



English

VISION:elite™

125M Ultra High Resolution

B/W Camera Link

VCC-GM60FV11CL

Product Specification
& Operational Manual

CIS Corporation

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1. Scope of Application

This is to describe VCC-GM60FV11CL, Ultra High Resolution Camera Link B/W CCD Camera.

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2. Handling Precautions

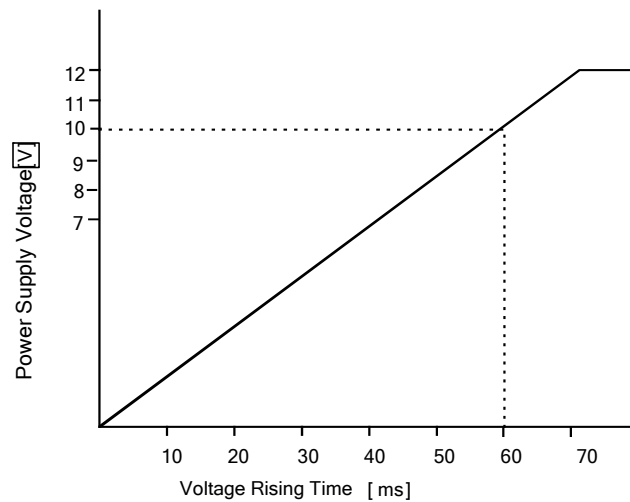
The camera must not be used for any nuclear equipments or aerospace equipments with which mechanical failure or malfunction could result in serious bodily injury or loss of human life. Our warranty does not apply to damages or defects caused by irregular and/or abnormal use of the product.

Please observe all warnings and cautions stated below.

Our warranty does not apply to damages or malfunctions caused by neglecting these precautions.

- No vibration shall be caused to the camera or the object to shoot while pixel shifting is in operation. If images are captured under vibration, the PC synthesized image will be blurred. We recommend you to install our camera into your actual application systems to try and evaluate it.
- Do not use or store the camera in the following extreme conditions:
 - Extremely dusty or humid places.
 - Extremely hot or cold places (operating temperature -5°C to $+40^{\circ}\text{C}$)
 - Close to generators of powerful electromagnetic radiation such as radio or TV transmitters.
 - Places subject to fluorescent light reflections.
 - Places subject to unstable (flickering, etc.) lighting conditions.
 - Places subject to strong vibration.
- Remove dust or dirt on the surface of the lens with a blower.
- Do not apply excessive force or static electricity that could damage the camera.
- Do not shoot direct images that are extremely bright (e.g., light source, sun, etc.), and when camera is not in use, put the lens cap on.
- Follow the instructions in Chapter 6, "External connector pin assignment" for connecting the camera. Improper connection may cause damages not only to the camera but also to the connected devices.
- Confirm the mutual ground potential carefully and then connect the camera to monitors or computers. AC leaks from the connected devices may cause damages or destroy the camera.
- Do not apply excessive voltage. (Use only the specified voltage.) Unstable or improper power supply voltage may cause damages or malfunction of the camera.

- The voltage ripple of camera power DC +12V±10% shall be within ±50mV. Improper power supply voltage may cause noises on the video signals.
- The rising time of camera power supply voltage shall be less than +10V, Max 60ms. Please avoid noises like chattering when rising.
- 2ch output CCD, separated into right and left, is utilized for VCC-G60FV11CL. Image signals for right half screen and left half screen are output via each independent circuit. Therefore, differences between right screen and left screen could be seen depending on the usage conditions (shooting conditions /temperature conditions and so on). CIS tries its best to adjust this differences but please be noted it would not be perfect.



3. Product Outline

VCC-GM60FV11CL is a Camera Link interfaced, ultra high-resolution industrial black and white video camera module. Pixel shifting technology with piezo-actuator, 45M pixels and 125M pixels ultra high resolutions are realized. Image synthesis processing shall be done by PC software.

In this Specification, we describe pixel shifting technology as "SOPT: Spatial Offsetting Pickup Technique".

Features

- Frame rates to read out entire pixels at full frame scan mode are as follows.
 - SOPT OFF (Basic Mode): 5M Pixels: approx. 15fps (66.7ms)
 - SOPT ON (45M Mode): 45M Pixels: approx. 1.43fps (700ms)
 - SOPT ON (125M Mode): 125M Pixels: approx. 0.516fps (1.94s)

※ When SOPT is ON, partial scan mode and pulse width trigger mode can not be used.
- CLK Sync, V-Sync reset Trigger
- At SPOT OFF, triggers can be input even when outputting images.
- 8bit/10bit output are selectable.
- Free Software
 - Sample software of image synthesis for DALSA Corporation SoperaLT.
 - Sample software of image synthesis for EURESYS Inc. Multicam Studio.
 - Sample software of image synthesis for Matrox Electronic Systems Ltd. MIL.
 - Sample software of image synthesis for AVAL DATA Corporation, Acap Lib2.
 - Sample software of image synthesis for Micro Technica Board Library/SDK.
 - ※ Please ask us for the details on image synthesis software.
- Verified Frame Grabber Board
 - TB-6S-LX150T-GB-R (Tokyo Electron Device LTD).
 - ※ Please ask Tokyo Electron Device Ltd for the details on the frame grabber board.

4. Specification

4.1.General Specification

Item	Specification			
(1) Pickup Device	Device type	2/3type interline transfer B/W CCD SONY ICX625ALA		
	Effective pixel number	2456(H) × 2058(V)		
	Unit cell size	3.45μm(H) × 3.45μm(V)		
	Chip size	9.93mm(H) × 8.70mm(V)		
(2) Sync. System	Internal Sync. System.			
(3) Video Output	Camera Link (Base Configuration)			
(4) SOPT Mode SOPTOFF (5M Basic Mode)	Pixel clock	60 MHz		
	Horizontal frequency	31.185 KHz	Pixel CLK	1924 CLK
	Vertical frequency at full frame sacn mode	15.000 Hz	Scanning Lines	2079 H
	Output pixels	Horizontal	2448 pixel	
		Vertical	2058 pixel	
		TTL pixels	Approx. 5 Mega pixels	
Resolutions	2058TV lines			
SOPT (45M Mode)	Frame rate of the synthetic image (When long term exposure mode is OFF)	Approx. 1.43fps		
	Pixel numbers of the synthetic image	Horizontal	7344 pixel	
		Vertical	6174 pixel	
		TTL pixels	Approx. 45 Mega pixels	
SOPT (125M Mode)	Frame rate of the synthetic image (When long term exposure mode is OFF)	Approx. 0.516fps		
	Pixel numbers of the synthetic image	Horizontal	12240 pixel	
		Vertical	10290 pixel	
		TTL pixels	Approx. 125 Mega pixels	
(5) Resolving power	8bit / 10bit			
(6) Sensitivity	F5.6 400lx (Shutter Speed 1/15s, Gain 0dB)			
(7) Minimum illumination	F1.4 1lx (Shutter Speed 1/15s, Gain Max(+12dB))			
(8) Dust or stains in optical system	No dust or stain shall be detected on the testing screen with setting the camera aperture at F16.			
(9) Power requirements	DC+12V±10%			
(10) Power consumption	4.8W (At DC +12V IN, normal mode, and full frame scan mode)			
	5.5W (At DC +12V IN, normal mode, and partial scan mode)			
(11) Dimensions	Refer to overall dimension drawing. H:55mm W:55mm D:84.5mm (excluding projection.)			
(12) Mass	Approx. 510g			
(13) Lens mount	C Mount (Refer to overall dimension drawing)			

Item	Specification	
(14) Optical axis accuracy	Refer to drawing for CCD Optical Axis Accuracy.	
(15) Gain variable range	0~+12dB (Analog Gain over 0dB~+6dB, Digital Gain 0dB~+6dB)	
(16) Shutter speed variable range	1/15s (OFF) ~1/30000s	
(17) Trigger shutter mode	<ul style="list-style-type: none"> •Fixed Trigger Shutter Mode •Pulse Width Trigger Shutter Mode (Only when SOPT OFF) 	
(18) Safety/Quality standards	<ul style="list-style-type: none"> •UL: Conform to UL Standard including materials and others. •RoHS: Conform to RoHS •CE: Conform to EN55022:2006 Class A for Emission Conform to EN61000-6-2:2005 for Immunity •FCC: To be applied to FCC Class A digital Device This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. 	
(19) Durability	Vibration	Acceleration : 19.61m/s ² (2.0G)
		Frequency : 20~200 Hz (Frequency varies every 5 minutes. It shall be tested 120 minutes each for 3 directions.
		Direction : X,Y,Z 3 directions
		Testing time : 15 min for each direction
Shock	No malfunction shall be occurred with 490m/s ² (50G) for ±X, ±Y, and ±Z, 6 directions. (without package)	
(20) Operation environment	Temperature	Performance guaranteed temperature: 0°C~+40°C Camera operation guaranteed temperature: -5°C~+45°C ※ All the specifications specified in this manual is guaranteed under performance guaranteed temperature. ※ All the camera functions operate normally under operation guaranteed temperature
	Humidity	RH 20~80% with no condensation.
(21) Storage Environment	Temperature	-25°C~+60°C
	Humidity	RH 20~80% with no condensation.

※ In this Specification, we describe pixel shifting technology as "SOPT: Spatial Offsetting Pickup Technique".

