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# CIS

CoaXPress I/F  
5M Pixel CMOS Black & White Camera

## VCC-5CXPHSM

### Product Specification

*(Preliminary)*

**CIS Corporation**

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PRELIMINARY

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## 1. Precautions for handling

### 1.1. Notes

- For camera protection, do not use in dusty or humid areas.
- Handle the camera carefully to avoid strong shocks and static electricity. It can cause a breakdown.
- To protect the CMOS image sensor, please do not directly image direct sunlight or high-brightness lights. Also, when not in use, please wear a protective cap.
- The connection to the camera is defined as "3.3.External Connection Connector Specifications. Please note that incorrect connections can not only damage the camera itself, but also cause irreparable failure to the connected equipment.
- If there is an AC leak from the device connected to the camera (monitor/computer, etc.), the camera may be broken. Please check the ground potential between each other and make sure that there is no problem before connecting.
- The power supply voltage of the camera should be used correctly within the specifications. If you use a power supply that does not meet the specifications or is unstable, the camera may malfunction or incorrect action.
- All camera failures or malfunctions caused by incorrect use without following the above precautions are not covered by the product warranty.

### 1.2. Restrictions on Applications

- This product is not designed and manufactured with the consideration that it will be used in devices that are directly related to human life, devices that may harm the human body, the space industry, etc., and should not be used for those applications.
- Please avoid using it under conditions or environments other than those specified, especially in applications where safety is required, or contact us in advance.

### 1.3. Disclaimer(Exception Clause)

- Damage or breakdown caused by earthquakes, lightning, floods, fires, or other force majeure is not covered by the warranty.
- Damage caused by the customer's negligence or damage caused by failure to comply with the contents of this specification is not covered by the warranty.
- Failures caused by repairs or modifications made by customers other than our company are not covered by the warranty.

## 2. Product Overview

The VCC-5CXPHSM is a CoaXPress output camera using a 2/3-inch 5-megapixel CMOS image sensor.

### 2.1. Feature

- Enclosure 29mm cube size
- Global Shutter CMOS Sensor (Monochrome)
- CoaXPress CXP-6/CXP-12
- 1 lane
- PoCXP support
- Maximum cable length 24m (CXP-12), 40m (CXP-6)
- ROI/Multi-ROI
- Binning addition and average
- Exposure, Gain Settings
- External trigger mode (fixed trigger shutter mode / pulse width trigger shutter mode)
- Compliant with CoaXPress standard (GenICam support)
- C-mount

### 2.2. Bundled Items

- Standard Bundled Items
  - Camera module

### 3. Specifications

#### 3.1. General Specifications

Electrical Specifications			
Pixel Sensor	Imaging Devices	2/3-inch global shutter CMOS	
	Effective number of pixels	2448(H) × 2048(V)	
	Pixel size	3.4μm(H) × 3.4μm(V)	
Video Output Mode		Ver,1.1.1 complied CXP6_X1 / CXP12_X1	
Video Output Frequency	Pixel Clock Frequency	72MHz	
Video Output Format		Mono8 / Mono10 / Mono12	
Frame Rate	CXP6 8bit/10bit/12bit	109.2fps/85.8fps/75.1fps	
	CXP12 8bit/10bit/12bit	218.5fps/171.7fps/150.2fps	
Synchronous Method		Internal synchronization	
Video Output Pixel Size (Max. Pixel Size)		2448 (H) × 2048(V)	
Video Signal (Gain 0dB)	White clip level	255digit	MONO 8bit
	Setup up level	0~1digit	MONO 8bit, and at factory settings
	Dark Shading	0~1 digit (H/V)	MONO 8bit, and at factory settings
Standard Sensitivity		F8, lx (Mono12, 10000μs, Others are factory settings )	
Minimum Subject Illumination		TBD, lx (Mono12, 10000μs, gain x32, level=50%, The others are factory setting values)	
Variable Gain		x1~x32 (0dB~+36dB)	
Shutter Speed		5[μs]~100,000[μs]	
Gamma Correction		Yes (γ=0.1~1.8)	
Trigger Mode		Freerun mode (internal camera trigger) Trigger Mode (Host, External Terminal) Fixed trigger shutter Pulse width trigger shutter	
Partial Scan		8-zone (max), vertical & horizontal variable size (However, horizontal offsets are common across all ROI )	
Supply Voltage		PoCXP: 18.5~26V	
Power Consumption		3.4 W (CXP12) [Freerun]	
Mechanism Specifications			
Dimensions		H: 29mm W: 29mm D: 29mm excluding protrusions	
Weight		TBD g	
Lens Mount		C-mount	
Usage Environment Specifications			
Safety Quality Standard		CE Planned acquisition EMC Instruction 2014/30/EU Conformity Standard Emission: EN61000-6-4:2007+A1:2011 Immunity: EN61000-6-2:2019 RoHS Instruction 2011/65/EU (EU)2015/863	
Durability	Vibration	Acceleration	: 98m/s <sup>2</sup> (10G)
		Frequency	: 20 ~ 200Hz
		Direction	: X, Y, Z 3 directions
		Testing time	: 120 minutes in each direction
Shock		It must be able to withstand shocks of up to 980 m/s <sup>2</sup> (100) G applied in the six directions of ±X, ±Y, ±Z without packing.	

Operation Guaranteed Environment	0 ~ +45°C Humidity 20 ~ 80%RH with no condensation
Storage Environment	-25 ~ +60°C Humidity 20 ~ 80%RH with no condensation

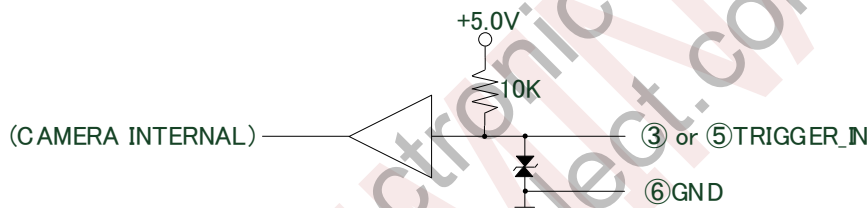
### 3.2. Input/Output Specifications

#### 3.2.1 Trigger Input (6-pin connector, pin 3 or pin 5)

- Open Collector Input
- You can enter triggers directly from external devices.

If you want to use this terminal, set the following:

- Set the LineSelector of the DigitalIOControl to Line0 (pin 3) or Line1 (pin 5).
- Set the LineMode of DigitalIOControl to Input.
- Set the LineSource of DigitalIOControl to FrameTrigger.
- Set the TriggerSource of AcquisitionControl to match the LineSelector.

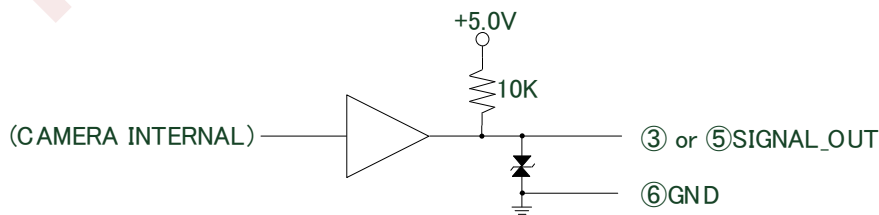


#### 3.2.2 Signal Output (6-pin connector, pin 3 or pin 5)

- Open collector output
- It can output the timing signal inside the camera.

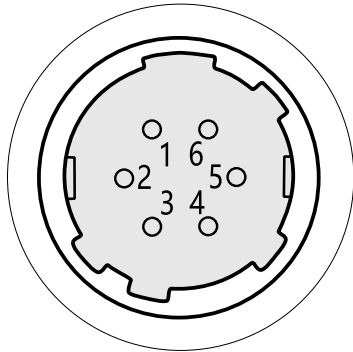
If you want to use this terminal, set the following:

- Set the LineSelector of the DigitalIOControl to Line0 (pin 3) or Line1 (pin 5).
- Set the LineMode of the DigitalIOControl to Output.
- Set the LineSource of DigitalIOControl to signal to output.



### 3.3. External Connection Connector Specification

#### 3.3.1 6-pin circular connector



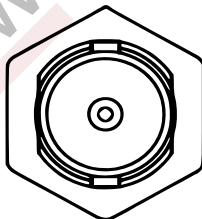
Equivalent to HR10-7R-6PA(Hirose)

Pin Number	Signal Name	Remarks
1	NC	
2	NC	
3	Line0	TRIGGER_IN SIGNAL_OUT (Exposure/FVAL/LVAL/LinkTrigger selective output)
4	NC	
5	Line1	TRIGGER_IN SIGNAL_OUT (Exposure/FVAL/LVAL/LinkTrigger selective output)
6	Common	TRIGGER_IN, Return of SIGNAL_OUT (common)

\*NC = Non-Connection. Do not connect anything to the terminals.

#### 3.3.2 75 Ω Micro BNC Connector

- This is the image output signal of CoaXPress.
- It supports PoCXP.



