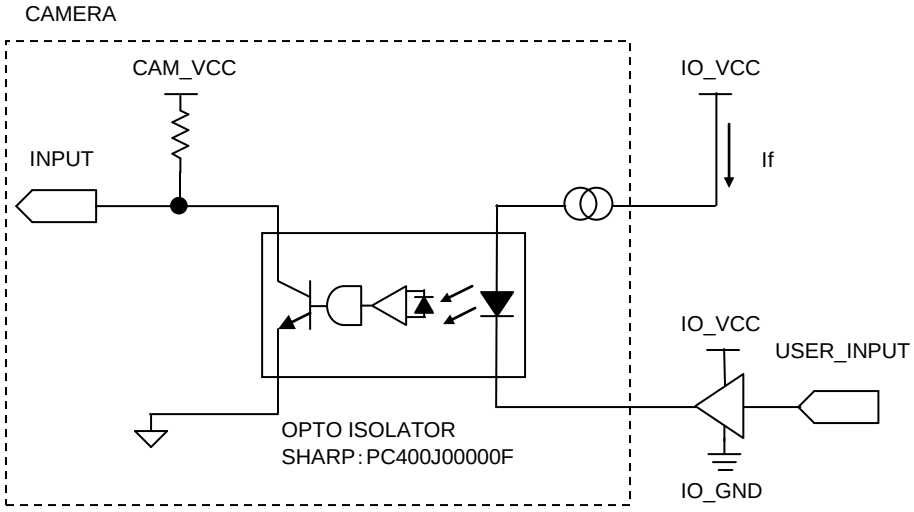
Response Timing



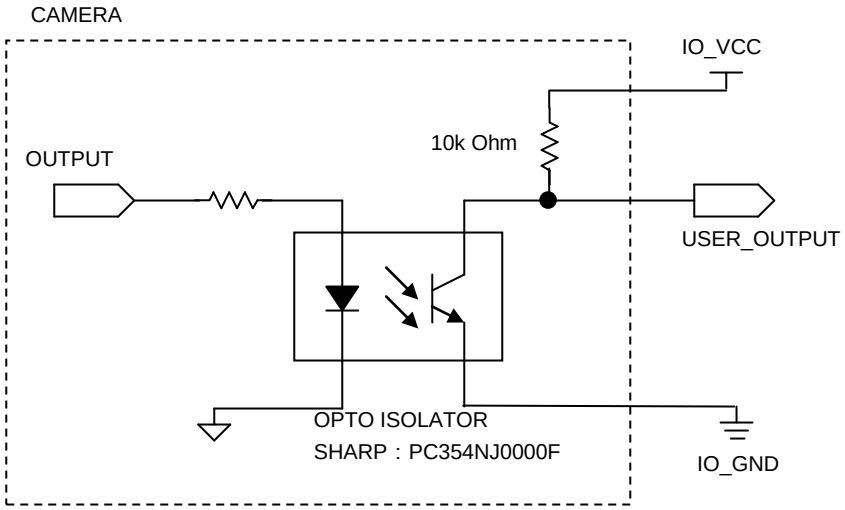
	IO_VCC			
	3.3[V]	5.0[V]	12[V]	24[V]
Td	2.5[us]	2.8 [us]	3.0[us]	3.0[us]
Tr	100[ns]	100[ns]	100 [ns]	100[ns]
Ts	689[ns]	584[ns]	545[ns]	520[ns]
Tf	11[ns]	11[ns]	11[ns]	11[ns]

Example Circuit for the Input Signal

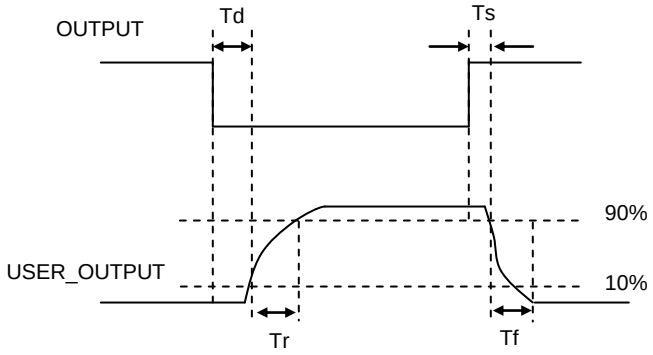




B. Output Circuit



Response Timing



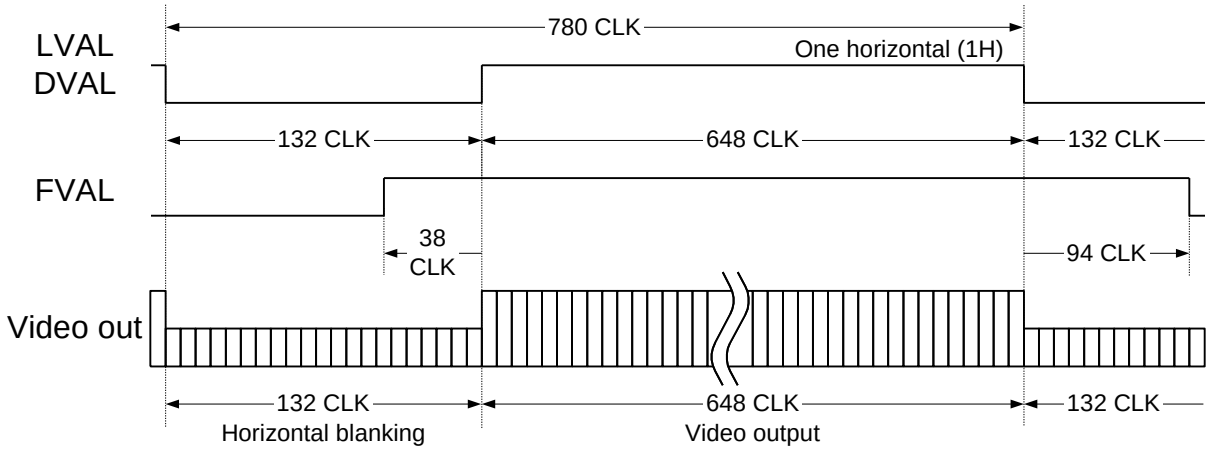
Response time

	IO_VCC			
	3.3[V]	5.0[V]	12[V]	24[V]
Td	29.6[us]	30.4 [us]	35.2[us]	28.4[us]
Tr	67.5[us]	60.2[us]	42.3[us]	31.0[us]
Ts	2.2[us]	2.2[us]	2.8[us]	2.8[us]
Tf	3.1[us]	3.8[us]	6.9[us]	10.9[us]

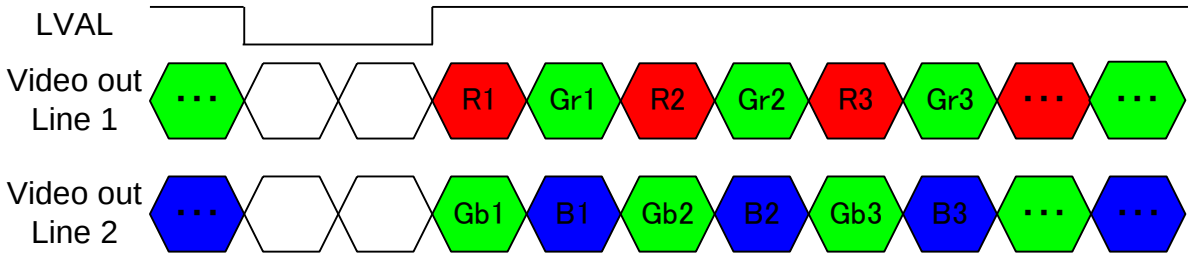
The Camera Output Timing Charts

A. The Horizontal Timing

1 CLK = 27.1605 nseconds



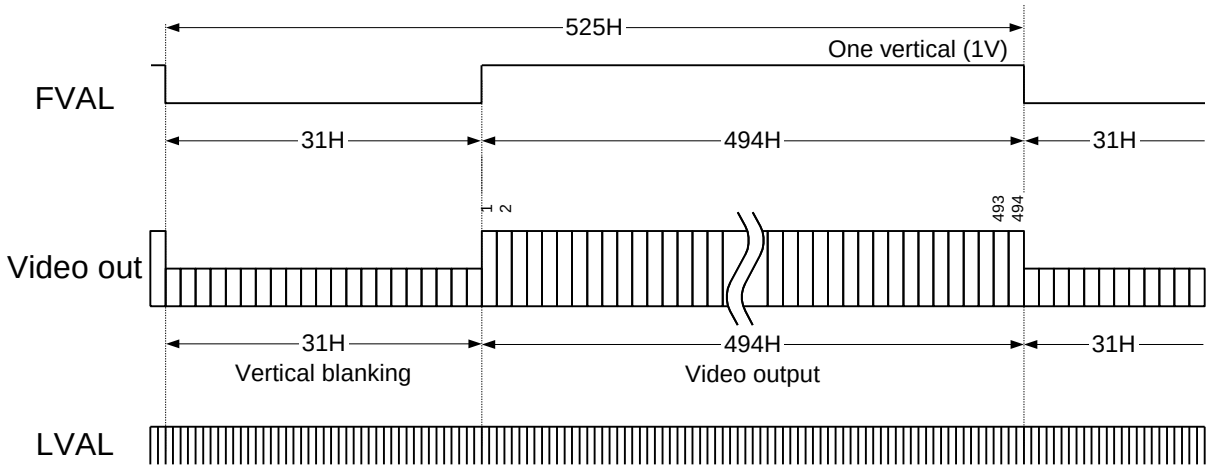
1. Color Bayer order (This information is only applicable to the STC-POGEC33A)