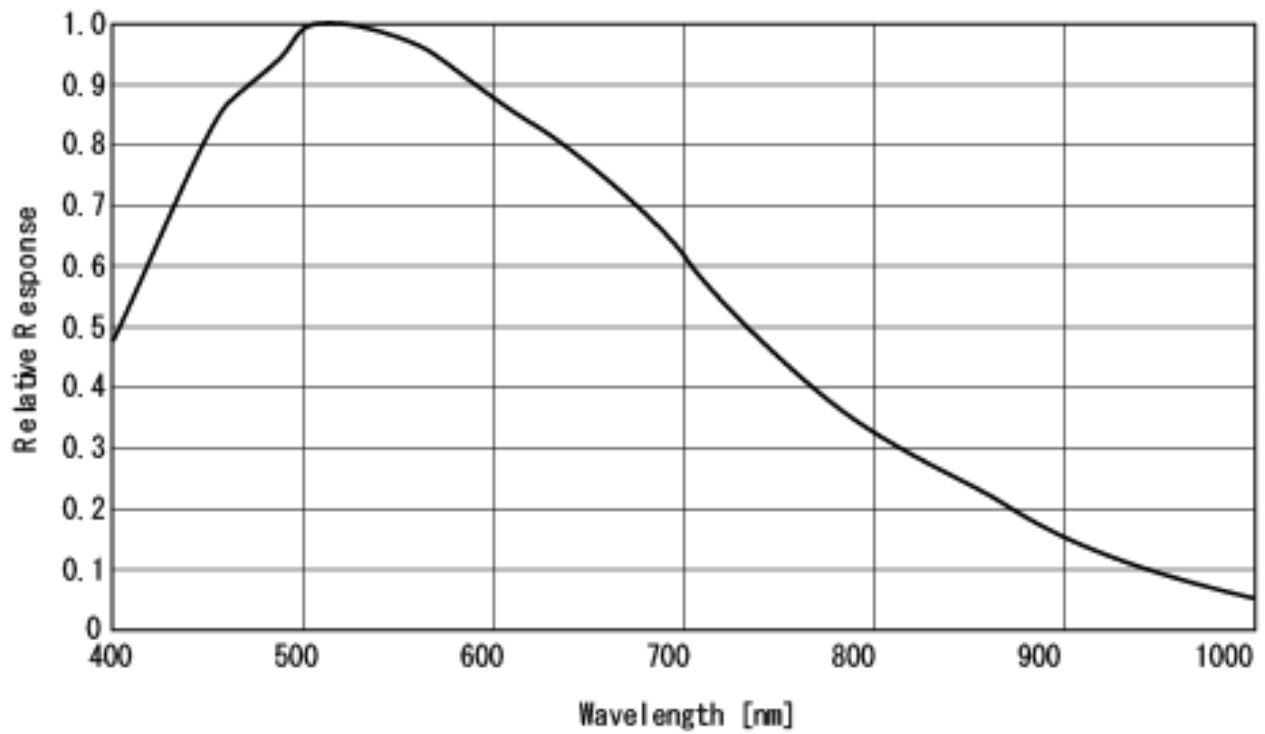
4.2.Camera Output Signal Specification

Item		Specification	
(1) Video output data	Video Output	2456(H) × 2058(V) 60MHz 2Tap output	At full frame scan mode
(2) Sync. Signal I/O	LVAL output	LVTTL(3.3V)	12pins Circular Connector
	FVAL output	LVTTL(3.3V)	
	DVAL output	LVTTL(3.3V)	
	Exposure	LVTTL(3.3V)	
(3) Trigger Input	Polarity	Positive/Negative Selectable	
	Pulse Width	Over 2H (min) ~ Under 4158H (max)	
	Hardware Trigger Input	LVTTL(5.0V Tolerant)	HR10-10R-12PA
	Software Trigger Input	Serial Communications	
(4) Video Signals	White Clip Level	At Digital 8bit : FFh	
	Setup Level	At Digital 8bit : 08h±04h (Conditions: Gain 0dB)	
	Dark Shading	At Digital 8bit : Under 08h for both horizontal and vertical. (Conditions: Gain 0dB)	
	Level differences between right and left	At Digital 8bit : Under 03h (Conditions: Gain 0dB)	

※ 2 seconds shall be waited after turning on power to get proper camera operation.

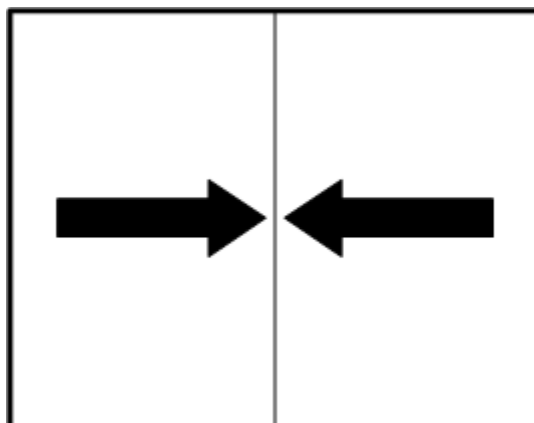
4.3. CCD Spectral Response (Representative Value)

※ Lens characteristics and luminous source characteristics are not considered.



4.4. Video Output Format

- 2-Taps Output
- Area of interest Width : 2448 Height : 2058 Offset X : 0 Offset Y : 12



5. Function Settings

(Camera functions can be set with serial communications.)

Function	Address	Data
Gain	001	0: 0 dB : Analog Fixed Gain 1: + 3 dB : Analog Fixed Gain 2: + 6 dB : Analog Fixed Gain 3: + 12 dB : Analog Gain(+6dB) + Digital Gain(+6dB) 4: Manual Gain (Refer to Address 005&006, 007&008, 126&127, and 128&129.)
Shutter * At SOPT mode, long term exposure mode settings are given priority. (Refer to address 098&099)	002	0: 1/15s(OFF) 1: 1/30s 2: 1/60s 3: 1/90s 4: 1/120s 5: 1/150s 6: 1/200s 7: 1/250s 8: 1/500s 9: 1/750s 10: 1/1000s 11: 1/2000s 12: 1/5000s 13: 1/10000s 14: 1/15000s 15: 1/30000s (1/15000s at SOPT mode.) 16: Manual Shutter (Refer to Address 009 and 010)
Trigger Shutter Mode	004	0: Normal Shutter Mode (Trigger Mode Off) 1: Fixed Trigger Shutter Mode (Shutter speed can be set with address 002.) 2: Pulse Width Trigger Shutter Mode (Shutter speed can be set with trigger pulse width.)
Manual Analog Gain (Right)	005&006	0~512: 0:0dB~512:+12dB and over (Log Linear) ※Set the data of address 001 to 004.
Manual Analog Gain (Left)	007&008	0~512: 0:0dB~512:+12dB and over (Log Linear) ※Set the data of address 001 to 004.
Manual Shutter Control	009&010	0~2078: 1/15s(OFF)~1/36058s ※Set the data of address 002 to 016. Address 009 MSB and address 010 LSB makes total 16bit. Shutter Speed = (2078 - (009&010))×32.07μs+27.73μs Max Data = 2078
Trigger Polarity	011	0: Positive Input 1: Negative Input
Trigger Input	012	0: Camera Link 1: 12pins Circular Connector
Output Data Select	013	0: 8bit Output Data 1: 10bit Output Data

Function	Address	Data
Gamma Mode	014	0: Gamma OFF(1.0)
		1: Gamma On (Option)
Partial Scan Mode	015	0: Full Frame Scan Mode
		1: Partial Scan Mode
Partial Scan Start Position	016&017	0~685: ※Set the data of address 015 to 001. Address 016 MSB and address 017 LSB makes total 16bit. Start Position:3 H/step Min Data:0(0 H) / Max Data:685(2055 H) Start Position (016&017) + Effective Line (019&020) should be <= 685.
		019&020
Partial Scan Effective Line	021&022	0~2078: Read Only Total line number at Partial Scan Mode or Full Frame Scan Mode minus 1 is to be set
Partial Scan Total Line	030	0: 9600bps 1: 19200bps 2: 38400bps 3: 57600bps 4: 115200bps
Baud Rate	060	0: OFF 1: ON
Frame ID ON/OFF	061	0: Software Trigger On Light access is recognized as a trigger. There is no need to prepare a pulse trigger with data values.
Software Trigger	062	0: 45M Mode 1: 125M Mode
SOPT Mode	063	0: Standby OFF 1: External Trigger Standby 2: Software Trigger Standby
SOPT Standby	098&099	2079: OFF: Operates at fixed trigger shutter setting.
		2080 ~ ON: 64449: Exposure Time=(098&099) x 32.07 μs + 27.73 μs Internal Trigger Cycle=((098&099) + 321) x 32.07 μs + 27.73 μs
SOPT Long Term Exposure Mode	126&127	256 ~ 256:×1(0dB)~512:×2(+6dB) 512: ※Set the data of address 001 to 004.
Manual Digital Gain (Right)	128&129	256 ~ 256:×1(0dB)~512:×2(+6dB) 512: ※Set the data of address 001 to 004.
Manual Digital Gain (Left)	255	Input 083 or 053 to save the data in EEP-ROM.
Data Save		

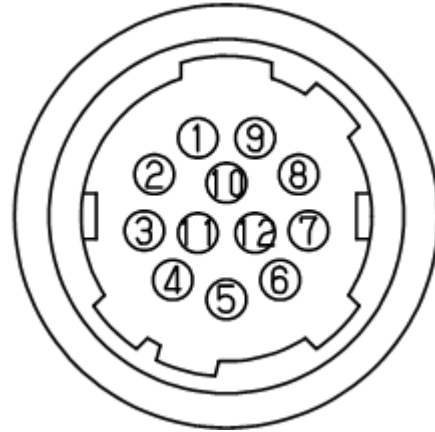
※ In this Specification, we describe pixel shifting technology as "SOPT: Spatial Offsetting Pickup Technique".