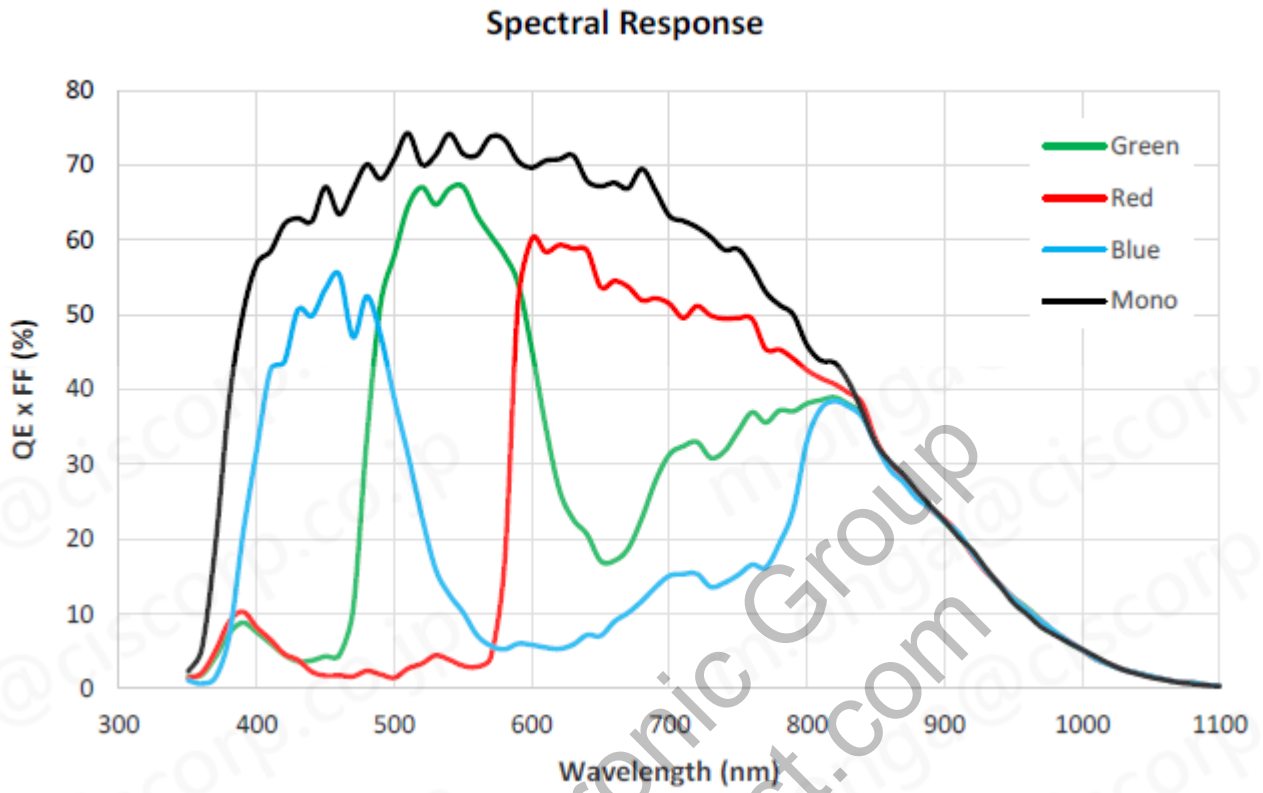
#### 3.3.3 LED Indicator

- When DeviceIndicatorMode is set to Active, the luminous state indicates the status of the camera.

LED status	Camera Status
OFF	No power supplied
Green Lighting	Device and host connection established
Green Fast Flashing [12.5Hz]	During video data transfer
Orange Low flashing [1Hz]	Waiting for trigger input
Red Fast Flashing [12.5Hz]	System error occurred /trigger error occurred

### 3.4. Spectral Response

\* Excludes lens characteristics, optical glass characteristics, and light source characteristics.



## 4. Camera Features

### 4.1. How to set it up

- Complies with the CoaXPress standard.

Each configuration item name complies with GenICam SFNC (Standard Features Naming Convention).

(Some of the settings are original)

The corresponding SFNC versions can get it with DeviceSFNCVersionMajor, DeviceSFNCVersionMinor, DeviceSFNCVersionSubMinor.

### 4.2. Device Information

#### 4.2.1 Camera Information

DeviceControl	
DeviceModel	ReadOnly
DeviceVersion	ReadOnly
DeviceFirmwareVersion	ReadOnly
DeviceSerialNumber	ReadOnly

- DeviceModel : Camera model name
- DeviceVersion : Circuit version
- DeviceFirmwareVersion : Firmware Versions
- DeviceSerialNumber : Camera Serial No.

TransferLayerControl		
DeviceTapGeometry	Geometry_1X_1Y	ReadOnly

#### 4.2.2 User Information

DeviceControl	
DeviceUserID	Manual
DeviceUserString	Manual

You can set a string of up to 16 characters for DeviceUserID and up to 256 characters for DeviceUserString (including the NUL character ¥0) on the camera. When you execute "UserSetSave", it will be saved to the non-volatile memory in the camera.

- Regardless of the UserSetSelector, it is a setting in the camera.
- Running UserSetLoad with UserSetSelector=Default maintains the current settings.
- When launched with UserSetDefault=Default, it reads out the saved settings.

### 4.3. Saving and Initializing Settings

- This function stores the operating settings in the camera's non-volatile memory and loads the settings in the non-volatile memory.

UserSets	
UserSetSelector	Default [Not subject to saving settings] UserSet0 UserSet1 UserSet2
UserSetLoad	(Execute)
UserSetSave	(Execute)
UserSetDefault	Default UserSet0

	UserSet1 UserSet2
--	----------------------

- ◆ **UserSetSelector** : Select the setpoint in the non-volatile memory. Alternatively, select the setting value stored in the non-volatile memory to read.  
 Default: Factory Initial Settings (UserSetLoadOnly executable.UserSetSaveis not executable)  
 UserSet[0|1|2] : User Settings
  - ◆ The Default area has the default settings, so you cannot save any settings.
  - ◆ The value of the UserSetSelector cannot be saved even if you run UserSetSave.  
 It will always be the same as UserSetDefault at startup.
  - ◆ Select UserSetLoad or UserSetSave each time you run.
- ◆ **UserSetLoad** : Load the camera settings for the area selected with UserSetSelector from the non-volatile memory. If the UserSetSelector is Default, it reads the factory settings, but DeviceSensorSpeed, CxpLinkConfiguration, PixelFormat, DeviceUserID, DeviceUserString, UserSetDefault, Defective pixel correction values and Shading correction values maintain the settings currently in operation. Even if the UserSetSelector is UserSet0,1,2, DeviceSensorSpeed, CxpLinkConfiguration, and PixelFormat will maintain the settings currently in operation.
- ◆ **UserSetSave** : Save the camera settings for the area selected with UserSetSelector.  
 When Default is selected, only UserSetLoad is enabled, and UserSetSave cannot execute.
- ◆ **UserSetDefault** : Select the settings when the camera starts.  
 Load the selected settings and the camera will start.  
 Even if you select Default, DeviceSensorSpeed, DeviceUserID, DeviceUserString, Defect pixel correction values, and Shading correction values will read the saved settings.

- UserSetDefault stores the settings immediately when set.
- UserSetLoad should not be executed while grabbing (while acquiring images).
- The following settings have a single storage area and do not depend on UserSet0, 1, or 2, but are stored with UserSetSave.  
 UserSetDefault, DeviceUserID, DeviceUserString, Defect pixel correction value, Shading correction value

The combination for saving and performing the invocation of the settings is as follows:

UserSetSelector	UserSetLoad/UserSetSave	Function
Default	UserSetLoad	Restore Factory Settings
	UserSetSave	- (Cannot be executed)
UserSet[0 1 2]	UserSetLoad	Restore User Settings
	UserSetSave	Save User Settings

#### 4.4. Sensor Data Output Speed

Change the sensor data output speed.

DeviceControl	
DeviceSensorSpeed	Lvds800Mbps Lvds1200Mbps

Set the sensor data output speed.

- Faster sensor data output speeds result in higher frame rates, while slower image quality tends to be more advantageous.
- If you change the settings, please review the settings as this will affect the frame rate and exposure time setting range. (if the operating settings exceed the upper limit, clip at the upper limit).
  - \* Do not change the DeviceSensorSpeed while grabbing (while acquiring an image).

#### 4.5. Link speed and number of links

Transfer Control	
CxpLinkConfiguration	CXP6_X1 CXP12_X1

- ♦ CXP6\_X1 : Link speed = 6.250 Gbps, number of links = 1
- ♦ CXP12\_X1 : Link speed = 12.500 Gbps, number of links = 1
- ※ Do not change CxpLinkConfiguration while grabbing (while acquiring images).

#### 4.6. Pixel format

ImageFormatControl	
PixelFormat	Mono8 Mono10 Mono12

- ♦ PixelFormat: Choosing a pixel format
  - Mono8: monochrome8-bit
  - Mono10: monochrome10-bit
  - Mono12: monochrome12-bit
- \* Do not change the PixelFormat while grabbing (while acquiring an image).

#### 4.7. Frame rate

AcquisitionControl	
AcquisitionFrameRate	AcquisitionFrameRate.Min~AcquisitionFrameRate.Max

Set the frame rate (Hz) for the internal sync mode.

Make sure you don't change it while the image is being acquired.

