CIS

CoaXPress I/F
5.3M CMOS Color (RAW) Camera

VCC-5CXP3R

Product Specifications
& Operational Manual

CIS Corporation

Table of Contents

1   Handling Precautions

The camera module 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.
All specifications contained herein are subject to change without prior notice.   Reproduction in whole or in part is prohibited.

Please observe all warnings and cautions stated below.
Our warranty does not apply to damages or malfunctions caused by neglecting these precautions.

- Do not use or store the camera module in the dusty or humid places.
- Do not apply excessive force, vibration, or static electricity that could damage the camera.   Handle the camera with caution.
- Do not shoot direct images that are extremely bright (e.g., light source, sun, etc).   When extremely strong light source is shot, smear or blooming may occur.   When the camera is not in use, please put the protection cap on.
- Follow the instructions in Chapter 5, "External Connector Pin Assignment" for connecting the camera module. Improper connection may cause damages not only to the camera module but also to the connected devices.
- Confirm the mutual ground potential carefully and then connect the camera module to monitors or computers.   AC leaks from the connected devices may cause damages or destroy the camera module.
- Do not apply excessive voltage. (Use only the specified voltage.)   Unstable or improper power supply voltage may cause damages or malfunction of the camera assembly.
- Do not disassemble the camera.   The camera once disassembled shall be out of warranty.

2   Product Outline

VCC-5CXP3R is a CoaXPress interfaced small Color camera utilizing a 1 type, 5.3M pixels CMOS image sensor.

Features
- ☐   29mm x 29mm x 55mm in size
- ☐   Global shutter CMOS (Color)
- ☐   CoaXPress CXP-1/2/3/5/6 x1 each
- ☐   The maximum cable length: Approx. 100m (at CXP-1)
- ☐   ROI
- ☐   Sub-sampling
- ☐   Exposure, Gain settings
- ☐   External trigger mode (Fixed trigger shutter mode / Pulse width trigger shutter mode)
- ☐   Sequence control
- ☐   Shading Correction
- ☐   GenICam complied

3   Bundled Items
    3.1   Standard Bundled Items
- ☐   Camera module, VCC-5CXP3R
- ☐   Lens cap

    3.2   Packaging
- ☐   Individual carton
- ☐   Master carton (10 pcs/carton)

Note) Q'ty per master carton may vary depends on the shipping q'ty.

4   Specifications

4.1 General Specifications

(1)	Image Sensor	Device Type	1 type Global shutter CMOS	
		Effective Pixel Numbers	2592(H) × 2048(V)	
		Unit Cell Size	4.8µm(H) × 4.8µm(V)	
(2)	Video Output Frequency	Pixel Clock	72MHz	
(3)	CoaXPress	Ver, 1.0complied. CXP1/2/3/5/6 x1 each		
(4)	Video Output Format	BayerRG8 / BayerRG10		
(5)	Resolution	2048 TV lines		
(6)	Output	Sensor AD	10bit	
(7)	Sensitivity	F2.8 2000 lx (Shutter 1/300(s), Gain 0dB)		
(8)	Minimum Illumination	F1.4 65lx (Shutter 1/300(s), Gain 18dB)		
(9)	Pixel Defect Correction	Corrected at Ex-factory		
(10)	Gain Variable Range	x1～x32 (0dB～30dB)		
(11)	Shutter	Global Shutter		
(12)	Shutter Speed Variable Range	Preset : 1/10000, 1/5000, 1/2500, 1/1200, 1/600, 1/300, 1/150, 1/100		
		Manual : 100[us]～Approx. 1/Framerate[us]		
(13)	Gamma Correction	1 fixed		
(14)	Trigger Mode	Free run mode (Camera internal trigger) Trigger mode ・Preset shutter trigger ・Pulse width shutter trigger		
(15)	Partial Scan (ROI)	8 Preset patterns ※Including Full-resolution (ROI OFF)		
(16)	Power Requirements	PoCXP		
(17)	Power Consumption	3.6W (CXP-6) [at full pixel and free run]		
(18)	Dimensions	H:29mm W:29mm D:55mm ※without protruding portion		
(19)	Weight	Approx. 75 g		
(20)	Lens Mount	C Mount		
(21)	Safety/Quality standards	UL: Conform to UL Standard including materials and others.		
(22)	Durability	CE:		
		EMC:	2014/30/EU	
		CE:	EN61000-6-4:2007+A1:2011 for Emission	
		FCC:	EN61000-6-2:2005 for Immunity	
		RoHS:	2011/65/EU EN50581 (RoHS2)	
		Vibration	No malfunction shall be occurred with 90m/s^2(50G) for ±X,±Y, and ±Z, 6 directions. (Without packaging).	
(23)	Operation Environment	Performance guaranteed	0 ～ +40℃	Humidity 20 ~ 80%RH	with no condensation
		Operation guaranteed	-5 ～ +45℃	Humidity 20 ~ 80%RH	with no condensation
		※Performance guaranteed: All the specifications specified in this manual is guaranteed under performance guaranteed temperature.			
		※Operation guaranteed: All the camera functions operate normally under operation guaranteed temperature.			
(24)	Storage Environment	Storage Temperature: -25 ~ +60℃, Humidity: 20 ~ 80%RH with no condensation.			

4.2 Camera In/Output Signal Specifications

(1)Video Output Data	Max. Effective Video Output	2592(H) × 2048(V)	
(2)Image Signal Output	BNC Connector LINK 0	PoCXP	Power, Video, and Superimposed Control signals
(3)Video Output Format	Tap Geometry	1X-1Y	
(4)Video Signals Output Level	White Clip Level	FFh	At 8bit
	Setup Level	CXP-1 :01 -1/+2 CXP-2/3 :01 ±01h	At 8bit and 0dB
	※Setup level shall be fractured at gain up. It can be adjusted by BlackOffset.		
(4)External Trigger Signal Input	CoaXPress BNC Connector	Low speed uplink	20.83Mbps
	6 pins round connector Pin No.5	TTL input	DC5.0V (Max. 5.5V)
(5)General Signal Output	6 pins round connector Pin No.3	EXPOSURE, FVAL, LVAL, Uplink Trigger (After decode)	With register settings, 1 can be output. 5V output

4.3 Spectral Response

※The lens characteristic and the illuminant characteristics are excluded.
※Please refer to RED, GREEN, and BLUE in the graph below.

Quantum Efficiency
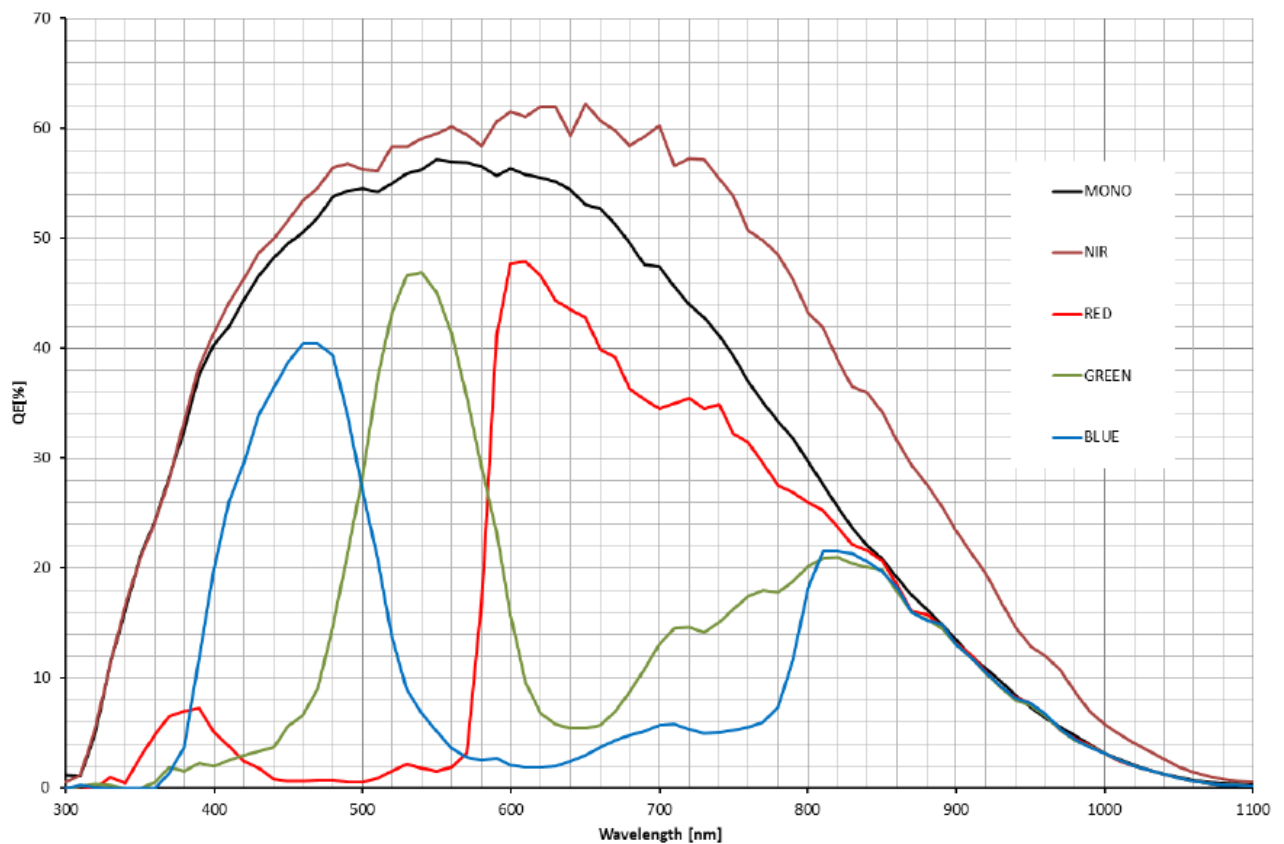
5   External Connector Pin Assignment