※ The data set with 2 Byte shall be set with High Byte first, then set with Low Byte. The camera rewrites the internal register when receiving Low Byte.

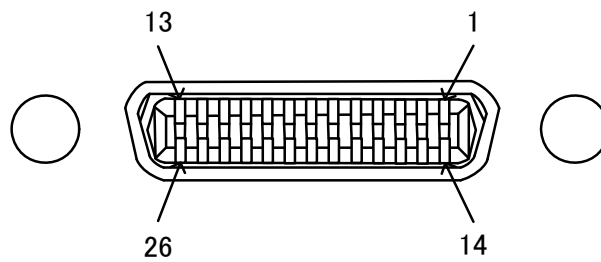
6. External Connector Pin Assignment

6.1. 12 pins Circular Connector HR10-10R-12PA (HIROSE) equivalent

Pin No.	
1	GND
2	POWER IN DC +12V
3	GND
4	NA
5	GND
6	LVAL/OUT
7	FVAL/OUT
8	GND
9	Exposure Out
10	DVAL/OUT
11	Trigger IN
12	GND



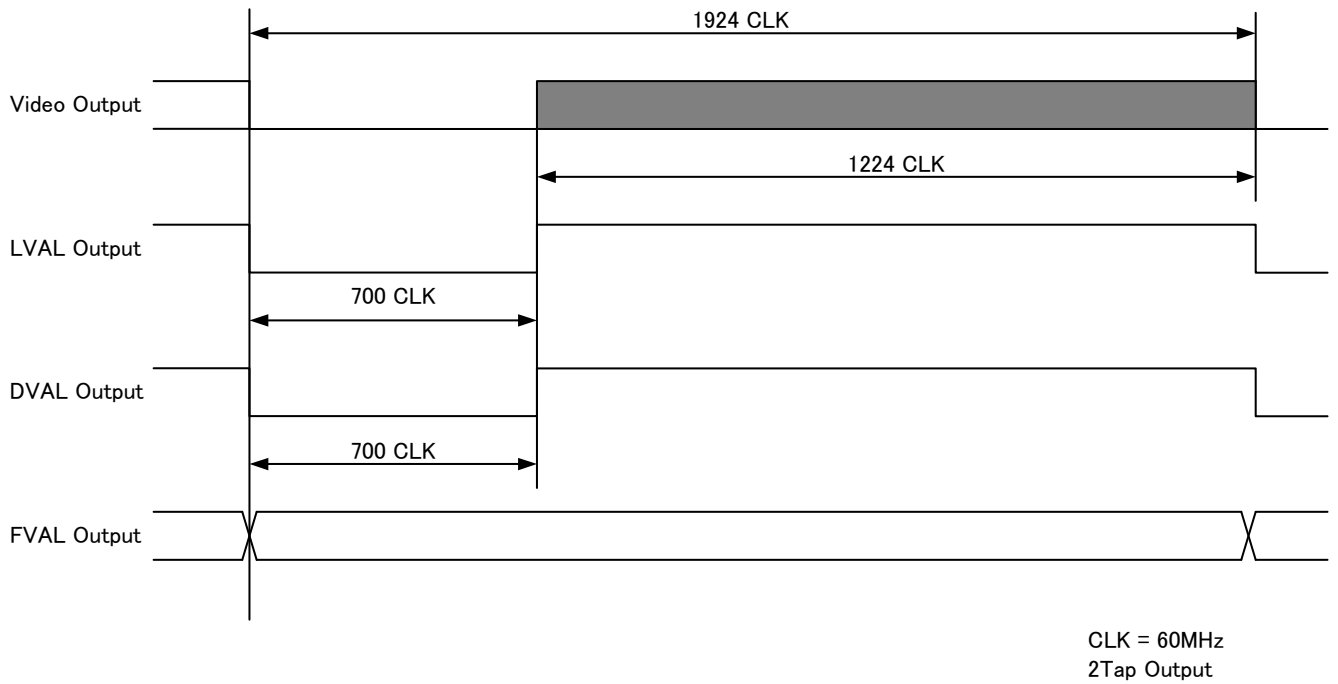
6.2. 26 pins Camera Link Connector 12226-1100-00 PL (SUMITOMO 3M)



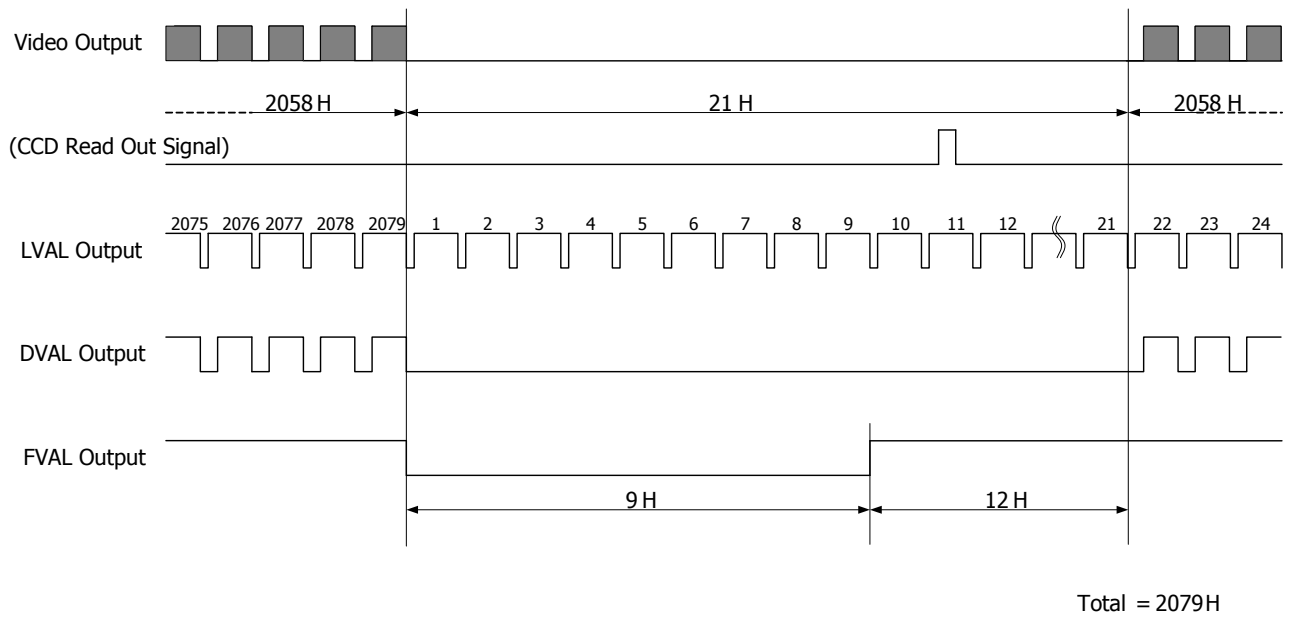
Pin No.		Pin No.	名称
1	GND	14	GND
2	X0-	15	X0+
3	X1-	16	X1+
4	X2-	17	X2+
5	XCLK-	18	XCLK+
6	X3-	19	X3+
7	SerTC+	20	SerTC-
8	SerTFG-	21	SerTFG+
9	CC1- (Trigger IN -)	22	CC1+ (Trigger IN +)
10	NA (CC2+)	23	NA (CC2-)
11	NA (CC3-)	24	NA (CC3+)
12	NA (CC4+)	25	NA (CC4-)
13	GND	26	GND