- ♦ AcquisitionFrameRate.Min : Lower limit 10Hz
- ♦ AcquisitionFrameRate.Max : Upper limit
- DeviceSensorSpeed and PixelFormat is varies depending on the ROI(Height) settings.
- ※ Binning does not increase the frame rate.
- ※ The frame rate is adjusted by increasing the number of vertical blanks.
- This may cause errors with the frame rate you set.

The frame rate can be calculated using the following formula:

**Frame rate [Hz] = 1 / ( 1 line time × (number of vertical blanking lines + number of output image lines) )**

Please refer to the table below for the time of one line at full-frame output and the fastest frame rate.

Sensor Data Output Speed: 800Mbps

CxpLinkCon figuration	PixelFormat	1 line time[us]	Number of vertical blanking lines	Frame rate at full frame [Hz]	Frame time at full frame
CXP12_X1	Mono8	2.94	21	164.39634704589844	6083
	Mono10	2.94	21	164.39634704589844	6083
	Mono12	4.8	20	100.741455078125	9926
CXP6_X1	Mono8	5.88	21	82.19817352294922	12166
	Mono10	5.88	21	82.19817352294922	12166
	Mono12	9.6	20	50.3707275390625	19853

Sensor Data Output Speed: 1200Mbps

CxpLinkCon figuration	PixelFormat	1 line time[us]	Number of vertical blanking lines	Frame rate at full frame [Hz]	Frame time at full frame
CXP12_X1	Mono8	2.2	32	218.53146362304688	4576
	Mono10	2.8	32	171.7032928466797	5824
	Mono12	3.2	32	150.24038696289063	6656
CXP6_X1	Mono8	4.4	32	109.26573181152344	9152
	Mono10	5.6	32	85.85164642333984	11648
	Mono12	6.4	32	75.12019348144531	13312

#### 4.8. Flip

ImageFormatControl	
ReverseX	True/False
ReverseY	True/False

- ♦ ReverseX : Flip the image horizontally
- ♦ ReverseY : Flip the image vertically
- \* Do not change ReverseX/Y while grabbing (while acquiring images).
- ※ The setting value of OffsetX、OffsetY of SingleROI , SensorROIOffsetX[SensorROISelector]、SensorROIOffsetY[SensorROISelector] of MultiROI is automatically updated when ReserseX or ReserseY is changed.

#### 4.9. Trigger-Mode

There are two trigger modes: internal synchronization mode and external trigger mode. You can select it with the following command:

Acquisition Control	
TriggerMode	Off/On
TriggerSelector	AcquisitionStart FrameStart

On this camera, the TriggerMode and TriggerSelector settings will be the same.

Changing the TriggerMode will change the TriggerSelector, and changing the TriggerSelector will synchronize change the TriggerMode.

- ♦ TriggerMode : Trigger Mode
  - ♦ Off : Works in Internal Sync Mode(Free Run Mode). (TriggerSelector = AcquisitionStart)
  - ♦ On : Works in external trigger mode.(TriggerSelector = FrameStart)
- \*Do not change the TriggerMode while grabbing (while acquiring an image).

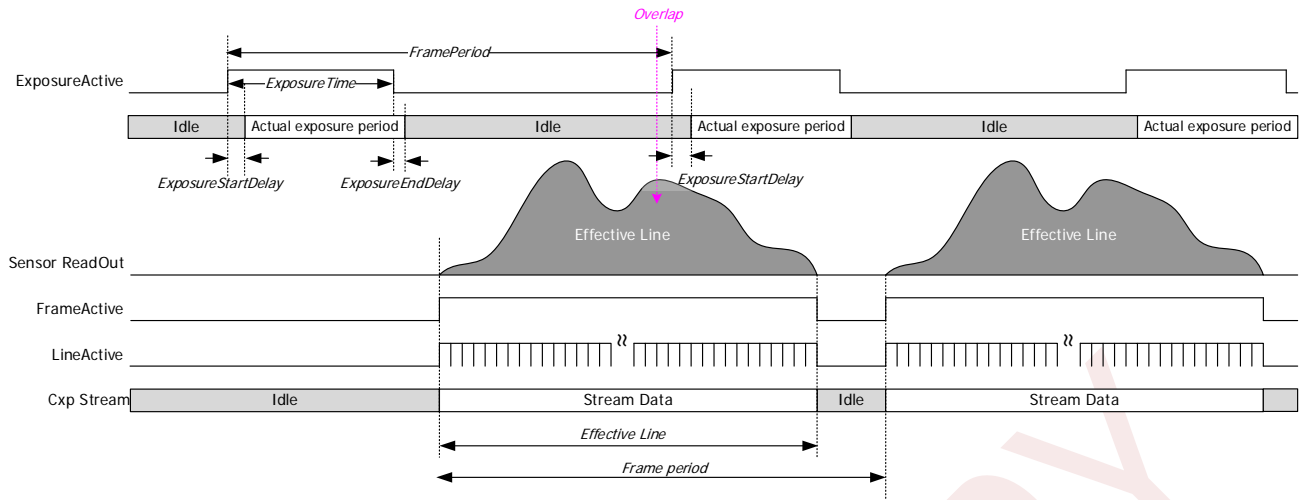
- ♦ TriggerSelector : Trigger Selector

Select the method and polarity to start the video capture from the following.

- ♦ AcquisitionStart : Works in Internal Sync Mode(Free Run Mode).(TriggerMode = Off)
- ♦ FrameStart : Works in external trigger mode. (TriggerMode = On)
- \*Do not change the TriggerSelector while grabbing(while acquiring an image).

##### 4.9.1 Internal Sync Mode (Freerun Mode)

- This mode does not require external trigger input, and reads out the video using a trigger that is continuously created inside the camera.
- Set TriggerMode to Off and TriggerSelector to AcquisitionStart.
- You can change the frame rate in the AcquisitionFrameRate setting.



Vertical Sync Timing Chart (Freerun Mode)

Timing Parameter	Value	Description
ExposureStartDelay	2	Delay time from ExposureActive rising to completion of exposure inside the sensor [H]
ExposureEndDelay	2.80	Delay time from ExposureActive falling to completion of exposure inside the sensor [ $\mu$ s]
Frame Period		Time of frame rate set in AcquisitionFrameRate

4.9.2 External Sync Mode

- This mode captures the video at any time by inputting a trigger signal.
- Set TriggerMode to On and TriggerSelector to FrameStart. When off, it is in internal sync mode.
- You can select detail functions by using the following commands: (When selecting a function, please do it with the trigger input stopped.)

Acquisition Control	
TriggerActivation	RisingEdge FallingEdge LevelHigh LevelLow
TriggerSource	LinkTrigger0 Line0 Line1 Software
TriggerSoftware	(Execute)

- ♦ TriggerActivation : Trigger Activation  
Select the method and polarity in which you want to start the video capture.
  - ♦ RisingEdge : Fixed trigger shutter mode: Start exposure at rising edge (Timed)
  - ♦ FallingEdge : Fixed Trigger Shutter Mode: Start Exposure at Falling Edge (Timed)
  - ♦ LevelHigh : Pulse Width Trigger Shutter Mode: Exposure during High Active Period (TriggerWidth)
  - ♦ LevelLow : Pulse Width Trigger Shutter Mode: Exposure during Low Active Period (TriggerWidth)
- \*Do not change the TriggerSelector while grabbing (while capturing an image).
- ♦ TriggerSource : Trigger Source  
Select the external trigger input destination.
  - ♦ Software : Enter the trigger using the TriggerSoftware command.

\*You can select Software only when the TriggerActivation is RisingEdge.

- ◆ LinkTrigger0 : Enter the trigger from the CoaXPress Host Device.
  - \*Please refer to the specification of the Host Device (grabber board, etc.) for how to generate triggers.
- ◆ Line0/Line1 : Enter the trigger from the 6-pin circular connector.
  - ※ You can choose it if LineMode[LineSelector]=Input and also LineSource[LineSelector]=FrameTrigger.

- ◆ TriggerSoftware : Software Trigger

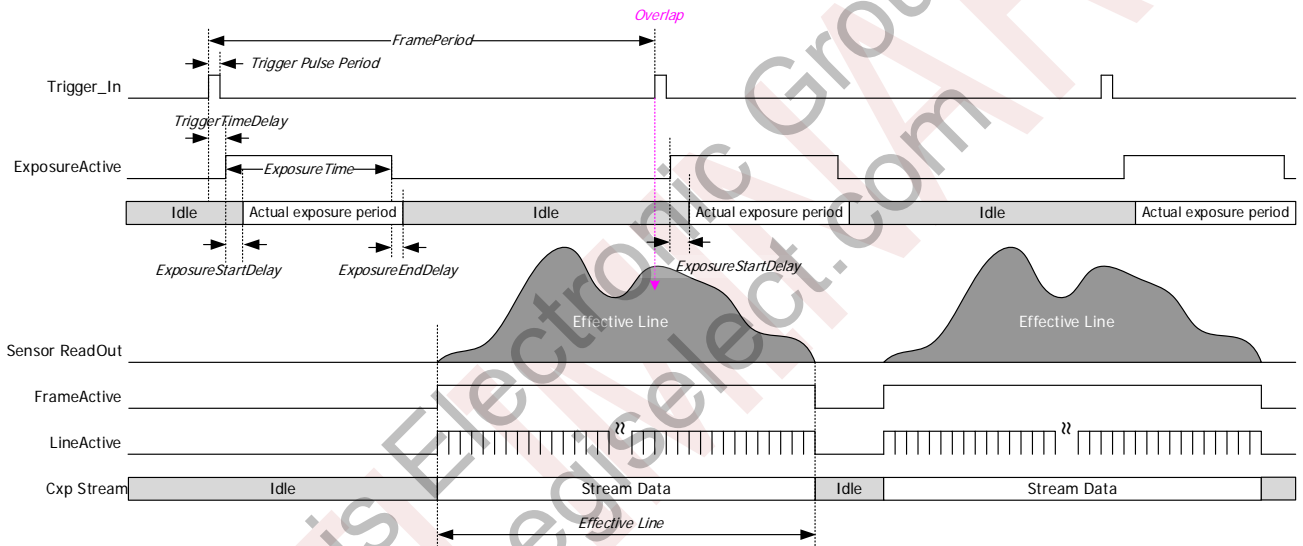
Issue a software trigger. Generate a trigger inside the camera and shoot one frame.