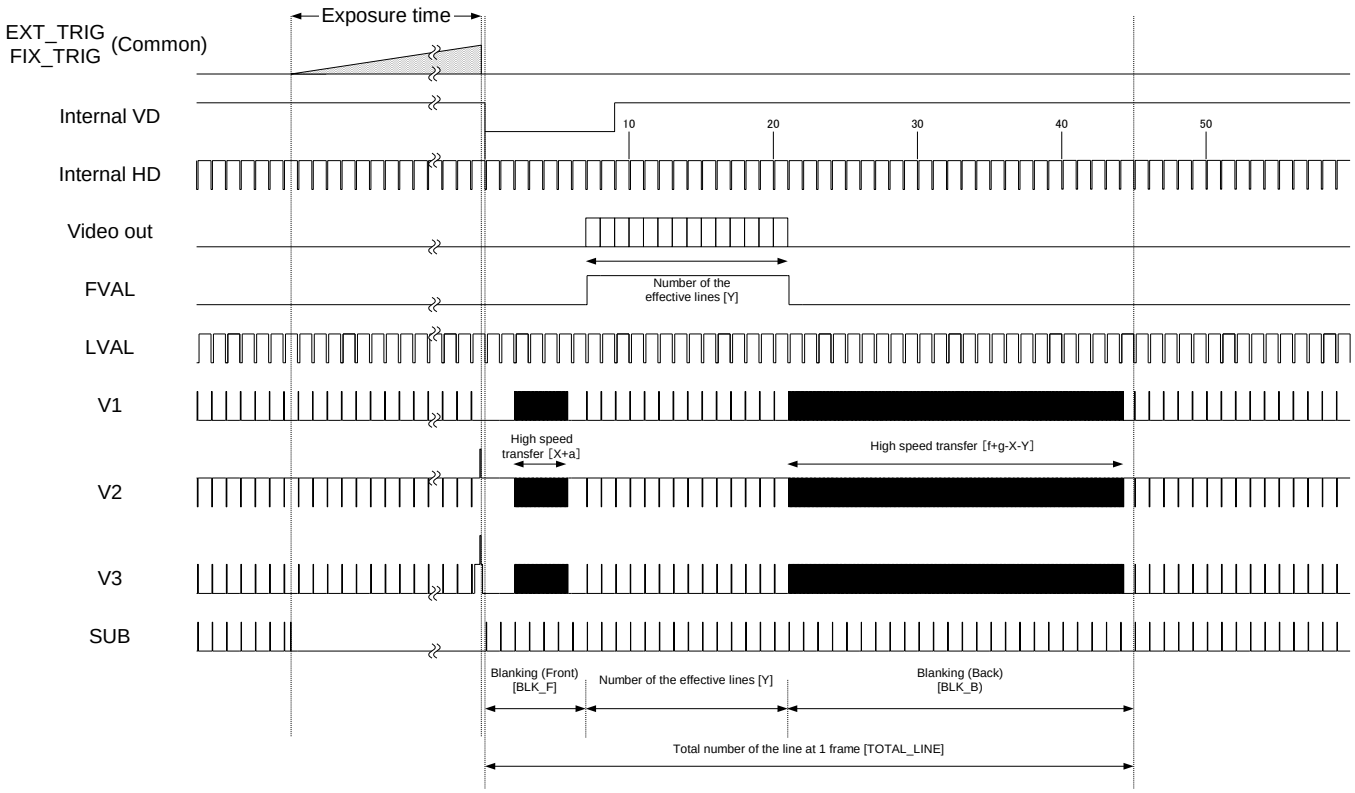
B. The Vertical Timing

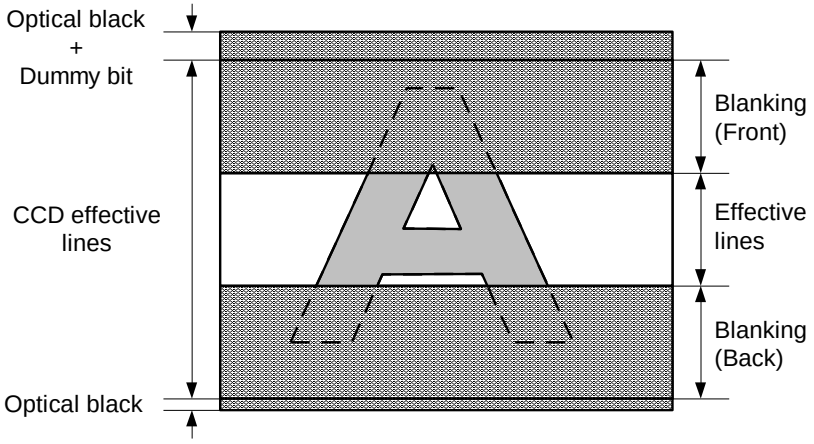
1. Full Scanning

1 H = 21.1852 µseconds, 89.910172 Hz



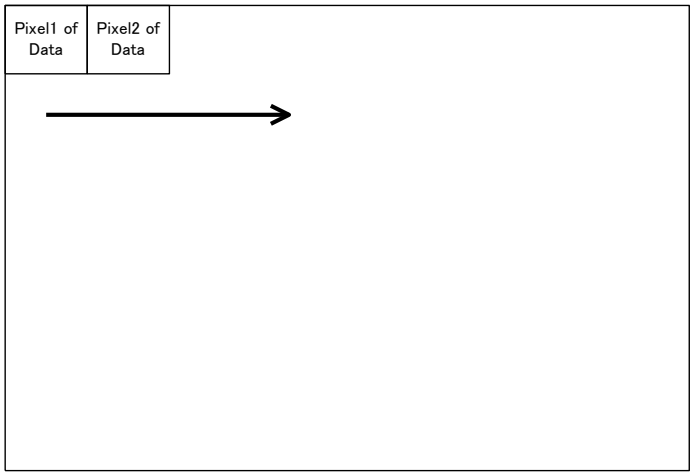
2. AOI


Exposure time
EXT_TRIG
FIX_TRIG
(Common)
Internal VD
10
20
30
40
50
Internal HD
Video out
FVAL
Number of the
effective lines [Y]
LVAL
V1
High speed
transfer [X+a]
High speed transfer [f+g-X-Y]
V2
V3
SUB
Blanking (Front)
[BLK_F]
Number of the effective lines [Y]
Blanking (Back)
[BLK_B]
Total number of the line at 1 frame [TOTAL_LINE]


Optical black
+
Dummy bit
CCD effective
lines
Optical black
Blanking
(Front)
Effective
lines
Blanking
(Back)

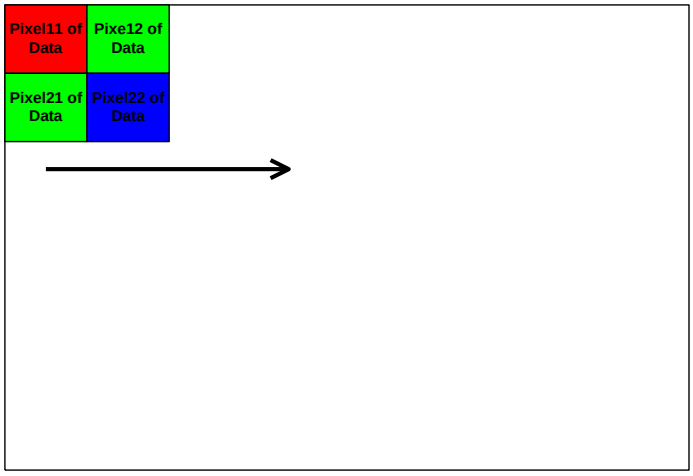
C. The Transferring Image

STC-POGE33A (Monochrome)



Pixeln of Data: The transferring pixel
n: The order number

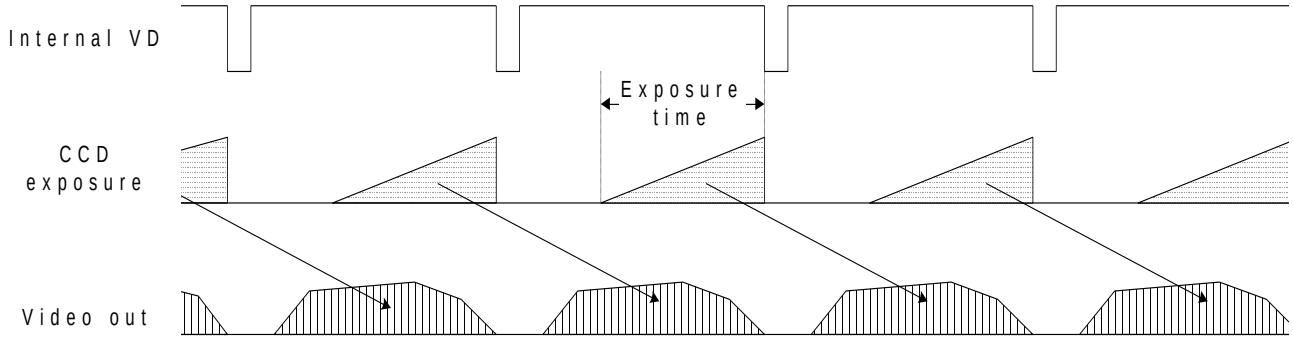
STC-POGEC33A (Color)



Pixelmn of Data: The transferring pixel
m: The line number
n: The order number

III. Camera Function Modes

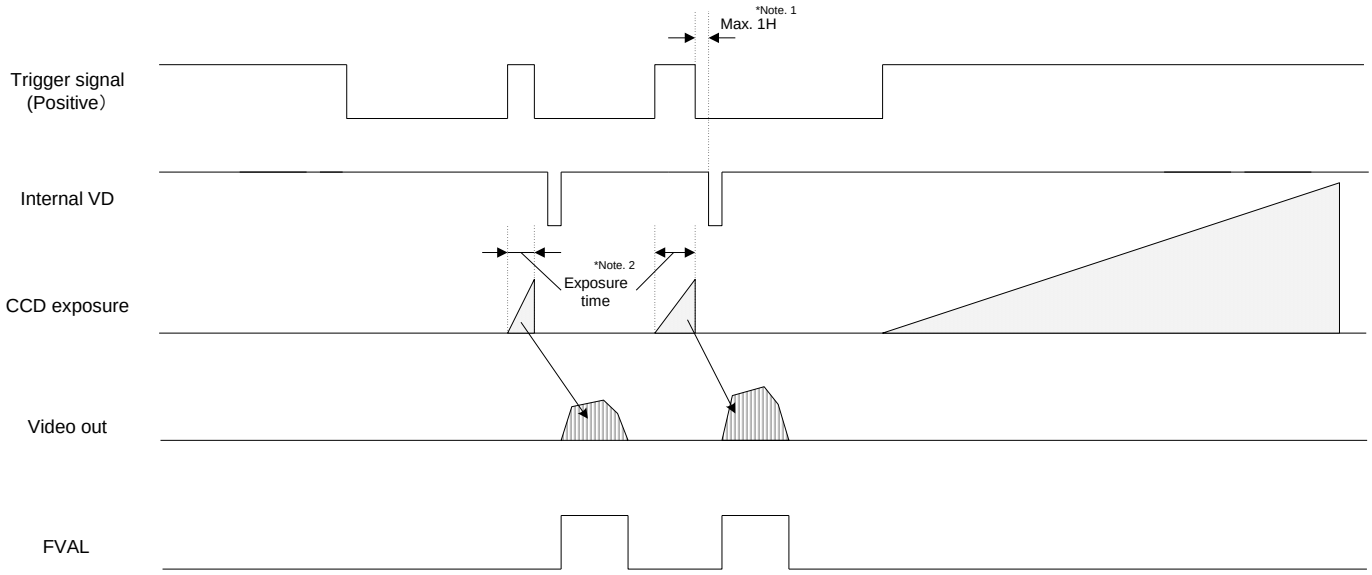
A. Normal Mode



B. Pulse Width Trigger Mode

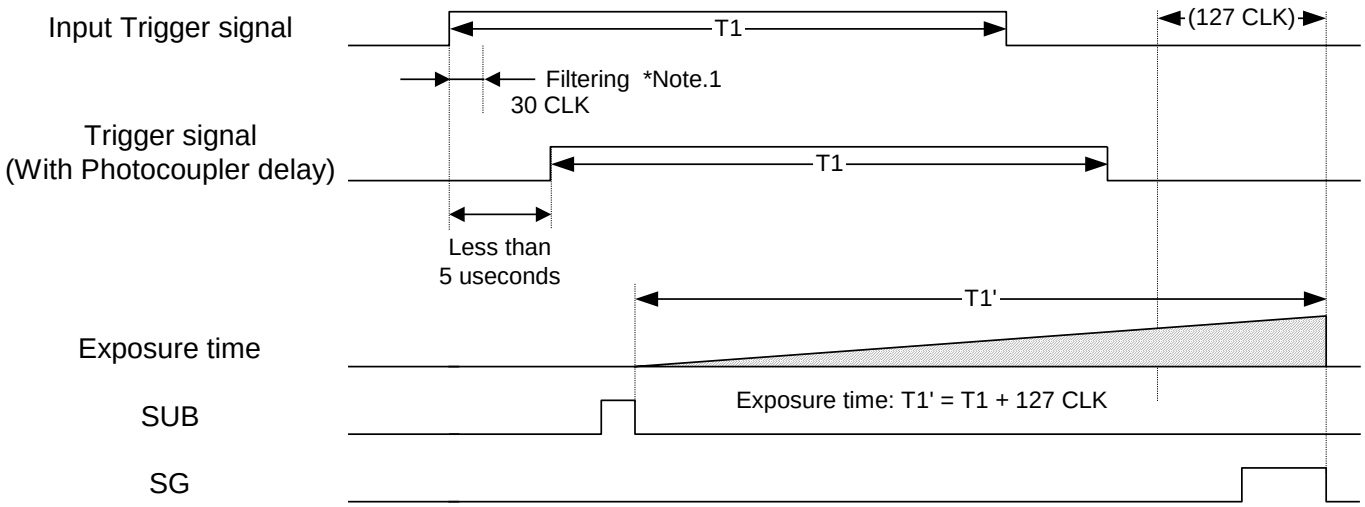
In this trigger mode with positive polarity, the camera exposure starts at the rising edge of the trigger pulse and stops at the falling edge of the trigger pulse. Therefore, if positive polarity exposure is selected, the exposure periods are the high states of the trigger pulse.