7. Timing Chart

7.1. Horizontal Synchronous Signals Timing

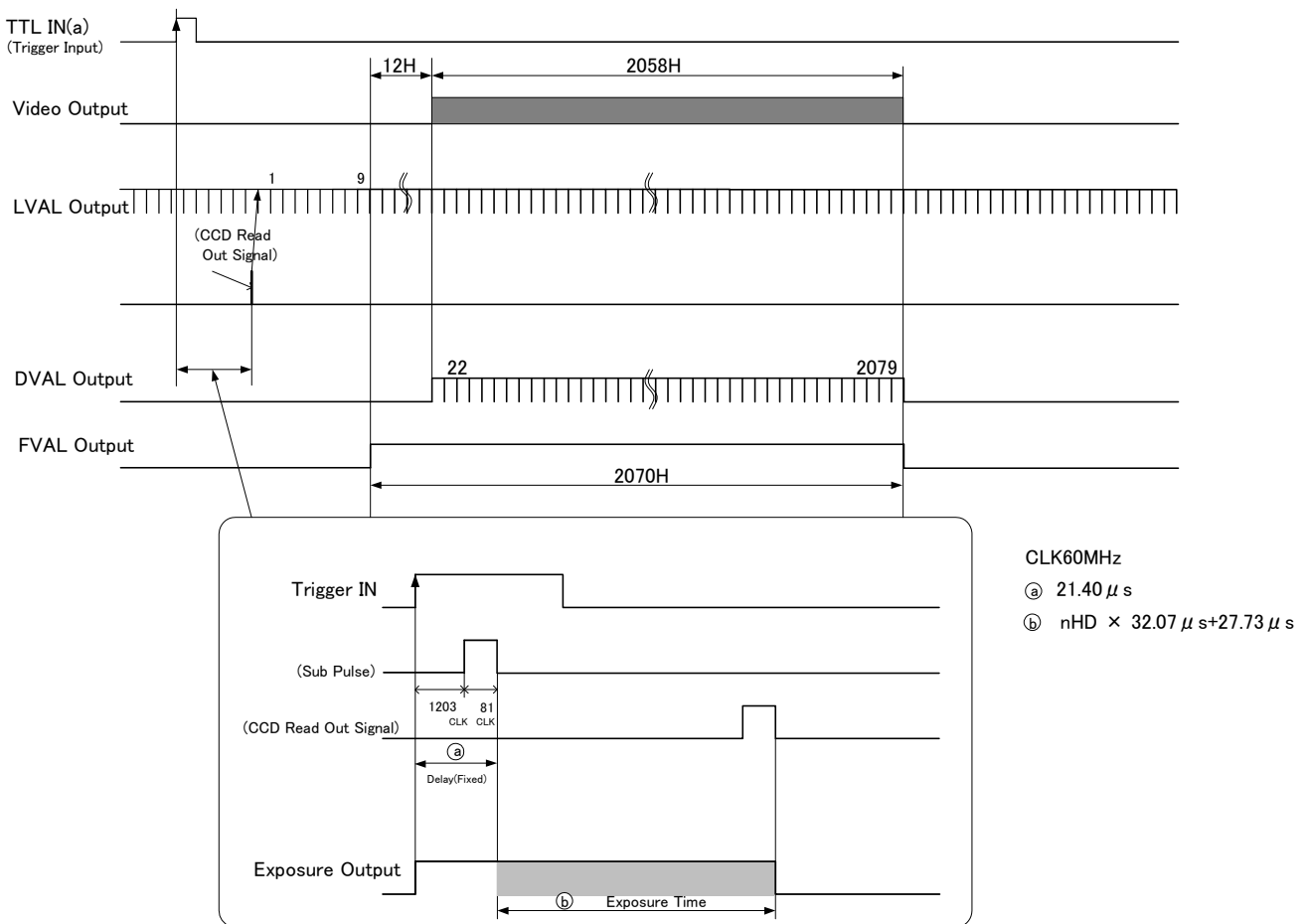


7.2. Full Frame Scan Mode

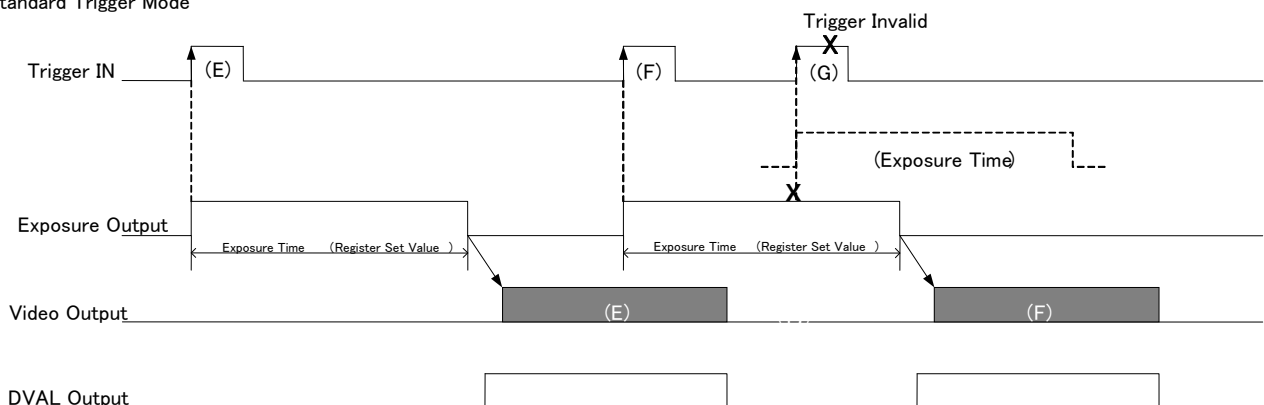


7.3. Fixed Trigger Shutter Mode

- Trigger operation is CLK Sync. V-Sync Reset. The delay time from detecting trigger edge in the camera to starting exposure is 21.40μs.
- Triggers can be accepted even when outputting video signals. However, shutter timing to start the next video output prior to the completion of video transmission for the prior video output signals can not be accepted. Trigger input while outputting video signals should be synchronized with the down edge of camera LVAL output.
- Trigger input during exposure time should be ignored. (Refer to the below G.).

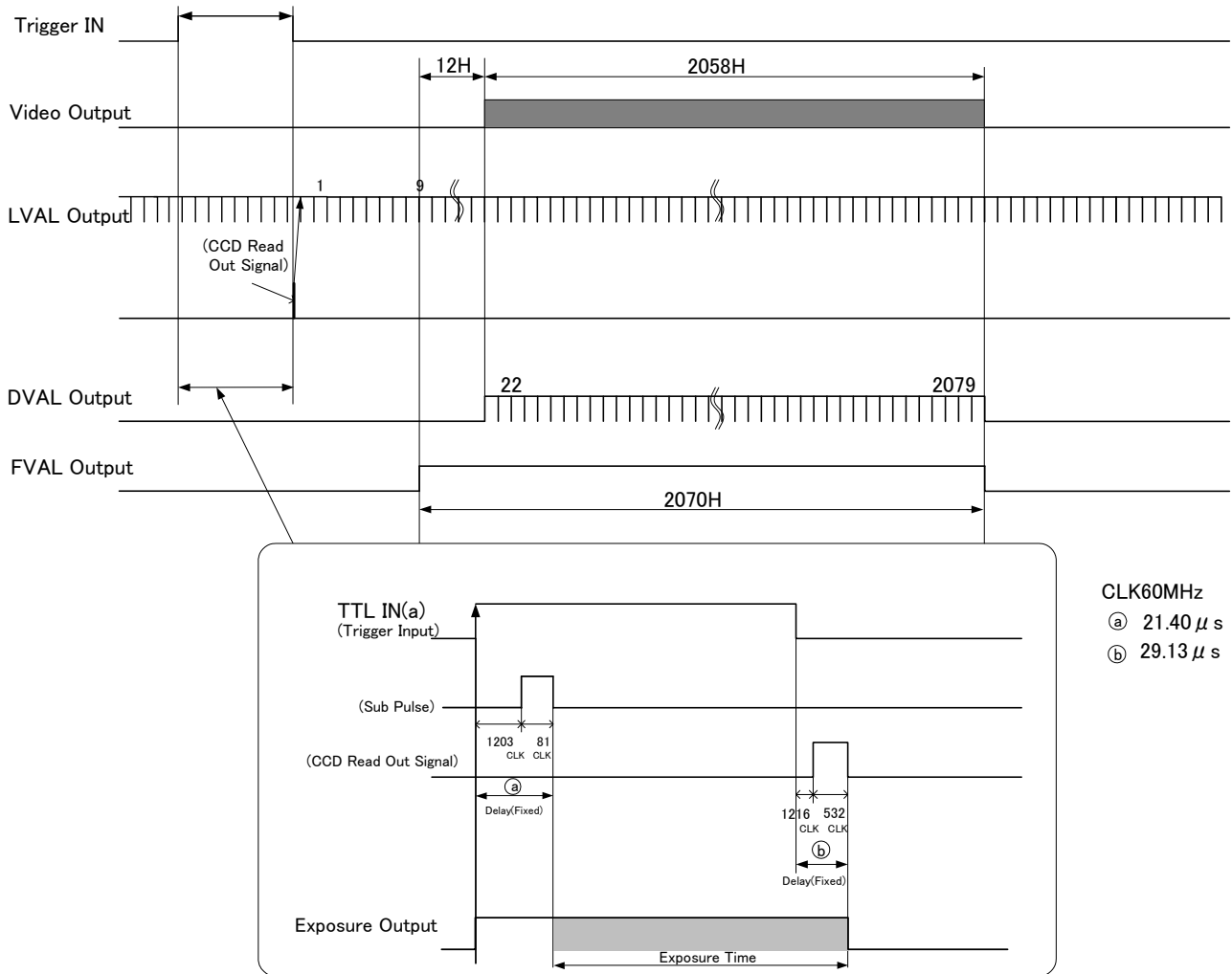


Standard Trigger Mode

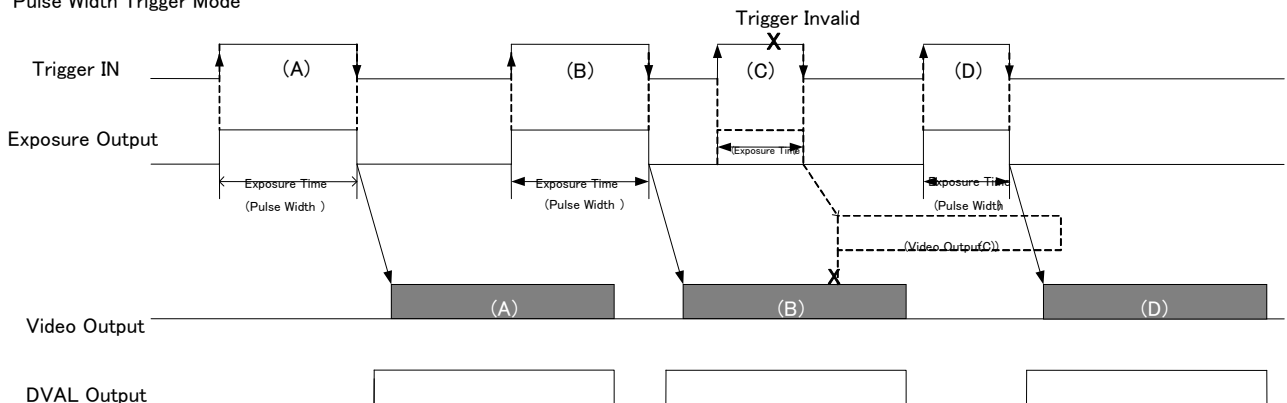


7.4. Pulse Width Trigger Shutter Mode

- Trigger operation is CLK Sync. V-Sync Reset. The delay time from detecting trigger edge in the camera to starting exposure is 21.40 μ s. The delay time from detecting trigger edge to complete exposure is 29.13 μ s.
- Triggers can be accepted even when outputting video signals. However, shutter timing to start the next video output prior to the completion of video transmission for the prior video output signals can not be accepted. (Refer to the below C). Trigger input while outputting video signals should be synchronized with the down edge of camera LVAL output.