\* This can only be done when the TriggerSource is set to Software.

### 4.9.3 External Sync Mode (Fixed Trigger Shutter Mode)

(TriggerMode = On, TriggerActivation = RisingEdge or FallingEdge)

- This mode starts the exposure with an external trigger input and performs the exposure at the time set by the ExposureTime command.
- The trigger is synchronized to the CLK in the camera to initiate the exposure with low latency.
- The timing chart and timing parameters in this operating mode are shown below.



Vertical Sync Timing Chart (Fixed Trigger Shutter Mode)

Timing Parameter	Value	Description
Trigger Pulse Period	1	Trigger Input Pulse Width (Minimum) [μs]
Trigger Time Delay	0.08~0.14	Delay time from trigger input rise to ExposureActive rise [μs]
ExposureStartDelay	2	Delay time from ExposureActive rise to completion of exposure inside the sensor [H]
ExposureEndDelay	2.80	Delay time from exposureActive descent to completion of exposure inside the sensor [μs]

\*1H indicates the time of 1 line. See the frame rate section.

- ※ The trigger period must be longer than the FVAL period (frame data read time).
- ※ The trigger period should be longer than the exposure time.
- ※ Please note that there will be a delay in trigger input to the camera and the actual exposure time.

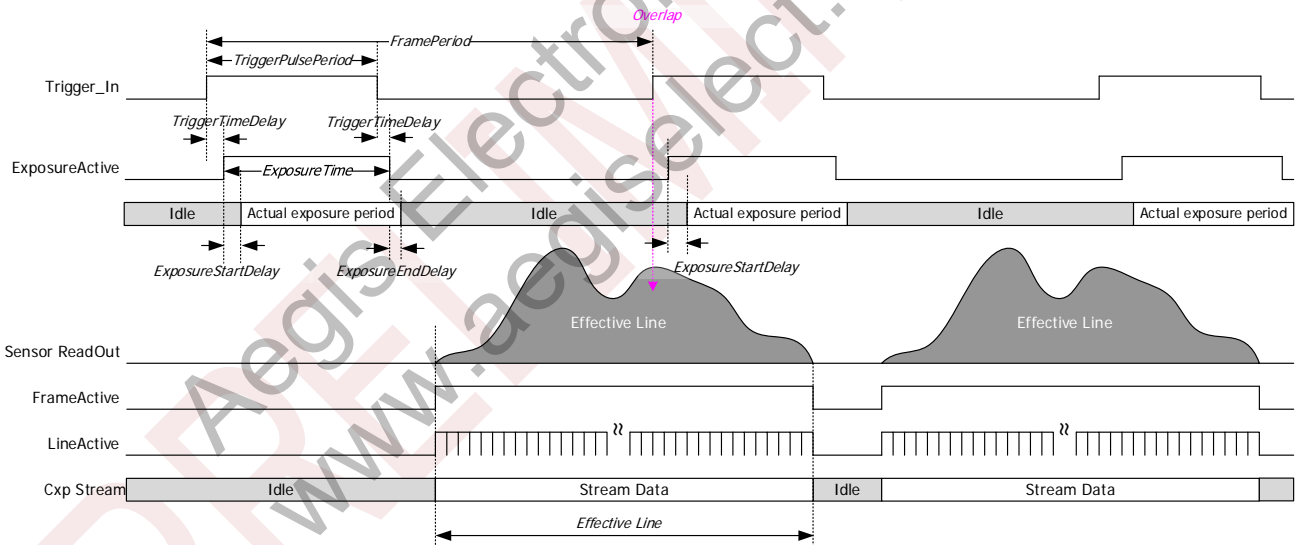
### 4.9.4 External synchronization mode (pulse width trigger shutter mode)

(TriggerMode = On, TriggerActivation = LevelHigh or LevelLow)

- This mode starts the exposure with an external trigger input and controls the exposure time with the trigger pulse width.
- The trigger is synchronized to the CLK in the camera to initiate the exposure with low latency.
- The shortest trigger width is shown in the table below.

DeviceSensorSpeed	CXP Rate	PixelFormat	Minimum trigger width [μs]
Lvds800Mbps	CXP12	Mono8	5.89
		Mono10	5.89
		Mono12	9.61
	CXP6	Mono8	11.77
		Mono10	11.77
		Mono12	19.21
Lvds1200Mbps	CXP12	Mono8	4.41
		Mono10	5.61
		Mono12	6.41
	CXP6	Mono8	8.81
		Mono10	11.21
		Mono12	12.81

- It is also possible to perform long exposures by extending the pulse width of the trigger. However, during long exposures, dark noise and shading noise may be noticeable.
- The timing chart and timing parameters in this operating mode are shown below.



Vertical Synchronization Timing Chart (Pulse Width Trigger Shutter Mode)

Timing Parameter	Value	Description
Trigger Time Delay	0.08~0.14	Delay time from trigger input rise to ExposureActive rise [μs]
ExposureStartDelay	2	Delay time from ExposureActive rise to completion of exposure inside the sensor [H]
ExposureEndDelay	2.80	Delay time from exposureActive descent to completion of exposure inside the sensor [μs]

\*1H indicates the time of 1 line. See the frame rate section.

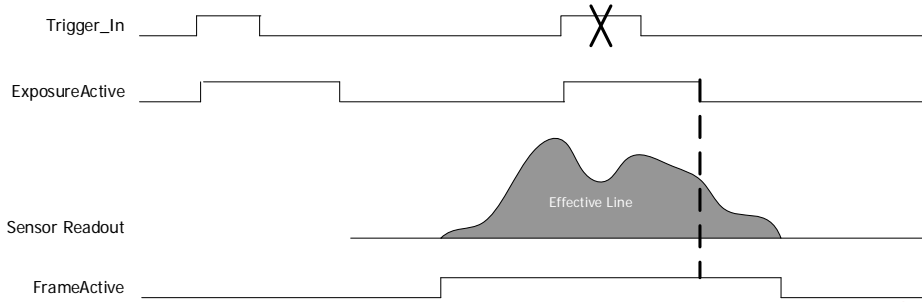
※ The trigger period must be longer than the FVAL period (frame data read time).

#### 4.9.5 Trigger Pulse Input Prohibition Timing

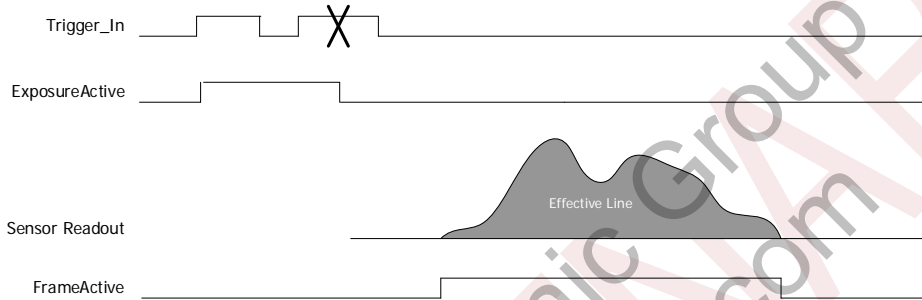
The input timing of external triggers has the following restrictions:

Please note that failure to meet these constraints will result in an error.

- ❑ You cannot enter a trigger when the exposure period of the next trigger is complete during image readout.



- ❑ You cannot enter the following triggers during the exposure period:



If an external trigger is entered during the ban period, the LED on the back of the camera will be in an error glowing state, and the status can be checked with the following command.

Acquisition Control	
IllegalTriggerFlag	0 or 1

- IllegalTriggerFlag: If there is a trigger input at the prohibition timing, it will be "1". It will be.

Device Control	
ErrorFlagReset	(Execute)

- ErrorFlagReset: Reset IllegalTriggerFlag to "0".

#### 4.10. Gain

AnalogControl	
Gain	1.00~32.00

Gain : You can set it arbitrarily from 1.00x to 32.00x in 0.01 steps.

It can be set up to 32.00x, but deterioration in image quality at high gain is inevitable.

Please use it after evaluation.