5.1   75ΩBNC Connector

PoCXP (Signal/Power+24V)

GND

(BCJ-BPLHA CANARE)
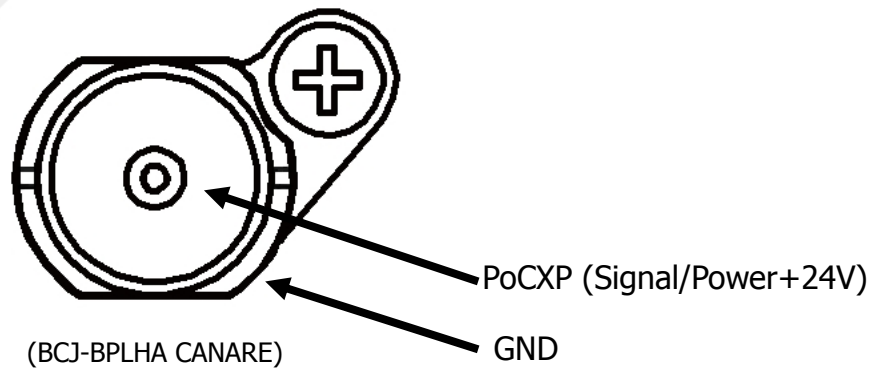
5.2   6 pins Circular Connector
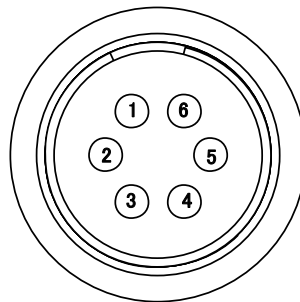
(SNH-8-6(RPCB) SamWoo Electronics)

Pin No.	Signals	Note
1	NC	
2	NC	
3	SIGNAL_OUT	The output of the selected signal
4	NC	
5	TRIGGER_IN	Trigger input
6	GND	Conducted with camera casing

※NC means Non-Connection.   Do not connect anything to the terminal.

3 pins SIGNAL_OUT Circuit

Timing signals inside the camera can be output. Output signal can be set by LineSource at Digital IO Control.
Please refer to the 8. Function Settings for the details.

・ 5.0V CMOS logic level output
・ Output voltage Low: 0.55Vdc (Max), High: 3.8Vdc (Min)

+5.0V

```
        1           5
                            +5.0V
        2
(CAMERA_INTERNAL)
        3           4
                            SIGNAL_OUT
        HD74LV1GT32ACME
```
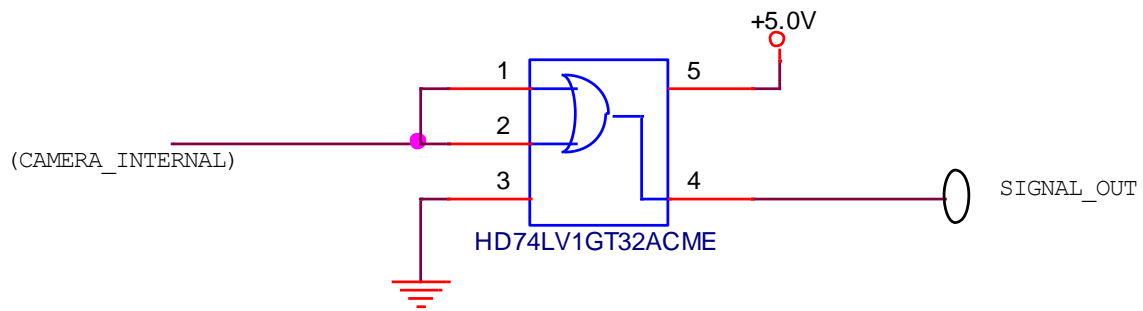
5 pins TRIGGER_IN Circuit

Trigger signals can be input directly into the camera. When to use this terminal, set TriggerSource of AcquisitionControl to LineIn. Please refer to 7. Camera Operation Mode for the details.

- · 5.0V, 3.3V CMOS level input (TTL compatible)
- · Input voltage Low: 0.5Vdc(Min), High: 2.1Vdc(Max)

```
+5.0V   HD74LV1GT14ACME
                                        100
        5           1
                    2
                            100
(CAMERA_INTERNAL)   4       3
                                        TRRIGER_IN

                                1K
```
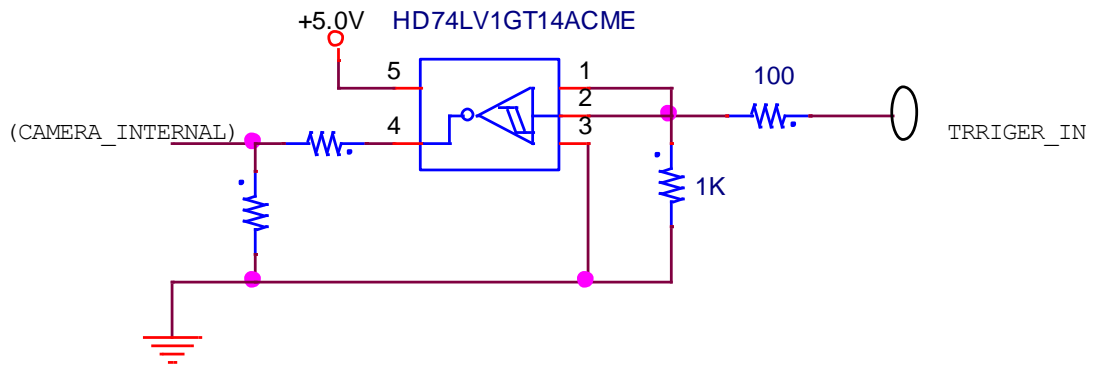
6   How to Save and Initialize the Setting

UserSets	
UserSetSave	(Execute)
UserSetDefault	(Execute)

If you wish to initialize the setting values, execute UserSetDefault. Execution is only valid at Link rate (CxpLinkConfiguration) CXP-1. However, as long as you do not execute UserSetSave, the setting values will not be saved. If you wish to save the setting values, execute UserSetSave. Setting values will be saved to the memory in the camera and will operate with the saved settings at next start-up.

7   Camera Operation Mode

  7.1   Link Configuration

Transfer Control	
CxpLinkConfiguration	CXP1_ X1 CXP2_ X1 CXP3_ X1 CXP5_ X1 CXP6_ X1

7.2 Pixel Format Settings

ImageFormatControl	
PixelFormat	BayerRG8 BayerRG10

  7.3   Camera Sync Mode

Acquisition Control	
TriggerSelectorAndActivation	AquisitionMode FrameStartRisingEdge FrameStartFallingEdge FrameStartLevelHigh FrameStartLevelLow FrameBurstStart
TriggerSource	LinkTrigger0 Line0
TriggerSoftware	(Execute)

TriggerSelectorAndActivation

AquisitionMode	: Internal Sync Mode (Free Run Mode)
FrameStartRisingEdge	: External Trigger Sync Mode (Fixed Trigger Shutter Mode: Rising Edge)
FrameStartFallingEdge	: External Trigger Sync Mode (Fixed Trigger Shutter Mode: Falling Edge)
FrameStartLevelHigh	: External Trigger Sync Mode (Pulse Width Trigger Shutter Mode: High Active)
FrameStartLevelLow	: External Trigger Sync Mode (Pulse Width Trigger Shutter Mode: Low Active)
FrameBurstStart	: Internal Sync Mode (Burst Mode of Sequence function)

・TriggerSource

  To set the method for trigger input at External Trigger Sync Mode.

  LinkTrigger0 : Utilize LOW SPEED uplink of CoaXPress, and input trigger from frame grabber via coaxical cable.
  LinkIn   : Input trigger from No.5 pin of circular connector at camera rear.

・TriggerSoftware

  This command generates trigger in the camera, and captures 1 frame. Please note that this trigger does not have the time accuracy like the trigger generated by TriggerSource.
  Only valid Acquisition Control mode is TriggerSelectorAndActivation --- FrameStartRisingEdge Mode

7.3.1   Internal Sync Mode (Free Run Mode)
This is a mode to use triggers continuously made in the camera. No external trigger shall be used.

・Please set TriggerSelectorAndActvation to AcquisitionMode.

Configuration	Frame rate （fps）	
	8bit	10bit
CXP-1	21.3	16.3
CXP-2	42.6	34.8
CXP-3	42.6	42.6
CXP-5	85.1	69.5
CXP-6	85.1	85.1

7.3.2   External Trigger Sync Mode
This is a mode to input external trigger signals to capture images by any preferred timings.
Some delay shall be considered from when camera recognized the trigger edge to when actual exposure starts.
Please refer to the delay time as below.

Input	Delay Time
LinkTrigger0	Approx. 3.4us
Line0	Approx. 150us

・Notes for trigger pulse input timing

A trigger pulse can be input during Readout. However, please do not input a trigger pulse while reading out signals for the prior frame since it ends its exposure. (In other words, please avoid inputting a trigger pulse while reading out signals for the prior frame and starts reading out signals for the next frame.)
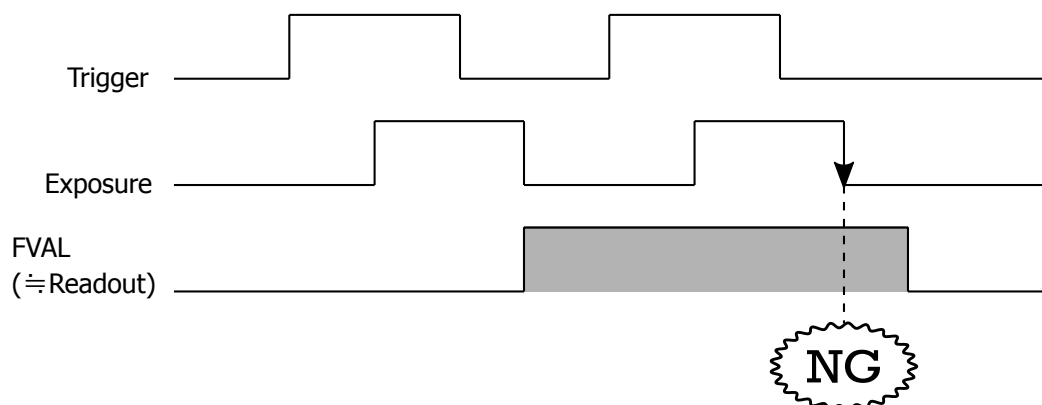
Video output from the camera might not be executed when the trigger is input again at the prohibited timing, or right after FVAL turns to "L" at the timing of the end of exposure. If the camera stops operating, or cannot output image data without malfunctions, please execute "SensorReset" command after quitting trigger input to start the operation again.