1. Timing



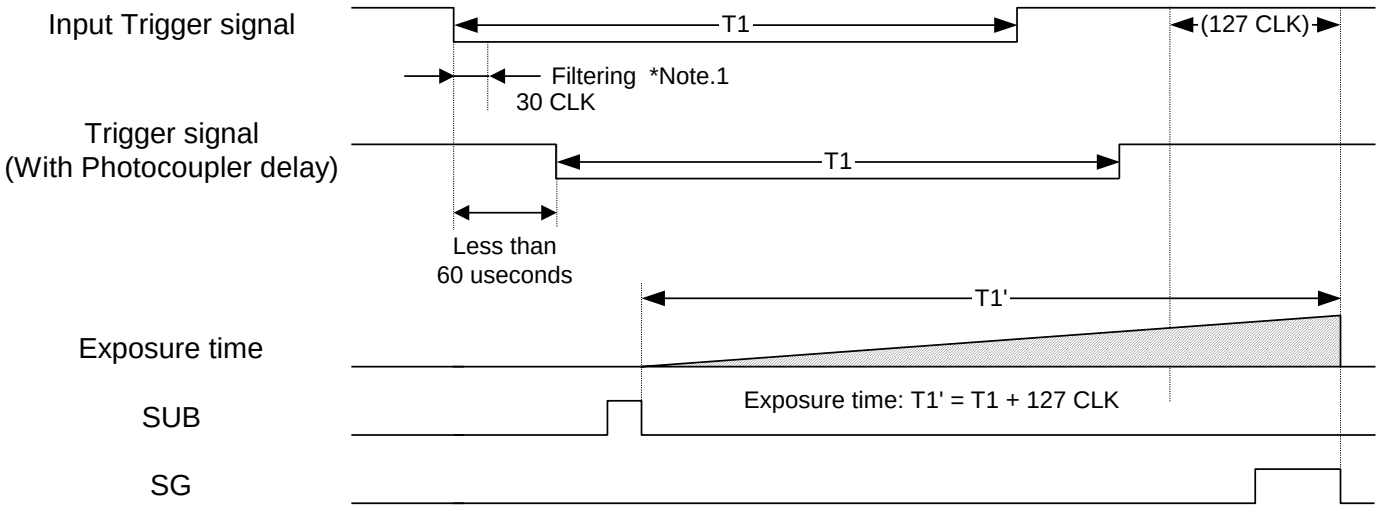
Note 1: The video output is going to be V reset by the next internal HD signal immediately after the exposure is finished.
Note 2: The exposure time is set by the pulse width of the trigger signal.

2. Exposure Timing with the Positive Polarity Trigger Signal



Note 1: The trigger signal will be removed by the filtering if the pulse width of the input trigger signal is less than 30 CLK. Please input a trigger signal with more than 31 CLK pulse width.
Note 2: The exposure will start 75 CLK after the rising edge of the trigger signal.

3. Exposure Timing with the Negative Polarity Trigger Signal

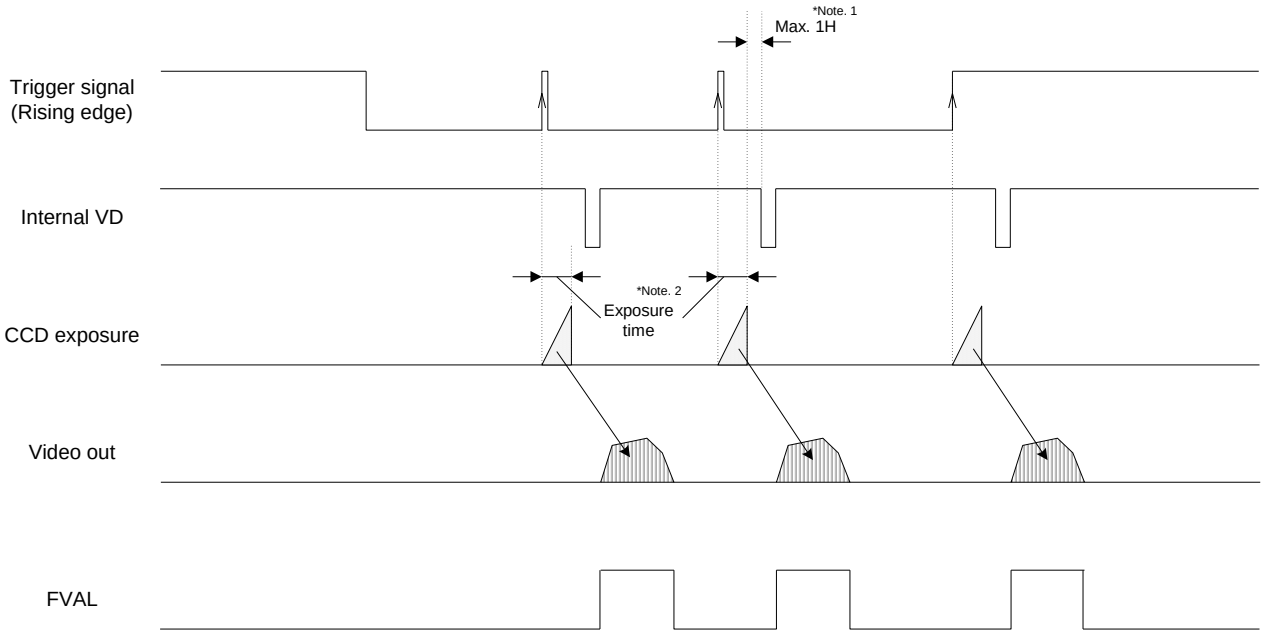


Note 1: The trigger signal will be removed by the filtering if the pulse width of the input trigger signal is less than 30 CLK. Please input a trigger signal with more than 31 CLK pulse width.
Note 2: The exposure will start 75 CLK after the rising edge of the trigger signal.

C. Edge Preset Trigger Mode

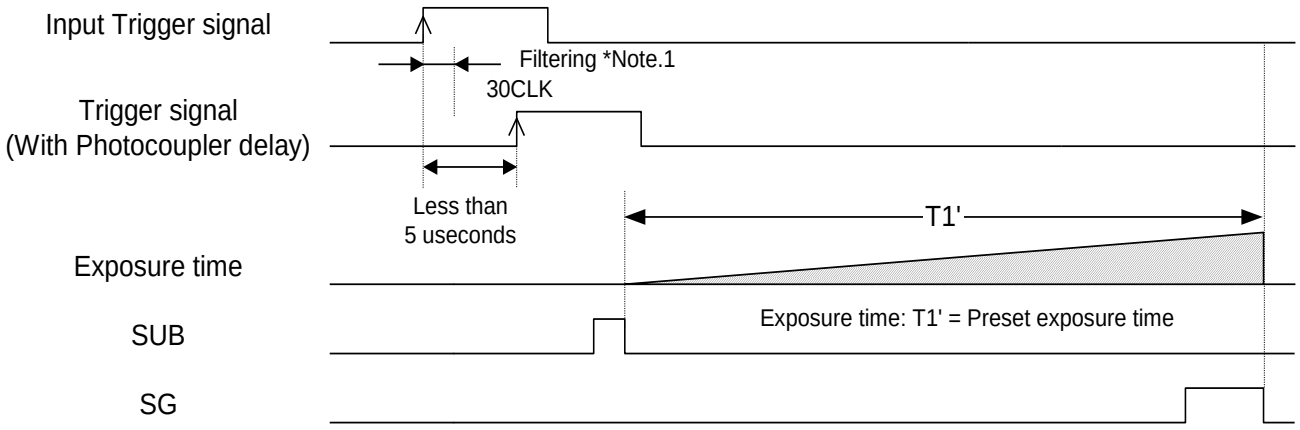
In this trigger mode, the camera exposure starts at the rising edge of the trigger pulse. The exposure duration time is preset by the DIP Switch settings.

1. Timing



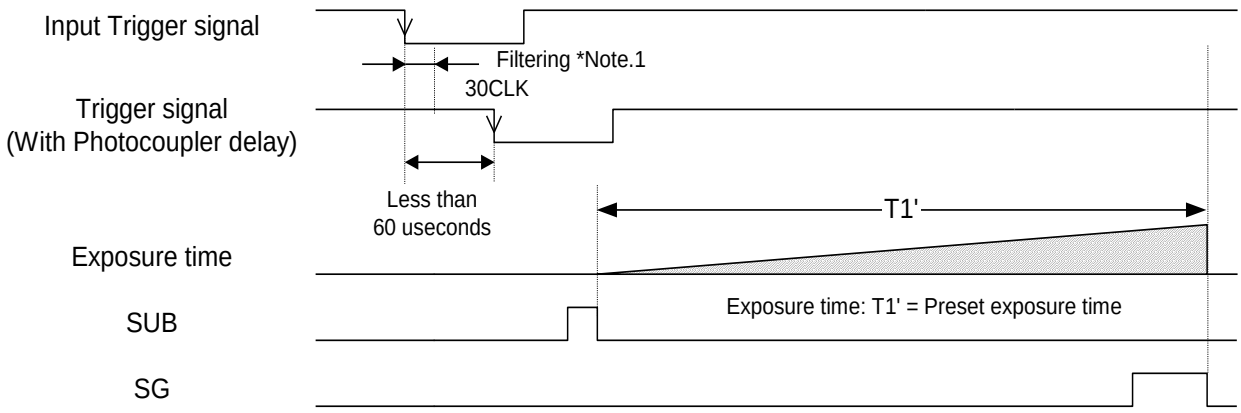
Note 1: The video output will be V reset by the next internal HD signal immediately after the exposure is finished.
Note 2: The exposure time is set by the preset electronic shutter speed.

2. Exposure Timing with the Positive Polarity Trigger Signal



Note 1: The trigger signal will be removed by the filtering if the pulse width of the input trigger signal is less than 30 CLK. Please input a trigger signal with more than 31 CLK pulse width.
Note 2: The exposure will start 75 CLK after the rising edge of the trigger signal.

3. Exposure Timing with the Negative Polarity Trigger Signal



Note 1: The trigger signal will be removed by the filtering if the pulse width of the input trigger signal is less than 30 CLK. Please input a trigger signal with more than 31 CLK pulse width.
Note 2: The exposure will start 75 CLK after the rising edge of the trigger signal.