#### 4.11. Gamma correction

AnalogControl	
Gamma	0.10~1.80

Gamma: You can set the gamma correction value from 0.10~1.80 in 0.01 steps.

※ Please do not change the gamma while grabbing (while acquiring images).

#### 4.12. Exposure Time

Acquisition Control	
ExposureTime (μs)	ExposureTime.Min~100,000

ExposureTime :Exposure Time

The exposure time can be set in units of 1μs.

The exposure time calculation formula is as follows

{ExposureTime} + 2.8μs - ( 2 × Tline )

※ Tline indicates 1 line time. See the frame rate section.

ExposureTime.Min : Lower Exposure Time Limit

DeviceSensorSpeed	CXP Rate	PixelFormat	ExposureTime.Min [μs]
Lvds800Mbps	CXP12	Mono8	6
		Mono10	6
		Mono12	10
	CXP6	Mono8	12
		Mono10	12
		Mono12	20
Lvds1200Mbps	CXP12	Mono8	5
		Mono10	6
		Mono12	7
	CXP6	Mono8	9
		Mono10	12
		Mono12	13

ExposureTime.Max : Upper exposure time

- In internal sync mode:

It varies depending on the settings of DeviceSensorSpeed, CxpLinkConfiguration, PixelFormat, Height, AcquisitionFrameRate.

The maximum exposure time values for full frame and maximum frame rate are as follows:

DeviceSensorSpeed	CXP Rate	PixelFormat	ExposureTime.Max [μs]
Lvds800Mbps	CXP12	Mono8	6059
		Mono10	6059
		Mono12	9892
	CXP6	Mono8	12118
		Mono10	12118
		Mono12	19785
Lvds1200Mbps	CXP12	Mono8	4554
		Mono10	5796
		Mono12	6630
	CXP6	Mono8	9108
		Mono10	11592
		Mono12	13260

- In external synchronization mode: 100,000 μs

#### 4.13. Partial Scan (SingleROI)

- This is a mode that displays the area by cutting out the area vertically and horizontally.

By cutting out and reducing the area vertically, you can speed up the frame rate.

The frame rate does not change when the area is cut horizontally.

ImageFormatControl	
RegionSelector	Region0
RegionMode	Off/On
RegionDestination	Stream0
Width	64~2448
Height	64~2048
OffsetX	0~(2448-Width)
Offsets	0~(2048-Height)

※ Please do not change the value while acquiring images.

SingleROI

- RegionSelector: Region0 is fixed.
- RegionMode: Toggles whether to enable or disable the Region set in the RegionSelector.  
If RegionMode=On, Width/Height/OffsetX/OffsetY cannot be set.  
If you want to set it, set it to RegionMode=Off.  
\* It cannot be set to On unless it is BinningHorizontal=BinningVertical=1.
- RegionDestination: Stream0 is fixed.
- Width: Set the width of the Region. Set it to multiples of 8.
- Height: Set the height of the Region. Set it to multiples of 2.
- OffsetX: Set the offset in the X direction of the Region. Set it to multiples of 8.
- Offsets: Set the offset in the Y direction of the Region. Set it to multiples of 2.
- ※ OffsetX and OffsetY must be configured to meet the following conditions:  
 $64 \leq \text{OffsetX} + \text{Width} \leq 2448$   
 $64 \leq \text{OffsetY} + \text{Height} \leq 2048$
- ※ For MultiROI (SensorROIEnable=True), Width/Height/OffsetX/OffsetY is not settable and displays values indicating the area where MultiROI is integrated. Be sure to enable one or more ROIs. You cannot save with all ROI disabled.
- ※ Cannot be used in combination with Binning.
- ※ It can be used in combination with Shading correction and Defect correction.

#### 4.14. Partial Scan (MultiROI)

- This mode allows you to speed up the frame rate by cutting out and reducing multiple vertical areas.
- It cannot be used with Binning, Shading, Defect correction, or Noise Filters.

ImageFormatControl	
SensorROIEnable	False/True
SensorROISelector	ROI0~ROI7 [Not subject to saving settings]
SensorROIMode[SensorROISelector]	Off/On
SensorROIWidth[SensorROISelector]	64~2448
SensorROIHeight[SensorROISelector]	64~2048 ※
SensorROIOffsetX[SensorROISelector]	0~(2448-SensorROIWidth)
SensorROIOffsetY[SensorROISelector]	0~(2048-Height) ※

- ※ For SensorROIHeight and SensorROIOffsetY, make sure that the area of all valid SensorROIs does not exceed the area of 2448x2048. Also, make sure that the SensorROI regions set in each SensorROIHeight and SensorROIOffsetY do not overlap.
- ※ Please do not change the value while acquiring images.

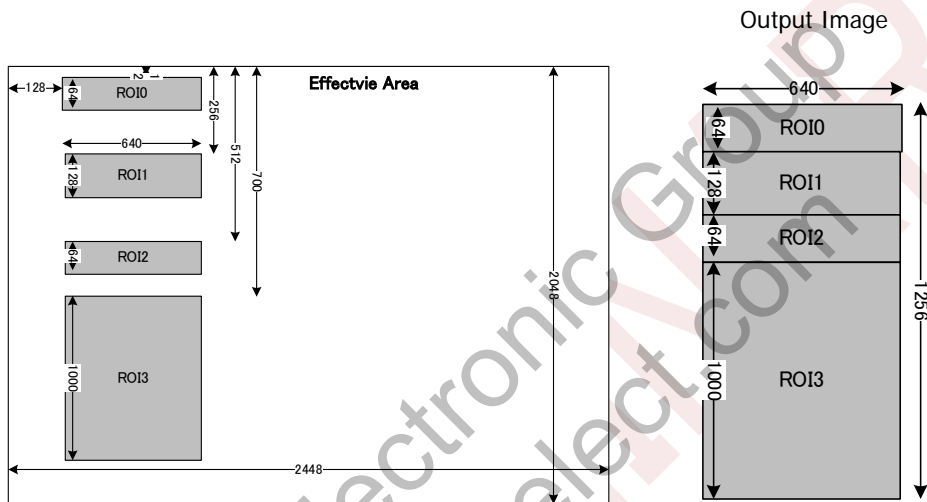
#### □ MultiROI

- SensorROIEnable: Setting it to True enables the MultiROI configuration.
  - ※ It cannot be enabled unless ShadingCorrectionDataSelector=Off, DefectPixelCorrection=Off, BinningHorizontal=BinningVertical=1 .
- SensorROISelector: You can change the settings of the configured ROI, including SensorROIMode, SensorROIWidth, SensorROIHeight, SensorROIOffsetX and SensorROIOffsetY.
- SensorROIMode: Toggles whether to enable or disable the ROI set in SensorROISelector.
  - If SensorROIEnable=False, the setting cannot be set.
  - If SensorROIMode=On, SensorROIWidth /SensorROIHeight /SensorROIOffsetX /SensorROIOffsetY cannot be set.
  - If you want to change the settings, set it to SensorROIMode=Off.
- SensorROIWidth: Set the width of each Region of MultiROI.
  - The same settings for each ROI. Set it to multiples of 8.
- SensorROIHeight: Set the height of the ROI set in SensorROISelector.
  - You can set an individual height for each ROI. Set it to multiples of 2.
- SensorROIOffsetX: MultiROISet the offset in the X direction for each Region.
  - The same settings for each ROI. Set it to multiples of 8.
- SensorROIOffsetY: The ROI set in SensorROISelectorSet the offset in the Y direction.
  - You can set individual heights for each ROI. Please set it to a multiple of 2.

#### 4.14.1 Example Configuration

Settings	Set value	Remarks
SensorROIEnable	True	
SensorROIMode[ROI0]	On	
SensorROIWidth[ROI0]	640	*This will be a common Width for all ROIs.
SensorROIHeight[ROI0]	64	
SensorROIOffsetX[ROI0]	128	*This will be a common OffsetX for all ROIs.
SensorROIOffsetY[ROI0]	12	
SensorROIMode[ROI1]	On	
SensorROIWidth[ROI1]	640	*This will be a common Width for all ROIs.
SensorROIHeight[ROI1]	128	
SensorROIOffsetX[ROI1]	128	*This will be a common OffsetX for all ROIs.
SensorROIOffsetY[ROI1]	256	
SensorROIMode[ROI2]	On	
SensorROIWidth[ROI2]	640	*This will be a common Width for all ROIs.
SensorROIHeight[ROI2]	64	
SensorROIOffsetX[ROI2]	128	*This will be a common OffsetX for all ROIs.

SensorROIOffsetY[ROI2]	512	
SensorROIWidth[ROI3]	640	*This will be a common Width for all ROIs.
SensorROIHeight[ROI3]	1000	
SensorROIOffsetX[ROI3]	128	*This will be a common OffsetX for all ROIs.
SensorROIOffsetY[ROI3]	700	
SensorROIOffsetY[ROI4]		
SensorROIOffsetY[ROI5]		
SensorROIOffsetY[ROI6]		
SensorROIOffsetY[ROI7]		



**4.15. Binning**

- You can set the binning mode (simple addition mode).