※If the camera does not start its operation, please execute the restoration of power.

Device Control	
SensorReset	(Execute)

Notes for the delay time for trigger pulse and exposure start
Due to the image sensor's features, there will be a difference between normal readout operation (exposure for next frame starts after readout has completed) and overlapping readout operation (exposure for next frame starts while readout.) There should be some gap of timing when trigger has input to image sensor, and the actual timing that exposure starts.

・At full pixel operation (ROI_OFF)

Link Rate	CXP1	CXP2	CXP3	CXP5	CXP6
Exposure delay at normal readout [μs] ※Please refer to Exposure delay time (A) in the timing chart below.	4	8	8	4	4
Exposure delay at overlapping [μs] ※Please refer to Exposure delay time (B) in the timing chart below.	26-49	19-31	19-31	9-15	9-15

・At operation with sub-sampling function

Link Rate	CXP1	CXP2	CXP3	CXP5	CXP6
Exposure delay at normal readout [μs] ※Please refer to Exposure delay time (A) in the timing chart below.	4	8	8	4	4
Exposure delay at normal readout [μs] ※Please refer to Exposure delay time (A) in the timing chart below.	18-34	14-22	14-22	7-11	7-11

※ Delay time will depend on the settings of frame rate and exposure time, but will not fluctuate in a fixed condition.

Fixed Trigger Shutter Mode

This is a mode to start exposure by inputting trigger signals, and to set its exposure time manually or with preset.

・Set "TriggerSelectorAndActivation" to "FrameStartRisingEdge" or "FrameStartFallingEdge."
・ Trigger cycle needs to be longer than the time for FVAL term (≒1/frame rate.)
・ Trigger cycle needs to be longer than the exposure time.
・ Trigger operation is CLK Sync HV Sync Reset.
・ More than 30μs of trigger pulse width can be input.
・ Maximum exposure time depends on ROI settings, "PixelFormat", and link rate.
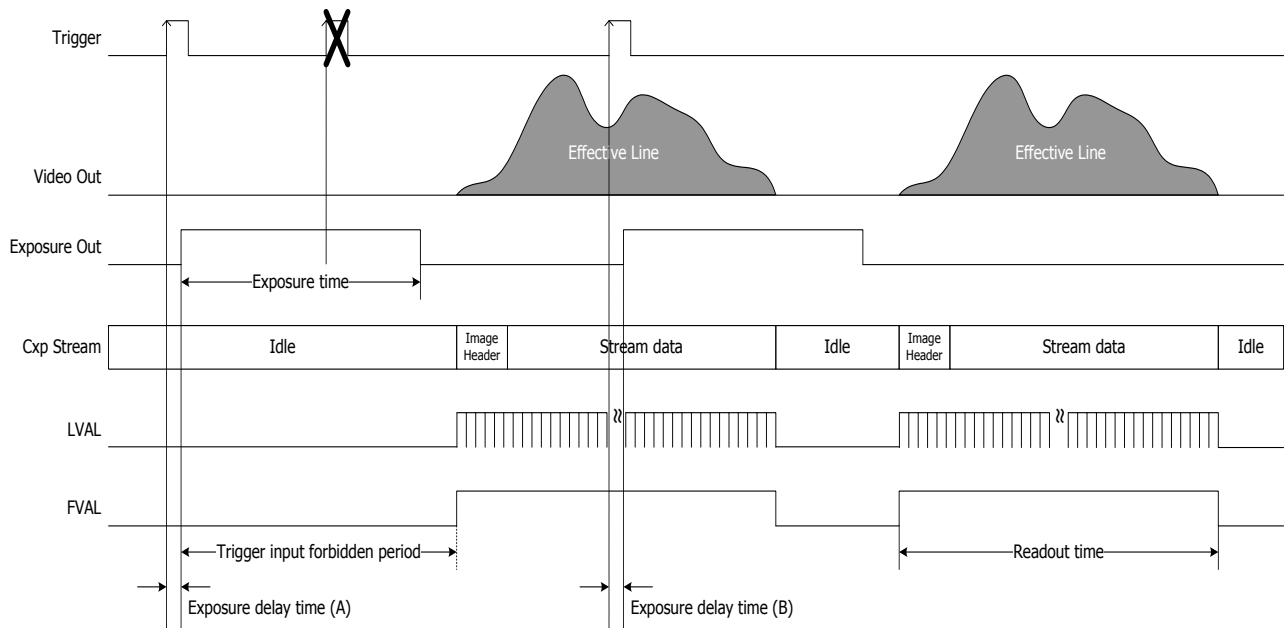
Pulse Width Trigger Shutter Mode

This is a mode to start exposure by inputting trigger signals, and to set its exposure time with trigger pulse width.

・ Set "TriggerSelectorAndActivation" to "FrameStartLevelHigh" or "FrameStartLevelLow."
・ Trigger cycle needs to be longer than the time for FVAL term (≒1/frame rate.)
・ Trigger operation is CLK Sync H-V Sync Reset.
・ Minimum trigger width is 30μs.
 ※Functionally, there is no upper limitation. However, at long exposure, some noises, lines, pearskin-like noises, and shading might be noticeable.

Trigger								
Video Out				Effective Line			Effective Line	
Exposure Out		Exposure time						
Cxp Stream		Idle	Image Header	Stream data	Idle	Image Header	Stream data	Idle
LVAL								
FVAL								

Exposure delay time (A)

Exposure delay time (B)

Readout time
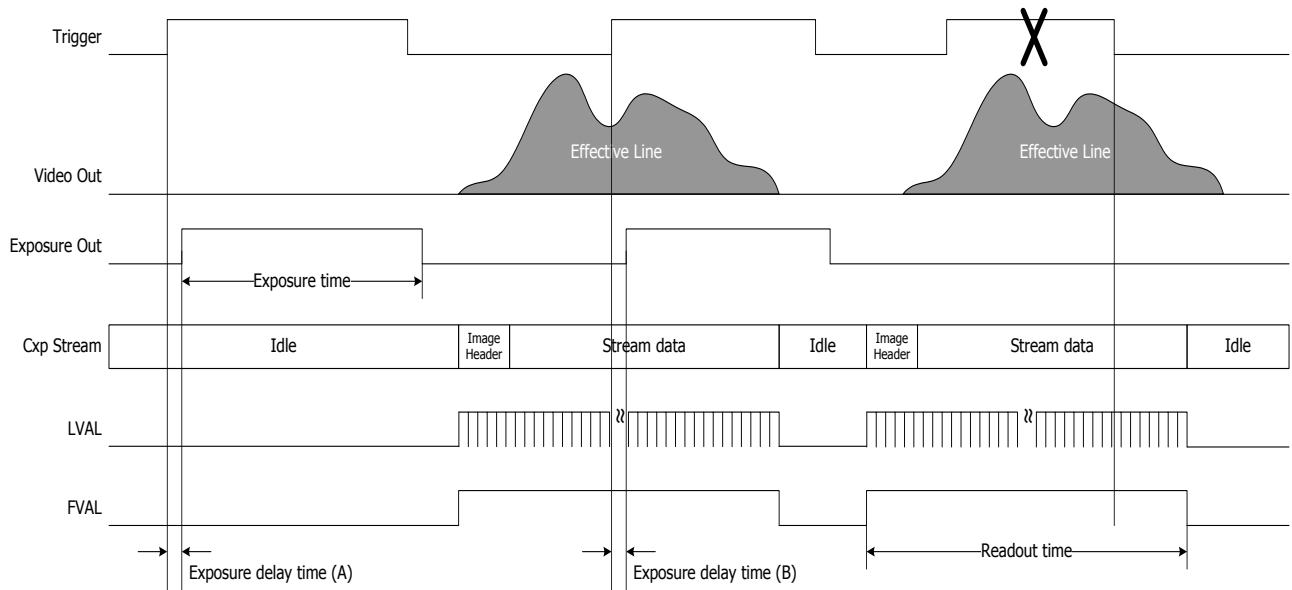
8   Function Settings
 8.1   Gain Settings

This is to increase the video out level with the preset gain or manual gain.   The setting values are powered values.   When preset value is set, it will be reflected to the manual setting value.

※Functionally, gain-up function is up to +32 times.   However, the image quality will be reduced when gain setting is increased.   We recommend you to evaluate it first.

AnalogControl	
PresetGainX	Gain_x1
	Gain_x1_5
	Gain_x2
	Gain_x3
	Gain_x4
	Gain_x6
	Gain_x8
Gain	(Manual)

・Preset GainX: (Preset Gain)
When preset value is set, it will be reflected to the manual gain setting value.

PresetGainX	Magnification	dB corresponding value
Gain_x1	x1	0dB
Gain_x1_5	x1.5	3.5dB
Gain_x2	x2	6dB
Gain_x3	x3	9.5dB
Gain_x4	x4	12dB
Gain_x6	x6	15.6dB
Gain_x8	x8	18dB

・Gain: Manual gain

Any preferred values from x1 to x32 can be set per x0.25.