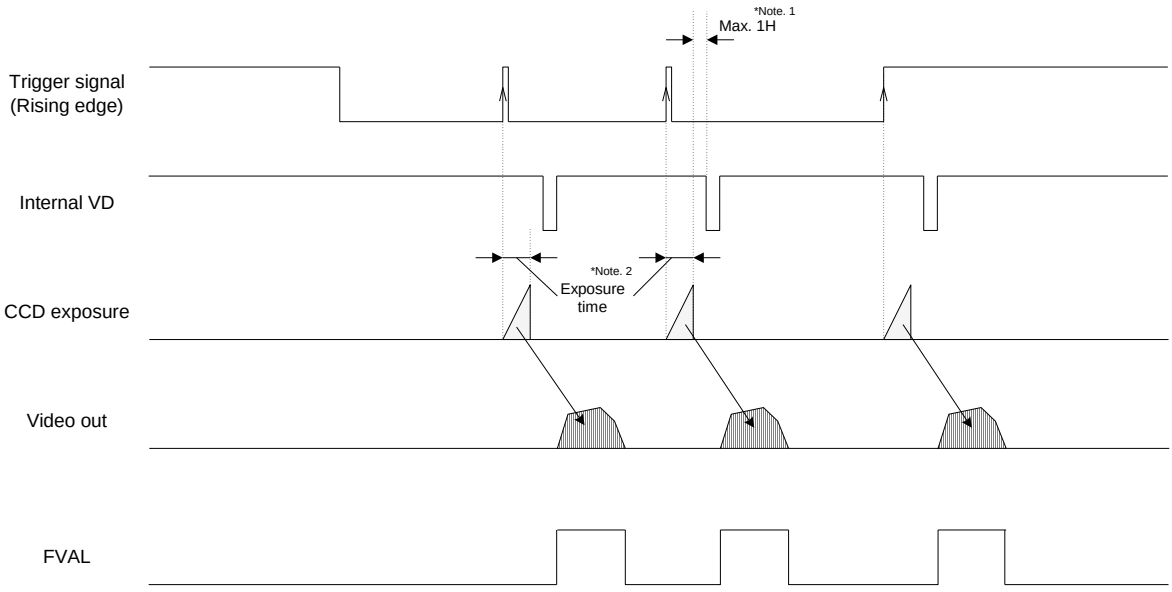
D. Edge Preset Trigger Mode (Trigger input while the image is out)

In this trigger mode, the camera exposure starts at the rising edge of the trigger pulse. The exposure duration time is preset by the DIP Switch settings.

If trigger signal input is required while the image is out, then it is necessary to disable the trigger signal mask with the communication.

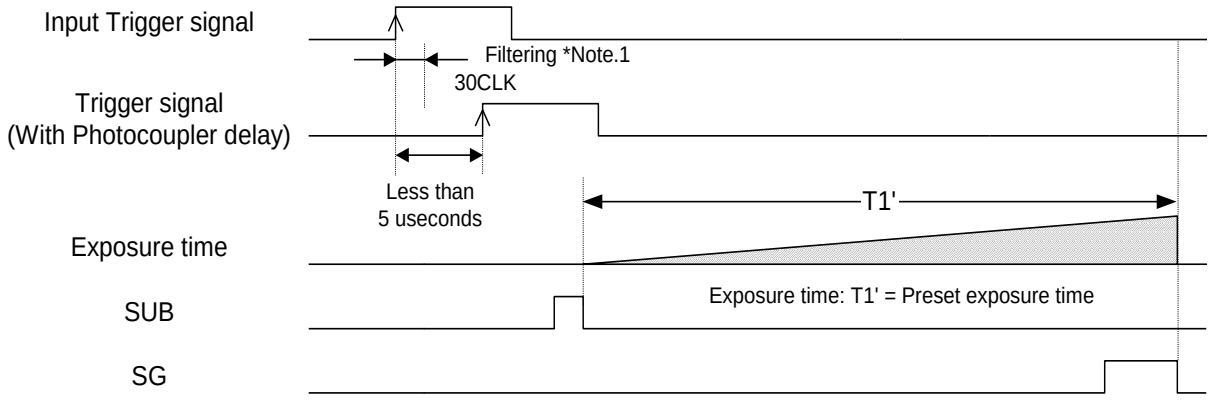
To avoid generating additional noise on the image, it is necessary to set the “H reset” at the exposure start mode.

1. Timing



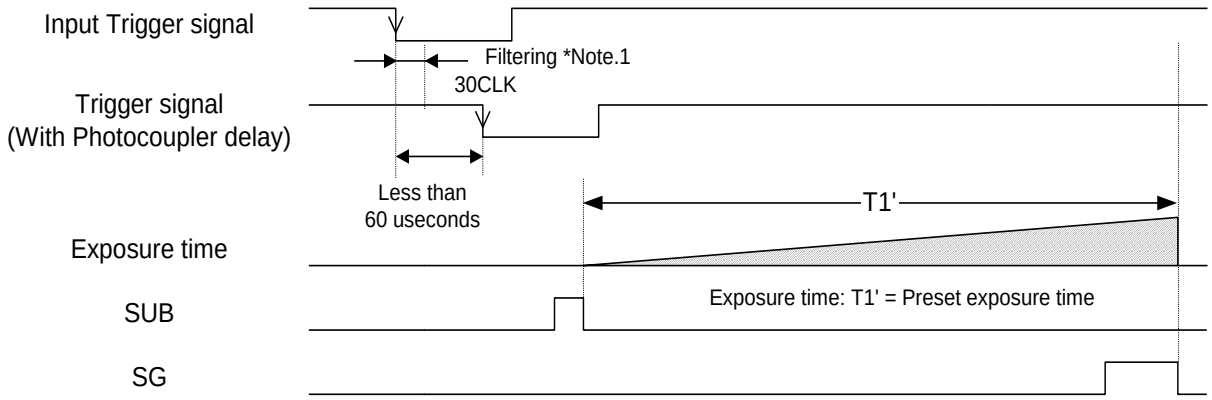
Note 1: The video output will be V reset by the next internal HD signal immediately after the exposure is finished.
Note 2: The exposure time is set by the preset electronic shutter speed.

2. Exposure Timing with the Positive Polarity Trigger Signal



Note 1: The trigger signal will be removed by the filtering if the pulse width of the input trigger signal is less than 30 CLK. Please input a trigger signal with more than 31 CLK pulse width.
Note 2: The exposure will start 75 CLK after the rising edge of the trigger signal.

3. Exposure Timing with the Negative Polarity Trigger Signal



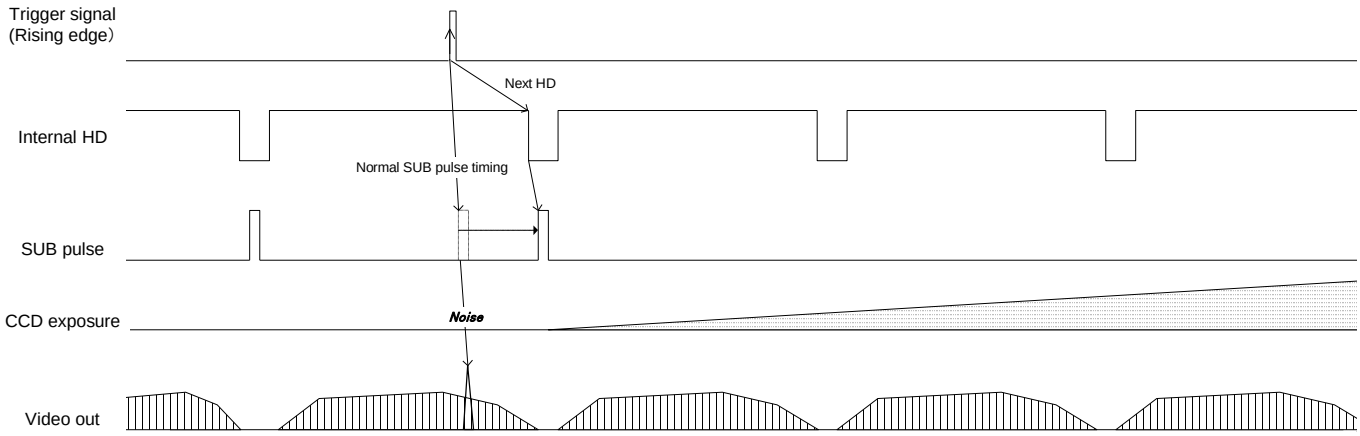
Note 1: The trigger signal will be removed by the filtering if the pulse width of the input trigger signal is less than 30 CLK. Please input a trigger signal with more than 31 CLK pulse width.
Note 2: The exposure will start 75 CLK after the rising edge of the trigger signal.

E. H Reset Mode

In this mode, the exposure can be initiated during the video out from the camera without any horizontal noise. A SUB pulse is generated to sweep the charges during the horizontal blanking period to prevent from getting horizontal noises.

The image will have horizontal noise that is caused by generating the SUB pulse during the video out during normal mode (H Reset Mode is OFF)

The maximum delay to start exposure from the trigger input is 1H.



IV. The Communication Protocol Specifications

This camera has a communication function that enables external devises, such as a PC, to control the camera's functions. Please use the "StCamGigEWare", "StGigECtrl" communication software, or the following communication protocol to communicate to the camera:

A. The Communication Method
UART (RS232C), Binary communication

B. The Communication Settings

	Settings
Baud rate	115,200bps
Data bit	8bit
Parity	None
Stop bit	1bit
Flow control	None

C. The Communication Format

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

a. Sending the Read Command:

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

b. Sending 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)

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

a. After the Read Command is sent:

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

b. After the Write Command is sent:

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

3. Descriptions of the Format

Name	Descriptions
SOF	Start of Frame Always set (or receive) the value as “02H”
Device Code	Set “000000” when accessing the camera’s function settings Set “100000” when accessing the camera’s extended function settings. Please refer to the “Camera Command List” and “Description of the Camera Control Commands”.
Read / Write	Set (or receive) “0” to send the read command. Set (or receive) “1” to send the write command.
Page Selection	After setting the read or write command, set “0” to access the command register of the camera. Data is pulled from the command register when the read command is sent. The existing data of the command register will be replaced by any data sent by the write command. In this command, the data of the EEPROM is not replaced. After setting the read or write command, set “1” to access the EEPROM of the camera. Data is pulled from the EERPOM when the read command is sent. The existing data of the EEPROM will be replaced by any data sent by the write command. The receiving code of “01H” is sent by the camera to the PC after the data of the EEPROM is replaced.
Command Code	Please refer to the following page.
Data Length	Data length (unit: byte) Receiving Data Receiving data length is dependent on the command that is sent after the read command. The data length is “00H” after sending the write command. Sending Data The data length is 1 byte when sending the read command. The data length is dependent on the write command that is sent.
Data	The value of the data is dependent of the command.
EOF	End of Frame Always set or receive the value as “03H”
Receiving Code	Results of the command sent 01H: OK (ACK), 14H: Time out error (Two seconds), 16H: Data length error (Not matching) 17H: EEPROM write error

4. Example of 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

D. The Camera Control Commands

1. The Camera Control Commands List

Note 1: The data unit of the each command is 1byte (8bit).
Note 2: The data can be saved to the EEPROM if “x” in the “Save to EEPROM” column on the list below.
The camera is operates with the data of the EEPROM when the camera is powered-on.