ImageFormatControl	
BinningHorizontal	1~2
BinningHorizontalMode	Sum/Average
BinningVertical	1~2
BinningVerticalMode	Sum/Average

- BinningHorizontal: Set horizontal binning to be enabled or disabled.
  - 1: Binning disabled
  - 2: Binning Enabled
- BinningHorizontalMode: Horizontal binning mode.
  - Sum: Addition Mode(Output 4 pixels in height and width as 1 pixel).  
The sensitivity is about 4 times higher.
  - Average: Average Mode(Output 4 pixels in height and width as 1 pixel).  
The sensitivity will be the same as usual.
- BinningVertical: Set the vertical binning to be enabled or disabled.
  - 1: Binning disabled
  - 2: Binning Enabled

- BinningVerticalMode: Vertical binning mode.
  - Sum: Addition Mode(Output 4 pixels in height and width as 1 pixel).  
The sensitivity is about 4 times higher.
  - Average: Average Mode(Output 4 pixels in height and width as 1 pixel).  
The sensitivity will be the same as usual.

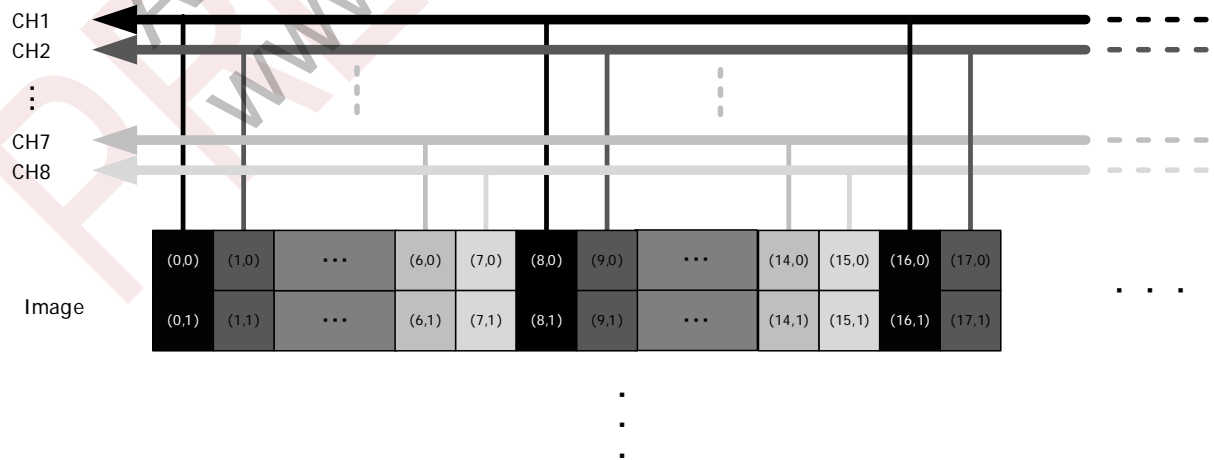
[Note]

- Please do not change the value of BinningHorizontal, BinningHorizontalMode I and BinningVertical, BinningVerticalMode while acquiring images.
- The BinningHorizontal and BinningVertical settings are interlocked.  
If you change one of them, the other will also change to the same setting.
- The BinningHorizontalMode and BinningVerticalMode settings are interlocked.  
If you change one of them, the other will also change to the same setting.
- It cannot be used in conjunction with the ROI feature. Valid only at full scale.
- The frame rate is the same as at full scale.

**4.16. Defect Pixel Correction**

- This function compensates for "defective pixels" contained in the data output from the sensor.
- Data is managed in two main types.
  - Factory data  
It retains white and black defects detected in the factory.  
This data cannot be deleted.
  - User registration data  
If the defect increases after shipment, it is possible to make additional corrections.  
By using 'Delete All User-Registered Defective Pixels (DefectPixelDefault),' you can delete the user-registered defective pixel data.
- The maximum number of user registrations is 512 points. (However, up to 64 points per channel.)

[ CH (Channel) ] The image is processed inside the camera with an 8CH interleave.



- On/Off Control of Defect Correction

AnalogControl	
DefectPixelCorrection	On/Off

- DefectPixelCorrection: Select Enable or Disable Defect Pixel Correction.
  - ※ Please note that factory data and user registration data are not differentiated and both are turned on/off.
  - ※ When enabling MultiROI, please set DefectPixelCorrection to Off.
  - ※ If you have the noise filter enabled, please disable it and then set it to Off.

User registration (coordinate designation)

This function allows you to register and delete any pixel as defective pixels by specifying X and Y coordinates.



As shown in the figure on the left, refer to the pixel values of the top, bottom, left, and right to calculate the X pixel value.

Even if you register a new X while the defective pixels of X1, X2, X3, and X4 are already registered, X is not compensated.

AnalogControl	
DefectPixelAdd	(Execute)
DefectPixelAddOffsetY	0~2447 [Not subject to saving settings]
DefectPixelAddOffsetX	0~2047 [Not subject to saving settings]
DefectPixelDelete	(Execute)
DefectDetectionStatus	(ReadOnly)

- DefectPixelAddOffsetY: Specify the Y coordinate to be registered(Coordinates before binning when binning)
- DefectPixelAddOffsetX: Specify the X coordinate to be registered(Coordinates before binning when binning)
- DefectPixelAdd: The specified coordinates are registered as trapped pixel correction points.
- DefectPixelDelete: Deletes data that has been registered as a defective pixel correction point with the specified coordinates.

- ※ The DefectPixelDelete command allows you to delete only user-registered (coordinated) data. Factory data cannot be deleted (if you specify the same coordinates as the factory defect data, it will be ignored).
- ※ When registered with the DefectPixelAdd command, it is not stored in non-volatile memory. If you want to save it to non-volatile memory, run the UserSetSave command.
- ※ Registration and deletion are limited for MultiROI (feasible for full-size and SingleROI).

- DefectDetectionStatus – Indicates the result of the user-registered defect detection action.

0	State with no user registration defect correction data
Number (512 or less)	Number of user registration defects
Error	
0x000e0001 (917505)	The total number of user registration defect correction data exceeds the maximum number of registrations (512 points).
0x000e0002 (917506)	The maximum number of users can register for a single CH (64) has been exceeded.

Delete all user registration information

You can delete the information registered by the user by specifying coordinates or defect detection in bulk with the following command.

AnalogControl	
DefectPixelDefault	(Execute)

- DefectPixelDefault : Delete all data of user registration(Coordinate Designation and Defect Correction)。

Defect Registration Data Display

You can view the information of the registered factory data and user registration data.

AnalogControl		
RegisteredDefectSelector	UserState/InitialState	[Not subject to saving settings]
RegisteredDefectNumber	(ReadOnly)	
DefectPixelNumber	1~512	[Not subject to saving settings]
DefectPixelOffsetY	(ReadOnly)	
DefectPixelOffsetX	(ReadOnly)	
DefectPixelType	(ReadOnly)	

- RegisteredDefectSelector: Select the type of data to display:
  - UserState: User registration data
  - InitialState: Factory Data
- RegisteredDefectNumber: Displays the number of defects being corrected.
- DefectPixelNumber: Specifies the number of the defect table that is registered in the selected data.
- DefectPixelOffsetY: Displays the Y coordinate of the defect specified by DefectPixelNumber. If the table number has no defect data, 65535 is displayed. When binning, the coordinates before binning are displayed. When in ROI mode, the coordinates of the ROI are displayed.
- DefectPixelOffsetX: Displays the X coordinates of the defect specified by the DefectPixelNumber. If the table number has no defect data, 65535 is displayed. When binning, the coordinates before binning are displayed. When in ROI mode, the coordinates of the ROI are displayed.
- DefectPixelType: Indicates the defect type specified by DefectPixelNumber.
  - 1: Factory white defects
  - 2: Factory black defects
  - 7: User Addition Registration Defect
  - 65535: Tables without defective data

AnalogControl		
ChannelNumber	1~8	[Not subject to saving settings]
DefectPixelChannelCount	(ReadOnly)	

- ChannelNumber : Specifies the channel number for defect handling.
- DefectPixelChannelCount : Displays the number of defects for the channel number specified in ChannelNumber. The number of types selected in the RegisteredDefectSelector.

#### 4.17. Noise Filter

- This is a function that compensates for pixel defects in real time.

Since this feature is used in conjunction with Pixel Defect Correction, the noise filter cannot be set to True when DefectPixelCorrection is off.

PixelCorrectionControl	
ImpulseNoiseFilter	True/False
ImpulseNoiseFilterThreshold	0~4095

- ◆ ImpulseNoiseFilter
  - ◆ If set to False, the noise filter function will not work.
  - ◆ If true, the compensation is applied for the point where the difference between the surrounding and featured pixels is greater than the value of ImpulseNoiseFilterThreshold.

- ※ Adverse effects of overcorrection may occur. Be sure to check the image before using it.
- ※ If the threshold is set to 4095, it will no longer detect defects.
- ※ Please check the image and adjust the threshold according to your usage.

[Note]

- MultiROI is not supported.

#### 4.18. Shading Correction

- This function compensates for the drop in ambient light caused by lenses and other factors.