8.2   Exposure Time Settings

Exposure time can be set.   There are two ways to set exposure time, one with preset value and the other with manual value.

Acquisition Control	
PresetShutter1_Xs	Shutter_1_100
	Shutter_1_150
	Shutter_1_300
	Shutter_1_600
	Shutter_1_1200
	Shutter_1_2500
	Shutter_1_5000
	Shutter_1_10000
ExposureTime	(Manual)

・PresetShutter1_Xs: Preset Shutter Mode

When preset value is set, it will be reflected to ExposureTime in manual settings. Execution shall be controlled by ROI and frame rate.

PresetShutter_1_Xs	Shutter (s)	Time
Shutter_1_100	1/100	10ms
Shutter_1_150	1/150	6.7 ms
Shutter_1_300	1/300	3.3 ms
Shutter_1_600	1/600	1.7 ms
Shutter_1_1200	1/1200	833 us
Shutter_1_2500	1/2500	400 us
Shutter_1_5000	1/5000	200 us
Shutter_1_10000	1/10000	100 us

・Manual Shutter Mode (ExposureTime)

Video output format, link rate, and ROI settings has their own maximum exposure time limitation.

Please refer to the chart below.

(Unit:us)

ROIQuick Change-	8Bit					10Bit				
	CXP1	CXP2	CXP3	CXP5	CXP6	CXP1	CXP2	CXP3	CXP5	CXP6
Off	46650	23360	23360	11680	11680	57270	28500	23300	14300	11550
Pattern1	39000	19300	19300	9510	9510	45600	22660	19300	11120	9520
Pattern2	21950	10890	10890	5340	5340	25210	12600	10850	6130	5300
Pattern3	19250	9550	9550	4640	4640	21200	10590	9510	5190	4640
Pattern4	14200	6960	6960	3410	3410	14650	7120	6980	3510	3410
Pattern5	12450	6070	6070	2920	2920	12440	6070	6070	2920	2920
Pattern6	6580	3110	3110	1450	1450	6580	3110	3110	1450	1450
Pattern7	4750	2370	2370	1160	1160	4750	2370	2370	1160	1160

	8Bit					10Bit				
	CXP1	CXP2	CXP3	CXP5	CXP6	CXP1	CXP2	CXP3	CXP5	CXP6
Subsampling	14190	7080	7080	3520	3520	14530	7260	7090	3630	3550

8.3 ROI (Region Of Interest)

This is a mode to increase its frame rate by cutting out and reducing the read out area.　One area out of the 7 preset patterns can be selected.

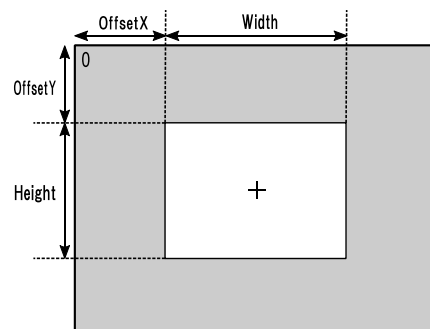| ImageFormatControl |
| --- |
| ROIQuickChangePattern1 - 7 |
| ROIQuickChangeOff |

- ・ This mode cannot be used with sub-sampling mode.
- ・ Execute re-grabbing the viewer to acquire images.
- ・ At ROI mode and the exposure timing, exposure end timing of image sensor might appear as pale horizontal lines on the image.

ROIQuick Change-	Pixel number	Resolution	Frame rate (fps)					
				CXP-1	CXP-2	CXP-3	CXP-5	CXP-6
Off	2592x2048	5.2M	8bit	21.3	42.6	42.6	85.1	85.1
			10bi	16.3	34.8	42.6	69.5	85.1
Pattern1	2048x2048	2K2K(4M)	8bit	21.5	51.0	51.0	101.4	101.4
			10bi	19.2	43.5	51.0	85.8	101.4
Pattern2	1920x1200	WUXGA	8bit	41.7	90.1	90.1	179.4	179.4
			10bi	37.4	77.8	90.1	155.6	179.4
Pattern3	1600x1200	UXGA	8bit	45.8	102.2	102.2	204.4	204.4
			10bi	40.7	92.5	102.2	185.0	204.4
Pattern4	1280x1024	SXGA	8bit	64.9	138.4	138.4	274.7	274.7
			10bi	61.0	135.2	138.4	266.3	274.7
Pattern5	1024x1024	1K1K(1M)	8bit	73.2	158.4	158.4	313.9	313.9
			10bi	64.6	158.4	158.4	313.9	313.9
Pattern6	800x600	SVGA	8bit	137.3	297.9	297.9	585.9	585.9
			10bi	122.1	297.9	297.9	585.9	585.9
Pattern7	640x480	VGA	8bit	199.8	399.5	399.5	799.0	799.0
			10bit	183.1	399.5	399.5	799.0	799.0

・Information below in selected ROI area can be readout.

ImageFormatControl
Width
Height
OffsetX
OffsetY

・Cutting out of ROI area is the center-standard of the image sensor.
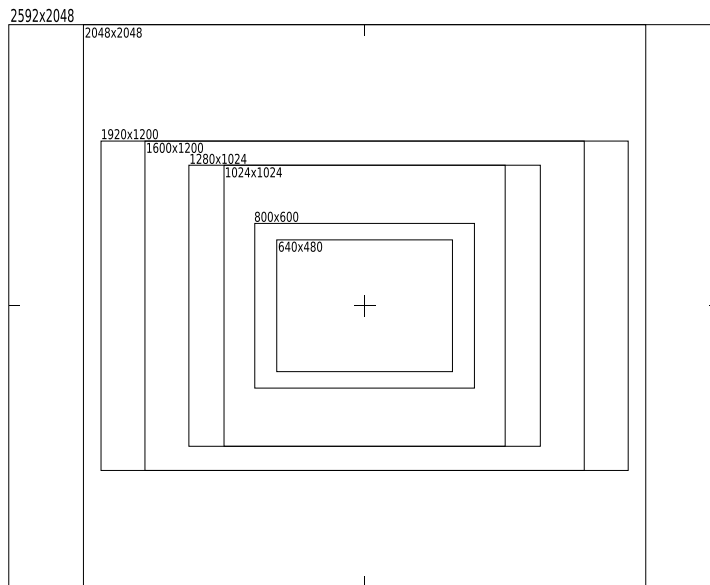
8.4 Sub-Sampling

This is a mode to increase its frame rate by reducing the pixel numbers to read out, reducing both horizontal and vertical pixel number in half, that is, 1/4 of the entire pixels.   The field angle remains the same as the one for full resolution.

ImageFormatControl	
SubsamplingMode	Subsampling_On
	Subsampling_Off

・ This mode cannot be used with ROI mode.
・ Execute re-grabbing the viewer to acquire images.
・Please refer to the chart below for the frame rate at free run mode with sub-sampling operation.

Configuration	Frame rate (fps)	
	8bit	10bit
CXP-1	64.6	57.8
CXP-2	138.6	135.4
CXP-3	138.6	138.6
CXP-5	277.1	270.4
CXP-6	277.1	277.1
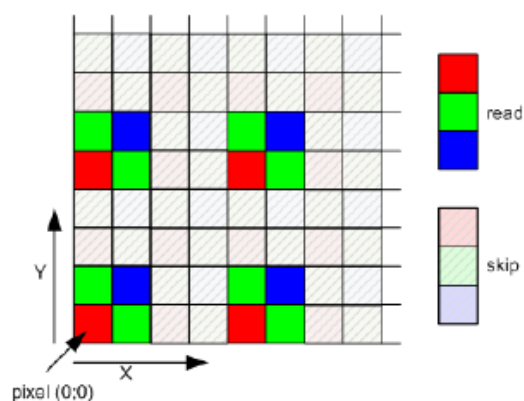
8.5 Defective Pixel Correction

CIS compensates the noticeable CMOS pixel defects found at the shipping inspection prior to our shipment.

Defective pixel correction can be set to OFF.

AnalogControl	
DefectivePixelCorrection	True
	False

8.6 Shading Correction

This is a function to correct the peripheral brightness lowering caused by the lens and others used.

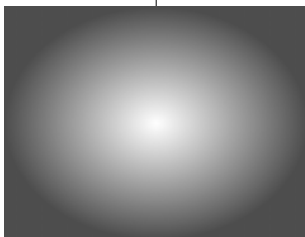| AnalogControl	
ShaddingCorrection	True
	False
DetectShading	(Execute)

・Shading Detection （DetectShading）

Shoot a uniform object such as a pattern box, to full screen, then turn shading detection ON, to calculate and save the correction data automatically in the camera.

※When setting a shading correction data, please make sure that ROI and sub-sampling settings are OFF.

※When execute DetectShading, please make sure to input trigger within 200ms after executing.

◆ Before Shading Correction   ◆ After Shading Correction

8.7 Black Offset

AnalogControl	
BlackOffset	0～255

・Initial value is 64.

・Black level can be adjusted by relative value. When increase/decrease 1 value, luminance level shall fluctuate per approx.
 0.25 lux when output 8bit. When in 10bit output, luminance level shall fluctuate per 1.0 lux.