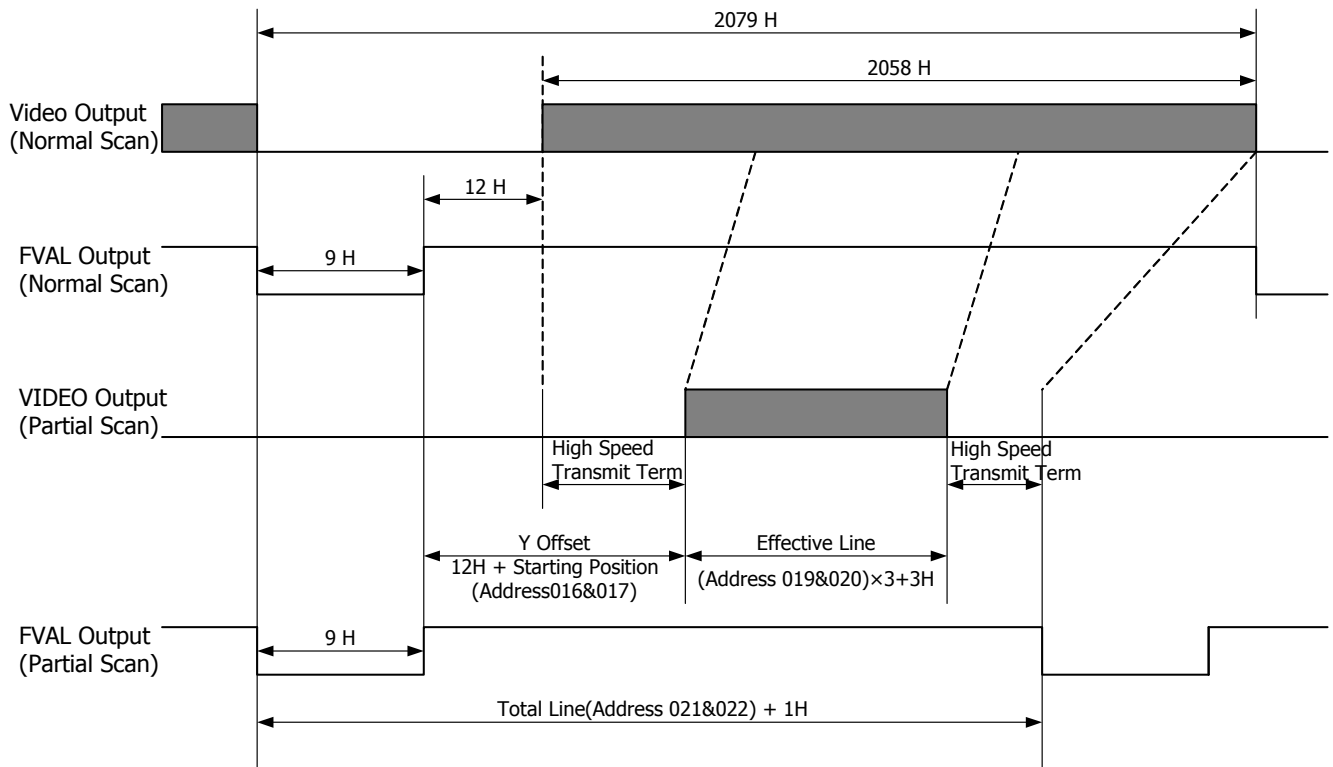


Pulse Width Trigger Mode



8. Partial Scan Mode Details

At Partial Scan Mode, both starting position and width of capturing can be set by 3H.



Reading out position register (Address 016&017) : 0(0 H) ~ 685(2055 H) 3 H/step

Effective line register (Address 019&020) : 0(3 H) ~ 685(2058 H) 3 H/step

Total line register (Address 021&022) : 706 H + (Effective line register x 2) + 2 (Read Only)

(Note) Reading out position and effective lines should meet the following conditions.

Reading out position register + Effective line register = < 685

If the above conditions are not met, the value, 685 – reading out position register is to be set to the effective lines register.

<Setting Example 1> Condition: Reading out position register (Address 016&017) = 000

Effective Line Register (Address 019&020)	Effective Lines	Total Line Register + 1 H	Frame Rate
0	3 H	709 H	44 fps
.	.	.	.
159	480 H	1027 H	30 fps
.	.	.	.
255	768 H	1219 H	26 fps
.	.	.	.
341	1026 H	1391 H	22 fps
.	.	.	.
399	1200 H	1507 H	21 fps
.	.	.	.
685	2058 H	2079 H	15 fps

9. Remote Communication Function

Via camera link cable, the camera can be controlled.

(1) The settings for RS232C

Baud rate : 9600bps
 Data : 8bit
 Stop bit : 1bit
 Parity : None
 XON/XOFF : Not controlled

(2) Control code

- The total control code is 14 bytes, which conforms to ASCII code.
- The control code consists of camera No. process code, remote controller address, remote controller data, and CR. Execute Read/Write through PC, and the camera will reply the data.

1	2	3	4	5	6	7th Byte	8	9	10	11	12	13	14
Camera No.						Process code	Remote controller address			Remote controller data			CR
000000: fixed						"R" Read mode	Please refer to the address table of Section 5. Function Settings.			000~255			0 Dh
						"W" Write mode							
						"C" Camera mode							

Camera No. is fixed with 6 bytes numerical strings, "000000".

Process code

Input any one of R, W, or C to the process code.

R (read mode) is to read the data of remote controller address.

Please be noted to set any dummy data (000~255) to 11th ~13th, since a command shall consists of 14 bytes.

W (write mode) is to write the data to the remote controller address.

Please be noted that the data cannot be saved into EEPROM of the camera.

(Reboot the camera, and the data is reset to the initial setting.)

To save the data into EEPROM, please refer to Section 5. Function Settings.

C is the code to send the data back from the camera.

Note: Do not set code C when sending the data from PC side.

Remote controller address

Note: Do not write the data into the address other than specified, since it may cause the damages or malfunction of the camera.

Remote controller data

Set the decimal number (000~255) for the remote controller data. Please be noted to set any dummy data at read control mode.

CR

Be sure to input "CR" to confirm the end of the command.

※ Note: The data set with 2 Byte shall be set with High Byte first, then set with Low Byte. The camera rewrites the internal resister when receiving Low Byte.