AnalogControl	
ShadingCorrectionDataSelector	Off/Table1/Table2/Table3/Table4
DetectShading	(Execute)

- ShadingCorrectionDataSelector :

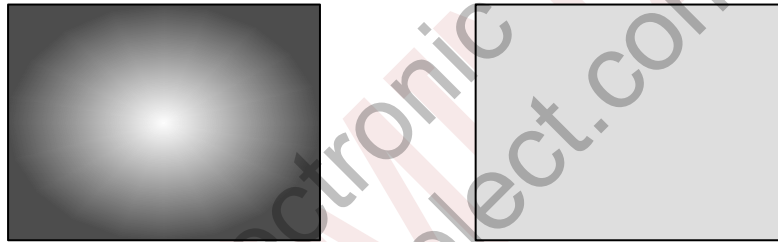
Shading Correction Off or select the Shading Correction Table to use.

If you select Table1- Table4, the correction function will be turned on for each correction value.

\*MultiROI and Shading Correction cannot be used together.

It can be used in conjunction with SingleROI.

Before Shading Correction After Shading Correction



- DetectShading :

You can retrieve correction data to the specified Table by performing DetectShading while selecting Table1- Table4.

When a uniform level of subject, such as a pattern box, is imaged on the entire screen and shading detection is performed, shading correction data is automatically calculated. The calculated correction data is stored in the table selected in the ShadingCorrectionDataSelector.

[Note]

- Obtain correction data only while the camera is in operation.  
(Shading correction data cannot be obtained when the camera is not output.)
- When performing shading detection, turn off partial scanning and perform it at full scale.
- When UserSetSave is executed, the correction data of Table1~Table4 is stored in non-volatile memory.
- The compensation data is retained even when Default is run on UserSetLoad.
- When performing a vertical reversal, obtain the shading correction data again.

#### 4.19. Black Level Adjustment

AnalogControl	
BlackOffset	-2048~2047 [-50%~+50%]

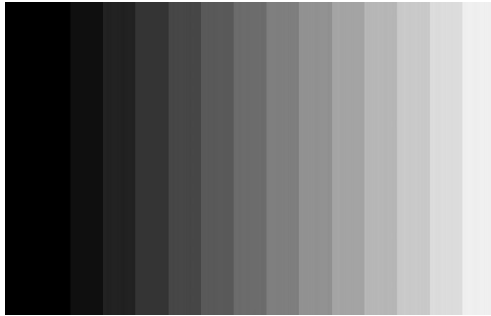
- BlackOffset: It is a function that adjusts the black level of the sensor.  
This feature does not specify the absolute value of the black level but rather adjusts relative to it.  
Set the 12-bit converted number.

\*Please do not change the values while the image is being acquired.

#### 4.20. Test Pattern Display

- The camera outputs a test pattern that can be used to check the operation of the system.

ImageFormatControl	
TestPattern	Off GreyScale



\*Cannot be used in conjunction with the cursor display.

#### 4.21. Cursor display

- Display the cursor on the output image.

ImageFormatControl	
CursorPattern	On/Off
CursorOffsetX	0~2447
CursorOffsetY	0~2047
CursorColor	White/Black

- CursorPattern : Specifies whether the cursor is displayed.
- CursorOffsetX : Specifies the X coordinate of the vertical cursor.
- CursorOffsetY : Specifies the Y coordinate of the horizontal cursor.
- CursorColor : Specifies the color of the cursor. (White/Black)

\*It cannot be used in conjunction with the test pattern display.

[Note]

- When displaying partial (ROI), the cursor coordinates are the origin of (0,0) in the upper left corner of the active area.
- When the displayed image is zoomed out, the cursor may not be displayed.

#### 4.22. LED Operating Modes

- Change the LED behavior on the rear of the camera. Refer to the LED indicator for the lighting pattern.

DeviceControl	
DeviceIndicatorMode	Active ErrorStatus Inactive

- DeviceIndicatorMode: Choose from three types of LED behavior.

- Active: CoaXPressDisplay communication status.  
 ErrorStatus: Normally turned off and turned on only when an error occurred.  
 Inactive: The lights are always turned off.

#### 4.23. Temperature display

- Displays the value of the temperature register of the camera's sensor.

DeviceControl		
DeviceTemperatureSelector	Sensor FPGA	[Not subject to saving settings]
DeviceTemperature	(ReadOnly)	

- DeviceTemperatureSelector: Select the temperature measurement location in the camera.
- DeviceTemperature: Displays the temperature of the selected area in ° C.

[Note]

- The readout values are not calibrated.

#### 4.24. Camera Timing IO

- The LineSelector and LineSource settings set the input and output of the 6-pin circular connector.

Digital IO Control		
LineSelector	Line0 Line1	[Not subject to saving settings]
LineMode[LineSelector]	Input Output	
LineSource[LineSelector]	Off FrameTrigger ExposureActive FrameActive LineActive TriggerPacketActive	

- LineSelector: Select the line for Settings/Display.  
 Line0: No.3 Pin of 6 Pin Circular Connector  
 Line1: No.5 Pin of 6 Pin Circular Connector
- LineMode: Displays the input/output direction of the selected Line.  
 \* If LineMode=Input is set to TriggerSource, it cannot be changed to Output.
- LineSource: Select the signal for the selected Line from the following:  
 Off : 0 fixed.  
 FrameTrigger (Input) : Receive a start trigger.  
 ExposureActive (Output) : Hi-active outputs the exposure period of the image sensor.  
 FrameActive (Output) : Outputs the lifetime of the frame with Hi-Active.  
 LineActive (Output) : Outputs the lifetime of the line with Hi-Active.  
 TriggerPacketActive(Output) : Decodes and outputs the uplink trigger packet signal.  
 \* If the LineSource does not match the LineMode (in parentheses above), it will be changed to Off.

#### 4.25. SourceTag Reset

DigitalIOControl	
SourceTagReset	(Execute)

- Reset the SourceTag in the image header to 0.