・If the value less than initial value is set, saturation level might not reach the max. value of output range.
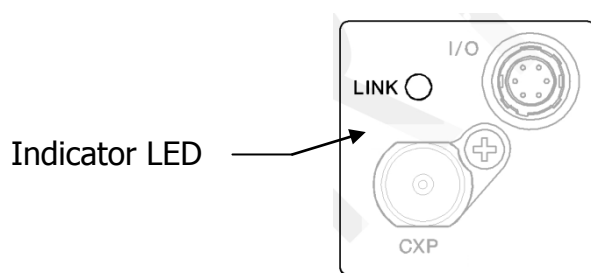
8.8 Test Pattern Indication

ImageFormatControl	
TestImageMode	OFF/ON

This function is to output the test pattern from the camera. Please execute it to check system operation.
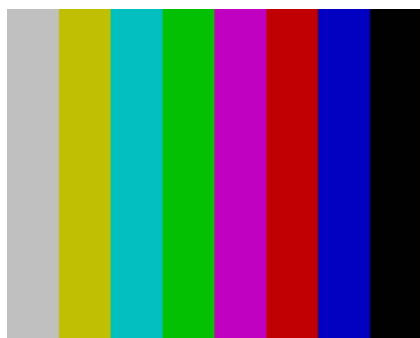
8.9 Indicator LED Lighting Control

Indicator LED

DeviceControl	
DeviceIndicatorMode	Active
	ErrorStatus
	Inactive

・Active   : To indicate the communication condition of CoaXPress.
・ErrorStatus   : Normally, the light is OFF. However, the light will turn on when system error occurs.
・Inactive   : To turn off all LEDs.

Please refer to the chart below for the lighting pattern at Active settings.

Lighting	Camera condition
Light OFF	PoCXP No supply
Green low-speed blinking [0.5 Hz]	Completion of device and host
Green light ON	Video data transmitting
Orange low-speed blinking [1 Hz]	Trigger input waiting
Red high-speed blinking	System error

※The camera might work fine even the red light is blinking. Also, the camera will remain indicating error once the camera has recognized error, such as when put the trigger in restricted timing, or switch ROI or sub-sampling function while grabbing image. Please execute power restoration or Device Control --- SensorReset to revert camera to normal lighting condition.

8.10 Camera Timing Output

The signals below can be output from 6pin circular connecter on camera rear by LineSource settings.

Digital IO Control	
LineSelector	Line1
LineMode	Output
LineSource	OFF ExposureActive FrameActive LineActive TriggerPacketActive

・LineSource

ExposureActive	:To indicate exposure period of image sensor by Hi Active.
FrameActive	:To indicate effective period of frame by Hi Active.
LineActive	:To indicate effective period of line by Hi Active.
TriggerPacketActive	:To output uplink trigger packet signal from frame grabber by decoding.

8.11 DeviceUserID Settings

DeviceControl	
DeviceUserID	[User definition]

The user-defined device names can be set in camera by a string of 16 characters. User-defined device names shall be saved in EEPROM in camera when execute "UserSetSave." It will revert to the factory setting when execute "UserDefault."

※This is a total of 16byte of register region. Please input in English one byte characters.

8.12 White Balance

AnalogControl	
BalanceWhiteControl	Off OnePush Manual

3 types of mode can be use at Balance White control.

1) OFF

To output without White balance control.

2) One Push White Balance

White Balance shall be adjusted in accordance with output image.

Please execute while the achromatic object is on the entire screen. We recommend you to execute is with approx. 50% of signal level. Red value, Green value, and Blue value after executed can be read out from BalanceWhiteOnePushGainRed and BalanceWhiteOnePushBlue.

AnalogControl	
BalanceWhiteOnePush	
BalanceWhiteOnePushGainRed	(Read Only)
BalanceWhiteOnePushGainBlue	(Read Only)

3) Manual White Balance

　　Red gain and Blue gain can be adjusted in the range of 0~800% by the commands below.

AnalogControl	
BalanceWhiteGainRed	0– 8.0
BalanceWhiteGainBlue	0– 8.0

If the BalanceWhiteControl of BalanceWhiteGainRed/Blue is set to Manual, the value at OnePush execution will be reflected. After that, preferred value can be input.

9　　Sequence Control Function

　This is a function to select one set of parameter out of several kinds of preset parameter sets per trigger input, and apply it to the camera.

☐　　Max. 16 kinds of parameter sets can be set in advance. The following parameters can be set per parameter set.
　　　Settable parameter： Shutter and Gain

☐　Specify the operation sequence as "Index". Specify the parameter set number to be applied for the maximum 16 indexes.

☐　　There are three sequence operation modes; trigger mode, index mode, and burst mode.

☐　　Please refer to the chart below for settable AcquisitionMode (Camera operation mode) and SequencerActivation (Start operation) which corresponds to each sequence mode.

AcquisitionControl AquisitionMode [TriggerSelectorAndActivation]　　　　　【Sequence Operation Mode】	FrameStartRisingEdge	FrameStartFallingEdge	FrameStartLevelHigh	FrameStartLevelLow	FrameBurstStart	SequencerControl [SequencerActivation]
Trigger Mode	◎	◎	◎	◎		FrameStartPredfined
Index Mode	◎	◎	◎	◎		FrameStartIndexselector
Burst Mode					◎	FrameBurstStartEdge FrameBurstStartLevel FrameBurstStartSoftware

9.1   Basic Operation

Please follow the procedures below when to use sequence control function.

① AcquisitionControl --- TriggerSelectorAndActivation settings

　　To set the operation mode of the camera.

② Sub-sampling and ROI settings

　　Please remain turn OFF SubsamplingMode. Please set ROI of ImageFormatControl to ROIQuickChangeOff.
　　These functions do not work at sequence control function.

③ Set the parameter table (SequenceerParameterSetSelector) for sequence

　　Please set ExposureTime and Gain of each parameter set.

④ Set ParameterIndexNumber for sequence and Index loop count

　　Set "IndexLoopCount", "SequencerLoopCount", and "ActiveIndexNumber".

⑤SequencerControl --- Settings for SequencerActivation.

　　To set the starting operation of sequence mode. If to set preferred [SequencerActivation], trigger waiting mode
　　shall be executed.

⑥Sequence Control operation shall be executed when the trigger to operate sequence is input.

※Note
　・Please decide link configuration beforehand when to set each functions.
　・The trigger input timing guideline at sequence control is the same as at normal mode.
　・When to set the settings for sequence, please turn OFF SequencerActivation once.
　・UseSetSave and UserSetDefault shall not be executed at SequencerMode. Please set them after turn on the
　　power. (UserSetSave and UserSetDefault can be executed at other settings for sequence except
　　SequencerMode.)
　・If the trigger is input, sequence shall start when the SequencerActivation is set to other than OFF. Please do not
　　input any triggers when to switch SequencerActivation.
　・Please refer to the maximum exposure time in 8.2 Exposure Settings for the exposure time for each parameter
　　settings.
　・At burst mode, the screen will hold the last picture of sequence control when finished sequence control.
　・When turn OFF SequencerActivation, the camera will return to the condition before sequence control.

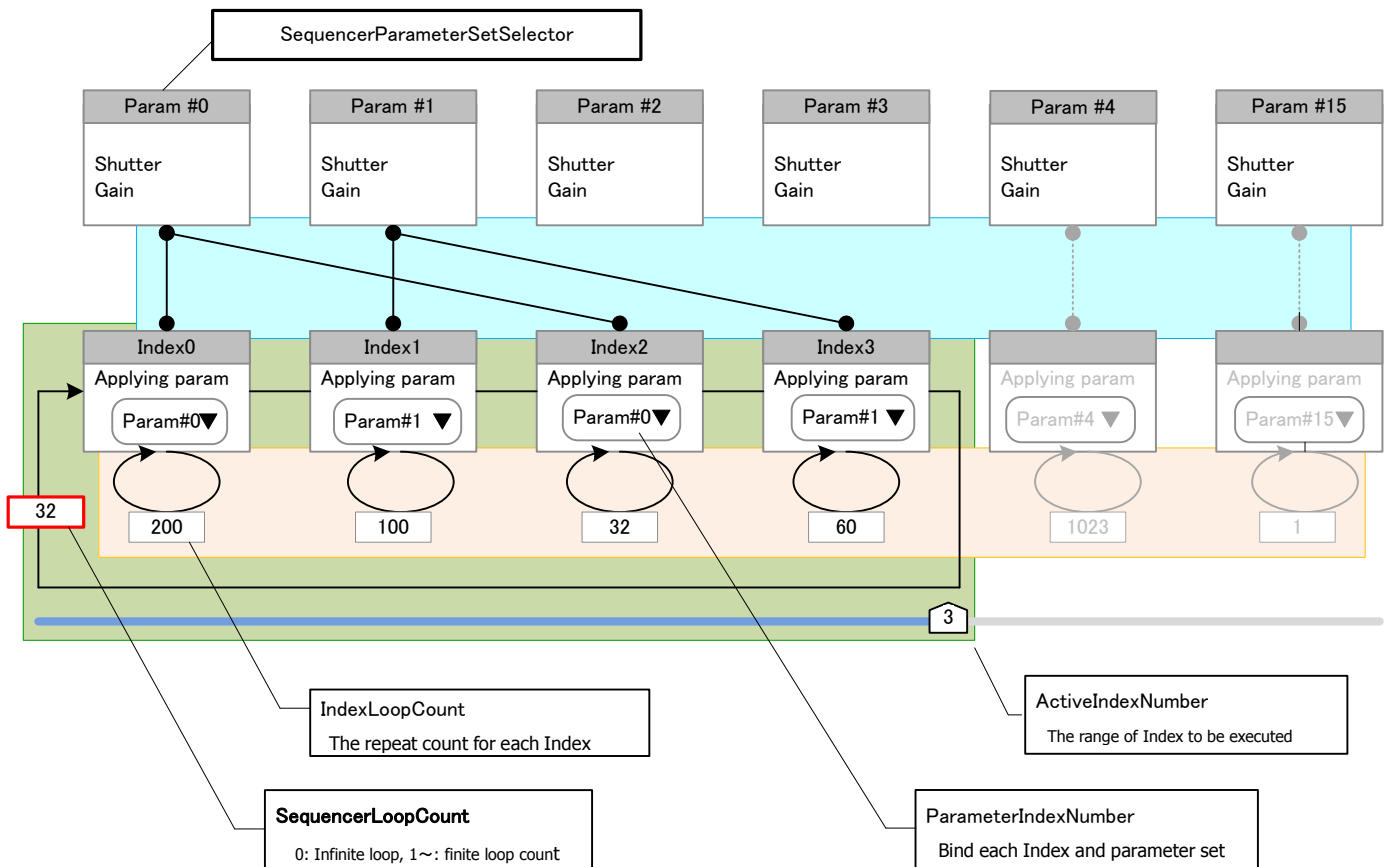### 9.2   Outline for Trigger Mode and Burst Mode Operation

This is a mode to specify Index transition flow in advance. (The repeating count for each Index, the number of the Index to be used, and the number of Loop can be set.)