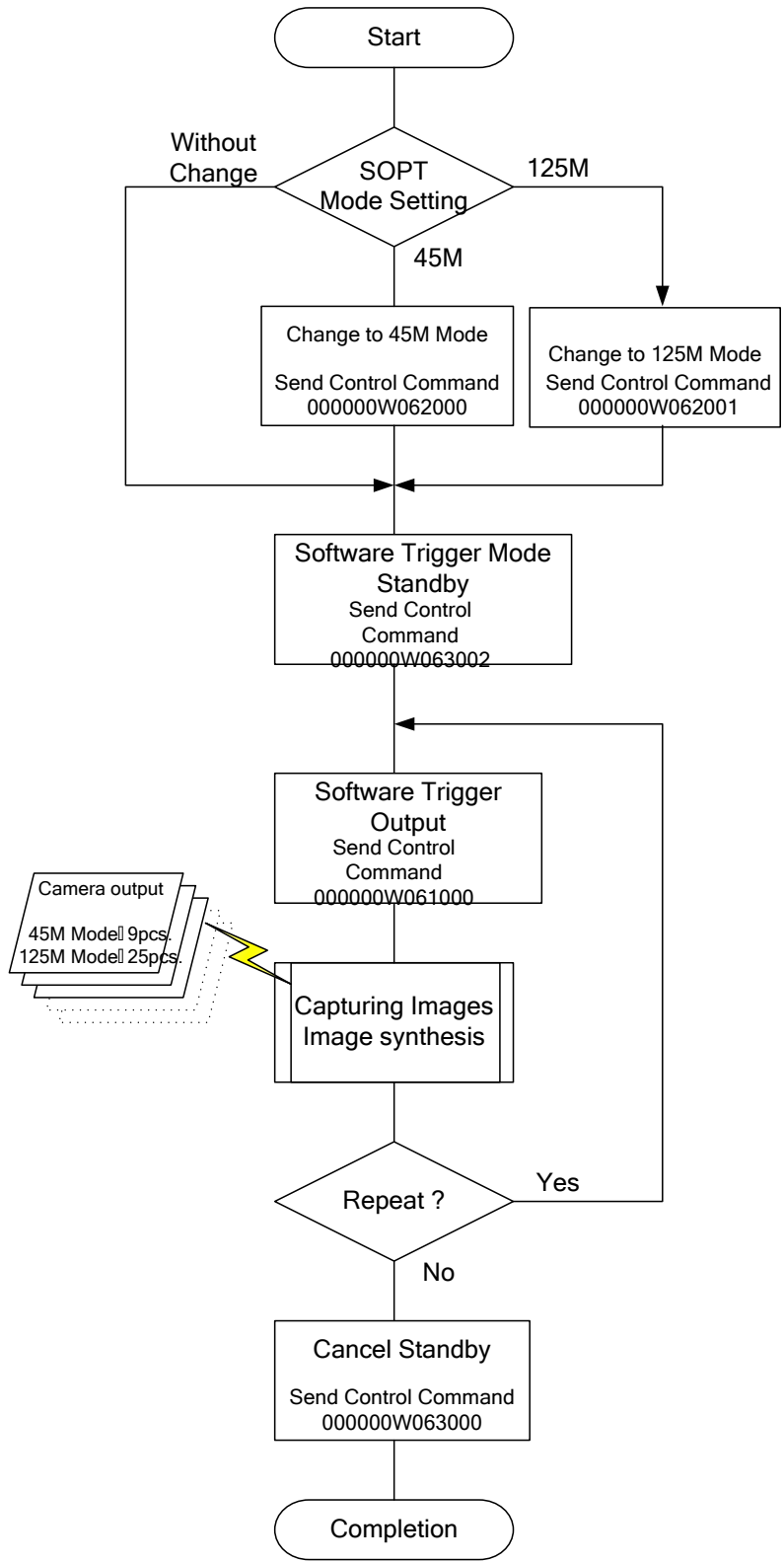
10. Initial Settings

Function	Address	Data
Gain	001 0:	0 dB
E-Shutter	002 0:	1/15s(OFF)
Trigger Shutter Mode	004 0:	Normal Shutter Mode (Trigger Mode OFF)
Trigger Polarity	011 0:	Positive Input
Trigger Input	012 0:	Camera Link
Output Data Select	013 0:	8bit Output Data
Partial Scan Mode	015 0:	Full Frame Scan Mode
Partial Scan Total Line	021&022 2078:	Read Only
Baud Rate	030 0:	9600bps
Frame ID ON/OFF	060 0:	OFF
SOPT Mode	062 0:	45M Mode
SOPT Standby	063 0:	Standby OFF
SOPT Long Term Exposure Mode	098&099 2079:	OFF

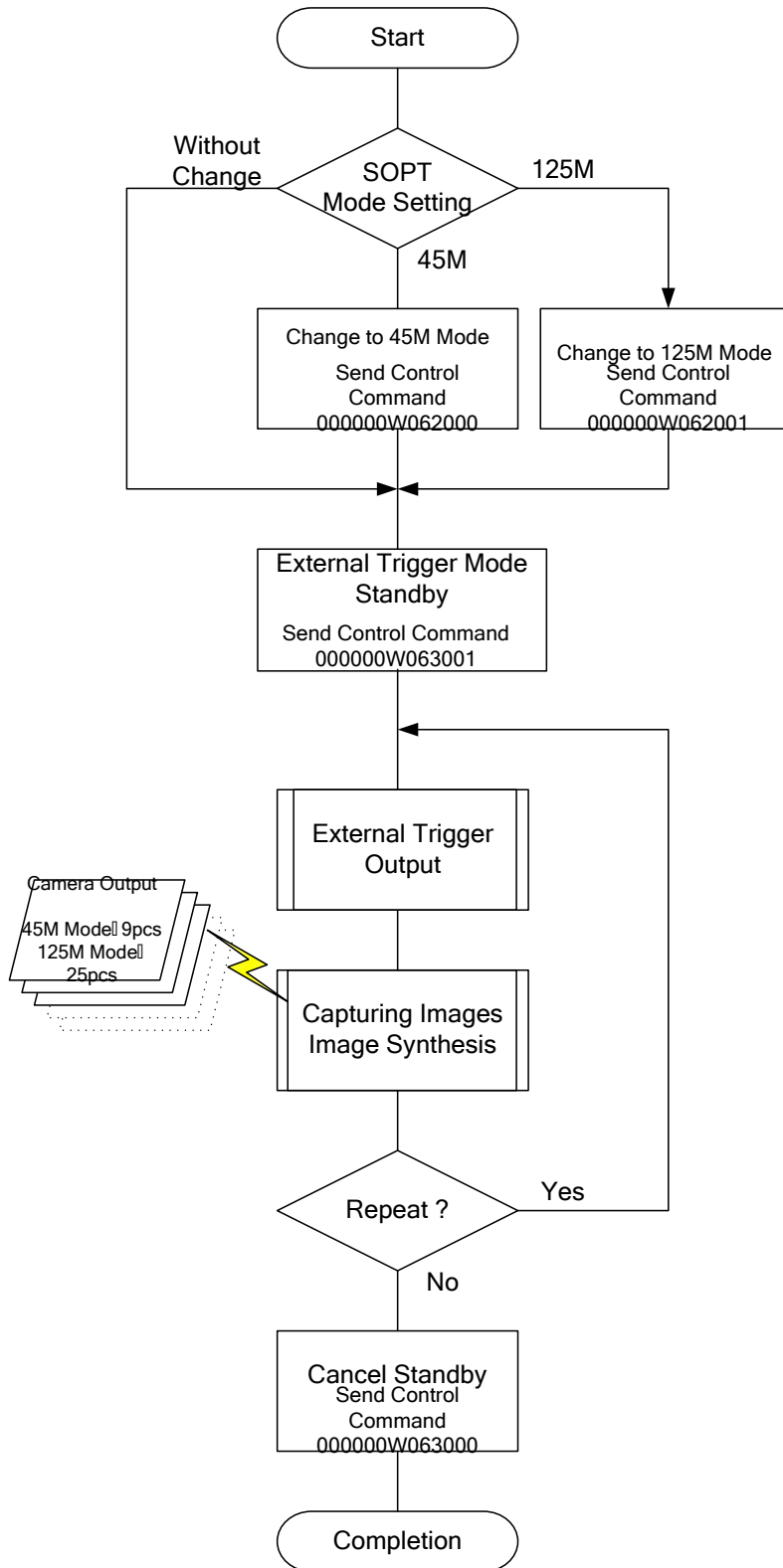
※ In this Specification, we describe pixel shifting technology as "SOPT: Spatial Offsetting Pickup Technique".

11. SOPT Control

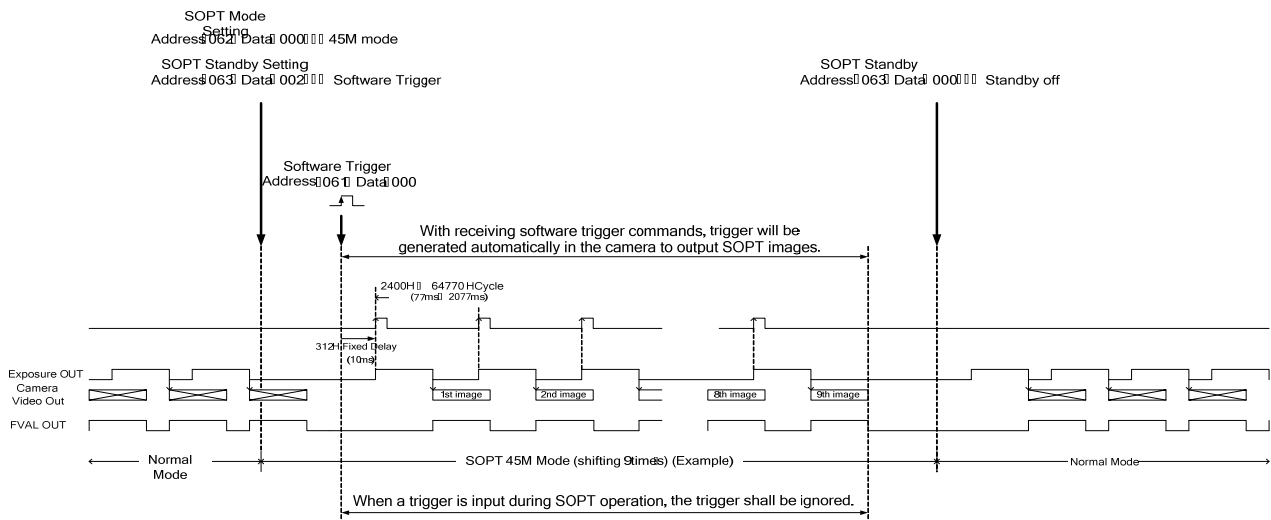
11.1. Software Trigger Control Sequence



11.2. External Trigger Control Sequence

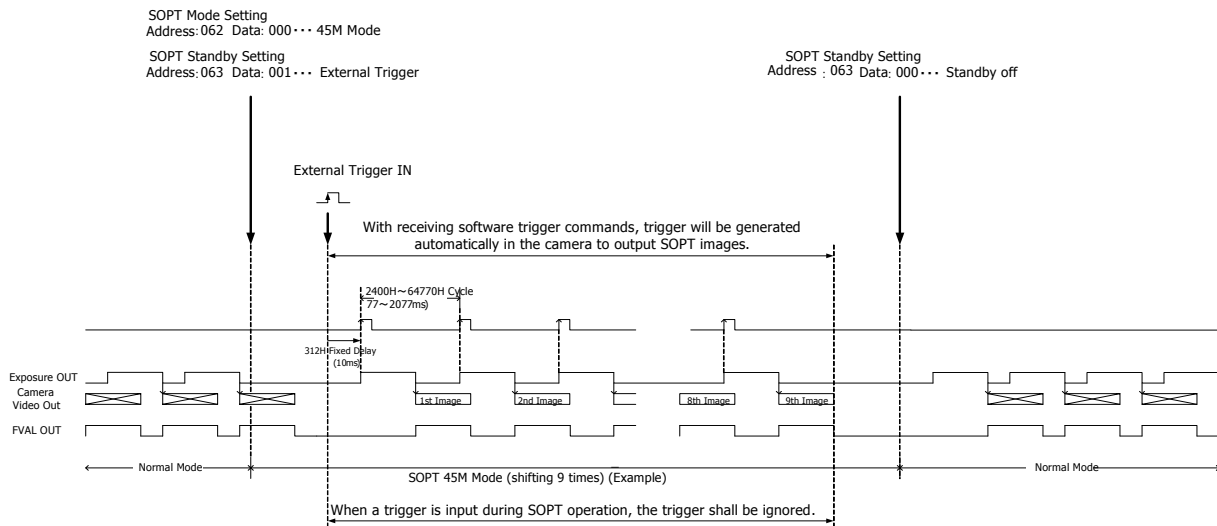


11.3. To operate SOPT with software trigger (45M Mode)



- (1) With 1 trigger input, 9 images can be output at 45M mode and 25 images can be output at 125M mode.
- (2) Partial scan mode can not be used at SOPT Mode.
- (3) Pulse width trigger mode can not be used at SOPT Mode. Shutter values should be set at the address 002.
- (4) Set the internal trigger cycle with address 098 & 099.