Device Code	Command No.	Read / Write	Save to EEPROM	Function	Initial data	Data range
000000	00 to 0FH			Reserved	-	-
	10H	Read / Write	x	The camera function mode 1 (8bit: D[7..0])	89H	
	11H	Read / Write	x	The camera function mode 2 (8bit: D[7..0])	0FH	
	12H	Read / Write	x	The camera function mode 3 (8bit: D[7..0])	00H	
	13H	Read / Write	x	The camera function mode 4 (8bit: D[7..0])	60H	
	14 to15H			Reserved	-	-
	16H	Read / Write	x	Software trigger mode (8bit: D[7..0])	00H	
	17H	Read / Write	x	Image data reset (8bit: D[7..0])	00H	
	18 to1FH			Reserved	-	-
	20H	Read / Write	x	The exposure time (useconds) of the electronic shutter (24bit: D[7..0])	0	0 to 16,777,215
	21H	Read / Write	x	The exposure time (useconds) of the electronic shutter (24bit: D[15..8])		
	22H	Read / Write	x	The exposure time (useconds) of the electronic shutter (24bit: D[24..16])		
	23 - 2FH			Reserved	-	-
	30H	Read / Write	x	CDS gin (8bit: D[7..0])	0	0 to 255
	31H	Read / Write	x	The digital gain (8bit: D[7..0])	The factory adjusted value	
	32H	Read / Write	x	The gain offset (8bit: D[7..0])	The factory adjusted value	
	33 to 37H			Reserved	-	-
	38H	Read / Write	x	The clamp level (8bit: D[7..0])	9	0 to 31
	39 to 3DH			Reserved	-	-
	3EH	Read / Write	x	White clip for the test pattern (16bit: D[15..8])	1,023	0 to 4,095
	3FH	Read / Write	x	White clip for the test pattern (16bit: D[7..0])		
	40 to 4FH			Reserved	-	-
	50H	Read / Write	x	The trigger delay time (useconds) (Integer) (24bit: D[7..0])	0	0 to 2,000,000
	51H	Read / Write	x	The trigger delay time (useconds) (Integer) (24bit: D[15..8])		
	52H	Read / Write	x	The trigger delay time (useconds) (Integer) (24bit: D[23..16])		
	53H	Read / Write	x	The trigger delay time (useconds) (Decimal) (8bit: D[7..0])		
	54 to 57H			Reserved	-	-
	58H	Read / Write	x	Frame rate (Hz) (Integer) (16bit: D[7..0])	89.91172	0.72028 to 360.33325
	59H	Read / Write	x	Frame rate (Hz) (Integer) (16bit: D[15..8])		
	5AH	Read / Write	x	Frame rate (Hz) (Decimal) (24bit: D[7..0])		
	5BH	Read / Write	x	Frame rate (Hz) (Decimal) (24bit: D[15..8])		
	5CH	Read / Write	x	Frame rate (Hz) (Decimal) (24bit: D[23..16])		
	5D to 77H			Reserved	-	-
	78H	Read / Write	x	Test pattern selection (8bit: D[7..0])	00H	
	79H	Read / Write	x	Image effect selection (8bit: D[7..0])	00H	
	7A to 7FH			Reserved	-	-
	80H	Read / Write		EEPROM control (8bit: D[7..0])	00H	
	81 to EFH			Reserved	-	-
	F0H	Read / Write	x	The signals of the power/IO connector (8bit: D[7..0])	20H	
	F1H	Read / Write	x	UserOutput signal for the power/IO connector (8bit: D[7..0])	00H	
	F2 to F7H			Reserved	-	-
	F8H	Read / Write	x	The signals of the power/IO connector (8bit: D[7..0])	00H	
	F9H	Read / Write	x	The signals of the power/IO connector (8bit: D[7..0])	00H	
	FA to FFH			Reserved	-	-

Device Code	Command No.	Read / Write	Save to EEPROM	Function	Initial data	Data range
100000	00 to 1FH			Reserved	-	-
	20H	Read / Write	x	Exposure mode (8bit: D[7..0])	00H	
	21H	Read / Write	x	AGC maximum limit (8bit: D[7..0])	255	0 to 255
	22H			Reserved	-	-
	23H	Read / Write	x	The upper limit of the electronic shutter for auto shutter (20bit: D[7..0])	11,122	0 to 1,048,575
	24H	Read / Write	x	The upper limit of the electronic shutter for auto shutter (20bit: D[15..8])		
	25H	Read / Write	x	The upper limit of the electronic shutter for auto shutter (20bit: D[20..16])		
	26H	Read / Write	x	The lower limit of the electronic shutter for auto shutter (20bit: D[7..0])	0	0 to 1,048,575
	27H	Read / Write	x	The lower limit of the electronic shutter for auto shutter (20bit: D[15..8])		
	28H	Read / Write	x	The lower limit of the electronic shutter for auto shutter (20bit: D[20..16])		
	29H	Read / Write	x	Weight1 for ALC (8bit: D[7..0])	11H	D3 to D0: 0 to 15 D7 to D4: 0 to 15
	2AH	Read / Write	x	Weight2 for ALC (8bit: D[7..0])	11H	D3 to D0: 0 to 15 D7 to D4: 0 to 15
	2BH	Read / Write	x	Weight3 for ALC (8bit: D[7..0])	1AH	D3 to D0: 0 to 15 D7 to D4: 0 to 15
	2CH	Read / Write	x	Weight4 for ALC (8bit: D[7..0])	11H	D3 to D0: 0 to 15 D7 to D4: 0 to 15
	2DH	Read / Write	x	Weight5 for ALC (8bit: D[7..0])	01H	D3 to D0: 0 to 15 D7 to D4: 0
	2EH	Read / Write	x	Target brightness for ALC (8bit: D[7..0])	128	0 to 255
	2FH	Read / Write	x	ALC peak-average (8bit: D[7..0])	0	0 to 255
	30H	Read / Write	x	Vertical_1 position for the ALC weight area (16bit: D[7..0])	32	0 to 493
	31H	Read / Write	x	Vertical_1 position for the ALC weight area (16bit: D[15..8])		
	32H	Read / Write	x	Vertical_2 position for the ALC weight area (16bit: D[7..0])	196	0 to 493
	33H	Read / Write	x	Vertical_2 position for the ALC weight area (16bit: D[15..8])		
	34H	Read / Write	x	Vertical_3 position for the ALC weight area (16bit: D[7..0])	298	0 to 493
	35H	Read / Write	x	Vertical_3 position for the ALC weight area (16bit: D[15..8])		
	36H	Read / Write	x	Vertical_4 position for the ALC weight area (16bit: D[7..0])	462	0 to 493
	37H	Read / Write	x	Vertical_4 position for the ALC weight area (16bit: D[15..8])		
	38H	Read / Write	x	Horizontal_1 position for the ALC weight area (16bit: D[7..0])	36	0 to 647
	39H	Read / Write	x	Horizontal_1 position for the ALC weight area (16bit: D[15..8])		
	3AH	Read / Write	x	Horizontal_2 position for the ALC weight area (16bit: D[7..0])	252	0 to 647
	3BH	Read / Write	x	Horizontal_2 position for the ALC weight area (16bit: D[15..8])		
	3CH	Read / Write	x	Horizontal_3 position for the ALC weight area (16bit: D[7..0])	396	0 to 647
	3DH	Read / Write	x	Horizontal_3 position for the ALC weight area (16bit: D[15..8])		
	3EH	Read / Write	x	Horizontal_4 position for the ALC weight area (16bit: D[7..0])	612	0 to 647
	3FH	Read / Write	x	Horizontal_4 position for the ALC weight area (16bit: D[15..8])		
	40H	Read / Write	x	White balance mode (8bit: D[7..0])	00H	
	41H	Read / Write	x	Preset_1 white balance (Red gain) (8bit: D[7..0])	0	0 to 255
	42H	Read / Write	x	Preset_1 white balance (Gr gain) (8bit: D[7..0])	0	0 to 255
	43H	Read / Write	x	Preset_1 white balance (Blue gain) (8bit: D[7..0])	0	0 to 255
	44H	Read / Write	x	Preset_1 white balance (Gb gain) (8bit: D[7..0])	0	0 to 255
	45H	Read / Write	x	Preset_2 white balance (Red gain) (8bit: D[7..0])	0	0 to 255
	46H	Read / Write	x	Preset_2 white balance (Gr gain) (8bit: D[7..0])	0	0 to 255
	47H	Read / Write	x	Preset_2 white balance (Blue gain) (8bit: D[7..0])	0	0 to 255
	48H	Read / Write	x	Preset_2 white balance (Gb gain) (8bit: D[7..0])	0	0 to 255
	49H	Read / Write	x	Preset_3 white balance (Red gain) (8bit: D[7..0])	0	0 to 255
	4AH	Read / Write	x	Preset_3 white balance (Gr gain) (8bit: D[7..0])	0	0 to 255
	4BH	Read / Write	x	Preset_3 white balance (Blue gain) (8bit: D[7..0])	0	0 to 255
	4CH	Read / Write	x	Preset_3 white balance (Gb gain) (8bit: D[7..0])	0	0 to 255
	4DH			Reserved	-	-
	4EH	Read / Write	x	Threshold for auto white balance (16bit: D[7..0])	3,072	0 to 4,095
	4FH	Read / Write	x	Threshold for auto white balance (16bit: D[16..8])		
	50H	Read / Write	x	Y_offset for AOI (8bit: D[7..0])	0	4 <= Y <= 494 Y: Y_offset + Height
	51H	Read / Write	x	Y_offset for AOI (16bit: D[15..8])		
	52H	Read / Write	x	Height for AOI (8bit: D[7..0])	494	4 <= Y <= 494 Y: Y_offset + Height
	53H	Read / Write	x	Height for AOI (16bit: D[15..8])		
	54H	Read / Write	x	X_offset for AOI (8bit: D[7..0])	0	8 <= X <= 648 X: X_offset + width
	55H	Read / Write	x	X_offset for AOI (16bit: D[15..8])		
	56H	Read / Write	x	Width for AOI (8bit: D[7..0])	648	8 <= X <= 648 X: X_offset + width
	57H	Read / Write	x	Width for AOI (16bit: D[15..8])		

Device Code	Command No.	Read / Write	Save to EEPROM	Function	Initial data	Data range
100000	58H	Read / Write	x	Vertical_1 position for the white balance area (16bit: D[7..0])	0	0 to 493
	59H	Read / Write	x	Vertical_1 position for the white balance area (16bit: D[15..8])		
	5AH	Read / Write	x	Vertical_2 position for the white balance area (16bit: D[7..0])	493	0 to 493
	5BH	Read / Write	x	Vertical_2 position for the white balance area (16bit: D[15..8])		
	5CH	Read / Write	x	Horizontal_1 position for the white balance area (16bit: D[7..0])	0	0 to 647
	5DH	Read / Write	x	Horizontal_1 position for the white balance area (16bit: D[15..8])		
	5EH	Read / Write	x	Horizontal_2 position for the white balance area (16bit: D[7..0])	647	0 to 647
	5FH	Read / Write	x	Horizontal_2 position for the white balance area (16bit: D[15..8])		
	60H	Read / Write	x	Camera mode1 (8bit: D[7..0])	00H	
	61 to 7FH			Reserved	-	-
	80H	Read / Write	x	Push set white balance (Red gain) (8bit: D[7..0])	0	0 to 255
	81H	Read / Write	x	Push set white balance (Gr gain) (8bit: D[7..0])	0	0 to 255
	82H	Read / Write	x	Push set white balance (Blue gain) (8bit: D[7..0])	0	0 to 255
	83H	Read / Write	x	Push set white balance (Gb gain) (8bit: D[7..0])	0	0 to 255
	84 to 8FH			Reserved	-	-
	90H	Read / Write	x	Iris lens adjustment (8bit: D[7..0])	80	0 to 255
	91H			Reserved	-	-
	92H	Read / Write	x	Iris lens manual adjustment (8bit: D[7..0])	01H	
	93 to FFH			Reserved	-	-

2. Description of the camera control commands (Device code: 000000); (The underline settings are the factory default settings)