　・Trigger Mode
　　Whenever an external trigger is input, the repeat count of Index shall be sum up, and the parameter set shall be applied to
　　the camera.

　・Burst Mode
　　This mode shall be executed by equivalent of free run at internal sync. mode. Sequence shall be started by trigger, repeat
　　count of Index will be sum up automatically by internal trigger, and the specified parameter set shall be applied to the
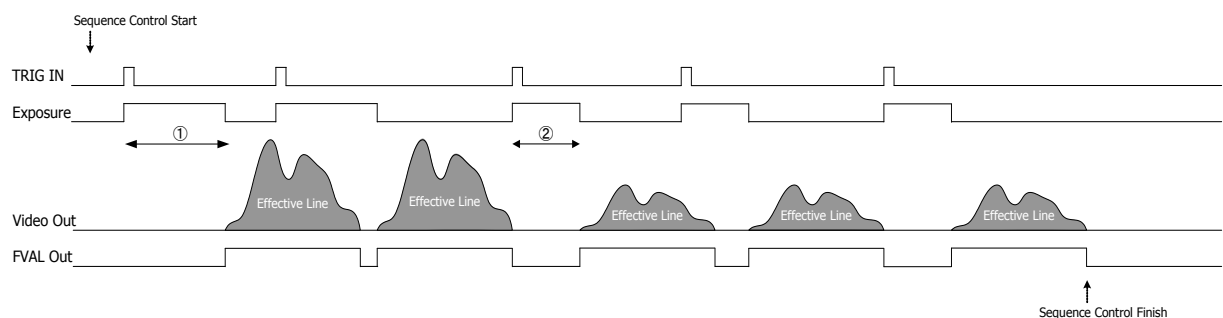　　camera.

SequencerParameterSetSelector

Param #0	Param #1	Param #2	Param #3	Param #4	Param #15
Shutter Gain	Shutter Gain	Shutter Gain	Shutter Gain	Shutter Gain	Shutter Gain

Index0	Index1	Index2	Index3	Applying param	Applying param
Applying param	Applying param	Applying param	Applying param	Param#4 ▼	Param#15 ▼
Param#0 ▼	Param#1 ▼	Param#0 ▼	Param#1 ▼		
200	100	32	60	1023	1

32

3

IndexLoopCount

The repeat count for each Index

ActiveIndexNumber

The range of Index to be executed

SequencerLoopCount

0: Infinite loop, 1〜: finite loop count

ParameterIndexNumber

Bind each Index and parameter set

9.3　Trigger Mode

There are 2 types of control in sequence performance.
　1. Edge control
　2. Pulse width control

・Please choose from FrameStartRisingEdge/ FrameStartFallingEdge/ FrameStartLevelHigh/ FrameStartLevelLow
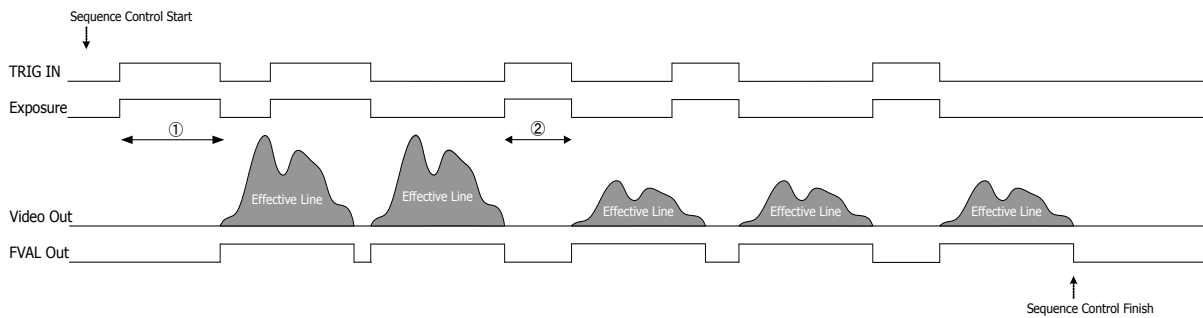　to set TriggerSelectorAndActivation in accordance with the way of control. (Edge control or Pulse width control)

(1) Edge Control

Sequence Control Start

TRIG IN

Exposure

①

②

Video Out

Effective Line   Effective Line   Effective Line   Effective Line   Effective Line

FVAL Out

Sequence Control Finish

When TriggerSelectorAndActivation is set to FrameStartRisingEdge orFrameStartFallingEdge, sequence will start
when the trigger is ON.

・The exposure time (①,②) for each frame shall be controlled by sequence parameter set which is set beforehand.
・Sequence performance will end after the sequence loop count of image output, and the performance will stop.

(2) Pulse Width Control

When TriggerSelectorAndActivation is set to FrameStartLevelHigh orFrameStartLevelLow, sequence will start when the trigger is ON.
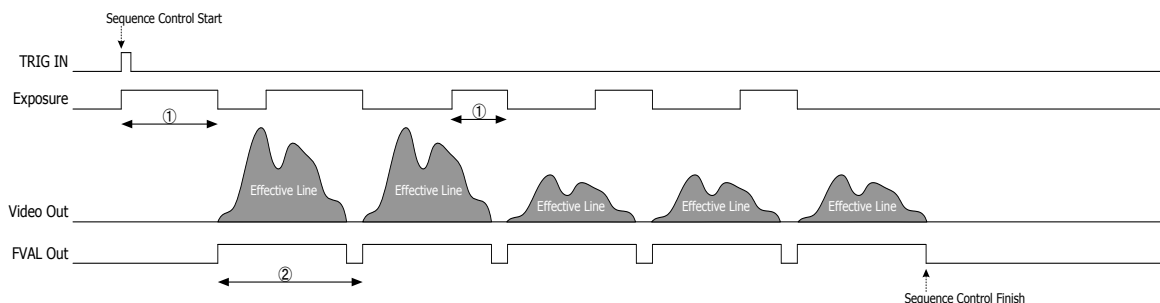
・Pulse width shall correspond to exposure time (①,②) for each frame.
・Sequence performance will end after the sequence loop count of image output. After that, the performance will stop.

9.4 Burst Mode

Edge control which uses trigger signal, level control, and register start is selectable for the start and hold of sequence.

・Please set TriggerSelectorAndActivation to FrameBurstStart.

(1) Edge Control

When TriggerSelectorAndActivation is set to FrameBurstStartEdge, sequence will start when the trigger is ON.

・The exposure time (①) and output frame time (②) for each frame shall be controlled by sequence parameter set and image size which are set beforehand.
・Sequence performance will end after the completion of sequence loop count of image output. After that, the performance will stop.

(2) High Level Control
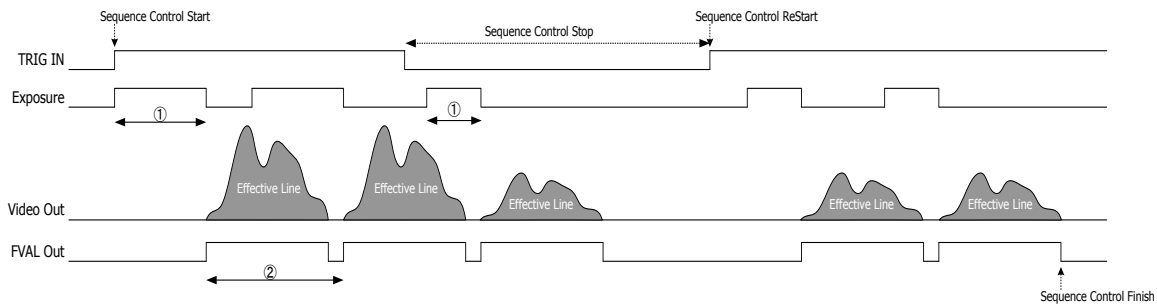
To execute sequence operation during the trigger input is set to High level, please set SequencerActivation to FrameBurstStartLevel.

- ・To pause the trigger input in mid-flow, please set the trigger input to Low level.
  (To finish the trigger input directly, please turn OFF sequence control.)
- ・Sequence shall continuously operates if the trigger input is set to High level again at pause.
- ・After completion of loop count of image output, the sequence operation will end and the operation will stop.

(3) Register Start

The sequence operation will start at the same timing as SequencerActivation is set to FrameBurstStartSoftware.

9.5   Index Mode

This mode is to specify the applying Index no. directly by IndexSelectorModeIndexNumber.

The Index parameter set specified by IndexSelectorModeIndexNumber shall be applied to camera per trigger input.