11.4. To operate SPOT with external trigger signals (45M Mode)



- (1) With 1 trigger input, 9 images can be output at 45M mode and 25 images can be output at 125M mode.
- (2) Partial scan mode can not be used at SPOT Mode.
- (3) Pulse width trigger mode can not be used at SPOT Mode. Shutter values should be set at the address 002.
- (4) Set the internal trigger cycle with address 098 & 099.

12. Image Synthesis

Alignment sequence of SPOT images should be changed as follows on the PC side with software processing. Please contact us for the details on the image synthesizing sample softwares.

Image Synthesis on a PC (Ex. 45M Mode)

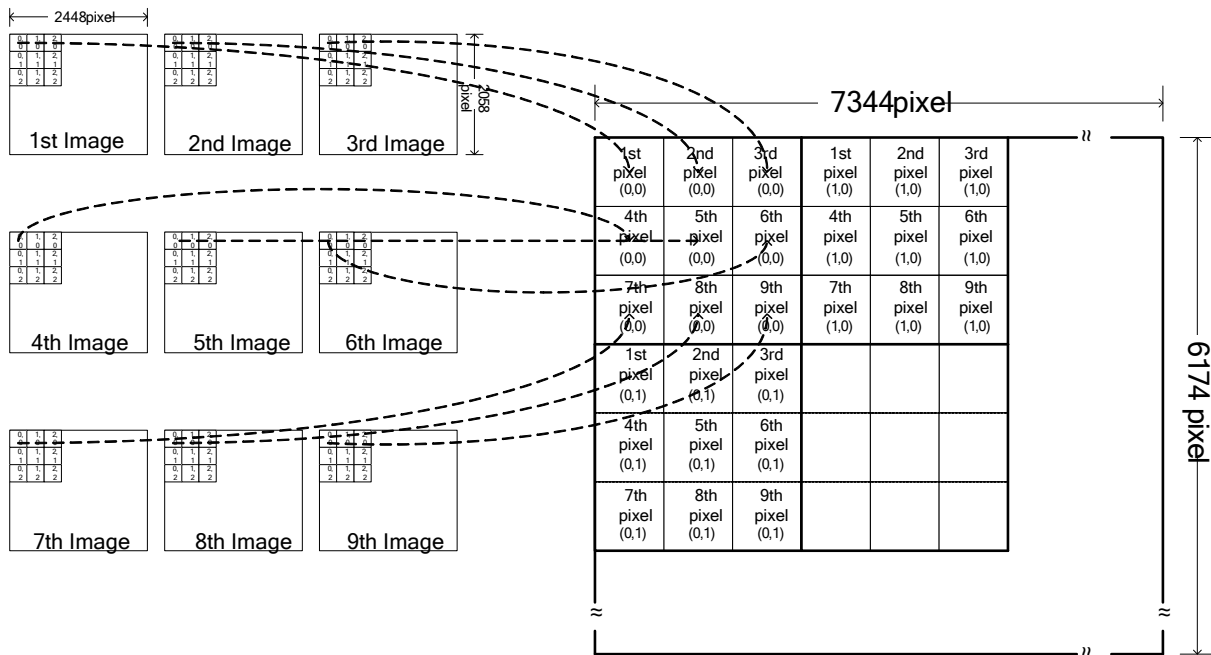
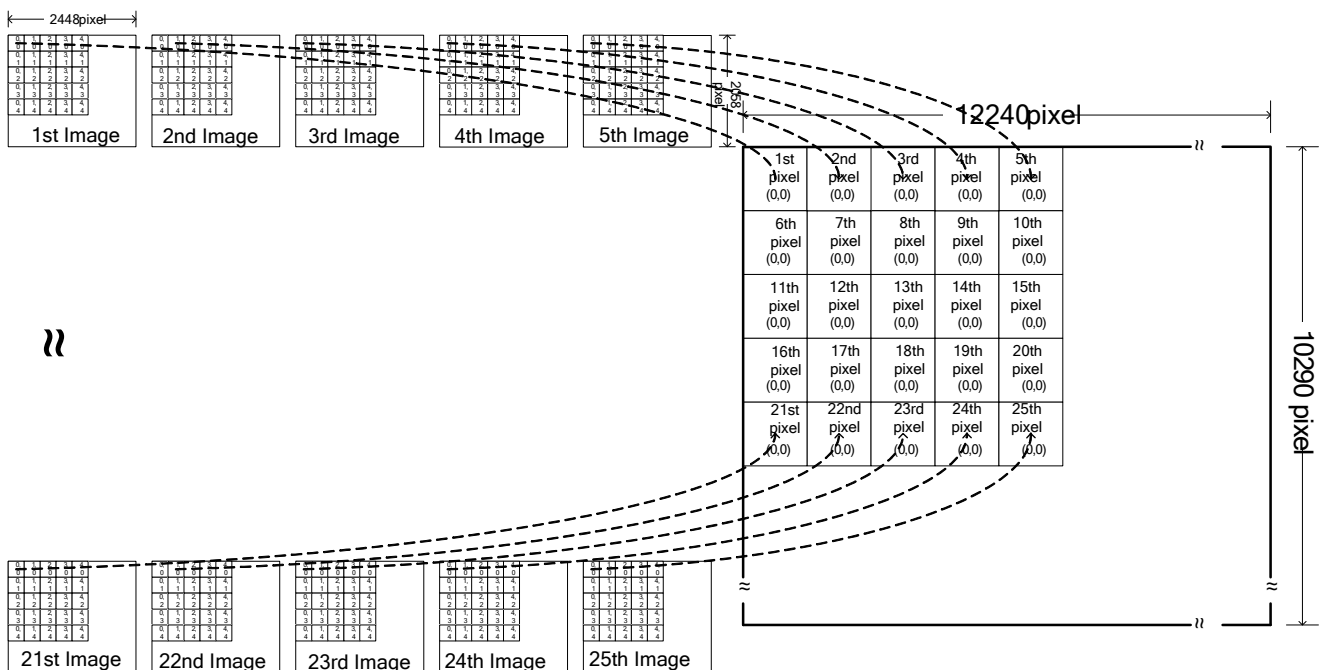
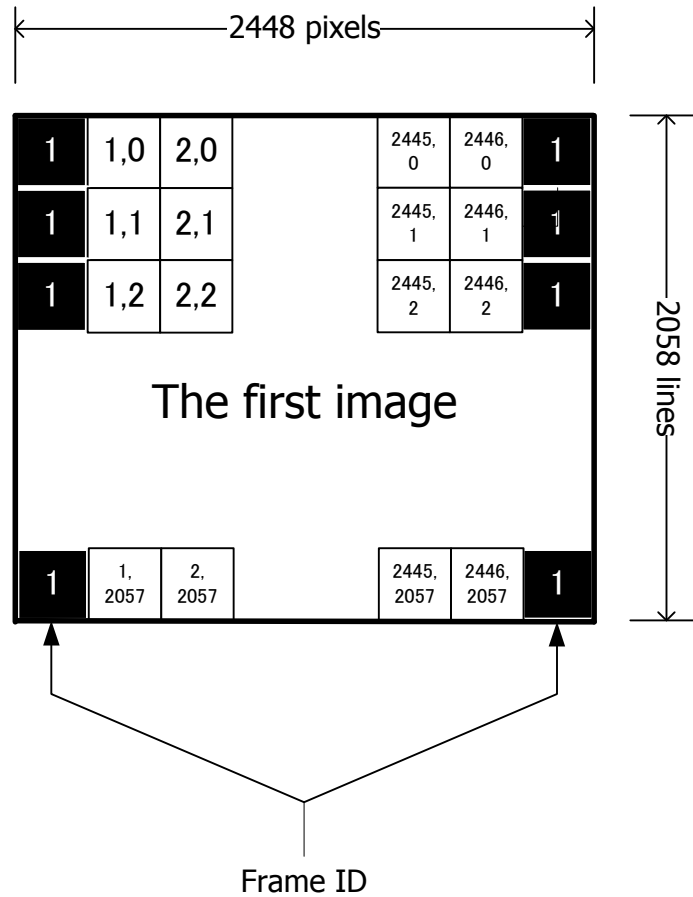


Image Synthesis on a PC (Ex. 125M Mode)