Command No.	Command Description
10H: MOD1[7..0]	[The camera function mode 1] Initial data: 89H Sets the camera function mode. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7: Continuous / Trigger mode — 0: Auto — 1: Manual D6: Trigger Polarity — 0: Positive — 1: Negative D5: Trigger Mode — 0: Edge Preset — 1: Pulse Width D4: Binning Mode — 0: OFF (Normal) — 1: ON (Binning) D3: Scanning Mode — 0: Full Scanning — 1: Partial Scanning D2 to D0: No Function — Always set as "001"
11H: MOD2[7..0]	[The camera function mode 2] Initial data: 0FH Sets the camera function mode. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7 to D6: No Function — Always set as "00" D5: TG Reset — 0: TG Partial Reset — 1: TG Partial Reset OFF D4: Smear Half Reduction — 0: OFF — 1: ON D3: Function Mode — 0: Trigger Mode — 1: Continuous Mode D2 to D0: No Function — Always set as "111" Note 1: The function mode is enabled whenever the "Continuous/Trigger mode (MOD1-D7)" is manual. Note 2: While the camera is in Trigger Mode, the video will not output without the trigger signal input.
12H: MOD3[7..0]	[The camera function mode 3] Initial data: 00H Sets the camera function mode. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7 to D6: Video Out — 00: 10bit — 01: 8bit 10: 12bit — 11: RGB 8bit D5: Trigger Signal Type — 0: Software Trigger — 1: Hardware Trigger (trigger signal input from 5pin of Power/IO connector) D4 to D3: Exposure Start Mode — 00: Normal — 10 to 11: H Reset 01: No Function (Prohibited setting. Do not set these values) D2 to D0: No Function — Always set as "000"
13H: MOD4[7..0]	[The camera function mode 4] Initial data: 60H Sets the camera function mode. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7: No Function — Always set as "0" D6: Trigger signal mask while image out — 0: OFF — 1: ON (Invalid the trigger signal while image is out) D5 to D0: No Function — Always set as "100000"

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>16H:
SOFTRG[7..0]</td><td>[Software Trigger Setting] Initial data: 00H
Sets the source of the software trigger.
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>

D7 to D6: Software trigger source selection — 00: Programming software trigger; 10: Command software trigger (200 useconds pulse width trigger signal); 01, 11: No function (Prohibited settings. Do not set these values)
D5 to D1: No Function — Always set as “00000”
D0: Generate software trigger command — 0: Hold (Low State); 1: Generate command software trigger (200 useconds high state)

Note 1: The software trigger source selection is enabled whenever “Trigger signal type (MOD3-D5)” is the software trigger (set as 0)
Note 2: The “Programming software trigger” is used to set up the pulse duration, trigger signal interval and generate the trigger signal.
Note 3: When selecting “Command software trigger”, it is necessary to generate the software trigger signal with the “Generate command software trigger (SOFTRIG-D0)”.</td></tr>
<tr><td>17H:
IMAGEREST
[7..0]</td><td>[Image Data Reset] Initial data: 00H
Reset the Image data (FVAL, LVAL and the image data).
Change from the reset to the image data out after starting the image acquisition.
The image data is not output when resetting the image data.
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>

D7 to D1: No Function — Always set as “0000000”
D0: Image Data Reset — 0: FVAL/LVAL/Image data reset (FVAL, LVAL and the image data are low state data); 1: FVAL/LVAL/Image data out</td></tr>
<tr><td>20H:
EXPTM[7..0]
21H:
EXPTM[15..8]
22H:
EXPTM[23..16]</td><td>[The exposure time (useconds) of the electronic shutter]
Initial data: EXPTM[23..0] = 0, data range: 0 to 16,777,215
Sets the exposure time for the electronic shutter.

Exposure time = EXPTM[23..0] useconds

When set as 0, the electronic shutter is OFF.</td></tr>
<tr><td>30H:
PGA[7..0]</td><td>[CDS gain] Initial data: PGA [7..0] = 0, data range: 0 to 255
Sets the CDS gain (programmable gain)

CDS gain = 6.16 + 0.04 x (PGA[7..0] x 2 + GOFS[7..0])dB

*CDS_BASEGAIN[15..0]: The gain base offset (The value of the address 5EH and 5FH)
*GOFS[7..0]: The gain offset (The value of the address 32H)</td></tr>
<tr><td>31H:
DGB[7..0]</td><td>[The digital gain] Initial data: DGB [7..0] = The factory adjusted value

Video level = (Input video level – CLAMP level) x (1 + DGB[7..0]/128) + CLAMP Level

*CLAMP Level Clamp level (The calculated value of the address 38H)</td></tr>
</table>

Command No.	Command Description
32H: GOFS[7..0]	[The gain offset] Initial data: GOFS[7..0] = The factory adjusted value, data range: 0 to 255
38H: CLAMP[7..0]	[The clamp level] Initial data: CLAMP[7..0] = 9; data range: 0 to 31 Sets the clamp level (The clamp level of the black signal) Clamp level = CLAMP[7..0] x 8 + 56 (for 12bit output) Clamp level = (CLAMP[7..0] x 8 + 56) / 4 (for 10bit output) Clamp level = (CLAMP[7..0] x 8 + 56) / 16 (for 8 bit output) Whenever it is set greater than 31, it will automatically resets to 31.
3EH: WHITE_CLIP[15..8] 3FH: WHITE_CLIP[7..0]	[The white clip level for the white clip test pattern] Initial data: WHITE_CLIP[15..0] = 1,023; data range: 0 to 4,095 Sets the white clip level of the white clip test pattern.
50H: DELAY_I[7..0] 50H: DELAY_I[15..8] 50H: DELAY_I[23..16]	[The delay time (usecond, integer) for the trigger signal] Initial data: DELAY_I[23..0] = 0, data range: 0 to 2,000,000 Sets the delay time that is from the trigger signal input to the start of the exposure as useconds. Delay time for the trigger signal = (DELAY_I[23..0]). (DELAY_F[7..0]) useconds
53H: DELAY_F[7..0]	[The delay time (useond, decimal) for the trigger signal] Initial data: DELAY_F[23..0] = 0, data range: 0 to 99 Sets the delay time that is from the trigger signal input to the start of the exposure as useconds. Delay time for the trigger signal = (DELAY_I[23..0]). (DELAY_F[7..0]) useconds
58H: FPS_I[7..0] 59H: FPS_I[15..8]	[Frame rate (Hz, integer)] Initial data: FPS_F[15..0] = 89, data range: 0 to 360 Sets the frame rate as Hz Frame rate = (FPS_I[15..0]). (FPS_F[23..0]) Hz Frame rate range: 0.72028 to 360.33325 Hz Maximum frame rate for full resolution: 89.91172 Hz (as initial data)
5AH: FPS_F[7..0] 5BH: FPS_F[15..8] 5CH: FPS_F[23..16]	[Frame rate (Hz, decimal)] Initial data: FPS_F[23..0] = 91,172; FPS_I[15..0], data range: 0 to 99,999 Sets the frame rate as Hz. Frame rate = (FPS_I[15..0}). (FPS_F[23..0]) Hz
78H: TESTP[7..0]	[Test pattern selection] Initial data: TESTP[7..0] = 00H Sets the test pattern output from the camera. D[7..0] D7 D6 D5 D4 D3 D2 D1 D0 D7 to D0: 00H: Video output 01H: Gray scale 02H: Ramp wave 03H: 100% white 04H: White clip 05H: Color bar (RGB Bayer) Others: Black

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>79H:
EFFCT[7..0]</td><td>[Image effect selection] Initial data: EFFCT[7..0] = 00H
Sets the image effect.
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>
D7: Negative video / Positive video selection — 0: Positive image; 1: Negative image
D6 to D0: Image effect — 00H: No effect (Original); 01H: 9bit gradation; 02H: 9bit gradation; 03H: 7bit gradation; 04H: 6bit gradation; 05H: 5bit gradation; 06H: 4bit gradation; 07H: 3bit gradation; 08H: 2bit gradation; 09H: 1bit gradation; 0A to 7FH: No function (Prohibited settings. Do not set these values)</td></tr>
<tr><td>80H:
E2P[7..0]</td><td>[EEPROM control] Initial data: 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>
D7 to D1: No function — Always set as “0000000”
D6 to D0: Write control to the EEPROM — 0: Prohibited; 1: Accept
Note: This bit is cleared to “0” automatically by the internal processes after the execution of the command.</td></tr>
<tr><td>F0H:
OUTSEL
[7..0]</td><td>[The output signal selection for the power/IO connector] Initial data: OUTSEL[7..0] = 20H
Sets the output signal from the power/IO connector.
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>
D7 to D4: Output signal for 3pin of the power/IO connector
0: FrameTriggerWait signal; 1: UserOutput signal
2: ExposureActive signal; 3: TriggerAuxiliary signal
4: TriggerInternal signal (after mask and delay process)
5: SensorReadOut signal
6 to F: No Function (Prohibited setting. Do not set these values)
D3 to D0: Output signal for 2pin of the power/IO connector
0: FrameTriggerWait signal; 1: UserOutput signal
2: ExposureActive signal; 3: TriggerAuxiliary signal
4: TriggerInternal signal (after mask and delay process)
5: SensorReadOut signal
6 to F: No Function (Prohibited setting. Do not set these values)
Note: When “UserOutput signal” is selected, set the status of the signal with “UserOutput signal for the power/IO connector (TEST2-D3,4)”.</td></tr>
<tr><td>F1H:
TEST2[7..0]</td><td>[UserOutput signal for the power/IO connector] Initial data: TEST2[7..0] = 00H
Sets the status of the UserOutput signal.
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>
D7: UserOutput signal for 7pin of the power/IO connector — 0: Low; 1: High
D6: UserOutput signal for 6pin of the power/IO connector — 0: Low; 1: High
D5: UserOutput signal for 5pin of the power/IO connector — 0: Low; 1: High
D4: UserOutput signal for 4pin of the power/IO connector — 0: Low; 1: High
D3: UserOutput signal for 3pin of the power/IO connector — 0: Low; 1: High
D2 to D0: No function — Always set as “000”
Note: The UserOutput signal is enabled whenever “UserOutput signal” is selected at the “Output signal selection (OUTSEL)”.</td></tr>
</table>

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>F8H:
OUTSEL1[7..0]</td><td>[The output signal selection for the power/IO connector] Initial data: OUTSEL1[7..0] = 00H
Sets the output signal from the power/IO connector.

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>

D7 to D4: Output signal for the 6pin of the power/IO connector
0: FrameTriggerWait signal
1: UserOutput signal
2: ExposureActive signal
3: TriggerAuxiliary signal
4: TriggerInternal signal (after mask and delay process
5: SensorReadOut signal
6 to F: No function (Prohibited setting. Do not set these values)
D3 to D0: Output signal for the 5pin of the power/IO connector
0: FrameTriggerWait signal
1: UserOutput signal
2: ExposureActive signal
3: TriggerAuxiliary signal
4: TriggerInternal signal (after mask and delay process
5: SensorReadOut signal
6 to F: No function (Prohibited setting. Do not set these values)

Note: When “UserOutput signal” is selected, this sets the status of the signal with the “UserOutput signal for the power/IO connector (TEST2-D3,4)”.</td></tr>
<tr><td>F9H:
OUTSEL2[7..0]</td><td>[[The output signal selection for the power/IO connector] Initial data: OUTSEL2[7..0] = 00H
Sets the output signal from the power/IO connector.