Performance Chart
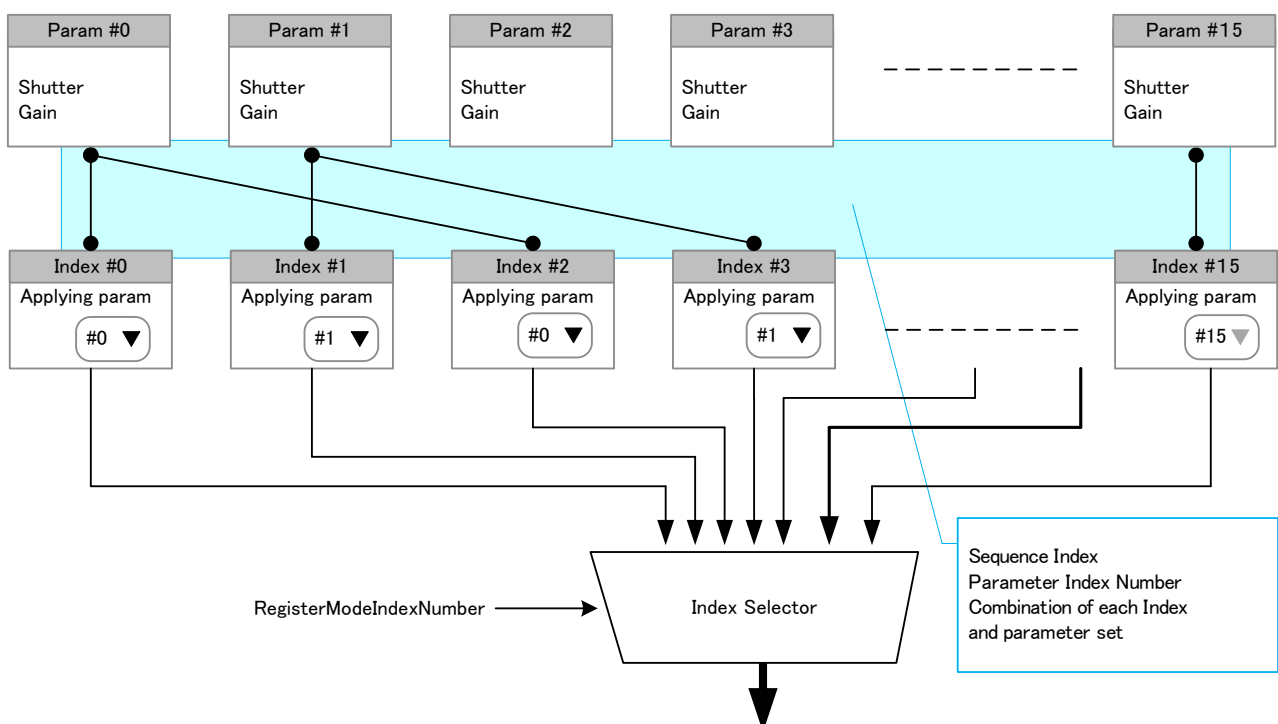
・Please choose from FrameStartRisingEdge/ FrameStartFallingEdge/ FrameStartLevelHigh/ FrameStartLevelLow to set TriggerSelectorAndActivation in accordance with the way of control.

(1)Edge Control
   The exposure time for each frame shall be controlled by sequence parameter set which is set beforehand.

(2)Pulse Width Control
   Pulse width shall correspond to the exposure time for each frame. The exposure time for parameter set shall not be referred.

※Notes for command issuing timing for IndexSelectorModeIndexNumber
   Please input the trigger pulse after confirmed ACK after issued IndexSelectorModeIndexNumber, to make sure to reflect parameter set to the next frame.

   9.6   Setting Items for Sequence Control

Please execute UserSetSave to save the settings. Please note that SequencerActivation shall not be saved, so it shall be always OFF after turn ON the power. Please set it accordingly when use Sequence Mode.

◇How to set Sequence control

Acquisition Control	
TriggerSelectorAndActivation	AquisitionMode FrameStartRisingEdge FrameStartFallingEdge FrameStartLevelHigh FrameStartLevelLow FrameBurstStart

・FrameStartRisingEdge   : To set sequence control to rising edge of trigger pulse

・FrameStartFallingEdge   : To set sequence control to falling edge of trigger pulse

・FrameStartLevelHigh   : To set sequence control to high level control of trigger pulse

・FrameStartLevelLow   : To set sequence control to low level control of trigger pulse

・FrameBurstStart   : To set sequence control at the use of burst mode.

◇Shifting to sequence mode

SequencerControl	
SequencerActivation	Off
	FrameStartPredefined
	FrameStartIndexSelector
	FrameBurstStartEdge
	FrameBurstStartLevel
	FrameBurstStartSoftware

・FrameStartPredefined   : To set to start trigger mode and burst mode
・FrameStartIndexSelector   : To set to start Index mode

・FrameBurstStartEdge   : To set to start burst mode edge control
・FrameBurstStartLevel   : To set to start burst mode high level control
・FrameBurstStartSoftware   : To set to start burst mode register start

◇Settings for sequence count and the range

SequencerConfigurationParameter		Setting range
SequencerLoopCount	The loop count of entire sequence	1-1023 0: Infinite
ActiveIndexNumber	The range of Index to be executed	0-15
IndexSelectorModeIndexNumber	The Index no. to be used at Index Mode	0-15
ParameterIndexNumber		
Index0-15	Parameter no. of Index0-15	0-15
IndexLoopCount		
IndexCount0-15	Each loop count for Index0-15	1-1023

◇Settings for sequence parameter set
There are 16 types of parameter set. If the number of SequencerParameterSetSelector has changed, the parameter set will also change. The setting data shall be saved even the parameter no. is changed.

SequencerParameterSetSelector		0～15 Parameter Set
SetConfiguration		
	SequencerExposureTime	Exposure time
	(SequencerExposureTimeMAX)	To indicate max. exposure time that can be set.
	SequencerGain	Gain
	(SequencerXSize)	X size which is set at ROI shall be set.
	(SequencerYSize)	Ysize which is set at ROI shall be set.
	(SequencerXStart)	X coordination which is set at ROI shall be set.
	(SequencerYStart)	Y coordination which is set at ROI shall be set.

9.7   Sequence Information Output
This function is to indicate the condition of sequence control. Effective image embedding status information can be output.

SequencerStatus		
SequencerInformationLocation		To specify the location of status information
	Off	Information output OFF
	TopLeft	Top left output
	TopRight	Top right output
	BottomLeft	Bottom left output
	BottomRight	Bottom right output
FrameBurstStatus		To indicate the condition of burst mode for
IndexNumberStatus		To indicate the executing Index no.
RepeatNumberStatus		To indicate loop count of executing Index no.
LoopNumberStatus		To indicate loop count of executing sequence ※If the indication of loop count is set to infinite, the indication of max. loop count is 1023.

The output location of status information can be chosen from 4 locations, and the information shall be embedded in 5pixels.
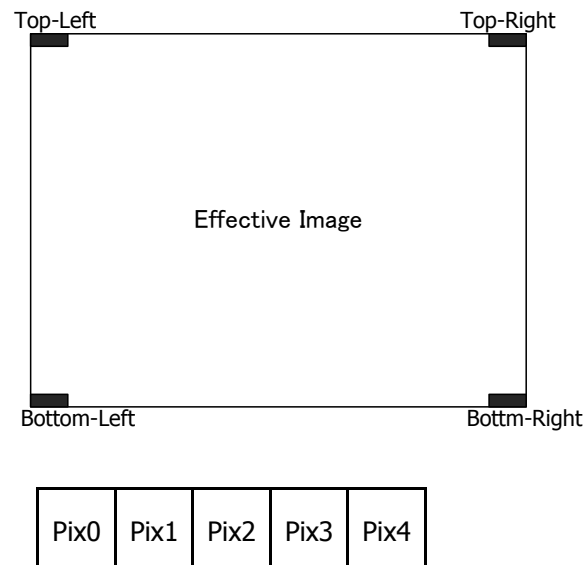
The information of Index no, Loop count in Index, and Loop no. shall be output for each pixel as below.
2bit at LSB side shall always be "00" at 10bit image.

	MSB				LSB
pix0	"00"	Index no. [3:0]		"0000"	"00"
pix1	"00"			Loop count[7:0]	"00"
pix2	"00"	"000000"		Loop count[9:8]	"00"
pix3	"00"			Loop no.[7:0]	"00"
pix4	"00"	"000000"		Loop no.[9:8]	"00"

10   Factory Settings

機能	データ	備考
DeviceControl		
DeviceUserID	ID00DevU0000000H	
DeviceIndicatorMode	Active	
ImageFormatControl		
ROIQuickChangeOff	Width : 2592	
	Height : 2048	
	OffsetX : 0	
	OffsetY : 0	
PixelFormat	BayerRG8	
AquisitionControl		
TriggerSelectorAndActivation	AcquisitionMode	
TriggerSource	LinkTrigger0	
ExposureTime	3333.0	
AnalogControl		
blackOffset	64	
Gain	1.0	
ShadingCorrection	False	
DefectivePixelCorrection	True	
BalanceWhiteControl		
BalanceWhiteOnePushGainRed	1.0	
BalanceWhiteOnePushGainBlue	1.0	
DigitalIOControl		
LineSource	OFF	
SequencerControl		
SequencerActivation	Off	
SequencerInformationLocation	Off	
Index0〜Index15	0〜15	The same value as Index no.
Index0Count〜Index15Count	1	All 1
SequencerLoopCount	0	
ActiveIndexNumber	0	
ActiveIndexModeIndexNumber	0	
SequencerExposureTime	1000.0	(Selector 0-15)
SequencerGain	1.0	(Selector 0-15)
TransportLayer		
CxpLinkConfiguration	CXP_X1	