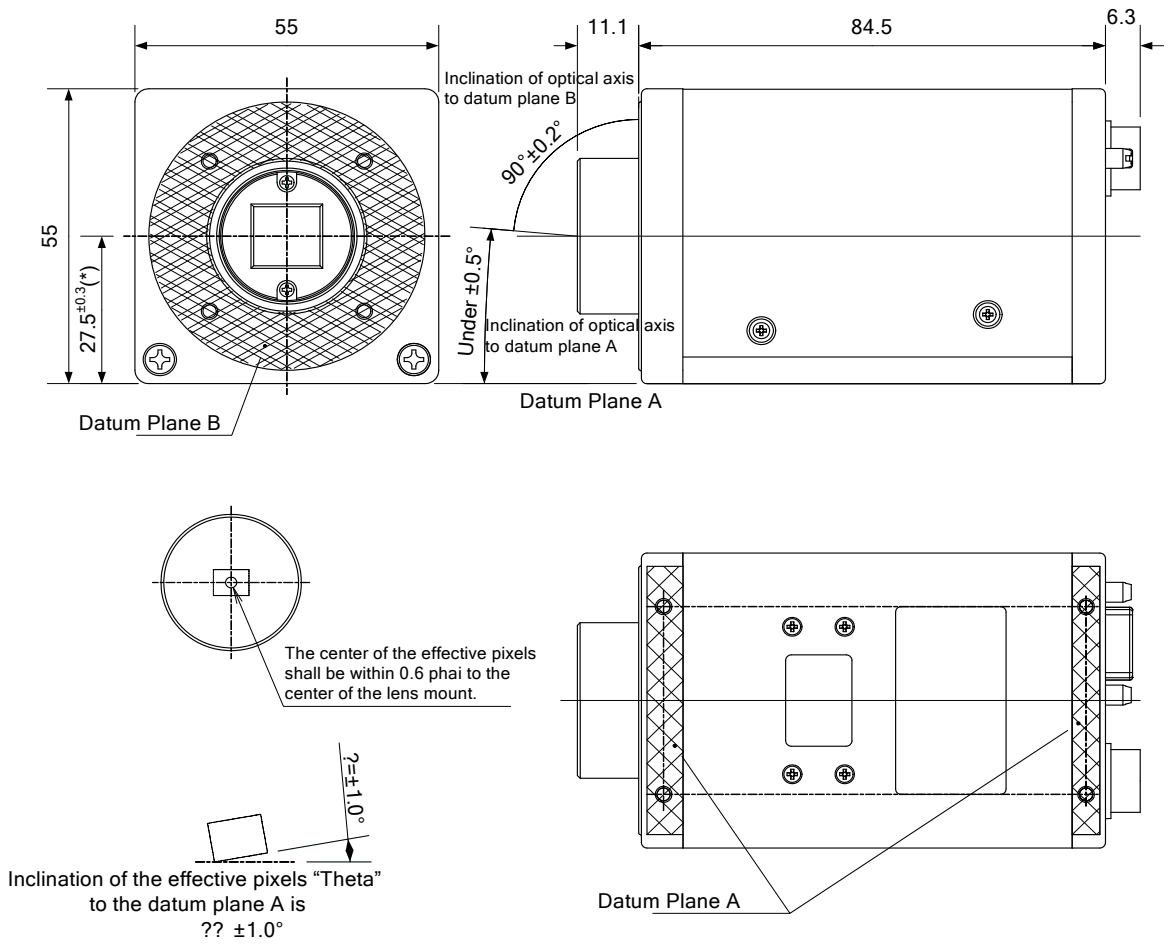
To simplify the processing for changing alignment sequence of SPOT images, Frame IDs can be added to the output images. However, when Frame ID is ON, (0,Y) and (2447, Y) data are used as Frame ID.



Frame ID Data (8bit) : SOPT OFF Image ... 00(Hex)
 SOPT ON Image ... 01(Hex) ~ 19(Hex) 45M Mode
 01(Hex) ~ 7D(Hex) 125M Mode

Address : 060 Data : 0 ... Frame ID OFF
 1 ... Frame ID ON

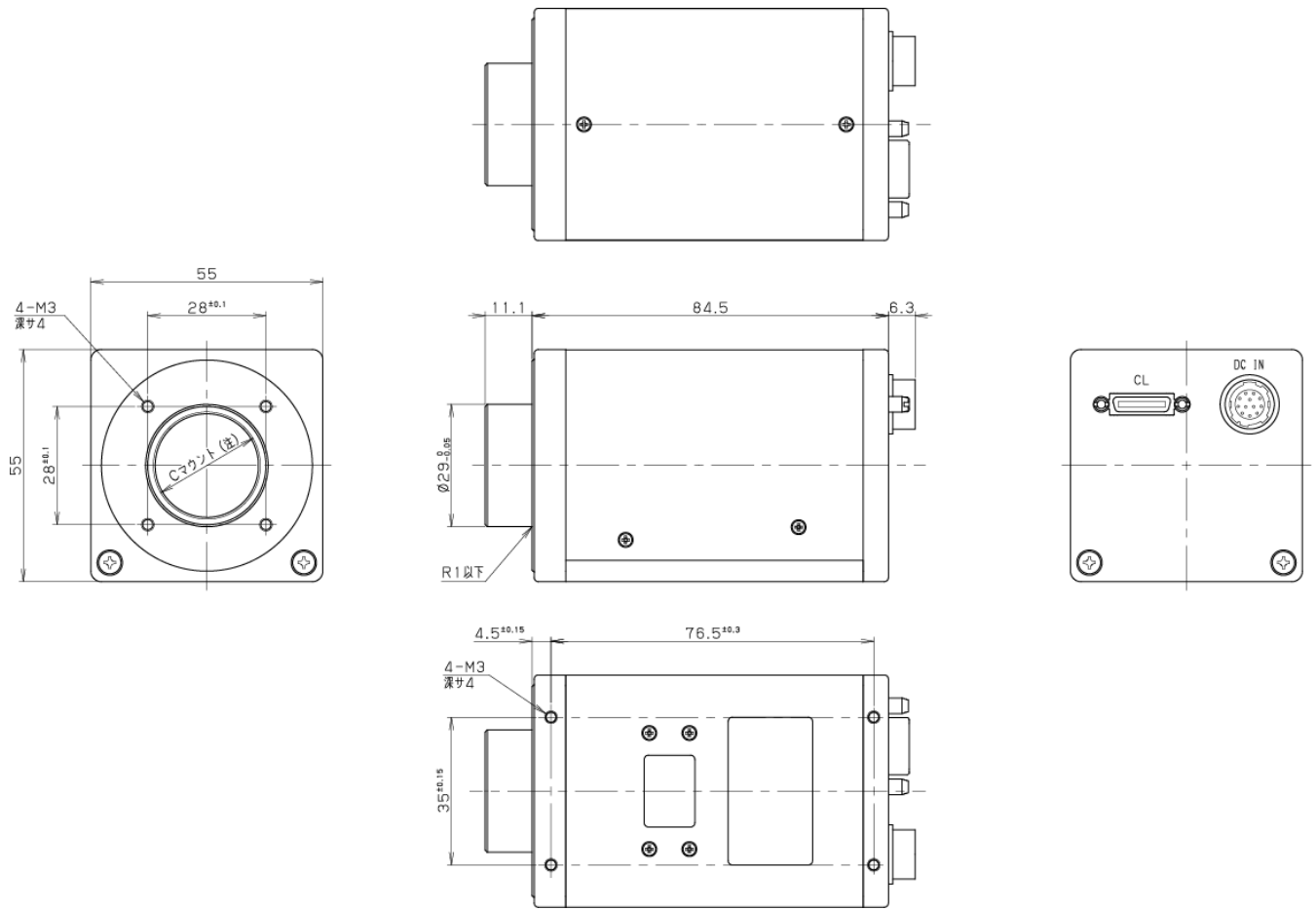
13. CCD Optical Axis Accuracy



*)Dimensions from datum plane A to the center of the lens mount.

910-018-00-00
(Unit:mm)

14. Dimensions



15. Cases for Indemnity (Limited Warranty)

We shall be exempted from taking responsibility and held harmless for damage or losses incurred by the user in the following cases.

- In case damage or losses are caused by fire, earthquake, or other acts of God, acts by third party, deliberate or accidental misuse by the user, or use under extreme operating conditions.
- In case indirect, additional, consequential damages (loss of business interests, suspension of business activities) are incurred as result of malfunction or non-function of the equipment, we shall be exempted from responsibility for such damages.
- In case damage or losses are caused by failure to observe the information contained in the instructions in this product specification & operation manual.
- In case damage or losses are caused by use contrary to the instructions in this product specification & operation manual.
- In case damage or losses are caused by malfunction or other problems resulting from use of equipment or software that is not specified.
- In case damage or losses are caused by repair or modification conducted by the customer or any unauthorized third party (such as an unauthorized service representative).
- Expenses we bear on this product shall be limited to the individual price of the product.

16. CCD Pixel Defect

CIS compensates the noticeable CCD pixel defects found at the shipping inspection prior to our shipment. On very rare occasions, however, CCD pixel defects might be noted with time of usage of the products.

Cause of the CCD pixel defects is the characteristic phenomenon of CCD itself and CIS is exempted from taking any responsibilities for them. Should you have any questions on CCD pixel defects compensation, please contact us.

17. Product Support

When defects or malfunction of our products occur, and if you would like us to investigate on the cause and repair, please contact your distributors you purchased from to consult and coordinate.