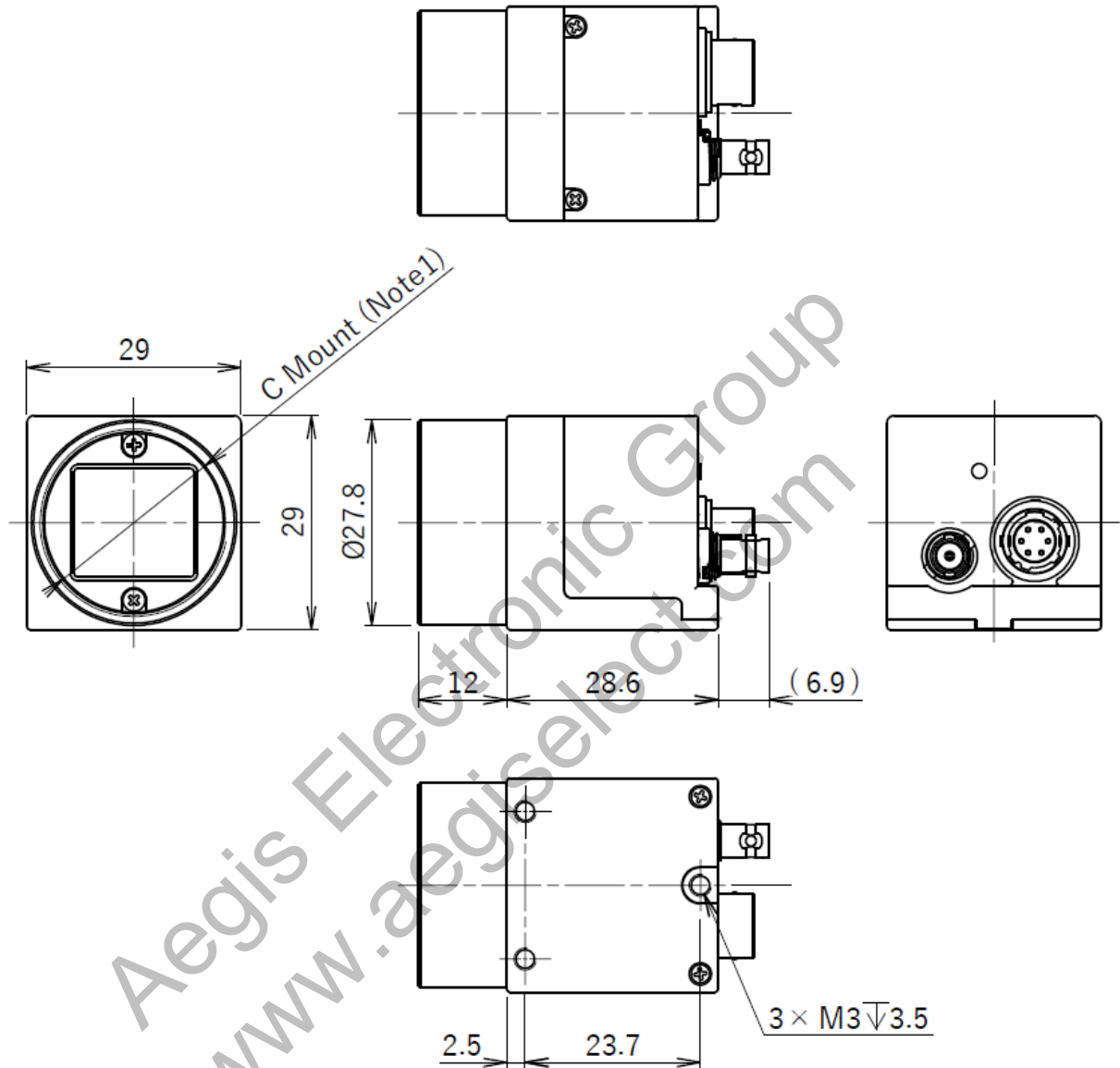
## 5. Shipping Settings

Feature	Initial Data	Explanation
<b>DeviceControl</b>		
DeviceUserID	""	No user string (16 characters) setting
DeviceUserString	""	No user string (256 characters) setting
DeviceIndicatorMode	Active	LED operating mode CoaXPress communication status display
DeviceSensorSpeed	Lvds800Mbps	
<b>ImageFormatControl</b>		
PixelFormat	Mono8	monochrome 8bit
RegionSelector	Region0	Partial Region (ROI) Region0 Enabled State
RegionMode	On	Partial Area (ROI) Behavior On
Width	2448	Partial Area (ROI) Horizontal 2448pixel (Full Size)
Height	2048	Partial Area (ROI) Vertical 2048 lines (full size)
OffsetX	0	Partial Area (ROI) Horizontal Start Position 0
Offsets	0	Partial Region (ROI) Vertical Start Position 0
SensorROIEnable	False	MultiROI 動作Off
SensorROISelector	ROI0	
SensorROIMode	Off	
SensorROIWidth	2448	
SensorROIHeight	2048	
SensorROIOffsetX	0	
SensorROIOffsetY	0	
BinningHorizontal	1	Binning mode disabled
BinningHorizontalMode	Average	Binning Average Mode Settings
BinningVertical	1	Binning mode disabled
BinningVerticalMode	Average	Binning Average Mode Settings
ReverseX	False	Left and right flip OFF
ReverseY	False	Flip up and down OFF
CursorPattern	Off	Cursor display off
CursorX	0	X coordinate of vertical cursor = 0
CursorY	0	Y coordinate of horizontal cursor = 0
CursorColor	White	Cursor Color = White
TestPattern	Off	Test Pattern Display Off
<b>AcquisitionControl</b>		
TriggerSelector	AcquisitionStart	Internal Sync Mode (Freerun)
TriggerMode	Off	Internal Sync Mode (Freerun)
TriggerSource	LinkTrigger0	CXP UpLink Triggers
TriggerActivation	RisingEdge	
ExposureTime	12118	Exposure time 12118 $\mu$ s
AcquisitionFrameRate	82.2	Frame rate @ CXP6 Mono8 LVDS800MHz
<b>AnalogControl</b>		
Gain	1.000	Gain 1.00x
Gamma	1.0	Gamma correction value 1.00
BlackOffset	0	Black Level Default
ShadingCorrectionDataSelector	Off	Shading Correction Off
ImpulseNoiseFilter	False	Noise Filter OFF

ImpulseNoiseFilterThreshold	4095	Noise Filter Threshold
<b>PixelCorrectionControl</b>		
DefectivePixelCorrection	On	Defect pixel correction On
DefectivePixelAddOffsetX	0	Specify the X coordinate of the correction pixel = 0
DefectivePixelAddOffsetY	0	Specify the Y coordinate of the correction pixel = 0
DefectivePixelThresholdValue	4095	Threshold for defect pixel detection
<b>TransferControl</b>		
CxpLinkConfiguration	CXP6_X1	CXP-6 (6.25Gbps), 1 link
<b>DigitalIOControl</b>		
LineMode[Line0]	Input	No. 3 Pin Trigger Input of 6-Pin Circular Connector
LineMode[Line1]	Output	No. 5 Pin Trigger Output of 6-Pin Circular Connector
LineSource[Line0]	Off	No.3 Pin Trigger Input of 6 Pin Circular Connector Off
LineSource[Line1]	Off	No.5 Pin Trigger Output of 6 Pin Circular Connector Off

## 6. Mechanism Diagram

### 6.1. External Dimensions



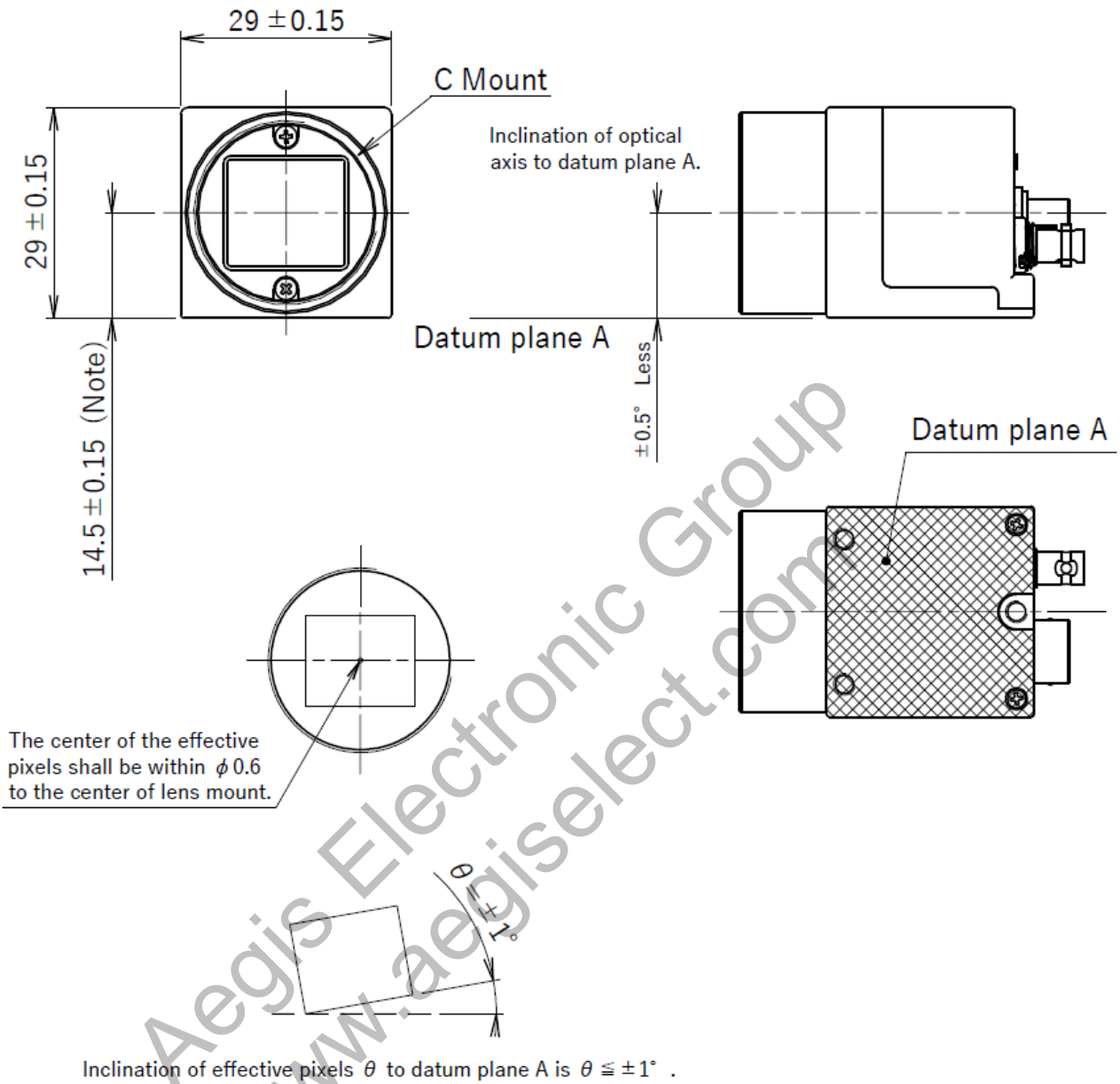
(Unit : mm)

Note 2) Screw length from the lens mount surface shall be less than 6mm.

And protruding portion of the C mount lens shall be less than X(TBD)mm.

Note 1) C mount screws comply with ANSI/ASME B1.1,1-32UN(2B).

6.2. Sensor Position Accuracy Diagram



Note: Dimensions from datum plane A to the center of the lens mount.

(Drawing Number : TBD)  
(Unit : mm)

## **7. Warranty Provisions and Others**

### **7.1. Product Warranty**

The warranty period of this product is 3 years from the date of shipment from our company.

During this period, if a malfunction occurs due to our design or manufacturing, we will repair it free of charge in accordance with the product service in clause 7.3.

However, damage or breakdown caused by the customer's negligence in handling, or natural disasters such as fire, earthquake, lightning strike, storm and flood damage, or force majeure is not covered by the warranty.

Repairs after the warranty period has expired will be repaired for a fee if repaired is possible.

### **7.2. CMOS pixel defects.**

At the time of shipment, noticeable pixel defects are corrected and shipped, but after the product is shipped, new pixel defects may occur due to the unique characteristics of the imaging sensor, and some defect levels may increase over time. These are excluded from the product warranty.

For details of pixel defect correction, please contact our sales department.

### **7.3. Products & Services**

If the product does not work properly due to any factor after purchasing the product, please contact the dealer where you purchased it for investigation, analysis, and repair.