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>

D7 to D4: No function Always set as “0000”
D3 to D0: Output signal for 7pin of the power/IO connector
0: FrameTriggerWait signal
1: UserOutput signal
2: ExposureActive signal
3: TriggerAuxiliary signal
4: TriggerInternal signal (after mask and delay process)
5: SensorReadOut signal
6 to F: No function (Prohibited setting. Do not set these values)

Note: When “UserOutput signal” is selected, this sets the status of the signal with “UserOutput signal for the power/IO connector (TEST2-D3,4)”.</td></tr>
</table>

Description of the camera control commands (Device code: 100000); (The underline settings are the factory default settings)

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>20H: [7..0]</td><td>[Exposure mode] Initial data: 00H
Sets the exposure mode, which is the AGC, the shutter mode and the iris lens control method.
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>

D7 to D4: No Function — Always set as “0000”
D3: AGC — 0: OFF (Fixed gain) — 1: ON (AGC)
D2: Shutter Mode — 0: OFF (Fixed shutter) — 1: ON (Auto shutter)
D1: Iris Lens Control Method — 0: OFF (Manual control) — 1: ON (Auto control)
D0: No Function — Always set as “0”</td></tr>
<tr><td>21H: [7..0]</td><td>[AGC maximum limit] Initial data: 255, data range: 0 to 255
Sets the maximum limit for the AGC.</td></tr>
<tr><td>23H: [7..0]
24H: [15..8]
25H: [20..16]</td><td>[The upper limit of the electronic shutter for auto shutter]
Initial data: 11,122; data range: 0 to 1,048,575
Sets the upper limit of the electronic shutter for the auto shutter as usecond.</td></tr>
<tr><td>26H: [7..0]
27H: [15..8]
28H: [20..16]</td><td>[The lower limit of the electronic shutter for auto shutter]
Initial data: 11,122; data range: 0 to 1,048,575
Sets the upper limit of the electronic shutter for the auto shutter as usecond.</td></tr>
<tr><td>29H: [7..0]</td><td>[Weight1 for ALC] Initial data: 11H
Sets the weight for ALC weight area 1 and 2.
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>

D7 to D4: Weight for ALC weight area 2 — 1 — Range: 0 to 15
D3 to D0: Weight for ALC weight area 1 — 1 — Range: 0 to 15

*Please set the ALC weight area with “30H to 3FH”</td></tr>
<tr><td>2AH: [7..0]</td><td>[Weight2 for ALC] Initial data: 11H
Sets the weight for ALC weight area 3 and 4.
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>

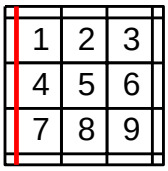
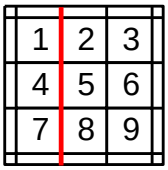
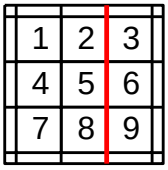
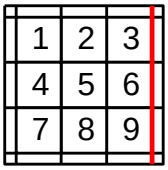
D7 to D4: Weight for ALC weight area 4 — 1 — Range: 0 to 15
D3 to D0: Weight for ALC weight area 3 — 1 — Range: 0 to 15

*Please set the ALC weight area with “30H to 3FH”</td></tr>
<tr><td>2BH: [7..0]</td><td>[Weight3 for ALC] Initial data: 1AH
Sets the weight for ALC weight area 5 and 6.
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>

D7 to D4: Weight for ALC weight area 6 — 1 — Range: 0 to 15
D3 to D0: Weight for ALC weight area 5 — 10 — Range: 0 to 15

*Please set the ALC weight area with “30H to 3FH”</td></tr>
</table>

Command No.	Command Description
2CH: [7..0]	[Weight4 for ALC] Initial data: 11H Sets the weight for ALC weight area 7 and 8. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7 to D4: Weight for ALC weight area 8 1 Range: 0 to 15 D3 to D0: Weight for ALC weight area 7 1 Range: 0 to 15 *Please set the ALC weight area with “30H to 3FH”
2DH: [7..0]	[Weight5 for ALC] Initial data: 01H Sets the weight for ALC weight area 9. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7 to D4: No Function Always set as “0000” D3 to D0: Weight for ALC weight area 9 1 Range: 0 to 15 *Please set the ALC weight area with “30H to 3FH”
2EH: [7..0]	[Target Brightness for ALC] Initial data: 128, data range: 0 to 255 Sets the target brightness for the ALC function (AGC, auto shutter or iris lens auto control).
2FH: [7..0]	[ALC peak-average] Initial data: 0, data range: 0 to 255 Sets the control standard for the ALC function (AGC, auto shutter or iris lens auto control) When set as 0 (Average: 100%, Peak: 0%), the ALC function with the average brightness of the photometry area. When set as 255 (Average: 0%, Peak: 100%), the ALC function with the peak brightness of the photometry area.
30H: [7..0] 31H: [15..8]	[Vertical_1 position for the ALC weight area] Initial data: 32, data range: 0 to 493 Sets the vertical 1 position for the ALC weight area.
32H: [7..0] 33H: [15..8]	[Vertical_2 position for the ALC weight area] Initial data: 169, data range: 0 to 493 Sets the vertical 2 position for the ALC weight area.
34H: [7..0] 35H: [15..8]	[Vertical_3 position for the ALC weight area] Initial data: 298, data range: 0 to 493 Sets the vertical 3 position for the ALC weight area.
36H: [7..0] 37H: [15..8]	[Vertical_4 position for the ALC weight area] Initial data: 462, data range: 0 to 493 Sets the vertical 4 position for the ALC weight area.

<table>
<tr><th>Command No.</th><th>Command Description</th></tr>
<tr><td>38H: [7..0]
39H: [15..8]</td><td>[Horizontal_1 position for the ALC weight area]
Initial data: 36, data range: 0 to 647
Sets the horizontal 1 position for the ALC weight area.
  </td></tr>
<tr><td>3AH: [7..0]
3BH: [15..8]</td><td>[Horizontal_2 position for the ALC weight area]
Initial data: 252, data range: 0 to 647
Sets the horizontal 2 position for the ALC weight area.
  </td></tr>
<tr><td>3CH: [7..0]
3DH: [15..8]</td><td>[Vertical_3 position for the ALC weight area]
Initial data: 396, data range: 0 to 647
Sets the horizontal 3 position for the ALC weight area.
  </td></tr>
<tr><td>3EH: [7..0]
3FH: [15..8]</td><td>[Vertical_4 position for the ALC weight area]
Initial data: 612, data range: 0 to 647
Sets the horizontal 4 position for the ALC weight area.
  </td></tr>
<tr><td>40H: [7..0]</td><td>[White Balance mode] Initial data: 00H
Sets the white balance mode for the color camera.
D[7..0]
<table>
<tr><th>D7</th><th>D6</th><th>D5</th><th>D4</th><th>D3</th><th>D2</th><th>D1</th><th>D0</th></tr>
</table>
D7 to D4: No Function — Always set as “0000”
D3: Push to set white balance operation — 0: OFF / 1: ON
D2 to D0: White balance mode — 000: OFF / 001: Preset 1, / 010: Preset 2 / 011: Preset 3 / 100: Auto white balance / 101: Push to set white balance / 110 to 111: No Function
(Prohibited settings. Do not set these values)

* When using the push-to-set white balance, set the white balance mode as “Push to set white balance” then change “0” to “1” for the push-to-set white balance operation.</td></tr>
<tr><td>41H:
GainR1[7..0]</td><td>[Preset_1 white balance (Red gain)] Initial data: 0, data range: 0 to 255
Sets the Red gain for the preset_1 white balance.

Red of the camera output image data = (CCD_R – CLAMP Level) x (1+ GainR1[7..0] / 64) + CLAMP Level

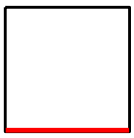
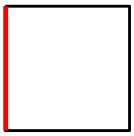
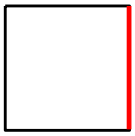
* CCD_R: Red of the CCD output image data
* CLAMP Level: Clamp level (The calculated value of 38H)</td></tr>
<tr><td>42H:
GainGr1[7..0]</td><td>[Preset_1 white balance (Gr gain)] Initial data: 0, data range: 0 to 255
Sets the Gr gain for the preset_1 white balance.

Gr of the camera output image data = (CCD_Gr – CLAMP Level) x (1+ GainGr1[7..0] / 64) + CLAMP Level

* CCD_Gr: Red of the CCD output image data
* CLAMP Level: Clamp level (The calculated value of 38H)</td></tr>
</table>

Command No.	Command Description
43H: GainB1[7..0]	[Preset_1 white balance (Blue gain)] Initial data: 0, data range: 0 to 255 Sets the Blue gain for the preset_1 white balance. Blue of the camera output image data = (CCD_B – CLAMP Level) x (1+ GainB1[7..0] / 64) + CLAMP Level * CCD_B: Blue of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
44H: GainGb1[7..0]	[Preset_1 white balance (Gb gain)] Initial data: 0, data range: 0 to 255 Sets the Gb gain for the preset_1 white balance. Gb of the camera output image data = (CCD_Gb – CLAMP Level) x (1+ GainGb1[7..0] / 64) + CLAMP Level * CCD_Gb: Gb of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
45H: GainR2[7..0]	[Preset_2 white balance (Red gain)] Initial data: 0, data range: 0 to 255 Sets the Red gain for the preset_1 white balance. Red of the camera output image data = (CCD_R – CLAMP Level) x (1+ GainR2[7..0] / 64) + CLAMP Level * CCD_R: Red of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
46H: GainGr2[7..0]	[Preset_2 white balance (Gr gain)] Initial data: 0, data range: 0 to 255 Sets the Gr gain for the preset_2 white balance. Gr of the camera output image data = (CCD_Gr – CLAMP Level) x (1+ GainGr2[7..0] / 64) + CLAMP Level * CCD_Gr: Red of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
47H: GainB2[7..0]	[Preset_2 white balance (Blue gain)] Initial data: 0, data range: 0 to 255 Sets the Blue gain for the preset_2 white balance. Blue of the camera output image data = (CCD_B – CLAMP Level) x (1+ GainB2[7..0] / 64) + CLAMP Level * CCD_B: Blue of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
48H: GainGb2[7..0]	[Preset_2 white balance (Gb gain)] Initial data: 0, data range: 0 to 255 Sets the Gb gain for the preset_2 white balance. Gb of the camera output image data = (CCD_Gb – CLAMP Level) x (1+ GainGb2[7..0] / 64) + CLAMP Level * CCD_Gb: Gb of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
49H: GainR3[7..0]	[Preset_3 white balance (Red gain)] Initial data: 0, data range: 0 to 255 Sets the Red gain for the preset_3 white balance. Red of the camera output image data = (CCD_R – CLAMP Level) x (1+ GainR3[7..0] / 64) + CLAMP Level * CCD_R: Red of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)

Command No.	Command Description
4AH: GainGr3[7..0]	[Preset_3 white balance (Gr gain)] Initial data: 0, data range: 0 to 255 Sets the Gr gain for the preset_3 white balance. Gr of the camera output image data = (CCD_Gr – CLAMP Level) x (1+ GainGr3[7..0] / 64) + CLAMP Level * CCD_Gr: Red of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
4BH: GainB3[7..0]	[Preset_3 white balance (Blue gain)] Initial data: 0, data range: 0 to 255 Sets the Blue gain for the preset_3 white balance. Blue of the camera output image data = (CCD_B – CLAMP Level) x (1+ GainB3[7..0] / 64) + CLAMP Level * CCD_B: Blue of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
4CH: GainGb3[7..0]	[Preset_3 white balance (Gb gain)] Initial data: 0, data range: 0 to 255 Sets the Gb gain for the preset_3 white balance. Gb of the camera output image data = (CCD_Gb – CLAMP Level) x (1+ GainGb3[7..0] / 64) + CLAMP Level * CCD_Gb: Gb of the CCD output image data * CLAMP Level: Clamp level (The calculated value of 38H)
4EH: [7..0] 4FH: [15..8]	[Bright level threshold fro auto white balance process] Initial data: 3,072, data range: 0 to 4,095 Sets the bright level threshold for auto white balance process. Auto white balance process uses the color information of the pixel (the brightness of the pixel that is greater than this value).
50H: [7..0] 51H: [15..8]	[Y_offset for AOI] Initial data: 0, data range: 4 ≤ “Y_offset + Height” ≤ 494 Sets the Y_offset (the vertical start position of the image for the AOI)
52H: [7..0] 53H: [15..8]	[Height for AOI] Initial data: 494, data range: 4 ≤ “Y_offset + Height” ≤ 494 Sets the height (the vertical size of the image for the AOI)
54H: [7..0] 55H: [15..8]	[X_offset for AOI] Initial data: 0, data range: 8 ≤ “Y_offset + Height” ≤ 648 Sets the X_offset (the horizontal start position of the image for the AOI)
56H: [7..0] 57H: [15..8]	[Width for AOI] Initial data: 648, data range: 8 ≤ “Y_offset + Height” ≤ 648 Sets the width (the horizontal size of the image for the AOI)
58H: [7..0] 59H: [15..8]	[Vertical_1 position for the white balance area] Initial data: 0, data range: 0 to 493 Sets the vertical 1 position, which is the vertical start position for the white blance area. This area is used for the gain calculation of the auto white balance and the push-to-set white balance. 