※The values of factory settings is the same as of those commands for UserSetDefault.
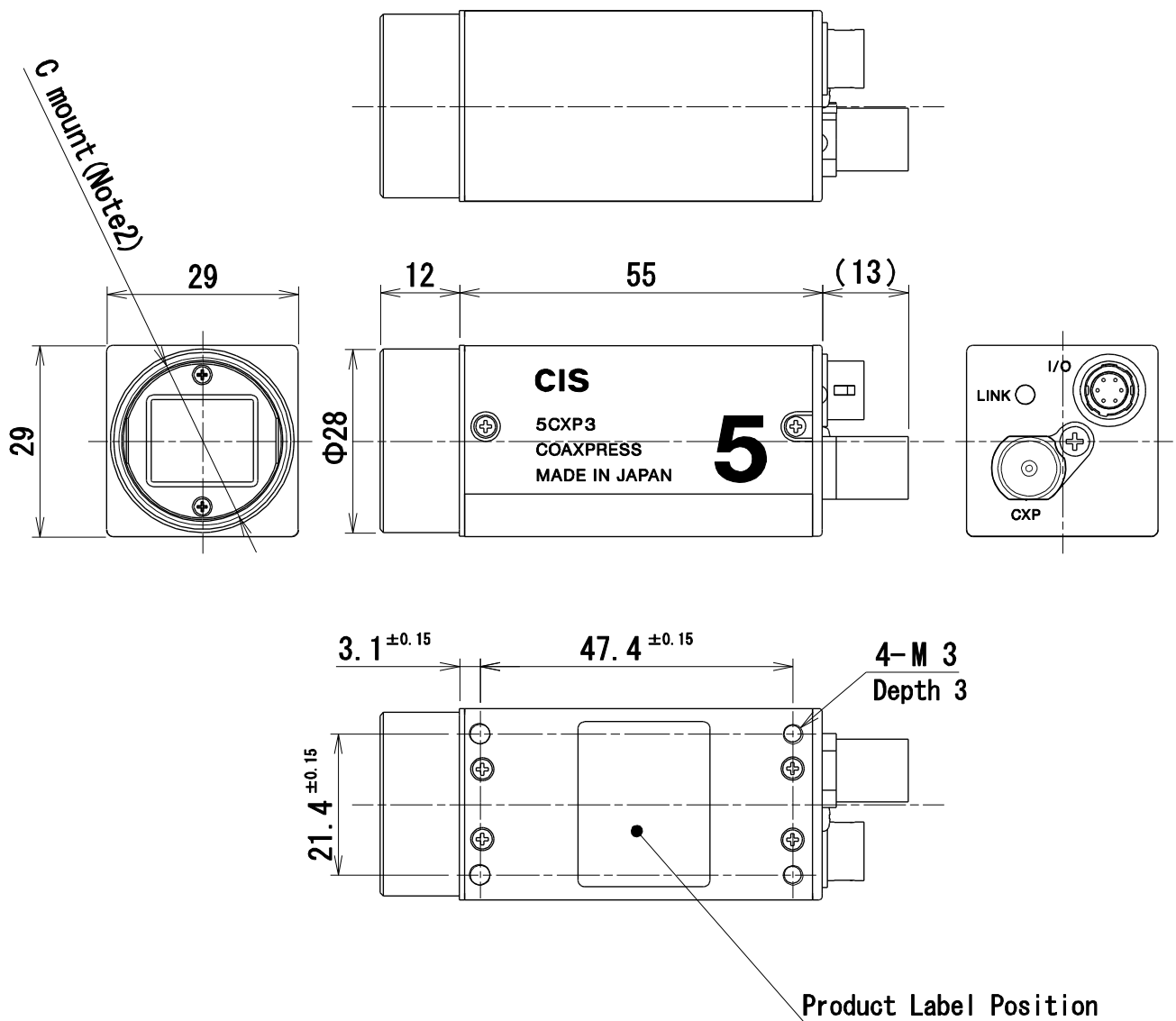
11   Dimensions
     11.1   Optical Axis Accuracy

Inclination of
optical axis to
datum plane

29

14.5 ±0.3 (*)

29

2-M3

±0.5 less

Datum
Plane

12

55

10.7 ±0.3   10.7 ±0.3

Datum Plane

Product Label
Position

±1°

Inclination of effective pixels Theta
to datum plane shall be θ ≦ ±1°

The center of effective pixels
shall be whthin Φ0.6 to the
center of lens mount.
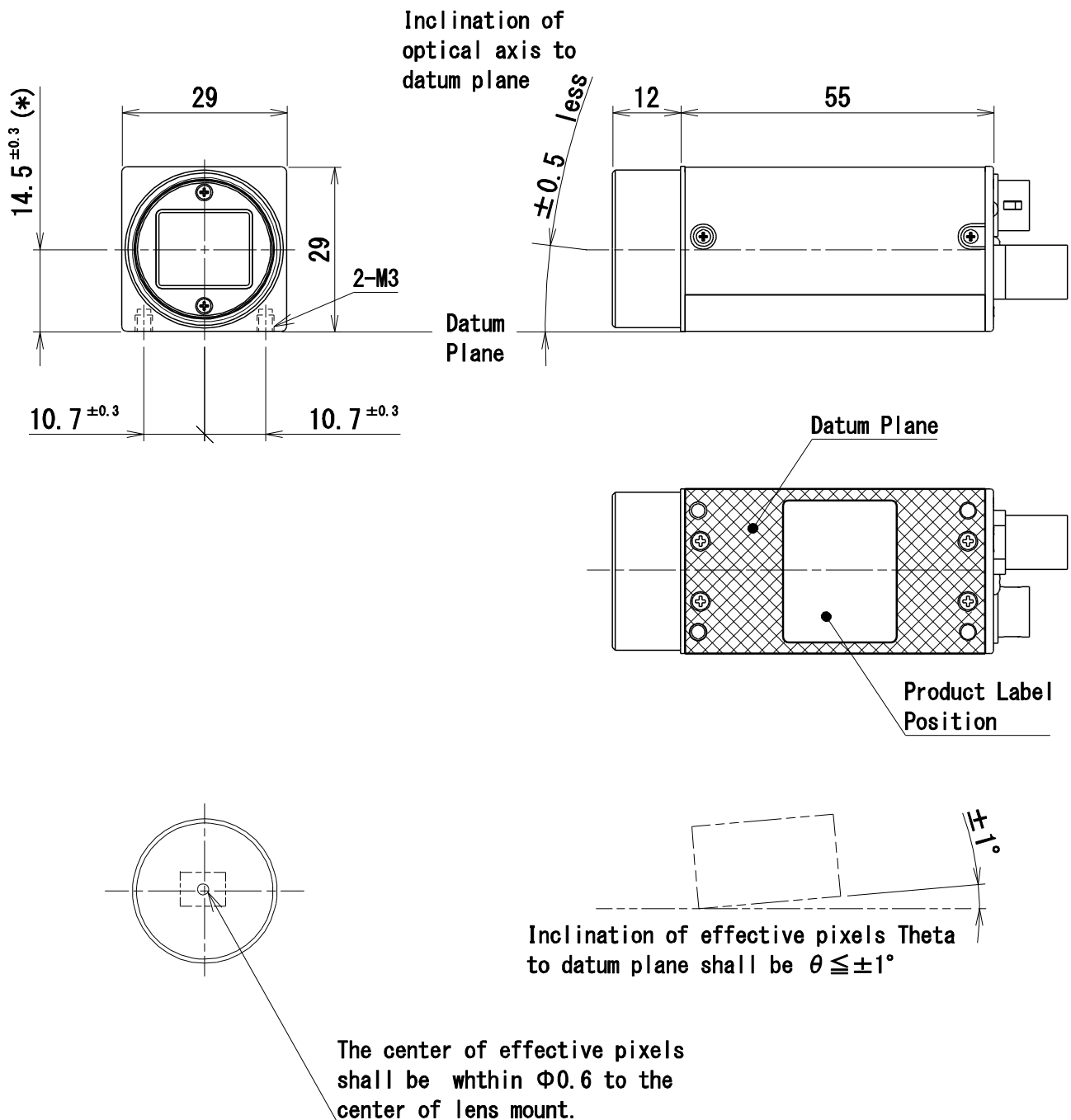
(∗)Dimension from datum plane to the center of lens mount.

937-0012-00
(Unit:mm)

11.2 Camera Dimension

29

29

12   55   (13)

Φ28

CIS

5CXP3
COAXPRESS
MADE IN JAPAN

5

C mount (Note2)

LINK   I/O

CXP

3.1 ±0.15   47.4 ±0.15   4-M 3
Depth 3

21.4 ±0.15

Product Label Position

Note2) C mount screws comply with ANSI/ASME B1.1.1-32UN(2B).

Note1) Screw length from the lens mount surface shall be less than 6 mm. And
protruding portion of the C mount lens shall be less than 10 mm.

935-0041-00
(Unit:mm)

12　Case for Indemnity (Limited Warranty)

The term of warranty of this product is within 3 years from the date of shipping out from our factory. If you use the product properly and discover a defect during the warranty period, and if that was caused by designing or manufacturing, CIS Corporation, at its option, repairs or replaces it at no charge to you. Products out of warranty period will be subject to charge.　CIS repairs the products as long as it is repairable.

CIS shall be exempted from taking responsibility and held harmless for damages or losses incurred by the following cases.

- In case damages or losses are caused by earthquake, lightning strike, fire, or other acts of God.
- In case damages or losses are caused by deliberate or accidental misuse by the user, or failure to observe the information contained in the instructions in this Product Specification and Operational Manual.
- In case damages or losses are caused by repair or modification conducted by the customer or any unauthorized party.

・CMOS Pixel Defect

CIS compensates the noticeable CMOS pixel defects found at the shipping inspection prior to our shipment. On very rare occasions, however, CMOS pixel defects might be noted with time of usage of the products. Cause of the CMOS pixel defect is the characteristic phenomenon of CMOS sensor itself and CIS is exempted from taking any responsibilities for them.　Should you have any questions on CMOS pixel defects compensation please contact us.

・Product Support

Should you have any problems in function of the product you purchased, and if you need our further analysis and/or repair, please contact the dealer you purchased it from.