Command No.	Command Description
5AH: [7..0] 5BH: [15..8]	[Vertical_2 position for the white balance area] Initial data: 493, data range: 0 to 493 Sets the vertical 2 position, which is the vertical end position for the white blance area. This area is used for calculating the gain of the auto white balance and the push-to-set white balance. 
5CH: [7..0] 5DH: [15..8]	[Horizontal_1 position for the white balance area] Initial data: 0, data range: 0 to 647 Sets the horizontal 1 position, which is the vertical end position for the white blance area. This area is used for calculating the gain of the auto white balance and the push-to-set white balance. 
5EH: [7..0] 5FH: [15..8]	[Horizontal_2 position for the white balance area] Initial data: 647, data range: 0 to 647 Sets the horizontal 2 position, which is the vertical end position for the white blance area. This area is used for the calculating the gain of the auto white balance and the push-to-set white balance. 
60H: [7..0]	[Camera mode 1] Initial data: 00H Sets the white balance area ON/OFF and the gamma table ON/OFF. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7 to D5: No function — Always set at “000” D4: White balance area ON/OFF — 0: OFF (Full screen) — 1: ON (setup area) D3 to D1: No function — Always set as “000” D0: Gamma table ON/OFF — 0: OFF (Gamma=1.0) — 1: ON
80H: GainRP[7..0]	[Push to set white balance (Red gain)] Initial data: 0, data range: 0 to 255 Sets the Red gain for the Push to set white blance. Red of the camera ouptut image data = (CCD_R – CLAMP Level) x (1 + GainRP[7..0] / 64) + CLAMP Level *CCD_R: Red of the CCD output image data *CLAMP Level: Clamp level (The calculated value of 38H)
81H: GainGrP[7..0]	[Push to set white balance (Gr gain)] Initial data: 0, data range: 0 to 255 Sets the Gr gain for the Push to set white blance. Gr of the camera ouptut image data = (CCD_Gr – CLAMP Level) x (1 + GainGrP[7..0] / 64) + CLAMP Level *CCD_Gr: Gr of the CCD output image data *CLAMP Level: Clamp level (The calculated value of 38H)

Command No.	Command Description
82H: GainBR[7..0]	[Push to set white balance (Blue gain)] Initial data: 0, data range: 0 to 255 Sets the Blue gain for the Push to set white blance. Red of the camera ouptut image data = (CCD_B – CLAMP Level) x (1 + GainBR[7..0] / 64) + CLAMP Level *CCD_B: Blue of the CCD output image data *CLAMP Level: Clamp level (The calculated value of 38H)
83H: GainGbP[7..0]	[Push to set white balance (Gb gain)] Initial data: 0, data range: 0 to 255 Sets the Gb gain for the Push to set white blance. Gb of the camera ouptut image data = (CCD_Gb – CLAMP Level) x (1 + GainGbP[7..0] / 64) + CLAMP Level *CCD_Gb: Gb of the CCD output image data *CLAMP Level: Clamp level (The calculated value of 38H)
90H: [7..0]	[Iris lens adjustment] Initial data: 80, data range: 0 to 255 Sets the driving voltage of the iris lens for the iris lens auto control.
92H: [7..0]	[Iris lens manual adjustment] Initial data: 01H Sets the iris lens manual adjustment operation. D[7..0] D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 D7 to D2: No function — Always set as “000000” D1 to D0: Manual adjustment operation — 00: Hold; 01: Open; 10: Close; 11: No Function (Prohibited setting. Do not set this value)

3. Sequence for the saving commands to the EEPROM
   Please use the following sequence for saving the commands to the EEPROM

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

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

   c. The camera sends back one of the following receiving codes after writing the EEPROM.
      01H: OK
      17H: EEPROM write error

   d. 80H.0 is changed to “0” automatically after writing the EEPROM

   Note 1: When 80H.0 is “0” it will not save to the EEPROM
   Note 2: When saving multiple sequence of commands: “10H, 11H, 12H and 13H” or “22H, 23H and 24H”.
   Note 3: When saving multiple command data (which are not a sequence command) to the EEPROM it is necessary to operate steps a.~d. the same number of times.
   Example of a multiple command: “10H, 13H, 19H and 1BH” or “20H, 23H and 25H”.

E. GenICam / Camera Command Reference Table

GenICam command	Camera command		
	Device	**Command**	**Function**
Width	100000	56-57H	Width for AOI
Height	100000	52-53H	Height for AOI
PixelFormat	000000	12H.6-7	Video out
OffsetX	100000	54-55H	X offset for AOI
OffsetY	100000	50-51H	Y offset for AOI
ExposureMode	000000	10H.5	Trigger mode
ExposureTimeRaw	000000	20-22H	Exposure time of the electronic shutter
ExposureAuto	100000	20H.2	Shutter mode
AcquistionFrameRate	000000	58-5CH	Frame rate
TriggerDelay	000000	50-53H	The delay time for the trigger signal
TriggerActivation	000000	10H.6	Trigger polarity
TriggerSource	000000	12H.5	Trigger signal type
TriggerSoftware	000000	16H.0	Generate command software trigger
TriggerSoftwareSource	000000	16H.6-7	Software trigger source selection
TriggerMode	000000	11H.3	Function mode
LineSource0	000000	F0H.0-3	Output signal for 2 pin of the power/IO connector
LineSource1	000000	F0H.4-7	Output signal for 3 pin of the power/IO connector
UserOutputValue0	000000	F1H.3	UserOutput signal for 2 pin of the power/IO connector
UserOutputValue1	000000	F1H.4	UserOutput signal for 3 pin of the power/IO connector
BalanceWhiteAuto	100000	40H.0-2	White balance mode
BalanceRatio_R_Preset1	100000	41H	Preset1 white balance (Red gain)
BalanceRatio_Gr_Preset1	100000	42H	Preset1 white balance (Gr gain)
BalanceRatio_B_Preset1	100000	43H	Preset1 white balance (Blue gain)
BalanceRatio_Gb_Preset1	100000	44H	Preset1 white balance (Gb gain)
BalanceRatio_R_Preset2	100000	45H	Preset2 white balance (Red gain)
BalanceRatio_Gr_Preset2	100000	46H	Preset2 white balance (Gr gain)
BalanceRatio_B_Preset2	100000	47H	Preset2 white balance (Blue gain)
BalanceRatio_Gb_Preset2	100000	48H	Preset2 white balance (Gb gain)

GenICam command	Camera command		
	Device	Command	Function
BalanceRatio_R_Preset3	100000	49H	Preset3 white balance (Red gain)
BalanceRatio_Gr_Preset3	100000	4AH	Preset3 white balance (Gr gain)
BalanceRatio_B_Preset3	100000	4BH	Preset3 white balance (Blue gain)
BalanceRatio_Gb_Preset3	100000	4CH	Preset3 white balance (Gb gain)
BalanceRatio_R_Once	100000	80H	Push to set white balance (Red gain)
BalanceRatio_Gr_Once	100000	81H	Push to set white balance (Gr gain)
BalanceRatio_B_Once	100000	82H	Push to set white balance (Blue gain)
BalanceRatio_Gb_Once	100000	83H	Push to set white balance (Gb gain)
GainAuto	100000	20H.3	AGC
GainRaw	000000	30H	CDS gain
SmearHalfReduction	000000	11H.4	Smear half reduction
ReloadGammaData	100000	60H.7	Gamma table ON/OFF
LensManualAdjustment	100000	92H.0-1	Iris lens manual adjustment operation
LensIrisAdjustment	100000	90H	Iris lens adjustment
ALCIrisLens	100000	20H.1	Iris lens control method
Min_ShutterTime	100000	26-28H	The lower limit of the electronic shutter for auto shutter
Max_ShutterTime	100000	23-25H	The upper limit of the electronic shutter for auto shutter
AGCRange	100000	21H	AGC maximum limit
TargetBrightness	100000	2EH	Target brightness for ALC
ALC_Peak_Average	100000	2FH	ALC peak-average
DigitalGain	000000	31H	The digital gain
ALCWeight1	100000	29H.0-3	Weight1 for ALC
ALCWeight2	100000	29H.4-7	Weight2 for ALC
ALCWeight3	100000	2AH.0-3	Weight3 for ALC
ALCWeight4	100000	2AH.4-7	Weight4 for ALC
ALCWeight5	100000	2BH.0-3	Weight5 for ALC
ALCWeight6	100000	2BH.4-7	Weight6 for ALC
ALCWeight7	100000	2CH.0-3	Weight7 for ALC
ALCWeight8	100000	2CH.4-7	Weight8 for ALC
ALCWeight9	100000	2DH.0-3	Weight9 for ALC

GenICam command	Camera command		
	Device	Command	Function
ALCWindowV1	100000	30-31H	Vertical1 position for the ALC weight area
ALCWindowV2	100000	32-33H	Vertical2 position for the ALC weight area
ALCWindowV3	100000	34-35H	Vertical3 position for the ALC weight area
ALCWindowV4	100000	36-37H	Vertical4 position for the ALC weight area
ALCWindowH1	100000	38-39H	Horizontal1 position for the ALC weight area
ALCWindowH2	100000	3A-3BH	Horizontal2 position for the ALC weight area
ALCWindowH3	100000	3C-3DH	Horizontal3 position for the ALC weight area
ALCWindowH4	100000	3E-3FH	Horizontal4 position for the ALC weight area
WB_WindowH1	100000	58-59H	Vertical1 position for the white balance area
WB_WindowH2	100000	5A-5BH	Vertical2 position for the white balance area
WB_WindowV1	100000	5C-5DH	Horizontal1 position for the white balance area
WB_WindowV2	100000	5E-5FH	Horizontal2 position for the white balance area
WB_WindowMode	100000	60H.4	White balance area ON/OFF
YThreshold	100000	4E-4FH	Bright level threshold for auto white balance
ALCWeight4	100000	2AH.4-7	Weight4 for ALC
ALCWeight5	100000	2BH.0-3	Weight5 for ALC

Caution:
Width, Height and PixelFormat all affect the image data size.
Please use GenICam command name command when changing these values, as exampled in the following sample code.

In the case to change the Width

```
BOOL SetWidth( PvDevice *pDevice, PvInt64 lValue )
{
PvGenInteger* lGenInteger = dynamic_cast<PvGenInteger*>( pDevice->GetGenParameters()->Get( "Width" ) );
PvResult lResult = lGenInteger->SetValue(lValue);
return lResult.IsOK();
}
```

Revision

Rev.	Date	Change	Notes
1.0	Aug. 29, 2011	New Document	

Sensor Technologies America, Inc.
1345 Valwood Pkwy, Suite 320
Carrollton, Texas 75006-6891
TEL (972) 481-9223 FAX (972) 481-9209
URL http://www.sentechamerica.com/

Sensor Technology Co., Ltd.
7F, Harada Center Building
9-17, Naka cho 4chrome
Atsugi-city, Kanagawa
243-0018 Japan
TEL +81-46-295-7061 FAX +81-46-295-7066
URL http://www.sentech.co.jp/

Taiwan Sensor Technology, Inc.
3F-6, No. 9, Aiguo W, Rd,. Jhong Jheng District
Taipei City 100, Taiwan, R.O.C.
TEL 886-2-2383-2331 FAX 886-2-2370-8775
EMAIL: sentech0501@yahoo.com.tw